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TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

P.W. DEPARTMENT

G.O. No. 1855 –
~~B.P. No.~~ 1856.

Press.
Mis.

Dated 4.7.1883 198.

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4th July 1883, No. 1855 W., Public Works.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Read—the following :—

Report of Committee appointed in G.O., No. 1259 W., dated 30th April 1883, to consider the best means for giving effect to the proposals made for the completion of the Madras Harbour, dated 20th June 1883.

Order—dated 4th July 1883, No. 1855 W., Public Works.

The Committee appointed in G.O., No. 1259 W., dated 30th April 1883, to consider the question of the restoration of the Madras Harbour Works, having now submitted their Report, the papers will be forwarded for the orders of the Government of India, and copies furnished for the information of the Secretary of State.

(Here enter No. 1856 W., dated 4th July 1883.)

(True Extract.)

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Superintendent, Madras Harbour Works.
" Marine Department.
" Master Attendant.
" Examiner, Public Works Accounts.

Exd. A. F. Goodall.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1883) Madras.

PUBLIC WORKS.

Dated July, 4th.

Recd.

Encl.

G.O., 4th July 1883, No. 1855 W.

JULY.

Madras Harbour Works

Report of the Committee appointed to consider the question of the restoration of the —, ordered to be forwarded for the information of the Government of India and the Secretar of State.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Letter—from

Colonel R. H. SANKEY, C.B., R.E.,
Secretary to the Government of Madras,
Public Works Department,

To

The SECRETARY to the GOVERNMENT of INDIA,
Public Works Department.

Sir,

With reference to Despatch No. 10, Public Works, dated 8th March 1883, from the Right Honorable the Secretary of State, on which this Government was desired to consider the recommendations of Sir John Hawkshaw's Committee on the Madras Harbour, dated 23rd January 1883, "in view to assisting the Government of India to arrive at a decision upon the course which it will be most desirable to follow in reference to the work of restoration," I am now directed by His Excellency the Governor in Council to submit the annexed report of a Committee which was lately assembled at Madras to frame the needful estimates, and to consider the question of restoration in all its bearings.

2. In the first place, as regards the estimated cost of the works, this Committee, on a close review of the rates of work, time required for execution, &c., find that to restore the breakwaters on the plan most favored by Sir John Hawkshaw's Committee (*i.e.*, as per Sections Nos. 1, 2, and 3 of their report) would be as follows, viz. :—

	RS.
(1) While retaining the present Harbour entrance	50,93,980
(2) While reducing the entrance to 450 feet	51,85,580

The latter sum compares directly with the Home Committee's Estimate No. 1, amounting to £479,219-15-2.

3. As will be observed, the Madras Committee have shown by the highest nautical opinion that it would be dangerous to decrease in any way the width of the present eastern entrance, and that so long as this latter is left open the Harbour must remain exposed, as at present, to continued disturbance, as well as being a perpetual source of the gravest anxiety to all concerned during cyclone periods.

4. They further show that, while carrying out for the seaward arms the random block method of reconstruction, which is stated to be "a safe system to follow" by Sir John Hawkshaw's Committee, the objectionable eastern entrance may be closed, and a perfectly still-water Harbour created, at a total outlay of Rs. 51,42,626, or for Rs. 42,954 less than that needed for reconstructing the works in the manner most approved by the Home Committee.

5. The incidental advantages of the plan suggested (see paragraphs 46 to 54 of the present Committee's Report) are so marked that His Excellency in Council trusts they may be fully weighed in arriving at a conclusion in regard to the completion of this great work.

6. Not only would the Harbour enjoy complete immunity from disturbance during ordinary weather, thus facilitating in every way all the trade operations of the port, but what is of the highest moment, no ships need be sent to sea on the commence-

ment of a storm. It is impossible, in the opinion of this Government, to lay too great stress on this single fact, or to doubt the soundness of the reasoning on which it has been established.

7. Not only, moreover, could the Harbour, under the altered conditions, be dredged out and its area increased to any required extent, but, as observed by the Committee, it might, by a suitable system of defences, form a complete Harbour of refuge in times of war.

8. As regards the resumption of the works, I am now to submit that every day's delay is adding to the cost of establishment, and continues the disadvantages under which the trade of the port has been suffering since the cyclone of the 12th November 1881.

9. Everything is in readiness for pushing on operations, excepting the needful machinery for placing the blocks in the manner now recommended, and as regards which it is probable that Mr. Parkes's services might at once be availed of.

10. So soon as the duty of providing this machinery has been performed by Mr. Parkes, it is thought that his further connection with the work should cease; indeed, His Excellency in Council would be well pleased if his services in the position of Engineer-in-Chief for the work could even now be dispensed with. His original plans for the Harbour Works have had to be abandoned as proving unsound in practice, and he no longer commands the confidence of this Government as its professional adviser.

11. On the other hand, the present Superintendent of the work, Mr. Thorowgood, by his assiduity, intelligence, and the soundness of his professional views, has established for himself a confidence which is shared alike by the Government and the public. Were he constituted Engineer-in-Chief, not only would Mr. Parkes's salary be saved, but the very serious inconveniences of his absence in London and divided control would be at once put an end to.

Soliciting very early orders,

I have the honor to be,
Sir,
Your most obedient servant,

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

Fort St. George,
4th July 1883.

Exd. A. F. Goodall
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1883) Madras.

PUBLIC WORKS.

Dated July, 4th.

Recd. *Encl.*

4th July 1883, No. 1856 W.

JULY.

Madras Harbour Works

FORWARDING Report of the Committee appointed to consider the question of the reconstruction of the —.

MADRAS HARBOUR.

REPORT OF THE COMMITTEE APPOINTED IN G.O., NO. 1259 W., DATED 30TH APRIL 1883, TO REPORT ON THE BEST MEANS FOR RESTORING THE WORKS OF THE MADRAS HARBOUR.

Dated 20th June 1883.

Report of the Committee appointed in G.O., No. 1259 W., dated 30th April 1883, to report on the best means for restoring the works of the Madras Harbour.

The Committee assembled under G.O., 30th April 1883, No. 1259 W., to consider the best means for giving effect to the proposals made for the completion of the Madras Harbour, have the honor to submit their report for the consideration and orders of Government.

2. The first point claiming attention is the probable cost of completing the works on the several systems suggested by the Home Committee in their report, dated London, 23rd January 1883.

3. As stated in paragraph 25 of that report, the estimates were based generally on the rates of work given by Mr. Parkes, but in some cases the Home Committee assumed higher ones with the results shown in the several appendices, which, though given in sterling, are apparently intended to be converted at two shillings to the rupee.

These estimates are professedly only approximate, or, as expressed by Mr. Parkes in paragraph 4 of his letter of the 10th February 1883, must be viewed "rather as illustrations of the general meaning of the authors, or at most as a basis for approximate estimate than as a basis for instructions to the Engineer who will be charged with the execution of the work."

4. In the appendices to the present report will be found estimates prepared by Mr. Thorowgood, which, though still in some degree approximate, will, it is hoped, from the intimate acquaintance of the framer with every detail of the work, prove to be very fairly accurate. It is only in regard to the cost of special plant (for which information is incomplete) that the Committee feel hesitation, but this is not a very material item.

5. The results as shown may be compared as follows, the £1 sterling being taken = 10 rupees in the Home Committee's estimates :—

TABLE No. I.

Systems for completing the works as given in the Home Committee's Report.	Home Committee's Estimate, including reduction of present Harbour entrance from 550 feet to 450 feet.	PRESENT COMMITTEE'S ESTIMATES—SEE APPENDICES.		Present Committee's Estimates more by [Column (4) — (2)].
		1. Retaining the present entrance.	2. Reducing the entrance to 450 feet.	
	RS.	RS.	RS.	RS.
(A.) As per Sections Nos. 1, 2 and 3 (*i.e.*, core of seaward arms constructed on immediate site of present work)	47,92,190	50,93,980	51,85,580	3,93,390
(B.) As per Sections Nos. 1, 2, and 4 (*i.e.*, core of seaward arms constructed on a new base some 60 feet on the harbour side of the present work)	42,92,170	45,36,779	46,13,179	3,21,009
(C.) As per Sections Nos. 1, 2, and 5 (*i.e.*, the seaward arms constructed entirely on the random block system)	46,56,000	48,70,472	49,55,672	2,99,672

6. The chief reason for the excess of the present estimates is due to the item for superintendence and contingencies being taken at 15 instead of 10 per cent. in those of the Home Committee, and the rest to a more accurate appraisement of the rates of the work as based on an analysis of the previous accounts, and to the fact that the Home Committee's lengths of pier to be built are 216 feet short of actual requirements.

7. So soon as the system of construction to be adopted has been finally decided on by the Government, it will be desirable to ascertain through the Secretary of State the probable cost of the special plant, which, of course, will vary somewhat with the system, and then recast that portion of the estimate prior to final sanction.

8. The Home Committee, while giving their opinion (paragraph 17) that, as regards the seaward arms from point B on the north pier and E on the south pier, "it would be desirable, if it could be done, to continue the walls on the original foundations," admit that the picking up of the blocks "buried or nearly so in debris, for the purpose of resetting them, or preparing a sufficiently level bed on the site of the destroyed wall, will involve great labor and expense, and possibly even it may be found impracticable to continue the wall on the original foundations."

9. In their present estimate (System A, see table) the Committee have assumed that the plan of picking up and relaying the blocks is practicable, but they can only do so in the sense that while being possible it must of necessity be attended with very great delay and expense.

10. The Home Committee have, as will be observed, strong doubts as to the applicability of the plan, and would apparently unhesitatingly prefer the System B were it not for the curtailment of the area of the harbour which is involved in taking up a space 60 feet in width along the seaward arms.

11. On a full consideration of the state of the present work, the Committee are of opinion that it would be most undesirable to attempt to erect the new superstructure on the present work, as even where the lower blocks have got displaced or subsided only to a very trifling extent (and it must be feared that considerable displacement exists) all the labor of removing them will of necessity have to be gone through, if, as specified, the wall has to be so relaid as to admit of bonding and clamping with iron throughout.

12. All such work, it must be remembered, has to be carried out by the tedious, expensive, and in many respects unsatisfactory agency of divers, to say nothing of the time occupied in slinging and removing each individual block and subsequent resetting.

13. If, therefore, the choice of systems is to be confined to (A) and (B), the Committee have no hesitation in recommending the latter, as the saving in outlay would be Rs. 5,72,401 (see Table No. 1), and in time not much less than a year. The small curtailment of the area of the harbour would practically be inappreciable, and should not, they consider, militate against such undoubted advantages.

14. But before arriving at a final decision regarding the most approved method of construction, it is necessary to consider the objections which have been urged against System (C), which the Home Committee, in paragraph 20 of their report, admit to "possess advantages," and to be, as regards construction, "a safe system to follow."

15. The first objection, if, indeed, it can be called one, is, that "it would be necessary to build a short length of wall at the end of each pier upon which to place the entrance lights." Such small addition could be readily made to the work at any time; but it may be observed that at present there is no need for such, as vessels are frequently taken out of harbour whenever required by the aid of two common signal lanterns carried on boats stationed at each of the entrance buoys. The departure of vessels, moreover, after 9 P.M. has been prohibited by law with the sanction of the Government of India. The question of such additions to the ends of the piers may therefore be left out of consideration.

16. The second objection against the random block system is that "owing to the size of the vacuities amounting to between one-third and one-fourth of the mass, the seas may pass through sufficiently to produce some disturbance inside," and that "the sheltered area being limited, it is important that the whole space should be as quiescent as possible."

17. This objection would no doubt have much weight were the proposal to construct the core of the work *de novo* and throughout with random blocks; but the fact appears to have been overlooked that already the core has been constructed on the monolithic system, and that however the wall may be in places distorted and the material displaced, the blocks are, as a rule, so far in position as effectually to arrest any movement of translation in the seas which impinge on the breakwater.

18. Local experience shows conclusively that at present no wave undulations occur *through* the present wall. The seas which enter the harbour come through the entrance and through the gaps in the damaged portions, and the Committee consider that beyond some percolation through the mass of the upper blocks only it would be impossible for a forward movement to be transmitted to the water inside the harbour.

19. It must be borne in mind that during heavy storms the top water of the seas, which is discharged over the work into the harbour, not only has its forward momentum destroyed, but as a fact must, by raising the general level of the water inside, occasion an outward flow, which of itself must tend to counteract any undulatory movement in the direction of the shore. In the storm of the 12th November 1881 so powerful was the outward current occasioned by the piling up of the water inside the harbour that masula boats which got adrift were carried seaward through the entrance.

20. It is believed that none of the known breakwaters of other ports belonging to this type have a solid screen of the character now existing with the Madras Harbour, and consequently that any analogy based upon the effects noticed in works constructed wholly from random blocks must fail in application.

21. Although, therefore, recognizing the force of the objection urged against breakwaters composed of loose blocks, the Committee cannot admit its application to the Madras piers if completed under System C, and feel themselves in a position to submit that *primâ facie* there is no valid professional objection to the random block system of construction (C) in this case.

22. The expense as shown in Table I (Rs. 49,55,672), although less by Rs. 2,30,000 than System (A), exceeds that of System (B) by Rs. 3,42,000; but in the opinion of the Committee there are advantages connected with this method of construction which fully outweigh this apparent saving—

First.—As regards the time required for completion of the works, it is considered that from there being no need to employ divers and machinery in clearing the debris, levelling the base, &c., at least a year would be saved.

Secondly.—One large crane of special design on each pier would suffice for the whole work, whereas with the Systems A and B two additional cranes will be needed for forming the "wave-breakers."

Thirdly.—Comparatively small material may be employed for the hearting of the mounds, reserving the heavier blocks for the outer and more exposed portions.

Lastly.—And this is a matter of great importance; the requirements of all future repairs, both in respect to the superintendence and material to be maintained, would be simplified by the absence of a special diving staff.

23. In this connection it is only necessary to draw attention to the fact that, in case the work is completed on either of the monolithic Systems (A) or (B), the repairs of breaches (should such occur) of the seaward arms must occasion great delay and expense from the difficulty of access to the foundations with divers, and from the necessity of maintaining in readiness for all emergencies a skilled diving establishment. Not only so, but disastrous results might easily be produced where, as is not unknown, a second severe storm follows in the wake of the first. If such should happen with unrepaired breaches in the monolithic work, the flanks would almost certainly be destroyed, and the mischief might easily extend in such a manner as to call for very serious outlay.

24. Looking, therefore, to the favorable opinion expressed by the Home Committee as regards the safety of the random block system, and the many attendant advantages

above pointed out, the Committee give a decided preference to this method of construction of the three adverted to in the report under consideration.

25. The Committee now proceed to consider the subject submitted for their opinion in paragraph 3 of G.O., No. 1259 W., as to the propriety of reducing the width of the present entrance from 550 feet to 450 feet, and to submit an alternative scheme, should such reduction appear to be undesirable.

26. In reference to the feasibility of narrowing the width of the entrance in the manner proposed, the Committee have been favored with the following recorded opinion of two of their members, the Master Attendant and Deputy Master Attendant.

27. These officers observe :—"As regards the proposal of the Home Committee to narrow the entrance 100 feet, we consider that it will render it difficult and dangerous to a degree out of all proportion to any advantage that can be gained by it. A large amount of sea and swell must always enter from the eastward, and no comfort to the ships or the boating operations or to beach improvements can be expected till this evil is removed. The completed harbour walls existed long enough to teach this lesson. This is the opinion of all nautical men who have been consulted, and especially the Harbour Master, who has daily opportunities of judging and appreciating the difficulties that attend the entry of large steamers (many of them over 400 feet long) even with the present width."

28. With this very distinct opinion of the professional officers before them, an opinion, the validity of which it may be observed has long impressed itself on all who have had an opportunity of witnessing the effect of the waves which come in by the present entrance, the Committee have felt that their duty would be very inadequately performed if they left unnoticed this blot on the present scheme, or if they disguised from the Government their clear opinion, not only as to the infeasibility of narrowing the present entrance, but as to the vital necessity for closing the latter completely if a quiet harbour is to be secured.

29. No matter what the direction of the wind, the unceasing swell on this portion of the coast rolls in with the crests of the waves parallel, or very nearly so, to the coast line. In no case is it believed that the angle exceeds 30° to the general line of the coast. The result is that seas enter the present mouth freely, and, owing to the small length of the harbour, are not dispersed before reaching the shore at its base. The action is of course greatly intensified during storms, and particularly with the wind from the east. At such times the sea inside the harbour, though not so high as outside, is certainly of a dangerous character, being exceedingly broken. Taking these and other facts into consideration, the Committee have to record their opinion that unless means be found for closing entirely the present entrance, no radical cure will have been applied to the chief defect of the work as at present designed.

30. In this view they beg now to submit a plan for the completion of the harbour (see annexed drawings and estimates D, E, F), the leading features of which are—

(1) The opening of a new entrance 500 feet in width, in from 7 to 7½ fathoms of water at the north-east angle of the harbour.
(2) The closing of the present entrance.

31. Before stating the cost and advantages of this proposed arrangement, the Committee desire to draw attention to one or two matters which, while not in reality interfering with constructive details as recommended by the Home Committee, may show how these can be modified without disadvantage.

First, as regards the amount of protection to be given to the portions from the shore to point B on the north, and to point E on the south pier. The Home Committee adopt Section No. 2 (Drawing No. 2) for both alike, but, while admitting the expediency of such additional protection for the north, there is nothing to show that such is needed on the south pier. Not only has the seaward face here not in any way been attacked, but there is apparently no probability that such will occur in any storm that may arise on the coast.

The heaviest seas yet observed have invariably been from the north and north-east, and again on the south the sand accumulations already protect the work for a considerable distance, and show a tendency to advance seaward along this pier.

32. The proposed wave-breaker of rough blocks may therefore, in the opinion of the Committee, be omitted on the south arm with safety and the expense saved.

33. The next point is the proposed cap of concrete, 6 feet in thickness, along the same portions of both piers. In reference to this the Home Committee, in paragraph 21, observe that "raising the walls by concrete in mass will be the last process, as that portion of the work can only conveniently be done by beginning it at the outer extremities of the walls and working back towards the shore."

34. When it is remembered that using Systems (A) or (B) four years must certainly (and possibly five or even six years may) elapse before the remodelled piers are sufficiently advanced to receive as the finishing work this cap of concrete, it is clear that the Home Committee, though considering it desirable in many respects, and chiefly as a means for keeping seas from breaking too freely over the piers, did not attach any very indispensably constructive value to this portion of their design.

35. It is fair, in fact, to conclude that if constructively essential to the stability of the work, this concrete cap should advance *puri passu* with the rest of the work.

36. The Committee, in offering this remark, have no desire to interfere in any way with this portion of the design so far as concerns the seaward arms, where they believe that raising the walls in the manner proposed to 12 feet above high water will prove of very sensible value.

37. As regards, however, the piers from the shore to points B and E, they are satisfied, from the effects of the waves on these portions, as hitherto observed, that the proposed cap would be of no material advantage. From the way in which the waves approach the coast the piers are, as a rule, normal to their direction, with the result that only a comparatively small amount of water comes over them into the harbour, the great mass being invariably, it may be said, poured over the seaward arms. Such being the case, the Committee consider that this block of concrete may with complete safety be omitted from the portions indicated.

38. Towards meeting the expense of opening and protecting the proposed new entrance to the north-east and closing the existing entrance there would be savings on the two items mentioned, viz. :—

(1) By the omission of the random block wave-breaker along the south pier to E.
(2) By the omission of the concrete cap from the shore to B on the north and to E on the south pier. The actual savings in cash outlay due to these modifications will be found further down, where is shown the probable cost of the harbour as thus completed, and here it will be desirable to advert to the formation of the proposed new entrance at the north-east angle of the harbour.

39. The position is shown on the tracing to lie between the 7 and 7½ fathom lines, and the width to be 500 feet.

40. On this point the Master and Deputy Master Attendants have supplied the following observations :—

"(1.) The proposed entrance to the north may safely be narrowed to 500 feet, because the cross currents and winds that affect the east entrance will no longer exercise a troubling effect.

"(2.) The proposed entrance to the north in 7 fathoms will allow of the whole deep water space being utilized, which is impossible under the conditions of the eastern entrance, and deep water space is especially valuable in a basin like the Madras Harbour."

41. The Committee have adopted the conclusions as above stated, and also one to the effect that the protecting horn should be not less than 600 feet in length, carried out tangentially to the curve at the north elbow, and curved slightly to the east, in order the better to deflect the seas from the entrance and from the north arm, and to give a *vena contracta* form of entrance for the more easy passage of vessels. Looking to the general parallelism of the crests of the waves to the shore, it is doubtful whether in practice so long a protective horn will be found to be indispensable, but as it is better to err on the safe side, the Committee have provided for one 600 feet long in the estimate.

42. As a matter of detail it may here be mentioned that the concrete blocks which now encumber the work at this point will in all probability be broken up by

dynamite, and the debris with the rubble base, down to a depth of 6 fathoms, removed by dredging.

43. The closing of the existing entrance will proceed so soon as the new north-east one has been worked out, and the final operation will be the construction of the horn. As the whole of the seaward arms can by this manner be dealt with continuously, only one titan crane would be needed, in case either of the Systems (A) or (B) is adopted, or one set of travellers if System (C) be decided on.

44. The following are the financial results of the above method of dealing with the harbour according to the system which may be approved :—

	RS.
(1.) If completed on Sections 1, 2 and 3, the present entrance closed also by Section No. 3 and entrance on north opened.	54,18,717
(2.) If completed on Sections 1, 2 and 4, the present entrance being closed on Section No. 3	50,26,348
(3.) If completed on Sections 1, 2 and 5, the present entrance being closed on Section No. 5 (random block-work) ...	51,42,636

(The cost of wave-breaker on south arm and concrete cap to both arms is omitted in these estimates.)

For detailed estimates see the appendices.

45. For the reasons before assigned, the Committee would strongly recommend the completion of the work on the random block system.

46. The Committee would here solicit attention to the following recorded observations by the Master and Deputy Master Attendants in reference to the above proposals :—"We," they observe, "consider that if the sea face is closed, and a height of 12 feet given to the sea wall, that much of the character of a protective work to shipping, under which sanction to it was first obtained, will be restored, and the question of sending ships to sea on approach of bad weather need no longer be considered."

47. To those who are acquainted with the fact that the main object of the late Lord Hobart in pressing the necessity of a harbour on the attention of the Secretary of State was the beneficent and humane idea of sheltering vessels in port from the dire effects of the cyclones, which unhappily but too often visit the Coromandel Coast, and which since the advent of European shipping have occasioned such fearful losses in life and property, the true import of the proposals now submitted will, it is hoped, be sufficiently obvious.

48. It is believed that Mr. Parkes never claimed for his work the character of a harbour of protection, and certainly the cyclone of the 12th November 1881 tended to show that, far from being an efficient protection to the shipping inside, it might on such occasions prove to be, as it were, a trap from which escape might be difficult and at times perhaps impossible.

49. The fear, indeed the certainty, that such would prove to be the result has, it may be said, imposed a much more severe responsibility on the Marine authorities than was the case when no harbour existed.

50. With the present eastern entrance unchanged, this extreme danger to shipping, and this terrible responsibility for life and property, must remain, no matter what the system adopted for the completion of the rest of the work; and to allow matters to remain as they are will add the evil of a perpetual and dangerous reef in front of Madras in the form of the present ruined piers.

51. Under the proposals now submitted, not only will, it is believed, the unexpected boon of a harbour of protection be conferred on Madras, but Imperial significance will be given to this great work, which, if finished in the manner suggested, could in time of war afford shelter and protection to the vessels of Her Majesty's navy, as also to all merchantmen who could make the port.

52. The Home Committee, in many parts of their report, correctly draw attention to the unduly small area of the present harbour, not much more than the outward half of which is suited for mooring vessels of any draft; but, as will no doubt at once be recognized, the proposals above made must, by affording the means, whenever desired, of dredging out the shallow portions to any required depth, admit of doubling the useful area.

53. An operation of this character, it is almost needless to say, could never be carried out so long as the present entrance remains open, the disturbance inside the harbour being such that, with the exception of a very few days each year, would render dredging operations impossible, excepting at an altogether prohibitive outlay.

54. Not only would the advantages here enumerated be secured, but in many other respects, such as the possibility of ~~moving~~ ships much closer together than is at present feasible, bringing ships much closer to the shore, establishing wharfs, jetties, &c., facilities to the trade of the port may be increased indefinitely.

55. The total cost of the work remodelled as recommended will, as shown, be Rs. 51,42,636 as compared with that of the Home Committee System A, Rs. 50,93,980. Practically, therefore, the two methods of dealing with the harbour may be considered as costing much the same.

(Signed) R. H. SANKEY, Colonel, R.E.
(„) J. O. HASTED, Colonel, R.E.
(„) J. H. TAYLOR, Lieutenant, R.N.R.
(„) T. E. MARSHALL.
(„) F. N. THOROWGOOD.
(„) N. St. B. BEARDMORE.*
(„) C. BOWEN, Major, R.E., Secretary.

20th June 1883.

Note by Mr. Beardmore on paragraph 41.

I consider it important that, in order to adequately protect the proposed north-east entrance, the protecting breakwater should be at least 650 feet in length measured from the eastern tangent point of the north pier, and that if it is thus constructed, an excavation through the old rubble base of 400 feet in *bottom* width will prove to be sufficient, and indeed better in checking north-eastern seas from entering the harbour.

(Signed) N. St. B. BEARDMORE.

MADRAS HARBOUR.

APPENDIX TO REPORT OF THE COMMITTEE APPOINTED IN G.O., No. 1259 W., DATED 30TH APRIL 1883.

ESTIMTAE of cost of restoration as proposed by the Home Committee, and as modified by the Special Local Committee.

Quantities and Prices by the Superintendent of the Madras Harbour Works.

NOTE.—The total lengths of the two piers, as shown by the figured dimensions in the plan accompanying the Home Committee's Report, do not agree with the actual lengths of work to be executed, but are 218 feet short of such lengths.

The following estimates are made with the corrected lengths for obtaining an entrance of 450 feet, viz., 3,916 feet for the north pier and 4,020 for south pier.

The lengths for each section of the Committee's proposal therefore are altered thus:—

	North Pier	(on Plan).	South Pier	(on Plan).
Section No. I	426	(400)	680	(650)
Section No. II	1,800	(1,800)	1,750	(1,750)
Sections Nos. III, IV, V	1,690	(1,600)	1,590	(1,520)
Total ...	3,916	(3,800)	4,020	(3,920)
Difference ...	116 feet.		100 feet.	

Total Difference ... 216 feet.

Both dimensions are shown in the plan accompanying these papers.

Estimate for Section No. I.

	FEET.
Length—North Pier	426·0
South do.	680·0
Total ...	1,106·0

Per lineal foot of Pier.

	RS.	A.	P.
Additional rubble...18·0 × 6½ × ½ = 58½ c. ft. = 3 tons at Rs. 1-8-0 =	4	8	0
Concrete topping ...24·0 × 4½ × 1·0 = 108 = 4 c. yds. at „ 12-0-0 =	48	0	0
Iron cramps ...44 lb. per lineal foot at ½ anna ... ... =	1	6	0
Total per lineal foot ...	53	14	0

For both Piers.

	RS.	A.	P.
1,106 lin. ft. at Rs. 53-14-0 ... ... =	59,585	0	0
Deduct for 480 lineal feet at south pier, thoroughly protected by sand and not needing rubble. Rubble 480 ft. with 3 tons to 1 ft. = 1,440 tons at Rs. 1-8-0 ... =	2,160	0	0
	57,425	0	0

Total for Section No. I, Rs. 57,425.

Section No. II.

	FEET.
Length—North Pier	1,800
South do.	1,750
	3,550

Per lineal foot of Pier.

Additional rubble—

	C. FT.
110·0 × 8½ × ½ =	467½
55·0 × 5½ × ½ =	151¼

	RS.	A.	P.
618¾ = 31 tons, at Rs. 2 ...	62	0	0
Concrete blocks in wave-breaker— 50 × 20/2 × 1·0 = 500 c. ft. = 18·5 c. yds., at Rs. 11	203	8	0
Concrete topping— 24·0 × 6·0 × 1·0 = 144 = 5⅓ c. yds., at Rs. 12 ...	64	0	0
Per lineal foot ...	329	8	0
For both piers 3,550, at Rs. 329-8-0	11,69,725	0	0
Add for 415 feet of piers to be cramped at Rs. 1-6-0 per foot	570	10	0
Total value of work, Section II ...	11,70,295	10	0

Section No. III.

	FEET.
Length—North Pier	1,690
South do.	1,590
Total ...	3,280

Per lineal foot of Pier.

Additional rubble—

79 × 18 × ½ = 711

65 × 17½ × ½ = 568¾

8·0 × 2·0 = 16

63·0 × 2·0 × 1·0 = 126

	RS.	A.	P.
1,421¾ cubic feet = 71 tons, at Rs. 2 =	142	0	0
Concrete blocks in wave-breaker— 65·0 × 23·0/2 = 28 cubic yards, at ... ... „ 11 =	308	0	0
Concrete blocks in regular work— 28·0 × 6·0 × 1·0 24·0 × 24·0 × 1·0 = 744 cubic feet = 27⅗ c. yds., at „ 11 =	303	0	0
Preparing base by removing old blocks, &c., per lineal foot, at ... ... „ 134 =	134	0	0
Concrete topping— 24·0 × 5·0 × 1·0 = 4½ yards at ... ... „ 12 =	54	0	0
Concrete bags— 20·0 × 2·0 × 1·0 = 40 cubic feet = 1½ c. yds., at „ 11 =	16	8	0
Two cramps or 88 lb. per foot, at ½ anna per lb.	2	12	0
	950	4	0
Deduct for old blocks recovered in foundation one-seventhth of the wave-breaker at 4 yards per foot, at „ 11	44	0	0
Total per lineal foot ...	916	4	0

Section No. III, 3,280 lineal feet, at Rs. 916-4-0 per foot, Rs. 30,04,480.

Section No. IV.

Alternative Section per No. III. Total length, 3,280 feet. Per lineal foot of Pier.

Additional rubble—

	C. FT.		RS.	A.	P.
$62·0 \times \frac{24}{2} \times 1·0 =$	744				
$50 \times \frac{24}{2} \times 1·0 =$	600				
	1,344	= 67 tons, at Rs. 2 =	134	0	0

Concrete blocks in wave-breaker—

	C. FT.		RS.	A.	P.
$40·0 \times \frac{26}{2} \times 1·0 =$	520				
Concrete blocks in regular work—					
$28·0 \times 6·0 \times 1·0 =$	168				
$24·0 \times 24·0 \times 1·0 =$	576				
	1,264	= 47 c. yds., at Rs. 11 =	517	0	0
Concrete topping—					
$24·0 \times 5·0 \times 1·0 =$		4½ cubic yards, at Rs. 12 =	54	0	0
Preparing base at per lineal foot		... . „ 40 =	40	0	0
Apron bags $20·0 \times 2·0 \times 1·0 =$ 1½ cubic yards		at „ 11 =	16	8	0
Two cramps to each course, per foot		... ... =	2	12	0
		Per lineal foot ...	764	4	0

3,280 feet of piers at Rs. 764-4-0 = Rs. 25,06,740.
Total per Section No. IV, Rs. 25,06,740.

Section No. V.

(Random Blockwork.)

Length same as No. III and No. IV, 3,280 feet.

Additional rubble—

	C. FT.		RS.	A.	P.
$90·0 \times 2·0 \times 1·0 =$	180·0				
$60·0 \times \frac{17}{2} \times 1·0 =$	510·0				
$85·0 \times \frac{18}{2} \times 1·0 =$	765·0				
$37·0 \times \frac{19}{2} \times 1·0 =$	351·6				
$50·0 \times \frac{17}{2} \times 1·0 =$	425·0				
	2,231·6	= 112 tons, at Rs. 2 =	224	0	0
Concrete blocks at random—					
$60·0 \times \frac{24}{2} =$	720				
$42·0 \times \frac{18}{2} =$	378				
$30·0 \times 24 =$	720				
	1,818	= 67⅓ cubic yards, at Rs. 11 =	740	0	0
Concrete topping and bags—					
$30·0 \times 8·0 \times 1·0 =$ 240		= 9 c. yds., at, say, Rs. 12 =	108	0	0
			1,072	0	0
Deduct for random blocks in ruined work about—					
$60 \times \frac{18}{2} \times 1·0 =$ 20 cubic yards,		at Rs. 1 ... =	220	0	0
		Per lineal foot ...	852	0	0

For both piers, 3,280 feet, at Rs. 852 = Rs. 27,94,560.

ALTERNATIVE PROPOSALS.

Estimate for full Section No. III (without any old work) to be used for closing eastern opening. Per lineal foot of Pier.

Memo.—The rubble base is to extend 33 feet from edge of blocks to top of slope on Harbour side.

Rubble base in 48 feet water—

		RS.	A.	P.
$75 \times \frac{21}{2} =$ 787½				
$75 \times \frac{50}{2} =$ 1,875				
$61 \times 26 =$ 1,586				
$42 \times \frac{20}{2} =$ 420				
4,668½ = 233 tons, at Rs. 2 =	... ...	466	0	0
Value of No. III Section without taking credit for old blocks per foot and without Rs. 134 for preparing base	... ...	826	0	0
Per lineal foot	... ...	1,292	0	0
Taking 500 feet as the additional amount of rubble base required at Rs. 466 =	... ...	2,33,000	0	0
And 550 feet for blockwork at Rs. 826 =	... ...	4,54,300	0	0
Total for closing entrance with No. III Section	...	6,87,300	0	0

For making a Northern Entrance.

Excavation of rubble for 600 feet in length—

	RS.	A.	P.
$40·0 \times 3·0 =$ 120·0 cubic feet.			
$41·0 \times \frac{19}{2} =$ 389·6 „			
$54 \times 17 =$ 918·0 „			
$43 \times \frac{15}{2} =$ 322·6 „			
$1,750·0 \times 500 =$ 32,107 c. yds., at Rs. 4 =	1,29,628	0	0
Excavation and removal of blocks— $28·0 \times 20 = 560 \times 500 =$ 10,333 c. yds., at Rs. 8 =	82,664	0	0
	2,12,292	0	0

Building a protective arm, 400 feet long, in Section No. 3, but without heavy charge for preparing base.

	RS.	A.	P.
600 of full Section No. III, at Rs. 1,292 per foot = ...	7,75,200	0	0
Deduct for value of old blocks recovered enough to make one-fourth wave-breaker or 7 cubic yards, at Rs. 11 = Rs. 77, for 400 feet	30,800	0	0
	7,44,400	0	0
Add for pier head-work	20,000	0	0
	7,64,400	0	0
	2,12,292	0	0
Excavation as above	9,76,692	0	0

Savings effected by making north-east entrance owing to there being less pier to build.

	RS.	A.	P.
(*a*) In Section No. III— 600 feet, at Rs. 916-4-0 per foot	5,49,750	0	0
(*b*) In Section No. IV— 600 feet at Rs. 764 per foot	4,58,400	0	0
Deduct lump sum for extra work in crossing over line of north pier for outer horn	50,000	0	0
Nett ...	4,08,400	0	0
(*c*) In Section No. V— 600 feet, at Rs. 852	5,11,200	0	0

Whole Section No. 5 for closing eastern entrance and building outer horn.

Rubble base (48 feet per lineal foot water)—

$65{\cdot}0 \times \frac{21}{2} = 682{\cdot}5$

$155{\cdot}0 \times \frac{27 + 24}{2} = 3{,}952{\cdot}5$

$72{\cdot}0 \times \frac{25}{2} = 900{\cdot}0$

	RS.	A.	P.
5,535·0 = 276 tons, at Rs. 2 =	552	0	0
Concrete blocks (as before) 67⅓ cubic yards, at „ 11 =	740	0	0
Concrete topping and bags 9 cubic yards, at „ 12 =	108	0	0
	1,400	0	0

		RS.	A.	P.
For closing entrance—				
500 feet rubble work, at Rs. 552 per foot = ...		2,76,000	0	0
550 feet blockwork at „ 848 do. = ...		4,66,400	0	0
		7,42,400	0	0
For building extra horn, 600 feet, at Rs. 1,100.	6,40,000			
Deduct for old blocks	30,800			
	6,09,200			
For work in pier head	20,000	6,29,200	0	0
		13,71,600	0	0

Saving by doing away with south pier wave-breaker to 1,750 feet and with concrete topping on Sections I and II.

	RS.	A.	P.
No. I Section—			
1,106 feet concrete top, at Rs. 48 = ...	53,088	0	0
No. II Section—			
3,550 feet concrete top, at Rs. 64 = ...	2,27,200	0	0
Wave-breaker, south pier—			
1,750 feet blocks, at Rs. 203-8-0 = ...	3,56,125	0	0
Rubble 1,780 feet, at Rs. 62 = ...	1,08,500	0	0
	7,44,913	0	0

SUMMARY OF ESTIMATES.

				RS.
(A.)	Restoring as per Sections I, II, and III	with 450 feet entrance.		51,85,580
	Do. do.	with 550 do.	...	50,93,980
(B.)	Do. Sections I, II, and IV	with 450 do.	...	46,13,179
	Do. do.	with 550 do.	...	45,36,779
(C.)	Restoring as per Sections I, II, and V	(450 feet cut)	...	49,55,672
	Do. do.	(550 do.)	...	48,70,472

ALTERNATIVE PROPOSALS.

With 500 feet entrance to the north-east abolishing concrete *capping on innerportion* of work, and wave-breaker *to inner portion* of south pier.

		RS.
(D.)	Restoration being carried on as Sections I, II, and III, and extra work built as Section III	54,18,717
(E.)	Restoration to be carried on as in Sections I, II, and IV, extra work being as Section III	50,26,348
(F.)	Restoration and extra work to be done as in Section V (Random Work). Memo.—This will be the *quickest* work	51,42,636

For blocks on stock a credit of Rs. 1,30,630 may be taken for every section.
Rs. 60,000 added for extra titan roads and rails omitted in detailed estimate.

9

SUMMARY OF ESTIMATES.

(A.) Estimate for restoring Harbour as proposed by Committee, in Sections I, II, and III.

	RS.
Total value for Section No. I	57,425
Do. do. No. II	11,70,295
Do. do. No. III	30,04,480
	42,32,200
Plant—	
Two titan cranes complete, at Rs. 45,000	90,000
Two cranes for setting wave-breakers, at Rs. 30,000	60,000
New railway lines, 230 tons of permanent-way material, at Rs. 100	23,000
200 tons titan rails, at Rs. 100	20,000
4,000 sál-wood sleepers, at Rs. 4-8-0	18,000
16,000 lineal feet titan roads, at Rs. 4	64,000
One Goliath crane, restored	2,000
	45,09,200
Add 15 per cent. for Establishment and Contingencies ...	6,76,380
	51,85,580
If with 550 feet entrance, deduct 100 feet, at Rs. 916	91,600
	50,93,980

SUMMARY OF ESTIMATES.

(B.) Estimate for restoring Harbour as proposed by Committee in Sections I, II, and IV.

	RS.
Total value for Section No. I	57,425
Do. do. „ II	11,70,295
Do. do. „ IV	25,06,740
	37,34,460
Plant, as for Sections I, II, and III	2,77,000
	40,11,460
Add 15 per cent. for Establishment and Contingencies ...	6,01,719
	46,13,179
If with 550 feet entrance, deduct 100 feet, at Rs. 764 ...	76,400
	45,36,779

SUMMARY OF ESTIMATES.

(C.) Estimate for restoring Harbour as proposed by Committee in Sections I, II, and V (Random Blocks).

	RS.
Total value for Section No. I	57,425
Do. for Section „ II	11,70,295
Do. for Section „ V	27,94,560
	40,22,280

4

		RS.
Plant—		
Two special titan cranes capable of setting regular work, and overhanging enough to build random blocks		1,60,000
Other plant as before, less the two extra cranes		1,27,000
		43,09,280
Add 15 per cent. for Establishment and Contingencies		6,46,392
		49,55,672
If with 550 entrance, deduct 100 feet, at		85,200
		48,70,472

COMMITTEE'S ALTERNATIVE PROPOSALS.

First Alternative.—To close present entrance by Section No. 3, and open one to the north, extending the eastern part of the breakwater 400 feet as an overlap to the entrance.

		RS.
(D.) Estimate for repairing by Sections I, II, and III, see Summary of Estimates (A)		42,32,200
Deduct 100 feet for making 550 feet entrance		91,600
		41,40,600
Add—		
For building across entrance		6,87,300
Do. 400 of protecting arm		7,64,400
Excavating and opening north entrance		2,12,292
		58,04,592
Deduct saving as shown (*a*) on page 11	5,49,750	
Also saving as shown on page 12	7,44,913	
		12,94,663
		45,09,929

Closing North Entrance.

Plant—		
One titan crane	45,000	
One crane for wave-breaker	30,000	
Other plant as in Summary of Estimates (A)	1,27,000	
		2,02,000
		47,11,929
Add 15 per cent. for Establishment and Contingencies		7,06,788
Grand Total ...		54,18,717

(E.) Estimate for closing eastern entrance and opening one to the north, the work being restored mainly on Sections I, II, and IV.

Value of restoring work by I, II, and IV (as shown in Summary of Estimates (B)	37,34,460
Deduct for 100 feet to restore 550 entrance	76,400
	36,58,060
Add—	
For building across entrance	6,87,300
600 feet of protecting arm	7,64,400
Excavating and opening northern entrance	2,12,292
	53,22,052

		RS.
Deduct—		
Saving as shown (*b*), page 11	4,08,400	
Also as shown on page 12	7,44,913	11,53,313
		41,68,739
Plant as before		2,02,000
		43,70,739
Add 15 per cent. for Establishment and Contingencies		6,55,609
Grand Total ...		50,26,348

(F.) Closing eastern entrance and opening one to north, with Sections I, II, and V.

Memo.—The entrance is supposed to be closed and the extra protective built on Section 5.

Restoring work, Sections I, II, and V with 450 feet entrance ...		40,22,280
Deduct for 550 feet entrance, 100 feet		85,200
		39,37,080
Add—		
Building across entrance		7,42,400
Do. extra protective arm		6,29,200
Excavation in north pier		2,12,292
		55,20,972
Deduct—		
Saving as shown (*c*) on page 11	5,11,200	
Also as shown on page 12	7,44,913	12,56,113
		42,64,859
Plant—		
One special titan	80,000	
Other plant as before	67,000	2,07,000
		44,71,859
Add 15 per cent. for Establishment and Contingencies		6,70,777
		51,42,636

Detailed Remarks on Prices and Methods of carrying out work suggested.

Rubble Stone for Base and Foreshore.—The rubble for base and foreshore is to be clean, hard syenitic rock from Pallávaram, similar to what has been used hitherto from that quarry. The price is generally taken at Rs. 2 per ton deposited in the sea, but for the shore ends of the piers, for protective work, Rs. 1-8-0 per ton has been taken. The ton has been taken as 20 cubic feet, and this is arrived at by frequent measurements and weighings. The price is based on what has already been done in depositing 800,000 tons of rubble, the cost of which varied from Rs. 1-8-0 to Rs. 2-4-0 per ton, the latter price being exceptionally high. The rubble will be deposited from large boats propelled by oars; also by being thrown from the piers and by being tipped by the overhanging crane. No steam hopper barges will be needed. The stones will vary in weight from 3 lb. to 300 lb.

2. *Concrete Blocks.*—The concrete blocks will be similar in composition to those made latterly for the damaged piers, of which 12,563 cubic yards are now on stock. The Madras local cement may, however, be used as much as possible, but this does not materially affect the price.

The cost of the concrete blocks per cubic yard has latterly been Rs. 8·90 in the yard, and the cost of setting by means of divers has been sometimes below Rs. 2, and sometimes a little above Rs. 2 per cubic yard, including all charges. Therefore the price chosen in the estimate of Rs. 11 is fair.

Concrete Topping and Concrete in Bags.—This has been taken at Rs. 12, as there will be more waste of cement in mixing, and the materials will have to be carried along the piers for mixing *in situ*, thus adding to their cost before they are converted into concrete.

Iron Cramps.—Iron cramps are taken at ½ anna lb. fixed in the blocks with cement. The price is based on actual work done.

Preparing foundations on site of ruined work.—This is a difficult item to estimate, as we have no similar experience. We know that it will be very tedious and difficult. There was a time in the north pier work when there was 7 feet of excavation to be carried on in laterite rubble. This reduced progress to nearly a standstill, and took a very strong diving force. The amount of material to be shifted was more than equal to a course of blocks. It was found to cost Rs. 134 per lineal foot. This price has been selected as the cost per lineal foot of preparing foundation in ruined work. It may cost twice as much.

Method of setting Blocks in Sections III and IV.—It is supposed that for the actual piers two titan cranes will be required, in which there should be some alterations and improvements. For depositing the blocks in the wave-breakers other cranes should be used, of special design, with their overhang extending on each side of the blocks. They should be capable of holding 30 tons with an overhang of 40 feet.

The blocks for the wave-breakers should be "tripped" and not lowered by lewis bolts.

Crane Roads.—The roads on which the setting machines (titan or similar cranes) travel are to be continuous. They should be 70 lb. flat-bottomed rails, fastened by fang bolts (not spikes) to teak longitudinal timbers 14" × 10". These timbers to be fixed to the blocks and built in.

Crane for Random Blockwork.—The cranes or crane required for this work must be one with enormous scope. It should be capable of carrying 30 or 40 tons at a radius of 50 feet, and should be on a circular girder to "jib" completely round. It will be absolutely necessary to deposit the blocks as far away from the centre line as possible, otherwise there will be no chance of retaining an even and solid road for the crane to advance upon.

Construction of Random Work.—To within 15 feet of low water no doubt rubble stone may be used as a hearting to the outer slopes of random work. But above this nothing but heavy blocks should be used, except for purposes of levelling up. If the individual blocks at the level of breaking sea are too light, say less than 25 tons, there is no stability in the random mound. At 6 feet above H. W. the work must be levelled and concreted up with bags, ready to receive the top course of blocks which must be brought up level enough to carry a railway as well as the crane roads.

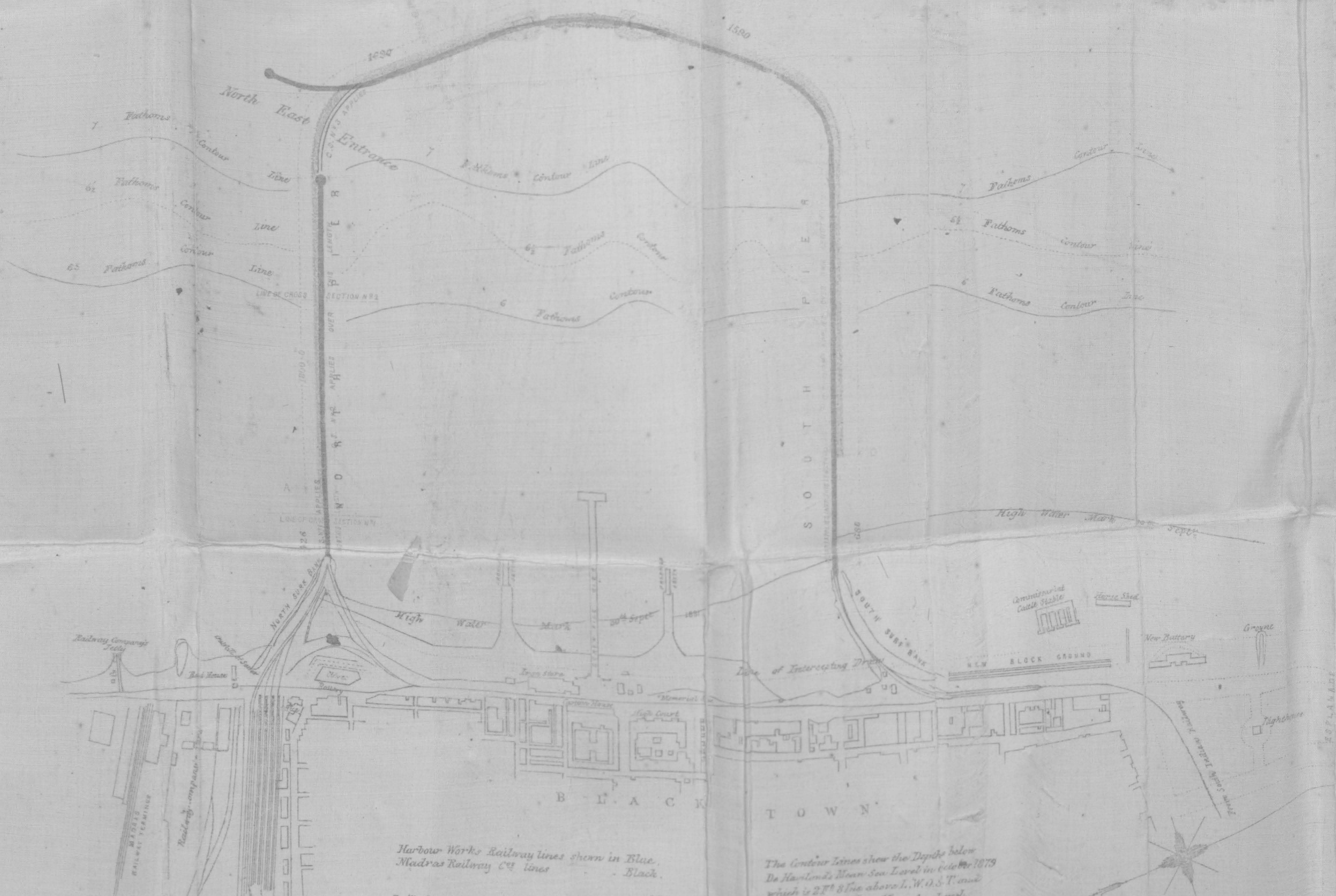
Estimate of Plant.—The estimate for plant is nothing more than a guess based upon the *known* cost of cranes, rails, sleepers, &c., as given by previous experience on these works. As the cranes are purchased as complete machines for a lump sum, it is not possible to enter into details except in communication with the builders in England.

Establishment and Contingencies.—It is believed that 7½ per cent. will be ample for "Establishment," but as in former experience 2½ per cent. was far too little for "Contingencies," it is judged safer to make the charge for the latter also 7½ per cent., which it is hoped will be more than sufficient.

MADRAS HARBOUR

PROPOSALS FOR RESTORATION BY MADRAS SPECIAL COMMITTEE

Plan showing North-East Entrance with protecting arm, suggested by Committee (with exceptions



Harbour Works Railway lines shewn in Blue.
Madras Railway Cº lines - - Black.

The Contour Lines shew the Depths below De Havilland's Mean Sea Level in October 1879 which is 2 Ft 8 Ins above L. W. O. S. T. and One Foot above True Mean Sea Level.

for Supt and Manager
Govt Lithc Depot, Chepauk

(Sigd) F. N. Thorowgood.
Supt Madras Harbour Works
21. 5. 83.

C. Bowers. Major. R. E.
Dy Chief Engineer P. W. D.

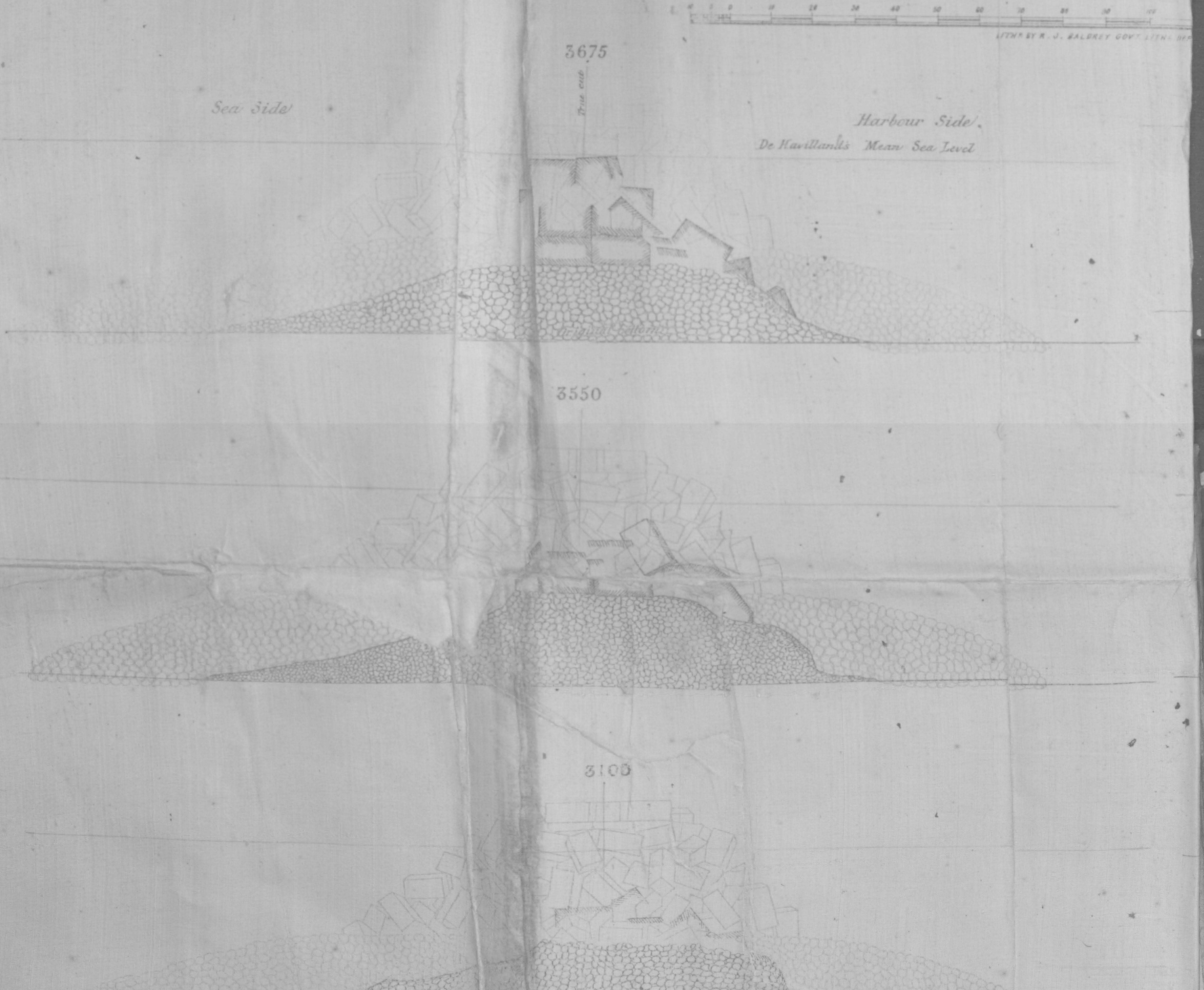
MADRAS HA

PROPOSALS FOR RESTORATION BY MA

Sections shewing actual state of piers in outer straight p

North Pier

Scale 20 Feet = 1 inch



NOTE The Sections at points as shewn measured from the point B. i.e. from the commencement of the Concrete Block Pier; and are shewn looking out to Sea so that the left hand side is the Sea side and the right hand side is the Harbour side

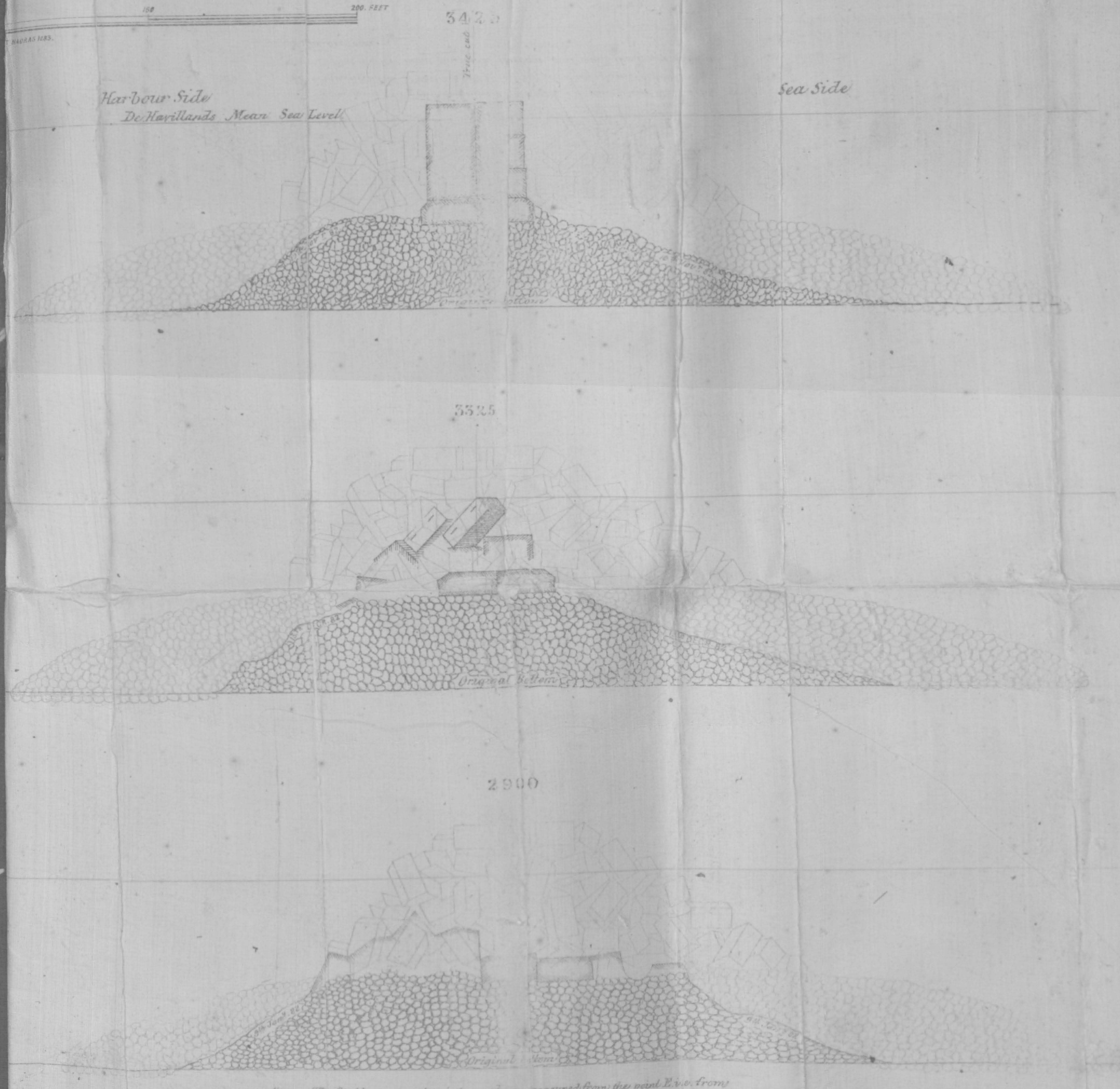
Supt. and Manager
Govt. Lithog. Dept. Chepauk
Madras. June 1883.

RBOUR

DRAS SPECIAL COMMITTEE

ortions, with random blocks over old work.

South Pier



Note. The Sections are at points as shewn measured from the point E. i.e. from the commencement of the Concrete Block Pier; and are shewn looking out to Sea so that the left hand side is the Harbour side and the right hand side is the Sea side

(Signed) F. N. Thornewood M.Inst. C.E.
Superintendent
Madras Harbour Works

C. Bowen Major R.E.
Dy. Chief Engineer P.W.D.

Memo by the Master and Deputy Master Attendant

1st As regards the proposal of the Home Committee to narrow the entrance 100 feet, we consider that it will render it difficult and dangerous to a degree, out of all proportion to any advantage that can be gained by it. A large amount of sea and swell must always enter from the Eastward, and no comfort to the ships, or the boating operations, or to beach improvement, can be expected, until this evil is removed. The completed Harbour walls existed long enough to teach this lesson. This is the opinion of all Nautical men, who have been consulted, and especially the Harbour Master, who has daily opportunities of judging and appreciating the difficulties that attend the entry of large steamers (many of them over 400 feet) even with the present width.

2nd The proposed entrance to the North may safely be narrowed to say 500 feet, because the cross currents and winds, that affect the East entrance, will no longer exercise a troubling effect.

3rd The proposed entrance to the North in 6 fathoms will allow of the whole deep water space being utilized, which is impossible

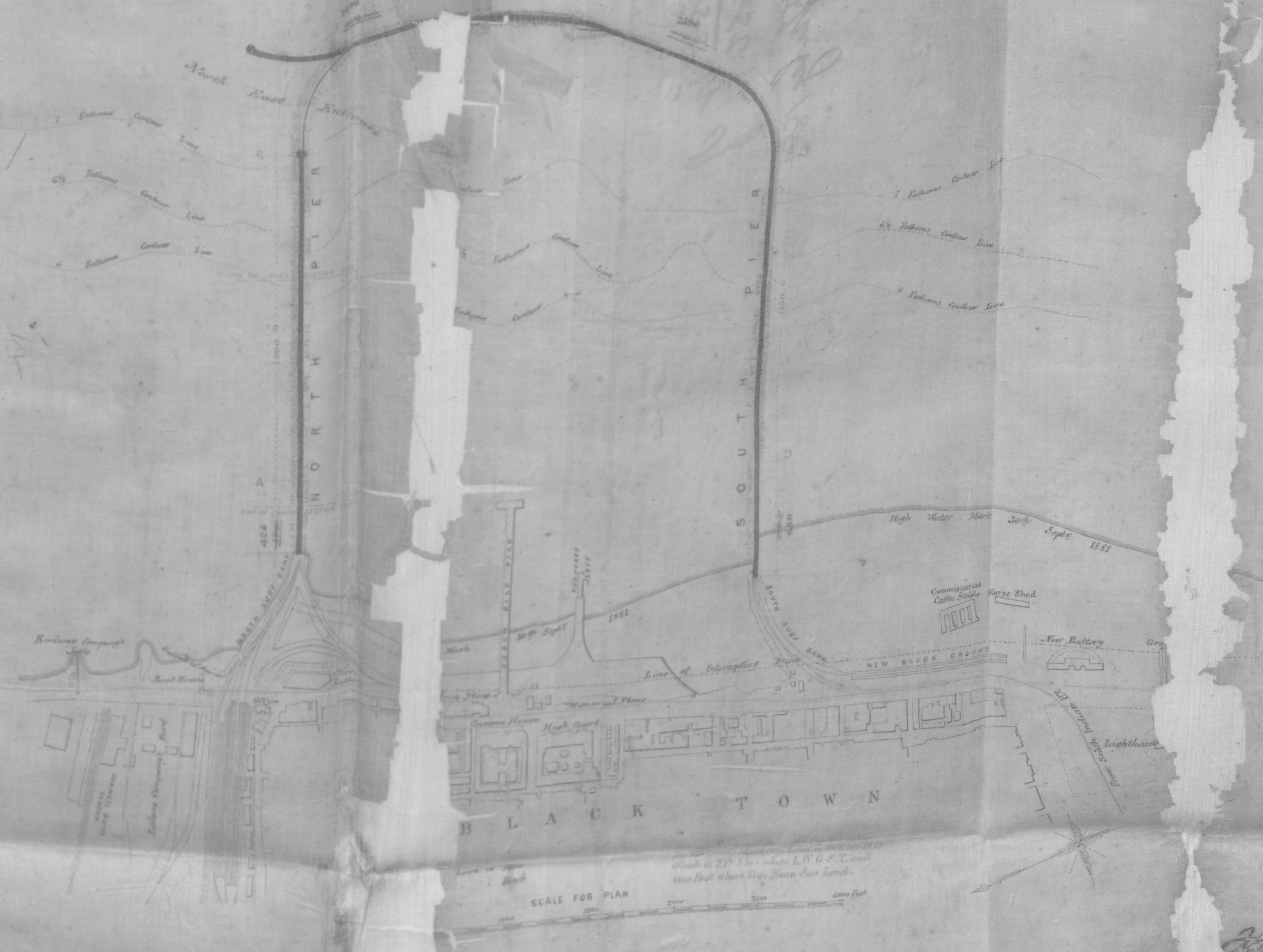
under

PROPOSALS FOR

MADRAS SPECI

Plan shewing North East Entranc

ig arm, suggested by Committee (with exceptions)



Supt. M.H. Works
21.5.83.

under the conditions of the East entrance, and deep water space is especially valuable in a basin like the Madras Harbour.

4th We consider that if the sea face is closed, and a height of 12 feet given to the sea wall, that much of the character of a protective work to shipping, under which sanction for it was first obtained, will be restored, and the question of sending ships to sea on approach of bad weather need no longer be considered.

5th As to the reconstruction we may state that setting aside the Engineering points upon which Nautical men may not claim any real knowledge, our experience, and that of all Commanders of ships whose opinions we have sought to obtain, must be held to be of value, in regard to the force and effect of the sea in storms, and we have found a complete consent to the theory that a random block system would best suit all conditions of the situation and treacherous character of the bottom.

6th The lighting is a minor consideration, which can be easily and economically effected, say by an iron tripod of 40 feet above HW, which can be well supported by the extra width to be afforded to the wall.

W Taylor

Hale

Memo by Master & Dy. Master
attendant [illegible]

(C)

Notes on the repairs of the Madras Harbour on the joint Report of Sir John Hawshaw F. R. S, Sir John Coode and Professor Stokes

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The height of the new walls as proposed by the London Committee, Viz 12 feet above high water mark, is considered very desirable from E to E across the whole sea face but some modification might be adopted on the shore piers.

2 The Committee's proposal to leave the Eastern entrance to the Harbour in statu quo is disapproved of, and the closing of the same is considered of greatest importance, as the only means of insuring still water enough to admit of beach improvements, close berthing of ships, and other desiderata.

3 That the restoration be conducted with as little reduction of area as possible, the Harbour being already too small.

4 With regard to the width of the present entrance, the Committee propose to reduce the same by 100 feet, ie from 550 feet to 450. With an Easterly entrance the present

present width should be maintained, as all Vessels during a fresh monsoon, North East or South West, are obliged to enter the Harbour at an Angle. But with an entrance to the Northward, the reduction proposed might be safely carried out.

5 In planning an entrance to the Northward two essentials required will be to place it in as a great depth of water as possible, and to have a projecting Eastern wall to protect the entrance from North East seas during the months of November, December and January.

6 The London Committee having carefully considered the question of reconstructing the outer walls, from B on the North pier and E. on the South, by mounds of random concrete blocks, acknowledge that it possesses advantages, and as regards construction state that it is a safe system to follow. They, moreover, practically acknowledge that, if the old consolidated foundation is to be built upon by picking up the old blocks which are buried in the debris for preparing a sufficiently level bed

on

on the site of the destroyed wall, it will involve great labour and expense, and they further add that this method of reconstruction may, after all, be found positively impracticable. Of this there is no doubt. They have, however, 2 objections to the random system. The first is that the lights required for the entrance cannot be constructed. This objection arises from a want of local knowledge, as Vessels are frequently moved out of the Harbour with the aid of 2 Common signal lanterns held up in 2 boats stationed at each buoy off the entrance.

7 The exit of Vessels after 9 P.M. has been prohibited by law, with the sanction of the Government of India, so that the consideration of this question may safely be postponed sine die. There remains therefore one single objection to the random method, and on this the Committee remark as follows.- "Owing "to the size of the vacuities amounting "to between one fourth and one third "of the mass the seas may pass through "sufficiently to produce some disturbance

inside"

inside. Local experience goes to show that at present no wave undulations occur through the old wall, which must necessarily have become one consolidated mass. The seas that do enter the Harbour come over it and through the entrance. And in the event of the new work being thrown down over the old, we may safely presume beyond some percolation through the mass, it would be impossible for a wave undulation to pass through and enter the Harbour, so as to disturb the surface of the water inside. It would appear therefore that the "random" method would be the most feasible and least expensive method of repairing the outer walls of the Harbour, and of closing the Eastern entrance. The one great practical advantage to be gained by the "random" method is the comparative ease with which it can be raised or repaired, if the height of the work is lowered at any time by a heavy storm or sinks from time and the action of the sand at the bottom of the sea, which may disturb the

the perpendicular of the upright wall.

Notes by Capt Taylor on Harbour estimates.

GOVT. OF MADRAS } 1883. { P.W. DEPT.

SECRETARY.

CHEPAUK, 5th June 1883.

OFFICE NOTE. No 1296D

To Capt Taylor, R.N.

My dear Capt. Taylor,

I have just received from Ooty the accompanying single draft of proposed Report by our Harbour Committee. It has been initialled by Col: Hasted, whose proposed omission of the portion of para 51 is (Colonel Sankey says) a matter of some little importance & should be discussed.

Col: Sankey desires me to circulate the Report to you & all the members of the Committee in Madras with a request that you will freely comment on it and suggest modifications, eliminations, &c.

Would you then kindly peruse the draft & note below this whether you approve thereof, making at same time such comments as you think called for or any further suggestions, &c?

Also please obtain Mr Marshall's approval with any remarks he may desire now to offer.

Should you consider that any alterations in the draft Report are desirable that would materially alter the sense, I shall ask you by & bye to hold a meeting of the members in Madras to discuss & dispose of them.

Or should any other member consider any sensible alterations or eliminations necessary the same course will have to be pursued. I think, however, the general sense & views of the Committee have been fully embodied in Col. Sankey's draft, & it is not likely that any material alteration of its terms will have to be made.

When I receive the documents back from you I shall forward them to Messrs Thornhill & [illegible]. It is desirable the matter should be disposed of with the least practicable delay. I shall therefore feel extremely obliged by your dealing with it in the light of the above remarks at your earliest convenience. I remain,

Yours truly,

C Unwin

21.

I approve of the draft throughout but agree with Major Hasted that para 57 thereof be omitted as it appears to go a little beyond the scope of the present committee.

6th June
1883.

I approve of the draft throughout [illegible] of the plans carried out [illegible] would leave a Harbour which at some [illegible] will [illegible] the question of fortification applies to all the plans of the [illegible] as well as to this report and need not be dealt with in my opinion.

J W Taylor

6.6.83.

My dear Unwin,

I can do all that I am asked to do in the way of giving my ideas of prices — "A general Specification" for a marine work of this size is a thing I would rather not take in hand unless I am the Engineer of the work.

I can give further details of the plant — (which by the way will cost more than I have put down I fear). but I do not know how to give greater detail than "per cub. yd", "per ton" or "per sq. ft." for items —

I can't (it is not I won't) give a Specification so long as I am under Parker for his work, don't you see! I can record my opinion & that is all — Yours sincerely

F W Thornhill.

GOVT. OF MADRAS. 1883. P.W. DEPT.

SECRETARY.

CHEPAUK, 5th June 1883.

OFFICE NOTE. No 12978

To F. W. Thornhill Esq.

My dear Thornhill,

I have just sent to Capt. Taylor Col. Sankey's proposed draft Report of Harbour Committee for his approval or any suggested alterations he may wish to make. On his returning it I shall send it to you —

In the mean time I have to ask your attention to the following.

Col: Sankey says: "As regards the "revised Estimates I think it might "not be amiss if a general specification "and analysis of rates were to pre-"cede them ~~[illegible]~~ Please consult Mr. "Thornhill about this as if desir-"able he could draw it up easily."

Kindly let me know therefore if you can undertake this. I presume you have copies of the Estimates by you. It is desirable to dispose of the whole business with the least practicable delay — but your preparing this specification & information may take time.

Yours sincerely,

C Unwin

Original
of
Report

MADRAS HARBOUR.

REPORT OF THE COMMITTEE APPOINTED IN G.O., NO. 1259 W., DATED 30TH APRIL 1883, TO REPORT ON THE BEST MEANS FOR RESTORING THE WORKS OF THE MADRAS HARBOUR.

Dated 20th June 1883.

Report of the Committee appointed in G.O., No. 1259 W., dated 30th April 1883, to report on the best means for restoring the works of the Madras Harbour.

The Committee assembled under G.O., 30th April 1883, No. 1259 W., to consider the best means for giving effect to the proposals made for the completion of the Madras Harbour, have the honor to submit their report for the consideration and orders of Government.

2. The first point claiming attention is the probable cost of completing the works on the several systems suggested by the Home Committee in their report, dated London, 23rd January 1883.

3. As stated in paragraph 25 of that report, the estimates were based generally on the rates of work given by Mr. Parkes, but in some cases the Home Committee assumed higher ones with the results shown in the several appendices, which, though given in sterling, are apparently intended to be converted at two shillings to the rupee.

These estimates are professedly only approximate, or, as expressed by Mr. Parkes in paragraph 4 of his letter of the 10th February 1883, must be viewed "rather as illustrations of the general meaning of the authors, or at most as a basis for approximate estimate than as a basis for instructions to the Engineer who will be charged with the execution of the work."

4. In the appendices to the present report will be found estimates prepared by Mr. Thorowgood, which, though still in some degree approximate, will, it is hoped, from the intimate acquaintance of the framer with every detail of the work, prove to be very fairly accurate. It is only in regard to the cost of special plant (for which information is incomplete) that the Committee feel hesitation, but this is not a very material item.

5. The results as shown may be compared as follows, the £1 sterling being taken = 10 rupees in the Home Committee's estimates :—

TABLE No. I.

Systems for completing the works as given in the Home Committee's Report.	Home Committee's Estimate, including reduction of present Harbour entrance from 550 feet to 450 feet.	PRESENT COMMITTEE'S ESTIMATES—SEE APPENDICES.		Present Committee's Estimates more by [Column (4) — (2)].
		1. Retaining the present entrance.	2. Reducing the entrance to 450 feet.	
	RS.	RS.	RS.	RS.
(A.) As per Sections Nos. 1, 2 and 3 (*i.e.*, core of seaward arms constructed on immediate site of present work)	47,92,190	50,93,980	51,85,580	3,93,390
(B.) As per Sections Nos. 1, 2, and 4 (*i.e.*, core of seaward arms constructed on a new base some 60 feet on the harbour side of the present work)	42,92,170	45,36,779	46,13,179	3,21,009
(C.) As per Sections Nos. 1, 2, and 5 (*i.e.*, the seaward arms constructed entirely on the random block system)	[illegible]56,000	48,70,472	49,55,672	2,99,672

6. The chief reason for the excess of the present estimates is due to the item for superintendence and contingencies being taken at 15 instead of 10 per cent. in those of the Home Committee, and the rest to a more accurate appraisement of the rates of the work as based on an analysis of the previous accounts, and to the fact that the Home Committee's lengths of pier to be built are 216 feet short of actual requirements.

7. So soon as the system of construction to be adopted has been finally decided on by the Government, it will be desirable to ascertain through the Secretary of State the probable cost of the special plant, which, of course, will vary somewhat with the system, and then recast that portion of the estimate prior to final sanction.

8. The Home Committee, while giving their opinion (paragraph 17) that, as regards the seaward arms from point B on the north pier and E on the south pier, "it would be desirable, if it could be done, to continue the walls on the original foundations," admit that the picking up of the blocks "buried or nearly so in debris, for the purpose of resetting them, or preparing a sufficiently level bed on the site of the destroyed wall, will involve great labor and expense, and possibly even it may be found impracticable to continue the wall on the original foundations."

9. In their present estimate (System A, see table) the Committee have assumed that the plan of picking up and relaying the blocks is practicable, but they can only do so in the sense that while being possible it must of necessity be attended with very great delay and expense.

10. The Home Committee have, as will be observed, strong doubts as to the applicability of the plan, and would apparently unhesitatingly prefer the System B were it not for the curtailment of the area of the harbour which is involved in taking up a space 60 feet in width along the seaward arms.

11. On a full consideration of the state of the present work, the Committee are of opinion that it would be most undesirable to attempt to erect the new superstructure on the present work, as even where the lower blocks have got displaced or subsided only to a very trifling extent (and it must be feared that considerable displacement exists) all the labor of removing them will of necessity have to be gone through, if, as specified, the wall has to be so relaid as to admit of bonding and clamping with iron throughout.

12. All such work, it must be remembered, has to be carried out by the tedious, expensive, and in many respects unsatisfactory agency of divers, to say nothing of the time occupied in slinging and removing each individual block and subsequent resetting.

13. If, therefore, the choice of systems is to be confined to (A) and (B), the Committee have no hesitation in recommending the latter, as the saving in outlay would be Rs. 5,72,401 (see Table No. 1), and in time not much less than a year. The small curtailment of the area of the harbour would practically be inappreciable, and should not, they consider, militate against such undoubted advantages.

14. But before arriving at a final decision regarding the most approved method of construction, it is necessary to consider the objections which have been urged against System (C), which the Home Committee, in paragraph 20 of their report, admit to "possess advantages," and to be, as regards construction, "a safe system to follow."

15. The first objection, if, indeed, it can be called one, is, that "it would be necessary to build a short length of wall at the end of each pier upon which to place the entrance lights." Such small addition could be readily made to the work at any time; but it may be observed that at present there is no need for such, as vessels are frequently taken out of harbour whenever required by the aid of two common signal lanterns carried on boats stationed at each of the entrance buoys. The departure of vessels, moreover, after 9 P.M. has been prohibited by law with the sanction of the Government of India. The question of such additions to the ends of the piers may therefore be left out of consideration.

16. The second objection against the random block system is that "owing to the size of the vacuities amounting to between one-third and one-fourth of the mass, the seas may pass through sufficiently to produce some disturbance inside," and that "the sheltered area being limited, it is important that the whole space should be as quiescent as possible."

17. This objection would no doubt have much weight were the proposal to construct the core of the work *de novo* and throughout with random blocks; but the fact appears to have been overlooked that already the core has been constructed on the monolithic system, and that however the wall may be in places distorted and the material displaced, the blocks are, as a rule, so far in position as effectually to arrest any movement of translation in the seas which impinge on the breakwater.

18. Local experience shows conclusively that at present no wave undulations occur *through* the present wall. The seas which enter the harbour come through the entrance and through the gaps in the damaged portions, and the Committee consider that beyond some percolation through the mass of the upper blocks only it would be impossible for a forward movement to be transmitted to the water inside the harbour.

19. It must be borne in mind that during heavy storms the top water of the seas, which is discharged over the work into the harbour, not only has its forward momentum destroyed, but as a fact must, by raising the general level of the water inside, occasion an outward flow, which of itself must tend to counteract any undulatory movement in the direction of the shore. In the storm of the 12th November 1881 so powerful was the outward current occasioned by the piling up of the water inside the harbour that masula boats which got adrift were carried seaward through the entrance.

20. It is believed that none of the known breakwaters of other ports belonging to this type have a solid screen of the character now existing with the Madras Harbour, and consequently that any analogy based upon the effects noticed in works constructed wholly from random blocks must fail in application.

21. Although, therefore, recognizing the force of the objection urged against breakwaters composed of loose blocks, the Committee cannot admit its application to the Madras piers if completed under System C, and feel themselves in a position to submit that *primâ facie* there is no valid professional objection to the random block system of construction (C) in this case.

22. The expense as shown in Table I (Rs. 49,55,672), although less by Rs. 2,30,000 than System (A), exceeds that of System (B) by Rs. 3,12,000; but in the opinion of the Committee there are advantages connected with this method of construction which fully outweigh this apparent saving—

First.—As regards the time required for completion of the works, it is considered that from there being no need to employ divers and machinery in clearing the debris, levelling the base, &c., at least a year would be saved.

Secondly.—One large crane of special design on each pier would suffice for the whole work, whereas with the Systems A and B two additional cranes will be needed for forming the "wave-breakers."

Thirdly.—Comparatively small material may be employed for the hearting of the mounds, reserving the heavier blocks for the outer and more exposed portions.

Lastly.—And this is a matter of great importance; the requirements of all future repairs, both in respect to the superintendence and material to be maintained, would be simplified by the absence of a special diving staff.

23. In this connection it is only necessary to draw attention to the fact that, in case the work is completed on either of the monolithic Systems (A) or (B), the repairs of breaches (should such occur) of the seaward arms must occasion great delay and expense from the difficulty of access to the foundations with divers, and from the necessity of maintaining in readiness for all emergencies a skilled diving establishment. Not only so, but disastrous results might easily be produced where, as is not unknown, a second severe storm follows in the wake of the first. If such should happen with unrepaired breaches in the monolithic work, the flanks would almost certainly be destroyed, and the mischief might easily extend in such a manner as to call for very serious outlay.

24. Looking, therefore, to the favorable opinion expressed by the Home Committee as regards the safety of the random block system, and the many attendant advantages

above pointed out, the Committee give a decided preference to this method of construction of the three adverted to in the report under consideration.

25. The Committee now proceed to consider the subject submitted for their opinion in paragraph 3 of G.O., No. 1259 W., as to the propriety of reducing the width of the present entrance from 550 feet to 450 feet, and to submit an alternative scheme, should such reduction appear to be undesirable.

26. In reference to the feasibility of narrowing the width of the entrance in the manner proposed, the Committee have been favored with the following recorded opinion of two of their members, the Master Attendant and Deputy Master Attendant.

27. These officers observe:—"As regards the proposal of the Home Committee to narrow the entrance 100 feet, we consider that it will render it difficult and dangerous to a degree out of all proportion to any advantage that can be gained by it. A large amount of sea and swell must always enter from the eastward, and no comfort to the ships or the boating operations or to beach improvements can be expected till this evil is removed. The completed harbour walls existed long enough to teach this lesson. This is the opinion of all nautical men who have been consulted, and especially the Harbour Master, who has daily opportunities of judging and appreciating the difficulties that attend the entry of large steamers (many of them over 400 feet long) even with the present width."

28. With this very distinct opinion of the professional officers before them, an opinion, the validity of which it may be observed has long impressed itself on all who have had an opportunity of witnessing the effect of the waves which come in by the present entrance, the Committee have felt that their duty would be very inadequately performed if they left unnoticed this blot on the present scheme, or if they disguised from the Government their clear opinion, not only as to the infeasibility of narrowing the present entrance, but as to the vital necessity for closing the latter completely if a quiet harbour is to be secured.

29. No matter what the direction of the wind, the unceasing swell on this portion of the coast rolls in with the crests of the waves parallel, or very nearly so, to the coast line. In no case is it believed that the angle exceeds 30° to the general line of the coast. The result is that seas enter the present mouth freely, and, owing to the small length of the harbour, are not dispersed before reaching the shore at its base. The action is of course greatly intensified during storms, and particularly with the wind from the east. At such times the sea inside the harbour, though not so high as outside, is certainly of a dangerous character, being exceedingly broken. Taking these and other facts into consideration, the Committee have to record their opinion that unless means be found for closing entirely the present entrance, no radical cure will have been applied to the chief defect of the work as at present designed.

30. In this view they beg now to submit a plan for the completion of the harbour (see annexed drawings and estimates D, E, F), the leading features of which are—

(1) The opening of a new entrance 500 feet in width, in from 7 to 7½ fathoms of water at the north-east angle of the harbour.

(2) The closing of the present entrance.

31. Before stating the cost and advantages of this proposed arrangement, the Committee desire to draw attention to one or two matters which, while not in reality interfering with constructive details as recommended by the Home Committee, may show how these can be modified without disadvantage.

First, as regards the amount of protection to be given to the portions from the shore to point B on the north, and to point E on the south pier. The Home Committee adopt Section No. 2 (Drawing No. 2) for both alike, but, while admitting the expediency of such additional protection for the north, there is nothing to show that such is needed on the south pier. Not only has the seaward face here not in any way been attacked, but there is apparently no probability that such will occur in any storm that may arise on the coast.

The heaviest seas yet observed have invariably been from the north and north-east, and again on the south the sand accumulations already protect the work for a considerable distance, and show a tendency to advance seaward along this pier.

32. The proposed wave-breaker of rough blocks may therefore, in the opinion of the Committee, be omitted on the south arm with safety and the expense saved.

33. The next point is the proposed cap of concrete, 6 feet in thickness, along the same portions of both piers. In reference to this the Home Committee, in paragraph 21, observe that "raising the walls by concrete in mass will be the last process, as that portion of the work can only conveniently be done by beginning it at the outer extremities of the walls and working back towards the shore."

34. When it is remembered that using Systems (A) or (B) four years must certainly (and possibly five or even six years may) elapse before the remodelled piers are sufficiently advanced to receive as the finishing work this cap of concrete, it is clear that the Home Committee, though considering it desirable in many respects, and chiefly as a means for keeping seas from breaking too freely over the piers, did not attach any very indispensably constructive value to this portion of their design.

35. It is fair, in fact, to conclude that if constructively essential to the stability of the work, this concrete cap should advance *pari passu* with the rest of the work.

36. The Committee, in offering this remark, have no desire to interfere in any way with this portion of the design so far as concerns the seaward arms, where they believe that raising the walls in the manner proposed to 12 feet above high water will prove of very sensible value.

37. As regards, however, the piers from the shore to points B and E, they are satisfied, from the effects of the waves on these portions, as hitherto observed, that the proposed cap would be of no material advantage. From the way in which the waves approach the coast the piers are, as a rule, normal to their direction, with the result that only a comparatively small amount of water comes over them into the harbour, the great mass being invariably, it may be said, poured over the seaward arms. Such being the case, the Committee consider that this block of concrete may with complete safety be omitted from the portions indicated.

38. Towards meeting the expense of opening and protecting the proposed new entrance to the north-east and closing the existing entrance there would be savings on the two items mentioned, viz.:—

(1) By the omission of the random block wave-breaker along the south pier to E.

(2) By the omission of the concrete cap from the shore to B on the north and to E on the south pier. The actual savings in cash outlay due to these modifications will be found further down, where is shown the probable cost of the harbour as thus completed, and here it will be desirable to advert to the formation of the proposed new entrance at the north-east angle of the harbour.

39. The position is shown on the tracing to lie between the 7 and 7½ fathom lines, and the width to be 500 feet.

40. On this point the Master and Deputy Master Attendants have supplied the following observations:—

"(1.) The proposed entrance to the north may safely be narrowed to 500 feet, because the cross currents and winds that affect the east entrance will no longer exercise a troubling effect.

"(2.) The proposed entrance to the north in 7 fathoms will allow of the whole deep water space being utilized, which is impossible under the conditions of the eastern entrance, and deep water space is especially valuable in a basin like the Madras Harbour."

41. The Committee have adopted the conclusions as above stated, and also one to the effect that the protecting horn should be not less than 600 feet in length, carried out tangentially to the curve at the north elbow, and curved slightly to the east, in order the better to deflect the seas from the entrance and from the north arm, and to give a *vena contracta form* of entrance for the more easy passage of vessels. Looking to the general parallelism of the crests of the waves to the shore, it is doubtful whether in practice so long a protective horn will be found to be indispensable, but as it is better to err on the safe side, the Committee have provided for one 600 feet long in the estimate.

42. As a matter of detail it may here be mentioned that the concrete blocks which now encumber the work at this point will in all probability be broken up by

dynamite, and the debris with the rubble base, down to a depth of 6 fathoms, removed by dredging.

43. The closing of the existing entrance will proceed so soon as the new north-east one has been worked out, and the final operation will be the construction of the horn. As the whole of the seaward arms can by this manner be dealt with continuously, only one titan crane would be needed, in case either of the Systems (A) or (B) is adopted, or one set of travellers if System (C) be decided on.

44. The following are the financial results of the above method of dealing with the harbour according to the system which may be approved :—

	RS.
(1.) If completed on Sections 1, 2 and 3, the present entrance closed also by Section No. 3 and entrance on north opened.	54,18,717
(2.) If completed on Sections 1, 2 and 4, the present entrance being closed on Section No. 3	50,26,348
(3.) If completed on Sections 1, 2 and 5, the present entrance being closed on Section No. 5 (random block-work) ...	51,42,636

(The cost of wave-breaker on south arm and concrete cap to both arms is omitted in these estimates.)

For detailed estimates see the appendices.

45. For the reasons before assigned, the Committee would strongly recommend the completion of the work on the random block system.

46. The Committee would here solicit attention to the following recorded observations by the Master and Deputy Master Attendants in reference to the above proposals :—"We," they observe, "consider that if the sea face is closed, and a height of 12 feet given to the sea wall, that much of the character of a protective work to shipping, under which sanction to it was first obtained, will be restored, and the question of sending ships to sea on approach of bad weather need no longer be considered."

47. To those who are acquainted with the fact that the main object of the late Lord Hobart in pressing the necessity of a harbour on the attention of the Secretary of State was the beneficent and humane idea of sheltering vessels in port from the dire effects of the cyclones, which unhappily but too often visit the Coromandel Coast, and which since the advent of European shipping have occasioned such fearful losses in life and property, the true import of the proposals now submitted will, it is hoped, be sufficiently obvious.

48. It is believed that Mr. Parkes never claimed for his work the character of a harbour of protection, and certainly the cyclone of the 12th November 1881 tended to show that, far from being an efficient protection to the shipping inside, it might on such occasions prove to be, as it were, a trap from which escape might be difficult and at times perhaps impossible.

49. The fear, indeed the certainty, that such would prove to be the result has, it may be said, imposed a much more severe responsibility on the Marine authorities than was the case when no harbour existed.

50. With the present eastern entrance unchanged, this extreme danger to shipping, and this terrible responsibility for life and property, must remain, no matter what the system adopted for the completion of the rest of the work; and to allow matters to remain as they are will add the evil of a perpetual and dangerous reef in front of Madras in the form of the present ruined piers.

51. Under the proposals now submitted, not only will, it is believed, the unexpected boon of a harbour of protection be conferred on Madras, but Imperial significance will be given to this great work, which, if finished in the manner suggested, could in time of war afford shelter and protection to the vessels of Her Majesty's navy, as also to all merchantmen who could make the port.

52. The Home Committee, in many parts of their report correctly draw attention to the unduly small area of the present harbour, not much more than the outward half of which is suited for mooring vessels of any draft; but, as will no doubt at once be recognized, the proposals above made must, by affording the means, whenever

27

desired, of dredging out the shallow portions to any required depth, admit of doubling the useful area.

53. An operation of this character, it is almost needless to say, could never be carried out so long as the present entrance remains open, the disturbance inside the harbour being such that, with the exception of a very few days each year, would render dredging operations impossible, excepting at an altogether prohibitive outlay.

54. Not only would the advantages here enumerated be secured, but in many other respects, such as the possibility of ~~moving~~ mooring ships much closer together than is at present feasible, bringing ships much closer to the shore, establishing wharfs, jetties, &c., facilities to the trade of the port may be increased indefinitely.

55. The total cost of the work remodelled as recommended will, as shown, be Rs. 51,42,636 as compared with that of the Home Committee System A, Rs. 50,93,980. Practically, therefore, the two methods of dealing with the harbour may be considered as costing much the same.

Richd. H. Sankey

J. H. Taylor

Deputy Master Attendant

F. H. Thorowgood. M. Inst. C.E.

Nathl. St. B. Beardmore C.E.
Asst. Supt. H.W.

C. Hraven

20th June 1883.

Note by Mr. Beardmore on paragraph 41.

I consider it important that, in order to adequately protect the proposed north-east entrance, the protecting breakwater should be at least 650 feet in length measured from the eastern tangent point of the north pier, and that if it is thus constructed, an excavation through the old rubble base of 400 feet in *bottom* width will prove to be sufficient, and indeed better in checking north-eastern seas from entering the harbour.

Nathaniel St. B. Beardmore

MADRAS HARBOUR.

APPENDIX TO REPORT OF THE COMMITTEE APPOINTED IN G.O., No. 1259 W., DATED 30TH APRIL 1883.

Estimate of cost of restoration as proposed by the Home Committee, and as modified by the Special Local Committee.

Quantities and Prices by the Superintendent of the Madras Harbour Works.

Note.—The total lengths of the two piers, as shown by the figured dimensions in the plan accompanying the Home Committee's Report, do not agree with the actual lengths of work to be executed, but are 218 feet short of such lengths.

The following estimates are made with the corrected lengths for obtaining an entrance of 450 feet, viz., 3,916 feet for the north pier and 4,020 for south pier.

The lengths for each section of the Committee's proposal therefore are altered thus:—

	North Pier (on Plan).		South Pier (on Plan).	
Section No. I	426	(400)	680	(650)
Section No. II	1,800	(1,800)	1,750	(1,750)
Sections Nos. III, IV, V	1,690	(1,600)	1,590	(1,520)
Total ...	3,916	(3,800)	4,020	(3,920)
Difference ...	116 feet.		100 feet.	
Total Difference ...	216 feet.			

Both dimensions are shown in the plan accompanying these papers.

Estimate for Section No. I.

	Feet.
Length—North Pier	426·0
South do.	680·0
Total ...	1,106·0

Per lineal foot of Pier.

	Rs.	A.	P.
Additional rubble...18·0 × $6\frac{1}{2}$ × $\frac{1}{2}$ = $58\frac{1}{2}$ c. ft. = 3 tons at Rs. 1-8-0 =	4	8	0
Concrete topping ...24·0 × $4\frac{1}{2}$ × 1·0 = 108 = 4 c. yds. at „ 12-0-0 =	48	0	0
Iron cramps ...44 lb. per lineal foot at $\frac{1}{2}$ anna ... ... =	1	6	0
Total per lineal foot ...	53	14	0

For both Piers.

	Rs.	A.	P.
1,106 lin. ft. at Rs. 53-14-0 ... ... =	59,585	0	0
Deduct for 480 lineal feet at south pier, thoroughly protected by sand and not needing rubble.			
Rubble 480 ft. with 3 tons to 1 ft. = 1,440 tons at Rs. 1-8-0 ... =	2,160	0	0
	57,425	0	0

Total for Section No. I, Rs. 57,425.

Section No. II.

	Feet.
Length—North Pier	1,800
South do.	1,750
	3,550

Per lineal foot of Pier.

Additional rubble—

	C. FT.		Rs.	A.	P.
110·0 × $8\frac{1}{2}$ × $\frac{1}{2}$ =	$467\frac{1}{2}$				
55·0 × $5\frac{1}{2}$ × $\frac{1}{2}$ =	$151\frac{1}{4}$				
	$618\frac{3}{4}$	= 31 tons, at Rs. 2 ...	62	0	0
Concrete blocks in wave-breaker— 50 × $\frac{20}{2}$ × 1·0 = 500 c. ft. = 18·5 c. yds., at Rs. 11.			203	8	0
Concrete topping— 24·0 × 6·0 × 1·0 = 144 = $5\frac{1}{3}$ c. yds., at Rs. 12 ...			64	0	0
		Per lineal foot ...	329	8	0
For both piers 3,550, at Rs. 329-8-0			11,69,725	0	0
Add for 415 feet of piers to be cramped at Rs. 1-6-0 per foot			570	10	0
		Total value of work, Section II ...	11,70,295	10	0

Section No. III.

	Feet.
Length—North Pier	1,690
South do.	1,590
Total ...	3,280

Per lineal foot of Pier.

Additional rubble—

79 × 18 × $\frac{1}{2}$ = 711
65 × $17\frac{1}{2}$ × $\frac{1}{2}$ = $568\frac{3}{4}$
8·0 × 2·0 = 16
63·0 × 2·0 × 1·0 = 126

		Rs.	A.	P.
$1,421\frac{3}{4}$ cubic feet = 71 tons, at Rs.	2 =	142	0	0
Concrete blocks in wave-breaker— 65·0 × $\frac{23·0}{2}$ = 28 cubic yards, at ... ... „	11 =	308	0	0
Concrete blocks in regular work— 28·0 × 6·0 × 1·0 24·0 × 24·0 × 1·0 = 744 cubic feet = $27\frac{2}{3}$ c. yds., at „	11 =	303	0	0
Preparing base by removing old blocks, &c., per lineal foot, at ... ... „	134 =	134	0	0
Concrete topping— 24·0 × 5·0 × 1·0 = $4\frac{1}{2}$ yards at ... ... „	12 =	54	0	0
Concrete bags— 20·0 × 2·0 × 1·0 = 40 cubic feet = $1\frac{1}{2}$ c. yds., at „	11 =	16	8	0
Two cramps or 88 lb. per foot, at $\frac{1}{2}$ anna per lb.		2	12	0
		960	4	0
Deduct for old blocks recovered in foundation one-seventhth of the wave-breaker at 4 yards per foot, at „	11	44	0	0
Total per lineal foot ...		916	4	0

Section No. III, 3,280 lineal feet, at Rs. 91[illegible]-4-0 per foot, Rs. 30,04,480.

Section No. IV.

Alternative Section per No. III. Total length, 3,280 feet. Per lineal foot of Pier.

Additional rubble—

	C. FT.
62·0 × $\frac{24}{2}$ × 1·0 =	744
50 × $\frac{24}{2}$ × 1·0 =	600

	RS.	A.	P.
1,344 = 67 tons, at Rs. 2 =	134	0	0

Concrete blocks in wave-breaker—

	C. FT.
40·0 × $\frac{26}{2}$ × 1·0 =	520

Concrete blocks in regular work—

28·0 × 6·0 × 1·0 =	168
24·0 × 24·0 × 1·0 =	576

	RS.	A.	P.
1,264 = 47 c. yds., at Rs. 11 =	517	0	0
Concrete topping— 24·0 × 5·0 × 1·0 = 4½ cubic yards, at Rs. 12 =	54	0	0
Preparing base at per lineal foot ... . „ 40 =	40	0	0
Apron bags 20·0 × 2·0 × 1·0 = 1½ cubic yards at „ 11 =	16	8	0
Two cramps to each course, per foot ... ... =	2	12	0
Per lineal foot ...	764	4	0

3,280 feet of piers at Rs. 764-4-0 = Rs. 25,06,740.
Total per Section No. IV, Rs. 25,06,740.

Section No. V.

(Random Blockwork.)

Length same as No. III and No. IV, 3,280 feet.

Additional rubble—

	C. FT.
90·0 × 2·0 × 1·0 =	180·0
60·0 × $\frac{17}{2}$ × 1·0 =	510·0
85·0 × $\frac{18}{2}$ × 1·0 =	765·0
37·0 × $\frac{19}{2}$ × 1·0 =	351·6
50·0 × $\frac{17}{2}$ × 1·0 =	425·0

	RS.	A.	P.
2,231·6 = 112 tons, at Rs. 2 =	224	0	0

Concrete blocks at random—

60·0 × $\frac{24}{2}$ =	720
42·0 × $\frac{18}{2}$ =	378
30·0 × 24 =	720

	RS.	A.	P.
1,818 = 67⅓ cubic yards, at Rs. 11 =	740	0	0
Concrete topping and bags— 30·0 × 8·0 × 1·0 = 240 = 9 c. yds, at, say, Rs. 12 =	108	0	0
	1,072	0	0
Deduct for random blocks in ruined work about— 60 × $\frac{18}{2}$ × 1·0 = 20 cubic yards, at Rs. 11 ... =	220	0	0
Per lineal foot ...	852	0	0

For both piers, 3,280 feet, at Rs. 852 = Rs. 27,94,560.

ALTERNATIVE PROPOSALS.

Estimate for full Section No. III (without any old work) to be used for closing eastern opening. Per lineal foot of Pier.

Memo.—The rubble base is to extend 33 feet from edge of blocks to top of slope on Harbour side.

Rubble base in 48 feet water—

75 × $\frac{21}{2}$ = 787½
75 × $\frac{50}{2}$ = 1,875
61 × 26 = 1,586
42 × $\frac{20}{2}$ = 420

	RS.	A.	P.
4,668½ = 233 tons, at Rs. 2 = ...	466	0	0
Value of No. III Section without taking credit for old blocks per foot and without Rs. 134 for preparing base	826	0	0
Per lineal foot	1,292	0	0
Taking 500 feet as the additional amount of rubble base required at Rs. 466 = ...	2,33,000	0	0
And 550 feet for blockwork at Rs. 826 = ...	4,54,300	0	0
Total for closing entrance with No. III Section ...	6,87,300	0	0

For making a Northern Entrance.

Excavation of rubble for 600 feet in length—

40·0 × 3·0 = 120·0 cubic feet.
41·0 × $\frac{19}{2}$ = 389·6 „
54 × 17 = 918·0 „
43 × $\frac{15}{2}$ = 322·6 „

	RS.	A.	P.
1,750·0 × 500 = 32,407 c. yds., at Rs. 4 =	1,29,628	0	0
Excavation and removal of blocks— 28·0 × 20 = 560 × 500 = 10,333 c. yds., at Rs. 8 =	82,664	0	0
	2,12,292	0	0

Building a protective arm, 400 feet long, in Section No. 3, but without heavy charge for preparing base.

	RS.	A.	P.
600 of full Section No. III, at Rs. 1,292 per foot = ...	7,75,200	0	0
Deduct for value of old blocks recovered enough to make one-fourth wave-breaker or 7 cubic yards, at Rs. 11 = Rs. 77, for 400 feet	30,800	0	0
	7,44,400	0	0
Add for pier head-work	20,000	0	0
	7,64,400	0	0
	2,12,292	0	0
Excavation as above	9,76,692	0	0

Savings effected by making north-east entrance owing to there being less pier to build.

	RS.	A.	P.
(*a*) In Section No. III— 600 feet, at Rs. 916-4-0 per foot	5,49,750	0	0
(*b*) In Section No. IV— 600 feet at Rs. 764 per foot	4,58,400	0	0
Deduct lump sum for extra work in crossing over line of north pier for outer horn	50,000	0	0
Nett ...	4,08,400	0	0
(*c*) In Section No. V— 600 feet, at Rs. 852	5,11,200	0	0

Whole Section No. 5 for closing eastern entrance and building outer horn.

Rubble base (48 feet per lineal foot water)—

$$65{\cdot}0 \times \tfrac{21}{2} = 682{\cdot}6$$
$$155{\cdot}0 \times \frac{27+24}{2} = 3{,}952{\cdot}6$$
$$72{\cdot}0 \times \tfrac{25}{2} = 900{\cdot}0$$

	RS.	A.	P.
5,535·0 = 276 tons, at Rs. 2 =	552	0	0
Concrete blocks (as before) 67½ cubic yards, at „ 11 =	740	0	0
Concrete topping and bags 9 cubic yards, at „ 12 =	108	0	0
	1,400	0	0

		RS.	A.	P.
For closing entrance—				
500 feet rubble work, at Rs. 552 per foot = ...		2,76,000	0	0
550 feet blockwork at „ 848 do. = ...		4,66,400	0	0
		7,42,400	0	0
For building extra horn, 600 feet, at Rs. 1,400.	6,40,000			
Deduct for old blocks	30,800			
	6,09,200			
For work in pier head	20,000			
		6,29,200	0	0
		13,71,600	0	0

Saving by doing away with south pier wave-breaker to 1,750 feet and with concrete topping on Sections I and II.

	RS.	A.	P.
No. I Section—			
1,106 feet concrete top, at Rs. 48 = ...	53,088	0	0
No. II Section—			
3,550 feet concrete top, at Rs. 64 = ...	2,27,200	0	0
Wave-breaker, south pier—			
1,750 feet blocks, at Rs. 203-8-0 = ...	3,56,125	0	0
Rubble 1,780 feet, at Rs. 62 = ...	1,08,500	0	0
	7,44,913	0	0

SUMMARY OF ESTIMATES.

				RS.
(A.)	Restoring as per Sections I, II, and III	with 450 feet entrance.		51,85,580
	Do. do.	with 550 do.	...	50,93,980
(B.)	Do. Sections I, II, and IV	with 450 do.	...	46,13,179
	Do. do.	with 550 do.	...	45,36,779
(C.)	Restoring as per Sections I, II, and V	(450 feet cut)	...	49,55,672
	Do. do.	(550 do.)	...	48,70,472

ALTERNATIVE PROPOSALS.

With 500 feet entrance to the north-east abolishing concrete *capping on innerportion* of work, and wave-breaker *to inner portion* of south pier.

		RS.
(D.)	Restoration being carried on as Sections I, II, and III, and extra work built as Section III	54,18,717
(E.)	Restoration to be carried on as in Sections I, II, and IV, extra work being as Section III	50,26,348
(F.)	Restoration and extra work to be done as in Section V (Random Work). Memo.—This will be the *quickest* work	51,42,636

For blocks on stock a credit of Rs. 1,30,630 may be taken for every section.
Rs. 60,000 added for extra titan roads and rails omitted in detailed estimate.

SUMMARY OF ESTIMATES.

(A.) Estimate for restoring Harbour as proposed by Committee, in Sections I, II, and III.

	RS.
Total value for Section No. I	57,425
Do. do. No. II	11,70,295
Do. do. No. III	30,04,480
	42,32,200
Plant—	
Two titan cranes complete, at Rs. 45,000	90,000
Two cranes for setting wave-breakers, at Rs. 30,000	60,000
New railway lines, 230 tons of permanent-way material, at Rs. 100	23,000
200 tons titan rails, at Rs. 100	20,000
4,000 sál-wood sleepers, at Rs. 4-8-0	18,000
16,000 lineal feet titan roads, at Rs. 4	64,000
One Goliath crane, restored	2,000
	45,09,200
Add 15 per cent. for Establishment and Contingencies ...	6,76,380
	51,85,580
If with 550 feet entrance, deduct 100 feet, at Rs. 916	91,600
	50,93,980

SUMMARY OF ESTIMATES.

(B.) Estimate for restoring Harbour as proposed by Committee in Sections I, II, and IV.

	RS.
Total value for Section No. I	57,425
Do. do. „ II	11,70,295
Do. do. „ IV	25,06,740
	37,34,460
Plant, as for Sections I, II, and III	2,77,000
	40,11,460
Add 15 per cent. for Establishment and Contingencies ...	6,01,719
	46,13,179
If with 550 feet entrance, deduct 100 feet, at Rs. 764 ...	76,400
	45,36,779

SUMMARY OF ESTIMATES.

(C.) Estimate for restoring Harbour as proposed by Committee in Sections I, II, and V (Random Blocks).

	RS.
Total value for Section No. I	57,425
Do. for Section „ II	11,70,295
Do. for Section „ V	27,94,560
	40,22,280

		RS.
Plant—		
Two special titan cranes capable of setting regular work, and overhanging enough to build random blocks		1,60,000
Other plant as before, less the two extra cranes		1,27,000
		43,09,280
Add 15 per cent. for Establishment and Contingencies		6,46,392
		49,55,672
If with 550 entrance, deduct 100 feet, at		85,200
		48,70,472

COMMITTEE'S ALTERNATIVE PROPOSALS.

First Alternative.—To close present entrance by Section No. 3, and open one to the north, extending the eastern part of the breakwater 400 feet as an overlap to the entrance.

		RS.
(D.) Estimate for repairing by Sections I, II, and III, see Summary of Estimates (A)		42,32,200
Deduct 100 feet for making 550 feet entrance		91,600
		41,40,600
Add—		
For building across entrance		6,87,300
Do. 400 of protecting arm		7,64,400
Excavating and opening north entrance		2,12,292
		58,04,592
Deduct saving as shown (*a*) on page 11	5,49,750	
Also saving as shown on page 12	7,44,913	
		12,94,663
		45,09,929

Closing North Entrance.

Plant—		
One titan crane	45,000	
One crane for wave-breaker	30,000	
Other plant as in Summary of Estimates (A)	1,27,000	
		2,02,000
		47,11,929
Add 15 per cent. for Establishment and Contingencies		7,06,788
Grand Total		54,18,717

(E.) Estimate for closing eastern entrance and opening one to the north, the work being restored mainly on Sections I, II, and IV.		
Value of restoring work by I, II, and IV (as shown in Summary of Estimates (B)		37,34,460
Deduct for 100 feet to restore 550 entrance		76,400
		36,58,060
Add—		
For building across entrance		6,87,300
600 feet of protecting arm		7,64,400
Excavating and opening northern entrance		2,12,292
		53,22,052

		RS.
Deduct—		
Saving as shown (*b*), page 11	4,08,400	
Also as shown on page 12	7,44,913	11,53,313
		41,68,739
Plant as before		2,02,000
		43,70,739
Add 15 per cent. for Establishment and Contingencies		6,55,609
Grand Total		50,26,348

(F.) Closing eastern entrance and opening one to north, with Sections I, II, and V.		
Memo.—The entrance is supposed to be closed and the extra protective built on Section 5.		
Restoring work, Sections I, II, and V with 450 feet entrance		40,22,280
Deduct for 550 feet entrance, 100 feet		85,200
		39,37,080
Add—		
Building across entrance		7,42,400
Do. extra protective arm		6,29,200
Excavation in north pier		2,12,292
		55,20,972
Deduct—		
Saving as shown (*c*) on page 11	5,11,200	
Also as shown on page 12	7,44,913	
		12,56,113
		42,64,859
Plant—		
One special titan	80,000	
Other plant as before	67,000	
		2,07,000
		44,71,859
Add 15 per cent. for Establishment and Contingencies		6,70,777
		51,42,636

Detailed Remarks on Prices and Methods of carrying out work suggested.

Rubble Stone for Base and Foreshore.—The rubble for base and foreshore is to be clean, hard syenitic rock from Pallávaram, similar to what has been used hitherto from that quarry. The price is generally taken at Rs. 2 per ton deposited in the sea, but for the shore ends of the piers, for protective work, Rs. 1-8-0 per ton has been taken. The ton has been taken as 20 cubic feet, and this is arrived at by frequent measurements and weighings. The price is based on what has already been done in depositing 800,000 tons of rubble, the cost of which varied from Rs. 1-8-0 to Rs. 2-4-0 per ton, the latter price being exceptionally high. The rubble will be deposited from large boats propelled by oars; also by being thrown from the piers. and by being tipped by the overhanging crane. No steam hopper barges will be needed. The stones will vary in weight from 3 lb. to 300 lb.

2. *Concrete Blocks.*—The concrete blocks will be similar in composition to those made latterly for the damaged piers, of which 12,563 cubic yards are now on stock. The Madras local cement may, however, be used as much as possible, but this does not materially affect the price.

The cost of the concrete blocks per cubic yard has latterly been Rs. 8·90 in the yard, and the cost of setting by means of divers has been sometimes below Rs. 2, and sometimes a little above Rs. 2 per cubic yard, including all charges. Therefore the price chosen in the estimate of Rs. 11 is fair.

Concrete Topping and Concrete in Bags.—This has been taken at Rs. 12, as there will be more waste of cement in mixing, and the materials will have to be carried along the piers for mixing *in situ*, thus adding to their cost before they are converted into concrete.

Iron Cramps.—Iron cramps are taken at ½ anna lb. fixed in the blocks with cement. The price is based on actual work done.

Preparing foundations on site of ruined work.—This is a difficult item to estimate, as we have no similar experience. We know that it will be very tedious and difficult. There was a time in the north pier work when there was 7 feet of excavation to be carried on in laterite rubble. This reduced progress to nearly a standstill, and took a very strong diving force. The amount of material to be shifted was more than equal to a course of blocks. It was found to cost Rs. 134 per lineal foot. This price has been selected as the cost per lineal foot of preparing foundation in ruined work. It may cost twice as much.

Method of setting Blocks in Sections III and IV.—It is supposed that for the actual piers two titan cranes will be required, in which there should be some alterations and improvements. For depositing the blocks in the wave-breakers other cranes should be used, of special design, with their overhang extending on each side of the blocks. They should be capable of holding 30 tons with an overhang of 40 feet.

The blocks for the wave-breakers should be "tripped" and not lowered by lewis bolts.

Crane Roads.—The roads on which the setting machines (titan or similar cranes) travel are to be continuous. They should be 70 lb. flat-bottomed rails, fastened by fang bolts (not spikes) to teak longitudinal timbers 14″ × 10″. These timbers to be fixed to the blocks and built in.

Crane for Random Blockwork.—The cranes or crane required for this work must be one with enormous scope. It should be capable of carrying 30 or 40 tons at a radius of 50 feet, and should be on a circular girder to "jib" completely round. It will be absolutely necessary to deposit the blocks as far away from the centre line as possible, otherwise there will be no chance of retaining an even and solid road for the crane to advance upon.

Construction of Random Work.—To within 15 feet of low water no doubt rubble stone may be used as a hearting to the outer slopes of random work. But above this nothing but heavy blocks should be used, except for purposes of levelling up. If the individual blocks at the level of breaking sea are too light, say less than 25 tons, there is no stability in the random mound. At 6 feet above H. W. the work must be levelled and concreted up with bags, ready to receive the top course of blocks which must be brought up level enough to carry a railway as well as the crane roads.

Estimate of Plant.—The estimate for plant is nothing more than a guess based upon the *known* cost of cranes, rails, sleepers, &c., as given by previous experience on these works. As the cranes are purchased as complete machines for a lump sum, it is not possible to enter into details except in communication with the builders in England.

Establishment and Contingencies.—It is believed that 7½ per cent. will be ample for "Establishment," but as in former experience 2½ per cent. was far too little for "Contingencies," it is judged safer to make the charge for the latter also 7½ per cent., which it is hoped will be more than sufficient.

1879-80-81-82.

1. Proposal for modifying sea face & for widening entrance of harbour to 550 ft.
2. Order to obtain highest professional advice on above.
3. Opinions of Captains of BISN^o on above
4. Merely reporting last.
5. Opinions of Captain of P+O on above. Capt. White objects to Eastern entrance.

---

6. Order to modify entrance. Board of Works concur therein.
7. Capt. Elton objects to Eastern entrance & recommends one South.
8. Capt. Taylor reports necessity of closing sea face. & alludes to disturbance of harbour during gales, &c.
9. Mr. Stiffe recommends narrowing of entrance. Recommends (para 34) entrance at N.E. angle in 7 fathoms — if smoothness cannot be attained by narrowing Eastward entrance.
10. Mr. Malcolmson's report — alludes to narrowing entrance — not to change position. para 91.

S.a.W.

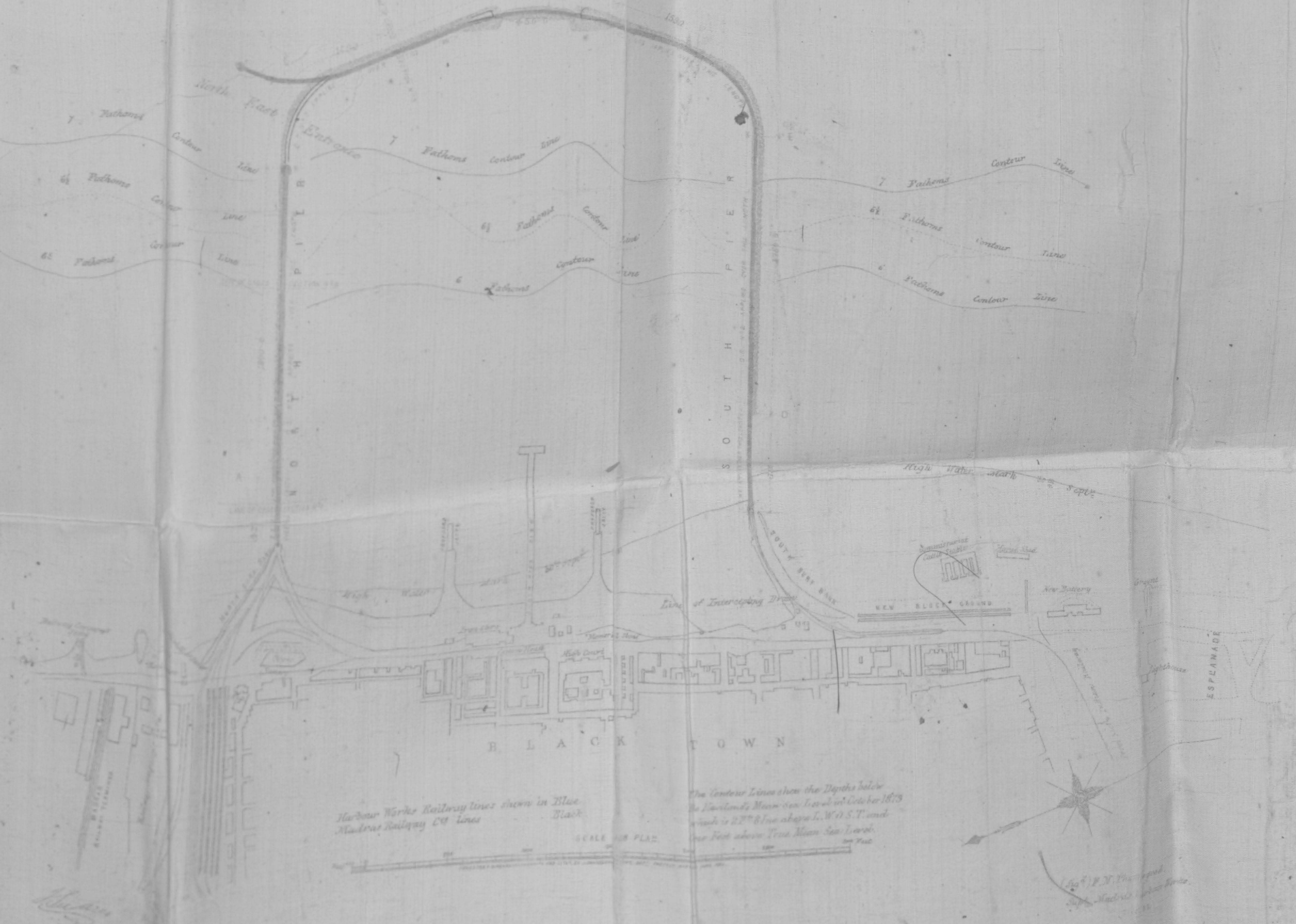
No longer required

CW

MADRAS HARBOUR

PROPOSALS FOR RESTORATION BY MADRAS SPECIAL COMMITTEE

Plan shewing North East Entrance with protecting arm, suggested by Committee (with exceptions



Harbour Works Railway lines shewn in Blue
Madras Railway Cº lines — Black

The Contour Lines show the Depths below the Harbour's Mean Sea Level in October 1873 which is 2 Ft. 8 Ins above L.W.O.S.T. and One Foot above True Mean Sea Level.

(Sig^d) F. N. Thompson
Sup^t Madras Harbour Works.

C. Bowser. Major R.E.
Dy Chief Engineer P.W.D.

Withdrawn. June 14/83

36

Madras Harbour

Dissent from opinions expressed in paras. 29 & 48 of the Report of the Local (Madras) Committee

In paragraph 29 of the Committee's report occurs the remark that during easterly winds in stormy weather "the seas inside the Harbour are more dangerous than outside." I regret to differ in any point from other members of the Committee but I must disagree with this opinion entirely. I submit that no one has observed the seas in the Harbour more constantly & persistently than myself from the date of making the first concrete block in August 1876 to the storm of Nov 1881. There is often a good deal of spray & white water on the beach inside the Harbour which looks more formidable than a regular surf outside, but I ~~[illegible]~~ do not think that the seas are more dangerous.

~~[illegible]~~ Lt. Col. C

This line omitted if para 48 is altered

Similarly in para: 48. I cannot concur in saying that anything was "proved in the most conclusive manner", except that a disastrous sea raged inside the Harbour as well as outside. I can see nothing to prove (whatever individual opinions may be) that the Harbour was a "trap" from which there was no escape". If any sort of attempt had been made at escape & resulted in failure the case would have been different, but in my opinion one cannot say that the Harbour was proved to be a trap of this sort. The Hopper Barges would most probably not have been wrecked if they had been separately moored & not fixed together. The ~~[illegible]~~ battering of the barges against one another caused them to sink, so I cannot consider ~~[illegible]~~ ~~[illegible]~~ that the loss of these vessels proves anything.

There were no other vessels in the Harbour.

F.W. Thorowgood.

I agree in Mr Thorowgood's remarks

H.B. Beardmore

12th June 1883

GOVT. OF MADRAS. } 188 . { P.W. DEPT.

SECRETARY.

CHEPAUK, June 13th 1883.

OFFICE NOTE.

To F. W. Thorowgood Esq
Harbour Report

My dear Thorowgood,

I have altered paras 29 & 48, &c.

Please now initial, passing pen through your red ink remark "with dissent from para 29 & 48".

Yours
C.G.

Should not all figures of your Estimates agree exactly with those of Table No. I – which I have altered in accordance with your pencil figures?

Seen [illegible]

FWT

Major C. Bowen R.E. June 14. 83.

I have now initialled the report, as also has Beardmore —

I have corrected all the details of the Estimate for the additional cost of plant in the Titan Roads, & I believe the Estimates now to be safe —

Although all the quantities were made out for a Protecting Arm 400 ft. long as distinctly proposed on May 12th (Beardmore & I dissenting in writing when the Estimates were submitted — see paper herewith 'B'). I see the report states that Estimates are made for a Arm 600 ft. long —

I only discovered this by accident, & have had to re-write the details of the Estimate to suit the new condition —

This should entail the withdrawal of sheet 'B' of 21.5.83 —

I have corrected the figures of the Estimate in the report as well as in all the details.

June 12. (2.30 Pm)

Since seeing you this morning I have considered para: 48 again — I have altered it in pencil to what I will agree to sign (& Beardmore also) — If you don't like my alteration, Beardmore & I must dissent as written on the sheet accompanying —

It is not right to say the Harbour "was conclusively proved to be a trap" — Capt. Taylor thinks it was but other opinions differ —

OF 187

I have altered the figures of the Estimate to include some Titan works omitted by error.

GOVT. OF MADRAS. } 38 187 . { P.W. DEPT.

Latest note in Red

Fort St. George, June 12th 1883.

OFFICE NOTE.

To Major C. Bowen.

Para. 12 —

I will not raise any trifling objection so let "unsatisfactory" remain — I dislike it however because it reminds me of Capt. Taylor's recommendation to Govt. to use his old diving bell, hinting that we did not work properly here. That is my only reason for noting it at all — and I still think that it is Capt. Taylor's accusation which induced the expression — Let it go

Para 22. (secondly)

I have written in pencil what I should like to see here — I think the paragraph as originally written is quite incorrect. "Any suitable kind of traveller" will not do — it must be special — "The sea" must not be allowed "to do the rest" I can't possibly sign the report while that remains — It is giving a false impression entirely —

Lastly.

I am extremely sorry - but I don't know what to say here - I have written in pencil the only simplification that I know of in the "absence of diving staff" —

Para 23.

What I most strongly object to here is attempting to show that in the monolithic system "the difficulty of access" to a breach would be greater than in the random work —

I can conceive of no possible way (unless special floating cranes are used) of getting at a breach for repairs in the random work without a regular crane road, a regular railway, a special crane, special blocks, a locomotive & some block trucks — I don't know how Colonel S. imagines blocks are to be deposited for repairs but I can see no royal road for them to travel on —

I don't know what to propose about 23 — The advantage of the random block work is that you can go straight to work setting blocks — no preparing the base, no levelling, no re-setting — It has occurred to me to put in the word "foundations" and "diving establishment" as helping to come to my view —

Para 29.

I cannot agree to the "more dangerous character" of the sea inside — In fact I deny it simply — I can sign a "demurrer" at the end if you keep this para. as it stands — I have seen more of the seas than the nautical authorities, I say —

Para 31.

Well. I can only say that I shall have to demur from "invariably" because it is not a fact —

"The heaviest seas yet observed have invariably been" from se. &c I will agree to that if you like —

I agree to everything except what I have noted here.

Para 61.

I would let Col. Sankey's words remain on the whole. ~~[illegible]~~ the figures are correct military engineer indeed who am I that I should criticise ~~the remark~~ his words on such a point?

I think the figures in the estimate may stand for the present. I can correct them afterwards for actual work.

I will initial the rough draft when I see what is done to 22.23.29.31 —

F.W.

12.6.83.

39

GOVT. OF MADRAS. } 1883. { P.W. DEPT.

SECRETARY.

CHEPAUK, 11th June 1883.

OFFICE NOTE.

To F. W. [illegible] Esq.

I have been going through your & Henderson's notes on the Draft Report. It is desirable of course that the Report should be as strong as possible & the approval of all the members to at least all the main points is very desirable. I wish to secure this if possible, so trouble you again. —

Para 6. I have made in red ink the necessary addition regarding Home Committee's error in the lengths.

Para 12. May not the word "unsatisfactory" be taken to refer to the fact that the European divers are somewhat difficult to manage, troublesome, possibly tipplers, &c? I rather think Col: Sankey meant this in using the expression, but am not sure. It does not mean that there is anything "unsatisfactory in diving". However if you still think that should be cut out I shall recast the clause. Do you approve of my alteration, in red ink, to meet your objection as regards the costliness of machinery?

Para 18. Please see my alterations in red ink.

Para 22

(Secondly) The only way I can see of meeting your objection to this clause is (1) to strike it out altogether, in which case "Thirdly" would become "Secondly", & "Lastly" "Thirdly" — or (2) to word it somewhat as follows: "The machinery required for transporting & tipping or dropping the blocks would be of a less elaborate & expensive character than that required under the other systems".. I doubt that it would be very different JH.

what do you say to this?

(Thirdly) I have substituted "heavier" for "20 tons."

(Lastly). Your not concurring with this is serious, it appears to me, inasmuch as it involves also the elimination of the whole of para 23.

Does not what you say regarding the "absence of divers & speed of depositing blocks" directly support Lt: Stanley's rendering of the advantages, viz: "the requirements of all future repairs both in respect to the superintendence and material to be maintained would be reduced to a minimum"?

I cannot well undertake to strike this out or weaken the clause & para 23 by modifications without first referring the draft back to Cttee — delay which it is most desirable to avoid. You may say it can stand & your objection be recorded at foot of Report, but that would take away from the weight of the Report as a whole. Kindly then think over it.

Boardman's suggestion of "great" or "some" for "greatest" can be carried out.

I cannot alter my opinion I am sorry to say. An even crane road, a special 30 ton crane, a locomotive, block trucks, railways & skilled hands will most certainly be as necessary for repairs as for first construction. JH

I cannot agree to 23 (1st clause). It is not right really. JH

40

GOVT. OF MADRAS. } 188 . { P.W. DEPT.

SECRETARY.

CHEPAUK, 188 .

OFFICE NOTE.

To

Para 23. I propose to let this stand, as for A & B special plant & skilled establishment must be maintained for repairs. No doubt for C special plant will also be required, but we do not say that it won't. The wording is stronger ~~than~~ as it is, and the general drive of it I think to back up the "concrete block" proposal. Why then weaken the case?

Para 29. I quite agree & have altered "depth" to "length".

Para 29 again. I rather think we might all accept this without demur as the nautical members have endorsed it. The general drive of the Committee is I think to make a strong case against the present entrance.

Para 31. I am inclined to think the words "apparently no stability" are not too strong. And speaking of "dangerous assaults" coming from N. & N.E. "invariably" sounds better & more telling. I spoke to Capt Taylor about this yesterday & he too thinks "invariably" ought to stand. At any

Note it is not a matter of much consequence. Col: S. deals here with the matter broadly & I don't like to disturb anything if it can fairly be avoided. If you & Beardmore agree, as I think you do, that the wave breaker, &c. may be dispensed with on South Pier up to Point E, that is the main point. The exact wording of draft in support of the opinion is immaterial if nothing has happened to weaken our faith.

Para 51. To this Col: Hasted takes exception & you think it is rather beyond the scope of the Committee. Col: Sankey would prefer to retain it. So would Beardmore & I myself think it ought to stand. Capt. Taylor is indifferent on this point I think. The proposed harbour ~~might~~ will surely afford shelter to merchant ships with cruisers of the Alabama type or privateers knocking about — the tempting target of a crowded harbour would probably not induce them to delay even a short time under our fort-big guns. — I am rather in a fix about retaining or omitting this.

Beardmore's note as to the importance of having the bows 650 ft. in length instead of 600 ft. I shall put at end for his signature. It cannot well otherwise be mended in the report.

Please pass this on to him after you have yourself dealt with it. I am most anxious to expedite it.

C. Bowen

Kindly make in pencil the alterations in figures as entailed by your previous short estimate for establishment &c. I have not had time to go into that. That is — if you think it necessary that this should be done in the report — —

and initial draft if you agree generally.

91

GOVT. OF MADRAS } 1883. { P.W. DEPT.

M.H.W.
~~Fort St. George,~~ June 9. 1883.

OFFICE NOTE.

To Major C. Bowen M.

My dear Bowen,

I have handed the draft report to Beardmore & he has taken it away — I trust he has forwarded it to you — I have a great many remarks to make about it, as you will see —

I send herewith in original all I can think of in the way of detailed description — In my estimates there is as much detail as most engineers give I think. Don't you?

If this description is what you believe Col. Sankey would like, you can either copy it, or alter it & return it & I will copy the revised form –

I have a correction to make in the Plant Estimate which adds R 60,000 to the total of every estimate – I have made a mistake in the value of the continuous Titan crane roads, by omitting the extra rails & fish plates required, and by under estimating the cost of Teak which is 30% higher than when I last purchased any –

There are concrete blocks in stock to much more than the value of this correction (R1,30,630) so it need not raise an alarm.

Yours very truly

J.W.T.

OF 187 .

GOVT. OF MADRAS. } 187 . { P.W. DEPT.

42

Fort St. George, 187 .

OFFICE NOTE.

To

With the exceptions noted on the preceding sheet, I approve of the Rough Draft report, which appears to me to embody the Committee's views most clearly.

June 8. 83.

Para 41

I consider it important that in order to adequately protect ~~the Protecting Breakwater~~ for the proposed North East Entrance, the Protecting Breakwater should be at least 650 ft in length measured fr: the Eastern Tangent point of the North Pier to adequatel ~~protect the Entrance~~; & that if it is thus constructed ~~so~~, an excavation thro' the old rubble base of 400 ft in bottom width will prove to be sufficient, & indeed better in checking North Eastern seas from entering the Harbr

F. H. B. Beardmore
12th June 1883

Also that an important reason for carrying the Protecting Breakwater towards the East is to afford a Vena contracta form of Entrance for the facility of passage in & out of ships, especially in stormy weather when they could steer for the offing at once in clearing out

Nathl B Beardmore

9th June 83

I cannot agree that during heavy storms the seas inside the Harbour as at present, are of a more dangerous character than those outside: nor do I think it was proved by the storms of Novr '81 that the Harbour in a storm would be a mere trap for a vessel from wh: there is no escape.–

N B Beardmore

GOVT.
OF MADRAS.

1883.

P.W.
DEPT.

43

Harbour Works

Fort St. George, June 8. 1883.

OFFICE NOTE.

To Major C Bowen.

I have carefully read the Draft report and have a few remarks to make.

Para 6. I think some notice might be taken of the fact that my estimates are for 218 feet more pier than the Home Committee as explained in the appendix 1.

Para 12. I would omit the word "unsatisfactory." I know nothing unsatisfactory is doing.

I cannot understand what costly or special machinery is required beyond cranes with good *overhang* and clips or claws for seizing blocks. The costly part of the work is the *time* occupied in slinging or unslinging a block.

Para. 15. I would just remark that H.M.S. Euryalus left at 10.30 P.M. on March 21. 83.

Para. 18.

It seems to me that a little more

is necessary here. There is plenty of undulation comes through the gaps in the damaged walls. all does not come through the entrance now – But the additional random blocks will doubtless close the gaps.

Para 22. (Secondly.)

I cannot conceive anyway of building the random mound without one (or two with Eastern entrance retained) powerful cranes. These should be capable of carrying 30 tons at the end of 50 or 60 feet & should be able to jib round the whole circle – I have estimated one at R 80,000 – but I daresay 90,000 R would be safer – I therefore cannot agree with this clause of para 22.

I do not think the sea ought to be left to do much – We must fix our minimum width at H.W. and try to work it – Of course a heavy sea will overturn blocks just balanced but it must not be allowed to wash "down" the slopes as in rubble work – (Thirdly). I would not limit the blocks to 20 tons – We have over 1,00,000 c yds of concrete blocks on hand, each weighing from 22 to 28 tons – The existing plant is capable of carrying 40 tons – I think we have no sufficient warrant for using lighter blocks than before.

(Lastly).

I regret that I cannot share the view expressed herein – Supposing the pier is breached down to 15 feet below L.W. I can conceive no way of repair but by advancing the crane used in construction and dropping in more 30 ton blocks – Small material will be of no use unless allowed to take 7 to 1 slopes. Large material must be handled by a crane, & a crane must travel on rails, so also must blocks for repairs. It must be remembered that the top course of the section must be regular & even as a railway – The immense advantages of the random system seem to me the absence of divers, and speed of depositing blocks.

Para 23.

I cannot see how Special Plant is to be avoided in repairing the random breakwater – Even if 20 ton blocks be used, a special crane is needed to drop 20 tons at a distance of 30 feet from the pier –

Para 29. Would not the word "length" be better than "depths", which naturally suggest soundings.

(Again 29.)
I do not think there is any evidence to show that the sea inside is more dangerous than outside in a storm — All we have is the evidence of some boatmen on Nov 12. 81. From my own personal observation on that day I should say there was greater sea inside than outside — conspicuously so — The contrary may be the case, but it certainly is not proved.

~~81 137~~.

Para 31.
I do not think the dangerous assault is invariably from the North — It generally is — On Nov 21. 1880 we had a very bad sea from the S.E. by E. which attacked the South side of the South pier; and made the N.W. corner of the Harbour the worst one — The Hotspur & Salisbury lying in the North half of the Harbour just kept from going ashore by steaming ahead on their cables. — (C.O. 2851 W. 9 Dec. 81)

Para 51. Perhaps this is rather beyond the scope of the Committee. It seems to me to be a question for the Royal Navy ships to decide.

GOVT. OF MADRAS. } 188 . { P. W. DEPT.

SECRETARY.

CHEPAUK, 44 7th June 1883.

OFFICE NOTE.

To F. N. Thorngood: Esq.

My dear Thorngood —

I have just received the proposed draft of Col: Sankey's back from Capt. Taylor. He & Lt. Marshall approve of the report, with exception of para 51 to which Col: Hasted also adverted, regarding the protection the harbour will afford to an enemy. Our President will probably consent to the elimination of that clause if other members press their objections, as it does not materially affect as a whole the decision & views of the Committee on the points submitted to them.

Kindly read my note to Capt. Taylor & digest review & revise the draft report in the light of my remarks to him.

You might then pass on the papers to Vearsdon for his opinion & approval or any suggestions he may wish to add, &c ...

Yours truly,

C. Browne.

My dear Brown.

I attach my remarks on two separate sheets. ~~[illegible]~~ ~~[illegible]~~ I have handed the papers to Beardmore.

W.J.

(B)

Madras Harbour.

Special Committee for considering designs for restoration

WS

In submitting quantities and estimates for restoring the Madras Harbour, as requested at the meeting of the Special Committee on May 12th, I wish to state that I have estimated as near as I am able, for the work as proposed at the above meeting.—

2. I must record my opinion, however, that I do not approve at all of the curtailing the protective arm or horn for the proposed North East entrance to a length of 400 feet. I believe that nothing less than 600 feet would be effective and that to cut off 200 feet in order to reduce the estimate is to render the design inefficient.— With this exception I approve of the proposal regarding the North East entrance.—

3. I must also draw attention to the fact that I have taken 15% as the amount for Establishment & Contingencies, as I do not consider 10% is sufficient. This of course

makes

makes all the Estimates higher than those submitted to the Committee on May 12th.

E. W. Thorowgood. M. Inst. C.E.
Superintendent M. H. Works

21. 5. 83.

I agree in Mr. Thorowgood's remarks except that I think the protecting Breakwater for the North Eastern Entrance should be at least 650 feet long measured from the Eastern tangent point of the North Pier, and that in this case the excavation for the entrance through the old rubble base need probably be no more than two feet in length.

Nath. H. B. Beardmore C.E.
Asst. Supt. M. H. W.

The Report appears to have altered [illegible] proposed 600 ft. [illegible], and [illegible] as agreed to (with Board) at the meeting [illegible]

9th May [illegible]

GOVT. OF MADRAS. } 188 . { P. W. DEPT.

SECRETARY.

CHEPAUK, 47 188

OFFICE NOTE.

To W.

Please read Thorowgood's reply to my note on back of the enclosed which refers to the required general specification & analysis of rates in connection with our Harbour Committee Estimates. –

I am not sure that T. realises quite what you wanted, tho' I can understand to a certain extent his position.

It was not as possible future Engineer of the work or as present Supdt. of Harbour Works under Parkes that he was to frame a specification, but as a Member of the Harbour Committee & the specification to prescribe the exact work of the Committee's Estimates. The Committee endorsing this specification if prepared it would be theirs. –

I have sent him a note about the "analysis of rates" or in other words data which I fancy he has misunderstood; & I think I shall write to him again in re "the general specification".

Draft Report has not yet come back from Capt. Taylor. Plans are being lithographed.

C. S.
7/6.

S. W

All I meant by General Specification was a very concise statement of the manner in which the work would be carried on, the materials employed, mode of putting them into the work, probable time employed. —

In specifying the materials the character of stone for the rubble base, the kind & quantities of materials used in the concrete blocks, age at which to be used &c. will be given

Rates of the work requires no definition but simply an abstract from the existing accounts &c.

Thorrowgood need not even sign any of ~~these statements~~ which may be appended to the Report as part of the Committee's proceedings — He in fact need not appear personally in ~~this~~ or any other matter connected with the Report further ~~than~~ as a Member of Committee, and he can meet his wishes in ~~this~~ or any other matter connected with the Report without further reference ~~to~~ to me

7.6.83

S.a.W.

Please retain till the Report &c. come in. CS

8/6

GOVT. OF MADRAS. } 188 . { P.W. DEPT.

SECRETARY.

CHEPAUK, 48 188 .

OFFICE NOTE.

To F. W. Thorrowgood Esq

My dear Thorrowgood,

I have sent your note about the general specification & rates on to Col: Sankey for his information, telling him you may perhaps have misunderstood matters, for might you not prepare a Specification as a member of the Committee without regard to the future chief superintendence of the work or to Mr Parkes?

Your Estimates & Specifications endorsed by the Committee & sent up with their Report would virtually be theirs & would be looked upon as such by Government.

Please think over it in this light & let me have your views by & bye. A brief analysis of the rates provided or data for rubble, concrete blocks, &c. is I fancy what Col. S. wants, in order to have our Report & its appendices as complete & full as possible — to show that everything has been discussed

CS

7/6

Major C. Bowen R.E.

My dear Bowen.

I can give an analysis of the prices most certainly - & a reason for them all -

But I understand a "General Specification" to be always a detailed account of how each step in the work is to be carried out, with a view to its being let by contract. and it invariably emanates from the Engineer of the work.

I will at once set to work to give an account of the prices &c. &c.

J.W.

8. 6. 83.

The report shall be returned

GOVT. OF MADRAS. } 188 . { P. W. DEPT.

SECRETARY.

CHEPAUK, 15th June 1883.

OFFICE NOTE.

To F. W. Thrangood Esqr

My dear Thrangood,

With reference to our more recent correspondence I find just as the plans are being lithographed off that the Harbour Plan too shows the protecting "horn" as only 400 ft. long.

It is as well that everything should be perfect if possible & I am told that making the necessary alteration in the lithographs will only involve a delay of 10 minutes.

So I send you the tracing in view to your altering the length of this "horn". ——

Yrs C.B.

My dear Bowen.

Herewith the 600 ft. horn - Of course it was 400 ft. before - everything was for 400 ft. as agreed to May 12th.

Yrs.

J.W.

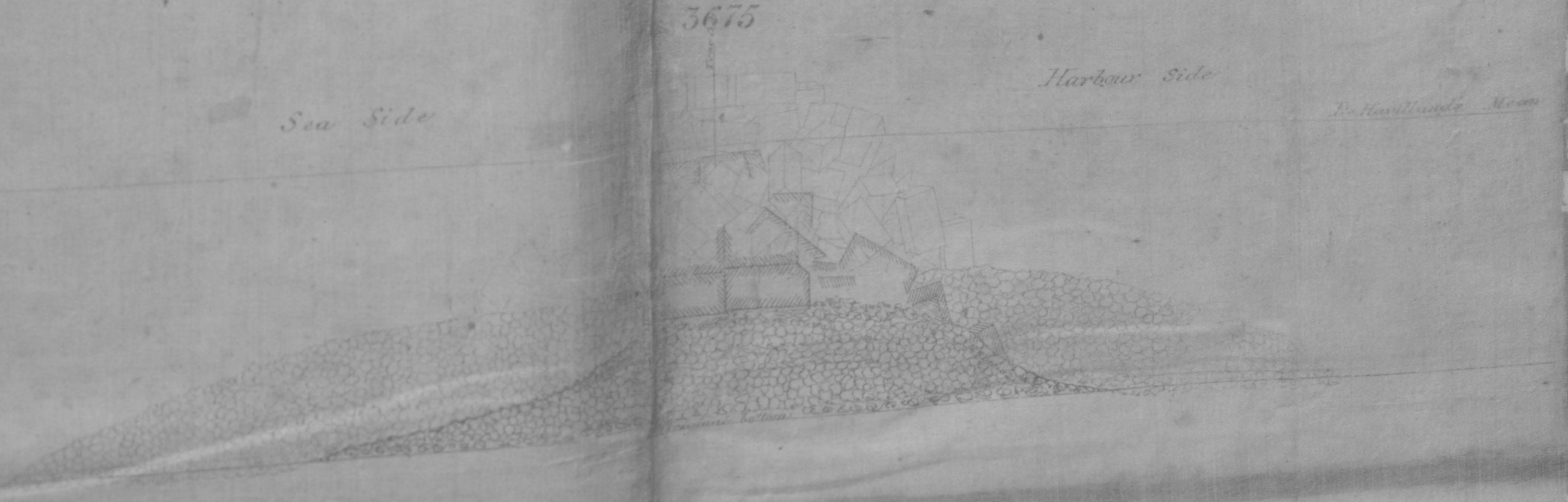
15. 6. 83. | Tracing enclosed

MADRAS

PROPOSALS FOR RESTORATION B

Sections shewing actual state of piers in outer str

th Pier

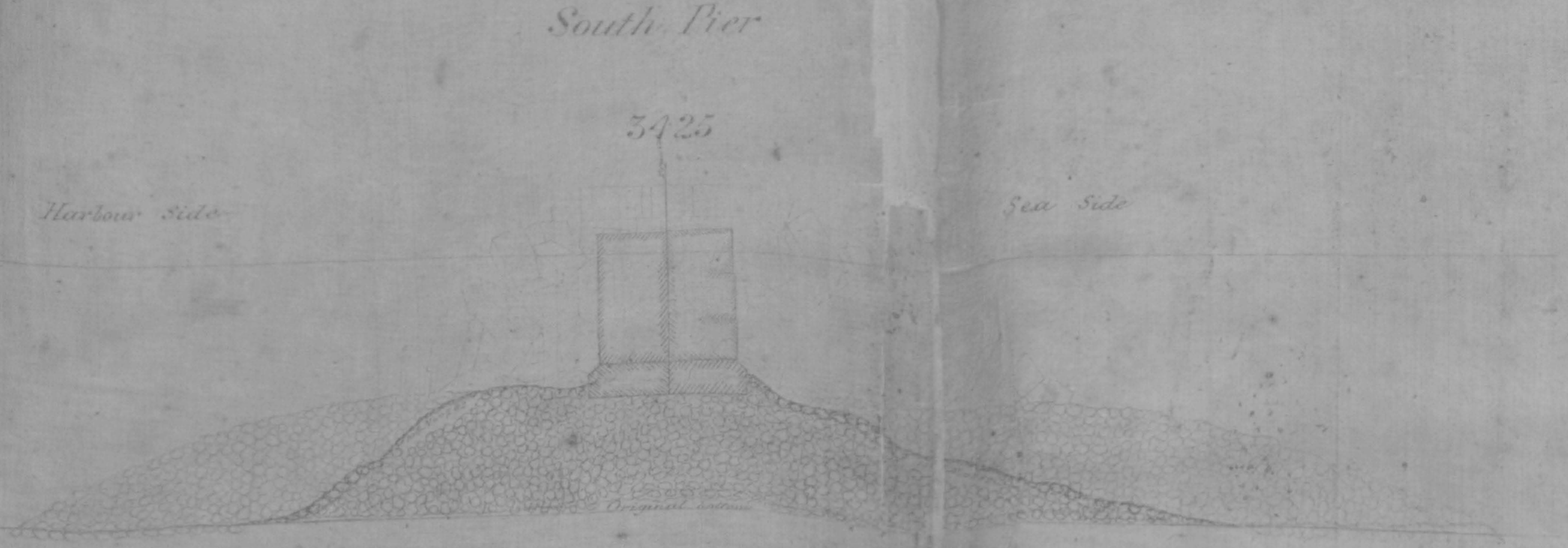


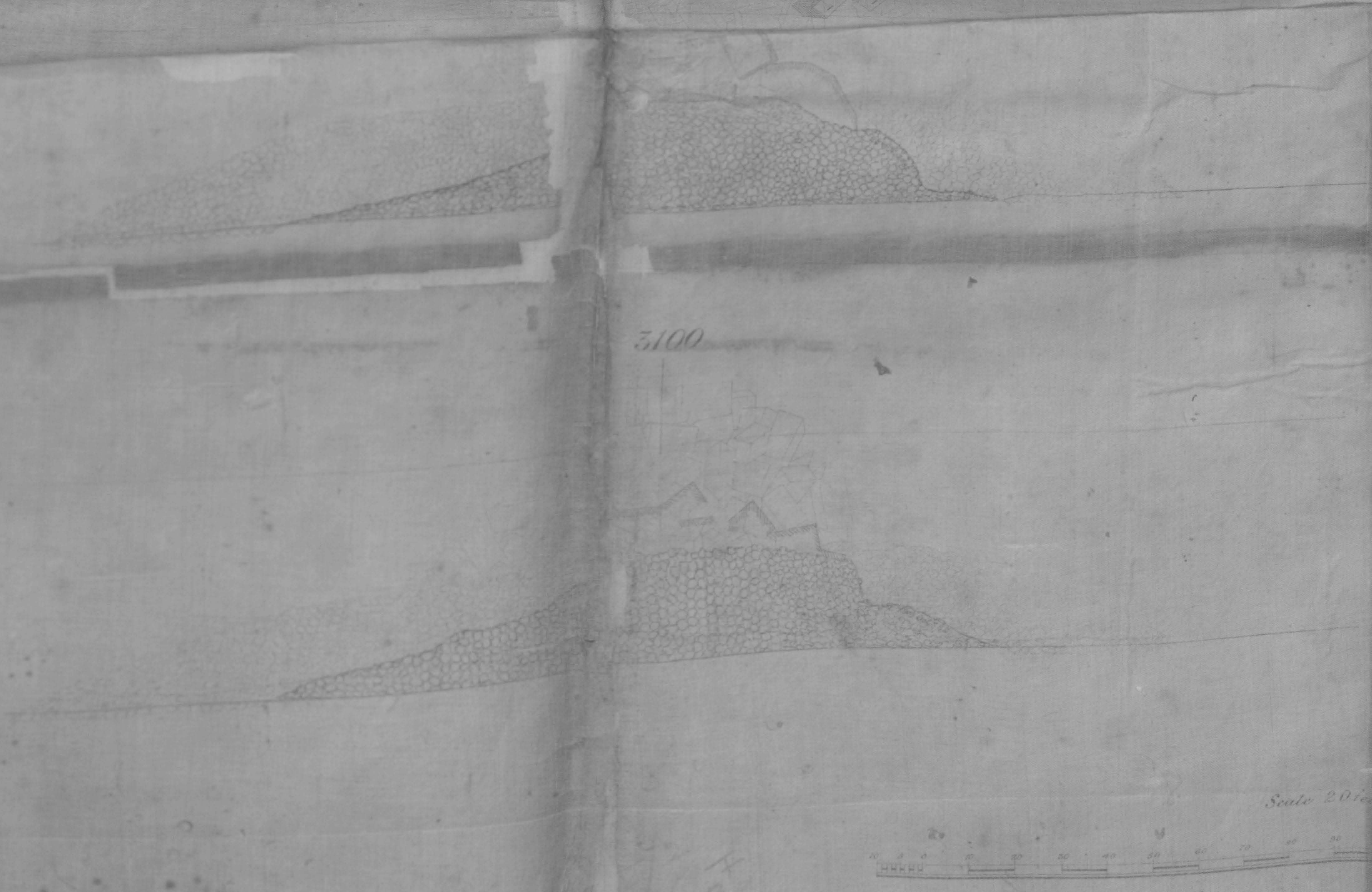
3550

ARBOUR

ADRAS SPECIAL COMMITTEE

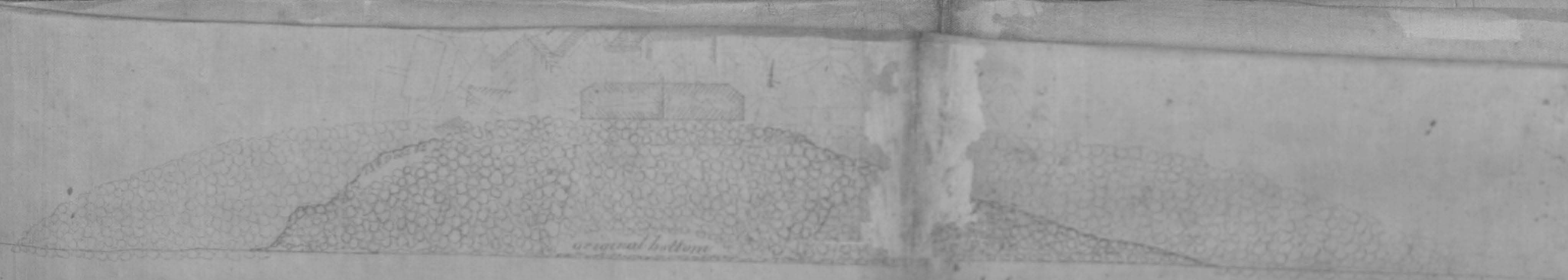
ons, with random blocks over old work.



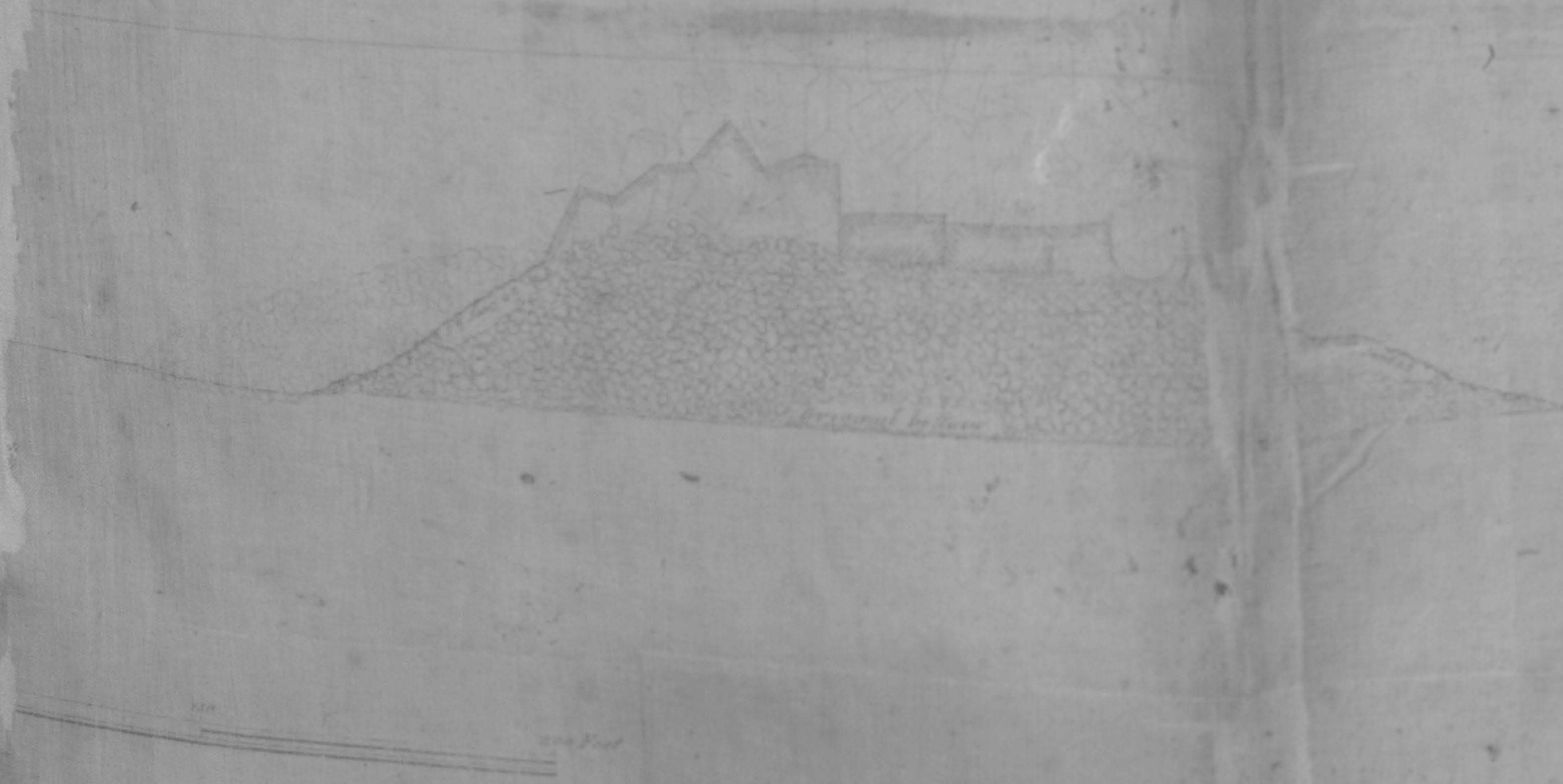


measured from the point E, [illegible] from

NOTE – The Sections are [illegible] [illegible] Pier; and are shown looking out to
the Commencement [illegible] the Sea side and the right hand
Sea so that the left [illegible]
side is the Harbour [illegible]



2900



Note.– The Sections are [illegible]
from the commencement of the Original Block [illegible]
to Sea [illegible] the left hand side is the Harbour side and the [illegible]
side to the Sea side.

Note by Col: Hasted on Para 51. — I think the protection is of doubtful character. A crowded harbour would be a capital target for an enemy's ship offering but a small mark for one or two big guns.

S.A.W.

Para 6 – Should not "in those of the Home Committee's" be "in those of the Home Committee". ✓

Para 22 Rs. 48,86,672 should I think be Rs 49,55,672 – 5

~~Rs. 2,30,000 should be~~

Para 37. ~~"[illegible] to those directions" is hardly equal. "parallel" I think is [illegible].~~

Para 55. Rs. 49,81,636 to be 51,42,636 & Rs. 50,24,980 to be 50,93,980.

with reference to Lucie.

"see Sheet 1, with sheet for with 450 entrance" — may be simply "see Summary of Estimates (A)"

omit all the other references to Sheet

S2

The order of Appendices is all wrong —

under heading
Madras Harbour

Appendix to Report of the Com &c &c

should come first

"Estimate of Cost of restoration as proposed by the Home Committee &c &c now marked 11 a

Then
Alternative Proposals (&c)

~~Next~~ Then
the "Summary of Estimates".

Lastly
Specification. —

In fact in the order the manuscript sheets now stand.

CCJ

J.a.W.

3 mistakes I think.—

Para 31, second clause, it seems to me "*piers*" should be "*pier*".

Para 48 – 5th line – "are" should be "is".

53

Para. 53 – Semicolon (;) should be comma (,).

Otherwise approved.

Under "Summary of Estimates" (C) the V should not be repeated twice.

D.W.

Clean proof of Harbour Committee Report — For approval

C
20/6.

INDIAN TELEGRAPH.

Local No. 03207

Class. D.S.

To (Station) Madras

From (Station) Ootacamund

Official Instructions.

Words 19 Day 15 Hour 14 Minute 22

To (Person) Major Bowen D.C.C. Chepauk

From (Person) Colonel Sankey

Harbour report + Hasted withdraws dissent but show means of defense

54

D

MADRAS 15-6-83

Telegraph Master.

Report of the Committee appointed in G.O. No 1259 W of 30 April 1883, to report on the best means for restoring the works of the Madras Harbour

The Committee assembled under G.O. 30th April 1883 No 1259 W to consider the best means for giving effect to the proposals made for the completion of the Madras Harbour have the honor to submit their report for the consideration and orders of Government.

2 The first point claiming attention is the probable cost of completing the work on the several systems suggested by the Home Committee in their report dat London 23rd January 1883

3 As stated in para 25

of that Report the estimates were based generally on the rates of work given by Mr Parke but in some cases the Home Committee assumed higher ones with the results shewn in the several appendices, which though given in Sterling are apparently intended to be converted at 2 Shillings to the Rupee.

These estimates are professedly only approximate or as Expressed by Mr Parkes in para 4 of his letter of the 10th Feby 1873 must be viewed rather as illustrations of the general meaning of the authors, or at most as a basis for approximate estimate, than as a basis for instructions to the Engineer who will be charged ith the Execution of the work."

4. In the appendices to the present Report will be found estimates prepared by Mr Thorowgood which though still in some degree approximate will it is hoped from the intimate acquaintance of the framer with every detail of the work prove to be very fairly accurate. It is only in regard to the cost of special plant (for which information is incomplete) that the Committee feel hesitation, but this is not a very material item.

5. The results as shewn may be compared as follows. the £1 sterling being taken =10 Rs in the Home Committee's Estimates.

Table No. I.

Systems for completing the works as given in the Home Committees' Report	Home Committee Estimate including reduction of present Harbour Entrance from 550' to 450' Rupees	Present Committees Estimates See Appendices		Present Committee's Estimates more by [Col. (4) — (2)] Rupees
		1. Retaining the present Entrance Rupees	2. Reducing the Entrance to 450' Rupees	
(A). As per Sections No. 1, 2, & 3 (i.e. core of seaward arms constructed on immediate site of present work.)	47,92,190	~~50,84,980~~ ~~50,24,980~~ 50,93,980	~~51,76,580~~ ~~51,16,580~~ 51,86,580	~~3,84,390~~ ~~3,24,390~~ 3,93,390
(B). As per Sections No. 1, 2 & 4 (i.e. core of seaward arms constructed on a new base some 60 feet on the harbour side of the present work)	42,92,170	~~45,27,779~~ ~~44,67,779~~ 45,36,779	~~46,04,179~~ ~~45,44,179~~ 46,13,179	~~3,12,009~~ ~~2,52,009~~ 3,21,009
(C.) As per Sections No. 1, 2, & 5 (i.e. the seaward arms constructed entirely on the random block System)	46,56,000	~~48,61,672~~ ~~48,01,672~~ 48,70,672	~~49,46,672~~ ~~48,86,672~~ 49,55,672	~~2,90,672~~ ~~2,30,672~~ 2,99,672
	6	6	6	6

6. The chief reason for the Excess of the present Estimates is due to the item for superintendence and

and contingencies being taken at 15 instead of 10 per cent in those of the Home Committee, and the rest to a more accurate appraisement of the rates of the work as based on an analysis of the previous accounts.

7. So soon as the system of Construction to be adopted has been finally decided on by the Government, it will be desirable to ascertain through the Secretary of State the probable cost of the special plant, which of course will vary somewhat with the system, and then recast that portion of the estimate prior to final sanction.

8. The Home Committee while giving their opinion

(para 17) that as regards the seawards arms from point B on the North Pier and E on the South Pier, "it would be desirable, if it "could be done, to continue the walls on the original "foundations" & but that the picking up of the blocks "buried or nearly so in "debris, for the purpose of "resetting them, or preparing "a sufficiently level bed "on the site of the destroyed "wall will involve great "labour and Expense, and "possibly even it may be found "impracticable to continue "the wall on the original "foundations."

9. In their present Estimate

[illegible]

Committee have assumed that the plan of picking up and relaying the blocks is practicable, but they can only do so in the sense that while being possible it must of necessity be attended with very great delay and Expense.

10. The Home Committee have as will be observed strong doubts as to the applicability of the plan, and would apparently unhesitatingly prefer the System B were it not for the curtailment of the area of the Harbour which is involved in taking up a space 60 feet in width along the seaward arms.

11. On a full consideration of the state of the present work the Committee are of

opinion that it would be most undesirable to attempt to erect the new superstructure on the present work, as even where the lower blocks have got displaced or subsided only to a very trifling extent (and it must be feared that considerable displacement exists) all the labour of removing them will of necessity have to be gone through, if as specified the wall has to be so relaid as to admit of bonding and clamping with ~~??~~ sion throughout.

12. All such work it must be remembered has to be carried out by the tedious, expensive and in many respects

I don't think the ordinary needed ~~??~~ for this work than for any other system - & the time that costs the money.

" the difficulties of divers work will be increased to an altogether inconceivable extent by reason of having to sling & remove the old blocks in places where it will be absolutely impossible for men to work except in the very smoothest days? F.B.J

divers - to say nothing of ~~very special and costly machinery.~~ the time occupied in slinging & lowering each individual block & in bringing to setting.

13. If therefore the choice of Systems is to be confined to (A) and (B) the Committee have no hesitation in recommending the latter as the saving in outlay would be R. 5,72,401 (See Table No. 1) and in time not much less than a year. The small curtailment of the area of the Harbour would practically be inappreciable and should not, they consider, militate against such undoubted advantages.

14. But before arriving at a final decision regarding the most approved method of Construction, it is necessary

to consider the objections which have been urged against System (C) which the Home Committee in para 20 of their report admit to "possess advantages" and to be as regards Construction "a safe system to follow."

15. The first objection if indeed it can be called one, is, that "it would be necessary "to build a short length "of wall at the end of each "pier upon which to place "the entrance lights."

Such small addition could be readily made to the work at any time, but it may be observed, that at present there is no need for such, as vessels are frequently taken out of harbour whenever required by the aid of two common signal lanterns carried on boats stationed at each of the entrance buoys. The departure of vessels moreover after 9 p.m. has been prohibited by law with the sanction of the Government of India.

The question of such addition to the ends of the piers may therefore be left out of consideration.

16. The second objection against the random block system is that "owing to the "size of the vacuities amounting "to between one third and "one fourth of the mass "the seas may pass through "sufficiently to produce some "disturbance inside" and

that "the sheltered area "being limited it is important "that the whole space should "be as quiescent as possible."

17. This objection would no doubt have much weight were the proposal to construct the core of the work "de novo" and throughout with random blocks, but the fact appears to have been overlooked that already the core has been constructed on the monolithic system and that however the wall may be in places distorted and the material displaced, the blocks are so far as a rule [illegible] in position as effectually to arrest any movement of translation in the seas which impinge on the break-water.

Seas come through the [illegible] gaps in the [illegible] portion. [illegible]

W^m. H.

18. Local Experience shows conclusively that at present no wave undulations occur __through__ the present wall. The seas which enter the Harbour come through the entrance, and through the gaps in the damaged portion and the Committee consider that beyond some percolation through the mass of the upper blocks only, it would be impossible for a forward movement to be transmitted to the water inside the Harbour.

19. It must be borne in mind that during heavy storms the top water of the seas which is discharged over the work into the Harbour not only

has its forward momentum destroyed but as a first must, by raising the general level of the water inside, occasion an outward flow which of itself must tend to counteract any undulatory movement in the direction of the shore. In the storm of the 12th November 1881 so powerful was the outward current occasioned by the ~~filling~~ piling up of the water inside the Harbour that ~~masula~~ masula boats which got adrift were carried seaward through the entrance.

20 It is believed that none of the known breakwaters of other ports belonging to the type have a solid screen of the character now

[illegible] forward momentum [illegible]
[illegible] waves [illegible] come over [illegible]
one [illegible]
[illegible] 48513
[illegible] parts of the forward
[illegible]
[illegible] the forward momentum
[illegible] through [illegible]
Nov 2 [illegible]

When translated waves come over
Piers eight feet in depth above the
Pier I cannot think they [illegible]
fall into still water [illegible] water
from an overshot wheel — Part of the
[illegible] but [illegible]
translating [illegible]
[illegible]
carried on [illegible]

Harbour, and consequently that any analogy based upon the effects noticed in works constructed wholly from random blocks must fail in application.

21. Although therefore recognizing the force of the objection urged against breakwaters composed of loose blocks, the Committee cannot admit its application to the Madras piers as ~~now~~ [illegible] under system C Existing, and feel themselves in a position to submit that *primâ facie* there is no valid professional objection to the random block system of Construction (C) in this case.

22. The Expense as shown in Table I (Rs 48,86,672) although less by Rs 2,30,000 than System (A) Exceeds that of System (B) by Rs 3,42,000;

but in the opinion of the Committee there are advantages connected with this method of construction which fully outweigh this apparent saving.

First as regards the time required for completion of the works it is considered that from there being no need to employ divers and machinery in clearing the debris, levelling the base &c. at least a year would be saved.

One large crane
Secondly - ~~No elaborate~~
of special design on each
~~titan cranes would be~~
pier would suffice for the
~~needed, as any suitable hand~~
& Stick-wing Derricks with the
~~of travellers, capable of trans-~~
systems A & B, two additional
~~porting and tipping the~~
cranes will be needed for forming
~~blocks from the advanced~~
the "wave breakers" -
~~part of the pontoon block~~

Mr. A very elaborate special [illegible]

My opinion would be conveyed by writing the word "great" [illegible] instead of "greatest"

~~mounds would answer the requirements - the sea being allowed to do the rest.~~

Thirdly - Comparatively small material may be employed for the hearting of the mounds receiving the ~~20 ton~~ heavier blocks for the outer and more exposed portions.

Lastly - and this is a matter of the ~~greatest~~ great importance - the requirements of all future repairs both in respect to the superintendence and material to be maintained would be simplified by the absence of a special reduced to a minimum.

23. In this connection it is only necessary to draw attention to the fact that in case the work is completed on either of the monolithic systems

(A) or (B) the repairs of breaches (should such occur) of the seaward arms must occasion great delay and Expense from the difficulty of access to the ~~affected~~ foundations with divers ~~points~~, and from the necessity of maintaining in readiness for all emergencies ~~special plant~~ ~~and~~ a skilled diving Establishment.

Not only so, but disastrous results might easily be produced where, as is not unknown, a second severe storm follows in the wake of the first. If such should happen with unrepaired breaches in the monolithic work, the flanks would almost certainly be destroyed, and the mischief might easily Extend in such a manner

24. Looking therefore to the favorable opinion Expressed by the Home Committee as regards the safety of the random block system, and the many attendant advantages above pointed out, the Committee give a decided preference to this method of construction of the three adverted to in the Report under consideration.

25. The Committee now proceed to consider the subject submitted for their opinion in para 3 of G.O. No. 1259 W as to the propriety of reducing the width of the present entrance from 550' to 450', and to submit an alternative scheme should such reduction appear to be undesirable.

26. In reference to the

feasibility of narrowing the width of the entrance in the manner proposed the Committee have been favoured with the following recorded opinion of two of their members – the Master Attendant and Deputy Master Attendant.

27. These officers observe

"As regards the proposal of the Home Committee to narrow the entrance 100 feet we consider that it will render it difficult and dangerous to a degree, out of all proportion to any advantage that can be gained by it. A large amount of sea and swell must always enter from the eastward, and no comfort to the ships or the boating operations or to beach improvements, can be expected till this evil is removed. The completed harbour walls existed long enough to teach this lesson. This is the opinion of all nautical men, who have been consulted, and especially the Harbour Master who has daily opportunities of judging and appreciating the difficulties that attend the entry of large steamers (many of them over 400 ft long) even with the present width."

28. With this very distinct opinion of the professional officers before them – an

Opinion, the validity of which it may be observed has long impreſsed itself on all who have had an opportunity of witneſsing the effect of the waves which come in by the present Entrance — the Committee have felt that their duty would be very inadequately performed if they left unnoticed this blot on the present scheme, or if they disguised from the Government their clear opinion not only as to the infeasibility of narrowing the present Entrance but as to the Vital neceſsity for closing the latter completely if a quiet Harbour is to be Secured.

Query Is it not the small
extent of the Harbour?
& of the [illegible] generally
[illegible] JW

29. No matter what the direction of the wind the unceasing swell on this portion of the coast rolls in with the crests of the waves — parallel or very nearly so to the coast line. In no case is it believed that the angle Exceeds 30° to the ~~normal~~ general line of the coast — The result is that seas enter the present mouth freely, and owing to the small depth of the Harbour are not dispersed before reaching the shore at its base. The action is of course greatly intensified during storms and particularly with the wind from the east. At such times the [illegible]

the Harbour though probably not quite so high as outside is certainly of a more dangerous character being Exceedingly broken. Taking these and other facts into consideration the Committee have to record their opinion that unless means be found for closing entirely the present Entrance no radical cure will have been applied to the chief ~~evil~~ defect of the work as at present designed.

30 In this view they beg now to submit a plan for the Completion of the Harbour (see annexed tracings and Estimate No.)

I do not think this is proved
210
Q. do I. [illegible] once chances [illegible] a life boat should rather be [illegible] in a heavy sea launched from the inside of the Harbour than from the outside — 4.8.23 — See also [illegible] [illegible] Para 48

? closure

the leading features of which are

(1) the opening of a new entrance 500' in width in from 7 to 7½ fathoms of water at the N.E. angle of the Harbour.

(2) the closure of the present entrance.

31. Before stating the cost and advantages of this proposed arrangement the Committee desire to draw attention to one or two matters which while not in reality interfering with constructive details as recommended by the Home Committee may shew how these can be modified without disadvantage.

First as regards the amount of protection to be given to the portions from the shore to point B on the north and to point E on the south pier - The Home Committee adopt Section No. 2 (Drawing No. 2) for both alike, but while admitting the Expediency of such additional protection for the north, there is nothing to shew that such is needed on the south pier. Not only has the seaward face here not in any way been attacked but there is apparently no probability that such will occur in any storm that may arise on the coast.

The ~~dangerous aspects~~ heaviest seas Exp^t claimed have ~~to~~ invariably been from the north and north east, and again on the south the sand accumulations already protect the work for a considerable distance and shew a tendency to advance seaward along this pier.

32. The proposed ~~apron~~ Wavebreaker of rough blocks may therefore in the opinion of the Committee be omitted on the South arm with safety and the Expense saved.

33. The next point is the proposed cap of Concrete 6 feet in thickness along the same portions of both piers - In reference to this the Home Committee in

para 21 observe that "Raising
"the walls by concrete in
"maſs will be the last
"proceſs as that portion of
"the work can only conveniently
"be done by beginning it
"at the outer Extremities
"of the walls and working
"back towards the shore."

34. When it is remembered
that using systems (A) or
(B) four years must certainly
and poſsibly five or even
six y[illegible]y elapse before
the remodelled piers are
sufficiently advanced to
receive as the finishing work
this cap of Concrete, it is
clear that the Home
Committee though considering
it desirable in many respects
and chiefly as a means
for keeping seas from breaking
too freely over the piers
did not attach any very
indispensably constructive
value to this portion of their
design.

35. It is fair in fact to conclude
that if constructively essential
to the stability of the work
this concrete cap should
advance 'pari paſsu' with the
rest of the work.

36. The Committee in offering
this remark have no desire
to interfere in any way with
this portion of the design so
far as concerns the seaward
arms, where they believe that
raising the walls in the manner

proposed to 12 feet above high water will prove very sensible value ~~in keeping out an Excess of water during storm~~

37. As regards however the piers from the shore to points B and E, they are satisfied from the effects of the waves on these portions as hitherto observed that the proposed cap would be of no material advantage.

From the way in which the waves approach the coast the piers are as a rule normal to their direction with the result that only a comparatively small amount of water comes over them into the Harbour - the great mass being invariably it may be said poured over the seaward arm.

Such being the case the Committee consider that this block of concrete may with complete safety be omitted from the portions indicated.

Wave breaker?

38. Towards meeting the Expence of opening and protecting the proposed new entrance to the N. E. and closing the Existing entrance there would be Savings on the two items mentioned vizt.

(1) by the omission of the random block wave breaker apron along the south pier to E.

(2) by the omission of the concrete cap from the shore to B on the north and to E. on the south pier.

The actual savings in cash outlay due to these modifications will be found further down ~~in shewing~~ which is shewn the probable cost of the Harbour as thus completed, and here it will be desirable to advert to the formation of the proposed new entrance at the N. E. angle of the Harbour.

39. The position is shewn on the tracing to lie between the 7 and 7½ fathom lines – and the width to be 500 feet.

40. On this point the Master and Deputy Master Attendants have supplied the following observations:—

(1) "The proposed entrance to "the north may safely be "narrowed to 500 feet because "the cross currents and winds "that affect the east entrance "will no longer exercise a "troubling effect.

(2) "The proposed entrance to "the north in 7 fathoms ~~6 (?)~~ fathoms "will allow of the whole "deep water space being "utilized which is impossible "under the conditions of the "eastern entrance, and deep "water space is especially "valuable in a basin like "the Madras Harbour."

41. The Committee have adopted the conclusion as above stated, and also one to the effect that the protecting arm should be not less than 800 feet in length carried out tangentially to the curve at the north elbow, and

curved slightly to the east in order the better to deflect the seas from the entrance + and from the north arm, + to give in "more extended" form of entrance for [illegible] of vessels.

+ [illegible] a more [illegible] line of entrance for the work & passage of vessels

Looking to the general parallelism of the crests of the waves to the shore it is doubtful whether in practice so long a protective horn will be found to be indispensable, but as it is better to err on the safe side the Committee have provided for one 600 feet long in the estimate.

The Estimate is tentatively made out for a protecting horn 400 ft. long, as agreed to at the Committee meeting. There [illegible] new drawing or [illegible] new estimate will have been made.
J.H.T. June 14, 83.

42. As a matter of detail it may here be mentioned that the concrete blocks which now encumber the work at this point will in all probability be broken up by dynamite and the debris with the rubble base, down to a depth of 6 fathoms, removed by dredging

43. The closing of the Existing entrance will proceed so soon as the new N. E one has been worked out, and the final operation will be the construction of the horn. As the whole of the seaward arm can by this manner be dealt with continuously only one titan crane would be needed in case either of the Systems (A) or (B) are adopted, or one set of travellers if System (C) be decided on.

44. The following are the financial results of the

of the above method of dealing with the Harbour according to the system which may be approved.

(1) If completed on Section 1, 2 & 3, the present entrance closed also by Section No. 3 and entrance on north opened Rs ~~50,53,559~~ 54,18,717

(2) – Ditto – Sections 1, 2 & 4. present entrance being closed on Section No. 3 . . . . . . " ~~46,60,188~~ 50,26,348

(3) – Ditto – Sections 1, 2 & 5. the present entrance being closed on Section No. 5. (random block work) " ~~49,81,656~~ 51,42,636
(the cost of [illegible] on both arms & concrete caps to both arms omitted in these estimates)

For detailed estimates see the Appendix.

45. For the reasons before assigned the Committee would strongly recommend the completion of the work on the random block system.

~~In this conclusion~~ The Committee would beg ~~beg to~~ solicit attention to the following recorded observations by the Master and Dy Master Attendants in reference to the above proposals:– "We" they observe – "Consider that if the sea face "is closed, and a height of "12 feet given to the sea wall, "that much of the character "of a protective work to "shipping, under which sanction "to it was first obtained, "will be restored, and the "question of sending ships to "sea on approach of bad "weather need no longer be "considered"

47. To those who are acquainted with the fact that the main object of the late Lord Hobart, in pressing the necessity of a harbour on the attention

was the beneficent and
humane idea of sheltering
vessels in port from the dire
effects of the cyclones which
unhappily but too often
visit the Coromandel
Coast, and which since the
advent of European shipping
have occasioned such fearful
losses in life and property,
the true import of the
proposals now submitted
will it is hoped be sufficiently
obvious.

48. It is believed that Mr
Parkes never claimed for his
work the character of a
Harbour of protection and
certainly the cyclone of the
tended to

~~in the most conclusive manner~~
that far from being an efficient
protection to the shipping
inside, it ~~would~~ might on such
occasions prove to be, as it were, a trap
from which ~~there could be~~
~~no~~ Escape might be difficult & at
times perhaps impossible.

49. The fear, indeed the
certainty, that such would
prove to be the result has
it may be said imposed
a much more severe responsi-
bility on the Marine
Authorities than was the
case when no Harbour
Existed.

50. With the present eastern
entrance unchanged this
Extreme danger to shipping
and this terrible responsibility
for life and property must

The vessels [illegible] were wrecked
in Nov 81 because the timbers
joining them into a strong vessel parted
the vessels knocked [illegible] each
other until they were wrecked,
had the timbers not broken, or had
the vessels been [illegible] separately
as originally contracted they would
probably have ridden out the storm
unharmed. H.S.B.

I cannot agree to para 48. – The
storm of Nov 18. 81 showed that
a very nasty sea could get into the
harbour. It must certainly
did not prove "in the most
conclusive manner" that the
harbour was "a trap from which
there was no escape." On what
evidence is this statement made?
No attempt was made to escape
so no test was applied – and
where no test is applied we
cannot certainly say anything is
proved "in the most conclusive
manner"
H.D. H.S.B.

the system adopted for the completion of the rest of the work, and to allow matters to remain as they are will add the evil of a perpetual and dangerous reef in front of Madras in the form of the present ruined pier.

51. Under the proposals now submitted not only will it, is believed, the unexpected boon of a Harbour of protection be conferred on Madras but Imperial significance will be given to this great work, which if finished in the manner suggested could in time of war afford shelter and protection to the vessels of H. M. navy as also to all merchantmen who could make the port.

52 - The Home Committee in many parts of this Report correctly draw attention to the unduly small area of the present Harbour, not much more than the outward half of which is suited for mooring vessels of any draft; but as will no doubt at once be recognized, the proposals above made, must, by affording the means whenever desired of dredging out the shallow portions to any required depth, admit of [illegible]

the useful area

53 - An operation of this character it is almost needless to say could never be carried out so long as the present entrance remains open the disturbance inside the Harbour being such that with the exception of a very few days each year, would render dredging operations impossible excepting at an altogether prohibitive outlay.

54. Not only would the advantages be enumerated be secured but in many other respects, such as the possibility of moving ships much closer ~~to shore~~ than is at

76

Floating pontoon [illegible]

Insures includes a floating pontoon which [illegible] as an immense benefit [illegible] water.

JWB

present feasible, bringing ships much closer to the shore, Establishing wharfs, jetties &c. facilities to the trade of the port may be increased indefinitely.

55 - The total cost of the work remodelled as recommended will as shown be Rs 49,81,636 as compared with that of the Home Committee System A Rs 50,24,980 Practically therefore the two methods of dealing with the Harbour may be considered as costing much the same.

W.T.

30/1/83

31/1/83

With remarks on para [illegible] & dissent from portions of paras 29 & 48

76

(28) R. H. Sankey, Col R.E.
" J. O. Hasted Col R.E.
" J. H. Taylor, Lieut R.N.R.
" T. S. Marshall
" F. W. Morowgood
" St. B. Beardmore
" C. Bowen Major R.E. Secretary.

Note by Col. Hasted on Para 57.

Omit ~~I think the protection is of doubtful character – A crowded Harbour would be a capital target for an enemy's ship, offering but a small mark for one or two big guns.~~

Note by Mr Beardmore on para 61 – I consider it important that in order to adequately protect the proposed North East entrance the protecting breakwater should be at least 650 feet in length measured from the Eastern Tangent point of the North Pier, and that if it is [illegible] constructed, an excavation through the old rubble base of 400 feet in bottom width will prove to be sufficient, & indeed better in checking north Eastern Seas from entering the Harbour.

77 No 2 (1)

Madras Harbour

Estimate of cost of Restoration as proposed by the Home Committee and as modified by the Special Local Committee.

Quantities & Prices by the Superintendent of the Madras Harbour Work.

Note. The total lengthes of the two Piers as shewn by the figured dimensions in the plan accompanying the Home Committee's Report do not agree with the actual lengthes of work to be executed, but are 218 feet short of such lengths.

The following estimates are made with the corrected lengthes for obtaining an entrance of 450 feet viz 3916 ft for North Pier and 4020 for the South Pier.

The lengthes for each Section of the Committee's proposal therefore are altered thus:–

	North Pier	(on plan)	South Pier	(on plan)
Section No I	426 –	(400)	680	(650)
Section No II	1800 –	(1800)	1750	(1750)
Section No III. IV. V.	1690 –	(1600)	1590	(1520)
Total	3916	3800	4020	3920.
	Diff 116 ft.		Diff: 100 ft.	

Total Difference 216 feet

Both dimensions are shewn in the plan accompanying these papers.

Estimate for Section No. I

Length North Pier - 426.0
South - 680.0
Total 1106.0

Per lineal foot of pier

		R. a.
Additional Rubble	$18.0 \times 6\frac{1}{2} \times \frac{1}{2} = \overset{c.ft}{58\frac{1}{2}} = \overset{tons}{3}$ @ $\overset{R}{1.8}$ –	4. 8 ..
Concrete Topping	$24.0 \times 4\frac{1}{2} \times 1.0 = 108 = \overset{c.yds}{4}$ @ $\overset{R}{12}$.	48 .. ..
Iron Cramps	44 lbs per ft. lin: @ $\overset{a}{\frac{1}{2}}$	1. 6 ..
	Total per lin: ft. Rs.	53. 14 ..

For both Piers
$\overset{Lin}{1106}$ ft. @ Rs. 53. 14. = 59,585

Deduct for 480 lin: feet at South Pier
thoroughly protected by sand
& not needing rubble

Rubble: 480 ft. with 3 tons to 1 ft.
= 1440 tons @ $\overset{R}{1/8}$ 2160
Rs. 57,425

Total for Section No. I Rs. 57,425

Section No II

Length North Pier 1800·0
South Pier 1750·0
3550·0

Per lineal ~~feet~~ foot of pier

Additional Rubble

	c. ft		R	A
$110{\cdot}0 \times 8\frac{1}{2} \times \frac{1}{2}$	$= 467\frac{1}{2}$			
$55{\cdot}0 \times 5\frac{1}{2} \times \frac{1}{2}$	$= 151\frac{1}{4}$			
	$618\frac{3}{4}$	= 31 tons @ Rs 2	62	0

Concrete Blocks in Wavebreaker

	c ft	Cyds		
$50 \times \frac{20}{2} \times 1{\cdot}0$	= 500	= 18·5 @ R 11	203	8

Concrete topping

		Cyds		
$24{\cdot}0 \times 6{\cdot}0 \times 1{\cdot}0$	= 144	= $5\frac{1}{3}$ @ Rs 12	64	0
		per ft. lin.l R	329	8

For both Piers 3550 @ R 329·8 = 11,69,725 - 0 A

Add for 415 ft of piers to be
cramped at 1 R - 6 A per ft. 570 - 10

Total Value of work Section II R 11,70,295 - 10

Section No. 3

Length North Pier 1690
South Pier 1590 80
Total 3280 ft

Per foot lineal of pier

		Rs
Additional Rubble		
79 × 18 × $\frac{1}{2}$ = 711		
65 × 17$\frac{1}{2}$ × $\frac{1}{2}$ = 568$\frac{3}{4}$		
8·0 × 2·0 = 16		
63·0 × 2·0 × 1·0 = 126		
1421$\frac{3}{4}$ Cft = $\overset{\text{tons}}{71}$ @ Rs 2 =		142–0–0
Concrete Blocks in wave breaker		
65·0 × $\frac{23·0}{2}$ = 28 Cyds	@ Rs 11	308–0–0
Concrete Blocks in regular work		
28·0 × 6·0 × 1·0		
24·0 × 24·0 × 1·0 = $\overset{\text{Cft}}{744}$ = $\overset{\text{Cyds}}{27\frac{2}{3}}$	@ Rs 11	303–0–0
Preparing Base by removing old blocks &c. per foot lineal	Rs 134	134–0–0
Concrete Topping		
24·0 × 5·0 × 1·0 = 4$\frac{1}{2}$ yds	Rs 12	54–0–0
Concrete Bags		
22·0 × 2·0 × 1·0 = $\overset{\text{Cft}}{40}$ = $\overset{\text{Cyds}}{1\frac{1}{2}}$	@ Rs 11	16–8–0
2 Cramps or 88 lbs per ft @ $\overset{a}{\frac{1}{2}}$ per lb		2–12–0
		Rs 960–4–0
Deduct for old blocks recovered in foundation &c. of the Wave breaker 4 yds per ft @ Rs 11		44–0–0
Total per foot lineal		Rs 916–4–0

Section No 3. 3280 Lft @ $\overset{\text{Rs}}{916}$·$\overset{a}{4}$ per ft Rs 3004480

№ 26

(8)

Section № 4

Alternative Section per № 3

Total length, 3280 feet

Per foot lineal of pier

Additional Rubble

C.ft

62·0 × $\frac{24}{2}$ × 1·0 = 744

50 × $\frac{24}{2}$ × 1·0 = 600

Rs. a

1344 = 67 tons @ Rs 2 134 - 0

Concrete Blocks in wave breaker

C.ft

48·0 × $\frac{26}{2}$ × 1·0 = 520

" in regular work

28·0 × 6·0 × 1·0 = 168

24·0 × 24·0 × 1·0 = 576

1264 = 47 Cyds @ Rs 11 - 517 - 0

Concrete Topping

24·0 × 5·0 × 1·0 = 4½ Cyds @ Rs 12 - 54 - 0

Preparing Base ate per lineal ft Rs 40 - 40 - 0

Apron Bags 20·0 × 2·0 × 1·0 = 1½ Cyds Rs 11 - 16 - 8

2 Cramps to each course per ft 2 - 12

Per lineal foot Rs 764 - 4

Rs.

3280 feet of piers @ Rs 764 - 4 = 25,06,740

Total per Section № 4

Rs 25,06,740

B 27 (6)

Section No. 5.

(Random Blockwork)
Length same as No. 3 & No. 4.
3280 ft.

Additional Rubble — c ft

90.0 × 2.0 × 1.0 = 180.0
60.0 × $\frac{17}{2}$ × 1.0 = 510.0
85.0 × $\frac{18}{2}$ × 1.0 = 765.0
37.0 × $\frac{19}{2}$ × 1.0 = 351.6
50.0 × $\frac{17}{2}$ × 1.0 = 425.0
2231.6 = 112 tons @ Rs 2 — Rs 224.0

Concrete Blocks at random

60.0 × $\frac{24}{2}$ = 720
42.0 × $\frac{18}{2}$ = 378
30.0 × 24 = 720
1818 = $67\frac{1}{3}$ Cyds @ Rs 11 — 740.0

Concrete Topping & Bags.

30.0 × 8.0 × 1.0 = 240 = 9 Cyds say Rs 12 — 108.0
Rs 1072.0

Deduct for random blocks in pierced work about

60 × $\frac{18}{2}$ × 1.0 = 20 Cyds @ Rs 11 — 220.0
Per ft lineal — Rs 852.0

For both Piers

3280 ft @ Rs 852 = Rs 27,94,560.

Alternative Proposals.

Estimate for full Section N° 3 (without any old work) to be used for closing Eastern opening

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Per foot lineal of Pier.

Mem – The rubble base is to extend 33 ft from edge of blocks to top of slope on Harbour Side.

Rubble Base in 48 ft water

$75 \times \frac{21}{2} = 787\frac{1}{2}$

$75 \times \frac{50}{2} = 1875$

$61 \times 26 = 1586$

$42 \times \frac{20}{2} = 420$

$4668\frac{1}{2}$ = 233 tons @ R 2 = 466. 0

(sheet 4) Value of N° 3 Section without taking credit for old blocks per ft and without R 134 for preparing base — 826. 0

per ft lin: 1292 – 0

Taking 500 feet as the additional amount of rubble base required @ R 466 = 2,33,000

And 550 feet for blockwork @ 826 = 4,54,300

Total for closing Entrance with N° 3 Section } Rs 6,87,300

Alternative Proposals.

For making a Northern Entrance.

Excavation of Rubble for 600 ft in length

c. ft.
40.0 X 3.0 = 120.0
41.0 X $\frac{19}{2}$ = 389.6
54 X 17 = 918.0
43 X $\frac{15}{2}$ = 322.6
1750.0 X 500 = 32407 c yds @ R 4 = R 1,29,620

Excavation and Removal of blocks.
28.0 X 20 = 560 X 500 = 10,333 c yds @ R 8 = 82,664

2,12,292

Building a Protective Arm 400 ft long as Section No 3, but without heavy charge for preparing base.

~~400~~ 600 of Full Section No 3 (Sheet 7) @ R. 1292 p ft = ~~5,16,800~~ 7,75,200

Deduct for value of old blocks recovered enough to make 1/4th wave breaker or 7 c yds @ R 11 = R 77 for 400 ft   30,800

R ~~4,86,000~~ 7,44,400

Add for Pier Head work   20,000

R ~~5,06,000~~ 7,64,400

Excavation as above   2,12,292

R ~~7,18,292~~

R 9,76,692

Alternative Proposals. —

Savings effected by making North East entrance owing to there being less pier to build. —

		Rs
(a)	In Section No 3 600 ft. @ 916. 4 per ft	5,49,750 (a)
(b)	In Section No 4 600 ft. @ 764 per ft	4,58,400
	Deduct lump sum for extra work in crossing over line of North Pier, for outer horn	50,000
	nett	4,08,400 (b)
(c)	In Section No 5 600 ft @ 852	5,11,200 (c)

SP 31.

86

Alternative Proposals.

Whole Section No 5. for closing Eastern Entrance and building outer horn.

Per ft lineal

Rubble Base (48 feet water)

$65.0 \times \frac{21}{2} = 682.6$

$155.0 \times \frac{27+24}{2} = 3952.6$

$72.0 \times \frac{25}{2} = 900.0$

5535.0 = 276 tons @ R. 2 =	R. 552 – 0
Concrete Blocks (as before)	67 1/3 c yds. @ R. 11 –	740 – 0
Concrete Topping & Bags	9 c yds. @ R. 12 –	108 – 0
		1,400 : 0

For closing Entrance

	R
500 ft rubble work @ 552 per ft =	2,76,000
550 ft blockwork @ 848 per ft =	4,66,400
	7,42,400

For building Extra horn.

500 ~~400~~ ft @ R. 1400 =	6,90, ~~5,60~~,000	
(sheet 8) Deduct for old blocks	30,000	
	5,09,200	
For work in Pier Head.	20,000	6,29,200 ~~5,49,200~~
		R ~~12,91,600~~
		R. 13,71,600

No 32 (11)

87

Committee's Alternative Proposals.

Saving by doing away with South Pier Wave breaker to 1750 feet and with Concrete Topping on Sections I & II –

No 1 Section	Rs
1106 feet Concrete Top @ Rs 48 –	53,088
No 11 Section	
3550 feet Concrete Top @ Rs 64 –	227,200
Wave Breaker, South Pier	
1750 feet Blocks @ Rs 203½ – – –	356,125
Rubble 1780 feet @ 62 —	108,500
Rs	744,913

H 4 86 (A)

Summary of Estimates

	Rs
(A) Restoring as per section 1.2, 3 with 450 ft entrance	51,85,580 ~~51,16,580~~
Ditto. with 550 ft entrance	50,93,980 ~~50,24,980~~
(B) Restoring as per section 1, 2 4 with 450 ft entrance	46,13,179 ~~45,44,179~~
Ditto with 550 ft entrance	45,36,779 ~~44,67,779~~
(C) Restoring as per section 1, 2, 5 (450 ft ent)	49,[illegible],672 57 ~~48,88,672~~
ditto do (550 ft ent)	70 48,~~01~~,472

Alternative Proposals.

With 500 ft entrance to the North East abolishing Concrete capping on inner portion of work, & wave breaker to inner portion of South Pier

	Rs
(D) Restoration being carried on as Section 1.2.3 & extra work built as Section 3	~~21~~ ~~[illegible]~~ ~~50,52,60[illegible]~~ 54,18,717
(E) Restoration to be carried on as in section 1.2 & 4. extra work being as section 3	~~47,19,1[illegible]~~ ~~[illegible]~~ 50,26,348
(F) Restoration & extra work to be done as in Section 5. (random work)	50 ~~52,[illegible],136~~ ~~49,81,636~~
Mem. This will be the *quickest* work	51,42,636

For blocks on stock a credit of R 1,30,630 may be taken for every Section

R 60,000 added for extra Titan Roads & rails omitted in detailed Estimate

Summary of Estimates

(A) Estimate for restoring Harbour as proposed by Committee in Sections I, II & 3.

	Rs
Total value for Section No I (sheet 2)	57,425
ditto Section No II (sheet 3)	11,70,295
ditto Section No III (sheet 4)	30,04,480
	42,32,200

Plant.

2. Titan Cranes complete @ Rs 45,000	90,000
2 Cranes for setting wave breakers @ Rs 30,000	60,000
New Railway lines. 230 tons of permanent way material @ Rs 100	23,000
200 tons Titan Rails @ R 100	20,000
4000 Salwood Sleepers @ 4/8	18,000
16,000 ft Lin. Titan Roads @ 4/8	64,000 ~~24,000~~
1 Goliath Crane, restored	2,000
	~~45,04,200~~ 45,04,200
Add 15% for Establishment & contingencies	6,76,380
	~~51,74,580~~ 51,85,580
If with 550 ft Entrance deduct 100 ft @ 916	91,600
	~~50,84,980~~ 50,93,980

~~Add Rs 6,000 for rail [illegible] of Titan Road omitted~~

90

Summary of Estimates.

(B) Estimate for restoring Harbour as proposed by Committee in Section I II & IV

	Rs
Total value for Section No 1 (Sheet 2) …	57.425
ditto Section No 2 (Sheet 3) …	11,70,295
ditto Section No 4 (Sheet 5) …	25,06,740
	Rs 37,34,460
Plant as for Sections I II & III —	2,77,000 ~~2,14,000~~
	~~3[illegible]4,60~~ 40,11,460
Add 15% for Establishment & Contingencies — — —	6,01,719 ~~5,92,719~~
	~~Rs 45,4[illegible]179~~ 46,13,179
If with 550 ft Entrance Deduct 100 ft. @ 764 — —	Rs 76,400
	~~Rs 44,6[illegible]9~~ R. 45,36,779

~~[illegible]~~

Summary of Estimates

91

(C) Estimate for restoring Harbour as proposed by Committee in Sections I II + 5 (Random Blocks)

	Rs
Total value for Section No 1 (sheet 2)	57,425
ditto Section No 2 (sheet 3)	11,70,295
ditto Section No 5 (sheet 6)	27,94,560
Rs.	40,22,280

Plant

2 Special Titan Cranes capable of setting regular work, + overhanging enough to build random block	1,60,000
Other plant, as before, less the 2 extra cranes	1,27,000 ~~67,000~~
Rs	~~42,49,280~~ 43,09,280
Add 15% Establishment + Contingencies	6,46,392 ~~6,37,392~~
Rs	~~48,86,672~~ 49,55,672
If with 550 Entrance deduct 100 ft. @	85,200
	~~48,01,472~~ 48,70,472

~~Add [illegible] for Titans~~

319

Committee's Alternative Proposals

1st Alternative – To close present entrance by section No 3, and open one to the North, extending the Eastern part of the breakwater 400 ft as an overlap to the entrance

---

(D) Estimate for Repairing by Sections I II & 3 see sheet 1) with sheet with 450 entrance		Rs 42,32,200
Deduct 100 ft for making 550 ft entrance		91,600
		Rs 41,40,600
Add		
For building across entrance (sheet 7)		6,87,300
For building 400 of protecting arm (sheet 8)		~~6,01,000~~ 7,64,400
Excavating & opening North Entrance) 8)		2,12,292
		Rs ~~[illegible]~~ 56,04,592
Deduct, saving as shewn (a) on sheet 9	549,750	
also saving as shewn on sheet (11)	7,44,913	12,94,663
Carried over		R. ~~[illegible]~~ R 45,09,929

~~[illegible]~~

Alternative Proposal

(D)

Closing North Entrance

		Rs
Brought forward		45,09,929
Plant		
1 Titan Crane	45,000	
1 Crane for Wave Breaker ..	30,000	
Other plant as on Sheet No 1^A	127,000	202,000
		47,11,929
Add 15% for Establishment & Contingencies		7,06,788
Grand Total Rs		54,18,717

Alternative Proposals

X (E) Estimate for closing Eastern entrance & opening onto the North, the work being restored mainly on Section 1. 2. & 4

		R
Value of Restoring work by 1. 2 & 4 (as shewn on sheet 2 A) with 450 entrance		37,34,460
Deduct for 100 ft. to restore 550 entrance		76,400.
	Rs	36,58,060
Add.		
For building across entrance (sheet 7)		6,87,300
~~[illegible]~~ 600 ft. of Protecting arm (sheet 8)		7,60,400 ~~6,00,000~~
Excavating & opening Northern entrance (8)		2,12,292
		~~56,13,657~~ 53,22,052
Deduct		
Saving as shewn (6) sheet 9.	R 4,08,400	
also as shewn in sheet 11	7,44,913	11,53,313
	Rs	~~39,10,339~~ 41,68,739
Plant as before (sheet 5 A)		2,02,000 ~~1,42,000~~
	R	43,70,739 ~~40,52,339~~ ~~41,16,339~~
Add 15 % Establishment & Contingencies	Rs	6,~~[illegible]~~ 55,609 ~~6,07,849~~
		~~[illegible],188~~
Grand Total	Rs	~~46,60,188~~
		R 50,26,348

~~Add~~ R [illegible]

Alternative Proposals.

(F) Closing Eastern Entrance and opening one to North, with Sections 1, 2 + 5 –

Mem – The Entrance is supposed to be closed and the Extra protective built on Section 5.

		Rs
Restoring work Sections 1, 2 + 5 (sheet 3A) with 450 ft Entrance		40,22,280
Deduct for 550 ft Entrance, 100 ft (sheet 3A)		85,200
		R 39,37,080
Add^s Building across Entrance (sheet 10)		7,42,400.
Building Extra protective arm (sheet 10)		~~5,44,~~ 6,39, 200.
Excavation in North Pier (sheet 8)		2,12,292.
		R ~~54,40,~~ 55,20, 972.
Deduct Saving as shewn sheet 9	R. 5,11,200	
also as shewn in sheet 11.	7,44,913	12,56,113.
		R ~~41,84,~~ 42,64, 859.
Plant. 1 Special Titan 80,000		2,07,000
Other Plant as before 67,000		~~1,47,000~~
		R ~~43,31,~~ 44,71, 859.
Add 15% Establishment + contingencies		6, ~~49,777~~ [illegible]
		~~49,87,636.~~
		[illegible]

Madras Harbour.

Appendix to Report of the ~~Local~~ Committee ~~(of Madras)~~ appointed in G.O. No 1259 W of 30th April 1883 -

Detailed remarks on prices and methods of carrying out work suggested

1. Rubble Stone for base & foreshore

The rubble for base and foreshore is to be clean hard ~~syenitic~~ syenitic rock from Pallavaram, similar to what has been used hitherto from that quarry. The price is generally taken at Rs 2 per ton deposited in the sea - but for the shore ends of the piers for protective work R 1 8 per ton has been taken. The ton has been taken as 20 cubic feet, and this is arrived at by frequent measurements and weighings. The price is based on what has already been done in depositing 800,000 tons of rubble, the cost of which varied from R 1. 8 to R 2. 11 per ton. The latter price being exceptionally high. The rubble will be deposited from large boats propelled by oars also by being thrown from the piers and by being tipped by the overhanging crane. No steam hopper barges will be needed. The stones will vary in weight from 3 lbs to 300 lbs.—

Concrete Blocks

The concrete blocks will be similar in composition to those made latterly for the damaged piers, of which 12,563 cubic yards are now in stock. The Madras local cement may however be used as much as possible—but this does not materially affect the price.—

The cost of the concrete blocks per cubic yard has latterly been Rs 8·90 in this yard and the cost of setting by means of divers has been sometimes below R 2 and sometimes a little above R 2 per cubic yard including all charges. Therefore the price chosen in the estimate of Rs 11 is fair.—

Concrete Topping & concrete in bags

This has been taken at Rs 12, as there will be more waste of cement in mixing, and the material will have to be carried along the piers for mixing "in situ" thus

adding to their cost before they are converted into concrete.

Iron Cramps.

Iron cramps are taken at ½ anna a ℔ fixed in the blocks with cement. The price is based on actual work done.—

Preparing Foundation on site of ruined work

This is a difficult item to estimate as we have no similar experience. We know that it will be very tedious and difficult. There was a time in the North Pier work when there was 7 feet of excavation to be carried on in laterite rubble. This reduced progress to nearly a stand still and took a very strong driving force. The amount of material to be shifted was more than equal to a course of blocks. It was found to cost Rs 134 per lineal foot. This price has been selected as the cost per lineal foot of preparing foundation in ruined work. It may cost twice as much.—

Method of setting block in Sections 3 & 4.

It is supposed that for the actual piers, two

Titan

Titan cranes will be required in which there should be some alterations and improvements. For depositing the block in the wave breakers other cranes should be used, of special design, with their overhang extending on each side of the blocks. They should be capable of holding 30 tons with an overhang of 40 feet. The blocks for the wave breakers should be "tipped" and not lowered by lewis bolts.—

Crane Roads

The roads on which the setting machines (Titan or similar cranes) travel are to be continuous. They should be 90lb flat-bottomed rails, fastened by fang bolts (not spikes) to teak longitudinal timbers 11" x 10". These timbers to be fixed to the blocks and built in.

Crane for Random Blockwork

The cranes or crane required for this work must be one with enormous scope. It should be capable of carrying 30 or 40 tons at a radius of 50 feet, and should be on a circular girder to "jib" completely round. It will be absolutely necessary to deposit the blocks as far away from the centre line as possible,

otherwise

otherwise there will be no chance of retaining an even and solid road for the crane to advance upon.—

Construction of Random work

To within 15 feet of Low water, no doubt rubble stone may be used as a hearting to the outer slopes of random work. But above this nothing but heavy blocks should be used, except for purposes of levelling up. If the individual blocks at the level of breaking sea are too ~~high~~ light, say less than 25 tons, there is no stability in the random mound. At 6 feet above H.W. the work must be levelled and concreted up with bags, ready to receive the top course of blocks which must be brought up level enough to carry a railway as well as the Crane roads.—

Estimate of Plant

The Estimate for Plant is nothing more than a guess based upon the known cost of cranes, rails, sleepers, &c. &c. as given by previous experience on these works

works. As the cranes are purchased as complete machines for a lump sum, it is not possible to enter into details except in communication with the builders in England.-

Establishment & Contingencies

It is believed that 7½% will be ample for "Establishment" but as in former experience 2½% was far too little for "Contingencies," it is judged safer to make the charge for the latter also 7½%, which it is hoped will be more than sufficient

J.W.P.

Specification (?)

FM

180

Harbour Committee Report

Circulated for Signature.

The Hon'ble Col. R. H. Sankey C.B. R.E.

Colonel J. O. Hasted R.E. JOH

Lieut. J. H. Taylor R.N.R. seen

T. G. Marshall Esqre [illegible]

F. W. Marangoot Esqre × seen FM

N. St. B. Beardmore Esqre Seen

C. Unwin

Major R.E.

Secy. Harbour Works Committee

Chepatt
23/6/83

F. W. Thorowgood
25/6/83

4th July 1883, No. 1[illegible]5 W., Public Works.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Read—the following :—

Report of Committee appointed in G.O., No. 1259 W., dated 30th April 1883, to consider the best means for giving effect to the proposals made for the completion of the Madras Harbour, dated 20th June 1883.

Order—dated 4th July 1883, No. 1855 W., Public Works.

The Committee appointed in G.O., No. 1259 W., dated 30th April 1883, to consider the question of the restoration of the Madras Harbour Works, having now submitted their Report, the papers will be forwarded for the orders of the Government of India, and copies furnished for the information of the Secretary of State.

(Here enter No. 1856 W., dated 4th July 1883.)

(True Extract.)

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

To the Superintendent, Madras Harbour Works.
" Marine Department.
" Master Attendant.
" Examiner, Public Works Accounts.

Exd. A. F. Goodall.
Spare Copies

BUILDINGS AND ROA
CIVIL WORKS.

Govt. of (1883) Madras.

PUBLIC WORKS.

Dated July, 4th.

Encl.

Recd.

G.O., 4th July 1883, No. 1855 W

JULY.

- Madras Harbour Works

Report of the Committee appointed t
sider the question of the restoration of th
ordered to be forwarded for the inform
of the Government of India and the Sec

10.3.1200

orders of the Gover

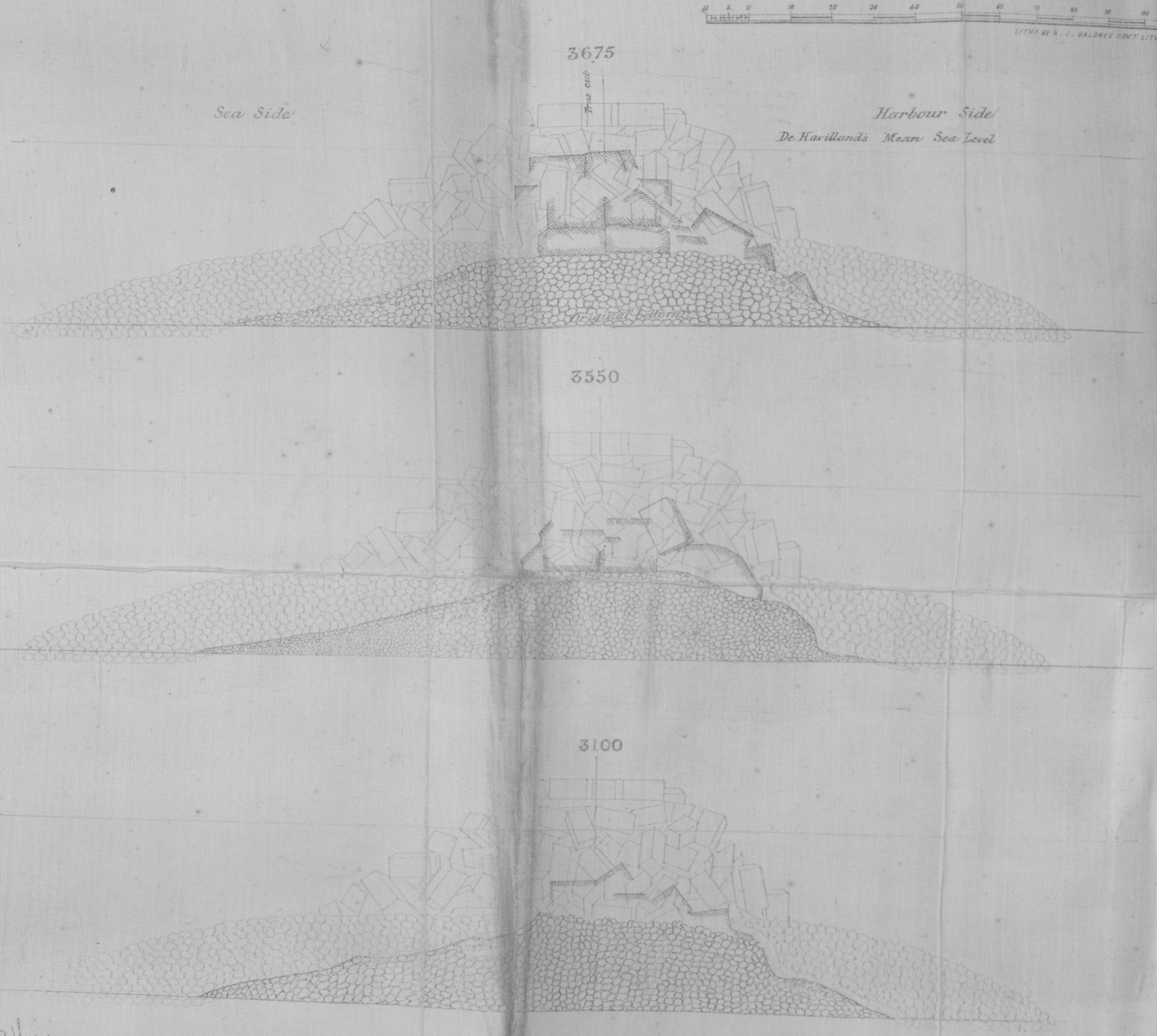
MADRAS HA

PROPOSALS FOR RESTORATION BY M

Sections shewing actual state of piers in outer straight

North Pier

Scale 20 feet = 1 inc



NOTE. The Sections are at points as shewn measured from the point B. i.e. from the commencement of the Concrete Block Pier; and are shewn looking out to Sea so that the left hand side is the Sea side and the right hand side is the Harbour side.

W. Dr. Waldren
Supt and Manager
Govt Lithoc Dept Chepauk
Madras...... June 1883.

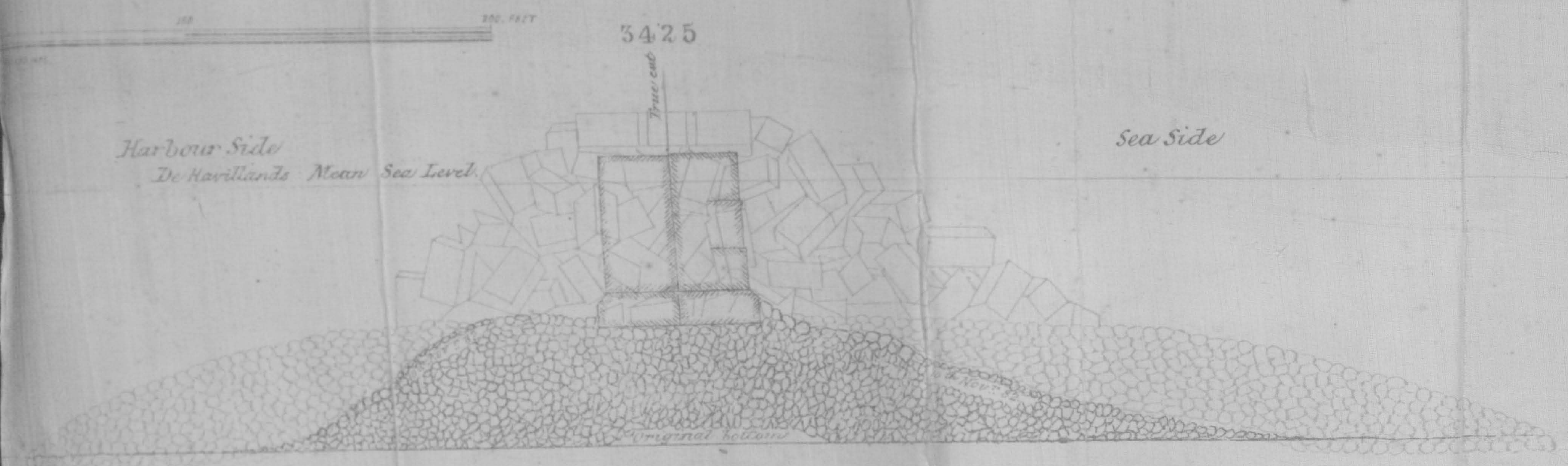
RBOUR

RAS SPECIAL COMMITTEE

tions, with random blocks over old work.

South Pier

3425



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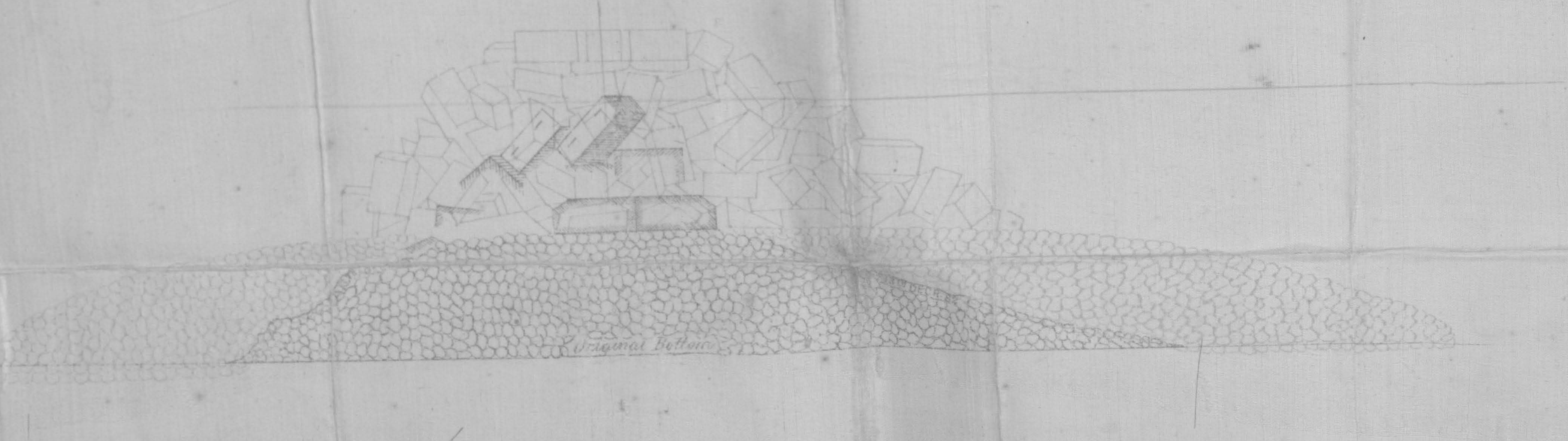

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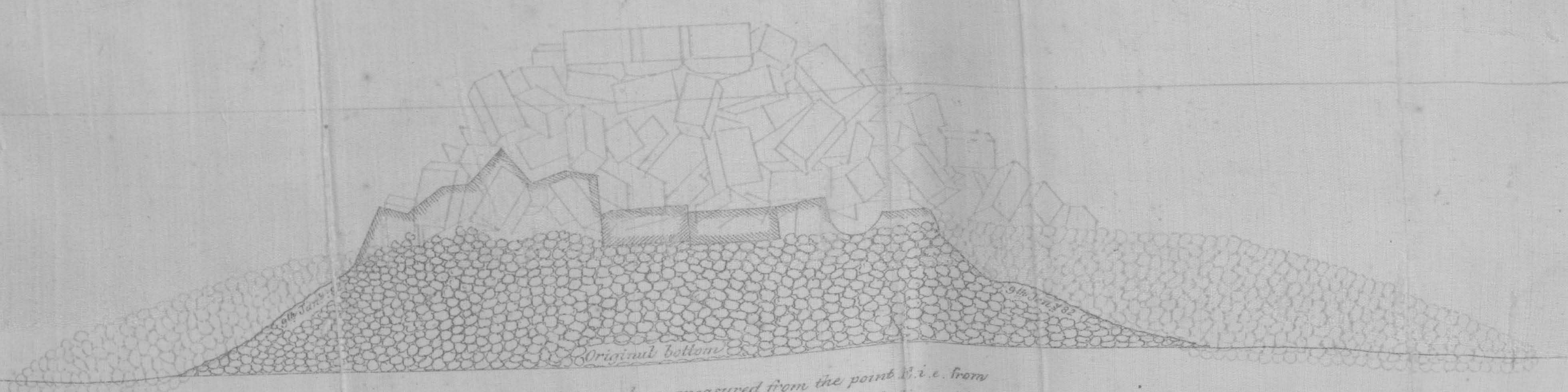

Note The Sections are at points as shewn measured from the point B. i.e. from the commencement of the Concrete Block Pier; and are shewn looking out to Sea so that the left hand side is the Harbour side, and the right hand side is the Sea side. –

(Signed) F. N. Thorowgood M Inst, C.E.
Superintendent
Madras Harbour Works

C. Bowen. Major R.E.
Dy Chief Engineer P.W.D.

XX

Print order

No. 1855W P. W. Department.

Proceedings of the Madras Government,

Under date the 4th July/83

Read the following

Report of Committee appointed in G.O. No. 1259W d/ 30th April 1883 to consider the best means for giving effect to the proposals made for the completion of the Madras Harbour dated 20th June 1883.

The Committee appointed in G.O. No. 1259W dated 30th April 1883 to consider the question of the restoration of the Madras Harbour Works, having now submitted their Report, the papers will be forwarded for the orders of the Government

of India, and copies —
furnished for the information
of the Secretary of State.

2/7/83

Superintendent,
Madras Harbour Works 4

Marine Dept 7

6

Master Attendant

Exr P.W. Accts. 11

Office 30

4

P. W. Department.

No 1856 W. d/4th July /83

To,

The Secretary to the
Government of India.
P. W. Department

Sir,

With reference to despatch No 10 P.W. dated 8th March 1883 from the Right Honorable the Secretary of State on which this Government was desired to consider the recommendations of Sir John Hawkshaw's Committee on the Madras Harbour dated 22nd January 1883 "in view to assisting the Govt. "of India to arrive at a "decision upon the course "which it will be most desirable to follow in reference "to the work of restoration," I am now directed by His Excellency the Governor in Council to submit the annexed Report of a Committee which was lately assembled at Madras to frame the needful Estimates, and to consider the question of restoration in all its bearings.

2. In the first place as regards the estimated cost of the works the Committee, on [illegible] of the rates of work, time required for Execution &ca, find that to restore the breakwaters on the plan most favored by Sir John Hawkshaw's Committee

Nos 1, 2 and 3 of their Report would be as follows viz:

(1) While retaining the present Harbour Entrance . . . Rs 50,93,980

(2) While reducing the Entrance to 400 feet " 51,85,580

The latter sum compares directly with the Home Committee's Estimate No 1 amounting to £479,219:15:2.

3. As will be observed the Madras Committee have shewn by the highest nautical opinions that it would be dangerous to decrease in any way the width of the present eastern entrance, and that so long as this latter is left open the Harbour must remain Exposed as at present

continued disturbance, as well as being a perpetual source of the gravest anxiety to all concerned during cyclone periods.

4. They further shew that while carrying out for the seaward arms the random block method of reconstruction, which is stated to be "a safe system to follow" by Sir John Hawkshaw's Committee, the objectionable eastern entrance may be closed, and a perfectly still water Harbour created, at a total outlay of Rs 51,42,626 or for Rs 42,954 less than that needed for reconstructing

most approved by the Home Committee.

5. The incidental advantages of the plan suggested (see paras 46 to 54 of the present Committee's report) are so marked that His Excellency in Council trusts they may be fully weighed in arriving at a conclusion in regard to the completion of this great work.

6. Not only would the Harbour enjoy complete immunity from disturbance during ordinary weather, thus facilitating in every way all the trade operations of the port, but what is of the highest moment

no ships need be sent to sea on the Commencement of a storm. It is impossible in the opinion of the Govt. to lay too great stress on the single fact or to doubt the soundness of the reasoning on which it has been established.

7. Not only moreover could the Harbour under the altered conditions be dredged out and its area increased to any required extent, but as deemed by the Committee it might by a suitable system of defences form a complete Harbour of refuge in times of war.

8. Taking into consideration the latter fact His Excellency

A fatal paragraph. Omit it. We should be soon I know and have many demons if we keep it.
M.K.

in Council would submit that as already forcibly pointed out by Sir Andrew Clarke when Public Works Member of His Excellency the Viceroy's Council the question of completing a Harbour of this character is not only an Indian but a British question, and that a material subsidy might with justice be looked for from the English Government. In any case His Excellency trusts that the claim thus established for a large subsidy from the general revenues of India may be favorably considered.

~~9~~. 8 As regards the [illegible]

resumption of the works. I am now to submit that every day's delay is adding to the cost of establishment and continues the disadvantage under which the trade of the port has been suffering since the cyclone of the 12th November 1881.

No 9. Everything is in readiness for pushing on operations Excepting the needful machinery for placing the block in the manner now recommended, and as regards which it is probable that Mr Parkes' services might at once be availed of.

10. So soon as the duty of providing this machinery has been performed by Mr Parkes it is thought that his further connection with the work should cease: indeed His Excellency in Council would be well pleased if his services in the position of Engineer in Chief for the work could even now be dispensed with. His original plans for the Harbour Works have had to be abandoned as proving unsound in practice and he no longer commands the confidence of this Government as its professional adviser.

12.11. On the other hand the present Superintendent of the work, Mr Thorowgood, by his aſsiduity, intelligence and the soundneſs of his profeſsional views has established for himself a confidence which is shared alike by the Government and the public. Were he constituted Engineer-in-Chief not only would Mr Parkes' salary be saved but the very serious inconvenience of his absence in London and divided control would be at once put an end to

!

early orders,

Ablt

28/6/83

ans Desp
4/7/83

P. W. Department

No. $\frac{34}{1855}$ W. dd 4th July /83

112

To,

The Right Hon'ble
The Secretary of State for India

My Lord,

We have the honor to acknowledge the receipt of your Lordships' Despatch No. 10 Public Works, dated 8th March 1883, forwarding copies of certain papers including the Report of the Home Committee on the Madras Harbour Works: with a view to our considering the matter and assisting the Government of India

arrive at a decision
upon the course which it
will be most advisable
to follow in reference to
the work of restoration.

2 On receipt of this
Despatch we caused the
accompanying orders No.
1259 W. of 30th April 1883 to
be issued assembling a
local Committee who have
now laid their Report
before us.

3 A Copy of the Report
with an Expression of our
views thereon as contained
in our Secretary's letter
to the Government of
India No 1858 W. of 4th July

---

to forward herewith for you
Lordships' information,

No 9

~~Obtt~~

2/7/83

Despd 14-7-83
with 4 of ser:
1858 W 1856 W
and 1259 W of
30th April/83

R.S.

31-1-98

5-10-015

Govt. of (1883) Madras.

PUBLIC WORKS.

4/7/83

Dated

Recd.

G. O. 4 July 1883 No. 1833 W
1836 W

do. 34
1835 W

Nos.

Madras Harbour works

Report of the Committee appointed to consider the question of the restoration of the [illegible] advised to be for[illegible] for the information of the Govt. of India & the Secy of State

2nd report of the Committee appointed to consider the question of the reconstruction of the Madras Harbour

3rd report of the Committee appointed to consider the question