Marine (1897) Department.

G.O., No. 1053 "Madras"

DATED 29th December 97

[Despatch Abstract.]

Madras Harbour; Orders that copy of a survey of the — and Roadstead recently made by Lieut. Beauchamp R.N. together with a Note by Mr S.J. Wilson the Local Consg. Engineer to the Madras Harbour Trust Board be forwarded to the Home Government.

Forwarding copy of a survey of the Madras Harbour and Roadstead recently made by Lieut Beauchamp R.N. together with a Note by Mr S.J. Wilson the Local Consulting Engineer to the Madras Harbour Trust Board. And requesting that the documents may be communicated to Sir Alexander Rendel for information.

7/1/98

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

GOVERNMENT OF FORT ST. GEORGE.

MARINE (1897) ***DEPARTMENT.***

Letter to the Right Honourable the Secretary of State for India.

Dated 29th December,

No. 9 of 1897.

FORWARDING copy of a survey of the Madras Harbour and Roadstead recently made by Lieutenant Beauchamp, R.I.M., together with a note by Mr. F. J. Wilson, the Local Consulting Engineer to the Madras Harbour Trust Board, and requesting that the documents may be communicated to Sir Alexander Rendel for information.

MARINE DEPARTMENT.

Letter—to

The Right Honourable the SECRETARY of STATE for INDIA.

My Lord,

In continuation of the correspondence ending with your Lordship's Despatch, No. 6, Public Works, dated 29th October 1896, on the subject of the Madras Harbour, we have the honour to forward the accompanying copy of a survey of the Madras Harbour and Roadstead recently made by Lieutenant Beauchamp, R.I.M., together with a note by Mr. F. J. Wilson, the Local Consulting Engineer to the Madras Harbour Trust Board, and to request that the documents may be communicated to Sir Alexander Rendel for information.

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

(Signed) A. E. HAVELOCK.
(„) H. W. BLISS.
(„) J. GROSE.

Fort St. George,
29th December 1897.

Exd. A. F. Eccleston.

Government {1897} of Madras.

MARINE.

Recd. } 1897. *Enclosures*

Regd. } *Spare copies*

G.O., No. 1053, 29th December 1897.

DECEMBER.

Madras Harbour

Ordered that copy of a survey of the — and Roadstead recently made by Lieutenant Beauchamp, R.I.M., together with a note by Mr. F. J. Wilson, the Local Consulting Engineer to the Madras Harbour Trust Board, be forwarded to the Home Government.

GOVERNMENT OF MADRAS.

MARINE DEPARTMENT.

Read—the following paper:—

From J. N. ATKINSON, Esq., I.C.S., Chairman, Harbour Trust Board, Madras, to the Acting Secretary to Government, Marine Department, dated Madras, 26th November 1897, No. 3791.

I have the honour to submit, herewith, a copy of a survey of the Madras Harbour and Roadstead made by Lieutenant Beauchamp, R.I.M., together with a printed copy of a note by Mr. F. J. Wilson, dated 26th October 1897, and in accordance with the Board's resolution No. 4, dated 12th November (copy enclosed), request that the survey and note may be forwarded for the information of Sir Alexander Rendel.

Enclosures.

From Lieutenant W. G. BEAUCHAMP, R.I.M., to the Officer in charge, Marine Survey of India, dated Poona, 14th September 1897.

In forwarding the tracing of my survey of the Madras Harbour to the Chairman of the Harbour Trust Board, I have the honour to suggest that it may be of some interest and help to the Board in coming to conclusions about the shoaling of the harbour, if I draw a few comparisons between my survey and those of previous years. To do this I have the honour to suggest that two charts should accompany my tracing. One of these is a survey by Lieutenant Jarrad, R. N., and though this chart is now obsolete, it shows the depth of water at the very commencement of the harbour works in 1876 and it is the last Marine survey that has been made of the harbour. The other chart is one made in the Marine Survey office in 1886, but taken entirely from Mr. Pogson's survey of that year. The scale of this chart is nearly the same as that of my survey, whereas the scale of Lieutenant Jarrad's is smaller, being 300 feet to the inch and mine 250 feet. The soundings of my chart are reduced to Indian spring low water mark or 1·86 feet below mean sea level. Those on Mr. Pogson's sheet are reduced to the mean of lowest ordinary spring tides or 1·6 feet below mean sea level. Those on Lieutenant Jarrad's chart to what was called low water ordinary springs, or 0·08 feet below what is now determined as mean sea level. Consequently the datum of soundings on my survey and the Marine survey sheet of Mr. Pogson's work differs only about 3 inches. But on Lieutenant Jarrad's chart the soundings must all be reduced by 1·78 feet (say 2 feet approximately) before comparing with the other sheets. With the above explanation I trust a comparison will be easily made.

Regarding the changes which have occurred, I have the honour to point out the following as probably the most noteworthy. At the centre of the entrance to the harbour, midway between the two breakwater lights, and about 3,600 feet from the pier-head there is now a depth of 41 feet. At the same spot, before the breakwater was begun there was 44 feet. In 1886 by Mr. Pogson there was 47 feet, or 3 feet more than before the breakwater was built and 6 feet more than there is now. In the north-east corner, the harbour seems to have shoaled about 3 feet since the breakwater was begun, and it all seems to have taken place since Mr. Pogson's survey of 1886. In the south-east corner it seems to be shoaler by about a foot than it was in 1876 and shoaler by about 4 feet than in 1886. I should imagine, however, that the depth in certain parts of the harbour may vary slightly at different times of the year. But I have no information of this. The coast line inside the harbour has advanced considerably, and taking it at the pier it can be said to have advanced 350 feet since 1876, though of this amount only about 50 feet in the last eleven years. The greatest change of all has taken place outside the breakwater to the southward. The point where the high water line there meets the breakwater has advanced about 750 feet since 1886, and probably more than 1,800 feet since the harbour works were begun. The shoal inside the harbour along the south breakwater has entirely arisen since 1886. All to the northward and all outside the 7 fathom contour line to the eastward and south-eastward is much the same as ever. In fact there is a striking similarity in the contour lines, particularly that of the 8 fathom contour east of the south breakwater light. There are also a couple of patches of 42 feet just inside the harbour entrance, which is the same depth of water as there was at that spot before the breakwaters were built, and the central area of the harbour also appears exactly the same.

From F. J. WILSON, Esq., Under Secretary to Government, Irrigation Branch, to the Chairman, Harbour Trust Board, Madras, dated 26th October 1897.

With reference to Board's resolution No. 7, passed at the meeting of the 15th instant and your letter, No. 3253, dated 16th instant, I have the honour to submit the following remarks on the papers forwarded to me.

Before dealing with the survey of the Madras roadstead lately made by Lieutenant Beauchamp, I propose to review the circumstances which led up to this survey being made.

As to what would be the final result of constructing a close harbour with an eastern entrance at Madras has been the subject of controversy ever since the scheme was first projected more than twenty years ago. Mr. Parkes, who designed the original harbour, anticipated a gradual accumulation of sand on the south side of the harbour, but at a constantly decreasing rate. In a paper read before the Institution of Civil Engineers in 1882, Mr. Vernon-Harcourt says with reference to the Madras Harbour, "as the breakwaters extend to a depth of 45 feet at low water, the sand is certain not to encumber the entrance for a long period"; and in the discussion on this paper Mr. Thorowgood said that he thought the accumulation was rather quicker than was at first anticipated, but he did not think that there was any reason to suppose that the harbour could not be made efficient in consequence. He also said that, judging from repeated surveys, there never had been the slightest indication of any shallowing at the mouth, or anything in the way of silting up, except from wave borne sand which was arrested mechanically by the solid obstruction of the south pier.

Proceedings, Vol. LXX, page 18.

In submitting the Progress Report of the Harbour for the quarter ending 30th September 1894, the Trustees drew particular attention to the advance seawards of the water line to the south of the harbour, and in noting on this, Sir Alexander Rendel says the importance of this advance depends very much on whether it is going on to the same extent below the water line as at and above it, and to ascertain this he asked that cross sections extending out to the 7 fathom line should be made *at intervals throughout the year*. G.O., No. 584 W., dated 12th March 1895, directs that arrangements should be made for doing this, and that the results should be recorded with the quarterly reports submitted to Government. It does not appear from the file what orders of the Board were passed on this G.O., but the sections asked for do not appear to have been taken.

Note, dated 11th January 1895.

With his report on the Harbour Works for the quarter ending 30th September 1895, the Engineer submitted the results of his survey of the harbour and roadstead, taken in July, August and September, which showed important movements of sand both inside and outside the harbour and a shallowing of the entrance of 2′ 7″ between 1893–95. The Engineer gave it as his opinion that the roadstead was shallowing, and that the time had now arrived when measures must be taken to prevent further accretion of sand outside the entrance, where dredging would be of no avail, and in a separate report recommended the construction of a groyne south of the present harbour. Mr. Pogson also stated his opinion that the shallowing of the roadstead was not due to the harbour, and that the Madras roadstead was subject to periods of shallowing and deepening before the harbour was constructed. Government sent this report home, and ordered whatever information on the subject there was in the Secretariat, or Presidency Port Officer's Offices, to be furnished to the Harbour Trust Board.

G.O., No. 529 W., dated 11th February 1896.

The Secretary to Government in the Marine Department in a memorandum, dated February 1896, pointed out that the records did not support Mr. Pogson's theory as to the shallowing of the roadstead, and asked for soundings for a series of years. In replying to this memorandum, Mr. Pogson gave some other particulars and again stated that soundings in deep water showed a steady shallowing at a distance from the harbour, and that, in his opinion, unless sand was prevented from reaching the entrance, it might be left high and dry a few years hence. The Board, in submitting Mr. Pogson's report to Government, asked that it might be submitted to an expert for opinion, and that the roadstead might be surveyed by a Marine officer.

Memorandum, No. 76 E., dated 18th February 1896.

The Secretary to Government in the Marine Department in noting on this report and accepting the fact that the entrance was getting shallower, advocated a north-eastern entrance as the only satisfactory solution of the question from an engineering point of view, and the matter was referred to Sir Alexander Rendel. Mr. Pogson, the Engineer, having been directed to proceed to England to consider the question with Sir Alexander Rendel, the latter gives his opinion in his report, dated 23rd September 1896.

No. 536, Marine, dated 4th August 1896.

The information laid before Sir Alexander Rendel was presumably that contained in the Engineer's reports referred to above, and the opinion he formed was, that sand was now beginning to travel past the harbour, that the deposit in the entrance was due to wave action, and is a bar formed in the same way as at river mouths. That whether the bar would increase or not depended mainly on whether the shallowing outside the harbour increases, but that as the

entrance was not originally placed in water sufficiently deep to bear much loss, we should act at once as if further loss was certain. He recommended the purchase of a sand pump dredger, capable of holding about 500 tons of sand, and that if dredging should fail to secure a sufficient depth in the present entrance and the harbour is to be maintained, he would recommend a new north-east entrance as shown on a plan which he forwarded.

About this time the Board was committed to the purchase from Government of the dredger *Wenlock* which is a bucket dredger with a hopper capacity of about 400 tons. Estimates have now been made for converting this dredger into a sand pump dredger, and indents sent home for the pumps, &c., which will be fitted in the Calcutta dockyard, where the dredger now lies. We have therefore taken the first step considered necessary by Sir Alexander Rendel, to meet further loss of depth at the entrance, should it occur.

Having taken this step, it remains for the Board to examine the information on which the recommendation to the purchase of a dredger was made, with the view of ascertaining whether anything further is required, and also to determine at what stage dredging should begin, and to what extent, or, in other words, what minimum depth of water should be maintained at the entrance to the harbour.

With regard to the first point the main statements made were—

(1) that the entrance had shallowed 2′ 7″ between 1893 and 1895 (paragraph 32 of Mr. Pogson's report, dated 17th December 1895);
(2) that 220 feet east of the entrance there had been a shallowing of 3 feet in the same time (paragraph 37 of the same report);
(3) that this change, together with what had taken place in deeper water, tended to show that the roadstead was shallowing.

We have now received the Marine survey made by Lieutenant Beauchamp in May and June 1897, and in his note accompanying this survey he compares it with a survey made by Lieutenant Jarrad, R.N., in 1876, and with a chart prepared from a survey made by Mr. Pogson in 1886. The result of this comparison is that the entrance was 3 feet deeper in 1886 than in 1876 before the harbour was constructed, and that now it is 6 feet shallower than in 1886, or 3 feet shallower than in 1876. That all to the northward, and outside the 7 fathom contour to the eastward and south-eastward is much the same as ever. This information is valuable so far as it goes, and it is satisfactory to know that there are now no grounds for believing that the Harbour is doomed to an early disappearance in the sand, as might be apprehended if a general shoaling up of the roadstead took place. I would point out, however, that the comparison of a single set of soundings taken in any one year with a similar set taken ten years previously, is not an absolutely reliable indication of what is taking place, more especially when it is desired to notice small differences in depth. Putting aside the many sources of error in a marine sounding, no account is taken of changes in the sea-bed due to the weather, or of what occurred in the intervening years. We are aware that the shore line advances and recedes at different seasons of the year, and it was to ascertain whether similar movements were going on below water that Sir Alexander Rendel asked for sections taken at intervals throughout the year two and a half years ago, and I have not been able to ascertain why these were not taken. The results of Lieutenant Beauchamp's survey must not in short be taken to mean that there has been a gradual deepening of the entrance by 3 feet between 1876 and 1886, and a gradual shallowing since that date to the present time. All that the survey tells us with regard to the entrance is that on a particular day of this year there was a certain depth of water, and the two previous charts give us similar information for two particular days in other years.

I have now before me the following sources of information regarding the harbour entrance:—

(1) The three charts—Lieutenant Beauchamp's and the two others of 1876 and 1886.
(2) A section of the entrance showing various sets of soundings in different years, which accompanied Engineer's letter, No. 68 A., dated 25th April 1896.
(3) A statement, which I have obtained from Mr. Pogson, showing soundings taken across the entrance at intervals of a month, since January 1897 and certain other dates.

For the purposes of comparison, I have reduced the chart soundings to the datum in use on harbour plans, that is what is there called DeHavilland's mean sea level. This level is 6·83 feet below the bench mark, known as DeHavilland's bench mark, under the north gate of the fort, and is the level which was accepted as the mean level of the sea up to 1885.

From the charts I find the depth of the entrance, below this datum, was 47·13 feet in 1876, 49·63 feet in 1886, and 43·89 feet in 1897.

From Mr. Pogson's section I find that in 1889 there was a depth of 51 feet, and that the sea bottom at the entrance is shown as the same on 25th October 1893 and January 1895. In paragraph 32 of Mr. Pogson's report for quarter ending 30th September 1895, it is stated that the soundings taken (presumably sometime in July, August or September 1895) showed a depth of only 44′ 5″ and no mention is made of any sounding in January. In looking at this section a few days ago, Mr. Pogson threw doubts on its correctness, but it purports to be a true copy of an original signed by Mr. Pogson, vouched for by Mr. Manual, the Manager of his office.

The third source of information, the statement showing soundings at short intervals in the present year, shows that it is possible for there to be a difference in level either shallowing or deepening of a foot in a month. For example, between the 11th June 1897 and 22nd July 1897, there was a shallowing of nearly a foot, and between 25th August 1897 and 22nd September 1897, there was a deepening of over a foot. The average depth of the entrance at 260 feet from south caisson for 1897 comes to 42·9 feet, the highest reading is that for September 0·8 feet above the average, and the lowest is that for July 0·8 feet below the average.

It is obvious, therefore, that if we wish to watch carefully what is taking place at the entrance, we must have soundings taken at regular intervals throughout the year, and that conclusions based on two single sets of soundings taken in different years may be absolutely misleading. Assuming similar variations in the depth to have been going on in 1893 and 1895, as are now observed to be going on in 1897, the actual average difference in depth between 1893 and 1895 might have been only about a foot, instead of 2′ 7″ as reported.

On the recommendation of Sir Alexander Rendel, Government has directed that soundings outside the harbour should be taken once in four years, and so far as the roadstead is concerned, I think this should be sufficient, as the maximum period that should be allowed to elapse without a regular set of soundings; but we still require to watch carefully the movements of sand in the immediate vicinity of the south arm and at the entrance. For this purpose, in my opinion, soundings taken once a year are altogether insufficient. Lithographed diagrams should be drawn up for regular submission once a month. I am aware that there are difficulties in taking accurate soundings when the sea is not calm, but so far as the entrance is concerned, I think it should be possible, with very rare exceptions, to get soundings once a month. In any case the diagrams should be submitted, with the reasons in such cases, why the soundings could not be taken. Spaces would be provided on these diagrams for information regarding any unusual disturbance of the sea, for the velocity and direction of currents observed outside the harbour, and in the entrance itself, and remarks would naturally be expected on any unusual alteration of the sea bottom. It will be observed from the statement submitted that Mr. Pogson has been collecting most of the information required, only it is not put on record in any systematic way. A copy of the diagram would be sent to the Deputy Port Conservator for information.

G.O. No. 34 W., dated 9th January 1895.

With regard to the minimum depth which should be maintained at the entrance: For a proper consideration of this question it is necessary to understand the different datum lines to which our different sources of information are referred. I annex a diagram showing these different levels—all the levels on the harbour works and the previous harbour surveys are referred to what is called DeHavilland's mean sea level. This was the accepted mean level of the sea up to 1885, and is 6·83 feet below the DeHavilland's bench mark on the fort. Under these circumstances I think it better to adhere to this datum remembering that the mean level of the sea as ascertained by latest tidal observations, and accepted by the Survey of India, is a little over a foot below the DeHavilland's mean sea level. The lowest recorded tide, as published in the preface to Official Madras Tide Tables for 1897, is 3·49 feet (say 3½ feet) below DeHavilland's mean sea level. This is a little lower than the lowest tide of 1897 as shown in the tide table to occur on the 20th March 1897. The highest recorded tide is 2·01 feet (say 2 feet) above DeHavilland's mean sea level, which is a little higher than the highest tide shown in the table for 1897 to occur on the 25th November 1897.

I understand that the nautical consideration desired by the Presidency Port Officer in fixing a minimum depth, is that the depth should be such that any vessel which might be inside the harbour on the occurrence of a storm should be able to get out without bumping.

The worst possible case would be that in which such a vessel should be one of the greatest draught which use the harbour, and that the occurrence of the storm should coincide with the lowest tide. Mr. Pogson informs me that he knows of a case of a vessel drawing 27 feet entering the harbour, but as the Colombo Harbour ship berths are only dredged out to 26 feet below low-water, I think we need not take account of more draught than 25 feet for the present.

Kyle on Colombo Harbour Works, Vol. LXXXVII, Minutes of Proceedings of Institution of Civil Engineers.

As regards height of waves I cannot get any direct evidence of the height of waves at Madras, The height of a wave is dependent on the velocity and the depth of water, and the velocity is governed by the strength of the wind and the distance in the direction of the wind over which the wind acts on the water. In a south-western direction there is no land between Colombo and Africa. The greatest heights of waves observed at Colombo during the south-west monsoon, as given in an appendix to the paper marginally quoted, were 13 feet in the offing, and 15 feet just outside the breakwater. Between 1878 and 1882 the greatest wave observed at Colombo during the north-east monsoon is 6 feet, but it is believed that a wave which broke the gauge rose to 7 feet.

It does not seem possible that a vessel should plunge to a greater depth than its own draught measured below the level of the trough of a wave, and taking therefore a vessel of 25 feet draught, and a wave 20 feet from trough to crest, occurring when the general level of the water

was at *lowest recorded tide*, *viz.*, $3\frac{1}{2}$ feet below DeHavilland's mean sea level, we get the greatest depth to which the vessel could plunge as $25 + \frac{20}{2} + 3{\cdot}5 = 38\frac{1}{2}$ feet below DeHavilland's mean sea level.

The level of the entrance at present is, according to Lieutenant Beauchamp, nearly 44 feet below DeHavilland's mean sea level, and according to Mr. Pogson's latest soundings 43 feet. The margin, under these assumptions, between the ship's bottom and that of the entrance is $4\frac{1}{2}$ or $5\frac{1}{2}$ feet. It must be remembered that this assumes a wave 5 feet greater than ever observed at Colombo, and that, as a matter of fact, the level of the sea during a cyclone is generally raised above its ordinary level.

Under these circumstances, I am inclined to think that it will be sufficient if we maintain the entrance to its present level, or 43 feet below DeHavilland's mean sea level. This is 40·11 feet below Indian spring low water mark, the Chart Datum. If this level were decided on, as the highest recorded tide rises to 2 feet above DeHavilland's mean sea level, some alteration would be required in the design of the dredger, which, I understand, is only intended to dredge to 40 feet below water level. To dredge to 43 below DeHavilland's mean sea level, at all states of the tide, the dredger should be capable of dredging to a depth of 45 feet.

N.B.—I wish to add to the above that at the time of writing I had in my mind that a greater depth than 43 feet below DeHavilland's mean sea level had been suggested, and the result of my enquiry was that this depth of 43 feet is the maximum depth that could, under any circumstances, be required, but there are reasons for adopting a less ruling depth. In the first place there is the tendency of suction dredgers to burrow holes, and so far as the stability of the piers is concerned, the less we go below the bottom of the caissons the better. Again, there is the probability of there being practical difficulties to making the *Wenlock* dredge to so great a depth as 45 feet, and the Trustees would not wish to have to purchase another specially designed dredger at present when there is no protected basin to keep it in. The suction dredgers used at Dunkirk, Calais and the first dredgers used at the Mersey bar could only dredge to 36 feet in still water, and I think we should be satisfiedi f the *Wenlock* be made capable of dredging to 40 feet which would enable us to dredge except at high water to 40 feet below DeHavilland's mean sea level.

Extract of Proceedings of the Trustees of the Harbour of Madras, at a meeting held at the offices of the Board on Friday, the 12th day of November 1897.

* * * * *

4. Read letter dated 26th October 1897, from Mr. F. J. Wilson, the Board's Local Consulting Engineer, replying to resolution No. 7 of 15th idem, in connection with the recent survey of the harbour and roadstead by Lieutenant Beauchamp, R.I.M.

Read minutes by trustees.

* * * * *
* * * * *

A copy of Lieutenant Beauchamp's survey together with copy of Mr. Wilson's note will be forwarded to Government, for the information of Sir Alexander Rendel.

* * * * *

(True Extract.)

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

Order—No. 1053, Marine, dated 29th December 1897.

Ordered to be forwarded to the Home Government.

[Here enter No. 9, Marine, dated 29th December 1897.]

(True Extract.)

(Signed) W. B. deWINTON,
Ag. Secretary to Government.

To the Chairman, Harbour Trust Board.

Exd. A. F. Eccleston.

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4 / 500-14-10-97.

Marine DEPARTMENT.

Papers to be read in proceedings:—

Madras Harbour Survey

Again G.O., dated 189 , No.

Again G.O., dated 189 , No.

Current No. 1522 of 189 7, dated 29th November , from the Chairman, H. T. Board.

" " " 189 , " , "

" " " 189 , " , "

The Hon'ble Sir Henry Blois K.C.I.E.

ORDER. No. 1053, Marine, dt. 29-12-97

Ordered to be forwarded to the Home Government.

(H.E. 9 Marine dt. 29-12-97)

The Chairman, Harbour Trust Board.

6/1/98

To

The Right Honourable
the Secretary of State
for India.

My Lord,

In continuation of the correspondence ending with your Lordship's Despatch No. 6 Public Works dated -- 29th October 1896 on the subject of the Madras Harbour, we have the --- honour to forward the accompanying copy of a survey of the Madras Harbour and Roadstead recently made by Lieut: Beauchamp, R. I. M., together with a note by Mr. F. J. Wilson, the Local Consulting Engineer to the Madras Harbour Trust Board, and to request that the documents may be communicated to Sir Alexander Rendel for information. We have &c. &c.

81 1897

29/12/97

Marine (1897) Department.

CURRENT No. 1522

Order

From
The Chairman,
Harbour Trust Board,
Madras.

No. 3491

Dated 26—11—94
Despatched 29—"—"
Received 29—"—"
Enclosures ~~4~~ 3
Spare copies 4 1 Main

SUBJECT.

Submitting for the information of Sir Alexander Rendel a copy of Survey of the Madras Harbour & Roadstead made by Lt Beauchamp R. I.M. together with a printed copy of a note by Mr. F. J. Wilson & Harbour Boards resolution thereon.

BACK PAPERS.

G. O.	No.	Department.	Date.
831	Mar	8	24-9-97 ✓
813	Mar	8	23-11-96 ✓
536	Mar	8	4-8-96 ✓
76	E	8	18-2-96 ✓
529	W	8	11-2-96 ✓
584	W	8	12-3-95 ✓

FURTHER PAPERS.

G. O.	No.	Department.	Date.
-	80	Mar.	28-1-98

From Lieutenant W.G.Beauchamp,R.I.M.,to the Officer in charge,Marine Survey of India,dated Poona,I4th September I897.

In forwarding the tracing of my survey of the Madras Harbour to the Chairman of the Harbour Trust Board,I have the honour to suggest that it may be of some interest and help to the Board in coming to conclusions about the shoaling of the harbour if I draw a few comparisons between my survey and those of previous years.To do this I have the hnnour to suggest that two charts should accompany my tracing.One of these is a survey by Lieutenant Jarrad,R.N.,and though this chart is now obsolete,it shows the depth of water at the very commencement of the harbour works in I876 and it is the last Marine Survey that has been made of the harbour.The other chart is one made in the Marine Survey office in I886 but taken entirely from Mr Pogson's survey of that year. The scale of this chart is nearly the same as that of my survey whereas the scale of Lieutenant Jarrad's is smaller,being 500 feet to the inch and mine 250 feet. The soundings on my chart are reduced to Indian spring low water mark or I.86 feet below mean sea level.Those on Mr. Pogson's sheet are reduced to the mean of lowest ordinary spring tides or I.6 feet below mean sea level.Those on Lieutenant Jarrad's chart to what was called low water ordinary springs,or 0.08 feet below what is now determined as mean sea level.Consequently the datum of soundings on my survey and the marine survey sheet of Mr Pogson's work differs only about 3 inches.But on Lieutenant Jarrad's chart the soundings must all be reduced by I.78 feet (say 2 feet approximately) before comparing with the other sheets.With the above explanation I trust a comparison will be easily made.

Regarding the changes which have occured,I have the honour to point out the following as probably the most noteworthy.At the centre of the entrance to the harbour,midway between the two breakwater lights,and about 5000 feet from the pier-head there is now a depth of 4I feet.At the same spot,before the breakwater was begun,there was 44 feet.In I886 by Mr Pogson there was 47 feet,or 3 feet more than before the breakwater was built and 6 feet more than there is now.In the north-east corner, the harbour seems to have shoaled about 3 feet since the breakwater was begun and it all seems to have taken place since Mr Pogson's survey of I886.In the south-east corner it seems to be shoaler by about a foot than it was in I876 and shoaler by about 4 feet than in I886.I should

imagine, however, that the depth in certain parts of the harbour may vary slightly at different times of the year. But I have no information of this. The coast line inside the harbour has advanced considerably, and taking it at the pier it can be said to have advanced 350 feet since 1876, though of this amount only about 50 feet in the last eleven years. The greatest change of all has taken place outside the breakwater to the southward. The point where the highwater line there meets the breakwater has advanced about 750 feet since 1886, and probably more than 1800 feet since the harbour works were begun. The shoal inside the harbour along the south breakwater has entirely arisen since 1886. All to the northward and all outside the seven fathom contour line to the eastward and south-eastward is much the same as ever. In fact there is a striking similarity in the contour lines, particularly that of the 8 fathom contour east of the south breakwater light. There are also a couple of patches of 42 feet just inside the harbour entrance, which is the same depth of water as there was at that spot before the breakwaters were built, and the central area of the harbour also appears exactly the same.

(True Copy.)

C Bryant

Secretary,

Harbour Trust Board.

MADRAS, 26th *October* 1897.

To

THE CHAIRMAN,
Harbour Trust Board,
MADRAS.

SIR,

With reference to Board's resolution No. 7, passed at the meeting of the 15th instant, and your letter No. 3253, dated 16th instant, I have the honour to submit the following remarks on the papers forwarded to me.

Before dealing with the survey of the Madras roadstead lately made by Lieut. Beauchamp, I propose to review the circumstances which lead up to this survey being made.

As to what would be the final result of constructing a close Harbour with an eastern entrance at Madras has been the subject of controversy ever since the scheme was first projected more than twenty years ago. Mr Parkes, who designed the original Harbour, anticipated a gradual accumulation of sand on the south side of the Harbour, but at a constantly decreasing rate. In a paper read before the Institution of Civil Engineers in 1882, Mr. Vernon-Harcourt says with reference to the Madras Harbour, "as the breakwaters extend to a depth "of 45 feet at low water, the sand is certain not to encumber the "entrance for a long period;" and in the discussion on this paper Mr. Thorowgood said that he thought the accumulation was rather quicker than was at first anticipated, but he did not think that there was any reason to suppose that the Harbour could not be made efficient in consequence. He also said that, judging from repeated surveys, there never had been the slightest indication of any shallowing at the mouth, or anything in the way of silting up, except from wave borne sand which was arrested mechanically by the solid obstruction of the south pier.

Proceedings, Vol. LXX, p. 18.

In submitting the Progress Report of the Harbour for the quarter ending 30th September 1894, the Trustees drew particular attention to the advance seawards of the water line to the south of the Harbour, and in noting on this, Sir Alexander Rendel says the importance of this advance depends very much on whether it is going on to the same extent below the water line as at and above it, and to ascertain this he asked that cross sections extending out to the 7 fathom line should be made *at intervals throughout the year.* G. O. No. 584 W., dated 12th March 1895, directs that arrangements should be made for doing this, and that the results should be recorded with the quarterly reports submitted to Government. It does not appear from the file what orders of the Board were passed on this G. O., but the sections asked for do not appear to have been taken.

Note, dated 11th January 1895.

With his report on the Harbour Works for the quarter ending 30th September 1895, the Engineer submitted the results of his survey of the Harbour and Roadstead, taken in July, August, and September, which showed important movements of sand both inside and outside the Harbour, and a shallowing of the entrance of 2′ 7″ between 1893—95. The Engineer gave it as his opinion that the Roadstead was shallowing, and that the time had now arrived when measures must be taken to prevent further accretion of sand outside the entrance, where dredging would be of no avail, and in a separate report recommended the construction of a groyne south of the present Harbour. Mr. Pogson also stated his opinion that the shallowing of the roadstead was not due to the Harbour, and that the Madras Roadstead was subject to periods of shallowing and deepening before the Harbour was constructed. Government sent this report home, and ordered whatever information on the subject there was in the Secretariat, or Presidency Port Officer's Offices, to be furnished to the Harbour Trust Board.

G. O. 529 W., dated 11—2—96.

The Secretary to Government in the Marine Department in a memo, dated February 1896 pointed out that the records did not support Mr. Pogson's theory as to the shallowing of the Roadstead, and asked for soundings for a series of years. In replying to this memo., Mr. Pogson gave some other particulars and again stated that soundings in deep water showed a steady shallowing at a distance from the Harbour, and that, in his opinion, unless sand was prevented from reaching the entrance, it might be left high and dry a few years hence. The Board, in submitting Mr. Pogson's report to Government, asked that it might be submitted to an expert for opinion, and that the Roadstead might be surveyed by a Marine Officer.

Memo. No. 76 E., dated 18—2—96.

The Secretary to Government in the Marine Department in noting on this report and accepting the fact that the entrance was getting shallower, advocated a north-eastern entrance as the only satisfactory solution of the question, from an engineering point of view, and the matter was referred to Sir Alexander Rendel. Mr. Pogson, the Engineer, having been directed to proceed to England to consider the question with Sir Alexander Rendel, the latter gives his opinion in his report, dated 23rd September 1896.

G. W. No. 536 Marine, 4th August 1896.

The information laid before Sir Alexander Rendel was presumably that contained in the Engineer's reports referred to above, and the opinion he formed was, that sand was now beginning to travel past the Harbour, that the deposit in the entrance was due to wave action, and is a bar formed in the same way as at river mouths. That whether the bar would increase or not depended mainly on whether the shallowing outside the Harbour increases, but that as the entrance was not originally placed in water sufficiently deep be bear much loss, we should act at once as if further loss was certain. He recommended the purchase of a sand pump dredger, capable of holding about 500 tons of sand, and that if dredging should fail to secure a sufficient depth in the present entrance and the Harbour is to be maintained, he would recommend a new N. E. entrance as shown on a plan which he forwarded.

About this time the Board was committed to the purchase from Government of the dredger "*Wenlock*" which is a bucket dredger with a hopper capacity of about 400 tons. Estimates have now been made for converting this dredger into a sand pump dredger, and indents sent home for the pumps, &c., which will be fitted in the Calcutta dockyard, where the dredger now lies. We have therefore taken the first step considered necessary by Sir Alexander Rendel, to meet further loss of depth at the entrance, should it occur.

Having taken this step, it remains for the Board to examine the information on which the recommendation to the purchase of a dredger was made, with the view of ascertaining whether anything further is required, and also to determine at what stage dredging should begin, and to what extent, or, in other words, what minimum depth of water should be maintained at the entrance to the Harbour.

With regard to the first point the main statements made were—

(1) that the entrance had shallowed 2' 7" between 1893 and 1895 (para. 32 of Mr. Pogson's report, dated 17th December 1895) ;

(2) that 220 feet east of the entrance there had been a shallowing of 3 feet in the same time (para. 37 of the same report) ;

(3) that this change, together with what had taken place in deeper water, tended to show that the Roadstead was shallowing.

We have now received the Marine Survey made by Lieut. Beauchamp in May and June 1897, and in his note accompanying this survey he compares it with a survey made by Lieut. Jarrad, R. N., in 1876, and with a chart prepared from a survey made by Mr. Pogson in 1886. The result of this comparison is that the entrance was 3 feet deeper in 1886 than in 1876 before the Harbour was constructed, and that now it is 6 feet shallower than in 1886, or 3 feet shallower than in 1876. That all to the northward and outside the seven fathom contour to the eastward and south-eastward is much the same as ever. This information is valuable so far as it goes, and it is satisfactory to know that there are now no grounds for believing that the Harbour is doomed to an early disappearance in the sand, as might be apprehended if a general shoaling up of the Roadstead took place. I would point out, however, that the comparison of a single set of soundings taken in any one year with a similar set taken ten years previously, is not an absolutely reliable indication of what is taking place, more especially when it is desired to notice small differences in depth. Putting aside the many sources of error in a marine sounding, no account is taken of changes in the sea-bed due to the weather, or of what occurred in the intervening years. We are aware that the shore line advances and recedes at different seasons of the year, and it was to ascertain whether similar movements were going on below water that Sir Alexander Rendel asked for sections taken at intervals throughout the year two and a half years ago, and I have not been able to ascertain why these were not taken. The results of Lieut. Beauchamp's survey must not in short be taken to mean that there has been a gradual deepening of the entrance by 3 feet between 1876 and 1886, and a gradual shallowing since that date to the present time. All that the survey tells us with regard to the entrance is that on a particular day of this year there was a certain depth of water, and the two previous charts give us similar information for two particular days in other years.

I have now before me the following sources of information regarding the Harbour entrance.

(1). The three charts—Lieut. Beauchamp's and the two others of 1876 and 1886.

(2). A section of the entrance showing various sets of soundings in different years, which accompanied Engineer's letter No. 68A, dated 25th April 1896.

(3). A statement, which I have obtained from Mr. Pogson, showing soundings taken across the entrance at intervals of a month, since January 1897 and certain other dates.

For the purposes of comparison, I have reduced the chart soundings to the datum in use on Harbour plans, that is what is there called DeHavilland's Mean Sea level. This level is 6·83 feet below the Bench mark, known as DeHavilland's Bench mark, under the north gate of the Fort, and is the level which was accepted as the mean level of the sea up to 1885.

From the charts I find the depth of the entrance, below this datum, was 47·13 feet in 1876, 49·63 feet in 1886, and 43·89 feet in 1897.

From Mr. Pogson's section I find that in 1889 there was a depth of 51 feet, and that the sea bottom at the entrance is shown as the same on 25th October 1893 and January 1895. In para. 32 of Mr. Pogson's report for quarter ending 30th September 1895, it is stated that the soundings taken (presumably sometime in July, August or September 1895) showed a depth of only 44′ 5″ and no mention is made of any sounding in January. In looking at this section a few days ago, Mr. Pogson threw doubts on its correctness, but it purports to be a true copy of an original signed by Mr. Pogson, vouched for by Mr. Manual, the Manager of his office.

The third source of information, the statement showing soundings at short intervals in the present year, shows that it is possible for there to be a difference in level either shallowing or deepening of a foot in a month. For example, between the 11th June 1897 and 22nd July 1897, there was a shallowing of nearly a foot, and between 25th August 1897 and 22nd September 1897, there was a deepening of over a foot. The average depth of the entrance at 260 feet from South Caisson for 1897 comes to 42·9 feet, the highest reading is that for September 0·8 feet above the average, and the lowest is that for July 0·8 feet below the average.

It is obvious, therefore, that if we wish to watch carefully what is taking place at the entrance, we must have soundings taken at regular intervals throughout the year, and that conclusions based on two single sets of soundings taken in different years may be absolutely misleading. Assuming similar variations in the depth to have been going on in 1893 and 1895, as are now observed to be going on in 1897, the actual average difference in depth between 1893 and 1895 might have been only about a foot, instead of 2' 7″ as reported.

On the recommendation of Sir Alexander Rendel, Government has directed that soundings outside the Harbour should be taken once in four years, and so far as the Roadstead is concerned, I think this should be sufficient, as the maximum period that should be allowed to elapse without a regular set of soundings ; but we still require to watch carefully the movements of sand in the immediate vicinity of the south arm and at the entrance. For this purpose, in my opinion, soundings taken once a year are altogether insufficient. Lithographed diagrams should be drawn up for regular submission once a month. I am aware that there are difficulties in taking accurate soundings when the sea is not calm, but so far as the entrance is concerned, I think it should be possible, with very rare exceptions, to get soundings once a month. In any case the diagrams should be submitted, with the reasons in such cases, why the soundings could not be taken. Spaces would be provided on these diagrams for information regarding any unusual disturbance of the sea, for the velocity and direction of currents observed outside the Harbour, and in the entrance itself, and remarks would naturally be expected on any unusual alteration of the sea bottom. It will be observed from the statement submitted that Mr. Pogson has been collecting most of the information required, only it is not put on record in any systematic way. A copy of the diagram would be sent to the Deputy Port Conservator for information.

G.O. No. 34 W. 9-1-95.

With regard to the minimum depth which should be maintained at the entrance :—For a proper consideration of this question it is necessary to understand the different datum lines to which our different sources of information are referred. I annex a diagram showing these different levels—all the levels on the Harbour Works and the previous Harbour surveys are referred to what is called DeHavilland's Mean Sea level. This was the accepted mean level of the sea up to 1885, and is 6·83 feet below the DeHavilland's B. M. on the Fort. Under these circumstances I think it better to adhere to this datum remembering that the mean level of the sea as ascertained by latest tidal observations, and accepted by

the survey of India, is a little over a foot below the DeHavilland's Mean Sea level. The lowest recorded tide, as published in the preface to Official Madras Tide Tables for 1897, is 3·49 feet (say 3½ feet) below DeHavilland's Mean Sea level. This is a little lower than the lowest tide of 1897 as shown in the tide table to occur on the 20th March 1897. The highest recorded tide is 2·01 feet (say 2 feet) above DeHavilland's Mean Sea level, which is a little higher than the highest tide shown in the tables for 1897 to occur on the 25th November 1897.

I understand that the nautical consideration desired by the Presidency Port Officer in fixing a minimum depth, is that the depth should be such that any vessel which might be inside the Harbour on the occurrence of a storm should be able to get out without bumping.

The worst possible case would be that in which such a vessel should be one of the greatest draught which use the Harbour, and that the occurrence of the storm should coincide with the lowest tide. Mr. Pogson informs me that he knows of a case of a vessel drawing 27 feet entering the Harbour, but as the Colombo Harbour ship berths are only dredged out to 26 feet below low-water, I think we need not take account of more draught than 25 feet for the present.

Kyle on Colombo Harbour Works, Vol. LXXXVII, Minutes of Proceedings of institution of C.E.

As regards height of waves I cannot get any direct evidence of the height of waves at Madras. The height of a wave is dependent on the velocity and the depth of water, and the velocity is governed by the strength of the wind and the distance in the direction of the wind over which the wind acts on the water. In a S. W. direction there is no land between Colombo and Africa. The greatest heights of waves observed at Colombo during the S. W. monsoon, as given in an appendix to the paper marginally quoted, were 12 feet in the offing, and 15 feet just outside the breakwater. Between 1878 and 1882 the greatest wave observed at Colombo during the N. E. monsoon is 6 feet, but it is believed that a wave which broke the gauge rose to 7 feet.

It does not seem possible that a vessel should plunge to a greater depth than its own draught measured below the level of the trough of a wave and taking therefore, a vessel of 25 feet draught, and a wave 20 feet from trough to crest, occurring when the general level of the water was at *lowest recorded tide, viz.*, 3½ feet below DeHavilland's Mean Sea level, we get the greatest depth to which the vessel could plunge as $25 + \frac{20}{2} + 3{\cdot}5 = 38\frac{1}{2}$ feet below DeHavilland's Mean Sea level.

The level of the entrance at present is, according to Lieut. Beauchamp, nearly 44 feet below DeHavilland's Mean Sea level, and according to Mr. Pogson's latest soundings 43 feet. The margin, under these assumptions, between the ship's bottom and that of the entrance is 4½ or 5½ feet. It must be remembered that this assumes a wave 5 feet greater than ever observed at Colombo, and that, as a matter of fact, the level of the sea during a cyclone is generally raised above its ordinary level.

Under these circumstances, I am inclined to think that it will be sufficient if we maintain the entrance to its present level, or 43 feet below DeHavilland's Mean Sea level. This is 40·11 feet below Indian spring low water mark, the Chart Datum. If this level were decided on, as the highest recorded tide rises to 2 feet above DeHavilland's Mean Sea level, some alteration would be required in the design of the Dredger, which, I understand, is only intended to dredge to 40 feet below water level. To dredge to 43 below DeHavilland's Mean Sea level, at all states of the tide, the Dredger should be capable of dredging to a depth of 45 feet.

I have the honor to be,
Sir,
Your obedient servant,
F. J. WILSON.

N.B.—I wish to add to the above that at the time of writing I had in my mind that a greater depth than 43 feet below DeHavilland's M. S. L. had been suggested, and the result of my enquiry was that this depth of 43 feet is the maximum depth that could, under any circumstances, be required but there are reasons for adopting a less ruling depth. In the first place there is the tendency of suction dredgers to burrow holes, and so far as the stability of the Piers is concerned, the less we go below the bottom of the caissons the better. Again, there is the probability of there being practical difficulties to making the "*Wenlock*" dredge to so great a depth as 45 feet, and the Trustees would not wish to have to purchase another specially designed dredger at present when there is no protected basin to keep it in. The suction dredgers used at Dunkirk, Calais and the first dredgers used at the Mersey bar could only dredge to 36 feet in still water, and I think we should be satisfied if the "*Wenlock*" be made capable of dredging to 40 feet which would enable us to dredge except at high water to 40 feet below DeHavilland's M. S. L.

Encl. 2 to 522/97

EXTRACT of Proceedings of the TRUSTEES OF THE HARBOUR OF MADRAS, at a Meeting held at the Offices of the Board on Friday **the** 12th **day of** November **189**7.

Sep

Read letter dated 21st October 97, from Mr F. J. Wilson, the Board's Local Consulting Engineer, replying to resolution No. 7 of 15th idem, in connection with the recent survey of the Harbour and Roadstead by Lt. Beauchamp R.I.M.

Read minutes by Trustees.

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A copy of Lt. Beauchamp's Survey together with copy of Mr Wilson's note will be forwarded to Government, for the information of Sir Alexander Rendel.

× × ×

True Extract

HARBOUR TRUST
MADRAS 26 NOV 97
SECRETARY'S OFFICE

President

Secretary
Harbour Trust Board

Harbour Trust Office,

MADRAS, 26th November 1897.

No. 3791

From

J.N.Atkinson Esq I.C.S.,

Chairman, Harbour Trust Board,

MADRAS.

To

W.B.DeWinton Esq.,

Ag: Secretary to Government,

Marine Department.

Sir,

I have the honour to submit herewith a copy of a survey of the Madras Harbour and Roadstead made by Lt:Beauchamp R.I.M together with a printed copy of a note by Mr F.J.Wilson dated 26th October 1897 and in accordance with the Boards resolution No.4 dated 18th November (copy enclosed) request that the survey and note may be forwarded for the information of Sir Alexander Rendel.

I have the honour to be,

Sir,

Your Obedient Servant,

Secy.

Chairman,

Harbour Trust Board.