

Proceedings of the Madras Government, Public Works Department, dated 2nd August 1881, No. 1899 W.

Read again the following papers:—

Proceedings of the Madras Government, Public Works Department, dated 13th August 1880, No. 1939 W.

29. Mr. Robertson's remarks on the exceptional case of Cochin, however, call for notice, as, notwithstanding the widely different circumstances as compared with Vizagapatam, there is apparently a point advanced by him which would appear at first sight to have a bearing on the case.

30. The backwater at Cochin swells, he says, into a magnificent sheet of water, and "the value of this as a tidal reservoir to keep clear the entrance to Cochin harbour cannot be over-estimated;" adding, "it renders Cochin quite independent of flood waters for scouring purposes, and makes that port almost unique in that respect amongst Indian harbours."

31. In dealing with this case Mr. Robertson has the following remarks:—

"Whenever the stream leaves the *fauces terre* at Vypeen Point it is discharged on the shallow, exposed sea-coast, but is still able to keep up a considerable depth for some distance out, although the water has now begun to spread out sideways, and escape especially towards the north. Meanwhile the surf is always striving to restore the natural profile of conservancy of the shore. After the current has flowed out to sea for nearly a mile it is no longer able to resist and keep down the ever working and powerful efforts of the waves to reform the profile of the coast by continuing the beach line which has been broken through by the outgoing current. Were," he adds, and this is the point I wish to draw attention, "the current to be kept together in full strength till it got into such a depth of water that the action of the waves was not sufficiently powerful to stir up the bottom, there would be no decided bar. The same result would happen were the current to discharge under shelter from the waves, as for instance in a land-locked estuary. At Cochin the surf has sufficient power on the bottom in 15 or 16 feet of water to overcome the levelling efforts of the current as at present existing, and throw up a bar with only 11 feet of water upon it."

32. These remarks would, no doubt, at first sight, seem to invalidate in some measure the argument that a bar must form at Vizagapatam, where either, as now proposed, the groynes are carried out into 17 feet water as suggested by Colonel Chrystie, or breakwaters were found terminating in 30 feet water as in Colonel Thomason's scheme; but notwithstanding the exceptionally favorable circumstances of the Cochin harbour, I cannot but think that Mr. Robertson has here been somewhat inconsistent.

33. A glance at the survey of the coast line at Cochin shows outside the immediate opening of the harbour a bulging line of deposit on which the bar is ultimately formed, and which clearly indicates the line along which the forces of the opposing currents becoming neutralized, velocity ceases and the silt deposits itself, as he himself observes: "After the current has flowed out to sea from nearly a mile it is no longer able to resist and keep down the over-working and powerful efforts of the waves, &c."

34. And this, be it remembered, is quite irrespective and independent of the great depth of water to be found at the harbour mouth, varying, as shown in the survey, from 30 to 44 feet! and depths carried well out in the same line for 24 to 18 feet, and thence gradually diminishing till only 11 feet is met on the bar.

35. There cannot, of course, be any direct analogy between the cases of Cochin harbour and Vizagapatam, but even the apparent one which I have above pointed out as seeming to militate against the general principle I am contending for does not to my judgment exist, and I cannot but think that in even this exceptional case Mr. Robertson has failed to appreciate at their true value the forces in operation.

36. My impression is that few Engineers who study the facts as illustrated by the survey and soundings of the Cochin harbour can arrive at any other conclusion than that the groynes proposed for concentrating the scour at the present bar will merely have the effect of pushing the bar further out to sea. That some beneficial result would be secured for a few years can hardly be doubted, but that the bar would ultimately reform seems to be inevitable.

37. It may be contended that there is little sand in movement with the littoral currents, or that once a certain régime has been established no further advance of the shore line is likely to occur; but even were such the case, we cannot get rid of the silt brought down by the rivers in the monsoon, and which, spite of all our efforts, must deposit itself the moment the velocity is diminished, and this too perfectly irrespective of the depth of water in which such check occurs.

38. The whole truth (at least in so far as concerns the streams of the Madras coast, which debouch into a well nigh tideless sea) is, I think, conveyed in the following quotation from paragraph 6 of the report of 13th March 1875, No. 1631, by Captain Taylor, to which I have before alluded:—

"All experience of Indian rivers shows them to be uncertain and unfit for nice harbour construction. Inland they are liable to come down in the rains or periodical storms with overwhelming force and laden with silt. They debouch on sands always in motion from surf, periodical current or storms."

39. In fact, the mouths of our rivers are, as a rule, the very worst places at which to construct a harbour, and I think Madras may be congratulated that at least this silt difficulty has not had to be encountered.

ORDER THEREON, 13th August 1880, No. 1939 W.

THE Government are satisfied, on the joint opinion of the Master Attendant and Chief Engineer, that it will be impossible, with the expenditure of any reasonable sum of money, to create either an inner or outer harbour at Vizagapatam for the use of vessels of large draught; but, as there would appear to be some probability of means being found for improving the depth of water on the bar at the mouth of the river, in the interest of cargo boats and other vessels of light draught, the requisite investigations with this object will be continued by the Public Works Department.

(True Extract.)

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

Docket from the Government of India, Public Works Department (Civil Works—Miscellaneous), dated Fort William, 27th December 1880, No. 293 M.

Copy of the following forwarded to the Government of Madras, Public Works Department, for information, with reference to its telegram of the 18th instant.

(By Order.)

(Signed) W. P. TOMKINS, Captain, R. E.,
Asst. Secy. to the Govt. of India.

From the Secretary to the Government of India, Public Works Department, to Commander A. DUNDAS TAYLOR, Superintendent of Marine Surveys, dated 27th December 1880, No. 292 M.

I am directed to forward a copy of the telegrams noted on the margin, and to

From Madras, dated 18th December 1880.

From Colonel Thomason, R.E., Indore, dated 21st December 1880.

request that the Madras Government may be furnished with copy of plans and of the report by Colonel Thomason, R.E., on the proposed harbour at Cochin.

ENCLOSURE.

Telegram from Colonel THOMASON, R.E., Indore, to the Secretary to the Government of India, Public Works Department, Calcutta, dated 21st December 1880.

Cochin have no copy of report made to Sir Andrew Clarke. See his printed Minute, Indian Harbours, July 1879. Ask Commander Taylor for latest map embodying our joint survey work if port has not since been accurately surveyed according to my recommendation. Until such survey, the consideration of my alternative proposals for groynes or knapps system submerged breakwater was postponed. For plans of other ports apply Marine Survey or Executive Engineers concerned.

From Captain W. P. TOMKINS, R.E., Assistant Secretary to the Government of India, Public Works Department (Civil Works—Miscellaneous), to the Secretary to the Government of Madras, Public Works Department, dated Fort William, 7th January 1881, No. 5 M.

In continuation of this office No. 293 M., dated the 27th December 1880, and with reference to your letter, No. 2944 W., of the same date, I am directed to forward, for

* No. 23, dated 29th December 1880. the information of the Madras Government, copy of a letter * and of its enclosure from Commander A. D. Taylor, Superintendent of Marine Surveys, affording all such information as are obtainable in regard to the harbour at Cochin.

Lithograph charts of the harbour also accompany.

ENCLOSURE.

From Commander A. DUNDAS TAYLOR, late I.N., Superintendent of Marine Surveys to the Government of India, to the Secretary to the Government of India, Public Works Department, dated Calcutta, 29th December 1880, No. 23.

In reply to your letter, No. 292 M., dated 27th December 1880, I have the honor to state that no copies of any reports by Colonel Thomason, R.E., have ever been forwarded to me. With regard to Cochin I beg to say that at the time of our visit to that port, I took angles to test the position of the buoys on the bar, and found that the bar had been thrown back considerably to the eastward (see Admiralty chart of Cochin herewith forwarded). I also took chain measurements from the south-west point of Vypeen, where a groyne had been constructed, along the sandy coast to the Cruz Milagre gap (see lithograph chart of the harbour also forwarded). From the Executive Engineer, Department of Public Works, at Cochin, I subsequently obtained a tracing of the town and the high water line of Vypeen island towards the gap, but I found that the bearing of that coast line differed so materially from my own observations that I could not apply it to the rectification of the chart. The original of the tracing above referred to must be in the possession of the Madras Government, or obtainable from Cochin.

It was my intention to have the port of Cochin re-examined last year, and a survey was sanctioned by the Government of India; but it was abandoned for the present in consequence of Mr. Chapman's death, and as we had no officers available to carry on the work, the department being so short-handed.

I beg to forward a copy of some remarks by myself on Cochin harbour submitted to the Government of India in June 1877.

Extract from remarks by Commander A. DUNDAS TAYLOR, Superintendent of Marine Surveys, on some ports of the Madras Presidency, after inspection in April and May 1877.

"Cochin was also visited by me on the 1st and 23rd May. Before my arrival Lieutenant Hammond, R.N., under my orders, had made an examination of the bar and inspected the dredge *Albuquerque* (his report has been already given to the Secretary to Government of Madras, in the Public Works Department). The merchants of Cochin are anxious that their river bar should be deepened by dredging, and the Government of Madras has obtained the *Albuquerque* for that purpose. But the difficulties are great and (I think) not generally understood. After examination of this port, just twenty years ago, I suggested that a steam rake might advantageously be used every fine season to scrape down (on the ebb tide) a narrow passage through the little ridge of sand which forms the bar, and has at low water a depth of 13 feet. The utmost I expected of such an operation was that a depth of 15 feet at low water might be gained and retained during four or five months through that narrow ridge, so that vessels with a draught of 15 feet might be towed across the bar. The vessel for this purpose was to be both steam tug and rake; and I merely suggested this in anticipation that English builders and engineers could carry out the idea if it met approval from the Government of Madras.

I never contemplated the possibility of dredging a channel with a depth of 13 feet right through the shallow water at the entrance of Cochin river. Inside the narrow ridge which is the bar proper the chart shows a plateau which is about 1,000 feet across and carries only 13 or 16 feet over it. The most sanguine engineer could hardly expect that the ocean swell and tidal streams of March would respect the trough he had succeeded in digging during December and January. Having been on that Malabar Coast at all times of year, I am bold to say that the dredge would not find 100 working days of 6 hours each, whilst Lieutenant Hammond estimated she would require 146 days of 10 hours each. The ocean swell, raised by the north-west winds of March, April and May would play havoc with the newly dug passage; but the south-west monsoon swell of five or six months' duration would obliterate all traces of any trench dug in that moveable sand."

Proceedings of the Madras Government, Public Works Department, dated 28th June 1881, No. 1603 W.

Read the following letter from Captain W. P. TOMKINS, R.E., Assistant Secretary to the Government of India, Public Works Department (Civil Works—Miscellaneous), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 6th June 1881, No. 178 M.:—

Referring to the Resolution of the Madras Government forwarded with its docket, No. 912 W., dated the 4th April 1881, regarding the question of converting the Cochin port into a first-class harbour, I am directed to state that, in the opinion of the Government of India, the Imperial interests involved in this undertaking are not of sufficient magnitude to justify an outlay which must inevitably be large, and which may possibly amount to 81 lakhs of rupees.

2. I am to invite, however, the attention of the Madras Government to the more important work of improving the harbour of Vizagapatam, in which Imperial interests are involved, inasmuch as this port would probably become the outlet, in the Madras Presidency, for the trade of the Central Provinces, in the event of the construction of a system of a metre-gauge railways, which is now, with reference to the Proceedings of the Madras Government received with your letter, No. 150 R., dated 15th February 1881, under the consideration of the Government of India.

3. I am to suggest, therefore, that Mr. Parkes, the Engineer for the Madras Harbour Works, be asked for a report on this harbour, and its capabilities as a port, and that the report may be submitted for the orders of the Government of India, with the opinion of the Madras Government on it, as early a date as possible.

ORDER THEREON, 2nd August 1881, No. 1899 W., Public Works.

2. Paragraph 1 of the letter from that Government will be communicated to the Chamber of Commerce, Cochin.

(True Extract.)

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

To the Chairman, Chamber of Commerce, Cochin.

All communications
should be addressed
to the Secretary.

No. 293 M
GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

Civil Works
Miscellaneous.

Fort William, 27th December 1880.

Copy of the following forwarded
to the Government of Madras, Public
Works Department for information,
with reference to its telegram of
the 18th instant.

By order,

W. Tomkins Capt. R.E.

Asst Secy to the Govt of India

No. 292 M. Dated 27th December 1880.

From - The Secy to the Govt of India
Public Works Deptt.

To - Commander A. Dundas Taylor.
Suptt of Marine Surveys.

From Madras dated
18th December 1880.
From Col. Thomson
R.E., Indore, dated
21st December 1880.

I am directed to forward a
copy of the telegrams, noted on the
margin, and to request that the
Madras

Madras Government may be
furnished with copy of plans
and of the report by Colonel
Thomason, R.E. on the proposed
harbour at Cochin.

P.W.D.
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Telegram dated 21st December 1880.
From Indore To Calcutta
" Col. Thomason " Works.

Cochin have no copy of report
made to Sir Andrew Clarke. See
his printed minute Indian Harbours
July 1879. Ask Commander Taylor
for latest map embodying our
joint survey work if port has
not since been accurately surveyed
according to my recommendation.
Until such survey the consideration
of my alternative proposals for
groynes or Knapps system sub-
merged breakwater was post-
poned. For plans of other ports
apply Marine Survey or Executive
Engineers concerned.

Harbours.

A-23

From.

Commander A. Dundas Taylor, later Lt.
Suptt. of Marine Surveys to the
Govt of India.

To, The Secy to the Govt of India.
Public Works Department.

Calcutta, dated 27th December 1880.

In reply to your letter A-29246,
dated 27th December 1880, I have the
honor to state that no copies of
any reports by Colonel Thomason,
R.E., have ever been forwarded
to me. With regard to Cochin I beg
to say that at the time of our visit
to that port I took angles to test the
position of the buoys on the bar, and
found that the bar had been thrown
back considerably to the eastward
(See Admiralty Chart of Cochin, here
with forwarded). I also took chain
measurements from the south-west
point of Typeen, where a groyne
had been constructed, along the
sandy coast to the Cruz Milagre Sap.

(See

(See Lithograph Chart of the Harbour, also forwarded). - From the Executive Engineer, Department of Public Works, at Cochin I subsequently obtained a tracing of the town and the high water line of Typen island towards the gap, but I found that the bearing of that Coast line differed so materially from my own observations that I could not apply it to the rectification of the Chart. The original of the tracing above referred to must be in the possession of the Madras Government, or obtainable from Cochin. -

It was my intention to have the port of Cochin re-examined last year, and a survey was sanctioned by the Govt. of India; but it was abandoned for the present in consequence of Mr. Chapin's death, and as we had no officers available to carry on the work, the Department being so short-handed. -

I beg to forward a copy of some remarks by myself on Cochin harbour submitted to the Govt. of India in June 1877. -

Extract from remarks by Commandr. A. Dundas Taylor, Supdt. of Marine Surveys, on some parts of the Madras Presidency, after inspection in April and May 1877. -

Cochin was also visited by me on the 1st and 23rd May. - Before my arrival Lieut. Hammond, R.N., under my orders, had made an examination of the bar and inspected the dredge Albuquerque (his report has been already given to the Secretary to Govt. of Madras, in the P. W. Dept.). The merchants of Cochin are anxious that their river bar should be deepened by dredging, and the Govt. of Madras has obtained the Albuquerque for that purpose. - But the difficulties are great and (I think) not generally understood. - After examination of this port, just twenty years ago, I suggested that a steam rake might advantageously be used every fine season to scrape down (on the ebb-tide) a narrow passage through the little ridge of sand which forms the bar, and has at low water a depth of 13 feet. - The utmost

1. /
I expected of such an operation was that a depth of 15 feet at low water might be gained and retained during four or five months through that narrow ridge, so that vessels with a draught of 15 feet might be towed across the bar. The vessel for this purpose was to be both steam tug and rake; and I merely suggested this in anticipation that English builders and engineers could carry out the idea if it met approval from the Govt of Madras.

I never contemplated the possibility of dredging a channel with a depth of 18 feet right through the shallow water at the entrance of Cochin river. Inside the narrow ridge which is the bar proper the chart shews a plateau which is about 1,000 feet across and carries only 15 or 16 feet over it. The most sanguine engineer could hardly expect that the ocean swell and tidal streams of March would respect the trough he had succeeded in digging during Decr and January. - Having been on that Malabar Coast at all times of year,

8/27
I am bold to say that the dredge would not find 100 working days of 6 hours each, whilst Lieutenant Hammond estimated she would require 146 days of 10 hours each. The ocean swell, raised by the north-west winds of March, April and May, would play havoc with the newly dug passage; but the south-west monsoon swell of five or six months duration would obliterate all traces of any trench dug in that moveable sand. -

x x x x x

No. 5 M.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

Civil Works.

Miscellaneous.

To, The Secretary to the Govt. of Madras.
Public Works Department.

Fort William, 7th January 1881.

Sir, In continuation of this
Office No. 293 M. dated the 27th Decr.
1880, and with reference to your
letter No. 2944 W. of the same date,
I am directed to forward, for
the information of the Madras
Government, copy of a letter and
of its enclosure, from Commander
A. D. Taylor, Superintendent of
Marine Surveys, affording all
such information as are obtain-
able in regard to the harbour
at Cochin. —

Lithograph Charts of the
harbour

All communications
should be addressed
to the Secretary.

harbour also accompany.

Have the honor to be,

Sir,
Your most obedt. servant,

W.P. Younkens Capt. R.E.

Asst Secy to the Govt. of India.

To be attached with the original
Go. No. 1899/14/2-5-871

Proceedings of the Madras Government, Revenue Department,
2nd April 1875.

Read the following papers:

No. 14. Endorsement of the Chief Secretary to Government, dated Fort St. George, 18th March 1875.

Read the following letter from Captain J. H. TAYLOR, R.N.R., Acting Master Attendant, Administrative Department, Madras, to the Hon. W. HUDLESTON, Chief Secretary to Government, Fort St. George, dated Madras, 13th March 1875, No. 1,631.

I HAVE the honor to report, for the information of His Excellency the Governor in Council, that I visited the port of Vizagapatam, in attention to G. O., No. 1,341, dated 17th October last, on the 11th of February 1875. I made a careful examination of the whole of the swamp reclaimed or under reclamation, and studied the position with relation to the course and action of the river. I then obtained interviews with all the parties directly or indirectly connected with the work, who could give me any information. Mr. Goodrich was absent, but left a letter in which his views were clearly embodied. I may first mention that the Roman-Catholic Bishop, through his co-adjutor, declared himself perfectly willing to meet the wishes of Government in any way that seemed desirable or for the interests of the port. He regretted the length of time the work had been in suspension, as not allowing the results of the labor to be considered in a favorable light, but was confident that the end, if he was allowed to advance, would justify the means. It must have been known, when the concession was made, that Dr. Tissot was not in a position to employ much capital or invite high private scientific advice; but what he has done is well done, and a large portion of the ground might now be planted either with binding shrubs or Casuarinas, and the work much expedited by the operation of nature. In its relation to the harbour or rather river, I came to the conclusion that it would be highly useful in concentrating the stream in the bed required for navigation. The Vizagapatam river is, for the greater portion of the year, a weak and useless stream, though it acquires considerable force in the freshes or during storms inland; but each inundation would bring an alluvial deposit of service to the reclamation, until the whole is raised high enough for building or docking purposes. It is only in this direction that Vizagapatam can seek an extension if a period of prosperity arrives. It appears to me that any arguments that can be used against Dr. Tissot's work apply with equal force to the Municipal reclamation and all the works that have affected the course of the river. There exists an engraving of Vizagapatam in an old work, dated 1756, which seems to show that the swamp was then of the nature of an island; that the arm now extending past the cutcherry and ending in a purposeless way passed through the ground and stagnant pools (which poison the air in their neighbourhood) and joined the present river. I am of opinion that (as the port has not materially changed since I examined it twenty years ago, and there is as much water on the bar as ever was known) the reclamation may be allowed to advance as suits Dr. Tissot's means; but if serious works and expense connected with a harbour is commenced, that some Government aid might be afforded him in completing, as soon as possible, the wall that will be wanted to keep the river confined to its present channel during high tides.

2. As regards the harbour itself, as proposed by Mr. Thomas and Mr. Addiss, acting for G. L. Nursing Row, I feel myself called upon to report that grave

*Proceedings of the Madras Government, Revenue Department,
2nd April 1875.*

difficulties, or, as I call them, impossibilities exist to carrying out the plan. In the first place, the deep basin (to which ingress is proposed by dredging away the bar) *does not exist*. Two separate patches or rather scores in the bottom are met with: one just round the inner bluff of the Dolphin's Nose; the other at the end of Ross Island where the ferry is. The intermediate portion and all the backwater are shallow, and as well as the bar would require not *raking or dredging* but excavating; the two first methods would be hopeless in such a depth and over such an extent. The whole harbour would have to be made, and when done could not allow a British India steamer, once entered to turn round again to go out. Now the whole coasting trade is in the hands of the British India Steam Navigation Company. The country trade, as it was called, is extinct. The steamers of this Company could derive no advantage, but constant risk of accident from entering this narrow canal (for it would not be more) out of about twenty ports of call in each voyage. They would refuse to use it. The native vessels, which lay up during the adverse monsoon, do so for many months; the place as it stands is readily accessible to them; and Mr. Thomas mentions that, as he was writing his report, he counted fifty-six enjoying the advantage of docks. What more could he desire. The probability is that, if they had to pay harbour dues, the number would be reduced. I left Vizagapatam for a week with all the papers and information for consideration, and when I returned secured the services of Captain Castor of Cocanada and the little steamer *Frank and Ada* in which, with the accompanying party, I made a complete examination of the port—Mr. Goodrich, Mr. Willock, Major Hindle, Mr. MacMurray. I had hoped to get Mr. Thomas also, but untoward circumstances prevented. The time was half tide, which I selected as a medium between Major Beattley's soundings at low water and the Master Attendant's, which had been taken at high-water spring tide. This plan served the purpose better than any discussion could do, and without entering into details I may say that to get water deep enough for a vessel, even of twenty feet draft, to enter such a harbour in a ground swell such as always exists, the work must be extended to the buoy on the plan, while an entrance of two hundred feet over-all, which must be contracted to, say, fifty at the bottom and centre, to admit of any base of support for the groynes, would be utterly inadequate. The *Frank and Ada*, drawing four feet, passed over the bar, but it was only with great care and attention she was kept from grounding in the harbour itself. She could not be turned, except with assistance, and on a pivot in the first-named deep spot off Dolphin's Nose. The whole of the harbour would have to be made, for the expedient of the Turkish Rake, suggested by Mr. Thomas, is too futile to deserve even a passing notice; but I may remark that to give support to my opinion I sought out the officer who had charge of the Raking Operation in the Hooghly, where the plan was tried with the advantage of the rapid tides of that river. I found him at False Point, and in answer to my inquiries he pronounced the whole a complete failure. He had powerful steam-rakes, and worked hard and long; but although he succeeded in some instances in reducing the depth on some of the bars six inches or so, it always restored itself after an interval of one or two days. I have given a careful perusal of Colonel Sir A. Cotton's letter quoted by Mr. Thomas and the promoters of the harbor, but I am led to a very different conclusion from the one adopted by them. They claim to make Vizagapatam a complete harbor for the LARGEST vessels to cargo, lay up, and repair.

*Proceedings of the Madras Government, Revenue Department,
2nd April 1875.*

Sir A. Cotton says it should be an important secondary harbour, and might, at moderate expense, be made a complete (*secondary*) harbour. He then says it might be improved, not even raised to a secondary port, by the very means suggested in the present report. *The estimate* for which is completely covered by the groynes; no mention made of the interior work and thousand requisites of a harbour and establishment.

3. The road suggested by Sir A. Cotton has been made. Several roads now exist, but the increase to the trade of the port is trifling, nor *does there* seem any prospect of increase.

4. The last proposition of Sir A. Cotton is virtually to abandon Vizagapatam as a port; to construct a canal ninety miles long and £200,000 cost; to connect Vizagapatam with Samulcottah and the vast interior traffic of the Godavery and Kistna, putting it also in connection with a first-class port, by which he evidently means his own favorite port of Cocanada, not the improved Vizagapatam one, as inferred by the promoters, the advantages of Cocanada being, in his opinion, worth carrying Vizagapatam trade ninety miles on a road, costing £200,000. I submit his letter, carefully considered, is capable of no other reading.

5. Mr. Nursing Row having munificently offered to provide the funds for the harbour, has assumed that the advice he has received on the subject from such high sources renders future success undoubted; and he looks forward, after certain concessions to be granted by Government have been made, to a splendid property, if not to him, at least his heirs, both honorably and financially. Now making a harbour in other places has rarely had the effect of drawing trade to them. All questions of finance should in such cases be considered by the light of present returns. If the same port dues obtain then as now, and all availed themselves of the harbour, Rupees 2,000, out of which the whole establishment of the port and road, light, "repairs," up-keep, &c., have to be borne, offer poor interest for the lakh or two; for he has offered to extend his liberality so far. And grave discouragement to native princes and gentlemen, when they come forward with patriotic intentions, would be, I would respectfully-submit, a misfortune to the whole country, as tending to check progress in this very desirable direction.

6. I beg most respectfully to state, in conclusion, that, in my opinion, a harbour, as proposed, would be impossible, even at an enormous outlay and ruinous up-keep. All experience of Indian rivers shows them to be uncertain and unfit for nice harbour construction. Inland, they are liable to come down in the rains or periodical storms with overwhelming force and laden with silt. They debouch on sand always in motion from surf, periodical current, or storms; and in connection with the question of sand, I may point out that these groynes, if run out on the present sandy bottom, would (when the excavation caused by removing the bar and opening up the harbour were made) be acted on by the current and wave, and soon undermined, causing them to settle and fall into the hollow; while if the sand were removed to the necessary depth, say twenty-four feet, and the groynes then placed firmly, the estimate must at least be quadrupled. But difficulties attend every step in the proposal, and the sanction to the Madras Harbour removes any ground of necessity for another between Calcutta and Trincomallee.

*Proceedings of the Madras Government, Revenue Department,
2nd April 1875.*

TRANSFERRED to the Revenue Department, with reference to the order in that department, dated 17th October 1874, No. 1,341.

Signed W. HUDLESTON,
Chief Secretary.

No. 15. From H. St. A. GOODRICH, Esq., Acting Collector of Vizagapatam, to D. F. CARMICHAEL, Esq., Secretary to Government, Revenue Department, Fort St. George, dated 16th March 1875, No. 430.

WITH reference to the Proceedings of Government, Revenue Department, No. 1,341, dated the 17th October 1874, I have the honor to request that you will inform me whether I may authorise Father Richard, who is empowered to act for the Right Reverend Dr. Tissot, now absent at Nagpore, to proceed with his work of reclaiming the swamp westward of the town of Vizagapatam.

2. Every day is now of the greatest importance to him. Heavy floods during the last N.E. Monsoon injured his dams, and he has been restrained from touching them since. If he may begin work now, he may make all safe against the rains to be looked for in June. Early planting operations are also desirable over a large area of the reclaimed land.

3. Captain Taylor lately visited this port, and I had the advantage of inspecting with him the estuary where it has been proposed to construct a harbour. I had previously communicated to him my opinion that if the harbor scheme were feasible, the reclamation must assist in its realisation, and I found that he held the same opinion after examining the place.

4. The lowland westward of the present market, and bounded three sides by the town, the concession to Dr. Tissot, and the Parade ground, has been raised to about the high-water level by the accumulated filth of years. As the plan in the original edition of Orme's History shows this plot of land once formed part of the estuary, its drainage is an urgent necessity; at present it is a most noisome swamp.

5. The work will be an expensive one, but the Municipality hope for liberal help from some of the wealthier inhabitants, and they further trust that Dr. Tissot's anxiety for the welfare of the town and its inhabitants will lead him to consent to the Municipality receiving a grant of a part of his concession shown in the plan* which I enclose, MMM, about 120 acres in extent.

6. The reasons for which the Municipality desire to receive this parcel of land are the following:—

The construction of masonry drains and an outfall near the Magazine (see Map), the filling up of the fishery tank, which is at present an open cess-pool, the raising of the land around the privies, below the Parade ground, and near the Catholic Burial Ground, will be a costly business. The possession of plot M will enable the Municipality to carry out the necessary drainage works much more easily than they could otherwise in a financial point of view. The town is crowded, and the only direction in which it can be extended is to the westward. Once raised and drained by deep channels, the plot of land M will be laid out in streets on an approved plan, and will

*Proceedings of the Madras Government, Revenue Department,
2nd April 1875.*

be a valuable property. The Municipality do not doubt their ability to raise a considerable loan on the security of this land.

7. The Commissioners think that the drain VDDD in the plan should be of such a size as to provide for the discharge of all the land-water that heavy rain may bring into them. In the rainy season they believe that there will be a sufficient amount of water to scour them cleanly; in the hot weather the tidal water can be admitted at the high-tide and run off at the ebb.

8. The cost of draining and partly raising the plot L will not be inconsiderable. Plot M is now above the level of ordinary tides. In plot L the land round the privies and fishery tank is now covered with water at high-tide.

9. The works are not such as should be discussed in the absence of an estimate or even on a rough estimate; the general scheme is one which, I believe, feasible and suited to local wants and means. I find it necessary, as I have said in paragraph 1, to urge that Dr. Tissot receive immediate permission to resume his work on the swamp; Father Richard, who represents the Bishop here, thinks that he will accede to the Municipality's wishes, as his main object in reclamation is the health and comfort of the town-people.

10. Captain Taylor has, I believe, before this reported to Government his opinion of the scheme for a harbour referred to in G. O., dated 17th October 1874, No. 1,341, Revenue Department. The orders of Government on Captain Taylor's report will no doubt contain instructions as to the treatment of the question of Dr. Tissot's concessions. Meanwhile, the Municipality will prepare estimates for the work which they propose to undertake, and lay the matter before Government with all needful information.

11. Whilst making the request that Father Richard may be allowed to resume work, I thought it best to report the conclusion which the Municipality have reached for consideration in so far as it bears on the general subject and at the desire of the Commissioners.

No. 16:

ORDER THEREON, 2nd April 1875, No. 509.

Miscellaneous.

IN G. O., 17th October last, No. 1,341, the Master Attendant, Madras, was requested to take an early opportunity

of visiting Vizagapatam, with a view of reporting how far the reclamation of the swamp to the west of the town by the Right Reverend Dr. Tissot, (1) as already carried out, and (2) as proposed, will injuriously affect the suggested harbour at that port.

2. Captain Taylor reports that the harbour, as proposed, "would be impossible, even at an enormous outlay and ruinous up-keep;" that in its relation to the harbour or rather river Dr. Tissot's reclamations would be highly useful as concentrating the stream in the bed required for navigation; and lastly that, though Dr. Tissot has not been in a position to employ much capital or invite high scientific advice, what he has done is well done, and that by successive alluvial deposits, brought down by freshes or during inland storms, the reclamation will be raised high enough for building or docking purposes.

*Proceedings of the Madras Government, Revenue Department,
2nd April 1875.*

3. In these circumstances, the Governor in Council has much pleasure in complying with the Acting Collector's request that Dr. Tissot be permitted to proceed with his work, which was suspended until the result of Captain Taylor's investigation should be known. Sanction will be communicated by telegram in view of the urgency of the case, as stated in paragraph 2 of Mr. Goodrich's letter.

4. The proposal to make over to the Municipality for drainage, and ultimate conversion into building lots, the noisome marsh lying to the west of the present market and bounded by the Parade ground, a portion of the town, and Dr. Tissot's concession, will be considered on the submission of the estimates and full information promised by the Acting Collector.

(True Extract.)

(Signed) D. F. CARMICHAEL,
Secretary to Government.

To the Board of Revenue,
„ the Collector of Vizagapatam.
„ the Master Attendant.
„ the Public Works Department.

Exd. F. R. Bantleman.

GOVERNMENT OF MADRAS.
PUBLIC WORKS DEPARTMENT.

13th August 1880, No. 1,939 W.

Buildings and Roads.
Civil Works.

Read the following papers:—

No. 30. From Lieutenant-Colonel H. L. PRENDERGAST, R.E., Superintending Engineer, First Circle, to the Chief Engineer, Public Works Department, dated Madras, 26th July 1880, No. 1,366.

WITH reference to paragraph 3 of G.O., No. 749 W., dated 22nd March 1880, I have the honor to submit a rough plan and estimate of Rs. 1,17,840 for constructing groynes at Vizagapatam together with copy of the Executive Engineer's letter, No. 1,032, dated 4th July 1880, and enclosures as per margin.

One Tracing.
One Plan of Groynes.
One Key Plan.
One Estimate with Specification and Report.

2. The groynes are proposed to be run out from the landing place to a length of 1,615 feet and into 20 feet depth of water. The channel between the groynes is given a bottom width of 75 yards. The formation of the groynes is described by the Executive Engineer to be a base of rubble stone of 3 feet thickness, the body to be built of boulders cased with granite cubes of 3 feet to a height of 6 feet above high water of spring tides. The top width to be 15 feet, the exterior slope 3 to 1, and the inner slope 1 to 1.

The object of the work is to keep the channel clear of deposit and to enable the ebb tide from the backwater to scour away the bar, which is about 300 yards out from the narrowest part of the harbour.

3. The estimate shows that two parallel groynes as contemplated may be constructed for about Rs. 1,20,000. But the method of construction is simply to throw out stone to find its own level for the base, and raise the stone work above, without taking into consideration the scouring effect to be produced in the channel between the groynes.

The Master Attendant at Vizagapatam states that there is now less than 2 feet of water at the lowest tide on the bar, and the groynes are expected to cause a depth of 15 feet. The consequence will be that as the groynes are pushed out from the shore, the rubble stone will settle down into the trough according to the nature of the bed and the action of the scour upon it.

4. There is no section across the bar to show the nature of the ground below the deposit caused by the meeting of the ebb tide with the littoral current. Borings ought therefore to be made at the bar to ascertain the character of the bed as it will be when the channel is scoured through, so that a better judgment may then be formed of the section which the groynes ought to have.

Nothing could be done at this time of year in the way of boring, and the month of December is usually a time of calm, when this work could be done.

5. The capacity of the harbour inland is very limited; the passage is narrow and there is no prospect of ships of any size coming in even if they had sufficient water to admit them over the bar.

By the soundings taken in 1879 there is a space of 62 acres from the landing place up the river, over which there is a depth of 9 feet of water, measured above mean low water. This 9 feet line is entered in red on the key plan for 1879, and the corresponding black line gives the 9 feet line for the year 1873. The trade of the port is principally in the hands of the British India Company's Steamers; in the

GOVT. OF MADRAS.

REVENUE.

THE BOARD OF REVENUE.

Secy. Secy. Secy.

Dated 2nd April

1880.

Encl.

G.O., 2nd April 1880, No. 600.

APRIL.

Nos. 14—16.

Declaration of the Survey of the Town of Vizagapatam.—With reference to Captain Taylor's report on the effect of the — on the suggested harbour at that port, complying with the Collector's request to permit Dr. J. J. to proceed with the work, and intimating that the proposal to make over to the Municipality the poisonous marsh referred to will be considered on the submission of estimates and full information promised by the Acting Collector.

last five years there have usually been less than twenty vessels that have come into the inner harbour during the year. Thus the river mouth forms a boat harbour, and it appears to me that measures of improvement are not called for beyond providing for the safer and easier passage of boats between the shipping and the shore. The bar is a source of danger at low water, and the swell that comes round the Dolphin's Nose adds to the danger of the surf. The shelter of the groynes would give protection from the swell, and the removal of the bar will do away with the present difficult surf. The same natural causes however may tend to the formation of the bar further seawards again; then, though relief might be given by dredging and the groynes be pushed on further from the shore, it seems questionable whether there will be any benefit for more than a short period, and whether the shifting of the bar out to seaward will not injuriously affect the anchorage for ships in the Roads.

From T. D. HARRIS, Esq., Executive Engineer, Vizagapatam, to the Superintending Engineer, First Circle, dated Waltair, 4th July 1880, No. 1,032.

YOUR No. 1,035, dated 25th June 1880. I have the honor to submit herewith rough plans, sections, estimates, and reports for constructing groynes at Vizagapatam as proposed by Colonel Chrystie, R.E., also for inner and outer harbour as proposed by Colonel Thomason, R.E., as I am not aware which of them will be adopted by you and the Chief Engineer after perusal and inspection. I have not prepared them in full detail; in fact I have not yet had time to collect all the information necessary.

2. I shall however submit complete plans and estimates with my full opinion as per instructions that you may consider necessary to give after personal inspection and deciding what should really be done.

3. Colonel Chrystie's scheme provides little more than a boat harbour, perhaps nothing more is required at present, but even this scheme still requires consideration.

4. Colonel Thomason's scheme embraces a grand work, providing an outer and perfectly sheltered inner harbour into which the largest vessels afloat may run; but you, of course, have Colonel Thomason's papers on his proposal with you, and know more about it than I can yet tell you, but, as I said before, after you have seen the place with the projected schemes before you, you will not doubt be able to decide all points correctly.

5. In conclusion, I may add that the people here are much interested in the improvement of the harbour, and I have had numerous communications from influential men regarding the same.

No. 30-A. *Notes by the Chief Engineer, Public Works Department.*

THE above is in answer to the call made by Government in paragraph 3 of G.O., No. 749 W., of 22nd March 1880, for an estimate for the construction of two rough stone groynes carried out in such manner as to scour out the bar as proposed by Colonel Chrystie, and as I have quite lately had the opportunity of examining personally the question of the proposed harbour at Vizagapatam in company with Captain Taylor, Master Attendant, as also the Superintending and Executive Engineers, with others well acquainted with the locality and general subject, I beg to submit the conclusions I have arrived at for the consideration of Government.

2. So much has already been written and so widely divergent have been the views expressed on this much-vexed subject, that it appears desirable at starting to note in a concise form the different character of the proposals which the Government have had before them at various times.

3. In 1859* the Chief Engineer submitted a scheme to Government, devised by Lieutenant Vertue, R.E., (estimated to cost Rs. 23,500) who expressed his conviction that "by artificially contracting

ing" the opening which now exists "by means of a groyne of rough stone projecting seaward from the northern side of the river's mouth sufficiently far in a direction slightly convergent to the rocky headland forming the southern boundary of the entrance, the loose material of which the bar consists would be swept away and be effectually prevented from reforming," adding that "no one can look at the locality without coming to the conclusion that there is not a single port between the Hooghly

and Cape Comorin that can compare with it." In fact Lieutenant Vertue contemplated with the simple expedient of a single groyne to the north of the present outlet and a very trifling outlay, the possibility of creating a first-class harbour.

4. On the question being referred to Colonel (now Sir Arthur) Cotton he considered* it to be a "fundamental mistake" to look on the Vizagapatam basin as a first-class site, and proposed "to form an outer harbour by running out a breakwater from the salient point of the Dolphin's Nose for about 200 yards." He appears to have entirely discarded the idea of making an inner harbour, and pointing out the vastly superior claims of his own port Cocanada, to which all future trade, north, south, and west would flow by canals, relegated the Vizagapatam harbour scheme to a secondary position. Sir Arthur was, however, apparently not consistent in this view, as in a memorandum of 1873 on Vizagapatam he states that "what is now first wanted is the training wall at the mouth of the river."

5. Mr. E. S. Thomas, M.C.S., writing* in 1872 submitted proposals for the creation of an inner harbour apparently for the reception of the largest class of ships, urging that "Vizagapatam is the most natural, the most easily formed, port on the East Coast of the Peninsula."

6. The works to be undertaken with this object were apparently groynes run out north and south for 300 yards, the space between these being sufficiently narrow to obtain a thorough scour, yet having sufficient space for ships to enter by, sluices to be inserted in the north wall for empounding high tides, the water to be let out, and thus creating the required scour.

7. The scouring action was to be aided by the use of "some form of Turkish rake or marine grubber." It is not quite clear how the inner basin for berthing of vessels was to be insured, as he observes "no breakwater and no steam dredges are necessary, nothing but a sea wall of moderate length with shutters;" adding, "I imagine no estimate for these simple works could rise above £10,000, and that they might well be completed within the year"***. "Thus at a cost of about half the price of one of the steam vessels calling weekly at the port, a safe harbour might be constructed in the middle of the Bay of Bengal, in which within half an hour of the open sea, vessels of any size might be laid up and repaired." No sufficiently defined plan or estimate was submitted to Government based on these views.

8. Major Beatty* who next took up the question in 1874† considered it feasible "to shelter the approach to the entrance of the river from the heavy swell of the south-west monsoon, to remove the bar, destroy the surf, and at a moderate expense construct in the Vizagapatam backwater a small but safe close harbour for a few of the largest ships and steamers that ever trade with the coast, &c."

* Major Beatty had previously, under date 8th November 1871, submitted a report and estimate, amounting to Rs. 2,29,800, for the construction of the harbour, but I have thought it best to quote from the more matured ideas contained in his report of 1874.

† See his letter, No. 1,844, 17th Jan. 1874.

9. The works to be undertaken with this object, and which he considered would cost less than five lakhs of rupees, were specified as follows:—

- "(1) A solid breakwater on the southern side of the river mouth to protect the bar from the effects of the deposits of the littoral currents ** protect communication with the shipping during eight months in the year from the heavy swell which so greatly increases the surf on the bar.
- "(2) A training wall on the northern bank to confine the current and cause the most powerful scour at the entrance.
- "(3) Training walls from the landing place as far as the Sheppa. Rewn ferry to deepen the river channel for ships into the backwater.
- "(4) Some dredging in the backwater to improve the mooring ground for large vessels."

10. As a preliminary and tentative measure Major Beatty advocated the immediate "construction of the groyne on the southern bank at the Dutch battery . . . to be run out into 15 feet at low water of spring," and subsequently, weather permitting, "dredge and rake a deep channel at the line of bar, say 200 feet broad," the cost being estimated at Rs. 30,000 or Rs. 35,000.

11. The next officer who examined the question, Captain Taylor, Master Attendant of Madras, reported* in 1875 that "grave difficulties or, as I call them, impossibilities exist to carrying out the plan" proposed by Mr. Thomas and Mr. Addis, acting for Mr. J. L. Nursing Row. "In the first place the deep basin (to which ingress is proposed by dredging away the bar) *does not exist*. Two separate patches or rather scores in the bottom are met with . . . the intermediate portion of and all the backwater are shallow, and as well as the bar would require not *raking* or *dredging*, but excavating . . . the whole harbour would have to be made, and when done could not allow a British India Steamer once entered to turn round again to go out . . . ; the steamers of the Company would refuse to use it," &c. After much cogent reasoning Captain Taylor concluded by observing that, in his opinion, "a harbour as proposed would be impossible even at an enormous outlay and ruinous upkeep . . . difficulties attend every step in the proposal, and the sanction to the Madras Harbour removes any ground of necessity for another between Calcutta and Trincomallee."

12. Major H. W. Wood, whose report* was submitted in 1877, considered that "the cardinal point to be kept in view is to economise the volume of the outflowing stream, by placing it in the most favorable position possible for exercising its scouring action on the bar. In other words the river should be prevented from dissipating its power in the backwater, and should be led to its mouth between embankments constructed through the valley it traverses on its lower course." He concludes by observing that "it is a question whether some day a judicious expenditure of public money might not really improve the Vizagapatam harbour materially, and in this connection it seems worthwhile to consider whether the Government in granting what will some day be a valuable property to the Roman Catholic establishment might now make such provision with the grantees as would prevent any difficulties growing up in the way of executing such a project should it even become desirable."

13. There is nothing in the above-quoted communication to show that the writer countenanced the possibility of forming an inner harbour suited for the reception of large vessels, nor did he submit any project or estimate for work with this object. His theory however of favoring Bishop Tissot's reclamation scheme and concentrating the scour produced by river floods in contradistinction to producing the required scour through tidal action will call for some remarks further on.

14. Following up the various proposals in their chronological order, I must now advert to a scheme for an outer harbour suited for the largest class of vessels, and an inner harbour for boats and docking purposes which is attributed to Colonel Thomason, R.E. I have none of the original papers or plans connected with this project before me, but as the present Executive Engineer appears to have drawn his statements from sufficiently authentic sources, I shall probably not err very much in adopting these.

15. The details of this great work will be readily seen from the annexed plans. Here we have an outer harbour of ample capacity formed by two breakwaters, the northern one about 2,500 feet long being run out nearly perpendicularly to the shore from the point known as No. 1 groyne, and the other about 3,500 feet in length from what is known as the northern Dolphin's Nose, the entrance in water of 30 feet in depth being apparently 500 feet wide. The whole area of this outer harbour would be about 200 acres, one-half of which would either now be (or be made by dredging) available for the largest class of ships. The whole sand-spit to

the north and a basin inside for a great length up the present river bed would be either dredged (or more properly *excavated*) where not of sufficient depth for a width of 500 feet.

16. Even without the specification of the author of this project it can at once be seen that arrangements proposed are for a first-class harbour affording every facility for anchoring or docking the largest class of vessels. The probable cost of such a harbour can of course at present be only stated at a mere guess, but if the class of work in the breakwaters be the same as in the new Madras Harbour, the outlay could not be much less than half the cost of that work, say 30 or 35 lakhs.

17. The last proposal which has reached the Government, and which is that now immediately under reference, is the scheme suggested by Colonel Chrystie* during the current year, by means of rough stone groynes each 1,615 feet long run out north and south of the present entrance (with a width of 225 feet between them) to concentrate the scour on the existing bar and deepen it if possible. Colonel Chrystie was of opinion that "the stream issuing from the backwater is able to prevent the deposit of sand," and that "if the harbour mouth were prolonged into deep water (17 feet) by parallel groynes . . . a bar would not form in front of it;" adding, however, "it would be necessary to dredge to keep the backwater at the requisite depth, but dredging in the present bar would be useless as the sand composing it is constantly in motion."

18. The proposals which have thus at various times been placed before Government have embraced the formation of both inner and outer harbours or both of these in combination of every conceivable magnitude, as also schemes like Colonel Chrystie's for merely getting rid of the bar at the present mouth of the river, and thus chiefly assisting the passage of cargo boats to the vessels in the roads, and the docking of the present coasting craft of moderate draft.

19. But while all the projects above enumerated differ so widely in degree they all (with the one exception perhaps of the small harbour first sketched by Sir Arthur Cotton and afterwards apparently abandoned by him) rest on the principle that it is possible, either by means of the natural scour, or by artificially aiding this, to do away with the bar at the river mouth and prevent its reformation.

20. It may possibly be thought on a first view of Colonel Thomason's scheme that it should be considered an exception to this, seeing that it provides for the harbour being dredged or excavated and the mouth placed in what is now 30 feet in depth of water, but a little reflection will show that the very fact of having to dredge at the outset shows that silt has been deposited by either the action of the river or the littoral currents or by both combined, and that as these still remain similar results must be looked for in future though no doubt modified as to the locality of the deposits.

21. The north and south littoral currents would no doubt according to the season sweep past his proposed harbour mouth, but as they must there meet the current of the outflowing tide daily, and this stream at times augmented by floods in the river, there must be some point (varying according to the velocities of the currents engaged) at or outside the harbour mouth, at which the opposing currents coming in contact must neutralize each other and where silt must consequently become deposited and form a bar.

22. This inevitable formation of a bar wherever the sea and river currents meet is therefore the main point to be considered before we can advance a single step in the present inquiry.

23. Turning to the reports by Mr. George Robertson, who was specially deputed in 1870 by the Secretary of State to prosecute inquiries for the improvement of harbours on the Indian Coast, we find this difficulty of the bar found at all river mouths invariably presenting itself.

24. At Mangalore, where the depth of water within the backwater on the survey of 1858 is shown to be as much as 23 feet, the bar immediately outside had

proposed, the groynes are carried out into 17 feet water as suggested by Colonel Crystie, or breakwaters were found terminating in 30 feet water as in Colonel Thomason's scheme; but notwithstanding the exceptionally favorable circumstances of the Cochin harbour, I cannot but think that Mr. Robertson has here been somewhat inconsistent.

33. A glance at the survey of the coast line at Cochin shows outside the immediate opening of the harbour a bulging line of deposit on which the bar is ultimately formed, and which clearly indicates the line along which the forces of the opposing currents becoming neutralized, velocity ceases and the silt deposits itself, as he himself observes: "After the current has flowed out to sea from nearly a mile it is no longer able to resist and keep down the ever-working and powerful efforts of the waves, &c."

34. And this, be it remembered, is quite irrespective and independent of the great depth of water to be found at the harbour mouth, varying, as shown in the survey, from 30 to 44 feet! and depths carried well out in the same line for 24 to 18 feet, and thence gradually diminishing till only 11 feet is met on the bar.

35. There cannot, of course, be any direct analogy between the cases of Cochin harbour and Vizagapatam, but even the apparent one which I have above pointed out as seeming to militate against the general principle I am contending for does not to my judgment exist, and I cannot but think that in even this exceptional case Mr. Robertson has failed to appreciate at their true value the forces in operation.

36. My impression is that few Engineers who study the facts as illustrated by the survey and soundings of the Cochin harbour can arrive at any other conclusion than that the groynes proposed for concentrating the scour at the present bar will merely have the effect of pushing the bar further out to sea. That some beneficial result would be secured for a few years can hardly be doubted, but that the bar would ultimately reform seems to be inevitable.

37. It may be contended that there is little sand in movement with the littoral currents, or that once a certain régime has been established no further advance of the shore line is likely to occur; but even were such the case, we cannot get rid of the silt brought down by the rivers in the monsoon, and which, spite of all our efforts, must deposit itself the moment the velocity is diminished, and this too perfectly irrespective of the depth of water in which such check occurs.

38. The whole truth (at least in so far as concerns the streams of the Madras coast, which debouch into a well nigh tideless sea) is, I think, conveyed in the following quotation from paragraph 6 of the report of 13th March 1875, No. 1,631, by Captain Taylor, to which I have before alluded :—

"All experience of Indian rivers shows them to be uncertain and unfit for nice harbour construction. Inland they are liable to come down in the rains or periodical storms with overwhelming force and laden with silt. They debouch on sands always in motion from surf, periodical current or storms."

39. In fact, the mouths of our rivers are, as a rule, the very worst places at which to construct a harbour, and I think Madras may be congratulated that at least this silt difficulty has not had to be encountered.

39. In fact, the mouth of the river is so shallow as to construct a harbour, and I think Madras silt difficulty has not had to be encountered.

40. The conclusion I have arrived at, therefore, in connection with the question of forming either an inner or outer harbour at Vizagapatam, coincides with that previously expressed by Captain Taylor, that such would "be impossible even at an enormous outlay and a ruinous upkeep."

As to the question of whether a harbour for large vessels is wanted, Captain Taylor is of opinion that the expense of such a harbour is entirely shared by the masters of steamers whom I have mentioned, and that the Government have no right to expect any return for the port from 1860-61 to 1879-80.

41. As to the question of whether a harbour for large vessels is wanted, Captain Taylor's observations, which are entirely shared by the masters of steamers whom I have met, are decisively in the negative.

41. As to the question of whether the enormous outlay and expense of the Taylor's observations, which are entirely un-
have met, are decisively in the negative.

42. An examination of the trade returns of the port from 1860-61 to 1879-80
given me by the Port Officer, Captain Winckler (who also, so far as I could under-
stand, did not consider a harbour necessary), shows how rapid has been the decline in
the number of sailing vessels either belonging to, or visiting the port, and how com-
pletely steamers are taking their place in the coasting trade. Although the return

[illegible]

Mr. Tolstean found from 6 to 7 feet of water on the bar, but about 12 feet at the latter end of August. It is about 100 feet long, while offering no suggestion as to the cause of the increase. In fact, within the whole range of hydraulic engineering, a cause should be sought in the whole range of hydraulic engineering.

21. At Baypore Mr. Robertson found from 6 to 7 feet of water on the bar, but was informed that the depth referred to 12 feet at the latter end of August. It is not said whether these depths referred to high or low water, though probably to the former. But even in reference to this case he says that "a bar was coming on when the channel is open would enlarge it to such an extent as seriously to injure the depth on the bar." He concludes that the greyns by which it was proposed to improve the action on the bar "would require to be 500 yards in length, and the result gained would not justify the expense."

25. At Quilon matters were just the same: there was from 5 to 6 feet of water on the bar during the dry season and about 4 feet more during the monsoon. Mr. Robertson observes: "there is enough water on the bar for native craft using the bar during the dry season and about 4 feet more during the monsoon. The result gained would not justify the expense."

27. At Tuticorin a scheme for getting rid of the bar by dredging out a canal up to the town with a basin at the end of it for ships to lie in while being discharged did not meet Mr. Robertson's approval. "Whether taking from the north or the south channel this would be a great expense, and the new channel would require constant dredging. The bottom of the bay is soft mud, and the tendency of any artificial channel would certainly be to silt up."

28. Through all his reports there is in fact nothing but a wearisome iteration of this great difficulty of the bar, which invariably forms at the mouths of all our rivers, and which, owing chiefly to the small rise and fall of the tide along the East and West Coast, varying from 2 to about 4½ feet as a maximum, produces too weak a scour to be effectual.

29. Mr. Robertson's remarks on the exceptional case of Cochin, however, call for notice, as, notwithstanding the widely different circumstances as compared with Vizagapatam, there is apparently a point advanced by him which would appear at first sight to have a bearing on the case.

29. Mr. Robertson says, notwithstanding the fact that the first sight to have a bearing on the case.

30. The backwater at Cochin swells, he says, into a magnificent sheet of water, and "the value of this as a tidal reservoir to keep clear the entrance to Cochin harbour cannot be over-estimated;" adding "it renders Cochin quite independent of flood waters for scouring purposes, and makes that port almost unique in that respect amongst Indian harbours."

In dealing with this case Mr. Robertson has the following remarks:—

the *faucis terra* at Vyneen Point it is discharged on the

30. The backwash of this as a tide gauge is not to be over-estimated; it renders Ocean quite unique in that the harbour cannot be over-estimated; adding that it renders Ocean quite unique in that of flood waters for scouring purposes, and makes that port almost unique in that respect amongst Indian harbours."

In dealing with this case Mr. Robertson has the following remarks:—

... the fauces terra at Vyneen Point it is discharged on the

31. In dealing with the *faucis terre* at Vypeen Point it is discharged on the shallow, exposed sea-coast, but is still able to keep up a considerable depth for some distance out, although the water has now begun to spread out sideways, and escape especially towards the north. Meanwhile the surf is always striving to restore the natural profile of conservancy of the shore. After the current has flowed out to sea for nearly a mile it is no longer able to resist and keep down the ever-working and powerful efforts of the waves to reform the profile of the coast by continuing the beach line which has been broken through by the outgoing current. Were," he adds, and this is the point I wish to draw attention, "the current to be kept together in full strength till it got into such a depth of water that the action of the waves was not sufficiently powerful to stir up the bottom, there would be no decided bar. The same result would happen were the current to discharge under shelter from the waves, as for instance in a land-locked estuary. At Cochin the surf has sufficient power on the bottom in 15 or 16 feet of water to overcome the levelling efforts of the current as at present existing, and throw up a bar with only 11 feet of water upon it."

32. These remarks would, no doubt, at first sight seem to invalidate in some measure the argument that a bar must form at Vizagapatam, where either, as now

has not till within the last four years separated sailing vessels from steamers. I am satisfied from my inquiries that the great majority of the vessels shown in this return from 1860-61 to, say, 1865-66, &c., from 82 to 201, were sailing craft of sorts. These, as will be noted, have dwindled down to 8 in 1876-77, 21 in 1877-78, 20 in 1878-79, and again 8 in 1879-80. In fact, this kind of trade may be almost now considered extinct, and must soon cease absolutely with the increasing competition of steamers.

43. That steamers taking in or discharging cargoes from boats in an open roadstead can do their work with the greatest ease and efficiency was fully proved at Madras in the famine; and as one of the Captains of the British India Steam Navigation Company's steamers told me that no less than 1,200 tons of cargo was passed over the ship's side into boats in a single day, it may well be asked what more is needed.

44. Looking to the long period over which this question has been constantly before Government, and the waste of time and energy in following what appears to me to be a mere dream, the time has, I venture to think, arrived for a decisive expression of opinion and a ruling by Government, that no further proposals for the construction of a harbour will be listened to, come from what quarter they may.

45. Setting aside, then, the schemes for a harbour, it may now be inquired whether something may not still be done to improve the mouth by deepening the bar.

46. As will have been inferred from the previous observations, I have no faith in any permanent advantage being derived from the construction of the groynes lately proposed. Having had the advantage of landing when there was a pretty heavy swell from the south-west, it was evident to me that although the traffic with boats is at such times carried on with some difficulty, the bar is now to a great extent recessed and protected, whereas by pushing it out further it would get more and more into the full swing of the rollers as the surge round Dolphin's head.

47. I am convinced that in this respect alone any works which would throw the bar more out into the roads, although even securing thereby a greater depth of water on it, would only add to the difficulties and even dangers of the boat traffic. We should not only incur useless outlay, but do perhaps irreparable mischief.

48. In the above observations I have carefully abstained from bringing in subsidiary questions connected with the reclamation schemes, which in reality do not in any way affect the harbour project, though they have a bearing on the maintenance of a scour on the bar.

49. Major Wood, as I have shown starting from the stand-point of the preponderating value of the river floods towards attaining that object, naturally concluded that to dissipate the flood volume over the low grounds now being reclaimed by Bishop Tissot (2½ square miles in extent) was a mistake, and that consequently the completion of the scheme was the object to be attained in the interests of the harbour.

50. Colonel Chrystie has since then shown that whereas the Bishop's banks are only from 3.42 to 4.52 feet above high tide level, they would need at least to have 6 feet added to their height, in order to keep them sufficiently above the limit of maximum flood, which in 1876 attained a height of 7 feet above high tide level.

51. Considering the great area of ground to be enclosed, the cost of a sufficiently high and substantial bank with the necessary subsidiary works would be considerable.

52. On the other hand it is contended, and my predecessor has favored the view,* that "it is the tidal ebb that must be looked to at Vizagapatam as elsewhere for keeping the bar open."

This if followed out to its logical sequence would at once put an end to all the reclamations, as the value of the tidal scour is directly proportioned to the area over which the tide (especially the highest springs) can spread themselves.

53. Every inch of rise over the 2½ square miles of backwater now being reclaimed would be worth 6,388,250 cubic feet of water, or for a rise of 6 inches 38,329,500 cubic feet. Such volumes as these could not fail to increase sensibly the

velocity and scour at the bar; but as the extreme rise of the tide is not much over 4½ feet, it is difficult to say as yet with absolute certainty whether the benefits of such increased scour would outweigh the loss feared by Major Wood during periods of river flood.

54. This question, as also one upon which the Executive Engineer is now engaged (viz., as to what has been the actual amount of soil deposited on the portion under reclamation since the commencement of the work), must take time to solve, as a very accurate series of levels, &c., will be necessary to ascertain the precise facts on which to base a reliable opinion.

55. I may, however, at once say that although some permanent deepening of the bar may be effected by following up one or other of these opposing proposals to their legitimate issue, I do not feel very sanguine as to the results of either.

56. The Master Attendant is, I understand, not disinclined to allow a very powerful steam dredge belonging to his department (the *Albuquerque*, I think, which has the great advantage of being able to work without the aid of punts) to proceed to Vizagapatam next December or January, if she can be got over the bar (she draws some 8 feet), as appears not improbable, the water always improving in the north-east monsoon.

57. The sea will then probably be sufficiently quiet, and if she can commence working from the still water of the inner harbour, some good may be effected, though whether the deepening of the bar will prove of permanent value remains to be seen. It will in any case be worth a trial, and I trust that Government will sanction the proposal.

OOTACAMUND,
6th August 1880.

(Signed) R. H. SANKEY, Colonel, R.E.,
Chief Engineer, P.W.D.

PARTICULARS of the Trade of the Port of Vizagapatam during twenty years from 1860-61 to 1879-80.

Official Years.	BRITISH.			FOREIGN.			COUNTRY OR NATIVE.			TOTAL.			VALUES OF			DUTY ON		Remarks.
	Vessels and Steamers.	Ton-nage.	Dues.	Ves-sels.	Ton-nage.	Dues.	Ves-sels.	Ton-nage.	Dues.	Ves-sels.	Ton-nage.	Dues.	Exporta.	Importa.	Exporta.	Importa.		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	1860-61	42	20,696	367 6 9	2	1,648	96 12 0	89	8,794	420 7 3	133	30,938	864 10 0	4,14,648	2,26,938	503 12 0	49 13 3	Incl. to Port
2	1861-62	52	19,329	461 9 3	4	1,873	117 1 0	108	13,178	705 4 0	164	31,380	1,283 14 3	6,03,346	3,49,680	2,472 0 3	80 0 0	Port
3	1862-63	26	15,152	338 2 6	10	5,725	335 4 6	128	12,728	650 3 3	137	31,605	1,283 14 3	6,03,346	3,49,680	2,472 0 3	80 0 0	Port
4	1863-64	23	13,971	517 9 6	5	2,902	181 6 6	109	13,839	635 14 9	156	30,713	1,354 14 9	6,86,516	3,49,680	2,472 0 3	80 0 0	Port
5	1864-65	67	37,158	1,210 2 0	10	4,606	287 14 0	169	13,198	623 1 9	186	34,562	2,121 1 9	7,25,971	3,49,680	2,472 0 3	80 0 0	Port
6	1865-66	87	56,982	1,874 8 6	4	1,647	103 15 0	201	14,594	734 13 6	292	73,133	2,712 4 11	7,25,971	3,49,680	2,472 0 3	80 0 0	Port
7	1866-67	76	49,686	1,454 3 2	4	1,701	105 5 6	80	10,806	661 12 7	185	61,963	2,122 5 3	8,31,727	3,49,680	2,472 0 3	80 0 0	Port
8	1867-68	85	64,368	1,603 10 9	4	1,697	182 10 0	96	13,500	704 0 11	220	74,905	2,838 9 6	8,40,346	3,49,680	2,472 0 3	80 0 0	Port
9	1868-69	80	65,997	1,600 5 3	8	3,641	411 4 0	132	16,367	967 0 3	219	73,016	1,999 3 6	8,40,346	3,49,680	2,472 0 3	80 0 0	Port
10	1869-70	90	66,108	1,657 14 6	6	2,786	348 4 0	123	14,121	793 0 3	218	73,016	1,999 3 6	8,40,346	3,49,680	2,472 0 3	80 0 0	Port
11	1870-71	88	73,633	1,557 14 6	7	2,842	355 4 0	107	11,324	652 4 8	202	87,803	2,660 2 0	8,40,346	3,49,680	2,472 0 3	80 0 0	Port
12	1871-72	80	73,733	1,663 9 6	6	2,382	281 0 6	215	22,818	1,215 8 0	200	98,933	2,660 2 0	8,40,346	3,49,680	2,472 0 3	80 0 0	Port
13	1872-73	86	87,270	1,642 10 6	3	1,542	162 0 0	195	20,770	1,257 14 3	284	109,582	3,244 13 0	11,92,163	3,49,680	2,472 0 3	80 0 0	Port
14	1873-74	98	91,875	1,415 1 3	4	2,615	327 0 0	72	8,677	602 11 9	174	103,167	3,244 13 0	11,92,163	3,49,680	2,472 0 3	80 0 0	Port
15	1874-75	134	144,296	3,045 9 0	4	1,974	246 11 0	68	7,203	418 12 6	196	153,473	3,244 13 0	11,92,163	3,49,680	2,472 0 3	80 0 0	Port
16	1875-76	163	186,905	1,526 15 0	4	2,095	237 4 6	108	10,725	568 14 0	273	199,725	3,333 1 6	13,47,694	3,49,680	2,472 0 3	80 0 0	Port
17	1876-77	161	179,182	1,804 13 6	4	1,893	236 9 0	74	10,018	503 15 0	239	191,094	3,369 6 6	13,47,694	3,49,680	2,472 0 3	80 0 0	Port
18	1877-78	188	197,875	2,601 11 0	4	4,072	466 11 0	72	9,444	669 4 0	264	211,091	3,369 6 6	13,47,694	3,49,680	2,472 0 3	80 0 0	Port
19	1878-79	213	216,168	2,499 13 6	3	2,420	275 15 0	69	8,613	593 9 11	273	230,111	3,737 10 0	16,23,348	11,74,146	5 9 6	194 6 3	Port
20	1879-80	169	196,577	2,356 15 0	1	1,178	147 5 0	48	5,604	307 2 0	218	203,349	2,811 6 0	12,86,946	6,41,234	..	649 15 2	Port

Previous to the year 1876-77 sailing vessels and steamers were grouped together and cannot be separately distinguished, now steamers and sailing vessels shown in Column 3 for the four years from 1876-77 to 1879-80 are distinguished below:—

	Steamers.	Tonnage.	Dues.	Sailing Vessels.	Tonnage.	Dues.	Total.	Tonnage.	Dues.
1876-77	153	172,747	999 15 6	8	6,438	804 14 0	161	179,185	1,804 13 6
1877-78	167	177,749	1,452 2 0	21	20,126	2,456 9 0	188	197,876	2,601 11 0
1878-79	193	199,264	697 2 9	20	16,914	1,802 10 9	213	216,168	2,499 13 6
1879-80	161	188,904	1,677 8 3	8	7,673	779 6 9	169	196,577	2,356 15 0

Exd. E. C. Shunker and A. F. Goodall.
Spore Copies

To the Superintending Engineer, First Circle.
To E. C. G. Thomas, Esq.
To the Marine Department.
" Revenue "

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

THE Government are satisfied, on the joint opinion of the Master Attendant and Chief Engineer, that it will be impossible, with the expenditure of any reasonable sum of money, to create either an inner or outer harbour at Vizagapatam for the use of vessels of large draught; but, as there would appear to be some probability of means being found for improving the depth of water on the bar at the mouth of the river, in the interest of cargo boats and other vessels of light draught, the requisite investigations with this object will be continued by the Public Works Department.

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1880) Madras.
PUBLIC WORKS.

To THE SUPERINTENDING ENGINEER,
FIRST CIRCLE.
&c. &c. &c.

Dated August, 1880.

Yours

Resd.

Encl.

G. O., 13th August 1880, No. 1,933 W.

AUGUST.
Nos. 30-31.

Harbour at Vizagapatam.—The formation of an inner or outer — considered impossible; and stating that investigations will be continued by the Public Works Department for improving the depth of water on the bar at the mouth of the river.

W. B. Williams

GOVERNMENT OF MADRAS.

MARINE DEPARTMENT.

26th August 1880, No. 425.

Out-ports.

Read the following papers:—

No. 47. From J. H. TAYLOR, Esq., Lieut., R.N.R., Master Attendant, Madras, to the Chief Secretary to Government, dated Madras, 10th August 1880, No. 6917.

Administrative Department.

I have the honor to submit the accompanying remarks on the ports of Vizagapatam and Cocanada, in the inspection of which I was requested by Colonel R. H. Sankey, C.B., R.E., Chief Engineer and Secretary to Government, Public Works Department, to join him, as already reported to Government.

ENCLOSURE No. 1.

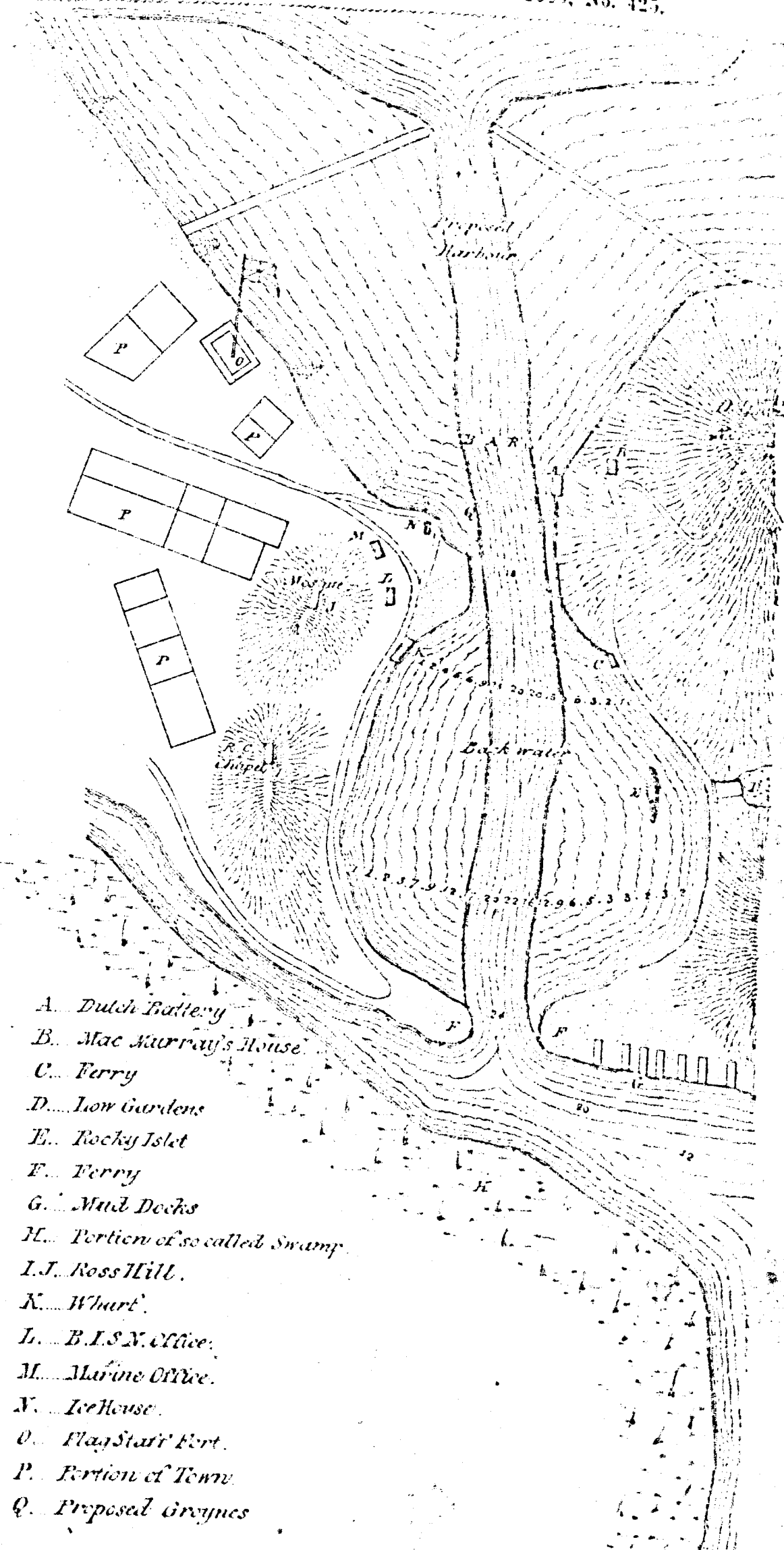
REMARKS ON THE PORTS OF VIZAGAPATAM AND COCANADA.

VIZAGAPATAM.

13th July.—On meeting Colonels Sankey and Prendergast and Mr. Harris this morning, I heard for the first time that Colonel Thomason's proposed harbour was not in the backwater, as all previous propositions have intended, but outside the present bar, and contemplates the enclosure of a basin of water within walls similar to those of the Madras Harbour piers. This therefore involves a reconsideration of the whole question.

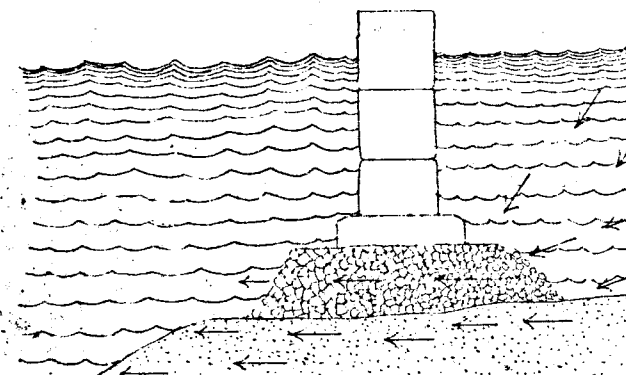
2. In the first place I have no hesitation in saying that such a harbour is not demanded either by the present or prospective state of the town and neighbourhood of Vizagapatam, nor by the actual requirements of the shipping that frequent the Bay of Bengal either in the matter of protection or repairs. It has never been able to be shown that the latter advantages were necessary, and the formation of the Madras Harbour appears to me to entirely dispose of that question so far as Vizagapatam is concerned.

Here follows a rough design of the proposed harbour, by which it will be seen that the general plan amounts to little more than "An area similar in nearly all respects as to size, conditions of flood and ebb, &c., to the backwater itself," is projected into the open sea away from the protection now afforded by the Dolphin's Nose and Ross Hill, and subject to all the coast vicissitudes from which Vizagapatam, in virtue of its land-locked position, has hitherto claimed to be exempt. Such a complete shift of ground compels a more definite answer to the question "why should a harbour be made at all?" with which I commenced my report, and the answer acquires much more cogency. It is one thing to be in possession of a basin claiming to be already almost a dock and only wanting cheap alteration to become one, but a totally different thing to construct a harbour in the sea at this port in particular rather than at others more conveniently placed for purposes of trade, &c., like Calingapatam, Gopálpur, &c., as evidenced by the trade returns and the general choice of these places for export of the country's produce.



- A. Dutch Battery
- B. Mac Kurray's House
- C. Ferry
- D. Low Gardens
- E. Rocky Islet
- F. Ferry
- G. Mud Docks
- H. Portion of so called Swamp
- I. J. Ross Hill
- K. Wharf
- L. B.I.S.N. Office
- M. Marine Office
- N. Ice House
- O. Flag Staff Fort
- P. Portion of Town
- Q. Proposed Groynes

3. But however, leaving these matters, if we proceed to examine the plan, it will be found to possess all the objections which in my opinion render a harbour unadvisable, not only here, but wherever a river or backwater and inland water-communication exists, viz., the bar at the outside and the constantly-accumulating silt inside. It may be considered certain that wherever a sluggish tidal river like the Vizagapatam one debouches into the sea a bar will form outside and, except perhaps in the very main channel itself, will lay up silt inside as shown in this backwater. No interruption to this law can be proved to exist on this coast, and the harbour here would be only a repetition and extension of the *status quo* where the backwater is proved to have only a narrow central channel of about twenty feet in depth and about thirty feet in width, rapidly shelving to either shore. If the walls of the outer harbour were constructed and the shallow water inside dredged into the required depth, it would within a very short period imitate the action of the backwater and silt up again in all but the central passage, while the occasional attacks of cyclone torrents and freshes, with perhaps twenty-four inches or more of rain, in a few hours over a large hill district, for which this harbour would be the only outlet to the sea, may be imagined, but cannot be described, nor their effects prophesied. The "strong connections," "nice dependencies," "gradations just" of engineering would hardly cope with these two



frequent foes, which leave traces behind them even upon the Dolphin's Nose itself, and expensive repairs would therefore be periodically demanded. Another danger to which the walls would be at all times exposed exists in the excavated deep basin on the one side and the comparatively shallow water in considerable portions of the wall on the other. The rubble base and the sand are porous enough to cause the currents to force a passage through, thereby undermining and giving the wall a tendency to slip into the basin below them, and this action would be unceasing. For these reasons I would not recommend such an outlay as the outer harbour would involve. I have only to add that the question of rock, which may be probably encountered in many of the most important positions, is of vital importance and may offer still greater impediment than those I have suggested.

4. The conversion of the backwater into a harbour and the removal of the present bar are however the real points to which local interest attaches and to which various suggestions of experience and invention have hitherto been directed. I have in former reports given my strong opinion against the possibility of a harbour being constructed here and my reasons for that opinion, which are not shaken by anything I have since seen or heard; but on the improvement of the bar for boat convenience I would beg to offer the following remarks.

5. The bar is now very wide, and the water of the river, on issuing from it in tides or freshes, disperses over this whole surface, losing thereby much of its force. It is observed that in the south-west monsoon the current seeks a passage near the sandy north shore and in the north-east monsoon has a drift towards the Dutch Battery. This is a necessary consequence of the permanent sea currents during those monsoons. The direction of the bar is from the Dutch Battery towards the second of the stone groynes thrown out by Sir A. Cotton to save beach. It is obvious to any looker-on that the sea on the bar enjoys a very considerable amount of protection from its position with regard to the Dolphin's Nose and that the farther the bar is projected the more that protection is weakened. This consideration, therefore, in my opinion should govern all operations having the improvement of the depth of water on the bar for their object. For this reason I would therefore not recommend any groyne extending from the Dutch Battery, but would look upon the natural barrier on the south side as sufficient for the purpose, but I would advise a groyne being thrown out from the mainland opposite the new British India Steam Navigation Company's Office, curving round till it becomes parallel to the Dutch Battery and continued until in fact it meets the line of the bar and becomes nearly, but not quite, opposite the battery; the whole stream would then attack the bar at a point where, without interfering with its natural direction, a good force of current might be at all periods of ebb or fresh brought to bear upon it, and the water is already deeper there from natural causes. I would curve the shore-end of this groyne until it meets the solid raised ground, because otherwise the sea and river might open another communication between the shore and groyne over the sand-spit where boats now lay up. This is the only measure of improvement I can suggest, and I do not know that it would be successful, but I think it is worth trying. It must, however, be borne in mind that the mouth there constructed must still be a wide one, or it will be difficult for several boats to shoot the bar at the same time, and yet it will be impossible to preserve regularity and strict order among them. If collisions occur from want of space, loss of life and property will follow

and the latter state be worse than the first. I consider 500 feet or even more should be arranged for.

6. I cannot, however, say that the boat-traffic of Vizagapatam has any disadvantages not shared in by other ports on the coast. Whatever trade can be directed here meets ready shipment or discharge, and therefore any distinct encouragement given by Government to the tax-payer here can only be purchased by an equal discouragement thrown upon similar classes of tax-payers elsewhere along the coast. This significant fact has been lost sight of in Vizagapatam itself, but report with a few words on the swamp and reclamation question which I will conclude this examine under orders of Government in March 1875. It is contended now, as at that time, that the reclamation may injure the scour of the harbour, and this might be the case if it could be shown that the swamp was ever previously covered at high water, but all the evidence that can be found goes to prove the contrary, while its being raised and planted can have only a beneficial effect on the health of the town. Owing to its immense area its complete or even partial removal would be difficult and expensive. As a famine work, however, if such were again unfortunately needed, a portion might usefully be lowered to, say, mean sea level or any depth that admits of direct hand-labor, and the soil thus obtained spread upon the remaining portion to bring it into earlier cultivation.

7. If it was never a portion of the water-supply, its present position does not affect the scour question, and the fact remains that so small a volume of water is required by the natural bed of the river to keep up the tidal levels with the sea that the run out and in is very slow when spread, as it must be, over six hours' alternate action. It would be better in my opinion that, in considering improvements to the bar, the actual normal condition of the river be alone considered and action taken with reference to that alone. The periodical freshes and storm-water floods often do more harm than good. What is called the swamp appears now dry and healthy and emits no odour, but the stagnant pools and large basins all the way from the Parade Ground to Ross Island are the real source of danger to the town; they receive a great portion of the drainage, and latrines are built over them. If they could be thrown open to tidal action, benefit would certainly follow; a broad canal might be carried along the line of direction nearest the town, and the excavated soil levelled over the remaining portion of what is now stagnation and filth. Although the sanitary condition of the town is not included in the present inquiry, its importance is really greater than that of the harbour.

COCANADA.

8. At daylight on the 20th Colonel Sankey and myself with Mr. Walsh and Captain Gillham, Conservator, started in the *S. Lady Mary Grenville* to inspect the harbour. We reached the new mouth of the Godavari with the intention of proceeding up to Hope Island and the localities where certain dam operations were suggested in Mr. Robertson's report, but a heavy swell was on and rolling across the mouth with broken water from the eastward and the intention had to be abandoned, but, as this is my fourth visit to this spot since the discovery of the new mouth, I have paid great attention to any alterations that I fancied I could detect. From such observations I feel a hopeful confidence that the bank on the Cocanada side is hardening and extending and that on the sea side being lessened, the result of which action, if continued, would be to throw the Godavari water in a more direct line out to sea and greatly improve the bay of Cocanada and the present anchorage. It is, however, too soon to pronounce definitely on such a subject. I think the two spits should be marked out and carefully watched and reported on monthly, and I think stakes would be preferable to buoys for the purpose.

9. As the extension of the groynes at the Cocanada river mouth is now sanctioned, nothing more need be said than that experiments as to the cheapest method of construction are ordered to be carried out by the Master Attendant.

10. In a memorandum from the Superintendent of Marine Surveys, dated 26th May 1880, forwarded to the Government of Madras from the Government of India, it will be observed that the points mentioned by the Superintendent of Marine Surveys have been brought before the Government of Madras by independent observations of Madras Marine, and sanction given to the only effective portion of the memorandum. The *Albuquerque* is a vessel utterly unsuited to the duty proposed by the Superintendent of Marine Surveys; she draws nine feet water and could not approach within two miles of Cocanada river bar, and, owing to the tenacity of the mud, her under-water valves would soon choke and render her helpless. The old Cocanada dredge is now being docked, and, when the report upon her condition comes in, I will again address Government on the subject.

MADRAS,
9th August 1880.

(Signed) J. H. TAYLOR,
Master Attendant.

No. 1624-A.

Referred to the Chief Engineer, Public Works Department, for remarks, with reference to his Note, dated 19th August 1880, No. 295.

OOTACAMUND,
18th August 1880.

(Signed) R. DAVIDSON,
Chief Secretary.

No. 333.

MEMORANDUM.

No. 48.

With reference to the Chief Secretary's endorsement, No. 1624-A, of 18th instant, forwarding for remarks a memorandum by the Master Attendant of the 9th instant, regarding the Vizagapatam and Cocanada Harbours, the undersigned has nothing to add to his memorandums on the same subjects of the 6th and 19th instant respectively, though he considers that it should in any case be communicated to this department with a view to its being forwarded for the information and guidance of the Superintending and Executive Engineers who are concerned with the investigations in regard to both the works in question.

2. He also thinks it would not be amiss if the papers, when disposed of by Government, were placed on the Editors' table, as there has been a good deal of misapprehension regarding especially the Vizagapatam Harbour scheme, which would probably be in great measure corrected by the publication of the professional opinions.

OOTACAMUND,
20th August 1880.

(Signed) R. H. SANKEY, Col., R.E.,
Chief Engineer, P.W.D.

To the Chief Secretary to Government.

No. 49.

ORDER THEREON, 26th August 1880, No. 425.

Recorded.

(True Extract.)

R. DAVIDSON,
Chief Secretary.

To the Master Attendant, Madras.
Public Works Department.
" Revenue Department.
" Collector of Vizagapatam.
" Collector of Godavari.

Exd. J. W. Fischer.

Ref.
4
15,000-10-2-06

Administrative Department.

CURRENT No. 409
MADRAS.

No. 6118.
Marine Office,
8th July 1881.

From
J. H. TAYLOR, Esq., LIEUT., R.N.R.,
Master Attendant,
Administrative Department,
Madras.

To
C. G. Hooper Esquire
Offg. Chief Secretary to Government,
Marine Department,
Fort Saint George.

SIR,
I have the honor to acknowledge receipt of the letter from the Government of India with its endorsement, relating to the Ports of Vizagapatam and Bimlipatam, and to forward herewith copies of the reports I have already made regarding the capabilities of Vizagapatam as a Harbour, from which reports it will be seen that I am of opinion that such a work would be a great mistake. If Vizagapatam was simply a bay, with no dangerous complications of backwater and swamps, a Pier from the Dolphin's nose, advanced to meet another from Waltair beach, if arranged to overlap one another, and keep out the Ocean swell, which is the cause of all surf on this Coast (thus avoiding the mistake at Choadras) would make

x
G.O. No. 301 dated
July 1st 1881.

x
G.O. Revenue No.
509, dated 22 April
1875

G.O. Marine No.
425, dated 26th
August 1880

Let this be?
W. H. H.
M. H.

Mr. H. H. H.

G.O. of (1880) 311013.

MARINE.

To
THE MASTER ATTENDANT,
Madras, &c.

&c., &c., &c.

Dated August, 26th.

Issued

Recd.

G.O., 26th August 1880, No. 425.

AUGUST.
Nos. 47-49.

Out-ports—Letter from the Chief Engineer, Public Works Department, with reference to the Master Attendant's memorandum on the Vizagapatam and Cocanada Harbours, that he has nothing to add to his memorandum of the 6th and 19th instant on the subject, &c., received.

See Marine 409-81

a Harbour at very great expense, far beyond what any prospective trade would justify. But supposing such a Harbour to be made, and a Railway constructed into the interior in the Jey-Pore direction, the first 20 miles of it would have to pass through a mass of Hills utterly unproductive, and a few valleys sparsely populated and cultivated, and the cost of these 20 miles would represent the most extravagant and useless portion of the Line, the object of the Railway being to tap the productive portions of the country, and stimulate Trade generally. I would beg very respectfully to point out, that hitherto no impediments worth mentioning to landing and shipping have ever occurred at any of the great ports on our N.E. Coast. On some few days in each year boat traffic is difficult, and on a very few impossible, but such causes of delay are common to all Ports in the World, even Harbours and Rivers are often weather bound. Vizagapatnam is a large and populous Town, but it would be a mistaken inference that any portion of its prosperity depends upon sea borne trade that all comes from the interior and is shipped through agencies chiefly European,

and

and representing large firms at Madras. A Harbour therefore at such a point, unless from very strong natural reasons is less useful than others at Bimlipatam, Calicut, and Gopaulpore, all of which have much larger trade with the interior. The natural effect is one so far from being given is entirely withheld, when the capabilities are carefully considered, and I would repeat what my former letters to Government have often urged that to the rapid and successful development of Trade on the Coromandel Coast, Harbours are not a necessity. Take the case of Madras itself. During the famine the demands upon the Port were enormous, yet cargoes were landed from countless vessels with a rapidity not excelled in Calcutta or Bombay, and far exceeding the powers of the inland traffic to carry off, aided as it was by two railways, and the stimulus given by starvation in the interior.

2. So with this N.E. Coast. If twenty years ago a port for such operations as seem contemplated by the Government of India had been chosen, there is no doubt Gungam would have been selected, yet in the course of a few years owing to redistribution of roads, and opening up of new tracts inland, it is now utterly deserted, and

and nothing remains but to remove its establish-
ment, as useless. I would therefore respect-
fully reiterate that the point on the Coast
atowards which the developments of the interior
in traffic is directed should be considered
of without any reference to a Harbour.

3. It appears from a consideration
of the map that, owing to the hilly diffi-
culties near Vizagapatam, and its being too
far south for direct operations, a point
further North should be selected. Now
Bimlipatam avoids the greatest difficulties
of Vizagapatam. The valley of the Chittanala-
river conducts through the hilly fringe near
to the Coast, and passes near Vizianagaram, the
head quarters of the Rajah, to whose liberali-
ty and assistance the Railway is likely to be
much indebted.

4. As a port Bimlipatam enjoys a good
reputation. When I commanded an Indian man-
of-war on this Coast, I visited it for six years con-
tinually, taking in by far the greater portion
of my cargo for England, and landing also
coals and other articles of Commerce. This was
in the N.E. monsoon, when the winds are
fresh and sea rough. I never experienced
any delay or difficulty. No other
vessels

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vessels frequented it at the same time, and
I never heard a remark against it. It was
considered a port convenient, healthy, and
giving good despatch. In this particular
I consider it enjoys an advantage over
Calcutta and Gopulpore, where
landing is not so convenient. The boats
load and deliver cargo inside a river
mouth, and this mouth is sometimes in
dry periods a cause of trouble owing to
the tendency to close, common to all these
Indian rivers. A ridge of rock, however,
runs out very conveniently from the south-
-ern side of the river mouth, which all-
our newly gained experience shows to be the
proper side to treat upon this Coast, and this
ridge if prolonged and raised would, I
believe, enable the river to be entered by boats
without any future difficulty. The material
for such a work being adjacent and easily
procurable.

5. I would therefore respectfully
recommend that Bimlipatam should
have its undoubted advantages placed
before the Government of India. A
railway would certainly do much for the
interior, but many years would elapse
before

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before the trade from its increase would
demand higher Harbour facilities than
Bimlipatan now affords. In point of fact,
all the ports on this Coast, including Madras,
will long remain ports of call, and facilities
for docking and repairing are not,
and will not be, required, except on
very rare occasions. The example of
Trincomallee, one of the finest harbours
in the world, being strictly a case in
point, no demands are ever made upon
its advantages.

I have the honor to be
Sir,
Your most Obedt Servt

W Langton
Master Attendant.
Administrative Dept.

MM

Colony 10/7

P. T. C. No. 4107
Munis (1881) DEPARTMENT.
(Act 5)

No. 1899 W PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 2nd Aug^r 1881.
Read the following:—

Transferred to
the Public Works
Department.

From: THE MASTER ATTENDANT,
ADMINISTRATIVE DEPARTMENT,
Madras.
To: THE CHIEF SECY. TO GOVERNMENT,
MARINE DEPARTMENT,
Fort Saint George.

No. 6118.

Dated 8th July 1881.
Received 10th July 1881.

CURRENT No. 409

Subject.

Reporting on the ports of
Vizagapatnam and Pimbi-
patam with reference to
letter from the Government
of India recorded in G.O.
No. 301 of 1st July 1881, re-
garding these ports.
Encl. in Receipt Regr.

Sent back to offy - 197-8
P.L. 14/4.

- (1) Letter from the Government of India, No. 178 B,
dated Simla 6th June 1881 -
recorded in G. O. 1603 of 15th June 1881.
- (2) Letter from the Master Attendant, Madras
No. 6118, dated 8th July 1881 for
forwarding
G. O. Revenue Department, 2nd April 1876,
No. 509 and G. O. Marine
Dept. No. 425 of 28th August 1880
(3) G. O. 13th February 1881, No. 149 and 150 B.
(4) G. O. 13th August 1880, No. 1939 B.
(5) From S. of S. No. 293 of 27th Dec. 80
(6) Do. " 5th of 7th Jan. 81

Ordered that the
Government of India
be addressed.

P.L. No. 1900 W of 2nd Aug^r 1881

2. Para 1 of the letter
from that Govt. of India
will be communicated
to the Chamber of Commerce
Cochin -

The Secy. to the Govt.
of India, P. W. D.

In reply to your

The Chairman Chamber
of Commerce Cochin

Letter No. 178 etc, of the
6th June 1881, inviting
the attention of this
Government to the
improvement of the
Vizagapatam Harbour
as a work of Imperial
interest and as likely
to become the terminus
of the proposed Rail-
way from the Central
Provinces and further
suggesting that Mr
Parker should be
called on to report
on the Harbour works
required with this
object, I am desired
to state that from the
information before

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this Government the
port of Binnelipatan
to the north of
Vizagapatam would
be preferable and
that Mr. Parker is
now in England
and therefore not
available for the
duty proposed.

2. Before a further
decision is arrived at
in the matter I am to
invite a perusal of
the papers ^{forwarded} herewith,
and especially of
No. 1939 & of 13th
August 1880 from
which it will be

observed that in the opinion of this Govt the attempt to form a large Harbour at Vizagapatam would only be an useless expenditure of public money.

3. I am to take this opportunity to press on the Government of India an early decision regarding the proposed line of Railway adverted to in G.O. No. 149 & 150 R of 15th February 1881, and to solicit the favor

Ref. 15,080-10-2-00
RTMEN
tials of
ender.
favor of an adequate staff of officers being appointed to frame a complete estimate for the through line from Bimlipatam via ~~Vizianagram~~ Vizianagram and Raigudalah to Raipur -

22/7/90

Desd with
G.O. No 149-50 R of
15-2-81. 1939W
f. 13-8-80 - Recd
G.O. No 509 of 20
April/75.

20-11-39 ✓
 10-2-92 ✓
 11-6-02 ✓
 7-7-26 ✓

Public Works 1938-1939

*Original
 B/ 80. 1899-1900 W-8 28-31.*

8/30/4. Cir 23/7-Red.

[Ref.]
 15,000-10-2-06.

DEPARTMENT

Paper taken out of the Records from the charge of the Referencer.

Press
 Miscellaneous No. *1200*, dated *2/8/81* 190
 Routine

Date taken out.	FOR WHAT PURPOSE.			Initials of clerk taking the paper or of attender.	Date returned.	Initials of attender.
	Department.	C. No.	Year.			
<i>7/7/86</i>	<i>Public Works</i>	<i>1200</i>	<i>86</i>	<i>B</i>	<i>9-9-08</i>	<i>B</i>

ENCLOSURE.

Telegram from Colonel THOMASON, R.E., Indore, to the Secretary to the Government of India, Public Works Department, Calcutta, dated 21st December 1880.

Cochin have no copy of report made to Sir Andrew Clarke. See his printed Minute, Indian Harbours, July 1879. Ask Commander Taylor for latest map embodying our joint survey work if port has not since been accurately surveyed according to my recommendation. Until such survey, the consideration of my alternative proposals for groynes or knapps system submerged breakwater was postponed. For plans of other ports apply Marine Survey or Executive Engineers concerned.

From Captain W. P. TOMKINS, R.E., Assistant Secretary to the Government of India, Public Works Department (Civil Works—Miscellaneous), to the Secretary to the Government of Madras, Public Works Department, dated Fort William, 7th January 1881, No. 5 M.

In continuation of this office No. 293 M., dated the 27th December 1880, and with reference to your letter, No. 2944 W., of the same date, I am directed to forward, for the information of the Madras Government, copy of a letter * and of its enclosure from Commander A. D. Taylor, Superintendent of Marine Surveys, affording all such information as are obtainable in regard to the harbour at Cochin.

Lithograph charts of the harbour also accompany.

ENCLOSURE.

From Commander A. DUNDAS TAYLOR, late I.N., Superintendent of Marine Surveys to the Government of India, to the Secretary to the Government of India, Public Works Department, dated Calcutta, 29th December 1880, No. 23.

In reply to your letter, No. 292 M., dated 27th December 1880, I have the honor to state that no copies of any reports by Colonel Thomason, R.E., have ever been forwarded to me. With regard to Cochin I beg to say that at the time of our visit to that port, I took angles to test the position of the buoys on the bar, and found that the bar had been thrown back considerably to the eastward (see Admiralty chart of Cochin herewith forwarded). I also took chain measurements from the south-west point of Vypeen, where a groyne had been constructed, along the sandy coast to the Cruz Milagre gap (see lithograph chart of the harbour also forwarded). From the Executive Engineer, Department of Public Works, at Cochin, I subsequently obtained a tracing of the town and the high water line of Vypeen island towards the gap, but I found that the bearing of that coast line differed so materially from my own observations that I could not apply it to the rectification of the chart. The original of the tracing above referred to must be in the possession of the Madras Government, or obtainable from Cochin.

It was my intention to have the port of Cochin re-examined last year, and a survey was sanctioned by the Government of India; but it was abandoned for the present in consequence of Mr. Chapman's death, and as we had no officers available to carry on the work, the department being so short-handed.

I beg to forward a copy of some remarks by myself on Cochin harbour submitted to the Government of India in June 1877.

Extract from remarks by Commander A. DUNDAS TAYLOR, Superintendent of Marine Surveys, on some ports of the Madras Presidency, after inspection in April and May 1877.

"Cochin was also visited by me on the 1st and 23rd May. Before my arrival Lieutenant Hammond, R.N., under my orders, had made an examination of the bar and inspected the dredge *Albuquerque* (his report has been already given to the Secretary to Government of Madras, in the Public Works Department). The merchants of Cochin are anxious that their river bar should be deepened by dredging, and the Government of Madras has obtained the *Albuquerque* for that purpose. But the difficulties are great and (I think) not generally understood. After examination of this port, just twenty years ago, I suggested that a steam rake might advantageously be used every fine season to scrape down (on the ebb tide) a narrow passage through the little ridge of sand which forms the bar, and has at low water a depth of 13 feet. The utmost I expected of such an operation was that a depth of 15 feet at low water might be gained and retained during four or five months through that narrow ridge, so that vessels with a draught of 15 feet might be towed across the bar. The vessel for this purpose was to be both steam tug and rake; and I merely suggested this in anticipation that English builders and engineers could carry out the idea if it met approval from the Government of Madras.

36. My impression is that few Engineers who study the facts as illustrated by the survey and soundings of the Cochin harbour can arrive at any other conclusion than that the groynes proposed for concentrating the scour at the present bar will merely have the effect of pushing the bar further out to sea. That some beneficial result would be secured for a few years can hardly be doubted, but that the bar would ultimately reform seems to be inevitable.

37. It may be contended that there is little sand in movement with the littoral currents, or that once a certain régime has been established no further advance of the shore line is likely to occur; but even were such the case, we cannot get rid of the silt brought down by the rivers in the monsoon, and which, spite of all our efforts must deposit itself the moment the velocity is diminished, and this too perfectly irrespective of the depth of water in which such check occurs.

38. The whole truth (at least in so far as concerns the streams of the Madras coast, which debouch into a well nigh tideless sea) is, I think, conveyed in the following quotation from paragraph 6 of the report of 13th March 1875, No. 1631, by Captain Taylor, to which I have before alluded:—

"All experience of Indian rivers shows them to be uncertain and unfit for nice harbour construction. Inland they are liable to come down in the rains or periodical storms with overwhelming force and laden with silt. They debouch on sands always in motion from surf periodical current or storms."

39. In fact, the mouths of our rivers are, as a rule, the very worst places at which to construct a harbour, and I think Madras may be congratulated that at least this difficulty has not had to be encountered.

ORDER THEREON, 13th August 1880, No. 1939 W.

THE Government are satisfied, on the joint opinion of the Master Attendant and Chief Engineer, that it will be impossible, with the expenditure of any reasonable sum of money, to create either an inner or outer harbour at Vizagapatam for the use of vessels of large draught; but, as there would appear to be some probability of means being found for improving the depth of water on the bar at the mouth of the river, in the interest of cargo boats and other vessels of light draught, the requisite investigations with this object will be continued by the Public Works Department.

(True Extract.)

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

Docket from the Government of India, Public Works Department (Civil Works—Miscellaneous), dated Fort William, 27th December 1880, No. 293 M.

Copy of the following forwarded to the Government of Madras, Public Works Department, for information, with reference to its telegram of the 18th instant.

(By Order.)

(Signed) W. P. TOMKINS, Captain, R.E.,
Asst. Secy. to the Govt. of India

From the Secretary to the Government of India, Public Works Department, to Commander A. DUNDAS TAYLOR, Superintendent of Marine Surveys, dated 27th December 1880, No. 292 M.

I am directed to forward a copy of the telegrams noted on the margin, and to

From Madras, dated 18th December 1880.
From Colonel Thomason, R.E., Indore, dated 21st December 1880.

request that the Madras Government may be furnished with copy of plans and of the report by Colonel Thomason, R.E., on the proposed harbour at Cochin.

Proceedings of the Madras Government, Public Works Department, dated 2nd August 1881, No. 1899 W.

Read again the following papers :—

Proceedings of the Madras Government, Public Works Department, dated 13th August 1880, No. 1939 W.

* * * * *

29. Mr. Robertson's remarks on the exceptional case of Cochin, however, call for notice, as, notwithstanding the widely different circumstances as compared with Vizagapatam, there is apparently a point advanced by him which would appear at first sight to have a bearing on the case.

30. The backwater at Cochin swells, he says, into a magnificent sheet of water, and "the value of this as a tidal reservoir to keep clear the entrance to Cochin harbour cannot be over-estimated;" adding, "it renders Cochin quite independent of flood waters for scouring purposes, and makes that port almost unique in that respect amongst Indian harbours."

31. In dealing with this case Mr. Robertson has the following remarks :—

"Whenever the stream leaves the *faucis terre* at Vypeen Point it is discharged on the shallow, exposed sea-coast, but is still able to keep up a considerable depth for some distance out, although the water has now begun to spread out sideways, and escape especially towards the north. Meanwhile the surf is always striving to restore the natural profile of conservancy of the shore. After the current has flowed out to sea for nearly a mile it is no longer able to resist and keep down the ever working and powerful efforts of the waves to reform the profile of the coast by continuing the beach line which has been broken through by the outgoing current. Were," he adds, and this is the point I wish to draw attention, "the current to be kept together in full strength till it got into such a depth of water that the action of the waves was not sufficiently powerful to stir up the bottom, there would be no decided bar. The same result would happen were the current to discharge under shelter from the waves, as for instance in a land-locked estuary. At Cochin the surf has sufficient power on the bottom in 15 or 16 feet of water to overcome the levelling efforts of the current as at present existing, and throw up a bar with only 11 feet of water upon it."

32. These remarks would, no doubt, at first sight, seem to invalidate in some measure the argument that a bar must form at Vizagapatam, where either, as now proposed, the groynes are carried out into 17 feet water as suggested by Colonel Chrystie, or breakwaters were found terminating in 30 feet water as in Colonel Thomason's scheme; but notwithstanding the exceptionally favorable circumstances of the Cochin harbour, I cannot but think that Mr. Robertson has here been somewhat inconsistent.

33. A glance at the survey of the coast line at Cochin shows outside the immediate opening of the harbour a bulging line of deposit on which the bar is ultimately formed, and which clearly indicates the line along which the forces of the opposing currents becoming neutralized, velocity ceases and the silt deposits itself, as he himself observes: "After the current has flowed out to sea from nearly a mile it is no longer able to resist and keep down the over-working and powerful efforts of the waves, &c."

34. And this, be it remembered, is quite irrespective and independent of the great depth of water to be found at the harbour mouth, varying, as shown in the survey, from 30 to 44 feet! and depths carried well out in the same line for 24 to 18 feet, and thence gradually diminishing till only 11 feet is met on the bar.

35. There cannot, of course, be any direct analogy between the cases of Cochin harbour and Vizagapatam, but even the apparent one which I have above pointed out as seeming to militate against the general principle I am contending for does not to my judgment exist, and I cannot but think that in even this exceptional case Mr. Robertson has failed to appreciate at their true value the forces in operation.