Department.	No.	Year.	the paper or of attender.		

3527

No. 1313 W of 5th May 83.

Communicated to Supdg Engineers for information

2. The Master attendant Madras will report whether the means at his disposal for maintaining a continuous record of the changes in depth of water at all ports is sufficient for future Engineering requirements

sd/ R. H. S.

To
Supdg Engrs.
Master attendant Madras.
Marine Department

S. W. D.

Govt. of {1883} Madras.

MARINE.

No. 1313 W. dt. 5-5-83
with
No. 6 E. 11/4/84

Issued

Read. *Encl.*

G.O., 17th April 1883, No. 196.

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APRIL.

Tour of Inspection.

Communicating to the Public Works Department report of the Master Attendant, Madras, on his recent tour in the Southern and Western Ports of this Presidency.

Letter order

Date taken out.	For what purpose.			Initials of clerk taking the paper or of attender.	Date returned	Initials of attender.
	Department.	C. No.	Year.			

GOVERNMENT OF MADRAS.

MARINE DEPARTMENT.

Read—the following paper :—

From J. H. TAYLOR, Esq., Lieutenant, R.N.R., Master Attendant, Madras, to the Chief Secretary to Government, dated Madras, 21st March 1883, No. 2687.

Administrative Department.

I have the honor to forward a report upon the recent tour I have made of the Southern and Western Ports of the Presidency, and, before entering into particulars, I would beg leave to introduce a few remarks of a general nature which are called for by the peculiar circumstances that present themselves on our Indian sea-board. In the first place, it is observed by every visitor to our ports, and His Excellency the Governor, on his extended tour, has had many opportunities of remarking, that at every one something is wanted by the European inhabitants, chiefly from their points of view, to give greatly-increased facilities to trade; and from those facilities it is inferred that greater prosperity will be given to the various districts. Under ordinary circumstances, such as obtain in Europe, America, Australia, and elsewhere, where regular tidal action and considerable rise and fall are found, or even in the Mediterranean, where no tide or other than partial currents are found, much might be, and is, done in the way of quays, harbours, piers, &c.; but unfortunately for India its coasts southward, where there is little or no tide, are acted upon by the semi-annual currents caused by the monsoons, and, sand being the principal element in the coast composition, it is constantly held in suspension in the surf-wave, which surf is also a peculiarity of Southern India, and it is readily deposited wherever an obstruction is formed or left as a bar at the mouths of all our rivers, where flood and ebb affect the conditions. The effect of this action, after several months and towards the ends of either monsoon current, is often to cause considerable and alarming alterations of the coast line and threaten property and, even in some cases, life. The approach of this evil is very insidious, because no daily low fall of tide reveals the movement in time for remedy, and the scale is often so gigantic that it is impossible to meet it by remedial agents. It is true that, as a rule, the next contrary monsoon restores, or nearly so, the *status quo*, but much temporary inconvenience is occasioned, and Government officials on whom responsibility rests are often charged with supineness and indifference to local interests, whereas no amount of care can anticipate the evil, nor any available amount of money suffice to destroy it. I will only mention here two recent examples out of the many with which the coast furnishes us. In July 1876 the existence of Calicut Pier, the new Custom-house, the coast north of the pier, and the Beach Road, south, was endangered; an unexpected erosion took place, the sea, after cutting into the north coast, attacked the buttress of the pier, destroyed it, eat into half the road, removed three bays of the pier and the revetment of the Beach Road and caused universal alarm. Such steps as were possible in the emergency were taken; temporary revetments of sand-bags were formed, piles and stones were collected, and, as soon as possible, two groynes were run out, one on each side of the pier, their ends resting well upon the road, and the result awaited anxiously. The pier road-way

was temporarily repaired. The next season brought about some reaction, the evil was not reproduced, and now the beach presents a much wider extent than formerly, extending 270 feet from the road, while the bays of the pier, which on its erection used to stand in the sea, now form portion of the beach and are filled up solidly. The short groynes could not have done this.

2. The other example is even more recent. On the occasion of His Excellency the Governor's visit to Cochin considerable erosion was going on from the light-house point towards the south, and some huts and trees were washed away. This formed a paragraph in the address to the Governor, and it was inferred in the address that some department was to blame; but now, only after six months' interval, I find the coast restored, there are 300 feet of sand between the coast boundary pillar and the sea line, while many huts and trees still remain where they never ought to have been placed, viz., between the pillar and the sea, showing that the injury never really reached the normal line. Although the injury and loss were so recent, the lesson is of so little use that new trees are here and there being planted, and new huts are preparing now. In the complaint referred to the inhabitants are treated of as ryots, but they are really fishermen, to whom the close proximity of the sea is a great object, and whose experience and tradition should be sufficient warning to them. The southern mouth of Cochin backwater is the only place where erosion is now visible, but that is very strongly revetted by the walls of the old fort.

3. The danger of interfering with nature on this coast with the idea of conferring temporary benefit to a few individuals may be inferred from a slight glance at its history within comparatively recent periods. To commence from the south, the enormous shoals between Points Pedro and Calimere were surveyed by a careful officer forty years ago. The observations now made in connection with the Pámban Canal reveal that, whether from the upheaving of the bottom or from sand-laden currents, great changes have taken place, and now a passage for large ships will have to be cut through the shoal before any practical use can be made of a canal. Then on the mainland of Tinnevelly, we learn from history, only three centuries old, that Tuticorin was the chief harbour in Southern India and frequented by all classes of ships; now it is silted up uniformly and no vessels of more than 6 to 8 feet draft can utilize it, while ships of larger draft are compelled to remain one mile outside Hare Island, where the light-house is built. Then proceeding southward, Kayal, now Káyalpatnam, was a large and noble city when Marco Polo wrote his history, and is mentioned in later authors up to the journal of Bartolomeo in 1780, when its traditions were still fresh. Its ruins are now to be found a-mile-and-a-half inland, and the remains of China pottery illustrate the truth of the description that such items formed a large portion of its trade. The Támbraparni river is accountable for this, but at present it does not commit any violent outbreak, but a large reef which, no doubt, formed the harbour of Kayal remains, and extends from Tiruchendúr to Tuticorin. Then Comorin was always quoted as a harbour, which it certainly is not now, and the term harbour is not merely used by old authors as a resort of trade, but a place where many vessels lie in safety during the south-west monsoon, which we have no reason to suppose was less violent then than now.

4. Passing westward we come to Colachel, which has now only a few rocks with a narrow passage between them and the shore. Now Colachel, Quilon, and Tuticorin are the three chief harbours mentioned over and over again in the histories of this region. No vessels could shelter at Colachel now, but at Enciam, a few miles off, a place never alluded to, a much larger natural breakwater exists. Colachel was well known to the Egyptians, Romans, Greeks, and Persians.

5. Quilon, or Collan as it was called, was in former times a port of the greatest importance, and there is reason to believe that an effort to restore some of its importance will soon be made by an artificial harbour, for which it presents great facilities. One significant proof of its greatness is conveyed in the fact that all over the kingdom of which it formed a centre dates were connected with the period of its building as in old Rome: thus 975 years U.C. correspond to 1789 old style of chronology, carrying its erection back to A.D. 814.

6. No other place of any importance appears until we reach Cochin, the history of which is very interesting and instructive. It was formerly a small place on the bank of a river and called Cocci, but in the year 1341 some extraordinary changes took place in the mighty backwater between the sea and the Western Ghâts, and whether from cyclone winds or earthquake, or other cause not now traceable, the pent waters effected a sudden and enormous outlet at Cocci, and formed the present river and the pot-hole, which is called the harbour. The Island of Vypeen was created at the same time. The tradition and history of Cochin show that violent and uncertain changes have always been experienced in this neighbourhood in exceptional south-west monsoons. At times the sand is driven out and the river cleansed, at others the sea and sand obtain a mastery, and a bad bar and danger and alteration to the coast line follow. All along this portion of the coast important changes are quoted. Islands and lakes have been formed; towns and harbours have risen and had their little day of prosperity, but have now so completely retired that, after the comparatively small interval of five centuries, their former sites and names are hardly recognizable.

7. Cochin itself was built in the tenth year after Vasco de Gama arrived at Calicut, and, its advantages being very apparent, the large colonies of White and Black Jews and other important portions of the community quitted Cranganore, which from time immemorial had been the headquarters of trade and the most convenient harbour north of Quilon. Cranganore soon encountered the same fate that has befallen Kayal, its river mouth filled up, and it is now some way inland.

8. Beypore is always alluded to in old records as a noble harbour, so much so that Haidar Alí and his son Típú selected it towards the close of the last century for the headquarters of their large coast trade, and it is probable that, in the absence of careful marine survey, something of its old importance weighed in the minds of those who selected it as the terminus of the Madras Railway.

9. Regarding Calicut it is written, and there seems to be no reasonable doubt, that it was once a harbour created and supported by the Coote reef, which extends southward and westward of the grain godowns and present light-house. Ships used to lay up here, and though all vessels trading on this coast were small in proportion to some of those now in use, yet the number of men they used to carry and the cargoes they disposed of prove that they were of considerable size. Now in the south-west monsoon all native craft leave the place. The present trade of Calicut is not to be compared with that enjoyed during its former period of commercial importance.

10. Quilandy, next in rotation, was a large flourishing port and town, of which many substantial buildings remain. It had also the advantage of a mud-bank resembling those at Alleppey and Narrakal. I have already in a former report drawn attention to the sudden destruction it met with towards the close of the last century, as described in a letter, still extant, written by Sir Ralph Abercrombie. One of the large East India Company's ships, *Morning Star*, had lain there during the south-west monsoon, as was a constant practice in those days, and she was waiting to embark some of the Company's chief officials to convey them to Calcutta. A cyclone in the Bay of Bengal, occurring at the October break of the monsoon passed across the Peninsula; its effects were felt severely at Quilandy, and during the confusion the mud-bank entirely broke up, the ship was driven ashore and lost, and the conditions of the river mouth so changed that the position of Quilandy as a port soon failed, and it has never recovered itself. Quilandy moreover enjoyed a large measure of protection from winds from North-west round to S.S.E. owing to the Cottar Reef and Promontory.

11. Cannanore and Tellicherry, being on rocky formations, seem to have undergone little change, but a large port of old, named Ballipatam, under the shelter of Mount Dilly, has vanished owing to the changes in the river mouth.

12. Finally, there remains Mangalore, and there can be, I think, little doubt (though I have not been able to verify the doubt historically) that in the period when it occupied a prominent position in the defended portion of the East India

Company's territories, it must have been on the sea-shore, as in the present situation of the old Fort and the Sultan Battery no artillery of that date could have reached ships in the present offing, nor could any reply from the ships have injured the inhabitants.

13. All the circumstances enumerated above show, I would respectfully submit to Government, overwhelming proof that it would be rash and impolitic to invest large amounts of public money in creating artificial harbours and projecting walls into a sea where their very presence would irritate the natural condition of things into adverse action that must, in all human probability, end in defeat and great pecuniary loss.

14. The first thing to be considered in designing a harbour is the marine survey aspect in which it is placed. Mr. Parkes makes a tardy admission of this fact after his remarks on harbours on our North-East Coast, but it should properly have preceded them. His Excellency the Governor has now visited many places where the advantages of harbours from the European inhabitants' point of view have been pressed upon his attention, and probably Cochin, with its large, though shallow, back-water and its deep pot-hole (for, though not a euphonious word, that is the only real description), has engaged His Excellency's serious consideration. Yet it is my duty to point out that a first-class or even a second-class harbour is impossible in that situation.

15. The approach to a harbour for large vessels from open ocean must have a sure and certain depth reliable at all seasons and weathers. The great ocean swells have an effect upon large vessels that renders it imperative that they be safely water-borne while subject to wave action. Vessels of 25 and even 26 feet draft pass through the Suez Canal, and our ironclads often when coaled up draw much more. Sir John Coode, in his reports upon Colombo Harbour, has insisted that a depth of 40 feet at the entrance is a necessity for a harbour for large vessels entering from the open ocean. It may be that in that he has somewhat exceeded the absolute necessity, but 10 feet is the least that a prudent Commander would care to have between his keel and the bottom of the sea in an ordinary ground swell, and this brings us to a required entrance of 34 to 36 feet. Now, if it could be conceded that all natural difficulties connected with sand and coast change were overcome and a basin dredged out in Cochin capable of holding, say, 20 vessels only in a strong tide way such as must always obtain there, and suppose the bar removed under cover of the walls of the harbour, estimated to cost for that purpose alone eighty lakhs, there still remains a-mile-and-a-half of shallow water outside, which no engineering effort or any amount of money could clear. For the first half mile beyond the bar (which is itself a mile from the river entrance) the depths lead to only 21 feet, and to secure 36 feet another mile has to be taken into account, ships of moderate draft of water being thus compelled to anchor two-and-a-half miles from the river entrance, where they may be seen now during the working season by any interested observer. During the foul weather season the mud-bank at Narrakal serves nearly all the purposes of a harbour and can be easily and safely approached, which could never be done in thick weather at the mouth of a narrow stone work.

16. Another large undertaking, which has acquired a firm hold upon public opinion from an engineering point of view, is a canal to afford direct passage between Ceylon and India. This project has been often discussed and often laid aside, but a private Company having now appeared on the scene with, we are told, a subscribed capital of one million, its agents have applied to the Ceylon and Madras Governments for assistance and concessions, and have seriously set to work to carry out the under-taking without having asked marine advice either as to the advisability or even possibility of its proving a success either practically or financially. Several schemes having the canal for their object have been before the Government of Madras, and one especially, which proposed to make a secure harbour for Southern India called Port Lorne, had much to recommend it, but, now that Colombo is adopted as the port-of-call and coaling station for steamers coming through the Suez Canal to Calcutta and Madras and returning homeward, a simple cut through Rámesvaram would confer no

substantial relief to the length of the voyage. Colombo Harbour is so near the southern side of the Island of Ceylon that it is easy to slip round Dondra Head by night or by day, and few Commanders, if they had the choice, would prefer delay, expense and risk of the canal and its many difficulties of nagivation. The present Pámban Pass provides for a large native trade, and a second-class canal would only ruin that without conferring any proportionate benefit to India.

17. But the difficulties from a nautical point are now to be considered, and they are of so formidable a description that I cannot persuade myself that any available sum of money can overcome them, even if the proposition, so often urged in these days, that modern engineering can perform any task be conceded.

18. In the first place, on approaching Rámesvaram from Colombo or Comorin, a shallow bank of sand and coral, having an average depth of 21 feet and a mile to perhaps a-mile-and-a-half of width, extends from Shingle Islet to the mainland, and has six dangerous shoal patches on its outer edge at almost uniform distances of about one mile. This is entirely outside the contemplated breakwaters, which have for their object the protection of the mouth of the canal. A misleading depth of 30 feet is found a few hundred yards from the Rámesvaram beach, and has apparently been considered by the Engineers who have investigated the canal project as a security of a fairly deep waterway out to sea—a dangerous fallacy which has tinted all the reports of Engineers employed by the Government of India. This bank must be dealt with, and a depth of, say, 35 feet secured, and the dangers lighted and buoyed before the canal can be negotiated, and this alone will prove a most expensive and perpetually-recurring nuisance. In the north side the canal, after perforating the Island of Rámesvaram, will require to be extended half a mile into the sea before it reaches 35 feet depth of water, and that end must also be protected by a breakwater and also lighted.

19. Pámban lies midway between the mountains of Ceylon and the Western Ghâts of India, and the alternate monsoon winds of north-east and south-west pour through the pass with a violence rarely encountered elsewhere for such continuous periods. A tumultuous sea is occasioned in the Gulf of Manaar and Palk's Bay and Straits, and thick weather and consequent difficult navigation is the rule for eight months out of the year.

20. Thus far the prospect of a successful navigation through the Straits does not appear favorable, but still greater difficulties arise when we leave Rámesvaram behind and approach the great shoals that extend from Point Calimere on the Indian side to Point Pedro on the Ceylon or rather Jaffna Promontory. These shoals were surveyed forty years ago by Mr. J. J. Franklin, a very careful officer, who became afterwards Superintendent of Marine at Madras. The means of carrying on marine surveys in those days were not so satisfactory as at present, and Mr. Franklin, except in one direct line between Calimere and the west end of the Jaffna Island, does not seem to have gone out of sight of land, and for more than twelve miles off the Jaffna shore a depth of six and seven fathoms is found until the east side of Point Pedro is gained, when a long shoal of about forty miles stretches to the southward and eastward along the line of coast called Point Pedro Shoal. It was too hastily assumed that this was a distinct bank, and that the depth of six and seven fathoms off Tondimanaar was continued to the northward. But the recent survey carried out by me in the Steamer *Madras* under orders of Government distinctly shows that the shallow water obtains in one unbroken line from one bank to the other, and that no greater depth of passage offers anywhere of more than $28\frac{1}{2}$ feet, and this out of sight of land. This misfortune is the gravest therefore that threatens the prosperity of the contemplated canal. A cutting of about three miles in length will be required here, and though I am assured by the Colombo Agents of the Company that the best dredging opinions have been obtained, and the difficulty is lightly considered by the holders of those opinions, all my own experience forbids my endorsing their views. I know of no situation where dredging in a heavy sea has yet been attempted, and I feel persuaded that, even if a mere cutting was achieved through the sand bank, the semi-annual currents, which must cross it at right angles, would soon relevel the bottom, and

constant upkeep would be demanded. The fact of the existence of deep pot-holes at the mouth of Indian rivers and the injury lately done to the foundations of the Madras Harbour prove that current action is carried on at a much greater depth than theory prescribes. While, therefore, I am not perhaps justified in saying the canal cannot be completed, I have a reasonable doubt whether the expenditure can be brought within such an amount as will leave a margin for dividend. As to the distance proposed to be saved by the Canal, it has been over-stated. The only ports to which any advantage in mileage would accrue are Calcutta and Madras. All ports on the east side like Rangoon, Moulmein, and the Straits and China would lose, and in the case of a ship passing the meridian of Cape Comorin bound to Calcutta, if she touched at Colombo the gain would only be 94 miles, while if she did not touch it at Colombo it would be 190 miles, or 9 and 19 hours' steaming espectively, against which has to be set the delay, risk and expense of the Canal.

21. Madras, of course, from its position, would be placed nearer the meridian of Comorin, but the saving to ships calling at Colombo would be only 167 miles, or 17 hours' steam, and the greatest possible saving to vessels coming direct, which is very rarely done, would be 264 miles, or 26 hours' steam, against the disadvantages enumerated above.

The statement that has found expression in the newspaper descriptions to the effect that three days' saving will be effected is therefore exceedingly incorrect. It would have been a source of the greatest satisfaction to me to have seen my way to recommending any important works of port improvement to the notice of Government, and the present able officer at the head of the Public Works Department would have gladly given me his advice and assistance; but natural difficulties seem to me to prevail over all local requirements, and the magnitude that marine works always assume compels the greatest prudence and proof of necessity before they are adopted. As to the advantages to trade secured by railroad and harbours united, they generally force themselves upon public attention, and though, in the case of the Madras Presidency, railroads are wanted to develop the wealth and resources of the country, yet the ports are at present more than equal to carrying off all import and export produce. We have now in the south Madras, Cuddalore, Negapatam, Tuticorin, and Beypore with direct railway communications, and yet it cannot with truth be said that as ports they have as yet benefited by it. Some suggestions, which I hope may benefit some of the ports visited lately, will form the subject of another letter.

ORDER—dated 17th April 1883, No. 196, Marine.

This interesting paper will be communicated to the Public Works Department.

(True Extract.)

C. G. MASTER,
Chief Secretary.

To the Public Works Department.
„ Master Attendant, Madras.

Exd. J. W. Fischer.

No. 1313 W dy 5th May/83.

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Govt. of {1883} Madras.

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Ltr. No. 1313 W. dt. 5-5-83
with
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20. Thus far the prospect of a successful navigation through the Straits does not appear favorable, but still greater difficulties arise when we leave Rámesvaram behind and approach the great shoals that extend from Point Calimere on the Indian side to Point Pedro on the Ceylon or rather Jaffna Promontory. These shoals were surveyed forty years ago by Mr. J. J. Franklin, a very careful officer, who became afterwards Superintendent of Marine at Madras. The means of carrying on marine surveys in those days were not so satisfactory as at present, and Mr. Franklin, except in one direct line between Calimere and the west end of the Jaffna Island, does not seem to have gone out of sight of land, and for more than twelve miles off the Jaffna shore a depth of six and seven fathoms is found until the east side of Point Pedro is gained, when a long shoal of about forty miles stretches to the southward and eastward along the line of coast called Point Pedro Shoal. It was too hastily assumed that this was a distinct bank, and that the depth of six and seven fathoms off Tondimanaar was continued to the northward. But the recent survey carried out by me in the Steamer *Madras* under orders of Government distinctly shows that the shallow water obtains in one unbroken line from one bank to the other, and that no greater depth of passage offers anywhere of more than $28\frac{1}{2}$ feet, and this out of sight of land. This misfortune is the gravest therefore that threatens the prosperity of the contemplated canal. A cutting of about three miles in length will be required here, and though I am assured by the Colombo Agents of the Company that the best dredging opinions have been obtained, and the difficulty is lightly considered by the holders of those opinions, all my own experience forbids my endorsing their views. I know of no situation where dredging in a heavy sea has yet been attempted, and I feel persuaded that, even if a mere cutting was achieved through the sand bank, the semi-annual currents, which must cross it at right angles, would soon relevel the bottom, and

constant upkeep would be demanded. The fact of the existence of deep pot-holes at the mouth of Indian rivers and the injury lately done to the foundations of the Madras Harbour prove that current action is carried on at a much greater depth than theory prescribes. While, therefore, I am not perhaps justified in saying the canal cannot be completed, I have a reasonable doubt whether the expenditure can be brought within such an amount as will leave a margin for dividend. As to the distance proposed to be saved by the Canal, it has been over-stated. The only ports to which any advantage in mileage would accrue are Calcutta and Madras. All ports on the east side like Rangoon, Moulmein, and the Straits and China would lose, and in the case of a ship passing the meridian of Cape Comorin bound to Calcutta, if she touched at Colombo the gain would only be 94 miles, while if she did not touch it at Colombo it would be 190 miles, or 9 and 19 hours' steaming espectively, against which has to be set the delay, risk and expense of the Canal.

21. Madras, of course, from its position, would be placed nearer the meridian of Comorin, but the saving to ships calling at Colombo would be only 167 miles, or 17 hours' steam, and the greatest possible saving to vessels coming direct, which is very rarely done, would be 264 miles, or 26 hours' steam, against the disadvantages enumerated above.

The statement that has found expression in the newspaper descriptions to the effect that three days' saving will be effected is therefore exceedingly incorrect. It would have been a source of the greatest satisfaction to me to have seen my way to recommending any important works of port improvement to the notice of Government, and the present able officer at the head of the Public Works Department would have gladly given me his advice and assistance; but natural difficulties seem to me to prevail over all local requirements, and the magnitude that marine works always assume compels the greatest prudence and proof of necessity before they are adopted. As to the advantages to trade secured by railroad and harbours united, they generally force themselves upon public attention, and though, in the case of the Madras Presidency, railroads are wanted to develop the wealth and resources of the country, yet the ports are at present more than equal to carrying off all import and export produce. We have now in the south Madras, Cuddalore, Negapatam, Tuticorin, and Beypore with direct railway communications, and yet it cannot with truth be said that as ports they have as yet benefited by it. Some suggestions, which I hope may benefit some of the ports visited lately, will form the subject of another letter.

ORDER—dated 17th April 1883, No. 196, Marine.

This interesting paper will be communicated to the Public Works Department.

(True Extract.)

C. G. MASTER,
Chief Secretary.

To the Public Works Department.
" Master Attendant, Madras.

Exd. J. W. Fischer.

Order No. 1313 W d/
5th May 1884

Comd to Supt Engr
for information.

2. The Master Attendant
Madras will report
whether the means at his
disposal for maintaining
a continuous record of
the changes in depth of
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S/ R H S

30/4

To Engrs
Master Attendant
Madras
Marine Dept

Govt. of {1883} Madras.

MARINE.

B No. 1313 W. 5-5-83
Sett 6 E 11/6/84

Issued

Recd. Encl.

G.O., 17th April 1883, No. 196.

No. 1313 W d/5 May/83

APRIL.

Tour of Inspection.

Communicating to the Public Works Department report of the Master Attendant, Madras, on his recent tour in the Southern and Western Ports of this Presidency.

With Order

B/

No. 1313 W Public Works Department.

PROCEEDINGS OF THE MADRAS GOVERNMENT

Under date the 5th May 1883.

Read the following

Pros: of the Marine Department. No. No. 196 d/ 17 April 1883

Communicated to Supty: Engineers for information.

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Cds 4/5

30/4

Dgw 5/5

To.
Supty: Engrs.
Master. Attendant. Madras.
Marine Dept

RS

Encls

25-2-83

No 1313 Wdy 5-5-83

14/4/83

Jones

GOVERNMENT OF MADRAS.

MARINE DEPARTMENT.

READ—the following paper :—

From J. H. TAYLOR, Esq., Lieutenant, R.N.R., Master Attendant, Madras, to the Chief Secretary to Government, dated Madras, 21st March 1883, No. 2687.

Administrative Department.

I have the honor to forward a report upon the recent tour I have made of the Southern and Western Ports of the Presidency, and before entering into particulars, I would beg leave to introduce a few remarks of a general nature which are called for by the peculiar circumstances that present themselves on our Indian sea-board. In the first place, it is observed by every visitor to our Ports, and His Excellency the Governor, on his extended tour, has had many opportunities of remarking that, at every one, something is wanted by the European inhabitants, chiefly from their points of view, to give greatly increased facilities to trade; and from those facilities it is inferred that greater prosperity will be given to the various districts. Under ordinary circumstances, such as obtain in Europe, America, Australia, and elsewhere, where regular tidal action and considerable rise and fall are found, or even in the Mediterranean where no tide or other than partial currents are found, much might be, and is, done in the way of Quays, Harbours, Piers, &c.; but unfortunately for India, its coasts southward, where there is little or no tide, are acted upon by the semi-annual currents caused by the monsoons, and sand being the principal element in the coast composition, it is constantly held in suspension in the surf-wave, which surf is also a peculiarity of Southern India, and it is readily deposited wherever an obstruction is formed or left as a bar at the mouths of all our rivers, where flood and ebb affect the conditions. The effect of this action, after several months, and towards the ends of either monsoon current, is often to cause considerable and alarming alterations of the coast line, and threaten property and, even in some cases, life. The approach of this evil is very insidious, because no daily low fall of tide reveals the movement in time for remedy, and the scale is often so gigantic that it is impossible to meet it by remedial agents. It is true that, as a rule, the next contrary monsoon restores or nearly so the *status quo*, but much temporary inconvenience is occasioned, and Government officials on whom responsibility rests are often charged with supineness and indifference to local interests, whereas no amount of care can anticipate the evil, nor any available amount of money suffice to destroy it. I will only mention here two recent examples out of the many with which the coast furnishes us. In July 1876 the existence of Calicut Pier, the new Custom House, the coast north of the Pier, and the Beach Road, south, was endangered; an unexpected erosion took place, the sea, after cutting into the north coast, attacked the buttress of the Pier, destroyed it, eat into half the Road, removed three bays of the Pier and the revetment of the Beach Road, and caused universal alarm. Such steps as were possible in the emergency were taken; temporary revetments of sand bags were formed, piles and stones were collected, and, as soon as possible, two groynes were run out, one on each side of the Pier, their ends resting well upon the road, and the result awaited anxiously. The Pier road-way

was temporarily repaired. The next season brought about some reaction, the evil was not reproduced, and now the beach presents a much wider extent than formerly, extending 270 feet from the road, while the bays of the Pier, which on its erection used to stand in the sea, now form portion of the beach and are filled up solidly. The short groynes could not have done this.

2. The other example is even more recent. On the occasion of His Excellency the Governor's visit to Cochin considerable erosion was going on from the Light-house point towards the south, and some huts and trees were washed away. This formed a paragraph in the address to the Governor, and it was inferred in the address that some department was to blame; but now, only after six months' interval, I find the coast restored, there are 300 feet of sand between the coast boundary pillar and the sea line, while many huts and trees still remain where they never ought to have been placed, viz., between the pillar and the sea, showing that the injury never really reached the normal line. Although the injury and loss were so recent, the lesson is of so little use that new trees are here and there being planted, and new huts are preparing now. In the complaint referred to, the inhabitants are treated of as ryots, but they are really fishermen, to whom the close proximity of the sea is a great object, and whose experience and tradition should be sufficient warning to them. The southern mouth of Cochin backwater is the only place where erosion is now visible, but that is very strongly revetted by the walls of the old Fort.

3. The danger of interfering with nature on this coast with the idea of conferring temporary benefit to a few individuals may be inferred from a slight glance at its history within comparatively recent periods. To commence from the south, the enormous shoals between Points Pedro and Calimere were surveyed by a careful officer (40) forty years ago. The observations now made in connection with the Pámban Canal reveal that, whether from the upheaving of the bottom or from sand-laden currents, great changes have taken place, and now a passage for large ships will have to be cut through the shoal before any practical use can be made of a canal. Then on the mainland of Tinnevelly, we learn from history, only three centuries old, that Tuticorin was the chief harbour in Southern India and frequented by all classes of ships; now it is silted up uniformly and no vessels of more than 6 to 8 feet draft can utilize it, while ships of larger draft are compelled to remain one mile outside Hare Island, where the Light-house is built. Then proceeding southward, Kayal, now Káyalpatnam, was a large and noble city when Marco Polo wrote his history, and is mentioned in later authors up to the journal of Bartolomeo in 1780, when its traditions were still fresh. Its ruins are now to be found a-mile-and-a-half inland, and the remains of China pottery illustrate the truth of the description that such items formed a large portion of its trade. The Támbraparni river is accountable for this, but at present it does not commit any violent outbreak, but a large reef which, no doubt, formed the harbour of Kayal remains, and extends from Tiruchendúr to Tuticorin. Then Comorin was always quoted as a harbour, which it certainly is not now, and the term harbour is not merely used by old authors as a resort of trade, but a place where many vessels lie in safety during the south-west monsoon, which we have no reason to suppose was less violent then than now.

4. Passing westward we come to Colachel, which has now only a few rocks with a narrow passage between them and the shore. Now Colachel, Quilon, and Tuticorin are the three chief harbours mentioned over and over again in the histories of this region. No vessels could shelter at Colachel now, but at Enciam, a few miles off, a place never alluded to, a much larger natural breakwater exists. Colachel was well known to the Egyptians, Romans, Greeks, and Persians.

5. Quilon, or Collan as it was called, was in former times a port of the greatest importance, and there is reason to believe that an effort to restore some of its importance will soon be made by an artificial harbour, for which it presents great facilities. One significant proof of its greatness is conveyed in the fact that, all over the kingdom of which it formed a centre, dates were connected with the period of its building as in old Rome: thus 975 years U. C. correspond to 1789 old style of chronology carrying its erection back to A. D. 814.

6. No other place of any importance appears until we reach Cochin, the history of which is very interesting and instructive. It was formerly a small place on the bank of a river and called Cocci, but in the year 1341 some extraordinary changes took place in the mighty backwater between the sea and the Western Ghâts, and whether from Cyclone winds or Earthquake, or other cause, not now traceable, the pent waters effected a sudden and enormous outlet at Cocci, and formed the present river and the pot hole, which is called the harbour. The Island of Vypeen was created at the same time. The tradition and history of Cochin show that violent and uncertain changes have always been experienced in this neighbourhood in exceptional south-west monsoons. At times the sand is driven out and the river cleansed, at others the sea and sand obtain a mastery, and a bad bar and danger and alteration to the coast line follow. All along this portion of the coast important changes are quoted. Islands and lakes have been formed; towns and harbours have risen and had their little day of prosperity, but have now so completely retired that, after the comparatively small interval of five centuries, their former sites and names are hardly recognizable.

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20. Thus far the prospect of a successful navigation through the Straits does not appear favorable, but still greater difficulties arise when we leave Rámesvaram behind and approach the great shoals that extend from Point Calimere on the Indian side to Point Pedro on the Ceylon or rather Jaffna Promontory. These shoals were surveyed forty years ago by Mr. J. J. Franklin, a very careful officer, who became afterwards Superintendent of Marine at Madras. The means of carrying on marine surveys in those days were not so satisfactory as at present, and Mr. Franklin, except in one direct line between Calimere and the west end of the Jaffna Island, does not seem to have gone out of sight of land, and for more than twelve miles off the Jaffna shore a depth of six and seven fathoms is found until the east side of Point Pedro is gained, when a long shoal of about forty miles stretches to the southward and eastward along the line of coast called Point Pedro Shoal. It was too hastily assumed that this was a distinct bank, and that the depth of six and seven fathoms off Tondimanaar was continued to the northward. But the recent survey carried out by me in the Steamer *Madras* under orders of Government distinctly shows that the shallow water obtains in one unbroken line from one bank to the other, and that no greater depth of passage offers anywhere of more than 28½ feet, and this out of sight of land. This misfortune is the gravest therefore that threatens the prosperity of the contemplated canal. A cutting of about three miles in length will be required here, and though I am assured by the Colombo Agents of the Company that the best dredging opinions have been obtained, and the difficulty is lightly considered by the holders of those opinions, all my own experience forbids my endorsing their views. I know of no situation where dredging in a heavy sea has yet been attempted, and I feel persuaded that, even if a mere cutting was achieved through the sand bank, the semi-annual currents, which must cross it at right angles, would

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21. Madras of course from its position would be placed nearer the meridian of Comorin, but the saving to ships calling at Colombo would be only 167 miles or 17 hours' steam, and the greatest possible saving to vessels coming direct, which is very rarely done, would be 264 miles or 26 hours' steam against the disadvantages enumerated above.

The statement that has found expression in the Newspaper descriptions to the effect that three days' saving will be effected is, therefore, exceedingly incorrect. It would have been a source of the greatest satisfaction to me to have seen my way to recommending any important works of Port improvement to the notice of Government, and the present able officer at the head of the Public Works Department would have gladly given me his advice and assistance; but natural difficulties seem to me to prevail over all local requirements, and the magnitude that marine works always assume compels the greatest prudence and proof of necessity before they are adopted. As to the advantages to trade secured by railroad and harbours united they generally force themselves upon public attention, and though, in the case of the Madras Presidency, railroads are wanted to develop the wealth and resources of the country, yet the Ports are at present more than equal to carrying off all import and export produce. We have now in the south, Madras, Cuddalore, Negapatam, Tuticorin and Beypore with direct railway communications, and yet it cannot with truth be said that as Ports they have as yet benefited by it. Some suggestions, which I hope may benefit some of the Ports visited lately, will form subject of another letter.

ORDER—dated 17th April 1883, No. 196, Marine.

This interesting paper will be communicated to the Public Works Department.

(True Extract.)

for Chief Secretary.

To the Public Works Department.
„ Master Attendant, Madras.

Exd. A. F. Aaron.

No 732 W of 7. 3. 83
" 229 C of 20. 1. 83
A No. 742 W of 7. 3. 83
" 441 W of 9. 2. 83
" 440 W of 9. 2. 83
" 439 W of 9. 2. 83
" 4 W of 5. 1. 83
" 5 W of 5. 1. 83
" 3430 W of 26. 12. 82
" 3429 W of 26. 12. 82
" 3210 W of 6. 12. 82
" 2983 W of 13. 11. 82
" 2982 W of 13. 11. 82
" 2884 W of 4. 11. 82
" 2883 W of 4. 11. 82
" 2726 W of 19. 10. 82
" 2454 W of 6. 10. 82

P. W. C. No. 3526

Govt. of {1883} Madras.

MARINE.

8 L.C.

Issued

Recd. 26/4/83 *Encl.*

G.O., 17th April 1883, No. 196.

6. 8 L.C.

APRIL.

Tour of Inspection.

Communicating to the Public Works Department report of the Master Attendant, Madras, on his recent tour in the Southern and Western Ports of this Presidency.

R/43.4
Oct 27/4 Rect 2/5

GOVERNMENT OF MADRAS.

MARINE DEPARTMENT.

READ—the following paper :—

From J. H. TAYLOR, Esq., Lieutenant, R.N.R., Master Attendant, Madras, to the Chief Secretary to Government, dated Madras, 21st March 1883, No. 2687.

Administrative Department.

I have the honor to forward a report upon the recent tour I have made of the Southern and Western Ports of the Presidency, and, before entering into particulars, I would beg leave to introduce a few remarks of a general nature which are called for by the peculiar circumstances that present themselves on our Indian sea-board. In the first place, it is observed by every visitor to our ports, and His Excellency the Governor, on his extended tour, has had many opportunities of remarking, that at every one something is wanted by the European inhabitants, chiefly from their points of view, to give greatly-increased facilities to trade; and from those facilities it is inferred that greater prosperity will be given to the various districts. Under ordinary circumstances, such as obtain in Europe, America, Australia, and elsewhere, where regular tidal action and considerable rise and fall are found, or even in the Mediterranean, where no tide or other than partial currents are found, much might be, and is, done in the way of quays, harbours, piers, &c.; but unfortunately for India its coasts southward, where there is little or no tide, are acted upon by the semi-annual currents caused by the monsoons, and, sand being the principal element in the coast composition, it is constantly held in suspension in the surf-wave, which surf is also a peculiarity of Southern India, and it is readily deposited wherever an obstruction is formed or left as a bar at the mouths of all our rivers, where flood and ebb affect the conditions. The effect of this action, after several months and towards the ends of either monsoon current, is often to cause considerable and alarming alterations of the coast line and threaten property and, even in some cases, life. The approach of this evil is very insidious, because no daily low fall of tide reveals the movement in time for remedy, and the scale is often so gigantic that it is impossible to meet it by remedial agents. It is true that, as a rule, the next contrary monsoon restores, or nearly so, the *status quo*, but much temporary inconvenience is occasioned, and Government officials on whom responsibility rests are often charged with supineness and indifference to local interests, whereas no amount of care can anticipate the evil, nor any available amount of money suffice to destroy it. I will only mention here two recent examples out of the many with which the coast furnishes us. In July 1876 the existence of Calicut Pier, the new Custom-house, the coast north of the pier, and the Beach Road, south, was endangered; an unexpected erosion took place, the sea, after cutting into the north coast, attacked the buttress of the pier, destroyed it, eat into half the road, removed three bays of the pier and the revetment of the Beach Road and caused universal alarm. Such steps as were possible in the emergency were taken; temporary revetments of sand-bags were formed, piles and stones were collected, and, as soon as possible, two groynes were run out, one on each side of the pier, their ends resting well upon the road, and the result awaited anxiously. The pier road-way

was temporarily repaired. The next season brought about some reaction, the evil was not reproduced, and now the beach presents a much wider extent than formerly, extending 270 feet from the road, while the bays of the pier, which on its erection used to stand in the sea, now form portion of the beach and are filled up solidly. The short groynes could not have done this.

2. The other example is even more recent. On the occasion of His Excellency the Governor's visit to Cochin considerable erosion was going on from the light-house point towards the south, and some huts and trees were washed away. This formed a paragraph in the address to the Governor, and it was inferred in the address that some department was to blame; but now, only after six months' interval, I find the coast restored, there are 300 feet of sand between the coast boundary pillar and the sea line, while many huts and trees still remain where they never ought to have been placed, viz., between the pillar and the sea, showing that the injury never really reached the normal line. Although the injury and loss were so recent, the lesson is of so little use that new trees are here and there being planted, and new huts are preparing now. In the complaint referred to the inhabitants are treated of as ryots, but they are really fishermen, to whom the close proximity of the sea is a great object, and whose experience and tradition should be sufficient warning to them. The southern mouth of Cochin backwater is the only place where erosion is now visible, but that is very strongly revetted by the walls of the old fort.

3. The danger of interfering with nature on this coast with the idea of conferring temporary benefit to a few individuals may be inferred from a slight glance at its history within comparatively recent periods. To commence from the south, the enormous shoals between Points Pedro and Calimere were surveyed by a careful officer forty years ago. The observations now made in connection with the Pámban Canal reveal that, whether from the upheaving of the bottom or from sand-laden currents, great changes have taken place, and now a passage for large ships will have to be cut through the shoal before any practical use can be made of a canal. Then on the mainland of Tinnevelly, we learn from history, only three centuries old, that Tuticorin was the chief harbour in Southern India and frequented by all classes of ships; now it is silted up uniformly and no vessels of more than 6 to 8 feet draft can utilize it, while ships of larger draft are compelled to remain one mile outside Hare Island, where the light-house is built. Then proceeding southward, Kayal, now Káyalpatnam, was a large and noble city when Marco Polo wrote his history, and is mentioned in later authors up to the journal of Bartolomeo in 1780, when its traditions were still fresh. Its ruins are now to be found a-mile-and-a-half inland, and the remains of China pottery illustrate the truth of the description that such items formed a large portion of its trade. The Támbraparni river is accountable for this, but at present it does not commit any violent outbreak, but a large reef which, no doubt, formed the harbour of Kayal remains, and extends from Tiruchendúr to Tuticorin. Then Comorin was always quoted as a harbour, which it certainly is not now, and the term harbour is not merely used by old authors as a resort of trade, but a place where many vessels lie in safety during the south-west monsoon, which we have no reason to suppose was less violent then than now.

4. Passing westward we come to Colachel, which has now only a few rocks with a narrow passage between them and the shore. Now Colachel, Quilon, and Tuticorin are the three chief harbours mentioned over and over again in the histories of this region. No vessels could shelter at Colachel now, but at Enciam, a few miles off, a place never alluded to, a much larger natural breakwater exists. Colachel was well known to the Egyptians, Romans, Greeks, and Persians.

5. Quilon, or Collan as it was called, was in former times a port of the greatest importance, and there is reason to believe that an effort to restore some of its importance will soon be made by an artificial harbour, for which it presents great facilities. One significant proof of its greatness is conveyed in the fact that all over the kingdom of which it formed a centre dates were connected with the period of its building as in old Rome: thus 975 years U.C. correspond to 1789 old style of chronology, carrying its erection back to A.D. 814.

6. No other place of any importance appears until we reach Cochin, the history of which is very interesting and instructive. It was formerly a small place on the bank of a river and called Cocci, but in the year 1341 some extraordinary changes took place in the mighty backwater between the sea and the Western Ghâts, and whether from cyclone winds or earthquake, or other cause not now traceable, the pent waters effected a sudden and enormous outlet at Cocci, and formed the present river and the pot-hole, which is called the harbour. The Island of Vypeen was created at the same time. The tradition and history of Cochin show that violent and uncertain changes have always been experienced in this neighbourhood in exceptional south-west monsoons. At times the sand is driven out and the river cleansed, at others the sea and sand obtain a mastery, and a bad bar and danger and alteration to the coast line follow. All along this portion of the coast important changes are quoted. Islands and lakes have been formed; towns and harbours have risen and had their little day of prosperity, but have now so completely retired that, after the comparatively small interval of five centuries, their former sites and names are hardly recognizable.

7. Cochin itself was built in the tenth year after Vasco de Gama arrived at Calicut, and, its advantages being very apparent, the large colonies of White and Black Jews and other important portions of the community quitted Cranganore, which from time immemorial had been the headquarters of trade and the most convenient harbour north of Quilon. Cranganore soon encountered the same fate that has befallen Kayal, its river mouth filled up, and it is now some way inland.

8. Beypore is always alluded to in old records as a noble harbour, so much so that Haidar Alí and his son Típú selected it towards the close of the last century for the headquarters of their large coast trade, and it is probable that, in the absence of careful marine survey, something of its old importance weighed in the minds of those who selected it as the terminus of the Madras Railway.

9. Regarding Calicut it is written, and there seems to be no reasonable doubt, that it was once a harbour created and supported by the Coote reef, which extends southward and westward of the grain godowns and present light-house. Ships used to lay up here, and though all vessels trading on this coast were small in proportion to some of those now in use, yet the number of men they used to carry and the cargoes they disposed of prove that they were of considerable size. Now in the south-west monsoon all native craft leave the place. The present trade of Calicut is not to be compared with that enjoyed during its former period of commercial importance.

10. Quilandy, next in rotation, was a large flourishing port and town, of which many substantial buildings remain. It had also the advantage of a mud-bank resembling those at Alleppey and Narrakal. I have already in a former report drawn attention to the sudden destruction it met with towards the close of the last century, as described in a letter, still extant, written by Sir Ralph Abercrombie. One of the large East India Company's ships, *Morning Star*, had lain there during the south-west monsoon, as was a constant practice in those days, and she was waiting to embark some of the Company's chief officials to convey them to Calcutta. A cyclone in the Bay of Bengal, occurring at the October break of the monsoon passed across the Peninsula; its effects were felt severely at Quilandy, and during the confusion the mud-bank entirely broke up, the ship was driven ashore and lost, and the conditions of the river mouth so changed that the position of Quilandy as a port soon failed, and it has never recovered itself. Quilandy moreover enjoyed a large measure of protection from winds from North-west round to S.S.E. owing to the Cottar Reef and Promontory.

11. Cannanore and Tellicherry, being on rocky formations, seem to have undergone little change, but a large port of old, named Ballipatam, under the shelter of Mount Dilly, has vanished owing to the changes in the river mouth.

12. Finally, there remains Mangalore, and there can be, I think, little doubt (though I have not been able to verify the doubt historically) that in the period when it occupied a prominent position in the defended portion of the East India

Company's territories, it must have been on the sea-shore, as in the present situation of the old Fort and the Sultan Battery no artillery of that date could have reached ships in the present offing, nor could any reply from the ships have injured the inhabitants.

13. All the circumstances enumerated above show, I would respectfully submit to Government, overwhelming proof that it would be rash and impolitic to invest large amounts of public money in creating artificial harbours and projecting walls into a sea where their very presence would irritate the natural condition of things into adverse action that must, in all human probability, end in defeat and great pecuniary loss.

14. The first thing to be considered in designing a harbour is the marine survey aspect in which it is placed. Mr. Parkes makes a tardy admission of this fact after his remarks on harbours on our North-East Coast, but it should properly have preceded them. His Excellency the Governor has now visited many places where the advantages of harbours from the European inhabitants' point of view have been pressed upon his attention, and probably Cochin, with its large, though shallow, back-water and its deep pot-hole (for, though not a euphonious word, that is the only real description), has engaged His Excellency's serious consideration. Yet it is my duty to point out that a first-class or even a second-class harbour is impossible in that situation.

15. The approach to a harbour for large vessels from open ocean must have a sure and certain depth reliable at all seasons and weathers. The great ocean swells have an effect upon large vessels that renders it imperative that they be safely water-borne while subject to wave action. Vessels of 25 and even 26 feet draft pass through the Suez Canal, and our ironclads often when coaled up draw much more. Sir John Coode, in his reports upon Colombo Harbour, has insisted that a depth of 40 feet at the entrance is a necessity for a harbour for large vessels entering from the open ocean. It may be that in that he has somewhat exceeded the absolute necessity, but 10 feet is the least that a prudent Commander would care to have between his keel and the bottom of the sea in an ordinary ground swell, and this brings us to a required entrance of 34 to 36 feet. Now, if it could be conceded that all natural difficulties connected with sand and coast change were overcome and a basin dredged out in Cochin capable of holding, say, 20 vessels only in a strong tide way such as must always obtain there, and suppose the bar removed under cover of the walls of the harbour, estimated to cost for that purpose alone eighty lakhs, there still remains a-mile-and-a-half of shallow water outside, which no engineering effort or any amount of money could clear. For the first half mile beyond the bar (which is itself a mile from the river entrance) the depths lead to only 21 feet, and to secure 36 feet another mile has to be taken into account, ships of moderate draft of water being thus compelled to anchor two-and-a-half miles from the river entrance, where they may be seen now during the working season by any interested observer. During the foul weather season the mud-bank at Narrakal serves nearly all the purposes of a harbour and can be easily and safely approached, which could never be done in thick weather at the mouth of a narrow stone work.

16. Another large undertaking, which has acquired a firm hold upon public opinion from an engineering point of view, is a canal to afford direct passage between Ceylon and India. This project has been often discussed and often laid aside, but a private Company having now appeared on the scene with, we are told, a subscribed capital of one million, its agents have applied to the Ceylon and Madras Governments for assistance and concessions, and have seriously set to work to carry out the under-taking without having asked marine advice either as to the advisability or even possibility of its proving a success either practically or financially. Several schemes having the canal for their object have been before the Government of Madras, and one especially, which proposed to make a secure harbour for Southern India called Port Lorne, had much to recommend it, but, now that Colombo is adopted as the port-of-call and coaling station for steamers coming through the Suez Canal to Calcutta and Madras and returning homeward, a simple cut through Rámesvaram would confer no

substantial relief to the length of the voyage. Colombo Harbour is so near the southern side of the Island of Ceylon that it is easy to slip round Dondra Head by night or by day, and few Commanders, if they had the choice, would prefer delay, expense and risk of the canal and its many difficulties of nagivation. The present Pámban Pass provides for a large native trade, and a second-class canal would only ruin that without conferring any proportionate benefit to India.

17. But the difficulties from a nautical point are now to be considered, and they are of so formidable a description that I cannot persuade myself that any available sum of money can overcome them, even if the proposition, so often urged in these days, that modern engineering can perform any task be conceded.

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(True Extract.)

C. G. MASTER,
Chief Secretary.

To the Public Works Department.
" Master Attendant, Madras.

Exd. J. W. Fischer.

28/8/01 ✓

P. W. D.

No 1313 dy 5th May 83

Communicated to
Supg Engr for information
2. Do. Marine Attendant
Madras will report whether
the means at his disposal
for maintaining a contin-
-uous record of the
changes in depth of water
at all ports is sufficient
for future Engineering
requirements.

Sd/ R. H.

To
Supg Engrs
Marine Attendant Madras.
Marine Department

Govt. of {1883} Madras.

MARINE.

Issued

Recd. Encl.

G.O., 17th April 1883, No. 196.

No 1313 dy 5th May 83

APRIL.

Vide portions marked in
pencil
re dilapidations

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Withorder

[Ref. 4]

DEPARTMENT.