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*For the use of the Superintendant
of Eastern Coast Canal.*

*Chadras
D. R. M.
17th November 1854*

FROM

THE RECORDS

OF

THE MADRAS GOVERNMENT.

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No. IV.

REPORT

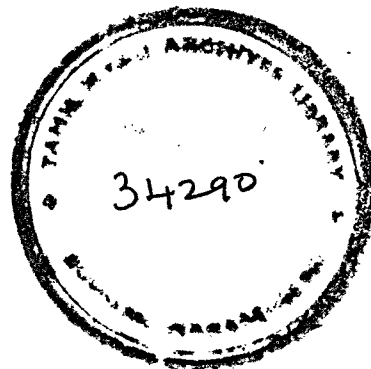
ON THE

PAUMBAN CHANNEL.

Madras:

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REPORT
ON
THE PAUMBAN CHANNEL
BY
THE CHIEF ENGINEER.

In considering what further proceedings should be adopted with respect to this Pass the leading points to be kept in view seem to be these, and though some of the things here said are contained in the former part of this report, I think it better to repeat them in order that this paper may be complete in itself.

1st. The success up to this time has been complete, both as respects accomplishing the object, viz. that of permanently deepening and straightening the Pass, and also as respects the advantages gained by doing it. The Pass instead of a depth at high water near tides of about 5 feet, and excessively crooked so that dhonies without keels, even after discharging most of their cargo, would be often days getting through when the current was strong, has now a depth of $10\frac{1}{2}$ feet and is very nearly straight, so that keeled vessels can pass through in either direction without delay and without discharging cargo. Vessels of 200 tons have passed through. The trade has increased from 17,000 tons in 1822 to nearly 160,000 tons in 1853; and the freight has been reduced by about 6 Rupees a ton or more than one half between Colombo and Negapatana, showing a saving on the whole trade of at least 5 lacs a year, as the effect of a total expenditure including superintendence, value of pioneers' labour and every item of about $3\frac{1}{2}$ lacs, with a trade still rapidly increasing, so that there is no room for doubt that within a short time the gain to the country will be 200 per cent on the outlay, while 4 per cent is paid by Government for Capital employed.

Or the present gain may be thus shown:

The annual charge on the Treasury at 4 per cent on 2½ lacs.	13,000
Deduct receipts for Pilotage	6,800
Net charge on the Treasury	6,200
Amount of gain in diminished Freight	6,00,000
Net annual saving	Rupees 4,93,800

This of course by no means shows the whole benefit, for no doubt a great part of this trade depends entirely upon the diminished freights. For instance the exports from Tanjore to Columbo value 25 lacs a year, and we know not how much of these goods would be unsaleable if 6 Rupees a ton were added to the cost of freight. But besides any gain in money there is that incalculable advantage above-mentioned, that the increased depth of the Pass has led to the extensive substitution of a much safer class of vessels for the old dangerous dhoney, by which many lives must be saved.

2d. All the supposed possible difficulties have been proved to be quite imaginary. The work accomplished shows that the question is simply that of *the cost of removing a certain known quantity of material*. It was questioned at first whether if materials were removed, the channel would not silt up again so fast as to render it a work of too great expense to keep it clear. But there has been no silting up, and indeed in the part where the main difficulty was, it is impossible there should be, for there the current is at times 7 or 8 miles an hour, and much greater than any where else in the neighbourhood, so that nothing can be brought in, that would not be immediately swept away again.

3d. We have now good data for estimating the cost of such work. Upwards of 100,000 cubic yards of sand, coral, and rock have been removed, for a certain sum.

4th. There is 4 fathom of water and upwards up to the Pass on both sides from the open ocean, so that there is nothing to prevent the Pass being entirely open for all vessels. It is simply a question of the quantity of material to be removed for that purpose, and this is known.

5th. The distance that would be saved by the Suez steamers in passing through this Strait, would be 350 geographical miles, and the time consequently 1½ day.

6th. The saving in money by this would be for 48 vessels, per annum probably at least 100,000 Rupees a year, and as there can be no doubt that before very long the communication will be weekly, the saving would then be 200,000 Rupees a year, or in this one item the interest of 50 lacs.

7th. The removal of sand by means of the steam dredge is so simple and so cheap, (not 2 Annas a cubic yard) and it can be done so rapidly (about 350 cubic yards are removed by the dredge here in 9 hours) that the cutting through the rock and coral is the only serious and expensive part of the work.

8th. The rocky part of the Pass will be about 800 yards long marked by posts on each side and the water will be perfectly smooth, so that probably 70 yards width will be sufficient for the large steamers. It must of course be lighted at night.

Under these circumstances there seems to me no question whatever about the importance of immediately opening the Pass completely, if it can be done within a sum that will not be excessive.

The estimate for this is very simple. I find that in the most convenient line, the materials to be removed will be as follows:

2,50,000 cubic yards of rock at 3 Rupees per cubic yard	8,40,000
6,80,000 do. of sand at 2 Annas do.	2,10,000
1,68,000 do. of coral at 1 Rupee do.	1,68,000
	12,18,000
3 Additional steam dredges at 50,000	1,50,000
Sundries	1,00,000
	14,68,000

These prices are estimated from the cost of the work hitherto, as will be shown more particularly below.

This sum of under 15 lacs will be equivalent to an annual charge on the Treasury of 60,000 Rupees a year, a sum which will surely be considered altogether insignificant, (independent of all saving in money,) for the hastening of the mails 1½ day.

If it be required to provide this amount, so that the Pass should be no charge upon the Treasury, the following would be the estimate for the toll.

200,000 tons of steam shipping at $\frac{1}{4}$ Rupee	50,000
300,000 tons sailing vessels at 1 Anna	20,000
Total Rupees	70,000

The present Suez steamers are about 90,000 tons a year, (48 vessels of 1,800 tons,) and when a weekly line is formed it will be 180,000, even supposing the vessels were not increased in size, as is now being done. So that there can be no question that in a few years, there would be, including other steamers, 200,000 tons a year. And as the present trade in sailing vessels is 160,000 tons, consisting entirely of small coasters and those rapidly increasing, there can be no question that when opened for large vessels that trade will soon be 300,000 tons a year.

This charge would be equivalent to 45£ in the present large steamers, while their saving in coal alone would be perhaps 100£.

Thus we may in my opinion confidently expect that if the complete channel is begun soon and finished in three years, there will be a trade of 500,000 tons a year through it soon after.

I here take it for granted that the large steamers would come through this Pass, if it were opened, because I know of no sort of objection to it, but this point can of course only be decided by those accustomed to the management of such vessels. It is not however very likely that any obstacle can arise to make it necessary to forego so great an advantage as that of saving a day and a half in the conveyance of the mails from England, to say nothing of the pecuniary gain.

With respect to the estimate here given;

First. The quantities of material to be removed are taken from the ascertained depths on the line, which appears to me the best for the deep channel.

The breadths of the lines of rock and coral are known by the work already executed—that of the rock being 800 yards and that of the coral 600. I have ascertained the prices by comparing the quantity of material already removed with the actual total expenditure of every kind, including superintendence, prisoners, materials, &c. and a portion of the cost of the steam dredge.

I have in this estimate allowed little more than $\frac{1}{4}$ of the above cost, because I propose to execute the new work out of the current (as well as for other reasons) so that the work will be carried on much more freely and also throughout the year.

The cost of the work hitherto has been increased by the following circumstances:

1st. By working in the current, which greatly hinders it, even when it is not sufficient to stop it entirely.

2d. The work can only be carried on in the present exposed situation for about 150 days in the year.

3d. The work has been carried on upon so small a scale that it has occupied 16 years, causing a very disproportionate expenditure in superintendence and all contingent expenses.

4th. The steam dredge has only been in use about 4 years out of the 16.

5th. The trade has now become so considerable as to cause some hindrance to the work.

6th. The mode of carrying on the work was of course not so well understood at first, as it now is.

7th. Upon so small a scale various expedients for cheapening the work could not be adopted, which would be admissible in more extensive operations.

8th. No diving apparatus has hitherto been used, so that the work has been wholly dependent upon the energy and honesty of Native divers. The presence of an experienced European diver such as those employed on the wreck of the Royal George, of whom there are one or two in the Sappers in Madras, would be a great and important check upon these men.

9th. I have every reason to believe that a much more free use of powder might have been made with a great saving in time and money.

10th. The blasting and removing the large stones has been carried on upon a scale so entirely disproportioned to the powers of the steam dredge that that apparatus has not been one quarter employed, while it has been on the works.

When these things are considered, it will be understood why a new extensive work carried on upon a large scale and with the benefit of all

the past experience, ought to cost less per cubic yard than what has already been done. On the other hand the expense will be increased in some degree, by the increased depth, but from the information I have obtained here I feel confident that the increase due to that will be very moderate, in still water.

I will not here discuss in detail the question of the precise line on which the channel should be made, as it is not by any means an essential point; excepting that it should not be in the line of the present one, for the following two reasons;

First.—Because it would be impossible to carry on the work rapidly in a channel in which vessels are continually passing, and

Second.—Because the increase of cost and time due to working in a current and where the work is entirely stopped for half the days of the year is so great, that it would be better if necessary to remove nearly double the material in still water. By carrying the channel either through the land at Point Tonitoray or where the high reef is compact, still water will always be found, and the work can be carried on at all times either in one side or the other, excepting that in very wet and cold days Native divers could not be employed. It would be necessary to raise the reef a little with loose stones so as to completely stop the sea from breaking over it, which it does in stormy weather, though this work would be trifling because the rocks are just awash. When the channel is completed close up to the reef on both sides, the latter might be cut through when the current was moderate. It is known that the Islands to the southward of the Pass effectually provide a sheltered anchorage for all vessels on that side. The northside however is without this advantage and though the sea in this confined and shallow bay is of course very insignificant at any time yet I think it would be a very important addition to the works, if an artificial break-water were constructed parallel to the reef within half a mile of the northern entrance of the channel. Such a work need not be of great length, as it would never have to shelter many vessels; and as the rock could be obtained at the water's edge along the northern shore of Point Ramen, the cost would not exceed 20,000 Rupees. The seas in the bay of Tandy are so light that a very slight work comparatively would answer the purpose. The force it would have to resist would obviously not be comparable to that sustained by break-waters exposed to the open ocean, and with deep water in their immediate neighbourhood.

I may mention here that if this channel is used by the large steamers, a Coaling Depot might be established here which would be exceedingly convenient as the steamers would lie along side of a wharf. Cape Comerin might be used as a rendezvous for the Australian steamers.

There is there a bay sheltered from the south west, which is the stormy point, and if necessary additional shelter might be provided by running out a break-water from the shore, at a cost which would be by no means serious; rock can be obtained at no great distance and could be deposited at from $\frac{1}{2}$ to $\frac{1}{2}$ Rupee per cubic yard of break-water.

That we may endeavour to form a judgment of the actual value of a deep channel here in money I give the following Estimate

100,000 tons of sailing vessels, saved 350 miles distance, at an average of 2 pice per ton per mile	10 lacs
100,000 tons steamers do. at 3 pice per ton per mile	10½ lacs
Total saving...	20½ lacs

The reason why the sailing vessels are rated so high as 2 pice per ton per mile is that the great mass of the sailing tonnage will be small coasting vessels which are worked at a much greater expense per ton than large vessels; for instance the freight from Negapatnam to Colombo 260 miles is Rupees 4 or 8 Shillings or about 3 pice per ton per mile.

Though the question of the practicability of using this channel for the Suez steamers must of course be fully discussed by those who are capable of judging in the case, it may not be out of place for me here to touch upon those points which have occurred to me, or have been suggested by others.

The accompanying chart compiled from those published and one which is still in manuscript, (the work of Captain Franklin now secretary to the Marine Board,) will shew exactly the nature of the passage, and the dangers connected with it. Only in considering this, two things must be kept in view, one is that we are always inclined to think more of new difficulties and dangers than of those we are accustomed to, and the other is that those who have to encounter the difficulties are not those who are personally interested in the profits that may arise from a new undertaking.

Thus the dangers that will be met in passing through the Paumban Pass, must be balanced against those incurred in going in and out of Galle harbour, and in passing the basses; and again if there is some additional difficulty in the proposed passage, the extra trouble will fall upon the Commanders of the vessels, but the saving will fall to the Owners, and to the public, who receive the Mails earlier.

Three principal objections have been started to this route.

1st. That Ceylon will lose the advantage of having her Mails landed near Colombo. To this a reply seems to be supplied by the report that it is already determined to give up Galle, and land the Mails at Trincomallee; and if so they had better be landed at Paumban, and conveyed from thence by a small vessel to the coast of Ceylon, by the sea side of Adam's Bridge. Or they might be transferred to a small steamer at Cape Comorin, and so conveyed to Colombo.

2d. It has been objected that vessels could not go through Paumban at night. This is answered first by the fact that they do not go into Galle at night, (as I have been informed,) so that there would be no loss of time on that account, compared with the present route; while there would be this decided advantage that instead of being out at sea all night when they did not reach the place before dark, (and in the S. W. Monsoon exposed to a tremendous sea) as they are off Galle, they would at Paumban run into smooth water and anchor for the night. But secondly the delay caused by this is not so great as it at first appears. In more than half the voyages on an average the vessel would arrive during day light and would not be detained at all; and in the remainder they would be detained from 10 hours downwards, or 5 on an average, so that the mean time of detention of all the voyages would be only $2\frac{1}{2}$ hours.

3d. It has been objected and that too by a Naval man that the passage must be made half a mile wide. This objection will no doubt be considered to refute itself. What would be thought of a man who should propose to make the "Panama" Canal $\frac{1}{2}$ mile broad. The present Pass is only 90 feet broad with one obtuse angle in it, and yet several steamers have gone through it, the Nemesis and others, indeed I suppose no body would dream of sending one round Ceylon, whose draft of water allowed of it going through the Pass. The water in the Pass will be perfectly smooth, and in that part where the current

will be strong, it will be quite straight and the stream flowing exactly in the direction of the channel. In the estimate I have proposed that the channel through the sand should be 100 yards or $3\frac{1}{2}$ times the present width, and that through the rock, 70 yards or more than double the latter. The passage through the sand may be widened at a very little additional expense. That through the rock might be doubled at an additional cost of about 8 lacs (80,000£). But in judging of the width, it must be borne in mind, that the rock removed from the channel will be employed in forming break-waters on each side and in other places so as to form a perfectly sheltered canal. The northern end of the channel may be sheltered from sea and current by a break-water of almost any length, as such a work will be very inexpensive.

The whole passage might also be closed, excepting the proposed channel, for a mere trifle by throwing in stone along the line of the reef which is broad and solid and almost throughout level with high water.

A Break-water might also be run out from the western island on the South side of the Pass, parallel with the southern coast of Ramisseram, so as to extend the shelter to the westward, and keep smooth water during the South West Monsoon, in that part of the passage which lies East and West.

Of course most complete arrangements may be made for taking in coal by laying the vessel along side of a wharf so that for that purpose, the Pass would have a great advantage over both Galle and Madras, and additional time might be saved in that operation.

In conclusion we must not lose sight of the progress of trade hitherto. In 30 years the traffic through the Pass has actually increased from 17,000 to nearly 160,000 or more than ninefold, although the channel is not yet improved sufficiently to admit of any but the small coasting vessels going through. It cannot be imagined that this astonishing rate of increase will suddenly stop if the improvements are carried on.

Chief Engineer's Office, Fort }
St. George, 23d January 1854. }

A. COTTON, Lieut. Col.,
Chief Engineer.

N. B.—A Chart on a small scale showing the present and proposed courses of the mail steamers is herewith forwarded, but a more detailed Chart will be prepared and forwarded hereafter in order to shew more clearly the proposed course through the Bay of Tondy with the soundings along the same.

A. C.

No. 212.

Master Attendant's Office, Madras,

20th May 1854.

FROM CAPTAIN C. BIDEN,

Master Attendant.

TO SIR H. C. MONTGOMERY, BART.,

Chief Secretary to Government.

SIR,

With reference to the Minutes of Consultation, under date the 12th ultimo, together with a Report on the Paumban Channel forwarded therewith, and especially to the 3d para of the Resolution passed in Council at the same time, which calls for my opinion whether the sea on either side of the Paumban Channel is easily navigable by large steamers, such as the "Himalaya" and "Bengal," I have the honor to submit for the consideration of the Right Honorable the Governor in Council the following remarks and observations.

2. In the first place, I consider that the navigation of Palk's Bay, to the vicinity of the Paumban Channel on the one side, and the navigation of the Gulf of Manaar towards the eastern entrance of that channel on the other side, so very intricate that those seas are neither safe nor easily navigable for large steamers; and to render those seas and the approaches to the Paumban Channel so safe and easy of navigation, as would ensure the perfect confidence of Commanders of Mail steamers and sailing ships of the largest class, excavating between sand banks to a very considerable extent would be indispensable, and fixed lights, buoys, and beacons in several prominent positions and dangers would be equally necessary, all which shall, in this communication, be pointed out and explained.

3. Secondly.—The Report on the Paumban Channel, in a nautical point of view, calls for some observations on those differences of opinion which some times prevail when Engineering and Military

operations are taken into consideration by Officers of those branches of the service on the one side, and by Naval Officers on the other.

4. And here I beg most respectfully to say that if His Lordship in Council should determine to advise the deepening and widening of the Paumban Channel, and to render the seas and approaches thereto safe and navigable for the largest class of steamers and sailing ships, it is of the utmost importance that a work of such vast utility should be carried into operation on so sure and certain a plan as would, with the expenditure which must be incurred, hold out every reasonable prospect of that permanent success as would justify so great and costly an undertaking.

5. There can be no doubt that, in a national and a commercial point of view, a successful completion of so great an enterprise would be of the utmost importance, and it is quite certain that scientific aid, and all those recent inventions which afford so much facility to the accomplishment of so great a work, are available; but the question for consideration is, whether ulterior advantages can ever be commensurate with the enormous expence which must be incurred.

6. Fully impressed as I am with the manifold advantages that would result from so great a national achievement which, in the event of a maritime war with a powerful adversary, and a struggle for naval supremacy in these seas, would prove most conducive to the celerity of naval operations and the welfare and security of commerce; I will now point out the dangers and difficulties which obstruct the safe and easy navigation of Palk's Straits, and the Gulf of Manaar, and explain how those difficulties may be overcome. I will also venture to submit some remarks on the construction of the new Paumban Pass or Channel, and offer a few suggestions, supported by the opinion of other nautical men whom I have consulted on the subject. I may here observe that having myself visited and inspected the Paumban Pass in 1846, I have some slight knowledge of its locality.

7. I have carefully reckoned the distance which would be saved by rounding Cape Comorin, and traversing the Gulf of Manaar and Palk's Bay, instead of passing round Ceylon, and it is full 360 geographical miles; but when it is considered that the one track is beset with narrow channels, and dangerous shoals which cannot be passed during the night, and that the other course (although more circuitous) is

through an open sea, and void of all danger or impediment, save and except the great, and the little passes which must always be given a very wide berth. And, moreover, when there can be no doubt that steamers would slacken their speed in the narrow seas and proceed on at full speed in the open sea; and that sailing ships would be equally cautious and carry less sail on the one side, and all the sail they could on the other, it is very doubtful whether, on the average of voyages by the inner passage, there would, in reality, be a saving of much time. I will now proceed to a brief consideration of the navigation from the Bay of Bengal to the Paumban Channel, and from Cape Comorin to the same destination.

PALK'S STRAITS.

8. I am indebted to Mr. Franklin for an inspection of his manuscript chart of his very able survey of the entrance of these straits, which shows that between the middle banks to the northward, and the shoals off the north coast of Ceylon, to the southward, the passage is not more than $4\frac{1}{2}$ (four and a half) miles broad, and as the soundings are not so regular as to indicate the approach to these very dangerous shoals between that bank and the Ceylon coast, and the current may deviate a vessel from her given course, it is very evident that neither steamers nor sailing ships should enter Palk's Straits during the night. Nor would that navigation be safe during the day, unless each of those shoals and the South end of the middle bank are denoted by distinguishing buoys. Therefore mail steamers, and sailing ships from Calcutta, and Madras when bound to Suez, or to the Malabar coast, or to Colombo, and intending to adopt the Paumban Channel, should either sight the coast about Tranquebar or Negapatam or be sure of their position in that parallel, and not having sufficient daylight to enter the Straits, they should anchor in 6 or 7 fathoms to the westward of Point Pedro on the North coast of Ceylon. But to ensure a safe anchorage I would recommend that a light house be erected, to exhibit a revolving light, in the vicinity of a place named Tondimansar noted in the chart, and situated on the coast 10 or 11 miles to the westward of Point Pedro, which would certainly (as the land is low) prove a most useful beacon by day and night. Without these safeguards the navigation of this intricate channel would be attended with considerable risk, as there are many shoal patches and overfalls off Point Calymere; the western extreme of the Straits, and off Manamakodah to the S. W. of that point

where a dangerous bank extends nearly due East from the mainland (or Indian shore) to the distance of 14 miles. The eastern limit of this spit should be denoted by a buoy. Having passed the narrows, and fairly entered Palk's Bay, a S. W. course, over an open sea, may be pursued until within one or two miles of the northern entrance to the Paumban Pass, where both steamers and sailing vessels may safely anchor in 6 or 7 fathoms until all would be ready according to wind and tide to enter that channel.

9. The N. E. Monsoon, at times, blows with great violence throughout Palk's Bay and severe gales have happened at the entrance of that sea,—and during the strength of this monsoon there is a heavy and confused swell at the northern entrance to the Paumban Channel, which can only be rendered safe at that season by the construction of a break-water.

10. In the S. W. Monsoon the sea is comparatively smooth, as it blows over the main land of India, and vessels are much sheltered as they approach towards the northern entrance of the Paumban Channel.

THE GULF OF MANAAR.

11. Steamers and sailing ships from the Red Sea, the Persian Gulf, and the Malabar Coast intending to Pass through the Paumban Channel, would pursue the usual track to Cape Comorin, situated at the southern entrance of this gulf, where I recommend a light house should be erected to exhibit a fixed light discernible at the distance of 5 or 6 leagues. Having rounded Cape Comorin, a course should be shaped to clear the shoals off the coast of Tinnevely, and thence towards the banks and dangerous islets in the vicinity of the eastern entrance of the Paumban Channel, which will hereafter be pointed out.

12. This gulf is exposed to severe gales and a heavy sea in both monsoons. I myself have experienced a heavy gale on the 25th and 26th of January, which is a season when stormy weather accompanied with a high sea prevails. Steamers would therefore find the advantage, during the N. E. Monsoon, of hauling over to the coast of Ceylon and steaming up under its lee. Whilst sailing ships should adopt the same course or track, and by beating to windward under the shelter of the coast, a better passage would be made than otherwise. At the head of the gulf the monsoon would abate in its strength, and well sheltered by

the land steamers and ships, would find a smooth sea in the vicinity of the islets and shoals off the eastern entrance to the Paumban Channel, and take up a safe anchorage as denoted in the following remarks.

13. In the S. W. Monsoon there is a heavy turbulent sea in the Gulf of Mannaar and it frequently blows hard, and both steam vessels and sailing ships could not reach a safe anchorage until they haul round the coral islets and sand banks to be denoted by distinguishing buoys, close to the eastern entrance of the Paumban Channel; and to ensure a safe passage around these shoals, which will be noticed by an inspection of the chart, it would be necessary to erect a light house exhibiting a revolving light (to distinguish it from the Paumban light) on the island Ramissacram near the Gadenda Rama Pagoda, and when vessels have approached these shoals which are laid down in latitude from $9^{\circ} 7'$, to $9^{\circ} 11' 30''$ N. and in longitude from $79^{\circ} 16' 30''$, to $79^{\circ} 18'$ East they would, by bringing that light to bear N. $\frac{1}{2}$ E., be clear of all danger and attending well to soundings could haul round to the westward and take up a safe anchorage in smooth water under the lee of banks and shoals in 5 fathoms, where they would await instructions from the Pilot establishment, for their guidance through the Paumban Channel. The coral islets and banks adjoining the line of the eastern branch of the Paumban Channel are denoted by beacons, which may hereafter be more conspicuously marked, and substantially constructed.

The distance from the middle banks, which intercept the safety of navigation in Palk's Straits, to a safe anchorage off the northern entrance to the Paumban Pass is, on a S. W. course.... 67 miles.

And the course and distance from Cape Comorin to a safe anchorage under the shelter of islets in the vicinity of the eastern entrance to the Paumban Channel would be first, to clear the dangers off the coast of Tinnevely and Tutacorin, as will be seen on the chart.
E. b. N. $\frac{1}{2}$ N. 50 miles.

Thence to a safe anchorage under the lee of the above mentioned islets and shoals..... 75 miles.

And the distance through the Paumban Pass, and to a safe anchorage on either side of it is about..... 10 miles.

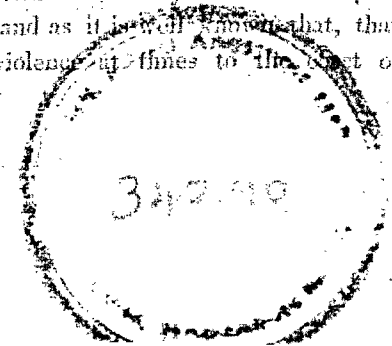
Thus the whole distance from the entrance to Palk's Straits, adjacent to the bay of Bengal to Cape Comorin, is..... 202 miles.

which, without any impediment, would, at the rate of 10 knots an hour, occupy 20 hours; and supposing a mail steamer either entered Palk's Bay, or rounded Cape Comorin at day-break, it would be impossible to avoid the detention of a whole night.

14. A light on Cape Comorin would, however, enable steamers to enter the Gulf of Mannaar at any hour of the night, and as their approach to the dangers off the eastern entrance of the Paumban Channel would be indicated by regular soundings, of from 12 to 7 fathoms, and as the light I have recommended on the island Ramissacram would be another guide, it may so happen that a safe anchorage could be reached before daylight, and then, if the state of the weather and the set of the current would allow immediate operations for the passage of the channel, steamers could (with only the loss of a few hours) get through Palk's Bay and straits before sunset, and proceed on to Madras and Calcutta. This is the most favorable point of view that the inner passage can be contemplated and to accomplish that object with the utmost celerity, anchor-boats, warps, kedges, and fair way buoys should be provided, and a very efficient establishment kept up which should include good boats for towing.

15. Having thus concluded my observations on the navigation of Palk's Bay, and the Gulf of Mannaar; I will now venture to submit to the notice, and for the consideration of His Lordship in Council a few remarks on the projected construction of a new Pass or channel from the one sea to the other. I would not attempt to do so were I not persuaded that the whole plan on which that project is based requires a serious consideration. In the first place if the Paumban Pass or Channel is to be made a safe and navigable ship-canal for steamers and sailing ships of the largest class, some very material amendments to the plan which is proposed are indispensably requisite. The alterations I allude to will be better understood after the direction and extent of the new channel are thoroughly explained.

16. An inspection of the Trigonometrical Survey of the Paumban Pass, will shew that where it is intended to excavate for the formation of the new channel at its northern entrance, heavy breakers are prevalent during the S. E. Monsoon, and as it is well known that, that monsoon blows home with great violence at times to the east of



Madura, it would be necessary to counteract the effects of a heavy swell and strong gusts of wind, by constructing a most substantial break-water, so that ships could be sheltered and take up a safe anchorage before they entered the channel, and as a further safeguard to that entrance it should be effectually protected by a bulwark on either side equal to the resistance of a heavy sea. This plan does appear to be contemplated by Colonel Cotton, but as he states that the sea in this confined and shallow bay is very insignificant at any time, I consider it my duty to point out the error of that conclusion, and to urge the necessity of erecting such very strong and efficient outworks as can alone give safety and security.

17. It is obvious that at each entrance of the channel, the one opening into Palk's Bay and the other into the Gulf of Mannaar, there should be at least a depth of 24 feet, at low water spring tides.

18. It is urged, in the report, that by closing or covering the channel by break-waters and bulwarks, the force of the current will abate. I cannot agree to that opinion, because the current in its flow and ebb from the one sea to the other would not be checked or subdued unless a lock was constructed at either extremity, and it is obvious that wherever there is an outlet, or an inlet the stream will force its way, and the more its limits are circumscribed the greater will be its velocity. Artificial means would diverge the course of the stream, and impede its course and ensure still water in immediate proximity therewith; but as the new channel would be the deepest; the stream, from either ocean, would find its level and force a vent with accumulated strength.

19. In the chart of the survey referred to, there are two lines marked out, I understand, by Colonel Cotton himself, the one is about eleven hundred yards to the westward of the present Pass, and the other is about the same distance still further to the westward, and I believe the latter is his most favorite scheme. If that plan should be adopted it would be necessary to cut through point Tonitory on the main land, whence the channel would open on a sand bank where it will be seen by the chart excavations to a very considerable extent would be required.

20. And, according to either of these plans and consulting the survey, the northern entrance, in 24 feet, would be 1,500 yards beyond that limit of the present Pass, and the direction of the channel would be as follows:

	Yards.
On a southerly line.....	4,000
On a south easterly line.....	3,000
And on a line bearing E. b. S. opening into sound- ings of 22 and 23 feet.....	2,000
Total length, yards.....	9,000

which is very nearly equal to four and a half geographical miles. But as the eastern entrance should certainly open out at a depth of four fathoms, or 24 feet, I think it would be found that the channel ought to extend still further in an easterly direction to the extent of one thousand yards.

21. The direction of the new channel shews that both the N. E. and the S. W. Monsoon would blow obliquely or directly across it, and as it is known that heavy gusts are occasionally experienced in both seasons, they would undoubtedly have some effect on the hull, masts, and rigging of vessels of the largest class, and tend, when acting on the broadside, or on the quarter of a ship to cause that yaw or deviation from her course, which may have the effect of parting as under warps and tow lines. The occurrence of such accidents would break a ship's sheer and might bring her broadside on and forge her ahead at the same time. Therefore to guard against such untoward events and the imminent danger which might follow, it is absolutely necessary that the new channel should be sufficiently broad to afford the best possible means of prevention and safety.

22. In the event of a ship coming broadside on through the influence of flaws and gusts of wind, the anchor should be let go, but where a ship comes to an anchor she must have room to swing, and even by obviating the necessity of anchoring by the head and adopting the other remedy of anchoring by the stern yet there must be room for driving some distance before a ship can be brought up—and there is also the liability of an anchor not holding. In fact these liabilities of serious accidents have been proved by past experience and forcibly indicate the imperative necessity of constructing canals and channels on those principles of security as will give the most perfect confidence. And having consulted Commanders of mail steamers and experienced Masters in the merchant service on this very important question, I can assert that they are unanimously of opinion that the Pamban Channel

cannot be safe for the passage of steamers and sailing ships unless its breadth is increased to (300) three hundred yards and I fully concur in that opinion.

23. The same arguments will hold good if steamers and ships are either warped through or steamed or sailed through the channel or adopt the practice of driving or hedging through when the tide would be in their favor. The tide is said to run at the rate of 6 miles an hour and although steamers might venture to steam against such a tide yet it would not be considered safe to drop or drive with such a stream in their favor.

24. I am also of opinion that the new channel should be guarded by an embankment or bulwarks on either side, from one extreme to the other, the banks should, I think, be six feet above high water mark, and so substantially constructed that stout bollards, or warping posts for checking lines could be firmly fixed thereon, buoys in mid-channel for the purpose of warping through should be well moored, but the anchors by which they are to be moored should be buried below the depth of 24 feet, and wherever the channel diverges from a straight line it would be advantageous to cut a light, or cove so as to give an increase of breadth at those points to the extent of 50 yards, and it would also be expedient to open each entrance in the form of a crescent so as to give it greater width.

25. In venturing to say so much on what is considered by Naval men ought to be the breadth of the new Paumotu Channel, I have taken into consideration the extreme length of the steamer "Himalaya" which I believe is at least 320 feet, and if a vessel of such dimensions was caught with a gust of wind and carried away warps, tow lines, &c., or even under steam was forced from her course broadside on, she might with her keel on our bank, and her fore foot on the other become a total wreck; and I may here observe that a fatal disaster of this very kind has recently occurred in England. In estimating the proper breadth of a pass or canal it is of much more importance to be guided by her length than by her breadth. It is therefore very evident that the projected breadth, as given in the Report,* is very inadequate to the safe passage of vessels of the largest class. The "Nemesis" and another small steamer that have gone through the present Pass are a class of

* 100 Yards.

vessels easily handled and they went through under most favorable circumstances; but mail steamers cannot afford to wait for a convenient opportunity beyond the delay of a few hours.

26. Each entrance to the channel would, under the protection of a break-water, open out into the sea, and in the N. E. Monsoon steamers and sailing ships would, so soon as they were beyond the shelter of the break-water, encounter a head sea which might cause so heavy a plunge as to make it doubtful whether 4 fathoms or 24 feet, would prevent them striking the ground. The same result would follow at the eastern extreme of the channel in the S. W. Monsoon, when vessels under way made their entrance into the northern limit of the Gulf of Manaar, and here it is as well to observe that ships of the line, when fitted and ready to proceed to sea, would draw at least..... 22 feet.

Whilst mail steamers of the dimensions of the "Himalaya" and "Bengal" would draw from 18 to 20 feet.

And merchant ships of the same class as the "Nile" and "Tristram," when loaded, would be at a draft of water from..... 19 to 21 feet.

And when encountering a heavy swell all that description of ships would pitch or send several feet.

COALING DEPOTS.

27. As it would be expedient that steamers should enter the channel at the least possible draft of water, there should be a coal depot on either side of the entrance, and as I am very certain that there is generally too much swell to allow steamers to lay alongside a wharf, I am of opinion that a good bulk moored in a safe anchorage should be provided for the purpose, or large boats, similar to those which are used at Aden, should be constructed for coaling steamers and held in readiness to warp to and from steamers.

28. Under all these circumstances, I may safely conclude by saying that the whole of this important subject can be discussed under the direction of the Honorable the Court of Directors (to whom it is to be referred) by those talented and scientific men who have so ably and skillfully constructed break-waters, harbours of refuge, and other far famed public works of great national utility. Their opinion, guided by sound

judgment and practical experience, can decide whether it is feasible to render the approaches to the Paumban Channel, and the channel itself safe and navigable for steamers and ships of the largest class; and whether so great an undertaking, impeded, and obstructed as it may be by the vicissitudes of wind and weather, can be accomplished within that limit of expenditure which would warrant the attempt.

I have the honor to be,

Sir,

Your most obedient servant,

CHRIS. BIDEN.

Master Attendant.

Master Attendant's Office, Madras, }
20th May, 1854. }

FROM J. J. FRANKLIN, ESQUIRE,

*Secretary Marine Board, late in
charge of Manaur Survey.*

TO SIR H. C. MONTGOMERY, BART.,

*Chief Secretary to Government,
Fort Saint George.*

Sir,

I have the honor to acknowledge the receipt of Extract from Minutes of Consultation of the 18th ultimo, No. 75, on the subject of a proposal by Colonel Arthur Cotton to excavate a new channel at Paumban, sufficiently deep to admit of the passage of large vessels including the contract mail steamers, and in obedience to the instructions conveyed in the 3d para of the Resolution of Government thereon, to offer the following remarks.

2. The improvement of the Paumban Channels has been the means of promoting a very active trade between the south eastern coast of India and the south western coast of Ceylon, carried on by small craft adapted to the navigation of the adjoining seas; but from the difficulty and intricacy of the approaches as well from the North as from the South, I am fully of opinion that no large ships or even steamers would attempt the passage, notwithstanding that the channels themselves offered no impediment. I have heard it urged that vessels voluntarily encounter much more difficult navigation than this, and no doubt such is the case, as in the Hoogly, the Thames and elsewhere; but it is because they have either no alternative, or that the inducements are greater. The only advantage gained by steamers proceeding through these channels would be a saving of about 350 miles, if the Ceylon mails were landed at Paumban, which the Imperial Government would probably not consent to; or about 170 miles if the mail were dropped at Colombo. Taking the average steaming at 10 knots, this would be a saving in time of 35 and 17 hours respectively; but as there would be

two stoppages for daylight, one in passing Paumban, the other in rounding the middle banks extending from Point Calimere to the North coast of Ceylon, which I have reason to believe are shifting, the advantage gained would not be much, while the risk would be considerably augmented. This is also the opinion of the Commanders of steamers with whom I have conversed on the subject.

3. So long as the steamers employed in the Indian seas were small and of low power, and were consequently unable to make sure of their passage round Ceylon, at certain seasons, the opening of the Paumban Pass to them was a matter of vital importance; but now that a larger class has been introduced capable of making head against the heaviest of our monsoons the case is materially altered. At first the question was one affecting the possibility of making the passage at all seasons; now it is only one of time, and as before stated the impediments are such that it is doubtful whether any saving would be effected.

4. The only steamers that could be benefitted are those running between Calcutta and Suez: those from the Cape could gain nothing, while those between Bombay and China would go out of their way by proceeding through the channels.

5. The Government will perceive that I have strictly confined myself to the point upon which I have been directed to report.

I have the honor to be,

Sir,

Your most obedient servant,

JOHN J. FRANKLIN,

Secretary Marine Board, late in
charge of Manuar Survey.

Madras, 12th May 1854.

