

PROCEEDINGS OF THE COURT OF WARDS.

READ—the following letter from C. S. CROLE, Esq., Collector of Madura, to the Secretary to the Court of Wards, dated 28th February 1885, No. 40 :—

I have the honor to submit, for orders, the enclosed original papers from Messrs. Grindrod Jenkins and Co. relating to the sale by the Court of land belonging to the Ramnad Zemindar for the construction of the Ramesvaram ship canal. I see no objection to the proposals, except that it seems undesirable to give any undertaking regarding the price for which land to be applied for hereafter will be sold.

ENCLOSURE No. 1.

From Messrs. GRINDROD JENKINS and Co., to the Collector of Madura, dated Colombo, 13th February 1885.

We have the honor to inform you that we have received a letter, dated 31st January last, from the Honorary Deputy Collector and Manager on the subject of the proposed Ramesvaram ship canal.

Before entering upon the subject of this letter, we would beg your reference to the enclosed documents, viz, a report on the scheme from Sir J. Coode and a small plan showing a slight deviation suggested by him from the course of the canal as proposed by Mr. Stoddart. The report alluded to states Sir J. Coode's reasons for the deviation. Kindly return us the documents when finished with.

You will readily see that until final surveys are complete, it is impossible to state the *specific* land required, but our London House thinks that Sir J. Coode has finally settled the route.

Under these circumstances, we have therefore the honor to apply for such land as may be required in accordance with such deviation in lieu of the land already conditionally granted. That is to say, a strip of land 300 yards wide across the island in the oblique direction marked in the plan herewith, price, terms, and conditions as previously agreed to on the line proposed by Mr. Stoddart.

An option granted us of taking on each side of this strip an extra hundred yards or thereabouts, the Zemindar agreeing to sell such land if we require it, and such extra land to be paid for as we require possession. Price, terms and conditions the same as for the 300 yards strip. For the sake of distinction, we think it would be advisable to have a separate agreement for the extra land.

Should any further change eventually be made in the route of the canal, we beg that we may be empowered to take the original land as agreed upon or other lands in addition or substitution at same price and on same terms as the original grant. We would call special attention to this, as in Sir J. Coode's plan a basin is marked at each end of the canal, and more land might be required.

All rights of the Zemindar or his tenants to be protected, and any compensation made for disturbance as agreed upon.

All agreements as to taking the land to be subject to actual cutting of the canal.

We have further to request that the proposed Company may have facilities for the landing of surveyors, tools, plant, &c., and for any preliminary work until actual possession of the land as required be taken.

ENCLOSURE No. 2.

From J. COODE, Esq., to Messrs. CLARKSON, GREENWELL, and WYLES, dated 5, Westminster Chambers, London, S.W., 26th August 1884.

Ramesvaram Ship Canal.

In compliance with the request conveyed to me in your letter of 31st ultimo, I have carefully considered the important question of forming a ship canal through the Island of Ramesvaram, for the purpose of shortening the sea passage between this country and Madras, Calcutta, and the other ports on the eastern coast of India; also between Bombay and ports upon the eastern coast; and likewise between Colombo and Madras, Calcutta, and intermediate ports on the western shore of the Bay of Bengal.

Any such reduction in the length of the voyage from England to Madras or Calcutta, &c., as would result in a material shortening of the distance to be traversed must obviously be a matter of great importance. In the case now under consideration it happens, as will hereinafter be more particularly explained, that, in addition to the saving in point of *actual distance*, the circumstances are exceptional, whether as regards (1) the direction of the courses navigated; (2) the relation of these courses to the north-east or south-west monsoon, as the case may be; (3) the ocean currents generated by those monsoons; and (4) the comparative smoothness of the sea at all times along that portion of the route which will be new.

I should here premise that I have examined the charts showing the line of canal recommended by Mr. McBean, C.E., and have also carefully considered the proposals for cutting through Toni Turei Point for the improvement of the navigation through the Pámban Pass, and for the construction of a canal through Rámesvaram, as described in the official documents printed by order of the Legislative Council of Ceylon, and of the House of Commons.

As to the several projects above adverted to, it will suffice here to remark, in general terms, that although the improvement of the Pámban Channel would appear, *prima facie*, to be the most simple and feasible solution of the problem, its great cost—estimated by Mr. Townshend, C.E., at nearly £1,400,000—would alone preclude its adoption. But in addition to this, I may observe that the navigation of large vessels through such a channel as that proposed would be so difficult and indeed so dangerous during the south-west monsoon that its execution should not be seriously entertained.

I agree entirely with Mr. G. Robertson, C.E., in the view expressed in his report of March 1873 to the effect that a canal through Rámesvaram will give the “cheapest satisfactory short cut to the East of India.” Having arrived at this conclusion, I addressed my particular attention to the best mode of carrying it into effect, and shall now state my views on this subject.

It may be well, however, to mention, by way of preface, that through the courtesy of the Chairman of the British India Steam Navigation Company, Mr. Mackinnon, and the Chairman of the Peninsular and Oriental Steam Navigation Company, Mr. Sutherland, I have placed before two of the most experienced captains of the former Company, and one of the latter, the proposals which I shall presently explain in detail, and I have the satisfaction of being able to state that these proposals have met with their entire concurrence.

I send herewith three drawings, in illustration of this report, viz:—

Sheet No. 1, a chart of the Bay of Bengal, on which the existing routes are shown by blue dotted lines, and the routes which would be adopted after the execution of the new canal and channels by red dotted lines.

Sheet No. 2, a chart of Palk's Strait and the Gulf of Manaar, with the proposed canal and navigation courses shown in red lines; and

Sheet No. 3, a chart, on a large scale, of the western portion of the Island of Rámesvaram, showing (also in red colour) the line of canal together with its northern and southern entrance channels, and the piers at either end.

Sheet No. 1 may be regarded as self-explanatory, when taken in connection with the remarks above made, as to the red and blue dotted lines respectively.

A reference to Sheet No. 2 will show, in detail, the navigation courses from the open water in the Gulf of Manaar to the open water in the Bay of Bengal, and also the three lightships and the several buoys which I consider to be desirable to render the navigation perfectly easy at all times. From these it will be seen that a vessel coming from the southward, if bound to Madras or Calcutta direct—whether from Europe by the Red Sea, or by the Cape of Good Hope, or from Bombay, or any of the ports on the western seaboard of India—after passing Cape Comorin would take her course on the bearing of N. 49° E., through the Gulf of Manaar up to Lat. 9° 8' N., and when between the lightship and the buoys lying to the southward of Rámesvaram, she would change her course to N. 36° W., which would lead her up to the entrance between the piers at the south end of the canal.

After passing through the canal itself, the main features of which I shall presently describe in some detail, the vessel's course would be N. 40° E. through the broad sheltered water of Palk's Strait, which has a depth of remarkable uniformity (7 to 8 fathoms) for a length of about fifty miles.

When off the Island of Kara-Tivo at the north-western extremity of the Island of Ceylon, the course would be N. 78° E., until about five miles north of Point Palmyra, which lies a little to the westward of Point Pedro (the north-eastern extremity of Ceylon), when it would be N. 18° E., and this would lead her into the open water (about 30 fathoms deep) in the Bay of Bengal.

Comparing the courses on the present and the proposed routes, an inspection of the respective lines no No. 1 Chart will serve to show how direct are the latter as compared with the former, the actual distance saved between a point off Cape Comorin and Madras would be from 320 to 360 nautic miles, according to circumstances. In case of a vessel calling at Colombo, the saving would, of course, be less; but, as before intimated, and as will presently be further explained, the question in this case is not simply one of saving of distance alone.

As to the direction of the proposed navigation courses with relation to the winds during the monsoons and to the ocean currents, it is well known that around the coasts of Ceylon the

winds during both the south-west and north-east monsoons are greatly modified in their direction by the direction of the land. As a matter of fact, within the region of the present steamers' tracks around the island the winds blow *along* the land, viz., towards the east along the south coast and towards the north along the east coast in the south-west monsoon, and towards the south along the east coast, and towards the west along the south coast, in the north-east monsoon.

It is equally established that strong sea currents are set up by the respective monsoons; these currents running in the same directions as the monsoon winds may be blowing.

With respect to the comparative smoothness of the sea along the respective routes, Charts Nos. 1 and 2 will show that the new route is sheltered by the land of Southern India on the west and the Island of Ceylon on the east, and, as a consequence, the water will at all times be smoother than along the present tracks.

In corroboration of what I have just stated, I may quote the following extract from a well-known book entitled *Navigation of the Indian Ocean*, by the late Capt. A. B. Becher, R.N., formerly of the Hydrographic Office of the Admiralty:—

“On the west coast of Ceylon the north-east monsoon brings the fine season, while on the east coast it is accompanied with storms and a heavy sea, and either continual rain or dark, cloudy, and foggy weather. Such weather prevails at this time of the year between the Basses and Point Palmyra, while fine weather is found between Galle and Jaffnapatam, a town situated in the Bay of Palk.”

I may here remark in passing that, according to the best information I can obtain, the new route will be out of the region of the cyclones which occasionally visit portions of the Bay of Bengal. These do not appear to extend to the southward of Lat. 11° N., and but *very rarely* as far down as Lat. 12° N., whereas the northern extremity of the new route is in Lat. 10° N.

In consequence of this combination of circumstances in favor of the new route, the saving in point of time on the voyage to Madras or Calcutta—whether from England by Aden, or from Bombay, or any of the ports on the western coast of India—may be fairly taken at thirty-six hours (a day and a half) on the voyage out, and the same on the voyage home, or three days in all, not to speak of the comfort and convenience to all concerned, and the diminished wear and tear, &c., owing to the navigation being in smoother water on the new than on the present route.

On the regular fortnightly voyages to Madras and Calcutta of the larger ships of the Peninsular and Oriental Company only, the reduction of time would thus amount to no less than 78 days per annum, the saving upon which in *coals alone* would amount to a very considerable sum annually.

Before describing the canal proper, and line upon which I would recommend it to be constructed, together with the reasons which have guided me in making these recommendations, it may be well to explain that the Island of Rámesvaram is separated from the mainland immediately opposite the south-east cape of Hindostan (Toni Turei Point) by a rocky barrier upwards of a mile in length from west to east. The channel known as the “Pámban Pass” is an artificial cut which has been made through this barrier, of about 50 yards in breadth, and with depths ranging from 10 to 14 feet at low water. The current through the Pass is usually about three knots an hour; it varies with the monsoons, and is sometimes as strong as six knots an hour, or even more. Patches of rock and shoals enumber the southern approaches to the Pass for several miles to such an extent that it cannot be rendered fit for navigation by large vessels at any reasonable cost. Even the expenditure of £1,400,000 hereinbefore alluded to as the estimate by Mr. Townshend, C.E., in 1871, contemplated a channel of such a character that it could not be used with safety by the large steamers of the present day, not to speak of the question of the possibility of maintaining it without such a heavy annual expense as would be inadmissible.

Rámesvaram is low and sandy; in length from W.N.W. to E.S.E. it is nearly fourteen miles; its eastern half is merely a narrow strip of sand. At the point of greatest breadth, on which stands the great Brahmin Temple,* the width of the island is about five miles.

It is across the westernmost part of Rámesvaram, as is shown on enlarged scale on Sheet No. 3, that it has been and is proposed to cut the ship canal for the purpose of shortening the passage of vessels to and from the eastern coasts of India.

As will be seen on Sheet No. 2, Rámesvaram is connected with the Island of Manaar (which latter is nearly joined to Ceylon) by a barrier consisting of a narrow ridge of sand and rocks, mostly dry, and known as “Adam's Bridge,” so that Ceylon is nearly joined with the continent of India.

Three different lines have hitherto been proposed for the suggested canal. The first in point of date was laid down by the late Sir William Denison, R.E.; this is the easternmost of the

* The great temple, or coil, stands on a piece of rising ground on the north part of the island, bearing north-west ten miles from Thani Kodi, and E. $\frac{1}{2}$ N. five miles from Pámban Lighthouse. Its height is about 120 feet, and with its majestic towers, its vast and gloomy colonnades, and its walls encrusted with carved work and statuary, this temple exhibits a grand example of the style of such monuments in Southern India, though inferior in dimensions to those of Seringam, Madura, and Tanjore. Thousands of pilgrims from all parts of India resort here. In the year 1877, 47,000 pilgrims visited the temple of Rámesvaram. (From the Admiralty Sailing Directions for the West Coast of Hindostan.)

three lines running from north to south; on Sheet No. 3 it is marked No. 1, and is colored yellow.

The northern entrance to this canal would be well placed, inasmuch as it would derive considerable shelter during the north-east monsoon from that part of the island which trends directly to the northward at a short distance from the proposed northern entrance of the canal.

But, on the other hand, this proposal has been objected to—and justly so—on the ground that the southern entrance would be so much exposed to the sea during the south-west monsoon that it would be necessary to construct for its protection a breakwater a mile in length, and in from 20 to 25 feet of water at low water. The cost of this breakwater alone would be considerably more than equal to that of the canal itself. This line may therefore be disregarded.

The westernmost of the three lines is that which was selected by Mr. G. Robertson, C.E., and recommended in his Report of March 1873; it is colored grey, and is marked No. 3 on the accompanying Sheet 3. I am unable to recommend the adoption of this line; 1st, because the direction of the south approach or entrance channel would be such as to expose vessels broadside to the wind and sea in the south-west monsoon to a greater extent than is desirable; and, 2nd, because the northern entrance of this canal would be so much exposed during the north-east monsoon.

The middle line, colored green on Sheet 3 (and marked as No. 2), is that which was recommended in November 1871 by Mr. Stoddart, of the Surveyor-General's Department, Ceylon, and has been adopted by Mr. McBean.

Having regard to all the conditions of the case, I regard this as decidedly preferable to either No. 1 or No. 3; but, nevertheless, it is open to considerable improvement.

The best line that can, in my opinion, be adopted for the canal is that shown by red color on Sheets Nos. 2 and 3, more especially on the latter, which is on a much larger scale than the former.

It will be seen that, as in the case of line No. 2, the southern entrance is well under the shelter of the Kallaroo Reef with the Shingle Islets, as also of the Coorisuddy, Pullivausel, and Pulli Islands, and their surrounding reefs, which, taken together, would form a great natural breakwater for this entrance during the south-west monsoon. At the same time, the northern entrance is so placed as to derive considerable shelter during the north-east monsoon from the northerly stretch of the coast immediately to the eastward.

It should be understood that this line may possibly be slightly modified after a complete (marine and land) engineering survey has been made, such as is usual, and indeed necessary, before finally determining the details of important works of this nature. There can be no doubt, however, that this may, for all practical purposes, be regarded as the line that will be adopted.

Although the placing of the canal obliquely, as I have shown it, will slightly lengthen the cutting through the island, as compared with a line running directly north and south, there will be a further advantage than the improved sheltering of the entrances to which I have just adverted, viz., the bringing of the course of vessels passing through it more directly in line of the winds, both in the north-east and south-west monsoons. This I regard as a material consideration, seeing that vessels of the largest class, which have their sides so high above the water, will be much less liable to be deflected from their true course whilst passing through the canal, owing to the wind being almost invariably nearly either ahead or astern whichever monsoon might be blowing. I have said "nearly," but am inclined to believe that, inasmuch as the average height of the canal banks will be from 12 to 15 feet above the water level, the wind through the cut will be either directly ahead or directly astern, according to the monsoon, and the outward or homeward course of the ship.

The total length of the canal through the island, from high water to high water, will be $2\frac{1}{6}$ miles (nautic), and the bottom width 100 feet, or nearly 40 per cent. wider than the Suez Canal at the present time. The inclination of the side slopes will be 2 to 1.

The tides here are irregular, but the depth would be 28 feet at low water of the lowest springs. The spring tides sometimes rise as much as 3 feet, but during neaps the range is frequently not more than a few inches, so that at neap tides there would be, throughout the whole twenty-four hours, a depth of, say, 29 feet. The mean depth in the canal for the twenty-four hours during spring tides would be 29 feet 6 inches, or fully 2 feet more than in the Suez Canal at present.

Inasmuch as the tide streams enter Palk's Strait from the north and the Gulf of Manaar from the south, the tidal range is practically the same in both. During the strongest of the monsoon winds, however, the sea level immediately on the weather side of the island and of Adam's bridge is sometimes 12 inches higher than on the opposite side. The effect of this will be that on such occasions a current of about two knots an hour will be generated through the canal and entrance channels, resulting in a most beneficial action in maintaining the depths when once they have been created by the dredging operations in executing the works.

It will be noticed that I have provided protecting piers at each entrance, and within the piers at each end of the canal a basin 400 feet wide clear of the canal channel and 1,000 feet long; these will serve mainly as "gares" or stopping places for vessels, and also as wave-traps; but having regard to the sheltered positions of the entrances, and the form given to the piers, I am of opinion that no really inconvenient disturbance will enter the canal at either end at any time.

In order to simplify the lighting arrangements, and to enable vessels to traverse the canal by night, I have so arranged the positions of the outer ends of the respective piers and the light houses thereon at the north and south entrances, that the same lights which serve to guide vessel into the canal shall also serve to guide them through it. For example, a vessel having entered between the southern pier heads by means of the light at the outer end of the western pier would at once port her helm and steer directly for the light on the outer end of the eastern pier at the north entrance; and *vice versa*, a vessel having entered between the northern pier heads would steer directly for the light on the western pier at the south entrance. These lights being powerful and but a little over two miles apart, vessels could enter the canal at night whenever it was safe to navigate at all near land.

A light, such as ordinarily used on pier heads, would be placed at the inner salient angle of each basin.

If it were deemed desirable, a small light on the "Pintsch" system might be placed at equal intervals of 600 yards along the length of the canal; the number thus required would only be five in all. Erected on standards set up on the side slope, about 25 feet landward of the junction of the slope with the floor of the canal, they would be found useful as guiding beacons by day as well as by night.

It will be seen by reference to Sheet No. 2, that a vessel coming from the southward, after passing the lightship off Thani Kodi, would steer a course N. 36° W., and, as will appear more clearly from Sheet No. 3, when on this course she would have the existing Pámban light near the Zemindari Bungalow as a guide, this being the line on which I have fixed the course for the south entrance channel, which is to be dredged to a depth of 30 feet at low water for a width of 600 feet. Being properly marked with three Pintsch's light buoys, this channel would be as easily and safely navigated by night as by day.

This Pámban light is 97 feet above sea level, being visible 14 miles "all round the compass," and the Thani Kodi lightship being only $11\frac{1}{2}$ miles distant from it, no change whatever would be needed to render the Pámban light available for the new navigable route.

The lightships to which I have already referred would be fitted with lighting apparatus of the best kind, and of ample power, and also with the means of signalling in foggy weather according to the method most approved by the Trinity House of London. The buoys also, and their moorings, and those for the lightships, would likewise be of the most approved type and strength, and provision has been made accordingly in the estimate.

I have considered that, in a navigation of such great importance, the works and accessories should be of the highest class, so as to ensure the confidence of all who may use it, or who may be interested therein.

Provision has also been made in the estimate for a complete ferry, adapted for road vehicles, and for the use of the numerous pilgrims resorting to the great Brahmin Temple in the northern part of the island.

Assuming, what seems to be almost certain, that the nature of the ground along the line of the canal herein recommended will be the same as that which has been found by borings to exist along line No. 2—the westernmost of those shown on Sheet No. 3—I estimate the cost of the canal complete, with the entrance channels, piers, and adjunct works hereinbefore described, at the sum of £865,270, say £870,000.

This sum comprehends the supply, delivery, and placing of the lightships and buoys ("Bell," "Pintsch," and ordinary), and a spare lightship, to be placed temporarily on either station, whilst that particular vessel may be removed for "overhaul," &c., as would be the case once in about every two years. It further includes the cost of spare buoys and moorings, and a proper margin upon the works, and for their supervision and direction.

I may add that I have the fullest confidence in the sufficiency of the amount of the estimate above given, from the circumstance that it is based to a great extent upon works executed under my own direction at Colombo during the past ten years.

With regard to time, I assume that four years from the actual commencement of operations on the ground would be necessary for the execution of the works, but previous to this a period of about nine months would be required for making the surveys, &c., and for preparing the contract, drawings, and specifications, and a further period of about nine months would be necessary for concluding a contract and enabling the contractor to commence the execution of the works, so that there completion might be safely calculated upon within six years from the time of the authorization of the detailed surveys.

In Sir Emerson Tennent's well-known work on "Ceylon," I find the following observation:—"It is remarkable that in the little Island of Ramesvaram, one of the chain which connects Adam's Bridge with the Indian continent, fresh water is found freely by sinking for it in the sand." I regard this as very important, and therefore quote it here.

There is not, as far as I am aware, any other point on which I need now make any comment; if, however, there should be any matter upon which explanation or further information is desired, I shall be happy to render it, so far as may be in my power.

P.W.D.
REVENUE DEPARTMENT.

1885.
Court of Wards,
MADRAS.

Recorded
Sd/- J.H.
Printed March 19th.

Proceedings, 9th March 1885, No. 795.

L. E. V. Arch
Passing orders on letter from Collector of Madura, submitting papers received from Messrs. Grindrod Jenkins and Co., of Colombo, relating to sale by Court of Wards of certain land belonging to Ramnad Zemindar required for the construction of the Ramesvaram ship canal.

With order

COURT OF WARDS, 9TH MARCH 1885, No. 795.

PROCEEDINGS OF THE COURT OF WARDS.

READ—the following letter from C. S. CROLE, Esq., Collector of Madura, to the Secretary to the Court of Wards, dated 28th February 1885, No. 40:—

I have the honor to submit, for orders, the enclosed original papers from Messrs. Grindrod Jenkins and Co. relating to the sale by the Court of land belonging to the Ramnad Zemindar for the construction of the Ramesvaram ship canal. I see no objection to the proposals, except that it seems undesirable to give any undertaking regarding the price for which land to be applied for hereafter will be sold.

ENCLOSURE No. 1.

From Messrs. GRINDROD JENKINS and Co., to the Collector of Madura, dated Colombo, 13th February 1885.

We have the honor to inform you that we have received a letter, dated 31st January last, from the Honorary Deputy Collector and Manager on the subject of the proposed Ramesvaram ship canal.

Before entering upon the subject of this letter, we would beg your reference to the enclosed documents, viz., a report on the scheme from Sir J. Coode and a small plan showing a slight deviation suggested by him from the course of the canal as proposed by Mr. Stoddart. The report alluded to states Sir J. Coode's reasons for the deviation. Kindly return us the documents when finished with.

You will readily see that until final surveys are complete, it is impossible to state the specific land required, but our London House thinks that Sir J. Coode has finally settled the route.

Under these circumstances, we have therefore the honor to apply for such land as may be required in accordance with such deviation in lieu of the land already conditionally granted. That is to say, a strip of land 300 yards wide across the island in the oblique direction marked in the plan herewith, price, terms, and conditions as previously agreed to on the line proposed by Mr. Stoddart.

An option granted us of taking on each side of this strip an extra hundred yards or thereabouts, the Zemindar agreeing to sell such land if we require it, and such extra land to be paid for as we require possession. Price, terms and conditions the same as for the 300 yards strip. For the sake of distinction, we think it would be advisable to have a separate agreement for the extra land.

Should any further change eventually be made in the route of the canal, we beg that we may be empowered to take the original land as agreed upon or other lands in addition or substitution at same price and on same terms as the original grant. We would call special attention to this, as in Sir J. Coode's plan a basin is marked at each end of the canal, and more land might be required.

All rights of the Zemindar or his tenants to be protected, and any compensation made for disturbance as agreed upon.

All agreements as to taking the land to be subject to actual cutting of the canal.

We have further to request that the proposed Company may have facilities for the landing of surveyors, tools, plant, &c., and for any preliminary work until actual possession of the land as required be taken.

ENCLOSURE No. 2.

From J. COODE, Esq., to Messrs. CLARKSON, GREENWELL, and WYLES, dated 5, Westminster Chambers, London, S.W., 26th August 1884.

Ramesvaram Ship Canal.

In compliance with the request conveyed to me in your letter of 31st ultimo, I have carefully considered the important question of forming a ship canal through the Island of Ramesvaram, for the purpose of shortening the sea passage between this country and Madras, Calcutta, and the other ports on the eastern coast of India; also between Bombay and ports upon the eastern coast; and likewise between Colombo and Madras, Calcutta, and intermediate ports on the western shore of the Bay of Bengal.

Any such reduction in the length of the voyage from England to Madras or Calcutta, &c., as would result in a material shortening of the distance to be traversed must obviously be a matter of great importance. In the case now under consideration it happens, as will hereinafter be more particularly explained, that, in addition to the saving in point of *actual distance*, the circumstances are exceptional, whether as regards (1) the direction of the courses navigated; (2) the relation of these courses to the north-east or south-west monsoon, as the case may be; (3) the ocean currents generated by those monsoons; and (4) the comparative smoothness of the sea at all times along that portion of the route which will be new.

I should here premise that I have examined the charts showing the line of canal recommended by Mr. McBean, C.E., and have also carefully considered the proposals for cutting through Toni Turei Point for the improvement of the navigation through the Pámban Pass, and for the construction of a canal through Rámesvaram, as described in the official documents printed by order of the Legislative Council of Ceylon, and of the House of Commons.

As to the several projects above adverted to, it will suffice here to remark, in general terms, that although the improvement of the Pámban Channel would appear, *prima facie*, to be the most simple and feasible solution of the problem, its great cost—estimated by Mr. Townshend, C.E., at nearly £1,400,000—would alone preclude its adoption. But in addition to this, I may observe that the navigation of large vessels through such a channel as that proposed would be so difficult and indeed so dangerous during the south-west monsoon that its execution should not be seriously entertained.

I agree entirely with Mr. G. Robertson, C.E., in the view expressed in his report of March 1873 to the effect that a canal through Rámesvaram will give the "cheapest satisfactory short cut to the East of India." Having arrived at this conclusion, I addressed my particular attention to the best mode of carrying it into effect, and shall now state my views on this subject.

It may be well, however, to mention, by way of preface, that through the courtesy of the Chairman of the British India Steam Navigation Company, Mr. Mackinnon, and the Chairman of the Peninsular and Oriental Steam Navigation Company, Mr. Sutherland, I have placed before two of the most experienced captains of the former Company, and one of the latter, the proposals which I shall presently explain in detail, and I have the satisfaction of being able to state that these proposals have met with their entire concurrence.

I send herewith three drawings, in illustration of this report, viz:—

Sheet No. 1, a chart of the Bay of Bengal, on which the existing routes are shown by blue dotted lines, and the routes which would be adopted after the execution of the new canal and channels by red dotted lines.

Sheet No. 2, a chart of Palk's Strait and the Gulf of Manaar, with the proposed canal and navigation courses shown in red lines; and

Sheet No. 3, a chart, on a large scale, of the western portion of the Island of Rámesvaram, showing (also in red colour) the line of canal together with its northern and southern entrance channels, and the piers at either end.

Sheet No. 1 may be regarded as self-explanatory, when taken in connection with the remarks above made, as to the red and blue dotted lines respectively.

A reference to Sheet No. 2 will show, in detail, the navigation courses from the open water in the Gulf of Manaar to the open water in the Bay of Bengal, and also the three lightships and the several buoys which I consider to be desirable to render the navigation perfectly easy at all times. From these it will be seen that a vessel coming from the southward, if bound to Madras or Calcutta direct—whether from Europe by the Red Sea, or by the Cape of Good Hope, or from Bombay, or any of the ports on the western seaboard of India—after passing Cape Comorin would take her course on the bearing of N. 49° E., through the Gulf of Manaar up to Lat. 9° 8' N., and when between the lightship and the buoys lying to the southward of Rámesvaram, she would change her course to N. 36° W., which would lead her up to the entrance between the piers at the south end of the canal.

After passing through the canal itself, the main features of which I shall presently describe in some detail, the vessel's course would be N. 40° E. through the broad sheltered water of Palk's Strait, which has a depth of remarkable uniformity (7 to 8 fathoms) for a length of about fifty miles.

When off the Island of Kara-Tivo at the north-western extremity of the Island of Ceylon, the course would be N. 78° E., until about five miles north of Point Palmyra, which lies a little to the westward of Point Pedro (the north-eastern extremity of Ceylon), when it would be N. 18° E., and this would lead her into the open water (about 30 fathoms deep) in the Bay of Bengal.

Comparing the courses on the present and the proposed routes, an inspection of the respective lines on No. 1 Chart will serve to show how direct are the latter as compared with the former, the actual distance saved between a point off Cape Comorin and Madras would be from 320 to 360 nautic miles, according to circumstances. In case of a vessel calling at Colombo, the saving would, of course, be less; but, as before intimated, and as will presently be further explained, the question in this case is not simply one of saving of distance alone.

As to the direction of the proposed navigation courses with relation to the winds during the monsoons and to the ocean currents, it is well known that around the coasts of Ceylon the

winds during both the south-west and north-east monsoons are greatly modified in their direction by the direction of the land. As a matter of fact, within the region of the present steamers' tracks around the island the winds blow *along* the land, viz., towards the east along the south coast and towards the north along the east coast in the south-west monsoon, and towards the south along the east coast, and towards the west along the south coast, in the north-east monsoon.

It is equally established that strong sea currents are set up by the respective monsoons; these currents running in the same directions as the monsoon winds may be blowing.

With respect to the comparative smoothness of the sea along the respective routes, Charts Nos. 1 and 2 will show that the new route is sheltered by the land of Southern India on the west and the Island of Ceylon on the east, and, as a consequence, the water will at all times be smoother than along the present tracks.

In corroboration of what I have just stated, I may quote the following extract from a well-known book entitled *Navigation of the Indian Ocean*, by the late Capt. A. B. Becher, R.N., formerly of the Hydrographic Office of the Admiralty:—

"On the west coast of Ceylon the north-east monsoon brings the fine season, while on the east coast it is accompanied with storms and a heavy sea, and either continual rain or dark, cloudy, and foggy weather. Such weather prevails at this time of the year between the Basses and Point Palmyra, while fine weather is found between Galle and Jaffnapatam, a town situated in the Bay of Palk."

I may here remark in passing that, according to the best information I can obtain, the new route will be out of the region of the cyclones which occasionally visit portions of the Bay of Bengal. These do not appear to extend to the southward of Lat. 11° N., and but *very rarely* as far down as Lat. 12° N., whereas the northern extremity of the new route is in Lat. 10° N.

In consequence of this combination of circumstances in favor of the new route, the saving in point of time on the voyage to Madras or Calcutta—whether from England by Aden, or from Bombay, or any of the ports on the western coast of India—may be fairly taken at thirty-six hours (a day and a half) on the voyage out, and the same on the voyage home, or three days in all, not to speak of the comfort and convenience to all concerned, and the diminished wear and tear, &c., owing to the navigation being in smoother water on the new than on the present route.

On the regular fortnightly voyages to Madras and Calcutta of the larger ships of the Peninsular and Oriental Company only, the reduction of time would thus amount to no less than 78 days per annum, the saving upon which in *coals alone* would amount to a very considerable sum annually.

Before describing the canal proper, and line upon which I would recommend it to be constructed, together with the reasons which have guided me in making these recommendations, it may be well to explain that the Island of Rámesvaram is separated from the mainland immediately opposite the south-east cape of Hindostan (Toni Turei Point) by a rocky barrier upwards of a mile in length from west to east. The channel known as the "Pámban Pass" is an artificial cut which has been made through this barrier, of about 50 yards in breadth, and with depths ranging from 10 to 14 feet at low water. The current through the Pass is usually about three knots an hour; it varies with the monsoons, and is sometimes as strong as six knots an hour, or even more. Patches of rock and shoals encumber the southern approaches to the Pass for several miles to such an extent that it cannot be rendered fit for navigation by large vessels at any reasonable cost. Even the expenditure of £1,400,000 hereinbefore alluded to as the estimate by Mr. Townshend, C.E., in 1871, contemplated a channel of such a character that it could not be used with safety by the large steamers of the present day, not to speak of the question of the possibility of maintaining it without such a heavy annual expense as would be inadmissible.

Rámesvaram is low and sandy; in length from W.N.W. to E.S.E. it is nearly fourteen miles; its eastern half is merely a narrow strip of sand. At the point of greatest breadth, on which stands the great Brahmin Temple,* the width of the island is about five miles.

It is across the westernmost part of Rámesvaram, as is shown on enlarged scale on Sheet No. 3, that it has been and is proposed to cut the ship canal for the purpose of shortening the passage of vessels to and from the eastern coasts of India.

As will be seen on Sheet No. 2, Rámesvaram is connected with the Island of Manaar (which latter is nearly joined to Ceylon) by a barrier consisting of a narrow ridge of sand and rocks, mostly dry, and known as "Adam's Bridge," so that Ceylon is nearly joined with the continent of India.

Three different lines have hitherto been proposed for the suggested canal. The first in point of date was laid down by the late Sir William Denison, R.E.; this is the easternmost of the

* The great temple, or coil, stands on a piece of rising ground on the north part of the island, bearing north-west ten miles from Thani Kodi, and E. $\frac{1}{2}$ N. five miles from Pámban Lighthouse. Its height is about 120 feet, and with its majestic towers, its vast and gloomy colonnades, and its walls encrusted with carved work and statuary, this temple exhibits a grand example of the style of such monuments in Southern India, though inferior in dimensions to those of Seringam, Madura, and Tanjore. Thousands of pilgrims from all parts of India resort here. In the year 1877, 47,000 pilgrims visited the temple of Rámesvaram. (From the Admiralty Sailing Directions for the West Coast of Hindostan.)

three lines running from north to south; on Sheet No. 3 it is marked No. 1, and is colored yellow.

The northern entrance to this canal would be well placed, inasmuch as it would derive considerable shelter during the north-east monsoon from that part of the island which trends directly to the northward at a short distance from the proposed northern entrance of the canal.

But, on the other hand, this proposal has been objected to—and justly so—on the ground that the southern entrance would be so much exposed to the sea during the south-west monsoon that it would be necessary to construct for its protection a breakwater a mile in length, and in from 20 to 25 feet of water at low water. The cost of this breakwater alone would be considerably more than equal to that of the canal itself. This line may therefore be disregarded.

The westernmost of the three lines is that which was selected by Mr. G. Robertson, C.E., and recommended in his Report of March 1873; it is colored grey, and is marked No. 3 on the accompanying Sheet 3. I am unable to recommend the adoption of this line; 1st, because the direction of the south approach or entrance channel would be such as to expose vessels broadside to the wind and sea in the south-west monsoon to a greater extent than is desirable; and, 2nd, because the northern entrance of this canal would be so much exposed during the north-east monsoon.

The middle line, colored green on Sheet 3 (and marked as No. 2), is that which was recommended in November 1871 by Mr. Stoddart, of the Surveyor-General's Department, Ceylon, and has been adopted by Mr. McBean.

Having regard to all the conditions of the case, I regard this as decidedly preferable to either No. 1 or No. 3; but, nevertheless, it is open to considerable improvement.

The best line that can, in my opinion, be adopted for the canal is that shown by red color on Sheets Nos. 2 and 3, more especially on the latter, which is on a much larger scale than the former.

It will be seen that, as in the case of line No. 2, the southern entrance is well under the shelter of the Kallaroo Reef with the Shingle Islets, as also of the Coorisuddy, Pullivausel, and Pulli Islands, and their surrounding reefs, which, taken together, would form a great natural breakwater for this entrance during the south-west monsoon. At the same time, the northern entrance is so placed as to derive considerable shelter during the north-east monsoon from the northerly stretch of the coast immediately to the eastward.

It should be understood that this line may possibly be slightly modified after a complete (marine and land) engineering survey has been made, such as is usual, and indeed necessary, before finally determining the details of important works of this nature. There can be no doubt, however, that this may, for all practical purposes, be regarded as the line that will be adopted.

Although the placing of the canal obliquely, as I have shown it, will slightly lengthen the cutting through the island, as compared with a line running directly north and south, there will be a further advantage than the improved sheltering of the entrances to which I have just adverted, viz., the bringing of the course of vessels passing through it more directly in line of the winds, both in the north-east and south-west monsoons. This I regard as a material consideration, seeing that vessels of the largest class, which have their sides so high above the water, will be much less liable to be deflected from their true course whilst passing through the canal, owing to the wind being almost invariably nearly either ahead or astern whichever monsoon might be blowing. I have said "nearly," but am inclined to believe that, inasmuch as the average height of the canal banks will be from 12 to 15 feet above the water level, the wind through the cut will be either directly ahead or directly astern, according to the monsoon, and the outward or homeward course of the ship.

The total length of the canal through the island, from high water to high water, will be $2\frac{1}{2}$ miles (nautic), and the bottom width 100 feet, or nearly 40 per cent. wider than the Suez Canal at the present time. The inclination of the side slopes will be 2 to 1.

The tides here are irregular, but the depth would be 28 feet at low water of the lowest springs. The spring tides sometimes rise as much as 3 feet, but during neaps the range is frequently not more than a few inches, so that at neap tides there would be, throughout the whole twenty-four hours, a depth of, say, 29 feet. The mean depth in the canal for the twenty-four hours during spring tides would be 29 feet 6 inches, or fully 2 feet more than in the Suez Canal at present.

Inasmuch as the tide streams enter Palk's Strait from the north and the Gulf of Manaar from the south, the tidal range is practically the same in both. During the strongest of the monsoon winds, however, the sea level immediately on the weather side of the island and of Adam's bridge is sometimes 12 inches higher than on the opposite side. The effect of this will be that on such occasions a current of about two knots an hour will be generated through the canal and entrance channels, resulting in a most beneficial action in maintaining the depths when once they have been created by the dredging operations in executing the works.

It will be noticed that I have provided protecting piers at each entrance, and within the piers at each end of the canal a basin 400 feet wide clear of the canal channel and 1,000 feet long; these will serve mainly as "gares" or stopping places for vessels, and also as wave-traps; but having regard to the sheltered positions of the entrances, and the form given to the piers, I am of opinion that no really inconvenient disturbance will enter the canal at either end at any time.

In order to simplify the lighting arrangements, and to enable vessels to traverse the canal by night, I have so arranged the positions of the outer ends of the respective piers and the light houses thereon at the north and south entrances, that the same lights which serve to guide vessel into the canal shall also serve to guide them through it. For example, a vessel having entered between the southern pier heads by means of the light at the outer end of the western pier would at once port her helm and steer directly for the light on the outer end of the eastern pier at the north entrance; and *vice versa*, a vessel having entered between the northern pier heads would steer directly for the light on the western pier at the south entrance. These lights being powerful and but a little over two miles apart, vessels could enter the canal at night whenever it was safe to navigate at all near land.

A light, such as ordinarily used on pier heads, would be placed at the inner salient angle of each basin.

If it were deemed desirable, a small light on the "Pintsch" system might be placed at equal intervals of 600 yards along the length of the canal; the number thus required would only be five in all. Erected on standards set up on the side slope, about 25 feet landward of the junction of the slope with the floor of the canal, they would be found useful as guiding beacons by day as well as by night.

It will be seen by reference to Sheet No. 2, that a vessel coming from the southward, after passing the lightship off Thani Kodi, would steer a course N. 36° W., and, as will appear more clearly from Sheet No. 3, when on this course she would have the existing Pámban light near the Zemindari Bungalow as a guide, this being the line on which I have fixed the course for the south entrance channel, which is to be dredged to a depth of 30 feet at low water for a width of 600 feet. Being properly marked with three Pintsch's light buoys, this channel would be as easily and safely navigated by night as by day.

This Pámban light is 97 feet above sea level, being visible 14 miles "all round the compass," and the Thani Kodi lightship being only $11\frac{1}{2}$ miles distant from it, no change whatever would be needed to render the Pámban light available for the new navigable route.

The lightships to which I have already referred would be fitted with lighting apparatus of the best kind, and of ample power, and also with the means of signalling in foggy weather according to the method most approved by the Trinity House of London. The buoys also, and their moorings, and those for the lightships, would likewise be of the most approved type and strength, and provision has been made accordingly in the estimate.

I have considered that, in a navigation of such great importance, the works and accessories should be of the highest class, so as to ensure the confidence of all who may use it, or who may be interested therein.

Provision has also been made in the estimate for a complete ferry, adapted for road vehicles, and for the use of the numerous pilgrims resorting to the great Brahmin Temple in the northern part of the island.

Assuming, what seems to be almost certain, that the nature of the ground along the line of the canal herein recommended will be the same as that which has been found by borings to exist along line No. 2—the westernmost of those shown on Sheet No. 3—I estimate the cost of the canal complete, with the entrance channels, piers, and adjunct works hereinbefore described, at the sum of £865,270, say £870,000.

This sum comprehends the supply, delivery, and placing of the lightships and buoys ("Bell," "Pintsch," and ordinary), and a spare lightship, to be placed temporarily on either station, whilst that particular vessel may be removed for "overhaul," &c., as would be the case once in about every two years. It further includes the cost of spare buoys and moorings, and a proper margin upon the works, and for their supervision and direction.

I may add that I have the fullest confidence in the sufficiency of the amount of the estimate above given, from the circumstance that it is based to a great extent upon works executed under my own direction at Colombo during the past ten years.

With regard to time, I assume that four years from the actual commencement of operations on the ground would be necessary for the execution of the works, but previous to this a period of about nine months would be required for making the surveys, &c., and for preparing the contract, drawings, and specifications, and a further period of about nine months would be necessary for concluding a contract and enabling the contractor to commence the execution of the works, so that there completion might be safely calculated upon within six years from the time of the authorization of the detailed surveys.

In Sir Emerson Tennent's well-known work on "Ceylon," I find the following observation:—"It is remarkable that in the little Island of Ramesvaram, one of the chain which connects Adam's Bridge with the Indian continent, fresh water is found freely by sinking for it in the sand." I regard this as very important, and therefore quote it here.

There is not, as far as I am aware, any other point on which I need now make any comment; if, however, there should be any matter upon which explanation or further information is desired, I shall be happy to render it, so far as may be in my power.

RESOLUTION—dated 9th March 1885, No. 795.

The Court of Wards will be prepared to grant such land as may be required for the altered alignment of the canal in lieu of the land already conditionally granted, that is to say, a strip of land across the island in the oblique direction marked in the plan, 300 yards wide, price, terms, and conditions as previously agreed.

2. They will also place no difficulty in the way of such further acquisition of lands as may be found necessary, which, however, must form the subject of a separate agreement.

3. The Collector will report if Rs. 200 per acre may be accepted for the extra land that may be taken up for the Company, and he will also inform the Court whether the proposed alteration in the alignment of the canal will interfere with any other rights or rights of way than those affected by the canal as originally aligned.

(True Copies and Extract.)

(Signed) C. F. MacCARTIE,
Acting Sub-Secretary.

To the Collector of Madura, with two enclosures returned.
Copy to the Secretary to Government, Revenue Department,
" " " Public Works Department.

P. W. D.

REVENUE DEPARTMENT.

1885.

Court of Wards,

MADRAS.

*Received
by J. S.*

Printed March 19th.

Proceedings, 9th March 1885, No. 795.

Passing orders on letter from Collector of Madura, submitting papers received from Messrs. Grindrod Jenkins and Co., of Colombo, relating to sale by Court of Wards of certain land belonging to Ramnad Zemindar required for the construction of the Ramesvaram ship canal.

S. E. V. Corah.

With order