

Marine (1896) Department.

G.O., No. 396 Marine

DATED 5th June 1896.

[Despatch Abstract.]

Madras Harbour Improvement: Letter from the Chairman, H. J. Boyd submitting an extract of the Proceedings of the Trustees, together with a report by the Engineer of the Board on the subject of the proposed groyne to the south of the South arm & the Harbour Canal, ordered to be transmitted to the Rt. Honble. the Secretary of State.

Despatch No. 7 Marine, D 5-6-96.

[200-15-4-96.] Despatch to the Secretary of State.

Letter from the Chairman, Harbour Trust Board, submitting an extract of the Proceedings of the Trustees, together with a report by the Board's Engineer on the subject of the proposed groyne to the south of the south arm, and the Harbour canal, ordered to be transmitted to the Right Honourable the Secretary of State for India.

GOVERNMENT OF MADRAS.

MARINE DEPARTMENT.

READ—the following paper :—

From W. AUSTIN, Esq., I.C.S., Chairman, Harbour Trust Board, Madras, to the Joint Secretary to Government, Marine Department, dated 13th April 1896, No. 167.

Referring to paragraph 5 of G.O. No. 119, Marine, dated 26th February 1896, I have the honour to submit, for the information of Government, an extract of the proceedings of the Trustees of the harbour at a meeting held on the 10th instant, together with a letter No. 966, dated 26th March, from the Board's Engineer, alluded to therein.

ENCLOSURES.

EXTRACT of Proceedings of the Trustees of the Harbour of Madras, at a meeting held at the Offices of the Board on Friday, the 10th day of April 1896.

* * * * *

2. Read letter No. 966, dated 23rd March 1896, from the Board's Engineer submitting remarks called for in paragraph 5 of G.O. No. 119, Marine, dated 26th February, passing orders on harbour improvements.

Read minutes by Trustees.

Resolved that copy of the above letter from the Board's Engineer be submitted for the consideration of Government in compliance with paragraph 5 of G.O. No. 119, Marine, dated 26th February 1896.

* * * * *

(True Extract.)

(Signed) S. HUTCHENCE,
Ag. Secy., Harbour Trust Board.

From A. LEE POGSON, M.I.C.E., M.I.M.E., &c., Engineer, Harbour Trust Board, to the Chairman, Harbour Trust Board, dated Madras, 23rd March 1896, No. 966.

I have the honour to acknowledge the receipt of G.O. No. 119, dated 26th February 1896, passing orders on the harbour improvements, referred to me, under your endorsement No. 718 of 2nd instant, for remarks, upon the suggestion therein made, to place the proposed groyne in a position explained in paragraph 5 of the above Government Order to which there are various objections.

2. A groyne in such a position will not only fail in its principal object, viz., that of preventing the sand from entering the harbour through the south pier, but prove it to be in the best possible position to be wrecked by the first heavy sea striking it, and if made of such enormous dimensions to enable it to withstand the sea, its action would be that of increasing the force of the waves, striking the now completed south pier outer straight, which would very probably wreck it instead.

3. Two positions have been suggested for the groyne, and to make references to them clear, I will refer to the parallel groyne, as groyne A (green on plan), and the one at right angles to the south pier curve, as groyne B.

4. The groyne A, I proposed to place at a position 1,250 feet south of the south pier and *parallel* to it, is the right one for several reasons, and I would ask the Trustees to strenuously oppose any other position, as, apart from engineering and nautical

objections, any other form or position for a groyne other than groyne A would at once set aside all chances of forming a harbour of refuge or dock in future at the least possible cost, as shown upon the plans A, B and C accompanying this report.

5. Groyne A has been purposely placed in the position shown, as no other position would prevent the sand from *accreting against* the south pier throughout its length, and more especially just where it is impossible to make the south pier sand-tight.

6. By placing groyne A in the position shown on plan B (in green), the south pier can be repaired as far as the wavebreakers, and beyond this point the action of groyne A will be to *deepen*, or recover the depth of water, to what it was before the sand began to enter the harbour through the south pier, by driving the sand already accumulated against the wavebreakers towards shore, where the south pier having been repaired will prevent the sand from entering the harbour.

7. If groyne B was placed at right angles to the south pier curve, as proposed per sketch accompanying G.O. No. 119, dated 26th February 1896, it would act in the very manner we are trying to prevent any groyne from doing, viz., *collecting* sand against the south pier wavebreakers, just where the pier *cannot* be made sand-tight. The sand must, therefore, *continue* to enter the harbour by groyne B, and thus fail in its primary object.

8. It is well known that the position of groyne A, with regard to the in-coming waves, is the correct one, and that it will stand a tremendous sea, being end on to the waves; but the position of groyne B being broadside on to the seas, is against all engineering principles, and the re-entering angle it forms with the south pier was condemned by the Harbour Committee of eminent Engineers in 1883, and all authorities on Marine works.

9. A re-entering angle would create an unknown force of sea, which striking the present harbour walls and groyne B, would overthrow one or the other.

10. I am also of opinion that no groyne (B) of rubble stone placed *broadside* on to the waves could stand a storm, unless provided with a massive masonry retaining wall behind it, equal to the present harbour piers; and then the weaker of the two walls forming the re-entering angle must be wrecked.

11. A groyne (B) so near the harbour entrance would be a source of danger to vessels missing it, and being forced southwards by the current into a confused sea, caused by the re-entering angle; in such a position, vessels would not be able to clear a groyne so near the entrance.

12. The position of groyne A further south, and detached from the south pier, would cause the waves to quietly roll along the groyne and be dispersed on shore.

13. There is therefore every objection to groyne B on engineering and nautical grounds, to say nothing of cost; and there is no doubt that it will fail in preventing the sand from entering the harbour over the wall, and through it below water level, where the wavebreakers prevent the pier from being repaired.

14. The fact that it permits the best site for a dock in future, to become silted up and lost, instead of for the same money spent, securing and reserving an extensive deep water area for a dock free of the cost of dredging, condemns it at once.

15. The re-entering angle it forms is against it, and should any sand pass groyne B, it would travel directly towards the entrance and shallow it as it is now doing, and where dredging would be useless.

16. With groyne A, should sand at any time happen to pass its termination for want of an extension, the sand *could not* reach the entrance to the harbour to shallow it, as on passing round the end of the groyne it would be caught between the groyne A and the south pier, and would there be secured and washed ashore, or thrown up at high water where it could be removed. The fact that sand had passed the groyne would be immediately detected by a permanent advance of the high water line *between* the groyne and the south pier, where the sand so thrown up could be dealt with by dredging, &c.

17. If any sand passed groyne B, it would not be caught in this way, but would reach the entrance unobserved, and result in a permanent shallowing of the harbour

entrance which is now going on, so that groyne B would be worse than no groyne at all, as it would fail in the four points which groyne A will succeed in, viz.:—

A. It will secure and retain a deep water site for a dock, at no extra cost.

B. It will prevent the sand from accreting against the wavebreakers, where repairs to the pier cannot be carried out; and by its action, an increased depth of water will be obtained without dredging, or the cost of such plan.

C. Should any sand pass the groyne, before it could be extended into deeper water, its position would catch and throw such sand up at high water on shore, where it could easily be removed without costly plant; while with groyne B, the result of sand passing it would be a permanent reduction in the depth of water at the harbour entrance.

D. Groyne A will, in no way, interfere with shipping; it is placed in the best position to stand a rough sea, and does not form the objectionable re-entering angle to damage it or the present work.

18. During a rough sea any groyne (B) connected with the south pier and forming such an angle must cause a heavy sea to be continually washing over the south pier and into the harbour, carrying with it a large quantity of sand and causing a confused sea in the south-east corner of the harbour where the water is now quiet.

19. Paragraph 2 of G.O. No. 119, dated 26th February, also refers to the question of the canal entrance, and cost of works connected therewith, at the north-west corner of the harbour.

20. When the Trustees considered and passed my plans for the harbour improvements, with the canal entering the harbour at the north-west corner, it will be remembered that the Harbour Committee, the Trustees, and myself were informed from the outset by Colonel Pennycuik that the canal *must* enter the harbour at the north-west corner; and that such a direction for the canal was necessary to cause circulation in the canal, Cooum, &c.

21. Since submitting my plans, providing for the canal entrance to the north of the harbour, I have gone into the question of this necessity myself, and have been watching the action of the water in the Buckingham canal, and find that the northern direction for the new canal is not the best one for the harbour improvements or the river Cooum scheme.

22. It is clear to any one who studies the project, that the best direction for the canal will be to the south of the harbour as I proposed some years ago. If the canal takes the southerly route, there will be a saving of *some lakhs* to Government and the Trustees, and a considerable increase in the supply of sea water and head available for the Cooum scheme. Extra coal landing and stacking accommodation will be secured to the north of the harbour at a less cost, and additional wharfage provided for customs, &c., at the boat-basin, as shown on plans A, B and C.

23. Before going into details about the advantages of the southerly direction for the canal, the one objection Colonel Pennycuik raised to it, and upon which it was rejected without, I believe, further enquiry, must first be removed, or confirmed by some higher authority.

24. The only argument Colonel Pennycuik had against a southerly direction for the canal from the harbour was "circulation along the Buckingham canal" from B to C on plan C.

25. That circulation would not take place at this point appears to have been accepted without other opinions, or investigation, while on many other points Colonel Pennycuik admitted that a canal to the south would be the better direction of the two.

26. When the question of circulation is carefully considered, it becomes clear to any one that neither a northern or southern canal will have the desired effect of cleaning the Cooum if Colonel Pennycuik's views on circulation are correct, as, if no circulation will take place up the Buckingham canal, it will certainly not do so up the Cooum between the General Hospital and Harris' bridge; and therefore, the Cooum scheme, whether connected by a canal from the north or south of the harbour, upon Colonel Pennycuik's own argument, will prove a failure in circulation, if he is correct.

27. His theory of circulation is that the sea water entering the Buckingham canal from the south, or C to B on plan C, would only have the effect of "driving the sewage," &c., in the canal backwards and forwards, and not that of cleansing it; therefore, if this is true, there can be no doubt that the same action must take place higher up the Cooum, where the clean water entering the Cooum at about the General Hospital (no matter whether supplied from a canal in either direction from the harbour) must simply have the effect of driving all the filth and sewage near the hospital up the that point into the odorous water of the lower Cooum, making Nungumbakum and its neighbourhood unhealthy, &c.; and therefore, the Cooum scheme upon Colonel Pennycuik's argument would be a failure in circulation, otherwise it remains to be proved why circulation should take place in one case, and conveniently fail in another—to condemn a cheaper and better direction for the canal, when all conditions are equal. There is therefore, something wrong, and money about to be spent in the wrong direction.

28. In my opinion, and I believe that of many other Engineers, there is little doubt that this theory is incorrect, as circulation must take place; and if so, the shortest and cheapest route will be the best.

29. Having reached this point—that one direction for the canal is as good as the other as far as circulation goes—I can add to the certainty of flushing the length of the Buckingham canal from B to C on plan C, by the constant supply of sea water which is obtained direct from Ennore, the utilization of which has been lost sight of.

30. That a good supply of water can be, and has been received from Ennore causing a fair current along the canal is known to every one connected with it, and therefore should the canal fail to be cleaned out by the sea water passing up it from the south as far as the Cochrane's basin, the construction of a lock at C on plan C would make this supply of clean water from Ennore act in the Buckingham canal, in the same manner as the canal from the harbour will do with the Cooum.

31. From the foregoing it is clear that a canal from the south of the harbour to the Cooum will be equal to a canal from the north of the harbour as far as circulation is concerned, but the former direction is preferable, as not only will it be some six lakhs cheaper, but being a much shorter canal, a better head and supply of sea water must reach the Cooum, which is the main object of the scheme.

32. In addition to these points, the southern direction for the canal has the advantage—

(a) Of providing better and increased coal landing and stacking accommodation and the non-interference, at considerable cost, of the present system of Harbour Trust Board coal hard and Madras Railway lines.

(b) Saving in cost, and inconvenience of an awkward three-track rail road bridge.

(c) A great saving in road bridges, as only half the number will be required.

(d) No interference with the Madras drainage system, or the Royapuram Sewage Pumping station, where, with a northern canal, all the Madras sewage must be syphoned beneath the canal, in which case a duplicate pipe or tunnel would be necessary for cleaning, repairs, &c., to prevent the complete stoppage of the Madras drainage system, to say nothing of the difficulty and unnecessary undertaking which, I believe, has been objected to by the Municipality. (Note—only Rs. 750 has been provided in the estimates for this work.)

(e) Saving in compensation for land and buildings, necessarily to be acquired along the line of canal to the north of Black Town (no compensation to the south).

(f) Saving or difference in length of the canals, viz.:—

New canal to be cut to the north of the harbour, approximately	...	MLS.
"	"	1 $\frac{3}{4}$
"	"	1 $\frac{3}{8}$

Saving in length of canal	...	$\frac{3}{8}$
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Loss of head by the sea water having to travel $1\frac{3}{4}$ miles along the new northern canal, and thence along $1\frac{1}{2}$ miles of the Buckingham canal = $3\frac{5}{8}$ miles, before the clean water would reach the Cooum via the north canal, against only $1\frac{3}{8}$ miles by the southern canal. The shorter route by $2\frac{1}{4}$ miles must give a greater head and supply of water, and a better chance of the Cooum bar being kept open.

(g) Great advantage in the canal entering the boat-basin where the canal boats could lie safely, in transshipping the canal traffic into suitable sea-going lighters, and the saving of the canal boats from having to cross the open harbour where, due to their build, they would be swamped. The above transshipment could never be permitted to take place in the canal to the north, as the boats would block up the water-way, as they now do, along the Buckingham canal at the wharves. There would also be the serious inconvenience of a strong current along the canal (vide plan No. 14, G.O. No. $\frac{1084}{A}$ I., 14th December 1895), unless special arrangements were made and the canal widened, and there is no reason why the Trustees should spend money in this direction, when by the canal entering the boat-basin to the south, this difficulty would be removed.

(h) The canal to the south would pass near to the Fort St. George moat, and the latter could, therefore, be flushed at every tide with fresh sea water for a small additional sum, clearing it of its present unhealthy, stagnant water. The canal to the north, at 6 lakhs extra, does not attempt this improvement, or the following, under (j).

(j) The drain outlet to the north-east corner of Fort St. George, which has so often been the cause of complaints, and upon which the Trustees have spent considerable sums of money from time to time in extensions, and which has now to be extended again, would cease, as the canal to the south would not only be able to flush this outlet, but a small discharge from the canal would also keep its bar open, in the same manner in which it is expected the Cooum discharge will act upon that bar.

33. I may add that there is considerable room for doubting that the Cooum scheme will at all times of the year keep the bar open at Napier bridge, without additional works, which, I believe, have not been included in the cost of the scheme.

34. I long ago mentioned to Colonel Pennycuik the necessity for such provisions being made in the estimates, and he said he would remember the suggestions, and that they could be carried out afterwards, when necessary, viz.:—

(k) The damming up of the arches of the Wallajah bridge to a few inches below high water to force a circulation round the Island and so secure a better supply and head of water up the canal, and the Cooum from C on plan C to Harris' bridge.

(l) The advisability of providing an auxiliary tank at the mouth of the Cooum, or by damming up part of the river to form a tank, which would furnish a small stream or discharge over the bar after the Cooum was empty, and so keep a small channel open to the sea until the Cooum had again filled, when the larger discharge of the Cooum would re-open the bar. Unless some arrangement of this kind is made, it is certain the bar will not always remain open during the rising tide, and manual labour will have to be resorted to to open it.

35. Paragraph 2 of G.O. No. 119 states that the alternative proposal for the position of the groyne will be submitted to the Secretary of State for India, and therefore, if the despatch has already left India, I would ask that the objections to it and reasons in favour of placing the groyne in a parallel position to the south pier, as originally proposed and approved of by the Trustees, may also be submitted for the information of the Consulting Engineer to the Secretary of State, together with the Trustees' views on the subject.

36. The alteration or suggested removal of the canal from the north-west to the south-west corner of the harbour, if approved of by the Trustees, will not alter the harbour improvements scheme, as the alteration is only a detail and not additional

work; and I believe it matters little to the Home authorities where the canal enters the harbour so long as any deviation from the plans already submitted does not effect the general outlines of the improvements so as to interfere with the stability of the existing or proposed harbour walls, which might thereby become weakened and liable to damage in a storm, &c.

37. No time should be lost in pointing out to Government the advantage it will be to the coal traffic, &c., to gain as much storage and coal landing ground as possible at the north side of the harbour, and the greater length of wharf accommodation which would become available at the south at no extra cost by the modification now proposed with regard to the position of the canal.

38. The removal of the canal to the south will also save much inconvenience to the coal traffic, and saving in cost of the alterations otherwise necessary to the present system of Railway lines upon the coal hard, together with a complete change in the new lines lately laid for the Madras Railway Company.

39. If the canal is to be of any use to the trade of the port, it should be connected direct with the boat-basin which has already been decided must be in the south-west corner of the harbour, and in such a position the canal will not only provide considerable additional wharfage and space for goods-sheds at no extra cost, but should docks be built in future, the canal would be in a position to be connected direct with them, and therefore the advantages of the canal entering the boat-basin to the south cannot be too strongly represented to Government.

ORDER—No. 396, Marine, dated 5th June 1896.

Ordered that the papers be transmitted to the Right Honourable the Secretary of State for India, and that a copy of Mr. Pogson's remarks in connection with the Harbour canal be communicated to the Chief Engineer for Irrigation for information.

[Here enter No. 7, Marine, dated 5th June 1896.]

(True Extract.)

Under Secy. to Government.

To the Chairman, Harbour Trust Board, Madras.
„ Chief Engineer for Irrigation.

MARINE DEPARTMENT.

LETTER—to

THE RIGHT HONOURABLE THE SECRETARY OF STATE FOR INDIA.

MY LORD,

In continuation of our despatch No. 2, Marine, dated 26th February 1896, on the subject of improvements to the Madras Harbour, we have the honour to transmit the accompanying further communication from the Trustees giving cover to a report of the Engineer to the Board, on the subject of the proposed groyne to the south of the south arm, and also in connection with the Harbour canal. As it has now been determined, under your Lordship's sanction, that Mr. Pogson shall proceed to England to confer with the Consulting Engineer there, in connection with these works, it seems unnecessary for us to express any opinion on Mr. Pogson's report. It may, however, be remarked that our Chief Engineer for Irrigation has recently proposed to dispense altogether with the harbour entrance of the canal, and to effect the desired circulation in the Coom by alternative means which have not yet been properly matured. We have, therefore, not yet come to a decision on the alternative proposals.

We have the honour to be,

My Lord,

Your Lordship's most obedient, humble servants,

(Signed) A. E. HAVELOCK.

(„) H. W. BLISS.

(„) J. GROSE.

OOTACAMUND,
5th June 1896.

GOVT. OF FORT ST. GEORGE.

MARINE (1896) DEPARTMENT.

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

Dated 5th June,

No. 7 of 1896.

TRANSMITTING further communication from the
Trustees giving cover to a report by the Engineer
of the Board on the subject of the proposed
groynes to the south of the south arm and also
in connection with the Harbour canal.

Marine
PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

Read the following

From the Chairman, H.T.B. Madras, No 167 of 13 April 1896
No 396 of 5 June 1896
Ordered that the

papers be transmitted to
the Right Honourable the
Secretary of State for India,
and that a copy of Mr.
Pogson's remarks in con-
nection with the Harbour
canal be communicated
to the Chief Engineer for
Irrigation for information.

To
The Chairman, H.T.B. Madras
" Chief Engineer for Irrig.



H.E. No 397 of 5 June 1896

To
The Right Honourable
the Secy. of State for India
My Lord.

In Continuation
of our despatch No 2,
Marine, of 26 February 1896,
on

On the subject of improve-
ments to the Madras
Harbour, we have the honour
to transmit the accom-
panying further Com-
munication from the
Trustees giving Cover to
a report of the Engineer
to the Board, on the subject
of the proposed groyne ^{at} the
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and also in Connection
with the Harbour Canal.
As it has now been deter-
mined, under your Lord-
Ship's Sanction, that Mr.
Pogson shall proceed to
England to confer with
the Consulting Engineer
there, in Connection with
these works, it seems
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to express any opinion
on Mr. Pogson's report. It
may

* Papers being separately
disposed of -
This is the first I have
heard of them. MS

Enclosures
Copy of proceedings
with plans.

16 P
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that our Chief Engineer for
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27/5/96

Madras Harbour Improvements
Harbour Canal

urgent

Back paper noted
on the Croissant

Despatches
Some the default
next mail & then
send the paper
printed.
Rogers
8/6.

cow

MS to Sub.

P. W. DEPARTMENT.
(Marine)

Read the following:—

From the Chairman, Harbour Trust Board, Madras, No. 167, d/13th April 1896.

FOR ORDERS.

It is submitted that this report and the accompanying plans be forwarded to the Secretary of State for communication to the Consulting Engineer in England in continuation of previous correspondence on the subject of Harbour Improvements.

2. The question of the canal -- entrance into the harbour and the circulation along the Buckingham Canal is now under the consideration of the Chief Engineer for Irrigation, and a copy of Mr. Pogson's remarks on these matters might be communicated to that officer.

A.H.
20.5.96

MS
22/5/96

RS
25/5/96

18/5/96

W.
(Marine)

R.S.

CHAD
13.5.96.



*Madras Harbour improve-
ments and Harbour Canals*

39/ 27 March

*Plans referred to
in the Engineer's letter*

MARINE DEPARTMENT.

FROM
THE CHAIRMAN,
HARBOUR TRUST BOARD,
MADRAS.

TO
THE SECRETARY TO GOVERNMENT,
Marine Department.

DATED 13th April 1896.

DESPATCHED 16th "

RECEIVED "

ENCLOSURES Two.
*Plans referred to
in the Engineer's letter*
No. 167.

SUBJECT.

Submitting Extract of Board's Proceedings to-
gether with a letter from the Board's Engineer, re-
plying to para. 5 of G. O. No. 119, Marine, dated 26th
February 1895, regarding the proposed groyne to the
south of the South Pier,

MARINE DEPARTMENT.

FROM

THE CHAIRMAN,

HARBOUR TRUST BOARD,

MADRAS.

TO

THE SECRETARY TO GOVERNMENT,

Marine Department.

DATED 13th April 1896.

DESPATCHED 16

RECEIVED

ENCLOSURES Two.

Plans referred to
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SUBJECT.

Submitting Extract of Board's Proceedings together with a letter from the Board's Engineer, replying to para. 5 of G. O. No. 119, Marine, dated 26th February 1896, regarding the proposed groyne to the south of the South Pier.

18

Harbour Trust Office,
MADRAS,
13th April 1896.

No. 167.

FROM

WARE AUSTIN, Esq., I. C. S.,
CHAIRMAN, HARBOUR TRUST BOARD,
Madras.

TO

THE HON'BLE COL. D. McNEIL CAMPBELL, R. E.,
JOINT SECRETARY TO GOVERNMENT,
Marine Department.

SIR,

Referring to para. 5 of G. O. No. 119, Marine, dated 26th February 1896, I have the honor to submit for the information of Government an extract of the proceedings of the Trustees of the Harbour at a Meeting held on the 10th instant together with a letter No. 966, dated 26th March, from the Board's Engineer, alluded to therein.

I have the honor to be,

Sir,

Your most obedient servant,

Ware Austin
Chairman,
Harbour Trust Board.

Extract of Proceedings of the Trustees of the Harbour of Madras, at a Meeting held at the Offices of the Board on Friday, the 10th day of April 1896.

* * *
2. Read letter No. 966, dated 23rd March 1896, from the Board's Engineer, submitting remarks called for in para. 5 of G. O. No. 119, Marine, dated 26th February, passing orders on Harbour Improvements.

Read minutes by Trustees.

Resolved that copy of the above letter from the Board's Engineer be submitted for the consideration of Government, in compliance with para. 5 of G. O. No. 119, Marine, dated 26th February 1896.

(True Extract.)

S. HUTCHENCE,
Ag. Secretary,
Harbour Trust Board.

No. 966.

Madras Harbour Trust,
MADRAS, 26th March 1896.

FROM

THE ENGINEER,
HARBOUR TRUST BOARD,

TO

THE CHAIRMAN,
HARBOUR TRUST BOARD,
MADRAS.

SIR,

MADRAS, 23rd March 1896.

I have the honor to acknowledge the receipt of G. O. No. 119, dated 26th February 1896, passing orders on the Harbour Improvements, referred to me, under your Endorsement No. 718 of 2nd Instant, for remarks, upon the suggestion therein made, to place the proposed groyne in a position explained in para. 5 of the above G. O., to which there are various objections.

2. A groyne in such a position will not only fail in its principal object, *viz.*, that of preventing the sand from entering the Harbour through the South Pier, but prove it to be in the best possible position to be wrecked by the first heavy sea striking it, and if made of such enormous dimensions to enable it to withstand the sea, its action would be that of increasing the force of the waves, striking the now completed South Pier outer straight, which would very probably wreck it instead.

3. Two positions have been suggested for the groyne, and to make references to them, clear, I will refer to the parallel groyne, as groyne A (green on plan), and the one at right angles to the South Pier curve, as groyne B.

4. The groyne A, I proposed to place at a position 1,250 feet south of the South Pier and parallel to it, is the right one for several reasons, and I would ask the Trustees to strenuously oppose any other position, as, apart from engineering and nautical objections, any other form or position for a groyne other than groyne A, would at once set aside all chances of forming a Harbour of Refuge, or Dock in future, at the least possible cost, as shown upon the Plans A, B and C accompanying this report.

5. Groyne A, has been purposely placed in the position shown, as no other position would prevent the sand from accreting against the South Pier throughout its length, and more especially, just where it is impossible to make the South Pier sand tight.

6. By placing groyne A in the position shown on Plan B (in green), the South Pier can be repaired as far as the wavebreakers, and beyond this point the action of groyne A, will be to *deepen*, or recover the depth of water, to what it was, before the sand began to enter the Harbour through the South Pier; by driving the sand already accumulated against the wavebreakers, towards shore, where the South Pier having been repaired, will prevent the sand from entering the Harbour.

7. If groyne (B) was placed at right angles to the South Pier Curve, as proposed per sketch accompanying G. O. No. 119, dated 26th February 1896, it would act in the very manner we are trying to prevent any groyne from doing, *viz.*, collecting sand against the South Pier wavebreakers, just where the Pier cannot be made sand tight. The sand must, therefore, *continue* to enter the Harbour by groyne B, and thus fail in its primary object.

8. It is well known that the position of groyne A, with regard to the in-coming waves, is the correct one, and that it will stand a tremendous sea, being end on to the waves; but the position of groyne B, being broadside on to the seas, is against all engineering principles, and the re-entering angle it forms with the South Pier was condemned by the Harbour Committee of eminent Engineers in 1883, and all authorities on Marine Works.

9. A re-entering angle would create an unknown force of sea, which striking the present Harbour walls, and groyne B, would overthrow one or the other.

10. I am also of opinion that no groyne (B), of rubble stone placed *broadside* on to the waves could stand a storm, unless provided with a massive masonry retaining wall behind it, equal to the present Harbour Piers; and then, the weaker of the two walls forming the re-entering angle, must be wrecked.

11. A groyne (B), so near the Harbour entrance, would be a source of danger to vessels missing it, and being forced southwards, by the current, into a confused sea, caused by the re-entering angle; in such a position, vessels, would not be able to clear a groyne, so near the entrance.

12. The position of groyne A, further south, and detached from the South Pier would cause the waves to quietly roll along the groyne, and be dispersed on shore.

13. There is therefore every objection to groyne B on engineering and nautical grounds, to say nothing of cost; and there is no doubt that it will fail in preventing the sand from entering the Harbour over the wall, and through it, below water level; where the wavebreakers prevent the Pier from being repaired.

14. The fact that it permits the best site for a Dock in future, to become silted up and lost, instead of for the same money spent, securing and reserving an extensive deep water area for a Dock, free of the cost of dredging, condemns it at once.

15. The re-entering angle it forms, is against it, and should any sand pass groyne B, it would travel directly towards the entrance and shallow it, as it is now doing; and where dredging would be useless.

16. With groyne A, should sand at any time happen to pass its termination for want of an extension, the sand *could not* reach the entrance to the Harbour to shallow

it, as on passing round the end of the groyne, it would be caught between the groyne A, and the South Pier, and would there be secured, and washed ashore, or thrown up at High Water where it could be removed. The fact that sand had passed the groyne, would be immediately detected by a permanent advance of the High Water Line between the groyne and the South Pier, where the sand so thrown up, could be dealt with by dredging &c.

17. If any sand passed groyne B, it would not be caught in this way, but would reach the entrance unobserved, and result in a permanent shallowing of the Harbour Entrance, which is now going on, so that groyne B, would be worse than no groyne at all, as it would fail in the four points, which groyne A, will succeed in, viz:—

A. It will secure and retain a deep water site for a Dock, at no extra cost.

B. It will prevent the sand from accreting against the wavebreakers, where repairs to the Pier cannot be carried out; and by its action, an increased depth of water will be obtained without dredging, or the cost of such plant.

C. Should any sand pass the groyne, before it could be extended into deeper water, its position would catch, and throw such sand up at High Water, on shore; where it could easily be removed without costly plant; while with groyne B, the result of sand passing it, would be a permanent reduction in the depth of water at the Harbour Entrance.

D. Groyne A will, in no way, interfere with shipping, it is placed in the best position to stand a rough sea, and does not form the objectionable re-entering angle to damage it, or the present work.

18. During a rough sea any groyne (B) connected with the South Pier, and forming such an angle, must cause a heavy sea to be continually washing over the South Pier and into the Harbour, carrying with it a large quantity of sand, and causing a confused sea in the south-east corner of the Harbour, where the water is now quiet.

19. Para. 2 of G. O., No. 119, dated 26th February, also refers to the question of the canal entrance, and cost of works connected therewith, at the north-west corner of the Harbour.

20. When the Trustees considered and passed my plans for the Harbour Improvements, with the canal entering the Harbour at the north-west corner, it will be remembered that the Harbour Committee, the Trustees, and myself, were informed from the outset, by Colonel Pennycuik, that the canal *must* enter the Harbour at the north-west corner; and that such a direction for the canal was necessary to cause circulation in the canal, Cooum &c.

21. Since submitting my plans, providing for the canal entrance to the north of the Harbour, I have gone into the question of this necessity myself, and have been watching the action of the water in the Buckingham canal; and find, that the northern direction for the new canal is not the best one for the Harbour Improvements, or the river Cooum scheme.

22. It is clear to any one who studies the project, that the best direction for the canal, will be to the south of the Harbour, as I proposed some years ago. If the canal takes the southerly route, there will be a saving of *some lakhs* to Government and the Trustees, and a considerable increase in the supply of sea water, and head available for the Cooum scheme. Extra coal landing and stacking accommodation will be secured to the north of the Harbour at a less cost, and additional wharfage provided for customs &c., at the boat-basin, as shown on Plans A, B and C.

23. Before going into details about the advantages of the southerly direction for the canal, the one objection Colonel Pennycuik raised to it, and upon which, it was rejected without, I believe, further enquiry, must first be removed; or confirmed by some higher authority.

24. The only argument Colonel Pennycuik had against a southerly direction for the canal from the Harbour, was "circulation along the Buckingham canal" from B to C, on Plan C.

25. That circulation would not take place at this point, appears to have been accepted without other opinions, or investigation, while on many other points, Colonel Pennycuik admitted that a canal to the south would be the better direction of the two.

26. When the question of circulation is carefully considered, it becomes clear to any one, that neither a northern or southern canal will have the desired effect of cleaning the Cooum if Colonel Pennycuik's views on circulation are correct, as, if no circulation will take place up the Buckingham canal, it will certainly not do so up the Cooum, between the General Hospital and Harris' Bridge; and therefore the Cooum Scheme, whether connected by a canal from the north, or south of the Harbour, upon Colonel Pennycuik's own argument, will prove a failure in circulation; if he is correct.

27. His theory of circulation is that the sea water entering the Buckingham canal from the south, or C to B on Plan C would only have the effect of "driving the sewage" &c. in the canal backwards and forwards, and not that of cleansing it, therefore if this is true, there can be no doubt that the same action must take place higher up the Cooum, where the clean water entering the Cooum at about the General Hospital, (no matter whether supplied from a canal in either direction from the Harbour) must simply have the effect of driving all the filth and sewage near the Hospital, up the Cooum as far as Harris' Bridge, thus converting the now comparatively clean water at that point, into the odorous water of the lower Cooum, making Nungumbakum and its neighbourhood unhealthy &c.; and therefore the Cooum Scheme upon Colonel Pennycuik's argument would be a failure in circulation; otherwise it remains to be proved why circulation should take place in one case, and conveniently fail in another to condemn a cheaper and better direction for the canal, when all conditions are equal; there is, therefore, something wrong and money about to be spent in the wrong direction.

28. In my opinion, and I believe that of many other Engineers, there is little doubt that this theory is incorrect, as circulation must take place; and if so, the shortest and cheapest route will be the best.

29. Having reached this point, that one direction for the canal is as good as the other as far as circulation goes, I can add to the certainty of flushing the length of the Buckingham canal from B to C on Plan C, by the constant supply of sea water which is obtained direct from Ennore, the utilization of which has been lost sight of.

30. That a good supply of water can be, and has been received from Ennore, causing a fair current along the canal is known to every one connected with it, and therefore *should* the canal fail to be cleaned out by the sea water passing up it from the south, as far as the Cochrane's Basin, the construction of a lock at C on Plan C, would make this supply of clean water from Ennore, act in the Buckingham canal, in the same manner as the canal from the Harbour, will do with the Cooum.

31. From the foregoing it is clear that a canal from the south of the Harbour to the Cooum will be equal to a canal from the north of the Harbour, as far as circulation is concerned, but the former direction is preferable, as not only will it be some *six lakhs* cheaper, but being a much shorter canal, a better head and supply of sea water must reach the Cooum, which is the main object of the scheme.

32. In addition to these points, the southern direction for the canal has the advantage—

- A. Of providing better and increased coal landing and stacking accommodation, and the non-interference, at considerable cost, of the present system of Harbour Trust Board coal hard, and Madras Railway lines.
- B. Saving in cost, and inconvenience of an awkward, three track rail road bridge.
- C. A great saving in road bridges, as only half the number, will be required.
- D. No interference with the Madras Drainage System, or the Royapooram Sewage Pumping Station; where, with a northern canal, all the Madras sewage must be *syphoned* beneath the canal, in which case, a duplicate pipe or tunnel would be necessary for cleaning, repairs &c., to prevent the complete stoppage of the Madras Drainage System, to say nothing of the difficulty and unnecessary undertaking, which, I believe, has been objected to, by the Municipality. (note, only Rs. 750 has been provided in the estimates for this work.)
- E. Saving in compensation for land and buildings, necessarily to be acquired along the line of canal to the north of Black Town. (no compensation to the south.)
- F. Saving or difference in length of the canals, viz:—

New Canal to be cut to the north of the Harbour, approximately	...	$1\frac{3}{4}$ miles.
"	"	"
"	"	south ... $1\frac{3}{8}$ "
Saving in length of Canal	...	$\frac{3}{8}$ mile.

Loss of head, by the sea water having to travel $1\frac{3}{4}$ miles along the new northern canal, and thence along $1\frac{1}{8}$ miles of the Buckingham Canal = $3\frac{5}{8}$ miles, before the clean

Water would reach the Cooum *via* the north canal; against only $1\frac{3}{8}$ miles by the southern canal. The shorter route by $2\frac{1}{4}$ miles, must give a greater head and supply of water, and a better chance of the Cooum bar being kept open.

G. Great advantage in the canal entering the boat-basin, where the canal boats could lie safely, in transshipping the canal traffic into suitable sea going lighters; and the saving of the canal boats from having to cross the open Harbour, where due to their build, they would be swamped. The above transshipment could never be permitted to take place in the canal to the north; as the boats would block up the water way, as they now do, along the Buckingham canal at the wharves. There would also be the serious inconvenience of a *strong current* along the canal (*Vide* Plan No. 14, G. O. No. $\frac{1984}{A}$ I, 14th December 1895), unless special arrangements were made, and the canal widened, and there is no reason why the Trustees should spend money in this direction; when by the canal entering the boat-basin to the south, this difficulty would be removed.

H. The canal to the south would pass near to the Fort St. George Moat, and the latter could, therefore, be flushed at every tide with fresh sea water, for a small additional sum, clearing it of its present unhealthy, stagnant water. The canal to the north, at 6 lakhs extra, does not attempt this improvement, or the following, under J.

J. The drain outlet, to the north-east corner of Fort St. George, which has so often been the cause of complaints, and upon which the Trustees have spent considerable sums of money from time to time, in extensions, and *which has now to be extended again*, would cease; as the canal to the south would not only be able to flush this outlet, but a small discharge from the canal would also keep its bar open, in the same manner in which it is expected, the Cooum discharge, will act upon that bar.

33. I may add that there is considerable room for doubting that the Cooum Scheme will at all times of the year keep the bar open at Napier Bridge, without additional works, which, I believe, have not been included in the cost of the scheme.

34. I long ago mentioned to Colonel Pennycuik the necessity for such provisions being made in the estimates, and he said he would remember the suggestions, and that they could be carried out afterwards, when necessary *viz*:

K. The damming up of the arches of the Wallajah Bridge to a few inches below High Water to force a circulation round the Island, and so secure a better supply, and head of water up the canal, and the Cooum from C on Plan C. to Harris' Bridge.

L. The advisability of providing an auxiliary tank at the mouth of the Cooum, or by damming up part of the river to form a tank, which would furnish a small stream or discharge over the bar, after the Cooum was empty, and so keep a small channel open to the sea, until the Cooum had again filled, when the larger discharge of the Cooum, would re-open the bar.

The Chart
shows for Ennore
a separate
canal made
from
Ennore
to
the
Cooum

Plans sent
to S. S. T. C. C.

Unless some arrangement of this kind is made, it is certain the bar will not always remain open during the rising tide, and manual labour will have to be resorted to, to open it.

35. Para. 2 of G. O. No. 119, states that the alternative proposal for the position of the groyne will be submitted to the Secretary of State for India, and therefore, if the despatch has already left India, I would ask that the objections to it, and reasons in favor of placing the groyne in a parallel position to the South Pier, as originally proposed, and approved of, by the Trustees, may also be submitted for the information of the Consulting Engineer to the Secretary of State, together with the Trustees' views on the subject.

36. The alteration or suggested removal of the canal from the north-west, to the south-west corner of the Harbour, if approved of by the Trustees, will not alter the Harbour Improvements Scheme, as the alteration is only a detail, and not additional work; and I believe, it matters little to the Home authorities where the canal enters the Harbour so long as any deviation from the plans already submitted, does not effect the general outlines of the improvements, so as to interfere with the stability of the existing, or proposed Harbour walls, which might thereby become weakened, and liable to damage in a storm &c.

37. No time should be lost in pointing out to Government the advantage it will be to the coal traffic &c., to gain as much storage and coal landing ground as possible, at the north side of the Harbour, and the greater length of wharf accommodation which would become available at the south at no extra cost, by the modification now proposed with regard to the position of the canal.

38. The removal of the canal to the south will also save much inconvenience to the coal traffic, and saving in cost of the alterations otherwise necessary to the present system of Railway lines upon the coal hard, together with a complete change in the new lines lately laid for the Madras Railway Company.

39. If the canal is to be of any use to the trade of the Port, it should be connected direct with the boat-basin, which has already been decided, must be in the south-west corner of the Harbour, and in such a position, the canal will not only provide considerable additional wharfage and space for goods sheds at no extra cost, but should Docks be built in future, the canal would be in a position to be connected direct with them, and therefore the advantages of the canal entering the boat-basin to the south, cannot be too strongly represented to Government.

I have the honor to be,

Sir,

Your most obedient servant,

A. LEE POGSON, M. INST. C. E., M. I. M. E., &c.,

Engineer,

Harbour Trust Board.