Archives I—10,006—16-8 77.

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TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

P.W. DEPARTMENT

G.O. No. / B.P. No.	2552(W) 2553.	Press. / Mis.
Dated	18.10-1887	197 .

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2552
1

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

18th October 1881, No. 2552 W.

Buildings and Roads
Civil Works.

Read the following paper:—

No. 89. Despatch from the Most Honorable the Secretary of State for India.

Public Works.
No. 26.

INDIA OFFICE, LONDON,
25th August 1881.

SIR,—Herewith is transmitted copy of a letter addressed (under cover to this office) by Mr. Parkes to the Secretary to your Government in the Public Works Department, on the subject of the construction of the Madras Harbour, as compared with the harbour which is now in course of construction at Colombo in Ceylon.

Dated 4th August 1881.

I have, &c.,
(Signed) HARTINGTON.

His Excellency the Honorable
The Governor in Council, Fort St. George.

From W. PARKES, Esq., C.E., to the Secretary to Government, Public Works Department, Madras, dated 23 Abingdon Street, 4th August 1881.

Madras Harbour.

IN the G.O., No. 1436 W., of the 8th June 1881, I am requested to offer such observations as I may desire on a memorandum signed by the Master Attendant and the Chief Engineer on the Harbour Works now in course of construction at Colombo from the designs of Sir John Coode.

2. In the remarks I am about to submit I shall think it right to abstain as far as possible from any comparison of the conditions to be met at Colombo and at Madras, or of the modes in which the Engineers of the two works have, in the independent exercise of their judgment, endeavoured to meet them. I shall simply address myself to the very legitimate questions raised:—

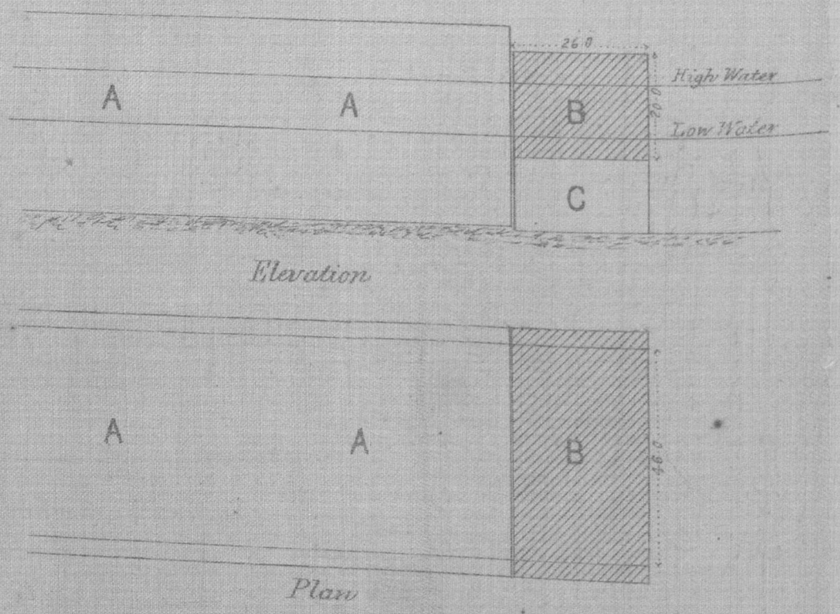
1*st*.—As to the propriety of the width of breakwater adopted at Madras.

2*nd*.—As to the necessity for any special protection by large stone of the surface of the rubble base beyond the walls of concrete blocks.

3. The determination of the proper width for a breakwater is one of those questions which cannot be based upon any definite data. It is seldom possible to ascertain the maximum height of the waves at any given site, and even where that is known there is no definite knowledge as to the relation between that height and the force which the heaviest waves may exert in any direction. Again, our knowledge is very imperfect as to the way in which the waves themselves are acted upon by the works intended to withstand them. Breakwaters of some forms act upon the waves on their first contact in such a way as to intensify their destructive force upon another portion of the work, and thus these works require to be more massive than would otherwise be necessary. Thus theory is almost entirely at fault in this question.

4. Practice and experience are not much more satisfactory than theory. There are numerous examples of damage by wave action, but these are with very few exceptions due to imperfections which are quite independent of the width of the whole work. The damage generally begins by the loosening of an individual block of stone or concrete. This forms the commencement of a breach which is widened by each successive wave and the work is destroyed in detail. Up to 1872 I do not think there is any case on record of a portion of pier or breakwater being moved as a whole mass by the force of the waves.

5. In December 1872, however, such a case occurred at Wick, in the north of Scotland. It is described in the Minutes of the Institution of Civil Engineers by Mr. David Stevenson, the Engineer of the work.



The above sketch roughly represents the work. A A is a pier of very massive masonry of the usual kind. The shaded portion B is a mass of concrete and masonry 26 feet long, 20 feet high, averaging 46 feet wide, and weighing 1,350 tons. During a heavy storm in December 1872 this mass was moved bodily from its position and deposited entire on the rubble inside the pier. After this protection had been removed the sea attacked the main body of the pier from the exposed end and destroyed it in detail in the usual manner for a length of 150 feet.

6. The pier was subsequently restored, and a new monolith placed at its end, of the same length and breadth as the former one, but secured by bolts to the portion C, making the whole mass 2,500 tons. This in its turn was carried away as its predecessor had been.

7. It will be easily understood that these extraordinary occurrences were matters of deep interest to Engineers connected with marine works. When the particulars became known to me the breakwater at Kurrachee, 24 feet wide, had been completed, and those at Madras of the same width had been sanctioned for execution. I carefully reviewed the bases of my own conclusions with this new fact before me, but I soon found that an indiscriminating application of the lesson would condemn, not only these works, but many others which have stood the test of many years' experience, and I ultimately saw no reason to alter my own designs.

8. An occurrence at Kurrachee which took place six months after the earlier one at Wick added another important fact to our data. It may be remembered that the first few hundred feet of the Manora breakwater suffered repeatedly from the failure of the foundations, which caused the displacement of several blocks. The most serious case of this involved the complete overthrow of the harbour side wall for a length of about 80 feet, leaving the sea side wall,

2552/2

consisting of a single row of blocks, standing 12 feet wide without any support. This stood perfectly throughout the remainder of the monsoon. This direct proof that 24 feet was more than enough at Kurrachee seemed to outweigh any indirect conclusion from the unprecedented occurrence at Wick.

9. I should mention that the force of sea at Wick is acknowledged to be most exceptional. A competent observer estimated the height of the waves at 42 feet from hollow to crest. The highest wave measured at Kurrachee was 15 feet. None have been recently measured at Madras, but a former Master Attendant, Captain Biden, estimated the maximum height at 10 feet. The most extreme alarmist therefore could hardly suggest the necessity of adopting the Wick proportions at either of these places.

10. I may state, however, that the only portions of the Madras work which can be subject to a destructive force similar in kind to that at Wick, though less in degree, are the pier heads. These for other reasons than stability will have dimensions considerably in excess of those at Wick. The bodies of the piers themselves will be 45 feet wide and this width will be further supported by a return towards the shore 75 feet long. It is therefore, I think, impossible to imagine them liable to any such damage.

11. There is, however, another effect of the sea in consequence of which some Engineers have considered it desirable to increase the width of breakwaters. There is no doubt that under a heavy sea the whole superstructure is subjected to a violent vibration, especially if it rests on a yielding foundation. This vibration would undoubtedly be lessened by increasing the total mass to be vibrated. But the necessity for this depends on the effect produced by the vibration. A mass of bonded masonry has its coherence entirely destroyed by such an action. The effect is like that of an earthquake. I have seen such work almost reduced to the appearance of ruins. But the effect on the unbonded work of the same dimensions at Kurrachee and Madras is very different. A heavy sea upon the last built lengths of either of those works has uniformly served to consolidate them and improve their condition, and the second sea had little or no effect. This, I consider, a most important result of our experience at Kurrachee and Madras, and I am happy to say that it is about to be further tested by the adoption of the unbonded system in other places by two of the most eminent Marine Engineers of the day, who are converts to it.

12. Such are the grounds upon which I consider that a narrower breakwater is justifiable at Madras than has been considered desirable in some other places. But I must repeat that there are no definite data upon which the proper width can be determined. An experience of ten years at Kurrachee and of five years at Madras without the slightest indication of weakness in a 24 feet breakwater has no doubt increased my expectation of its absolute stability, but in dealing with such a force as the sea I am not disposed to accept the invitation "to pronounce definitely my conviction" on the subject. When the long-threatened cyclone visits Madras it will no doubt teach a lesson. I will not speculate whether the alarmists will be taught that their fears were unfounded, or that a more or less unexpected weak point will be detected in the work. All I feel justified in saying at present is that I see no reason for thinking that the breakwaters would be strengthened by adding to their width, nor can I at present suggest any other way in which they can be made more secure.

13. With respect to the second question, that of covering the surface of the foreshore with large stones, I would remark that where such covering is resorted to, it is generally with the view of giving additional security to the foundations of the vertical sea face. But such security may be given in other ways.

1*st*.—By founding the walls at a great depth below water.

2*nd*.—By using blocks which have a great depth of bed and consequent hold in the wall.

3*rd*.—By reducing to a minimum the height of the wall above water, so that the waves may expend themselves over the top of the breakwater instead of falling, with accelerated force on their recoil, down the sea face.

14. In these particulars the design of the Madras breakwaters is carried further than in any other work with which I am acquainted, and I intended these particular features to be carried so far as to make us quite independent of the use of large rough stones. These are more than usually difficult to be got at Madras, and the execution of the work was materially simplified by dispensing with their use. The deep foundations may be viewed as a substitute for them, and I have every reason to be satisfied with the result.

15. In special cases, however, the principle is adopted at Madras. Thus near the commencement of the north pier, where the original depth of water did not admit of deep foundations, the shallow foundations are protected most effectually by a foreshore of large concrete blocks, and it is further intended, as an extra precaution to place some large blocks at the feet of the pier head walls, where the waves will rush round with great force, but for the ordinary face of the sea wall there is such an ample reserve of stability in the depth of foundation and the great length of the blocks, 14 feet, in the wall, that any special protection for the surface of the rubble is unnecessary.

No. 89-A. NOTE BY THE CHIEF ENGINEER.

IN G.O., 8th June 1881, No. 1436 W., Mr. Parkes was invited to express his opinion regarding the small section of the Madras Harbour piers as compared with that at Colombo. His reply, dated 4th August, has been forwarded under the despatch from the Secretary of State, No. 26, of the 26th idem.

2. The questions practically raised as put by Mr. Parkes were—

1*st*.—As to the propriety of the width of the breakwater adopted at Madras.

2*nd*.—As to the necessity for any special protection by large stone on the surface of the rubble base beyond the walls of concrete blocks.

3. Notwithstanding the great wind pressure observable in a severe cyclone at Madras, few who have witnessed the phenomena at such times would be disposed to question the general contention of Mr. Parkes that the height of the seas at such times as measured from summit to trough is very sensibly less than is the case in many other parts of the world, and particularly in places like Wick, exposed to the full swing of the Atlantic rollers.

4. The validity of the "unbonded system" of construction, confirmed as it has been by the effect as stated by Mr. Parkes that heavy seas upon the last built length of the piers "has uniformly served to consolidate them and improve their condition," seems also to be beyond controversy.

5. Still neither of these contentions quite meet the question raised by the Chief Engineer and the Master Attendant, which was that if an acknowledged high authority like Sir John Coode found it necessary to give a thickness of 34 feet to the section of his pier in deep water it was not clear why the thickness at Madras should have been reduced by 10 feet. Nor are the arguments adduced in support of the narrow section strengthened by the expression of Mr. Parkes's opinion, in paragraph 12, that he sees "no reason for thinking that the breakwaters would be strengthened by adding to their width."

6. From paragraph 13 to the end of his letter Mr. Parkes deals with the second question.

7. The Chief Engineer and the Master Attendant finding at Colombo that large masses of granite were being tipped over the seaward face of the work, so as to form an apron of indestructible material, considered the question of some similar expedient at Madras to be worthy of attention.

8. The outer portions of the rubble base at Madras is composed wholly or in large proportion of laterite, which if not exposed for long periods to the action of the weather in the form of detached boulders is held by Engineers experienced in its use to be an extremely unreliable material. Though possibly hard on the surface the interior may be quite soft, and for this reason has long been rejected as a building material, excepting for very minor structures.

9. It being desirable that the behaviour of this material, as applied in the rubble base, should be ascertained, the Superintendent of the Works, Mr. Thorowgood, was requested to state the facts. His observations are as follow:—

"The settlement of the two piers at their ends is at present (8th September 1881) from 1 foot 10 inches to 2 feet 4 inches from the time of setting the blocks till the titan has travelled over them. The greatest total settlement at the south pier has been 4 feet, and this brought the top level 9 inches too low; the greatest at the north pier has been 3 feet 6 inches.

"When the blocks have once made their great settlement there is never any subsequent depression beyond two or three inches. This is very marked.

"The places of greatest settlement are at 2,500 feet north pier, and at 3,000 and 3,800 feet south pier.

"The height of the rubble bank is now 27 feet before any blocks comes on it, so the greatest compression is about one-seventh" (of the total height).

10. In a subsequent note, dated 16th September, Mr. Thorowgood observes in regard to the laterite:—

"It has been one of the greatest difficulties in the construction, because we have had always to allow for the compression as the titan passed over.

"There is, however, absolutely no further settlement after this first and great subsidence. The laterite becomes covered all over with barnacles and shells, and the bases themselves approach a natural concrete in their structure."

11. When further asked for the reasons on which he had based the opinion expressed in the last quoted words, Mr. Thorowgood says in his note dated 3rd October—

"I judge of the state of the base by the result of deep excavations in laterite that has been a long time deposited, and which is very hard to shift."

12. Notwithstanding what has been said in favor of this material the fact remains that there has been a greater amount of total subsidence in the rubble base than would have been the case with a harder material like gneiss or granite, and this must leave a doubt as to whether such subsidence is not accompanied by the crushing of the material itself, further that the titan in passing over this forms a compacted surface of the crushed material while leaving the interior of the mass to a considerable extent in its original condition.

13. Whether this be a perfectly satisfactory condition for the future of the rubble bases time alone will show, but whatever the state of the interior, none of the material on either side outside the toe of the concrete blocks is now in any other condition than when first deposited.

14. It is with reference to this part of the work that the suggestion occurred of applying the same kind of protection which has been deemed essential at Colombo.

15. Mr. Parkes, after a clear exposition of the principles to be followed in affording security to walls constructed on bases of loose stone, states as his conclusion that "deep foundations (*i.e.*, sea walls carried down to a sufficient depth below the sea level —in the case of the Madras work, 24 feet) may be viewed as a substitute for "protection such as that now being employed at Colombo"—and adds that at Madras "there is such an ample reserve of stability in the depth of foundations, and the great length of the blocks, 14 feet, in the wall, that any special protection for the surface of the rubble is unnecessary."

16. Mr. Parkes is acknowledged to be such a high authority on Marine Works that the Government may well feel disposed to accept this definite expression of opinion as conclusive, yet it would certainly have been more satisfactory had the reasons assigned for this opinion borne more directly on the facts of the case, and particularly in reference to the comparatively soft quality of the material used for the rubble base, in reference to the comparatively soft quality of the material used for the rubble base.

17. Water, whether salt or fresh, acts on well ascertained laws, and one of these is that a mass of water in motion when coming in contact with a vertical object, whether it be a bridge pier or sea wall must find room for escape. The low sea walls as shown by Mr. Parkes, admits of this to a great extent by the simple process of the mass of water in the upper portions of each successive sea passing over the work. But for the lower portion not so vented there is no other escape than down the perpendicular face of the wall till it impinges directly on the foundation; and it entirely depends on the character of the material in the latter whether it is capable of standing the attack.

18. With bridge piers this action is well recognised by Engineers and provided against. As showing the effect of a downward scour of this character, the case of one of the great wells for the Sutlej Railway Bridge has been cited. Here the stream attacking this portion of the work, passed, it is said, down the face of the well, scouring the loose foundation out to a depth of some 80 feet, when the well fell forward *up stream*.

19. The question, it will be thus seen, is one of the capacity of the rubble base composed as it is of laterite to resist the down scour on occasions of extraordinarily high seas, and is not merely dependant on the depth of the base below the surface of the sea, or again of the manner in which the sea wall or pier has been constructed.

20. Should Mr. Parkes be perfectly satisfied that, notwithstanding all appearances to the contrary, the conditions have been fulfilled, there is really nothing more to be said on the question.

21. If Mr. Parkes prove right on this point he may justly claim to have executed a work on bolder principles than elsewhere; and as his work, judged by the length of the piers, will not have cost probably one half of that of Colombo, foot by foot of length, he will have every reason to be proud of the achievement and to claim as a distinct merit the comparative economy of his great work.

11th October 1881. (Signed) R. H. SANKEY, Colonel, R.E.,
Chief Engineer, P.W.D.

No. 89-B. From the Government of India, dated 22nd September 1881, No. 315 M.

No. 90. ORDER THEREON, 18th October 1881, No. 2552 W.

THE despatch from the Secretary of State read above gives cover to a report by the Engineer-in-Chief, Madras Harbour Works, on the subject of the construction of the Madras Harbour as compared with that at Colombo, an expression of opinion on certain points regarding which was called for in G.O., No. 1436 W., dated 8th June 1881, passed on a joint report by the Chief Engineer and Master Attendant after personal inspection of the latter works.

2. The Chief Engineer, Public Works Department, has in his note of the 11th October reviewed Mr. Parkes's observations on the questions raised as to the section given the Madras Breakwaters and as to the necessity for special protection to the rubble base on the most exposed faces of the work.

3. The Chief Engineer's remarks will be forwarded to Mr. Parkes for information, and the Government of India will be supplied with copies of the papers in compliance with their request, contained in their letter No. 315 M., dated 22nd September 1881.

(Here enter No. 2553 W., dated 18th October 1881.)

(True Extract.)

Major, R.E.,
Under Secy. to Govt., P.W.D.

To the Engineer-in-Chief, Madras Harbour Works.
" Superintendent, do. do.
" Marine Department.

E. J. S. T. Austin.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1881) Madras.

PUBLIC WORKS.

To

THE ENGINEER-IN-CHIEF, MADRAS
HARBOUR WORKS,

&c., &c., &c.

Dated October, 18*th*.

Issued

Rec'd. *Encl.*

G. O., 18th October 1881, No. 2552 W.

OCTOBER.
Nos. 89-90.

Madras Harbour.—Orders on Mr. Parkes's report on the construction of the — as compared with the Colombo Harbour.

2552/1

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 2553 W.

No. 91.

FROM

THE SECRETARY TO THE GOVERNMENT OF MADRAS,
Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
Public Works Department.

SIR,—I am directed to acknowledge the receipt of your letter, No. 315 M., dated 22nd September 1881, requesting to be furnished with a copy of Mr. Parkes's report, drawing a comparison between the Madras and Colombo Harbour Works; and in reply to forward a copy of G.O., No. 1436 W., dated 8th June 1881, with which is recorded a joint report by the Chief Engineer, Public Works Department, and the Master Attendant, Madras, made after personal inspection of the mode of construction at Colombo, the remarks contained in which elicited Mr. Parkes's observations now received through the Secretary of State. A copy of these, and of a further note by the Chief Engineer, Public Works Department, dated 11th October 1881, are also forwarded herewith.

I have the honor to be,
Sir,
Your most obedient servant,

Major, R.E.,
Under Secy. to Govt., P.W.D.

FORT ST. GEORGE,
18th October 1881.

Exd. S. T. Austin.
Spare Copies

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of [1881] Madras.

PUBLIC WORKS.

To

THE SECRETARY TO THE
GOVERNMENT OF INDIA.

Dated October, 18th.

Issued

Recd. *Encl.*

G. O., 18th October 1881, No. 2553 W.

OCTOBER.

No. 91.

FORWARDING Proceedings recording a joint report by the Chief Engineer, Public Works Department, and the Master Attendant, and a report by Mr. Parkes on the construction of the Madras Harbour as compared with the Colombo Harbour.

To the Hon'ble the Secretary
2553 W

For orders

I transmit herewith some Cases connected with the Madras Harbour works which require disposal

My note marked (A) deals with Mr Parkes's explanation as to the difference of Section between the Colombo & Madras breakwaters, and as the G of I have just now in their letter No 315 M of 22/9/81 called for a copy of Mr Parkes's report forthwith it will be well to send them with it. Copies of G.O. 18th June 1881 No 1430 W

and one of my former
note dated 11/10/81
— and also forward
Copy of the letter to
Mr Parker through the
S of S — ?

7/h (B)
// The next matter
relates to the District
of S.O. 28/5/81 No
1340 W to which
Mr Parker replied
in his letter of 18th July
forwarded under the
S of S despatch No 25
of 11th August 1881

The question here was
one purely connected
with the method of
construction employed
in placing the end block
of the north pier
These failed as put-
together on Mr Parker's
plans, were taken up
and have been refixed

in a manner which
has satisfied Mr
Thorowgood 25/A

Mr Parker is also satisfied
also satisfied and states
that in proposes to
lay large blocks of concrete
round the toe at the
corner so as to counter-
act any scour that
may attack the base
here

With these precautions
and the ties which Mr
Thorowgood is about
to introduce I have
no objection on sustainable
grounds to make, and
if Government desire the
correspondence may
now be "Recorded"

17/10/81. Ackt

The third file marked
(C) might be "Recorded"
also as although it
raises certain questions

which may eventually
call for considerable
expenditure with the
greatest disturbance
at certain periods within
the Harbour when even
anticipated circumstances
have not as yet been sufficiently
ascertained to admit of
decision.

Ptt

1613

India Office.
London. 25th August. 1881.

Public Works

No. 26.

H. 4. Augt 1881.

Sir,

Herewith is transmitted copy of a letter addressed (under cover to this Office) by Mr. Parkes to the Secretary to your Government in the Public Works Department, on the subject of the construction of the Madras Harbour, as compared with the Harbour which is now in course of construction at Colombo in Ceylon.

I have the honor to be,
Sir,
Your most obedient
humble Servant

His Excellency
The Honorable
The Governor in Council,
Fort Saint George.

No 7.

P. W. C. No 5609

Public Works

25th Augt 1881.

The

Secretary to Govt Fort St George

No 26

Rec'd 31st Augt

Time: 12.10.81. Rt. 15.10.81

Rec'd 15 Sept 81

Madras Harbour.

23. Abingdon Street

4th August 1881.

Sir

In the Government Order No. 1436 W. of the 8th June 1881, I am requested to offer such observations as I may desire on a Memorandum signed by the Master Attendant and the chief Engineer on the Harbour Works now in course of construction at Colombo from the designs of Sir John Coode.

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1° As to the propriety of the width of Breakwater adopted at Madras.

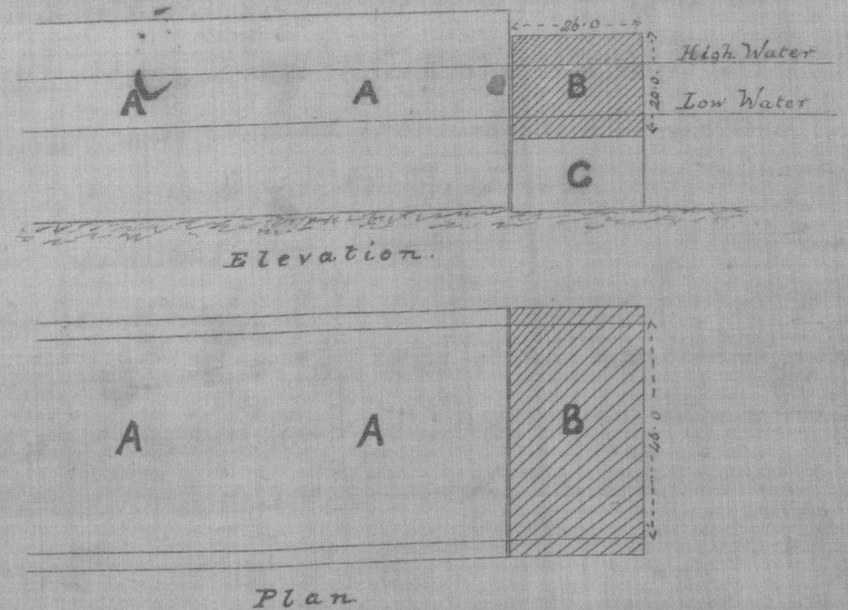
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The Secretary to Government.
Public Works Department.
Madras.

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5. In December 1872 however such a case occurred at Wick in the North of Scotland. It is described in the Minutes of the Institution of Civil Engineers by Mr David Stevenson the Engineer of the work.



Elevation.

Plan

The above sketch roughly represents the work. **AA** is a pier of very massive masonry of the usual kind. The shaded portion **B** is a mass of concrete and masonry 26 feet long 20 feet high averaging 46 feet wide and weighing 1350 tons During a heavy storm in December 1872 this mass was moved bodily from its position and deposited entire on the rubble inside the pier. After this protection had been removed the sea attacked the main body of the pier from the exposed end and destroyed it in detail in the usual manner for a length of 150 feet.

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There is no doubt that under a heavy sea the whole superstructure is subjected to a violent vibration, especially if it rests on a yielding foundation. This vibration would undoubtedly be lessened by increasing the total mass to be vibrated. But the necessity for this depends on the effect produced by the vibration. A mass of bonded masonry has its coherence entirely destroyed by such an action. The effect is like that of an earthquake. I have seen such work almost reduced to the appearance of ruins. But the effect on the unbonded work of the same dimensions at Kurrachee and Madras is very different. A heavy sea upon the last built lengths of either of those works has uniformly served to consolidate them and improve their condition, and the second sea had little or no effect. This I consider a most important result of our experience at Kurrachee and Madras, and I am happy to say that it is about to be further tested by the adoption of the unbonded system in other places by two of the most eminent marine Engineers of the day, who are converts to it.

12. Such are the grounds upon which I consider that a narrower breakwater is justifiable at Madras than has been considered desirable in some other places. But I must repeat that there are no definite data upon which the proper width can be determined. An experience of 10 years at Kurrachee, and of 5 years at Madras without the slightest indication of weakness

in a 24 feet breakwater has no doubt increased my expectation of its absolute stability, but in dealing with such a force as the sea I am not disposed to 'accept the invitation' to pronounce definitely my conviction' on the subject. When the long threatened cyclone visits Madras it will no doubt teach a lesson. I will not speculate whether the alarmists will be taught that their fears were unfounded, or that a more or less unexpected weak point will be detected in the work. All I feel justified in saying at present is that I see no reason for thinking that the breakwaters would be strengthened by adding to their width, nor can I at present suggest any other way in which they can be made more secure.

13. With respect to the second question, that of covering the surface of the foreshore with large stones, I would remark that where such covering is resorted to, it is generally with the view of giving additional security to the foundations of the vertical sea face. But such security may be given in other ways:

1st. By founding the walls at a great depth below water.

2nd. By using blocks which have a great depth of bed and consequent hold in the wall.

3rd. By reducing to a minimum the height of the wall above water, so that the waves may expend themselves over the top of the break water instead of falling,

2332
16

with accelerated force on their recoil, down the sea face.

14. In these particulars the design of the Madras Breakwaters is carried further than in any other work with which I am acquainted, and I intended these particular features to be carried so far as to make us quite independent of the use of large rough stones. These are more than usually difficult to be got at Madras, and the execution of the work was materially simplified by dispensing with their use. The deep foundations may be viewed as a substitute for them, and I have every reason to be satisfied with the result.

15. In special cases however, the principle is adopted at Madras. Thus near the commencement of the North Pier, where the original depth of water did not admit of deep foundations, the shallow foundations are protected most effectually by a foreshore of large concrete blocks, and it is further intended, as an extra precaution to place some large blocks at the feet of the Pier Head Walls, where the waves will rush round with great force, but for the ordinary face of the sea wall there is such an ample reserve of stability in the depth of foundation and the great length of the blocks, 14 feet, in the wall, that any special protection for the surface of the rubble is unnecessary.

2-23-2
19

I have the honor to be
Sir
Your most obedient Servant
W Parkes.

W. Dept.

P44

8 X 57
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Note by the Chief Engineer

In GO. 8th June 1881
No. 1436 W. Mr. Parkes was
invited to express his opinion
regarding the small section
of the Madras Harbour piers
as compared with that at
Columbo. His reply dated
4th August has been forwarded
under the Despatch from
the Secretary of State No.
26 of the 26th idem.

2. The questions practically
raised as put by Mr.
Parkes were:

1st

1st As to the propriety of the inditts of the Breakwater adopted at Madras.

2d As to the necessity for any special protection by large stone on the surface of the pubble base beyond the walls of Concrete blocks.

3. Notwithstanding the great wind pressure observable in a severe cyclone at Madras, few who have witnessed the phenomena at such times would be disposed to question the general contention of Mr. Parke that, the height of the seas at such times so measured from summit to trough is very sensibly less than is the case in many other parts of the world, and particularly in places like Wick exposed to the full swing of the Atlantic rollers.

4. The stability of the "unbonded system" of Construction, confirmed as it has been by the effect as stated by Mr. Parkes that heavy seas upon the last built length of the piers "has uniformly served "to consolidate them and "improve their condition", seems also to be beyond Controversy.

5 Still neither of these

contentions quite meet the
question raised by the
Chief Engineers and the
Master Attendant & which
was that if an acknow-
ledged high authority
like Sir John Coode
found it necessary to
give a thickness of 34
feet to the section of his
pier in deep water it
was not clear why the
thickness at Madras
should have been reduced
by 10 feet. Nor are
the arguments adduced
in support of the narrow
section strengthened by
the expression of Mr. Parkes

opinion in para 12
that he sees no reason
for thinking that the
breakwaters would be
strengthened by adding
to their width."

6. From para 13 to the
end of his letter Mr.
Parkes deals with the 2nd
question.

7. The Chief Engineer
and the Master Attendant
finding at Colombo that
large masses of granite
were being tipped over the
seaward face of the
work so as to form

of indestructible
material, considered the
question of some similar
expedient at Madras
to be worthy of attention.

8 The outer portions
of the rubble base at
Madras is composed
wholly or in large
proportion of laterite
which if not exposed
for long periods to the
action of the weather
in the form of
detached boulders is
held by

Vide 53

Engineers experienced in
its use to be an extremely
unreliable material -
though possibly hard
on the surface the interior
may be quite soft and
for this reason has been long
rejected as a building
material, excepting for
very minor structures
9. It being desirable that
the behaviour of this
material as applied in
the rubble base should
be ascertained the Superintendent of the work
Mr Shenvgaod was requested to state the
~~Contents~~ facts - His observations are as follows
"The settlement of the
"two piers at their ends
"is at present (8th September 87)
"from 1'-10" to 2'-4" from
"the time of setting the
"blocks like the labour
"has travelled over them
"the greatest total
"settlement at the South

pier has been 4 feet,
"and this brought the
"top level 9 inches low
"low the greatest at the
"North pier has been 3' 6"
"When the blocks have
"been made their great set-
"tlement there is never any
"subsequent depression be-
"yond two or three inches
"This is very marked"
"The places of greatest
"settlement are at 2600 feet
"North Pier, and at 3000 ft
"3800 feet South Pier"
"The height of the
"rubble backs is now 27
"feet before any block
"comes on it so the great-
"est compression is about
"one seventh." (of the total height)
"In a subsequent note
dated 8th September
Mr Shorrocks ob-
serves in regard to the
Caterites

"It has been one of the
"greatest difficulties in
"the Construction be-
"cause we have had
always to allow for
the Compression as the

"piers passed over.
"There is however also
"likely no further settle-
"ment after this first and
"great subsidence. The
"Caterite becomes covered
"all over with barnacles &
"shells, and the bases then
"selves approach a natu-
"ral concrete in their struc-
-ture."

"When further asked for
the reasons on which
he had based this
opinion expressed in
the last Quoted words
Mr Shorrocks says
in his note dated 3rd
October.

"I judge of the state
"of the bases by the re-
"sult of deep excavations
"in Caterite that has
"been a long time de-
"posited, and which
"is very hard to shift"
"Notwithstanding what
has been said in fa-
-vour of this material

the fact remains that there has been a great amount of total subsidence in the rubble base than would have been the case with a harder material like gneiss or granite, and this must leave a doubt as to whether such subsidence is not accompanied by the crushing of the material itself - for then that the titanic pressing over this found a

Compacted surface of the crushed material

while leaving the interior of the mass to a considerable extent in its original condition

B. whether this be a perfectly satisfactory Condition for the future of the rubble base as time alone will show, but whatever the state of the interior, none of the material on either side outside the toe of the Concrete block is now

2nd/28

in any other condition than when first deposited

14. It is with reference to this part of the work that the suggestion occurred of applying the same kind of protection which has been deemed essential at Colombo.

15. Mr Parkes applies a clear exposition of the principles to be followed in affording security to walls constructed on basis of loose stone, stakes as his conclusion that deep foundations (i.e. low walls carried down to sufficient depth below the sea

level - in the case of the Madras Bank, 24 feet) may be viewed as a substitute for "protection such as that now being employed at Colombo" — and adds that at Madras "there is such an ample reserve of stability in the depth of foundations, and the great length of the blocks, 14 feet, in the wall, that any special protection for the surface of the rubble is unnecessary".

6. Mr. Parkes is understood to be such a

high authority on Marine works that the Government may well feel disposed to accept this definite expression of opinion as conclusive, yet it would certainly have been more satisfactory had the persons assigned for this opinion borne more directly on the facts of the case, and particularly in reference to the comparatively low quality of the material used for the rubble base.

7. Water whether salt or fresh acts on well

ascertained law
and one of these is that
a mass of water in
motion when coming
in contact with a
vertical object whether
it be a bridge pier,
or sea wall must
find room for escape.
The law as well
as shown by Mr. Parker
admits of this to a
great extent by the
simple process of the
mass of water in
the upper portion
of each successive
sea passing over
the work. But for the

lower portion not so
vented there is no other
escape than down
the perpendicular face
of the wall till it
impinges directly on
the foundation; and is
entirely depends on the
character of the ma-
terial in the latter
whether it is capable
of standing the attack.

18. With bridge piers
this action is well
recognised by Engineers
and provided against.
As showing the effect
of a downward stream
of this character, the
case of one of the

great walls for the
Dudley Railway Bridge
has been cited. Here
the stream attacking
this portion of the
work, passed it is to
said, down the face
of the wall, & down
the loose foundation
out to a depth of 20
20 feet when the wall
fell forward upon Stre
ng. The question is w
he then seen is one
of the capacity of
rubble base compos
as it is of Laberin
to resist the down
thrust on occasion

[illegible]

of extraordinary high
seas, and is not merely
dependant on the depth
of the base below the
surface of the sea,
or again of the manner
in which the sea wall
or pier has been con=
=structed.

2. Should Mr. Parkes
be perfectly satisfied
that, notwithstanding
all appearances to the
contrary, the conditions
have been fulfilled
there is really nothing
more to be said on
the question.

3. If Mr. Parkes prove
right on this point

File (A)

he may justly claim to have executed a work on bolder principles than elsewhere; and as his work judged by the length of the pier no will not have cost probably one half of that of Colombo, took by foot of length, he will have every reason to be proud of the achievement and to claim as a distinct merit the comparative economy of his great work.

A. M. Lindsay
Col R.E.

Cash 10 11/10/81 Cmi 12. 10. 0 Rl 10 10 0 Rs 1.17.10

All communications should be addressed to the Secretary.

No. 315 M.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

Civil Works
Miscellaneous.

2 Sr/29

To, The Secy: to the Govt: of Madras.
P. W. Deptt.

Simla, 22nd September 1881.

Sir,

I am directed to request that, with the permission of His Excellency the Governor the Govt: of India may be furnished with a copy of Mr. Parkes's report, drawing a comparison between the Madras and Colombo harbour works, which is referred to in the Secretary of State's despatch to the Madras Govt, No. 26 P. W. dated the 25th August 1881. —

I

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

Wm. Lo. Cumming Major R.E.
Offg. Asstt. Secy. to the Govt. of India.

S. W.

G.P. No. 1436W. dt 8th June 1881.
2077 W — 20-8-81

O.L.S. 1/10. Cne. 12-10-81 RE

A
From orders

No. 2552 W PUBLIC WORKS DEPARTMENT.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 18th Octr 1881

Read the following :—

Despatch from the Secretary of State for India (Rd. 28/12/81) (No. 26 dated 25th August 81)

Note by the Chief Engr. PW Dept. (dated 11th October 81.)

From the Govt of India (No. 315 M dated 22 Sept 1881)

The despatch from the Secretary of State read above gives cover to a report by the Engineer in Chief, Madras Harbour Works on the subject of the construction of the Madras Harbour as compared with that at Colombo, an expression of opinion

R.S.

on certain points re-
=specting which was
called for in G.O. No: 1436
of 8th June 1881, passed
on a joint report by
the Chief Engineer and
Master Attendant,
after personal inspec
=tion of the latter
works.

The Chief Engineer
Bo. dept. has in his
letter of the 11th October,
reviewed Mr. Parkes
observations on the
questions raised as
to the Section given
the Madras Breakwaters
and as to the necessity

927

for special protection
to the rubble base on the
~~seaward side of the~~
most exposed faces of
~~Concrete blocks~~
the work

The Chief Engineers
remarks, will be for-
=warded to Mr Parkes
for information, and
the Govt. of India will
be supplied with
copies of the papers
in compliance with
their request contained
in their letter No: 315 Bn
of 22nd Sept. 1881.

Engineer-in-Chief
Railways.
Inspr. Railways
Marine dept.

(Ry) No 2553 W of 18 Oct. 81
To the Secy. to the
Govt. of India
P.W. dept.

Sir, I am directed to

acknowledge the receipt of your letter No 315 Da 22nd Sept. 81, requesting to be furnished with a copy of Mr. Parkes's re= =port, drawing a Com= =parison between the Madras and Colombo Harbour Works; and in reply to forward a Copy of G.G. No: 1436 dated 8th inst, with which is recorded a joint report by the Chief Engineer, P.W. Dept. and the Master Attendant Madras, made after personal inspection of the mode of con= =struction at Colombo, the remarks contained

in which obviate Mr. Parkes observations now received through the Secretary of State. A Copy of these, and of a further note by the Chief Engineer, P.W. Dept. of 11th Oct. 81, are also forwarded herewith.

15-10-81

C. P. 5538
5609.

Govt. of [1881] Madras.

PUBLIC WORKS.

To

Dated

Issued

Recd.

Encl.

G. O., 15th Oct 1881, No. 2552 W
2553 W

Nos. 8969

Madras Harbour. Ord on Mr. Parkes' report on construction of the — as compared with the Colombo Harbour.

Sabd in Receipt Regr.

Forwarding for record a joint report by the Chief Engr. Dept. & the Master Attendt, and a report by Mr. Parkes on the construction of the Madras Harbour as compared with the Colombo Harbour.