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TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

DEPARTMENT

Public Works Dept.

No.
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d or roughly handled.

6. The conclusion which I draw from the report and the further information given in Mr. Thorowgood's weekly letters is, that he and his staff have made a very creditable attempt to master the difficulty, and that the attempt though unsuccessful was well worth making. The difficulty applies to only one feature of the work, which though useful is not essential, and I have no doubt that by a modification of this feature the difficulty may be for the future materially reduced, if not altogether avoided.

7. The whole difficulty has been confined to the operation of preparing a level foundation for the lowest course of blocks at a depth of about 16 feet below low water. The base of the work is a bank of rubble stone previously deposited from boats, but this bank has sunk or been buried nearly its whole depth into the sand, so that its top is almost level with the natural bottom of the sea. That natural bottom itself is subject to changes of level under the influence of the waves, but we are as yet unable to trace the immediate causes of those changes. Previous to April the tendency appeared to be towards deepening, and the rubble bank consequently kept clear. Then however a phase of temporary shoaling set in and the rubble bank was buried.

8. This state of things continued with temporary intervals of clearance and occasional indications of change sufficient to encourage the hope of a permanent improvement up to the end of September, and even as I was informed by telegram up to the end of October, so that some doubt is now thrown on the reasonable anticipation that the change of monsoon would bring a change of conditions.

9. But it will be observed that the difficulty was only in making a bed for the blocks at 16 feet below low water. The same difficulty would not be felt in bedding the blocks at 8 or 9 feet below water, at which depth they would be above the influence of the shifting sand, though other difficulties would be introduced which would have to be met in a different way. These latter difficulties have however already been met and overcome in the greater part, of the portion already built, which was founded at about that level.

10. It seems obvious then that we must now go back to that system with such evils as are inherent to it, and carry out the work with a greater height of rubble base and only two instead of three courses of blocks, until a sufficient depth of water is reached to place the foundations of the blocks above the ordinary fluctuations of the level of the sand.

11. The evils which would be avoided by adopting a deeper foundation, but to which it appears we must return for a time are these:—In a depth of 8 or 9 feet a diver cannot work except in an almost perfect calm, as the least swell is converted into a breaking wave which carries him off his legs. The blocks must therefore be set with only such levelling of the foundations as can be accomplished without the aid of divers, and the work will consequently not be so regular, though it may be made sufficiently so for stability.

12. Again, at the depth of 8 or 9 feet rubble stone is acted on by heavy seas, and the work must be protected by a foreshore and by additional concrete blocks laid upon it to break the force of the sea.

13. Further, though blocks can be lowered into place in a state of the sea which does not permit divers to descend, there is more interruption to work in 8 feet without divers, than in 16 feet with divers, so that progress would not be so rapid.

14. These evils were certainly worth an attempt to avoid. The attempt has brought us face to face with a greater difficulty, and we can only retrace our steps for a time. It may be carried away, and then the blocks may be set at the deeper level. If so had been hoped, be as originally intended. If not the plan must be modified, as I have described, for a distance of about 300 feet, after which the depth will be sufficient to allow of the deeper foundations being laid without being within the range of fluctuation to which the sand is liable. I have already made the suggestion to Mr. Thorowgood. He must decide as to the proper time for adopting it.

15. I should mention that this way out of the difficulty which on a retrospect looks, and in principle is so simple, could not have been adopted hitherto, as it involves the use of a considerable additional quantity of rubble stone, and this it would have been impossible to obtain during the pressure of the famine traffic on the Madras Railway. It is to be hoped however that this obstacle is now in course of removal.

16. Although so little advance of the pier seaward has been effected, a good deal has been done in the way of protecting the portion already built. It will be remembered that the heavy sea in the cyclone of the 16th May acted on the comparatively shallow foundation of a portion of the built work and caused a slight settlement. This portion has since been protected in the way that had previously been determined on. A bank of laterite rubble has been formed against the north face of the pier, and on the top of this two rows of concrete blocks, 6 feet cube, have been made. As the sea washes down the slope of the rubble bank the blocks will fall and form a barrier against further encroachment. This plan of protection will have to be continued till the intended deep foundation can be carried out.

17. In my last report I stated that I believed the sand difficulty to be only a local and temporary one. The further observations reported to me all tend to confirm this conclusion. There is nothing to support the idea that the fluctuations of level are connected with any along-shore movement which would be interrupted by the solid piers of the Harbour and cause a permanent deposit. The currents of which so much has been said are proved by repeated observations to be as a rule insensible a few feet below the surface, and cannot therefore act on the bottom, and moreover it is obvious that if the sand which has troubled us were current-borne it could not have accumulated at the end of an abrupt projection like the north pier. That would have been the site of increased scour, and of the formation of a pit rather than a heap. It is probable, though it is impossible to verify the supposition by direct observation, that the occasional clearances are due to the surface current being temporarily forced by some cause as yet untraced to a greater depth than usual, so as to act on the sand. Then as soon as the temporary acceleration of the current ceases the sand is brought back by the action of the waves. Observations have been made of the action on the bottom at different depths out to 7 fathoms. These prove the existence of wave action carrying sand in directions transverse to the shore, though in deep water the quantities are very small, but they absolutely negative the idea of any current action on the bottom parallel with the shore.

18. Though much disappointed and annoyed at the delay in the work caused by this sand difficulty, I have never had any anxiety as to its ultimately being overcome. On another point however I confess to have felt considerable anxiety, but this has been removed by Mr. Thorowgood's observations. The repeated reports of delay by the state of the sea had made me fear that I had over-estimated the number of days in the year during which work could be carried on. Mr. Thorowgood however informs me that the surf which prevented his work was in a large proportion of instances produced by the breaking of the waves on the very sand bank which he was endeavoring to cut through. While his men were unable to work on the shoal on account of the breakers, the swell in deeper water was not enough to have interfered with his operations if he could have got past the sand. He judges from his twelve months' experience that my estimate of 200 working days in a year is a fair one. If so, a rate of progress of 1,500 feet per annum on each pier may well be expected as soon as the difficulties near shore are past.

19. The progress at the south pier is much more satisfactory than that at the north. The "surf bank" may now be said to be completed so far as its extension seaward is concerned, and the further advance of the pier will be made by concrete blocks. The end of the rubble bank was at the date of my last advice being protected by a number of 6-ton concrete blocks which had been prepared for the purpose. These are set by a light portable crane, and will form a substantial starting point for the more ponderous Titan, which will set the 27-ton blocks in advance of the smaller ones. The Titan is now ready for the work.

20. This south surf bank has been so far carried out very successfully and economically, and there has been no loss of stone by dispersion. Some dispersion indeed would be a convenience to make a base for building on below water, but if it do not take place the base will have to be formed in some other way.

21. It will be seen by the plan that the south bank now projects from the shore about as far as the point B on the north bank where the block work commences. This invites a comparison between the two banks, which however if made from the official figures without explanation would be misleading.

22. The quantity of rubble stone in the south bank is 30,583 tons. That in the north is 93,650. It is this difference which I wish to explain. Although the point B is shown as the termination of the north surf bank, the 93,650 tons were employed for much more than the actual bank between that point and the shore. The point B was originally reached early in June 1876, with an expenditure of about 51,000 tons of stone, and at that time was in a state corresponding to that in which the south bank is now.

23. The difference of 30,000 and 54,000 for the same length of bank is due to two causes. First, the north bank was originally carried out of much larger dimensions than the south bank, or than was necessary, and therein the south bank is superior, for even if a greater height and width be ultimately required it will be more economical to add to it afterwards. But another reason is that the north bank having been commenced earlier in the year (in January instead of April) it was more in advance of the advancing beach, and so was generally in deeper water. So far as can be judged no sand ever passed the end of the north bank while in progress, while in the case of the south bank sufficient passed to add to the beach between the two piers an average width of 80 feet before the end of June. Since then however there has been very little advance.

24. These two causes account for the greater economy in stone in the south bank as compared with the first formation of the north bank as far as the point B, but there was in the north bank a subsequent deposit of about 46,000 tons, for which there is at first sight nothing to

August.—August commenced with similar weather until the 9th, when the water was calmer. The sand now was only one foot deep close to the blocks, and as I was becoming very impatient I ordered the idea of the abutment to be abandoned and that three more ordinary courses should be set. At this time two of my best divers were laid up with dysentery and fever, and on the 15th the third was sent to hospital suffering from a severe jelly-fish sting.

From this time to the end of August the movements of the sand became so capricious that nothing could be done. At times the accumulation was only 2 feet deep, and in three days it would go through variations to 4, 5, 7, and even 8 feet deep, and then disappear almost entirely for a day. The usual state of affairs was however for it to be about 4 feet deep close to the blocks and to be 7 feet deep 30 feet off. The sea was constantly liable to break with great force on the end of the pier, the sand bank in advance causing the rolling surf to become a crested wave.

September.—With September there came no improvement and the sand remained 6 to 8 feet deep close to the block work.

On the 6th I took a section over the base to within as near a distance of the pier as a catamaran could go. This section showed that close to the blocks there was 8 feet of sand, and that at 50 feet off the laterite was almost clear. The sea all this time broke so heavily at the pier end that no work could have been carried on.

From the 6th to the 11th the sand appeared to be gradually decreasing, but still the sea broke heavily. On the 12th however the caisson was sunk once more and the divers started to work as well as the sea would allow them. On the 17th three blocks were set, the lowest being in the caisson.

The caisson was then shifted to the north row of blocks, and divers commenced to take the sand out, aided by one of Bull's patent dredgers which did good service.

On the 19th, 20th, and 21st the sea was so heavy that nothing could be done and the question arose as to whether the Titan should not be run back. It was determined however that this was not necessary.

The sand had now buried the caisson three feet deep, and accumulated as badly as ever. On the 22nd I ordered that one desperate effort should be made to set one set of blocks (the north row) as the sand had gone down to 4 feet deep, and by working till nearly dark at great risk to the divers (one of whom got his leg hurt by the swell) three blocks were at length set. The bottom block of these three was set on eighteen inches of sand in the caisson, and it never reached a satisfactory bed.

From this date to the end of the month the sand returned worse than ever, and on the 29th the depth was not less than 7 feet anywhere on the base, the sea at times constantly breaking with violence on this sand.

MADRAS,
6th October 1877.

(Signed) F. N. THOROWGOOD,
Superintendent, Madras Harbour Works.

No. 134-B. ORDER THEREON, 15th January 1878, No. 255-A W.

ORDERED that the following telegram be sent:—

"Sea still prevents sufficient soundings to decide effect of monsoon on bottom. Sand partially swept from front of north groin. Sand accretion above water undiminished inside or outside Harbour although position slightly changed. Block setting progressing at both groins more favorably."

(True Extract.)

(Signed) E. A. FOORD, Colonel, R.E.,
Secretary to Government, P.W.D.

To the Superintendent, Madras Harbour Works.
Marine Department.

E. J. S. T. Austin.

By C. J. S.

show. The bank was however in the months of July, August and September 1876 advanced about 250 feet further, and this portion was washed down by the sea, the results being, first, an excellent base on which the first 250 feet of the block work was built, and, second, a large accumulation on the north side of the bank forming a wide foreshore very necessary for the protection of that side from the seas to which it will be permanently exposed. No protection of this kind has yet been provided for the south bank and indeed it will require less, for as the plan shows a less length of face is exposed to the north, and that only till the Harbour Works themselves give shelter. The sand accumulation provides protection on the south side which would otherwise be permanently exposed.

25. These considerations will show that the difference of cost of the two surf banks is not to be represented by the difference in the quantity of stone debited to them in the official accounts. Still Mr. Thompson appears to have made excellent use of the experience gained in the north bank to effect further economies in the quantity of stone, and as the cost of the north bank was considerably under my estimate, that of the south bank will be more so. It will have a further advantage in the matter of cost from the fact that owing to the keen competition of native contractors the work was let at low remunerative rates, a cause of economy which it is not desirable should continue.

26. The plan shows very clearly the effect of the south-west monsoon in accumulating sand on the south sides of the piers, which at the date of the plan was about at its maximum. During the ensuing north-east monsoon it will be cut away and to the south of the south pier, the old line of coast will probably be nearly if not quite restored. The portion however which has accumulated between the piers is permanently imprisoned, though it will be cut away from the northern half and deposited in the southern half of the beach within the harbour limits.

27. A total area of about 14 acres has been permanently added to the foreshore of the beach between the piers by the two monsoons of 1876 and 1877, of which 5½ acres are due to that of the present year. The advance of both piers will prevent any further change in the total quantity, though the form of the coast line may change with the seasons.

28. Although I could have wished that at least the addition of the last 5½ acres had been prevented by the earlier commencement of the south surf bank, I do not at all concur with those who consider a much rate increase to the foreshore between the piers as an evil. On the contrary, I believe the grounds thus gained will prove to be of great value to the trade of the port, as indeed it has already proved to be during the exceptional crowd of grain traffic for the last 12 months. A convenient site for the temporary storage of inward and outward cargoes is made more necessary by the rapid system of discharging and shipping by steamers. In some form or other this must have been provided, if it had not been provided by the natural action of the monsoons.

29. The preliminary works may now be said to be complete. The railway along the beach between the two piers is now in use, though as it passes through the crowd of grain traffic there is as little as possible done upon it for the present. The south block ground is also complete, and is nearly filled with blocks. In all about 700 blocks are ready to be put in place. The only department of the work not in operation is the deposit of rubble base by the hopper barges. There cannot be brought into action till a deep water berth has been formed for them by a further advance of the north pier, and even if this had been ready, stone could not have been conveyed to them on account of the loading traffic on the Madras Railway.

30. On the whole I think I may admit that though the want of progress in the north pier is disappointing there is no ground for discouragement. The reasons given for the delay are sufficient, and the means of preventing an indefinite continuance of the evil are obvious. But the works could have been carried on at all in the very midst of the unexampled disturbance of ordinary business by the former repairs, and I think, a matter for remark, and I may state that although the works actually in operation were wonderfully little retarded by that cause, yet that its existence did really have fully justified the freedom of the Superintendent in various other arrangements.

31. I would request that a copy of this Report be forwarded to the Government of Madras, for their information.

Copy of Report to the Engineer-in-Chief on the causes of delay in the progress of work on the North Pier since March 31st, 1877.

March, 1877.—The work of block setting on the north pier had gone on satisfactorily up to the end of March, but on the 31st March the diver who was at work preparing the rubble base reported that an accumulation of sand had appeared at the pier end and covered the rubble base to a depth of about 2 feet.

April.—On the first five days in April the sea and surf were so heavy, with a fresh E.N.E. wind blowing, that no submarine work could be attempted, but on the 6th April diving was resumed, and it was then found that the accumulation above referred to had disappeared leaving the rubble base clear, so that on the 6th and 7th April twelve blocks (or two complete courses) were properly set.

On the following six days the sea again was rough, and at times it broke heavily outside the block work, the waves coming over the pier end. From soundings taken from the Titan crane it now became evident that the sand had returned and that this was the cause of the broken water. One attempt at diving was made and this only served to prove that the sand had come back to a depth of about 4 feet. On the 18th I reported this new difficulty of the sand to Government (in order that the delay might be accounted for at an early date), and from the 18th to the 23rd all the diving force that could be mustered was put on with the intention of trying to remove the sand by excavation. But this proved useless.

I then stopped the diving and took the boatmen away for surveying purposes. The longitudinal section taken on April 25th showed that at 20 feet from the block work eastward the sand was 6 feet deep, and the rubble base was wholly covered to a depth of from 3 to 6 feet. Cross sections were also taken, and these showed that the heap of sand did not extend very far north and south, I therefore ordered that one more vigorous attempt be made with divers working a double shift. (I was met here by a slight difficulty which only lasted one day, viz., the divers refusing to work two shifts.)

The method of working was to have an iron box holding about 3rd cube yard lowered by the Titan, the divers then filled this and it was hauled up and emptied. Four wagon loads of sand and silt were removed in one day by this means, but the foundation for one block could not be prepared. It was at this time that I resolved to try a caisson* as the above method of working was a failure.

May.—Up to the 9th May the sea continued to break heavily on the sand bank and thus prevented work from being even attempted. On the 9th the water was more smooth and I sent a diver down who reported an increase in the accumulation. On the 12th May the caisson was ready, and it was lowered successfully down on the 14th. Two divers at a time worked inside it and they quickly got through the sand and cleared the rubble base.

After this date the weather changed and became violent, the cyclonic storm of the 16th and 17th upsetting all work for many days. When the weather moderated sufficiently to allow a dive to descend it was found that both the sand and the caisson had disappeared. The caisson was never found again. The sand however returned in one day, the wind having got into the southward again and thus prevented any work being done during the few remaining days of the month.

June.—From the 1st to the 12th June the sand kept on shifting its position and its depth was constantly varying. Sometimes it was close to the blocks and at other times the base would be almost clear at the blocks, but the sand would be in a heap about 20 feet away to the eastward. On the 13th a section was taken along the base which showed that diving could be tried with advantage as there was no sand within 7 feet of the blocks. Consequently on days when the sea was smooth work was resumed, and by the 21st three courses of blocks had been set, though somewhat roughly. From the 21st to the end of the month all work at the pier end was stopped by the sea breaking over the end of the pier.

July.—I had now determined that if block setting could be carried on I would have the abutment of the pier set, and so correct an increasing error in the batter of the block work. (The latter was about 1 foot 6 inches too much in a height of 3 blocks.)

July began rather favorably, the sand keeping away from the pier end, but still remaining in a heap about 30 feet off. A second and stronger caisson† was now ready in case the sand should return which it did on the 4th July, and was spread over the base to a depth of about six inches. On the 5th and subsequent days this depth of six inches increased to more than a foot. The caisson however was ready and hopes were entertained of being able by means of it to level the bed for the abutment in small portions at a time.

However from the 12th July the sea was very rough and no work could be done, and although the general appearance and state of the sea during the rest of the month was smooth, yet at intervals of about seven or eight minutes the surf would break on the sand heap and come crashing over the pier end with such force as would carry a man off his legs. This state of things continued to the end of the month.

* This caisson consisted of a kind of frame 4 feet high, made of wrought iron plates, which enclosed a space of 14 feet by 7 feet, within which the divers could excavate the sand.

† This caisson is only 3 feet deep.

(Signed) W. PARKES.

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3. Certainly they hoped that before another quarter had elapsed the difficulty would either have disappeared or have been overcome but I am again compelled to report a disappointment in this respect.

4. I think however that a satisfactory explanation of the delay may be given and at the same time an assurance that we shall now be enabled to adopt a course which will prevent its continuance in the North Pier or its repetition in the South Pier ⁱⁿ which we shall probably have to meet similar conditions.

5. With a view to enable me to form an opinion upon the whole case I requested Mr. Thorowgood to send me a full report of his proceedings in endeavouring to advance the North Pier since the sand first appeared on

on the 31 March. I append a copy of this report which I think will be found to be of interest.

6. The conclusion which I draw from the report and the further information given in Mr. Thorowgood's weekly letters is that he and his staff have made a very creditable attempt to master the difficulty, and that the attempt though unsuccessful was well worth making. The difficulty applies to only one feature of the work, which though useful is not essential, and I have no doubt that by a modification of this feature the difficulty may be for the future materially reduced, if not altogether avoided.

7. The whole difficulty has been confined to the operation of preparing a level foundation for the lowest course of blocks at a depth of about 16 feet below Low Water. The base of the Work is

in the greater part, of the portion already built, which was founded at about that level.

10. It seems obvious then that we must now go back to that system with such evils as are inherent to it, and carry out the work with a greater height of rubble base and only two instead of three courses of blocks, until a sufficient depth of water is reached to place the foundations of the blocks above the ordinary fluctuations of the level of the sand.

11. The evils which would be avoided by adopting a deeper foundation but to which it appears we must return for a time are these. In a depth of 8 or 9 feet a diver cannot work except in an almost perfect

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half of the beach within the
harbour limits.

27. A total area of about
 $\frac{1}{4}$ Acres has been permanently
added to the foreshore of the beach
between the Piers by the two monsoons
of 1876 and 1877 - of which $\frac{5}{12}$ Acres
are due to that of the present year.

The

17/12
The advance of both Piers will prevent
any further change in the total
quantity though the form of the
Coast line may change with the
seasons.

28. Although I could have
wished that at least the addition
of the last $\frac{5}{12}$ Acres had been prevented
by the earlier commencement of the
South Pier Bank, I do not at all
concur with those who consider
a moderate increase to the
foreshore between the Piers as an
evil. On the contrary, I believe
the ground thus gained will
prove to be of great value to the
trade of the Port, as indeed it has
already proved to be during the
exceptional crowd of grain
traffic for the last 12 months.
A convenient site for the temporary
storage of inward and outward
Cargoes is made more necessary
by the rapid system of discharging
and

and shipping by Steamers. In
consequence of other this must have
been provided, if it had not been
provided by the natural action of
the monsoons.

29. The preliminary works
may now be said to be complete.
The Railway along the Beach between
the two Piers is now in use though
as it passes through the Crowd of
grain traffic, there is as little
as possible carried upon it for the
present. The North Block ground
is also complete, and is nearly
filled with blocks. In all about
700 blocks are ready to be put
in place. The only department
of the Work not in operation is
the deposit of rubble base by the
Hopper barges. These cannot
be brought into action till a
deep water berth has been
formed.

formed for them by a further
advance of the North Pier, and even
if this had been ready, stone could
not have been conveyed to them
on account of the famine traffic
on the Madras Railway.

30. On the whole I think I
may submit that though the
want of progress in the North Pier
is disappointing there is no
ground for discouragement.
The reasons given for the delay
are sufficient and the means
of preventing an indefinite
continuance of the evil are obvious.
That the Works could have been
carried on at all in the very
midst of the unexampled
disturbance of all ordinary
business by the famine requirements
is I think a matter for remark
and I may state that although

the Works actually in operation were wonderfully little retarded by that cause, yet that its existence did ^{really} materially restrict the freedom of the Superintendent in various collateral & arrangements.

31. I would request that a Copy of this Report be forwarded to the Government of Madras for their information.

I have &c

S^d W. Port Res.

(Copy)

Madras Harbour Works

Special Report to the Engineer-in-Chief on the causes of delay in the progress of work on the North Pier since March 31st 1877.

March 1877. The work of block setting on the North Pier had gone on satisfactorily up to the end of March, but on the 31st March the diver who was at work preparing the rubble base for the foundation course reported that an accumulation of sand had appeared at the pier end which covered the rubble base to a depth of about 2 feet.

April. On the first five days in April the sea and surf were so heavy, with a fresh E.N.E. wind blowing that no submarine work could be attempted, but on the 6th April diving was resumed, and it was then found that the accumulation above referred to had disappeared leaving the rubble base clear, so that on the 6th and 7th

April

April twelve blocks (or two complete courses) were properly set.

On the following 6 days the sea again was rough, and at times it broke heavily outside the block work, the waves coming over the pier end. From soundings taken from the Titan crane it now became evident that the sand had returned and that this was the cause of the broken water. One attempt at diving was made and this only served to prove that the sand had come back to a depth of about 14 feet. On the 18th I reported this new difficulty of the sand to Government, (in order that the delay might be accounted for at an early date) and from the 18th to the 23rd all the diving force that could be mustered was put on with the intention of trying to remove the sand by excavation. But this proved useless.

I then stopped the diving and took the boatmen away for surveying purposes. The longitudinal section taken on April 25th showed that at 20 feet from the block work eastward the sand was 6 feet deep, and the rubble base was wholly covered to a depth of from 3 to 6 feet. Cross sections were also taken, and these showed that

that the heap of sand did not extend very far North and South. I therefore ordered that one more vigorous attempt be made with divers working a double shift. (I was met here by a slight difficulty which only lasted one day, namely the divers refusing to work two shifts.)

The method of working was to have an iron box holding about 1000 yards lowered by the Titan, the divers then filled this and it was hauled up and emptied. Four waggon loads of sand and silt were removed in one day by this means, but the foundation for one block could not be prepared. It was at this time that I resolved to try a caisson* as the above method of working was a failure.

May.

Up to the 9th May the sea continued to break heavily on the sand bank and thus prevented work from being even attempted. On the 9th

*Note. This Caisson consisted of a kind of fence 14 feet high, made of wrought iron plates, which enclosed a space of 14 feet by 7 feet, within which the divers could excavate the sand.
(Sd) W. Parkes.

The water was more smooth and I sent a diver down who reported an increase in the accumulation. On the 12th May the caisson was ready, and it was lowered successfully down on the 14th. Two divers at a time worked inside it and they quickly got through the sand and cleared the rubble base.

After this date the weather changed and became violent, the cyclonic storm of the 16th and 17th upsetting all work for many days. When the weather moderated sufficiently to allow a diver to descend it was found that both the sand and the caisson had disappeared. The caisson was never found again. The sand however returned in one day, the wind having got into the southward again and thus prevented any work being done during the few remaining days of the month.

From the first to the 12th June the sand kept on shifting its position and its depth was constantly varying. Sometimes it was close to the blocks and at other times the base would be almost clear at the blocks but the sand would be in a heap about 20 feet away to the eastward. On the 13th a section was taken along the base which showed that diving could be tried with advantage as

June

as there was no sand within 7 feet of the blocks. Consequently on days when the sea was smooth work was resumed and by the 21st three courses of blocks had been set, though somewhat roughly. From the 21st to the end of the month all work at the pier end was stopped by the sea breaking over the end of the pier.

July.

I had now determined that if block setting could be carried on, I would have the abutment of the pier set and so correct an increasing error in the batter of the block work. (The batter was about 1.6" too much in a height of 3 blocks).

July began rather favorably, the sand keeping away from the pier end, but still remaining in a heap about 30 feet off. A second and stronger caisson* was now ready in case the sand should return which it did on the 4th July, and was spread over the base to a depth of about six inches. On the 5th and subsequent days this depth of six inches increased to more than a foot. The caisson however was ready and hopes were entertained of being able by means of it to level

* This caisson is only 3 feet deep.

(P) H.F.

the bed for the abutment in small portions at a time.

However from the 12th July the sea was very rough and no work could be done, and although the general appearance and state of the sea during the rest of the month was smooth, yet at intervals of about seven or eight minutes the surf would break on the sand-heap and come crashing over the pier end with such force as would carry a man off his legs. This state of things continued to the end of the month.

August commenced with similar weather until the 9th when the water was calmer. The sand now was only 1 foot deep close to the blocks, and as I was becoming very impatient, I ordered the idea of the abutment to be abandoned and that three more ordinary courses should be set. At this time two of my best divers were laid up with dysentery and fever, and on the 15th the third was sent to Hospital suffering from a severe jelly-fish sting.

From this time to the end of August the movements of the sand became so capricious that nothing could

August.

could be done. At times the accumulation was only 2 feet deep, and in three days it would go through variations to 4, 5, 7, and even 8 feet deep, and then disappear almost entirely for a day. The usual state of affairs was however for it to be about 4 feet deep close to the blocks and to be 7 feet deep 30 feet off. The sea was constantly liable to break with great force on the end of the pier, the sand bank in advance causing the rolling surf to become a crested wave.

September

With September there came no improvement and the sand remained 6 to 8 feet deep close to the block work.

On the 6th I took a section over the base to within as near a distance of the pier as a catamaran could go. This section showed that close to the blocks there was 8 feet of sand, and that at 50 feet off the laterite was almost clear. The sea all this time broke so heavily at the pier end that no work could have been carried on.

From the 6th to the 11th the sand appeared to be gradually decreasing, but still the sea broke heavily. On the 12th however the caisson was sunk once more and the divers started to work

work as well as the sea would allow them. On the 17th three blocks were set, the lowest being in the caisson.

The caisson was then shifted to the North row of blocks, and divers commenced to take the sand out, aided by one of Bull's Patent Dredgers which did good service.

On the 19th, 20th, and 21st the sea was so heavy that nothing could be done and the question as to whether the Titan should not be run back. It was determined however that this was not necessary.

The sand had now buried the caisson three feet deep, and accumulated as badly as ever. On the 22nd I ordered that one desperate effort should be made to set one set of blocks (the north row) as the sand had gone down to 4 feet deep and by working till nearly dark at great risk to the divers (one of whom got his leg hurt by the steel) three blocks were at length set.

The bottom block of these three was set on eighteen inches of sand in the caisson and it never reached a satisfactory bed.

From this date to the end of the month the sand returned worse than ever and on the 29th the depth was not less than 7 feet anywhere on the base, the sea at time constantly breaking with violence on this sand.

(Sd) J. N. Thoroughgood
Superintendent
M. S. Works.

Madras
6th Oct^r 1877. (Sd) True Copy
W. Parkes.

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No. 4.

Copy Report by Mr. Parker
dated 30th Sept. 1877.

Public Works.

No. 21.

India Office, London.
20th December, 1877.

My Lord Duke,

1. In continuation
of my Public Works letter
of the 27th of September
last, I forward for your
Grace's information, copy
of a Report by Mr. Parker,
on the progress of the
Madras Harbour Works
during the quarter ended
30th September last.

His Excellency,
The Most Noble,
The Governor in Council
Fort St. George.

2:1

Referred to in Public Works letter
Madras, No 21, dated 20th Dec. 1877

* dated 30th September, 1877.

2. I am anxious
to receive your promised
report on the effect
of the North East
Monsoon upon the
sand accumulated
within the harbour
space. I telegraphed
to you to that effect
on 13th instant.

I have the honor to be,
My Lord Duke,
Your Grace's most obedient
humble servant,

Salisbury

From the report of
Lieut. Mearns and
the result of my
interview with him
yesterday. I think
we may properly
telegraph as follows

~~Some sand at the~~
~~of sufficient~~
~~except to give any~~
~~indication~~

Sea still prevents
sufficient soundings
to decide ^{effect} changes of
~~bottom~~ monsoon
on bottom -
Sands practically
swept from front of

Lt.

Despatched 15-1-78

Anti-groin
Sand accretion above
water undiminished
inside or outside of
although position
slightly changed
Block setting proping
at both groins more
favorably -

By 10/1

B & R
C. works

No 255A. W Public Works Department.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

UNDER date the 15 Jan/78

Read the following :-

From
The Secy: of State for
India } (H.C. No. 21 of 20th Decr 1877)

255 A

558

Howan

(16/1/78)

255 A
Howan
16/1/78
Supt. Madras H. Works
Marine Dept.

Ordered that the
following telegram be
sent

"Sew still prevents
sufficient soundings to
decide effect of monsoon
on bottoms. Sand partially
swept from front of North
groin. Sand accretion above
water undiminished inside
or outside Harbours although
position slightly changed.
Block setting progressing at
both groins more favourably."

Supt. Madras H. Works 15
Marine Dept. 17
Office 27
31-1-78

19-1-78.
Telegram to Secy: of State.
Despatch 15th Jan/78.

19-1-78.

P.W.D.

To The Most Honorable the Secretary of State
for India.

My Lord Marquis

We have the honor
to acknowledge the receipt
of your despatch No 21 Public
Works dated 20 Decr 1877
forwarding copy of a report
by Mr. Parkes on the progress
of the Madras Harbour Works
during the quarter ended
30th Sept last, and requesting
a report on the effect of the
North East Monsoon upon
the sand accumulated
within the Harbour space.

In reply we have sub-
-ed to your Lordship's order.

the 15th January a telegram
of which the following is a
copy.

"Sea still presents sufficient
soundings to decide effect of
monsoon on bottom. Sand
partially swept from front
of North groin. Sand
accretion above water
undiminished inside or
outside Harbour although
position slightly changed.

Block setting progressing
at both groins more favor-
ably.

At this date we are
unable to get 10/1/78
anything of the above

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Copy
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Aug 590
SOUTH AFRICA
To
The Capt Madras Harbour
Dated
Received
Recd.

Q. Q. 15 Jan 1853

Madras Harbour by the
Despatch from the East
of state forwarding copy
of Mr Parkes report with
progress of the — during
the quarter ended 30 days
last

Sopt
Madras Harbour