

(1) Number of pages _____

(2) Date of repair _____

(3) Initials of the Referencer _____

MADRAS RECORD OFFICE

Government of Madras

Public Works

DEPARTMENT

G.O. No.	298	Press
B.P. No.		Mis.
Dated	31-3-1874	195

Original

Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Works Department,
31st March 1874.*

No. 794. Read the following despatch from the Right Honourable the Secretary of State for India:—
Railway.

INDIA OFFICE, LONDON,
12th February 1874.

No. 1.

MY LORD,—Herewith is transmitted, for your Excellency's information, a copy

* Letter from Mr. J. Byrne, No. 2,970, dated 31st January 1874, and enclosures. of a correspondence* with the Madras Railway Board, explaining the circumstances under which I have sanctioned

Do. to do., dated 5th February 1874. the provision of two sets of pneumatic apparatus for use at the Cheyaur, Huggry, and other bridges of the Railway; and the appointment of six men to work the apparatus.

I have, &c.,
ARGYLL.

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

From JULIAN BYRNE, Esq., Secretary, Madras Railway Company, to the Under Secretary of State for India, India Office, dated 23, New Broad Street, London, E.C., 31st January 1874, No. 2,970.

I AM directed by the Board to forward herewith copy of a letter from the Acting Agent and Manager at Madras, dated 12th ultimo, and of its enclosure, requesting that the opinion of the Company's Consulting Engineer may be obtained as to the necessity for the rock surface being rendered level for the pier cylinders of the Cheyaur Bridge to rest upon, and if deemed necessary in the case of all the cylinder piers, as to how the work may best be carried out.

2. I am also to transmit the enclosed copies of letters from Sir John Hawkshaw, dated 12th and 26th instant, from which it will be observed that, after fully discussing the subject with the Chief Engineer, he is of opinion that it is necessary to level the solid rock not only beneath those piers where the rock will be met with at the shallow depths, but under the whole of the piers of the Cheyaur and Huggry Bridges, and that the best way of doing this is by means of pneumatic apparatus.

3. In a recent order of Government, His Excellency the Governor in Council remarks that considerable loss and inconvenience are experienced owing to the incomplete state of the Huggry Bridge, I am therefore to request that the Secretary of State will be pleased to sanction the immediate provision, as recommended by Sir John Hawkshaw, of two sets of pneumatic apparatus, which the Board are informed will cost about £1,200 each, and also for the reasons stated the appointment, when the proper time arrives, of six suitable men for working the apparatus, at a rate of pay not exceeding £6 per week each.

From J. W. MELLIIS, Esq., for the Acting Agent and Manager, to JULIAN BYRNE, Esq., Secretary Madras Railway Company, dated Madras, 12th December 1873, No. 3,736.

I REQUEST that you will be so good as to lay before the Directors the enclosed copy of the Acting Chief Engineer's letter, No. 828, of the 10th instant, in order that they may obtain for Mr. Going's guidance the opinion of the Company's Consulting Engineer as to the necessity for the rock surface being rendered level for the pier cylinders of the Cheyaur Bridge to rest upon. If Sir John Hawkshaw considers this absolutely necessary in the case of all the cylinder piers, Mr. Going will be glad of his advice as to the means by which the work may be best carried out.

2. If Sir John Hawkshaw concurs with the Acting Chief Engineer in thinking that the pneumatic principle must be adopted, I shall feel obliged by your arranging for the early despatch of the apparatus, or such other as may be advised, and I will send you the indent upon hearing from you.

*Proceedings of the Madras Government, Public Works Department,
31st March 1874.*

From T. H. GOING, Esq., Acting Chief Engineer, to the Acting Agent and Manager of the Madras Railway Company, dated Madras, 18th December 1873, No. 828.

As the process of sinking the pier cylinders of the Cheyaur Bridge progresses, I find difficulty present itself which had not been anticipated, and which I think it desirable to state in order that it may be referred to the Company's Consulting Engineer for his opinion.

2. I allude to the question of pumping the cylinders dry when they have sunk down to the rock surface, with a view to having it dressed off to a level bed.

3. With the exception of the first three piers, Nos. 14, 15, and 16, and probably also the last five piers, Nos. 41, 42, 43, 44 and 45, where the material worked through is pure sand down to the rock surface, the cylinders of all the other piers are penetrating the sand which is a stratum of clay at a depth of 8 ft. below the river bed.

4. If this clay were soft and pervious to water, there would be no difficulty in pumping the cylinders dry to any depth and then working down upon the rock. Unfortunately however the clay is mixed with gravel and sand, and is not pervious to water, the cylinders without first making their bottom water-tight by a concrete or cement lining, are unable to perform a process which would defeat the object in view of pumping them down to the rock.

5. I should now state the progress which has been made in sinking the cylinders, and the stages at which they have arrived up to the present time, as follows:

Piers 14, 15, and 16, sunk through sand to rock, and are reaching from 17 to 21 feet.
Piers 17 to 22 inclusive, sunk through sand to rock, and are reaching from 23 to 25 feet.

Piers 23, 24, and 25, sunk through sand and clay to rock, and are reaching from 26 to 46 feet.

Piers 26 to 40 inclusive, sunk through sand and clay, and are reaching from 27 to 46 feet.

Piers 41 and 42, sunk through sand and clay, and are reaching from 27 to 46 feet, but have not reached the substratum, and it is probable that there is a layer above the sand from 1 ft. to 4 ft. per pier.

Piers 43, 44, and 45 not yet commenced. Mr. Stoney has been to the site, and is sinking through sand, in which it is most difficult. It will not however penetrate the clay, and I have employed Wells' Compressor for this purpose.

6. The condition of the surface of rock at the bottom of some of the cylinders which have thus far reached it, viz., Piers 14, 15, 16, and 23, 24 and 25, has been ascertained by means of an iron rod and by divers to be as follows:

In Pier 14, rock nearly level in east cylinder, irregular in west cylinder.

In Pier 15, rock at bottom of both cylinders pretty level.

In Pier 16, do do do.

In Pier 23, rock in both cylinders even.

In Pier 24, rock is uneven and varies 4 feet in level within the area of bottom of each cylinder. The rock in west cylinder is 4 feet below that in the east one.

In Pier 25, rock in both cylinders pretty level.

7. An attempt was made to render the surface of rock in Piers 14 and 15 accessible to workmen, by filling in 3 feet of Portland cement concrete and allowing this time to set hard, after which the cylinder was pumped dry, and a circular excavation of 4 feet diameter made through the concrete. As soon however as the rock was exposed water came in so fast as to overpower the pump, which raised 150 gallons per minute. The centrifugal pump, raising 1,000 gallons per minute, was applied to the west cylinder of Pier No. 15, the bottom of which rested on a level bed of rock at a depth of 21 feet below bed of river, and the result was that sand poured in faster than the workmen could remove it.

8. Mr. Stoney also attempted to pump out the cylinders of Piers 24 and 25 after their bottoms had penetrated several feet into the clay. A bucket raising 150 gallons per minute was used, but was unable to reduce the head of water more than 12 feet.

9. It appears, then, certain that the water in Piers 14 to 17 inclusive, which are sunk through pure sand to a bed of rock, cannot be so reduced as to enable workmen to dress the rock surface,

*Proceedings of the Madras Government, Public Works Department,
31st March 1874.*

even supposing we had a pump sufficiently powerful to draw off the water, sand would pour in and choke the pump.

10. It also appears extremely improbable that the cylinders of any of the succeeding piers can be so far cleared of water as to allow of men working in the bottom; were the clay through which they pass less pervious to water it might be possible to keep the cylinders dry by means of bailing buckets, but, as the matter stands, nothing less than a suction pump capable of raising 400 to 500 gallons per minute would be able to cope with the water, and even then it would be necessary to allow three or four feet in depth of water to remain in the bottom, as otherwise the suction pipe would not draw. Under such circumstances men could not use their stone-cutting tools.

11. Taking all things into consideration, I do not think it will be possible to dress the rock at bottom of the cylinders without having resort to the pneumatic principle.

12. This will be an extremely expensive process if applied to all the cylinders. I do not however think it will be at all necessary to level the rock surface beneath those of them which are sunk in the deep bed of the river, viz., from 23rd to 45th pier, where the rock surface lies from 30 to 60 feet below the bed. Independently of the argument to be deduced from the great depth at which these cylinders will be founded, there is an additional one in the fact that over that portion of the river bed in which they are sunk none except very high floods ever rise, and then to a height not exceeding two feet. There is thus no danger from scour in that part of the channel, and since the column of concrete will rest on the rock and transmit the pressure of the superincumbent load uniformly, this resistance, added to that of friction, which amounts to between 80 and 90 tons for each cylinder, in sinking must effectually prevent settlement.

For these reasons I see no necessity for levelling the rock surface below piers 23 to 45.

13. Piers Nos. 14 to 22 inclusive are however founded at depths varying from 17 to 32 feet, and are situated in the portion of the river bed most liable to scour. I am therefore of opinion that means should be adopted to dress a level surface on the rock for those cylinders to rest on, and the pneumatic process seems the most suitable one to adopt. As the depth below bed of river in these piers does not exceed 28 feet, an air pressure of only one atmosphere will suffice, and this would not, I should think be a severe trial to workmen even in this country.

14. If Sir John Hawkshaw agrees in the views which I have expressed, caps with air locks for one cylinder will, I think, be sufficient, accompanied of course by air compressors and all necessary fittings. I have had no experience however in the use of the pneumatic apparatus, so that the number required, as well as the expediency of supplying the process to the Cheyaur foundations, must be left to his judgment.

15. I will, in the meantime, suspend the operation of filling in the cylinders with concrete, awaiting a decision of the question now submitted.

From Sir JOHN HAWKSHAW, to JULLAN BYRNE, Esq., 33, New Board Street, E.C., dated 33, Great George Street, Westminster, 12th January 1874.

I HAVE considered the question submitted to me in the correspondence you sent with yours of the 5th instant.

2. Referring thereto, I informed you in mine of the 7th instant, that the correspondence required consideration, not that I had any doubt as to the necessity of levelling the rock foundations (certainly in the shallow piers), which must be done to ensure the stability of the bridge, but I wished carefully to consider the best way of doing this levelling.

3. I believe that probably you will have to procure a pneumatic apparatus for this purpose, but before reporting thereon I wished to ascertain how long it would take to provide one, and also what the cost of such an apparatus would be.

4. I accordingly requested Messrs. Easton and Anderson to give me a price, and they undertake to construct a pneumatic apparatus such as would be required, and to deliver it in four months, for the sum of £1,080. A few more extras, however, in addition to those they have included in their quotation may be required, so that the price altogether may perhaps be £1,200.

*Proceedings of the Madras Government, Public Works Department,
31st March 1874.*

5. Messrs. Easton and Anderson will be able to make the apparatus in four months, as they have patterns in stock of one about the same size.

6. But before the Board determine to send out a pneumatic apparatus, and, indeed, before I could satisfactorily to myself complete its design in every detail, and before I could decide whether it is necessary to reach and level the rock at every pier, I should much like to have an interview with Mr. Beresford Anderson, to ask him questions relative to the possibility of using divers in India, the maximum depth of water that may have to be encountered, and also as to whether the bed of the river is in a permanent channel, or whether it is subject to alteration in its course in the neighbourhood of the bridge.

7. I shall be glad, therefore, of an early interview with Mr. Anderson, and I shall be obliged if, in fixing a time, you could give me notice a day or two before.

From the same Officer, dated Westminster, 26th January 1874.

I have had an interview with Mr. Beresford Anderson on the questions relating to levelling the rock foundations of the piers of the Cheyaur and Huggry Bridges, referred to in my letter to you of the 12th instant in reply to yours of the 6th instant.

2. Mr. Anderson tells me the rock is very irregular, and the material of the bed of the river down to the rock is, for the most part, sand. There is no doubt in my mind that the channel of the rivers may, at any time, shift and pass through any of the openings of the viaducts and there create a scour.

3. Under these circumstances I deem it necessary to carry down to the solid rock not only those piers where the rock will be met with at the shallower depths, but the whole of the piers of both structures.

4. The best way of doing this is by means of a pneumatic apparatus. A difficulty that occurred to me in connection with the use of this apparatus was whether natives could be found of sufficient strength and stamina to work under compressed air. Mr. Anderson is of opinion that it would not be safe to rely upon native workmen, and that proper men should be sent from this country. I have, therefore, come to the conclusion to advise the Board to send out two sets of pneumatic apparatus, which might cost about £1,200 each, and also to send out, when the time arrives, six suitable men from England. The pay of these men will have to be at the rate of £5 to £6 a week, and their services would be required for 18 months or two years.

5. I shall be glad to know if the Board approve of this arrangement, in the necessity of which Mr. Anderson concurs.

6. If the Board assent to the proposal the apparatus should be provided as soon as practicable, but the men need not go until it is necessary to despatch them to ensure their reaching India about the time the apparatus arrives. It will take at least four months to make and deliver in England the necessary apparatus.

7. As I informed you in my letter of the 12th, I have obtained a price from Messrs. Easton for the apparatus. Another firm capable of making it is the Horseley Company, who made the iron-work of the piers of the Cheyaur and Huggry Bridges, and I am now obtaining a price from them so that I may be able, if I get the decision of the Board, to report as to the speedy provision of the work.

From W. T. THORNTON, Esq., Secretary, Public Works Department, to J. BYRNE, Esq., dated India Office, London, 2nd February 1874.

I AM directed by the Secretary of State for India to acknowledge the receipt of your letter of the 31st ultimo, No. 2,970, and to acquaint you in reply that, in the circumstances therein represented, he sanctions the provision of two sets of pneumatic apparatus for use in the construction of cylinder bridges at an estimated cost of £1,200 each. His Grace also sanctions the appointment, when the apparatus are ready for shipment, of six men to work the same, at wages not exceeding £6 a week each.

*Proceedings of the Madras Government, Public Works Department,
31st March 1874.*

No. 795.

ORDER THEREON, 31st March 1874, No. 898.

ESTABLISHMENT, No. 38.

COMMUNICATED to the Consulting
Engineer for Railways.

(True Extract.)

Colonel, R.E.,
Secretary to Government.

To the Consulting Engineer for Railways.
,, Examiner of Railway Accounts.

Exd. S. T. Austin.
Spare Copies

No 2970

Madras Railway Company
33 New Broad Street
London E.C. 31 Jan'y 1874.

Sir

I am directed by the Board to forward herewith copy of a letter from the Acting Agent and Manager at Madras dated 12th ult. and of its enclosure, requesting that the opinion of the Company's Consulting Engineer may be obtained as to the necessity for the rock surface being rendered level for the Pier Cylinders of the Cheyair Bridge to rest upon, and if deemed necessary in the case

The Under Secretary
of State for India
India Office

of

of all the Cylinder piers, as to how the work may best be carried out.

I am also to transmit the enclosed copies of letters from Sir John Hawkshaw dated 12th and 26th inst from which it will be observed that, after fully discussing the subject with the Chief Engineer, he is of opinion that it is necessary to level the solid rock not only beneath those piers where the rock will be met with at the shallow depths, but under the whole of the Piers of the Cheyair and Huggrey bridges, and that the best way of doing this is by means of pneumatic apparatus.

Yours
Sir

9
In a recent order of Government His Excellency the Governor in Council remarks that considerable loss and inconvenience are experienced owing to the incomplete state of the Huggrey Bridge, I am therefore to request that the Secretary of State will be pleased to sanction the immediate provision as recommended by Sir John Hawkshaw, of two sets of pneumatic apparatus which the Board are informed will cost about £1200 each, and also for the reasons stated, the appointment when the proper time arrives of 6 suitable men for working the apparatus

apparatus, at a rate of pay not
exceeding £6 per week each.

I have &c

(sd) Julian Byrne
Secretary

No 3736

11 5
Madras Railway Company
Agent & Manager's Office
Madras 12th Decr 1873.

Dear Sir

I request that you will be so good
as to lay before the Directors the
enclosed copy of the Acting Chief Engineer's
letter No 828 of the 10th instant in order
that they may obtain from Mr Lyong's
guidance the opinion of the Company's
Consulting Engineer as to the necessity for
the rock surface being rendered level
for the Pier Cylinders of the Cheyair
Bridge to rest upon. If Sir John
Hawshaw considers this absolutely
necessary in the case of all the Cylinders
Piers

Julian Byrne Esq

a, Piers, Mr. Loring will be glad of his
advice as to the means by which the
work may be best carried out.

If Sir John Hawkshaw concurs
with the Acting Chief Engineer in
thinking that the pneumatic
principle must be adopted, I shall
feel obliged by your arranging for the
early despatch of the apparatus, or
such other as may be advised, and
I will send you the indent upon
hearing from you.

I am &c

(sd) J. W. Mellis
for the Acting Agent & Manager

N^o 828

N^o 828

Madras Railway Coy.
Chief Engr's Office
Madras 10th Decr 1873.

Dear Sir

As the process of sinking the
Pier Cylinders of the Cheyair Bridge
progresses I find a difficulty present
itself which had not been anticipated
and which I think it desirable to
state in order that it may be referred
to the Company's Consulting Engineer
for his opinion.

2. I allude to the question of
pumping the Cylinders dry after they
have been sunk to the rock surface
with a view to having it dressed off by
chisels to a level bed.

The Acting Agent & Manager.

3.

3. With the exception of the first three piers Nos 14, 15, and 16, and probably also the last 6 piers Nos 41, 42, 43, 44 and 45, where the material passed through is pure sand down to the rock surface, the Cylinders of all the other piers after penetrating the sand arrive at a stratum of clay at a depth of not less than 20 feet below the river bed.

4. If this clay were stiff and impervious to water there would be no difficulty in pumping the Cylinders dry to any depth and then sending down men to dress the rock, Unfortunately however the clay is mixed with gravel and



and sand and it is not possible to pump out the Cylinders without first making their bottoms watertight by a considerable thickness of cement concrete, a process which would defeat the object in view by rendering the rock inaccessible.

5. I shall first state the progress which has been made in sinking the Cylinders, and the stages at which they have arrived up to the present time as follows vizt.

Piers 14, 15, & 16 sunk through sand to rock, are at depths varying from 17 to 21 feet.

Piers 17 to 22 inclusive sunk through sand to clay are at depths varying from 20 to 25 feet.

Piers

Piers 23, 24 & 25 sunk through sand
and clay to rock are at depths
varying from 33 to 46 feet.

Piers 26 to 40 inclusive sunk through
sand to clay are at depths
varying from 22 to 40 feet.

Piers 41 & 42 sunk through sand to
depths varying from 31 to 46 feet
have not yet reached the
substratum and it is probable
that there is no clay above the
rock from 41st to 45th Pier.

Piers 43, 44, & 45. not yet commenced
Bulls Dredger has been hitherto
used in sinking through sand in
which it is most effective. It will
not however penetrate the clay and
I have employed Webb's excavator
for this purpose.

6. The condition of the surface of
rock at the bottom of those of the
Cylinders which have thus far
reached it viz: Piers 14, 15, 16, & 23,
24 & 25 has been ascertained by means
of an iron rod and by divers to be as
follows viz: -

In pier 14 Rock nearly level in east
Cylinder irregular in west
Cylinder.

In pier 15 Rock at bottom of both
Cylinders nearly level.

In pier 16 — do — do — do —

In pier 23 Rock in both Cylinders even

In pier 24 Rock is uneven and varies
one foot in level within the
area of bottom of each Cylinder

The

P. The rock in west cylinder is far below that in the east one.

In pier 25. Rock in both cylinders pretty

level

y. An attempt was made to render the surface of rock in piers 14 & 15

Re Accessible to workmen by filling in with
of portland cement concrete and allowing
this time to set hard after which the
cylinder was pumped dry and a
circular excavation of 3 ft diameter
made through the concrete. As soon

Re however as the rock was exposed
water came in so fast as to overpower
the pump which raised 150 gallons
per minute. The Centrifugal pump
raising 1000 gallons per minute was
applied



19
applied to the west cylinder of pier
No 15 the bottom of which rested on a
level bed of rock at a depth of 21 feet
below bed of river & the result was that
sand poured in faster than the
workmen could remove it.

D. Mr Stoney also attempted to
pump out the cylinders of piers 24 &
25 after their bottoms had penetrated
several feet into the clay. A bucket
raising 150 gallons per minute was
used but was unable to reduce the
head of water more than 12 feet

g. It appears then certain that
the water in piers 14 to 17 inclusive
which are sunk through pure sand

9. to a bed of rock cannot be so reduced
as to enable workmen to dress the
rock surface even supposing we had
a pump sufficiently powerful to
draw off the water, sand would pour
in & choke the pump.

10. It also appears extremely un-
probable that the cylinders of any
of the succeeding piers can be so
far cleared of water as to allow of
men working in the bottom, were the

clay through which they pass less
perVIOUS to water it might be possible
to keep the cylinders dry by means
of Bailing Buckets but as the matter
stands, nothing less than a suction
pump capable of raising 14 to 500

gallons

gallons per minute would be able
to cope with the water and even then
it would be necessary to allow 3 or 4
feet in depth of water to remain in
the bottom, as otherwise the suction
pipe would not draw. Under such
circumstances men could not
use their stone cutting tools.

11. Taking all things into con-
sideration, I do not think it will
be possible to dress the rock at bottom
of the cylinders without having
recourse to the pneumatic principle.

12. This will be an extremely
expensive process if applied to all
the cylinders. I do not however
think it will be at all necessary
to level the rock surface beneath
those of them which are sunk in
the deep bed of the river viz! from

23rd to 45th pier where the rock surface lies from 30 to 60 feet below the bed. Independently of the argument to be deduced from the great depth at which these Cylinders will be founded there is an additional one in the fact that over that portion of the river bed in which they are sunk none except very high floods ever rise and then to a height not exceeding 2 feet. There is thus no danger from scour in that part of the channel and since the column of concrete will rest on the rock and transmit the pressure of the superincumbent load uniformly this resistance added to that of friction which amounts to between 80 + 90 tons for each Cylinder, in sinking must effectually prevent settlement.

For



For these reasons I see no necessity for levelling the rock surface below piers 23 to 45.

13. Piers Nos 14 to 22 inclusive are however founded at depth varying from 17 to 32 feet and are situated in the portion of the river ^{bed} most liable to scour. I am therefore of opinion that means should be adopted to dress a level surface on the rock for those Cylinders to rest on and the pneumatic process seems the most suitable one to adopt. As the depth below bed of river in these piers does not exceed 28 feet, an air pressure of only one atmosphere will suffice

and

Madras Railway
(Engineer's Office)

39 Great George Street Westminster
January 12th 1874.

Dear Sir,

I have considered the question submitted to me in the correspondence you sent with yours of the 5th Inst.

Referring thereto I informed you in mine of the 7th Inst that the correspondence required consideration, not that I had any doubt as to the necessity of levelling the rock foundations (certainly in the Challow piers) which must be done to ensure the stability of the Bridge, but I wished carefully to consider the best way of doing this levelling.

I believe that probably you will have to procure a Pneumatic apparatus for this purpose, but before reporting thereon, I wished to ascertain how long it would take to provide one and also what the cost of such an apparatus would be.

I accordingly requested Messrs Easton & Anderson to give me a price and they undertake to construct a Pneumatic Apparatus such as would be required and to deliver it in 4 months for the sum of £1,080. A few more extras, however, in addition to those they have included in their quotation may be required, so that the price altogether may perhaps be £1,200.

Messrs Easton & Anderson will be able to make the apparatus in 4 months as they have patterns in stock of one about the same size.

But before the Board determine to send out a Pneumatic Apparatus, and indeed before I could satisfactorily to myself complete its design in every detail and before I could decide whether it is necessary to reach and level the rock at every pier I should much like to have an interview with Mr. Bradford and Anderson to ask him questions relative to

to the possibility of seeing drains in India, the maximum depth of water that may have to be encountered and also as to whether the bed of the river is in a permanent channel or whether it is subject to alteration in its course in the neighbourhood of the Bridge.

I shall be glad, therefore, of an early interview with Mr. Anderson. I shall be obliged if, in fixing a time, you could give me notice a day or two before.

Yours truly,
Edw John Hankshaw

Lucian Byrne Esq,
33 New Broad St
E.C.

Madras Railway
(Engineers Office)
33 Great George St West
January 20th 1894

Dear Sir, I have had an interview with

with Mr. Rensford Anderson on the questions relating to levelling the rock foundations of the Piers of the Chesapeake & Hupper Bridges referred to in my letter to you of the 12th Inst in reply to yours of the 5th Inst.

Mr. Anderson tells me the rock is very irregular & the material of the bed of the river down to the rock is for the most part, sand. There is no doubt in my mind that the channel of the river may, at any time, shift & pass through any of the openings of the Viaducts and there create a scour.

Under these circumstances I deem it necessary to carry down to the solid rock not only those Piers where the rock will be met with at the shallowest depths, but the whole of the Piers of both structures.

The best way of doing this is by means of a Pneumatic Apparatus.

A.

31
A difficulty that occurred to me in connection with the use of this apparatus was whether natives could be found of sufficient strength & stamina to work under compressed air. Mr. Anderson is of opinion that it would not be safe to rely upon native workmen and that proper men should be sent from this country. I have, therefore, come to the conclusion to advise the Board to send out two sets of Pneumatic Apparatus which might cost about £1,200 each, & also to send out, when the time arrives, 6 suitable men from England. The pay of these men will have to be at the rate of £5 to £6 a week, & their services would be required for 18 months or two years.

I shall be glad to know of the Board approve of this arrangement in the necessity of which Mr. Anderson concurs.

If the Board assent to the proposal, the Apparatus should be provided

33
I decided as soon as practicable, but
the men need not go until it is necessary
to despatch them to ensure their reaching
India about the time the apparatus
arrives. It will take at least 4 months
to make & deliver in England the
necessary apparatus.

As I informed you in my letter
of the 12th I have obtained a price from
Messrs. Easton for the apparatus.
Another firm, capable of making it
is the Kinsley Company who made
the ironwork of the Piers of the Chertsey
& Hagger Bridges & I am now obtaining
a price from them so that I may be able
if I get the decision of the Board to report
as to the speedy provision of the work.

Yours truly,

J. H. Cockburn

J. Byrne Esq

33 New Broad St

E. C.

India Office
London 24 February 1874.

Sir,

I am directed by the Secretary of State for India to acknowledge the receipt of your letter of the 31st ultimo, No. 2940, & to acquaint you in reply that, in the circumstances therein represented, he sanctions the provision of two sets of Pneumatic Apparatus for use in the construction of Cylinder Bridges at an estimated cost of £1,200 each. His Grace also sanctions the appointment, when the Apparatus are ready for shipment, of six men to work the same, at wages not exceeding £6 a week each.

I am &c,

/ s/d W. F. Thornton

Secy P. W. Dept.

J. Byrne Esq

N.G.

Copy Correspondence with the
Madras Railway Board

Referred to in Railway Letter to
Madras, No. 1, dated 12th Feb 1874

R.P.H.D. of 31st March 1874.
L.B. a/p 12/74

Railway
No. 1

* Letter from W. G. Byrne, N. 297, dated
31st January, 1874, and enclosure.
do - do - do - dated 5th February, 1874

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

37

India Office London

12th February, 1874

My Lord,

Herewith is transmitted for
your Excellency's information a copy
of a Correspondence* with the Madras
Railway Board, explaining the
circumstances under which I
have sanctioned the provision
of two sets of pneumatic
apparatus for use at the
Chayair, Fuggery and other
Bridges of the Railway; and
the appointment of six men
to

to work the apparatus.

I have the honour to be

My Lord

Your Lordship's most obedient

humble Servant,

Chas. M.

N. 8.

Railway

12th Feb 1874

Recd 12th March 1874

The

Letter to Fort St. George

N. 1.

Encl.

Forwarding
a copy of correspondence
relative to the provision
of two sets of pneumatic
apparatus for use of
bridges of the Madras
Railway & the appoint-
ment of six men to
work the apparatus -

for Railways

Min.

Communicated to the General & Engineer

23 Feb 1874
By Mr. Roberts

Recd 12th March 1874

No 8

Govt. of 1874 Madras
PUBLIC WORKS.

The Comm. Engineer
for Railways

Date

By

Eng.

31 March 1898

Nos 794-795-

To the Comm. Engineer
for Railways

Pneumatic Apparatus
(Railway)

Despatch from the Secy
of State forwarding a copy
of correspondence relative to
the provision of two sets of
pneumatic apparatus
for use of Bridges of the
Madras Railway & the
appointment of six men
to work the apparatus

Comd