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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No.	1743	Press
		Mis.
Dated	20 11 18	

Not to be folded or roughly handled

CONSULTING ENGINEER'S OFFICE.

Railway Department.

No 250.

From

Major P. L. Prendergast R.E.,
Ag. Consulting Engineer for Railways,

To

Colonel A. Harpendale R.E.,
Secretary to Government,

Public Works Department,

Port Saint George.

SIR,

I have the honour to submit a report
on the foundations of the Cheyrie Bridge,
by the Committee appointed in G. O. N. 2710
dated 12th November 1870.

2. I have to express regret on the
part of the Committee, that the Palmer bridge
has not also been examined: but it was
found impracticable with the ordinary country
appliances to get down the water, and
the Committee were obliged to wait till
the steam pumps could be taken from

the

the Cheyair river. These pumps were re-
-moved to the Palat, after the last inspec-
-tion at the Cheyair.

3. All the bridges, giving 90 feet
waterway and upwards, on the South-
West Line, with the exception of those
over the Peiny and Gaurathum rivers, have
been examined, and all on the North-
West Line. A report in continuation of
that dated 1st March 1871, will shortly be
furnished.

4. I beg to bring to the notice
of the Government that Captain A. C. Scott
has been deputed to Kurnool, and that
his place on the Committee is at present
vacant.

I have the honour to be
Sir
Your most obedient servant
Ch. Henderson
Major &
As. Cons. Engr. for Railway & and
Member of Committee.

Madras
7 June 1871

Letter No. 12, dated 12 June 1871, and dated 12 June 1871

Report of the Committee appointed to enquire

Recd 12 June 1871 No 12-216
" 30 March 1871 - 702-703

P. W. 1871 Dept. Madras
Railway Department.

From
The Consulting Engineer
for Railways,
Chamber of Commerce
To
The Secretary to Government,
P. W. Department,
Fort St. George.

Dated 7th June 1871.
Received 8th June 1871.
No 250-1-8-1871

Submitting a
report on the foundation of the
truss of the Cheyair, of the
bridge by the Committee, May, a
No. 1743-30 dated 1871, which

As 116
6/7 June 1871 A. 192

again retarded pumping operations. The
temporary road way across the river, runs on
the down-stream side of the bridge; so
that

3.

4.

Madras }
7 June 1871 }

Your most obedient servant

Dear Friend & guest Major Q3,

Ag. Cons. Engr. for Railway and
Member of Committee.

The first of the Committee appointed to enquire into the state of the bridges of the Madras Railway, on the Chygar Bridge.

The Committee are now enabled to report upon the foundations of the Chydis bridge. The investigation called for in G.O. No. 2710 of the 12th November 1870, has been performed, first, till the monsoon time was passed, and since then, from other reasons, especially the want of sufficient pumping power. Considerable difficulty has been experienced from the quantity of water held in suspension beneath the surface of the river bed, and on the 12th of May, a slight flood came down the river, which again retarded pumping operations. The temporary road way across the river, runs on the down-stream side of the bridge; so that

that no advantage could be taken of the rapid
fall of the river, in clearing a channel from
the excavations at the piers, so as to reduce
the level of the water at one of the piers, the
14th two steam pumps were kept working
together, and at the others, either a steam pump
or several picattahs were worked, but though in
most cases, it was found impossible to get
down the water altogether, so as to leave the
lowest courses of the foundations dry: still
the Committee were able to satisfy themselves
of the nature of the work, and to measure
the depth of the masonry, either from ob-
servation through the clear water, or by
probing into the sand below the lowest
course of stone. The only portions of the work
absolutely founded on Rock, are the south
abutment and first three Piers. The foun-
dations of the 4th, 5th and 6th piers at
the points where they were opened up for
examination

3 4
examination, were very close to Rock and it
is probable that portions of these foundations
are actually in contact with it.
The Committee were informed, that in these
instances, as the surface of the rock was
uneven, a swelling course of sand was left
between its projections, and that the founda-
tions were commenced on this. It may thus
have happened that the actual spot examined
by the Committee was not in contact with
rock, while the foundations in general may
have been on it. From the 7th to the 9th
piers, (both inclusive) there can be no doubt
that the foundations do not rest on rock.
An iron bar was thrust through sand
beneath the bottom courses of these piers.
at the 10th pier the depth of sand in-
creased to $17\frac{1}{2}$ feet. From the 11th pier to
the 35th, the masonry is laid on a timber
frame 18 inches deep, in each instance and
of

of the construction is shown in the accompanying tracing, with this exception that the longitudinal beams are not by the Committee are round, uncurved, instead of being circular square.

Another tracing accompanies this report, showing the section of the bed of the Chupair river, as it was when the masonry of the bridge was founded, compared with the section of the bed, as it was after the subsidence of the flood of October 1870, and it must here be noted that all the measurements, following, where the bed of the river is mentioned, have reference to the bed as it was when the bridge was being built, and not to the present bed. The section also shows the depth below the surface, at which rock exists, as ascertained by boring. A general plan is also explanatory of the arrangements, and numbering of the piers and abutments, as depicted in this report. The details of the result of examination of the foundations are as follow.

5
The abutment on the South bank, and the three first piers are founded on rock, at depths varying from $2\frac{1}{2}$ to $9\frac{1}{4}$ feet below the river bed. At the pier the footing from which the fair work commences, is 2 feet below the river bed, and rock is found $6\frac{1}{2}$ feet below the footing, but the rectangular foundation below the cut-water does not rest on the rock. The piers are built firmly in chunam, but under these the stones, large and small, fell away, as the excavation was deepened. 5th pier. The footing is 3 feet below the river bed, and the rock is 8 feet further down. The work is bad, as in No. 4 pier, and gave way at the edge, when left without support. 6th pier. The footing is 3 feet below the river bed, and the rock was ascertained by using a crowbar, to be at a further depth of $7\frac{1}{2}$ feet. Two courses below the footing, are built in chunam. Boring was not continued, as the

the outer stones fall away, having been
loosely set together, some very small and
without chunam.

7th pier. The footing is 3 feet below the river
bed; and the rock is at a further depth of
7 feet. Outside the cut-water, the stone work
in two footings became detached; there being
no appearance of chunam in the lower courses,
and the probe was thrust in several places
through sand, under the masonry, showing
that it did not rest on rock.

8th pier. The same remarks apply, except that
the probe was thrust in, at the angle outside
the cut-water, not under the face of the
pier. The rock was found to be 9 feet 10 inches
below the river bed.

9th pier. The rock is reached at a depth of
11 1/2 feet. The footing is 3 feet below the river
bed, and the masonry was measured to

a further depth of 6 feet. But in this pier
again the iron bar plainly showed that the
foundations did not rest upon the rock.
10th pier. The pumps having broken down
the water stood in the excavation only about
2 feet below the river bed; and 4 inches
above the footing. The depth of foundations
was not accurately tested, but it appeared
by means of a probe, that the masonry is
6 feet below the footing, at 8 1/2 feet about,
below the bed.

11th pier. This is the first of the piers, built
on a wooden platform. The top of the plat-
form was plainly felt by a sharp iron rod,
its depth from the footing being only 5 feet
6 inches, the footing is 18 inches below the
river bed; and adding 18 inches for the
thickness of the wood work, the total depth
of

of foundations is 8 feet 7 inches.
The masonry is good and undisturbed.
12th pier. Above, except that the top
of the platform is 6 feet below the footing;
and the total depth of foundations is 9 feet.
13th pier. The pump here failed, and as at
the 10th pier, accuracy was not obtained in
measuring the depth of the platform foundation.
This appeared, though by means of a picket,
to be 5 feet below the footing, and the
latter being 2 feet below the bed, the
total depth of foundations is probably
8 1/2 feet.
14th pier. A coffer dam was built all
round this pier, so as to expose the foundation
everywhere. This pier is the last of
those left untouched by the great flood,
and being the nearest to the deep bed of
the river where the great scour took place,
special pains were taken for a thorough
inspection.

inspection. Two steam pumps and several
picattos were worked to get out the water, and
though a good deal of water was left in the
excavation, it was perfectly clear, so as to
admit of the lowest round timber of the
platform being plainly seen. From the
bottom of the timber to the footing, was
measured to be 8 feet 7 inches, and with
2 feet above to the river bed, the total
depth of foundations is 10 feet 9 inches.
The masonry below the footing is 7 feet
3 inches in depth, the stones are large
and well built, and for about 4 to 5 feet
down are set in chunam, below that
there is no evidence of chunam having
been used. The stone work was pulled
down at one corner, and at the depth of
5 feet 6 inches (from top of footing) a
crowbar could be thrust in to full length
into the work.

3. On the northern section of the
bridge

bridge, one pier was examined, that the
from the island embankment. The water
here was pumped out, down to the lowest
course. But one of the stone courses. The measure-
ments were taken, 12 feet 9 inches from
the river bed to footing, and 5 feet 2 inches
to the timber platform, so that adding 12
feet for this latter, the total depth is
11 1/2 feet. The masonry is good.

Soon after the subsidence of the
October flood, cracks were perceived in
the wing walls of the abutment on the North
bank of the river. The cracks increased
slightly, and an excavation was made
for examination of the foundations. As
the sand was removed, it appeared unsafe
to leave the abutment standing, and it
was accordingly pulled down. On the
24th May, the Committee made their
inspection and measured 3 feet from
the

the river bed to footing, and 7 feet more
to the top of the timber platform. The total
depth including thickness of timber is thus 12
feet, corresponding to 11 1/2 feet below the old
level of River bed, which at this point,
has been scoured away for a depth of
3 feet. The crack along the junction of the
abutment with the wing wall, was plainly
traced to the lowest course of the masonry.
The abutment had subsided, and the
foundations could be of no use again.
The lower courses are very roughly built,
and it appears doubtful if the stone is
set in chunam.

It is recorded that the island abut-
ment of the Northern section of the bridge
is built on wells. This and all the piers
appear to be sound. The depths of founda-
tions of the North abutment, and of
the 6th pier (selected at random) are

the

the same 11.5 feet, and the Committee infer that this is the general depth of the other piers.

Of the 14 piers ^{South Channel} at 11.5, the greatest depth to which the bottom of the platform sinks is under 11 feet, and the least depth less than 9 feet.

4. The foundations of the piers which have fallen, have not been inspected, though the Committee still propose to examine the 16 piers to ascertain at what depth the foundations were laid which were thrown over by the sea.

The minimum depth of 14 feet that Mr. Reppel the former Chief Engineer stipulated should be reached, appears not to have been attained at all, but even if the foundations had been carried down to that depth, the Committee consider it doubtful whether the piers in the deepest parts of the bed would have withstood the flood which destroyed the bridge.

The

9
The Committee are of opinion that the contraction of the natural waterway by the construction of the embankment across the island was injudicious, having in view the great fall of the river bed, 12 feet per mile, and the consequent danger of serious rushes the water above the piers was headed up; and they are impelled to the conclusion that the bridge must be condemned as a permanent structure, and that an entirely new work must be built.

5. The excavations made for inspection of the foundations have been filled in carefully, and the rough stone replaced that was found displaced in each of the piers. The exceptionally high flood of 1870, did not damage the 14th pier, or the others up to the south bank, and the Committee consider that with proper precautions, the bridge may be temporarily made use of, by filling the gap with piers of iron piles, on the plan approved by the Government in their order No. 1185 dated the 28th April 77.

The

This plan also provides for a pile pier, just clear of the abutment on the North bank of the river, to support the girders in place of the abutment, which, as mentioned above, has been found unsafe and taken down.

No alteration could be made in this year, in the island embankment, but in order to prevent an oblique cut of the stream from the embankment in the event of there being another high flow, a rough stone revetment has been thrown up from the abutment on the south end of the island, to a length of about 600 feet up stream. A definite bank is thus given to the previously shifting edge of the island, and should there be any scour in the coming monsoon, it will take place in the deep bed of the river, where there will be a comparatively free opening, and also increased waterway, in the substitution of iron piles for the masonry piers.

According to the present Time Table, no train crosses the river, before daylight,

nor after dusk, and it was in the judgment of the Committee so necessary, to restrict, in the afternoon the bridge as restricted, to the day time. The bridge should be constantly watched, and the rise of water made known to the District Engineer of the Division; no engine should be allowed to go over the bridge at a speed exceeding 12 miles; no train should be allowed to cross upon the bridge till it has received an all-right signal; and a responsible subordinate should be retained in special charge of the bridge.

It is expected that the gap in the bridge will be restored before the end of the month; (I am) and if the Government approve of the recommendations above made, through the communication may be restored during the next month.

The Government expressed an opinion, in their Order of the 13th November, para 2, that no such serious damage as has occurred, would have been possible had the foundations

cop

of the piers laid laid on the original specification
 provided for, and subsequently they were sup-
 posed to have been built. There is at present
 very strong presumptive evidence, from the depth of
 the foundations that have been measured, that the
 piers or high piers, were not founded at that depth,
 at which they were supposed to have been built.
 and the Committee intend examining the 18th pier,
 to ascertain whether such is the case. But it has
 appeared to them advisable, not to defer this report
 inasmuch as it is of primary importance, that the
 roadway should be restored, over the broken part
 of the bridge, now that the stone is fast approa-
 ching when water may come down the river;
 and directed that the Government may give them
 sanction to the recommendation, that an estimate
 may be prepared without delay, for a new structure.

Lewis Pendergast, Major R.E.
 Acting Consulting Engineer for Railways.

Madras }
 7th June 1871 }
 Signed on behalf of the Committee
 J. S. Pendergast

P. H. Dept. 12
 17/43
 Proceedings of the Madras Government
 Under date the 30 June 1871
 P. H.

From
 The Committee for the time 1871
 Examination of
 Bridges.

To the Secretary & Govt in the
 P. H. Dept. on the
 dated 7th June 1871 }
 Recd }
 P. H. 2605/71 }
 Cheyair bridge
 have been

Report of the
 Committee appointed
 to enquire into the
 state of the bridges
 of the Madras Railway, served
 on the Cheyair bridge & as

to have
 been built on piers raised
 on well foundations sunk
 to a depth of 20 ft. below
 the level of the bed of the
 river: that the Company's
 Chief

may be for
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In their order of the 12th November 1870, the Government observed that the bridge as sanctioned was to have been built on piers raised on well foundations sunk to a depth of 20 ft. below the level of the bed of the river: that the Company's Chief

Handwritten signature

Chief Engineer and the
Cons. Engineer to Govt
had agreed to substitute
for mells, foundations
in blocks on strong
timber curbs, and that
the Executive Engineer
in special charge of the
bridge, acting on his own
responsibility, had
adopted a different mode
of construction for what
were at the time called
the 38th and 39th piers
(answering to Nos. 14 &
15 of the northern section
in the plan now sub-
mitted) and built them
on piers only 11' 6" in
total depth of foundation.
The nature of the construction
being

1313
being solid masonry on
a timber platform;
and the reason assigned
for following this plan
being that
near, because at those
points there was a
depth of 26 ft. of sand
to a sound bottom.

The Company's Chief
Engineer expressed a
doubt as to the sufficiency
of this depth, and, in
intimating to the Exe-
cutive Engineer his
own opinion that it
was the minimum safe
limit, recorded his desire
that every effort should
be made to sink the
foundations of the other
piers at that depth,
but

but so far as the Govt.
have been informed there
is nothing on record to
show that the Chief
Engineer took any steps
to see that this obviously
proper precaution was
attended to, and it would
appear to have been
simply supposed that
the foundations were
built accordingly.

It further appears from
the correspondence printed
with the H. O. quoted
above that the Executive
Engineer Mr. E. Johnston
reported...

That piers Nos 1 to 11
inclusive were founded
on solid rock, and that

14 14
the foundations varied in
depth from 9 to 14 ft.

That on the
plan of the bridge as
finished Mr. Johnston
showed the foundations
of the 27 piers from Nos 11
to 38 varied in depth
from 18 to 26 ft. averaging
a little over 20 ft.

That writing to the
Chief Engineer on the 6.
May 1861, Mr. Johnston
reported that he was
perfectly satisfied ^{that} all the
foundations were built
in the most satisfactory
manner possible, and
of course with mortar,
and here it must be
noted that as an
absolute

absolute matter of fact
this statement would
only apply to the founda-
tions which had actually
been built on that date,
on which particular the
reports before Govt are
silent, but Mr. Johnston's
letter of the 20th Jan'y. 1861
shows that piers Nos. 1 to
11. had been completed.
Turning now to the
Committee's report, it is
found that the South
abutment and piers Nos. 1
2 and 3 only are absolutely
founded on rock.

Nos. 4, 5 and 6 are
probably partially founded
on rock.

Nos. 7, 8, 9 and 10 do not
rest on rock.

The construction

moreover

15 15
moreover of the founda-
tions is in part very
bad and altogether
unwarrantable. In regard
to Nos. 4 it is described
that two courses of ma-
sonry only are built
firmly in mortar, be-
low which the stones
large and small were
loose and fell away as
the excavation was
deepened.

Nos. 5 and 6 are of a
similar nature, and,
as the rock is only from
8 to 11 ft. below what was
the bed of the river, dif-
ficulty of reaching it would
be an inadmissible
expense.

From the 7th to the 9th
pier

firm rock is found at
from 9' - 10" to 11' - 6" below
the former river bed,
and the lower courses are
described of similar bad
construction, without
mortar. In the 9th pier
the foundations are shown
to have a total depth of
9 $\frac{1}{4}$ ft. and in the 10th
pier about 8 $\frac{1}{2}$ ft. only.

The 11th pier is the first
that is built on a flat-
form of wood and the
total depth of foundation
to the bottom of the flat-
form is 8' - 9" the masonry
being described as good
and undisturbed.

In the 12th pier the total
depth as above is 9 ft.

In

In the 13th pier the
total depth as above is
8 $\frac{1}{2}$ ft. probably.

In the 14th pier the
total depth as above is
10' - 9" the masonry for
from 4' to 5 ft. down, out
of a total depth of 7' - 3"
below the footing is des-
cribed as well built
and the stones set in
mortar, but below that
there is no evidence of
any mortar having
been used.

In the northern
section of the bridge one
pier only, called No. 6
in the plan submitted
and which would
correspond to No. 30
formerly

formerly, was examined;
the total depth of founda-
tion is $11\frac{1}{2}$ ft. and the
masonry is good.

The wing walls of the
North abutment were
found to have
unsound foundations
at a total depth of $11\frac{1}{2}$ ft.
below the former bed.
and had to be removed.
the lower courses are des-
cribed as very roughly
built, and it is doubtful
if mortar was used.

The Committee have
not yet examined the
foundations of any of the
fallen piers but record
their intention of exami-
ning that of No. 18, they
have come to the conclusion
however

by examining the
foundations of all the
injured piers, the
Gt. will be enabled to
definitively state the work

17
17
however, that the mini-
mum depth of the pre-
scribed by the Chief
Engineer had not been
attained in any case,
and they express a doubt
whether even with that
depth of foundation the
piers would have re-
mained uninjured.
in the flood which
occurred.

There is no sceptible of
proof and the Committee
should not consider
their labours completed
until they have cleared
up all doubt as to the
depth of scour at the
time of the accident.
It seems more than
probable

probable that the piers
 were undermined and
 part of the debris will
 doubtless be found at
 what was at the time
 the deep bed. ~~The Govt~~
 the Government
 consider the Committee
 of opinion regarding the
 injurious effect of the in-
 . Amusement on the
 island to be well
 founded, and they wholly
 concur in condemning
 the Cheyar bridge as a
 permanent structure, and
 direct that plans and
 estimates for a new
 bridge be forthwith
 prepared. ~~The Govt can~~
 only give a very re-
 . luctant consent to the
 further

amount of culpability
 attached to the
 Cheyar
 Govt

18
 With reference to Para 2 further use of the existing
 of the Consulting Engineer's letter the Government
 consider it of much im-
 portance that the ex-
 mination of the foundations
 of the Palar bridge should be order was issued on the
 expected.

16. Instant
 During the absence
 of Captain R. de C. Scott
 on other duty his place
 on the Committee will be
 filled by Capt. C. J. Smith,
 Deputy Comd Engineer
 for Railways.
 Govt

To the Secy for
 Railways
 Secy 1/7/71

2605-

Govt of 1871 Madrid.

PUBLIC WORKS.

To *Chief Consulting Eng^r*
for Railways

Dated

Recd.

G O 30^o Dec 71, No 1743.

Nos. 6161617

your bridge - saying
on the Committee's
on the condition
foundations of
the bridge on
the West Side of the
Railway -