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Government of Madras

Public Works

DEPARTMENT

G.O. No.

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Dated

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1876

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1

*Proceedings of the Madras Government, Public Works Department,
2nd December 1876. No 3,273*

No. 81 Read the following letter from T D HARRIS, Esq, District Engineer, Ganjam, to Major-General G W WALKER, R L, Secretary to Government, Public Works Department, dated Ganjam, 20th November 1876, No 83 —

In continuation of mine No C I, dated 19th October 1876, I have the honor to

- | | |
|---|--|
| No 1 Sketch of Chicacole river showing the site of the bridge | submit herewith the report promised (with illustrations as per margin) on the destruction of the Chicacole bridge |
| No 2 Sketch of a bridge of 24 arches of 36 feet span in Nangoolia river at Chicacole | |
| No 3 Sketch plan of the Chicacole bridge, showing rocks, fallen arches and ruined masonry as far as visible with the currents | 2 This bridge was the connecting link between the Ganjam and Vizagapatam districts over the Nangoolia river, which |
| No 4 Section across the Chicacole river | forms the natural boundary on the south |

and south-west, while a series of mountain ranges define the western limit and separates Ganjam district from Garipore and Jeypore, and the taluq of Palkondah belonging to the Vizagapatam district

3 The site of the bridge is situated in north latitude 18° 18' east longitude 83° 57' 30" and was commenced about the year 1853 and completed in 1856, and opened to traffic about the end of the year 1856, so that the bridge may be said to be in use for just twenty years, was designed by Colonel F H Rundall, R E, and constructed under the superintendence of the late Lieutenant Palmer with Mr Overseer (now Lieutenant and Assistant Engineer) Lever as Assistant in charge of the work, there are no records to be found in this office and no plans or estimates in connection with its original cost or construction, so that I cannot give the exact cost thereof, but from inquiry I learn that the first or original estimate was Rupees 48,000, this sum not being found sufficient a further grant of Rupees 10,000 was allotted, and, subsequently to complete the work, another grant of Rupees 10,000 was found necessary, making in all a total of Rupees 68,000

4 The bridge consisted of 24 segmental arches of 36 feet clear span between piers and abutments, rise of arch one-fourth the span or 9 feet, having two abutment piers, the arches were in three sets of eight each between abutments, resting on masonry piers 12 feet in height and 4 feet 6 inches in thickness, the river abutments being 9 feet in superstructure and the shore abutments 12 feet, the material used in construction was brick in superstructure, stone in foundation, and square dressed stone or ashlar masonry for up and down stream cutwaters throughout, the rest of the masonry of the bridge was brick set flush in mortar plastered and fine polished throughout, the materials and workmanship in all cases being of excellent quality

5 The site or position of the bridge was arbitrary I expect with reference to the town of Chicacole and the direction of the main street, and rock being present it formed the best basis for foundations, the direction of the bridge over the river was, I expect, controlled by similar circumstances as will be seen by the accompanying plans Nos 1 and 2, and rock being found for all the abutments and piers except one, Nos 11 or 12 as may be observed on plan No 2, this pier was built on a purely sand foundation at great cost and with much trouble I am informed by the masons who worked on the bridge A coffer-dam was formed round the site, and excavation and baling carried on to a depth of from 10 to 12 feet when boring was tried, but no rock could be found, and it was resolved to build on the sand I cannot say if a concrete bedding was formed

for the foundation or if piles were used, I think not, and this is to be regretted; but at the same time I am not disposed to say that the failure of the bridge is due to this one weak point, but only as being what may be considered, and which is believed to be the weak point of the bridge I have noticed it in detail, the arch on the east of it cracked laterally through the crown immediately after the bridge was completed, but it has stood for twenty years, and it is difficult to understand how further subsidence or settlement can have taken place in the pier foundations, the crack in the arch however may have been the weak point during the late floods that destroyed the centre arches, but it is not however manifested from what may be observed on plans Nos 2 and 3 this was the No 12 arch, and if it was this arch that first gave way it is strange to observe how only one arch on the west of it the No 13 gave way while on the east Nos 11, 10 and 9 up to the abutment pier gave way, and everything was pitched down stream in a westerly direction, and, as you may observe, the No 12 pier was lifted bodily up 7 feet 6 inches of the foundation attached to it. It will be observed that the 14th arch gave way subsequently on the 12th when the floods had subsided, and the pieces of parapets and debris about in the 14th and 13th arches as shown in plans are the pieces of this arch, but of the five arches that first gave way there is nothing left but the three piers in masses nearly complete as lifted or thrown off their base No 9 pier was built on rock and the exact base is cleared off next the east abutment pier not a trace of 9th pier left but the base on rock. I regret the falling of this 14th arch subsequently as it greatly marred my investigations, and I regret also the other two did not fall at the same time up to the west abutment pier; it is desirable to get them away, as they can be of no use even in the event of restoring the break in the bridge, and they are liable to come down at any moment, and, if it was the 12th pier or arch that first gave way it is surprising to me that they have not been destroyed as on the east side. I am inclined to think from what I have seen, and all the observations I have been able to make, that it was the 9th or 10th arch next to the east abutment pier that first gave way, but most probably these two arches gave way simultaneously throwing over the rest and shooting the 12th pier out of its foundations, and here the shock expended its force; the 13th arch only having fallen, the 14th, 15th and 16th remained intact, the 14th coming down only in three days when the flood water had subsided; the shock force or combination of forces that overthrew the centre arches of the bridge appears to have been impelled off the huge rock on which the east abutment Nos. 8th and 9th piers rested as pedestals supporting the arches, *vide* plans Nos. 2 and 3; the 8th pier in addition to being the abutment pier has a firm grip in the rock and the base is well protected, it could not be displaced, but the 9th pier had no grip in the rock, but was built on an incline, the rock sloping down stream as much as 1' 6", however it was in perfect form and order and never gave any indication of failure, probably the 10th pier vent or arch blew up first followed by the 9th pier which was swept clean away, not a trace of superstructure left, *vide* plans Nos 2 and 3; this relieved the bridge opening a vent for the accumulated force against it, and the shock expended itself on the other arches sooner than might be anticipated, the groups of rocks in close proximity to the shore end or landward arches rising from 2 to 5' 6" above the floor neutralized the discharging capacity of the landward vents and sent the currents force and debris always to the centre set of arches, so that they have always had the major part of the duty to perform, other-

wise the vent capacity or waterway given in the bridge was ample for all floods that can ever come down the Nangoolia river. Notwithstanding the obstruction of the numerous and massive piers that supported the arches of the bridge, and in the present case I do not think the destruction of the arches is due alone to the action of the river flood water, you will observe from the flood level on the plan that the actual flood at its highest point or time did not come up to within 6 inches of the intrados under the crown of arches on the landward ends of the bridge, but the flood wave or splash you will observe rose 4 to 6 feet over this, inclining to the centre, I hardly know how to account for this, but it is manifest from the fact that the water rushed over and between the balusters of parapets with great violence, tearing off the road metal from the point marked on plan, whereas the four arches on either side landward were not washed over, it might be due to a splash when the arches fell in, but, if so, it is difficult to account for the water not passing over the roadway towards either end approaches, and there was no sign of any rush or splash on the sides but only in the centre, *vide* plan No 2. I attribute the destruction of the bridge to the ingress of a storm wave or bore up the river from the sea, forming slack water above the bridge and holding in suspension the constantly increasing debris brought down by the flood-water of the river from its banks. The natives informed me, who were present on the bridge, on the 8th and 9th morning when the arches gave way, that large trees and clumps of bamboos used to come and rest for a time against the arches and piers of the bridge and eventually disappear, coming up 100 or 200 yards below it. The Executive Engineer states that on the night of the 8th, near midnight, he heard a loud report similar to the discharge of cannon, and this was also heard by Messrs Grahame and Maltby, C.S., and he concludes it was the bursting up of the arches of the bridge, but this does not appear to me to be the case, the natives who were near the bridge state that the arches gave way about 5-30 A.M. on the 9th of October, and this agrees with the Executive Engineer's statement about the river overtopping its banks in the 3rd mile of the Valconda road at 4-30 A.M. of the 9th and flooding the town of Chicacole, it was then at its maximum above the bridge, but the flooding was of short duration, for the arches gave way, as I have stated, at 5-30 or one hour after, and the floods rapidly subsided, it may easily be inferred, I think, what took place the storm wave came up the river after midnight forming the slack water and impounding the debris above bridge, the egress of sea-water was as rapid as its ingress, and the wind veering west and moderating at the same time released the impounded water above the bridge, it came down with compounded velocity bringing with it the debris in such vastness, the centre arches were blocked no doubt for a time till relieved by the bursting up of the 9th or 10th arch, or the pounding away of either the 9th or 10th pier (or it may be 11th pier, *vide* direction of currents on plan No 1) by missiles impelled on them from the group of rocks on the east and finally off the rock on which the 8th pier of the bridge stands; the river above the bridge, I am informed, was one enormous floating mass of all kinds of jungle trees, timber, planks, stakes, and the debris of villages washed off its banks, and, as I have stated, the groups of rocks drove all these to the centre arches, and to this may be attributed the destruction thereof, *vide* plans Nos 1, 2 and 3.

The break in this bridge is much to be regretted both in a commercial and political point of view, but I am not disposed to recommend its restoration on masonry piers, because, as may be seen on reference to plans, the axis of the bridge is not perpendi-

cular to the water-level, and the current is not therefore as it should be parallel to the lateral faces of the piers, and on account of the group of rocks which cannot easily be removed now, but I consider the west and east sets of arches and both abutment piers safe, as far as I was permitted to judge, owing to the presence of water in the river; it is not possible to me to be certain on all points yet, but in the month of March next, when the river bed is dry, I will be able to ascertain all particulars with certainty and will make it a point to do so. An iron Warren girder bridge might be put over the break on iron piles screwed down to or let into and cemented in the rock as the case required with Mallet's patent buckle plates, and a preparation of granite cubes and asphalt to form a road surface over them, the cost thereof could hardly exceed 35,000 Rupees, and the work might be done in one working season, or six months after procuring the material, which might be got out and landed at Calingapatam. A bridge of this description would offer but little obstruction to floods, and might be considered perfectly safe under all circumstances if properly constructed with the proper material. In support of this suggestion I further beg to explain that the foundations of piers and aprons of these fallen arches have been subjected to great wear and tear since the construction of the bridge, as you may observe by plan No 2, all the aprons have been scoured out, and during the last five years there has been an expenditure of Rupees 2,658 in repairs. In 1873 and 1874 the District Engineer examined the bridge carefully and sanctioned an estimate, amounting to Rupees 1,110, for its repairs, which consisted of renewing the foundation of the 14th pier which was undermined and was then in a dangerous state, a well of 8 feet diameter was sunk at it and the damage to the pier and cutwater carefully repaired; the arches contiguous to the pier was floored with packed rubble stone 3 feet deep, and the front and rear of these arches were also paved 6 feet up and down stream to a depth of 3 feet, apparently these measures were successful, and were carried out under the supervision of Lieutenant Lever, Assistant Engineer.

In 1874-75 the District Engineer also sanctioned an estimate for emergent repairs to the bridge, amounting to Rupees 2,000, and the work consisted of repairing the retaining walls and flooring of 4th, 5th, 7th, 8th and 13th arches, and providing new retaining walls and flooring to the 11th, 12th, 14th, 15th, 16th and 17th arches, and also examining the cracks in the arch alluded to above and closing them; this work was carried out under the supervision of Mr. Executive Engineer Leggatt apparently with success, for the bridge was in order after the next monsoon and was also prepared for the monsoons of this year. A groyne was also constructed in 1875-76 above the bridge 900 yards, at a cost of Rupees 2,955, the length of the groyne, 100 yards, composed of large boulder stone, with a view of turning the water off the east bank, the groyne remains intact with the exception of 35 feet cut off on the river end, it is of little use but has done no harm. It will thus be seen that the bridge was constantly and carefully attended to, and it appears to have required attention; but with the centre piers away and the break restored, as I have suggested, there would be no necessity for floors or retaining walls, the bed might be left to itself, and, in fact, I would never put a loose stone in it, on the contrary I would rather have any that were removed, particularly in proximity with the piers of the bridge.

I beg to enclose a section of the river taken twenty five years ago before the bridge was built, but I cannot vouch for it; I am afraid but little reliance can be placed in it.

In conclusion I regret to inform you that I fear some time must elapse before the Local Fund Board of the circle are in a position to restore the break, and although I should like to see it restored, I feel that I would not be justified at the present moment in soliciting you to move a generous Government for aid in doing so. I therefore beg to leave the subject for your disposal, trusting the explanation given regarding the destruction of the arches may be found satisfactory.

No. 82 ORDER THEREON, 2nd December 1876, No. 3,273.

CIVIL WORKS, No 6-B.

ORDERED to be recorded

2 The eight arches between the abutment piers will have to be replaced.

And the District Engineer will plan and estimate for replacing them in such manner as may be considered most advisable, after accurate sections and borings shall have been taken in the dry weather.

(True Extract)

Major-General, R.E.,
Secretary to Government

To the District Engineer, Ganjam
,, Financial Department

Exd E O Shunker
Spare Copies

No. 83.

Chatterjee
District Engineer's Office.

GANJAM. 20th Nov.

1876.

FROM

THE DISTRICT ENGINEER,

GANJAM.

To

THE

Secretary
Government of Madras

SIR,

Enclosures 4

No. 1. Sketch of
Chicaile river
showing the site
of the bridge

No. 2. Sketch of a
bridge of 24 arches
of 86 feet span
in a ravine in
river at Chicaile

No. 3. Sketch plan of
the Chicaile Bridge
showing rocks fallen
across & masonry
as far as
visible with the
currents.

No. 4. Section across
the Chicaile
river.

In continuation of mine letter
dated 19 October 1876, I have the
honour to submit herewith the report
promised (with illustrations) as
per message in the destruction of
the Chicaile Bridge.

This Bridge was the connect-
ing link between the Ganjam and
Pargapatam Districts over the Kan-
gah River which forms the na-
tural boundary on the South and
Southwest, while a series of
mountain ranges define the western
limit.

limit and separates Coayam District
from Coimbre and Jeyapure and
the taluq of Palhinda belonging
to the Nagapatam District.

The site of the Bridge is
situated in North Latitude $18^{\circ} 18'$
East Longitude $83^{\circ} 57' 30''$ and
was commenced about the year 1853
and completed in 1856 and opened
to traffic about the end of the
year 1856 - so that the Bridge may
be said to be in use for just 20 years
was designed by Colonel H. H.
Pondal Royal Engineer and
constructed under the superintendence
of the late Lieutenant Palmer
with Mr. Oversee (now Lieut-
nant and Assistant Engineer) as

an Assistant in Charge of the work,
there are no records to be found in
this Office and no plans or estimates
in connection with its original cost
or construction, so that I cannot
give the exact cost thereof, but
from enquiry I learn that the
first or original estimate was Rs
48000 this sum not being found
sufficient a further grant of
Rupees 10,000 was allotted and
subsequently to complete the work
another grant of Rs 10,000 was
found necessary making in all
a total of Rs 68,000.

The Bridge consisted of
24 segmental arches of 36 clear
span between piers & abutments
rise of arch $\frac{1}{4}$ the span or 9 feet
having two abutment piers the arches

were
up to

were in three sets of 8 each between
abutments resting on masonry piers
12 feet in height and 4.6 in
thickness, the River abutments being
9 feet in superstructure and the
shore abutments 12', the material
used in construction was brick
in superstructure, stone in foundation
and square dressed stone or
ashlar masonry for up and down
stream cutwaters throughout, the
rest of the masonry of the Bridge
was pink set flush in mortar
plastered and fine polished
throughout, the materials and
workmanship in all cases being
of excellent quality.

The site or position of the
Bridge was arbitrary I expect
with reference to the Town of Chicago
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and the direction of the main street
and rock being present it formed
the best basis for foundations the
direction of the Bridge over the
River was I expect controlled
by similar circumstances as will
be seen by the accompanying
plans at 1 & 2 and rock being
found for all the abutments and
piers except one at 3 & 2 as may
be observed on plan at 2, thus
the Pier was built on a purely sand
foundation at great cost and
with much trouble I am informed
by the masons who worked on
the Bridge. A coffer-dam was
formed round the site and
excavation and baling carried
on to a depth of from 10 to 12
feet when boring was tried
but

but no rock could be found and
it was resolved to build on the
sand I cannot say if a concrete
bedding was formed for the founda-
tion or if piles were used I
think not and this is the
regretted, but at the same
time I am not disposed to
say that the failure of the
Bridge is due to this one weak
point, but only as being what
may be considered and which
is believed to be the weak
point of the Bridge I have
noticed it in detail, the arch
on the East of it - cracked later
through the crown immediately
after the bridge was completed
but it has stood for 20 years

and it is difficult to understand
how further subsidence or settlement
can have taken place in the
other foundations; the cracks in the
arch timbers may have been
the weak point during the late
floods that destroyed the Centre
arch but it is not timbers
manifested from what may
be observed on plan nos 2 & 3,
this was the st 12 arch and
if it was this arch that first
gave way it is strange to observe
only one arch on the West
of it the st 13 gave way while
on the East st 11, 10 & 9 up to
the abutment the gave way
and everything was pitched down
Stream in a westerly direction, and
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as you may observe the 12th
Pier was lifted bodily up & 8'
of the foundation attached to it
it will be observed that the
14' Arch gave way subsequently
on the 12th when the floods had
subsided and the pieces of parapet
& debris about in the 14' & 13'
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pieces of this arch; but of the
fine arches that first gave
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the three piers in masses nearly
complete as lifted & thrown off
their base. No 9th Pier was built
on rock and the exact base is
cleared off next the east abut-
ment pier not a trace of 9th pier
left but the base on rock. I
regret

15/5
regret the falling of this 14' arch
subsequently as it greatly marred
my investigations and I regret
also the other two did not fall
at the same time up to the present
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use even in the event of restoring
the Break in the Bridge and
they are liable to come down at
any moment, and if it was the
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have been able to make that it
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and here the shock expended its
force the 13th Arch only having fallen
the 14th, 15th and 16th remained in tact
the 14th coming down only in 3 days
when the flood water had subsided
the shock force, a combination of
forces that overthrew the Centre
arch of the Bridge appears to have
impelled off the huge rock
which the East abutment of 18th
Pier rested as pedestals
supporting the arches vide plans
nos 2 & 3. The 8th Pier in addition
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firm grip in the rock and the
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was ample for all floods that
can ever come down the Chongoria
River, notwithstanding the obstruc-
tion of the numerous and massive
Piers that supported the arches
of the Bridge, and in the present
case I don't think the destruction
of the arches is due alone to the
action of the River flood water,

19
you will observe from the flood
level on the plan that the actual
flood at its highest point or
time did not come up to within
six inches of the intrados under
the crown of arches in the land-
ward end of the Bridge, but
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the incline to the Centre I
hardly know how to account for
this but it is manifest from
the fact that the water rushed
over and between the balusters
of Parapets with great violence
tearing off the road metal from
the points marked on plan whereas
the four arches on either side of
landward were not washed out
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when the anchors fell in but if
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roadway towards either end approaches
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I attribute the destruction of the
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Lieutenant Engineer states that on
the night of the 18th near midnight
he heard a loud report similar to
the discharge of a cannon and
this was also heard by Messrs.
Cochrane & Malley C.S. and
he concludes it was the bursting
of the anchors of the bridge
but this does not appear to me
to be the case the natives who
were near the bridge states that
the anchors gave way about 1/2
past 5 o'clock A.M. in the night
October and this agrees with
the Lieutenant Engineer's statement
about

about the River overflowing its
banks in the 3 mile of the Valmora
road at 4:30 A.M. of the 9th and
flooding the Town of Chicacole,
it was then at its maximum
above the Bridge but the flooding
was of short duration for the
arches gave way as I have stated
at 1/2 past 5 o'clock or one hour
after and the floods rapidly
subsided, it may easily be inferred
I think what took place the
Storm wave came up the River
after midnight forming the
black water and impounding
the debris above Bridge the Egress
of sea water was as rapid as its ingress
and the wind veering west and
moderating at the same time
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the Bridge it came down with
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it the debris in such vastness the
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The break in this Bridge
is much to be regretted both in
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to recommend its restoration on
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axis of the Bridge is not per-
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do so. On Iron Warren Girders
the bridge might be put over the
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to a set into and cemented in
the rock as the case required
with mallets Patent buckle plates
and a preparation of granite cubes
and asphalt to form a road
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could hardly exceed 35000 Rupees
and the work might be done in
one

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be got out and landed at
Caluagapatan, a bridge of this description
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to floods and might be considered
perfectly safe under all circum-
stances if properly constructed
with the proper material. In
support of this suggestion I further
beg to explain that the foundations
of Piers and Aprons of these fallen
arches have been subjected to
great wear and tear since the
construction of the Bridge, as you
may observe by plan No 2 all
the Aprons have been scoured
out and during the last 5
years there has been an expenditure
of P 2658 in repairs in 1874
the District Engineer examined the

27 11
Bridge carefully and sanctioned
an estimate amounting to P 1110
for its repairs which consisted of
renewing the foundation of the pier
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then in a dangerous state, a well
of 8 feet diameter was sunk at it
and the damage to the pier and
abutment carefully repaired, the arches
contiguous to the Pier was flooded
with packed rubble stone 3 deep
and the front and rear of these
arches were also framed 6 up and
down stream to a depth of 3' ap-
proximately these measures were suc-
cessful, and were carried out under
the supervision of Lieutenant
Colonel Engineer.
In 1874 the District Engineer
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amounting to Rupees 2000 and the
work consisted of repairing the re-
taining walls and flooring of
(4, 5, 7, 8 and 13 arches and
providing new retaining walls and
flooring to the 11, 12, 14, 15, 16 & 17
arches and also examining the cracks
in the arch abutments to some and
closing them. This work was
carried out under the supervision
of Mr. Executive Engineer. A report
apparently with success for the
bridge was made after the
next monsoon and was also pre-
pared for the Commission of this year.
A groyne was also constructed in
1875-76 along the bridge 900 yards
at a cost of Rupees 2955, the
length of the groyne 100 yards com-
posed of large boulder stone with

29/12/9
a view of turning the water off
the right bank, the groyne remains
in fact with the exception of 36
feet out of on the right side
it is of little use but has done
no harm, it will thus be seen
that the bridge was constantly
and carefully attended to, and
it appears to have required at
tention but with the centre pier
away and the break pier lost as
I have suggested there would be
no necessity for floors or retaining
walls the pier might be left
to decay and in fact I would
never put a loose stone in it
on the contrary I would rather
have any stone removed
particularly in the pier with the

View of the Bridge

I beg to enclose a section
of the Plan taken 25 years ago
before the Bridge was built but
I cannot vouch for it I am afraid
but little reliance can be placed
in it.

In conclusion I regret to
inform you that I fear some
time must elapse before we shall
find a Board of the Church are
in a position to restore the break
and although I should like to
see it restored I feel that I
would not be justified at the
present moment in soliciting
you to make a generous movement
for aid in doing so. I therefore
hes

31 13

beg to leave the subject for your
disposal. trusting the explanation
given regarding the destruction
of the Arches may be found
satisfactory.

Received
of the
Church
of the
Trinity
at
St. John's
N.Y.

I have the honor to be
Dear Sir
Your most obedient servant
P. H. H. H.
District Engineer, Ganjam

4030-10-76 No 2910

P.W.D.

29 NOV 76

1876

Dated 20
Dispatched 21
Received 1876.

Enclosure 4
14/11/76

From
The District Engineer
GANJAM.
To
The Secretary &
Government
No. 83
Ganjam

Submits the
Report with illustration
on the structure
of the bridge
at Bheeraboli.

No 81

104

No 3273

Public Works Department

33/14

PROCEEDINGS OF THE MADRAS GOVERNMENT

Under date the 2 Dec 76
Read the following -

From

The Dist. Eng^r Ganjam (H.E. No 83 of 20th Nov 1876)

Ordered to be
recorded.

2. The 8 arches between
the abutment Piers will
have to be replaced.
And the District Eng^r
will plan and estimate
for replacing them in
such manner as may
be considered most
advisable; after accurate
sections and borings
shall have been taken

in the dry weather.

Mr.

8548
Govt. of 1876 Madras.
PUBLIC WORKS.

To Mr. N. S. Ganjam

Lat d

Insured

Recd

Encl

G. O. 2nd No. 187, No 3173

No. 81-82

Instruction of the bridge
at Chicacole, Ganjam
Dist—Letter from the
District Engineer
with illustrations on the
— recorded with
instructions for the prepara-
— tion of plans & estimates
for repairing the damage.

8548

8548
An. 30-11-96