

(1) Number of pages 126(2) Date of repair 25.11.71(3) Initials of the Referencer

MADRAS RECORD OFFICE.

Government of Madras.

Public works DEPARTMENT.

G.O. No. <u>406</u>	Press ~~Mis.~~
<u>220-221</u>	
Dated <u>9-2-</u>	<u>1871.</u>

Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Works Department,
9th February 1871.*

No. 220. Read the following letter from the Acting Superintending Engineer, 1st Division, to the Secretary to Government, Public Works Department, dated Dowlaishweram, 16th December 1870, No. 3,173 —

I HAVE the honour to forward, for submission to the Government, copies of the reports, as per margin, from Captain Beckley, R E, and Lieutenant Dorward, R.E, detailing the destruction of a large bridge of five arches thirty feet span on the road from Vizianagaram to Kassipur by the late heavy floods in the Vizagapatam District; at the same time, I beg to send the only plan connected with the work which is now to be found.

2. I have requested Lieutenant Dorward to be good enough to send me transverse and longitudinal sections of this river, taken both above and below the site of the old bridge, showing also the surface inclination of the late floods; when these are received, I shall be better able to report what kind of bridge should be put up in this locality.

3. If the nullah bed has the inclination, reported by Lieutenant Dorward, of twelve or fifteen feet per mile, the destruction of this bridge by so heavy a flood can be easily accounted for, however well the work may have been executed, a similar failure having occurred some years ago in Bellary in a river of this kind, having a bed-fall of twenty feet per mile. I do not think masonry structures adapted to such localities, and would much prefer using Warren girders in them. The workshops here could make these up, and it would not be difficult to pack and send them up to most parts of this division.

From the Executive Engineer on Special Duty, Ganjam and Vizagapatam, to the Superintending Engineer, 1st Division, dated Gajapatnagram, 27th November 1870, No. 210

I HAVE the honour to inform you that I have inspected the ruins of the Bowdara bridge, and report as follows —First, stating that no one but a bricklayer was on the spot to give me any information. Lieutenant Dorward, R E, had been there the day before, but my movements being uncertain, I had made no appointments with him. I remember once seeing a plan of the bridge, but forgot now concerning the foundations as designed.

2. The bridge, I believe of 5-30 feet arches, was built a few hundred yards below the point where the river escapes from the hills, the site is unobjectionable, but the current is strong, as evidenced by a large mass of brick-work carried on to the bank below the ruins. The bridge contracted the water-way, this was an error in such a locality, still the water appears to have only risen to the springs when the piers yielded almost certainly from the foundations being sapped. There remains standing only the wing-walls and abutments, the latter badly cracked, so that an entirely new bridge must be built, 30 feet are needlessly small spans; probably a bridge of 5-45 feet arches would be about the best design, though so far as safety alone is concerned 60 feet spans would be better.

3. The piers, abutments, and wing-walls were of brick. It appears to me a great but very common error in this country to use brick in preference to stone even in places where stone,

besides being heavier and more durable, is also cheaper than brick. No doubt bricklayers and maistries prefer brick, but, I think, they should waive their preference. I would recommend that in the new design the cut-waters should be cut-stone, the piers of hammer-dressed stone and not more bulky than is considered absolutely necessary, the current being, as we know from experience, strong and deep, and therefore bad to resist.

4 From what my native informant told me, it appears the aprons were very insignificant in dimension, the rear apron should have been very massive and supported by a retaining wall. There is a hill about 200 yards distant, from which large stone might be obtained and laid down at 8 or 10 annas per yard. Probably the destruction of the bridge may be almost wholly attributed to the want of good aprons. I do not know the depth of sand in the river-bed, but the foundation of the new bridge ought to be deep.

5 I think the flooring of the new bridge be 1 foot or 1-5 feet below bed of river to facilitate the passage of sand through the arches.

From the Assistant Engineer, Vizagapatam, to the Superintending Engineer, 1st Division, dated Waltair, 5th December 1870, No 708

I HAVE the honour to report that, on my late inspection of the ruins of the bridge at Murdham on the road from Vizianagaram to Bowdara, I was unable to take levels so as to write with certainty of the quantity of water discharged by the stream during the late extraordinary flood, as there was still about three feet of water in the nullah. But approximately at the height of that flood, as evidenced by the marks on the banks, there was a breadth of from 480 to 500 feet of water, of which at least 230 must have had a very great velocity.

The depth was, as nearly as possible, 15 feet in the ordinary bed, and, judging from similar streams with whose conditions I am acquainted, the longitudinal fall must be from 12 to 15 feet per mile.

2 I have not been able to find anywhere a copy of the report (if there ever was one) containing the reasoning on which the bridge was designed. But I enclose the only plan among my records. The drawing is not signed, but I gather from the letter embodied in G O, No 2,202, dated 22nd July 1867, that the District Engineer who drew up the design intended to have seven arches, such as are shown on the plan, but that Captain Ryves altered it according to his notes written on that plan, and according to the amended design the bridge was built. I have got no record of its commencement, as it was then under the Executive Agent in charge of No 3 Range, but it probably was begun in 1863 or 1864, that officer had completed it up to the springing line by December 1866, when, by order of the Superintending Engineer, it was handed over to my predecessor, and was finished by him in 1867 and 1868.

3 When deciding upon the plan on which the bridge was to be built, it is clear that such a flood as the one under notice was never anticipated, being indeed unparalleled. The water-way was very much contracted, it was further obstructed by the four piers which were required to support the small arches, very probably the trees which were brought down by the stream collected in one or two of the arches, causing the water to rush through the others with redoubled force; the bed of the river was moved to a greater depth than that to which the foundations reached, and the bridge was swept away. With what violence was to be seen from the position of the remains of the bridge, only a few pieces were to be found near the site.

4 Captain Beckley, R E, is of opinion that to the small apron (*vide* plan) the disaster is greatly due. Had the bridge been protected by a broad up-stream apron, secured by a retaining wall resting on very deep wells indeed, and well bonded into the banks, together with similar tail protection, the structure might have stood. But the up-stream curtain walls being the mainstay of such a design would probably not have been safe unless sunk to a depth of thirty to forty feet, and the cost of such protection would have been very heavy, perhaps more than that of the small bridge itself.

5. At no period of the year is this stream dry throughout its breadth, which leads me to think that, with its steep longitudinal fall, and with such a depth of water as 15 feet, there must have been a strong current under the sand, which might have set the sand in motion under aprons even such as those above alluded to. Once the sand commenced to move, it is hard to say where that motion would stop, and such shallow foundations as those of this bridge might thus have been sapped notwithstanding expensive protective works.

6 Captain Beckley remarks that it is a great but very common error in this country to build with brick in preference to stone. That error was long ago corrected, as far as regards this range; you will observe, from my predecessor's reports and estimates, that he used rubble wherever it was possible to do so. I think that it was Captain Chambers who first ordered him to do so, and am under the impression that Captain Beckley's informant was mistaken when he said that the piers, abutments, and wing-walls of this bridge were of brick. The arches were, and perhaps the broken ends of these might have been looked upon as part of the abutments; but, if it is of any importance, I can easily knock off the plaster from the abutments, which are still standing, and clear up the point.

7. Captain Beckley further remarks that stone would have been heavier and more durable. Am I wrong in believing that, especially on shallow well foundations, the lighter the materials used in the piers and abutments the better, provided that they are sufficiently durable? I would like to have your opinion on this point, as the random rubble in use here has little bond, and is more liable to crack than good brick-work.

8 In January or February the water will be low enough in the nullah to enable me to examine accurately its conditions, and after doing so, I will submit a design in accordance with Captain Beckley's suggestions, and, also, if you see no objections, an alternative design for a light suspension bridge, which would give a larger water-way at a less cost, and would have the advantage of having its supports founded on the solid banks; no piers in the sandy bed, and therefore, no expensive protective works. The site is far enough from the coast to be out of the reach of the violent cyclonic storms which seem to haunt the Bay of Bengal.

9. It may interest you to know that the next work which this river encountered was an anicut, built by the Maharajah some seven miles further down, also founded on wells. There is not, I am told, a trace of it now. The next was the Chittivalsu bridge, which, although the water tipped over its road-way and surrounded it, so that the parapets only were seen in the middle of the raging flood, stood well. To the north of the river at its mouth was a long line of sand hills, evidently the accumulation of years. The river made a clean breach through them, luckily for Bimlipatam, which, situated on the south bank, would otherwise have been inundated.

No 221.

ORDER THEREON, 9th February 1871, No. 406.

CIVIL WORKS, No. 18.

THE Government regret to learn that, during the late heavy floods in the Vizagapatam District, the bridge across the Gostanady on the road from Vizianagaram to Kassipur was destroyed, but it is not clear whether the accident is due to the shallow nature of the foundations of the bridge or to the insufficiency of the water-way provided for it. The alteration by Captain Ryves of the plan of the bridge from seven arches of 30 feet span and 16½ feet rise, each, to five arches of 30 feet span and 22 feet rise each, would not appear, from the result, to have been judicious, as the diminution of the width of free water-way must necessarily have increased the depth, and probably added to the velocity of the stream through the arches to a greater extent than their contraction by being of less rise would have done.

Proceedings of the Madras Government, Public Works Department,
9th February 1871.

2. The Government can, however, form no definite opinion without fuller information of the character of the apron and retaining walls on which the security of all bridges over sandy river-beds so immediately depends. The Superintending Engineer will give this information in submitting a plan and estimate for a new bridge, and will be careful in preparing the design to be certain of the maximum water-way that it will be necessary to allow.

(True Extract.)

(Signed) CHARLES A. ORR, Colonel, R.E.,
Secretary to Government.

To the Superintending Engineer, 1st Division.

And F. R. Bandlamani.

No 708

Wattar 5th December 1870

From

Lieut. J. F. Dorward R.E.

Assistant Engineer Viganapattam

To

Major J. F. Fischer R.E.

Superintending Engineer 1st Div.

Sir,

I have the honor to report that, on my late inspection of the ruins of the Bridge at Muddham on the road from Viganagarani to Bowdara. I was unable to take levels so as to write with certainty of the quantity of water discharged by the stream during the late extraordinary flood, as there was still about three feet of water in the kullah. But, approximately, at the height of that flood, as evidenced

by the marks on the banks there was a breadth of from 480 to 500 feet of water, of which, at least 230 must have had, a very great velocity.

The depth was, as nearly, as possible, 15 feet in the ordinary bed, and, judging from similar streams with whose conditions I am acquainted, the longitudinal fall must be from 12 to 15 ft per mile.

2 I have not been able to find any where, a Copy of the report, (if there ever was one) containing the reasoning on which the Bridge was designed. But I enclose the only plan among my records, the drawing is not signed, but I gather from the letter embodied in G. O. No 2202, dated 22nd July 1864, that the District Engineer who drew up the design intended to have seven Arches such, as are shewn on the plan, but that Captain Ryves, altered it according to his notes written on that plan, and, according to the amended design the Bridge

13rdg was built. I have got no record of its commencement, as it was then under the Ex Agent in charge of No 3 Range, but it probably was begun in 1863 or 1864, that Officer had completed it up to the springing line by December 1866, when, by order of the Superintending Engineer it was handed over to my predecessor and was finished by him in 1867 and 1868.

3 When deciding upon the plan on which the Bridge was to be built, it is clear that such a flood as the one under notice was never anticipated, being indeed unparalleled. The water way was very much contracted, it was further obstructed by the four piers which were required to support the small arches; very probably, the trees which were brought down by the stream collected in one or two of the Arches, causing the water to rush through the others with redoubled force, the bed of the river was moved to a greater depth than that

to which the foundations reached, and the
Bridge was swept away. With what violence
it was to be seen from the position of the remains
of the bridge, only a few pieces were to be found
near the site.

Captain Beckley R.E. is of
opinion that to the small apron (vide plan) the
disaster is greatly due. Had the Bridge been
protected by a broad up-stream apron, secured
by a retaining wall, resting on very deep wells
indeed, and well bonded into the banks, to-
gether with similar tail protection, the struc-
ture might have stood. But the up stream
cutting wells, being the mainstay of such a
design, would probably not have been
safe unless sunk to a depth of thirty to forty
feet. And the cost of such protection would
have been very heavy; perhaps more than
that of the small Bridge itself.

At no period of the year is this
stream dry throughout its breadth, which
leads me to think that, with its steep longitudi-
nal fall, and with such a depth of water, as
15 feet, there must have been a strong current
under the sand, which might have set the sand
in motion under aprons even such as those
above alluded to. Once the sand commenced
to move, it is hard to say where that motion
would stop; and such shallow foundations as
those of this Bridge might thus have been
sapped notwithstanding expensive protective
works.

Captain Beckley remarks
that it is a great but very common error in this ward
country to build with brick in preference to
stone. That error was long ago corrected, as far
as regards this Range. You will observe, from
my predecessors reports and estimates, that he
used rubble wherever it was possible to do so.
I think that it was Captain Chambers who
first ordered him to do so, and am under
the impression

the impression that Captain Beckley's information was mistaken when he said that the piers, abutments, and wing walls of this Bridge were of brick. The arches were, and perhaps the broken ends of them might have been looked upon, as part of the abutments, but if it is of any importance, I can easily knock off the plaques from the abutments which are still standing, and clear up the point.

Captain Beckley further remarks that stone would have been heavier and more durable. Am I wrong in believing that, especially on shallow foundations, the lighter the materials used in the piers & abutments the better, provided that they are sufficiently durable? I would like to have your opinion on this point, as the random rubble in use here has little bond, and is more liable to crack than good brick work.

In January or February the water

water will be low enough in the nullah to enable me to examine accurately its conditions, and after doing so, I will submit a design in accordance with Captain Beckley's suggestions, and, also, if you see no objections, an alternative design for a light suspension bridge, which would give a larger waterway at a less cost, and would have the advantage of having its supports founded on the solid banks, no piers in the sandy bed, and therefore no expensive protective works. The site is far enough from the coast to be out of the reach of the violent cyclonic storms which seem to haunt the Bay of Bengal.

It may interest you to know that the next work which this river encountered, was an Anicut, built by the Maharajah some seven miles further down, and also founded on wells. There is not, I am told, a trace of it now. The next was the Chittoor Bridge, which, although the water, capped over the inclination

over its road way, and surrounded it so that
 the parapets only were seen, in the middle
 of the raging flood, stood well. To the north
 of the river, at its mouth, was a long line
 of sand hills, evidently the accumulation
 of years. The river made a clean breach
 through them; luckily for Bimlipatam,
 which situated on the south bank, would
 otherwise have been inundated.

I have the honor to be &c &c
 (Signed) J. H. Dorward Lieut. R.E.
 Asst. Engineer Vizayapatnam
 (True Copy)

W. T. Tischer Major R.E.

Ag. Supg. Engineer
 Enclosure in a
 letter to the 3173 dated
 16th Dec from the
 Asst. Engineer
 18th Dec to the
 Asst. Engineer
 20th Dec from
 the Asst. Engineer

49/52/15/70

Special Executive Engineer's Office
 Camp Vijayapatnam 27th Feb
 1870

No 210

The Superintending Engineer
 1st Division

Sir

I have the honor to inform you
 that I have inspected the ruins of the Bowdaria
 Bridge and report as follows. First stating that
 no one but a Builder was on the spot to give me
 any information. Lieutenant Dorward R.E. had been
 there the day before, but my movements being un-
 certain, I had made no appointments with him, con-
 I remember once seeing a plan of the Bridge but
 forgot now concerning the foundations as designed
 The Bridge. It is of 5-30 feet
 arches was built, a few hundred yards below the
 point where the river escapes from the hills, the
 the site is unobjectionable, but the current is
 strong, as evidenced by a large mass of brickwork
 carried on to the bank below the ruins. The Bridge
 contracted the waterway. This was an error in
 the
 such
 estimation

such a locality, still the water appears to have
only risen to the springs when the Piers yielded
almost certainly from the foundations being
sapped, these remains standing only the Wing
walls and Abutments, the latter badly cracked
so that an entirely new Bridge must be built,
30 feet, are needlessly small spans. Probably a
Bridge of 5-25 feet arches would be about the
best design, the so far, as safety alone is concerned
60 feet spans would be better.

3rd The Piers, Abutments, and
Wing walls were of brick it appears to me, a
great but very common error in this country
to use brick in preference to stone even in places
where stone is being, heavier and more
durable is also cheaper than brick. No doubt
brick-layers and masons prefer brick but I
think they should waive their preference. I
would recommend that in the new design the
outwaters should be cut stone, the piers of hammer
dressed stone and not more, butting than is con-
sidered absolutely necessary, the current being
as we know from Experience strong and deep.

and therefore had to resist.

2nd From what my native informant
told me it appears the aprons were very insigni-
ficant in dimension, the rear apron should have
been very massive and supported by a retaining
wall, there is a hill about 200 Yards distant
from which large stone might be obtained and
laid down at 8 or 10 Annas per yard, probably
the destruction of the Bridge may be almost whol-
ly attributed to the want of good Aprons. I do
not know the depth of sand in the river bed
but the foundation of the new Bridge ought to
be deep.

3rd I think the flooring of the new
Bridge be 1 ft. or 1.5 ft below bed of river to
facilitate the passage of sand thro the
Arches.

I have the honor &c. &c.

(Signed) J. Beasley Captain R.E.

Engr. on Special Duty

Ganjam Vizagapatnam

(True Copy)

W. T. Tucker Major R.E.

Asst. Supy. Engrs. R.E. D. 3
Buckingham

70 14 1/2
Sup Engineer's Office, 1st Dn
103173 Dowlaismam 16th December/70
From

Major J. F. Fisher M.E.
Acting Sup Engineer 1st Dn
Colonel C. A. Orr M.E.
Secretary to Government P.W.D.
Madras

I have the honor to forward for
submission to the Government ^{copies of} the reports
as per margin from Captain Beekley M.E.
and Lieut. Darwood M.E. detailing the destruction
of a large bridge of 5 arches 30 ft span on the road
from Vijayanagaram to Masipin by the late heavy
floods in the Vijayanagaram District, at the
same time I beg to send the only plan con-
nected with the work which is now to be found.

2/. I have requested Lieut. Darwood
to be good enough to send me transverse and
longitudinal sections of this River taken
both above and below the site of the old
bridge shewing also the surface inclination
of the late floods; when these are received
I shall be better able to report what kind
of bridge should be put up in this locality.

3/. If the Mullah has the
inclination

P.M. 10.32.15/71

Enclosed in all the
103173, dated 21.12.70
from the Sup Engr
1st Division to the
Secy to Govt
Madras

inclination reported by Lieut. Darward
of 12 or 15 feet per mile the destruction of
this bridge by so heavy a flood can be
easily accounted for, however well the work
may have been executed, a similar failure
having occurred some years ago in Bellary
in a river of this kind having a bed fall of
20 ft. per mile. I do not think masonry
structures adapted to such localities and
would much prefer using Warren girders
in them. The Workshops here could make
these up and it would not be difficult to
pack and send them up to most parts of this
Division -

I have the honor to be

Sir,

Your most obed^t servant

W. T. Titcher Major R.E.

Asst. Supy Engineer, et Dn

No. 406 P.M.S. 9

Proceedings of the Madras Government
 Recd the following
 From, The Deputy Engineer
 1st Div. } (14. E. No. 31738/16. Dec 1910)

The Government
 regret to learn that during
 the late heavy floods in
 the Vijayapattanam District,
 the bridge across the Gopikandya
 on the road from Vijayanagram
 to Kaccipur was destroyed,
 but it is not clear whether
 the accident is due to the
 shallow nature of the founda-
 tions of the bridge or to the
 inefficiency of the maker.
 may provided for it. The
 attention by Capt Pyres

N.

Pl. No. 1821 of 1910
 (No. 1000 of 1910)
 13.12.10

The Deputy Engineer
 1st Division

To The Secretary to Government
 P.M.S.

Recd 16th Dec 1910
 2-6-1911

Pl. No. 1821 of 1910
 (No. 1000 of 1910)
 13.12.10
 from Capt. Pyres and
 Lieut. Brown on the dis-
 -struction of a bridge and
 -Boradara road in Vijaya-
 -pattanam District, Late
 heavy floods and promise
 to send full report when
 details information is
 received.

No. 406-9 July 1911

No. 220

6/8 July 1912 P.M.S.

Of the plan of the bridge from
seven arches of 30 feet span
and 16 1/2 feet rise, each, to
five arches of 30 feet span
and 22 feet rise each,
would not appear, from
the result, to have been
indicated as the diminution
of the width of free water
may most necessarily
have increased the depth,
and probably added to the
velocity of the stream
through the arches to a
greater extent than their
contraction by being of
this rise would have
done.

The

The Govt. Comr, however,
forms no definite opinion
without fuller information
of the character of the apron
and retaining walls on which
the security of all bridges
over sandy river beds so
immediately depends. The
Professr will give this in-
formation in submitting
a plan and estimate for
a new bridge, and will be
careful in preparing the
design to be certain of the
maximum water way
that it will be necessary
to allow.

To The Asst. Engineer
1st Div.
Decr 10/2/71

W. B.

(3)

Nov 8 Dec 63 Ar 11
22nd July 67 53
3rd Oct 41

6 18 Aug 11 Dec 19th

Mr 525

Govt of 1871 Madras.

PUBLIC WORKS.

To The Superintending Engr.
1st Division

Date

Recd

Ex. 3

G O. 7. *Suppl. No. 706*

No. 2701221

Accept the proposed road from Tirumangal to Kurur in the Tirumangal district. Further information
asked in con-
nection with the destruction
of the bridge across the river
and from Tirumangal to
Kurur.

6 18 Aug 1871 No. 19th