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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No. 2197 Press / Mis:

362-63

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G.O., No. 2197, 28th August 1871.

AUGUST.

Bridges (Railway).

Passing orders on the further Report, submitted by the Acting Consulting Engineer for Railways, on the foundations of bridges on the South-West, North-West, and Bangalore branch lines of the Madras Railway.

Read the following paper:—

No. 362. Read the following letter from the Acting Consulting Engineer for Railways, to the Secretary to Government, Public Works Department, dated Madras, 15th July 1871, No. 311:—

I HAVE the honour to submit a further Report of the Committee's examination of the foundations of bridges on the Madras Railway, in continuation of that published in G.O., No. 942, dated 30th March 1871.

2. Of the five bridges left uninspected, on the 1st March, on the North-West Line, all have now been examined excepting that at 59 miles 68 chains over the Naggery river. I regret that I inadvertently mentioned in my letter of the 7th June 1871, No. 250, that all the bridges on the North-West Line had been G.O., No. 1743, dated 30th July 1871. inspected; but there is so much water at all times under the surface of the sand in the Naggery river, that as pumping appliances were more particularly required at the Palar river, the Committee could not but postpone their examination. The present Acting Chief Engineer has a recollection of some of the foundations being got in, he having been on duty in the adjacent district; and the Committee, therefore, had the more confidence in leaving the Naggery bridge for future inspection.

3. The bridges on the Bellary and Bangalore branches have now been examined, also all those on the South-West Line; though at three on the latter further inspection has to be made.

4. The Inspecting Committee has consisted of three members, except on the 30th and 31st May, when the bridges on the South-West Line, from 220 miles to the western end, were examined only by Mr. Going and myself; Captain Scott was at that time under orders to inspect the Irrigation Company's works. The foundations of bridges in the Malabar district had been opened, with some difficulty, owing to early rains in May, and when a telegram was received to the effect that inspection might be made at once, if the monsoon still held off, it appeared most desirable to take the opportunity without any delay, as otherwise several months might be lost. As it happened there was little time to spare, for the rivers were in flood on the 2nd June.

5. The foundations of the bridges have been generally found to be satisfactory, as substantially built, and resting on a firm substratum. The Chief Engineer has, since the last monsoon, been taking measures in his own department for additional works of protection, and the Committee have considered it advisable that retaining walls and flooring should be put in at the bridges at—

239 miles 16 chains, South-West Line.
71 " 25 " "
97 " 40 " "
106 " 21 " "

These last three bridges span the Poiney river, the Goriattum river, and the Palar river; wells are being sunk with a view to ascertain the depth of the hard substratum under the sand, for the east abutment pier of the Palar bridge rests on sand, and the same is the case with the pier that has been examined on the Goriattum river, while the Poiney bridge foundations are on sand, though built on wells. A further examination of the Palar bridge will, it is expected, be made in a few days.

6. Only two of the other bridges call for special remark. At 375 miles 15 chains on the South-West Line the foundations were found to be only $2\frac{1}{2}$ feet in depth, but on gravel, not sand. It is not known why these foundations were not sunk deeper, but there is no scour, inasmuch as the water is still standing back from the Thootha river. A flooring appears to have been begun and then stopped, as it is incomplete. The Committee propose that this should be completed.

At 373 miles 59 chains the laterite piers are built on brick wells, but over the wells there is a timber platform, apparently put on to give a uniform surface, on which to build the masonry. The top of the timber is only 20 inches below the bed of the river, so that it is not likely to be always in water throughout the year; and the Committee recommend that an examination should be made every year in the dry season.

SOUTH-WEST LINE.

Bridge at 48 *miles* 71 *chains.*

Description.—Eight 31-feet segmental arches.

Remarks.—Inspected 24th April 1871.

Excavation made on east side of fourth pier; foundations 7 feet below bed of river, resting on decomposed gneiss.

Bridge at 125 *miles* 71 *chains.*

Description.—Twelve 31-feet openings with wrought-iron girders.

Remarks.—Inspected 24th April 1871.

Excavation made on west side of sixth pier; foundations of stone-in-chunam, 6 feet below river bed, resting on blue clay.

Bridge at 129 *miles* 5 *chains.*

Description.—Five $29\frac{1}{2}$-feet segmental arches.

Remarks.—Inspected 25th April 1871.

Excavation made on west side of second pier; foundations resting on gravel $6\frac{1}{2}$ feet below river bed. Above bed, stone-in-chunam to a height of 4 feet, and the piers above of brick. The footings are stepped out in offsets amounting to 3 feet.

Bridge at 129 *miles* 63 *chains.*

Description.—Three $30\frac{1}{2}$-feet segmental arches.

Remarks.—Inspected 1st July 1871.

Excavation made on west side of first pier. The foundations of stone are 7 feet in depth below the river bed, and rest on morrumboo. There is a depth of only about 2 feet of sand in the river bed, the rest being morrumboo.

Bridge at 144 *miles* 57 *chains.*

Description.—Two 30-feet and three $49\frac{1}{2}$-feet segmental arches.

Remarks.—Inspected 25th April 1871.

The third pier opened at the north end; foundations resting on rock, $8\frac{3}{4}$ feet below river bed, of stone-in-chunam; the same to a height of 4 feet above bed, and brick-work above. Footings stepped off in offsets to an aggregate of $5\frac{1}{2}$ feet.

Bridge at 191 *miles* 76 *chains.*

Description.—Seven 30-feet segmental arches.

Remarks.—Inspected 25th April 1871. Third pier opened on east side; foundations of stone-in-chunam 9 feet deep, resting on boulders and gravel. The channel above the bridge requires clearing. This has been ordered.

Bridge at 199 *miles* 27 *chains.*

Description.—Four 30-feet segmental arches.

Remarks.—Inspected 25th April 1871.

Second pier opened at cut water, lower end; foundations stone-in-chunam, 9 feet deep, resting on clay.

Bridge at 220 *miles* 9 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 30th May 1871.

Excavation made on south side of the second pier; the foundations consist of 10 feet depth of masonry upon a course of concrete 1 foot thick, over clay. The river bed consists principally of clay.

Bridge at 239 *miles* 16 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 31st May 1871.

The second pier opened on south side; foundations 3 feet deep on a levelling course of concrete over rock. First pier opened on south side; foundations $5\frac{1}{2}$ feet deep on decayed rock. North abutment opened; foundations $4\frac{1}{2}$ feet deep resting on clay.

It is considered advisable that a retaining wall and flooring be put in between this abutment and the next pier. This has been ordered.

Bridge at 242 *miles* 41 *chains.*

Description.—Four 30-feet segmental arches.

Remarks.—Inspected 31st May 1871.

Excavation made on north side of the third pier. The foundations rest on hard rock 4 feet 10 inches below the river bed.

Bridge at 280 *miles* 46 *chains.*

Description.—Four 30-feet segmental arches.

Remarks.—Inspected 31st May 1871. The second pier opened on the east side; the foundations are 5 feet in depth below the river bed, resting on hard rock; the other piers are visibly founded upon rock.

Bridge at 305 *miles* 37 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 30th May 1871. The first pier was opened on the east side; at 2 feet 4 inches below the bed there is a footing, and 5 feet below that there is the rock on which the foundations rest. At the second pier, opened also on the east side, the footing is 1 foot 9 inches below the bed, and the foundation rest on soft rock $8\frac{1}{2}$ feet below the footing. The river bed is of sand and clay.

Bridge at 307 *miles* 70 *chains.*

Description.—Seven 15-feet semi-circle arches.

Remarks.—Inspected 30th May 1871. The third pier opened on the east side. The footing is about on the level of the river bed. The foundations are 6 feet deep on rock. The lower portion of $1\frac{1}{2}$ foot is of brick work.

The fourth pier opened on the east side. The footing is 1 foot 9 inches below bed of river, and the depth of masonry to rock below is 3 feet 3 inches. Bed, sand.

Bridge at 313 *miles* 27 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 30th May 1871. The second pier opened on the west side. The footing is 1 foot 4 inches below river bed, and the rock is $1\frac{1}{2}$ foot below footing. West abutment, rock comes up to surface.

Bridge at 316 *miles* 14 *chains.*

Description.—Three 30-feet semi-circle arches.

Remarks.—Inspected 30th May 1871. The first pier opened on the west side. The foundations are 6 feet in depth, on rock. Bed, clay.

Bridge at 321 *miles* 16 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 30th May 1871. The second pier opened on the west side. The foundations are 10 feet deep, 5 feet 9 inches to footing from river bed. The foundations rest on blue clay. Bed, coarse sand and gravel.

Bridge at 329 *miles* 25 *chains.*

Description.—Fifteen 30-feet segmental arches.

Remarks.—Inspected 30th May 1871. The second pier opened on east side. The foundations are on solid rock 4 feet deep, with footing 9 inches below bed.

West abutment foundations 8 feet deep on soft rock. Eleventh pier opened on east side. Foundations 4 feet deep on hard rock. Bed, gravel, and clay, little sand.

Bridge at 334 *miles* 25 *chains.*

Description.—Three 30-feet openings with wrought-iron girder.

Remarks.—Inspected 30th May 1871. The first pier opened on east side. Foundations 6 feet deep on hard rock, through clay; no sand.

Bridge at 373 *miles* 59 *chains.*

Description.—Twelve 62-feet openings with wrought-iron girders over the Thootha river.

Remarks.—Inspected 30th May 1871. The sixth pier opened on the east side. The laterite pier about 20 inches below the bed rests on timber baulks 6 inches thick, in two courses laid over brick wells, which are said to be sunk 18 to 20 feet. The fall of river is only about 3 inches per mile. It is doubtful if the timber is always under water in the dry weather. It is advisable that the timber should be examined once a year; that seen appeared to be sound.

Bridge at 375 *miles* 15 *chains.*

Description.—Five 20-feet semi-circular arches.

Remarks.—Inspected 30th May 1871. The third pier opened. Foundations of laterite, $2\frac{1}{2}$ feet deep, on gravel. There is now partial flooring. Curtain walls should be built and flooring completed. There is no fall in the river at the bridge; the water stands back from the Thootha river.

Bridge at 385 *miles* 55 *chains.*

Description.—Five 20-feet openings with wrought-iron girders.

Remarks.—Inspected 30th May 1871. The second pier opened; the foundations are $5\frac{1}{2}$ feet deep, through clay, resting on gravel.

NORTH-WEST LINE.

Bridge at 51 *miles* 23 *chains.*

Description.—Three 40-feet segmental arches.

Remarks.—Inspected 29th April 1871. No inspection required; the piers are built on solid rock.

Bridge at 72 *miles* 52 *chains.*

Description.—Three 30-feet segmental arches over the Gadeky river.

Remarks.—Inspected 30th April 1871. No. 2 pier, having its foundations pumped dry, was ascertained to have its bottom course at a depth of 6 feet 6 inches below bed of river, laid on morrumboo. The bed of the river is gravel.

Bridge at 248 *miles* 36 *chains.*

Description.—Four 64-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The first pier was opened for inspection; the foundations are 11 feet deep below the bed, resting on gravel. There are curtain walls at a depth of 10 feet, with flooring between.

Bridge at 263 *miles* 13 *chains.*

Description.—Four 64-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The first pier opened for inspection; the foundations are 10 feet below the bed of the river, resting on clay.

BELLARY BRANCH.

Bridge at 277 *miles* 42 *chains.*

Description.—Five 30-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The first pier opened, showing the foundations 7 feet below the footing, and resting on morrumboo; the masonry is sunk 2 feet into the morrumboo, over which the bed is black cotton soil. It is intended to put in curtain walls and flooring at this bridge, preparations are being made.

Bridge at 284 *miles* 69 *chains.*

Description.—Seven 30-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The first pier opened; the foundations are 13 feet deep below the river bed, resting on morrumboo under black cotton soil. It is intended to put in curtain walls and flooring at this bridge. Preparations are being made.

Bridge at 286 *miles* 61 *chains.*

Description.—Three 30-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The second pier was opened; the foundations are $9\frac{1}{2}$ feet deep below the river bed, resting on disintegrated granite. This bridge has flooring and curtain walls, put in last year, in consequence of the appearance of scour; the flooring is 62 feet in width.

BANGALORE BRANCH LINE.

Bridge at 183 *miles* 79 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 24th April 1871. First pier opened on west side; foundations of stone-in-chunam, resting on stiff clay $7\frac{1}{2}$ feet below river bed with offsets to a width of 3 feet.

SOUTH-WEST LINE.

Bridge at 71 *miles* 25 *chains.*

Description.—Fifty-six 29 feet 6 inches segmental arches over the Poiney river.

Remarks.—Inspected 24th April 1871. Excavation made at the north end of the 32nd pier; the foundations of stone-in-chunam rest at a depth of 5 feet on brick-in-mud wells, filled with broken stone, etc. The height of pier above river bed is 7 feet 2 inches to spring of arch. There are stone-in-chunam segmental inverts between piers; a line of wells runs under face of inverts, throughout, up and down stream. The water was pumped out, exposing the wells about 2 feet. The wells are said to be sunk 10 feet.

In order to ascertain at what depth below the surface of sand the hard substratum lies, the Acting Chief Engineer has ordered some experimental wells to be sunk in the bed of the river, as it seems desirable that a curtain wall founded on wells sunk to a depth of not less than 25 feet should be built along the lower face of the inverts, outside the present wells, which being only 15 feet deep can hardly be considered absolutely beyond the influence of scour, although there are no evidences that scour has been observed at this bridge. The fall of channel above bridge is 13·69 feet per mile. High flood level, according to local evidence, shows about 5 feet 6 inches above lowest part of river bed.

Bridge at 97 *miles* 40 *chains.*

Description.—Twenty-four 30-feet and at 97 miles 50 chains five 30-feet segmental arches over the Gooriattum river.

Remarks.—Inspected 24th April 1871. Twelfth pier opened on the west side; foundations built $1\frac{1}{2}$ foot in chunam and $9\frac{1}{2}$ feet in clay (blue stiff) to a total depth of 11 feet below the river bed; footings are in two offsets of 2 feet each, total width of pier at base 13 feet. The foundations rest on sand. The excavation was not pumped dry, but the lowest course was felt by hand and measured. In order to ascertain what depth below the surface of sand the hard substratum lies, the Acting Chief Engineer has ordered some experimental wells to be sunk in the bed of the river, as it is desirable to build curtain walls and flooring to this bridge.

The fall of channel at one bridge is 15·63 feet per mile.

High flood level, according to local evidence, shows about 5 feet 9 inches above lowest part of river bed.

Bridge at 106 *miles* 21 *chians.*

Description.—Fourteen 31-feet segmental arches (seven at each end) and five 63-feet openings with wrought-iron girders over the Palar river.

Remarks.—Inspected 24th April 1871. East abutment pier opened on west side; water not got down.

Further examination to be made when pumps are procured.

Inspected 3rd July 1871.

East abutment pier examined again. The water was got down to the level of the top of the lowest course of masonry.

The foundations are about 8 feet 10 inches below the river bed resting on sand. There appears to be from 2 to 3 feet of sand below the masonry, and then a hard stratum, this was judged by using an iron pricker. The Acting Chief Engineer has ordered wells to be sunk to ascertain the depth of sand, as it seems advisable that there should be curtain walls in the pre-openings over the sandy bed of the river.

The west abutment pier is now being prepared for examination, and will, it is hoped, be inspected shortly.

MADRAS,
15*th July* 1871.

(Signed) A. deC. SCOTT, Captain, R.E.
(„) H. L. PRENDERGAST, Major, R.E.
(„) T. H. GOING.

No. 363. ORDER THEREON, 28th August 1871, No. 2197.

RAILWAY, No. 47.

FROM the above Report, on the further examination of Railway bridges on the South-West, North-West and Bangalore branch lines, the Government are glad to learn that the Committee consider the foundations generally to be satisfactory, being substantially built and resting on a firm substratum; also, that it is intended to take the precaution of adding a masonry flooring with retaining wall in certain cases where there is much depth of sand and probability of scour, and it appears very desirable that, although the circumstances are somewhat different, a like precaution should be taken at the bridge at 375 miles 15 chains, South-West Line.

2. The Government share the Committee's apprehensions regarding the probability of decay in the timber used in the foundations of certain bridges, and they trust that the Agent will take such steps as may ensure the periodical examination recommended by the Committee. The examination of the Naggery bridge, which has been deferred, should not be lost sight of.

3. Looking to the description given of the foundations of the Poiney bridge and the great fall of the river, the addition of the curtain wall on wells sunk to a depth of 25 feet is, in the opinion of the Government, a necessary precaution. The same remark applies in the case of the Gooriattum bridge where, moreover, the foundations, except for a depth of 18 inches, are laid in clay. The Government would wish to be informed what nature of foundations were sanctioned for the last two named bridges as they are inclined to doubt the use of wells made of brick-in-mud, and, foundations of stone set in clay having been authorized, they will await the Committee's further report after the completion of the experimental wells.

4. In regard to the Palar bridge, respecting which the Government had the greatest anxiety, it appears that the foundations of the east abutment pier only extend to a depth of 8 feet 10 inches below the river bed, and resting in sand 2 or 3 feet deep before a hard substratum is reached.

5. The fall of the river is not reported, and, if there is not much real cause for apprehension regarding the stability of this bridge from its appearance, the circumstances of its foundation, so far as they have been examined, are such as to dictate the expediency of the greatest caution being used in the transit over it of passenger trains. The Government are desirous that a more extended examination shall be made of the foundations of its piers, the result of which should be reported, for, looking to the shallow depth of the foundations, it is very doubtful whether a curtain wall would be a sufficient protection against injury in the event of a great flood. Meanwhile, it is expedient that the precautions of inspection and signalling prescribed in regard to the renewed use of the Cheyaur bridge should be adopted in the cases of the bridges over the Palar, Poiney and Gooriattum rivers, especially over the first named one, which should accordingly be done, and the additional precaution of slackening the speed of trains in passing over the Palar river should also be taken, and likewise in rainy weather in the cases of the Poiney and Gooriattum bridges.

6. The Consulting Engineer for Railways will be requested, when further reporting on this subject, to submit the sanctioned plans of the bridges over the Palar, Poiney, and Gooriattum rivers, and the specifications of the foundations, or the estimates explanatory of the nature of their construction.

(True Extract.)

(Signed) A. deC. SCOTT, Captain, R.E.,
Under Secretary to Government.

To the Acting Consulting Engineer for Railways.

CONSULTING ENGINEER'S OFFICE.

Railway Department.

No. 511—

From Major H. L. Prendergast R.E.
Acting Consulting Engineer for Railways,

To Colonel J. Carpendales R.E.
Secretary to Government,
Public Works Department,
Fort Saint George.

Sir,

I have the honour to submit herewith for the report of the Committee's examination of the foundations of bridges on the Madras Railway, in continuation of that published in G. O. No. 942 dated 30th March 1871.

2. Of the 5 bridges left unexamined on the 1st March on the North-West Line; all have now

been examined, excepting that at 59 miles 68 chains over the Nagger river. I regret that I inadvertently mentioned in my letter of the 7th June 1871, No 250, that all the bridges on the North-West Line had been inspected: but there is so much water at all times under the surface of the sand in the Nagger river, that no pumping appliances were more particularly required at the Palar river, the Committee could not but postpone their examination. The present Acting Chief Engineer has a recollection of some of the foundations being got in; he having been on duty in the adjacent district; and

G.O. No 1743 dated 30 June 1871.

the Committee therefore had the more confidence in leaving the Nagger bridge for future inspection.

3. The bridges on the Bellary and Bangalore branches have now been examined; also all those on the South-West Line; though at 3 on the latter, further inspection has to be made.

4. The inspecting Committee has consisted of three members, except on the 30th and 31st May, when the bridges on the South West Line from 220 miles to the Western end, were examined only by Mr Going and myself. Captain Scott was at that time

under orders to inspect the Irrigation Company's works: the foundations of bridges in the Malabar district had been opened with some difficulty, owing to early rains in May: and when a telegram was received to the effect that inspection might be made at once, if the monsoon still held off; it appeared most desirable to take the opportunity without any delay; as otherwise several months might be lost. As it happened, there was little time to spare, for the rivers were in flood on the 2d June.

5. The foundations of

the bridges have been generally found to be satisfactory: as substantially built: and resting on a firm sub-stratum. The Chief Engineer has since the last monsoon been taking measures in his own Department, for additional works of protection: and the Committee have considered it advisable that retaining walls and flooring should be put in: at the bridges at

239 miles	16 chains	P. W. Line	
71 —	25 —	—	Do —
97 —	40 —	—	Do —
106 —	21 —	—	Do —

These last three bridges span, the Ponney river, the Goorcatturn river

and the Palar river: wells are being sunk, with a view to ascertain the depth of the hard sub-stratum under the sand: for the East abutment pier of the Palar bridge rests on sand, and the same is the case with the pier that has been examined on the Goosiatlum river: while the Poiney bridge foundations are on sand, though built on wells. A further examination of the Palar bridge, will it is expected be made in a few days.

6. Only two of the other bridges call for special remark. At 375 miles 15 chains

on the South-West Leine, the foundations were found to be only 2½ feet in depth, but on gravel, not sand. It is not known why these foundations were not sunk deeper: but there is no scour, inasmuch as the water is still, standing back from the Thoothaa river. A flooring appears to have been begun, and then stopped, as it is incomplete. The Committee propose that this should be completed.

At 373 miles 59 chains, the laterite piers are built on brick wells: but over the wells, there is a timber platform, apparently put on to give a uniform surface on which to build the masonry. The top of the timber is only 20 inches below the

bed of the river: so that it is not likely to be always in water throughout the year: and the Committee recommend that an examination should be made every year in the dry season.

I have the honour to be,
Sirs,
Your most obedient Servant.

Madras
15th July
1870

Alex. Pendergast Major R.E.
Acting Chief Engineer
for Railways
and Member of Committee.

To
The Secretary to Government,
P. W. Department,
Fort St. George.

From
The Consulting Engineer
for Railways,

Dated 20th July 1870.
Received 21st July 1870.

No. 2197
Forwarding a further Report by the Committee appointed to examine the Foundations of Bridges on the Madras Railway.

Rec'd 28th July 1870

Rec'd 21st July 1870
Public Works Department
Railway Department.

No 2197

South-West Line

Bridge at 118 miles 71 chains.

Description— Eight 31 feet segmental arches.

Remarks— Inspected 24th April 1871.

Excavation made on East side of 4th Pier; foundations 7 feet below bed of River, resting on decomposed gneiss.

Bridge at 125 miles 71 chains.

Description— Twelve 31 feet openings with Wrought Iron girders.

Remarks

Remarks— Inspected 24th April 1871.

Excavation made on West side of 6th pier; found stone of stone in channel, 6 feet below river bed, resting on blue clay.

Bridge at 129 miles 5 chains.

Description— Stone 29½ feet segmental arches.

Remarks— Inspected 25th April 1871.

Excavation made on West side of 5th pier; found stone resting on gravel, 6½ feet below river bed, stone in channel, 4 feet below river bed, stone in channel to a height of 4 feet; and the piers above of brick. The foreings are stepped out on off-sets amounting to 3 feet.

Bridge at 129 miles 63 chains.

Description— Three 30½ feet segmental arches.

Remarks— Inspected 1st July 1871.

Excavation made on West side of 1st pier. The foundations of stone, are 7 feet in depth below the river bed, and rest on

on morrumboo. There
is a depth of only about
12 feet of sand in the
river bed, the rest
being morrumboo.

Such terms should not be used in a report of this nature

Bridge at 144 miles 57 chains.

Description— Two 30 feet
and three 49½ feet
segmental arches.

Remarks— Inspected 25
April 1871.

The 3d pier opened at the
North end; foundations
resting on rock, 8¾ feet
below river bed, of stone
in

in cement, the same to
a height of 4 feet above
bed, and brick-work
above. Footings stepped
off on each side to an
aggregate of 5½ feet.

Bridge at 191 miles 76 chains.

Description— Seven 30 feet
segmental arches.

Remarks— Inspected 25 April
1871.

3d Pier opened on East side:
foundations of stone in
cement 9 feet deep
resting on boulders and
gravel. The channel
above the bridge requires
clearing. This has been
ordered.

Bridge at 199 miles 27 chains.

Description— Piers 30 feet
segmental arches.

Remarks— Inspected 25th
April 1871.
2d Pier opened at east-water
level, only foundations
done in channel, 9 feet
deep, resting on clay.

Bridge at 220 miles 9 chains.

Description— Piers 30 feet
segmental arches.

Remarks— Inspected 30th
May 1871.
Excavation made on South
side of 1st & 2d Piers 3 feet
for foundations, which are 9 to 10
feet deep to top of masonry
upon

upon a course of concrete
1 foot thick, over clay.
The inner beds consists
principally of clay.

Bridge at 239 miles 16 chains.

Description— Piers 30 feet
segmental arches.

Remarks— Inspected 31st
May 1871.
The 2d Pier opened on
South side; foundations
3 feet deep on a levelling
course of concrete over rock.
1st Pier opened on South
side; foundations 5½
feet deep on decayed rock.
North abutment opened;
foundations 4½ feet deep.
Resting

Remarks— It was considered advisable that a retaining wall and flooring be put in between the abutment and the next pier. This has been ordered.

Bridge at 242 miles 41 chains

Description— Four 30 feet segmental arches.

Remarks— Inspected 31st May 1871.

Excavation made on south side of the 3? Piers.

The foundations rest on hard rock, 4'-10" below the river bed.

Bridge at 280 miles 46 chains

Description— Four 30 feet segmental arches.

Remarks— Inspected 31st May 1871.

The 2? Pier opened on the East side; the foundations are 5 feet in depth below the river bed, resting on hard rock; the other piers are visibly founded upon rock.

Bridge at 305 miles 37 chains.

Description— Three 30 feet segmental arches.

Remarks— Inspected 30th May 1871.

The first Pier was opened on the East side, at 2'-6" below the bed there is a footing, and 5 feet below that.

that, three to the South
on which the foundations
rest. At the second
Pier opened also on the
East side, the footing is
1 foot 9 inches below the
bed, and the foundations
rest on soft Rock 8½ feet
below the footing. The
lower bed is of sand and
clay.

Bridge at 3.07 miles 7 chains.

Description— Seven 15 feet
semi-circle arches.

Remarks— Inspected 30 May 1871.
The 3rd Pier opened on the
East side. The footing
is about on the level of
the

(21)

the lower bed. The foundations are 6 feet deep on Rock. The lower portion of 1½ feet is of Rock work.

The 4th Pier opened on the East-side. The footing is 1 foot 9 inches below bed of masonry of river, and the depth to Rock below is 3 ft 3 inches. Bed sand.

Bridge at 3.13 miles 27 chains.

Description— Three 30 feet segmental arches.

Remarks— Inspected 31st May 1871.
The 2nd Pier opened on the West-side. The footing is 1 foot 4 inches below founded

bed, and the foot is 1½
feet below footing.
West abutment. Rock comes
up to surface.

Bridge at 316 miles 14 chains.

Description — Three 30 feet
semi circular arches.

Remarks — Inspected 31st May 1871.
The first Pier opened on the
West side. The foundations
are 6 feet deep to rock.
Red clay.

Bridge at 321 miles 16 chains.

Description — Three 30 feet
segmental arches.

Remarks — Inspected 30th May 1871.
The 2d Pier opened on the
West

West side. The foundations
are 10 feet deep; 5 feet
9 inches to footing stone
River bed. The foundations
rest on blue clay. Bed;
coarse sand, and gravel.

Bridge at 329 miles 25 chains.

Description — Fifteen 30 feet
segmental arches.

Remarks — Inspected 31st May 1871.
The 2d Pier opened on East
side. The foundations are
on solid rock, 4 feet deep;
with footing 9 inches —
below bed. —
West abutment. Foundations 8 feet deep on rock

Government {1871} of Madras.

PUBLIC WORKS.

Recd. } 1871. *Enclosures*

Regd. } *Spare copies*

G.O., No. 2197, 28th August 1871.

AUGUST.

Bridges (Railway).

Passing orders on the further Report, submitted by the Acting Consulting Engineer for Railways, on the foundations of bridges on the South-West, North-West, and Bangalore branch lines of the Madras Railway.

Read the following paper:—

No. 362. Read the following letter from the Acting Consulting Engineer for Railways, to the Secretary to Government, Public Works Department, dated Madras, 15th July 1871, No. 311:—

I HAVE the honour to submit a further Report of the Committee's examination of the foundations of bridges on the Madras Railway, in continuation of that published in G.O., No. 942, dated 30th March 1871.

2. Of the five bridges left uninspected, on the 1st March, on the North-West Line, all have now been examined excepting that at 59 miles 68 chains over the Naggery river. I regret that I inadvertently mentioned in my letter of the 7th June 1871, No. 250, that all the bridges on the North-West Line had been inspected; but there is so much water at all times under the surface of the sand in the Naggery river, that as pumping appliances were more particularly required at the Palar river, the Committee could not but postpone their examination. The present Acting Chief Engineer has a recollection of some of the foundations being got in, he having been on duty in the adjacent district; and the Committee, therefore, had the more confidence in leaving the Naggery bridge for future inspection.

G.O., No. 1743, dated 30th July 1871.

3. The bridges on the Bellary and Bangalore branches have now been examined, also all those on the South-West Line; though at three on the latter further inspection has to be made.

4. The Inspecting Committee has consisted of three members, except on the 30th and 31st May, when the bridges on the South-West Line, from 220 miles to the western end, were examined only by Mr. Going and myself; Captain Scott was at that time under orders to inspect the Irrigation Company's works. The foundations of bridges in the Malabar district had been opened, with some difficulty, owing to early rains in May, and when a telegram was received to the effect that inspection might be made at once, if the monsoon still held off, it appeared most desirable to take the opportunity without any delay, as otherwise several months might be lost. As it happened there was little time to spare, for the rivers were in flood on the 2nd June.

5. The foundations of the bridges have been generally found to be satisfactory, as substantially built, and resting on a firm substratum. The Chief Engineer has, since the last monsoon, been taking measures in his own department for additional works of protection, and the Committee have considered it advisable that retaining walls and flooring should be put in at the bridges at—

239 miles 16 chains, South-West Line.
71 „ 25 „ „
97 „ 40 „ „
106 „ 21 „ „

These last three bridges span the Poiney river, the Goriattum river, and the Palar river; wells are being sunk with a view to ascertain the depth of the hard substratum under the sand, for the east abutment pier of the Palar bridge rests on sand, and the same is the case with the pier that has been examined on the Goriattum river, while the Poiney bridge foundations are on sand, though built on wells. A further examination of the Palar bridge will, it is expected, be made in a few days.

6. Only two of the other bridges call for special remark. At 375 miles 15 chains on the South-West Line the foundations were found to be only 2½ feet in depth, but on gravel, not sand. It is not known why these foundations were not sunk deeper, but there is no scour, inasmuch as the water is still standing back from the Thootha river. A flooring appears to have been begun and then stopped, as it is incomplete. The Committee propose that this should be completed.

At 373 miles 59 chains the laterite piers are built on brick wells, but over the wells there is a timber platform, apparently put on to give a uniform surface, on which to build the masonry. The top of the timber is only 20 inches below the bed of the river, so that it is not likely to be always in water throughout the year; and the Committee recommend that an examination should be made every year in the dry season.

SOUTH-WEST LINE.

Bridge at 48 *miles* 71 *chains.*

Description.—Eight 31-feet segmental arches.

Remarks.—Inspected 24th April 1871.

Excavation made on east side of fourth pier; foundations 7 feet below bed of river, resting on decomposed gneiss.

Bridge at 125 *miles* 71 *chains.*

Description.—Twelve 31-feet openings with wrought-iron girders.

Remarks.—Inspected 24th April 1871.

Excavation made on west side of sixth pier; foundations of stone-in-chunam, 6 feet below river bed, resting on blue clay.

Bridge at 129 *miles* 5 *chains.*

Description.—Five 29½-feet segmental arches.

Remarks.—Inspected 25th April 1871.

Excavation made on west side of second pier; foundations resting on gravel 6½ feet below river bed. Above bed, stone-in-chunam to a height of 4 feet, and the piers above of brick. The footings are stepped out in offsets amounting to 3 feet.

Bridge at 129 *miles* 63 *chains.*

Description.—Three 30½-feet segmental arches.

Remarks.—Inspected 1st July 1871.

Excavation made on west side of first pier. The foundations of stone are 7 feet in depth below the river bed, and rest on morrumboo. There is a depth of only about 2 feet of sand in the river bed, the rest being morrumboo.

Bridge at 144 *miles* 57 *chains.*

Description.—Two 30-feet and three 49½-feet segmental arches.

Remarks.—Inspected 25th April 1871.

The third pier opened at the north end; foundations resting on rock, 8¾ feet below river bed, of stone-in-chunam; the same to a height of 4 feet above bed, and brick-work above. Footings stepped off in offsets to an aggregate of 5½ feet.

Bridge at 191 *miles* 76 *chains.*

Description.—Seven 30-feet segmental arches.

Remarks.—Inspected 25th April 1871. Third pier opened on east side; foundations of stone-in-chunam 9 feet deep, resting on boulders and gravel. The channel above the bridge requires clearing. This has been ordered.

Bridge at 199 *miles* 27 *chains.*

Description.—Four 30-feet segmental arches.

Remarks.—Inspected 25th April 1871.

Second pier opened at cut water, lower end; foundations stone-in-chunam, 9 feet deep, resting on clay.

Bridge at 220 *miles* 9 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 30th May 1871.

Excavation made on south side of the second pier; the foundations consist of 10 feet depth of masonry upon a course of concrete 1 foot thick, over clay. The river bed consists principally of clay.

Bridge at 239 *miles* 16 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 31st May 1871.

The second pier opened on south side; foundations 3 feet deep on a levelling course of concrete over rock. First pier opened on south side; foundations $5\frac{1}{2}$ feet deep on decayed rock. North abutment opened; foundations $4\frac{1}{2}$ feet deep resting on clay.

It is considered advisable that a retaining wall and flooring be put in between this abutment and the next pier. This has been ordered.

Bridge at 242 *miles* 41 *chains.*

Description.—Four 30-feet segmental arches.

Remarks.—Inspected 31st May 1871.

Excavation made on north side of the third pier. The foundations rest on hard rock 4 feet 10 inches below the river bed.

Bridge at 280 *miles* 46 *chains.*

Description.—Four 30-feet segmental arches.

Remarks.—Inspected 31st May 1871. The second pier opened on the east side; the foundations are 5 feet in depth below the river bed, resting on hard rock; the other piers are visibly founded upon rock.

Bridge at 305 *miles* 37 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 30th May 1871. The first pier was opened on the east side; at 2 feet 4 inches below the bed there is a footing, and 5 feet below that there is the rock on which the foundations rest. At the second pier, opened also on the east side, the footing is 1 foot 9 inches below the bed, and the foundation rest on soft rock $8\frac{1}{2}$ feet below the footing. The river bed is of sand and clay.

Bridge at 307 *miles* 70 *chains.*

Description.—Seven 15-feet semi-circle arches.

Remarks.—Inspected 30th May 1871. The third pier opened on the east side. The footing is about on the level of the river bed. The foundations are 6 feet deep on rock. The lower portion of $1\frac{1}{2}$ foot is of brick work.

The fourth pier opened on the east side. The footing is 1 foot 9 inches below bed of river, and the depth of masonry to rock below is 3 feet 3 inches. Bed, sand.

Bridge at 313 *miles* 27 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 30th May 1871. The second pier opened on the west side. The footing is 1 foot 4 inches below river bed, and the rock is $1\frac{1}{2}$ foot below footing. West abutment, rock comes up to surface.

Bridge at 316 *miles* 14 *chains.*

Description.—Three 30-feet semi-circle arches.

Remarks.—Inspected 30th May 1871. The first pier opened on the west side. The foundations are 6 feet in depth, on rock. Bed, clay.

Bridge at 321 *miles* 16 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 30th May 1871. The second pier opened on the west side. The foundations are 10 feet deep, 5 feet 9 inches to footing from river bed. The foundations rest on blue clay. Bed, coarse sand and gravel.

Bridge at 329 *miles* 25 *chains.*

Description.—Fifteen 30-feet segmental arches.

Remarks.—Inspected 30th May 1871. The second pier opened on east side. The foundations are on solid rock 4 feet deep, with footing 9 inches below bed.

West abutment foundations 8 feet deep on soft rock. Eleventh pier opened on east side. Foundations 4 feet deep on hard rock. Bed, gravel, and clay, little sand.

Bridge at 334 *miles* 25 *chains.*

Description.—Three 30-feet openings with wrought-iron girder.

Remarks.—Inspected 30th May 1871. The first pier opened on east side. Foundations 6 feet deep on hard rock, through clay; no sand.

Bridge at 373 *miles* 59 *chains.*

Description.—Twelve 62-feet openings with wrought-iron girders over the Thootha river.

Remarks.—Inspected 30th May 1871. The sixth pier opened on the east side. The laterite pier about 20 inches below the bed rests on timber baulks 6 inches thick, in two courses laid over brick wells, which are said to be sunk 18 to 20 feet. The fall of river is only about 3 inches per mile. It is doubtful if the timber is always under water in the dry weather. It is advisable that the timber should be examined once a year; that seen appeared to be sound.

Bridge at 375 *miles* 15 *chains.*

Description.—Five 20-feet semi-circular arches.

Remarks.—Inspected 30th May 1871. The third pier opened. Foundations of laterite, $2\frac{1}{2}$ feet deep, on gravel. There is now partial flooring. Curtain walls should be built and flooring completed. There is no fall in the river at the bridge; the water stands back from the Thootha river.

Bridge at 385 *miles* 55 *chains.*

Description.—Five 20-feet openings with wrought-iron girders.

Remarks.—Inspected 30th May 1871. The second pier opened; the foundations are $5\frac{1}{2}$ feet deep, through clay, resting on gravel.

NORTH-WEST LINE.

Bridge at 51 *miles* 23 *chains.*

Description.—Three 40-feet segmental arches.

Remarks.—Inspected 29th April 1871. No inspection required; the piers are built on solid rock.

Bridge at 72 *miles* 52 *chains.*

Description.—Three 30-feet segmental arches over the Gadeky river.

Remarks.—Inspected 30th April 1871. No. 2 pier, having its foundations pumped dry, was ascertained to have its bottom course at a depth of 6 feet 6 inches below bed of river, laid on morrumboo. The bed of the river is gravel.

Bridge at 248 *miles* 36 *chains.*

Description.—Four 64-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The first pier was opened for inspection; the foundations are 11 feet deep below the bed, resting on gravel.

There are curtain walls at a depth of 10 feet, with flooring between.

Bridge at 263 *miles* 13 *chains.*

Description.—Four 64-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The first pier opened for inspection; the foundations are 10 feet below the bed of the river, resting on clay.

BELLARY BRANCH.

Bridge at 277 *miles* 42 *chains.*

Description.—Five 30-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The first pier opened, showing the foundations 7 feet below the footing, and resting on morrumboo; the masonry is sunk 2 feet into the morrumboo, over which the bed is black cotton soil. It is intended to put in curtain walls and flooring at this bridge, preparations are being made.

Bridge at 284 *miles* 63 *chains.*

Description.—Seven 30-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The first pier opened; the foundations are 13 feet deep below the river bed, resting on morrumboo under black cotton soil. It is intended to put in curtain walls and flooring at this bridge. Preparations are being made.

Bridge at 286 *miles* 61 *chains.*

Description.—Three 30-feet openings with wrought-iron girders.

Remarks.—Inspected 11th May 1871. The second pier was opened; the foundations are $9\frac{1}{2}$ feet deep below the river bed, resting on disintegrated granite. This bridge has flooring and curtain walls, put in last year, in consequence of the appearance of scour; the flooring is 62 feet in width.

BANGALORE BRANCH LINE.

Bridge at 183 *miles* 79 *chains.*

Description.—Three 30-feet segmental arches.

Remarks.—Inspected 24th April 1871. First pier opened on west side; foundations of stone-in-chunam, resting on stiff clay $7\frac{1}{2}$ feet below river bed with offsets to a width of 3 feet.

SOUTH-WEST LINE.

Bridge at 71 *miles* 25 *chains.*

Description.—Fifty-six 29 feet 6 inches segmental arches over the Poiney river.

Remarks.—Inspected 24th April 1871. Excavation made at the north end of the 32nd pier; the foundations of stone-in-chunam rest at a depth of 5 feet on brick-in-mud wells, filled with broken stone, etc. The height of pier above river bed is 7 feet 2 inches to spring of arch. There are stone-in-chunam segmental inverts between piers; a line of wells runs under face of inverts, throughout, up and down stream. The water was pumped out, exposing the wells about 2 feet. The wells are said to be sunk 10 feet.

In order to ascertain at what depth below the surface of sand the hard substratum lies, the Acting Chief Engineer has ordered some experimental wells to be sunk in the bed of the river, as it seems desirable that a curtain wall founded on wells sunk to a depth of not less than 25 feet should be built along the lower face of the inverts, outside the present wells, which being only 15 feet deep can hardly be considered absolutely beyond the influence of scour, although there are no evidences that scour has been observed at this bridge. The fall of channel above bridge is 13·69 feet per mile. High flood level, according to local evidence, shows about 5 feet 6 inches above lowest part of river bed.

Bridge at 97 *miles* 40 *chains.*

Description.—Twenty-four 30-feet and at 97 miles 50 chains five 30-feet segmental arches over the Gooriattum river.

Remarks.—Inspected 24th April 1871. Twelfth pier opened on the west side; foundations built $1\frac{1}{2}$ foot in chunam and $9\frac{1}{2}$ feet in clay (blue stiff) to a total depth of 11 feet below the river bed; footings are in two offsets of 2 feet each, total width of pier at base 13 feet. The foundations rest on sand. The excavation was not pumped dry, but the lowest course was felt by hand and measured. In order to ascertain what depth below the surface of sand the hard substratum lies, the Acting Chief Engineer has ordered some experimental wells to be sunk in the bed of the river, as it is desirable to build curtain walls and flooring to this bridge.

The fall of channel at one bridge is 15·63 feet per mile.

High flood level, according to local evidence, shows about 5 feet 9 inches above lowest part of river bed.

Bridge at 106 *miles* 21 *chians.*

Description.—Fourteen 31-feet segmental arches (seven at each end) and five 63-feet openings with wrought-iron girders over the Palar river.

Remarks.—Inspected 24th April 1871. East abutment pier opened on west side; water not got down.

Further examination to be made when pumps are procured.

Inspected 3rd July 1871.

East abutment pier examined again. The water was got down to the level of the top of the lowest course of masonry.

The foundations are about 8 feet 10 inches below the river bed resting on sand. There appears to be from 2 to 3 feet of sand below the masonry, and then a hard stratum, this was judged by using an iron pricker. The Acting Chief Engineer has ordered wells to be sunk to ascertain the depth of sand, as it seems advisable that there should be curtain walls in the pre-openings over the sandy bed of the river.

The west abutment pier is now being prepared for examination, and will, it is hoped, be inspected shortly.

MADRAS,
15*th July* 1871.

(Signed) A. deC. SCOTT, Captain, R.E.
(„) H. L. PRENDERGAST, Major, R.E.
(„) T. H. GOING.

No. 363. ORDER THEREON, 28th August 1871, No. 2197.

RAILWAY, No. 47.

FROM the above Report, on the further examination of Railway bridges on the South-West, North-West and Bangalore branch lines, the Government are glad to learn that the Committee consider the foundations generally to be satisfactory, being substantially built and resting on a firm substratum; also, that it is intended to take the precaution of adding a masonry flooring with retaining wall in certain cases where there is much depth of sand and probability of scour, and it appears very desirable that, although the circumstances are somewhat different, a like precaution should be taken at the bridge at 375 miles 15 chains, South-West Line.

2. The Government share the Committee's apprehensions regarding the probability of decay in the timber used in the foundations of certain bridges, and they trust that the Agent will take such steps as may ensure the periodical examination recommended by the Committee. The examination of the Naggery bridge, which has been deferred, should not be lost sight of.

3. Looking to the description given of the foundations of the Poiney bridge and the great fall of the river, the addition of the curtain wall on wells sunk to a depth of 25 feet is, in the opinion of the Government, a necessary precaution. The same remark applies in the case of the Gooriattum bridge where, moreover, the foundations, except for a depth of 18 inches, are laid in clay. The Government would wish to be informed what nature of foundations were sanctioned for the last two named bridges as they are inclined to doubt the use of wells made of brick-in-mud, and, foundations of stone set in clay having been authorized, they will await the Committee's further report after the completion of the experimental wells.

4. In regard to the Palar bridge, respecting which the Government had the greatest anxiety, it appears that the foundations of the east abutment pier only extend to a depth of 8 feet 10 inches below the river bed, and resting in sand 2 or 3 feet deep before a hard substratum is reached.

5. The fall of the river is not reported, and, if there is not much real cause for apprehension regarding the stability of this bridge from its appearance, the circumstances of its foundation, so far as they have been examined, are such as to dictate the expediency of the greatest caution being used in the transit over it of passenger trains. The Government are desirous that a more extended examination shall be made of the foundations of its piers, the result of which should be reported, for, looking to the shallow depth of the foundations, it is very doubtful whether a curtain wall would be a sufficient protection against injury in the event of a great flood. Meanwhile, it is expedient that the precautions of inspection and signalling prescribed in regard to the renewed use of the Cheyaur bridge should be adopted in the cases of the bridges over the Palar, Poiney and Gooriattum rivers, especially over the first named one, which should accordingly be done, and the additional precaution of slackening the speed of trains in passing over the Palar river should also be taken, and likewise in rainy weather in the cases of the Poiney and Gooriattum bridges.

6. The Consulting Engineer for Railways will be requested, when further reporting on this subject, to submit the sanctioned plans of the bridges over the Palar, Poiney, and Gooriattum rivers, and the specifications of the foundations, or the estimates explanatory of the nature of their construction.

(True Extract.)

(Signed) A. deC. SCOTT, Captain, R.E.,
Under Secretary to Government.

To the Acting Consulting Engineer for Railways.

CONSULTING ENGINEER'S OFFICE.

Railway Department.

No. 711—

From Major H. L. Pinwill R.E.
Acting Consulting Engineer for Railways,

To Colonel C. J. Carpendale R.E.
Secretary to Government,
Public Works Department,
Fort Saint George.

Sir,

I have the honour to submit a further report of the Committee's examination of the foundations of bridges on the Madras Railway, in continuation of that published in G. O. No. 942 dated 30th March 1871.

2. Of the 6 bridges left unreported on the 1st March on the North-West Line; all have now

been examined, except during the last
29 miles 68 chains over the Nagpoor
river. I regret that Consideration
mentioned in my letter of the 7th June
1871; No 250, that also the Bridges
on the North-West Line had been
inspected: but there is no means of
water at all times under the surface
of the sand in the Nagpoor river, for
pumping appliances were more
particularly required, at the Wurdha
river, the Committee could not then
postpone their examination. The
present Acting Chief Engineer has
a recollection of some of the foundations
being got in; he having been on
duty in the adjacent district, and

the Committee therefore had the more
confidence in leaving the Nagpoor
bridge for future inspection.

3. The bridges on the Bellary and Bangalore branches have now been examined; also all those on the South-West Line; though at 3 on the latter, further inspection has to be made.

4. The inspecting Committee has consisted of three members, except on the 30th and 31st May, when the bridges on the South West Line from 220 miles to the Western end, were examined only by Mr Going and myself. Captain Scott was at that time

under orders to inspect the Irrigation Company's works: the foundations of bridges in the Malabar district had been opened with some difficulty owing to early rains in May: and when a telegram was received to the effect that inspection might be made at once, if the monsoon still held off; it appeared most desirable to take the opportunity without any delay; as otherwise several months might be lost. As it happened, there was little time to spare, for the rivers were in flood on the 2nd June.

5. The foundations of the bridges have been generally found to be satisfactory: as substantially built: and resting on a firm sub-stratum. The Chief Engineer has since the last monsoon been taking measures in his own Department, for additional works of protection: and the Committee have considered it advisable that retaining walls and flooring should be put in: at the bridges at

239 miles 16 chains S. W. Line

71 — 25 — Do —

97 — 40 — Do —

106 — 21 — Do —

These last three bridges span, the Poiney river, the Goorcatturn river

and the Palar river: wells are being
sunk, with a view to ascertain the
depth of the hard sub-stratum under
the sand: for the East abutment
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on sand, and the same is the case
with the pier that has been examined
on the Goodiatteum river: while
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on sand, though built on wells.
A further examination of the
Palar bridge, will it is expected,
be made in a few days.

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other bridges call for special
remark.

At 375 miles 15 chains

on the South-West Levee, the foundations
were found to be only 2½ feet in
depth, but on gravel, not sand.
It is not known why these foundations
were not sunk deeper: but there
is no scour, inasmuch as the water
is still, standing back from the
shoot the river. A flooring
appears to have been begun, and then
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The Committee propose that this
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timber platform, apparently put on
to give a uniform surface, on which
to build the masonry. The top of
the timber is only 20 inches below the

South West Line

Madras 15th August 1871.

From

The Consulting Engineer
for Railways,

To

The Secretary to Government,
P. W. Department,
Fort St. George.

Dated 14th August 1871.
Received 15th August 1871.

No. 311.

Submitting a further report of the Committee's re-examination of the foundations of bridges on the Madras Railway.

No. 2197 - 28 Aug. 71.

Proceedings of Government, Public Works Department.

Read the following report from the Consulting Engineer for Railways, dated 14th August 1871, No. 311.

Ordered, that the Consulting Engineer for Railways be informed that the Government have perused with much interest the report of the Committee appointed to re-examine the foundations of bridges on the Madras Railway, and that they are glad to find that the Committee have arrived at the conclusion that the bridges are safe.

Ordered, that a copy of the report be sent to the Consulting Engineer for Railways, and that the Madras Railway Company be requested to submit a report on the subject of the Committee's recommendations.

(True Extract)
(Signed) H. Stokes,
Secretary to Government.

To

The Consulting Engineer for Railways.

Sir,

I have the honor to forward a report of the Committee appointed to re-examine the foundations of bridges on the Madras Railway, and to request that you will favor me with your opinion on the subject.

I have, &c.
(Signed) H. Stokes,
Secretary to Government.

Fort St. George,
15th August 1871.

No. 362

Consulting Engineer's Office,
Madras, 14th August 1871.

From

Lieut. Col. H. A. Hutchinson, R.E.,
Consulting Engineer for Railways,

To

The Secretary to Government,
Public Works Department,
Fort St. George.

Sir,

I have the honor to forward herewith a report of the Committee appointed to re-examine the foundations of bridges on the Madras Railway, and to request that you will favor me with the opinion of Government on the subject.

I have, &c.
(Signed) H. A. Hutchinson, Lieut. Col.,
Consulting Engineer for Railways.

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I have, &c.
(Signed) H. A. Hutchinson, Lieut. Col.,
Consulting Engineer for Railways.

Remarks— Inspected 2nd April 1871.

Excavation made on West side of Pier; found stone of stone in channel, 6 feet below Inner bed, resting on blue clay.

Bridge at 129 miles 5 chains.

Description— Span 29½ feet segmental arches.

Remarks— Inspected 2nd April 1871.

Excavation made on West side of 2nd Pier; found stone resting on gravel, 6½ feet below Inner bed. stone in channel to a height of 4 feet; and the piers above of brick. The footings are stepped out on each side to amounting to 3 feet.

Bridge at 129 miles 63 chains.

Description— Span 30½ feet segmental arches.

Remarks— Inspected 1st July 1871.

Excavation made on West side of 1st Pier. The foundations of stone are 7 feet in depth below the Inner bed, and rest on

on Morrumboo. There
is a depth of only about
12 feet of sand in
the lower bed, the rest
being Morrumboo.

Such items should be underscored thus

Bridge at 144 miles 57 chains.

Description— Five 31 feet and three 49½ feet segmental arches.

Remarks— Inspected 25th April 1871.

The 3d Pier opened at the North end; foundations resting on rock, 8¾ feet below lower bed, of stone in

in cofferdams to a height of 12 feet above bed, and brick-work above. Foundations stepped in 11 courses, to an aggregate of 5½ feet.

Bridge at 191 miles 76 chains.

Description— Seven 30 feet segmental arches.

Remarks— Inspected 25 April 1871.

3d Pier opened on East side: foundations of stone in cement 9 feet deep resting on boulders and gravel. The channel above the bridge requires clearing. This has been ordered.

Bridge at 199 miles 27 chains.

Description— River 30 feet
segmental arches.

Remarks— Inspected 25th
April 1871.

2 Piers opened at east-side
down to foundations
alone in channel 9 feet
deep. Resting on clay.

Bridge at 220 miles 9 chains.

Description— River 30 feet
segmental arches.

Remarks— Inspected 31st
July 1871.

Excavation made on South
side of 1st & 2nd Piers 3 feet
below foundations consist of 9/10
feet of depth of masonry
upon a course of concrete
1 foot thick, over clay.
The former beds consists
principally of clay.

Bridge at 239 miles 16 chains.

Description— River 30 feet
segmental arches.

Remarks— Inspected 31st
May 1871.

The 2 Piers opened on
South side; foundations
3 feet deep on a levelling
course of concrete over rock.
1st Pier opened on South
side; foundations 5½
feet deep on decayed rock.
North abutment opened;
foundations 4½ feet deep.

Footing

Station [illegible]

It is considered advisable that a retaining wall and flooring be put in between the abutment and the next pier. This has been ordered.

Bridge at 242 miles 41 chains

Description — Four 31 feet segmental arches.

Remarks — Inspected 31st May 1871.

Excavation made on south side of the 3? Piers. The foundations rest on hard rock, 4' 10" below the river bed.

Bridge at 280 miles 46 chains

Description

Description — Four 34 feet segmental arches.

Remarks — Inspected 31 May 1871.

The 2? Pier opened on the East side; the foundations are 5 feet in depth below the river bed, resting on hard rock; the other piers are visibly founded upon rock.

Bridge at 305 miles 37 chains.

Description — Three 30 feet segmental arches.

Remarks — Inspected 30 May 1871.

The first pier was opened on the East side at 2'-6" below the bed, there is a footing, and 5 feet below that.

that stands to the South
on which the foundations
rest. At the second
Pier opened also on the
East side; the footing is
1 foot 9 inches below the
bed, and the foundations
rest on soft rock 8½ feet
below the footing. The
lower bed is of sand and
clay.

Bridge at 317 miles 7 chains.

Description— Seven 15 feet
semi-circular arches.

Remarks— Inspected 30 May 1871.
The 3rd Pier opened on the
East side. The footing
is about on the level of
the

(2)

the surrounding. The foundations are 6 feet deep on rock &c. The lower portion of 1½ feet is of brick work &c.

The 4th Pier opened on the East side. The footing is 1 foot 9 inches below bed of river, and the depth to rock below is 8 feet 3 inches. Bed sand.

Bridge at 318 miles 7 chains.

Description— Three 30 feet segmental arches.

Remarks— Inspected 30th May 1871.
The 2nd Pier opened on the West side. The footing is 1 foot 4 inches below finished bed

bed, and clay & sand in 1/2
feet below footing.
West abutment. Rock comes
up to surface.

Bridge at 316 miles 14 chains.
Description — Three 30 feet
semi-circular arches.
Remarks — Inspected 31st May 1871.
The 2nd Pier opened on the
West side. The foundations
are 6 feet deep in Rock.
Red Clay.

Bridge at 321 miles 16 chains.
Description — Three 30 feet
segmental arches.
Remarks — Inspected 30th May 1871.
The 2nd Pier opened on the
West

West side. The foundations
are 11 feet deep; 5 feet
9 inches to footing from
finer bed. The foundations
rest on blue clay. Bed;
coarse sand and gravel.

Bridge at 329 miles 25 chains.
Description — Three 30 feet
segmental arches.
Remarks — Inspected 31st May 1871.
The 2nd Pier opened on East
side. The foundations are
on solid Rock, 4 feet deep;
with footing 9 inches —
below bed. —
West abutment. Founda-
tions 8 feet deep on soft
Rock

Description— Piers 20 feet semi-
circular ends.

Remarks— Inspected 30th May 1870.
The 2d Pier opened. Founda-
tions of laterite, 27 feet
deep, on gravel. There is
now partial flooring.
Curtain walls should be
built, and flooring com-
pleted. There is no fall
in the River at the bridge;
the water stands back from
the Ghorbha River.

Bridge at 385 miles 55 chains.

Description— Piers 20 feet —
openings with Wrought
Iron girders.

Remarks— Inspected 31st May 1870.
The

The 2d Pier opened; the
foundations are 5½ feet
deep, through clay, resting
on gravel.

North West Line

Bridge at 51 miles 23 chains.

Description— Piers 40 feet
segmental arches.

Remarks— Inspected 29th
April 1871. On inspection
required the Piers are
built in coled work.

Bridge

Bridge at 72 miles 52 chains.

Description. Three 30 feet segmental arches over the Gadeby River.

Remarks. Inspected 30th April 1871. No 2 Pier, leaning into foundations. Sounded deep, was ascertained to have its bottom course at a depth of 6 feet 6 inches below bed of River. Laid on morrumboo. The bed of the river is gravel.

Bridge at 248 miles 36 chains.

Description. Four 66 feet openings, with Wrought Iron girders.

Remarks. Inspected 11th May 1871.

The

The 1st Pier was opened for inspection, the foundations are 11 feet deep below the bed, resting on gravel. Three are cylinder walls, at a depth of 11 feet, with flooring between.

Bridge at 263 miles 18 chains.

Description. Four 66 feet openings, with Wrought Iron girders.

Remarks. Inspected 11th May 1871. The 1st Pier opened for inspection, the foundations are 10 feet below the bed of the river resting on clay.

Bellary Branch.

Bridge at 211 miles 60 chains.

Description. Iron 30 feet
Opening with Wrought
Iron girders.

Remarks. Inspected 11th May
1871. The foundations
of the piers opened,
the former being on the
rock, the latter on
timber piles and
planking on which
the brick work rests.
The bed is black cotton soil.
It is intended to put in
certain walls and flooring
at this bridge, preparations
are being made.

Bridge

Bridge at 218 miles 69 chains

Description. Iron 30 feet
Opening with Wrought
Iron girders.

Remarks. Inspected 11th May
1871. The foundations
of the piers opened,
the former being on the rock,
the latter on timber piles and
planking on which the brick
work rests. The bed is
black cotton soil. It is
intended to put in certain
walls and flooring at this
bridge. Preparations are
being made.

Bridge at 228 miles 61 chains

Description. Iron 30 feet
Opening with Wrought
Iron girders.

Remarks.

Remarks. Inspected 11th May 1871.

The 2d Pier was opened; the foundations are 9½ feet deep below the Iron bed, resting on disintegrated granite. The bed of the flooring and curtain walls, sunk last year; in consequence of the appearance of Sand: the flooring is 62 feet in width.

Bangalore Branch Line.

Bridge at 183 miles 79 chains.

Description. Three 30 feet segmental arches.

Remarks. Inspected 24th April 1871. Pier opened on West side; foundations of clay and clinkum; resting on stiff clay 7½ feet below Iron bed with offset to a width of 13 feet.

South-West Line

Bridge at 71 miles 25 chains.

Description. Left pier 29 deg: 0 min: Right pier 29 deg: 0 min: Iron.

Remarks. Inspected 24th April 1871. Excavation made at the south end of the 32d pier; the foundations of clinkum laid at a depth

15 feet in breadth mined
well, filled with broken
stone &c. The height of
Peel above river bed is 7 feet
2 inches. In sinking of a cel-
lular stone in alluvium seg-
mental circle, between
piers, a line of wells from
under face of concrete, through-
out, up and down stream.
The water was pumped out,
previous to the wells about
2 feet. The wells are said to be
sunk 10 feet, in order to ascertain at
what depth below the
surface sand and shingle
alternated, the Engineer
Colonel Engineer has ordered
some experimental wells
to be sunk in the bed
of

of river, as it seems desir-
able that a curtain wall
founded on wells sunk to
a depth of not less than
25 feet, should be built
along the lower face of the
concrete, inside the present
wall, which being only
15 feet deep can hardly
be considered absolutely
beyond the influence of
scour, although there are no
evidences that scour has been
observed at the bridge.
The fall of channel above
bridge is 13½ feet per mile.
Mean flood level according
to local evidence is about
5 feet 6 inches above
lowest part of river bed

Bridge at 9.7 miles 4 chains.

Description Twenty four
30 feet and at 9 7 miles
50 chains five 30 feet segmental arches over the
Goodradium River.

Remarks. Inspected 24th April
1891. 1/2 Piers opened on
the West side foundations
should 1 1/2 foot in shingle
and 9 1/2 feet in clay (blue
stiff) to a total depth of
11 feet below the river bed.
Foundations are in 2 offsets
7 feet each. Total width
of pier at base, 19 feet.
The foundations rest on
sound The excavation was
not pumped deep, but the
lowest

lowest stratum was penetrated
hand and measured.
In order to ascertain what
depth below the surface
of sand the hard substra-
tum lies, the Engineer Chief
Engineer has ordered some
experimental wells to be
sunk in the bed of the
river, as it is desirable to
build certain walls and
flooring to the bridge.
The fall of channel at the
bridge is 15.13 feet per mile.
The flood level, according
to local evidence,
is about 15 feet greater
at the lowest part of river
bed.

Bridge at 10 miles 2 chains.
Description

Description. Fourteen 31 feet segmental arches (seven at each end) and five 63 feet openings with Wrought Iron Girders over the Palar River.

Remarks. Inspected 24th April 1871.

East abutment pier opened on West side; water not got down.

Further examination to be made, when pumps are removed.

Inspected 3rd July 1871.

East abutment pier examined again. The water got down to the level of the top of the lowest course of masonry.

The foundations are about 8 feet 10 inches below the river bed, resting on sand: & there appears to be from 2 to 3 feet of sand below the masonry, and then a hard stratum, this was judged by using an iron probe. The Asst Chief Engineer has ordered wells to be sunk to ascertain the depth of sand, as it is considered desirable that there should be curtain walls in the pier openings over the sandy bed of the river.

The West abutment pier is now being prepared for examination, and well it is hoped be inspected shortly.

Madras
15 July 1871.

H. Levin

Asst. Engr. Scott Capt. RA.
Chas. L. Sundry Asst. Engr. RE

Public Works Department

No 2899

Proceedings of the Madras Government

Under date the 28th Sept 71.

Read the following

From The Consulting Engineer for Railways No H.E. No 311 Dated 15th July 1871

From the above report, on the further examination of Railway Bridges on the South West, North West, and Bangalore branch lines, the Government are glad to learn that the Committee consider the foundations generally to be satisfactory being substantially built and resting on a firm substratum; also, that it

Read also the G.O. thereon dated 8th Sept 71.

Ordered that the Govt Chief Engineer's opinion be decidedly against the use of timber platforms for the foundations of bridges as a safeguard against floods; and that the foundations of the masonry piers for the Pudatur Challakere in lieu of piles

portion of such wells filled with stone or brick in chunam mortar is in good water resisting

is intended to take the
precaution of adding a
masonary flooring with
retaining wall in certain
cases where there is much
depth of sand and pro-
bability of scour, and it
appears very desirable that
altho' the circumstances are
somewhat different, a like
precaution should be taken
at the bridge at 375. 15 Ch.
S.W. Line.

The Government
share the Committee's ap-
prehensions regarding the
probability of decay in the
timber used in the foundations
of certain bridges, and they
trust that the Agent will

take

take such steps as may
ensure the periodical exa-
mination recommended by the Com-
mittee. The examination of the Nagger
Bridge which has been
deferred should not be
lost sight of.

Looking to the
description given of the
foundations of the Taymor
bridge and the great fall
of the River, the additional
of the curtain walls on
wells sunk to a depth
of 25 feet is in the opinion
of the Government, a
necessary precaution.
The same remark applies
in the case of the Sorcatum
bridge where moreover
the foundations, except for
a

a depth of 18 inches, are laid in Clay. The Government would wish to be informed what nature of foundations were sanctioned for the last two named bridges as they are inclined to doubt the use of Wells made of brick-in-mud, and foundations of stone set in clay having been authorized, they will await the Committees further report after the completion of the experimental Wells.

In regard to the Palar bridge, respecting which the Government had the greatest anxiety, it appears that the foundations of the East abutment Pier only extend

extend to a depth of 8 feet 10" below the river bed, and resting in sand two or three feet deep before a hard substratum is reached.

The fall of the River is not reported, and if there is not much real cause for apprehension regarding the stability of this bridge from its appearance, the circumstances of its foundation, to prevent its being undermined are such as to dictate the expediency of the greatest caution being used in the transit over it of the Passenger trains. The Government are deserved that

that a more extended
examination shall be made
of the foundations of its
piers the result of which
should be reported, for,
looking to the shallow
depth of the foundations,
it is very doubtful whether
a curtain wall would be
a sufficient protection
against injury in the
event of a great flood.—
Meanwhile, it is expedient
that the precautions of in-
spection and signalling
prescribed in regard to the
renewed use of the Cheyaur
bridge should be adopted in
the cases of the bridges over
the Palar, Paynee, and
Goriattum

Goriattum rivers, especially
over the first named one,
which should accordingly
be done, and the additional
precaution of slackening
the speed of trains in
passing over the Palar
river should also be
taken, and likewise in
rainy weather in the Paynee and Goriattum
bridges.

The Consulting
Engineer for Railways
will be requested, when
further reporting on this
subject, to submit the
sanctioned plans of the
bridges over the Palar,
Paynee and Goriattum
Rivers, and the specifications
of

of the foundations, or the
estimates explanatory of
the nature of their construc
tion.

29th July

3/2

To the Ag: Consulg: Engrs
for Railways —
Desp. 30/8/71

(5)

9.11.03 ✓
26.1.04 ✓

Of 1426

Govt of India. Madras.

PUBLIC WORKS.

To

The Acting Consulting
Engr for Railways

Dated

Rec'd.

G. O. 28 Augt. No. 2197.

Nos. 362 & 363

Bridges (Railway) Papers

Letters in the margin referred to,
submitted by the Acting
Engr for Rys, on the
recommendations of Bridges
on the S.M., N.W. and
Bangalore
Branch lines of the
Madras Rys