

(1) Number of pages _____

(2) Date of repair _____

(3) Initials of the Referencer _____

MADRAS RECORD OFFICE

Government of Madras

Public Works

DEPARTMENT

G.O. No.

177

~~B.P. No.~~

Press

Mis.

Original

Dated

21

/

195

1875

Not to be folded or roughly handled

Proceedings of the Madras Government, Public Works Department,
21st January 1875.

Read the following papers:—

No. 365. From Lieutenant-Colonel J. H. M. SILLAW-STEWART,
Consulting Engineer for Railways, to Colonel G. W. WAINMAN,
Secretary to Government, Public Works Department, dated
December 1874, No. 771.

ADVERTING to the Proceedings of Government, under date this
No. 3,460, I have the honor to lay before His Excellency in Council
by the Deputy Consulting Engineer,
upon the blasting operations and
for the purpose of removing an overhanging boulder at the "Tiger Rock cutting" on the Bangalore Branch of the Madras Railway.

* Dated 17th December 1874.

2. Upon the 9th instant I made a careful inspection of the cutting with the
Company's Chief Engineer, and a survey is now in progress with a view to deter-
mine the best mode of insuring the future safety of the line.

*Note on the removal of a large boulder at the "Tiger Rock cutting" on the Bangalore
Branch of the Madras Railway.*

I HAVE the honor to submit the following report on the removal of a large boulder at the
"Tiger Rock cutting" on the Coopum ghaut of the Bangalore Branch, Madras Railway. I visited
the Tiger Rock on the 21st and 25th of November and 2nd of December 1874.

2. Near the summit of the Coopum ghaut, on the Bangalore Branch of the Madras Railway,
the line runs through a deep cutting in the 145th mile, commonly known as the "Tiger Rock
cutting."

A semaphore signal and signaller's hut are erected on the portion of this rock, which forms
the lower side of the cutting, or that which is on the right hand side of the line when ascending
the ghaut. The line passes through the cutting on a curve of 40 chains radius, and the gradient
is 1 in 68.

Drivers of trains when approaching the Tiger Rock signal, from either side, are required
to give *one long whistle*, and to be prepared to bring their trains to a stand should the signal be
kept against them.

3. When the Bangalore Branch was constructed in 1864 all boulders at the Tiger Rock
which were at all likely to slip down on the line were either removed or supported with substan-
tially built masonry on foundations stepped in the underlying rock. The rock and boulders in the
neighbourhood, however, appear to disintegrate rapidly, and to crumble away with exposure to
weather; much of what now lies round the boulders in the form of rotten, earthy looking debris
was solid rock in 1864, requiring blasting to remove it.

During the last ten years however decay and disintegration have been at work on the rock and
boulders, and the soil in which some of the boulders were embedded and supported has been loosened
and washed away by the rains.

4. The changes in the condition of the rock and boulders in the vicinity of the "Tiger
Rock cutting" likely to affect the railway, in the event of this falling over or slipping, have for
some time past been carefully noted by Mr. Scott, the Resident Engineer of the Bangalore
Branch. In October last he forwarded a report upon the subject to Mr. Beresford Anderson, the
Chief Engineer of the Madras Railway.

5. Early in November Mr. Anderson and Mr. Scott inspected the locality, and came to the
conclusion that it would be prudent to remove by
blasting the face of the larger rock nearest

* Boulder.

to, and almost overhanging, the line on the upper side of the cutting, or that which is on the left
hand side when ascending the ghaut.

Eng. of the Madras Govt. Public Works Department,
21st January 1875

had so washed away the supporting earth and debris from about it, the work at once small charges, but of which were "jumped" in the face of the large boulder, and not apparent on the 15th of November by electricity, under the direction of Engineer of the Company.

perfectly successful in every respect, and nothing more would have been been quite solid. Unfortunately it was not so. It was found to have two veins which were imperceptible before the boulder was shaken by the face, but with the concussion these veins enlarged to dangerous cracks, and the boulder was left in a condition which rendered its immediate total removal necessary. The veins extended through the top of the boulder in a plane at an angle of about one horizon, so that when the boulder was shaken by the concussion, the whole top slid backwards 6 feet, and was only kept from sliding further by a piece of rock projecting from the ground.

The other vein, which had enlarged to a dangerous crack, was in a nearly vertical plane through the boulder, which, when the face had been removed, was thus divided into three large pieces, liable to fall down on the line at any moment.

A series of shots was therefore put in the supporting piece of rock B, and another series in the top of the boulder marked A. The two series of shots A and B were then fired simultaneously by electricity, and the whole of the boulder which had been threatening the line was thus successfully brought down.

7. The permanent-way was not removed from the line below the boulder prior to its removal, as the rails are laid in chairs spiked to wooden sleepers forming a roadway troublesome to take up and relay. The permanent-way was however sufficiently protected with earth and sleepers.

The fragments of the boulder did not fall on the line with a crash, but slipped down quietly and rested there.

Men were then set to work to jump holes in the large pieces, and series of shots were fired off from time to time by electricity which broke them up into manageable pieces. It is estimated that between 500 and 600 tons of rock had thus to be broken up and removed from the line. A number of old unserviceable permanent-way rails were laid flat on the roadway between the rails of the line, to some distance on each side of the rock as it lay on the line. As soon as a series of shots had been fired, chains were put round such pieces of rock as could be moved; an engine then came up and the chains being attached to it, it moved off again, dragging the rock along with it over the old rails to a little distance clear of the cutting; men with levers then tipped it over the side of the ghaut into the valley below. Some pieces were so heavy it was found impossible to turn them over with levers; screw jacks were then made use of to tilt them up to such an angle as enabled men with levers to complete the work of tipping them into the valley below.

Electricity was always employed when it was found desirable to fire a series of shots simultaneously. The ordinary patent fuze was used when isolated shots were fired.

8. No more powder was used in the first operation, viz., that of removing the overhanging face of the boulder, than was necessary to effect the required result.

Owing to the veins with which the boulder was intersected however, it cracked into three large pieces, the immediate removal of which, as has been already shown, became absolutely necessary. It was at first thought that the entire boulder might be removed at a single operation, by firing a mine with a large charge of powder in rear of and below it, and a rocky projection below and in front of it rather favored the hope that when the boulder had been blown from its position, it would in its downwards course come in contact with the projecting rock, and thus be thrown clear over the line. On further examination of the ground, however, at the other or lower side of the line, the plan of removing the boulder by a mine fired in rear of it was abandoned, and its removal in the manner afterwards carried out, decided upon.

9. One hundred and fifty men were employed in "jumping" shot holes in the rock which was brought down on the line. Three men to each jumper, fifty jumpers were thus constantly at work;

Proceedings of the Madras Govt. Public Works Department,
21st January 1875

a short time work was carried on night and day, but it was found that from fever from night exposure, all work excepting day work, had to be given up. That one of the men has since died of fever, and several others are now suffering from fever, proving that the Resident Engineer did not abandon night work at all too soon.

10. The men employed in jumping the shot-holes were chiefly brought from the neighbourhood of that town.

It was with great difficulty that they were prevailed upon to complete the removal of the rock. Their work was in an uninhabited, jungle place, and was considered by all a few localities. They remained at night time at Jollapett, and were conveyed by ballast trains to their work, returning again to Jollapett in the same way at dusk.

11. On several days, during the removal of the rock, heavy rain fell; on these days the men, excepting the regular gang coolies attached to the line, could be prevailed upon to work, this of course added greatly to the delay in opening up the line again for traffic. I am not aware, however, of any serious inconvenience having been felt, as passengers had no difficulty in walking round the rock from the train at one side to that on the other, which was always ready to convey them on, and the accumulation of goods at Bangalore and Jollapett was all worked off by special trains in the course of one or two days after the obstruction had been removed.

12. The line was blocked from the 15th of November until the 2nd of December. On the 15th of November the first shots were fired in the overhanging face of the boulder, on the 19th of November the remainder of the boulder was brought down by blasting; on the 1st of December some small loose boulders and pieces of rock were brought down and removed, and on the 2nd of December the line was clear and open for goods as well as passenger traffic.

13. Every credit is due to Mr. Scott, the Resident Engineer, who, remaining at Coopum during the removal of the rock, by his energy and example encouraged the men employed to work with a will. Considering the large number of men employed constantly on so small space, the nature of the work to be done, and the constant firing of blasts, it is a matter for some wonder that there were no accidents of at all a serious nature amongst the workmen, and shows that the arrangements made for their safety were well planned and efficiently carried out.

BANGALORE, (Signed) ROSS THOMPSON, Captain, R.E.,
17th December 1874. Offg. Dy. Consulting Engineer for Railways.

No. 366. Endorsement of the Consulting Engineer for Railways, dated Madras, 30th December 1874, No. 782.

From R. B. ELWIN, Esq., Agent and Manager of the Madras Railway Company, to Lieutenant-Colonel J. H. M. SHAW-STEWART, R.E., Consulting Engineer for Railways, dated Madras, 29th December 1874, No. 1,135.

WITH reference to your letter No. 1,178, of the 12th instant, and to the order of Government which accompanied it, I have the honor to enclose a copy of a report made by the Resident Engineer of the 2nd Division, South-West Line, in which he furnishes full particulars regarding the blasting operations at the Tiger Rock.

From P. SCOTT, Esq., Resident Engineer, 2nd Division, South-West Line, to B. ANDERSON, Esq., Chief Engineer of the Madras Railway Company, dated Bangalore, 18th December 1874, No. 376.

Your No. 1,860 of the 14th instant.

2. The quantity of rock removed by blasting at Tiger Rock was about 300 cubic yards, the is, the large boulder about 280 cubic yards and several smaller ones which were loosened by the fall of the large one; there was no more rock moved than was calculated on before operations were

of the Cutting, or

Er. S. T. Austin.
Spare Copies

2. Near the Summit of the
Cooperng Shant, on
the Bangalore Branch
of the Madras Railway
the line runs through
a deep Cutting in the
145th mile, commonly
known as the "Liger
Rock Cutting".
A Semaphore Signal
and Signaller's Hut
are erected on the top of
this rock, which
forms the lower side
of the Cutting, or that

which is on the right
hand side of the line.
When ascending the
branch the line passes
through the cutting on
a curve of 40 chains to
radius, and the gradient
is one in 48.

Drivers of trains when
approaching the Tiger
Rock signal from either
side, are required to
give one long whistle
and to be prepared to
bring their trains to
a stand, should the
signal be kept against
them.

3.

When the Bangalore
Branch was constructed
in 1864, all boulders
at the Tiger Rock which
were at all likely to slip
down on the line, were
either removed, or supported
with substantially built
masonry on foundations
stepped in the underlying
rock. The rock and
boulders in the neighborhood
however appear to
disintegrate rapidly

to crumble away with
exposure to weather,
much of what now
lies round the boulders
in the form of rotten
earth. Looking at this
was solid rock in 1864
requiring blasting to
remove it.

During the last ten
years however, decay
and disintegration have
been at work on the
rock and boulders,
and the soil in which
some of the boulders were
embedded and
supported has been
loosened and washed
away by the rains.

4. The changes in the
condition of the rock
and boulders in the
vicinity of the Tiger Rock
cutting, which we feared
the railway, in the
event of these falling
over or slipping, have
for some time past
been carefully noted
by Mr. Sest. Mr.
Resident Engineer of
the Bangalore Branch
in October last he

forwarded a report upon
the subject to Mr
Berisford Anderson,
the Chief Engineer of the
Madras Railway.
Early in November Mr 5.
Anderson and Mr
Scott inspected the
locality, and came
to the conclusion that
it would be prudent
to remove by blasting
the face of the lower
rock, nearest to and * boulder.
Almost overhanging
the line, on the upper
side of the cutting,
or that which is on
the left hand side
when ascending the
shant.

The late heavy monsoon
had so washed away
the supporting earth
and debris from about
it, that it was decided
to carry out the work at
once.

To effect this a number 6.
of holes were "jammed"
in the face of the lower
boulder, and two series
of shots were fired
on the 15th of November
by electricity. Under the

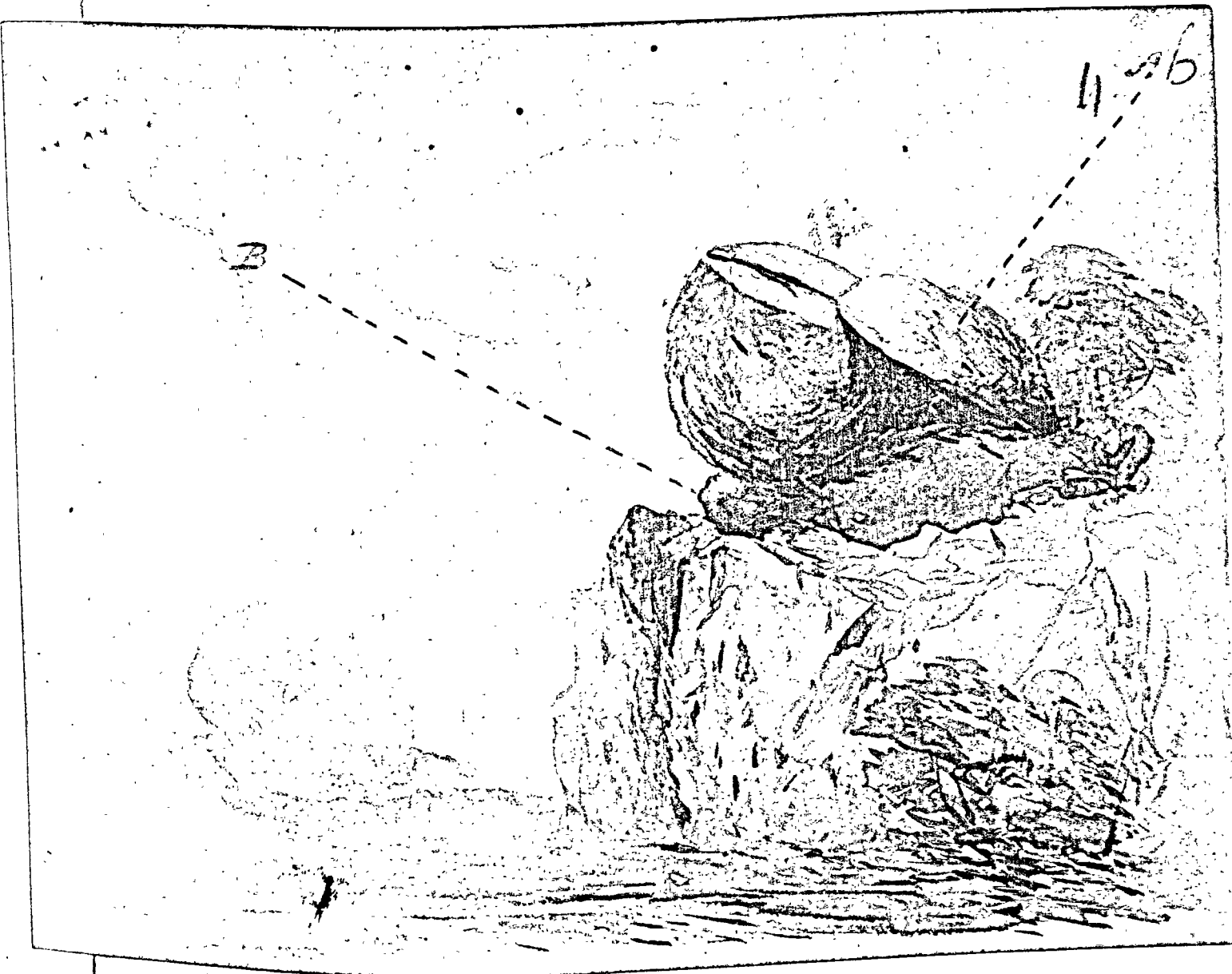
direction of Mr. Winton,
the Telegraph Engineer
of the Company.
This operation was
perfectly successful
in every respect, and
nothing more would
have been required, had
the boulder been quite
solid. Unfortunately
it was not so. It
was found when being
intersected by two veins
which were found to
be imperceptible before.
The boulder was shaken
by the blasting off of
the face, but with
the concussion these
veins enlarged to
dangerous cracks, and
the remainder of the
boulder was left in
a condition which
rendered its immediate
total removal necessary.
One of the veins extended
through the top of the
boulder in a plane at
an angle of about 30°
to the horizon, so that
when the boulder was
shaken by the concussion
the whole top slid

backwards six feet -
and was only kept
from sliding further
by a piece of rock
projecting from the
ground.

The thin vein which
had enlarged to a
dangerous crack was
in a nearly vertical
plane through the
boulder, which, when
its face had been
removed, was thus
divided into three
large pieces, liable to
fall down on the line
at any moment.

A series of shots was
therefore put in the
supporting piece of
rock B, and another
series in the top of the
boulder marked A.

The two series of shots
A and B were then
fired simultaneously
by electricity, and the
whole of the boulder
which had been
threatening the line
was thus successfully



brought down 13 1/2

4. The permanent way was not removed from the line, below the boulder prior to its removal, as the rails are laid on chairs spiked to wooden ^{sleepers} ~~chairs~~, forming a roadway troublesome to take up and relay. The permanent way was however sufficiently protected with earth and sleepers.

The fragments of the boulder did not fall on the line with a crash, but slipped down quietly and rested there. Men were then set to work to jump holes in the cusp piece and series of shots were fired off from time to time by electricity which broke them up into manageable pieces. It is estimated that between 500 and 600 tons of rock had then to be broken up and removed from the line.

A number of old
unserviceable permanent-
way rails were laid
flat on the roadway
between the rails of the
line, to some distance
on each side of the
rock, as it lay on the
line. As soon as
a series of 8 shots had
been fired, chains were
put round such pieces
of rock as could be
moved, an engine then
came up and the
chain being attached
to it, it moved off again
dragging the rock along
with it over the old
rails to a little distance
clear of the cutting.
Men with levers then
tipped it over the side
of the shaft into the
valley below. Some
pieces were so heavy
it was found impossible
to turn them over with
levers. Screw jacks were
then made use of to
tilt them up to such an
angle as enabled them

men with levers to
complete the work of
tipping them into the
valley below. Electricity
was always
employed when it was
found desirable to
fire a series of shots
simultaneously. The
ordinary patent fuse
was used when isolated
shots were fired.

8. No more powder was used
in the first operation
viz. that of removing the
overhanging face of the
boulder, than was
deemed necessary to effect the
desired result.
Owing to the veins with
which the boulder was
intersected however, it
cracked into three large
pieces, the immediate
removal of which as
has been already shown
became absolutely
necessary. It was
at first thought that
the entire boulder
might be removed at
a single operation, by
firing a mine with a

a large charge of powder
in rear of and below it-
And, a rocky projection
below and in front of it-
rather firm. The hope
that when the boulder
had been blown from its
position, it would in
its downward course
come in contact with
the projecting rock
and thus be thrown
clear over the line.

On further examination
of the ground beneath
at the other or lower
side of the line, the
plan of removing the
boulder by a mine fired
in rear of it was
abandoned, and its
removal piece meal in
the manner afterwards
carried out decided
upon.

One hundred and fifty 9.
men were employed
in jumping shot-holes
at the rock which was
brought down on the line
Three men to each jumper
fifty jumpers were thus
employed.



For a short time work
was carried on night and
day, but it was
found that the men
suffered so much from
fever from night exposure
all work excepting day
work had to be given up.

I understand that one
of the men has since
died of fever, and several
others are now suffering
seriously from it, proving
that the Resident Engineer
did not abandon night
work at all too soon.

10. The men employed in
jumping the shot-holes
were chiefly brought
from Tripalou, and
the neighboring head
of that town.

It was with great
difficulty that they
were prevailed upon
to complete the work
removal of the rock.

Their work lay in an
uninhabited, jungle
place, and was con-
sidered by all a
perishous, unhealthy
locality. They remained
at night time at

Jallarpett, and were
arranged by ballast-
train in the mornings
to their work, returning
again to Jallarpett
in the same way at
dusk.

On several days during 11.
the removal of the
rock, heavy rain fell,
on these days some
of the men, especially
the regular Sany Cobles
attached to the line,
could be prevailed upon
to work. Some of course
added greatly to the delay
in opening up the line
again for traffic.

I am not aware however
of any serious inconvenience
having been felt, as
passengers had no
difficulty in walking
round the rock from
the train at one side
to that on the other, which
was always ready to
carry them on
and the accumulation
of goods at Bangalore
and Jallarpett was
all worked off by special

Special trains in the
course of one or two days
after the obstruction had
been removed - 19

12. The line was blocked
from the 15th of November
until the 25th of December.
On the 15th of November
the first shot was
fired in the overhanging
face of the boulder.
On the 19th of November
the remainder of the
boulder was brought
down by blasting. On
the 1st of December
some small loose
boulders and pieces
of rock were brought
down and removed,
and on the 25th of
December the line
was clear and open
for goods as well
as passenger traffic.

13. Every credit is due
to Mr. Scott the Resident
Engineer, who, remaining
at Coopers, during
the removal of the
rock, by his energy
and example the
superintendent the

men employed to
work with a mill.

Considering the great
number of men employed
constantly on so small
a space, the nature
of the work to be done,
and the constant firing
of blasts, it is a matter
for some wonder that
there were no accidents
of at all a serious
nature amongst the
work men, and shows
that the arrangements
made for their safety
were well planned,
and efficiently carried
out.

R. Thompson
Captain R.E.

Offg. Dy. Comm. Engr. for Railways
Bangalore
14th December 1874

Railway Department.

CONSULTING ENGINEER'S OFFICE.

No. 771

From

LIEUT.-COLONEL J. H. M. SHAW STEWART, R.E.,
Consulting Engineer for Railways,

To

COLONEL G. W. WALKER, R.E.,

Secretary to Government,
Public Works Department.

Fort Saint George.

SIR,

Adverting to the Pro-
ceedings of Government under date
the 9th instant, No. 4460, I have the
honour to lay before His Excellency
dated 17th Decr 74 in Council a note by the Deputy
Consulting Engineer upon the blasting
operations undertaken for the purpose
of removing an overhanging boulder
at the "Tiger Rock cutting" on the
Bangalore Branch of the Madras -
Railway.

Upon

Dear

~~Muntion~~ LPL & E

Madras
21 December
1874
Eug. Buff.

This image shows a blank, aged, cream-colored page, likely an endpaper or flyleaf of a book. The paper has a slightly textured appearance with some minor discoloration and small dark spots, possibly due to age or handling. The left edge of the page shows the binding, with visible stitching or staples. The overall tone is warm and slightly off-white.

P. W. 1874 Dept.
P.W. 1874
RAILWAY DEPARTMENT.

From
The Consulting Engineer
for Railways,

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

Dated 23rd Dec 1874.
Recd 23

E. 1. No. 771
Forwarding with
remarks a note by the
Dy. Supt. Engineer upon
the blasting operations
between boulders at
the Tiger Rock cutting

El. No. 177. 21-1-75

365

No. 1135

MADRAS RAILWAY.

AGENT AND MANAGERS OFFICE

Madras, 29 December 1874.

From

The Agent and Manager M. R. Compang.

To

Lieut Colonel J. H. M. Shaw Stewart
Consulting Engineer for Railways.

Sir,

With reference to your letter No. 1178
of the 12th instant, and to the order of
Government which accompanied it, I
have the honour to enclose copy of a
Report made by the Resident Engineer,
of the 2nd Division South West Line, in
which he furnishes full particulars
regarding the blasting operations at
the Tiger Rock.

I have the honour to be,
Sir

Your most obedient servant
Blissful Ancher.

for the Agent and Manager

Madras Railway
Resident Engineer's Office
Bangalore, 18th December 1874

N: 376

From

Resident Engineer

2nd Division South West Line

To

The Chief Engineer

My dear sir,

Yours N: 1861 of the 14th instant.
The quantity of rock removed by blasting at Tiger Rock was about 300 cubic yards, that is the large boulder about 280 cubic yards, and several smaller ones which were loosened by the fall of the large one. There was no more rock moved than was calculated on before operations were commenced, you may remember it was proposed to remove the large boulder in pieces so as to prevent any lengthened stoppage of Traffic. I tried to do this by blasting the overhanging portion first with small charges, in this I succeeded, but on examining the rock I found that two veins which were not apparent before had opened out with the first discharge, and left the remainder of the rock in such a dangerous state that I did not consider it safe to let a train pass under it, and I therefore commenced at once to remove the whole boulder. Unfortunately there was no room for it to clear the line, on account of some large boulders on the opposite side, which prevented it being shot clear over the embankment into the Valley, but I tried to get it as far out of the way as possible, by stacking up jungle wood sleepers and earth

MADRAS RAILWAY

From

The Agent and Manager

The Consulting Engineer

for Railways

Dated 29th December 1874

Recd. 30.11.74

No. 1135

Forwarding copy of a Report made by the Resident Engineer 2nd Divn. S.W. & J. concerning full particulars regarding the blasting operations at the Tiger Rock

and I expected that a boulder embedded on the shoulder of the cutting, under the large one, would tilt it, and throw it partially clear of the line, however as it happened the boulder on the shoulder of the cutting gave way, and the whole mass instead of turning over slipped down, right on the centre of the way. I had already collected all the jumper men I could get on the Division, 150 men, and they were set to work immediately to jump holes to blast the rock into small pieces for its removal, which would have been effected in a much shorter time had it not been for the unhealthy state of that portion of the line at this season, the men after a good deal of persuasion agreed to work in relays night and day, but after two nights work, finding that several of the men were attacked with fever, I was forced to abandon night work, and I had to convey them to their villages near Tripatore every evening by ballast train. The work was also delayed by rain, for two or three days none of the jumper men would turn out, and I had only my own Gang Boles to depend on.

As the rock was blasted into tolerably small pieces, I laid down unserviceable rails on which the pieces were dragged through the cutting by chains attached to the ballast engine, and tilted over the embankment.

I am now awaiting your orders to commence the further work necessary for the permanent security of the line through

the Tiger Rock cutting

Yours very truly
/sd/ Peter Scott
Resident Engineer

/ True Copy /
/sd/ Percival Anderson
Chief Engineer

/ True Copy /
Blusford Architects
for the Agent & Manager

21/12/74
PMS/12/74

No. 782

15

31

SUBMITTED for the information of Government, with
reference to Order N° 3460, d/9 Decem:
ber 1874, and in continuation of this
Office letter N° 771 of the 21st idem.

Maintenance

desir Hol
R.E.,

Consgr. Engineer for Railways.

CONSULTING ENGINEER'S OFFICE,
Madras, 30 Dec 1874

To

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

cmr

Pub. Works 1874
Mr. G. S. S. S.
 RAILWAY DEPARTMENT.

1873.

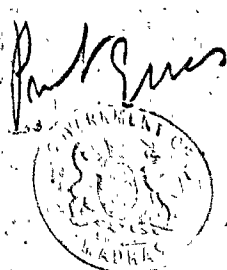
From
 The Chief Engineer
 and Consulting Engineer
 for Railways

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

CC. no. 177-21-1-25
 Dated 30th Decr 1874
 Received

No. 382
 Submitting letter
 from Agent Madras
 Rly Co regarding the
 blasting operations at
 the Tiger Rock.

No 366



177 P.M.D.
Proceedings of the Madras Government
Read the following 33

From the Com. Engg. for Rly. (M.R. no. 771 of 21st Decr. 1874)
Do do " 782 " 30 " " "

W. S.

His Excellency the
Governor in Council has
read with interest
these
Letter from Thomson Re.
ports on the blasting op.
erations in connection
with the removal of the
Tiger Rock on the Banga.
lore Branch of the Ma.
dras Railway. He has
no doubt that the in.
convenience

Emm

$$\begin{array}{r} 127 \\ 8038 \end{array} \checkmark$$

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Mr. C. S. L. S. S.

ated

Encl. 3

eed.

O. 21 Larry. No. 177

OS. 365-367

Railway - Passing
orders on ~~for~~ Reports
submitted by the Engineer
for Railways on the
blasting operations in
connection with the re-
newal of the Tiger rock
on the Bangalore Branch.
Madras Pz -