

(1) Number of pages _____

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MADRAS RECORD OFFICE.

Government of Madras.

Public Works DEPARTMENT.

G.O. No.	497	(W)	Press
			~~Miss~~
Dated	14-2-	1877.	

Not to be folded or roughly handled

17

*Proceedings of the Madras Government, Public Works Department;
14th February 1877. No. 497.*

Read the following papers:—

No. 349. From Major H. W. WOOD, R.E., District Engineer, Vizagapatam, to Major-General G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Camp at Vizianagram, 6th January 1877, No. X.

I HAVE the honor to submit the following remarks on Mr. Addis' Patent Tramway, of which about one hundred yards, with a semi-circular curve of seven feet radius, have been laid down at Vizianagram for inspection.

The tramway had placed upon it a wagon stated to weigh half a ton and containing three tons of brick.

Two pairs of my own bullocks were successively yoked to the wagon and either pair was found unequal to the draught. A part of this failure doubtless arose from the animals being ordinary ones and only accustomed to draw the common carts of the country. However the behaviour of a third pair of bullocks which had before drawn the wagon on the tramway, shewed that two and a half tons would be as much as any bullocks could conveniently draw, even when they had become accustomed to the wagon and tramway. There was some difficulty also experienced in turning the sharp curve on the tramway; but the "bogy" works well and habit would overcome this difficulty. Such a sharp curve would not besides be met with in actual practice.

Mr. Addis' system has the advantage, that the centre wheels of the wagon can be elevated from the rail by the screw of the "bogy," and the wagon could be returned empty along an ordinary road upon the side wheels. Sidings for return traffic of empties would consequently be unnecessary. The arrangements for fixing the centre rail are efficient and simple, though perhaps it would be as well to fix the tire iron with three screws for every two running yards instead of with two screws.

The weak point in the system is the vertical play which must be allowed to the side wheels in order to provide for inequalities in the cross section of ground. In the tramway inspected the side wheels had a 3 inch play, which gave the wagon a rolling motion that must strain the central screw of the "bogy" excessively. This screw is 3 inches diameter, and Mr. Addis stated that all of smaller dimensions which he had previously tried had "snapped like carrots." The rolling motion tends to throw the centre wheel off the rail, and, although the ground at Vizianagram was level, the wagon was twice thrown off the line in the course of half an hour. With a loaded wagon it is a matter of time and difficulty to replace it on the rail, even by the aid of screw jacks.

C₁
The sole certain remedy for the above defects would be to lay down a continuous double track of stone pavement for the side wheels to run up. Metalling would not suffice, for it would wear away into a chain of holes from the intermittent shocks communicated by the side wheels, and repairs could not practically be executed to metalling so speedily as to prevent these holes forming. Immediately the holes are formed, there is great risk of the centre wheel being thrown off the rail.

In Bellary and Cuddapah it would probably be easy to provide these continuous stone tracks, and, if time pressed, they could be put down in advance of the centre rail, and this roadway could be used by common carts until the tramway and wagons were ready. Both common carts and Addis' wagons could profitably use such a line

in common; and if it should be determined to utilize this system in the districts just mentioned for famine purposes, I beg to submit my opinion that certainty and continuity of transport operations could only be ensured by the above suggested addition of stone pavements.

With these stone tracks the rolling motion of the loaded wagons, the formation of holes by the side wheels, and the resulting shock to the central screw of the "bogy" will be reduced to a minimum, and this part of the iron work might perhaps consequently be made lighter and less costly.

I beg to annex rough sketches showing the arrangement I have above proposed, as well as the rolling action of Mr. Addis' cart as observed at Vizianagram, and I also append a memorandum of the comparative probable cost *per mile* of this and other tramways.

From the Government of Bombay, dated 30th January 1877, No. 124.

No. 349-A. MEMORANDUM.

THE Chief Engineer is of opinion that a tramway on Mr. Addis' system, even if it could be laid down in time, would not be suitable for the ground to be traversed in the Cuddapah and Kurnool Districts, where many severe gradients occur on the ordinary roads. Major Wood states that ordinary bullocks failed to move Mr. Addis' wagon, when fully loaded, on a level; and the probability is that a 2-ton load would overpower ordinary cattle on the road gradients either up or down. No doubt also the wagons would be perpetually thrown off the central rail; owing to which practical objections it is that Mr. Addis' scheme failed to give sufficient satisfaction, when originally tried in the Bombay Presidency, to cause its general adoption.

(Signed.) G. W. WALKER, Major-General, R.E.,

Dated 16th January 1877, Chief Engineer, Public Works Department.

No. 349-B. From District Engineer, Vizagapatam, No. 2,166, dated 31st January 1877.

No. 350. ORDER THEREON, 14th February 1877, No. 497.

CIVIL WORKS, No. 26A.

THE Government are not disposed to adopt Mr. Addis' Tramway.

(True Extract.)

Colonel,
Acting Joint Secretary to Government.

To Mr. Addis, C. E.
... the District Engineer, Vizagapatam.

Exd. E. C. Shunker.
Spare Copies

ADDIS' SINGLE RAIL TRAMWAY.

REPORT OF THE MANAGING DIRECTOR CALLIAN AND MYJEE S. R. TRAMWAY COMPANIES.

Mr. Addis has requested me, being the largest shareholder and the Managing Director of both the Callian and Myjee Single Rail Tramway Companies, Limited, to put on record a few remarks regarding the capabilities of his system of Tramway, which has been adopted by the abovenamed Companies.

Mr. Addis' Single Rail System, with his patent carts, has had a fair and full trial at Callian; for the system was worked from 10th February to 4th June of the present year; and in that period two thousand tons of salt and a small quantity of other merchandise were carried along the line, in the patent carts drawn by bullocks, from the Bunder to the Railway Station, a distance of $1\frac{1}{4}$ miles; the capabilities of the rail and the carts, therefore, have been tested as perfectly as could be desired.

The system, if worked by bullocks, as has been the case here, does not appear to offer any advantages in the way of increased speed. There was no appreciable difference between the speed with which loaded carts belonging to the Company could be drawn along the Tramway and that with which ordinary country carts, also loaded, could be drawn along the ordinary road—the bullocks in each case being of about equal strength.

But the load in one of the Company's carts was equal to more than three, more nearly equal to four, loads in other carts. To be more precise: The loads were almost always bags of salt, each weighing on an average above two and a half máns. Now a full load for a single pair of bullocks in a Company's cart was 30 of these bags, and this was drawn with ease, whereas a full load for a country cart was 8 bags and in rare cases 10. Indeed some carts had never more than 6 bags put into them. It would appear therefore that a single pair of bullocks, using Addis' carts on a Single Rail Tramway, is able to draw along a level a load of about 80 máns, or about 3 tons; the quantity which a pair could draw in an ordinary cart along an ordinary level road hardly ever reaching one ton, and being generally about three-quarters of a ton. One pair of bullocks therefore is by this system enabled to do the work of three at least, though I believe it would be nearer the truth to say four pair.

With regard to the cost of constructing a road on which to lay the Tramway. The Company's experience does not admit of my stating what would be the cost of making a new road, specially for laying down the Tramway upon; but I have an accurate account of what was expended for laying down the line upon an existing road, three or four feet from its edge, and ballasting it up so as to make it level. This cost includes royalty, the first cost and carriage of rails, sleepers, spikes, ballasting, (a heavy item, as the road on which the Tramway was laid sloped a good deal towards the edge,) and labour. The exact cost of all was Rs. 5,136-1-8, so that the cost per mile was Rs. 4,108-14-2. I believe, although not being an engineer, I would express my opinion, with deference, that it would be actually less expensive to lay down a road specially for the Tramway than to make use, as the Callian Company has done, of the side of an existing road. All that would be necessary in the case of a road made specially would be a narrow strip well ballasted for placing the sleepers in for the rails to rest upon, and two narrower strips, ballasted, on which the bullocks would walk, and on which also the outside wheels of the cart would rest. Small watercourses such as those crossing the road at Callian could be bridged by planks.

5A

Financially the Callian Company has not been as yet a success; but this I think will excite small wonder. Its operations came to an abrupt termination after going on less than five months, through circumstances quite beyond the control of the Company on the system upon which it worked. On 4th June the members of the Callian Municipality, by an almost unanimous vote, resolved that the concession of the road, or rather part of the road, on which the line had been laid down, should not be renewed after 31st October next, the date up to which the Company had been allowed to make use of the road. This being the case, as there is little business in the rains, the Company felt compelled to suspend operations at once, so as to avoid the expence of keeping up an establishment during an unprofitable season, seeing that there would be no opportunity of doing anything next busy season. Whatever were the reasons which induced the Municipality to give such a vote, they gave it in the exercise of their undoubted right, and I do not see that there is any appeal. I may mention however that the Company's Tramway was getting rapidly into favor with the salt merchants; for our books show that the quantities of salt carried were these:—February 1,550 bags, March 2,900 bags, April 3,100 bags, May 6,000 bags. At the rates charged by the Company it was calculated that if 9,600 bags were carried monthly, all expenses would just be paid; and every bag beyond that number would give a certain profit. The amount of traffic at Callian averages about 30,000 bags per month.

I have thought it necessary to go into these matters, as I am bound to show, in fairness, that the failure of the undertaking at Callian is not in consequence of anything deficient in the Single Rail System, as worked by bullocks and Addis' carts, but from an entirely separate and independent cause.

On account of the refusal of the Municipality to concede to the Company the right to use the road after 31st October next,—though the Company had agreed to keep their part of the road in repair, and also at the same time to pay for each cart five times the amount of toll paid for an ordinary cart—the present Callian Single Rail Tramway Company, Limited, must be wound up; but the working of the Tramway system itself has been so satisfactory that some of the shareholders contemplate forming a road of their own, somewhat shorter than the present Municipal one, and working it either by bullocks or by a small engine.

On the whole, the working of the Single Rail Tramway System at Callian has demonstrated that this system can be introduced almost anywhere at a cost much less than that of making an ordinary road, and placing the necessary number of vehicles upon it; and also that by means of this system a single pair of bullocks can do the work of four, thus setting free three pair for agricultural or other purposes.

I have said nothing of the line at Myjee, a length of 2½ miles, as this was laid down at too late a period to allow of a proper trial of the system there, this year at least.

W. H. HAMILTON,
Managing Director.

Bombay, 27th June 1870.

To. General J. W. Walker. B. L.
1. H. Cotton per Mr. Cotton of the

day, date—PRINTED AT THE "TIMES OF INDIA" OFFICE.

15th January 1871

17A

15th January 1877.
Vijaynagar

My dear Sir,
I have the honor to acknowledge the receipt of your letter of the 10th inst. in relation to the proposed tramway. I am sorry to hear that the Government have not yet decided upon the matter. I am, however, sure that the Government will eventually decide in favor of the tramway, as it is a very important and useful project for the city.

General J. W. Walker. P.S.
Secretary to Government. P.S.
Madam.

I am forwarding to you a copy of the report of the Committee on the proposed tramway. I hope that you will find it of interest. I am, however, sure that the Government will eventually decide in favor of the tramway, as it is a very important and useful project for the city.

Yours most obediently,
W. J. Aldrich. Esq.

(1-2-77)

I write Wm.?
 Mich. 10. 1864,
 on receipt of
 this. In reply
 I have come copy
 of Official Report
 by the Land
 Dept. to the Govt.
 of New York; &
 a private report
 from Mr. Compton,
 Secretary of the
 New York Dock-
 Co. Mr. Wood's
 2. report is rather
 in the line of
 a general over-
 view.

L.W.
 5.2.

Private

My dear Hall, 2 9/10
 Report that the paper
 about the electric rail
 tramway got into the
 bottom of my box and
 I only came across them
 by accident this aft.
 I never saw the system
 worked except in the
 patentees' yard and
 there I put a stone
 on the rail which
 shunted the Car off
 at once & on left it.

I certainly would
not recommend to
buy me and
would never use
it myself or for
my son-in-law.
I consider it to be
a perfectly worthless
invention, and do
not recommend
you to have anything
to do with it.
Sincerely,
27/1/77 The Doctor

W. NICOL & CO

Private

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Bombay 29th June 1877

My Dear General

I opened your note of 25th
sent addressed to Maxwell.

He is absent in the
Southern Mahratta Country

I enclose a note to me
from Mr. Ormiston, whose
Character you know regarding
the railway. Col. L.

Raucock to whom I have
your letter informed me
that the P.W.D. here

had reported on the line
and at his suggestion

wrote to Major Marriott
R.C. for a copy of that

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P. W. DEPARTMENT

13875

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The Chief Engineer is of opinion that a steam-
way on Mr. Addis's
system, even if it
could be laid down
in time, would not
be suitable for the
ground to be traversed
in the Cuddaspath &
Kurnool Districts,
where many severe
gradients occur on
the ordinary road.
Major Wood states
that ordinary bul-
locks failed to move
Mr. Addis's waggon

when fully loaded,
on "level"; and the
probability is that
a 2 ton load would
overpower ordinary
cattle on the road
gradients either up
or down. No doubt
also the Waggon w.
be perpetually thrown
off the central rail -
being to which prac-
tical objections it is
that Mr. Addis's scheme
failed to give sufficient
satisfaction, when ori-
ginally tried in the
Hamburg Presidency,

15A
to cause its general
rejection -
C. M. Walker, Major Genl.
Chief Eng. D.P.W.

16.1.77.

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P. W. DEPARTMENT.

Read the following:—

From
The District Engineer Bangalore No 24 of 6th January 1877
The Government of Bombay No 124 dated 30th January 1877.

FOR ORDERS. with reference to

I am to refer to the General Walker's Memo of 16th ultimo now for the first time circulated.

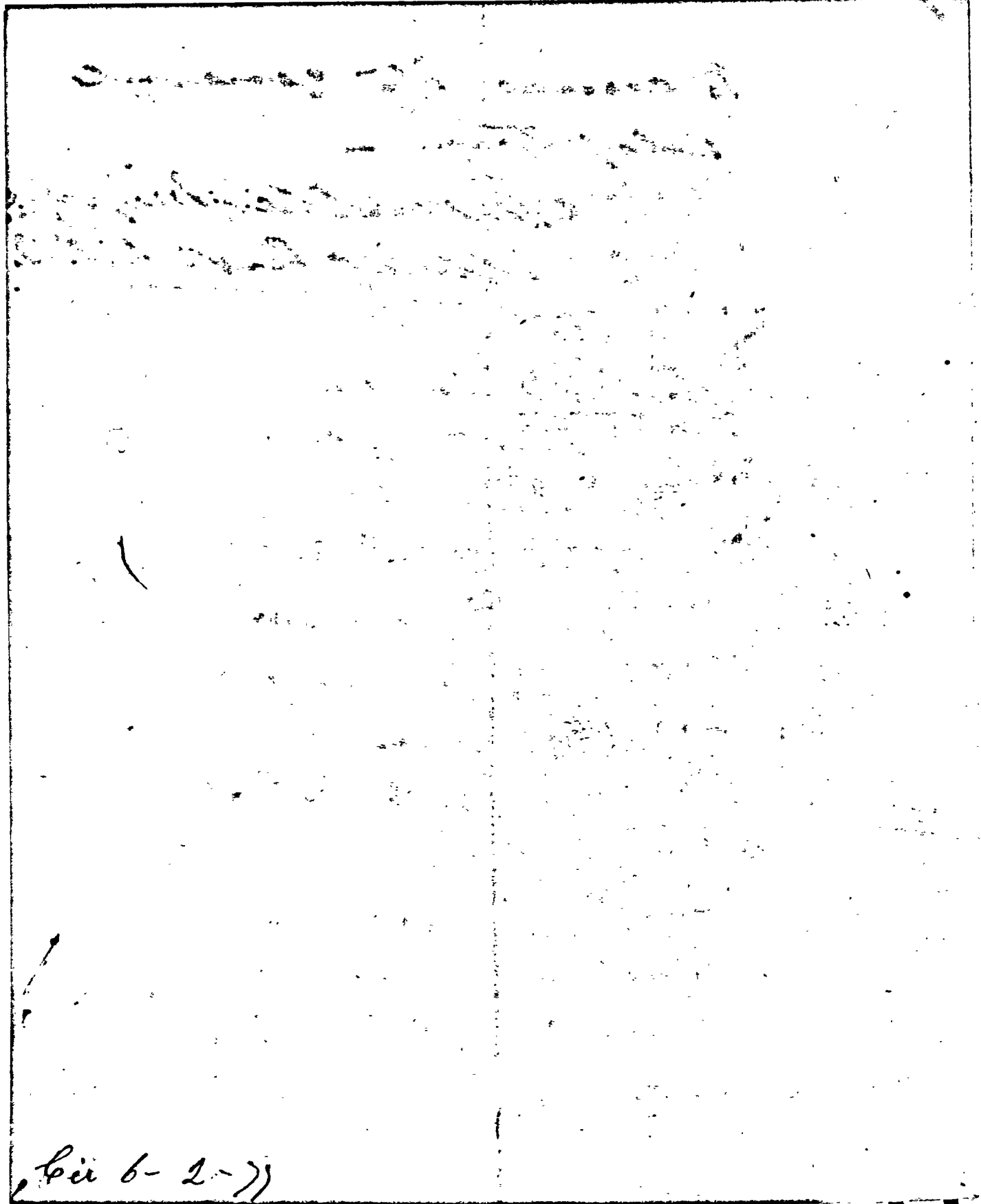
is great - for the white
stone - a small quantity
and the quantity of the
cemented in the stone
but a public heavy
not given -

W. Marshall Col.
Offg Under Secretary to Govt.

by 6/2

The stone track & heavy
weight be an advantage
or a double track way of.

With light rails if such are in the country, for the



See 6-2-77

FOR ORDERS.

1411

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Vizag

Feb. 13. 2. 77

N^o 2166

1917
District Engineer's Office Camp
Palcoudah
dated 31st January 1877
Dep^d 3rd February 1877

From

Major H. W. Wood R.E.

District Engineer Vizagapatam

To

Major General G. W. Walker R.E.

Secretary to Government P.W.D.
Madras.

Sir,

With reference to O. G. dated 10th January
N^o 79, and in continuation of my letter N^o X
dated Camp Vizianagram 6th January 1877; I have
the honor to report that I am entirely unacquaint-
ed either with Mr. Addis' resources or his capa-
city for carrying an important undertaking to
completion.

2. Mr. Addis is I understand employed by
H. H. the Maharajah of Vizianagram as his
private Engineer, and if this hearsay information
is correct, I gather his pecuniary resources are not
large. As to his professional capacity, I have no
means whatever of judging. He has executed
work as a contractor, to the best of my belief
this

216 4
this District with the exception of building
two or three common ferry boats for the Local
Fund Board.

3. I beg to enclose a Report on Addis
Single Rail Tramway, forwarded to me two
days ago by the Patentee: this report appears
to be very much to the same effect as that
previously submitted in my letter N^o 1852
dated 7th December 1876.

I have the honor to be

Sir

Your most Obedt Serv^t

A. M. M. M. Major & Co

District Engineer,
Vizagapatam.

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P.W.D.
9 FEB 77
No. 1411

From

Mr. D. D. D. Engineer
Bengal

Mr. D. D. D. Secretary to Govt.
P.W.D.
Calcutta

Dated 31st January 1877
Recd. 3rd February 1877
Recd.

2/6/66

Mr. D. D. D. Single Rail
Bengal — Reports
that he is entirely un-
acquainted with all the
local resources or
capacity for carrying
the important undertaking
to completion.

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No. 3059
Consulting Engineer's Department
Bombay 26th September 1870
From
The Consulting Engineer
for Railways - Bombay
To
The Secretary to Government
Public Works Department
Bombay

I beg to submit papers
relative to Addis single rail
tramway. The only fair way in
which to test the advantages of
the single line tramway is to
compare it as regards first cost,
convenience of working and
capacity for carrying traffic with
an ordinary double rail road
of equal power.

No. 349 B

Feb. 13. 1877

3. The load to be carried in a cart is 3 tons and the weight of the cart is to be 16 cwt, or, in all, the load on the rail is to be about 4 tons.

The cart is to have 4 wheels, but 2 of these are intended to balance the vehicle. The other 2 carry the weight and bear, when the cart is fully loaded, with a pressure of 2 tons each on the rail.

4. The common rough rule for the determination of the strength of a rail is to allow 15 lbs weight per yard per ton of maximum wheel load. By this rule the weight Mr. Addis should give his rail is 30 lbs to the yard, and this is the weight proposed for the cross sleeper road.

It

5. It is stated in the specification that vehicles of any kind could be adapted to be run on the single rail, but, as the adaptation could not be made except at considerable cost, it will be best to accept the cost of the carts used - namely Rs 325 - as the probable charge for a vehicle to carry 3 tons on the single rail.

6. The width between outer wheels of the model carts is 5 feet. These carts could not be used on a road of a less clear minimum width than 8 feet. This, therefore, is the surface width required for a single rail tramway. The surface would have to be finished like that of a first class road otherwise!

otherwise pits would form
and there would be danger
of the cart being thrown
violently from side to side.
7. With a 4 wheeled
vehicle weighing a ton and
intended to carry 3 tons and
in each wheel took its full
share of load, the maximum
pressure on a rail, in a
double rail tramway, would
be only 1 ton, or half the pressure
in the single line tramway,
and its weight might be made
15 lbs per yard.

8. In the Testering
railway of 2 feet gauge, the
waggons carry 3 tons paying
load, weigh from 18 to 19
cwt, and cost about £32
each. The clear width of
road wanted for a gauge
of

of 2 feet is 10 feet 6 inches. 20
9. Mr. Aldis's single
rail tramway requires therefore
the same weight of metal
in rails, the same width of
road, and a carriage of the
same price, as is wanted in
the construction of a double
rail tramway for the carriage
of the same maximum
paying load of 3 tons per vehicle.
The two points in which there
would be a saving in material
by the adoption of the single
rail are sleepers and spikes.
Mr. Aldis estimates the cost
of the former at 4 annas each.
The dimensions are not all
specified, but the length is
to be 2 feet and the depth 4
inches. For the double rail
tramway a sleeper of 4 feet
would

would be required, and the cost of this would be about 12 Annas at the addition rates. The cost of spikes would be doubled. 10. There are two additional charges amount to Rs 970 or say Rs 1000 per mile. There would be some saving in cost of laying, but against this may be put on the other side, escape from payment of Royalty. Should it be held that a patent can be taken out in India by a charge for a description of tramway in work at the time on the continent of Europe. 11. The disadvantages of the single compared to the double rail tramway are 1st. The greater tendency of

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of the wheels to get off the rail and the consequent expense and detention of traffic. 2nd. The greater cost of maintenance due to the balance wheels bumping on and off the metalled road surface. 3rd. The impracticability from the same cause of working except at slow speed. 4th. The unsuitability also for the same reason of the vehicles for passenger traffic. 5th. The impossibility of working the single rail tramway with a locomotive engine except at great disadvantage. 6th. The greater tractive power required to draw equal weights from the load being partly

partly carried at times on
the balance wheels over
the metalled road instead
of on the iron rail.

12 Other disadvantages
might be pointed out and
objections might be taken to
details of the scheme - no
provision being made for
plan suggested for passenger
carts and other equally prominent
defective features. But
I think what I have already
said is sufficient to show that
the slight saving in first cost
of Rs 5000 a mile is obtained
at so great a sacrifice of
efficiency as to render it a
hardly a matter of question
that if a tramway is wanted
it is better to sink another Rs
1000 per mile in first cost
than

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than to rest content with a
line at Rs 1250 per mile
that has but few advantages
over the ordinary road on which
it is laid, while it is as
destructive to the efficiency
of that road for the conveyance
of its ordinary traffic as it
would be a railway adapted
for the working of Locomotive
Engines.

I have the honor to be,

Sy. J. S. Trevor

Attd. R.E.

Comptroller for Railways

20th September 1870

From

Captain Mathew R.E.

Adj. Gen. for Rys.

To

Lt. Col. Trevor R.E.

Comd. Engrs. for Rys.

du

I have the honor to submit the following report upon the construction and probable working of the single rail tramway patented in this country by Mr. Addison B.E.

2. In the cheapest form of the arrangement, a single rail $2\frac{1}{2}$ inches high, of a T section with a flat base, weighing $30\frac{1}{2}$ lbs per yard, is laid without chairs upon transverse wooden sleepers which

which are $1\frac{1}{2}$ feet in length and 3 feet from centre to centre. The rails are fastened to the sleepers by Dog spikes; the flanges are not notched and the ends are not united.

3. Two small double flanged iron wheels are placed centrally one behind the other with a 7 foot base, and are either the body of an ordinary two wheeled cart to which the usual side wheels are also supplied. Each central or rail wheel works upon a swivel attached to a screw by means of which the body can be raised so as to throw the weight upon the central bearing wheels. The rail, the side wheels serving to

to keep the balance of the
vehicle by alternately resting
on or striking the ground on
either side of the rail.
Each cart may be
dragged by bullocks, or teams
if wagons may be hauled by
steam power - but no design
for a traction engine especially
adapted to this purpose, is
supplied by Mr. Addis.
No provision is made to enable
carts or trains to pass one another
in the same direction.
The tramway may be
applied upon an existing road
or upon a road especially
constructed to support it.
In the former case the rail
would have to be laid at not
less than 4 feet from the edge
if the road is broad and well
made

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made, and if the surface
is unevenly on either side
of the rail is hard and kept
always in good repair. Little
inconvenience would be
caused to the regular traffic
and a pair of bullocks would
easily drag a 3 ton load or
a traction engine (properly
adapted) haul 60 tons and
move up considerable inclines.
In the latter case
an equally well made and
carefully maintained road
would have to be constructed
8 feet wide at the least -
6 feet for descending
inclines when bullocks are
employed. Brake power would
have to be applied to each
cart or train.
The surface of the
ground

ground on either side of
the rail would need constant
attention. If the track
trodden by the bullock and
come upon or struck (according
to the position of the load)
by the side wheels be not
kept hard and at the proper
elevation, a serious side to
side rolling motion of the
carts would ensue. The
ground would be broken up
into holes and ruts and the
employment of an Engineer
would become impossible.

8. With side wheels
dipping deeply or striking
against impediments not of
the most trifling nature loads
would be partially jerked off
carts would be strained and
overturned or would leave the
line

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leave the line, and the
permanent way would be
displaced. The
greater the speed and the
more bulky the load, i.e.
the higher the goods are &
necessarily piled in each
cart in order to obtain the
full 3-ton weight, the more
severe in effect upon the stock
and tramway would be the
rolling motion.

9. Drawings and papers are
attached.

I have &c
Sd/ B. Mathias
Capt R.E.
Actg Dy Com Engr
for Ry -

No. 1089

No 124 of 1877.
P. & Deputant, Railway,
Bombay Castle, 30 January 1877.

From
The Government of Bombay

Forwarded to the Sec^y to Gen^l P. W. D.
Nashua with Colonel Hancock's
compliments, he having been informed
by Mr. W. C. Hall that Gen^l Walker
was anxious to get any reports
which had been made on the
"Golden Treasury".

Dated 30th January 1877

82124

Change for Lt Col R.I.

Indus. Sec. 5-600' R. 100'

Bentley.
30 Jan 1877.

Submitting Report from
the Com^r Eng^r for Port Bombay
relative to the proposed
tramway.

W. W. W.

N^o 349a

Car 6-2-77

№. 8

9/10/1911

District Engineers Office
Camp Vinnianagram 6th Janry 1877.

The District Engineer
Vizagapatam

The Chief Engineer

Madras

ver.

I have the honor to submit the following remarks, on Mr Addis' patent Tramway, of which about one hundred yards, with a semi circular curve of seven feet radius, have been laid down, at Virginia gram for inspection. The tramway, had placed upon it, a wagon, stated to weigh half a ton and containing three tons of bricks.

Two pairs of my own bullocks, were successively yoked to the wagon, and either pair was found unequal to the draught. A part of this failure, doubtless, arose from the animals being ordinary ones, and only accustomed to draw the common carts, of the country. However, the behaviour of a third pair of bullocks, which had before drawn the wagon, on the tramway, showed that two and a half tons would be, as much as

any bullocks, could conveniently draw, even ^{on level} when they had become accustomed to the wagon and tramway. There was some difficulty, also, experienced in turning the sharp curve on the tramway, but the 'bogy' works well and habit would overcome this difficulty. Such a sharp curve, would not besides be met with in actual practice.

Mr. Addis' system has the advantage, that the centre wheels of the wagon, can be elevated from the rail by the screw of the 'bogy', and the wagon could be returned empty along an ordinary road, upon the side wheels. Sidings for return traffic, of empties, would consequently be unnecessary. The arrangements for fixing the centre rail, are efficient and simple; though perhaps it would be as well to fix the tire iron with three screws for every two running yards, instead of with two screws.

The weak point in the system, is the vertical play which must be allowed to the side wheels, in order to provide for inequalities in the cross section of ground. In the tramway inspected, the side wheels had a 3" play; which gave the wagon a rolling motion, that must strain the Central screw of the 'bogy' excessively. This screw is 3" diameter,

and Mr. Addis stated, that all of smaller dimensions which he had previously tried, had "snapped like carrots." The rolling motion tends to throw the centre wheel off the rail, and, although the ground at Vizianagram was level, the wagon was twice thrown off the line in the course of half an hour. With a loaded wagon it is a matter of time, and difficulty, to replace it on the rail, even by the aid of screw jacks.

The sole, certain, remedy for the above defects, would be to lay down a continuous, double track of stone pavement for the side wheels to run up. Metalling would not suffice, for it would wear away into a chain of holes, from the intermittent shocks communicated by the side wheels, and repairs could not practically be executed to metalling, so speedily, as to prevent these holes forming. Immediately the holes are formed, there is great risk of the centre wheel being thrown off the rail.

In Bellary and Cuddapah, it would probably be easy to provide these continuous stone tracks, and if time pressed, they could be put down in advance of the centre rail, and this roadway could be used by common carts, until the tramway and wagons were ready. Both common carts and Addis' wagons could profitably use

such a line in Common; and if it should be determined to utilize this system in the districts just mentioned for famine purposes

P.W.D.
13 JAN 77
No 318

I beg to submit my opinion, that Certainty and Continuity of transport operations could only be ensured by the above suggested addition of stone pavements.

With these stone tracks the rolling motion of the loaded wagons, the formation of holes by the side wheels, and the resulting shock to the Central screw of the "bogie" will be reduced to a minimum; and this part of the iron work might, perhaps, consequently be made lighter and less costly.

I beg to annex rough sketches showing the arrangement I have above proposed as well as the rolling action of Mr. Addis' Cart as observed at Vizianagram, and I also append a Memo of the Comparative probable Cost per mile of this and other tramways.

1 Sketch with Librarian
with S. K. S.

I have the honor to be Sir

Your most Obedt Servt

Major R.E.
District Engineer
Vizagapatam

No 319 -

Go to 718-16-3-74
79-10-1-77

Ret 13.2.77

Col Works
Public Works Department
1131

No 497

PROCEEDINGS OF THE MADRAS GOVERNMENT.

Under date the 14 Feb/77
Read the following

From
The Dt. Engr. Vizagapatam (H.R. No. 2 of 6th. Jan. 1877)
--- Govt. of Bombay (--- 124, 30th. ---)
--- Dt. Engr. Vizagapatam (--- 2156, 31st. ---)
Ch's. Memorandum dated 16th Jan. 1877.

The Govt are not disposed to adopt Mr. Addis' tramway. As far as can be judged from the information now before them, the cost of it would be great in comparison with the work to be done. Of the result of the tramway upon gradients nothing is said. How has it been stated what gradients would have to be encountered; but ~~there~~ probably some would be heavy.

Mr Addis C.E.
D.E. Vizagapatam
1-3-77

W.H.
10.2.77

Mackell 9-
318
Capt. of 1089
187

To Mr. Arthur B. B.

Dated

Issued

Recd

Encl

G. O., 1st Feb^y 1877, No. 40

Nos. 349-50

Mr Addison's Single Rail
Tramway. Intimating that
Instruments are not desired
to adopt —

Sept in May