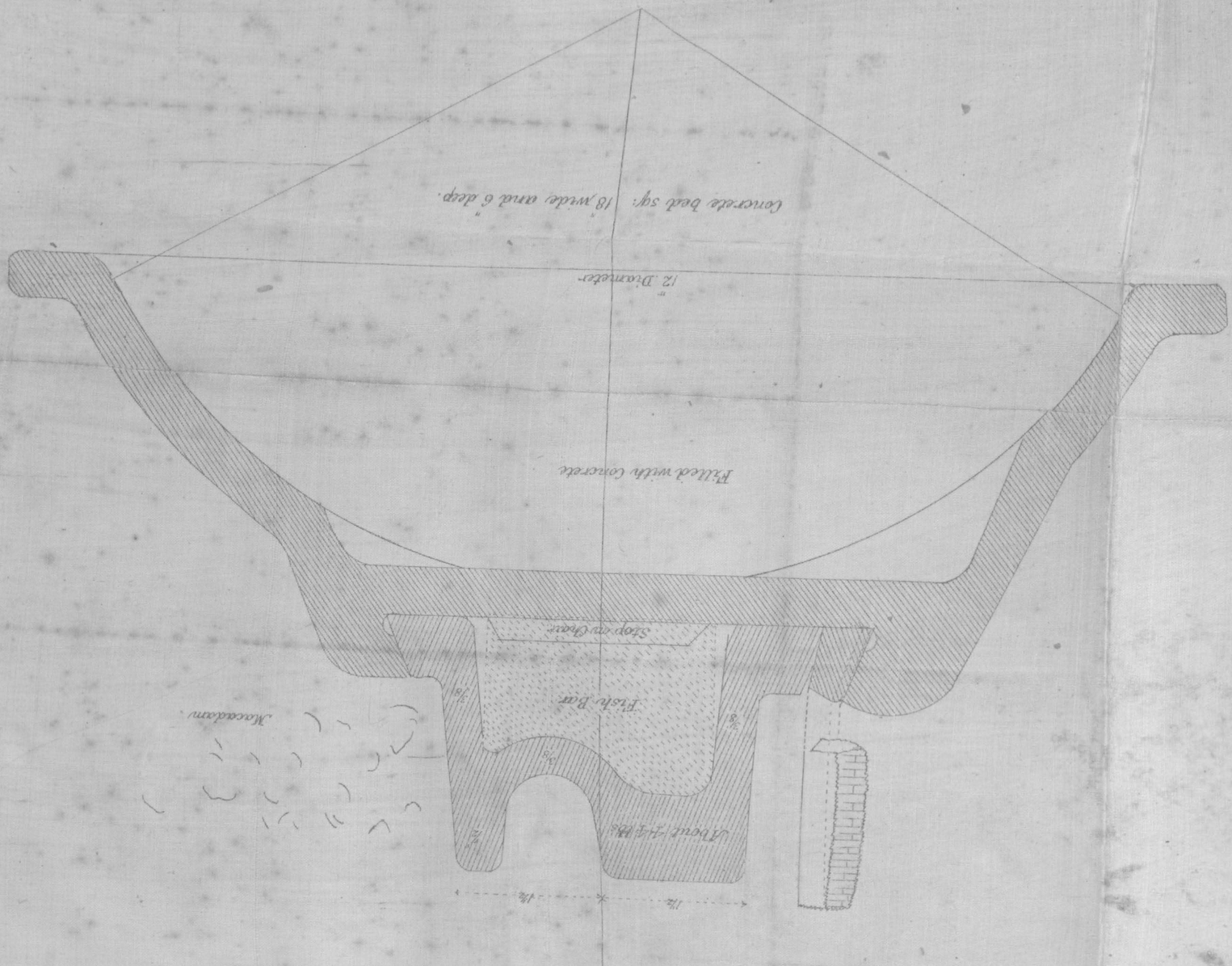

Macadam
Fish Bar
Step over Chase
Filled with Concrete
12" Diameter.
Concrete bed 3ft. 18 wide and 6" deep.

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1883} Madras.

PUBLIC WORKS.

Dated December, 4th.

Read. *Encl.*

G.O., 4th Dec. 1883, No. 3479 W.

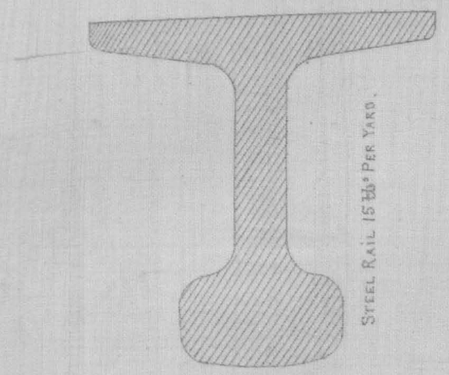
DECEMBER.

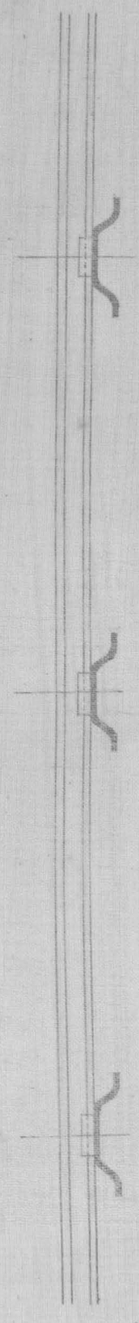
6504

Light Railways

Passing orders on the report of the Committee appointed to consider the question of — to be constructed as protective works against famine.

36/365





STATEMENT showing the Receipts and Charges of the Road Fund of the Local Fund Circles for the Years 1881-82, 1882-83, and 1883-84.

Districts.	Circles.	ACTUALS, 1881-82.			ACTUALS, 1882-83.			ESTIMATE, 1883-84.		
		Receipts.	Expenditure.	Balance.	Receipts.	Expenditure.	Balance.	Receipts.	Expenditure.	Balance.
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. Arcot, North	Chittoor	3,06,666	2,21,849	1,61,018	2,84,292	2,21,374	1,24,936	2,10,750	1,68,710	61,040
2. Arcot, South	Vellore	2,31,870	1,36,157	1,60,275	2,12,038	2,03,563	1,33,411	1,36,960	76,680	60,280
3. Anantapur	South Arcot	2,68,118	1,99,603	45,629	2,13,486	2,09,660	37,237	2,17,660	2,01,940	15,060
4. Bellary	Anantapur	1,09,276	95,886	54,396	1,11,726	87,330	61,633	85,910	73,020	12,890
5. Canara, South	Bellary	1,98,126	1,02,789	1,50,099	1,66,234	69,155	1,58,712	1,49,090	1,07,090	42,000
6. Chingleput	South Canara	1,63,227	1,36,996	26,704	1,46,309	1,06,669	1,98,352	1,14,790	1,12,890	1,900
7. Coimbatore	Chingleput	2,43,998	1,72,650	82,330	1,79,137	90,797	1,86,692	2,13,700	2,09,120	4,580
8. Cuddapah	Coimbatore	2,35,987	1,50,737	89,250	2,02,782	1,73,382	1,15,092	1,82,370	1,69,660	12,710
9. Ganjam	Cuddapah	1,51,837	1,44,789	68,298	1,78,099	1,09,292	1,84,899	98,410	98,000	410
10. Godavari	Madanapalle	60,461	59,703	68,756	79,378	37,326	1,26,951	43,160	43,180	830
11. Kistna	Chicacole	99,256	88,758	18,060	97,534	80,987	1,43,498	85,080	81,330	3,750
12. Kurnool	Chittoor	1,03,722	1,00,995	46,447	90,367	90,367	1,43,498	95,430	92,880	2,550
13. Madura	Cossimda	3,14,998	1,91,053	13,808	1,64,375	1,58,293	1,49,580	1,67,330	1,67,330	46,540
14. Malabar	Elore	1,91,053	1,68,569	1,76,869	2,75,102	1,16,311	3,08,371	1,72,990	1,31,990	41,000
15. Nellore	Masulipatam	1,68,569	1,58,775	84,944	2,01,255	2,30,306	2,79,320	1,65,770	1,65,030	740
16. Nilgiris	Guntur	2,34,304	1,47,393	57,411	3,07,717	1,06,330	3,80,707	1,67,780	1,67,780	1,190
17. Salem	Kurnool	1,05,417	86,159	1,47,188	2,63,518	83,699	3,60,526	98,270	98,270	11,070
18. Tanjore	Madura	1,27,504	1,33,317	11,087	96,586	1,26,523	3,30,589	1,39,250	1,35,250	4,150
19. Tinnevelly	Malabar	98,504	72,393	6,191	1,32,714	70,765	3,92,538	1,41,100	1,30,000	11,100
20. Trichinopoly	Nellore	2,31,723	2,02,282	2,916	73,684	2,80,032	3,85,990	87,630	87,630	860
21. Vizagapatam	Nilgiris	2,11,038	2,33,209	82,611	2,72,643	1,65,189	4,93,444	4,08,640	4,08,640	7,630
	Salem	1,40,114	1,88,346	1,06,538	2,71,397	98,123	5,66,718	2,20,320	2,24,980	21,310
	Hosur	2,22,267	43,999	1,13,078	1,28,780	1,17,849	5,77,649	87,280	79,630	
	Tanjore	53,747	9,818	5,848	2,20,927	49,356	5,78,220	1,55,960	1,34,440	21,510
	Negapatam	3,76,185	1,69,272	1,92,541	53,291	95,836	5,35,675	45,310	45,310	
	Tinnevelly	4,12,643	1,62,031	2,82,563	3,75,695	1,43,112	7,68,259	2,43,410	1,94,250	49,160
	Sherundevi	2,41,701	1,68,878	1,13,919	2,33,961	1,26,042	8,75,178	3,00,130	2,27,500	77,630
	Trichinopoly	60,446	50,785	71,344	65,973	1,44,160	8,89,366	1,62,990	1,33,880	29,109
	Vizagapatam	1,50,480	1,13,863	1,79,747	1,44,120	1,73,080	8,60,406	50,800	50,470	330
		2,84,650	1,85,993	1,24,617	2,28,500	1,71,740	9,17,166	1,44,120	1,17,680	26,440
	Total ..	60,42,918	41,72,751	23,48,367	60,29,312	36,86,040	32,91,438	47,55,020	41,32,560	6,02,460

ORDER—dated 4th December 1883, No. 3479 W., Public Works.

The Committee appointed in G.O., No. 2062 W., dated 30th July 1883, to consider and report on the question of light railways to be constructed as protective works in the tracts of the Madras Presidency liable to famine, have now concluded their inquiries. The thanks of Government will be conveyed to the members of the Committee for their labour, the results of which are embodied in the carefully drawn out report recorded at the head of these Proceedings.

2. The recommendations of the Committee, which are approved generally by Government, embrace the construction of the following light metre-gauge lines of railway on existing roads where practicable, and elsewhere on independent embankments :—

(1) Guntakal to Hindupur.
(2-3) Vellore to Villupuram.
(4) Porto Novo to Kallakurchi.
(5) Pálghat to Dindigul or Karur to Dharapuram.
(6) Madura to Ramnad.

3. Of these, No. (1) will probably be undertaken from Imperial funds, as an extension of the Bellary-Kistna Railway now under construction.

Nos. (2) and (3) are now being surveyed by Mr. deClosets. Their construction will be further considered by Government on receipt of the survey and estimates.

Mr. deClosets will be invited to undertake the survey of No. (5),—Palghat to Dindigul,—on completion of the work on which he is now employed.

The remaining lines will be further considered hereafter.

4. As regards the class of railway to be constructed, the Committee propose light metre-gauge lines, with steel rails of 35 lb. to the yard, capable of carrying the rolling stock of any metre-gauge railway in India, but having engines of a lighter type than those ordinarily in use on such main lines. These proposals are generally approved.

5. The suggestions of the Committee for raising the requisite capital, involving as they do a riteable deduction from all Local Fund incomes for the formation of a general railway fund, cannot be entertained. The question of the best means of providing funds will, however, be further considered when the Government are in possession of the surveys of the proposed lines between Villupuram and Chittoor.

6. The Government are of opinion that the cost of constructing short connections between railway stations and existing roads should devolve on the Local Fund Boards concerned. It will be the duty of the Railway Companies, a duty which they doubtless recognise, to afford facilities by the provision of stations wherever needed. It is the Committee remark, in proportion to the number of stations on a line of railway that the facilities for passenger or goods traffic are great or small; especially on lines such as those in the Madras Presidency where there is comparatively little long-distance traffic.

(True Extract.)
(Signed) J. SHAW-STEWART, Colonel, R.E.,
Secretary to Govt., P.W.D.

To J. H. Garstin, Esq., C.S.I.
" Colonel H. L. Prendergast, R.E.
" Major C. Bowen, R.E.
" Lieut.-Colonel C. J. Smith, R.E.
" Superintending Engineers.
" the Consulting Engineer for Railways.
" " Financial Department.
" ~~E. deClosets, Esq., C.E.~~

Exd. E. Fernandez.
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struction would involve a break of gauge, while for ordinary purposes of trade such a line would be but little used by native traders, who, for distances of about twenty miles, prefer to use their own, or hired, carts.

9. If the lines of railway above indicated are constructed, and if existing high-roads are maintained in an efficient state, then the improvement of village-roads and the connection of every railway station with the nearest high-road by a well bridged and metalled road, would go far towards placing the communications of the Presidency on a footing which would leave little room for apprehension, in time of famine, on the score of difficulty of distributing food throughout the country. We attach great importance to the extension of railway communication to such secondary commercial centres as most of those above named, mainly because in them already exists the machinery by which the produce of the land is ordinarily collected and stored, and from them already diverge the channels of communication by which the food supply of the country is generally distributed. Not only are these centres of great importance from a famine protection point of view, but in ordinary seasons the premium afforded by the substitution of rail for cart communication could not fail to prove a powerful stimulant to trade. This will be apparent if it be remembered that a spur line forty miles in length would enable goods to be put on to the main line at Rs. 6-0-8 per ton less than by ordinary road.

10. We lay special stress on the connection of railway stations with the high-roads nearest to them, because, unless the railway is thus connected with the high-road system, the construction of railway stations, even of the cheapest kind, is useless to trade; and it is in proportion to the number of stations on a line of railway that the facilities for passenger or goods traffic is great or small. In other words, the utility of railways, such as those in this Presidency, where there is comparatively little long distance traffic, depends greatly on the number of stations upon them.

11. As to the agency by which the works should be carried out, and the source from which the necessary funds should be drawn, we are of opinion that in all cases the works should, if possible, be undertaken by the companies with whose main lines the suggested light railways may be connected. These companies would be in a position to carry out the work more cheaply and quickly than any one else, the best professional supervision and local experience being ready at hand; and would have a direct interest in seeing that the work was well done. If these companies will not undertake the work (which we consider is unlikely) then we would suggest that they might be undertaken by other companies or by contractors, subject to the inspection of the Government engineers.

12. The question of the source whence the necessary funds should be derived, seems to us, under existing circumstances, to admit, generally, of but one answer. The Government of India having refused to carry out these works from Imperial funds the burden must necessarily be borne by Provincial or Local funds, and as, from the replies of the Local Fund Boards given above, it is clear that Local funds are not available, except, perhaps, in one or two instances, there is no alternative but that the burden should be principally thrown on Provincial funds, supplemented, where possible, by Local funds.

13. We estimate that a line of light railway such as we advocate would not cost more than Rs. 35,000 a mile, including rolling-stock and halting-sheds or stations of the simplest character. The total length of line we suggest for investigation is about 370 or 420 miles, according as the line from Pálghat to Dindigul, or that from Karúr to Dharapuram, is selected; which, at the above rate, would cost 129½ or 147 lakhs of rupees, and if either sum were borrowed on a Provincial guarantee of 4 per cent., which we consider is the best plan to adopt, the interest on it would amount to 5·18 or 5·88 lakhs per annum. That the lines will pay something over and above their working expenses, we take for granted; and, assuming that this return will be 2 per cent. on the capital outlay, the whole annual charge to be provided for would probably not exceed 2·59 or 2·94 lakhs.

14. We enclose a statement showing the Road Fund assets of each district throughout the Presidency for the last two years, and the estimates for the current year. The last column also shows the estimated Road Fund balances of the various districts. From this it will be seen that there are now only seven districts where these balances are estimated to exceed Rs. 25,000 at the end of the current year. They are specified in the margin, with the balance which is estimated to be in hand in each at the end of the said period. These balances amount altogether to nearly five lakhs of rupees, while the whole of the Road Fund balances throughout the Presidency are estimated to amount only to about six lakhs.* As the Local Fund law now stands, these funds, being raised for local expenditure, cannot be expended outside the limits of the circles in which they are raised. Apart from this law, however, there is nothing in the least inequitable in regarding Local Fund taxation, provided the cess on land is everywhere uniform, as taxation available for expenditure for the general benefit of the Presidency; and if the law were altered to admit of it being done, we think there could be no reasonable objection taken to a rateable deduction from all Local Road Fund incomes for the formation of a Railway Fund, from which to meet, to some extent, the cost of making the Provincial lines we propose. Such a deduction of 6 per cent. on the estimated incomes of all the Road Funds of the Presidency would give a sum of about 2·85 lakhs of rupees per annum; and if this was supplemented by an equal annual grant from Provincial funds, a sum of about 5·70 lakhs of rupees might be made available, which would suffice to pay 4 per cent. interest on 142·60 lakhs, a sum nearly equal to the total cost of all the lines we suggest; or (allowing 2 per cent. for earnings by the lines) 2 per cent. on 285·20 lakhs, a sum far more than sufficient to construct them and nearly enough to admit of the construction of twice that length of line. Or, to put the matter differently, when the proposed lines pay, on an average, 2 per cent. on the whole capital outlay on their construction, an annual contribution of 1½ lakhs from Provincial funds added to a 3 per cent. deduction from Local Road Funds, would more than suffice to pay the remainder of the guarantee.

Districts.	Total District Road Fund Balance.	Circle Balances.	Circles.
	RS.	RS.	
Tanjore	1,26,810	49,180	Tanjore.
		77,630	Negapatam.
North Arcot ...	1,21,320	61,040	Chittoor.
		60,280	Vellore.
Godávari ...	86,540	45,540	Cocanada.
		41,000	Ellore.
Vizagapatam ...	56,760	...	...
Bellary	42,050	...	...
Tinnevelly ...	29,100	29,100	Tinnevelly.
Trichinopoly ...	26,440	...	...
	4,89,020	...	

* *Vide* statement accompanying.

15. We have laid great stress on the connection of all railway stations with the high-roads nearest to them, but we are aware that in one or more instances Local Fund Boards have objected to make such station-roads unless assisted with Provincial funds; while the Government in G.O., Financial Department, No. 1476 of 1883, have declared that it is opposed to their fixed policy to give grants-in-aid from such funds for such works. When the Local Fund Act first came into force, and for some years after, considerable grant-in-aid allotments used to be made to all districts from Provincial funds; and from these joint funds, in some instances, we believe station-roads were made. We trust we may be permitted to solicit a reconsideration of the order above quoted, for we consider there is no more legitimate way in which Provincial funds can be spent than in carrying out, or in aiding Local funds to carry out, such works, which are of a protective and provincial character as linking the district road-systems with the systems of railways throughout the Presidency.

(Signed) J. H. GARSTIN, C.S.I.
(,,) H. L. PRENDERGAST, Colonel, R.E.
(,,) C. BOWEN, Major, R.E.
(,,) C. J. SMITH, Lieut.-Colonel, R.E.

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seventy-six miles long is needed, but they do not say how it is to run. They are unwilling to borrow money to make it, but would borrow to make three short lines: (1) from Jangalapuram to Kistnagiri (18 miles); (2) from Mórappár to Dharmapuri (17 miles), and (3) from Kelamangalam, *via* Hosúr, to some point in Mysore territory (15 miles). The utmost they can guarantee is Rs. 8,000 a-year. They prefer to have the works carried out by a company.

The Salem Circle Board consider light railways are needed, the existing roads not being sufficient. They are ready to borrow and carry out the works which they would construct themselves. The largest guarantee they would afford to make is Rs. 25,000 a-year. The lines they propose are—

1. From Suramangalam (Salem railway station) *viâ* Salem to Námakal (35 miles).
2. From Tirupatúr to Kistnagiri (26 miles—10 in the Salem Circle and 16 in the Hosúr).
3. From Suramangalam to Ahtúr (35 miles).

They suggest trying a tramway, laid on the existing road to Námakal, as a first experiment, and consider it would pay 5 per cent.

Tinnevelly.—The Tinnevelly Circle Board are in favor of a steam tramway from Tinnevelly to Kayalpatnam and Kulasekharapatnam. They decline to borrow money to make the line, but will guarantee up to Rs. 20,000 a-year to a private company.

The Shermádevi Circle Board consider their circle is naturally protected from famine. A slight addition to existing roads would suffice for all purposes.

The Collector thinks that a railway should be made from Tinnevelly *viâ* Nagercoil and Trivandrum to Quilon; and that the line suggested by the Tinnevelly Local Fund Board is impracticable.

Vizagapatam.—The Circle Board say they cannot afford to pay for railways. Their circle wants more roads, to make which they are prepared to borrow money and repay it by annual instalments of Rs. 55,000, provided they are allowed to put tolls on them as recommended by Mr. Goodrich in his letter, of 21st September 1877, No. 762.

The Superintending Engineer of the First Circle (Ganjam and Vizagapatam) is in favor of a light railway, worked by mechanical power, from Gopálpúr nearly to Russellkondah on the existing road. Between Aska and Gopálpúr the traffic is very heavy and the line would, he thinks, probably pay between those points. He also suggests a tramway from Calingapatam up the valley of the Vamshadara to near Gunapúr.

The Superintending Engineer of the Second Circle has not answered the reference made to him.

The Superintending Engineer of the Third Circle (Bellary, Anantapur and Kurnool) is opposed to light railways or tramways except in towns and thickly populated districts. He thinks, however, the suggestion of the Kurnool Local Fund Board, that Kurnool should be connected by rail with the railway from Bezváda to Guntakal, is worthy of consideration.

The Superintending Engineer of the Fourth Circle (Coimbatore, Salem, North Arcot, Nílgiris, Malabar and Canara) is in favor of metre-gauge railways on independent embankments, worked by steam-power. He advocates a line to run from Satyamangalam down the valley of Bhaváni to Erode.

The Superintending Engineer of the Fifth Circle is a member of our Committee.

The Superintending Engineer of the Sixth Circle (Tinnevelly, Madura, &c.,) gives no opinion on the engineering question; but considers that, if Government do not carry out the Madura-Ramnad railway, the Local Fund Board should not do the work unless the zemindars, through whose estates it would pass, give a considerable part of the guarantee.

8. We have given the matter submitted to us our most careful consideration and beg to answer the questions put to us by Government as follows:—

We are of opinion that, while the majority of the great centres of production and consumption in this Presidency, south of the Kistna river, are already either connected by rail or about to be so, or are so close to some existing line as to leave little room for anxiety regarding the supply of food to them in time of famine, there

are other centres, though of less importance, which should be put in direct communication with the existing systems of railway, and that the best method of doing this is by making light metre-gauge railways, with steel rails of 35 lb. to the yard, capable of carrying the rolling-stock of any metre-gauge railway in India, but having engines of a lighter type than those generally used on such main lines. These railways could be laid on existing roads, where practicable, and elsewhere on independent embankments. The routes to be followed, or the lines to be constructed, as above suggested, should, we consider, be some or all of the following, subject, of course, to further detailed investigation:—

In Bellary.

(1.) From Guntakal *via* Anantapur, Dharmavaram and Penukonda to Hindupur, about 100 miles.

In North Arcot.

(2.) From Vellore *via* Arni and Pólúr to Tiruvannámalai, about 60 miles.

In South Arcot.

(3.) From Villupuram to Tiruvannámalai, about 30 miles.
(4.) From Porto Novo *via* Vriddháchalam to Kallakurchi, about 60 miles.

In Coimbatore.

(5.) From Karúr to Dhárápuram, about 50 miles, or,
From Pálghat to Dindigul, about 100 miles (of which about 60 would be within the Coimbatore district and the rest in Madura).

In Madura.

(6.) From Madura to Ramnad and Kilakarai, about 70 miles.

As regards the Ganjam and Vizagapatam districts, we think the construction of no light lines of railways in them need be considered until the State line from Vizagapatam to Raipur has been opened and its effect on trade ascertained. As regards the Kurnool district, we consider that, when the railway from Bezváda through Nandyál to Guntakal is finished, there will be no need for any railway to Kurnool, seeing that that town is in direct communication by canal with Nandyál. We think it likely that the line we suggest from Porto Novo to Kallakurchi (No. 4) will be the one which will be recommended by the South Arcot Local Fund Board at their next meeting, when the question is to be discussed. We note that there is a large area of unprotected country in the eastern part of Madura regarding which we make no proposals, because it is chiefly foreign territory which has no claim on Local or Provincial funds. We refer to the Native State of Pudukóta. We think a line of rail to connect Tanjore with Pudukóta would be decidedly advantageous, but it is a line, the making of which, we think, may be deferred till the time referred to in paragraph 8 of the Government of India letter, of 28th April 1883, No. 364 R.C., when the further development of the system of constructing minor distributaries from Imperial Protective funds may be again considered. We have not suggested any line for the protection of the western taluks of the Bellary district, because when the lines from Bangalore *via* Tumkur and Tiptur to Hubli, and from Bellary to Hubli, now in progress, are finished, those taluks will be dominated by these two lines of regular railroads. Nor have we suggested any line in Tinnevelly, because we understand the Madras and Travancore Governments contemplate constructing an extension of the South Indian Railway from Tinnevelly to Quilon *via* Tenkási and Shencotta, and we do not consider a line from Tinnevelly to the south-east coast needed as a protective work. As a rule we consider that it is useless to make any line, even as a famine protective work, that is not at least about thirty miles long, especially when its con-

5. We, accordingly, placed ourselves in communication with most of the Local Fund Boards throughout the Presidency, and invited an expression of their views on the following points, so far as their respective circles were concerned :—

(*a*) Was it expedient or necessary for the better supply of food in times of famine, either from or to the circle, that light railways or tramways should be made to connect the centres of production and consumption within the circle with existing or proposed lines of railway, or would the existing high roads suffice if kept in good order.

(*b*) If the Board were in favor of constructing light railways or tramways, were they prepared to borrow money to pay for them, even if they might not be shown to be remunerative.

(*c*) If prepared to borrow, what was the largest sum they could guarantee to pay the interest on the amount borrowed.

(*d*) Would the Board prefer to carry out the works themselves or leave it to a company working under a guarantee.

The replies to the circular letter containing the above queries were to be forwarded to us through the Superintending Engineers of the various circles, who were requested, in forwarding them, to favor us with their own views on the matter.

6. We have now received answers from all the Local Fund Boards and from most of the Superintending Engineers addressed, and subjoin a précis of them for the information of Government. We did not address the Nilgiri or South Canara Local Fund Board, because the physical character of the former district precludes the making of cheap railways, while from the position and never-failing rainfall of South Canara we considered that district might be looked on as not needing any means of communication as a protection against famine. Nor did we invite the opinions of the Local Fund Boards of the Cocanada, Ellore, Masulipatam, Cuddapah, Chingleput, Tanjore, Negapatam, or Trichinopoly circles, because in the five first-named circles there seemed to be little room or need for making railways, while each of the two last-named districts has three lines of railway radiating through it from its chief town, and because, owing to their fertility and relatively small areas, they are less likely to suffer from famine than other districts in the south of India. Moreover, the Tanjore Local Fund Boards have already given a very practical reply to the question now under consideration, by resolving, some months ago, to construct a metre-gauge railway, out of Local Funds, from Máyavaram *via* Tiruválúr to Mutupet. We may here remark that, when we drafted our circular letter to the Local Fund Boards we were not aware (owing to the absence on tour of Colonel Shaw-Stewart, the Consulting Engineer for Railways and a member of our Committee,) of the existence of the letter from the Government of India of the 28th April 1883, No. 363 R.C., which excludes from present consideration, as lines to be constructed from Imperial funds, the lines of railway noted in the margin, which we had understood were likely to be so constructed, and to which we had referred in our letters to the various Local Fund Boards as lines likely to be made by Government. We also alluded to the Madura to Ramnad as being likely to be taken up by Government, but we now understand that this is not so.*

1. Párvatípur to Calingapatam.
2. Gopálpur to Sonpur.
3. Vellore to Chittoor and Madanapalle.
4. Vellore to Villupuram.
5. Tadpatri to Mysore frontier.

lines from Pálghat to Dindigul and from

* Letter from the Government of India, dated 28th April 1883, No. 363 R.C., printed in G.O., of 1st June 1883, No. 556 R., Public Works.

7. The following is the précis of replies above referred to :—

Anantapur.—The Local Fund Board consider that, if a railway is made by Government through the district to the Mysore frontier, the existing roads will suffice for some time to come.

Arcot (North).—If a railway is made by Government from Villupuram *viâ* Tiruvannámalai, Vellore, and Chittoor to Madanapalle, the two Boards of the district (Vellore and Chittoor) consider that no branches to that line are needed, as the existing roads will suffice; but if Government will not make the railway, then they are willing to guarantee Rs. 50,000 a year between them towards the interest on the cost of making a line of light railway from Chittoor *via* Vellore to Arni.

Arcot (South).—The Local Fund Board think a light railway is needed to supply the western taluks of the district in time of famine, but do not say how it should run. They are not prepared to borrow money for the work, and will only guarantee Rs. 25,000 a year to a company approved by Government.

Bellary.—The Local Fund Board consider that the existing roads are not sufficient to protect the western taluks in famine time, and suggest two lines of railway or tramway—

(1.) From Hospet *viâ* Harpanahalli to Daggavati on the Mysore frontier.
(2.) From Bellary to Ráyadrug.

They are unable to guarantee anything and decline to borrow money to carry out either work.

Coimbatore.—The Local Fund Board consider that, if Government will make a railway from Pálghat to Dindigul, existing roads will suffice as feeders; but it would be an advantage if a tramway is laid down from Satyamangalam *viâ* Avanáshi and Palladam to the said line. They do not think it would pay, however, and they would not attempt to borrow money to make it.

Cuddapah.—The Madanapalle Board are of opinion that light railways are needed between Tirupati and Ráyachóti, and between Ráyachóti, Kadiri and Madanapalle. They cannot, however, afford to incur any of the expense of making the lines.

Ganjam.—The Chatrapur Circle urge the necessity of making a light railway from Gopálpúr *via* Aska to Russellkondah, to be prolonged to Sompur in the Central Provinces, a total distance of about 140 miles, of which seventy would lie within the limits of the circle. They believe the line would pay, but not having funds available they cannot guarantee anything.

The Chicacole Board recommend light railways being made from Parlákimedi to Calingapatam, a distance of thirty-five miles, and from Jalmur to a point on the proposed line from Párvatipur to Calingapatam, a distance of fifteen miles. They object to tramways and are unable to make any guarantee, not having funds.

Kistna.—The Guntúr Board consider that neither railways nor tramways are needed, and they cannot afford to pay for them.

Kurnool.—The Board are in favor of a tramway from Kurnool to the nearest point on the line of railway from Bezváda to Guntakal, to be carried out by unguaranteed private enterprise.

Madura.—The Madura Circle Board think that, if the Government make a line of railway from Madura to Ramnad, the existing roads will suffice to bring centres of production and consumption into connection with it.

The Dindigul Circle Board are in favor of a light railway from Ammayanáyakanúr to Periyakulam, but cannot afford to undertake the work themselves.

Malabar.—The Local Fund Board, adopting generally the views of the President, consider the district is practically safe from famine, and that neither light railways nor tramways are needed to bring the centres of production into connection with the existing lines of railway; but, in order to facilitate the export of the surplus produce of the district, they advocate two lines of light railway—

(1.) From Shoranur to Cochin, and
(2.) From Tellicherry *via* Coorg to Mysore.

There are no Local Funds available, however, to pay for these lines.

Nellore.—The Local Fund Board declare their readiness to connect centres of production or consumption by good roads with any line of railway which may be made, but do not consider light railways or tramways suitable for the district except between Nellore and Kistnapatam, between which two places they are willing to make a tramway.

Salem.—The Hosúr Circle Board consider existing roads insufficient in time of famine, owing to the then existing want of cattle. They consider a light railway

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BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of [1883] Madras.

PUBLIC WORKS.

Dated July, 30th.

Read. *Encl.*

G.O., 30th July 1883, No. 2062 W.

JULY.

Light Railways

Appointing a Committee to report on questions connected with the scheme for the construction of — as protective works in tracts of the Madras Presidency liable to famine.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

Read the following paper:—

From the President and Members of the Railway Committee, to the Secretary to Government, Public Works Department, dated Madras, 24th October 1883.

We have the honor to submit the report called for in G.O., Public Works Department, No. 2062 W., dated 30th July 1883.

2. With their letter, No. 130 W., of the 18th December 1882, the Government of Madras submitted to the Government of India a scheme for the construction of light railways as protective works in the tracts of this Presidency liable to famine. The scheme involved the selection of 1,000 miles of existing roadway within the famine zone and their preparation to receive the permanent-way of any rail system that it might be decided to lay down on them, by widening, metalling, and otherwise improving them; and, subsequently, the laying down of light rails, weighing 20 pounds to the yard and with a gauge of two feet, on such improved roads. It was estimated that it would take forty years to complete the whole of the works involved in the scheme, and it was pointed out in the Chief Engineer's note of the 11th November 1882 (on which the proposals were based) that every mile of such improved road would, even without the rails, be so much gained, and, were scarcity or famine to recur in the interval, the work would all be of a character well adapted for affording relief. The funds required for carrying the scheme into effect were proposed to be provided from the Imperial Protective grant, under a new sub-head in the budget of "Famine Roads."

3. The Government of India, in their letter of the 28th April 1883, No. 364 R.C., condemned the scheme, remarking that it would be a fatal mistake, until the main arterial protective lines were finished, to expend Imperial funds on detached distributary lines of the lightest types, which, however much they might benefit the tracts they immediately served, were incapable, from their very character, of coping with the exigencies of a severe famine affecting large areas of country and a vast population. At the same time they pointed out that light railways and metalled roads were unquestionably valuable auxiliaries for the mitigation of distress in times of scarcity, but that it was the duty of the Local Government to provide them.

4. Thereupon, the Madras Government appointed us as a Committee to report on two points—

1st.—The best method of connecting the great centres of production and consumption with the main arterial protective lines to which the Government of India refer as having the first claim on the Imperial exchequer, and the routes to be followed.

2nd.—The agency by which the work should be done, and the source whence the necessary funds should be drawn.

In connection with the first point we were directed to consider whether mechanical power should be substituted for animal draught; and, if so, whether road-engines working on the high-roads or steam tramways or light railways would be preferable; and, in the event of the railways being preferred, whether they should be of the metre or two-foot gauge.

famine. That Government are not, it is stated, prepared to undertake the financial responsibility of a scheme of auxiliary lines such as that recommended, but would be willing to help the local Government by considering the propriety of any changes in the law requisite to allow of Local Boards guaranteeing, under due control and to a limited extent, interest for works constructed by private agency within their circles.

2. As regards main lines of communication which the Government of India consider should first be undertaken, Railway Surveys are, it is observed, in active progress, and these will provide, so far as can now be judged, all that is needed in the way of trunk lines in the famine zone.

3. The immediate subjects for consideration therefore are—

(1) the best method of connecting the great centres of production and consumption with these main lines, and the routes to be followed;

(2) the agency by which the work is to be done, and the source whence funds are to be drawn.

4. Under Item (1) should be considered whether it will be advisable to substitute mechanical power for animal draft, and, if so, whether it would be desirable to apply such power in the form of road-engines or steam-engines working on tram or light railways applied to existing roads improved for the purpose, or to light railways carried on independent embankments.

5. Should the preference be given to light railways, it is also for consideration whether the gauge should be the metre, or 2 feet.

6. To deal satisfactorily with these questions the Government resolve to nominate the following officers, who will form themselves into a Committee for the purpose, with power to add to their number :—

J. H. Garstin, Esq., C.S.I., President.
Colonel J. H. M. Shaw-Stewart, R.E., } Members.
Colonel H. L. Prendergast, R.E., } Members.
Major C. Bowen, R.E., }

7. The Committee will have power to take evidence *viva voce*, if necessary, from Collectors and Superintending Engineers, and to call on those officers to furnish reports direct. The latter will probably be preferable.

8. As regards Item (2), there seems little prospect of the ordinary establishment or resources of Government or Local Fund Boards being available to the required extent, but it would appear that by revised rules issued by the Government of India under the Local Loans Act, it will in future be practicable for Local Fund Boards to raise funds for works which are not strictly remunerative. The removal of this restriction by putting it in the power of Local Boards to open out lines of communication which, though unremunerative as a commercial investment will be useful in ordinary times, will doubtless to a certain extent facilitate the distribution of food in seasons of scarcity. The Committee should endeavour to ascertain how far local bodies may be depended on to co-operate in this direction with the State for the object in view.

9. The report of the Committee should reach Government not later than the middle of October.

(True Extract.)

(Signed) R. H. SANKEY, Major-General, R.E.,
Secretary to Government, P.W.D.

To the Members of the Committee.
" Superintending Engineers.
" the Consulting Engineer for Railways.
" the Financial Department.

Exd. A. F. Goodall.
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munication by canal between Cocanada and Madras the prospect of its becoming a port of any importance has entirely disappeared; the steamers of the British India Steam Navigation Company have long ceased to call there. On the other hand, three villages of the Guntúr Taluk are situated within the Kistna Western Delta, and the town of Guntúr is only nine miles distant by a good road from the through canal.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

READ—again G.O., dated 25th April 1883, No. 361 R., Public Works.

READ—also the following letter from Colonel W. S. TREVOR, R.E., Secretary to the Government of India, Public Works Department (Railway Construction), to the Secretary to the Government of Madras, Public Works Department, dated Simla, 28th April 1883, No. 364 R.C.:—

I am directed to acknowledge the receipt of your letter, No. 3347 W., dated 18th December 1882, forwarding, for the favorable consideration of the Government of India, certain documents containing proposals for a scheme of light railways to be constructed as protective works in the tracts of the Madras Presidency liable to famine. That scheme is summarised in the 55th paragraph of the Chief Engineer's Note, dated 11th November, which forms one of the accompaniments to your letter.

2. From the summary it would appear that nothing more definite than the bare outline of a general policy for the gradual improvement of the means of inland communication within the so-called famine zone has yet been matured.

3. It would further appear that the intention is to carry out these improvements from funds to be provided out of the Imperial protective grant under a new sub-head of "Famine Roads." The contributions from this source are to begin with one lakh in 1883-84, and to increase thereafter by one lakh annually until a maximum outlay of five lakhs per annum is reached.

4. It is also contemplated that the improvements under the scheme shall be limited to an aggregate of 1,000 miles of reformed roadway, and that in the first instance these improvements shall be confined to widening, metalling and otherwise improving as many of the selected lines of road as possible for the reception of permanent-way of such character as may hereafter be decided on. But, except for purely experimental purposes on a small scale, and as a reserve against possible contingency of severe scarcity or famine, no expenditure is to be incurred on the provision of permanent-way or rolling stock until the complete reformation of all the roadways embraced by the scheme has been effected.

5. Finally, it is expected that these operations will extend over a period of forty years, at the close of which term it is hoped that the whole of the 1,000 miles of road under treatment will have been converted into light railways or trams on the 2 feet gauge; though the final process of conversion will not practically begin until at least ten years after the scheme has been set on foot, that time being apparently needed to carry out the preliminary operation of putting the selected roads into proper order for the reception of the permanent-way.

6. If the above summary correctly expresses the character and scope of the proposals submitted for the approval of the Government of India, I am to say that His Excellency the Governor-General in Council regrets his inability to accept them. In the first place, His Excellency in Council is not prepared to relieve the provincial and local revenues of the obligation legitimately devolving on them to provide for the construction, improvement and maintenance of provincial and local roads at the expense of the general revenues of the empire, on which the burden of the protective grant falls.

7. Moreover, the application of funds from that grant to the construction of isolated tramways, or even light railways in short lengths for the exclusive benefit of a few restricted localities, is a measure which does not commend itself unreservedly to the Government of India. Until the main arterial protective lines, traversing trade-locked districts and connecting them with the great centres of production and consumption, have been made, it would, in the opinion of the Government of India, be a fatal mistake to expend the not too plentiful resources at its command on detached distributary or feeder lines of the lightest types, which, however much they might benefit the tracts they immediately serve, are incapable from their very character of coping with the exigencies of a severe famine affecting large areas of country and a vast population.

8. After the main arterial lines, projects for which are already under preparation, have been made through the most exposed tracts, and substantial security for an adequate supply of food being thrown into them on emergencies within reasonably accessible distances of the more populated parts has been afforded, the policy of applying the protective funds to the further development of the system by constructing minor distributaries to carry those supplies into the remoter villages may perhaps be considered. But until that desirable consummation is reached, I am to say that the Government of India cannot pledge itself to provide funds from Imperial sources for the prosecution of works which are essentially of a kind to be undertaken either directly by the Provincial Government itself or through the agency of Local Boards.

9. I am to observe, however, that though the Government of India is not prepared to take upon itself the financial responsibility of the scheme now submitted to it, it does not disapprove of the principle of adding to and improving internal communications on a systematic plan. Light railways and metalled roads are unquestionably valuable auxiliaries for the mitigation of distress in times of scarcity, as well for the general development of trade and prosperity in ordinary times. But it is the duty of the Local rather than of the Imperial Government to provide such auxiliaries.

10. To help the Local Government to carry out its object with the resources at its own command, the Government of India would be prepared to consider the propriety of any changes in the law which may be requisite in order to allow of Local Boards guaranteeing, under due control and to a limited extent, interest for works constructed by private agency in their districts. It must, however, be carefully considered in each case whether the system of guaranteeing interest to a private company is or is not preferable to a system under which the Boards would borrow direct and construct the lines without the intervention of any such agency. Under the revised rules of the Act of 1879 such local authorities are, moreover, not restricted to remunerative works in their borrowing. They already possess, therefore, the powers to raise the necessary funds for carrying on these protective works, and it seems to the Government of India that this power might with advantage be exercised for so beneficial an object, under the general controlling authority of the Local Government. I am, however, to explain that the above remarks are subject to any decision which may be arrived at on the question of railway policy in general, upon which the Government of India are in correspondence with the Secretary of State.

11. In conclusion, I am to say that His Excellency the Governor-General in Council will await any further proposals that the Government of Madras may have to make in respect to this matter.

G.O., dated 28th June 1883, No. 1335, Financial.

ORDER—dated 30th July 1883, No. 2062 W., Public Works.

In their letter of the 28th April 1883 recorded above, the Government of India reply to the proposals which have been laid before them for a scheme of light railways to be constructed as protective works in the tracts of the Madras Presidency liable to

2. The line from Bezváda to Hyderabad, now proposed by the Collector, was, with other lines, discussed in the papers printed with G.O., dated 20th September 1871, No. 2396, Public Works Department, and it was also reported upon by the Consulting Engineer for Railways in his letter printed in G.O., dated 19th September 1868, No. 2967, Public Works Department.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

Proceedings of the Board of Revenue, dated 5th January 1883, No. 13.

Read—the following letter from J. LEE-WARNER, Esq., Acting Collector of Nellore, to the Secretary to the Board of Revenue, dated 15th December 1882, No. 6727:—

With reference to the Board's reminder in memorandum, 7th December 1882, I have the honor to express regret that it had escaped my memory that a reply was expected to Board's Proceedings, dated 7th September 1882, No. 2230. Since I have joined the district my attention has been drawn to the advantages of a line of road connecting Nellore with the Madras Railway almost direct *viâ* Podalakur and Rápúr, and I would certainly propose to add this one to the lines suitable for a tramway suggested by my predecessor. It should be observed that the experience gained by this year shows that the East Coast Buckingham Canal cannot be depended upon at all in times of drought. The Canal Officers can say what they please as to water-level having been abnormally low in the Pulicat lake, and so on and so on; but the fact remains that during the most important months of this year, when the merchants wanted to export their goods to Madras, the Buckingham Canal failed. Again, as soon as heavy freshes came down the rivers in November, the canal became so silted in places that it became impassable for days together. Traffic between Kistnapatam and Kottapatam (Ongole), suspended since the 28th November, is only just re-opened. A great advantage of this route now proposed is that it encounters no cross drainage, if the Kandleru is excepted; and even where the Kandleru has to be crossed, that stream is only in its infancy, and therefore not a very formidable obstacle. The only difficulty of any magnitude is the last mile of the ghât over the Rápúr pass, and no doubt the Engineers will find an easy mode of surmounting that.

Resolution—dated 5th January 1883, No. 13.

Submitted to Government in continuation of Board's Proceedings, dated 7th September 1882, No. 2230.

2. The reminder was sent to the Collector by a clerical error, but the Board are glad to receive Mr. Lee-Warner's suggestions.

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

Proceedings of the Board of Revenue, dated 5th January 1883, No. 14.

Read—the following letter from H. W. BLISS, Esq., Commissioner of Salt Revenue, to the Secretary to the Board of Revenue, dated Madras, 11th December 1882, No. 13754:—

I have the honor to furnish the report called for in the last paragraph of the Board's Proceedings, No. 2230, dated September 7, 1882, which was inadvertently overlooked until the receipt of a reminder.

2. The following, of those mentioned by the Board, are the steam tramway lines, the construction of which seems to me most likely to be beneficial to the salt trade:—

Nellore.—Iskapalle or Krishnapatam *viâ* Sangam and Dornal Pass into Cuddapah.

South Arcot.—(1) Merkanam to Sámalpati, (2) Cuddalore *viâ* Kallakurchi, Chinna Salem and Atúr to Salem.

Madura.—Madura to Ramnad and Pámban (with a branch to Kílakarai and possibly another branch to Devipatam).

3. To these I would add—

Tanjore.—Nídámangalam *viâ* Mannárgudi to Mutupet and Adirámpatnam.

Tinnevelly.—Tinnevelly (Railway Station) *viâ* Palamcottah, Pudugudi (Srívaikuntham), Alvár Tinnevelly and Arumugneri (salt-pans) to Káyalpatnam (port) and Tiruchendúr (great place of pilgrimage).

4. I think the usefulness of these two lines is obvious. They would carry grain towards the coast and salt from it, and passengers both ways. The passenger traffic between Mutupet and Káyalpatnam on this side and Cingalese ports on the other is, I believe, very considerable. On the whole, I should say that these two lines are as likely to pay as any which could be named. It is, at all events, certain that the Tanjore and Tinnevelly Local Fund Boards are at least as well able as those of any other district to guarantee interest on the cost of constructing tramway lines if that method of raising capital for their construction should find favor, as I think it should do.

5. With regard to the connection of Kurnool with the coast, which appears a most desirable preventive measure in the event of famine, I beg to point out that the Government of India has already ordered the survey of a line from that district to Guntúr. The line selected would presumably be from Kurnool by the existing pass through the Nallamalai Hills to Cumbum, and thence *viâ* Podili and Darsi; and the object would be to connect Kurnool with the deltas of the Kistna and Godávari, where food-supplies should never fail. But Guntúr is, if I mistake not, separated by some distance from the deltaic tracts and from the canals by which their produce should be brought to the railway. It also appears to me a matter of importance that lines running inland should have a terminus at the best available port on the coast. I would therefore suggest, as an alternative route for this line, that it should run *viâ* Podili to Ongole, and thence turn northward to Ipurupálem, a good anchorage and a place already of sufficient trade for it to be worth while for the British India steamers to call there pretty regularly. With a very slight detour such a line would touch Kanuparti, whence the transport of salt into Kurnool and Bellary would then be greatly cheapened; and at its crossing of the Commamur Canal (possibly over the bridge already sanctioned on the road from Inkole to Chinna Ganjam) would communicate in the easiest manner with the whole navigation system of the East Coast, delivering direct into the canal boats the timber of Kurnool and receiving from them the rice of the two deltas. It may be that Guntúr is only intended as the temporary terminus of the Kurnool line; but I do not see how such a line can possibly pay, or even fulfil its purpose as a protection against famine, unless it is at least extended so as actually to join the great system of inland communication formed by the navigable canals branching from the Kistna and Godávari rivers and by the Buckingham Canal, which traverses the whole length of the Nellore District. I may add that I believe Mr. Wilson, who is intimately acquainted with the Kistna District, has given considerable attention to the capabilities of the port of Ipurupálem, and would be able at once to say how far my idea that it is the natural terminus of the Kurnool line is correct.

Resolution—dated 5th January 1883, No. 14.

Submitted to Government in continuation of Board's Proceedings, dated 7th September 1882, No. 2230.

2. The Board have consulted Mr. Wilson regarding the capabilities of the port of Ipurupálem, and learn that he is of opinion that since the opening of through com-

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of (1882) Madras.

PUBLIC WORKS.

Dated December, 18th.

Recd. *Encl.*

18th Dec. 1882, No. 3347 W.

DECEMBER.

No. 130.

Tramways or Light Railway.

CONSTRUCTION OF — as protective wo
against famine.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads,
Civil Works.

READ—again G.O., dated 18th December 1882, No. 3346-7 W., Public Works.

READ—also the following papers :—

Proceedings of the Board of Revenue, dated 5th January 1883, No. 10.

Read—the following letter from J. G. HORSFALL, Esq., Collector of Kistna, to the Secretary to the Board of Revenue, dated Masulipatam, 6th November 1882, No. 2840 :—

In accordance with paragraph 17 of Board's Proceedings, No. 2230, dated 7th September 1882, I have the honor to bring to the recollection of the Board the project for a railway or tramway from Bezváda to Hyderabad.

2. This scheme has been discussed more than once as is known to the present Acting Third Member of the Board.

3. From Bezváda, connected by canal with Cocanada, Masulipatam and Madras, the line would pass on the left bank of the Kistna, crossing only two tributaries—the Muniru and Pálér—which would not present very great difficulties, and then would traverse the Nizam's territory. A glance at the map will show that no difficulty in the construction of this line need be apprehended there. No large river need be crossed, and a comparatively level trace can doubtless be made winding among the undulating hills of the Deccan.

4. The line would pass by the important trading town of Jaggayapet. Opium and other goods from Central India would find their way to the coast, and the salt and rice of the Kistna District would take this route inland. It seems strange that the line was not made long ago.

5. The Nizam's Government are, I understand, about to construct a line from Hyderabad to Chanda. This would considerably shorten the proposed line from Bezváda, which need only to be carried to the nearest point of the Chanda line.*

* Probably one hundred miles.

6. The Singareni coal-fields in the vicinity of Varangal would not be far to the north of this line.

7. The Famine Commissioners when here appeared to be favorably impressed with the proposal.

8. A recent paragraph in the newspapers stated that among the projects before the Government of India was one for a railway from Kurnool to Guntúr. That would be of little use except in famine years, but the line I suggest would be profitable in favorable as well as unfavorable years.

Resolution—dated 5th January 1883, No. 10.

Submitted to Government in continuation of Board's Proceedings, dated 7th September 1882, No. 2230.

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1882} Madras.

PUBLIC WORKS.

Dated December, 18th.

Recd. *Encl.*

G.O., 18th Dec. 1882, No. 3346 W

DECEMBER.

Nos. 128-129.

Tramways or Light Railways.

Construction of — as protective work against famine.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 130.

LETTER—from

COLONEL R. H. SANKEY, R.E., C.B.,
Secretary to the Government of Madras, Public Works Department,

To

THE SECRETARY TO THE GOVERNMENT OF INDIA,
PUBLIC WORKS DEPARTMENT.

SIR,

With reference to the correspondence quoted in the margin, I am now directed to forward, for the favorable consideration of the Government of India, the accompanying papers containing proposals for a scheme of light railways as protective works in the tracts of this Presidency liable to famine.

To Government of India, No. 1697 W., dated 9th July 1881.
G.O., No. 2018 W., dated 17th August 1881.
From Government of India, No. 437 I., dated 12th November 1881.
To do., No. 2965 W., dated 28th Nov. 1881.
From do., „ 381-94 M., „ 30th „ „
To do., „ 3198 W., „ 31st Dec. „
From do., „ 163 M., „ 6th May 1882.
To do., „ 466 I., „ 13th June „
From do., „ 161 M., „ 6th May „
To do., „ 1475/5 W., „ 13th June „
From do., „ 270 M., „ 5th Aug. „

2. The scheme for adapting 1,000 miles of selected existing roads within the famine zone as proposed in the Chief Engineer's Note accompanying these Proceedings was brought in a general manner under the notice of the Finance Minister, who seemed to think that the time named for completion of the scheme, viz., 40 years, was excessive, and that it might with advantage be abridged. There can, in the opinion of the Governor in Council, be little doubt as to the great advantage of completing a scheme of this kind in the shortest possible time, as, notwithstanding the generally poor country through which the railways will be carried, it is not improbable that owing to the economical style of construction recommended, the lines may prove to some extent remunerative.

3. In any case it is desirable that the matter should be taken up as early as possible, and I am accordingly to request that the orders of the Government of India may be communicated in time to admit of work being commenced next official year.

I have the honor to be,

Sir,

Your most obedient servant,

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

FORT ST. GEORGE,
18th December 1882.

Exd. S. T. Austin.
Spare Copies

demanding a large expenditure, or in other words to provide the money from ordinary revenues, making an equivalent reduction from the surplus of 1,500,000*l.*

"Lord Lytton's Government considered that there was only one way in which the works could be made with the speed which the necessity of protecting the country against famine required, and at the same time without financial risk. In any case, they said, in which it would be justifiable in principle, although not expedient in practice, to diminish our annual famine insurance surplus, with the object of defraying the capital expenditure on protective works, it would be unobjectionable to apply a portion of that surplus in payment of interest on the capital required. It was therefore proposed to allow, in case of necessity, money to be borrowed for these works, subject to the condition that the net charge for the interest on their capital cost, and for their maintenance, after setting off the income yielded by them, should not exceed a specific maximum amount, to be provided from the ordinary standard surplus. The amount of the liability thus admitted might be altered, from time to time, as experience was gained; but to be on the safe side, it was proposed, in the first instance, to fix at 250,000*l.* the sum by which the yearly charge for interest and maintenance might exceed the net revenue from the works. It was believed that the annual surplus of 1,500,000*l.* reserved for famine, might safely be reduced by this amount, not only because the construction of these works would reduce the ultimate liability for the relief of famines when they occur, but because, as the inquiries of the Famine Commission have since more decidedly shown, there is reason to think that, in originally determining the standard amount of that surplus, it was fixed at a sum somewhat higher than was really essential.

The sum of 250,000*l.*, to be annually expended in paying interest on fresh capital for protective works, would have been distributed between the Local Governments according to the urgency of their wants; and as soon as the quota of any province became exhausted, the further capital outlay in that province would have been suspended until the growing income from the provincial works as a whole, or, under certain conditions, from other sources of provincial income, again relieved the provincial revenues and supplied a surplus.

Even if the works should produce no net income at all, and should merely cover their working expenses—a supposition so improbable that it does not really deserve to be considered—a capital sum of about 6,000,000*l.* might, under this plan, be gradually expended, and such a sum would go far towards providing the protective works most urgently required. But, in fact, the growing income would, without the least doubt, rapidly provide the means of extending the capital expenditure, while, as already said, the gain to the country from the improvement of its communications would far outweigh any deficiency in the direct return from the works. The adoption of this plan would create no fresh ultimate obligation beyond what has already been accepted; the interest payment would be nothing more than an indirect continuation of the capital itself, and no greater risk would be incurred than if the capital had been directly supplied from surplus revenue.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads.
Civil Works.

No. 128.

READ—the following paper:—

Note by the Chief Engineer, Public Works Department, dated 11th November 1882, submitting papers on the subject of Tramways or Light Railways as protective works in Famine Tracts.

No. 129.

ORDER—dated 18th December 1882, No. 3346 W., Public Works.

The question of constructing tramways or light railways as protective works against famine has been engaging the attention of Government, and with his Note recorded above the Chief Engineer submits the results of the enquiries which have been made.

2. The information obtained is sufficiently complete to admit of some practical advance being made. The Right Honorable the Governor in Council accordingly resolves to forward the papers for the orders of the Government of India, with an expression of concurrence in the recommendations made by Colonel Sankey in paragraph 55 of his note.

3. The Government anticipate the best results from the extension of communication by means of light railways if constructed on the most economical principles. It is an admitted fact that even in the more favored localities traversed by the Madras and South Indian Railways, the traffic requirements would be sufficiently met by lighter and more economical means of conveyance than those which have been provided. It would thus be most unwise to construct similarly costly lines for protective purposes in the localities comprised within the less-favored famine zone of the Presidency.

4. The necessity for opening up such tracts by means of railways is forced on the attention of the Government by the fact that in times of scarcity, and particularly during a grass famine, the ordinary means of transport by cart and bullocks is rendered extremely difficult, if not impossible, owing to the dearth of fodder at such seasons. It is a *sine quâ non* that the capital outlay should be reduced to a minimum if the whole famine zone has to be opened by this means of communication within a reasonable time.

5. The gauge most suitable, with other accessory details, must be left for consideration till the general outlines of the scheme have been finally approved and decided on by the Government of India.

(Here enter No. 3347 W., dated 18th December 1882.)

(True Extract.)

(Signed) R. H. SANKEY, Colonel, R.E.,
Secretary to Govt., P.W.D.

To Superintending Engineers.
To the Revenue Department.
" Financial
" Comm.r Ry. for Railways
Exd. S. T. Austin.
Spare Copies

1037.

Govt. of [1883] Madras

PUBLIC WORKS.

22/12

Dated

Rcts. Encl.

G. O. 13th Dec. 1883, No. 3150

Light Railways

Copy of Despatch to the Govt of Madras in reply to their proposal of 20th Sept. 1883 — as proposed works in certain Districts in the Madras Presidency

Recorded

5-0
1/3

Sir,

No. 3346 W&S 18.12.82.
" 3347 W&S 18.12.82
" 2062 W&S 30.7.83.
" 3479 W&S 4.12.83.

PWCNo 1037

Under Secretary

4

B.T.P
Clerk

Rec 12/12/83

No. 3650 W&S Dec 19th 1883

Recorded with reference to G.O. No. 3479 W&S 4th December 1883.

CW 13/12

WS 13-12-83

Rec 4/11/84

WS 18-12-83

Cons: Engr for Rys. to
Financial Dept

Forwarded to the Secretary to the Government of Madras, Public Works Department for information in continuation of Public Works Department No. 364 R&L dated 28th March 1883.

Govt of India, P.W.D.
Fort William, 3rd December 1883.

By order
C. Lilly Colonel R.E.
Offg. Under Secretary

No. 1800 R&L.

39/365

38/365 8/2

No. 122 Railway, dated 11th October 1883.

From—The Secretary of State for India,

To—The Government of India.

Your Excellency's Railway Despatch No. 102, dated the 7th of July last, transmits, for my information, copy of Proceedings of your Government in respect to a scheme submitted to you by the Government of Madras for construction of a system of light railways or trams on the 2 feet gauge as protective works in certain tracts of the Madras Presidency liable to famine, the necessary funds being provided by annual allotments from the Imperial Protective Grant.

2. Your Government, while expressing approval of the principle of extending internal and local communications on the plan proposed, declines to apply, for that purpose, funds which are, in your opinion, more urgently required for main arterial lines designed to afford protection to larger and more exposed tracts of country. At the same time you suggested to the Madras Government that the necessary funds for operations might be obtained from Provincial resources, or through the agency of Local Boards, who, under suitable regulations, might borrow, direct, and construct the lines, or might enlist private capital for their construction by the offer of a guarantee of interest.

3. Your Excellency's Government possesses the best means of deciding in what manner and on what lines the funds at your disposal for protective purposes can most advantageously be expended, and, for the reasons you assign, I concur in your decision not to apply these funds at present to the prosecution of works which, as you say, "are essentially of a kind to be undertaken either directly by the Provincial Government itself or through the agency of Local Boards."

4. At the same time a cautious experiment in the construction of light lines, such as are proposed by the Madras Government, seems unobjectionable if funds for its prosecution can be provided from Provincial resources, or by the agency of Local Boards. There would, however, appear to be many reasons for doubting how far such a scheme could be practically carried out with success, and, in the absence of experience in its favor, the experiment should be made with every care and caution. Further attention should be given to the selection of the gauge, on which point I would refer your Excellency to paragraphs 5 and 6 of my Railway Despatch No. 10 of 25th January last.

5. Until there is more clear evidence that the project is one of a really practical nature, it seems premature to discuss the financial arrangements which might be suitable for giving it a general application, such as is contemplated by the Madras Government.

No. 1010 R.C.

Copy forwarded to the Finance and Commerce Department for information and such action as may be considered desirable, with reference to its No. 1266 of the 8th June 1883.

H. F. HANCOCK, Col., R.E.,
Offg. Deputy Secretary.

GOVERNMENT OF INDIA,
PUBLIC WORKS DEPT.;
Simla, 17th November 1883.

J. C. LEDGER,
In charge of the Public Works Department at Simla.

Govt. C. B. Press, Simla. No.—699 P. W. B.—20-11-83.—50

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pointed out may be as bad as a grain famine) exists, all cattle not immediately required for agricultural purposes, should it is thought be as much as possible driven off to the tracts where grazing is sufficiently abundant, and the home supplies of fodder carefully conserved for the remainder. For these latter, if less worked than usual, less will be consumed of the scant provision. Grain being much easier carried about the country than fodder, it would also in this sense be better policy to feed if necessary at a distance from their homes the owners of bullocks on whose preservation the entire prospect of future agriculture depends, than hold out inducements which would have the effect of the more rapidly exhausting the supplies of fodder. Certain it is that enormous numbers of cattle perished in these districts, and that agricultural operations have ever since it is believed suffered in consequence.

14. As stated in the Madras Famine Report, p. 40, there was a Special Transport Agency established under Colonel Hicks in December 1876. The total quantity of grain moved was 25,108 tons, and about 245 tons of tools for famine works. It is added that "by this agency about 4,500 carts, 9,000 bullocks, and 5,400 men were at one time actually employed daily and supported, besides about 800 carts, 1,600 bullocks, and 960 men engaged in carrying food and fodder to different halting places."

15. Even were steam as a motive power be not employed, the mere substitution of cattle tramways would have allowed of all this work being done with infinitely less outlay, as it is proved that a horse or bullock can do from twelve to fifteen times as much work if employed for haulage on a tramway, than in the usual way.

16. During the late famine in Mysore, owing partly to the losses of cattle or their absence in the grazing grounds of the western ghâts, where numbers were sent, grain particularly in the Chittledroog Division had to be distributed by means of carts dragged by coolies, men and women.

17. In Madras the Famine Report shows that cattle were "either sold by their owners or driven away to distant and more favored localities where grazing could be found," and Colonel Hicks distinctly says that "almost simultaneously with the Government transport operations ceasing, and the different transport routes being abandoned, the difficulty of obtaining carts increased until eventually carts drawn by bullocks almost entirely disappeared on many roads."

18. That great strain as regards the supply of cattle is one of the possibilities of a grass famine is, I think, sufficiently evident, and must be provided for. For such cattle as can, consistent with their receiving proper nourishment, be kept in the neighbourhood of the village, it will be advantageous that they should not be drawn away to any great distances under engagements for distributing grain; cultivators will thus be better able to take instant advantage of any favorable opportunities for commencing their ploughing operations. No objection would of course exist to their undertaking engagements for carrying grain to the comparatively short distances required in case a general tramway scheme is carried out, but for all not absolutely required on the spot it would apparently be better policy to send them to any available grazing grounds, and not to stimulate retention near their famine-stricken homes by needlessly artificial arrangements.

19. Further, it does not appear necessary to lay much stress on the fact, that animals as argued consume less water than steam motors for moving equal loads, as it is almost certain that along any line of rail or tramway exceptionally favorable arrangements can be made for the supply of water, which though enabling engines to do their work, would have but little or no effect in maintaining the cattle of a district, even did the fodder question not of itself present insuperable difficulties.

20. On the whole, therefore, if on other grounds light railways or tramways can be constructed on main lines, well suited for the distribution of food in famine, and at such moderate outlay as may be certain not to create any financial embarrassment, the arguments above quoted against the use of mechanical agency should not, I think, be allowed to weigh against an acknowledged beneficial measure.

21. The general financial considerations involved will be better dealt with when the extent and cost of the works proposed by the different authorities has been considered; here therefore it will be convenient to deal with the second head of inquiry, viz., "the lines in order of importance within the famine zone which it might be desirable to carry out."

22. To lay down any very definite limits for the so-called "famine zone" would be impracticable, but as a general idea of its extent, the areas shown on the annexed map as having suffered from "intense" and "severe" famine, in both 1866-67 and again in 1876—78, may be fairly accepted as indicating very nearly the extreme limits; unfortunately it covers a very large proportion of the area of this Presidency. On the same map will be found the existing or proposed Guaranteed and State lines of railway and the navigable canals; also the famine lines of tram or light railways as proposed by the several authorities which have been consulted.

23. The following table, compiled from the Proceedings of the Board of Revenue, and the reports of Public Works Officers, shows in the aggregate the lengths of lines suggested as suitable in their opinion for each district. The districts are given in the order in which they respectively stand according to the returns of the last famine, showing generally their need for development of communications of the description contemplated:—

Abstract of Proposals made by the Civil and Public Works Officers for either Tramways or light Railways in the several Districts most liable to Famine.

Civil Districts.	Maximum Numbers on Relief Works in any one Month, Famine of 1876-78—Daily Average.	Proposed Lengths of Road, Tram or Railway.		Remarks as to existing Railways or Navigable Canals.
		By Collectors.	By Public Works Officers.	
		MILES.	MILES.	
Bellary and Anantapur ..	January 1877—360,597 ..	265	183	District is traversed by Madras, Raichore, and Guntakal Hoobly Railway.
Kurnool	" " 298,568 ..	..	158	Ditto by Kurnool Canal available for eight months annually, though not in the worst famine months.
Cuddapah	" " 194,425 ..	370	127	Ditto by Madras Railway from North-West to South-East Raichore.
North Arcot	August " 62,573 ..	112	91	Ditto by Madras Railway from South-West to East.
Salem	May " 55,824 ..	162	133	Ditto by Madras Railway from South-West to North-East.
Nellore	January " 55,512 ..	144	193	Ditto Buckingham Canal South to North.
Coimbatore	August " 29,211 ..	131	150	Ditto by Madras Railway South-West to North-East.
Chingleput	" " 28,245 ..	..	53	Ditto by Madras Railway, South Indian Railway, and Arkónam-Chingleput Railway; also by South Buckingham Canal South to North.
Madura	" " 24,606 ..	144	262	Ditto by South Indian Railway.
South Arcot	May " 1,559 ..	238	176	Ditto ditto.
Ganjam ..	Famine of 1866-67 ..	..	60	Chilka Lake and Canal to Ganjam.
Vizagapatam ..		..	143	No Railway or Canal at present.
	Total ..	1,606	1,730	

24. Without attempting to criticize minutely the general scheme here sketched by a number of independent authorities, who have viewed the requirements of their respective districts from a strictly local stand point, it may at once be concluded that when the Government has decided on the general principles to be observed in view to action, many of the proposed lines must apparently disappear, and the scheme as a whole be sensibly reduced.

25. In Bellary for instance it can scarcely be doubted that the suggested northern line to Siruguppa serving the Bellary and Alúr Taluks is not very essential, as no part of these is now more than 35 miles from a railway; again as regards the three southern branches, viz., Hospet to Duggarati, Bellary towards the Madaksira Taluk of Mysore, and Tadpatri to Penukonda, probably one line in, if possible, continuation of the Mysore line now about to be constructed from Bangalore to Toomkoor, or at most two southern branches opening up sufficiently the great block of sparsely inhabited and nearly rainless country in this direction, would be found adequate for the object in view.

26. For the Kurnool District 50 miles of light railway will probably answer all purposes, and as regards Cuddapah it is clear that the Collector, in suggesting a series

arches of 62 feet span are crossed by engines weighing 18 tons. Where new works are found necessary, the smaller openings could be spanned with Madras Railway old rails. The tramway between Arkónam and Conjeeveram was nominally laid on the road; but the gradients were so much improved that practically but little advantage was derived from following the line of the road. Unless the gradients of a road are fairly suitable for a tramway, it would be better to lay the latter on a separate track. The gradients of the Arkónam tramway were made to correspond with those of ordinary railways, with the result that one train a day sufficed for the traffic. During the best year of its existence as a separate undertaking this line earned Rs. 2,200 per mile, with working expenses of Rs. 1,100 per mile, but the line was most economically managed.

24. The following are the conclusions arrived at:—

(1.) The permanent-way for tramways or light railways should consist of 35 lb. steel rails, with wrought-iron cross sleepers.

(2.) The line should be laid in the surface of roads, and covered with metalling, where the roads are sufficiently good for the purpose.

(3.) Where the roads are not good enough to admit of lines being laid in the metalling, the tramway should be carried on ballast about a foot above road level.

(4.) Where the gradients of roads are unsuitable, the line should be carried on a separate track, but should join the roads at large bridges, so that these may be utilised.

(5.) The Porteur Decauville is suitable for laying temporary famine lines to be worked by bullocks or coolies.

(6.) No fence is required between tramway and the road.

(Signed) W. H. COAKER, Captain, R.E.,
Deputy Consulting Engineer for Railways.

1st November 1882.

Note by the Chief Engineer, Public Works Department, dated 11th November 1882.

1. In G.O., No. 2018 W., of the 17th August 1881, the opinions of officers of the Revenue and Public Works Departments were called for—

(1.) As to what tracts subject to famine, tramways as protective works would specially apply.

(2.) The lines in order of importance within the famine zone, which it might be desirable to carry out.

(3.) The probable cost per mile, gauge, rate of speed to be considered as a maximum, &c.

(4.) A rough estimate of the traffic returns in ordinary years.

(5.) The advantages which might result from the tramways in famine years.

(6.) Whether, and if so to what extent, these works might be applicable outside the famine zone.

2. The annexed Proceedings of the Board of Revenue, No. 2230, of 7th September 1882, and No. 2414, of 2nd October 1882, with a *résume* of replies by Superintending Engineers and other selected officers, deal with the subject under inquiry. Some papers of special interest by Mr. G. Molesworth, Colonel H. M. Shaw-Stewart, Captain Coaker, &c., are printed *in extenso*. The paper by the last mentioned officer, dated the 1st instant, is specially valuable as giving the most recent experience and the results of personal inquiry on the spot, in regard to light railways and tramways in Italy and elsewhere on the continent.

3. It is needless to say that in dealing with a subject presenting so many peculiar features divergent opinions have been expressed; still, however, sufficient has been elicited to admit of definite proposals being submitted for the consideration and orders of the Government of India.

4. Before dealing with the replies that have been received to the several queries it may be observed that stress is laid by several of the professional officers consulted as to the inapplicability of the term "tramway" as applied to the Milanese system

advocated for adoption by Mr. Vincent in his pamphlet on the subject, and employed generally in my note of the 14th August 1881.

5. Strictly speaking a tramway consists of a pair of rigidly supported rails carried on an unyielding foundation, laid on a public road or street, and having the top of the rails flush, or nearly so, with the road surface to allow of ordinary passengers or wheeled vehicles passing from side to side.

6. To fulfil the conditions tramway rails must be of exceptional lateral strength and weight, (double probably in most cases that of ordinary rails) and be laid on a concrete foundation, or consist of a double set of rails bolted together at short intervals apart, in the manner described by Captain Coaker as common with the Milanese System, where passing through streets over bridges and at other places where there may be insufficient breadth of roadway, &c., all of which adds materially to the prime cost.

7. The system advocated by Mr. Vincent adopts as a rule where the roadway is wide enough, the much more economical flat-footed, or as it is called the Vignoles pattern rail. As this latter however projects not less than two inches above the surface of the roadway, it is considered that to protect it from the shocks of passing vehicles, the line must be either fenced off or be otherwise protected, thus constituting it virtually a system of light railways.

8. Technically speaking this distinction regarding the term "tramway" is perfectly correct and should be borne in mind; but as will be subsequently shown in the proposals which I have to submit, means can be adopted for combining the advantages of both tram and light railways in a manner, that will apparently secure in the best way the objects in view. Should these proposals, meet with approval, the practical bearing of the distinction alluded to will be of the less importance.

9. Turning now to the replies received to the first of the above questions, viz., as to what tracts subject to famine tramways as protective works would specially apply, it will be noted that while some of the officers consulted either warmly welcome such works, or tacitly accept them as valuable adjuncts in dealing with famine, others on the contrary dispute their supposed advantages, or at least consider their proposed construction of doubtful propriety.

10. The Collector of Kurnool, for example, trusting solely to the existing canal and railway, which both traverse his district, feels himself unable to recommend the construction of a light railway even to his headquarter station. He adds "I am quite certain that a very great deal of good was done by the large and sustained demand for carts and bullocks in this line (*i.e.*, from Gooty to Kurnool) during the famine. Owners of carts and bullocks came from all parts of the district, and earned the keep of themselves and their animals. Village to village distribution from Kurnool, if we had had a tramway in those days, would have been a poor substitute for steady employment in 60 miles of road."

11. The Board of Revenue, paragraph 5 of their Proceedings, No. 2230, observe that Mr. Glenny's experience as above "will probably be borne out by every officer employed on famine duty in that neighbourhood at the time." "Carriage," they add, "for grain never failed, and thousands of bullocks, many of them doubtless set free from agricultural work, were kept throughout the season of draught in good working order," and in their recommendations on the subject of employing mechanical means for distributing food, in view to first testing the remunerative returns, merely propose (paragraph 15, Proceedings, No. 2230) the construction of two very short lines connecting the towns with the railway stations at Vellore and Tirupati respectively.

12. In much the same way Major Pennycuick (paragraph 25 of his letter, No. 105, of 21st April 1882) says:—"As a fact there was never any serious difficulty in getting the grain away from the railway except for a short time at Bellary; in Salem there was certainly none, and at no time was there any lack of food for people who had money to buy it;" and further in paragraphs 33 and 34 shows that "a railway or a tramway, or to do any other amount of mechanical work by steam, requires rather more water than to do the same amount of work by animal power."

13. These are all no doubt strongly put arguments against doing anything in favor of endeavouring to substitute mechanical for animal power. I cannot however think they are altogether sound. Where a grass famine (which as Sir Andrew Clarke

sent to the workshops of the Swiss Central Railway at Otten. At Liestal there are only a few short sidings for rolling stock, and one for transhipment of goods; no transfer platform.

13. The line is unprovided with fences; the train by which I travelled was stopped to allow two frightened horses to pass; but as a rule horses take very little notice of the trains. The ordinary road is maintained by the Railway Company, this being one of the conditions of the concession. There are no signals. The line cost about £1,920 per mile, and is very similar to that proposed by Mr. Anderson between Ammayanáyakanúr and Periyakulam.

14. Porteur Decauville.—This system of portable railway has lately been brought before the Indian public. The permanent-way is supplied complete in lengths of 16½ feet, the two rails being connected by iron plates which form the sleepers, and the whole fastened by rivets. The rails weigh 9, 14, and 19 lb. per yard, and each length of permanent-way weighs 115, 187, and 259 lbs., the gauges being 16, 20, and 24 inches. The wheel weights for which the lines are suitable vary from 1 to 2½ tons per axle. The movement of heavy weights is effected by using a number of small trucks so as to distribute the weight over several axles. The advantages claimed for this line are portability, durability, and the rapidity with which it can be laid. Trucks of every description suited to requirements can be supplied with the permanent-way, together with small locomotives for running on the heavier lines. The turn-tables, points, crossings, &c., are all made in one piece, and can be laid quickly, and without skilled labor.

15. I went over the works of M. Dreauville, near Paris, and saw the construction of permanent-way and rolling stock throughout. Everything is done by machinery, and the work appears to be of the best description. The frames for rolling stock are made of four channel irons riveted together at the corners. Long wagons for running round sharp curves are on bogies, but the ordinary stock is mounted on four wheels brought close together. The 19 lb. rails have ordinary fish plates and bolts.

16. A gun weighing 4 tons, mounted on two small trucks (four wheels each), was run across a ditch 8 feet wide on the 14 lb. permanent-way without any intermediate support, a wooden sleeper only being laid at each side of the ditch for the permanent-way to rest upon. The deflection was considerable, but the permanent-way regained its original form. The gun was then run across a ploughed field on the same permanent-way which was moved rapidly from place to place. The permanent-way was not packed at all; it appears to possess great elasticity, and does not easily become bent. For a permanent line on ordinary soil a small quantity of ballast would be used. M. Decauville has a line with 14 lb. rails laid on his estate, and we went over this with an engine weighing 4 tons at about 8 miles an hour.

17. This description of road is too light for permanent lines of railway in this country, but it is, I believe, well adapted for laying temporary lines during a famine. It is exported to all parts of the world, and appears to be utilised chiefly in workshops, factories, on planfations in the Colonies, in opening out forests, and in carrying out excavations or large works of any kind, where it is desired to economise labor. The Russian expedition to Turkestan was provided with 66 miles of the 14 lb. rail, and in Tunis the French used 43 miles of the 19 lb. rail. In connection with the Panama Canal 14 miles have been sent out. It was found impossible in the military expeditions to use engines, and the small wagons were hauled by horses or mules. It is stated that by this means a horse was enabled to do 12 or 15 times as much effective work as in drawing an ordinary cart. In Turkestan the materials for a heavy railway, together with provisions and water for troops and workmen, were led forward by the Porteur Decauville, which was laid in advance of the permanent line.

18. During a famine these lines could be laid on the roads, and would be perfectly serviceable for use with bullocks. Thus one bullock would probably be enabled to do the work of ten, and the difficulty which was experienced in 1877 in providing means of transport could be overcome. Should it be found necessary the small wagons could be hauled or pushed by coolies. Such lines could be laid as fast as delivered, and though they are not perhaps quite suited to some roads in wet weather, still with the ample labor available during a famine sufficient ballast could be got together to give them a firm bedding. By using rough sleepers of any kind, here and there, under the permanent-way, there should be no difficulty in keeping the line in working order on unfavorable soils in bad weather, which, however, would not be frequent during a famine. One advantage in working these lines by horses or bullocks is that it is possible to surmount gradients over which a locomotive could not work, it being necessary only to keep additional power at these points.

19. The cost of a mile of line with 14 lb. rails delivered in Madras would be about Rs. 8,000, including 15 wagons; with 19 lb. rails the cost would be about Rs. 9,500. The price of this permanent-way per ton is high compared with the market rate for steel rails, after making allowance for the small section of the rails; but possibly a reduction might be made if several miles were taken. A short length of this line would be found useful in carrying out any large work, and it would, I think, be well for the Government to obtain a few miles by way of experiment.

20. The best form of Tramway or Light Railway for India.—Three forms of communication have been described, two of which are suitable for permanent, and one for temporary lines. The Milan lines, and the Liestal-Waldenbourg line, present two distinct types, the former being in most respects a tramway, while the other is a light railway. The advantages possessed by the Milan lines are that they can be more easily laid and kept in order, the cost of upkeep being much less than on an ordinary line. They also offer less obstruction to foot passengers, who can walk freely along and across them. A disadvantage is that when laid with wooden sleepers these deteriorate rapidly from the absence of drainage; a difficulty which can, however, be got over by using iron sleepers. This form of line should, I think, be adopted where the roads are sufficiently good for the purpose, and the gradients are suitable for a tramway. These conditions are fulfilled between Vellore station and town; and this description of line appears to be especially suitable for laying between Beypore and Calicut, where houses occur at intervals along the whole length of the road. The metalling would probably be extended on both sides of the road, in order to provide as much room as possible for vehicle traffic.

21. Where the roads are not sufficiently good to admit of a line being laid in the metalling the lines should be similar to that between Liestal and Waldenbourg. There is some difficulty in providing for the proper drainage of a road in a line of this description, as a portion of it slopes towards the railway.

22. In the Note already submitted by this office on the question of steam tramways, it is recommended that all such lines should be of the metre gauge and capable of carrying the goods stock of the South Indian Railway, and if the foregoing principles as regards construction are approved, it is only necessary to determine the description of permanent-way to be used. It is thought that a Vignoles rail weighing 35 lb. per yard, with wrought-iron transverse sleepers, is the best that can be adopted. Several forms of wrought-iron and steel sleepers have been tried, but that which appears to have come into most general use is known as "Wood's patent." Large quantities of these sleepers have during the last year been exported, and a paper describing them was recently read at the Institution of Civil Engineers. An iron subway will cost more than wooden sleepers, but there can be no question as to its ultimate economy at present prices of iron. This system of permanent-way would be suitable for use in either a tramway or a light railway; and with the addition of a guard rail similar to that used in the Milan lines, there would be no objection to its passing through towns, or occupying the whole of a road where necessary, such as in crossing a bridge.

23. Probably there are few roads throughout which the gradients and curves are suitable for a tramway, and careful consideration will be necessary to determine to what extent they shall be followed. For the South Indian Railway rolling stock the curves should have a radius of not less than 5 chains. As a rule steeper gradients are allowed on tramways than on railways, but this has the effect of diminishing the loads. On the lines visited in Europe the maximum gradient was 1 in 30, and the load only 4 or 5 vehicles. It is evident that for even moderate earnings several such trains are required, and the cost of working the traffic in these small trains is greater than with longer trains. In cases where a line is laid on a separate track, it will be advantageous to make use of the large road bridges. It is probable that most bridges could be made to carry a 10-ton engine, by merely laying a timber framing over the arches to distribute the weight, as is done on the Mysore State Railway, where

34. The want of water is held to be one reason for the use of steam power in preference to cattle for transport during famine, but it does not seem to be generally known that to haul a ton of goods for a given distance, whether on a road, a railway or a tramway, or to do any other amount of mechanical work by steam, requires rather more water than to do the same amount of work by animal power.

35. A pair of bullocks will exert in net work about a mechanical horse-power for six hours per day, and will do very well on twenty gallons of water between them or thirty-three pounds per horse-power per hour; a locomotive or traction engine requires from thirty to thirty-five pounds per indicated horse-power, or from forty-five to fifty per net useful horse-power per hour.

36. Allusion is made in your note above quoted, and in Mr. Vincent's pamphlet to the Decauville system of light railways; this is only one of many similar systems, and is essentially a *railway* requiring its own ground to run on. It would be useless to attempt to lay it on a road; the first cart that came along would knock it to pieces. These systems are however mainly intended for temporary and not for permanent lines.

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(11.) *Note on Steam Tramways and Light Railways, by Captain Coaker, R.E.*

1. During the time I spent on the continent, inspecting the Rigi and other lines, I was able to see something of steam tramways, and light railways, now at work, and I have the honor to submit the following notes thereon.

2. Milan Tramways.—As explained in Mr. Vincent's pamphlet these lines possess exceptional advantages in that the roads about Milan are almost level, and of more than ordinary width. In passing through towns and villages the lines are laid in all respects as street tramways; that is to say a guard rail is provided throughout and the whole of the road is paved and available for ordinary traffic. Outside towns the lines are laid in the road surface, without guard rail, and rail-level is therefore slightly raised above the surface of the road.

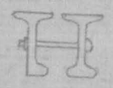
3. An important feature in the roads round Milan is a line of upright stones about 10 or 12 yards apart on each side. Where the road is of sufficient width one line of stones is moved in, and the rails are laid outside it, thus:—



In such cases the line of stones becomes, so far as wheel traffic is concerned, a fence, and no carriages or carts use the portion of road occupied by the tramway. Foot passengers, however, circulate freely over it; in fact, they generally walk along it.

4. Where the road is narrower the line of stones on the tramway side is removed altogether. The portion of road occupied by the tramway is not generally used by wheel traffic, but occasionally a vehicle, in turning or in passing another, may cross the inner rail. Practically therefore, except in towns and villages, or on bridges, where the whole of the road is required for vehicle traffic, these lines are light railways.

5. The horse tramways in the city of Milan are laid with rails as shown in sketch.



Instead of the grooved rail generally used, an ordinary Vignoles rail and a light rail with one upper flange only are bolted together at intervals of about 2 feet 6 inches,

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the two rails breaking joint so as to afford one another mutual support. This form of permanent-way is well suited for the steam tramways outside the city; as where the line is required to be laid flush with the road surface, the second rail can be used, and the road being also paved, it becomes the same as a street tramway. The rails are laid on wooden cross sleepers.

6. The whole of the line laid on the roads partakes of the nature of a tramway so far that there are no maintenance gauges for the daily upkeep of the permanent-way. The sleepers are firmly embedded in the road, and covered with metal, the line being hardly touched until the sleepers require renewal. The cost of daily upkeep is saved at the expense of new sleepers after a few years; there being no provision for drainage their life is short.

7. The engines are boxed in to a certain extent, the sides being about 4 feet above frame, with a roof on iron standards about 3 feet 6 inches higher. The carriages are similar to ordinary tram cars; some have longitudinal and others cross seats. A train consists of 4 or 5 vehicles, most of them provided with brakes. There is also a brake on the engine. The coupling is central, but the slack is taken up by an ordinary screw coupling placed over the central buffer. A bell is rung when approaching points where other roads join, but speed is not slackened. There appear to be no fixed dimensions, and carriages often skirt a wall very closely. In going through streets a man with flag walks in front of the train; but in open country a speed of 15 miles an hour is not unusual. The sanctioned maximum is 11 miles an hour.

8. So far as I could learn the average cost of a line laid along a road is francs 30,000 per kilometre = £1,920 per mile. On the line from Milan to Barzano it has been necessary to diverge from the road for considerable distances owing to the road being narrow, gradients steep, or curves sharp. This line cost francs 46,000 per kilometre = £2,944 per mile. Short lengths of gradient of 1 in 30 are allowed, and curves of 130 feet radius. Railways are crossed on the level.

9. I was informed that most of these lines do not pay, partly from competition with the railways, and partly from the rigorous conditions now exacted by Government. The line from Milan to Lodi pays because the timing of trains on the railway is inconvenient, and people therefore use the tramway. No goods traffic is worked. Some bridges have to be strengthened to comply with the Government test. Tramway Companies pay one-fifth the cost of maintaining the portion of road not occupied by them, and 13·2 per cent. of their net receipts go to the Government as tax.

10. Liestal-Waldenbourg Line.—This is a cheap feeder line of light railway 9 miles long starting from Liestal on the Swiss Central Railway. The gauge is 2 feet 6 inches; rails weigh 30 lb. per yard, with timber cross sleepers 2′ 7½″ apart, fastened by wood screws. For ¾ mile the line follows the Swiss Central, being laid midway between the broad gauge rails, an arrangement which admits of the same sleepers being used for both. Special points and crossings are required where the lines diverge. It was found necessary to widen the road in places, and the line follows it except at two points, where short diversions are made to avoid steep gradients and sharp curves. Formation level follows generally that of the road, and the rails are raised about a foot above it by ballast. There are only a few small bridges.

11. The carriages are open at ends, each vehicle being provided with brake, and the guard walks along and puts on brakes when necessary. For connecting the vehicles a simple form of central coupling is used. The engines are of the ordinary type on four wheels; they weigh 8 tons, and take a load of 4 or 5 vehicles. The maximum gradient is 1 in 33, and the ruling curve 197 feet in main line, and 131 feet in sidings. Water is turned on to the flange of the leading wheels of engines, to enable them to pass more freely round these curves.

12. The maximum speed is 12½ miles an hour; through speed 9 miles, with 6 stoppages in that distance. There are no station buildings except at the terminus. Trains stop at the principal inns, where tickets are issued. There are short lay-byes for goods at certain points, but this traffic is small. Ordinary repairs are done in small shops at Waldenbourg, but engines and vehicles requiring heavy repair are

railways have yet been constructed of a cheaper class than those now at work in this country, it does not follow that none can be.

13. As a matter of fact, a railway with 15 pound rails and a gauge of 2 feet or 2 feet 6 inches could be laid down for certainly not more than Rs. 12,000 per mile (exclusive of land) and would carry a traffic considerably greater than that now borne by any road fifteen miles long in the Madras Presidency.

14. The idea of tramway construction proving financially remunerative may be dismissed as chimerical, and indeed as hardly deserving discussion; and it may be taken as certain that if rail transport is to be employed in any given case the rails must be independent of the road.

15. In Colonel Prendergast's letter, No. 1700, of 5th October last, a list of roads is given on which it is considered that tramways might with advantage be laid. It will be seen that Colonel Prendergast does not commit himself to any expression of opinion as to their proving remunerative, and for the reasons given above I am obliged to say that I think no such result is to be looked for.

16. How far light railways laid independently of the roads, though following their general line, might pay a reasonable interest on their cost is a question that I cannot attempt to answer without more detailed information as to the nature of the country and amount of traffic than we at present possess.

17. As far as the first point is concerned, it is not probable that there are any special features about any of the lines in question which would raise their cost to more than Rs. 12,000 per mile including bridging of all streams except the largest, such as the Tungabhadra and Pennér, but exclusive of the cost of rolling stock, which, as it depends on the amount of traffic to be carried, is more conveniently considered as part of the cost of transport, and separate from the cost of construction. The practice of mixing up the cost of stocking per mile with that of construction is a very inconvenient one; two lines costing the same for construction may require very different quantities of rolling stock.

18. It is probable that on lines such as those under contemplation goods could be carried at a rate (including interest on cost of rolling stock) which would give a profit of two pies per ton per mile, and passengers at one, which would give one pie per head per mile.

19. To give a return of one per cent. on Rs. 12,000 would therefore require a traffic of 11,520 tons of goods, or 23,040 passengers per annum, or say 32 tons of goods, or 64 passengers per diem, or any intermediate combination of the two.

20. Whether two, three, four or five times the above quantities could be looked for on any of the lines in question is a point upon which, I am sorry to say, our information is exceedingly deficient.

21. Some months ago I asked Mr. Garrett to try and collect information as to the traffic on the different lines of road in the Bellary District, but the Collector informed him that no trustworthy information existed, and without a special establishment to collect it none could be obtained.

22. I am therefore obliged to speak with considerable reserve upon this point; but so far as my information extends there is no line in Cuddapah or Kurnool which could be expected to return two per cent. on its cost, and in Bellary only the lines from Hospet to Harpanahalli and from Tadpatri through Anantapur to Penukonda. These two might pay a moderate return; but if the subject is to be taken up seriously, the first step is to collect trustworthy statistics of traffic, existing and possible.

23. It will be seen that I am not sanguine as to the financial prospects of railways in this circle; there remains the question of their value for the conveyance of food during famine.

24. I certainly do not think it would be desirable to construct works of this class irrespective of their financial result merely with a view to their use as grain carriers during famine. It appears bad policy to saddle a country with unremunerative works for nineteen years on the chance of their being useful in the twentieth.

25. Certainly additional facilities for the distribution of grain during famine would be beneficial to the country, but I cannot but think that the deficiencies of the existing system of communication have been much exaggerated. A great deal has been made of the accumulation of grain at *Raichore* and on the Madras beach during the late famine; but this was obviously due not to the insufficient carrying power of the roads leading *from* the Madras Railway, but to the insufficient carrying power of that railway itself, and would not have been obviated if every road in the Presidency had been covered with a steam tramway. As a fact there was never any serious difficulty in getting the grain away from the railway except for a short time at Bellary; in Salem there was certainly none, and at no time was there any lack of food for people who had money to buy it.

26. Moreover, a special and temporary demand for the carriage of goods along an existing line of communication could be much better met by the use of traction engines when the emergency arose than by the construction of a tramway or a railway.

27. It is certain that the cost of transport, exclusive of cost of permanent-way, on a tramway is not less by more than half an anna per ton per mile than that of transport by means of traction engines. It is also certain that there was no road in this Presidency on which the total extra traffic due to the famine of 1877-78 reached 50,000 tons. The utmost saving in cost of transport by the use of a tramway as compared with traction engines on any individual road could not have exceeded Rs. 1,500 per mile.

28. It is not likely that such famines as that of 1877-78 would recur in the same district at shorter intervals than 30 years, during which period the loss on a tramway whose returns fell short of the interest on first cost by even one per cent. would amount to Rs. 6,000 per mile.

29. Traction engines moreover can be used where they are wanted, but a tramway in Bellary could not be moved to meet a future famine in Coimbatore.

30. There is an idea which appears to be encouraged by a passage in paragraph 15 of your Note, printed with G.O., No. 2018 W., of 17th August last, that the weight of traction engines is a drawback to their use on ordinary roads; but if so, the tramway engine is in a worse case; for on any gradient exceeding one in thirty-seven and-a-half, a tramway engine must be heavier than a traction engine to draw the same weight of train, and there are very few roads where such a gradient as this does not occur at some point or other.

31. The co-efficients of adhesion and of resistance to traction on the tramway may be taken at $\frac{1}{5}$ and $\frac{1}{75}$ respectively; for a traction engine on an ordinary road they are $\frac{1}{8}$ and $\frac{1}{30}$, but as only about three-fourths of the weight of the latter engine rests on the driving wheels, the actual adhesion available is only $\frac{1}{4}$ the weight of the engine.

32. If E be the weight of the engine, T that of the train, and X the fraction representing the gradient, then for the tramway $(E+T)\left(\frac{1}{75}+X\right)=\frac{E}{6}$

$$\frac{E}{T}=\frac{2+150X}{23-150X} \quad \ldots \quad \ldots \quad (1.)$$

for the traction engine

$$(E+T)\left(\frac{1}{30}+X\right)=\frac{E}{4}$$

$$\frac{E}{T}=\frac{2+60X}{13-60X} \quad \ldots \quad \ldots \quad (2.)$$

(1) is greater than (2) if X be greater than $\frac{20}{750}$ or $\frac{1}{37\cdot5}$, and as a practical fact the weights of traction engines in ordinary use do not average higher than those of tramway engines.

33. It must be understood that I am not now expressing any opinion as to the desirability of using steam power as compared with cattle, but merely wish to show that if steam is to be used on an ordinary road at all, for meeting an *abnormal* demand for transport, it had better be used through the traction engine than on a tramway.

large river, together with improvements of gradient equivalent very nearly to the construction of a new track, with the exception of bridges.

15. An estimate was lately prepared by Mr. G. Anderson, for some years an Assistant Engineer on the South Indian Railway, and of considerable railway experience, for a light line 29 miles in length from Ammayanáyakanúr to Periyakulam at the foot of the Palni Hills. This estimate provides for occupying the existing road, with 4 miles in length of diversions where necessary, for a 30 lb. steel rail on jungle wood sleepers, for strengthening where necessary the existing bridges, and for the necessary rolling stock, station buildings, &c. The cost is estimated by Mr. Anderson at Rs. 18,000 a mile, and, were creosoted fir sleepers substituted for those of jungle wood, and superintendence provided for, it is probable that a rate of Rs. 20,000 to Rs. 25,000 per mile might suffice.

16. To conclude, I would recommend the adoption of the metre gauge, with 35 lb. steel rails, on either creosoted fir or iron sleepers; that the wheel weight be limited to 2½ tons, and the speed to 10 miles an hour. I believe that lines of this character can be laid on existing roads for Rs. 25,000 per mile, and on embankments of their own for Rs. 30,000 to Rs. 35,000.

It must be added however that, before any such line is undertaken, it will be necessary to ascertain whether the Government of India is prepared, under Act IV of 1879, to sanction its being worked. Lines of this description would do more towards the development of traffic on railways in this Presidency than any other measures that can be suggested; and they would offer this advantage, that, should they in any instance be found unremunerative, both the permanent-way and the rolling stock could be removed and utilised on other existing State lines.

17. It should be remembered that economy in construction, and in the subsequent working of a line, are to be looked for not so much in the selection of the form of permanent-way to be used, or in the gauge, as in restricting the speed and wheel weight to all that the wants of trade and of the native community require. If a speed exceeding ten miles an hour be rendered by the character of the track and stock absolutely impracticable, the necessity at once ceases for fencing, signals, gates, high standard of maintenance, highly paid officials, station buildings, extensive bridges; in fact almost all that distinguishes a railway from the street tramway or a line of omnibuses; but, so long as a higher speed is practicable, public opinion will prove, as it has already proved, too strong to permit of its restriction, and economy in working becomes impossible.

18. There is one further point to which it may be well to call attention. It should be remembered, in comparing estimates for different descriptions of track, that small savings in prime cost, particularly in the matter of the ruling gradients and curves, may eventuate in costly traffic expenses. It will often be found expedient to improve the gradient of the existing road, or, with enhanced cost, to abandon it altogether, rather than to limit the loads and lessen the capacity of the engines. With engines weighing 12 tons, the loads possible with a ruling gradient of 1 in 100 will be very moderate compared with the traffic which must be forthcoming to secure financial success. In illustration of this, the computed loads of a locomotive engine recently built by the Société de St. Leonard, Liége, for a light railway, gauge 29·53 inches, may with advantage be studied.

The engine on eight wheels (six coupled) weighs in steam 18 tons, and with a working pressure of 132 lb. is computed to haul at a speed not exceeding 15 miles an hour—

	TONS.
On a level	456
One in 200	209
„ in 100	133
„ in 66⅔	95
„ in 50	72
„ in 40	57
„ in 33⅓	46½

(Signed) J. SHAW-STEWART, Colonel, R.E.,
Consulting Engineer for Railways.

30th January 1882.

(10.) From Major J. PENNYCUICK, R.E., Superintending Engineer, Third Circle, to the Chief Engineer, Public Works Department, dated Bellary, 21st April 1882, No. 105.

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2. I do not believe in the existence of a single road ten miles long in this Presidency on which a tramway could be laid with the remotest possibility of even a moderate return, and I am quite sure that if any such road exists, it would be much better to construct a railway of a class suitable to the traffic than to lay a tramway on the road.

3. No trustworthy inference can be drawn from the results of tramways in England, France and elsewhere; the conditions required to make a tramway a success are entirely absent from the lines in this Presidency, and arguments drawn from experience in crowded English towns and in an exceptionally level and wealthy country like the neighbourhood of Milan are utterly worthless as applied to Madras.

4. It ought also to be noted that the so-called tramways in the neighbourhood of Milan (and I believe many of the French lines as well) are not really tramways at all, but light railways occupying a portion of the roads which are so wide that a portion of them can be given up entirely to the use of the rail traffic. The special condition of a tramway, namely that the road traffic shall pass freely over the rails, is wanting, the road and rail traffic being kept practically distinct.

5. To argue on generalities is always unsatisfactory, and the only way to arrive at a correct conclusion is to take an existing road, and prepare an estimate of cost and returns supported by proper data as to gradients, nature, amount of traffic, &c.

6. It may, however, be worth while to point out the principal reason which will in almost every case in this country cause a tramway to be more expensive than a light railway; this is the additional cost of the tramway *rail* over the railway rail for the same amount of traffic.

7. The railway rail requires only sufficient strength to bear the weight passing over it; the tramway rail requires additional substance to stand the lateral shocks to which it is exposed by the road traffic, and if the weights of existing tramway rails are examined, it will be found that they are in all cases, and especially in those of the latest construction, far greater than would be required for railways to carry the same traffic.

8. None of the tramway cars in regular use on the European lines weigh when loaded more than 1½ tons on each wheel, a weight that could be easily carried on a railway by a 30 pound rail, but none of the lines on which these cars run have rails of less than 50 pounds per yard, and the average is more nearly 60.

9. Probably the *minimum* weight for a tramway rail to stand the shocks of the road traffic should be 30 pounds to the yard. But even if 25 lb. rails were admissible, the traffic contemplated could be carried with the greatest ease on a railway with 15 pound rails. The extra weight of rails alone would thus be about 17 tons per mile, and the cost of these would certainly more than cover any saving in construction by the use of the road as a surface on which to lay them.

10. In addition to this it must be borne in mind that the whole of the bearings and fastenings of a tramway must be of a much more expensive character than those of a railway to carry the same amount of traffic, while as regards cost of transport there is of course no comparison.

11. I am prepared to assert confidently that under no circumstances whatever, in any place in the Madras Presidency outside the limits of a large town, could a tramway on an existing road be laid, maintained or worked for the same cost as an independent railway to carry an equal amount of traffic.

12. It is altogether beside the question to compare the *estimated* cost of *proposed* tramways to carry a couple of hundred passengers and sixty tons of goods per day with the *actual* cost of completed railways carrying two thousand passengers and as many tons of goods; especially when we remember that the cost of the latter per mile includes that of bridging all rivers, a by no means inconsiderable item. Because no

The exceptional circumstances, pointing to the necessity in my opinion for a departure from the gauge of the parent line in the case of the Madras Railway, lie in the fact that it is hopeless to expect that the branch line can be made to carry goods stock, having a wheel weight of 8 tons on an axle (33 per cent. greater than that of a South Indian Railway engine) that could earn a fair rate of interest on its cost with the traffic known to be forthcoming.

Weight of Rail.—The weight of the rail to be used must be decided with reference to the wheel weight and the speed to which the line will be subjected. In the case of feeders to the South Indian Railway, I have no hesitation in recommending that the rail be of a weight capable of carrying, at a maximum speed of 10 miles an hour, the ordinary goods vehicle of the parent line.

On the metre gauge a fully laden wagon weighs 9 tons 12 cwt., or nearly 5 tons on an axle—a limit to which it is not difficult to restrict that of a suitable locomotive; for instance, the engines of the late Arkónam-Conjeeveram tramway weighed about 14 tons on six wheels (four of which were coupled), and on the metre gauge line between Hairon Ville and Triancourt, running alongside a high road, with a ruling gradient of 1 in 33 and ruling curve of 115 feet, an engine weighing in steam 15½ tons on six wheels coupled draws a load of 60 tons; for such wheel weight and speed a 30 to 35 lb. still rail would be sufficient.

See Proceedings of Institutes of Civil Engineers, Vol. LIX, page 349.

Sleepers.—Creosoted fir sleepers have on the South Indian Railway given very fair results as regards durability; but of late years several varieties of wrought-iron sleepers have been introduced, and from these probably an effective substitute for timber sleepers might be selected; although, except as regards durability, iron sleepers offer few advantages over timber ones.

Rolling Stock.—The description of goods stock to be used, the speed and wheel weight being fixed, depends to some extent upon the traffic to be dealt with. The goods stock on metre gauge State Railways has proved to be none too strong to stand the ordinary wear and tear of loading and unloading. The passenger stock in use on these lines is heavier than need be provided for the low speed proposed for the lines under report.

On the South Indian Railway, where the goods stock is somewhat heavier than that in use on the metre gauge State Railways, the cost of the different wagons is approximately as follows:—

	Rs.
Covered goods	1,400
High sided open	1,100
Cotton truck	1,600
Low sided open	1,000

Stock of this description would be suitable for the branch lines proposed for this Presidency.

Cost of such a Line.—The following is an approximate estimate of the cost of laying one mile of unfenced metre gauge line on an existing road with 30 lb. steel rails on creosoted fir sleepers:—

		Rs.
Rails and fastening 53½ tons at Rs. 165, 2,100 sleepers at Rs. 1-13-0.	Permanent-way	9,406
	Carriage of permanent-way for 200 miles at 10 pies per ton per mile	1,250
	Leading and laying	1,200
		11,856
	Add $\frac{1}{13}$th for sidings	1,185
	Total, Permanent-way	13,041
	Ballast	600
	Stations and shops	1,200
	Altering masonry works	1,000
	Rolling stock	5,000
	Establishment	2,000
	Contingencies	1,159
	Total	24,000

With a 35 lb. rail the estimate would be Rs. 25,000, and with a 40 lb. rail Rs. 26,000.

Were such a line to be laid on an embankment specially made for it, the estimate would be as follows; assuming a formation width of 12 feet, an average height of bank of 4 feet, slopes of 1½ to 1, and waterways aggregating 20 feet per mile of line for minor bridges (those affording waterway of less than 60 feet):—

	Rs.
Preliminary expenses	300
Land	1,000
Earthwork	1,750
Minor bridges	2,000
Level crossings	200
	5,250
Contingencies	750
	6,000
Track, stock, and stations, &c., as before	24,000
Total	30,000

But it must be remembered that this estimate provides for the least possible accommodation for traffic, no staff quarters and no station-yard enclosures, &c. No provision, moreover, is made for the crossing of large rivers.

It may be added that the Mysore State Railway, 86 miles in length, will, it is expected, be finished for a sum not exceeding Rs. 40,000 per mile; but this sum provides for all large bridges, including 68 spans of 30 feet over the Cauvery river.

Comparison of Estimates framed by Consulting Engineer with those of Mr. Vincent and Major Fraser (See G.O., No. 2018 W., dated 17th August 1881).—As regards the cost of the South Indian Railway, it is observed that in paragraph 11 of the Note by the Chief Engineer, Public Works Department, embodied in Proceedings of Government, No. 2018 W., dated 17th August 1881, my estimate of Rs. 45,000 to Rs. 50,000 per mile for a metre gauge line, which was based to some extent on the cost of that line, is compared with the figures given in Mr. Vincent's pamphlet and by Major Fraser. But it seems to have escaped notice that the sum named includes the provision of a first-class railway on a fully bridged embankment; whereas the tramway estimates, with which the comparison is made, provide for the utilisation of existing roads, the cost of which is not included.

My estimates also provide for rolling stock.

14. Description of similar Lines in India.—The following brief descriptions of cheap feeder lines that have been already constructed will be interesting, as illustrating the arguments adduced in favor of light railways.

On the line owned by the Gaickwar of Baroda, 58 miles in length of 2 feet 6 inches gauge, the rails are flat-footed, weighing 30 lb. to the yard, and are spiked to wooden sleepers. The entire line is on embankment, the formation width being 10 feet: the stations average 9 miles apart. This line is reported to have cost Rs. 19,813 per mile up to 1880, and earns Rs. 51 per mile per week, with net profits equivalent to 5·57 per cent. on Capital cost.

The Muthra-Hathras line (53 miles), a branch from the East Indian Railway, is of metre gauge; the rails weigh 30 lb. to the yard, and are spiked to wooden sleepers. It is laid partly on a metalled road, and is reported to have cost, up to 1880, Rs. 37,523 per mile. With gross earnings of Rs. 89 per mile per week it paid 5·3 per cent. on Capital cost. It is observed that it has been recently proposed to increase the weight of the rails.

The Nalhati line (27 miles in length), which meets the East Indian Railway at a point 145 miles from Calcutta, was constructed on the 4 feet gauge, with rails weighing 32 lb. to the yard, and was laid on one-half of a metalled road. It had cost Rs. 11,934 per mile in 1879, and with a gross earning of Rs. 65 per mile per week it paid 9·39 per cent. on its Capital cost, although in 1880 its working expenses appear to have more than absorbed its gross earnings. The so-called tramway between Arkónam and Conjeeveram was laid for the most part on an existing road with 36 lb. rails. It cost Rs. 31,560 per mile, including rolling stock, and the bridging of one

I have had no experience in tramways, but from what I have read on the subject am of opinion that a gauge of 2½ feet or even less would fully meet all the requirements of the country.

The most recent experiments prove that Meraski's compressed air locomotive takes 2½ times as much fuel to move a ton one mile as Merryweather's direct steam locomotive to move the same weight the same distance.

It would therefore appear that until some very much more favorable results can be attained the idea of using compressed air as a motive power must be abandoned.

(9.) *Note on Tramways as Protective Works, with reference to Proceedings of Government, No.* 2018 *W., dated* 17*th August* 1881.

The points specially referred to this office for report are the probable cost per mile, the gauge, rate of speed, &c., but in making the recommendations that follow, it seems advisable to go rather further into the subject generally than is implied in these instructions.

Definition of "Tramway" and "Light Railway."—In dealing with the papers embodied in the Proceedings of Government under report, it is evidently necessary to lay down some definition of the term "tramway," as distinguished from what is known in this office as a "light railway," and for the purposes of this Note it is assumed that a tramway is an iron way laid flush with the road on which it rests, and that any other form of iron way is a railway. The "Commission for the investigation of the economies to be introduced in the construction and working of new railways in Italy, in November 1879," Minutes of Institution of Civil Engineers. held "that in many cases cheap railways may be laid alongside the existing highways; and that a division, either by a fence, or by maintaining a different level for the road and the rail, is the main distinction in such cases between a railway and a tramway established according to the law of 29th July 1879."

The "conditions" usually to be met by Tramways.—Accepting this definition, it seems clear that "tramways" are designed to meet conditions that will rarely, if ever, be met with on the lines of communication which it is suggested should be made for the purpose of protection against famine, while a comparison of the cost of the permanent-way most generally used on such lines, exclusive of pavement, with that employed for light railways, shows that these conditions can only be met by largely increased outlay, and it seems hardly necessary to add that cheap expedients, such as timber substructures laid in an ordinary metalled road, with no provision for their drainage, cannot in the end secure economy.

	Weight of Rail per Yard.	Cost per Mile.
	lb.	£
Bristol	43	1,749
Southport	40	2,072
Manchester	40	2,320
Average of 15 lines		2,084
South Indian Railway metre gauge (in England) ...	40	About 1,000

Requisites for a Tramway.—The first requisites for a tramway are that it shall be durable and independent of daily upkeep for the maintenance of its gauge and level, and that it shall as seldom as possible entail interference with the road surface and therefore with the ordinary cart traffic on the road. A tramway is in fact, as described by Mr. D. K. Clark, "a pair of rigidly supported rails carried on an unyielding foundation." Tramways by D. K. Clark.

Tramways as a rule objects for private enterprise.—It is not denied that there may be short lines of existing road, some of them in connection with the railways in this Presidency, where the extent of the ordinary traffic,—the limited width of the road,—and other conditions, may necessitate recourse to the more expensive form of iron way peculiar to tramways; but none of these, it is thought, fall within the scope of this Note as protective lines against famine, or even as railway feeders; they are rather objects for private enterprise either as paying speculations or as furthering local interests.

Light Railways preferable to Tramways.—In my opinion therefore tramways proper are, as a rule, unsuited to the requirements of railway feeders, either with a view to protection against famine, or for the development of the ordinary traffic of the country. They involve an unnecessarily expensive form of permanent-way, render the interchange of railway rolling stock difficult to arrange, and offer few, if any, advantages that cannot be secured by light railways. It may be added that experience derived from the Madras Railway goes to prove that the bearing surface of concrete, inseparable from the tramway rail proper, would, besides entailing extra expense, be inapplicable to the black cotton soil and some other soils met with in India, where even an ordinary ballast bank, with a bottom width of perhaps 16 feet, continues year after year to sink until it almost reaches the subjacent lime-kunkur bed.

Description of Permanent-way.—It is not stated in the Order of Government whether it is contemplated that lines of railway have to be laid for famine purposes over the open country, but it has been assumed that it is intended to construct and open the lines for ordinary traffic in the first instance as railway feeders, and in every case that the permanent-way will be laid, either on the ordinary roads of the country, or on an already consolidated embankment, fully bridged with the exception of large rivers.

The description of permanent-way I consider suitable for such lines is the ordinary flat-footed rail with timber or iron sleepers ballasted with broken stone or sand.

Should it be found necessary to lay such a line for famine purposes across the open country, I believe that few forms of permanent-way will compare with it either for expedition or efficiency.

Such a line can be laid at the rate of ¼ a mile a day from each face worked at, and a rate of one mile of track per day has been attained. The Durbunga line for instance, 53 miles in length, was laid for famine purposes and opened for traffic in 53 days.

A line of this description can be laid along an existing road, bridges being strengthened when necessary.

On the Mysore State Railway ordinary road arches of 62 feet span are now used in this way by engines weighing 18 tons (3 tons on a wheel). Where bridges are too narrow for both road and railway, some form of tramway rail would have to be substituted for that used elsewhere.

Large rivers still unbridged would be crossed on causeways.

Gauge.—As regards the gauge that should be given to light railways in this Presidency, the fact that the South Indian Railway is on the metre gauge has an important bearing; for it is considered that the difference between even a 2′ 0″ and the metre gauge, either in first cost or in working, would not justify the abandonment of the advantages to be derived from the South Indian Railway goods vehicles being able to run over the branch lines, and from the facility with which extra stock could at all times be transferred from other metre gauge lines in India. It is certain that, were the proposed feeders laid on any other narrow gauge than the metre, spare stock would have to be procured sooner or later in proportion to the full carrying capacity of the line; and the greater part of it would, in all but famine time, lie idle and unremunerative.

In the case of feeders to the Madras Railway, although there must in any case be a break of gauge, the same consideration is in my opinion conclusively in favor of the metre gauge; the more so, as it is not improbable that lines first made as feeders to the Madras Railway will eventually be extended and joined to one or other of the metre gauge lines.

On a somewhat similar question, the Commission appointed by the French Minister of Public Works to inquire into the economical conditions of construction and working of secondary railways (chemins de fer de l'interet local) recommended as follows:—

(1.) The gauge of the parent line, save in exceptional circumstances.
(2.) A 2 feet 6 inches gauge, where existing roads are to be utilized.
(3.) The metre gauge, where exceptional conditions render advisable the adoption of narrow gauge on its own track, as presenting the greatest advantages in respect of facility of working.

the small trucks by coolies. It is presumed that permanent tramways will be provided along the main roads before a famine; and the famine lines will probably be laid along cross-country roads or tracks incapable of sustaining the weight of an engine.

6. Ordinary railways can be laid with sufficient rapidity, provided the material be available in the country. As an instance of a famine line, it may be observed that in 1874 a temporary line on the metre gauge from the Ganges to Durbhanga, 53 miles in length, was opened after only 53 days work. If a stock of material is to be laid in against a famine, it would, it is thought, be better to have it of the ordinary type. If, on financial grounds, no steps are taken until after the commencement of a famine, probably the Porteur Decauville could be obtained in a shorter time than ordinary rails of small section which are not kept on hand in England.

7. The cost of laying the Porteur Decauville of 20 inch gauge (B) on a well-metalled road, with suitable gradients, would not greatly exceed the cost of the material, and allowing for rolling stock it may be thus estimated :—

	Rs.
Cost of material as per statement	6,930
Carriage by train	504
Cost of laying (telescopically)	880
Ballast	200
Five trucks per mile, at Rs. 120	600
Sheds and sundries	600
Total ...	9,714

or say Rs. 10,000 per mile. This provides only for the conveyance of goods in small wagons hauled by coolies, or by ponies (if available).

8. It must be remembered, however, that even if a good road be available, alterations of gradient will generally be needed to suit it for a permanent tramway worked by engine-power. The following is an estimate of the cost of laying the 24" gauge (C) on a road which though not fully metalled is sufficiently wide and good for the tramway to be laid on one side of it, and with bridges sufficiently strong to carry a 5-ton engine :—

	Rs.
Permanent-way	8,870
Carriage of permanent-way by train	792
Cost of laying (telescopically)	880
Altering gradients and curves	1,000
Ballast	300
Stations and Workshops	600
Establishment	500
Rolling stock	4,000
	16,852
Contingencies, 5 per cent.	843
Cost of one mile	17,695

9. The cost of the 30 inch gauge (E) with 30 lb. rail laid entirely on a new bank may be estimated as follows :—

	Rs.
Preliminary expenses	300
Land (10 acres at Rs. 100)	1,000
Earthwork (14,000 cubic yards at 2 annas)	1,750
Minor bridges (20 lineal feet at Rs. 100)	2,000
Large bridges and causeways	2,000
Level crossings	200
Ballast	600
Permanent-way	12,200
Carriage of permanent-way by train	1,130
Laying (telescopically)	1,200
Stations and Workshops	1,200
Plant	300
Rolling stock	5,000
Establishment	2,000
	30,880
Contingencies, 5 per cent.	1,544
Cost of one mile	32,424

The estimate for earthwork provides for a bank 12 feet wide at top, with slopes of $1\frac{1}{2}$ to 1, averaging 4 feet high.

The rate for minor bridges is somewhat below the cost of these works on the South Indian Railway, but would, it is thought, be sufficient for foundations of moderate depth protected by aprons.

It is difficult to estimate the cost of large bridges and causeways. By a large bridge is meant one providing 60 feet of waterway or more; and although causeways might be generally used, it would probably be found desirable to build bridges in some cases, *e.g.*, over large irrigation channels. The amount entered would probably be sufficient for this purpose.

The cost of stations on the Southern Extension of the South Indian Railway was Rs. 4,000 per mile. The amount entered provides only for the cheapest description of accommodation for passengers and goods, sheds for engines and rolling stock, staff quarters, and station machinery.

Rolling stock is estimated on the following basis for a line 50 miles long :—

	Rs.
Eight locomotives, at Rs. 9,700	77,600
Six composites (1st and 2nd Class), at Rs. 2,110	12,660
Thirty third-class carriages, at Rs. 1,200	36,000
Eight brakes, at Rs. 1,200	9,600
Eighty covered wagons, at Rs. 1,080	86,400
Forty open wagons, at Rs. 700	28,000
For 50 miles ...	2,50,260
= Rs. 5,000 per mile.	

Provision is made for carriage of materials 300 miles by railway, on the supposition that the lines are laid in the Bellary and Kurnool Districts.

Particulars of Weight, Cost, &c., of "Porteur Decauville."

		Gauge.				
		A. 16 Inch.	B. 20 Inch.	C. 24 Inch.	D. 30 Inch.	E. 30 Inch.
Weight of each length (16 feet 5 inches).	lb.	117	187	259	332	420
Do. per lineal yard	,,	21	34	47	60	76
Do. of single rail per yard ...	,,	9	14	19	24	30
Do. of one mile of permanent-way.	Tons.	16·4	26·7	37·2	47·1	59·7
Do. do. including 5 per cent. for sidings	,,	17¼	28			
Cost per lineal foot	Rs.	·85	1·25	39	50	63
Do. mile (84 chains) including sidings	,,	4,712	6,930	1·6	1·9	2·2
Landing charges and carriage by train for 300 miles, at 10 pies per ton mile.	,,	310	504	8,870	10,534	12,197
Type of engine suitable for each rail.	No.	...	1	702	900	1,134
Cost of engine	Rs.	...	6,700	3	4 or 5	6
Weight of engine in steam	Tons.	...	3½	8,240	9,060	9,700
		...		5	7½	10½

22nd November 1881. (Signed) W. H. COAKER, Captain, R.E.,
Dy. Consulting Engineer for Railways.

(8.) From the Acting Chief Engineer, to the Agent and Manager, Madras Railway Company, dated Madras, 14th December 1881, No. C. 141/555.

Your endorsement on Consulting Engineer's letter, No. 719, forwarding Proceedings of Government, dated 17th August 1881, No. 2018 W.

6. The tramway should be laid, as suggested, on the common country roads; but much lighter and consequently cheaper than any proposed in the papers which accompanied your letter.

7. The rails should not exceed 15 lb. per yard: and the cost of the whole thing, including rolling stock, should not exceed Rs. 10,000 per mile. That this is practicable may be understood from the advertisements of sufficiently well-known makers in England, who undertake to deliver steel rails and iron sleepers at prices which admit of a road being made within this limit.

8. The ordinary rolling stock of the tramways should be built almost exactly like the ordinary country-carts; but each vehicle with two sets of wheels, one with flanges and one without. When the carts arrive, drawn as they generally would be by the consignees own bullocks, or by the bullocks of the bandy-men who now carry on the ordinary road traffic, at the point on the tram nearest their destination, the wheels would be changed (just as they are on the Paris and Versailles tram), and the load would proceed over the common field tracks.

9. The object of making the ordinary rolling stock thus is twofold, partly to admit of its running on the road as well as on the tram, and, partly, because it could be easily built and repaired without special appliances, by the means at hand in every village. Two-wheeled bandies would be inconvenient for steam traction; and a supply of four-wheeled bandies would also be required for use when the steam engine is applied. A train of half four-wheeled and half two-wheeled bandies drawn by an engine would work well enough.

10. The gauge of the line should be the usual gauge of the country bandy. The section of the rails should be that known as the Vignolles' section, and of the sleepers that known as Wood's system, or similar (see sketch). Flat bar rails would be convenient in many ways, but would never be stiff enough at the limit of weight and cost fixed to carry engines.

11. The necessary equipment at the outset for each tramway would be no more than a few country bandies fitted with flanged wheels to enable them to keep the rails, and a few extra flanged wheels to be used as required in the country-carts of private owners. In addition to this a few locomotives to be kept in store as equally applicable to all the trams in the district, and a few special four-wheeled vehicles of a rather larger calibre than the ordinary country cart, but built in exactly the same manner, to be used in trains at times when it becomes necessary to employ the locomotives.

12. There should be no stations or signals. The bandies should travel in convoys in charge of native pilots or guards belonging to the tram, who would arrange for the passing of the convoys at suitable and previously agreed places; where sidings or a so-called "turn-out" would be provided. A stray bandy meeting a convoy would simply pull off the rails till the convoy passed and then go on again. The speed even with the locomotives should never exceed 8 to 10 miles an hour, and at such a speed it is believed they could be safely worked in this manner; although no doubt, during the rush of such a famine traffic as was experienced in 1877, special and extraordinary arrangements would have to be made to work the trains even as they were with the railways.

13. Short lengths of 15, 20 or 30 miles of tram could not afford to maintain each an engineering staff; but being Government property they should be maintained by the same engineering staff that now looks to the roads.

14. It may be doubted that such a line, so worked, could pay at all under any circumstances. I think it could. Take, for example, a line 20 miles long, worth, at Rs. 10,000 a mile, Rs. 2,00,000. I take this length as being the limit of a day's work for bullocks. Any shorter length, so long as it still could be considered and paid for as a day's work, would be rather more advantageous.

15. It is customary to charge for freight, travelling long distances in bullock bandies, at so much per day. The weight of a two-wheeled country cart usually drawn by two bullocks is 800 to 900 lb. and it will carry or rather the bullocks will draw in it about 1,000 lb. of freight. They will travel 15 to 20 miles a day, and the charge is Rs. 2 per day, or, say, 1 anna 7 pie per mile, equal to Rs. 0-3-7 per ton per mile.

16. Now, if the same pair of bullocks that do the above work can be made by help of the tram to do double by carrying double the load at the same speed, the traffic such as it is could well afford to pay an extra toll.

17. The return in interest for this 20-mile line at 5 per cent. must be Rs. 10,000 per annum, and taking working expenses to be 50 per cent. of receipts the total earnings must be Rs. 20,000 per annum.

18. With the figures quoted the calculation depends on the power of a pair of bullocks to pull double as much in the tram as on the road. The rate at present in force on the roads is Rs. 2 per load of 1,000 lb. for a day's journey. Let the new rate be Rs. 3 per 2,000 lb., of which Rs. 2½ go to the owner of the bandy and bullocks and Annas 8 to the tram. Then the receipts must be Rs. 55 per day, which would be realized by 110 journeys, or 55 bandies a day each way.

19. This number could certainly be easily worked if they were there to work, and I think there is good reason to believe that out of a number of tramways built and worked as described some at least would be likely to return a fair rate of interest on the money expended on their construction.

20. A passenger traffic in the tram has hardly been considered, but there would be no difficulty in providing very light and suitable vehicles to be drawn by horses or country tats.

(7.) *Note on the "Porteur Decauville."*

The annexed table has been compiled to show the weight, cost, &c., of the permanent-way and locomotives for the different gauges. The cost of permanent-way for the 16 and 20 inches gauges is that supplied by Mr. Gostling, and for the other gauges the cost is based on those figures, with a due allowance for the cheaper rate at which the larger sections of rail could be obtained.

2. For permanent lines it is thought that the rail should weigh at least 24 lb. to the yard, and 30 lb. would be better. The lighter sections of rail would not give good results, as the engines, which it would then be necessary to use, could take only a small load on the gradients that would be met with on an ordinary Indian road.

3. In the item of cost the Porteur Decauville appears to compare unfavorably with an ordinary line of light railway with rails of similar section. With wooden sleepers the ordinary line would be far cheaper, and wrought-iron sleepers of the best description could be supplied for less than the cost of the Decauville system. This is due in great measure to the high price of the Porteur Decauville, which varies from Rs. 273 per ton for 9 lb. rails to Rs. 193 per ton for 30 lb. rails. Steel rails weighing 30 lb. per yard could probably be purchased in England for £7 per ton = Rs. 84; and allowing Rs. 20 for freight and insurance, their cost in Madras would be Rs. 104 per ton. The permanent-way of the South Indian Railway (40 lb. rails on creosoted pine sleepers) costs at the present time about Rs. 12,000 per mile, or almost the same as the Porteur Decauville with a 40 lb. rail.

4. With regard to the relative merits of the Porteur Decauville, and an ordinary light railway, it may be said that the former could be laid rather more rapidly, but if the ordinary rails were supplied in similar lengths (16 feet 5 inches) they would be nearly as portable with the sleepers attached. This could be done after the material was landed, and the component parts could be sent out separately, and would thus pack better on board ship.

5. The ordinary permanent-way has larger bearing surface, and could be more easily kept in good order during rains, when owing to the banks being soft the Porteur Decauville would be liable to become bent, and there would be some difficulty in straightening it. If bent transversely, the gauge would be lost. Owing to its small bearing surface the Porteur Decauville appears to be suited only for a metalled road, or a bank which has thoroughly consolidated, and has a good coating of gravel or stone ballast. It is observed that the Russians were unable to use the engines on a line laid on sand, and had to work the traffic by horses. An ordinary railway is on the other hand thoroughly efficient on sand. If during famines it be considered desirable to use the 16 inch or 20 inch gauge, it would probably be better to work

4. Please return the tracing to me, and if you think the design a promising one I would suggest your writing to Mr. F. G. Stoney for estimates of its cost, &c.

I enclose a memorandum of my views on the subject of steam tramways.

ENCLOSURE.

Memorandum on Steam Tramways for Indian Roads.

I quite agree with Mr. Vincent on most points, and think steam tramways eminently suited to aid the traffic and develop the resources of districts which cannot afford to pay for railways even of the cheapest sort.

2. They should be laid on existing roads, and if possible divided from the portion set apart for ordinary conveyances by stout wire fencing, which would add more than Rs. 1,100 per mile to the original cost, and this would be more than recovered by the saving effected in the upkeep of the roadway occupied by the tramway, which if not fenced should be maintained for cart traffic.

3. The gauge most suitable would, I think be, either the metre, or 3'-6", nothing wider being needed; and by adopting either of these and placing the tram rails as near one side as possible, most roads on which there was traffic enough to need a tramway, would be most likely wide enough to permit of its being fenced off, and also to accommodate the cart traffic.

It might be necessary to widen a few bridges, and to improve bad curves, but it should be remembered that the cart and passenger traffic on a given road would be reduced by that carried by the tramway laid thereon, so that a smaller width of road would suffice to accommodate what remained.

4. Where metre-gauge railways exist, steam tramways should be made of the same gauge; and if it was arranged, as I propose, to fence them off from the rest of the road, the tramway rails might be of a similar, but lighter type, to those used on the railways with which they were connected; and be laid so as to stand 2 or 3 inches above the road level.

If so constructed there would be no great difficulty in arranging to run light metre-gauge railway wagons on the adjoining steam tramways; and this would no doubt be an advantage on lines likely to be needed as grain distributors in times of famine.

5. No useful end would, I think, be gained by making steam tramways adjoining 5'-6" gauge railways of the same width, because the ordinary tramway rails, &c., would not bear safely the loads which would be imposed on them by adjoining broad gauge loaded goods wagons; so that if they were made wide with this object (which is apparently the only one there is for such a course) much heavier rails, sleepers, &c., would be required, and bridges, &c., would also need to be proportionately stronger, so that the cost of a 5'-6" gauge steam tramway capable of carrying broad gauge wagons, would probably be from one and a-half to twice that of an ordinary metre-gauge tram.

The advantages gained would not, I think, be at all in proportion to the extra capital expended.

6. Break of gauge would be of small consequence, as there ought to be little, if any, difficulty by means of suitable appliances, in rapidly transhipping from railway to tramway wagons, or *vice versâ*, all a tramway could carry.

7. Wood-burning steam locomotives would be, I believe, the most suitable and economical power to use; they might be fitted with arrangements for suppressing the exhaust and smoke for short periods, when passing horses, &c., by means of condensers or other suitable appliances.

There appears to me to be no practical objection to allowing the engines used to discharge their exhaust steam and smoke into their chimneys in ordinary work, provided that efficient spark catchers be used.

The South Indian Railway from Arkonam to Conjeevaram runs alongside the public road for miles, and the passing of ordinary trains does not apparently cause any trouble to the cart traffic on the adjacent road.

The South Indian Railway Harbour line at Madras is a still more notable example of this.

8. The estimates given by Mr. Vincent appear liberal, the cost of working short lengths of tramway having to support their own managers, &c., would be so great as to leave little chance of profit to any private Company, but some arrangement might perhaps be made by which Railway Companies would construct and work for Government, at cost price plus a small percentage for supervision, steam tramways from large towns along their line, such as Vellore, Salem, &c., the Government paying their cost either from local or other funds, and receiving the net earnings.

9. If an arrangement of this sort could be made, such steam tramways could be constructed and worked most economically; and in consideration of the advantages likely to be derived by the Railway Companies by these feeders, such a system as I suggest might perhaps be tried with success.

10. The road from Beypore to Calicut would, I think, offer exceptional advantages for the construction and trial of a steam tramway with every prospect of success, as it is level and straight, and there is much goods and passenger traffic over it.

Permanent-way materials and rolling stock could be shipped direct both to Beypore and Calicut, so that the cost of carriage would be reduced to a minimum.

The traffic on this road could, I presume, be accurately ascertained at a nominal cost.

(Signed) E. W. STONEY, B.C.E., M. INST. C.E.

Hollow rail about 44 lb. per yard laid on small pit sleepers or chairs filled with concrete

and laid on longitudinal bed of concrete



The concrete in the chairs adheres fast to them and unites with the bed of concrete and no tie-bars are required. The peculiarity I propose is in constructing the rail so that while it forms a good basis it still allows a certain amount of elasticity between its feet below, which greatly facilitates the action of keying in places by means of iron keys and allows of small corrugations to be made in the key and in the jaw of the chair, so that nothing short of smart hammering could undermine a key, and the rail is securely held. The chair sleepers may be 3 feet apart for light trains and at the junction of two rails, the sleepers would be 15 feet apart and a fish or joint bar 18" long used *inside* the rail resting on each adjacent chair and confined by a stop endways on each chair, the fish bar to be so deep that the rails will bear on it and not on the chairs; the fish bar to fit tight into the rail on its upperside and to taper downwards the reverse way from the rail for clearance in keying up and facility of rolling, &c. The sketch will explain itself clearly. Rails, chairs, fishes, keys, iron or (steel rail) about 110 *to* 112 *tons per mile.*

18th September 1881. (Signed) E. W. STONEY, B.C.E., M. INST. C.E.

(6.) From F. H. TREVITHICK, Esq., Locomotive Superintendent, Madras Railway, to the Secretary to the Madras Government, Public Works Department, dated Perambúr, 18th November 1881, No. 2749-563.

Your No. 2176 W., dated 2nd September 1881.

Indian Tramways.—With reference to Proceedings of Government, dated 17th August 1881, No. 2018 W.

In reply to the questions raised in the above quoted order of Government I have the honor to make the following suggestions.

2. Assuming that the particular object of the proposed steam tramways is that they should serve as a means of distributing food in districts remote from railways during famine time; that they are not required in time of plenty, at least not required so much as to induce the Government to build them without the certainty of a fair return of interest for the outlay: but that it is expedient to construct them in certain districts as an insurance against famine even with the foreknowledge that they are not likely to return a fair rate of interest.

3. I would abandon altogether the idea of working them regularly by steam. A steam tramway worked with regular trains is practically a railway, and is pretty certain to soon acquire many expensive railway ideas in the way of stations, work-shops, and highly paid staff.

4. The principle to be adopted should be concisely this. The tramway should be considered in time of plenty as nothing more than an improvement of the common roads, to be used by the native country-carts drawn by country bullocks, at a small charge for toll. If the traffic is sufficient to admit of a regular service in addition to this, so much the better; but to commence with, steam should not be used.

5. A supply of steam-engines should be kept at convenient Government depôts, and, as one end of every tramway would touch a railway, the tram-engines could be readily disposed where required.

(4.) *Memorandum by the Consulting Engineer to the Government of India for State Railways.*

STEAM TRAMWAYS.

Comparisons (such as that which Mr. Vincent has made in his pamphlet) between a tramway costing about £2,000 per mile, and a railway costing from £6,000 to £7,000 per mile are calculated to mislead unless they are accompanied by a thorough knowledge of all the circumstances in each case, and by an explanation of the items of which the cost is composed; a so-called "tramway" is in reality nothing but a railway laid on an existing road, consequently the expense of surveys, earth-works, bridges, fencing, &c., having already been provided in the first construction of the road is not debited to the capital expenditure of the tramway. Mr. Vincent is in error in stating (page 7) that "Tramways generally are quite of modern origin, and *steam* tramways in particular may be said to be still in the earliest stage of development." He is also in error in stating that "To America belongs the credit of being the pioneer of this new mode of locomotion." Tramways were in common use in England before the existence of railways, and I can remember thirty years ago in Wales tramways worked by steam which were by no means new at that period, but which were afterwards converted at much expense into railways. All that America has done in the matter has been to popularise them for street traffic in their populous cities.

Mr. Vincent is also inaccurate in stating (in page 5) that "It is scarcely probable that even a light line of railway in India will ever be constructed for much less than from £6,000 to £7,000 a mile." Several of our State railways have been constructed at a much lower cost. I may instance the Bhownuggur-Gondal line, metre gauge, 75 miles in length, which has been constructed for Rs. 34,760 per mile (say £2,897 per mile), and the Miani line, metre gauge, 57 miles in length, which has been constructed for Rs. 37,320 per mile (say £3,110 per mile).

Taking as a basis for comparison the figures which Mr. Vincent has given in the case of the Milanese tramway and comparing these with similar items of cost of the Bhownuggar-Gondal railway after eliminating from the latter those items which, in the case of the tramway, have been provided free of cost by the existing road, the tramway appears to be the more costly of the two, as may be seen by the following comparison, in which I have for facility of comparison, reduced pounds sterling to the equivalent in rupees:—

Items.	Cost per Mile Rupees.	
	Milanese Tramway.	Bhownuggur Gondal Railway.
	Rs.	Rs.
Preliminary expenses ... Miscellaneous, Establishment...	1,620	*2,331
Buildings, Stations and, Workshops	5,076	2,650
Ballast and Permanent-way	13,596	15,256
Rolling Stock	7,584	5,430
Total ...	27,876	25,667

To place this comparison on a fair equality with Indian rates, and to allow for the greater distance of India from the sources of supply of permanent-way and rolling stock, the Italian rates should be increased by at least 25 per cent., and if this were done the comparison would stand as follows:—

	Rs.
Cost of Tramway per mile	34,845
,, Railway ,,	25,667

* Includes Survey expenses, which cannot be separated.

The items which I have eliminated from the cost of the railway in the foregoing comparison are the following:—

	Rs.
Earth-work per mile	3,049
Bridge-work	3,929
Plant	1,442
Part of the Establishment	672
Total ...	9,092

The working expenses of the Milanese tramway are stated to be 20 pence per train mile, which may at first sight appear to be low when compared with the train mile expenses of a railway, but the comparison by train mile is in this instance most fallacious and misleading, and when it is considered that the tramway train seldom consists of more than three vehicles the *apparently* low rate becomes in reality *very high*, being at the rate of more than 6*d.* per vehicle mile, whereas 2*d.* is a fair rate on railways of the metre-gauge, and it must, moreover, be remembered that the railway vehicle has as a rule much greater capabilities than the tramway vehicle. It will be seen, therefore, that while the tramway is not less costly than the railway, and is more expensive to work, it is inferior to the railway in capabilities. In making these observations I do not wish to imply that the tramway may not in some cases, when the traffic is light, be adopted with advantage, but it is necessary to warn the Government against the danger of being led astray by over-sanguine comparisons and illusive advantages claimed for tramways which may not be realized in practice.

The tramway is well adapted to towns with large population and to their suburbs, and I would suggest that before the tramway system is adopted on a large scale, for long lines in the country, it should be first tried under its most favorable conditions in a large town, and gradually extended to its suburbs and thence into the country. If found to be successful under such conditions the system may be more extensively adopted, but if under such favorable conditions it does not succeed, it is scarcely probable that it will answer for long lines, in a sparsely populated country, where the vicinity of a large town is not available to give an impetus to business, or to make the time spent in travel an object of importance, or to render high fares practicable to compensate for the high rate of working expenses. Tramways appear to have been successful rather from the high fares leviable from passengers on what may be termed "Omnibus lines," and on the Milanese tramway the goods traffic appears to be inconsiderable. At all events before the tramway system is adopted for long lines in the country a careful and intelligent estimate of the comparative cost of a railway should also be framed.

2nd September 1882. (Signed) G. L. MOLESWORTH.

To the Secretary to the Government of Madras, Public Works Department.

(5.) From E. W. STONEY, Esq., Resident Engineer, Madras Railway, to the Secretary to the Madras Government, Public Works Department, dated Pódanúr, 18th September 1881.

1. I have the honor to acknowledge the receipt of your letter No. 2176 W. of the 2nd instant, with its enclosures, and regret that I have not been able to reply to it sooner, as I have lately been moved from Arkónam to this district.

2. I have for the last two years thought that steam tramways might be laid on Indian roads with great advantage, and was so much impressed with their value that I requested Mr. F. G. Stoney, of 4, Westminster Chamber, London, some fifteen months ago, to design a suitable permanent-way for this purpose.

3. I now enclose for your inspection a tracing of what he then proposed, which would form, I think, both a cheap and suitable tramway, easily laid and repaired.

outside the famine zone, as judging from the communications received by Government from private parties and companies, offering to take up a number of such lines there will apparently be no lack in this respect.

(Signed) R. H. SANKEY, Colonel, R.E.,
11th November 1882. Chief Engineer, Public Works Department.

APPENDIX TO NOTE BY THE CHIEF ENGINEER, P.W.D.

Extract from "the Finances and Public Works of India," by Sir John and General R. Strachey.

"But it was apparent that, under the strict rules laid down for the application of borrowed funds, no facilities existed for meeting a very important class of cases, in which, although it is obviously necessary to construct certain works for the prevention of famine, it cannot be assumed that they will be so directly remunerative as to yield a net income equal to the interest on the capital expended on them. The question therefore arose how to provide means for the construction of this class of works, called for the sake of distinction protective, when the required expenditure was too large to be met from ordinary income.

"The province of Bandelkhand supplies an illustration. It suffers frequently from serious drought, is peculiarly exposed to failure of the periodical rains and consequent famine. It is cut off from the existing railway system, and its means of communication are very imperfect. Designs for irrigation works and for cheap railways had been completed, which would render the province secure against serious danger, and would make its relief in case of necessity easy. But the country being naturally poor, it could not confidently be said that the direct money return from these works would cover the interest of the capital expended on their construction. It might, perhaps, for a good many years cover only half of it, and leave, say, £20,000 or £30,000 a year unprovided for. Under the existing rules these works could not be undertaken, except from the ordinary revenues, and, in the absence of funds from this source, Bandelkhand was left exposed to the dangers of famine.

"The first suggestion for dealing with such cases was that these protective works might properly be constructed from the famine insurance surplus, which would be reduced to a corresponding extent. But, although this plan had been proposed by the Secretary of State, the Government of India considered that it was not admissible. 'It is essential,' they wrote to the Secretary of State,* 'that the limited amount of that surplus should not be trenched upon to an extent that will frustrate the main object of its creation, viz., the prevention of any permanent increase of the public debt by reason of the public expenditure upon famines. If the assumption be true upon which our recent measures were founded, viz., that 1,500,000*l.* sterling is the amount which it is necessary to secure as a yearly surplus to provide for the cost of counteracting famines, it is plain that, if unremunerative works were carried out under conditions which caused a reduction of that surplus beyond a certain limit, additional taxation would be eventually required to make good the loss. This result could only be avoided if the works were found so useful as, when famine occurred, to cause a diminution of the expenditure which must otherwise have been incurred for purposes of relief, sufficient to compensate for the cost of the construction and maintenance of the works at other times.'

"The suggestion that the supply of funds from the famine surplus for the construction of protective works may be justified by such an expectation as that just referred to, should be received with much hesitation. The true object of these works is to give increased security against the greatest dangers that arise in extreme drought, to supply the means of saving life and averting suffering and misery, rather than to cause an eventual reduction in the cost of famine relief. Experience indicates no valid ground for hoping for any important diminution of the burden of such relief. On the contrary, the probabilities of the future, within any period to which for practical purposes we can now look forward, assuredly are in the direction of a constantly growing demand for a more bountiful administration, and of increased efficiency rather than for reduced costs. In short, no reduction of any insurance fund against future liabilities could be prudently accepted on grounds such as those just noticed.

"Further, one of the most essential conditions to be observed in the construction of great public works is that, when they have been commenced, they should be carried on to completion without interruption, at a certain and steady rate of expenditure; the neglect of this condition has notoriously been already a fruitful cause of wasteful expenditure in India; and consequently if the construction of protective works depended on the possession of a sufficient surplus, there could be no certainty that they would go on uninterruptedly for a single year, for their progress might at any time be disturbed by famine, or war, or other causes

"For such reasons, to which no reply can be given, the Government of India rejected the proposal to provide from the famine special surplus the capital required for protective works

* Despatch from Government of India to Secretary of State, dated September 16, 1878.

extent, establish permanent lines on the most economical plan, which, while meeting in the fullest way the requirements of famine, would aid materially in developing traffic at other times. Road engines could also, as recommended by Major Pennycuick, be freely used whenevr desired.

42. At this stage of the inquiry it is needless to do more than express as has been done a general opinion as to the character of the permanent-way, the gauge, weight of rails, gradients, radius of curves, &c., as upon these and other technical points an authoritative ruling will doubtless be received from the Government of India.

43. As regards questions 4 and 5, viz., the returns which may be expected from traffic in ordinary years, and the advantages which might result in famine years, the papers sent up afford but little information of a reliable charcter. The Board of Revenue sum up with the observation (paragraph 14, Proceedings No. 2230,) that the general result of inquiry made appears to be this:— "that tramways as protective works against famine are chiefly required in poor and thinly-populated tracts of country, and consequently that viewed as a commercial speculation the profits to be looked for ordinarily must necessarily be in the inverse ratio to the value of the lines in times of scarcity."

44. Major Pennycuick shows that to pay even 1 per cent. on a capital charge of Rs. 20,000 per mile over 50 tons, or say 100 bandy loads, must be moved daily along the whole distance, and as will be seen by a reference to the Collector's report, the local traffic on even the best line proposed in Bellary (letter from Mr. H. P. Gordon of 19th September 1882) only just amounts to this, while for the others the quantity moved falls far short of it.

45. Mr. Gordon is of opinion that in ordinary times the lines "would do much to develop agriculture by opening up markets to the ryots," and if to the local be added probably as much again on account of through traffic and passengers, it does not appear improbable that 2 per cent. on outlay might be realized. The lately completed Bangalore-Mysore line, which runs through a very poor and difficult country, and has cost Rs. 40,000 per mile, has lately been shown by the Dewan to be paying already 3 per cent., and it is difficult to suppose that looking generally to the easier gradients over which the Bellary and Kurnool lines would be carried, that the profits would be less than one-third of this example.

46. So far as he can commit himself to an opinion on imperfect data, Major Pennycuick thinks there is no line in Cuddapah or Kurnool which would on his low basis of outlay, Rs. 12,000 per mile, return 2 per cent., and in Bellary only the lines from Hospet to Harpanahalli, and from Tadpatri through Anantapur to Penukonda might do so. He also looks upon it as bad policy to saddle a country with an unremunerative outlay for nineteen years, on the chance of the lines becoming useful in the twentieth.

47. The outlook from a commercial point of view is certainly by no means encouraging although sufficient allowance does not appear to have been made for the recognized powers of railways to stimulate traffic both of goods and passengers, but however bad the prospects in this sense, famine, like war, must be encountered on other grounds than those of a strictly financial character.

48. A case of precisely analogous character has been so clearly dealt with from the financial point of view, in the late work by Sir John and General R. Strachey, "Finances and Public Works of India," that I make no apology for appending to this note their remarks (pages 186 to 193) chiefly relating to proposed lines of railway for the relief of Bundelkhand.

49. Here it is shown that from the annual imperial surplus of £1,500,000 a sum of £250,000 might, in the authors' opinion, "be distributed between the Local Governments according to the urgency of their wants," in order to meet the demands of interest on fresh capital for "protective" works. It being notorious that Madras has suffered far more from famine than any other province in India, and further that hitherto it has never received anything approaching to its ratable share of the Imperial surpluses, it is not advancing too much to express a hope that of the sum above named, £50,000 per annum, might be assigned exclusively for meeting the case in question.

50. Taken in round numbers the 1,000 miles of famine lines would, when fully carried out, have as above roughly estimated cost 1,000 × 20,000 = 200 lakhs of rupees, so that the amount named if merely viewed as interest for meeting loan, would at 4 per cent. precisely meet the requirements.

51. There is however no need to suppose that the lines if carried out will be so barren of all profits as only just to cover the working expenses, or again to carry at once to completion an undertaking of such magnitude, in order to meet the contingency of a famine so wide-spread and disastrous as the last, which it may be hoped will not recur within the present generation.

52. Viewed in this light it seems to me that the operations for some years to come should be confined to widening, metalling and otherwise preparing as many of the selected lines of road as possible, for receiving the permanent-way of the character that may be decided on. Every mile of such improved road will, even without the permanent-way, be so much gained, and were scarcity or famine to recur in the interval, the work would all be of a character well adapted for affording relief, and road engines could be freely employed,

53. The time thus employed in raising and preparing the selected roads, would further afford the much needed opportunity for studying the details of the precise character of the permanent-way and rolling stock most likely to suit the object in view. This decided on an experiment might be made with one or two of the lines and, say, 100 miles of permanent-way also provided extra for meeting any special emergency arising from severe famine. A certain amount also of the "Porteur Decauville" 16 inch gauge, 14 lb. rails, with a few wagons might also with advantage be procured, as recommended by Captain Coaker, for experiment and for purely temporary use in famine.

54. Some temporary establishment would no doubt have to be engaged in addition to the present normal scale, but if the outlay on preparing the roads is not to exceed from three to five lakhs per annum at first, the present permanent divisional establishment, so far as can at present be judged, should not be overtaxed. When the time comes for laying down the metals, &c., other special arrangements will have to be made.

55. The proposals therefore which I desire to submit for the consideration of Government may be briefly summarised as follows, in reference to the scheme for distributing food during famine by mechanical means viz:—

I.—That a modified scheme be prepared, in conference between Collectors and the Superintending Engineers, which shall not exceed in the aggregate 1,000 miles of reformed roadway for the so-called famine zone.

II.—That detailed estimates be prepared for such of the individual portion as may receive the sanction of Government, exclusive of all cost of laying down permanent-way, rolling stock, &c.

III.—That the funds for such work be provided for in a distinct budget of the Roads and Buildings Branch, Imperial Protective Works, sub-head 'Famine Roads.'

IV.—That commencing with an outlay of 1 lakh in 1883-84, including such extra temporary establishment as may be needed 1 lakh, per annum be added till a maximum annual expenditure of 5 lakhs shall have been reached.

V.—That no permanent-way or rolling stock shall be provided, excepting experimentally to the extent above indicated, till the complete reformation of the roadways for the entire scheme shall have been carried out, and excepting as a reserve against possible contingency of severe scarcity or famine.

VI.—That the Government of India be solicited to lay down authoritatively all details as regards gradients, curves, gauge, weight of rails, speeds, &c.

56. In conclusion I may observe that no reply seems now called for to the 6th inquiry, viz., as to whether, and if so, to what extent, tramways might be applicable

of lines reticulating the district with no less than 370 miles of tramway, has lost sight of the now generally recognized principle suggested by Sir Andrew Clarke and accepted by the Famine Commission, that it would as a rule suffice if famine lines were about 50 miles apart.

27. On the whole, therefore, it may be concluded that the outside demands for works of this character to serve fairly well the whole of the famine zone in this Presidency will not exceed in the aggregate 1,000 miles when the details come to be finally worked out.

28. As to the next point, viz., the probable cost per mile, gauge, rate of speed, &c., much valuable evidence will be found in the papers which have been sent up. As shown by Mr. Molesworth, the Bownaggur-Goondal line, metre gauge, 75 miles in length, has been constructed for Rs. 34,760 per mile, and the Miani line, 57 miles, on the same gauge, for Rs. 37,320 per mile. But if carried along an existing road the first would not have cost more than Rs. 25,667.

29. Colonel Shaw-Stewart, in his memorandum of 31st January 1882, gives the following examples among others of very cheap lines:—

I.—That constructed by the Gaekwar of Baroda, 58 miles in length, 2½ feet gauge, 30 lb. rails, and independent embankment with 10 feet formation width, cost Rs. 19,813 per mile.

II.—Nalhatti line, 27 miles in length, 4 feet gauge, 32 lb. rails, laid on the existing road may cost only Rs. 11,934 per mile.

He recommends light railways on the metre-gauge, 35 lb. steel rails, Vignols' section, with creosoted fir or iron sleepers, wheel weight to be limited to 2½ tons, and maximum speed to 10 miles per hour. Such lines, he considers, might generally speaking be built on existing lines of road at Rs. 25,000, and on independent embankments at between Rs. 30,000 and Rs. 35,000 per mile; in case of emergency they could be laid down at the rate of 1 mile per diem on existing roads, strengthening the bridges where necessary. Where bridges are too narrow for both road and railway some form of tramway rail would have to be substituted for that used elsewhere. Large unbridged rivers would have to be crossed on causeways.

30. The inquiries made regarding the suitability of the Decauville system of light railways, which was being brought under public notice when my previous memorandum was written, have resulted in an adverse opinion as to its suitability for permanant lines, though well adapted in many respects as temporary lines during famine when, in Captain Coaker's opinion, they would be perfectly serviceable for use with bullocks—one bullock in fact, in his opinion, would probably be enabled to do the work of ten if so employed, and the small wagons could be hauled or pushed by coolies. With such motive powers neither bad soils nor unfavorable gradients would be of much consequence. The cost of a mile of line with 14 lb. rails, including wagons, would be only Rupees 8,000, or with 19 lb. rails, Rupees 9,500 as delivered at Madras.

31. Steam could not be employed, in Captain Coaker's opinion, on a line built on the Decauville system of less than 24 to 30 inch gauge. He estimates the cost of the former generally, if laid on a fully metalled road and with bridges strong enough to bear a 5-ton engine, at Rupees 17,695; and of a line similarly laid, on the 30-inch gauge with 30 lb rails, on an independent embankment, at Rupees 32,424. Stations are not included. Both estimates include a moderate supply of rolling stock.

32. For permanent lines Captain Coaker is of opinion that those laid on the Milan system can be more easily laid and kept in order than others, the upkeep being in fact much less than on an ordinary railway; they also offer less obstruction to foot-passengers, who can walk freely along and across them. He considers that for the metre gauge a Vignols' pattern rail, weighing 35 lb. per yard, with wrought iron and steel sleepers, or what is known as "Wood's Patent," would be found most suitable. With the addition of a guard-rail, similar to that used in the Milan lines, there would, he thinks, "be no objection to its passing through towns, or occupying the whole of a road where necessary, such as in crossing a bridge."

33. For further details the papers above quoted should be referred to. As none of them deal, however, precisely with the description of permanent-way which I consider most suitable for meeting in all respects the case immediately under consideration, I will

here state very briefly my views of the subject and as all turns on this point, it would be essential to obtain a ruling from the Government of India before moving further in the matter.

34. In his memorandum above quoted, Colonel Shaw-Stewart considers the advantages which would accrue in times of famine, from being enabled to utilize the spare rolling stock of the South Indian Railway and other metre gauge lines, as sufficient in itself to decide the question of gauge in its favor; and Captain Coaker, apparently acquiescing in this decision, recommends that all the permanent famine lines should be of the metre gauge.

35. The advantages claimed might no doubt, under certain eventualities, be considerable, but in case of wide-spread famine, affecting the country through which the South Indian Railway passes, they would in great measure, if not indeed entirely, disappear; and as the question we are now considering affects the construction of a system aggregating no less than 1,000 miles of railway, it may with equal or even more force be contended, that if the whole proposed system be fully worked out, the advantages will, on the whole, be found to rest with the adoption of an entirely new and more truly narrow gauge system, adequately furnished with rolling stock, which might be interchanged or supplemented as needed.

36. I confess therefore, that in case the Government decide to enter on this great work however gradually, but with the firm determination to complete it within a definite number of years, the gauge should not, in my opinion, exceed 2 feet or the weight of the rail 20 lb. per yard.

37. Calculations of cost on hypothetical cases have already been given in abundance; without therefore needlessly continuing these, it may be assumed that to lay down such a permanent-way on the existing roadway on a system analogous to that of the Milanese lines, would not cost over Rs. 16,000 per mile, excluding however the expense of adapting the roadway itself to the requirements.

38. The latter will in all cases probably require a good deal of improvement in regard to gradients and curves, as also in widening the surfaces. Speaking under correction, it appears to me that to ensure fairly effective work from the engines, the gradients should nowhere exceed, and then only for short lengths 1 in 40, or the curves be of less radius than 150 feet. Although the rail to be employed, Vignols' section, only projects 2 inches above the roadway surface, it is doubtful whether carts would cross the line if guard-stones at intervals, as in the Milanese system, or other simple expedient be adopted, or in case of their even doing so whether, owing to the small loads ordinarily taken by carts in this country (not usually over half a ton), the shock would injure the rail. The cost of the separation of the portion of road occupied by the rails need not in any way be serious.

39. For a gauge of 2 feet it will apparently suffice to reserve 8 feet along one side of a road, and if to this be added 12 feet for meeting the requirements of ordinary cart traffic, the total normal width to which the existing roadway should be increased need not exceed 20 feet. However small the width thus left may appear, it must be borne in mind that once the new system has been fairly established on any road, a large proportion of the ordinary traffic should take to the rail; and further that as a fact on many of the existing ghât roads, accommodating an enormous amount of cart traffic, even so much as 12 feet cannot always be counted on as available, and is found to suffice. No serious inconvenience should therefore be occasioned on this account. Through towns, over bridges or wherever a greater than the present width of roadway cannot be secured without needless cost, some good form of tramway rail, as suggested by both Colonel Shaw-Stewart and Captain Coaker, might be substituted, and if necessary the whole roadway occupied.

40. To carry out the several modifications of the existing roads as above indicated, as also to provide for widening road-drains and minor bridges, as also to make some needful deviations from the existing line, metal the roadways throughout, &c., it will certainly suffice to allow Rs. 4,000 per mile, which added to the cost of permanent-way and rolling stock (Rs. 16,000) would bring the eventual total outlay to not over Rs. 20,000 per mile.

41. This system which combines as before mentioned the features of a light railway and those in part of a tramway should, if eventually carried out to its full

List of Tramways proposed—(Continued).

Districts.		Miles.
Nellore ...	1. Kottapatam *viâ* Ongole, Addanki, Dársi, Podili, &c., and Venkatagiri to Tirupati Railway Station.	
	2. Iskapalle or Kistnapatam *viâ* Sangum and Dornal Pass into Cuddapah.	
North Arcot ...	1. Vellore Railway Station *viâ* Vellore, Arni, &c., to Pólúr and Tiruvannámalai.	
	2. Tirupati Railway Station *viâ* Tirupati, Chandragiri, &c., to Damalcheruvu.	
	3. Vellore Railway Station to Chittoor and Damalcheruvu.	
South Arcot ...	1. Merkunam to Chengam *viâ* Tindivanam, Ginji and Tiruvannámalai	85
	Thence to Sámalpati (Madras Railway) *viâ* Uttankarai... ...	(22)
	2. Panruti to Chinna Salem *viâ* Sovalai, Trinkolur, Tyága Drug and Kallakurchi	63
	Thence *viâ* Atúr to Salem	(51)
	3. Cuddalore to Tyága Drug *viâ* Kuringipadi, Vriddháchalam, Mandalam, Ulundurpet and Elavánásúr	67
Coimbatore ...	1. Pálghat *viâ* Polláchi, Udamalpet and Dhárápuram to Dindigul.	
	2. From Erode to Satyamangalam *viâ* Bhaváni.	
Madura ...	1. Madura to Ramnad to Pámban.	
	2. Ammayanáyakanúr to Periyakulam.	
Salem ...	1. Bangalore to Kelamangalam *viâ* Hosúr	35
	2. Suramangalam to Námakal	35
	3. Mórappúr to Pálakód *viâ* Dharmapuri	35
	4. Salem to Atúr	31
	5. Tirupatúr to Krishnagiri	26

(A true Copy and Extract.)

(Signed) E. GIBSON,
Acting Secretary.

(2.) G.O., dated 18th October 1882, Mis. No. 3438, Revenue.

Proceedings of the Board of Revenue, dated 2nd October 1882, No. 2414.

Read—the following letter from H. P. GORDON, Esq., Collector of Bellary, to the Secretary to the Board of Revenue, dated 19th September 1882, No. 3236 :—

With reference to Board's Proceedings, No. 2591, of 27th October 1881, I have the honor to report as follows :—

The tracts in this district to which tramways as protective works would specially apply are—

(1) The taluks of Harpanahalli, Hadagally, and Kúdligi with the portion of Hospet west of Sandúr.

(2) The tract lying south and south-south-east of Bellary and comprising the taluks of Ráyadrug and the Kalyándrúg Division of the Dharmavaram Taluk (now in Anantapur District) and some portions of Mysore territory as far as Madakasíra.

(3) The northern portions of the Bellary and Alúr Taluks.

2. The lines which, in my opinion, it would be desirable to carry out are, in order of importance (as regards this district)—

I. A line from the Mysore Frontier at Duggavati, south-south-west of Harpanahalli, *viâ* Harpanahalli, Ittigi, Naraindevakerra to Hospet, where it would join the Bellary-Marmagoa Railway (about 63 miles) with a branch from Ittigi to Kothur (Kúdligi), about 13 miles.

II. A line from Bellary to Kalyándrúg Anantapur) to be carried on *viâ* Cumbadur to Hindupur (both places in the Anantapur District), or should a line be extended from Gooty or Tadpatri to Anantapur and

Penukonda, then *viâ* Kundarpedrúg to Amarapuram in Madakasíra Taluk.

From Bellary to Kalyándrúg, I would prefer the direct road to that passing through the Kusbah town of Ráyadrug, because it is more direct and would be more convenient for the distribution of food to our population than the line *viâ* Ráyadrug which runs along the border of Mysore territory. The direct line is also that taken by through traffic in ordinary times between Hindupur and Bellary.

III. A line from Bellary to Siruguppa (due north 35 miles).

3. Line No. I should be made in connection with a line from Hurryhur (Mysore) to Duggavati. If the Mysore Government is not prepared to make such a line, I would not extend the line to the southwards beyond Harpanahalli.

4. There is no reliable information as to the traffic on any of these lines, and observations unless carried out with a special establishment for at least a year would not afford reliable data.

5. The local traffic on Line No. I is estimated at 100 bandies daily. An estimate, however, of local traffic on a road which carries a considerable quantity of through traffic must necessarily be very imperfect.

The trade returns for the three stations on the southern boundary of Harpanahalli for 12 months give the following results :—

Stations.		Maunds.	Value.	Number of Indian Maunds imported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
			Rs. A. P.		
Imports ...	Duggavati ...	29,457	1,92,004 15 8	2,454	204
	Mágalgiri ...	36,510	87,423 2 4	3,042	253
	Boodihall ...	1,755	3,943 11 0	146	12
	Total ...	67,722	2,83,371 13 0	5,642	469

Stations.		Maunds	Value.	Number of Indian Maunds exported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
			Rs. A. P.		
Exports ...	Duggavati ...	36,211	2,11,200 4 6	3,017	251
	Mágalgiri ...	194,406	94,705 3 4	16,200	1,350
	Boodihall ...	4,471	5,382 12 0	372	31
	Total ...	235,088	3,11,288 3 10	19,589	1,632
	Add Imports ...	67,722	2,83,371 13 0	5,642	469
	Grand Total ...	302,810	5,94,660 0 10	25,231	2,101

A considerable portion of the traffic entering and leaving at Boodihall probably passes to and from Kothur (the principal centre of trade in Kúdligi Taluk), but the mass of the traffic entering on the south of the taluk would probably take Line No. I.

6. *Line No. II.*—The traffic is estimated at thirty laden carts and thirty-six laden cattle daily.

7. The trade returns at Cumbadur and Kundarpedrúg for eight months give the following results. The routes through both these stations pass through Kallyandrúg :—

7. *Nellore.*—While indicating certain lines of tramway to pass through the western portion of the district into Cuddapah *viâ* Dornal, the Collector of Nellore records his opinion that only a small percentage of profit could be looked for upon the capital required. In a further letter he submits a proposal by the Local Fund Engineer for constructing what is called a "Wellington permanent-way" along the roads already in use.

1. Kottiapatam to Tirupati.
2. Iskapalle or Kistnapatam to Cuddapah District.

8. *Chingleput.*—The Collector of Chingleput, whilst admitting that in times of famine steam tramways would be of value, states his opinion that in ordinary times they would never be remunerative, and that, as regards Chingleput, they are certainly not needed, and he adds that he is confident that they would not pay in any district with which he is acquainted.

9. *North Arcot.*—The Collector of North Arcot proposes three lines—one from the Vellore (Kátpádi) Railway Station through Vellore to Arni and thence to Pólúr and Trinomalai; a second from Tirupati Railway Station to the town and thence to Damalcheruvu on the Northern Trunk Road; and a third from Vellore Station to Chittoor, to be prolonged eventually to join the Tirupati line at Damalcheruvu.

1. Vellore Railway Station to Pólúr.
2. Tirupati Railway Station to Damalcheruvu.
3. Vellore to Chittoor.

Mr. Whiteside speaks hopefully of the financial results which may be expected, and probably the lines from the Madras Railway Stations to the towns from which they derive their names may be expected to give a good return upon the outlay. For the rest it is impossible, in the absence of more complete statistics of traffic, to form any trustworthy estimate.

10. *South Arcot.*—The Collector of South Arcot proposes the construction of three lines in his district, with an aggregate length of upwards of 200 miles, and he would extend them into the neighbouring district of Salem. Mr. Cruickshank ventures no opinion upon the probable financial results to be looked for, having no sufficient data regarding traffic upon which to base calculations.

1. Mel-Kanam to Chengam.
2. Panruti to Chinna Salem.
3. Cuddalore to Tyága Drug.

11. *Coimbatore.*—The Collector of Coimbatore suggests two lines, viz., one from Pálghat through Polláchi to Dindigul and one from Erode to Satyamangalam *viâ* Bhaváni. In regard to the first of these, he states its advantages as follows:—"(1) It would give an impetus to the commercial development of the country in ordinary years as well as (2) in famine years, when the gain in time, in distance, and in the use of steam as against half-starved cattle, will act as an extra protection from famine, as also (3) the advantage of a line fed from both ends by the South Indian and Madras Railways and on the west ending in a coast district never yet touched by famine." And he adds that the passenger traffic in pilgrims to Madura and Rámesvaram will be large.

1. Pálghat to Dindigul.
2. Erode to Satyamangalam.

Regarding this proposal, it is observed that the matter has already been very fully discussed, but Mr. Stuart makes no reference to this fact, or to G.O., dated 8th August 1878, No. 750 R., in which the correspondence is printed.

12. *Madura.*—The Collector of Madura recites that three lines of tramway have been proposed in that district, and refers to former correspondence on the subject. He doubts whether any of these lines can be regarded as protective famine works, and says that during the last famine there was no difficulty in transporting grain.

1. Madura to Pámban.
2. Ammayanáyakanúr to Periyakulam.

G.Os., dated 4th December 1878, No. 1228 R., and 23rd February 1881, No. 177 R.

13. *Salem.*—Tha Collector of Salem proposes five lines in the order of importance noted in the margin, and gives rough estimates of the return upon outlay to be expected, but does not predict that they would be financially profitable.

1. Bangalore *viâ* Hosúr to Kelamangalam.
2. Suramangalam to Namákal.
3. Mórappúr to Pálakód *viâ* Dharmapuri.
4. Salem to Atúr.
5. Tirupatúr to Krishnagiri.

14. The general result of inquiry made appears to be this—that tramways, as protective works against famine, are chiefly required in poor and thinly-populated tracts of country, and consequently that, viewed as a commercial speculation, the profits to be looked for ordinarily must necessarily be in inverse ratio to the value of the lines in time of scarcity.

15. With a view to affording opportunity for the fair trial which Major Frazer considers necessary in India, the Board would select, from among the several lines enumerated in the appended list, one or two of the most promising in a financial aspect for the purpose of experiment. Among these, one of the most suitable appears undoubtedly to be a line from the Vellore (Kátpádi) Railway Station to the town; the traffic on this road is both heavy and continuous, and assuming that there would be no difficulty in carrying the rails over the Pálár bridge, a fair prospect opens of the work proving successful, both financially and otherwise. Next to this, the line from Tirupati station to the town of that name promises well, and might be taken up either simultaneously or at a later date; it would in all probability prove remunerative, as well as a great convenience to the crowds of pilgrims who visit the celebrated temple on Tirupati Hill.

16. So far as the famine zone is concerned, the Board are not prepared to recommend that any more lines should at present be undertaken; the experience obtained from the two works suggested will doubtless be of value, and will probably enable the Government to take further steps for developing tramway communication in the future.

17. But in districts which lie outside the area liable to be affected by famine, the Board believe that the construction of tramways would be both beneficial and remunerative. In this connexion they would refer to certain proposals made by their First Member, when Collector of Tanjore, recorded in G.O., dated 1st April 1878, No. 606, and to a more recent communication* relating to a similar scheme in Tinnevelly. Lately, too, Government have caused certain investigations to be made in Vizagapatam regarding a suggested line of railway from the coast to Raipore in the Central Provinces.† It is also possible that light steam tramways might be of service in connection with salt works, and a copy of these Proceedings will accordingly be furnished to the Commissioner of Salt Revenue in case he should be disposed to offer any suggestions on the subject, and they will also be forwarded to all Collectors for information, and with the intimation that the Board will be glad to receive any further observations or proposals which may be regarded as deserving consideration, either with reference to the subject generally or to definite schemes.

* Board's Proceedings, dated 4th September 1882, No. 2213.

† G.O., dated 16th Sept. 1881, No. 2294 W.

APPENDIX.

List of Tramways proposed.

Districts.		Miles.
Anantapur	1. From Tadpatri Railway Station *viâ* Anantapur, Dharmavaram, Penukonda to Hindupur	94
	1. Proddutur to Yerraguntla Railway Station	7
	2. Do. to Jammalamadugu	11
	3. Jammalamadugu to Minnuladinne	10
	4. Cuddapah to Vempalle	25
	5. Vempalle to Pulivendla	18
	6. Pulivendla to Tadpatri (Bellary)	46
Cuddapah	7. Tirupati to Ráyachóti	65
	8. Ráyachóti to Kadiri	42
	9. Do. to Madanapalle	43
	10. Badvél to Cumbum (Kurnool)	65
	11. Do. to Nandialampet	22
	12. Nandialampet to Maidkur	5
	13. Maidkur to Proddutur	12

and Kurnool. I need say no more to show that in this valley, the best part of the district, the canal has forestalled anything in the nature of an iron road.

5. The western section of our district consists of the taluks of Pattikonda and Rámallakót. The area of these two taluks is 2,000 square miles, the population 1,99,501. If we had a tramway in this part of the district, Kurnool would be the terminus; the line might take off from the line of rail either at Gooty or at Aspari. I speak subject to professional correction, but I venture to pronounce a line from Gooty to Kurnool impracticable. The line of road passes through 57 miles of our district: the gradients are very severe indeed for the first ten miles from Gooty, and for the rest of the way the line crosses basin after basin of the affluents of the Hindri river, and traverses the very poorest part of the district, closely flanked on the east by spurs of the Erramalais. The line from Aspari to Kurnool, 50 miles, is remarkably free from engineering difficulties. But it would be of exceedingly little use. Aspari is at the wrong side of the Guntakal junction for grain coming from Madras, and is in the midst of a treeless regada tract that is sure to have a bad eminence in any future famine in these districts as it had in the last famine; and the station is most unfortunately situated. A more unpromising site for a large depôt could not well be imagined. But, turning to the terminus of this line, which I take to be the only line that need for a moment be thought of, I fail to see that much would be gained by throwing large quantities of grain into Kurnool. We have, it is true, 20,500 people in the town itself. But apart from the fact that grain from Madras could with much greater advantage be brought to Kurnool itself, *viâ* Cuddapah, by the canal, it must be noted that as a centre of distribution for the district, Kurnool is about as badly situated as it could be. Nandyál, through which the canal passes, is centrally situated. Kurnool is in the north-west corner of the district: on political and military grounds it is the head-quarters of the district, but for no other reasons.

6. I happen to have had a very intimate personal acquaintance in the late famine with the question of cartage between Gooty and Kurnool; and I have now made inquiries among the merchants here. I think I am not wrong in saying that no grain was left at Gooty for any considerable length of time for want of cartage. Colonel Hicks and Messrs. Harvey and Sabapati and (earlier) Chithambaram Pillay seemed to be able to get as much cartage as they wanted. And I am quite certain that a very great deal of good was done by the large and sustained demand for carts and bullocks on this line. Owners of carts and bullocks came from all parts of this district and earned the keep of themselves and their animals. Village to village distribution from Kurnool, if we had had a tramway in those days, would have been a poor substitute for steady employment on 60 miles of road. As Sir Andrew Clarke said, a grass famine is nearly as bad as a grain famine. I would suggest that a grass famine is best met by early and sustained utilization, on a large scale, of the animal transport we find in the country at the beginning of the scarcity.

7. I do not think it would serve any good purpose to go further into this question. My opinion in brief is that as we shall possess the canal we need not entertain the idea of a tramway on the only practically feasible line, viz., from Aspari to Kurnool.

From the Collector of Madura, dated 23rd December 1881, No. 550.
" " Nellore, " 4th February 1882, " 527.
" " " " 12th April " " 24.
" " Salem, " 18th February " " 400.

Resolution—dated 7th September 1882, No. 2230.

By G.O., 17th August 1881, No. 2018 W., the Board were called upon to report, after communicating with such officers of the Revenue Department as they might

think fit to consult, upon the following points in connection with a proposal to introduce steam tramways into the Madras Presidency:—

(*a*) To what tracts tramways as protective works would specially apply.
(*b*) A rough estimate of the traffic returns in ordinary years.
(*c*) A general idea of the advantages which might result from the lines in famine years.
(*d*) Whether, and if so to what extent, applicable outside the famine zone.

2. Upon receipt of the Government Order, the Board referred for their opinions to the Collectors of the districts noted in the margin, who, with the exception of the Collector of Bellary, who has not yet reported, have communicated their views in the letters read above.

Bellary.	Nellore.	Coimbatore.
Anantapur.	Chingleput.	Madura.
Kurnool.	North Arcot.	Salem.
Cuddapah.	South Arcot.	

3. A list is appended of the several lines of tramway which those Collectors who are in favor of them would cause to be constructed. Information regarding traffic is afforded in certain cases, but it is for the most part incomplete and untrustworthy.

4. The following is the substance of the several replies received:—

Anantapur.—The Collector of Anantapur proposes that a line be laid running through the district north and south to connect the north-west line, Madras Railway, with the Mysore country, and eventually with Bangalore. Such a line would certainly carry all the traffic—by no means inconsiderable—which now passes along the old trunk road from Bangalore to Gooty, and would be of value during famine in the carriage of food-grain. The country through which the line would run is, however, comparatively poor and sparsely populated. As a financial speculation it is not likely that the undertaking would prove a success.

Tadpatri to Hindupur.

5. *Kurnool.*—The Collector of Kurnool (Mr. Glenny) is opposed to the introduction of steam tramways into his district, and maintains that the means of communication by road and canal are quite adequate to meet the requirements of any emergency. He considers that the only practically feasible line would be from Aspari Railway Station to Kurnool, and that such a line would be of little use. With a population of only 97 persons to the square mile, it is pretty certain that a tramway would not pay its way. As regards the value and the quantity of cartage available in time of famine, Mr. Glenny relates his own experience in 1877, and what he says will probably be borne out by every officer employed on famine duty in that neighbourhood at the time. Carriage for grain never failed, and thousands of bullocks, many of them doubtless set free from agricultural work, were kept throughout the season of drought in good working order. But in estimating the carrying power of the canal on such occassions, Mr. Glenny is over-sanguine. Water at such a time is necessarily scarce, and even in ordinary years the sluices at the anicut are opened to the Kistna on the 31st December, and as famine does not declare itself until November, when hope of the north-west monsoon is abandoned, it follows that carriage by canal would be possible for only two months before the worst period of scarcity, and during the hot months navigation would be impossible for want of water.

1. Proddutur to Yerraguntla.
2. Do. to Jammalamadugu.
3. Jammalamadugu to Minnuladinne.
4. Cuddapah to Vempalle.
5. Vempalle to Pulivendla.
6. Pulivendla to Tadpatri.
7. Tirupati to Rávachóti.
8. Rávachóti to Kadiri.
9. Do. to Madanapalle.
10. Badvél to Cumbum
11. Do. to Nandialampet.
12. Nandialampet to Maidkur.
13. Maidkur to Proddutur.

6. *Cuddapah.*—The Collector of Cuddapah explains that steam tramways would be of inestimable use in famine in a great part of the district, and forwards maps showing the several lines which he would suggest. He explains that the estimate of traffic which is given is of no great value, but it may be taken for granted that few, if any, of the lines suggested would be remunerative in ordinary years.

BUILDINGS AND ROADS.
CIVIL WORKS.

Govt. of {1883} Madras.

PUBLIC WORKS.

Dated December, 19th.

Encl.

Read.

G.O., 19th Dec. 1883, No. 3650 W.

DECEMBER.

Light Railways

Copy of despatch from the Secretary of State forwarded by the Government of India on proposals for the construction of — as protective works in certain tracts in the Madras Presidency, recorded.

(1.) READ—the following Proceedings of the Board of Revenue, dated 7th September 1882, No. 2230 :—

Read—again the following Proceedings of the Board of Revenue, dated 27th October 1881, No. 2501 :—

ABSTRACT.—Referring to certain Collectors, for report on the points indicated by the Chief Engineer, Government Order regarding the introduction of steam tramways in the Madras Presidency.

Read—also the following papers :—

From the Collector	of Anantapur,	dated	4th June	1882,	No.	45.
" "	of North Arcot,	"	24th January	"	"	27.
" "	of "	"	28th February	"	"	76.
" "	of South Arcot,	"	8th May	"	"	184.
" "	of Chingleput,	"	21st February	"	"	84.
" "	of Coimbatore,	"	9th January	"	"	9.
" "	of "	"	11th February	"	"	29.
" "	of Cuddapah,	"	9th "	"	"	56.
" "	of "	"	25th "	"	"	81.

From W. H. GLENNY, Esq., Collector of Kurnool, to the Secretary to the Board of Revenue, dated Kurnool, 13th December 1881, No. 567.

With reference to Board's Proceedings, No. 2,501 of 27th October 1881, I have the honor to say that, in my opinion, the idea of constructing in this district tramways as protective works against famine need not be seriously entertained.

2. I imagine that these works would be in their proper place in districts of short distances, open country, and dense population. None of these conditions exist here. We have on the average only about ninety-seven persons to the square mile. The average area of each of our eight taluks is between nine hundred and a thousand square miles. And our district is cut up longitudinally by hill-ranges into three tracts, of which the most eastern is separated from the other two by the formidable Nallamallai range which is crossed at present by only a single road practicable for cart-traffic: while the middle tract, the Kunderu valley, is on the west bounded by the Erramalais, which though they nowhere attain any considerable height, and are passable at several points, are sufficiently high and rugged to interpose a very serious barrier between the Kunderu valley and the western tract, which is the basin of the Hindri.

3. The trans-Nallamalai tract consists of the taluks of Cumbum and Markapur. Cumbum is 96½ miles from the Cuddapah Railway Station; and Markapur 16 miles north of Cumbum. The area of these two taluks is 1,900 square miles and their population 192,712. It does not seem necessary (even if I were in a position to offer a confident opinion) to touch upon the features of the line of road between Cuddapah and Cumbum from an engineering point of view. It seems sufficient to add that these outlying and isolated taluks of our district are in tolerably easy communication by road with the upland taluks of the Kistna District, and also with the seabord of the Nellore District, the distance from Cumbum to the port of Kottapatam being 65 miles.

4. Our middle tract, the valley of the Kunderu, the richest part of the district, is traversed from end to end by the Madras Irrigation Company's Canal. This canal maintains communication for eight months of the year between Cuddapah, Nandyál,

No. 1010 R.C.

Copy forwarded to the Finance and Commerce Department for information and such action as may be considered desirable, with reference to its No. 1266 of the 8th June 1883.

(Signed) H. F. HANCOCK, Colonel, R.E.,
Offg. Deputy Secretary.

ORDER—dated 19th December 1883, No. 3650 W., Public Works.

Recorded with reference to G.O., No. 3479 W., dated 4th December 1883.

(True Extract.)

Major, R.E.,
Under Secy. to Govt., P.W.D.

To the Consulting Engineer for Railways.
" Financial Department.

Exd. T. D. Ryan.
Spare Copies

1/3650

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Buildings and Roads
Civil Works.

READ—the following papers:—

Docket from the Officiating Under Secretary to the Government of India, Public Works Department, dated Fort William, 7th December 1883, No. 1050 R.C.

Forwarded to the Secretary to the Government of Madras, Public Works Department, for information in continuation of Public Works Department No. 364 R.C., dated 28th April 1883.

(By Order.)

(Signed) R. A. SARGEAUNT, Major, R.E.,
Offg. Under Secretary.

ENCLOSURE.

Despatch from the Secretary of State for India, to the Government of India, dated 11th October 1883, No. 122 Railway.

Your Excellency's Railway despatch, No. 102, dated the 7th of July last, transmits, for my information, copy of Proceedings of your Government in respect to a scheme submitted to you by the Government of Madras for construction of a system of light railways or trams on the two feet gauge as protective works in certain tracts of the Madras Presidency liable to famine, the necessary funds being provided by annual allotments from the Imperial Protective grant.

2. Your Government, while expressing approval of the principle of extending internal and local communications on the plan proposed, declines to apply, for that purpose, funds which are, in your opinion, more urgently required for main arterial lines designed to afford protection to larger and more exposed tracts of country. At the same time you suggested to the Madras Government that the necessary funds for operations might be obtained from Provincial resources, or through the agency of Local Boards, who, under suitable regulations, might borrow, direct, and construct the lines, or might enlist private capital for their construction by the offer of a guarantee of interest.

3. Your Excellency's Government possesses the best means of deciding in what manner and on what lines the funds at your disposal for protective purposes can most advantageously be expended, and, for the reasons you assign, I concur in your decision not to apply these funds at present to the prosecution of works which, as you say, "are essentially of a kind to be undertaken either directly by the Provincial Government itself or through the agency of Local Boards."

4. At the same time a cautious experiment in the construction of light lines, such as are proposed by the Madras Government, seems unobjectionable if funds for its prosecution can be provided from Provincial resources, or by the agency of Local Boards. There would, however, appear to be many reasons for doubting how far such a scheme could be practically carried out with success, and, in the absence of experience in its favor, the experiment should be made with every care and caution. Further attention should be given to the selection of the gauge, on which point I would refer your Excellency to paragraphs 5 and 6 of my Railway despatch, No. 10, of 25th January last.

5. Until there is more clear evidence that the project is one of a really practical nature, it seems premature to discuss the financial arrangements which might be suitable for giving it a general application, such as is contemplated by the Madras Government.

(1) Number of pages 78

(2) Date of repair 10-8-87

(3) Initials of the Referencer

TAMIL NADU ARCHIVES

GOVERNMENT OF TAMIL NADU

P.W. DEPARTMENT

G.O. No. / B.P. No.	3650.W	Press. / Mis.
Dated	19-12-1883	198 .

C&D

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Archives —I 10,006-9 88

Abstract of proposals made by the several Superintending Engineers, Madras Public Works Department, for the construction of light Railways, &c.—*cont.*

Districts.	Length in Miles.	Tramway or Railway Lines proposed.	Digest of reasons assigned very briefly.	Opinion of Writer as to whether they will pay or not in ordinary years.
10. NELLORE.				
COLONEL H. L. PRENDERGAST, R.E.				
From Kottapatam on the canal through Ongole to Cumbum in the Kurnool District.	76	Tramway ...	This line would supply the eastern taluks of Kurnool and complete the lines of protective works for that district.	Colonel Prendergast expresses no opinion as to whether these lines will prove remunerative, but Major Pennycuick considers that no such result can be looked for. The first two lines may yield a moderate return.
Do. Dumgarázpatnam to Gúdúr and Rápur.	48	Do. ...	This line would supply the taluks of Gúdúr and Rápúr and assist the Venkatagiri Zemindari.	
Do. Tummalapenta by Kávali and Kaligiri to Udayagiri.	53	Do. ...	If an intermediate line be required in Nellore it will be best taken on this route.	
Do. Kistnapatam to Nellore	16	Do. ...	The above three lines are all at some distance from the head-quarters of the district, and it may be considered necessary to take the tramway into Nellore.	
Total ...	193			
11. MADURA.				
COLONEL J. BEATTY, R.E.				
From Dindigul to Palni	36	Tramway ...	The Palni and Dindigul taluks suffered worst of all in the famine of 1877. In G.O., No. 750 R., dated 8th August 1878, the Government recognised the importance of connecting Dindigul with Pálghat by a line of railway, but stated that the question of construction must stand over.	The Collector is of opinion that this line would be useful, but neither so useful nor so likely to pay as the Periyakulam-Ammayanáyakanúr project.
Do. Palni to Pálghat eventually extended.	74	Steam Tramway.		
Do. Madura to Pámban *viâ* Ramnad ...	91	Do. ...	The desirableness of constructing a railway on this line has been under the consideration of Government, and the last order on the subject is G.O., 177 R., dated 23rd February 1882. The Ramnad Zemindari suffered very severely in the famine of 1877.	The Collector thinks that this line will not pay, the country being poor and thinly populated, with little trade.
From Ammayanáyakanur to Cumbum *viâ* Periyakulam.	61	Do. ...	The Local Fund Board of the Dindigul Circle have referred to Government the question of opening a tramway on this route, but as the Cumbum valley suffered least in the famine, the Superintending Engineer places the project last in order of importance as a protective work.	The Collector considers this line would prove remunerative and useful in times of dearth.
	262			
12. CHINGLEPUT.				
COLONEL H. L. PRENDERGAST, R.E.				
From Pulicat to Tiruvallúr on the line of the Madras Railway.	32	Railway ...	Tramways are not required in this district, through which the Madras Railway runs to the west, the South Indian Railway to the south, with the Chingleput-Arkónam branch, and the Buckingham Canal along the coast. If Government are prepared to undertake such works merely as a means of facilitating communication in times of famine, regardless of other considerations, then the lines mentioned would be desirable as linking the railways and the canal and making the Presidency town a centre of distribution.	The lines would be a very losing concern in all ordinary times, and would not be of such use in periods of scarcity as to render it wise to incur the expense of their construction.
Do. Cheyaur to Madurántakam on the main line of South Indian Railway with a continuation to Utremerur.	21	Do. ...		
Total ...	53			

ABSTRACT OF PROPOSALS.

	MILES.		MILES.
Vizagapatam	143	Cuddapah	127
Ganjam	60	Nellore	193
North Arcot	91	Madura	262
South Arcot	176	Chingleput	53
Salem	123		
Coimbatore	150	Total ..	1,719½ miles either of Tramway or Railway.
Bellary	183		
Kurnool	158½		

Abstract of proposals made by the several Superintending Engineers, Madras Public Works Department, for the construction of light Railways, &c.—*cont.*

Districts.	Length in Miles.	Tramway or Railway Lines proposed.	Digest of reasons assigned very briefly.	Opinion of Writer as to whether they will pay or not in ordinary years.
4. SOUTH ARCOT.				
LIEUT.-COLONEL H. R. MEAD, R.E.				
From Arsikarad on to Pólúr and Tiruvannámalai.	38	Railway ...	This district has the Madras Railway passing through it from east to west and also the North-west Line on its eastern boundary. The southern and north-western tracts might with advantage be opened out.	Some return might be expected in ordinary times.
COLONEL H. L. PRENDERGAST, R.E.				
From Porto-Novo to Vriddháchalam ...	30	Tramway ...	To open up the taluks of Tiruvannámalai, Tirukoilúr, Vriddháchalam and Kallakurchi in which the famine was most severely felt.	No opinion expressed.
Do. Vriddháchalam to Tallavasel ...	39	Do.		
Do. Tallavasel to Chinna Salem and on to Kallakurchi.	18	Do.		
Do. Pauruti to Tirukoilúr and on to Tiruvannámalai.	51	Do.		
Total ...	176			
5. SALEM.				
LIEUT.-COLONEL H. R. MEAD, R.E.				
From Bangalore to Hosúr	27	Do.	These tracts suffered severely during the famine and are not reached by the railway.	Do.
Do. Mórappúr Station on the Madras line to Pálakód.	28	Do.		
Do. Salem to Námakal	38	Do.		
Do. Salem down to Atúr valley ...	30	Do.		
Total ...	123			
6. COIMBATORE.				
LIEUT.-COLONEL H. R. MEAD, R.E.				
From Pálghat Station to Dindigul ...	110	Rail or tramway.	This line would open the country that suffered so much during the last famine.	Might perhaps give some return.
Do. Erode to Satyamangalam.	40	Do.	For the protection of the northern portion of the district.	Country thickly populated.
Total ...	150			

7. BELLARY.				
COLONEL H. L. PRENDERGAST, R.E.				
From Hospet through Harpanahalli to Hurrihur in Mysore.	73	Tramway ...	The Bellary-Hubli Railway will cross the Tungabhadra near Hospet. The latter is therefore the point of departure for a tramway for the advantage of the Hadagalli, Harpanahalli and Kudligi taluks.	Colonel Prendergast expresses no opinion as to whether these lines will prove remunerative, but Major Pennycuick considers that no such result can be looked for. The first two lines may yield a moderate return.
Do. Tadpatri through Anantapur to Penakonda.	75	Do.	The main road between Hyderabad and Bangalore passes through Gooty, but there is a cross road from the Tadpatri station to Anantapur by which the crossing of the Pennér is avoided.	
Do. Bellary southward through Hirihal on the Bangalore road through the Mysore territory.	35	Do.	The extension of this line into Mysore territory will give assistance to the Kudligi taluk on the west and to the Raidrug, Anantapur, and Dharmavarum taluks on the east.	
Total ...	183			
8. KURNOOL.				
COLONEL H. L. PRENDERGAST, R.E.				
From Gooty through Pyápali to Kurnool.	71½	Do.	These two lines would throw supplies into the centre and southern part of Kurnool as well as the northern part of the Cuddapah district.	
Do. Pyápali through Banganapalli to Nandyál.	45	Do.		
Do. Kurnool eastward to Atmakúr on the road to Guntúr.	42	Do.	This would provide for the northern part of the district.	
Total ...	158½			
9. CUDDAPAH.				
COLONEL H. L. PRENDERGAST, R.E.				
From Madanapalle through Gurrumkonda to Ráyachóti.	43	Do. ...	No part of the Cuddapah District is far from the railway in a direct line, but the hills and the drop from the Mysore plateau prevent access being obtained laterally to the borders of the district. There are roads along the lines indicated and tramways aloug them would bring supplies to the high taluks.	
Do. Madanapalle to Kadiri	50	Do. ...		
Do. Pilér to Ráyachóti	34	Do.	In the event of a tramway being laid from Vellore to Chittoor and thence on the road to Cuddapah to Peelair, the prolongation of the line to Ráyachóti would be carried out with advantage.	
Total ...	127			

Stations.		Maunds.	Value.	Number of Indian Maunds imported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
			Rs. A. P.		
Imports ...	Kundarpedrúg ...	1,732	8,650 4 0	216	18
	Cumbadur ...	2,771	9,502 12 11	346	28
Total ...		4,503	18,153 0 11	562	46

Stations.		Maunds.	Value.	Number of Indian Maunds imported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
			Rs. A. P.		
Exports ...	Kundarpedrúg ...	21,968	4,369 14 0	2,746	229
	Cumbadur ...	13,425	22,303 5 6	1,678	139
Total ...		35,393	26,673 3 6	4,424	367
Add Imports ...		4,503	18,153 0 11	562	46
Grand Total ...		39,896	44,826 4 1	4,986	413

8. *Line No. III.*—The average traffic is estimated at about fifteen carts daily. The trade returns at Sirugúppa show the following results for twelve months :—

Stations.		Maunds.	Value.	Number of Indian Maunds imported or exported Monthly.	Number of Bandies at 12 Maunds for a Bandy-load.
			Rs. A. P.		
Imports	Sirugúppa ...	23,293	1,36,033 0 0	1,941	162
Exports	...	13,542	44,438 8 0	1,128	94
Total, Imports and Exports ...		36,835	1,80,471 8 0	3,069	256

9. The principal advantage of these lines in famine years would be the power of rapid distribution of food-grains.

10. All three lines pass through and render accessible tracts of country which are almost entirely dependent upon local rainfall.

11. In ordinary times they would do much to develop agriculture by opening up markets to the ryots.

Resolution—dated 2nd October 1882, No. 2414.

Submitted to Government in continuation of Board's Proceedings, dated 7th September 1882, No. 2290.

(A true Copy and Extract.)

(Signed) F. GIBSON,
Acting Secretary.

Order—dated 16th October 1882, Mis. No. 3438, Revenue.

Transferred to the Public Works Department.

(Signed) E. F. WEBSTER,
Secretary to Government.

(3.) Abstract of proposals made by the several Superintending Engineers, Madras Public Works Department, for the construction of light Railways or Tramways for famine purposes in their circles.

Districts.	Length in Miles.	Tramway or Railway Lines proposed.	Digest of reasons assigned very briefly.	Opinion of Writer as to whether they will pay or not in ordinary years.
1. VIZAGAPATAM.				
Mr. G. T. Walch.				
From Bimlipatam to Párvatipur ...	75	Tramway ...	Would at all times be useful works, and in case of famine in the district would be most valuable as grain distributaries. No special engineering difficulties in the way of their construction.	Both lines would doubtless give appreciable return, especially the first.
Do. Calingapatam, *vid* Chicacole, to Párvatipur.	68	Do. ...		
Total ...	143			
2. GANJAM.				
Mr. G. T. Walch.				
From port of Gopálpur, *vid* Berhampore and Aska, to Russellkonda.	60	Do. ...	Would be useful at all times, and as a famine protective work. No special engineering difficulties.	Not likely to prove remunerative from direct returns.
Total ...	60			
3. NORTH ARCOT.				
Lieut.-Colonel H. R. Mead, R.E.				
From Vellore Railway Station through Vellore and Arni.	30	Railway ...	This district has the Madras Railway passing through it from east to west and also the North-west Line on its eastern boundary. The southern and north-western tracts might with advantage be opened out.	Some return might be expected in ordinary times.
From Vellore Railway Station to Chittoor.	22	Do. ...	Do. do.	The short length of 6 miles would almost pay during feasts, &c., but beyond this the country is poor and thinly populated.
Do. Tirupati Station to the town of Lower Tirupati.	6	Do. ...		
Do. Tirupati Station through Chandragiri to Damalcheru.	33	Do. ...		
Total ...	91			