

MADRAS RECORD OFFICE.

Government of Madras.

Revenue DEPARTMENT.

G.O. No. 1475	Press ~~Mis.~~
83.84	
Dated	8. 8. 19 1863

Not to be folded or roughly handled

*Proceedings of the Madras Government, Revenue Department,
8th August 1863.*

No. 83. Read the following Proceedings of the Madras Government in the Financial
Railway Department :—

Passing orders on Lieutenant-Colonel J. Ouchterlony's } (Here enter 16th May 1863, No. 221.)
report on the Neilgherry Tramway Project.

No. 84. ORDER THEREON, 8th August 1863, No. 1,475.
Communicated to the Board of Revenue for information.
(True Extract.)

Deputy Secretary to Government.

To the Board of Revenue with Proceedings Financial Railway Department, No. 221.

Exd. S. T. Augustin.

FINANCIAL RAILWAY DEPARTMENT.
PROCEEDINGS OF THE MADRAS GOVERNMENT.

Read the following letter from Lieutenant Colonel J. OUCHTERLONY, R. E., Deputy Chief Engineer, Southern Circle; to Colonel W. I. BIRDWOOD, R. E., Secretary to Government, Department Public Works, dated Ootacamund, 19th March 1863, No. 504.

Public.

I have the honor to report for the information of Government that I have again examined the Coonoor valley in company with Mr. Fraser, and have arranged the course of operations which are to be undertaken by that gentleman in connection with the Neilgherry Tramway project, on the completion of the duty which just now appears to demand his presence at Madras.

Enclosure 1.

1 Letter from Mr. Sanderson, dated 21st February 1863.

2. Before proceeding to specify the instructions which I have given to Mr. Fraser for his guidance, I will offer some explanation upon the question raised in paragraphs 2 and 3 of the Order of Government in the Financial Railway Department, No. 66, under date 3rd February 1863, as to the "important change in my original project as described in my letter, dated 26th November last," which Government deem involved by the proposed introduction of water engines for traction up the steep inclines to be formed above Burliar.

3. I beg to submit that in paragraph 12 of the letter* alluded to, I made special mention of these agents in the following terms.
* No. 327, dated 26th November 1862.

"I am sanguine of being able to turn to highly profitable account for propelling trains the magnificent water power which now falls wastefully in cataracts down the Coonoor pass, if the inclined Tramway should be established;" and I referred to the practice prevailing in Europe of raising minerals, &c., up to steep inclines by the agency of water wheels in support of my expectations of success.

4. The advantages to be gained by introducing this system of traction on the Neilgherry Tramway are, firstly, great economy in working the line by substituting for steam engines a machine which is fed by a costless element; which can be worked with ease by an intelligent but unskilled laborer; which involves no charge for wear and tear, (beyond that due to the wear of the rope) which would be appreciable for many years. The second advantage is safety. If the ropes are properly tested before use, and if their wear is carefully watched, no accident in the ascent or descent of trains can, humanly speaking, happen. On easy gradients such as I hope can be established above and below what I may term the water power inclines, trains light as our descending ones will probably no doubt be easily and safely taken down by powerful breaks on each truck or carriage; but where, as I indicated in my letter No. 420, steep inclines are introduced, this system could not be resorted to; and traction by a stationary engine of some description becomes indispensable.

5. The importance of studying the employment of water on lines carried amongst rugged mountain chains has of late years been much dwelt upon; and the attention of Engineers was prominently drawn to it in a very valuable paper on the subject of traction on Railway inclines read by Mr. Drysdale, C. E., on the 8th April 1856, in the presence of the most eminent

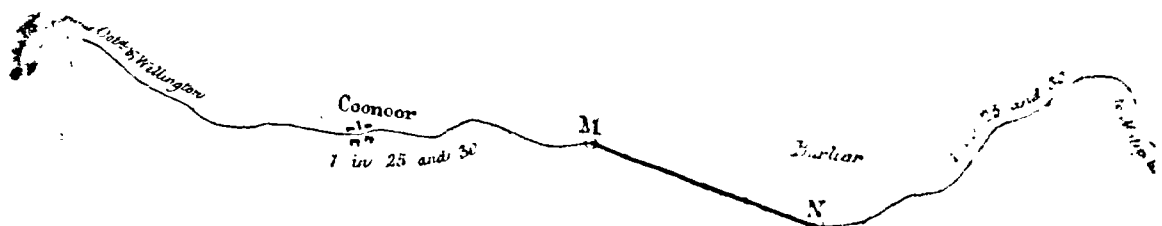
members of the Civil Engineers' Institute, such as Messrs. Robert Stephenson, Brunel, Hawkshaw, Bignoles, Fairbairn, Captain Monsom, &c. &c., by whom the question in all its bearings was on that, and on the occasion of the next meeting of the Association, discussed with animation. Amongst other conclusions arrived at was the following, that "where mountain chains had to be passed it was desirable to consider the application of the rope traction as a matter of economy both in construction and working;" and that "one advantage in the use of ropes for steep inclines in such localities was that the water power of the district, generally ample in mountainous countries, might be used as an auxiliary." A comparison is given in the interesting paper alluded to between the cost of traction by locomotives, and that by a wire rope worked by a stationary steam engine on the Glasgow and Edinburgh incline, $1\frac{1}{4}$ miles in length, and with a gradient as low as 1 in 42; and even in this unfavorable case the result of two years' experience showed that the cost of locomotive was nearly 7 times that of the stationary engine. And at the close of their proceedings the Association deduce from the facts elicited during the discussion that "in the ascent of long alpine gradients of 10 or 12 miles, where ropes 6 miles in length might be used, the employment of stationary engines would admit of the adoption of gra-

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 "dients of 1 in 25, or even 1 in 20; in which case enormous expense in viaducts, &c. would be avoided."

6. From these arguments, from the absolute costlessness of working the water wheels which will become our "stationary engine," and from the circumstance that no single plane of the Coonoor valley steep inclines is likely to be longer than a mile, Government will be able to judge what a vast saving must be effected by the introduction of the mode of traction suggested in my former letters. It would be my aim to lay out all the inclines so worked, in right lines, or in curves of very long radius, so as to reduce as much as possible the severe friction of the rope against the tangent guide rollers, shown in diagram accompanying my letter, No. 483, dated 21st February 1863. But even where a considerable amount of friction on this account had to be encountered, I should feel confident that with the abundance of water power at command, it would form no bar to the successful working of the portion of the line affected.

7. I will now proceed to detail the plan of preliminary operations which I have in communication with Mr. Fraser arranged: it is as follows:—

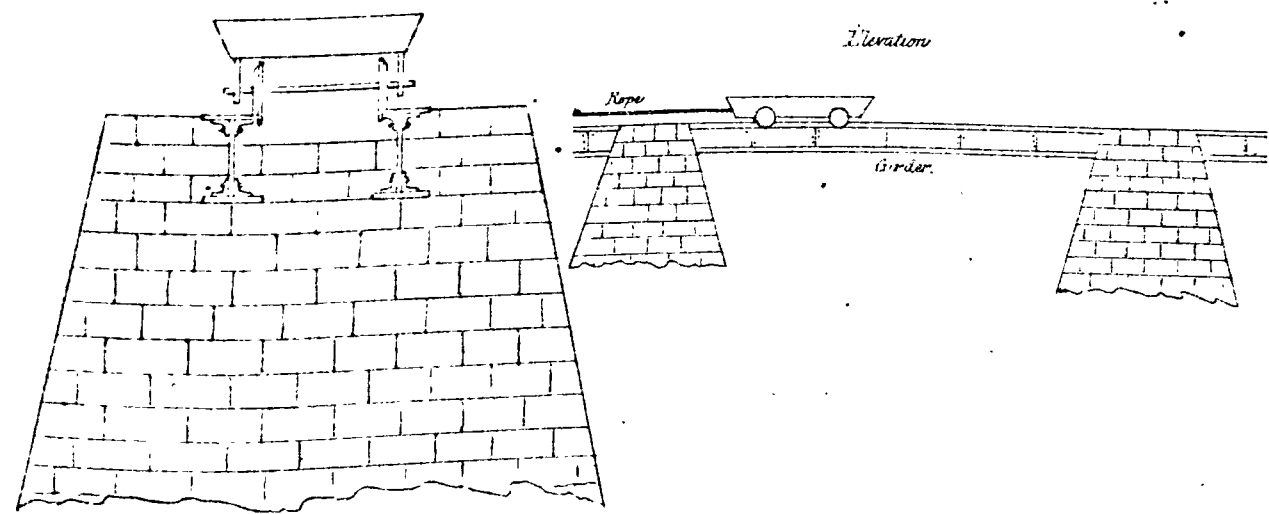
First.—To trace a prolongation of the existing cart road from Ootacamund through Wellington and Coonoor at its present easy gradient, or improving it as circumstances permit to 1 in 30, onwards beyond Coonoor bridge, as far as the features of the country will permit, which will apparently be for about 3 miles. Then to commence at Matepolliem bridge tracing a line to strike the base of the Neilgherry slopes at a point near the foot of the Kotergherry Ghaut, and thence to carry it upwards in the direction of Burliar, preserving a general gradient of 1 in 25, with occasional level, or slightly reversed platforms to check the velocity of descending trains, until a point is reached beyond which it is found, or deemed impracticable to advance it. The two points thus defined (marked M and N in the accompanying diagram) are then to be connected by one great constructed incline, divided into series of varying length and gradient according to the circumstances and physical character of the intervening ground. Level platforms for landing the trains are to be established at the summit of each incline, 100 yards or so in length: the water wheels being hung at the inner, or base extremity.



It is conjectured by Mr. Fraser that the distance M N will not exceed 3 miles; my own impression is that it will prove to be less, but even at this estimation the project wears a most favorable aspect, because within these limits are circumscribed all the real Engineering difficulties, and sources of expenditure. The formation of a Tram line from Coonoor bridge to M, or the upper line, and from Matepolliem bridge to N, on the lower, will be a comparatively easy and economical work, the cost of which may, after the trace is completed, be readily estimated. But with the section included between M and N, the case will be different; and it will require skill, experience and boldness such as, fortunately, Mr. Fraser possesses, so to explore it as to admit of the project being properly elaborated at this point and of adequate designs and estimates being framed. In constructing this great incline with due regard to economy both of capital and of time I count much as I have remarked in previous correspondence,* on the introduction of iron girders resting on masonry piers for forming viaducts to span most of the rugged gullies which occur above Burliar. Stone is abundant, and lime near at hand; the girders could be rivetted together at Matepolliem and sent along the completed line to the site of the work, where with the help of proper tackle and appliances, they could be laid in position with ease. Also if in fixing them on the piers the standard gauge is preserved, and if an extra thickness is given to the angle iron rivetted on the inside of

* No. 432, dated 30th January 1863, paragraph 6.

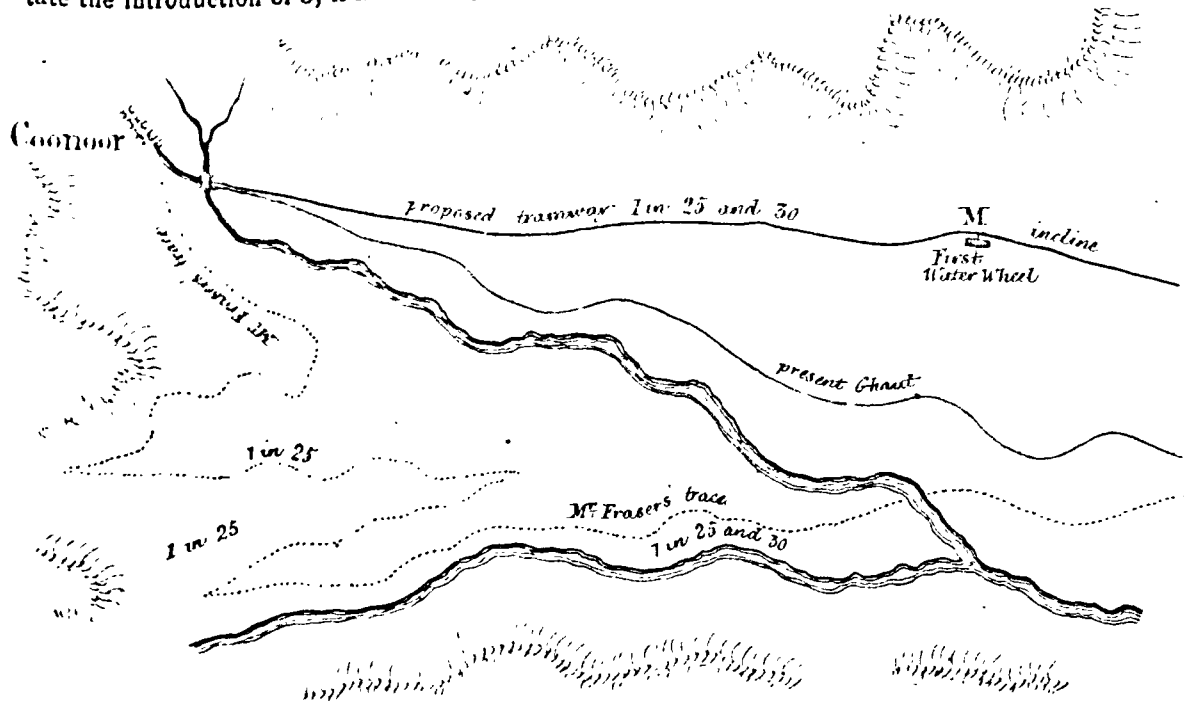
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 a web under the top flange the wheels of the trucks might run on the surface, and the girders themselves would represent, and save the necessity of rails.

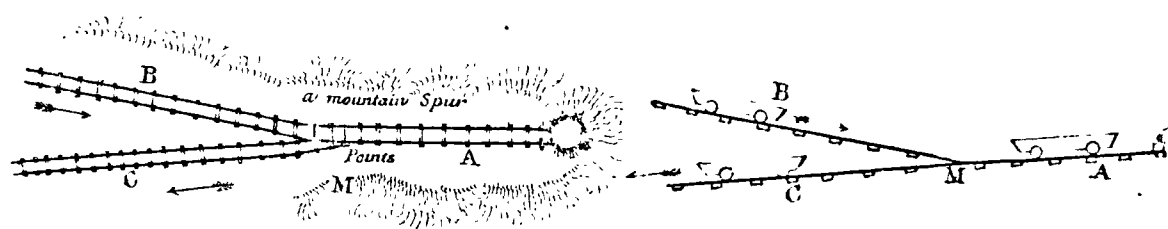


Assuming that the gauge of the Tramway will not exceed 4 feet, I assign a clear width of 12 feet for all the comparatively easy soil portions of the upper and lower 1 in 25 lines, reducing this dimension to 10 feet where high revetments or rock blasting are required.

8. Such is the outline of the project as now detailed for Mr. Fraser's investigation and report. But I have now to add that this gentleman who possesses a very intimate knowledge of the Coonoor valley owing to the circumstance of his having not many years ago carried a trace down it for a new road with a gradient of 1 in 25, suggests an improvement upon it as follows. Keeping on the south side of the ravine, he proposes to follow from Coonoor bridge the trace alluded to (shown by a dotted line on the diagram), which finds its way through the sharp spurs of the Hoodicul ridge; to cross the main stream of the valley at a favorable spot, and finally to attain a point for the commencement of the water power inclines which shall have considerably less elevation than M from which according to the preceding programme the series would begin to descend.

9. I have looked at the ground, and I confess I object to the alteration, first, because it will add very considerably to the length of the entire line, and secondly, because it will necessitate the introduction of 3, if not 4 sharp zigzags on it.





I was informed that on the Bhore Ghaut "reversing station" a mound of earth is to be thrown up at the extremity Z; but though this may stop trains from going over the precipice beyond it under accelerated speed, it could not prevent all the carriages or trucks composing it from being crushed to pieces against the arrested engine and tender. Where the inclines B and C are marked in the plan this system might be very advantageously adopted to save the expense of cutting the road over deep ravines as it would admit of the inclines being carried along the face of the gully, a water wheel being established at the gorge to work the lower plane, C, and if circumstances prove suitable this arrangement will be introduced in laying out the inclines between M and N.*

10. Although, as I have remarked, I prefer my own line on the north side of the Coonoor valley to Mr. Fraser's on the south, I have far too high an opinion of that gentleman's professional judgment to desire to adhere pertinaciously to my own, and I have therefore requested him after completing plan, sections, and estimates for the work according to my view, to prepare a similar exposition of the scheme framed after the design which he is disposed to suggest for adoption; and Government will then be able to judge which is the most expedient.

11. Before concluding this letter I think it right to make allusion to a communication† of very considerable interest with which I have been favored by Mr. Charles Sanderson, C. E., late Chief Engineer of the Bombay and Baroda Railways, upon the subject of the projected Neilgherry Tramway; which has I believe already been laid before Government through the Collector of the District. Coming from the pen of one whose speciality is Railroad engineering, and who is therefore in every way more competent to the task of details pertaining to that science than myself, it is with considerable diffidence that I venture to argue in opposition to the views which it sets forth. But at the same time as the expression of some of these may have a tendency to induce doubt as to the feasibility of the original scheme, I feel constrained to submit a few remarks in the hope of countervailing it.

12. One of Mr. Sanderson's leading arguments is in condemnation of Tramways in substitution for Railways of the standard gauge. A break of gauge is, I think with Mr. Sanderson, very inexpedient under many circumstances; as for example when a branch forms a loop connecting two points on permanent Railways; but in cases where, as in the Coonoor and Ootacamund line, a rugged and difficult country has to be traversed chiefly by means of costly works in masonry and iron, the saving in expense is so great in every way, whether in capital outlay or in maintenance of way and rolling stock, that I certainly cannot see sufficient reason for rejecting Tram gauges. In the Neilgherry line, about 54 miles long, there

13. Mr. Sanderson next objects to the Coonoor valley line as being too steep and one which he proposes by the Sundabetta Ghaut, branching off from the Coimbatore and Matepolliem road at Goodaloor and serpentine among the spurs, which project from Ooshe-mulley, crossing the Bhowany above Nellatorey, and gaining the summit of the Neilgherries near Sundabetta by an incline. I am acquainted with the country which this line would traverse, having surveyed it all about ten years ago, and I feel confident that a Tramway established upon its trace would cost much more than one by the Coonoor valley, and that it would be far less safe and less economical to work. It would moreover serve no other purpose than to bring Ootacamund in communication by Rail with Coimbatore; whereas the rival line takes in the important stations of Wellington and Coonoor, (the former a paramount consideration with Government) besides Matepolliem, now an extensive emporium to which market produce powers in large quantities from the grazing and dry grain lands of the valley of the Bhowany eastward, and of the plateau of north Coimbatore above Sattimungalum. The consideration of favoring half a dozen Coffee plantations in the Mailoor valley, the full produce of which will hardly, I imagine, exceed a few hundred tons, cannot be held as of any weight in comparison with the advantage of intercepting feeders so important as those which come in from the eastward all along the line from Goodaloor to Matepolliem. Mr. Sanderson however evidently does not adopt this view; and in paragraph 11, he even suggests that if the formation of the line on the table land between Mailoor and Ootacamund were found too expensive, the prolongation of the Tramway might be abandoned, and a common cart road substituted. Another objection to the Sundabetta line, according to my views, is the absence of water to move stationary engines for drawing up and down steep inclines which does not necessarily follow. I hope and trust they will prove to be objects to my estimates as too high, after examination of the line has not

14. Mr. Sanderson objects to my estimates as too high, I hope and trust they are not so; but at the same time I am bound to confess that after examination of the line has not shaken my conviction that it would be wrong to induce a Company to expect that the entire project could be carried out for a less sum than that at which I originally estimated it, viz., 20 lakhs of Rupees, with a reserve of 5 lakhs to meet all contingencies. Mr. Sanderson's estimate of Rupees 20,000 per mile for the low country portion is clearly far too low, even for my four feet gauge 36 lbs. light Tram rails; and hence it seems impossible that it could suffice for the 56 lbs. broad gauge rails which that gentleman proposes to use. Again Rupees 30,000 a mile for the Ghaut incline is in my opinion utterly inadequate; being no more than is allowed for the line on the comparatively level plateau, between Sundabetta and Ootacamund.

15. Mr. Sanderson's views on the subject are as follows:—The lower portion of the line steam will no doubt receive with great respect. On the summit, or upper portion of the line steam which is to be obtained more economical than animal power if it can be generated by wood fuel which is to be obtained on the spot; whereas the grain food of the cattle must be carried up by the rail for their support. It would also be safer because of the great breaking power exerted by a locomotive with a heavy load bearing upon the driving wheels, in taking trains down the inclines. On the low country portion of the line it will remain an open question—to be decided only by actual trial—which motive power is best.

The following statement that "experience has shown that all rope traction for Railway small radii," is not borne out by the

16. Mr. Sanderson's assertion that "experience has shown that all rope traction for Railway traffic is too expensive to work; and especially on curves of small radii;" is not borne out by the extracts given in a preceding paragraph† of this letter from Vol. XV, p. 349, et seq., of the proceedings of the Civil Engineers' Institute. That the friction of a wire rope against the pivot guide rollers in curved inclines would be considerable is true; but it would vary inversely at a high ratio, with the radius of curvature; and as I hope our curves on the Coonoor steep inclines, will be favored in this respect, and as I feel sure we shall always have abundance of water power at command, the tractive power due to resistance on this account can be readily supplied, in excess of that required for moving the trains.

17. Assuming radius of curvature 7,000 feet, length of incline 4,000 feet, gradient 1 in 12, and weight of rope 4 tons, a stationary engine working up to 275 horse power would be able to raise a train of 50 tons at a speed of 4 miles an hour by a rope, overcoming all resistance due to friction. To move a water wheel of this power an amply sufficient supply exists even at this the driest season of the year; and I apprehend that Mr. Sanderson has been led to doubt this by estimating only the quantity which flows through the Coonoor opening, overlooking or not noting the fact that at a short distance below, affluents come in to swell the stream at every 3 or 400 yards. Mr. Sanderson has also I conclude not borne in mind that by throwing dams across the vallies through which the main streams from Jakatalla and Aravangkaad flow, and by taking care that water was not allowed to escape below a fixed level except when feeding the incline engines, the present supply could be trebled by the quantity which would be garnered up during the night, and when the water wheels were at rest. The stream would of course descend intact by a leet from wheel to wheel, and nothing would be lost.

18. The question raised by Mr. Sanderson of the absolute necessity of employing locomotives having powerful adhesion to the rails, to break trains down inclines, is a very important one. On the Bhore Ghaut to secure the utmost attainable grip both for ascent and descent, engines are being fitted up of the great weight of 37 tons, though the average gradient is 1 in 40. On the upper and lower, or 1 in 25 and 30 portions of the Coonoor incline, waggons can descend by their own gravity; and since high speed can never, or very rarely, be requisite we could afford to break every passenger carriage and goods truck down singly, by their own breaks, if this practice were considered necessary, or advisable. Rather than incur any risk in this respect, I would even prefer to have wire ropes attached to drums at fixed stations to let the passenger trains down by, to give security extra to that of the breaks: the drums to have powerful breaks attached to them, and small water wheels hung on their axles to wind the rope on. For down goods traffic, as it must for some years necessarily bear but a small proportion of the ascending traffic, such a precaution would hardly be necessary; but it could be resorted to without causing any delay.

19. I beg leave to add in concluding my replies to Mr. Sanderson's strictures, that I have had the pleasure of communicating on the subject personally with that gentleman, and that I find him to be a warm advocate of the project of a Tram, or Railway up the Neilgherries by which ever line it is found best to bring it. So confident is he of its being a remunerative undertaking, that he has already reported warmly in its favor as an investment to Sir Morton Petc and other Engineer Capitalists in England. Here and in Coimbatore the community are greatly interested and excited regarding it; and parties have already, under the impression that a special Association is to be formed for carrying it out, made application for shares. If both the Tramway and Branch Railway Companies should decline the scheme, I should not despair of inducing the Madras Railway Company to take it up under a separate deed of Association, as is proposed in the case of the Southern of India Company and the Combaconum branch, for there can be no doubt that the establishment of the rail as far as Ootacamund would give an impetus to trade and to building there, which must bring a vast increase of traffic to the main line. Already I am informed that, contingent on the success of the Tramway scheme, a Company is projected for the erection and administration of family Hotels, upon an extended scale and upon the European system; supplying a want grievously felt by the yearly increasing community of visitors, and encouraging resort to these valuable Hills not only by residents of India in search of health, but by Capitalists from England in quest of remunerative investments in land and agriculture.

20. There is another point connected with the general subject which would wish I to advert to. Should this important undertaking be carried out—and I feel sure it is only a question of time—the consumption of wood for fuel, if locomotives are run on the upper line, will be very great; and the existing supply will very soon be exhausted. Land ought therefore to be enclosed and planted with quick growing trees, like the Australian Gum tree or Acacia, in convenient situations, simultaneously with the commencement of operation for constructing the Tramway and it hence becomes a matter for consideration whether, looking to the great public utility of the work to all interests concerned, public as well as private, a reservation in the allotting of land so situated, should not be enjoined until at all events the prospects of the embryo undertaking

are more clearly defined, and the same with regard to land for a Terminal Station at Ootacamund, which I learn from Mr. Grant the Collector, is still available at "Charing Cross," a very suitable position, in the possession of Government. The neighbourhood of the market place would of course be the best site, but unfortunately every acre of land around it has, under a former administration, been allotted to private parties.

21. The "Australian tree" as it is called (acacia lophanta is I believe the generic name) would also, I may remark, yield excellent Railway sleepers if felled at the age of 10 or 11 years, and if the slabs are "kyanized" or creosoted, and hence plantations of this valuable timber will become of the greatest importance to the Tramway Company. A resident of this place has lately shown me some fine slabs sawn from a log of this timber of only 15 or 16 years growth. The quality of the wood is tough and hard, the grain close and firm, and there is not a heart-shake visible throughout the entire length. This tree which in past years required very careful tending after planting art, has now become completely acclimatized, and springs up from the seed like other indigenous products of the soil.

Referred to the Financial Railway Department.

(Signed) W. I. BIRDWOOD, Colonel, R. E.,
Secretary to Government, P. W. D.

1st April 1863.

ORDER THEREON, 16th May 1863, No. 221.

In their Proceedings of the 16th January last, No. 29, the Government sanctioned the cutting of a trace up the slopes of the southern face of the Neilgherry Plateau to the bridge at Coonoor, at a cost not exceeding Rupees 70 a mile. It was at the same time pointed out that Lieutenant Traill could not be spared for the work, and that an Officer must be appointed to it specially. Mr. Fraser was selected for the duty; but subsequently, on it appearing from Colonel Ouchterlony's letter of the 21st January, that he contemplated a material change in the line of the Tramway,

Government were constrained to direct, that before expenditure was incurred in making the trace, a full and complete explanation should be furnished as to the necessity of the change and its probable effect on the estimated cost of the Tramway.

2. It appears from the letter above recorded that Lieutenant Colonel Ouchterlony, from the first, contemplated the use of water power. No explanation, however, is given as to the change in the line which is shown in paragraphs 7 and 9.

3. Under present circumstances, His Excellency in Council resolves to refer the project to Lieutenant Colonel Walker, who has succeeded the late Lieutenant Colonel Ouchterlony as Superintending Engineer of the Seventh Division, and to direct him to examine the various lines which have been suggested including that up the Meyloor Ghaut in company with Mr. Fraser, as soon as Mr. Fraser may be available for the duty.

4. Meanwhile, the Collector will be instructed to sell no more land in, or near the valley of the Coonoor Ghaut, above Kullaur, and to arrange with the Conservator of Forests for planting Australian Acacias wherever there may be land for the purpose near the top of the Ghaut.

5. He will also reserve such land near Charing Cross as belongs to Government.

(True Extract.)

H. J. Armstrong
Chief Secretary.

To the Public Works Department.

Collector of Coimbatore.

Revenue Department.

Conservator of Forests.

Edw. T. McMootry.

July 16 Aug 13 1879

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Proceedings of the
Indian Post in the
Quinn & Railways
Department

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