Public Works (1890) Department.

RAILWAY BRANCH.

G.O., No. 860-61 Rys.

DATED 19th June

[Despatch Abstract.]

South Indian Railways.— Ordered that the report of the Consulting Engineer for Railways regarding the weight on the axle of some of the engines on the — being nine tons, be forwarded to the Govt of India.

Forwarded

Indexed.

[P. W. Ry. 760—26-9-99.]

BACK PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

FURTHER PAPERS.

G.O.	No.	Department.	Date.	G.O.	No.	Department.	Date.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Railways.

Read the following paper :—

From Colonel B. M. PEMBERTON, R.E., Secretary to the Government of India, Public Works Department (Railway—Stores), to the Joint Secretary to the Government of Madras, Railway Branch, Public Works Department, dated Simla, the 17th June 1889, No. 86-R. S.

In continuation of Public Works Department endorsement No. 70-R.C., dated 28th January 1889, I am directed to forward copy of a Despatch No. 39, Ry., dated 18th April 1889, from Her Majesty's Secretary of State for India, together with copy of the Memorandum received therewith, by Sir A. Rendel, K. C. I. E., on the question of the relative economy in the use of light and heavy rails.

2. It will be observed that His Lordship desires that special inquiry may be made on the subject of the substitution of 50 lb. for 41¼ lb. rails on the South Indian Railway which was duly authorized by the Government of India in Public Works Department No. 310-R. C., dated 25th April 1884. I am therefore to request that, with the permission of His Excellency the Governor in Council, a report on the subject may be submitted detailing the exact state of the permanent way on the South Indian Railway at the present time and showing the distribution of the 40⅓, 35½, 41 and 68 lb. rails over the various sections of the line, and the traffic they have to carry, with reasons for the necessity of renewing each kind of rail with 50 lb. rails on the sections where this has been decided upon. A similar report on the sleepers should also accompany and I am to say that the Government of India desires that the question of confining the substitution of the 50 lb. rails for the 41 lb. rails to the more heavily worked sections of the line may be carefully considered in consideration of the high amount of maintenance charges on the South Indian Railway during the past 3 or 4 years referred to in Sir A. Rendel's Memorandum.

3. I am also to invite attention to the remarks under the head "Permanent way" in the Consulting Engineer's Half-yearly Inspection Notes on the South Indian Railway for the two periods of 1886, in the first of which the average renewals are estimated at not less than 50 miles per annum while in the latter the proposed rate of renewals is mentioned as 100 miles per annum. It seems probable that the first remark referred to miles of railway and the latter to miles of rails and I am to inquire whether this is the case and whether there has been any definite programme of renewal, and what considerations have governed the quantity renewed each half-year.

4. As a matter of fact, however, 189¾ miles of line seem, according to paragraph 18 of the Inspection Report for the half year ended 31st December 1888, to

have been actually relaid with 50 lb. steel rail up to the 28th February 1889, which gives an average for 38 months, of about 60 miles of railway per annum.

5. The figures noted on the margin, which have been extracted from the half-yearly Inspection Reports from 1st January 1886, to 20th February 1889, shew the renewals that were carried out during each half year of the period under reference.

	Miles of line renewed.	
	During half year.	To end of half year.
1st half, 1886	23	23
2nd half, 1886	21½	44½
1st half, 1887	Nil	44½
2nd half, 1887	56¼	100¾
1st half, 1888	33½	134¼
2nd half, 1888	31¼	165½
January and February 1889 ...	24¼	189¾

ENCLOSURES.

Despatch from Her Majesty's Secretary of State for India, to the Government of India, dated 18th April 1889, No. 39.

[Memorandum by Sir A. Rendel on light and heavy rails.]

With reference to the questions which have been discussed in recent correspondence as to the advisability of using 41-lb. steel rails for the new lines now being constructed in Madras by the South Indian Railway Company, I transmit herewith, for your Excellency's information, copy of a Memorandum* by Sir Alexander Rendel, K.C.I.E., Consulting Engineer for State Railways, on the relative economy in using 50-lbs., and 41-lbs. rails.

* Dated 19th March 1889.

I have to request, with reference to this memorandum, that the operations on the South Indian Railway Company may be specially inquired into, and that in all cases where new lines have to be laid, or where existing lines have to be renewed, the facts and observations contained in the memorandum may receive due consideration.

Memorandum by Sir A. Rendel, dated 19th March 1889.

I hear rumours of an attack to be made on the light rails hitherto in use on Indian metre gauge railways. That Engineers should have a strong preference for a heavy rail is only natural. We all like—whether Engineers or not—things substantial and strong, specially where the payment for them does not fall on our own shoulders. The real question here, however, is how best to combine economy of capital with economy of revenue. In a wealthy country we can afford to indulge in that subtle form of extravagance which is euphemistically termed "economy in the long run," but in a poor country like India it has always seemed to me that the economy of the moment, which is certain, is the thing to be secured, and that the economy of the future, which is uncertain, had better be left to take care of itself. The American practice, in a word, is to be preferred for India to the English.

The following remarks on the rails used on the Rajputana and South-Indian Railways may at the present moment be of some use.

According to the returns given in the analysis of Working, Appendix 4, there were on the Rajputana Railway on the 30th June 1885, the line being then 1,412 miles long, 1,622 miles of 40-lb. iron rails (811 miles of railway) and 50 miles 36-lb. iron rails (25 miles of railway), and they had then been in the road an average of about 8½ years.

The rest of the line was laid with steel rails, steel having been substituted for iron when the fall in the price of steel admitted of its use. Of this material there were in the road, on the 30th June 1885, 1,494 miles of 41¼-lb. rails (747 miles of railway), of the average age of three years, about 31 miles of 36-lb. rails of the average age of five years, and about nine miles of 50-lb. rails quite new.

By the 30th June 1888, when the length of the line had been increased by amalgamations to 1,664 miles, the length of iron rails in use had been reduced to 1,296 miles of 40-lb. rails, of the average age of about 11½ years; the quantity of 36-lb. iron rails was rather increased; and the length of steel rails amounted to 2,078 miles of 41¼-lb. rails of the average age of six years, 28 miles of 36-lb. rails of the average age of eight years, and 282 miles of 50-lb. rails averaging 1½ years old.

Therefore, during the three years, 326 miles of 40-lb. iron rails were replaced by 273 miles of 50-lb. rails and 53 miles of 41¼-lb. steel rails.

But it must not be supposed that the 326 miles of iron rails thus taken out of the road were of no further use. The chief reason for taking them out was that it had been determined, rightly or wrongly that the traffic of the Rajputana was or would be so great that a heavier rail, which must of course be of steel because iron was no longer manufactured, was or would be necessary to carry it on the sections on which either the gradients or the traffic were heaviest. This heavier rail must obviously be laid in considerable continuous lengths, and to allow of this the old rails must of course be removed in similar lengths. In such cases the old rails after removal are returned to store at a valuation, which is rarely too high, to be re-issued if in good condition, for ordinary maintenance in the parts of the road not laid with 50-lb. rails, or sold if in bad condition. In such good condition were the 326 miles of rails taken up, that I find their store value is stated by the Engineer at no less than three fifths of the value of the rails which replaced them. Allowing for the greater weight of the 50-lb. rail, this valuation implies that the rails which they replaced were as a whole but little worn, and shows that, if the 50-lb. rail had not been introduced, the bulk of them would still be in the road.

The case against even the 40-lb. iron rail on the Rajputana seems, under these circumstances, to be very meagre, and to be wholly non-existent against the 41¼-lb. steel rail. No doubt the heavy traffic of the Rajputana, and the low price of rails for some years past, justified the Government, in a measure, in yielding to the pressure put upon it some five years ago in India, to adopt a 50-lb. rail on, at any rate, its heaviest sections. For my own part I would rather have seen a better sleeper introduced, for it is the sleeper on this line which has in my opinion been the chief cause of trouble, and not the rail. The creosoted fir originally sent out from England for the Rajputana was as bad and short-lived a sleeper as can be laid. But we had then no option. Practically there was no other kind of sleeper available at a reasonable cost. We can do better now, and the sooner we do it the better for the rails, for nothing tends to damage rails, and to shorten their life, more than weak sleepers. The iron rails were also supplied during the last years of the manufacture of iron rails, when quality had fallen to its lowest point, and inspection was beaten by practices little to the credit of the trade. The 41¼-lb. steel rails were very good, and have evidently so far given no trouble. But with all its faults the maintenance of the Rajputana permanent way has not been costly, and even if there has been some extravagance in respect to the 50-lb. rail, as I think there has been both in weight and quantity, it is an extravagance which the traffic on this line can afford, and perhaps justify, and which, if some reasonable check be kept on it in the future, may be readily condoned.

Referring to Analysis of Working No. 8, Table A, and charging the maintenance of the permanent way with half the total cost of "General Superintendence," with the whole of "Maintenance and Renewal of Permanent Way," which includes sleepers and ballast, and with four fifths of "Loss by Exchange," of "Loss on Stores," and of "Freight on Stores," I find that the cost of keeping up the permanent way and ballast on the Rajputana line, including the relaying with 50-lb. rails, averaged, during the three years ending 30th June 1888, Rs. 404 per mile of track per annum, including sidings, Rs. 1·31 per 1,000 gross ton miles moved over the line, and Rs. 5·25 approximately per 1,000 ton miles of net traffic.

I doubt very much if a better account would have been shown had the line been originally laid with 50-lb. steel or iron rails, and we should, of course, have had a much larger capital to pay dividend upon; for it must be remembered that in a the early days of the Rajputana, rails cost on the average, speaking from memory, about 11*l.* a ton in England, whereas the rails, lately bought for the line have not cost on the average more than 4*l.* 10*s.* a ton. The case, in fact, in this respect is curiously illustrative of the superiority of economy in first cost over "economy in the long run."

Turning now to another metre gauge line, the South Indian, I find the following:—

The analysis of working this line for the first half of 1888 is not in my possession, and I can only review the three years ending 31st December 1887.

The length of this line on the 30th June 1885 was 662 miles, and, including sidings, it comprised 721 miles of railway, or 1,442 miles of rail. Of this 364·7 miles of rail were 68-lb. iron, 892·8 miles 40⅓-lb. iron, 41 miles 35½-lb. iron, and 143 miles 41-lb. steel. There were no 50-lb. rails then in use. The 40⅓, 35½, and 41-lb. rails are of the same section respectively as the 40, 36, and 41¼-lb. flat-footed rails of the Rajputana. The 68-lb. rail was of the double-headed pattern sent out and used originally, I believe, on broad gauge lines.

At the end of 1887 the length of the South Indian was the same as in June 1885, but its track had increased (by additions to sidings, I presume) to 726½ miles of railway, equal to 1,453 miles of rail, composed of 343½ miles of 68-lb. iron rail, 726 miles of 40⅓-lb. iron rail, 35½ miles of 35½-lb. iron rail, 143½ miles of 41-lb. steel rail, and 204 miles of 50 lb. iron rail

So that in the interval, 21 miles of 68-lb., 167 miles of 40-lb., and 5¼ miles of 35½-lb. iron rail had been taken out. The 41-lb. steel rails remained, in regard to length, as before; but, as 20 miles are said to have been taken out in the three years, new 41-lb. steel rails must have been substituted for them. The iron rails taken out were replaced by 204 miles of 50-lb. steel rails.

At the end of the period I am reviewing, the 68-lb. iron rails were 23 years old, the 35½-lb. iron rails 22¾ years, the 40½ rails 11 years, and the 41-lb. steel rails 7¼ years. It might be said that the great comparative age of the 68-lb. rail showed the advantage of weight, and, of course, the more the wearing surface the longer the rail should last, but the 35½-lb. rails are of the same age. The age of the latter may, perhaps, be accounted for by their situation, though I suspect the quality of the rails, or of the sleepers on which they are laid, or both, have something to do with it. The 40½-lb. iron and the 41-lb. steel rail are about the same age as those of the Rajputana, and I have no doubt their removals have been very largely due to the same cause as on that line, namely, the necessity, if a rail of new and heavier section is introduced, of laying it in continuous lengths, removing of course equal lengths, of the old rails, and placing them in store till required for repairing the old line. It would be found, I suspect, on examining the condition of the rails taken out, that, as in the case of the Rajputana, the bulk of them were in good condition, and that, if the 50-lb. rail had not been sanctioned, the whole or nearly the whole of the 20 miles of 41-lb. steel rail and the bulk of the 40-lb. iron rail removed from the road in the three years would have been in it at the present time.

But why, if the Rajputana was content in three years with 282 miles of 50-lb. rails out of a total of 3,793 miles of rail, or 1 mile in 13½, should the South Indian in the same time require 204 miles of 50-lb. rail, or 1 mile in 7? The South Indian traffic will not account for the difference; for, mile for mile, its gross ton mileage is not more than two thirds or its net ton mileage more than half the Rajputana's, and its gradients are not worse, and its sleepers and its age are very much the same. Unless, therefore, we suppose its 40½-lb. iron and 41-lb. steel rails to be of worse quality than those sent out for the Rajputana, it is inconceivable that a 50-lb. rail, if wanted at all, should be wanted more or faster on the South Indian than on the Rajputana.

The results of this lavish relaying will be seen in the following figures. Taking the same items of maintenance charge as in the cases of the Rajputana, I find that the cost of keeping up the rails, sleepers, and ballast of the South Indian for the three years ending December 1887 averaged Rs. 636 per mile of track, Rs. 3·24 per 1,000 gross ton miles of traffic, and, approximately, Rs 16 per 1,000 net ton miles of traffic; that is to say, 58 per cent., 150 per cent., and 200 per cent. respectively more than similar charges on the Rajputana; and 1888 will show, I fear, a still worse comparison, for the difference is worst at the end of the period, and is apparently increasing.

If the 50-lb. rail had not been introduced on the South Indian, these differences, I am satisfied, would have been very much less. It is plain, in fact, that the South Indian neither requires nor can afford this rail. The burden of such a rail, if it be confined, as I hope and expect it will be, to the heavier portions of the road, may pass unfelt on lines with a traffic like the Rajputana. On lines like the South Indian it is a burden which, in my opinion, they should not be called on to bear.

My conclusion, therefore, on this question, as regards the Rajputana and South Indian Railways, is that, so far as the 40-lb. iron rail has failed, which is not very far, the failure is mainly due to the quality of the rails and the character of the sleepers; that the 41-lb. steel rail has not failed at all, and meets all the reasonable requirements of even the Rajputana; that a 50-lb. steel rail is condonable on parts of the Rajputana, and on any part, if there be any, of the South Indian which has an equal traffic, but that its general introduction on the South Indian has been the result of a prejudice which has induced a faulty diagnosis, and led to a remedy which is worse than the disease.

ORDER—dated 6th July 1889, No. 756 R., Public Works.

Communicated to the Consulting Engineer for Railways for report.

(True Extract.)

(Signed) C. J. SMITH, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Railway Branch.

To the Consulting Engineer for Railways.

RAILWAY.

Govt. of {1889} Madras.

PUBLIC WORKS.

Dated July, 6th.

Recd. *Encl.*

G.O., 6th July 1889, No. 756-R.

JULY.

Materials.
South Indian Railway.

Letter from the Government of India forwarding copy of Despatch from the Secretary of State with a Memo. by Sir A. Rendel on the relative economy in the use of light and heavy rails and requesting to make a special report on the substitution of the 50 lb. for 41¼ lb. rails on the————————also to report on the present state of the permanent way of that line.—Communicated to the Consulting Engineer for Railways for report.

13TH MARCH 1890, No. 355 R., PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Railway.

Read the following papers :—

From the Consulting Engineer for Railways, dated Madras, 8th March 1890, No. 168.

From the Consulting Engineer for Railways, dated Madras, 11th April 1889, Circular No. 692.

I have the honor to request that I may be favored with any information you may have on record bearing on the durability of any 41¼ steel rails that have been laid in the lines under your control.

2. It is desired to ascertain what may fairly be reckoned the life of such a rail as compared with that of a 40-lb. iron rail under the same traffic.

3. I shall be obliged if you will inform me whether in your opinion the 41¼ steel rail, is at present prices, as economical in the end as a 50-lb. rail for that section of your line on which you have the least traffic, and that you will kindly state approximately what that traffic amounts to.

4. I write on the assumption that your views have probably been already expressed on the subject and that you can refer me to information already on record.

To the Agent and Chief Engineer,
Southern Mahratta Railway, Dharwar.
„ Agent, Bombay-Baroda and
Central India Railway, Bombay.
„ Manager, Bengal and North-Western Railway, Lahore.
„ Manager, Eastern Bengal Railway, Calcutta.
„ Manager, Tirhoot State Railway, Mozufferpore.

———

From the Manager and Engineer-in-Chief, Tirhoot State Railway, to the Consulting Engineer for Railways, Madras, dated Mozufferpore, 27th April 1889, No. 2447.

[*Maintenance—Permanent-way.*]

In reply to your Circular No. 692, dated 11th April 1889, I have the honor to state as follows.

2. About 80 miles of 40-lb. iron rails were laid in this line between 1874 and 1876.

3. The majority of these rails have already been renewed, and the remainder are rapidly wearing out, giving an average of under 15 years as the life of these iron rails. The average traffic over them amounted to three trains daily each way.

4. The 40-lb. steel rails, of which we now have about 220 miles, were laid since 1882, and show very little signs of wear. I expect their life will prove to be between 20 and 25 years. All renewals are now being carried out as far as possible with 50-lb. steel rails, which, in my opinion, will be found far more economical in the end.

5. The tendency at present is to increase both the speed and the weight of metre-gauge engines and stock, and I believe that in a few years a 50-lb. rail will be found absolutely necessary to carry the increased weight.

———

From the Agent and Chief Engineer, Bengal and North-Western Railway Company, to the Consulting Engineer for Railways, Madras, dated Gorakhpur, 7th May 1889, No. 4 P.

In reply to your No. 692, dated 11th April 1889, I have the honor to offer you the following remarks.

2. The rails on this line have not been sufficiently long in use to enable more accurate information of their durability to be supplied. The few 40-lb. iron rails that have been used on this railway, and which were obtained from the Tirhoot State Railway, have proved quite unequal to resisting the wear and tear of our heavy engines over them; some of these rails became unfit to remain in the road, in less than 18 months, whilst the best of them will not have a longer life than five years. I am of opinion, however, that these rails were made of bad material.

3. As regards the wear and tear of the 41¼-lb. steel rails, this has so far been satisfactory. I should say it would be impossible to tell at present whether it would prove to be more economical in the end to have laid 50-lb. instead of 41¼-lb. rails in the first place.

From the Manager, Eastern Bengal State Railway, to the Consulting Engineer for Railways, Madras, dated Sealdah, Calcutta, 17th May 1889, No. 1324 M.

In reply to your Circular No. 692, dated 11th April 1889, I have the honor to give you the following information regarding the metre-gauge lines in this system, though I do not think it will throw any light on the comparison between the life of a 41¼-lb. steel rail and a 40-lb. iron rail.

2. I have three separate metre-gauge lines, the accounts of which are kept distinct:—

(*a*) Northern section, 281 miles, with a traffic averaging 211 rupees a mile a week for the whole year 1888, laid with 40-lb. iron rails 11 years' old at the end of 1888. Heavy F class engines run over this not only with goods trains but with a daily mail at high speed. These rails are too light for this traffic and these engines. They are now being replaced by 50-lb. steel rails.

(*b*) Assam-Behar section, 38 miles, with a traffic averaging 90 rupees a mile a week for the whole year 1888. This is laid with 41¼-lb. steel rails, which were only one year old at the end of 1888. No opinion can therefore be formed of their durability. There are at present no F class engines on this section. So long as they are not required, and the traffic and speed are moderate, this weight of rail should be sufficient, and would be the best rail to lay if a heavy traffic was never anticipated.

(*c*) Dacca section, 86 miles, with a traffic averaging 66 rupees a mile a week for the whole year 1888. This is the lightest traffic on any section of my metre-gauge lines. It is a very poor traffic, and does little more than pay its working expenses. It is laid with 41¼-lb. steel rails, which were three years' old at the end of 1888. The same remarks apply to this section as to the Assam-Behar section, see above.

3. In my opinion a 41¼-lb. steel rail would be good enough for a short branch line which was never likely to carry a heavy traffic. For such a line I think a 41¼-lb. steel rail would be more economical than a 50-lb. steel rail. But nothing less than a 50-lb. steel rail should, I think, be laid on a main line where a high speed and good traffic may be looked for.

4. I have a branch line, 36 miles long, on the 2′ 6″ gauge laid with 25-lb. and 30-lb. iron rails. This line does a small traffic mainly in cooly passengers *en route* to Assam, though it also carries a little goods traffic. The rolling stock is of the tramcar type, of a very good pattern. If you should desire any further information regarding this line, I shall be happy to furnish it.

From the Agent, Bombay-Baroda and Central India Railway, including Rajputana-Malwa Railway, to the Consulting Engineer for Railways, Madras, dated Bombay, 28th June 1889, No. 7809 W.

With reference to your Circular No. 692 of 11th April 1889, I have the honor to forward herewith a copy of a letter No. 3256 of 19th June 1889, from the Engineer-in-Chief of the Rajputana-Malwa Railway, regarding the durability of rails.

2. You will observe that the 41¼-lb. steel rails have not been in the road sufficiently long to enable any accurate comparison with iron rails to be made.

ENCLOSURE.

Copy of letter No. 3256, dated 19th June 1889, from the Acting Engineer-in-Chief, Rajputana-Malwa Railway, Ajmere, to the Agent, Bombay-Baroda and Central India and Rajputana-Malwa Railway, Bombay.

[*Subject.*—Life of Rails.]

In reply to your No. 4915 W., dated 23rd April 1889, forwarding a communication from the Consulting Engineer for Railways, Madras, regarding above, I have the honor to report that the average *age* of 41¼-lb. steel rails on the Abu Division, where this class of rail is oldest, is at present only 8·63 years. I think we may fairly hope that the average life of the rails will be at least double this.

2. The average age of 40-lb. iron rails taken out of the road during second half 1888 on the Bandikin Division, on which these rails are oldest, was 13·45 years, and of those left in the road 13·70 years at end of the half-year. Our statistics show that the average age of the rails both taken out and left in the road are still increasing, and therefore we have not yet arrived at what the average life of our iron rails will be.

3. The 41¼-lb. steel rail is certainly quite up to light traffic, such as we have on our Sindia-Neemuch section where three trains are run daily each way at a through speed of 12 to 14 miles an hour—weight of trains 200 tons including engine. This with reference to para. 3 of the enclosure to your letter.

From the Agent, Bombay-Baroda and Central India Railway including Rajputana-Malwa Railway, to the Consulting Engineer for Railways, dated Bombay, 19th November 1889, No. 13668 W.

I have the honor to forward copy of a letter from the Acting Engineer-in-Chief of the Rajputana-Malwa Railway, No. 4993 of 10th September 1889, and its accompaniment, which furnishes the information asked for in your No. 1461 of 22nd August 1889. I have added two brief notes in the margin.

ENCLOSURES.

Copy of a letter No. 4993, dated 10th September 1889, from the Acting Engineer-in-Chief, Rajputana-Malwa Railway, Ajmere, to the Agent, Bombay-Baroda and Central India Railway.

Relative economy in the use of light and heavy rails.

In acknowledging receipt of your No. W. 10361 of the 27th August last, forwarding, in original, with its enclosure, letter No. 1461 of 22nd August 1889, from the Consulting Engineer for Railways, Madras (herewith returned), and with reference to certain inquiries therein made by the Consulting Engineer, I have the honor to state that the price of second-hand 40-lb. rails was based on the market value at the time of new 40-lb. rails less estimated depreciation; this gave a rate of Rs. 66-3-0 per ton, and for the unserviceable rails fit for structural purposes Rs. 40-12-0 per ton. Of the rails taken out of the road, the proportion of serviceable rails fit for main line to the unserviceable ones was 3 to 1*.

* Or ¾ of the whole.
(Intld.) W.S.S.B.

2. If the 50-lb. rails had not been introduced on this line, I think we may assume that about 70 per cent. of the rails taken out would now be in the road. The percentage of renewals of these rails at the time the relaying with 50-lb. steel rails was commenced was 1·59 miles of rails per annum.

3. A statement showing the cost under the usual sub-headings of keeping up the permanent-way and ballast on this railway during the three years ending 30th June 1888 is herewith sent as requested

I would draw your attention to a mistake that has been made by Sir. A. Rendel. The Rs. 404 quoted in para. 9 of his memorandum of 19th March 1889 is the cost of maintenance for six months and not for one year as therein stated.

4. With reference to the inquiry contained in para. 4 of the Consulting Engineer's letter, I am of opinion that the past experience has shown that the 40-lb. iron rails thus taken out could be accepted as suitable for branch lines where traffic is light and does not exceed, say, 2 or 3 trains † a day each way.

† I would say up to 4 trains a day each way.
(Intld.) W.S.S.B.

BOMBAY-BARODA AND CENTRAL INDIA RAILWAY INCLUDING RAJPUTANA-MALWA RAILWAY.

STATEMENT showing the cost under the usual sub-headings of the cost of keeping up the permanent-way and ballast on the Rajputana-Malwa Railway during the three years ending 30th June 1888.

REFERENCE TO REVENUE ACCOUNTS.		Details.	HALF-YEAR ENDING 31ST DECEMBER 1885.	HALF-YEAR ENDING 30TH JUNE 1886.	HALF-YEAR ENDING 31ST DECEMBER 1886.	HALF-YEAR ENDING 30TH JUNE 1887.	HALF-YEAR ENDING 31ST DECEMBER 1887.	HALF-YEAR ENDING 30TH JUNE 1888.
Table and main head.	Sub-head.		Per mile of line maintained. (1412·32)	Per mile of track including siding. (1603·61).	Per mile of line maintained. (1538·94).	Per mile of track including siding. (1748·34).	Per mile of line maintained. (1664·419).	Per mile of track including siding. (1889·74).	Per mile of line maintained. (1664·419).	Per mile of track including siding. (1896·645).	Per mile of line maintained. (1664·419).	Per mile of track including siding. (1896·816).
		Maintenance and renewals of Permanent-way.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Table IX.	1 ..	Wages	171·52	151·06	158·21	139·26	138·13	121·66	144·87	127·13	133·45	117·10
A-2 ..	2 ..	Materials { Rails .. .. .. / Ballast .. .. .. / Sleepers	283·62	249·79	227·91	200·61	129·47	114·03	228·31	200·36	227·93	200·01
		Total ..	455·14	400·85	386·12	339·87	267·60	235·69	373·18	327·49	361·38	317·11
A-1 ..	1 to 6 ..	Half the total cost of general superintendence	..	52·095	..	46·705	..	46·65	..	43·94	..	43·37
A-7 ..	3 ..	Four-fifths of loss by exchange	..	..	..	..	..	..	..	..	..	..
	4 ..	Four-fifths of loss on stores	..	0·424	..	0·376	..	0·016	..	1·576	..	0·12
	5 ..	Four-fifths of freight on stores	..	32·192	..	27·628	..	23·232	..	28·12	..	33·648
		Total ..	485·561	421·087	..	413·727	..	304·688	..	400·526	..	394·248

Average during the three years ending 30th June 1888—

1603·61 × 485·561 = 778650·47521
1607·49 × 421·087 = 676893·14163
1748·34 × 413·727 = 723335·46318
1889·74 × 304·688 = 575592·12602
1896·645 × 400·526 = 759665·63527
1896·816 × 394·248 = 747815·91436

10642·641 778650·47521 = Rs. 400 per mile of track per half-year including sidings.

10642·641

(Signed) W. HARVEY,
Acting Engineer-in-Chief.

From the Agent and Chief Engineer, Southern Mahratta Railway Company, to the Consulting Engineer for Railways, Madras, dated Dharwar, 10th December 1889, No. 2133.

I must apologize for being so long in replying to your queries in regard to 41¼ steel rails.

2. Those which have been longest on the road are on the Bijapur branch; they were laid in 1883 and have had to be renewed as follows:—

1884	0	1887	46
1885	5	1888	87
1886	16	to 31st August 1889	97

The rails have almost all been found broken or split.

3. This amounts to nearly half-a-mile of rails out of 173½ in 6½ years.

4. I am of opinion that 41¼-lb. steel rails are too light for the engines (32-ton) used, and speed of trains. Not only are the rails destroyed, but the cost of maintenance is either increased or the road is maintained in bad order; the comparative ease with which a road with heavier rails is maintained is shown on the Braganza Ghât where the West of India Portuguese Railway and this line are laid with 50-lb. rails.

5. In considering the question of light as compared with heavy rails it should be borne in mind that light rails affects the wear and tear of rolling stock even more than the wear and tear of the permanent-way.

6. It is sometimes suggested that it is better to add to the number of sleepers (say 11 instead of 9 sleepers to a 24-feet rail), but this would come to about the same cost (see comparative estimates attached) and would not give, in my opinion, so good or so durable a road.

7. I have not been called upon to give my opinion on the subject before nor have I found it necessary to make any report on the subject; it was necessary that the capital outlay on these lines should be as low as possible, and the question of using 41-lb. rails was accepted from the outset as settled.

ENCLOSURE.

COMPARATIVE cost of Permanent-way per 23′ 9½″ (8 metre) pair of rails.

41¼-lb. rails with 11 wooden sleepers per pair of rails.

	RS.	A.	P.
Cost of pair of rails	24	12	0
„ 11 sleepers	27	8	0
„ 4 No. fish-plates	0	12	3
„ 8 No. fish-bolts	1	1	5
„ 44 No. dog spikes ...	1	9	6
„ 22 bearing plates ...	0	2	4
Total ...	55	13	6

50-lb. rails with 9 wooden sleepers.

	RS.	A.	P.
Cost of pair of rails	30	0	0
„ 9 sleepers	22	8	0
„ 4 No. fish-plates	0	15	9
„ 8 No. fish-bolts	1	1	5
„ 36 dog spikes	1	5	0
„ 18 bearing plates ...	0	1	10
Total ...	56	0	0

From the Chief Engineer, to the Agent, South Indian Railway, dated Trichinopoly, 10th January 1890, No. C. 60.

Your No. 10216/1225 of the 16th July last.

I enclose herewith a tracing showing—

1*stly*.—The different kinds of permanent-way laid upon the various sections of the line when originally opened for traffic.

2*ndly*.—The same information at the end of the year 1883, that is, about 2½ years previous to the introduction of the 50-lb. rails.

3*rdly*.—The same information at the end of the year 1888.

P.W. 164. S.C.9 Encl 3353/90.

4thly.—The same information when the 50-lb. material already arranged for shall have been laid. Also statements A and B in manuscript showing the length of main line and sidings and the material with which laid at the end of the years 1883 and 1888, respectively.

2. *Rails.*—Allusion is made in the 2nd paragraph of Colonel Pemberton's letter, dated Simla, 17th January 1889, No. 86 R.S., to 35½ lb., 40⅓ lb., 41 lb., and 68 lb. rails. In this report I allude to both 40⅓ lb. (iron) and 41 lb. (steel) under the one designation of 40-lb. rails, as on the introduction of the 41-lb. steel rails they were used indiscriminately (with one exception) with iron rails for renewals, the one exception being the Chingleput-Conjeeveram Branch on which 41-lb. steel rails were originally laid throughout when this branch was constructed.

3. The 50-lb. rails were first introduced in the year 1886, at which date we had practically no new rails of any description in stock, and were dependent on the material released by the introduction of the 50-lb. rails for renewals on those lengths laid with other rails, viz., 35, 40, and 68 lb.

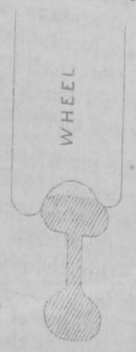
4. The heavy stone traffic for the Madras Harbour Works over the first 13 miles of the line (Madras to Pallávaram) causing continuous and heavy renewals of the 40-lb. rails, the 50-lb. rail was substituted, and as the 40-lb. rails were rapidly wearing out, the substitution was continued on to Chingleput, a further distance of 23 miles.

5. On the 45th and 46th miles, where the line was lowered to form a causeway over which extraordinary floods might pass, the opportunity was taken to substitute 50 for 40-lb. rails, first, as being much more suitable for such a situation, and next because the substitution could be more economically and properly done, while the traffic was being carried past the place on a deviation of the line and there was nothing to interrupt the work.

6. Similarly, on the occasion of other alterations in the way and works necessitating temporary diversions from the main line, the opportunity was taken to substitute 50-lb. rails, and this accounts for the number of isolated points at which the change was made. The other and more continuous lengths were selected chiefly because of the worn state of the rails there, or because of the proximity to the port of supply and the necessity for releasing a stock of unexpended 40-lb. rails for renewals elsewhere over the line.

7. For instance, the lengths of line between Madura and Kaligudi (345 to 365 miles) and between Tataparai and Tuticorin (435 to 444 miles) were renewed with 50-lb. rails, partly because a great number of the 40-lb. rails were in a very bad state and required immediate removal, and partly because the southern portion of the line was in emergent want of stock of 40-lb. rails to maintain it in a safe condition.

8. Again, on the only part of the main line on which the 68-lb. rails existed, Tanjore to Trichinopoly (218 to 250 miles), it was deemed expedient to substitute the 50-lb. rails, partly to get 68-lb. rails for renewals elsewhere, and partly to provide a rail with a section nearer to the 40-lb. one in order to prevent undue wear and tear on wheel tyres and on the heavy rail. It is found that the tyres of engines and carriages get worn hollow (see marginal sketch) by running on the narrow 40-lb. rail head, and when these hollowed tyres run on the broad 68-lb. rail, the effect is that the outside edge of the tyre travels on the outside edge of the rail to the detriment of both, the outside of the rail getting crushed and cut away. By taking out this length of 68-lb. and substituting 50-lb. rails, a nearer approach to similarity of rail section is obtained and injury to tyre and rail avoided.



9. The 35-lb. iron rail on the Arkónam Branch was replaced by the 50-lb. steel rail because, in my opinion, the 35-lb. rail had become unsafe under the existing weight of engines and traffic. This part of the line was originally laid in 1865 with very sharp curves as a tramway along the public road, and never during 16 years had any traffic worth mentioning to try it.

The normal traffic on this isolated piece of tramway consisted of two short trains a day, one each way with small light vehicles and engines.

10. After it became part of the South Indian Railway, and heavier engines and trains began to work over it, the result was that the 35-lb. rails went so rapidly that it was found necessary to remove them to guard against accident. For example, on the 9th September 1887 one of these 35-lb. rails crushed in for about 10 feet of its length owing to want of strength in the vertical web.

The foot or bottom flange of these rails was also found to yield and turn up at the ends and edges.

They were laid on teakwood sleepers.

11. With reference to the steel 41-lb. rails, the line between Chingleput and Conjeeveram (20 miles) was laid with them throughout when the branch was made in 1880-81. These rails have stood well, but they have not been tried by traffic nearly so heavy as on the main line. There were 67 miles of these rails sent out from England, the balance after laying the Chingleput-Conjeeveram—length of 27½ miles of line and sidings—was used in ordinary repairs, here a rail and there a rail, as occasion required, and I have no record of where they are laid, a steel rail being simply substituted for an iron one when the latter was worn out.

Of the 41-lb. steel rails removed from the line by the substitution for the 50-lb. ones, most are in good order after having been in the road for about 5 years.

12. In every case the programme for the substitution of the 50-lb. rail was thought and laid out beforehand with the greatest care and endeavour to avoid all unnecessary expenditure.

13. *Sleepers.*—The 40-lb. rails are laid on creosoted pine sleepers which rapidly decayed, and although there are about 147,482 equal to 83 miles of used sleepers reported in stock available for renewals, many of these sleepers are much cracked, cut into by the rail-foot and pierced with old spike holes and are deteriorating while in stock almost as much as those laid in the line. I do not think we can safely estimate the average life of the creosoted sleepers in stock and in the line at more than 2 years. It is even doubtful if this average life will be attained, for when sleepers have been in use in the line they get cut into by the flat foot of the rails and pierced by the spikes in such a manner as to render them not very fit for renewals.

They are only from 6′ to 6′ 6″ long, so that there is but little space for shifting the rails into fresh places where the original ones become damaged or worn.

14. The time has come therefore when we must elect whether to hold to the 40-lb. or to the 50-lb. rail for future renewals, for it would be manifestly unwise to purchase new sleepers (hard wood or iron) to lay under a rapidly-wearing-out rail which the new sleepers would long outlive to become useless if renewals with a 40-lb. rail were not continued, while if we do not pursue this course and do not continue to renew with 50-lb. permanent-way, we shall before long arrive at a stage where the rails at present in stock will have outlived the stock of sleepers available for maintenance. Under the circumstances and with a line possessing the considerable and steadily increasing traffic of the South Indian Railway, it would surely be unwise not to take the opportunity of replacing the lighter by a heavier and more durable rail.

15. Up to 31st December 1889 there have been laid into the main line 212 miles of 50-lb. bull-headed steel rails, and deducting this from the length (445 miles) of main line laid with 40-lb. rails between Madras and Tuticorin, there remains 233 miles of 40-lb. permanent-way for which 50-lb. rails have to be substituted. It would therefore, in my opinion, under existing circumstances be well within the requirements of the case to continue to relay with 50-lb. rails at the rate of 50 miles per annum. If this is not done we shall probably have to purchase a large number of hard-wood sleepers (teak or pingadu) wherewith to maintain the line in safety as the creosoted pine ones decay. It will soon be seen whether I have over or under estimated the life of the 40-lb. permanent-way still in the line; if overestimated, 50 miles of 50-lb. road per annum will not suffice for the upkeep of the line, if underestimated, the relaying can be diminished or stopped for a time.

16. Referring to Sir A. Rendel's remarks on the estimated value at which rails returned to stock are credited, my experience is that in this as in most cases of

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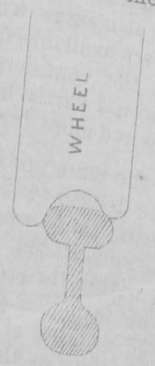
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16. Referring to Sir A. Rendel's remarks on the estimated value at which rails returned to stock are credited, my experience is that in this as in most cases of

returned stores the materials are liable to be much overpriced. For some time we valued our second-hand rails fit for renewals at Rs. 56 per ton, the rate at which we sold considerable quantities of the useless and worn-out rails, but lately it was decided in a Committee of Government and Railway officers to assess the value of used rails at only half that rate, and our stock of useable rails is now valued at only Rs. 26 per ton. To judge of the present value of any article by the price put upon it when returned to stores would, according to my experience, be most misleading, the tendency almost always being to overprice, seeing that the department returning it is usually anxious to be credited with the highest value obtainable.

17. With reference to Sir A. Rendel's assumption that, on examining the condition of the rails taken out of the line, the bulk of them would be found in good condition, and that if the 50-lb. rail had not been sanctioned, the whole, or nearly the whole, of the 20 miles of 41-lb. steel rail and the bulk of the 40-lb. iron rails removed from the road in the 3 years would have been in it at the present time, he is correct concerning the steel rails, but in error as regards the 40-lb. iron rails. Most of the steel rails are in stock and are being drawn upon for renewals; they would not have been taken out of the line had they not been mixed up with the 40-lb. iron rails as described above (in para. 11 *ante*). With reference to the 40-lb. iron rails as that at the present moment we have accumulated a considerable stock of these, removed from the line, which are in a sufficiently good condition to be used again; but it was absolutely necessary to accumulate a stock to provide for the maintenance of the 40-lb. road. At one time before this was accomplished the 50-lb. permanent-way came forward from England more slowly than I anticipated, and we were put to such straits owing to want of 40-lb. rails to keep the line in safe running order that I had to strip many of the stations of the serviceable rails in sidings, substituting worn ones to procure what was required. It is so far a matter of opinion and estimate of which those on the ground may probably be allowed to be the best judges, whether or not a larger stock of 40-lb. rails has been removed from the line and placed in stock than is necessary, but there can be no doubt whatever that the measures taken were adopted after very careful consideration and with the desire of all concerned to avoid all unnecessary expenditure.

ENCLOSURES.

A.

SOUTH INDIAN RAILWAY.

ENGINEER DEPARTMENT.

STATEMENT showing length of Rails and Sleepers as laid on 31st December 1883, distinguishing Main Line from Sidings.

	IRON POT ROAD.	WOODEN SLEEPER ROAD.				
	Weight of iron rails.				Weight of steel rails.		Total.
	68 lb. per yard.	68 lb. per yard.	40·3 lb. per yard.	35·5 lb. per yard.	41 lb. per yard.	32 lb. per yard.	
	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.
Main Line.							
Madras to Tuticorin	13 71 0	15 68 0	392 48 53	..	23 11 3	..	445 38 56
Branches.							
(1) Arkónam	..	..	..	18 20 50	20 67 55	..	39 8 5
(2) Pondicherry (Villupuram to Gingee river)	..	..	16 20 0	..	..	..	16 20 0
(3) Negapatam	24 31 89	23 72 11	..	..	..	..	48 24 0
(4) Erode	86 77 92	..	..	..	0 18 54	..	87 16 46
(5) Tinnevelly	..	..	17 72 84½	..	0 18 15½	..	18 11 0
Total ..	125 20 81	39 60 11	426 61 37½	18 20 50	44 35 27½	..	654 38 7
Sidings.							
Main line	0 9 51	3 20 75	34 27 18	..	6 62 67¾	..	44 40 11¾
Arkónam Branch	..	..	..	2 30 80	0 59 77	..	3 10 57
Pondicherry Branch	..	..	0 42 23¾	..	0 5 21	0 1 73	0 49 17¾
Negapatam do.	0 24 13	7 53 69	0 6 30	..	..	..	8 4 12
Erode do.	4 70 76	0 65 46	..	..	..	..	5 56 22
Tinnevelly do.	..	..	1 71 50	..	0 0 66	..	1 72 16
Total ..	5 24 40	11 59 90	36 67 21¾	2 30 80	7 48 31¾	0 1 73	63 72 36½
Grand Total, Main Line and Sidings ..	130 45 21	51 40 1	463 48 59¼	20 51 30	52 3 59¼	0 1 73	718 30 43½

TRICHINOPOLY,
10th January 1890.

(Signed) D. LOGAN,
Chief Engineer.

B.

SOUTH INDIAN RAILWAY.

ENGINEER DEPARTMENT.

STATEMENT showing length of Rails and Sleepers as laid on 31st December 1888, distinguishing Main Line from Sidings.

—	STEEL TRANSVERSE SLEEPER ROAD.	IRON POT ROAD.				WOODEN SLEEPER ROAD.					Total.
	Weight of iron rails.	Weight of iron rails.		Weight of steel rails.		Weight of iron rails.			Weight of steel rails.		
	40·3 lb. per yard.	68 lb. per yard.	40·3 lb. per yard.	41 lb. per yard.	50 lb. per yard.	68 lb. per yard.	40·3 lb. per yard.	35·5 lb. per yard.	41 lb. per yard.	32 lb. per yard.	Bridge rails 56 lb. per yard.	
Main Line.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.	M. CH. LKS.
Madras to Tuticorin	5 63 29	15 41 20	6 29 21	..	143 17 57½	14 1 38	226 66 21	..	33 54 67½	..	0 14 61	445 48 15
Branches.												
(1) Arkónam	..	..	..	..	15 72 36	..	..	1 73 56	21 22 13	..	..	39 8 5
(2) Pondicherry (Villupuram to Gingee river)	..	..	..	..	0 13 69	..	15 51 46	..	0 34 54	..	..	16 19 69
(3) Negapatam	..	19 19 0	..	..	10 55 0	18 30 0	..	..	..	..	..	48 24 0
(4) Erode	..	86 77 92	..	..	..	..	..	..	0 18 54	..	..	87 16 46
(5) Tinnevelly	..	..	..	..	..	..	17 13 20	..	0 77 80	..	..	18 11 0
Total ..	5 63 29	121 58 12	6 29 21	..	169 78 62½	32 31 38	259 50 87	1 73 56	56 47 68½	..	0 14 61	654 47 35
Sidings.												
Main Line	0 55 99	0 12 73	0 4 61	..	3 43 32	3 4 92	36 20 24⅞	..	9 15 83¼	..	..	52 77 65⅛
Arkónam Branch	..	..	..	..	0 9 32	..	0 5 94⅛	1 79 11	1 1 66⅞	..	..	3 16 4
Pondicherry Branch ..	..	..	..	..	..	..	0 44 20¼	..	0 8 24⅝	0 1 73	..	0 54 17¾
Negapatam do.	..	1 63 90	..	..	0 6 40	6 39 96	1 76 10	..	..	..	..	10 26 36
Erode do.	..	4 77 72⅛	..	..	..	0 78 85	0 3 77	..	..	..	..	6 0 34½
Tinnevelly do.	..	..	..	..	..	..	1 76 8⅞	..	0 2 57⅛	..	..	1 78 66
Total ..	0 55 99	6 74 35½	0 4 61	..	3 59 4	10 43 73	40 66 35⅛	1 79 11	10 28 31⅜	0 1 73	..	75 13 23⅜
Grand Total, Main Line and Sidings ..	6 39 28	128 52 47½	6 33 82	..	173 57 66½	42 75 11	300 37 22½	3 72 67	66 75 99⅞	0 1 73	0 14 61	729 60 58⅜

TRICHINOPOLY,
10th January 1890.

(Signed) D. LOGAN,
Chief Engineer.

C.

SOUTH INDIAN RAILWAY.

STATEMENT showing the Number and Mileage of Trains run during the year 1889.

Section.		Mileage of section.	Number of trains.	Mileage.	AVERAGE PER DAY. Number of trains.	AVERAGE PER DAY. Mileage.	Average mileage per train per day.
Madras-Chingleput	Special	34½	2,618	49,875½	7·17	136·64	19·05
	Ordinary	..	..	..	11·00	308·00	28·00
Chingleput-Cuddalore Old Town	Special	92⅝	1,341	82,354	3·67	228·37	62·22
	Ordinary	..	..	..	6·00	556·50	92·75
Cuddalore-Trichinopoly	Special	121¼	1,106	74,452¼	3·03	203·98	67·32
	Ordinary	..	..	..	6·00	634·50	105·75
Trichinopoly-Madura	Special	96	1,143	96,157½	3·13	263·44	84·16
	Ordinary	..	..	..	6·00	576·00	96·00
Madura-Tuticorin	Special	99	1,230	106,701¼	3·37	292·33	86·74
	Ordinary	..	..	..	4·00	396·00	99·00
Arkónam Branch	Special	39	405	8,899	1·10	24·38	22·17
	Ordinary	..	..	..	4·00	121·00	30·25
Pondicherry Branch	Special	24¼	611	14,630⅝	1·68	40·08	23·85
	Ordinary	..	..	..	4·00	97·00	24·25
Negapatam Branch	Special	48	384	14,542½	1·05	39·84	37·94
	Ordinary	..	..	..	8·00	384·00	48·00
Erode Branch	Special	87¼	1,905	43,699¼	5·21	119·72	22·98
	Ordinary	..	..	..	8·00	359·00	44·87
Tinnevelly Branch	Special	18¼	95	1,734	·26	4·75	18·26
	Ordinary	..	..	..	8·00	146·00	18·25

NOTE.—During no portion of the year were the Harbour stone trains working to the full extent—1,200 tons per day.

TRICHINOPOLY,
22nd February 1890.

(Signed) W. S. BETTS,
Agent.

Extract from Inspection Report of the South Indian Railway for half-year ended 31st December 1885.

Permanent-way.—The permanent-way is in good running order throughout, and the station yards are generally well maintained. Between Madras and Pallávaram, where the traffic has for many years been heavy in connection with the Madras Harbour, the rails and sleepers are wearing out rapidly, and this length should be laid, as soon as possible, with the new permanent-way, consisting of 50-lb. bull-head rail with deep fish-plates on cast-iron pots. A commencement has been made in laying this at Madras, Chingleput, Tanjore and Negapatam; but as the work has to be done between trains, progress is slow, only four or five rail-lengths being done in a day on each face. Special arrangements should be made for expediting the work between Madras and Pallávaram, and I understand that the Chief Engineer concurs in this view.

Extract from Inspection Report of the South Indian Railway for half-year ended 30th June 1886.

[This inspection was made between 12th and 22nd July 1886.]

Permanent-way.—The permanent-way shows signs of deterioration. Between Madras and Chingleput this is very marked, and on other sections the line is not, in my opinion, in such good order as on the last inspection. Renewals are being made with the new 50-lb. rails on pot-sleepers, but greater progress is necessary to enable the line to be kept in good running order. The works generally show signs of insufficient personal inspection by Engineers. During the last eighteen months much extra work has been thrown upon all grades, and this has prevented that strict attention to details which is necessary to insure a line being kept up to a high standard. Unless renewals are pushed more vigorously now, a time will arrive when the powers of the staff in this direction will be very severely taxed. The total length of line originally laid with 40-lb. iron rails is 474 miles, of which about 34 miles have been renewed with steel rails of the same

weight. The length of 50-lb. permanent-way laid up to date is 23 miles, so that 57 miles in all have been renewed. The average age of iron rails now in the line is 10 years, and probably all will have to be renewed within the next seven years. The average renewals therefore cannot be taken at less than 50 miles per annum. The wooden sleepers between Negapatam and Trichinopoly, which have been down 23 years, must soon be renewed, and the rails on this length have seen their best days, though with the heavy section (68 lb.) they will not go so rapidly as the lighter ones.

Extract from Inspection Report of the South Indian Railway for half-year ended 30th June 1887.

2. *Permanent-way.*—The permanent-way, considering the heavy renewals in progress, is generally in good order. The new 50-lb. road and much of the old 40-lb. road is as good as it could be made. Portions of it, however, between Vikravándi and Shiyáli and the Pondicherry branch, fell short of the standard attained elsewhere, and should receive special attention.

3. Considerable inconvenience and some extra cost to the Company has been caused by some of the 50-lb. material being sent out *viâ* the Cape instead of by the Canal as was anticipated, and therefore arranged for out here. It has been necessary on this account to send 40-lb. material removed from the Madras end to the line in the neighbourhood of Madura for renewals there, and the programme for the distribution of the 50-lb. way, carefully thought out and embodied in a printed manual issued by the Chief Engineer for the use of the district staff, has been upset.

4. The condition of the 40-lb. road and the heavy renewals still called for continue to justify the forecast of the Chief Engineer as to the Engineering staff and permanent-way material that would be necessary to maintain the line for the next few years.

Submitted to Government with reference to G.O., No. 756 R., dated 6th July 1889.

2. It will be seen that the most favorable verdict on the 40-lb. rail is received from the Rajputana-Malwa Railway where the traffic, held to justify the replacement of this rail, by a heavier rail, is estimated by the Chief Engineer of that line at anything exceeding two or three trains daily and by Major Bissett at anything exceeding four trains each way daily; an estimate which I learn from a demi-official communication applies to the 41¼-lb. steel rails.

3. If this be accepted, it appears that the traffic during 1889 on the South Indian Railway justifies a 50-lb. rail everywhere except on the Arkónam and Pondicherry branches and on the main line between Madura and Tuticorin where, however, the traffic has already reached seven trains daily and will certainly increase.

4. There is, as the returns show, a steady development of traffic both over the Madras and the South Indian Railways, and in my opinion the passenger traffic possible with a 2-pie fare on the latter is small compared to the passenger traffic possible with a reduced fare and better train service. The South Indian Railway engines have now some of them a weight of 9 tons on the axle and the speed for mixed and goods trains has been quite recently increased to 25 miles an hour. I am of opinion therefore that eventually the main line should be laid throughout with a 50-lb. rail, and in doing this I would follow the present programme of the Chief Engineer, laying each year only so many 50-lb. rails as are essential to provide second-hand rails for renewal of the rest of the line to a standard of safety and no more.

5. When the main line shall have been laid throughout with the 50-lb. rail, the question may arise whether the 41¼-lb. rail will suffice for a time for the branches. It is neither necessary nor desirable to decide this point at present.

6. Similarly I see no necessity at present to decide the question whether a fresh supply of timber sleepers will be necessary in order that the full life of every light rail and sleeper may be worked out. The decision will depend on the actual life of second-hand sleepers and rails made available from time to time, by replacement with the 50-lb. road, for renewals, and upon the price of iron that may happen to rule when the decision is called for.

7. With reference to para. 3 of Government of India letter No. 86 R.T., 17th June 1889—the first estimate of 50 miles per annum was based on the assumption of

regular progress in renewal; the second estimate appears to have been based on the knowledge that no rails had been sent out by the Board and that no renewals could therefore be effected during the current half-year, and on the assumption therefore that the renewals would have to be doubled in order to maintain the estimated regular progress.

Order—dated 13th March 1890, No. 355 R., Public Works.

Ordered to be forwarded to the Government of India with reference to its letter No. 86 R.S., dated 17th June 1889.

(Here enter No. 356 R., dated 13th March 1890.)

(True Extract.)

(Signed) C. J. SMITH, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Railway Branch.

To the Consulting Engineer for Railways.

Endorsement—dated 13th March 1890, No. 356 R., Public Works.

Forwarded.

(By Order.)

(Signed) C. J. SMITH, Colonel, R.E.,
Joint Secy. to Govt., P.W.D.,
Railway Branch.

Exd. J. Moses.
Spare Copies

RAILWAY.

Govt. of {1890} Madras.

PUBLIC WORKS.

Dated March, 13th.

Recd. *Encl.*

G.O., 13th Mar. 1890, Nos. 355 R., 356 R.

MARCH.

Substitution of the 50-lb. for 41¼-lb. rails on the South Indian Railway

Forwarding report of the Consulting Engineer for Railways on the subject of the — and on sleepers.

No. 43 R. S.

All communications should be addressed to the Secretary.

GOVERNMENT OF INDIA.

PUBLIC WORKS DEPARTMENT.

RAILWAY *Stores.*

4/2490

To

The Secretary to the Government of Madras, Public Works Department. (Railway Branch)

Simla, the 21st May 1890.

Sir,

I am directed to acknowledge the receipt of your No. 356 R, dated 13th March 1890, forwarding Copy of correspondence on the subject of the substitution of 50 lb for 41¼ lb Rails on the South Indian Railway and with reference to paragraph 4 of the Report by the Consulting Engineer for Railways Madras received therewith to enquire whether the Statement is correct to the effect that the weight on the Axle of some of the Engines on the South Indian Railway is 9 tons.

2. According to Appendix I (page 16) to the Analysis of working of the South Indian Railway for the

P. W. C. No. 4998.

the 1st half of 1889, the weight on the driving axle of a 4 wheel coupled Passenger Engine is only 7 tons, and that on the driving axle of a 6 wheel coupled Goods Engine is 6 tons.

Rd. 29-5-90.

I have the honour to be,
Sir,
Your most Obedt. Servt.

Major, R. E.
Under Secretary.

Hon. 22/5/90

Documents accompg:

Nil.

No. 2506. C dy 6th June/90

Referred to the Consulting Engineer for Railways for report with advertence to Progs: of Govt: no: 355 R dated 13th March 1890.-

Rue Rale-Buchanan
Lt Col: R.E.
Actg: Jt. Secy: to Govt. P.W. Deptt.
6.6.90.

Fr. Ano 355-561 R 13.3.90
" " 756 R 6.7.89.

0/20/5

Hd. 2-6- R 3.6.90

353 R dy 13-3-90
356
756 R dy 6-7-89

189 0.

P. W. DEPARTMENT.

Current No. 4998

From

The Govt. of India

ENCLOS.—

No. 43. R.S
Dated 21-5-90
Received 29-5-90

SUBJECT.

S. I. Railway

Enquiring whether the statement in para 4 of the Report by C.R. no. 9 dy 13-3-90 is correct to the effect that the weight on the axle of some of the engines on the —— is 9 tons.

DISPOSAL.

No. 2506 C dated 6th June/90

Referred to the Consg. Engr: for Rys: for report with advertence to Progs: of Govt: No. 355 R dy 13-3-90.

Dy. Sgd. R.R. de B
For. R

Consg. Engr.'s No. 13.

OFFICE OF CONSULTING ENGINEER FOR RAILWAYS,

Madras, 13th June 1890.

No. 417.

MEMORANDUM.

× herewith returned

With reference to G.O. No: 2506 C dated 6th June 1890. the undersigned has the honor to state that there are four 4 wheel coupled bogie tank Engines on the South Indian Railway having a weight on the driving axle of tons 9. Cwt. 0. Qrs 3.

These engines are used mainly for the stone traffic between Pallaveram and the Madras Harbour.

The description of these engines was inadvertently left out in the Analysis of Working Appendix I. and the attention of the Agent South Indian Railway has been called to the omission.

To
The Jt. Secy. to the
Govt. P.W.D. Rly. Br.

Sidney Smith
Major R.E.
Offg. Consg. Engr.

Form No. 3.

From

THE CONSULTING ENGINEER
FOR RAILWAYS,
MADRAS,

No. 417

Dated 13th
Received 14 } June 1890

No. OF ENCLOSURES. 1

Subject.

Stating that the attention of the Agent, S. I. Ry has been called to the omission of certain tank engines in the Analysis of working Appendix I for the 2nd half of 1889 of S. I. Ry:

B. No. 860-61 R. dt. 19th June 1890

PWC No. 55-99

Memo No. 2506 dt. 6-6-90
F. A/No. 351R./352 dt. 13-2-90
B. No. 860 R. dt. 19th June 1890

H.R.S. 17/June
Ordered to be forwarded to the Government of India with reference to its letter No. 43 R. S. dated 21st May 1890.

A.R. No. 861 R. dt. 19th June 1890.

Forwarded.

Recd 16-6-90 W for R.

Info despatched to India 19/6/90.

D/14/6 Reg 21/6

R. 17-6-90