

Public Works (1894) Department.

RAILWAY BRANCH.

G.O., No. 500-1.R

DATED 24th September

[Despatch Abstract.]

Inspection Report.

The — of the S.D. (including the Mayavaram Mutahet + Villupuram - Dharmavaram Rys) for the half year ended 30th June 1894 communicated to the Agent, and a copy of the Pros: ordered to be forwarded to the Govt of India.

Trig copy of Pros: embodying the — of the S.D. (including the Mayavaram - Mutahet + Villupuram - Dharmavaram Rys) for the half year ended 30th June 1894.

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

Bridge of 3 spans of 30 feet continuous girders, mileage 262/2 N.—The weak cross girders have all been strengthened by the addition of a plate $9" \times \frac{3}{4}"$, with $\frac{1}{2}"$ iron rivets to each flange. New longitudinal timbers are being laid over the bridge. The cross girders are $14' 6"$ long, and the lengths of the added plates are 12 feet long, so that there is an unstrengthened gap of $1' 3"$ at each end. This method of central patching is not very satisfactory, as the cross girders being to some extent fixed, it is possible that the section of greatest stress may not have been strengthened. This course of action was forced on the railway authorities by the impossibility of procuring plates $14' 6"$ long in the country, but I think if any plates for these bridges are being obtained from England, they should be of the full length of the cross girders. The flange stress on the strengthened section will be about 7 tons per square inch.

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Mileage of bridge.	Number of spans.	Span in feet and type of girder.	Portion of bridge to be strengthened.	Method of strengthening.	Main girder.				Cross girder.				Remarks.	
					Flange areas square inches.		Flange stresses tons per square inch.		Flange areas square inches.		Flange stresses tons per square inch.			
					Before strengthening.	After strengthening.	Before strengthening.	After strengthening.	Before strengthening.	After strengthening.	Before strengthening.	After strengthening.		
393/19	3	20 D	Cross girder	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
414/6	3	20 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
415/10	3	20 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
423/10	2	20 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
431/12	1	20 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
429/4 T	1	20 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
429/6 T	1	20 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
430/15 T	3	20 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
442/13 T	1	20 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
218/8	2	16 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
271/12	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
286/16	3	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
314/9	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
321/14	2	16 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
323/2	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
325/17	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
326/5	2	16 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
337/14	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
357/14	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
361/8	2	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
364/9	3	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
370/1	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
371/6	3	16 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
372/14	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
380/9	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
383/13	2	16 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
387/16	1	16 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
413/14	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
414/2	3	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
421/8	3	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
430/14	1	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
431/16 T	2	16 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
434/10 T	2	16 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
439/1 T	3	15 D	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
213/6	1	12 R	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
317/4	1	12 R	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
317/16	1	12 R	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
316/7	1	12 R	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
327/7	2	12 R	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
323/10	3	12 R	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
324/14	3	12 R	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	
334/17	3	12 R	Do.	..	..	..	..	..	..	3.55	4.33	12.38	7.29	

Addition of steel plates 6" x 1' to the bottom flanges.

332/10	1	13 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
342/16	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
345/13	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
346/5	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
349/13	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
351/11	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
356/13	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
358/3	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
360/9	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
366/7	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
367/10	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
368/13	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
369/1	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
369/4	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
401/1	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
406/4	3	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
407/16	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
410/9	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
412/7	6	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
422/14	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
440/3	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
442/4	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
446/8 T	2	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
435.1 T	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
436.7 T	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
437/15 T	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
438.2 T	2	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
438.11 T	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
441/6 T	3	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
443/2 T	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	
443.11 T	1	12 B	Do.		..	..	..	..	2.55	4.33	12.38	7.29	

6. The railway authorities do not propose to strengthen the main girders of the bridges at mileages 231/16, 232/11, 233/3, 234/4, 235/2, 236/10 N., 237/2 N., 238/3 N., 247/2 N., 262/2 N., 266/5 N. The Company's Consulting Engineer, in taking out the stresses, arrived at the conclusion that, under Board of Trade rules, the main girders were sufficiently strong. As far as I can make out he has treated these bridges as having non-continuous spans of 30 feet, whereas, with the exception of the bridge at 247/2 N., the girders are continuous and in all cases the clear span should be taken as 35 feet. Making these corrections I find that, under the Board of Trade rules, there is a deficiency of nearly half a square inch in the flanges of the continuous girders, and about $1\frac{1}{2}$ square inches in those of the discontinuous spans. Under the Government of India rules the continuous girders are deficient 3.84 square inches in the top and 3.90 square inches in the bottom flange, while the non-continuous flanges are short to the extent of 5 square inches approximately. The areas of metal in the top and bottom flanges are 11.75 and 11.5 square inches, or, deducting rivet holes 9.31 and 9.25 square inches respectively.

7. Some of the plate girder bridges of 70, 50 and 30 feet spans have tee iron cross girders on the upper flanges. The web of the tee is secured by one or three rivets to angle iron chubs which are either bolted or rivetted to the main girder flanges. All these cross girders are theoretically very weak, particularly some of those on the 70 feet spans, whose section is stated by the railway authorities to be $4" \times 4" \times \frac{1}{8}"$, $4" \times 4" \times \frac{1}{8}"$. The smallest section I could find during inspection was $4" \times 4" \times \frac{1}{8}"$, but of course I was unable to measure every cross girder, and the lighter type may be in the road. In my opinion all these cross girders are unsafe and should be thrown out of use either by lifting the road and putting in a stronger section or by substituting cross sleepers. The former seems to me the better method as the stronger cross girders, of which I understand there is a considerable spare stock, could be easily inserted, and, moreover, the longitudinals are generally in good condition with several years' life left in them. Sir George Bruce, the Company's Consulting Engineer, does not consider the condition of these cross girders to be dangerous, and is of opinion that the weakest section, viz., $4" \times 4" \times \frac{1}{8}"$ is practically safe though strained to a greater extent than desirable. He has also tested a similar section of girder under conditions which he considered the same as those actually obtaining on these spans, and found that, in the worst case, failure commenced under 17 tons dead load. As Sir George Bruce arranged for the testing span to be the distance between the inner edges of the main girder flanges, or 4 feet, while the span in reality is $5\frac{1}{2}$ feet or the distance between the main girder centres, his experiments give a more favorable result than ought to be taken. It was doubtless intended when the girders were designed that a fair bearing should be obtained on the flanges of the main girders, but owing to the latter being sometimes bent and to imperfections in fitting, about 50 per cent. of the cross girders are suspended from the angle iron chubs quite clear of the main girders. I found on examination that all the tee iron cross girders were weakened by the boring of numerous holes, of which fact Sir George Bruce was of course ignorant. I also noticed that nearly every alternate cross girder is supported on the rivet head of the horizontal diagonal bracings which intersect immediately under the web of the tee. The cross girders were carefully examined for signs of failure, but nothing was found except on two spans of the bridge of 7×70 feet spans at mileage 353/8. On this bridge 5 spans have cross girders $4" \times 5" \times \frac{1}{2}"$ and 2 have cross girders $4" \times 4" \times \frac{1}{8}"$; the former showed no indications of weakness, but on the latter the web of the tee iron and the girder flange had in several cases slightly cut into each other. Knowing the theoretical weakness of these cross girders I can only regard this as incipient failure and a warning that collapse is but a matter of time. I think that immediate steps should be taken to secure the longer bearing of the cross on the main girders, and to give the former a broader bearing than the bottom edge of the tee iron. This action should be taken in anticipation of the measures to be adopted in connection with the replacement of the cross girders, and can easily be effected by the insertion of thin packings.

8. In connection with this type of girder it was noticed that frequently the angle iron chubs do not rest fairly on the flanges; in a few cases one end was so much raised that the finger could be inserted in the opening. I am unable to say whether this is due to the wrenching action of the weak cross girder, or to original faulty construction, but I incline dubiously to the latter alternative. These chubs are some-

times rivetted and sometimes bolted to the main girders, which rather supports the conclusion that much care in construction was not exercised.

9. Now that automatic vacuum brakes are to be introduced on the railway, I think care should be taken to securely anchor the longer of the continuous girders at their centres, and that the fixed bearings of the long span single girders be carefully examined. None of the piers and abutments are in my opinion sufficiently high to have a heavy overturning moment, but I consider the security of the bridges as affected by the longitudinal brake stress should be thoroughly investigated. As the continuous girders are now in the hands of the engineers, opportunity should be taken to renew the sliding bed plates which in many cases are broken or absent.

10. The following points on individual bridges were noticed:—

Adyar bridge, 6 × 66 feet spans—The girders are of the Whipple-Murphy type, with the road carried on cross girders resting on the upper boom. The cross girders are spaced on either side of the joints of the bays, an arrangement which I think was not contemplated in the original design. The longitudinal baulks require renewal, and if a cross sleeper road is substituted, the capability of the upper boom to resist the extra bending stress thus imposed should be first ascertained.

Bridge of 1 × 10 feet span and 1 × 15 feet span at mileage 8/19—The bed stones are shaken and new longitudinals are wanted.

Bridge of 6 × 20 feet spans at Chingleput tank Culingula—The stiffeners are in a few instances cracked over the cross girders. Several of the stiffener and cross girder rivets are quite loose. In one place the rail and longitudinal timber joint occur over the same cross girder.

Bridge of 1 × 30 feet span at mileage 54/7 A—Several of the rivets fixing the cross girders are loose. The west abutment is cracked across, and the face is buttressed with a large stack of boulders; heavy distance framing has also been put in. It has been decided to open out the back and fill in with boulder packing.

Bridge of 9 × 20 feet spans at mileage 63/14—The cross girders of this bridge are theoretically weak. There are several loose rivets, and four were out. Two stiffeners are broken at their junction with the cross girders.

Vikravandi bridge 1 × 120 feet span and 6 × 30 feet spans—Several of the cross girder attachment rivets are loose.

Gingee bridge of 22 × 30 feet and 2 × 15 feet—This bridge requires painting and holes to be drilled to allow of the escape of water. A small flight of masonry steps to one of the refuges has been crushed by the expansion of the girders and should be removed.

Ponnur bridge of 17 × 100 feet spans—Several useless rivet holes in the compression flanges of the main girders might be filled in. Overhead bracing is required. The old cracks in the straps of the cross girders have not increased and appear to be due to the original bending.

Bridge of 1 × 25 feet span at mileage 102/2—One of the abutments is cracked. It is proposed to open out the back and build a transverse wall parallel to the face of the abutment and anchor the latter to it. A boulder backing is to be put in and weep-holes provided in the abutment.

Deva Nuddi bridge, 7 × 30 feet spans continuous girders—The top flange of the south main girder is much rusted, and the rivet heads are considerably eaten away. This is attributed to the bridge being used as a highway by the workman employed in the Negapatam shops, who bring on their feet in wet weather the sultry soil of the adjoining country. I think this bridge will have to be reflagged shortly, and even now some of the rivets should be replaced. I would advise this flange being boarded over if workmen are to be allowed a thoroughfare over the bridge.

Korijur bridge, 10 × 30 feet spans—Five spans have tee cross girders $4" \times 5"$ deep and 5 spans $4" \times 6"$ deep. The cross girders have numerous holes, and several do not touch the main girder flanges.

Vagai bridge, 15 × 70 feet spans—This bridge has tee cross girders $5" \times 4"$ deep pierced by numerous rivet holes, and many are clear of the main girder. About 80 per cent. of the wooden keys are loose and the road over the bridge requires a good deal of straightening. The maintenance of this bridge is by far the worst on the line.

Bridge of 5 × 50 feet spans at mileage 231/7.—The tee cross girders are held down by three rivets in the angle iron clips, and, as a rule, have no bearing on the flanges or on the horizontal bracing. On one span the cross girders are 4" × 4" × 1/4" in section, on the others 4" × 5" × 1/4".

Bridge of 10 × 70 feet spans at mileage 433/6.—The tee cross girders are 4" × 5" × 1/4" and generally are clear of the main girders. Over portions of this bridge a slighter section of longitudinal rail bearer resting in two angle irons is laid. In two cases the angle irons have worked off the cross girder.

Vaipar bridge 12 × 70 feet spans.—Several of the angle iron chubs are not bearing fair on the main girder, and the tee cross girders are clear of the flanges. The timbers on pier No. 10 are defective, and a few keys are loose.

Bridge of 7 × 70 feet spans at mileage 353/8.—On 5 spans the tee cross girders are 4" × 5" × 1/4" in section, and on 2 4" × 4" × 1/4". On the latter spans the web of the tee iron and the edge of the main girder flanges are cutting into each other. Where the deeper section of cross girder occurs over a cover plate in the main girder the web has been cut out for a depth of about 1/4 inch; this of course adds considerably to the weakness of a girder none too strong originally, and which, according to Sir George Bruce's experiments, fails at the supports.

Overhead bracing is about to be fixed or raised to conform to standard dimensions on the Tondiyar, Ponniar, Gadilam, Old Vellar, Old Coleroon and Madagu bridges.

11. *General.*—The remaining bridges inspected being in good order and those referred to in the last report call for no comment, I would however suggest that the filling up of rivet holes in all compression flanges be put in hand, and that more care be taken to prevent the lodgment of rain water by drilling suitable escape holes and filling in small retaining spaces with tar and sand.

12. *Ballast.*—As a rule the ballast is sufficient, but more is required between miles 43/14 to 44/5 and also where the renewals with 50 lb. rails are in hand.

13. *Sleepers.*—The timber sleepers require squaring at mileage 415/1 and also at 412/4. The pot sleepers, where unconnected by a tie bar, are also in a few cases skew to the line. On the wooden road three hard wood sleepers have been inserted to each rail length. The renewals of sleepers during the past half-year are shown in statement A at the end of this report.

14. *Rails and fastenings.*—With the exception of three miles, 256 to 258, the whole of the main line from Madras to mile 381 and from Maniyachi to Tuticorin has been laid with 50 lb. steel rails on iron pots. The following statement shows the mileages of the various weights of rails:—

	68 lb. rails.	60 lb. rails.	40 lb. and 41 lb. rails.	35-6 lb. rails.	56 lb. bridge rails, i.e., flat footed.	Total.
<i>Main Line.</i>						
Madras to Tuticorin	47	391-28	63-41	..	57	448-73
<i>Branches.</i>						
Arkonam	..	18-11	20-99	..	..	39-10
Pondicherry (Villupuram to Ginjee river) ..	..	21	18-84	..	21	18-26
Negapatam	37-51	10-73	..	..	..	48-23
Erude	86-93	23	..	..	..	87-18
Tinnevely	..	..	18-10	..	..	18-10
Total, Main Line ..	124-93	420-65	108-34	..	78	654-60
<i>Sidings.</i>						
Main line, Madras to Tuticorin	8-18	7-16	64-80	..	..	64-84
<i>Branches.</i>						
Arkonam	..	16	1-51	1-30	..	3-97
Pondicherry (Villupuram to Ginjee river) ..	..	..	67	..	..	67
Negapatam	8-42	08	4-72	..	..	13-22
Erude	7-61	..	..	..	..	7-61
Tinnevely	..	..	3-18	..	..	3-18
Total, Sidings ..	19-21	7-40	63-58	1-30	..	91-49

The renewals of rails for the past half-year are shown in statement B at the end of this report.

15. *Level crossings.*—The level crossings are generally in good order, but in a few cases, notably at Madura, the road wants making up. In some places the space between the rails and the guard rails has been filled up. The level crossing gates at the south end of Madura station require lifting, so that the bolts may work in their proper catches instead of having to be held in a loop of wire.

16. *Boundary pillars.*—The railway land is not at present sufficiently demarcated especially south of Trichinopoly.

17. *Fencing.*—The aloe fencing is indifferently maintained and especially between Madras and Chingleput is more a source of danger than protection. On this length in the six miles between 13 to 24 miles, 119 gaps were counted on the east side of the line. In one section alone, that between Trichinopoly and Tanjore, was the aloe fencing properly maintained and the gaps closed efficiently. The wire fencing is invariably in good order.

18. *Carriage stock.*—The general condition and upkeep of the carriages are far and away, better than I have ever known them, and the exertions that have been made in recent years have resulted in some excellent stock being placed on the line. I have travelled in all classes of the bogie trains and found the running excellent, and the internal arrangements of the higher classes most comfortable. In the servants' compartment of the first and second class bogie composites, a large opening has been provided to enable the passengers to communicate with their servants. It has been found, however, that the public are misusing this convenience and that 3rd-class passengers who are not servants occupy the servants' compartment in order to get through the aperture into the higher class while the train is running. It will, I fear, be necessary to reduce the size of the opening to prevent this. It has come to my knowledge that the cleanliness of the carriages is not properly attended to, and that first-class passengers are frequently inconvenienced by the prevalence of bugs. The white paint used by the Locomotive Department is evidently largely adulterated, probably with chalk. A shower of rain brings down the paint from the carriage roofs on to the sunshades, and the white lettering on the stock can be rubbed out with the finger.

19. *Locomotive stock.*—The engines as usual are kept in most perfect condition, and the drivers evidently take the keenest interest in the cleanliness and smartness of their locomotives. None of the "O" class engines have so far adjusted wheel weights in consequence of the non-arrival of the lighter foot-plates daily expected from home. There are at present two engines ready prepared for the new foot-plates.

20. *Stations.*—The stations are generally clean and the compounds neat. The yards on the Trichinopoly-Dindigul section are particularly well kept. The waiting room accommodation is as a rule very uninviting, ragged matting, insecure chairs, and broken or rickety tables affording but scant inducements for passengers to use the rooms. I am afraid that the dilapidated state of the furniture is due to divided responsibility, and that in consequence neither the Engineering nor Traffic Departments do their proper duties in connection with its upkeep.

21. *Beach Station.*—The Harbour Trust Board have invited the Madras and South Indian Railways to discuss the building of a joint station at the beach. Now that the harbour is approaching completion it should be possible for the Board to give up sufficient land to enable a suitable and much needed station to be built.

22. *Egmore.*—The first and second class booking arrangements might be improved by throwing the present passage into the parcels office and converting the room thus formed into a general waiting room and booking office, a screen wall being erected to separate the ladies' retiring room. The present waiting room would thus be available for railway private use.

23. *Chetpet.*—A steel pale fence should be substituted for the present wire fencing, as passengers to avoid giving up their tickets get over the wires.

24. *St. Thomas' Mount.*—A new through siding has been put in, the platform being widened over the site of the former siding so as to serve the main line. The matting in the waiting rooms is in bad order and the furniture very shaky, particularly the table in the ladies' room.

25. *Pallāraram*.—A corrugated iron engine shed has been in course of erection for many months. I think an effort should be made to complete this almost historic structure.

26. *Acharapakkam*.—The trees on the platform require a little trimming, and the floor of the station-house should be levelled.

27. *Tindivanam*.—The approach road requires a little metal here and there. Although there are about 200 passengers daily, no third-class waiting accommodation is provided.

28. *Villupuram*.—The junction arrangements at the south between the Pondicherry branch and the main line are in my opinion decidedly dangerous. The Pondicherry line runs into the main line at No. 34 points; from here to No. 33 points both trains use the same road; the Pondicherry train then crosses over to the west side of the island platform. The Pondicherry distant signal cannot be seen from the station, and it is worked by the pointsman at the junction points No. 34 who is in electrical communication with the stationmaster. There are no interlocking arrangements, and moreover the green light of the main line distant signal is visible on the Pondicherry branch. A short time ago a collision at this junction was most narrowly averted by the presence of mind of the shunter and the promptness of a main line driver, so it is obvious that the danger pointed out is by no means visionary. I would suggest that the crossing of the main line, which cannot be avoided, should be as direct as possible in order to shorten the dangerous area; also that the home and distant signals and the facing points be interlocked and that a screen be put up to prevent the main line distant signal showing down the Pondicherry branch. The Chief Engineer, I understand, shares these views and will shortly submit a scheme to improve matters. On the north of the station the junction arrangements are satisfactory.

29. *Punruti*.—More closed-in accommodation is required in the goods shed. I would suggest that it be provided and rented to merchants at so much per day. The road to the station might be more liberally provided with lamps.

30. *Nellikuppam*.—There is no third-class waiting shed. This might advantageously be given by closing in the north verandah to form a lamp room, when the present stationmaster's room could be released for passengers.

31. *Cuddalore Old Town*.—Something better than the present reading room should be provided for the Company's employes at this station. It always appears to me that moderate expenditure in promoting the comfort of the staff is money well spent, and operates to the advantage of the railway by attracting a better class of men to the service. A driver's latrine at this station appears to be built of bricks laid dry, and, where the outside skin of plaster and tar has stripped, seems in a shaky condition.

32. *Kumbakonam*.—The goods shed floor has been undermined by rats and requires attention.

33. *Tanjore*.—New water tanks holding about 7,000 gallons have just been erected on rail staging. The goods shed floor has fallen in in places, apparently in consequence of excavation by rats. The punkah in the refreshment room is hung far too high, the lower edge of the fringe being 6' 10" above the floor.

34. *Kivalur*.—The through siding and lay-bye are to be transferred to the south side of the main line, and the platform which is now 200 feet long is to be lengthened to 600 feet. The earthwork in connection with these alterations is nearly done on the south side; the north side cannot be touched until the old lines are taken up. When the work is done the platform will be on the main line.

35. *Nidamangalam*.—The third-class waiting shed should have a ramp instead of a vertical drop wall round it. The station fencing generally requires attention and the trees over the platform lopping. I found the line in the goods shed blocked with bales and packages, which, instead of being unloaded on the platform, were thrown down on the ballast.

36. *Ammappet*.—The point levers are of the old Carnatic type and are rather out of date now, but the levers at No. 2 points were also a little out of repair.

37. *Mayappārai*.—The south distant signal appears out of order.

38. *Ayalur*.—Slip points are required at this station and proposals will shortly be submitted for slip points and catch-sidings at this and other stations on heavy grades.

39. *Madura*.—A recreation bungalow for the staff has just been finished and is not altogether suitable for the purpose. The building consists of a large and a small room both paved with stone flagging, and a small room for retiring purposes is being added in the verandah. I would suggest that a wooden floor be laid in the large room to permit of it being used for dancing, and that a billiard room be added communicating with the larger room through a wide arch. More quarters are wanted at this station, and they should be located behind the present bungalows and not on the water-logged ground in front of the station.

40. *Kumarapuram*.—The trial station is being made permanent.

41. *Working of trains*.—The South Indian Railway is worked on the "Line Clear and Caution Message" system, but as recently there have been narrow escapes from accidents, the administration is considering the advisability of introducing the "Absolute Block" system. I quite share the opinion that some change is desirable, as the present system gives too great discretionary powers to stationmasters who in many cases are not sufficiently trustworthy. I was shown at Trichinopoly Fort station a couple of Webb and Thomson's electric staff block instruments which have been imported for trial. The instruments are expensive, costing £75 per pair, and do not seem suitable for through-running unless non-stopping stations can be switched out. Mr. Winter of the Madras Railway has recently perfected a machine which electrically controls the issue of line clear tickets, and which, though costing half the price of the staff instrument, seems better adapted to the requirements of the South Indian Railway. I am not at liberty to further describe the machine as it is not yet fully protected.

42. *Tanjore-Pulliyarpati ballast siding*.—A siding $4\frac{1}{2}$ miles in length has just been completed from Tanjore to the laterite quarries at Pulliyarpati. It takes off from one of the goods lines and rises sharply at 1 in 85 from the yard for 25 chains; the grade then moderates to 1 in 155 for 10 chains, after which the formation is level for some distance. The siding is practically a surface line on hard laterite soil and traverses scrub jungle. There are three six-feet, two four-feet, and one three-feet openings, all of which are substantially built. Although not run over before inspection there was practically no subsidence under the engine. The permanent-way consists of old 68 lb. iron rails with 4-holed fish-plates laid on three new pyngadu and four old half round sleepers per 21-feet rail. The siding is unfenced. In consequence of the steep grade out of Tanjore station a dead end siding 500 feet long is to be laid in the yard in continuation of the ballast siding.

MAYAVARAM-MUTUPET RAILWAY.

(54 miles.)

43. Taking all things into account the running over the Mayavaram-Mutupet Railway was decidedly good, and the banks are standing well. The whole line from Mayavaram to Tiruvālūr requires lifting about 6 inches to bring it to the proper level. The banks still require a good deal of making up in numerous places, and ballast is generally somewhat deficient. Now that the siding at Tanjore is opened, it will be possible to train ballast on to the line.

44. *Bridge and Culverts*.—The following work in bridges and culverts remains to complete:—

Fifty-four culverts require plastering, and the stone pitching of 22 has yet to be done.

Bridge 2 × 25 feet spans, mileage 176/3 M.—Concrete and masonry of the floor in both spans, and the pitching in the apron and river banks not yet done. Boulders at site.

Bridge 2 × 20 feet spans, mileage 177/4 M.—A small amount of concrete and the masonry of the floor of No. 2 span has to be put in. The pitching of the down-stream apron and the river slopes remains to be completed.

Bridge 1 × 10 feet spans, mileage 182/17 M.—The bridge is finished but for about 100 cubic feet of masonry in the floor at the north-east side, and the pitching of the river slope on the same side.

Bridge 1 × 30 feet spans, mileage 185/4 M.—Everything done except pitching of the apron and river slope.

Bridge 5 × 40 feet spans, mileage 186/10 M.—This work is completed with the exception of a little masonry in the floor and the pitching in the up-stream aprons of spans 2, 3, 4 and portions of 1 and 5.

Bridge 5 × 40 feet spans, mileage 187/11 M.—The floor and drop walls of spans 4 and 5 to be done, also the pitching in both aprons except No. 1 span down stream, and of bank at south-east side.

Bridge 3 × 40 feet spans, mileage 197/13 M.—About 1,000 cubic feet of pitching has still to be put in in front of the return wall.

Bridge 5 × 40 feet spans, mileage 224/10 M.—In No. 5 span about 24 feet of flooring has to be done, no pitching or aprons in yet. Painting is badly required, and the holes in the compression flanges of the cross girders might be filled up.

Bridge 3 × 30 feet spans, mileage 220/12 M.—Completed except as regards pitching and aprons.

45. Stations and Buildings.—Passenger requirements are practically completed; and the accommodation to be provided for goods should soon be finished.

As far as I can judge, work is being delayed for want of small stores, such as chubs and screws.

Manganallur.—The earthwork of the loading bank is nearly done, the roofing and flooring of the goods shed is in progress, and the metalling of the roads is not yet commenced. The flagging of the passenger shed requires rellevelling, and the latrine flooring is not yet down.

Perulam.—The goods shed floor is laid, and the roofing is in hand. The goods shed line requires ballasting, and the loading bank, making up. The latrine floor has still to be laid. The platform in rear of the station house should be fenced round to prevent passengers from falling into the neighbouring borrow pits, which are full of water. I understand a woman was drowned one night a short time ago by getting off the platform in the dark. The station-approach road should be protected by earth parapets at the sides.

Nannilam.—The goods shed is about half done, and the earth-work of the loading bank is in hand. Wire fencing not commenced. The tank rail staging is almost finished, and the floor of the waiting shed properly completing.

Vettar.—The masonry of the goods shed is built to window level, and is waiting for window frames. The earthwork of the roads has been thrown up, but requires dressing and metalling. The gable end of the station house has yet to be closed and the latrine to be floored.

Kottagam.—The goods shed has to be floored and the roads to be metalled. The loading bank wall is not started.

Ponnerai.—Goods shed floor is not in yet, nor is the loading bank ready. At this station there appears to be fair traffic, and the goods arrangements ought to be hurried up.

Tirutturaiippundi.—The platform in rear of the station should be fenced, and an earthen parapet thrown up on the tank side of the approach road. The permanent watering arrangements are not finished yet.

Pandi.—The loading bank wall has to be completed and the floor of the goods shed to be laid.

Tillaiwilagam.—The goods loading bank is not started, the iron work of the goods-shed roof is half done, and the staff well is in progress.

VILLUPURAM-DHARMAVARAM STATE RAILWAY AND NELLORE BRANCH.

(386-91 miles.)

46. The upkeep of this section is on the whole far better than that of the main line, and the standard of maintenance attained is very high. Considering that there are several troublesome banks on the new line and particularly on the Nellore branch, the general condition of the line reflects great credit on the responsible officers.

47. Banks and Cuttings.—The banks and cuttings are in good order. The bank from 331/12 to 327/0 is still giving a great deal of trouble, and will continue to do so until the original soil is displaced by the trained earth. The new portions of the bank between 321/6 to 323/0, breached in November 1893, show slight signs of erosion. The recent heavy rains washed a good deal of soil into the cuttings, but this is in course of removal and the drainage is as a rule not now impeded.

48. Bridges and Culverts.—The bridges and culverts are mostly in good order, the principal defects being the condition of the timber longitudinals, which have not stood the dry climate between Pakala and Dharmavaram at all well.

Bridge of 1 × 60 and 4 × 40 feet spans, mileage 144/11 G.—Two rivets are out, and the road requires a little straightening.

Pāpāghni bridge 8 × 60 feet spans, mileage 316/3 G.—There are some short and several badly cracked timbers on this bridge.

At mileage 290/16 G., a girder bridge of 15 or 20 feet span is to be put in.

Bhimavaram bridge 3 × 120 feet spans, mileage 254/6 G.—Three cross girder rivets are out.

Bridge of 15 × 40 feet spans at mileage 322/12 B.—The cross sleepers require squaring. An attempt has been made to prevent the free expansion of the girders by inserting wooden blocks. These should be removed.

49. Sleepers.—The line was opened out in several places with a view to ascertain how the steel transverse sleepers are standing. The results obtained by mere inspection are conflicting, as the life of the sleepers will vary greatly in different parts of the line, although there appears to be no change in the ballast. Some samples of ballast were taken by the Superintending physician for analysis, and it will probably be found that the amount of rust developed in a given time is some function of the quantity of salt present in the soil. The following examinations were made:—

Mileage 362/3 G.—Sleepers in good order, but want squaring.

Mileage 351/3 G.—Sleepers in good condition.

Mileage 340/18 G.—Sleepers in good order.

Mileage 319/6 G.—Sleepers in good condition.

Mileage 290/7 G.—Sleepers just commenced to rust.

Mileage 289/6 G.—Sleepers commenced to rust.

Mileage 331/12 B.—Sleepers rusting badly, and the rail flange is nearly rusted out, over sleepers. The road was laid in 1886, the rails being 41½ lb. in weight and of steel. At this mileage one of the rails is so weakened as to be unsafe, and the Chief Engineer ordered its removal.

Mileage 328/13 B.—Sleepers commenced to rust.

50. Stations and Buildings.—The stations and buildings are almost without exception in excellent order. The following points were noticed:—

Tiruvannāmalai.—The roof evidently leaks in a couple of places. The chairs in the waiting room are shaky.

Vellore.—The loading bank should be properly metalled; at the time of inspection it was in a muddy state with pools of standing water.

Kadiri.—The goods-approach road and loading bank ought to be metalled.

Muddiguba.—The iron doors and their rail framing in the porters' lines should be properly erected. The drainage arrangements of these lines is not quite satisfactory.

Dharmavaram.—The South Indian Railway have three blocks of buildings, one of which is temporary; the other structures on the South Indian side of the line are supposed to belong to the Southern Mahratta Railway, but I think this is probably an error. The ownership of the bungalows at this station ought to be at once determined.

Pakala.—There is a great deficiency of accommodation for the staff at Pakala, and a large scheme for providing the necessary quarters is about to be submitted.

Kalahasti.—A new goods shed has been built, and the earthwork of the road to it is finished.

Venkatagiri.—A goods shed, loading bank and lay-bye have lately been provided.

MADRAS,
3rd September 1894.

A. D. G. SHELLEY, Capt., R.E.,
Govt. Inspector of Railways.

A.—STATEMENT showing the renewals of sleepers for the half-year ending 30th June 1894.

	Sleepers displaced.										Sleepers replaced.									
	Crossed 6'.	Crossed 8'.	Pygadu.	Teak of mus.	Pot, 60 lb.	Pot, 40 lb.	Transverse steel sleepers.	D and O sleepers.	Crossed 6'.	Crossed 8'.	Pygadu.	Teak of mus.	Pot, 60 lb.	Pot, 40 lb.	Transverse steel sleepers.	D and O sleepers.	Crossed 6'.	Crossed 8'.	Pygadu.	Teak of mus.
January 1894	7,647	2,096	771	2,096	41	21	16	16	492	1,338	17	19	3	10,447	21	16	16	16	106	329
February "	9,228	2,896	200	2,896	41	10	11	11	1,338	1,338	17	19	3	12,261	21	16	16	16	106	667
March "	2,581	1,402	4	1,402	13	14	9	9	930	930	15	15	3	2,970	6	6	6	6	67	258
April "	938	34	1	34	6	8	13	13	938	938	18	18	1	81	6	6	6	6	69	288
May "	1,192	61	2	61	7	20	83	83	1,187	1,187	40	40	2	3,302	8	8	8	8	136	734
June "	4,225	7,364	981	7,364	61	61	132	132	1,203	1,203	61	61	28	28,909	22	136	136	136	857	8,913
Total	26,813	7,364	981	7,364	41	21	132	132	6,084	6,084	144	144	63	28,909	22	136	136	136	857	8,913
January 1894	389	46	8	46	21	10	16	16	329	329	106	106	3	212	21	136	136	136	106	329
February "	867	46	8	46	21	10	16	16	667	667	106	106	3	212	21	136	136	136	106	667
March "	693	46	8	46	21	10	16	16	693	693	106	106	3	212	21	136	136	136	106	693
April "	231	46	8	46	21	10	16	16	231	231	106	106	3	212	21	136	136	136	106	231
May "	319	46	8	46	21	10	16	16	319	319	106	106	3	212	21	136	136	136	106	319
June "	873	46	8	46	21	10	16	16	873	873	106	106	3	212	21	136	136	136	106	873
Total	3,123	447	27	447	21	10	132	132	2,859	2,859	713	713	28	212	21	136	136	136	713	2,859
Grand Total	28,936	7,801	1,008	7,801	67	71	132	132	8,913	8,913	857	857	63	28,909	22	136	136	136	857	8,913

B.—Statement showing the renewals of rails for half-year ending 30th June 1894.

Rails replaced.																			
Iron.										Steel.									
60 lb.					40-8 lb.					35-5 lb.					50 lb.				
21'	18'	cwt.	24'	21'	18'	cwt.	19'	16½'	14'	cwt.	30'	27'	24'	21'	18'	cwt.	24'	21'	18'
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
<i>Main line.</i>																			
January 1894	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
February "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
March "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
May "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
June "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	273	4	..	6,763	1,238	70	3,684	..	..	..	..	..	..	..	2	..	477	250	4
<i>Sidings.</i>																			
January 1894	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
February "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
March "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
May "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
June "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	143	8	197	161	181	65	3,684	..	..	..	..	..	..	..	..	..	477	250	4
Grand Total	416	12	197	6,924	1,419	141	7,368	..	..	..	..	..	..	..	2	..	954	500	8

B.—Statement showing the renewals of rails for half-year ending 30th June 1894—cont.

Rails replaced.																			
Iron.										Steel.									
60 lb.					40-8 lb.					35-5 lb.					50 lb.				
21'	18'	cwt.	24'	21'	18'	cwt.	19'	16½'	14'	cwt.	30'	27'	24'	21'	18'	cwt.	24'	21'	18'
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
<i>Main line.</i>																			
January 1894	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
February "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
March "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
May "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
June "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	273	4	..	6,763	1,238	70	3,684	..	..	..	..	..	..	..	2	..	477	250	4
<i>Sidings.</i>																			
January 1894	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
February "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
March "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
May "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
June "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total	150	7	..	23	38	16	..	..	..	..	..	..	..	..	..	..	68	138	50
Grand Total	423	11	..	90	44	22	..	..	..	..	..	..	..	..	..	..	365	381	73

Note by Senior Government Inspector.

Main line.

Bridges and Culverts.—The chief points under this head are the strengthening of the 20' main plate girders, the strengthening of the lower flanges of the built cross girders of the 12', 15' and 20' spans, the strengthening of both flanges of the cross girders of the 30' spans which both the Consulting Engineer to the Board and I are agreed as primarily necessary.

These are being done and the list given shows the method of strengthening. I agree with Captain Shelley that for the cross girders of the 30' spans the plates should be of the full length of the cross girders if the plates are not yet supplied from England. Thus strengthened, the girders, both main and cross, will be up to the Government of India standard, and it may here be noted that, in carrying out any alterations in girders, the standard adopted should be that laid down by the Government of India and not that of the Board of Trade.

When these girders are finished it will be necessary to take in hand the alterations noticed in paragraphs 6 and 7; of these it appears from examination that the tee iron cross girders on the 70', 50' and 30' spans demand early attention. The inspection shows that 50 per cent. of these tee irons are suspended from the angle iron knee or "chub" and further weakened by the boring of numerous holes and that therefore the tests as carried out by the Board's Consulting Engineer did not actually reproduce the existing conditions.

I suggest the 8" knees or chubs of all defective joints be cut out and replaced by an 18" knee the full width of the top flange of the main girder, and that the top flange be strengthened where requisite by an angle iron stiffener rivetted to the web and both flanges.

This method will be cheap and will not disturb the traffic.

The repairs mentioned in paragraph 10 should be carried out.

Locomotive stock.—The alteration of the 20 O class engines was one of points mentioned by the Board's Consulting Engineer to be taken in hand. According to the last report 12 of these engines are working on the Negapatam-Erode section and 8 are waiting for the new footplates and are then to be adjusted to bring the axle weights down to 8 tons 6½ cwt.

Stations.—The alterations mentioned in paragraph 28 for the safe working of Villupuram junction should be at once carried out.

Working of trains.—Orders having been issued regarding the time to be allowed for asking and obtaining "line clears," I am not of opinion that the "absolute block" is necessary. The general evidence points rather to the need of a better class of stationmasters.

Sleepers (Villupuram-Dharmavaram Branch).—The number of steel sleepers replaced is 135 against 151 during last 6 months to December 1893, showing due attention is paid to their condition.

General.—The condition of the line cannot be considered satisfactory until the O class engines are fully at work over the main line, hauling the mail trains and using the vacuum brake provided.

My estimate of 6 months in which this would be effected was too sanguine; indeed I foresee at the present rate of alterations to the engines and repairs to the bridges that it will take perhaps 12 months longer.

The attention of the Railway authorities is called to the numerous complaints which appear from time to time in the vernacular papers.

12th September 1894.

(Signed) F. R. UPCOTT,
Senior Government Inspector.

24TH SEPTEMBER 1894, No. 500 R, PUBLIC WORKS.

GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Railway.

Read the following paper:—

Report of inspection of the South Indian Railway for the half-year ended 30th June 1894.

ORDER—dated 24th September 1894, No. 500 R., Public Works.

Communicated to the Agent, South Indian Railway, for information and necessary action.

2. A copy of these Proceedings will be forwarded for the information of the Government of India.

[Here enter No. 501 R., dated 24th September 1894.]

(True Extract.)

(Signed) F. R. UPCOTT,
Joint Secy. to Govt., P.W.D.,
Railway Branch.

To the Agent, South Indian Railway.

ENDORSEMENT—dated 24th September 1894, No. 501 R., Public Works.

Forwarded.

(By Order.)

Joint Secy. to Govt., P.W.D.,
Railway Branch.

Ed. C. A. Maniamay.
Spare Copies

RAILWAY.

Gobt. of {1894} Madras.
PUBLIC WORKS.

Dated September, 24th.

Recd.

Encl.

G.O., 24th Sept. 1894, Nos. 500,
501 R.

SEPTEMBER.

Inspection Report

Forwarding copy of Proceedings embodying the — of the South Indian Railway (including the Mayavaram-Muttupet and Villupuram-Dharmavaram Railways) for the half-year ended 30th June 1894.

SOUTH INDIAN RAILWAY.

(INCLUDING THE MAYAVARAM-MUTTUPET AND VILLUPURAM-DHARMAVARAM RAILWAYS.)

(Metre Gauge.)

Total mileage open for traffic 1,103.33 miles.

Inspection report by Captain A. D. G. SHELLEY, R.E., Government Inspector of Railways, Madras, for the half-year ended 30th June 1894.

MAIN LINE AND BRANCHES.

The inspection was carried out between the 5th and 31st August 1894. The Chief Engineer and the Superintending Physician were present throughout the inspection, and the Resident Engineers accompanied the party over their respective lengths.

2. **General.**—The road throughout was in good running order. The best maintained section was between Trichinopoly and Dindigul, the worst between Madras and Chingleput. The latter section requires attention, for, although the running over it, is not at all bad, it is very untidy.

3. **Banks and Cuttings.**—Beyond a little clearing out of side drains, the banks and cuttings are in good condition. It is proposed to put in 500 feet of causeway south of mileage 251/7 and slightly lower the formation level, and also to have a similar length of causeway near mileage 252/4, in order to avoid the damage to the railway which is caused about every ten years, by the bursting of tanks and the inability of the Koriyar to carry off the excess water. The bank at mileage 254/2 is slightly eroded by a shallow tank on the south-west of the line, and should be protected by stone pitching for about 200 feet in length.

4. **Bridges and Culverts.**—The work of strengthening such bridges as do not conform to the Board of Trade requirements with the adjusted axle loads of the "O" class engine, has recently been commenced. It is the present intention of the railway administration to only strengthen up to the Board of Trade standard, but this intention does not appear to have been actually carried out, as the strengthening work now in hand and proposed will bring the bridges up to the Government standard.

5. The following bridges are being strengthened:—

Rajah Nullah.—Ten spans of 20 feet, mileage 219/8. Six strengthened spans are in position on the masonry of the bridge which is for a double line, and are ready to be slid under the road. These girders had originally flanges of angle iron 3" x 3" x 1/2", which are now supplemented by plates 12" x 1/2"; stiffeners have also been added.

Bridge of 3 spans of 30 feet continuous girders, mileage 262/2 N.—The weak cross girders have all been strengthened by the addition of a plate 9" x 1/2", with 1/2" iron rivets to each flange. New longitudinal timbers are being laid over the bridge. The cross girders are 14' 6" long, and the lengths of the added plates are 12 feet long, so that there is an unstrengthened gap of 1' 3" at each end. This method of central patching is not very satisfactory, as the cross girders being to some extent fixed, it is possible that the section of greatest stress may not have been strengthened. This course of action was forced on the railway authorities by the impossibility of procuring plates 14' 6" long in the country, but I think if any plates for these bridges are being obtained from England, they should be of the full length of the cross girders. The flange stress on the strengthened section will be about 7 tons per square inch.

The following statement shows the programme of strengthening operations as advanced by the railway :—

[illegible]

6. The railway authorities do not propose to strengthen the main girders of the bridges at mileages 231/16, 232/11, 233/3, 234/4, 235/2, 236/10 N., 237/2 N., 238/3 N., 247/2 N., 262/2 N., 266/5 N. The Company's Consulting Engineer, in taking out the stresses, arrived at the conclusion that, under Board of Trade rules, the main girders were sufficiently strong. As far as I can make out he has treated these bridges as having non-continuous spans of 30 feet, whereas, with the exception of the bridge at 247/2 N., the girders are continuous and in all cases the clear span should be taken as 35 feet. Making these corrections I find that, under the Board of Trade rules, there is a deficiency of nearly half a square inch in the flanges of the continuous girders, and about $1\frac{1}{2}$ square inches in those of the discontinuous spans. Under the Government of India rules the continuous girders are deficient 3.84 square inches in the top and 3.90 square inches in the bottom flange, while the non-continuous flanges are short to the extent of 5 square inches approximately. The areas of metal in the top and bottom flanges are 11.75 and 11.5 square inches, or, deducting rivet holes 9.31 and 9.25 square inches respectively.

7. Some of the plate girder bridges of 70, 50 and 30 feet spans have tee iron cross girders on the upper flanges. The web of the tee is secured by one or three rivets to angle iron chubs which are either bolted or rivetted to the main girder flanges. All these cross girders are theoretically very weak, particularly some of those on the 70 feet spans, whose section is stated by the railway authorities to be $4" \times 4" \times \frac{1}{8}"$, $4" \times 4" \times \frac{1}{8}"$. The smallest section I could find during inspection was $4" \times 4" \times \frac{1}{8}"$. but of course I was unable to measure every cross girder, and the lighter type may be in the road. In my opinion all these cross girders are unsafe and should be thrown out of use either by lifting the road and putting in a stronger section or by substituting cross sleepers. The former seems to me the better method as the stronger cross girders, of which I understand there is a considerable spare stock, could be easily inserted, and, moreover, the longitudinal are generally in good condition with several years' life left in them. Sir George Bruce, the Company's Consulting Engineer, does not consider the condition of these cross girders to be dangerous, and is of opinion that the weakest section, viz., $4" \times 4" \times \frac{1}{8}"$ is practically safe though strained to a greater extent than desirable. He has also tested a similar section of girder under conditions which he considered the same as those actually obtaining on these spans, and found that, in the worst case, failure commenced under 17 tons dead load. As Sir George Bruce arranged for the testing span to be the distance between the inner edges of the main girder flanges, or 4 feet, while the span in reality is $5\frac{1}{2}$ feet or the distance between the main girder centres, his experiments give a more favorable result than ought to be taken. It was doubtless intended when the girders were designed that a fair bearing should be obtained on the flanges of the main girders, but owing to the latter being sometimes bent and to imperfections in fitting, about 50 per cent. of the cross girders are suspended from the angle iron chubs quite clear of the main girders. I found on examination that all the tee iron cross girders were weakened by the boring of numerous holes, of which fact Sir George Bruce was of course ignorant. I also noticed that nearly every alternate cross girder is supported on the rivet head of the horizontal diagonal bracings which intersect immediately under the web of the tee. The cross girders were carefully examined for signs of failure, but nothing was found except on two spans of the bridge of 7×70 feet spans at mileage 353/8. On this bridge 5 spans have cross girders $4" \times 5" \times \frac{1}{2}"$ and 2 have cross girders $4" \times 4" \times \frac{1}{8}"$; the former showed no indications of weakness, but on the latter the web of the tee iron and the girder flange had in several cases slightly cut into each other. Knowing the theoretical weakness of these cross girders I can only regard this as incipient failure and a warning that collapse is but a matter of time. I think that immediate steps should be taken to secure the longer bearing of the cross on the main girders, and to give the former a broader bearing than the bottom edge of the tee iron. This action should be taken in anticipation of the measures to be adopted in connection with the replacement of the cross girders, and can easily be effected by the insertion of thin packings.

8. In connection with this type of girder it was noticed that frequently the angle iron chubs do not rest fairly on the flanges; in a few cases one end was so much raised that the finger could be inserted in the opening. I am unable to say whether this is due to the wrenching action of the weak cross girder, or to original faulty construction, but I incline dubiously to the latter alternative. These chubs are some-

times rivetted and sometimes bolted to the main girders, which rather supports the conclusion that much care in construction was not exercised.

9. Now that automatic vacuum brakes are to be introduced on the railway, I think care should be taken to securely anchor the longer of the continuous girders at their centres, and that the fixed bearings of the long span single girders be carefully examined. None of the piers and abutments are in my opinion sufficiently high to have a heavy overturning moment, but I consider the security of the bridges as affected by the longitudinal brake stress should be thoroughly investigated. As the continuous girders are now in the hands of the engineers, opportunity should be taken to renew the sliding bed plates which in many cases are broken or absent.

10. The following points on individual bridges were noticed:—

Adyar bridge, 6 × 66 feet spans—The girders are of the Whipple-Murphy type, with the road carried on cross girders resting on the upper boom. The cross girders are spaced on either side of the joints of the bays, an arrangement which I think was not contemplated in the original design. The longitudinal baulks require renewal, and if a cross sleeper road is substituted, the capability of the upper boom to resist the extra bending stress thus imposed should be first ascertained.

Bridge of 1 × 10 feet span and 1 × 15 feet span at mileage 8/19.—The bed stones are shaken and new longitudinals are wanted.

Bridge of 6 × 20 feet spans at Chingleput tank Calingula.—The stiffeners are in a few instances cracked over the cross girders. Several of the stiffener and cross girder rivets are quite loose. In one place the rail and longitudinal timber joint occur over the same cross girder.

Bridge of 1 × 30 feet span at mileage 54/7 A.—Several of the rivets fixing the cross girders are loose. The west abutment is cracked across, and the face is buttressed with a large stack of boulders; heavy distance framing has also been put in. It has been decided to open out the back and fill in with boulder packing.

Bridge of 9 × 20 feet spans at mileage 63/14.—The cross girders of this bridge are theoretically weak. There are several loose rivets, and four were out. Two stiffeners are broken at their junction with the cross girders.

Vikravandi bridge 1 × 120 feet span and 6 × 30 feet spans.—Several of the cross girder attachment rivets are loose.

Gingee bridge of 22 × 30 feet and 2 × 15 feet.—This bridge requires painting and holes to be drilled to allow of the escape of water. A small flight of masonry steps to one of the refuges has been crushed by the expansion of the girders and should be removed.

Ponniar bridge of 17 × 100 feet spans.—Several useless rivet holes in the compression flanges of the main girders might be filled in. Overhead bracing is required. The old cracks in the straps of the cross girders have not increased and appear to be due to the original bending.

Bridge of 1 × 25 feet span at mileage 102/2.—One of the abutments is cracked. It is proposed to open out the back and build a transverse wall parallel to the face of the abutment and anchor the latter to it. A boulder backing is to be put in and weep-holes provided in the abutment.

Deva Nuddi bridge, 7 × 30 feet spans continuous girders.—The top flange of the south main girder is much rusted, and the rivet heads are considerably eaten away. This is attributed to the bridge being used as a highway by the workman employed in the Negapatam shops, who bring on their feet in wet weather the salty soil of the adjoining country. I think this bridge will have to be reflagged shortly, and even now some of the rivets should be replaced. I would advise this flange being boarded over if workmen are to be allowed a thoroughfare over the bridge.

Koriyar bridge, 10 × 30 feet spans.—Five spans have tee cross girders $4" \times 5"$ deep and $5\frac{1}{4}" \times 6"$ deep. The cross girders have numerous holes, and several do not touch the main girder flanges.

Vagai bridge, 15 × 70 feet spans.—This bridge has tee cross girders $5" \times 4"$ deep pierced by numerous rivet holes, and many are clear of the main girder. About 80 per cent. of the wooden keys are loose and the road over the bridge requires a good deal of straightening. The maintenance of this bridge is by far the worst on the line.

Bridge of 5 × 50 feet spans at mileage 231/7.—The tee cross girders are held down by three rivets in the angle iron clips, and, as a rule, have no bearing on the flanges or on the horizontal bracing. On one span the cross girders are 4" × 4" × 1/8" in section, on the others 4" × 5" × 1/8".

Bridge of 10 × 70 feet spans at mileage 433/6.—The tee cross girders are 4" × 5" × 1/8" and generally are clear of the main girders. Over portions of this bridge a slighter section of longitudinal rail bearer resting in two angle irons is laid. In two cases the angle irons have worked off the cross girder.

Vaipar bridge 12 × 70 feet spans.—Several of the angle iron chubs are not bearing fair on the main girder, and the tee cross girders are clear of the flanges. The timbers on pier No. 10 are defective, and a few keys are loose.

Bridge of 7 × 70 feet spans at mileage 353/8.—On 5 spans the tee cross girders are 4" × 5" × 1/8" in section, and on 2 4" × 4" × 1/8". On the latter spans the web of the tee iron and the edge of the main girder flanges are cutting into each other. Where the deeper section of cross girder occurs over a cover plate in the main girder the web has been cut out for a depth of about 1/2 inch; this of course adds considerably to the weakness of a girder none too strong originally, and which, according to Sir George Bruce's experiments, fails at the supports.

Overhead bracing is about to be fixed or raised to conform to standard dimensions on the Tondiyar, Ponnur, Gadilam, Old Vellar, Old Coleroon and Madagu bridges.

11. General.—The remaining bridges inspected being in good order and those referred to in the last report call for no comment, I would however suggest that the filling up of rivet holes in all compression flanges be put in hand, and that more care be taken to prevent the lodgment of rain water by drilling suitable escape holes and filling in small retaining spaces with tar and sand.

12. Ballast.—As a rule the ballast is sufficient, but more is required between miles 43/14 to 44/5 and also where the renewals with 50 lb. rails are in hand.

13. Sleepers.—The timber sleepers require squaring at mileage 415/1 and also at 412/4. The pot sleepers, where unconnected by a tie bar, are also in a few cases skew to the line. On the wooden road three hard wood sleepers have been inserted to each rail length. The renewals of sleepers during the past half-year are shown in statement A at the end of this report.

14. Rails and fastenings.—With the exception of three miles, 256 to 258, the whole of the main line from Madras to mile 381 and from Maniyachi to Tuticorin has been laid with 50 lb. steel rails on iron pots. The following statement shows the mileages of the various weights of rails:—

	68 lb. rails.	50 lb. rails.	40 lb. and 41 lb. rails.	35-6 lb. rails.	56 lb. bridge rails, i.e., flat footed.	Total.
Main Line.						
Madras to Tuticorin	47	891.28	83.41	..	57	445.73
Branches.						
Arkonam	..	18.11	20.99	..	21	39.10
Pondicherry (Villupuram to Ginjee river) ..	37.51	10.72	15.84	..	..	64.28
Negapatam	86.93	23	18.10	..	..	128.16
Erude	..	..	..	..	..	..
Tinnevely	..	..	..	..	..	..
Total, Main Line ..	124.93	420.55	108.34	..	78	634.60
Sidings.						
Main line, Madras to Tuticorin	2.18	7.18	64.60	..	..	64.84
Branches.						
Arkonam	..	16	1.61	1.30	..	2.07
Pondicherry (Villupuram to Ginjee river) ..	8.42	0.08	4.72	..	..	13.22
Negapatam	7.61	..	2.18	..	..	9.79
Erude	..	..	..	..	..	..
Tinnevely	..	..	..	..	..	..
Total, Sidings ..	19.21	7.40	63.68	1.30	..	91.49

The renewals of rails for the past half-year are shown in statement B at the end of this report.

15. Level crossings.—The level crossings are generally in good order, but in a few cases, notably at Madura, the road wants making up. In some places the space between the rails and the guard rails has been filled up. The level crossing gates at the south end of Madura station require lifting, so that the bolts may work in their proper catches instead of having to be held in a loop of wire.

16. Boundary pillars.—The railway land is not at present sufficiently demarcated especially south of Trichinopoly.

17. Fencing.—The aloe fencing is indifferently maintained and especially between Madras and Chingleput is more a source of danger than protection. On this length in the six miles between 13 to 24 miles, 119 gaps were counted on the east side of the line. In one section alone, that between Trichinopoly and Tanjore, was the aloe fencing properly maintained and the gaps closed efficiently. The wire fencing is invariably in good order.

18. Carriage stock.—The general condition and upkeep of the carriages are far and away, better than I have ever known them, and the exertions that have been made in recent years have resulted in some excellent stock being placed on the line. I have travelled in all classes of the bogie trains and found the running excellent, and the internal arrangements of the higher classes most comfortable. In the servants' compartment of the first and second class bogie composites, a large opening has been provided to enable the passengers to communicate with their servants. It has been found, however, that the public are misusing this convenience and that 3rd-class passengers who are not servants occupy the servants' compartment in order to get through the aperture into the higher class while the train is running. It will, I fear, be necessary to reduce the size of the opening to prevent this. It has come to my knowledge that the cleanliness of the carriages is not properly attended to, and that first-class passengers are frequently inconvenienced by the prevalence of bugs. The white paint used by the Locomotive Department is evidently largely adulterated, probably with chalk. A shower of rain brings down the paint from the carriage roofs on to the sunshades, and the white lettering on the stock can be rubbed out with the finger.

19. Locomotive stock.—The engines as usual are kept in most perfect condition, and the drivers evidently take the keenest interest in the cleanliness and smartness of their locomotives. None of the "O" class engines have so far adjusted wheel weights in consequence of the non-arrival of the lighter foot-plates daily expected from home. There are at present two engines ready prepared for the new foot-plates.

20. Stations.—The stations are generally clean and the compounds neat. The yards on the Trichinopoly-Bindigul section are particularly well kept. The waiting room accommodation is as a rule very uninviting, ragged matting, insecure chairs, and broken or rickety tables affording but scant inducements for passengers to use the rooms. I am afraid that the dilapidated state of the furniture is due to divided responsibility, and that in consequence neither the Engineering nor Traffic Departments do their proper duties in connection with its upkeep.

21. Beach Station.—The Harbour Trust Board have invited the Madras and South Indian Railways to discuss the building of a joint station at the beach. Now that the harbour is approaching completion it should be possible for the Board to give up sufficient land to enable a suitable and much needed station to be built.

22. Egmore.—The first and second class booking arrangements might be improved by throwing the present passage into the parcels office and converting the room thus formed into a general waiting room and booking office, a screen wall being erected to separate the ladies' retiring room. The present waiting room would thus be available for railway private use.

23. Chelpet.—A steel pale fence should be substituted for the present wire fencing, as passengers to avoid giving up their tickets get over the wires.

24. St. Thomas' Mount.—A new through siding has been put in, the platform being widened over the site of the former siding so as to serve the main line. The matting in the waiting rooms is in bad order and the furniture very shaky, particularly the table in the ladies' room.

25. *Pallāraram*.—A corrugated iron engine shed has been in course of erection for many months. I think an effort should be made to complete this almost historic structure.

26. *Acharapakkam*.—The trees on the platform require a little trimming, and the floor of the station-house should be levelled.

27. *Tindivanam*.—The approach road requires a little metal here and there. Although there are about 200 passengers daily, no third-class waiting accommodation is provided.

28. *Villupuram*.—The junction arrangements at the south between the Pondicherry branch and the main line are in my opinion decidedly dangerous. The Pondicherry line runs into the main line at No. 34 points; from here to No. 33 points side of the island platform. The Pondicherry train then crosses over to the west station, and it is worked by the pointsman at the junction points No. 34 who is in electrical communication with the stationmaster. There are no interlocking arrangements, and moreover the green light of the main line distant signal is visible on the Pondicherry branch. A short time ago a collision at this junction was most narrowly averted by the presence of mind of the shunter and the promptness of a main line driver, so it is obvious that the danger pointed out is by no means visionary. I would suggest that the crossing of the main line, which cannot be avoided, should be as direct as possible in order to shorten the dangerous area; also that the home and distant signals and the facing points be interlocked and that a screen be put up to prevent the main line distant signal showing down the Pondicherry branch. The Chief Engineer, I understand, shares these views and will shortly submit a scheme to improve matters. On the north of the station the junction arrangements are satisfactory.

29. *Panruti*.—More closed-in accommodation is required in the goods shed. I would suggest that it be provided and rented to merchants at so much per day. The road to the station might be more liberally provided with lamps.

30. *Nellikuppam*.—There is no third-class waiting shed. This might advantageously be given by closing in the north verandah to form a lamp room, when the present stationmaster's room could be released for passengers.

31. *Cuddalore Old Town*.—Something better than the present reading room should be provided for the Company's employees at this station. It always appears to me that moderate expenditure in promoting the comfort of the staff is money well spent, and operates to the advantage of the railway by attracting a better class of men to the service. A driver's latrine at this station appears to be built of bricks laid dry, and, where the outside skin of plaster and tar has stripped, seems in a shabby condition.

32. *Kumbakonam*.—The goods shed floor has been undermined by rats and requires attention.

33. *Tanjore*.—New water tanks holding about 7,000 gallons have just been erected on rail staging. The goods shed floor has fallen in in places, apparently in consequence of excavation by rats. The punkah in the refreshment room is hung far too high, the lower edge of the fringe being 6' 10" above the floor.

34. *Kivulur*.—The through siding and lay-bye are to be transferred to the south side of the main line, and the platform which is now 200 feet long is to be lengthened to 400 feet. The earthwork in connection with these alterations is nearly done on the south side; the north side cannot be touched until the old lines are taken up. When the work is done the platform will be on the main line.

35. *Nūlamangalam*.—The third-class waiting shed should have a ramp instead of a vertical drop wall round it. The station fencing generally requires attention and the trees over the platform lopping. I found the line in the goods shed blocked with bales and packages, which, instead of being unloaded on the platform, were thrown down on the ballast.

36. *Ammappet*.—The point levers are of the old Carnatic type and are rather out of date now, but the levers at No. 2 points were also a little out of repair.

37. *Manappārai*.—The south distant signal appears out of order.

38. *Ayalur*.—Slip points are required at this station and proposals will shortly be submitted for slip points and catch-sidings at this and other stations on heavy grades.

39. *Madura*.—A recreation bungalow for the staff has just been finished and is not altogether suitable for the purpose. The building consists of a large and a small room both paved with stone flagging, and a small room for retiring purposes is being added in the verandah. I would suggest that a wooden floor be laid in the large room to permit of it being used for dancing, and that a billiard room be added communicating with the larger room through a wide arch. More quarters are wanted at this station, and they should be located behind the present bungalows and not on the water-logged ground in front of the station.

40. *Kumarapuram*.—The trial station is being made permanent.

41. *Working of trains*.—The South Indian Railway is worked on the "Line Clear and Caution Message" system, but as recently there have been narrow escapes from accidents, the administration is considering the advisability of introducing the "Absolute Block" system. I quite share the opinion that some change is desirable, as the present system gives too great discretionary powers to stationmasters who in many cases are not sufficiently trustworthy. I was shown at Trichinopoly Fort station a couple of Webb and Thomson's electric staff block instruments which have been imported for trial. The instruments are expensive, costing £75 per pair, and do not seem suitable for through-running unless non-stopping stations can be switched out. Mr. Winter of the Madras Railway has recently perfected a machine which electrically controls the issue of line clear tickets, and which, though costing half the price of the staff instrument, seems better adapted to the requirements of the South Indian Railway. I am not at liberty to further describe the machine as it is not yet fully protected.

42. *Tanjore-Pulliyarpati ballast siding*.—A siding $4\frac{1}{2}$ miles in length has just been completed from Tanjore to the laterite quarries at Pulliyarpati. It takes off from one of the goods lines and rises sharply at 1 in 85 from the yard for 25 chains; the grade then moderates to 1 in 155 for 10 chains, after which the formation is level for some distance. The siding is practically a surface line on hard laterite soil and traverses scrub jungle. There are three six-feet, two four-feet, and one three-feet openings, all of which are substantially built. Although not run over before inspection there was practically no subsidence under the engine. The permanent-way consists of old 68 lb. iron rails with 4-holed fish-plates laid on three new pyngadu and four old half round sleepers per 21-feet rail. The siding is unfenced. In consequence of the steep grade out of Tanjore station a dead end siding 500 feet long is to be laid in the yard in continuation of the ballast siding.

MAYAVARAM-MUTUPET RAILWAY.

(54 miles.)

43. Taking all things into account the running over the Mayavaram-Mutupet Railway was decidedly good, and the banks are standing well. The whole line from Mayavaram to Tiruvālūr requires lifting about 6 inches to bring it to the proper level. The banks still require a good deal of making up in numerous places, and ballast is generally somewhat deficient. Now that the siding at Tanjore is opened, it will be possible to train ballast on to the line.

44. *Bridge and Culverts*.—The following work in bridges and culverts remains to complete:—

Fifty-four culverts require plastering, and the stone pitching of 22 has yet to be done.

Bridge 2 × 25 feet spans, mileage 176/3 M.—Concrete and masonry of the floor in both spans, and the pitching in the apron and river banks not yet done. Boulders at site.

Bridge 2 × 20 feet spans, mileage 177/4 M.—A small amount of concrete and the masonry of the floor of No. 2 span has to be put in. The pitching of the down-stream apron and the river slopes remains to be completed.

Bridge 1 × 40 feet spans, mileage 182/17 M.—The bridge is finished but for about 100 cubic feet of masonry in the floor at the north-east side, and the pitching of the river slope on the same side.

Bridge 1 × 30 feet spans, mileage 185/4 M.—Everything done except pitching of the apron and river slope.

Bridge 5 × 40 feet spans, mileage 186/10 M.—This work is completed with the exception of a little masonry in the floor and the pitching in the up-stream aprons of spans 2, 3, 4 and portions of 1 and 5.

Bridge 5 × 40 feet spans, mileage 187/11 M.—The floor and drop walls of spans 4 and 5 to be done, also the pitching in both aprons except No. 1 span down stream, and of bank at south-east side.

Bridge 3 × 40 feet spans, mileage 197/13 M.—About 1,000 cubic feet of pitching has still to be put in in front of the return wall.

Bridge 5 × 40 feet spans, mileage 224/10 M.—In No. 5 span about 24 feet of flooring has to be done, no pitching or aprons in yet. Painting is badly required, and the holes in the compression flanges of the cross girders might be filled up.

Bridge 3 × 30 feet spans, mileage 220/12 M.—Completed except as regards pitching and aprons.

45. Stations and Buildings.—Passenger requirements are practically completed; and the accommodation to be provided for goods should soon be finished.

As far as I can judge, work is being delayed for want of small stores, such as chubs and screws.

Manganallur.—The earthwork of the loading bank is nearly done, the roofing and flooring of the goods shed is in progress, and the metalling of the roads is not yet commenced. The flagging of the passenger shed requires relevelling, and the latrine flooring is not yet down.

Peralam.—The goods shed floor is laid, and the roofing is in hand. The goods shed line requires ballasting, and the loading bank, making up. The latrine floor has still to be laid. The platform in rear of the station house should be fenced round to prevent passengers from falling into the neighbouring borrow pits, which are full of water. I understand a woman was drowned one night a short time ago by getting off the platform in the dark. The station-approach road should be protected by earth parapets at the sides.

Nannilam.—The goods shed is about half done, and the earth-work of the loading bank is in hand. Wire fencing not commenced. The tank rail staging is almost finished, and the floor of the waiting shed properly completing.

Vettar.—The masonry of the goods shed is built to window level, and is waiting for window frames. The earthwork of the roads has been thrown up, but requires dressing and metalling. The gable end of the station house has yet to be closed and the latrine to be floored.

Kottagam.—The goods shed has to be floored and the roads to be metalled. The loading bank wall is not started.

Ponnerai.—Goods shed floor is not in yet, nor is the loading bank ready. At this station there appears to be fair traffic, and the goods arrangements ought to be hurried up.

Tirutturaiippundi.—The platform in rear of the station should be fenced, and an earthen parapet thrown up on the tank side of the approach road. The permanent watering arrangements are not finished yet.

Pandi.—The loading bank wall has to be completed and the floor of the goods shed to be laid.

Tillaiivilagam.—The goods loading bank is not started, the iron work of the goods-shed roof is half done, and the staff well is in progress.

VILLUPURAM-DHARMAVARAM STATE RAILWAY AND NELLORE BRANCH.

(386.91 miles.)

46. The upkeep of this section is on the whole far better than that of the main line, and the standard of maintenance attained is very high. Considering that there are several troublesome banks on the new line and particularly on the Nellore branch, the general condition of the line reflects great credit on the responsible officers.

47. Banks and Cuttings.—The banks and cuttings are in good order. The bank from 331/12 to 327/0 is still giving a great deal of trouble, and will continue to do so until the original soil is displaced by the trained earth. The new portions of the bank between 321/6 to 323/0, breached in November 1893, show slight signs of erosion. The recent heavy rains washed a good deal of soil into the cuttings, but this is in course of removal and the drainage is as a rule not now impeded.

48. Bridges and Culverts.—The bridges and culverts are mostly in good order, the principal defects being the condition of the timber longitudinals, which have not stood the dry climate between Pakala and Dharmavaram at all well.

Bridge of 1 × 60 and 4 × 40 feet spans, mileage 144/11 G.—Two rivets are out, and the road requires a little straightening.

Pāpaghni bridge 8 × 60 feet spans, mileage 316/3 G.—There are some short and several badly cracked timbers on this bridge.

At mileage 290/16 G., a girder bridge of 15 or 20 feet span is to be put in.

Dharmavaram bridge 3 × 120 feet spans, mileage 254/6 G.—Three cross girder rivets are out.

Bridge of 15 × 40 feet spans at mileage 322/12 B.—The cross sleepers require squaring. An attempt has been made to prevent the free expansion of the girders by inserting wooden blocks. These should be removed.

49. Sleepers.—The line was opened out in several places with a view to ascertain how the steel transverse sleepers are standing. The results obtained by mere inspection are conflicting, as the life of the sleepers will vary greatly in different parts of the line, although there appears to be no change in the ballast. Some samples of ballast were taken by the Superintending physician for analysis, and it will probably be found that the amount of rust developed in a given time is some function of the quantity of salt present in the soil. The following examinations were made:—

Mileage 362/3 G.—Sleepers in good order, but want squaring.

Mileage 351/3 G.—Sleepers in good condition.

Mileage 340/18 G.—Sleepers in good order.

Mileage 319/6 G.—Sleepers in good condition.

Mileage 290/7 G.—Sleepers just commenced to rust.

Mileage 239/6 G.—Sleepers commenced to rust.

Mileage 331/12 B.—Sleepers rusting badly, and the rail flange is nearly rusted out, over sleepers. The road was laid in 1896, the rails being 41½ lb. in weight and of steel. At this mileage one of the rails is so weakened as to be unsafe, and the Chief Engineer ordered its removal.

Mileage 328/13 B.—Sleepers commenced to rust.

50. Stations and Buildings.—The stations and buildings are almost without exception in excellent order. The following points were noticed:—

Tiruvannamalai.—The roof evidently leaks in a couple of places. The chairs in the waiting room are shaky.

Vellore.—The loading bank should be properly metalled; at the time of inspection it was in a muddy state with pools of standing water.

Kadiri.—The goods-approach road and loading bank ought to be metalled.

... and their!

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... and their!

B.—Statement showing the renewals of rails for half-year ending 30th June 1894.

Rails displaced.																															
Iron.														Steel.																	
68 lb.						40-3 lb.						35-6 lb.						60 lb.						41 lb.							
21'		18'		cpl.		24'		21'		18'		cpl.		18'		21'		24'		27'		30'		cpl.		21'		18'		cpl.	
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	
Main line.																															
January 1894	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
February "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
March "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
April "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
May "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
June "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Total ..	273	4	..	..	6,763	1,238	76	3,884'	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Sidings.																															
January 1894	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
February "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
March "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
April "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
May "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
June "	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Total ..	143	8	197	161	161	65	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
Grand Total ..	416	12	197	6,924	1,419	141	3,884'	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	

D.—Statement showing the renewals of rails for half-year ending 30th June 1894—cont.

Rails replaced.																				Steel.																			
Iron.										Steel.																													
68 lb.					40-3 lb.					35-6 lb.					60 lb.					41 lb.																			
31'	18'	cut.	24'	21'	18'	cut.	19'	16 1/2'	14'	cut.	30'	27'	24'	21'	18'	cut.	34'	31'	28'	cut.																			
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43																			
																				Mean./ins.																			
January 1894	..	19	..	7	..	..	..	..	..	..	1,904	6	32	3	2	..	56	40	..	..																			
February "	..	93	..	..	..	..	..	..	..	..	2,018	304	84	4	..	1,711	72	44	..	..																			
March "	..	67	..	..	..	..	..	..	..	..	517	2	36	7	1	..	11	16	..	..																			
April "	..	33	..	..	..	..	..	..	..	..	..	..	2	..	..	..	144	33	4	..																			
May "	..	47	..	..	..	..	..	..	..	..	..	..	4	..	..	..	173	44	7	..																			
June "	..	14	..	..	..	..	..	..	..	..	602	..	..	..	..	..	179	61	4	24'																			
Total ..	..	273	4	..	67	6	7	..	..	..	6,043	314	118	13	3	297'	816	238	23	34'																			
																				Siding.																			
January 1894	..	..	..	3	5	6	..	..	..	..	..	..	..	..	..	..	38	34	15	..																			
February "	..	11	..	8	16	..	..	..	..	..	..	..	..	..	..	..	7	6	..	..																			
March "	..	69	..	4	1	7	..	..	..	..	..	..	..	..	..	..	16	9	6	..																			
April "	..	60	..	3	..	..	..	..	..	..	..	..	..	..	..	..	24	40	6	..																			
May "	..	10	..	7	12	..	..	..	..	..	..	..	..	2	..	..	32	16	4	..																			
June "	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	21	18	10	..																			
Total ..	..	150	7	23	38	16	..	..	..	..	..	..	..	4	..	..	138	123	60	..																			
Grand Total ..	..	423	11	..	80	46	23	..	..	..	6,043	314	122	13	3	306'	963	361	73	24'																			

NOTE BY SENIOR GOVERNMENT INSPECTOR.

Main line.

Bridges and Culverts.—The chief points under this head are the strengthening of the 20' main plate girders, the strengthening of the lower flanges of the built cross girders of the 12', 15' and 20' spans, the strengthening of both flanges of the cross girders of the 30' spans which both the Consulting Engineer to the Board and I are agreed as primarily necessary.

These are being done and the list given shows the method of strengthening. I agree with Captain Shelley that for the cross girders of the 30' spans the plates should be of the full length of the cross girders if the plates are not yet supplied from England. Thus strengthened, the girders, both main and cross, will be up to the Government of India standard, and it may here be noted that, in carrying out any alterations in girders, the standard adopted should be that laid down by the Government of India and not that of the Board of Trade.

When these girders are finished it will be necessary to take in hand the alterations noticed in paragraphs 6 and 7; of these it appears from examination that the tee iron cross girders on the 70', 50' and 30' spans demand early attention. The inspection shows that 50 per cent. of these tee irons are suspended from the angle iron knee or "chub" and further weakened by the boring of numerous holes and that therefore the tests as carried out by the Board's Consulting Engineer did not actually reproduce the existing conditions.

I suggest the 8" knees or chubs of all defective joints be cut out and replaced by an 18" knee the full width of the top flange of the main girder, and that the top flange be strengthened where requisite by an angle iron stiffener rivetted to the web and both flanges.

This method will be cheap and will not disturb the traffic.

The repairs mentioned in paragraph 10 should be carried out.

Locomotive stock.—The alteration of the 20 O class engines was one of points mentioned by the Board's Consulting Engineer to be taken in hand. According to the last report 12 of these engines are working on the Negapatam-Erode section and 8 are waiting for the new footplates and are then to be adjusted to bring the axle weights down to 8 tons 6½ cwt.

Stations.—The alterations mentioned in paragraph 28 for the safe working of Villupuram junction should be at once carried out.

Working of trains.—Orders having been issued regarding the time to be allowed for asking and obtaining "line clears," I am not of opinion that the "absolute block" is necessary. The general evidence points rather to the need of a better class of stationmasters.

Sleepers (Villupuram-Dharmavaram Branch).—The number of steel sleepers replaced is 135 against 151 during last 6 months to December 1893, showing due attention is paid to their condition.

General.—The condition of the line cannot be considered satisfactory until the O class engines are fully at work over the main line, hauling the mail trains and using the vacuum brake provided.

My estimate of 6 months in which this would be effected was too sanguine; indeed I foresee at the present rate of alterations to the engines and repairs to the bridges that it will take perhaps 12 months longer.

The attention of the Railway authorities is called to the numerous complaints which appear from time to time in the vernacular papers.

(Signed) F. R. UPCOTT,
Senior Government Inspector.

24 September 1894.

No 500. Rd 24/9/94

PUBLIC WORKS DEPARTMENT.

RAILWAY BRANCH.

PROCEEDINGS OF THE MADRAS GOVERNMENT.

Read the following

*Report of inspection of the South Indian
Railway for the half-year ended 30th June 1894.*

*Communicated to
the Agent, South Indian
Railway, for information
and necessary action.*

*2. A copy of these
Proceedings will be forward
for the information of
the Government of India*

HC No 501. Rd 24th Sept 1894

DESPATCHED
2-55131

Forwarded

20/9/94
22/9/94
R

*To
The Agent S. I. Ry.*