GOVERNMENT OF MADRAS.

PUBLIC WORKS DEPARTMENT.

Railway.

Read the following paper:—

From the Consulting Engineer for Railways, dated Madras, 5th April 1890, No. 241.

Note on inspection of the South Indian Railway and Nellore branch of the Villupuram-Guntakal State Railway for the half-year ending 31st December 1889.

Submitted for the information of Government.

ORDER—dated 14th April 1890, No. 512 R., Public Works.

The Agent's attention will be called to para. 4, clauses 1 to 6, 8, 11, 13, 14, 18 to 22, 24, 27, 31, 32, 35, 36, 40 to 42; para. 5, clause 5; para. 8, clauses 3, 6, 8, 9 and 15; and para. 10, clauses 11 and 12; and in the Nellore branch report to para. 3, clauses 3, 4, 5 and 7; paras. 5 and 6, clauses 1 and 2.

2. He will also report on the remedies he proposes with regard to the defects noticed in the diversion at 130/14 and 57/10A mentioned in para. 4, clauses 51 to 55; and give his opinion on the question raised in para. 4, clause 58.

(True Extract.)

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

To the Consulting Engineer for Railways.

Exd. A. Aubert.
Spare Copies

RAILWAY.

Govt. of {1890} Madras.

PUBLIC WORKS.

Dated April, 14th.

Read. *Encl.*

G.O., 14th Apr. 1890, No. 512 R.

APRIL.

Report of an Inspection of the South Indian Railway

Passing orders on the — and Nellore branch of the Villupuram-Guntakal State Railway by the Deputy Consulting Engineer for Railways for the half-year ending 31st December 1889.

REPORT OF AN INSPECTION OF THE SOUTH INDIAN RAILWAY,

FOR

THE HALF-YEAR ENDED 31ST DECEMBER 1889.

The inspection which was commenced at Nellore on the 8th February and ended at Erode on the 20th February 1890, was made in company with Mr. F. F. Smith, Deputy Chief Engineer, and the Resident Engineers of the several sections. The Chief Engineer, Mr. D. Logan, accompanied the inspection party over the section between Trichinopoly and Tuticorin.

2. There is so much that is interesting on the South Indian Railway that a very long time would be required for anything like a complete inspection by any one who like myself had never had an opportunity of seeing the south of India before. Indeed I was compelled in order to get through the inspection at all within the prescribed time to go hurriedly over the principal works and to leave for the most part the minor and even some of the large works unseen.

3. **Earthwork.**—The banks and cuttings appeared generally to be in good order.

(1) The causeways with one exception are in my opinion set too high and would be safer and more effective if lowered. As far as I could learn one only had been actually used by the floods.

(2) If this system of dealing with floods were extensively used it would perhaps be well to provide engines with high fire-boxes or to protect the fires in some other way.

4. **Bridges.**—The permanent bridges generally appear to be well looked after and maintained. The temporary bridges in the diversion at the Gadilam bridge, mile 124, show more movement than is desirable—especially the bridge of 12 spans of 12 feet at the south end of the diversion—and should, I think, be run over very cautiously. Bridges of this description, viz., with sleeper cribs carrying a platform of 40-feet rails laid close together though fairly stiff when first put up as was satisfactorily shown at other diversions to which I shall refer later on, naturally work loose in time. In the case of the Gadilam the temporary bridges were in use I understand before the last monsoon.

The following points were noted in regard to the bridges which were inspected as far as time would permit on the Railway:—

(1) 5/5 *Adyár, six* 66-*feet girders.*—Superstructure shows a good deal of movement. Rail joints appear to be too tight.

(2) 36/6.—North abutment cracked from top to bottom under west end of plate. The south wing wall on the east side also cracked.

(3) 41/2, *one-foot culvert.*—Return walls have moved bodily on both sides.

(4) 42/7, *one* 10-*feet girder.*—North abutment cracked from top to bottom. Both wing walls on the west side also cracked.

(5) 49/1, *twenty-two* 40-*feet girders.*—Some deficient rivets noticed in cross bracing.

(6) 63/14, *nine* 20-*feet girders.*—Some rivets loose in cross bracing.

(7) 102, *one* 25-*feet span.*—Badly cracked. Cracks have not opened since they were plastered up.

(8) 104/8, *four* 25-*feet girders.*—The holding-down bolts which secure the longitudinal timbers have nuts on the under side without split pins. Additional spikes appear to be required to secure the rails. There were intervals of 6 feet or more in some cases between the spikes.

(9) 124/0 *Gadilam River*—originally ten 100-feet girder openings. Five more are being added. The condition of the temporary bridges in the diversion at this bridge has already been noticed.

(10) 130/14, *double 3-feet culvert.*—One 12-feet girder opening to be added. A diversion has been put in at the site of the new bridge which will be referred to further on.

(11) 134/10, *five 40-feet girder openings.*—Four spans added in 1888. The high ground in front of two of the four new spans will have to be cut away to make this portion of the bridge effective. The wing walls in this bridge have a considerable amount of batter in front. The bed joints are in planes perpendicular to the batter and the wing walls therefore imperfectly bonded into the abutments and return walls which have horizontal joints. The return walls in all cases have cracked right through and have had to be strengthened by heaping boulders against them. One of the wing walls on the east side is also cracking. The method adopted in connecting the new return walls with the old wing walls of one of the abutments is an awkward one.

(12) 134/13.—Two feet brick culvert cracked and tied together by an iron rod running right through the culvert.

(13) 134/15, *seven 40-feet girder openings.*—Battered wing walls built in the same way as those at the bridge of five 40-feet openings mile 134/10 and with the same result in the cracking of all the return walls and in the provision of heaps of boulders to strengthen the return wall.

(14) 146/6, *one 100-feet girder opening.*—One link in this bridge shows a flaw apparently of long standing.

(15) 151/6.—A temporary bridge of three 15-feet openings spanned by rail platforms carried on sleeper cribs 15 feet high showed a good deal of movement. A 30-feet girder bridge on wells 10 feet deep said to have been scoured out by floods is being replaced by a 70-feet girder bridge. The rail-bearers in the new bridge are carried on the lower flanges of the cross girders, and the longitudinal timbers are cut up into short lengths so as to fit in between the cross girders. This arrangement has not been found satisfactory in all cases on other railways because each of the short lengths is isolated from the others and therefore a weak length gets no assistance from stronger lengths on either side of it and it is therefore a difficult matter to prevent movement in the short lengths. It is understood that the object of this arrangement is to secure a better attachment for the rail-bearers than that supplied in the original design by knees which have cracked in several cases at other bridges.

(16) 152/13.—Two 100-feet girder opening with longitudinal beams in short lengths on rail-bearers carried on bottom flanges of cross girders.

(17) 155/7, *Coleroon River, fourteen 150-feet girder openings.*—Several of the knees holding the rail-bearers in this bridge are said to have cracked in 1883. The ends of the rail-bearers are now supported in addition by wooden blocks resting upon the lower flanges of the cross girders.

(18) 201/6, *six 30-feet girder openings.*—Longitudinal timbers in this and other bridges on either side of it are secured by one holding-down bolt only to each of the shoes. The shoes are secured in each case by two rivets only (one on either side) to the cross-bearers. Chips of wood or spikes were in many cases packed in round the shoes with a view apparently to keep the timbers from shifting. The holding-down bolts have nuts on the under side without any split pins or soft washers or other arrangement to prevent them from getting loose.

(19) 211/9, *four 50-feet girder openings.*—The longitudinal timbers are carried by shoes which have in many cases been packed round with chips or spikes.

(20) 214/5, *six 50-feet openings.*—The longitudinal timbers are carried on shoes packed round in several cases with spikes or chips in the same way as the two bridges last noticed.

(21) 235/2, *eight 30-feet girder openings.*—Some of the chairs appeared to be loosely spiked.

(22) 279/1, *five 20-feet girder openings on a curve.*—The holding-down bolts securing the longitudinal timbers have nuts on the under side without split pins in some cases. The gauge on this bridge was too tight.

(23) 283/6, *one 8-feet rail opening covered with 68-lb. rails.*—The superstructure of this bridge appears to contain about 6 tons of iron, if my count of the number of rails is correct, or about six times the weight of iron in a girder bridge of the same span.

(24) 323/2, *one 5-feet girder opening.*—The floods are said to have risen above girder bed level at this bridge in September last, while at the bridge two 20-feet openings close by, namely, at mile 323/4, the flood on the same date is stated to have been 2 feet 4 inches below girder bed level. Communication between the two bridges is impeded by a growth of prickly-pear in the borrow pits and at times by cultivation in the fields.

(25) 327/12.—The Irrigation Department have asked for a bridge of three 25-feet openings to replace the 6-feet bridge at this site in connection with the Periyár project.

(26) 344/8, *Bridge of 15 spans of 70 feet with plate girders.*—The longitudinal timbers on this bridge have recently been renewed. The holding-down bolts which secure the longitudinal timbers require examination. In many cases the bolts came directly under the rail and the heads were so long as to be caught by the rail when depressed by a passing train. In some cases the nuts on the under sides of the bolts were unprovided with split pins.

(27) 361/9, *two 15-feet girder openings in black cotton soil.*—The south abutment of this bridge is badly cracked from top to bottom.

(28) 389/7, *Satur Bridge, twelve 70-feet plate girder openings.*—The longitudinal beams 9″ × 6″ in scantling are carried by continuous troughs of angle iron rivetted to the cross girders and held by wooden distance pieces and iron tie-rods. The timbers generally appear to be sound though they are a good deal shaken and cut into at places. The distance pieces have shrunk and in many cases bear against the angle iron troughs instead of holding the longitudinal timbers. The timbers are said to have been hurriedly put on in order to be in time for the Prince of Wales' visit to India. They can, in my opinion, be made to last for a considerable time longer by strapping and cross-bolting the shaken places and putting in new distance pieces where necessary. It appears doubtful whether sufficient room for expansion has been allowed for the girders. In most cases the ends of the girders appear to be tight up against each other. One of the girders in the first span on the north side is considerably bent. It is said to have been dropped by accident when the superstructure was under erection.

(29) 396/15, *five 30-feet girder openings.*—The longitudiual timbers in this bridge have been recently renewed. The holding-down bolts have nuts on the under side, some of which were apparently unprovided with split pins. The gauge appeared too tight at the north end.

Arkonam Branch.

(30) 57/10-*A*, *one 15-feet opening.*—Bridge has failed owing apparently to movement in the bank under which both abutments have bulged. The diversion with a temporary bridge with two 15-feet rail openings which has been put in here requires some alteration to make it safe during bad weather. A fuller notice of this diversion will be found further on.

(31) 63/15-*A*, *four 25-feet openings.*—Some scour to a depth of 3 or 4 feet has occurred at one of the piers. It is stated that there is no floor in the bridge.

(32) 63/13-A, *four 10-feet girder openings.*—The upper part of the north abutment of this bridge has moved bodily apparently under a movement in the bank.

(33) 71-*A*—*Kortalayár River: nine 30-feet girder openings on screw piles.*—It is stated that the floods in 1888 rose nearly up to girder bed level.

(34) Over-bridge with span of 72 feet at Arkónam station looks light for a bridge which may be subjected to a rush of pilgrim traffic.

Negapatam Branch.

(35) 266/5-*N.*, *seven* 30-*feet continuous girder bridge.*—The girders appear to be out of line on the north side and the rails to be slightly kinked. The girders have been shifted off the bed-plate at one of the piers and put on to two blocks of wood. The holding-down bolts need examination, two appeared to be deficient at one place on the second span from the west and the bolts at other places had not been tightened up against the cotters.

(36) 238/2-*N.*, *nine* 30-*feet girder openings.*—Some bad rails were noticed at this bridge. The rail joints seemed to be very tight. It was stated that the road goes out of shape in very hot weather.

(37) 237/2-N, *five* 30-*feet girders.*—The longitudinal timbers appeared to have much cut up. A rough attempt had been made to secure the joints of the timbers by bolting the ends of the timbers together with hook-bolts. Some old rails were noticed.

Erode Branch.

(38) 253/0-*E.*, *seven* 30 *and two* 15 *feet openings.*—The longitudinal timbers are bolted down to the cross girders. Distance pieces and tie-rods are provided at the piers but not intermediately, as ought I think plainly to be done since no knees, shoes or angle irons have been provided to hold the timbers. The gauge appeared to be too tight at several places on the bridge.

(39) 267/8-*E.*, *five* 30-*feet girder openings.*—Same as the last bridge.

(40) 296/10-*E.*, *Amarávati River*, *twenty* 50-*feet bowstring girder openings and one* 20-*feet girder opening.*—The rivets holding the cross girders of this and another bridge with six 50-feet openings of the same type at mile 310/7 should be examined.

(41) 315/13-*E.*, *eight* 20-*feet girder openings.*—Insufficient room for expansion appears to have been allowed between the girders. The girders were not exactly in line and the gauge was tight at places. One or two of the timber bed-plates under the girders appeared to need renewal.

(42) *Timber over-bridge at Erode station.*—The spans have been trussed in a peculiar way. It is stated that the bridge was found to be wanting in stiffness. If this is really the case, it seems doubtful if the iron ties which have been added will hold, if the bridge sways much under a rush of pilgrim traffic.

(43) In regard to the bridges generally it may be pointed out that the absence of footways on many or most of the bridges, in several cases lengthy ones with 30-feet spans or under, makes it a difficult matter to inspect properly. One cannot examine a bridge properly if one has to walk as we had to do at several bridges on the top of a girder perhaps under one foot in width or to pick one's way amongst the bolts and spikes on a longitudinal beam not much more than 10 or 12 inches wide. Besides the absence of footways makes the work of patrolling the line at night eminently dangerous to the staff of the line.

(44) The bridges of the Whipple Murphy type ought I think in every case to be tested again now under one of the heavy goods trains which are being run over the line and diagrams taken in order to make sure that the bridges are sufficiently strong. I had no opportunity of noticing their behaviour under these heavy trains, but in a few cases I had an opportunity of watching the passage of light trains and there I noticed in some instances a tendency to buckle in some of the tension pieces indicating that an unfair amount of work was being thrown upon other parts of the bridge.

(45) The system of cross bracing at the older bridges of this type appears to me to be defective, inasmuch as the strains are transferred at the ends to the free ends of the rail-bearers and tend to wrench off the rail-bearers and to run backwards and forwards up and down the bridge.

(46) It is not surprising I think under these circumstances that the rivets in the cross bracing and in the rail-bearers should as shown by the annual report to be getting loose and that the knees securing the rail-bearers to the cross girders should in some cases have been broken. In this connection I noted that in the majority of cases in which it had been necessary to renew rivets the defective rivets were situated near

the ends of the girders where the strains as pointed out tend to wrench off the rail-bearers and not in the middle. This tends I think plainly to show that the failure of the rivets is due mainly to the defective arrangement of the cross bracing and not entirely to bad work in rivetting.

(47) In the Gingee bridge the arrangement of the cross bracing seems better but apparently gusset plates are required at the cross pieces to make a better connection with the cross bracing. I noticed the rivets in the cross bracing had failed at these places in most of the spans. The rails generally are carried on longitudinal timbers over the bridges. These timbers are secured in a variety of ways. In the oldest bridges they were carried on long shoes, each of which was secured by two rivets only (one on either side) to one of the cross girders. The timbers were bolted down by a single holding-down bolt to the shoe. This arrangement which is plainly objectionable because it tends to wrench off the rivet which holds the shoe on the opposite side to that at which the timber is bolted to the shoe is being got rid of whenever the timbers are renewed by substituting "Chubbs" or knees by which the timbers are kept from moving laterally and their bolting the timbers down to the cross girders. There appear however to be many bridges at which the timbers are still held by shoes.

(48) On the Erode branch the longitudinal timbers are bolted down to the cross girders, but there is nothing to prevent lateral displacement with the exception of holding-down bolts which tend of course in time to work loose in the timbers, and distance pieces and tie-rods at the piers only. If a sufficient number of stout distance pieces and ties were introduced intermediately, this would in my opinion be the most satisfactory arrangement of all.

(49) Beyond Trichinopoly the longitudinal timbers were carried in angle iron troughs running continuously across the bridge. The Engineering Department object to this arrangement because of the difficulty of fitting the timbers accurately into the troughs and are gradually replacing it by a system of "Chubbs." It seems to me however a much safer arrangement than that of the shoes.

(50) Lastly the arrangement of cutting the longitudinal timbers up into short lengths and rivetting their ends in under the cross girders is being tried as stated at the bridge at mile 151/6. A reference to the Tirhoot State will I believe elicit the fact that this arrangement is a very unsatisfactory one. The timbers generally appeared to be sound at the heart, but the unsatisfactory methods of securing them have led in many cases to their being cut into and knocked about in such a way as to make the early renewal of a considerable number of them advisable.

(51) I have already referred to the temporary bridges in actual use at the Gadilam river and at the bridge at mile 151/6. In addition to these I inspected two other temporary bridges, viz., one on the Arkónam branch at mile 57/10-A, with two 15-feet rail openings, and the other at mile 130/14 with a 12-feet rail opening.

(52) The bridge at mile 130/14 has curves of 1,000 feet radius in the approaches and gradients of 1 in 100 for a length of 350 feet on either side and is constructed in a bank about 6 feet high. The superstructure had been hurriedly put on to be ready for the inspection. Some very old holding-down bolts had been used to secure the sleepers upon the superstructure, one at all events was broken. The sleepers did not appear to have been spaced in all cases so as to support the joints properly. No sill had been provided at the middle of the crib so as to give the rail platform a fair bearing upon the middle of the crib.

(53) When these defects have been remedied and the permanent-way thoroughly examined there seems no reason why the diversion should not be taken into use with the usual restrictions in regard to speed, provided that the Engineering Department are prepared to take the construction of the new bridge in hand at once and get it finished straight off.

(54) I think however that some modification is necessary in the case of the other temporary bridge at mile 57/10-A of the Arkónam branch before sanction to the use of the diversion is given. In this case the bridge of two 15-feet openings is constructed in a bank 15-feet high made up of soil which shows so much movement in the monsoon that not only have both abutments of the old bridge of 15-feet span given way under it and one abutment of another bridge a little further on, viz., at mile 63/13

as before stated also failed, but in addition the soil of the diversion itself showed so much tendency to move when the bank was being thrown up during the rains that it was found necessary to retain it by a revetment of sand-bags and a row of sleepers planted endwise all along the toe of the slope.

(55) If the diversion remains open during the monsoon the sleeper cribs will have to stand the thrust of a 15-feet bank in soil of this description with the weight of an engine on the top of it. I am informed that a revised estimate is to be submitted providing for a larger bridge. There is little hope therefore that in the ordinary course the bridge will be completed before the monsoon. I think therefore that a revetment of sand-bags or dry stone in courses or something of a similar kind should be provided to take the thrust of the bank off the cribs, or failing this that the diversion should not be taken into use until after the monsoon when sanction for the new bridge has been received and material for its construction collected.

(56) In connection with the subject of bridges I may mention that I was shown two nullah diversions, one called the Samunderam diversion at the 267th mile by which a nullah which was setting towards the bank has been diverted away by a cut strengthened by groynes across a bend of the nullah; and another at the 275th mile by which a cut made across a bend in the bed of a nullah which crossed and recrossed the line has saved the cost of two bridges.

(57) Both of these diversions have so far been completely successful, and since the banks of the diversions are being fortified by the growth of prickly-pear and jungle there can I think be little ground for anxiety now on their behalf. These are the only instances as far as I could learn in which the railway has gone outside railway land to construct defensive works. In fact with the exception of a retaining wall and some small groynes on the 431st and 432nd miles and perhaps half-a-dozen groynes in all elsewhere these were the only places in which I noticed that any attempt had been made to control the rivers and streams and prevent them from wandering. While on the other hand very large additions have been made at many places to the waterway. In my opinion the success which attended these nullah diversions ought to have prompted further endeavours in the same direction.

(58) I think that it is essential that something of this kind should be taken in hand at mile 432, where a nullah is deserting the straight channel through a bridge of four 50-feet openings at mile 43/8 and setting full against the bank at a point several chains away to the north. Instead of keeping within railway land and building a retaining wall fortified by groynes all along the toe of the slope as has actually been done, the proper course I think would have been to have thrown a bund across the mouth of the new channel which the river is forming and then forced the river back by spurs to its old channel. If this is not done I believe that it will be necessary before long to build a new bridge at the site of the new channel. I do not believe that the nullah will long allow itself to be deflected as is now the case by a right angle bend to the present bridge when its new channel is completed.

5. **Permanent-way.**—The permanent-way is well looked after and in as good order as a defective road can be expected to be.

(1) The worst part of the road in my opinion is on the Negapatam branch where the 68-lb. rails are much worn and splayed on the outside and the wooden sleepers are very old having been in the road I understand since the line was first opened. The ends of the rails have splayed and the joints are in consequence so tight that the road was said to get crooked at one part of the line on a hot day.

(2) There appear to be upwards of 250 miles of half-round creosoted sleepers with an average age of 13 years of the same kind as the sleepers which failed on the Northern Bengal and Tirhoot State Railways after a life of not more than 12 or 13 years.

(3) The 40-lb. rails are cutting into these sleepers and the spikes plainly do not hold properly.

(4) The gauge appeared to be tight throughout on these sleepers, but is probably safer to have it tight than slack with sleepers of this description.

(5) It seems necessary that a pair of hardwood sleepers should be inserted at each joint and double spiked on the outside and that a hard wood sleeper should in

addition be put in at the middle of the rail on the straight with an additional pair of hardwood sleepers at each rail in curves and that this should be done without delay.

(6) The 40-lb. rails appear to be in fair order and with good sleepers and light traffic would doubtless last for a good many years.

(7) With the present sleepers and heavy traffic they will doubtless be knocked to pieces before long. They ought in my opinion to be replaced by 50-lb. rails and utilized in the construction of some of the many branch lines which are required.

(8) The running over the 50-lb. road was not altogether so smooth as might have been expected, neither had the road as good a top on it as might have been expected. These defects I attribute to the fact that ties are inserted only at every alternate pair of pots except at joints and curves where the full number of ties are inserted. I believe it will be difficult to maintain the road in perfect order until the full number of ties are inserted.

(9) The sidings at roadside stations are too short for the long trains now run.

6. **Signals.**—The distant signals are in many cases too near to the points. They should be set back to a sufficient distance to allow one of the longest goods trains to draw inside so as to be protected by the signal without fouling the points when the signal is against the driver, with a sufficient margin for safety in view of the fact that steam-brakes are not fitted to the engines and therefore drivers will find a difficulty in pulling up heavy goods trains exactly at the right spot when the rails are greasy. The distant signals are in my opinion much too low. In most cases they are viewed against a back ground of trees owing to their lowness and cannot be seen without great difficulty. In many cases the approach to the station from one side or the other is round a curve which prevents the signal from being seen from the station platform. No station signals have been provided at the roadside stations with the exception of perhaps half-a-dozen of the largest stations.

(1) The distant signals are so low that drivers may readily mistake a light alongside of the line for a distant signal in the absence of station signals to supplement them. The present arrangement of sidings and signals is not in my opinion safe with heavy traffic.

7. **Ballast and Fencing.**—The ballast with the exception of a few miles on which quartz ballast is used is very dirty, and in many places little else but earth or sand.

(1) It is said that the pot-sleepers stand well on quartz and other kinds of broken stone ballast.

(2) The aloe fence on the main line is generally in very good order.

(3) I only saw two head of cattle on the line during the whole of the inspection and they were on the Erode branch on which wire fencing is to a great extent used.

8. **Station Buildings.**—The buildings as far as I could see were sound in every respect with very few exceptions and were generally neat and clean and well cared for. The walls of the station building at Vaithísvarankoil and of the north-east angle of the waiting shed at Samayanallúr are however badly cracked and the roof of the goods shed at Cuddalore is stated to have given trouble. The floors at several stations on the Erode branch and south of Trichinopoly need repair, also the steps at Sikkil. The old station buildings at Kivalúr and Koradáchéri should be put into repair if they are retained. The building at the former station appeared to be used as a cattle shed and at the latter as quarters for station menials.

(1) The block of offices at Trichinopoly is a particularly fine one. The station buildings at road side stations with the exception of a few which have been recently constructed are all set back at a considerable distance away from the platform. This arrangement makes it very difficult for the stationmasters to supervise the work of the station yard since he can see nothing of the yard from his own office. When traffic increases this will be a serious drawback to the safe working of the railway.

(2) Quarters have been provided for stationmasters at all stations, but no quarters have been provided for signallers or for menials. With light traffic it might be possible to allow men to sleep in the villages around, but with heavy traffic emergencies and accidents will arise which will make it necessary for the men to be always

available when wanted. The matter is one under consideration. It would be well to make a commencement by taking in hand a certain number of stations in each half-year.

(3) Portable goods sheds both covered and open have been provided at many of the stations. The covered goods sheds have the walls and roofs of corrugated iron. With one or two exceptions these buildings had no tie in the middle to keep the roof from spreading. I noticed that the roof of one of these sheds at Acharapákam had sagged already in the middle. In the open goods sheds the roofs are carried on uprights made of old rails. These uprights are not tied or connected together in any way except in some cases at the end bays where the two end uprights are sometimes braced together. Each of the uprights therefore stands alone and the buildings are thus likely to be overturned if a strong side wind sweeps through the shed. Some of the sheds are large, being as much as 300 feet in length in some instances. Complaints were made at several stations of damage caused by rats at the goods sheds. I have seen a deep layer of sand tried up-country with good effect in the floors of goods sheds. The sand fills up the rat-holes as fast as they are dug and prevents the rats from making a lodgment. I was informed that a layer of sand had been used below the paving at one of the goods sheds on the South Indian Railway with good results. It would be well to make some further experiments in the same direction.

(4) Part of the stone coping at the platform wall of the goods shed at Madura had been displaced. Loose dowels were projecting above the floor.

(5) The coping of the ash-pits at most of the roadside stations is kept in position by three or four transoms fixed across the top of the pit. These transoms must be very much in the way and ought to be removed.

(6) The arrangements for securing rolling-stock in the sidings do not appear to be very complete. Scotch blocks have been provided at most of the stations at one end of the sidings, but seldom at both ends. I did not see in the case of loop sidings however a single one of these Scotch blocks in use at any of the stations. It is plain that at mill and other sidings where wagons are loaded and unloaded by mill hands or by coolies employed by traders the Scotch block to the mill or goods sidings should be permanently locked and never opened except by permission of the stationmaster and under the supervision of some responsible Railway official when wagons have to be taken out or put into the sidings.

(7) It is stated that no chains or other appliances other than brakes and Scotch blocks are provided for securing the wheels of wagons so as to prevent wagons being blown out of sidings on the occurrence of storms. This is not in accordance with the practice on other railways.

(8) At Tiruvallúr station I noticed that there was a well in actual use immediately at the back of and close up the wall of the *station latrine*. This well is adjacent to the third-class waiting shed and is practically the only well the passengers can use. The station well is on the opposite side of the line and passengers are debarred from crossing the line. There is said to be a heavy passenger traffic at this station, an average of 700 passengers daily. A rope and pully at the well in question showed plainly that it was in use.

(9) Complaints were made in regard to the water-supply at Kumarapuram. A well has been provided, but the water on this part of the line is so brackish that it is not used for engines, and special arrangements are made to provide a water-supply for engines. Special arrangements should also be made to provide a water-supply for the station staff and for passengers. It is manifest that water which is too brackish for use in locomotive boilers is unfit for drinking.

(10) I was greatly pleased to find that considerable attention is paid to the condition of the running rooms for drivers throughout the line. The rooms in every case were clean and well furnished, and at Negapatam were particularly good.

(11) The Traffic Department might with advantage make some provision of the same kind for their guards. I only succeeded in finding one traffic running-room upon the line, and that was a bare ill-found room at Chingleput.

(12) The reading-room at Negapatam is much too small.

(13) The locomotive, and carriage and wagon workshops, at Negapatam appeared to be cool and airy buildings, well suited to the purposes to which they were applied. When the reorganization now in progress is finished and the space between the old smiths' shop and the fitting shop is roofed in and central shafting put up and machines of different classes grouped together, the arrangements will be very complete and good. A hydrant and a steam fire-engine are provided for the workshops and a fire brigade is kept up. The tanks at running sheds appeared to me to be too low to give a proper head of water for washing out. It is stated that the water is so bad on the line that it is necessary to wash out after every trip. The store buildings at Negapatam appeared to be well arranged and in good order.

(14) The trees have grown well at most of the stations in the Tanjore and Madura districts and now afford pleasant shade to the platforms. More attention might with advantage be paid to the cultivation of trees and gardens at other stations.

(15) The Port authorities at Tuticorin have laid a beach line of railway which will connect the South Indian Railway with a line of rails upon the pier as soon as the South Indian Railway establish a connection with the beach line by a curve from one of the sidings in the station yard. The beach line will manifestly facilitate greatly the loading and unloading of boats at the pier. The delay on the part of the South Indian Railway in completing their portion of the work seems inexplicable.

9. **Rolling-stock.**—The rolling-stock appeared to be in good order as far as I had an opportunity of seeing it. The wooden covered goods wagons however appeared to require painting.

(1) Accident vans are kept in readiness at the principal engine changing stations and a basket packed with surgical appliances, tourniquets, bandages, plaster, &c., is kept in readiness at Negapatam.

(2) It was stated that arrangements were under consideration for providing instruction similar to that afforded by ambulance classes in England to guards and others.

10. **Traffic.**—The traffic of the South Indian Railway is steadily increasing under the reduced third-class fare which the South Indian Railway were wise enough to adopt in 1883.

(1) A comparison of the coaching receipts for the four years preceding 1883 in which the reduced fare was adopted with the receipts during the four years succeeding 1883 is very instructive :—

Year.	Coaching receipts. Rs.	Year.	Coaching receipts. Rs.
1879	20,03,022	1884	22,29,840
1880	20,62,512	1885	25,30,471
1881	21,06,449	1886	25,42,671
1882	21,14,966	1887	26,95,465

It will be seen that prior to the introduction of the reduced fare the coaching traffic was almost in a state of stagnation, having increased by about one lakh of rupees only in four years. While in the four years subsequent to the year in which the reduction was made it increased by nearly $4\frac{3}{4}$ lakhs of rupees.

(2) I have not had time for more than a cursory examination of the traffic, but in the face of such figures the wisdom of the policy of reducing fares can scarcely be disputed.

(3) I think that these results should be given the widest publicity as a guide for other railways and in the interests of the country at large which will never have its resources properly developed until the people begin to move about and ascertain for themselves what is being done in the large cities and in districts outside their own.

(4) If the South Indian Railway could see their way to a further reduction so as to bring the cost of a railway journey down more nearly to the cost of a journey done on foot, I feel sure they would reap a still greater benefit, while doing at the same time a great benefit to the country at large by inducing the people to move about and get new ideas.

(5) The South Indian Railway have commenced a system of local trains on the principal sections of their line. In this respect they are, as far as my experience goes,

in advance of all other railways in India which usually confine their service to through trains with a local service at the largest cities only.

(6) The local train service might however, I think, be better arranged. A man living in the country should in my opinion be able to take his basket of produce in the early morning to the bazaars of the large stations and to return to his home at midday when he has disposed of his things.

(7) And in the case of the more important civil stations persons attending the courts should be able to reach the civil station a little before the opening of the courts and then return to his home after the courts close.

(8) If the train service is so timed that a man must come in the day before in order to be in time for his business and thus take two days over a journey which could easily be done in one day, he is not likely to travel more frequently than he can possibly help. I notice that with the present train service a man who has business at the important station of Trichinopoly must practically come in the day before, as the earliest train does not arrive until 11-50 from the Tanjore direction and 11-40 from the Madura direction.

(9) The case is much the same at Tuticorin.

(10) I ascertained by inquiry during the inspection that there was a considerable amount of local goods traffic as well as of passenger traffic on some of these sections and this local goods will doubtless increase largely if the agricultural population are afforded facilities for disposing of their produce to better advantage at the bazaars in large stations. I believe therefore that it will pay well to give an improved local service on the various sections of the line after a time.

(11) I think that the train service on the Beach line should be improved. At present one train only is run out from Pallávaram to the Beach line, and this one train seems to carry a large number of passengers to the Fort and to the offices and shops near the beach. The East Indian Railway run 14 trains into Calcutta daily and 14 out in connection with the suburban traffic of Calcutta. The Great Indian Peninsula Railway run about the same number and the Bombay-Baroda and Central India Railway a much larger number of trains in connection with the suburban traffic of Bombay. It would be well therefore for the South Indian Railway to follow suit and make an earnest effort to nurse the suburban traffic of Madras.

(12) It would undoubtedly be a great convenience to Black Town and neighbourhood if 3 or 4 carriages were run out to the Beach line before the departure of every train from Egmore and after the arrival of every train at Egmore and arrangements made to book passengers through. I have not however had time to study the set and volume of traffic as closely as I had intended to do.

(13) In conclusion I may state my conviction that the line on the whole is well looked after and will in course of time become a prosperous undertaking when its permanent-way and bridges have been put into a satisfactory condition and when its station yards and signals have been remodelled so as to allow a heavy traffic to be safely dealt with.

MADRAS,
27th February 1890.

(Signed) W. SEDGWICK, Lt.-Col., R.E.,
Deputy Consulting Engineer for Railways.

NELLORE BRANCH.

The inspection of the Nellore-Tirupati section was made on the 8th February in company with Mr. F. F. Smith, Deputy Chief Engineer, and Mr. Gwyther, Executive Engineer.

2. **Earthwork.**—The banks appeared to be in good order except at the abutments of the over-bridge crossing the Madras Railway where additional earth is required.

3. **Bridges.**—The hook or holding-down bolts appeared to require examination. The nuts in a good many cases were found to be loose and in some cases were deficient.

(1) The gauge was tight at most of the bridges. There was a perceptible lurch in the train when it crossed the small bridges. This was I think partly due to the tightness of the gauge and partly to want of packing under the sleepers at the abutments.

The following points were noted in regard to bridges :—

(2) *Mile* 1/21, *three* 20-*feet openings*.—It is said that the district road was under water in 1874. It might perhaps be well to pass the floods across the railway by providing a causeway.

(3) *Mile* 14/6.—Flooring and spurs on both sides of the line require repair. A current is said to set towards a causeway on the Nellore-Madras Road to the south of the bridge down the borrow pits. The flow comes first down the borrow pits on the west of the line and is continued after crossing the line at the bridge by the borrow pits on the east of the line. In consequence the end of a spur at the north abutment has been scoured away on the west side of the line and the end of a spur at the south abutment on the east side of the line.

(4) *Mile* 15/6, *six* 40-*feet girder openings*.—Bridge built of laterite blocks. The north abutment is cracked and continuing to crack. The flow of the current is said to turn northwards after passing through this bridge towards the causeway on the Madras road.

(5) 15/19, *two* 40-*feet girder openings*.—A hole about 8 feet deep has been scoured out beyond the floor on the west side of the bridge.

(6) 22/15, *twenty* 40-*feet girder openings*.—One of the timber bed plates displaced from the 10th pier from the south.

(7) *Over-bridge crossing, Madras Railway*.—Retaining wall at the south abutment requires repair.

(8) A part only of the bridges are floored. The South Indian Railway from their experience on their own line are anxious to get floors and drop walls put in at all the bridges.

4. **Permanent-way.**—The permanent-way appeared to be in good order.

The Permanent way Inspector said that the breakages in the jaws of Denham Olphert's sleepers averaged about 1,200 per month.

(1) The light 41-lb. steel rails will soon wear out, it is to be feared, under the heavy F class locomotives in use on the line.

5. **Fencing.**—The first three miles at the Nellore end are fenced with a wire fence. The remainder of the line is unfenced. The line requires a fence on the 5th mile where it passes a large village, and it seems desirable that it should be fenced all along to prevent the destruction of cattle. By putting the fence along the top of the bank the temptation to trespass on the line will be minimized.

6. **Stations and Buildings.**—The stations would look somewhat better if whitewashed, but otherwise they are neatly kept and in good order.

(1) Wells are required at Manubolu and Venkatachellum and a lining to the well at Venkatagiri. A portable goods shed with a blind siding is wanted at Venkatachellum where a considerable salt traffic is developing. A goods shed is wanted at Venkatagiri and Kálahasti. A fine goods shed at Gúdúr was quite empty, but it was stated that a large cart traffic in tobacco and chillies passes the station along the Nellore-Madras road. It therefore seems probable that traffic will come to the station in course of time when rates are properly adjusted.

(2) The Locomotive Foreman's bungalow at Nellore is badly cracked, and has been tied together by iron tie-rods running the whole length of the building. A shed for repairing carriages and wagons is wanted at Nellore. The corrugated iron for the shed is available at Nellore. Repairs are not likely to be done at Nellore after the line is opened beyond Tirupati. If any shed is put up it should therefore be a portable one. A roof is required over the pump at Nellore.

(3) The line generally appears to be in good order and well looked after.

MADRAS,
28th February 1890.

(Signed) W. SEDGWICK, Lt.-Col., R.E.,
Deputy Consulting Engineer for Railways.

SOUTH INDIAN RAILWAY.

Locomotive Department.

Statement showing the Coaching and Goods Stock received for renewals and repairs and turned out for the quarter ending 30th September 1889.

Particulars.	Passengers' vehicles.	Covered goods wagons.	High-sided wagons.	Other vehicles.	Total.	Remarks.
Total stock on hand on 1st July 1889	53	26	14	33	126	
Total stock received from 1st July to 30th September 1889 ..	56	47	25	98	226	
Total ..	109	73	39	131	352	
Deduct stock turned out from 1st July to 30th September 1889 ..	52	18	10	77	157	
Total stock on hand ..	57	55	29	54	195	Undergoing repairs. 145 Awaiting do. .. 50

Negapatam,
5th October 1889.

(Signed) W. S. BETTS,
Agent.

(Signed) C. E. CARDEW,
for Loco. and Carriage Superintendent.

SOUTH INDIAN RAILWAY.

Statement showing the Coaching and Goods Stock received for renewals and repairs and turned out for the quarter ending 31st December 1889.

Particulars.	Passengers' vehicles.	Covered goods wagons.	High-sided wagons.	Other vehicles.	Total.	Remarks.
Total stock on hand on 1st October 1889.	57	83	36	19	195	
Total stock received from 1st October to 31st December 1889.	63	60	39	21	183	From column headed "other vehicles" 28 have been transferred to covered goods and to high-sided wagons 7
Total ..	120	143	75	40	378	
Deduct stock turned out from 1st October to 31st December 1889.	76	111	43	28	258	
Total stock on hand ..	44	32	32	12	120	Undergoing repairs. 100 Awaiting do. 20

Trichinopoly,
27th January 1890.

(Signed) W. F. HOOPER,
for Agent.

REPORT OF AN INSPECTION OF THE SOUTH INDIAN RAILWAY,

FOR

THE HALF-YEAR ENDED 31st DECEMBER 1889.

The inspection which was commenced at Nellore on the 8th February and ended at Erode on the 20th February 1890, was made in company with Mr. F. F. Smith, Deputy Chief Engineer, and the Resident Engineers of the several sections. The Chief Engineer, Mr. D. Logan, accompanied the inspection party over the section between Trichinopoly and Tuticorin.

2. There is so much that is interesting on the South Indian Railway that a very long time would be required for anything like a complete inspection by any one who like myself had never had an opportunity of seeing the south of India before. Indeed I was compelled in order to get through the inspection at all within the prescribed time to go hurriedly over the principal works and to leave for the most part the minor and even some of the large works unseen.

3. **Earthwork.**—The banks and cuttings appeared generally to be in good order.

(1) The causeways with one exception are in my opinion set too high and would be safer and more effective if lowered. As far as I could learn one only had been actually used by the floods.

(2) If this system of dealing with floods were extensively used it would perhaps be well to provide engines with high fire-boxes or to protect the fires in some other way.

4. **Bridges.**—The permanent bridges generally appear to be well looked after and maintained. The temporary bridges in the diversion at the Gadilam bridge, mile 124, show more movement than is desirable—especially the bridge of 12 spans of 12 feet at the south end of the diversion—and should, I think, be run over very cautiously. Bridges of this description, viz., with sleeper cribs carrying a platform of 40-feet rails laid close together though fairly stiff when first put up as was satisfactorily shown at other diversions to which I shall refer later on, naturally work loose in time. In the case of the Gadilam the temporary bridges were in use I understand before the last monsoon.

The following points were noted in regard to the bridges which were inspected as far as time would permit on the Railway:—

(1) 5/5 *Adyár*, *six* 66-*feet girders*.—Superstructure shows a good deal of movement. Rail joints appear to be too tight.

(2) 36/6.—North abutment cracked from top to bottom under west end of plate. The south wing wall on the east side also cracked.

(3) 41/2, *one-foot culvert*.—Return walls have moved bodily on both sides.

(4) 42/7, *one* 10-*feet girder*.—North abutment cracked from top to bottom. Both wing walls on the west side also cracked.

(5) 49/1, *twenty-two* 40-*feet girders*.—Some deficient rivets noticed in cross bracing.

(6) 63/14, *nine* 20-*feet girders*.—Some rivets loose in cross bracing.

(7) 102, *one* 25-*feet span*.—Badly cracked. Cracks have not opened since they were plastered up.

(8) 104/8, *four* 25-*feet girders*.—The holding-down bolts which secure the longitudinal timbers have nuts on the under side without split pins. Additional spikes appear to be required to secure the rails. There were intervals of 6 feet or more in some cases between the spikes.

(9) 124/0 *Gadilam River*—originally ten 100-feet girder openings. Five more are being added. The condition of the temporary bridges in the diversion at this bridge has already been noticed.

(10) 130/14, *double 3-feet culvert.*—One 12-feet girder opening to be added. A diversion has been put in at the site of the new bridge which will be referred to further on.

(11) 134/10, *five 40-feet girder openings.*—Four spans added in 1888. The high ground in front of two of the four new spans will have to be cut away to make this portion of the bridge effective. The wing walls in this bridge have a considerable amount of batter in front. The bed joints are in planes perpendicular to the batter and the wing walls therefore imperfectly bonded into the abutments and return walls which have horizontal joints. The return walls in all cases have cracked right through and have had to be strengthened by heaping boulders against them. One of the wing walls on the east side is also cracking. The method adopted in connecting the new return walls with the old wing walls of one of the abutments is an awkward one.

(12) 134/13.—Two feet brick culvert cracked and tied together by an iron rod running right through the culvert.

(13) 134/15, *seven 40-feet girder openings.*—Battered wing walls built in the same way as those at the bridge of five 40-feet openings mile 134/10 and with the same result in the cracking of all the return walls and in the provision of heaps of boulders to strengthen the return wall.

(14) 146/6, *one 100-feet girder opening.*—One link in this bridge shows a flaw apparently of long standing.

(15) 151/6.—A temporary bridge of three 15-feet openings spanned by rail platforms carried on sleeper cribs 15 feet high showed a good deal of movement. A 30-feet girder bridge on wells 10 feet deep said to have been scoured out by floods is being replaced by a 70-feet girder bridge. The rail-bearers in the new bridge are carried on the lower flanges of the cross girders, and the longitudinal timbers are cut up into short lengths so as to fit in between the cross girders. This arrangement has not been found satisfactory in all cases on other railways because each of the short lengths is isolated from the others and therefore a weak length gets no assistance from stronger lengths on either side of it and it is therefore a difficult matter to prevent movement in the short lengths. It is understood that the object of this arrangement is to secure a better attachment for the rail-bearers than that supplied in the original design by knees which have cracked in several cases at other bridges.

(16) 152/13.—Two 100-feet girder opening with longitudinal beams in short lengths on rail-bearers carried on bottom flanges of cross girders.

(17) 155/7, *Coleroon River, fourteen 150-feet girder openings.*—Several of the knees holding the rail-bearers in this bridge are said to have cracked in 1883. The ends of the rail-bearers are now supported in addition by wooden blocks resting upon the lower flanges of the cross girders.

(18) 201/6, *six 30-feet girder openings.*—Longitudinal timbers in this and other bridges on either side of it are secured by one holding-down bolt only to each of the shoes. The shoes are secured in each case by two rivets only (one on either side) to the cross-bearers. Chips of wood or spikes were in many cases packed in round the shoes with a view apparently to keep the timbers from shifting. The holding-down bolts have nuts on the under side without any split pins or soft washers or other arrangement to prevent them from getting loose.

(19) 211/9, *four 50-feet girder openings.*—The longitudinal timbers are carried by shoes which have in many cases been packed round with chips or spikes.

(20) 214/5, *six 50-feet openings.*—The longitudinal timbers are carried on shoes packed round in several cases with spikes or chips in the same way as the two bridges last noticed.

(21) 235/2, *eight 30-feet girder openings.*—Some of the chairs appeared to be loosely spiked.

(22) 279/1, *five 20-feet girder openings on a curve.*—The holding-down bolts securing the longitudinal timbers have nuts on the under side without split pins in some cases. The gauge on this bridge was too tight.

(23) 283/6, *one 8-feet rail opening covered with 68-lb. rails.*—The superstructure of this bridge appears to contain about 6 tons of iron, if my count of the number of rails is correct, or about six times the weight of iron in a girder bridge of the same span.

(24) 323/2, *one 5-feet girder opening.*—The floods are said to have risen above girder bed level at this bridge in September last, while at the bridge two 20-feet openings close by, namely, at mile 323/4, the flood on the same date is stated to have been 2 feet 4 inches below girder bed level. Communication between the two bridges is impeded by a growth of prickly-pear in the borrow pits and at times by cultivation in the fields.

(25) 327/12.—The Irrigation Department have asked for a bridge of three 25-feet openings to replace the 6-feet bridge at this site in connection with the Periyár project.

(26) 344/8, *Bridge of 15 spans of 70 feet with plate girders.*—The longitudinal timbers on this bridge have recently been renewed. The holding-down bolts which secure the longitudinal timbers require examination. In many cases the bolts came directly under the rail and the heads were so long as to be caught by the rail when depressed by a passing train. In some cases the nuts on the under sides of the bolts were unprovided with split pins.

(27) 361/9, *two 15-feet girder openings in black cotton soil.*—The south abutment of this bridge is badly cracked from top to bottom.

(28) 389/7, *Satur Bridge, twelve 70-feet plate girder openings.*—The longitudinal beams 9″ × 6″ in scantling are carried by continuous troughs of angle iron rivetted to the cross girders and held by wooden distance pieces and iron tie-rods. The timbers generally appear to be sound though they are a good deal shaken and cut into at places. The distance pieces have shrunk and in many cases bear against the angle iron troughs instead of holding the longitudinal timbers. The timbers are said to have been hurriedly put on in order to be in time for the Prince of Wales' visit to India. They can, in my opinion, be made to last for a considerable time longer by strapping and cross-bolting the shaken places and putting in new distance pieces where necessary. It appears doubtful whether sufficient room for expansion has been allowed for the girders. In most cases the ends of the girders appear to be tight up against each other. One of the girders in the first span on the north side is considerably bent. It is said to have been dropped by accident when the superstructure was under erection.

(29) 396/15, *five 30-feet girder openings.*—The longitudiual timbers in this bridge have been recently renewed. The holding-down bolts have nuts on the under side, some of which were apparently unprovided with split pins. The gauge appeared too tight at the north end.

Arkonam Branch.

(30) 57/10-*A*, *one 15-feet opening.*—Bridge has failed owing apparently to movement in the bank under which both abutments have bulged. The diversion with a temporary bridge with two 15-feet rail openings which has been put in here requires some alteration to make it safe during bad weather. A fuller notice of this diversion will be found further on.

(31) 63/15-*A*, *four 25-feet openings.*—Some scour to a depth of 3 or 4 feet has occurred at one of the piers. It is stated that there is no floor in the bridge.

(32) 63/13-*A*, *four 10-feet girder openings.*—The upper part of the north abutment of this bridge has moved bodily apparently under a movement in the bank.

(33) 71-*A*—*Kortalayár River: nine 30-feet girder openings on screw piles.*—It is stated that the floods in 1888 rose nearly up to girder bed level.

(34) Over-bridge with span of 72 feet at Arkónam station looks light for a bridge which may be subjected to a rush of pilgrim traffic.

NEGAPATAM BRANCH.

(35) 266/5-*N.*, *seven* 30-*feet continuous girder bridge.*—The girders appear to be out of line on the north side and the rails to be slightly kinked. The girders have been shifted off the bed-plate at one of the piers and put on to two blocks of wood. The holding-down bolts need examination, two appeared to be deficient at one place on the second span from the west and the bolts at other places had not been tightened up against the cotters.

(36) 238/2-*N.*, *nine* 30-*feet girder openings.*—Some bad rails were noticed at this bridge. The rail joints seemed to be very tight. It was stated that the road goes out of shape in very hot weather.

(37) 237/2, *five* 30-*feet girders.*—The longitudinal timbers appeared to have been much cut up. A rough attempt had been made to secure the joints of the timbers by bolting the ends of the timbers together with hook-bolts. Some old rails were noticed.

ERODE BRANCH.

(38) 253/0-*E.*, *seven* 30 *and two* 15 *feet openings.*—The longitudinal timbers are bolted down to the cross girders. Distance pieces and tie-rods are provided at the piers but not intermediately, as ought I think plainly to be done since no knees, shoes or angle irons have been provided to hold the timbers. The gauge appeared to be too tight at several places on the bridge.

(39) 267/8-*E.*, *five* 30-*feet girder openings.*—Same as the last bridge.

(40) 296/10-*E.*, *Amarávati River*, *twenty* 50-*feet bowstring girder openings and one* 20-*feet girder opening.*—The rivets holding the cross girders of this and another bridge with six 50-feet openings of the same type at mile 310/7 should be examined.

(41) 315/13-*E.*, *eight* 20-*feet girder openings.*—Insufficient room for expansion appears to have been allowed between the girders. The girders were not exactly in line and the gauge was tight at places. One or two of the timber bed-plates under the girders appeared to need renewal.

(42) *Timber over-bridge at Erode station.*—The spans have been trussed in a peculiar way. It is stated that the bridge was found to be wanting in stiffness. If this is really the case, it seems doubtful if the iron ties which have been added will hold, if the bridge sways much under a rush of pilgrim traffic.

(43) In regard to the bridges generally it may be pointed out that the absence of footways on many or most of the bridges, in several cases lengthy ones with 30-feet spans or under, makes it a difficult matter to inspect properly. One cannot examine a bridge properly if one has to walk as we had to do at several bridges on the top of a girder perhaps under one foot in width or to pick one's way amongst the bolts and spikes on a longitudinal beam not much more than 10 or 12 inches wide. Besides the absence of footways makes the work of patrolling the line at night eminently dangerous to the staff of the line.

(44) The bridges of the Whipple Murphy type ought I think in every case to be tested again now under one of the heavy goods trains which are being run over the line and diagrams taken in order to make sure that the bridges are sufficiently strong. I had no opportunity of noticing their behaviour under these heavy trains, but in a few cases I had an opportunity of watching the passage of light trains and there I noticed in some instances a tendency to buckle in some of the tension pieces indicating that an unfair amount of work was being thrown upon other parts of the bridge.

(45) The system of cross bracing at the older bridges of this type appears to me to be defective, inasmuch as the strains are transferred at the ends to the free ends of the rail-bearers and tend to wrench off the rail-bearers and to run backwards and forwards up and down the bridge.

(46) It is not surprising I think under these circumstances that the rivets in the cross bracing and in the rail-bearers should as shown by the annual report to be getting loose and that the knees securing the rail-bearers to the cross girders should in some cases have been broken. In this connection I noted that in the majority of cases in which it had been necessary to renew rivets the defective rivets were situated near

the ends of the girders where the strains as pointed out tend to wrench off the rail-bearers and not in the middle. This tends I think plainly to show that the failure of the rivets is due mainly to the defective arrangement of the cross bracing and not entirely to bad work in rivetting.

(47) In the Gingee bridge the arrangement of the cross bracing seems better but apparently gusset plates are required at the cross pieces to make a better connection with the cross bracing. I noticed the rivets in the cross bracing had failed at these places in most of the spans. The rails generally are carried on longitudinal timbers over the bridges. These timbers are secured in a variety of ways. In the oldest bridges they were carried on long shoes, each of which was secured by two rivets only (one on either side) to one of the cross girders. The timbers were bolted down by a single holding-down bolt to the shoe. This arrangement which is plainly objectionable because it tends to wrench off the rivet which holds the shoe on the opposite side to that at which the timber is bolted to the shoe is being got rid of whenever the timbers are renewed by substituting "Chubbs" or knees by which the timbers are kept from moving laterally and their bolting the timbers down to the cross girders. There appear however to be many bridges at which the timbers are still held by shoes.

(48) On the Erode branch the longitudinal timbers are bolted down to the cross girders, but there is nothing to prevent lateral displacement with the exception of holding-down bolts which tend of course in time to work loose in the timbers, and distance pieces and tie-rods at the piers only. If a sufficient number of stout distance pieces and ties were introduced intermediately, this would in my opinion be the most satisfactory arrangement of all.

(49) Beyond Trichinopoly the longitudinal timbers were carried in angle iron troughs running continuously across the bridge. The Engineering Department object to this arrangement because of the difficulty of fitting the timbers accurately into the troughs and are gradually replacing it by a system of "Chubbs." It seems to me however a much safer arrangement than that of the shoes.

(50) Lastly the arrangement of cutting the longitudinal timbers up into short lengths and rivetting their ends in under the cross girders is being tried as stated at the bridge at mile 151/6. A reference to the Tirhoot State will I believe elicit the fact that this arrangement is a very unsatisfactory one. The timbers generally appeared to be sound at the heart, but the unsatisfactory methods of securing them have led in many cases to their being cut into and knocked about in such a way as to make the early renewal of a considerable number of them advisable.

(51) I have already referred to the temporary bridges in actual use at the Gadilam river and at the bridge at mile 151/6. In addition to these I inspected two other temporary bridges, viz., one on the Arkónam branch at mile 57/10-A, with two 15-feet rail openings, and the other at mile 130/14 with a 12-feet rail opening.

(52) The bridge at mile 130/14 has curves of 1,000 feet radius in the approaches and gradients of 1 in 100 for a length of 350 feet on either side and is constructed in a bank about 6 feet high. The superstructure had been hurriedly put on to be ready for the inspection. Some very old holding-down bolts had been used to secure the sleepers upon the superstructure, one at all events was broken. The sleepers did not appear to have been spaced in all cases so as to support the joints properly. No sill had been provided at the middle of the crib so as to give the rail platform a fair bearing upon the middle of the crib.

(53) When these defects have been remedied and the permanent-way thoroughly examined there seems no reason why the diversion should not be taken into use with the usual restrictions in regard to speed, provided that the Engineering Department are prepared to take the construction of the new bridge in hand at once and get it finished straight off.

(54) I think however that some modification is necessary in the case of the other temporary bridge at mile 57/10-A of the Arkónam branch before sanction to the use of the diversion is given. In this case the bridge of two 15-feet openings is constructed in a bank 15-feet high made up of soil which shows so much movement in the monsoon that not only have both abutments of the old bridge of 15-feet span given way under it and one abutment of another bridge a little further on, viz., at mile 63/13

as before stated also failed, but in addition the soil of the diversion itself showed so much tendency to move when the bank was being thrown up during the rains that it was found necessary to retain it by a revetment of sand-bags and a row of sleepers planted endwise all along the toe of the slope.

(55) If the diversion remains open during the monsoon the sleeper cribs will have to stand the thrust of a 15-feet bank in soil of this description with the weight of an engine on the top of it. I am informed that a revised estimate is to be submitted providing for a larger bridge. There is little hope therefore that in the ordinary course the bridge will be completed before the monsoon. I think therefore that a revetment of sand-bags or dry stone in courses or something of a similar kind should be provided to take the thrust of the bank off the cribs, or failing this that the diversion should not be taken into use until after the monsoon when sanction for the new bridge has been received and material for its construction collected.

(56) In connection with the subject of bridges I may mention that I was shown two nullah diversions, one called the Samunderam diversion at the 267th mile by which a nullah which was setting towards the bank has been diverted away by a cut strengthened by groynes across a bend of the nullah; and another at the 275th mile by which a cut made across a bend in the bed of a nullah which crossed and recrossed the line has saved the cost of two bridges.

(57) Both of these diversions have so far been completely successful, and since the banks of the diversions are being fortified by the growth of prickly-pear and jungle there can I think be little ground for anxiety now on their behalf. These are the only instances as far as I could learn in which the railway has gone outside railway land to construct defensive works. In fact with the exception of a retaining wall and some small groynes on the 431st and 432nd miles and perhaps half-a-dozen groynes in all elsewhere these were the only places in which I noticed that any attempt had been made to control the rivers and streams and prevent them from wandering. While on the other hand very large additions have been made at many places to the waterway. In my opinion the success which attended these nullah diversions ought to have prompted further endeavours in the same direction.

(58) I think that it is essential that something of this kind should be taken in hand at mile 432, where a nullah is deserting the straight channel through a bridge of four 50-feet openings at mile 43/8 and setting full against the bank at a point several chains away to the north. Instead of keeping within railway land and building a retaining wall fortified by groynes all along the toe of the slope as has actually been done, the proper course I think would have been to have thrown a bund across the mouth of the new channel which the river is forming and then forced the river back by spurs to its old channel. If this is not done I believe that it will be necessary before long to build a new bridge at the site of the new channel. I do not believe that the nullah will long allow itself to be deflected as is now the case by a right angle bend to the present bridge when its new channel is completed.

5. **Permanent-way.**—The permanent-way is well looked after and in as good order as a defective road can be expected to be.

(1) The worst part of the road in my opinion is on the Negapatam branch where the 68-lb. rails are much worn and splayed on the outside and the wooden sleepers are very old having been in the road I understand since the line was first opened. The ends of the rails have splayed and the joints are in consequence so tight that the road was said to get crooked at one part of the line on a hot day.

(2) There appear to be upwards of 250 miles of half-round creosoted sleepers with an average age of 13 years of the same kind as the sleepers which failed on the Northern Bengal and Tirhoot State Railways after a life of not more than 12 or 13 years.

(3) The 40-lb. rails are cutting into these sleepers and the spikes plainly do not hold properly.

(4) The gauge appeared to be tight throughout on these sleepers, but is probably safer to have it tight than slack with sleepers of this description.

(5) It seems necessary that a pair of hardwood sleepers should be inserted at each joint and double spiked on the outside and that a hard wood sleeper should in addition be put in at the middle of the rail on the straight with an additional pair of hardwood sleepers at each rail in curves and that this should be done without delay.

(6) The 40-lb. rails appear to be in fair order and with good sleepers and light traffic would doubtless last for a good many years.

(7) With the present sleepers and heavy traffic they will doubtless be knocked to pieces before long. They ought in my opinion to be replaced by 50-lb. rails and utilized in the construction of some of the many branch lines which are required.

(8) The running over the 50-lb. road was not altogether so smooth as might have been expected, neither had the road as good a top on it as might have been expected. These defects I attribute to the fact that ties are inserted only at every alternate pair of pots except at joints and curves where the full number of ties are inserted. I believe it will be difficult to maintain the road in perfect order until the full number of ties are inserted.

(9) The sidings at roadside stations are too short for the long trains now run.

6. **Signals.**—The distant signals are in many cases too near to the points. They should be set back to a sufficient distance to allow one of the longest goods trains to draw inside so as to be protected by the signal without fouling the points when the signal is against the driver, with a sufficient margin for safety in view of the fact that steam-brakes are not fitted to the engines and therefore drivers will find a difficulty in pulling up heavy goods trains exactly at the right spot when the rails are greasy. The distant signals are in my opinion much too low. In most cases they are viewed against a back ground of trees owing to their lowness and cannot be seen without great difficulty. In many cases the approach to the station from one side or the other is round a curve which prevents the signal from being seen from the station platform. No station signals have been provided at the roadside stations with the exception of perhaps half-a-dozen of the largest stations.

(1) The distant signals are so low that drivers may readily mistake a light alongside of the line for a distant signal in the absence of station signals to supplement them. The present arrangement of sidings and signals is not in my opinion safe with heavy traffic.

7. **Ballast and Fencing.**—The ballast with the exception of a few miles on which quartz ballast is used is very dirty, and in many places little else but earth or sand.

(1) It is said that the pot-sleepers stand well on quartz and other kinds of broken stone ballast.

(2) The aloe fence on the main line is generally in very good order.

(3) I only saw two head of cattle on the line during the whole of the inspection and they were on the Erode branch on which wire fencing is to a great extent used.

8. **Station Buildings.**—The buildings as far as I could see were sound in every respect with very few exceptions and were generally neat and clean and well cared for. The walls of the station building at Vaithísvarankoil and of the north-east angle of the waiting shed at Samayanallúr are however badly cracked and the roof of the goods shed at Cuddalore is stated to have given trouble. The floors at several stations on the Erode branch and south of Trichinopoly need repair, also the steps at Sikkil. The old station buildings at Kivalúr and Koradáchéri should be put into repair if they are retained. The building at the former station appeared to be used as a cattle shed and at the latter as quarters for station menials.

(1) The block of offices at Trichinopoly is a particularly fine one. The station buildings at road side stations with the exception of a few which have been recently constructed are all set back at a considerable distance away from the platform. This arrangement makes it very difficult for the stationmasters to supervise the work of the station yard since he can see nothing of the yard from his own office. When traffic increases this will be a serious drawback to the safe working of the railway.

(2) Quarters have been provided for stationmasters at all stations, but no quarters have been provided for signallers or for menials. With light traffic it might be possible to allow men to sleep in the villages around, but with heavy traffic emergencies and accidents will arise which will make it necessary for the men to be always

available when wanted. The matter is one under consideration. It would be well to make a commencement by taking in hand a certain number of stations in each half-year.

(3) Portable goods sheds both covered and open have been provided at many of the stations. The covered goods sheds have the walls and roofs of corrugated iron. With one or two exceptions these buildings had no tie in the middle to keep the roof from spreading. I noticed that the roof of one of these sheds at Acharapákam had sagged already in the middle. In the open goods sheds the roofs are carried on uprights made of old rails. These uprights are not tied or connected together in any way except in some cases at the end bays where the two end uprights are sometimes braced together. Each of the uprights therefore stands alone and the buildings are thus likely to be overstrained if a strong side wind sweeps through the shed. Some of the sheds are large, being as much as 300 feet in length in some instances. Complaints were made at several stations of damage caused by rats at the goods sheds. I have seen a deep layer of sand tried up-country with good effect in the floors of goods sheds. The sand fills up the rat-holes as fast as they are dug and prevents the rats from making a lodgment. I was informed that a layer of sand had been used below the paving at one of the goods sheds on the South Indian Railway with good results. It would be well to make some further experiments in the same direction.

(4) Part of the stone coping at the platform wall of the goods shed at Madura had been displaced. Loose dowels were projecting above the floor.

(5) The coping of the ash-pits at most of the roadside stations is kept in position by three or four transoms fixed across the top of the pit. These transoms must be very much in the way and ought to be removed.

(6) The arrangements for securing rolling-stock in the sidings do not appear to be very complete. Scotch blocks have been provided at most of the stations at one end of the sidings, but seldom at both ends. I did not see in the case of loop sidings however a single one of these Scotch blocks in use at any of the stations. It is plain that at mill and other sidings where wagons are loaded and unloaded by mill hands or by coolies employed by traders the Scotch block to the mill or goods sidings should be permanently locked and never opened except by permission of the stationmaster and under the supervision of some responsible Railway official when wagons have to be taken out or put into the sidings.

(7) It is stated that no chains or other appliances other than brakes and Scotch blocks are provided for securing the wheels of wagons so as to prevent wagons being blown out of sidings on the occurrence of storms. This is not in accordance with the practice on other railways.

(8) At Tiruvallúr station I noticed that there was a well in actual use immediately at the back of and close up the wall of the *station latrine*. This well is adjacent to the third-class waiting shed and is practically the only well the passengers can use. The station well is on the opposite side of the line and passengers are debarred from crossing the line. There is said to be a heavy passenger traffic at this station, an average of 700 passengers daily. A rope and pully at the well in question showed plainly that it was in use.

(9) Complaints were made in regard to the water-supply at Kumarapuram. A well has been provided, but the water on this part of the line is so brackish that it is not used for engines, and special arrangements are made to provide a water-supply for engines. Special arrangements should also be made to provide a water-supply for the station staff and for passengers. It is manifest that water which is too brackish for use in locomotive boilers is unfit for drinking.

(10) I was greatly pleased to find that considerable attention is paid to the condition of the running rooms for drivers throughout the line. The rooms in every case were clean and well furnished, and at Negapatam were particularly good.

(11) The Traffic Department might with advantage make some provision of the same kind for their guards. I only succeeded in finding one traffic running-room upon the line, and that was a bare ill-found room at Chingleput.

(12) The reading-room at Negapatam is much too small.

(13) The locomotive, and carriage and wagon workshops, at Negapatam appeared to be cool and airy buildings, well suited to the purposes to which they were applied. When the reorganization now in progress is finished and the space between the old smiths' shop and the fitting shop is roofed in and central shafting put up and machines of different classes grouped together, the arrangements will be very complete and good. A hydrant and a steam fire-engine are provided for the workshops and a fire brigade is kept up. The tanks at running sheds appeared to me to be too low to give a proper head of water for washing out. It is stated that the water is so bad on the line that it is necessary to wash out after ~~evening~~ every trip. The store buildings at Negapatam appeared to be well arranged and in good order.

(14) The trees have grown well at most of the stations in the Tanjore and Madura districts and now afford pleasant shade to the platforms. More attention might with advantage be paid to the cultivation of trees and gardens at other stations.

(15) The Port authorities at Tuticorin have laid a beach line of railway which will connect the South Indian Railway with a line of rails upon the pier as soon as the South Indian Railway establish a connection with the beach line by a curve from one of the sidings in the station yard. The beach line will manifestly facilitate greatly the loading and unloading of boats at the pier. The delay on the part of the South Indian Railway in completing their portion of the work seems inexplicable.

9. **Rolling-stock.**—The rolling-stock appeared to be in good order as far as I had an opportunity of seeing it. The wooden covered goods wagons however appeared to require painting.

(1) Accident vans are kept in readiness at the principal engine changing stations and a basket packed with surgical appliances, tourniquets, bandages, plaster, &c., is kept in readiness at Negapatam.

(2) It was stated that arrangements were under consideration for providing instruction similar to that afforded by ambulance classes in England to guards and others.

10. **Traffic.**—The traffic of the South Indian Railway is steadily increasing under the reduced third-class fare which the South Indian Railway were wise enough to adopt in 1883.

(1) A comparison of the coaching receipts for the four years preceding 1883 in which the reduced fare was adopted with the receipts during the four years succeeding 1883 is very instructive :—

Year.	Coaching receipts. Rs.	Year.	Coaching receipts. Rs.
1879	20,03,022	1884	22,29,840
1880	20,62,512	1885	25,30,471
1881	21,06,449	1886	25,42,671
1882	21,14,966	1887	26,95,465

It will be seen that prior to the introduction of the reduced fare the coaching traffic was almost in a state of stagnation, having increased by about one lakh of rupees only in four years. While in the four years subsequent to the year in which the reduction was made it increased by nearly $4\frac{3}{4}$ lakhs of rupees.

(2) I have not had time for more than a cursory examination of the traffic, but in the face of such figures the wisdom of the policy of reducing fares can scarcely be disputed.

(3) I think that these results should be given the widest publicity as a guide for other railways and in the interests of the country at large which will never have its resources properly developed until the people begin to move about and ascertain for themselves what is being done in the large cities and in districts outside their own.

(4) If the South Indian Railway could see their way to a further reduction so as to bring the cost of a railway journey down more nearly to the cost of a journey done on foot, I feel sure they would reap a still greater benefit, while doing at the same time a great benefit to the country at large by inducing the people to move about and get new ideas.

(5) The South Indian Railway have commenced a system of local trains on the principal sections of their line. In this respect they are, as far as my experience goes,

in advance of all other railways in India which usually confine their service to through trains with a local service at the largest cities only.

(6) The local train service might however, I think, be better arranged. A man living in the country should in my opinion be able to take his basket of produce in the early morning to the bazaars of the large stations and to return to his home at midday when he has disposed of his things.

(7) And in the case of the more important civil stations persons attending the courts should be able to reach the civil station a little before the opening of the courts and then return to his home after the courts close.

(8) If the train service is so timed that a man must come in the day before in order to be in time for his business and thus take two days over a journey which could easily be done in one day, he is not likely to travel more frequently than he can possibly help. I notice that with the present train service a man who has business at the important station of Trichinopoly must practically come in the day before, as the earliest train does not arrive until 11-50 from the Tanjore direction and 11-40 from the Madura direction.

(9) The case is much the same at Tuticorin.

(10) I ascertained by inquiry during the inspection that there was a considerable amount of local goods traffic as well as of passenger traffic on some of these sections and this local goods will doubtless increase largely if the agricultural population are afforded facilities for disposing of their produce to better advantage at the bazaars in large stations. I believe therefore that it will pay well to give an improved local service on the various sections of the line after a time.

(11) I think that the train service on the Beach line should be improved. At present one train only is run out from Pallávaram to the Beach line, and this one train seems to carry a large number of passengers to the Fort and to the offices and shops near the beach. The East Indian Railway run 14 trains into Calcutta daily and 14 out in connection with the suburban traffic of Calcutta. The Great Indian Peninsula Railway run about the same number and the Bombay-Baroda and Central India Railway a much larger number of trains in connection with the suburban traffic of Bombay. It would be well therefore for the South Indian Railway to follow suit and make an earnest effort to nurse the suburban traffic of Madras.

(12) It would undoubtedly be a great convenience to Black Town and neighbourhood if 3 or 4 carriages were run out to the Beach line before the departure of every train from Egmore and after the arrival of every train at Egmore and arrangements made to book passengers through. I have not however had time to study the set and volume of traffic as closely as I had intended to do.

(13) In conclusion I may state my conviction that the line on the whole is well looked after and will in course of time become a prosperous undertaking when its permanent-way and bridges have been put into a satisfactory condition and when its station yards and signals have been remodelled so as to allow a heavy traffic to be safely dealt with.

MADRAS,
27th February 1890.

(Signed) W. SEDGWICK, Lt.-Col., R.E.,
Deputy Consulting Engineer for Railways.

NELLORE BRANCH.

The inspection of the Nellore-Tirupati section was made on the 8th February in company with Mr. F. F. Smith, Deputy Chief Engineer, and Mr. Gwyther, Executive Engineer.

2. **Earthwork.**—The banks appeared to be in good order except at the abutments of the over-bridge crossing the Madras Railway where additional earth is required.

3. **Bridges.**—The hook or holding-down bolts appeared to require examination. The nuts in a good many cases were found to be loose and in some cases were deficient.

(1) The gauge was tight at most of the bridges. There was a perceptible lurch in the train when it crossed the small bridges. This was I think partly due to the tightness of the gauge and partly to want of packing under the sleepers at the abutments.

The following points were noted in regard to bridges :—

(2) *Mile* 1/21, *three* 20-*feet openings.*—It is said that the district road was under water in 1874. It might perhaps be well to pass the floods across the railway by providing a causeway.

(3) *Mile* 14/6—Flooring and spurs on both sides of the line require repair. A current is said to set towards a causeway on the Nellore-Madras Road to the south of the bridge down the borrow pits. The flow comes first down the borrow pits on the west of the line and is continued after crossing the line at the bridge by the borrow pits on the east of the line. In consequence the end of a spur at the north abutment has been scoured away on the west side of the line and the end of a spur at the south abutment on the east side of the line.

(4) *Mile* 15/6, *six* 40-*feet girder openings.*—Bridge built of laterite blocks. The north abutment is cracked and continuing to crack. The flow of the current is said to turn northwards after passing through this bridge towards the causeway on the Madras road.

(5) 15/19, *two* 40-*feet girder openings.*—A hole about 8 feet deep has been scoured out beyond the floor on the west side of the bridge.

(6) 22/15, *twenty* 40-*feet girder openings.*—One of the timber bed plates displaced from the 10th pier from the south.

(7) *Over-bridge crossing, Madras Railway.*—Retaining wall at the south abutment requires repair.

(8) A part only of the bridges are floored. The South Indian Railway from their experience on their own line are anxious to get floors and drop walls put in at all the bridges.

4. **Permanent-way.**—The permanent-way appeared to be in good order.

The Permanent-way Inspector said that the breakages in the jaws of Denham Olphert's sleepers averaged about 1,200 per month.

(1) The light 41-lb. steel rails will soon wear out, it is to be feared, under the heavy F class locomotives in use on the line.

5. **Fencing.**—The first three miles at the Nellore end are fenced with a wire fence. The remainder of the line is unfenced. The line requires a fence on the 5th mile where it passes a large village, and it seems desirable that it should be fenced all along to prevent the destruction of cattle. By putting the fence along the top of the bank the temptation to trespass on the line will be minimized.

6. **Stations and Buildings.**—The stations would look somewhat better if whitewashed, but otherwise they are neatly kept and in good order.

(1) Wells are required at Manubolu and Venkatachellum and a lining to the well at Venkatagiri. A portable goods shed with a blind siding is wanted at Venkatachellum where a considerable salt traffic is developing. A goods shed is wanted at Venkatagiri and Kálahasti. A fine goods shed at Gúdúr was quite empty, but it was stated that a large cart traffic in tobacco and chillies passes the station along the Nellore-Madras road. It therefore seems probable that traffic will come to the station in course of time when rates are properly adjusted.

(2) The Locomotive Foreman's bungalow at Nellore is badly cracked, and has been tied together by iron tie-rods running the whole length of the building. A shed for repairing carriages and wagons is wanted at Nellore. The corrugated iron for the shed is available at Nellore. Repairs are not likely to be done at Nellore after the line is opened beyond Tirupati. If any shed is put up it should therefore be a portable one. A roof is required over the pump at Nellore. (3) The line generally appears to be in good order and well looked after.

MADRAS,
28th February 1890.

(Signed) W. SEDGWICK, Lt.-Col., R.E.,
Deputy Consulting Engineer for Railways.

SOUTH INDIAN RAILWAY.

LOCOMOTIVE DEPARTMENT.

STATEMENT showing the Coaching and Goods Stock received for renewals and repairs and turned out for the quarter ending 30th September 1889.

Particulars.	Passengers' vehicles.	Covered goods wagons.	High-sided wagons.	Other vehicles.	Total.	Remarks.
Total stock on hand on 1st July 1889	53	26	14	33	126	
Total stock received from 1st July to 30th September 1889 ..	56	47	25	98	226	
Total ..	109	73	39	131	352	
Deduct stock turned out from 1st July to 30th September 1889 ..	52	18	10	77	157	
Total stock on hand ..	57	55	29	54	195	Undergoing repairs. 145 Awaiting do. .. 50

NEGAPATAM,
5th October 1889.

(Signed) W. S. BETTS,
Agent.

(Signed) C. E. CARDEW,
for Loco. and Carriage Superintendent.

SOUTH INDIAN RAILWAY.

STATEMENT showing the Coaching and Goods Stock received for renewals and repairs and turned out for the quarter ending 31st December 1889.

Particulars.	Passengers' vehicles.	Covered goods wagons.	High-sided wagons.	Other vehicles.	Total.	Remarks.
Total stock on hand on 1st October 1889.	57	33	36	19	195	From column headed "other vehicles" 28 have been transferred to covered goods and to high-sided wagons 7
Total stock received from 1st October to 31st December 1889.	63	60	39	21	183	
Total ..	120	143	75	40	378	
Deduct stock turned out from 1st October to 31st December 1889.	76	111	43	28	258	
Total stock on hand ..	44	32	32	12	120	Undergoing repairs. 100 Awaiting do. 20

TRICHINOPOLY,
27th January 1890.

(Signed) W. F. HOOPER,
for Agent.

Form No. 1.

PUBLIC WORKS DEPARTMENT.

OFFICE OF CONSULTING ENGINEER FOR RAILWAYS,
Madras, 5th April 1890.

Note on inspection of the South Indian Railway and Nellore Branch of the Villupuram Guntakal State Railway for the half year ending 31st December 1889.

No. 241.

Submitted for the information of Government.

~~SUBMITTED.~~

Sidney Smith
Major R.E.
Consg. Engr. for Rys.

A
No. 512 R dy 14th April 90

Form No. 3.

P.W.C. No. 3444

From

THE CONSULTING ENGINEER,
FOR RAILWAYS,
MADRAS,

No. 241

Dated 5th April 1890
Received 9th April 1890

No. of Enclosures. 1

A
No. 512 R dy 14th April 1890

Subject.

Submitting note on inspection of the South Indian Railway and Nellore Branch of Villupuram Gudalur Railway, for the half year ending 31st December 1889.

Mch
12apr 90

The Agent's attention will be called to para 4 clauses 1 to 6, 8, 11, 13, 14, 18 to 22, 24, 27, 31, 32, 35, 36, 40 to 42; para 5 clause 5; para 8 clauses 3, 6, 8, 9 and 15 and para 10 clauses 11 and 12; and in the Nellore Branch Report to para 3 clauses 3, 4, 5 and 7; paras 5 and 6 clauses 1 and 2.-

2. He will also report on the remedies he proposes with regard to the defects noticed in the diversion at 130/14 and 57/10A mentioned in para 4 clauses 51 to 55; and give his opinion on the question raised in para 4 clause 58.-

Rucds
11.4.90 W
for R.

To

The Consulting Engineer for Rys.

O
D 11/4

9-4-90 R 11-4-90

Hm. 11.4.90 R 14.4.90.

withdrawn

3444.

Govt. of 18 Madras.

PUBLIC WORKS.

Dated

Read. Encl.

G.O., 14 April 1890 No. 512 R.

Report regarding inspection by the S. I Ry,

Passing orders on the — & Million Bridges of the V. & S. Ry for the half year ending 31st December 1889.