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MADRAS RECORD OFFICE

Government of Madras

Public Works DEPARTMENT

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No. 385. Read the following letter from Lieutenant-Colonel J. H. M. SHAW-STEWART, R.E., Consulting Engineer for Railways, to Colonel G. W. WALKER, R.E., Secretary to Government, Public Works Department, dated Madras, 10th December 1873, No. 663 :—

I HAVE the honour to submit, for the information of Government, a Report* by the Deputy Consulting Engineer upon the progress of work on the Southern

* Dated 5th December 1873.

Extension of the Great Southern of India Railway, which was inspected by Captain Thompson during the months of October and November.

2. Paragraphs 23 to 27 of the Report have been communicated to the President of the Local Fund Board, Madura; with a request that he will take into consideration Captain Thompson's recommendation, that the additional waterway required upon the public road should be provided, if possible, opposite to the girder bridge opening in the railway.

3. Certain paragraphs of the Report have also been communicated to the Agent of the Great Southern of India Railway for his consideration.

4. In paragraph 97, Captain Thompson again draws attention to the superior economy of erecting permanent lines of telegraph in the first instance. In my letter, dated the 27th ultimo, No. 637, I addressed the Government at length upon this subject; and I trust that His Excellency in Council will be able to support my recommendations.

5. In paragraph 98 and elsewhere in his Report, Captain Thompson alludes to the expected delay in the arrival of the rolling stock; and from the Agent's letter, No. 5,282, dated the 29th ultimo, which was laid before Government with my letter of the 2nd instant, No. 646, it seems probable that this delay will interfere with the opening of the extension. It is not easy to explain this satisfactorily. The Board, in their letter to the Agent, dated the 20th December 1872, mention that the indent for rolling stock was then in the hands of their Consulting Engineer, who had received instructions to prepare the necessary designs and specifications; and, in their letter, dated the 18th July 1873, the Board inform their Agent that these designs and specifications are in part prepared; so that their preparation seems to have occupied seven months. This delay is much to be regretted, to whatever cause it may be due.

6. In paragraph 103 of this Report, Captain Thompson again advocates the use of covered in preference to open goods wagons. In the papers printed with the Proceedings of Government, dated the 21st ultimo, No. 2,820, this question was discussed at some length. Upon the Great Southern of India Railway covered wagons have always been used much more largely than on the Madras Railway; and, in my opinion, the choice between the two descriptions of goods vehicles may safely be left to the Railway Authorities to be determined by the experience already gained.

Note on the Great Southern of India Railway Extension between Trichinopoly, Palamcottah, and Tuticorin, inspected in the months of October and November 1873.

1. I HAVE the honour to submit the following Report upon the progress of the works under construction along the extension of the Great Southern of India Railway from Trichinopoly to Palamcottah and Tuticorin.

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DISTRICT I.

Length 15 Miles and 5 Chains.

2. On my last inspection of this line of railway, viz., in March 1873, the two first miles of District I. had not been commenced. This portion of line has since been partially opened, up to the site of the proposed Trichinopoly Cantonment Station, and connected with the open line between Erode and Negapatam, near the "Commander-in-Chief's" platform, to admit of the permanent-way material now being sent up from Negapatam being conveyed to the material depôt near the Chief Engineer's Office.

3. *Earthworks.*—The earthwork of District I. is almost completed, and will be quite so before sufficient permanent-way material is available for it.

4. *Masonry.*—A bridge of five 30 feet girder spans over the Coryaur river near Trichinopoly, and another of four 20 feet girder openings at the 4th mile 20th chain, the only works of any considerable size in the district, are now ready for their girders, and the rest of the masonry is far advanced towards completion.

5. *Permanent-way.*—Permanent-way has been laid down (but the roadway not yet ballasted) from the stores depôt, near the Chief Engineer's Office, to the District Engineer's bungalow at Poganoor, a distance of about seven miles. There is nothing to hinder its being laid down up to the end of the district as material comes in and is available for it.

DISTRICT II.

Length 15 Miles and 21 Chains.

6. *Earthwork.*—The earthwork of this district is all but completed.

7. *Masonry.*—The only masonry work of any size remaining unfinished is a bridge of four 20 feet girder openings. The south abutment and three piers have been put in and a coffer-dam is being constructed for laying the foundations of the north abutment. The masonry of District II. will be practically completed by the end of the current year.

8. *Permanent-way.*—A good deal of permanent-way material has been forwarded by bullock bandies from Trichinopoly to Manaparay, a distance of about twenty-five miles. It is there stored on the station ground near the District Engineer's bungalow. A short portion of line has been laid near Manaparay. Another depôt for permanent-way material has been formed at Mullaadaputty in the 11th mile of the district, and about half a mile of the line has been laid down at that place.

DISTRICT III.

Length 15 Miles and 59 Chains.

9. *Earthwork.*—The earthwork of this district will be practically completed by the end of the current year.

10. *Masonry.*—The most important masonry works are—

A bridge of five 20 feet girder openings, of which the north abutment and four piers have been put in, and the foundation of the south abutment laid;

A bridge of one 70 feet girder span close to Culpatty, nearly completed; and,

A bridge of three 30 feet girder openings, the north abutment of which is finished and the foundations of the two piers and south abutment put in. Both earthwork and masonry are progressing rapidly.

DISTRICT IV.

Length 15 Miles and 13 Chains.

11. *Earthwork.*—There is but little to do to complete the earthwork of this district. A plentiful supply of good ballast is to be had in the first section. This is fortunate, as in the second section of the third district there is none to be had.

12. *Fencing.*—A good deal of aloe and euphorbia fencing has been planted. The aloe appears to have thriven best in places where there is a good deal of kunkur in the soil. Under such conditions it has grown rapidly; the leaves are thick and fleshy, and covered with that beautiful bluish bloom which always indicates the healthy growth of the aloe plant.

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13. The euphorbia seems to have thriven best in dry, well-drained situations, and to have simply rotted away in such places as were badly drained and always damp. The euphorbia will, I fear, prove as a rule to be a failure for fencing purposes.

14. *Masonry.*—There is but little masonry work to be carried out now in this district.

The largest work is a skew bridge of six 30 feet girder openings in the 8th mile. Considerable difficulty was experienced in getting some of the foundations in, owing to the extreme unevenness in the depths at which the hard substratum for founding upon was met with.

15. *Permanent-way.*—Permanent-way material is being collected at the Dindigul station-ground. It is forwarded from Trichinopoly in bullock bandies. About 25 chains of bank have been trimmed, and "bottom" ballast laid down from the Nuttun road which passes the Dindigul station to the first bridge south of it.

16. About 20 chains of permanent-way material has been distributed along this portion of line, but not yet linked in.

17. *Dindigul Station-ground.*—The aloe fencing round the Dindigul station-ground is thriving well. Several rows of trees have also been planted parallel to, and within the, aloe fencing, and appear to be doing well.

18. The station buildings (which are not yet commenced) will be on slightly sloping ground, well drained, and with a good supply of water close by.

19. The approach to the station ground from the Nuttun road for passengers will have a gradient of one in sixty, that for goods will be a little further to the eastward, and will be on a level.

DISTRICT V.

Length 15 Miles and 22 Chains.

20. *Earthwork.*—The earthwork in this district is practically completed. An abundance of good ballast is to be found in the first section, and at short intervals throughout the district. The line is at present being left to weather, but ballasting from the side ditches will be taken in hand as soon as the permanent-way material begins to come in in sufficient quantities to lay down.

21. *Masonry.*—The masonry of this district is well advanced; there is little to do now except finishing up copings, parapets, etc.

22. The most important work is a bridge of three 20 feet arches, which is nearly completed. It has been necessary to cart stone for bridge-work from Dindigul up to a distance of ten miles from that place, no suitable building material being procurable nearer. The stone brought from Dindigul is in fine large flat bedded pieces, working up into beautiful masonry.

23. *Water-way of public road opposite 15th mile of District V.*—In the 15th mile of District V. the Madura road runs parallel and close to the line of railway. The openings allowed for flood-water in the public road are insufficient to carry it off from the eastward; it is therefore, I understand, in contemplation by the Local Fund Authorities to construct an "Irish bridge" nearly opposite the 14th mile and 50th chain of the line, at the same time raising the level of the roadway at each side.

24. The effect of this would be to collect and discharge a large body of water perpendicularly against the foot of the railway embankment, at a distance of 25 or 30 yards from it.

25. Now, about 40 yards to the south of the spot at which, I understand, it is in contemplation to construct the "Irish bridge," the public road bridge is situated, consisting of a number of small rectangular openings. Immediately opposite to this public road bridge is situated the railway flood opening of the 12 feet girder spans, so designed and placed as to carry off direct all the water which passes through the public road bridge.

26. The public road being at present low and level, and the water-way of its bridge insufficient, the water during floods rises on the east side of the road and flows tolerably evenly and steadily over the roadway, without therefore endangering the railway embankment.

27. If any change or improvement is required in the public road it would seem to me to be a better arrangement to enlarge its bridge immediately opposite the railway opening, instead of

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raising the roadway and constructing an "Irish bridge" some distance from it, which, as I have already said, would have the effect during floods of shooting a considerable body of water perpendicularly against, and at a short distance from, the railway embankment.

DISTRICT VI.

Length 15 Miles.

28. *Earthwork.*—There is little remaining to be done in earthwork in this district.

29. *Masonry.*—The masonry is rather backward, owing to the contractors having failed, during the dry season, to lay in a sufficient supply of materials on the works they took in hand to admit of their being pushed on to completion, and to their now being unable to convey materials to the sites of the works owing to the greater part of the district being under wet cultivation.

30. More than half the masonry has however been completed, and as all the works are small, it is not anticipated that there will be any delay. The district will in all probability be completed both in masonry and earthwork sometime before there is any permanent-way material available for it.

31. The largest works in the district are a bridge of one 20 feet and two others of two 15 feet girder openings each. All the masonry work will probably be completed by the end of March 1874.

DISTRICT VII.

Length 12 Miles.

32. *Earthwork.*—The earthwork of District VII. is practically completed, there being little left to do now but to fill up at the gaps where bridges and culverts are being put in.

33. *Masonry.*—The masonry is well advanced and is rapidly approaching completion. The work of most importance is the Vigay bridge at Madura. The centre of this bridge is at the 5th mile and 13th chain (district mileage). It consists of fifteen girder openings of 70 feet clear span each, or 76 feet from centre to centre.

34. The south abutment is within one or two courses of its full height. Twelve of the piers next it have been founded, and each raised several courses above the river bed. The foundation of the 13th pier was being put in at the date of my inspection. The excavations for the north abutment and wing-walls, and the 14th or last pier, were almost completed.

35. The piers have been founded at an average depth of 10 feet below the lowest point in the river bed, in a whitish clay and kunkur conglomerate, which appears to be in a transition state. This stratum becomes gradually harder towards the north bank of the river Vigay, and is softer at the surface than a little deeper. Excavations have been carried down in every instance for the foundations of the piers until a hard and firm bed has been reached. The conglomerate at foundation level being always so hard as to cause the crow-bars and pick-axes used in excavating it to ring.

36. The stone used in the construction of the Vigay bridge is quarried by blasting at the Skanda Mullay rock, about 5 miles south of Madura, and has hitherto been brought to the site of the bridge in ordinary country bandies. As permanent-way has now been laid down from the bridge up to near the Skanda Mullay quarry, the stone will shortly be conveyed to the work on trolleys, and a considerable saving in carriage thus effected.

37. The stone is of excellent quality, and is quarried in large blocks; the courses of masonry on the piers and abutment range from 14 to 16 inches in thickness.

38. The stones are dressed in a cocoanut top on the south bank of the river, close to the bridge site, then lifted on a trolly, to be conveyed to the work on a temporary tramway which has been laid down across the bed of the Vigay just above the piers.

39. The stones are then lifted from the trolleys by means of crane composed of 21 feet permanent-way rails, and lowered down on the work on the beds prepared for them.

40. The same tramway leads chunam down from the south bank, and fuel for the pumping engines from the north bank.

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41. The excavations for the piers foundations have been kept clear of water by a Gwynn's centrifugal pump, which discharges on an average about 600 gallons of water per minute. One engine of this capacity has usually been found equal to the work of keeping the excavations for two piers clear of water at the same time, thus admitting of the two foundations being laid simultaneously; the two excavations were connected by a channel and the pump worked in a small well at the downstream side of one of the excavations, the well being sunk a little lower than the bed for the first course of masonry in the foundations so as to keep it dry when being laid.

42. Hydraulic cement has been used throughout up to two or three courses above the river bed.

43. The upper bed of the river is sand to a depth of four or five feet, then comes the whitish clay and kunkur conglomerate.

44. Simple and efficient coffer-dams were put down for the foundations of the piers. Piles were driven in at each corner of the space to be excavated, and two or three more piles at intervals along the sides and ends. Stout planks were then bolted horizontally to the backs of these piles, and behind these horizontal planks were put down vertically the narrow gauges permanent-way, half-round, creosoted pine sleepers; the flat sides of the sleepers being next the horizontal planks. A couple of transverse struts between the longer sides of the coffer-dam completed it.

45. The masonry throughout this work could scarcely be better than it is. From the bottom courses of the foundations upwards the stones are large and flat bedded, accurately fitted and carefully laid.

46. At the 11th mile of this district, not far from the Skanda Mullay quarry, the line runs into heavy bank of 22 feet in height. It has been necessary unfortunately to construct several bridges of small span in this bank. Owing to its height the slopes are correspondingly broad and the wing-walls of the bridges consequently contain an enormous amount of masonry. In one small arched bridge of only one 10 feet span there are as many as 500 cubic yards of masonry. Stone has fortunately been found quite close to these works, and a little tramway has been laid down on which it is easily and cheaply carried.

47. *Permanent-way.*—Platelaying has been in progress for some time past at Madura, and the permanent-way material, as it arrives from Trichinopoly in bullock-bandies, is being gradually pushed out on trolleys from the station yard and laid southwards. About five miles have been put down, but the roadway not yet ballasted. One hundred and forty yards of permanent-way are being laid steadily per diem.

DISTRICT VIII.

Length 14 Miles and 77 Chains.

48. *Earthwork.*—The earthwork of this district may now be regarded as almost completed. A little still remains to be done where bridges are now being constructed.

49. *Masonry.*—The masonry is also well advanced.

The largest works are a bridge of seven 30 feet girder spans over the Goondaur river, and another of six 30 feet girder spans over the Shevaracootay stream.

The Goondaur bridge is completed with the exception of one or two courses which have yet to be put on the piers.

50. At the Shevaracootay stream the south abutment of the bridge is completed, and four piers have been put in but not raised to their full height yet. The foundation for the 5th pier is not yet in, but piling for a coffer-dam round it is in progress. The north abutment has not been commenced.

51. The masonry works in low-lying paddy land in this district will be stopped during the rains, and the masons sent to complete other works in higher and dryer situations.

52. Nearly all the masonry works in the 7th and 8th districts will be completed by the end of January next, except the Vigay and Shevaracootay bridges.

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53. *Shevaracootay Station-ground.*—A piece of ground of 20 acres in extent has been taken up for the Shevaracootay station-ground, but as it is not proposed to erect a station there for some time to come, it is a pity to see meanwhile the ground lying idle, and lapsing into scrub jungle. The land is good and would, I have no doubt, be gladly rented and cultivated by some of the villagers in the vicinity until required for station purposes.

DISTRICT IX.

Length 14 miles and 69 Chains.

54. *Earthwork.*—With the exception of a few chains, the earthwork in this district is completed.

55. *Masonry.*—All the small bridges and culverts are completed, with the exception of copings, girder bed stones, etc.

The largest work in the district is a bridge of nine 30 feet girder spans over a tributary of the Vipar near Virduputty. The foundations of the two abutments and all the piers are in, the latter being raised several courses above river-bed level. The foundations are on hard morum at an average depth of 10 feet below the river bed.

56. A bridge at the 13th mile and 73rd chain of four 20 feet girder spans over the Kalangapoomany river is also nearly completed. The foundations are on rock at an average depth of about 5 feet below the river bed.

57. Another bridge of three 20 feet girder spans, at the 14th mile 1st chain, has also been founded on rock at an average depth of about 6 feet.

58. *Probably insufficient water-way at 8th Mile, 32nd Chain.*—At the 8th mile, 32nd chain, of this district there is an arched bridge of one 20 feet opening, to pass flood-water from the westward.

The public road runs parallel to, and at a few chains distance from, the line, and is provided with a number of long "Irish bridges," capable of discharging any amount of water.

59. If the provision made for passing flood-water over the public road by means of these "Irish bridges" has not been over-estimated, then a single 20 feet arch in the railway embankment will, I fear, be found insufficient.

60. If a heavy flood comes and the railway bridge and embankment stand all right, the public road will I have no doubt be submerged, as it appears to be considerably lower than the railway.

DISTRICT X.

Length 14 miles and 67 Chains.

61. *Earthwork.*—The earthwork of this district has not been very heavy, and is now almost completed.

62. An enormous amount of ballast will, I fear, be swallowed up as usual before the road in this district becomes permanently good, as it is formed almost entirely of black cotton soil.

63. *Masonry.*—The bridge-work in this district is very heavy, and from the nature of the soil (very deep black cotton) the foundations have all been troublesome and costly.

64. At the 2nd mile and 23rd chain the Gunnechary river, one of the chief tributaries of the Vipar, is crossed on a bridge of five 70 feet girder openings. Excavations are being made for the foundations of the north abutment and the pier next it (No. 1). Pier No. 4 has been raised up to plinth level.

The south abutment has been founded. Hard firm foundations are being met with at an average depth of 10 feet below the river bed in hard kunkur.

65. At the 6th mile and 34th chain there is a bridge of five 50 feet girder spans. All the foundations are in. Pier Nos. 1, 2, 3, and 4 and the south abutment are up to within two feet of girder bed level. The average depth of the foundations is 13 feet on hard morum and rock.

66. The river Vipar, at the 8th mile and 30th chain, will be crossed at Satoor on a bridge of twelve 70 feet spans. The south abutment and three piers next it have been put in, and are within 10 feet of girder bed level.

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The foundations of the piers are on an average 14 feet below the river bed, and the south abutment about 21 feet in hard morum.

67. At the 8th mile and 64th chain a stream is crossed on a bridge of one 70 feet girder opening. The south abutment is founded and raised to within a feet of girder bed stone level. The foundation of the north abutment is also in, and raised 3 feet above the footings. The foundations are between 13 and 14 feet in depth on hard morum.

68. At the 9th mile and 12th chain a masonry arched bridge has been founded on hard morum at a depth of 13 feet in black cotton soil. This bridge is up to springing level.

69. At the 11th mile and 67th chain there is a bridge of two 20 feet girders. The south abutment and pier are up to girder bed level. The foundations are nearly 20 feet deep in black cotton soil. The north abutment has not yet been put in.

70. Another bridge of three 20 feet spans (girder) is also approaching completion at the 12th mile and 35th chain. Two footings of the north abutment foundation have been put in. The piers are up to girder bed stone level, and the north abutment is within 8 feet of being the same height.

71. With the exception of the Satoor bridge all the masonry in this district will probably be completed by the end of February 1874. The Satoor bridge will probably be completed by June 1874.

72. *Permanent-way.*—Permanent-way has been laid down, but the joints not yet fished from the 9th mile and 44th chain to the 12th mile and 25th chain. This portion of permanent-way will be found useful in conveying stone for the Satoor bridge from the quarry at the 11th mile and 50th chain, where excellent stone is being procured by "burning."

DISTRICT XI.

Length 16 Miles and 29 Chains.

73. *Earthwork.*—The earthwork of this district is almost all done. It will probably be completed by the end of this year.

74. *Masonry.*—The masonry is all but completed. There are no large bridges in the district, one of three 30 feet openings (girder) being the largest.

DISTRICT XII.

Length 17 Miles and 60 Chains.

75. *Earthwork.*—The earthwork of this district is practically completed. Nothing remains to be done except some trimming, turfing, etc.

76. *Masonry.*—The masonry is completed.

DISTRICT XIII.

Length 16 Miles and 30 Chains.

77. *Earthwork.*—The earthwork of this district is well advanced, and will in all probability be completed before the end of February 1874.

78. For several miles before entering Tuticorin the line in this district passes over a very fine light, sandy soil, which drifts greatly in the strong winds which prevail at certain seasons of the year in the Tinnevely District. A considerable amount of the embankment close to Tuticorin had been blown away prior to my last inspection of the line (viz., in March 1873). This embankment has all been made up again, and the slopes are being planted with the saddle-shape leaved creeping convolvulus usually found in this country in sandy districts bordering on the sea. A coarse grass somewhat like nanul, with binding roots, and a little plant resembling a vetch, but more bushy, wiry, and with underspreading roots, are also being planted on the slopes.

As all these plants are indigenous to the locality, they will, I think, thrive well enough, and preserve the slopes of the embankment from being blown away or furrowed by rain.

The ballast on the top of the embankment will effectually secure it from being cut up or blown away.

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9. *Masonry.*—The masonry of this district will probably be completed by the end of February next. Owing to the scarcity of stone and length of lead (about eight miles from the quarry over bad tracks), the masonry is dear, ranging from 10 to 14 Rupees per cubic yard.

80. At the 4th mile and 3rd chain a bridge of one 20 feet girder opening is being constructed. One abutment has been put in and the other is being founded on hard rock.

81. At the 3rd mile and 67th chain a bridge of four 50 feet girder spans is being constructed over the Showramungalun nullah. The foundations are on a species of hard conglomerate.

82. The stone used in construction has a very pretty variegated appearance, especially when wet. The courses are about 14 inches in thickness, very neatly cut and laid.

83. The soil in this part of the district is black cotton; and for some distance north of Showramungalum bridge it has been found necessary to construct groynes or short bunds, at right-angles to, and springing from, the embankment, at intervals of two chains, to arrest and divert the rush of water along the east side of the line, caused during floods by "spill" from the Kurtapillaynuttam nullah, about 1½ miles to the north. It has also been found necessary to raise the gradients slightly on each side of the Showramungalum bridge.

84. At 2 miles and 46 chains a bridge of three 70 feet girder spans on the skew is being constructed, over the Kurtapillaynuttam river. It has been founded on a bed of granite, through an upper stratum of kunkur a few inches only in thickness.

The material used in construction is a fine hard stone, built in 12 inch courses, making very pretty work. This river joins the Showramungalum stream a little to the west of the line.

85. Close to Tuticorin a bridge of one 30 feet girder opening is being constructed on two large square wells. A well on each side of the nullah, carrying an abutment with its wing-walls. The wells are of masonry (not brick-work) built on kerbs with cutting edges. They will be sunk 20 feet below the bed of the nullah, and then filled with concrete. They were being sunk very satisfactorily when I saw them, although one would be disposed to imagine that square wells of such dimensions could not be sunk to any depth without an even settlement and consequent cracking.

86. The foundations of the compound wall of the Tuticorin station are in, and one-half of the necessary road diversions has been carried out.

87. *Flood gauge, self-registering.*—An ingenious, simple, and efficient self-registering gauge has been adopted by the Resident Engineer of District XIII. for determining the highest flood levels, where streams cross the line in various places. It consists of a piece of bamboo of sufficient length, the internal diaphragms at the joints of which have been bored out. The bamboo is then well coated inside with a mixture of indigo or other colouring matter and congee. A number of holes about one-fourth inch in diameter are bored in the sides of the bamboo, and it is then firmly planted vertically in a convenient position in the bed of the stream to be gauged. A wooden cover is fitted on the top of the bamboo to keep out the rain, and to this wooden cover is attached a rod covered with white paper; this rod is inserted in the bamboo.

When floods come down the river, the water enters the bamboo through the small holes bored in its sides, melts the coating of colouring matter inside the bamboo, and stains the rod covered with white paper up to the level to which the flood rises.

88. *Permanent-way.*—About a mile of permanent-way has been laid from the beach at Tuticorin up through the station yard. The permanent-way material, girders, etc., are thus being conveyed on trolleys from where boats from the ships discharge cargo to the material dépôt, in the station yard.

89. About five miles of permanent-way have been landed from the *Lincelles*, and of these five miles four have been sent up to the Engineer in charge of District X., and one mile has been retained for XIII. or Tuticorin District. The *York* had just arrived, and was discharging more permanent-way and girders, points, crossings, switches, etc. No girders have been received yet of more than 20 feet span.

DISTRICT XIV.

Length 15 Miles and 57 Chains.

90. *Earthwork.*—The earthwork of this district is completed except in the station grounds.

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91. *Masonry.*—The masonry has progressed very well since my last inspection, in March of the current year. It will, I should think, be completed early in 1874. The estimated quantity of masonry for this district is larger than for any of the others, being more than 8,400 cubic yards.

92. The bridge over the Chittaur river at the 5th mile and 10th chain is the most important work in it. It consists of ten 70 feet girder spans. Excavations were in progress for the north abutment, and Pier No. 1 next it had been raised to plinth level. Piers Nos. 2, 3, 4 and 5 are up to girder bed level. Piling for a coffer-dam for the foundation of Pier No. 6 has been put in. Piers Nos. 7 and 8 have not yet been commenced; the foundations for Pier No. 9 was being put in, and the excavation for the foundation of the south abutment nearly completed.

93. The foundations of the Chittaur bridge average about 14 feet below the level of the river bed, and rest partly on a species of white conglomerate and partly on granite or gneiss.

Pier No. 1 is founded on granite.

Pier No. 2 on granite at one cut water, and on the white conglomerate at the other.

Piers Nos. 3, 4, 5, and 9 are all founded on the white conglomerate.

General Remarks.

94. *Fencing.*—Not much has been done yet in planting fences along the line, but this work is now being taken in hand. In some places the aloe promises to thrive well, and in others the euphorbia; but, in my opinion, the latter will be found a slow-growing and generally unsatisfactory fence, even under the best conditions.

95. *Turfing.*—A good deal of turfing has been done where turf has been procurable. In black cotton soil, where there is no turf to be found, a small fleshy-leaved aloe, with reddish orange flowers on a tall stem, has been planted on the slopes of embankments.

96. In most instances these aloes have thriven well, and will form a good protection to the banks. They have a long tap root, but very few spreading ones, so they require to be *thickly planted* and *not in regular lines*, else rain water running off the tops of cotton soil embankments furrows up the slopes *between the lines of plants*. I noticed this particularly in District XII., in parts of which the aloe plants have been put in in regular lines, and the rain-water, after collecting on the tops of the embankment had coursed down, deeply furrowing the slopes.

A few plants put in at irregular intervals between these lines would have had the effect of diverting the little streams of rain water and depriving them of their furrowing power.

97. *Temporary Telegraph.*—As I have already pointed out on a former occasion, (*vide* my Report on the Great Southern of India open line, dated 26th June 1873, published with G. O. No. 1,849, of July 19th 1873,) the temporary telegraph line along the Southern Extension has been found troublesome and costly to maintain. There have been frequent interruptions in communication owing to the bamboo or palmyra rafter standards giving way, being either blown down, eaten away below the ground level by white-ants, or more commonly having rotted just at the ground surface level from the constant alternations of dryness and damp. I would therefore again beg to draw attention to the economy of at once laying down in future the permanent lines of telegraph as soon as the lines of rail along which they are to be laid have been definitely located.

98. *Station Buildings.*—None of the station buildings have yet been commenced; but as most of them are small, and the amount of masonry inconsiderable, there is every probability of their being all completed by the time the permanent-way has been laid, almost a certainty, I fear, of their being finished sometime before the line is opened for traffic, unless engines and rolling stock are received from home at an earlier date than is at present anticipated.

99. The wood-work of the station buildings is being prepared at the workshops at Trichinopoly, so that there will not be any delay on that account when their construction has been commenced.

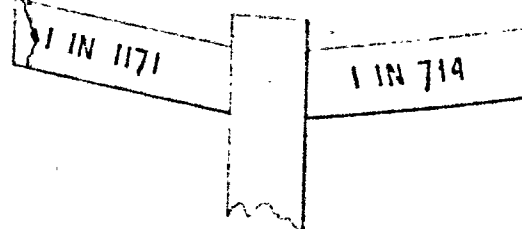
100. If girders, permanent-way material, rolling stock, etc., were available now, there would be nothing, so far as I can see, to prevent the line being opened throughout its entire length by July or August 1874.

101. *Gradient Boards.*—When inspecting the open line of the Great Southern of India Railway on the 22nd ultimo between Trichinopoly and Negapatam, where the gradients are very light, and the figures on the gradient boards correspondingly high, it struck me that time,

Proceedings of the Madras Government, Public Works Department,
28th January 1874.

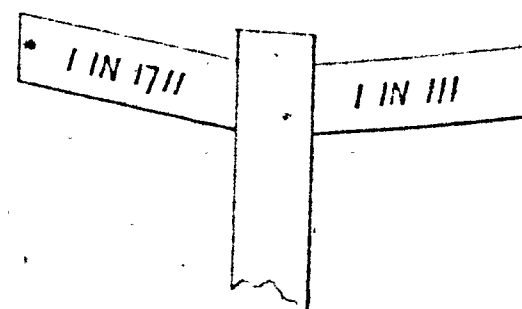
money, and material might be economized and additional clearness gained by merely putting on the gradient boards the number of feet in which there is a unit of rise or fall.

102. The gradient boards on the open line are figured thus:—

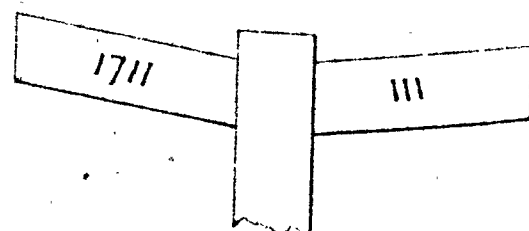


When there is neither rise nor fall the gradient board is horizontal, and "LEVEL" is painted on it.

The position of the board, or the angle at which it is placed with reference to the horizon, sufficiently indicating the direction in which the ground rises or falls, the figure and word "1 IN" appear to be superfluous, and clearness would be gained by dispensing with them thus—



is not so clear as



103. *Covered Wagons for Goods.*—I have in paragraph 77 of this Report already referred to the high winds which prevail in the Tinnevely District during certain seasons of the year; and in my last Report on the North-West Line of the Madras Railway, dated the 11th of October 1873, I have drawn attention to the danger attending the high piling of light goods on open wagons during high winds. As the only cotton screws or presses in the Tinnevely District that I am aware of are at Tuticorin, and as there will undoubtedly be a large cotton traffic on the southern portion of this line, I would again beg to draw attention to the advantages of having a stock of "covered goods" in preference to "open goods" wagons for unpressed cotton, and goods of a class liable to injury from exposure to weather. There is an important traffic in piece goods between Tuticorin and Madura. With defective tarpaulins goods of this class are liable to a good deal of damage which must be considered preventible if "covered goods" wagons can I believe with so much mutual advantage to the Railway Company and the owner of the good be substituted for open goods wagons with tarpaulins.

MADRAS,

5th December 1873.

(Signed) R. THOMPSON, Captain, R.E.,
Offg. Dy. Consgr. Engr. for Railways.

Proceedings of the Madras Government, Public Works Department,
28th January 1874.

No. 386.

ORDER THEREON, 28th January 1874, No. 195.

RAILWAY, No. 53.

THE reports above recorded are the results of an inspection of the Great Southern of India Railway Extension

between Trichinopoly, Palamcottah, and Tuticorin during October and November 1873. Such points as call for special remark will be noticed below.

2. In paragraphs 23 to 27 of his Report Captain Ross Thompson points out that the arrangements proposed to be made by the Madura Local Fund Authorities for the disposal of flood waters opposite the 15th Mile of District V. will endanger the railway embankment. The subject, it is observed, has been remitted by the Consulting Engineer for the consideration of the Local Fund Board.

3. It is presumed that paragraphs 53 and 58 to 60 of the Report have already been communicated to the Railway Authorities; if not, attention should now be called to the questions treated of.

4. The erection of permanent lines of telegraph, advocated by the Officiating Deputy Consulting Engineer in paragraph 97, was urged on the consideration of the Government of India in letter No. 1,850, dated 19th July 1873; and in the letter submitting the correspondence which accompanied the Consulting Engineer's No. 637, dated 27th November, the question is again prominently noticed.

5. The anticipated delay in opening the Extension for traffic has formed the subject of recent orders in connection with the Regular and Budget Estimates of the line. It appears from paragraph 100 of the Deputy Consulting Engineer's Report that if all the girders, permanent-way materials, and rolling stock, etc., were available now there would be nothing to prevent the line being opened throughout its entire length by July or August 1874. The circumstances will be brought to the notice of the Home Authorities.

6. In paragraph 103 of his Report Captain Ross Thompson reverts to the question of the superiority of covered goods wagons under certain conditions. The prevalence of high winds in the Tinnevely District, the large amount of traffic expected in cotton and piece goods, and, it may be added, the narrow gauge which makes high piling on open wagons more objectionable than on the broad gauge, are weighty reasons in favour of a reserve stock of covered goods wagons on the Southern Extension. The attention of the Railway Authorities should be specially drawn to the subject.

(True Extract.)

Colonel, R.E.,

Secretary to Government.

To the Consulting Engineer for Railways.

Exd. S. T. Austin.

Sapre Copies.

Railway Department. CONSULTING ENGINEER'S OFFICE.

No. 663

From

LIEUT. COLONEL J. H. M. SHAW STEWART, R.E.,

Consulting Engineer for Railways,

To

COLONEL G. W. WALKER, R.E.,

Secretary to Government,

Public Works Department,

Fort Saint George.

SIR,

Dated
5 Dec. 1873

I have the honour to submit, for the information of Government, a report by the Deputy Consulting Engineer upon the progress of work on the Southern extension of the Great Southern of India Railway, which was inspected by Captain Thompson during the months of October and November.

Paragraphs

2. Paragraphs 23 to 27 of the report have been communicated to the President of the Local Fund Board, Madras, with a request that he will take into consideration Captain Thompson's recommendation that the additional waterway required upon the public road should be provided, if possible opposite to the girder bridge opening in the railway.

3. Certain paragraphs of the report have also been communicated to the Agent of the Great Southern of India Railway for his consideration.

In

4. In paragraph 94 Captain Thompson again draws attention to the superior economy of erecting permanent lines of telegraph in the first instance. In my letter dated the 24th ultimo, No 637, I addressed the Government at length upon this subject, and I trust that His Excellency in Council will be able to support my recommendations.

5. In paragraph 98, and elsewhere in his report, Captain Thompson alludes to the expected delay in the arrival of the rolling stock, and from the Agent's letter.

No.

No 5282 dated the 29th ultimo, which
was laid before Government with
my letter of the 2nd instant, No 646,
it seems probable that this delay
will interfere with the opening
of the extension. It is not easy to
explain this satisfactorily. The
Board, in their letter to the Agent
dated the 20th December 1872, mention
that the indent for rolling stock
was then in the hands of their
Consulting Engineer, who had
received instructions to prepare the
necessary designs and specifications,
and, in their letter dated the 18th
July 1873, the Board inform their
agent

agent that these designs and
specifications are in part prepared; so
that their preparation seems to have
occupied seven months. This delay
is much to be regretted, to whatever
cause it may be due.

6. In paragraph 103 of
this report, Captain Thompson again
advocates the use of covered in
preference to open goods wagons.
In the papers printed with the
Proceedings of Government dated
the 21st ultimo, No 2820, this
question was discussed at some
length. Upon the Great
Southern of India Railway
covered

covered wagons have always been used much more largely than in the Madras Railway; and in my opinion the choice between the two descriptions of goods vehicles may safely be left to the Railway Authorities to be determined by the experience already gained.

I have the honour to be

Sir

Your most obedt. servant
 Matthew L. P. R. E.
 Comm. Engineer for Railways

Madras
 15 Decr 1873
 End Bond

Submitting for
 the information of
 the Government a report
 by the Dy. Comm. Engrs.
 upon the progress of
 works on the Southern
 Extension of the
 Great Southern
 Indian Railway.
 15/12/73 - 20/12/73

21/12/73
 No. 6693.

Dated 11 Decr 1873.
 Recd. 11

To
 The Secretary to Government,
 P. W. Department,
 Fort Saint George.

From
 The Consulting Engineer
 for Railways,
 1873.

Per 1873 Decr 11
 M. L. P. R. E.
 RAILWAY DEPARTMENT.

Note on the Great-Southern of India Railway Extension, between Trichinopoly, Palamcottah and Tuticorin, inspected in the months of October and November 1873.

1. I have the honour to submit the following report upon the progress of the works under construction along the Extension of the Great-Southern of India Railway from Trichinopoly to Palamcottah and Tuticorin.

District I.
 Length 15 miles and 5 Chains

2. On my last inspection of this line of railway, viz in March 1873, the two first-miles of District I had not been commenced. This portion of line has since been partially opened, up to the Sd of the proposed Trichinopoly Cantonment Station, and connected with the open line between Erode and Tirupattur, near the Command

in Chufs" platform, to admit
of the permanent way material
now being sent-up from
Mangalore being conveyed to
the material depot near the
Chief Engineer's Office

The Earth-work of District-I is
almost completed, and will
be quite so, before sufficient
permanent-way material
is available for it.

A bridge of five 30ft-girders
spans over the Concan river
near Trichinopoly, and another
of four 20ft-girders openings
at the 4th mile 20th Chain,
the only works of any considerable
size in the District, are now
ready for their girders, and
the rest of the masonry is far
advanced towards completion

Permanent-way has been laid
down (but the roadway not yet
ballasted) from the stores depot
near the Chief Engineer's Office
to the District-Engineer's bungalow
at Paganoor, a distance of
about 7 miles. There is nothing
to hinder its being laid down
up to the end of the District as
material comes in, and is

available for it.

District-II

Length-15 miles and 21 Chains

Earth-work. 6. The Earth-work of this District
is all but completed.

Masonry 7. The only masonry work of
any size remaining un-
finished, is a bridge of four
20ft-girders openings. The
South Abutment and three
piers have been put in
and a Cofferdam is being
constructed for laying the
foundations of the North
Abutment. The masonry of
District-II will be practically
completed by the end of the
current-year

Permanent-Way 8. A good deal of permanent-
way material has been
forwarded by bullock bands
from Trichinopoly to
Mangalore, a distance
of about 25 miles. It is
there stored on the station
ground near the District-
Engineer's bungalow. A
short-posting of line has been

Laid near Manapara
Another depot for permanent-
way material has been formed
at Mullayadaipatty in the
11th mile of the district, and
about half a mile of the line
has been laid down at
that place.

District III

Length - 15 miles and 59 chains

9. Earthwork
The Earthwork of this district
will be practically completed
by the end of the current year.

10. Masonry
The most important masonry
works are

A bridge of five 20ft. girder
openings, of which the North-
aboutment and four piers
have been put in, and the
foundation of the South-
aboutment laid;—

A bridge of one 40ft. girder span
close to Culputty, nearly
completed;— and —

A bridge of three 30ft. girder
openings, the North aboutment
of which is finished and

and the foundations of the
two piers and South aboutment
put in. Both Earthwork
and masonry are progressing
rapidly.

District IV

Length - 15 miles and 13 chains

Earthwork
11.

There is but little to do to
complete the Earthwork of
this district. A plentiful
supply of good ballast is
to be had in the first section.
This is fortunate, as in the
second section of the III
district there is none to be
had.

Fencing
12.

A good deal of Aloe and
Euphorbia fencing has been
planted. The Aloe appears
to have thriven best in places
where there is a good deal
of humus in the soil. Under
such conditions it has grown
rapidly, the leaves are thick
and fleshy and covered
with that beautiful bluish
bloom, which always

indicates the healthy growth
of the above plant.

The Euphorbia seems to have 13.
thrive best in dry, well
drained situations, and to
have simply rotted away
in such places as were
badly drained and always
damp. The Euphorbia
will, I fear, prove as a rule
wholly a failure for fencing
purposes.

There is but little masonry 14.
work to be carried out now
in this district.

The largest work is a skew
bridge of 8 ft. 3 in. span
opening in the 8th mile.
Considerable difficulty was
experienced in getting some
of the foundations in, owing
to the extreme unevenness
in the depths at which
the hard substratum for
founding upon was met
with.

Permanent Way 15.

Permanent-way material
is being collected at the
Dindigul Station Ground.
It is forwarded from
Tritchinopoly in bullock
buries. About 25-
chains of bank have been
trimmed, and "bottom" ballast
laid down from the Mullam
road which joins the
Dindigul Station to the
first bridge south of it.

16. About 20 chains of permanent-
way material has been
distributed along this
portion of line, but not yet
linked in.

Dindigul
Station Grounds 17.

The above fencing round
the Dindigul Station Ground
is now well. Several
rows of trees have also
been planted parallel to
and within the above fencing,
and appear to be doing well.

18. The Station buildings, (which
are not yet commenced)
will be on slightly sloping

Ground, well drained and
with a good supply of
water close by.

The Approach to the Station 19.
Ground from the Mullum
Road for passengers
will have a gradient of
one in sixty, that for goods
will be a little further to
the Eastward and will be
on a level.

District V

Length 15 miles and 22 chains

The Earthwork in this District
is practically completed. 20.

An abundance of good
ballast is to be found in
the front section, and at
8 short intervals throughout
the District. The line

is at present being left
to weather, but ballasting
from the side ditches will
be taken in hand as soon

21 Masonry

Soon as the permanent
way material begins to
come in in sufficient quantities
to lay down.

The masonry of this district
is well advanced, there
is little to do now except
finishing up copings,
parapets, &c.

22.

The most important work
is a bridge of three 20 ft arches
which is nearly completed.
It has been necessary to
cart stone for bridge work
from Dundigul up to a
distance of ten miles from
that place; no suitable
building material being
procurable nearer.

The stone brought from
Dundigul is in fine large
flat-bedded pieces, working
up into beautiful masonry.

23. Waterway of Public Road of front 15- mile of District V

In the 15-mile of District V
the Madura Road runs
parallel, and close to
the line of railway.

The openings allowed for flood water in the public road are insufficient to carry it off from the Eastward, it is

Therefore I understand in contemplation by the Local Fund Authorities, to construct an "Irish bridge" nearly opposite the 14th mile, and 60th chain of the line, at the same time raising the level of the roadway at each side.

The effect of this would be to collect and discharge a large body of water perpendicularly against the foot of the railway embankment, at a distance of 25 or 30 yards from it.

Now, about 40 yards to the south of the spot at which I understand it is in contemplation to construct the "Irish bridge", the public road bridge is situated, consisting of a number

of small rectangular openings. Immediately opposite to this public road bridge is situated the railway flood opening of the 12 ft girder spans so designed and placed as to carry off direct all the water which passes through the public road bridge.

26. The public road being at present low and level, and the waterway of its bridge insufficient, the water during floods rises on the East side of the road and flows tolerably evenly and steadily over the roadway, without endangering the railway embankment.

27. If any change or improvement is required in the public road it would seem to me to be a better arrangement to enlarge its bridge immediately opposite the

The Railway opening, instead
of raising the roadway and
constructing an "Irish bridge".
Some distance from it,
which as I have already
said would have the
effect during floods of
shooting a considerable
body of water perpendicular,
against and at a short
distance from the Railway
embankment.

District VI

Length - 15 miles O. & C. line

There is little remaining
to be done in Earth-work in
this district.

Earth-work
28.

The Masonry is rather
backward, owing to the
Contractor having failed
during the dry season to
lay in a sufficient supply

Masonry
29

Supply of materials on
the works. They took in
hand to admit of their
being pushed on to completion,
and to their now being
unable to convey materials
to the sites of the works
owing to the greater part
of the district being under
cultivation.

30. More than half the Masonry
has however been completed,
and as all the works
are small, it is not
anticipated that there
will be any delay. The
district will in all
probability be completed
both in Masonry and
Earth-work some time
before there is any
permanent way material
available for it.

31. The Carriage-works in the
district are, a bridge
of one 20ft and ^{two} others
of two 15ft girder openings.

Each. All the masonry work will probably be completed by the end of March 1874.

District VII

Length - 12 miles. 0 chains.

The masonry work of District VII is practically completed, there being little left to do now but to fill up at the gaps where bridges and culverts are being put in. Masonry 32.

The masonry is well advanced and is rapidly approaching completion. The work of great importance is the Vijay bridge at Madurai. The center of this bridge is at the 6th mile and 13th chain (district mileage). It consists of 15 girders opening of 70 feet clear span each, or 76 feet from center to center. Masonry 33.

34 The South-abutment is within one or two courses of its full height. The piers next it have been founded, and each raised several courses above the river bed. The foundation of the 13th pier was being put in at the date of my inspection. The excavations for the North-abutment and wing walls, and the 14th or last pier, were almost completed. 179

35. The piers have been founded at an average depth of 10 feet below the lowest point in the river bed, in a whitish clay and tuffaceous conglomerate, which appears blue in a transition state. This stratum becomes gradually harder ~~at~~ towards the North-bank of the river.

Tigay, and is softer at the surface than a little deeper. Excavations have been carried down in every instance for the foundations of the piers until a hard and firm bed has been reached.

The conglomerate at foundation level being always so hard as to cause the crow-bars and pick axes used in excavating to break.

The stone used in the construction of the Tigay bridge is quarried by blasting at the Skanda Mullay rock, about 5 miles south of Madras, and has hitherto been brought to the site of the bridge in ordinary country bandies. As permanent way has now been laid down from the bridge up to near the

The Skanda Mullay quarry, the stone will shortly be conveyed to the work on rollers, and a considerable saving in cartage thus effected.

37. The stone is of excellent quality, and is quarried in large blocks: the courses of masonry in the piers and abutment range from 14 to 16 inches in thickness.

38. The stones are dressed in a coconut-lopse on the south bank of the river, close to the bridge site; then lifted on a bolly, to be conveyed to the work on a temporary tramway which has been laid down across the bed of the Tigay just above the piers.

The stones are

Then lifted from the brolies
by means of Crane composed
of 21 ft. permanent way rails,
and covered down on the
work on the beds prepared
for them.

The same tramway leads
Chumam down from the
South bank, and fuel for
the pumping engines from
the mill bank.

The excavations for the piers 40.
foundations have been kept
clear of water by a Gwynne's
Centrifugal pump, which
discharges on an area of
about 600 gallons of water
per minute. The engine
of this capacity has
usually been found equal
to the work of keeping the
excavations for two piers
clear of water at the same
time, this admitting of

13
The two foundations being
laid simultaneously, the
two excavations were
connected by a channel
and the pump worked in
a small cell at the
down stream side of one
of the excavations. The
well being sunk a little
lower than the bed for
the first course of masonry
in the foundations, so
as to keep it dry when
being laid.

42. Hydraulic Cement has been
used throughout, up to
two or three courses above
the river bed.

43. The upper bed of the river
is sand to a depth of
four or five feet, then
comes the whitish clay
and Kunker Conglomerate.

44. Simple and efficient Coffin
dams were put down
for the foundations of the

piers. Piles were driven
in at each corner of the
space to be excavated, and
two or three more piles
at intervals along the
sides and ends. Stout
planks were then bolted
horizontally to the backs
of these piles; and behind
these horizontal planks
were put down vertically
the narrow gauge permanent-
way, half round, creosoted
pine sleepers; the flat-
sides of the sleepers being
next the horizontal planks.
A couple of transverse struts
between the longer sides of
the eff. dam completed
it.

The masonry throughout - this 45.
work could scarcely be better
than it is. From the bottom
courses of the foundations
upwards, the stones are large

large and flat-bedded,
accurately fitted and
carefully laid

46. - At the 11th mile of this
district, not far from the
Skanda Mullay quarry,
the line runs into heavy bank
of 22 feet in height.
It has been necessary
unfortunately to construct
several bridges of small
span in this bank, owing
to the height of the slopes
are correspondingly broad
and the wing walls of the
bridges consequently contain
an enormous amount of
masonry. In one small
arched bridge of only 10 feet
span there are as many
as 500 cubic yards of
masonry. Stone has
fortunately been found
quite close to these works,
and a little transway
has been laid down on

Which is easily and
cheaply carried.

Plank laying has been in
progress for some time past
at Madurai; and the
Permanent way material,
as it arrives from Trichinopoly
in bullock loads, is being
gradually pushed out on
rollers from the Station yard
and laid Southwards.

About 5 miles has been
put down, but the roadway
not yet ballasted.

One hundred and forty yards
of permanent-way are being
laid steadily per diem.

District VIII

Length - 14 miles and 7/8 chains 48

The earth work of this district
may now be regarded as
almost completed. A little

Earthwork

Masonry.
49.

Still remains to be done
where bridges are now
being constructed.

The masonry is also well
advanced.

The largest works are a
bridge of seven 30 ft girders
spans over the Gondaar
River; and another of
six 30 ft ^{girders} spans over the
Shevaracottay Stream.

The Gondaar bridge
is completed, with the
exception of one or two
courses which have yet
to be put on the piers.

At the Shevaracottay
Stream, the South-abutment
of the bridge is completed,
and four piers have been
put in, but not raised
to their full height yet.
The foundation for the fifth
pier is not yet in, but
piling for a Cofferdam
round it is in progress.

The North aboutment has not been commenced

The masonry works in low lying paddy land in this district will be stopped during the rains, and the masonry sent to complete other works in higher and dryer situations

Nearly all the masonry works in the VII and VIII districts will be completed by the end of January next, except the Teyan and Shevaracostay bridges —

A piece of ground of 20 acres in extent has been taken up for the Shevaracostay Station Ground, but as it is not proposed to erect a station there for some time to come, it is a pity to see meanwhile, the ground lying idle, and lapsing into scrub jungle

Shevaracostay
Station Ground

Jungle? The land is good and would I have no doubt be gladly rented and cultivated by some of the tillagers in the vicinity until required for station purposes

District IX

Length - 14 miles and 69 chains

Earthwork

54.

With the exception of a few chains, the earthwork in this district is completed

Masonry

55.

All the small bridges and culverts are completed with the exception of Copings, girder bed stones, &c.

The largest work in the district is a bridge of mild 30 ft girder spans, over a tributary of the Teyan near Virudupet. The foundations of the two aboutments and all the piers are in, the latter being

Raised several courses above
river-bed level. The
foundations are on bedded
morum at an average depth
of 10 feet below the river-bed.

A bridge at the 13th - 56.
mile and 73rd chain of four
20 ft. girder spans, over the
Malangapoomay river, is
also nearly completed. The
foundations are on rock, at
an average depth of about
5 feet below the river bed.

Another bridge of three 57.
20 ft. girder spans, at the 14th
mile 1 chain, has also been
founded on rock at an
average depth of about
6 feet.

At the 8th mile 32nd chain of
the district there is an
arched bridge of one 20 ft.
opening, to pass flood water
from the westward.
The public road runs parallel
to and at a few chains distance

58.
Probably
insufficient
water at
8th mile 32nd chain.

from the line, and is
provided with a number
of long "Irish bridges" capable
of discharging any amount
of water.

59. The provision made for
passing flood water over
the public road by means
of these "Irish bridges" has
not been over-estimated,
then a single 20 ft arch
on the railway embankment
will I fear be found insufficient.

60. If a heavy flood comes
and the railway bridge
and embankment stand
all right, the public road
will I have no doubt be
entirely merged, as it appears
to be considerably lower than
the railway.

District - X

Length - 14 Miles and 67 Chains

61.

The Earthwork of this district -
has not been very heavy,
and is now almost completed.

62.

An enormous amount of
ballast will I fear be
swallowed up as usual
before the road in this
district becomes

permanently good.

As it is formed almost
entirely of black cotton
soil

63

The bridge work in this district
is very heavy, and from the
nature of the soil (very
deep black cotton) the
foundations have all been
troublesome and costly.

64.

At the 2nd mile and 23rd chain
the Samuchang River, one of
the chief tributaries of the Tigris,

~~Bridge~~ is crossed in a bridge
of five 70 feet - girders spanning
the river. The foundations are being made
for the foundations of the
North-Abutment and the
pier next it - (No 1). Pier
No 4 has been raised up
to plumb level.

The South-Abutment
has been founded. Hard
firm foundations are being
put in at an average
depth of 10 feet below the
river bed, in hard timber
and bed.

65.

At the 6th mile and
34th chain there is a bridge
of five 50 feet - girders spans.
All the foundations are in.
Piers Nos 1, 2, 3 and 4,
and the South-Abutment
are up to within two feet
of girder bed level. The
average depth of the
foundations is 13 feet in
hard morum and rock.

66

The river Tigar, at the 8th mile
and 30th chain, will be
crossed at Saloor on a
bridge of twelve 70 ft spans.
The South-Abutment and
two piers next it have
been put in, and are within
ten feet of girder-bed level.

The foundations of
two piers are on an average
14 feet below the river-bed,
and the South-Abutment
about 21 feet in hard
morum.

67

At the 8th mile and 64th
chain a stream is crossed
on a bridge of one 70 ft girder
opening. The South-Abutment
is founded, and raised 3 feet
7 in below girder-bed stone
level. The foundation of
the North-Abutment is also
in, and raised 3 feet above
the footings. The foundations
are between 13 and 14 feet
in depth, in hard morum.

68. At the 9th mile and 12th chain
a masonry arched bridge
has been founded on hard
morum at a depth of 13
feet, in black cotton soil.
This bridge is up to springing
level.

69. At the 11th mile and 67th chain
there is a bridge of two
20 ft girders. The South-
Abutment and pier are up
to girder-bed level. The
foundations are nearly
20 feet deep, in black
cotton soil. The North-
Abutment has not yet
been put in.

70. Another bridge of three 20 ft
spans (girders) is also approaching
completion at the 12th mile
and 35th chain. The
footings of the North-
Abutment foundation have
been put in. The piers
are up to girder-bed stone

level, and the North-
Abutment is within eight-
feet of being the same height-

With the exception of the 71.
Saloon bridge, all the
masonry in this district
will probably be completed
by the end of February 1874.
The Saloon bridge will
probably be completed by
June 1874

Permanent-way has been 72.
laid down, but the joints
not yet-fished, from the
9th mile and 44th Chain
to the 12th mile and 25th
Chain. This portion of
permanent-way will be
found useful in conveying
stone for the Saloon bridge
from the quarry at the
11th mile and 50th Chain,
where excellent stone is
being quarried.

967 0
District IX
Length - 16 miles and 29 Chains

Earthwork
73.

The earthwork of this district
is almost all done. It
will probably be completed
by the end of this year

Masonry
74

The masonry is all but-
completed. There are no
large bridges in this district,
one of three 30ft openings
(girders) being the largest.

District X
Length - 14 miles and 60 Chains

Earthwork
75.

The earthwork of this district
is practically completed.
Nothing remains to be
done except some trimming
and turfing, &c.

Masonry
76

The masonry is completed

District VII

Length - 16 miles and 30 chains

The Earthwork of this District is well advanced, and will in all probability be completed before the end of February 1874

77.
Earthwork

For several miles before entering Lulicorin, the line in this District passes over a very fine, light, sandy soil, which drifts greatly in the strong winds which prevail at certain seasons of the year in the Linnelly District.

78.

A considerable amount of the Embankment close to Lulicorin had been blown away prior to my last inspection of the line (viz in March 1873). This Embankment has all been made up again, and the slopes are being planted with the Saddle-shape grass

- Creeping Corbicularius usually found in the country in sandy districts bordering on the sea. A coarse grass somewhat like mammul, with binding roots, and a little plant resembling a Vetch, but more bushy, rosy, and with under spreading roots, are also being planted on the slopes.

As all these plants are indigenous to the locality they will I think prove well enough, and preserve the slopes of the Embankment from being blown away or destroyed by rain.

The ballast on the top of the Embankment will effectually secure it from being cut up or blown away.

79.
Masonry

The masonry of this District will probably be completed by the end of February

Dept. Along the
Scarcity of Stone and Length
of Lead (about 8 miles from
the Quarry over land tracks)
The Masonry is clear, ranging
from ten to fourteen rupees
per cubic yard.

At the 3rd mile and 6th Chain
a bridge of four 50 ft. girder
spans is being constructed.
One abutment has been put
in and the other is being
founded on hard rock.

At the 3rd mile and

At the 4th mile and 3rd Chain 80.
a bridge of two 20 ft. girder
spans is being constructed.
One abutment has been
put in, and the other is being
founded on hard rock.

At the 3rd mile and 6th Chain 81.
a bridge of four 50 ft.
girder spans is being constructed.
Over the Shouramungalam
Mullah. The foundations are
on a species of hard Conglomerate.

82. The stone used in construction
has a very pretty variegated
appearance, especially
when wet. The courses
are about 14 inches in
thickness, very neatly cut
and laid.

83. The soil in the part of
the district is black cotton,
and for some distance north
of Shouramungalam bridge
it has been found necessary
to construct drains or short
bunds, at right angles to,
and springing from
the embankment, at intervals
of two chains, to carry off
desert. The rush of water
along the east side of the
line, caused during floods by
"spill" from the Horta-
pillaymulla Mullah,
about 1 1/3 miles to the
north. It has also been
found necessary to raise
the gradients slightly on
each side of the

Showramungalum Bridge.

At 2 miles and 46 Chains on
bridge of three 70 ft. girder spans
on the skew is being constructed,
over the Kurlapillaynattam
River. It has been founded
on a bed of granite, through
an upper stratum of Kunkur
a few inches only in thickness.

The material used in
construction is a fine hard
stone, built in 12 inch
courses, making very pretty
work. The river joins the
Showramungalum stream
a little to the west of the
Cue.

Close to Fulecorn a bridge
of one 30 ft. girder opening
is being constructed on
two large square piers.

A wall on each side of
the Mullah, carrying an
abutment with sloping
walls. The walls are of
masonry (not brick work)
built on rocks with cutting

84.

85.

edges. They will be sunk
20 feet below the bed of the
Mullah, and then filled
with concrete. They
were being sunk very
satisfactorily when I saw
them, although one would
be as good as imagine
that square walls of such
dimensions could not be
sunk to any depth without
under settlement - and
consequent cracking.

86.

The foundations of
the compound wall of the
Fulecorn station are in,
and one-half of the necessary
road dimensions has been
carried out.

Flood Gauge
Self registering.

87.

An ingenious, simple, and
efficient self-registering
gauge has been adopted
by the Resident Engineer
of District ~~XIII~~ for
determining the highest
flood levels, where
streams cross the line
at various places.

It consists of a piece of bamboo
of sufficient length; the internal
diaphragms at the joints of
which have been bored out:

The bamboo is then well coated
inside with a mixture of
indigo or other colouring matter
and Crude. A number of
holes about $\frac{1}{4}$ inch in
diameter are bored in the
sides of the bamboo, and
it is then firmly put
vertically in a convenient
position in the bed of the
stream where gauged.

A wooden cover is fitted on
the top of the bamboo to
keep out the rain, and
when the wooden cover is
attached a rod covered
with white paper. This
rod is inserted in the
bamboo.

When floods come down
the river, the water enters
the bamboo, the water

The small holes bored in
the sides, melts the
coating of colouring matter
inside the bamboo, and
stains the rod covered
with white paper up
to the level to which the
flood rises.

Permanent Way 88.

About a mile of permanent
way has been laid from
the beach at Telicorm
up through the station
yard. The permanent
way material, girders, &c.,
are now being conveyed on
trolleys from where boats
bring the ship discharge
cargo, to the material
dips, in the station yard.

89.

About 5 miles of permanent
way have been landed
from the "Lincells"; of
these five miles, four have
been sent up to the Engineer
in Charge of the district,
and one mile has been
retained for XIII on

Julicorin district. The
"York" had just arrived,
and was discharging more
permanent way, and girders,
posts, crossings, switches, &c.
No girders have been recd
yet of more than 20 feet span.

District XIV
Length 15 miles. 57 chains.

The Earth work of this district
is completed except in the
Station grounds

Earth work
90.

The masonry has progressed
very well since my last
inspection, in March of
the current year. It will
I should think be completed
early in 1874. The estimated
quantity of masonry in this
district is larger than for
any of the others, being more
than 8400 cubic yards.

Masonry
91.

92. The bridge over the Chittaur
river at the 5th mile and
10th chain is the most
important work in it.
The consists of ten 40ft-girders
spans. Excavations are
in progress for the north
abutment; and pier No 1
next it had been raised
to plinth level. Piers
Nos 2, 3, 4 and 5 are
up to girder-bed level.
Piling for a coffer-dam
for the foundation of pier
No 6 has been put in.
Piers Nos 7 and 8 have
not yet been commenced;
the foundation for pier
No 9 was being put in,
and the excavation for
the foundation of the
south abutment nearly
completed.

93. The foundation of the
Chittaur bridge are at
about 14 feet below the
level of the river-bed,
and rest partly on a species

of white Conglomerate and
partly on Granite or Gneiss.

Pier No 1 is founded on Granite

Pier No 2 on Granite at one
End - water, and on the
White Conglomerate at
the other.

Piers Nos 3, 4, 5 and 9 are all
founded on the White Conglomerate.

General Remarks

Not much has been done
yet in planting fences
along the line, but the
work is now being taken
in hand. In some places
the Aloe promensis is planted
well, and in others the
Euphorbia; but in my
opinion the latter will
be found a slow-growing
and generally unsatisfactory
fence, even under the
best conditions.

Fencing
94.

Turfing
95.

A good deal of turfing
has been done where
turfing has been procurable.
In black cotton soil, where
there is no turf to be found,
a small fleshy leaved aloe
with reddish orange flowers
on a tall stem has
been planted on the slopes
of Embankments.

In most instances this
aloe has thriven well
and will form a good
protection to the banks.
They have a long tap root,
but very few spreading
ones, so they require to be
thickly planted and not
in regular lines. The rain
water running off the tops
of Cotton Soil Embankments
furrows up the slopes
between the lines of plants -
I noticed this particularly
in District XII, in parts

96

of which the above plants
have been put in in regular lines,
and the same after collecting
on the top of the embankment;
had covered down, and
furrowing the slopes.

A few plants put in at irregular
intervals between these lines
would have had the effect
of directing the little streams
of rain water and depriving
them of their furrowing power.

Temporary
Telegraph
97.

As I have already pointed out
on a former occasion,
(vide my report on the Great
Southern of India Open Line
dated 26th June 1873.
published in the G.O. No
1849 of July 19th 1873)

The temporary telegraph line
along the Southern Extension
has been found troublesome
and costly to maintain.

There have been frequent
interruptions in communication,
owing to the bamboo or palmyra
falling down.

being either blown down,
eaten away below the ground
level by white ants, or
more commonly having rotted
just at the ground surface
level from the constant
alternations of dryness and
damp. I would therefore
again beg to draw attention
to the economy of at once
laying down in future the
permanent lines of telegraph
as soon as the lines of rail
along which they are to be
laid have been definitely
located.

Station
Buildings

98.

None of the station buildings
have yet been commenced;
but as most of them are
small, and the amount
of masonry inconsiderable,
there is every probability
of their being all completed
by the time the permanent
way has been laid, almost
a certainty I fear of their

being finished some time before
the line is opened for traffic,
unless engines and rolling
stock are secured from some
at an earlier date than is at-
present anticipated.

The work of the station 99.
buildings is being prepared
at the work-shops at Fitchburg,
so that there will not be
any delay on that account
when their construction has
been commenced.

Of engines, permanent way
material, rolling stock, &c.,
now available now, there
would be nothing, so far as
I can see, to prevent the
line being opened throughout
its entire length by July or
August - 1874.

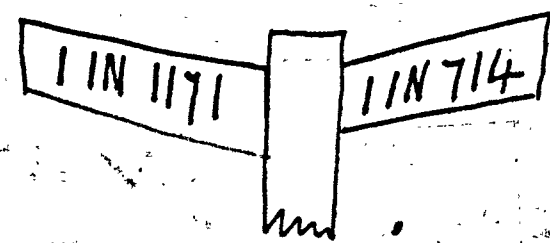
When inspected the open line
of the ~~Providence and~~ Great
Northern of India Railways
on the 22nd ultimo (1874)

Gradient
Boards

101.

between Fitchburg and
Dedham, where the
gradients are very light,
and the figures on the gradient
boards correspondingly ~~low~~
high. It struck me that
time, money, and material
might be economized and
additional clearance gained
by merely putting on the
gradient-boards the number
of feet in which there is
a unit of rise or fall.

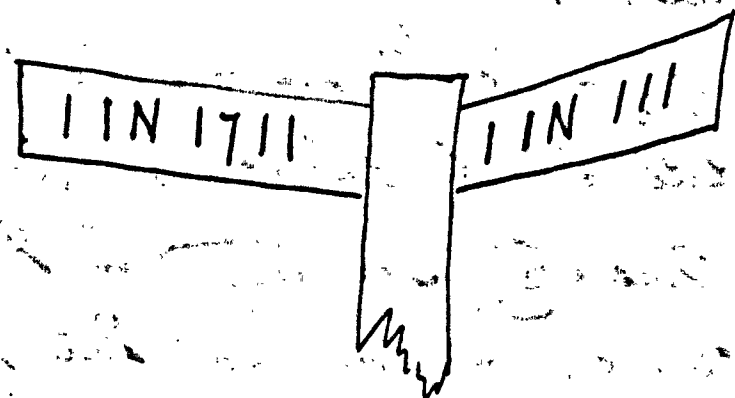
102. The gradient-boards on the
open line are figured thus.



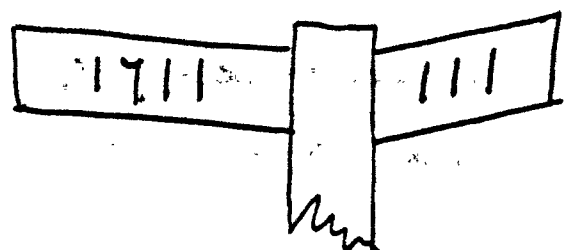
Where there is neither rise nor
fall the gradient-board
is horizontal, and "LEVEL"
is painted on it.

The position of the board,
or the angle at which it
is placed with reference to
the horizon, sufficient

indicating the direction in which the ground rises or falls, the figure and word "1 IN" appear to be superfluous, and charges might be saved by dispensing with them, thus



is not so clear as



I have in para 77 of this report already referred to the high winds which prevail in the Tenasserim District during certain seasons of the year; and in my last report of the North-West line of the Madras Railway, dated

Covered wagons
for goods
103.

The 11th of October 1873, I have drawn attention to the danger attending the high jacking of light-goods on open wagons during high winds. As the only Cotton Screws or presses in the Tenasserim District - I am aware of are at Faticoria, and as there will undoubtedly be a large Cotton traffic in the Southern portion of this line, I would again beg to draw attention to the advantages of having a stock of "Covered Goods" in preference to "Open Goods" wagons for improved Cotton, and goods of a class liable to injury from exposure to weather. There is an important traffic in piece goods between Faticoria and Madras, with Deposits (Carpaulins, Sorts) of this class are liable to a good deal of damage

which must be considered
preventable, if "Covered Goods"
wagons can be used with
so much mutual advantage
to the Railway Company and
the owner of the goods, be
substituted for open goods
wagons with tarpaulins.

Ross Thompson

Captain Royal Engineers
Offg. Dy. Comm. Engr. for Railways

Madras

December 5th 1873.

8. Dec. 1873.

Mr Dy. Comm. Engr. for Railways
29. 12. 73
29. 12. 73
29. 12. 73

195 P. W. Sept. 1873

Proceedings of the Madras Government
Read the following

From the Comptroller
for Railways

(H. C. No. 6638/10th Decr. 1873)
45

The reports above
recorded are the results
of an inspection of the
Great Southern of
India Railway Station
between Trichinopoly,
Palamcottah and
Tuticorin during Octo-
ber and November 1873.
Such points as call for
special remark will
be noticed below.

In paras 25 to 27
of his report Captain
Ross Thompson points

Mob
18/12

18/12

out that the arrangements
proposed & made by
the Madras Local Fund
authorities for the disposal
of flood waters opposite
the 15th mile of District X
will endanger the Rail-
way embankment.

The subject it is observed
has been remitted by the
Consulting Engineer for
the consideration of
the Local Fund Board.

It is presumed that
Paras. 53 and 58 to 60
of the report have already
been communicated to
the Railway authorities,
if not, attention should
now be called to the questions
treated of.

The erection of per-
manent

& C. No. 70 in the

advocated by the offici-
ating Deputy Consulting
Engineer in para 94 was
based on the considera-
tion of the Govt. of
India in letter No. 1850
dated 19th July 1873 and
in the letter submitting
the correspondence which
accompanied the Con-
sulting Engineer's No. 637
dated 27th November the
question is again pro-
minently noticed.

The anticipated delay
in opening the Extension
for traffic has formed the
subject of recent orders
in connection with the
regular and Budget Notes
minutes of the line. It
appears from para 100
of the Deputy Consulting

Engineer's report that if
all the girders, perma-
nent way materials
and rolling stock ~~etc~~
were available now
there would be nothing
to prevent the line being
opened throughout its
entire length by July
or August 1874. The
circumstances are strongly
corroborative of one of
the main objections to the
guarantee system as
applied to Railway en-
terprise, and will be
brought to the notice
of the Home Authorities.

In para 103 of his
report Captain Ross
Chambers reverts to the
question of the superi-
ority of covered goods

Wagons under certain
conditions. The preva-
-lence of high winds
in the Tinnevely Dis-
-trict, the large
amount of traffic
expected in cotton
and price goods, and
it may be added, the
narrow gauge which
makes high piling
on open wagons
more objectionable
than in the broad
gauge, are weighty
reasons in favour
of a reserve stock
of covered goods
wagons on the Lon-
-don Extension.
The attention of the
Railway authorities
should be specially

Galp

drawn to the subject.
Q.M.W.

Amie L. ...
...

38
Lo. L. C. for Ryo: ✓
Desp. with S-C 4/2/74

Ch. 6697
Govt. of Madras.
PUBLIC WORKS.

2. *Recommending Com.
for Railways*

Dated

By

Encl.

1873, No. 195.

Nos. 3851386

S. S. Railway Paving
Enclosed is letter from the
S. S. Railway Paving
Committee a report by
the Engineer on the
works in progress on
the Southern Extension
of the S. S. Railway.