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# Pioneer Railways in N.S.W.

BY J. W. ROBERTS, B.E.

*(A Paper read before the Sydney University Engineering Society,  
on 10th November, 1897).*

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THE great commercial crisis of 1893 was responsible for a reduction in the amount of public borrowing in this Colony, and the consequent curtailing of expenditure in connection with public works. The effect of this change of policy, whilst it enhanced the credit of the Colony abroad, and rendered it possible to obtain future loans at a lower rate of interest, at the same time accentuated the unemployed difficulty at home, and cheapened the price of labour.

The check thus placed on the carrying out of public works has in its action been most severe in the matter of the construction of railways. For a couple of years no new lines were negotiated, only works in hand being carried out. Nevertheless, the demand from outlying settlements for branch lines was not less strenuous; and it was generally recognised that in a new country like this, with great possibilities before it, the railway system must be extended in every direction, preceding traffic and population—acting, in fact, itself as a stimulus for the creation of those desiderata.

In the early days of American railway development this was felt to be the correct procedure from the purely commercial stand-point of a private company. To a State, with the interests of its component parts at heart, it should commend itself still more strongly. So far, however, most of the branch lines have proved serious burdens on the revenue. An analysis of the recent report of the Railway Commissioners shows that, out of a total of 2,531 miles of line open in this country, 1,257 miles, or a shade under 50%, do not pay working expenses and interest combined; a few do not even pay working expenses alone. The total loss on these lines for 1896 amounted to £357,000. Extending over a decade of years it must run to several millions. The older lines are gradually redeeming themselves, but the process is a slow one, and newer lines take their place on the list.

This is an obviously undesirable state of things, and when the non-political Board of Railway Commissioners was appointed they naturally resented the foisting on them of lines likely to prove unremunerative for a long space of years, pointing out that it is impossible to reduce working

expenses and maintenance to a much lower figure than that at which they now stand. If their results be compared with those obtained in other countries, the justice of the contention must be admitted. Wellington, for instance, computes the average working cost per train mile in America at about a dollar. Here it averages about four shillings. It is clear, therefore, that it is the other great financial item that must be reduced, viz., interest on cost, if paying railways are to be constructed. This is possible only in two ways—either by building with cheaper money, or with less of it. It has already been pointed out that our financial credit has improved. The early railways of New South Wales were built with capital costing from 5% upwards, but this rate has gradually declined until the present time, so that the average interest on capital cost of all existing lines does not exceed 3.7%. At the present time there is no difficulty in getting accommodation at 3%, and this in itself is a material gain, since it will enable 20% more to be spent on a given work for the same annual outlay. Then, again, materials have improved in quality and declined in price, while labour can be obtained at lower rates. These items all help considerably in cheapening railway construction, but are not in themselves sufficient, except, perhaps, in isolated cases, to render the work remunerative.

In the Commissioners' report for 1891 it was suggested that in outlying districts, where the country was practically level and the traffic light, a cheap class of construction, to be designated "Pioneer Railways," should be carried out. They considered that £1,750 per mile would cover the cost, excluding land and bridges; trains to be run in daylight only, at a speed not exceeding 15 miles per hour. This suggestion did not germinate for some considerable time, and was repeated at intervals, until the Minister for Works, Mr. Lyne, became seized with the idea, and pushed the matter forward. During a subsequent visit of the Engineer-in-Chief for Railway Construction to America, special attention was given by him to this class of work. Finally, when the Narrabri to Moree Railway came on for consideration, it was decided to initiate some experimental work in its construction, with a view to testing the possibilities of cheapness as suggested by the Commissioners. These are the historic facts leading up to the inauguration of pioneer railways in New South Wales. It remains to consider the special features that distinguish them from those of the normal construction.

*Gauge.*—It must be remarked, in the first place, that the standard gauge has been adhered to. The question of maintaining or breaking the gauge on a given system of railways has always divided engineers. Certainly the vast majority are in favour of the former course, but there are many notable examples in the world of narrow-gauge lines acting as feeders to a main standard gauge system. To consider arguments for or

against, however, would unduly lengthen this Paper, and the writer is content to leave the matter as one yielding fruitful discussion, but few results.

*Cuttings and Embankments.*—Maintaining full width of gauge involves, of course, keeping to standard width of cuttings and banks, unless drainage is seriously interfered with. Such a course, however, would be most serious in the particular class of work under consideration. In the older country lines, 15' 0" was the usual width of road at formation level, but this has been increased to 17' 0" on all recent lines, including the pioneer type, the distance being measured between the lowest formation points. The extra width is beneficial in keeping the permanent way well drained. It is obvious, therefore, that any saving in earthwork must be in a vertical, not in a horizontal, direction; that is to say, the depths of cuttings and banks must be reduced, and the line located as near the surface as possible. Under certain circumstances this would involve the use of steep gradients and sharp curves, tending to increase maintenance and working expenses. Nevertheless, with a light traffic and low speeds, the procedure is an economical one. Happily, the country through which pioneer lines have so far been constructed lends itself most favourably to surface locations, being for the most part flat or gently undulating. In the three lines which are now open to traffic, viz., Narrabri to Moree, Jerilderie to Berrigan, and Parkes to Condobolin, totalling altogether 147 miles, the road, with the exception of a few miles near Woolabra, on the Narrabri to Moree line, is laid entirely on shallow banks, averaging probably from 9" to 18" in depth, yet the sharpest curve is not less than 20 chains radius on the Narrabri-Moree line, and flatter still on the other two lines. Then, again, the former line has grades of only 1 in 100 towards Sydney, and 1 in 76 (a very short piece) outwards. The ruling grade on the Parkes to Condobolin line is 1 in 100, equal to that on the main suburban line, while Jerilderie to Berrigan is practically a dead level. On some of the proposed new lines, however, matters are not quite so favourable.

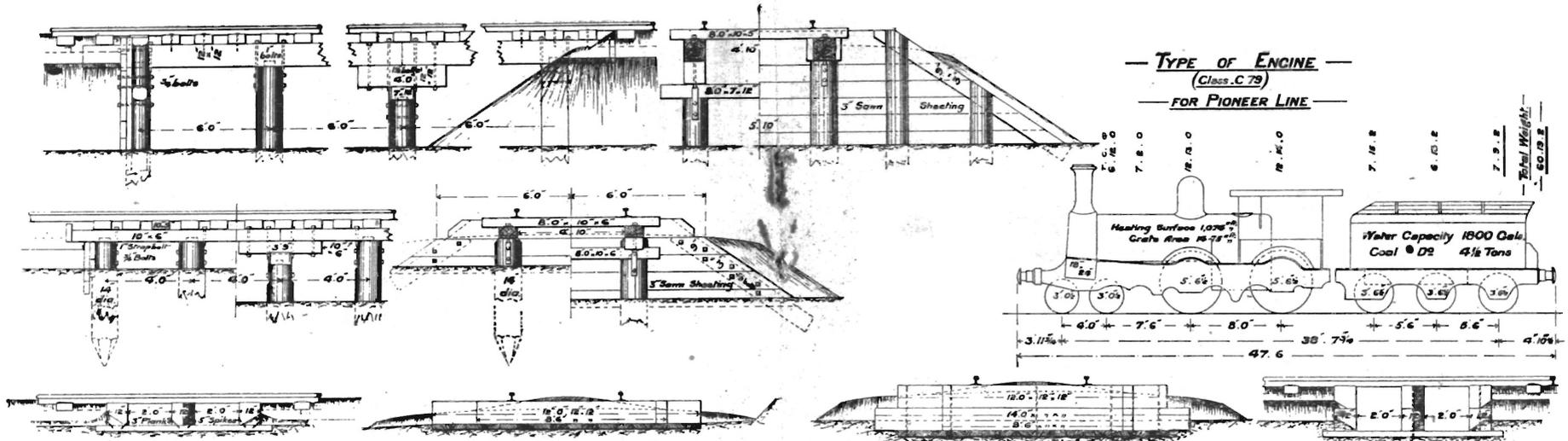
These banks are constructed entirely from side cuttings running parallel with the line inside the railway boundary. The minimum distance from toe of bank to edge of cutting is 6' 0". Where there is a fall in the land in the direction of these cuts they can be utilised as drains, and connected with the main watercourses. In level country, however, they form stagnant pools of water in the winter, often keeping the ground round about in a sodden condition, and attracting animals to the vicinity of the line. In such cases it is better to merely scrape the ground over a large area, thus increasing the opportunity for evaporation. On account of the fairly uniform section of the banks they are paid for by lineal measurement, the usual price being 30s. per chain, though on the

Narrabri-Moree it was only 20s. The construction is then called "forming." On the latter line the work of forming the bank was carried out very largely by means of elevating ploughs and graders on the American system. The plough is drawn by eight horses, and the excavated material is thrown on to a travelling belt, supported by a jib-crane arrangement, and deposited on the site. The plough works up and down a given length, generally about a mile, until the bank is of sufficient depth and width. It can execute, on an average, 800 cubic yards per day. The bank is then trimmed to the exact shape required by means of the graders, which are simply knives cut to the proper template, and carried at the rear of a four-wheeled vehicle. The blade lies diagonally across the bank. These two appliances are very effective, and do the work satisfactorily and expeditiously. Where the bank is deep or the country undulating, pick and barrow men are employed, or scoops. The depth of the bank will depend generally on the class of country traversed; for its function is not, as hitherto, to level up depressions, but simply to lift the track beyond the reach of possible accumulations of water during rainy seasons.

The formation is laid to a vertical curve of 159 feet radius for a central chord of 9 feet, thence falling to the sides on curves of 27 feet radius. The total fall, centre to sides, is 6 inches, or 3 inches more than the normal type shown. The surface is consolidated with a 5-ton roller before the permanent way is put in place.

On the Parkes to Condobolin and Jerilderie to Berrigan lines, earth ballast (of the shape and dimensions shown on section) was used for packing the sleepers in place. The earth, if suitable, was taken from the side cutting. At stations and sidings a light ballasted section, as shown, was adopted. On the Narrabri to Moree line, however, the black, loamy soil which covers most of the country was found unsuitable for this purpose, and ballast from the Namoi River bed was used instead, being packed to the form shown in dotted lines on the section. An inferior ballast taken from cuttings, or condemned for general use, was utilised to form the top of banks under the sleepers, so that this line has a somewhat better equipment than the other two; but, since it lies through country much addicted to flooding, this is necessary. A few miles of earth ballast were laid in the black soil plains by way of experiment. Stations and sidings are ballasted as shown. The ballast averages about 1,100 cubic yards per mile, as against 2,200 on the heavier country section, and usually cost 5s. per cubic yard, or 3s. 6d. per yard of single track.

*Permanent Way.*—The sleepers are of the rough-hewn, half-round type, with the sapwood generally left on. There must, however, be sufficient good red wood to give a minimum bearing for the rail of



**— TYPES OF LOW WATERWAYS —**

