

adoption of sharper curves and gradients, it is capable of very considerable reduction in works. But the latter section gives a very crude idea of the levels and works which may be obtained by a complete examination of the ground. The levels are run merely on the traverse lines, without any attempt at ranging curves. Although it is more than five years since I explored this extension, I have a sufficient recollection of the ground, which has enabled me to make what I fully believe to be a very close estimate of the amount of earthworks necessary to obtain a maximum gradient of 1 in 40; and by the free use of curves in many places where the trial levels were run in straight courses, a practically surface line can be obtained in places where heavy works are now shown.

The trial section does not show the line nearer to Tuakau than by about four miles, diverging at about the eleventh mile to Mangatawhiri, in accordance with the instructions under which I then acted. The ground thence to Tuakau is, however, of very similar nature to the first eleven miles, and I have estimated for it at something over the rate of the latter, and feel confident that when the ground is fully surveyed, a good working section will be obtained, showing less than the total amount of works now estimated.

The estimate is from Newmarket, from whence the line is ready for ballast and rails for a distance of four miles six furlongs. The total length from Newmarket to Tuakau is thirty-four miles six furlongs, and including the Onehunga branch thirty-six miles six furlongs. The length of line to be formed is exactly thirty miles, the other six and three-quarter miles being ballasting and permanent way only.

The gauge I have estimated is three feet, but a few inches more or less will make very little difference in the cost of works.

The main saving consequent on adopting a narrow gauge lies in the sleepers and ballast, although, rigidly viewed, both those items should be a function of the weight of traffic. By the adoption of Fairlie's patent locomotives, however, and limiting their weight to eighteen or twenty tons (almost the least possible with this design), the use of thirty-pound rails becomes possible, as each wheel would have only  $2\frac{1}{4}$  to  $2\frac{1}{2}$  tons load. The ballast I have taken at 9 inches, the very least which will enable the road to be packed. I propose no boxing at first, but the ballast can be gradually increased as found desirable in the maintenance. The sleepers may be of kauri or any other suitable timber, much of which can be found alongside the line at Pukekohe.

I might be allowed a few suggestions regarding the plant at present on the ground, as affected by any change of gauge. A great part of it consists of the ironwork merely of carriages and trucks, and very little alteration would make the axles suit any gauge, and even the carriages which are finished might be altered at little cost.

The locomotives of course are unalterable, and the best way that I can think of to utilize them would be to put them both, or one of them, on a Waikato steamer. Both would propel a suitable steamer at the rate of 10 knots per hour in still water, or one of them at 8 knots, under the same circumstances. Another alternative is, to use the 4 ft. 8 $\frac{1}{2}$  in. gauge to Onehunga, and mix the gauges from Newmarket to the junction. I do not advocate such a course, but merely throw it out as a suggestion. Being merely of the class called "Contractors' Locomotives," I am afraid, if exported to New South Wales, the returns over freight and expenses would be very small.

In conclusion, I would only add that though the estimate works out at a low rate per mile for a railway, yet the prices are ample, and in all the principal items are more than those at which I am aware the works now done on the line were executed for, and at a profit. When it is considered that not a single engineering difficulty exists beyond Newmarket, and that six miles and a half are ready for ballast, and that of the thirty miles remaining to be formed no less than about nine miles and a half will have earthwork under an average of one foot, it will readily be seen that the whole line is exceptionally easy.

The speed which may be safely attained with the proposed plant may be put at 25 miles per hour, and at this rate a very great traffic can be carried on.

I shall only be too glad to further the work in any way in my power, by verification of the estimates or considering any modification which may be thought to expedite the formation of a Company to take the matter up.

His Honor the Superintendent, Auckland.

I have, &c.,

JAMES STEWART, A.J.C.E.

ESTIMATE of the Cost of a Light Railway from Newmarket to the Waikato at Tuakau.

Description of Work.	Amount.	
	£	s. d.
170,000 yards cubic, general earth cuttings, @ 1s. 6d. ... ..	12,750	0 0
24,800 " " stone embankment, @ 2s. ... ..	2,480	0 0
1,040 " " rock cuttings, @ 5s. ... ..	260	0 0
5,820 feet lineal culverts, 1 ft. to 2 ft. 6 in., @ 20s. ... ..	5,820	0 0
1,180 " " timber bridges, @ £5 ... ..	5,900	0 0
9 $\frac{1}{2}$ miles forming, 12 feet wide, @ £100 ... ..	950	0 0
	<hr/>	<hr/>
30 miles fencing, ditching, and gates, @ £350 ... ..	28,160	0 0
	10,500	0 0
<i>Permanent Way, per mile.</i>		
1,320 yards cubic, ballast, @ 4s. ... ..	£264	0 0
60 tons rails and fastenings @ £11 ... ..	660	0 0
2,100 sleepers, @ per hundred, £7 ... ..	147	0 0
1,760 yards lineal plate-laying, @ 2s. ... ..	176	0 0
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36 m. 6 f. above Newmarket, Onehunga, and Tuakau, @ ... ..	1,247	0 0
	45,827	5 0
Carried forward ... ..	£84,487	5 0