

trains. The ruling gradient via the Manawatu line against traffic to Wellington is 1 in 56, with 42-chain curves, as against 1 in 70 on the straight by the Tauherenikau deviation.

I have endeavoured to condense into the attached table all the information available as to the costs as estimated and the salient features of the several routes. The costs given for hauling 100,000 tons of gross loads of goods-trains (*i.e.*, the weight of wagons and their loads only, exclusive of the weights of the engines) from Woodside to the Upper Hutt, over the several routes, are computed on the supposition that engines of about the power of the new B engines will be run on the deviation, also that the gross weight of the trains up the 1 in 15, exclusive of the weights of the Fell engines and Fell brake-vans, is 110 tons. The average weight of the trains up the incline is, for the last year, just under 100 tons, so the comparison should not be unfair to the existing line. It would, however, be possible to get Fell engines capable of taking up greater loads; but, on the other hand, it would also be possible to get more powerful engines than the B engines, and I have no doubt by the time the deviation is made that such engines will be in use.

The volume of the present traffic over the Rimutaka Incline is given in the attached memorandum from the General Manager of Railways.

The information regarding the Wainui-o-mata-Wairongomai route is hardly complete enough to enable any very definite comparisons being drawn between it and the other possible deviations between the Upper Hutt and Woodside. The estimated cost of this deviation is given by Mr. Dobson at £378,000, and is so high that the route will not at all compare with the Road Saddle-Featherston route, with equal grades 1 in 40, but for which the ascertained cost is only £181,200. In addition to this the distance would be ten miles longer. The great cost, the steep ruling grade, and the great extra length are, I think, quite sufficient to condemn this route.

A considerable time will be required to make the permanent survey of the whole deviation from the Upper Hutt to Woodside—say, eighteen months to two years for a party as ordinarily constituted; therefore, if anything is intended to be done in the near future, the survey should be put in hand soon. The first work to be done should, I think, be the running of a grade-line from the north end of the tunnel down the Tauherenikau to Woodside on the 1-in-70 grade. This, with a sufficient number of cross-sections at suitable points, would enable the general character and amount of the works required to be approximately ascertained. Then a similar survey should be made from the east end of the Road Saddle Tunnel to Woodside. The limits of curvature should be 10 chains radius, except for the worst parts of the Tauherenikau, when $7\frac{1}{2}$ -chain as well as 10-chain curves should be tried. In the final location of the adopted line all grades on curves should be reduced to make the probable traction on each curve no worse than on the steepest grade on the straight. I think also that provision should be made for putting transition curves at the ends of all curves. As there is no very reliable information available for curve-resistance on 3 ft. 6 in. gauge lines, I would recommend that some measurements of curve-resistance be made sufficiently numerous and accurate to enable the results to be used with confidence in all future railway locations.

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PROPOSED DEVIATION, WELLINGTON-NAPIER RAILWAY, OVER RIMUTAKA.

SUMMARY OF LEADING FEATURES OF THE SEVERAL ROUTES BETWEEN UPPER HUTT AND WOODSIDE STATIONS.

Route.	Ruling Gradients.		Ruling Grade to Wairarapa required for Existing Ratio of Traffic for Grade in (1).	Length: Upper Hutt to Woodside.	Rise and Fall: Upper Hutt to Woodside.	Estimated Cost.	Estimated Number of Trains required for Haulage of 100,000 Tons of Gross Engine-load from Woodside to Upper Hutt, and Cost of Haulage.				Lengths of Tunnels.		Height of Summit above Sea-level.
	Wairarapa to Wellington.	Wellington to Wairarapa.					B Engines.	Two Fell Engines.	Number of Trains-miles.	Cost.	Summit Tunnel.	Other Tunnels.	
Upper Hutt to Featherston, via No. 1 line and Road Saddle	(1) 1 in 40 + 10-chain curves 1 in 50 on straight	(2) 1 in 55	1 in 34 on straight 1 in 45 on straight	Miles. 22 $\frac{3}{4}$	Ft. 1,585	£ 285,000 298,000	Trains 538 380	Trains	12,235 8,645	£ 1,835 1,297	Yd. 3,146 3,146	Yd. 440 440	Ft. 897
Upper Hutt to Fernside, via No. 1 line and Road Saddle	1 in 66 on straight	1 in 55	1 in 60 on straight	23	1,419	370,000	287	..	6,601	990	3,120	440 + 500*	897
Upper Hutt to Woodside, via No. 1 line and Road Saddle	1 in 82 on straight	1 in 55	1 in 74 on straight	23 $\frac{1}{4}$	1,279	460,000	235	..	5,464	820	3,100	440 + 800*	897
Upper Hutt to Woodside, via No. 1 line and Tauherenikau	1 in 70 on straight 1 in 56 on straight	1 in 60 on straight on str.	1 in 64 on straight 1 in 53 on straight	22 $\frac{1}{2}$	1,347	325,000	(272 338)	6,120 7,605	918 1,041	1,540 to 1,650	440 + 800*	979 to 927
Existing line ..	1 in 15 + 5-chain curves	1 in 35 + 5-chain curves	..	29 $\frac{3}{4}$	2,485	910	..	5,200	1,144

* Assumed aggregate length of short tunnels.