

500 feet. Two, if not three, tunnels would be required, besides a steep grade; the longest tunnel being through Kerr's Hill. In favour of this route most of the country is open.

If the present line is adopted, the following alternative lines should be tried:—Commencing at the Motueka River, at 31 miles, the alternative should quit the surveyed line and rise on to the high terrace at the junction of the Motueka and Motupiko Rivers; it should then follow along it, and descend to the valley level at Long Valley, and continue up the east side of the Motupiko; and crossing opposite,  $36\frac{1}{2}$  miles, re-join the original line. This line would have a heavy cutting and bank in descending from the high terrace; but once done, a level line would be obtained for about 4 miles, a large part of which would be open, and it would avoid at least 2 miles of bad sideling ground on the west side. The bridge across the Motupiko would also be shorter.

A second alternative might be tried to avoid crossing the Hope so many times. Quitting the present line at 53 miles 60 chains, the alternative would follow round the high-rock bluff, and the tunnel would begin 4 chains farther up the Hope, and emerge  $2\frac{1}{2}$  chains lower down (increasing the tunnel about 88 yards); here it should cross the river, and following down the same side re-join the old line 54 miles 77 chains. The present road siding along the sand hill would have to be widened, to make room for the railway and road, and a retaining wall built up from the river. This alternative would save four bridges, in all 425 feet.

A third alternative might be tried at 80 miles, a little above the Marina River. This should re-cross the Buller here, and continue along the south side nearly to the Lyell, when the Buller should be crossed and the old line re-joined. In either case a bridge would be wanted at this point to connect the Lyell with the railway. This alternative may have less rock cutting, and most probably the number of high viaducts and tunnels would be lessened.

The last alternative I would recommend is at 119 miles, on the Inangahua River. This is a more central place for a principal station than Reefton, keeping in view the fact that Reefton is near the extreme end of the gold-bearing country now being worked, and that Boatman's, Larry's Creek, and the Landing are now coming into prominence as reefing country. These are all below the point indicated above. This alternative would cross the Inangahua River here, and pass through the watershed into the Mawhera-iti by the old track, and re-join the present railway line at 134 miles. It would save a bridge over the Waitui, 760 feet long, and shorten the line about half a mile. The watershed presents about the same section as the line surveyed.

*Grades.*—The first 3 miles are nearly level, and run through chiefly open land; there is then a rise of 1 in 35 for  $3\frac{1}{2}$  miles (through bush) to the tunnel at Spooner's Range; this however can be reduced to 1 in 40 by commencing the ascent a mile farther back. The tunnel is 997 yards long, through gravel, which stands in the road cutting nearly vertical. The worst feature in the tunnel is the great difference of level between the two ends, the Foxhill side being 115 feet higher than the Norris Gully side. From this point there is open for 6 miles, then the forest extends to the Mawhera-iti, excepting a few open patches, amounting in all to about 3 miles. Returning to the tunnel—the grade on the west side is also 1 in 35, but can be reduced to 1 in 43 by lengthening out the grade; the line then is level for  $8\frac{1}{2}$  miles to a bluff 150 feet high, near the confluence of the Clarke. This is graded up at an inclination of 1 in 40, and then the line runs nearly level for  $1\frac{1}{2}$  miles, until it falls into the Clarke Valley. It then runs up to the Clarke at the valley level about  $1\frac{1}{2}$  miles; the ascent from this point to the watershed will work out to 1 in 41 for  $4\frac{1}{2}$  miles. Here there is a tunnel of 693 yards, and the flat of the Hope beyond can be reached by a short grade of 1 in 55, with a slight alteration of the present plans. The line then runs down the Hope Valley to the Buller at an easy grade; the total distance to this point is  $35\frac{1}{2}$  miles, and  $54\frac{1}{2}$  from Nelson. If the line were taken by the Roundell and Upper Buller route it would be 74 miles from Nelson.

From the confluence of the Hope and Buller to where the latter river is crossed ( $17\frac{1}{2}$  miles) the line runs along alternate sidings and terraces, and a tolerably good line can be got; but many of the terraces are short, and the quick change of level causes a serious amount of earthwork. The Buller is crossed here to avoid a very ugly long rock bluff immediately below. The bridge is short (100 feet), and will have rock abutments, and must be in one span. The line now runs along level country to Doughboy Creek ( $6\frac{1}{2}$  miles), and is 3 miles shorter than if it was taken on the opposite side; the township of Hampden and the Matakita River lay in this flat. This last river will require a long bridge (730 feet), besides a high embankment 15 chains long on one side, and 13 on the other, to keep the line above the flood-water, which is backed up by the Buller.

At Doughboy Creek the true gorge of the Buller begins, and extends to a mile below the Lyell, and the line has to be kept 70 feet above the ordinary river level to be out of the way of floods. The distance is  $18\frac{1}{2}$  miles; of this, the first  $3\frac{1}{2}$  miles to the Marina are moderate, but the remainder, with a few small exceptions, is exceedingly rough, and contains many bare rock points and deep gullies, necessitating five high viaducts and seven short tunnels, and many deep cuttings through rock.

The following  $6\frac{1}{2}$  miles to opposite Christie's (Inangahua Junction) is much lighter, being about half flat and half siding; there are however two or three rock cuttings, and two small tunnels in this length. The average fall of the Buller is 23 feet per mile, which leaves a large margin for easing the grades in bad country. The next 5 miles, ending at the ferry (first landing), are flat, but broken by three high terraces, ending in bluffs on the river. Heavy through cuttings and one tunnel will be advisable, also a high viaduct over Coal Creek, which must be 154 feet in one span. A high cutting occurs just beyond, which however will be cutting only on one side, as the ground (soft rock) falls abruptly to the river.

From this point to the Waitui River, a distance of  $11\frac{1}{2}$  miles, the country is flat, and presents no difficulty greater than two bridges, of a total length of 1,000 feet.

The next  $3\frac{1}{2}$  miles are also flat, and bring us to Reefton; this portion includes one large bridge of 730 feet, which will be saved if the alternative I suggest is adopted.

The following 6 miles, ending at Square Town, include the watershed of the Grey and Buller, which is on an average 330 feet above the level country on either side; it is crossed with a short tunnel 345 yards long, through clay or gravel.