

Lines D, D1, and D2 are therefore common to each other from a point on the west side of Rolleston Creek to the Bealey Station. The following are the physical characteristics of these lines :—

	D.	D1.	D2.
Length of east approach ...	2 m. 29 ch.	2 m. 29 ch.	2 m. 29 ch.
Length of west approach ...	7 m. 75 ch.	8 m. 19 ch.	8 m. 5 ch.
Total length of line ...	10 m. 24 ch.	10 m. 48 ch.	10 m. 34 ch.
Maximum grade, east approach ...	1 in 40	1 in 40	1 in 40.
Maximum grade, west approach ...	1 in 28	1 in 28	1 in 28.
Grade in summit tunnel ...	1 in 33	1 in 33	1 in 33.
Minimum radius of curve ...	8 ch.	8 ch.	8 ch.
Total degrees of curvature ...	1,216	1,442	1,264.
Percentage of line curved ...	34	38	35.
Length of summit tunnel ...	15,378 ft.	15,378 ft.	15,378 ft.
Total length of tunnels outside summit tunnel ...	4,950 ft.	5,300 ft.	4,686 ft.
Total length of bridges ...	1,850 ft.	2,560 ft.	1,950 ft.
Elevation of grade at summit ...	2,624 ft.	2,624 ft.	2,624 ft.
Estimated cost of construction ...	£492,000	£493,000	£473,000.

Line E.

This line begins to climb at a point a few chains east of the Otira common point, and keeps to the southerly slopes of the Otira on a maximum grade of 1 in 22, turning in Rolleston Creek Gorge, and thence following the slopes of Rolleston Spur and the southerly slopes of the gorge to the bend of the Otira at the upper end of Pegleg Flat, where it gains entrance to the summit tunnel. The east end of this tunnel is on the slope of the pass on the south side of the creek, which flows east from the pass at a point 31 chains east of the summit of the pass proper. From the east end of the proposed tunnel the line descends along the northerly slopes of the Bealey, by maximum grades of 1 in 26, to the Bealey common point. The following are the physical characteristics of this line :—

Length of east approach ...	2 m. 78 ch.
Length of west approach ...	7 m. 50 ch.
Total length of line ...	10 m. 48 ch.
Maximum grade, east approach ...	1 in 26.
Maximum grade, west approach ...	1 in 22.
Grade in summit tunnel ...	1 in 55.
Minimum radius of curve ...	8 ch.
Total degrees of curvature ...	952.
Percentage of line curved ...	24.
Length of summit tunnel ...	5,788 ft.
Total length of tunnels outside summit tunnel ...	7,000 ft.
Total length of bridges ...	2,516 ft.
Elevation of grade at summit ...	2,870 ft.
Estimated cost of construction ...	£435,000.

Line F.

Line F keeps to the southerly slopes of the Otira, beginning an ascending maximum grade of 1 in 20 a little over half a mile east of the Otira common point. It curves back at Rolleston Creek, and follows the slopes of the Rolleston Spur and the southerly slopes of the gorge, gaining the summit at an elevation of 3,000 ft., no summit tunnel being required. Thence it descends along the northerly slopes of the Bealey River to the Bealey common point on maximum grades of 1 in 24. The following are the physical characteristics of this line :—

Length of east approach ...	3 m. 33 ch.
Length of west approach ...	7 m. 13 ch.
Total length of line ...	10 m. 46 ch.
Maximum grade, east approach ...	1 in 24.
Maximum grade, west approach ...	1 in 20.
Minimum radius of curve ...	8 ch.
Total degrees of curvature ...	953.
Percentage of line curved ...	24.
Total length of tunnels ...	6,732 ft.
Total length of bridges ...	2,296 ft.
Elevation of grade at summit ...	3,000 ft.
Estimated cost of construction ...	£400,000.

In the case of each of the above projects the summit tunnel is straight from end to end, all curvature being outside the summit tunnel.

The above data of the several lines are tabulated for convenience in Table I., which, with lithographic plans showing on a small scale the grades of each line, are attached to this report.

ESTIMATES.

The estimates of cost as to work outside of tunnels practically depend on rates which were determined for substantially similar work on the 1-in-50 grade line, but the estimates of the short tunnels and bridges have been prepared independently, the basis for them in each case being the cost of doing similar work at the present time in New Zealand. The summit tunnel in each case has, of course, been treated separately.