decidedly too weak; considerable expense would therefore be incurred in strengthening the bridge. The formation of the combined road and railway approaches to the bridge would involve heavy cuttings and embankments.

We estimate the cost of the construction of the extra five and a half miles of railway, together with the necessary combined approaches, at £17,600.

We also calculate approximately that the annual cost of engine power and maintenance of the railway for five and a half miles of road and 315 feet ascent would amount to £2,600.

We are of opinion that more traffic would be developed by the line which we recommend below.

The crossing of the river which we recommend to be adopted is situated about seven miles below the existing bridge. The river at this point is very much wider than at the bridge, and its banks much lower. Within the last few years the river has shifted into an old bed to the southward. We think that the deserted bed might be embanked over with the exception of 25 chains left as a flood opening, and the existing bed be spanned by a trestle bridge, 60 chains in length.

We should recommend that the site of the above bridges should be one mile and a quarter or thereabouts above the parliamentary direct line, for the following reasons:—

1. That the terraces on the south side are better defined, and the river less liable to change its course.

2. That, owing to the uncertainty attending the ultimate course of the River Orari, the railway must cross that river at a point two and a half miles above the parliamentary crossing on the direct line.

3. That the proposed crossings of the Rangitata are in a direct line from the Ashburton to the above point on the Orari.

4. We think the Rangitata, though continually liable to shift in its wide bed, has little tendency to wear away its banks, and with such an extent of bridging as we have suggested, the line of railway would incur no risk.

We would suggest, in the construction of the bridge over the Rangitata, the simplest style of skeleton trestle with good piles of hard Australian timber, heavily shod with steel-pointed shoes; the boulders and shingle in the river bed being large, nothing but the best piles and heavy shoes would stand driving.

We are of opinion that a strong and durable bridge could thus be built upon the line suggested for a sum but little in excess of the amount required for the additional works on the upper route, thus saving the annual outlay of £2,600 referred to above for extra engine-power and maintenance on the upper route.

CHARLES NAPIER BELL, M.I.C.E.,
THOMAS SELBY TANCRED, District Engineer.

J. Carruthers, Esq., Engineer-in-Chief.

RANGITATA BRIDGE.

Weights on Span.

	Lbs.	Tons.
Weight of girders, 8 tons = ...		16
Weight of cross girders, 800 lbs. each × 9 = ...	7,200	
Road bearers, 104 cubic feet @ 35 lbs.	3,640	
Planking	10,850	
Ballast, 62 × 13 × ¼—201 cubic feet	44,120	
	45,810 =	20·5
Fixed load		36·5
Rolling do.		60·0
		96·5
Load on each girder		48·25

W

A′ 12 sq. inches $\frac{a.d.c.}{c}$ = 83 = 6 times maximum load.

d = 78
l 756
c 75

W = 48·25 tons S = $\frac{Wl}{8d.}$ = 58$\frac{8}{12}$ area bottom flange, 4·8 strain per inch.

l = 6·3 feet.
d = 6·5 feet.
s Strain centre.

Consequently the girder is barely strong enough. Road-bearers also require to be made heavier.

Weight of roadway on each cross girder	1·35 tons.
„ rolling load (say)	6·6 „
Strain due to distributed load = ...	2·5 „
„ „ rolling load = ...	24·0 „
Area bottom flange cross girders = ...	3·2 sq. in.

Consequently cross girders too weak.