

Going Southwards—					Miles.
Extra traction power required 315 feet height =	...	...	...	...	19.75
Less descent by gravity only	...	...	...	...	9.0
					10.75
Going Northwards, 312 feet =	...	...	...	...	19.25
Less descent by gravity only	...	...	...	...	21.0
					1.75
Average power required for ascent	...	...	...	...	19.0
					4.50
Additional length saved	...	...	...	...	5.50
					10.00
Cost of engine power, at per train mile, 1s. 9d. =	£0	17	6		
Cost of maintenance, at per train mile, 2s. on 5½ miles	0	11	0		
	£1	8	6		
Less wages of guard, driver, stoker, per train	0	3	6		
	£1	5	0		
Trains per annum—					
Days of 6 trains, 313 =	1,878				
„ 4 „ 52 =	208				
	2,086	×	£1 5s.,	or £7 2s. 6d.	per day.
Saving per annum on traction, say =	£2,607.				
Saving of cost of construction on 5½ miles at £1,850 =	...	...	...	£10,175	
Extra works on line excavation	...	...	...	5,600	
„ culverts and diversion	...	...	...	1,000	
Metal for road, say 3,200 at 2s. 6d.	...	...	...	400	
„ fencing dis. 120 at £3 10s.	...	...	...	300	
				£17,475	

No. 4.

REPORT by Mr. W. N. BLAIR.
Rangitata Bridge.

SIR,—

Timaru, 4th September, 1872.

I have the honor to acknowledge the receipt of your letters of the 14th August and this date, forwarding a copy of Messrs. Bell and Tancred's report on the crossing of the Rangitata River, and asking if they are right in saying that the bridge is not strong enough to carry a railway, and also for information with reference to the strata gone through in sinking the cylinders.

The bridge was originally calculated for a dead weight of 10 cwt. and a moving load of 15 cwt. per running foot, with a maximum strain of 5 tons per square inch on the iron. The dead weight is however only a little over 7 cwt. per foot, so the rolling load may be increased to 18 cwt. without altering the strains on the metal. Besides, in designing the various parts of the girders a fair margin was left beyond the actual quantity required.

In calculating the strength of the bridge, Messrs. Bell and Tancred have taken the weight of the main girders at 16 tons, and each of the cross-girders at 800 pounds; the actual weights are 11½ tons and 676 pounds. They also propose to load each span with about 10¾ tons of ballasting, a thing which was never contemplated and which is not required. The total fixed load on each span assumed by them in calculating the strength of the bridge is 36½ tons; the actual load is barely 21 tons.

They have taken the rolling load at 60 tons, equal to 19 cwt. per running foot. A train of the ordinary locomotive engines used on the heavy English lines, which is the greatest load that can be put on any bridge of this description, would only weigh about 16 cwt. per foot.

I do not know the weight of the 5' 3" Canterbury locomotives, but two of the ordinary engines for the 4' 8½" gauge in Southland weigh 14¾ cwt. per foot.

Under "The Railway Act, 1870," the break of gauge is fixed at the Rakaia, so the locomotives requiring to cross the Rangitata must weigh very much less per foot than any of the above—in all probability 12 or 13 cwt. will be about the mark.

After allowing for the rails and timber work required to adapt the bridge for railway traffic, the total load on each girder will be 35 tons, as against 48½ taken by Messrs. Bell and Tancred. With the former weight the metal will not be strained to 4 tons per square inch. Notwithstanding the excessive loading, Messrs. Bell and Tancred's figures show only a strain of 48 tons on the square inch, which is lower than the standard of 5 tons fixed by the Board of Trade in England; and some bridges are built with a much greater strain; for instance, the metal in the Menai Straits Bridge is strained to 5.62 tons; the Newark Dyke Bridge, to 5.32; the Saltwater Creek Bridge, in Victoria, 5.29; and the Jumna Bridge, in India, to 5.14. When it is considered that the iron in the Rangitata Bridge can stand without injury a strain of 20 tons on the square inch, the margin is ample.