

The estimated cost, including rolling-stock and all other charges necessary to complete the line, is £1,505,000—say £15,900 a mile.

Difficulties of Construction.—In my report of 1879 I pointed out the difficulties of construction and excessive cost of maintenance on this railway, particularly at the crossing of the main range. The detailed surveys that have since been made show the difficulties of construction to be considerably less than was anticipated—not so much in cost as in the superiority of the line obtainable. It was then supposed that a fairly-workable locomotive-railway could not be got at anything like a reasonable cost; and the estimates were based on gradients of 1 in 7 with stationary engines, or 1 in 15 with central rails, as at the Rimutaka. The best locomotive-gradient calculated on was 1 in 33, and even this was not supposed to be obtainable at Arthur's Pass.

As already stated, the ruling gradient on the latest surveys is 1 in 50, with $7\frac{1}{2}$ -chain curves, which is the same as on the Middle Island main line. Comparing this with other railways throughout the colony, we have,—

			Gradients.		Curves.
Auckland-Mercer	...	...	1 in 40	...	12 chains.
Napier-Woodville	...	...	1 in 45	...	7 "
Wanganui-New Plymouth	...	...	1 in 35	...	5 "
Wellington to Rimutaka Summit	...	...	1 in 35	...	5 "

Some of the locomotives already in the colony will pull 100 tons paying load up the Arthur's Pass incline as it is now laid out.

Although small when compared with some of the Alpine tunnels that have been constructed in Europe within the last few years, the Arthur's Pass tunnel is a heavy piece of engineering for a new country. It is of great length, inclines all in one direction, and large quantities of water are likely to be met with—a combination of circumstances that can only be met by a liberal expenditure. Beyond this, however, the difficulties are not serious. There has of late years been a great improvement in the art of tunnelling, and the streams in the vicinity afford ample water-power for machinery, so, considering its magnitude, I have no doubt the work could be done in a reasonable time and at a reasonable cost. Four and a half miles of the St. Gothard Tunnel were pierced by machinery at the rate of a mile and a third per annum.

Maintenance.—With reference to the maintenance of the East and West Coast Railway: In the Waimakariri Gorge it will always be very heavy, for the line in many places cuts into loose sidling ground that slopes a long way up the ranges. The best remedy for this evil is tunnelling, which should be resorted to if the slips become excessive. I have no doubt there will be considerable trouble with slips in the Otira during construction and for some time thereafter; but I do not think it will be a cause of heavy expenditure permanently, for on the West Coast, where there is so much rain, the steepest slopes quickly get covered with vegetation.

HOKITIKA-GREYMOUTH RAILWAY.

This line does not call for a very minute description. It extends along the coast between the two towns named. Practically, the railway is level throughout, and the curves are very easy. With the exception of about 22 chains of expensive bridging at the Arahura and Teremakau, there are no works on the line worth mentioning.

The length of the railway is $23\frac{3}{4}$ miles, of which $5\frac{1}{2}$ miles are finished, and $4\frac{3}{4}$ miles more partly formed. The expenditure and liabilities to date are £41,839, and the estimate to complete is £180,000; which gives a total of, say, £220,000—equal to about £9,170 per mile.

WEST COAST-NELSON RAILWAY.

Route.—This line commences at Brunnerton, the present terminus of the Greymouth-Brunnerton Railway, and follows the Grey Valley right up to the watershed between that river and the Inangahua, near Reefton. The saddle is pierced by a short tunnel, and the valley of the Inangahua followed down to the confluence of that river with the Buller, at which point the branch from Westport joins. The Buller is next followed up on the southern bank to the Mangles, and thence on the northern bank to the watershed near Tophouse. A descent is then made to Belgrove by the Big Bush, Blue Glen, Ray Saddle, and the Wai-iti Valley.

Surveys.—As already stated, there is only an ordinary preliminary survey of the railway from Nelson Creek to Tophouse. It is, however, sufficiently in detail to give a fair idea of the line and works, including the $2\frac{1}{4}$ miles already formed. A contract section has been made of nineteen and three quarter miles out of the twenty-seven between Tophouse and Belgrove, and an ordinary preliminary survey of the remainder.

Alignment and Levels.—The survey of the portion between Brunnerton and Hope Junction having been made in 1874, when the standard was lower than at present, there are a considerable number of 1-in-40 gradients, with 6-chain curves. These are, however, quite unnecessary, for the sections in many of these places show practically a surface-line. Gradients of 1 in 65 or 70, with $7\frac{1}{2}$ -chain curves, can easily be got all the way from Brunnerton to Tophouse; and there is no necessity to adopt curves anything so sharp as this on the portion between Brunnerton and the Inangahua Landing.

As there is a fall of 1,940ft. over irregular country in the twenty-seven miles between Roundell Saddle, near Tophouse, and Belgrove, the 1-in-50 gradients, with $7\frac{1}{2}$ -chain curves, cannot be avoided at anything like a reasonable cost. This is, however, the only long incline on the whole line, and it is in favour of any heavy traffic that comes from the west. Furthermore, the incline is not continuous, as at the Otira, there being several breaks in it—the largest stretch of 1 in 50 is about $6\frac{1}{4}$ miles.