

1894.
NEW ZEALAND.

NORTH ISLAND MAIN TRUNK RAILWAY.

REPORTS OF EXPLORATORY SURVEYS BY MESSRS. R. W. HOLMES AND R. DONKIN,
WITH MEMORANDUM BY THE ENGINEER-IN-CHIEF.

Laid on the Table by the Hon. R. J. Seddon, by leave of the House.

Public Works Office, Wellington, 20th August, 1894.

Hon. the Minister for Public Works.

Re Surveys of Proposed Routes for North Island Main Trunk Railway.

THE Resident Engineer, Mr. R. W. Holmes, who has been engaged in exploring and running trial lines for the proposed deviation of the central route between Ohakune and Poro-o-tarao, *via* the Ohura Valley, and Mr. R. Donkin, C.E., who was specially employed to survey a line from the Waitara Railway, by way of the Urenui River, to Tangarakau, on the Ngairu route, which was surveyed in 1889, have sent in their reports of the explorations and surveys conducted by them on these routes.

Ohura Deviation.—With regard to the surveys executed by Mr. Holmes with a view of obtaining a better line for the railway on the central route by a nearly direct course from the present surveyed line at Ohakune to the junction of Ohura with the Wanganui River, thence by the Ohura Valley till it would join the Ngairu line about Nionio, the Engineer has made a thorough examination of the whole country along the route from Ohakune to the Wanganui River, and his report, which gives a full description of the character of the country gone over, indicates very clearly that no practicable line for a railway can be obtained in this direction that would be any improvement on the line previously explored for the central route, and avoid the rise over the Waimarino Plateau.

Urenui Route.—The work done by Mr. Donkin on this route consists of exploring and making a careful trial survey of a line for a railway for a length of eight miles along the Urenui River, from a point on the Waitara line surveyed several years ago by Mr. James Blackett, 11 miles 30 chains north from the Waitara terminus of the opened railway, and a rough traverse for a further length of five miles along the valley of a small stream called Mangawhero, and over the dividing-range between the Urenui and Waitara Rivers, to the Tangita Creek, a total length of thirteen miles.

Of the eight miles of surveyed line along the Urenui Valley, the plans and sections prepared by Mr. Donkin show that, for the first two miles, the formation would be light, but as the line skirts the base of the hills on the south side of the river there are frequent curves and changes of direction in the alignment; and for the next six miles the valley narrows in, so that, except in one or two places where it crosses short flats at the bends of the stream, it runs along the hill-sides, which have numerous steep spurs running out to the river-banks; consequently, there are numerous curves and short straights, and the earthworks required in formation will be heavy. From the end of the surveyed line at 8m., the plan of the rough traverse shows that the line is over rough country, crossing a number of gullies of varying depths, until the point where it is proposed to tunnel through the range is reached; this portion, about 2 miles 13 chains in length, is supposed to be on a grade of 1 in 50, which is carried through the tunnel a further length of 62 chains. At the east end of the tunnel the line is along the Pehu Creek for about a mile, but there is no section of this length to indicate what the contour of the ground is like. Except at the two miles in the entrance of the Urenui Valley, the land on this line is very rough and broken, and therefore unsuitable for agricultural and close-settlement purposes.

As compared with the Waitara line, *via* the Mimi River, surveyed by Mr. Blackett, the Urenui line recently surveyed cannot be considered superior in any respect, as, except for about three miles on the Waitara line—where the works would be very heavy—the character of the country is similar on both. Besides, the Urenui line will be longer than the Waitara line, which, for thirteen miles north from the starting-point of the Urenui line is over exceptionally easy country, about six miles of which is in old settlement.

WILLIAM H. HALES.

Public Works Department, Feilding, 7th April, 1894.

Memorandum for the Engineer-in-Chief, Wellington.

North Island Main Trunk Railway.—Marton—Te Awamutu.

I HAVE the honour to submit the following report on the explorations recently carried out with a view to improving the line adopted for the central route of the North Island Main Trunk Railway between Ohakune and the Porotakau Tunnel:—

The drawbacks to the original route are, briefly: The rise to the Waimarino Plain, and

consequent addition to the long downgrade to the Wanganui River at Taumaranui; and the poor nature of the country in the region of the Waimarino Plain and the Ongarue Valley.

The objects in view were, therefore, to obtain a line which should not rise any considerable height after passing Ohakune until after crossing the Wanganui River, and which should pass through country more suitable for settlement by means of small farms.

To effect these objects, the idea was to utilise the Valley of the Ohura River, a long tributary from the westward of the Wanganui River, which valley was known to be suitable for railway construction for a considerable distance, having been previously explored for three-quarters its whole length in connection with and utilised for some twenty miles for the Stratford route of the North Island trunk line, surveyed a few years ago. Such a course would therefore aid in shortening the Stratford line, the future connection with Taranaki, to the extent of one-quarter of its length.

The first efforts were devoted to obtaining as direct a line as possible from Ohakune to the Ohura Valley.

The confluence of the Ohura River with the Wanganui River lies due north-west (mag.) from Ohakune. Following this course for about nine miles the country is a slightly undulating plateau, with a decided slope in the direction of the courses of the rivers, so that the rises and falls caused by the undulations could be lessened or avoided altogether by contouring. At the end of the 9m. the elevation is about the same as at Ohakune. A sudden change in the features of the country then occurs, the plateau being succeeded by a mazy succession of sharp ridges and gullies with precipitous sides.

This necessitates following the valleys to obtain a suitable line, and forces a slight deviation to the westward from the course.

The main valley of the Manganui-o-te-Ao River first presents itself, being followed down to the confluence of the Pekanga Stream.

The lowest level reached in the Valley of the Manganui-o-te-Ao is where the turn up the Pekanga Valley occurs. It is about 1,000ft. below Ohakune. This descent is accomplished by a continuous grade of 1 in 50 from the 9m. point.

A tributary of the Manganui-o-te-Ao River, called the Orautaha, would be followed a short distance on the plateau between 8m. and 9m.; thence, as this valley falls too rapidly to be utilised, the line would have to turn up the Manganui-o-to-Ao Valley in order to obtain sufficient distance for the grade. This makes the lowest point at the Pekanga Stream, about nineteen miles from Ohakune. As the general fall in bottom of the valley of the Manganui-o-te-Ao River is approximately as steep as the grade of the railway, it necessarily follows that the valley must be followed up to reach the bottom. This is an objectionable feature, causing an increase in distance without getting ahead.

The line would then follow up the Pekanga Stream for half a mile, and enter the valley of the Mokau Stream by means of a tunnel, some 25 chains in length, through the intervening ridge.

The Mokau Stream would then be followed up to its source in the divide between it and the Retaruke River, requiring a rise in the time of some 900ft. The actual saddle is about 1,100ft. above the lowest point, or 100ft. above Ohakune; but about 200ft. of the rise can be avoided by tunnelling, thus reducing the summit-level to the 900ft. mentioned above.

The line has now proceeded about thirty miles from Ohakune, and arrived at a point only 100ft. below that place—i.e., instead of fulfilling the object of not rising any considerable height before crossing the Wanganui River it has risen 900ft., or some 200ft. more than the original route.

Further progress along this route was barred by the country ahead consisting of precipices, down which it would be impossible to construct a line limited to 1-in-50 grades with anything like reasonable expenditure. Further examination of this route was therefore abandoned.

The country passed over to 9m., being a plateau with fair soil, offers special facilities for settlement. Beyond this the country is simply a mass of precipitous hills and gullies, being fit for little else than a forest reserve.

Both the Pekanga and Mokau Streams run in small gorges with precipitous sides in the valley-bottom, the spurs from the main ridges on either side generally running out to the creek gorge and terminating in a bluff, rendering travelling along or across the valleys an extremely difficult and arduous undertaking. This formation of the country will also cause road construction anywhere but on the ridge-tops to be almost impracticable. The main valley of the Manganui-o-te-Ao River is also very broken, the river having for miles perpendicular banks on both sides cut in the sandstone, varying in height from 40ft. or 50ft. to 100ft. or more. In other places, the banks are easy slopes, alternating with high bluffs, so that a fairly even road parallel to the river is out of the question.

As regards scenery, both picturesque and grand, the valley of the Manganui-o-te-Ao River, in its present state, with its clothing of indigenous forest, will be difficult to surpass, and would prove a great attraction to tourists. No doubt, a road judiciously located with this object between the Wanganui River and the Waimarino Plain, *via* the valley, would form part of a high-way from Wanganui to Rotorua, which, as a tourist route, could not be excelled in New Zealand.

The geological formation of the country in the region of the plateau is distinctly volcanic, the subsoil being volcanic tufa, whilst the rest of the country consists of a soft sandstone, interspersed with fossil remains of sea shell-fish and indurated pieces forming boulders.

The bush consists of rimu, kahikatea, tawa, matai, towai (*Weinmannia racemosa*), rata, hinau, maire, pokako, with a few kawhaka and totara trees on the plateau, and some beech near Ohakune and on some spurs down the Manganui-o-te-Ao Valley, *Fagus fusca*, *F. cliffortioides*, and *F. menziesii* being noticed.

The soil on the broken country appears to be generally of good quality, and much superior to that on the plateau, the difference being very marked as the mountains are approached.

If the country were a little less broken, the superior quality of the soil could be taken full advantage of, and a large population located on some small holdings, with an outlet for their produce by the Wanganui River, *via* the Valley of the Manganui-o-te-Ao, but as it is the rougher parts are only suitable for forestry, the rest for large sheep- and cattle-runs. There can be no doubt that when the bush is felled and the roots decay a large percentage of the surface-soil will be lost

through slips, which will disclose the absolutely barren surface of the sandstone beneath, a result far from satisfactory to the settler, the smaller ones in particular.

In many places patches of young bush were noted, in which towai (*Weinmannia racemosa*) predominated. By searching the humus, charcoal was invariably discovered, showing that the original bush must have been destroyed by fire between fifty and a hundred years ago. It is a peculiar circumstance, and one which I am at a loss to account for, having never observed similar patches before, except in places which had undoubtedly been Native settlements.

The constructive works required to form a line of railway to the 30m. point would be very easy for nine miles, the formation and culverts especially, while the rivers to be crossed—viz., the Mangawhero, Taonui, Makotuku, Makara, and Orautaha—would only require short and low bridges, of a simple type; but beyond this point the line would offer special scope for the exercise of engineering ingenuity, in constructing every variety of formation and bridge-work, from the lightest to the heaviest description; the precipitous side-lying ground, narrow spurs and ridges, and gorgy creeks would require very numerous tunnels, bridges, and culverts, and therefore render the cost of construction extremely heavy.

Another drawback is the almost total absence in the broken country of sites suitable for station purposes.

This route has been abandoned for the following reasons: (a.) Impracticable beyond the Manganui-o-te-Ao Retaruke divide. (b.) Large rise to the top of same divide. (c.) Heavy cost of construction.

Referring to the first reason, it may be as well to observe that had the route proved easy as far as the 30m. a very heavy expenditure might have been concentrated on a short distance, and the divide negotiated by means of a long tunnel, between a mile and a half and two miles in length.

Finding a direct route to be impracticable, attention was given to a more circuitous route *via* the Retaruke Valley, leaving the original route immediately on entering the open country, a short distance to the northward of the Makatote Gorge.

This line would, after crossing the Waimarino River, immediately pass the divide by means of a short upward grade and a tunnel, and enter the head of the Retaruke Valley; it would then immediately descend to the valley-bottom, 1,500ft., by a continuous 1-in-50 grade; thence it would follow down the valley until the confluence of the Ohura River with the Wanganui River bears W. $\frac{1}{2}$ N. mag. 276°; thence it would follow up a small tributary, rising about 300ft., and pass through the intervening ridges by means of one or two long tunnels to the main valley of the Wanganui River. Once this valley is reached in the vicinity of the Ohura River all difficulties are overcome. The Ohura Valley, although crooked, does not present any serious difficulties to the construction of a railway.

The Waimarino Plateau is left immediately on crossing the Waimarino River; thence the country is all ridges and gullies, except in the bottoms of the Retaruke Valley and two of its tributaries from the eastward, where a little flat land of very poor quality occurs, the subsoil being pure pumice, which in many places extends to the surface. The 1-in-50 grade at the head of the valley would, if located on the left or western side, adhere closely to the main valley, but if located on the eastern side it would leave the main valley and turn up one or more tributaries, which would probably be an advantage, as the left side would most likely prove too straight to give the required distance. Both sides of the valley towards the upper end are very steep, especially high up, where in many places bare cliffs show up above the bush, but the right side appeared the more suitable for railway construction purposes.

One feature peculiar to the whole, but more particularly to this part of the country, and which requires special notice, is that the numerous spurs to be passed nearly at right angles by a line of railway could not be graded round, but would in most instances have to be tunnelled through, owing to their being too sharp and narrow to allow of turning round the ends with the maximum sharpness of curvature allowed. The alternating gullies would, owing to similar reasons, require to be bridged in many cases.

The bottom of the Retaruke Valley has been shortly described as flat; more fully it should rather be described as having flats in it, lying at different levels, thus forming anything but an even surface. The river, as is generally the case, runs from side to side, cutting up the valley-bottom in a very irregular manner. The bed of the river in its upper part is generally open and shingly, with low banks, but as it descends the valley the banks gradually become much higher and precipitous, forming small gorges in many places, with papa rock bottoms and sides. To construct a line along the bottom of the valley would, therefore, be anything but easy.

The sandstone of the Manganui-o-te-Ao Valley is intermixed with the ordinary blue papa in the bottom of the Retaruke Valley.

To follow down the Retaruke Valley to its junction with the Wanganui, thence upwards to the Ohura Valley, would not improve the route, because it would be very much longer, and because the last five or six miles of the valley narrows in, forming a vast gorge, with bare sandstone precipices on each side, the summits being over 1,000ft. above the river, and also because the Wanganui Valley for about half the distance between the Retaruke and Ohura confluences is very narrow and gorgy.

The bottoms of the Retaruke Valley and the two tributaries already referred to are covered with fern, manuka, tutu, and other small vegetation, the rest of the country being covered with bush similar in character to that existing on the former route.

Finding the Retaruke Valley so rough, and not considering it suitable for the trunk line, I, in accordance with instructions, did not examine the lower part with that minuteness which would otherwise have been advisable, nor did I proceed beyond Tawata and Maraekowhai on the Wanganui River.

I tried to obtain a canoe at Tawata, so as to more fully examine, quickly and at little cost, the Wanganui and Retaruke Valleys for about four miles above the confluence in each case; but the Natives, in the absence of their chief, would not oblige me. There is no doubt but that a line of railway could be constructed *via* the Retaruke Valley, but I am decidedly not prepared to recommend the route for the trunk line, on account of—

1. Large increase in distance, which would to a great extent counteract any advantage gained by shortening the Stratford connection.
2. Non-avoidal of rise to Waimarino.
3. Increase of rise and fall.
4. Very heavy cost of construction.
5. Poor country in Retaruke Valley.

R. W. HOLMES, Resident Engineer.

P.S.—There is a very marked difference in the characteristics of the Manganui-o-te-Ao and Retaruke Valleys, caused by the fall in the former being evenly distributed along nearly its whole course, whilst in the latter case the bulk of the fall takes place within the first three or four miles, the remainder of the valley having a more gentle slope. The scenery is also very different, that of the former valley being varied and grand, as already described, whilst in the latter case there is a sameness and absence of striking features, which makes it unattractive.

A tracing showing the two routes herein referred to is attached.—R. W. H.

New Plymouth, 2nd July, 1894.

SIR,—

Urenui Route.

I have the honour to report as follows *re* the survey of part of the Urenui route, North Island Main Trunk Railway, which commences at a point 11m. 30ch. on Mr. Blackett's Mimi line, near the bridge over the Urenui River :—

The line from here winds up the valley of the Urenui River through open country, until the river is crossed. The work consists of a few light cuttings, sideling, and flat land. After crossing the river the bush-country is entered, and continues the whole distance of the survey. A bridge of about 60ft. long, with one or more openings at each end, according to the height of the approaches, will be required to cross the Urenui River at 2m. 62ch.

From this crossing to the 3m. 70ch. peg, where not flat, the line passes along sideling cuttings on narrow, sharp spurs, excepting at 3m. 4ch. and 3m. 15ch., where the line passes through narrow spurs.

From 3m. 70ch. to 5m., where the cross-section is not flat, the line is a long sideling of the ordinary character.

At about 5m. 68ch. a sharp, narrow spur is passed through. Thence to 6m. 30ch., where a spur-end is passed through; the work is of the usual class—sideling or flat.

From here to 6m. 41ch. cross-section is flat. At 6m. 41ch. the River Urenui is again crossed by a bridge of a similar class to the first one, at 2m. 62ch.

From this crossing to 6m. 78ch. the cross-section is flat and the line easy.

At 6m. 78ch. the River Urenui is crossed for the last time by a bridge about 50ft. long, with usual openings at each end. From hence to 8m. 15ch. up the Mangawhiro Creek the work is of an ordinary character—viz., flat or sideling of an easy class.

At 8m. 15ch. a gradient of 1 in 50 commences, and for 2 miles 15 chains leads up to the seaward end of a tunnel. To this point there are no engineering difficulties.

The tunnel will be about 55 chains long, through papa formation. The approach to the tunnel at the inland end is level.

The line then continues from the inland end of the tunnel, with an easy grade and very moderate work, to the "Tangitu" Creek, which is a tributary of the Waitara River.

The line from the end of the tunnel to the twelve-mile peg on the "Tangitu" Creek is almost straight, and the creeks scarcely run, having very little fall.

The line has been cut further than the 12m., and a good track has been formed for some miles, which, if the survey is not finished, will, of course, be useless.

I could have got a line with a much shorter tunnel, but it would have been necessary to grade up for three miles along a very steep sideling, which would have been costly to construct in the first place, and consequently liable to be obstructed afterwards by land-slips.

It would have been also about four miles longer than the course I have taken. There would have been the maintenance of such extra mileage ever afterwards; so that, altogether, I came to the conclusion that it was better and cheaper to lengthen the tunnel, to which a line could be obtained that would not be liable to be obstructed by slips of earth, &c.

I beg to point out that, excepting the tunnel, there are no difficulties but of the most ordinary kind so far as this survey has gone.

Also, that I know that the remaining portion that is now unsurveyed is much more favourable than that in the Urenui River Valley.

Of course, until this survey is complete it is impossible for any one to institute comparisons, but, from my knowledge of the remainder of the country through which this line is intended to pass, I have no doubt in my mind that, if the existing railway system of this Island is connected by any other route, it will cost a very large sum more than by the Urenui route.

Gravel for ballast will be found in a few places along the line.

The papa-formation prevails the whole distance surveyed. The country passed through is chiefly pastoral, but of a good class.

The soil covers the tops of the highest hills. The whole of this part of the country would be immediately settled if open for selection by the public. I have not been able to refer to gradients up the Urenui Valley, as I did not keep any sections of the line surveyed, but I know they are quite easy.

R. DONKIN, Civil Engineer.

The Hon. the Minister for Public Works.

Approximate Cost of Paper.—Preparation, not given; printing (1,375 copies), £2 8s. 6d.

By Authority: SAMUEL COSTALL, Government Printer, Wellington.—1894.

Price 3d.]