1884.

NEW ZEALAND

MAIN TRUNK LINE, AUCKLAND TO WELLINGTON.

(REPORTS ON).

Laid on the Table by the Hon. Mr. Mitchelson, with Leave of the House, and ordered to be printed.

CENTRAL ROUTE

Mr. J. ROCHFORT to the ENGINEER-IN-CHARGE, North Island, Wellington.

SIR,— Nelson, 5th February, 1884.

Having completed the exploration for a line of railway between Marton and Te Awamutu, I have the honour to report as follows:—

Starting from Marton the country over which the line runs is principally open, and presents no difficulty, the Pourewa being reached by a side-cutting from the terrace of the Rangitikei almost on a level. The line then follows up the Pourewa Valley to about three miles beyond Hunterville, and thence crosses to the Rangitikei. The Pourewa is all flat bush of good sawing quality, and the land is good; the river is about 20ft. wide, and, winding much about the flat, will have to be bridged several times in order to run the line straight; ballast can be got near

The Rangitikei Valley lies about 150ft. below the level of the Pourewa where the most favourable place for leaving the latter occurs. The Rangitikei River is generally confined between marl (*papa*) cliffs 150ft. to 200ft. high, but there are occasionally lower terraces, a large one occurring at Otairi, where there is a Native settlement. It is free from side gullies of any importance, and the hills which bound the terraces are generally of very easy slopes. The Makohine, at 30 miles, a detail of which is shown on the section, forms a break in the line of considerable difficulty, owing to its great depth below the terrace levels; but, as the creek itself is only 30ft. wide, and the opening V-shaped, the deep part of the viaduct would be confined to a short distance, pier foundations easily obtained, and any work done built on dry land. On careful survey considerable modifications might be effected. Near the confluence of the Hautapu (44 miles) the bluffs are rather higher, and several spurs run down to the bluffs through one a tunnel of perhaps two chains will be necessary, and the grading will then run nearly level into the Hautapu. About three miles of the Rangitikei is open grass and fern, the remainder bush of good mill timber—pines, rimu, totara, tawa, and maire-totara. The soil is very good, as the soil usually is overlying marl formations.

The Hautapu Valley as far as 66 miles is similar in character, with high marl cliffs and terraces above, occasionally a spur coming down and ending in a higher bluff on the river, which will cause side-cutting; at 53 miles there is a limestone outcrop. These spurs almost invariably widen out into a terrace more or less long near the river, with high bluffs, but narrow into a razor-back ridge behind, often actually of a lower level. The timber and soil are both excellent. There is one old Native clearing, overgrown with scrub, of about twenty acres at the lower end of the river. There are no side gullies of importance, and no large creeks as at the Rangitikei, culverts will generally carry the drainage. The north-east side of the Hautapu appears to be very considerably rougher. Ballast can be got in creeks near the Hautapu confluence, but I did not see any between there and the 66 miles.

From 66 miles to 79 miles will be side-cuttings and flats about half open, the side-slopes are easy, and the land very good. I believe that, on survey, the grades will work out much flatter, as it is a matter of impossibility to judge distances accurately, and to the eye the river appears much flatter than the section shows. All the country towards Ruanui and Raketepauma, lying west and north-west of this, is very good up to the edge of the Murimotu Plain. Turangarere and the highest point of the Waihora will both be places of importance, the former as the nearest point to Patea, the latter as the probable connection with Tokaano and Taupo; and a few miles lower the Murimotu Plains will connect with Wanganui.

From 79 miles to 84 miles the river has open grass and fern flats nearly all along, and limestone outcrops occur along the hill-sides about 50ft. above the valley Above, on the hill-tops, which are generally table-lands, there are considerable totara forests. Near this point (84th mile) the line follows a small branch of the Hautapu called Waiouru, which penetrates clear through the hills on to the Murimotu Plains. The Waiouru takes its rise near 86 miles in an extensive swamp of several thousand acres, which is good land. The land may also be considered good three or four miles below this point. The Makiokio and Waitangi have limestone outcrops on the flats. From 88 miles down past Karioi to the beginning of the forest the land is very poor made so from the large admixture of pumice-sand. It is found that one burning of tussock grass completely takes the life from the soil by destroying the little organic matter there is in it.

In two miles from the entrance to the bush, 98 miles, the timber is birch, and the soil, although richer than the open land, is poor, but after that the timber is large and fit for sawing, and the land flat and good for about eighteen or twenty miles. The flat is five to ten miles wide, and all country lying between it and the Wanganui River (some twenty miles in breadth) is formed of low marl hills, the land good, the timber principally tawa. On the side of the flat next the mountain Ruapehu there is a table-terrace land some fourteen miles long, from Raitihi to Manganui-a-te-Ao. This table-land is generally poor, but heavily timbered with rimu and kaikawakaroa, and some white pine, maire, and totara but the country and timber below it are good to the Wanganui River A part of this table-land would be traversed by the railway, and the crossings of two of the affluents of the Manganui-a-te-Ao, called the Manganui-a-te-Ao and Mangatote, are bad, being wide, deep depressions, one 100ft. and the latter 200ft. deep; but I ascertained, by going up these rivers a short distance, that they could be crossed without any extraordinary engineering work.

From Mangatote, 119 miles, to 121 miles, where the forest ends, the soil is good and from there to about 124 miles are the Waimarino Plains. These are not better than the Murimotu the growth is tussock-grass. The Natives have a number of horses and cattle, but they are generally poor. This is a central point from whence branch lines could be taken eastwards to Rotoaira, Tokaano, and Tapuaeharuru in Taupo, all of which are large hot-spring areas, the nearest (Rotoaira) being only fifteen miles, and Tokaano about thirty miles, distant from this railway route. It is also a good place for a branch line on the west side to the Wanganui River about Retaruka and Ohura, and from thence to Lower Mokau and the west coast. This is the highest part of the line, being about 2,600ft.

From 126 miles to the Matakerepuru Falls the line is through forest, and follows down the Piopiotea River (which is a branch of the Wanganui), on terrace land varying from 40ft. to 100ft. above the river There are a few side gullies coming in, with very small watercourses, only requiring culverts, but the gullies die out and can be avoided by going back a little. I do not feel sure this is the best line, although it appeared to me to be so from the Hahungatahi, which I ascended for the purpose of choosing a direction. The country all falls towards Taumaranui, and it would be advisable to try another line skirting the rear of Kirikau Block before finally locating the line. (I may here again refer to the grades, which on the section in several places show as heavy, while on the ground they appear the reverse, and can only ascribe it to the difficulty of judging the distances. I am sure very satisfactory grades can be got all through. The land and timber are both of good quality, and the land generally marl, the timber tawa, rimu, pines, maire, and totara—trees very fine for sawing purposes, in fact (excepting, of course, the open land) saw-mills might be profitably located nearly all through.

At 138 miles, on the Piopiotea River, occurs the Matakerepuru Fall, probably not previously seen by any European, and by very few Natives. It is an object of great interest the whole river, some 90ft. wide, shoots over a precipice 60ft. deep, springing clear from its bed in an unbroken transparent arch, through which the ferns and growth beneath can be seen as through a window, on one side there is a sort of cave hollowed in the *papa* rock, which is coloured red and yellow with iron oxide; the banks of the river above and below are lined with trees, which overhang the river cliffs, and add to its beauty Below the fall the river falls rapidly, and swirls and eddies in heavy rapids for about 10 chains while above it for a long distance the water is still, deep, and lake-like. Below this fall for ten miles the country is almost a dead flat, covered with timber (except a natural clearing called Ohongo, which is grass and scrub)—totara, tawa, rimu, maire, matai, and kahikatea, most of the bush is good in some parts pumice shows, but even there the timber and soil appear good.

From 148 miles to within four miles of Taumaranui the line would be sometimes graded and sometimes on terraces till it reached the level of the Wanganui River, no rock would be met with, and the side slopes are light.

From 155 to 159 miles the line would run along the flat of the Wanganui River, crossing the latter about a mile and a half above Taumaranui. This bridge would be about 300ft. long, but the bottom is small shingle, and pile-driving would be easy the river is fordable on horseback. The land about Taumaranui is good, though some pumice shows in it, and it is good for ten miles above. There are many Native settlements in the neighbourhood. Below Taumaranui, on the east side of the Wanganui River, there is an extensive flat called Makokomiko, some fifteen miles long, extending to Kirikau, said by the Natives to be of good quality There is other good land towards Tuhua in this direction, if anywhere, gold will be found.

From Taumaranui (159 miles) nearly to its confluence with the Maramataha the country is open fern, good in the valleys, poor on the hillsides, and good again on the higher lands, which are generally bush. The line follows up the River Ongaruhe, crossing, about seven miles up, at 165 miles, with a bridge about 150ft. long the banks are level and low and the bottom shingle. There are seven Native cultivations and five occupied pas, and the Natives possess and use ploughs and horses.

From 179 miles to Waimika (184 miles) the country is poor, and the river passes through a short gorge. At the Waimika there is an extensive plain lying between the Ongaruhe and Waimika,

but the land is exceedingly poor I followed a considerable distance up each of these rivers with a view of finding a better route, but each has formidable gorges a few miles up, and leads off in an unfavourable direction.

At 184 miles there is an extensive Native pa, with large cultivations of good land up on the hills some 300ft. or 400ft. From the Waimika the line goes up a small creek called Ohinemoa: fern for about two miles up, and good land. At the head of this creek, which is bush, there is a watershed, which will have to be pierced with a tunnel some 20 chains long. There are two ways of overcoming the hill one by grading up from 179 miles, mostly over open hill land and terraces, in which some of the cutting would be rather heavy, and soft sandstone rock would be met with occasionally, the other, to which I give the preference, would be to follow up the Ohinemoa at a lower level, and pierce the hill with a tunnel into a branch of the Mokau called Te Mangapihi. The work on this line would be much lighter, but two bridges over the Ongaruhe would be necessary, one of 70ft. and the other of 120ft.

From this point to Te Awamutu (some seventy miles) the country may be called all good, and, with the exception of about four miles, is all open.

The Mangapihi, a branch of the Mokau, contains limestone, and the line follows it down for about three and a half miles. It is a flat grass valley, with its stream flowing without rapids, and has open hills with occasional bush patches on either side. The land is of good quality

At 194½ miles the line crosses a low place in the watershed into the Paritikona, which is followed down about three and a half miles, and from thence, at 198 miles, crosses another low place in a watershed to the main stream of the Mokau, which is followed down seven or eight miles. Each of these valleys is similar to the Mangapihi. Another low watershed is now crossed into the Waititi, which is nearly all open fern and grass, with perhaps a mile of bush. The land in this valley is also very good, but the valley falls rather quicker, and about six miles down it joins the Mangaokewa, which is at this point a rocky limestone gorge. Just beyond a low place occurs in the hills very suitable for the railway, which leads direct to Te Kuiti. It is remarkable that all these watersheds are mere razor-backs one to two chains wide, consequently the earthwork will be inconsiderable.

Te Kuiti, the former residence of King Tawhiao, contains a number of whares. Above Te Kuiti the Mangaokewa runs through limestone gorges, and does not offer inducement to seek the other route of the Ongaruhe or Waimika. From Te Kuiti to Maraeohine is splendid grass and fern country, following down the Mangaokewa, Mangapu, and Waipa, which have flats of considerable width, and some large patches of timber, chiefly white-pine and pukatea.

Brown coal is visible in a creek which I visited near the Mangawhero, some five miles off the railway-line.

A low watershed occurs at Maraeohine, another across the Mangaorongo, and another near Puniu, all of which are inconsiderable. This latter place is all open country, and presents no difficult feature.

The length of the line shown on my section is 244 miles, which corresponds with my field-book, but which I could by no means find room for on the map. The difficulty of judging distances is very great, and can only be a rough approximation, especially as the only marks I could make use of were the larger mountains, which are themselves not yet correctly placed on the maps. I consider the line will not exceed 200 or 210 miles in length at the outside, and I am also of opinion that, on survey, the grades will work out more favourably, probably nowhere steeper than 1 in 80. The probable cost per mile, including everything except land, may be estimated at from £6,000 to £6,500.

In conclusion, I may say that I made notes all through my trip of whatever seemed to be of value in the way of information but, the time being so short in which my plans and report have to be prepared, I have not attempted to mention anything beyond what is required in a report of an exploratory survey

I have, &c.,

The Engineer-in-Charge, North Island, Wellington. JOHN ROCHFORT.

Appendix to Mr John Rochfort's Report.

FINDING my report as to the line of railway would become complicated by attempting to introduce any particulars as to the Natives encountered along the route, I do so in the form of an appendix.

Before commencing work I obtained letters from Mr. Woon and the Rev T Grace to the following Natives along my route Hoani Mete, Wiari Turoa Ma (Porewa) Nika Waiata, Teata Pikirau, Ropana (Ngahurukehu) Meriana, Patihapa (Raketepauma) Porokoro Patapu (Murinotu), Meiha Keepa, Aropeta Haeretu, Paora Patapu (Murimotu and Ranana), Hirika te Raupo, Ihakara, Meiha Topia Turoa, Te Heuheu, Matuahu, Kingi te Harakeke, Kingi Topia, &c. (Murimotu, Taupo, and Tokaano) Ngarupiki, Tukimata, Ngatai (Tuhua)

26th June.—I commenced work at Marton, and after about a fortnight, during which it rained almost incessantly, arrived at Ngahurukehu. At Turangarere, where I first met any Natives, they were unwilling to let me pass until a general meeting took place but, as the opposition was feeble, I went on, and have since had a letter from the same people, requesting me to come again and see the advantages they had to offer for the railway coming there.

On arriving at Kerioi I was stopped by the Natives (said to be twenty armed men, but found afterwards to be only six) occupying part of the Rangataua Block (Government land) who allege that Adamson (employed by me on the work) had sold land on the part of Nika Waiata—the woman who is living with him, and who, by the way is a great warrior—to the extent of three thousand acres more than belonged to her Pita te Rahui and others were said to be placed in possession of the Rangataua Block by Major Kemp and his council until satisfaction was had for the lost land, and I was informed that if I went on I should be shot. I soon found out that Adamson's presence only added fuel to the fire, and discharged him. Finding Major Kemp was the head, and that he

was at Upokongaro, I went down *viâ* Hales's Track, but was somewhat delayed by snow on the road down. I found Major Kemp at Upokongaro. He said the stopping me was done without his authority This is doubtful, but he at once said, I will support you and help you with five hundred men, if necessary, for I consider a railway will be for the good of my people." I returned to my work armed with letters from Kemp to Pita te Rahui, and also to some of the principal chiefs of Manganui-a-te-Ao. I returned, and met the stopping party at Rangataua. Pita te Rahui and Remona still held out, as owners of the part in dispute. However, I told them I had nothing to do with the land question, my work concerned the railway only, and that they would be lunatics to stop the railway, which would be a benefit to them. After a long *korero* they, obtaining the consent of a daughter of Pita te Rahui's, allowed me to proceed, and eventually came to work for me, cutting the line through their own district. This may by-and-by be a troublesome question, as they are still planting and occupying part of the block, which, according to Mr. Thorpe's survey, is part of the Government block (Rangataua). These same people are now very anxious for the line to be made, and asked me to get the fact of the Government approval of this line inserted in the Maori newspaper

From the Mangawhero (Ohakune) my course lay through Waimarino, near the Hahungatahi, and the country was said to be flat, with but some twenty miles of bush to get through, but there was a Native track which led to Ruakaka, a Native village some twelve miles below Hahungatahi, on the Manganui-a-te-Ao. To save swagging I took the horses through this track to Ruakaka, intending to follow up the River Manganui-a-te-Ao to Waimarino, and cut back to Ohakune. On arriving at Ruakaka I was compelled to pitch my camp within the Native village, and found that the Native, Paora Patapu, whom Kemp had promised to send up before me, had not arrived, and the Natives received my letters from Kemp and Woon with suspicion, alleging, after three days' *korero*, that if Kemp desired their concurrence he should have sent word up to them before now I had arrived among them without any notice, and they should take me back to Kemp. Accordingly I was marched back to Papatupu, some two miles above the confluence of the Manganui-a-te-Ao with the Wanganui, and there found about eighty Natives assembled I was kept there another two or three days. The principal men present were Taumata, Te Kuru Kaanga, Te Peehi, Winiata te Kakai, Manurewa, Turehu, Raukawa, Rangihuatau, Te Aurere, Huriwaka, Te Whaiti, Eniko, Kaiatua.

Rangihuatau spoke in a vacillating way, but said he was a Government man, Taumata was decidedly averse to the railway, and also to any Europeans coming on their land, and said if I had been taken on his land he should have cut up all my belongings in small pieces, and made slaves of myself and party, Te Kuru spoke against any violence, but was decidedly in favour of keeping Europeans away All spoke, but Winiata and Te Aurere (who were at heart in favour of the railway) were afraid to speak out and eventually letters were written to Kemp, and Mr Woon, and myself, saying if I returned a second time I should be turned back, and any Maoris who were with me would be killed, and if I returned a third time I should be killed. Taumata would agree to nothing, and strongly advised keeping us prisoners here, but several others (including Te Aurere, Te Peehi, Te Kuru, Turehu, and Taurere) were more moderate, and said if I could bring letters from Wahanui or Tawhiao they would not obstruct me. Taumata then came over to me and asked if I understood their ultimatum, at the same time observing, "If you come again, remember you will go to the ground." Then he asked me what I thought of his letter to Mr. Woon. I replied I had not thought anything about it, but I should take care that a copy of it found its way to the Government, and they could think what they liked about it. After this seven chiefs were appointed to paddle us down to Wanganui. The following men were fixed on, so that they might have influence to talk to Major Kemp Winiata te Kakai, Te Kuru Kaanga, Potatau, Te Aurere, Te Peehi, Iko, Patena. Going down the river we called at Pipiriki, Herurarema, Koriniti, Parikino, and Kaiwhaiki, at all of which places the usual speeches were made, and most of the lower-river Natives were in favour of the railway We were two and a half days coming down. Some of the Native villages on the Wanganui River are thickly peopled, for instance, at Herurarema and Koriniti there are about 130 to 150 at each place. At Herurarema there is a Catholic mission, consisting of the Rev Fathers Soulas and Marot, two nuns, and a lay sister, Maria Joseph, long known in Napier by the old residents they very hospitably entertained me. There is a school here with sixty-four scholars, and average attendance fifty-nine. The Natives possess 2,500 sheep, horses, and cattle, besides ploughs, &c. At Ranana, the site of the celebrated fight at Moutoa, there is also a large flock of sheep, and a fine wharepuni, 83ft. by 37ft. this is called Huriwhenua, and is the arena of the labours of Kemp's council.

On arrival at Upokongaro I secured the services of Mr Woon, and a meeting took place between my captors and Major Kemp, the result of which I forwarded to you on the 22nd September. Te Kuru Kaanga firmly opposed my returning, saying they did not want the railway and Winiata and Raukawa privately told me to wait, their tongues were tied now, but by-and-by they would speak.

I then returned to Wellington to seek the advice of the Native Minister and, if possible, get letters from Wahanui and Tawhiao. During my stay in Wellington overtures were made by Kemp through Mr. R. Woon, which resulted in a more amicable understanding with the Government, and a meeting between the Hon. the Native Minister and Major Kemp after which the latter renewed his promises of assistance, and advised my attendance at a large Native meeting at Ranana, and provided a canoe and men for my return. The meeting was largely attended, and included four or five chiefs of Manganui-a-te-Ao, who were convinced by Major Kemp of the advantages of railway communication, and agreed to my going on but it was considered necessary to take a strong force. Accordingly, on the 27th September six canoes accompanied me with the following people From Ranana—Paora Patapu, Rena (wife), Eruera te Ua, Te Wikirini, Te Nau, H. N Walker, from Pipiriki—Kaioroto, Maata (wife) Turawhi, Mahirini, Maehe, Kaawa (wife), Te Rua, Te Heuheu,

Te Huia, Te Whainga, Ramere (wife), Rehana, Te Hoeroa; from Herurarema—Tohiora, Reri, from Koriniti—Paori Kurimati, Teake; from Kaiwhaiki—Matiaka, Tutaua, Te Rou from Kukuta—Hikaka, Wikitoria (wife); from Manganui-a-te-Ao—Te Peehi, Peata (wife).

The Wanganui River closes in at about seven miles up, and from thence to Ranana it is more or less gorgy, enclosed by hills some three or four hundred feet high. It is, however, possible to get a horse up to Koriniti along a sort of track at the foot of the river-cliffs, but no further, except inland; there are a few low flats, but not of any great extent. At Ranana there is a large clearing, perhaps a thousand acres, a good deal of which is in English grass. Between Koriniti and Manganui-a-te-Ao is almost a continuous gorge. Excepting at Ranana, Herurarema, and Pipiriki the cliffs frown above one almost perpendicularly, especially between Pipiriki and Manganui-a-te-Ao, and the river runs stilly, I am told that for a long distance above Manganui-a-te-Ao the river has the same gorgy character. I remarked no leading valleys coming from the east from Upokongaro to Manganui-a-te-Ao, but many of the side-hills have extensive flat terraces on top, and small creeks, and doubtless good roads could be graded out, more especially as the hills (mostly *papa*) are not of any great height.

On arriving at Papatupu we were received by about eighty Natives with anything but a friendly demonstration, Taumata, Te Kuru, and Te Oeo being the most determinedly obstructive. The *korero* lasted several days, and at last ended with the up-river Natives leaving the whare in a body and refusing to say or hear any more, and they next morning left Papatupu and went up the river seven miles to their principal place—Te Papa. On the following day we followed them up, and, on arriving within a couple of miles, sent our messenger (Raukawa) to them. This man, Raukawa, being an up-river Native, was considered a seceder and a spy: so they decided to shoot him then and there. A considerable time, however, elapsed before a man could be found to undertake the deed: at last one volunteered, who seized a gun and went towards the door to effect his purpose, but time enough had elapsed to allow for reflection, and several stopped him. Our messenger returned early next morning and said he had come on our opponents busy making cartridges, but after a night's talk they had agreed to meet us. We accordingly went to Te Papa, found a white flag flying, and some twenty-five Natives armed, who fired over our heads twice, and, after two or three days' endeavouring to come to terms, they almost (to use my Native companion's words) forced us back at the muzzle of the gun, and I eventually returned to Wanganui and put myself in communication with the Native Minister and asked for a few troopers. Mr. Bryce thought it unwise to force our way, and directed me to go round to the north end of their district and endeavour to secure the friendship of Peehi Turoa, but, on returning to Ranana, I learned that the obstructionists had dispersed and gone to their planting, so I went on with my work and completed to Waimarino without any further stoppage. Here I found Peehi Turoa, although a rank Hauhau, after a little talk, not averse to the railway and ready to help me. About this time I learned that Major Kemp, who was to have gone to Taumaranui by canoe before me, had gone down to Wanganui, summoned as a witness in a Court case: so I visited Topia Turoa, Matuahu, and Te Heuheu at their pas at Rotoaira, Tokaano, and Waihi, urging them to send men of influence to help me at Taumaranui. The former contented himself by sending a telegram to Mr Bryce informing him that he would allow me to go on, but the latter sent two men with me. About this time two Maoris arrived from Tuhua saying that there were two powerful *aukatis* to stop my further progress, and, besides, a dozen mounted Hauhaus patrolling and waiting for us, averring that they were sure to be hung for Moffatt's murder and one or two more would not alter the case. This news so alarmed the Taupo Natives that it was with the utmost difficulty at last I got the promised two to go with us, but on getting within a few miles of Taumaranui they refused to go further, and returned. I had still some other Natives with me, two of whom were of those who engaged determinedly in the armed opposition at Manganui-a-te-Ao one of these went before me, and at every slight noise he started back on my toes, fearing the mounted patrol. I may here say the Wanganui River above Taumaranui is open for seven or eight miles, with five Maori settlements, and Watarupurupu, the furthest open land up the river, where I first came out of the bush from Waimarino, is the scene of a celebrated fight between the Patutokotoko (who gave me so much trouble in the Manganui-a-te-Ao) and the Ngatimaniapoto. The old pa of the Patutokotoko is on a flat-topped isolated hill, with open land all round, except towards Piopiotea, in which direction the forest stretches to Waimarino. Dotted over the flat below the pa for a mile or more are short posts stuck in the ground some are rotted and fallen these mark the spots where the fallen in battle lay or were buried. Turangatahi and Tuhiora were the chiefs of the Patutokotoko, and their descendants speak with pride of having beaten back their border enemies.

To resume We reached Taumaranui without obstruction, but were received sullenly without a word of welcome. So, as it was raining, we pitched our tents in the pa, and waited several hours; after which Ngatai and some others arrived and welcomed us, saying he would protect us here, but we could get no further as the country was stopped. After a couple of days, in reply to my letters, about a dozen men of the *aukatis* came down, but after a long talk refused permission to go further or even send a messenger through their country. They said Wahanui had stopped the country for a long time: some of these had been waiting watching the district for the last six months. So I had no choice but to return by Tokaano and go round the west side of Taupo to Kihikihi, some 150 miles. This I did, and saw Rewi and Wahanui, who informed me that Mr Bryce was coming in a week's time, and that I must wait till then, when it would be settled satisfactorily This I did, and in the meantime Wahanui sent and brought all the men who had stopped me out to Kihikihi, including the principal in Moffatt's murder The meeting which took place was satisfactory in its result, and I have since completed the exploration, and the last words of Rewi (Manga) were, "Tell Mr Bryce to hasten on the railway I am an old man now, and I should like to ride in the railway before I die."

JOHN ROCHFORT.

EASTERN ROUTE.

Mr. G. P Williams to the Engineer-in-Chief, Wellington.

Sir,— Public Works Office, Wellington, May, 1884.

I have the honour to make the following final report upon the proposed trunk line of railway from Hastings, on the Wellington–Napier line, to Te Awamutu, the present terminus of the southern line from Auckland. I have completed the reconnaissance survey of the country through which such a line would pass, and I attach to this report general plan and sections of the line.

For the purpose of comparing this route with others that have been proposed for the trunk line I have indicated upon the general section the probable lengths of the principal stretches of gradients that are as steep or steeper than 1 in 50, and the probable dimensions of any important bridges and tunnels.

The length of the line is estimated at 170 miles. The chief difficulties on the line are in the Hawke's Bay portion, between 16 miles and 58 miles. The ranges which lie all along the south and east bank of the Mohaka River are a formidable barrier for a line running westwards from the coast. The coach-road goes over the Titiokura Hill, which is some 500ft. higher than the saddle at the Puketitiri Bush, where the line would go, and which is the only feasible gap in the range for railway purposes. The Mohaka cuts the general slope of the country into two, and, after the line has dropped down with a sharp descent to its bed, the main watershed has still to be surmounted. To do this the proposed line follows up the Repia, which runs into the Mohaka, and has a good general direction, cutting down deeply through very high and broken country, covered with bush.

The route described by Mr Ellman as being peculiarly favourable for railway purposes, an account of which appeared in the *Hawke's Bay Herald*, is only adapted for a road, though it is suggested that it would answer equally well for railway purposes. I except the portion up the Repia, where for a great length the difficulties for a railway are probably no greater than they would be for the construction of a road. "The long ridge separating the waters of the Mangahouhou from those of the Mangaone," along which the present road goes to Patoka Station, rises far too steeply for ordinary railway gradients, and falls and rises again without any advantage of level being gained; it is also too narrow and crooked for railway curves. Further on in the account of the route mentioned the line is described as going from the Anawhenua "flats [which are really only a few broken terraces] by light cuttings to the south-west bank of the Makahu." Now the Anawhenua, before joining the Makahu, enters into a very narrow gorge with steep slopes, about $\frac{3}{4}$ to 1, and several hundred feet high, so that neither a road nor railway could follow it down and the line must therefore pass over or tunnel through a saddle which rises 270ft. above the creek at 39½ miles on section, while on the other side of the saddle the Mohaka River runs about three miles off and 700ft. below it. Yet, in spite of this very rapid descent down to the Mohaka, it is stated, in the description of the bridge site at the Mohaka, that "up to this point the whole road has been almost a gradual rise." This is misleading, as is also the description of the Repia, which is treated as if it were an ordinary valley, any exceptional difficulties being ignored, although for at least eight miles of its length it can only be utilized by means of works of the heaviest description.

I do not wonder however, that the Repia was not fully understood, as I found that no one had ever been right through it before I went. For six miles its slopes are covered with dense bush, principally Fagus, and this had prevented any passage between its upper and lower ends, until I had a rough foot-track cut through it, though there was an old disused Maori track, now grown over, which led over the hill-tops out of sight of the gorge.

I will now describe the route which is in my opinion the most practicable, premising that, on account of the great summit-levels to be surmounted, long stretches of steep gradients are unavoidable, and that, in order to make them as even as possible, certain river-courses must be followed, the country generally being much too broken up by confused spurs and gullies to admit of grading being carried out otherwise. After leaving Hastings the line passes through easy country to the crossing of the present channel of the Ngaruroro River, at about 5 miles on section. This river has a shingle-bed similar to those in Canterbury, and can be crossed at a height of 15ft. above the bed, with seven or eight spans of 40ft., nearly opposite Mr Donelly's house. The line would then strike through easy open country, Native land, to the Tutaikuri River, which it would follow up on its south bank, and, commencing to rise at a point opposite where the road strikes off to Rissington on the north bank, it would continue, without any difficulty but a few small cuttings, up to the terrace opposite Seale's homestead, at the junction of the Mangaone with the Tutaikuri River near 15 miles. Now, to reach the Puketitiri Bush the natural course would be to follow up the Tutaikuri to the mouth of the Mangatutu, and then all the way up the Mangatutu but this is impracticable, as the features of the banks of the Tutaikuri are on too large a scale, consisting often of *papa* reef-terraces two or three hundred feet in height, intersected by deep ravines, or of steep spurs running down from adjacent hills. I propose therefore to follow up the Waihau Creek, whose banks are on a smaller scale, from above its junction with the Mangahouhou up to its source, and, although to follow it up would involve heavy cuttings along its whole distance, yet, by keeping about 100ft. above its bed, in ground sloping on an average between 2 to 1 and 3 to 1, a line may be got following generally on the south-west side. The Mangahouhou is worse, if anything, and besides by going more to the north the line would be approaching too near the high country about the Patoka Hill, where the gradients would be inadmissible. In order to get to the Waihau from the river junction at 15 miles the line must go round one side of Mount Cameron. The Waihau and the Mangahouhou after their junction form one stream called the Wai-iti, which flows in a deep broken gorge on the north and east of Mount Cameron, and this would be too difficult to follow I propose therefore to keep the line on the south-west side, and, crossing the Tutaikuri at a favourable site near 16 miles, at a height of about 60ft., to rise on to the terrace on the north bank, making use of the channel of

a small creek which has worn down the terrace, and then, after grading up through some slopes of from 2½ to 1 to 2 to 1, to tunnel through some of the precipitous spurs of Mount Cameron, a limestone hill, and, crossing in one 120ft. span a deep chasm with perpendicular *papa* sides, above the Ardlussa Station, to come out on the Ardlussa Downs and strike the Waihau at about 21 miles on section. Then, following up the Waihau, as before described, to its source, the line would cut through the low saddle, where a road has been formed, on the watershed of the Mangatutu, and cross that stream at the site indicated on plans at 30½ miles. Then, skirting round behind Groom's old station and through another small saddle, the line follows up the Mangatutu Stream, principally on its western side, as far as the Puketitiri Bush. As the grade has to be kept high from 31 miles to 33 miles, the bridges at the crossings would have to be excessively large, so that it is better to keep on the one side if possible in limestone-rock cutting.

From 34 miles to the summit the work will be of a lighter character. The level of the saddle in the bush is 2,070ft. There is another way of reaching the Puketitiri Bush shown on plans, viz., by recrossing the Mangatutu at 31¼ miles, and following up the Manaroa Creek to its head, from which a fairly good line could be got by skirting round some downs and through the Puketitiri Bush. The Manaroa is much easier to follow than the Mangatutu, being nearly straight, and having sloping sides of 2 or 3 to 1, but the gradient would be even worse, and the deviation would make an extra length of 2¾ miles of line. After leaving the bush (which is mostly on a flat, and contains some fine trees of black and white pine, rimu, and a little totara) the line descends on the right bank of the Anawhenua, through fairly good ground for benching, to the saddle at 39½ miles, where a tunnel 25 chains long is required. As mentioned before, this creek is blocked in, and escapes through an impracticable gorge. From the tunnel there will be some very difficult grading or sideling of from 1½ to 1 to 3 to 1, in order to drop down to the Mohaka Bridge site at 43 miles 10 chains. This is one of the worst portions of the line it must be kept well up on the hill-side on the left bank at about the height above the creek indicated on section. The slopes of the railway banks will require rubble-pitching to diminish their length. The Mohaka Bridge site is the same as described in Mr. Ellman's report, and is about 20 chains above some old Maori whares. The banks are about 80ft. apart, and the line for rail level would be at about 40ft. above the river. Also, a better grade is got by going to this site and back again down the river, with an ascending grade on the north side reaching the Repia by a cutting through a high terrace and some more sideling work. In the Repia the line soon enters a deep gorge, and for at least eight miles—viz., from 46 miles to 54 miles—it is necessary to cross and recross the stream at an average of five times to the mile. The outer edge of each bend is usually perpendicular rock for perhaps a hundred feet, then there is a slope of about ½ to 1 for another hundred feet or two, and above that again from 1 to 1 to 3 to 1 for a total height of say a thousand feet, sometimes much higher On the inner edge of the bends, which the water does not wear into, the slopes are about 1 to 1, terminating usually at the foot in a flatter spur of from 2 to 1 to 3 to 1. By keeping the line at an average of 40ft. or 50ft. above the stream these spurs may be cut through or tunnelled. Small stretches of flat may occasionally be utilized, but heavy rock-cuttings will be the rule. The bush consists chiefly of Fagus, the so-called black and red birch. The line emerges from it at 53 miles and follows the creek to 54 miles, when it begins to rise up to a terrace flat, which it reaches at 57 miles and continues along on the south-west side of the creek, the work being easier as the volume of the stream diminishes, until the summit-level of 2,680ft. (or about 2,600ft. for formation-level) is reached at 64 miles 10 chains. This point is on the watershed between Hawke's Bay and the Bay of Plenty, and is a conveniently low saddle above Lake Pouarua, whence the Rangitaiki River issues. The line skirts round and through some low pumice downs, and drops down on to the open pumice plains at 66½ miles, following near the Rangitaiki to the Taupo Road, and then in the general direction of the road over the watershed of the Rangitaiki and the Waikato Rivers, at a height of 2,445ft., until the small village of Opepe is reached, then, skirting round Mount Tauhara, a continuous grade of 1 in 50 will enable the line to drop down to the Waikato, crossing near the Huka Falls. To obtain sufficient length of line to get a uniform grade, it may be necessary, in surveying the line, to skirt round with a wider sweep and with more curves than I have indicated on plans, but the country is sufficiently open to admit of this.

Instead of following up the Repia it was proposed to take the line up the Mohaka to where the Taharua runs into it, and then to follow up the Taharua to its head on the open pumice plains, as shown in Drawing No. 4. I do not think that any advantage would be gained by this route, for the following reasons: The banks of the Mohaka are, on the whole, quite as difficult for a line as in the Repia, on account of the abrupt spurs from the Kaweka on the west and from Te Matai and Big Ben on the north-east side, which rise precipitously above the river The length of the line up the Mohaka, from the proposed bridge-site to the junction of the Taharua, would be about sixteen miles of very difficult work, but in the Repia a distance of fifteen miles from the same point is sufficient to take the line out of any difficulties, excepting the cuttings at the head, at 64 miles. On the other hand, after traversing equally difficult ground in the Mohaka for sixteen miles, there are two miles of bad ground at the lower end of the Taharua. The bridges in the Mohaka would be at least as numerous as in the Repia, but larger and much more expensive on account of the big boulders there would be a difficulty in constructing piers by driving piles, so that a single span of 120ft. would often be necessary, instead of one of 60ft. or 80ft., as in the Repia. On account of its larger drainage area the floods in the Mohaka are much worse than those in the Repia, and piers would interfere with the passage of trees in flood-time. The level of the junction of the Taharua with the Mohaka is 1,935ft., and the open watershed at its head 2,475ft., or 200ft. lower than that of the Repia, so that the Taharua gradients would be somewhat better. The total length of the two routes would be about the same.

On arriving at the Waikato River the line might cross in one span of 40ft. above the Huka Falls, where the level of the bed of volcanic rock through which the water has cut a channel is 1,110ft., the line would then have to bench up the terraces on north-west bank, but, as these are

here very steep and broken, I have shown the line descending on the south-east bank on the skew with the river, in sideling of 2 or 3 to 1, principally pumice, and about half a mile further down the river, and then crossing, with two bridges of 60ft. and 100ft. span, at a height of 70ft. above the river, at this site there is an island about eight chains in length, and there is just room for a reverse curve; the line would then rise in cuttings up to the terrace at 95 miles, near the junction of the Wairakei Creek but above it, on its south-west bank. A detailed survey, with cross sections, will be required to fix which of the two modes of crossing would be the cheaper.

At Wairakei there will be some bad ground for working in near the hot springs, but I think the line can be kept above the worst portion, and the creek followed to its head near the crossing of the Main North Road, about 30 chains beyond which is a small watershed near Oruanui, where some heavy cutting will be required in volcanic rock.

In descending to the Ongarahu there is a long dry gully, which may be made use of to assist the cutting; and I think on reaching near the mouth of this the line should bend round sharply to the left (possibly requiring a few chains of tunnel through a rocky spur), and then grade down to the bed of the Ongarahu through some gently-sloping ground. The Ongarahu may be easily followed to near Pukemoremore, the banks being low, and its course being through a tolerably open valley, consisting of shallow swamps and low hillocks of pumice. At 107 miles a low ridge at the foot of Pukemoremore divides the Ongarahu from the Waipapa Creek, and here a choice of two routes can be made. I will first mention the one marked on plans and section as "Deviation." This line would follow down the Waipapa Creek to the Waikato River where an expensive bridge, of probably 200ft. span, would be required; but after crossing the river it may be followed down on its right bank for fourteen miles, without any very heavy work, on terrace flats, which are not intersected by any very bad gullies. From 121 miles to 122 miles, on "deviation," the spurs from Whakamaru rise abruptly over the river but with occasional rock-cuttings there is room to get round them, and the terrace flats open out again for a width of a quarter of a mile, and present no difficulty up to 129 miles on deviation near the Kopokorahi Stream, after which there would be some heavy cutting in sideling. Besides the bridge being probably costly, the objection to the deviation would be that it is three miles longer than the line as laid down on maps.

The line as laid down on plans, instead of branching down the Waipapa at 107½ miles, crosses the Waipapa Creek at the junction of two small streams, and rises with moderate gradients in the direction of the Waipapa Bush, as far as about 112 miles, through some swamps of no great depth, and among hillocks of from 50ft. to 150ft. high covered with poor tussock grass. There are several good patches of bush in this locality growing on high flats and ridges, the position of which is marked upon the plans; they contain a large proportion of totara trees, and there is a noticeable improvement in the soil where the bush is there is less depth of pumice, which has probably been washed down at some period into the lower-lying lands. At 112 miles the line bends sharply to the left, still rising towards the saddle at a break in the hills called Ngatakurua, at about 113 miles. Through this pass the Maori track leads to Kihikihi. The line would then descend quickly to the Potangotango Creek, and down the banks of it to near the Whakakaho, a very prominent hill with broken angular outlines. In following this creek some heavy cuttings would be necessary, principally in pumice, and the line should be kept at about 40ft. above the creek, utilizing occasional terraces. At 121 miles, at a level of about 750ft., the line leaves the creek and slopes with a more gentle descent to the Mangakino Creek, which contains a considerable volume of water, but may be crossed with two spans, of a total length of 120ft., at a height of about 100ft. above the water, and at about 10 chains from the junction of the Waikato River.

On my first journey through this country I kept entirely on the western side of the Waikato, with a view of seeing if a line could be got without crossing and recrossing that river I found the ground pretty fair as far as the next big creek (also called Waipapa), but beyond this there is a narrow range or ridge rising abruptly some 500ft. above that creek, and called Moetahanga it reaches down to the Waikato, and further on there is a higher range, of which the principal hill is called Wharepuhunga. This whole range is covered with bush, and extends down to the Waikato. On its northern slopes it is intersected by deep ravines, especially one called the Waipare. The difficulties caused by these obstructions would be too great for the location of a line entirely on the western side of the Waikato; so that I propose to follow the Waikato River closely on its right or eastern bank, crossing over to it at about 127 miles, at the spot shown on plans. The river here goes over a fall of about 15ft., and above this again there are several rapids. I think the river can be crossed just above the fall by a bridge of 160ft. in length, and that a pier could be built into the rocky bed of the river in order to divide the bridge into two spans.

The country on the eastern side now consists of high fern downs broken up by volcanic action, and unsuitable for a line; but the watershed on these downs runs nearly parallel with the river and only a few miles back from it, and the water reaches the Waikato, from the eastern side of this ridge, only by running northwards for some miles beyond the Waotu. Consequently there are few stream-channels intersecting the eastern bank of the river, which consists usually of a cliff of volcanic rock about 100ft. high, with a slope of about 2 to 1 of loose rock and pumice below the cliff; or else a terrace-flat, at a height of about 20ft. to 80ft. above the river, is to be found at the foot of the cliff. There are several spurs of volcanic rock which would probably require short tunnels, not exceeding, I think, a total of 40 chains in length. There would be a good deal of heavy rock-cutting in places, but the ground would be all solid and free from slips, and the long stretches of narrow flats would allow the cost of the work on this portion to be reduced to an ordinary average. Near the Waotu the hills rise to a considerable height at a mile from the river, but the flats on the river-bank below are well adapted for a line.

I think the river can be recrossed by one span of 160ft. at a point about a mile and a half above the old pa opposite Mangere Creek. There is a small island on the west side of the river, just above site of bridge. The line would commence to rise after crossing the river, and, cutting into the slopes of the rising ground at the edge of the river-flats, it might be some 80ft. or 90ft. above the river at the

mouth of the Mangere—a small creek with a deeply-cut bed, which should be followed up so far as it would serve to take the place of cutting. There is a flat, with some large swamps in it, extending for a mile or two back from the river on this side, and about 200ft. above it. A small ridge west of this flat forms the watershed between the Waikato and the Puniu, and the saddle is only 300ft. above the former river. From the saddle some careful laying-out will be required for two miles, in order to locate the line among some gullies at the head of the Wairaka Creek, which can afterwards be followed without difficulty from 152 miles to its junction with the Puniu at about 157½ miles. There are some small swamps to cross, but they can easily be drained. The southern side of the valley is, on the whole, the better one. Below the junction with the Puniu I should prefer to keep on the northern side, but a few crossings are unavoidable. This river has a shingle-bed, and flows with a moderate fall through a fine open valley well adapted for a line, and the soil is a rich loam. The line would leave the bank of the river near 167 miles, and, rising for about three miles through some undulating downs, would reach the Te Awamutu terminus at 170 miles.

With regard to the capabilities of the country generally for supporting a line passing through it, I am afraid I cannot speak favourably For the first sixteen miles the line passes through good agricultural country, but it is already fairly well served with roads leading to the railway to Napier. I think it probable that a branch line so far would be a success. For the next ten miles the country is so broken that only a small proportion of it can be considered agricultural land, and beyond this to 66 miles the line passes for forty miles through very rough country, which is coated frequently with pumice, and will apparently only bear very thin stocking. The line will open up about 120,000 acres of similar country belonging to the Crown in Hawke's Bay For the next eighty miles the line passes through purely pumice country, which is so sterile that sheep will not thrive on it, and it is doubtful whether it is capable of being put to any profitable use. Afterwards for ten miles the country would take grass with surface-sowing, and the last fifteen miles of line run through good agricultural country

In examining the Maori country between Taupo and Te Awamutu, and west of Lake Taupo, I found that the work occupied twice as much time as it should have done, owing to the dilatory habits of the Natives and the difficulty of moving about anywhere without constant long talks with them. The country west of the Waikato being unsurveyed, I was obliged to employ Maoris as guides. Although several times ordered to go back, I managed to prosecute my work without any active resistance, and found that the letters with which I was provided from the Hon. Mr Bryce to the different chiefs were always received with great respect.

With regard to a possible combination of the Waikato line with a central route from the Wanganui District, I found, on travelling inland round the west side of Lake Taupo, that the country between the Hurakia Range and the lake consists of high flats, terminating in precipitous cliffs from 100ft. to 300ft. high; and the country is intersected with enormous ravines, the creek-beds in which are about 600ft. below the average level of the country, and consequently no practicable line could be got for railway purposes. Along the eastern side of the lake, however, a capital beach line could be constructed at moderate cost, partly by low embankment through shallow swamps, and partly in shallow water under the pumice cliffs, but nowhere meeting with any great difficulty A good line could be got down the Upper Waikato River from Lake Rotoaira, which is at a level of 1,900ft., and round the southern shore of this lake, to join with any practicable line from the south.

In order to fix my position by compass bearings I had to ascend several hills which were hitherto *tapu*, and had not been ascended by any European—notably the remarkable hill called "Titiraupenga," the northern summit of the Hurakia Range its height is 3,450ft.

I have calculated all the levels given herein from barometrical observations carefully taken, and, in most cases, checked by repeated observations, and they were all corrected by simultaneous observations taken at stations of well-ascertained levels. Wherever possible the levels were referred to the calculated heights of trig. stations.

In concluding my report, I am glad to have the opportunity of thanking Mr Horace Baker, Chief Surveyor of Hawke's Bay, for his kind assistance, as well as the several station-owners along the line of my route. My thanks are also due to Major Scannell, in command of the Armed Constabulary at Taupo, and to the two Maori chiefs, Hitiri Paerata and Rewi, or Manga, of the Ngatimaniapoto.

An approximate estimate of the cost of this line of railway, including formation, rails, rolling-stock, and stations, amounts to £1,200,000. The cost of land is not included in this estimate.

I have, &c.,

The Engineer-in-Chief, Wellington. GEORGE PHIPPS WILLIAMS, M.Inst.C.E.

WESTERN ROUTE.

Mr. R. W Holmes to the Engineer-in-Chief, Wellington.

Sir,— New Plymouth, 26th May, 1884.

I have the honour to report as follows on the proposed line of railway between Stratford and its junction with Mr Rochfort's line (known as the central route), about six miles to the north of Te Uira. Te Uira is a small Native settlement about four miles in an easterly direction from Te Kuiti, and about thirty miles to the south of Te Awamutu.

Starting from Stratford, the line runs through flat country as far as the Toko River, about seven and a half miles. There is a descent of about 400ft., owing to Stratford being situated on the slope of Mount Egmont · this gives a general grade of 1 in 99, but, owing to sundry depressions, 1 in 50 will probably be required for short distances, making the balance flatter Between 7½ and 10 miles the line passes over a low ridge which separates the Toko and Makuri Rivers 1 in 66 or a flatter grade can be employed here. At 3½ miles the Kakouri River is crossed.

Before proceeding further, I wish to draw your attention to the position of Stratford with regard to the general direction of the line beyond 10 miles. It will be seen that the line takes a large bend at 10 miles, Stratford being situated too far to the north, so that a more suitable position for the junction station would be about two miles south of Ngaire, where a good station-site can be obtained. This would save about six miles on the through line between Wellington and Auckland, though the actual length to be constructed would be the same; it would also save a considerable portion of the rise and fall to and from Stratford. I have not been over the country between Ngaire and 10 miles, so I cannot say that the alteration would save any expense. I am nearly certain the line could be constructed this way, so I draw your attention to the direction, as I consider it quite worth running a trial line through.

The line from 10 to 12¾ miles follows up the Makuri Valley; grades nearly level, and cross section flat. The construction from Stratford to this point will be very easy.

At 12¾ miles the line commences to ascend with a 1 in 66 grade to 14½ miles, where the ridge between the Makuri and Mangaotuku Rivers is passed through with a tunnel 10 chains in length. The line then descends to 16 miles with a 1 in 66 grade. The work of construction, with the exception of tunnel, will be moderate. The tunnel at this place could be dispensed with by running long grades of 1 in 50 and rising to top of ridge, thereby lengthening the sideling work about a mile on each side, making the works over cross gullies very much heavier, probably costing more, and rising an unnecessary height of about 130ft.

From 16 to 28 miles the line follows up the Mangaotuku Valley; cross section flat, grades easy, and work of construction light. The creek might have to be bridged in a few places to straighten the line.

Between 28 and 32 miles the line ascends with a 1 in 66 grade, passes through a ridge with 5 chains in length of tunnel, and descends to the Makatiu Valley with a 1 in 66 grade. A tunnel is shown here for similar reasons to preceding one. The work of construction along sidings will be moderate.

From 32 to 34 miles the line follows down the Makatiu and up the Pohokura Valley, cross section level, and construction easy.

From 34 to 35½ miles the line rises with 1 in 50 grade to a tunnel 16 chains long, through the Patea-Wanganui watershed. This tunnel cuts 300ft. off ridge, and is actually necessary. It then descends with a grade of 1 in 66 to 39 miles. This grade is shown 1 in 66 on section, but it might be found advisable to employ a 1 in 50 grade to lessen cost of construction.

From 34 to 39 miles the construction-works will be heavy, principally on account of steep cross section and deep cross gullies.

Between 31 and 36 miles an alternative line was explored to endeavour to shorten the distance, and save fall and rise; but it would require an additional 25 chains of tunnel, and much heavier work throughout, and is altogether impracticable.

From 39 to 42½ miles the line follows up the Wangamomona Valley: cross section level, and construction-works easy The Wangamomona will probably require crossing a few times to straighten line.

From 42½ miles the line rises with a 1 in 50 grade to 44½ miles: this grade may probably be eased. At 44½ miles a short tunnel 4 chains in length is required, but it may be found advisable to lengthen it to ease work on the preceding grade.

Between 44½ and 45½ miles the line runs along sideling ground without cross spurs—grade level, then through a 6-chain length of tunnel. Falling then to 46¾ miles, with a 1 in 66 grade (but a 1 in 50 grade may possibly be required), the line runs level along sideling to 47¾ miles, work moderate.

From 47½ to 50¼ miles the line rises with a 1 in 50 grade to a tunnel 5 chains in length through a ridge, and falls with another 1 in 50 grade into the Waingangara Valley This portion will require rather heavy construction-works. It then continues down the Waingarara Valley, with easy grades and work, to its junction with the Tangarakau at 51 miles.

From Stratford to about 12 miles the character of the country is flat, being on the slope of Mount Egmont, and consisting of volcanic earths. The rivers are very rapid, with boulder-beds, with a low terrace on each side, forming the river valley At about 12 miles the character of the country changes altogether, the volcanic earths giving place to *papa* rock and clay liable to slips in places the rivers, after a rapid descent for a short distance from their sources, run very slowly, the fall in them being by short rapids or low falls, with long reaches of comparatively still water between. The valleys are narrow at bottom, and are formed by ranges of hills with sharp ridges, ranging in height from 300ft. to 800ft. above the valleys this style of country continues to the Tangarakau River, at 51 miles.

From 51 to 57¼ miles the line continues up the Tangarakau Gorge with an easy grade, a considerable distance being saved by cutting off two long bends by passing over low saddles, as shown on section. On each side of the Tangarakau River there are from 2 to 10 chains of easy sideling ground, then a perpendicular cliff of about 300 feet in height of *papa* rock, and sideling ground up to a height varying from 600ft. to 1,000ft. above river The tops of the ridges are generally covered with black-birch, all *Fagus fusca*, with good barrels. The piece of comparatively-flat ground along base of cliffs will enable the line to be constructed without exceptional work or sharp curves. It will be necessary to bridge the river in three, and possibly in five, places.

At 57¼ miles the line commences to ascend by a 1 in 50 grade to 59½ miles, and then by a flatter grade to the saddle in the Tangarakau Range at 60½ miles.

At 57½ miles the line enters a small creek-gorge, which rises rapidly to 59½ miles, the sides being very steep, which will make the work heavy

From 59½ to 60½ miles the creek runs slowly, the sides being much flatter, and the work of construction will consequently be very much easier. In consequence of the creek falling so slowly at the top, it will be impossible to cut off any more of the rise than can be done by a cutting.

From 60½ to 63¾ miles the descent into the Eao Valley occurs by a 1 in 50 grade. The work of onstruction along this grade will be very heavy

From 63¾ to 66½ miles the line passes up the Eao Valley with easy grades and work to a saddle at the head of the Mahorahora, it then descends by a 1 in 50 grade, with moderate work, to the Mangaroa Valley at 68¾ miles (this grade may probably be flattened), then up the Mangaroa Valley to 72 miles, then crossing into the Ohura Valley on a very low saddle with an easy grade then up the Ohura and Waikaka valleys to 85 miles with easy grades. The work of construction to 81 miles will be easy, then to 83 miles it will be a little heavier, and from 83 to 85 miles it will be heavy, requiring a short tunnel at 84 miles to cut off a bend in the river Between 85 and 87¼ miles the ascent to the saddle in the Wanganui-Mokau watershed is made by a 1 in 50 grade, the work of construction being moderate.

From 87¼ to 91½ miles the line descends by a 1 in 50 grade. The work of construction along this grade will be very heavy including one tunnel 10 chains long through a cross spur in fact, I consider this the worst portion of the whole line.

Before proceeding further, I might state that, from a view I had of the country I think the the line between 63 and 71 miles may be straightened considerably I was unable to examine this part as thoroughly as I wished, on account of provisions running short.

From 91½ to 93¼ miles the line passes over open flat country, the construction-works required being easy

Between 94¼ and 97½ miles the line rises by a 1 in 50 grade, and descends by a 1 in 55 grade to cross the low hills between the Mokau-iti and Mokau rivers, work moderate.

From 97½ to 109½ miles the line runs up the Mokau Valley, with flat grades and easy work, the large bends in the river being cut off by passing over saddles in the low hills in the valley

Between 109½ and 112 miles the line descends by a 1 in 50 grade into the Mangapu Valley Two lines for this grade are shown on the plan, as a trial line must be run on both to decide which is the better The work on both will be very heavy on account of steep sidelings, cross gullies, and tunnel.

From 112 to 123 miles the line follows down the Mangapu Valley to Mr Rochfort's line near the confluence of the Mangapu and Mangaokewa creeks, work easy

The Tangarakau Range, which is crossed by the line at 60½ miles, extends from thence in a northerly and south-westerly direction, the country towards the east being a great deal lower than that towards the west. The country on east side consists of valleys varying in width from 20 to 100 chains, with low hills on each side varying in height from 200ft. to about 400ft. while the Tangarakau Range stands out like a wall, the top being very straight, with very few peaks, and reaches an extreme elevation of about 1,100ft. above the Ohura Valley The valleys narrow in again at about 83 miles, near where the line commences to ascend to the saddle in a branch of the Tangarakau Range, which forms the Mokau-Wanganui watershed, and continues narrow to 90 miles, there being no flat land in them the hills on each side are very steep.

At 90 miles the line is in open country, comparatively flat, which is drained by the Hinoteko, a tributary of the Mokau-iti both these rivers are crossed at about 94 miles, they being situated very close together From there to 100 miles, in crossing from the Mokau-iti to the Mokau, the country is rather broken.

From 100 miles to Te Awamutu the valleys are altogether wider, and covered (with very few exceptions) with dense fern. At 94 miles the line enters the limestone country This stone will form a suitable material for building culverts, as slabs varying in thickness from 1 to 6 inches can be obtained without any quarrying or dressing, which would suit well for the floors and roofs of 9in. to 18in. drains.

The Wairere Falls, in the Mokau River near 98 miles, are formed by a mass of stone of the same description as that in the hills round Wellington this is covered above the river-level with a cap of limestone horizontally stratified.

A seam of coal, about 5ft. thick, is exposed to view on each side of the Tangarakau River at 55 miles, and is similar in character to that now being worked about twenty-four miles from the sea up the Mokau River

The maximum length of the bridge required to cross any of the rivers, on the square, will be 80ft., with the usual end-spans according to height of approaches.

Before finally adopting this line, I consider it advisable to explore the country to find whether a line could be run from 42 miles in an easterly direction to the Eao, and up that river until the line already explored is reached this would avoid the rough and valueless country in the Tangarakau Gorge, and would open more effectively the good country said to exist in the lower part of the

Eao Valley. This line was not examined because time was short, and, having found a practicable route, I did not consider it advisable to waste time and money in trying to improve the line already obtained, as it could be done to better advantage while running the trial line.

From 61 to 74 miles an alternative line was explored as shown on plan, which is not an improvement, as it runs out of the direction, and lengthens the line, and is no saving in cost.

A line was also explored from 77 miles up the Ohura Valley, across a very low saddle, to join Mr Rochfort's line in the Ongaruhe Valley The grades would be easy to the saddle, from thence a drop of 200ft. occurs, which would require a 1 in 50 grade. At 87 miles this alternative line enters the pumice-stone country, which extends the remainder of the distance, viz., to 123 miles, where the line, as described, would join Mr. Rochfort's, at a distance of 25 miles from Te Awamutu. The construction-works required would be moderate over a considerable length of the line, but very costly over other portions, the formation averaging probably a little over £4,000, and this with rails, rolling-stock, stations, &c., added, would amount to a total of about £7,000 per mile, not including cost of land.

I have, &c.,
R. W Holmes,
Resident Engineer.

The Engineer-in-Chief, Wellington.

By Authority: George Didsbury, Government Printer Wellington.—1884.

MAP OF THE
NORTH ISLAND,
NEW ZEALAND.

SHOWING EXPLORATIONS FOR RAILWAY ROUTES BETWEEN AUCKLAND AND WELLINGTON.

Scale of Miles.

10 5 0 10 20 40 60 80

Reference.

Chief Towns ..... shown thus WELLINGTON
Minor Towns and Post Offices ..... HAMILTON
Roads .....
Railways .....
Boundaries of Provincial Districts .....

REFERENCE.

Mr. Williams' exploration
Mr. Rochfort's ,,
Messrs Carkeek and Holmes' ,,
Coastal line exploration

Blue Figures along the respective lines indicate mileages.

AUCKLAND
TARANAKI
HAWKE'S BAY
WELLINGTON
NELSON
MARLBOROUGH
MIDDLE ISLAND
BAY OF PLENTY
TE URIWERA COUNTRY
North Taranaki Bight
South Taranaki Bight
Karamea Bight
Golden Bay
Tasman Bay
Cook Strait
GULF
D'Hausses Group
Barrier I.
Taupo Moana
Malta Peninsula

172° 173° 174° 175° East Longitude 176° 177° 178°
South Latitude 35° 36° 37° 38° 39° 40° 41° 42°

Lithographed at the General Survey Office Wellington N.Z. June 1884.