

require careful study in location to keep in-view safety from floods and river encroachments. The route would touch Ormond and Karaka. About twenty-five miles of this section are common to the Gisborne—Opotiki route. A minimum of 10 chains radius may be used here, and the grades would be very easy, the level of Wharekopae being about 455 ft. above the sea, and the intermediate risings and fallings short and of no account in limiting the haulage.

2. Wharekopae to Galatea, about a hundred miles of mountainous country, extreme limits of curves and grades. The section commences where the maximum grades and curvature must be used to ascend and traverse the mountainous country of Tuhoe-land. The first ascent is long and continuous, being about 1,230 ft. rise, and requiring a length of about twelve miles, which can just be obtained by grading up the hills and valleys, whence arise the southern tributaries of the river, to a saddle near the north end of Kupenga-ataramainuku. From this summit the line would grade along the north-west side of the valley, keeping on the lower spurs of the Mokonui-Aorangi Range to the Ngutuwa Gorge. This gorge is narrow and deep, and offers no serious obstruction. The rise to this place from Wharekopae saddle would not be more than 260 ft. in nine miles. From Ngutuwa the line would pass over a flat under Trig. R. 111, and thence grade round the numerous spurs and ravines of the head-waters of the Hangaroa, which above the Ngutuwa is called Waimana. An average grade of 1 in 116 for twenty-two miles would reach the Waimana-Anini saddle, 2,900 ft. This would be crossed with a moderate cutting, and the line graded down the Anini Valley to a distance sufficient to admit of grading up on the other side to the next saddle, that between the Pukukaho and Owahakaroto. This is one of the most difficult parts of the country to surmount. I had hoped to avoid a tunnel here, and left the examination of it until after my return from Gisborne, but I cannot place its elevation at less than 3,460 ft. The grade-level at Anini Viaduct would be about 2,500 ft., and the rise in six miles 620 ft., making grade-level at the saddle 3,120 ft., or 340 ft. under the saddle. The eastern face of the ridge is very steep and precipitous; the western is less so. I did not make, for reasons before stated, any detail measurements of this ridge, but the length of tunnel may be taken as 30 chains. From this tunnel the line would descend easily to the Owahakarotu, and on to the main divide, at 88½ miles, crossing on the surface at an elevation of about 3,100 ft.

The line is now in the drainage of the Whakatane, and the course is, with generally level formation, along the middle slopes of Maungapohatu to the saddle at the head of the Waiawa and Hopuruahine Valleys. This saddle is on the main divide, which is here recrossed at nearly the same elevation, and the line, with a nearly level formation, keeps along the slopes of Te Peke, rounding into the Orangitutaetutu and out again on to the eastern slope of the Huiairau range. It could now finally recross on the level at the place crossed by the Waikaremoana Road, elevation 3,165 ft. But this would entail, in rounding into the Okahutara, and the spurs stretching from the main range into that valley, a length of about three miles and a half, which may be saved by passing on to a point about two miles and a half south-west of the road-crossing, and, at a narrow part, tunnel about 200 ft. under the ridge. The length of tunnel would be about 22 chains, but, besides saving the length as above, it would avoid much interference with the Waikaremoana Road, along the Tuakura Range, which would otherwise result.

From this point the line would wind around the spurs of the Kopainui and the Ruatahuna Streams, in the Whakatane drainage, grading down into the Mimiha to a point in that valley high enough to allow of grading out of it and into the Okahu, at 114 miles. There is a low saddle in the ridge between the valleys, estimated, by comparison with other known points, at 2,800 ft. high; but I did not move the camp up the Mimiha, and I am not so clear on this point as on the other parts of the line. This saddle is the last one on this section, and a tunnel of about 22 chains in length, and 200 ft. under the ridge, must be reckoned on. From this point the line would grade down the Okahu and Whirinaki Valleys to the entrance of the Rangitaiki Plains at about 135 miles.

There is more difficulty to be encountered in the western half of this section than in the eastern. Between Maungapohatu and Galatea the ravines are deeper, closer together, and the mountain-sides more precipitous than in the country drained by the Anini and the Hangaroa to the eastward, and the grade down the Okahu and Whirinaki is equal to the worst of it in the number and narrowness of the ravines and the sharpness of the dividing spurs.

3. Galatea to Rotorua, forty-five miles: This section includes the plains between the Urewera Hills and the Rangitaiki, and is wholly in open country. There will be a heavy grade up to the Kaingaroa Plains of the maximum rate. There are several convenient gorges, which would allow of a surface-line being laid out with easy curves. The maximum grade will be required, to a shorter extent, in descending to the Mangakokonoku Creek, near Kakaramaea, but thence into Rotorua the line will be comparatively easy, following the road route, excepting near Pakaraka, where a location more to the westward would be desirable. I have shown the route, as correctly as the circumstances will allow, on sheets Nos. 4 and 5 herewith, of the four-miles-to-the-inch maps of the Survey Department; but, from the paucity of topographical features, and the inaccurate condition of river sketches shown thereon, this must be taken as an approximation merely. I have made what I consider due allowance in length for the sinuosities of location, in grading in and out of ravines. Without actually running contours in position, this cannot be more accurately determined. Appended also is a diagrammatic section of the line, showing at a glance the conditions of grades and elevations as above described.

DESCRIPTION OF THE COUNTRY.

From Gisborne to Wharekopae the country is the alluvial of the papa and limestone of the Poverty Bay district. Papa formation is also to be traced close up to the Ngutuwa; westward of that, however, no trace of calcareous formation was observed. The rocks along the Waimana, Anini, Pukukaho, and Owahakarotu are all clay-slate of a very loose structure near the surface,