Waitara Route.—With reference to the country on this route, the Assistant Engineer who made the survey reports : " The country is all settled and open as far as 17 miles, at which point the line enters the bush, and from this to the junction with the Stratford (Ngaire) line in the Tangarakau there is no land of any value for settlement with the exception of three or four hundred acres, at 24 miles, in Uruti valley, about the same quantity in Makarakia valley, at 35 miles, and five or six hundred acres in Waitara valley, at 42 miles. The bush contains no timber of any value except rimu and kahikatea, and these only as scattered trees, with no quantity in any one place.

DESCRIPTION OF LINES.

General. — Attached to this report are tables of altitudes (A) at various important points on the routes under discussion, and on the portion of the open line between Marton and New Plymouth. The best idea of the levels of the lines is got by examining these tables.

Central Route.—As will be seen from the tables, there are great undulations on the Central Route. It rises to an altitude of 2,642ft. in getting on to the Murimutu Plain, then drops 637ft. to the lower end of the plain, rises again to an altitude of 2,680ft. on the Waimarino Plateau, and falls 2,115ft. to Taumaranui, which is only 565ft. above sea-level. The Poro-o-tarao tunnel, on the portion of the line common to all routes, stands at an altitude of 1,117ft., after which there is a gradual fall northwards.

It may be possible to reduce some of the undulations on the Central Route in making the working survey—for instance, the height at the upper end of the Murimutu Plain and the dip at the lower end : both of these may possibly be reduced in finally locating the line. The descent from Waimarino to Taumaranui cannot, however, be avoided ; and this is one of the most important features on the Central Route. It was expected that a ruling gradient of 1 in 70, with minimum curves of 7½ chains radius, could be got all the way from Marton to Te Awamutu ; but it is impossible to get such an easy gradient on this incline ; even 1 in 50 cannot be got without very heavy works. Occurring as it does in one locality, and that near the centre of the Island, where the traffic must always be lightest, the carrying-capacity of the railway will be little impaired by this gradient. It is a question, however, as to whether the gradients on other parts of the line should not be reduced to the same standard : by doing so a large saving would be made in the cost of construction. 1 in 50 is the ruling gradient on the Middle Island Main Trunk Railway, and the same or steeper gradients occur between Wellington and Marton and Te Awamutu and Auckland. I think, therefore, that under the circumstances 1 in 50 may well be adopted for the whole of the North Island Main Trunk line.

In general direction the Central Route is tolerably straight, and the minor bends are comparatively few. The minimum curves on the surveyed portion are 7½ chains radius, and this standard can be maintained throughout.

There are three sections on the Central Route where very heavy works are required—about nine miles of the twenty-two miles between Rangatira and Lower Hautapu, seven miles on the incline between Murimutu and Waimarino, and ten on the incline between Waimarino and Taumaranui. The Rangatira–Hautapu section will have about 1,500,000 cubic yards of earthwork, 95 chains of tunnelling, and three viaducts. The viaduct over the Makohine ravine will be 700ft. long and 230ft. high : it is the largest work of the kind hitherto proposed in New Zealand. There will be five viaducts on the incline between Murimutu and Waimarino, and nine between Waimarino and Taumaranui ; but in the present state of the surveys the amount of the other works at these places cannot be determined.

Ngaire Route.—As shown by the table of altitudes, the undulations on this route are comparatively small. The line commences at Eltham Junction at a level of 757ft. : the greatest rise from this level is 212ft. and the greatest fall 322ft. Generally the line is flat in the valleys and rising towards the saddles, with short gradients of 1 in 50. There are thirteen lengths of 1-in-50 grade, the longest being 4½ miles.

In general direction the Ngaire line is very straight, but it has a great number of minor bends. The radius of the sharpest curve is 7½ chains.

The heaviest works on the Ngaire route occur at intervals all along the line, at the crossings of the various watersheds. There are generally heavy earthworks on the inclines leading to the ridges, and a tunnel at the summit. The earthworks average 39,000 cubic yards per mile for the whole distance between Eltham Junction and Ongaruhe, but on eight miles in the Tangarakau–Heao inclines the average is 71,700 cubic yards. There are thirty-one tunnels, amounting in the aggregate to 188 chains, and ranging from 2 to 26 chains : the longest is that through the Patea–Wanganui watershed, 26 chains.

The bridging on the Ngaire line is comparatively light. There are only two viaducts, both over the Tangarakau River. The largest is considerably smaller than the one recently erected over the Waiteti gully, and the other still less. The remainder of the bridging generally is ordinary low-level river and creek bridges, of short span.

Waitara Route.—Commencing near sea-level, at Waitara, this line rises to an altitude of 144ft. at the Waiau, and falls nearly as much to the Mimi valley. There is a rise again to 847ft. at the head of the Waitara, and a fall to 435ft. at the junction with the Ngaire line in the Tangarakau valley.

From the commencement to the Uruti, at the 24th mile, the works on the Waitara route are comparatively light, and the same may be said of twelve miles at other places ; but the remaining eleven miles are far above the average. And of this again three and a half miles are the heaviest piece of railway hitherto surveyed in the North Island : the country is a regular succession of saw-tooth ridges and ravines, over which a railway cannot possibly be taken except at an enormous cost. The earthwork on the whole line averages 45,000 cubic yards a mile ; but the three and a half miles on the Uruti incline average 104,000 cubic yards per mile, in addition to which there are 106 chains of tunnelling and four viaducts on the same short section.