The trigonometrical survey so long needed was now at once set on foot by Mr. Jackson—at first in three separate sections,[1] in the Wellington, Rangitikei and Wairarapa districts, so as to include all those parts of the province that were immediately under survey. In each section a principal base was measured, while in the Rangitikei there were two, and in the Wairarapa three bases of verification—eight in all, varying from about 86 to 202 chains in length. Errors were distributed in these cases so as to bring all dimensions into conformity with the measured bases. The unit employed was a 66-feet standard chain, and due precautions were taken as to tension, correction for temperature, &c. The triangulations spread out from these bases varied in size according to the character of the country covered by them—from the so-called "major," with sides from seven to twelve miles long, to the "minor" with sides of from two to three miles. Where major triangulation was executed, it was afterwards broken down into minor. About three-fourths of the angles were observed with an eight-inch instrument, the rest with a six-inch, at least four arcs being used in every case; and residual errors were distributed by Sir A. Waugh's method so as to make each series geometrically consistent. Vertical as well as horizontal angles were observed in every case. When the work ultimately came to be tested by means of the verification bases the results proved satisfactory, the discrepancy between computed and measured lengths in no case exceeding the ratio of 14¼ inches per mile, while the average was but 6½ inches per mile. Thus, between the years 1866 and 1870, the relative positions of about 150 principal and 750 minor stations, in all 900 points, extending over 2,250,000 acres, were fixed with considerable accuracy at a cost of £7,000. The following is the basis on which the work was laid down. An initial latitude was computed from four observations of stars in the prime vertical, made by Mr. Jackson with a portable transit instrument, and agreeing very well with one another; and an initial longitude by combining (by means of the electric telegraph) results arrived at by Mr. Jackson at the Hutt, and by Mr. Thomson at Caversham, in Otago, from series of observations of lunar transits. This was used as the fundamental true position for all the triangulations, slight connexions between the three parts enabling it to be carried from one to the other. True meridian was determined by Mr. Jackson at the Hutt by finding the azimuth error of a portable transit instrument from circumpolar stars in the usual way (eighteen determinations in five nights); and at Opaki, in the Wairarapa district, by observing the sun at equal altitudes east and west of meridian with an eight-inch instrument, on two days. The Hutt meridian was used for the Wellington and Rangitikei triangulations, the Opaki meridian for the Wairarapa; and the two, when afterwards compared by observations at a point of junction, differed by about 30 seconds, a very creditable result considering the means employed. With these *data* the latitudes and longitudes of the chief trigonometrical points were computed, and the work rendered available for geographical purposes. Since 1870 the number of trigonometrical points has been increased to 1,200, and the area triangulated to 2,496,000 acres; and at present the work is in progress of connecting the three series by a system of large triangles extended across the main central range; this, when finished, will raise the triangulated area to about 3,917,000 acres. Records of the whole of the above trigonometrical operations have been systematically kept, and nearly all of the stations are erect; and, considering the degree of accuracy which has been achieved, it may fairly be assumed that the work thus zealously and persistently carried out by Mr. Jackson can be counted on for incorporation, with but little further trouble, into any general trigonometrical system.

Upon the triangulations, as they gradually progressed, all new section surveys were tied; thus the detail measurements were well checked at every two or three miles, and errors were confined within small limits. Concurrently with the new surveys, a great deal of old work also was gradually reduced to an accurate state by revision and resurvey, processes which brought to light no fewer than 2,400 cases of erroneous grants.

In the detail survey of sections before selection—which is usually made in the large blocks of from 5,000 to 150,000 acres in which the land is originally acquired and thrown open for settlement—a chain and theodolite traverse of the block boundaries, and of those main features which are likely to serve as section boundaries, is first made, and connected at all practicable points with the triangulation. Sections, and generally roads, are then designed on the plan. Agricultural sections are usually from 50 to 150 acres in area, as nearly rectangular as practicable, and arranged with due regard to road access and the general "lay" of the country. But if roads are not laid out at the time of survey, an addition of five per cent. to the acreage is made for that purpose. Pastoral lands are never laid out before purchase in allotments of less than 640 acres,[2] and the road allowance is then three or four per cent., according as the area is more or less than 1,000 acres. The roads and undefined boundaries of the sections are next marked on the ground by corner pegs fixed by a combination of chainage and intersections, the cutting of lines being as far as possible avoided. Reserves, if any, are also laid off. In the interior detail measurements, no greater error than 0·1 per cent. is allowed to pass without correction in the field. The surveyor's plan is now examined by Mr. Jackson. The bearings and distances written to every line being resolved by traverse tables into components perpendicular and parallel to the meridian of the work, a test can thus be applied at every intersection: this method of co-ordinates, indeed, is used in plotting in preference to that of laying off directions. Areas are also checked

[1] The connection between the Wellington and Rangitikei triangulations is so slight that it may be disregarded.

[2] But if pastoral land is applied for at 5s. per acre, the part applied for is put up to auction in parcels of 80 to 320 acres.