

form of a triangulation was gone through, but no real use seems to have been made of it. As an example of the ignorance which characterized this latter work, it may be well to mention that an attempt was made to find the true meridian by directing a theodolite to the stars Alpha and Gamma *Crucis* when they appeared to be in the same vertical—an observation which, even if it could be accurately made with such means, would produce an error in azimuth of more than  $3^\circ$ . But although the maps of these so-called surveys are now in the custody of the Inspector of Surveys, he is not responsible for the quality of the work, of which nearly all had been done before he took charge. Small surveys of remnants or “ullages” have since been added under his direction, and attempts have been made to correct those cases of faulty work which have been brought to his special notice. The result, in every such instance, has been to disclose the most alarming blunders and distortions, and to cast discredit on the whole mass of the work. Often the Crown grants utterly fail to give a true description of the land conveyed: cases of five or six-sided plots having been granted as rectangles are not uncommon.

It has transpired, also, that numbers of lines were charged and paid for in the course of these surveys as cut lines which had not been cut at all, an additional proof of the carelessness with which the work must have been conducted. All efforts to incorporate the surveys accurately on the index maps, even after connection with trigonometrical points, have failed: some parts have been fitted in as they best could be, when absolutely required for map-making purposes; but there is no hope that they can ever be put on a proper footing except by complete revision, or until, by systematic replotting on new sheets, any good work that exists may possibly be separated from the bad. The maps, drawn on the scale of eight inches to a mile, are old and much worn; it is hardly necessary to add that they are nearly worthless as accurate records.

#### BOUNDARY SURVEYS OF BLOCKS.

This branch of work, which has only come into operation within the last few months, consists simply of a periphery traverse of the boundaries of any block about to be acquired, Natives and Government Agents agreeing on the ground as to the course of the boundary lines. The traverses are executed with a theodolite, connected with trigonometrical points either at the time or afterwards, and mapped on the scales of eight or four inches to a mile. About 520,000 acres under this class are now being surveyed.

#### TRIANGULATION.

The triangulation conducted by Mr. Heale is mainly of the secondary order, the sides averaging about eight miles in length. It is in two parts, covering together an area of some 10,623,200 acres, in the Provinces of Auckland, Hawke's Bay and Wellington. These parts are long and straggling, owing in the one case to the shape of the land, in the other to the course of survey demanded by circumstances. The northern part rests on a base about four miles long, near Kaipara; the southern on a base about three miles long, near Napier. At these base lines, initial azimuths were determined by circumpolar stars at elongation, or by the method of high and low stars; and initial latitudes by meridian zenith distances of high stars, the observations being made with ten-inch instruments. At Kaipara there were ten determinations of azimuth, differing about 19 seconds among themselves, and nineteen of latitude differing 21 seconds. At Napier there were ninety determinations of latitude, differing about 29 seconds *inter se*; and true azimuth was found from several nights' observations with a ten-inch theodolite.

The Kaipara base was measured three times with standard chains in 1870, the greatest difference of measures being about twenty inches. The Napier base was measured three times in 1871, with a 66-foot steel band and straining apparatus. It was divided into two sections, each about one mile and a half long; and, though a single measurement of a section took but one day—so quickly was the work done, after much preparation and previous practice—yet the published results exhibit a very satisfactory degree of uniformity in the measures, and show that due care and vigilance were used: one-third of a link, or about  $2\frac{3}{4}$  inches, was the greatest difference between the measures after correction for temperature. It appears, then, that the Napier work is a good deal the more trustworthy of the two, and if any discrepancy is found when the triangulations come to be connected together, superior weight will be given to the southern section. Of the absolute value of the Napier measure in feet there is less satisfactory proof. The band was compared with the 66-foot standard on the stone basement of the Supreme Court at Auckland, which had been originally laid down with a beam-compass from a standard yard at  $62^\circ$  Fahr. Mr. Heale thinks that the Auckland standard is no doubt correct within 1-25th of an inch, which would correspond with a probable error of about three inches per mile. Though this is fairly good, it falls short of a high class of accuracy for purposes of base-measurement; and, viewing the triangulation as a whole, its chief value for ulterior uses will no doubt lie in the observations of its angles, which have been made with good instruments of ten and twelve-inch circles, and with considerable care, three arcs at least having been used in every case, and all observations registered and preserved. The trigonometrical stations, too, have been well marked, and descriptions kept. For immediate purposes, residual errors of observations of angles have been corrected by a method closely resembling that devised by Sir A. Waugh, so as to make the various figures, regarded as parts of a plane survey, geometrically exact. The probable error, from all sources, of the Napier triangulation thus reduced is