

THE GEODETIC SURVEY

The following report of the Surveyor-General of Victoria, on the proposed geodetic system of survey for 1859, was recently laid on the table of the Melbourne Assembly:—

"As the distinctive feature of a geodetic survey is the adoption of the geographical divisions as the skeleton on which the survey into minute subdivisions of the country is to be based, it has been necessary in the first place to determine a 'standard meridian.'

"The position of the Williamstown Observatory has been determined by a series of observations extending over several years, and with sufficient accuracy to warrant its adoption as absolute.

"As opinions have been hazarded, without a sufficient knowledge of facts, adverse to the absolute accuracy of the standard, tables have been prepared, showing, *in extenso*, the deductions of all the observations, made for longitude, which establish the position of the Observatory so completely, that it is not considered necessary to say anything more in support of that assumption.

"The 145th meridian being the nearest to the Observatory, has been selected as the standard, for which its proximity particularly fits it, the distance between it and the Observatory being less than two miles. Its position was permanently ascertained by means of triangulation, and finally determined by a series of transit observations, compared with others made simultaneously at the Observatory, and communicated by means of the electric telegraph and heliotrope signals.

"The position of the meridian having been determined, it next became necessary to trace it northward towards the boundary of the colony. In order to do this without deviation, observing stations were placed at short intervals along the line, from which numerous observations were taken, and the true direction rigidly maintained: so much so, that in the 40 miles already laid down the error of deviation is confidently believed not to exceed 1 inch."

"In order to render the meridian immediately available as a basis for minor surveys, it has been determined to establish the point at which the 37th parallel of latitude intersects it, and from thence to trace the parallel to the 144th and the 146th meridians respectively. In effecting this one of the principal difficulties of the work appears. The curvature exhibited by a parallel in traversing a degree of longitude being sufficient to make its tracing a matter of considerable labour and intricacy. To overcome this, it is proposed to make the parallels of latitude to assume the forms of the chords of their curvature, when they would be the segments of great circles, and would not show a greater deviation from their proper curvature than would be represented by the diameter of the chord, equalling about 87 feet, which, in the length of a degree, would be inappreciable.

"By adopting this course, the scientific efficacy of the survey would not be practically impaired, while at the same time a large amount of time and labour would be saved.

"The first and standard meridian having been established, and the parallels of latitude intersecting it laid down, the determination of other meridians becomes comparatively easy by adopting a system of differentiation, by means of which the maximum error in determining a meridian only one degree distant from the standard is limited to the probability of an insignificant error in the observations for local time, which would seldom amount to more than a fraction of a second of time, and could be destroyed altogether by repeated observations. Each meridian, as it is thus obtained, becomes a standard from which others may be differentially deduced. To facilitate the eventual

be differentially deduced. To facilitate the eventual subdivisions of the large geographical sections contained by the meridians and parallels of latitude, it has been decided that each of them shall be divided into tenths, and tables are in course of preparation calculated on an assumed compression of the earth of 1:300, in which the values of these divisions will be given in terms of ordinary measurements.

"The divisions will individually have to be measured by the chain, but will be collectively subjected to the additional test of triangulation, by means of which it is proposed to check and bind up the work done in the first instance astronomically."

"This necessary triangulation must not be confounded with a minute trigonometrical survey of the colony, which is not at present intended; but as the measurement of a base line and other preliminary work will have to be done, it can hereafter, if desired, be made available for that purpose, in addition to the end it is intended to answer now.

"The nature of a trigonometrical survey is to bind up and determine the distances between certain points. It has its full application in an old country, where every boundary has been set out and marked on the ground, and is adapted particularly for the measurement of things as they are found to exist. The peculiar shape of the triangle renders it unsuited as the basis of the subdivisions of land required for sale. If a country were ever so carefully and minutely surveyed trigonometrically, not a single farm or allotment of land would have been marked and set out for occupation."

"A trigonometrical survey is adapted for representing things as they are found, and not for creating a new series of artificial boundaries, or for setting out roads.

" CONTRACT SURVEYS.

"The Geodetic Surveyor having, after the manner described, divided the country most required for settlement, into the geographical divisions, and these again into tenth parts of a degree, will be followed by contract surveyors, who will take up the work where the other left it. The Geodetic Surveyor will have furnished to the office the accurate boundaries of the squares, which will in round numbers be about thirty square miles, or 19,200 acres each.

"The four corners of the squares will be permanently defined by stones, carefully embedded in the ground, with reference marks thereon, to be used for all future measurements.

"The length of the lines will be given to the contractor, as well as the area of the whole square.

A minute specification, detailing the mode in which everything is to be done, will be given him, being prepared on a general and uniform plan.

"He will be required to conform to the usual stipulation, as provided for now in all Government contracts.

"His work will demand but moderate scientific requirements, and will consist in the greater part, of the manual labour of digging trenches, numbering and preparing the corner pegs, and marking trees, which it will be his interest to get done well but expeditiously.

"He will be required, nevertheless, to hold a certificate of the necessary qualifications.

"He will have ample directions as to the main lines of roads, sites for towns and villages.

"He will not be paid until the work has been checked by a diagonal line across the survey, and by the personal examination on the ground of the Government Inspecting-Surveyor.

"The area of each lot he sets out will thus be checked, and the sum of the parts, including the spaces occupied by roads and water, will be required to correspond to the area of the square bounded by the

spaces occupied by roads and water, will be required to correspond to the area of the squire handed over to him. This will ensure as great an amount of accuracy as now obtained, and more uniformity.

"It may be said that the Contract-Surveyor will not have so much interest in returning good work; but it is found in practice that he has more at stake than many of the persons holding appointments.

"With reference to the fear that has been expressed, that the marks will be obliterated before the land is sold; if a few of the marks should be destroyed by the

* The principal astronomical instrument used in the work is an 18-inch altazimuth, which from its great solidity and faithful construction, has been available not only for extra meridional observations, but as a transit instrument.

Next in importance to the altazimuth instrument come the time-keepers, consisting of one sidereal and two mean time chronometers. In addition to these, there is a portable transit instrument, a 12-inch biconvex, and two Wauich heliostopes, for the use of which the department has been indebted to Professor Neumayer.

The observations adopted to determine the meridian were chiefly of "circumpolar" and "high and low stars," from which are deduced the local time and the true direction. Moon culminations differentially compared with others taken at the Observatory at Williamstown, have been obtained, as affording an additional check on the accuracy of the determination.

The astronomical value of the arcs of meridians contained between the several observing stations has been also determined by extra meridional and polar observations. The use of the heliostope—an instrument of recent construction—has afforded extraordinary facilities in tracking, and has enabled the stations to be made at far greater distances than could otherwise have been done, besides rendering the placing of distant points both quick and certain.

It is satisfactory and will be of great use to the future operations of the Geodetic Survey to have the valuable advice and assistance of such an eminent astronomer as Professor Airy; his past experience in Geodesy is well known.

He has already, in reply to Mr. Ellery, F.R.S., Superintendent of the Astronomical Observatory, Williamstown, to whom the Geodetic Survey is in duty to be entrusted, prepared and forwarded tables for insuring accuracy in the geographical determinations, which will be used in future. Appended is the letter addressed to Mr. Ellery on the subject:—

Copy of an extract from a letter from the Astronomer Royal,
Royal Observatory, Greenwich, London, S.E.,

October 21st, 1858.

Sir,—I have the pleasure of sending on the other leaf, right ascensions of the moon and stars from transit observations, and errors of the Nautical Almanac, places of the moon from observations with the Transit and with the Altazimuth, as far as will be necessary for your longitude observations. I shall be happy to continue them as may be required.

It will be a matter of great interest to receive accounts of your operations, both purely astronomical and geodetic.

I am, &c.,

(Signed)

G. B. AIRY.

Robert J. Ellery, Esq., Superintendent of Observatory
and of Geodetic Survey, Victoria.

need, and a portion of the money devoted to salaries and wages instead of to contracts.

"CHARLES W. LIGAR, Surveyor-General.

"February 2."

passage of vehicles, as will always be the case, their position can easily be found by measuring to the sunk stone reference marks in the neighbourhood, or to adjoining lots. As to the commencement of the contract system, and its being made to work into the present plan of employing Government surveyors, without causing an inconvenient delay, there now may be some difficulty. It is desirable that it might be brought about gradually, and for this purpose authority should be given to the Commissioner of Land and Surveys to substitute, as he may think necessary, a portion of the vote for salaries and wages of labourers for the cost of surveys by contract, or, in the event of Parliament voting a given sum for contracts, the reverse might then be authorised in case of need, and a portion of the money devoted to salaries