

South Africa, India, &c., is the 12 in. theodolite. The latest models can be packed in three boxes, and are therefore more portable than the 8 in. size referred to above. Mr. Cox, a representative of Messrs. Watt and Sons, London, who visited Wellington recently, stated that twenty of these 12 in. theodolites were supplied by his firm for reconstruction surveys in Belgium and the north of France after the war.

Several auxiliary instruments, which have not been generally used before on triangulation work in the Dominion, but which are necessary in order that accurate differences in the heights of the stations may be determined, are barometers, hygrometers, and thermometers.

The permanent marking of the **trig. stations, and the signals to be used while the observations are in progress**, are matters that require careful consideration, and suitable designs should be prepared and adopted for the guidance of the staff officers to whom the field operations connected with the survey are entrusted. The work has an important scientific value also in connection with the determination of the size and shape of the earth.

The measurement of an arc of the meridian was contemplated in the Surveyor-General's report of 1877 (H.-17A, page 7), and again referred to in the report of 1900-1 (page xiii), but such a work as a separate survey will not be required, as all the data for determining the figure of the earth will be supplied by the triangulation, since the astronomical and geophysical observations for latitude, azimuth, and gravity measures are now recognized as part of the routine work of a modern survey of this kind.

STANDARD SURVEYS.

A standard survey of the Borough of Gisborne has been urgently needed for a long time, and a visit was made to discuss the details of the work with the municipal authorities in February, and satisfactory arrangements were concluded with them for commencing the survey at an early date, when the services of a staff surveyor experienced in that class of work will be available. Further standard surveys are required in all the cities and boroughs in the Dominion, and it is now indispensable that a uniform system should be inaugurated for the performance of this important work. A surveyor engaged in this work has many difficulties to contend with in investigating the original survey and subsequent subdivisions in order to decide the most probable position for the permanent blocks that indicate the street-intersections. He is to search for the original pegs, or for the places where they were originally located, and allow these to control, if he finds them. In many cases all the marks of the original survey have disappeared, and it becomes necessary to establish an alignment by reference to the occupation-lines. To do this satisfactorily the surveyor is all the better for a few years' experience, and should bring good sense and sound judgment to all questions with which he may have occasion to deal, as well as a knowledge of the correct principles to apply in deciding the position of the alignment from a multitude of preliminary measurements. After the permanent blocks have been located he is required to make a most precise measurement of each line and a refined observation of every angle.

It is therefore evident that the staff surveyors, before being entrusted with a standard survey, should receive additional instruction and training to that required to qualify for sectional work. In the past each surveyor has used his own judgment as to what instruments and apparatus should be used in performing the work; the various surveys therefore exhibit different standards of precision according to the power of the instruments employed. The instruments used in the operations connected with the standard survey of Auckland by Mr. J. Langmuir, Inspecting Surveyor, were described and illustrated in the Survey Report for the year 1909-10 (Appendix III, page 20 *et seq.*). A report on the methods and instruments used on the survey of Dunedin was prepared in 1916, but on account of the war conditions prevailing at that time the publication of it was postponed. That report is as under:—

Report on the Standard Survey of the City of Dunedin, by W. T. Neill, District Surveyor.

The operations connected with this work comprise three separate and distinct surveys—viz., (1) a preliminary survey, (2) a precise survey, and (3) an offset survey. A brief account of the salient points of each of these surveys, and a description of the instruments and apparatus used in performing the work, is given below:—

(1.) *Preliminary Survey.*—This work was undertaken to define the occupation of the various townships and subdivisions that had been made at different times, and often independently of each other, for the purpose of deciding the positions of the permanent monuments of the precise survey, of the area to be surveyed outside the boundary of the original city, and within the boundary of the original city to check the positions of the blocks of an earlier standard survey executed by J. A. Connell about forty years ago.

The accuracy observed in performing the work was similar to that enforced by the Survey Regulations under the Land Transfer Act. The survey was therefore effected by means of a 5-chain $\frac{1}{8}$ in. steel band and the standard pattern of 5 in. transit theodolite (No. 3 in Fig. 9). The temporary reference-points were marked with second-hand bolts and spikes obtained from the Railway Engineer's Department, driven slightly below the surface of the street, the exact centre being shown by a centre-punch mark. The alignment was established by taking offsets to both sides of the street from a trial line and computing the most probable line by an application of the "method of least squares" in most cases where the original pegs had disappeared.

(2.) *Precise Survey.*—As its name implies, the object of this work is to obtain a high degree of precision in the linear and angular measurements of all the distances and angles between the points fixed by the preliminary survey, and in addition to erect permanent monuments that will securely