

The Canadian Engineer

A weekly paper for engineers and engineering-contractors

NOTES ON PROVINCIAL LAND SURVEYING

CALCULATION OF COMPASS-SURVEYED AREAS BY DOUBLE MERIDIONAL DISTANCES—PLOTting BY THE USE OF CO-ORDINATES—RESPECTS IN WHICH THE PRACTICE OF SURVEYING HAS CHANGED

By J. A. MACDONALD, Ottawa, Ont.

It is generally conceded among surveyors that there is but one absolutely correct method of calculating the area of a compass-surveyed plot of ground. In compass surveying there is necessarily the intrusion of a number of errors, the number generally depending upon the number of courses. This may be readily explained. Five minutes is the closest reading that any surveyor may expect from the compass, and frequently the variation may be ten or even fifteen minutes. In one mile, therefore, where ten minutes mean twenty-three links, the liability of error becomes comparatively great, considering the fact that errors often occur in reading with a good transit, where there is fine precision, to the extent of thirty seconds, and with levels in good order. With such a liability of error, therefore, one may not expect to tie on the starting point of a compass survey. In plotting, it is found necessary to balance the errors of each course, i.e., to divide them *pro rata* among the courses according to length. This is done most satisfactorily by Double Meridional Distances.

Double Meridional Distances.—In plotting a compass-survey which, by the way, must be done by latitudes and departures, there is a favorable feature in the compass which the transit does not possess, that is noticeable. If there is an error in one deflection angle read from the transit, this error arising from improper levelling of the instrument, or its being set up on marshy or infirm ground, all the following courses are intensified in error, a succeeding course depending on the course just taken as a back-sight. With a compass an error in one course does not necessarily lead to an error in the succeeding courses, every course being independent of the other. In plotting a compass survey, therefore, latitudes and departures must, in nearly all cases, be taken, rather than measurements by deflection angles. This, of course, is the proper method of plotting a transit survey also, but it is not always used on account of the extra labor involved in calculating the latitudes and departures. With a table of latitudes and departures, given to minutes, as are now obtainable, however, it is not a laborious task.

The parallel ruler used to be an indispensable requisite of the old compass surveyor. This is found very convenient in plotting—in fact, it is almost the *sine qua non* of a compass surveyor's instruments. Set squares are now used more generally and particularly for railway

work. It might be stated that the method of latitudes and departures is now mostly used in plotting railway plans. But in plotting railway plans the meridian, whether magnetic or astronomical, is not passed through each station as is usually done when plotting a field survey made by a compass, and using the parallel ruler, and the protractor for plotting. These two instruments go hand in hand, one being a complement of the other.

There is another method, and the one mostly used in plotting railway plans by latitudes and departures. This is by the use of the set squares and the scale; no protractor being used. On the National Transcontinental Railway, plotting the traverses and the locations with a protractor was forbidden. The latitudes and departures, sine and cosine, being calculated, the latitude was scaled from the last station, using the set of squares to parallel the meridian on the plan and precisely at right angles with it, the distance measured and marked. From this point, and precisely at right angles, the departure was scaled and marked, and the intersection of these lines indicated the new station. This method, while it would answer with a compass survey, is seldom, if ever, used; at least, it was not used by the old surveyors. The protractor and the parallel ruler were usually the instruments used for plotting, and are, as already stated, the most convenient instruments for plotting surveys made with the compass to-day.

Much more attention was given by the old compass surveyors to plotting and lettering than is given by present-day surveyors. It is interesting to note the beautiful work (now considered altogether unnecessary) of some of the old surveyors, which is to be seen in the land office at Ottawa. There must necessarily have been a good deal of time taken over this work, which one would now be ready to call "lost time," but in those days time was not such an important factor as in these strenuous times, and the mighty rush and competition existing at present does not warrant taking any more time over a plan than is absolutely necessary. There is no time now for artistic work, old English letters and elaborate north prints. Stamps and stencils, and even the typewriter, do considerable of the lettering to-day.

Taking the plot, shown on page 498 of *The Canadian Engineer*, (Fig. 2) the plot, Fig. 1, is how it looks when plotted with the protractor and parallel ruler. It will be seen that the last course does not tie to the starting