

gress and condition of the settlers and the resources of the township are also noted.

The personnel of a stadia survey party consists of, in addition to the surveyor, an articulated pupil, two rodmen and a cook. For transport, two teams with light wagons and a collapsible canvas boat are provided. In open prairie townships one wagon may profitably be exchanged for a democrat. Both oars and paddles are provided for the canvas boat. Oars are generally found more satisfactory, as these boats, presenting a large surface to the wind and riding light on the water, are hard to manage with one man only, paddling, if there is any wind. The canvas boat if in use every day, and on lakes, the most of which are alkaline, will not last through one season without the exercise of considerable care and much repairing. Holes are closed with patches of duck, the seams being rubbed with wax. If the lakes or rivers on which the boat is being used are rocky and gravelly, the keel should be protected with patches of duck or tin from the first, as this part is difficult to repair and make water-tight once it is worn through, as it soon will be if not protected.

In reedy lakes it is difficult to use a canvas boat, and time will be saved by taking sounding by wading if the water is not too deep and the bottom is not too soft. The water in lakes completely covered with reeds is seldom over five feet deep.

The stadia traverse is commenced from a section or quarter-section corner, the transit being set up to read the bearing of the meridian or chord shown on the township plan. If the bearing cannot be obtained from the section lines, the instrument is oriented by means of the compass, the azimuth of magnetic north having been previously ascertained by the surveyor. When the compass is used to orient the instrument, an astronomical observation, either solar or stellar, is taken when the weather is favorable. If an observation is not taken the traverse is continued until it closes upon another section or quarter-section corner.

The needles supplied are sensitive and accurate, and on the prairie it is seldom that the compass bearing differs by more than two or three minutes from the bearing by observation, unless there is local attraction, such as wire fences or telephone wires.

In any case, as many ties as possible are made to adjacent monuments, and a tie must be made in at least every three miles.

In producing the traverse towards the lake, it is important that the stations should be carefully located. The majority of the lakes in the western townships can be traversed from one station if the lake is carefully approached and the final station well placed. Economy of stations can only be practised in the approach to the lake if the topography of the surrounding country is well understood. In Northern Saskatchewan and Alberta, lakes generally lie in chains or groups, and here the selection of the stations so that no lakes may be missed, and no time lost, is a more difficult matter. Unless the front rodman is an unusually good topographer, it is best that the surveyor should reconnoitre the ground and lay out the stations himself. A general reconnaissance before the close of the day's work of the ground over which it is proposed to run the next day's traverse should be made, if possible, in order to determine the amount of water and the best direction for running the traverse, taking into consideration the location of ridges and ravines, and in timber, of clearings and openings in the

bush, and the direction of old logging roads and trails, or any other natural advantages that will save cutting.

In no other way can so much time be saved or lost in stadia traversing as in the placing of the traverse stations. The rear rodman gives backsights at the instrument stations. He also looks after the horses, and if the nature of the country permits, brings them up with him when he goes ahead. It is also his duty to take the necessary soundings, either from the canvas boat, with a lead and plumb-line, or in the case of shallow lakes, by wading out with a graduated staff. His stadia rod should not be used in either of these cases for taking soundings. In the case of large lakes, he may help the front rodman by giving side shots as he advances towards the transit, or if the lake is traversed from one station, he may proceed around it in the opposite direction to that taken by the front rodman. On some occasions, too, he may go ahead and put in the next station while the front rodman is completing the traverse of the outline of the lake. The two rodmen, if of equal intelligence, may thus be allowed to alternate in their positions. The rear rodman, while driving the team, may also investigate the surrounding country for more lakes. In this case it is, of course, necessary that he should be a thoroughly reliable man and a fair topographer.

Any of the standard D. L. S. transits equipped with stadia wires may be used on the stadia surveys. Owing to the constant turning on the plate and axis, this part of the transit needs to be strong, close fitting, and easy to turn, and there should be no eccentricity. Much depends on the vertical circle holding its adjustment, and its arrangement should be the best possible. The transits are tested in the Surveys Laboratory each winter, and the proper corrections to the stadia intervals determined. The corrections for each chain of reading from one chain to forty chains for the half interval are then printed on cards for the use of the surveyors in the field. While the conditions under which the stadia intervals are determined are rather different from the conditions in the field, any loss of accuracy in this respect is likely compensated for by the extra accuracy with which the determinations are made. Changes in the wire interval result from radical changes in the climate or seasons, as well as from physical changes in the wires themselves. Intervals should be tested every few months on a carefully measured base.

The standard stadia rod has been improved by having the hinges strengthened and by having a metal strap placed at the back. The level bubble, too, has been much improved and the color used in graduating the rod has been brightened. The rods are fourteen feet long, and are graduated to read in chains and tens of links, a total distance of forty-two chains, each group of ten being a different color.

In reading a rod the chains and tens of links are counted and the fraction of ten links estimated. All the wires are read for precision and accuracy. The whole reading, being twice as accurate as the half readings, is always read up to distances of twenty chains, if possible. The slope of ground, and intervening reeds, grass, branches and leaves of trees often prevent the reading of the whole interval for distances less than twenty chains. The upper and lower interval reading should agree when reduced, and their sum should be equal to the reading with the whole interval. Where there is a difference between the upper and lower interval readings, the upper is preferable as there is less interference from refraction, which is greatest in the strata of air next to