

sensitive needles. As the observation can be made in a few minutes and with very little trouble, it is desirable that all surveyors should observe when they can do so without inconvenience.

The observation and recording forms are arranged for the determination of the bearing of the magnetic needle instead of the magnetic declination. The arrangement is made for the sake of simplicity in observing and recording, the bearing in question being, subject to instrumental corrections, the angle read on the horizontal circle of the transit. Moreover, it is not liable to errors of sign, as in adding or subtracting the declination.

Directions for Observing.—Place the instrument on a section or other line, defined astronomically, and after adjustment, set the vernier to read the astronomical bearing of the line.

Release the lower clamp, direct the telescope on the line, and fasten the lower clamp.

Release the vernier clamp, and turn the vernier plate until the north end of the magnetic needle observed with a magnifying glass, is seen exactly opposite the zero mark. Tap the trough lightly with the pencil to be sure that the needle has taken the position of rest. Note the reading of the horizontal circle. Take several readings by repeating the operation.

Repeat the third operation for the south end of the needle.

Enter in the notes the place of observation, date, hour of the day, weather and other remarks, if any. It is important to record auroras occurring within 24 hours of the time of observation.

Remarks on Observations.—For saving trouble and calculations, it is suggested that observations be made on any lines of which the bearing is known.

The direction of the magnetic needle is subject to a daily fluctuation called the diurnal variation. During the greater part of the night the direction is not far from normal. In the early morning, the north end of the needle in Canada moves towards the east, reaching its maximum deflection about 7 or 8 a.m. The motion is now reversed, the north end travelling westwards, and crossing the normal direction about 10 or 11 a.m. The extreme western position is reached in the afternoon and then the needle comes back to its normal position at some time after 5 or 6 p.m. This march is subject to wide variations during magnetic storms. The magnitude of the diurnal variation is not constant. In the inhabited parts of Canada, it may exceed 20 minutes. Observations at both eastern and western elongations of the needle on the same day, that is, between 7 and 8 a.m. and between 1 and 2 p.m., give the best results, and it is desirable that when convenient they may be taken then. This gives not only the best value for the declination, but also the diurnal variation which it is most useful to know. Failing this, however, the best time to observe is after 5 p.m., when the needle is about in its normal position. It is true that the normal position is crossed generally between 10 and 11 a.m., but the motion being very rapid and the time of crossing uncertain, the afternoon observation is preferable.

When an instrument is brought from England, where many of the transits and compasses are made, it is usually found that the north end of the needle is dropping. To balance it without injuring the pivot point or cap, proceed as follows:—

Raise the needle with the lifter, unscrew the end of the trough, withdraw the cover glass, take out the needle and shift the small brass counterweight. Then the lifter being still raised, place the needle upon it and lower the lifter gently. If the needle is not yet balanced, raise the lifter again and repeat the operation. The greatest care must be taken not to bend the needle in the slightest degree while shifting the counterweight, because the bending would change the direction of the magnetic axis.

If the needle is sluggish, the observation cannot be accurate. The sluggishness is generally due to a dull pivot or a scratched cap. To keep both in proper condition, the needle must always be lowered gently on its pivot and never be allowed to play, except when actually in use.

OBSERVATION FOR MAGNETIC DECLINATION

Date 19th July 1908 Observer G. J. Lonergan D.L.S.
 Place 40 Chs. E of the S. E. Cor. of Sec. 5
 Tp. 50 Rge. 20 W. of 4th Mer.
 Time 7¹⁵ P.M. Instrument Watts #2216 (Give No.)
 Bearing of reference line 89° - 59'

H. C. R. FOR DIRECTION OF MAGNETIC NEEDLE.

NORTH END.		SOUTH END.	
(1)	27 - 15'	27	17
(2)	11		16
(3)	12		10
(4)	11		10
(5)	10		12
Mean of North End. 27 - 11.8		Mean of South End. 27 - 13.0	
(a) H. C. R. of compass north		27 - 12.4	
(b) Corr. for convergence		- 1.2	
(c) Bearing of compass north		27 - 11.2	
(d) Index error		5.8	
(e) Bearing of magnetic north		27 - 05.4	

REMARKS.

*A few clouds Windy
 No aurora.*

Fig. 2.

Explanation of Specimen Observation.

1. The H.C.R. of compass north is the average of the mean north and south end readings. The transit was adjusted to read correctly the bearing of the section line, so that the horizontal circle reading of compass north is the bearing of compass north referred to the astronomical meridian through the centre of the township. If the transit had not been so adjusted a correction to this reading would have been required.

2. The correction for convergence has for object to refer the bearing read on the horizontal circle to the astronomical meridian of the point of observation. The value of the correction is taken from the diagram in the