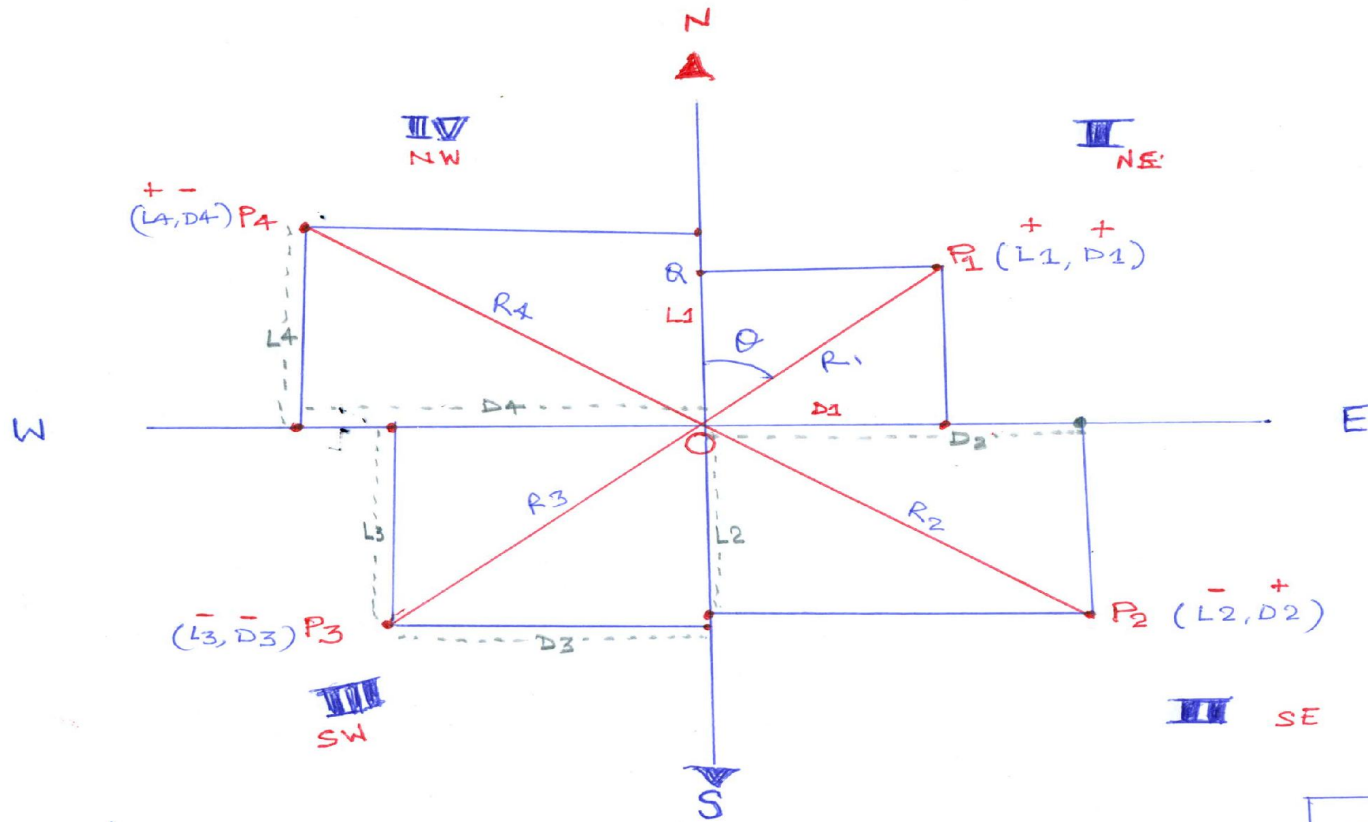# Tutorials on Traverse Survey

General Concept

A survey line may be represented on plane by two rectangular coordinates, if length and bearing be known, the axis of coordinates being North or south line and east or West line . Distance measured parallel to North –South line is called Latitude while that measured parallel to East –West line is called Departure (Longitude).

Latitude = Distance measured x Cosine angle of Reduced bearing.

Longitude = Distance measured x sine of Reduced bearing.

Note

1. Latitude is positive when measured North or upward direction and negative when measured South or downward direction.

2. Longitude / departure is positive when it is east and negative when it is west.

N

IV
NW

I
NE

$+$ $-$
(L_4, D_4) P_4

$+$ $+$
P_1 (L_1, D_1)

R_4

Q

L_1

θ

R_1

L_4

D_4

D_1

W

O

D_2

E

R_3

R_2

L_3

L_2

$(\bar{L_3}, \bar{D_3})$ P_3

$-$ $+$
P_2 $(\bar{L_2}, D_2)$

D_3

III
SW

II
SE

S

Line OB makes an angle θ from North reference meridian
Then in $\triangle$ QOP₁

$\dfrac{OQ}{OP_1} = \cos\theta \Rightarrow \dfrac{L_1}{R_1} \Rightarrow L_1 = R_1 \times \cos\theta$

$\dfrac{QP_1}{OP_1} = \sin\theta \Rightarrow \dfrac{D_1}{R_1} \Rightarrow D_1 = R_1 \times \sin\theta$

Where L₁ ⇒ Latitude
D₁ = Longitude

$Tan\theta = \dfrac{\Delta E}{\Delta N}$

$\theta = Tan^{-1}\left(\dfrac{\Delta E}{\Delta N}\right)$

Where, ΔE = difference in Easting between two points
ΔN = Diff in Northing between two points

- North latitude is called Northing and south latitude is called Southing.
- Similarly East departure is called Easting and West departure is called Westing.
- Horizontal angle measured clockwise direction between True Meridian and a Survey Line is called Bearing.
- Horizontal angle measured in anti- clockwise between True Meridian and a Survey line is called Azimuth.
- Calculation of azimuth

If True bearing of a line is > 180 degree then

Azimuth of line is 360 - true bearing.

If True bearing is < 180 then

Azimuth of line is equal to True bearing.

- Magnetic Declination Horizontal angle between True North and Magnetic North at the place of observation is called Magnetic declination.

 if Magnetic meridian is east of true meridian the angle of declination is said to be +ve or Eastern Meridian and if it is on West   of True meridian , it is –ve or called as Western Meridian.

(Isogonic lines having zero declination also called " Agonic Lines")

- The Whole Circle Bearing System :- the whole circle bearing system (WCB) is also known as Azimuthal system, in this system, bearing of a line is measured from True or magnetic north in clockwise direction. The value of a bearing may vary from 0 ° to 360° , utilizing the whole circle of graduation to minimize the mechanical errors which may occurs during engraving the horizontal plate of Theodolite.

- The system of measuring bearing from north direction is adopted in India and United Kingdom. In some countries , W.C.B of survey lines are reckoned from the South. Those bearing differ by 180 ° in magnitude as compared to those expressed from North.
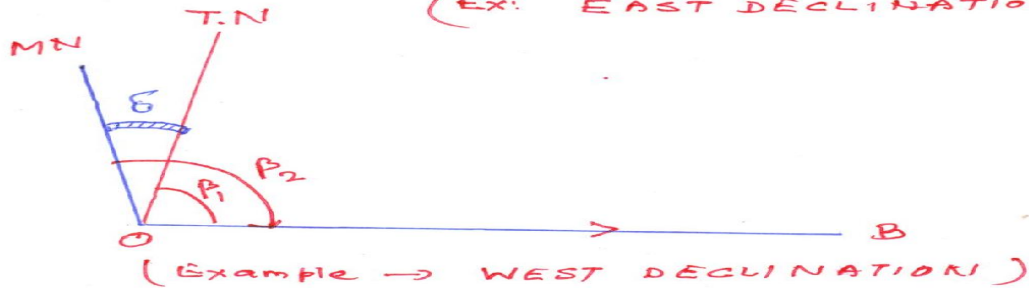
Antidoc TN
AZIMUTH
Clockwise
Bearing
B
O
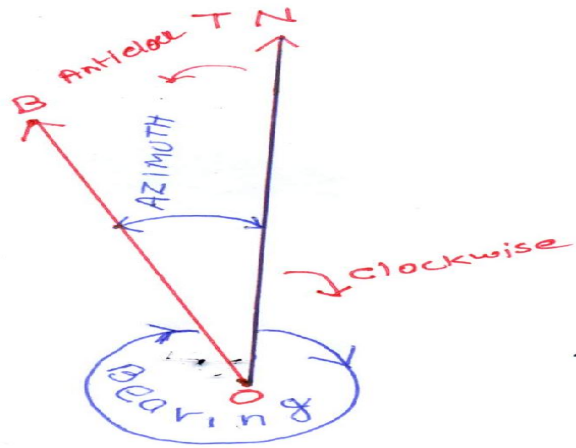
T.N = TRUE NORTH
MN = MAGNETIC NORTH

TN
MN
δ
β_1
β_2
O
B
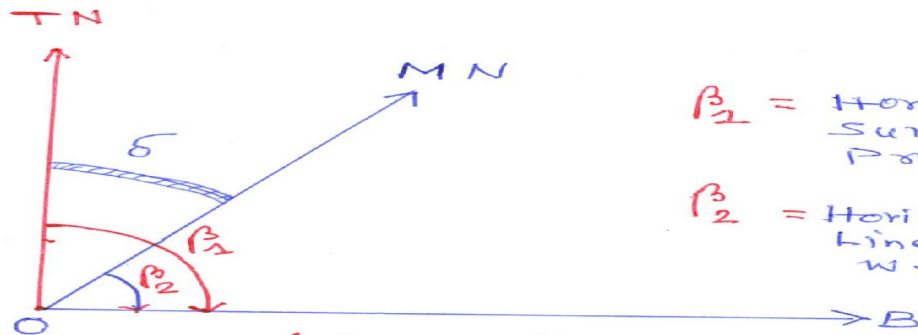
β_1 = Horizontal angle/bearing of a Survey Line in the direction of Propagation w.r.t. True North

β_2 = Horizontal angle/bearing of a Survey Line in the direction of Propagation w.r.t. Magnetic North.

$(\beta_1 - \beta_2)$ = Magnetic Declination (δ)
(EX: EAST DECLINATION)

MN
T.N
δ
β_1
β_2
O
B

(Example → WEST DECLINATION)

- Local Attraction :- it is a common experience that the magnetic needle gets deflected from its normal position, if placed near magnetic rocks, iron ores, high tension lines, iron or electric poles etc. such disturbing force is know as local attraction.

- Magnetic bearing are therefore not reliable unless these are checked against the presence the local attraction at each station and their elimination.

Practical hints for locating local attraction and its correction

- Observe the line whose fore bearing and back bearing differ exactly bye 180 °.

- Accept the bearing taken from the end stations of the line having no errors, accept it as correct.

- Calculate the back bearing and fore bearing of the next line and find the error between the observed bearing and its correct bearing.

- If at a station, observed bearing of line is more than that of its correct value, the error at the station is positive and the correction to be applied to the other bearing , is negative and vice versa.

Precautions to be taken in compass survey

- Before taking reading, the compass box should be gently tapped t ensure that the magnetic needle is freely swinging and has not come to rest due to friction.

- Stations should be selected such that these are away from the sources of local attraction.

- Observer should not carry iron articles, such as bunch of keys, belts etc.

- Avoid taking a reading in wrong direction viz, 25 ° to 20 ° instead 20 ° to 15 ° and so.

- Object vane and eye vane much be straightened before making observation.