# Compass traversing: Important Definition

- **True meridian: Line or plane passing through geographical north pole and geographical south pole**

- **Magnetic meridian: When the magnetic needle is suspended freely and balanced properly, unaffected by magnetic substances, it indicates a direction. This direction is known as magnetic meridian. The angle between the magnetic meridian and a line is known as magnetic bearing or simple bearing of the line.**

North pole

True meridian

True bearing

Magnetic bearing

Magnetic meridian
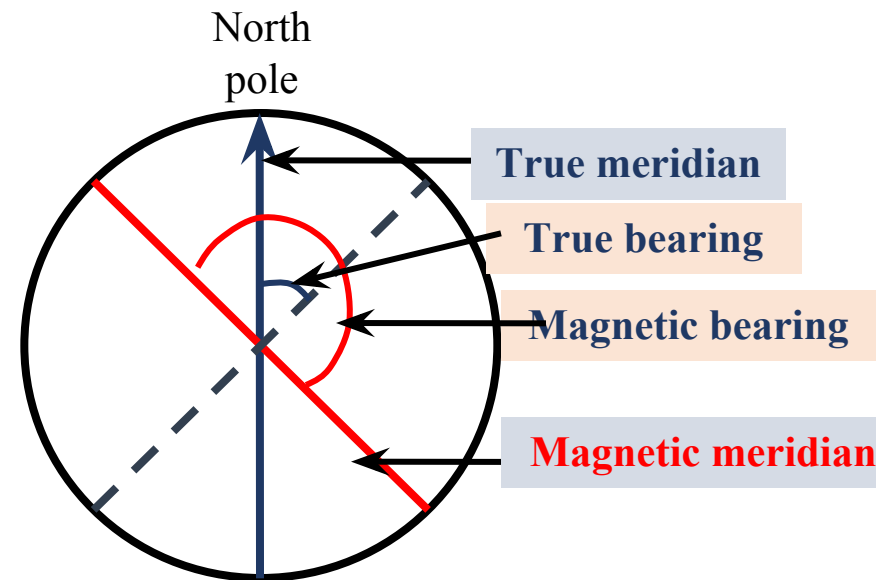
True Meridian :- the line of intersection of the earth surface by a plane containing a North pole , South pole and observers position is called True meridian or geographical meridian. Geographical meridian are not parallel to each other. These converge to a point in northern and southern hemisphere.

Equatorial circumference of the earth surface is divided into 360 degree. The true meridian of Greenwich has been assumed internationally as 0 degree. Determination of true meridian at any place precisely is made by making astronomical observations to heavenly bodies i.e. sun and stars. The true meridian at any place is not variable. In engg surveys it is very useful to save time in laying the surveying lines during constructions . it may be mentioned here that the maps prepared by National survey deptt in any country are based on true meridian.

Convergence of True meridian:- convergence of the meridian varies according to the latitude of the place. It is higher near the equator.

The convergence of meridian at latitude (θ) is the angle between their tangent at latitude (0)

Grid Meridian:-

In every country, state survey maps are based on one or more true meridians o the place so chosen that they are centrally placed in definite belts bounded by some geographical meridians and paralles.such maps have a rectangular grid plotted on them.

Azimuth and bearing :-

True bearing :- the horizontal angle between the true meridian and the survey line measured in the clockwise direction is called true bearing.

Azimuth :- the interior angle (smaller) angle which a survey line makes with the true meridian is called Azimuth, Azimuth doesn't specify the direction of measuring the angle.

Calculation of Azimuth :-

1.   If the true bearing of any line is more than 180°, the azimuth of line may be calculated by subtracting it by 360°.

2.   If the true bearing is less than 180 , the azimuth of the line will be equal to the true bearing.

Magnetic bearing :- the horizontal angle of survey line makes with the magnetic meridian is called magnetic bearing . it is not constant at a point but varies with laps in time.

•**Forward and backward bearing :-**

•A line may be defined by two bearing. one observed at either end of the line. Both the bearing differ each other by 180. The bearing of line in the direction of progress of survey is called Fore while the bearing in the opposite direction of the progress of survey line is called back bearing.

- **Arbitrary meridian: Convenient direction is assumed as a meridian.**

- **Grid meridian: Sometimes for preparing a map some state agencies assume several lines parallel to the true meridian for a particular zone these lines are termed as grid meridian.**

- **Designation of magnetic bearing**
  - Whole circle bearing (WCB)
  - Quadrantal bearing (QB)

- WCB: The magnetic bearing of a line measured **clockwise from the North Pole** towards the line is known as WCB. Varies 0-360°

- **Quadrantal Bearing:** The magnetic bearing of a line measured clockwise or anticlockwise from NP or SP (whichever is nearer to the line) towards the east or west is known as QB. This system consists of 4-quadrants NE, SE, NW, SW. The values lie between 0-90°
  - QB of OA = N a E

- **Reduced Bearing:** When the whole circle bearing of a line is converted to quadrantal bearing it is termed as reduced bearing.
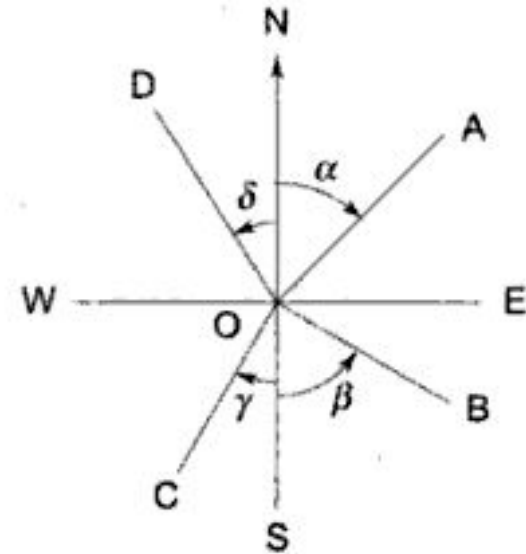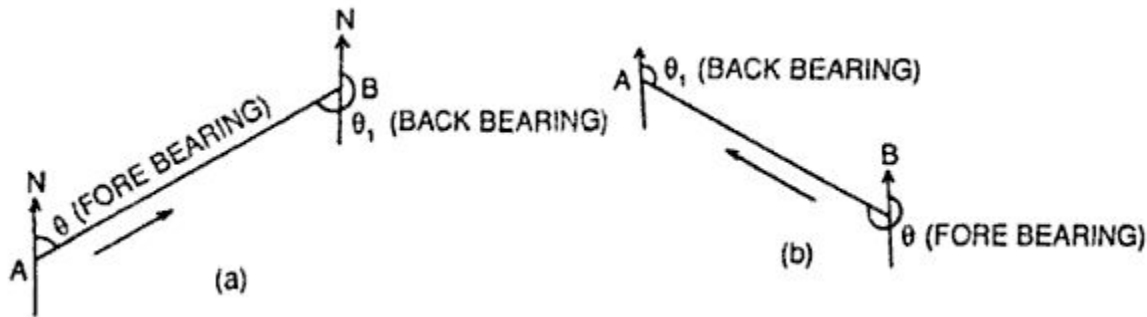
- **Fore and Back Bearing:**

    In WCB the difference between FB and BB should be exactly 180°
  - BB=FB+/-180°
 - Use the +ve sign when FB<180°
  - Use the –ve sign when FB> 180°

- **Magnetic declination:** The horizontal angle between the magnetic meridian and true meridian is known as magnetic declination.

- **Dip of the magnetic needle:** If the needle is perfectly balanced before magnetisation, it does not remain in the balanced position after it is magnetised. This is due to the magnetic influence of the earth. The needle is found to be inclined towards the pole. This **inclination of the needle with the horizontal** is known as dip of the magnetic needle.

- **Local Attraction**
- **Method of correction for traverse:**
  - **First method:** Sum of the interior angle should be equal to (2n-4) x 90. if not than distribute the total error equally to all interior angles of the traverse. Then starting from unaffected line the bearings of all the lines are corrected using corrected interior angles.

  - **Second method:** Unaffected line is first detected. Then, commencing from the unaffected line, the bearing of other affected lines are corrected by finding the amount of correction at each station.

Remember the following:
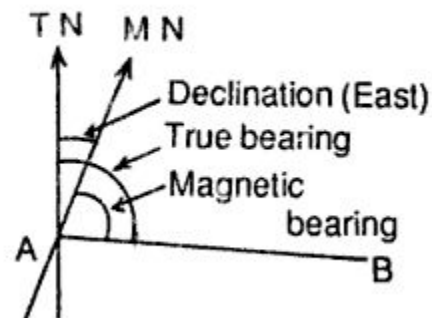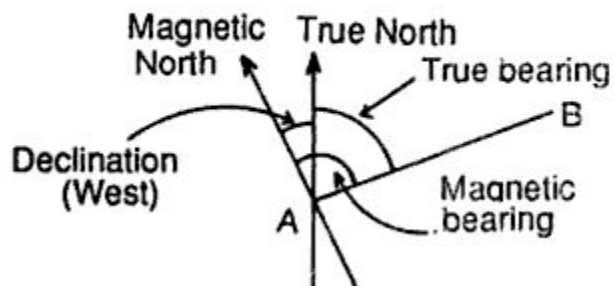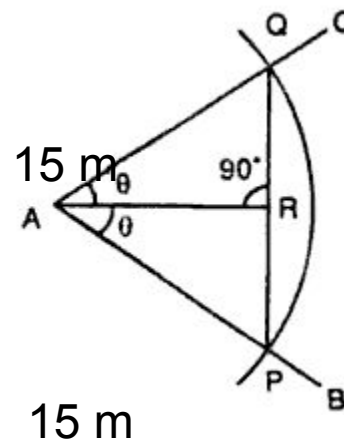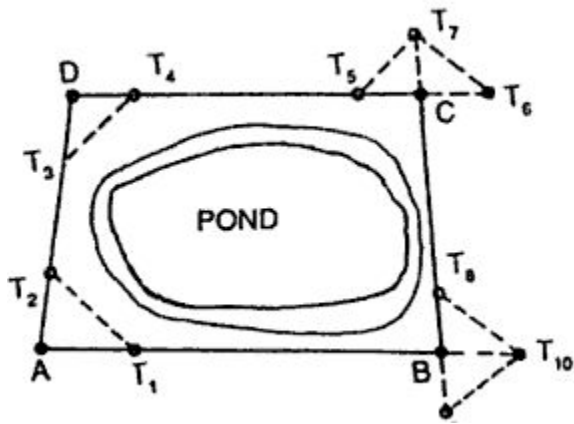

Determination of true bearing and magnetic bearing:

(a) True bearing = magnetic bearing ± declination

Note $\left[\begin{array}{l}\text{use the positive sign when declination east,} \\ \text{and the negative sign when declination west.}\end{array}\right]$

(b) Magnetic bearing = true bearing ± declination

Note $\left[\begin{array}{l}\text{Use the positive sign when declination west,} \\ \text{and the negative sign when declination east.}\end{array}\right]$

Methods of traversing

Left diagram labels: D, T₄, T₅, T₇, T₆, C, T₃, POND, T₂, A, T₁, B, T₉, T₁₀, A

Middle diagram: 15 m, θ, 90°, Q, C, A, R, P, B, 15 m

Right side:

Let $\angle PAR = \theta$

Then $\angle BAC = 2\theta$

Here $AP = AQ = 15$ m

In triangle PAR,

$$\sin\theta = \frac{PR}{AP} = \frac{2\,PR}{2\,AP} = \frac{PQ}{30}$$

$$\therefore \quad \theta = \sin^{-1}\frac{PQ}{30}$$

- **Compass traversing:** Fore bearings and back bearings between the traverse leg are measured
- **Theodolite traversing:** Horizontal angles between the traverse legs are measured. The length of the traverse legs are measured by chain/tape or by stadia method
- **Plane table traversing:** Plane table is set at every traverse station in clockwise and anticlockwise direction and the circuit is finally closed. During traversing the sides of the traverse are plotted according to any suitable scale.

Computation of latitude and departure

- Latitude of a line is the distances measured parallel to the north south of the North-South direction
- Departure of the line is the distance measured parallel to the east-west direction

Fig. 9.21
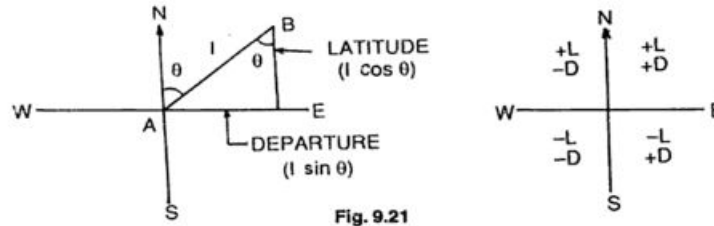
The latitude and departure of lines are also expressed in the following ways:

Northing = latitude towards north = $+ L$
Southing = latitude towards south = $- L$
Easting = departure towards east = $+ D$
Westing = departure towards west = $- D$
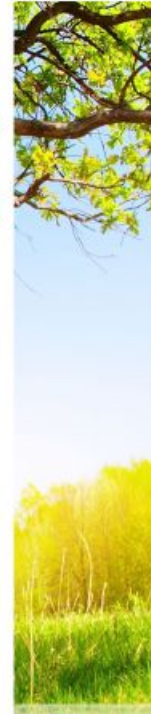
Checks on traverse: Closed traverse

- Check on closed traverse:
    - Sum of the measured interior angles (2n-4) x 90°
    - Sum of the measured exterior angles (2n+4) x 90 °
    - The algebric sum of the deflection angles should be equal to 360°. Right hand deflection is considered +ve, left hand deflection –ve

- Check on linear measurement
    - The lines should be measured once each on two different days (along opposite directions). Both measurement should tally.
    - Linear measurement should also be taken by the stadia method. The measurement by chaining and stadia method should tally.

- Conclusion:-

- Merits

- compass survey is good for dense forest covered regions where GPS and other signal based modern equipments can't work in this particular situation.

- Compass survey is good when the large area under survey measurement is undulating ground survey requirement is urgent.

Economical and easy to understand .

Demerits

 not recommended in the area which is magnetically disturbed.

Not suitable in the area where high tension electricity line or microwave tower, power grid station , industrial area etc.

Without proper knowledge of converting magnetic bearing into true or grid bearing , we may deviate few meters to few kilometers distance from the actual maps which are based on National   Spatial Reference coordinate system (NSRCF) of the country.