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TOPIC: TRAVERSE SURVEY

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Traverse Surveying

A traverse surveying is one in which the framework consists of connected lines whose lengths are measured with a chain or tape and the directions are determined with an angular instrument.

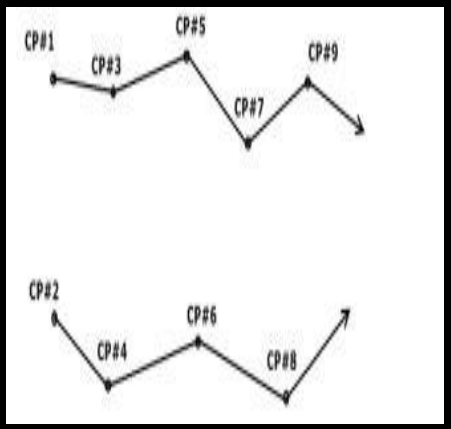
Types of traverse:

There are two types of traverse

- Open traverse
- Closed travers

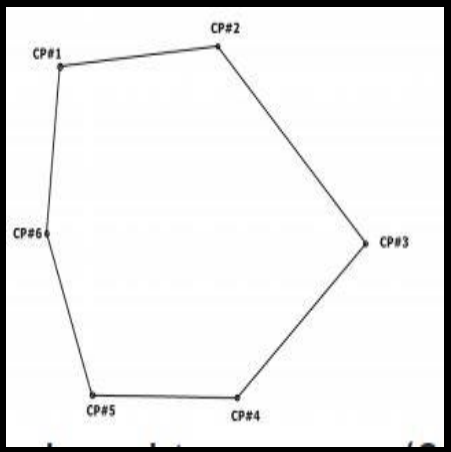
Open Traverse:

- A traverse is said to be an open traverse when it does not form a closed polygon.
- It consists of a series of lines extending in the same general direction and does not return to the starting point. Similarly, it does not start and end at points whose positions on plan are known.
- It is suitable for the survey of a long narrow strip of country e.g the roads, canals or railways etc



Closed Traverse:

- A traverse is said to be closed when a complete circuit is made i.e. when it returns to the starting point forming a closed polygon as shown in figure. Or when it begins and ends at points whose positions on the plan are known.
- Sum of angles for a closed traverse = (2N ± 4) 900
- Where N = No. of sides of closed traverse. • +ve sign for exterior angles and –ve sign for the interior angles



Method of traversing:

There are four methods by which the direction of the survey lines are determined are as follow.

1.By the chain angle
2. By the free or loose needle method
3. By the fast needle method

By the chain angle method/ chain traversing

In this method, the entire work is done with a chain/tape only and the angle between the successive lines is measured with the chain. Angles fixed by the measurements are known

Free or loose needle method

In this method, an angular instrument such as compass or theodolite, is set up at each of the successive stations and the bearing of each lines is taken with reference to the magnetic meridian and not with reference to the adjacent lines

Fast Needle Method

In this method, a theodolite is used to determine the bearing of each line. The bearing of first line is measured with the magnetic meridians and the bearing of the successive lines are found from the deflection angle or from the included angle.

Method of measurement of angles

In this method, a theodolite is used for measurement of angles. The horizontal angles measured in a traverse may be

- Included angles or
- Deflection angles (between the successive lines).

This is the most accurate method and is generally used for large surveys and accurate work.

Instruments for measurement of angles
The instruments commonly used are:

- Compass • Total station
- Theodolite • Box sextant.

Compass.

The compass is an instrument used for measuring the bearing i.e. the angle between the magnetic meridian and the line. Some special types of compass used in survey are:

- Prismatic compass
- Lensetic compass
- Trough compass
- Surveyor's compass.

Bearing of line.

The horizontal angle between the reference meridian and the survey line is termed as bearing of the survey line. Different types of bearings are:

- True bearing
- Magnetic bearing
- Arbitrary bearing

True Bearing

The geographical North of earth is different from the magnetic North. Hence, the angle which the survey line makes with the true geographical North is termed as true bearing of the survey line.

Magnetic Bearing

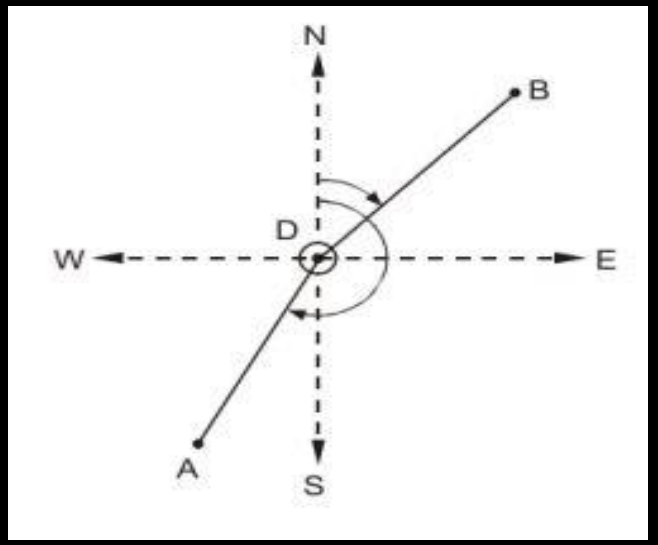
The magnetic needle of the compass always points towards the magnetic north-south (N-S) direction indicating earth's magnetic axis. Since this direction is same at all the places on the earth's surface, it is universally used as the reference direction. The angle made by survey line in a clockwise direction with reference to magnetic N-S line is termed as magnetic bearing of the line. The value of magnetic bearing ranges from 0 o to 360o

Arbitrary Bearing

It is the horizontal angle which a survey line makes with any arbitrary meridian, which is any convenient direction towards a permanent and prominent mark or signal, such as a Mosque spire or top of a chimney. Such bearings are used to determine the relative position of line in a small area.

Whole Circle Bearing (WCB)

The complete circle of angular measurement starts with north as 0 o and ends at north at 360o . The bearing of line directly obtained by magnetic needle ranging from 0 o to 360o is called whole circle bearing as shown in Figure.

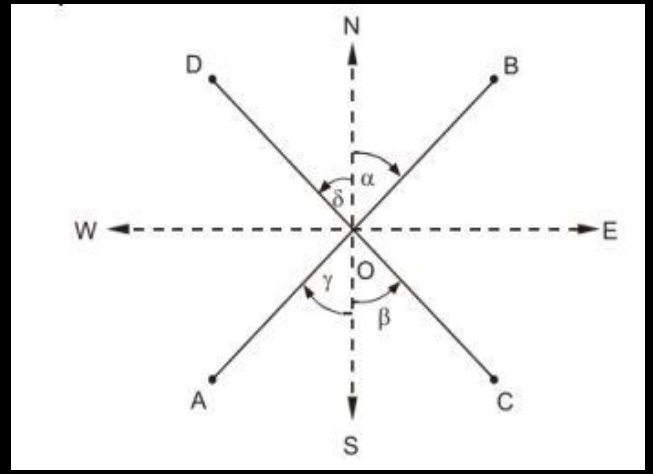


Quadrental system

In this system, the bearing of a line is measured clockwise or counterclockwise from the north point or the south point whichever is nearer the line, toward the east or west. In this system, the bearing is reckoned from 0° to 90° in each quadrant

Reduced Bearing (RB)

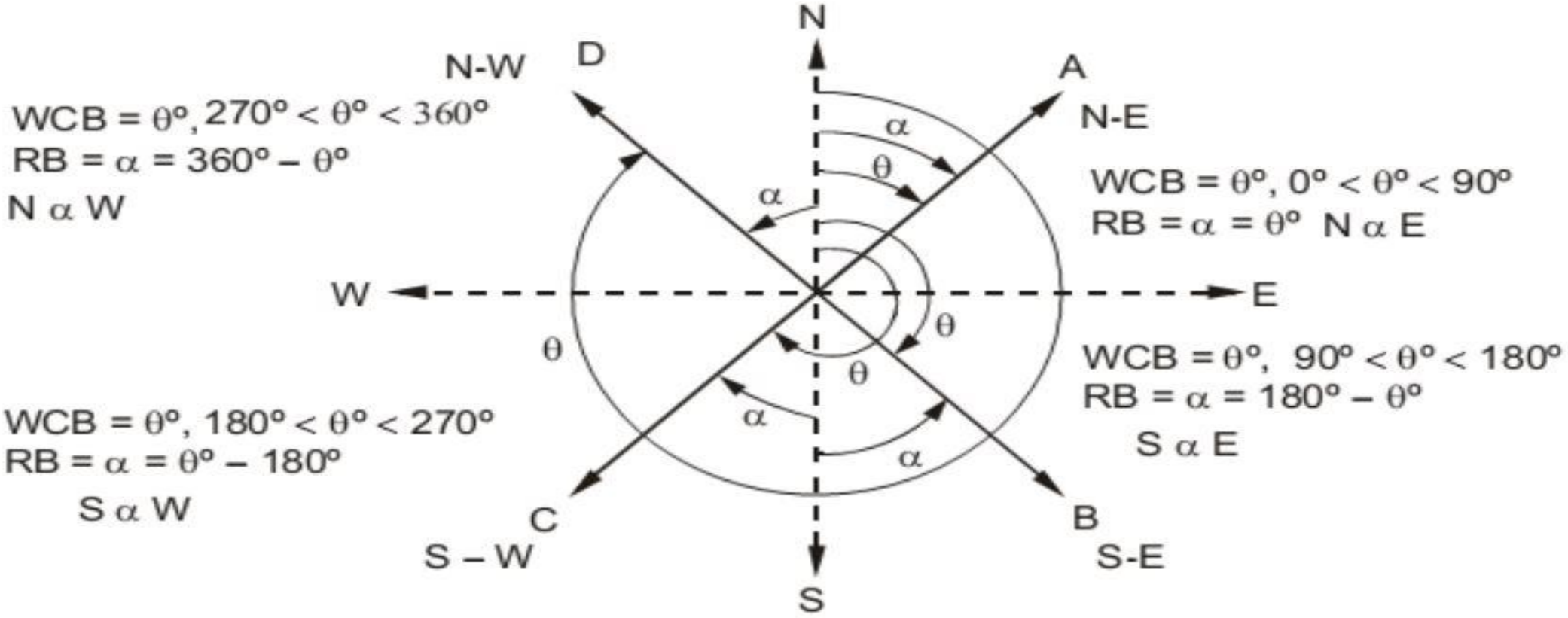
The more convenient way to understand the direction of a survey line is to represent the bearing on a quadrantal system. The angle is measured with respect to N–S line towards east or west as shown in Figure.



Relation between the whole circle bearing and the Reduced bearing

Case	W.C.B Between	Rules for R.B	Quadrant
I	0 and 90°	=W.C.B	N.E
II	90° and 180°	=180°- WCB	S.E
III	180° and 270°	=WCB-180°	S.W
IV	270° and 360°	=360°-WCB	N.W

Relation between the whole circle bearing and the Reduced bearing



ERRORS IN TRAVERSE SURVEYING

- **Instrumental error**
- **Personal error**
- **Natural error**

Instrument error

- No Permanent Adjustment
- Minimized
  - Do Permanent Adjustment
  - Multiple observations (Face left /face right)
  - Repetitio

Personal Error

- **Error of Manipulation**
  - Inaccurate centering
  - Inaccurate levelling

- Error of Observation

- Inaccurate bisecting signal
- Non vertical signal
- Displacement of pegs / signal
-Wrong Reading & Booking

Natural Error

- Wind
- High temperature
- Haze

The source of errors during observation are:

Total station is not perpendicular to the station
Total station is not level during observation
Wrong handling theodolite and tripod
Parallax
Effect from curvature and refraction
Error in reading or booking

Problems

Problem 1 Convert the following WCBs to QBs.

(a) WCB of AB = 45°30′
(b) WCB of BC = 125°45′
(c) WCB of CD = 222°15′
(d) WCB of DE = 320°30′

Solution

(a) QB of AB = N 45°30′ E
(b) QB of BC = 180°0′ – 125°45′ = S54°15′ E
(c) QB of CD = 222°15′ – 180°0′ = S42°15′ W
(d) QB of DE = 360°0′ – 320°30′ = N39°30′ W

Problem 2 Convert the following QBs to WCB

(a) QB of AB = S 36°30′ W
(b) QB of BC = S 43°30′ E
(c) QB of CD = N 26°45′ E
(d) QB of DE = N 40°15′ W

Solution

(a) WCB of AB = 180°0′ + 36°30′ = 216°30′
(b) WCB of BC = 180°0′ – 43°30′ = 136°30′
(c) WCB of CD = given QB = 26°45′
(d) WCB of DE = 360°0′ – 40°15′ = 319°45′

3.11 PROBLEMS ON FORE AND BACK BEARINGS

Problem 1 The FBs of the following lines are given. Find the BBs.

(a) FB of AB = 310°30′

Problems

(b) FB of BC = 145°15′
(c) FB of CD = 210°30′
(d) FB of DE = 60°45′

Solution
(a) BB of AB = 310°30′ − 180°0′ = 130°30′
(b) BB of BC = 145°15′ + 180°0′ = 325°15′
(c) BB of CD = 210°30′ − 180°0′ = 30°30′
(d) BB of DE = 60°45′ + 180°0′ = 240°45′

Problem 2 FBs of the following lines are given. Find the BBs.
(a) FB of AB = S 30°30′ E
(b) FB of BC = N 40°30′ W
(c) FB of CD = S 60°15′ W
(d) FB of DE = N 45°30′ E

Solution
(a) BB of AB = N 30°30′ W
(b) BB of BC = S 40°30′ E
(c) BB of CD = N 60°15′ E
(d) BB of DE = S 45°30′ W

Problem 3 BBs of the following lines are given. Find the FBs.
(a) BB of AB = 40°30′
(b) BB of BC = 310°45′
(c) BB of CD = 145°45′
(d) BB of DE = 215°30′

Solution
(a) FB of AB = 40°30′ + 180° 0′ = 220°30′
(b) FB of BC = 310°45′ − 180° 0′ = 130°45′
(c) FB of CD = 145°45′ + 180° 0′ = 325°45′
(d) FB of DE = 215°30′ − 180° 0′ = 35°30′

Problem 4 BBs of the following lines are given. Find the FBs.
(a) BB of AB = N 30°30′ W
(b) BB of BC = S 40°15′ E
(c) BB of CD = N 60°45′ E
(d) BB of DE = S 45°30′ W

Solution
(a) FB of AB = S 30°30′ E
(b) FB of BC = N 40°15′ W
(c) FB of CD = S 60°45′ W
(d) FB of DE = N 45°30′ E

Problems

Problem 1 (a) The magnetic bearing of a line AB is 135°30′. What will be the true bearing, if the declination is 5°15′ W.

(b) The true bearing of a line CD is 210°45′. What will be its magnetic bearing, if the declination is 8°15′ W.

Solution

(a) True bearing of AB = magnetic bearing – declination

$$= 135°30' - 5°15' = 130°15'$$

(b) Magnetic bearing = true bearing + declination

$$= 210°45' + 8°15' = 219°0'$$

Problem 2 The magnetic bearing of a line CD is S 30°15′ W. Find its true bearing, if the declination is 10°15′ E.

Solution First convert the RB to WCB, and then follow the usual procedure to find the true bearing in WCB. Finally, convert the true bearing to RB.

RB of CD = S 30°15′ W

WCB of CD = 180°0′ + 30°15′ = 210°15′

Now TB = MB + declination (east)

$$= 210°15' + 10°15' = 220°30'$$

Required true bearing = 220°30′ – 180° = S 40°30′ W

Problems

Problem 3 On an old map a line was drawn to a magnetic bearing of 320°30′, when the declination was 3°30′ W. Find the present bearing of the line, if the declination is 4°15′ E.

Solution

True bearing = magnetic bearing – declination (west)

= 320°30′ – 3°30′ = 317°0′

The true bearing of a line is constant.

So, the present true bearing of the line is also 317° 0′

Magnetic bearing = true bearing – declination (east)

= 317°0′ – 4°15′ = 312°45′


Thank You!