PRISMATIC COMPASS SURVEY

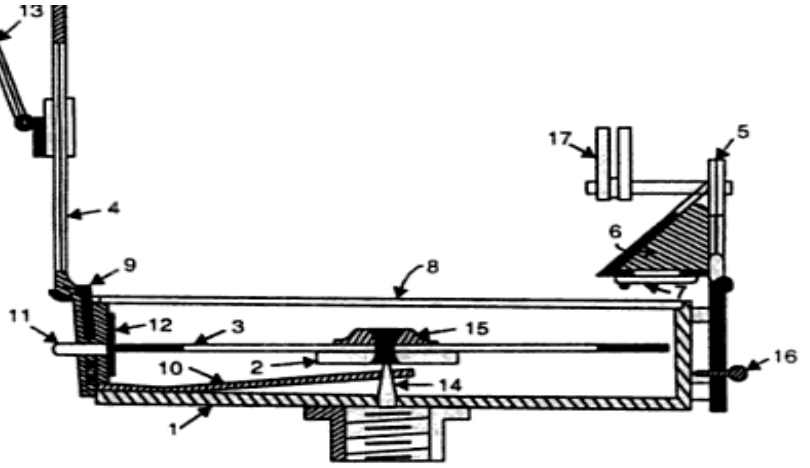
The survey which is based on the readings of learning takes with the help of a prismatic compass survey. In this survey the length of a line is measured with a chain or a tape. Thus the direction and length being known, the line can be easily plotted.

Prismatic Compass: This type of compass also has a compact circular metallic shallow box with a glass cover. It also has a diameter between 6.25 and 15 cms. and the rim about 1.5 cms. in height.

Parts of Prismatic Compass

The main parts of a prismatic compass are:

1. Graduated disc
2. Pivot
3. Prism
4. Vertical slit
5. Sighting Vane
6. Brake Pin
7. Mirror
8. Coloured Glasses



1. Box	7. Prism cap	13. Mirror
2. Needle	8. Glass cover	14. Pivot
3. Graduated ring	9. Lifting pin	15. Agate cap
4. Object vane	10. Lifting lever	16. Focusing stud
5. Eye vane	11. Brake pin	17. Sun glass
6. Prism	12. Spring brake	

FIG. 5.12. THE PRISMATIC COMPASS.

Graduated disc

It is made of a aluminium with a least count of 30 minutes. It has 0 degree or 360 degree mark at the south and the graduations are in a clockwise direction. Zero or 360 degree mark is at south because it is from here that we take the reading through the prism. It is made of

aluminium so that it is not affected by the magnetic needle and also because it is very light metal and it will rotate freely.

A small bar magnet is fixed just below the graduated disc which rotates along with the needle. The north side of the magnetic needle is fixed below the disc to coincide with 180 degree

Pivot

It is triangular shaped and is made of agate over which the graduated disc rotates. Agate is a very hard fine grained quartz which is very sharply pointed so that there is no friction in the movement of the graduated disc. When the sharpness is dulled, the accuracy of the movement of the disc is hampered.

Prism

It is made up of glass with a triangular base with angle of 45 degree. It has metallic cover with two circular openings to read the bearings.

The Prism has three main functions as far as the prismatic compass is connected:

i) The sighting of the object and reading of the bearing can be done simultaneously which is not possible in surveyors compass because there is no prism attached to it.

ii) The figures written on the graduated disc are enlarged.

iii) The figures on the graduated disc are inverted e.g. 240^0 on the graduated disc is written as which appears as 240^0 through the prism.

Vertical Slit

Through it the object is sighted.

Sighting vane

It has a vertical wire with which the object to be sighted is aligned.

Break Pin

It is a small pin projected on the outer cover of the compass which when pressed checks the movement of the graduated disc.

Small Mirror

It can sight the objects which are at a higher or lower level. The objects are reflected through the mirror.

Coloured Glasses

One green and other red glass which is used when the sunlight is too strong.

Tripod

A tripod over which the prismatic compass is fixed

Accessories

I. Prismatic compass with tripod.

II. Ranging Rod

III. Measuring tape

IV. Arrows

Bearing

The angles that are read with a prismatic compass are called bearing.

True Bearing

A bearing is defined as a horizontal angle measured from magnetic north in a clockwise direction. If the angle is measured with respect to geographical north or true north which is the north pole of the earth, the bearing is called as True bearing.

Geographical north or true north is the north pole of the earth.

Magnetic north is the direction indicated by a magnetic needle freely suspended from its centre of gravity.

Magnetic declination: The angle subtended between the magnetic north and the geographical north is called Magnetic declination. This angle varies from place to place. It also varies for the same place from time to time. Somewhere it is increasing whereas at other place it is decreasing. Its value swings from + 10 to – 10 minutes.

Traverse Method

When survey of a large area is to be conducted, then one base line is not sufficient. We have to take more than one base line. These base lines are mutually connected to one another and form a traverse. Thus the method of surveying in which more than one base lines are involved is called traverse method.

Types of Traverse

Traverse is of the following two types

1. Open Traverse
2. Closed Traverse

1. Open Traverse

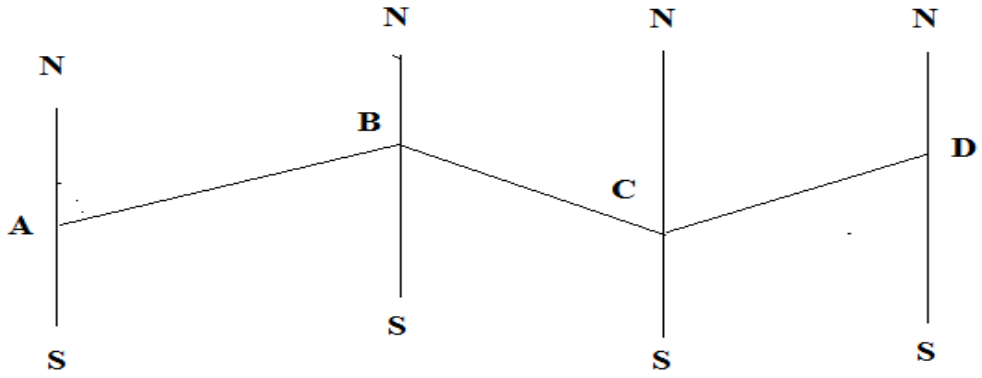
When the survey is started at a given point and finished at some other point. It is known as open traverse. Thus method is applied to a long and narrow area such as a river, canal, road or railway. For example we have to conduct the survey of a zig - zag path as in figure; we will start our survey at A and finish it at D.

For completing this survey we will have to take following observations

F.B. of AB from A	B.B. of BA from B
F.B. of BC from B	B.B. of CB from C
F.B. of CD from C	B.B. of DC from D

In addition the length of lines AB, BC and CD are also to be measure.

The above observations are plotted on a drawing paper by selecting a suitable scale and complete the survey.



2. Closed Traverse

When the surveyor comes to the starting point after covering the survey along a number of base line, it is called Closed Traverse. This method is applied for surveying some settlement, a big building, a lake or some other larger area. Both forward and backward bearings are to be recorded at all the survey stations. For example, we have to conduct closed survey of an area ABCD. We will start the survey at A and come back to A after reading the points B, C and D.

For completing this survey we will have to take following observations

F.B. of AB from A B.B. of BA from B

F.B. of BC from B B.B. of CB from C

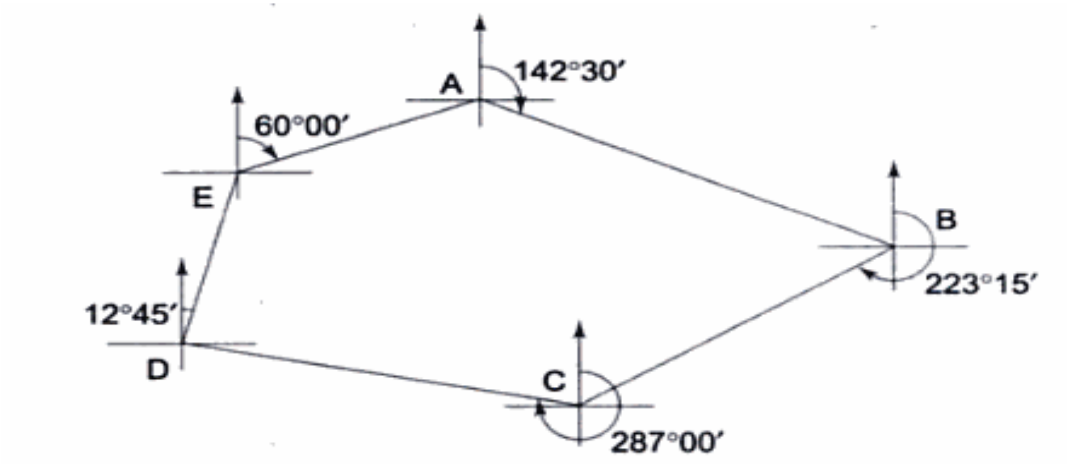
F.B. of CD from C B.B. of DC from D

F.B of DA from D B.B of AD from A

In addition the length of lines AB, BC and CD and DA are also to be measure.

The above observations are plotted on a drawing paper by selecting a suitable scale and complete the survey.

Lines	F.B.	B.B.
AB	142°30′	322°30′
BC	223°15′	44°15′
CD	287°00′	107°45′
DE	12°45′	193°15′
EA	60°00′	239°00′



Sources of Errors in a prismatic compass survey

There are three sources of errors in prismatic compass survey

1. Errors due to external influences.
2. Instrumental errors.
3. Errors of Observation

1. **Errors due to external influences**

   Magnetic substances like iron, nickel, cobalt etc., when brought near a prismatic compass deflects its magnetic needle. Therefore, these materials should be kept away from the compass when readings are taken.

2. **Instrumental errors**

   The prismatic compass may develop faults in manufacture and these may be due to

   (i) The pivot being not exactly in the centre.

   (ii) The balance of the graduated disc being imperfect.

   (iii) The line of sight not passing exactly through the centre of the prismatic compass i.e. the pivot

   (iv) Weak magnet. Sometimes, the graduated disc does not rotate freely. A prismatic compass also develops faults as a result of rough use.

3. **Errors of observation**

   Sometimes the surveyor does not tape proper care to observe the readings accurately and error creep in. The observer should be careful regarding the proper levelling and centring of the prismatic compass and allow the graduated disc to come at rest. Prism should be properly focussed to have a clear view of the graduated scale.

4. Local attraction
5. The bearing and the station lines are not correctly measured.

Necessary precautions in the use of prismatic compass

Following precautions are necessary in the use of prismatic compass

1. Since the working of prismatic compass is based on the magnetic needle, care should be taken to avoid the effect of local attraction. For this all magnetic substances are to be kept away from the prismatic compass.
2. Make sure that the difference between fore bearing and back bearing of a line is 180 degree. If it is not so, then there must be some error or there may be effect of local attraction for which correction may be applied.
3. The graduated ring should be perfectly horizontal so that it can move freely on the pivot point.
4. The object vane and the eye vane should be perfectly vertical so that readings can be taken without any error.
5. When the compass is not in use or it is taken from one station to another, the object vane should be pressed against the glass cover. This will lift the graduated ring through the lifting lever and avoid unnecessary wear and tear of the pivot.
6. As far as possible, keep the magnetic needle in north direction to maintain its magnetic properties.

Closing error

This is also known as error of closure. Sometimes, it is so happens that the surveyor does not reach the starting point in a closed traverse due to some error. Instead he reaches some other point near the starting point. For example the surveyor starts his survey from A and reaches A' instead of A after traversing B, C and D as shown in the figure. Then AA' is the closing error.

Bowditch's rule

If the closing error is not much, it is assumed that small errors at different stations have been at the end point. This error is divided among all the survey stations in proportion to their distance from their starting point. This can be done by using the following methods

Graphical Method (Removal of closing error)

First of all a straight line equal to the total length of the station lines in the traverse is drawn on the same scale on which the traverse was plotted. If the total length cannot be accommodated in the size of the sheet, it may be reduced to ½, ¼, or to any convenient scale. On this line proportional distance of AB, BC, CD, and EA are measured and marked A, B, C, D, E and A as shown in figure 1. At the last A, a perpendicular AA' equal to the actual length of the closing error is drawn (Note: The length of the closing error will not be reduced to the scale on which the station lines have been plotted but it will be equal to the actual length of the closing error). The top of the perpendicular is joined to the first A and from B, C, D, and

E points, perpendiculars are drawn so as to meet the hypotenuse AA' at a, b, c, d, and e respectively.

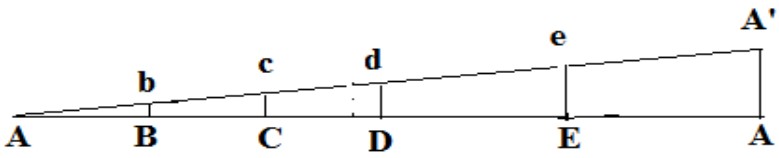


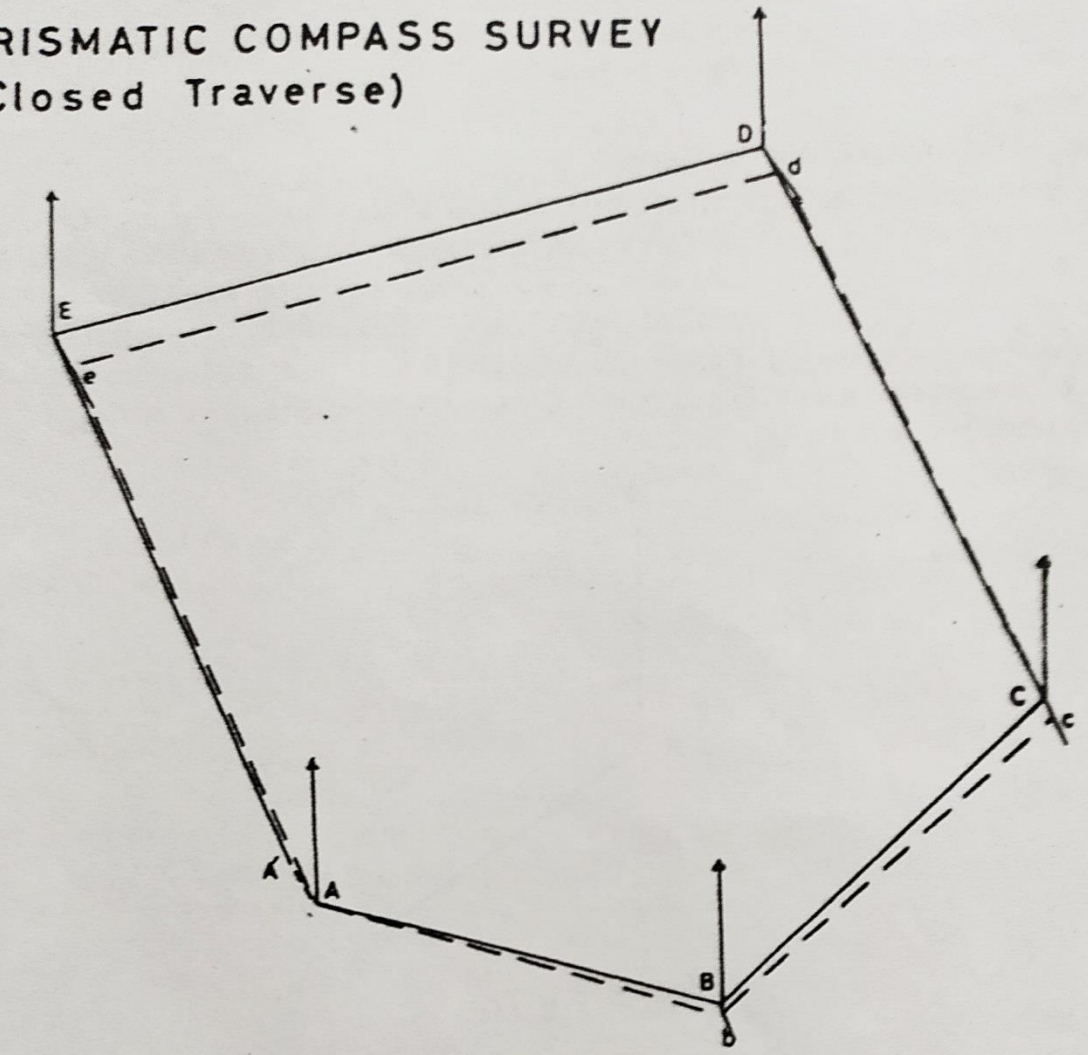
Figure 1

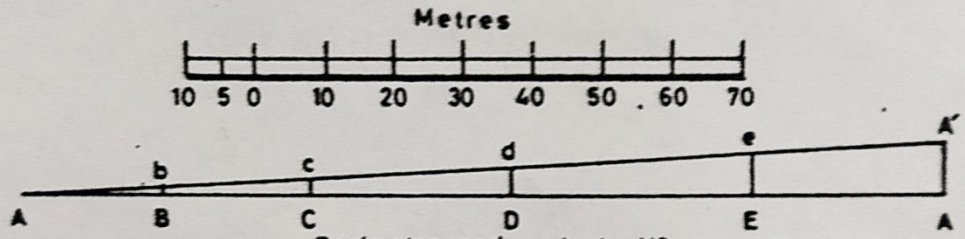
In the close traverse plotted we find that the closing error is AA'. To remove this error, A' has to be shifted towards the right hand side. Hence from the stations B, C, D and E draw lines parallel to the closing error towards the right hand side. From the parallel line drawn at station B, cut a distance equal to Bb, at station C a distance equal to Cc, at station D, a distance equal to Dd and at station E, a distance equal to Ee (Figure 2). Now joins A with b, b with c, c with d, d with e and e with A. The original plotting is done by drawing continuous line whereas the lines forming corrected to polygon is drawn by broken lines as shown in figure 2.

Station Line	**Distance (metres)**	**Forward bearing**	**Forward bearing**	**Difference**
AB	60	105^0	285^0	180^0
BC	62.4	48^0	228^0	180^0
CD	87.2	335^0	155^0	180^0
DE	105.6	257^0	77^0	180^0
EA	84.7	156^0	336^0	180^0

Horizontal scale 1: 800

PRISMATIC COMPASS SURVEY
(Closed Traverse)





Perimeter reduced to 1/3

LINE	F.B.	B.B.	DIFF.	DIST.
AB	105°	285°	180°	60
BC	48°	228°	180°	62·4
CD	335°	155°	180°	87·2
DE	257°	77°	180°	105·6
EA	156°	336°	180°	64·7

eA, bcd

NAME

—— Original Figure

— — Corrected Figure

Merits of prismatic compass survey

1. This is a light instrument and can be easily carried from one place to another place.
2. It can be easily used in bad weather when chain and tape survey as well as plane table survey become useless.
3. It can be conducted in rugged and crowded areas.
4. If some bearing is wrongly recorded, it can be corrected by using special methods.

Demerits

1. It is affected by magnetic substances
2. There are some instrumental errors also
3. It is used when high degree of accuracy is not required.