CHAPTER 4: DIRECTION

OBJECTIVES OF THE UNIT

At the end of this unit, the reader must be able to:
Define direction as it is applied in real property;
Explain the difference between true north and magnetic north;
Differentiate azimuth from bearing;
Identify surveying instruments which are used to measure angles.

RATIONALE FOR THE UNIT

This unit is designed to improve the learners' understanding of direction and identify surveying instruments used to measure angles.

ASPECTS AND ISSUES

When locating properties, distance without direction is useless. Just imagine if one just says BA ISAGO University is 3km from the CBD, there are many places that are 3km from the CBD and BA ISAGO University is just one of them. For the message to be complete there is need for one to give direction that was given as North-West of the CBD in the first example.

Direction is the position of one point on the earth relative to another point or a course along that someone or something moves, that must be taken to reach a destination. Compass directions, such as north, south, east, west, southwest, and so on are commonly used when speaking of direction. Note that the international convention is to place north and south before east and west. With reference to Figure 30, we can describe the location of points B and C relative to our position at A as:

- Point B: west south-west,
- Point C: north north-west.

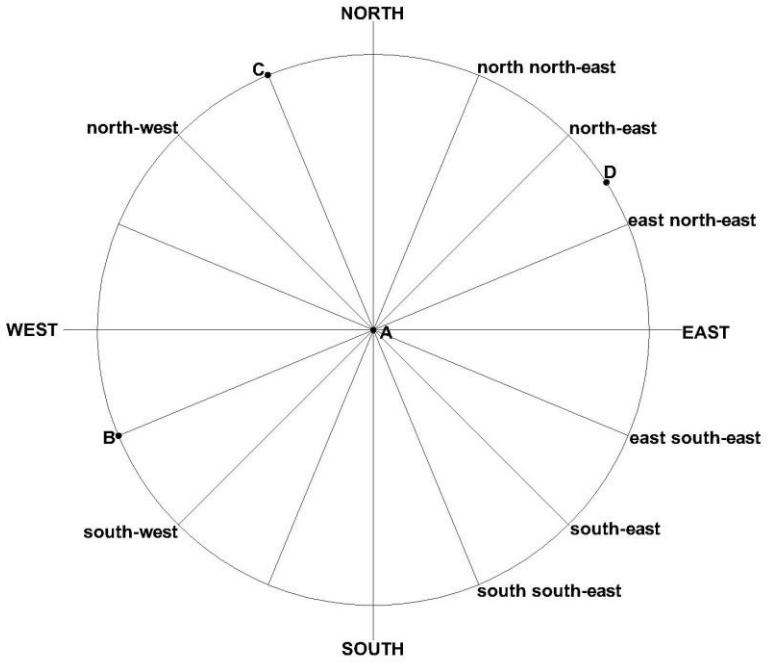

Figure 30: Sixteen campus direction (Adopted and Modified from Vlok, Harmse and de Jager, 2009:51).

NORTH

We need to point out that there are two types of north namely true north (geographic north) and magnetic north. True north points to what we know as the North Pole. Maps indicate true north. However, when using a compass, the needle does not point to polar north but to magnetic north. A further complication is that the magnetic north is a floating point – its position constantly changes (Vlok, Harmse and de Jager, 2009).

In fact, the magnetic North Pole has moved more than 600 miles since the early 19th century and it is still at it, moving at a rate of about 15 miles per year, just a bit faster than it used to be. The Earth's magnetic field is variable. For example, if the needle of a compass at a place points 15° west of geodetic north, there is said to be a west declination of 15°. At the same place 20 years later, that declination may have grown to 16° west of geodetic north. This kind of movement is called secular variation. Also known as declination, it is a change that occurs over long periods and is probably caused by convection in the

material at the Earth's core (Van Sickle, 2004). The position of magnetic north is governed by natural forces, but grid north is entirely artificial. The direction to north is established by choosing one meridian of longitude. Thereafter, throughout the system, at all points, north is along a line parallel with that chosen meridian. This arrangement purposely ignores the fact that a meridian pass through each of the points and that all the meridians inevitably converge with one another (Van Sickle, 2004).

So what? The point is that if one is using a compass in the field to get to from point A to B and the direction was given to in terms of true north one will walk in the wrong direction. The problem is easy to solve. On the 1:50 000 maps of South Africa the angular difference (referred to as the magnetic declination) between true north and magnetic north is given as a diagram that also indicates how the magnetic declination changes over time. As illustrated in Figure 31 we can infer that the magnetic declination measured at the place is 20° west of True North (Vlok, Harmse and de Jager, 2009).

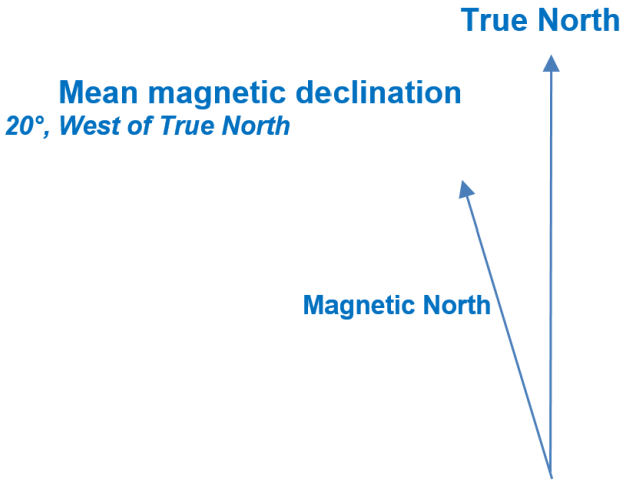

Figure 31: The true north, magnetic North, and magnetic decline (Adapted from Vlok, Harmse and de Jager, 2009:52).

DETERMINING DIRECTION IN THE FIELD

Just saying North, East, West South is not enough, to be accurate about the actual location of a property there is need state the angle at that one is

supposed to take moving toward the stated direction. This angle is determined in two way that are azimuth and bearing as discussed in the sections to follow.

AZIMUTH

One can surely agree that the cardinal directions are convenient but that it is still rather vague. A much more accurate way of describing direction is to divide the circle into 360°. Azimuth is the angle measured clockwise from the reference line and has a value between 0° and 360° (Van Sickle, 2004; Vlok, Harmse and de Jager, 2009; Tyner, 2010). By placing a protractor on Figure 32 (or on a map) in such a way that 0° coincides with north, angles of azimuth varying between 0° and 360° can be read off the protractor in a clockwise direction. We can now describe the location of points B, C and D relative to our position at A as:

Point B: 250°
Point C: 340°
Point D: 50°

Figures 32 and 33 illustrate how direction is expressed in terms of azimuth.

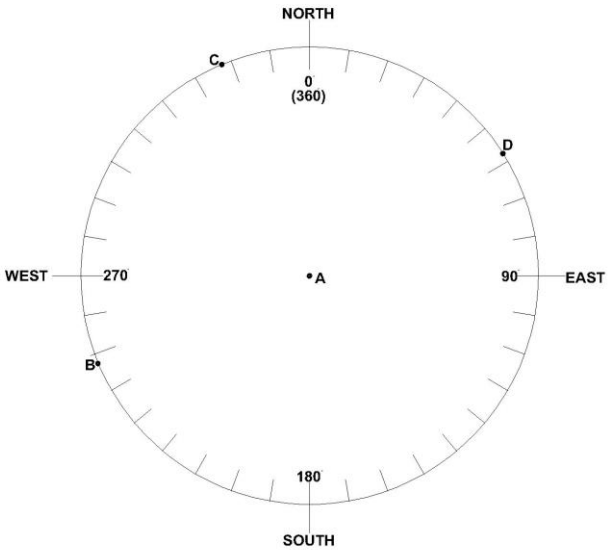

Figure 32: Expressing direction in terms of Azimuth (Adapted from Vlok, Harmse and de Jager, 2009:51).

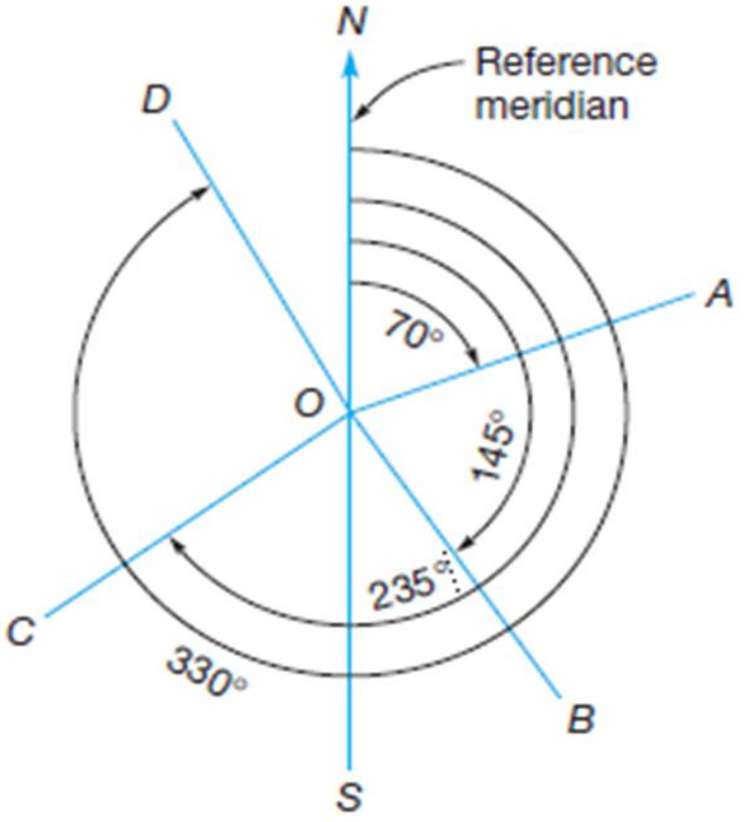

Figure 33: Azimuth (Ghilani and Wolf, 2012)

As illustrated in Figure 33, the azimuth of OA is 70°; of OB, 145°; of OC, 235°; and of OD, 330°.

BEARING

Another way of describing direction is to take a bearing. A bearing is also expressed as an angular measurement but there are two differences:

a. bearings can be measured clockwise or anti-clockwise.

b. bearing may not be larger than 90° as illustrated in Figure 28 (Van Sickle, 2004; Vlok, Harmse and de Jager, 2009).

Figures 34 and 35 illustrates how direction is expressed in terms of bearing.

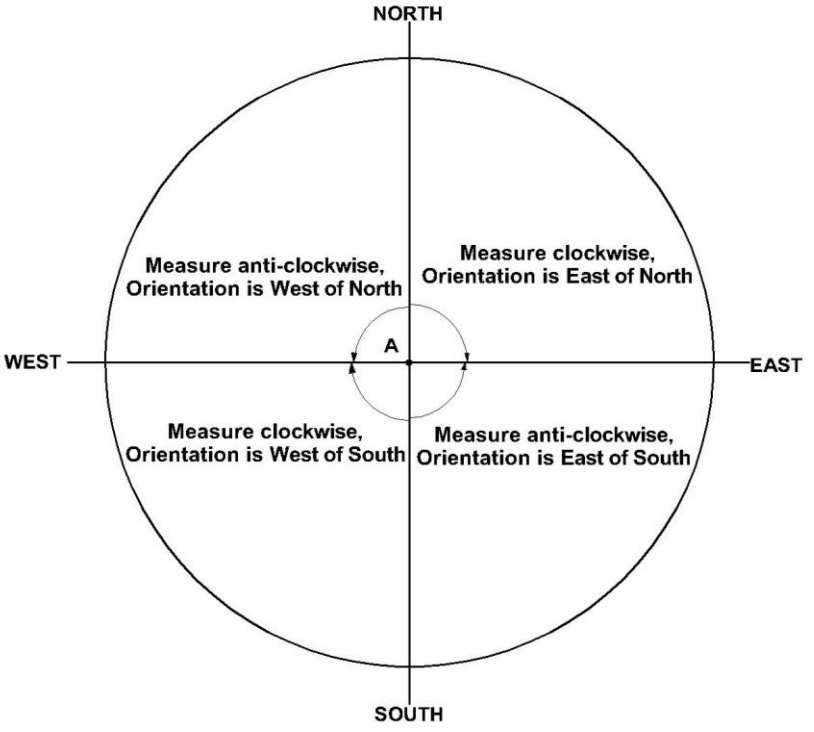

Figure 34: Bearings (Adapted from Vlok, Harmse and de Jager (2009:52).

A bearing is used to represent the direction of one-point relative to another point. Bearings are another system for designating directions of lines. The bearing of a line is defined as the acute horizontal angle between a reference meridian and the line. The angle is observed from either the north or south toward the east or west, to give a reading smaller than 90°.The letter N or S preceding the angle, and E or W following it shows the proper quadrant. Thus, a properly expressed bearing includes quadrant letters and an angular value. An example is N80°E. In Figure 36, all bearings in quadrant NOE are measured clockwise from the meridian. Thus, the bearing of line OA is N70°E. All bearings in quadrant SOE are anticlockwise from the meridian, so OB is S35°E. Similarly, the bearing of OC is S55°W and that of OD, N30°W (Ghilani and Wolf, 2012).

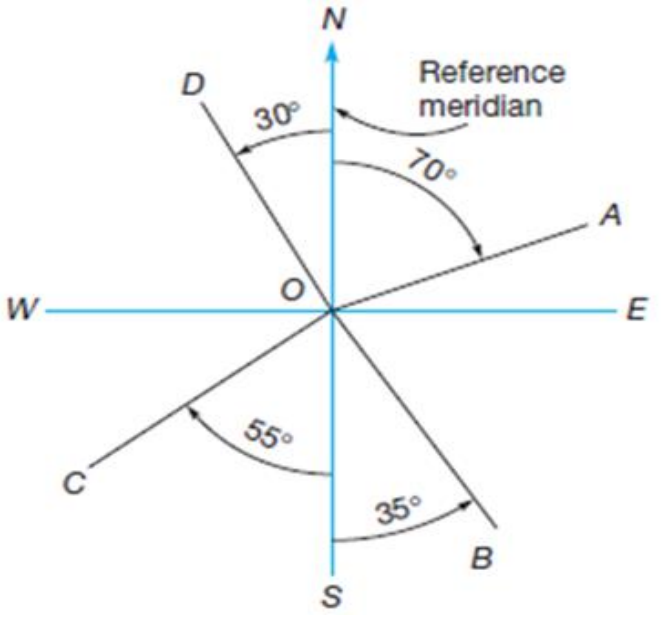

Figure 35: Bearings (Ghilani and Wolf (2012).

In this section we have discussed that the direction of property is best illustrated by use of angles that are either bearing or azimuth. Let us discuss how these angles are measured and or calculated. Please note that measurement and calculation of bearing or azimuth are not a considered to be core competencies of real estate professionals. That is the job of Land Surveyors and where one should get professional assistance when there is need for measurement of angles the same way one is supposed to get a Bill of Quantities from a Quantity Surveyor. However, one need to have an appreciation of how Land Surveyors measure and calculate angles. Let us start by learning about traversing.

INSTRUMENTS FOR FIELD MEASUREMENT OF ANGLES

Horizontal angles (azimuth and bearings) are usually measured with a theodolite or total station.

THEODOLITES

A theodolite is a precision instrument for measuring angles in the horizontal and vertical planes. It is capable of measuring angles and, when used in conjunction with graduated reference objects, distances with a high degree of

accuracy (Ghilani and Wolf, 2012). There are two different kinds of theodolites: digital and non-digital. Non digital theodolites are rarely used anymore. Digital theodolites consist of a telescope that is mounted on a base, as well as an electronic readout screen that is used to display horizontal and vertical angles. Digital theodolites are convenient because the digital readouts take the place of traditional graduated circles and this creates more accurate readings (Ghilani and Wolf, 2012). It also works with a rod that is used to determine the relative heights of the different points Figure 36 shows a theodolite.

Figure 366: Theodolite (Image taken by the Authors)

TOTAL STATIONS

A total station consists of a theodolite with a built-in distance meter (EDM), and so it can measure angles and distances at the same time (Ghilani and Wolf, 2012). The coded scales of the horizontal and vertical circles are scanned electronically, and then the angles and distances are displayed digitally. The horizontal distance, the height difference and the coordinates are calculated automatically, and all measurements and additional information can be recorded. Total stations are used wherever the positions and heights of points,

or merely their positions, need to be determined (Ghilani and Wolf, 2012). A total station is shown in Figure 37.

Figure 37: Total Station (Image taken by the Authors)

ACTIVITIES FOR THE READER

Define direction as it is applied in real property;

1. Explain the difference between true north and magnetic north;
2. Differentiate azimuth from bearing;
3. Point out any 2 surveying instruments which are used to measure angles.

CONCLUSION

Now that we have come to the close of this unit, learners should be able to define direction, explain the difference between true and magnetic north as well as azimuth and bearing. Lastly learners should be able to point out surveying instruments used to measure angles.

SUGGESTIONS FOR FURTHER READINGS

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