**SOME TERMS USED IN LEVELLING OPERATIONS**

**1.** Bench mark (BM): it is a fixed point on the earth's surface whose level above ordance datum is known.

**2.** Ordnance Datum (OD): it is the mean sea level to which all other levels are related.

**3.** Back sight (BS): is the first sight taken after the level has been set up. A sight taken to a point whose height is known or can be calculated.

**4.** Foresight (FS): The last sight taken. A sight taken to a point whose height is required to carry on the line of level.

**5.** Intermediate Sight (IS): it is any other sight taken.

**6.** Reduced Level (RL): calculated level of a point above or below the datum.

**7.** Height of Instrument (HI): The height of the line of collimation above the datum.

**8.** Line of Collimation (LM): It is an imaginary horizontal line drawn between two points.

**9.** Rise and fall: The difference is height or is level between two is referred to as a rise or fall.

**10.** Change Point (CP): the point at which both a foresight and then a back sight are taken.

**LEVELING INSTRUMENTS**

These include:

. A Level e.g. theodolite, transit dumpy level(automatic level),e.t.c.

. A staff

. Devices for angle measurements e.g. graphometer, magnetic compass, prismatic compass, orientation compass

. Chain or tape

. Pegs, arrows and ranging poles

**TACHEOMETRY**

This is the operation of measuring distances by means of stadia hairs. Measuring the distances using stadia hairs involves setting the instruments at one end of the line being measured and a leveling staff is held vertically at the other end. The points where the stadia hairs cut the staff are read. The difference between the readings is the staff intercept, S. Assuming H is the horizontal distance between the instrument and staff, then

**$H = KS + (f + C)$**

Where K = constant multiplier

(f +c) = additive constant

Note that $K = f/i$

Where f = focal length of the objective lens.

i= interval between stadia hairs

The equation above is applied to external focusing telescope, but when an anallactic lens is fitted is the telescope to bring the focal point on the vertical axis and therefore remove the need for additive constant.

**$H = KS.$**

But when the ends of the line being measured are on different levels such that the telescope has to be elevated of depressed through an angle of $\Theta_0$, the formulae above changes to:

**$H = KS \cos 2\theta$**

`and reduced level:

**$V = KS \cos \Theta \sin \Theta + HI – H$**

HI = height of instrument

h = staff reading

Occasionally, if $\theta$ exceeds $45_0$, it is better to tilt the staff so that it is perpendicular to the line of sight. Short sight is therefore attached to the staff to enable this to be done accurately. The method is called normal staffing then the formulae becomes:

**$H = KS \cos \theta + h \sin \theta$**

**$V = KS \sin \theta + HI — h \cos \theta$**

**TYPES OF LEVELLING**

1. Continuous leveling

2. Reciprocal leveling