Leveling

Leveling is the most widely used method for obtaining the elevations of ground points or their differences in elevation relative to a reference datum.

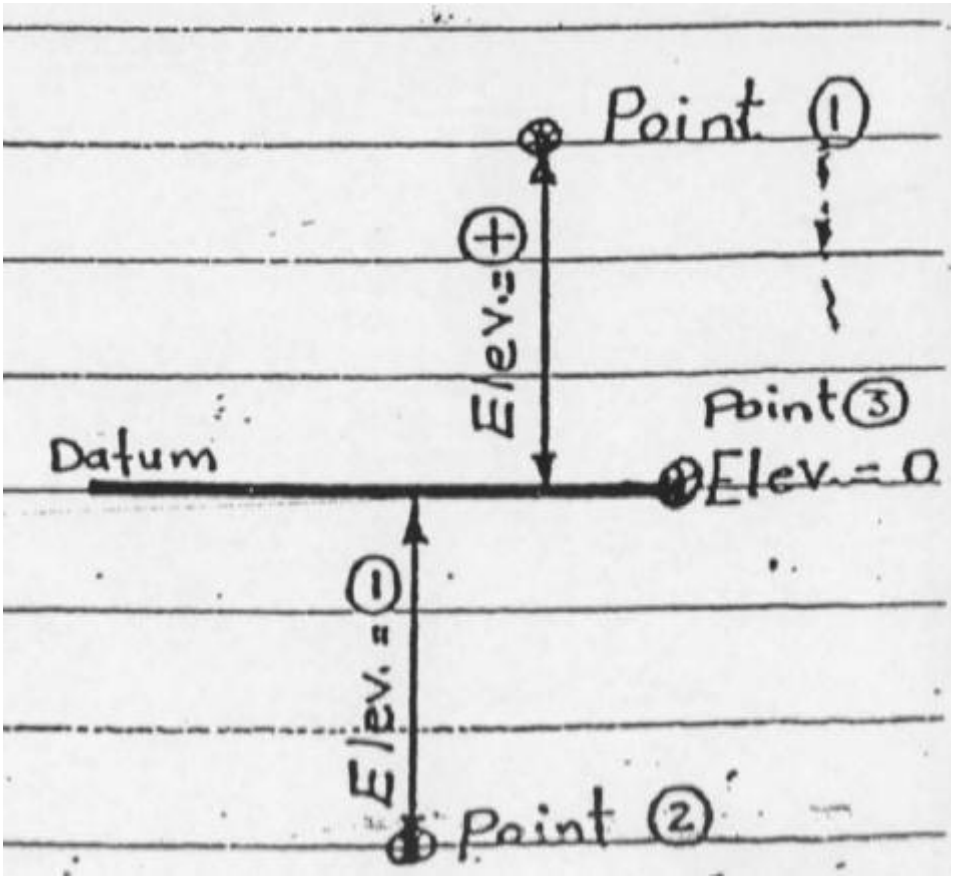
Basic variable in leveling

1- Datum

A datum is any reference surface to which the elevations of points are referred. The most commonly used datum is that of mean sea level (MSL).

2- Elevation

The distance measured along a vertical line from a vertical datum to a point or object.



3- Benchmark (B.M)

A fixed reference point or object, the elevation of which is known.

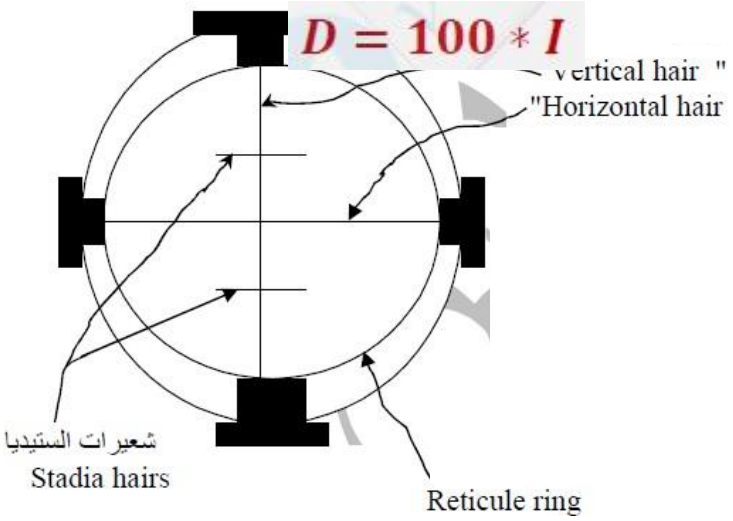
Level

Rod (staff)

BasicComponents

1- Telescope

- objective lens
- eye piece lens
- Focusing lens
- Cross – hairs The stadia method determines the horizontal distance to points through the use of readings on the upper and lower (stadia)wires on the reticle.

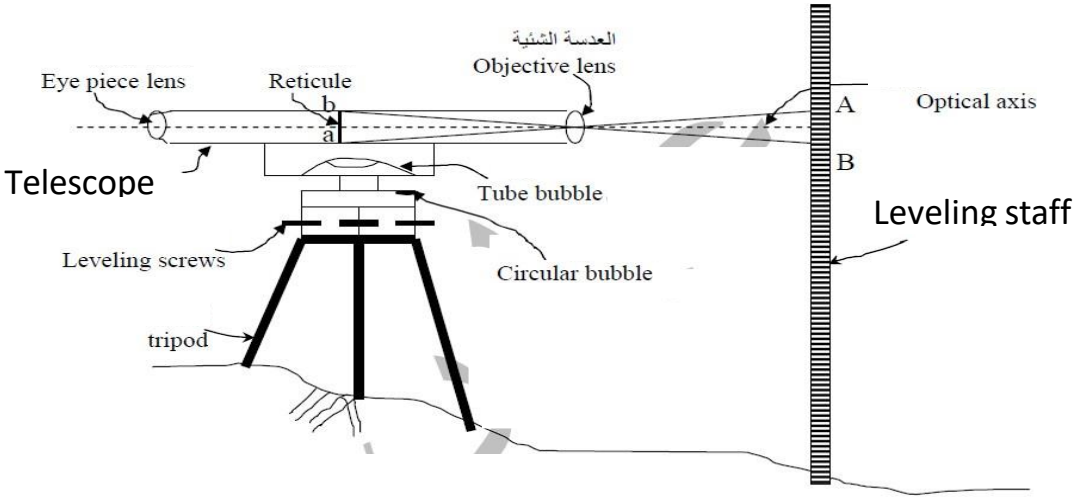


Where D is the distance from instrument to rod,and I is the stadia interval (upper minus lower rod reading)

2- Circular bubble

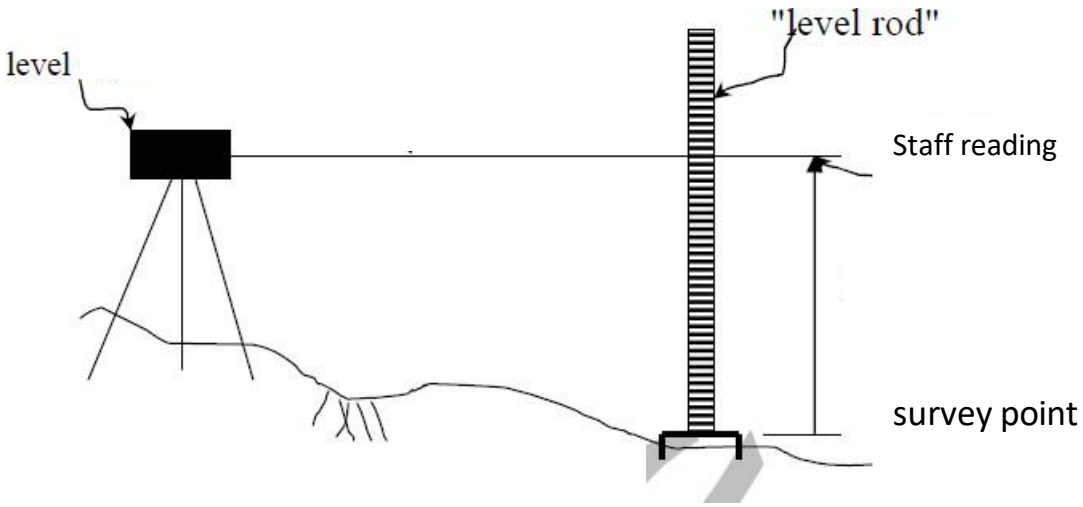
3- leveling screws

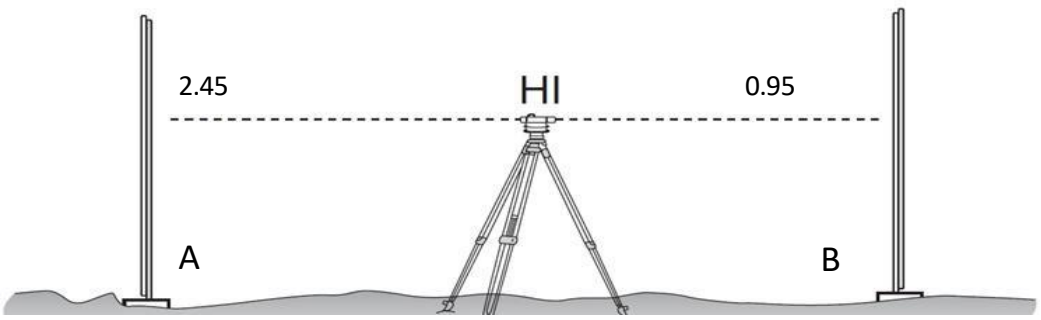
4-Tripod



Staff reading

The vertical distance from a survey point to the line of sight of the telescope.





1- Back sight reading (B.S)

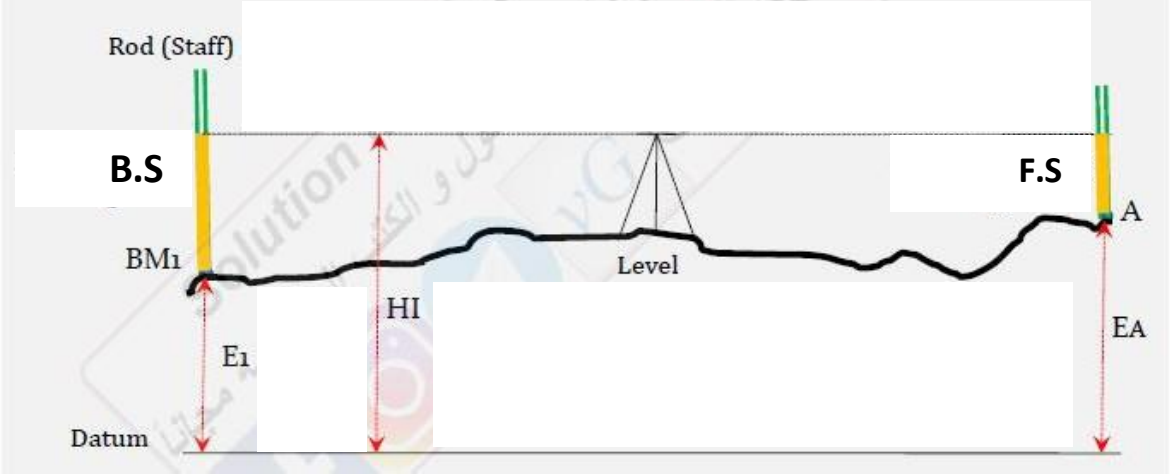
It is the sight taken on a level staff held on the point of known elevation. It is always the first staff reading after the instrument is set in a place.

2- Foresight reading (F.S)

It is the last staff reading taken from a setting of the level.

3- Intermediate sight reading (I.S)

It is any other staff reading taken from the setting of the level between the backsight reading and foresight reading



Turning point (T.P)

a point on which both fore sights and back sights are taken. After taking fore sight on this point instrument is set at another point and back sight is taken on the staff held at the same point.

Height of instrument (H.I)

The height of the line of sight of the telescope above a station or control point.

Differential leveling

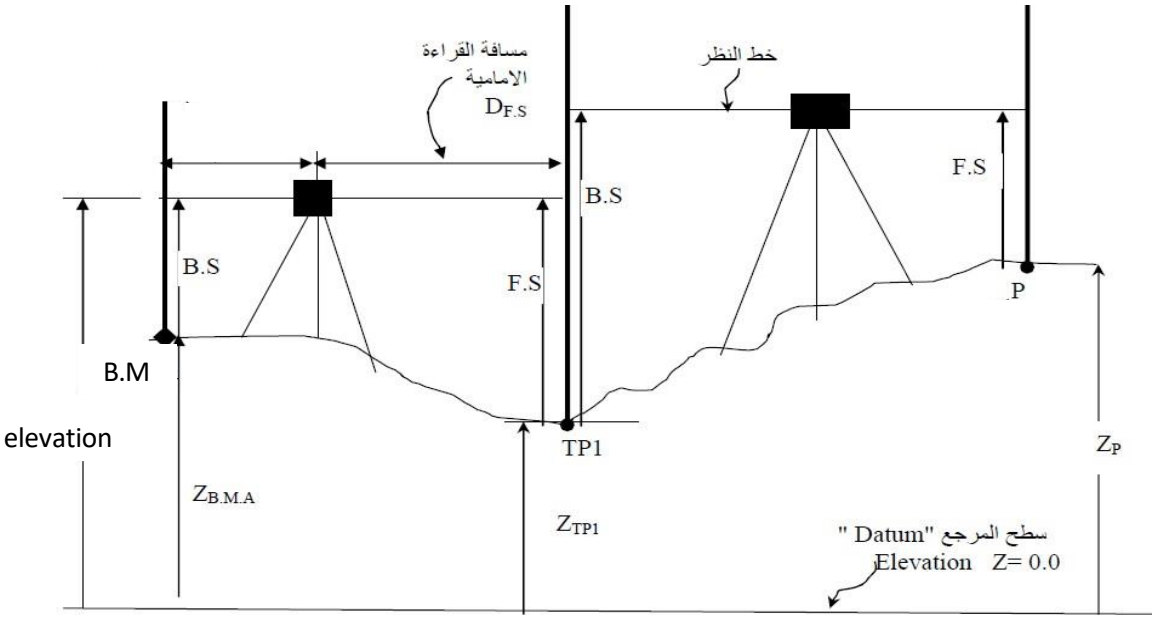
Methods of Computation

The following methods are adopted :-

1. Height of Instrument method

2. Rise and Fall method

1. Height of Instrument method



$H.I_1$= Elevation (B.M)+B.S 1

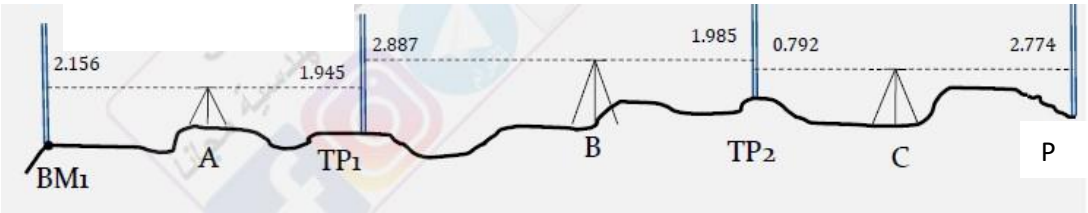
Elevation (T.P)=$H.I_1$-$F.S_1$

$H.I_2$= Elevation (T.P)+B.S 2

Elevation (P)=$H.I_2$-$F.S_2$

Example

Find the elevation of all points by height of instrument method if the elevation of B.M is equal to 50.733



Solution

Station	B.S	H.I	F.S	Elev.
B.M	2.156			50.733
T.P 1	2.887		1.945	
T.P 2	0.792		1.985	
P			2.774	

Station	B.S	H.I	F.S	Elev.
B.M	2.156	52.889		50.733
T.P 1	2.887	53.831	1.945	50.944
T.P 2	0.792	52.638	1.985	51.846
P			2.774	49.864

$$\sum \text{B.S} - \sum \text{F.S} = \text{Elev (p)} - \text{Elev (B.M)}$$

$$(2.156 + 2.887 + 0.792) - (1.945 + 1.985 + 2.774) = 49.864 - 50.733$$

-0.869=-0.869