

DUMPY LEVEL

HEIGHT OF COLLIMATION AND RISE & FALL METHOD

Aim:

To determine to difference in elevation between the given points adopting height of collimation (HC) and rise & fall method.

Instruments required:

Dumpy Level with stand, Telescopic Metric Staff

HEIGHT OF COLLIMATION

Procedure:

Compound leveling in also called as differential or fly leveling. This leveling is resorted under the following circumstances.

1. When the two stations are quite apart beyond the reach of telescope.
2. Difference in elevation is too great.
3. There is an obstacle between the two stations.

Under the above circumstances, a number of settings of the instrument are required. We have to start the levels from one station and carry out upto the end station continuously. Hence we have to conveniently install some change points.

After setting the instruments, the first reading we have to take it on a station of known elevation, called as Bench Mark and the sight is known as 'Back Sight'. The reading taken on the staff held at last point whose elevation is to be determined, just before shifting the instrument is called 'Fore Sight'. Normally the back sight distance and fore sight distance should be approximately equal to eliminate instrumental errors.

The sights that are taken on the intermediate stations are called 'Intermediate Sights' normally. Changed point is a point where we take two readings one fore sight, from the previous station and one back sight from the successive station.

Suppose we want to determine the difference in elevation between P & Q stations which are quite apart, we have to select number of change points as required. As shown in figure first set the instrument at O_1 , and take a back sight on station P_1 of known elevation. Then keep the staff at CP_1 and take a foresight. Then shift the instrument to station O_1 and set it. Then take a back sight to CP_2 . Similar way repeat the procedure till

the station Q is touched. If any intermediate sights are needed that also can be taken. Then the reduced levels can be worked out systematically tabulating the reading. There is a separate field book available for working out reduced levels (RL). The RL can be computed in two ways (1) Height of Collimation (2) Rise and Fall method. The HC method is a very simple method, less tedious method quicker than rise and fall method. It can be used when there are no inter sights.

Back sight <i>(1)</i>	Inter sight <i>(2)</i>	Fore sight <i>(3)</i>	HC <i>(4)</i>	RL <i>(5)</i>	Remarks <i>(6)</i>
0.500			100.500	100.00	Bench mark, P
0.750		0.890	100.450	99.700	CP ₁
0.650		1.250	99.850	99.200	CP ₁
		1.300		98.550	Station Q
1.900		3.350		1.450	

Arithmetical check:

$$\sum \text{Back} - \sum \text{Fore} = \text{Difference between point first RL and last RL}$$

Result:

The difference in elevation between stations P & Q,

$$100.000 - 98.550 = 1.450 \text{ m}$$

Back sight <i>(1)</i>	Inter sight <i>(2)</i>	Fore sight <i>(3)</i>	HC <i>(4)</i>	RL <i>(5)</i>	Remarks <i>(6)</i>

RISE AND FALL METHOD

The following table shows a page of level book for rise and fall method. There are seven columns. The first three columns are exactly same as in the previous table. Instead of columns HC there are two columns marked rise and fall respectively. The last two columns are also identical with previous table.

Back sight (1)	Inter sight (2)	Fore sight (3)	Rise (4)	Fall (5)	RL (6)	Remarks (7)
2.150					100.000	Back bearing on P
1.64		1.650	0.500		100.500	CP ₁
	2.345			0.700	99.800	Inter
		1.965	0.380		100.180	CP ₂
1.425		1.825		0.400	99.780	Station
5.220		5.440	0.880	1.100	0.220	

Arithmetic check

The calculations is based on the principle that two consecutive readings from same instrument station give the difference of levels, which may be rise from the proceedings station or fall. The RL of the various stations are computed by adding rise to the preceding station or by subtracting the fall. The major advantage of this system is it gives a visual picture of topography. The RL of intermediate station is also checked under this method, and this method is recommended for a long run of differential leveling for important and accurate works.

$$\sum \text{Back sight} - \sum \text{Fore sight} = \sum \text{Rise} - \sum \text{Fall} = \text{Last RL} - \text{First RL}$$

Result:

The difference in elevation between the given station =

Back sight <i>(1)</i>	Inter sight <i>(2)</i>	Fore sight <i>(3)</i>	Rise <i>(4)</i>	Fall <i>(5)</i>	RL <i>(6)</i>	Remarks <i>(7)</i>