SNS COLLEGE OF TECHNOLOGY

Coimbatore – 641 035

An Autonomous Institution

DEPARTMENT OF CIVIL ENGINEERING

23GET102-BASIC CIVIL AND MECHANICAL ENGINEERING

I YEAR / I SEMESTER

UNIT 1 : CIVIL ENGINEERING MATERIALS AND SURVEYING

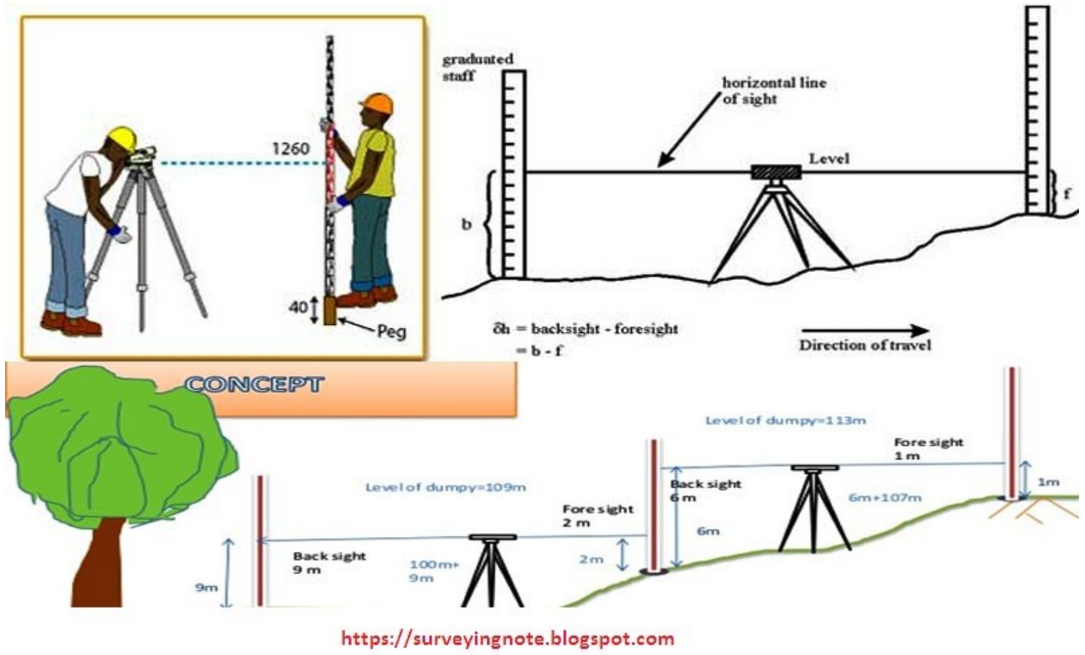
Topic :Levelling

UNIT 1 :CIVIL ENGINEERING MATERIALS AND SURVEYING

1. *Introduction to Civil engineering*
2. *Scope of civil engineering*
3. *Building materials*
4. *Brick, stone, cement, concrete, properties-uses*
5. *Introduction to Surveying*
6. *Objectives – types – classification – principles of Surveying*
7. *Measurements of distances, angles*
8. *Concepts of Levelling*
9. *determination of areas*
10. *Illustrative examples.*

What is Levelling?

1. *It is defined as the art of determining the relative heights of points on the earth's surface.*
2. *This technique of surveying deals with measurements in vertical planes.*



Objectives of Levelling

1. *Levelling provides an accurate network of heights, covering the entire area of the project.*
2. *For the execution of many engineering projects levelling becomes very essential. For instance, the construction of railways, highways, canals, dams, water supply, sanitary lines, etc.*
3. *A good network of levels provides an excellent idea of the existing terrain for the engineer, who can then plan and design his project keeping in view the economy and safety.*
4. *Greater the accuracy in the observations, the greater will be the saving in expenditure during project execution.*

Important Definitions in Levelling

- *Level surface* *The surface which is normal to the direction of gravity at all points is called a level surface. Every point on the level surface will be equidistant from the centre of the earth. For example, the surface of a still lake forms a level surface.*
- *Horizontal plane* *The plane tangential to the level surface at any point is known as a horizontal plane.*
- *Vertical plane* *The plane which contains vertical line at a place is called a vertical plane. The vertical line at any point will be perpendicular to the level surface at that point.*
- *Datum surface* *This is an arbitrary surface with reference to which the heights (elevations) of points are measured and compared.*

Important Definitions

- *Reduced level (RL) Reduced level of a point is its height above or below the datum.*
- *Back sight (BS) It is the first staff reading taken after setting up the instrument in any position. This will always be a reading on a point of known height.*
- *Fore sight (FS) This is the last staff reading taken on a point before shifting the instrument. This will always be a point whose height has to be determined.*
- *Intermediate sight (IS) Intermediate sight refers to any staff reading taken on a point of unknown elevation after the back sight and before the fore sight. This is necessary if it is needed to take more than two readings from the same position of the instrument.*
- *Change point (CP) A change point indicates the shifting of the instrument. Both the back sight and the fore sight are taken on a change point.*

Benchmark (BM)

- *A benchmark is a fixed point of reference of known elevation. The reduced level of the benchmark is used to determine the reduced levels of other points.*

Benchmarks are classified into the following types:

(a) Great Trigonometrical Survey benchmarks (GTS bench marks)

(b) Permanent benchmarks

(c) Arbitrary benchmarks

(d) Temporary benchmarks

Instruments Used For Levelling

- *Dumpy Levels*
- *Levelling Staffs*

Dumpy Level

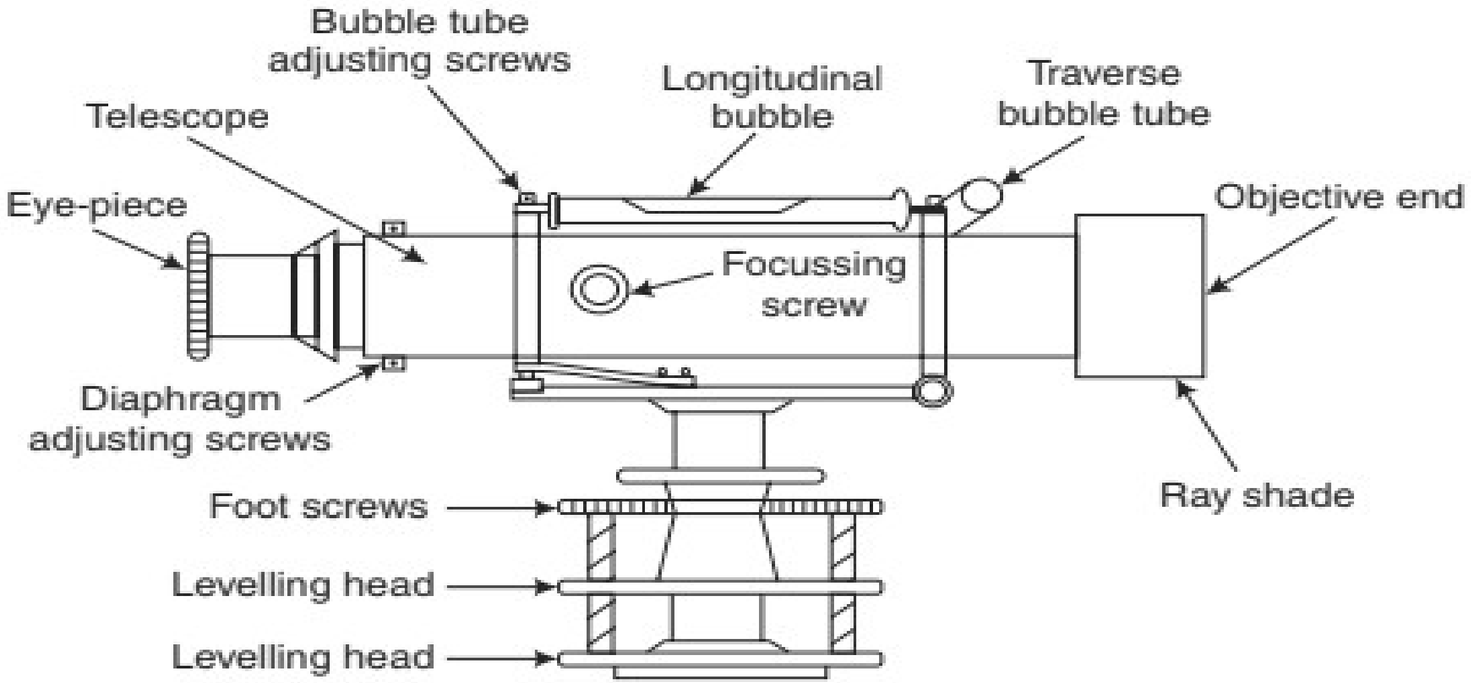


Fig. 2.18 *Dumpy level*

Levelling Staff

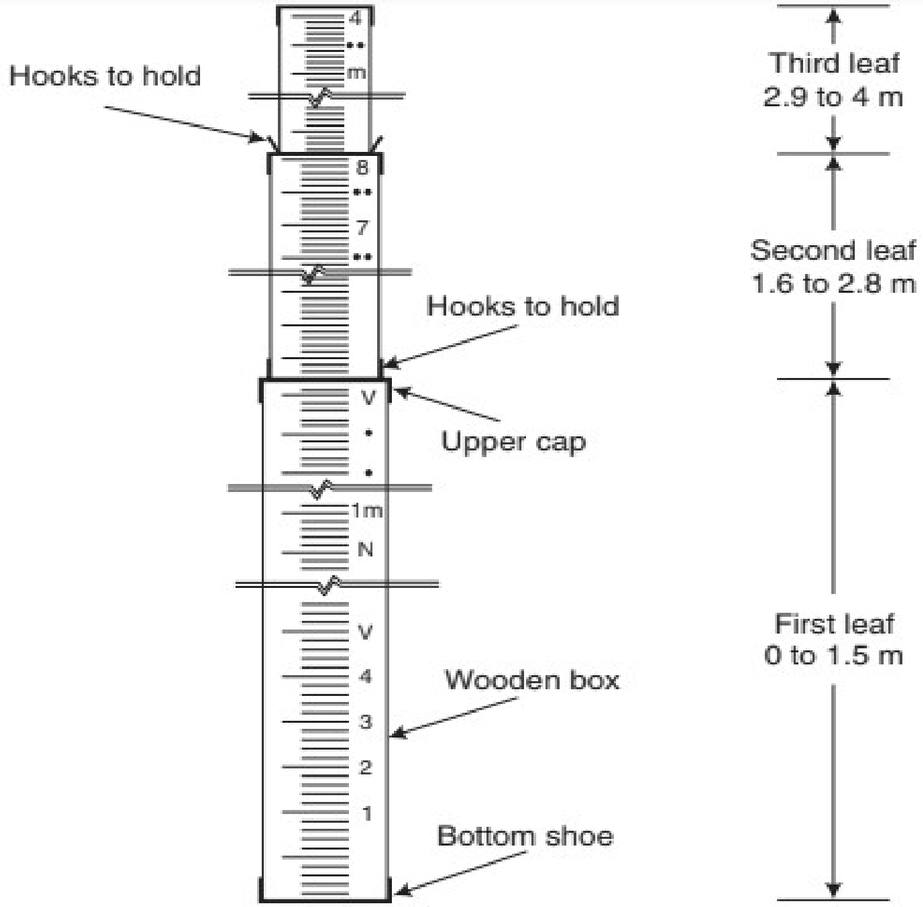


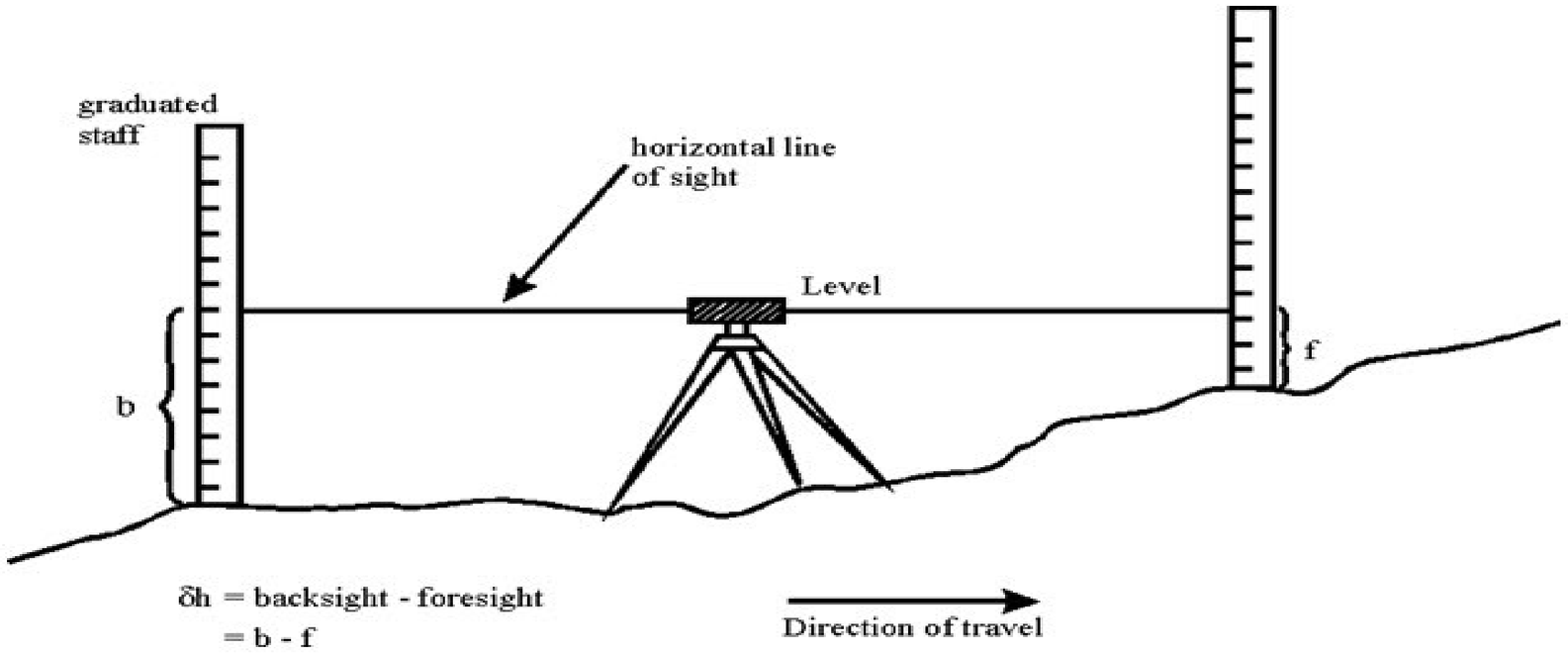
Fig. 2.19 *4 m telescopic levelling staff*

Classification of Levelling

- *Simple Levelling*
- *Differential Levelling*
- *Reciprocal Levelling*

Simple Levelling

- *This method is used to find the difference in elevation between two points which are visible from a single position of the level.*



Differential Levelling

If it is necessary to find the difference in elevation between two points

1. *Which are too far apart*
2. *If there are any obstacles between them or*
3. *If the difference in elevation is high then differential levelling is adopted.*

This is a simple levelling adopted in successive stages. Hence, it is also known as compound or continuous levelling.

Differential Levelling

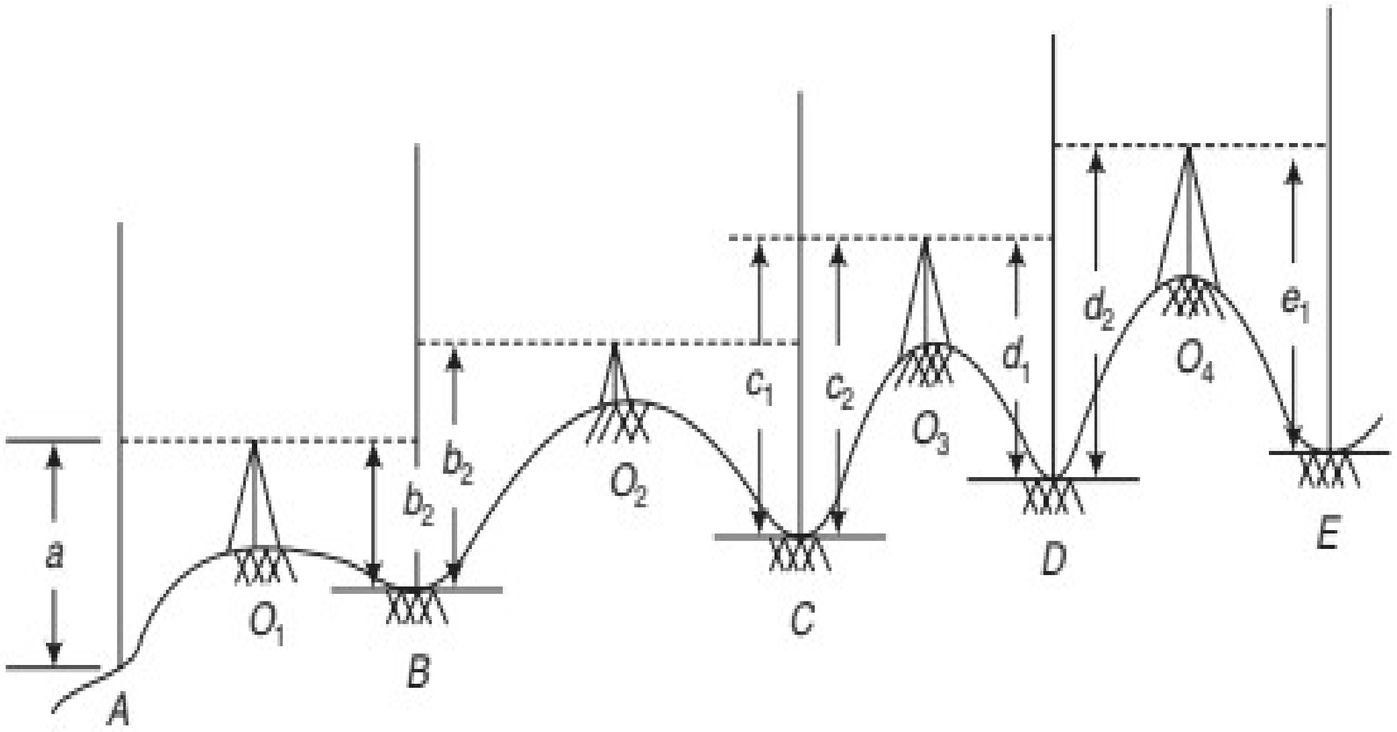


Fig. 2.21 *Differential levelling*

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Reduction of Levels

There are two methods for calculating the reduced levels of points

1. *The height of Collimation or height of instrument method*
2. *The rise and fall method.*

Formulas

The height of Collimation or height of instrument method

- $\Sigma BS - \Sigma FS = Last\ RL - First\ RL$

The rise and fall method.

$\Sigma BS - \Sigma FS = \Sigma Rise - \Sigma Fall = Last\ RL - First\ RL$

Difference between height of collimation and Rise and Fall method

Height of collimation method	*Rise and fall method*
1. It is more rapid and saves time and labour.	It is laborious as the staffreading of each station is compared to get a rise or fall.
2. It is adopted for reduction of levels for longitudinal or cross sectional levelling works.	This is adopted for determining the difference in levels of two points where precision is required.
3. There is no check on the RL of intermediate stations.	There is a complete check on the RLs of intermediate stations.
4. There are only two arithmetic checks, i.e. Σ BS – Σ FS = Last RL – First RL	There are three arithmetic checks, i.e. Σ BS – Σ FS = Last RL – First RL = Σ Rise – Σ Fall
5. Errors in any of the intermediate sights are not noticed.	Errors in the intermediate sights are noticed as these are used for finding out the rises and falls.

Illustrative Examples

- *Levelling Problem*
- *All Basic Problems in Levelling*


Thank You!