DUMPY LEVEL SURVEY : WHAT, WHERE AND HOW?

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LEVELLING

- Levelling is a process of determining the height of one level relative to another. It is used in surveying to establish the elevation of a point relative to a datum, or to establish a point at a given elevation relative to a datum.

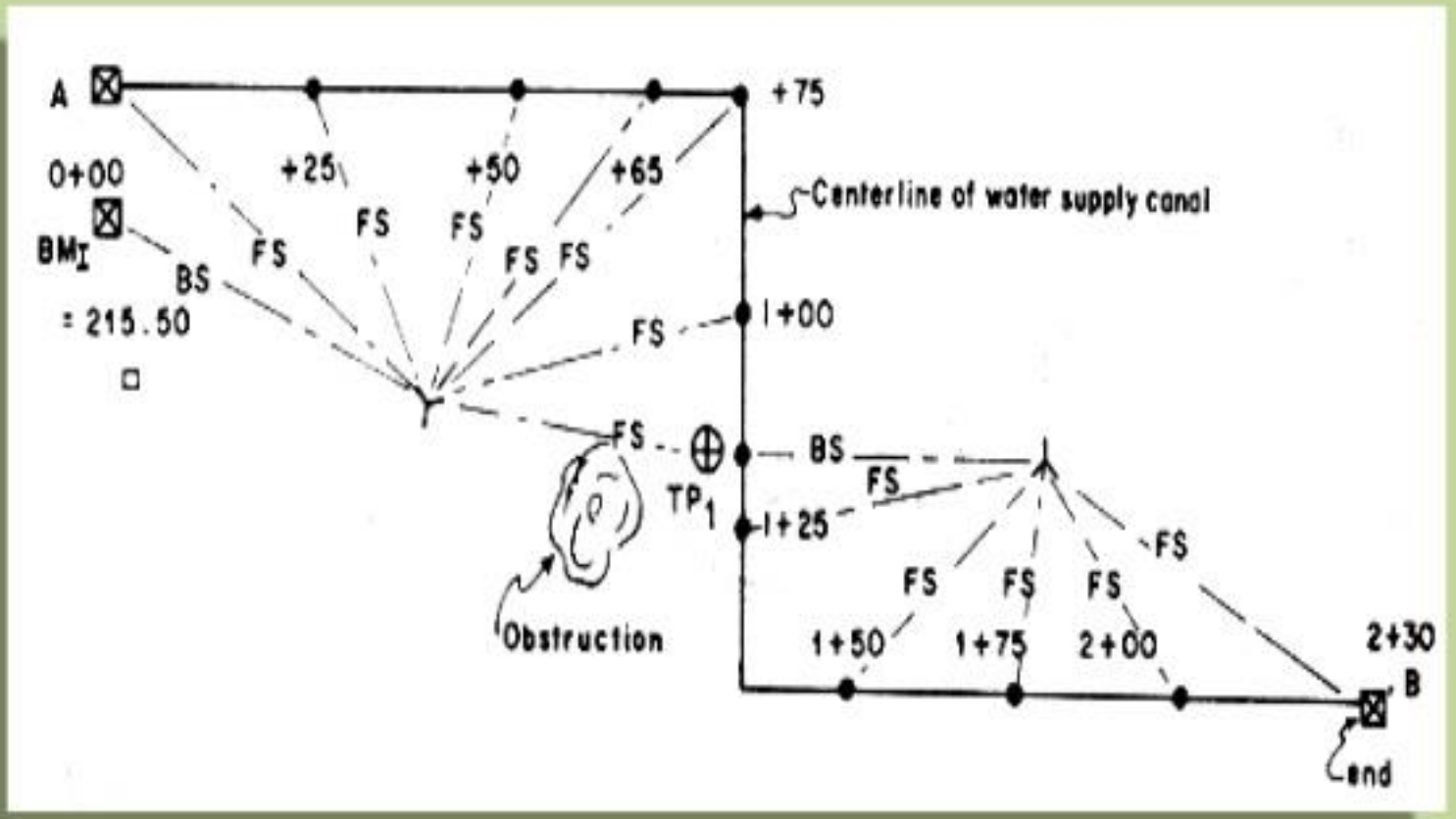
Terms used in Levelling

Fore sight(F.S.) It is the last staff reading taken denoting the shifting of the instrument.

Intermediate sight.(I.S.) It is staff reading taken on a point whose elevation is to be determined. All staff reading between B.S. and F.S. are Intermediate sight.

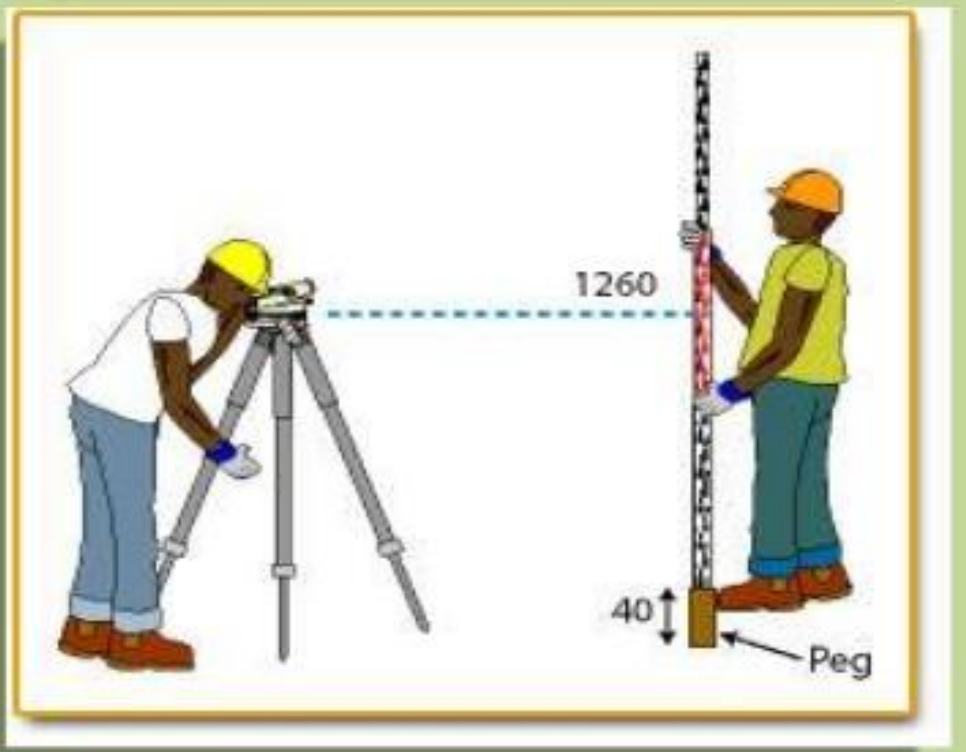
Change Point (T.P) It is a point on which both fore and back sight are taken.

Terms used in Levelling



Instruments for levelling

- The following instruments are essentially required for levelling
- Level
- Levelling Staff



Instruments for levelling

- **Level and types of level**
- Level
- The instrument used to furnish horizontal line of sight for observing staff readings and determining R.L.s

Types of Level

- Dumpy level
- Tilting level
- Wye level
- Automatic level

Dumpy level

- The Dumpy level is a simple, compact and stable instrument. The telescope is rigidly fixed to its supports. Hence it cannot be rotated about horizontal axis.

Dumpy level

Dumpy level

Bench Marks

Arbitrary Bench Marks

- These are reference points whose R.L.s are arbitrarily assumed. They are used in small works such bench mark may be assumed as 100 or 50 m

Temporary Bench Marks

- They are the reference points established during the levelling operations when there is a break in work, or at the end of day's work the value of reduced levels are marked on some permanent objects such as stones, trees etc.

Temporary Adjustments of a level

Focusing the eye piece

- To focus the eye piece, hold a white paper in front of object glass, and move the eye piece in or out till the cross hair are distinctly seen.

Focusing of object glass

Direct the telescope to the levelling staff and on looking through the telescope, turn the focusing screw till the image appears clear and sharp.

Errors in Levelling

The following are the different sources of Errors

- **Personal Error**
- The Instruments may not be levelled
- The focusing of eye piece and objective glass may not be perfect
- The parallax may not be eliminated
- The position of staff may have changed
- Entry and recording in the field book may not be correct
- The staff may not be fully extended, may not be held vertical.

Errors in Levelling

Instrumental Error

- The Permanent adjustment of the instrument may not be perfect. That is the line of collimation may not be horizontal line.
- The internal arrangement of focusing tube may not be correct
- The graduation of the staff may not be perfect
- Defective bubble tube, if the bubble tube is sluggish, it may apparently be in the mid-position even though the bubble line is not horizontal.

Errors in Levelling

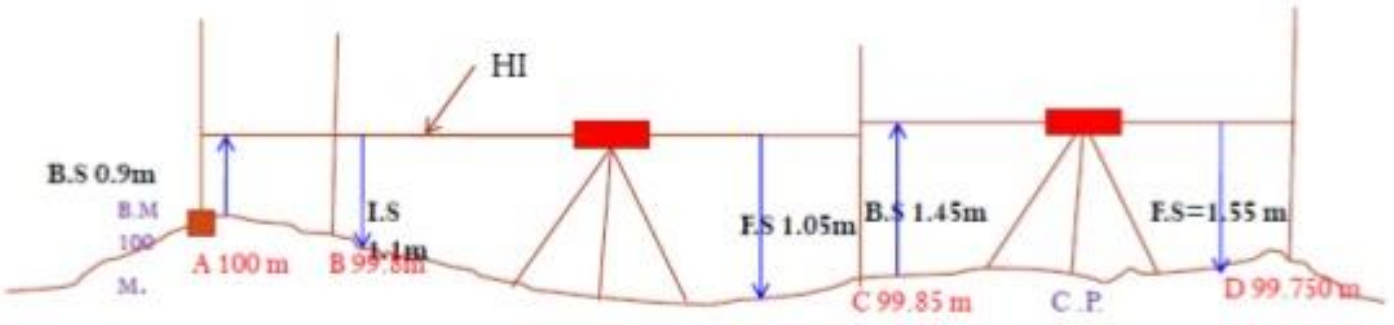
Errors due to Natural Causes

- The Curvature of the Earth may affect the staff readings when the distance of sight is long.
- The effect of refraction may cause a wrong staff reading
- There are some errors in staff readings due to high velocity wind

Common errors in Leveling

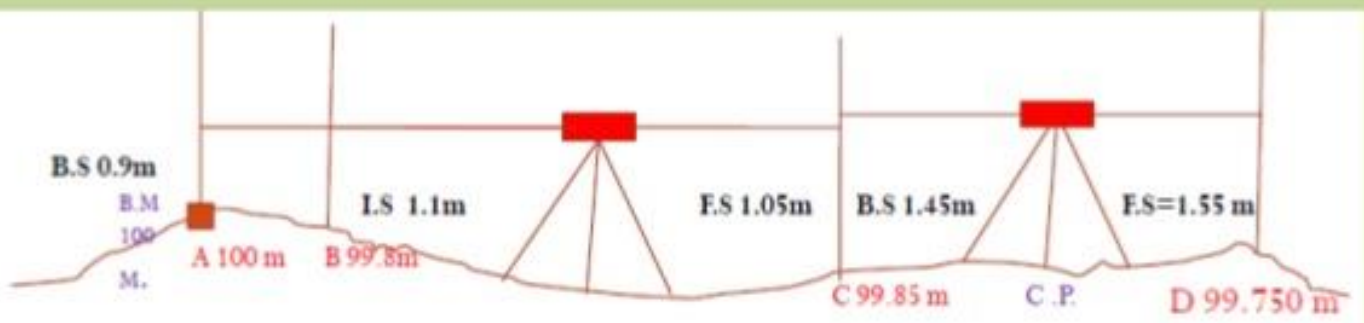
- Foresight and back sight not being taken on exactly the same point
- Reading the staff upward instead of downward
- Reading of stadia hair
- Reading of wrong number of metre and decimeter
- Entering backsight in F.S and vice versa
- Transposing the figures
- Omitting an entry
- The leveling staff not being fully extended.

Height of Instrument Method



Station	B.S	I.S	F.S	H.I	R.L	Remark
A	0.9			100.9	100.00	B.M
B		1.1			99.800	
C	1.450		1.05	101.3	99.850	C.P.
D			1.550		99.750	

Rise and Fall Method



Station	B.S	I.S	F.S	Rise	Fall	R.L	Remark
A	0.9					100.00	B.M
B		1.1			0.2	99.800	
C	1.450		1.05	0.05		99.850	C.P.
D			1.550		0.1	99.750	

Example

- The Following observations were taken with dumpy level and **4 m leveling staff**. The instrument were shifted after the **4th** and **7th** reading. The first reading was taken on a bench mark whose **R.L. was 15.575 m**. prepare a page of level book and calculate RL of all the points. The observations were taken at every **30 m interval**. Also find out the gradient between first and last point. Also draw the profile of ground. **Use H.I. Method**. Observations are: **0.565, 1.250, 1.675, 3.695,0.125, 2.345, 0.500, 1.785, 2.535.**

Observations are: 0.565, 1.250, 1.675, 3.695 (CP),0.125, 2.345, 0.500 (CP), 1.785, 2.535.

Station	B.S.	I.S.	F.S	HI	RL	Remarks
A	0.565			16.14	15.575	BM
B		1.250			14.89	
C		1.675			14.46	
D	0.125		3.695	12.565	12.44	CP
E		2.345			10.22	
F	1.785		0.500	13.85	12.065	CP
G			2.535		11.315	
CHECK	$\sum$ BS- $\sum$ FS				L.RL –F. RL	
	2.47		6.73			
	$\sum$ BS- $\sum$ FS= -4.26				L.RL –F. RL= -4.255	

Observations are: 0.565, 1.250, 1.675, 3.695 (CP),0.125, 2.345, 0.500 (CP), 1.785, 2.535.

Station	B.S.	I.S.	F.S	RISE	FALL	RL	Remarks
A	0.565					15.575	BM
B		1.250			0.685	14.89	
C		1.675			0.425	14.46	
D	0.125		3.695		2.02	12.44	CP
E		2.345			2.22	10.22	
F	1.785		0.500	1.845		12.065	CP
G			2.535		0.75	11.315	
CHECK	∑ BS- ∑ FS					L.RL –F. RL	
	2.47		6.73				
	∑ BS- ∑ FS= -4.26			∑RISE- ∑ FALL =-4.26		L.RL –F. RL= -4.26	

Observations are: 0.565, 1.250, 1.675, 3.695 (CP),0.125, 2.345, 0.500 (CP), 1.785, 2.535.

Station	B.S.	I.S.	F.S	RISE	FALL	RL	Remarks
A (0 m)	0.565					15.575	BM
B (30 m)		1.250			0.685	14.89	
C (60 m)		1.675			0.425	14.46	
D (90 m)	0.125		3.695		2.02	12.44	CP
E (120 m)		2.345			2.22	10.22	
F (150 m)	1.785		0.500	1.845		12.065	CP
G (180 m)			2.535		0.75	11.315	
CHECK		∑ BS- ∑ FS				L.RL –F. RL	
	2.47		6.73				
	∑ BS- ∑ FS= -4.26			∑RISE- ∑ FALL =-4.26		L.RL –F. RL= -4.26	

GRADIENT

- Gradient of line AG = $\frac{\text{Diff of RLs}}{\text{Length}}$

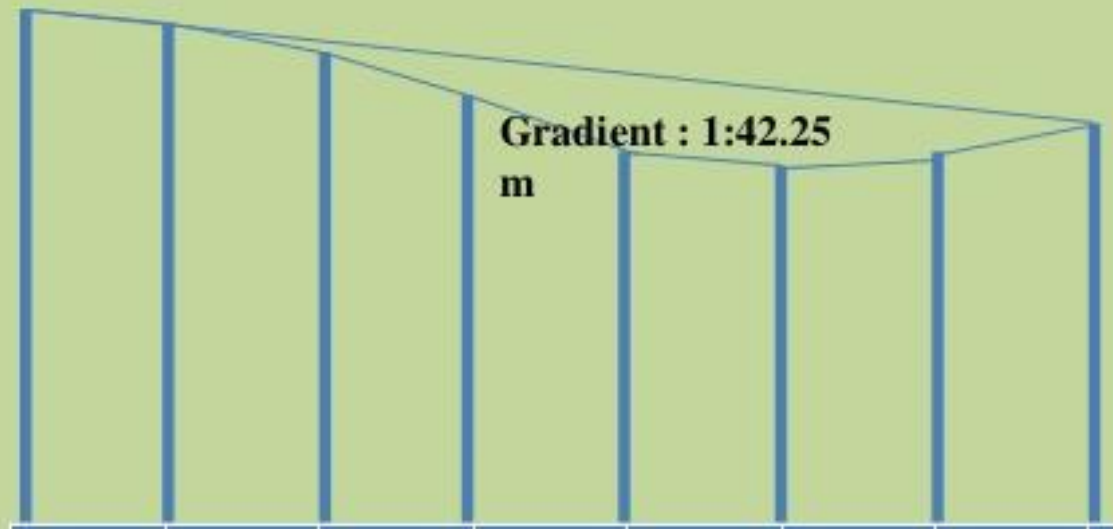
- Gradient of line AG = $\frac{4.260}{180}$

$= \frac{1}{42.25}$

= 1 in 42.25 Gradient.

Profile

Levelling survey by Dumpy Level
Profile along the line A-G of Survey



15.575	14.89	14.46	12.44	10.22	12.065	13.315	R.L.
0	30	60	90	120	180	m	Distance

Scale
Horizontal: 1cm=15m
Vertical: 1cm=1m