## HEIGHT OF INSTRUMENT METHOD



## Methods of Reducing Levels

## Height of Instrument Method

- This method consist of finding H.I. for every setup of instrument, and then obtaining the R.L. of point of reference with respect to H.I


## 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 |  |
|  |  |  |  |  |  |  |

## Example

- The following staff readings were observed successively with a level the instrument is moved by third, sixth and eighth readings.
- $2.228: 1.606: 0.988: 2.090: 2.864: 1.2620 .602: 1.982$ : 1.044 :2.684 m
- enter the reading in record book and calculate R.L. if the first reading was taken at a B.M of $\mathbf{4 3 2 . 3 8 3 m}$


## H.I. Method

| Station | B.S | I.S | F.S | HI | RL | REMAR <br> KS |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 1 | 2.228 |  |  | 434.612 | 432.384 M | B.M. |
| 2 |  | 1.606 |  |  | 433.006 |  |
| 3 | 2.090 |  | 0.988 | 435.714 | 433.624 | $3^{\text {RD }}$ C.P. |
| 4 |  | 2.864 |  |  | 432.850 |  |
| 5 | 0.602 |  | 1.262 | 435.054 | 434.452 | $6^{\mathrm{TH}}$ C.P |
| 6 | 1.044 |  | 1.982 | 434.116 | 433.072 | $8^{\text {TH }}$ C.P |
| 7 |  |  | 2.684 |  | 431.432 |  |
|  | 5.964 |  | 6.916 |  |  |  |

CHECK $\Sigma$ B.S- $\Sigma$ F.S $=5.964-6.916=-0.952$ = LAST R.L-FIRST R.L= 431.432-432.384=0.952

- The following readings were taken with a dumpy level and $\mathbf{4 m}$ leveling staff. The instrument was shifted after $3^{\text {rd }}$ and $6^{\text {th }}$ readings. The readings are $\mathbf{2 . 6 6 5}, \mathbf{3 . 2 2 5}, 2.905,1.85,0.98,2.62,1.585,0.96$, $0.425 . \mathrm{m}$ Enter the above readings in a page of level book and calculate R.L. of points, if the first reading was taken with a staff held on B.M. of 240 m . use rise and fall method. Apply arithmetic checks


## HI Method

| Station | B.S. | I.S. | F.S | HI | RL | Remarks |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| A | 2.665 |  |  | 242.665 | 240.00 | BM |
| B |  | 3.225 |  |  | 239.44 |  |
| C | 1.85 |  | 2.905 | 241.61 | 239.76 | $3^{\text {rd }}$ CP |
| D |  | 0.98 |  |  | 240.63 |  |
| E | 1.585 |  | 2.62 | 240.575 | 238.99 | $6^{\text {th }}$ CP |
| F |  | 0.96 |  |  | 239.615 |  |
| G |  |  | 0.425 |  | 240.15 |  |
| CHECK |  | $\sum$ BS- $\sum$ FS |  |  | L.RL-F. RL |  |
|  |  |  |  |  |  |  |
|  | 6.1 |  | 5.95 |  |  |  |
|  | $\sum$ BS $\sum$ FS $=0.15$ |  |  | L.RL-F. RL= 0.15 |  |  |

## Example

- The Following observations were taken with dumpy level and $4 \mathbf{~ m}$ leveling staff. The instrument were shifted after the $\mathbf{4}^{\text {th }}$ and $7^{\text {th }}$ 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 $\mathbf{3 0} \mathbf{m}$ interval. 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: $\mathbf{0 . 5 6 5}, \mathbf{1 . 2 5 0 , 1 . 6 7 5}$, 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 |  |  |  |  |  |
|  |  |  |  |  |  | L.RL-F. RL= |

## GRADIENT

- Gradient of line $\mathrm{AG}=$ Diff of RLs


## Length

- Gradient of line $\mathrm{AG}=\mathbf{4 . 2 6 0}$

180
$=\frac{1}{42.25}$
$=1$ in 42.25 Gradient.

## Example

The following readings are taken on continuous falling ground with staff of 4 m the are 0.4 m , $0.765,1.270,2.56,3.22,3.95,0.390,1.690,3.5$, $0.8,1.920,2.45,3.98$. Enter the reading in the page of level book and calculate the RLs of all point if the first reading was taken on Benchmark of 100 m .
$0.400,0.765,1.270,2.560,3.220,3.950,0.390,1.690,3.500,0.800,1.920,2.450,3.980$ (Continuous Sloping Ground) 4 m staff

| Station | B.S. | I.S. | F.S | HI | RL | Remarks |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| A | 0.400 |  |  | 100.4 | 100.00 | BM |
| B |  | 0.765 |  |  | 99.635 |  |
| C |  | 1.270 |  |  | 99.13 |  |
| D |  | 2.560 |  |  | 97.84 |  |
| E |  | 3.220 |  |  | 97.18 |  |
| F | 0.390 |  | 3.950 | 96.84 | 96.45 | CP |
| G |  | 1.690 |  |  | 95.15 |  |
| H | 0.800 |  | 3.500 | 94.14 | 93.34 | CP |
| I |  | 1.920 |  |  | 92.22 | CP |
| J |  | 2.450 |  |  | 91.69 |  |
| K |  |  | 3.98 |  | 90.16 |  |
| $\sum$ | 1.59 |  | 11.43 |  |  |  |
| CHECK | $\sum$ BS- $\sum$ FS $=$ | -9.84 m |  |  | L.RL-F. RL= -9.84 m |  |

## Example

- The following consecutive readings were taken with a level and a $\mathbf{4 m}$ staff at a common interval of $\mathbf{3 0 m}$; The first reading was taken at B.M. having R.L. $\mathbf{= 1 0 0 m}$. The instrument were shifted after the $4^{\text {th }}$ and $9{ }^{\text {th }}$ readings. Rule out a page of a level book, enter the readings given and also calculate the reduced levels of the points by the collimation method. Also apply arithmetic checks.
- Consecutive readings are: 2.650, $\mathbf{1 . 7 4 5}, \mathbf{0 . 6 2 5}, \mathbf{0 . 2 6 0}, \mathbf{2 . 5 2 5}$, $2.160,1.235,0.870,1.365,0.625,1.790$, and 2.535 .

Consecutive readings are: $\mathbf{2 . 6 5 0}, 1.745,0.625,0.260(C P), 2.525,2.160$, $1.235,0.870,1.365(C P), 0.625,1.790$, and 2.535.

| Station | B.S. | I.S. | F.S | HI | RL | Remarks |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| A | 2.65 |  |  | 102.65 | 100 m | BM |
| B |  | 1.745 |  |  | 100.905 |  |
| C |  | 0.625 |  |  | 102.025 |  |
| D | 2.525 |  | 0.260 | 104.915 | 102.39 | CP |
| E |  | 2.160 |  |  | 102.755 |  |
| F |  | 1.235 |  |  | 103.68 |  |
| G |  | 0.87 |  |  | 104.045 |  |
| H | 0.625 |  | 1.365 | 104.175 | 103.55 | CP |
| I |  | 1.79 |  |  | 102.385 |  |
| J |  |  | 2.535 |  | 101.64 |  |
| K | 5.8 |  | 4.16 |  |  |  |
| $\sum$ |  |  |  |  |  |  |
| CHECK | $\sum$ BS- $\sum$ FS $=1.64 \mathrm{~m}$ |  |  | L.RL-F. RL= 1.64 m |  |  |

## EXAMPLE

- The following consecutive readings were taken with a level and a 4 m leveling staff on a continuously sloping ground at a common interval of 30 m on line AB.

| Chainag <br> e | 0 | 30 | 60 | 90 | 120 | 150 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Level | $\mathbf{0 . 5 8 5}$ | $\mathbf{0 . 9 3 0}$ | $\mathbf{1 . 9 5}$ | $\mathbf{2 . 8 4 5}$ | $\mathbf{3 . 6 4 5}$ | $\mathbf{3 . 9 3}$ |
| Station | A |  |  |  |  | B |

The reduced level ( $\mathbf{R L}$ ) of station $\mathbf{A}$ is $\mathbf{5 0 . 0 0}$. Calculate the reduced levels at all the points where the leveling staff is placed. Tabulate the results and apply usual checks. Also determine the gradient of line $A B$.

## EXAMPLE (HI Method)

| Station | B.S. | I.S. | F.S | HI | RL | Remarks |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| A (0 m) | 0.585 |  |  | 50.585 | 50.00 | BM |
| B ( $\mathbf{3 0} \mathrm{m}$ ) |  | 0.930 |  |  | 49.655 |  |
| C ( 60 m ) |  | 1.950 |  |  | 48.635 |  |
| D (90 m) |  | 2.840 |  |  | 47.745 |  |
| E (120 m) |  | 3.645 |  |  | 46.94 |  |
| F (150 m) |  |  | 3.930 |  | 46.655 |  |
| G (180 m) |  |  |  |  |  |  |
| CHECK |  | $\sum$ BS- |  |  | L.RL-F. RL |  |


| 0.585 3.930 |  | 3.345 |
| :--- | :--- | :--- |
| $\sum$ BS- $\sum$ FS $=-\mathbf{3 . 3 4 5} \mathbf{m}$ | L.RL-F. RL= $\mathbf{3 . 3 4 5} \mathbf{~ m}$ |  |

## THANKS !



