



Yildiz Technical University
Faculty of Civil Engineering
Department of Geomatic Engineering



TOPOGRAPHY (HRT3351)

Lecture Notes

Prof. Dr. Burak AKPINAR

Title	Code	Local Credit	ECTS	Lecture (hour/week)	Practical (hour/week)	Laboratory (hour/week)
Topography	HRT3351	3	4	3	0	0

Course Objectives

The aim of this course, gains required skills of basic of surveying techniques, mathematical definitions using for large scale map production.

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TOPOGRAPHY (HRT3351)

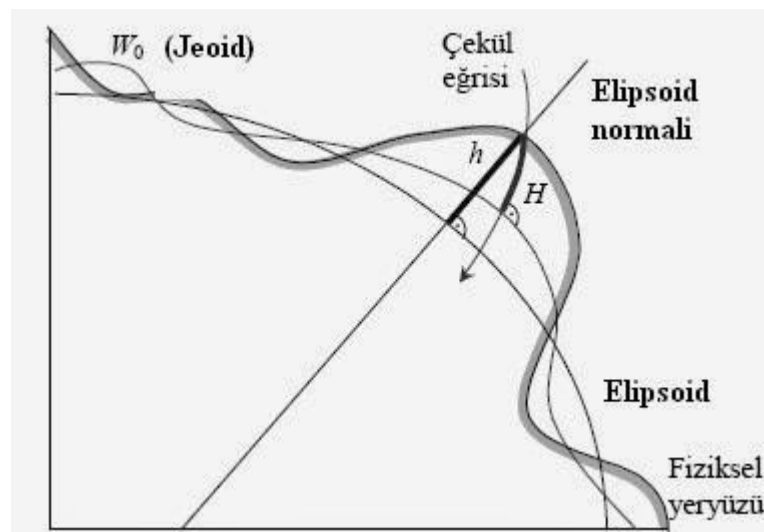
Prof. Dr. Burak AKPINAR

Week	Subject
1	Introduction to Topography
2	Measurement Units and Sources of Measurement Errors
3	Types of Errors
4	Coordinate Systems and Map Projections
5	Geodetic Network Points and Distance Measurements
6	Direction Measurements
7	Traverse Computations
8	Height Measurements
9	Midterm exam 1
10	Area and Volume Computations
11	Field work
12	Field work
13	Geographic Information System, GIS
14	Midterm exam 2
15	GNSS Global Positioning Systems
16	Final exam

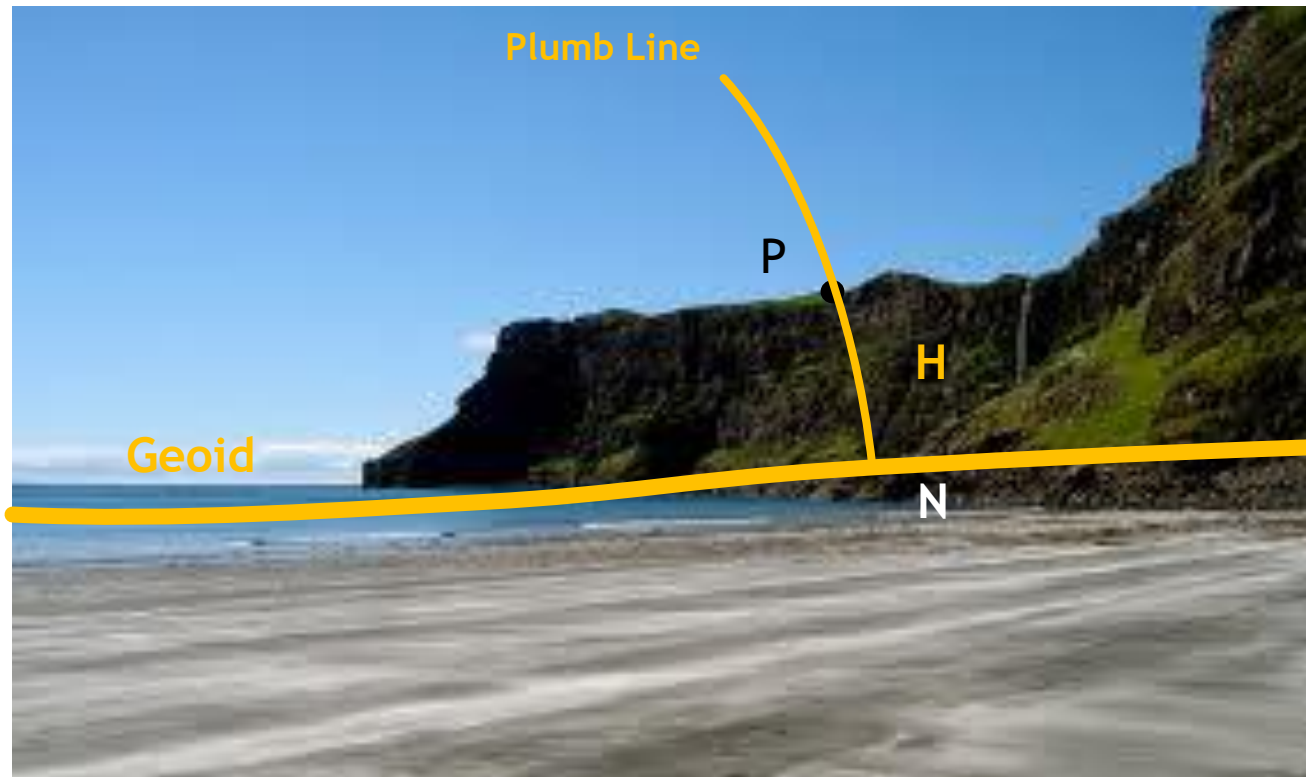
Week-8

Height Measurements

Height



Height



Levels



Old Levels



Automatic Levels

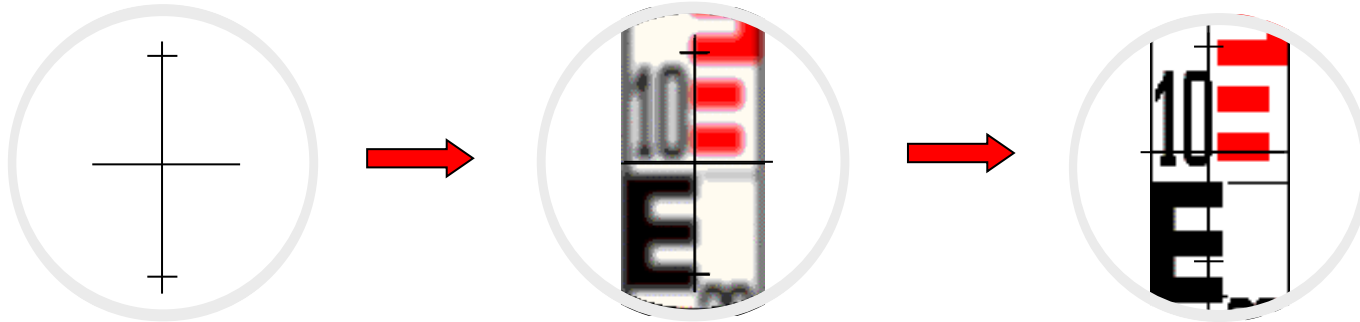
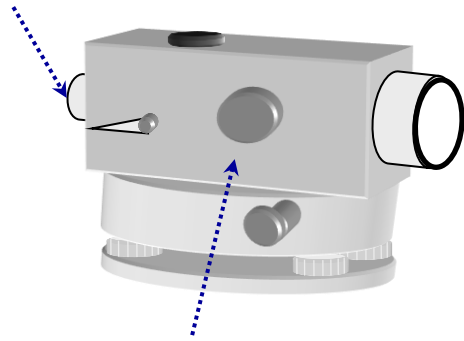


Digital Levels



Laser Levels

Automatic Levels



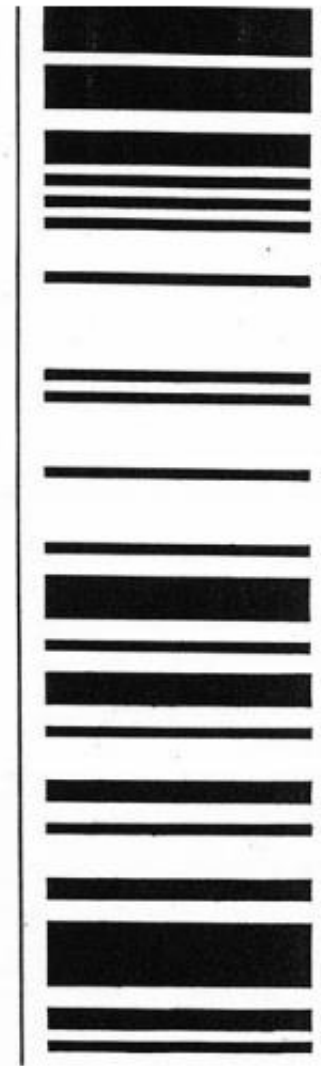
Digital Levels



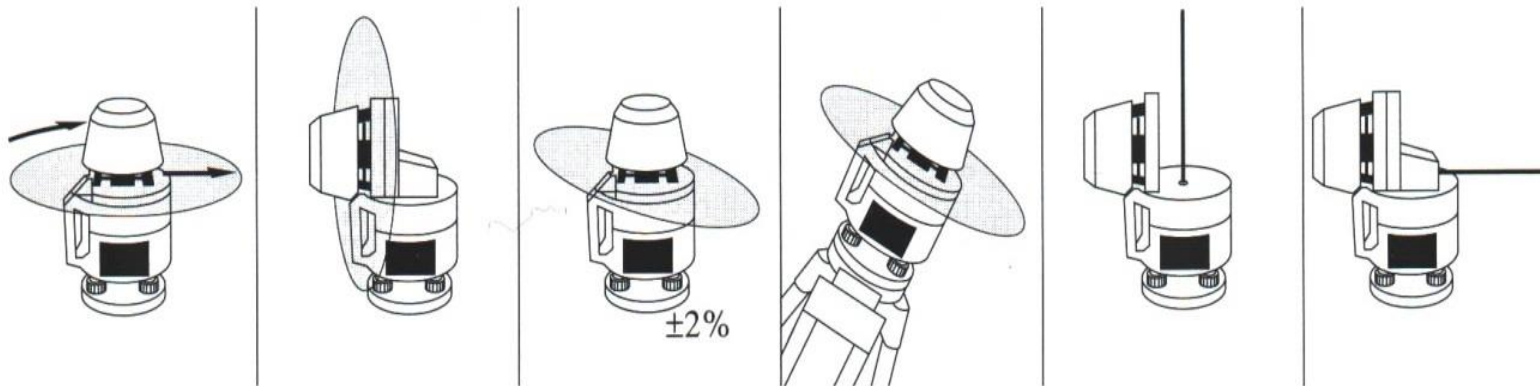
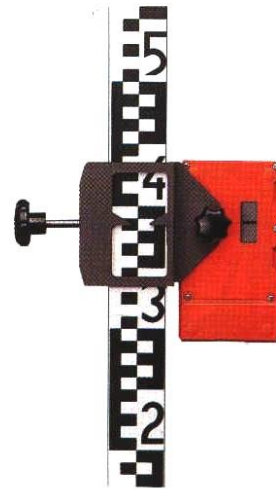
Screen



Barcode Level Rod

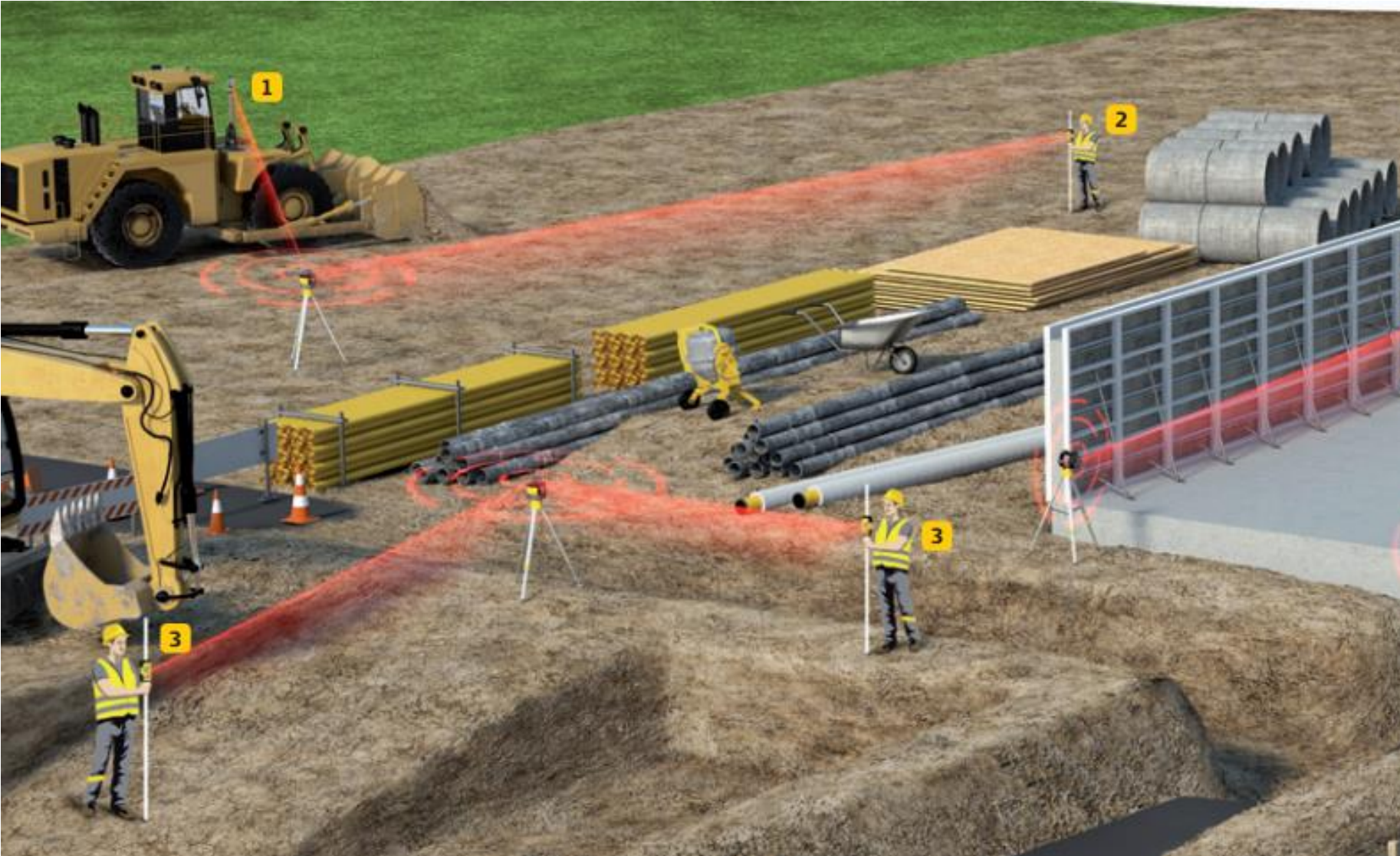


Laser Levels



Accuracy: 1.5mm-3.0 mm / 30m

Laser Levels



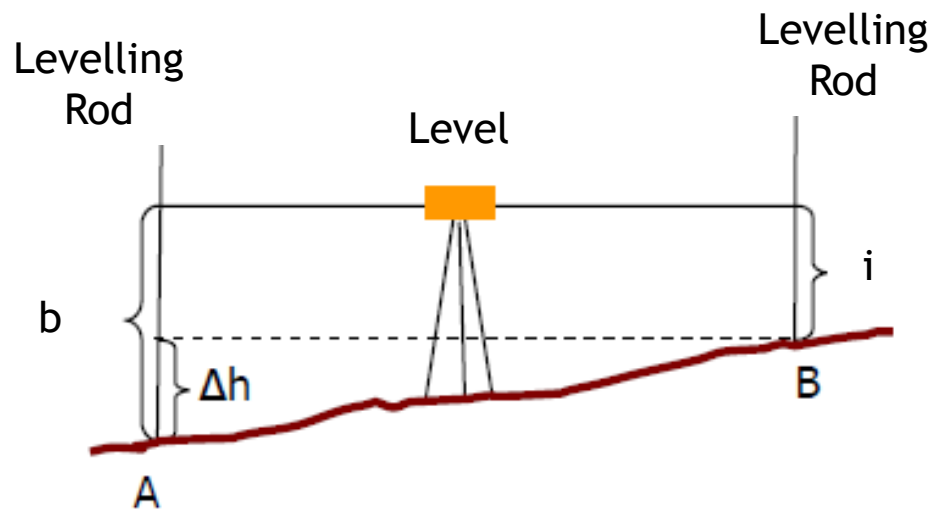
Laser Levels



Differential Levelling

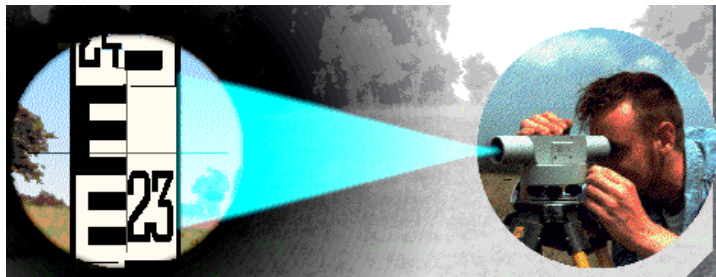
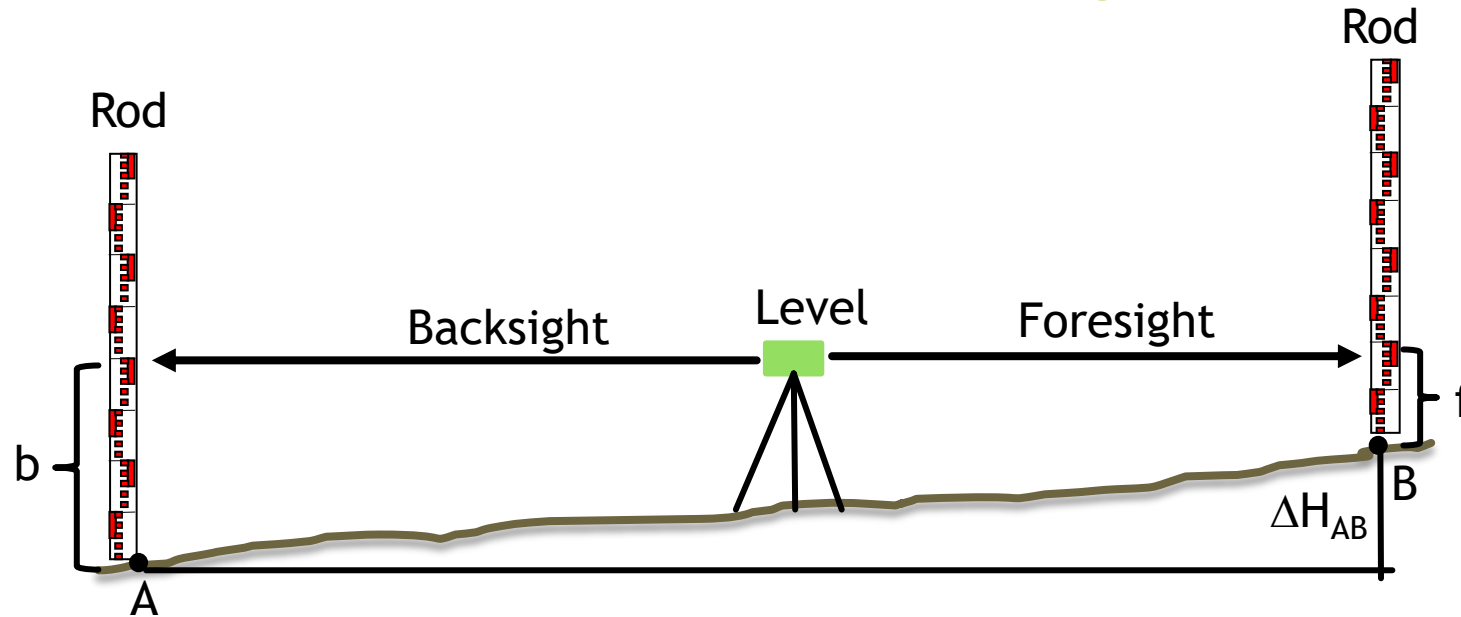
Height is defined as the vertical distance between the point and the reference surface along plumb line.

Differential levelling is the measurement procedure for determining the height differences between points.

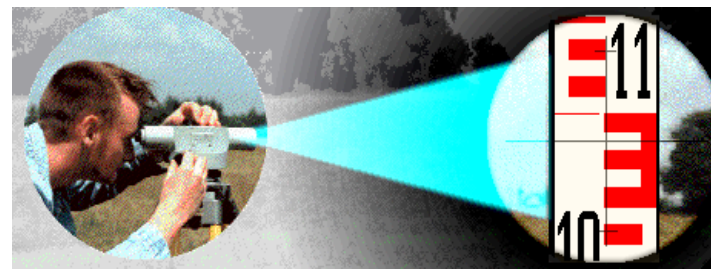


$$\Delta h = HB - HA = \text{backsight-foresight} = b - i$$
$$\Delta h = b - i$$

Differential Levelling



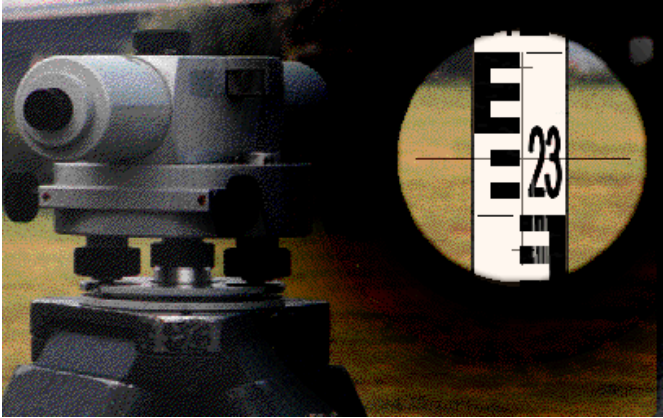
$b = 2.362\text{m}$



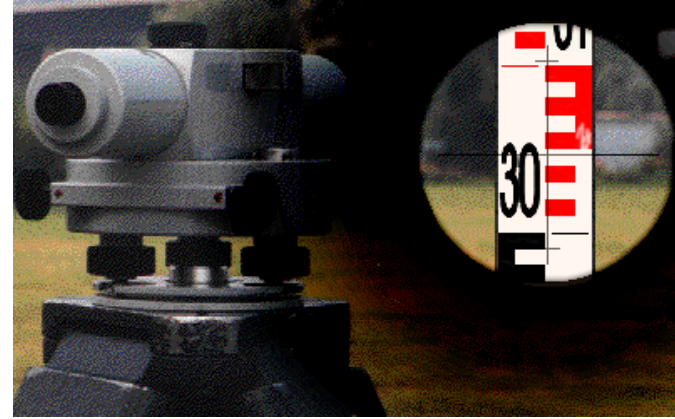
$f = 1.085\text{ m}$

$$\Delta H_{AB} = \text{Backsight} - \text{Foresight} = 2.362 - 1.085 = 1.277\text{m}$$

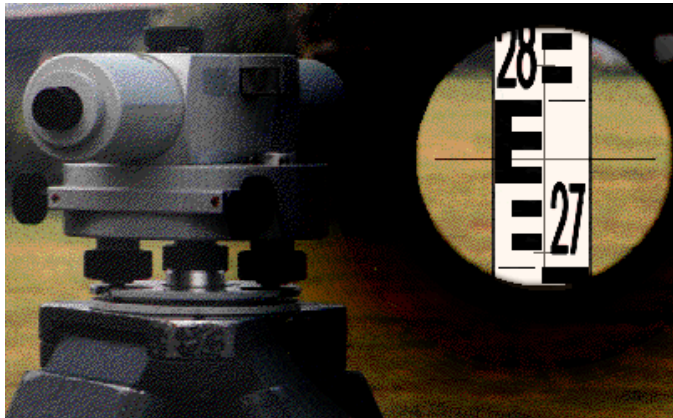
Differential Levelling



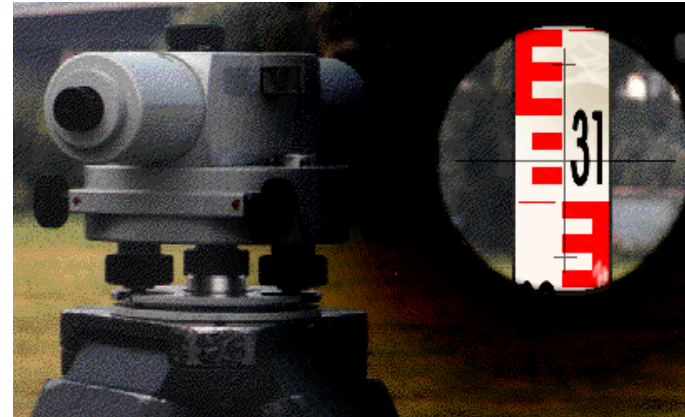
2.334m



3.049m

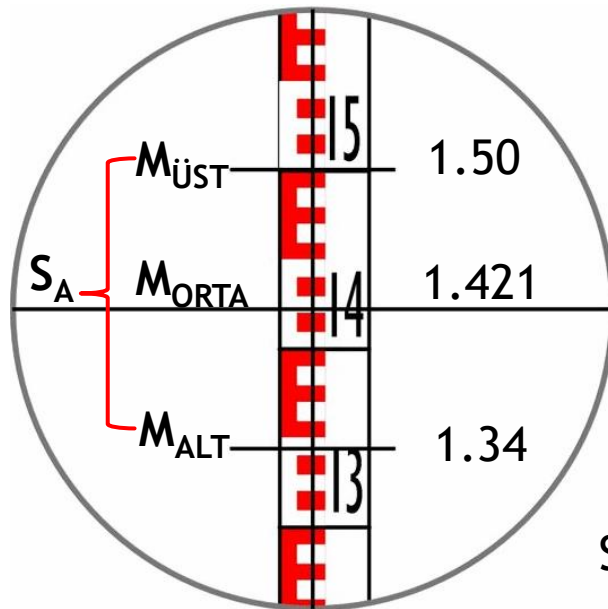
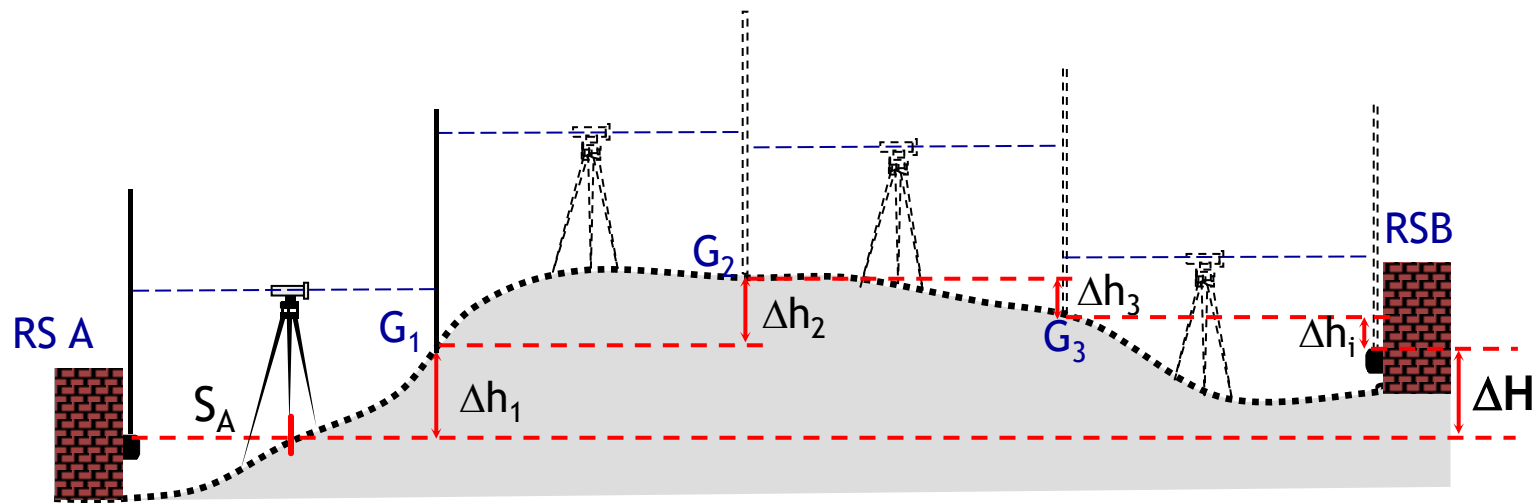


2.765 m



3.123 m

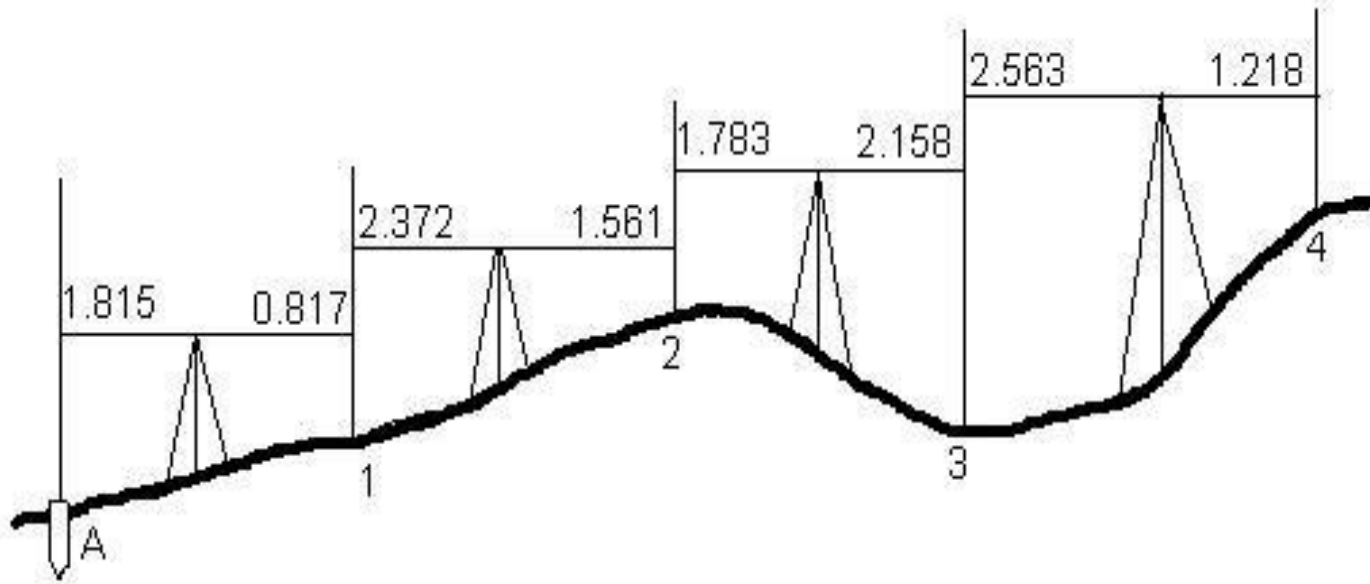
Differential Levelling



$$\Delta H = \sum \Delta H_i = \sum b - \sum f$$

$$H_{RSB} = H_{RSA} + \Delta H$$

Differential Levelling



$$\Delta H_{A1} = g_A - i_1 = 1.815 - 0.817 = 0.998\text{m}$$

$$H_1 = H_A + \Delta H_{A1} = 100.000 + 0.998 = 100.998\text{m}$$

$$\Delta H_{12} = g_1 - i_2 = 2.372 - 1.561 = 0.811\text{m}$$

$$H_2 = H_1 + \Delta H_{12} = 100.998 + 0.811 = 101.809\text{m}$$

$$\Delta H_{23} = g_2 - i_3 = 1.783 - 2.158 = -0.375\text{m}$$

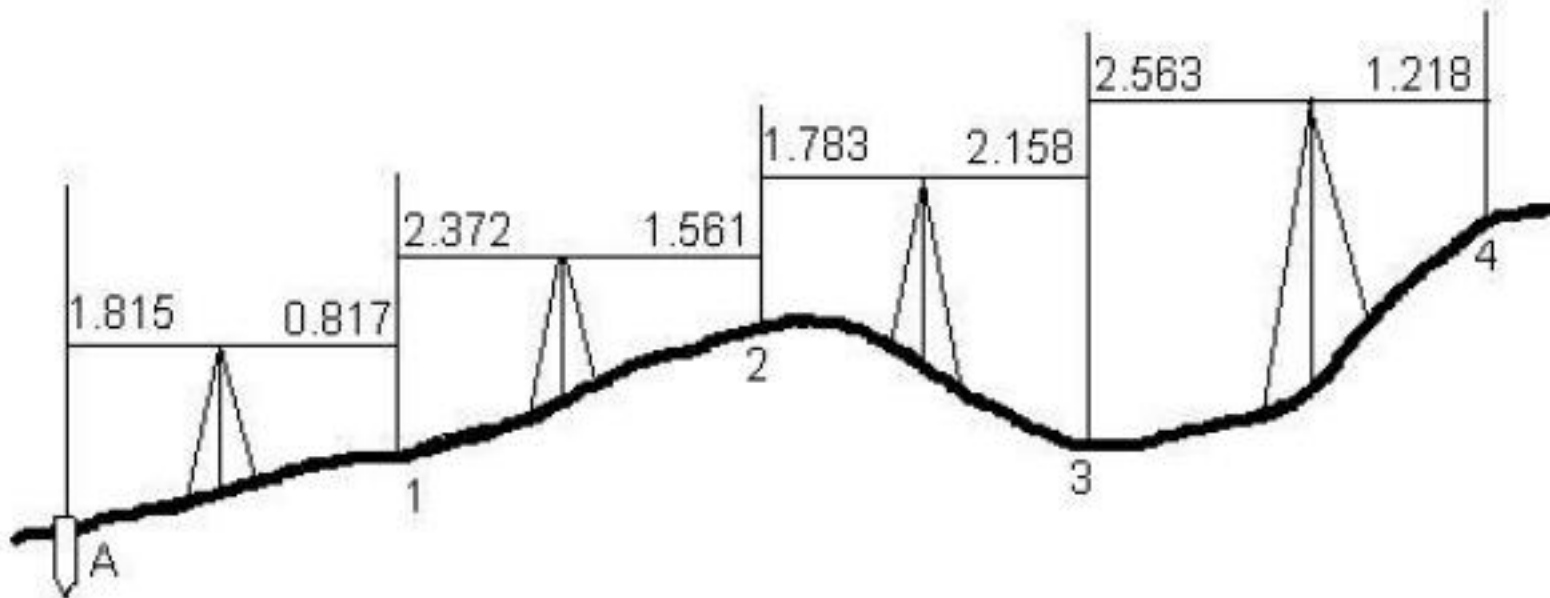
$$H_3 = H_2 + \Delta H_{23} = 101.809 - 0.375 = 101.434\text{m}$$

$$\Delta H_{34} = g_3 - i_4 = 2.563 - 1.218 = 1.345\text{m}$$

$$H_4 = H_3 + \Delta H_{34} = 101.434 + 1.345 = 102.779\text{m}$$

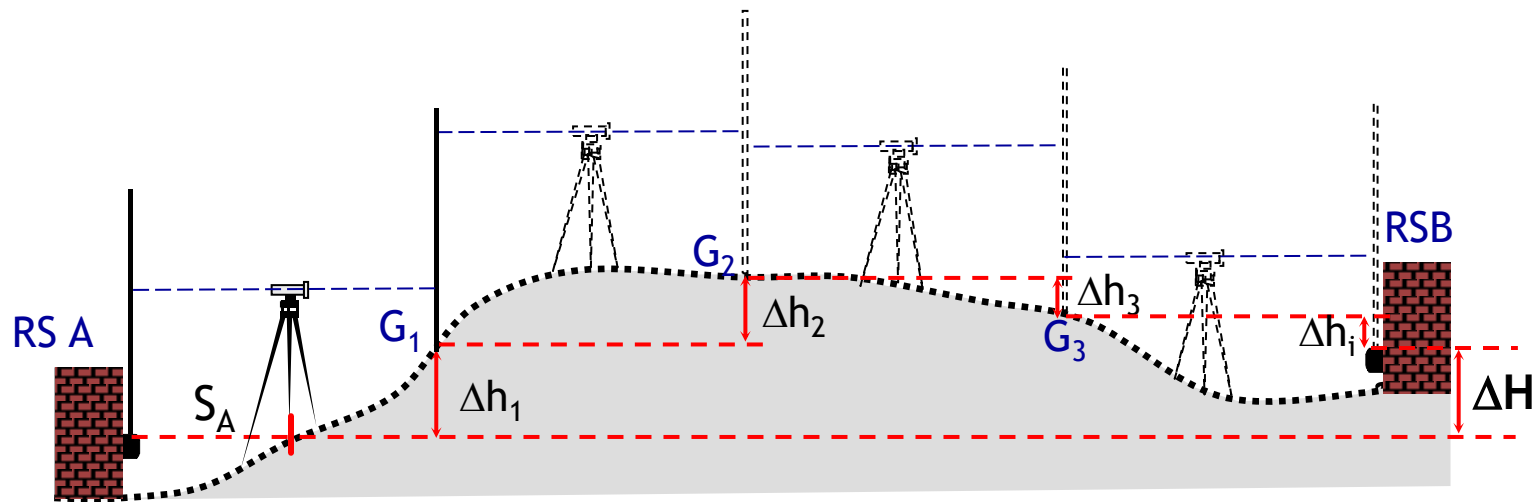
Differential Levelling

Open Levelling



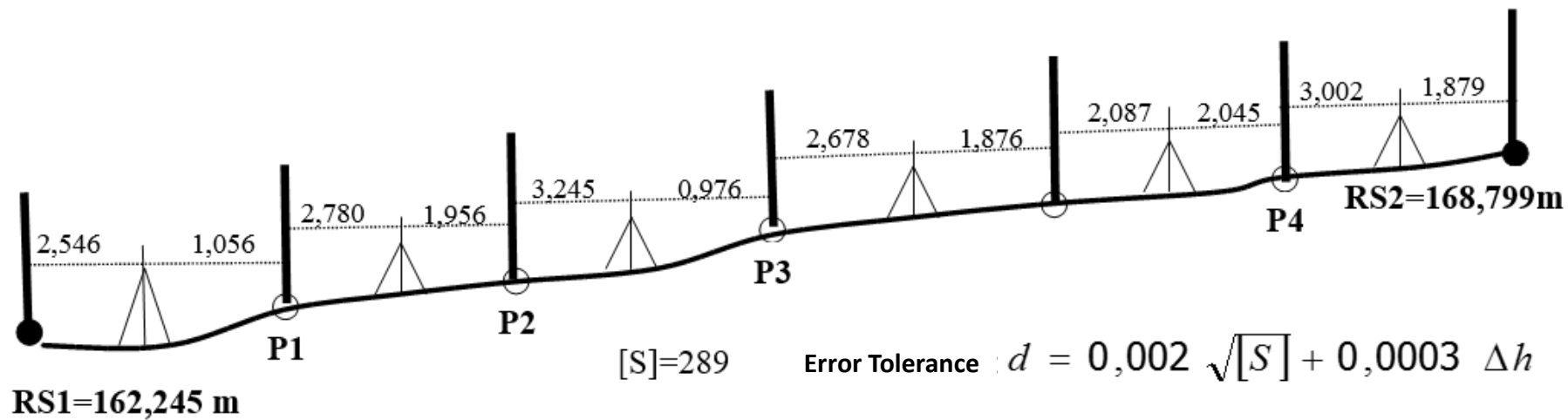
Differential Levelling

Closed-Link Levelling



Differential Levelling

Closed-Link Levelling Computation



Differential Levelling

Closed-Link Levelling Computation

<u>NNo</u>	Backsight (m)	Foresight (m)	Δh	H(m)
RS1	2.546 ⁺¹			162.245
P1	2.780 ⁺¹	1.056	1.491	163.736
P2	3.245 ⁺¹	1.956	0.825	164.561
P3	2.678 ⁺¹	0.976	2.270	166.831
	2.087	1.876	0.803	167.634
P4	3.002	2.045	0.042	167.676
RS2		1.879	1.123	168.799

$$[b] = 16.338 \quad [f] = \underline{9.788}$$

$$DH = 6.554$$

$$[b] - [f] = 6.550$$

$$\text{Misclosure error} = 6.550 - 6.554 = -0.004 \text{ m} = -4\text{mm}$$

$$\text{Tolerance } d = 0,002 \sqrt{[S]} + 0,0003 \Delta h = 0.036 \text{ m} = 36\text{mm}$$