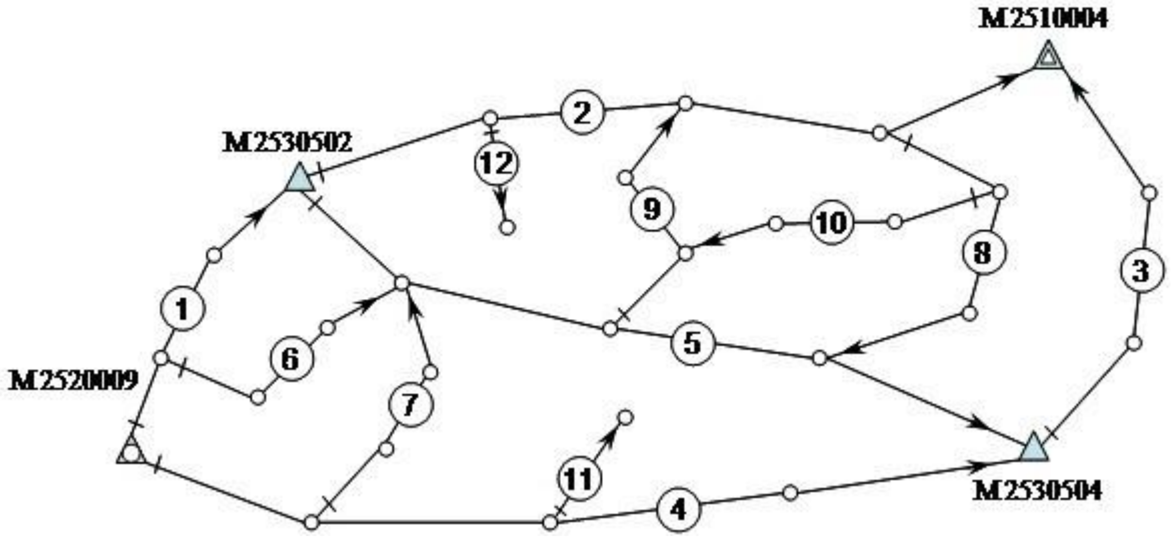
Week-7
Traverse Computations

TOPOGRAPHY (HRT3351)

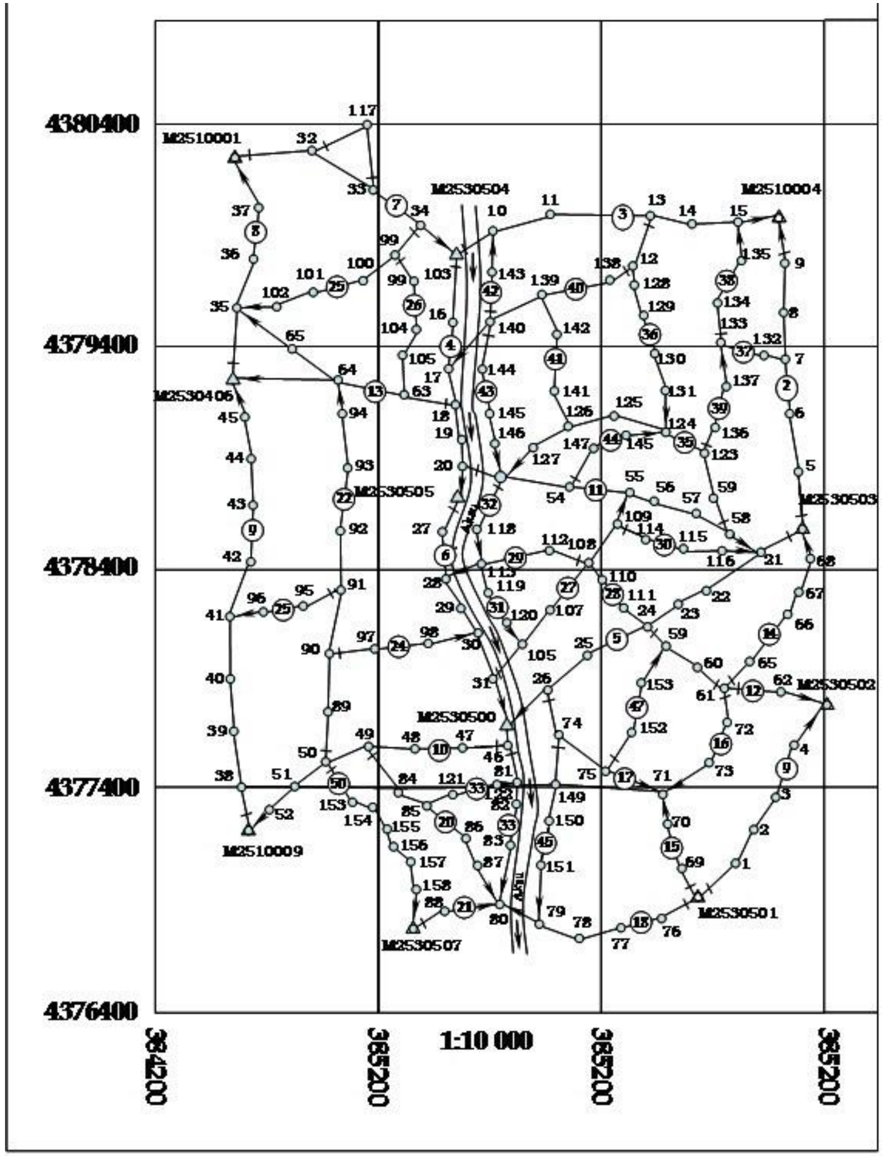
Assoc. Prof. Dr. Burak AKPINAR

Traverse

A traverse consist of a series of straight lines connected at established points, along the route of survey.



Traverse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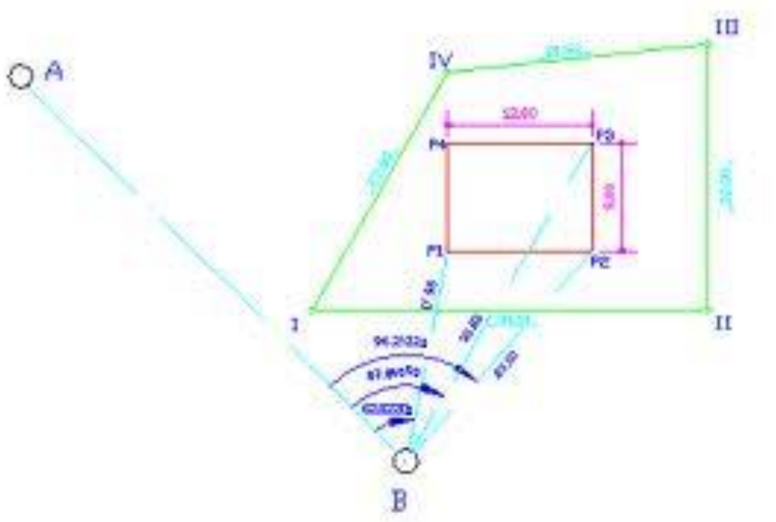
Purpose of Traverse Stations

- To determine the horizontal location of natural or artificial objects and topographic detail points on the ground to prepare plans or maps with contour lines.

- To determined the location of points of which horizontal positions are unknown by the help of other points of which positions are known by making necessary observations between traverse stations



Types of Traverse

There are three kinds of traverses with their geometrical properties;

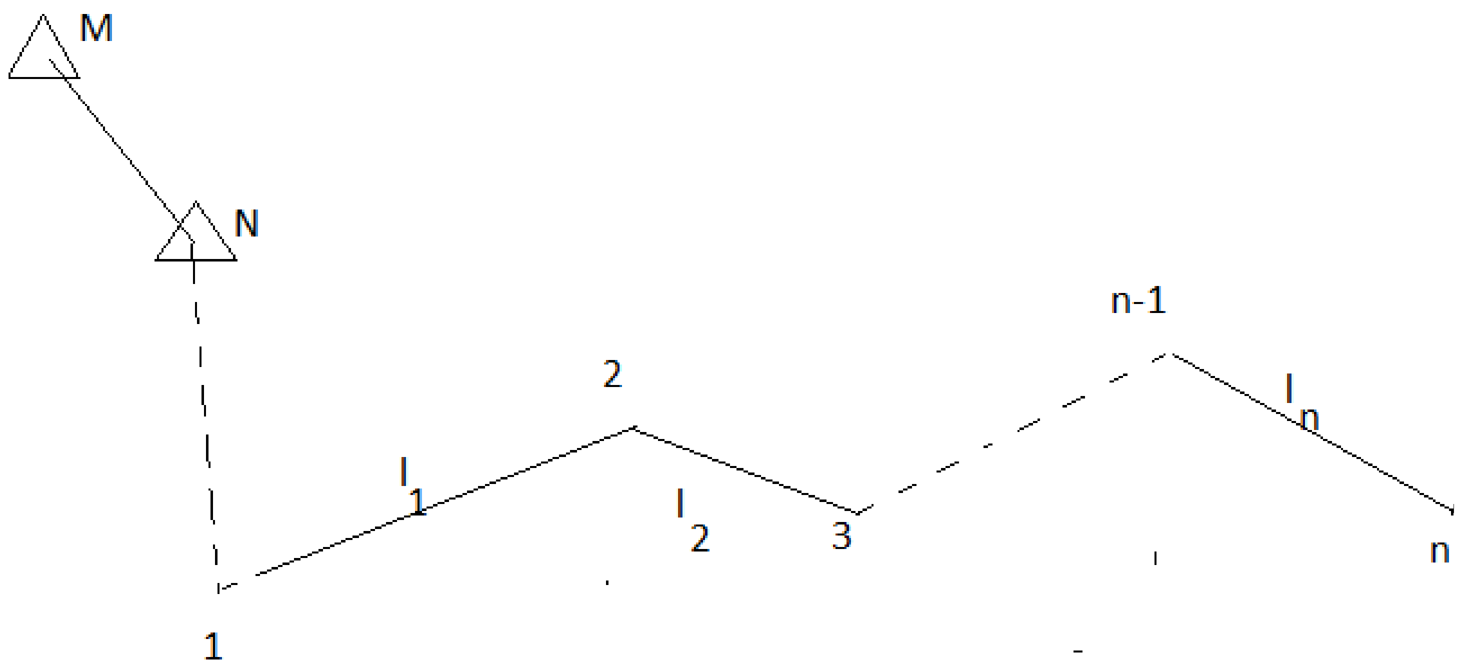
- Open Traverse
- Closed-Loop Traverse
- Closed-Link Traverse

OPEN TRAVERSE:

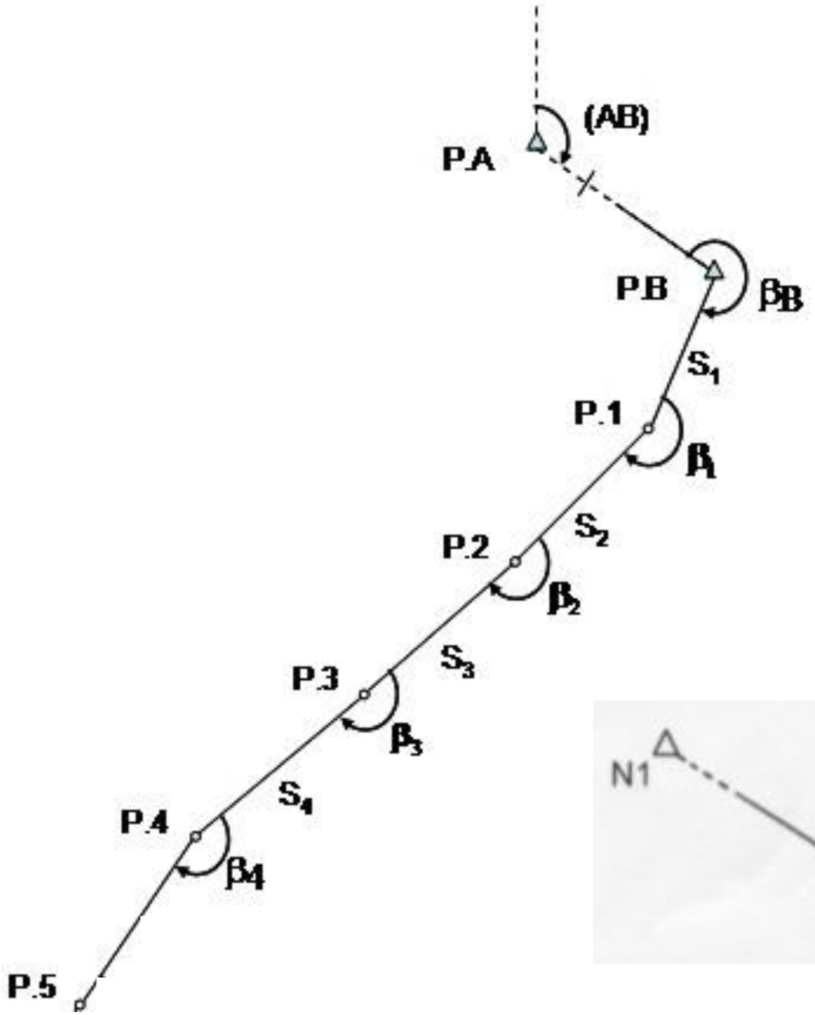
Open traverse does not create a closed shape, may begin at a point of known position and end at a point of previously unknown position.

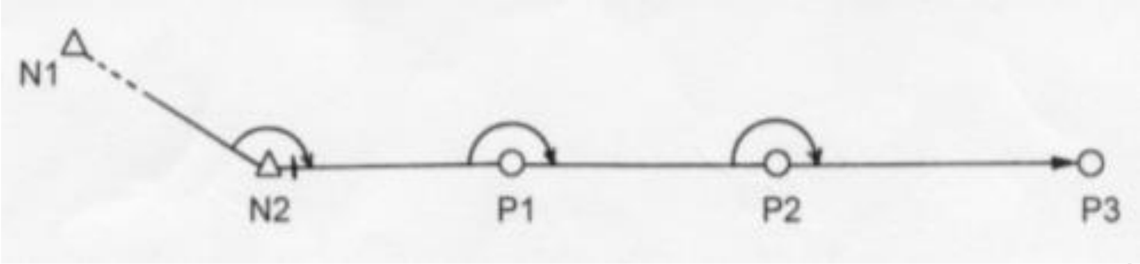
Computational check is not possible to detect error or blunder in distance and directions.

Open Traverse



Open Traverse



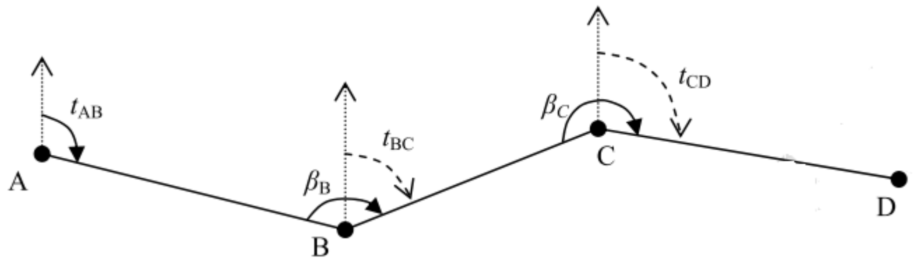


Open Traverse Computation

Traverse surveying in the field yields observed angles or directions and length of the traverse sides. Thus, these parameters are used in traverse computations which are performed in a plane rectangular coordinate system.

Computation of Azimuths:

Computational check is not possible to detect error or blunder in distance and directions in open traverse computation. Therefore, it is impossible to balance traverse angles.



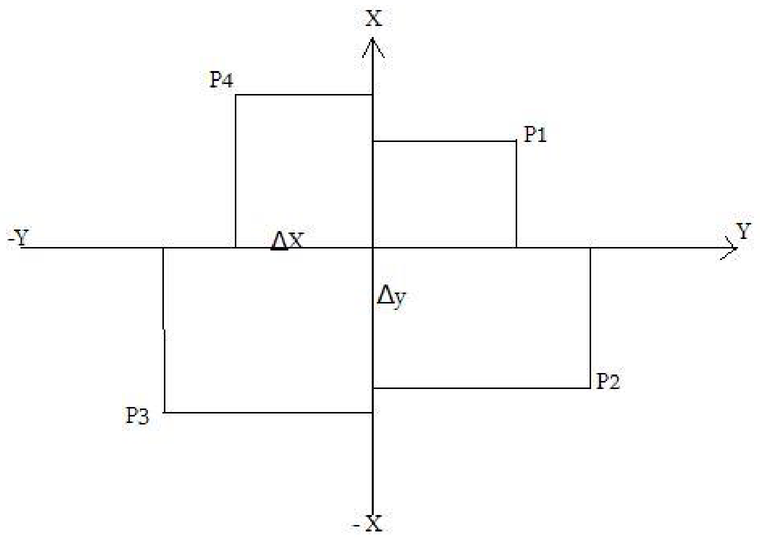
FUNDAMENTAL COMPUTATION -3

$$t_{AB} + \beta_B = K$$

- $K < 200^g$; $K + 200^g$; $t_{BC} = t_{AB} + \beta_B + 200^g$
- $200^g < K < 600^g$; $K - 200^g$; $t_{BC} = t_{AB} + \beta_B - 200^g$
- $K > 600^g$; $K - 600^g$; $t_{BC} = t_{AB} + \beta_B - 600^g$

Open Traverse Computation

Computation of Departures and Latitudes:



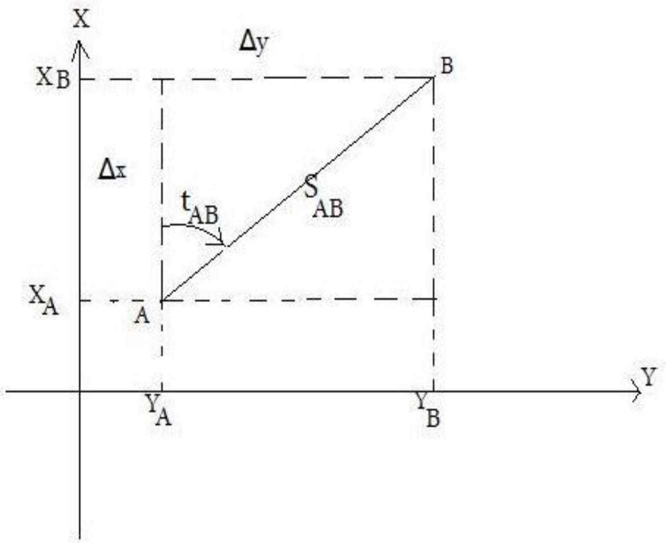
Rectangular Coordinate System

Direction of

+X, refers to North,
+Y, refers to East

Open Traverse Computation

Computation of Departures and Latitudes:



$$Sin\alpha = \frac{\Delta Y}{S} \rightarrow \Delta Y = S \cdot Sin\alpha$$

$$Cos\alpha = \frac{\Delta X}{S} \rightarrow \Delta X = S \cdot Cos\alpha$$

$$\Delta Y = Departure$$

$$\Delta X = Latitude$$

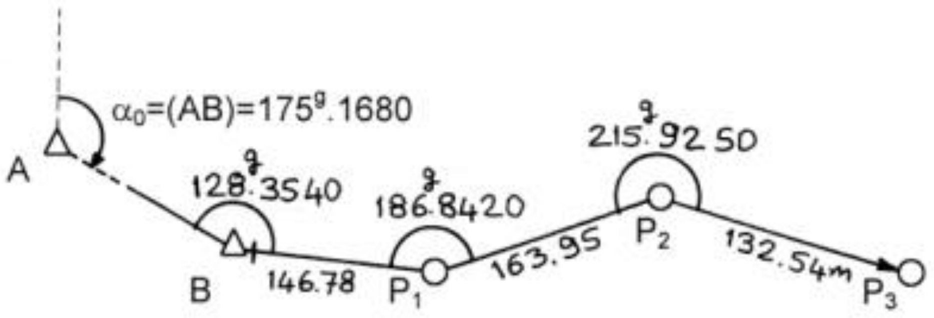
$$Y_B = Y_A + \Delta Y = Y_A + S \cdot Sin\alpha$$

$$X_B = X_A + \Delta X = X_A + S \cdot Cos\alpha$$

FUNDAMENTAL COMPUTATION -1

Open Traverse

EXAMPLE - 1



<u>Known</u> :
YB = 1000.00 m
XB = 1000.00 m
(AB) = 175g.1680

<u>Unknown</u>:
P1(X,Y) = ?
P2(X,Y) = ?
P3(X,Y) = ?

Open Traverse

EXAMPLE - 1

<u>Known</u> :
YB = 1000.00 m
XB = 1000.00 m
(AB) = 175g.1680

<u>Unknown</u>:
P1(X,Y) = ?
P2(X,Y) = ?
P3(X,Y) = ?

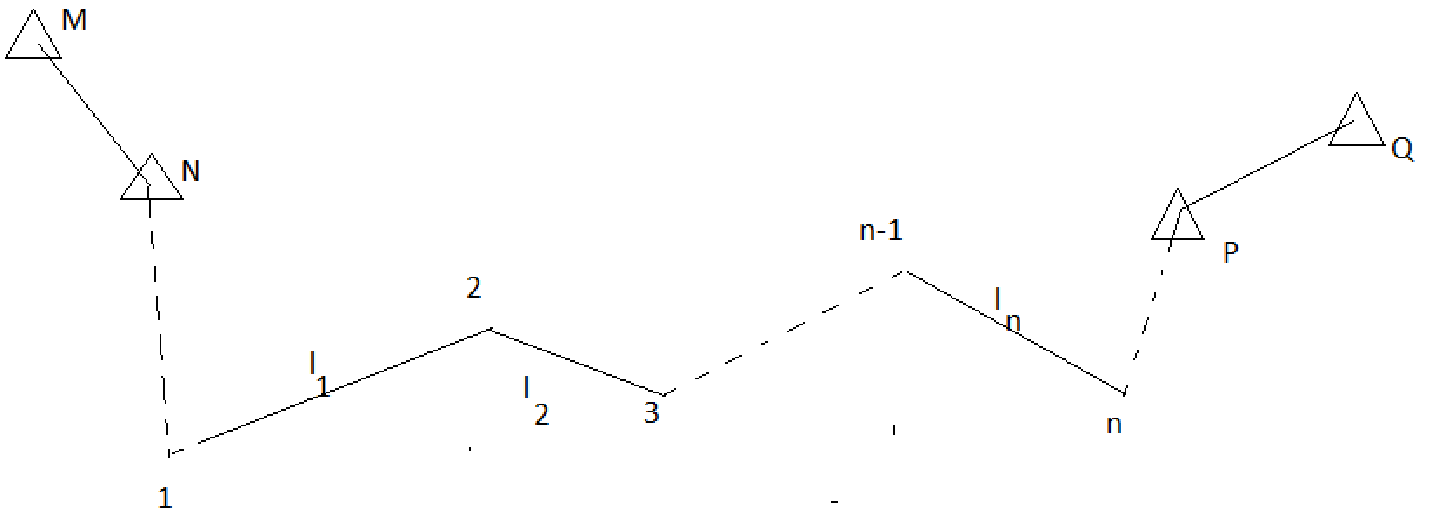
Station Point	Measured Traverse Angles (β - grad)	Azimuths (α-grad)	Lengths (m)	Departure ΔY (m)	Latitude ΔX (m)	Coordinates Y (m)	Coordinates X (m)	Station Point
A								A
		$175^{g}.1680$						
B	$128^{g}.3540$					1000.00 m	1000.00 m	B
		103.5220	146.78 m	146.56	-8.12			
P_1	186.8420					1146.56	991.88	P_1
		90.3640	163.95	162.08	24.72			
P_2	215.9250					1308.64	1016.60	P_2
		106.2890	132.54	131.89	-13.07			
P_3						1440.53	1003.53	P_3

Closed-Link Traverse

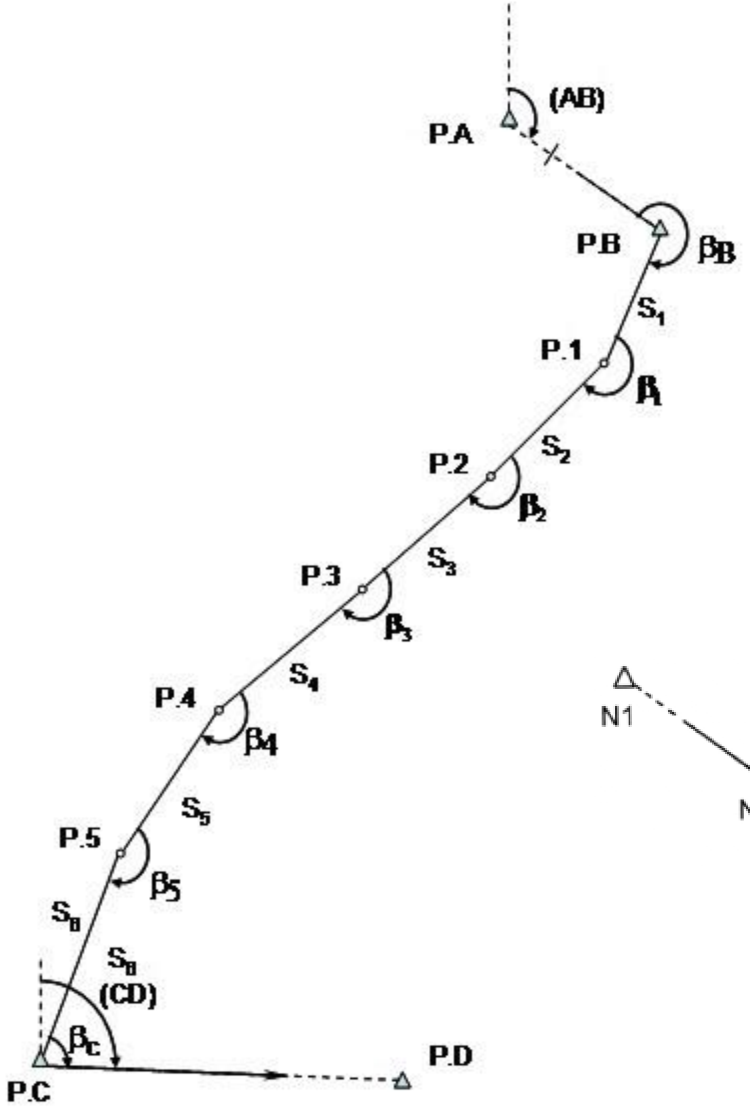
CLOSED-LINK TRAVERSE:

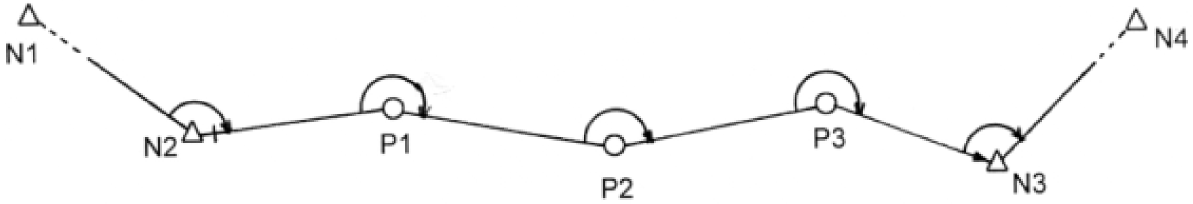
Closed-Link traverse is connected to at least two points, at the beginning and at the end of traverses, whose coordinates have been previously determined.

Calculations can be made to check for errors.

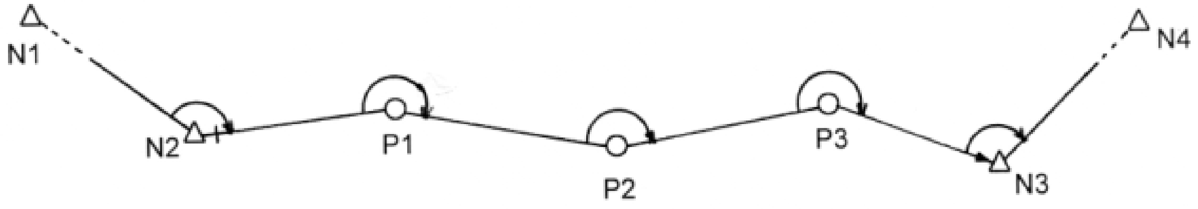


Closed-Link Traverse





Closed-Link Traverse Computation



Balancing Traverse Angles:

Firstly, azimuth of N1N2 and azimuth of N3N4 must be calculated.

$$\tan(AB) = \frac{Y_B - Y_A}{X_B - X_A} \rightarrow (AB) = \arctan\frac{Y_B - Y_A}{X_B - X_A} = \arctan\frac{\Delta Y}{\Delta X} = atn\frac{\Delta Y}{\Delta X}$$

FUNDAMENTAL COMPUTATION -2

Closed-Link Traverse Computation

Balancing Traverse Angles:

Angular Condition:

$$(N3N4) = (N1N2) + \Sigma\beta - n.200^{grad}$$

n -> number of stations with starting and end points.

Angular Misclosure:

$$f_{\beta} = ((N1N2) + \Sigma\beta - n.200^{grad}) - (N3N4)$$

The maximum angular misclosure of a traverse is calculated by below equation.

$$F_B = 1.5^c \sqrt{n}$$

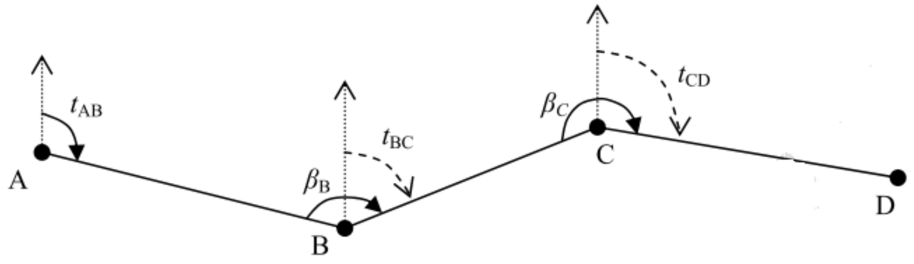
n -> number of traverse angles.

If the angular misclosure (fB) < the maximum angular misclosure (FB), measurement can be accepted and traverse angles can be balanced.

Closed-Link Traverse Computation

Computation of Azimuths:

Computational check is not possible to detect error or blunder in distance and directions in open traverse computation. Therefore, it is impossible to balance traverse angles.



FUNDAMENTAL COMPUTATION -3

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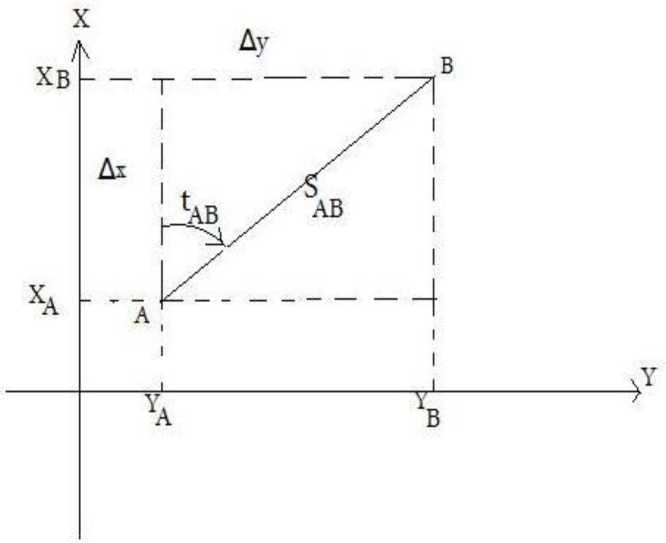
Closed-Link Traverse Computation

Computation of Departures and Latitudes:



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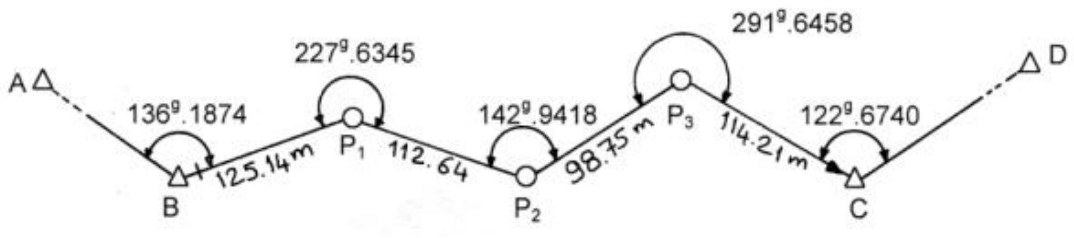
$$Y_B = Y_A + \Delta Y = Y_A + S \cdot Sin\alpha$$

$$X_B = X_A + \Delta X = X_A + S \cdot Cos\alpha$$

FUNDAMENTAL COMPUTATION -1

Closed-Link Traverse Computation

EXAMPLE - 2



Nokta	Y	X
B	1000.00 m	1000.00 m
C	1388.45	946.65

(AB) = 156g.3885

(CD) = 77g.5020

Closed-Link Traverse Computation

EXAMPLE - 2

Station	Traverse Angle (β)	Azimuth (α)	Length S	ΔY	ΔX	Y	X	Station
A								A
		$156^g.3885$						
B	+ 60 $136^g.1874$					1000.00 m	1000.00 m	B
		92.5819	125.14	+ 2 124.29	- 2 14.55			
P1	+ 60 227.6345					1124.31	1014.53	P1
		120.2224	112.64	+ 1 107.00	- 2 -35.18			
P2	+ 60 142.9418					1231.32	979.33	P2
		63.1702	98.75	+ 1 82.68	- 2 54.00			
P3	+ 60 291.6458					1314.01	1033.31	P3
		154.8220	114.21	+ 2 74.42	- 2 -86.64			
C	+ 60 122.6740					1388.45	946.65	C
		77.5020						
D								D

[β] = 921.0835
α_0 = 156.3885
1077.4720
5·200 = 1000.0000
77.4720
77.5020
$f_\beta = -0^g.0300 = -3^c = -300^{cc}$

[S]=450.74 m [ΔY]=388.39 [ΔX]=-53.27 $Y_C - Y_B$ = 388.45 $X_C - X_B$ = -53.35
388.45 -53.35
f_y = -0.06 m f_x = +0.08 m
f_y = -6 cm f_x = +8 cm

$$F_\beta = 1^c + \sqrt{n} = 1^c + \sqrt{5} = 3^c.35 = 335^{cc}$$

TRAVERSE COMPUTATIONS

Week-8
Height Measurements

TOPOGRAPHY (HRT3351)

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