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**Co-ordinate Computation:-**

The objective of traverse computation is to determine the independent coordinates of traverse stations. This is used to plot the position of stations on drawing sheet. The computations can be performed systematically, by carrying out computations in a tabular form, suggested by Gale. Such table is known as Gale's traverse table.

**Gale's traverse table :-**

The columns of Gale's table are filled as illustrated below:

Column 1 : Enter the names of the stations at which the instrument is set up, say P, Q, R, etc

Column 2 : Enter the names of traverse sides in between an instrument station and its forward station such as PQ, QR, RS etc.

Column 3 : Enter the observed length of the traverse sides.

Column 4 : Enter the angles observed at the stations. These may be included / interior angles or deflection angles. Sum of all the angles are entered in the end of this column. Check if there is any error of closure of the observed angles (The type of checking depends on the on the type of angles observed and the type of traverse).

Column 5 : If there is any error of closure, necessary corrections are to computed and the same is to be presented in this column. Thus, column 5 provides the correction for error of closure.

Column 6 : After making necessary correction to the observed angles, adjusted angles are computed and thus adjusted angles are represented in column 6.

Column 7 : From the known azimuth (from previous surveying or determined before the starting of traversing) of a line present in the site and/ or from known angle between the line of known

azimuth and that of a traverse side, compute the WCB of the all the traverse sides using the adjusted angles of column 6 .The WCB of traverse sides are represented in column 7.

Column 8 : Compute the consecutive coordinates of the stations in terms of departure and latitude with appropriate algebraic sign from the observed length (Column 3) and the WCB (Column 7) of the sides. The same are represented in column 8 along proper row and under proper sub-heading. Check the error of closure of the traverse. If any error is present, adjustment and balancing of traverse is to be done. The algebraic sum of the departures and latitudes are to be represented at the end of the appropriate columns.

Column 9 : The error associated with the traverse is to be distributed to all the stations in such a way that there is no error of closure. Thus, corrections are to be computed for different stations. Usually Bowditch's Analytical method is usually adopted to find the correction for each individual consecutive coordinates and the same is represented in column 9 under appropriate sub-heading. At the end of the column, sum of the corrections are also represented. It is to be checked that the total correction should be same as the amount of error but opposite in nature

Column 10 : The adjusted consecutive coordinates of the stations are computed making due corrections (column 9) to the consecutive coordinates (column 8). The adjusted consecutive coordinates of the stations are thus represented in column 10.

Column 11 : From the known coordinates of at least one of the stations the Independent coordinates of all the other stations are computed and the same is represented in column 11.

**Example-1** A closed traverse was run among stations P, Q, R,S and T having following observation :

Stations (1)	Sides (2)	IncludedAngle (3)	Length (L) m	Remarks
X				Sign convention: for Clockwise interior angle + ve Anti-Clockwise interior angle - ve Azimuth of PX = 43° 31' 30" TY = 106° 17' 30"
	PX			
P		104° 00' 30"		
	PQ		305.41	
Q		63° 20'		
	QR		359.61	
R		-101° 49'		
	RS		612.15	
S		120° 45'		
	ST		485.12	
T		-123° 29' 30"		
	TY			

Gale's traverse table given below:-

Stations (1)	Sides (2)	Length (L) m (3)	Included Angle (4)	Correction (5)	Corrected angle (6)	WCB (7)	Consecutive coordinates, m (8)		Bowditch Correction (9)		Corrected Consecutive Coordinates		Corrected Independent Coordinates	
							Departure (D)	Latitude (L)	Departure	Latitude	Departure	Latitude	X <sub>i</sub>	Y <sub>i</sub>
							(D)	(L)	(D)	(L)	(D)	(L)		
X						43° 31' 30"								
PX														
P			104° 00' 30"	-12"	104° 00' 18"								2346.633	3157.148
PQ		305.41				147° 31' 48"	163.962	-257.666	0.052	0.033	164.014	-257.633		
Q			63° 20'	-12"	63° 19' 48"								2510.833	2899.515
QR		359.61				30° 51' 35"	184.459	308.698	0.060	0.039	184.519	308.737		
R			-101° 49'	-12"	-101° 49' 12"								2695.372	3208.618
RS		612.15				109° 02' 24"	578.660	-199.700	0.104	0.066	578.764	-199.634		
S			120° 45'	-12"	120° 44' 48"								3274.136	3008.618
ST		485.12				49° 47' 12"	370.460	313.210	0.082	0.053	370.542	313.262		
T			-123° 29' 30"	-12"	-123° 29' 42"								3644.678	3321.881
TY						106° 17' 30"								
Y														
S		1762.24	62° 47' 00"				1297.541	162.542	0.298	0.191				

Error = (S Interior included angle - S Exterior included angle) - (Azimuth of last line - Azimuth of first line)

$$= (288^{\circ} 05' 30'' - 225^{\circ} 18' 30'') - (106^{\circ} 17' 30'' - 43^{\circ} 31' 30'')$$

$$= 62^{\circ} 47' 00'' - 62^{\circ} 46' 00'' = + 1'$$

Closure corrections = = 0.354m

Therefore, corection = - 1'

$$= 32^{\circ} 39' 26''.70$$

Therefore, Azimuth of closure correction =

$$57^{\circ} 20' 33''.30$$