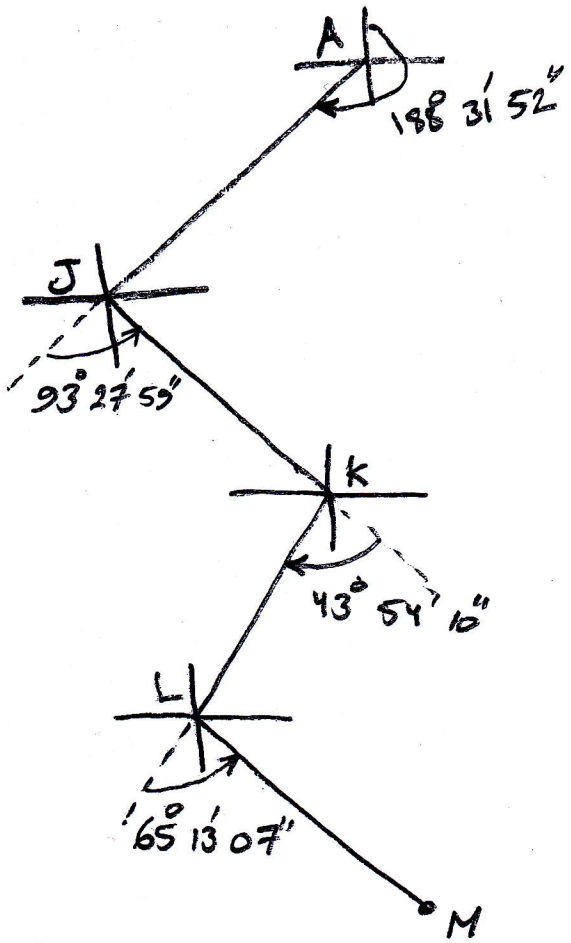
Example/ The table illustrates the field measurments for closed traverse J, K, L, M. if the coordinates of points J and M were (3000, 3000) and (3780.32, 2670.18), respectively and $A_{Z\,AJ} = 188° 31' 52''$. Compute:

1. The correct coordinates, bearing and lengths for the traverse.
2. closing error and relative accuracy of traverse.

Point	line	Length	deflection angle
A			
	AJ		
J			93° 27' 59" L
	JK	346.95	
K			43° 54' 10" R
	KL	449.76	
L			65° 13' 07" L
	LM	144.82	
M			

Sol.

Calculate azimuth of each side from deflection angle



$Az\ AJ = 188^\circ 31' 52''$

$Az\ JK = 188^\circ 31' 52'' - 93^\circ 27' 59'' = 95^\circ 03' 53''$

$Az\ KL = 95^\circ 03' 53'' + 43^\circ 54' 10'' = 138^\circ 58' 03''$

$Az\ LM = 138^\circ 58' 03'' - 65^\circ 13' 07'' = 73^\circ 44' 56''$

Point	side	length	Azimuth	Dep.	Lat.	coordinate (X, Y)
J						(3000, 3000)
	Jk	346.95	95° 03′ 53″	+345.6	−30.63	
k						3345.6, 2969.37
	kL	449.76	138° 58′ 03″	+295.26	−339.27	
L						3640.86, 2630.1
	LM	144.82	73° 44′ 56″	+139.03	+40.53	
M						3779.89, 2670.63

$\Sigma = 941.53$

$Dep. = L \sin\theta$

- $346.95 \sin 95^\circ 03' 53'' = +345.60$ (E)
- $449.76 \sin 138^\circ 58' 03'' = +295.26$ (E)
- $144.82 \sin 73^\circ 44' 56'' = +139.03$ (E)

$Lat. = L \cos\theta$

- $346.95 \cos 95^\circ 03' 53'' = -30.63$ (S)
- $449.76 \cos 138^\circ 58' 03'' = -339.27$ (S)
- $144.82 \cos 73^\circ 44' 56'' = +40.53$ (N)

$X_k = 3000 + 345.6 = 3345.6$ | $y_k = 3000 + (-30.63) = 2969.37$

$X_L = 3345.6 + 295.26 = 3640.86$ | $y_L = 2969.37 + (-339.27) = 2630.1$

$X_M = 3640.86 + 139.03 = 3779.89$ | $y_M = 2630.1 + 40.53 = 2670.63$

T.C for E = $E_{calc.\ Last\ point} - E_{given\ for\ last\ point}$

$= 3779.89 - 3780.32 = -0.43 = R_x$

T.C for N = $N_{calc.\ Last\ point} - N_{given\ for\ last\ point}$

$= 2670.63 - 2670.18 = +0.45 = R_y$

Closing error $= \sqrt{R_x^2 + R_y^2}$

$= \sqrt{(0.43)^2 + (0.45)^2} = 0.62$

Relative accuracy $= \dfrac{\text{Closing error}}{\text{Total length of traverse}} = \dfrac{0.62}{941.53} \simeq \dfrac{1}{1500}$

Calculation of correction for Departure and Latitude for each side

Departure :

$$JK = \frac{+0.43}{941.53} * 345.6 = {}^{+}0.16$$

$$KL = \frac{+0.43}{941.53} * 449.76 = {}^{+}0.2$$

$$LM = \frac{+0.43}{941.53} * 144.82 = 0.07$$

$$\Sigma = {}^{+}0.43$$

Latitude

$$JK = \frac{-0.45}{941.53} * 345.6 = -0.17$$

$$KL = \frac{-0.45}{941.53} * 449.76 = -0.21$$

$$LM = \frac{-0.45}{941.53} * 144.82 = -0.07$$

$$\Sigma = -0.45$$

Point	side	Dep.	Lat.	Correction Dep.	Correction lat.	Adj Dep.	Adj lat.	Coordinate E 3000	Coordinate N 3000	Adj. Azimuth	Adj. Length
J										95° 5′ 26″	347.13
	JK	+345.6	−30.63	+0.16	−0.17	345.76	−30.8	3345.76	2969.2		
K										138° 57′ 57″	450.05
	KL	+295.26	−339.27	+0.2	−0.21	295.46	−339.48	3641.22	2629.72		
L										73° 46′ 55″	144.86
	LM	+139.03	+40.53	+0.07	−0.07	139.1	40.46	3780.32	2670.18		
M											

Adj. Azimuth

- JK = $\theta = \tan^{-1}\frac{\text{Adj Dep.}}{\text{Adj lat.}} = \tan^{-1}\frac{345.76}{-30.8} = -84° 54′ 35″ \rightsquigarrow 180 - 84° 54′ 35″ = 95° 5′ 26″$
- KL = $\tan^{-1}\frac{295.46}{-339.48} = -41° 02′ 02″ \rightsquigarrow 180 - 41° 02′ 02″) = 138° 57′ 57″$
- LM = $\tan^{-1}\frac{139.1}{40.46} = 73° 46′ 55″$

$\sin\theta$ Dep. $= L \sin\theta \Rightarrow L_{adj} = \frac{\text{Dep. adjusted}}{\sin\theta}$

$L_{JK} = \frac{345.76}{\sin -84° 54′ 35″} = 347.13$ (neglect negative sign

$L_{KL} = \frac{295.46}{\sin -41° 02′ 02″} = 450.05$ (neglect negative sign)

$L_{LM} = \frac{139.1}{\sin 73° 46′ 55″} = 144.86$

(5)