جامعة الفرات الاوسط التقنية /المعهد التقني سماوة

قسم / تقنيات المساحة

المحاضرة الرابعة

اسم المادة / المساحة-٢

المرحلة الدراسية / الثانية

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ERROR OF CLOSURE

- Is usually a short line of unknown length and direction
- connecting the initial and final traverse stations

$$LEC = \sqrt{(\Sigma Dep)^2 + (\Sigma Lat)^2}$$

$$Tan\theta = \left(\frac{-\Sigma Dep}{-\Sigma Lat} \right)$$

Note: In computing for Θ, use the absolute values for ΣDep and ΣLat. Determine the quadrant where the line falls using corresponding signs of the 2 sums.

RELATIVE ERROR OF CLOSURE (REC)

- Ratio of the linear error of closure to the perimeter
- or total length of the traverse

REC = Relative Error of Closure

LEC = Linear Error of Closure

D = Total Length or perimeter of the traverse

$$REC = \frac{LEC}{D}$$

TRAVERSE ADJUSTMENTS

- Methods of adjustment are usually classified as:
- I. Rigorous
- Least Squares Method
- II. Approximate
- Compass Rule (or Bowditch Rule)
- Transit Rule

COMPASS RULE (BOWDITCH RULE)

- Named after the distinguished American navigator
- Nathaniel Bowditch (1773-1838)
- Based on the assumption that:
- 1. All lengths are measured with equal care
- 2. All angles are taken with approximately the same precision
- 3. Errors are accidental
- 4. Total error in any side is directly proportional to the length
- of the traverse

COMPASS RULE (BOWDITCH RULE)

$$c_{lat} = -C_L\left(\frac{d}{D}\right)$$

$$c_{dep} = -C_D\left(\frac{d}{D}\right)$$

- c
- lat = correction to latitude
- c
- dep= correction to departure
- C
- L= total closure in lat = ΣLat
- C
- D= total closure in dep= ΣDep
- d = length of any course
- D = total length of the traverse

TRANSIT RULE

- No sound theoretical foundation since it is purely
- empirical
- Not commonly used but best suited for surveys where
- traverse sides are measured by stadia or subtensed bar
- method
- Based on the assumption that:
- 1. Angular measurements are more precise than linear
- measurements
- 2. Errors in traversing are accidental
- Not applicable in some instances (lines in E , W, N or S)

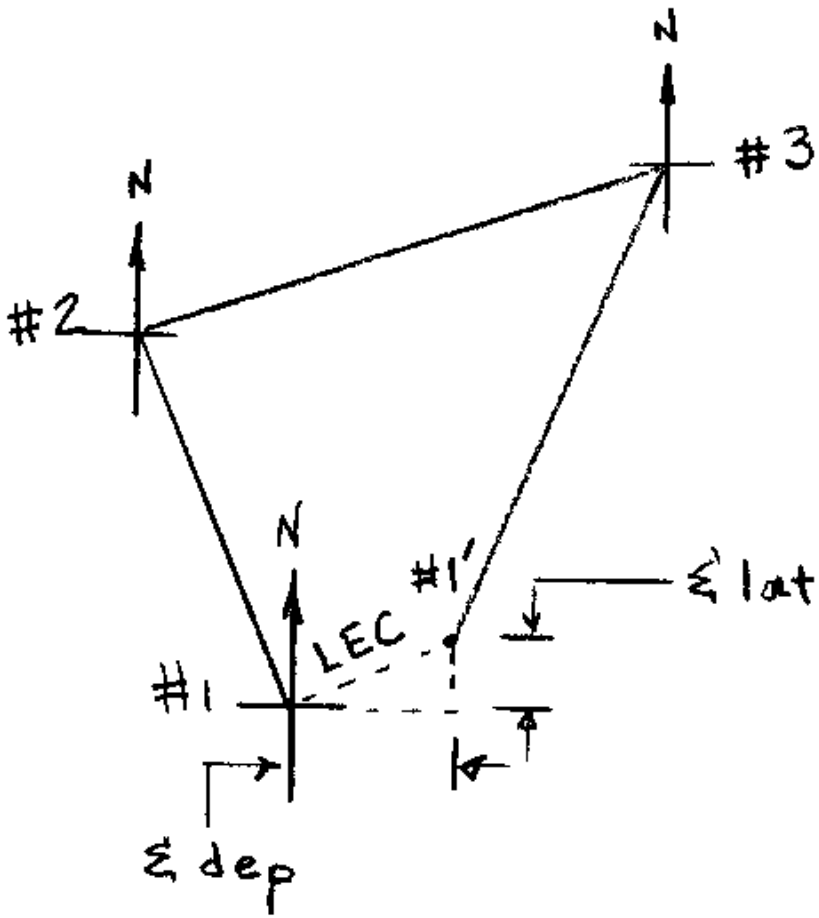
TRANSIT RULE

$$c_{lat} = -\frac{|Lat|(C_L)}{\sum|Lat|}$$

$$c_{dep} = -\frac{|Dep|(C_D)}{\sum|Dep|}$$

- Where:
- c
- lat = correction to latitude
- c
- dep= correction to departure
- C
- L= total closure in lat = ΣLat
- C
- D= total closure in dep= ΣDep

Calculate L.E.C. and R.E.C.



Loop Traverse

$$\text{Closure lat} = \Sigma\ \text{lat} - 0 = \Sigma\ \text{lat}$$

$$\text{Closure dep} = \Sigma\ \text{dep} - 0 = \Sigma\ \text{dep}$$

$$\text{L.E.C} = \sqrt{(\Sigma\ \text{lat})^2 + (\Sigma\ \text{dep})^2}$$

$$\text{R.E.C.} = \frac{\text{L.E.C.}}{\sum \text{HD}_i} = \frac{1}{n}$$

L.E.C. and R.E.C. (cont.)

- The R.E.C. should meet the standard of accuracy
- required for the traverse specification being followed.
- See ALTA-ACSM specifications for boundary traverses
- for an example.
- • If the R.E.C. does not meet the standard of accuracy, a
- gross blunder and/or an unaccounted-for systematic error
- among the measurements should be isolated and
- corrected before continuing with further adjustments

L.E.C. and R.E.C. (cont.)

- If angle closure was satisfactory, a failure to meet the
- standard of accuracy for the R.E.C. at this point, likely
- points to a problem with distances.

L.E.C. and R.E.C. (cont.)

Connecting Traverse

$$\text{Closure lat} = \Sigma\ \text{lat} - \Delta N = E_L$$

$$\text{Closure dep} = \Sigma\,\text{dep} - \Delta E = E_D$$

$$L.E.C = \sqrt{(E_L)^2 + (E_D)^2}$$

$$R.E.C. = \frac{L.E.C.}{\sum HD_i} = \frac{1}{n}$$

L.E.C. and R.E.C. (cont.)

Example Calculation

Loop Traverse

$$\textbf{Closure lat} = \Sigma\ \textbf{lat} - \textbf{0} = \Sigma\ \textbf{lat} = +0.056$$

$$\textbf{Closure dep} = \Sigma\,\textbf{dep} - \textbf{0} = \Sigma\,\textbf{dep} = +0.050$$

$$\textbf{L.E.C} = \sqrt{(\Sigma\ \textbf{lat})^2 + (\Sigma\ \textbf{dep})^2} = \sqrt{(0.056)^2 + (0.050)^2} = 0.075$$

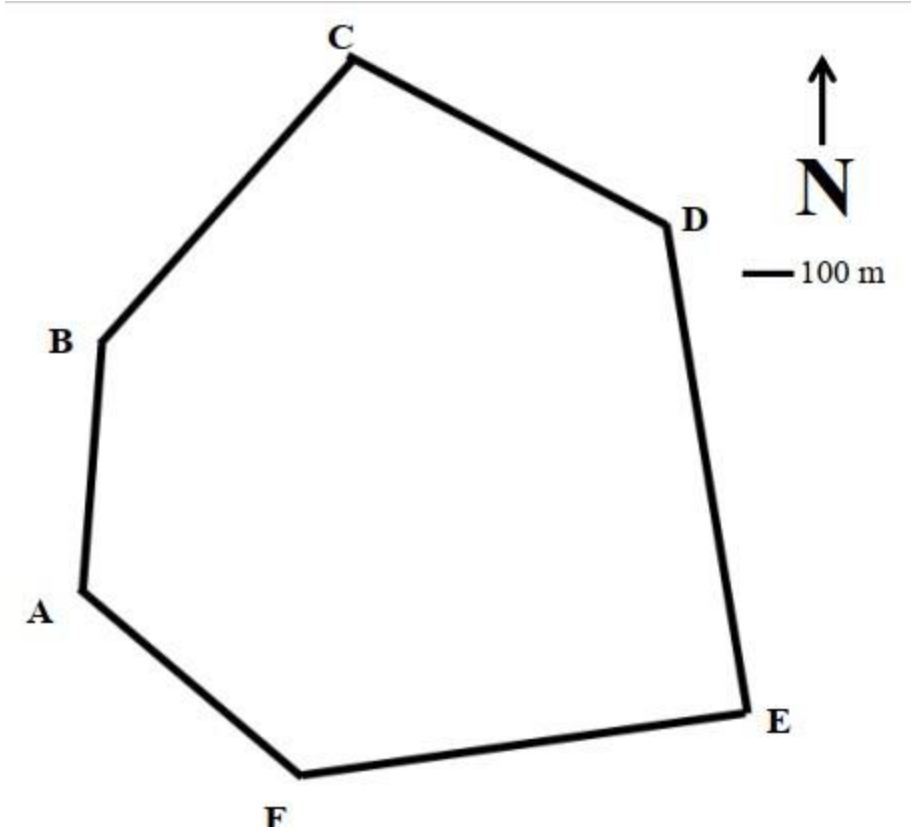
$$\textbf{R.E.C.} = \frac{\textbf{L.E.C.}}{\sum \textbf{HD}_i} = \frac{0.075}{552.784} = \frac{1}{7370}$$

TRAVERSE ADJUSTMENTS (EXAMPLE)

Line	Length(m)	Azimuth (from South)	Line	Length (m)	from (South) Azimuth
AB	٤٩٥,٨٥	185o30’	DE	١٠٢٠,٨٧	347o35’
BC	٨٥٠,٦٢	226o02’	EF	١١١٧,٢٦	83o44’
CD	٨٥٥,٤٥	292o22’	FA	٦٦٠,٠٨	124o51’

Note: Coordinates of A are
N
A=20,000.000,
EA=20,000.000

Compute for:
1. Latitude and Departure of each line
2. Bearing of the side error, LEC, REC
3. Adjust the traverse and compute for the adjusted coordinates of traverse stations using Compass Rule
4. Adjust the traverse and compute for the adjusted coordinates of traverse stations using using Transit Rule
5. Provide a sketch of the traverse

TRAVERSE ADJUSTMENTS (EXAMPLE)

Sketch of the traverse