جامعة بيرزيت

BIRZEIT UNIVERSITY

Faculty of Engineering and Technology

Department of Civil & Environmental Engineering

Surveying for Civil Engineering

ENCE337

HW (1)

" Traverses "

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Problem (1):

St.	Leg	L(m)	θ_{cor}	α_{cor}	ΔE(m)	ΔN(m)	C_E(m)	C_N(m)	ΔE_{cor}(m)	ΔN_{cor}(m)	E(m)	N(m)
A			80^o 46' 36"								9256.41	8476.29
	AB	551.40		340^o 46' 36"	-181.55	520.66	-0.07	-0.21	-181.62	520.45		
B			91^o 42' 36"								9074.79	8996.74
	BC	318.25		252^o 29' 12"	-303.50	-95.77	-0.04	-0.12	-303.54	-95.89		
C			122^o 48' 36"								8771.25	8900.85
	CD	374.63		195^o 17' 48"	-98.83	-361.36	-0.05	-0.14	-98.88	-361.50		
D			112^o 41' 36"								8672.37	8539.35
	DE	219.78		127^o 59' 24"	173.21	-135.28	-0.03	-0.08	173.18	-135.36		
E			132^o 00' 36"								8845.55	8403.99
	EA	417.26		80^o 00' 00"	410.92	72.46	-0.06	-0.16	410.86	72.30		
A											9256.41	8476.29
∑		1881.32	540^o 00' 00"		$\delta_E = 0.25$	$\delta_N = 0.71$	-0.25 = $-\delta_E$	-0.71 = $-\delta_N$	0.00 = E_{end} - E_{start}	0.00 = N_{end} - N_{start}	= E_A	= N_A

$$\varepsilon_{\substack{misc \\ (ang)}} = \left(\sum \theta\right) - 180(n-2) = 539^o\ 57'\ 00'' - 540^o\ 00'\ 00'' = 00^o\ 03'\ 00''$$

$$C_{ang} = \frac{00^o\ 03'\ 00''}{5} = 00^o\ 00'\ 36''$$

Sample Calculations (First three rows):

$$\theta_{A(cor)} = 80^o\ 46'\ 00'' + 00^o\ 00'\ 36'' = 80^o\ 46'\ 36''$$

$$\alpha_{AB(cor)} = 260^o\ 00'\ 00'' + 80^o\ 46'\ 36'' = 340^o\ 46'\ 36''$$

$$\Delta E_{AB} = 551.4 \sin(340^o\ 46'\ 36'') = -181.55\ m$$

$$\Delta N_{AB} = 551.4 \cos(340^o\ 46'\ 36'') = 520.66\ m$$

$$C_{E(AB)} = -0.25\left(\frac{551.40}{1881.32}\right) = -0.07\,m$$

$$C_{N(AB)} = -0.71\left(\frac{551.40}{1881.32}\right) = -0.21\,m$$

$$\Delta E_{AB(cor)} = -181.55 + (-0.07) = -181.62\,m$$

$$\Delta N_{AB(cor)} = 520.66 + (-0.21) = 520.45\,m$$

$$E_{B(cor)} = 9256.41 + (-181.62) = 9074.79\,m$$

$$N_{B(cor)} = 8476.29 + (520.45) = 8996.74\,m$$

Assuming urban area surveying:

$$\left(\varepsilon_{\substack{misc \\ (ang)}} = 180''\right) > \left(\varepsilon_{\substack{all \\ (ang)}} = 60\sqrt{5} = 134''\right) \Rightarrow Not\ OK, Field\ work\ should\ be\ repeated$$

$$\left(\delta_{Total} = \sqrt{0.25^2 + 0.71^2} = 0.75\,m\right) < (\delta_{all} = 0.0006(1881.32) + 0.20 = 1.33\,m) \Rightarrow OK$$

Problem (2):

$$\alpha_{BA} = 90^o + \tan^{-1}\left(\frac{180067.29 - 178658.08}{176000.14 - 166238.10}\right) = 98^o\ 12'\ 51''\ \ (Known\ Azimuth)$$

$$\alpha_{EF} = 90^o + \tan^{-1}\left(\frac{177510.91 - 173371.62}{168816.43 - 164095.24}\right) = 131^o\ 14'\ 33''\ \ (Known\ Azimuth)$$

$$\alpha_{BC} = \alpha_{BA} + \theta_B = 98^o\ 12'\ 51'' + 138^o\ 59'\ 50''\ = 237^o\ 12'\ 41''$$

$$\alpha_{CD} = \alpha_{CB} + \theta_C = 417^o\ 12'\ 41'' + 167^o\ 34'\ 45''\ = 224^o\ 47'\ 26''$$

$$\alpha_{DE} = \alpha_{DC} + \theta_D = 404^o\ 47'\ 26'' + 75^o\ 24'\ 40''\ = 120^o\ 12'\ 06''$$

$$\alpha_{EF} = \alpha_{ED} + \theta_E = 300^o\ 12'\ 06'' + 191^o\ 01'\ 40''\ = 131^o\ 13'\ 46''$$

$$\underset{(ang)}{\varepsilon_{misc}} = \alpha_{EF} - \alpha_{EF(known)}\ = 131^o\ 13'\ 46'' - 131^o\ 14'\ 33''\ = -47''$$

$$\alpha_{BC(cor)} = \alpha_{BC} + \left(-\frac{\varepsilon_{misc}}{\underset{(ang)}{4}}\right) = 237^o\ 12'\ 53''$$

$$\alpha_{CD(cor)} = \alpha_{CD} + \left(-2\frac{\varepsilon_{misc}}{\underset{(ang)}{4}}\right) = 224^o\ 47'\ 50''$$

$$\alpha_{DE(cor)} = \alpha_{DE} + \left(-3\frac{\varepsilon_{misc}}{\underset{(ang)}{4}}\right) = 120^o\ 12'\ 41''$$

$$\alpha_{EF(cor)} = \alpha_{EF} + \left(-4\frac{\varepsilon_{misc}}{\underset{(ang)}{4}}\right) = 131^o\ 14'\ 33''$$

$$E_c = E_B + L_{BC}\sin(\alpha_{BC}) = 166238.10 + 1838.30\sin(237^o\ 12'\ 53'') = 164692.63\ m$$

$$N_c = N_B + L_{BC}\cos(\alpha_{BC}) = 180067.29 + 1838.30\cos(237^o\ 12'\ 53'') = 179071.86\ m$$

$$E_D = E_C + L_{CD}\sin(\alpha_{CD}) = 164692.63 + 1702.98\sin(224^o\ 47'\ 50'') = 163492.71\ m$$

$$N_D = N_C + L_{CD}\cos(\alpha_{CD}) = 179071.86 + 1702.98\cos(224^o\ 47'\ 50'') = 177863.42\ m$$

$$E_E = E_D + L_{DE}\sin(\alpha_{DE}) = 163492.71 + 697.83\sin(120^o\ 12'\ 41'') = 164095.76\ m$$

$$N_E = N_D + L_{DE}\cos(\alpha_{DE}) = 177863.42 + 697.83\cos(120^o\ 12'\ 41'') = 177512.28\ m$$

$$\delta_E = E_E - E_{E(Known)} = 164095.76 - 164095.24 = 0.52\,m$$

$$\delta_N = N_E - N_{E(Known)} = 177512.28 - 177510.91 = 1.37\,m$$

$$E_{c(cor)} = E_c + -\delta_E\left(\frac{L_{BC}}{L_{BC}+L_{CD}+L_{DE}}\right) = 164692.63 + -0.52\left(\frac{1838.30}{4239.11}\right) = 164692.40\,m$$

$$N_{c(cor)} = N_c + -\delta_N\left(\frac{L_{BC}}{L_{BC}+L_{CD}+L_{DE}}\right) = 179071.86 + -1.37\left(\frac{1838.30}{4239.11}\right) = 179071.27\,m$$

$$E_{D(cor)} = E_D + -\delta_E\left(\frac{L_{BC}+L_{CD}}{L_{BC}+L_{CD}+L_{DE}}\right) = 163492.71 + -0.52\left(\frac{3541.28}{4239.11}\right) = 163492.28\,m$$

$$N_{D(cor)} = N_D + -\delta_N\left(\frac{L_{BC}+L_{CD}}{L_{BC}+L_{CD}+L_{DE}}\right) = 177863.42 + -1.37\left(\frac{3541.28}{4239.11}\right) = 177862.28\,m$$

$$E_{E(cor)} = E_E + -\delta_E\left(\frac{L_{BC}+L_{CD}+L_{DE}}{L_{BC}+L_{CD}+L_{DE}}\right) = 164095.76 + -0.52\left(\frac{4239.11}{4239.11}\right) = 164095.24\,m = E_{E(known)}$$

$$N_{E(cor)} = N_E + -\delta_N\left(\frac{L_{BC}+L_{CD}+L_{DE}}{L_{BC}+L_{CD}+L_{DE}}\right) = 177512.28 + -1.37\left(\frac{4239.11}{4239.11}\right) = 177510.91m = N_{E(known)}$$

Assuming urban area surveying:

$$\left(\left|\varepsilon_{\substack{misc\\(ang)}} = 47''\right|\right) < \left(\varepsilon_{\substack{all\\(ang)}} = 60\sqrt{4} = 120''\right) \Rightarrow OK$$

$$\left(\delta_{Total} = \sqrt{0.52^2 + 1.37^2} = 1.47\,m\right) < (\delta_{all} = 0.0006(4239.11) + 0.20 = 2.74\,m) \Rightarrow OK$$