leveling

$HI = h + R \Rightarrow h_i = HI - R_i$

checks: $\# B.S = \# F.S$ ①

$\sum B.S - \sum F.S = h_{i.p} - h_{f.p}$ ②

$\#$ of setup $= T.P + 1$ ③ T.P

I.P intermediate point

$\sum_{i=1}^{n} HI_i (\alpha_i) + \sum I.S - \sum F.S = \sum_{i=1}^{n} h_i$

inverted staff ← إذا النقطة معكوسة بنعتبر

$R = -1.5$ مثلاً القراءة بنحطها سالب

---

profiles: one direction

[road, tunnels, water channel, pipeline (fresh water, oil, gas, waste water)]

أنواع: longitudinal profile: profile taken along the centre line

cross sections of profiling taken orthogonal to the centre line

Scale = distance in map / distance in ground

misclosure error:

$(\varepsilon) = h_m - h_n$ المحسوبة − الحقيقية المعلومة

$\varepsilon_{all} = c\sqrt{k}$ mm | الجواب بالـ mm

$K = \frac{\sum D_{BS} + \sum D_F}{1000}$ (km)

$D = (r_1 - r_3)\,100$

$C_{TP} = \frac{-n}{n_{total}}\,\varepsilon$

contour:

① إذا خطوط الكنتور متقاربة بيكون الـ slope عالي

② كل النقاط على نفس الكنتور إلها نفس الارتفاع

③ خطوط الكنتور ما بتتقاطع إلا caves

④ الكنتور دائماً حلقات مغلقة

① max, min elevation.

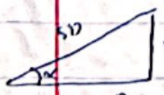
② direction of ground slope (uphill / downhill)

③ degree of slope (sharp, mild, constant, flat) from closer contour

④ identify shape of ground (valley, ...)

Slope $= \frac{\Delta h}{L} = \tan^{-1}\alpha$ ($\Delta h = v$)

Slope dist $= \sqrt{D^2 + V^2}$



①

Systematic error: ① collimation: different distance

$\varepsilon_{A_1} = R_{A_1} - R'_{A_1} = d_{A_1}\tan\alpha$

$\varepsilon_{B_1} = R_{B_1} - R'_{B_1} = d_{B_1}\tan\alpha$

$\Delta h'_{A_1B_1} = R'_{A_1} - R'_{B_1}$

$R'_i = R_i - d_i \tan\alpha$

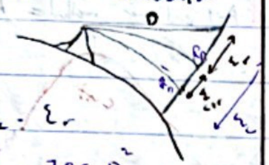
equal distance

$\varepsilon_{A_2} = \varepsilon_{B_2}$

$\Delta h'_{AB_2} = R'_{A_2} - R'_{B_2}$
$= R_{A_2} - R_{B_2}$
$= h_B - h_A$

$\tan\alpha = \frac{R_{A_1} - R_{B_1} - (R_{A_2} - R_{B_2})}{d_{A_1} - d_{B_1}}$

② curvature and refraction



$\varepsilon_{cr} = \varepsilon_c - \varepsilon_r$

$\Rightarrow \varepsilon_c = 0.0785\,D^2_{(km)}$

$\Rightarrow \varepsilon_r = \varepsilon_c / 7$

$\varepsilon_{cr} = 0.0675\,D^2$

$R'_i = R_i - \varepsilon_{cr}$

$\Rightarrow R'_i = R_i - d_i\tan\alpha - \varepsilon_{cr}$

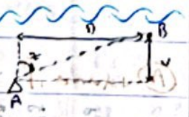
Theodolite

H.A (x, y) — (z) V.A

azimuth (0, 360) — Bearing (0, 90) — Zenith angle ~~Bearing~~ (0, 180)

$BD_C = HR_C - HR_B$

Zenith angle



$h_B = h_A + HI + V$, $V = \frac{D}{\tan z}$

when we D nothing [illegible]

① Tangential method

measurement (r_1, z_1) (r_2, z_2)

$D = \frac{r_1 - r_2}{\frac{1}{\tan z_1} - \frac{1}{\tan z_2}}$

$V_1 = \frac{D}{\tan z_1}$, $V_2 = \frac{D}{\tan z_2}$

$h_B = h_A + HI + V_1 - r_1$

or

$h_B = h_A + HI + V_2 - r_2$

②

② Stadia method

measurement (z, r_1, r_2, r_3)

$D = K r \sin^2 z$, $K = 100$ stadia constant

$V = \frac{1}{2} K r \sin 2z$

$r = r_1 - r_3$

$h_B = h_A + HI + V - r_2$

إذا ما في staff [illegible]

$h_C = h_A + HI + V$, $V = \frac{D_{AC}}{\tan z_{AC}}$

① select A, B

② measure: $D_{AB}, h_A, \hat{a}, \hat{b}$ (H.A), z_{AC} (V.A)

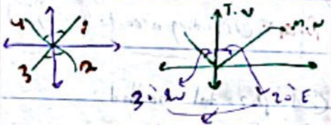
$\hat{c} = 180 - \hat{a} - \hat{b}$

$\frac{D_{AC}}{\sin b} = \frac{D_{AB}}{\sin c} \rightarrow D_{AC} = ??$

Azimuth

Back azimuth $= \alpha_{BA} = \alpha_{AB} + 180°$

reduced bearing (φ) NφE (−) SφE (+)



magnetic declination

$\Delta E_{AB} = E_B - E_A$ (change in Dep.)

$\Delta N_{AB} = N_B - N_A$ (change in lat)

$\Delta E_{AB} = L_{AB}\sin\alpha_{AB}$

$\Delta N_{AB} = L_{AB}\cos\alpha_{AB}$

$\tan^{-1}\phi = \frac{\Delta E}{\Delta N}$

$E_B = E_A + \Delta E_{AB}$

$N_B = N_A + \Delta N_{AB}$

Traverse → closed / opened

→ closed (loop)

$\varepsilon = \sum \text{interior angle} - 180(n-2)$

$\varepsilon <$ Tolerance error $= c\sqrt{n} \Rightarrow$ تصحيح

$\Rightarrow$ correction $= -\frac{\varepsilon}{n}$

corrected angle = observed angle + correction

③

checking all traverse

$\rightarrow E_{end} - E_{start} = \sum \Delta E$

$\rightarrow N_{end} - N_{start} = \sum \Delta N$

closing error:

$\delta E = \sum \Delta E - (E_{final} - E_{start})$

$\delta N = \sum \Delta N - (N_{final} - N_{start})$

$\delta = \sqrt{\delta E^2 + \delta N^2}$

Precision $= 1 / \frac{\sum L}{\delta}$

$\delta E : \Delta E$ $\delta N : \Delta N$ closed loop

$C_{\Delta E} = \frac{-\delta E\,L}{\sum L}$, $\Delta E' = \Delta E + C_{\Delta E}$

$C_{\Delta N} = \frac{-\delta N\,L}{\sum L}$, $\Delta N' = \Delta N + C_{\Delta N}$

$E_2 = E_1 + \Delta E'$, $N_2 = N_1 + \Delta N'$

checks:

1. $\sum C_{\Delta E} = \delta_E$, $\sum C_{\Delta N} = \delta_N$
2. $\sum \Delta E' = 0$ $\sum \Delta N' = 0$
3. $E_n = E_1$ $N_n = N_1$

$\sum \Delta E_c = E_{end} - E_{start}$

$\sum \Delta N_c = N_{end} - N_{start}$

stn	الطول	الزاوية	az	ΔE	ΔN	$C_{\Delta E}$	$C_{\Delta N}$	ΔE'	ΔN'	E	N

closed link

ما بنضبط الزوايا الداخلية بحسب

الـ azimuth ومن آخر azimuth حسب

بطلع الـ error وبعدين بنحسب

على n الكور، [illegible] انه نفرض مطالب

[illegible] نفرض حالة

بعد الأولى ٦ الثانية ١٦ وهكذا.

وآخر واحد بوخذ الـ n كامل

وبعدين بحسب t [illegible] بطلع

بنطلع الـ error لـ inlet [illegible]

$\varepsilon = \alpha_{F_o} - \alpha_{F_{a_n}}$

$\varepsilon \le \varepsilon_n = C\sqrt{n}$, $L = 60''$, $90''$

شكل الجواب 7

أول اشي بنحسب 7 والنتايج ... [illegible] وحطلك آخر واحد يوقف ال error لـ E و N بتاعت [illegible]

$E_B = E_A + D \sin \alpha$ } $N_B = N_A + D \cos \alpha$

لحد ما أوصل آخر نقطة وبقارن ... المعلومة

$\varepsilon_E = E_{f_m} - E_{f_n}$ } $\varepsilon_N = N_F - N_f$

$C_E = \frac{-\varepsilon E (L_i)}{\Sigma L_{ij}}$ } $C_N = \frac{-\varepsilon N\, L_i}{\Sigma L_{ij}}$

وتصحيح الإحداثيات الـ ...

				X
				δ_y
				m
				Z
				m^n
				$2n$
				r_1
				2_1

بنحسب الـ ... آخر نقطة ... الحدود δ_E وبتحط ...

بنحسب الـ ...

δ_E ← آخر نقطة ...

بنحسب الـ ...

$\delta_f = \sqrt{\delta_E^2 + \delta_N^2}$

$\delta_s = 0.008 \sqrt{\Sigma l} + 0.2$ important road

$0.004 \sqrt{\Sigma l} + 0.2$ less important road

Angle error $\varepsilon_a = 60''\sqrt{n}$, $= 90''\sqrt{n}$

$R.P = \frac{1}{\Sigma L / \delta}$

توضيح الـ correction كثير بس ... L_i

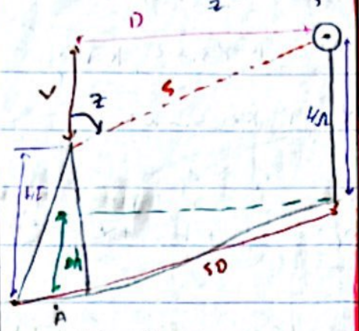
$L_B = L_{AB}$

$L_C = L_{AB} + L_{BC}$

$L_D = L_{AB} + L_{BC} + L_{CD}$

نعيد ... أول تصحيح لـ B بجمع كل الأطوال لحد B ونقسم الـ length الـ ...

Total Station = Theodolite + EDM

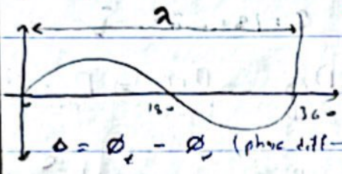


HR = HI إذا الا ... شرط SD

$V = S \cos Z$ $\quad D = S \sin Z$

$\Delta h_{AB} = h_B - h_A \quad SD = \sqrt{HD^2 + \Delta h^2}$

$h_B = h_A + HI + V - HR$



$\theta = \phi_t - \phi_r$ (phase diff)

$S = \frac{1}{2}\left(n\lambda + \frac{\theta}{360}\lambda\right)$

λ = السرعة / freq

... $h2$ ال $nh2$ ...

Area: ① Dividing area to (مساحات صغيرة)

② Trapizoidal method:

$A = \frac{base}{2}\left[h_1 + h_{الاخير} + 2(\text{الباقيات})\right]$

③ Simpson's rule:

# of trapizoids is even:

$A = \frac{b}{3}\left[h_1 + h_l + 2(\text{الفردي}) + 4(\text{الزوجي})\right]$

# of trapizoids is odd

آخر شبه منحرف نحسبه لحال ويوضع ... إذا ... أول ... والباقي لحال

$A = a_1 + a_2$

$\frac{b}{2}(h_7 + h_8)$

④ area from point coordinate

$x_1 \; x_2 \; x_3 \; x_4 \; x_5 \; x_1$
$y_1 \; y_2 \; y_3 \; y_4 \; y_5 \; y_1$

$k_2 = x_1 y_2 + x_2 y_3 + \dots + x_5 y_1$

$k_1 = y_1 x_2 + y_2 x_3 + \dots + y_5 x_1$

$Area = \frac{k_1 - k_2}{2}$

Volume: h = ground level − final level

$\frac{+cut}{-fill}$

Transported volume = Volume × C.F

Volume transport = (gross cut) − (gross fill)

① Volume from grid

① cut/fill heights = ground − final { +cut, −fill

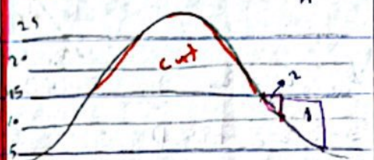
② avg heights = $\frac{h_1 + h_2 + h_3 + h_4}{4}$

③ volume $\frac{\text{cell}}{}$ = grid cell area × avg height

④ total grid volume = Σ cell volume

② volume from contour map

Avg end area method = $\frac{A_1 + A_2}{h}$



$V_c = \frac{C.I}{2}\left[A_{25} + A_{15} + 2A_{20}\right]$

$V_f = V_1 + V_2$

$V_1 = \frac{5 + 10}{2}(A_5 - A_{10})$

$V_2 = \frac{0 + 5}{2}(A_{10} - A_{15})$

③ volume from profile:

$h_f = h_i \mp$ slope × dist

upward (+) downward (−)

④ volume if constant width

	12.3	2.54	5.44	0
	4.82	8.54	6.22	5
	0	0	8.54	2.54

$\frac{b}{2}(0 + 2.12 + 2(\dots))$

بحسب الـ slope من طريق الـ final (h)

وبصير أطرح الـ ... و ground من الجواب

وبطلع عندي ارتفاع الـ cut والـ fill

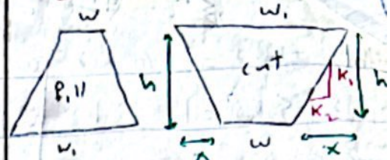
بحسب مساحة الـ fill والـ cut عن الـ trapizoidal في الحجم

بضرب الجواب بالـ width وبحسب

gross volume = volume × c.f

fig gross = ...

(b width) (Side slope)



w: final road width

h: is the cut or fill hight

Side slope = k_1 / k_2

1 : 2 $\quad$ 1/2

V : H $\quad$ V / H

$k_1 : k_2 \quad k_1 / k_2$

$\frac{x}{k_2} = \frac{h}{k_1} \Rightarrow x = \frac{k_2}{k_1} h$

$w_1 = w + 2x$

$w_1 = w + 2\frac{k_2}{k_1}h$

$Area = \frac{w + w_1}{2} h$

$area = \left[w + \frac{k_2}{k_1}h\right] h$

dis	grd	final	cut (+)	fill (−)	cut area	fill area
0	5.4_4	$1._4$		2.12		31.22
	6.22	1.2_3				
	8.5_4	8.5_4	6	0	0	0

لـ الـ cut (h) والـ fill (h) قبل كل ... نحسب الـ cut area والـ fill area لكل واحد لحال من القانون

والـ volume من قبل ...

$V_c = \frac{b}{2}(A_1 + 0 + 2(\text{الباقي}))$

$V_f = \frac{b}{2}(0 + A_4 + 2(\text{الباقي}))$

gross cut = V_{cut} × c.f

gross fill = V_{fill} × c.f

Horizontal Alignment

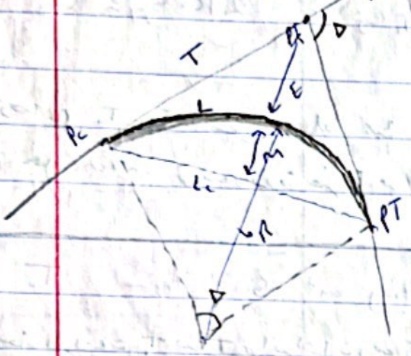
$L = \frac{\Delta}{180}\pi R$ طول الـ curve

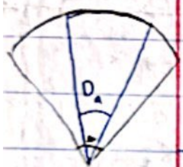
$T = R \tan\frac{\Delta}{2}$

$L_c = 2R\sin\frac{\Delta}{2}$ long chord (distance)

$M = R(1 - \cos\frac{\Delta}{2})$

$E = R\left(\frac{1}{\cos\frac{\Delta}{2}} - 1\right)$





Degree of curvature (D)

$D = \frac{1718.873}{R}$ ← لإيجاد R_{min}

Setting out the sc

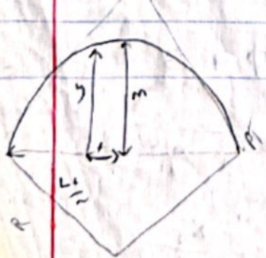
(1) short curve (distance type)

linear method for setting out short curves

(a) ordinates from long chord

x	y
0	M
⋮	⋮
$\frac{L_c}{2}$	0

$\Rightarrow y = \sqrt{R^2 - x^2} - \sqrt{R^2 - (\frac{L_c}{2})^2}$



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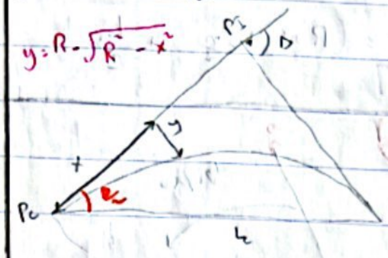
(b) offset from tangent:

بنمشي مسافة x عن الـ T ونتزل عمودي مسافة y

x	y
0	0
⋮	⋮
$L_c\cos\frac{\Delta}{2}$	$L_c\sin\frac{\Delta}{2}$

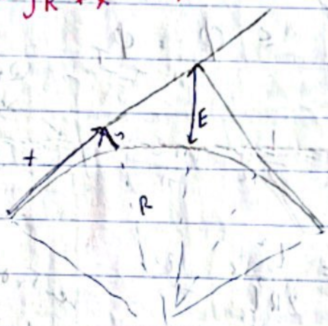
$y = R - \sqrt{R^2 - x^2}$



(c) Radial offset: بنعمود ٩٠ على امتداد R

x	y
0	0
⋮	⋮
T	E

$y = \sqrt{R^2 + x^2} - R$



(d) offset from middle coordinates

$M_1 = R(1 - \cos\frac{\Delta}{2})$

$M_2 = R(1 - \cos\frac{\Delta}{4})$

$M_3 = R(1 - \cos\frac{\Delta}{8})$

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long curves (dist + angle)

Theodolite, total station …

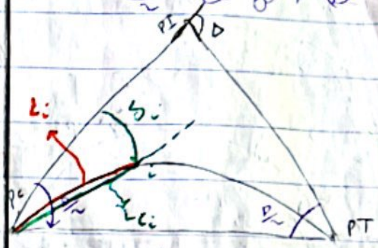
$\frac{\Delta}{2}$: total deflection angle

δ_i: deflection angle

$0 \le \delta_i \le \frac{\Delta}{2}$

deflection angle [للنقطة (i)] يعني

أي نقطة من الـ curve غير الـ PT الـ δ لها أقل من $\frac{\Delta}{2}$



$L_i = Sta_i - Sta_{P_c}$ (1)

$L_{c_i} = 2R\sin\delta_i$ (3)

$\delta_i = \left(\frac{\Delta}{2}\right)\left(\frac{L_i}{L}\right)$ (2)

طريقة ثانية للحل

$c \le \frac{R}{20}$

l: partial arc / c: partial chord

$l \approx c$

الـ c متساويات بس أول وحدة

حيث c تساوي Sta النقطة بعد P_c مباشرة - Sta P_c

وطبعاً لازم تكون أقل من $\frac{R}{20}$

وبالعادة لو فيها أعشار بنوخذ

في الأساس

$n = \frac{370 - 320}{10} = 15$

$n+1$ = # of points excluding P_c and PT

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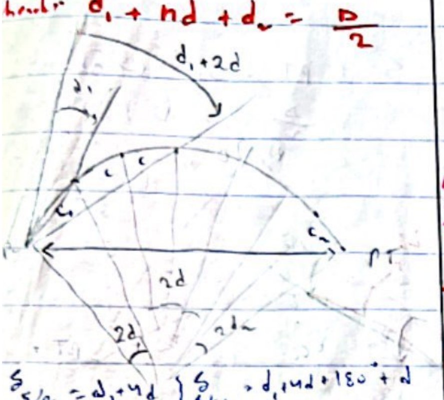
$S_i = d_1 + (i-1)d$

$* \; d = \frac{28.648\,c}{R}$

$* \; d_1 = \frac{28.648\,c_1}{R}$

$* \; d_2 = \frac{28.648\,c_2}{R}$

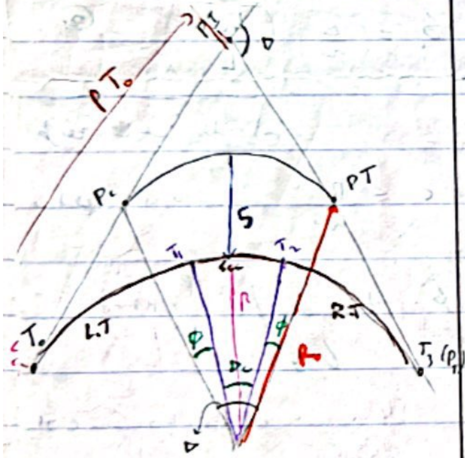
check: $d_1 + nd + d_2 = \frac{\Delta}{2}$



$\delta_{5/P_0} = d_1 + 4d$ } $\delta_{6/5/6} = d_1 + 4d + 180 + d$

compound curves

Left + circular + Right



$\Delta = 2\phi + \Delta_c \rightarrow \Delta_c = \Delta - 2\phi$

$R_0 = R + S$

$S = \frac{L_s^2}{24R}$, S: shift

$L_s = \frac{V^3}{aR}$

V: speed ← ثابتة (m/s)

a: rate of change in radial acceleration

$a = (0.3 - 0.6)\frac{m}{s^3}$

range متغيرة

$L_s = sta\ T_1 - sta\ T_0$

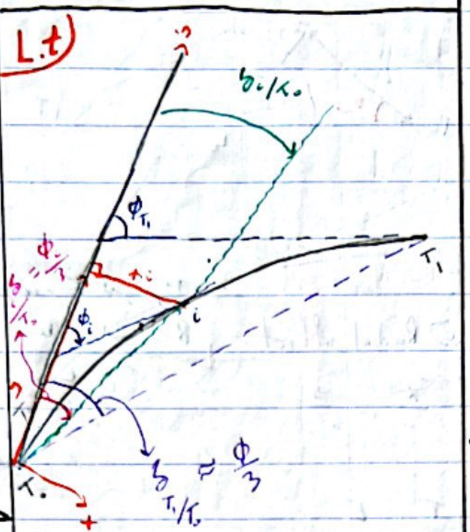
$= sta\ T_3 - sta\ T_2$

$L_{curve} = sta\ T_2 - sta\ T_1$

$= \frac{\Delta_c}{180}\pi R$

$PT_0 = (R+S)\tan\frac{\Delta}{2} + \frac{L_s}{2}$

L.t



$\phi_i \le \phi = \phi_T$

$\phi = \left(\frac{L_s}{2R}\right)\left(\frac{180}{\pi}\right) = \phi_T$

$\phi_i = \frac{l_i^2}{2RL_s}\frac{180}{\pi}$

$l_i = sta\ i - sta\ T_0$

$* \; x_i \approx \frac{l_i^3}{6RL_s}$

$* \; y_i = l_i - \frac{l_i^5}{40(RL_s)^2}$

$* \; d_{T_0-i} = \left(x_i^2 + y_i^2\right)^{\frac{1}{2}}$

$c \le \frac{R}{40}$ المسافات بين النقاط

n نفس الأشي

$l_i = sta\ i - sta\ T_0$

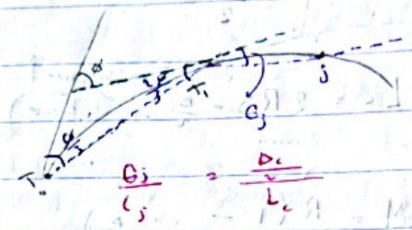
$= c_1 + (i-1)c$

deflection angles, distance

R.t

$L_s = sta\ T_3 - sta\ k$

Setting out sec from T_1

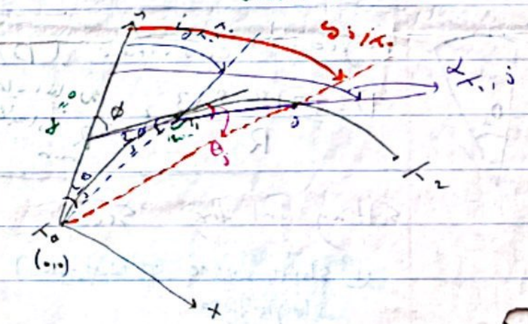


$\frac{\theta_j}{l_j} = \frac{\Delta_c/2}{L_c}$

$l_j = sta\ j - sta\ T_1$

$d_{T_1-j} = 2R\sin\theta_j$

Setting out sec from T_0



$X_{T_1} = \frac{L_s^2}{6R}$

$Y_{T_1} = L_s - \frac{L_s^5}{40(RL_s)^2}$

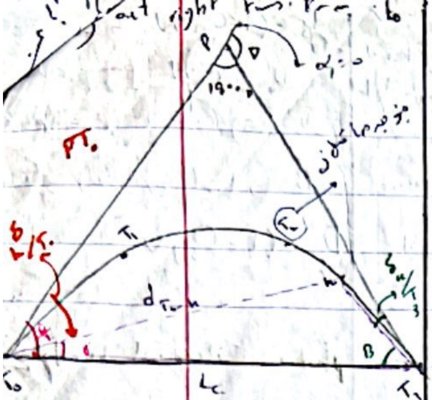
$X_j = X_{T_1} + d_{T_1-j}\sin\alpha_{T_1-j}$

$Y_j = Y_{T_1} + d_{T_1-j}\cos\alpha_{T_1-j}$

$\alpha_{T_1-j} = \phi + \theta_j$

$d_{T_0-j} = \sqrt{x_j^2 + y_j^2}$

$\delta_{T_3/T_0} = \tan^{-1}\frac{x_j}{y_j}$



$d_{T_1-T_3} = L_c = 2(PT_0)\cos\frac{\Delta}{2}$

$E_{T_3} = E_{T_1} + d_{T_1-T_3}\sin\alpha$

$S_{k/T_3} = \frac{l_k^2}{6 l_s R}\frac{180}{\pi}$

$B = \frac{\Delta}{2} - S_{k/T_3}$

$X_k = \frac{l_k^3}{6 l_s R}$

$Y_k = l_k - \frac{l_k^5}{40(l_s R)^2}$

$d_{T_3-k} = \sqrt{X_k^2 + y_k^2}$

$d_{T_1-k} = \sqrt{d_{T_3-k}^2 + L_c^2 - (2 d_{T_3-k} L_c)(\cos B)}$

$\frac{\sin\gamma}{d_{T_3-k}} = \frac{\sin B}{d_{T_1-k}} \Rightarrow \gamma$

$S_{T_1,k} = \frac{\Delta}{2} - \gamma$

vertical alignment

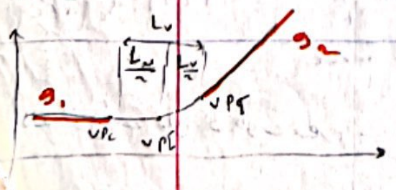
e: super elevation rate

$2\% \le e \le e_{max}$

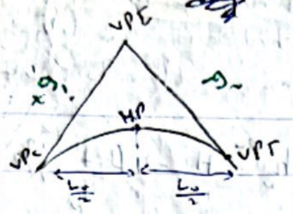
$e + f = \frac{V^2}{127R}$ — f: friction factor (side friction), V: km, R: m

vertical allig (longitudinal prof)

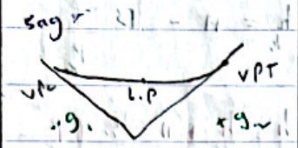
g: gradient (slope)



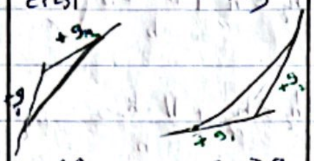
crest



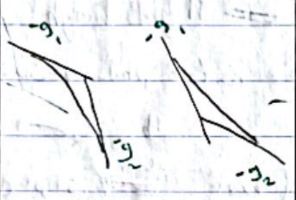
sag



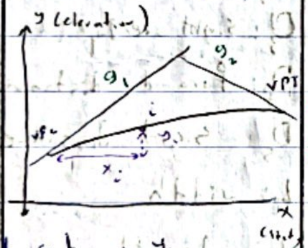
crest Sag



$g_2 < g_1$ $g_2 > g_1$



$|g_1| > |g_2|$ $|g_2| > |g_1|$



$h_i = h_{vpc} + y_i$

$y_i = g_1 x_i + \frac{A x_i^2}{2L}$

$A = g_2 - g_1$ بدون قيمة مطلقة

$x_i = Sta_i - Sta\ VPC$

$h_i = h_{VPC} + g_1 x_i + \frac{A x_i^2}{2L}$

اذا بدنا ارتفاع (high point) (low point)

x_m نشتق x_i صفر

$X_m = \frac{-g_1 L}{A}$

واذا بدنا ... بنعوض X_m مع Sta VPC

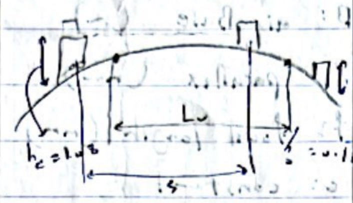
اي نقطة لسة مع التعويض

ارتفاع (...) من VPI الى ...

$h_{VPC} = h_{VPI} - slope(\frac{L}{2})$:قبل

$h_{VPT} = h_{VPI} + slope(\frac{L}{2})$ (المسافة)

min. vertical length (L_v)



SSD $\le$ S

SSD = S = $d_1 + d_2$

$d_1 = tV$, t = 2.5 sec

$d_2 = \frac{V^2}{2(9.81)(f \mp g)}$

f: forward friction

اذا طالع موجب واذا نازل سالب ونبوض و الاكبر ونازل والاصغر

crest

$S < L$: $L = \frac{|A| S^2}{2[\sqrt{h_e} + \sqrt{h_o}]^2}$

$S > L$: $L = 2S - \frac{2}{|A|}[\sqrt{h_e} + \sqrt{h_o}]^2$

Sag

$L < S$: $L = 2S - \frac{(1.22 + 0.035 S)}{|A|}$

$L > S$: $L = \frac{|A| S^2}{1.22 + 0.035 S}$

$A = g_2 - g_1$

$S = SSD = tV + \frac{V^2}{2(9.81)(f \mp g)}$

ثانيات سواء crest أو sag

$\frac{80\ km/h}{1.6} = 50$ mil. ph

نقسم على 1.6 عشان نحول

طالما ثانية m/s لازم السرعة

عشان الـ gravity

وصو طالع بنوخذ و الاصغر

وصو نازل بنوخذ و الاكبر

وصو طالع بنوخذ موجب (+)

وصو نازل بنوخذ سالب (-)

mass diagram

grading factor = $\frac{V_e}{V_c}$

اذا اكبر من واحد swell

اذا اصغر من واحد shrinkage

Sta	exca	shr. factor	correct exca	emba	$V_c - V_f$	V

اذا بين ... excess ... cut

اذا بين ... borrow ... fill

اذا shrinkage ... emb ... exca

اذا swell ... exca ... emb

max point: change from cut to fill (haul forward)

min point: change from fill to cut (haul back)

photogrammetry

perspective center: نقطة التقاء

أي نقطة ... positive ...

... negative ...

f: focal length (mm)

H: flight height (m) من focal center لل datum

f = 6" = 6 × 25.4 = 152.4 mm

Scale of photo at image (a) = $\frac{1}{\frac{H - h_A}{f}}$

Scale of photo at image (b) = $\frac{1}{\frac{H - h_B}{f}}$

avg scale of photograph = $\frac{1}{\frac{H - h_{avg}}{f}}$

r = radial distance pt

Δr = radial distance bt

Δh = height of building

$= h_T - h_B$

$= \frac{\Delta r}{r}(H - h_B)$

O_1: Principle point one

O_f: Forward over lap

B: air base (m)

المسافة بين النقطتين على الأرض (وتمثلها على الصورة b) photo

P: parallax (mm)

$P_n = x_1 - x_2$

البارالاكس للنقطة n هو condition

النقطة n عن الـ left تاقص الـ

النقطة عن الـ right

$$\frac{f}{H-h} = \frac{x_1}{X_1} = \frac{P}{B} = \frac{x_1 - x}{B}$$

$$\rightarrow h = H - \frac{B}{P} f$$

$$\rightarrow X_1 = \frac{B}{P_1} x_1$$

$$\rightarrow Y_1 = \frac{B}{P_1} y_1$$

مع وجود المركز واحد في الـ left photo

البارالاكس لنقطة 1: $P_1 = c + r_1$

h: elevation of any point (m)

H: flight height (m)

B: air Base (m)

P: parallax (mm)

f: focal length (mm)

c: constant

r: parallax reading

$P_{o_1} = o - (-b') = b'$

$\rightarrow c_1 = P_{o_1} - r_{o_1}$

$P_{o_2} = b'' - o = b''$

$\rightarrow c_2 = P_{o_2} - r_{o_2}$

$$c = \frac{c_1 + c_2}{2} \Big\} \text{نجيب الـ c avg}$$

$$b = \frac{b' + b''}{2} \rightarrow \text{photo air base}$$

$$\text{avg scale} = \frac{b}{B} = \frac{1}{\frac{B}{b}}$$

$$\text{Scale} = \frac{1}{\frac{H - h_{avg}}{f}} = \frac{1}{\frac{B}{b}}$$

$\frac{\text{Photo Distance}}{\text{ground distance}}$

elevation الـ حسب على حساب مرات

للنقطة اعتمادا على الـ elevation الـ third

لا يمكن حسابه من الـ parallax per difference

$$h_N = H - B\left(\frac{f}{P_N}\right), \; N: \text{known elevation}$$

(m, m, m, mm)

$$h_k = H - B\frac{f}{P_k} \Big\} k: \text{unknown elevation}$$

$$h_i = h_N + \frac{H - h_N}{b}(P_k - P_N)$$

$$h_i = h_N + \frac{H - h_N}{b}(r_k - r_N)$$

$$h_i = h_N + \frac{H - h_{avg}}{b}\Delta P$$

~~***~~ Flight height

المسافة بين الـ two photo على

الورق b اسمه

(المسافة بين النقطتين B على الواقع)

O_f: Forward overlap (60-65)%

O_s: sight overlap (20-30)%

D_f: Forward distance

D_s: sight distance

L_1: width

L_2: length

Total # of photographs

$D_f = (1 - O_p)W = B$

لازم نستخدم W وليس D_f

مسافة على الـ ground وبالتالي

هي عبارة أخرى لـ B

$D_s = (1 - O_s)W$

D_f: المسافة بين الـ photo والـ photo عن الـ flight line

D_s: المسافة بين flight line والـ flight line

$$\text{Scale} = \frac{w}{W}$$

الصورة ← w، الحقيقة ← W

w, W

$$N_p = \frac{L_2}{(1 - O_p)W} + 2$$

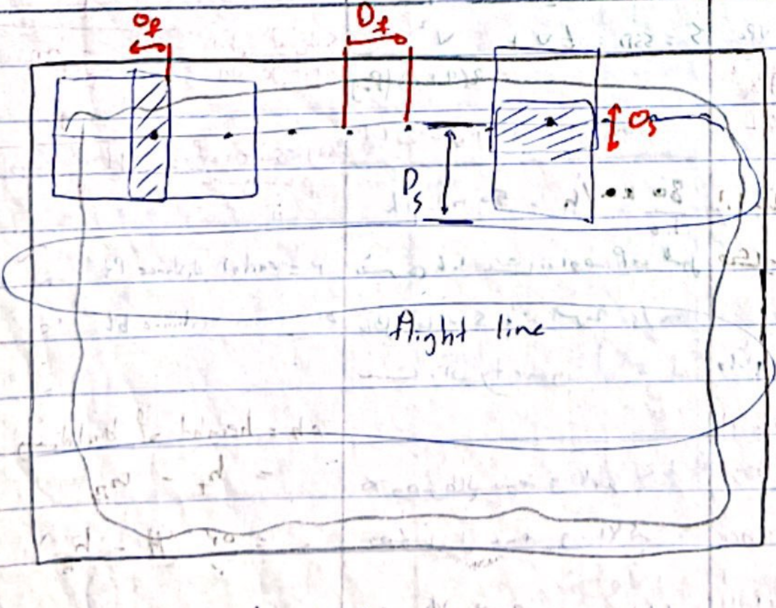
N_p: # of photo per line

$$N_s = \frac{L_1 - W}{(1 - O_s)W} + 1$$

N_s: # of flight line

$N = N_p \times N_s$

total # of photo we need



L_1: width

L_2: length

للتحويل من متر² إلى Hectares نقسم على 10^4

ونضيف الوحدة بدل الـ "m² نكتب Ha"

$$D_{AB} = \sqrt{(X_A - X_B)^2 + (Y_A - Y_B)^2}$$

للتحويل من متر إلى قدم فوت نضرب 3.28×10^{-3}

للتحويل من انش إلى فوت نضرب 0.0833

للتحويل من فوت² إلى arc نقسم على 43560

$$\frac{(7500)^2 \; ft^2}{43560 \; \frac{ft^2}{arc}} = 1291.3 \text{ arc}$$

للتحويل من ميل إلى فوت نضرب بـ 5280