⇐ تنبيه هام :-

- على من تعذر عليه حضور الـ Quiz الأول أو الثاني أو امتحان الـ Midterm في مادة الـ Steel Structeures الذهاب إلى مكتب الدكتور سعد الدين مصطفى « على السلم الدور الثاني بلوك 4 » في يوم الأحد الموافق 2016/5/15 من الساعة 10 صباحا حتى 11 صباحا ....

⇐ ويعتبر هذا آخر موعد متاح لهم لإعادة الامتحان ,,, وذلك ليتمكنوا من الحصول على درجات أعمال السنة .....

And ThanX :D

ہندسی تالیف

Geometric Design

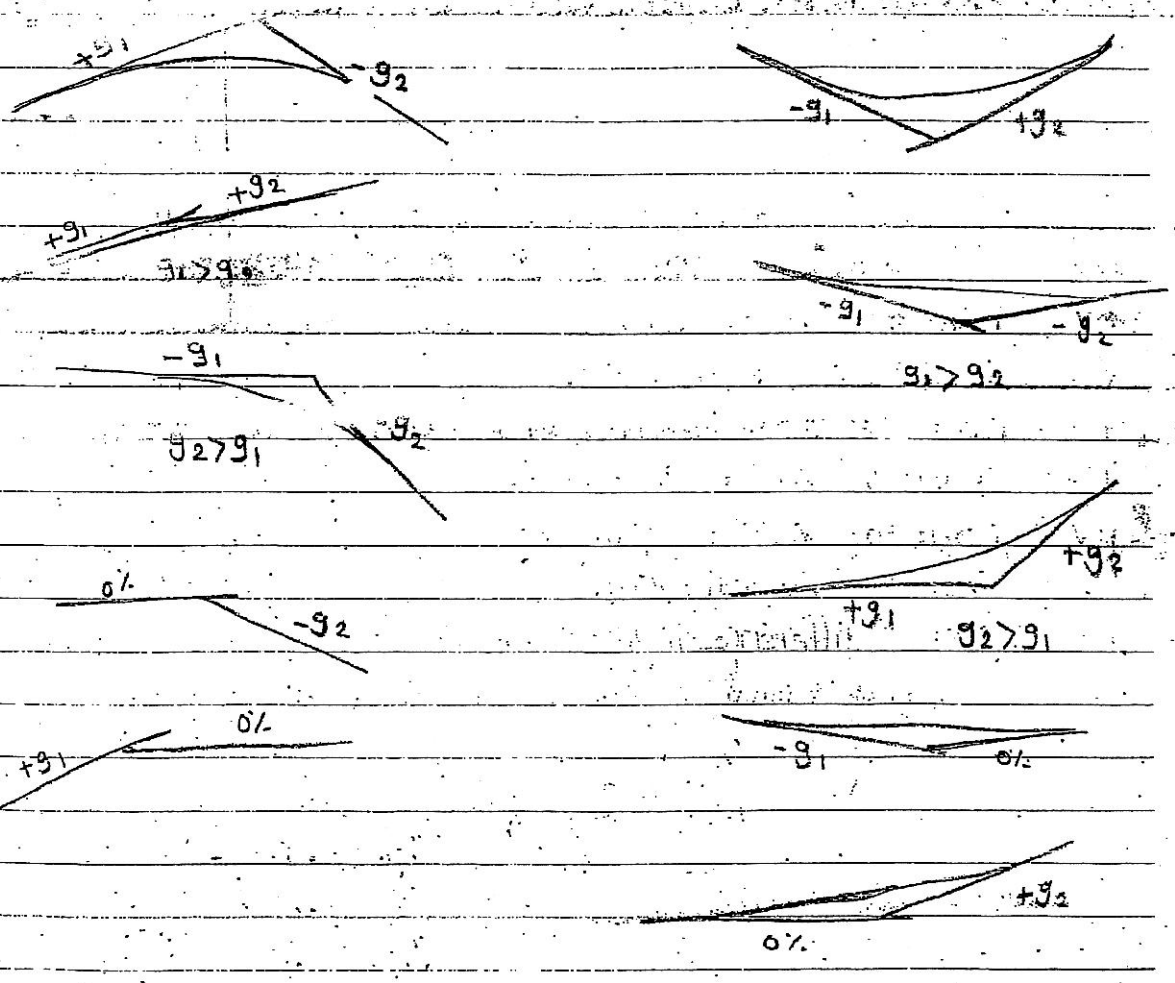
(3)

Page
Date

"Geometric design" ch4 "Vertical alignment" التخطيط الرأسي

→ Types of Vertical Curves:

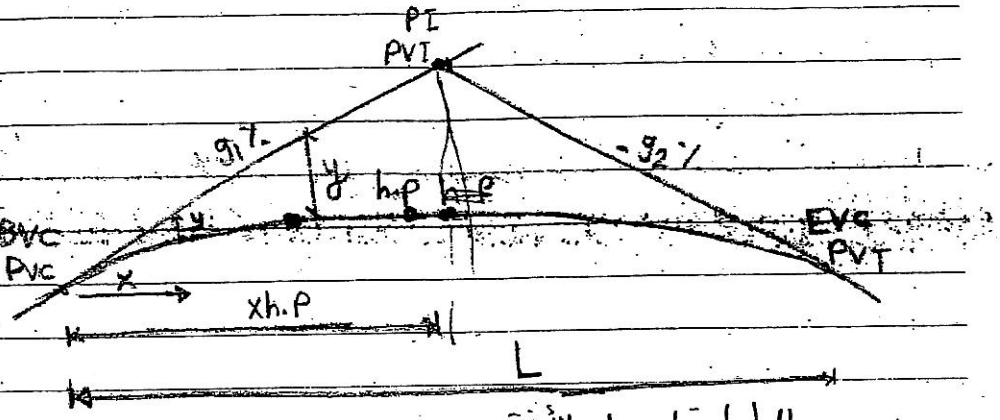
1) (Summit) Vertical Curve 2) Sag (Valley) Vertical Curve



For the memories of yesterday,
For the happiness of today...

Page
Date

Elevation of Vertical Curve



الطول يقاس على الأفق

- PVC = Point of Vertical Curve
- BVC = Beginning of Vertical Curve
- PI = Point of Intersection
- PVI = Point of Vertical intersection
- PVT = Point of Vertical Tangent
- EVC = End of Vertical Curve
- A = Algebric difference ingrade inPercent

الفرق الجبري بين الميلين كنسبة مئوية

$$A = +g_1 - (\pm g_2)$$

- y = offset
- X = any distance From PVC
- L = Length of Curve

$$X_{highest\ Point} = \frac{g_1 L}{(g_1 - g_2)}$$

$$Y_{highest\ Point} = \frac{g_1^2 L}{2(g_1 - g_2)}$$

طول المنحنى يقاس على الأفق

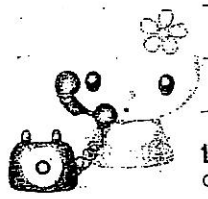
$$y = \frac{Ax^2}{200L}$$

$$X_{high\ Point} = \frac{g_1 L}{A}$$

$$Y_{high} = \frac{g_1^2 L}{2A} = \frac{g_2^2 L}{2A}$$

$$y_m = \frac{4e(Xm)^2}{L^2}$$ at any Point

$$e = \frac{AL}{8}$$



Love is like a dying ember
only memories remain

Page
Date

St PVC = St PI − L/2 ele (PVC) = ele (PVI) − $g_1 \times \frac{L}{2}$

St PVT = St PI + L/2 ele (PVT) = ele (PVI) + $g_2 \times \frac{L}{2}$

Design of Crest Curve

- length of Curve (L):

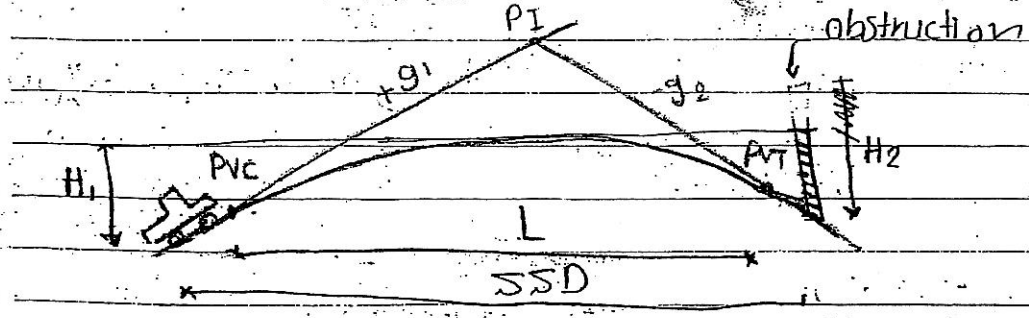
A) Stopping Sight distance (SSD):

Case 1: SSD > L

$$L = 2(SSD) - \frac{200(\sqrt{h_1} + \sqrt{h_2})^2}{A}$$

H_1 = "eye height" ارتفاع عين السائق

H_2 = obstruction height ارتفاع العائق



H_1 = 3.75 Ft H_2 = 0.5 ft ⇒ (2Ft)

H_1 = 1.2m H_2 = 0.15m

$L = \frac{2(SSD) - 440}{A}$ (m)

For the memories of yesterday,
For the happiness of today...

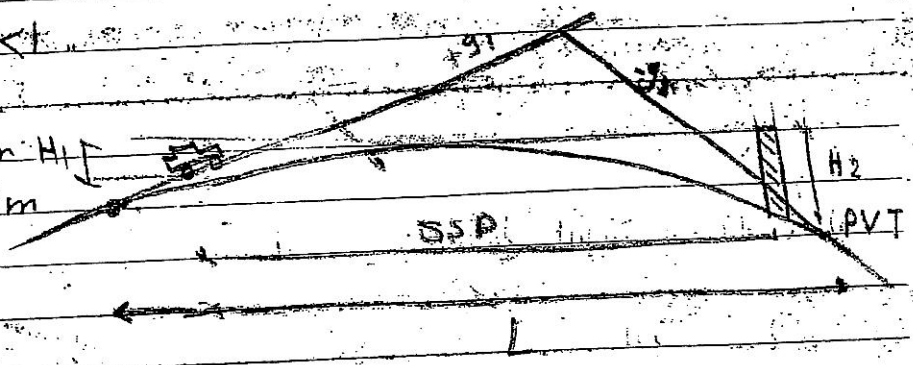
Page
Date

$L = 2(SSD) + \frac{1329}{A}$ (ft) ⇒ $L = 2(SSD) - \frac{2158}{A}$ ✓

Case (2): SSD < L

$H_1 = 3.75\,ft = 1.2m$ H_1

$H_2 = 0.5\,ft = 0.15m$



$$L = \frac{AS^2}{200(\sqrt{H_1} + \sqrt{H_2})^2}$$

$L = \frac{AS^2}{440}$ (m)

$L = \frac{AS^2}{1329}$ (ft) ⇒ $\boxed{L = \frac{AS^2}{2158}}$ ✓✓

3.75 ft = 1.2m

1 ft = 0.32

$SSD = 1.47\,Vt + \frac{V^2}{30(f - G)}$ (ft) ⇒ or (من الجدول من خلال السرعة V)

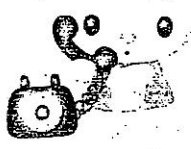
g_1 or g_2 لـ الميل الأكبر المستخدم

→ Passing sight distance:

$SP < L \Rightarrow L = \frac{ASP^2}{2800}$

$SP > L \Rightarrow L = 2SP - \frac{2800}{A}$

عند الحل نفرض أولاً أن (SSD < L)



Love is like a dying ember
only memories remain

Page
Date

Example:

A Vertical Curve Connecting two grades, upward grade 3% and down grade 4%. The station and elevation of PVC are (142+30) and 58 ft. respectively. If the Curve Passes through Point M that has station of (144+10) and elevation of 59.6 ft. Would Passing be allowed on this Curve if V0 = 60 mph?

Solution.

$\Rightarrow g_1 = 3\%$ & $g_2 = -4\%$

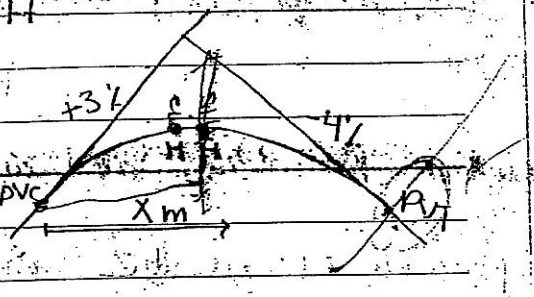
$\Rightarrow St(PVC) = (142+30)$ & $ELE(PVC) = 58$ ft

$\Rightarrow St(M) = (144+10)$ & $ELE(M) = 59.6$ ft

$A = +(g_1) - (+g_2)$

$\therefore A = 3+4 = 7\%$

$Xm = (144+10) - (142+30) = 180$ ft



$ELE\,M = ELE\,PVC + g_1 Xm - \frac{A Xm^2}{200L}$

$59.6 = 58 + \frac{3}{100}(180) - \frac{7(180)^2}{200L}$

$L = 298.4$ ft

assume S<L:

$L = 2S - \frac{1329}{A}$

$298.4 = 2S - \frac{1329}{7} \Rightarrow S = 244.1$ ft $\not< L$

assume S<L:

$L = \frac{AS^2}{1329} \Rightarrow 298.4 = \frac{7S^2}{1329} \Rightarrow S = 238$ ft $< L$

For the memories of yesterday,
For the happiness of today...

Page
Date

$= S = 238\ ft$

$$SSD = 1.47Vt + \frac{V^2}{30(f+G_1)}$$

$$238 = 1.47 \times V \times 2.5 + \frac{V^2}{30(0.3 - 0.04)}$$

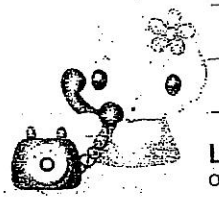
$$1856.4 = 28.67V + V^2 \Rightarrow V = 31\ mph$$

← أقصى سرعه لا تزيد من ٣١ ميل/ساعه
وبالتالي لن يسمح بمرور مركبات ذات سرعه أكبر من 31mph.
Passing not allowed.

Design of Sag Curve

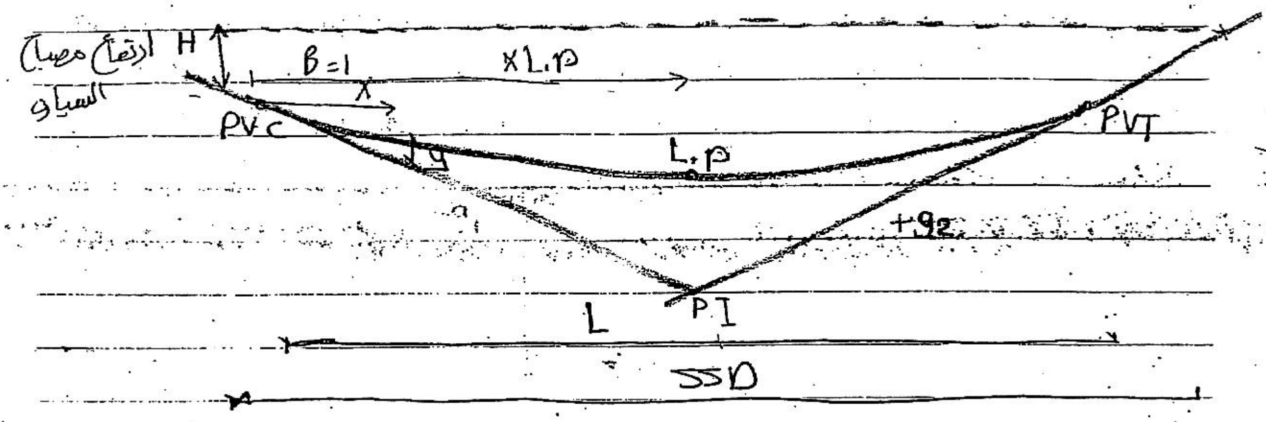
← لا توجد مشكله في مسافه الرؤيه في المنحنيات المقعره المشكله في عدم راحه الراكب حيث تضيق القوه الطارده منخفظ اضافه على العربه

Design Cretieria → SSD
- Comfortable
- aPPearance
- drainage



Love is like a dying ember
only memories remain

Page
Date



SSD $H = 2ft = 0.6m$

case① : SSD > L $\rightarrow y = \frac{AX^2}{200L}$

$L = 2SSD - \frac{400 + 3.5(SSD)}{A}$ (ft) → ft

L → ft, SSD → ft

$L = 2SSD - \left(\frac{120 + 3.5 SSD}{A}\right) \rightarrow (m)$

→ gives (St(PI), ele(PI))

$ele\ PVC = ele\ PI + g_1\left(\frac{L}{2}\right)$

$Ele\ PVT = Ele\ PI + g_2\left(\frac{L}{2}\right)$

Case② SSD < L

$L = \frac{A(SSD)^2}{400 + 3.5(SSD)}$ (ft)

L → ft, SSD → (ft)

$XL.P = \frac{g_1 L}{A}$

$L = \frac{A\ SSD^2}{120 + 3.5S}$ (m)

OR $L = KA$ بيعطيني الـ (K) من الـ (L) Curve لدوائر الجداول ندخل على السرعة المصممة ونحصل على (K)

For the memories of yesterday,
For the happiness of today...

Page
Date

Problem:

A Sag Vertical Curve joins -3% and +3% grades. If the PVI on the grade is at Station (435+50) and has an elevation of 235 ft. Determine the Station and elevation of PVC and PVT For a design speed of 70mph. Also Compute the elevation on the Curve at 100 ft intervals

Solution:

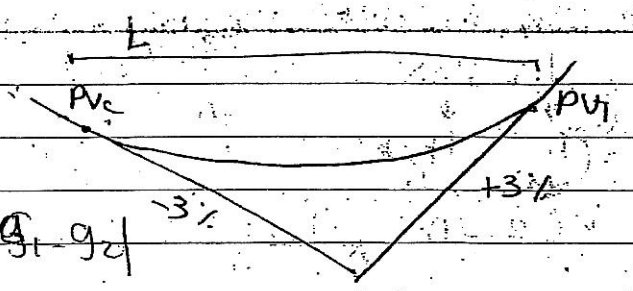
$g_1 = -3\%$, $g_2 = +3\%$

St (PVI) = (435+50) , Ele (PVI) = 235 ft

St PVC ?? , Ele PVC ??

St PVT ?? , Ele PVT ??

V = 70 mph , assume f = 0.3



length of Curve:

assume SSD = L

$A = 3 + 3 = 6\%$ $A = |g_1 - g_2|$

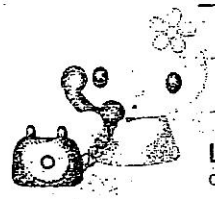
$SSD = 1.47 Vt + \frac{V^2}{30(f \pm G)}$ ⇒ OR ( )

$= 1.47 * 70 * 2.5 + \frac{70^2}{30(0.3 - 0.03)} = 862.2$ ft

$L = 2S \frac{400 + 3.5}{A}$

$= 2 * 862.2 \frac{400 + 3.5 * 862.2}{6} = 1154.8$ ft

L ≠ S



Love is like a dying ember
only memories remain

226.77

Page
Date

assume $S < L$

$$L = \frac{AS^2}{400 + 3.5S} = \frac{6 \times 862.2^2}{400 + 3.5 \times 862.2} = 1305 \text{ ft}$$

$S < L$

$L = 1305$ ft

St (PVC) = St PVI − L/2

$= (435 + 50) - (6 + 52.5) = (428 + 97.5)$

$$\text{Ele PVC} = \text{Ele PVI} + g_1 \frac{L}{2}$$

$$= 235 + \frac{3}{100} * \frac{1305}{2} = 254.58 \text{ ft}$$

St PVT = St PVI + L/2

$= (435 + 50) + (6 + 52.5) = (442 + 2.5)$

$$\text{Ele PVT} = \text{Ele PVI} + g_2 \frac{L}{2}$$

$$= 235 + \frac{3}{100}\left(\frac{1305}{2}\right) = 254.58 \text{ ft}$$

For the memories of yesterday,
For the happiness of today...