Short Span Bridge

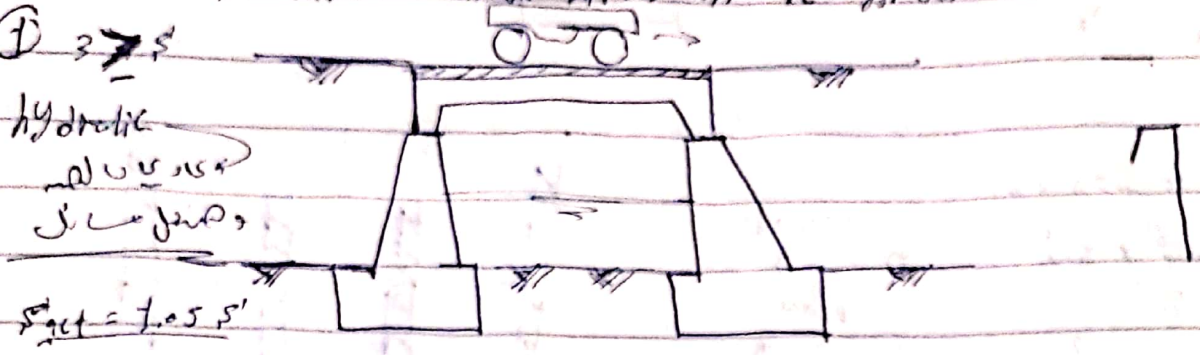
$S \leq 3m$ → Simple slab

$3 < S \leq 7$ → slab with main girder

$7 < S \leq 15$ → slab with main girder with X-girder

① $3 > S$

hydraulic



$S_{act} = S - 0.5$

Load

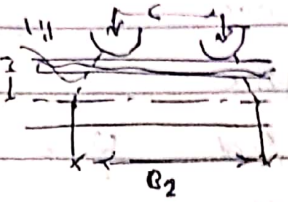
Designed strip

Dead load assm $t_s = 0.25$ $\gamma_c = 25$

$t_c = 0.25$ $\gamma_A = 2.2$ $w_{D.L} = \gamma_c t_c + \gamma_A \times t_c$ # $m_{D.L} = \frac{w_{D.L} \times S_{act}^2}{8}$ #

Live load Lorry Boden

$B_2 = 2b_2 + C + t_s + 2t_c$



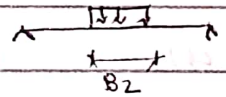
$B_3 = B_1 + 0.3 * S_{act}$

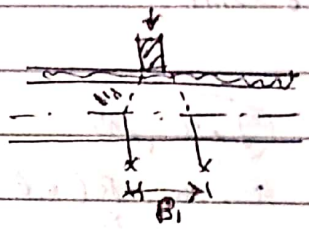
$B_1 = b_1 + t_s + 2t_c$

$I = 0.4 - 0.008 S_{act}$ #

$M_{LL} =$ =#

hydraulic

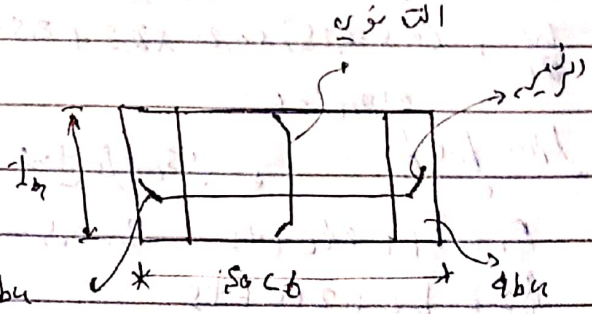




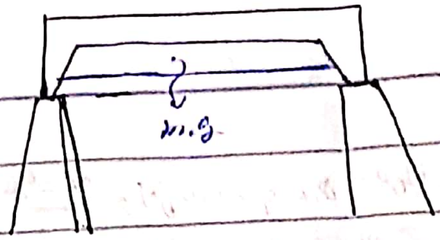
Shear $\frac{AB}{Ac} > 0.6$

$h_H = \frac{V^2}{2gC^2}\left[\left(\frac{A_c}{A_B}\right)^2 - 1\right]$

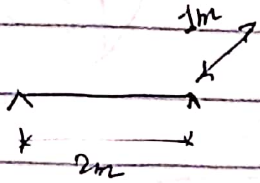
$S \leq 2$	0.72
$2 < S < 4$	0.82
$S > 4$	0.92



$\frac{L_2}{L_1} > 3$ → slab with m.g

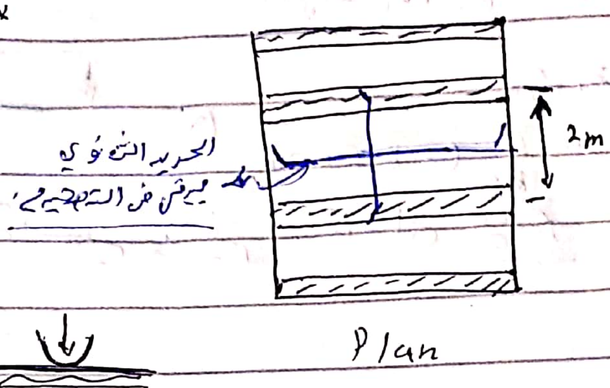


وانتا بتصمم البلاطة one way

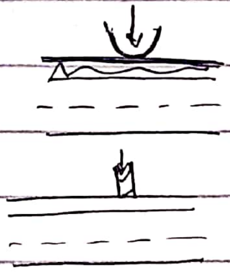


D.L $w_{D.L} = t_c \gamma_c + t_c \times \gamma_A$

$M_{D.L} = \frac{w_{D.L} \times 2^2}{8}$



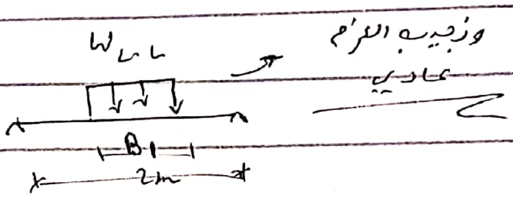
Live load ⇒ لا يظهر الا عجلة واحدة



$B_2 = b_2 + t_s + 2t_c$

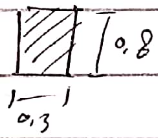
$B_1 = b_1 + t_s + 2t_c$

$B_3 = B_2 + 0.3 \times 2$

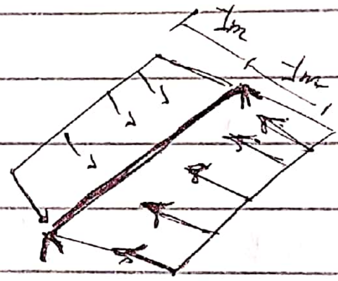


$I = 0.4 - 0.008\, S_{ac}$ → 2m $M_{L.L}$ = = #

* Design m.g   assum B



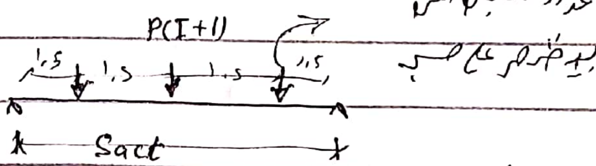
$W_{D.L} = \frac{O.W}{Beam} + \{$ البلاطة اللي شايلها على الكمرة $\}$



$W_{D.L} = (0.8-0.25) \times 0.3 \times 25 + t_s \times \gamma_c \times 2 + t_c \times \gamma_A \times 2 = \#$

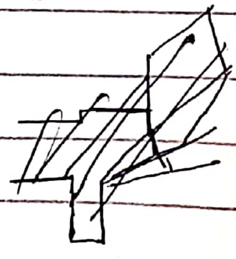
$M_{D.L} = \frac{W_{D.L} \times S_{ac}^2}{8}$ → مش 2 متر / عرض الـ span الكمرة

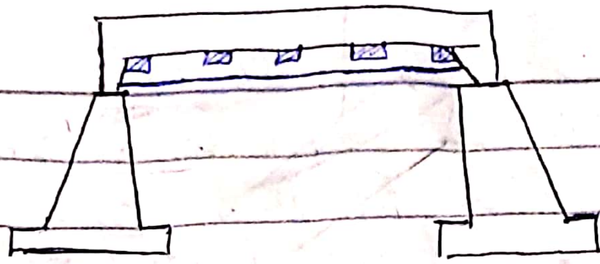
Live load Lorry 60 ton



• ونجيبه دلوقتي عادي قالعم

• هنشيل الكمرة الحالية





X - g → 25 cm ts

① تصميم البلاطة باتجاهين

assum 2m ↔ 2m

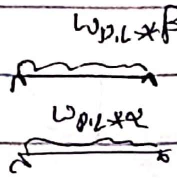
Dead load

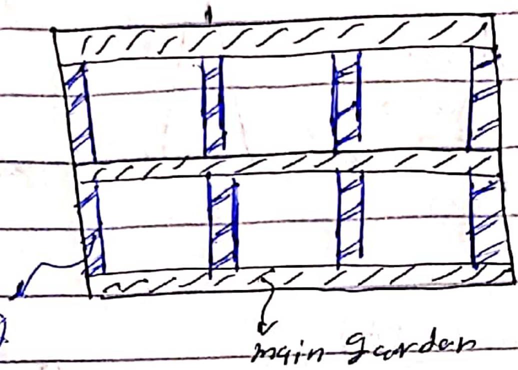
$\beta = \alpha = 0.5$

$W_{D.L} = 2.5 \times 0.25 + 2.2 \times 0.2$

$M_\beta = \frac{W_{D.L} \alpha \beta \times S_{ac}^2}{8}$

$M_\alpha = \frac{W_{D.L} \alpha \alpha \times S_{ac}^2}{8}$





Live Load يعطى الاحمال Emp19

$B_2 = b_2 + t_s + 2t_c$

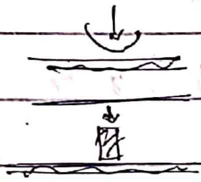
$B_4 = B_2 + 0.3 \times S_{ac}$

$B_1 = b_1 + t_s + 2t_c$

$B_3 = B_1 + 0.3 \times S_{act}$

$I = 0.4 - 0.008 \times S_{act}$

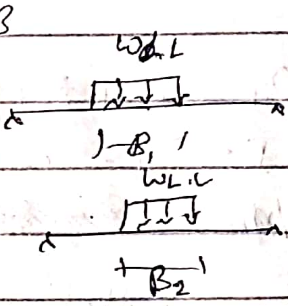
$W_{L.L} = \frac{P(1+I)}{B_3 \times B_4}$



ملحوظة: تم التوضيح في B_1 و B_2 لانه يوجد حديد ثانوي في الاتجاهين

→ نضرب β

ونعيد العزوم

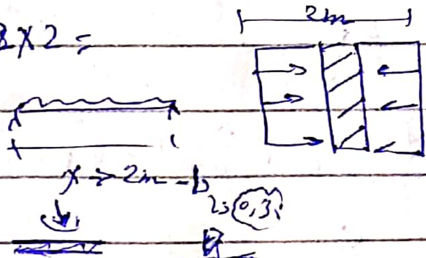


② → تصميم g-x

Dead load assum B (0.6 x 0.25)

$W_{D.L} = (0.6 - 0.25) \times 0.25 \times 2.5 + 2.5 \times 0.25 \times 2 + 0.2 \times 2.2 \times 2 =$

$M_{D.L} = wl^2$



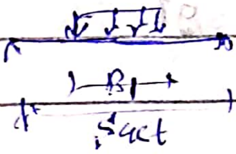
Live load نحسب على الحيد

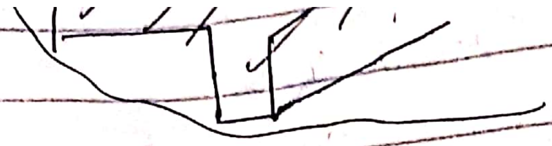
$B_1 = b_1 + 2t_c + t_s$ $I = 0.4 - 0.008 S$

$B_2 = b_2 + 2t_c + t_s$

$W_{L.L} = \frac{P \times (1+I)}{B_1 \times B_2}$

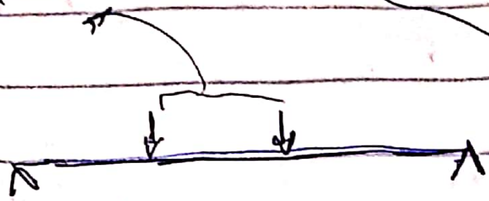
ونعيد العزوم





$X-g$ وأنا بحسب $D.L$ بيقى اللي جاي من $D.L$

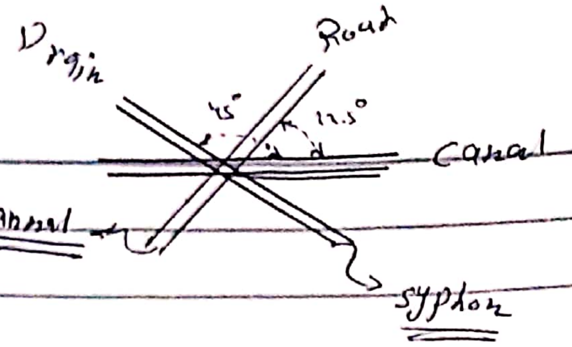
وأنا بحسب $L.L$ بيقى اللي جاي من $L.L$



→ $m.g$

assum $\beta_{m.g}$ (0,8 & 0,3)

ونحسب Σ سقف ونطلع R على $X-g$



Jurad 2017 Q1

① up < 10 cm S_{clean}

$A = by + ty^2 =$ ~~2x2.25 + 1x2.25~~ =

$= 2 \times 2.25 + 1 \times 2.25^2 = 9.5625\ m^2$

$V_C = \frac{5}{9.5625} = 0.522\ m/s$ assum $V_V = 2.5\ V_C = 1.3\ m/s$

$A_B = \frac{Q}{V_V} = \frac{5}{1.3} = 3.85\ m^2$

assum $n = 1$ $H = 2.25$ $S' = ??$

$3.85 = 1 \times 2.25 \times S'$ $S' = 1.7\ m$

ch

$\frac{A_B}{A_C} = \frac{3.85}{9.5625} = 0.4 < 0.6$ (No)

assum $A_B = 0.6\ A_C = 0.6 \times 9.5625 = 5.73\ m^2$

assum $n = 1$ $H = 2.25$ $S' = ??$

$5.73 = 1 \times 2.25 \times S'$ $S = 2.55\ m$

$S_{cl} = \frac{2.55}{\sin(22.5)} = 6.66\ m \rightarrow$ slab with main garder

$h_L = \frac{V^2}{2gC}\{(\frac{A_C}{A_B})^2 - 1\} = \frac{1.3^2}{2 \times 9.81 \times 0.92^2}\{(\frac{9.5625}{5.73})^2 - 1\} = 0.18 < 0.2$ O.K

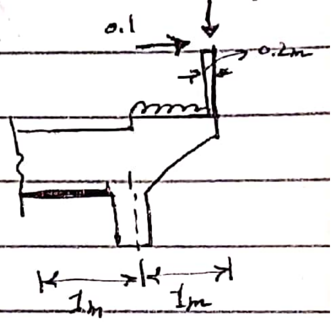
C → 0.92

② ~~$S_{m.g} = 2m$, $t_c = 0.20m$ $t_s = 0.25m$,~~ Design B_1 $W_{shorder} = 0.5\ t/m^2$

Dead load assum B (0.8 x 0.3)

$W_{D.L} = (0.8 - 0.25) \times 0.3 \times 2.5 + 0.25 \times 2.5 \times 2 + 0.2 \times 2.2 \times 2 = 2.54\ \frac{t}{m}$

$M_{D.L} = \frac{W_{D.L} \times S_{ac}^2}{8} = \frac{2.54 \times 6.99^2}{8} = 15.51\ t.m$



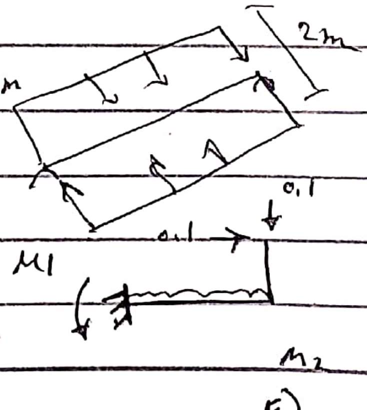
Torsion moment #

$M_1 = 0.1 \times 1 + 0.1 \times 1 + 0.2 \times 2.5 \times 1 \times 0.5 + 0.25 \times 2.5 \times 1 \times 0.5$

$+ 0.5 \times 1 \times 2.2 \times 0.2 + 1 \times 0.5 \times 0.5 = 1.2325\ t.m$

$M_2 = 0.25 \times 2.5 \times 1 \times 0.5 + 1 \times 0.5 \times 1 + 2.2 \times 0.2 \times 1 \times 0.5 = 1.03\ t.m$

$M_T = M_1 - M_2 = 1.2325 - 1.03 = 0.2\ t.m$



$6.66 \times 1.05 = 6.99$

$= \frac{0.2 \times 6.66}{2}$