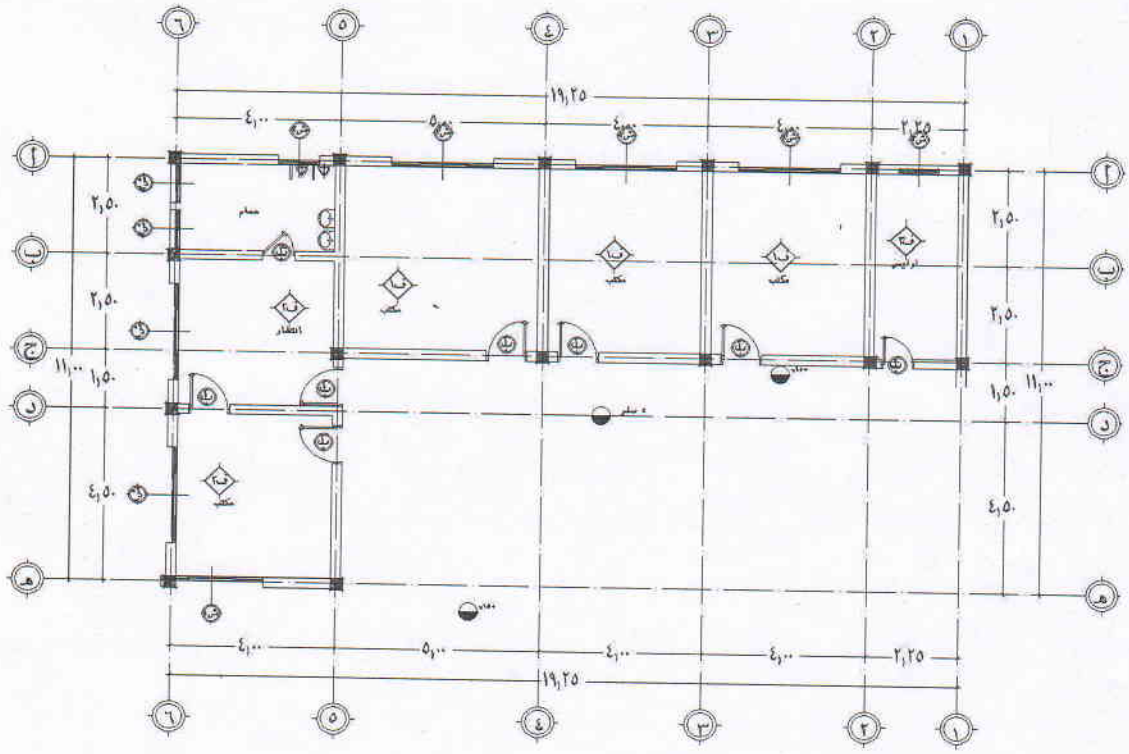
REINFORCED CONCRETE I

EXAMLLE 1 :



-Live Load = 200 kg/m2

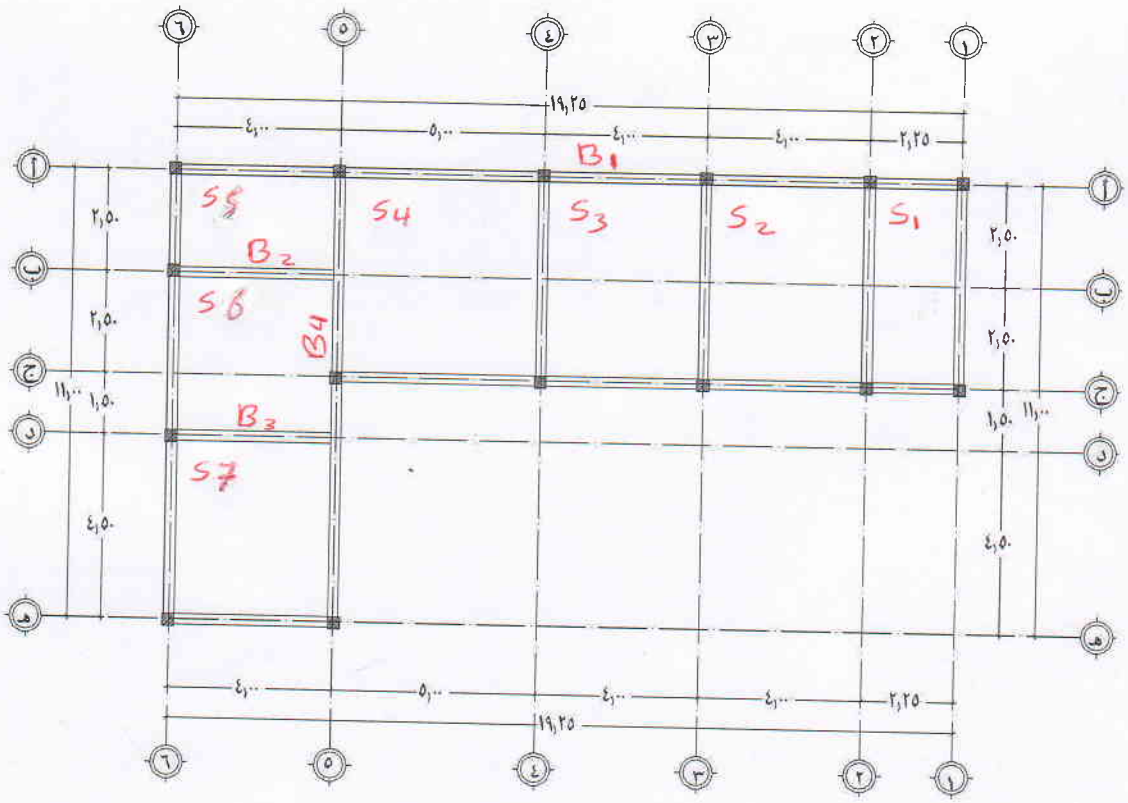
-Flooring = 150 kg/m2

-Specific weigh of wall = 1.8 t/m3

- Floor Height = 3.50 m

-It is required to find the loads acting on the beam B1,B2,B3,B4.

-STATICAL SYSTEAM :



$$\Rightarrow r_1 = \frac{L_1}{L_2} = \frac{5}{2.25} = 2.22 \Rightarrow \text{oneway} > 2$$

$$\Rightarrow r_2 = \frac{5}{4} = 1.25 < 2 \Rightarrow \text{Two way}$$

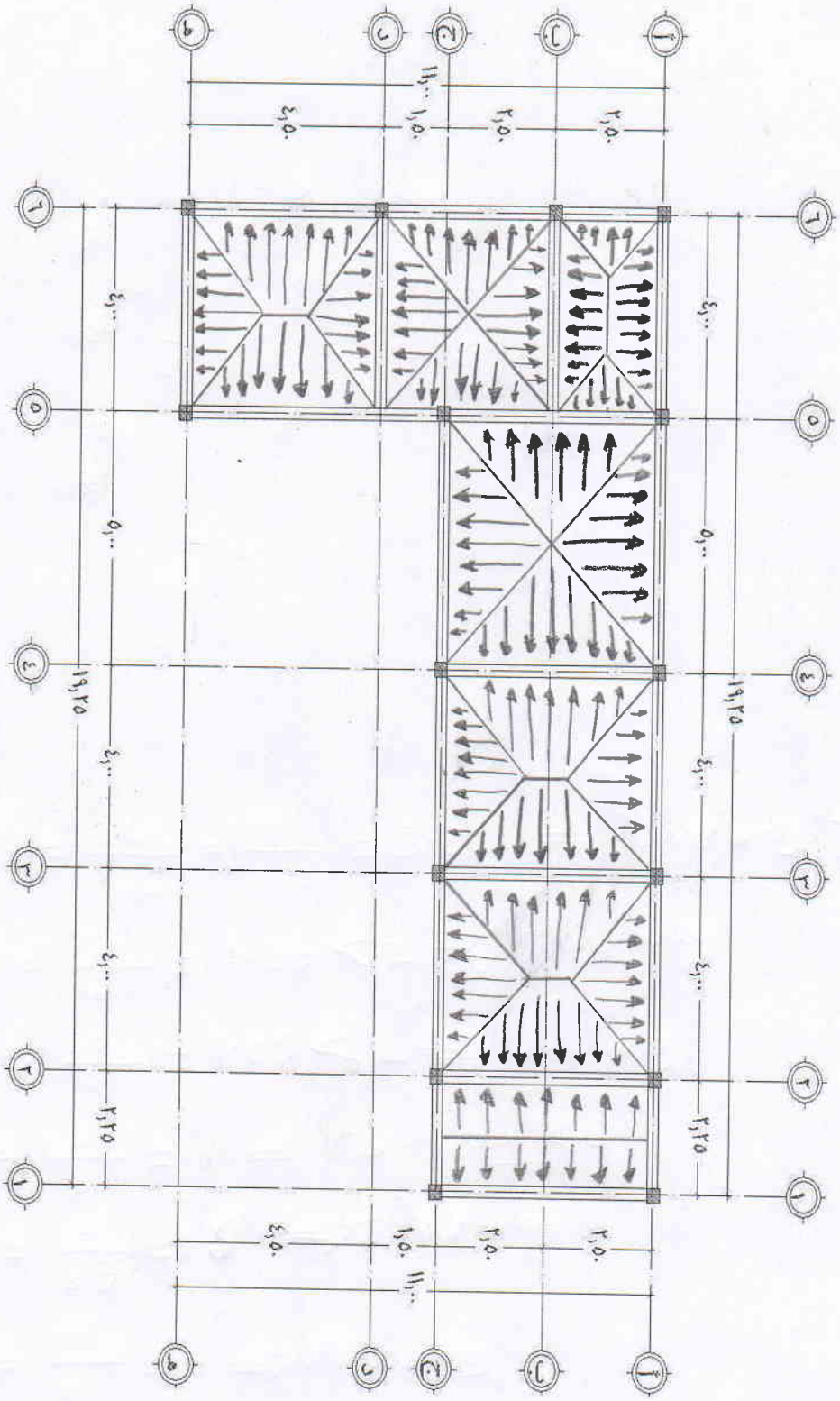
$$\Rightarrow r_3 = \frac{5}{4} = 1.25 < 2 \Rightarrow \text{Two way}$$

$$\Rightarrow r_4 = \frac{5}{5} = 1 \Rightarrow \text{two way} < 2$$

$$\Rightarrow r_5 = \frac{4}{2.5} = 1.6 \Rightarrow \text{two way}$$

$$\Rightarrow r_6 = \frac{4}{4} = 1 \Rightarrow \text{two way}$$

$$\Rightarrow r_7 = \frac{4.5}{4} = 1.125 < 2 \Rightarrow \text{two way}$$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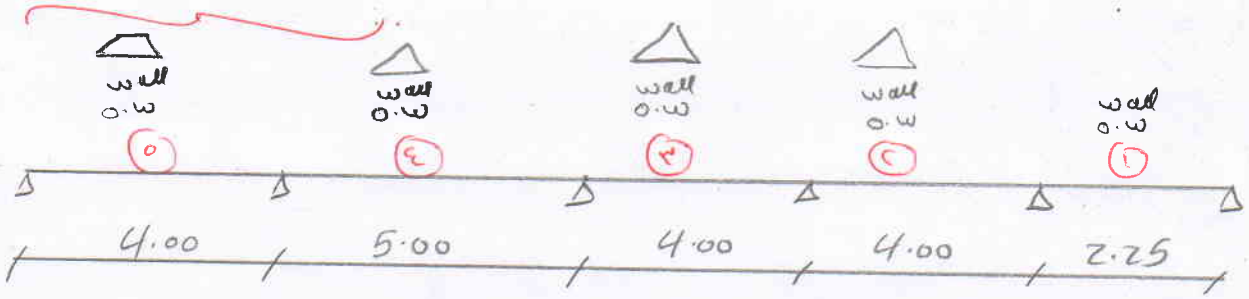
* Loads For B_1 :-

* For moment :-



⇒ Assume that slab thickness is equal = 15 cm

⇒ Assume that the thickness of the beam in The range of (span / lo)

Take Beam = (25 X 60) cm

⇒ w_{u1}

كثافة الخرسانة

$$g_{b_1} = o.w + wall = b * t * \gamma_c + bw * hw * \gamma_w$$

$$g_{b1} = 0.25 * 0.6 * 2.5 + 0.25 * (3.5 - 0.6) * 1.8$$

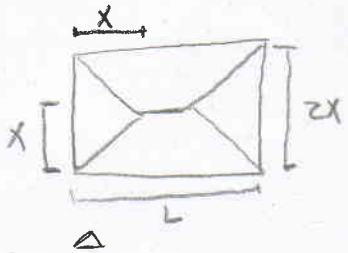
$$g_{b_1}^{(D.L)} = 1.68 \ t/m'$$

$$P_{b_1}^{(L.L)} = \text{Zero}$$

$$w_u = 1.5 (D.L + L.L) = 1.5(1.68 + 0)$$
$$= 2.52 \ t/m'$$

⇒ wu_2

$$gb_2 = \text{o.w} + \text{wall} + \triangle = \overbrace{b * t * \gamma_c}^{\text{o.w}} + \overbrace{bw * hw * \gamma_w}^{\text{wall}} * \alpha * X * ws$$



$$\Rightarrow ws_1 = 0.15 * 2.5 + 0.15 = 0.525\ t/m^2$$

(0.15 ↗ Flooring)

$$gb_2 = 0.25 * 0.6 * 2.5 + 0.25 * (3.5 - 0.6) * 1.8 + 0.667 * 2 * 0.525$$

$$gb_2 = 2.38\ t/m^2$$

$$pb_2 = \triangle = \alpha * LL * X = 0.667 * 0.2 * 2$$

$$pb_2 = 0.2668\ t/m^1$$

$$wu_2 = 1.5\,(gb_2 + pb_2) = 1.5(2.38 + 0.2668)$$

$$wu_2 = 3.97\ t/m^1$$

⇒ wu_3

$$gb_3 = \text{o.w} + \text{wall} + \triangle$$

$$gb_3 = 0.25 * 0.6 * 2.5 + 0.25 * (3.6 - 0.6) * 1.8 + 0.667 * 2 * 0.525$$

$$gb_3 = 2.38\ t/m^2$$

$$pb_3 = \triangle = \alpha * LL * X = 0.667 * 0.2 * 2$$

$$pb_3 = 0.2668\ t/m^1$$

$$wu_3 = 1.5\,(0.2668 + 2.38) = 3.97\ t/m^1$$

⇒ w_{u4}

$$gb_4 = 0.w + wall + \triangle$$

$$gb_4 = 0.25*0.6*2.5 + 0.25*(3.5-0.6)*1.8 + 0.667*2.5*0.525$$

$$gb_4 = 2.55\ t/m^2$$

$$Pb_4 = 0.667*2.5*0.2 = 0.3335\ t/m^2$$

$$w_{u4} = 1.5(2.55 + 0.3335) = 4.325\ t/m'$$

⇒ w_{u5}

$$gb_5 = 0.w + wall + \text{trapezoid}$$

$L/L_x = \frac{4}{2.5} = 1.6 \rightarrow \alpha = 0.870,\ \beta = 0.688$

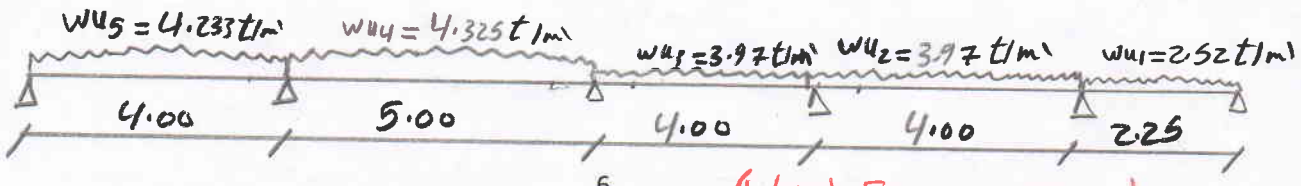
$$gb_5 = 0.25*0.6*2.5 + 0.25*(3.5-0.6)*1.8 + 0.87*\frac{2.5}{2}*0.525$$

$$gb_5 = 2.251\ t/m^2$$

$$Pb_5 = \text{trapezoid} = \alpha*L.L*X = 0.87*0.2*\frac{2.5}{2}$$

$$Pb_5 = 0.571\ t/m^2$$

$$w_{u5} = 1.5(2.251 + 0.571) = 4.233\ t/m'$$



(Load For moment B_1)

* Load For shear B1 :

⇒ w_{u_1}

$$g_{S_1} = o.w + wall = 0.25 * 0.6 * 2.5 + 0.25 * (3.5 - 0.6) * 1.8$$

$$g_{S_1} = 1.68\ t/m'$$

$$_{L.L}P_{S_1} = zero$$

$$w_{u_1} = 1.5\,(g_{S_1} + P_{S_1}) = 1.5\,(1.68 + 0)$$

$$w_{u_1} = 2.52\ t/m'$$

⇒ w_{u_2}

$$g_{S_2} = o.w + wall + \Delta = b * t * \gamma_c + b_w * h_w * \gamma_w + \underbrace{B * X * w_s}_{\Delta shear}$$

$$g_{S_2} = \underbrace{0.25 * 0.6 * 2.5}_{0.375} + \underbrace{0.25 * (3.5 - 0.6) * 1.8}_{1.305} + 0.5 * 2 * 0.525$$

$$g_{S_2} = 2.205\ t/m^2$$

$$P_{S_2} = \Delta = B * X * L.L = 0.5 * 2 * 0.2 = 0.2\ t/m^2$$

$$w_{u_2} = 1.5\,(g_{S_2} + P_{S_2}) = 1.5\,(2.205 + 0.2)$$

$$w_{u_2} = 3.6075\ t/m'$$

⇒ W_{u_3}

$g_{s_3} = o.w + wall + \triangle$

$g_{s_3} = 0.25 * 0.6 * 2.5 + 0.25 * (3.6 - 0.6) * 1.8 + 0.5 * 2 * 0.525$

$g_{s_3} = 2.205\ t/m^2$

$P_{s_3} = \triangle = B * X * 1.1 = 0.5 * 2 * 0.2 = 0.2\ t/m^2$

$w_{u_3} = 1.5\ (2.205 + 0.2) = 3.607\ t/m$

⇒ W_{u4}

$g_{s4} = o.w + wall + \triangle$

$g_{s4} = 0.25 * 0.6 * 2.5 + 0.25 * (3.5 - 0.6) * 1.8 + 0.5 * 2.5 * 0.525$

(B, X, w_s)

$g_{s4} = 2.336\ t/m^2$

$P_{s4} = \triangle = B * X * LL = 0.5 * 2.5 * 0.2$

$P_{s4} = 0.25\ t/m^2$

$w_u = 1.5\ (2.336 + 0.25) = 3.879\ t/m$

⇒ Wu_5

$q_{s_5} = 0.w + wall +$  $q = 0.87$, $\beta = 0.688$

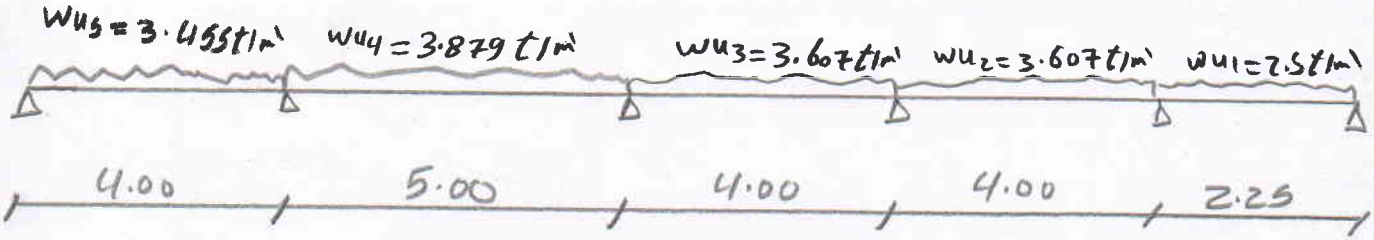
$q_{s_5} = 0.375 + 1.305 + 0.688 * \frac{2.50}{2} * 0.525$

$q_{s_5} = 2.1315\ t/m^2$

$P_{s_5} =$  $= \beta * l.l * X = 0.688 * 0.2 * 1.25$

$P_{s_5} = 0.172\ t/m^2$

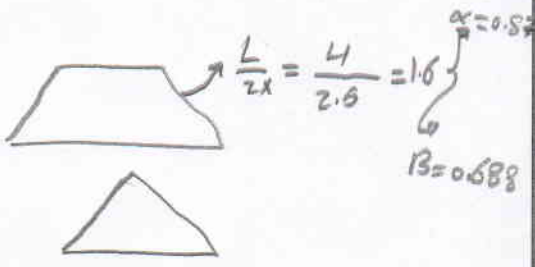
$Wu_5 = 1.5\ (0.172 + 2.1315) = 3.455\ t/m'$

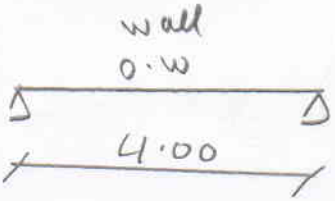


(Load For shear ⇒ B1)

* Load For B_2 :.

* For moment :.





$$gb_1 = 0.w + wall + \triangle + \trapezoid$$

$$gb_1 = b*t*\gamma_c + b_w*h_w*\gamma_w + \alpha*X*w_s + \alpha*X*w_s$$

$$gb_1 = 0.25*0.6*2.5 + 0.25*(3.5-0.6)*1.8 + 0.867*2*0.525 + 0.87*1.25*0.525$$

$$gb_1 = 2.951\ t/m^2$$

$$Pb_1 = \triangle + \trapezoid = \alpha*X*1.L + \alpha*X*1.L$$

$$Pb_1 = 0.867*2*0.2 + 0.87*1.25*0.2$$

$$Pb_1 = 0.4843\ t/m^2$$

$$wu_1 = 1.5(2.951 + 0.4843) = 5.153\ t/m'$$

* For shear :.

$$gs_1 = 0.w + wall + \triangle + \trapezoid$$

$$gs_1 = 0.375 + 1.305 + 0.5*B*2*X*0.525 + 0.688*1.25*0.525$$

$$gs_1 = 2.6565\ t/m^2$$

$$Ps_1 = \triangle + \trapezoid = 0.5*2*0.2 + 0.688*1.2*0.2$$

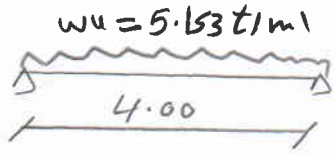
$$Ps_1 = 0.365\ t/m^2$$

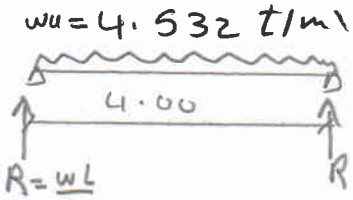
$$wu_1 = 1.5(0.365 + 2.6565) = 4.532\ t/m'$$

* B_2 :

Load For moment

Load For Shear



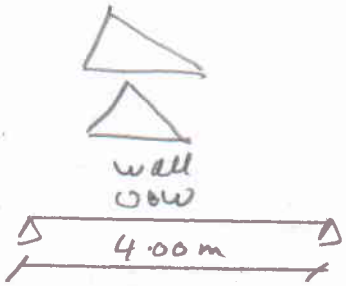


$= \frac{4.532 * 4}{2}$

$= 9.064\ t$

* Load For B_3 :

* For moment :



$$96_1 = O.W + wall + \triangle + \triangle$$

$$96_1 = 0.375 + 1.305 + \alpha * X * ws + \alpha * X * ws$$

$$96_1 = 0.375 + 1.305 + 0.667 * 2 * 0.525 + 0.667 * 2 * 0.525$$

$$96_1 = 3.08\ t/m^2$$

$$P_{b1} = \triangle + \triangle = \alpha * X * LL + \alpha * X * LL = 2 * 0.667 * 2 * 0.2$$

$$P_{b1} = 0.5336\ t/m2$$

$$w_{u1} = 1.5\ (3.08 + 0.5336) = 5.42\ t/m\backslash$$

* For shear :

$g_{S1} = o.w + wall + \triangle + \triangle$

$g_{S1} = 0.375 + 1.305 + B*X*w_S + B*X*w_S$

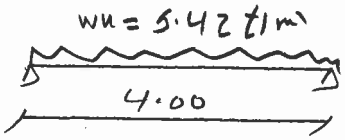
$g_{S1} = 0.375 + 1.305 + 0.5*2*0.525*2$

$g_{S1} = 2.73\ t/m^2$

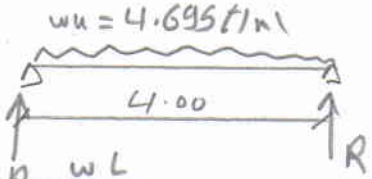
$P_{S1} = \triangle + \triangle = 2*0.5*2*0.2 = 0.4\ t/m^2$

$W_u = 1.5\,(0.4 + 2.73) = 4.695\ t/m$

⇒ For moment



* For shear



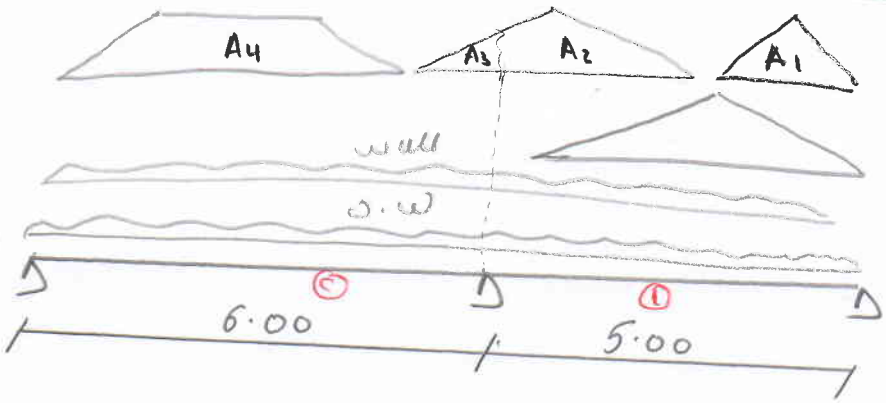
$R = \frac{wL}{2}$

$= \frac{4.695*4}{2}$

$= 9.39\ t$

* For B4 :

* For moment :



$A_1 = \frac{2.5 * 1.25}{2} = 1.5625\ m^2$

$A_2 = \frac{4 * 2}{2} - \frac{1.5 * 1.5}{2} = 2.875\ m^2$

$A_3 = \frac{1.5 * 1.5}{2} = 1.125\ m^2$

$A_{4'} = \frac{(4.5 + 0.5)}{2} * 2 = 5\ m^2$

$96_1 = o.w + wall +$ 

$96_1 = 6 * t * \gamma_c + b_w * h_w * \gamma_w + \alpha * X * w_s$

$96_1 = 0.25 * 0.6 * 2.5 + 0.75\ (3.5 - 0.8) * 1.8 + 0.667 * 2.5 * 0.525$

$96_1 = 2.55\ t/m^2$

$Pb_1 =$  $= \alpha * 1.1 * X = 0.667 * 2.5 * 0.2$

$Pb_1 = 0.3335\ t/m^2$

$w_{u_1} = 1.5\ (0.3335 + 2.55) = 4.32\ t/m$

$96_{A_{11}} = \frac{ws * \text{Area loaded}_1}{\text{Loaded length}_1} = \frac{0.525 * 1.5625}{2.5} = 0.328\ t/m^2$

$$P_{bA11} = \frac{\text{LL} * \text{Area loaded}}{\text{Loaded Length}} = \frac{0.2 * 1.5625}{2.5} = 0.125\ t/m^2$$

$$w_{uA11} = 1.5\ (0.328 + 0.125) = \boxed{0.6795\ t/m^2}$$

$$g_{bA22} = \frac{0.525 * 2.875}{2.5} = 0.603\ t/m^2$$

$$P_{bA22} = \frac{0.2 * 2.875}{2.5} = 0.23\ t/m^2$$

$$w_{uA22} = 1.5\ (0.603 + 0.23) = \boxed{1.2495\ t/m^2}$$

$$g_{bz} = 0.w + \text{wall} = 0.375 + 1.305 = 1.68\ t/m^2$$

$$P_{bz} = 0$$

$$w_{uz} = 1.5\ (1.68 + 0) = 2.52\ t/m^2$$

$$g_{bA33} = \frac{0.525 * 1.125}{1.5} = 0.393\ t/m^2$$

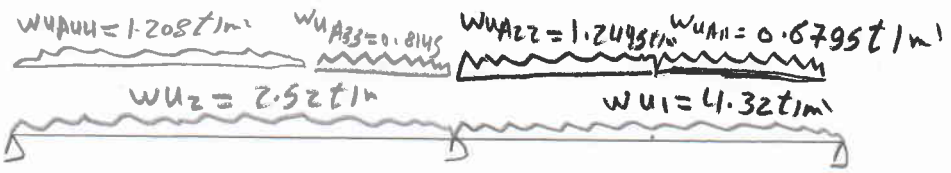
$$P_{bA33} = \frac{0.2 * 1.125}{1.5} = 0.15\ t/m^2$$

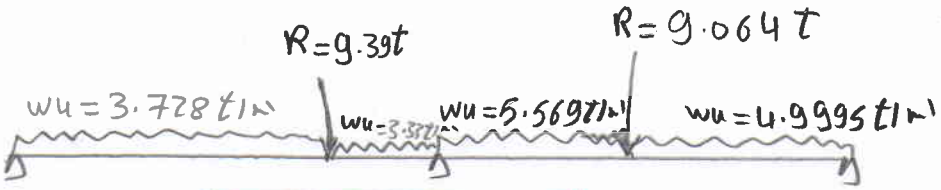
$$w_{uA33} = 1.5\ (0.15 + 0.393) = 0.8145\ t/m^2$$

$$g_{bA44} = \frac{0.525 * 5}{4.5} = 0.583\ t/m^2$$

$$P_{bA44} = \frac{0.2 * 5}{4.5} = 0.22\ t/m^2$$

$$w_{uA44} = 1.5\ (0.22 + 0.583) = 1.208\ t/m^2$$





For moment

* For shear :

$$96_1 = 0.w + wall + \triangle = 0.375 + 1.305 + 0.5 * 2.5 * 0.525$$

$$96_1 = 2.336\ t/m^2$$

$$P_{b1} = \triangle = 0.5 * 0.2 * 2.5 = 0.25\ t/m^2$$

$$w_{u1} = 1.5\,(0.25 + 7.336) = 3.879\ t/m'$$

$$w_{uA11} = 0.6795\ t/m'$$

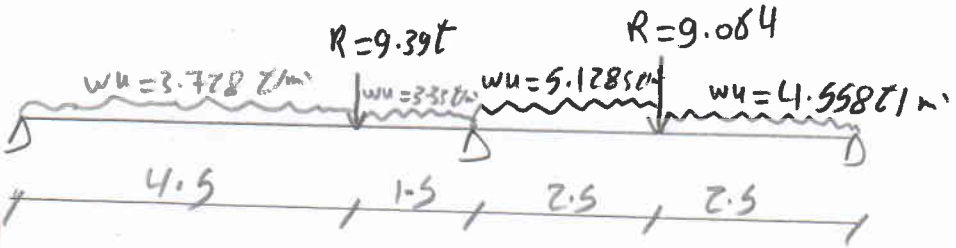
يتغير

$$w_{uA22} = 1.2495\ t/m'$$

$$w_{uA33} = 0.8145\ t/m'$$

$$w_{uA44} = 1.208\ t/m'$$

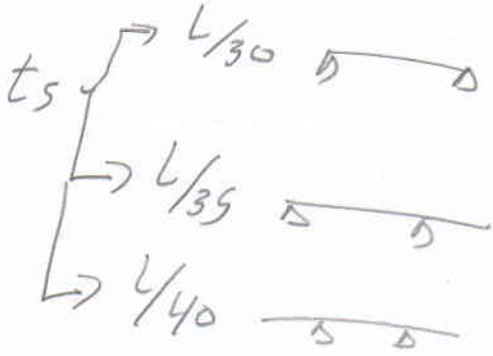
$$w_{u2} = 2.52\ t/m'$$



For shear

* ملاحظات :-

⇒ one way



⇒ في البلاطه الكابوليه

$$t_s = \frac{L \rightarrow \text{smaller}}{10}$$

⇒ $w_u = 1.5(L.L + D.L)$

$L.L < 0.75 D.L$

⇒ $w_u = 1.4 D.L + 1.6 L.L$

$L.L > 0.75 D.L$

$w_s = t_s * \gamma_c + \text{Flooring}$ (كثافة الخرسانة)

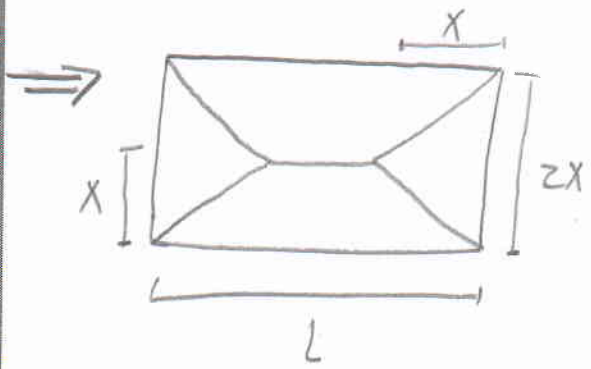
$1\ ton = 10\ KN$

⇒ $\alpha = 0.667$, $\beta = 0.5$

⇒ $\alpha = \beta = 1$

⇒ $r = \frac{L}{2X} \Rightarrow \alpha, \beta$

⇒



⇒ two way