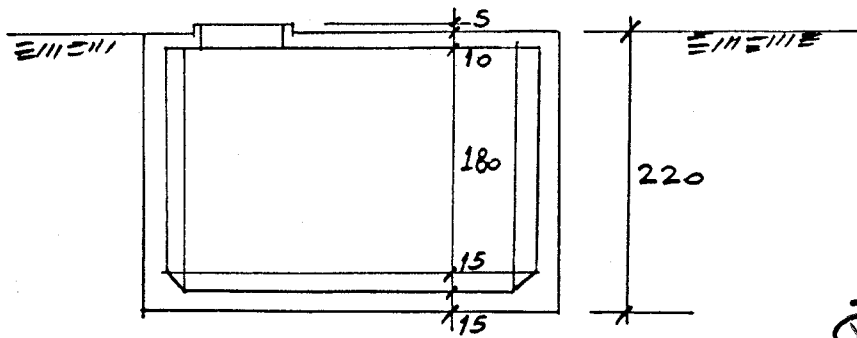


"RESERVATÓRIO ENTERRADO"

Corte A-A



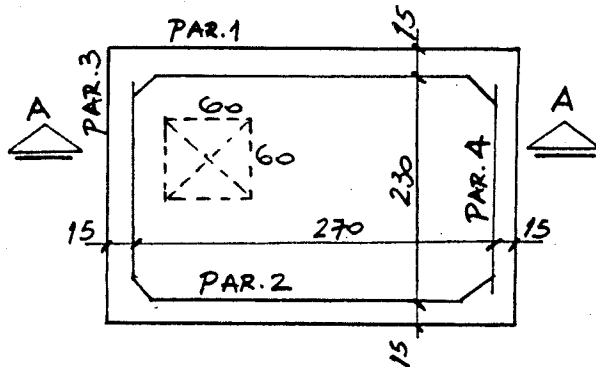
$$\gamma_s = 18 \text{ KN/m}^3$$

$$K_s = 0,33$$

$$\bar{\sigma}_s = 0,06 \text{ MPa}$$

$$\bar{\sigma}_s = 0,6 \text{ Kg/cm}^2$$

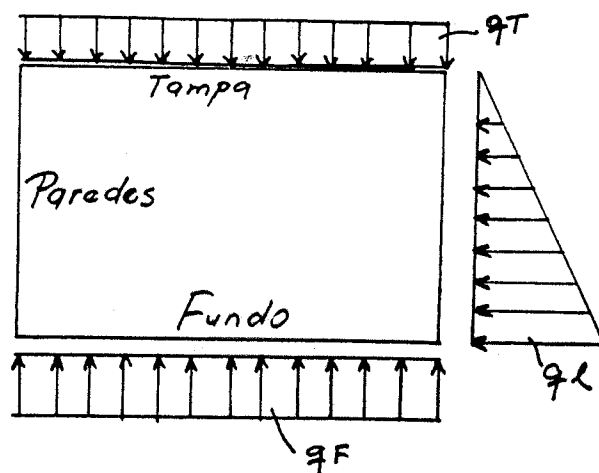
Planta



Medidas em cm.

1ª SITUAÇÃO DE CÁLCULO - CAIXA VAZIA.

- CARREGAMENTOS - ESQUEMA DE CARGAS



- TAMPA : Peso próprio $q = 0,10 \cdot 25 = 2,5 \text{ KN/m}^2$

Sobrecarga $p = 1,0 \text{ KN/m}^2$

TOTAL $q_T = 3,5 \text{ KN/m}^2$

- PAREDES : Empuxo solo $q_l = \gamma_s \cdot K \cdot h = 18 \times 0,33 \times 2,20 =$

$q_l = 13,07 \text{ KN/m}^2$

- FUNDO :

TAMPA $P_T = q_T \times A_T = 3,5 \times 2,70 \times 2,30 = 21,74 \text{ KN}$

PAREDES $P_P = h \times e \times L_{PAR} \times \gamma_c = 2,20 \times 0,15 \times (2 \times 3,0 + 2 \times 2,30) \times 25$

$P_P = 87,45 \text{ KN}$

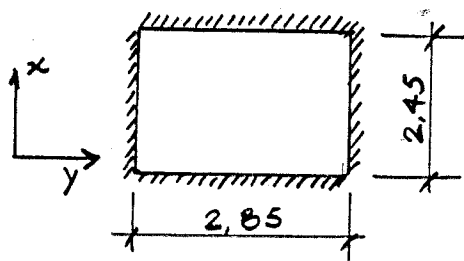
$\Sigma P = P_T + P_P = 21,74 + 87,45 = 109,19 \text{ KN}$

CARGA NO FUNDO $q_F = \frac{\Sigma P}{A_F} = \frac{109,19}{3,0 \times 2,60} = 14,0 \text{ KN/m}^2$

- REAÇÃO NO SOLO : $q_s = q_F + \gamma_c \times h_F = 14,0 + 25 \times 0,15 = 17,75 \text{ KN/m}^2$

- ESFORÇOS NOS ELEMENTOS ESTRUTURAIS . $\leq \bar{\sigma}_s$

LAJE DE FUNDO



$q_F = 14,0 \text{ KN/m}^2$

TAB 2.5 C TIPO 6

$\lambda = \frac{l_y}{l_x} = \frac{2,85}{2,45} \approx 1,15$

$M_x = 2,65$

$m_x = 2,65 \times \frac{14,0 \times 2,45^2}{100} = 2,23 \text{ KN.m/m}$

$M'_x = 6,14$

$m'_x = 6,14 \times 0,84 = 5,16 \text{ KN.m/m}$

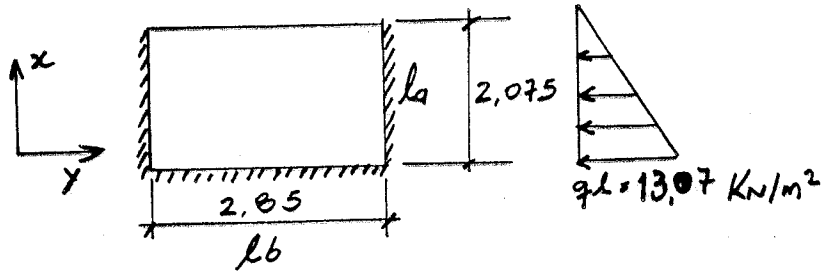
$M_y = 1,94$

$m_y = 1,94 \times 0,84 = 1,63 \text{ KN.m/m}$

$M'_y = 5,51$

$m'_y = 5,51 \times 0,84 = 4,63 \text{ KN.m/m}$

PAR. 1 = PAR. 2



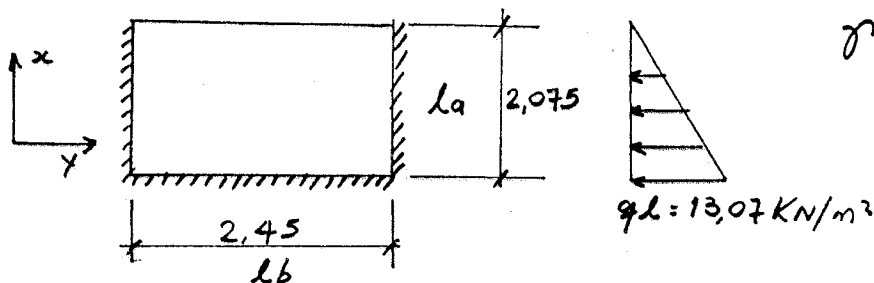
TAB. 2.6b TIPO 16

$$\gamma = \frac{l_a}{l_b} = \frac{2.075}{2.85}$$

$$\gamma \approx 0.75$$

$$\begin{aligned} M_x &= 1.75 & m_x &= 1.75 \times \frac{13.07 \times 2.075^2}{100} = 0.98 \text{ KN.m/m} \\ M'_x &= 4.75 & m'_x &= 4.75 \times 0.56 = 2.67 \text{ KN.m/m} \\ M_y &= 1.21 & m_y &= 1.21 \times 0.56 = 0.68 \text{ KN.m/m} \\ M'_y &= 3.38 & m'_y &= 3.38 \times 0.56 = 1.90 \text{ KN.m/m} \end{aligned}$$

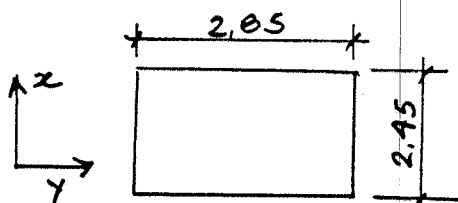
PAR. 3 = PAR. 4



$$\gamma \approx 0.85$$

$$\begin{aligned} M_x &= 1.45 & m_x &= 1.45 \times \frac{13.07 \times 2.075^2}{100} = 0.82 \text{ KN.m/m} \\ M'_x &= 4.17 & m'_x &= 4.17 \times 0.56 = 2.35 \text{ KN.m/m} \\ M_y &= 1.24 & m_y &= 1.24 \times 0.56 = 0.70 \text{ KN.m/m} \\ M'_y &= 3.17 & m'_y &= 3.17 \times 0.56 = 1.78 \text{ KN.m/m} \end{aligned}$$

- TAMPA



TAB. 2.5a TIPO 1

$$\lambda \approx 1.15$$

$$q_T = 3.5 \text{ KN/m}^2$$

$$\begin{aligned} M_x &= 5.35 & m_x &= 5.35 \times \frac{3.5 \times 2.45^2}{100} = 1.12 \text{ KN.m/m} \\ M_y &= 4.25 & m_y &= 4.25 \times 0.21 = 0.89 \text{ KN.m/m} \end{aligned}$$

OBSERVAÇÃO: Não faremos a compensação e a correção dos momentos, pois, os momentos resultarão em armadura mínima.

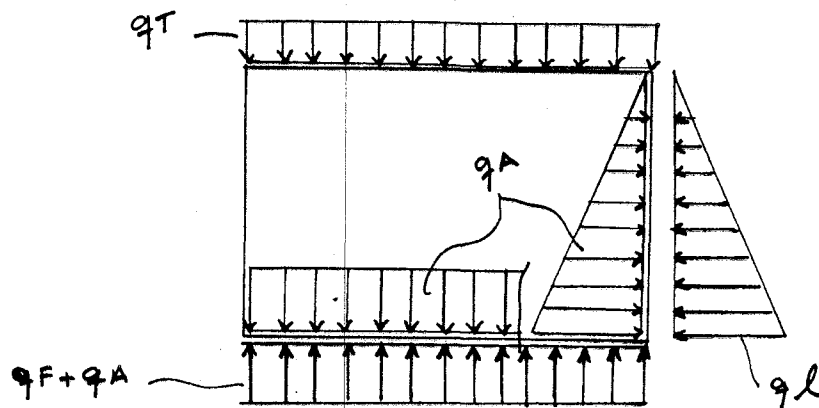
TAMPA: $M_{\max} = 1,12 \text{ KN.m/m}$ $A_s = A_{s\min} = 1,50 \text{ cm}^2/\text{m}$

PAREDES

E FUNDO: $M_{\max} = 5,16 \text{ KN.m/m}$ $A_s = A_{s\min} = 2,25 \text{ cm}^2/\text{m}$

2ª SITUAÇÃO DE CÁLCULO - CAIXA CHEIA.

- CARGAMENTOS - ESQUEMA DE CARGAS



- TAMPA $q_T = 3,5 \text{ KN/m}^2$

- PAREDES $\begin{cases} q_L = 13,07 \text{ KN/m}^2 \\ q_A = \gamma_A \cdot h = 10 \times 1,95 = 19,50 \text{ KN/m}^2 \end{cases}$

$$q_{\text{RES}} = q_A - q_L = 19,50 - 13,07 = \underline{6,43 \text{ KN/m}^2}$$

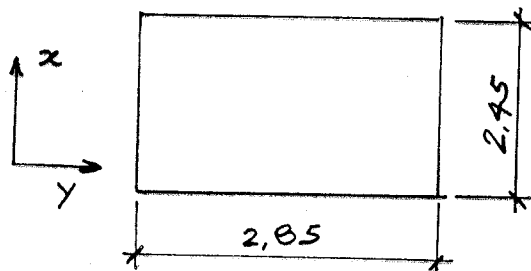
- FUNDO $q_F = 14,0 \text{ KN/m}^2$

REAÇÃO NO SOLO: $q_s = q_F + q_A + \gamma_c \cdot h_F = 14,0 + 19,50 + 25 \times 0,15 =$

$$q_s = 37,25 \text{ KN/m}^2 \leq \bar{\sigma}_s$$

- ESFORÇOS NOS ELEMENTOS ESTRUTURAIS .

LAJE DE FUNDO



TAB. 2.5a TIPO 1

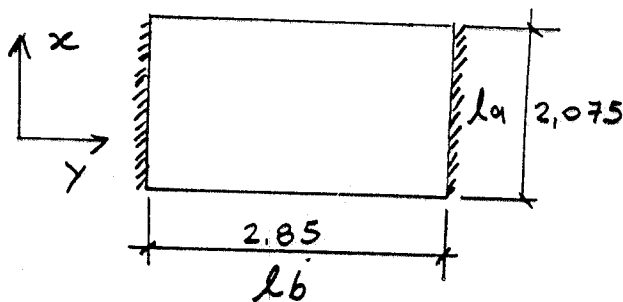
$$q_F = 14.0 \text{ KN/m}^2$$

$$\lambda \approx 1.15$$

$$M_x = 5.38 \quad m_x = 4.52 \text{ KN.m/m}$$

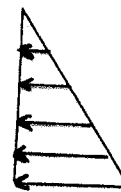
$$M_y = 4.25 \quad m_y = 3.57 \text{ KN.m/m}$$

PAR. 1 = PAR. 2



TAB. 2.66 TIPO 15

$$\gamma \approx 0.75$$



$$q_L = 13.07 \text{ KN/m}^2$$

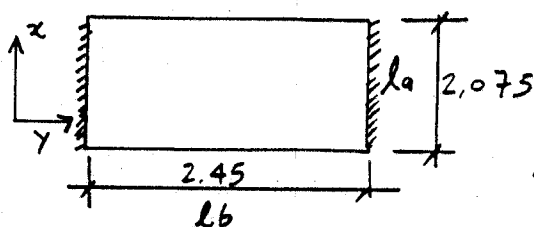
$$q_{res} = 6.43 \text{ KN/m}^2$$

$$M_x = 2.52 \quad m_x = 1.41 \text{ KN.m/m} \quad 0.70$$

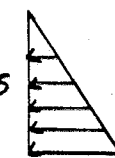
$$M_y = 1.94 \quad m_y = 1.09 \text{ KN.m/m} \quad 0.54$$

$$M'_y = 4.99 \quad m'_y = 2.80 \text{ KN.m/m} \quad 1.38$$

PAR. 3 = PAR. 4



$$\gamma \approx 0.85$$



$$q_L = 13.07 \text{ KN/m}^2$$

$$q_{res} = 6.43 \text{ KN/m}^2$$

$$M_x = 2.08 \quad m_x = 1.17 \text{ KN.m/m} \quad 0.58$$

$$M_y = 1.83 \quad m_y = 1.02 \text{ KN.m/m} \quad 0.50$$

$$M'_y = 4.49 \quad m'_y = 2.51 \text{ KN.m/m} \quad 1.24$$

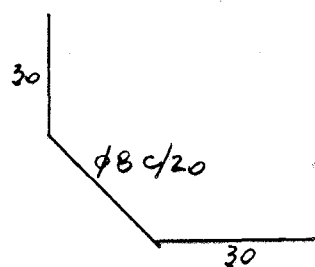
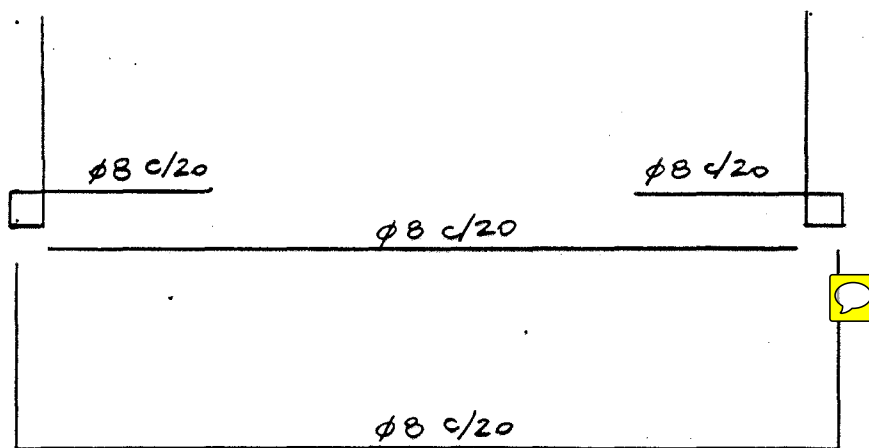
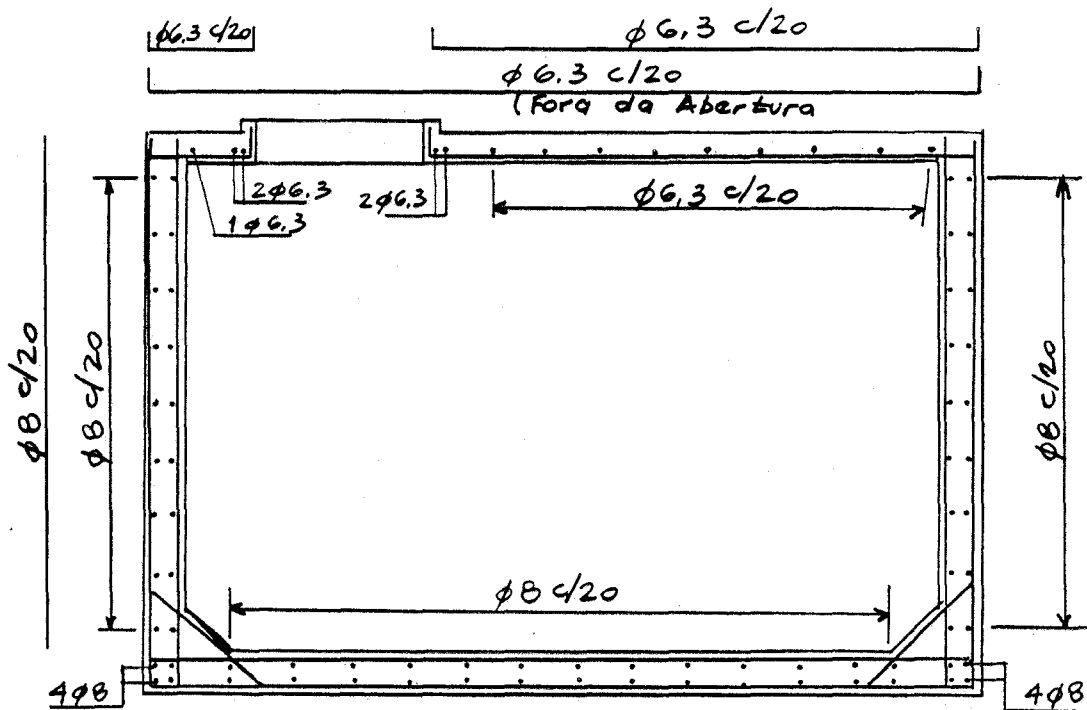
- TAMPA: IDEM ANTERIOR CAIXA VAZIA

OBSERVAÇÃO: Não faremos a compensação e a correção dos momentos, pois, os momentos resultarão em armadura mínima.

TAMPA: $M_{\max} = 1,12 \text{ KN.m/m}$ $A_s = A_{s\min} = 1,50 \text{ cm}^2/\text{m}$

PAREDES

E FUNDO: $M_{\max} = 4,52 \text{ KN.m/m}$ $A_s = A_{s\min} = 2,25 \text{ cm}^2/\text{m}$



Reforço da Misula