1C - 2024

EJEMPLO BASE CENTRADA C/ MOMENTO

DATOS:

CARGAS

	D	L	Servicio	
N	75	25	100	t
M	30	10	40	t

COLUMNA 40cm x 40cm

MATERIALES

$\sigma_{adm} = 2 \frac{kg}{cm^2} = 20 \frac{t}{m^2}$ a $-2,00$ m

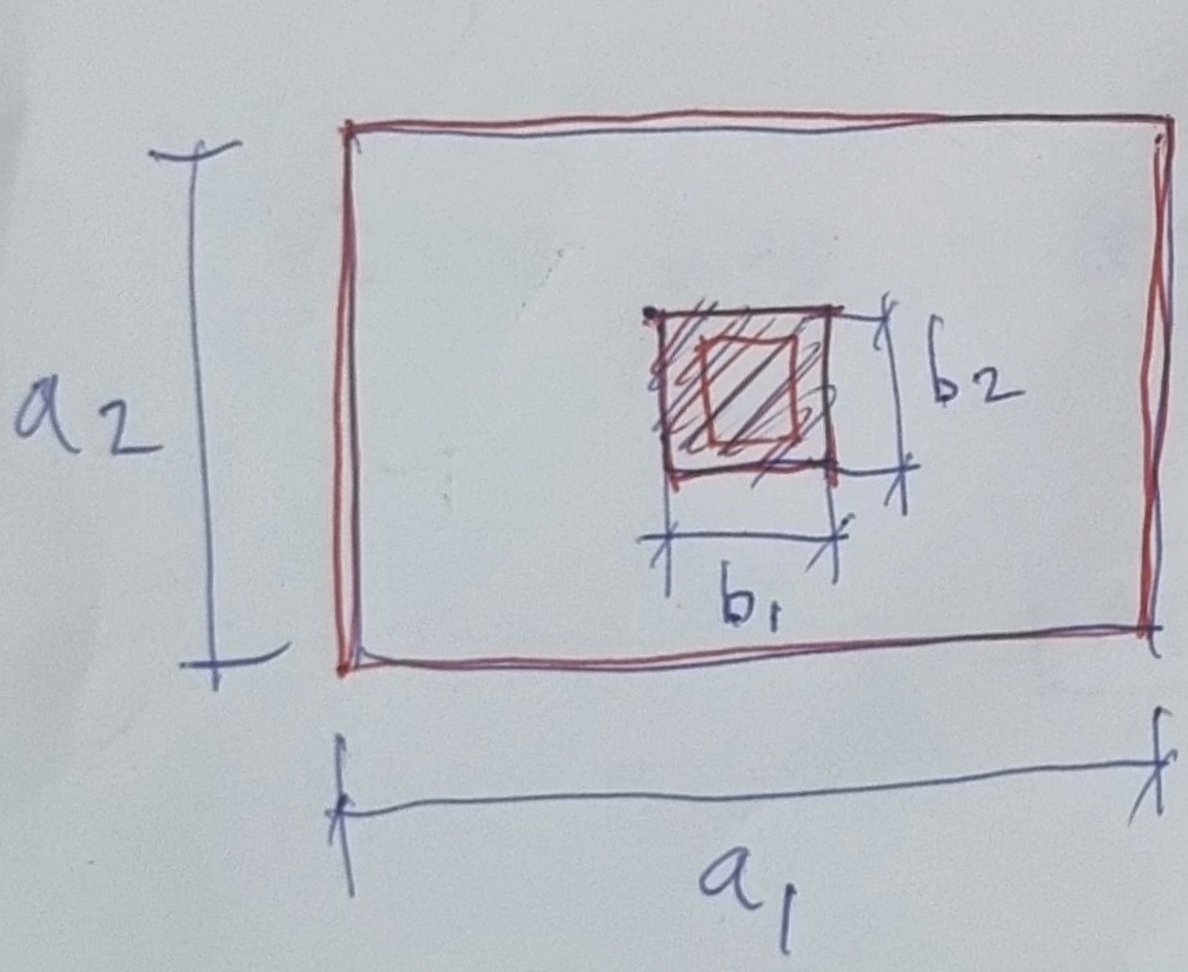
$H30 = 300 \frac{kg}{cm^2} = 3000 \frac{t}{m^2}$

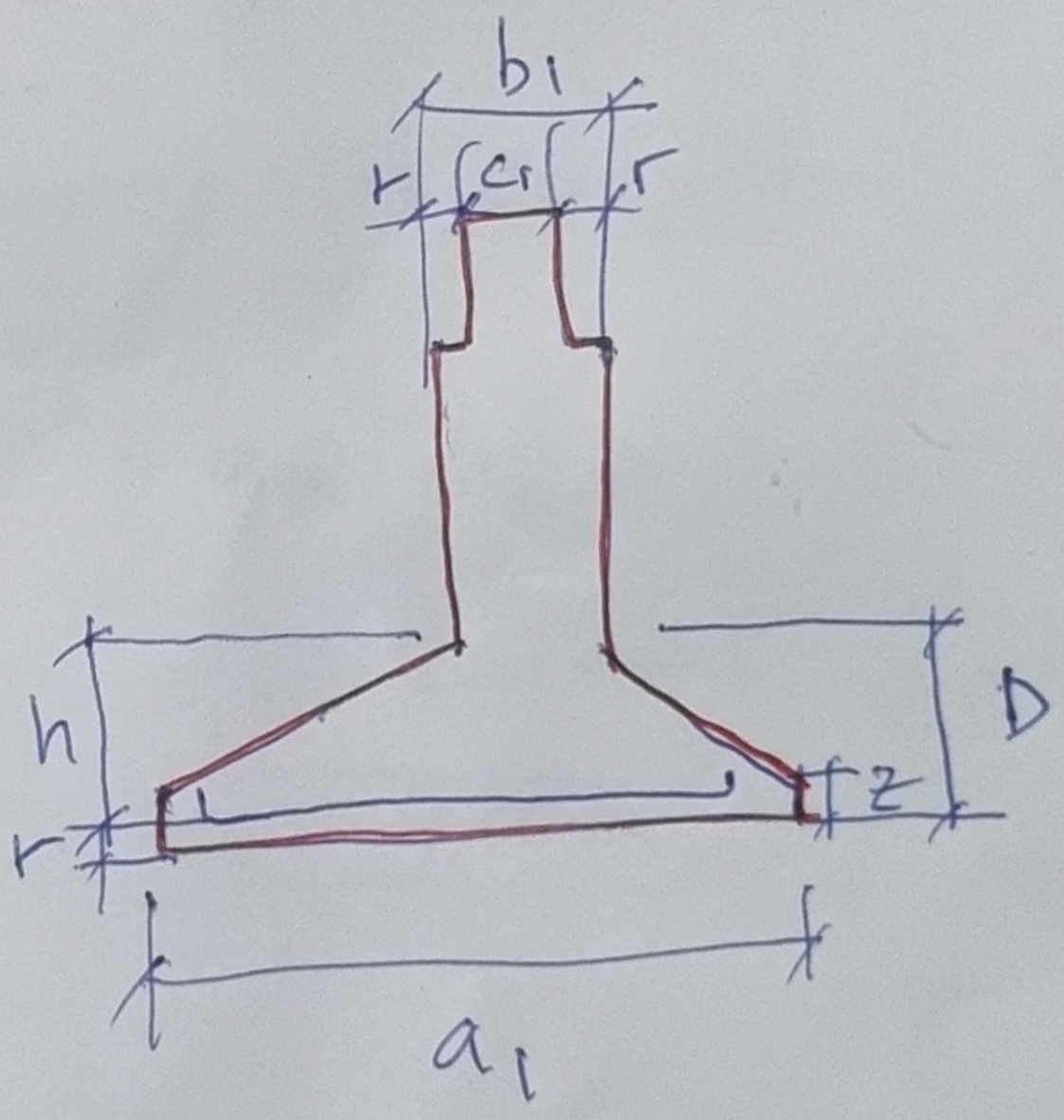
$ADN420 = 4200 \frac{kg}{cm^2} = 42000 \frac{t}{m^2}$

COMBINAC. DE CARGA

$U_1 = 1,4\,D$

$U_2 = 1,2\,D + 1,6\,L$





PROCEDIMIENTO DE CALCULO

1. CALCULO DE "e" (excentricidad)

$$e = \frac{Mt}{Nt}$$

adopto $\alpha = 1{,}1$ (consideración de peso propio base)

$$\Rightarrow e = \frac{40\,tm}{1{,}1 \times 100\,t} = 0{,}36\,m$$

2. ADOPTO DIMENSIÓN LADO a_1

a) $a_1 \geq 6e \rightarrow$ Diag TRAPECIAL

b) $6e > a_1 \geq 3e \rightarrow$ Diag TRIANGULAR

c) $a_1 < 3e \rightarrow$ VUELCA $\Rightarrow$ REDIMENSIONAR

ELIJO DIAG TRAPECIAL $\Rightarrow a_1 \geq 6e \geq 6 \times 0{,}36\,m$

$$a_1 \geq 2{,}18\,m$$

ADOPTO $a_1 = 4{,}00\,m$

3. CALCULO DIMENSIÓN LADO a_2

a) TRAPECIAL $\rightarrow$ $a_2 = \frac{\alpha N}{a_1 \sigma_{adm}} \left(1 + \frac{6e}{a_1}\right)$

b) TRIANGULAR $\rightarrow$ $a_2 = \frac{2\alpha N}{x \sigma_{adm}}$

con $x = 3\left(\frac{a_1}{2} - e\right)$

$\therefore$ como estoy en "diagrama trapecial"...

$\Rightarrow$ $a_2 = \frac{\alpha N}{a_1 \sigma_{adm}} \left(1 + \frac{6e}{a_1}\right)$

$= \frac{1{,}1 \times 100\,t}{4{,}00\,m \times 20 \frac{t}{m^2}} \left(1 + \frac{6 \times 0{,}36\,m}{4{,}00\,m}\right)$

$= 2{,}13\,m$

ADOPTO $a_2 = 2{,}20\,m$

4. CONDICIÓN $\frac{a_1}{a_2} \leq 2$

$\therefore$ verifico $\frac{a_1}{a_2} = \frac{4{,}00\,m}{2{,}20\,m} = 1{,}82 < 2$ ✓

VERIFICA

5. CALCULO GEOMETRÍAS BASE

a) D = altura base

$$D = \max\left(\frac{a_1 - b_1}{3}; \frac{a_2 - b_2}{3}\right) \quad \text{con } b = c + r$$

$$= \max\left(\frac{4{,}00 - 0{,}45}{3}; \frac{2{,}20 - 0{,}45}{3}\right)$$

$$= \max\left(1{,}18\,m; 0{,}58\,m\right)$$

$$= 1{,}18\,m$$

ADOPTO $D = 1{,}20\,m$

b) h = altura de calculo

$h = D - r$ (con $r = 0{,}05\,m$)

$h = 1{,}20\,m - 0{,}05\,m$

$h = 1{,}15\,m$

c) z = talón

$$z = \max\left(0{,}25\,m;\ 0{,}2 \times D\right)$$

$$= \max\left(0{,}25\,m;\ 0{,}2 \times 1{,}20\,m\right)$$

$$= \max\left(0{,}25\,m;\ 0{,}24\,m\right)$$

$$\Rightarrow \boxed{z = 0{,}25\,m}$$

6. CÁLCULO DE ARMADURAS

→ las solicitaciones deben calcularse en ESTADOS ÚLTIMOS:

a) MAYORES CARGAS

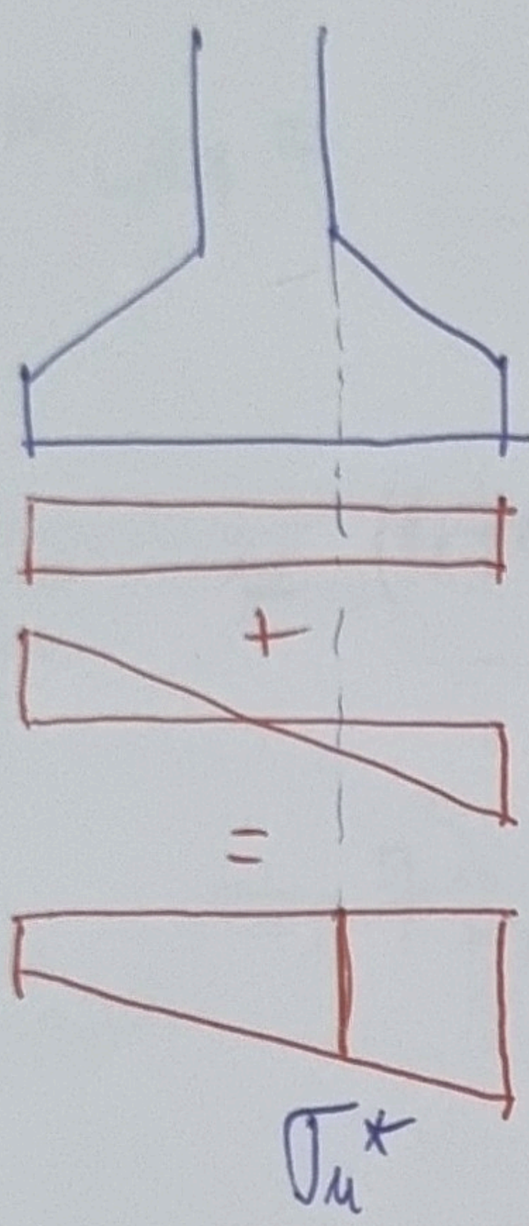
$$N \begin{cases} U_1: & N_{U_1} = 1{,}4 \times 75\,t = 105\,t \\ U_2: & \boxed{N_{U_2} = 1{,}2 \times 75\,t + 1{,}6 \times 25\,t = 130\,t} \end{cases}$$

$$M \begin{cases} U_1: & M_{U_1} = 1{,}4 \times 30\,tm = 42\,tm \\ U_2: & \boxed{M_{U_2} = 1{,}2 \times 30\,tm + 1{,}6 \times 10\,tm = 52\,tm} \end{cases}$$

b) CALCULO TENSIONES SUELO MAYORADAS

b.1) $$\sigma_{No} = \frac{Nu}{a_1 \times a_2} = \frac{130\,t}{4{,}00m \times 2{,}20m} = 14{,}77\,\frac{t}{m^2}$$

b.2) $$\sigma_{Mu} = \frac{6Mu}{a_1^2 \times a_2} = \frac{6 \times 52\,tm}{(4{,}00m)^2 \times 2{,}20m} = 8{,}86\,\frac{t}{m^2}$$

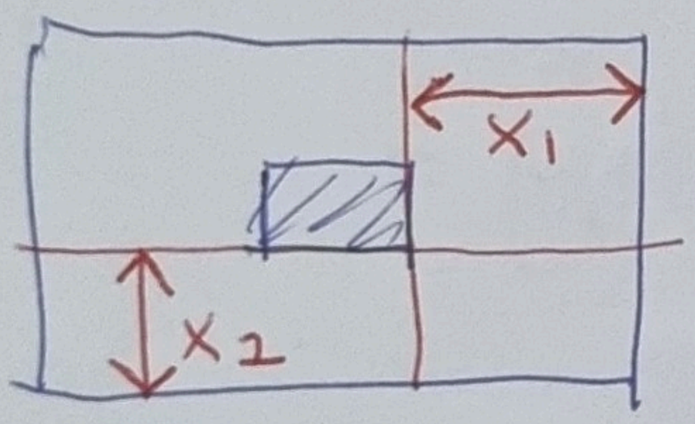


b.3) $$\sigma_{u1} = \sigma_{Nu} + \sigma_{Mu} = 14{,}77 + 8{,}86 = 23{,}64\,\frac{t}{m^2}$$

b.4) $$\sigma_{u2} = \sigma_{Nu} - \sigma_{Mu} = 14{,}77 - 8{,}86 = 5{,}91\,\frac{t}{m^2}$$

b.5) $$\sigma_u^* = \sigma_{u1} - (\sigma_{u1} - \sigma_{u2})\,\frac{x_1}{a_1}$$

b.6)



$$x_1 = \frac{a_1 - b_1}{2} = \frac{4{,}0 - 0{,}45}{2}$$

$$x_1 = 1{,}78\,m$$

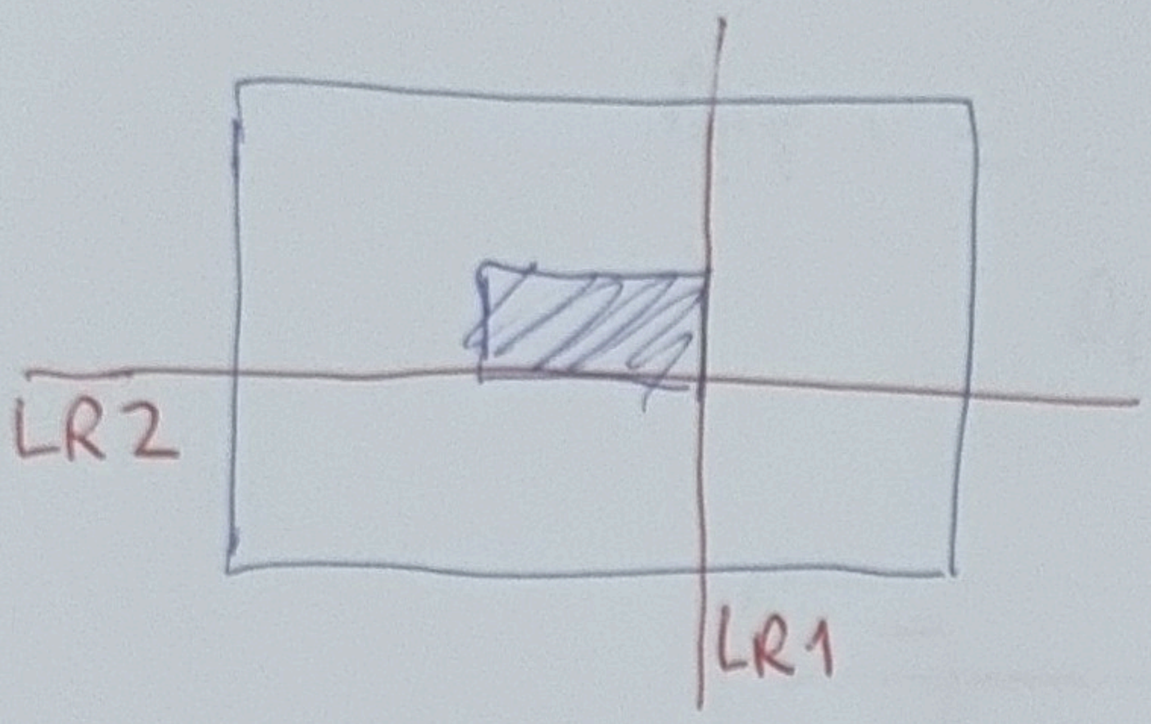
$$x_2 = \frac{a_2 - b_2}{2} = \frac{2{,}20 - 0{,}45}{2}$$

$$x_2 = 0{,}88\,m$$

$$= 23{,}64 - (23{,}64 - 5{,}91)\,\frac{1{,}78\,m}{4{,}00\,m}$$

$$= 15{,}77\,\frac{t}{m^2}$$

c) CALCULO MOMENTOS BASE MEDIANTE TEORÍA de LÍNEAS DE ROTURA



c.1) $$M_{LR1} = \frac{X_1^2 \times a_2 \times (\sigma_u^* + 2\sigma_{u1})}{6} \quad (total)$$

$$= \frac{(1{,}78m)^2 \times 2{,}20m \times (15{,}77 + 2 \times 23{,}64)\frac{t}{m^2}}{6}$$

$$= 72{,}83\ tm$$

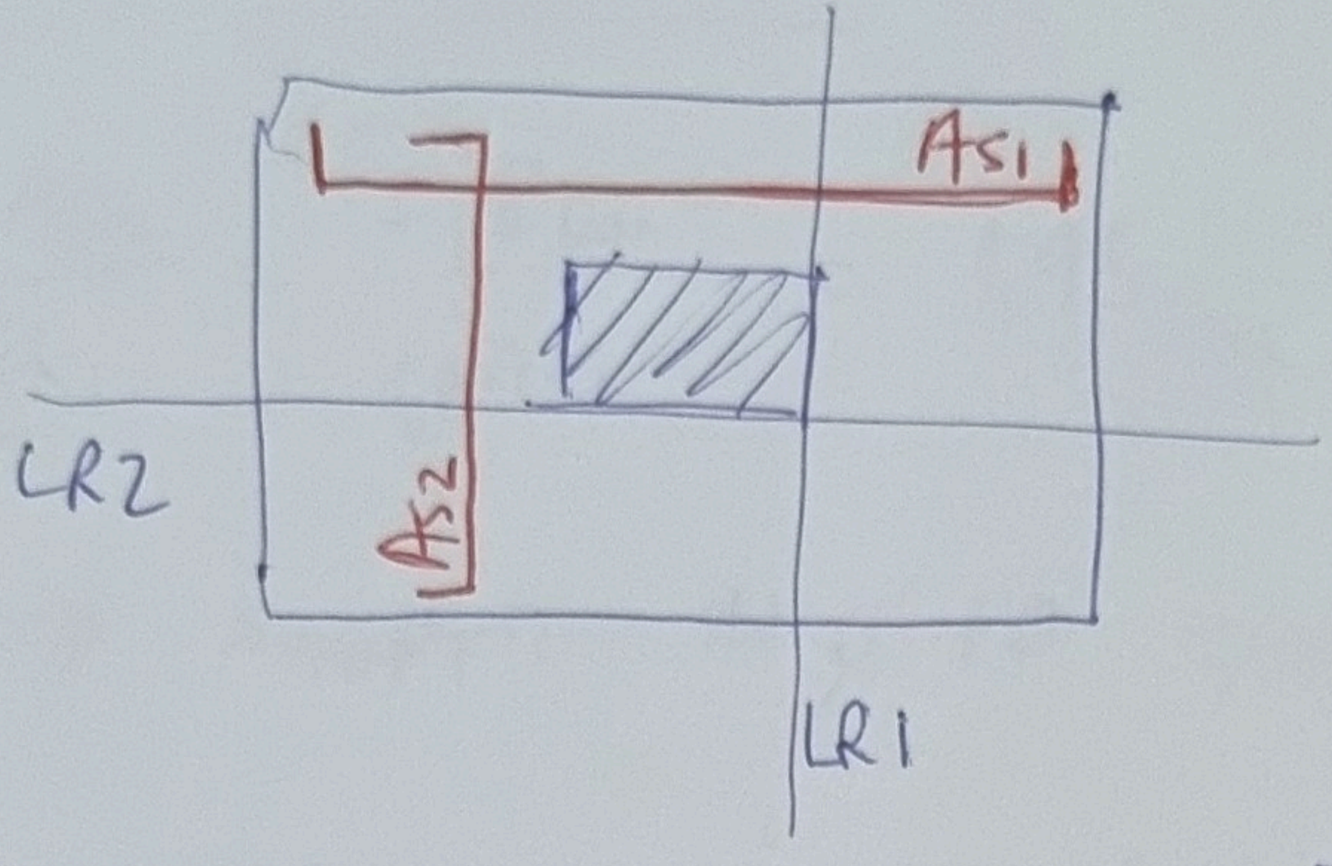
c.2) $$M_{LR2} = \frac{X_2^2 \times a_1 \times (\sigma_{u1} + \sigma_{u2})}{4} \quad (total)$$

$$= \frac{(0{,}88m)^2 \times 4{,}00m \times (23{,}64 + 5{,}91)\frac{t}{m^2}}{4}$$

$$= 22{,}62\ tm$$

D) CALCULO Y ADOPCION DE ARMADURAS

$$A_{S\,i} = \frac{1{,}2 * M_{LR\,i}}{0{,}8 * h * \phi * f_y}$$



D.1) $A_{S_1} = \dfrac{1{,}2 * 72{,}83\ tm * (10.000)}{0{,}8 * 1{,}15m * 0{,}9 * 42.000 \frac{t}{m^2}} =$ ← de m^2 a cm^2

$$\boxed{A_{S1} = 25{,}13\ cm^2} \quad (total)$$

$$\frac{A_{S1}}{a_2} = \frac{25{,}13\ cm^2}{2{,}20\ m} = 11{,}4\ \frac{cm^2}{m} \quad (A_{S_1}\ por\ metro)$$

⇒ ADOPTO $\boxed{13\ \phi\ 16\ \ c/17_{cm}}$

$13\phi 16 = 13 * 2{,}01\ cm^2 = 26{,}13\ cm^2 > A_{S_1}$ ✓

$Separacion = \dfrac{a_2 - 2r}{\#barras - 1} = \dfrac{2{,}20 - 0{,}1}{13 - 1} = 0{,}17m$

$$0.2)\quad As_2 = \frac{1{,}2 * 22{,}62\ tm * (10.000)}{0{,}8 * 1{,}15m * 0{,}9 * 42.000 \frac{t}{m^2}} =$$

$$\boxed{As_2 = 7{,}8\ cm^2} \quad (total)$$

$$\frac{As_2}{a_1} = \frac{7{,}8\ cm^2}{4{,}00\ m} = 1{,}95 \frac{cm^2}{m} \quad (As_2\ por\ metro)$$

$$\Rightarrow \text{ADOPTO} \quad 11\ \emptyset 10 \quad c/39\ cm$$

$$11\emptyset 10 = 11 * 0{,}78 cm^2 = 8{,}63\ cm^2 > As_2 \checkmark$$

$$\text{separación} = \frac{a_1 - 2r}{\#barras - 1} = \frac{4{,}00 - 0{,}10}{11 - 1} = 0{,}39\ m \ X$$

$$\rightarrow \text{ADOPTO} \quad \boxed{As\ min = \emptyset 10\ c/20cm}$$