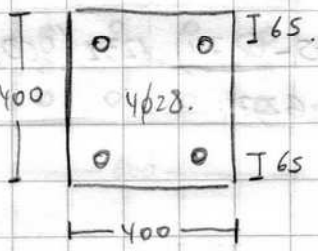
Auxiliar (17/10/08).

P1)



$h = b = 400$ mm
$d' = 65$ mm
$f_c' = 30$ MPa
$f_y = 420$ MPa

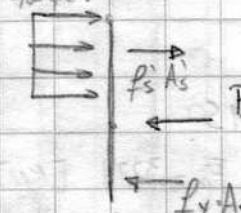
$A_s = A_s' = 1232$ mm²

(a) Determinar diagrama de interacción simplificado considerando los ptos: $(P_0, 0)$; (P_b, M_b); $(0, M_0)$.

-) $(P_0, 0)$: $P_0 = 0{,}85 \cdot 30 \cdot 400^2 + 420 \cdot 2 \cdot 1232 = 5115$ [KN]

-) (P_b, M_b): $c_b = \dfrac{\varepsilon_u \cdot d}{\varepsilon_u + \varepsilon_y} = \dfrac{0{,}003 \cdot (400-65)}{0{,}003 + 0{,}0021} = 197{,}1$ [mm] $\rightarrow a = 167{,}5$ [mm]

$\varepsilon_s' = \varepsilon_u \dfrac{(c-d')}{c} = 0{,}003 \cdot \dfrac{(197{,}1-65)}{197{,}1} = 0{,}002 \rightarrow f_s' = 402{,}1$ [MPa]



$\rightarrow$ $P_b = 0{,}85 \cdot 30 \cdot 167{,}5 \cdot 400 + 402{,}1 \cdot 1232 - 420 \cdot 1232$

$P_b = 1686$ [KN]

$M_b = 0{,}85 \cdot 30 \cdot 167{,}5 \cdot 400 \left(\frac{400}{2} - \frac{167{,}5}{2}\right) + 402{,}1 \cdot 1232 \left(\frac{400}{2} - 65\right)$

$+ 420 \cdot 1232 \cdot \left(400 - 65 - \frac{400}{2}\right)$

$M_b = 335{,}3$ [KN-m]

Alternativamente: $M_b = 420 \cdot 1232 (400-65) + 1686 \cdot 10^3 \cdot 200 - 0{,}85 \cdot 30 \cdot 400 \cdot \dfrac{167{,}5^2}{2} - 402{,}1 \cdot 1232 \cdot 65$

$M_b = 335{,}3$ [KN-m]

-) M_0? $0{,}85 \cdot 30 \cdot 0{,}85 \cdot c \cdot 400 + 200.000 \cdot 0{,}003 \left(\dfrac{c-65}{c}\right) \cdot 1232 = 420 \cdot 1232$ (c)

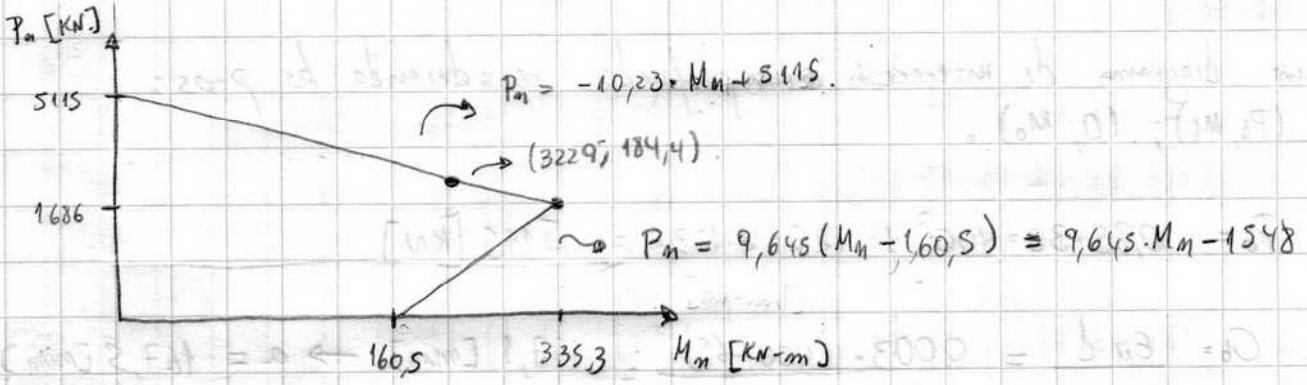
$8670\, c^2 + 2{,}218 \cdot 10^5 c - 4{,}805 \cdot 10^7 = 0 \rightarrow c = \dfrac{-2{,}218 \cdot 10^5 + \sqrt{(2{,}218 \cdot 10^5)^2 + 4 \cdot 8670 \cdot 4805 \cdot 10^7}}{2 \cdot 8670}$

$c = 62{,}74$ [mm]

$a = 53{,}33$ [mm]

$$M_n = 0{,}85 \cdot 30 \cdot 400 \cdot 53{,}33 \cdot \left(400 - 65 - \frac{53{,}33}{2}\right) - 200.000 \cdot 0{,}003 \frac{(65 - 62{,}74)}{62{,}74} \cdot 1232\,(400 - 130)$$

$$M_0 = 160{,}5 \text{ [KN-m]} \;//$$



(b). SeA $P_{u1} = 2000$ [kN] → Concentrica
$P_{u2} = ?$ → $e = 150$ mm

Determinar par P_n, M_n que genera la falla.

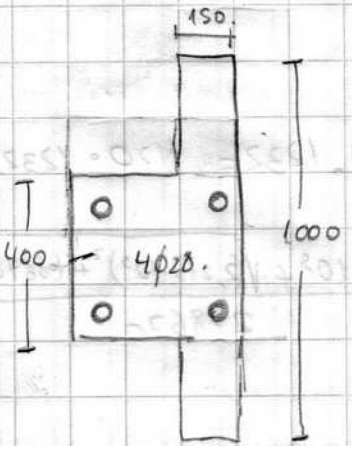
$P_n = 2000 + P_{u2}$
$M_n = P_{u2} \cdot 0{,}15$ → $2000 + P_{u2} = -10{,}23 \cdot 0{,}15 \cdot P_{u2} + 5115$

$P_{u2} = 1229$ [KN] → $P_n = 3229$ [KN]
$M_n = 184{,}4$ [KN-m]

¿En el otro tramo del diagrama?

$2000 + P_{u2} = 9{,}645 \cdot P_{u2} \cdot 0{,}15 - 1548$ → $P_{u2} = 7942$ [KN] → $P_n = 9942$ [KN]
$M_n = 1191$ [KN-m.]
↳ No está en el diagrama.

(c).

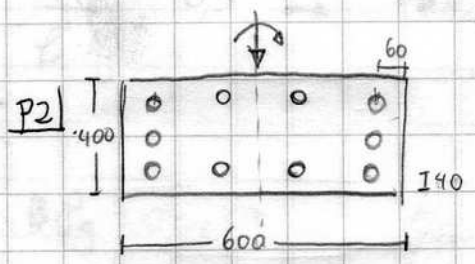


$$e^* = \frac{0{,}85 \cdot 30 \cdot \left(400^2 \cdot 200 + 150 \cdot 600 \cdot (400 - 75)\right) + 420 \cdot 1232\,(65 + 400 - 65)}{0{,}85 \cdot 30\,(400^2 + 150 \cdot 600) + 420 \cdot 1232 \cdot 2}$$

$e^* = -38{,}7$ [mm] → excentricidad para P_{max} en diagrama de interacción de sección asimetrica.

Auxiliar (17/10/08).

P2



$f_c' = 30$ [MPa]

$f_y = 420$ [MPa]

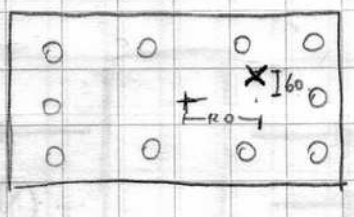
(a) Determine armadura (uniformemente repartida) necesaria para resistir $P_u = 4200$ KN y $M_u = 410$ [KN]

$$\gamma = \frac{600 - 2\cdot 60}{600} = 0,8.$$

$$\frac{P_u}{f_c' A_g} = \frac{4200\cdot 10^3}{30\cdot 400\cdot 600} = 0,5833 \qquad \frac{M_u}{f_c' A_g h} = \frac{410\cdot 10^6}{30\cdot 400\cdot 600^2} = 0,0949.$$

$\rho_g = 3,5‰ = 8400$ [mm²] (diagrama ACI 318-99. $A_s = 7200$ [mm²])

(b). Determinar ϕP_n para $A_s = 10\phi 28$ uniformemente repartida ρ_g:



$$\rho_g = \frac{6158}{400\cdot 600} = 0,0257$$

Dirección x: $\gamma = 0,8$. $e/h = \frac{120}{600} = 0,2 \Rightarrow \frac{P_u}{f_c' A_g} = 0,47 \rightarrow \phi P_{nx_0} = 3384$ [KN]

Dirección y: $\gamma = \frac{400-80}{400} = 0,8$. $\frac{e}{h} = \frac{60}{400} = 0,15 \rightarrow \frac{P_u}{f_c' A_g} = 0,54 \rightarrow \phi P_{ny_0} = 3888$ [KN]

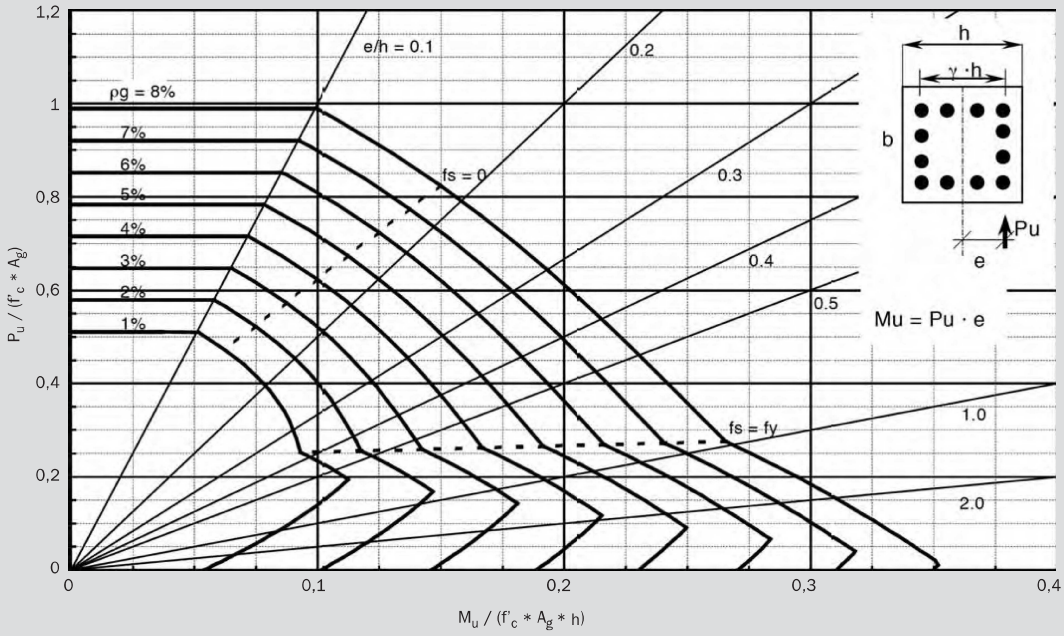
¿P_0?: $\phi P_0 = (0,85\cdot 30(400\cdot 600 - 6158) + 6158\cdot 420)\cdot 0,65 = 5557$ [KN.]

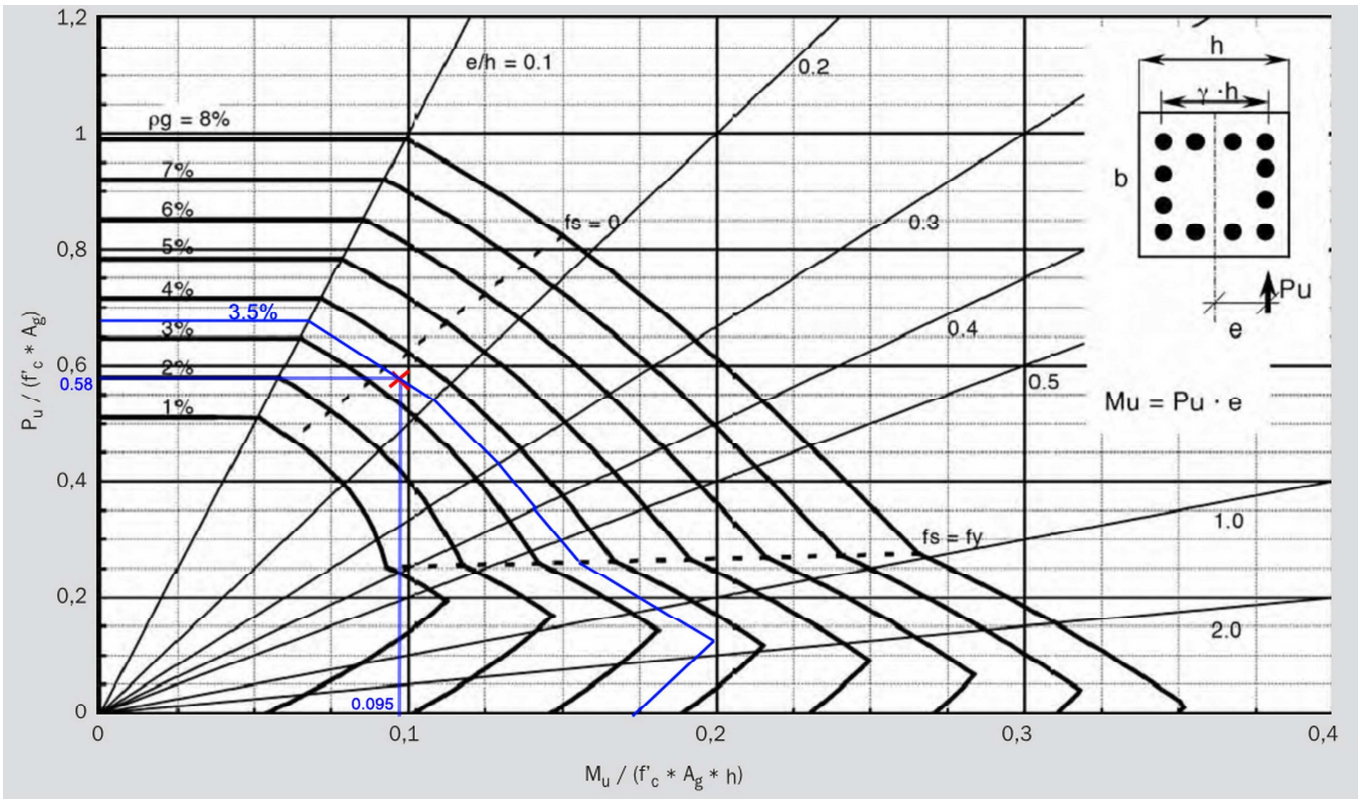
$$\frac{1}{\phi P_n} = \frac{1}{3384} + \frac{1}{3888} - \frac{1}{5557} \Rightarrow \phi P_n = 2683 \text{ [KN]} \quad (\leq \alpha\phi P_0 = 4446 \text{ [KN]})$$

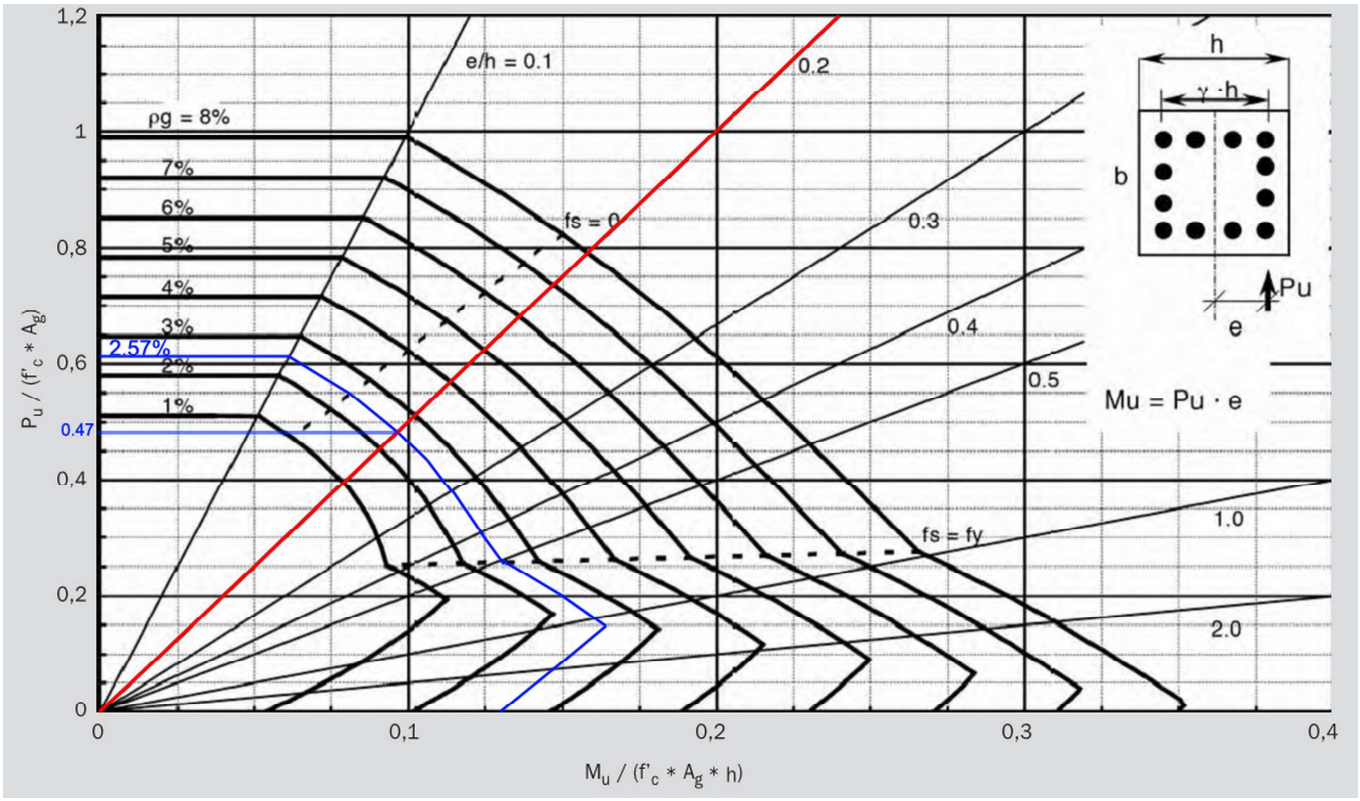
B-019 Diagrama de Interacción Pu-Mu

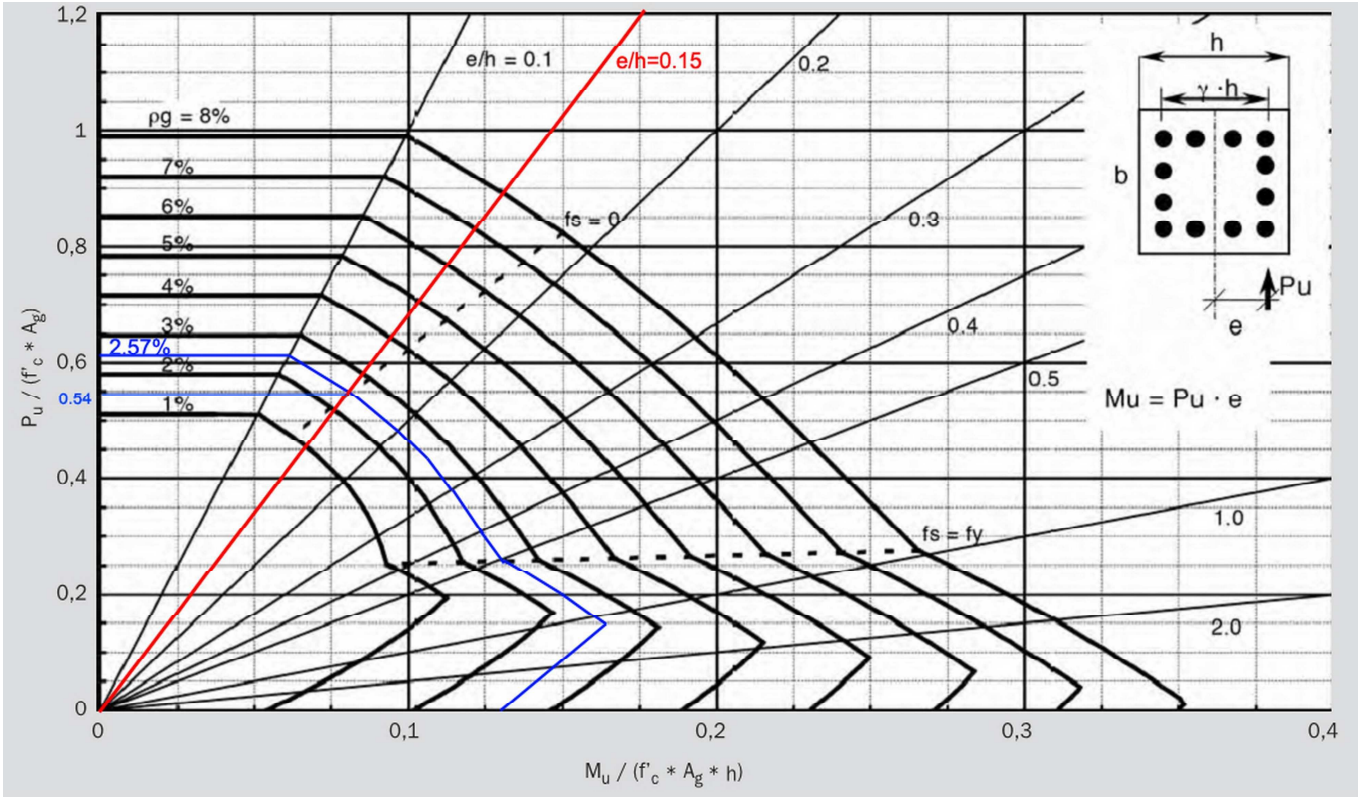
Columnas Armadura Perimetral

f'_c = 30 MPa
f_y = 420 MPa
γ = 0,8






1,2
1
0,8
0,6
0,4
0,2
0
0
0,1
0,2
0,3
0,4
e/h = 0.1
0.2
ρg = 8%
7%
6%
5%
4%
3%
2.57%
2%
1%
0.47
fs = 0
0.3
0.4
0.5
1.0
2.0
fs = fy
h
γ ·h
b
Pu
e
Mu = Pu · e
Pu / (f'c * Ag)
Mu / (f'c * Ag * h)


1,2
1
0,8
0,6
0,4
0,2
0
0
0,1
0,2
0,3
0,4
e/h = 0.1
e/h=0.15
0.2
ρg = 8%
7%
6%
5%
4%
3%
2.57%
2%
1%
0.54
fs = 0
0.3
0.4
0.5
1.0
2.0
fs = fy
h
γ ·h
b
Pu
e
Mu = Pu · e
Pu / (f'c * Ag)
Mu / (f'c * Ag * h)