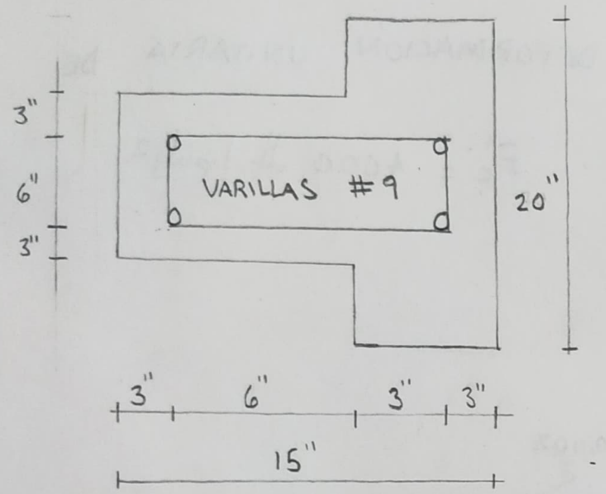
TALLER #1

LOCALIZAR EL CENTOIDE PLÁSTICO SI

$f'_c = 4000$ lb/pulg^2 Y $f_y = 60\ 000$ lb/pulg^2



$C_1 = 9(12)(0,85)(4) = 367,2$ Klb

$C_2 = 6(20)(0,85)(4) = 408$ Klb

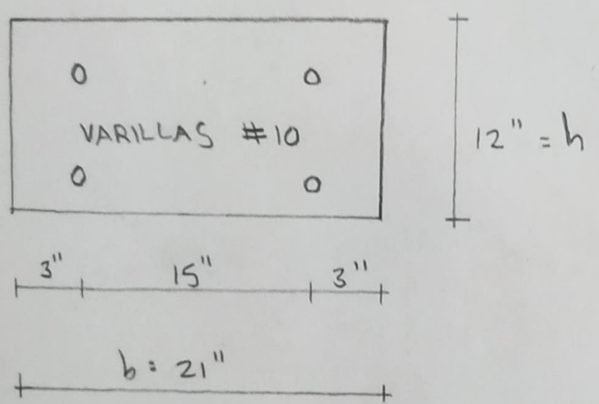
$C'_s = 4(60 - 0,85(4)) = 226,4$ Klb

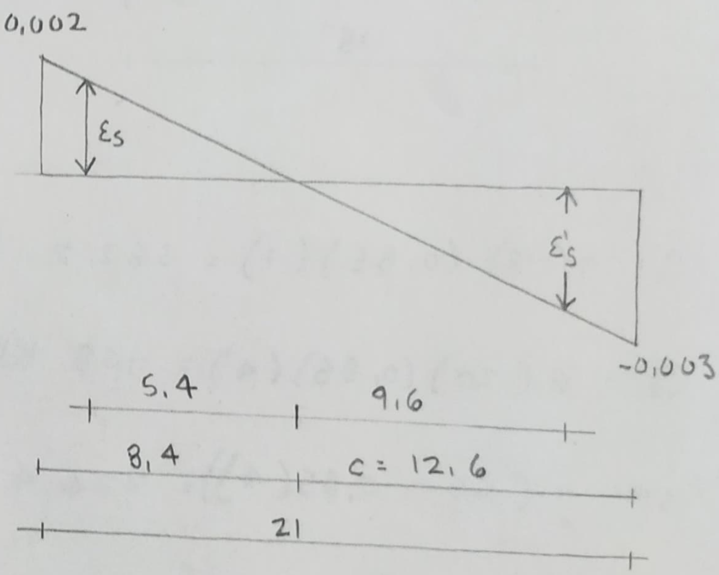
$P_n = 367,2 + 408 + 226,4 = 1001,6$ Klb

$-367,2(4,5) - 408(12) - 226,4(7,5) + 1001,6X = 0$

$\boxed{X = 8,23''}$

USANDO LAS ECUACIONES DE LA ESTÁTICA, DETERMINE LOS VALORES DE P_n Y M_n, PARA LA COLUMNA MOSTRADA, SUPONIENDO QUE TIENE UNA DEFORMACIÓN UNITARIA DE -0.003 EN EL BORDE DERECHO Y UNA DEFORMACIÓN UNITARIA DE $+0.002$ EN EL BORDE IZQUIERDO. $f'_c = 4000$ lb/pulg² Y $f_y = 60000$ lb/pulg².





$$c = \left(\frac{0{,}003}{0{,}003 + 0{,}002}\right)(21) = 12{,}6$$

$$\varepsilon'_s = \left(\frac{9{,}6}{12{,}6}\right)(0{,}003) = 0{,}002\,286 > 0{,}00207$$

¿DE DONDE SALE ESTE VALOR?

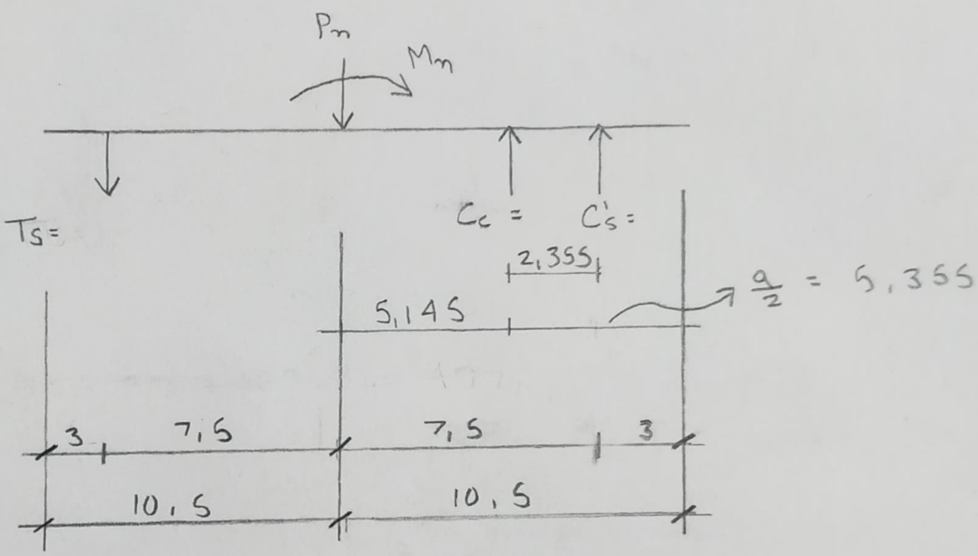
$$\varepsilon_s = \left(\frac{5{,}4}{8{,}6}\right)(0{,}002) = 0{,}001\,256$$

$a = 0{,}85\,c = 0{,}85\,(12{,}6) = 10{,}71''$

$C_c = 0{,}85 \cdot a \cdot h \cdot f'_c = 0{,}85\,(10{,}71)\,(12)\,(4) = 436{,}97$ Klb

$C'_s = f_y \cdot \frac{\text{numero barras}}{2} - 0{,}85 \cdot \frac{\text{numero barras}}{2} \cdot (f'_c) = 60(2) - 0{,}85(2)(4) = 113{,}2$ Klb

$T_s = \varepsilon_s\,(29\,000) \cdot \frac{\text{numero barras}}{2} = 0{,}001256\,(29\,000)(2) = 72{,}848$



$+\uparrow \Sigma F_v = 0$

$-P_n - 72{,}848 + 436{,}97 + 113{,}2 = \boxed{477{,}32 \text{ Klb}} \downarrow$

$\circlearrowright + \Sigma M = 0$ RESPECTO AL ACERO DE TENCION

$477{,}32\,(7{,}5) + M_n - 436{,}97\,(12{,}645) - 113{,}2\,(15) = 0$

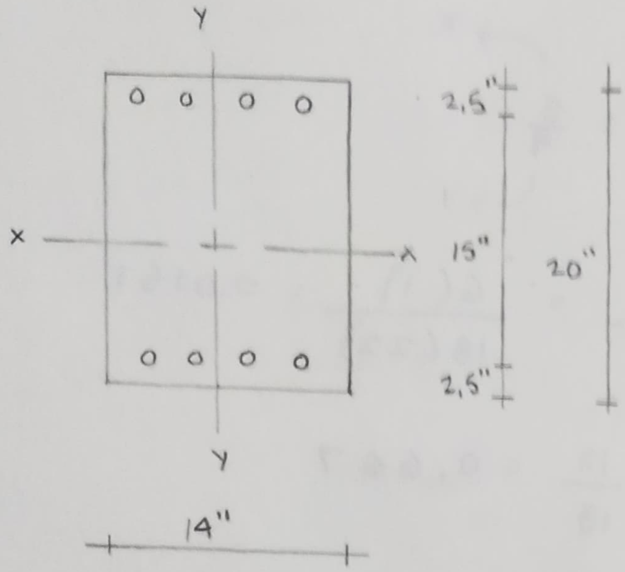
$M_n = 3643{,}59$ Klb · pulg $= \boxed{303{,}63 \text{ Klb} \cdot \text{pie}}$ $\circlearrowright +$

$P_n = 0{,}85\,f'_c\,(A_g - A_s) + A_s\,f_y$

$P_n = 0{,}85\,(4)\,[21\,(12) - 5{,}08] + 5{,}08\,(60) = \boxed{1144{,}33 \text{ Klb}}$

TALLER #2

USANDO LOS DIAGRAMAS DE INTERACIÓN DETERMINE EL ACERO DE REFUERZO REQUERIDO PARA $f'_c = 4000$ PSI Y $f_y = 60\,000$ PSI. $P_n = 400$ Klb y $e_x = 8''$



$$\gamma = \frac{h'}{h} = \frac{15}{20} = 0{,}75$$

$$K_n = \frac{P_n}{f'_c\,A_g} = \frac{400}{4(14)(20)} = 0{,}3571$$

$$R_n = \frac{P_n\,e}{f'_c\,A_g\,h} = \frac{400(8)}{4(14)(20)(20)} = 0{,}1429$$

γ	0,7	0,75	0,8
ρ_g	0,008	0,008	0,08

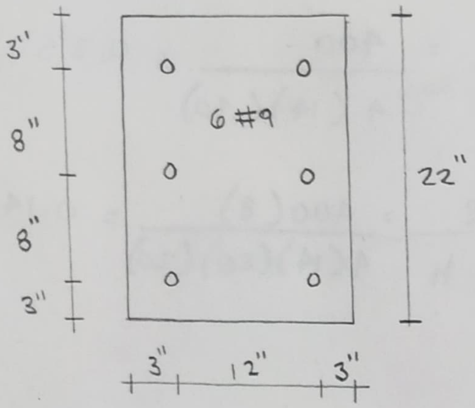
↳ USAR 0,01 COMO MINIMO

$A_s = \rho_g\,b\,h = 0{,}01(14)(20) = 2{,}8$ pulg²

USAR 8 #6 = 3,52 pulg²

USAR DIAGRAMA DE INTERACCIÓN PARA DETERMINAR VALORES DE ϕP_n PARA LAS COLUMNAS CORTAS MOSTRADAS QUE TIENEN FLEXIÓN ALREDEDOR DE UN EJE. $f_y = 60\,000$ lb/pulg² Y $f'_c = 4000$ lb/pulg².

$e_y = 10''$



X

$$\frac{e}{h} = \frac{10}{18} = \frac{5}{9}$$

Y

$$P_g = \frac{A_s}{b\,h} = \frac{6(1)}{18(22)} = 0{,}0151$$

$$\gamma = \frac{h'}{h} = \frac{12}{18} = 0{,}667$$

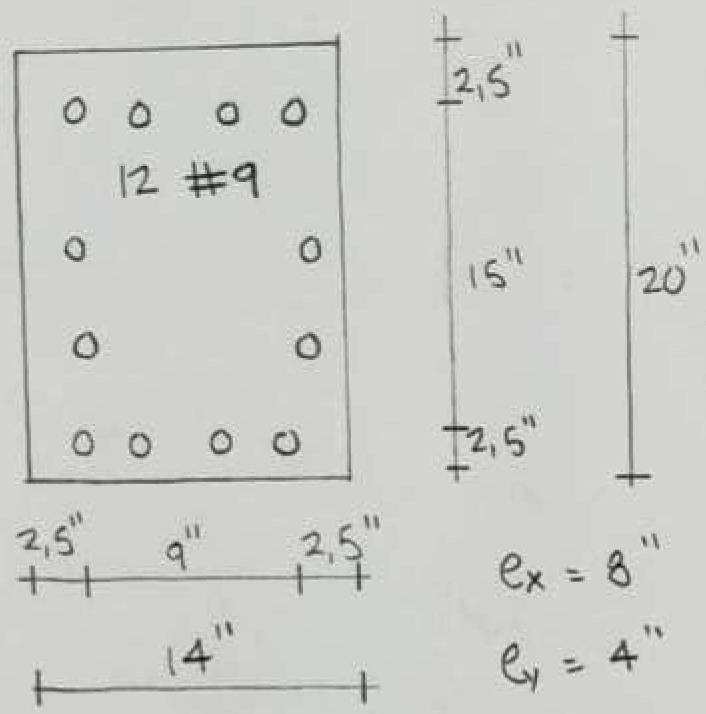
$$R_n = 0{,}107$$

$$P_n = \frac{R_n \cdot f'_c \cdot A_g \cdot h}{e} = \frac{0{,}107\,(4)(18)(22)(18)}{10} = \boxed{305{,}08 \text{ Klb}}$$

$$\phi P_n = 0{,}65\,(305{,}08) = \boxed{198{,}3 \text{ Klb}}$$

TALLER #3

PARA LA COLUMNA MOSTRADA DETERMINE LA CAPACIDAD DE CARGA RESISTENTE ϕP_n, USANDO LA ECUACIÓN DE BRESLER.



$e_x = 8"$

$e_y = 4"$

DATOS GENERALES

$A_g = 20\,(14) = 280$ pulg

$A_s = 12\,(1) = 12$ pulg^2

$\rho_g = \dfrac{A_s}{A_g} = \dfrac{12}{280} = 0{,}043$

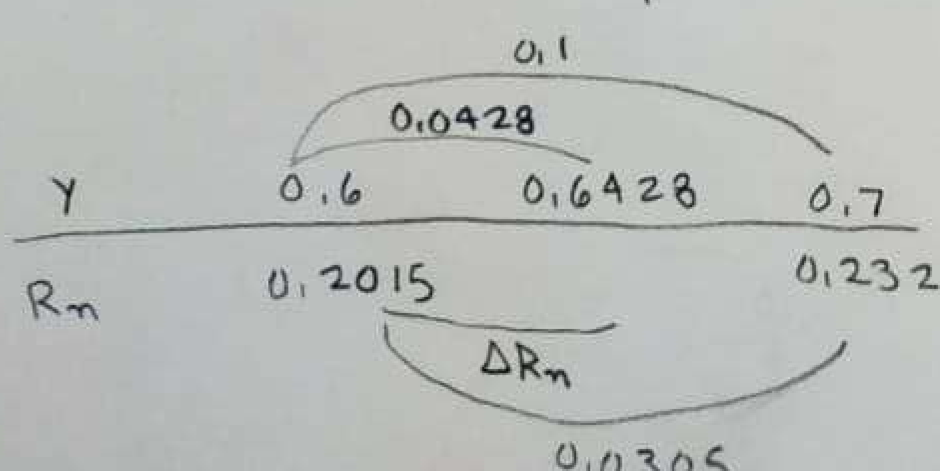
≡ PARA FLEXIÓN EN X

$\gamma = \dfrac{h'}{h} = \dfrac{15}{20} = 0{,}75$ | $\dfrac{e}{h} = \dfrac{4}{20} = \dfrac{1}{5}$ | $R_n^{0,7} = 0{,}24$; $R_n^{0,8} = 0{,}269$; $R_n = 0{,}2545$

$$P_{nx} = \frac{R_n \cdot f'_c \cdot A_g \cdot h}{e_y} = \frac{0{,}2545\,(4)(280)(20)}{4} = 1425{,}2 \text{ Klb}$$

≡ PARA FLEXIÓN EN Y

$\gamma = \dfrac{h'}{h} = \dfrac{9}{14} = 0{,}6428$ | $\dfrac{e}{h} = \dfrac{8}{14} = \dfrac{4}{7}$



$\dfrac{0{,}1}{0{,}0305} = \dfrac{0{,}0428}{\Delta R_n}$ $\qquad \Delta R_n = 0{,}01305$

$R_n = 0{,}2015 + 0{,}01305 = 0{,}21455$

$P_{ny} = R_n \cdot f'_c \cdot A_s \cdot h / e_x$

$= 0{,}214\,(4)(280)(14) / 8$

$P_{ny} = 419{,}44$ Klb

$$P_o = 0.85\ f'_c\ A_g + F_y\ A_s$$

$$= 0.85(4)(280) + 60(12)$$

$$P_o = 1672\ \text{Klb}$$

$$\frac{1}{P_{ni}} = \frac{1}{P_{nx}} + \frac{1}{P_{ny}} - \frac{1}{P_o}$$

$$\frac{1}{P_{ni}} = \frac{1}{1425{,}2} + \frac{1}{419{,}44} - \frac{1}{1672}$$

$$P_{ni} = 401{,}98\ \text{Klb}$$

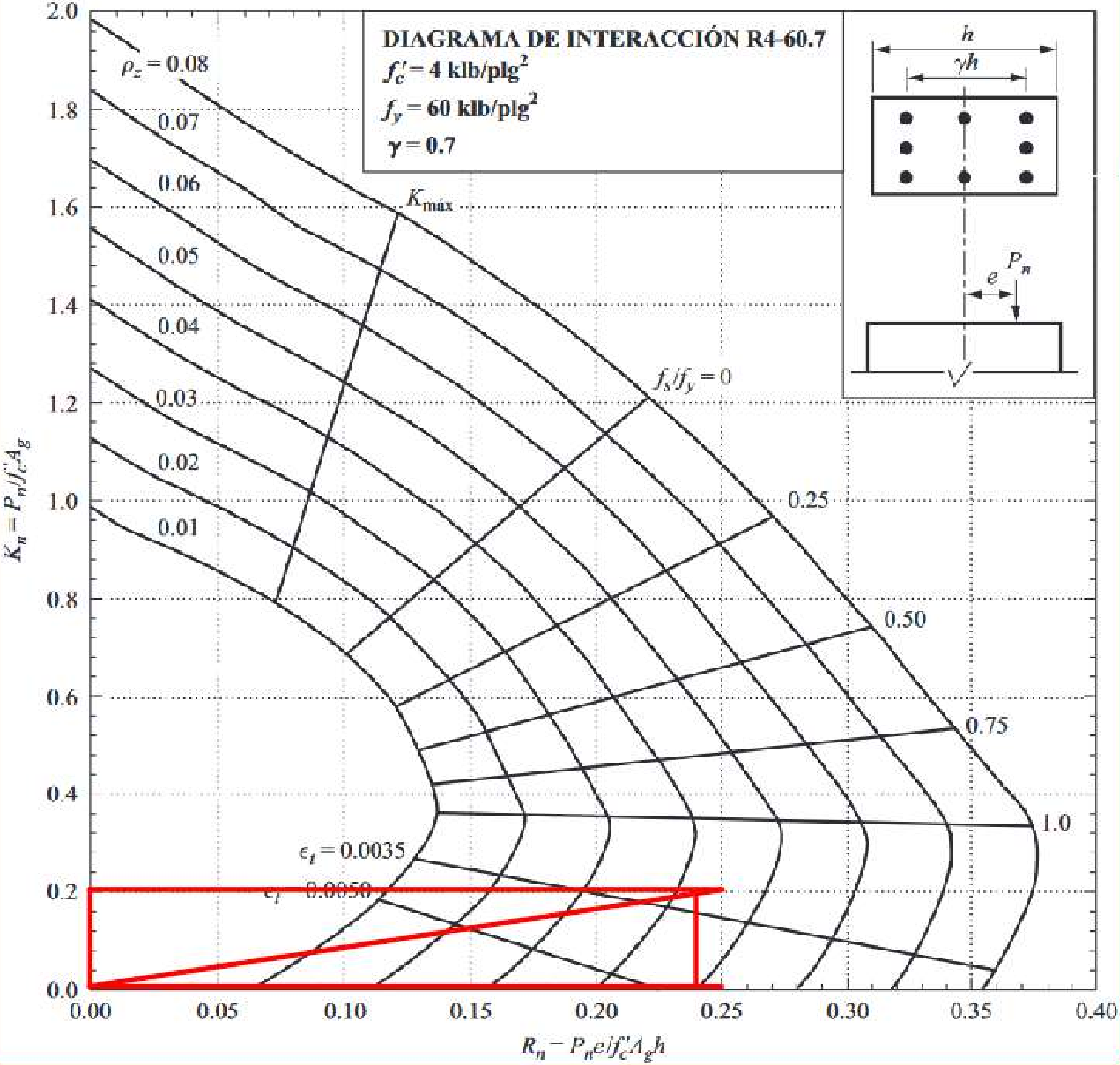


DIAGRAMA DE INTERACCIÓN R4-60.7
$f_c' = 4$ klb/plg^2
$f_y = 60$ klb/plg^2
$\gamma = 0.7$
h
γh
e
P_n
$\rho_z = 0.08$
0.07
0.06
0.05
0.04
0.03
0.02
0.01
$K_{máx}$
$f_s/f_y = 0$
0.25
0.50
0.75
1.0
$\epsilon_t = 0.0035$
$\epsilon_t = 0.0050$
$K_n = P_n/f_c' A_g$
$R_n = P_n e/f_c' A_g h$
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40

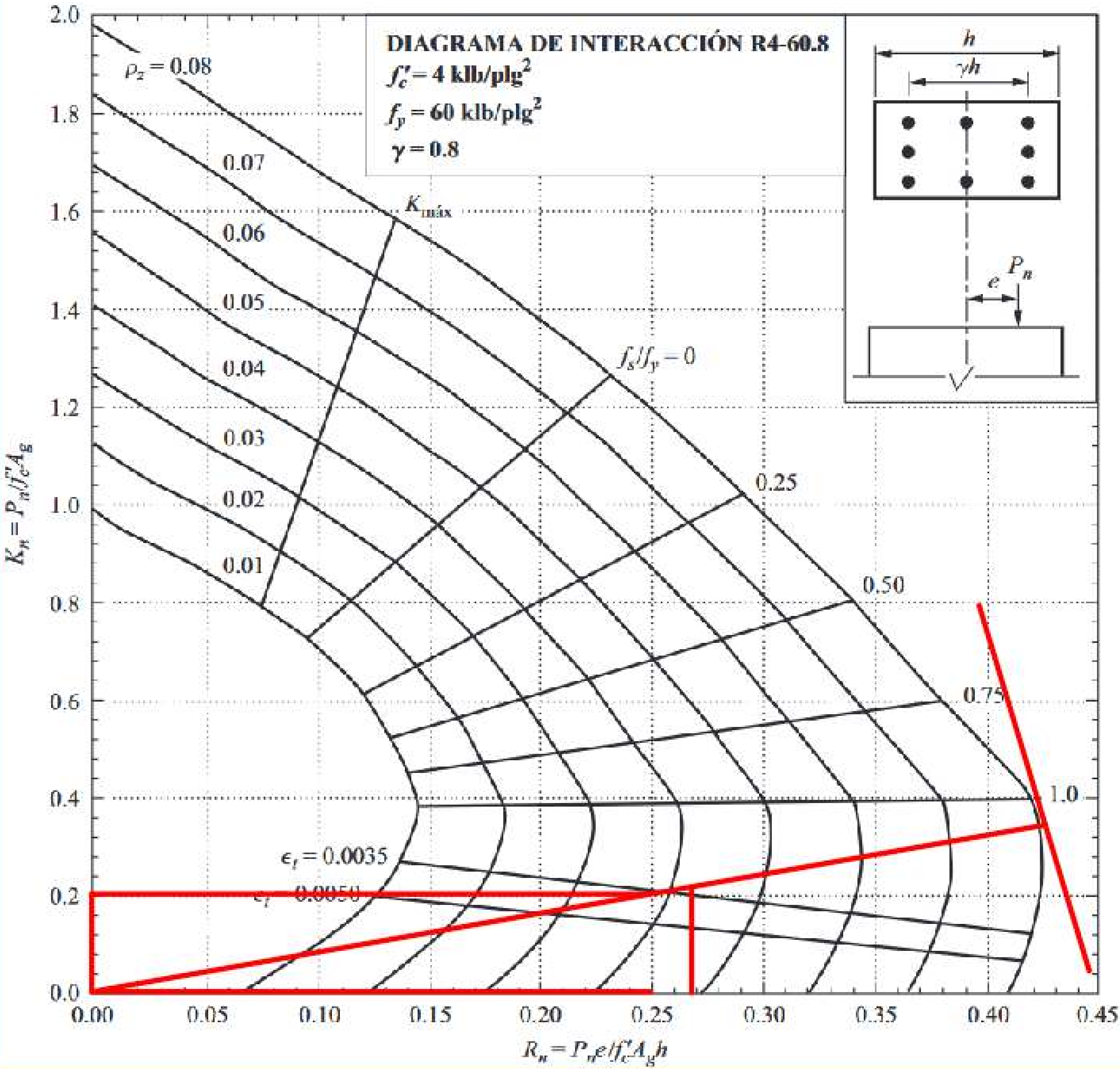


DIAGRAMA DE INTERACCIÓN R4-60.8
$f'_c = 4$ klb/plg^2
$f_y = 60$ klb/plg^2
$\gamma = 0.8$
h
γh
e
P_n
$\rho_z = 0.08$
0.07
0.06
0.05
0.04
0.03
0.02
0.01
$K_{máx}$
$f_s/f_y = 0$
0.25
0.50
0.75
1.0
$\epsilon_t = 0.0035$
$\epsilon_t = 0.0050$
$K_n = P_n/f'_c A_g$
$R_n = P_n e/f'_c A_g h$

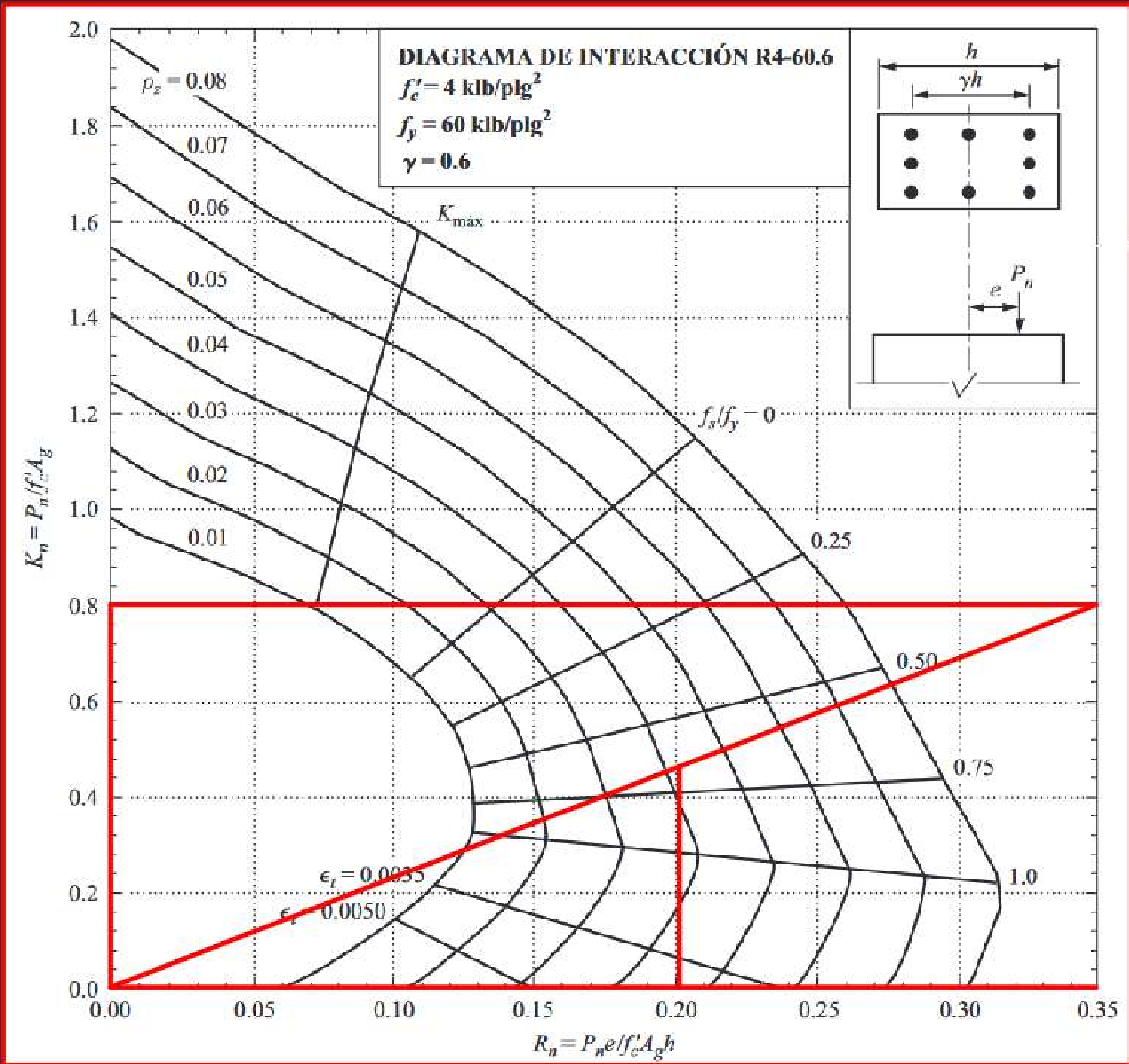


DIAGRAMA DE INTERACCIÓN R4-60.6
$f'_c = 4$ klb/plg^2
$f_y = 60$ klb/plg^2
$\gamma = 0.6$
h
γh
e
P_n
$\rho_z = 0.08$
0.07
0.06
0.05
0.04
0.03
0.02
0.01
$K_{máx}$
$f_s/f_y = 0$
0.25
0.50
0.75
1.0
$\epsilon_t = 0.0035$
$\epsilon_t = 0.0050$
$K_n = P_n/f'_c A_g$
$R_n = P_n e/f'_c A_g h$
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35

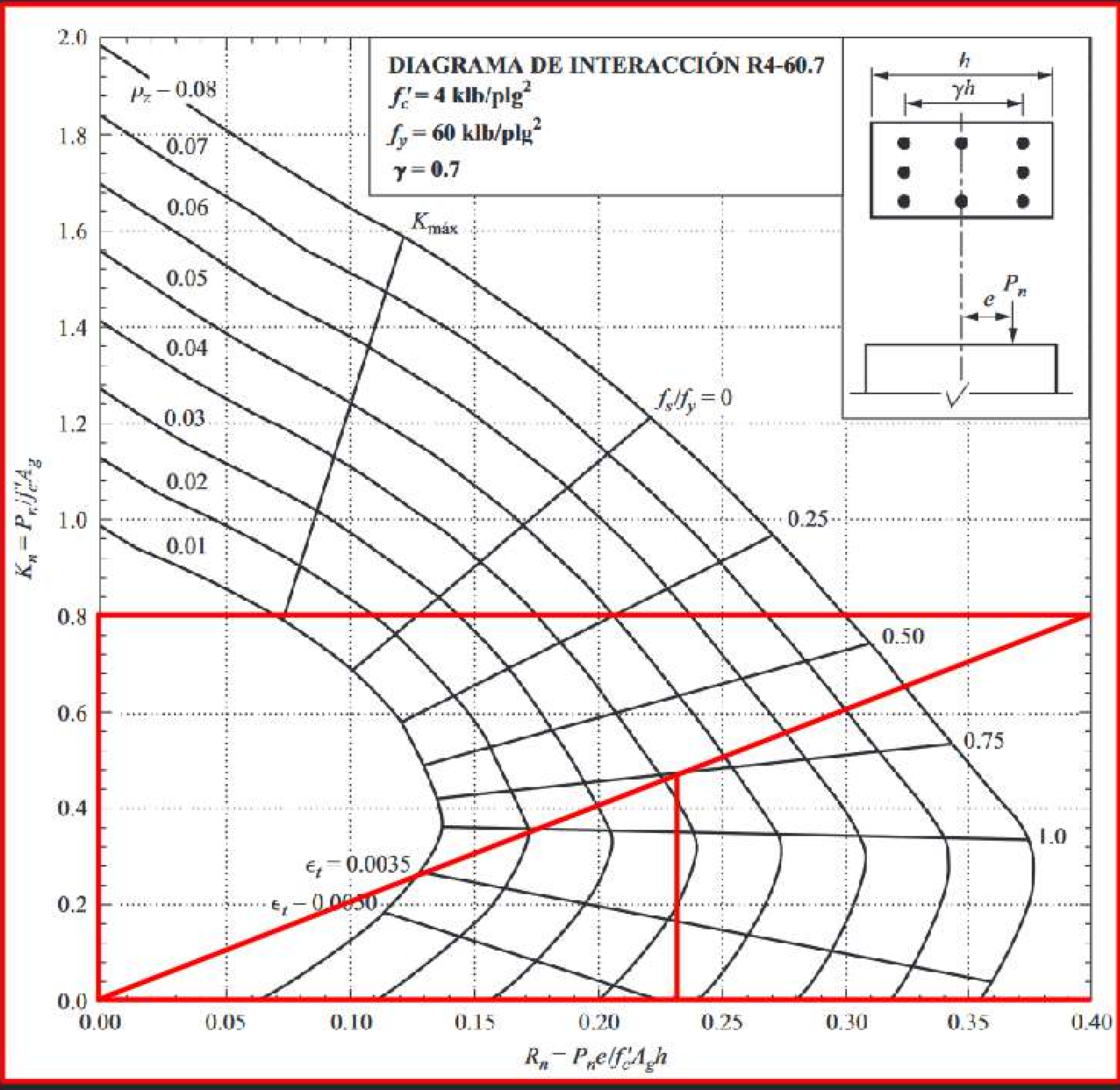
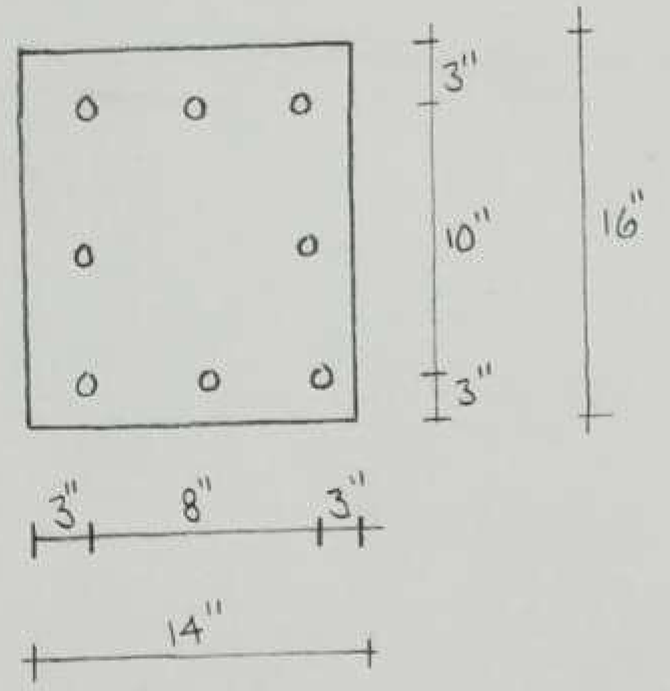


DIAGRAMA DE INTERACCIÓN R4-60.7
$f_c' = 4$ klb/plg^2
$f_y = 60$ klb/plg^2
$\gamma = 0.7$
h
γh
e
P_n
$K_{máx}$
$\rho_z = 0.08$
0.07
0.06
0.05
0.04
0.03
0.02
0.01
$f_s/f_y = 0$
0.25
0.50
0.75
1.0
$\epsilon_t = 0.0035$
$\epsilon_t = 0.0050$
$K_n = P_n/f_c'A_g$
$R_n = P_n e/f_c' A_g h$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40

CALCULE EL REFUERZO DE LA COLUMNA EN LAS 4 CARAS SOMETIDAS A FLEXIÓN BIAXIAL.

$P_u = 104$ Klb $\quad e_x = 9''$ $\quad e_y = 5''$



$A_g = 14(16) = 224$ pulg

$$\frac{P_u}{f'_c A_g} = \frac{104}{4(224)} = 0,1161$$

$$P_n = \frac{P_u}{0,65} = \frac{104}{0,65} = 160 \text{ Klb}$$

≡ PARA FLEXIÓN EN X

$$\gamma = \frac{h'}{h} = \frac{10}{16} = 0,625 \quad \Big| \quad R_n = \frac{P_n \cdot e_y}{f'_c A_g h_y} = \frac{160(5)}{4(224)(16)} = 0,0558$$

$$K_n = \frac{P_n}{f'_c A_g} = \frac{160}{4(224)} = 0,1786$$

$\rho_g = 0,01$ → USAR MINIMO

$A_s = 0,01(224) = 2,24 \text{ in}^2$

≡ PARA FLEXIÓN EN Y

$$\gamma = \frac{h'}{h} = \frac{8}{14} = 0,57 \quad \Big| \quad R_n = \frac{P_n \cdot e_x}{f'_c A_g h_x} = \frac{160(5)}{4(224)(14)} = 0,064$$

$K_n = 0,1786$

$\rho_g = 0,01$ → USAR MINIMO

$A_s = 0,01(224) = 2,24 \text{ in}^2$

" USAR 8 # 5 "

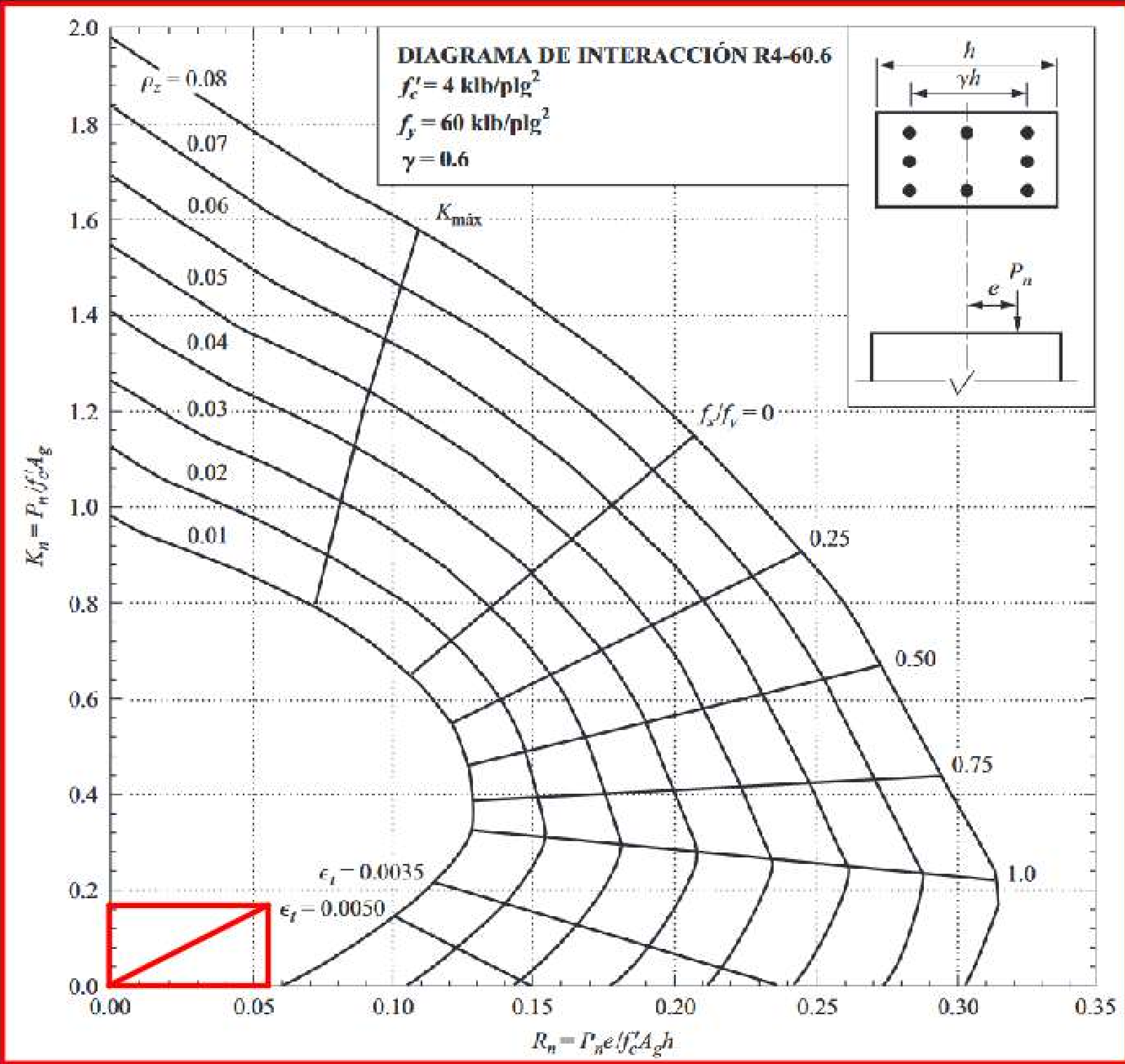


DIAGRAMA DE INTERACCIÓN R4-60.6
$f'_c = 4$ klb/plg^2
$f_y = 60$ klb/plg^2
$\gamma = 0.6$
h
γh
e
P_n
$\rho_z = 0.08$
0.07
0.06
0.05
0.04
0.03
0.02
0.01
$K_{máx}$
$f_s/f_y = 0$
0.25
0.50
0.75
1.0
$\epsilon_t = 0.0035$
$\epsilon_t = 0.0050$
$K_n = P_n/f'_c A_g$
$R_n = P_n e/f'_c A_g h$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35

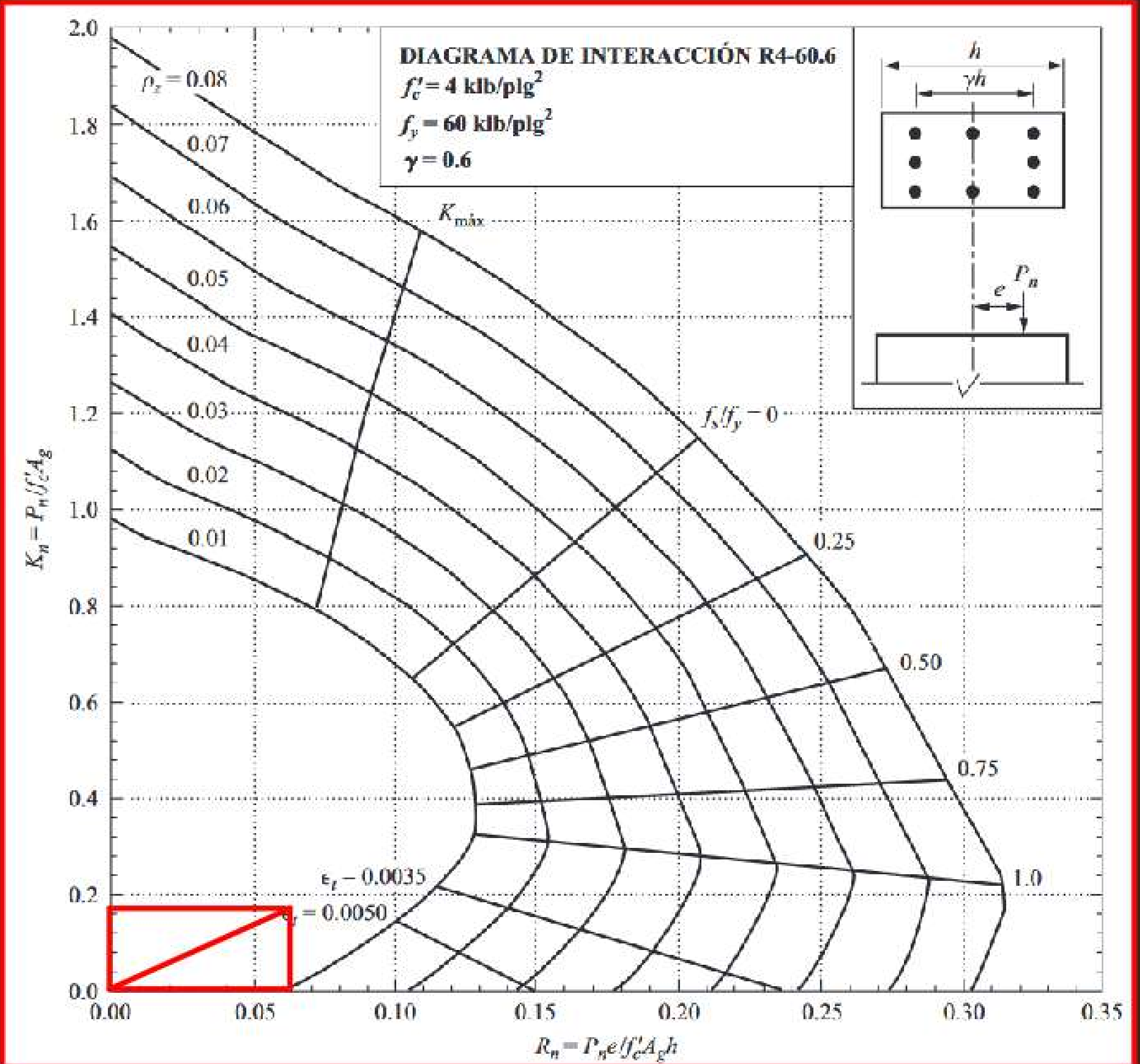
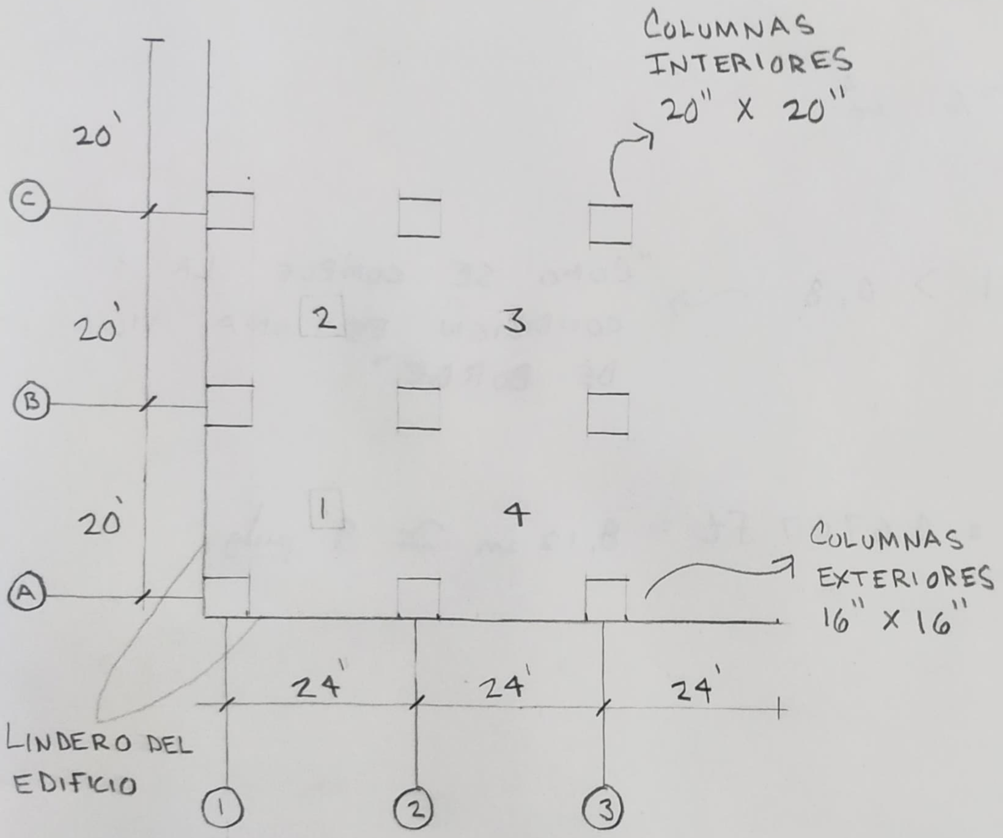


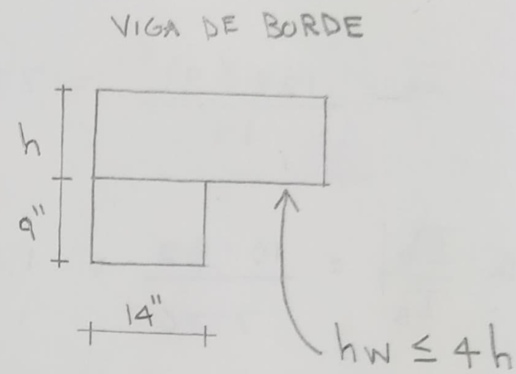
DIAGRAMA DE INTERACCIÓN R4-60.6
f'_c = 4 klb/plg^2
f_y = 60 klb/plg^2
γ = 0.6
h
γh
e
P_n
ρ_z = 0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
$K_{máx}$
f_s/f_y = 0
0.25
0.50
0.75
1.0
ϵ_t = 0.0035
ϵ_t = 0.0050
$K_n = P_n/f'_c A_g$
$R_n = P_n e/f'_c A_g h$
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35

TALLER #4

DETERMINE EL ESPESOR MÍNIMO PARA LOS TABLEROS 1 Y 3. LA VIGA DE BORDE SE MUESTRA EN EL DIBUJO.

$f'_c = 4000$ PSI Y $f_y = 60\,000$ PSI





≡ PARA TABLERO INTERIOR 3

$\alpha_f = 0$ (YA QUE LOS TABLEROS INTERIORES NO TIENEN VIGAS PERIMETRALES)

DISTANCIA LIBRE ENTRE COLUMNAS

l_n = DISTANCIA MAYOR ENTRRE COLUMNAS DE CENTRO A CENTRO − LONGITUD DE COLUMNA EN EL MISMO SENTIDO DE LA DISTANCIA MAYOR ENTRE COLUMNAS

$$l_n = 24 - \frac{20}{12} = 22{,}33 \text{ ft}$$

$$h_{MIN} = \frac{l_n}{33} = \frac{22,33}{33} = 0,6767 \text{ ft} = 8,12 \text{ pulg} = \text{USAR } 9 \text{ pulg}$$

≡ PARA TABLERO EXTERIOR 1

$$I_b = \frac{16\,(19)^3}{12} + \frac{10\,(9)^3}{12} + (304)(1,14)^2 + 10\,(1,86)^2 = 10182 \text{ in}^4$$

$$I_s = \frac{128\,(9)^3}{12} = 7776 \text{ in}^4$$

$$a = \frac{I_b}{I_s} = \frac{10182}{7776} = 1,31 > 0,8$$

"COMO SE CUMPLE LA CONDICIÓN ES UNA VIGA DE BORDE"

$$h_{MIN} = \frac{l_n}{33} = \frac{22,33}{33} = 0,6767 \text{ ft} = 8,12 \text{ in} \simeq 9 \text{ pulg.}$$

ENCUENTRE PARA EL TABLERO 3 EL MOMENTO INTERNO NEGATIVO DEL EJE B Y EL ACERO DE REFUERZO REQUERIDO PARA UNA CARGA VIVA DE 80 lb/pie² Y UNA CARGA MUERTA DE 60 lb/pie² ADEMAS DE SU PROPIO PESO. UTILIZAR EL DIBUJO DEL PROBLEMA ANTERIOR.

$$q_{pq} = 150\left(\frac{9}{12}\right) = 112{,}5\ \frac{lb}{ft^2}$$

$$q_u = 1{,}2(60 + 112{,}5) + 1{,}6(80) = 335\ \frac{lb}{ft^2}$$

$$l_n = 24 - \frac{20}{12} = 22{,}33\ ft$$

$$M = \frac{0{,}335(20)(22{,}33)^2}{8} = 417{,}6\ Klb \cdot ft$$

$$d = 9 - \frac{3}{4} - 0{,}5 = 7{,}75\ pulg$$

= MOMENTO INTERNO NEGATIVO

$$M_u^- = 0{,}65(0{,}75)(417{,}6) = 203{,}58\ Klb \cdot ft$$

$$\frac{M_u^-}{\phi b d^2} = \frac{203{,}58(12)(1000)}{0{,}9(10)(12)(7{,}75)^2} = 376{,}61\ \frac{lb}{pulg^2}$$

= DE LA TABLA A12

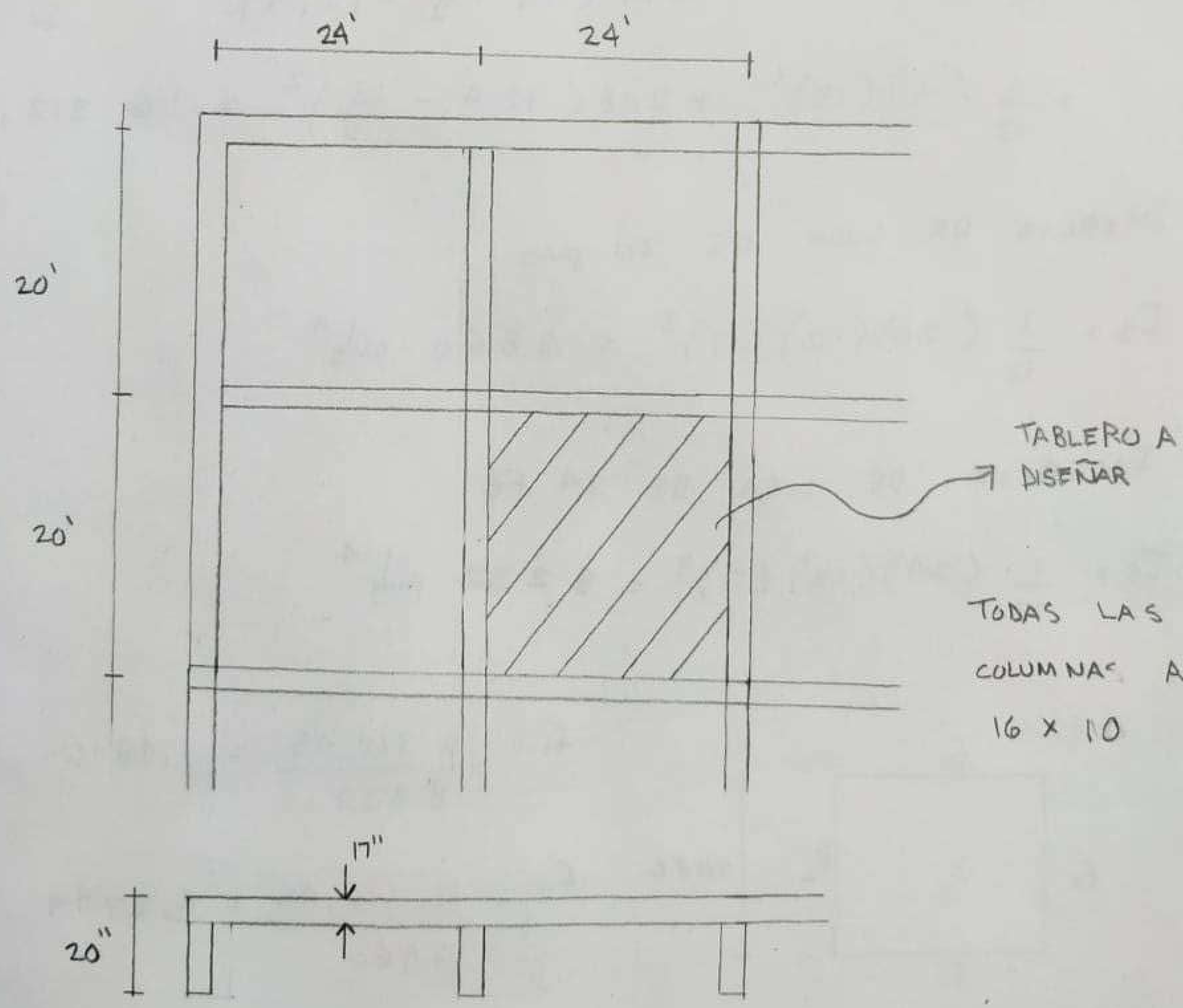
$$\rho = 0{,}00683$$

$$A_s = (0{,}00683)(120)(7{,}75) = 6{,}3519 \text{ pulg}^2$$

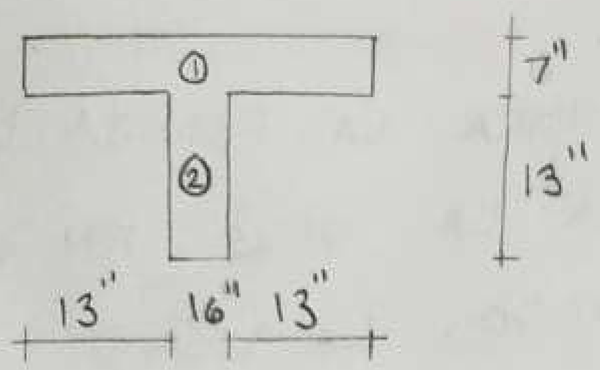
"USAR 8 # 8"

TALLER #5

DETERMINAR EL MOMENTO POSITIVO EN X PARA LA FRANJA DE LOSA Y EL MOMENTO NEGATIVO QUE APORTA LA VIGA EN LA DIRECCIÓN Y DEL TABLERO INTERIOR MOSTRADO. LA LOSA SOPORTARÁ UNA CARGA VIVA DE 115 / pie^2 Y UNA CARGA MUERTA INCLUYENDO LA LOSA DE 90 lb / pie^2. TODAS LAS COLUMNAS SON 16" x 16", $f'_c = 3000$ PSI Y $f_y = 60000$ PSI.



≡ CENTROIDE TABLERO INTERNO



$4h_f = 4(7) = 21$

$h - h_f = 20 - 7 = \underline{\underline{13}}$

$A_1 = 7(42) = 294$ pulg²

$A_2 = 16(13) = 208$ pulg²

$A_T = 502$ pulg²

$$\bar{Y} = \frac{294\left(13 + \frac{7}{2}\right) + 208\left(\frac{13}{2}\right)}{502} = 12{,}4 \text{ pulg}^2$$

≡ INERCIA EN VIGAS

$$I_b = \frac{1}{12}(42)(7)^3 + 294\left(13 + \frac{7}{2} - 12{,}4\right)^2$$

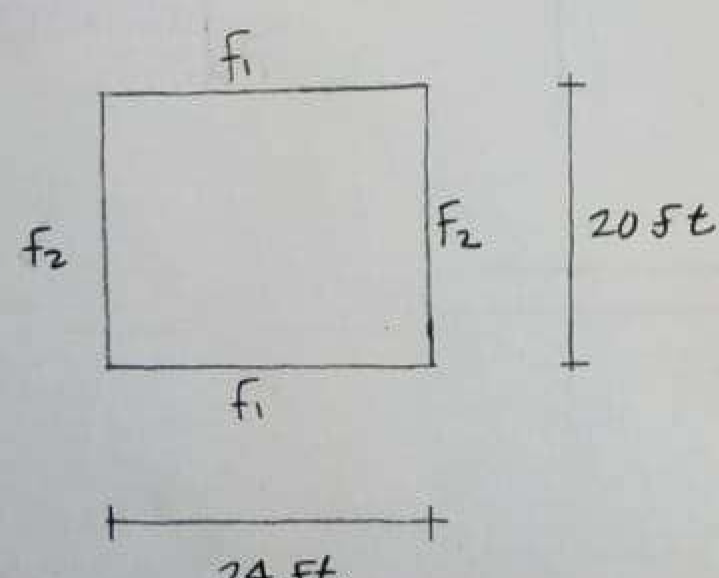
$$+ \frac{1}{12}(16)(13)^3 + 208\left(12{,}4 - \frac{13}{2}\right)^2 = 16\,312{,}45 \text{ pulg}^4$$

≡ INERCIA DE LOSA DE 20 pies

$$I_s = \frac{1}{12}(20)(12)(7)^3 = 6860 \text{ pulg}^4$$

≡ INERCIA DE LOSA DE 24 ft

$$I_s = \frac{1}{12}(24)(12)(7)^3 = 8232 \text{ pulg}^4$$



$$f_1 = \frac{16\,312{,}45}{8232} = 1{,}9816$$

$$f_2 = \frac{16\,312{,}45}{6860} = 2{,}3779$$

$$f_{PROM} = \frac{1{,}9816 + 2{,}3779}{2} = 2{,}1797$$

≡ CALCULO DE MOMENTOS

$$q_n = 1{,}2\,C_V + 1{,}6\,C_M = 1{,}2\,(90) + 1{,}6\,(115) = 292 \text{ lb/pie}^2$$

≡ DIRECCIÓN EN X

$$l_n = 24 - \frac{16}{12} = 22{,}67 \text{ ft}$$

$$l_2 = 20 \text{ ft}$$

$$M_o = \frac{292\,(20)\,(22{,}67)^2}{8} = 375\,168 \text{ lb}\cdot\text{pie}$$

≡ DIRECCIÓN EN Y

$$l_n = 20 - \frac{16}{12} = 18.67 \text{ ft}$$

$$l_2 = 24 \text{ ft}$$

$$M_o = \frac{292\,(24)\,(18{,}67)^2}{8} = 305\,346{,}36 \text{ lb}\cdot\text{pie}$$

≡ DISTRIBUCIÓN DE MOMENTOS EN EL EJE X

$$M^+ = 0{,}35\,(375\,168) = 131\,308{,}8 \text{ lb}\cdot\text{pie}$$

$$M^- = 0{,}65\,(375\,168) = 243\,859{,}2 \text{ lb}\cdot\text{pie}$$

≡ DISTRIBUCION DE MOMENTOS EN EL EJE Y

$$M^+ = 0{,}35\,(305\,346{,}36) = 106\,871{,}23 \text{ lb}\cdot\text{pie}$$

$$M^- = 0{,}65\,(305\,346{,}36) = 198\,475{,}13 \text{ lb}\cdot\text{pie}$$

≡ DISTRIBUCIÓN DE MOMENTOS EN FRANJA EN X

$$\frac{l_2}{l_1} = \frac{20}{24} = 0{,}8333$$

$$f_1 \frac{l_2}{l_1} = 1{,}98\,(0{,}8333) = 1{,}65$$

0,5

0,3333

0,5 0,8333 1

90 75

Δ%

15

$$\frac{\Delta\%}{0{,}3333} = \frac{15}{0{,}5}$$

$$\Delta\% = 10$$

$$\% = 90 - 10 = 80$$

MOMENTO EN LA FRANJA COLUMNA POSITIVA

$$M^{+} = 0{,}8\,(131\;308{,}8) = 105\;047{,}04 \text{ lb}\cdot\text{ft} = 105{,}05 \text{ K}\cdot\text{ft}$$

≡ DISTRIBUCION DE MOMENTOS PARA LA FRANJA EN Y

$$\frac{l_2}{l_1} = 1{,}2$$

$$f_2 \frac{l_2}{l_1} = 2{,}38\,(1{,}2) = 2{,}86$$

1

0,2

1 1,2 2

75 45

Δ%

30

$$\frac{\Delta\%}{0{,}2} = \frac{30}{1}$$

$$\Delta\% = 6$$

$$\% = 75 - 6 = 69$$

MOMENTO EN LA FRANJA DE COLUMNA NEGATIVA

$$M^{-} = 0{,}69\,(198\;475{,}13) = 136\;947{,}84 \text{ lb}\cdot\text{ft} = 136{,}95 \text{ K}\cdot\text{ft}$$

TALLER #6

$b_{o1} = 4\ (10 + 6) = 64$ pulg

$\emptyset V_c = 0,85\ (4)(\sqrt{3000})(64)(6) = 71,5\ K$

$\emptyset V_n = 0,85\ (6)(\sqrt{3000})(64)(6) = 107,3\ K$

$M_p = \dfrac{113}{2(0,4)}\left(4 + 0,25\,(22,2 - 5)\right) = 1,17\ K \cdot$ pulg

$b_{o2} = \dfrac{113\,000}{4\,(0,85)(\sqrt{3000})(6)} = 101,13$ pulg

$y = 8,9\,(6) + 19,9\,(2,75 + 3y^2) = 7,3$ pulg

$I_c = \frac{1}{3}(16)(2,29^3) + 8,90\,(3,71)^2 + 6\,(9) + 19,9\,(0,46)^2$

$I_c = 2,45$ pulg^4

$F_c = 244\ (3\,100\,000) = 756\,000\,000$ pulg^2

$d_v = \dfrac{174}{756} = 0,2302$

TALLER # 7

≡ CUANDO $a = 6$ - PRIMER TANTEO

$$\sqrt{20{,}25 + 6^2} = 7{,}5$$

$$\theta_1 = \frac{1}{7{,}5}\left(\frac{6}{4{,}5} + \frac{4{,}5}{6}\right) = 0{,}2778$$

$$\theta_2 = \frac{1}{4{,}5} + \frac{1}{4{,}5} = 0{,}44$$

$$W_L = 7{,}5\,(0{,}2778)(4) + 8\,(0{,}44) = 11{,}85\ m$$

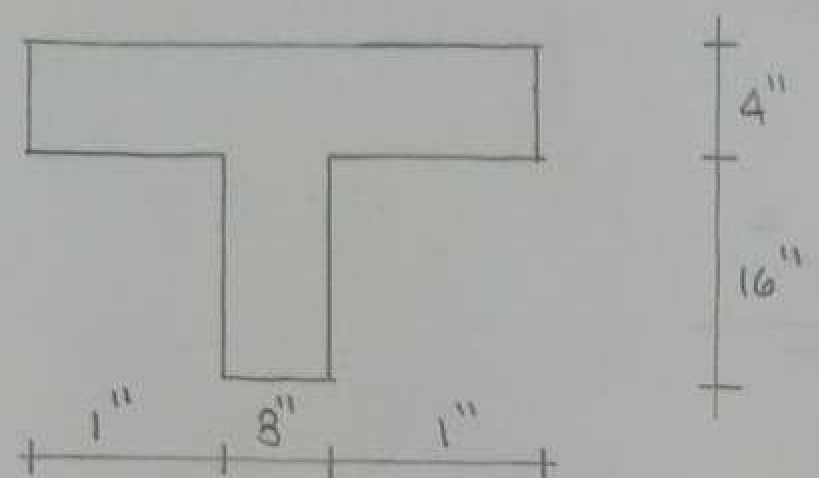
$$W_e = 9\,(6)\left(\tfrac{1}{2}\,w\right)\left(\tfrac{1}{3}\right)(2) + 8\,(4{,}5\,w)\left(\tfrac{1}{2}\right)(2)$$
$$+ 12\,(4{,}5)\left(\tfrac{1}{2}\,w\right)\left(\tfrac{1}{3}\right)(2) = 63\ w$$

$$m = \frac{63}{11{,}85} = 5{,}32\ w$$

a	W_L	W_e	m
6	11,85 m	63 w	5,32 w
7	12,33 m	75 w	6,1 w
8	12,9 m	78 w	6,57 w

TALLER #8

$h = 20 \text{ in} \rightsquigarrow$ POR TANTEO



$b = 0{,}5(20) = 10 \text{ in}$

$b_w = 0{,}4(20) = 8 \text{ in}$

$h_f = 0{,}2(20) = 4 \text{ in}$

$$\bar{x} = \frac{8(16)(8) + 10(4)(18)}{8(16) + 10(4)}$$

$\bar{x} = 10{,}38 \text{ in}$

$$I_g = \frac{1}{12}(8)(16)^3 + 8(16)(16 - 10{,}38)^2 + 10(4)(18 - 10{,}38)^2 + \frac{1}{12}(10)(4)^3 = 9150 \text{ in}^4$$

$f_r = 7{,}5\sqrt{5000} = 530{,}3 \text{ PSI}$

$$S_b = \frac{I_g}{Y_t} = \frac{9150}{10{,}38} = 881{,}5 \text{ in}^3$$

$$M_c = \frac{881{,}5(530{,}3 + 0{,}8(3000))}{1000(12)} = 215{,}25 \text{ K}\cdot\text{ft}$$

$q_u = 1{,}2(0{,}6) + 1{,}6(1{,}2) = 2{,}64 \text{ K/ft}$

$$M_u = \frac{2,64\ (55)^2}{8} = 998,25\ K \cdot ft$$

≡ CONDICIONAL

$$M_u > M_c$$

$$998,25 > 215,25 \leadsto \text{" OK "}$$

$$A_s = 0,003\ (8)(18) = \underline{\underline{0,432\ in^2}}$$