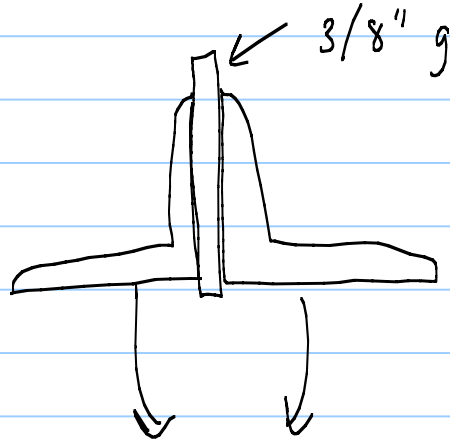
Note Title 3/1/2007

Problem 4.20, 4.12, 4.24 Due 3/6

Load Combos: 1.4 D
1.2D + 1.6 (Roof)

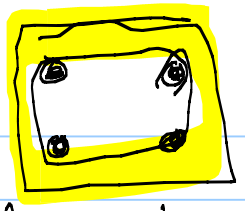


2L - - -

HW #4 9.6, 9.10, 9.12 Due 3/8
Concrete

ACI Eq. 10-1 & 10-2

spiral tied

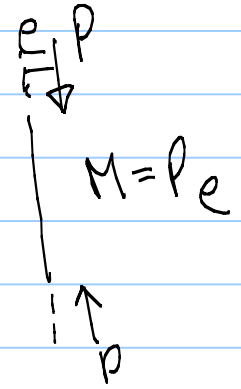


variability & criticality of member

$$\phi P_n = \underbrace{\alpha}_{\text{some bending}}\ \phi \Big[\underbrace{0.85 f'_c (A_g - A_{st})}_{\text{concrete } \sigma_f A} + \underbrace{f_y A_{st}}_{\text{steel } \sigma_f A} \Big]$$

spalling

f_y – steel yield stress
f_c – concrete ult. stress
A_{st} – Area steel
A_g – Gross Area



$\alpha = 0.85$ spiral
$\alpha = 0.80$ tied
$\phi = 0.70$ spiral
$\phi = 0.65$ tied

1% steel 8%

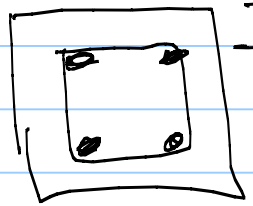
$0.01 \leq \rho \leq 0.08$ $\rho = A_{st} / A_g$

min steel for ductility creep & shrinkage

can't pour concrete

P_D, P_L

Know f'_c, f_y, shape cross-section, ρ assume



= clear cover $1\frac{1}{2}$"

$A_{st} = .02 A_g$

Problem 9.13

Design Round Column $P_D = 300k$, $P_L = 350k$
$f'_c = 4$ ksi, $f_y = 60$ ksi assume $\rho = 2\%$

$\phi P_n \geq P_u$ $\quad P_u = 1.2D + 1.6L$

$P_u = 1.2(300) + 1.6(350) =$ [redacted]

$$\phi P_n = \alpha \phi \left[.85 f'_c (A_g - 0.02 A_g) + f_y (.02 A_g) \right] \leftarrow$$

$$920k = \phi P_n = (.85)(.70)\left[.85(4)(0.98 A_g) + 60 (.02 A_g) \right]$$

$A_g = 341.2 \text{ in}^2 = \pi d^2/4$ $\quad 20.84$ $\quad d = 21''$

$341.2(.02) = 6.82 \text{ in}^2$

$\pi (21)^2/4 \ (.02) = 6.92 \text{ in}^2$

$A_g = 346 \text{ in}^2$

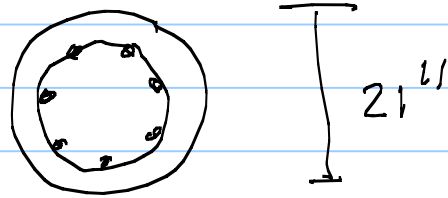
$$(.85)(.70) \qquad (4) \qquad (60)$$

$$920 = \alpha\phi\left[.85 f'_c (346 - A_{st}) + f_y (A_{st})\right]$$

$$A_{st} = 6.53 \text{ in}^2$$

$7 \#9 \quad A_{st} = 7.00$

$1\frac{1}{2}"$



7#9 bars

$$\rho = A_{st}/A_g = 7/346 = .02$$

$$.01 \le \rho \le .08 \quad \checkmark$$

$$\phi P_n = (.85)(.70)\left[.85(4)(346 - 7) + 60(7)\right]$$

50% 1152 420

$$\phi P_n = 936 \text{k}$$

$$\phi P_n = 936 \text{k} > 920 \text{k} \quad \checkmark$$