CIEG 302

HW # 4

PROB #9.5

Using 8 #10 bars ($A_{st} = 10.12\ in.^2$)

$$\phi P_n = 0.80\,\phi\,[0.85 f'_c (A_g - A_{st}) + f_y A_{st}]$$

$$= (0.80)(0.65)[(0.85)(4)(400-10.12)+(60)(10.12)]$$

$$= \boxed{1005.1\ k}$$ ✓ g CM

* PROB #9.6

Using 6 #9 bars ($A_{st} = 6.00\ in.^2$)

$$\phi P_n = 0.80\,\phi\,[0.85 f'_c (A_g - A_{st}) + f_y A_{st}]$$

$$= (0.80)(0.65)[(0.85)(4)(256-6)+(60)(6)]$$

$$= \boxed{629.2\ k}$$ ✓ g CM

PROB #9.7

Using 8 #8 bars ($A_{st} = 6.28\ in.^2$)

$$\phi P_n = 0.80\,\phi\,[0.85 f'_c (A_g - A_{st}) + f_y A_{st}]$$

$$= (0.80)(0.65)[(0.85)(4)(240-6.28)+(60)(6.28)]$$

$$= \boxed{609.2\ k}$$ ✓ g CM

PROB #9.8

Using 6 #11 Bars ($A_{st} = 9.37\ in.^2$)

$$\phi P_n = 0.85\,\phi\,[0.85\,f'_c\,(A_g - A_{st}) + f_y A_{st}]$$

$$= (0.85)(0.70)[(0.85)(4)(452 - 9.37) + (60)(9.37)]$$

$$= \boxed{1229.9\ k}$$ ✓ g.cm

PROB #9.9

Using 4 #11 bars ($A_{st} = 6.25\ in.^2$)

$$\phi P_n = 0.80\,\phi\,[0.85\,f'_c\,(A_g - A_{st}) + f_y A_{st}]$$

$$= (0.80)(0.65)[(0.85)(3)(600 - 6.25) + (60)(6.25)]$$

$$= \boxed{982.3\ k}$$ ✓ g.cm

✳ PROB #9.10

$P_u = (1.2)(280) + (1.6)(500) = 1136\ k$

$$\phi P_n = P_u = 0.80\,\phi\,[0.85\,f'_c\,(A_g - A_{st}) + f_y A_{st}]$$

$$1136 = (0.80)(0.65)[(0.85)(4)(A_g - 0.02A_g) + (60)(0.02A_g)]$$

$A_g = 482.04\ in.^2$ (USE $22 \times 22 = 484\ in.^2$)

$$1136 = (0.80)(0.65)[(0.85)(4)(484 - A_{st}) + 60A_{st}]$$

$A_{st} = 9.52\ in.^2$ USE 8 #10 ($A_{st} = 10.12\ in.^2$)

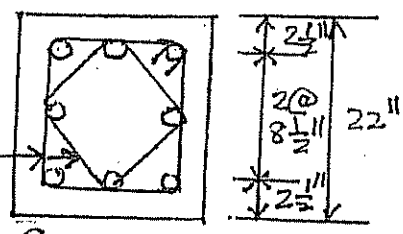
Design of Ties (Assuming #3 bars)

Spacing (a) $48 \times \frac{3}{8} = 18''$ ←

(b) $16 \times 1.27 = 20.32''$

(c) Least dimension $= 22''$

Use #3 Ties @ $18''$ →



237 ✓ g.cm

PROB # 9.12 ✳

Selection of column size

$$P_u = (1.2)(300) + (1.6)(350) = 920\,k$$

$$\phi P_n = P_u = 0.85\phi\,[0.85 f'_c (A_g - A_{st}) + f_y A_{st}]$$

$$920 = (0.85)(0.70)[(0.85)(3.5)(A_g - 0.04A_g) + (60)(0.04A_g)]$$

$$A_g = 294.2\ in.^2$$

use 20-in. diameter column ($A_g = 314\ in.^2$)

Select reinforcing bars

$$920 = (0.85)(0.70)[(0.85)(3.5)(314 - A_{st}) + 60\,A_{st}]$$

$$A_{st} = 10.73\ in.^2$$

use 7 #11 bars ($10.94\ in.^2$)

Design of spiral (Assuming #3 bar)

$A_{core} = 227\ in.^2$ with $1\frac{1}{2}$" clear cover for spirals

$$\min \rho_s = 0.45\left(\frac{A_g}{A_c} - 1\right)\frac{f'_c}{f_y} = 0.45\left(\frac{314}{227} - 1\right)\left(\frac{3.5}{60}\right)$$

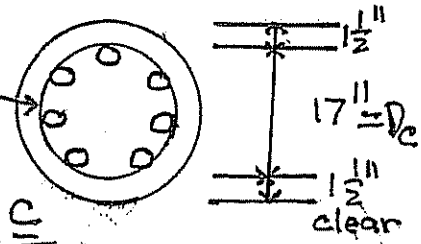
$$= 0.010$$

$$\rho_s = \frac{4a_s(D_c - d_b)}{s D_c^2}$$

$$0.010 = \frac{(4)(0.11)(17 - 0.375)}{(s)(17)^2}$$

$$s = 2.53\ in.$$

use #3 spiral @ $2\frac{1}{2}$"



239 ✓ gcm ≅