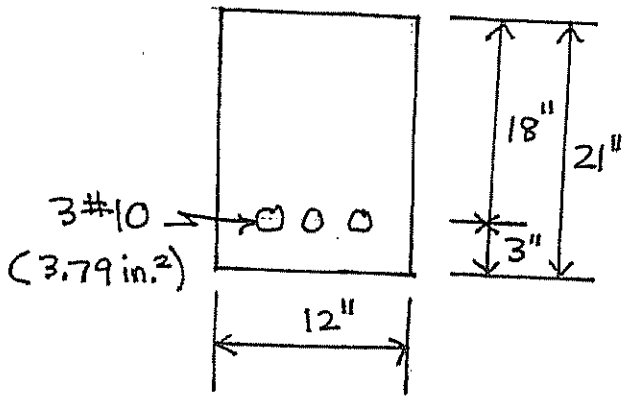
CIEG 302
HW #8

PROB# 3.8



$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(3.79)(75)}{(0.85)(6)(12)} = 4.645 \text{ in.}$$

$$\beta_1 = 0.85 - \left(\frac{f'_c - 4000}{1000}\right)(0.05) = 0.85 - \left(\frac{6000-4000}{1000}\right)(0.05)$$

$$= 0.75$$

$$c = \frac{a}{\beta_1} = \frac{4.645}{0.75} = 6.193 \text{ in.}$$

$$\varepsilon_t = \frac{d-c}{c}(0.003) = \left(\frac{18-6.193}{6.193}\right)(0.003)$$

$$= \underline{0.00572} > 0.005 \quad \therefore \text{ Its ductile}$$

and $\phi = 0.90$

$$\phi M_m = \phi A_s f_y \left(d - \frac{a}{2}\right) = (0.90)(3.79)(75)\left(18 - \frac{4.645}{2}\right)$$

$$= 4010.7 \text{ in.-k} = \underline{334.2 \text{ ft-k}} \quad \checkmark \text{ gcm}$$

PROB #4.6

Assume beam wt = 500 #/ft

$w_u = (1.2)(1.500) + (1.6)(2) = 5.0 k/ft$

$M_u = \frac{(5.0)(28)^2}{8} = 490$ ft-k

$\rho = \frac{0.18 f'_c}{f_y} = \frac{(0.18)(4)}{60} = 0.012$

$< \rho_{max} = 0.0181$ and $> \rho_{min} = 0.00333$

?

from Appendix A Table A.7

$\frac{M_u}{\phi b d^2} = 643.5$ from Appendix Table A.13

$bd^2 = \frac{M_u}{\phi\, 643.5} = \frac{(12)(490{,}000)}{(0.90)(643.5)}$

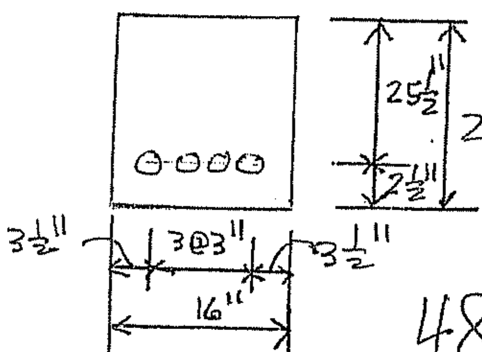
$= 10{,}153$
- 14 X 26.93
- 16 X 25.19 ←
- 18 X 23.75

Use 16 X 28 beam (d = 25.50 in.)

Bm wt $= \frac{(16)(28)}{144}(150) = 467$ #/ft < 500 #/ft ok

$A_s = (0.012)(16)(25.50) = 4.90$ in.^{2}

USE 4 #10 (5.06 in.^{2})



✓ JCMc

PROB #4.10

Assume beam wt = 475 #/ft

$w_u = (1.2)(.475) = 4.17$ k/ft

$P_u = (1.6)(30) = 48$ k

$M_u = \frac{(4.17)(24)^2}{8} + \frac{(48)(24)}{4} = 588.24$ ft-k

$\rho = \frac{0.18 f'_c}{f_y} = \frac{(0.18)(4)}{60} = 0.012$

$\frac{M_u}{\phi b d^2} = 643.5$ from Appendix Table A.13

$bd^2 = \frac{M_u}{\phi 643.5} = \frac{(12)(588,240)}{(0.9)(643.5)}$

$= 12,188$ { 12 X 31.87 ; 14 X 29.51 ← ; 16 X 27.60

USE 14 x 33 beam (d = 30.00 in.)

Beam wt $= \frac{(14)(33)}{144}(150) = 481$ #/ft > 475 #/ft BUT OK

$A_s = \rho b d = (0.012)(14)(30) = 5.04$ in.^{2}

USE 4 #10 Bars (5.06 in.^{2})

$\rho = \frac{A_s}{bd} = \frac{5.06}{(14)(30)} = 0.01205$

> $\rho_{min} = 0.0033$ and < $\rho_{max} = 0.0181$ from Table A.7

∴ Section is ductile and $\phi = 0.90$

Beam Cross Section