CHAPTER TWO

PROB # 2.1

$$I_g = \frac{1}{12} bh^3 = \left(\frac{1}{12}\right)(12)(21)^3 = 9261 \text{ in.}^4$$

f_r = modulus of rupture $= 7.5\sqrt{f'_c} = 7.5\sqrt{4000}$

$= 474$ psi

$$M_{cr} = \frac{f_r I_g}{y_t} = \frac{(474)(9261)}{10.5} = 418{,}068 \text{ in. lbs}$$

$$= \boxed{34.8 \text{ ft-k}}$$

rgcm

PROB # 2.2

$$I_g = \left(\frac{1}{12}\right)(12)(18)^3 = 5832 \text{ in.}^4$$

$$f_r = 7.5\sqrt{4000} = 474 \text{ psi}$$

$$M_{cr} = \frac{(474)(5832)}{9.00} = 307{,}152 \text{ in. lbs}$$

$$= \boxed{25.6 \text{ ft-k}}$$

rgcm

PROB # 2.26

Using 3 #10 bars (3.79 in.²)

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(3.79)(60)}{(0.85)(4)(16)} = 4.18 \text{ in.}$$

$$M_n = A_s f_y \left(d - \frac{a}{2}\right) = (3.79)(60)\left(25 - \frac{4.18}{2}\right)$$

$$= 5209.7 \text{ in.-k} = \boxed{434.1 \text{ ft-k}}$$ ✓ JCMS

PROB # 2.27

Using 6 #9 bars (6.00 in.²)

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(6.00)(60)}{(0.85)(4)(16)} = 6.62 \text{ in.}$$

$$M_n = A_s f_y \left(d - \frac{a}{2}\right) = (6.00)(60)\left(26.25 - \frac{6.62}{2}\right)$$

$$= 8258.4 \text{ in.-k} = \boxed{688.2 \text{ ft-k}}$$ ✓ JCMS

PROB # 2.28

Using 4 #10 bars (5.06 in.²)

$$a = \frac{A_s f_y}{0.85 f'_c b} = \frac{(5.06)(60)}{(0.85)(4)(16)} = 5.58 \text{ in.}$$

$$M_n = A_s f_y \left(d - \frac{a}{2}\right) = (5.06)(60)\left(23 - \frac{5.58}{2}\right)$$

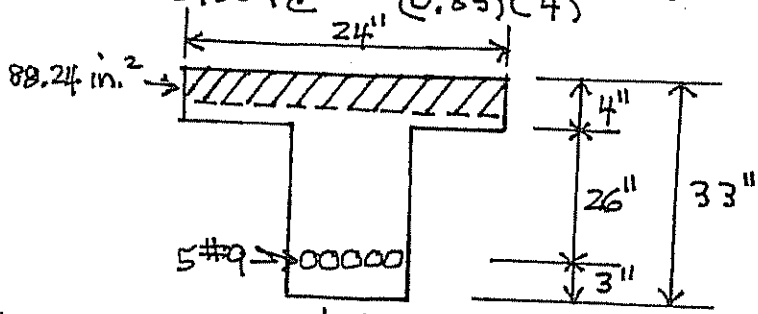
$$= 6135.8 \text{ in.-k} = \boxed{511.3 \text{ ft-k}}$$ ✓ JCMS

PROB # 2.35

Using 5 #9 bars (5.00 in.²)

$0.85 f'_c A_c = A_s f_y$

$A_c = \frac{A_s f_y}{0.85 f'_c} = \frac{(5.00)(60)}{(0.85)(4)} = 88.24 \text{ in.}^2$



Noting that $88.24 \text{ in.}^2 < (4)(24) = 96 \text{ in.}^2$

∴ N.A. is in flange

$a = \frac{88.24}{24} = 3.68 \text{ in.}$

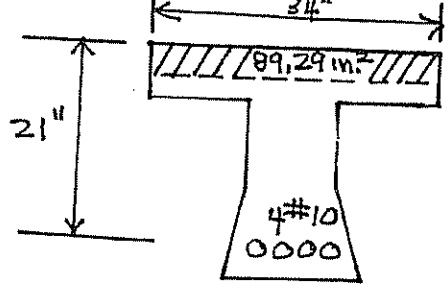
$M_n = A_s f_y (d - \frac{a}{2}) = (5.0)(60)(30 - \frac{3.68}{2})$

$= 8448 \text{ in.-k} = \boxed{704 \text{ ft-k}}$ ✓ jcm

PROB # 2.36

Using 4 #10 bars (5.06 in.²)

$A_c = \frac{A_s f_y}{0.85 f'_c} = \frac{(5.06)(60)}{(0.85)(4)} = 89.29 \text{ in.}^2$



$a = \frac{89.29}{34} = 2.63 \text{ in.}$

$M_n = A_s f_y (d - \frac{a}{2}) = (5.06)(60)(21 - \frac{2.63}{2})$

$= 5976.4 \text{ in.-k} = \boxed{498.0 \text{ ft-k}}$ ✓ jcm