PROB # 4-12

LRFD	ASD
$P_u = (1.2)(450)+(1.6)(120) = 732\ k$	$P_a = 450+120 = 570\ k$

(a) Min. $A_g = \frac{P_u}{\phi_t F_y} = \frac{732}{(0.90)(36)} = 22.59\ in.^2$ ←

(b) Assume $U = 0.90$ after study of AISC Table 1-1 & Table D3-1

Min $A_g = \frac{P_u}{\phi_t F_u U}$ + Estimated A of holes

$= \frac{732}{(0.75)(58)(0.90)} + (4)\left(\frac{3}{4}+\frac{1}{8}\right)(0.735) = 21.27\ in.^2$

(c) Min preferable $r = \frac{(12)(24)}{300} = 0.96\ in.$

Try W12X79 ($A = 23.2\ in.^2$, $d = 12.4\ in.$, $t_f = 0.735\ in.$, $r_y = 3.05\ in.$, $\bar{x} = \bar{y} = 1.06\ in.$ for a WT 6X39.5, $b_f = 12.1\ in.$)

Checking

(a) $P_n = F_y A_g = (36)(23.2) = 835.2\ k$

LRFD $\phi_t = 0.90$	ASD $\Omega_t = 1.67$
$\phi_t P_n = (0.90)(835.2) = 751.7k > 732k$	$\frac{P_n}{\Omega_t} = \frac{835.2}{1.67} = 500.1 < 570k$ N.G.

(b) $U = 1 - \frac{\bar{x}}{L} = 1 - \frac{1.06}{4} = 0.735$

But AISC Table D3.1 Case 7 says $U = 0.90$ if $b_f > \frac{2}{3}d$

$b_f = 12.1 > \frac{2}{3}\times 12.4 = 8.27\ in.$ ∴ $U = 0.90$

$A_n = 23.2 - (4)\left(\frac{3}{4}+\frac{1}{8}\right)(0.735) = 20.63\ in.^2$

$A_e = U A_n = (0.90)(20.63) = 18.57\ in.^2$

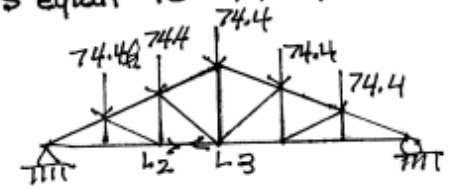
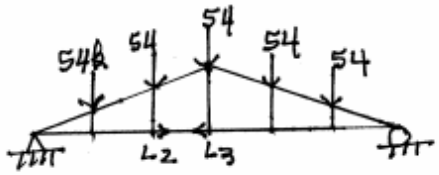
$P_n = F_u A_e = (58)(18.57) = 1077.1\ k$

LRFD $\phi_t = 0.75$	ASD $\Omega_t = 2.00$
$\phi_t P_n = (0.75)(1077.1) = 807.8k > 732k$	$\frac{P_n}{\Omega_t} = \frac{1077.1}{2.00} = 538.5k < 570k$ N.G.

Ans. W12X79 W12X87

VGCMC

PROB #4-20

LRFD	ASD
Truss loads $P_u = (1.2)(30) + (1.6)(24) = 74.4$ k By analysis of the truss force in member L_2L_3 is equal to 446.4 k 	Truss loads $P_a = 30 + 24 = 54$ k By analysis of the truss the force in member $L_2L_3 = 324$ k 

(a) Min. $A_g = \frac{446.4}{(0.9)(36)} = 13.79$ in.^{2}

(b) Min. $A_g = \frac{P_u}{\phi_t F_u U}$ + Estimated area of holes

Assume U = about 0.8 after studying AISC Table D3.1

Min. $A_g = \frac{446.4}{(0.75)(58)(0.8)} + (2)\left(\frac{3}{4} + \frac{1}{8}\right)$(estimated $\frac{3}{4}$ in.) $= 14.14$ in.^{2}

(c) Min. preferable $r = \frac{L}{300} = \frac{(12)(12)}{300} = 0.48$ in.

After studying double angle tables (AISC 1-15)

Try 2Ls 8 x 4 x $\frac{5}{8}$ ($A = 14.3$ in.^{2}, $\bar{x} = 0.902$, $r_y = 1.52$)

Checking

(a) $P_n = F_y A_g = (36)(14.3) = 514.8$ k

LRFD $\phi_t = 0.90$	ASD $\Omega_t = 1.67$
$\phi_t P_n = (0.90)(514.8) = 463.3$ k > 446.4 k	$\frac{P_n}{\Omega_t} = \frac{514.8}{1.67} = 308.3$ k < 324 k NG

PROB # 4-20 CONTD

(b) $U = 1 - \frac{\bar{x}}{L} = 1 - \frac{0.902}{2 \times 4} = 0.89$

$A_m = 14.3 - (4)\left(\frac{3}{4} + \frac{1}{8}\right)\left(\frac{5}{8}\right) = 12.11 \text{ in.}^2$

$P_m = F_u U A_m = (58)(0.89)(12.11) = 625.1 \text{ k}$

LRFD $\phi_t = 0.75$	ASD $\Omega_t = 2.00$
$\phi_t P_n = (0.75)(625.1) = 468.8 \text{ k} > 446 \text{ k}$	$\frac{P_n}{\Omega_t} = \frac{625.1}{2.00} = 312.5 \text{ k} < 324 \text{ k}$

N.G.

(c) $\frac{L}{r} = \frac{(12)(12)}{1.52} = 94.7 < 300$ ok

ANS. USE 2Ls 8x4 x $\frac{5}{8}$ For LRFD

USE 2Ls 8x4 x $\frac{3}{4}$ For ASD

JCM

PROB # 4-24

LRFD	ASD
$P_u = (1.2)(10) + (1.6)(12) = 31.2$ k	$P_a = 10 + 12 = 22$ k

$$A_D \geq \frac{P_u}{\phi\, 0.75 F_u} = \frac{31.2}{(0.75)(0.75)(58)} = 0.956 \text{ in.}^2$$

Try $1\frac{1}{8}$ in. diameter rod from AISC Table 7-18 using the gross area of the rod 0.994 in.^{2}

$$R_n = 0.75 F_u A_D = (0.75)(58)(0.994) = 43.24 \text{ k}$$

LRFD $\phi = 0.75$	ASD $\Omega = 2.00$
$\phi R_n = (0.75)(43.24) = 32.43$ k > 31.2 k ok	$\frac{R_n}{\Omega} = \frac{43.24}{2.00} = 21.62$ k ≈ 22 k ok

USE $1\frac{1}{8}$ in. diameter rod with 7 threads per inch for LRFD and ASD