ENCE 355 – Introduction to Structural Design
SOLUTIONS to Homework Set No. 9
Fall 2002

PROB# 2-2

1. $u = (1.4)(40) = 56$ psf

2. $u = (1.2)(40) + (0.5)(25) = 60.5$ psf

3. $u = (1.2)(40) + (1.6)(25) + (0.8)(30) = 112$ psf

4. $u = (1.2)(40) + (1.6)(30) + (0.5)(25) = 108.5$ psf

5. $u = (1.2)(40) + (0.2)(25) = 53$ psf

6. $u = (0.9)(40) + (1.6)(30) = 84$ psf

7. $u = (0.9)(40) = 36$ lbs/ft

$\boxed{u = 112 \text{ psf}}$ ← gcm≡

PROB # 2-4

CASE I WITH W = 60 lb

1. $u = (1.4)(120) = 168$ lb
2. $u = (1.2)(120) + (1.6)(80) + (0.5)(40) = 292$ lb
3. $u = (1.2)(120) + (1.6)(40) + (0.5)(80) = 248$ lb
   $u = (1.2)(120) + (1.6)(40) + (0.8)(60) = 256$ lb
4. $u = (1.2)(120) + (1.6)(60) + (0.5)(80) + (0.5)(40) = 300$ lb ←
5. $u = (1.2)(120) + (0.5)(80) = 184$ lb
6. $u = (0.9)(120) + (1.6)(60) = 204$ lb
7. $u = (0.9)(120) = 108$ lb

CASE II WITH W = −70 lb

1. $u = (1.4)(120) = 168$ lb
2. $u = (1.2)(120) + (1.6)(80) + (0.5)(40) = 292$ lb
3. $u = (1.2)(120) + (1.6)(40) + (0.5)(80) = 248$ lb
   $u = (1.2)(120) + (1.6)(40) + (0.8)(-70) = 152$ lb
4. $u = (1.2)(120) + (1.6)(-70) + (0.5)(80) + (0.5)(40) = 92$ lb
5. $u = (1.2)(120) + (0.5)(80) = 184$ lb
6. $u = (0.9)(120) + (1.6)(-70) = -4$ lb ←
7. $u = (0.9)(120) = 108$ lb

u = 300 lb or −4 lb

✓ JCM

PROB # 2-10 (1)

(a) Specified Load Components

	Axial	Bending	Shear	
Dead Load D	300.000000		0.000000	0.000000
Live Load L	200.000000		0.000000	0.000000
Roof Live Load L	40.000000	0.000000	0.000000	
Fluid Load F	0.000000	0.000000	0.000000	
Lateral Load H	0.000000	0.000000	0.000000	
Earthquake Load E	60.000000	0.000000	0.000000	
Rain Load R	0.000000	0.000000	0.000000	
Snow Load S	0.000000	0.000000	0.000000	
Wind Load W	150.000000		0.000000	0.000000

Calculated Combined Loading Using ASCE 7-98

Group 1 Load Combination	Axial	Bending	Shear	
1.4(D+F)	420.000000		0.000000	0.000000

Group 2 Load Combinations	Axial	Bending	Shear	
1.2(D+F) + 1.6(L+H) + 0.5Lr	700.000000		0.000000	0.000000
1.2(D+F) + 1.6(L+H) + 0.5S	680.000000		0.000000	0.000000
1.2(D+F) + 1.6(L+H) + 0.5R	680.000000		0.000000	0.000000

Group 3 Load Combinations	Axial	Bending	Shear	
1.2D + 1.6Lr + 0.5L	524.000000		0.000000	0.000000
1.2D + 1.6S + 0.5L	460.000000		0.000000	0.000000
1.2D + 1.6R + 0.5L	460.000000		0.000000	0.000000
1.2D + 1.6Lr + 0.8W	544.000000		0.000000	0.000000
1.2D + 1.6S + 0.8W	480.000000		0.000000	0.000000
1.2D + 1.6R + 0.8W	480.000000		0.000000	0.000000

Group 4 Load Combinations	Axial	Bending	Shear	
1.2D + 1.6W + 0.5L + 0.5Lr	720.000000		0.000000	0.000000
1.2D + 1.6W + 0.5L + 0.5S	700.000000		0.000000	0.000000
1.2D + 1.6W + 0.5L + 0.5R	700.000000		0.000000	0.000000

PROB # 2-10(2)

Group 5 Load Combination	Axial	Bending	Shear	
1.2D + 1.0E + 0.5L + 0.2S	520.000000		0.000000	0.000000

Group 6 Load Combination	Axial	Bending	Shear	
0.9D + 1.6W + 1.6H	510.000000		0.000000	0.000000

Group 7 Load Combination	Axial	Bending	Shear	
0.9D + 1.0E + 1.6H	330.000000		0.000000	0.000000

(b) Specified Load Components

	Axial	Bending	Shear	
Dead Load D	300.000000		0.000000	0.000000
Live Load L	200.000000		0.000000	0.000000
Roof Live Load L	40.000000	0.000000	0.000000	
Fluid Load F	0.000000	0.000000	0.000000	
Lateral Load H	0.000000	0.000000	0.000000	
Earthquake Load E	-75.000000	0.000000	0.000000	
Rain Load R	0.000000	0.000000	0.000000	
Snow Load S	0.000000	0.000000	0.000000	
Wind Load W	-130.000000		0.000000	0.000000

Calculated Combined Loading Using ASCE 7-98

Group 1 Load Combination	Axial	Bending	Shear	
1.4(D+F)	420.000000		0.000000	0.000000

Group 2 Load Combinations	Axial	Bending	Shear	
1.2(D+F) + 1.6(L+H) + 0.5Lr	700.000000		0.000000	0.000000
1.2(D+F) + 1.6(L+H) + 0.5S	680.000000		0.000000	0.000000
1.2(D+F) + 1.6(L+H) + 0.5R	680.000000		0.000000	0.000000

PROB #3-2

$A_{gross} = \left(\frac{3}{4}\right)(12) = 9.00 \text{ in.}^2$

$-\text{Hole areas} = -(2)\left(\frac{7}{8}+\frac{1}{8}\right)\left(\frac{3}{4}\right) = -1.50$

$A_{net} = \boxed{7.50 \text{ in.}^2}$

PROB #3-8

Using a W X50 ($A_g = 14.70 \text{ in.}^2$, $t_f = 0.355 \text{ in.}$, plus 1 PL $\frac{1}{2}$ X10 each flange)

$A_{gross} = 14.70 + (2)\left(\frac{1}{2}\right)(10) = 24.70 \text{ in.}^2$

$-\text{Hole areas} = -(4)\left(1+\frac{1}{8}\right)\left(\frac{1}{2}+0.535\right) = -4.66$

$A_{net} = \boxed{20.04 \text{ in.}^2}$