

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

PROB# 2-2

$$1. u = (1.4)(40) = 56 \text{ psf}$$

$$2. u = (1.2)(40) + (0.5)(25) = 60.5 \text{ psf}$$

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

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

$$5. u = (1.2)(40) + (0.2)(25) = 53 \text{ psf}$$

$$6. u = (0.9)(40) + (1.6)(30) = 84 \text{ psf}$$

$$7. u = (0.9)(40) = 36 \text{ lbs/ft}$$

$$u = 112 \text{ psf} \quad \checkmark \text{ gcm}$$

PROB # 2-4

CASE I WITH $W = 60$ k

1. $u = (1.4)(120) = 168$ k

2. $u = (1.2)(120) + (1.6)(80) + (0.5)(40) = 292$ k

3. $u = (1.2)(120) + (1.6)(40) + (0.5)(80) = 248$ k

$u = (1.2)(120) + (1.6)(40) + (0.8)(60) = 256$ k

4. $u = (1.2)(120) + (1.6)(60) + (0.5)(80) + (0.5)(40) = 300$ k ←

5. $u = (1.2)(120) + (0.5)(80) = 184$ k

6. $u = (0.9)(120) + (1.6)(60) = 204$ k

7. $u = (0.9)(120) = 108$ k

CASE II WITH $W = -70$ k

1. $u = (1.4)(120) = 168$ k

2. $u = (1.2)(120) + (1.6)(80) + (0.5)(40) = 292$ k

3. $u = (1.2)(120) + (1.6)(40) + (0.5)(80) = 248$ k

$u = (1.2)(120) + (1.6)(40) + (0.8)(-70) = 152$ k

4. $u = (1.2)(120) + (1.6)(-70) + (0.5)(80) + (0.5)(40) = 92$ k

5. $u = (1.2)(120) + (0.5)(80) = 184$ k

6. $u = (0.9)(120) + (1.6)(-70) = -4$ k ←

7. $u = (0.9)(120) = 108$ k

$u = 300$ k or -4 k

✓ g.c.m.c

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 Lr	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	Load Combination	Axial	Bending	Shear
Group 5	1.2D + 1.0E + 0.5L + 0.2S	520.000000		0.000000 0.000000
Group 6	0.9D + 1.6W + 1.6H	510.000000		0.000000 0.000000
Group 7	0.9D + 1.0E + 1.6H	330.000000		0.000000 0.000000

(b) Specified Load Components

Component	Axial	Bending	Shear
Dead Load D	300.000000		0.000000 0.000000
Live Load L	200.000000		0.000000 0.000000
Roof Live Load Lr	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	Load Combination	Axial	Bending	Shear
Group 1	1.4(D+F)	420.000000		0.000000 0.000000
Group 2	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

✓ gcm

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

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

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

PROB # 3-8

Using a W X50 ($A_g = 14.70 \text{ in.}^2$, $t_f = 0.355 \text{ in.}$)
plus 1 PL $\frac{1}{2} \times 10$ each flange)

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

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

A_{net}

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

✓ gcm