

EXAM #1, Solution

a

1. What is the dead load for 3/4-in. plywood? (3%)
 (a) 2.25 psf (b) 1.75 psf (c) 2.50 psf (d) 3.0 psf

$$\frac{3}{4} \times 3 \text{ psf} = 2.25 \text{ psf}$$

b

2. What is the minimum uniformly distributed live load for bowling alleys? (3%)
 (a) 50 psf (b) 75 psf (c) 67 psf (d) 100 psf

c

3. What is the reduced design live load for a beam member in a residential structure (live roof = 40 psf) if the influence area of the member is 900 ft²? (6%)
 (a) 20 psf (b) 25 psf (c) 30 psf (d) 35 psf

$$L_o \left(0.25 + \frac{15}{\sqrt{A_E}} \right) = 40 \left(0.25 + \frac{15}{\sqrt{900}} \right) = 30$$

b

4. What is the allowable deflection for a 25-ft long floor beam member subject to live load only? (3%)

(a) 0.78 in (b) 0.83 in (c) 0.90 in (d) 0.85 in

$$\frac{L}{360} = \frac{25 \times 12}{360} = 0.83 \text{ in}$$

a

5. Give: A 2-story special steel moment-resisting frame system office building, Redundancy/reliability factor = 1, $S_S = 1.75$ g, $S_1 = 0.50$ g
 Site Class "C", Occupancy Category II, Seismic Use Group I.

Level	Weight (kips)	Height (ft) from the ground floor
Roof	1400	30
2 nd	1600	15

a

- 5.1 What is the building period? (3%)

(a) 0.43 second (b) 0.50 second (c) 0.64 second (d) 1.0 second

$$T = C_t h^x = 0.028 (30)^{0.8} = 0.425 \text{ sec}$$

b

- 5.2 What is F_a ? (3%)

(a) 1.1 (b) 1.0 (c) 1.2 (d) 0.9

$$F_a = 1$$

a

- 5.3 What is F_v ? (3%)

(a) 1.3 (b) 1.4 (c) 1.5 (d) 1.6

$$F_v = 1.3$$

d

- 5.4 What is S_{DS} ? (3%)

(a) 1.25 g (b) 1.35 g (c) 1.75 g (d) 1.17 g

$$S_{DS} = \frac{2}{3} S_{MS} = \frac{2}{3} \times 1.75 \times 1 = 1.167 \text{ g}$$

d

- 5.5 What is S_{D1} ? (3%)

(a) 0.75 g (b) 0.48 g (c) 0.65 g (d) 0.43 g

$$S_{D1} = \frac{2}{3} S_{M1} = \frac{2}{3} \times 0.5 \times 1.75 = 0.43 \text{ g}$$

a

- 5.6 What value of R , would be used for seismic design? (3%)

(a) 8.0 (b) 7.0 (c) 5.0 (d) 4.5

$$R = 8$$

c

- 5.7 What is the base shear for this building? (3%)

(a) 439 kips (b) 532 kips (c) 375 kips (d) 450 kips

$$V = C_s W = \frac{S_{D1}}{T(R/I)} = \frac{0.43}{0.43 \times 8} \times W$$

$$= 0.125 W = 375 \text{ kips}$$

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d 5.8 What is the floor force at the 2nd floor level? (3%)
(a) 149.2 kips (b) 239.3 kips (c) 159.2 kips (d) 136.4 kips

d 5.9 What is the diaphragm force at the roof level? (3%)
(a) 450 kips (b) 239 kips (c) 309 kips (d) 490 kips

5.10 Please draw the IBC design response spectrum. (3%)

$$T = 0.43 \text{ sec} < 0.5 \quad \therefore K = 1$$

$$F_{\text{Roof}} = \frac{w_i h_i}{\sum w_i h_i} V = .6364 V = 238.6 \text{ K}$$

$$F_{2\text{nd}} = .3636 V = 136.4 \text{ K}$$

$$\text{Min. Roof Diap.} = 0.2 S_{DS} I_{wp} x = .2 \times 1.17 W = 327.6 \text{ Kips.}$$

d 6. What is the basic snow load is required in an area near Lake Tahoe ? (3%)
(a) 50 psf (b) 100 psf (c) 140 psf (d) 240 psf

b 7. Given a ground snow load of 90 psf, Importance factor =1, Snow Exposure B, "Sheltered" roof, Thermal factor=1.0, roof slope is 30 degree. What is the design snow load? (6%)
(a) 80.2 psf (b) 75.6 psf (c) 70.5 psf (d) 68.3 psf

$$S = 0.7 \times 1.2 \times 1.0 \times 90 = 75.6 \text{ psf}$$

a 8. According to IBC Sec. 1609.6.2.2.1, the minimum positive net design wind pressure and the maximum negative net design wind pressure for components and claddings are (3%)
(a) 10 psf (b) 7.5 psf (c) 12 psf (d) 15 psf

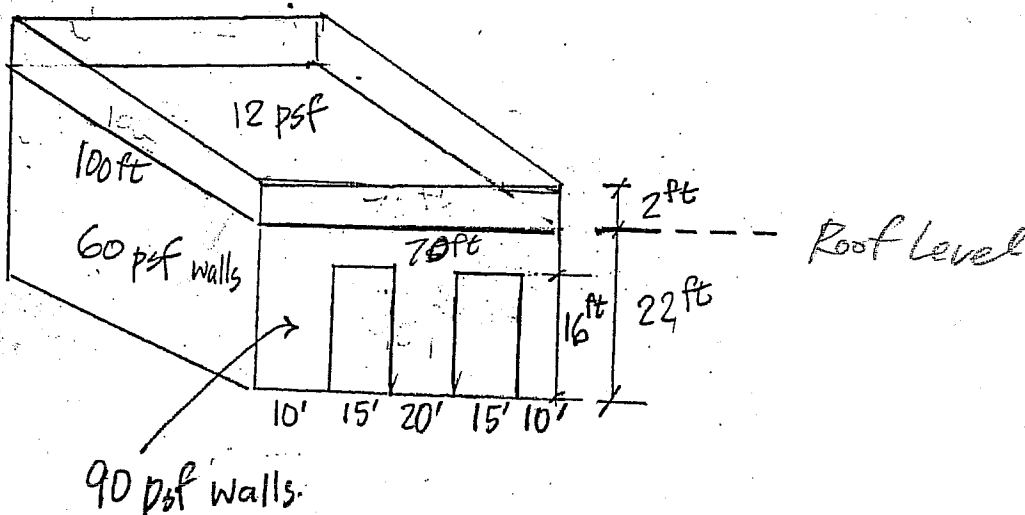
c 9. Given: the wind importance factor =1, wind exposure C, the mean roof height = 50 ft, roof angle = 15 degree, basic wind speed, V=100 mph. What is the design wind pressure for the End Zone A? (6%)
(a) 21 psf (b) 25 psf (c) 31 psf (d) 28 psf

$$P_s = 19.9 \times 1.56 = 31 \text{ psf.}$$

b 10. What is the load duration factor for snow load? (3%)
(a) 1.6 (b) 1.15 (c) 1.25 (d) 0.9

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- d 11. What is the size factor for 14x14 DF-L timber? (3%)
(a) 1.0 (b) 0.782 (c) 0.927 (d) 0.983 $C_F = \left(\frac{12}{14}\right)^{1/9} = .983$
- C 12. What are the uniform partition loads when the location of partition is unknowns or subject to change? (3%)
(a) 36 psf (b) 32 psf (C) 20 psf (d) 50 psf
- b 13. What is the moment of inertia (in^4) along x-x axis for 2 x 8 sawn lumber? (3%)
(a) 2.039 (b) 47.63 (c) 10.88 (d) 13.14
- a 14. What is the design bending stress value for a roof rafter, 2 x 6 No. 1, DF-L at 16 inches o.c., under normal temperature, dry-service conditions? Loads are D+S. Bracing conditions are such that buckling is not a concern. $C_i=1$ (6%)
(a) 1719 psi (b) 1587 psi (c) 1780 psi (d) 1600 psi $F'_b = 1000 \times 1.15 \times 1.15 \times 1.3 = 1719 \text{ psi}$
- b 15. What is the importance factor in designing for wind for essential and hazardous facilities? (3%)
(a) 1.25 (b) 1.15 (c) 1.5 (d) 1.0
16. A rectangular one-story building with a wood roof system and masonry walls is analyzed to determine seismic forces.
Given: $I=1$, Redundancy/Reliability factor =1, $R=5$ for a bearing wall system, roof dead load $D=12$ psf, exterior wall dead load $D=60$ psf along longitudinal walls and $D=90$ psf along transverse walls. $T_a=0.2$ seconds. $S_{DS}=1.35g$ and $S_{D1}=0.75g$. $V=0.27W$ (4% each)
- Determine the uniform force, adjusted to an ASD level, to the roof diaphragm in lb/ft along the transverse walls.
 - Determine the unit diaphragm unit shear adjusted to an ASD level adjacent to the transverse walls.
 - The total wall shear adjusted to an ASD level adjacent to the transverse walls
 - The unit shear at the midheight of the transverse walls.



16

$$\therefore V = .27W$$

(a) Weight of 1-ft wide strip tributary to Roof

$$\text{Roof Dead load } D = 12 \text{ psf} \times 70 \text{ ft} = 840 \text{ plf}$$

$$\text{Wall Dead load (2 long. wall)} = 2 \times 60 \times \left(\frac{22}{2} + 2\right) = 1560 \text{ plf}$$

$$\therefore W_u = .27W = .27 \times 2400 \quad 2400 \text{ plf}$$

$$= \frac{576}{2} \text{ plf} = 288 \text{ plf}$$

$$W = 0.7(698) = \frac{488.6}{2} \text{ plf} = 244.3 \text{ plf}$$

(b)

$$R = 453.6 \text{ plf} \times \frac{100 \text{ ft}}{2} = 22680 \text{ plf} \cdot \text{lb}$$

$$\frac{22680}{70} = 324 \text{ plf}$$

(c)

$$W_{\text{wall}} = 70 \times (2 + 22 - 16) \times 90 + (16 - \frac{22}{2}) \times (10 + 20 + 10) \times 90$$

$$= 68400 \text{ lb}$$

$$V_u = .27W = .27 \times 68400 = 18468 \text{ lbs}$$

$$V = 0.7(18468) = 12928 \text{ lbs}$$

(d) Total Shear = 22680 + 12928 = 35608 lb

$$\text{unit shear} = \frac{35608}{10 + 20 + 10} = 890.2 \text{ lb/ft}$$

117 2x6. No. 1 & Better, DF-L.

$$F_b = 1200 \text{ psi} \quad F_v = 180 \text{ psi}, \quad E = 1,800,000 \text{ psi}$$

$$C_D = 1.25, \quad C_r = 1.15, \quad C_F = 1.3 \quad C_M = C_t = C_i = C_L = 1$$

$$F'_b = 1200 \times 1.25 \times 1.15 \times 1.3 = 2242 \text{ psi}$$

$$F'_v = 180 \times 1.25 = 225 \text{ psi}$$

$$f_b = \frac{M}{S} = \frac{\frac{1}{8} w l^2}{S} = \frac{\frac{1}{8} \times (35) \times \frac{18}{12} \times 15^2 \times 12}{7.563} = 2342 \text{ psi}$$

$$\therefore f_b = 2342 \text{ psi} > F'_b = 2242 \text{ psi} \quad \text{N.G.}$$

$$f_v = \frac{1.5V}{A} = \frac{1.5 \times (\frac{1}{2})(35) \times \frac{18}{12} \times 15}{0.25} = 71.6 \text{ psi} < F'_v = 225 \text{ psi}$$

OK

$$\Delta_{\text{allow}} = \frac{L}{240} = \frac{15 \times 12}{240} = 0.75''$$

$$\Delta = \frac{5 w l^4}{384 E I} = \frac{5 \times \frac{52.5}{12} \times (15 \times 12)^4}{384 \times 1.8 \times 10^6 \times 20.8} = 1.597'' > \Delta_{\text{allow}}$$

N.G.