Architecture 544 Winter 2004 Name: KEY

Wood Framing
Mid-term Exam

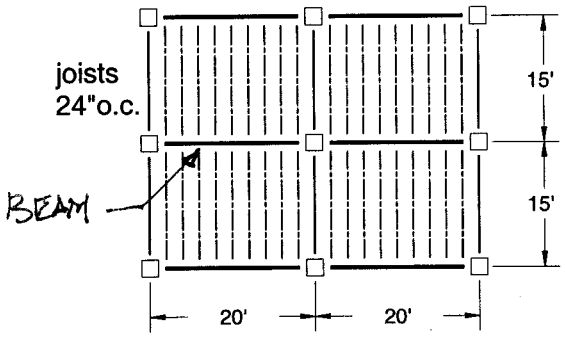
4 pts. 1. Determine C_D for a roof rafter in the plan shown

LOADS:

Dead Load (D)	10 PSF
Roof Live Load (L_r)	20 PSF
Snow Load (S)	20 PSF

LOAD COMB.:

1. D
2. $D + L_r$
3. $D + S$



$D \rightarrow 10/.9 = 11.1$

$D+L_r \rightarrow 30/1.25 = 24.0$

$D+S \rightarrow 30/1.15 = 26.1 \leftarrow$ CONTROLS

$\therefore C_D = 1.15$

4 pts. 2. Based on the following conditions, determine C_M for F_V for a rafter from question 1.

$C_M = 0.97$

Size	2x12
Spec.	Aspen
Grade	No.1
M.C.	20%

4 pts. 3. Based on the following conditions, determine C_F for a rafter from question 1.

$C_F = 1.0$

Size	2x12
Spec.	Aspen
Grade	No.1
M.C.	20%

4 pts. 4. Based on the following conditions, determine F_b (not F'_b) for a rafter from question 1.

$F_b = 625$ psi

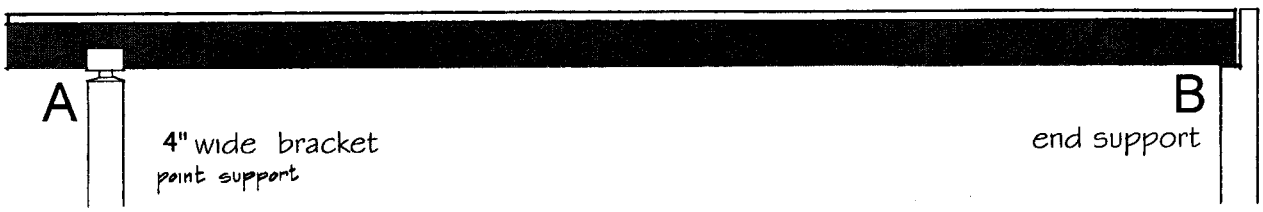
Size	2x12
Spec.	Aspen
Grade	No.1
M.C.	20%

4 pts. 5. What adjustment factor would apply the rafters, but not to the beam in question 1?

C_r

4 pts. 6. What is the largest Dimensioned Lumber size shown in the Supplement table 1B?

4x16



4 pts. 7. Calculate C_b for each support condition of the continuous 4x12 beam shown above.

A. C_b = 1.10 TAB 3.10.4

B. C_b = 1.0 END

4 pts.. 8. Using a Southern Pine Glulam beam, what depth is closest to but exceeding 13"?

13 3/4"

4 pts.. 9. Give an example where the factor C_L would = 1.0 (without calculation)

IF $d/b \leq 2$ $C_L = 1.0$

eg 4x8

4 pts.. 10. Determine C_V for a 12 ¼" x 24" Western Species Glulam spanning 32' in x-x bending.

TAB 4.5

$C_V = 0.820$

4 pts. 11. Which stress typically controls design in sawn lumber beams?

A

A) F_b
B) F_v
C) $F_{c\perp}$
D) E

4 pts. 12. Which stress typically controls design in Glulam beams?

A

A) F_b
B) F_v
C) $F_{c\perp}$
D) E

4 pts. 13. What is the wood product shown at the front of the room? (there is a sample somewhere – you have to look at it)

T&G DECKING

4 pts. 14. Give an example of "Structural Composite Lumber" (SCL)?

LVL OR PSL

4 pts. 15. What is the most common application of gang nail?

B

A) stud walls
B) trusses
C) I-Joists
D) Glulam beams

4 pts. 16. What 2 adjustment factors are already included the F_b values given in table 4E for decking.?

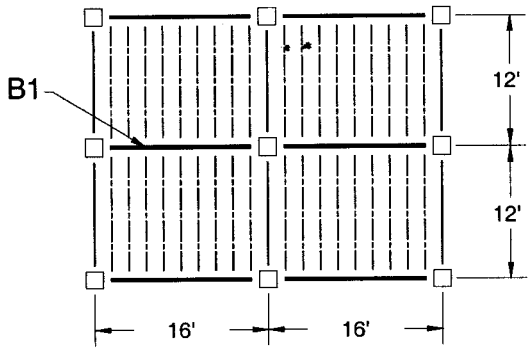
C_{fu} C_r

4 pts.. 17. A Glulam with a span of 24' deflects a total of 1". If the applicable limit is ℓ/240, does this pass or fail?

$\frac{24 \times 12}{240} = 1.2" > 1"$ PASSES

16 pts. 18. Analyze beam B1. Check allowable flexure and shear.

D = 10 PSF L = 40 PSF
D_{self} use 19 PLF
Size 6x20 5.5 x 19.5
Spec. Eastern White Pine
Grade No.1
M.C. 12%
Braced full length (ℓ_u=0)



Tabulated stresses:

F_b 875 psi F_v 125 psi E 1100 000 psi

Factors:

C_D 1.0 C_F 0.9475 C_L 1.0
C_M 1.0 C_{fu} 1.0 C_r 1.0

$C_F = (12/19.5)^{1/9} = 0.9475$

Factored stresses:

F'b 829 psi F'v 125 psi E' 1100 000 psi

$875(0.9475) = 829$

Forces:

M_{max} 19800 ft-lbs V_{max} 4952 lbs.

$M = \frac{wl^2}{8} = \frac{((50\times12)+19)16^2}{8} = 19800$ ft-#

$V = \frac{wl}{2} = \frac{619(16)}{2} = 4952$ #

Actual stresses:

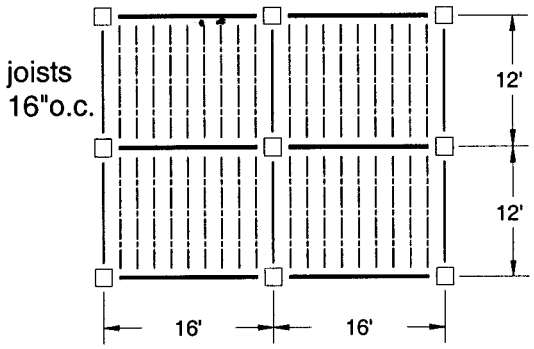
f_b 681.9 psi f_v 69.26 psi

$f_b = \frac{M}{S_x} = \frac{19800(12)}{348.6} = 681.9$ psi < 829 ✓ OK

$f_v = \frac{3}{2}\frac{V}{A} = \frac{1.5(4952)}{107.25} = 69.26$ psi < 125 ✓ OK

16 pts. 19. **Design** a floor joist for the plan shown.

D = 10 PSF L = 40 PSF
D_{self} included above
Size 2x?
Spec. Eastern White Pine
Grade Select
M.C. 12%
Braced full length (ℓ_u=0)



Tabulated stresses:

F_b 1250 psi F_v 135 psi

$w = (10+40)\frac{16}{12} = 66.67$ PLF

Forces:

M_{max} 1200 ft-lbs V_{max} 400 lbs.

$M = \frac{wl^2}{8} = \frac{66.67(12^2)}{8} = 1200'^{\#}$ $V = \frac{wl}{2} = \frac{66.67(12)}{2} = 400^{\#}$

Trial Selection (first estimate):

S_{req} 11.52 in^3 $= M/F = 1200(12)/1250 = 11.52\ in^3$

Size 2x8 = 13.14

Factors(from final size):

C_D 1.0 C_F 1.2 C_L 1.0
C_M 1.0 C_{fu} 1.0 C_r 1.15

$F'_b = 1250(1.2)(1.15) = 1775$ psi

Revised Selection (final size to use):

Size 2x8 $S_x = 13.14 in^3$ $A = 10.88 in^2$

$S_x = \frac{M}{F'_b} = \frac{1200(12)}{1775} = 8.55 in^3$

Factored stresses(from final size):

F'_b 1775 psi F'_v 135 psi

Actual stresses(from final size):

f_b 1096 psi f_v 55.15 psi

$f_b = \frac{M}{S} = \frac{1200(12)}{13.14} = 1095.9$ psi $f_v = \frac{3}{2}\frac{V}{A} = \frac{1.5(400)}{10.88} = 55.15$ psi