Arch 544 - Wood Framing
Test One

Show all work. Label additional calculations with problem number.

6 pts. 1. Find the floor live load in PSF on the floor system and in PLF on one beam. Occupancy: an office in an office building.

Total live load (L) in PSF on floor

\[ 50 \]

Total live load (L) in PLF on one beam.

\[ 300 \]

Total live load (L) = \( 50 \left( \frac{1}{2} \right) = \)

6 pts. 2. Find the flat roof snow load in PSF on the roof system and in PLF on one beam. Location: the "box" on the west side of this building (assume occupied, sheltered and heated).

Total snow load (S) in PSF on floor

\[ 21 \]

\[ Ce = 1.2 \]
\[ Ct = 1.1 \]
\[ I = 1.0 \]
\[ pg = 25 \]

Total snow load (S) in PLF on one beam.

\[ 126 \]

Total snow load (S) = \( 21 \left( \frac{1}{2} \right) = \)

10 pts. 3. Find the maximum wind pressure on the windward wall of the "box" in question 2. Height = 15'. Assume it is an "enclosed" classroom.

Velocity wind pressure, \( q_{z} \) in PSF

\[ 10.05 \]

\[ Kz = 0.57 \]
\[ Kzt = 1.0 \]
\[ Kd = 0.85 \]
\[ V = 90 \]
\[ I = 1.0 \]

\[ 82 = 0.00256(0.57)(90) \]
\[ (0.85)(90)(1.0) = 10.05 \]

Surface wind pressure, \( p \) in PSF.

\[ 8.64 \]

\[ G = 0.85 \]
\[ C_p = 0.8 \]
\[ GCpi = -0.18 \]

\[ p = 10.05(0.85)(0.8) - 10.05(-0.18) = 8.64 \]
4 pts.  4. Name the wood sample being passed around. Yellow Poplar

Is the wood you named hardwood or softwood? Hardwood

6 pts.  5. Eastern White Pine has a specific gravity of 0.36. For a moisture content of 20%, what is the actual total weight of a 12 FT 2x10 (nominal)? Include the water. Ge 1

\[
25.32 \text{ PCF} \times 62.4 \left[ \frac{0.36}{1 + 0.36(0.009)(20)} \right] \left[1 + \frac{20}{100} \right]
\]

2.44 PLF

29.28 LBS Total

25.32 \left( \frac{13.88}{14.4} \right) = 2.44 \text{ PLF}

2.44 (12) = 29.28 \text{ LBS}

3 pts.  6. What is \( C_M \) for the member described in Question 5 above for flexure (Fb)?

\[
F_b = \frac{775}{1.1} = 702.5 < 1150 \text{ psi}
\]

\[
C_F = 1.1
\]

\[
C_M = 1.0
\]

5 pts.  7. What is the longest allowable length of a nominal 6x6 in compression (column)? Assume pinned end conditions.

\[
\frac{F_e}{d} = 50
\]

\[
L_e = 50 \times 5.5 = 275'' = 22.91'\]

3 pts.  8. According to the NDS, \( C_L \) can be taken as 1.0 if certain bracing conditions are met. What are the conditions for 2x10 floor joists?

CompressioN Edge Must Be Held In Line For Its Entire Length

End Points Must Be Held In Place

3 pts.  9. In determining the load duration factor, \( C_D \), what length of time is associated with snow loads?

A) 1 week
B) 1 month
C) 2 months...
D) 3 months
27 pts.  10. **Analyze** the floor system shown to determine if the 6x14 BEAM will pass or fail. Check both flexure and shear stress for the given load.

**Given:**
- DL = 8 PSF (including joists)
- LL = 50 PSF
- Braced by joists and flooring: CL = 1.0
- Beam Size 6x14
- Spec. Eastern White Pine
- Density (including water) 25 PCF
- Grade No.1 M.C. 18%

**Load on Beam:**
- DL (floor) \( \frac{48}{8 \times 6} = 48 \) plf
- LL \( \frac{300}{12} = 300 \) pf

**Tabulated properties:**
- \( S_x = 160.9 \text{ in}^3 \)
- \( A = 72.88 \text{ in}^2 \)
- \( W_{total} = 360.9 \text{ plf} \)

**Adjustment Factors for \( F_b \):**
- \( C_D = 1.0 \)
- \( C_M = 1.0 \)
- \( C_{fl} = 1.0 \)
- \( C_I = 1.0 \)
- \( C_F = 0.989 \)

**Adjustment Factors for \( F_v \):**
- \( C_D = 1.0 \)
- \( C_M = 1.0 \)
- \( C_I = 1.0 \)

**Factored allowable stresses:**
- \( F_b' = 865 \) psi
- \( F_v' = 125 \) psi

**Maximum moment from D+L:**
- \( M_{max} = \frac{w f^2}{8} = \frac{360.9 (16)^2}{8} = 11542 \) ft-lbs

**Actual flexure stress, \( f_b \):**
- \( f_b = \frac{M}{S_x} = \frac{11542 (16)}{160.9} = 860.8 \) psi

**Check on shear stress:**
- \( \frac{3}{2} \frac{V_{max}}{b} = 1.5 \frac{2885}{72.88} = 59.4 \) psi

(both pass or fail) **PASS**
11. **Analyze** the single column to find the load capacity in LBS. The load combination is \(D + S\)

- **Size**: 4x8
- **Species**: Eastern White Pine
- **Grade**: No. 1

  - \(L_1 = 120\) in.
  - \(L_2 = 60\) in.
  - \(M.C. = 12\%\)

**Actual dimensions:**

- \(d_2 = 3.5\) in.
- \(d_1 = 7.25\) in.

**Tabulated stresses:**

- \(F_c = 1000\) psi
- \(E_{min} = 400,000\) psi

**Slenderness ratios:**

- \(\frac{L_1}{d_1} = \frac{120}{7.25} = 16.55\)
- \(\frac{L_2}{d_2} = \frac{60}{3.5} = 17.14\)

- Controlling \(\frac{L}{d} = 17.14\)

**Buckling Stress & \(C_P\):**

- \(F_{ce} = 1118.8\) psi
- \(F_e = 1207.5\) psi
- \(c = 0.8\) psi

**Factors for \(F_c\):**

- \(C_D = 1.15\)
- \(C_M = 1.0\)
- \(C_F = 1.05\)
- \(C_i = 1.0\)
- \(C_t = 1.0\)

**Factored stresses:**

- \(F_c' = 801.8\) psi
- \(E_{min'} = 400,000\) psi

**Forces (max. actual):**

- \(P_{max} = 20,347\) lbs