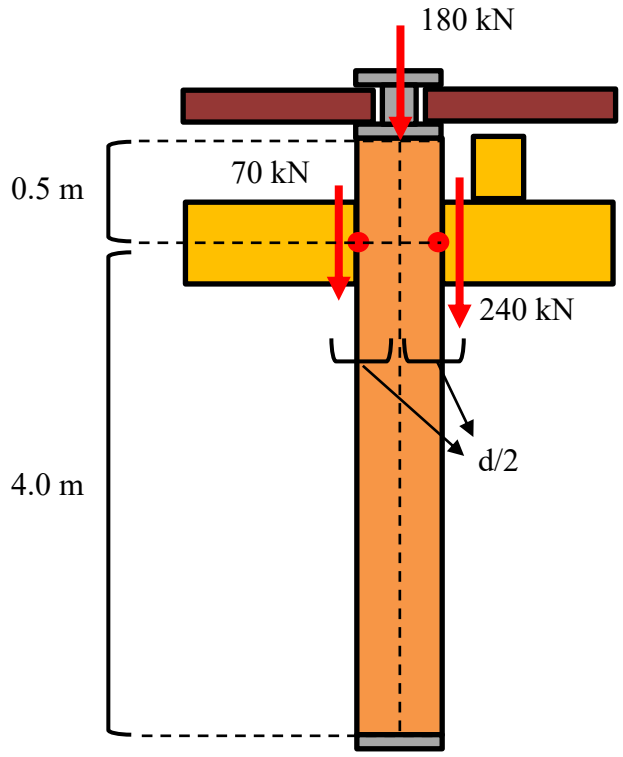
CWC Wood Design
Assignment 3: Combined Loading, CLT (Modules 7,8)

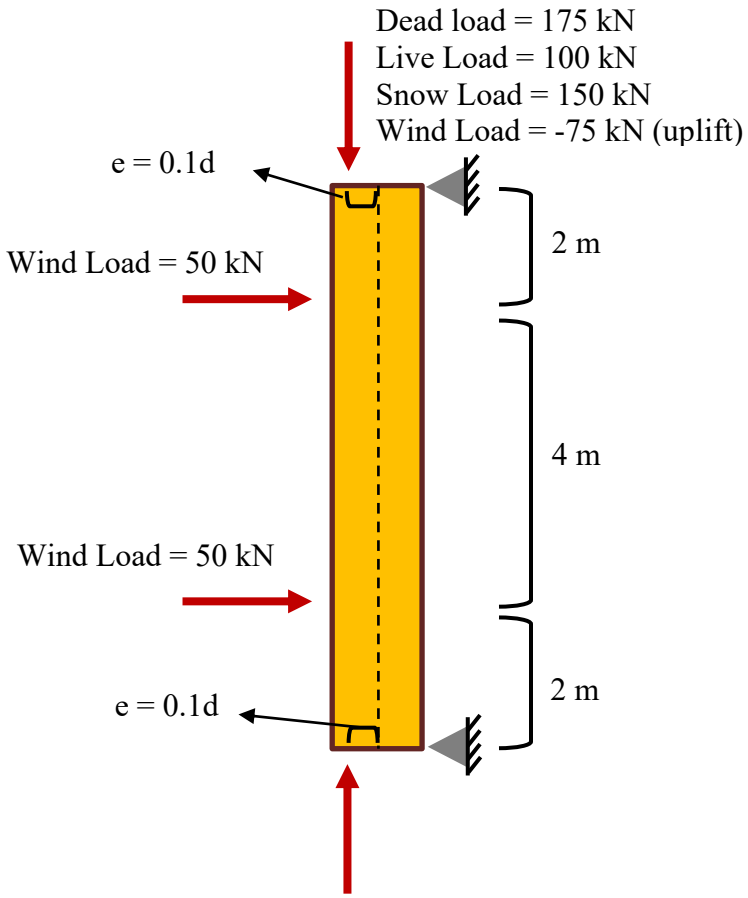
QUESTION 1

A 4.5 m glulam column supports two glulam girders, a CLT slab, and loads from the upper storeys. The reaction loads from the supported girders act at an eccentricity of 1/2 the column's depth. The loads from the CLT slab and the upper storeys are represented by an axial load at the top of the column with no eccentricity. The initial member sizing suggested a 215x266 mm SPF 20f-EX glulam column. Using resistance values from the O86-14 member selection tables, determine if this member sizing is suitable. If found unsuitable, suggest a suitable SPF 20f-EX alternative with a width of 215 mm. Assume pin-pin support and no intermediate restraint from the girders. The eccentricity is in the direction of the column's strong axis. Service conditions are dry and no treatment has been applied to the members. The load duration factor, K_D, is 1.0. Full design calculations are not required except where specific resistance info is not given in the selection tables.



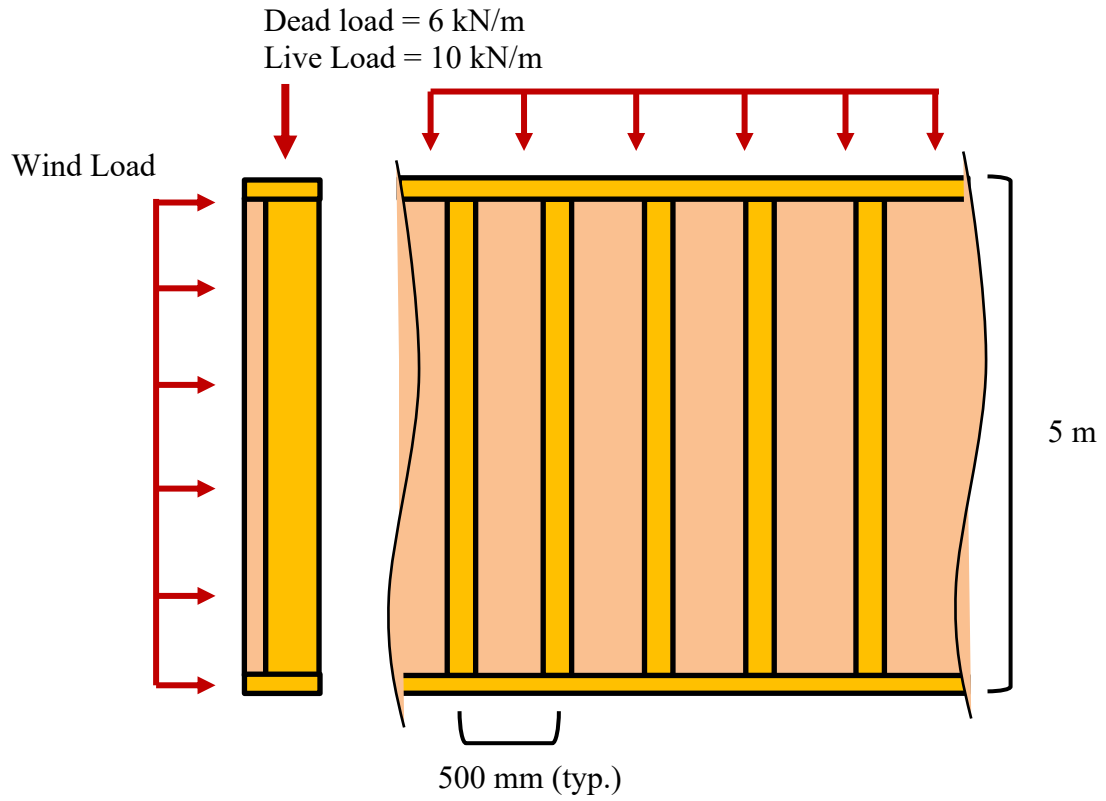
QUESTION 2

A column is subjected to an axial load and two lateral point loads. Assuming an axial load eccentricity of 10% of the member's depth for both the applied load and the axial reaction at the pin, select an efficient SPF 20f-EX glulam member to resistance the specified loading. A utilization of 85% or greater is considered sufficient. You may ignore bearing. A deflection limit of L/180 is required. Service conditions are dry and the members are untreated. The lateral wind loads do not brace the member. Assume a laminate width of half the full beam width. You may use selection tables for intermediate sizes but the final member must be supported by full design calculations.



QUESTION 3

A stud wall using 38 x 140 mm SPF No. 2 members at 500 mm spacing supports a distributed axial load and a distributed lateral load. Assuming 10 mm thick plywood sheathing with 2 inch common nails at 150 mm centers, what is the maximum lateral wind load that can be applied? Assume no eccentricity in applied loads. Consider only load cases that result in a load duration factor of K_D = 1.15. Assume the wall is pin-pin supported. Compare your final factored wind load to that specified in the O86-14 selection tables. Service conditions are dry and the members are untreated. You may assume pin-pin connections. No bracing is present.



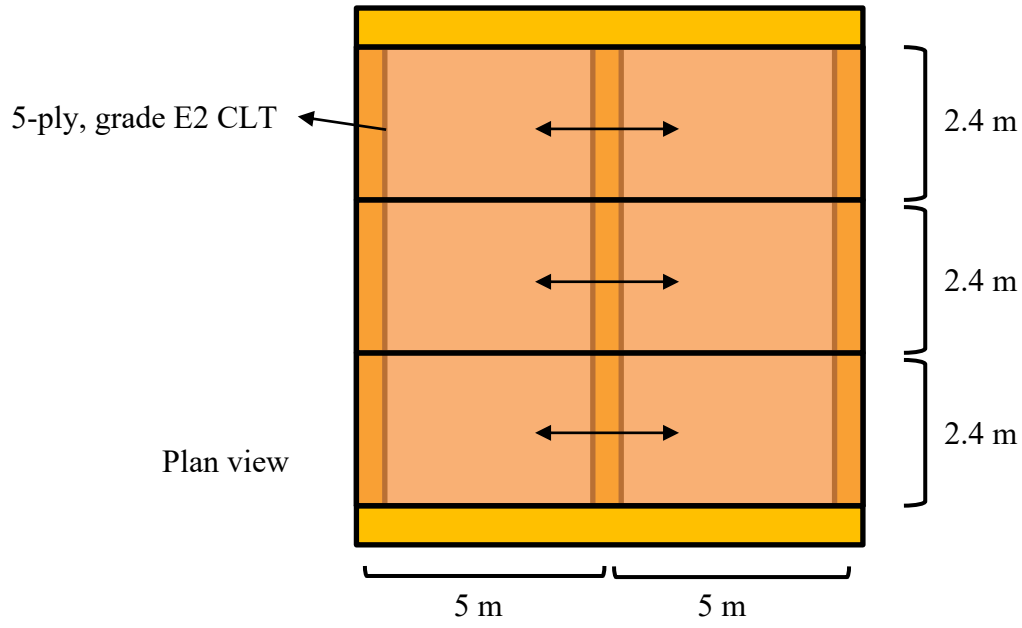
QUESTION 4

A timber building uses 5-ply grade E2 CLT panels as one-way slabs. The CLT panels are manufactured in widths of 2.4 m and span the 10 m length of the bay while being supported by three secondary beams. Service conditions are dry and the members are untreated. Plies are 35 mm thick.

a) Calculate the effective bending and in-plane shear stiffnesses for both the longitudinal and transverse direction of the typical CLT panel. The longitudinal direction is the 10 m span.

b) Assuming specified dead and live load pressures of 1.5 kPa and 4.8 kPa, respectively, determine if this size and grade of CLT panel is sufficient for the ULS requirements. Ignore bearing.

c) If the CLT span is reduced to 5 meters, such that each span is now simply supported (instead of continuously supported as in parts A and B), determine if this size and grade of CLT panel can adequately meet a deflection limit of L/180 and the vibration requirements in O86-14 A.8.5.3. Assume a CLT density of 420 kg/m^3.



QUESTION 5

A CLT bearing wall supports a series of joist loads represented by a factored 350 kN/m distributed axial load. The connection detail results in an axial load eccentricity equal to 3/5ths the depth of the CLT. The wall also resists a factored lateral pressure of 12 kPa. Assuming grade E1 CLT and a panel width of 3 m, determine the minimum number of CLT plies needed to support the factored loading. Assume a load duration factor, K_D, of 1.0. Service conditions are dry and no treatment is applied. Assume pin-pin connections with no lateral bracing.