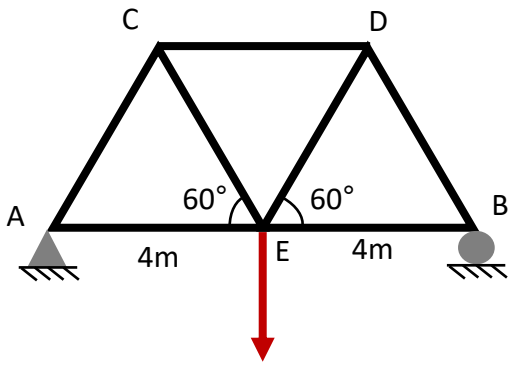
CWC Wood Design
Assignment 2: Basic Tension, Compression, Flexural Design (Modules 5-7)

QUESTION 1

A timber truss system is subjected to an unfactored dead load of 12 kN and an unfactored live load of 5 kN. Assuming dry conditions and untreated wood:

a) Indicate the governing factored load case for the axial design of member CE. Explain your reasoning.

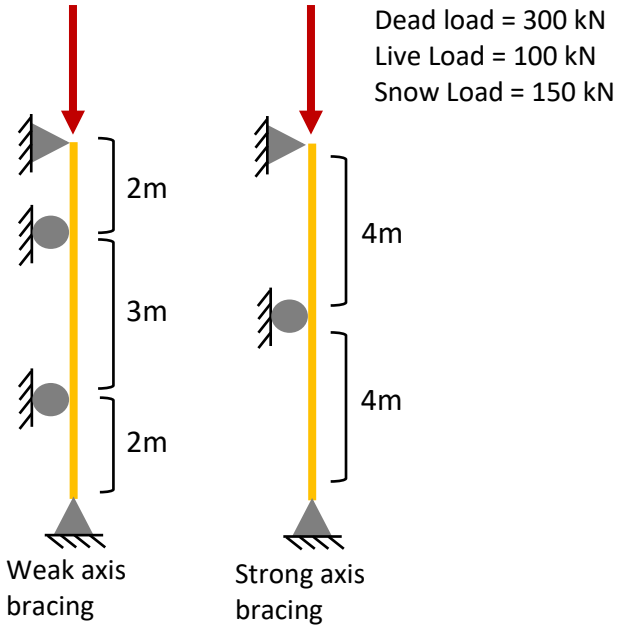
b) For truss member CE, determine the smallest member depth capable of supporting the applied factored loads if the member width is 38 mm. Use Northern grade No. 1 wood. Assume the net section is 85% of the gross section to account for connections. Show that your selection is the smallest suitable member (with a width of 38 mm) with full design calculations.



Dead load = 12 kN
Live Load = 5 kN

QUESTION 2

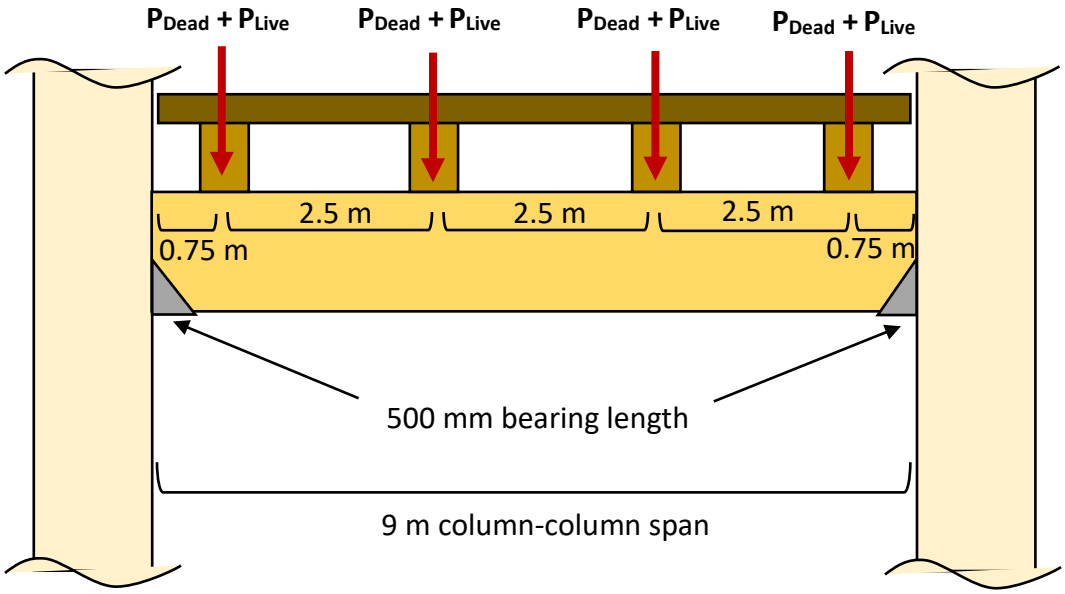
A 16c-E D. Fir-L glulam column is subjected to the axial loading shown below. The weak axis and strong axes have different bracing conditions. If service conditions are wet and the member is untreated, determine a reasonably efficient (>80% utilization) rectangular cross-section if one dimension is restricted to 215 mm. Assume the dimensions listed in the member selection tables of Volume 1 of the CWC Wood Design guide are the only available sizes. Selection tables can be used for intermediate selections but the final selection must be supported by full design calculations. Assume no eccentricity in the applied loads.



QUESTION 3

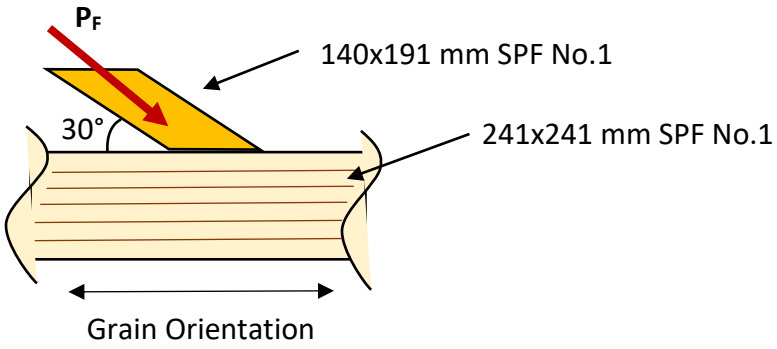
A 215x950 Spruce-Pine 20f-E glulam girder is supporting four select structural 191x343 Douglas Fir joists. All joists carry the same **unfactored** point load of $P_{Dead} + P_{Live}$ (where the live load is 50% of the dead load) to the girder. The girder is simply supported in bearing with a bearing length of 500 mm at each end.

Ignoring the columns and girder connections, determine the maximum P_{dead} and P_{live} this system can support based on the capacity of the girder and joists. Assume the joists are adequate in shear and flexure only. Assume the girder length for resistance calculations is the full 9 m span. Assume a glulam laminate width of half the beam width and a depth of 38 mm. The joists rest on half of the girder's width. Apply a girder deflection limit of L/180.



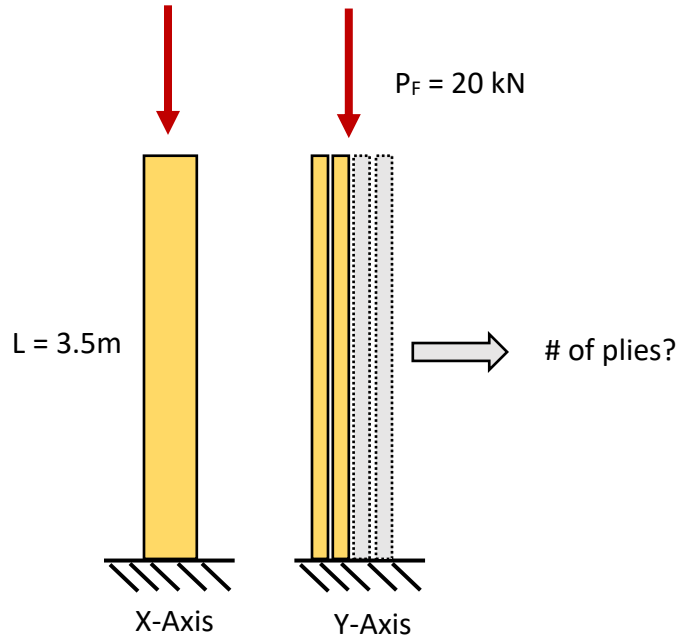
QUESTION 4

A 140x191 mm SPF No.1 strut bears into a larger 241x241 mm SPF No. 1 beam at an angle of 30° relative to the grain direction of the beam. Determine the bearing resistance of the beam for this applied load.



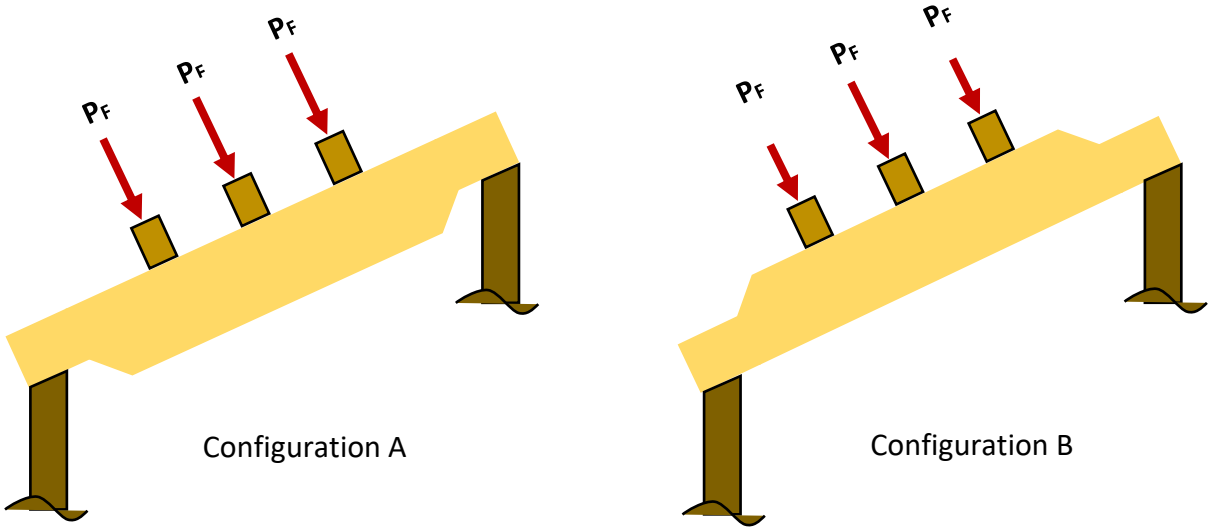
QUESTION 5

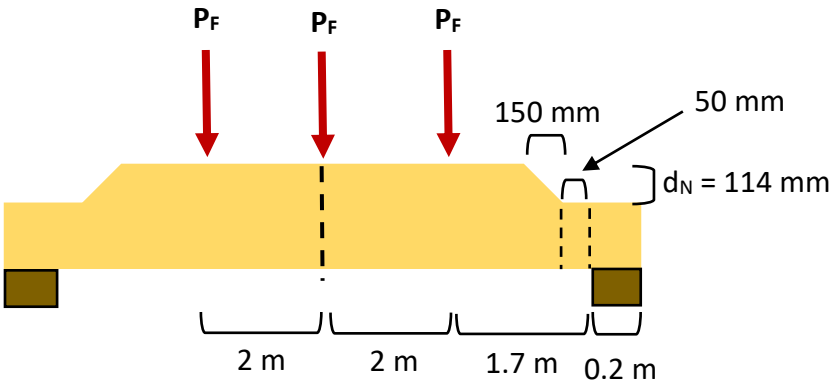
For a factored axial load of 20 kN on the cantilever column below (assuming no eccentricity), determine how many D. Fir-L No. 2 38x184 mm members must be built-up to support the load. The members are connected with nails meeting all requirements of Clause 6.5.6.4 of O86-14. Assume wet service conditions, incised treatments, and a standard load duration factor (K_D = 1.0).



QUESTION 6

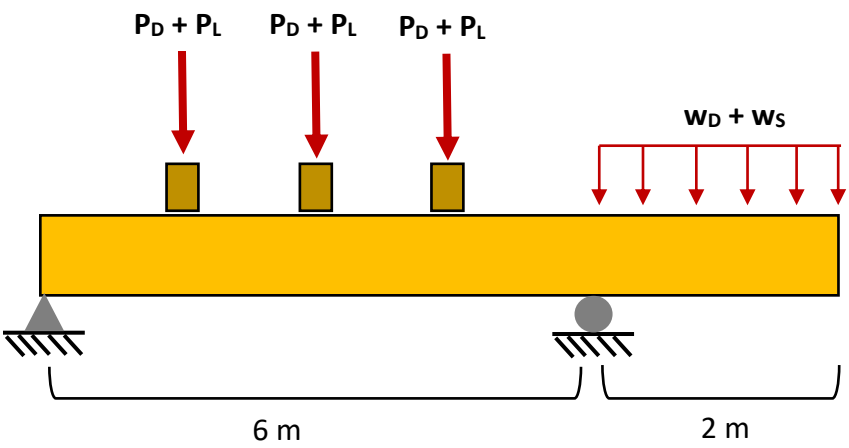
An architect is deciding between two configurations of an inclined notched glulam beam supporting three purlins. Ignoring the deflections and bearing capacity of the system, determine which beam configuration enables the maxmimum factored load P_F to be applied and indicate the critical value of P_f. Assume a load duration factor of 1.15. The glulam is untreated and service conditions are dry. Ignore beam self-weight. The beam is symmetric and the notch dimensions are the same in both configurations. Assume the beam is simply supported and the support widths are 200 mm. The D. Fir-L 24f-E glulam beam has a gross cross-section of 365x798 mm. The laminates have a width of half the beam and a thickness of 38 mm.





QUESTION 7

7. A 20f-E SPF glulam cantilever beam supports three equally spaced joists acting as dead and live point loads on the main span, and a distributed snow and dead load on the cantilever. The main span is 6 m and the cantilever span is 2 m. For a beam width of 315 mm, determine a suitable (and reasonably efficient) beam depth that can support the loading conditions shown in the figure. Ignore deflections requirements. Assume the bearing capacity of all members is sufficient.



P_D = 15 kN
P_L = 25 kN
w_D = 10 kN/m
w_S = 15 kN/m