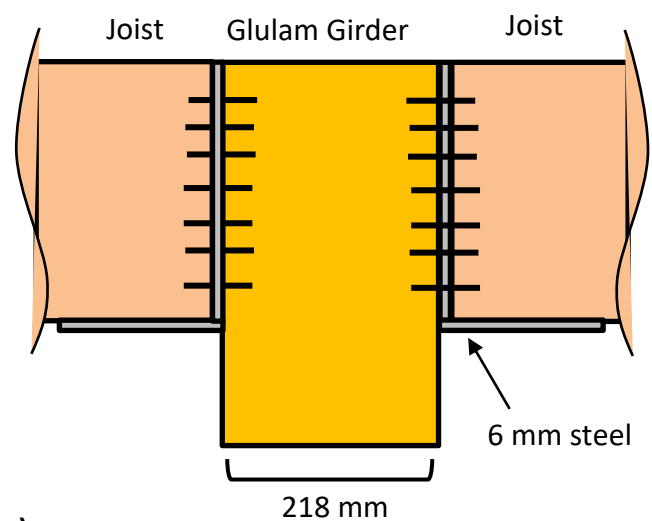
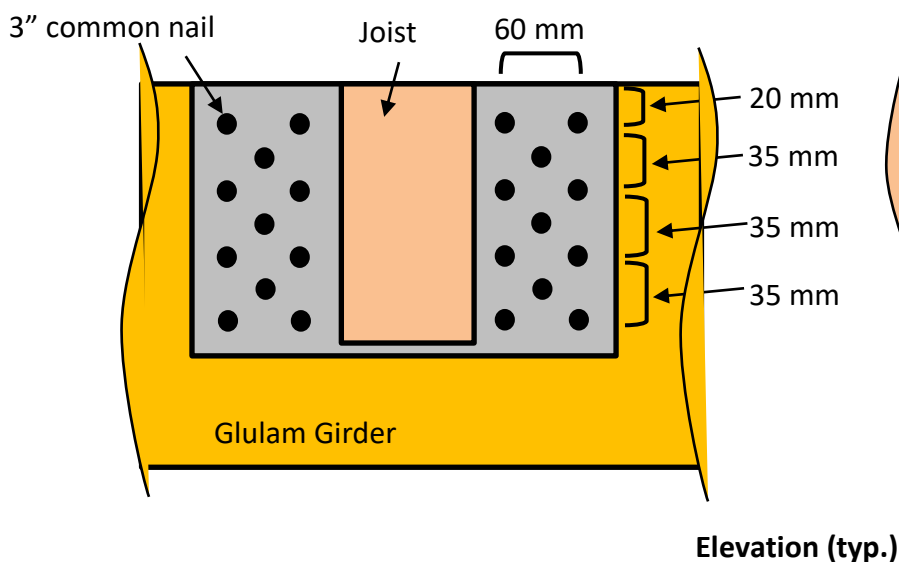
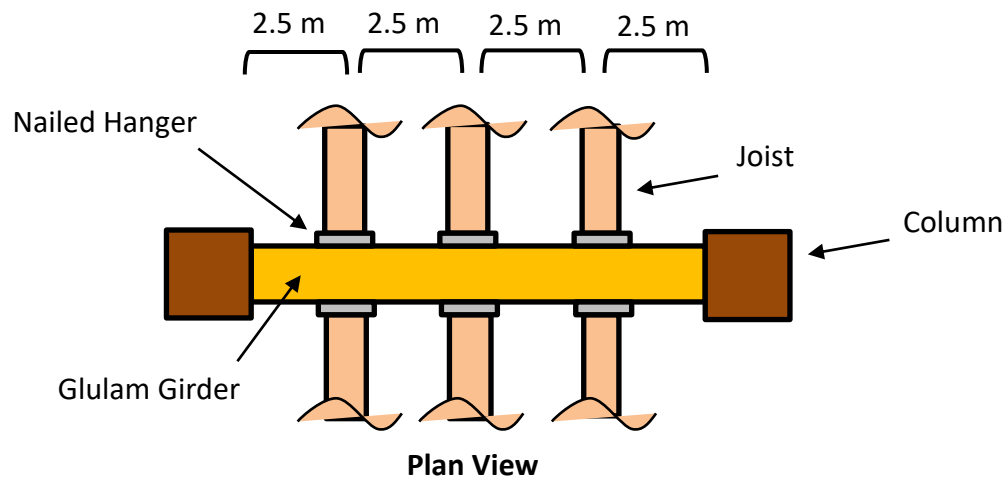


CWC Wood Design

Assignment 4: Lateral Loading, Connection Design, Fire Safety (Modules 8, 9, 10)

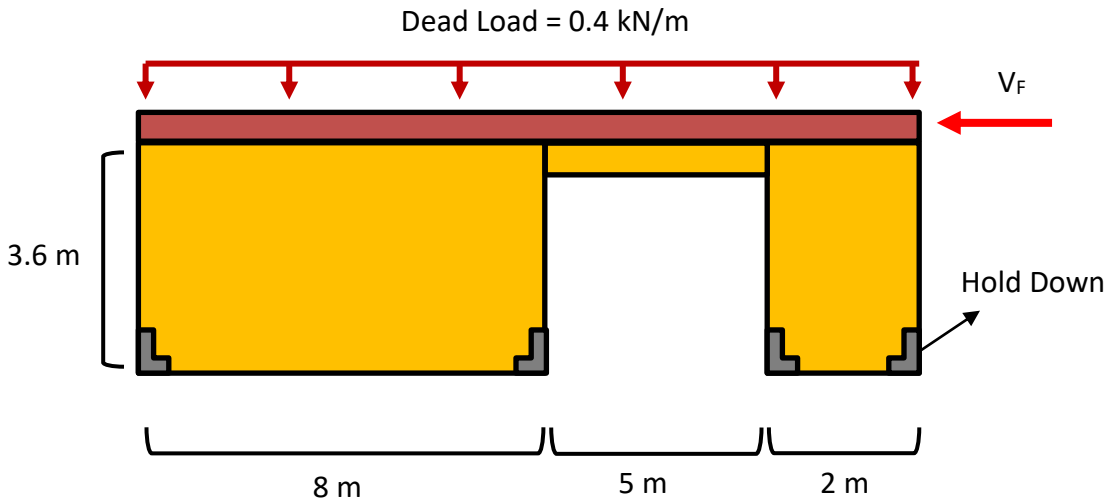
QUESTION 1

A 218 mm wide SPF 20f-E glulam girder supports six 175x190 mm joists connected with a nailed connection. Each connection uses 22, 3-inch long common nails to support a 6 mm thick steel plate hanger. Determine a suitable member depth for the 218 mm wide girder such that the shear resistance is 25% greater than the demand induced when all six nailed connections reach their max capacity. You need not consider the moment resistance of the girder. Ensure the fastener spacing requirements of the connections are met. Assume $K_D = 1.0$. The steel plate is 350W grade and 6 mm thick.



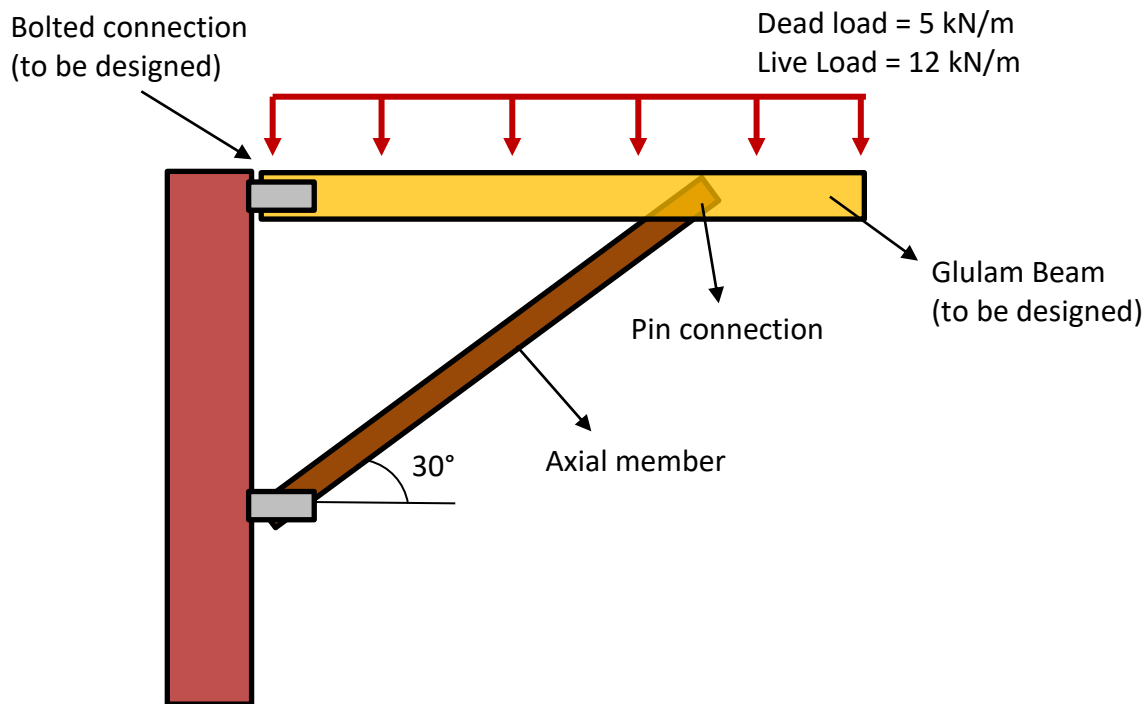
QUESTION 2

The single-storey wood frame structure below is subjected to a lateral load of V_f applied at the roof level and a dead load of 0.4 kN/m . Two light frame timber shear walls resist the lateral load. The shear walls are sheathed on the exterior by 1F20 SPF OSB and on the interior 12.5 mm gypsum board. The studs are SPF and spaced at 500 mm with 100 mm fastener spacing along edges. The gypsum screws ensure a penetration of 19 mm while the OSB is fastened using 3.5" common wire nails. Assume panel sizes of $2400 \times 1200 \text{ mm}$. Both walls are blocked. Calculate the lateral load resistance of the shear walls and determine the max V_f that can be applied. Assume the walls shown are half of the lateral load resisting system (there are identical walls on the opposite side of the building). The load duration factor is $K_D = 1.15$. State any assumptions not listed to complete the analysis.



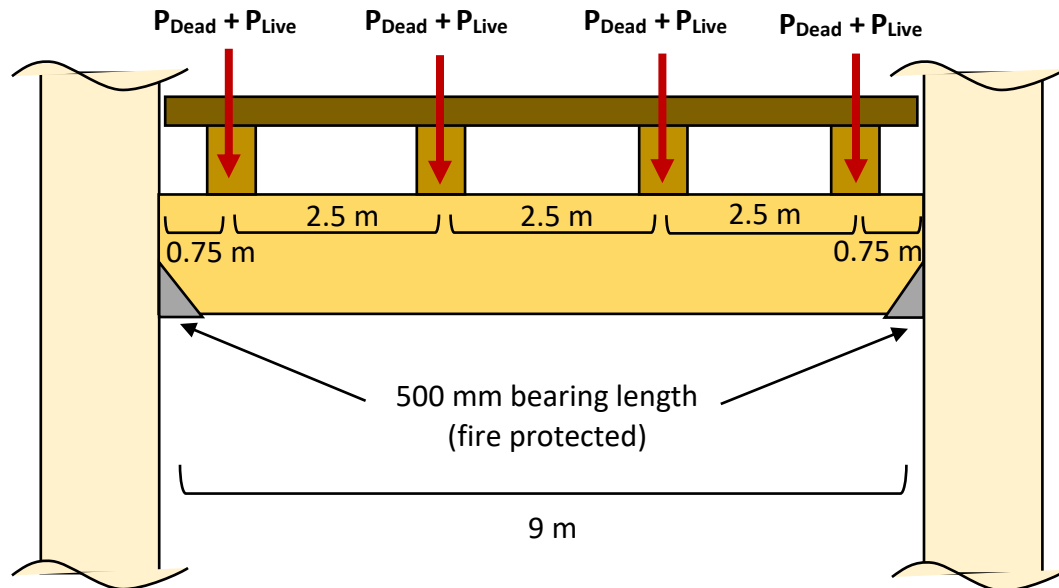
QUESTION 3

A glulam awning is designed using a beam and an angled axial member to support a distributed dead and live load. Design the beam member using SPF 20f-EX glulam and the pinned-support assuming a bolted, 3-member connection with two 6 mm steel side plates. The bolted connection must be designed to resist the support reaction provided to the beam member. Assume the axial member and its connections are sufficient. Assume the steel side plates are 350W mild steel and the bolts have a yield strength of 310 MPA. The glulam beam can be designed through the member selection tables but ensure all relevant design checks are completed.



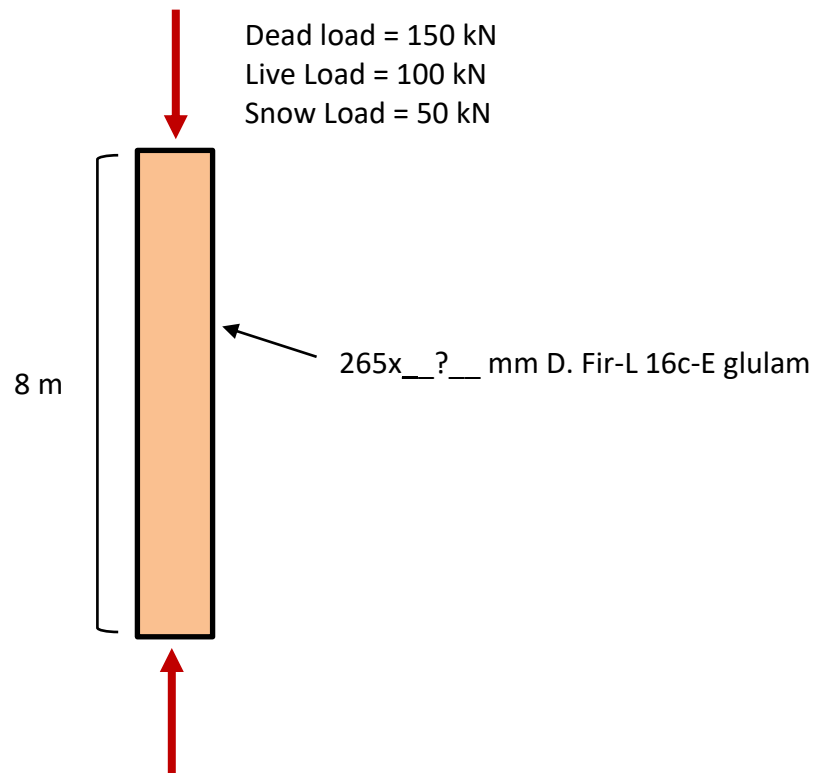
QUESTION 4

A glulam girder supports four joists as part of a timber floor system. Each joist transfers the same dead and live load to the girder per the configuration shown below. The joists are continuous over the girder and therefore use the full girder width as a support in bearing. Assess the fire resistance rating (FRR) of the girder by considering the shear, flexural, and bearing resistances based on **Annex B** of **O86-14** assuming all exposed surfaces will char. Assume the girder-column bearing connection is completely fire protected and the 500 mm bearing length will not change. The girder is a 215x950 mm SPF 20f-E member. The joist dimensions are 191x343 mm. The specified dead load and live load are 20 kN and 10 kN respectively. Assume the conditions of **O86-14 B.2.2** are met. Assume a glulam laminate width of half of the girder and a depth of 38 mm.



QUESTION 5

A 265 mm wide, pin-supported glulam column is subjected to the loading below. Select the smallest suitable depth to resist the applied loads and achieve a fire resistance rating (FRR) of 30 minutes based on the axial compressive strength. Use D. Fir-L 16c-E glulam. Assume the conditions of **O86-14 B.2.2** are met. Assume no eccentricity in the applied loads.



QUESTION 6

A single storey timber structure uses a CLT diaphragm and shear walls to resist a factored lateral load of V_f applied at the top of the structure.

a) Based on the assumptions of 1) a rigid diaphragm and flexible shear walls and 2) a flexible diaphragm and rigid shear walls, estimate the design loads for shear walls 1-4 in terms of the applied load V_f . You may assume the stiffness of the shear walls is directly proportional to their length. Ignore torsional effects.

b) Estimate the maximum chord forces in the diaphragm using a rational approximation.

