CIV 102 Final Exam Study Package

Q1 Equilibrium

Q2 Stress and Strain Energy

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Q4 Analysis and Design of a Truss

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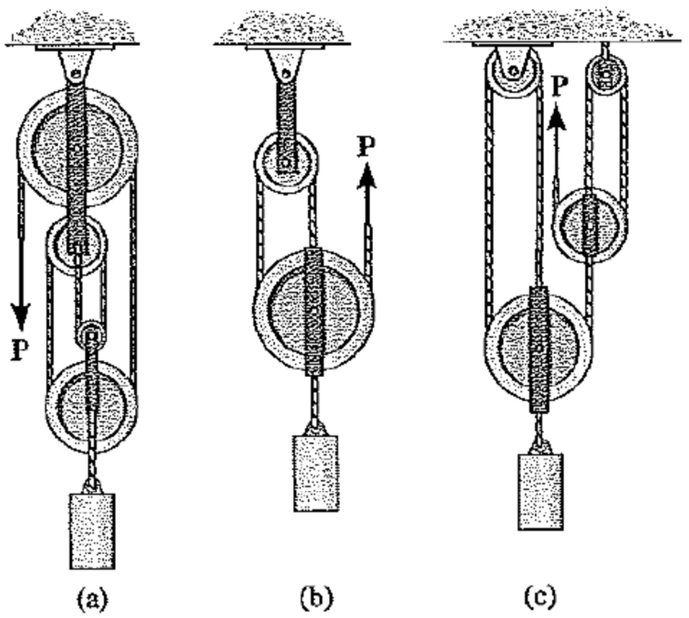
Q8 Shear Stress

Q9 Box Girder Bridge Design

Q10 Reinforced Concrete Beams

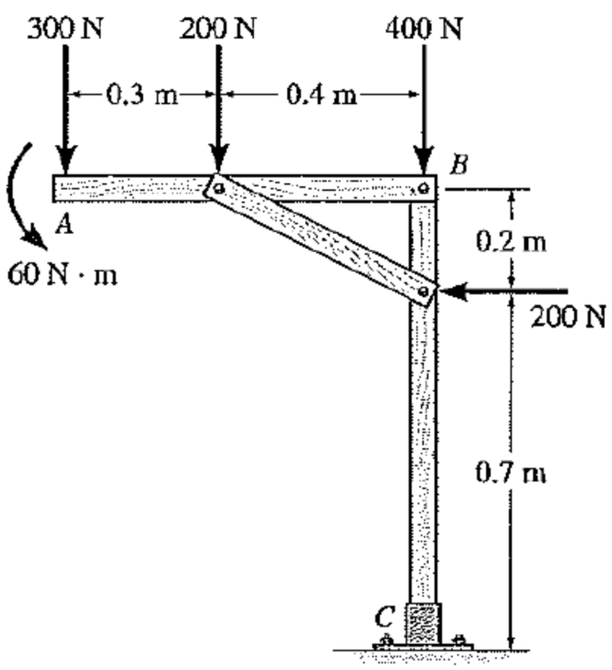
Q1 Equilibrium

5-34. In each case, determine the force **P** required to maintain equilibrium. The block weighs 100 N (≈ 10 kg).

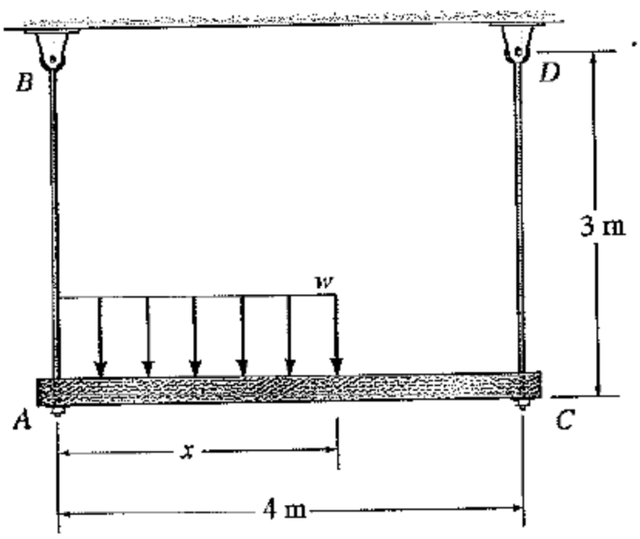


Prob. 5–34

3-90. Replace the loading on the frame by a single resultant force. Specify where its line of action intersects member AB, measured from A.

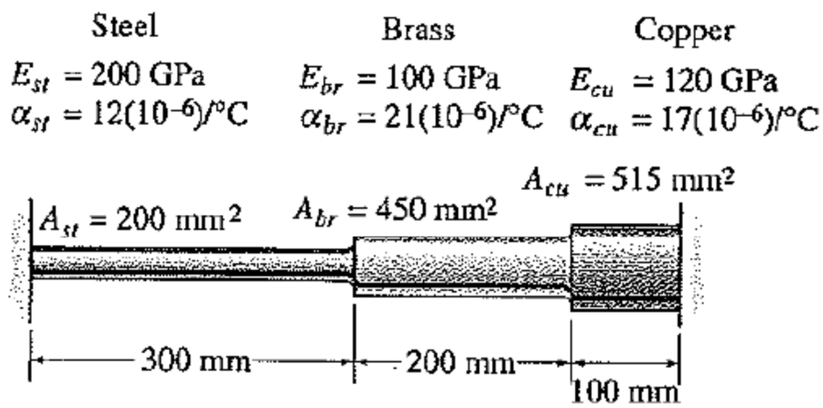


10-21. The rigid beam is supported at its ends by two A-36 steel tie rods. The rods have diameters $d_{AB} = 13$ mm and $d_{CD} = 8$ mm. If the allowable stress for the steel is $\sigma_{allow} = 110$ MPa, determine the intensity of the distributed load w and its length x on the beam so that the beam remains in the horizontal position when it is loaded.



Probs. 10–20/21

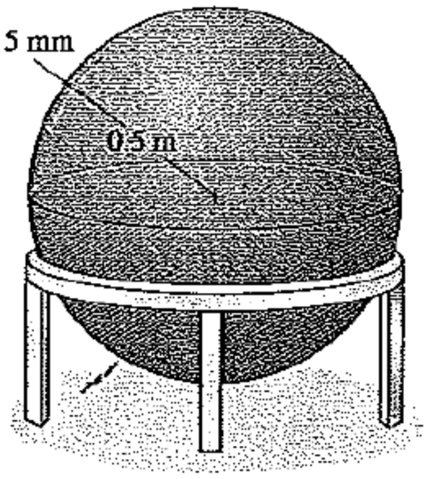
10-38. Three bars each made of different materials are connected together and placed between two walls when the temperature is $T_1 = 12°C$. Determine the force exerted on the (rigid) supports when the temperature becomes $T_2 = 18°C$. The material properties and cross-sectional area of each bar are given in the figure.



Prob. 10–38

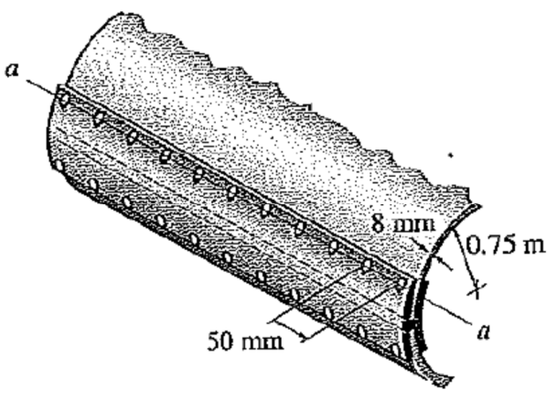
Q3 Thin walled pressure vessel

14-5. Two hemispheres having an inner radius of 0.5 m and wall thickness of 5 mm are fitted together, and the inside gauge pressure is reduced to −0.1 MPa. If the coefficient of static friction is $\mu_s = 0.5$ between the hemispheres, determine *(a)* the torque T needed to initiate the rotation of the top hemisphere relative to the bottom one, *(b)* the vertical force needed to pull the top hemisphere off the bottom one, and *(c)* the horizontal force needed to slide the top hemisphere off the bottom one.



Prob. 14–5

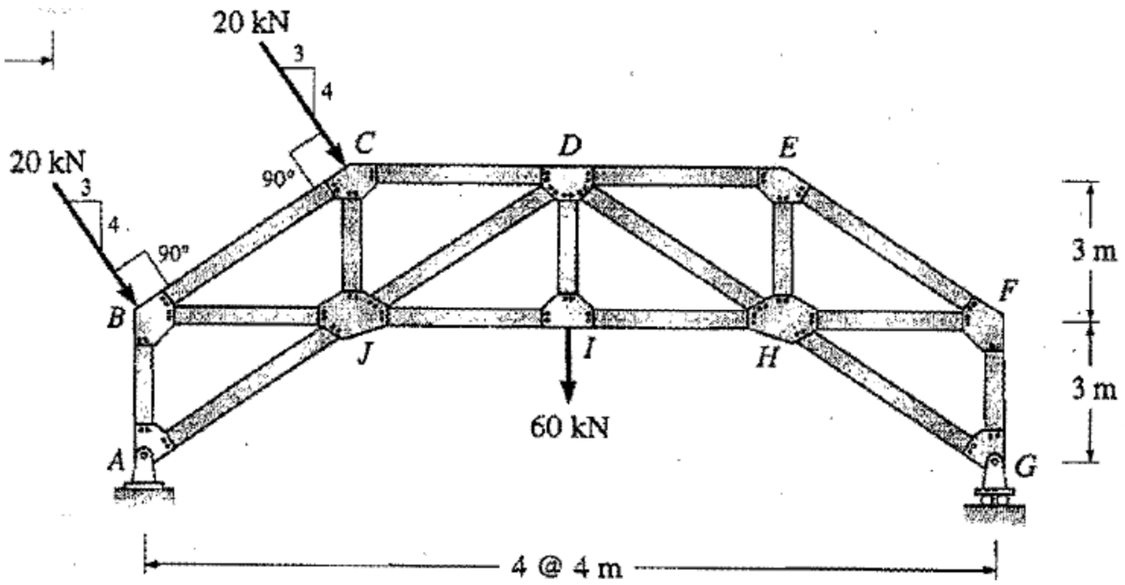
14-10. A boiler is constructed of 8-mm steel plates that are fastened together at their ends using a butt joint consisting of two 8-mm cover plates and rivets having a diameter of 10 mm and spaced 50 mm apart as shown. If the steam pressure in the boiler is 1.35 MPa, determine (*a*) the circumferential stress in the boiler's plate apart from the seam, (*b*) the circumferential stress in the outer cover plate along the rivet line *a–a*, and (*c*) the shear stress in the rivets.



Prob. 14–10

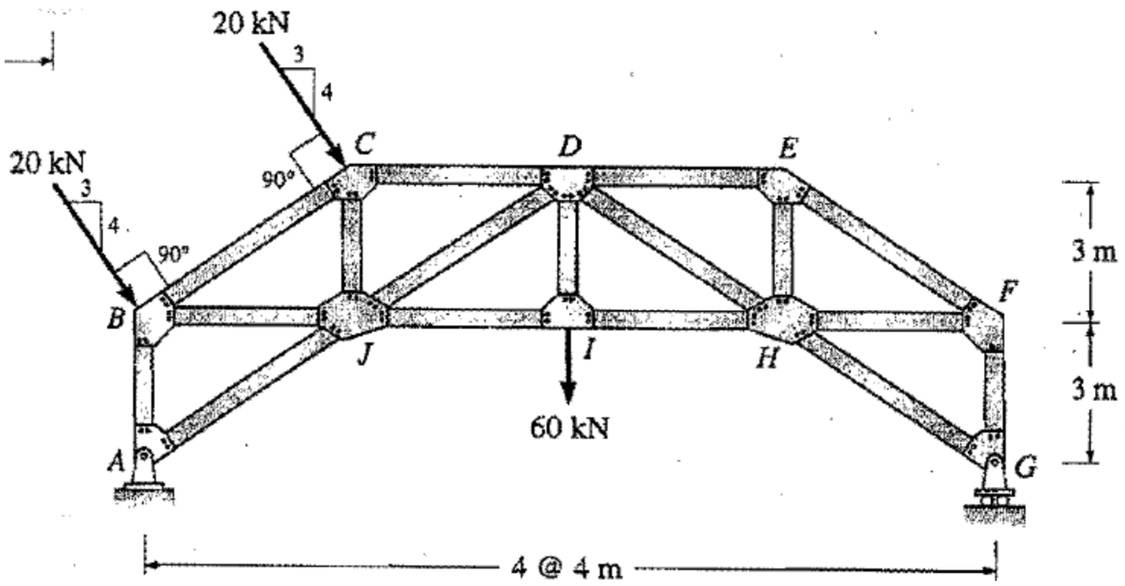
Q4 Analysis and Design of a Truss

a) Solve the truss and design the members using one HSS section.



Q5 Deflection of A Truss

a) Calculate the horizontal deflection of point C using the design from Q4

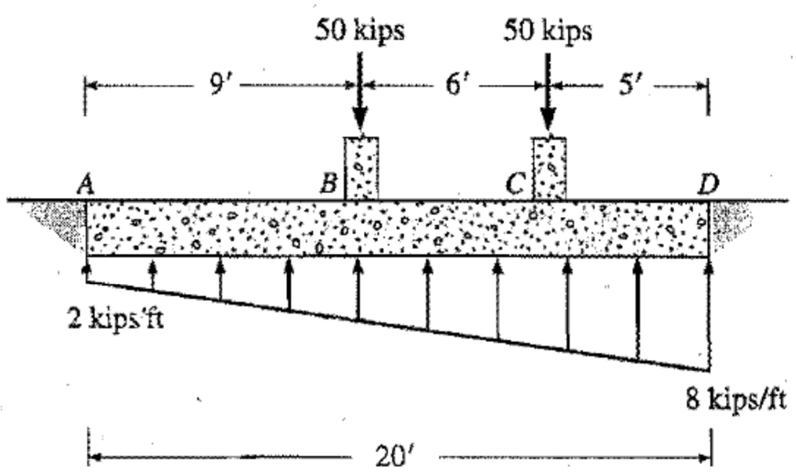


Q6 Shear Force and Bending Moment Diagrams

a) The following figure is the concrete foundation of a building with two columns supported on the foundation. Analysis of the soil pressures has reviled a trapezoidal pressure distribution. Draw the shear force and bending moment diagram for the following foundation:

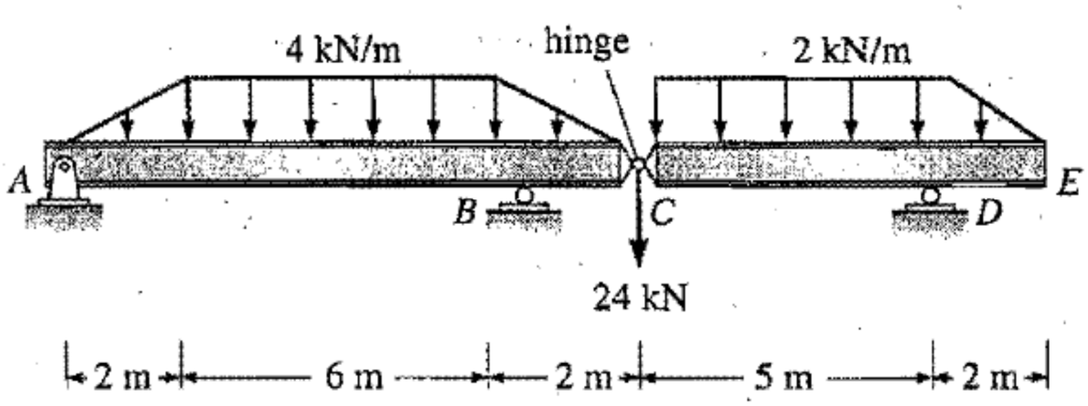
Note: 1 kip = 4.448 kN

1 ft = 0.3048 m



P5.43

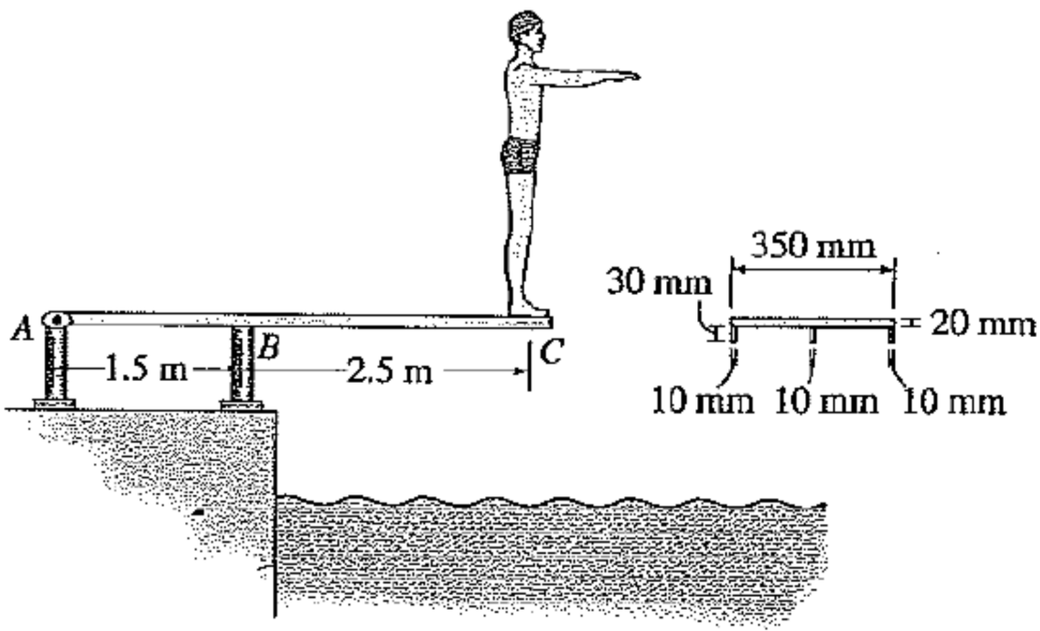
b) Draw the shear force diagrams and bending moment diagrams for the following two beams:



Q7 Flexural and Shear Stress and Deflection of Beams

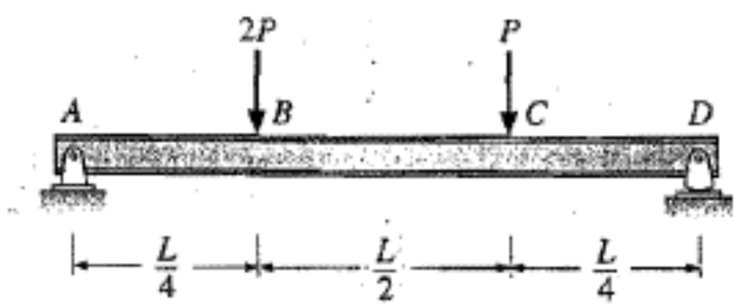
a) Find the reactions if the man has a mass of 78 kG and is motionless on the diving board.
b) Find the maximum flexural stress in the diving board and label it on the diagram.
c) If the man is “bouncing” on the diving board with a frequency of 1 Hz determine the maximum deflection of the diving board. Neglect the self-weight of the diving board

Assume: a damping ratio of 0.10, E = 125 GPa, A is a pin and B is a roller.

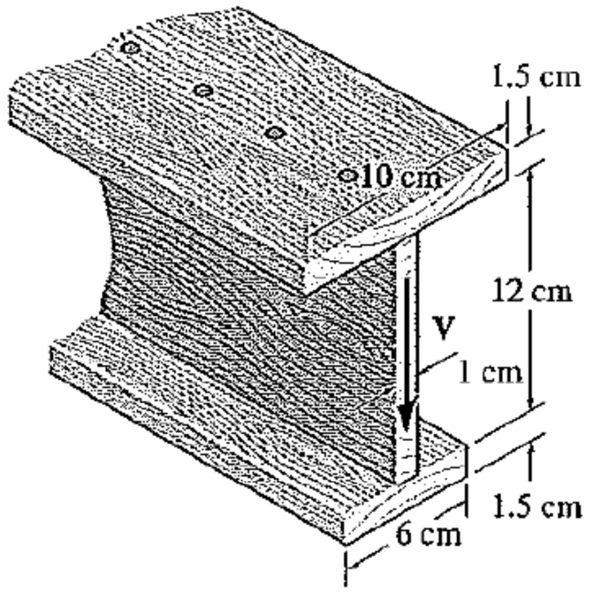


Prob. 12–25

Find the location and magnitude of the Maximum deflection of the following beam if it has a stiffness of EI

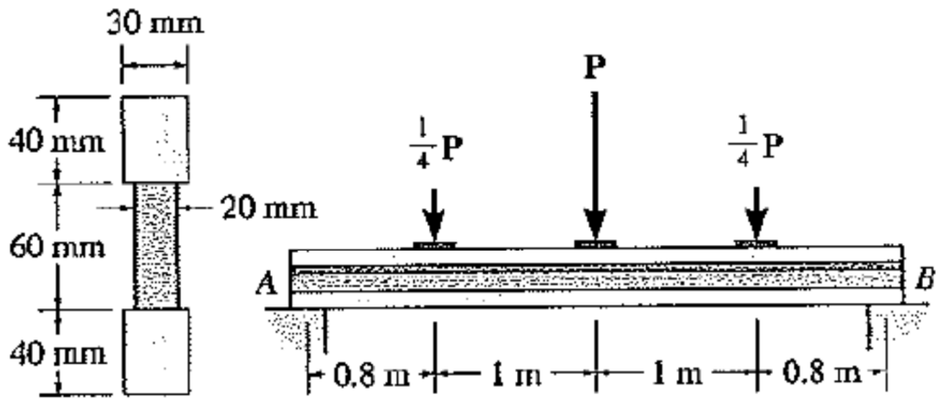


***13-23.** The beam is constructed from three boards. Determine the maximum shear V that it can sustain if the allowable shear stress for the wood is $\tau_{allow} = 4$ MPa. What is the required spacing s of the nails if each nail can resist a shear force of 800 N?



Prob. 13–23

13-30. The beam is made from three polystyrene strips that are glued together as shown. If the glue has a shear strength of 80 kPa, determine the maximum load P that can be applied without causing the glue to lose its bond.



Q9 Box Girder Bridge Design

Find the maximum load w that the following mat board box girder bridge can support if the reactions are as shown:

Assume E = 4000 MPa,

$\sigma_{Comp} = -6\ MPa,$

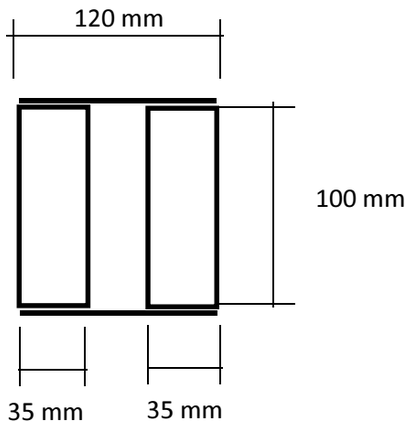
$\sigma_{Ten} = 14\ MPa,$

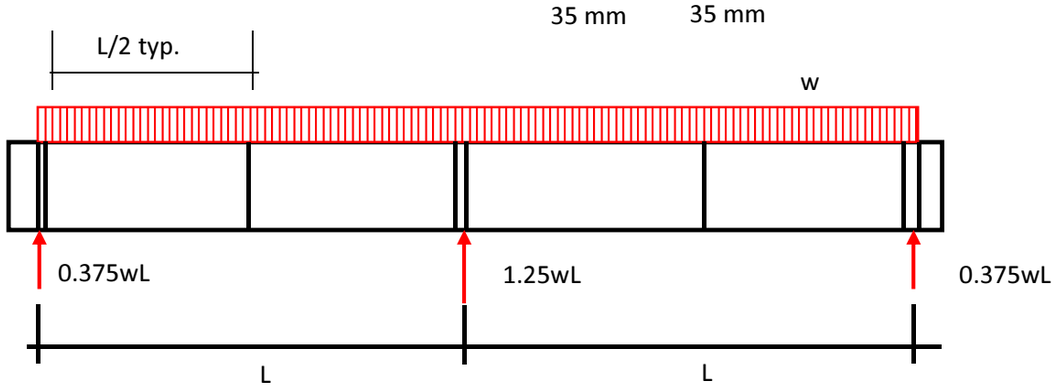
$\tau_{Matboard} = 4\ MPa,$

$\tau_{Glue} = 2\ MPa,$

t = 1.25 mm

L = 600 mm





Q10 Reinforced Concrete Beams

For the RC beam shown below, determine the following:

a) What is the flexural strength for the positive moment? (steel on the bottom)
b) What is the flexural strength for the negative moment? (steel on the top)
c) What spacing of shear reinforcement is needed if the applied shear force is 200 kN.

For a) and b) assume only the steel on the tension side contributes to the strength.