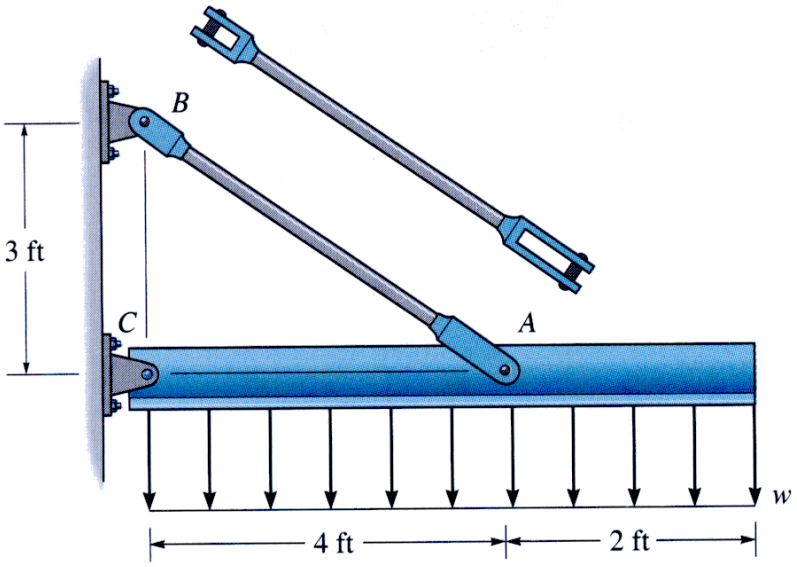
IDE 110 - Mechanics of Materials - Summer 2006

Name:

Exam 1 – Stress; Strain; Axial Structures

Section: A

1. The hanger assembly is used to support a distributed loading of $w = 0.8$ kip/ft. The 0.4-in.-diameter bolt at A is in double shear and has an allowable shear stress $\tau_{allow} = 25$ ksi. The 0.5-in.-diameter rod AB has an allowable normal stress $\sigma_{allow} = 38$ ksi. Determine the factor of safety FS_{bolt} and FS_{rod} for the bolt and rod, respectively.



Write legibly – box answers
Include proper units

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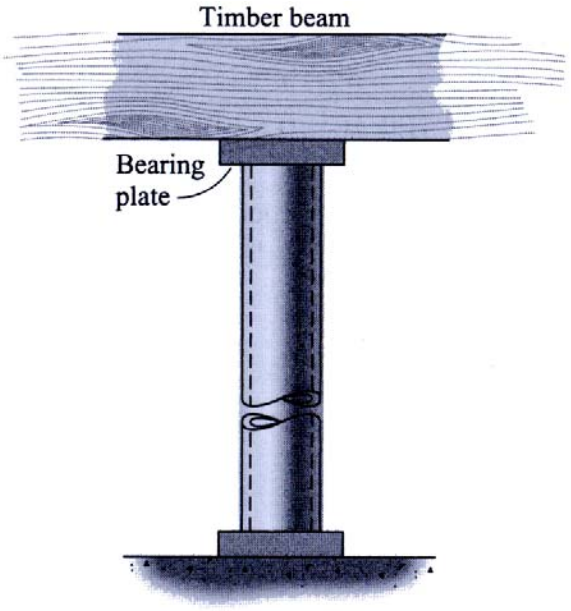
2. The steel (E = 29,000 ksi) pipe column has an outside diameter of 6 in., a wall thickness of 0.6 in., and a length of 24 in. The solid-circular bearing plate has a diameter of 8 in. The axial load imposed on the column by the timber beam is 30 kip. Determine:

a) the normal stress in the column.
b) the bearing stress between the column and the bearing plate.
c) the bearing stress between the bearing plate and the timber beam.
d) the change in length of the column.
e) the axial normal strain in the column.



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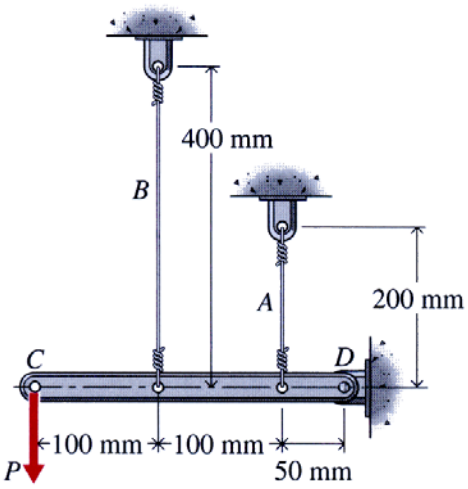
3. Rigid member *CD* is subjected to load P = 5 kN. Members *A* and *B* are steel (E = 200 GPa) wires, and each has a cross-sectional area of 80 mm^2. Determine:

a) the normal force in each wire N_A and N_B.
b) the vertical displacement δ_c of point C.



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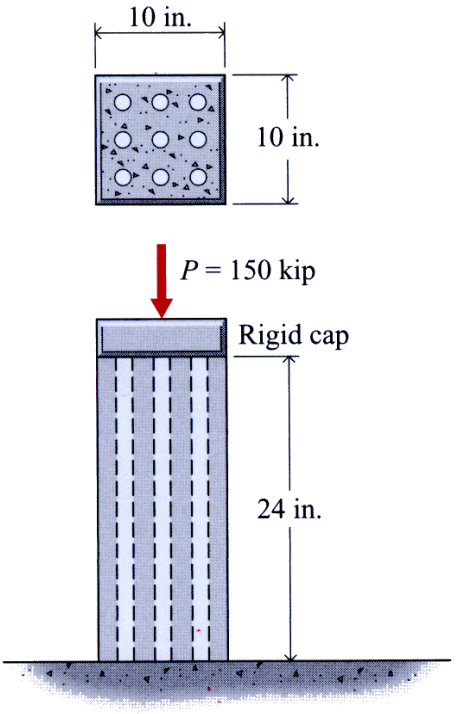
4. Nine ¾-in.-diameter steel (E_s = 30,000 ksi) reinforcement bars were used when the short concrete (E_c = 4500 ksi) pier was constructed. After a load *P* of 150 kip was applied to the pier, the temperature increased 100°F. The coefficient of thermal expansion for steel and concrete are $\alpha_s = 6.6 \times 10^{-6}$/°F and $\alpha_c = 6.0 \times 10^{-6}$/°F, respectively. Determine the normal force in the concrete N_c and in the steel bars N_s.



Write legibly – box answers
Include proper units