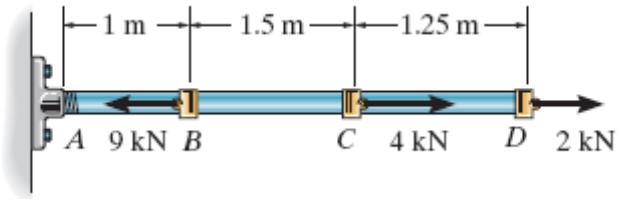
CHAPTER 4- AXIAL LOAD

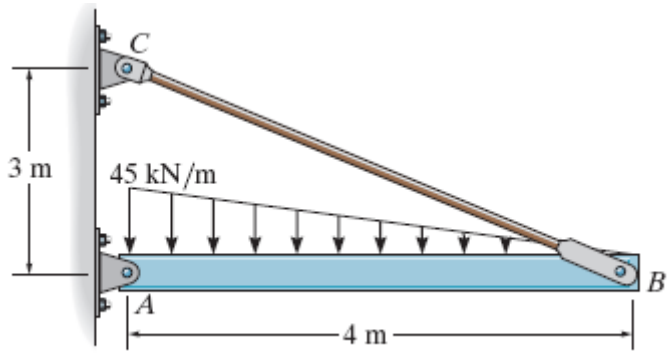
1- The A-36 steel rod is subjected to the loading shown. If the cross-sectional area of the rod is 50 mm^2 determine the displacement of its end *D*. Neglect the size of the couplings at *B*, *C*, and *D*.

(0.850 mm)



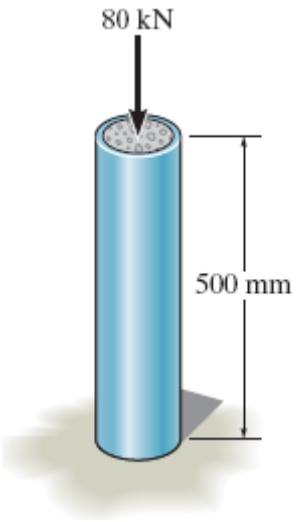
2- The rigid bar is supported by the pin-connected rod *CB* that has a cross-sectional area of 500 mm^2 and is made of A-36 steel. Determine the vertical displacement of the bar at *B* when the load is applied.

(4.17 mm)



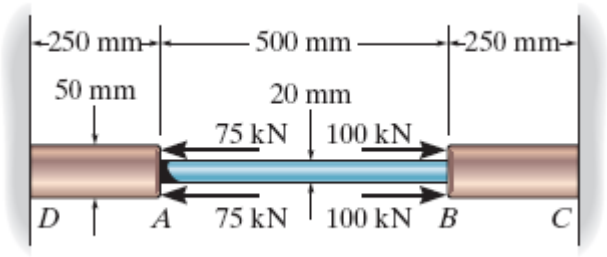
3- The steel pipe is filled with concrete and subjected to a compressive force of 80 kN. Determine the average normal stress in the concrete and the steel due to this loading. The pipe has an outer diameter of 80 mm and an inner diameter of 70 mm. Est = 200 GPa, Ec = 24 GPa.

(48.8 MPa, 5.85 MPa)



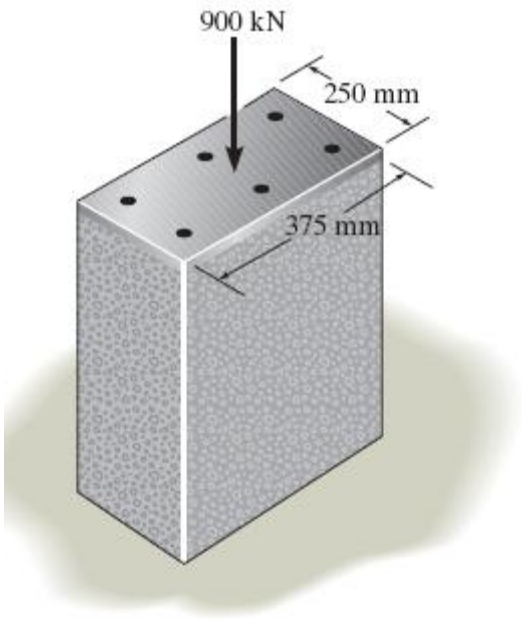
4- The composite bar consists of a 20-mm-diameter A-36 steel segment *AB* and 50-mm-diameter red brass C83400 end segments *DA* and *CB*. Determine the displacement of *A* with respect to *B* due to the applied load.

(0.335 mm)



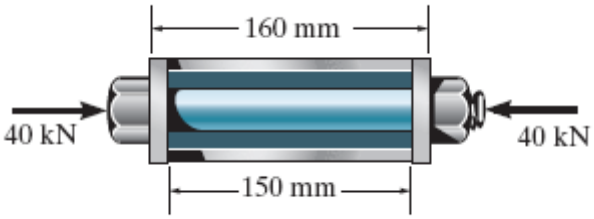
5- The concrete post is reinforced using six steel reinforcing rods, each having a diameter of 20 mm. Determine the stress in the concrete and the steel if the post is subjected to an axial load of 900 kN. E_{st}= 200 GPa, Ec = 25 GPa

(8.42 MPa, 67.3 MPa)



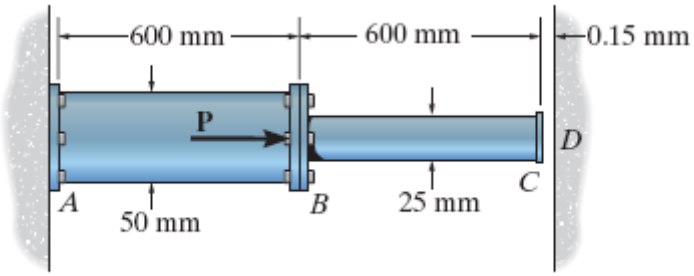
6- The bolt has a diameter of 20 mm and passes through a tube that has an inner diameter of 50 mm and an outer diameter of 60 mm. If the bolt and tube are made of A-36 steel, determine the normal stress in the tube and bolt when a force of 40 kN is applied to the bolt.Assume the end caps are rigid.

(32.4 MPa, 34.5 MPa)



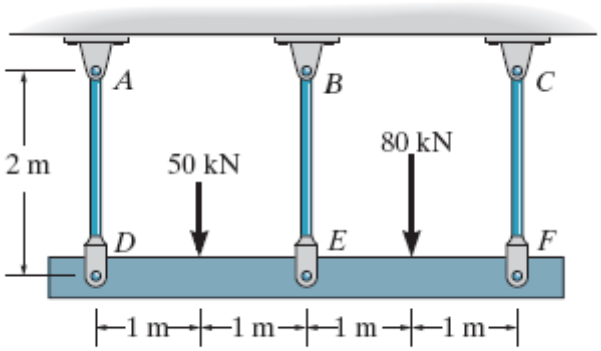
7- If the gap between *C* and the rigid wall at *D* is initially 0.15 mm, determine the support reactions at *A* and *D* when the force P=200 kN is applied. The assembly is made of A36 steel.

(20.4 kN, 180 kN)



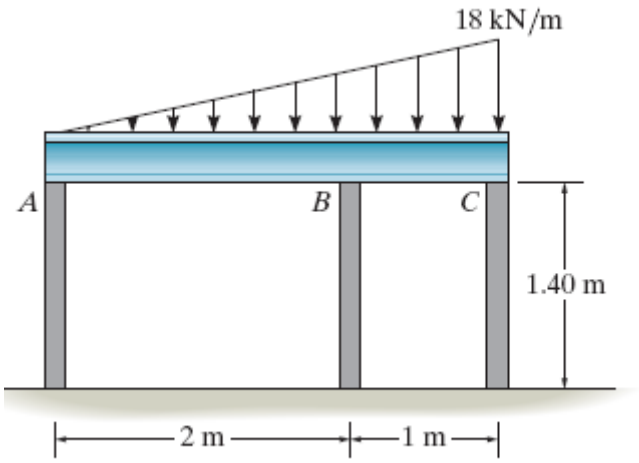
8- The three suspender bars are made of A-36 steel and have equal cross-sectional areas of 450 mm^2 . Determine the average normal stress in each bar if the rigid beam is subjected to the loading shown.

(96.3 MPa, 79.6 MPa, 113 MPa)



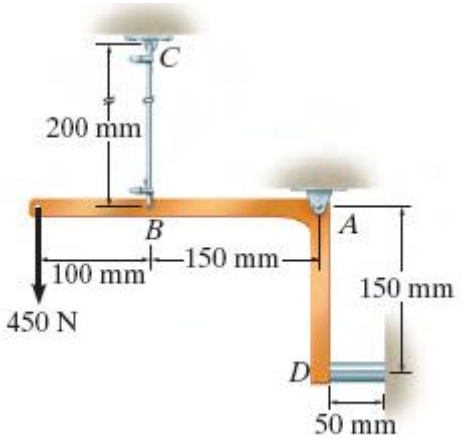
9- The horizontal beam is assumed to be rigid and supports the distributed load shown. Determine the angle of tilt of the beam after the load is applied. Each support consists of a wooden post having a diameter of 120 mm and an unloaded (original) length of 1.40 m.Take Ew = 12 GPa.

(0.0199(10-3) rad)



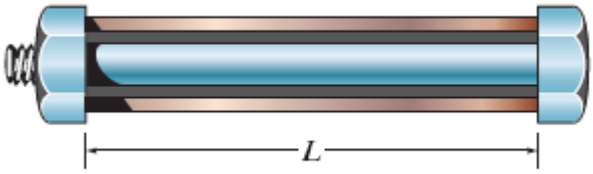
10- The rigid link is supported by a pin at *A*, a steel wire *BC* having an unstretched length of 200 mm and cross-sectional area of 22.5 mm^2 and a short aluminum block having an unloaded length of 50 mm and cross-sectional area of 40 mm^2 If the link is subjected to the vertical load shown, determine the average normal stress in the wire and the block. Est = 200 GPa, Eal = 70 GPa.

(13.4 MPa, 9.55 MPa)



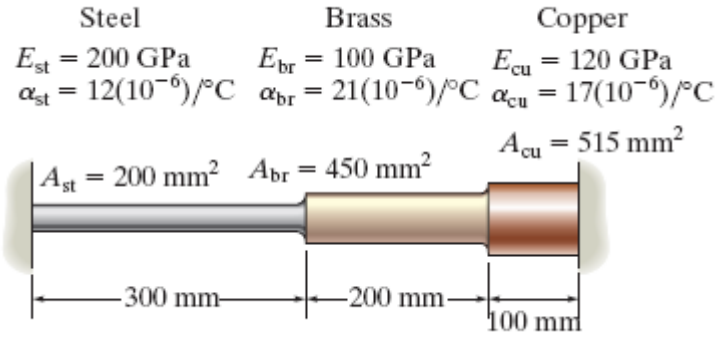
11- The assembly consists of an A-36 steel bolt and a C83400 red brass tube. The nut is drawn up snug against the tube so that L=75 mm. Determine the maximum additional amount of advance of the nut on the bolt so that none of the material will yield. The bolt has a diameter of 7 mm and the tube has a cross-sectional area of 100 mm2.

(0.120 mm)



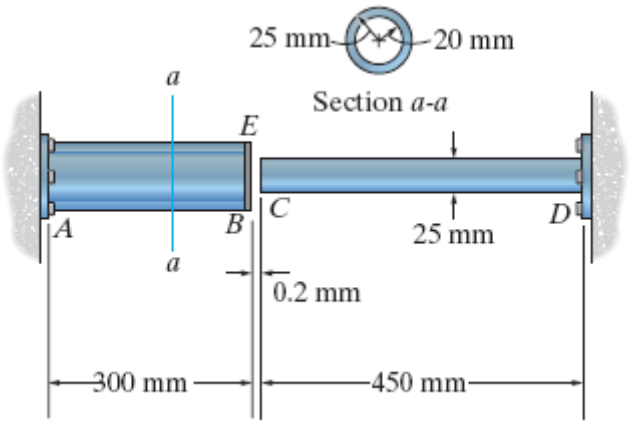
12- Three bars each made of different materials are connected together and placed between two walls when the temperature is $T_1=12^0$ C Determine the force exerted on the (rigid) supports when the temperature becomes $T_2=18^0$ C . The material properties and cross-sectional area of each bar are given in the figure.

(4.20 kN)



13- The AM1004-T61 magnesium alloy tube *AB* is capped with a rigid plate *E*.The gap between *E* and end *C* of the 6061-T6 aluminum alloy solid circular rod *CD* is 0.2 mm when the temperature is at 30° C. Determine the normal stress developed in the tube and the rod if the temperature rises to 80° C. Neglect the thickness of the rigid cap.

(45.3 MPa, 65.2 MPa)


25 mm
20 mm
Section a-a
a
E
A
B
C
D
25 mm
a
0.2 mm
300 mm
450 mm