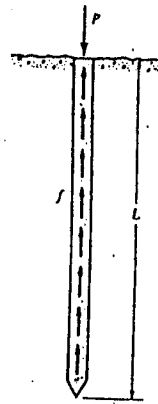
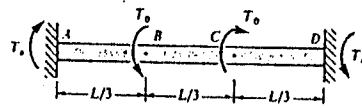


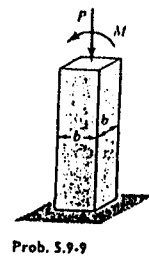
1. A concrete pile, driven into the earth, supports a load P by friction along its sides (see figure). The friction force is assumed to be uniform and is denoted as f per unit length of the pile, and embedment length L . Derive a formula for the total shortening δ of the pile in terms of f , E , A , and L . (20%)



2. A solid circular bar with fixed ends is acted upon by two oppositely directed torques T_0 , as shown in the figure. Obtain formulas for the reactive torques T_a and T_b , the angle of twist ϕ_b at section B, and the angle of twist ϕ_m at the midsection of the bar. (20%)

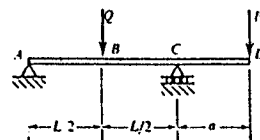


3. A square pillar is subjected to a compressive force $P=3500$ Kn and a bending moment $M=85$ kN.m (see figure). What is the required side dimension b of the pillar if the allowable stresses are 18 MPa in compression and 6 MPa in tension? (Disregard the weight of the pillar itself.) (20%)

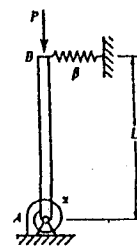


Prob. 5.9.9

4. The overhanging beam shown in the figure supports two concentrated loads P and Q . (a) Determine the deflection δ_d at point D. (b) For what ratio P/Q will the deflection at D equal zero? (20%)



5. Determine the critical load P_{cr} for the bar-spring system shown in the figure. (20%)



Prob. 9.1.2