PROBLEMS

1102. A 50-mm by 100-mm timber is used as a column with fixed ends. Determine the minimum length at which Euler's formula can be used if $E = 10$ GPa and the proportional limit is 30 MPa. What central load can be carried with a factor of safety of 2 if the length is 2.5 m?

Ans. $L = 1.66$ m; $P = 32.9$ kN

1103. An aluminum strut 6 ft long has a rectangular section $\frac{3}{4}$ in. by 2 in. A bolt through each end secures the strut so that it acts as a hinged column about an axis perpendicular to the 2-in. dimension, and as a fixed-ended column about an axis perpendicular to the $\frac{3}{4}$-in. dimension. Determine the safe central load, using a factor of safety of 2 and $E = 10.3 \times 10^6$ psi.

Ans. $P = 2770$ lb

1104. A square steel bar is to support a load of 20 kips on a length of 10 ft. Assuming rounded ends, determine the length of each side. Use $E = 29 \times 10^6$ psi.

Ans. 1.86 in.

1105. Repeat Prob. 1104 if the column is made of wood for which $E = 1.6 \times 10^6$ psi.

1106. Two C310 × 45 channels are latticed together so they have equal moments of inertia about the principal axes. Determine the minimum length of a column having this section, assuming pinned ends, $E = 200$ GPa, and a proportional limit of 240 MPa. What safe load will the column carry for a length of 12 m with a factor of safety of 2.5?

Ans. $L = 9.89$ m; $P = 742$ kN

7. Repeat Prob. 1106 assuming that one end is fixed and the other hinged.

. Select the lightest W shape that will act as a column 8 m long with hinged ends