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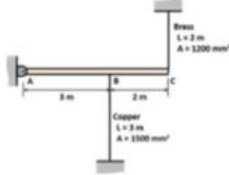
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Question: Situation 1: A rigid bar ABC weighs 10 kN/m. The compressive ...

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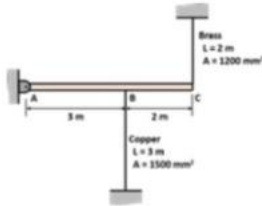
Situation 1: A rigid bar ABC weighs 10 kN/m. The compressive stress of the copper bar is 20 MPa. Answer the following questions:



- _____ A. What is the stress of the brass bar? Indicate if it will experience tension (T) or compression (C) (MPa)
- _____ B. What is the minimum required diameter of the pin at A assuming that the pin connection is in double shear? Consider the allowable shearing stress of the pin as 15 MPa. Round your answer in a multiple of 5. (mm)

Situation 2: A steel plate 8 mm thick is to be embedded in a horizontal concrete slab and is used to anchor a high-strength vertical cable 12 mm in diameter as shown. The diameter on the hole on the plate is 20 mm. Assuming that $P = 10$ kN, determine the safest minimum dimensions a and b as the width of the plate and the depth of embedment, respectively. Consider the following design parameters:

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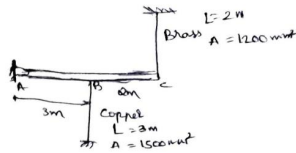
WABC = 10 kNm
 Compressive stress in copper bar = 20 MPa

$$\sigma_c = \frac{F}{A}$$

$$20 = \frac{F}{1500} \Rightarrow F = 1500 \times 20$$

$$F = 30 \times 10^3 \text{ N}$$

$$\boxed{F_c = 30 \text{ kN}} \text{ Tension (T)}$$



FBD: a

From Equilibrium Equations

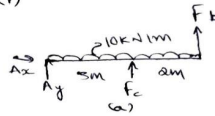
$$\sum F_y = 0 \Rightarrow A_y + F_c + F_b = 10 \times 5$$

$$A_y + F_b = 50 - 30$$

$$A_y + F_b = 20 \text{ kN}$$

$$\Rightarrow A_y = 20 - 7$$

$$\boxed{A_y = 13 \text{ kN}}$$



$\sum M_A = 0$

$$F_b \times 5 + F_c \times 3 = 10 \times 5 \times \frac{5}{2}$$

$$F_b \times 5 = 125 - 90 = 35 \text{ kN}$$

$$\therefore F_b = \frac{35}{5} = 7$$

$$\boxed{F_b = 7 \text{ kN}} \text{ Tension (T)}$$

⑥

stress in brass bar

$$\sigma_b = \frac{F_b}{A_b} = \frac{7 \times 10^3}{1200}$$

$$\boxed{\sigma_b = 5.83 \text{ MPa}} \text{ Tensile stress}$$

$$F_b = 13000 \text{ N}$$

shear stress at pin A = $\tau_A = 15 \text{ MPa}$

$$15 = \frac{R_y}{A} = \frac{13000}{\frac{\pi}{4} D^2 \times 2}$$

[Double shear so, Area get twice]

$$D^2 = 23.5$$

$$D \approx 25 \text{ mm}$$

Minimum required diameter of Pin at A = 25 mm

② Given that

$$P = 10 \text{ kN}, d_{\text{hole}} = 20 \text{ mm}$$

$$d_{\text{hole}} = 20 \text{ mm}, \sigma_{\text{st}} = 250 \text{ MPa}$$

$$\tau_{\text{st}} = 50 \text{ MPa}, t = 8 \text{ mm}$$

* Net Area of plate = $(a - d_h) \times t$

$$\text{Normal strength} = \frac{F_{\text{tension}}}{\text{Area of c/h}}$$

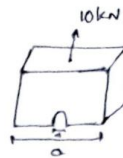
$$\sigma_{\text{st}} = \frac{F}{A} \Rightarrow P = \sigma_{\text{st}} \times A$$

$$\Rightarrow 10 \times 10^3 = 250(a - 20) \times 8$$

$$\frac{10^3}{25} = a - 20 \Rightarrow 40 + 160 = a \times 8$$

$$\Rightarrow a = \frac{200}{8}$$

$$\boxed{a = 25 \text{ mm}}$$



Bonding stress $\tau_{\text{st}} = 50 \text{ MPa}$

$$\tau_{\text{st}} = \frac{F}{A}$$

$$F = \tau_{\text{st}} \times A$$

$$10 \times 10^3 = 50 \times 10^3 \times (a + 2t) \times b$$

$$10 \times 10^3 = 50 \times 10^3 \times (50 + 2 \times 8) \times b$$

$$b = \frac{10 \times 10^3}{50 \times 10^3 \times (66)}$$

$$\boxed{b = 30303.03 \text{ mm}}$$



$A = \text{Perimeter} \times t$

$$= (t + a + t) \times d$$

$$= (a + 2t) \times d$$

[1 kPa = 10³ MPa]

$$a = 50 \text{ mm} \quad b = 90 \text{ mm}$$

$$P_a = \sigma(a - d_h) \times t$$

$$= 250(50 - 20) \times 8$$

$$= 250 \times 30 \times 8$$

$$= 60000 \text{ N}$$

$$P = 60000 \text{ N}$$

$$V = \frac{60}{10} = 6$$

$$FOS = 6$$

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Up next for you in Civil Engineering

The end chord of a timber truss is framed into the bottom chord as shown. Neglecting friction, comp...

6. The end chord of a timber truss is framed into the bottom chord as shown. Neglecting friction, compute dimension 'b' if the allowable shearing stress is 150 psi. Determine dimension 'a' so that the bearing stress does not exceed 1200 psi.



[See answer](#)

A water tank, 22 ft in diameter, is made from steel plates that are 1/2 in. thick. Find the maximum height to which the tank may be filled if the circumferential stress is

[See answer](#)

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Q: Situation 2: A steel plate 8 mm thick is to be embedded in a horizontal concrete slab and is used to anchor a high-strength vertical cable 12 mm in diameter as shown. The diameter of the hole on the plate is 20 mm. Assuming that $P = 10$ kN, determine the safest minimum dimensions a and b as the width of the plate and the depth of embedment respectively. Consider the following design...

A: [See answer](#)

Q: please answer 3,4 and 5

A: [See answer](#)

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