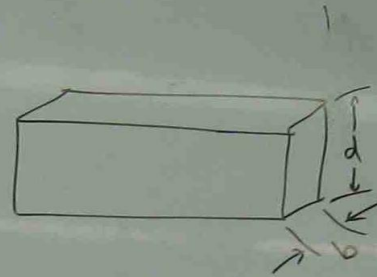
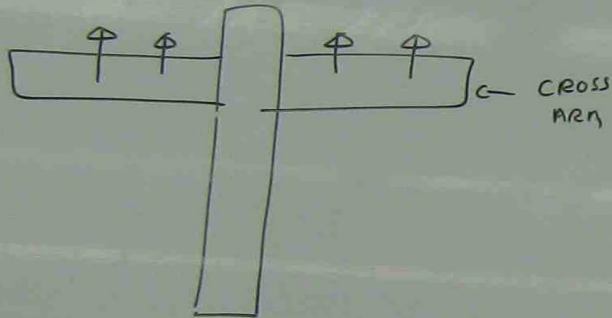
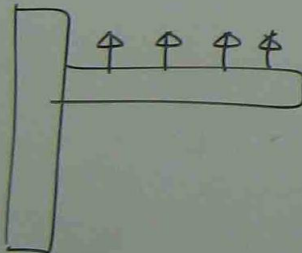


# CROSS ARM DESIGN

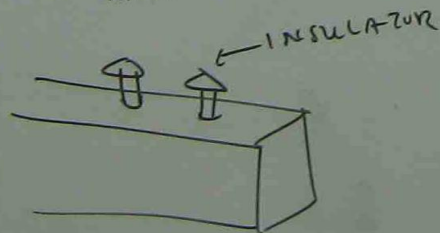


$$I = \text{MOMENT OF INERTIA} = \frac{bd^3}{12}$$

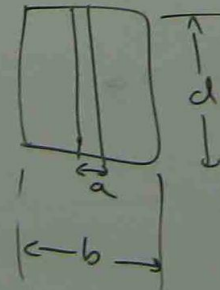
$$C = \text{STRESS NEUTRAL} = \frac{d}{2}$$



$$\text{SOLID CROSS ARM} = \frac{I}{C} = \frac{\frac{bd^3}{12}}{\frac{d}{2}} = \frac{bd^3}{12} \times \frac{2}{d} = \frac{bd^2}{6}$$



$a = \text{DIAMETER OF INSULATOR PIN}$



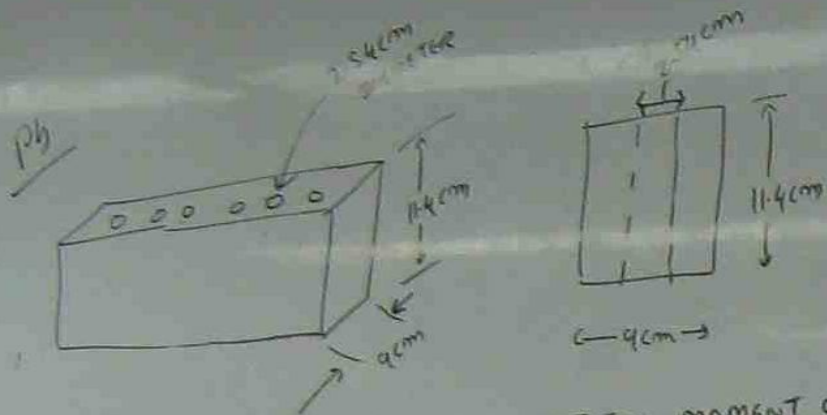
$$\frac{I}{c} = \frac{1}{6} d^2 (b-a)$$

CROSS ARM WITH  
INSULATOR PIN HOLE

$$f = \frac{m}{I/c}$$

$m$  = TOTAL MOMENT OF INERTIA  
ON CROSS ARM

$f$  = CROSS ARM MAXIMUM  
STRESS



IN GIVEN CROSS ARM FIXTURE, TOTAL MOMENT OF INERTIA  
ON THE CROSS ARM IS 493 N-m.  
CALCULATE THE STRESS OF THE CROSS ARM MATERIAL.

$$\frac{I}{c} = \frac{1}{6} d^2 (b - a)$$

$$= \frac{1}{6} \times \left( \frac{11.4}{100} \right)^2 \left( \frac{9}{100} - \frac{2.54}{100} \right)$$

$$d = 11.4 \text{ cm}$$

$$b = 9 \text{ cm}$$

$$a = 2.54 \text{ cm}$$

$$f = \frac{m}{I/c} = \frac{493}{\frac{1}{6} \left( \frac{11.4}{100} \right)^2 \left( \frac{9}{100} - \frac{2.54}{100} \right)}$$

$$= 390 \times 10^4 \text{ N/m}^2$$

ph

12 m pole set in 1.83 m in ground with three no 4/0  
stranded copper conductors on cross arm with conductor level and  
45.7 m span in heavy loading area.

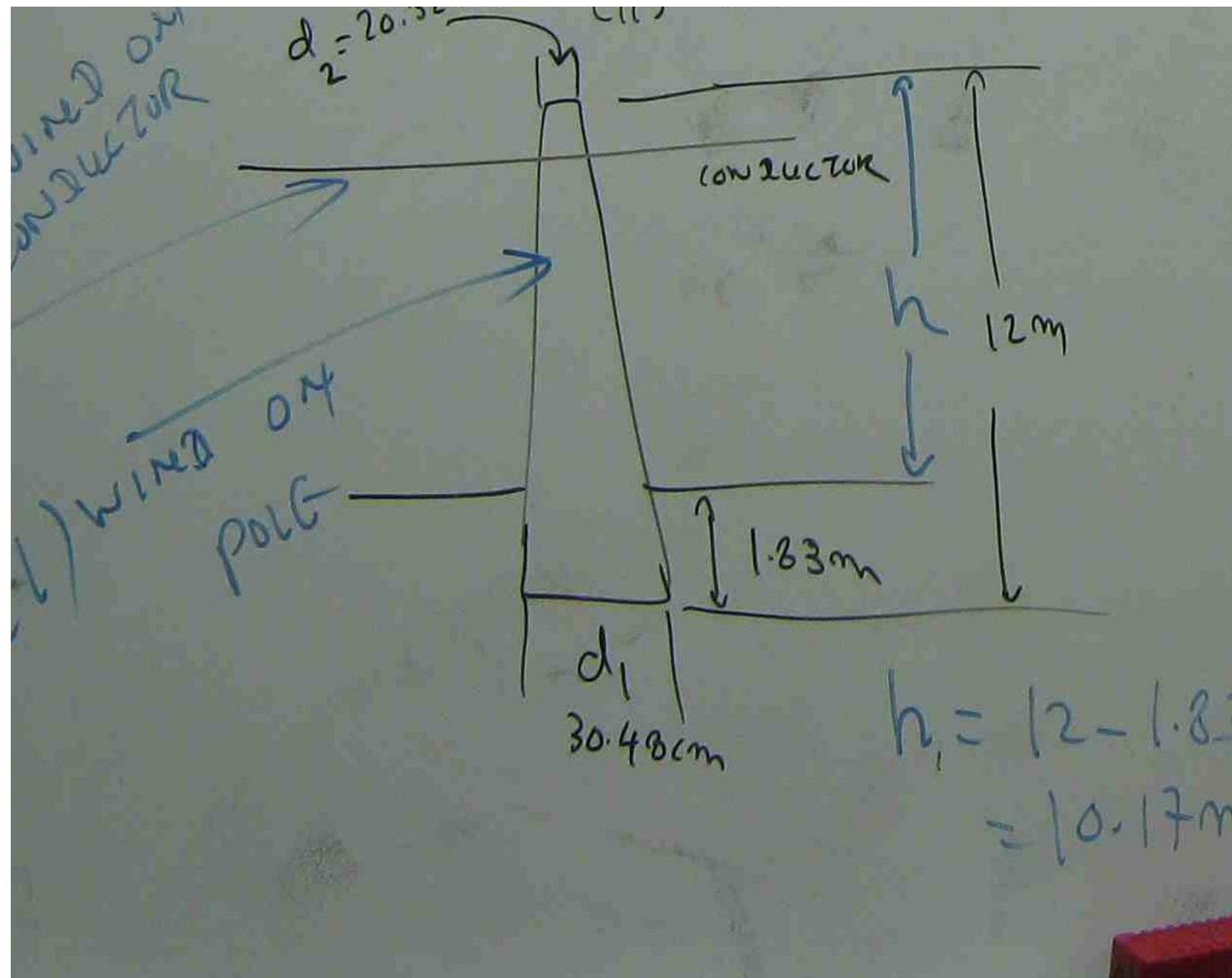
pole has 20.32 cm at top and 30.48 cm at bottom.

The moment due to wind on conductor when ice coated is as follows:

no 4/0 copper wire of 1.34 cm diameter, 2.54 cm thickness of ice.

Calculate (i) Total moment of inertia

$d = 20.32 \text{ cm}$  (ii) Maximum fibre stress



BENDING MOMENT

CAUSED BY WIND

FORCE ON POLE

$$= \text{WIND PRESSURE} \times h^2 \times \left( \frac{d_1}{6} + \frac{d_2}{3} \right)$$

$$= 196.2 \times 10.17^2 \times \left( \frac{30.48 \times 10^{-2}}{6} + \frac{20.32 \times 10^{-2}}{3} \right)$$

$$= 2404 \text{ N-m}$$

BENDING MOMENT

CAUSED BY

8.3

WIND FORCE ON

-m

CONDUCTOR

$$= \text{WIND PRESSURE} \times \text{AREA OF CONDUCTOR TO WIND} \times \text{NO. OF CONDUCTOR} \times h$$

$$\text{TOTAL DIAMETER} = \text{COPPER} + \text{ICE} = 1.34 + 2.54 \\ = 3.88 \text{ cm}$$

$$\begin{array}{l} \text{BM} \\ \text{ON} \\ \text{CONDUCTOR} \end{array} = 196.2 \times \frac{\text{DIAMETER}}{\text{SPAN}} \times 3 \times 10.17$$

$$= 196.2 \times \frac{3.88}{100} \times 45.7 \times 3 \times 10.17$$

$$= 10614 \text{ N-m}$$

$$\left( \frac{d_1}{6} + \frac{d_2}{3} \right)$$

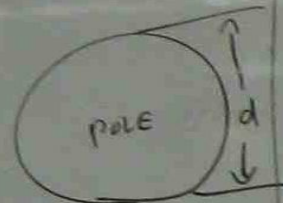
$$\left( \frac{20.32 \times 10^{-2}}{6} + \frac{20.32 \times 10^{-2}}{3} \right)$$

$\frac{\text{BM}}{\text{BENDING moment}}$

$$\begin{aligned} \text{TOTAL BENDING MOMENT (M)} &= \text{BM ON CONDUCTOR} + \text{BM ON POLE} \\ &= 10614 + 2404 \\ &= 13018 \text{ N-m} \end{aligned}$$

$$f = \frac{m}{I/c} \quad (\text{OR})$$

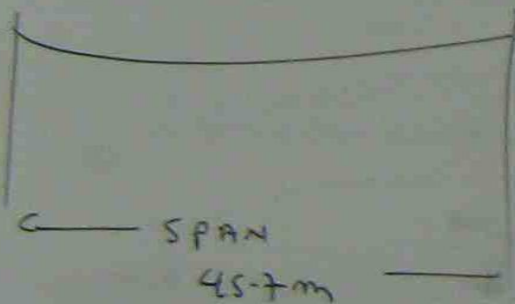
$$f = m \times \frac{c}{I}$$



BOLT

CROSS ARM

PIN



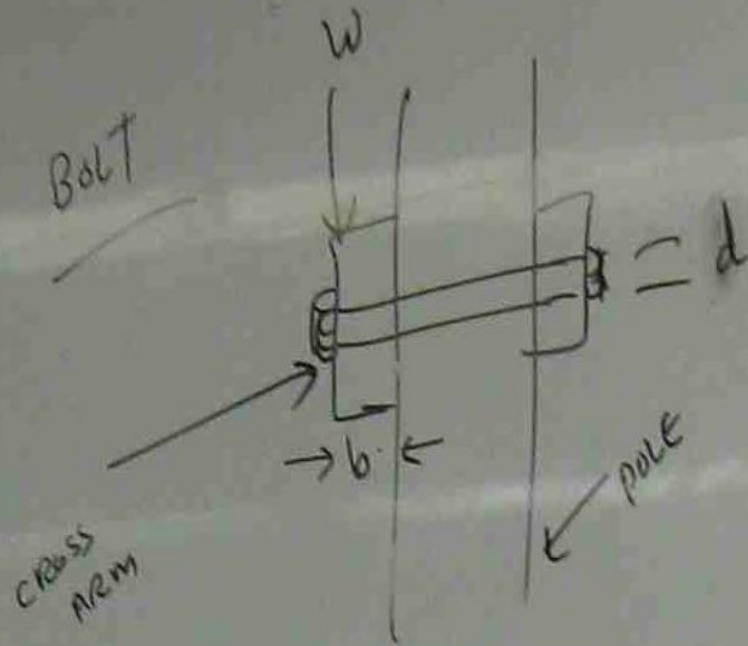
$$c = \frac{d}{2}, \quad I = \frac{\pi d^4}{64}$$

$$d = \frac{d_1 + d_2}{2} = \frac{20.32 + 30.48}{2}$$

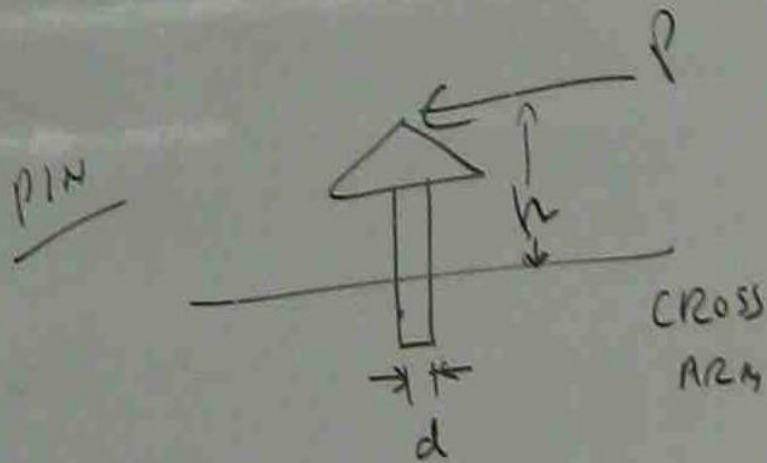
$$= 25.4$$



$$f = 13018 \times \frac{25.4 \times 10^{-2}}{\frac{\pi}{64} \times (25.4 \times 10^{-2})^4} = 8.098 \times 10^5 \text{ N/m}^2$$



$$\text{UNIT PRESSURE ON BOLT} = \frac{W}{b \times d}$$



$$f = \frac{P h}{0.982 d^3}$$