الكلية الإسلامية الجامعة
قسم هندسة تقنيات البناء والانشاءات
المادة: مقاومة مواد

المرحلة: الثانية
السنة الدراسية: 2017-2018
اسم التدريسي: أ.م.د علي العذاري

Bending Stresses in Beams

اجهادات العزم في الجسر

$\frac{1}{\rho}$ = Curvature تقويس

cd' elongate by dd'

$dd' = y\,d\theta$

original length was $cd' = dx$

$$\varepsilon_x = \frac{dd'}{cd'} = \frac{y\,d\theta}{dx} = y\frac{d\theta}{dx} = \frac{y}{\frac{dx}{d\theta}} = \frac{y}{\rho}$$

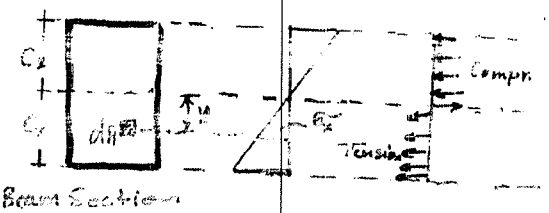
$$\varepsilon_x = \frac{y}{\rho}$$

$d\theta = \frac{dx}{\rho}$

$\rho = \frac{dx}{d\theta}$

Stress in the Fiber at (y) distance

$$\sigma_x = \varepsilon_x \cdot E = \frac{y}{\rho} \cdot E$$



Force at $dA = \sigma_x \cdot dA$

$$= \frac{y}{\rho} \cdot E\,dA$$

$$= \frac{E}{\rho} \int y\,dA$$

$I = \int y^2 dA$

= moment of Inertia

M = Force x distance

$$M = \int \sigma_x\,dA \cdot y = \frac{E}{\rho} \int y\,dA \cdot y = \frac{E}{\rho} \int y^2 dA$$

$$M = \frac{E}{\rho} \cdot I \qquad \frac{M}{EI} = \frac{1}{\rho}$$

$$\boxed{\frac{1}{\rho} = \frac{M}{EI}}$$

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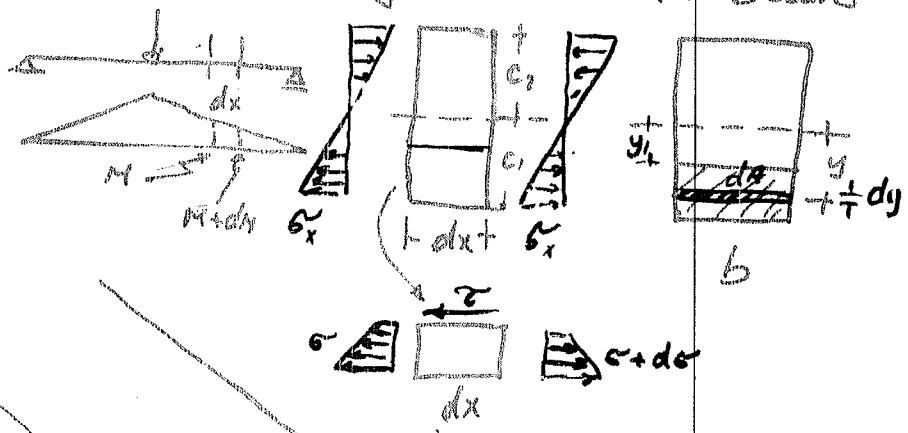
29-3-2017
د. علي العذاري

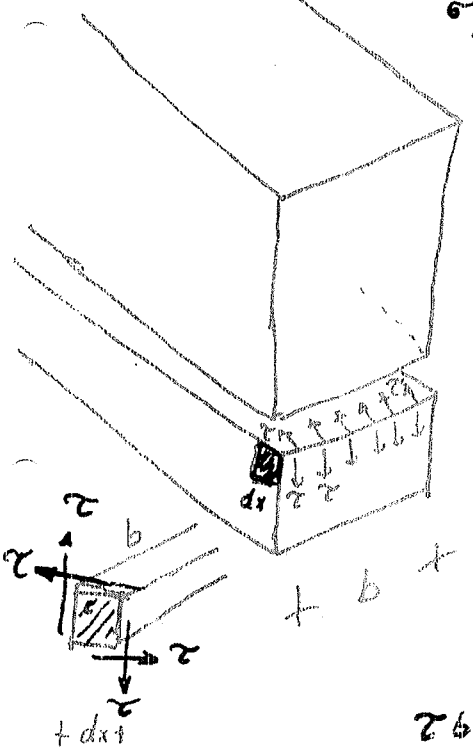
(34) مقاومة المواد
الصف الثاني

(50)

ابجادات القص في الجسور

Shearing Stresses in Beams





$$\sigma = \frac{My}{I}$$

$$dA.\sigma = \frac{My}{I}.dA$$

$$\text{left side force} = \int_{y_1}^{c_1} \frac{My}{I}\,dA$$

$$\text{right side force} = \int \frac{(M+dM)y}{I}\,dA$$

The Shear Force τ on the upper face of the block is:

$$\tau b\,dx$$

Equilibrium condition:

$$\tau b\,dx = \int_{y_1}^{c_1} \frac{(M+dM)y}{I}\,dA - \int_{y_1}^{c_1} \frac{My}{I}\,dA$$

$$\tau = \frac{dM}{dx}\cdot\frac{1}{Ib}\int_{y_1}^{c_1} y\,dA$$

$$\tau = \frac{V}{Ib}\int_{y_1}^{c_1} y\,dA$$

يتبع

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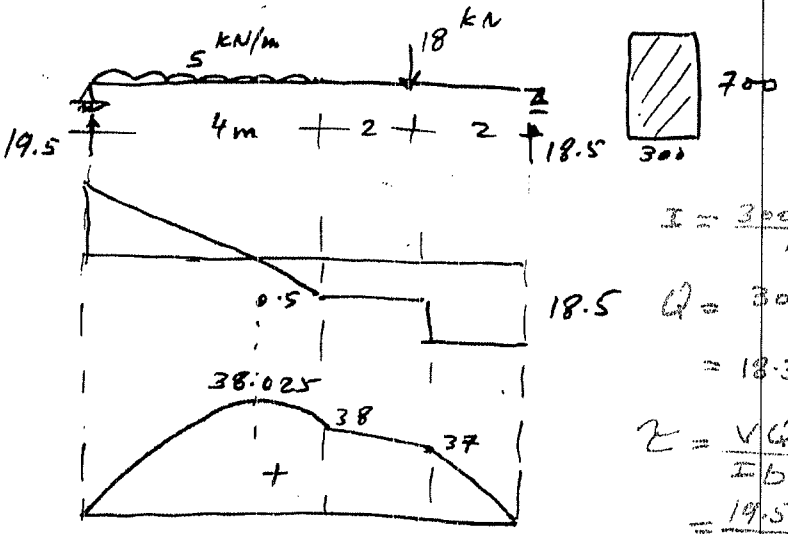
(86) (52)

Example : Calculate the Shearing Stress acting on Beam



$$I = \frac{300 \times 700^3}{12} = 85.75 \times 10^8 \ mm^4$$

$$Q = 300 \times 350 \times \frac{350}{2}$$

$$= 18.38 \times 10^6 \ mm^3$$

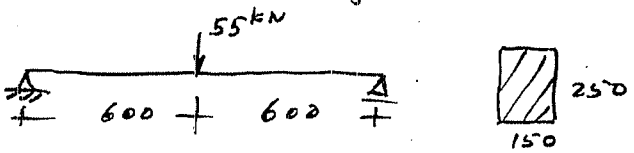
$$\tau = \frac{VQ}{Ib}$$

$$= \frac{19.5 \times 10^3 \times 18.38 \times 10^6}{85.75 \times 10^8 \times 300}$$

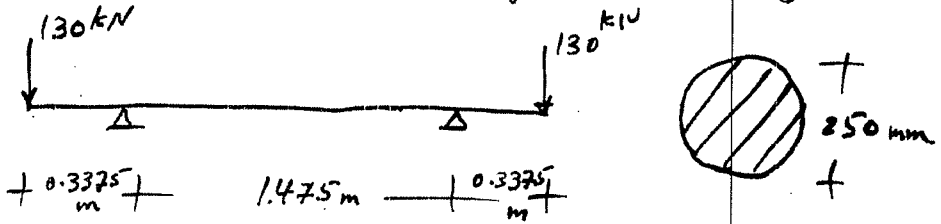
$$= 0.139 \ \frac{N}{mm^2}$$

واجب

Q1 Calculate the max Shearing stresses τ in the Beam :



Q2 - Calculate the max Shearing stresses acting on the Beam



Note : the Centroid of half circle is : $\frac{4}{3}\frac{r}{\pi}$

the moment of Inertia of the circle :

$$I = \frac{\pi D^4}{64}$$

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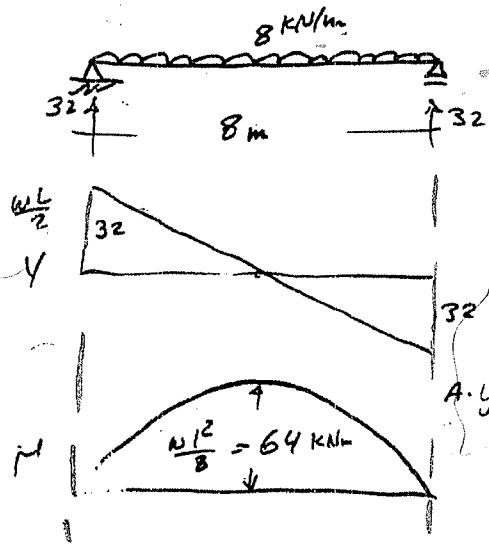
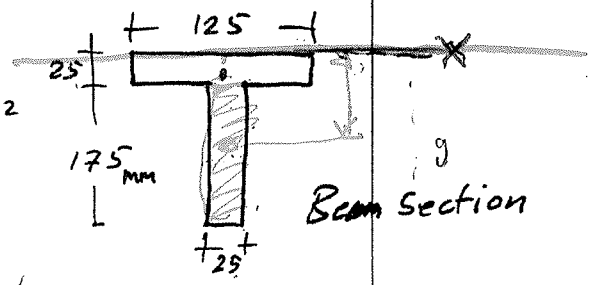
Example 2: Calculate the τ_{max} and σ_{max} for the Beam



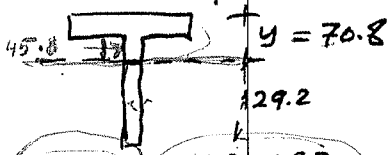


$A = 125 \times 25 + 175 \times 25 = 7500$

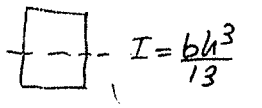
$A \cdot y = 125 \times 25 \times 12.5 + 175 \times 25 \times 112.5$

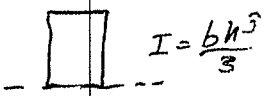
$= 39062 + 492187$

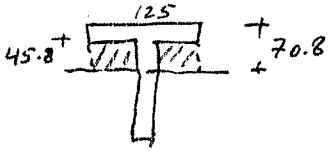
$\frac{125}{2} + 25 = 112.5$



$y = \frac{A_1 y_1 + A_2 y_2}{A_1 + A_2} = \frac{531250}{7500} = 70.8$ mm



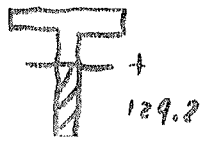




$$I = \frac{125 \times 70.8^3}{3} + \frac{25 \times 129.2^3}{3} - 2 \times \frac{50 \times 45.8^3}{3}$$

$$I = 14.78 \times 10^6 + 17.97 \times 10^6 - 3.2 \times 10^6 = 29.55 \times 10^6 \text{ mm}^4$$

for Q



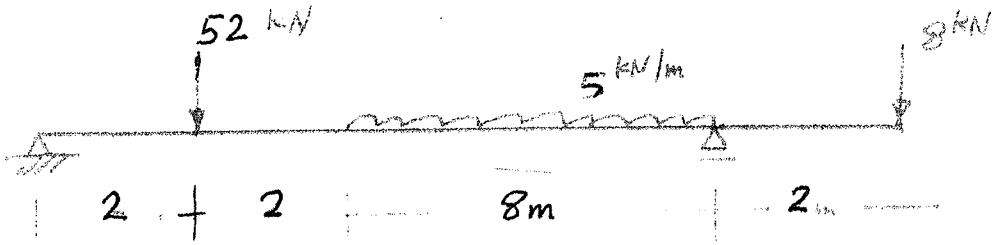
$Q = 129.2 \times 25 \times \frac{129.2}{2} = 0.209 \times 10^6 \text{ mm}^3$

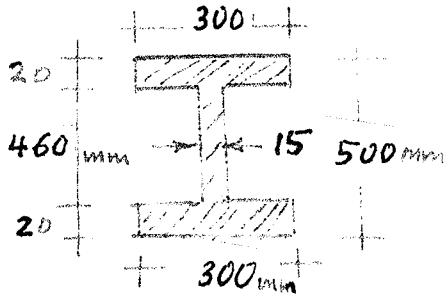
$I = $ ——

$y = \frac{A \cdot y}{A}$

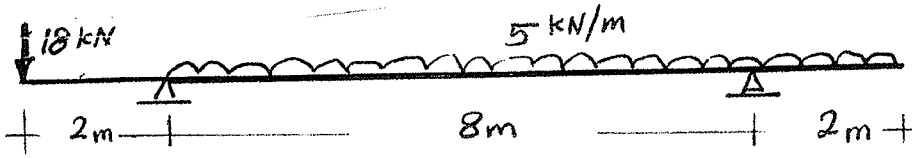
$A \cdot y = \Sigma \cdot y$

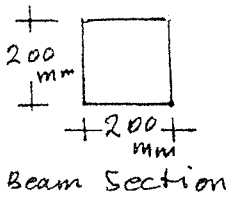
Q2-calculate the Maximum Bending & Shearing STRESSES



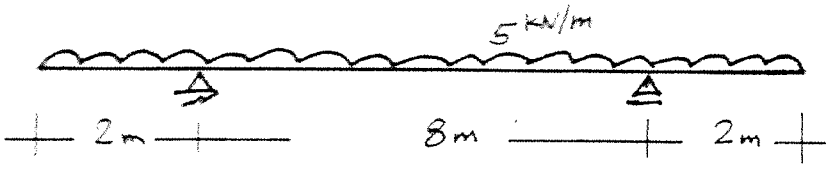


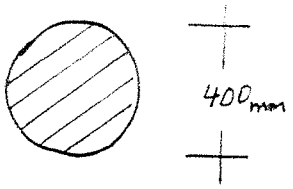
Q1-Draw the Bending &Shearing Force and calculate The stresses





Q1-for the beam calculate the max bending and shearing stresses





Q1-calculate the Maximum Bending & Shearing STRESSES