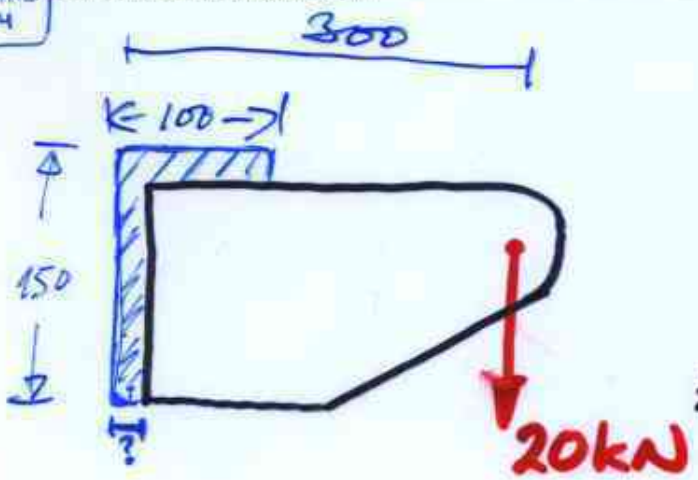
26-MAR-2004

1



PREVIOUS DAY

$S_y = 345\ MPa$

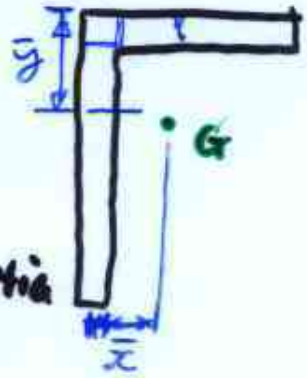
F.S. = 2.5

* specify weld *

SOLUTION SEQUENCE:

① find centroid of weld group

$$\bar{x} = \frac{\Sigma A_i x_i}{\Sigma A_i} \qquad \bar{y} = \frac{\Sigma A_i y_i}{\Sigma A_i}$$



② find POLAR MOMENT of INERTIA about G: J

$$J = I_x + I_y \qquad (I_x = \int y^2\, dA)$$

③ EXPRESS LOAD AS A FORCE + TORQUE at G. i.e. 20kN & $(20)(300-\bar{x})$ Nm

④ CALCULATE Stresses @ EXTREME PTS.

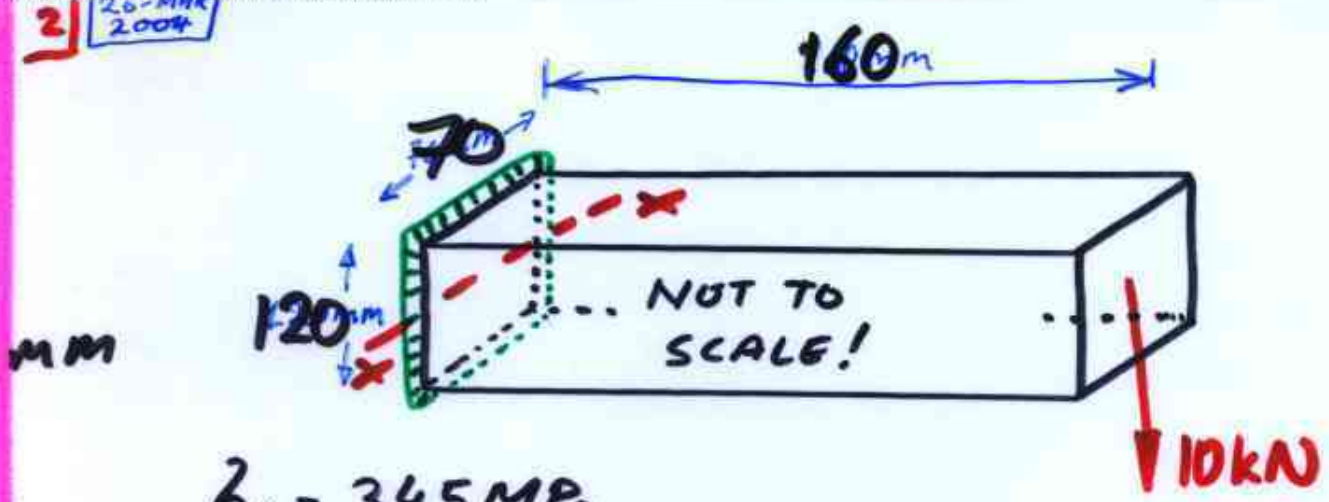
$\tau = \frac{Tr}{J}$ but NOTE: $\tau_x = \frac{T r_y}{J}$ ← fn of t $\qquad \tau_y = \frac{T r_x}{J}$ ← TORQUE

$\tau = \frac{V}{A}$ ... HERE $\tau = \frac{20\,kN}{(250\,mm)(t)}$ DIRECT

⑤ FIND LARGEST RESULTANT SHEAR: $\frac{692}{t}$

FAIL CRITERION (SHEAR ... DIST. EN.) $\qquad \frac{692}{t} = \frac{(0.58)(S_y)}{(F.S.)}$ etc.,

2] 20-MAR 2004



$\sigma_y = 345 MPa$

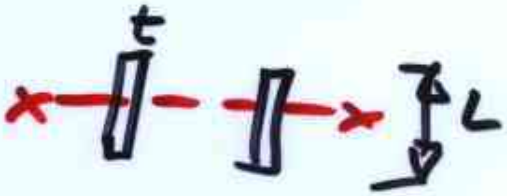
find required WELD DIMENSION

① Bending moment

$$(10 \times 10^3)(160 \times 10^{-3}) = 1600 Nm$$

② $\sigma = \frac{My}{I}$ NEED I_{xx}

$I_{vertical\ welds}$

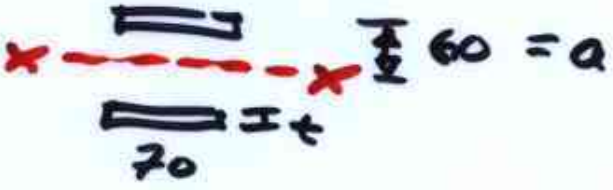


$$I = \left(\frac{L^3 t}{12}\right)(\times 2)$$

↑ 2 welds

$$= 2\,(144 \times 10^{-9} t)\ m^4$$

$I_{H2\ welds}$



$$= 2\,Lt\,a^2$$

$$= 2\,(70)(t)(60)^2 = 2\,(252 \times 10^{-9} t)\ m^4$$

TOTAL $I_{xx} = 2\times252 + 2\times144$

$= 792\times10^{-9}\,t\ m^4$

(3) $\sigma = \frac{My}{I} = \frac{(1600)(60\times10^{-3})}{792\times10^{-9}\,t}$

$\sigma = \frac{121.2}{t}\times10^6\ N/m^2$

DUE TO BENDING

$\tau = \frac{V}{A} = \frac{10\,000}{(120\times2+70\times2)t} = \frac{26.3\times10^6}{t}$

total length

N/m^2

(4) Combine Stresses.

ADD to get resultant

Do a vector sum

$\frac{1}{t}\sqrt{(121.2)^2+(26.3)^2}$

$= \frac{124}{t}\ MPa$

So we have $\frac{124}{t}$ MPa on weld throat, shear

$$\frac{(345)(0.58)}{(3)} = \frac{124}{t} \text{ MPa}$$

(3) ← F.S.

$t = 1.86$ mm

$h = t/0.707 = 2.63$ mm

$\therefore$ spec 3mm