# Ch7. Transverse Shear

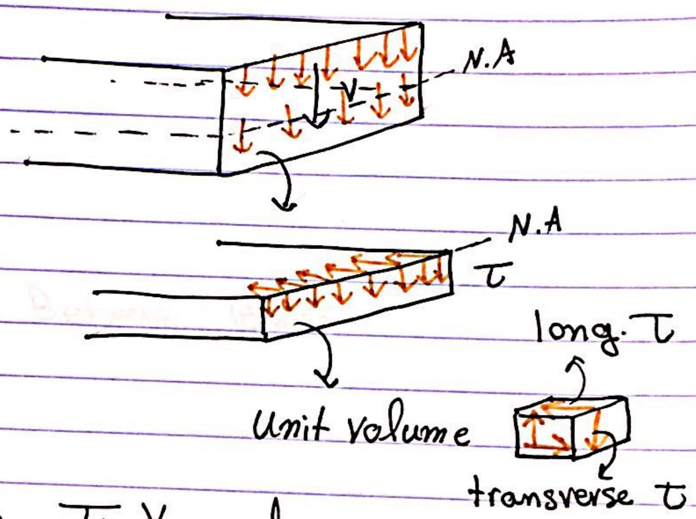
## 7.1+2 : Shear in straight members and shear formula.

Shear →
- longtudinal shear
- transverse shear

- Shear stress at the top = 0

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

and $\tau_{max}$ is at the N.A.




▸ Difference between $\tau = \frac{V}{A}$ and shear formula $\tau = \frac{VQ}{It}$

$\tau = \frac{V}{A}$ Calculates Avg shear stress in the cross section

$\tau = \frac{VQ}{It}$ ~ shear stress in a specefic point or Area

Now : what's t and Q :-

Q : Moment of Area above or under point

t: width of cross sectional area at where τ is measured.

## 7.3: Shear Flow in Built up Members.

Shear flow $q = \frac{VQ}{I}$

q: is the loading measured as a force per unit length

You can relate shear flow and shear stress

$$\tau = \frac{q}{t}$$

→ Now:

$$F = \frac{S \times q}{n}$$

S → spacing Between Bolts

F → Strength of each nail

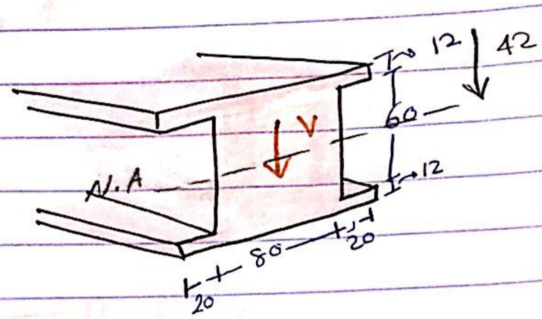
n: number of nails crossing the Area Boundry (see page 382 in Book)

► to find shear stress in each Bolt

$$\tau = \frac{F}{A} = \frac{S \times q}{n \times A}$$

# Examples solved on Ch7:

7.14 $V_{max} = ?$




$\tau_{all} = 40\ MPa$

$\tau_{all} = \frac{VQ}{It}$

→ $Q_{max}$ is at N.A

- $t = 80\ mm$

- $I = 2\left(\frac{1}{12}(120)(12)^3 + (12)(120)(36)^2\right) + \left(\frac{1}{12}\right)(80)(60)^3$

$= 5207040\ mm^4 = 5207040 \times 10^{-12}\ m^4$

$= 5.20704 \times 10^{-6}\ m^4$

- $Q = \Sigma \bar{y} A = (0.036)(0.012)(0.12) + \left(\frac{0.03}{2}\right)(0.08)(0.03)$

$= 8.784 \times 10^{-5}$

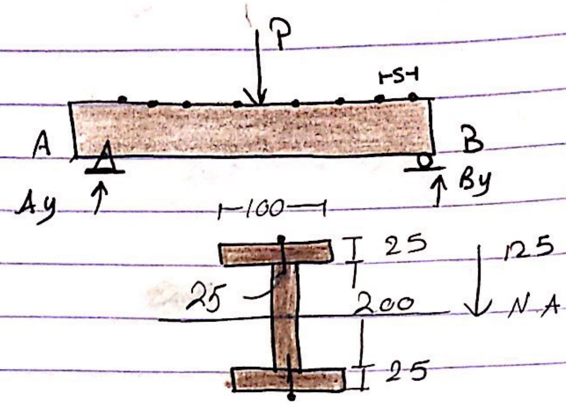
$40\mu = \frac{V(8.784 \times 10^{-5})}{(5.20704 \times 10^{-6})(0.08)}$

$V = 189691.8\ N$

7.41

$P = 12\ KN$

$S = ??$ if $F_{ma.T}$ 1.5 KN




$F = \frac{q \times S}{n}$

$S = \frac{nF}{q}$

$q_{max} = \frac{V_{max} Q_{max}}{I} =$

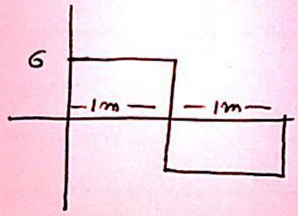
To find $V_{max}$:

• Reactions :

$\Sigma M_A = 0$ : $-P(1) + (B_y)(2) = 0$

$B_y = 6\ KN = A_y$

• So $V_{max} = 6\ KN$




$Q_{max}$ (Around N.A)

$Q = (0.1125)(0.025)(0.1)$

$Q = 2.8125 \times 10^{-4}$

So $q_{max} = \frac{(6K)(2.8125)(10^{-4})}{(8.0208)(10^{-5})}$

$= 21039.048\ N/m$

$I = 2\left[\frac{1}{12}(0.1)(0.025)^3 + (0.1)(0.025)(0.1125)^2\right] + \left(\frac{1}{12}\right)(0.025)(0.200)^3$

$I = 8.0208 \times 10^{-5}$

$S = \frac{(1)(1.5 \times 10^3)}{(21039.048)}$

$S = 0.071296\ m$

$= 71.296\ mm$

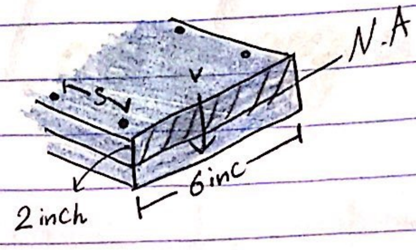
7-33

$s = 6$ inch

$V = 600\ lb$

$F = \frac{q \times s}{n}$

$F = \frac{q \times 6}{2}$ ~ 2 rows




$q = \frac{VQ}{I} = \frac{600 \ ((1)(2)(6))}{(\frac{1}{12})(6)(4)^3} \frac{in^3}{in^4} = 225\ lb/in$

$F = \frac{(225)(6)}{2} = 675\ lb$