Step 3: Strain Energy due to Shear Forces

Shear force in AB = 0; Shear force in BC = 12 kN

Strain Energy due to Shear for the whole str. Is

$$(U_i)_V = \sum_{i=1}^{n=2} \frac{V_x^2 L}{2A_r G} = \frac{(12*10^3)^2 * 4000}{2*2736*0.8\,x10^5} = 1315.78\ N-mm$$

Step 4: **Strain Energy due to Bending Moment**

Bending Moment in AB = -12 * 4 = -48 kN-m

Bending Moment in BC = -12 x

Strain Energy due to BM for the whole structure is

$$(U_i)_M = \sum_{i=1}^{n=2} \frac{M_x^2 dx}{2EI} = \frac{(-48*10^6)^2 * 5000}{2*2x10^5 * 47.54*10^6} + \int_0^{4000} \frac{(-12*10^3 * x)^2 dx}{2*2*10^5 * 47.54*10^6} = 767.34*10^3\ N-mm$$

Step 5: **Comparison**

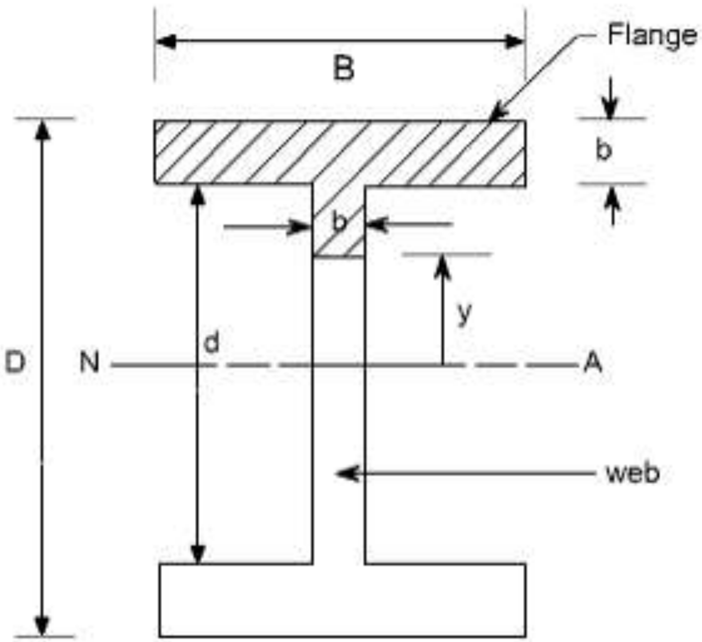
Total Strain Energy = (Ui)p + (Ui)V+ (Ui)M

Total Strain Energy =328.94 +1315.78 +767.34 x 103

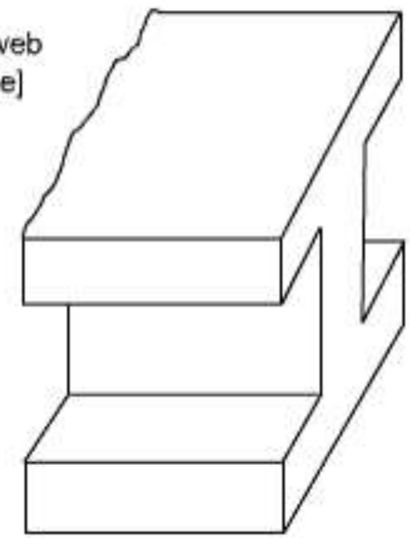
= 768.98 x 103 N-mm

Strain Energy due to axial force, shear force and bending moment are 0.043%, 0.17% & 99.78 % of the total strain energy.

Consider an I - section of the dimension shown below.




[Here flange and web thickness are same]



The shear stress distribution for any arbitrary shape is given as $\tau = \frac{F A \bar{y}}{Z I}$

Let us evaluate the quantity $A\bar{y}$, the $A\bar{y}$ quantity for this case comprise the contribution due to flange area and web area