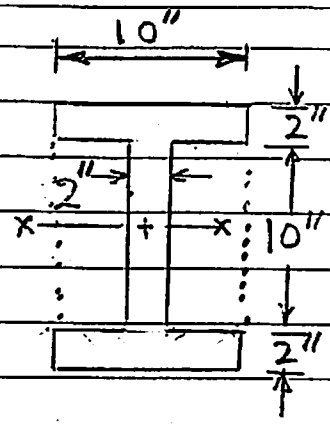
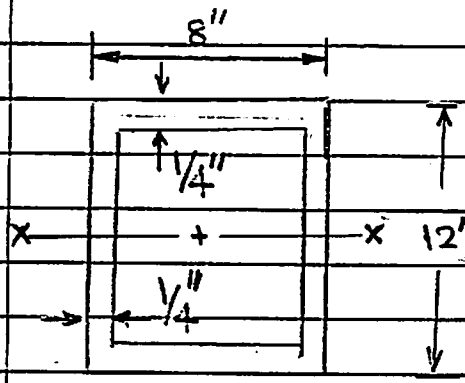
SYMMETRICAL CASES

15



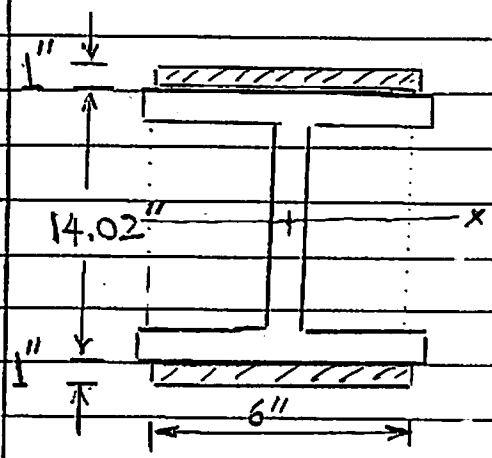
$$I_x = \frac{1}{12}(10)(14)^3 - \frac{1}{12}(10-2)(10)^3$$

16.



$$I_x = \frac{1}{12}(8)(12)^3 - \frac{1}{12}(7.5)(11.5)^3$$

17. GIVEN: W14X90 section with $I_x = 999\ in^4$ and depth $d = 14.02"$. Two plates $1" \times 6"$ are welded to the flanges. Calculate moment of inertia about centroidal axis.



SOLUTION: Add moment of inertia contributed by 2 plates to I_x of W14X90. (SYMMETRICAL)

PARALLEL AXIS THEOREM:

$$I_x = 999 + 2\left[\frac{1}{12}(6)(1)^3 + (6\times1)\left(\frac{14.02}{2}+0.5\right)^2\right]$$

$$I_x = 1676.8\ in^4$$

SUPERPOSITION METHOD:

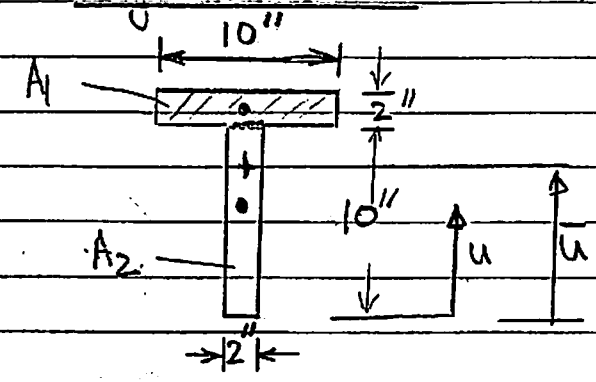
$$I_x = 999 + \left[\frac{1}{12}(6)(14.02+2)^3 - \frac{1}{12}(6)(14.02)^3\right]$$

$$I_x = 1676.8\ in^4$$

MOMENT OF INERTIA

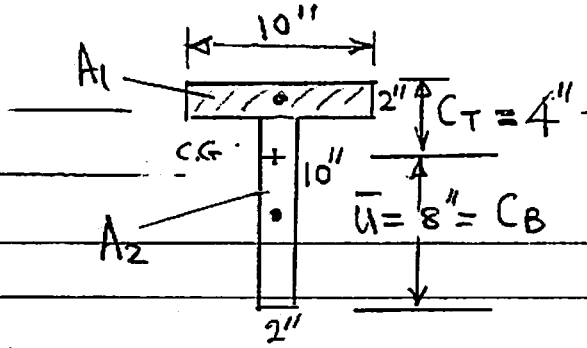
18. UNSYMMETRICAL CASE

Unsymmetrical case



Area	A (in²)	u (in)	Au (in³)
A_1	20	11	220
A_2	20	5	100
	ΣA = 40		ΣAu = 320

$$\bar{u} = \frac{\Sigma Au}{\Sigma A} = \frac{320}{40} = 8 \text{ in.}$$

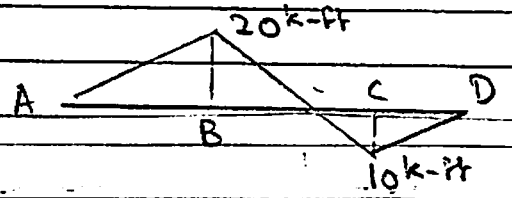


$$I_x \text{ due to } A_1 = \frac{1}{12}(10)(2)^3 + 20(11-8)^2 = 186.7 \text{ in}^4$$

$$I_x \text{ due to } A_2 = \frac{1}{12}(2)(10)^3 + 20(8-5)^2 = 346.7 \text{ in}^4$$

$$\text{Total } I_x = 186.7 + 346.7 = 533.4 \text{ in}^4$$

19. BENDING STRESSES



Calculate max stresses at point B. Use $\sigma = \frac{MC}{I}$

$$\sigma_{com} = \frac{M C_T}{I} = \frac{(20 \times 12)(4)}{533.4} = 1.8 \text{ ksi}$$

$$\sigma_{ten} = \frac{M C_B}{I} = \frac{(20 \times 12)8}{533.4} = 3.6 \text{ ksi}$$

SECTION MODULUS
$S = I/C$
$\sigma = \frac{M}{S}$