Date ..../......./....... No ....

(Structure)

(Buckling)

افضل في المنشآت المتجانسة ← (Steel)

يحدث في → Inplan ← , → out of plan ←

$$\sigma = \boxed{\frac{N}{A}} + \frac{M_x}{I_x} y + \frac{M_y}{I_y} x$$

هوا نفسه تمام بس بيجيب مومنت اضافي

اما اضرب factor * (N/A) ← اكبر من واحد

محمد طارق عبد الحميد

او استخدم

$$\frac{\sigma_{compression}}{\sigma_{allowable}} + \frac{\sigma_{bx}}{\sigma_{ab}} + \frac{\sigma_{by}}{\sigma_{ab}} \leq 1$$

($\sigma_{compression}$ منه $\frac{N}{A}$ ، Bending (x))

:: هوا قسم على allowable

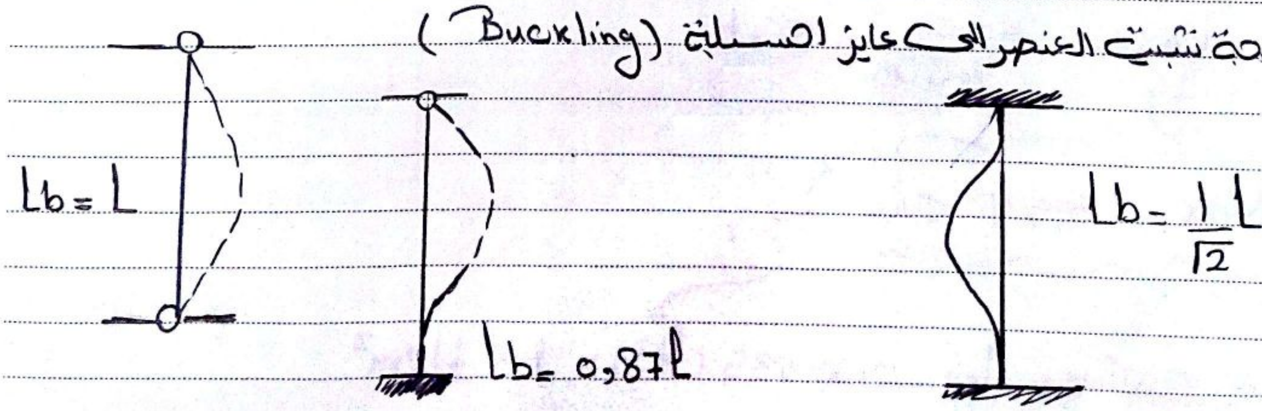
(حاجة حسب نوع steel Given)

لو اكبر من (1) :: القطاع مختار (unsafe)

$$\lambda = \frac{L_b}{i_{min}}$$ :: كمعامل نحافة

$$\lambda = \frac{L_{bx}}{i_x} \quad , \quad \frac{L_{by}}{i_y}$$

نتيجة تثبيت العنصر اللي عايز اسلكه (Buckling)



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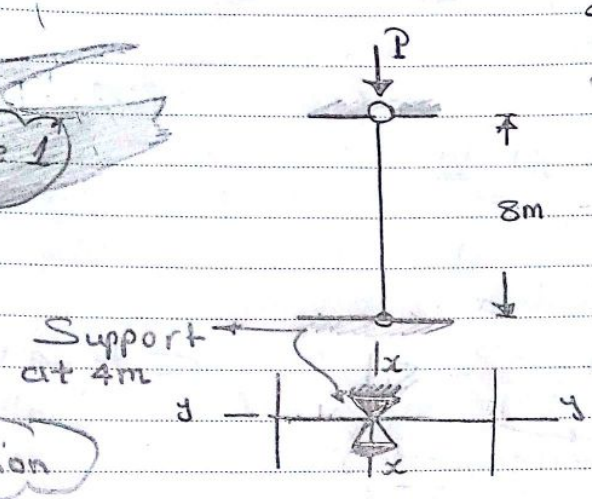
$\lambda < 100 \rightarrow \therefore \sigma_{all\ bu} = 1.6 - 0.000085(\lambda)^2$

Buckling of steel (44)

$\lambda > 100 \rightarrow \sigma_{all\ bu} = \frac{7500}{\lambda^2}$

$\sigma_{all} = 1.6\ t/cm^2$

Example 1



Data

Area = 144 cm^2

I_x = 20000 cm^4

I_y = 7320 cm^4

Solution

$L_{bx} = 8m = 800\ cm$

$L_{by} = 4m = 400\ cm$

$* i_x = \sqrt{\frac{I_x}{Area}} = \sqrt{\frac{20000}{144}} = 11.79\ cm$ $* i_y = \sqrt{\frac{I_y}{Area}} = \sqrt{\frac{7320}{144}} = 7.13\ cm$

$\lambda_x = \frac{L_{bx}}{I_x} = \frac{800\ cm}{11.79\ cm} = 67.9$

$\lambda_y = \frac{L_{by}}{I_y} = \frac{400\ cm}{7.13\ cm} = 56.1$

$\lambda\ Max = 67.9 < 100$

$\therefore \sigma_{allow} = 1.6 - 0.000085(\lambda^2) = 1.2\ t/cm^2$

$N = P$

$M_x = 0$

$M_y = 0$

$\therefore \sigma_c = \frac{N}{A} = \frac{P}{144}$

$\therefore \frac{P/144}{1,2} = 1$

$P = 174$ ton

$L_{bx} = 2L = 10m$

$L_{by} = 0,87\,L = 4,35\,m$

$i_x = \sqrt{\frac{I_x}{A}} = \sqrt{\frac{1505\,0}{121}} = 11,15$

$i_y = \sqrt{\frac{I_y}{A}} = \sqrt{\frac{5280}{121}} = 6,6$

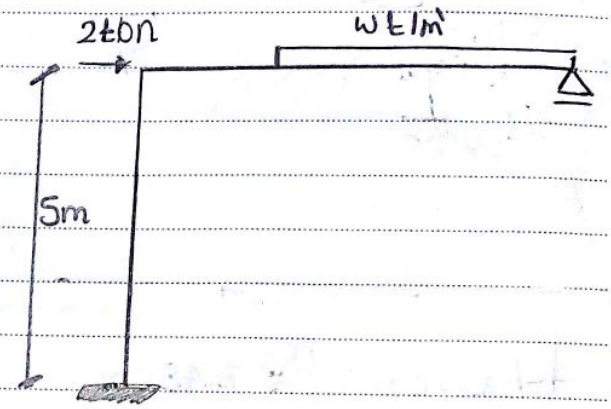
$\lambda_x = \frac{L_{bx}}{I_{ox}} = \frac{1000}{11,15} = 89,9$

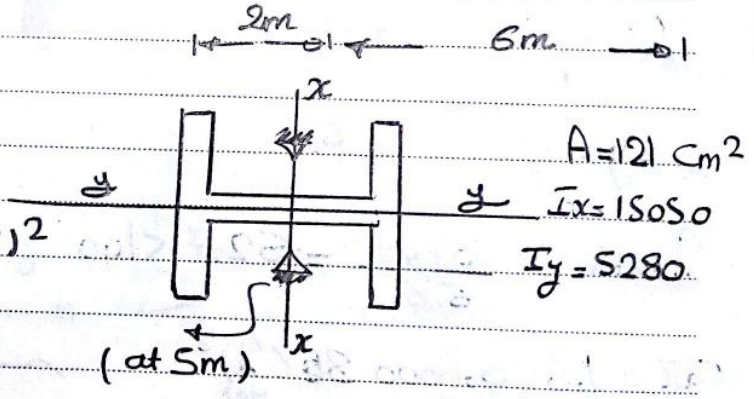
$\lambda_y = \frac{435}{6.6} = 65,9$

$\lambda_{Max} = 89,9 < 100$

$\sigma_{allowable}{}_{by} = 1,6 - 0,000085\,(89,9)^2$

$\sigma_{au}{}_{bu} = 0,91\ t/cm^2$





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$N = 3\omega$

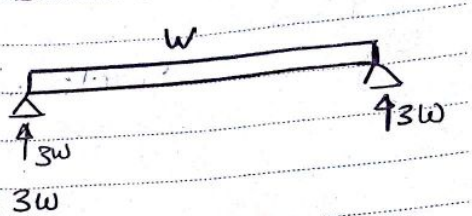
$M_x = 2*5 + 3\omega*2 = 10 + 6\omega$

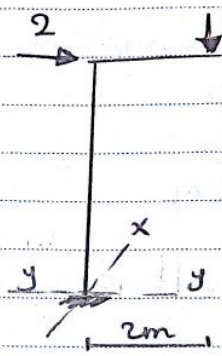
$M_y = 0$

كوبل نابتر لاسم

$$\frac{3\omega/121}{0,91} + \frac{10+6\omega}{\frac{15050}{1,6}} * 13 * 100 = 1$$

$\omega = 1,3$ t/m





$l_{bx} = 0,87\,l = 3,48$ cm

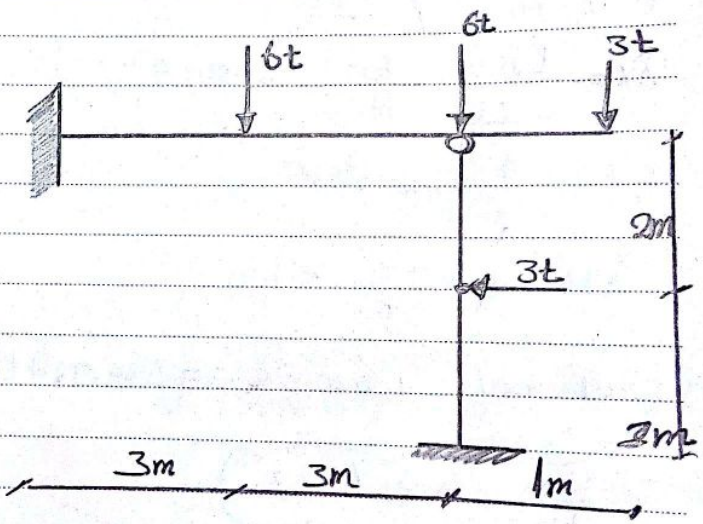
$i_x = \sqrt{\quad} = 11,15$

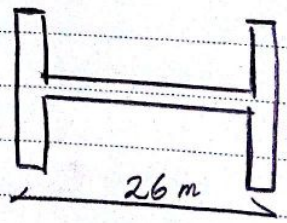
$i_y = \sqrt{\quad} = 6,6$

$\lambda_{Max} = \frac{3,48}{6.6} = 52,7 < 100$

$\sigma_{all} = 1,6 - 0,0000\,85(\lambda)^2_{Max}$

$1,36$ t/cm²





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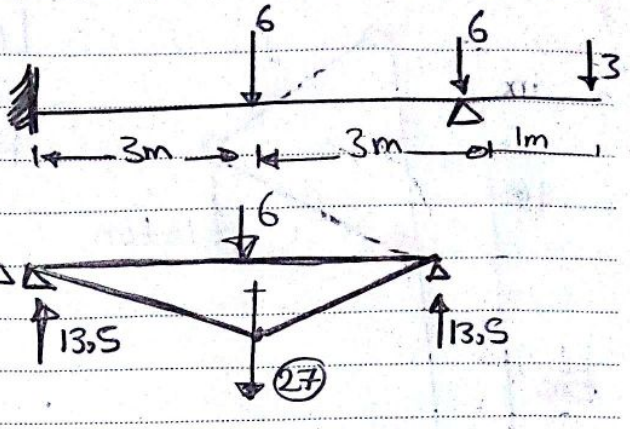
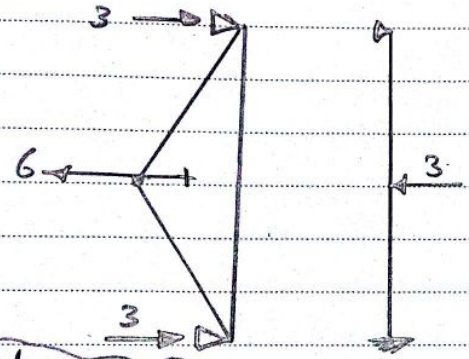
3 Momment equation at (a)

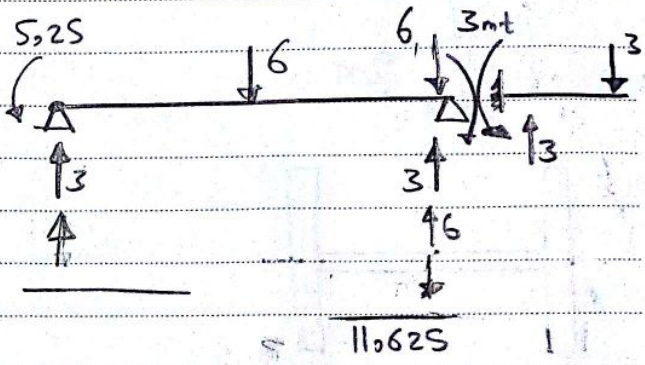
$0 + 2Ma(0+6) + Mb(6) = -6*13,5$

$12Ma + 6Mb = -6*13,5$ (÷3)

$Ma = -5,25$







$Mc = 2,25$

$V = 11,625$

$Mx = 2,25$

$$\frac{11,625/121}{1,36} + \frac{\frac{2,25*100}{15050}*13}{1,6} = \checkmark$$

Given

Safe لو اصغر من 1

unSafe 1 اكبر من