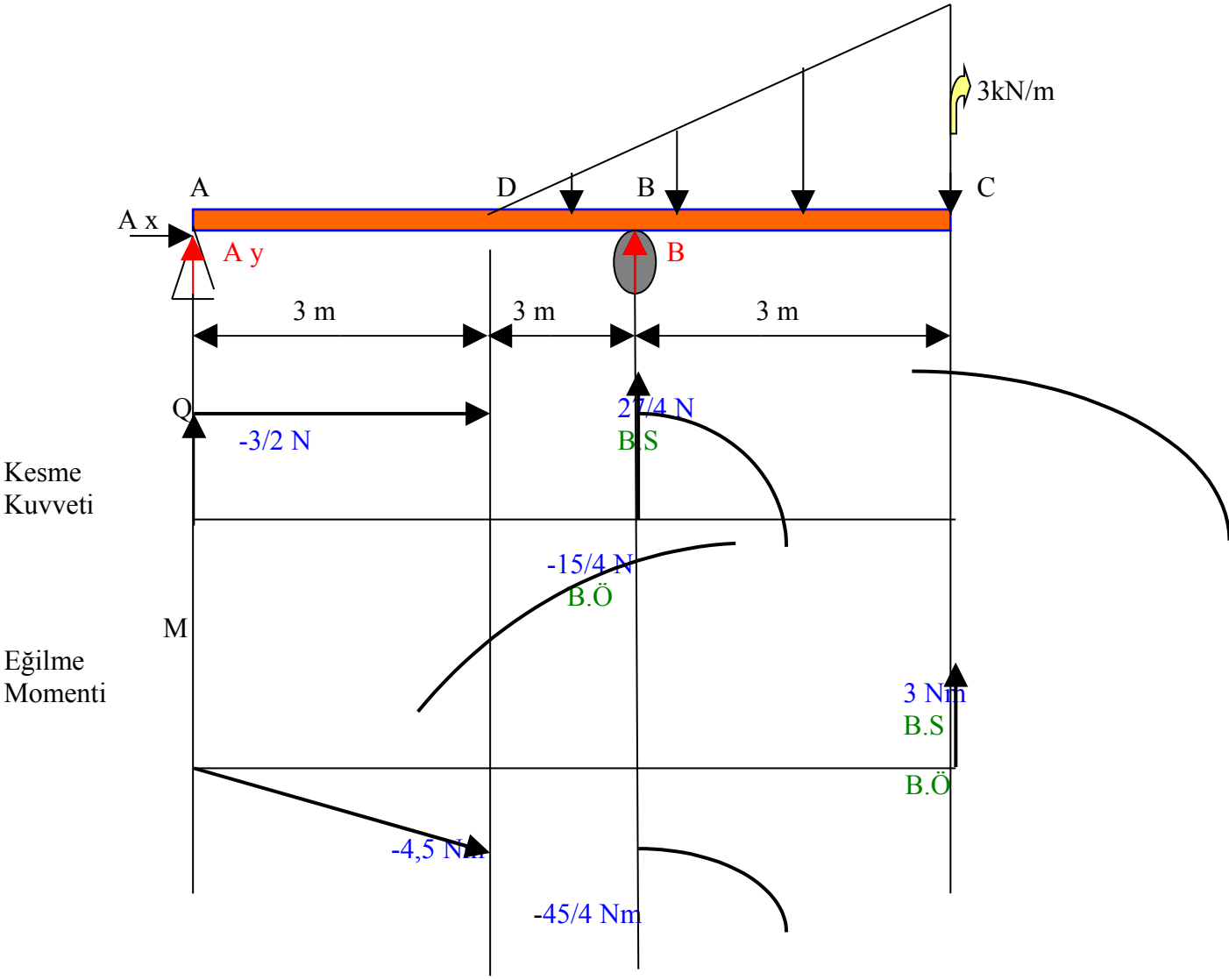
Gürer KIRATLI 01062058
Endüstri Mühendisliği(İ.Ö)
Mühendislik Mekaniği



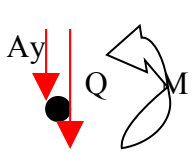
+ $\Sigma M = 0$

$Ay*6+9=0$
$Ay*6=-9$
$Ay=-3/2$ ↓

+ ↑ $\Sigma Fy=0$

$Ay+B-(3*6/2)=0$
$-3/2+B-9=0$
$B=21/2$ ↑

X=0;A noktasında:



+↑ ΣFy=0

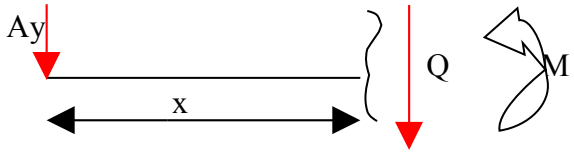
-Ay-Q=0

Q=-Ay=-3/2

+↻ ΣM=0

- M=0⇒ M=0

0≤X≤3;A-D aralığında:



+↑ ΣFy=0

-Ay-Q=0

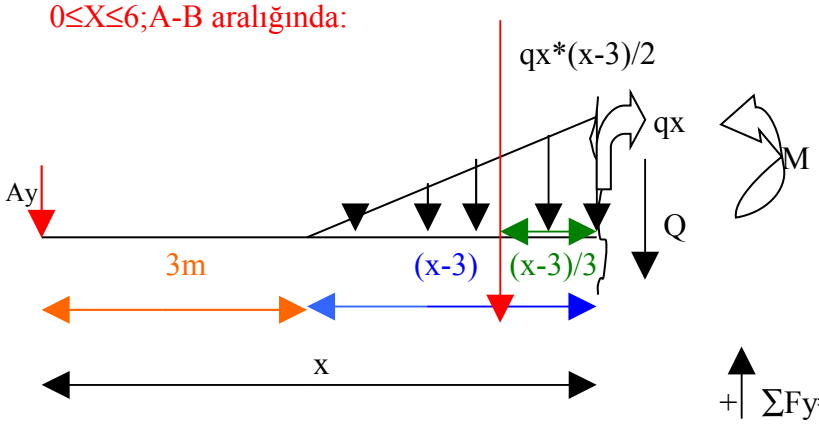
Q=-Ay=-3/2

+↻ ΣM=0

(-3x/2)-M=0⇒M=-3x/2

Q=dM/dx denklemi gerçeklenmektedir.

0≤X≤6;A-B aralığında:



(qx/3)= (x-3)/6

⇒qx=(x-3)/2

+↑ ΣFy=0

(-3/2)-(x-3)²/4-Q=0

Q=(-3/2)-[(x-3)²/4]

-q=dQ/dx denklemi gerçeklenmektedir.

+↻ ΣM=0

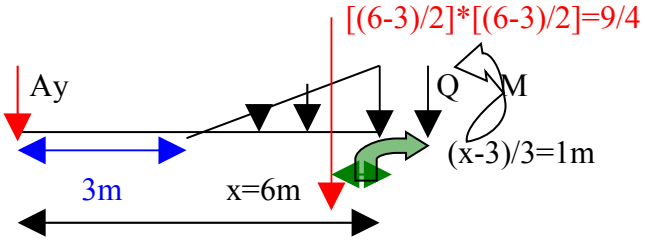
(-3x/2)-[(x-3)²/4]*[(x-3)/3]=M

M=(-3x/2)-[(x-3)³/12]⇒Q=dM/dx denklemi gerçeklenmektedir.

X=6,B noktasında:

Biraz önce:
$Q=(-3/2)-[(6-3)^2/4]$
$Q=-15/4$ ↑

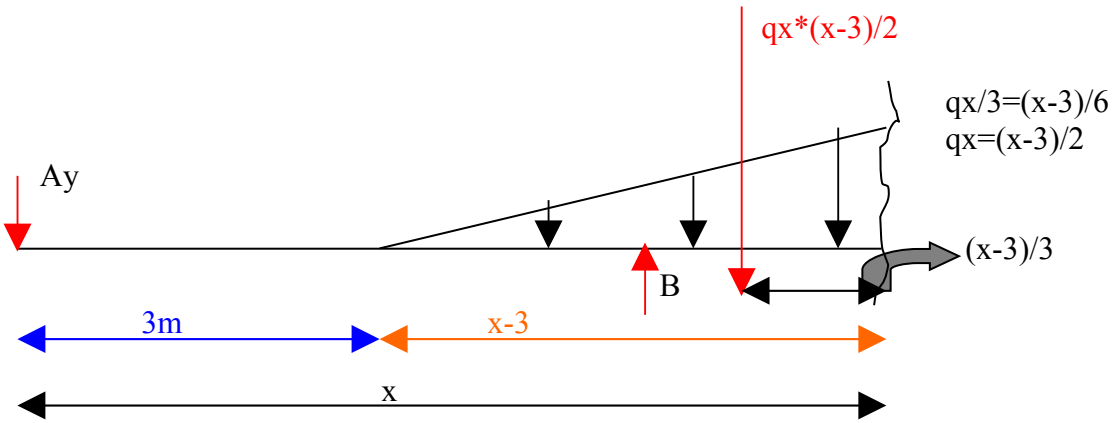
Biraz sonra:
$Q=(-15/4)+B$
$Q=(-15/4)+(21/2)$
$Q=27/4$ ↓



$\circlearrowleft \Sigma M=0$
$(-Ay*6)-(9*1/4)-M=0$
$M=-9-(9/4)$

$M=-45/4$ $\circlearrowright$

0≤X≤9;A-C aralığında:



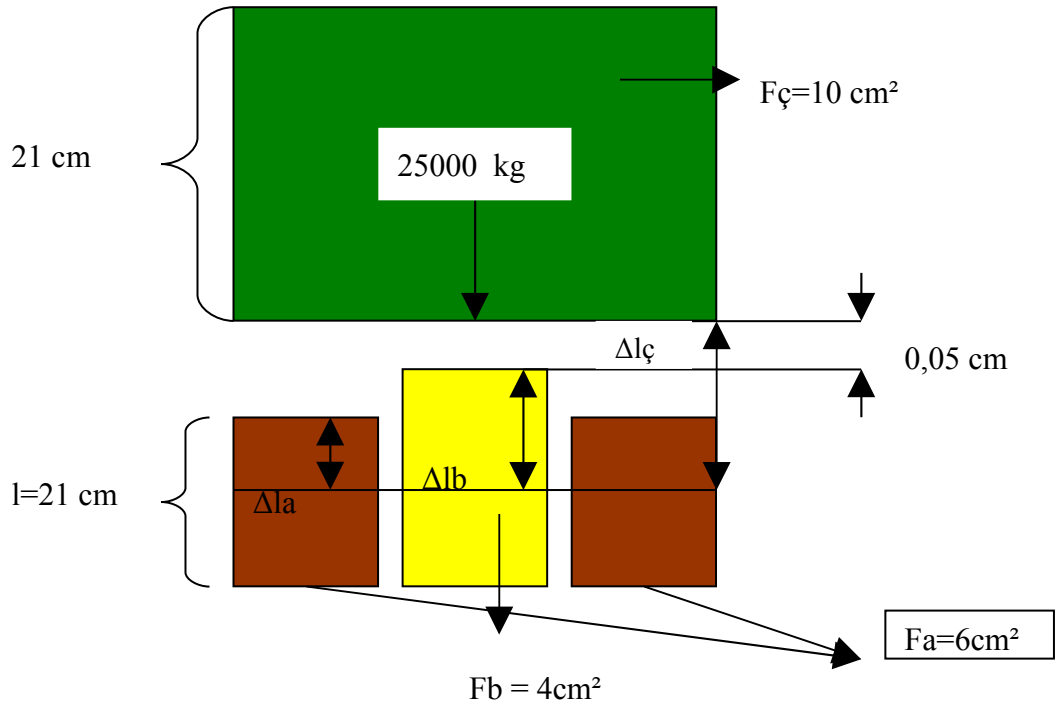
$+\uparrow \Sigma Fy=0$
$(-3/2)-[(8x-3)^2/4]+(21/2)-Q=0$
$Q=9-[(x-3)^2/4]$

$\circlearrowleft \Sigma M=0$
$(-3x/2)-M-[(x-3)^2*(x-3)/12]+[21*(x-3)/2]=0$
$M=(18x/2)-[(x-3)^3/12]-63 \Rightarrow Q=dM/dx$ gerçeklenmektedir.

X=9;C noktasında:

Biraz önce:
$Q=0$
$M=9x-[(x-3)^3/12]-63$
$M=0$ (Biraz önce)

Biraz sonra:
$Q=0$
$M=3$ (Biraz Sonra)



Denge denklemi (1) Pç - 25000 - Pa – Pb = 0

Uygunluk denklemi (2) Δlç + Δlb = 0,005 cm

Uygunluk Denklemi (3) Δlç + Δla = 0,01 cm

(2) Pç . 21 / 21 .10^6 + Pb . 21 / 1,05 . 10^6 .4 = 0,005 → Pç + 5 Pb = 5000 kg

Pb = 1000 – 0,2 Pa

(3) Pç . 21 / 21 . 10^6 + Pa . 21 / 0,7 . 10^6 . 6 = 0,01 → Pç + 5 Pa = 10000 kg

Pa = 2000 - 0,2 Pa

Pç – 25000 – (2000 – 0,2.Pç) – (1000 – 0,2 Pç) = 0

Pç = 20000 kg Pb = - 3000 kg Pa = - 20000 kg

Δlç = 20000 . 21 / 21 . 10^6 = 0,02 cm

Δlb = -30000 . 21 / 1,05 . 10^6 . 4 = -0,015 cm

Δlç = -20000 . 21 / 0,7 . 10^6 . 6 = - 0,01 cm

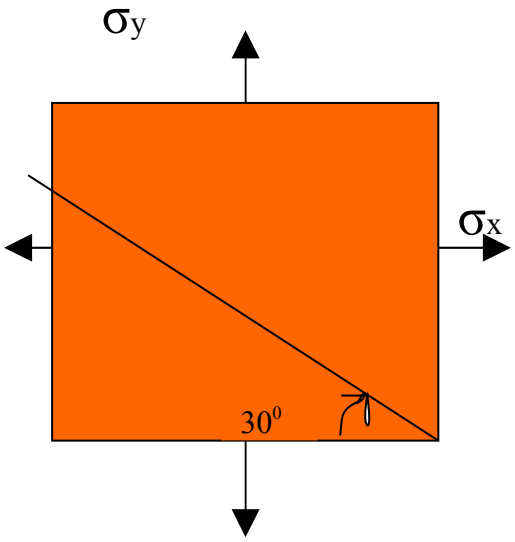
σç = 20000 / 10 = 2000 kg/cm²

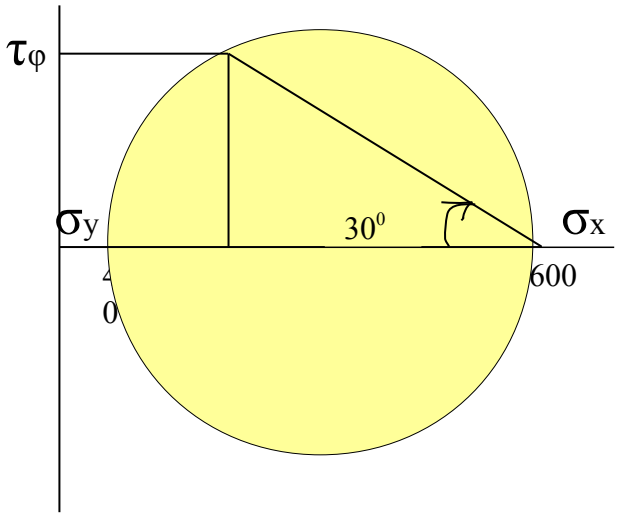
σb = -3000 / 4 = -7500 kg/cm²

σç = 2000 / 6 = -333 kg/cm²

A = Aç + Ab + Aa = ½ (20000 . 0,02 + 3000 . 0,015 + 2000 . 0,01)

A= 465/2 = 232,5 kg cm



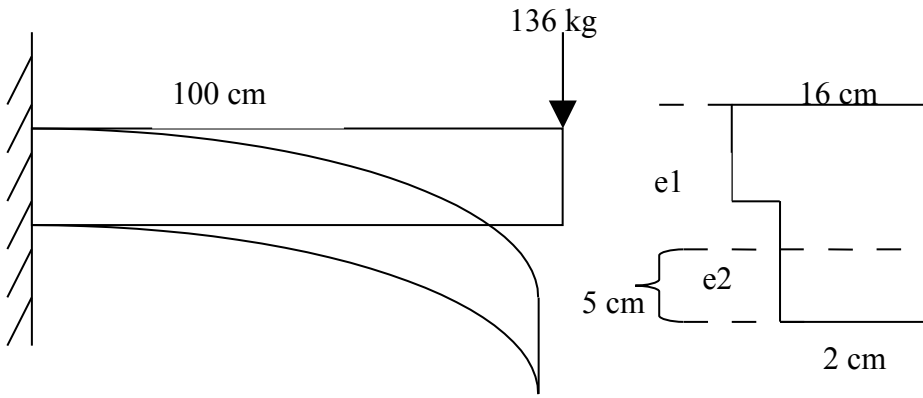


$\sigma x = 1600$ kg / cm ² $\sigma x = 16$ cm $\sigma\varphi \approx 7$ cm = 700 kg / cm²

$\sigma y = 400$ kg / cm ² $\sigma y = 4$ cm $\tau\varphi \approx 5$ cm = 500 kg / cm²

$\sigma\varphi = (1600 + 400 / 2) - (1600 - 400 \cdot \cos 60 / 2) = 700$ kg /cm ²

$\tau\varphi = 1600 - 400 \cdot \sin 60 / 2 = 300\sqrt{3} \approx 520$ kg /cm²



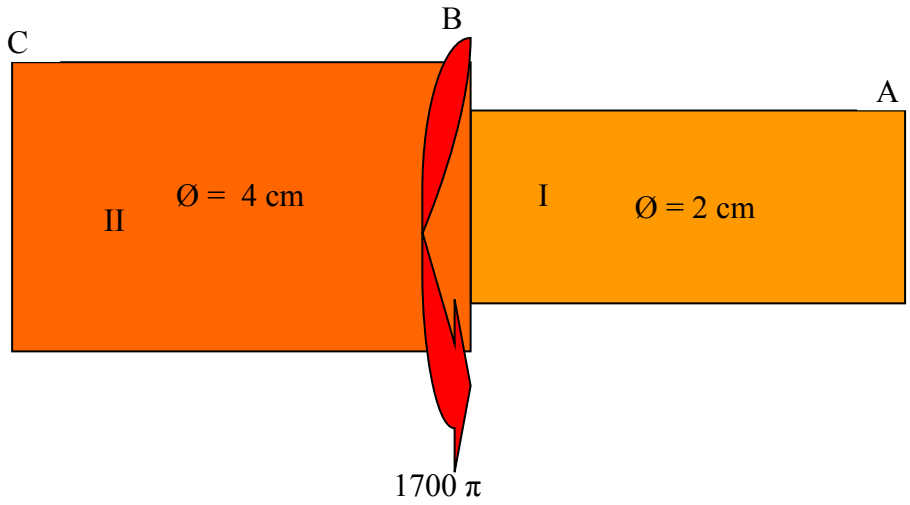
$\sigma_{em} = 600$ kg / cm²

$\sigma_1 = M / W_1 \leq \sigma_{emçeki}$ $\sigma_2 = M / W_2 \leq \sigma_{embası}$

$W_1 = I / e_1$ $W_2 = I / e_2$ $W_1 = 136/3$ $W_2 = 136/-5$

$\sigma_1 = 136 . 100 / (136/3) = 300$ $\sigma_2 = 136 . 100 / 136 / -5 = |-500| = 500 \leq 600$

Sistem emniyetlidir.



Gç = 800000 kg / cm²

$Md_1 + Md_2 + 1700\,\pi = 0$

$\varphi_{ab} - \varphi_{bc} = 0$

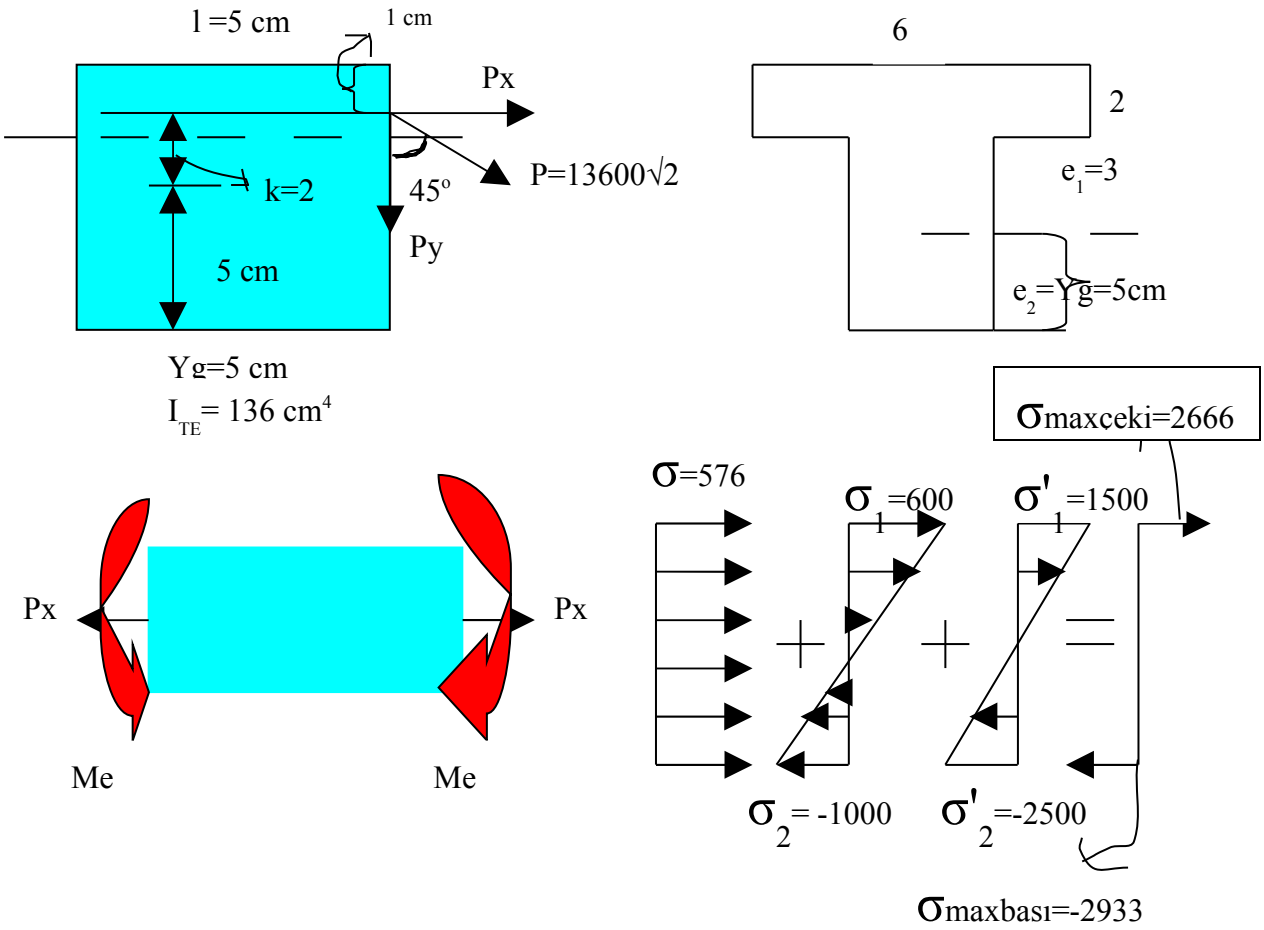
$Md_1 + Md_2 = 1700\,\pi$

$$\frac{Md_1 \cdot l_1}{G \cdot \frac{\pi d_1^4}{32}} = \frac{Md_2 \cdot l_2}{G \cdot \frac{\pi d_2^4}{32}}$$

$Md_1 / d_1^4 = Md_2 / d_2^4$

$Md_1 / 2^4 = Md_2 / 4^4$

$16Md_1 = Md_2$
$Md_1 = 100\,\pi$
$Md_2 = 1600\pi$



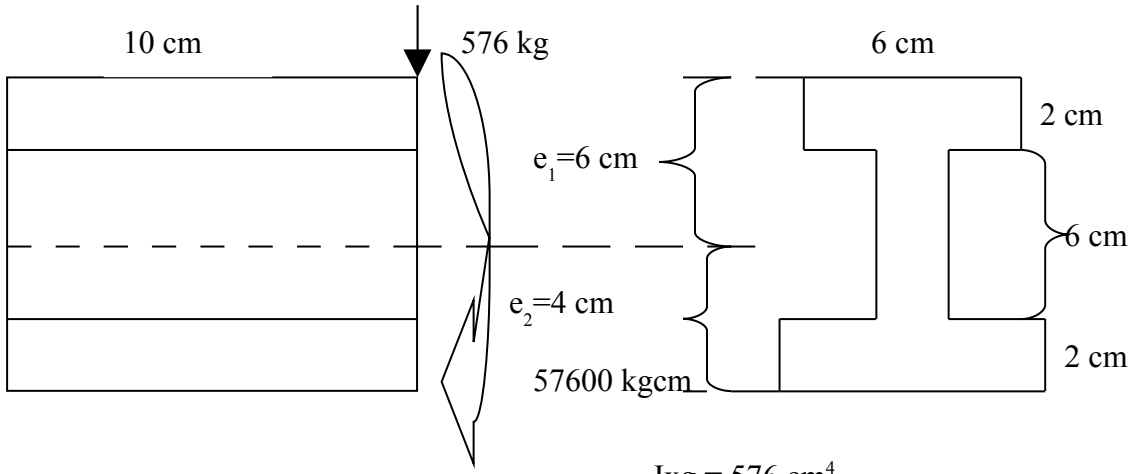
$\sigma = P / F = 13600 / 24 = 576 \text{ kg / cm}^2$

$\sigma_1 = 13600 \cdot 2 / (136 / 3) = 600 \text{ kg / cm}^2$

$\sigma_2 = 13600 \cdot 2 / (136 / -5) = - 1000 \text{ kg / cm}^2$

$\sigma'_1 = 13600 \cdot 5 / (136 / 3) = 1500 \text{ kg / cm}^2$

$\sigma'_2 = 13600 \cdot 5 / (136 / -5) = - 2500 \text{ kg / cm}^2$



$I_{xg} = 576\ cm^4$

$Y_g = 4\ cm$

$M' = P \cdot l = 576 \cdot 10 = 5760\ kgcm$

$\sigma_1' = (M' / I) \cdot e_1 = (5760 / 576) \cdot 6 = 60\ kg / cm^2$

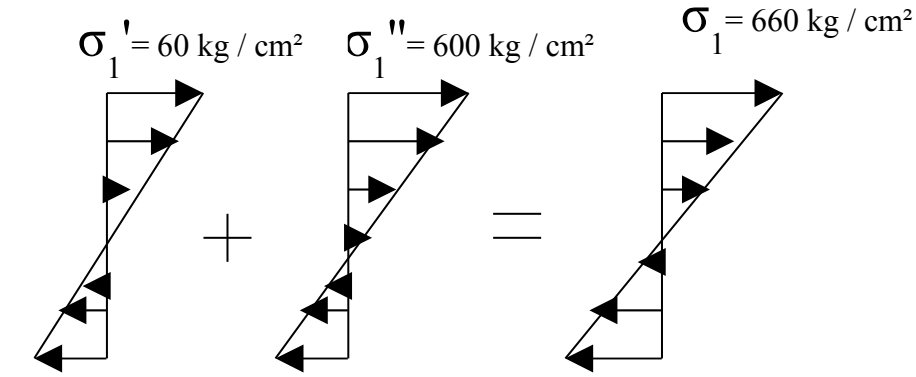
$\sigma_2' = (M' / I) \cdot e_2 = (5760 / 576) \cdot -4 = -40\ kg / cm^2$

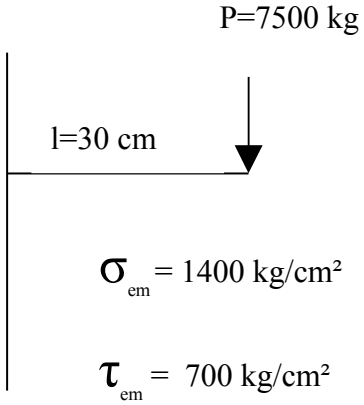
$\sigma_1'' = (M'' / I) \cdot e_1 = (57600 / 576) \cdot 6 = 600\ kg / cm^2$

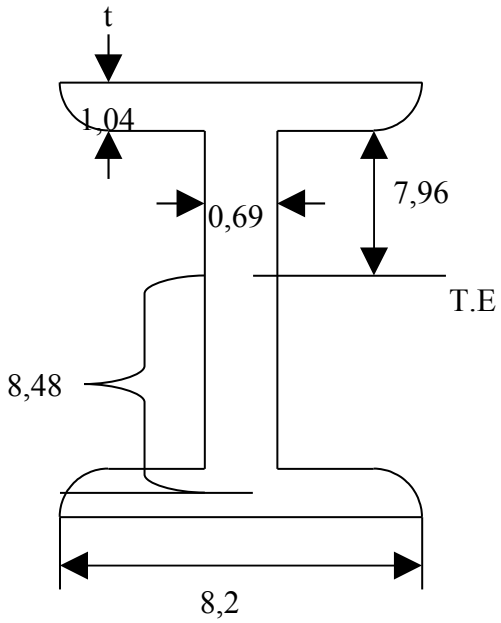
$\sigma_2'' = (M'' / I) \cdot e_2 = (57600 / 576) \cdot -4 = -400\ kg / cm^2$

$\sigma_1 = \sigma_1' + \sigma_1'' = 60 + 600 = 660\ kg / cm^2$

$\sigma_2 = \sigma_2' + \sigma_2'' = -40 - 400 = -440\ kg / cm^2$







$\sigma_{1,2} = M / W_{1,2} \leq \sigma_{em}$

$W = \pm I / e$ $M = P \cdot l = 30 \cdot 7500 = 225000$

$22500 / \sigma_{em} = 160\ cm^3$

I_{18} profili olduğu anlaşıldı

$St = 93,4\ cm^3$
$I = 1450\ cm^4$

$\sigma_{1,2} = 1400$

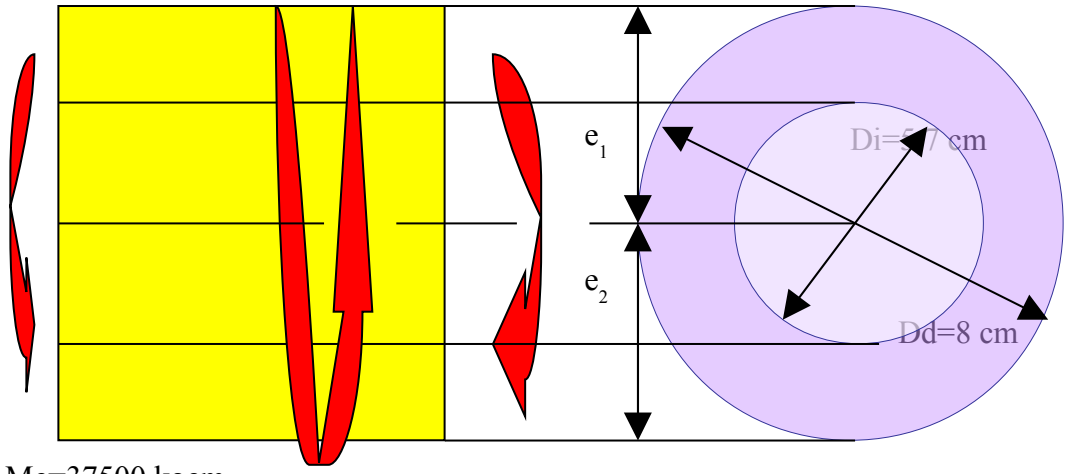
$\tau_{max} = 7500 \cdot 93,4 / 1450 \cdot 0,69 = 700$

$\tau_b = 7500\ (\ 1,04 \cdot 8,2\ ) \cdot 8,48 / 1450 \cdot 0,69 = 542$

$\sigma_b = 7500 \cdot 30 \cdot 796 / 1450 = 1235$

$\tau_{maxmax} = \sqrt{[(1235 / 2)^2 + 542^2]} \approx 822 > \tau_{em} = 700\ kg/cm^2$

$\sigma_{maxmax} = 1235 / 2 + 822 = 1440 > \sigma_{em} = 1400\ kg/cm^2$



Me=37500 kgcm

$\sigma_{em} = 1400\ kg/cm^2$

$\tau_{em} = 700\ kg/cm^2$

Eğilmeden Dolayı:

$\sigma = Me / We$ $\qquad Ix = (\pi \cdot Dd^4 / 64) - (\pi \cdot Di^4 / 64) = 150\ cm^4$

$W = Ix / Dd/2$ $\qquad W = 150 / 7/2 = 37,5\ cm^3$

$\sigma = 37500 / 37,5 = 1000\ kg / cm^2$

Burulmadan Dolayı:

$\tau_{max} = Md / Wp$ $Wp = Ip / Dd/2$

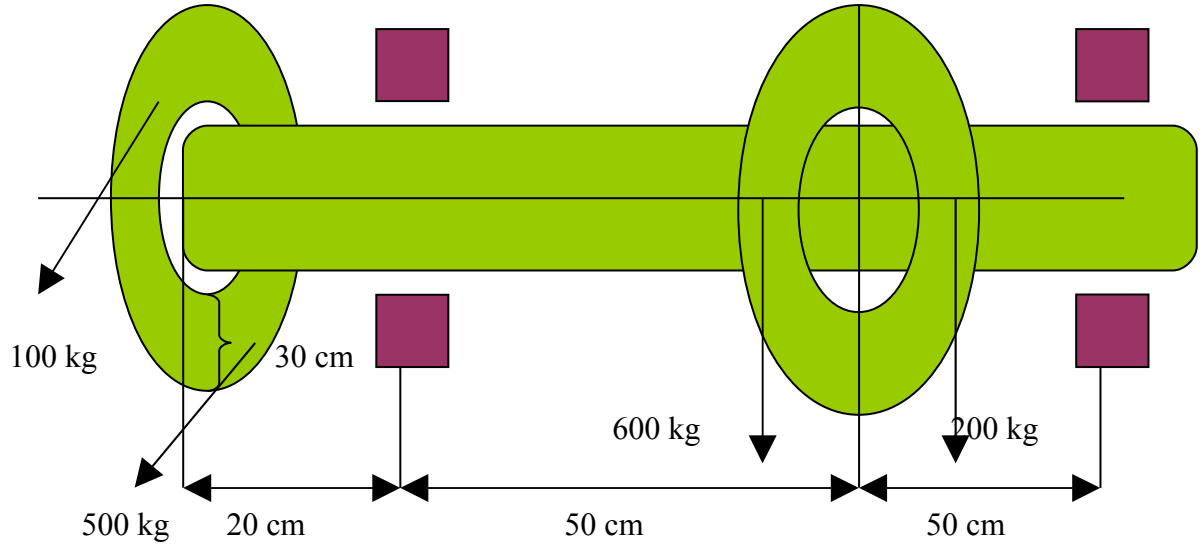
$Ip = \pi . Dd^4/ 32 – \pi . Di^4 / 32 = 300\ cm^4$
$Wp = 300 / 8/2 = 75\ cm^3$

$\tau_{max} = 22500 / 75 = 300\ kg / cm^2$

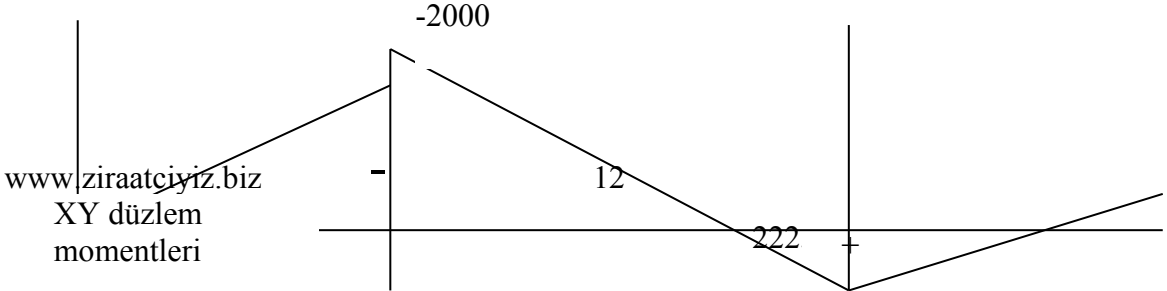
$\tau_{max\ max} = \sqrt{[(\sigma/2)^2 + \tau_{max}]} = 583\ kg / cm^2$

$\sigma_{max} = \sigma/2 + \tau_{maxmax} = 1000/2 + 583 = 1083\ kg / cm^2$

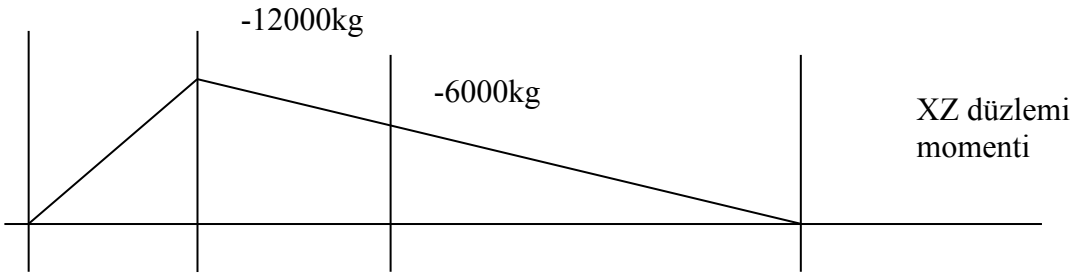
Sistem Emniyetli olarak çalışır







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XY düzlem momentleri



$Me_c = \sqrt{Mc_y^2 + Mc_x^2} = \sqrt{2250^2 + 6000^2} = 23000$ kg cm

$Me_b = \sqrt{3000^2 + 12000^2} = 12400$ kg cm

$\tau_{max\ max} = 16 / \pi d^3 \sqrt{Me^2 + Md^2} \leq \tau_{em}$

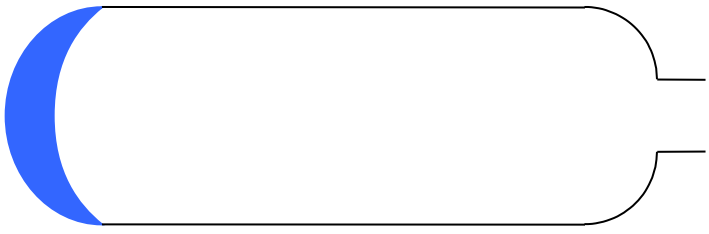
$= 16 / \pi d^3 \sqrt{2300^2 + 12000^2} \leq 400$

$d = 6,9$ cm

$\sigma_{max} = 16 / \pi d3 (Meğ \sqrt{Meğ^2 + Md^2} \leq \sigma_{em}$

$= 16 / \pi d3 (23000 \sqrt{23000^2 + 12000^2} \leq 1200$

d=5,9 cm Mil çapı 7 cm seçilir.



d=0,8 cm
s=6 mm
P=5 atü

$\sigma = P.d / 2s = 5 . 80 / 2 (0,6) = 333,3$ kg/cm²