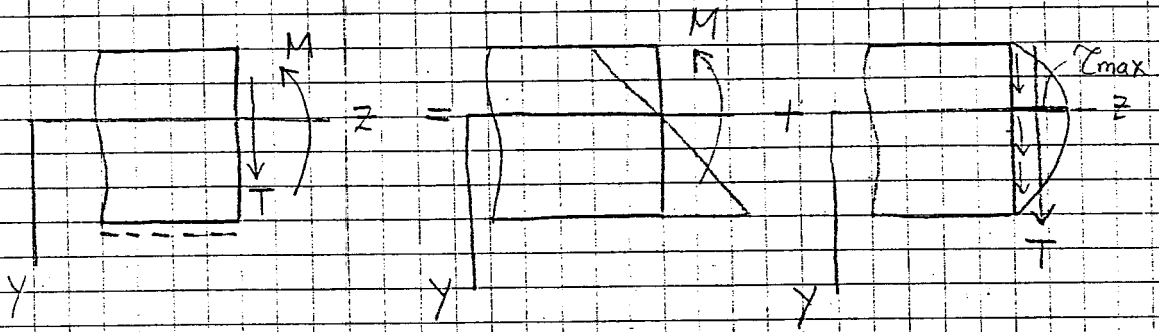
KESMELİ EĞİLMEDE KAYMA VE NORMAL GERİLMELERİN KARŞILAŞTIRILMASI



$$\sigma = \frac{M}{I_x} y$$

$$\sigma_{max} = \frac{M}{W_x}$$

max |σ|

$$\tau_{max} = k \frac{T}{F}$$

max |τ|

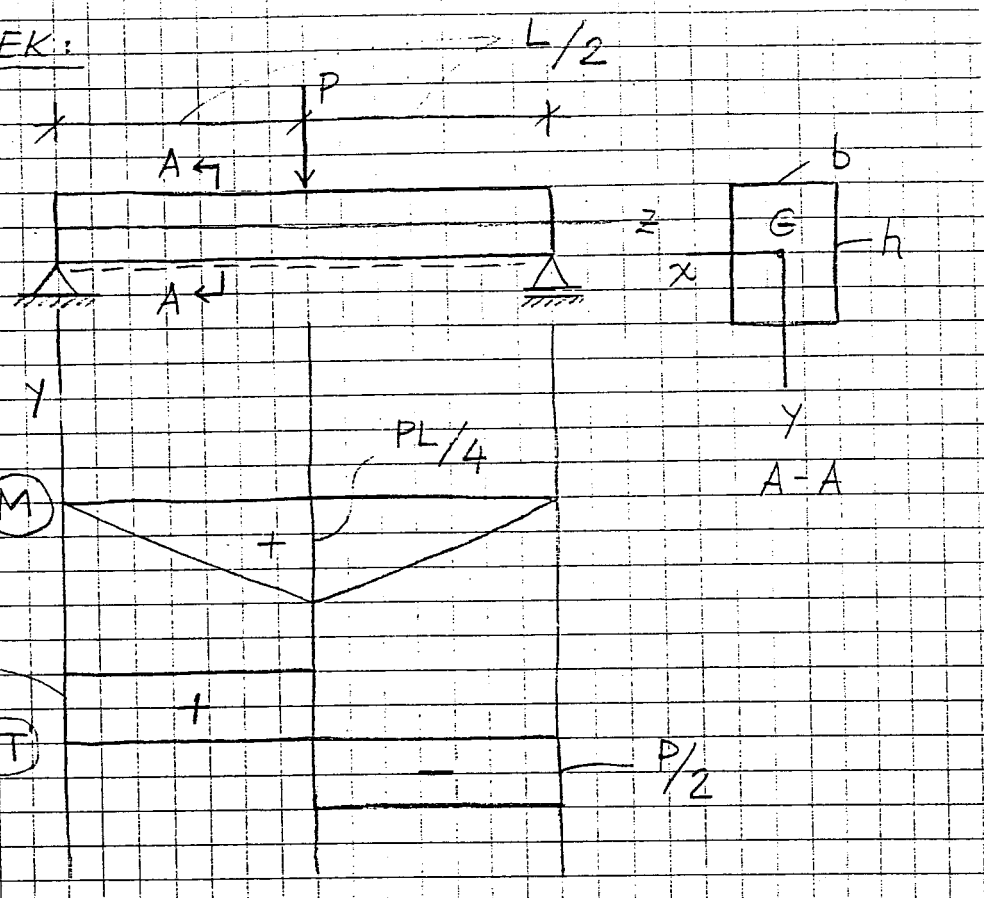
$$\frac{\tau_{max}}{\sigma_{max}} = ?$$

mesnet ve yükleme durumuna bağlı

(*)

(*) oranının mertebesi hakkında bilgi edinmek için aşağıdaki örneği göz önüne alalım:

ÖRNEK:



$$\sigma_{max} = \frac{M}{W_x} \qquad \max|M| = PL/4$$

$$\max|\sigma| \qquad \frac{bh^2}{6}$$

$$\Rightarrow \sigma_{max} = \frac{PL/4}{bh^2/6} = \frac{3}{2}\frac{PL}{bh^2}$$

σ_{max}

$$\tau_{max} = \underbrace{k}_{\frac{3}{2}} \frac{\overbrace{T}^{\max|T|}}{\underbrace{F}_{\frac{P}{2}}} \underbrace{\frac{}{bh}}$$

$$= \frac{3}{2} \frac{P/2}{bh}$$

$$\Rightarrow \boxed{\tau_{max} = \frac{3}{4} \frac{P}{bh}}$$

$$\Rightarrow \frac{\tau_{max}}{\sigma_{max}} = \frac{3}{4} \frac{P}{bh} \left(\frac{2}{3} \frac{bh^2}{PL} \right)$$

$$\Rightarrow \boxed{\frac{\tau_{max}}{\sigma_{max}} = \frac{1}{2} \left(\frac{h}{L} \right)}$$

$\frac{h}{L} = \frac{1}{10}$ olsa:

$$\Rightarrow \frac{\tau_{max}}{\sigma_{max}} = \frac{1}{20}$$

Normal hallerde:

$$\boxed{\tau_{max} << \sigma_{max}}$$ (X)

KESMELİ EĞİLME HALİNDE BOYUTLANDIRMA

(*) gözlemiin ışığı altında kesmeli eğilme halinde boyutlandırma aşağıdaki basamaklar izlenerek yapılır:

Basamak 1:

Boyutlandırma eğilmeye göre yapılır.

$\sigma_{em} = \sigma'_{em}$ ise:

$$\sigma_{max} = \frac{M}{W_x} \leq \sigma_{em}$$

$\sigma_{em} \neq \sigma'_{em}$ ise:

$$\sigma = \frac{M}{I_x} y \Rightarrow \begin{matrix} \max \sigma_ç \\ \max \sigma_b \end{matrix}$$

$\left(\begin{matrix} ç \rightarrow \text{çekme} \\ b \rightarrow \text{basınç} \end{matrix} \right)$.

$$\max \sigma_ç \leq \sigma_{em}$$

$$|\max \sigma_b| \leq \sigma'_{em}$$

→

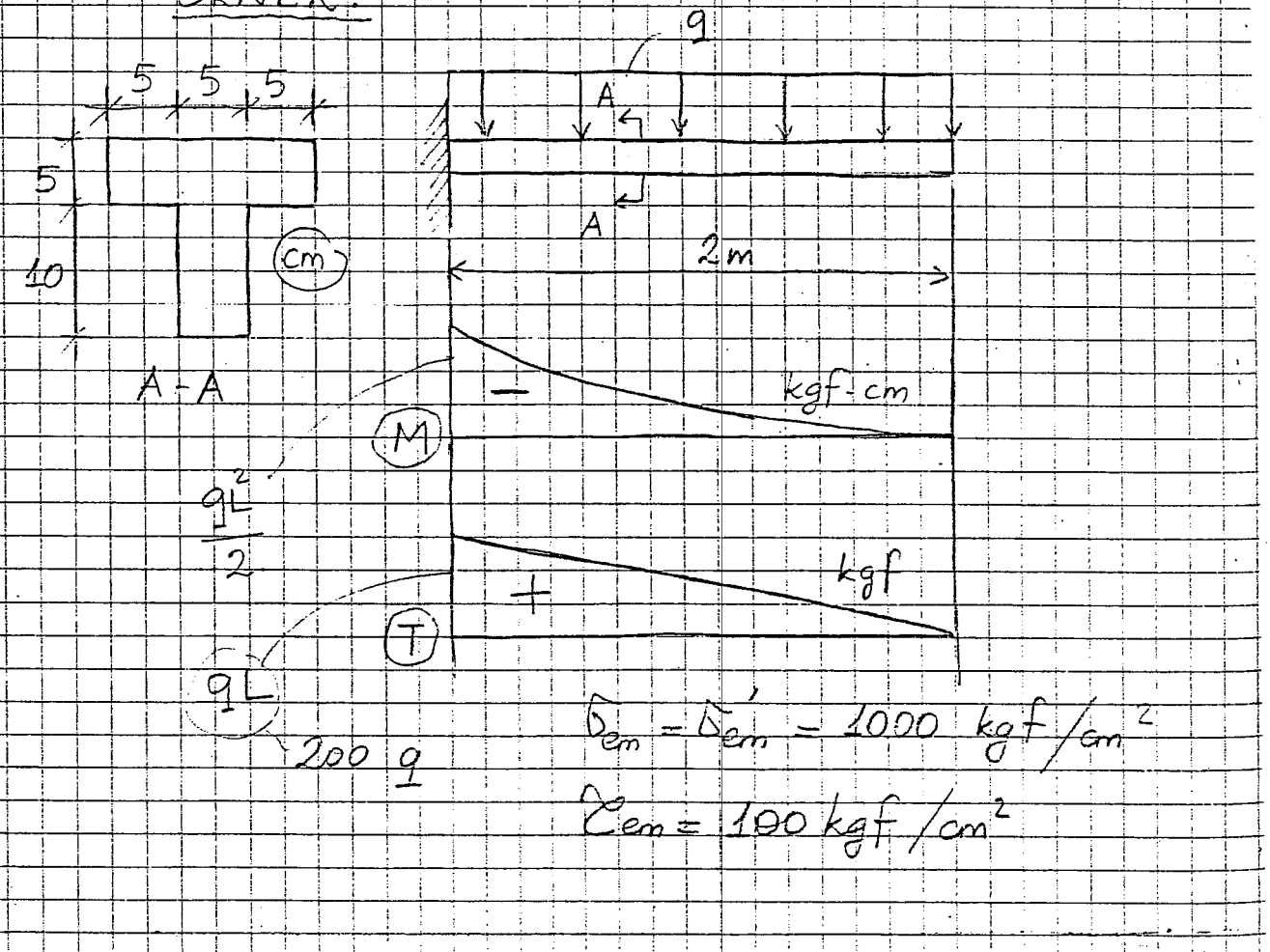
Basamak 2:

Boyutlandırmadan sonra kayma gerilmesi için kontrol yapılır.

$$\tau_{max} = k\frac{T}{F} \leq \tau_{em}$$

τ_{em} : kayma emniyet gerilmesi

ÖRNEK:



$\sigma_{em} = \sigma'_{em} = 1000\ kgf/cm^2$

$\tau_{em} = 100\ kgf/cm^2$

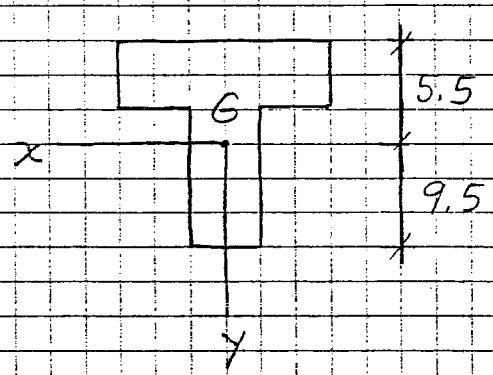
Kirişin emniyetle taşıyabileceği maximum q yükü soruluyor.

$$\left.\begin{matrix} F \to kgf \\ L \to cm \end{matrix}\right\} \Rightarrow q \to kgf/cm$$

$$qL = 200\,q \text{ kgf} \quad (200\ cm)$$

$$\frac{qL^2}{2} = \frac{q}{2}(200)^2 = 20000\,q \text{ kgf-cm}$$

Önce max "q" yu eğilmeye göre bulalım:



$$I_x \cong 2260\ cm^4$$

$$W_x = \frac{I_x}{h_{max}} = \frac{2260}{9.5} \cong 238\ cm^3$$

$$\sigma_{max} = \frac{M}{W_x} \leq \sigma_{em}$$

$M \to \max|M| \to 20000\,q$

$W_x \to 238$

$\sigma_{em} \to 1000$

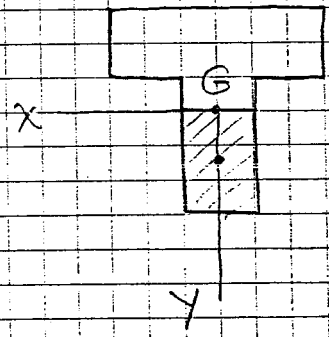
$$\Rightarrow \frac{20000q}{238} \leq 1000$$

$$\Rightarrow q \leq 11.9 \text{ kg/cm}$$

$$\Rightarrow \boxed{q_{max} = 11.9 \text{ kgf/cm}}$$

$q = q_{max}$ için kayma gerilmesi kontrolü:

$$\tau_{max} = \tau\Big|_G = \frac{T\, S_x' \quad \max|T|}{b\, I_x} \qquad b = 5, \quad I_x = 2260$$



$$S_x' = (5)(9.5) * \frac{9.5}{2}$$

$$= 226 \text{ cm}^3$$

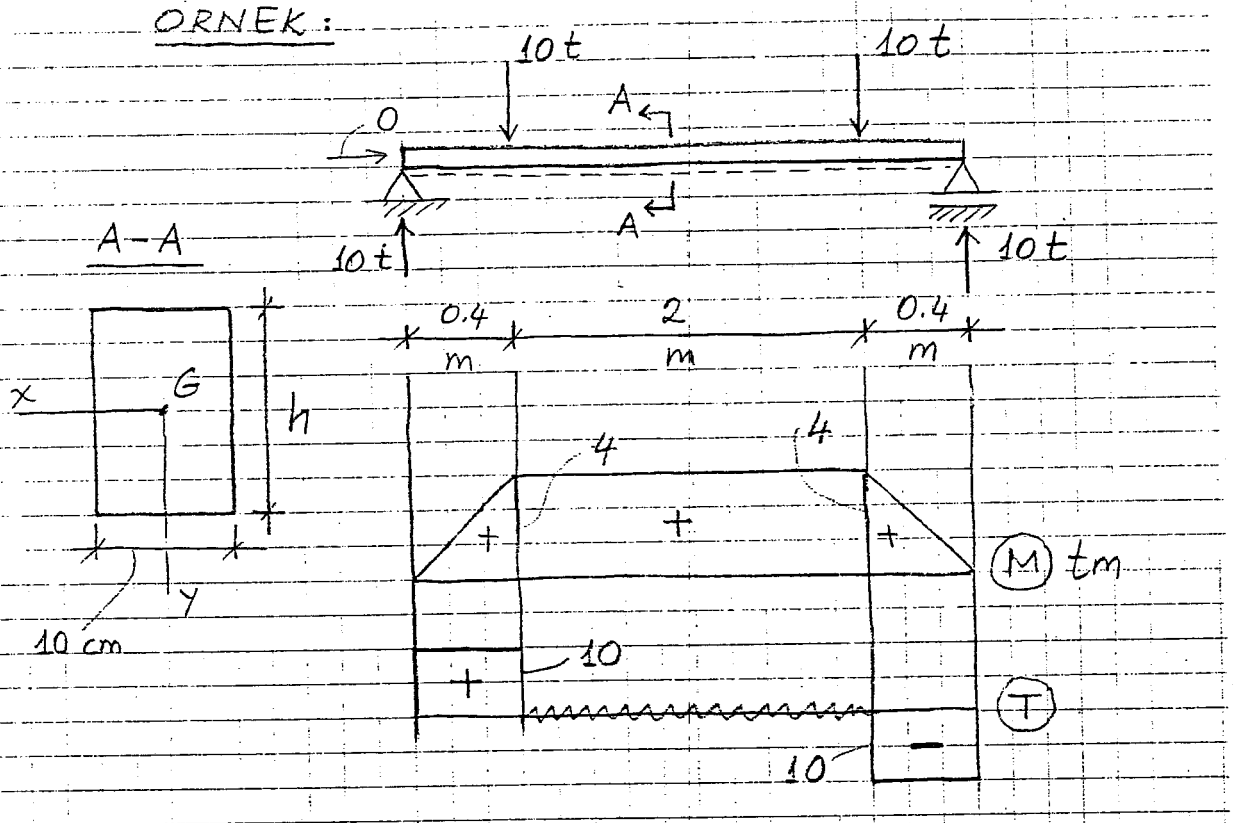
$$T = \max|T| = q_{max} * L$$

$$= (11.9) * (200)$$

$$= 2380 \text{ kgf}$$

$$\Rightarrow \tau_{max} = 47.6 \text{ kgf/cm}^2 < 100 \quad \text{TAMAM} \checkmark$$

ÖRNEK:



$\sigma_{em} = \sigma'_{em} = 1000\ kgf/cm^2$

$\tau_{em} = 200\ kgf/cm^2$

Soru: $h = ?$

$L \rightarrow cm$

$F \rightarrow kgf$

Eğilmeye göre boyutlandırma:

$$\frac{M}{W_x} \leq \sigma_{em} \quad (*)$$

$\max|M| = 4\ tm = 4 \times 10^5\ kgf\text{-}cm$

$\sigma_{em} = 1000$

$$W_x = \frac{bh^2}{6} = \frac{(10)h^2}{6}$$

$$(*) \Rightarrow \frac{4 * 10^{-5} 2}{W_x} \leq 1000$$

$$\Rightarrow W_x = \frac{10h^2}{6} = 400\ cm^3$$

$$\Rightarrow h \geq \sqrt{\frac{400 * 6}{10}}$$

$$\Rightarrow h \geq 15.49\ cm$$

SEÇ $\rightarrow$ $h = 20$ cm

Kayma gerilmesi için kontrol:

$$\tau_{max} = k \frac{T}{F}$$

$T = \max |T| = 10\ t = 10000\ kgf$

$k = 3/2$

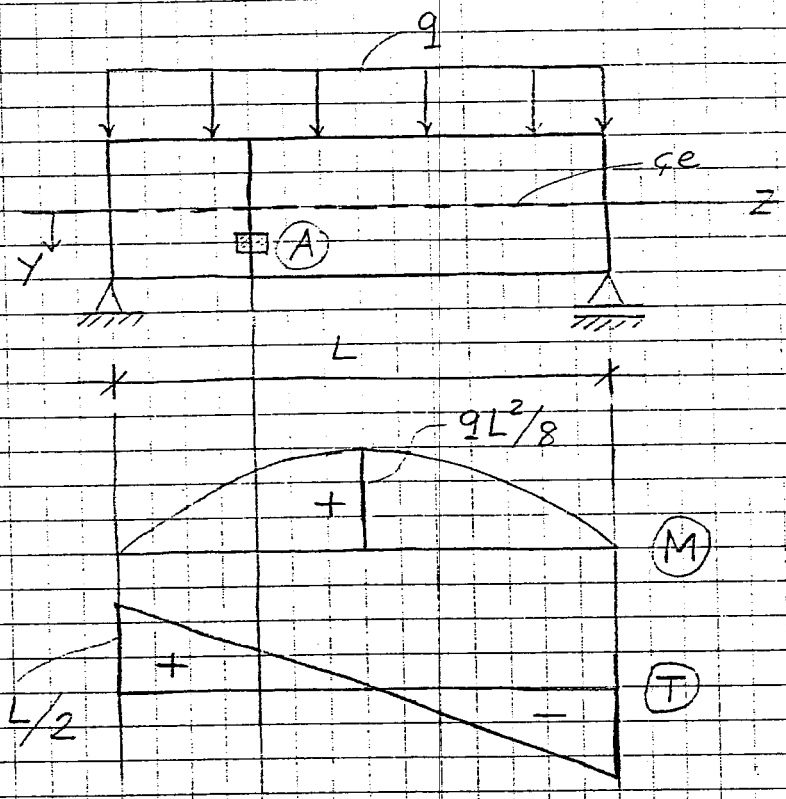
$F = 200$

$$\Rightarrow \tau_{max} = 75 < 200\ kgf/cm^2$$

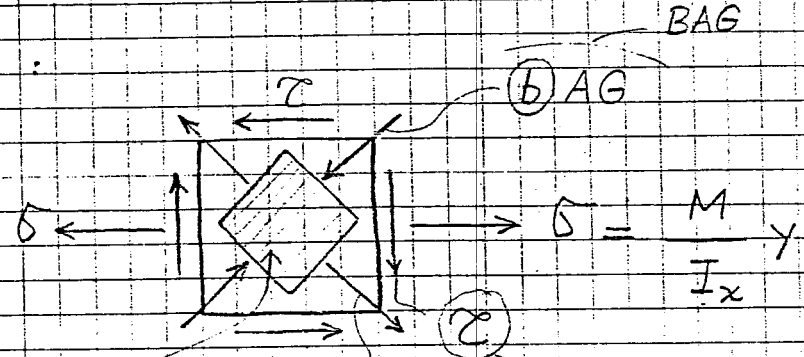
TAMAM ✓

AG

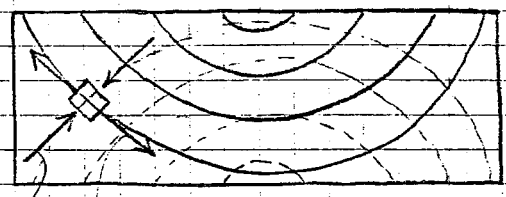
ASAL GERİLME YÖRÜNGELERİ

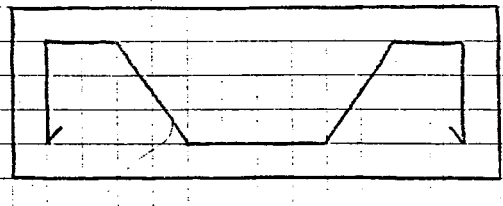


A :



Asal gerilmelerin teğet olduğu eğrilere asal gerilme yörüngeleri denir.





PİLYE

→ Ⓒ gerilmelerini almak için konuyor.

Betonarme bir kirişte çekme gerilmeleri Pilye'ler yardımıyla alınır.