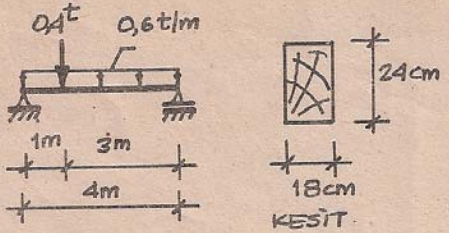
MUKAVEMET UYGULAMA -7-
KESMELİ EĞİLME ETKİSİ

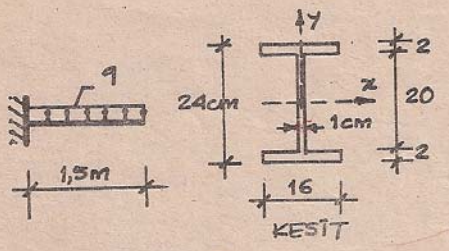
1-)



Şekilde kesit ölçüleri ve yükleme durumu verilen sistemde,
a-) M, T diyagramlarını çiziniz.
b-) Normal ve kayma gerilmesi kontrolu yapınız.

$\sigma_{em} = 110\ kg/cm^2$, $\tau_{em} = 10\ kg/cm^2$

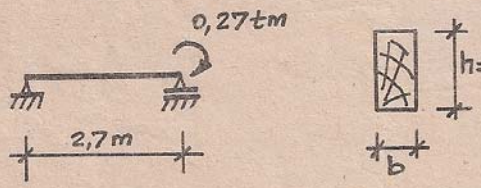
2-)



Şekilde kesit ölçüleri ve yükleme durumu verilen sistemde,
a-) Kesitin güvenle taşıyabileceği en büyük Mx momentini ve Ty kesme kuvvetini,
b-) Sistemin güvenle taşıyabileceği en büyük q yükünü hesaplayınız.

$\sigma_{em} = 1{,}40\ t/cm^2$
$\tau_{em} = 0{,}90\ t/cm^2$.

3-)

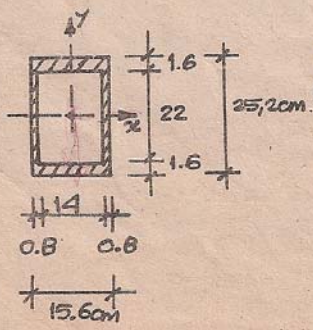


Şekilde kesit ölçüleri ve yükleme durumu verilen sistemde gereklı olan b değerini hesaplayınız.

$\sigma_{em} = 80\ kg/cm^2$, $\tau_{em} = 8\ kg/cm^2$.

4-)

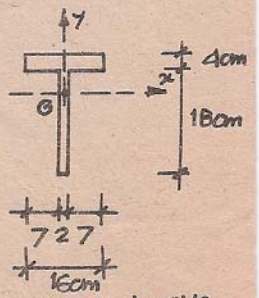
a-)



Şekilde verilen kesitte $(T_y)_{max}$ ve $(T_x)_{max}$ değerlerini hesaplayınız.

$\tau_{em} = 900\ kg/cm^2$

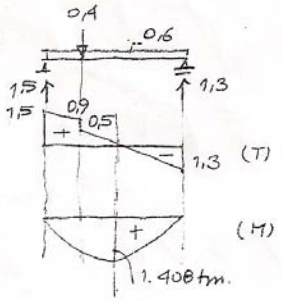
b-)



Şekilde verilen kesitte $(T_y)_{max}$ değerini hesaplayınız. $\tau_{em} = 12\ kg/cm^2$

KESMELİ EĞİLME

1-)



b-) $\square$ 24 / 18 $\quad W_x = 172B\ cm^3$.

$\sigma_{MAX} = \frac{1,408 \times 10^5}{172B} = 81,48 < 110$ ✓

$\tau_{max} = 1,50 \cdot \frac{1500}{18 \cdot 24} = 5,21 < 10$ ✓

2-) $I_x = 8432\ cm^4$, $W_x = 702,67\ cm^3$.

$(M_x)_{max} = 1,40 \cdot 702,67 \cdot 10^{-2} = 9,84\ tm$

$\tau_{max} = \frac{T_{max} \cdot S_x}{I_x \cdot t_g} \leq \tau_{em}$ $\quad S_x = 16 \cdot 2 \cdot 11 + 1 \cdot 10 \cdot 5 = 402\ cm^3$

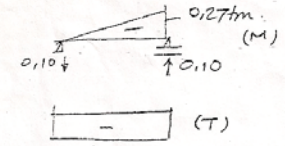
$\frac{(T_y)_{max} \cdot 402}{8432 \cdot 1} = 0,900 \rightarrow (T_y)_{max} = 18,88\ ton$.

$M_{max} = q \cdot \frac{1,5^2}{2} = 9,84 \rightarrow q = 8,75\ t/m$.

$T_{max} = q \cdot 1,5 = 18,88 \rightarrow q = 12,59\ t/m$.

$\Big\} (q)_{max} = 8,75\ t/m$.

3-)



$\tau_{max} = \frac{0,27 \cdot 10^5}{b \cdot \frac{(2b)^2}{6}} \leq 80 \rightarrow b = 7,97\ cm$. $\rightarrow b \cong 8\ cm$ seçildi.

$\square$ 16 / 8 $\quad h = 2b = 16\ cm$

$\tau_{max} = 1,5 \cdot \frac{100}{8 \cdot 16} = 1,17 < 8$ ✓

4-) a-) $S_x = 13,6 \cdot 12,6 \cdot 6,30 - 14 \cdot 11 \cdot 5,5$

$S_x = 391,33\ cm^3$; $I_x = 8381,24\ cm^4$.

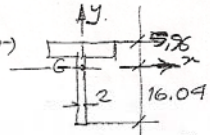
$I_y = 2941,81\ cm^4$

$S_y = 25,2 \cdot 7,8 \cdot 3,9 - 22 \cdot 7 \cdot 3,5 = 227,58\ cm^3$

$T_y = \frac{I_x \cdot t_g}{S_x} \cdot \tau_{em} = \frac{8381,24 \cdot 1,6}{391,33} \cdot 0,9 = 30,84\ t$ //

$T_x = \frac{I_y \cdot t_g}{S_y} \cdot \tau_{em} = \frac{2941,81 \cdot 3,2}{227,58} \cdot 0,9 = 37,23\ ton$ //

b-)



$I_x = 3845,17\ cm^4$ //

$S_{alt} = 2 \cdot 16,04 \cdot 8,02 = 257,28\ cm^3$ //

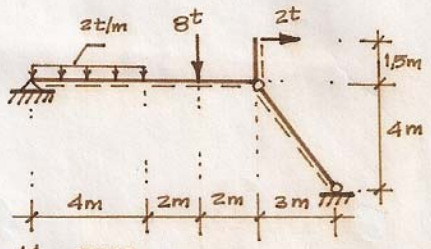
$\tau_{max} = \frac{3845,17 \cdot 2 \cdot 12}{257,28} \cdot 10^{-3}$

$(T_y)_{max} = 0,36\ ton$ //

MUKAVEMET ARA SINAVI-YAZ OKULU

25

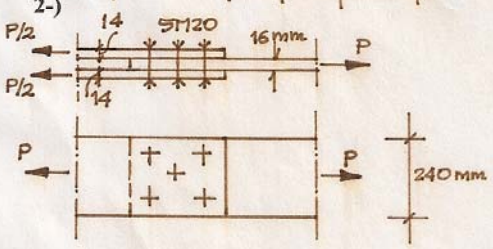
1-)



Şekilde ölçüleri ve yükleme durumu verilen sistemde M,N,T diyagramlarını çiziniz.

20

2-)



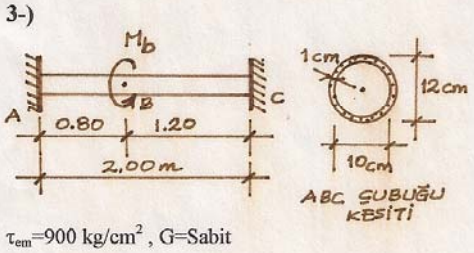
Şekilde verilen kaba bulonlu birleşimin güvenle taşıyabileceği en büyük P yükünü hesaplayınız.

Bulonda: $\tau_{a,em}=1.12$ t/cm^2
$\sigma_{l,em}=2.40$ t/cm^2

Levhada: $\sigma_{em}=1.40$ t/cm^2

25

3-)

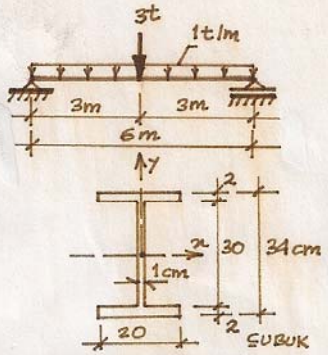


Şekilde verilen sistemde,
a-) Kesitin güvenle taşıyabileceği en büyük M_b burulma momentini hesaplayınız.
b-) Buna göre sistemin taşıyabileceği en büyük M_b burulma momentini hesaplayınız.

$\tau_{em}=900$ kg/cm^2, G=Sabit

30

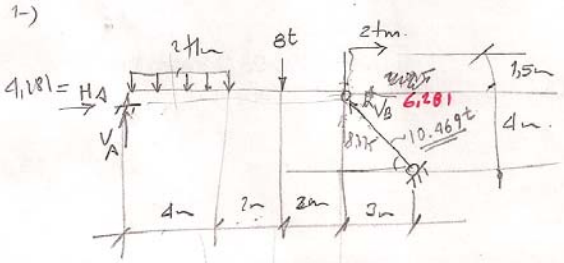
4-)



Şekilde ölçüleri ve yükleri verilen sistemde,
a-) Kesitin taşıyabileceği en büyük M_x, M_y ve T_y değerlerini hesaplayınız.
b-) Kesitte M_x= 10 tm ile birlikte taşınabilecek en büyük M_y eğilme momentini hesaplayınız.
c-) Verilen sistemde gerekli tüm kontrolları yapınız.

$\sigma_{em}=1400$ kg/cm^2, $\tau_{em}=900$ kg/cm^2, $E=2.1\times10^6$ kg/cm^2, $f_{em}=L/300$

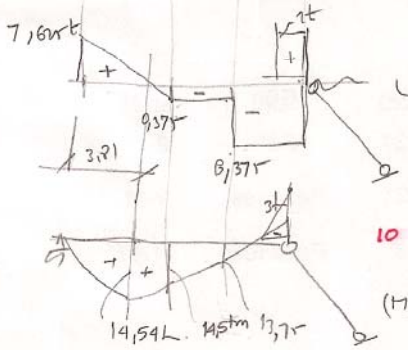
1-)



$\sin\alpha = 0{,}8$
$\cos\alpha = 0{,}6$

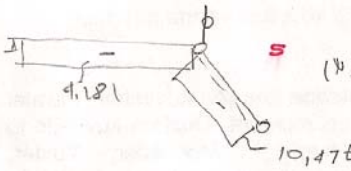
$V_B \cdot \sin\alpha \cdot 8 - 3 - 8 \cdot 6 - 8 \cdot 2 = 0$

$V_A = 7{,}625t$, $H_A = 4{,}281t$
$V_B = 10{,}469t$ //



(T) 10

(M) 10

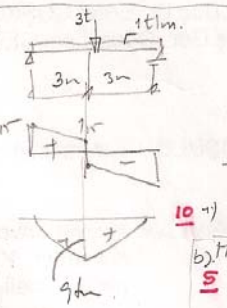


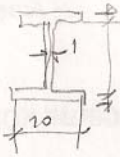
(N) 5

$M_2 - 14{,}1T = -0{,}37T \cdot 2$

$M_1 - 13{,}1T = -8{,}07T \cdot 2$

4-)





$I_x = 22756{,}67$
$W_x = 1338{,}63$
$I_y = 2669{,}17$
$W_y = 266{,}92$

10 a) $M_{x\,max} = 1338{,}67 \cdot 1{,}40 = 18{,}74tm$

5 b) $M_x = 10tm \rightarrow \frac{1000}{1338{,}63} + \frac{M_y \cdot 10^2}{266{,}92} = 1{,}40$

$M_y = 1{,}74tm$

$(M_{y\,max} = 266{,}92 \cdot 1{,}40 = 3{,}74tm$, $T_{max} = 27{,}22t$ //

2)

5 $P_{tens} = 2 \cdot \pi \cdot \frac{2^2}{4} \cdot 1{,}12 = 7{,}04t$) 7,04

5 $P_{tal} = 2 \cdot 1{,}6 \cdot 2{,}40 = 7{,}68$

$P_{max} = 7{,}04 \cdot 5 = 35{,}2t$

$F_{net} = (24 \cdot 1{,}6 - 2 \cdot 2{,}1 \cdot 1{,}6) = 31{,}68cm^2$

$P_{max} = 1{,}40 \cdot 31{,}68 = 44{,}35t$ // 5

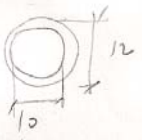
c-) $\sigma_{max} = \frac{9000}{1338{,}63} = 0{,}67 < 1{,}40$ 5

$\tau_{max} = \frac{41T \cdot 752{,}5T}{2 \cdot 756{,}67 \cdot 1} = 0{,}19 < 0{,}90$ 5

35,20t 5

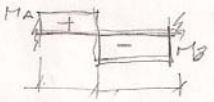
$f_{max} = 0{,}64cm < 2cm$

3-)



$I_0 = 1054cm^4$ 5

$\sigma = \frac{M_b}{I_0} \cdot y_{max} \leq 900 \rightarrow \frac{M_b \cdot 10^5}{1054} \cdot 6 \leq 900 \rightarrow M_b = 1T8tm$ 10 5



$M_A + M_0 = M_b \ldots (1)$

$\frac{M_A \cdot 0{,}80}{G \cdot I_0} = \frac{M_0 \cdot 1{,}20}{G \cdot I_0} \rightarrow M_A = 1{,}5 M_B$ 5

~~$M_A + M_0 + M_B = 1{,}18 \rightarrow M_B =$~~

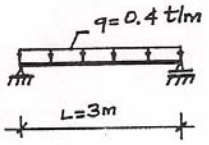
$1{,}5 M_B + M_B = M_b \rightarrow M_B = 0{,}40 M_b$ 5 5

$M_A = 0{,}60 M_b$ 5 $= 1{,}58 \rightarrow M_b = 2{,}63t$ 5

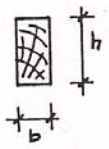
MUKAVEMET UYGULAMA
EĞİLME MOMENTİ ETKİSİ

OĞUZ

SORU 1-)



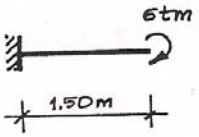
$\sigma_{max.} = 80\ kg/cm^2$

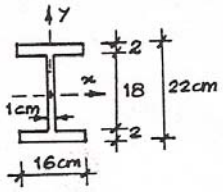


KESİT

Şekilde verilen sistemde,
a-) b=12cm, h=20cm iken normal gerilme kontrolu yapınız.
b-) h=16cm iken b genişliğini hesaplayınız.
c-) b=12cm, h=20cm iken sistemin taşıyabileceği en büyük $q_{max.}$ yükünü hesaplayınız.

SORU 2-)

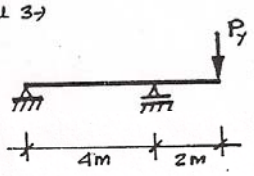


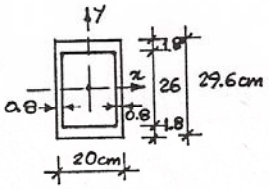


KESİT

Şekilde yükleme durumu ve ölçüleri verilen konsolda normal gerilme kontrolu yapınız.
$\sigma_{max.} = 1,40\ t/cm^2$

SORU 3-)



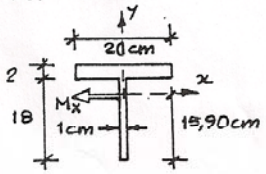


KESİT

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

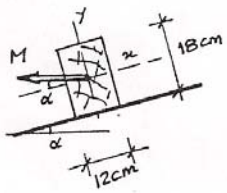
Şekilde verilen sistemde,
a-) Kesitin güvenle taşıyabileceği en büyük $(M_x)_{max.}$ ve $(M_y)_{max.}$ momentlerini hesaplayınız.
b-) Sistemin taşıyabileceği en büyük P yükünü hesaplayınız.

SORU 4-)



Şekilde verilen kesite $M_x = 1,20$ tm etkidiğine göre maksimum ve minimum normal gerilmeleri hesaplayarak, gerilme diyagramını çiziniz.
$\sigma_{em} = 1400\ kg/cm^2$

SORU 5-)



Şekilde ölçüleri verilen kesitte,
$\alpha = 0$ ve $\alpha = 20^\circ$ olması durumunda kesitin güvenle taşıyabileceği en büyük M momentini hesaplayınız.

$\sin 20 = 0,34$
$\cos 20 = 0,94$
, $\sigma_{em} = 110\ kg/cm^2$

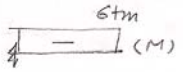
EĞİLME MOMENTİ ETKİSİ

1-) 

a-) $\sigma_{max} = \dfrac{0{,}45 \times 10^5}{\frac{12 \cdot 20^2}{6}} = 56{,}25\ kg/cm^2 < 80$ ✓

b-) $\dfrac{0{,}45 \cdot 10^5}{b \cdot \frac{16^2}{6}} = 80 \rightarrow b = 13{,}18cm \rightarrow$ seçilen $b = 14\ cm$ ✓

c-) $\dfrac{q \cdot \frac{3^2}{8} \cdot 10^5}{800} = 80 \rightarrow q_{max.} = 0{,}57\ t/m$ ✓

2-) 

$I_x = 6907{,}33 cm^4$ $\quad W_{min} = 627{,}93$ $\quad \sigma_{max} = \dfrac{600}{627{,}93} = 0{,}96 < 1{,}40$ ✓

3-) a-) $I_x = 16274.03\ cm^4 \rightarrow W_x = 1099{,}60\ cm^3 \rightarrow M_x = 1{,}40 \cdot 1099{,}60 \cdot 10^{-2} = 15{,}39\ tm$

$I_y = 6236{,}07\ cm^4 \rightarrow W_y = 623{,}61 \rightarrow M_y = 8{,}73\ tm.$

b-) 

$2P = 15{,}39 \rightarrow P = 7{,}70\ ton$ ✓

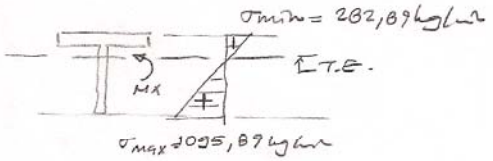
4-) $I_x = 1740{,}71 cm^4.$

$W_{üst} = 424{,}20 cm^3.$

$W_{alt} = 109{,}50\ cm^3$

$\sigma_{max} = \dfrac{1{,}20 \cdot 10^5}{109{,}50} = 1095{,}89\ kg/cm^2 < 1400$ ✓

$\sigma_{min} = \dfrac{1{,}20 \cdot 10^5}{424{,}20} = 282{,}89\ kg/cm^2 < 1400$ ✓



5-) $M_x = M \cdot \cos\alpha = 0{,}94M \qquad W_x = 648 cm^3$

$M_y = M \cdot \sin\alpha = 0{,}34M \qquad W_y = 432\ cm^3$

$\alpha = 20°$ için $\rightarrow \sigma_{mom} = \dfrac{M_x}{W_x} + \dfrac{M_y}{W_y} = \dfrac{0{,}94M \times 10^5}{648} + \dfrac{0{,}34M \cdot 10^5}{432} = 110$

$M = 0{,}49\ tm$

$\alpha = 0$ için $\quad \dfrac{M}{W_x} = 110 \rightarrow M = 0{,}71\ tm.$