Mukavemet

Kesme Kuvveti Etkisi

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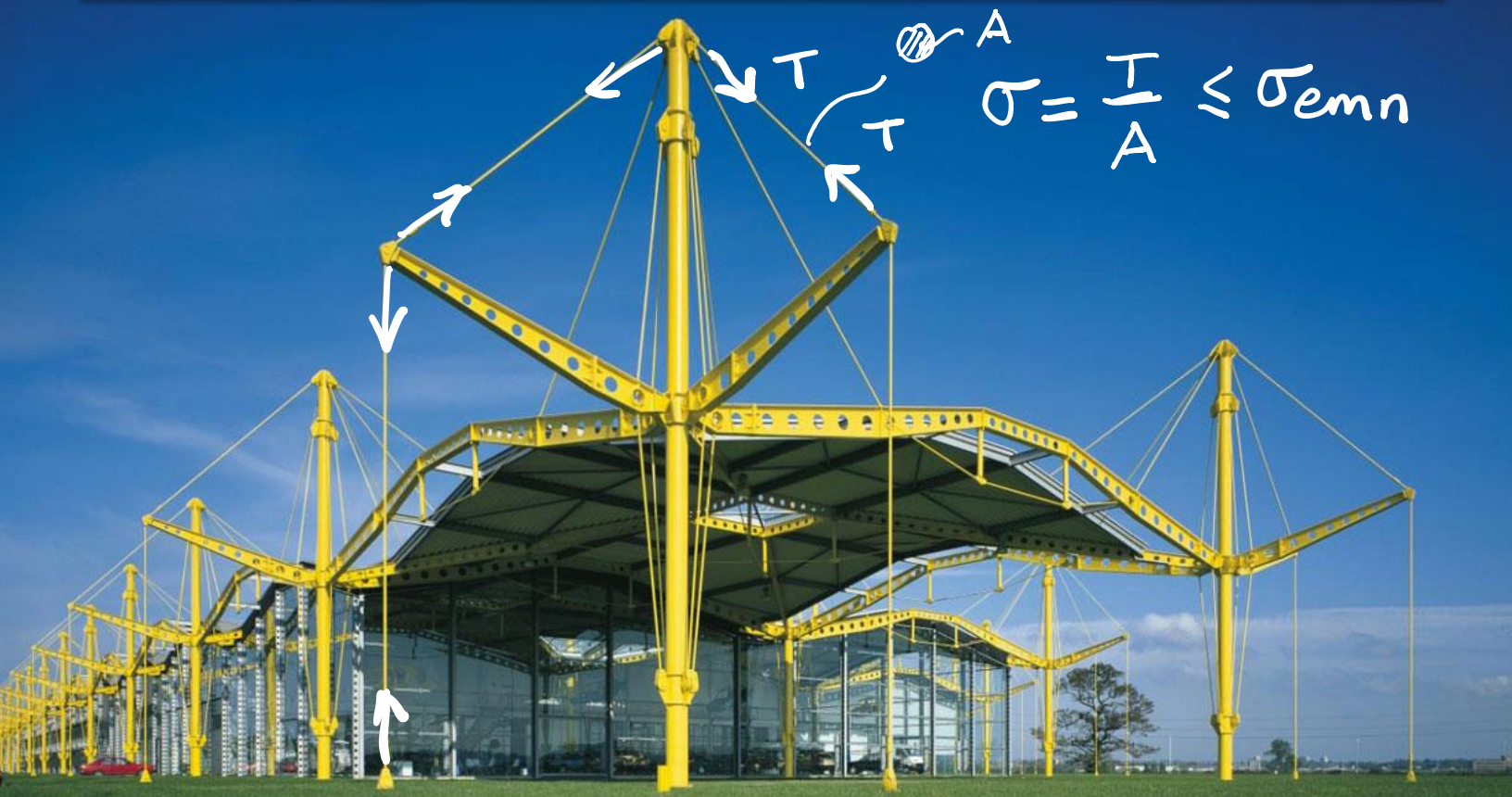
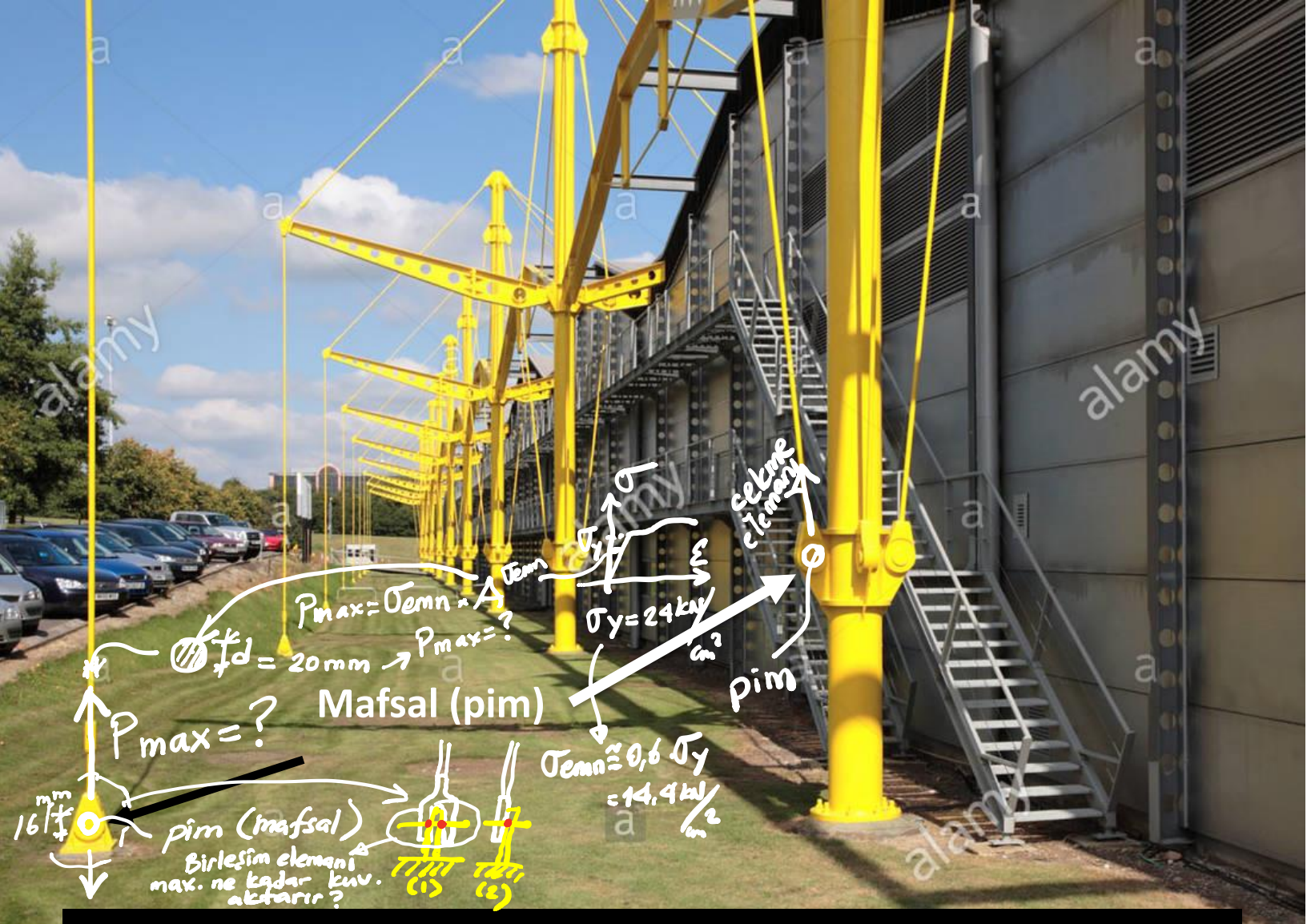
İ.T.Ü. Mimarlık Fakültesi
Yapı ve Deprem Mühendisliği

Renault Distribution Centre, Swindon, UK, 1980-1982, Foster+Partners



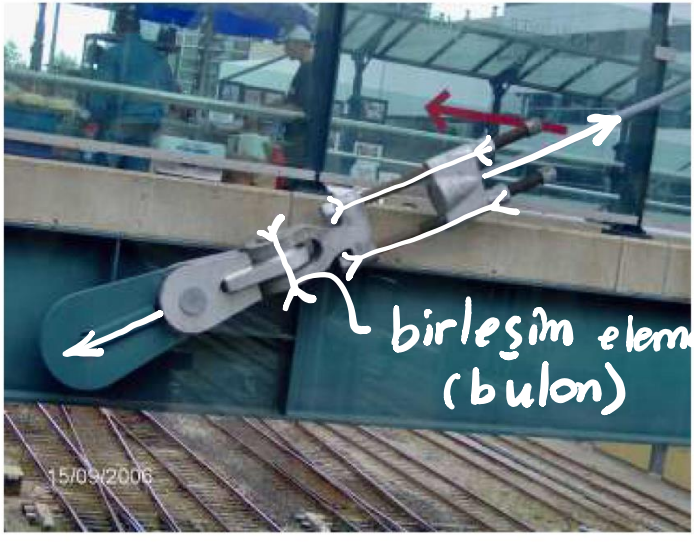
Asma Sistemler

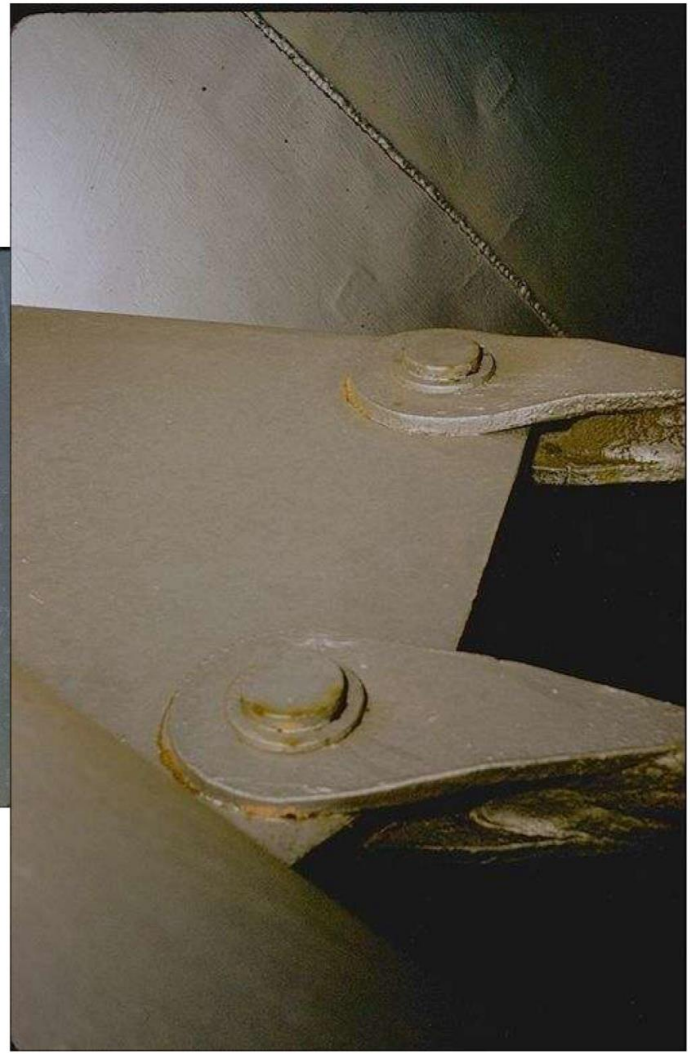


Renault Distribution Centre, Swindon, UK, 1980-1982, Foster+Partners

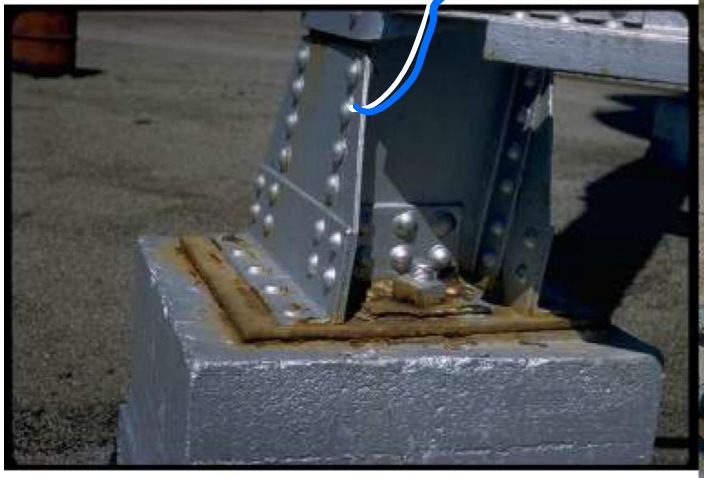
ÇATAL UÇ ÖRNEĞİ

(clevis)





PERÇİNLİ BİRLEŞİM



BULONLU -CİVATALI- BİRLEŞİM
KİRİŞ EKİ

BULONLU -CİVATALI- BİRLEŞİM
KOLON EKİ


05.25.2004 13:37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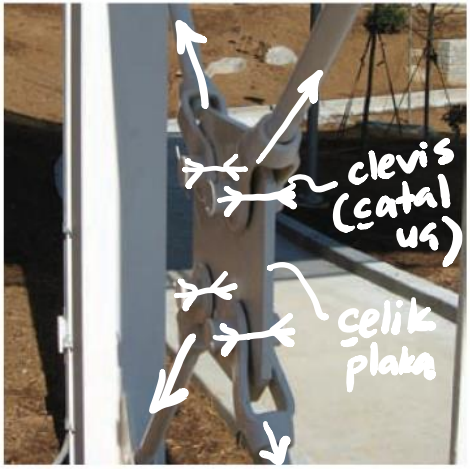
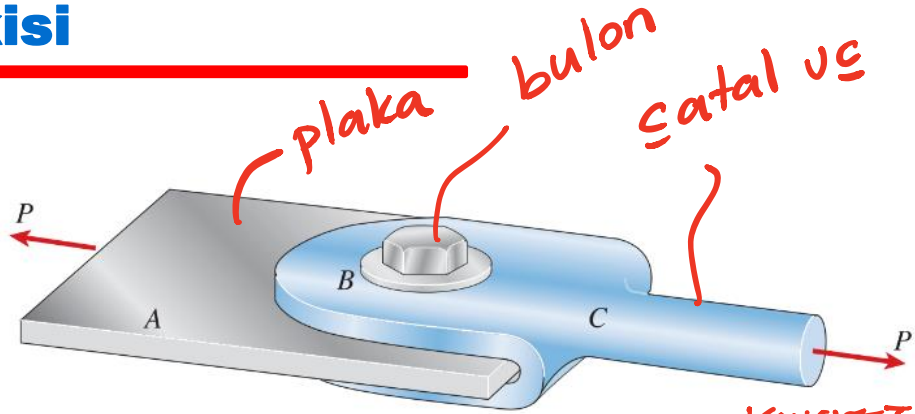
Kesme Kuvveti Etkisi



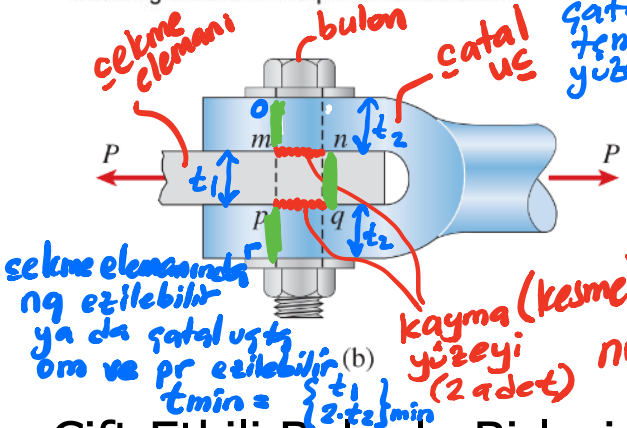
Diagonal bracing for an elevated walkway showing a clevis and a pin in double shear



GERİLME = KUVVET / ALAN

σ normal gerilme (ezilme gerilmesi)

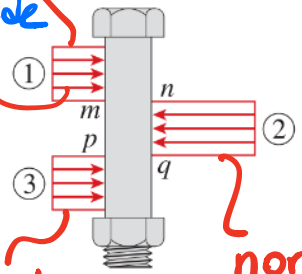
bulon ve çatal uç temas yüzeyinde



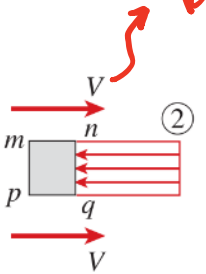
çekme elemanında ng ezilebilir ya da çatal uçta om ve pr ezilebilir

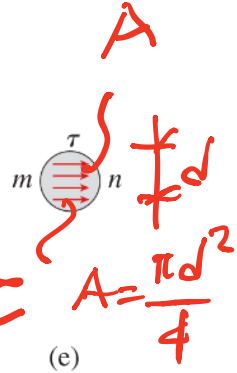
$t_{min} = \{t_1 \; 2 \cdot t_2\}_{min}$

kayma (kesme) yüzeyi (2 adet)



normal gerilme σ (ezilme gerilmesi)





$A = \frac{\pi d^2}{4}$

τ (to) kayma

σ sigma

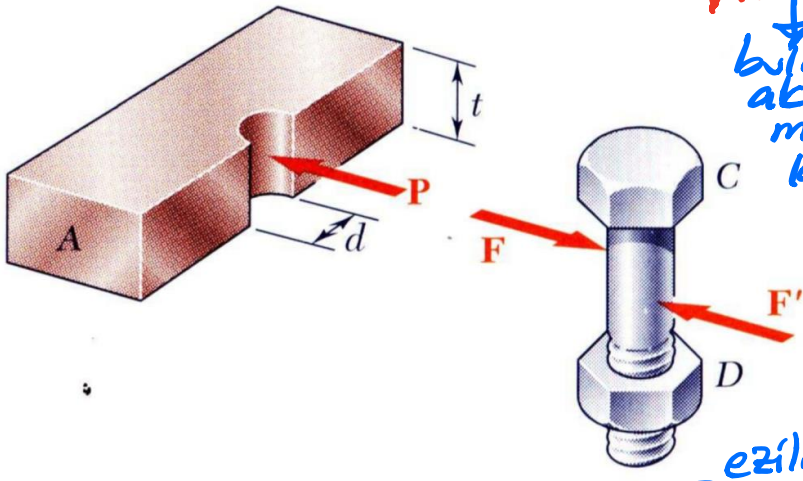
Çift Etkili Bulonlu Birleşim

Ezilme Kesme Kuvveti Etkisi

gerilmesi

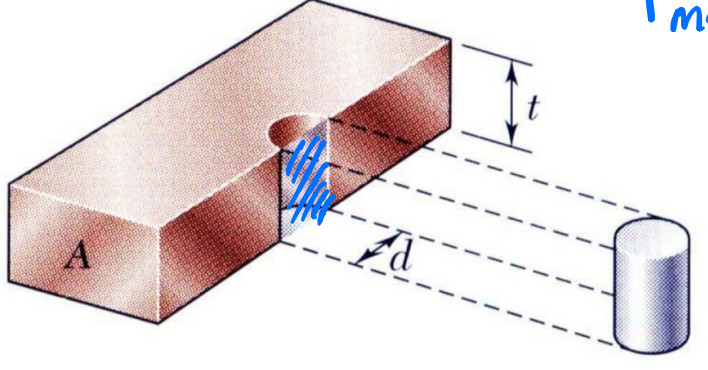
$V_{max} = \tau_{emn} \cdot (A.2)$

- V_{max}: bulonun aktarabil. max. kesme kuv.
- τ_{emn}: kayma yüzeyi sayısı
- (A.2)

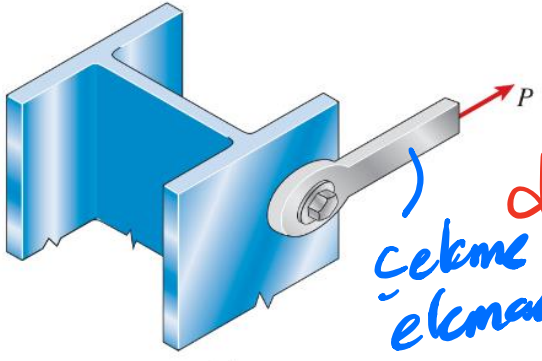


$P_{max}^{ezilme} = \sigma_{emn}^{ezilme} \cdot A_{ezilen}$

$= \sigma_{emn}^{ezilme} \cdot d \cdot t$

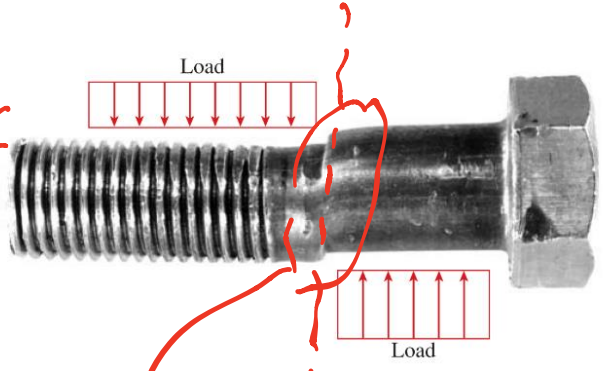


Kesme Kuvveti Etkisi

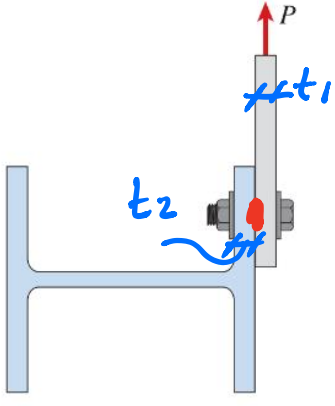


(a)

çekme elemanı



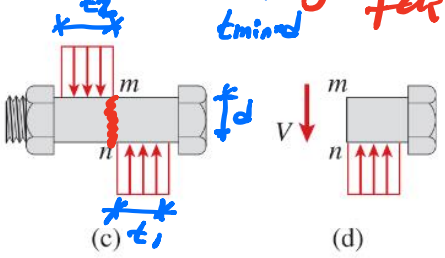
hasar oluşmuş (kayma gerilmesini taşıyamamış) kesme yüzeyi



(b)

$P^{max}_{ezilme} = \sigma^{max}_{ezilme} \cdot A^{ezilen}$

KUVVET = GERİLME × ALAN



(c) (d)

örnek:

$P^{max}_{kesme} = 40\,kN$

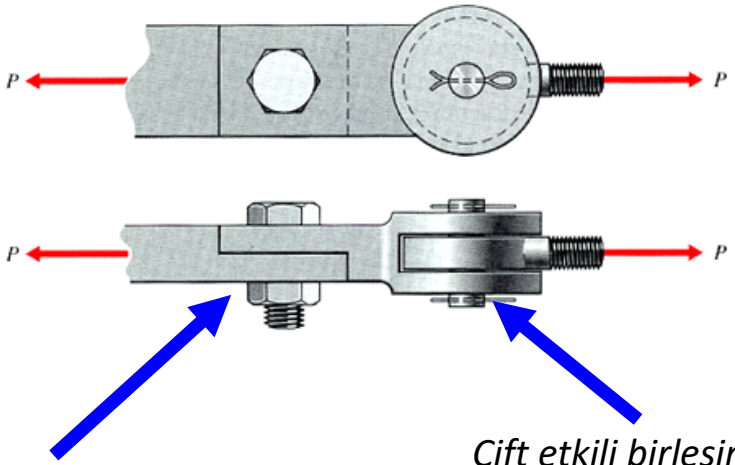
$P^{max}_{ezilme} = 50\,kN$

$P^{max}_{birleşim} = 40\,kN$

Tek Etkili Bulonlu Birleşim

Kesme Kuvveti Etkisi

Kayma gerilmesi → Perçinli, bulonlu birleşimler

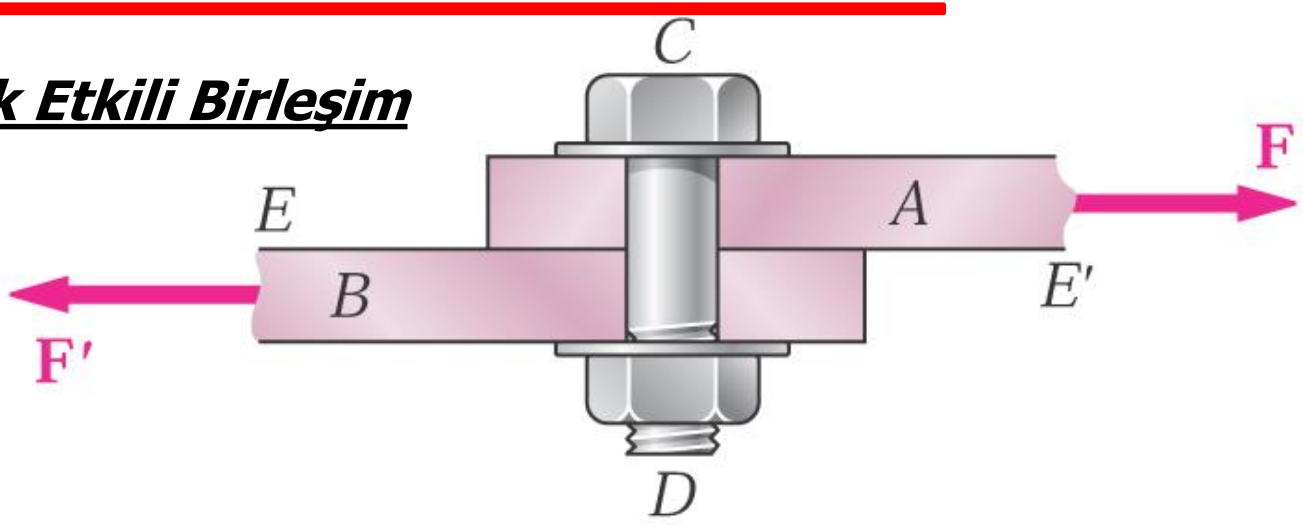


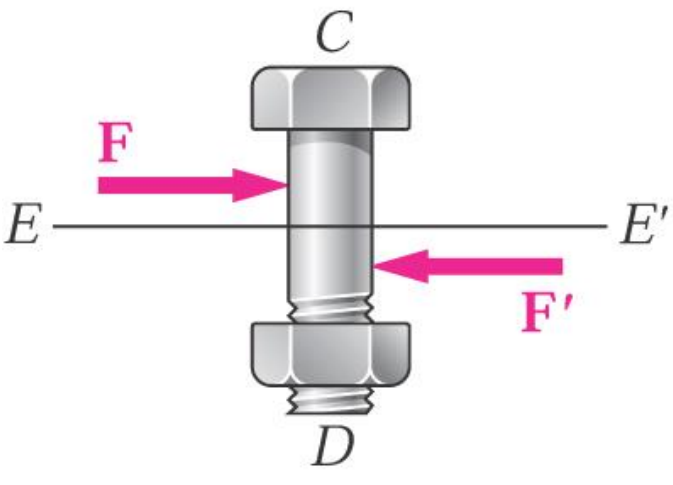
Tek etkili birleşim

Çift etkili birleşim

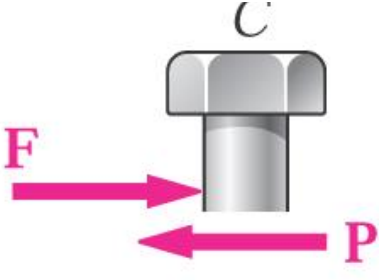
Kesme Kuvveti Etkisi

Tek Etkili Birleşim





(a)

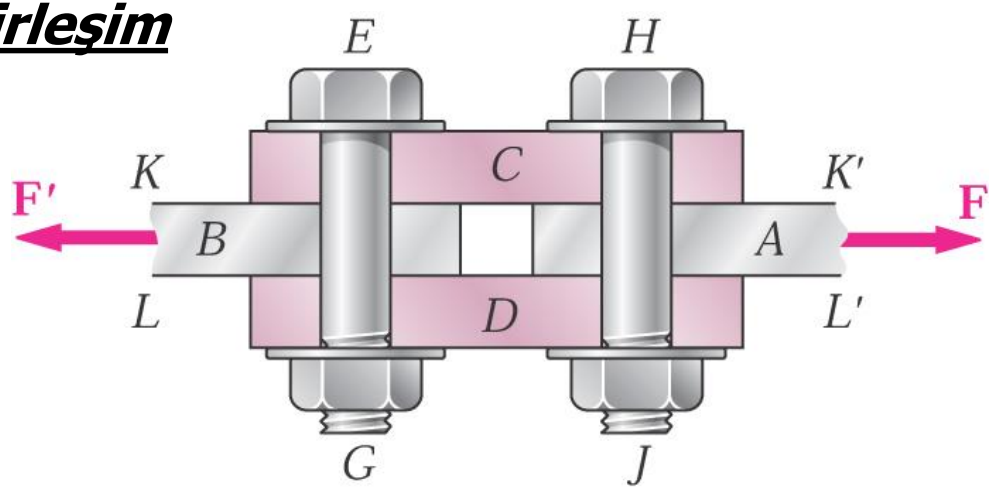


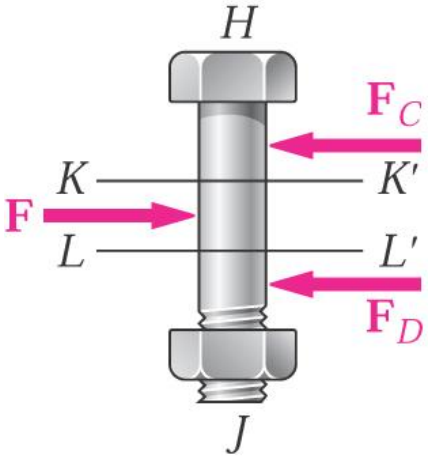
(b)

$$\tau_{\text{ort}} = \frac{P}{A} = \frac{F}{A}$$

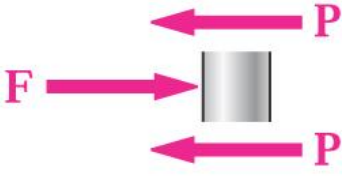
Kesme Kuvveti Etkisi

Çift Etkili Birleşim





(a)

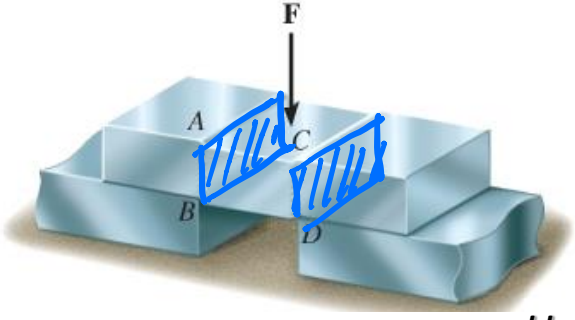


(b)

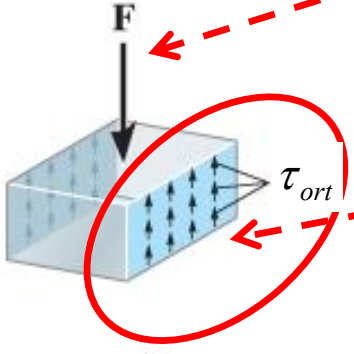
$$\tau_{ort} = \frac{P}{A} = \frac{F}{2A}$$

Kesme Kuvveti Etkisi (Zımbalama etkisi)

taşıyıcı elemanı delip geçme.

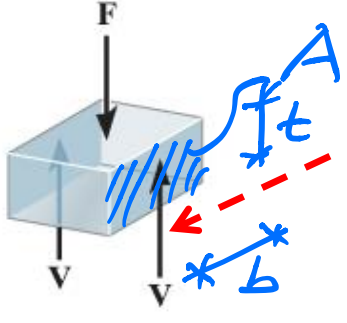


Uygulanan kuvvet



Kesit içinde oluşan kayma gerilmeleri

$$\tau_{ort} = \frac{V}{A} \rightarrow V = \tau_{ort} \cdot A$$

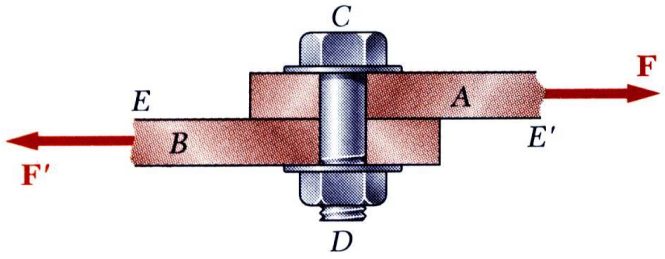


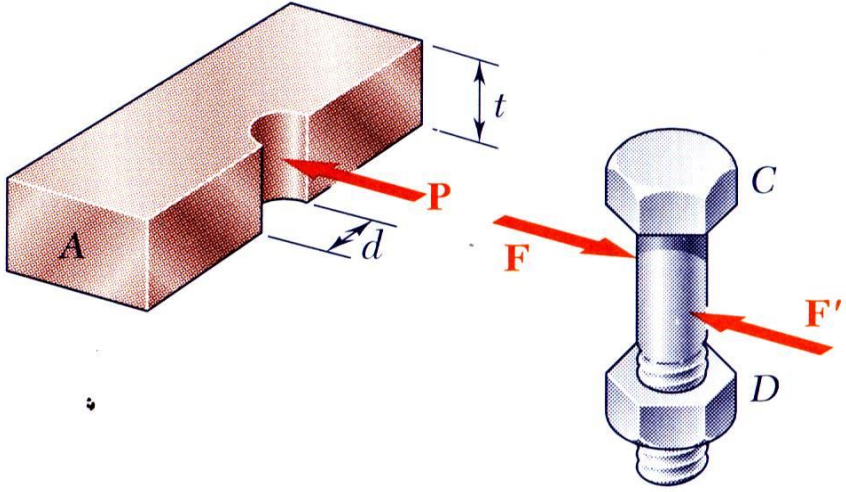
Kayma gerilmelerinin bileşkesi

$$V_{max} = \tau_{emn} \cdot A$$

Kesme Kuvveti Etkisi

Birleşimde ezilme gerilmesi:



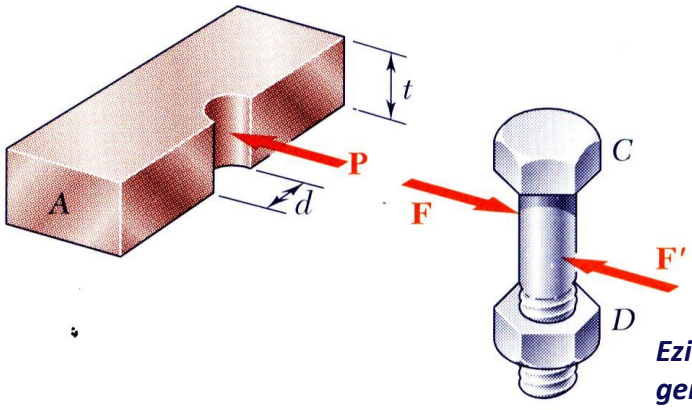


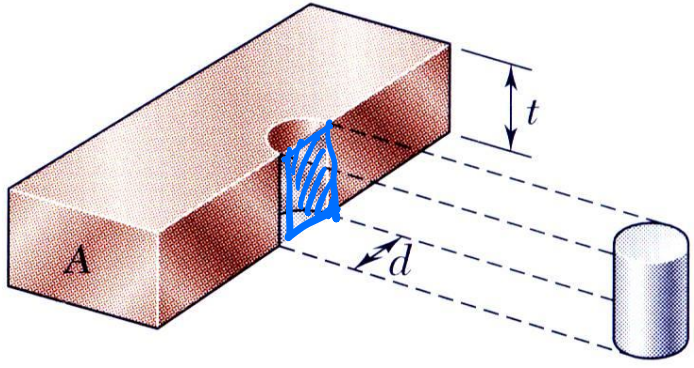
- Birleşim elemanlarının levhalar ile temas ettikleri yüzeylerde ezilme oluşabilir.
- Birleşim elemanına etkiyen Kuvvet etki tepki prensibi Gereğince eşit şiddette Levhaya da etkir.
- Ezilme gerilmesi ortalama Normal gerilme olarak Aşağıdaki şekilde hesaplanır

$$\sigma_1 = \frac{P}{A} = \frac{P}{t\,d}$$

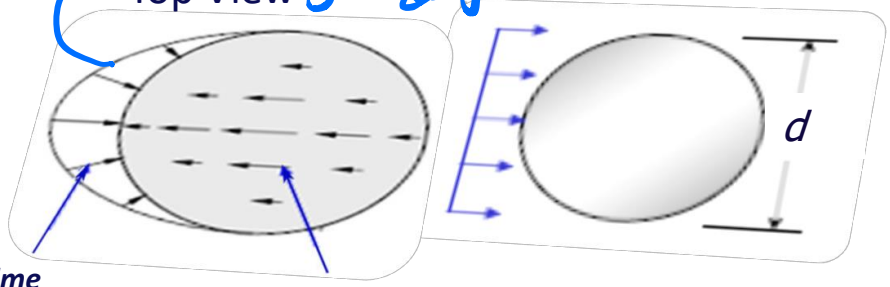
Kesme Kuvveti Etkisi

Birleşimde ezilme gerilmesi :





temas yüzeyindeki gerçek gerilme dağılımı

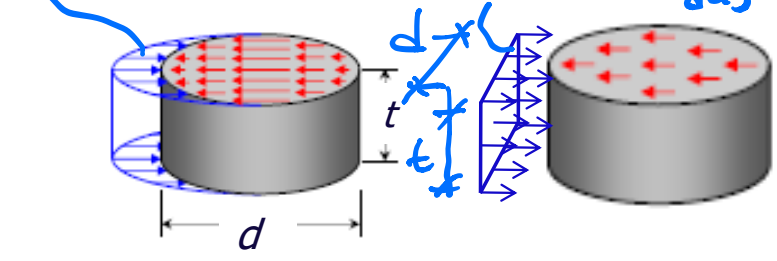


Ezilme gerilmeleri

Kayma gerilmeleri

Ortalama ezilme gerilmesi

idealize edilmiş ezilme gerilmesi dağılımı



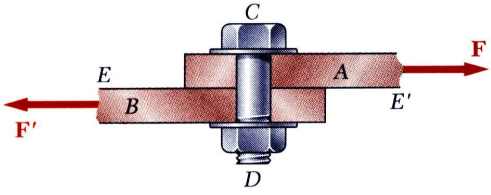
Gerçek ezilme ve kayma gerilmeleri

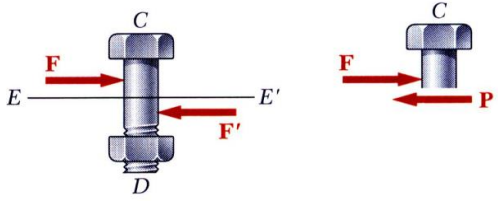
Ortalama ezilme gerilmesi

$$\sigma_1 = \frac{P}{A} = \frac{P}{t_{\min} d}$$

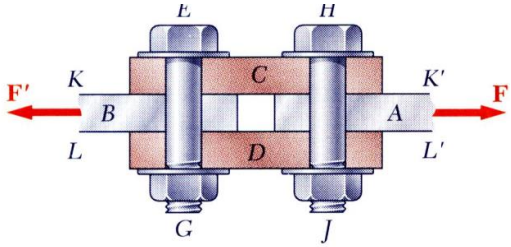
Kesme Kuvveti Etkisi

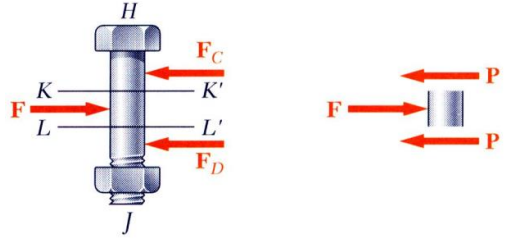
Tek etkili





Çift etkili





Kesme kuv.

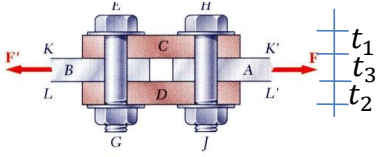
$$P^1_{emn,\tau} = \frac{\pi d^2}{4} . \tau_{emn}$$

$$P^1_{emn,l} = d . t_{min} . \sigma_{emn}$$

$$P^1_{emn,\tau} = 2 . \frac{\pi d^2}{4} . \tau_{emn}$$

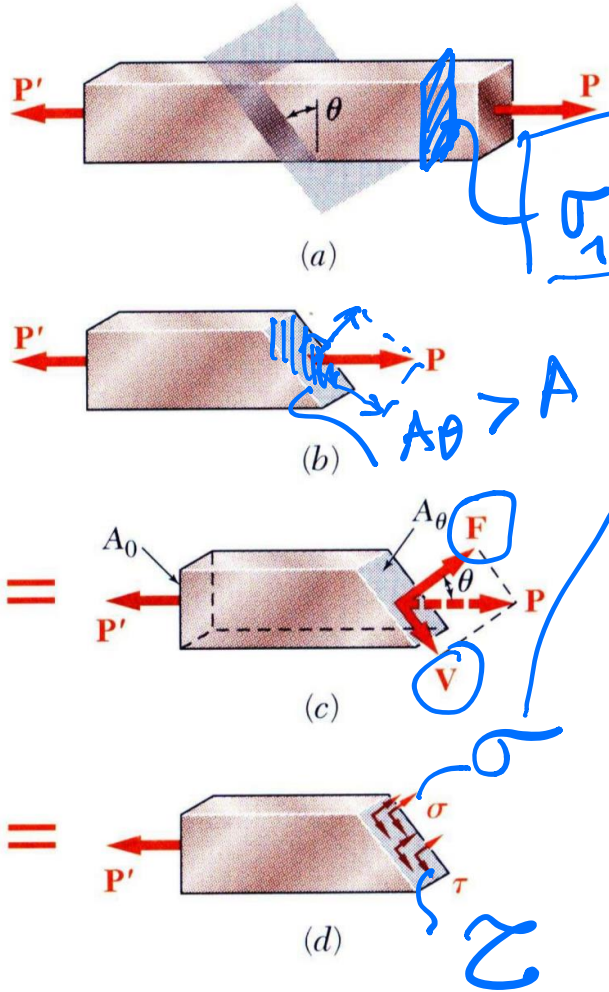
$$P^1_{emn,l} = d . t_{min} . \sigma_{l,emn}$$

ezilme .



$$t_{min} = min(t_1 + t_2 ; t_3)$$

Kesme Kuvveti Etkisi



$$F = P\cos\theta \qquad V = P\sin\theta$$

$\sigma_1 > \sigma_2$

$$\sigma_1 = \frac{P}{A}$$

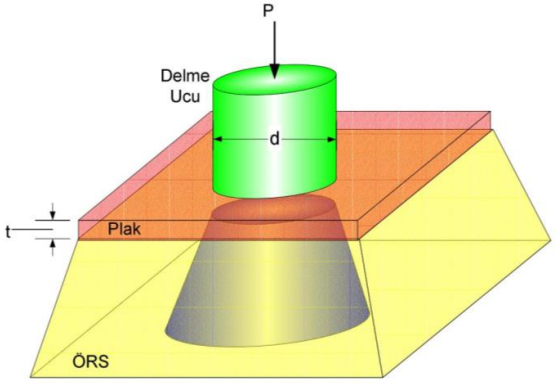
$A_\theta > A$

$$\sigma_2 = \frac{F}{A_\theta} = \frac{P\cos\theta}{A_0/\cos\theta} = \frac{P}{A_0}\cos^2\theta$$

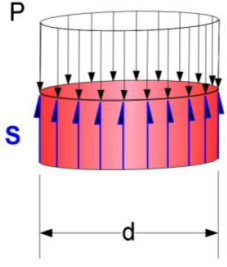
$$\tau = \frac{V}{A_\theta} = \frac{P\sin\theta}{A_0/\cos\theta} = \frac{P}{A_0}\sin\theta\cos\theta$$

Kesme Kuvveti Etkisi (Zımbalama Dayanımı)

Direkt kesme haline örnekle: Bir plak üzerinde delik açılması

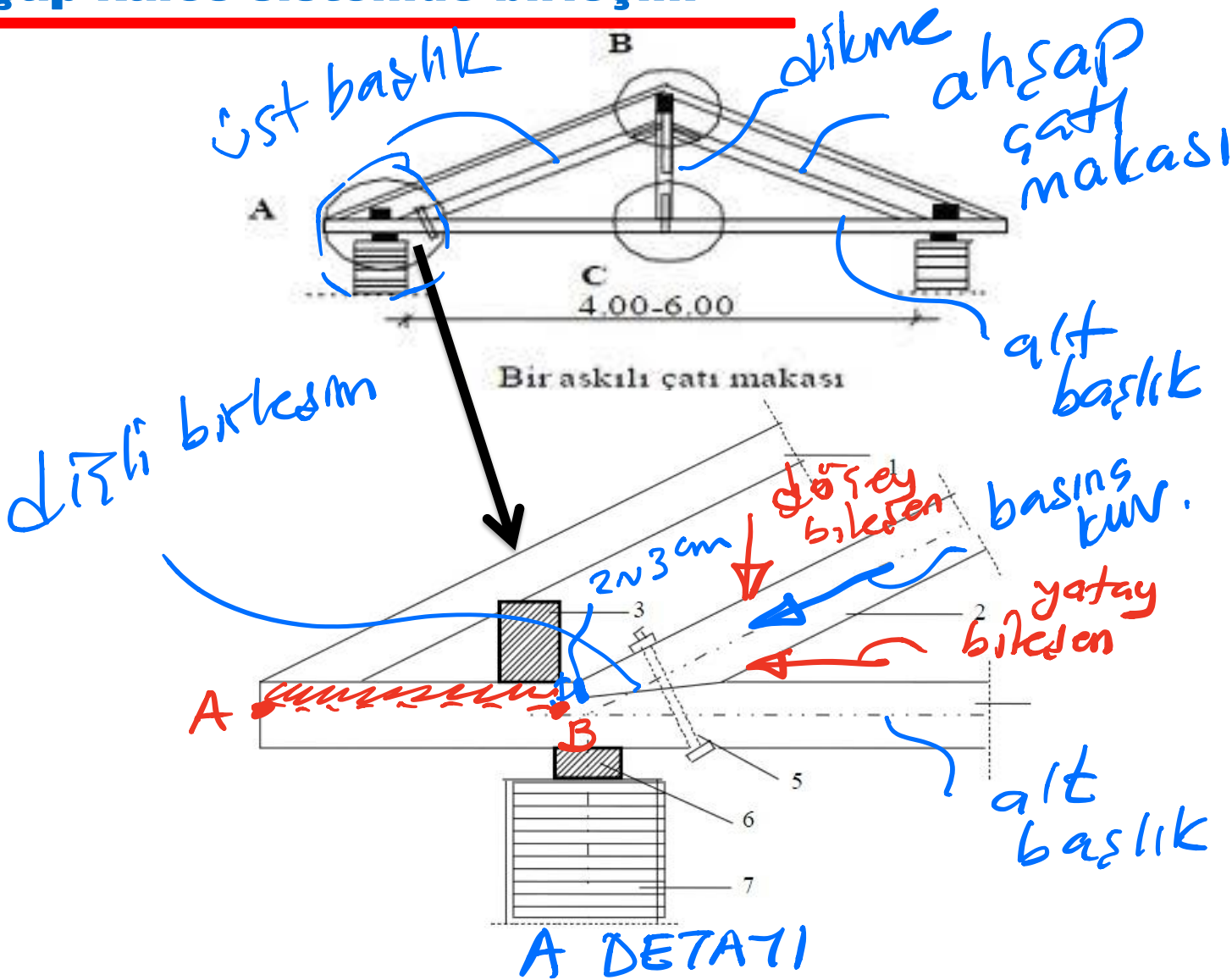


Japonya da bulunan bu köprü zımbalama etkisi yüzünden kullanılamaz halde

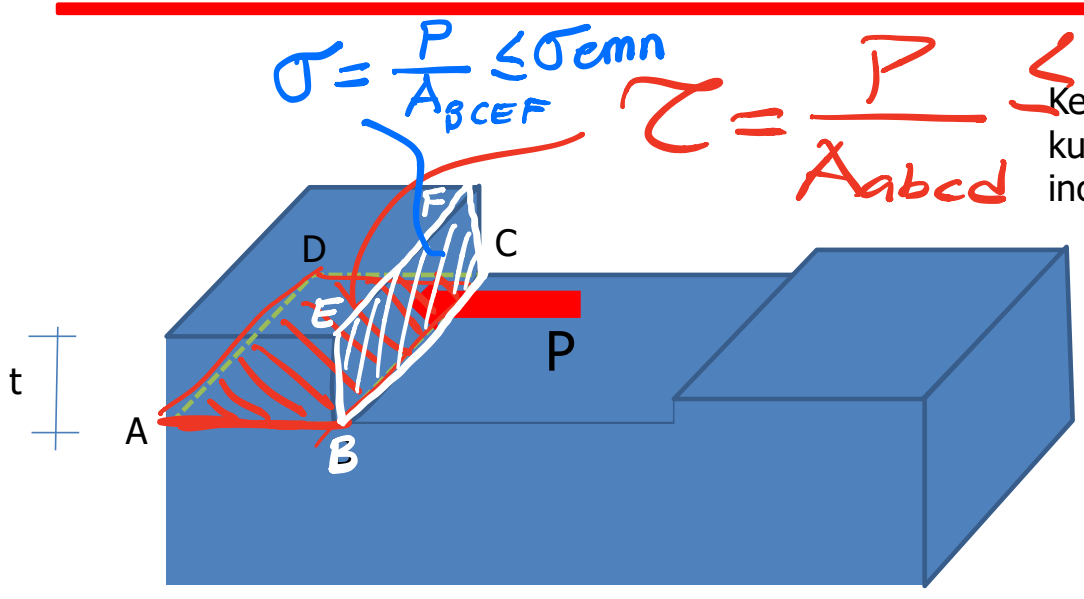


$$\tau_{ort} = \frac{P}{2 \cdot \pi \cdot r \cdot t}$$

Ahşap kafes sistemde birleşim



Kesme Kuvveti Etkisi



Kesitte yalnız T kesme kuvvetinin olduğu durum incelenir.

$$T = P$$

$$\tau = \frac{T}{A_{abcd}}$$

$$\tau = \frac{T}{A} \leq \tau_{em}$$