

DEPREME DAYANIKLI YAPI TASARIMI

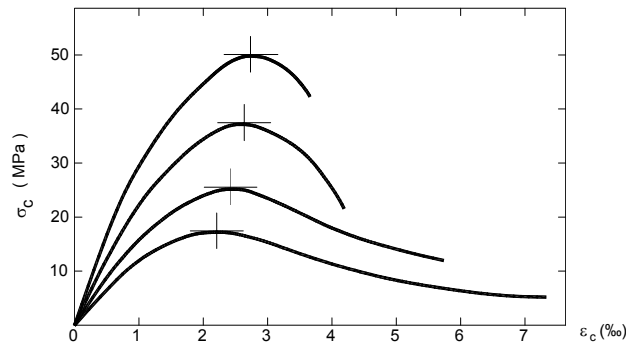
Zekai Celep
İnşaat Fakültesi
İstanbul Teknik Üniversitesi

DEPREME DAYANIKLI YAPI TASARIMI

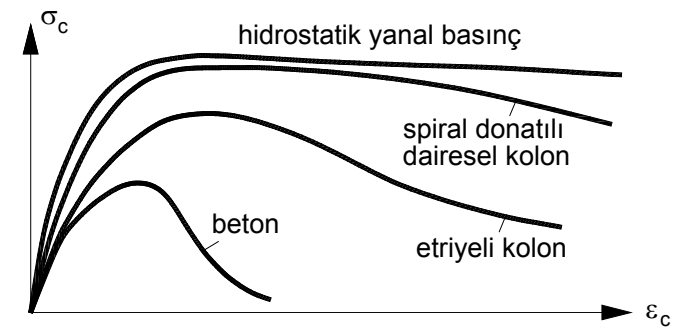
- Deprem hareketi
- Yapıların yer hareketi etkisindeki titreşimi
- Deprem etkisindeki betonarme yapı elemanlarının davranışı
- Depreme dayanıklı yapı tasarımı
- Yurdumuzdaki önemli depremler
- Yapılarda deprem sonrası hasar belirlenmesi, onarım ve güçlendirme yöntemleri
- Mevcut binaların deprem etkisindeki davranışının değerlendirilmesi

Deprem etkisindeki betonarme yapı elemanlarının davranışı

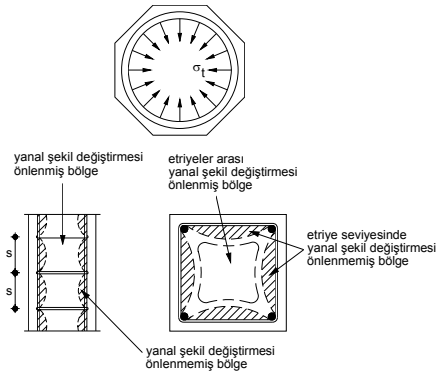
Beton



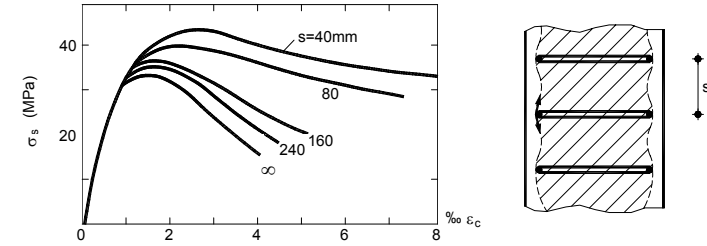
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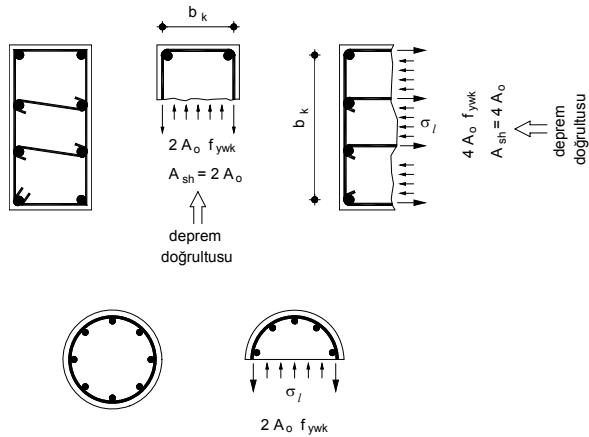
Beton



Beton



Beton

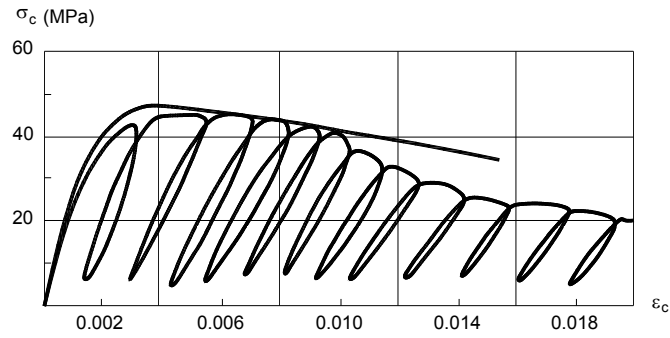
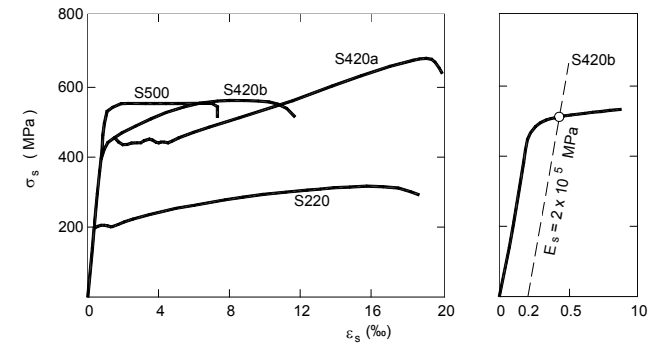
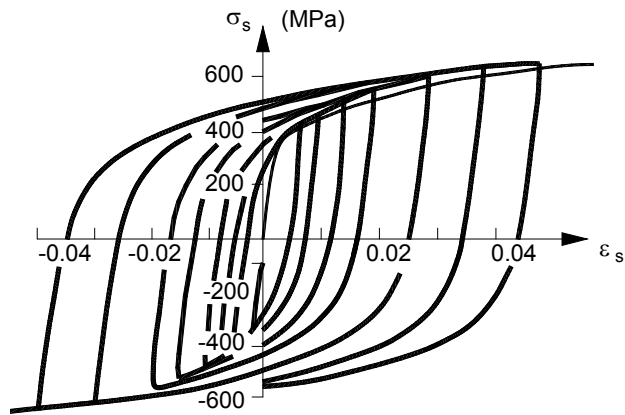
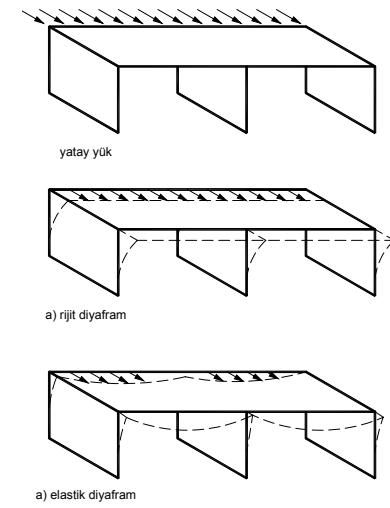


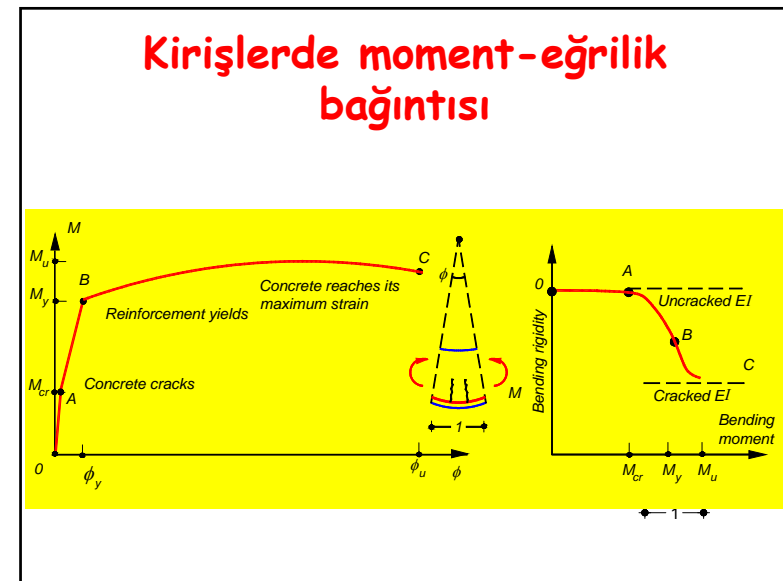
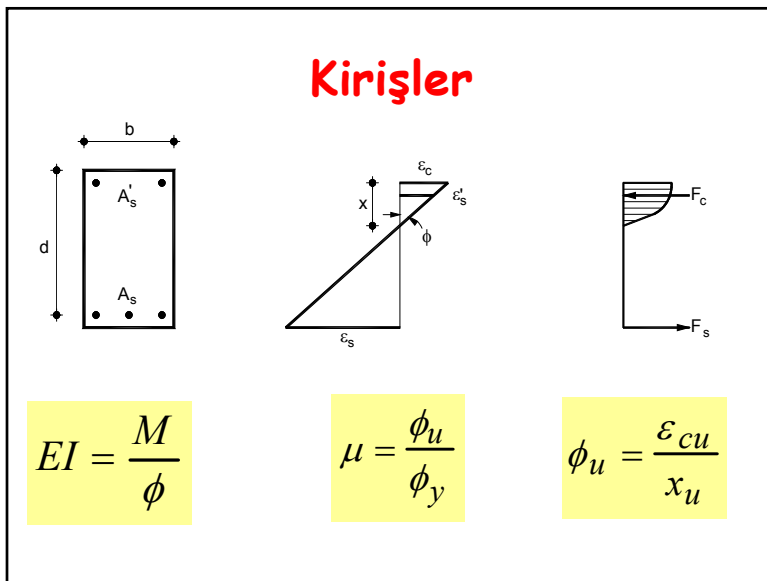
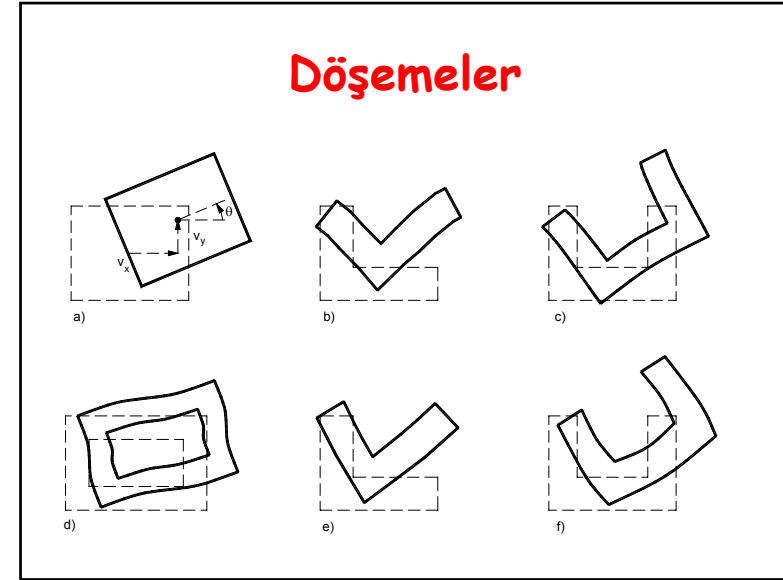
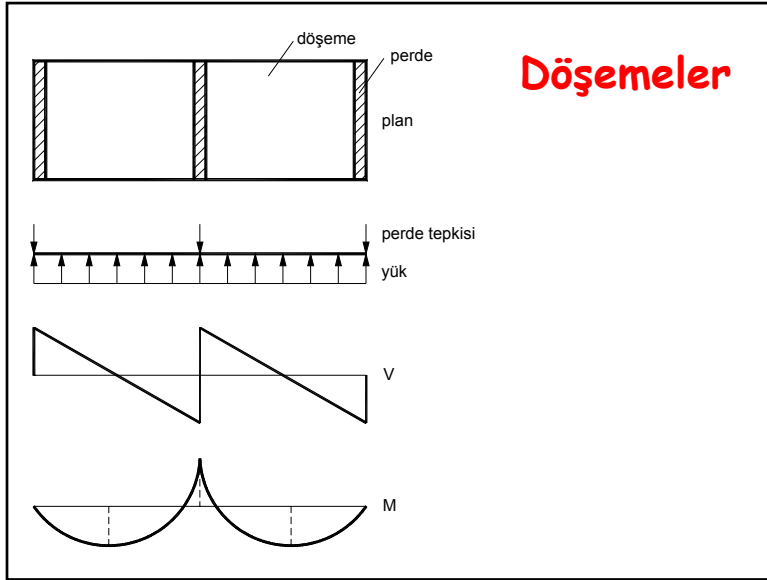
Beton

$$0.85 f_{ck} (A_c - A_{ck}) \leq 4.1 \sigma_l A_{ck} \quad \sigma_l = \frac{A_{sh} f_{yw}}{s b_k}$$

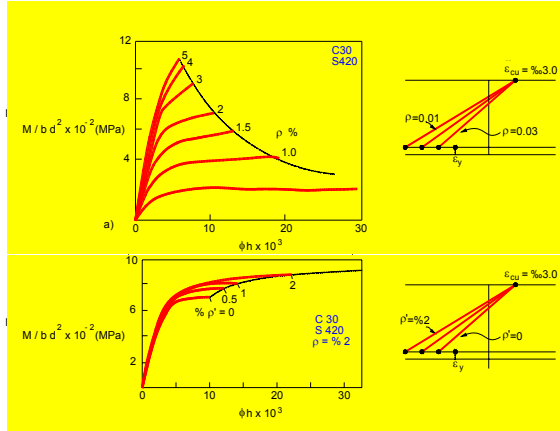
$$A_{sh} \geq A_{sh \min} = 0.207 \frac{f_{ck}}{f_{yw}} \left(\frac{A_c}{A_{ck}} - 1 \right) s b_k$$

$$\rho_s = \frac{\pi D A_o}{s \pi D^2 / 4} = \frac{4 A_o}{s D} \geq \rho_{s \min} = 0.415 \frac{f_{ck}}{f_{yw}} \left(\frac{A_c}{A_{ck}} - 1 \right)$$

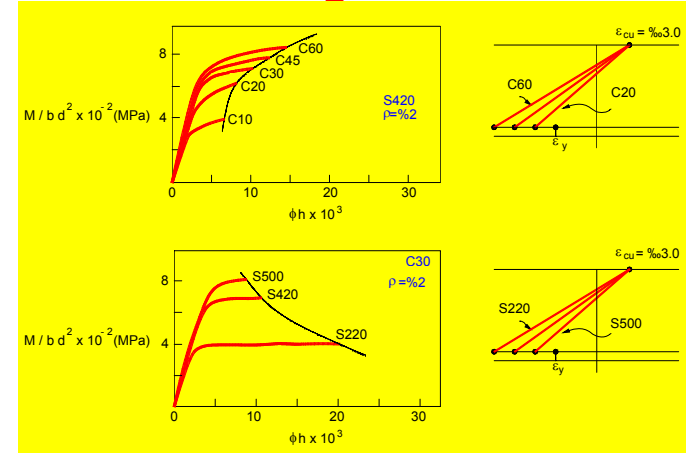
Beton**Çelik****Çelik****Döşemeler**



Kirişlerde moment-eğrilik bağıntısı



Kirişlerde moment-eğrilik bağıntısı



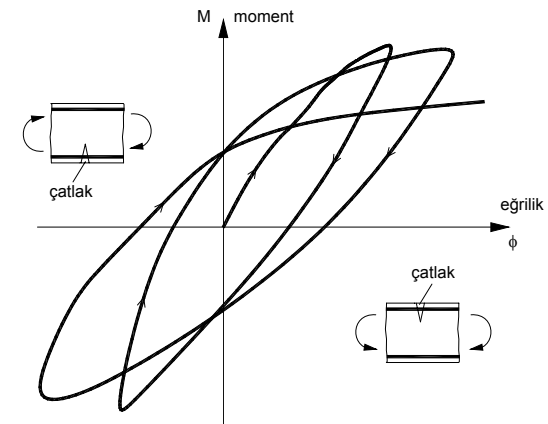
Moment-eğrilik bağıntısı

$$0.85 f_c b a = A_s f_y$$

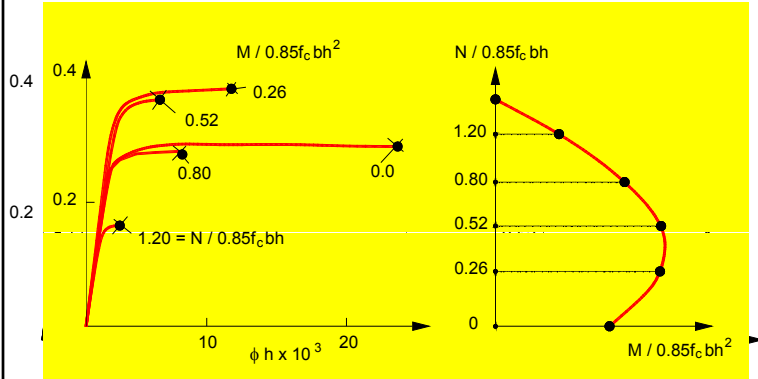
$$M_u = 0.85 f_c b a (d - 0.5 a)$$

$$M_u = A_s f_y (d - 0.5 a) \quad a = k_1 x$$

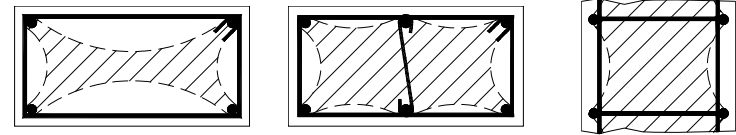
Kirişler



Kolonlar

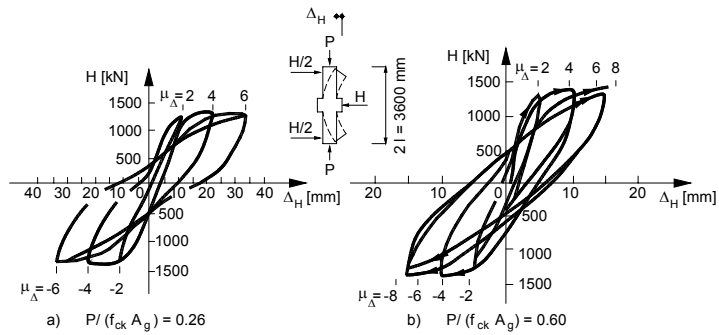


Kolonlar

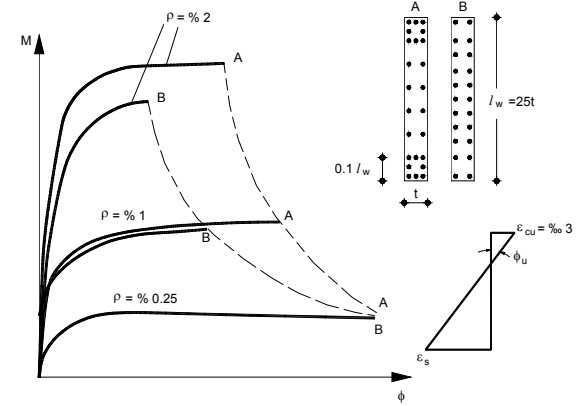


yanal şekil değiştirmesi önlenmiş beton bölgesi

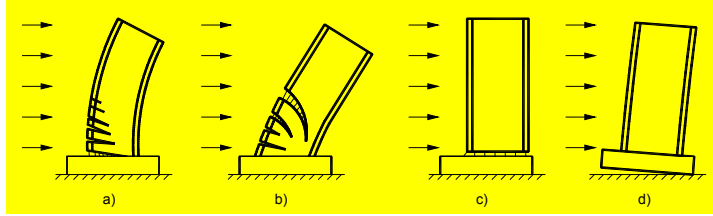
Kolonlar



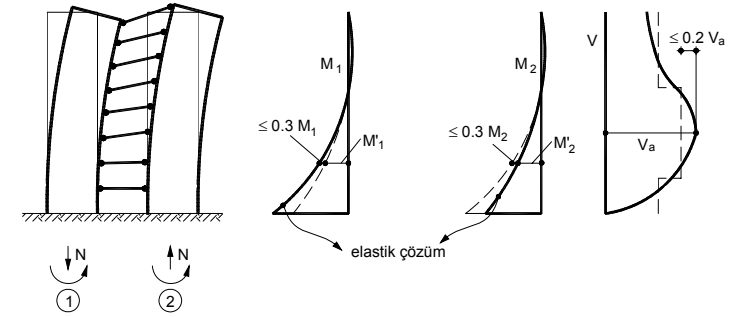
Perdeler



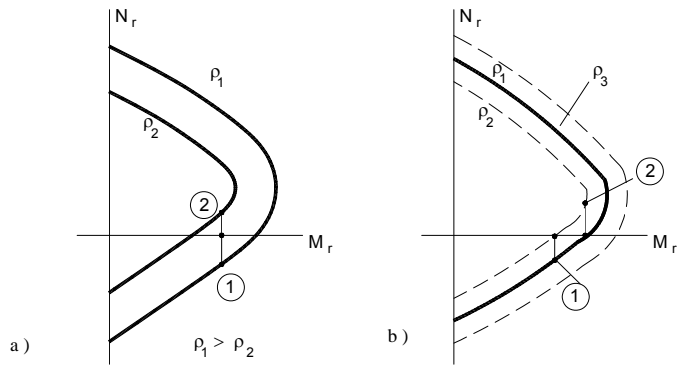
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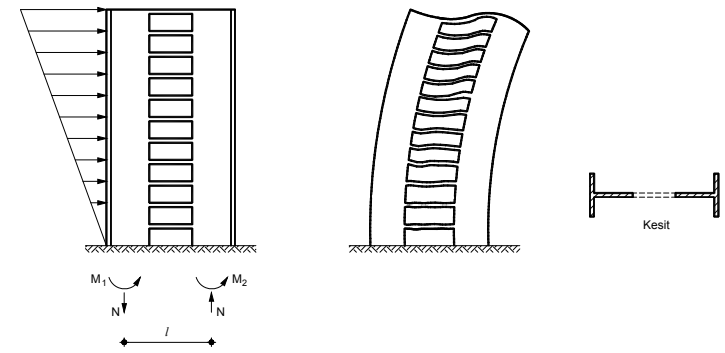
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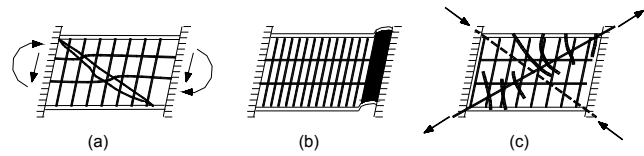
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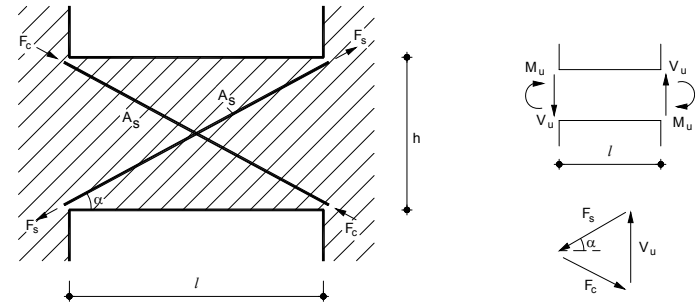
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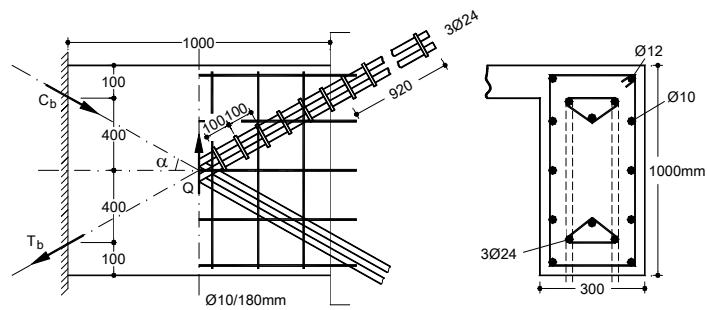
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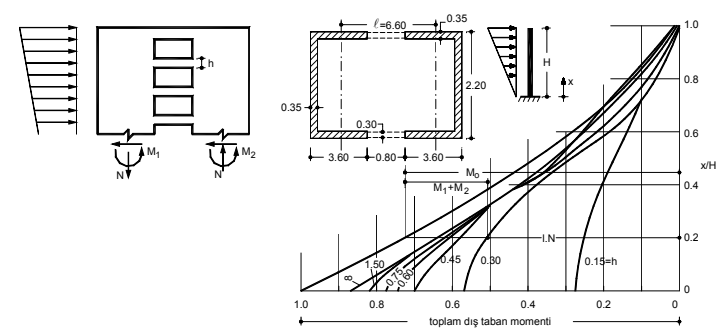
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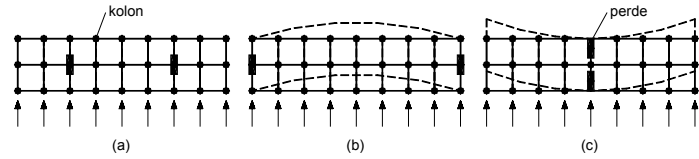
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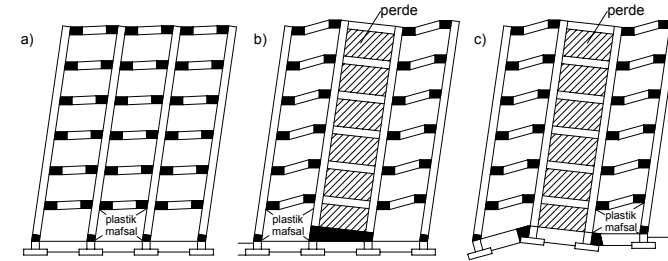
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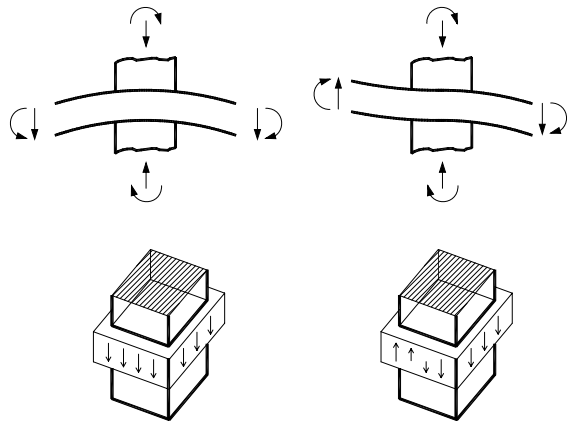
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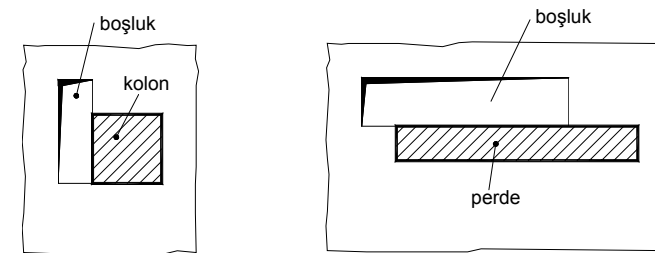
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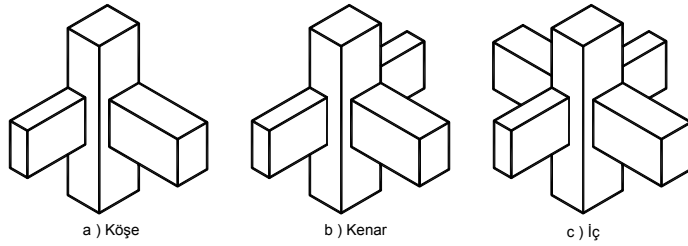
Birleşim bölgeleri Kolon ile döşeme



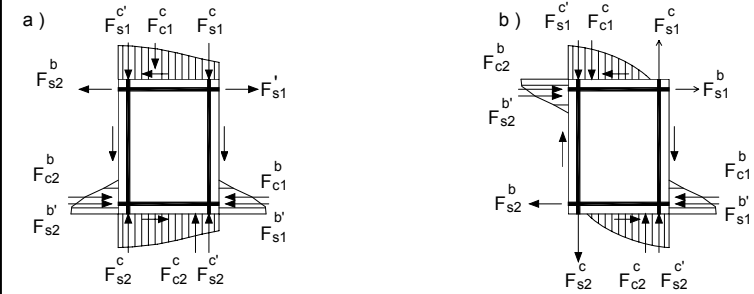
Birleşim bölgeleri Kolon/perde ile döşeme



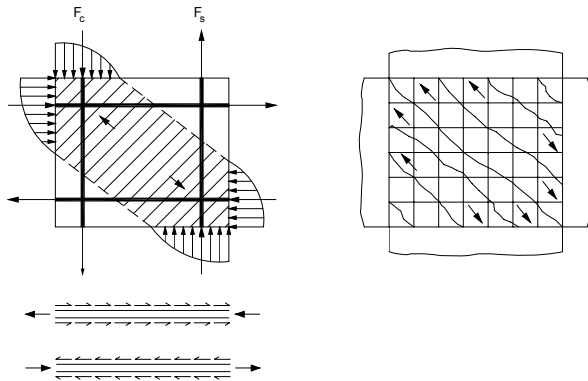
Birleşim bölgeleri Kolon ile kiriş



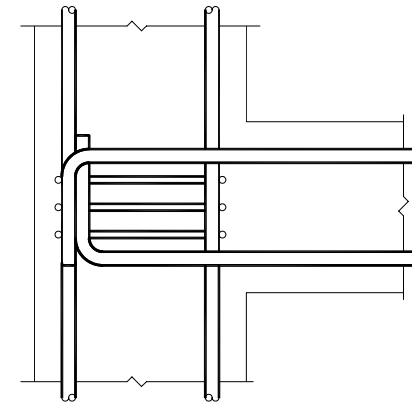
Birleşim bölgeleri Kolon ile kiriş



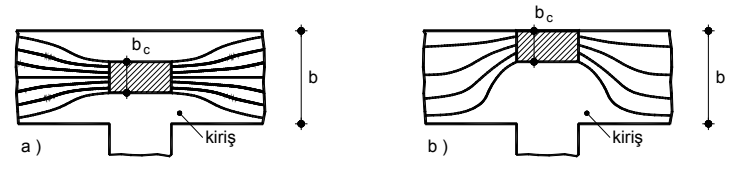
Birleşim bölgeleri Kolon ile kiriş



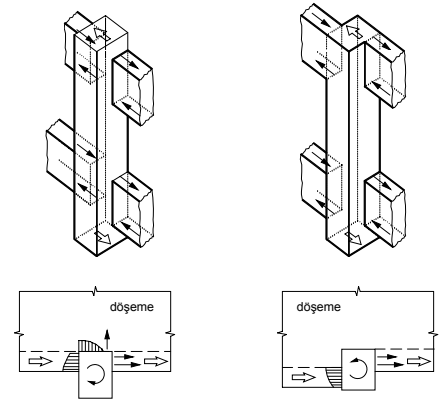
Birleşim bölgeleri Kolon ile döşeme



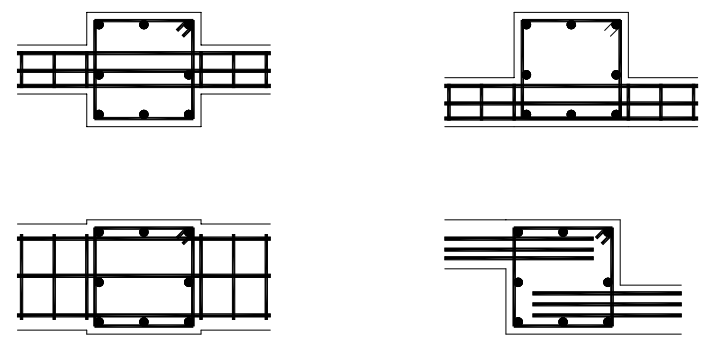
Birleşim bölgeleri Kolon ile kiriş



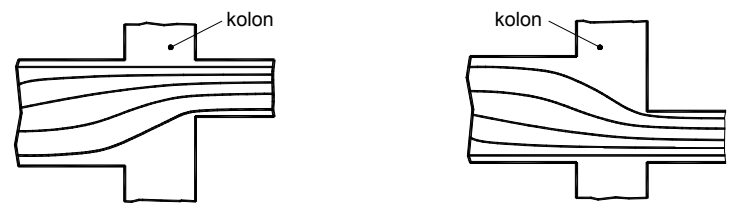
Birleşim bölgeleri Kolon ile kiriş



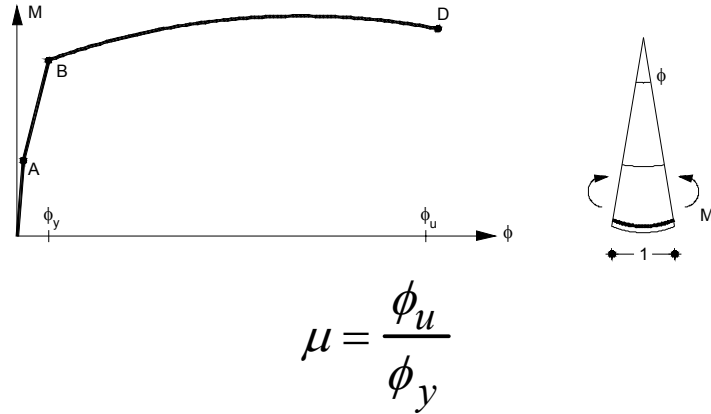
Birleşim bölgeleri Kolon ile kiriş



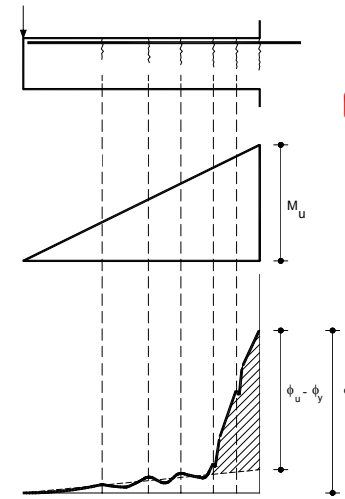
Birleşim bölgeleri Kolon ile kiriş



Plastik mafsal ve sünelik



Konsol kirişte moment-eğrilik değişimi



Plastik mafsal

$$\theta_{AB} = \int_A^B \phi \, dx = \int_A^B \frac{M}{EI_e} \, dx \quad \Delta_{AB} = \int_A^B x \frac{M}{EI_e} \, dx$$

$$I_e = \left(\frac{M_{cr}}{M} \right)^3 I_g + \left[1 - \left(\frac{M_{cr}}{M} \right)^3 \right] I_{cr}$$

$$\theta_p = (\phi_u - \phi_y) l_p$$

Plastik mafsal

$$\theta_{AB} = \theta_e + \theta_p = 0.5 l \phi_y + (\phi_u - \phi_y) l_p$$

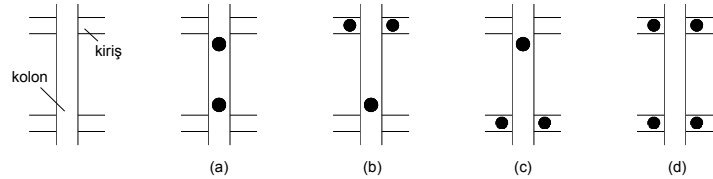
$$\Delta_{AB} = \phi_y \frac{l}{2} \times \frac{2l}{3} + (\phi_u - \phi_y) l_p \left(l - \frac{l_p}{2} \right)$$

$$l_p = 0.25 d + 0.075 z$$

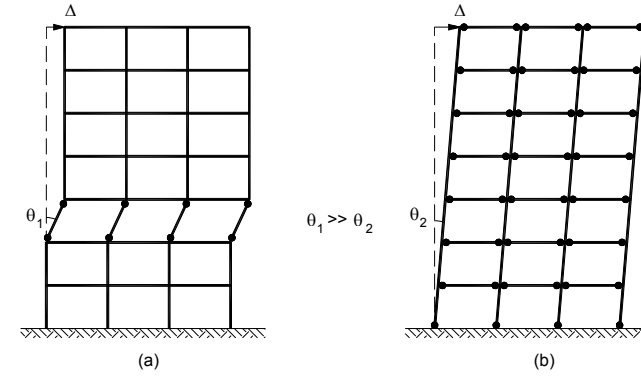
$$\theta_p = \left(\frac{\varepsilon_{cu}}{x_u} - \frac{\varepsilon_{ce}}{x_e} \right) l_p$$

$$l_p = 0.50 d + 0.050 z$$

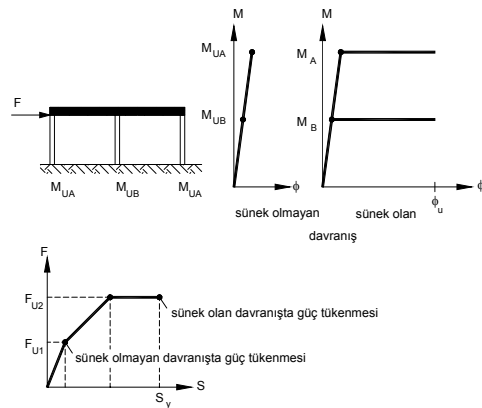
Kat kiriş ve kolonlarında plastik mafsalsal



Çerçeve plastik mafsalsal



Boyutlamada kapasite ilkesi



Boyutlamada kapasite ilkesi

$$F_{U1} = \frac{M_{UA}}{h/2} + \frac{M_{UB}}{h/2} + \frac{M_{UA}}{h/2} = \frac{6M_{UB}}{h}$$

$$F_{U2} = \frac{M_{UA}}{h/2} + \frac{M_{UB}}{h/2} + \frac{M_{UA}}{h/2} = \frac{2}{h} (2M_{UA} + M_{UB})$$

$$M_{UA} = 2 M_{UB}$$

$$F_{U2} = \frac{10M_{UB}}{h}$$

