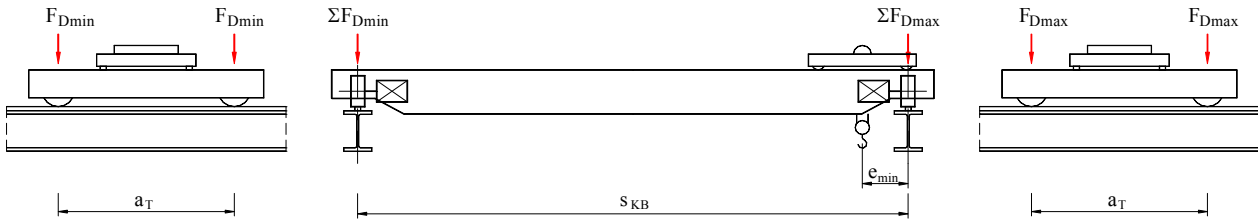
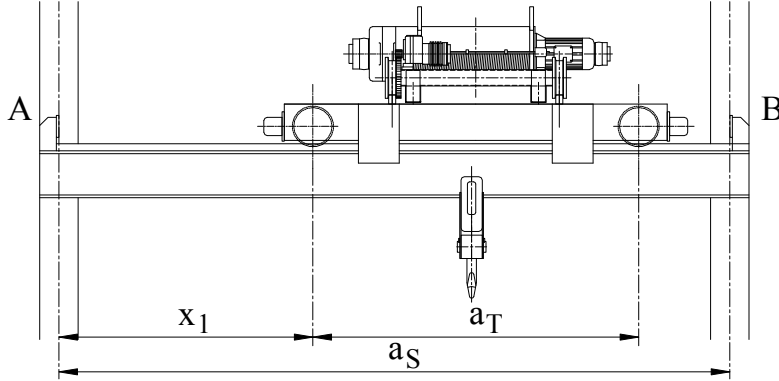


1 Aralıklı Vinç Yolu, Tekerlek kuvvetleri eşit

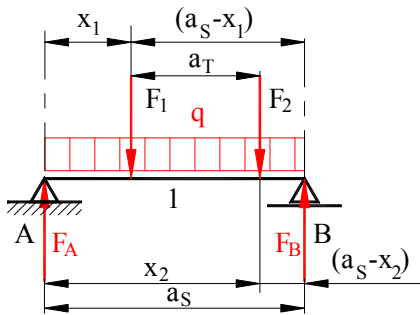
Değerler Ornek_01_01_Kiris100kNx20m.pdf dosyasından

Reference: C:\0\42_00_Ornek_01_0_Giris-TK-Esit.xmcd

Vinç ve vinç yolu hakkında bilgiler



Hesaplar için gereken değerler



VY nun birim ağırlık kuvveti

$$q = 1138.8 \cdot \text{N} \cdot \text{m}^{-1}$$

Raya dik dikey kuvvetler:

$$F_{Dmax} = 93.50 \cdot \text{kN}$$

Raya dik yatay kuvvetler:

$$F_Y = 13.75 \cdot \text{kN}$$

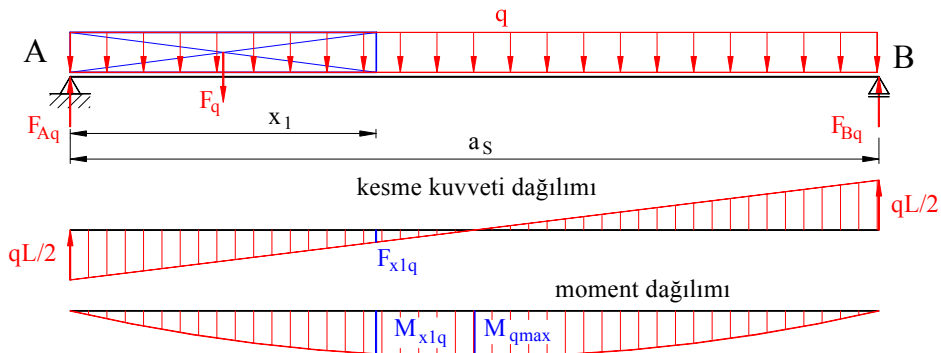
Ray boyunca kuvvetler:

$$F_B = 18.70 \cdot \text{kN}$$

Tekerlek kuvvetlerinin torsiyon momenti:

$$M_{tmax} = 7.86 \cdot \text{kN} \cdot \text{m}$$

Vinç yolunun kendi ağırlığından oluşan değerler



Kritik kesit x_1 de moment

$$M_{1qx1} := 0.5 \cdot q \cdot x_1 \cdot (a_S - x_1)$$

$$M_{1qx1} = 6.56 \cdot \text{kN} \cdot \text{m}$$

max kesme kuvveti

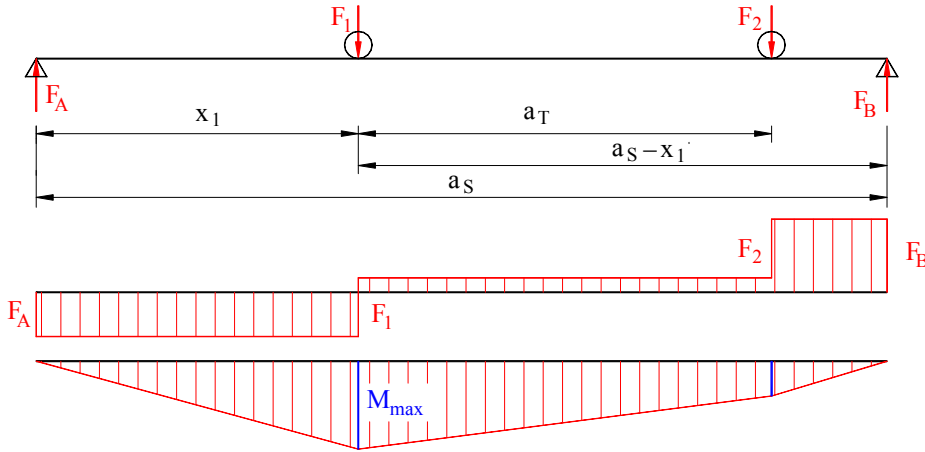
$$F_{1\tau q} := 0.5 \cdot q \cdot a_S$$

$$F_{1\tau q} = 3.99 \cdot \text{kN}$$

Sistemin ortasındaki sehim

$$w_{1mq} := \frac{5 \cdot q \cdot a_S^4}{384 \cdot E \cdot I_y}$$

$$w_{1mq} = 0.344 \cdot \text{mm}$$

Vinç yolunda tekerlek kuvvetlerinden oluşan değerler

Kritik kesit x_1 de moment $M_{1Fy\max} := \frac{F_{D\max} \cdot x_1}{a_S} \cdot (2 \cdot a_S - 2x_1 - a_T) \cdot \varphi_{dy}$

$$M_{1Fy\max} = 281.41 \cdot \text{kN} \cdot \text{m}$$

$$M_{1Fz\max} := M_{1Fy\max} \cdot \varphi_Y$$

$$M_{1Fz\max} = 41.37 \cdot \text{kN} \cdot \text{m}$$

$$F_{1\tau F} := F_{D\max} \cdot \left(1 + \frac{a_S - a_T}{a_S} \right)$$

$$F_{1\tau F} = 141.59 \cdot \text{kN}$$

$$w_{1zF} := \frac{F_{D\max} \cdot (a_S - a_T)}{48 \cdot E \cdot I_y} \cdot [3 \cdot a_S^2 - (a_S - a_T)^2]$$

$$w_{1zF} = 9.09 \cdot \text{mm}$$

$$w_{1yF} := w_{1zF} \cdot \varphi_Y \cdot I_y \cdot I_{züt}^{-1}$$

$$w_{1yF} = 7.30 \cdot \text{mm}$$

Vinç yolu için toplam değerler:

x1 deki toplam moment

$$M_{1y\max} := M_{1Fy\max} + M_{1qx1}$$

$$M_{1y\max} = 287.98 \cdot \text{kN} \cdot \text{m}$$

$$M_{1z\max} := M_{1Fz\max}$$

$$M_{1z\max} = 41.37 \cdot \text{kN} \cdot \text{m}$$

Maksimum kesme kuvvet

$$F_{1\tau\max} := F_{1\tau F} + F_{1\tau q}$$

$$F_{1\tau\max} = 145.58 \cdot \text{kN}$$

$$w_{1z} := w_{1zF} + w_{1mq}$$

$$w_{1z} = 9.44 \cdot \text{mm}$$

maksimum sehim

$$w_{1y} := w_{1yF}$$

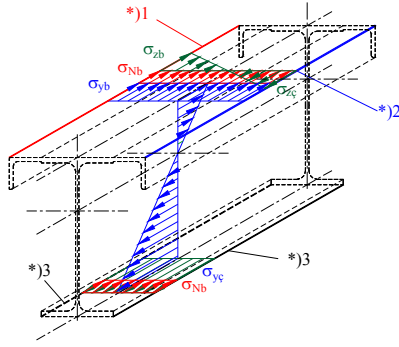
$$w_{1y} = 7.30 \cdot \text{mm}$$

Maksimum torsiyon momenti

$$M_{1t\max} := M_{t\max}$$

$$M_{1t\max} = 7.86 \cdot \text{kN} \cdot \text{m}$$

1. Gerilmelerin kontrolü



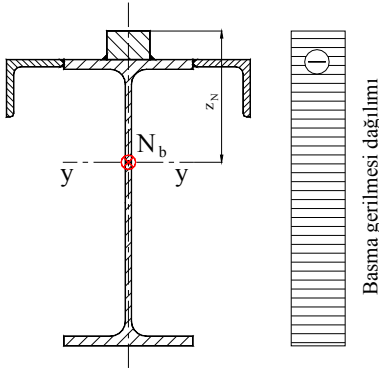
1. Hal üst kuşakta gerilmeler

$$\sigma_{1H} = \sigma_{Nb} + \sigma_{yb} + \sigma_{zb}$$

2. Hal alt kuşakta gerilmeler

$$\sigma_{2H} = \sigma_N + \sigma_{y\varphi}$$

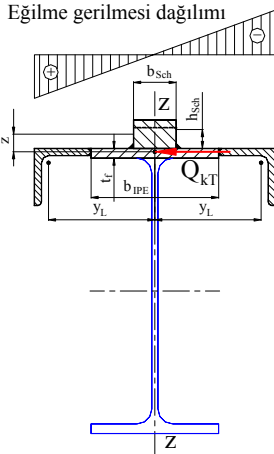
Boyuna kuvvetten oluşan gerilme



Gerilmeler alanın her noktasında sabit kabul edilir.

$$A_{Si} = 14780.00 \cdot \text{mm}^2$$

$$\sigma_{Nb} := \frac{F_B \cdot \varphi_{dy}}{A_{Si}} \quad \sigma_{Nb} = 1.90 \cdot \text{MPa}$$



z-eksenine göre eğilme gerilmesi

$$y_L = 159.60 \cdot \text{mm}$$

$$b_{Tot} := b_p + 2 \cdot b_L$$

$$b_{Tot} = 370.00 \cdot \text{mm}$$

$$b_R = 60.00 \cdot \text{mm}$$

$$h_R = 30.00 \cdot \text{mm}$$

xy-Düzleminde eğilme gerilmesi " σ_{zBi} "

$$M_{1Fzmax} = 41.4 \cdot \text{kN} \cdot \text{m}$$

$$W_{züT} = 487.4 \cdot 10^3 \text{ mm}^3$$

$$\sigma_{1zmax} := \frac{M_{1Fzmax}}{W_{züT}}$$

$$\sigma_{1zmax} = 84.9 \cdot \text{MPa}$$

Yalnız köşebent köşelerinde. Alt kuşakta etkisi yok.

y-eksenine göre eğilme gerilmesi

Alt kuşakta eğilme gerilmesi

$$\sigma_{y\varphi} := \frac{M_{1ymax}}{W_y}$$

$$\sigma_{y\varphi} = 173.19 \cdot \text{MPa}$$

Üst kuşakta eğilme gerilmesi

$$h_{\bar{u}} := e_o - h_R$$

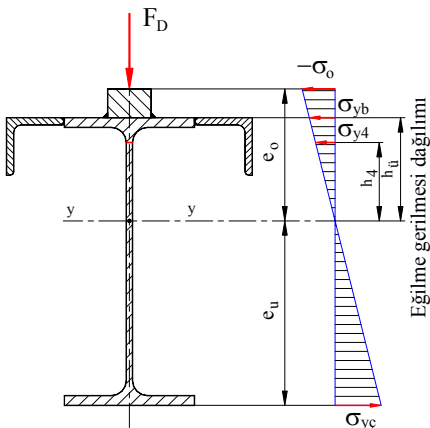
$$\sigma_{yb} := \sigma_{y\varphi} \cdot \frac{h_{\bar{u}}}{e_u}$$

$$\sigma_{yb} = 90.02 \cdot \text{MPa}$$

$$h_{\bar{u}} = 153.91 \cdot \text{mm}$$

$$e_o = 183.91 \cdot \text{mm}$$

$$e_u = 296.09 \cdot \text{mm}$$



1. Hal üst kuşakta gerilmeler

$$\sigma_{1H} := \sigma_{Nb} + \sigma_{yb} + \sigma_{1zmax} \quad \sigma_{1H} = 176.79 \cdot \text{MPa}$$

2. Hal alt kuşakta gerilmeler

$$\sigma_{2H} := \sigma_{Nb} + \sigma_{yç} \quad \sigma_{2H} = 175.09 \cdot \text{MPa}$$

Maksimum toplam gerilme:

$$\sigma_{1y_{max}} := \sigma_{1H} \quad \sigma_{1y_{max}} = 176.79 \cdot \text{MPa}$$

$$\sigma_{1y_{max}} = 177 \cdot \text{MPa} < f_{\sigma EM} = 214 \cdot \text{MPa} \quad \text{yeterli}$$

$$\sigma_{1z_{max}} = 85 \cdot \text{MPa} < f_{\sigma EM} = 214 \cdot \text{MPa} \quad \text{yeterli}$$

1.2. Kayma gerilmeleri kontrolü

$$\text{Üst kuşakta} \quad h_{\tau} := e_o - h_R - 0.5 \cdot t_f$$

$$F_{1\tau y} := \frac{M_{1tmax}}{h_{\tau}} \quad F_{1\tau y} = 53.62 \cdot \text{kN}$$

$$\tau_{1max} := \frac{F_{1\tau y}}{A_{\tau}} \quad h_{\tau} = 146.61 \cdot \text{mm}$$

$$\tau_{1max} = 6.99 \cdot \text{MPa} < f_{\tau EM} = 123 \cdot \text{MPa} \quad \text{yeterli}$$

$$\text{Dikmede} \quad h_{Di} := h_p - 2 \cdot t_f - 2 \cdot r_p$$

$$A_{Di} := h_{Di} \cdot t_w \quad A_{Di} = 3560.72 \cdot \text{mm}^2$$

$$\tau_{1Di} := \frac{F_{1\tau max}}{A_{Di}} \quad F_{1\tau max} = 145.58 \cdot \text{kN}$$

$$\tau_{1Di} = 40.88 \cdot \text{MPa} < f_{\tau EM} = 123 \cdot \text{MPa} \quad \text{yeterli}$$

Minimum dikme boyu

$$h_{1Dimin} := \frac{F_{1\tau max}}{t_w \cdot f_{\tau EM}}$$

$$h_{1Dimin} = 125.56 \cdot \text{mm} < h_{Di} = 378.80 \cdot \text{mm} \quad \text{yeterli}$$

1.3. Toplam gerilim kontrolü

$$\sigma_{1top} := \sqrt{\sigma_{1y_{max}}^2 + 3 \cdot \tau_{1max}^2}$$

$$\sigma_{1top} = 177.21 \cdot \text{MPa} < f_{\sigma EM} = 214 \cdot \text{MPa} \quad \text{yeterli}$$

2. Sehim kontrolü

Dikey z-yönünde sehim

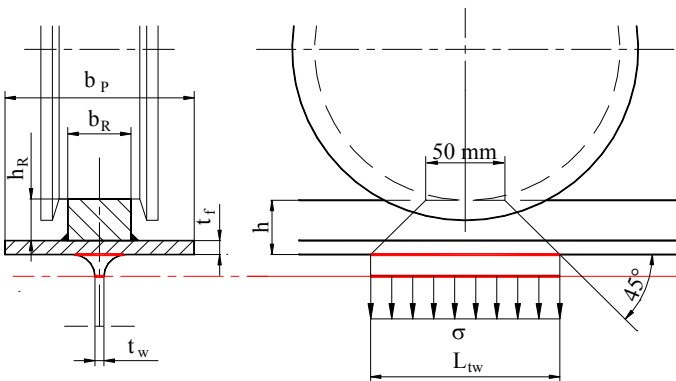
$$w_{zEM} := \frac{a_S}{700}$$

$$w_{zEM} = 10.00 \cdot \text{mm} > w_{Lz} = 9.44 \cdot \text{mm} \quad \text{yeterli}$$

Yatay y-yönünde sehim

$$w_{yEM} := \frac{a_S}{800}$$

$$w_{yEM} = 8.75 \cdot \text{mm} > w_{Ly} = 7.30 \cdot \text{mm} \quad \text{yeterli}$$

3. Lokal kuvvetlerin iletişim kontrolü

$$L_{tw} := 2 \cdot (h_R + t_f) + 50 \cdot \text{mm} \quad L_{tw} = 139.20 \cdot \text{mm}$$

$$A_{tw} := L_{tw} \cdot t_w \quad A_{tw} = 1308.48 \cdot \text{mm}^2$$

Kesitin taşıyacağı emniyetli kuvvet

$$F_{TDEM} := \frac{f_y \cdot A_{tw}}{\gamma_{M1}} \quad F_{TDEM} = 293 \cdot \text{kN}$$

Tekerlerde max kuvvet

$$F_{Dmax} = 94 \cdot \text{kN} < F_{TDEM} = 293 \cdot \text{kN} \quad \text{yeterli}$$

4. Stabilite kontrolü

Profil flanşının narinlik sayısı $\beta_{1s} := \sqrt[4]{\frac{b_p}{10 \cdot t_f}}$ $\beta_{1s} = 1.07$ $\beta_{1s} < 1,25$

Tek taraflı yüklemenin narinlik sayısı $\beta_{2s} := \sqrt[2]{\frac{60t_w}{h_p - t_f}}$ $\beta_{2s} = 1.14$ $\beta_{2s} > 1,0$

Kuvvet etkisinin faktörü $\beta_{3s} := 1 + \frac{L_{tw}}{h_p - t_f}$ $\beta_{3s} = 1.32$ $\beta_{3s} < 1,5$

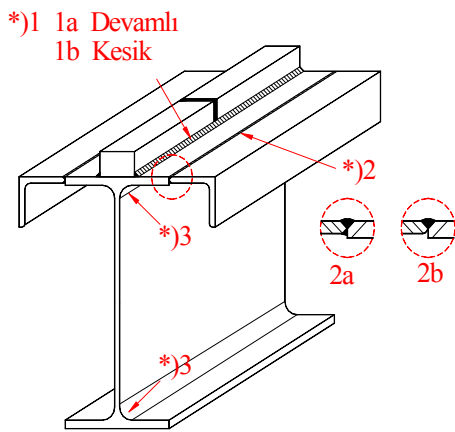
$h_4 := e_o - t_f - r_p$ $h_4 = 148.31 \cdot \text{mm}$ $\sigma_{y4eg} := \sigma_{yç} \cdot \frac{h_4}{-e_u}$ $\sigma_{y4eg} = -87 \cdot \text{MPa}$

$\sigma_{\beta 4} := \sigma_{y4eg} + \sigma_{Nb}$ $\sigma_{\beta 4} = -84.85 \cdot \text{MPa}$

Boyuna gerilme faktörü $\beta_{4sx} := 1.5 - \frac{\sigma_{\beta 4} \cdot \gamma_{M1}}{f_y}$ $\beta_{4sx} = 1.88$ $\beta_{4s} < 1,0$ $\beta_{4s} := 1.0$

$F_{TEM} := \frac{f_y \cdot t_w^2}{2 \gamma_{M1}} \cdot \sqrt{\frac{E \cdot t_f}{f_y \cdot t_w}} \cdot \beta_{1s} \cdot \beta_{2s} \cdot \beta_{3s} \cdot \beta_{4s}$ $F_{TEM} = 591 \cdot \text{kN} > F_{Dmax} = 94 \cdot \text{kN}$ **yeterli**

5. Yorulma kontrolleri



Yorulma mukavemet değerleri

*1a $\Delta\sigma_{c1} := 125 \cdot \text{MPa}$

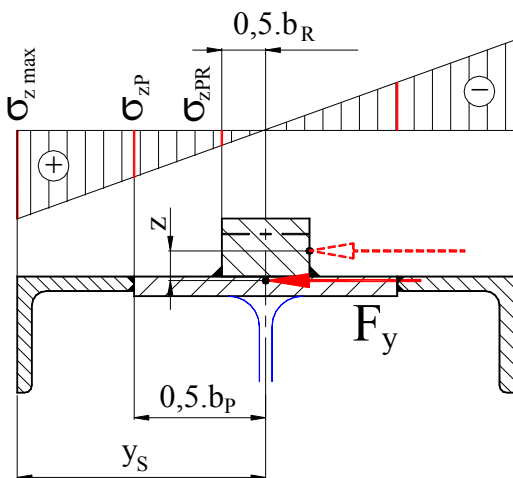
*2b $\Delta\sigma_{c2} := 100 \cdot \text{MPa}$

*3 $\Delta\sigma_{c3} := 125 \cdot \text{MPa}$

5.1. Yorulma kontrolü; Ray/profil kaynak bağlantısı *)1a

Profil Ray kaynak bağlantısında mukavemet değeri:

$\Delta\sigma_{c1} = 125.00 \cdot \text{MPa}$



$\sigma_{zPR} := \sigma_{1zmax} \cdot \frac{b_R}{2 \cdot y_S}$

$\sigma_{zPR} = 13.76 \cdot \text{MPa}$

*)1 de eşdeğer gerilmeler

$\sigma_{1maxE} := \sigma_{Nb} + \sigma_{yb} + \sigma_{zPR}$

$\sigma_{1maxE} = 105.68 \cdot \text{MPa}$

$\sigma_{1minE} := \frac{M_{1qx1}}{W_y}$

$\sigma_{1minE} = 3.95 \cdot \text{MPa}$

Gerilme farkı

$\lambda_E = 0.49$

$\Delta\sigma_{1zPR} := (\sigma_{1maxE} - \sigma_{1minE}) \cdot \lambda_E$ $\Delta\sigma_{1zPR} = 50 \cdot \text{MPa}$

Emniyetli gerilme $\Delta\sigma_{1EM} := \frac{\Delta\sigma_{c1}}{\gamma_{Mf}}$

$\Delta\sigma_{1EM} = 109 \cdot \text{MPa} > \Delta\sigma_{1zPR} = 50 \cdot \text{MPa}$ **yeterli**

5.2. Yorulma kontrolü; L/IP kaynak bağlantısı *)2b

Profil L-Profilli kaynak bağlantısında mukavemet değeri:

$$\Delta\sigma_{c2} = 100.00 \cdot \text{MPa}$$

$$\sigma_{zP1} := \sigma_{1z\max} \cdot \frac{b_p}{2 \cdot y_S}$$

$$\sigma_{zP1} = 43.58 \cdot \text{MPa}$$

*)2 de eşdeğer gerilmeler

$$\sigma_{1\max2E} := \sigma_{Nb} + \sigma_{yb} + \sigma_{zP1} \quad \sigma_{1\max2E} = 135.50 \cdot \text{MPa} \quad \sigma_{1\min E} = 3.95 \cdot \text{MPa}$$

Gerilme farkı

$$\Delta\sigma_{1zP} := (\sigma_{1\max2E} - \sigma_{1\min E}) \cdot \lambda_E$$

$$\Delta\sigma_{1zP} = 64 \cdot \text{MPa}$$

Emniyetli gerilme

$$\Delta\sigma_{2EM} := \frac{\Delta\sigma_{c2}}{\gamma_{Mf}}$$

$$\Delta\sigma_{2EM} = 87 \cdot \text{MPa}$$

$$> \Delta\sigma_{1zP} = 64 \cdot \text{MPa} \quad \text{yeterli}$$

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5.3. Yorulma kontrolü; Dikmeye bağlanan radyusta *)3

Dikmeye bağlanan yerde mukavemet değeri:

$$F_{1\tau\max} = 145.58 \cdot \text{kN}$$

$$\Delta\sigma_{c3} = 125.00 \cdot \text{MPa}$$

*)3 de gerilmeler

$$\sigma_{13\max} := \frac{F_{D\max}}{L_{tw} \cdot t_w}$$

$$\sigma_{13\max} = 71.46 \cdot \text{MPa}$$

$$\sigma_{13\min} := 0 \cdot \text{MPa}$$

Gerilme farkı

$$\Delta\sigma_{13} := (\sigma_{13\max} - \sigma_{13\min}) \cdot \lambda_E$$

$$\Delta\sigma_{13} = 35 \cdot \text{MPa}$$

$$\Delta\sigma_{3EM} := \frac{\Delta\sigma_{c3}}{\gamma_{Mf}}$$

$$\Delta\sigma_{3EM} = 109 \cdot \text{MPa}$$

$$> \Delta\sigma_{13} = 35 \cdot \text{MPa} \quad \text{yeterli}$$

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Sonuç: Hesaplara ve kabullere göre düşünülen konstrüksiyon üretime verilebilir.

Son
