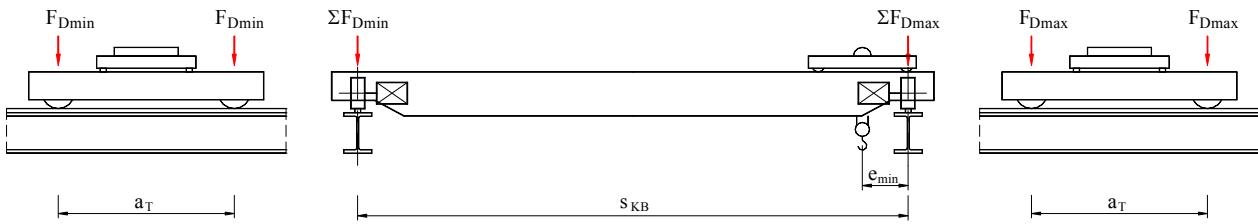
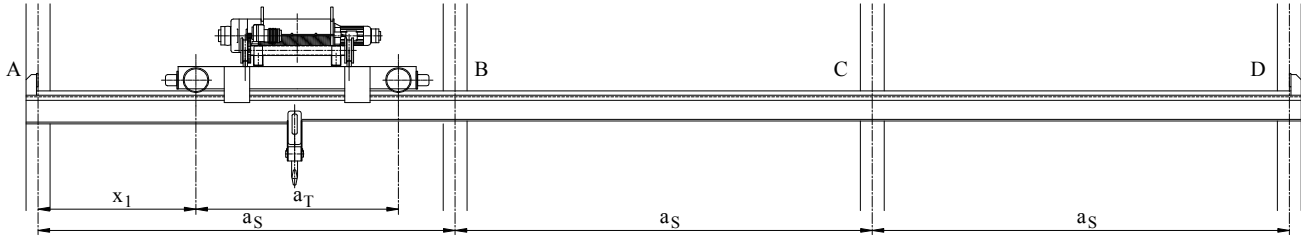
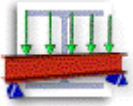


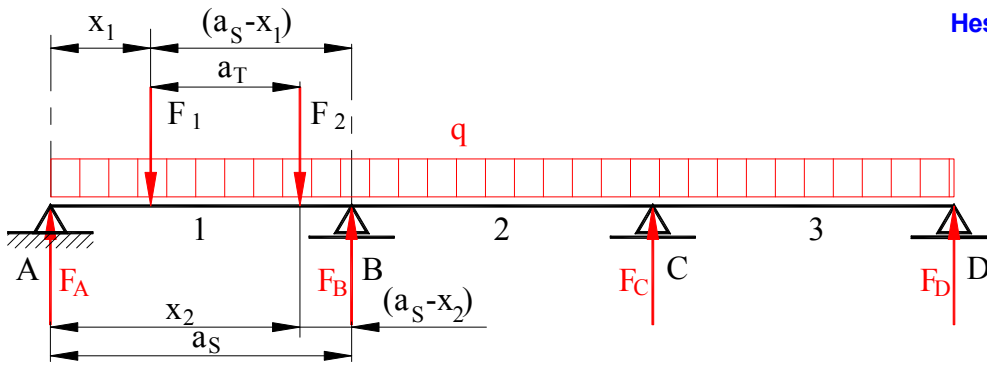
3 Aralıklı Vinç Yolu, Tekerlek kuvvetleri eşit

Değerler Ornek_01_01_Kiris100kNx20m.pdf dosyasından

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



Hesaplar için gereken değerler



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

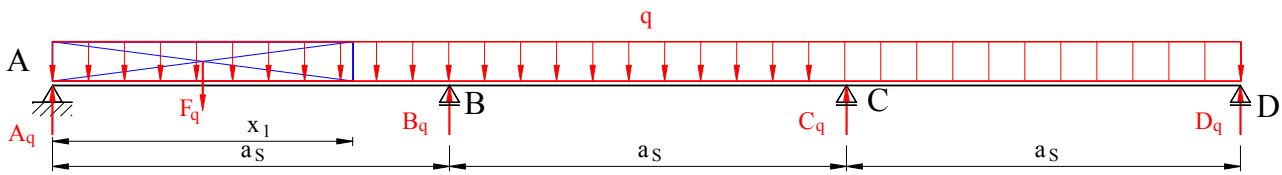
$$F_{Dmax} = 93.50 \cdot \text{kN}$$

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

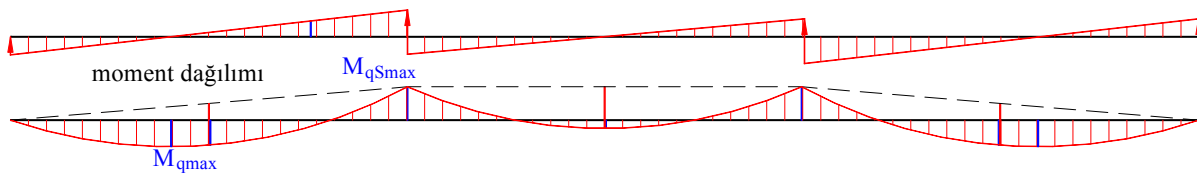
$$F_B = 18.70 \cdot \text{kN}$$

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

Vinç yolunun kendi ağırlığından oluşan değerler



kesme kuvveti dağılımı

Kritik kesit x_1 de moment

$$M_{3qx1} := 0.1 \cdot q \cdot x_1 \cdot (4 \cdot a_s - 5 \cdot x_1)$$

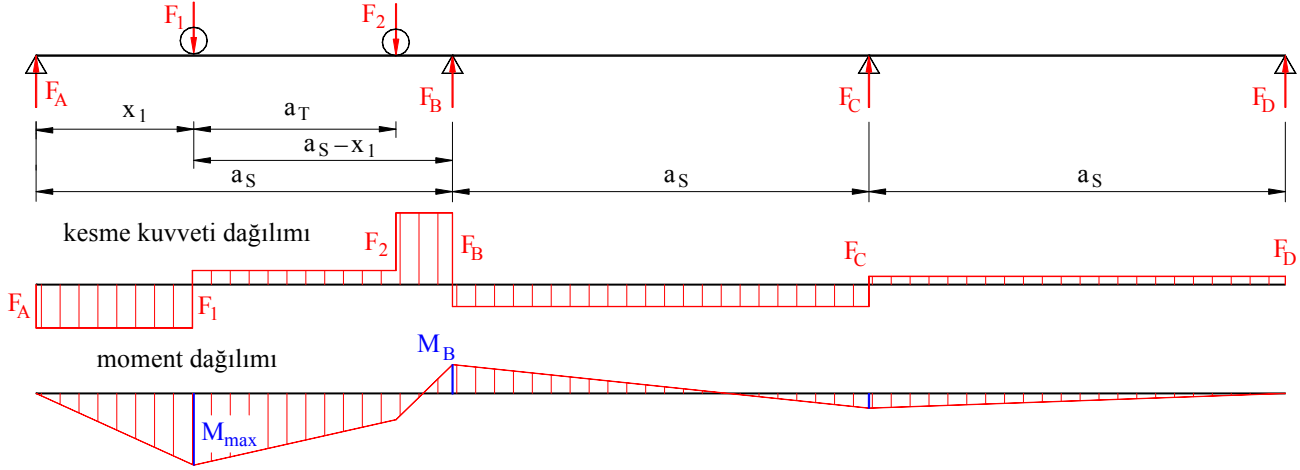
$$M_{3qx1} = 4.45 \cdot \text{kN} \cdot \text{m}$$

max kesme kuvveti

$$F_{3\tau q} := 1.1 \cdot q \cdot a_s$$

$$F_{3\tau q} = 8.769 \cdot \text{kN}$$

Aralık ortasında sehim $w_{3qm} := \frac{13 \cdot q \cdot a_S^4}{1920 \cdot E \cdot I_y}$ $w_{3qm} = 0.179 \cdot \text{mm}$

Vinç yolunda tekerlek kuvvetlerinden oluşan değerler

$$M_{3Fy\max} := \frac{F_{D\max} \cdot x_1}{34 \cdot a_S^3} \left[68 \cdot a_S^3 - 43 \cdot a_S^2 \cdot (x_1 + x_2) + 9 \cdot (x_1^3 + x_2^3) \right] \cdot \varphi_{dy} \quad M_{3Fy\max} = 227.99 \cdot \text{kN} \cdot \text{m}$$

$$M_{3Fz\max} := M_{3Fy\max} \cdot \varphi_Y \quad M_{3Fz\max} = 33.51 \cdot \text{kN} \cdot \text{m}$$

$$F_{3\tau F} := \frac{F_{D\max}}{17 \cdot a_S^3} \left[27 \cdot a_S^2 \cdot (x_1 + x_2) - 10 \cdot (x_1^3 + x_2^3) \right] \quad F_{3\tau F} = 146.08 \cdot \text{kN}$$

$$w_{3mFz} := \frac{F_{D\max}}{1632 \cdot E \cdot I_y} \cdot \left[75 \cdot a_S^2 \cdot (x_1 - x_2) - 109 \cdot (x_1^3 - x_2^3) \right] \quad w_{3mFz} = 5.33 \cdot \text{mm}$$

$$w_{3mFy} := w_{3mFz} \cdot \varphi_Y \cdot I_y \cdot I_{züT}^{-1} \quad w_{3mFy} = 4.28 \cdot \text{mm}$$

Vinç yolunun toplam değerleri:

$$x_1 \text{ deki toplam moment} \quad M_{3y\max} := M_{3Fy\max} + M_{3qx1} \quad M_{3y\max} = 232.44 \cdot \text{kN} \cdot \text{m}$$

$$M_{3z\max} := M_{3Fy\max} \cdot \varphi_Y \quad M_{3z\max} = 33.51 \cdot \text{kN} \cdot \text{m}$$

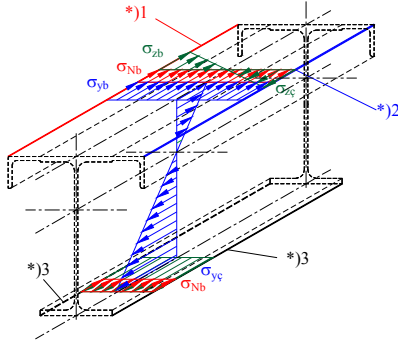
$$\text{maksimum kesme kuvveti} \quad F_{3\tau\max} := F_{3\tau F} + F_{3\tau q} \quad F_{3\tau\max} = 154.85 \cdot \text{kN}$$

$$\text{maksimum sehim} \quad w_{3z} := w_{3mFz} + w_{3qm} \quad w_{3z} = 5.51 \cdot \text{mm}$$

$$w_{3y} := w_{3mFy} \quad w_{3y} = 4.28 \cdot \text{mm}$$

$$\text{maksimum torsiyon momenti} \quad M_{t\max} = 7.86 \cdot \text{kN} \cdot \text{m}$$

1. Gerilmelerin kontrolü



1.1. Normal gerilmelerin kontrolü:

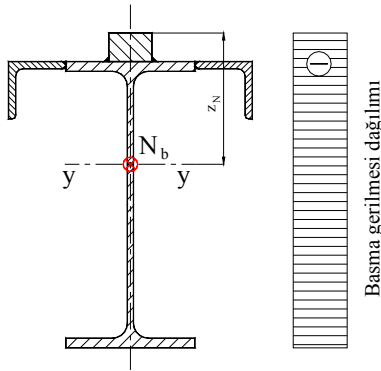
1. Hal üst kuşakta gerilmeler

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

2. Hal alt kuşakta gerilmeler

$$\sigma_{2H} = \sigma_N + \sigma_{yç}$$

Boyuna kuvvetten oluşan gerilme

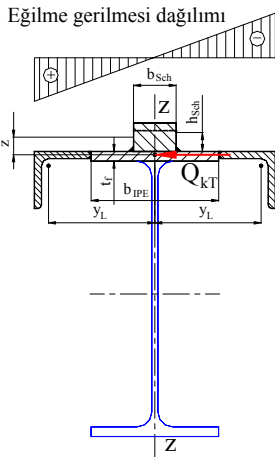


Kabul: Gerilmeler alanın her noktasında sabit

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

$$\sigma_{Nb} := \frac{F_B \cdot \varphi_{dy}}{A_{Si}}$$

$$\sigma_{Nb} = 1.90 \cdot \text{MPa}$$



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_{Bi} "

$$M_{3zmax} = 33.5 \cdot \text{kN} \cdot \text{m}$$

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

$$\sigma_{3zmax} := \frac{M_{3zmax}}{W_{züT}}$$

$$\sigma_{3zmax} = 68.8 \cdot \text{MPa}$$

Yalnız köşebent köşelerinde. Alt kuşakta etkisi yok.

y-eksenine göre eğilme gerilmesi

Alt kuşakta eğilme gerilmesi

$$\sigma_{yç} := \frac{M_{3ymax}}{W_y}$$

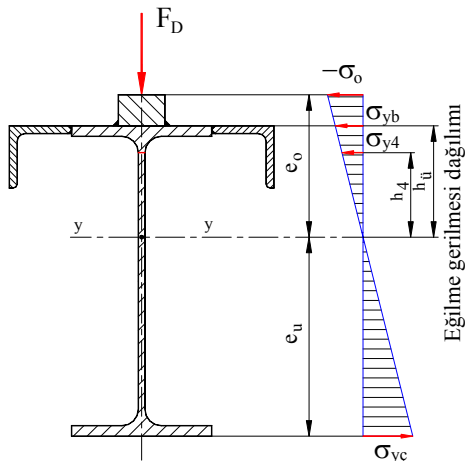
$$\sigma_{yç} = 139.79 \cdot \text{MPa}$$

Üst kuşakta eğilme gerilmesi

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

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

$$\sigma_{yb} = 72.66 \cdot \text{MPa}$$



1. Hal üst kuşakta gerilmeler

$$\sigma_{1H} := \sigma_{Nb} + \sigma_{yb} + \sigma_{3zmax} \quad \sigma_{1H} = 143.32 \cdot \text{MPa}$$

2. Hal alt kuşakta gerilmeler

$$\sigma_{2H} := \sigma_{Nb} + \sigma_{yç} \quad \sigma_{2H} = 141.69 \cdot \text{MPa}$$

Maksimum toplam gerilme

$$\sigma_{3ymax} := \sigma_{1H}$$

$$\sigma_{3ymax} = 143 \cdot \text{MPa} < f_{\sigma EM} = 214 \cdot \text{MPa} \quad \text{yeterli}$$

$$\sigma_{3zmax} = 69 \cdot \text{MPa} < f_{\sigma EM} = 214 \cdot \text{MPa} \quad \text{yeterli}$$

1.2. Kayma gerilmeleri kontrolü

Üst kuşakta

$$h_{SP} := e_o - h_R - 0.5 \cdot t_f$$

$$F_{3üT\tau} := \frac{M_{tmax}}{h_{SP}}$$

$$F_{3üT\tau} = 53.62 \cdot \text{kN}$$

$$\tau_{3max} := \frac{F_{3üT\tau}}{A_{üT}}$$

$$\tau_{3max} = 6.99 \cdot \text{MPa} < f_{\tau EM} = 123 \cdot \text{MPa} \quad \text{yeterli}$$

Dikmede

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

$$A_{Di} := h_{Di} \cdot t_w$$

$$A_{Di} = 3560.72 \cdot \text{mm}^2$$

$$\tau_{3Di} := \frac{F_{3\tau max}}{A_{Di}}$$

$$F_{3\tau max} = 154.85 \cdot \text{kN}$$

$$\tau_{3Di} = 43.49 \cdot \text{MPa} < f_{\tau EM} = 123 \cdot \text{MPa} \quad \text{yeterli}$$

Sütunda minimum dikme boyu

$$h_{3Dimin} := \frac{F_{3\tau max}}{t_w \cdot f_{\tau EM}}$$

$$h_{3Dimin} = 133.55 \cdot \text{mm} < h_{Di} = 378.80 \cdot \text{mm} \quad \text{yeterli}$$

1.3. Toplam gerilim kontrolü

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

$$\sigma_{3top} = 143.83 \cdot \text{MPa} < f_{\sigma EM} = 214 \cdot \text{MPa} \quad \text{yeterli}$$

2. Sehim kontrolü

Dikey z-yönünde sehim

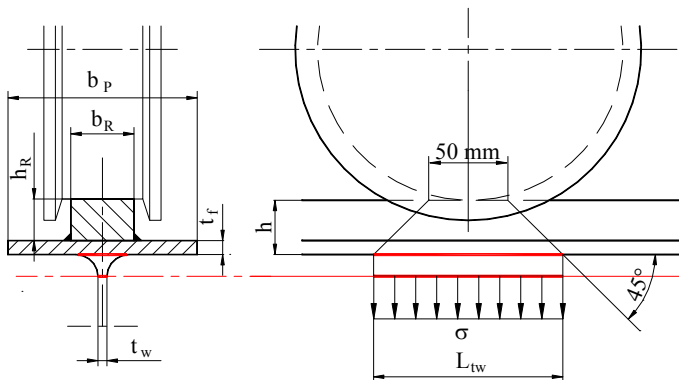
$$w_{zEM} := \frac{a_s}{700}$$

$$w_{zEM} = 10.00 \cdot \text{mm} > w_{3z} = 5.51 \cdot \text{mm} \quad \text{yeterli}$$

Yatay y-yönünde sehim

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

$$w_{yEM} = 8.75 \cdot \text{mm} > w_{3y} = 4.28 \cdot \text{mm} \quad \text{yeterli}$$

3. Lokal kuvvetlerin iletim kontrolü

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

$$L_{tw} = 139.20 \cdot \text{mm}$$

$$A_{tw} := L_{tw} \cdot t_w$$

$$A_{tw} = 1308.48 \cdot \text{mm}^2$$

Kesitin taşıyacağı emniyetli kuvvet

$$F_{TDEM} := \frac{f_y \cdot A_{tw}}{\gamma_{M1}}$$

$$F_{TDEM} = 293 \cdot \text{kN}$$

Tekerlekte max kuvvet

$$F_{Dmax} = 94 \cdot \text{kN}$$

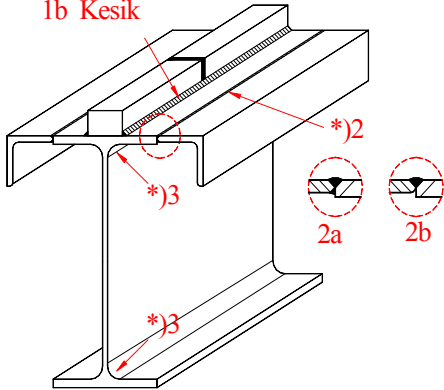
$$F_{Dmax} = 94 \cdot \text{kN} < F_{TDEM} = 293 \cdot \text{kN} \quad \text{yeterli}$$

4. Stabilité 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	$\beta_{3s} := 1 + \frac{L_{tw}}{h_p - t_f}$	$\beta_{3s} = 1.32$	$\beta_{3s} < 1,5$
$h_4 := e_o - t_f - r_p$	$h_4 = 148.31 \cdot \text{mm}$	$\sigma_{y4eg} := -\sigma_{yç} \cdot \frac{h_4}{-e_u}$	$\sigma_{y4eg} = 70 \cdot \text{MPa}$
$\sigma_{\beta 4} := \sigma_{y4eg} + \sigma_{Nb}$	$\sigma_{\beta 4} = 71.92 \cdot \text{MPa}$		
Boyuna gerilme faktörü	$\beta_{4sx} := 1.5 - \frac{\sigma_{\beta 4} \cdot \gamma_{M1}}{f_y}$	$\beta_{4sx} = 1.18$	$\beta_{4s} < 1,0$ $\beta_{4s} := 1.0$
$F_{TEM} := \frac{f_y \cdot t_w^2}{2\gamma_{M1}} \cdot \sqrt{\frac{E \cdot t_f}{f_y \cdot t_w}} \cdot \beta_{1s} \cdot \beta_{2s} \cdot \beta_{3s} \cdot \beta_{4s}$	$F_{TEM} = 591 \cdot \text{kN}$	$F_{Dmax} = 94 \cdot \text{kN}$	yeterli

5. Yorulma kontrolleri

*)1 la Devamlı
1b Kesik



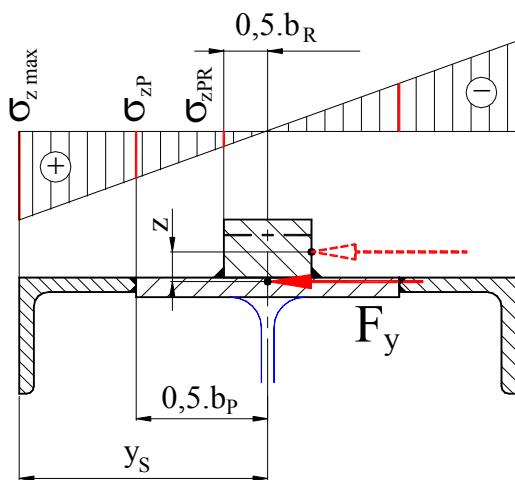
Yorulma mukavemet değerleri

*)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:

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



$$\sigma_{zPR} := \sigma_{3zmax} \cdot \frac{b_R}{2 \cdot y_S}$$

$$\sigma_{zPR} = 11.15 \cdot \text{MPa}$$

*)1 de eşdeğer gerilmeler

$$\sigma_{3maxE} := \sigma_{Nb} + \sigma_{yb} + \sigma_{zPR}$$

$$\sigma_{3maxE} = 85.71 \cdot \text{MPa}$$

$$\sigma_{3minE} := \frac{M_{3qx1}}{W_y}$$

$$\sigma_{3minE} = 2.68 \cdot \text{MPa}$$

Gerilme farkı

$$\Delta\sigma_{3zPR} := (\sigma_{3maxE} - \sigma_{3minE}) \cdot \lambda_E \quad \Delta\sigma_{3zPR} = 41 \cdot \text{MPa}$$

Emniyetli gerilme

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

$$\Delta\sigma_{1EM} = 109 \cdot \text{MPa} > \Delta\sigma_{3zPR} = 41 \cdot \text{MPa} \quad \text{yeterli}$$

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

Profil L-Profilı kaynak bağlantısında mukavemet değeri:

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

$$\sigma_{3zP} := \sigma_{3z\max} \cdot \frac{b_p}{2 \cdot y_S}$$

$$\sigma_{3zP} = 35.31 \cdot \text{MPa}$$

*)2 de eşdeğer gerilmeler

$$\sigma_{3\max2E} := \sigma_{Nb} + \sigma_{yb} + \sigma_{3zP}$$

$$\sigma_{3\max2E} = 109.87 \cdot \text{MPa}$$

$$\sigma_{3\min2E} := \frac{M_{3qx1}}{W_y}$$

$$\sigma_{3\min2E} = 2.68 \cdot \text{MPa}$$

Gerilme farkı

$$\Delta\sigma_{3zP} := (\sigma_{3\max2E} - \sigma_{3\min2E}) \cdot \lambda_E$$

$$\Delta\sigma_{3zP} = 53 \cdot \text{MPa}$$

Emniyetli gerilme

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

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

$$> \Delta\sigma_{3zP} = 53 \cdot \text{MPa} \quad \text{yeterli}$$

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5.3. Yorulma kontrolü; Dikmeye bağlanan radyusta *)3

Dikmeye bağlanan yerde mukavemet değeri:

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

*)3 de gerilmeler

$$\sigma_{33\max} := \frac{F_{D\max}}{L_{tw} \cdot t_w}$$

$$\sigma_{33\max} = 71.46 \cdot \text{MPa}$$

$$\sigma_{33\min} := 0 \cdot \text{MPa}$$

$$\sigma_{33\min} = 0.00 \cdot \text{MPa}$$

Gerilme farkı

$$\Delta\sigma_{33} := (\sigma_{33\max} - \sigma_{33\min}) \cdot \lambda_E$$

$$\Delta\sigma_{33} = 35 \cdot \text{MPa}$$

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

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

$$> \Delta\sigma_{33} = 35 \cdot \text{MPa} \quad \text{yeterli}$$

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Sonuç: Hesaplara ve kabullere göre düşünülen konstrüksiyon üretime verilebilir.

Son