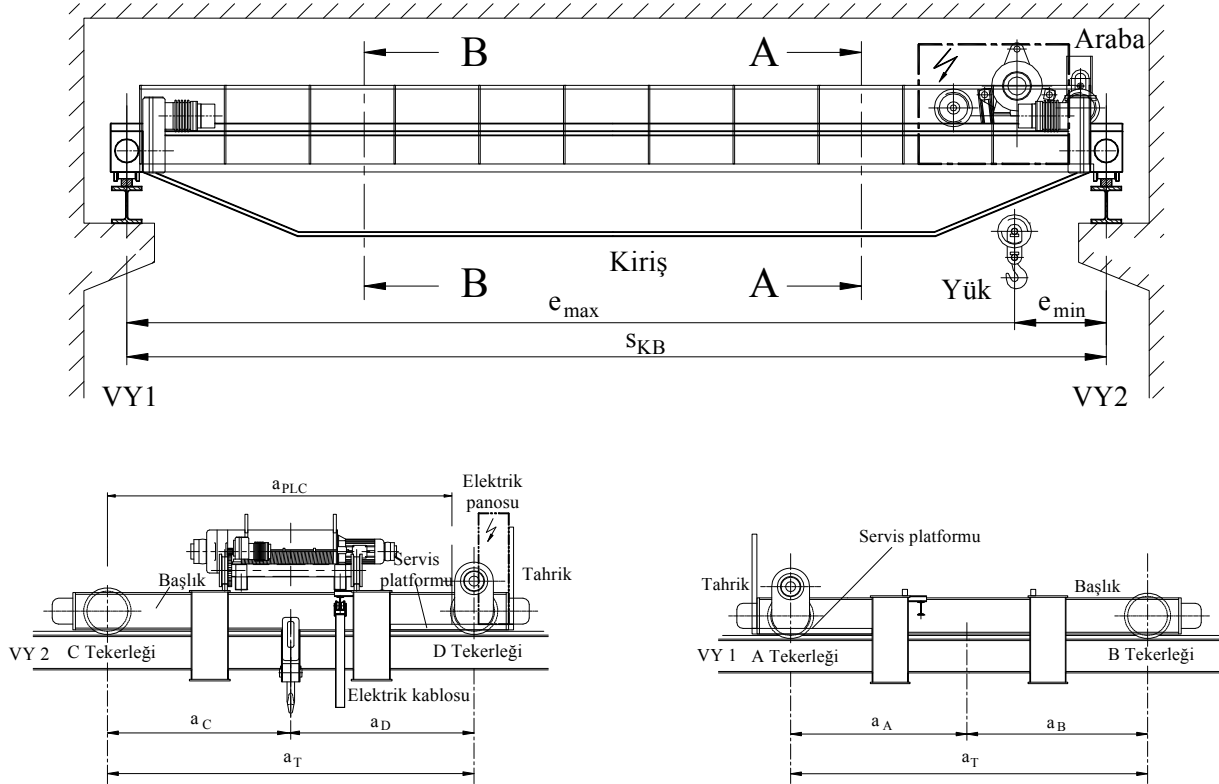


## Vinç Yolu, Eşit kuvvetler için giriş

Değerler Ornek\_01\_01\_Kiris100kNx20m.pdf dosyasından

## 1. Vinç ve vinç yolu hakkında bilgiler



Sütunlar mesafesi

$a_S := 7 \cdot \text{m}$

Vincin kaldırma kapasitesi

$F_{Yü} := 100 \cdot \text{kN}$

Arabanın kendi ağırlık kuvveti

$F_{Ar} := 27.5 \cdot \text{kN}$

Kirişlerin başlıklarla komple ağırlığı

$F_{K1} := 71.2 \cdot \text{kN}$

Elektrik panosunun ağırlık kuvveti

$F_{EP} := 1.5 \cdot \text{kN}$

Servis platformunun ağırlık kuvveti

$F_{PL} := 8.8 \cdot \text{kN}$

Yürüyüş redüktörünün ağırlık kuvveti

$F_{YR} := 2 \cdot \text{kN}$

Vincin kiriş boyu veya ray açıklığı

$S_{KB} := 20 \cdot \text{m}$

Kancanın vinç rayına en küçük mesafesi

$e_{\min} := 1 \cdot \text{m}$

Servis platformunun C tekerleğine mesafesi

$a_{PLC} := 3.2 \cdot \text{m}$

Vinç tekerleklerinin eksen mesafesi

$a_T := 3.4 \cdot \text{m}$

Kaldırma hızı

$v_K := 0.2 \cdot \text{m} \cdot \text{s}^{-1}$

Vincin yükleme sınıfı, Vincin yükleme sayısı sınıfı

$YS := "S1"$

$YG := "C5"$

## Kritik kesitin A sütununa mesafesi

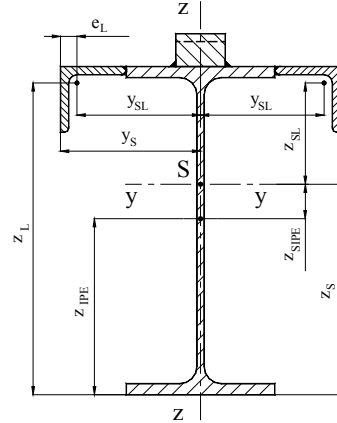
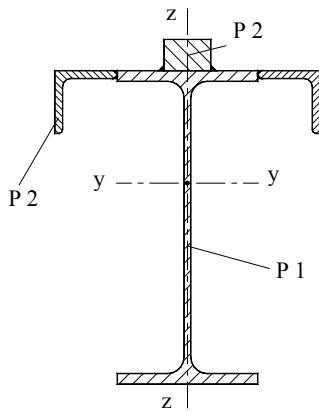
$x_1 := 0.25 \cdot (2 \cdot a_S - a_T)$

$x_1 = 2.65 \text{ m}$

$x_2 := x_1 + a_T$

$x_2 = 6.05 \text{ m}$

## Seçilen vinç yolunun değerleri

**P1, Profil IPE 450,  
Çelik S235 (St 37)**

$$h_p := 450 \cdot \text{mm}$$

$$t_f := 14.6 \cdot \text{mm}$$

$$r_p := 21 \cdot \text{mm}$$

$$A_p := 9880 \cdot \text{mm}^2$$

$$b_p := 190 \cdot \text{mm}$$

$$t_w := 9.4 \cdot \text{mm}$$

$$z_p := 0.5 \cdot h_p$$

$$m_p := 77.6 \cdot \text{kg} \cdot \text{m}^{-1}$$

$$I_{vP} := 337.4 \cdot 10^6 \cdot \text{mm}^4$$

$$I_{zP} := 16.8 \cdot 10^6 \cdot \text{mm}^4$$

**P2, Vinç rayı 60x40,  
Çelik S235 (St 37)**

$$h_s := 40 \cdot \text{mm}$$

$$b_R := 60 \cdot \text{mm}$$

$$m_R := A_R \cdot 7850 \cdot \text{kg} \cdot \text{m}^{-3}$$

$$I_{yR} := \frac{b_R \cdot h_R^3}{12}$$

$$z_R := h_p + 0.5h_R$$

25% aşınma payı

$$A_R := h_R \cdot b_R$$

$$m_R = 14.13 \cdot \text{kg} \cdot \text{m}^{-1}$$

$$I_{zR} := \frac{b_R^3 \cdot h_R}{12}$$

$$z_R = 465.00 \cdot \text{mm}$$

$$h_R := 30 \cdot \text{mm}$$

$$A_R = 1800.00 \cdot \text{mm}^2$$

$$I_{yR} = 0.14 \cdot 10^6 \cdot \text{mm}^4$$

$$I_{zR} = 0.54 \cdot 10^6 \cdot \text{mm}^4$$

**P3, 2xEşitkollu L,  
LNP 90x9, S 235**

$$h_L := 90 \cdot \text{mm}$$

$$t_L := 9 \cdot \text{mm}$$

$$A_L := 1550 \cdot \text{mm}^2$$

$$z_L := h_p - e_{Lmin}$$

$$b_L := 90 \cdot \text{mm}$$

$$e_{Lmin} := 25.4 \cdot \text{mm}$$

$$m_L := 12.2 \cdot \text{kg} \cdot \text{m}^{-1}$$

$$z_L = 424.60 \cdot \text{mm}$$

$$I_{yL} := 1.16 \cdot 10^6 \cdot \text{mm}^4$$

$$I_{zL} := 1.16 \cdot 10^6 \cdot \text{mm}^4$$

Sistemin alanı

$$A_{Si} := A_p + A_R + 2 \cdot A_L$$

$$A_{Si} = 14780 \cdot \text{mm}^2$$

$$z_S := \frac{A_p \cdot z_p + A_R \cdot z_R + 2 \cdot A_L \cdot z_L}{A_{Si}}$$

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

$$z_{SP} := z_S - z_p$$

$$z_{SP} = 71.09 \cdot \text{mm}$$

$$z_{SL} := z_L - z_S$$

$$z_{SL} = 128.51 \cdot \text{mm}$$

$$z_{SR} := z_R - z_S$$

$$z_{SR} = 168.91 \cdot \text{mm}$$

$$h_{Tot} := h_p + h_R$$

$$h_{Tot} = 480.00 \cdot \text{mm}$$

$$e_u := z_S$$

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

$$e_o := h_{Tot} - e_u$$

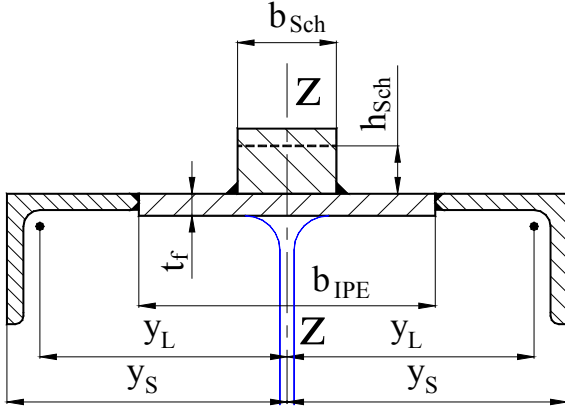
$$e_o = 183.91 \cdot \text{mm}$$

$$I_y := I_{yP} + A_p \cdot z_{SP}^2 + I_{yR} + A_R \cdot z_{SR}^2 + 2 \cdot I_{yL} + 2 \cdot A_L \cdot z_{SL}^2$$

$$I_y = 492.34 \cdot 10^6 \cdot \text{mm}^4$$

$$W_y := I_y \cdot z_S^{-1}$$

$$W_y = 1662.78 \cdot 10^3 \cdot \text{mm}^3$$



$$y_L := 0.5 \cdot b_P + b_L - e_{Lmin} \quad y_L = 159.60 \cdot \text{mm}$$

$$y_S := 0.5 \cdot b_P + b_L \quad y_S = 185.00 \cdot \text{mm}$$

$$\text{Üst kuşak} \quad I_{züK} := \frac{b_P^3 \cdot t_f}{12} \quad I_{züK} = 8.35 \cdot 10^6 \cdot \text{mm}^4$$

$$I_{züT} := I_{züK} + 2 \cdot I_{yL} + I_{zR} + 2A_L \cdot y_L^2 \quad I_{züT} = 90.169 \cdot 10^6 \cdot \text{mm}^4$$

$$W_{züT} := I_{züT} \cdot y_S^{-1} \quad W_{züT} = 487.40 \cdot 10^3 \cdot \text{mm}^3$$

$$A_{üT} := 2 \cdot A_L + A_R + b_P \cdot t_f \quad A_{üT} = 7674.00 \cdot \text{mm}^2$$

### Kaynaklar hariç kendi ağırlığı

$$\text{Kaynaklar hariç kendi ağırlığı} \quad q_{Tr} := m_p + m_R + 2 \cdot m_L \quad q_{Tr} = 116.13 \cdot \text{kg} \cdot \text{m}^{-1}$$

$$q := q_{Tr} \cdot g \quad q = 1138.8 \cdot \text{N} \cdot \text{m}^{-1}$$

### Faktörler :

Boyuna kuvvetler faktörü

$$\varphi_B := 0.2$$

Dinamik faktör

$$\varphi_{dy} := 1.5$$

Statik faktör

$$\varphi_{st} := 1.35$$

Genel emniyet faktörü

$$\gamma_M := 1.1$$

Lokal kuvvet emniyet faktörü

$$\gamma_{M1} := 1.05$$

Yorulma gerilmeleri farkı faktörü

$$\gamma_{Mf} := 1.15$$

### Gereken Malzeme S235 değerleri

Akma mukavemeti

$$f_y := 235 \cdot \text{MPa}$$

Elastiklik modülü

$$E := 210000 \cdot \text{MPa}$$

Emniyetli kayma mukavemeti

$$f_{\tau EM} := \frac{f_y}{\gamma_M \cdot \sqrt{3}}$$

$$f_{\tau EM} = 123 \cdot \text{MPa}$$

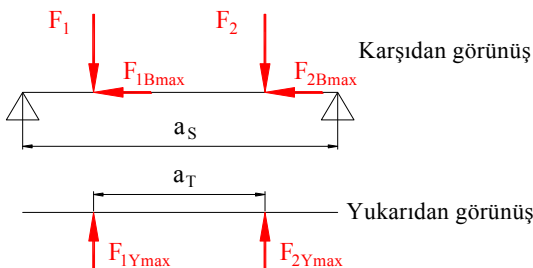
Emniyetli normal mukavemet

$$f_{\sigma EM} := \frac{f_y}{\gamma_M}$$

$$f_{\sigma EM} = 214 \cdot \text{MPa}$$

### Tekerlek kuvvetleri

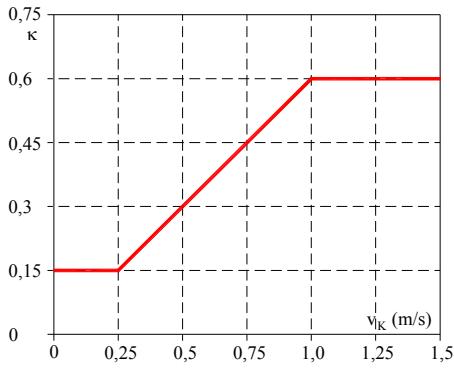
#### Raya dik dikey kuvvetler:



$$F_{1D1} := \frac{F_{Ki}}{4} + \frac{(F_{Yü} + F_{Ar}) \cdot (s_{KB} - e_{min})}{2s_{KB}} \quad F_{1D1} = 78.36 \cdot \text{kN}$$

$$F_{1D2} := \frac{F_{PL}}{2 \cdot a_T} \cdot a_{PLC} + F_{YR} + F_{EP} \quad F_{1D2} = 7.64 \cdot \text{kN}$$

$$F_{1D} := F_{1D1} + F_{1D2} \quad F_{1D} = 86.00 \cdot \text{kN}$$

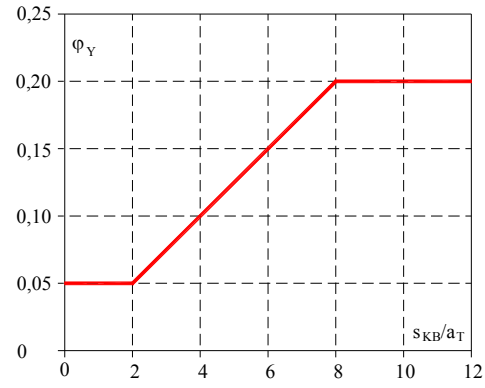


$$v_K = 0.20 \cdot \frac{m}{s}$$

$$\kappa_K := 0.15$$

$$\varphi_K := 1 + \kappa_K \cdot \frac{F_{Y\ddot{u}}}{2 \cdot F_{1D}}$$

$$\varphi_K = 1.09$$



Yatay kuvvetler faktörü

$$\frac{s_{KB}}{a_T} = 5.88$$

$$\varphi_Y := 0.1 + \frac{0.15 - 0.1}{20} \cdot 18.8 \quad \varphi_Y = 0.147$$

Tekerlek kuvvetleri eşit

$$F_{Dmax} := \varphi_K \cdot F_{1D}$$

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

Raya dik yatay kuvvetler:

$$F_Y := \varphi_Y \cdot F_{Dmax}$$

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

Ray boyunca kuvvetler:

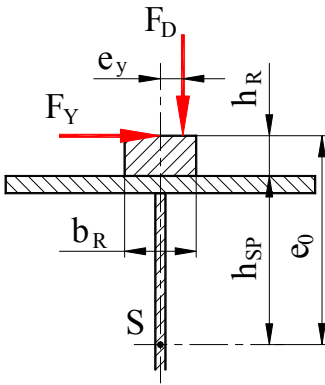
$$F_B := \varphi_B \cdot F_{Dmax}$$

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

Tekerlek kuvvetlerinin torsiyon momenti:

$$e_y := 0.25b_R$$

$$e_y = 15.00 \cdot \text{mm}$$



$$M_{tmax} := 2 \cdot F_{Dmax} \cdot (e_y + e_0 \cdot \varphi_Y)$$

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

$$M_{tmin} := 2 \cdot F_{Dmax} \cdot (e_y - e_0 \cdot \varphi_Y)$$

$$M_{tmin} = -2.25 \cdot \text{kN} \cdot \text{m}$$

Eşdeğer gerilmeler farkı faktörü

$$\lambda_1 := 1 \quad \lambda_3 := 1$$

$$F_{Vi} := F_{Ki} + F_{Ar} + F_{PL} + 2F_{YR} + F_{EP}$$

YS = "S1"

YG = "C5"

$$KK := \frac{F_{Vi}}{F_{Y\ddot{u}}}$$

$$KK = 1.13$$

$$KK = 1,5 \quad \text{için}$$

$$\lambda_4 := 0.49$$

$$\lambda_E := \lambda_1 \cdot \lambda_3 \cdot \lambda_4$$

$$\lambda_E = 0.49$$

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:

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

Son