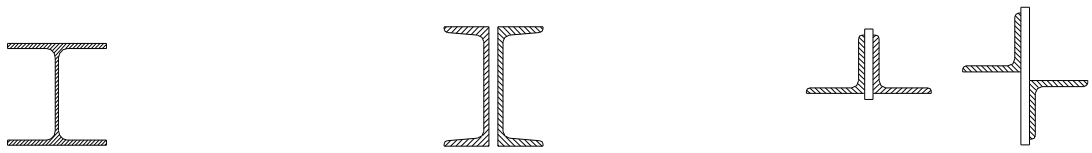
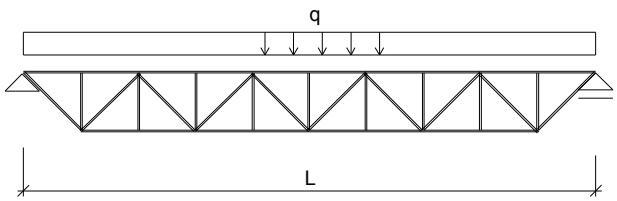
13. Zadatak

Dimenzionisati rešetkasti nosač koji je prikazan na skici. Veze štapova u čvorovima ostvariti zavarivanjem, a montažne nastavke pomoću neobrađenih zavrtnjeva klase čvrstoće 5.6. Za štapove rešetkastog nosača upotrebiti valjane profile sledećih oblika:

Gornji pojas | Donji pojas | Ispuna: Zatezanje, Pritisak



Statički sistem i opterećenje



Raspon nosača: $L = 20$ m
Razmak susednih rešetkastih nosača je: $\lambda = 8{,}0$ m
Totalno vertikalno opterećenje: $q = 5{,}0$ kN/m^2
Osnovni materijal: Č0361 (I slučaj opterećenja)
Radionički crtež dati u razmeri: 1:10

Dopušteni naponi

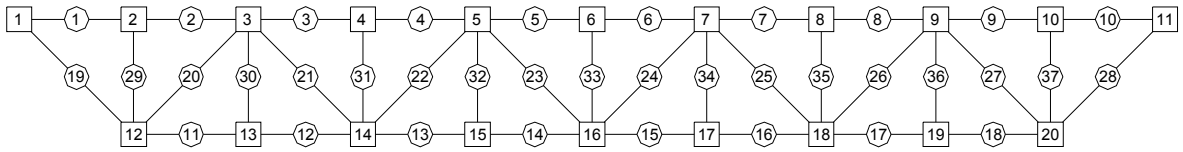
Osnovni materijal: Č0361 $\sigma_{dop} = 16{,}0$ kN/cm^2
Zavrtnjevi: klase čvrstoće 5.6 $\tau_{dop} = 14{,}0$ kN/cm^2 $\sigma_{b,dop} = 27{,}0$ kN/cm^2
Ugaoni šavovi $\sigma_{w,dop} = 12{,}0$ kN/cm^2

Pri izradi zadatka koriste se sledeći standardi:

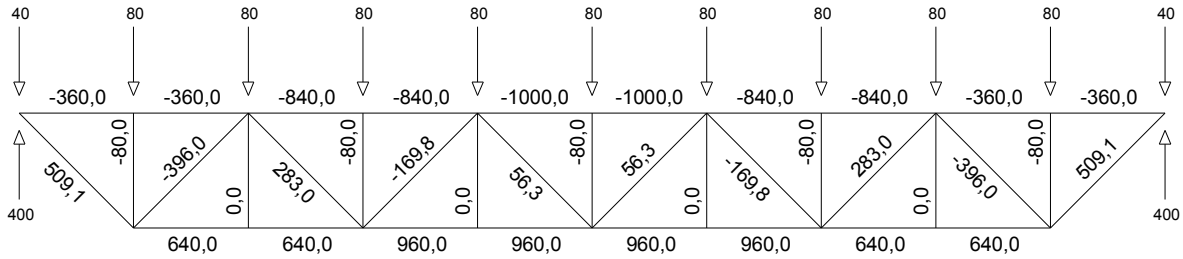
1. JUS U.E7.081/1986 knjiga ČELIČNE KONSTRUKCIJE U GRAĐEVINARSTVU strane 643-649
2. JUS U.E7.086/1986 knjiga ČELIČNE KONSTRUKCIJE U GRAĐEVINARSTVU strane 650-661
3. JUS U.E7.091/1986 knjiga ČELIČNE KONSTRUKCIJE U GRAĐEVINARSTVU strane 662-668

1. Statički uticaji

Sema cvorova i stapova



Aksijalne sile [kN]



Napomena: Znakom minus (-) je oznacen pritisak

2. Dimenzionisanje štapova rešetkastog nosača

2.1 Donji pojas Maksimalni uticaji (štapovi 14 i 5): N_t = 960 kN

$$A_{pot} = \frac{N_t}{\sigma_{dop}} = \frac{960}{16} = 60\,\text{cm}^2$$

Usvajaju se dva valjana profila U200. A=2·32,2=64,4 cm^2

Kontrola napona: $\sigma = \frac{960}{64,4} = 14,91\,\text{kN/cm}^2 < \sigma_{dop}$=16 kN/cm^2

2.2 Gornji pojas Maksimalni uticaji (štapovi 5 i 6): N_c = 1000 kN

Predpostavlja se valjani profil HEA 240 sa sledećim geometrijskim karakteristikama: b_f=240 mm
t_f =12 mm d=230 mm t_w =7,5 mm
A=76,8 cm^2 I_y= 7760cm^4 i_y= 10,1 cm
I_z= 2770 cm^4 i_z= 6,0 cm

Izvijanje oko y-y ose l_{iy}= 200 cm i_y= 10,1 cm
(videti JUS U.E7.086)

$$\lambda_y = \frac{l_y}{i_y} = \frac{200}{10,1} = 19,8 \qquad \bar{\lambda}_y = \frac{\lambda_y}{\lambda_v} = \frac{19,8}{92,9} = 0,213$$

kriva izvijanja B (α=0,339)

$$\beta_y = 1 + \alpha \cdot (\bar{\lambda}_y - 0,2) + \bar{\lambda}_y^{\,2} = 1 + 0,399 \cdot (0,213 - 0,2) + 0,213^2 = 1,050$$

$$\chi_y = \frac{2}{\left(\beta_y + \sqrt{\beta_y^{\,2} - 4\bar{\lambda}_y^{\,2}}\right)} = \frac{2}{\left(1,050 + \sqrt{1,050^2 - 4 \cdot 0,213^2}\right)} = 0,995$$

Izvijanje oko z-z ose $l_{iz}=\beta_z \cdot l=1{,}0 \cdot 200 = 200$ cm $i_z = 6{,}0$ cm
(videti JUS U.E7.086)

$$\lambda_z = \frac{l_z}{i_z} = \frac{200}{6{,}0} = 33{,}33 \qquad \overline{\lambda}_z = \frac{\lambda_z}{\lambda_v} = \frac{33{,}33}{92{,}9} = 0{,}359$$

kriva izvijanja C (α=0,489)

$$\beta_z = 1 + \alpha \cdot \left(\overline{\lambda}_z - 0{,}2\right) + \overline{\lambda}_z{}^2 = 1 + 0{,}489 \cdot \left(0{,}359 - 0{,}2\right) + 0{,}359^2 = 1{,}207$$

$$\chi_z = \frac{2}{\left(\beta_z + \sqrt{\beta_z{}^2 - 4\overline{\lambda}_z{}^2}\right)} = \frac{2}{\left(1{,}207 + \sqrt{1{,}207^2 - 4 \cdot 0{,}359^2}\right)} = 0{,}919$$

Kontrola napona: $\chi_{\min} = \min(0{,}995 \ ; \ 0{,}919) = 0{,}919$

$$\sigma = \frac{N_c}{A} = 13{,}02 \text{ kN/cm}^2 < \sigma_{i,dop} = \chi_{\min} \cdot \sigma_{dop} = 0{,}919 \cdot 16 = 14{,}7 \text{ kN/cm}^2$$

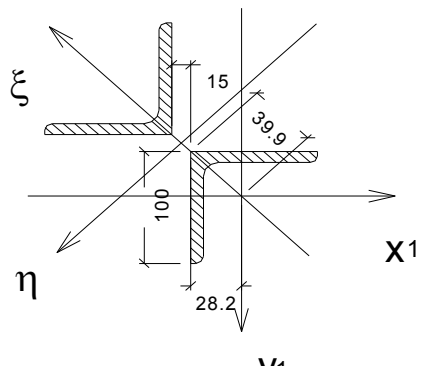
2.3 Zategnute dijagonale Maksimalni uticaji (štapovi 28 i 19): $N_t = 509{,}1$ kN

$$A_{pot} = \frac{N_t}{\sigma_{dop}} = \frac{509{,}1}{16} = 31{,}82 \text{ cm}^2$$

Usvajaju se dva valjana profila L100x100x10. A=2·19,2=38,4 cm^2

Kontrola napona: $\sigma = \dfrac{509{,}1}{38{,}4} = 13{,}26 \text{ kN/cm}^2 < \sigma_{dop}$=16 kN/cm^2

2.4 Pritisnuta dijagonala Maksimalni uticaji (štapovi 20 i 27): $N_c = 396{,}0$ kN



Predpostavljaju se dva valjana profila L100x100x10.
Geometrijske karakteristike štapa:
A = 2·19,2 = 38,4 cm^2 $i_{\min,1}$ = 1,95 cm
$i_{\min} = i_\xi$=3,82 cm

NAPOMENA: Razmak veznih limova:
a = 450 mm < 70· $i_{min,1}$ =70·19,5 = 1365 mm
Kontrola stabilnosti štapa se može sprovesti kao za jednodelni štap.

(videti JUS U.E7.091/1986)

Kontrola stabilnosti štapa:

Dužina izvijanja: $l_{i\xi}=\beta_\xi \cdot l=0{,}9 \cdot 282{,}8 = 254{,}5$ cm $i_\xi = 3{,}82$ cm
(videti JUS U. E7. 086.)

$$\lambda_\xi = \frac{l_\xi}{i_\xi} = \frac{254{,}5}{3{,}82} = 66{,}6 \qquad \overline{\lambda_\xi} = \frac{\lambda_\xi}{\lambda_v} = \frac{66{,}6}{92{,}9} = 0{,}717$$

kriva izvijanja C (α=0,489)

$$\beta = 1 + \alpha \cdot \left(\overline{\lambda}_\xi - 0{,}2\right) + \overline{\lambda}_\xi{}^2 = 1 + 0{,}489 \cdot \left(0{,}717 - 0{,}2\right) + 0{,}717^2 = 1{,}767$$

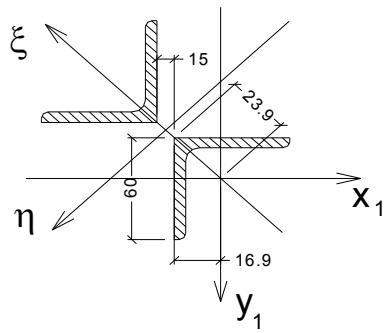
$$\chi = \frac{2}{\left(\beta + \sqrt{\beta^2 - 4\overline{\lambda}_\xi{}^2}\right)} = \frac{2}{\left(1{,}767 + \sqrt{1{,}767^2 - 4 \cdot 0{,}717^2}\right)} = 0{,}714$$

Kontrola napona:

$$\sigma = \frac{N_c}{A} = \frac{396}{38,4} = 10,3\,\text{kN/cm}^2 < \sigma_{i,dop} = \chi \cdot \sigma_{dop} = 0,714 \cdot 16 = 11,42\,\text{kN/cm}^2$$

2.5 Vertikale

Maksimalni uticaji (štapovi 29, 31, 33, 35 i 37): N_c = 80,0 kN



Predpostavljaju se dva valjana profila L60x60x6.
Geometrijske karakteristike štapa.
A = 2·6,91=13,8 cm^2 $i_{min,1}$ = 1,17 cm
$i_{min} = i_\xi$=2,29 cm

NAPOMENA: Razmak veznih limova:
a = 300 mm < 70· $i_{min,1}$ =70·11,7 = 819 mm
Kontrola stabilnosti štapa se može sprovesti kao za jednodelni štap.

Dužina izvijanja: $l_{i\xi}=\beta_\xi \cdot l$=0,9·200 = 180 cm

i_ξ= 2,29 cm

$$\lambda_\xi = \frac{l_\xi}{i_\xi} = \frac{180}{2,29} = 78,6$$

$$\overline{\lambda}_\xi = \frac{\lambda_\xi}{\lambda_v} = \frac{78,6}{92,9} = 0,846$$

kriva izvijanja C (α=0,489)

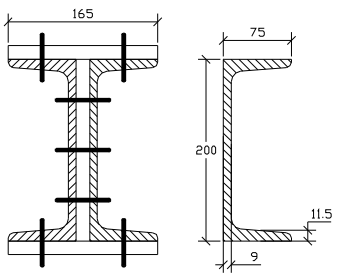
$$\beta = 1 + \alpha \cdot \left(\overline{\lambda}_\xi - 0,2\right) + \overline{\lambda}_\xi{}^2 = 1 + 0,489 \cdot \left(0,846 - 0,2\right) + 0,846^2 = 2,032$$

$$\chi = \frac{2}{\left(\beta + \sqrt{\beta^2 - 4\overline{\lambda}_\xi{}^2}\right)} = \frac{2}{\left(2,032 + \sqrt{2,032^2 - 4 \cdot 0,846^2}\right)} = 0,634$$

Kontrola napona:

$$\sigma = \frac{N_c}{A} = \frac{80}{13,82} = 5,79\,\text{kN/cm}^2 < \sigma_{i,dop} = \chi \cdot \sigma_{dop} = 0,634 \cdot 16 = 10,14\,\text{kN/cm}^2$$

3, Proračun montažnih nastavaka



3.1 Montažni nastavak zategnutog pojasa

Položaj montažnog nastavka (štapovi 12 i 17): N_t=640 kN

Geometrijske karakteristike:
A=32,2·2 = 64,4 cm^2
A_f= 2·(7,5·1,15) = 17,24 cm^2
A_w= 64,4-2·17,24 = 29,92 cm^2
Preraspodela sile:

$$N_{t,f} = \frac{A_f}{A} \cdot N_t = \frac{17{,}24}{64{,}4} \cdot 640 = 171{,}33\ \text{kN}$$
$$N_{t,w} = N_t - 2 \cdot N_w = 640 - 2 \cdot 171{,}32 = 297{,}34\ \text{kN}$$

3.1.1 Nastavak nožica (Predpostavljaju se zavrtnjevi M20 ... 5.6)

Podvezice na nožicama :

$$\frac{N_{t,f}}{t_{p,f} \cdot (16{,}5 - 2 \cdot d_0)} = \frac{171{,}33}{t_{p,f} \cdot (16{,}5 - 2 \cdot 2{,}1)} \le \sigma_{dop} = 16\ \text{kN/cm}^2 \ \Rightarrow \ t_{p,f} \ge 8{,}7\ \text{mm}$$

Usvajaju se podvezice: = 165 x 10

$$F_b = 1{,}0 \cdot 2{,}0 \cdot 27 = 54\ \text{kN}$$
$$F_v = 1 \cdot \frac{2{,}0^2 \pi}{4} \cdot 14 = 43{,}98\ \text{kN}$$

$F_{v,dop}$ = min {54 ; 43,98} = 43,98 kN

$$n = \frac{N_{f,t}}{F_{v,dop}} = \frac{171{,}32}{43{,}98} = 3{,}89$$ **Usvajaju se: 4 M20 ... 5.6**

Kontrola napona u podvezicama:

$$\sigma = \frac{171{,}33}{1{,}0 \cdot (16{,}5 - 2 \cdot 2{,}1)} = 13{,}93\ \text{kN/cm}^2 < \sigma_{dop} = 16\ \text{kN/cm}^2$$

Kontrola napona u oslabljenom preseku :

$$\Delta A = 2 \cdot 2{,}1 \cdot 1{,}15 = 4{,}83\ \text{cm}^2 \qquad A_{f1,net} = 17{,}24 - 4{,}83 = 12{,}41\ \text{cm}^2$$
$$\sigma_{net} = \frac{171{,}33}{12{,}41} = 13{,}81\ \text{kN/cm}^2 \le 16\ \text{kN/cm}^2$$

3.1.2 Nastavak rebra (predpostavljaju se zavrtnjevi M16 ... 5.6)

Predpostavlja se jedna podvezica: = 200 x 15

$$\frac{N_{t,w}}{t_{p,w} \cdot (20 - 3 \cdot d_0)} = \frac{297{,}34}{1{,}5 \cdot (20{,}0 - 3 \cdot 1{,}7)} = 13{,}30\ \text{kN/cm}^2 \le \sigma_{dop} = 16\ \text{kN/cm}^2$$

Usvajaja se podvezica: = 200 x 15

$$F_b = 1{,}5 \cdot 1{,}6 \cdot 27 = 64{,}8\ \text{kN}$$
$$F_v = 2 \cdot \frac{1{,}6^2 \pi}{4} \cdot 14 = 56{,}30\ \text{kN}$$

$F_{v,dop}$ = min {64,8 ; 56,30} = 56,30 kN

$$n = \frac{N_{t,w}}{F_{v,dop}} = \frac{297{,}34}{56{,}30} = 5{,}28$$ Usvaja se: **6 M16 ... 5.6**

Kontrola napona:

$$\sigma = \frac{297{,}34}{(14{,}96 - 3 \cdot 1{,}7) \cdot 2} = 15{,}07\ \text{kN/cm}^2 < \sigma_{dop} = 16\ \text{kN/cm}^2$$

Kontrola napona u oslabljenom preseku :

$$\Delta A = 2 \cdot 3 \cdot 1{,}7 \cdot 0{,}9 = 9{,}18\,\text{cm}^2$$

$$A_{w1,net} = 29{,}92 - 9{,}18 = 20{,}74\,\text{cm}^2$$

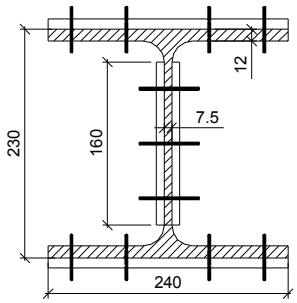
$$\sigma_{net} = \frac{297{,}34}{20{,}74} = 14{,}34\,\text{kN/cm}^2 \le 16\,\text{kN/cm}^2$$

Kontrola napona u čitavom preseku:

$$\sigma = \frac{640{,}0}{(32{,}2 - 2 \cdot 2{,}1 \cdot 1{,}15 - 3 \cdot 1{,}7 \cdot 0{,}85) \cdot 2} = 13{,}89\,\text{kN/cm}^2 < \sigma_{dop} = 16\,\text{kN/cm}^2$$

3.2 Pritisnuti pojas

Položaj montažnog nastavka (štapovi 3 i 8): N_c=840 kN



Geometrijske karakteristike:
A=76,8 cm^2
A_f= 1,2·24 = 28,8 cm^2
A_w= 76,8-2·28,8 = 19,2 cm^2

Preraspodela sile:

$$N_{c,f} = \frac{A_f}{A} \cdot N_c = \frac{28{,}8}{76{,}8} \cdot 840 = 315\,\text{kN}$$

$$N_{c,w} = N_c - 2 \cdot N_{c,f} = 840 - 2 \cdot 315 = 210\,\text{kN}$$

3.2.1 **Nastavak nožica** (predpostavljaju se zavrtnjevi M20 ... 5.6)

Podvezice na nožicama:

$$\frac{N_{c,f}}{t_{p,f} \cdot b_p} = \frac{315{,}0}{t_{p,f} \cdot 24} \le \sigma_{dop} = 16\,\text{kN/cm}^2 \;\Rightarrow\; t_{p,f} = 8{,}2\ \text{mm}$$

Usvajaju se podvezice = 240 x 10

$$F_b = 1{,}0 \cdot 2{,}0 \cdot 27 = 54\,\text{kN}$$

$$F_v = 1 \cdot \frac{2{,}0^2\,\pi}{4} \cdot 14 = 43{,}98\,\text{kN}$$

$F_{v,dop}$ = min {54 ; 43,98} = 43,98 kN

$$n = \frac{N_{c,f}}{F_{v,dop}} = \frac{315{,}0}{43{,}98} = 7{,}16$$

Usvaja se: 8 M20 ... 5.6

3.2.2 **Nastavak rebra** (predpostavljaju se zavrtnjevi M16 ... 5.6)

Podvezice na rebru:

$$\frac{N_{c,w}}{2 \cdot t_{p,w} \cdot h_p} = \frac{210{,}0}{2 \cdot t_{p,w} \cdot 16} \le \sigma_{dop} = 16\,\text{kN/cm}^2 \;\Rightarrow\; t_{p,f} \ge 4{,}1\ \text{mm}$$

Usvajaju se podvezice: **2 x = 160 x 6**

$$F_b = 0{,}75 \cdot 1{,}6 \cdot 27 = 32{,}4\,\text{kN}$$

$$F_v = 2 \cdot \frac{1{,}6^2\,\pi}{4} \cdot 14 = 56{,}30\,\text{kN}$$

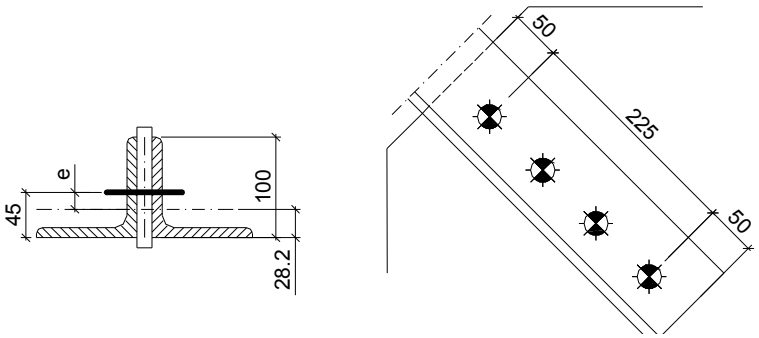
$F_{v,dop}$ = min {32,4 ; 56,30} = 32,40 kN

$$n = \frac{N_{c,w}}{F_{v,dop}} = \frac{210}{32,4} = 6,48$$ Usvaja se: **9 M16 ... 5.6**

3.3 Veza montažne dijagonale za čvorni lim

Položaj montažne dijagonale (štapovi 21 i 26): N_t = 282,9 kN

Predpostavljaju se zavrtnjevi **M24 ... 5.6**



A = 2·19,2 = 38,4 cm^2 A_{net}=38,4-2·2,5·1=33,4 cm^2

Kontrola napona:

$$\sigma = \frac{N_t}{A_{net}} = \frac{282,9}{33,4} = 8,47\ \text{kN/cm}^2 \le \sigma_{dop} = 16\ \text{kN/cm}^2$$

Proračun zavrtnjeva:
e = 55 - 28,2 = 26,8 mm
M_e = 2,68·282,9 = 758,12 kNcm

$$F_b = 1,5 \cdot 2,4 \cdot 27 = 97,2\ \text{kN}$$

$$F_v = 2 \cdot \frac{2,4^2 \pi}{4} \cdot 14 = 126,7\ \text{kN}$$ $F_{v,dop}$ = min {97,2 ; 126,7} = 97,2 kN

$$n = \frac{N_t}{F_{v,dop}} = \frac{282,9}{97,2} = 2,91$$ Usvajaju se: **4M24 ... 5.6**

$$F_N = \frac{282,9}{4} = 70,7\ \text{kN}$$

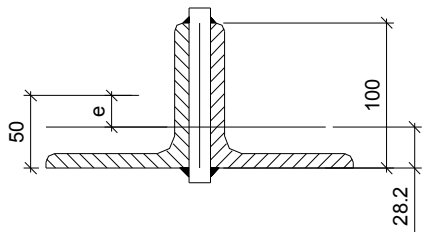
$$F_{M,\max} = \frac{M_e \cdot h_{\max}}{\sum h_i^2} = \frac{758,12 \cdot 22,5}{7,5^2 + 22,5^2} = 30,32\ \text{kN}$$

$$F = \sqrt{F_{M,\max}{}^2 + F_N{}^2} = \sqrt{30,32^2 + 70,7^2} = 76,93\ \text{kN} < 97,2\ \text{kN}$$

4. Veze štapova ispune za čvorni lim

4.1 Zategnute dijagonale

Maksimalni uticaji (štapovi 28 i 19): N_t = 509,1 kN



e = 50-28,2=21,8 mm
N_t = 509,12 kN
M_e = 509,12 · 2,18 = 1109,9 kNcm
Za vezu se predpostavljaju četiri ugaona šava: a_w = 7 mm, l_w = 250 mm.
$l`_w = l_w - 2 \cdot a_w$ = 25,0 - 2·0,7 = 23,6 cm
Geometrijske karakteristike šavova:
A_w = 4·(23,6·0,7) = 66,08 cm^2

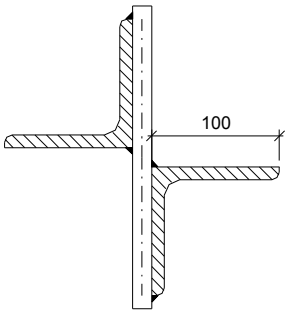
$$V_{II,N} = \frac{N_t}{A_w} = \frac{509,12}{66,08} = 7,70\ \text{kN/cm}^2$$

$$V_{II,M} = \frac{M_e / h}{2 \cdot a_w \cdot l_w'} = \frac{1109,9/10}{2 \cdot 0,7 \cdot 23,6} = 3,36\ \text{kN/cm}^2$$

$$\sigma_u = V_{II,N} + V_{II,M} = 7,70 + 3,36 = 11,06\ \text{kN/cm}^2 < \sigma_{w,dop} = 12\ \text{kN/cm}^2$$

4.2 Pritisnute dijagonale

Maksimalni uticaji (štapovi 20 i 27): N_c = 396,0 kN



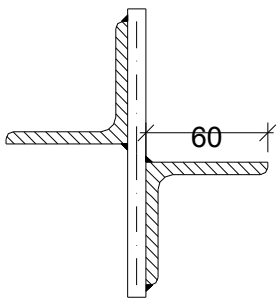
Za vezu se predpostavljaju četiri ugaona šava:
a_w= 6 mm, l_w = 150 mm.
$l`_w = l_w - 2 \cdot a_w$ = 150 - 2·6 = 138 mm

Geometrijske karakteristike šavova:
A_w = 4·(13,8·0,6) = 33,12 cm^2

$$V_{II} = \frac{N_c}{A_w} = \frac{396,0}{33,12} = 11,96\ \text{kN/cm}^2 < \sigma_{w,dop} = 12\ \text{kN/cm}^2$$

4.3 Vertikale

Maksimalni uticaji (štapovi 29, 31, 33, 35 i 37): N_c = 80,0 kN



Za vezu se predpostavljaju četiri ugaona šava:
a_w= 3 mm, l_w = 100 mm.
$l`_w = l_w - 2 \cdot a_w$ = 100 - 2·3 = 94 mm

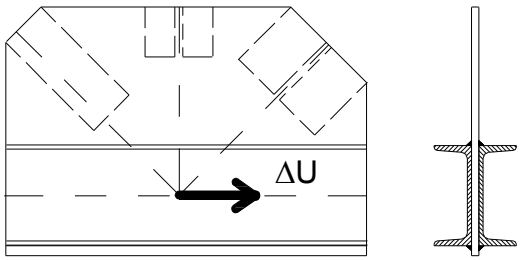
Geometrijske karakteristike šavova:
A_w = 4·9,4·0,3 = 11,28 cm^2

$$V_{II} = \frac{N_t}{A_w} = \frac{80,0}{11,28} = 7,1\ \text{kN/cm}^2 < \sigma_{w,dop} = 12\ \text{kN/cm}^2$$

5. Veze čvornih limova za pojasne štapove

5.1 Donji pojas:

$$\Delta U_{\max} = 640\ \text{kN}$$



Veza će se izvesti pomoću četiri ugaona šava
a_w= 4 mm, l_w=100·a_w=100·4=400 mm A_w=4·a_w · l_w=40,0·0,4·4 = 64,00 cm^2

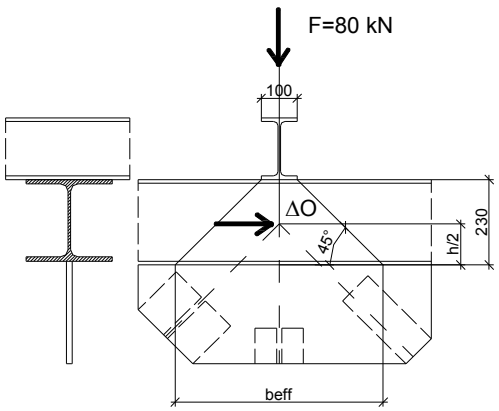
$$V_{II} = \frac{\Delta U_{\max}}{A_w} = \frac{640}{64,00} = 10,00\ \text{kN/cm}^2 < \sigma_{w,dop}=12\ \text{kN/cm}^2$$

Iz konstruktivnih razloga usvajaju se četiri ugaona šava **4x725 mm**

5.2 Gornji pojas:

$$\Delta O_{\max} = 840 - 360 = 480\ \text{kN} \quad M_e = \Delta O_{\max} \cdot h/2 = 480 \cdot 11,5 = 5520\ \text{kNcm}$$

Veza će se izvesti pomoću dva ugaona šava
a_w= 6 mm, l_w=100·a_w=100·6=600 mm
b_{eff}=100+2·240=580 mm
$A_{w,eff}$=2·a_w · b_{eff} =58,0·0,6·2 = 69,6 cm^2
A_w=2·a_w · l_w=60,0·0,6·2 = 72,00 cm^2



$$n_F = \frac{F}{A_{w,eff}} = \frac{80}{69,6} = 1,15\ \text{kN/cm}^2$$

$$n_M = \frac{M_e}{W_w} = \frac{5520,0}{2 \cdot \frac{0,6 \cdot 60,0^2}{6}} = 7,67\ \text{kN/cm}^2$$

$$V_{II} = \frac{\Delta O_{\max}}{A_w} = \frac{480}{72,0} = 6,67\ \text{kN/cm}^2$$

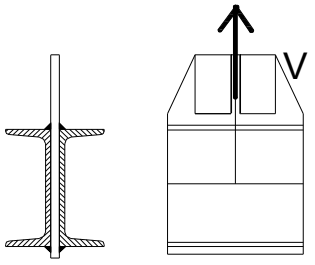
$$\sigma_u = \sqrt{(n_F + n_M)^2 + V_{II}^{\ 2}} = \sqrt{(1,15 + 7,67)^2 + 6,67^2} = 11,06\ \text{kN/cm}^2 < \sigma_w = 12\ \text{kN/cm}^2$$

Iz konstruktivnih razloga usvajaju se dva ugaona šava dimenzija **6 x725 mm**

5.3 Čvorni lim vertikale (donji pojas)

$$V_{\max} = 0,0\ \text{kN}$$

Iz konstruktivnih razloga veza će se izvesti pomoću četiri ugaona šava a_w= 3 mm, l_w=227 mm

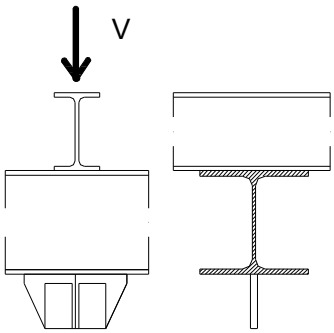


5.4 Čvorni lim vertikale (gornji pojas)

$V_{\max} = 80\,\text{kN}$

Veza će se izvesti pomoću dva ugaona šava

$a_w = 3$ mm, $l_w = 227$ mm, $l_w' = 227 - 2 \cdot a_w = 221$ mm



$A_w = 2 \cdot a_w \cdot l_w = 2 \cdot 22{,}1 \cdot 0{,}3 = 13{,}26\ \text{cm}^2$

$$n = \frac{V}{A_w} = \frac{80}{13{,}26} = 6{,}03\ \text{kN/cm}^2 < \sigma_{w,dop} = 12\ \text{kN/cm}^2$$

Usvajaju se dva ugaona šava dimenzija 4 x 227mm

6. Kontrola napona u čvornim limovima

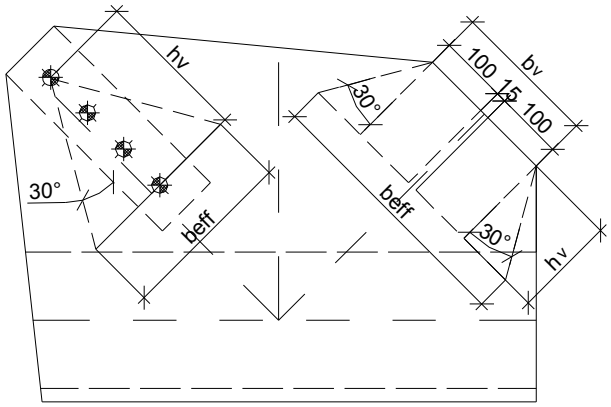
Za debljinu čvornog lima usvaja se $t = 15$ mm

6.1 Vertikale 2L60x60x6 (N_c = 80,0 kN)

$b_{eff} = 2 \cdot 6 + 1{,}5 + 2 \cdot 10 \cdot \text{tg}(30) = 25{,}05$ cm $\qquad A_{eff} = b_{eff} \cdot t = 25{,}05 \cdot 1{,}5 = 37{,}6\ \text{cm}^2$

$$\sigma = \frac{N_c}{A_{eff}} = \frac{80}{37{,}6} = 2{,}13\ \text{kN/cm}^2 \le \sigma_{dop} = 16\ \text{kN/cm}^2$$

$b_{eff} = 2 \cdot h_v \cdot tg\ 30$



$b_{eff} = b_v + 2 \cdot h_v \cdot tg\ 30$

6.2 Zategnute dijagonale 2L100x100x10 (N_t = 509,1 kN)

$b_{eff} = 10 + 2 \cdot 25 \cdot \text{tg}(30) = 38{,}9$ cm $\qquad A_{eff} = b_{eff} \cdot t = 38{,}9 \cdot 1{,}5 = 58{,}3\ \text{cm}^2$

$$\sigma = \frac{N_t}{A_{eff}} = \frac{509{,}1}{58{,}3} = 8{,}73\ \text{kN/cm}^2 \le \sigma_{dop} = 16\ \text{kN/cm}^2$$

6.3 Montažne dijagonale 2L100x100x10 (N_t = 282,9 kN)

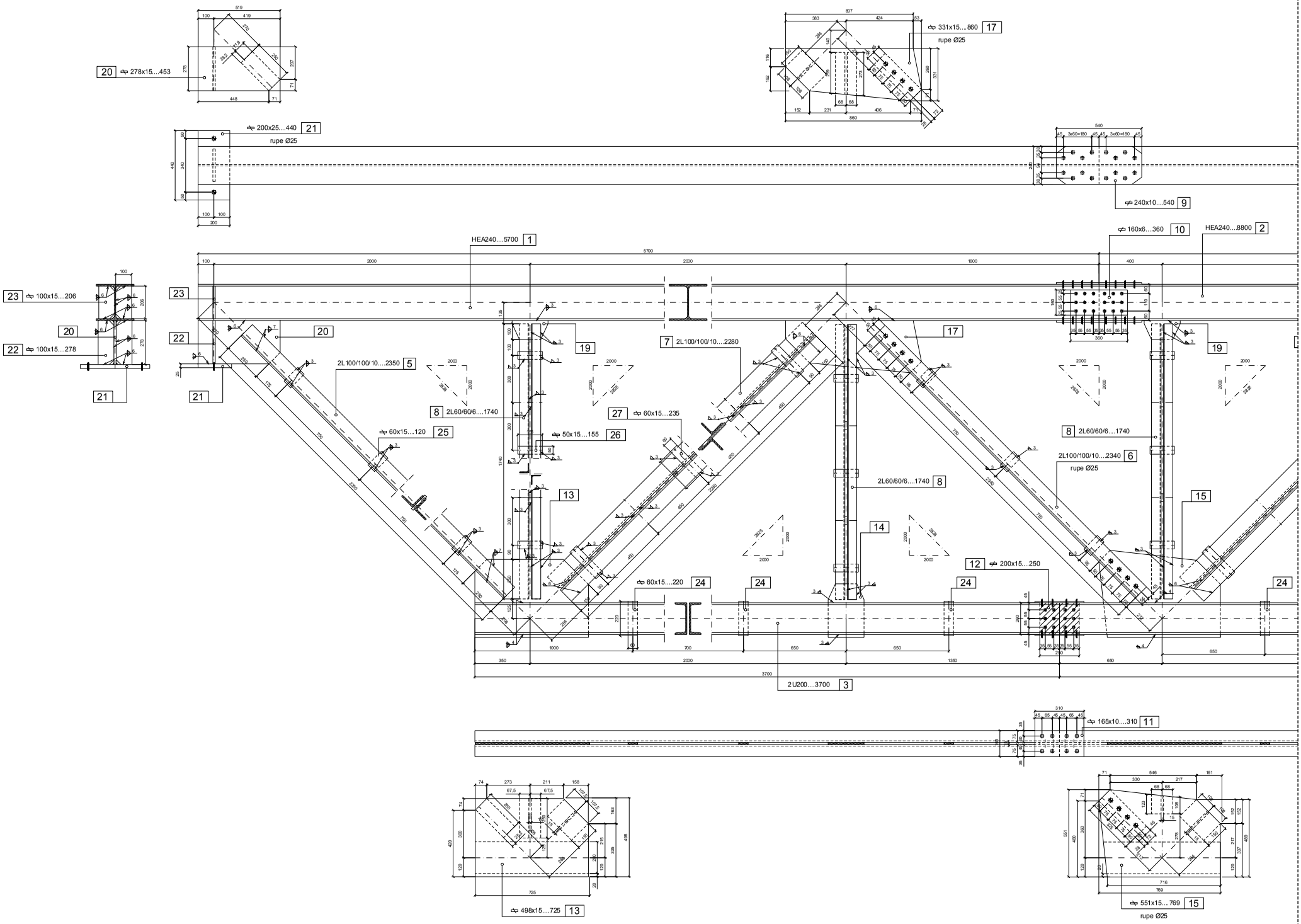
$b_{eff} = 2 \cdot 22{,}5 \cdot \text{tg}(30) = 25{,}98$ cm $\qquad A_{eff,net} = b_{eff} \cdot t - d_0 \cdot t = 25{,}98 \cdot 1{,}5 - 2{,}5 \cdot 1{,}5 = 35{,}22\ \text{cm}^2$

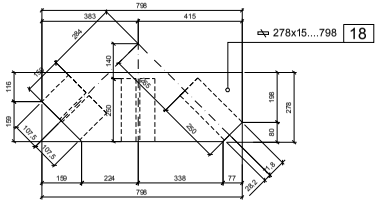
$$\sigma = \frac{N_t}{A_{eff,net}} = \frac{283}{35{,}22} = 8{,}04\ \text{kN/cm}^2 \le \sigma_{dop} = 16\ \text{kN/cm}^2$$

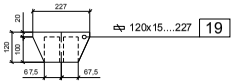
6.4 Pritisnute dijagonale 2L100x100x10 (N_c = 396,0 kN)

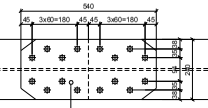
$b_{eff} = 2 \cdot 10 + 1{,}5 + 2 \cdot 15 \cdot \text{tg}(30) = 38{,}8$ cm $\qquad A_{eff} = b_{eff} \cdot t = 38{,}8 \cdot 1{,}5 = 58{,}2\ \text{cm}^2$

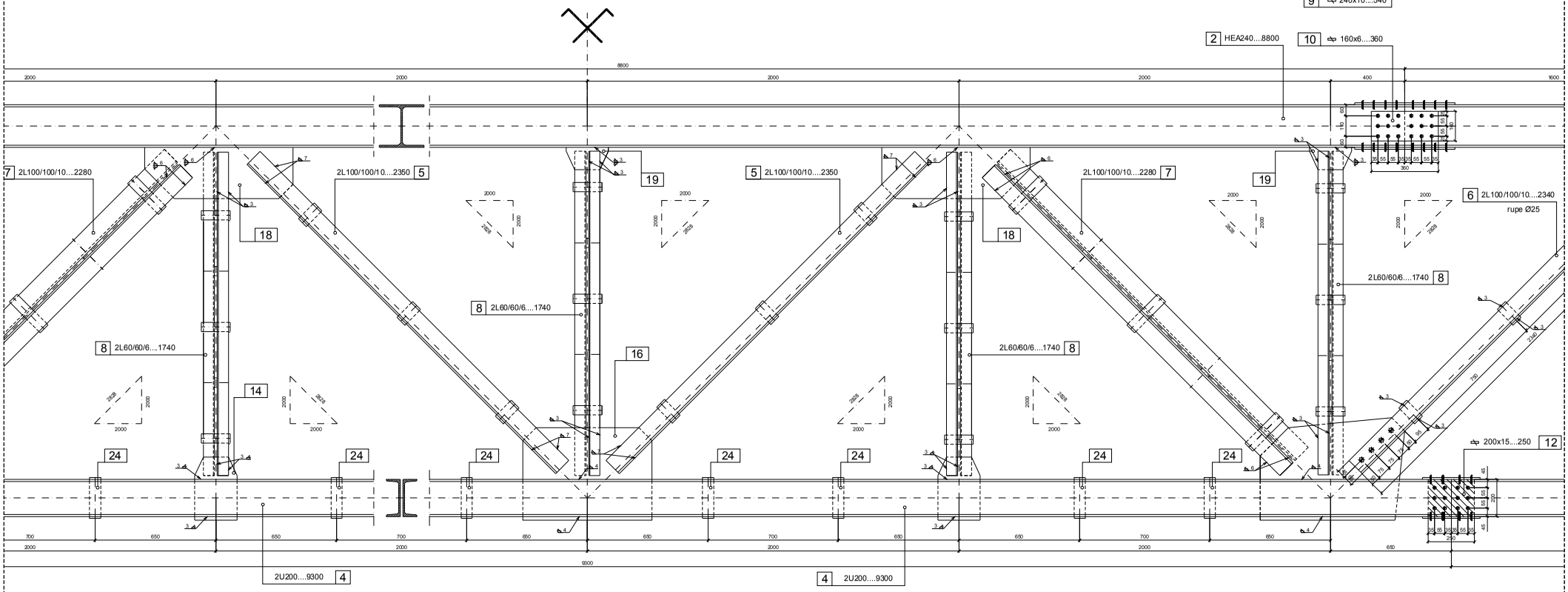
$$\sigma = \frac{N_c}{A_{eff}} = \frac{396}{58{,}2} = 6{,}8\ \text{kN/cm}^2 \le \sigma_{dop} = 16\ \text{kN/cm}^2$$

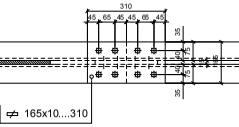

20 ⏀ 278x15....453
⏀ 331x15....860 17
rupe Ø25
⏀ 200x25....440 21
rupe Ø25
⏀ 240x10....540 9
HEA240....5700 1
⏀ 160x6....360 10
HEA240....8800 2
23 ⏀ 100x15....206
20
22 ⏀ 100x15....278
21
2L100/100/10....2350 5
7 2L100/100/10....2280
8 2L60/60/6....1740
27 ⏀ 60x15....235
⏀ 60x15....120 25
⏀ 50x15....155 26
2L60/60/6....1740 8
2L100/100/10....2340 6
rupe Ø25
⏀ 60x15....220 24
12 ⏀ 200x15....250
2U200....3700 3
⏀ 165x10....310 11
⏀ 498x15....725 13
⏀ 551x15....769 15
rupe Ø25

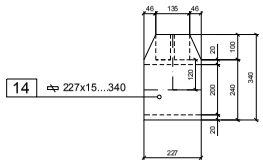

278x15....798 18

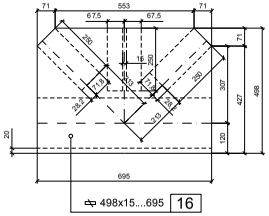

120x15....227 19

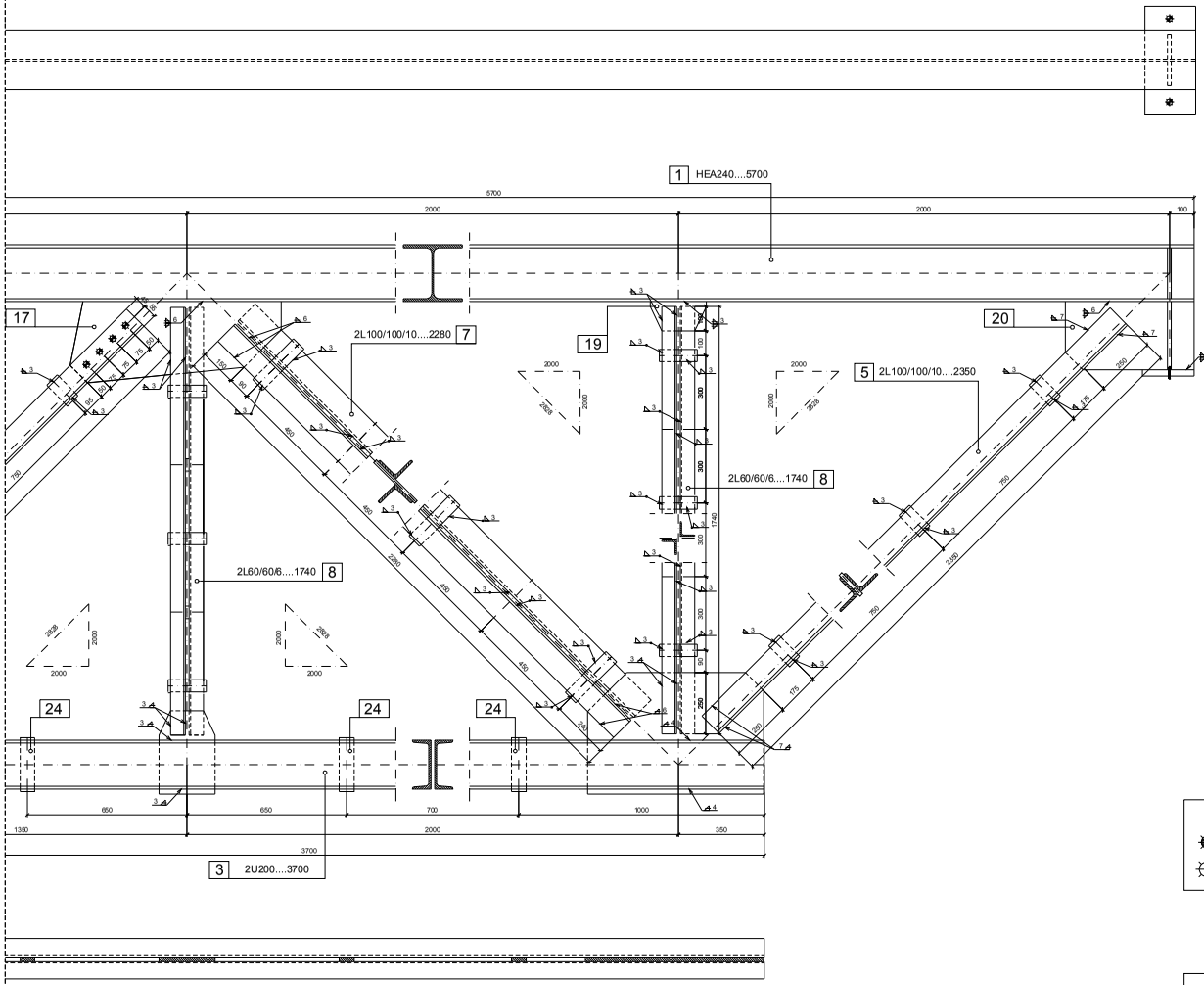

9 240x10....540


2 HEA240....8800
10 160x6....360
7 2L100/100/10....2280
2L100/100/10....2350 5
5 2L100/100/10....2350
2L100/100/10....2280 7
6 2L100/100/10....2340
rupe Ø25
8 2L60/60/6....1740
18
19
16
14
24
12 200x15....250
2U200....9300 4
4 2U200....9300


11 165x10....310


14 227x15....340


498x15....695 16



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Zavrtnjevi M16 klase 5.6
Zavrtnjevi M20 klase 5.6

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		Projektant:	Marko Marković, dipl.inž.građ.
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