

## NASLOVNA STRAN NAČRTA

## 2 NAČRT GRADBENIŠTVA

## PODATKI O GRADNJI

naziv gradnje

PODRUŽNIČNA ŠOLA LOKAVEC

kratek opis gradnje

Rekonstrukcija strehe Podružnične šole Lokavec.

## VRSTE GRADNJE

označiti vse ustrezne vrste gradnje

☐

NOVOGRADNJA - NOVOZGRAJEN OBJEKT

☐

NOVOGRADNJA - PRIZIDAVA

☒

REKONSTRUKCIJA

☐

SPREMEMBA NAMEMBNOSTI

☐

ODSTRANITEV CELOTNEGA OBJEKTA

☐

LEGALIZACIJA

☐

MANJŠA REKONSTRUKCIJA

## PODATKI O PROJEKTNIM DOKUMENTACIJI

vrsta dokumentacije

PZI - projektna dokumentacija za izvedbo rekonstrukcije

številka projekta

55/2023

## PODATKI O NAČRTU

strokovno področje načrta

2 Načrt s področja gradbeništva

naziv načrta

2 Načrt gradbeništva

številka načrta

1100/2024

datum izdelave

junij 2024

datum spremembe

## PODATKI O PROJEKTANTU NAČRTA

projektant načrta (naziv družbe)

STATICON IB d.o.o.

naslov

Lokarjev drevored 1, 5270 Ajdovščina

odgovorna oseba projektanta načrta

Bogomir Ipavec

podpis odgovorne osebe

projektanta načrta



**STATICON IB**  
Družba za projektiranje, inženiring in svetovanje, d.o.o.  
Lokarjev drevored 1, 5270 Ajdovščina

## PODATKI O IZDELOVALCU NAČRTA

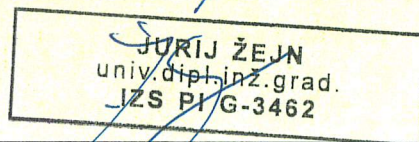
ime in priimek pooblaščenega arhitekta, pooblaščenega inženirja

Jurij Žejn, univ.dipl.inž.grad.

identifikacijska številka

IZS G-3462

podpis pooblaščenega arhitekta, pooblaščenega inženirja



**JURIJ ŽEJN**  
univ.dipl.inž.grad.  
IZS PI/G-3462

**2.2 KAZALO VSEBINE NAČRTA št. 1100/2024**

|      |   |
|------|---|
| 1.   | Naslovna stran načrta                                     |
| 2.   | Kazalo vsebine načrta                                     |
| 20A. | Mnenje pooblaščenega strokovnjaka s področja gradbeništva |
| 3.   | Tehnično poročilo   |
| 4.   | Statični račun  |
| 5.   | Risbe   |



MNENJE POOBlaščenega strokovnjaka  
s področja gradbeništva

|   |                                      |
|---|--------------------------------------|
| OSNOVNI PODATKI O INVESTITORJU, OBJEKTU IN ZEMLJIŠČIH |                                      |
| ime in priimek ali naziv družbe                       | OBČINA AJDOVŠČINA                    |
| naslov ali sedež družbe                               | ULICA 5. MAJA 6A, 5270 AJDOVŠČINA    |
| naziv objekta   | PODRUŽNIČNA ŠOLA LOKAVEC             |
| naslov objekta  | LOKAVEC 128, 5270 AJDOVŠČINA         |
| katastrska občina                                     | k.o. Lokavec                         |
| parc. št.   | 2658/1                               |
| št. stavbe  | 220                                  |
| št. stanovanja v večstanovanjski stavbi               |                                      |
| PROJEKTANT/ NADZORNIK/ IZVAJALEC                      |                                      |
| naziv družbe  | Stacion IB d.o.o.                    |
| poslovni naslov družbe                                | Lokarjev drevored 1, 5270 Ajdovščina |
| odgovorna oseba                                       | Bogomir Ipavec                       |
| POOBlašČeni strokovnjak s področja gradbeništva       |                                      |
| ime in priimek  | Jurij Žejn, univ.dipl.inž.grad.      |
| identifikacijska številka                             | IZS G-3462                           |

UGOTAVLJAVA, DA PREDVIDENA MANJŠA REKONSTRUKCIJA PREDSTAVLJA:  
označiti vsa ustrezna dela

|                                     |   |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | statično ojačitev posameznega ali več posameznih konstrukcijskih elementov  |
| <input checked="" type="checkbox"/> | zamenjavo istovrstnih posameznih konstrukcijskih elementov (zamenjava ostrešja, delov medetažne konstrukcije, ipd.)   |
| <input type="checkbox"/>            | zamenjavo elementov javnega vodovoda in javne kanalizacije  |
| <input type="checkbox"/>            | dolbenje utorov in niš v nosilno konstrukcijo   |
| <input type="checkbox"/>            | izvedbo odprt in večjih konstrukcijskih prebojev ter povečanje obstoječih odprt in v objektu, ki ne presegajo ene tretjine površine posameznega konstrukcijskega elementa in niso širši od 2 m  |
| <input type="checkbox"/>            | povečanje obstoječih prebojev fasade stavbe do 2 m; velikost povečanja odprtine ne presega ene tretjine površine fasade   |
| <input type="checkbox"/>            | nov preboj fasade stavbe, pri čemer je ravnina fasade, na kateri se izvajajo preboji, oddaljena od meje zemljišča drugega lastnika več kot 2 m, velikost novih prebojev ne presega ene tretjine površine fasade in noben preboj ni širši od 2 m   |
| <input type="checkbox"/>            | vgradnjo dvigala v notranjosti objekta, s katerim se posega v nosilno konstrukcijo  |
| <input checked="" type="checkbox"/> | manjše povečanje prostornine, ki ne poveča bruto tlorisne površine objekta, ter pomeni izvedbo posameznih konstrukcijskih elementov na objektu (izvedba frčade, vsaj z dveh strani odprt nadstrešek na obstoječi pohodni strehi, dvig obodnega zidu pod poševno streho za višino horizontalne vezi za največ 0,3 m, ipd.) |
| <input type="checkbox"/>            | prizidavo nakladalnih ramp in klančin   |
| <input type="checkbox"/>            | izvedbo nepohodnega konzolnega nadstreška površine do 6 m <sup>2</sup>  |

S KATERO SE NE BODO OGROŽALE ALI POSLABŠALE GRADBENOTEHNIČNE LASTNOSTI OBJEKTA.

|   |  |
|---|--|
| datum   | junij 2024   |
| podpis pooblaščenega strokovnjaka s področja gradbeništva | Jurij Žejn, univ.dipl.inž.grad. <div><div>JURIJ ŽEJN<br/>univ.dipl.inž.grad.<br/>IZS PI G-3462</div></div> |

|                        |   |
|------------------------|---|
| podpis odgovorne osebe | Bogomir Ipavec <div><div>STATICON IB</div><div>Družba za projektiranje, inženiring in svetovanje, d.o.o.<br/>Lokarjev drevored 1, 5270 Ajdovščina</div></div> |
|------------------------|---|

|                                     |   |
|-------------------------------------|---|
| PRILOGA                             |   |
| <input checked="" type="checkbox"/> | Grafični prikaz manjše rekonstrukcije (tloris, prerez ipd.) |

## 2.3 TEHNIČNO POROČILO

### 1.0 SPLOŠNO

Predmet načrta je sanacija strehe na objektu Podružnične šole Lokavec, na parc. št. 2658/1 k.o. Lokavec. Ker na več mestih ob deževju zamaka v notranjost objekta, se domneva, da kritina ni ustrezna, enako velja za sekundarno kritino. Zadnja sanacija strehe se je zgodila pred več kot 20 leti, zato se celotna strešna konstrukcija zamenja z novo, tudi na račun energetske sanacije.

Ostrešje objekta je jeklene in lesene izvedbe. Tlorisno je streha v oblike črke T, s podlogovato štirikapnico, na katero se na sredini priključuje trikapnica. Naklon strehe je 23stopinj, predvideno je prekritje z opečnato kritino.

### 2.0 STREŠNA KONSTRUKCIJE

Osnovni koncept strehe se ohrani, nosilne elemente pa se zamenja z novimi, močnejšimi. Nosilna konstrukcija strehe je sestavljena iz:

- jeklenega okvirja, ki je zvarjen iz profila HEA260. Imamo 4 takšne okvirje, ki se naslanjajo na obstoječe ležišča, katere bo verjetno potrebno razširiti, kar se bo videlo tekom izvedbe. Jeklen okvir ima na eni strani fiksno ležišče, na drugi strani pa pomično ležišče (pomično ležišče naredimo z eliptičnimi luknjami na podložnih ploščah in vmesnim teflonom za zagotavljanje zdrsa).
- grebenskih in žlotnih elementov, ki so narejeni iz škatlastega profila 180/120/6mm. Elementi so privarjeni na osnovni jekleni okvir, ter na slemenski nosilec, na drugi strani pa so sidrani na obstoječe ležišče na robnem vencu.
- slemenskega elementa, ki je narejen iz škatlastega profila 180/120/6mm, privarjen je med jekleni okvir HEA260, ter na drugi strani sidran v ležišče nosilne stene. Krajši slemenski nosilec se opira je greben in na jekleni okvir sestavljen iz škatle 180/120/6mm.
- dveh krajši jeklenih okvirjev, izvedenih iz škatlastega profila 180/120/6mm, katera sta sidrana na nosilne stene; okvirja podpirata grebenske elemente
- vmesnih lesenih leg dimenzij 16/18cm. Lege potekajo na osnem rastru cca 80cm in se naslanjajo na nosilne zidove, jeklene okvirje, grebene in žlote. Na vrhu jeklenih elementov se privari ustrezne ploščice, oz. izdeli »čevelj«, ki služijo za bočno podporo lesenim legam, ter obenem omogočajo vijačenje in pritrdjevanje letih. Lesene lege morajo potekati kontinuirno preko dveh polj. Če temu ni tako, morajo biti lege večjih dimenzij! Lege katere morajo potekati preko dveh polj ali več, so označene v prilogi (z oranžno barvo). Na mestu kjer se stikujeta dve legi na jeklenem elementu, mora biti čevelj ustrezno predelan, podaljšan, da je omogočeno kvalitetno vijačenje z dovoljšnimi odmiki vijakov od roba lesa. Robne lege, večje dolžine med 400 - 650cm, ki gredo ob robnem vencu, morajo biti dodatno sidrane v venec (npr. s pomočjo jeklenega kotnika).
- vmesnega jeklenega škatlastega profila 180/120/6mm, profil se naslanja in je privari na grebenski jekleni element. Zaradi velikega razpona se na dveh mestih uporabi jeklen profil namesto lesene lege.

### 3.0 MATERIALI

Lesene elementi strešne konstrukcije so naslednje predvidene kvalitete:

| Element             | Trdnostni razred lesa |
|---------------------|-----------------------|
| vmesne lege 16/18cm | masivni les C24       |

Les je glede na predvideno vlažnost prostorov uvrščen v drugi razred uporabnosti. Pri izvedbi lesene konstrukcije je potrebno upoštevati določila standarda SIST EN 1995-1-1, poglavje 10. Lesene lege morajo biti ustrezno posušene, da ne pride do neželenih dilatacij in razpok.

Jekleni elementi strešne konstrukcije so naslednje predvidene kvalitete:

| Element                    | Jeklo |
|----------------------------|-------|
| jekleni okvir HEA260       | S275  |
| pravokotna cev 180/120/6mm | S275  |

Izvedba in montaža jeklenega okvirja in jeklenih elementov mora biti v skladu s SIST EN 1090-2, EXC2. Vezna sredstva so trdnostnega razreda 8.8.. Vsi kovinski elementi morajo biti ustrezno protikorozijsko zaščiteni, z vročim cinkanjem, z upoštevanjem določil skupine standardov SIST EB ISO 12944 – Protikorozijska zaščita jeklenih konstrukcij z zaščitnimi premazanimi sistemi in v skladu z zahtevami investitorja in projektanta. Če v nadaljnjih fazah ne bo drugače določeno, je potrebno upoštevati kategorijo korozijske zaščite C3, s srednjo trajnostjo (razred M), v skladu z EN ISO 12944-5, Tabela A.4 (glej tudi EN ISO 12944-1).

Vsi vgrajeni materiali, kot tudi zaščita in izvedba mora ustrezati veljavnim standardom in predpisom.

#### 4.0 ZUNANJI VPLIVI

Pri projektiranju so bili upoštevani vplivi na konstrukcije kot jih določa standard SIST EN 1991 in SIST EN 1998 ob upoštevanju delnih faktorjev obtežbe v skladu s standardom SIST EN 1990. V splošnem so bile upoštevane sledeče obtežbe:

##### LASTNA IN STALNA OBTEŽBA:

VETER: - Cona vetra 3:  $v_{ref}=30\text{m/s}$  , kat. terena II

SNEG: - Cona snega A1: nadmorska višina=170m

##### KORISTNA OBTEŽBA:

- streha, kat. H nepohodna streha  $q=0,40\text{ kN/m}^2$

Podrobnejša analiza obtežb je prikazana v nadaljevanju.

#### 5.0 ZAKLJUČEK

Pred izvedbo posameznih elementov objekta je treba obvezno uskladiti arhitekturne, gradbene in instalacijske načrte, da se izdela vse potrebne odprtine in preboje, ter točno določi višine.

Delavniške načrte jeklene konstrukcije izdela izvajalec jeklene konstrukcije. Načrti morajo biti pregledani in potrjeni s strani projektanta. Vse mere za izvedbo jeklene konstrukcije mora izvajalec preveriti na licu mesta in s takimi merami šele pristopiti k izvedbi.

Tekom izvedbe se pregleda ali je potrebna sanacija, ojačitev AB robnih vencev in vezi.

Investitor je med gradnjo objekta dolžan zagotoviti strokovni nadzor in kontrolo izdelave z vsemi ustreznimi meritvami vgrajenega materiala po veljavnih predpisih in standardih.

Izvajalec je dolžan pred pričetkom gradnje izdelati elaborat postopka gradnje, vključno z vsemi varnostnimi ukrepi. Med gradnjo mora voditi vso po veljavnih predpisih zahtevano dokumentacijo, ki se nanaša na dokazovanje kvalitete vgrajenih materialov in tehnoloških postopkov posameznih faz gradnje. Vsi vgrajeni produkti morajo imeti ustrezna tehnična soglasja oz. certifikate. Ves vgrajen, dodatni in spojni material mora biti opremljen v skladu z Zakonom o gradbenih proizvodih (ZGPro) oziroma Direktivo EU o gradbenih proizvodih (DGP), z izjavami o skladnosti proizvoda oz. certifikati o skladnosti proizvoda in mora biti vgrajen po veljavnih predpisih in standardih. Vsak vgrajen material mora biti označen in sledljiv.

Pri delu je potrebno upoštevati ustrezne predpis iz varstva pri delu. Dokumenti morajo biti pregledani s strani strokovnega nadzora investitorja.

Investitor objekta je dolžan poskrbeti za vizualne kontrole in preglede nosilnih delov konstrukcije (tekoči pregledi, redni glavni pregledi v časovnih razdobjih po 5 let). Na konstrukciji je potrebno pregledati in evidentirati pojav eventualnih deformacij in razpok, ki bi lahko povzročile večjo škodo na objektu. V primeru, da se pri vizualnem pregledu ugotovi večje poškodbe, je potrebno opraviti točnejše meritve in ugotoviti dejanske vrednosti poškodb, ter označiti njihovo lokacijo.

Vzdrževanje in nadzorovanje nosilnih delov objekta mora biti tako, da bo objekt varen in funkcionalen, ter bo s tem odgovarjal namenu, kateremu je predviden.

V primeru nenavadne izjemne zasnežitve je potrebno sneg odstranjevati s strešne konstrukcije.

V kolikor nastanejo pri izvedbi odstopanja od projekta (spremembe v nosilni konstrukciji), je potrebno konstrukcijo ponovno analizirati in o tem obvestiti odgovornega projektanta.

Naknadno prebijanje nosilnih elementov konstrukcije ni dovoljeno brez soglasja pooblaščenega projektanta.

## **2.4 STATIČNI RAČUN**

Statični izračuni:

- analiza vplivov na objekt »Streha šola Lokavec«
- poz 100: strešna jeklena konstrukcija
- poz 101: vmesna lega razpona 4,4m + 2,6m
- poz 102: jeklen nosilec (kot vmesna lega)
- poz 103: vmesna lega razpona 4,65m + 1,20m
- poz 104: vmesna lega razpona 3,4m

# ANALIZA VPLIVOV NA OBJEKT "PODRUŽNIČNA ŠOLA LOKAVEC"

## 1. VPLIV LASTNE TEŽE

Za vse konstrukcijske elemente je lastna teža v izračunu upoštevana avtomatsko (računalniški program Tower) s pripadajočo prostorninski težo elementa.

## 2. VPLIV STALNE OBTEŽBE

### Dvokapna streha

- fotovoltaika

$$g_{\text{fot}} = 0.30 \text{ kN} \cdot \text{m}^{-2}$$

- opečna kritina

$$g_{\text{kr}} = 0.65 \text{ kN} \cdot \text{m}^{-2}$$

- prečne letve 3/5cm

$$b_{\text{p.l.1}} = 5 \text{ cm} \quad h_{\text{p.l.1}} = 3 \text{ cm}$$

$$\text{razdalja}_{\text{p.l.1}} = 33 \text{ cm}$$

$$g_{\text{pl.1}} = 0.02 \cdot \text{kN} \cdot \text{m}^{-2}$$

- vzdolžne letve 5/3cm

$$b_{\text{v.l}} = 5 \text{ cm} \quad h_{\text{v.l}} = 3 \text{ cm}$$

$$\text{razdalja}_{\text{v.l}} = 60 \text{ cm}$$

$$g_{\text{v.l}} = 0.01 \cdot \text{kN} \cdot \text{m}^{-2}$$

- paropropustna vodoodbojna folija

$$g_{\text{fo}} = 0.02 \text{ kN} \cdot \text{m}^{-2}$$

- MDF plošča 25mm

$$g_{\text{mdf}} = 0.12 \text{ kN} \cdot \text{m}^{-2}$$

- špirovci 16/18cm, e=80cm

$$g_{\text{spi}} = 0.15 \text{ kN} \cdot \text{m}^{-2}$$

- jeklena konstrukcija

$$g_{\text{jk}} = 0.00 \text{ kN} \cdot \text{m}^{-2} \quad \dots \text{avtomatski izračun}$$

- top. izolacija med legami + spodaj, deb.36cm

$$g_{\text{ti}} = 0.25 \text{ kN} \cdot \text{m}^{-2}$$

- parna zapora

$$g_{\text{pa}} = 0.02 \text{ kN} \cdot \text{m}^{-2}$$

- MK plošče

$$g_{\text{mk}} = 0.25 \text{ kN} \cdot \text{m}^{-2}$$

---

**streha skupaj =**

$$g_{\text{st.sk}} = 1.80 \cdot \text{kN} \cdot \text{m}^{-2}$$

## 3. SPREMENLJIVI VPLIVI

Streha:

- nepohodna streha, kat. H

$$q_{\text{sk.st}} = 0.4 \text{ kN} \cdot \text{m}^{-2}$$



#### 4. VPLIV SNEGA

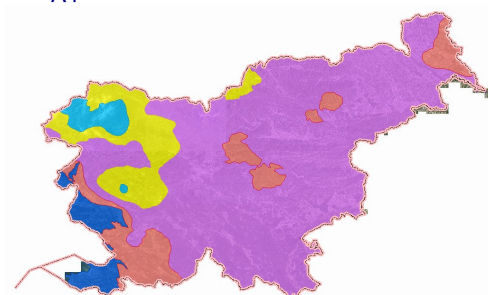
- nadmorska višina:

visina = 170m

... naselje Lokavec

- cona:

A1



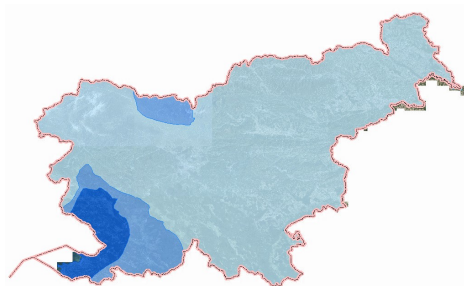
V primeru nenavadne izjemne zasnežitve je potrebno sneg odstranjevati s strešne konstrukcije.

Izračun vpliva snega je izveden v nadaljevanju.

#### 5. VPLIV VETRA

Dvokapna streha naklona 23stopinj

- cone z enakimi vrednostmi osnovne hitrosti vetra  $v_{b,0}$ :



- cona:

3

- osnovna hitrost vetra:

$$v_b = 30 \text{ m} \cdot \text{s}^{-1}$$

... naselje Lokavec

- osnovni tlak vetra:

$$q_{\text{ref}} = 0.56 \cdot \text{kN} \cdot \text{m}^{-2}$$

- kategorija terena:

II

Izračun vpliva vetra je izveden v nadaljevanju.



## Item: obtežba snega in vetra

Wind and Snow Loads (x64) LWS+ 01/23D (FRILO R-2023-1/P04)

### System

#### Base values

Country Europe  
Snow-code EN 1991-1-3:2010-12  
Wind-code EN 1991-1-4:2010-12  
Town -  
Altitude of terrain hMSL = 170.00 m  
Climatic region Alpine region  
Snow region 1

Category of terrain CategoryII  
(A community assignment is not legally binding regulated in the snow and wind standards!)

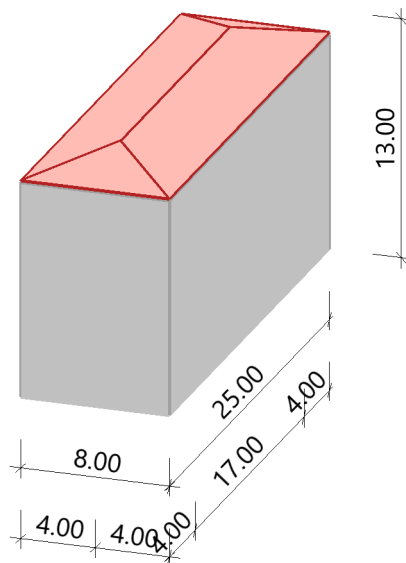
#### Factors

Factor snow load on eaves  $k = 3.00$

#### Geometry Hipped roof

|                           |                            |                            |
|---------------------------|----------------------------|----------------------------|
| Building height           | $h = 13.00$ m              |                            |
| Building length           | $l = 25.00$ m              |                            |
| Building width            | $b = 8.00$ m               |                            |
|                           | $b_{le} = 4.00$ m          | $b_{ri} = 4.00$ m          |
| using Hipped roof         |                            |                            |
| Slope                     | $\alpha_{le} = 17.0^\circ$ | $\alpha_{ri} = 17.0^\circ$ |
| Overhang                  | $ov_{le} = 0.00$ m         | $ov_{ri} = 0.00$ m         |
| Overhang                  | $ov_1 = 0.00$ m            | $ov_2 = 0.00$ m            |
| Roof width/length         | $dx = 8.00$ m              | $dy = 25.00$ m             |
| Distance snow guard ridge | $a_{le} = 0.00$ m          | $a_{ri} = 0.00$ m          |
| Hip                       |                            |                            |
| Slope                     | $\alpha_1 = 17.0^\circ$    | $\alpha_2 = 17.0^\circ$    |
| Length of hip             | $l_1 = 4.00$ m             | $l_2 = 4.00$ m             |
| Distance snow guard ridge | $a_1 = 0.00$ m             | $a_2 = 0.00$ m             |

#### Graphics

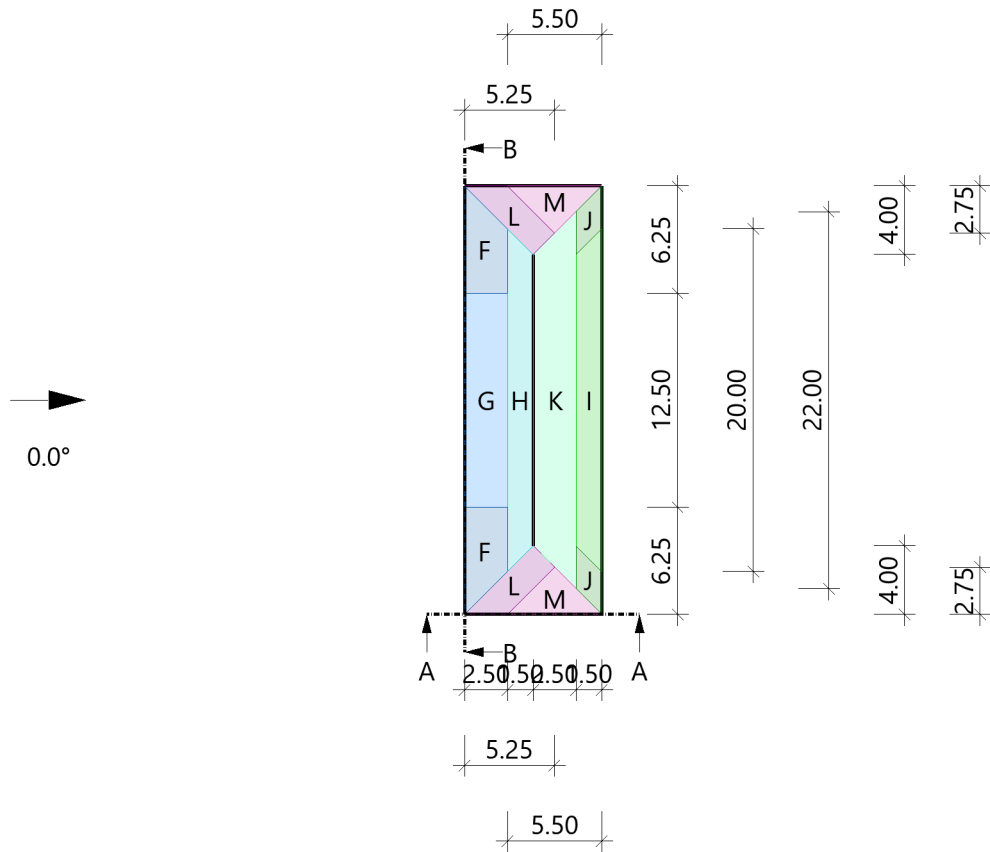


All values are characteristic ones.  
Sit: P/T=persistent/transient, excp=exceptional

Sit: P/T=persistent/transient, excp=exceptional

Wind

Graphics, 0°, Top view



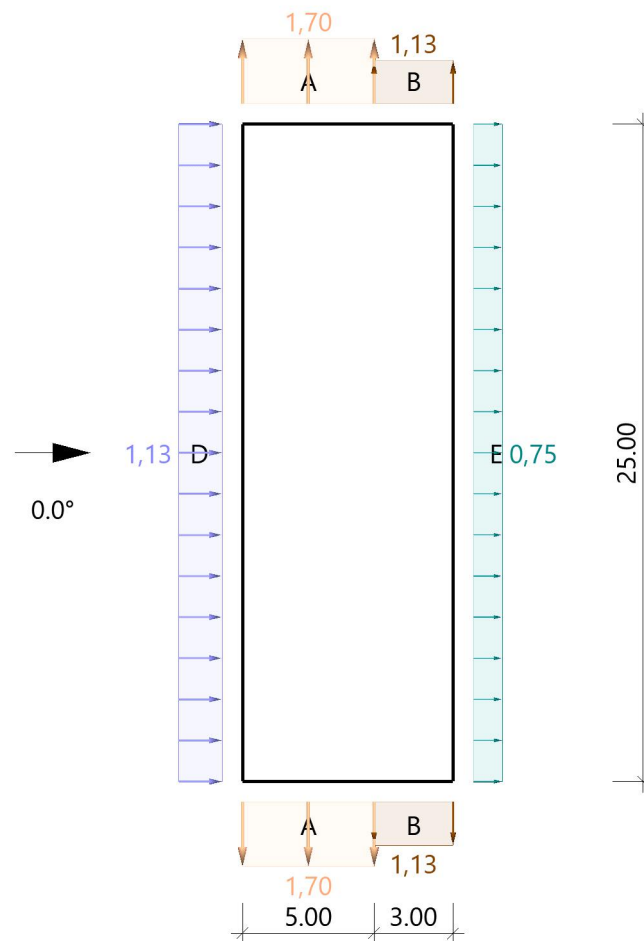
Table, 0°, Top view

Reference influence width    e = 25.00 m

| Region | structural component | Cpe,10+ | Cpe,10- | Cpe,1+ | Cpe,1- | We,10+<br>[kN/m²] | We,10-<br>[kN/m²] | We,1+<br>[kN/m²] | We,1-<br>[kN/m²] | lx<br>[m] | ly<br>[m] |
|--------|----------------------|---------|---------|--------|--------|-------------------|-------------------|------------------|------------------|-----------|-----------|
| F      | DF links             | 0.24    | -0.85   | 0.24   | -1.93  | 0.34              | -1.20             | 0.34             | -2.74            | 2.50      | 6.25      |
| G      | DF links             | 0.27    | -0.76   | 0.27   | -1.50  | 0.38              | -1.08             | 0.38             | -2.13            | 2.50      | 12.50     |
| H      | DF links             | 0.23    | -0.29   | 0.23   | -0.29  | 0.32              | -0.41             | 0.32             | -0.41            | 1.50      | 20.00     |
| K      | DF rechts            | 0.00    | -1.11   | 0.00   | -1.80  | 0.00              | -1.57             | 0.00             | -2.55            | 2.50      | 22.00     |
| J      | DF rechts            | 0.00    | -0.96   | 0.00   | -1.46  | 0.00              | -1.36             | 0.00             | -2.07            | 1.50      | 4.00      |
| I      | DF rechts            | 0.00    | -0.49   | 0.00   | -0.49  | 0.00              | -0.69             | 0.00             | -0.69            | 1.50      | 20.00     |
| L      | Walm vorne           | 0.00    | -1.40   | 0.00   | -2.00  | 0.00              | -1.99             | 0.00             | -2.84            | 5.25      | 4.00      |
| M      | Walm vorne           | 0.00    | -0.63   | 0.00   | -1.20  | 0.00              | -0.89             | 0.00             | -1.70            | 5.50      | 2.75      |
| L      | Walm hinten          | 0.00    | -1.40   | 0.00   | -2.00  | 0.00              | -1.99             | 0.00             | -2.84            | 5.25      | 4.00      |
| M      | Walm hinten          | 0.00    | -0.63   | 0.00   | -1.20  | 0.00              | -0.89             | 0.00             | -1.70            | 5.50      | 2.75      |

All values are characteristic ones.

Graphics, 0°, Section wall



Reference wind area for graphics = 10.00 m<sup>2</sup>

Table, 0°, Section wall

Reference influence width e = 25.00 m

Ratio h/d = 1.625 h/b = 0.520 d/b = 0.320

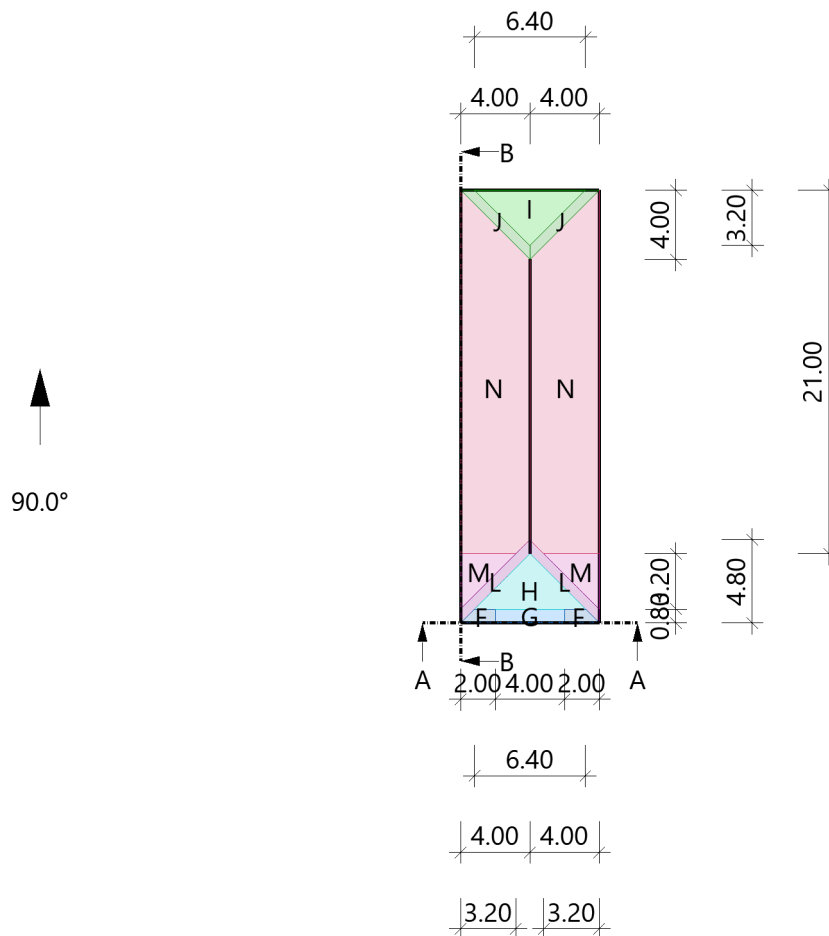
| Region | structural component    | C <sub>pe,10+</sub> | C <sub>pe,10-</sub> | C <sub>pe,1+</sub> | C <sub>pe,1-</sub> | W <sub>re,10+</sub><br>[kN/m <sup>2</sup> ] | W <sub>re,10-</sub><br>[kN/m <sup>2</sup> ] | W <sub>re,1+</sub><br>[kN/m <sup>2</sup> ] | W <sub>re,1-</sub><br>[kN/m <sup>2</sup> ] | l <sub>x</sub><br>[m] | l <sub>y</sub><br>[m] |
|--------|-------------------------|---------------------|---------------------|--------------------|--------------------|---|---|--|--|-----------------------|-----------------------|
| D      | <sup>1</sup> Wand links | 0.80                | 0.00                | 1.00               | 0.00               | 1.13  | 0.00  | 1.42                                       | 0.00                                       |                       | 25.00                 |
| E      | Wand rechts             | 0.00                | -0.53               | 0.00               | -0.53              | 0.00  | -0.75                                       | 0.00                                       | -0.75                                      |                       | 25.00                 |
| A      | Wand vorne              | <sup>2</sup> 0.00   | -1.20               | 0.00               | -1.40              | 0.00  | -1.70                                       | 0.00                                       | -1.99                                      | 5.00                  |                       |
| B      | Wand vorne              | <sup>2</sup> 0.00   | -0.80               | 0.00               | -1.10              | 0.00  | -1.13                                       | 0.00                                       | -1.56                                      | 3.00                  |                       |

All values are characteristic ones.

- 1 : the reference height z<sub>e</sub> acc. to Figure 7.4 applies to the windward wall  
2 : Wand hinten contains the same values



Graphics, 90°, Top view



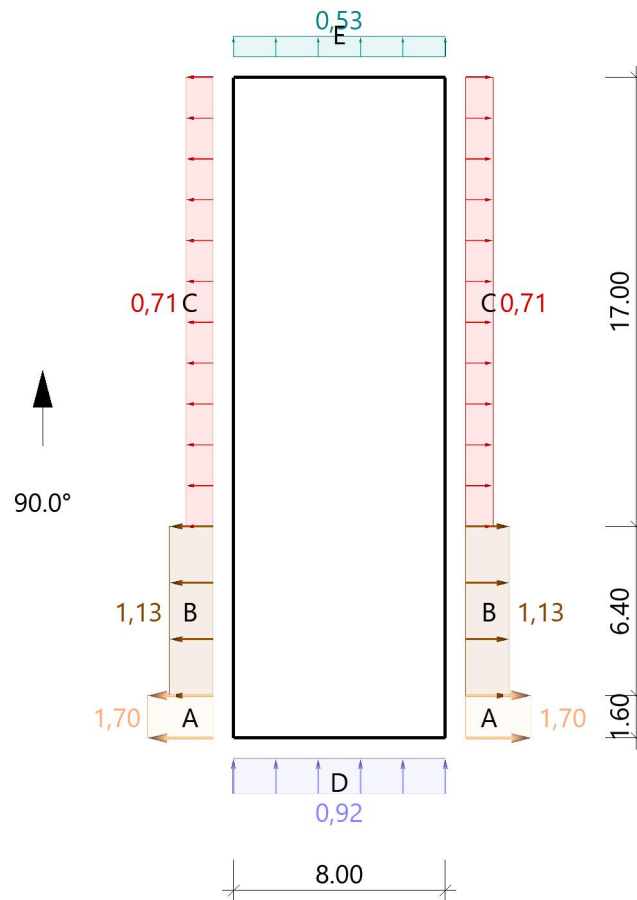
Table, 90°, Top view

Reference influence width  $e = 8.00 \text{ m}$

| Region | structural component | $C_{pe,10+}$ | $C_{pe,10-}$ | $C_{pe,1+}$ | $C_{pe,1-}$ | $W_{e,10+}$<br>[kN/m <sup>2</sup> ] | $W_{e,10-}$<br>[kN/m <sup>2</sup> ] | $W_{e,1+}$<br>[kN/m <sup>2</sup> ] | $W_{e,1-}$<br>[kN/m <sup>2</sup> ] | $l_x$<br>[m] | $l_y$<br>[m] |
|--------|----------------------|--------------|--------------|-------------|-------------|-------------------------------------|-------------------------------------|------------------------------------|------------------------------------|--------------|--------------|
| F      | Walm vorne           | 0.24         | -0.85        | 0.24        | -1.93       | 0.34                                | -1.20                               | 0.34                               | -2.74                              | 2.00         | 0.80         |
| G      | Walm vorne           | 0.27         | -0.76        | 0.27        | -1.50       | 0.38                                | -1.08                               | 0.38                               | -2.13                              | 4.00         | 0.80         |
| H      | Walm vorne           | 0.23         | -0.29        | 0.23        | -0.29       | 0.32                                | -0.41                               | 0.32                               | -0.41                              | 6.40         | 3.20         |
| J      | Walm hinten          | 0.00         | -0.96        | 0.00        | -1.46       | 0.00                                | -1.36                               | 0.00                               | -2.07                              | 4.00         | 4.00         |
| I      | Walm hinten          | 0.00         | -0.49        | 0.00        | -0.49       | 0.00                                | -0.69                               | 0.00                               | -0.69                              | 6.40         | 3.20         |
| L      | DF links             | 0.00         | -1.40        | 0.00        | -2.00       | 0.00                                | -1.99                               | 0.00                               | -2.84                              | 4.00         | 4.80         |
| M      | DF links             | 0.00         | -0.63        | 0.00        | -1.20       | 0.00                                | -0.89                               | 0.00                               | -1.70                              | 3.20         | 3.20         |
| N      | DF links             | 0.00         | -0.29        | 0.00        | -0.29       | 0.00                                | -0.41                               | 0.00                               | -0.41                              | 4.00         | 21.00        |
| L      | DF rechts            | 0.00         | -1.40        | 0.00        | -2.00       | 0.00                                | -1.99                               | 0.00                               | -2.84                              | 4.00         | 4.80         |
| M      | DF rechts            | 0.00         | -0.63        | 0.00        | -1.20       | 0.00                                | -0.89                               | 0.00                               | -1.70                              | 3.20         | 3.20         |
| N      | DF rechts            | 0.00         | -0.29        | 0.00        | -0.29       | 0.00                                | -0.41                               | 0.00                               | -0.41                              | 4.00         | 21.00        |

All values are characteristic ones.

Graphics, 90°, Section wall



Reference wind area for graphics = 10.00 m<sup>2</sup>

Table, 90°, Section wall

Reference influence width  $e = 8.00$  m  
Ratio  $h/d = 0.520$   $h/b = 1.625$   $d/b = 3.125$

| Region                    | structural component | $C_{pe,10+}$ | $C_{pe,10-}$ | $C_{pe,1+}$ | $C_{pe,1-}$ | $W_{e,10+}$<br>[kN/m <sup>2</sup> ] | $W_{e,10-}$<br>[kN/m <sup>2</sup> ] | $W_{e,1+}$<br>[kN/m <sup>2</sup> ] | $W_{e,1-}$<br>[kN/m <sup>2</sup> ] | $l_x$<br>[m] | $l_y$<br>[m] |
|---------------------------|----------------------|--------------|--------------|-------------|-------------|-------------------------------------|-------------------------------------|------------------------------------|------------------------------------|--------------|--------------|
| D (>8.00 m) <sup>1</sup>  | Wand vorne           | 0.74         | 0.00         | 1.00        | 0.00        | 1.04                                | 0.00                                | 1.42                               | 0.00                               | 8.00         |              |
| D (<=8.00 m) <sup>1</sup> | Wand vorne           | 0.74         | 0.00         | 1.00        | 0.00        | 0.92                                | 0.00                                | 1.24                               | 0.00                               | 8.00         |              |
| E                         | Wand hinten          | 0.00         | -0.37        | 0.00        | -0.37       | 0.00                                | -0.53                               | 0.00                               | -0.53                              | 8.00         |              |
| A                         | Wand links           | 0.00         | -1.20        | 0.00        | -1.40       | 0.00                                | -1.70                               | 0.00                               | -1.99                              |              | 1.60         |
| B                         | Wand links           | 0.00         | -0.80        | 0.00        | -1.10       | 0.00                                | -1.13                               | 0.00                               | -1.56                              |              | 6.40         |
| C                         | Wand links           | 0.00         | -0.50        | 0.00        | -0.50       | 0.00                                | -0.71                               | 0.00                               | -0.71                              |              | 17.00        |

All values are characteristic ones.

- 1 : the reference height  $z_e$  acc. to Figure 7.4 applies to the windward wall  
2 : Wand rechts contains the same values

### Vhodni podatki - Konstrukcija

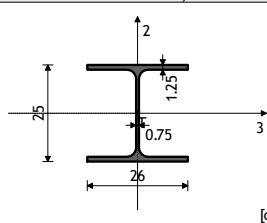
#### Tabele materialov

| No | Naziv materiala | E[kN/m <sup>2</sup> ] | $\mu$ | $\gamma$ [kN/m <sup>3</sup> ] | $\alpha_t$ [1/C] | Em[kN/m <sup>2</sup> ] | $\mu_m$ |
|----|-----------------|-----------------------|-------|-------------------------------|------------------|------------------------|---------|
| 1  | Jeklo           | 2.100e+8              | 0.30  | 78.50                         | 1.000e-5         | 2.100e+8               | 0.30    |
| 2  | Masiven les-C24 | 1.100e+7              | 0.20  | 4.20                          | 1.000e-5         | 1.100e+7               | 0.20    |

#### Seti gred

##### Set: 1 Prerez: IPB1 260, Fiktivna ekscentričnost

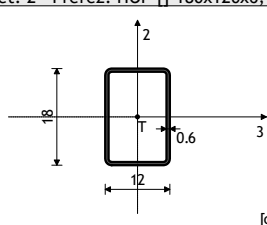
| Mat.      | A1       | A2       | A3       | I1       | I2       | I3       |
|-----------|----------|----------|----------|----------|----------|----------|
| 1 - Jeklo | 8.680e-3 | 2.874e-3 | 5.806e-3 | 5.260e-7 | 3.670e-5 | 1.045e-4 |



[cm]

##### Set: 2 Prerez: HOP [] 180x120x6, Fiktivna ekscentričnost

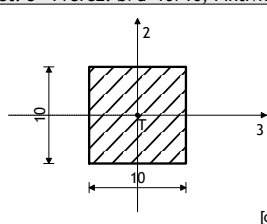
| Mat.      | A1       | A2       | A3       | I1       | I2       | I3       |
|-----------|----------|----------|----------|----------|----------|----------|
| 1 - Jeklo | 3.363e-3 | 2.160e-3 | 1.440e-3 | 1.673e-5 | 7.963e-6 | 1.491e-5 |



[cm]

##### Set: 3 Prerez: b/d=10/10, Fiktivna ekscentričnost

| Mat.                | A1       | A2       | A3       | I1       | I2       | I3       |
|---------------------|----------|----------|----------|----------|----------|----------|
| 2 - Masiven les-C24 | 1.000e-2 | 8.333e-3 | 8.333e-3 | 1.408e-5 | 8.333e-6 | 8.333e-6 |



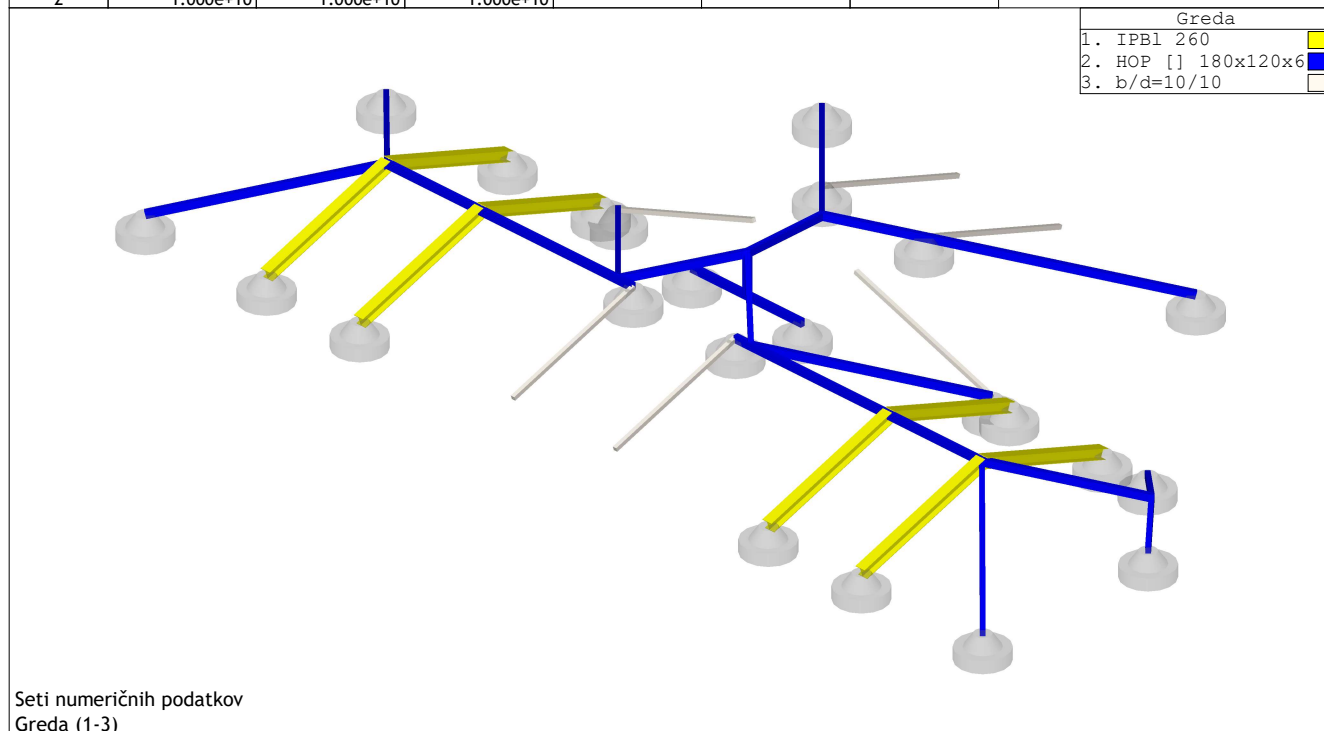
[cm]

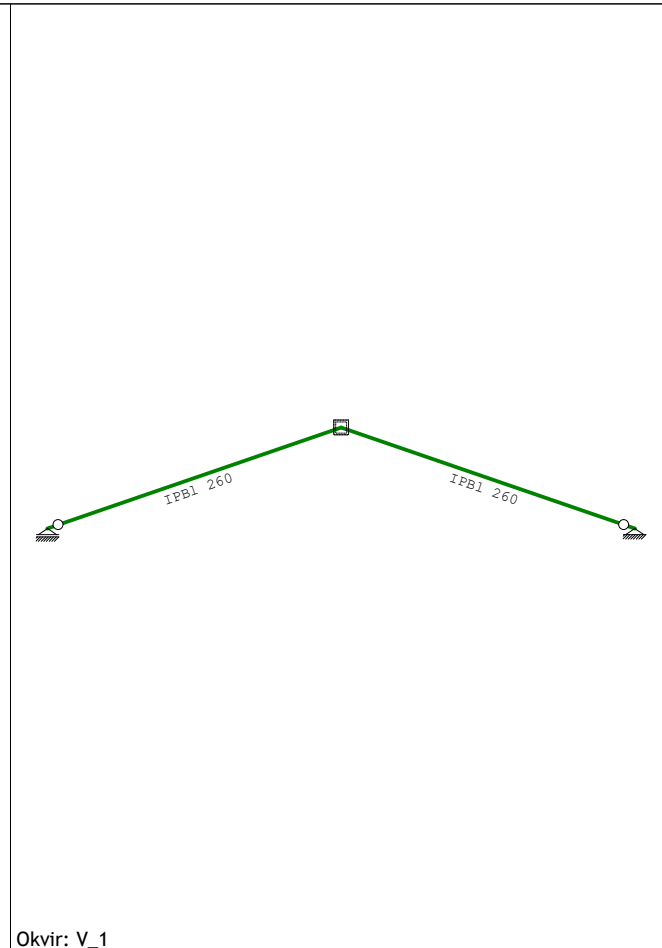
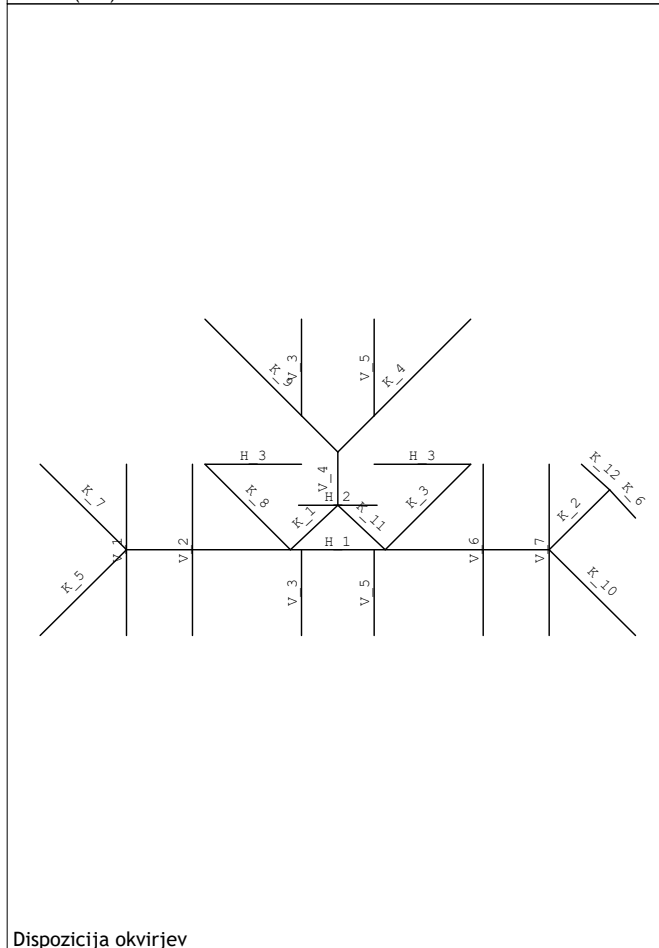
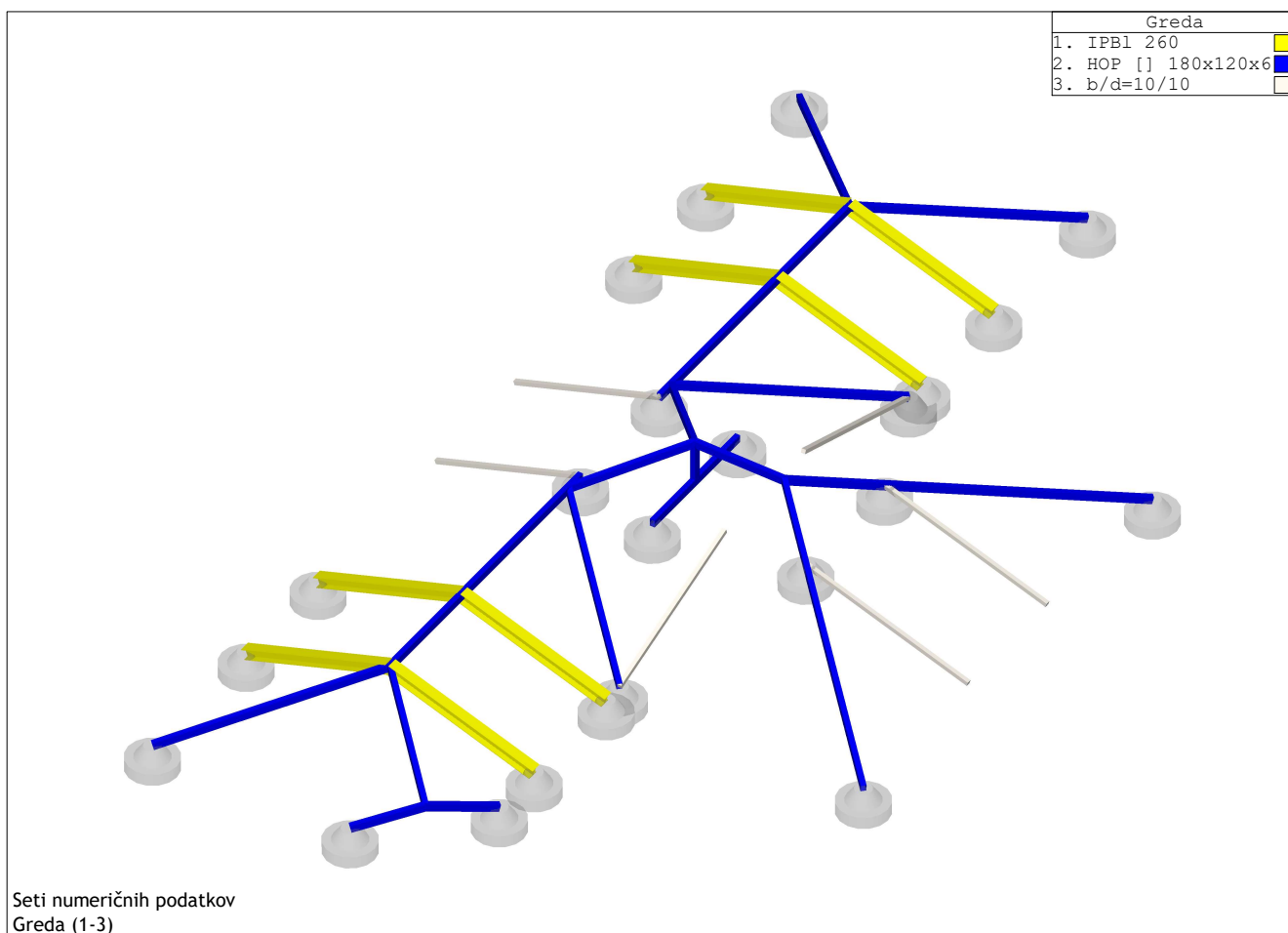
#### Seti linijskih podpor

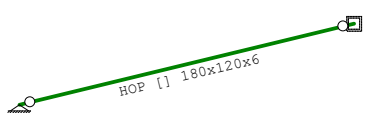
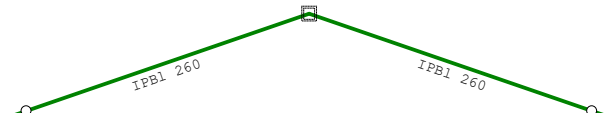

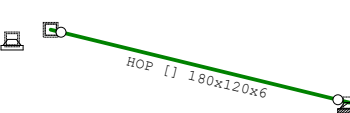
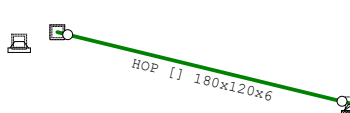
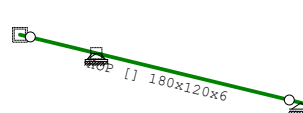
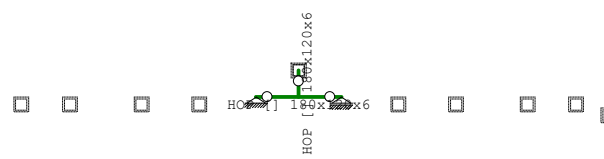
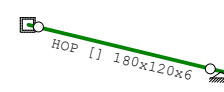
| Set | K,R1      | K,R2      | K,R3      | K,M1 | Tla [m] |
|-----|-----------|-----------|-----------|------|---------|
| 1   | 1.000e+10 | 1.000e+10 | 1.000e+10 |      |         |

#### Seti točkovnih podpor

| Set | K,R1      | K,R2      | K,R3      | K,M1 | K,M2 | K,M3 |
|-----|-----------|-----------|-----------|------|------|------|
| 1   |           |           | 1.000e+10 |      |      |      |
| 2   | 1.000e+10 | 1.000e+10 | 1.000e+10 |      |      |      |





|   |  |
|---|--|
|  <p>Okvir: K_7</p>   |  <p>Okvir: V_2</p>     |
|  <p>Okvir: H_1</p>  |  <p>Okvir: K_8</p>   |
|  <p>Okvir: K_3</p> |  <p>Okvir: K_9</p>  |
|  <p>Okvir: H_2</p> |  <p>Okvir: K_10</p> |



## Vhodni podatki - Obtežba

## Lista obtežnih primerov

| LC | Naziv                                  |
|----|--|
| 1  | lastna+stalna (g)                      |
| 2  | koristna čez celo                      |
| 3  | koristna 1                             |
| 4  | koristna 2                             |
| 5  | sneg                                   |
| 6  | veter tlak                             |
| 7  | veter srk                              |
| 8  | veter levo                             |
| 9  | veter desno                            |
| 10 | Komb.: I                               |
| 11 | Komb.: I+II                            |
| 12 | Komb.: I+III                           |
| 13 | Komb.: I+IV                            |
| 14 | Komb.: I+V                             |
| 15 | Komb.: I+VI                            |
| 16 | Komb.: I+VII                           |
| 17 | Komb.: I+V+0.6xVI                      |
| 18 | Komb.: I+0.5xV+VI                      |
| 19 | Komb.: I+II+0.5xV                      |
| 20 | Komb.: I+II+0.5xV+0.6xVI               |
| 21 | Komb.: I+0.7xII+V+0.6xVI               |
| 22 | Komb.: I+0.7xII+0.5xV+VI               |
| 23 | Komb.: 1.8xI                           |
| 24 | Komb.: 1.8xI+II                        |
| 25 | Komb.: 1.8xI+III                       |
| 26 | Komb.: 1.8xI+IV                        |
| 27 | Komb.: 1.8xI+V                         |
| 28 | Komb.: 1.8xI+VI                        |
| 29 | Komb.: 1.8xI+VII                       |
| 30 | Komb.: 1.8xI+V+0.6xVI                  |
| 31 | Komb.: 1.8xI+0.5xV+VI                  |
| 32 | Komb.: 3xI                             |
| 33 | Komb.: 3xI+II                          |
| 34 | Komb.: 3xI+III                         |
| 35 | Komb.: 3xI+IV                          |
| 36 | Komb.: 3xI+V                           |
| 37 | Komb.: 3xI+VI                          |
| 38 | Komb.: 3xI+VII                         |
| 39 | Komb.: 3xI+II+0.5xV+0.6xVI             |
| 40 | Komb.: 3xI+0.7xII+V+0.6xVI             |
| 41 | Komb.: 3xI+0.7xII+0.5xV+VI             |
| 42 | Komb.: 3xI+III+0.5xV+0.6xVI            |
| 43 | Komb.: 3xI+0.7xIII+V+0.6xVI            |
| 44 | Komb.: 3xI+0.7xIII+0.5xV+VI            |
| 45 | Komb.: 3xI+IV+0.5xV+0.6xVI             |
| 46 | Komb.: 3xI+0.7xIV+V+0.6xVI             |
| 47 | Komb.: 3xI+0.7xIV+0.5xV+VI             |
| 48 | Komb.: 1.35xI+1.05xIV+1.5xV+0.9xVIII   |
| 49 | Komb.: 1.35xI+1.05xIV+1.5xV+0.9xVIII   |
| 50 | Komb.: 1.35xI+1.05xIV+1.5xV+0.9xVII    |
| 51 | Komb.: 1.35xI+1.05xIV+1.5xV+0.9xVI     |
| 52 | Komb.: 1.35xI+1.05xIII+1.5xV+0.9xIX    |
| 53 | Komb.: 1.35xI+1.05xIII+1.5xV+0.9xVIII  |
| 54 | Komb.: 1.35xI+1.05xIII+1.5xV+0.9xVII   |
| 55 | Komb.: 1.35xI+1.05xIII+1.5xV+0.9xVI    |
| 56 | Komb.: 1.35xI+1.05xII+1.5xV+0.9xIX     |
| 57 | Komb.: 1.35xI+1.05xII+1.5xV+0.9xVIII   |
| 58 | Komb.: 1.35xI+1.05xII+1.5xV+0.9xVII    |
| 59 | Komb.: 1.35xI+1.05xII+1.5xV+0.9xVI     |
| 60 | Komb.: 1.35xI+1.05xIV+0.75xV+1.5xIX    |
| 61 | Komb.: 1.35xI+1.05xIV+0.75xV+1.5xVIII  |
| 62 | Komb.: 1.35xI+1.05xIV+0.75xV+1.5xVII   |
| 63 | Komb.: 1.35xI+1.05xIV+0.75xV+1.5xVI    |
| 64 | Komb.: 1.35xI+1.05xIII+0.75xV+1.5xIX   |
| 65 | Komb.: 1.35xI+1.05xIII+0.75xV+1.5xVIII |
| 66 | Komb.: 1.35xI+1.05xIII+0.75xV+1.5xVII  |
| 67 | Komb.: 1.35xI+1.05xIII+0.75xV+1.5xVI   |
| 68 | Komb.: 1.35xI+1.05xII+0.75xV+1.5xIX    |
| 69 | Komb.: 1.35xI+1.05xII+0.75xV+1.5xVIII  |
| 70 | Komb.: 1.35xI+1.05xII+0.75xV+1.5xVII   |
| 71 | Komb.: 1.35xI+1.05xII+0.75xV+1.5xVI    |
| 72 | Komb.: 1.35xI+1.5xIV+0.75xV+0.9xIX     |
| 73 | Komb.: 1.35xI+1.5xIV+0.75xV+0.9xVIII   |
| 74 | Komb.: 1.35xI+1.5xIV+0.75xV+0.9xVII    |
| 75 | Komb.: 1.35xI+1.5xIV+0.75xV+0.9xVI     |
| 76 | Komb.: 1.35xI+1.5xIII+0.75xV+0.9xIX    |
| 77 | Komb.: 1.35xI+1.5xIII+0.75xV+0.9xVIII  |
| 78 | Komb.: 1.35xI+1.5xIII+0.75xV+0.9xVII   |
| 79 | Komb.: 1.35xI+1.5xIII+0.75xV+0.9xVI    |
| 80 | Komb.: 1.35xI+1.5xII+0.75xV+0.9xIX     |
| 81 | Komb.: 1.35xI+1.5xII+0.75xV+0.9xVIII   |
| 82 | Komb.: 1.35xI+1.5xII+0.75xV+0.9xVII    |
| 83 | Komb.: 1.35xI+1.5xII+0.75xV+0.9xVI     |
| 84 | Komb.: I+1.05xIV+1.5xV+0.9xIX          |
| 85 | Komb.: I+1.05xIV+1.5xV+0.9xVIII        |
| 86 | Komb.: I+1.05xIV+1.5xV+0.9xVII         |
| 87 | Komb.: I+1.05xIV+1.5xV+0.9xVI          |
| 88 | Komb.: I+1.05xIII+1.5xV+0.9xIX         |
| 89 | Komb.: I+1.05xIII+1.5xV+0.9xVIII       |

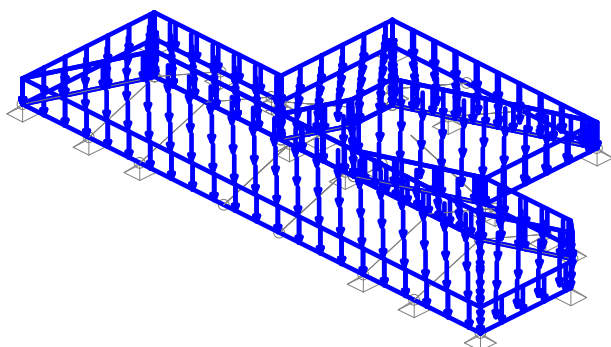
| LC  | Naziv                             |
|-----|-----------------------------------|
| 90  | Komb.: I+1.05xIII+1.5xV+0.9xVII   |
| 91  | Komb.: I+1.05xIII+1.5xV+0.9xVI    |
| 92  | Komb.: I+1.05xII+1.5xV+0.9xIX     |
| 93  | Komb.: I+1.05xII+1.5xV+0.9xVIII   |
| 94  | Komb.: I+1.05xII+1.5xV+0.9xVII    |
| 95  | Komb.: I+1.05xII+1.5xV+0.9xVI     |
| 96  | Komb.: I+1.05xIV+0.75xV+1.5xIX    |
| 97  | Komb.: I+1.05xIV+0.75xV+1.5xVIII  |
| 98  | Komb.: I+1.05xIV+0.75xV+1.5xVII   |
| 99  | Komb.: I+1.05xIV+0.75xV+1.5xVI    |
| 100 | Komb.: I+1.05xIII+0.75xV+1.5xIX   |
| 101 | Komb.: I+1.05xIII+0.75xV+1.5xVIII |
| 102 | Komb.: I+1.05xIII+0.75xV+1.5xVII  |
| 103 | Komb.: I+1.05xIII+0.75xV+1.5xVI   |
| 104 | Komb.: I+1.05xII+0.75xV+1.5xIX    |
| 105 | Komb.: I+1.05xII+0.75xV+1.5xVIII  |
| 106 | Komb.: I+1.05xII+0.75xV+1.5xVII   |
| 107 | Komb.: I+1.05xII+0.75xV+1.5xVI    |
| 108 | Komb.: I+1.5xIV+0.75xV+0.9xIX     |
| 109 | Komb.: I+1.5xIV+0.75xV+0.9xVIII   |
| 110 | Komb.: I+1.5xIV+0.75xV+0.9xVII    |
| 111 | Komb.: I+1.5xIV+0.75xV+0.9xVI     |
| 112 | Komb.: I+1.5xIII+0.75xV+0.9xIX    |
| 113 | Komb.: I+1.5xIII+0.75xV+0.9xVIII  |
| 114 | Komb.: I+1.5xIII+0.75xV+0.9xVII   |
| 115 | Komb.: I+1.5xIII+0.75xV+0.9xVI    |
| 116 | Komb.: I+1.5xII+0.75xV+0.9xIX     |
| 117 | Komb.: I+1.5xII+0.75xV+0.9xVIII   |
| 118 | Komb.: I+1.5xII+0.75xV+0.9xVII    |
| 119 | Komb.: I+1.5xII+0.75xV+0.9xVI     |
| 120 | Komb.: 1.35xI+1.05xIV+1.5xIX      |
| 121 | Komb.: 1.35xI+1.05xIV+1.5xVIII    |
| 122 | Komb.: 1.35xI+1.05xIV+1.5xVII     |
| 123 | Komb.: 1.35xI+1.05xIV+1.5xVI      |
| 124 | Komb.: 1.35xI+1.05xIV+1.5xV       |
| 125 | Komb.: 1.35xI+1.05xIII+1.5xIX     |
| 126 | Komb.: 1.35xI+1.05xIII+1.5xVIII   |
| 127 | Komb.: 1.35xI+1.05xIII+1.5xVII    |
| 128 | Komb.: 1.35xI+1.05xIII+1.5xVI     |
| 129 | Komb.: 1.35xI+1.05xIII+1.5xV      |
| 130 | Komb.: 1.35xI+1.05xII+1.5xIX      |
| 131 | Komb.: 1.35xI+1.05xII+1.5xVIII    |
| 132 | Komb.: 1.35xI+1.05xII+1.5xVII     |
| 133 | Komb.: 1.35xI+1.05xII+1.5xVI      |
| 134 | Komb.: 1.35xI+1.05xII+1.5xV       |
| 135 | Komb.: 1.35xI+1.5xV+0.9xIX        |
| 136 | Komb.: 1.35xI+1.5xV+0.9xVIII      |
| 137 | Komb.: 1.35xI+1.5xV+0.9xVII       |
| 138 | Komb.: 1.35xI+1.5xV+0.9xVI        |
| 139 | Komb.: 1.35xI+1.5xIV+0.9xIX       |
| 140 | Komb.: 1.35xI+1.5xIV+0.9xVIII     |
| 141 | Komb.: 1.35xI+1.5xIV+0.9xVII      |
| 142 | Komb.: 1.35xI+1.5xIV+0.9xVI       |
| 143 | Komb.: 1.35xI+1.5xIII+0.9xIX      |
| 144 | Komb.: 1.35xI+1.5xIII+0.9xVIII    |
| 145 | Komb.: 1.35xI+1.5xIII+0.9xVII     |
| 146 | Komb.: 1.35xI+1.5xIII+0.9xVI      |
| 147 | Komb.: 1.35xI+1.5xII+0.9xIX       |
| 148 | Komb.: 1.35xI+1.5xII+0.9xVIII     |
| 149 | Komb.: 1.35xI+1.5xII+0.9xVII      |
| 150 | Komb.: 1.35xI+1.5xII+0.9xVI       |
| 151 | Komb.: 1.35xI+0.75xV+1.5xIX       |
| 152 | Komb.: 1.35xI+0.75xV+1.5xVIII     |
| 153 | Komb.: 1.35xI+0.75xV+1.5xVII      |
| 154 | Komb.: 1.35xI+0.75xV+1.5xVI       |
| 155 | Komb.: 1.35xI+1.5xIV+0.75xV       |
| 156 | Komb.: 1.35xI+1.5xIII+0.75xV      |
| 157 | Komb.: 1.35xI+1.5xII+0.75xV       |
| 158 | Komb.: I+1.05xIV+1.5xIX           |
| 159 | Komb.: I+1.05xIV+1.5xVIII         |
| 160 | Komb.: I+1.05xIV+1.5xVII          |
| 161 | Komb.: I+1.05xIV+1.5xVI           |
| 162 | Komb.: I+1.05xIV+1.5xV            |
| 163 | Komb.: I+1.05xIII+1.5xIX          |
| 164 | Komb.: I+1.05xIII+1.5xVIII        |
| 165 | Komb.: I+1.05xIII+1.5xVII         |
| 166 | Komb.: I+1.05xIII+1.5xVI          |
| 167 | Komb.: I+1.05xIII+1.5xV           |
| 168 | Komb.: I+1.05xII+1.5xIX           |
| 169 | Komb.: I+1.05xII+1.5xVIII         |
| 170 | Komb.: I+1.05xII+1.5xVII          |
| 171 | Komb.: I+1.05xII+1.5xVI           |
| 172 | Komb.: I+1.05xII+1.5xV            |
| 173 | Komb.: I+1.5xV+0.9xIX             |
| 174 | Komb.: I+1.5xV+0.9xVIII           |
| 175 | Komb.: I+1.5xV+0.9xVII            |
| 176 | Komb.: I+1.5xV+0.9xVI             |
| 177 | Komb.: I+1.5xIV+0.9xIX            |
| 178 | Komb.: I+1.5xIV+0.9xVIII          |

## Lista obtežnih primerov

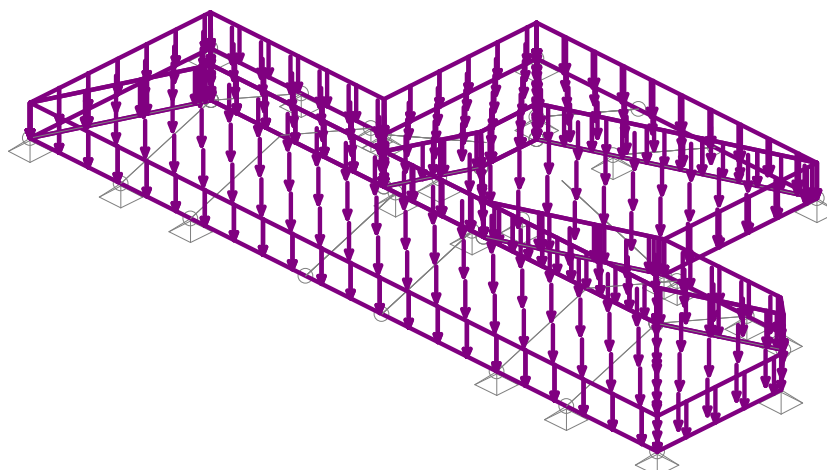
| LC  | Naziv                     |
|-----|---------------------------|
| 179 | Komb.: I+1.5xIV+0.9xVII   |
| 180 | Komb.: I+1.5xIV+0.9xVI    |
| 181 | Komb.: I+1.5xIII+0.9xIX   |
| 182 | Komb.: I+1.5xIII+0.9xVIII |
| 183 | Komb.: I+1.5xIII+0.9xVII  |
| 184 | Komb.: I+1.5xIII+0.9xVI   |
| 185 | Komb.: I+1.5xII+0.9xIX    |
| 186 | Komb.: I+1.5xII+0.9xVIII  |
| 187 | Komb.: I+1.5xII+0.9xVII   |
| 188 | Komb.: I+1.5xII+0.9xVI    |
| 189 | Komb.: I+0.75xV+1.5xIX    |
| 190 | Komb.: I+0.75xV+1.5xVIII  |
| 191 | Komb.: I+0.75xV+1.5xVII   |
| 192 | Komb.: I+0.75xV+1.5xVI    |
| 193 | Komb.: I+1.5xIV+0.75xV    |
| 194 | Komb.: I+1.5xIII+0.75xV   |
| 195 | Komb.: I+1.5xII+0.75xV    |
| 196 | Komb.: 1.35xI+1.5xIX      |

| LC  | Naziv                  |
|-----|------------------------|
| 197 | Komb.: 1.35xI+1.5xVIII |
| 198 | Komb.: 1.35xI+1.5xVII  |
| 199 | Komb.: 1.35xI+1.5xVI   |
| 200 | Komb.: 1.35xI+1.5xV    |
| 201 | Komb.: 1.35xI+1.5xIV   |
| 202 | Komb.: 1.35xI+1.5xIII  |
| 203 | Komb.: 1.35xI+1.5xII   |
| 204 | Komb.: I+1.5xIX        |
| 205 | Komb.: I+1.5xVIII      |
| 206 | Komb.: I+1.5xVII       |
| 207 | Komb.: I+1.5xVI        |
| 208 | Komb.: I+1.5xV         |
| 209 | Komb.: I+1.5xIV        |
| 210 | Komb.: I+1.5xIII       |
| 211 | Komb.: I+1.5xII        |
| 212 | Komb.: 1.35xI          |
| 213 | Komb.: I               |

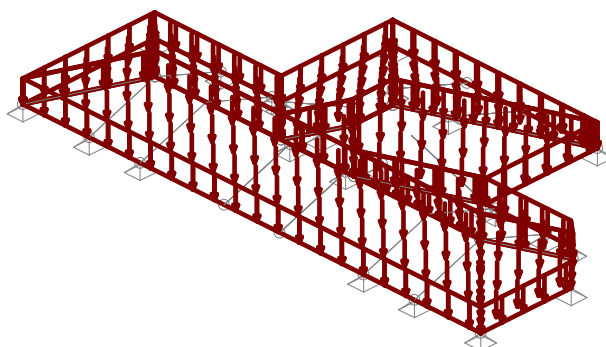
Obt. 1: lastna+stalna (g)

Površinska obtežba  
2.  $p = -1.80 \text{ kN/m}^2$ 

Seti numeričnih podatkov  
Površinska obtežba (2)

Obt. 5: sneg


Seti numeričnih podatkov  
Površinska obtežba (3)

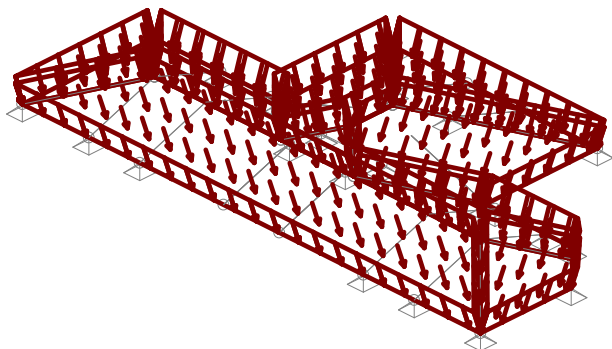
Obt. 2: koristna čez celo

Površinska obtežba  
1.  $p = -0.40 \text{ kN/m}^2$ 

Seti numeričnih podatkov  
Površinska obtežba (1)

Površinska obtežba  
3.  $p = -1.00 \text{ kN/m}^2$

Obt. 6: veter tlak

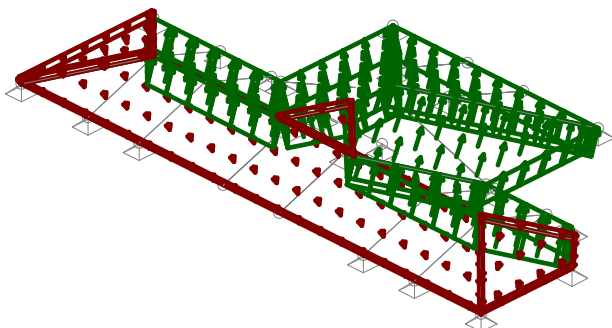
Površinska obtežba  
1.  $p = -0.40 \text{ kN/m}^2$



Seti numeričnih podatkov  
Površinska obtežba (1)

Obt. 8: veter levo

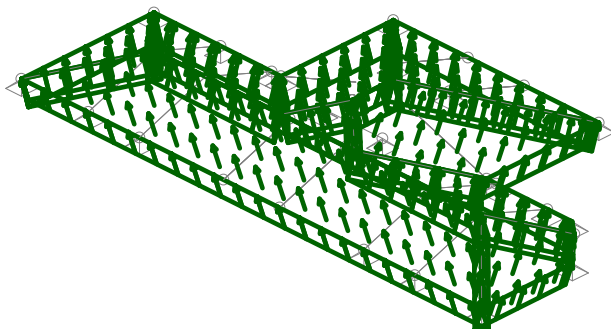
Površinska obtežba  
1.  $p = -0.40 \text{ kN/m}^2$   
4.  $p = 1.50 \text{ kN/m}^2$



Seti numeričnih podatkov  
Površinska obtežba (1,4)

Obt. 7: veter srk

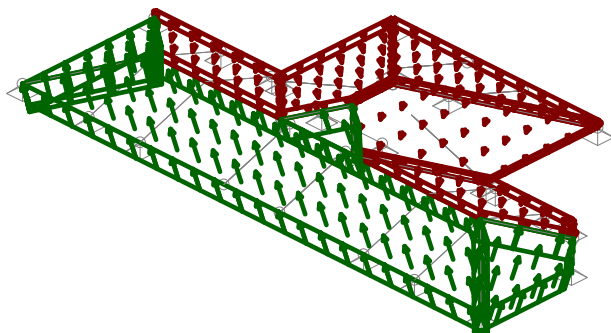
Površinska obtežba  
4.  $p = 1.50 \text{ kN/m}^2$



Seti numeričnih podatkov  
Površinska obtežba (4)

Obt. 9: veter desno

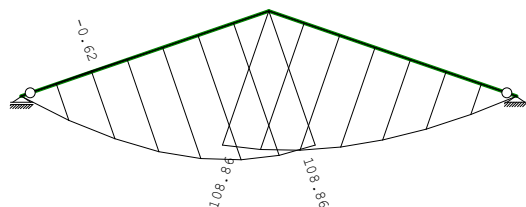
Površinska obtežba  
1.  $p = -0.40 \text{ kN/m}^2$   
4.  $p = 1.50 \text{ kN/m}^2$



Seti numeričnih podatkov  
Površinska obtežba (1,4)

### Statični preračun

Obt. 219: [MSN] 50-215

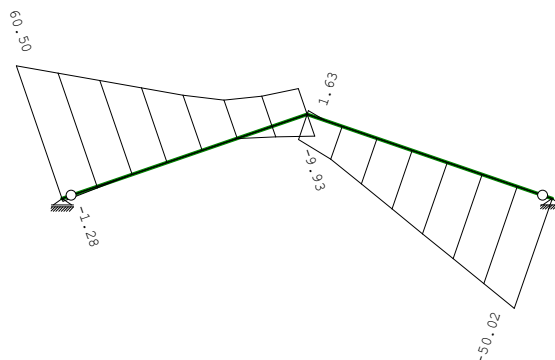


Okvir: V\_2

Vplivi v gredi: max M3= 108.86 / min M3= -0.62 kNm

Obt. 219: [MSN] 50-215

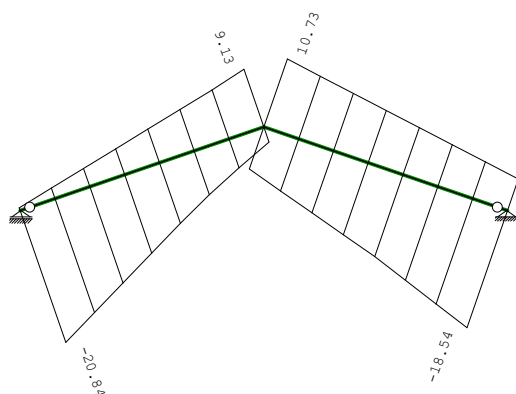
Obt. 219: [MSN] 50-215



Okvir: V\_2

Vplivi v gredi: max T2= 60.50 / min T2= -50.02 kN

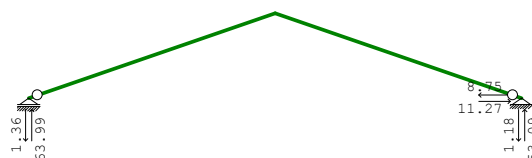
Obt. 219: [MSN] 50-215



Okvir: V\_2

Vplivi v gredi: max N1= 10.73 / min N1= -20.84 kN

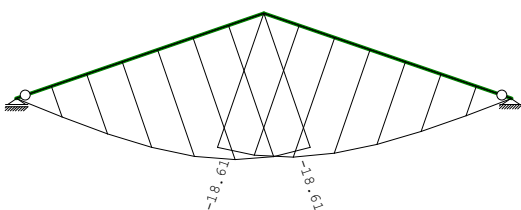
Obt. 216: [U.elas] 10-24



Okvir: V\_2

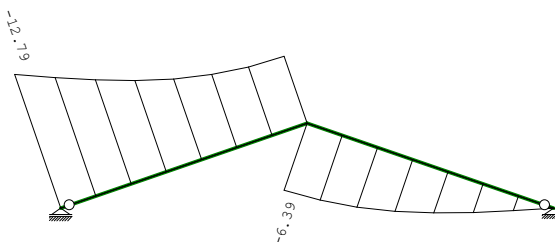
Reakcije podpor (Min/Max)

Obt. 216: [U.elas] 10-24



Okvir: V\_2

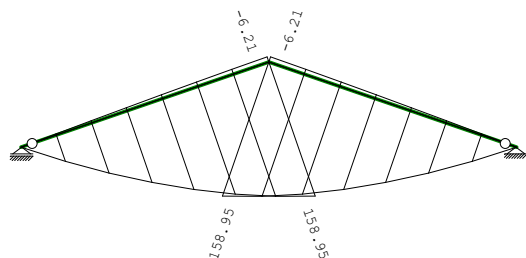
Vplivi v gredi: max Zp= -0.00 / min Zp= -18.61 m / 1000



Okvir: V\_2

Vplivi v gredi: max Yp= 0.00 / min Yp= -12.79 m / 1000

Obt. 219: [MSN] 50-215

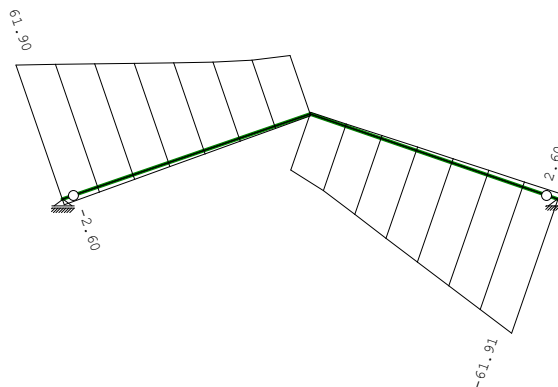


Okvir: V\_1

Vplivi v gredi: max M3= 158.95 / min M3= -6.21 kNm

Obt. 219: [MSN] 50-215

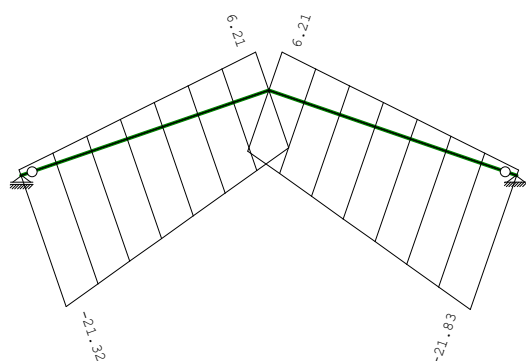
Obt. 219: [MSN] 50-215



Okvir: V\_1

Vplivi v gredi: max T2= 61.90 / min T2= -61.91 kN

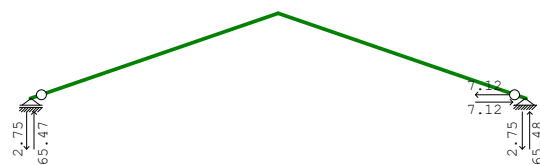
Obt. 219: [MSN] 50-215



Okvir: V\_1

Vplivi v gredi: max N1= 6.21 / min N1= -21.83 kN

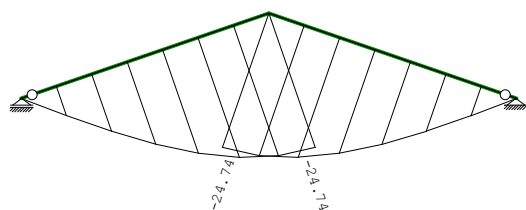
Obt. 216: [U.elas] 10-24



Okvir: V\_1

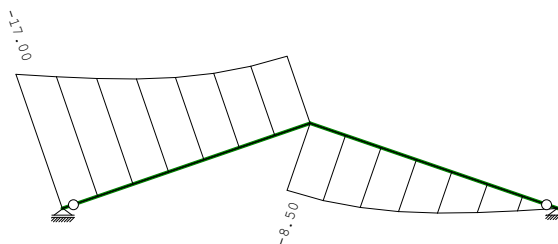
Reakcije podpor (Min/Max)

Obt. 216: [U.elas] 10-24



Okvir: V\_1

Vplivi v gredi: max Zp= -0.00 / min Zp= -24.74 m / 1000

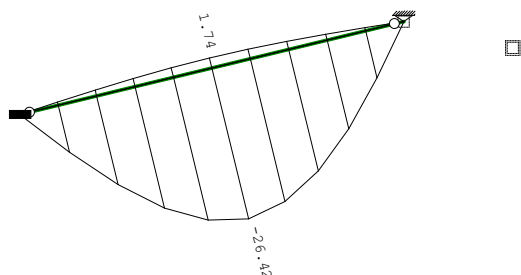


Okvir: V\_1

Vplivi v gredi: max Yp= 0.00 / min Yp= -17.00 m / 1000



Obt. 219: [MSN] 50-215

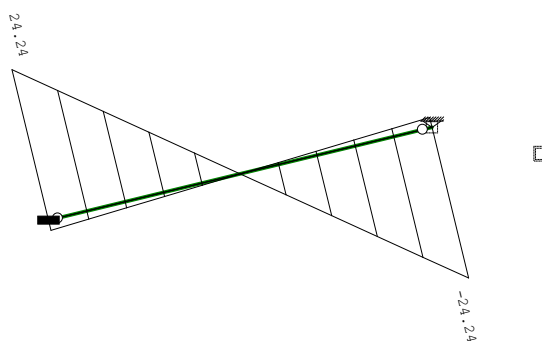


Okvir: K\_8

Vplivi v gredi: max  $u_2 = 1.74$  / min  $u_2 = -26.42$  m / 1000

Obt. 219: [MSN] 50-215

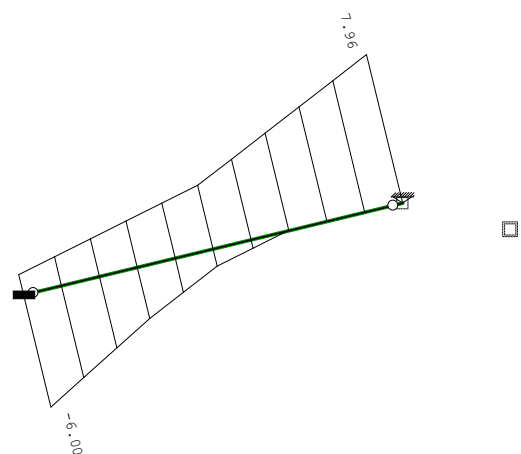
Obt. 219: [MSN] 50-215



Okvir: K\_8

Vplivi v gredi: max  $T_2 = 24.24$  / min  $T_2 = -24.24$  kN

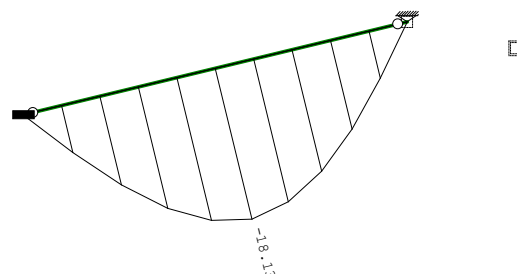
Obt. 216: [U.elas] 10-24



Okvir: K\_8

Vplivi v gredi: max  $N_1 = 7.96$  / min  $N_1 = -6.00$  kN

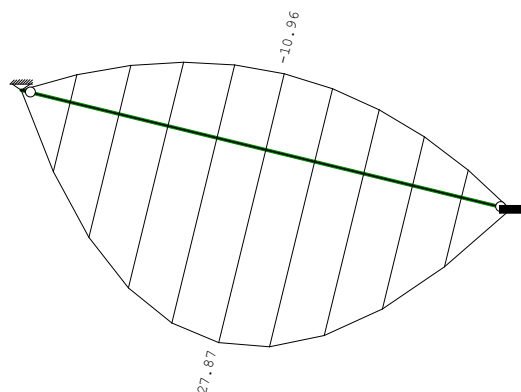
Obt. 219: [MSN] 50-215



Okvir: K\_8

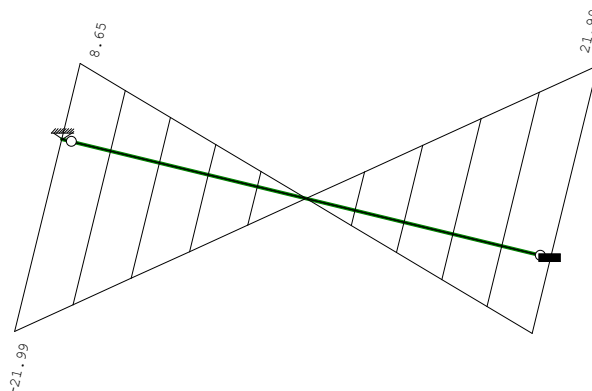
Vplivi v gredi: max  $Z_p = -0.00$  / min  $Z_p = -18.13$  m / 1000

Obt. 219: [MSN] 50-215



Okvir: K\_9

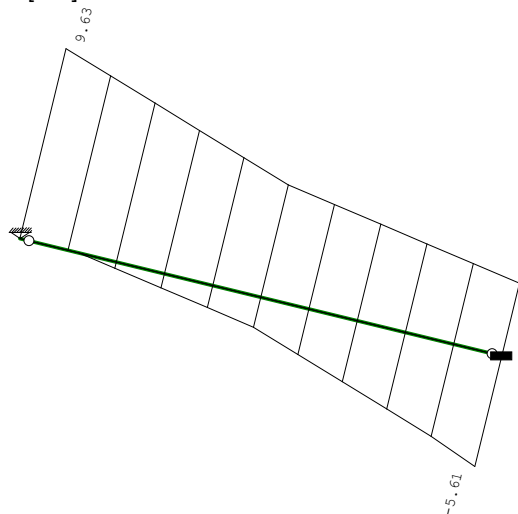
Vplivi v gredi: max  $M_3 = 27.87$  / min  $M_3 = -10.96$  kNm



Okvir: K\_9

Vplivi v gredi: max  $T_2 = 21.99$  / min  $T_2 = -21.99$  kN

Obt. 219: [MSN] 50-215

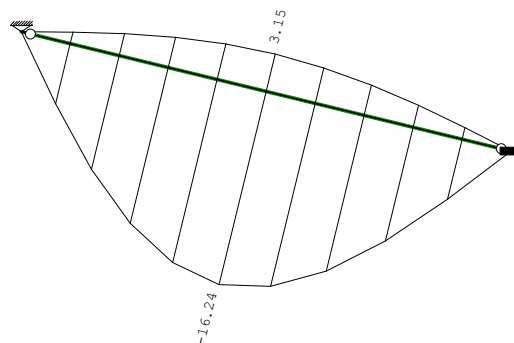


Okvir: K\_9

Vplivi v gredi: max N1= 9.63 / min N1= -5.61 kN

Obt. 219: [MSN] 50-215

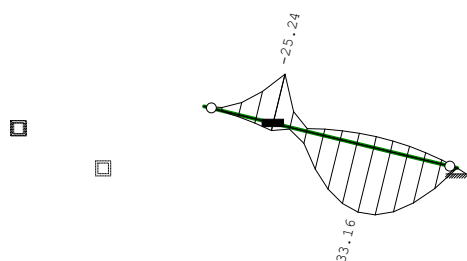
Obt. 216: [U.elas] 10-24



Okvir: K\_9

Vplivi v gredi: max Zp= 3.15 / min Zp= -16.24 m / 1000

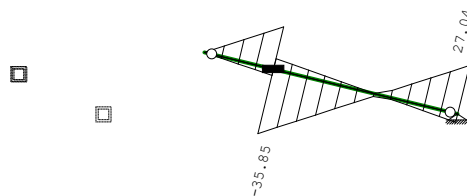
Obt. 219: [MSN] 50-215



Okvir: K\_11

Vplivi v gredi: max M3= 33.16 / min M3= -25.24 kNm

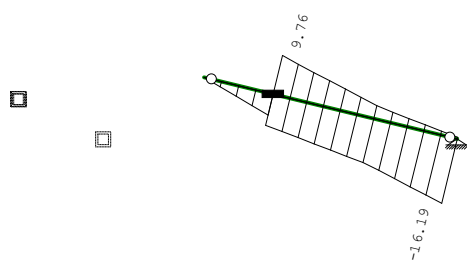
Obt. 219: [MSN] 50-215



Okvir: K\_11

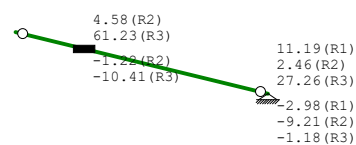
Vplivi v gredi: max T2= 27.04 / min T2= -35.85 kN

Obt. 219: [MSN] 50-215



Okvir: K\_11

Vplivi v gredi: max N1= 9.76 / min N1= -16.19 kN

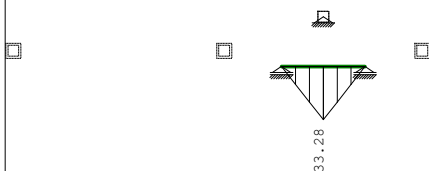


Okvir: K\_11

Reakcije podpor (Min/Max)



Obt. 219: [MSN] 50-215

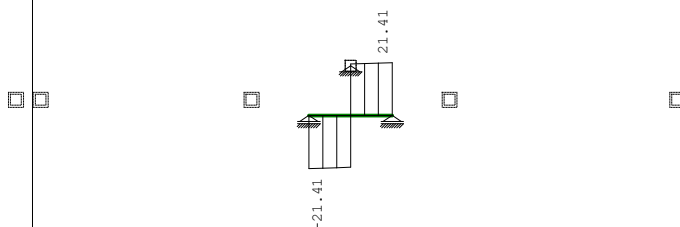


Okvir: H\_2

Vplivi v gredi: max M3= 33.28 / min M3= -0.00 kNm

Obt. 216: [U.elas] 10-24

Obt. 219: [MSN] 50-215



Okvir: H\_2

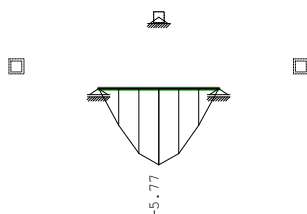
Vplivi v gredi: max T2= 21.41 / min T2= -21.41 kN

Obt. 219: [MSN] 50-215

Okvir: H\_2

Vplivi v gredi: max Zp= -0.00 / min Zp= -5.77 m / 1000

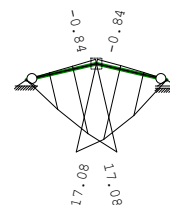
Obt. 219: [MSN] 50-215



Okvir: K\_14

Vplivi v gredi: max M3= 17.08 / min M3= -0.84 kNm

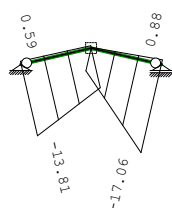
Obt. 219: [MSN] 50-215



Okvir: K\_14

Vplivi v gredi: max T2= 0.88 / min T2= -17.06 kN

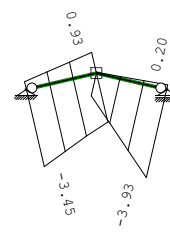
Obt. 219: [MSN] 50-215



Okvir: K\_14

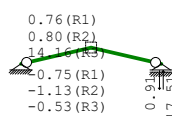
Vplivi v gredi: max N1= 0.93 / min N1= -3.93 kN

Obt. 216: [U.elas] 10-24



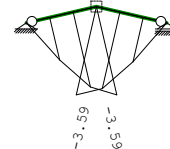
Okvir: K\_14

Reakcije podpor (Min/Max)

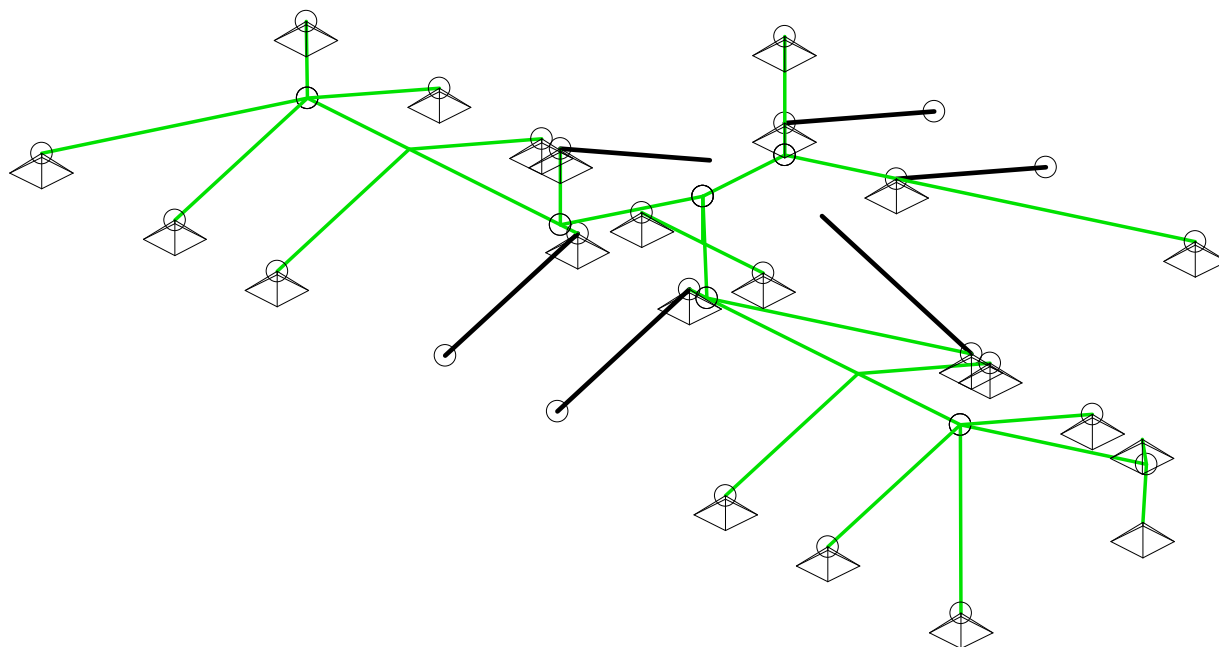


Okvir: K\_14

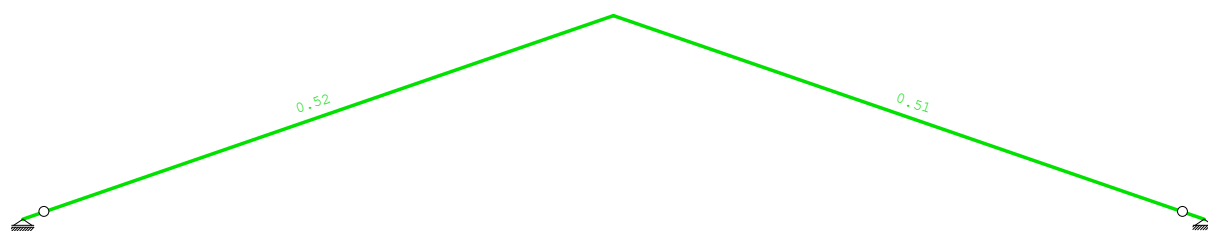
Vplivi v gredi: max Zp= -0.00 / min Zp= -3.59 m / 1000



### Dimenzioniranje (jeklo)



Izometrija  
Kontrola stabilnosti



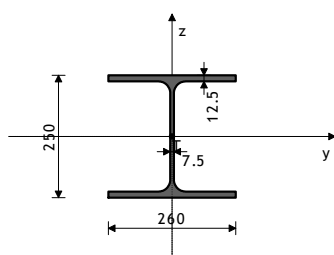
Okvir: V\_2  
Kontrola stabilnosti

PALICA 4-8

PREČNI PREREZ: IPBL 260 [S 275] [Set: 2]  
EUROCODE 3 (EN 1993-1-1:2005)

( $f_y = 27.5 \text{ kN/cm}^2$ ,  $f_u = 43.0 \text{ kN/cm}^2$ )

GEOMETRIJSKE KARAKTERISTIKE prereza



$A_x = 86.800 \text{ cm}^2$   
 $A_y = 58.063 \text{ cm}^2$   
 $A_z = 28.738 \text{ cm}^2$   
 $I_x = 52.600 \text{ cm}^4$   
 $I_y = 10450 \text{ cm}^4$   
 $I_z = 3670.0 \text{ cm}^4$   
 $W_y = 836.00 \text{ cm}^3$   
 $W_z = 282.31 \text{ cm}^3$   
 $W_{y,pl} = 904.09 \text{ cm}^3$   
 $W_{z,pl} = 422.50 \text{ cm}^3$   
 $\gamma_{M0} = 1.100$   
 $\gamma_{M1} = 1.100$   
 $\gamma_{M2} = 1.250$   
 $A_{net}/A = 0.900$

FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| 61. $\gamma=0.52$  | 136. $\gamma=0.49$ | 53. $\gamma=0.48$  |
| 57. $\gamma=0.48$  | 140. $\gamma=0.48$ | 73. $\gamma=0.47$  |
| 85. $\gamma=0.47$  | 97. $\gamma=0.45$  | 126. $\gamma=0.45$ |
| 131. $\gamma=0.45$ | 202. $\gamma=0.45$ | 58. $\gamma=0.44$  |
| 59. $\gamma=0.44$  | 159. $\gamma=0.43$ | 156. $\gamma=0.43$ |
| 69. $\gamma=0.43$  | 65. $\gamma=0.43$  | 174. $\gamma=0.41$ |
| 93. $\gamma=0.41$  | 178. $\gamma=0.41$ | 89. $\gamma=0.41$  |
| 81. $\gamma=0.40$  | 77. $\gamma=0.40$  | 50. $\gamma=0.40$  |
| 54. $\gamma=0.40$  | 137. $\gamma=0.40$ | 55. $\gamma=0.40$  |
| 51. $\gamma=0.40$  | 138. $\gamma=0.40$ | 109. $\gamma=0.39$ |
| 135. $\gamma=0.39$ | 121. $\gamma=0.39$ | 152. $\gamma=0.39$ |
| 82. $\gamma=0.39$  | 83. $\gamma=0.38$  | 60. $\gamma=0.37$  |
| 169. $\gamma=0.37$ | 164. $\gamma=0.37$ | 210. $\gamma=0.37$ |
| 158. $\gamma=0.37$ | 157. $\gamma=0.37$ | 94. $\gamma=0.37$  |
| 95. $\gamma=0.36$  | 197. $\gamma=0.36$ | 205. $\gamma=0.35$ |
| 105. $\gamma=0.35$ | 194. $\gamma=0.35$ | 101. $\gamma=0.35$ |
| 130. $\gamma=0.35$ | 125. $\gamma=0.35$ | 201. $\gamma=0.35$ |
| 70. $\gamma=0.35$  | 71. $\gamma=0.33$  | 56. $\gamma=0.33$  |
| 139. $\gamma=0.33$ | 52. $\gamma=0.33$  | 113. $\gamma=0.33$ |

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| 117. $\gamma=0.33$ | 144. $\gamma=0.33$ | 148. $\gamma=0.33$ |
| 175. $\gamma=0.33$ | 86. $\gamma=0.33$  | 90. $\gamma=0.33$  |
| 78. $\gamma=0.33$  | 74. $\gamma=0.33$  | 87. $\gamma=0.32$  |
| 176. $\gamma=0.32$ | 91. $\gamma=0.32$  | 75. $\gamma=0.32$  |
| 79. $\gamma=0.32$  | 173. $\gamma=0.32$ | 118. $\gamma=0.31$ |
| 84. $\gamma=0.31$  | 190. $\gamma=0.31$ | 149. $\gamma=0.31$ |
| 62. $\gamma=0.31$  | 66. $\gamma=0.31$  | 153. $\gamma=0.31$ |
| 119. $\gamma=0.30$ | 150. $\gamma=0.30$ | 96. $\gamma=0.30$  |
| 196. $\gamma=0.29$ | 195. $\gamma=0.29$ | 203. $\gamma=0.29$ |
| 204. $\gamma=0.29$ | 214. $\gamma=0.29$ | 154. $\gamma=0.29$ |
| 63. $\gamma=0.29$  | 67. $\gamma=0.29$  | 213. $\gamma=0.28$ |
| 106. $\gamma=0.27$ | 209. $\gamma=0.27$ | 132. $\gamma=0.27$ |
| 168. $\gamma=0.27$ | 163. $\gamma=0.27$ | 107. $\gamma=0.26$ |
| 133. $\gamma=0.26$ | 110. $\gamma=0.25$ | 114. $\gamma=0.25$ |
| 145. $\gamma=0.25$ | 141. $\gamma=0.25$ | 182. $\gamma=0.25$ |
| 186. $\gamma=0.25$ | 111. $\gamma=0.25$ | 115. $\gamma=0.25$ |
| 177. $\gamma=0.24$ | 88. $\gamma=0.24$  | 92. $\gamma=0.24$  |
| 142. $\gamma=0.24$ | 76. $\gamma=0.24$  | 80. $\gamma=0.24$  |
| 146. $\gamma=0.24$ | 187. $\gamma=0.24$ | 102. $\gamma=0.23$ |
| 191. $\gamma=0.23$ | 98. $\gamma=0.23$  | 122. $\gamma=0.23$ |
| 127. $\gamma=0.23$ | 198. $\gamma=0.23$ | 188. $\gamma=0.23$ |
| 120. $\gamma=0.23$ | 151. $\gamma=0.23$ | 192. $\gamma=0.22$ |
| 99. $\gamma=0.22$  | 103. $\gamma=0.22$ | 123. $\gamma=0.22$ |
| 211. $\gamma=0.22$ | 212. $\gamma=0.22$ | 128. $\gamma=0.22$ |
| 199. $\gamma=0.22$ | 72. $\gamma=0.21$  | 170. $\gamma=0.20$ |
| 171. $\gamma=0.19$ | 183. $\gamma=0.18$ | 179. $\gamma=0.18$ |
| 184. $\gamma=0.17$ | 180. $\gamma=0.17$ | 112. $\gamma=0.17$ |
| 116. $\gamma=0.17$ | 147. $\gamma=0.17$ | 143. $\gamma=0.17$ |
| 155. $\gamma=0.17$ | 64. $\gamma=0.17$  | 68. $\gamma=0.17$  |
| 160. $\gamma=0.16$ | 165. $\gamma=0.16$ | 206. $\gamma=0.16$ |
| 189. $\gamma=0.16$ | 161. $\gamma=0.15$ | 166. $\gamma=0.15$ |
| 207. $\gamma=0.15$ | 108. $\gamma=0.14$ | 134. $\gamma=0.13$ |
| 181. $\gamma=0.10$ | 185. $\gamma=0.10$ | 100. $\gamma=0.09$ |
| 193. $\gamma=0.09$ | 104. $\gamma=0.09$ | 124. $\gamma=0.09$ |
| 200. $\gamma=0.09$ | 129. $\gamma=0.09$ | 172. $\gamma=0.06$ |
| 162. $\gamma=0.02$ | 167. $\gamma=0.02$ | 208. $\gamma=0.02$ |

PALICA IZPOSTAVLJENA PRITISKU IN UPOGIBU  
(obtežni primer 61, začetek palice)

|                             |                                 |
|-----------------------------|---------------------------------|
| Računska osna sila          | $N_{Ed} = -1.144 \text{ kN}$    |
| Prečna sila v z smeri       | $V_{Ed,z} = -1.404 \text{ kN}$  |
| Upogibni moment okoli y osi | $M_{Ed,y} = 108.86 \text{ kNm}$ |
| Sistemska dolžina palice    | $L = 368.42 \text{ cm}$         |

#### 5.5 KLASIFIKACIJA PREČNIH PREREZOV

Razred prereza 2

#### 6.2 NOSILNOST PREČNIH PREREZOV

|  |                                |
|--|--------------------------------|
| 6.2.4 Tlak   |                                |
| Računska nosilnost na tlak   | $N_{c,Rd} = 2170.0 \text{ kN}$ |
| <b>Pogoj 6.9: <math>N_{Ed} \leq N_{c,Rd}</math> (1.14 <math>\leq</math> 2170.00)</b> |                                |

|  |                                  |
|--|----------------------------------|
| 6.2.5 Upogib y-y   |                                  |
| Plastični odpornostni moment   | $W_{y,pl} = 904.09 \text{ cm}^3$ |
| Računska nosilnost na upogib   | $M_{c,Rd} = 226.02 \text{ kNm}$  |
| <b>Pogoj 6.12: <math>M_{Ed,y} \leq M_{c,Rd,y}</math> (108.86 <math>\leq</math> 226.02)</b> |                                  |

|  |                                   |
|--|-----------------------------------|
| 6.2.6 Strig  |                                   |
| Računska strižna nosilnost   | $V_{pl,Rd,z} = 414.79 \text{ kN}$ |
| Računska strižna nosilnost   | $V_{c,Rd,z} = 414.79 \text{ kN}$  |
| <b>Pogoj 6.17: <math>V_{Ed,z} \leq V_{c,Rd,z}</math> (1.40 <math>\leq</math> 414.79)</b> |                                   |

6.2.10 Upogib z osno in prečno silo  
Ni potrebno zmanjšanje upogibne nosilnosti  
Pogoj:  $V_{Ed,z} \leq 50\%V_{pl,Rd,z}$

|   |                                   |
|---|-----------------------------------|
| 6.2.9 Upogib in osna sila                     |                                   |
| Razmerje $N_{Ed} / N_{pl,Rd}$                 | 0.001                             |
| Zmanjšana plast.upogibna nosilnost            | $M_{N,y,Rd} = 226.02 \text{ kNm}$ |
| Koeficient                                    | $\alpha = 1.000$                  |
| Razmerje $(M_{y,Ed} / M_{N,y,Rd})^\alpha$     | 0.482                             |
| <b>Pogoj 6.41: (0.48 <math>\leq</math> 1)</b> |                                   |

#### 6.3 NOSILNOST ELEMENTA NA UKLON

|   |                                  |
|---|----------------------------------|
| 6.3.1.1 Nosilnost na uklon  |                                  |
| Uklonska dolžina y-y  | $l_y = 368.42 \text{ cm}$        |
| Relativna vitkost y-y   | $\lambda_y = 0.387$              |
| Uklonska krivulja za os y-y: B  | $\alpha = 0.340$                 |
| Elastična kritična sila   | $N_{cr,y} = 15957 \text{ kN}$    |
| Koeficient nepopolnosti   | $\chi_y = 0.931$                 |
| Računska uklonska nosilnost   | $N_{b,Rd,y} = 2020.9 \text{ kN}$ |
| <b>Pogoj 6.46: <math>N_{Ed} \leq N_{b,Rd,y}</math> (1.14 <math>\leq</math> 2020.90)</b> |                                  |

|   |                                  |
|---|----------------------------------|
| Uklonska dolžina z-z  | $l_z = 368.42 \text{ cm}$        |
| Relativna vitkost z-z   | $\lambda_z = 0.653$              |
| Uklonska krivulja za os z-z: C  | $\alpha = 0.490$                 |
| Koeficient nepopolnosti   | $\chi_z = 0.754$                 |
| Računska uklonska nosilnost   | $N_{b,Rd,z} = 1635.7 \text{ kN}$ |
| <b>Pogoj 6.46: <math>N_{Ed} \leq N_{b,Rd,z}</math> (1.14 <math>\leq</math> 1635.65)</b> |                                  |

#### 6.3.2.1 Nosilnost na bočno-torzijski uklon

|  |                                 |
|--|---------------------------------|
| Koeficient   | $C1 = 1.132$                    |
| Koeficient   | $C2 = 0.459$                    |
| Koeficient   | $C3 = 0.525$                    |
| Koef.ukl.dolžine za uklon  | $k = 1.000$                     |
| Koef.ukl.dolžine za vbočenje   | $kw = 1.000$                    |
| Koordinata   | $z_g = 0.000 \text{ cm}$        |
| Koordinata   | $z_j = 0.000 \text{ cm}$        |
| Razmak med bočnimi podporami   | $L = 368.42 \text{ cm}$         |
| Sektorski vztrajnostni moment  | $I_w = 5.16e+5 \text{ cm}^6$    |
| Krit.moment bočne zvrnitve   | $M_{cr} = 933.41 \text{ kNm}$   |
| Ustrezni odpornostni moment  | $W_y = 904.09 \text{ cm}^3$     |
| Koeficient imperf.   | $\alpha_{LT} = 0.210$           |
| Brezdimenz.vitkost   | $\lambda_{LT} = 0.516$          |
| Koeficient zmanjšanja (6.3.2.2.)   | $\chi_{LT} = 0.919$             |
| Računska uklonska nosilnost  | $M_{b,Rd} = 207.76 \text{ kNm}$ |
| <b>Pogoj 6.54: <math>M_{Ed,y} \leq M_{b,Rd}</math> (108.86 <math>\leq</math> 207.76)</b> |                                 |

6.3.3. Elementi konstantnega prečnega prereza obremenjeni z upogibom in osnim tlakom  
Preračun koeficienta interakcije je izvršen z alternativno metodo št.2 (Aneks B)

|                           |                   |
|---------------------------|-------------------|
| Koeficient oblike momenta | $C_{my} = 0.916$  |
| Koeficient oblike momenta | $C_{mz} = 1.000$  |
| Koeficient oblike momenta | $C_{mLT} = 0.916$ |
| Koeficient interakcije    | $k_{yy} = 0.916$  |
| Koeficient interakcije    | $k_{yz} = 0.600$  |
| Koeficient interakcije    | $k_{zy} = 1.000$  |
| Koeficient interakcije    | $k_{zz} = 1.000$  |

|   |                  |
|---|------------------|
| Koeficient nepopolnosti                         | $\chi_y = 0.931$ |
| $N_{Ed} / (\chi_y N_{Rk} / \gamma_{M1})$        | 0.001            |
| $k_{yy} * (M_{y,Ed} + \Delta M_{y,Ed}) / \dots$ | 0.480            |
| <b>Pogoj 6.61: (0.48 <math>\leq</math> 1)</b>   |                  |

|   |                  |
|---|------------------|
| Koeficient nepopolnosti                         | $\chi_z = 0.754$ |
| $N_{Ed} / (\chi_z N_{Rk} / \gamma_{M1})$        | 0.001            |
| $k_{zy} * (M_{y,Ed} + \Delta M_{y,Ed}) / \dots$ | 0.524            |
| <b>Pogoj 6.62: (0.52 <math>\leq</math> 1)</b>   |                  |

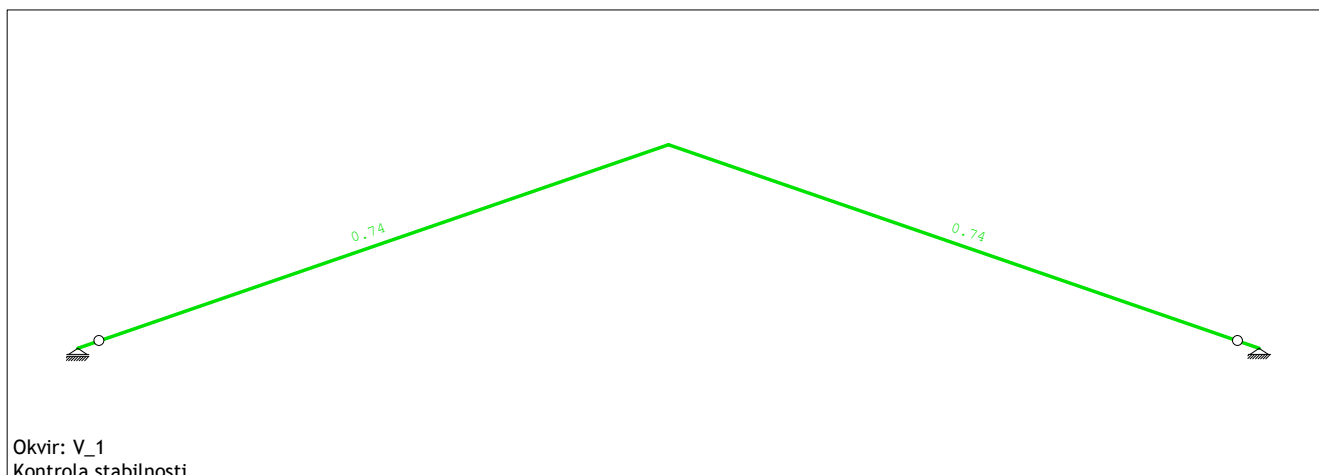
#### KONTROLA STRIŽNE NOSILNOSTI

(obtežni primer 61, konec palice)

|                          |                                |
|--------------------------|--------------------------------|
| Računska osna sila       | $N_{Ed} = -20.843 \text{ kN}$  |
| Prečna sila v z smeri    | $V_{Ed,z} = 60.501 \text{ kN}$ |
| Sistemska dolžina palice | $L = 368.42 \text{ cm}$        |

#### 6.2 NOSILNOST PREČNIH PREREZOV

|   |                                   |
|---|-----------------------------------|
| 6.2.6 Strig   |                                   |
| Računska strižna nosilnost  | $V_{pl,Rd,z} = 414.79 \text{ kN}$ |
| Računska strižna nosilnost  | $V_{c,Rd,z} = 414.79 \text{ kN}$  |
| <b>Pogoj 6.17: <math>V_{Ed,z} \leq V_{c,Rd,z}</math> (60.50 <math>\leq</math> 414.79)</b> |                                   |



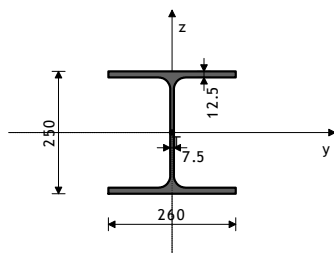
Okvir: V\_1

Kontrola stabilnosti

PALICA 2-6

PREČNI PREREZ: IPBL 260 [S 275] [Set: 2]  
EUROCODE 3 (EN 1993-1-1:2005)

GEOMETRIJSKE KARAKTERISTIKE prereza



[mm]

|          |                        |
|----------|------------------------|
| Ax =     | 86.800 cm <sup>2</sup> |
| Ay =     | 58.063 cm <sup>2</sup> |
| Az =     | 28.738 cm <sup>2</sup> |
| Ix =     | 52.600 cm <sup>4</sup> |
| Iy =     | 10450 cm <sup>4</sup>  |
| Iz =     | 3670.0 cm <sup>4</sup> |
| Wy =     | 836.00 cm <sup>3</sup> |
| Wz =     | 282.31 cm <sup>3</sup> |
| Wy,pl =  | 904.09 cm <sup>3</sup> |
| Wz,pl =  | 422.50 cm <sup>3</sup> |
| γM0 =    | 1.100                  |
| γM1 =    | 1.100                  |
| γM2 =    | 1.250                  |
| Anet/A = | 0.900                  |

(fy = 27.5 kN/cm<sup>2</sup>, fu = 43.0 kN/cm<sup>2</sup>)

FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB

|             |             |             |
|-------------|-------------|-------------|
| 61. γ=0.74  | 136. γ=0.69 | 53. γ=0.68  |
| 57. γ=0.68  | 140. γ=0.68 | 58. γ=0.67  |
| 73. γ=0.67  | 85. γ=0.66  | 59. γ=0.65  |
| 97. γ=0.64  | 126. γ=0.63 | 131. γ=0.63 |
| 202. γ=0.63 | 137. γ=0.61 | 50. γ=0.61  |
| 54. γ=0.61  | 69. γ=0.61  | 156. γ=0.61 |
| 65. γ=0.61  | 159. γ=0.60 | 51. γ=0.59  |
| 138. γ=0.59 | 55. γ=0.59  | 82. γ=0.58  |
| 174. γ=0.58 | 93. γ=0.58  | 178. γ=0.58 |
| 89. γ=0.58  | 94. γ=0.57  | 81. γ=0.57  |
| 77. γ=0.57  | 83. γ=0.57  | 109. γ=0.56 |
| 135. γ=0.55 | 95. γ=0.55  | 121. γ=0.55 |
| 70. γ=0.55  | 152. γ=0.54 | 169. γ=0.52 |
| 164. γ=0.52 | 210. γ=0.52 | 71. γ=0.52  |
| 158. γ=0.51 | 157. γ=0.51 | 90. γ=0.51  |
| 86. γ=0.51  | 175. γ=0.51 | 194. γ=0.50 |
| 105. γ=0.50 | 101. γ=0.50 | 78. γ=0.50  |
| 74. γ=0.50  | 197. γ=0.50 | 201. γ=0.49 |
| 125. γ=0.49 | 130. γ=0.49 | 87. γ=0.49  |
| 91. γ=0.49  | 176. γ=0.49 | 60. γ=0.49  |
| 62. γ=0.49  | 66. γ=0.49  | 153. γ=0.49 |
| 205. γ=0.48 | 118. γ=0.48 | 79. γ=0.48  |
| 75. γ=0.48  | 149. γ=0.47 | 113. γ=0.47 |
| 117. γ=0.47 | 119. γ=0.46 | 67. γ=0.46  |
| 154. γ=0.46 | 63. γ=0.46  | 144. γ=0.45 |
| 148. γ=0.45 | 150. γ=0.45 | 173. γ=0.45 |
| 106. γ=0.45 | 190. γ=0.44 | 132. γ=0.43 |
| 139. γ=0.43 | 52. γ=0.43  | 56. γ=0.43  |
| 107. γ=0.41 | 196. γ=0.41 | 195. γ=0.41 |
| 133. γ=0.41 | 84. γ=0.40  | 203. γ=0.40 |
| 204. γ=0.40 | 214. γ=0.40 | 110. γ=0.39 |
| 114. γ=0.39 | 209. γ=0.39 | 163. γ=0.39 |
| 168. γ=0.39 | 96. γ=0.39  | 102. γ=0.38 |
| 145. γ=0.38 | 191. γ=0.38 | 98. γ=0.38  |
| 141. γ=0.38 | 213. γ=0.38 | 115. γ=0.38 |
| 111. γ=0.38 | 122. γ=0.37 | 127. γ=0.37 |
| 198. γ=0.37 | 187. γ=0.37 | 142. γ=0.37 |
| 146. γ=0.37 | 192. γ=0.35 | 99. γ=0.35  |
| 103. γ=0.35 | 182. γ=0.35 | 186. γ=0.35 |
| 188. γ=0.35 | 123. γ=0.34 | 128. γ=0.34 |
| 199. γ=0.34 | 170. γ=0.33 | 177. γ=0.33 |
| 92. γ=0.33  | 88. γ=0.33  | 80. γ=0.32  |
| 76. γ=0.32  | 171. γ=0.30 | 120. γ=0.30 |
| 211. γ=0.29 | 212. γ=0.29 | 151. γ=0.29 |
| 183. γ=0.28 | 179. γ=0.28 | 160. γ=0.27 |

|             |             |             |
|-------------|-------------|-------------|
| 165. γ=0.27 | 206. γ=0.27 | 180. γ=0.26 |
| 184. γ=0.26 | 72. γ=0.25  | 166. γ=0.24 |
| 161. γ=0.24 | 207. γ=0.24 | 116. γ=0.21 |
| 112. γ=0.21 | 147. γ=0.20 | 143. γ=0.20 |
| 155. γ=0.19 | 64. γ=0.19  | 68. γ=0.19  |
| 189. γ=0.19 | 108. γ=0.14 | 134. γ=0.13 |
| 181. γ=0.10 | 185. γ=0.10 | 100. γ=0.08 |
| 193. γ=0.08 | 104. γ=0.08 | 124. γ=0.07 |
| 200. γ=0.07 | 129. γ=0.07 | 172. γ=0.03 |
| 162. γ=0.03 | 167. γ=0.03 | 208. γ=0.03 |

PALICA IZPOSTAVLJENA PRITISKU IN UPOGIBU  
(obtežni primer 61, začetek palice)

|                             |                     |            |
|-----------------------------|---------------------|------------|
| Računska osna sila          | N <sub>Ed</sub> =   | -9.353 kN  |
| Prečna sila v z smeri       | V <sub>Ed,z</sub> = | 24.388 kN  |
| Upogibni moment okoli y osi | M <sub>Ed,y</sub> = | 158.95 kNm |
| Sistemska dolžina palice    | L =                 | 368.42 cm  |

5.5 KLASIFIKACIJA PREČNIH PREREZOV  
Razred prereza 2

6.2 NOSILNOST PREČNIH PREREZOV

6.2.4 Tlak

Računska nosilnost na tlak N<sub>c,Rd</sub> = 2170.0 kN

Pogoj 6.9: N<sub>Ed</sub> ≤ N<sub>c,Rd</sub> (9.35 ≤ 2170.00)

6.2.5 Upogib y-y

Plastični odpornostni moment Wy,pl = 904.09 cm<sup>3</sup>

Računska nosilnost na upogib Mc,Rd = 226.02 kNm

Pogoj 6.12: M<sub>Ed,y</sub> ≤ Mc,Rd,y (158.95 ≤ 226.02)

6.2.6 Strig

Računska strižna nosilnost V<sub>pl,Rd,z</sub> = 414.79 kN

Računska strižna nosilnost V<sub>c,Rd,z</sub> = 414.79 kN

Pogoj 6.17: V<sub>Ed,z</sub> ≤ V<sub>c,Rd,z</sub> (24.39 ≤ 414.79)

6.2.10 Upogib z osno in prečno silo

Ni potrebno zmanjšanje upogibne nosilnosti

Pogoj: V<sub>Ed,z</sub> ≤ 50%V<sub>pl,Rd,z</sub>

6.2.9 Upogib in osna sila

Razmerje N<sub>Ed</sub> / N<sub>pl,Rd</sub> = 0.004

Zmanjšana plast.upogibna nosilnost M<sub>N,y,Rd</sub> = 226.02 kNm

Koeficient α = 1.000

Razmerje (M<sub>y,Ed</sub> / M<sub>N,y,Rd</sub>)<sup>α</sup> = 0.703

Pogoj 6.41: (0.70 ≤ 1)

6.3 NOSILNOST ELEMENTA NA UKLON

6.3.1.1 Nosilnost na uklon

Uklonska dolžina y-y l<sub>y</sub> = 368.42 cm

Relativna vitkost y-y λ<sub>y</sub> = 0.387

Uklonska krivulja za os y-y: B α = 0.340

Elastična kritična sila N<sub>cr,y</sub> = 15957 kN

Koeficient nepopolnosti χ<sub>y</sub> = 0.931

Računska uklonska nosilnost N<sub>b,Rd,y</sub> = 2020.9 kN

Pogoj 6.46: N<sub>Ed</sub> ≤ N<sub>b,Rd,y</sub> (9.35 ≤ 2020.90)

Uklonska dolžina z-z l<sub>z</sub> = 368.42 cm

Relativna vitkost z-z λ<sub>z</sub> = 0.653

Uklonska krivulja za os z-z: C α = 0.490

Koeficient nepopolnosti χ<sub>z</sub> = 0.754

Računska uklonska nosilnost N<sub>b,Rd,z</sub> = 1635.7 kN

Pogoj 6.46: N<sub>Ed</sub> ≤ N<sub>b,Rd,z</sub> (9.35 ≤ 1635.65)

6.3.2.1 Nosilnost na bočno-torzijski uklon

Koeficient C1 = 1.879

Koeficient C2 = 0.000

Koeficient  
 Koef. ukl. dolžine za uklon  
 Koef. ukl. dolžine za vbočenje  
 Koordinata  
 Koordinata  
 Razmak med bočnimi podporami  
 Sektorski vztrajnostni moment  
 Krit. moment bočne zvrnitve  
 Ustrezni odpornostni moment  
 Koeficient imperf.  
 Brezdimenz. vitkost  
 Koeficient zmanjšanja (6.3.2.2.)  
 Računska uklonska nosilnost  
**Pogoj 6.54:  $M_{Ed,y} \leq M_{b,Rd}$  (158.95 ≤ 215.32)**

C3 = 0.939  
 k = 1.000  
 kw = 1.000  
 zg = 0.000 cm  
 zj = 0.000 cm  
 L = 368.42 cm  
 lw = 5.16e+5 cm<sup>6</sup>  
 M<sub>cr</sub> = 1549.4 kNm  
 W<sub>y</sub> = 904.09 cm<sup>3</sup>  
 α<sub>LT</sub> = 0.210  
 λ<sub>LT</sub> = 0.401  
 χ<sub>LT</sub> = 0.953  
 M<sub>b,Rd</sub> = 215.32 kNm

Koeficient nepopolnosti  
 $N_{Ed} / (\chi_y N_{Rk} / \gamma M1)$   
 $k_{yy} * (M_{yEd} + \Delta M_{yEd}) / \dots$   
**Pogoj 6.61: (0.45 ≤ 1)**

χ<sub>y</sub> = 0.931  
 0.005  
 0.443

Koeficient nepopolnosti  
 $N_{Ed} / (\chi_z N_{Rk} / \gamma M1)$   
 $k_{zy} * (M_{yEd} + \Delta M_{yEd}) / \dots$   
**Pogoj 6.62: (0.74 ≤ 1)**

χ<sub>z</sub> = 0.754  
 0.006  
 0.737

#### KONTROLA STRIŽNE NOSILNOSTI (obtežni primer 61, konec palice)

Računska osna sila  
 Prečna sila v z smeri  
 Sistemska dolžina palice

N<sub>Ed</sub> = -21.323 kN  
 V<sub>Ed,z</sub> = 61.896 kN  
 L = 368.42 cm

#### 6.2 NOSILNOST PREČNIH PREREZOV

##### 6.2.6 Strig

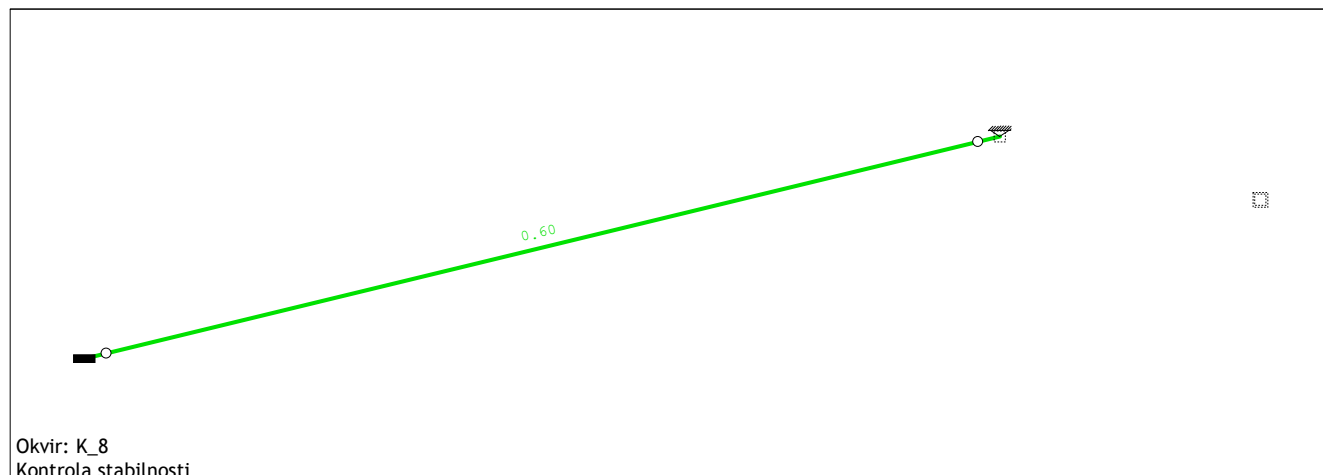
Računska strižna nosilnost  
 Računska strižna nosilnost  
**Pogoj 6.17:  $V_{Ed,z} \leq V_{c,Rd,z}$  (61.90 ≤ 414.79)**

V<sub>pl,Rd,z</sub> = 414.79 kN  
 V<sub>c,Rd,z</sub> = 414.79 kN

6.3.3. Elementi konstantnega prečnega prereza obremenjeni z upogibom in osnim tlakom  
 Preračun koeficienta interakcije je izvršen z alternativno metodo št.2 (Aneks B)

Koeficient oblike momenta  
 Koeficient oblike momenta  
 Koeficient oblike momenta  
 Koeficient interakcije  
 Koeficient interakcije  
 Koeficient interakcije  
 Koeficient interakcije

C<sub>my</sub> = 0.600  
 C<sub>mz</sub> = 1.000  
 C<sub>mLT</sub> = 0.600  
 k<sub>yy</sub> = 0.601  
 k<sub>yz</sub> = 0.602  
 k<sub>zy</sub> = 0.999  
 k<sub>zz</sub> = 1.004



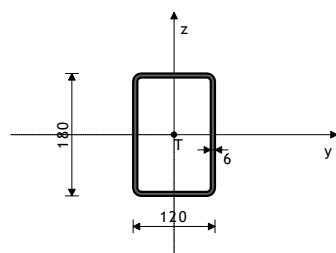
Okvir: K\_8

Kontrola stabilnosti

#### PALICA 3-5

PREČNI PREREZ: HOP [ ] 180x120x6 [S 275] [Set: 1]  
 EUROCODE 3 (EN 1993-1-1:2005)

#### GEOMETRIJSKE KARAKTERISTIKE prereza



Ax = 33.630 cm<sup>2</sup>  
 Ay = 13.452 cm<sup>2</sup>  
 Az = 20.178 cm<sup>2</sup>  
 Ix = 1672.8 cm<sup>4</sup>  
 Iy = 1491.3 cm<sup>4</sup>  
 Iz = 796.28 cm<sup>4</sup>  
 Wy = 165.70 cm<sup>3</sup>  
 Wz = 132.71 cm<sup>3</sup>  
 Wy,pl = 209.95 cm<sup>3</sup>  
 Wz,pl = 158.11 cm<sup>3</sup>  
 γ<sub>M0</sub> = 1.100  
 γ<sub>M1</sub> = 1.100  
 γ<sub>M2</sub> = 1.250  
 A<sub>net</sub>/A = 0.900

(f<sub>y</sub> = 27.5 kN/cm<sup>2</sup>, f<sub>u</sub> = 43.0 kN/cm<sup>2</sup>)

#### FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB

61. γ=0.60  
 57. γ=0.55  
 85. γ=0.53  
 126. γ=0.50  
 65. γ=0.48  
 69. γ=0.48  
 55. γ=0.47  
 89. γ=0.46  
 77. γ=0.46  
 83. γ=0.45  
 95. γ=0.44  
 164. γ=0.42  
 137. γ=0.41  
 158. γ=0.41  
 101. γ=0.40  
 82. γ=0.40  
 125. γ=0.39  
 91. γ=0.39

136. γ=0.55  
 140. γ=0.55  
 59. γ=0.52  
 131. γ=0.50  
 156. γ=0.48  
 174. γ=0.47  
 51. γ=0.47  
 178. γ=0.46  
 81. γ=0.46  
 121. γ=0.45  
 152. γ=0.44  
 210. γ=0.42  
 54. γ=0.41  
 157. γ=0.41  
 105. γ=0.40  
 201. γ=0.39  
 205. γ=0.39  
 176. γ=0.39

53. γ=0.55  
 73. γ=0.54  
 97. γ=0.52  
 202. γ=0.50  
 159. γ=0.48  
 138. γ=0.47  
 58. γ=0.47  
 93. γ=0.46  
 109. γ=0.45  
 135. γ=0.44  
 169. γ=0.42  
 71. γ=0.42  
 50. γ=0.41  
 194. γ=0.40  
 197. γ=0.40  
 130. γ=0.39  
 60. γ=0.39  
 87. γ=0.39

94. γ=0.38  
 113. γ=0.37  
 63. γ=0.37  
 148. γ=0.36  
 150. γ=0.36  
 52. γ=0.34  
 86. γ=0.33  
 196. γ=0.33  
 74. γ=0.32  
 84. γ=0.32  
 70. γ=0.32  
 163. γ=0.31  
 96. γ=0.31  
 115. γ=0.30  
 99. γ=0.29  
 182. γ=0.28  
 128. γ=0.28  
 62. γ=0.26  
 177. γ=0.25  
 171. γ=0.25  
 114. γ=0.24  
 120. γ=0.24  
 145. γ=0.23  
 132. γ=0.22  
 180. γ=0.21  
 207. γ=0.20  
 98. γ=0.18  
 198. γ=0.17  
 112. γ=0.16  
 183. γ=0.15  
 170. γ=0.14  
 155. γ=0.14  
 165. γ=0.09  
 181. γ=0.07  
 193. γ=0.05  
 200. γ=0.04  
 162. γ=0.04

75. γ=0.38  
 117. γ=0.37  
 67. γ=0.37  
 144. γ=0.36  
 190. γ=0.35  
 107. γ=0.34  
 90. γ=0.33  
 133. γ=0.33  
 78. γ=0.32  
 203. γ=0.32  
 118. γ=0.31  
 213. γ=0.31  
 149. γ=0.30  
 142. γ=0.29  
 192. γ=0.29  
 186. γ=0.28  
 123. γ=0.28  
 66. γ=0.26  
 88. γ=0.25  
 76. γ=0.25  
 110. γ=0.24  
 211. γ=0.24  
 141. γ=0.23  
 187. γ=0.22  
 166. γ=0.20  
 72. γ=0.19  
 191. γ=0.18  
 127. γ=0.17  
 147. γ=0.15  
 179. γ=0.15  
 64. γ=0.14  
 108. γ=0.10  
 206. γ=0.09  
 185. γ=0.07  
 104. γ=0.05  
 129. γ=0.04  
 208. γ=0.04

79. γ=0.38  
 119. γ=0.37  
 154. γ=0.37  
 173. γ=0.36  
 139. γ=0.34  
 56. γ=0.34  
 175. γ=0.33  
 195. γ=0.33  
 204. γ=0.32  
 214. γ=0.32  
 209. γ=0.31  
 168. γ=0.31  
 111. γ=0.30  
 146. γ=0.29  
 103. γ=0.29  
 188. γ=0.28  
 199. γ=0.28  
 153. γ=0.26  
 92. γ=0.25  
 80. γ=0.25  
 212. γ=0.24  
 106. γ=0.23  
 151. γ=0.23  
 184. γ=0.21  
 161. γ=0.20  
 102. γ=0.18  
 122. γ=0.17  
 116. γ=0.16  
 143. γ=0.15  
 189. γ=0.14  
 68. γ=0.14  
 134. γ=0.09  
 160. γ=0.09  
 100. γ=0.05  
 124. γ=0.04  
 167. γ=0.04  
 172. γ=0.02

#### PALICA IZPOSTAVLJENA PRITISKU IN UPOGIBU (obtežni primer 61, na 244.2 cm od začetka palice)

Računska osna sila  
 N<sub>Ed</sub> = -0.328 kN



Prečna sila v z smeri  
Upogibni moment okoli y osi  
Upogibni moment okoli z osi  
Sistemska dolžina palice

$V_{Ed,z} = -0.970 \text{ kN}$   
 $M_{Ed,y} = 30.583 \text{ kNm}$   
 $M_{Ed,z} = -0.138 \text{ kNm}$   
 $L = 508.74 \text{ cm}$

Koeficient  
Koef. ukl. dolžine za uklon  
Koef. ukl. dolžine za vbočenje  
Koordinata  
Koordinata  
Razmak med bočnimi podporami  
Sektorski vztrajnostni moment  
Krit. moment bočne zvrnitve  
Ustrezni odpornostni moment  
Koeficient imperf.  
Brezdimenz. vitkost  
Koeficient zmanjšanja (6.3.2.2.)  
Računska uklonska nosilnost  
**Pogoj 6.54:  $M_{Ed,y} \leq M_{b,Rd}$  (30.58 <= 51.08)**

$C_3 = 0.525$   
 $k = 1.000$   
 $kw = 1.000$   
 $zg = 0.000 \text{ cm}$   
 $zj = 0.000 \text{ cm}$   
 $L = 508.74 \text{ cm}$   
 $I_w = 0.000 \text{ cm}^6$   
 $M_{cr} = 1050.7 \text{ kNm}$   
 $W_y = 209.95 \text{ cm}^3$   
 $\alpha_{LT} = 0.760$   
 $\lambda_{LT} = 0.234$   
 $\chi_{LT} = 0.973$   
 $M_{b,Rd} = 51.077 \text{ kNm}$

#### 5.5 KLASIFIKACIJA PREČNIH PREREZOV

Razred prereza 1

#### 6.2 NOSILNOST PREČNIH PREREZOV

##### 6.2.4 Tlak

Računska nosilnost na tlak

$N_{c,Rd} = 840.75 \text{ kN}$

**Pogoj 6.9:  $N_{Ed} \leq N_{c,Rd}$  (0.33 <= 840.75)**

##### 6.2.5 Upogib y-y

Plastični odpornostni moment

$W_{y,pl} = 209.95 \text{ cm}^3$

Računska nosilnost na upogib

$M_{c,Rd} = 52.488 \text{ kNm}$

**Pogoj 6.12:  $M_{Ed,y} \leq M_{c,Rd,y}$  (30.58 <= 52.49)**

##### 6.2.5 Upogib z-z

Plastični odpornostni moment

$W_{z,pl} = 158.11 \text{ cm}^3$

Računska nosilnost na upogib

$M_{c,Rd} = 39.528 \text{ kNm}$

**Pogoj 6.12:  $M_{Ed,z} \leq M_{c,Rd,z}$  (0.14 <= 39.53)**

##### 6.2.6 Strig

Računska strižna nosilnost

$V_{pl,Rd,z} = 291.24 \text{ kN}$

Računska strižna nosilnost

$V_{c,Rd,z} = 291.24 \text{ kN}$

**Pogoj 6.17:  $V_{Ed,z} \leq V_{c,Rd,z}$  (0.97 <= 291.24)**

##### 6.2.10 Upogib z osno in prečno silo

Ni potrebno zmanjšanje upogibne nosilnosti

**Pogoj:  $V_{Ed,z} \leq 50\%V_{pl,Rd,z}$**

##### 6.2.9 Upogib in osna sila

Razmerje  $N_{Ed} / N_{pl,Rd}$

0.000

Zmanjšana plast. upogibna nosilnost

$M_{N,y,Rd} = 52.488 \text{ kNm}$

Koeficient

$\alpha = 1.660$

Razmerje  $(M_{y,Ed} / M_{N,y,Rd})^\alpha$

0.408

**Pogoj 6.41: (0.41 <= 1)**

#### 6.3 NOSILNOST ELEMENTA NA UKLON

##### 6.3.1.1 Nosilnost na uklon

Uklonska dolžina y-y

$l_y = 508.74 \text{ cm}$

Relativna vitkost y-y

$\lambda_y = 0.880$

Uklonska krivulja za os y-y: C

$\alpha = 0.490$

Elastična kritična sila

$N_{cr,y} = 1194.2 \text{ kN}$

Koeficient nepopolnosti

$\chi_y = 0.612$

Računska uklonska nosilnost

$N_{b,Rd,y} = 514.68 \text{ kN}$

**Pogoj 6.46:  $N_{Ed} \leq N_{b,Rd,y}$  (0.33 <= 514.68)**

Uklonska dolžina z-z

$l_z = 508.74 \text{ cm}$

Relativna vitkost z-z

$\lambda_z = 1.204$

Uklonska krivulja za os z-z: C

$\alpha = 0.490$

Koeficient nepopolnosti

$\chi_z = 0.432$

Računska uklonska nosilnost

$N_{b,Rd,z} = 362.97 \text{ kN}$

**Pogoj 6.46:  $N_{Ed} \leq N_{b,Rd,z}$  (0.33 <= 362.97)**

##### 6.3.2.1 Nosilnost na bočno-torzijski uklon

Koeficient

$C_1 = 1.132$

Koeficient

$C_2 = 0.459$

#### 6.3.3. Elementi konstantnega prečnega prereza obremenjeni z upogibom in osnim tlakom

Preračun koeficienta interakcije je izvršen z alternativno metodo št. 2 (Aneks B)

Koeficient oblike momenta

$C_{my} = 0.950$

Koeficient oblike momenta

$C_{mz} = 0.950$

Koeficient oblike momenta

$C_{mLT} = 0.950$

Koeficient interakcije

$k_{yy} = 0.950$

Koeficient interakcije

$k_{yz} = 0.570$

Koeficient interakcije

$k_{zy} = 0.570$

Koeficient interakcije

$k_{zz} = 0.951$

Koeficient nepopolnosti

$\chi_y = 0.612$

$N_{Ed} / (\chi_y N_{Rk} / \gamma_{M1})$

0.001

$k_{yy} * (M_{y,Ed} + \Delta M_{y,Ed}) / \dots$

0.569

$k_{yz} * (M_{z,Ed} + \Delta M_{z,Ed}) / \dots$

0.002

**Pogoj 6.61: (0.57 <= 1)**

Koeficient nepopolnosti

$\chi_z = 0.432$

$N_{Ed} / (\chi_z N_{Rk} / \gamma_{M1})$

0.001

$k_{zy} * (M_{y,Ed} + \Delta M_{y,Ed}) / \dots$

0.341

$k_{zz} * (M_{z,Ed} + \Delta M_{z,Ed}) / \dots$

0.003

**Pogoj 6.62: (0.35 <= 1)**

#### KONTROLA STRIŽNE NOSILNOSTI

(obtežni primer 61, začetek palice)

Računska osna sila

$N_{Ed} = 4.904 \text{ kN}$

Prečna sila v y smeri

$V_{Ed,y} = 0.109 \text{ kN}$

Prečna sila v z smeri

$V_{Ed,z} = -24.240 \text{ kN}$

Sistemska dolžina palice

$L = 508.74 \text{ cm}$

#### 6.2 NOSILNOST PREČNIH PREREZOV

##### 6.2.6 Strig

Računska strižna nosilnost

$V_{pl,Rd,z} = 291.24 \text{ kN}$

Računska strižna nosilnost

$V_{c,Rd,z} = 291.24 \text{ kN}$

**Pogoj 6.17:  $V_{Ed,z} \leq V_{c,Rd,z}$  (24.24 <= 291.24)**

Računska strižna nosilnost

$V_{pl,Rd,y} = 194.16 \text{ kN}$

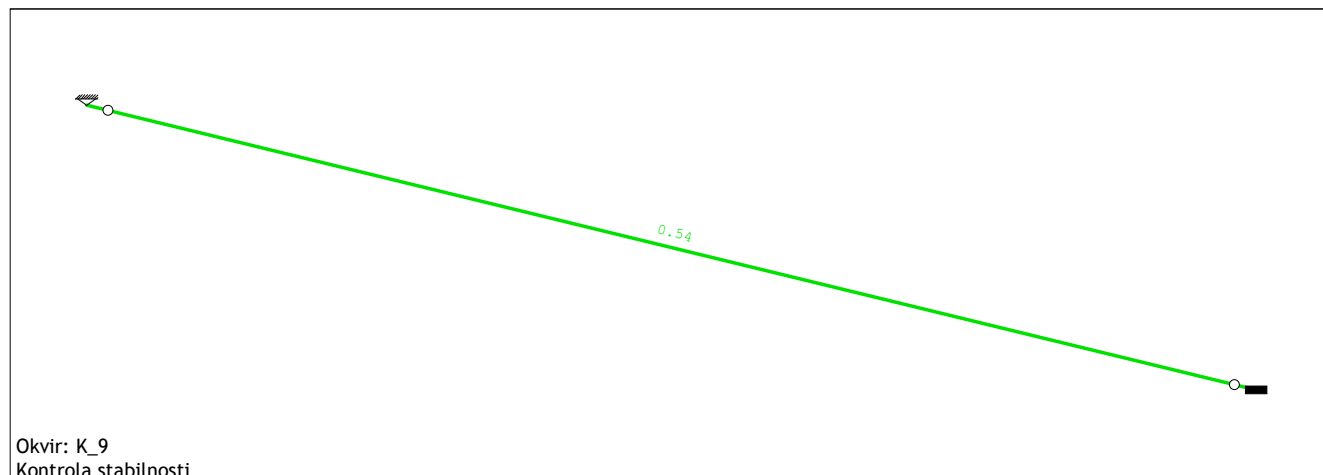
Računska strižna nosilnost

$V_{c,Rd,y} = 194.16 \text{ kN}$

**Pogoj 6.17:  $V_{Ed,y} \leq V_{c,Rd,y}$  (0.11 <= 194.16)**

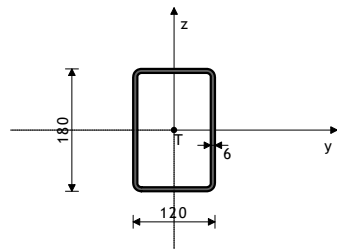
Okvir: K\_9

Kontrola stabilnosti



**PALICA 10-11**

PREČNI PREREZ: HOP [ 180x120x6 [S 275] [Set: 1]  
EUROCODE 3 (EN 1993-1-1:2005)

**GEOMETRIJSKE KARAKTERISTIKE prereza**


[mm]

|          |                        |
|----------|------------------------|
| Ax =     | 33.630 cm <sup>2</sup> |
| Ay =     | 13.452 cm <sup>2</sup> |
| Az =     | 20.178 cm <sup>2</sup> |
| Ix =     | 1672.8 cm <sup>4</sup> |
| Iy =     | 1491.3 cm <sup>4</sup> |
| Iz =     | 796.28 cm <sup>4</sup> |
| Wy =     | 165.70 cm <sup>3</sup> |
| Wz =     | 132.71 cm <sup>3</sup> |
| Wy,pl =  | 209.95 cm <sup>3</sup> |
| Wz,pl =  | 158.11 cm <sup>3</sup> |
| γM0 =    | 1.100                  |
| γM1 =    | 1.100                  |
| γM2 =    | 1.250                  |
| Anet/A = | 0.900                  |

(fy = 27.5 kN/cm<sup>2</sup>, fu = 43.0 kN/cm<sup>2</sup>)

**FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB**

|             |             |             |
|-------------|-------------|-------------|
| 58. γ=0.54  | 61. γ=0.54  | 70. γ=0.51  |
| 73. γ=0.51  | 50. γ=0.50  | 53. γ=0.50  |
| 54. γ=0.50  | 57. γ=0.50  | 137. γ=0.50 |
| 140. γ=0.50 | 82. γ=0.48  | 85. γ=0.48  |
| 136. γ=0.47 | 97. γ=0.47  | 94. γ=0.47  |
| 65. γ=0.46  | 66. γ=0.46  | 69. γ=0.46  |
| 62. γ=0.46  | 153. γ=0.46 | 156. γ=0.46 |
| 109. γ=0.44 | 106. γ=0.44 | 135. γ=0.43 |
| 132. γ=0.43 | 131. γ=0.43 | 126. γ=0.43 |
| 202. γ=0.43 | 90. γ=0.42  | 93. γ=0.42  |
| 86. γ=0.42  | 175. γ=0.42 | 178. γ=0.42 |
| 89. γ=0.42  | 78. γ=0.42  | 81. γ=0.42  |
| 74. γ=0.42  | 77. γ=0.42  | 159. γ=0.42 |
| 121. γ=0.41 | 118. γ=0.41 | 149. γ=0.41 |
| 152. γ=0.41 | 174. γ=0.40 | 98. γ=0.39  |
| 101. γ=0.39 | 102. γ=0.39 | 191. γ=0.39 |
| 194. γ=0.39 | 105. γ=0.39 | 122. γ=0.39 |
| 127. γ=0.39 | 130. γ=0.39 | 198. γ=0.39 |
| 201. γ=0.39 | 125. γ=0.39 | 170. γ=0.36 |
| 173. γ=0.36 | 164. γ=0.36 | 169. γ=0.36 |
| 210. γ=0.36 | 157. γ=0.35 | 158. γ=0.35 |
| 113. γ=0.35 | 114. γ=0.35 | 117. γ=0.35 |
| 110. γ=0.35 | 197. γ=0.34 | 144. γ=0.34 |
| 145. γ=0.34 | 148. γ=0.34 | 141. γ=0.34 |
| 205. γ=0.34 | 187. γ=0.33 | 190. γ=0.33 |
| 163. γ=0.32 | 160. γ=0.32 | 165. γ=0.32 |
| 206. γ=0.32 | 209. γ=0.32 | 168. γ=0.32 |
| 195. γ=0.28 | 196. γ=0.28 | 203. γ=0.28 |
| 204. γ=0.28 | 214. γ=0.28 | 182. γ=0.27 |
| 183. γ=0.27 | 186. γ=0.27 | 179. γ=0.27 |
| 213. γ=0.27 | 59. γ=0.22  | 60. γ=0.22  |
| 207. γ=0.21 | 208. γ=0.21 | 161. γ=0.21 |
| 166. γ=0.21 | 167. γ=0.21 | 162. γ=0.21 |
| 211. γ=0.20 | 212. γ=0.20 | 139. γ=0.18 |
| 52. γ=0.18  | 55. γ=0.18  | 56. γ=0.18  |
| 51. γ=0.18  | 138. γ=0.18 | 171. γ=0.17 |
| 172. γ=0.17 | 83. γ=0.17  | 84. γ=0.17  |
| 95. γ=0.15  | 96. γ=0.15  | 129. γ=0.14 |
| 124. γ=0.14 | 199. γ=0.14 | 200. γ=0.14 |
| 123. γ=0.14 | 128. γ=0.14 | 99. γ=0.14  |
| 192. γ=0.14 | 193. γ=0.14 | 100. γ=0.14 |
| 103. γ=0.14 | 104. γ=0.14 | 91. γ=0.11  |
| 92. γ=0.11  | 87. γ=0.11  | 176. γ=0.11 |
| 177. γ=0.11 | 88. γ=0.11  | 79. γ=0.10  |
| 80. γ=0.10  | 75. γ=0.10  | 76. γ=0.10  |
| 133. γ=0.10 | 134. γ=0.10 | 119. γ=0.09 |
| 120. γ=0.09 | 107. γ=0.09 | 108. γ=0.09 |
| 151. γ=0.09 | 150. γ=0.09 | 155. γ=0.06 |
| 68. γ=0.06  | 63. γ=0.06  | 64. γ=0.06  |
| 67. γ=0.06  | 154. γ=0.06 | 71. γ=0.05  |
| 72. γ=0.05  | 185. γ=0.05 | 180. γ=0.05 |
| 181. γ=0.05 | 184. γ=0.05 | 111. γ=0.03 |
| 112. γ=0.03 | 115. γ=0.03 | 116. γ=0.03 |
| 143. γ=0.03 | 146. γ=0.03 | 147. γ=0.03 |
| 188. γ=0.03 | 189. γ=0.03 | 142. γ=0.03 |

**PALICA IZPOSTAVLJENA PRITISKU IN UPOGIBU  
(obtežni primer 58, na 243.4 cm od začetka palice)**

|                             |                     |            |
|-----------------------------|---------------------|------------|
| Računska osna sila          | N <sub>Ed</sub> =   | -0.724 kN  |
| Prečna sila v z smeri       | V <sub>Ed,z</sub> = | -0.879 kN  |
| Upogibni moment okoli y osi | M <sub>Ed,y</sub> = | 27.646 kNm |
| Upogibni moment okoli z osi | M <sub>Ed,z</sub> = | -0.308 kNm |
| Sistemska dolžina palice    | L =                 | 507.02 cm  |

**5.5 KLASIFIKACIJA PREČNIH PREREZOV**

Razred prereza 1

**6.2 NOSILNOST PREČNIH PREREZOV**
**6.2.4 Tlak**

Računska nosilnost na tlak

N<sub>c,Rd</sub> = 840.75 kN

**Pogoj 6.9:** N<sub>Ed</sub> ≤ N<sub>c,Rd</sub> (0.72 ≤ 840.75)

**6.2.5 Upogib y-y**

Plastični odpornostni moment

Wy,pl = 209.95 cm<sup>3</sup>

Računska nosilnost na upogib

M<sub>c,Rd</sub> = 52.488 kNm

**Pogoj 6.12:** M<sub>Ed,y</sub> ≤ M<sub>c,Rd,y</sub> (27.65 ≤ 52.49)

**6.2.5 Upogib z-z**

Plastični odpornostni moment

Wz,pl = 158.11 cm<sup>3</sup>

Računska nosilnost na upogib

M<sub>c,Rd</sub> = 39.528 kNm

**Pogoj 6.12:** M<sub>Ed,z</sub> ≤ M<sub>c,Rd,z</sub> (0.31 ≤ 39.53)

**6.2.6 Strig**

Računska strižna nosilnost

V<sub>pl,Rd,z</sub> = 291.24 kN

Računska strižna nosilnost

V<sub>c,Rd,z</sub> = 291.24 kN

**Pogoj 6.17:** V<sub>Ed,z</sub> ≤ V<sub>c,Rd,z</sub> (0.88 ≤ 291.24)

**6.2.10 Upogib z osno in prečno silo**

Ni potrebno zmanjšanje upogibne nosilnosti

**Pogoj:** V<sub>Ed,z</sub> ≤ 50%V<sub>pl,Rd,z</sub>

**6.2.9 Upogib in osna sila**

Razmerje N<sub>Ed</sub> / N<sub>pl,Rd</sub>

0.001

Zmanjšana plast.upogibna nosilnost

M<sub>N,y,Rd</sub> = 52.488 kNm

Koeficient

α =

1.660

Razmerje (M<sub>y,Ed</sub> / M<sub>N,y,Rd</sub>)<sup>α</sup>

0.345

**Pogoj 6.41:** (0.35 ≤ 1)

**6.3 NOSILNOST ELEMENTA NA UKLON**
**6.3.1.1 Nosilnost na uklon**

Uklonska dolžina y-y

l<sub>y</sub> = 507.02 cm

Relativna vitkost y-y

λ<sub>y</sub> = 0.877

Uklonska krivulja za os y-y: C

α = 0.490

Elastična kritična sila

N<sub>cr,y</sub> = 1202.3 kN

Koeficient nepopolnosti

χ<sub>y</sub> = 0.614

Računska uklonska nosilnost

N<sub>b,Rd,y</sub> = 516.23 kN

**Pogoj 6.46:** N<sub>Ed</sub> ≤ N<sub>b,Rd,y</sub> (0.72 ≤ 516.23)

Uklonska dolžina z-z

l<sub>z</sub> = 507.02 cm

Relativna vitkost z-z

λ<sub>z</sub> = 1.200

Uklonska krivulja za os z-z: C

α = 0.490

Koeficient nepopolnosti

χ<sub>z</sub> = 0.434

Računska uklonska nosilnost

N<sub>b,Rd,z</sub> = 364.60 kN

**Pogoj 6.46:** N<sub>Ed</sub> ≤ N<sub>b,Rd,z</sub> (0.72 ≤ 364.60)

**6.3.2.1 Nosilnost na bočno-torzijski uklon**

Koeficient

C1 = 1.132

Koeficient

C2 = 0.459

Koeficient

C3 = 0.525

Koef. ukl.dolžine za uklon

k = 1.000

Koef. ukl.dolžine za vbočenje

kw = 1.000

Koordinata

zg = 0.000 cm

Koordinata

zj = 0.000 cm

Razmak med bočnimi podporami

L = 507.02 cm

Sektorski vztrajnostni moment

I<sub>w</sub> = 0.000 cm<sup>6</sup>

Krit.moment bočne zvrnitve

M<sub>cr</sub> = 1054.3 kNm

Ustrezni odpornostni moment

Wy = 209.95 cm<sup>3</sup>

Koeficient imperf.

αLT = 0.760

Brezdimenz.vitkost

λLT = 0.234

Koeficient zmanjšanja (6.3.2.2.)

χLT = 0.973

Računska uklonska nosilnost

M<sub>b,Rd</sub> = 51.093 kNm

**Pogoj 6.54:** M<sub>Ed,y</sub> ≤ M<sub>b,Rd</sub> (27.65 ≤ 51.09)

**6.3.3. Elementi konstantnega prečnega prereza obremenjeni z upogibom in osnim tlakom**

Preračun koeficienta interakcije je izvršen z alternativno

metodo št.2 (Aneks B)

Koeficient oblike momenta

C<sub>my</sub> = 0.950

Koeficient oblike momenta

C<sub>mz</sub> = 0.950

Koeficient oblike momenta

C<sub>mLT</sub> = 0.950

Koeficient interakcije

k<sub>yy</sub> = 0.951

Koeficient interakcije

k<sub>yz</sub> = 0.571

Koeficient interakcije

k<sub>zy</sub> = 0.571

Koeficient interakcije

k<sub>zz</sub> = 0.952

Koeficient nepopolnosti

χ<sub>y</sub> = 0.614

N<sub>Ed</sub> / (χ<sub>y</sub> N<sub>Rk</sub> / γM1)

0.001

k<sub>yy</sub> \* (M<sub>y,Ed</sub> + ΔM<sub>y,Ed</sub>) / ...

0.515

k<sub>yz</sub> \* (M<sub>z,Ed</sub> + ΔM<sub>z,Ed</sub>) / ...

0.004

**Pogoj 6.61:** (0.52 ≤ 1)

Koeficient nepopolnosti

χ<sub>z</sub> = 0.434

N<sub>Ed</sub> / (χ<sub>z</sub> N<sub>Rk</sub> / γM1)

0.002

k<sub>zy</sub> \* (M<sub>y,Ed</sub> + ΔM<sub>y,Ed</sub>) / ...

0.309

k<sub>zz</sub> \* (M<sub>z,Ed</sub> + ΔM<sub>z,Ed</sub>) / ...

0.007

**Pogoj 6.62:** (0.32 ≤ 1)

**KONTROLA STRIŽNE NOSILNOSTI**  
(obtežni primer 58, začetek palice)

Računska osna sila  
Prečna sila v y smeri  
Prečna sila v z smeri  
Sistemska dolžina palice

$N_{Ed} = 3.784 \text{ kN}$   
 $V_{Ed,y} = 0.245 \text{ kN}$   
 $V_{Ed,z} = -21.987 \text{ kN}$   
 $L = 507.02 \text{ cm}$

**6.2.6 Strig**

Računska strižna nosilnost

$V_{pl,Rd,z} = 291.24 \text{ kN}$

Računska strižna nosilnost

$V_{c,Rd,z} = 291.24 \text{ kN}$

**Pogoj 6.17:**  $V_{Ed,z} \leq V_{c,Rd,z}$  ( $21.99 \leq 291.24$ )

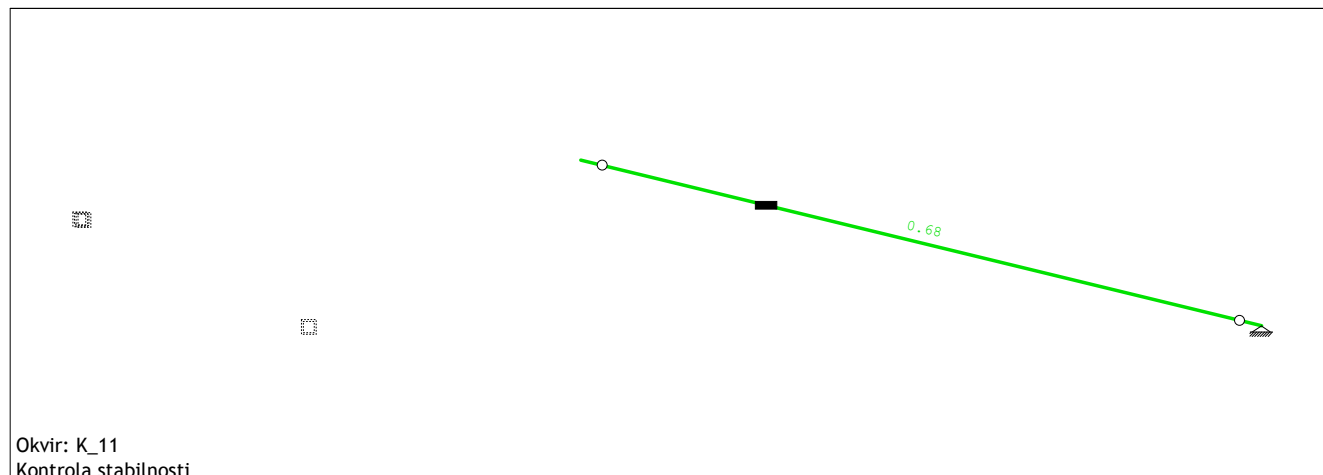
Računska strižna nosilnost

$V_{pl,Rd,y} = 194.16 \text{ kN}$

Računska strižna nosilnost

$V_{c,Rd,y} = 194.16 \text{ kN}$

**Pogoj 6.17:**  $V_{Ed,y} \leq V_{c,Rd,y}$  ( $0.24 \leq 194.16$ )

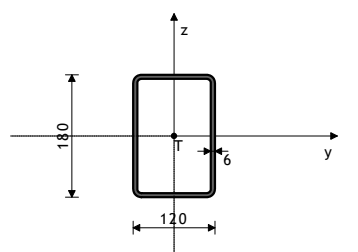
**6.2 NOSILNOST PREČNIH PREREZOV**


Okvir: K\_11

Kontrola stabilnosti

**PALICA 31-38**

PREČNI PREREZ: HOP [ ] 180x120x6 [S 275] [Set: 1]  
EUROCODE 3 (EN 1993-1-1:2005)

**GEOMETRIJSKE KARAKTERISTIKE prereza**


$A_x = 33.630 \text{ cm}^2$   
 $A_y = 13.452 \text{ cm}^2$   
 $A_z = 20.178 \text{ cm}^2$   
 $I_x = 1672.8 \text{ cm}^4$   
 $I_y = 1491.3 \text{ cm}^4$   
 $I_z = 796.28 \text{ cm}^4$   
 $W_y = 165.70 \text{ cm}^3$   
 $W_z = 132.71 \text{ cm}^3$   
 $W_{y,pl} = 209.95 \text{ cm}^3$   
 $W_{z,pl} = 158.11 \text{ cm}^3$   
 $\gamma_{M0} = 1.100$   
 $\gamma_{M1} = 1.100$   
 $\gamma_{M2} = 1.250$   
 $A_{net}/A = 0.900$

( $f_y = 27.5 \text{ kN/cm}^2$ ,  $f_u = 43.0 \text{ kN/cm}^2$ )

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| 182. $\gamma=0.32$ | 177. $\gamma=0.27$ | 92. $\gamma=0.27$  |
| 87. $\gamma=0.27$  | 88. $\gamma=0.27$  | 91. $\gamma=0.27$  |
| 176. $\gamma=0.27$ | 211. $\gamma=0.26$ | 212. $\gamma=0.26$ |
| 79. $\gamma=0.26$  | 80. $\gamma=0.26$  | 75. $\gamma=0.26$  |
| 76. $\gamma=0.26$  | 119. $\gamma=0.25$ | 120. $\gamma=0.25$ |
| 151. $\gamma=0.24$ | 150. $\gamma=0.24$ | 71. $\gamma=0.20$  |
| 72. $\gamma=0.20$  | 167. $\gamma=0.17$ | 162. $\gamma=0.17$ |
| 161. $\gamma=0.17$ | 166. $\gamma=0.17$ | 207. $\gamma=0.17$ |
| 208. $\gamma=0.17$ | 115. $\gamma=0.17$ | 116. $\gamma=0.17$ |
| 111. $\gamma=0.17$ | 112. $\gamma=0.17$ | 143. $\gamma=0.16$ |
| 146. $\gamma=0.16$ | 147. $\gamma=0.16$ | 142. $\gamma=0.16$ |
| 67. $\gamma=0.15$  | 188. $\gamma=0.15$ | 189. $\gamma=0.15$ |
| 68. $\gamma=0.15$  | 63. $\gamma=0.15$  | 154. $\gamma=0.15$ |
| 155. $\gamma=0.15$ | 64. $\gamma=0.15$  | 171. $\gamma=0.14$ |
| 172. $\gamma=0.14$ | 107. $\gamma=0.13$ | 108. $\gamma=0.13$ |
| 133. $\gamma=0.12$ | 134. $\gamma=0.12$ | 123. $\gamma=0.12$ |
| 128. $\gamma=0.12$ | 199. $\gamma=0.12$ | 200. $\gamma=0.12$ |
| 129. $\gamma=0.12$ | 124. $\gamma=0.12$ | 103. $\gamma=0.11$ |
| 192. $\gamma=0.11$ | 193. $\gamma=0.11$ | 104. $\gamma=0.11$ |
| 99. $\gamma=0.11$  | 100. $\gamma=0.11$ | 181. $\gamma=0.08$ |
| 184. $\gamma=0.08$ | 185. $\gamma=0.08$ | 180. $\gamma=0.08$ |

**PALICA IZPOSTAVljena NATEGU IN UPOGIBU**

(obtežni primer 58, na 530.6 cm od začetka palice)

Računska osna sila

$N_{Ed} = 2.051 \text{ kN}$

Prečna sila v y smeri

$V_{Ed,y} = 0.013 \text{ kN}$

Prečna sila v z smeri

$V_{Ed,z} = -1.156 \text{ kN}$

Upogibni moment okoli y osi

$M_{Ed,y} = 33.113 \text{ kNm}$

Upogibni moment okoli z osi

$M_{Ed,z} = -0.270 \text{ kNm}$

Sistemska dolžina palice

$L = 787.22 \text{ cm}$

**5.5 KLASIFIKACIJA PREČNIH PREREZOV**

Razred prereza 1

**6.2 NOSILNOST PREČNIH PREREZOV**
**6.2.3 Nateg**

Plast.rač.nosilnost bruto prereza

$N_{pl,Rd} = 840.75 \text{ kN}$

Mejna rač.nosilnost neto prereza

$N_{u,Rd} = 937.07 \text{ kN}$

Računska nos. na nateg

$N_{t,Rd} = 840.75 \text{ kN}$

**Pogoj 6.5:**  $N_{Ed} \leq N_{t,Rd}$  ( $2.05 \leq 840.75$ )

**6.2.5 Upogib y-y**

Plastični odpornostni moment

$W_{y,pl} = 209.95 \text{ cm}^3$

Računska nosilnost na upogib

$M_{c,Rd} = 52.488 \text{ kNm}$

**Pogoj 6.12:**  $M_{Ed,y} \leq M_{c,Rd,y}$  ( $33.11 \leq 52.49$ )

**6.2.5 Upogib z-z**

Plastični odpornostni moment

$W_{z,pl} = 158.11 \text{ cm}^3$

Računska nosilnost na upogib

$M_{c,Rd} = 39.528 \text{ kNm}$

**Pogoj 6.12:**  $M_{Ed,z} \leq M_{c,Rd,z}$  ( $0.27 \leq 39.53$ )

**6.2.6 Strig**

Računska strižna nosilnost

$V_{pl,Rd,z} = 291.24 \text{ kN}$

Računska strižna nosilnost

$V_{c,Rd,z} = 291.24 \text{ kN}$

**Pogoj 6.17:**  $V_{Ed,z} \leq V_{c,Rd,z}$  ( $1.16 \leq 291.24$ )

**FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB**

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| 58. $\gamma=0.68$  | 61. $\gamma=0.68$  | 54. $\gamma=0.62$  |
| 57. $\gamma=0.62$  | 50. $\gamma=0.62$  | 53. $\gamma=0.62$  |
| 137. $\gamma=0.62$ | 140. $\gamma=0.62$ | 136. $\gamma=0.62$ |
| 73. $\gamma=0.61$  | 70. $\gamma=0.61$  | 85. $\gamma=0.60$  |
| 82. $\gamma=0.60$  | 97. $\gamma=0.59$  | 94. $\gamma=0.59$  |
| 131. $\gamma=0.56$ | 126. $\gamma=0.56$ | 202. $\gamma=0.56$ |
| 62. $\gamma=0.56$  | 65. $\gamma=0.56$  | 66. $\gamma=0.56$  |
| 153. $\gamma=0.56$ | 156. $\gamma=0.56$ | 69. $\gamma=0.56$  |
| 159. $\gamma=0.54$ | 93. $\gamma=0.53$  | 86. $\gamma=0.53$  |
| 89. $\gamma=0.53$  | 175. $\gamma=0.53$ | 178. $\gamma=0.53$ |
| 90. $\gamma=0.53$  | 174. $\gamma=0.53$ | 106. $\gamma=0.52$ |
| 109. $\gamma=0.52$ | 78. $\gamma=0.52$  | 81. $\gamma=0.52$  |
| 74. $\gamma=0.52$  | 77. $\gamma=0.52$  | 132. $\gamma=0.51$ |
| 135. $\gamma=0.51$ | 118. $\gamma=0.51$ | 121. $\gamma=0.51$ |
| 152. $\gamma=0.50$ | 149. $\gamma=0.50$ | 164. $\gamma=0.47$ |
| 169. $\gamma=0.47$ | 210. $\gamma=0.47$ | 105. $\gamma=0.47$ |
| 98. $\gamma=0.47$  | 191. $\gamma=0.47$ | 194. $\gamma=0.47$ |
| 101. $\gamma=0.47$ | 102. $\gamma=0.47$ | 157. $\gamma=0.46$ |
| 158. $\gamma=0.46$ | 127. $\gamma=0.45$ | 130. $\gamma=0.45$ |
| 198. $\gamma=0.45$ | 201. $\gamma=0.45$ | 125. $\gamma=0.45$ |
| 122. $\gamma=0.45$ | 197. $\gamma=0.45$ | 205. $\gamma=0.44$ |
| 113. $\gamma=0.42$ | 114. $\gamma=0.42$ | 117. $\gamma=0.42$ |
| 110. $\gamma=0.42$ | 173. $\gamma=0.42$ | 170. $\gamma=0.42$ |
| 145. $\gamma=0.41$ | 148. $\gamma=0.41$ | 59. $\gamma=0.41$  |
| 60. $\gamma=0.41$  | 141. $\gamma=0.41$ | 144. $\gamma=0.41$ |
| 187. $\gamma=0.40$ | 190. $\gamma=0.40$ | 195. $\gamma=0.36$ |
| 196. $\gamma=0.36$ | 165. $\gamma=0.36$ | 168. $\gamma=0.36$ |
| 163. $\gamma=0.36$ | 206. $\gamma=0.36$ | 209. $\gamma=0.36$ |
| 160. $\gamma=0.36$ | 55. $\gamma=0.36$  | 56. $\gamma=0.36$  |
| 51. $\gamma=0.36$  | 138. $\gamma=0.36$ | 139. $\gamma=0.36$ |
| 52. $\gamma=0.36$  | 203. $\gamma=0.35$ | 204. $\gamma=0.35$ |
| 214. $\gamma=0.35$ | 213. $\gamma=0.34$ | 83. $\gamma=0.34$  |
| 84. $\gamma=0.34$  | 95. $\gamma=0.33$  | 96. $\gamma=0.33$  |
| 183. $\gamma=0.32$ | 186. $\gamma=0.32$ | 179. $\gamma=0.32$ |

Računska strižna nosilnost

Računska strižna nosilnost

**Pogoj 6.17:**  $V_{Ed,y} \leq V_{c,Rd,y}$  ( $0.01 \leq 194.16$ )

 $V_{pl,Rd,y} = 194.16 \text{ kN}$ 
 $V_{c,Rd,y} = 194.16 \text{ kN}$ 

Koeficient imperf.

Brezdimenz. vitkost

Koeficient zmanjšanja (6.3.2.2.)

Računska uklonska nosilnost

**Pogoj 6.54:**  $M_{Ed,y} \leq M_{b,Rd}$  ( $33.11 \leq 48.80$ )

 $\alpha_{LT} = 0.760$ 
 $\lambda_{LT} = 0.292$ 
 $\chi_{LT} = 0.930$ 
 $M_{b,Rd} = 48.799 \text{ kNm}$ 

6.2.10 Upogib z osno in prečno silo

Ni potrebno zmanjšanje upogibne nosilnosti

**Pogoj:**  $V_{Ed,z} \leq 50\%V_{pl,Rd,z}$ ;  $V_{Ed,y} \leq 50\%V_{pl,Rd,y}$ 

6.2.9 Upogib in osna sila

Razmerje  $N_{Ed} / N_{pl,Rd}$ 

Zmanjšana plast.upogibna nosilnost

Koeficient

Razmerje  $(M_{y,Ed} / M_{N,y,Rd})^{\alpha}$ 
**Pogoj 6.41:** ( $0.47 \leq 1$ )

 $M_{N,y,Rd} = 0.002$ 
 $M_{N,y,Rd} = 52.488 \text{ kNm}$ 
 $\alpha = 1.660$ 
 $\alpha = 0.465$ 

6.3 NOSILNOST ELEMENTA NA UKLON

6.3.2.1 Nosilnost na bočno-torzijski uklon

Koeficient

Koeficient

Koeficient

Koef. ukl. dolžine za uklon

Koef. ukl. dolžine za vbočenje

Koordinata

Koordinata

Razmak med bočnimi podporami

Sektorski vztrajnostni moment

Krit. moment bočne zvrnitve

Ustrezni odpornostni moment

 $C1 = 1.132$ 
 $C2 = 0.459$ 
 $C3 = 0.525$ 
 $k = 1.000$ 
 $k_w = 1.000$ 
 $z_g = 0.000 \text{ cm}$ 
 $z_j = 0.000 \text{ cm}$ 
 $L = 787.22 \text{ cm}$ 
 $I_w = 0.000 \text{ cm}^6$ 
 $M_{cr} = 679.04 \text{ kNm}$ 
 $W_y = 209.95 \text{ cm}^3$ 

KONTROLA STRIŽNE NOSILNOSTI

(obtežni primer 58, na 214.7 cm od začetka palice)

Računska osna sila

Prečna sila v y smeri

Prečna sila v z smeri

Upogibni moment okoli y osi

Upogibni moment okoli z osi

Sistemska dolžina palice

 $N_{Ed} = 9.757 \text{ kN}$ 
 $V_{Ed,y} = 0.304 \text{ kN}$ 
 $V_{Ed,z} = -35.853 \text{ kN}$ 
 $M_{Ed,y} = -25.242 \text{ kNm}$ 
 $M_{Ed,z} = 0.230 \text{ kNm}$ 
 $L = 787.22 \text{ cm}$ 

6.2 NOSILNOST PREČNIH PREREZOV

6.2.6 Strig

Računska strižna nosilnost

Računska strižna nosilnost

**Pogoj 6.17:**  $V_{Ed,z} \leq V_{c,Rd,z}$  ( $35.85 \leq 291.24$ )

 $V_{pl,Rd,z} = 291.24 \text{ kN}$ 
 $V_{c,Rd,z} = 291.24 \text{ kN}$ 

Računska strižna nosilnost

Računska strižna nosilnost

**Pogoj 6.17:**  $V_{Ed,y} \leq V_{c,Rd,y}$  ( $0.30 \leq 194.16$ )

 $V_{pl,Rd,y} = 194.16 \text{ kN}$ 
 $V_{c,Rd,y} = 194.16 \text{ kN}$ 

Okvir: K\_10

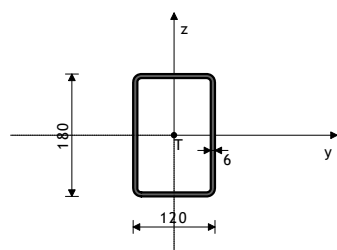
Kontrola stabilnosti

PALICA 20-24

PREČNI PREREZ: HOP [ 180x120x6 [S 275] [Set: 1]

EUROCODE 3 (EN 1993-1-1:2005)

GEOMETRIJSKE KARAKTERISTIKE prereza


 $A_x = 33.630 \text{ cm}^2$   
 $A_y = 13.452 \text{ cm}^2$   
 $A_z = 20.178 \text{ cm}^2$   
 $I_x = 1672.8 \text{ cm}^4$   
 $I_y = 1491.3 \text{ cm}^4$   
 $I_z = 796.28 \text{ cm}^4$   
 $W_y = 165.70 \text{ cm}^3$   
 $W_z = 132.71 \text{ cm}^3$   
 $W_{y,pl} = 209.95 \text{ cm}^3$   
 $W_{z,pl} = 158.11 \text{ cm}^3$   
 $\gamma_{M0} = 1.100$   
 $\gamma_{M1} = 1.100$   
 $\gamma_{M2} = 1.250$   
 $A_{net}/A = 0.900$ 

( $f_y = 27.5 \text{ kN/cm}^2$ ,  $f_u = 43.0 \text{ kN/cm}^2$ )

FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| 58. $\gamma=0.54$  | 61. $\gamma=0.54$  | 70. $\gamma=0.51$  |
| 73. $\gamma=0.51$  | 50. $\gamma=0.50$  | 53. $\gamma=0.50$  |
| 54. $\gamma=0.50$  | 57. $\gamma=0.50$  | 137. $\gamma=0.50$ |
| 140. $\gamma=0.50$ | 82. $\gamma=0.48$  | 85. $\gamma=0.48$  |
| 136. $\gamma=0.47$ | 97. $\gamma=0.47$  | 94. $\gamma=0.47$  |
| 65. $\gamma=0.46$  | 66. $\gamma=0.46$  | 69. $\gamma=0.46$  |
| 62. $\gamma=0.46$  | 153. $\gamma=0.46$ | 156. $\gamma=0.46$ |
| 109. $\gamma=0.44$ | 106. $\gamma=0.44$ | 135. $\gamma=0.43$ |
| 132. $\gamma=0.43$ | 131. $\gamma=0.43$ | 126. $\gamma=0.43$ |
| 202. $\gamma=0.43$ | 90. $\gamma=0.42$  | 93. $\gamma=0.42$  |
| 86. $\gamma=0.42$  | 175. $\gamma=0.42$ | 178. $\gamma=0.42$ |
| 89. $\gamma=0.42$  | 81. $\gamma=0.42$  | 81. $\gamma=0.42$  |
| 74. $\gamma=0.42$  | 77. $\gamma=0.42$  | 159. $\gamma=0.42$ |
| 121. $\gamma=0.41$ | 118. $\gamma=0.41$ | 149. $\gamma=0.41$ |
| 152. $\gamma=0.41$ | 174. $\gamma=0.40$ | 98. $\gamma=0.39$  |
| 101. $\gamma=0.39$ | 102. $\gamma=0.39$ | 191. $\gamma=0.39$ |

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| 194. $\gamma=0.39$ | 105. $\gamma=0.39$ | 122. $\gamma=0.39$ |
| 127. $\gamma=0.39$ | 130. $\gamma=0.39$ | 198. $\gamma=0.39$ |
| 201. $\gamma=0.39$ | 125. $\gamma=0.39$ | 170. $\gamma=0.36$ |
| 173. $\gamma=0.36$ | 164. $\gamma=0.36$ | 169. $\gamma=0.36$ |
| 210. $\gamma=0.36$ | 157. $\gamma=0.35$ | 158. $\gamma=0.35$ |
| 113. $\gamma=0.35$ | 114. $\gamma=0.35$ | 117. $\gamma=0.35$ |
| 110. $\gamma=0.35$ | 197. $\gamma=0.34$ | 144. $\gamma=0.34$ |
| 145. $\gamma=0.34$ | 148. $\gamma=0.34$ | 141. $\gamma=0.34$ |
| 205. $\gamma=0.34$ | 187. $\gamma=0.33$ | 190. $\gamma=0.33$ |
| 163. $\gamma=0.32$ | 160. $\gamma=0.32$ | 165. $\gamma=0.32$ |
| 206. $\gamma=0.32$ | 209. $\gamma=0.32$ | 168. $\gamma=0.32$ |
| 195. $\gamma=0.28$ | 196. $\gamma=0.28$ | 203. $\gamma=0.28$ |
| 204. $\gamma=0.28$ | 214. $\gamma=0.28$ | 182. $\gamma=0.27$ |
| 183. $\gamma=0.27$ | 186. $\gamma=0.27$ | 179. $\gamma=0.27$ |
| 213. $\gamma=0.27$ | 59. $\gamma=0.24$  | 60. $\gamma=0.24$  |
| 207. $\gamma=0.23$ | 208. $\gamma=0.23$ | 161. $\gamma=0.23$ |
| 166. $\gamma=0.23$ | 167. $\gamma=0.23$ | 162. $\gamma=0.23$ |
| 211. $\gamma=0.20$ | 212. $\gamma=0.20$ | 139. $\gamma=0.20$ |
| 52. $\gamma=0.20$  | 55. $\gamma=0.20$  | 56. $\gamma=0.20$  |
| 51. $\gamma=0.20$  | 138. $\gamma=0.20$ | 171. $\gamma=0.19$ |
| 172. $\gamma=0.19$ | 83. $\gamma=0.18$  | 84. $\gamma=0.18$  |
| 95. $\gamma=0.17$  | 96. $\gamma=0.17$  | 129. $\gamma=0.17$ |
| 124. $\gamma=0.17$ | 199. $\gamma=0.17$ | 200. $\gamma=0.17$ |
| 123. $\gamma=0.17$ | 128. $\gamma=0.17$ | 99. $\gamma=0.16$  |
| 192. $\gamma=0.16$ | 193. $\gamma=0.16$ | 100. $\gamma=0.16$ |
| 103. $\gamma=0.16$ | 104. $\gamma=0.16$ | 91. $\gamma=0.13$  |
| 92. $\gamma=0.13$  | 87. $\gamma=0.13$  | 176. $\gamma=0.13$ |
| 177. $\gamma=0.13$ | 88. $\gamma=0.13$  | 133. $\gamma=0.13$ |
| 134. $\gamma=0.13$ | 75. $\gamma=0.12$  | 76. $\gamma=0.12$  |
| 107. $\gamma=0.12$ | 108. $\gamma=0.12$ | 79. $\gamma=0.12$  |
| 80. $\gamma=0.12$  | 119. $\gamma=0.11$ | 120. $\gamma=0.11$ |
| 151. $\gamma=0.11$ | 150. $\gamma=0.11$ | 155. $\gamma=0.10$ |
| 68. $\gamma=0.10$  | 63. $\gamma=0.10$  | 64. $\gamma=0.10$  |
| 67. $\gamma=0.10$  | 154. $\gamma=0.10$ | 71. $\gamma=0.07$  |
| 72. $\gamma=0.07$  | 185. $\gamma=0.06$ | 180. $\gamma=0.06$ |
| 181. $\gamma=0.06$ | 184. $\gamma=0.06$ | 111. $\gamma=0.05$ |
| 112. $\gamma=0.05$ | 115. $\gamma=0.05$ | 116. $\gamma=0.05$ |
| 143. $\gamma=0.05$ | 146. $\gamma=0.05$ | 147. $\gamma=0.05$ |
| 142. $\gamma=0.05$ | 189. $\gamma=0.04$ | 188. $\gamma=0.04$ |

PALICA IZPOSTAVLJENA PRITISKU IN UPOGIBU  
(obtežni primer 58, na 243.4 cm od začetka palice)

|                             |              |            |
|-----------------------------|--------------|------------|
| Računska osna sila          | $N_{Ed} =$   | -4.508 kN  |
| Prečna sila v z smeri       | $V_{Ed,z} =$ | -0.879 kN  |
| Upogibni moment okoli y osi | $M_{Ed,y} =$ | 27.646 kNm |
| Upogibni moment okoli z osi | $M_{Ed,z} =$ | -0.308 kNm |
| Sistemska dolžina palice    | $L =$        | 507.02 cm  |

5.5 KLASIFIKACIJA PREČNIH PREREZOV  
Razred prereza 1

6.2 NOSILNOST PREČNIH PREREZOV

6.2.4 Tlak

|   |              |           |
|---|--------------|-----------|
| Računska nosilnost na tlak  | $N_{c,Rd} =$ | 840.75 kN |
| <b>Pogoj 6.9: <math>N_{Ed} \leq N_{c,Rd}</math> (4.51 ≤ 840.75)</b> |              |           |

6.2.5 Upogib y-y

|  |              |                        |
|--|--------------|------------------------|
| Plastični odpornostni moment   | $W_{y,pl} =$ | 209.95 cm <sup>3</sup> |
| Računska nosilnost na upogib   | $M_{c,Rd} =$ | 52.488 kNm             |
| <b>Pogoj 6.12: <math>M_{Ed,y} \leq M_{c,Rd,y}</math> (27.65 ≤ 52.49)</b> |              |                        |

6.2.5 Upogib z-z

|   |              |                        |
|---|--------------|------------------------|
| Plastični odpornostni moment  | $W_{z,pl} =$ | 158.11 cm <sup>3</sup> |
| Računska nosilnost na upogib  | $M_{c,Rd} =$ | 39.528 kNm             |
| <b>Pogoj 6.12: <math>M_{Ed,z} \leq M_{c,Rd,z}</math> (0.31 ≤ 39.53)</b> |              |                        |

6.2.6 Strig

|  |                 |           |
|--|-----------------|-----------|
| Računska strižna nosilnost   | $V_{pl,Rd,z} =$ | 291.24 kN |
| Računska strižna nosilnost   | $V_{c,Rd,z} =$  | 291.24 kN |
| <b>Pogoj 6.17: <math>V_{Ed,z} \leq V_{c,Rd,z}</math> (0.88 ≤ 291.24)</b> |                 |           |

6.2.10 Upogib z osno in prečno silo  
Ni potrebno zmanjšanje upogibne nosilnosti  
**Pogoj:  $V_{Ed,z} \leq 50\%V_{pl,Rd,z}$**

6.2.9 Upogib in osna sila

|   |                |            |
|---|----------------|------------|
| Razmerje $N_{Ed} / N_{pl,Rd}$             |                | 0.005      |
| Zmanjšana plast.upogibna nosilnost        | $M_{N,y,Rd} =$ | 52.488 kNm |
| Koeficient                                | $\alpha =$     | 1.660      |
| Razmerje $(M_{y,Ed} / M_{N,y,Rd})^\alpha$ |                | 0.345      |
| <b>Pogoj 6.41: (0.35 ≤ 1)</b>             |                |            |

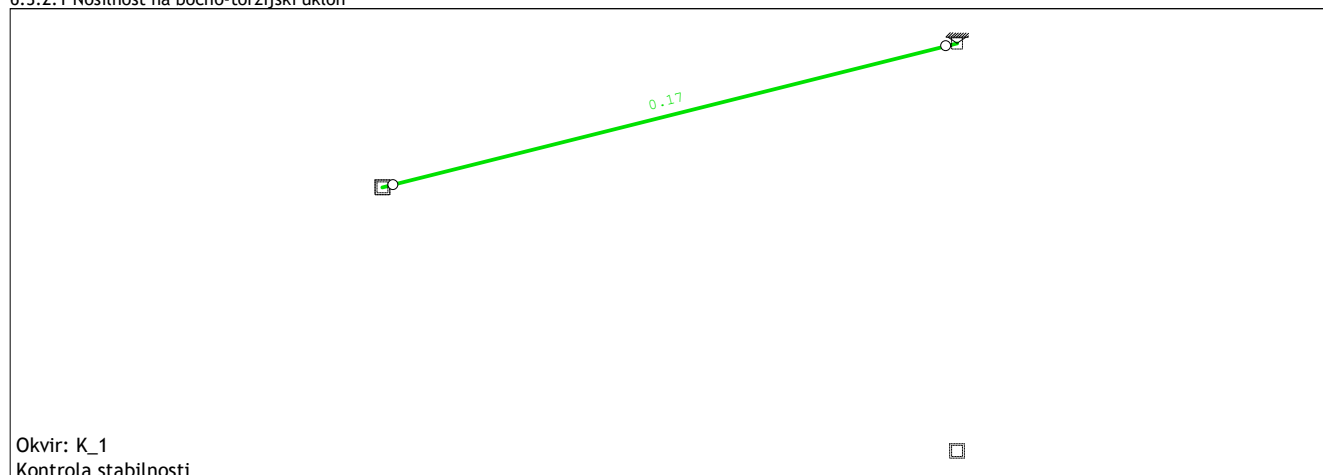
6.3 NOSILNOST ELEMENTA NA UKLON

6.3.1.1 Nosilnost na uklon

|  |                |           |
|--|----------------|-----------|
| Uklonska dolžina y-y   | $l_y =$        | 507.02 cm |
| Relativna vitkost y-y  | $\lambda_y =$  | 0.877     |
| Uklonska krivulja za os y-y: C   | $\alpha =$     | 0.490     |
| Elastična kritična sila  | $N_{cr,y} =$   | 1202.3 kN |
| Koeficient nepopolnosti  | $\chi_y =$     | 0.614     |
| Računska uklonska nosilnost  | $N_{b,Rd,y} =$ | 516.23 kN |
| <b>Pogoj 6.46: <math>N_{Ed} \leq N_{b,Rd,y}</math> (4.51 ≤ 516.23)</b> |                |           |

|  |                |           |
|--|----------------|-----------|
| Uklonska dolžina z-z   | $l_z =$        | 507.02 cm |
| Relativna vitkost z-z  | $\lambda_z =$  | 1.200     |
| Uklonska krivulja za os z-z: C   | $\alpha =$     | 0.490     |
| Koeficient nepopolnosti  | $\chi_z =$     | 0.434     |
| Računska uklonska nosilnost  | $N_{b,Rd,z} =$ | 364.60 kN |
| <b>Pogoj 6.46: <math>N_{Ed} \leq N_{b,Rd,z}</math> (4.51 ≤ 364.60)</b> |                |           |

6.3.2.1 Nosilnost na bočno-torzijski uklon



|  |                  |                        |
|--|------------------|------------------------|
| Koeficient   | $C1 =$           | 1.132                  |
| Koeficient   | $C2 =$           | 0.459                  |
| Koeficient   | $C3 =$           | 0.525                  |
| Koef.ukl.dolžine za uklon  | $k =$            | 1.000                  |
| Koef.ukl.dolžine za vbočenje   | $k_w =$          | 1.000                  |
| Koordinata   | $z_g =$          | 0.000 cm               |
| Koordinata   | $z_j =$          | 0.000 cm               |
| Razmak med bočnimi podporami   | $L =$            | 507.02 cm              |
| Sektorski vztrajnostni moment  | $I_w =$          | 0.000 cm <sup>6</sup>  |
| Krit.moment bočne zvrnitve   | $M_{cr} =$       | 1054.3 kNm             |
| Ustrezni odpornostni moment  | $W_y =$          | 209.95 cm <sup>3</sup> |
| Koeficient imperf.   | $\alpha_{LT} =$  | 0.760                  |
| Brezdimenz.vitkost   | $\lambda_{LT} =$ | 0.234                  |
| Koeficient zmanjšanja (6.3.2.2.)                                       | $\chi_{LT} =$    | 0.973                  |
| Računska uklonska nosilnost  | $M_{b,Rd} =$     | 51.093 kNm             |
| <b>Pogoj 6.54: <math>M_{Ed,y} \leq M_{b,Rd}</math> (27.65 ≤ 51.09)</b> |                  |                        |

6.3.3. Elementi konstantnega prečnega prereza obremenjeni z upogibom in osnim tlakom

Preračun koeficienta interakcije je izvršen z alternativno metodo št.2 (Aneks B)

|                           |             |       |
|---------------------------|-------------|-------|
| Koeficient oblike momenta | $C_{my} =$  | 0.950 |
| Koeficient oblike momenta | $C_{mz} =$  | 0.950 |
| Koeficient oblike momenta | $C_{mLT} =$ | 0.950 |
| Koeficient interakcije    | $k_{yy} =$  | 0.956 |
| Koeficient interakcije    | $k_{yz} =$  | 0.576 |
| Koeficient interakcije    | $k_{zy} =$  | 0.573 |
| Koeficient interakcije    | $k_{zz} =$  | 0.959 |

Koeficient nepopolnosti

|   |            |       |
|---|------------|-------|
| $N_{Ed} / (\chi_y N_{Rk} / \gamma M1)$          | $\chi_y =$ | 0.614 |
| $k_{yy} * (M_{y,Ed} + \Delta M_{y,Ed}) / \dots$ |            | 0.009 |
| $k_{yz} * (M_{z,Ed} + \Delta M_{z,Ed}) / \dots$ |            | 0.517 |
| <b>Pogoj 6.61: (0.53 ≤ 1)</b>                   |            | 0.004 |

Koeficient nepopolnosti

|   |            |       |
|---|------------|-------|
| $N_{Ed} / (\chi_z N_{Rk} / \gamma M1)$          | $\chi_z =$ | 0.434 |
| $k_{zy} * (M_{y,Ed} + \Delta M_{y,Ed}) / \dots$ |            | 0.012 |
| $k_{zz} * (M_{z,Ed} + \Delta M_{z,Ed}) / \dots$ |            | 0.310 |
| <b>Pogoj 6.62: (0.33 ≤ 1)</b>                   |            | 0.007 |

KONTROLA STRIŽNE NOSILNOSTI  
(obtežni primer 58, začetek palice)

|                          |              |            |
|--------------------------|--------------|------------|
| Prečna sila v y smeri    | $V_{Ed,y} =$ | 0.245 kN   |
| Prečna sila v z smeri    | $V_{Ed,z} =$ | -21.987 kN |
| Sistemska dolžina palice | $L =$        | 507.02 cm  |

6.2 NOSILNOST PREČNIH PREREZOV

6.2.6 Strig

|   |                 |           |
|---|-----------------|-----------|
| Računska strižna nosilnost  | $V_{pl,Rd,z} =$ | 291.24 kN |
| Računska strižna nosilnost  | $V_{c,Rd,z} =$  | 291.24 kN |
| <b>Pogoj 6.17: <math>V_{Ed,z} \leq V_{c,Rd,z}</math> (21.99 ≤ 291.24)</b> |                 |           |

|  |                 |           |
|--|-----------------|-----------|
| Računska strižna nosilnost   | $V_{pl,Rd,y} =$ | 194.16 kN |
| Računska strižna nosilnost   | $V_{c,Rd,y} =$  | 194.16 kN |
| <b>Pogoj 6.17: <math>V_{Ed,y} \leq V_{c,Rd,y}</math> (0.24 ≤ 194.16)</b> |                 |           |

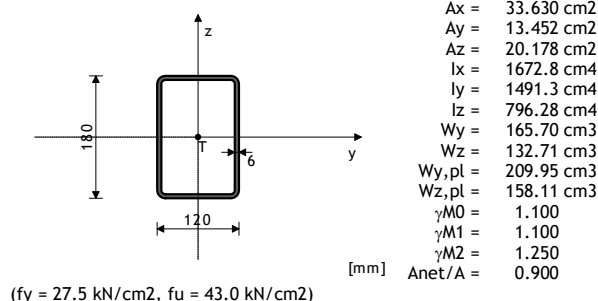
Okvir: K\_1

Kontrola stabilnosti



**PALICA 37-24**

PREČNI PREREZ: HOP [ 180x120x6 [S 275] [Set: 1]  
EUROCODE 3 (EN 1993-1-1:2005)

**GEOMETRIJSKE KARAKTERISTIKE prereza**


(fy = 27.5 kN/cm<sup>2</sup>, fu = 43.0 kN/cm<sup>2</sup>)

**FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB**

|             |             |             |
|-------------|-------------|-------------|
| 61. γ=0.17  | 136. γ=0.16 | 53. γ=0.16  |
| 57. γ=0.16  | 140. γ=0.16 | 73. γ=0.15  |
| 58. γ=0.15  | 85. γ=0.15  | 97. γ=0.15  |
| 126. γ=0.14 | 131. γ=0.14 | 202. γ=0.14 |
| 65. γ=0.14  | 156. γ=0.14 | 159. γ=0.14 |
| 69. γ=0.14  | 50. γ=0.14  | 137. γ=0.14 |
| 54. γ=0.14  | 174. γ=0.14 | 89. γ=0.13  |
| 93. γ=0.13  | 178. γ=0.13 | 82. γ=0.13  |
| 59. γ=0.13  | 77. γ=0.13  | 81. γ=0.13  |
| 109. γ=0.13 | 94. γ=0.13  | 121. γ=0.13 |
| 135. γ=0.13 | 152. γ=0.13 | 70. γ=0.12  |
| 169. γ=0.12 | 164. γ=0.12 | 210. γ=0.12 |
| 158. γ=0.12 | 157. γ=0.12 | 55. γ=0.12  |
| 51. γ=0.12  | 138. γ=0.12 | 194. γ=0.12 |
| 197. γ=0.12 | 101. γ=0.12 | 105. γ=0.12 |
| 175. γ=0.11 | 86. γ=0.11  | 90. γ=0.11  |
| 201. γ=0.11 | 125. γ=0.11 | 205. γ=0.11 |
| 130. γ=0.11 | 78. γ=0.11  | 74. γ=0.11  |
| 60. γ=0.11  | 83. γ=0.11  | 118. γ=0.11 |
| 62. γ=0.11  | 95. γ=0.11  | 153. γ=0.11 |
| 66. γ=0.11  | 113. γ=0.11 | 117. γ=0.11 |
| 149. γ=0.11 | 148. γ=0.10 | 144. γ=0.10 |
| 173. γ=0.10 | 190. γ=0.10 | 106. γ=0.10 |
| 139. γ=0.10 | 56. γ=0.10  | 52. γ=0.10  |
| 132. γ=0.10 | 196. γ=0.09 | 195. γ=0.09 |
| 87. γ=0.09  | 176. γ=0.09 | 91. γ=0.09  |
| 204. γ=0.09 | 84. γ=0.09  | 203. γ=0.09 |
| 214. γ=0.09 | 75. γ=0.09  | 168. γ=0.09 |
| 209. γ=0.09 | 79. γ=0.09  | 213. γ=0.09 |
| 163. γ=0.09 | 96. γ=0.09  | 114. γ=0.09 |
| 110. γ=0.09 | 119. γ=0.09 | 71. γ=0.09  |
| 145. γ=0.09 | 141. γ=0.09 | 150. γ=0.08 |
| 98. γ=0.08  | 191. γ=0.08 | 102. γ=0.08 |
| 187. γ=0.08 | 127. γ=0.08 | 122. γ=0.08 |
| 198. γ=0.08 | 186. γ=0.08 | 182. γ=0.08 |
| 177. γ=0.07 | 92. γ=0.07  | 88. γ=0.07  |
| 170. γ=0.07 | 154. γ=0.07 | 80. γ=0.07  |
| 63. γ=0.07  | 67. γ=0.07  | 76. γ=0.07  |
| 212. γ=0.07 | 120. γ=0.07 | 211. γ=0.07 |
| 111. γ=0.07 | 115. γ=0.07 | 151. γ=0.07 |
| 107. γ=0.06 | 146. γ=0.06 | 142. γ=0.06 |
| 133. γ=0.06 | 179. γ=0.06 | 183. γ=0.06 |
| 188. γ=0.06 | 165. γ=0.06 | 160. γ=0.06 |
| 206. γ=0.06 | 192. γ=0.06 | 103. γ=0.06 |
| 99. γ=0.06  | 128. γ=0.05 | 123. γ=0.05 |
| 72. γ=0.05  | 199. γ=0.05 | 116. γ=0.05 |
| 112. γ=0.05 | 171. γ=0.04 | 143. γ=0.04 |
| 147. γ=0.04 | 189. γ=0.04 | 184. γ=0.04 |
| 180. γ=0.04 | 64. γ=0.04  | 68. γ=0.04  |
| 155. γ=0.04 | 161. γ=0.03 | 166. γ=0.03 |
| 207. γ=0.03 | 108. γ=0.03 | 134. γ=0.03 |
| 181. γ=0.02 | 185. γ=0.02 | 100. γ=0.01 |
| 193. γ=0.01 | 104. γ=0.01 | 162. γ=0.01 |
| 124. γ=0.01 | 200. γ=0.01 | 167. γ=0.01 |
| 129. γ=0.01 | 208. γ=0.01 | 172. γ=0.01 |

**PALICA IZPOSTAVLJENA NATEGU IN UPOGIBU  
(obtežni primer 61, na 116.9 cm od začetka palice)**

|                             |                                |
|-----------------------------|--------------------------------|
| Računska osna sila          | N <sub>Ed</sub> = 4.638 kN     |
| Prečna sila v y smeri       | V <sub>Ed,y</sub> = 0.011 kN   |
| Prečna sila v z smeri       | V <sub>Ed,z</sub> = -1.975 kN  |
| Upogibni moment okoli y osi | M <sub>Ed,y</sub> = 9.051 kNm  |
| Upogibni moment okoli z osi | M <sub>Ed,z</sub> = -0.050 kNm |
| Sistemska dolžina palice    | L = 272.75 cm                  |

**5.5 KLASIFIKACIJA PREČNIH PREREZOV  
Razred prereza 1**
**6.2 NOSILNOST PREČNIH PREREZOV**
**6.2.3 Nateg**

|                                   |                                |
|-----------------------------------|--------------------------------|
| Plast.rač.nosilnost bruto prereza | N <sub>pl,Rd</sub> = 840.75 kN |
| Mejna rač.nosilnost neto prereza  | N <sub>u,Rd</sub> = 937.07 kN  |
| Računska nos. na nateg            | N <sub>t,Rd</sub> = 840.75 kN  |

**Pogoj 6.5:** N<sub>Ed</sub> ≤ N<sub>t,Rd</sub> (4.64 ≤ 840.75)

**6.2.5 Upogib y-y**

|                              |  |
|------------------------------|--|
| Plastični odpornostni moment | W <sub>y,pl</sub> = 209.95 cm <sup>3</sup> |
| Računska nosilnost na upogib | M <sub>c,Rd</sub> = 52.488 kNm             |

**Pogoj 6.12:** M<sub>Ed,y</sub> ≤ M<sub>c,Rd,y</sub> (9.05 ≤ 52.49)

**6.2.5 Upogib z-z**

|                              |  |
|------------------------------|--|
| Plastični odpornostni moment | W <sub>z,pl</sub> = 158.11 cm <sup>3</sup> |
| Računska nosilnost na upogib | M <sub>c,Rd</sub> = 39.528 kNm             |

**Pogoj 6.12:** M<sub>Ed,z</sub> ≤ M<sub>c,Rd,z</sub> (0.05 ≤ 39.53)

**6.2.6 Strig**

|                            |                                  |
|----------------------------|----------------------------------|
| Računska strižna nosilnost | V <sub>pl,Rd,z</sub> = 291.24 kN |
| Računska strižna nosilnost | V <sub>c,Rd,z</sub> = 291.24 kN  |

**Pogoj 6.17:** V<sub>Ed,z</sub> ≤ V<sub>c,Rd,z</sub> (1.98 ≤ 291.24)

**Računska strižna nosilnost**

|                            |                                  |
|----------------------------|----------------------------------|
| Računska strižna nosilnost | V <sub>pl,Rd,y</sub> = 194.16 kN |
| Računska strižna nosilnost | V <sub>c,Rd,y</sub> = 194.16 kN  |

**Pogoj 6.17:** V<sub>Ed,y</sub> ≤ V<sub>c,Rd,y</sub> (0.01 ≤ 194.16)

**6.2.10 Upogib z osno in prečno silo**

Ni potrebno zmanjšanje upogibne nosilnosti

**Pogoj:** V<sub>Ed,z</sub> ≤ 50%V<sub>pl,Rd,z</sub> ; V<sub>Ed,y</sub> ≤ 50%V<sub>pl,Rd,y</sub>

**6.2.9 Upogib in osna sila**

|  |                                  |
|--|----------------------------------|
| Razmerje N <sub>Ed</sub> / N <sub>pl,Rd</sub>                    | 0.006                            |
| Zmanjšana plast.upogibna nosilnost                               | M <sub>N,y,Rd</sub> = 52.488 kNm |
| Koeficient   | α = 1.660                        |
| Razmerje (M <sub>y,Ed</sub> / M <sub>N,y,Rd</sub> ) <sup>α</sup> | 0.054                            |

**Pogoj 6.41:** (0.05 ≤ 1)

**6.3 NOSILNOST ELEMENTA NA UKLON**
**6.3.2.1 Nosilnost na bočno-torzijski uklon**

|                                  |   |
|----------------------------------|---|
| Koeficient                       | C1 = 1.132                              |
| Koeficient                       | C2 = 0.459                              |
| Koeficient                       | C3 = 0.525                              |
| Koef.ukl.dolžine za uklon        | k = 1.000                               |
| Koef.ukl.dolžine za vbočenje     | kw = 1.000                              |
| Koordinata                       | zg = 0.000 cm                           |
| Koordinata                       | zj = 0.000 cm                           |
| Razmak med bočnimi podporami     | L = 272.75 cm                           |
| Sektorski vztrajnostni moment    | I <sub>w</sub> = 0.000 cm <sup>6</sup>  |
| Krit.moment bočne zvrnitve       | M <sub>cr</sub> = 1959.9 kNm            |
| Ustrezni odpornostni moment      | W <sub>y</sub> = 209.95 cm <sup>3</sup> |
| Koeficient imperf.               | αLT = 0.760                             |
| Brezdimenz.vitkost               | λLT = 0.172                             |
| Koeficient zmanjšanja (6.3.2.2.) | χLT = 1.000                             |
| Računska uklonska nosilnost      | M <sub>b,Rd</sub> = 52.488 kNm          |

**Pogoj 6.54:** M<sub>Ed,y</sub> ≤ M<sub>b,Rd</sub> (9.05 ≤ 52.49)

**KONTROLA STRIŽNE NOSILNOSTI**

(obtežni primer 61, začetek palice)

|                          |                                |
|--------------------------|--------------------------------|
| Računska osna sila       | N <sub>Ed</sub> = 1.888 kN     |
| Prečna sila v y smeri    | V <sub>Ed,y</sub> = 0.077 kN   |
| Prečna sila v z smeri    | V <sub>Ed,z</sub> = -13.827 kN |
| Sistemska dolžina palice | L = 272.75 cm                  |

**6.2 NOSILNOST PREČNIH PREREZOV**
**6.2.6 Strig**

|                            |                                  |
|----------------------------|----------------------------------|
| Računska strižna nosilnost | V <sub>pl,Rd,z</sub> = 291.24 kN |
| Računska strižna nosilnost | V <sub>c,Rd,z</sub> = 291.24 kN  |

**Pogoj 6.17:** V<sub>Ed,z</sub> ≤ V<sub>c,Rd,z</sub> (13.83 ≤ 291.24)

**Računska strižna nosilnost**

|                            |                                  |
|----------------------------|----------------------------------|
| Računska strižna nosilnost | V <sub>pl,Rd,y</sub> = 194.16 kN |
| Računska strižna nosilnost | V <sub>c,Rd,y</sub> = 194.16 kN  |

**Pogoj 6.17:** V<sub>Ed,y</sub> ≤ V<sub>c,Rd,y</sub> (0.08 ≤ 194.16)



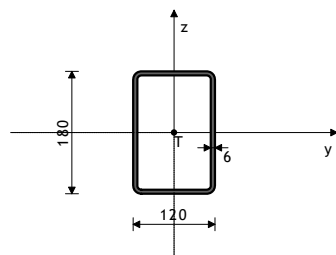
Okvir: H\_1

Kontrola stabilnosti

PALICA 26-12

PREČNI PREREZ: HOP [ ] 180x120x6 [S 275] [Set: 1]  
EUROCODE 3 (EN 1993-1-1:2005)

GEOMETRIJSKE KARAKTERISTIKE prereza



|          |                        |
|----------|------------------------|
| Ax =     | 33.630 cm <sup>2</sup> |
| Ay =     | 13.452 cm <sup>2</sup> |
| Az =     | 20.178 cm <sup>2</sup> |
| Ix =     | 1672.8 cm <sup>4</sup> |
| Iy =     | 1491.3 cm <sup>4</sup> |
| Iz =     | 796.28 cm <sup>4</sup> |
| Wy =     | 165.70 cm <sup>3</sup> |
| Wz =     | 132.71 cm <sup>3</sup> |
| Wy,pl =  | 209.95 cm <sup>3</sup> |
| Wz,pl =  | 158.11 cm <sup>3</sup> |
| γM0 =    | 1.100                  |
| γM1 =    | 1.100                  |
| γM2 =    | 1.250                  |
| Anet/A = | 0.900                  |

(fy = 27.5 kN/cm<sup>2</sup>, fu = 43.0 kN/cm<sup>2</sup>)

FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB

|             |             |             |
|-------------|-------------|-------------|
| 61. γ=0.29  | 58. γ=0.28  | 73. γ=0.27  |
| 57. γ=0.26  | 53. γ=0.26  | 140. γ=0.26 |
| 136. γ=0.26 | 85. γ=0.26  | 54. γ=0.25  |
| 137. γ=0.25 | 50. γ=0.25  | 97. γ=0.25  |
| 70. γ=0.25  | 82. γ=0.25  | 65. γ=0.24  |
| 69. γ=0.24  | 156. γ=0.24 | 94. γ=0.24  |
| 126. γ=0.23 | 131. γ=0.23 | 202. γ=0.23 |
| 109. γ=0.23 | 159. γ=0.23 | 93. γ=0.23  |
| 89. γ=0.23  | 178. γ=0.23 | 135. γ=0.23 |
| 66. γ=0.22  | 153. γ=0.22 | 62. γ=0.22  |
| 77. γ=0.22  | 81. γ=0.22  | 174. γ=0.22 |
| 121. γ=0.22 | 90. γ=0.21  | 175. γ=0.21 |
| 86. γ=0.21  | 152. γ=0.21 | 78. γ=0.21  |
| 74. γ=0.21  | 106. γ=0.21 | 118. γ=0.21 |
| 132. γ=0.21 | 149. γ=0.20 | 105. γ=0.20 |
| 194. γ=0.20 | 101. γ=0.20 | 125. γ=0.20 |
| 201. γ=0.20 | 130. γ=0.20 | 164. γ=0.19 |
| 169. γ=0.19 | 210. γ=0.19 | 157. γ=0.19 |
| 158. γ=0.19 | 197. γ=0.19 | 98. γ=0.19  |
| 173. γ=0.19 | 191. γ=0.19 | 102. γ=0.19 |
| 205. γ=0.18 | 117. γ=0.18 | 113. γ=0.18 |
| 122. γ=0.18 | 198. γ=0.18 | 127. γ=0.18 |
| 148. γ=0.18 | 144. γ=0.18 | 190. γ=0.17 |
| 110. γ=0.17 | 114. γ=0.17 | 145. γ=0.17 |
| 141. γ=0.17 | 170. γ=0.17 | 187. γ=0.16 |
| 163. γ=0.16 | 209. γ=0.16 | 168. γ=0.16 |
| 59. γ=0.16  | 196. γ=0.15 | 195. γ=0.15 |
| 204. γ=0.15 | 203. γ=0.15 | 214. γ=0.15 |
| 213. γ=0.14 | 60. γ=0.14  | 165. γ=0.14 |
| 206. γ=0.14 | 160. γ=0.14 | 182. γ=0.14 |
| 186. γ=0.14 | 51. γ=0.13  | 138. γ=0.13 |
| 55. γ=0.13  | 183. γ=0.13 | 179. γ=0.13 |
| 83. γ=0.13  | 56. γ=0.12  | 52. γ=0.12  |
| 139. γ=0.12 | 95. γ=0.12  | 84. γ=0.11  |
| 211. γ=0.11 | 212. γ=0.11 | 96. γ=0.10  |
| 87. γ=0.10  | 176. γ=0.10 | 91. γ=0.10  |
| 79. γ=0.09  | 75. γ=0.09  | 119. γ=0.09 |
| 150. γ=0.09 | 92. γ=0.08  | 177. γ=0.08 |
| 88. γ=0.08  | 76. γ=0.08  | 80. γ=0.08  |
| 120. γ=0.07 | 151. γ=0.07 | 167. γ=0.07 |
| 162. γ=0.07 | 208. γ=0.07 | 115. γ=0.06 |
| 111. γ=0.06 | 71. γ=0.05  | 142. γ=0.05 |
| 146. γ=0.05 | 188. γ=0.05 | 207. γ=0.04 |
| 166. γ=0.04 | 172. γ=0.04 | 161. γ=0.04 |
| 112. γ=0.04 | 116. γ=0.04 | 147. γ=0.04 |

|             |             |             |
|-------------|-------------|-------------|
| 143. γ=0.04 | 189. γ=0.03 | 72. γ=0.03  |
| 154. γ=0.03 | 67. γ=0.03  | 63. γ=0.03  |
| 200. γ=0.03 | 129. γ=0.03 | 124. γ=0.03 |
| 193. γ=0.03 | 104. γ=0.03 | 100. γ=0.03 |
| 171. γ=0.02 | 133. γ=0.02 | 107. γ=0.02 |
| 184. γ=0.02 | 180. γ=0.02 | 68. γ=0.01  |
| 155. γ=0.01 | 64. γ=0.01  | 185. γ=0.01 |
| 181. γ=0.01 | 199. γ=0.01 | 128. γ=0.01 |
| 123. γ=0.01 | 134. γ=0.01 | 103. γ=0.01 |
| 192. γ=0.01 | 108. γ=0.01 | 99. γ=0.01  |

PALICA IZPOSTAVLJENA PRITISKU IN UPOGIBU  
(obtežni primer 61, na 667.5 cm od začetka palice)

|                             |                     |            |
|-----------------------------|---------------------|------------|
| Računska osna sila          | N <sub>Ed</sub> =   | -7.684 kN  |
| Prečna sila v z smeri       | V <sub>Ed,z</sub> = | 30.237 kN  |
| Upogibni moment okoli y osi | M <sub>Ed,y</sub> = | 13.643 kNm |
| Sistemska dolžina palice    | L =                 | 712.50 cm  |

5.5 KLASIFIKACIJA PREČNIH PREREZOV

Razred prereza 1

6.2 NOSILNOST PREČNIH PREREZOV

6.2.4 Tlak

Računska nosilnost na tlak N<sub>c,Rd</sub> = 840.75 kN

Pogoj 6.9: N<sub>Ed</sub> ≤ N<sub>c,Rd</sub> (7.68 ≤ 840.75)

6.2.5 Upogib y-y

Plastični odpornostni moment Wy,pl = 209.95 cm<sup>3</sup>

Računska nosilnost na upogib Mc,Rd = 52.488 kNm

Pogoj 6.12: M<sub>Ed,y</sub> ≤ Mc,Rd,y (13.64 ≤ 52.49)

6.2.6 Strig

Računska strižna nosilnost V<sub>pl,Rd,z</sub> = 291.24 kN

Računska strižna nosilnost V<sub>c,Rd,z</sub> = 291.24 kN

Pogoj 6.17: V<sub>Ed,z</sub> ≤ V<sub>c,Rd,z</sub> (30.24 ≤ 291.24)

6.2.10 Upogib z osno in prečno silo

Ni potrebno zmanjšanje upogibne nosilnosti

Pogoj: V<sub>Ed,z</sub> ≤ 50%V<sub>pl,Rd,z</sub>

6.2.9 Upogib in osna sila

Razmerje N<sub>Ed</sub> / N<sub>pl,Rd</sub> 0.009

Zmanjšana plast.upogibna nosilnost M<sub>N,y,Rd</sub> = 52.488 kNm

Koeficient α = 1.000

Razmerje (M<sub>y,Ed</sub> / M<sub>N,y,Rd</sub>)<sup>α</sup> 0.260

Pogoj 6.41: (0.26 ≤ 1)

6.3 NOSILNOST ELEMENTA NA UKLON

6.3.1.1 Nosilnost na uklon

Uklonska dolžina y-y l<sub>y</sub> = 712.50 cm

Relativna vitkost y-y λ<sub>y</sub> = 1.232

Uklonska krivulja za os y-y: C α = 0.490

Elastična kritična sila N<sub>cr,y</sub> = 608.86 kN

Koeficient nepopolnosti χ<sub>y</sub> = 0.419

Računska uklonska nosilnost N<sub>b,Rd,y</sub> = 351.92 kN

Pogoj 6.46: N<sub>Ed</sub> ≤ N<sub>b,Rd,y</sub> (7.68 ≤ 351.92)

Uklonska dolžina z-z l<sub>z</sub> = 712.50 cm

Relativna vitkost z-z λ<sub>z</sub> = 1.687

Uklonska krivulja za os z-z: C α = 0.490

Koeficient nepopolnosti χ<sub>z</sub> = 0.261

Računska uklonska nosilnost N<sub>b,Rd,z</sub> = 219.48 kN

Pogoj 6.46: N<sub>Ed</sub> ≤ N<sub>b,Rd,z</sub> (7.68 ≤ 219.48)

6.3.2.1 Nosilnost na bočno-torzijski uklon

Koeficient C1 = 1.132

Koeficient C2 = 0.459

Koeficient  
 Koef. ukl. dolžine za uklon  
 Koef. ukl. dolžine za vbočenje  
 Koordinata  
 Koordinata  
 Razmak med bočnimi podporami  
 Sektorski vztrajnostni moment  
 Krit. moment bočne zvrnitve  
 Ustrezni odpornostni moment  
 Koeficient imperf.  
 Brezdimenz. vitkost  
 Koeficient zmanjšanja (6.3.2.2.)  
 Računska uklonska nosilnost  
**Pogoj 6.54:  $M_{Ed,y} \leq M_{b,Rd}$  (13.64 <= 49.36)**

C3 = 0.525  
 k = 1.000  
 kw = 1.000  
 zg = 0.000 cm  
 zj = 0.000 cm  
 L = 712.50 cm  
 lw = 0.000 cm<sup>6</sup>  
 M<sub>cr</sub> = 750.25 kNm  
 W<sub>y</sub> = 209.95 cm<sup>3</sup>  
 α<sub>LT</sub> = 0.760  
 λ<sub>LT</sub> = 0.277  
 χ<sub>LT</sub> = 0.940  
 M<sub>b,Rd</sub> = 49.358 kNm

Koeficient nepopolnosti  
 $N_{Ed} / (\chi_y N_{Rk} / \gamma M1)$   
 $k_{yy} * (M_{yEd} + \Delta M_{yEd}) / \dots$   
**Pogoj 6.61: (0.29 <= 1)**

χ<sub>y</sub> = 0.419  
 0.022  
 0.267

Koeficient nepopolnosti  
 $N_{Ed} / (\chi_z N_{Rk} / \gamma M1)$   
 $k_{zy} * (M_{yEd} + \Delta M_{yEd}) / \dots$   
**Pogoj 6.62: (0.20 <= 1)**

χ<sub>z</sub> = 0.261  
 0.035  
 0.160

#### KONTROLA STRIŽNE NOSILNOSTI (obtežni primer 61, konec palice)

Računska osna sila  
 Prečna sila v z smeri  
 Sistemska dolžina palice

N<sub>Ed</sub> = -7.684 kN  
 V<sub>Ed,z</sub> = 30.397 kN  
 L = 712.50 cm

#### 6.2 NOSILNOST PREČNIH PREREZOV

##### 6.2.6 Strig

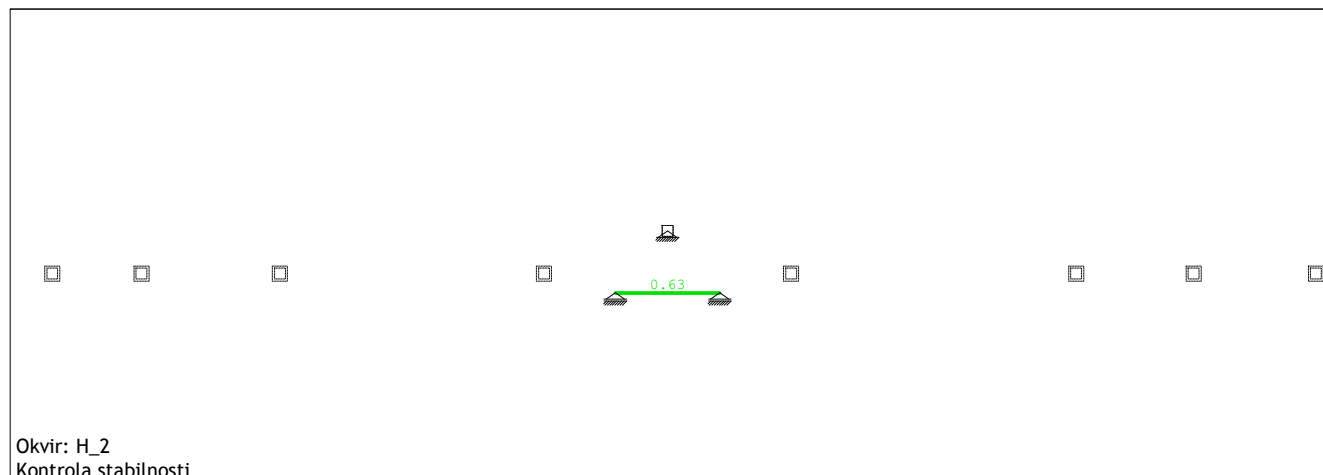
Računska strižna nosilnost  
 Računska strižna nosilnost  
**Pogoj 6.17:  $V_{Ed,z} \leq V_{c,Rd,z}$  (30.40 <= 291.24)**

V<sub>pl,Rd,z</sub> = 291.24 kN  
 V<sub>c,Rd,z</sub> = 291.24 kN

6.3.3. Elementi konstantnega prečnega prereza obremenjeni z upogibom in osnim tlakom  
 Preračun koeficienta interakcije je izvršen z alternativno metodo št.2 (Aneks B)

Koeficient oblike momenta  
 Koeficient oblike momenta  
 Koeficient oblike momenta  
 Koeficient interakcije  
 Koeficient interakcije  
 Koeficient interakcije  
 Koeficient interakcije

C<sub>my</sub> = 0.950  
 C<sub>mz</sub> = 1.000  
 C<sub>mLT</sub> = 0.950  
 k<sub>yy</sub> = 0.967  
 k<sub>yz</sub> = 0.617  
 k<sub>zy</sub> = 0.580  
 k<sub>zz</sub> = 1.028



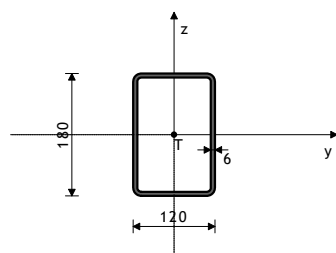
Okvir: H\_2

Kontrola stabilnosti

#### PALICA 36-28

PREČNI PREREZ: HOP [ ] 180x120x6 [S 275] [Set: 1]  
 EUROCODE 3 (EN 1993-1-1:2005)

#### GEOMETRIJSKE KARAKTERISTIKE prereza



(f<sub>y</sub> = 27.5 kN/cm<sup>2</sup>, f<sub>u</sub> = 43.0 kN/cm<sup>2</sup>)

Ax = 33.630 cm<sup>2</sup>  
 Ay = 13.452 cm<sup>2</sup>  
 Az = 20.178 cm<sup>2</sup>  
 Ix = 1672.8 cm<sup>4</sup>  
 Iy = 1491.3 cm<sup>4</sup>  
 Iz = 796.28 cm<sup>4</sup>  
 Wy = 165.70 cm<sup>3</sup>  
 Wz = 132.71 cm<sup>3</sup>  
 Wy,pl = 209.95 cm<sup>3</sup>  
 Wz,pl = 158.11 cm<sup>3</sup>  
 γM0 = 1.100  
 γM1 = 1.100  
 γM2 = 1.250  
 A<sub>net</sub>/A = 0.900

#### FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB

59. γ=0.63  
 55. γ=0.59  
 83. γ=0.56  
 154. γ=0.56  
 136. γ=0.54  
 53. γ=0.53  
 133. γ=0.52  
 87. γ=0.51  
 79. γ=0.50  
 126. γ=0.49  
 54. γ=0.49  
 99. γ=0.48  
 150. γ=0.47  
 156. γ=0.47  
 128. γ=0.47  
 94. γ=0.46  
 93. γ=0.45  
 81. γ=0.44

71. γ=0.61  
 138. γ=0.59  
 63. γ=0.56  
 95. γ=0.55  
 57. γ=0.53  
 107. γ=0.53  
 85. γ=0.51  
 176. γ=0.51  
 75. γ=0.50  
 131. γ=0.49  
 202. γ=0.49  
 192. γ=0.48  
 65. γ=0.47  
 159. γ=0.47  
 199. γ=0.47  
 174. γ=0.46  
 178. γ=0.45  
 77. γ=0.44

51. γ=0.59  
 61. γ=0.58  
 63. γ=0.56  
 58. γ=0.54  
 140. γ=0.53  
 73. γ=0.52  
 91. γ=0.51  
 97. γ=0.50  
 137. γ=0.49  
 50. γ=0.49  
 119. γ=0.48  
 103. γ=0.48  
 123. γ=0.47  
 69. γ=0.47  
 82. γ=0.47  
 89. γ=0.45  
 70. γ=0.45  
 109. γ=0.44

171. γ=0.44  
 152. γ=0.42  
 164. γ=0.41  
 90. γ=0.41  
 142. γ=0.41  
 157. γ=0.40  
 78. γ=0.40  
 66. γ=0.40  
 161. γ=0.39  
 105. γ=0.39  
 118. γ=0.39  
 205. γ=0.38  
 106. γ=0.37  
 132. γ=0.36  
 52. γ=0.36  
 173. γ=0.35  
 184. γ=0.33  
 110. γ=0.32  
 98. γ=0.32  
 196. γ=0.32  
 203. γ=0.31  
 198. γ=0.31  
 168. γ=0.30  
 213. γ=0.30  
 88. γ=0.28  
 186. γ=0.27  
 76. γ=0.27  
 160. γ=0.23  
 211. γ=0.23  
 206. γ=0.23  
 112. γ=0.19  
 68. γ=0.18  
 189. γ=0.16  
 193. γ=0.10  
 100. γ=0.10  
 200. γ=0.09  
 162. γ=0.01

121. γ=0.43  
 111. γ=0.41  
 169. γ=0.41  
 175. γ=0.41  
 146. γ=0.41  
 158. γ=0.40  
 153. γ=0.40  
 188. γ=0.39  
 194. γ=0.39  
 166. γ=0.39  
 201. γ=0.38  
 149. γ=0.38  
 117. γ=0.36  
 56. γ=0.36  
 144. γ=0.35  
 190. γ=0.34  
 180. γ=0.33  
 102. γ=0.32  
 114. γ=0.32  
 141. γ=0.31  
 204. γ=0.31  
 145. γ=0.31  
 209. γ=0.30  
 187. γ=0.30  
 92. γ=0.28  
 182. γ=0.27  
 120. γ=0.25  
 183. γ=0.23  
 212. γ=0.23  
 72. γ=0.22  
 147. γ=0.18  
 143. γ=0.18  
 108. γ=0.14  
 185. γ=0.10  
 181. γ=0.10  
 129. γ=0.09  
 167. γ=0.01

135. γ=0.43  
 115. γ=0.41  
 86. γ=0.41  
 210. γ=0.41  
 60. γ=0.40  
 62. γ=0.40  
 74. γ=0.40  
 101. γ=0.39  
 197. γ=0.39  
 207. γ=0.39  
 125. γ=0.38  
 130. γ=0.38  
 113. γ=0.36  
 139. γ=0.36  
 148. γ=0.35  
 84. γ=0.33  
 96. γ=0.32  
 191. γ=0.32  
 195. γ=0.32  
 127. γ=0.31  
 122. γ=0.31  
 214. γ=0.31  
 163. γ=0.30  
 170. γ=0.28  
 177. γ=0.28  
 80. γ=0.27  
 151. γ=0.24  
 179. γ=0.23  
 165. γ=0.23  
 116. γ=0.19  
 64. γ=0.18  
 155. γ=0.18  
 134. γ=0.13  
 104. γ=0.10  
 124. γ=0.09  
 172. γ=0.05  
 208. γ=0.01

PALICA IZPOSTAVLJENA UPOGIBU  
(obtežni primer 59, na 157.5 cm od začetka palice)

Prečna sila v z smeri  
 V<sub>Ed,z</sub> = 20.850 kN



Upogibni moment okoli y osi  
Sistemska dolžina palice

$M_{Ed,y} = 33.281 \text{ kNm}$   
 $L = 315.00 \text{ cm}$

5.5 KLASIFIKACIJA PREČNIH PREREZOV  
Razred prereza 1

6.2 NOSILNOST PREČNIH PREREZOV

6.2.5 Upogib y-y

Plastični odpornostni moment

Računska nosilnost na upogib

Pogoj 6.12:  $M_{Ed,y} \leq M_{c,Rd,y} (33.28 \leq 52.49)$

$W_{y,pl} = 209.95 \text{ cm}^3$   
 $M_{c,Rd} = 52.488 \text{ kNm}$

6.2.6 Strig

Računska strižna nosilnost

Računska strižna nosilnost

Pogoj 6.17:  $V_{Ed,z} \leq V_{c,Rd,z} (20.85 \leq 291.24)$

$V_{pl,Rd,z} = 291.24 \text{ kN}$   
 $V_{c,Rd,z} = 291.24 \text{ kN}$

6.2.8 Upogib in strig

Ni potrebno zmanjšanje upogibne nosilnosti

Pogoj:  $V_{Ed,z} \leq 50\% V_{pl,Rd,z}$

6.3 NOSILNOST ELEMENTA NA UKLON

6.3.2.1 Nosilnost na bočno-torzijski uklon

Koeficient

Koeficient

Koeficient

Koef. ukl. dolžine za uklon

$C1 = 1.365$   
 $C2 = 0.553$   
 $C3 = 1.730$   
 $k = 1.000$

Koef. ukl. dolžine za vbočenje

Koordinata

Koordinata

Razmak med bočnimi podporami

Sektorski vztrajnostni moment

Krit. moment bočne zvrnitve

Ustrezni odpornostni moment

Koeficient imperf.

Brezdimenz. vitkost

Koeficient zmanjšanja (6.3.2.2.)

Računska uklonska nosilnost

Pogoj 6.54:  $M_{Ed,y} \leq M_{b,Rd} (33.28 \leq 52.49)$

$k_w = 1.000$   
 $z_g = 0.000 \text{ cm}$   
 $z_j = 0.000 \text{ cm}$   
 $L = 315.00 \text{ cm}$   
 $I_w = 0.000 \text{ cm}^6$   
 $M_{cr} = 2046.3 \text{ kNm}$   
 $W_y = 209.95 \text{ cm}^3$   
 $\alpha_{LT} = 0.760$   
 $\lambda_{LT} = 0.168$   
 $\chi_{LT} = 1.000$   
 $M_{b,Rd} = 52.488 \text{ kNm}$

KONTROLA STRIŽNE NOSILNOSTI

(obtežni primer 59, začetek palice)

Prečna sila v z smeri

Sistemska dolžina palice

$V_{Ed,z} = -21.411 \text{ kN}$   
 $L = 315.00 \text{ cm}$

6.2 NOSILNOST PREČNIH PREREZOV

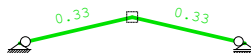
6.2.6 Strig

Računska strižna nosilnost

Računska strižna nosilnost

Pogoj 6.17:  $V_{Ed,z} \leq V_{c,Rd,z} (21.41 \leq 291.24)$

$V_{pl,Rd,z} = 291.24 \text{ kN}$   
 $V_{c,Rd,z} = 291.24 \text{ kN}$



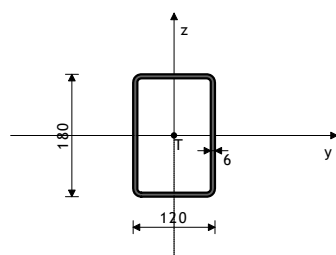
Okvir: K\_14

Kontrola stabilnosti

PALICA 75-73

PREČNI PREREZ: HOP [ ] 180x120x6 [S 275] [Set: 1]  
EUROCODE 3 (EN 1993-1-1:2005)

GEOMETRIJSKE KARAKTERISTIKE prereza



$A_x = 33.630 \text{ cm}^2$   
 $A_y = 13.452 \text{ cm}^2$   
 $A_z = 20.178 \text{ cm}^2$   
 $I_x = 1672.8 \text{ cm}^4$   
 $I_y = 1491.3 \text{ cm}^4$   
 $I_z = 796.28 \text{ cm}^4$   
 $W_y = 165.70 \text{ cm}^3$   
 $W_z = 132.71 \text{ cm}^3$   
 $W_{y,pl} = 209.95 \text{ cm}^3$   
 $W_{z,pl} = 158.11 \text{ cm}^3$   
 $\gamma_{M0} = 1.100$   
 $\gamma_{M1} = 1.100$   
 $\gamma_{M2} = 1.250$   
 $\text{Anet}/A = 0.900$

( $f_y = 27.5 \text{ kN/cm}^2$ ,  $f_u = 43.0 \text{ kN/cm}^2$ )

FAKTORJI IZKORIŠČENOSTI PO KOMBINACIJAH OBTEŽB

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| 61. $\gamma=0.33$  | 136. $\gamma=0.30$ | 53. $\gamma=0.30$  |
| 57. $\gamma=0.30$  | 140. $\gamma=0.30$ | 73. $\gamma=0.29$  |
| 85. $\gamma=0.29$  | 59. $\gamma=0.28$  | 97. $\gamma=0.28$  |
| 126. $\gamma=0.27$ | 131. $\gamma=0.27$ | 202. $\gamma=0.27$ |
| 65. $\gamma=0.26$  | 156. $\gamma=0.26$ | 159. $\gamma=0.26$ |
| 69. $\gamma=0.26$  | 51. $\gamma=0.26$  | 138. $\gamma=0.26$ |
| 174. $\gamma=0.26$ | 55. $\gamma=0.26$  | 58. $\gamma=0.25$  |
| 89. $\gamma=0.25$  | 178. $\gamma=0.25$ | 93. $\gamma=0.25$  |
| 77. $\gamma=0.25$  | 81. $\gamma=0.25$  | 83. $\gamma=0.25$  |
| 109. $\gamma=0.25$ | 135. $\gamma=0.24$ | 121. $\gamma=0.24$ |
| 152. $\gamma=0.24$ | 95. $\gamma=0.24$  | 169. $\gamma=0.23$ |
| 164. $\gamma=0.23$ | 210. $\gamma=0.23$ | 137. $\gamma=0.23$ |
| 50. $\gamma=0.23$  | 54. $\gamma=0.23$  | 158. $\gamma=0.23$ |
| 157. $\gamma=0.23$ | 71. $\gamma=0.22$  | 194. $\gamma=0.22$ |
| 197. $\gamma=0.22$ | 101. $\gamma=0.22$ | 105. $\gamma=0.22$ |
| 82. $\gamma=0.22$  | 201. $\gamma=0.22$ | 130. $\gamma=0.22$ |
| 205. $\gamma=0.22$ | 125. $\gamma=0.22$ | 60. $\gamma=0.21$  |

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| 91. $\gamma=0.21$  | 176. $\gamma=0.21$ | 87. $\gamma=0.21$  |
| 94. $\gamma=0.21$  | 75. $\gamma=0.21$  | 79. $\gamma=0.21$  |
| 113. $\gamma=0.20$ | 117. $\gamma=0.20$ | 119. $\gamma=0.20$ |
| 144. $\gamma=0.20$ | 148. $\gamma=0.20$ | 150. $\gamma=0.20$ |
| 173. $\gamma=0.20$ | 63. $\gamma=0.20$  | 154. $\gamma=0.20$ |
| 67. $\gamma=0.20$  | 190. $\gamma=0.19$ | 139. $\gamma=0.19$ |
| 52. $\gamma=0.19$  | 56. $\gamma=0.19$  | 90. $\gamma=0.18$  |
| 86. $\gamma=0.18$  | 175. $\gamma=0.18$ | 196. $\gamma=0.18$ |
| 195. $\gamma=0.18$ | 74. $\gamma=0.18$  | 78. $\gamma=0.18$  |
| 107. $\gamma=0.18$ | 204. $\gamma=0.18$ | 84. $\gamma=0.18$  |
| 203. $\gamma=0.18$ | 214. $\gamma=0.18$ | 70. $\gamma=0.17$  |
| 133. $\gamma=0.17$ | 118. $\gamma=0.17$ | 209. $\gamma=0.17$ |
| 163. $\gamma=0.17$ | 168. $\gamma=0.17$ | 213. $\gamma=0.17$ |
| 149. $\gamma=0.17$ | 96. $\gamma=0.17$  | 111. $\gamma=0.16$ |
| 115. $\gamma=0.16$ | 142. $\gamma=0.16$ | 146. $\gamma=0.16$ |
| 182. $\gamma=0.15$ | 186. $\gamma=0.15$ | 188. $\gamma=0.15$ |
| 103. $\gamma=0.15$ | 192. $\gamma=0.15$ | 99. $\gamma=0.15$  |
| 62. $\gamma=0.15$  | 66. $\gamma=0.15$  | 199. $\gamma=0.15$ |
| 128. $\gamma=0.15$ | 153. $\gamma=0.15$ | 123. $\gamma=0.15$ |
| 177. $\gamma=0.14$ | 88. $\gamma=0.14$  | 92. $\gamma=0.14$  |
| 80. $\gamma=0.14$  | 76. $\gamma=0.14$  | 110. $\gamma=0.13$ |
| 114. $\gamma=0.13$ | 212. $\gamma=0.13$ | 120. $\gamma=0.13$ |
| 211. $\gamma=0.13$ | 141. $\gamma=0.13$ | 145. $\gamma=0.13$ |
| 171. $\gamma=0.13$ | 106. $\gamma=0.13$ | 151. $\gamma=0.13$ |
| 132. $\gamma=0.13$ | 187. $\gamma=0.12$ | 184. $\gamma=0.11$ |
| 180. $\gamma=0.11$ | 72. $\gamma=0.11$  | 102. $\gamma=0.10$ |
| 98. $\gamma=0.10$  | 166. $\gamma=0.10$ | 191. $\gamma=0.10$ |
| 161. $\gamma=0.10$ | 207. $\gamma=0.10$ | 122. $\gamma=0.10$ |
| 198. $\gamma=0.10$ | 127. $\gamma=0.10$ | 116. $\gamma=0.09$ |
| 112. $\gamma=0.09$ | 147. $\gamma=0.09$ | 143. $\gamma=0.09$ |
| 183. $\gamma=0.08$ | 179. $\gamma=0.08$ | 189. $\gamma=0.08$ |
| 170. $\gamma=0.08$ | 64. $\gamma=0.08$  | 68. $\gamma=0.08$  |
| 155. $\gamma=0.08$ | 108. $\gamma=0.06$ | 134. $\gamma=0.06$ |
| 165. $\gamma=0.05$ | 206. $\gamma=0.05$ | 160. $\gamma=0.05$ |
| 181. $\gamma=0.04$ | 185. $\gamma=0.04$ | 100. $\gamma=0.03$ |
| 193. $\gamma=0.03$ | 104. $\gamma=0.03$ | 124. $\gamma=0.03$ |
| 200. $\gamma=0.03$ | 129. $\gamma=0.03$ | 167. $\gamma=0.02$ |
| 162. $\gamma=0.02$ | 208. $\gamma=0.02$ | 172. $\gamma=0.01$ |

PALICA IZPOSTAVLJENA PRITISKU IN UPOGIBU  
(obtežni primer 61, konec palice)

|                             |                                 |
|-----------------------------|---------------------------------|
| Računska osna sila          | $N_{Ed} = -1.809 \text{ kN}$    |
| Prečna sila v y smeri       | $V_{Ed,y} = -0.053 \text{ kN}$  |
| Prečna sila v z smeri       | $V_{Ed,z} = -7.637 \text{ kN}$  |
| Upogibni moment okoli y osi | $M_{Ed,y} = 17.076 \text{ kNm}$ |
| Sistemska dolžina palice    | $L = 159.25 \text{ cm}$         |

**5.5 KLASIFIKACIJA PREČNIH PREREZOV**

Razred prereza 1

**6.2 NOSILNOST PREČNIH PREREZOV**
**6.2.4 Tlak**

Računska nosilnost na tlak  $N_{c,Rd} = 840.75 \text{ kN}$ 
**Pogoj 6.9:**  $N_{Ed} \leq N_{c,Rd} \text{ (1.81} \leq 840.75 \text{)}$ 
**6.2.5 Upogib y-y**

Plastični odpornostni moment  $W_{y,pl} = 209.95 \text{ cm}^3$   
Računska nosilnost na upogib  $M_{c,Rd} = 52.488 \text{ kNm}$ 
**Pogoj 6.12:**  $M_{Ed,y} \leq M_{c,Rd,y} \text{ (17.08} \leq 52.49 \text{)}$ 
**6.2.6 Strig**

Računska strižna nosilnost  $V_{pl,Rd,z} = 291.24 \text{ kN}$   
Računska strižna nosilnost  $V_{c,Rd,z} = 291.24 \text{ kN}$ 
**Pogoj 6.17:**  $V_{Ed,z} \leq V_{c,Rd,z} \text{ (7.64} \leq 291.24 \text{)}$ 

Računska strižna nosilnost  $V_{pl,Rd,y} = 194.16 \text{ kN}$   
Računska strižna nosilnost  $V_{c,Rd,y} = 194.16 \text{ kN}$ 
**Pogoj 6.17:**  $V_{Ed,y} \leq V_{c,Rd,y} \text{ (0.05} \leq 194.16 \text{)}$ 
**6.2.10 Upogib z osno in prečno silo**

Ni potrebno zmanjšanje upogibne nosilnosti

**Pogoj:**  $V_{Ed,z} \leq 50\%V_{pl,Rd,z}$ ;  $V_{Ed,y} \leq 50\%V_{pl,Rd,y}$ 
**6.2.9 Upogib in osna sila**

Razmerje  $N_{Ed} / N_{pl,Rd} = 0.002$   
Zmanjšana plast.upogibna nosilnost  $M_{N,y,Rd} = 52.488 \text{ kNm}$   
Koeficient  $\alpha = 1.000$   
Razmerje  $(M_{y,Ed} / M_{N,y,Rd})^\alpha = 0.325$ 
**Pogoj 6.41:**  $(0.33 \leq 1)$ 
**6.3 NOSILNOST ELEMENTA NA UKLON**
**6.3.1.1 Nosilnost na uklon**

Uklonska dolžina y-y  $l_y = 159.25 \text{ cm}$   
Relativna vitkost y-y  $\lambda_y = 0.275$   
Uklonska krivulja za os y-y: C  $\alpha = 0.490$   
Elastična kritična sila  $N_{cr,y} = 12187 \text{ kN}$   
Koeficient nepopolnosti  $\chi_y = 0.962$   
Računska uklonska nosilnost  $N_{b,Rd,y} = 808.50 \text{ kN}$ 
**Pogoj 6.46:**  $N_{Ed} \leq N_{b,Rd,y} \text{ (1.81} \leq 808.50 \text{)}$ 

Uklonska dolžina z-z  $l_z = 159.25 \text{ cm}$   
Relativna vitkost z-z  $\lambda_z = 0.377$   
Uklonska krivulja za os z-z: C  $\alpha = 0.490$   
Koeficient nepopolnosti  $\chi_z = 0.909$   
Računska uklonska nosilnost  $N_{b,Rd,z} = 764.60 \text{ kN}$ 
**Pogoj 6.46:**  $N_{Ed} \leq N_{b,Rd,z} \text{ (1.81} \leq 764.60 \text{)}$ 
**6.3.2.1 Nosilnost na bočno-torzijski uklon**

Koeficient  $C1 = 1.879$ 

|  |                                 |
|--|---------------------------------|
| Koeficient   | $C2 = 0.000$                    |
| Koeficient   | $C3 = 0.939$                    |
| Koef.ukl.dolžine za uklon  | $k = 1.000$                     |
| Koef.ukl.dolžine za vbočenje   | $kw = 1.000$                    |
| Koordinata   | $z_g = 0.000 \text{ cm}$        |
| Koordinata   | $z_j = 0.000 \text{ cm}$        |
| Razmak med bočnimi podporami   | $L = 159.25 \text{ cm}$         |
| Sektorski vztrajnostni moment  | $I_w = 0.000 \text{ cm}^6$      |
| Krit.moment bočne zvrnitve   | $M_{cr} = 5571.6 \text{ kNm}$   |
| Ustrezni odpornostni moment  | $W_y = 209.95 \text{ cm}^3$     |
| Koeficient imperf.   | $\alpha_{LT} = 0.760$           |
| Brezdimenz.vitkost   | $\lambda_{LT} = 0.102$          |
| Koeficient zmanjšanja (6.3.2.2.)   | $\chi_{LT} = 1.000$             |
| Računska uklonska nosilnost  | $M_{b,Rd} = 52.488 \text{ kNm}$ |
| <b>Pogoj 6.54:</b> $M_{Ed,y} \leq M_{b,Rd} \text{ (17.08} \leq 52.49 \text{)}$ |                                 |

**6.3.3. Elementi konstantnega prečnega prereza obremenjeni z upogibom in osnim tlakom**

Preračun koeficienta interakcije je izvršen z alternativno metodo št.2 (Aneks B)

|                           |                   |
|---------------------------|-------------------|
| Koeficient oblike momenta | $C_{my} = 0.600$  |
| Koeficient oblike momenta | $C_{mz} = 0.950$  |
| Koeficient oblike momenta | $C_{mLT} = 0.600$ |
| Koeficient interakcije    | $k_{yy} = 0.600$  |
| Koeficient interakcije    | $k_{yz} = 0.570$  |
| Koeficient interakcije    | $k_{zy} = 0.360$  |
| Koeficient interakcije    | $k_{zz} = 0.950$  |

**Koeficient nepopolnosti**

|   |                  |
|---|------------------|
| $N_{Ed} / (\chi_y N_{Rk} / \gamma M1)$          | $\chi_y = 0.962$ |
| $k_{yy} * (M_{y,Ed} + \Delta M_{y,Ed}) / \dots$ | $0.002$          |
| <b>Pogoj 6.61:</b> $(0.20 \leq 1)$              | $0.195$          |

**Koeficient nepopolnosti**

|   |                  |
|---|------------------|
| $N_{Ed} / (\chi_z N_{Rk} / \gamma M1)$          | $\chi_z = 0.909$ |
| $k_{zy} * (M_{y,Ed} + \Delta M_{y,Ed}) / \dots$ | $0.002$          |
| <b>Pogoj 6.62:</b> $(0.12 \leq 1)$              | $0.117$          |

**KONTROLA STRIŽNE NOSILNOSTI**

(obtežni primer 61, začetek palice)

|                          |                                 |
|--------------------------|---------------------------------|
| Računska osna sila       | $N_{Ed} = -3.132 \text{ kN}$    |
| Prečna sila v y smeri    | $V_{Ed,y} = 0.053 \text{ kN}$   |
| Prečna sila v z smeri    | $V_{Ed,z} = -13.807 \text{ kN}$ |
| Sistemska dolžina palice | $L = 159.25 \text{ cm}$         |

**6.2 NOSILNOST PREČNIH PREREZOV**
**6.2.6 Strig**

Računska strižna nosilnost  $V_{pl,Rd,z} = 291.24 \text{ kN}$   
Računska strižna nosilnost  $V_{c,Rd,z} = 291.24 \text{ kN}$ 
**Pogoj 6.17:**  $V_{Ed,z} \leq V_{c,Rd,z} \text{ (13.81} \leq 291.24 \text{)}$ 

Računska strižna nosilnost  $V_{pl,Rd,y} = 194.16 \text{ kN}$   
Računska strižna nosilnost  $V_{c,Rd,y} = 194.16 \text{ kN}$ 
**Pogoj 6.17:**  $V_{Ed,y} \leq V_{c,Rd,y} \text{ (0.05} \leq 194.16 \text{)}$

## Item: poz 101 - špirovec razpona 4,4m +2.6m - preko dveh polj

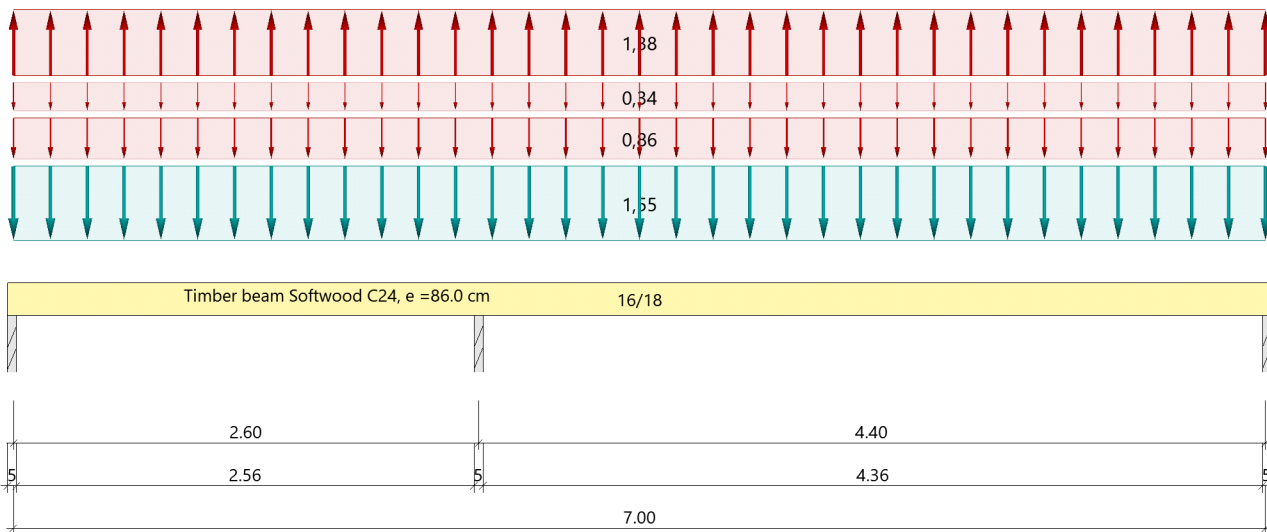
Continuous Beam Timber (x64) HTM+ 01/23D (FRILO R-2023-1/P04)

### Basic Parameters

Timber beam by 2 Spans (e = 86.0 cm) Softwood C24 DIN EN 1995-1-1/NA:2013-08

### System

#### System Graphic



### Material

#### Softwood C24, acc.to EN 338:2016

| $f_{m,k}$<br>$f_{v,k}$<br>[N/mm <sup>2</sup> ] | $f_{t,0,k}$<br>$f_{c,0,k}$<br>[N/mm <sup>2</sup> ] | $f_{t,90,k}$<br>$f_{c,90,k}$<br>[N/mm <sup>2</sup> ] | $E_{0,mean}$<br>$E_{0,05}$<br>[N/mm <sup>2</sup> ] | $E_{90,mean}$<br>$E_{90,05}$<br>[N/mm <sup>2</sup> ] | $G_{mean}$<br>$G_{05}$<br>[N/mm <sup>2</sup> ] | $\rho_k$<br>$\rho_m$<br>[kg/m <sup>3</sup> ] |
|--|--|--|--|--|--|--|
| 24.00<br>4.00                                  | 14.50<br>21.00                                     | 0.40<br>2.50   | 11000<br>7400                                      | 370<br>247   | 690<br>460                                     | 350<br>420                                   |

$f_{m,k}$  : characteristic value of bending strength  
 $f_{t,0,k}$  : characteristic value of tensile strength parallel to grain  
 $f_{t,90,k}$  : characteristic value of tensile strength perpendicular to the grain  
 $E_{0,mean}$  : Average value of modulus of elasticity parallel to the fiber  
 $E_{90,mean}$  : Average value of the modulus of elasticity perpendicular to the grain  
 $G_{mean}$  : Average value of the shear modulus  
 $\rho_k$  : Characteristic value of gross density  
 $f_{v,k}$  : characteristic value of shear strength  
 $f_{c,0,k}$  : characteristic value of compressive strength parallel to grain  
 $f_{c,90,k}$  : characteristic value of compressive strength perpendicular to the grain  
 $E_{0,05}$  : 5% fractile value of the modulus of elasticity parallel to grain  
 $E_{90,05}$  : 5% fractile value of the modulus of elasticity perpendicular to the grain  
 $G_{05}$  : 5% fractile value of the shear modulus  
 $\rho_m$  : Average value of the density

### Geometry

#### Cross-sections

| Name  | $I_y$<br>[cm <sup>4</sup> ] | $I_z$<br>[cm <sup>4</sup> ] | $W_y$<br>[cm <sup>3</sup> ] | $W_z$<br>[cm <sup>3</sup> ] | A<br>[cm <sup>2</sup> ] |
|-------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------|
| 16/18 | 7776                        | 6144                        | 864                         | 768                         | 288.0                   |

Cross-section is constant over the entire length of the beam.

### Support ( Bearing conditions)

| No | x<br>[m] | Width<br>[cm] | Depth<br>[cm] | k <sub>c90</sub> | u <sub>y</sub><br>[kN/m] | u <sub>z</sub><br>[kN/m] | Rotations *)                |                             |                             |
|----|----------|---------------|---------------|------------------|--------------------------|--------------------------|-----------------------------|-----------------------------|-----------------------------|
|    |          |               |               |                  |                          |                          | Φ <sub>x</sub><br>[kNm/rad] | Φ <sub>y</sub><br>[kNm/rad] | Φ <sub>z</sub><br>[kNm/rad] |
| 1  | 0.00     | 5.0           | 16.0          | 1.00             | -1                       | -1                       | -1                          | 0.0                         | 0.0                         |
| 2  | 2.60     | 5.0           | 16.0          | 1.00             | -1                       | -1                       | 0.0                         | 0.0                         | 0.0                         |
| 3  | 7.00     | 5.0           | 16.0          | 1.00             | -1                       | -1                       | 0.0                         | 0.0                         | 0.0                         |

\*) -1 = fixed, 0 = free, > 0 = elastically restraint

### Loads

#### Line loads from area loads

| Reference | No | Type | A<br>[m] | L1<br>[m] | L2<br>[m] | W1<br>[kN/m <sup>2</sup> ] | W2<br>[kN/m <sup>2</sup> ] | GF                                | Sim | Alt |
|-----------|----|------|----------|-----------|-----------|----------------------------|----------------------------|-----------------------------------|-----|-----|
| System    | 1  | GL   |          | 7.00      |           | 1.80                       |                            | Permanent<br>Snow<br>Wind<br>Wind |     |     |
|           | 2  | GL   |          | 7.00      |           | 1.00                       |                            |                                   |     |     |
|           | 3  | GL   |          | 7.00      |           | 0.40                       |                            |                                   |     |     |
|           | 4  | GL   |          | 7.00      |           | -1.60                      |                            |                                   |     |     |

The load no. 2, 3 und 4 act span by span.

The load no. 1 acts simultaneously

The load values are multiplied internally by the beam spacing e = 0.86 m.

Reference : System-related (front edge of beam) or span load  
Type : 1 - uniformly distributed load (GL), 4 - trapezoidal load (TL), 5 - triangular load (DL)  
A : Distance to the load from the beginning of the span or the front edge of the beam  
GF : Load effect  
Sim : Simultaneous group  
Alt : Alternate group

- Load 1: Width 0.86 m
- Load 2: Width 0.86 m
- Load 3: Width 0.86 m
- Load 4: Width 0.86 m

### Self-weight

Total weight = 85 kg taken into account with gamma = 4.20 kN/m<sup>3</sup>.

### Overview of the actions used

#### Actions

| Designation           | ψ <sub>0</sub> | ψ <sub>1</sub> | ψ <sub>2</sub> | γ <sub>F,inf</sub> | γ <sub>F,sup</sub> | KLED             |
|-----------------------|----------------|----------------|----------------|--------------------|--------------------|------------------|
| Permanent loads       |                |                |                | 1.00               | 1.35               |                  |
| Wind loads            | 0.60           | 0.20           | 0.00           |                    | 1.50               | short/very short |
| Snow loads H < 1000 m | 0.50           | 0.20           | 0.00           |                    | 1.50               | short            |

Consequences class CC 2 according to EN 1990 Tab. B1 -> K<sub>FI</sub> = 1.0 Tab. B3

### Results

#### Design parameter

Design code : DIN EN 1995-1-1/NA:2013-08  
Basis : EN 1995-1-1/A2:2014  
Safety concept / load combinatorics : DIN EN 1990/NA:2010-12  
Consequence class : CC 2  
ψ<sub>2</sub> = 0.5 for snow (AE) : not considered  
Permanent loads : all equal γ<sub>F</sub> (γ<sub>G,sup</sub> or γ<sub>G,inf</sub>)  
CLED at wind : Average of short and very short

#### Design parameter Timber

Service class 2 : roofed, open  
Rel. air humidity ~ 85% Equilibrium moisture content < 20%  
Design situation serviceability : characteristic  
Shear stresses = Tau with red. Q  
Initial deflection W<sub>inst</sub> = l/300  
Final deflection W<sub>net,fin</sub> = l/250  
W<sub>fin</sub> = l/250

Summary

| Check  | Design situation                       | $\eta_{\text{Bending}}$ | $\eta_{\text{Shear}}$ | $\eta_{c,90}$ | $\eta_{\text{Stabi}}$ | $\eta_{\text{Deformation}}$ |
|--|--|-------------------------|-----------------------|---------------|-----------------------|-----------------------------|
| Load capacity<br>Serviceability  | persistent/transient<br>characteristic | 0.45                    | 0.25                  | 0.54          | 1)                    | 0.77                        |
| 1) Stability check was not carried out because the upper chord is held continuously. |  |                         |                       |               |                       |                             |

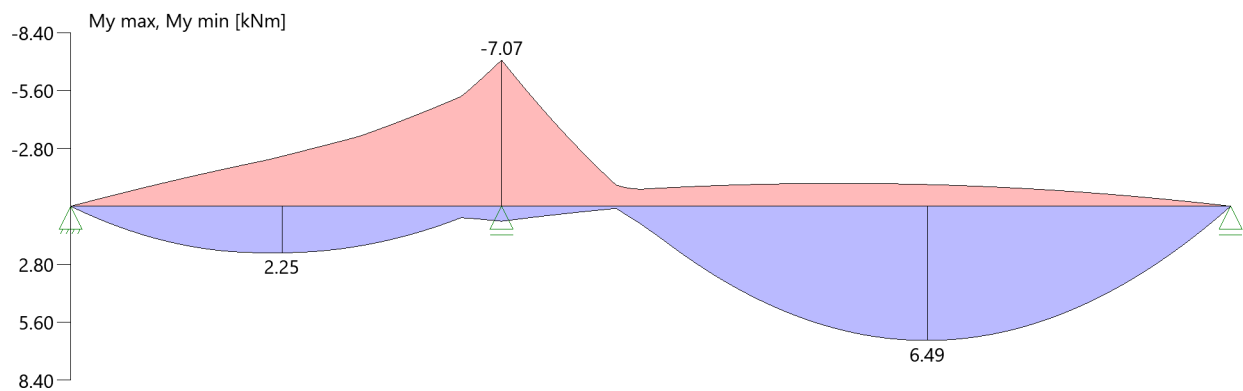
Structural safety per cross-section (compact)

| Design situation     | Cross-section | $V_{z,Ed}$ [kN] | $M_{y,Ed}$ [kNm] | $\eta_{\text{Shear}}$ | $\eta_{\text{Bending}}$ | $\eta_{\text{Stabi}}$ |
|----------------------|---------------|-----------------|------------------|-----------------------|-------------------------|-----------------------|
| persistent/transient | 16/18         | -6.4            | -6.50            | 0.25                  | 0.45                    |                       |

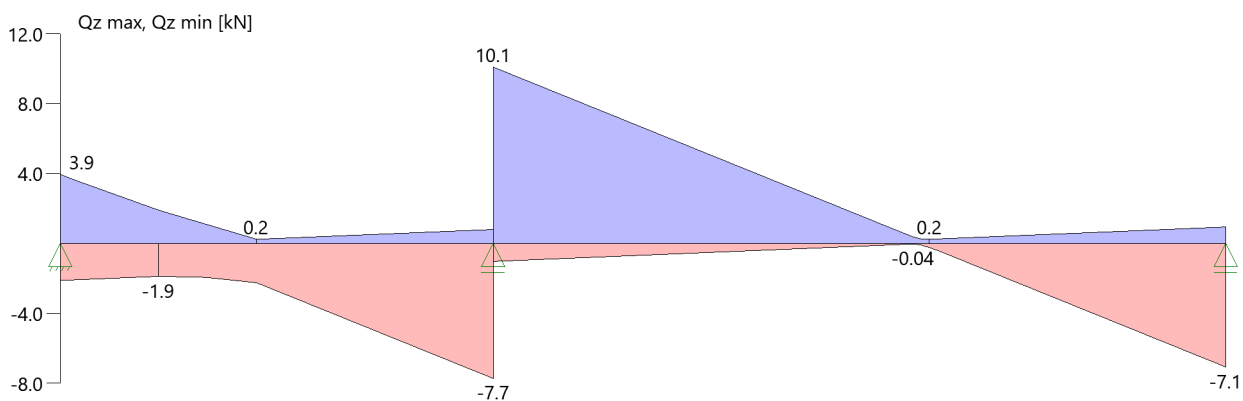
Structural safety - Load combination persistent/transient

Internal forces

Envelope of the moments



Envelope of the transverse forces



Check of SLS

|  | l <sub>eff</sub><br>[m] | Position<br>[m] | typ     |   | w <sub>g</sub> | w <sub>q</sub> | w    | W <sub>lim</sub> | η    | Lk |
|--|-------------------------|-----------------|---------|---|----------------|----------------|------|------------------|------|----|
|  |                         |                 |         |   | [cm]           |                |      |                  |      |    |
| Span 1   | 2.60                    | 1.51            | inst    | z | -0.04          | -0.1           | -0.2 | 0.9              | 0.20 | 14 |
|  | 2.60                    | 1.92            | net,fin | z | -0.1           | 0.0            | -0.1 | 1.0              | 0.09 | 11 |
|  | 2.60                    | 1.64            | fin     | z | -0.1           | -0.1           | -0.2 | 1.0              | 0.20 | 15 |
| Span 2   | 4.40                    | 2.32            | inst    | z | 0.5            | 0.4            | 0.9  | 1.5              | 0.64 | 12 |
|  | 4.40                    | 2.32            | net,fin | z | 0.9            | 0.0            | 0.9  | 1.8              | 0.54 | 11 |
|  | 4.40                    | 2.32            | fin     | z | 0.9            | 0.4            | 1.4  | 1.8              | 0.77 | 13 |
| l <sub>eff</sub> : Effective length<br>Position : Position of the deformation<br>typ : Start-/End deformation (direction)<br>w <sub>g</sub> : Deformation due to permanent load<br>w <sub>q</sub> : Deformation due to variable load<br>w : Deformation total<br>W <sub>lim</sub> : Permissible deformation<br>η : Degree of utilization<br>Lk : No. of the load combination |                         |                 |         |   |                |                |      |                  |      |    |

Support forces

Support forces per [m] - characteristic of each action

| No | x<br>[m] | Action                | R <sub>z,min</sub><br>[kN/m] | R <sub>z,max</sub><br>[kN/m] | M <sub>y,min</sub><br>[kNm/m] | M <sub>y,max</sub><br>[kNm/m] |
|----|----------|-----------------------|------------------------------|------------------------------|-------------------------------|-------------------------------|
| 1  | 0.00     | Permanent loads       | 1.15                         | 1.15                         |                               |                               |
|    |          | Wind loads            | -2.12                        | 1.41                         |                               |                               |
|    |          | Snow loads H < 1000 m | -0.59                        | 1.18                         |                               |                               |
| 2  | 2.60     | Permanent loads       | 8.97                         | 8.97                         |                               |                               |
|    |          | Wind loads            | -7.40                        | 1.85                         |                               |                               |
|    |          | Snow loads H < 1000 m |                              | 4.62                         |                               |                               |
| 3  | 7.00     | Permanent loads       | 3.46                         | 3.46                         |                               |                               |
|    |          | Wind loads            | -3.00                        | 0.86                         |                               |                               |
|    |          | Snow loads H < 1000 m | -0.07                        | 1.85                         |                               |                               |

Item: poz 102 - jeklen nosilec (kot vmesna lega)

Continuous Beam Steel (x64) STM+ 01/23D (FRILO R-2023-1/P04)

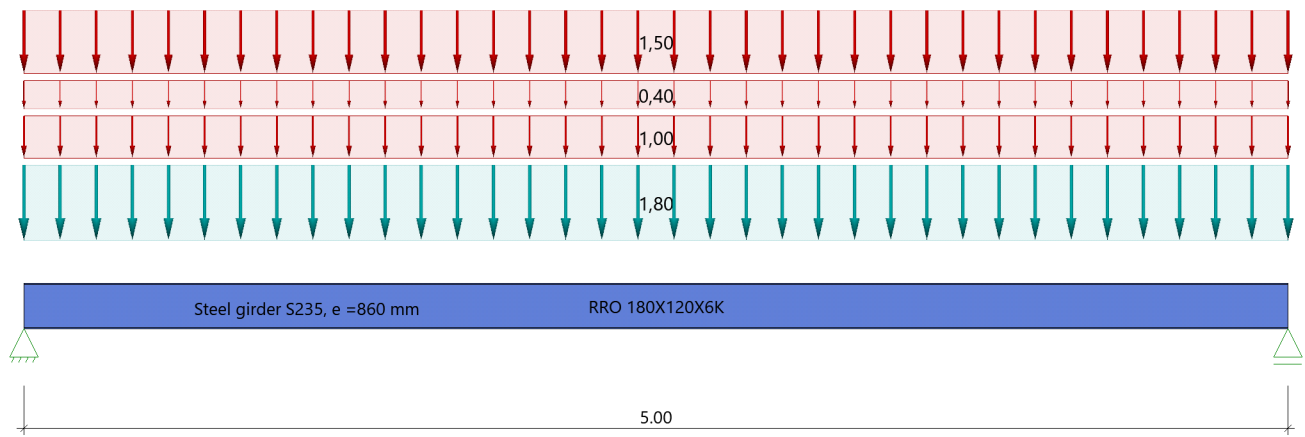
Basic Parameters

Steel girder (e = 86.0 cm) , DIN EN 1993-1-1/NA:2015-08

Steel grade:S235

System

System Graphic



Material

Material S235

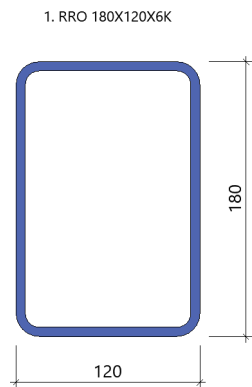
|                  |                                 |                                  |
|------------------|---------------------------------|----------------------------------|
|                  | $E_k = 210000 \text{ N/mm}^2$   | $G_k = 80769 \text{ N/mm}^2$     |
|                  | $\gamma = 78.50 \text{ kN/m}^3$ | $\mu = 0.30$                     |
| Elastic limit    | $t \leq 40 \text{ mm}$          | $f_{yk} = 235.00 \text{ N/mm}^2$ |
| Tensile strength | $t \leq 40 \text{ mm}$          | $f_{uk} = 360.00 \text{ N/mm}^2$ |

Geometry

Cross-sections

| Name  | $I_y$<br>[cm <sup>4</sup> ] | $I_z$<br>[cm <sup>4</sup> ] | $W_y$<br>[cm <sup>3</sup> ] | $W_z$<br>[cm <sup>3</sup> ] | A<br>[cm <sup>2</sup> ] |
|---|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------|
| RRO 180X120X6K  | 1466.1                      | 785.1                       | 163.0                       | 131.0                       | 33.3                    |
| Cross-section is constant over the entire length of the beam. |                             |                             |                             |                             |                         |

used cross sections



### Support ( Bearing conditions)

| No | x<br>[m] | uy<br>[kN/m] | uz<br>[kN/m] | Rotations *)          |                       |                       |
|----|----------|--------------|--------------|-----------------------|-----------------------|-----------------------|
|    |          |              |              | $\Phi_x$<br>[kNm/rad] | $\Phi_y$<br>[kNm/rad] | $\Phi_z$<br>[kNm/rad] |
| 1  | 0.00     | -1           | -1           | -1                    | 0.0                   | 0.0                   |
| 2  | 5.00     | -1           | -1           | 0.0                   | 0.0                   | 0.0                   |

\*) -1 = fixed, 0 = free, > 0 = elastically restraint

### Loads

#### Line loads

| Reference | No | Type | A<br>[m] | L1<br>[m] | L2<br>[m] | W1<br>[kN/m] | W2<br>[kN/m] | GF                                | Sim | Alt |
|-----------|----|------|----------|-----------|-----------|--------------|--------------|-----------------------------------|-----|-----|
| System    | 1  | GL   |          | 5.00      |           | 1.80         |              | Permanent<br>Snow<br>Wind<br>Wind |     |     |
|           | 2  | GL   |          | 5.00      |           | 1.00         |              |                                   |     |     |
|           | 3  | GL   |          | 5.00      |           | 0.40         |              |                                   |     |     |
|           | 4  | GL   |          | 5.00      |           | 1.50         |              |                                   |     |     |

Reference : System-related (front edge of beam) or span load  
Type : 1 - uniformly distributed load (GL), 4 - trapezoidal load (TL), 5 - triangular load (DL)  
A : Distance to the load from the beginning of the span or the front edge of the beam  
GF : Load effect  
Sim : Simultaneous group  
Alt : Alternate group

### Self-weight

Total weight = 131 kg taken into account with gamma = 78.50 kN/m<sup>3</sup>.

### Overview of the actions used

#### Actions

| Designation           | $\psi_0$ | $\psi_1$ | $\psi_2$ | $\gamma_{F,inf}$ | $\gamma_{F,sup}$ |
|-----------------------|----------|----------|----------|------------------|------------------|
| Permanent loads       |          |          |          | 1.00             | 1.35             |
| Wind loads            | 0.60     | 0.20     | 0.00     |                  | 1.50             |
| Snow loads H < 1000 m | 0.50     | 0.20     | 0.00     |                  | 1.50             |

Consequences class CC 2 according to EN 1990 Tab. B1 -> K<sub>Fi</sub> = 1.0 Tab. B3

### Results

#### Design parameter

|                                     |                  |   |
|-------------------------------------|------------------|---|
| Design code                         | :                | DIN EN 1993-1-1/NA:2015-08                                    |
| Safety concept / load combinatorics | :                | DIN EN 1990/NA:2010-12  |
| Consequence class                   | :                | CC 2  |
| $\psi_2 = 0.5$ for snow (AE)        | :                | not considered  |
| Permanent loads                     | :                | all equal $\gamma_F$ ( $\gamma_{G,sup}$ or $\gamma_{G,inf}$ ) |
| Check of cross-section              | :                | elastic   |
| Stability                           | :                | 6.3.3 - annex B   |
| Design situation serviceability     | :                | characteristic  |
| Check of absolutely deformation     | $\delta_{lim} =$ | 5.0 cm  |
| Check of relative deformation       | $\delta_{lim} =$ | Cantilever $l_{eff}/ 150$                                     |
|                                     | $\delta_{lim} =$ | Spans $l_{eff}/ 250$  |

#### Summary

| Check                           | Design situation                       | $\eta_{Qs}$ | $\eta_{Stabi}$ | $\eta_{Deformation}$ |
|---------------------------------|--|-------------|----------------|----------------------|
| Load capacity<br>Serviceability | persistent/transient<br>characteristic | 0.52        | 1)             | 0.59                 |

1) Stability check was not carried out because the upper chord is held continuously.

### Structural safety per cross-section (compact)

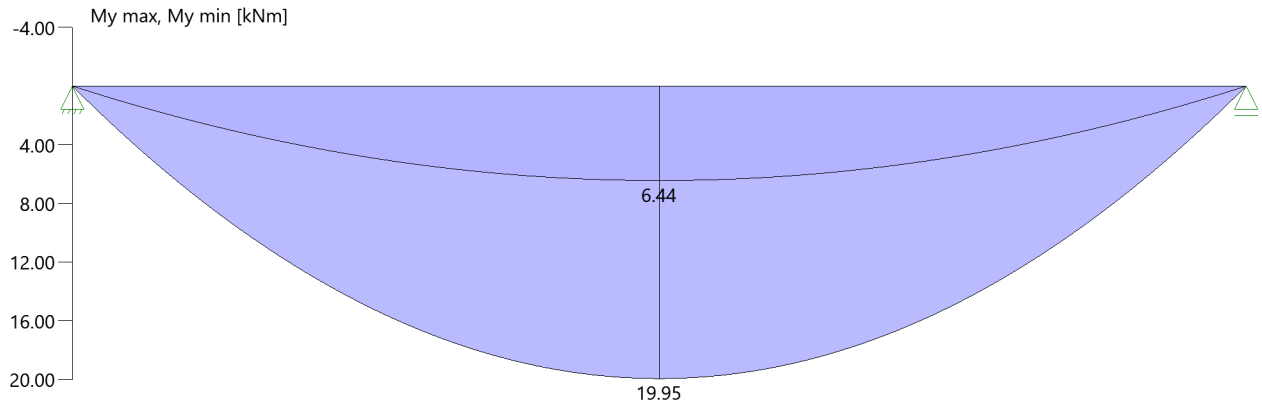
| Design situation     | Cross-section  | Stelle           | $V_{z,Ed}$<br>[kN] | $M_{y,Ed}$<br>[kNm] | $\eta_{Qs}$ | $\eta_{Stabi}$ | Lcomb |
|----------------------|----------------|------------------|--------------------|---------------------|-------------|----------------|-------|
| persistent/transient | RRO 180X120X6K | Span 1, x = 2.50 | 0.0                | 19.95               | 0.52        |                | 1     |



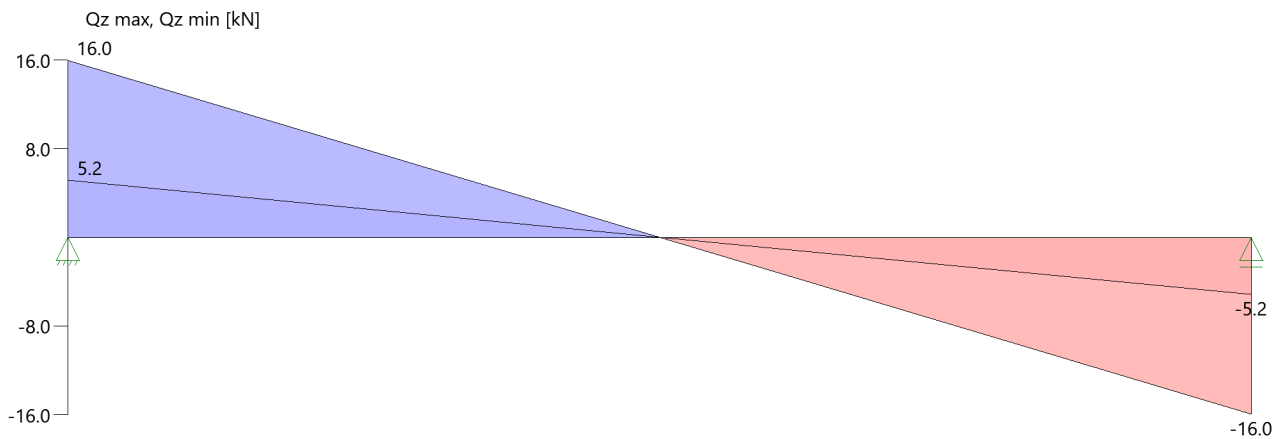
## Structural safety - Load combination persistent/transient

### Internal forces

#### Envelope of the moments



#### Envelope of the transverse forces



## Serviceability - Load combination characteristic

### Deflection check - Absolute deformations $f_{Cd} = 5.0$ cm

| Span   | x<br>[m] | $f_{y,Ed}$<br>[cm] | $f_{z,Ed}$<br>[cm] | $f_{res,Ed}$<br>[cm] | $\eta$ | Comb |
|--------|----------|--------------------|--------------------|----------------------|--------|------|
| Span 1 | 2.50     | 0.0                | -1.2               | 1.2                  | 0.24   | 3    |

### Deformation analysis - Relative deflection in z $f_{Cd} = l_{eff}/250$

| Span   | x<br>[m] | $l_{eff}$<br>[m] | $l_{eff,x0}$<br>[m] | $l_{eff,x1}$<br>[m] | $f_{z,Ed}$<br>[cm] | $f_{z,Cd}$<br>[cm] | $\eta$ | Comb |
|--------|----------|------------------|---------------------|---------------------|--------------------|--------------------|--------|------|
| Span 1 | 2.50     | 5.00             | 0.00                | 5.00                | 1.2                | 2.0                | 0.59   | 3    |

Span : Description  
x : Coordinate X of the calculated position  
 $l_{eff}$  : effective length of this section  
 $l_{eff,x0}$  : Begin of effective length of this section (point of return in the bend line)  
 $l_{eff,x1}$  : End of effective length of this section (point of return in the bend line)  
 $f_{z,Ed}$  : Design value of the displacement  
 $f_{z,Cd}$  : permissible displacement from  $l_{eff}$   
 $\eta$  : largest utilization of the calculated position  
Comb : Load case combination

**Support forces**

**Support forces - characteristic of each action**

| No | x<br>[m] | Action   | R <sub>z,min</sub><br>[kN] | R <sub>z,max</sub><br>[kN] | M <sub>y,min</sub><br>[kNm] | M <sub>y,max</sub><br>[kNm] |
|----|----------|--|----------------------------|----------------------------|-----------------------------|-----------------------------|
| 1  | 0.00     | Permanent loads<br>Wind loads<br>Snow loads H < 1000 m | 5.2                        | 5.2<br>4.7<br>2.5          |                             |                             |
| 2  | 5.00     | Permanent loads<br>Wind loads<br>Snow loads H < 1000 m | 5.2                        | 5.2<br>4.7<br>2.5          |                             |                             |

## Item: poz 103 - špirovec razpona 4,65m +1,20m - preko dveh polj

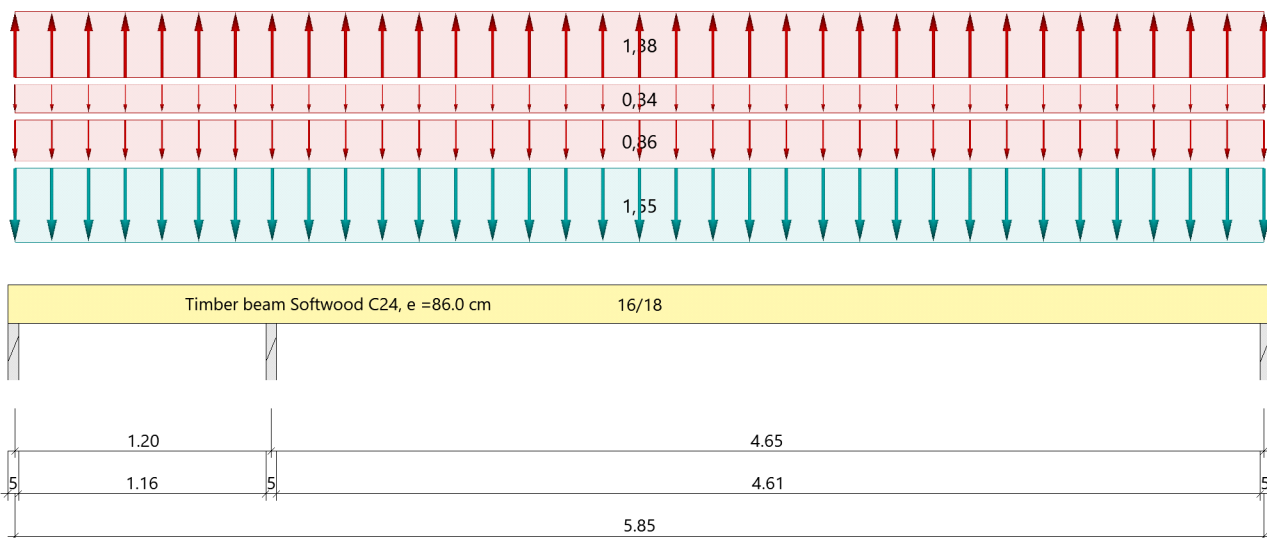
Continuous Beam Timber (x64) HTM+ 01/23D (FRILO R-2023-1/P04)

### Basic Parameters

Timber beam by 2 Spans (e = 86.0 cm) Softwood C24 DIN EN 1995-1-1/NA:2013-08

### System

#### System Graphic



### Material

#### Softwood C24, acc.to EN 338:2016

| $f_{m,k}$<br>$f_{v,k}$<br>[N/mm <sup>2</sup> ] | $f_{t,0,k}$<br>$f_{c,0,k}$<br>[N/mm <sup>2</sup> ] | $f_{t,90,k}$<br>$f_{c,90,k}$<br>[N/mm <sup>2</sup> ] | $E_{0,mean}$<br>$E_{0,05}$<br>[N/mm <sup>2</sup> ] | $E_{90,mean}$<br>$E_{90,05}$<br>[N/mm <sup>2</sup> ] | $G_{mean}$<br>$G_{05}$<br>[N/mm <sup>2</sup> ] | $\rho_k$<br>$\rho_m$<br>[kg/m <sup>3</sup> ] |
|--|--|--|--|--|--|--|
| 24.00<br>4.00                                  | 14.50<br>21.00                                     | 0.40<br>2.50   | 11000<br>7400                                      | 370<br>247   | 690<br>460                                     | 350<br>420                                   |

$f_{m,k}$  : characteristic value of bending strength  
 $f_{t,0,k}$  : characteristic value of tensile strength parallel to grain  
 $f_{t,90,k}$  : characteristic value of tensile strength perpendicular to the grain  
 $E_{0,mean}$  : Average value of modulus of elasticity parallel to the fiber  
 $E_{90,mean}$  : Average value of the modulus of elasticity perpendicular to the grain  
 $G_{mean}$  : Average value of the shear modulus  
 $\rho_k$  : Characteristic value of gross density  
 $f_{v,k}$  : characteristic value of shear strength  
 $f_{c,0,k}$  : characteristic value of compressive strength parallel to grain  
 $f_{c,90,k}$  : characteristic value of compressive strength perpendicular to the grain  
 $E_{0,05}$  : 5% fractile value of the modulus of elasticity parallel to grain  
 $E_{90,05}$  : 5% fractile value of the modulus of elasticity perpendicular to the grain  
 $G_{05}$  : 5% fractile value of the shear modulus  
 $\rho_m$  : Average value of the density

### Geometry

#### Cross-sections

| Name  | $I_y$<br>[cm <sup>4</sup> ] | $I_z$<br>[cm <sup>4</sup> ] | $W_y$<br>[cm <sup>3</sup> ] | $W_z$<br>[cm <sup>3</sup> ] | A<br>[cm <sup>2</sup> ] |
|-------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------|
| 16/18 | 7776                        | 6144                        | 864                         | 768                         | 288.0                   |

Cross-section is constant over the entire length of the beam.

## Support ( Bearing conditions)

| No | x<br>[m] | Width<br>[cm] | Depth<br>[cm] | k <sub>c90</sub> | u <sub>y</sub><br>[kN/m] | u <sub>z</sub><br>[kN/m] | Rotations *)                |                             |                             |
|----|----------|---------------|---------------|------------------|--------------------------|--------------------------|-----------------------------|-----------------------------|-----------------------------|
|    |          |               |               |                  |                          |                          | Φ <sub>x</sub><br>[kNm/rad] | Φ <sub>y</sub><br>[kNm/rad] | Φ <sub>z</sub><br>[kNm/rad] |
| 1  | 0.00     | 5.0           | 16.0          | 1.00             | -1                       | -1                       | -1                          | 0.0                         | 0.0                         |
| 2  | 1.20     | 5.0           | 16.0          | 1.00             | -1                       | -1                       | 0.0                         | 0.0                         | 0.0                         |
| 3  | 5.85     | 5.0           | 16.0          | 1.00             | -1                       | -1                       | 0.0                         | 0.0                         | 0.0                         |

\*) -1 = fixed, 0 = free, > 0 = elastically restraint

## Loads

### Line loads from area loads

| Reference | No | Type | A<br>[m] | L1<br>[m] | L2<br>[m] | W1<br>[kN/m <sup>2</sup> ] | W2<br>[kN/m <sup>2</sup> ] | GF                                | Sim | Alt |
|-----------|----|------|----------|-----------|-----------|----------------------------|----------------------------|-----------------------------------|-----|-----|
| System    | 1  | GL   |          | 5.85      |           | 1.80                       |                            | Permanent<br>Snow<br>Wind<br>Wind |     |     |
|           | 2  | GL   |          | 5.85      |           | 1.00                       |                            |                                   |     |     |
|           | 3  | GL   |          | 5.85      |           | 0.40                       |                            |                                   |     |     |
|           | 4  | GL   |          | 5.85      |           | -1.60                      |                            |                                   |     |     |

The load no. 2, 3 und 4 act span by span.

The load no. 1 acts simultaneously

The load values are multiplied internally by the beam spacing e = 0.86 m.

Reference : System-related (front edge of beam) or span load  
Type : 1 - uniformly distributed load (GL), 4 - trapezoidal load (TL), 5 - triangular load (DL)  
A : Distance to the load from the beginning of the span or the front edge of the beam  
GF : Load effect  
Sim : Simultaneous group  
Alt : Alternate group

- Load 1: Width 0.86 m
- Load 2: Width 0.86 m
- Load 3: Width 0.86 m
- Load 4: Width 0.86 m

## Self-weight

Total weight = 71 kg taken into account with gamma = 4.20 kN/m<sup>3</sup>.

## Overview of the actions used

### Actions

| Designation           | ψ <sub>0</sub> | ψ <sub>1</sub> | ψ <sub>2</sub> | γ <sub>F,inf</sub> | γ <sub>F,sup</sub> | KLED             |
|-----------------------|----------------|----------------|----------------|--------------------|--------------------|------------------|
| Permanent loads       |                |                |                | 1.00               | 1.35               |                  |
| Wind loads            | 0.60           | 0.20           | 0.00           |                    | 1.50               | short/very short |
| Snow loads H < 1000 m | 0.50           | 0.20           | 0.00           |                    | 1.50               | short            |

Consequences class CC 2 according to EN 1990 Tab. B1 -> K<sub>FI</sub> = 1.0 Tab. B3

## Results

### Design parameter

Design code : DIN EN 1995-1-1/NA:2013-08  
Basis : EN 1995-1-1/A2:2014  
Safety concept / load combinatorics : DIN EN 1990/NA:2010-12  
Consequence class : CC 2  
ψ<sub>2</sub> = 0.5 for snow (AE) : not considered  
Permanent loads : all equal γ<sub>F</sub> (γ<sub>G,sup</sub> or γ<sub>G,inf</sub>)  
CLED at wind : Average of short and very short

### Design parameter Timber

Service class 2 : roofed, open  
Rel. air humidity ~ 85% Equilibrium moisture content < 20%  
Design situation serviceability : characteristic  
Shear stresses = Tau with red. Q  
Initial deflection w<sub>inst</sub> = l/300  
Final deflection w<sub>net,fin</sub> = l/250  
w<sub>fin</sub> = l/250

Summary

| Check  | Design situation                       | $\eta_{\text{Bending}}$ | $\eta_{\text{Shear}}$ | $\eta_{c,90}$ | $\eta_{\text{Stabi}}$ | $\eta_{\text{Deformation}}$ |
|--|--|-------------------------|-----------------------|---------------|-----------------------|-----------------------------|
| Load capacity<br>Serviceability  | persistent/transient<br>characteristic | 0.54                    | 0.35                  | 0.61          | 1)                    | 0.82                        |
| 1) Stability check was not carried out because the upper chord is held continuously. |  |                         |                       |               |                       |                             |

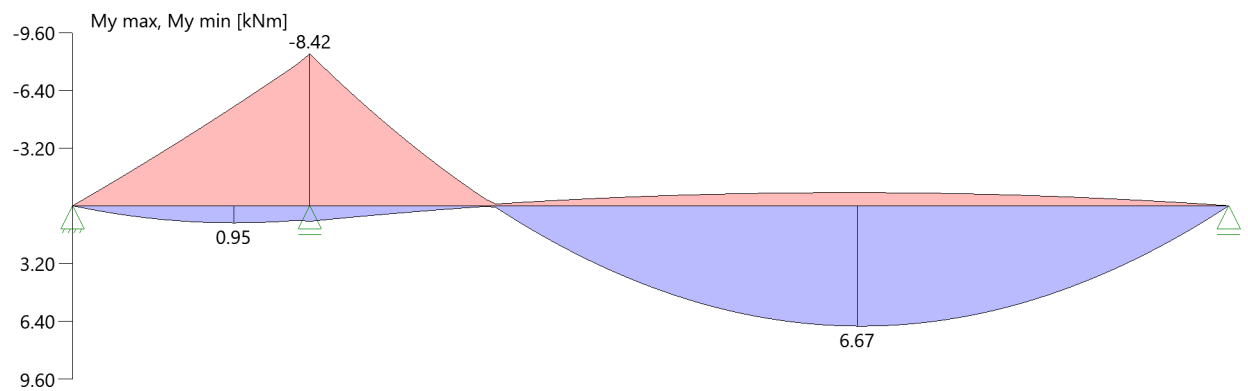
Structural safety per cross-section (compact)

| Design situation     | Cross-section | $V_{z,Ed}$ [kN] | $M_{y,Ed}$ [kNm] | $\eta_{\text{Shear}}$ | $\eta_{\text{Bending}}$ | $\eta_{\text{Stabi}}$ |
|----------------------|---------------|-----------------|------------------|-----------------------|-------------------------|-----------------------|
| persistent/transient | 16/18         | 9.2             | -7.74            | 0.35                  | 0.54                    |                       |

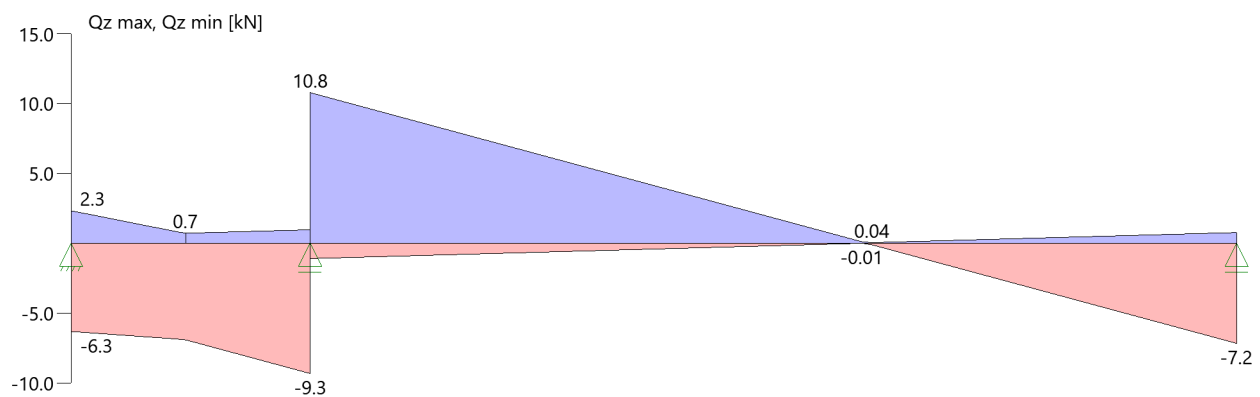
Structural safety - Load combination persistent/transient

Internal forces

Envelope of the moments



Envelope of the transverse forces



Check of SLS

|  | l <sub>eff</sub><br>[m] | Position<br>[m] | typ     |   | W <sub>g</sub> | W <sub>q</sub> | W    | W <sub>lim</sub> | η    | Lk |
|--|-------------------------|-----------------|---------|---|----------------|----------------|------|------------------|------|----|
|  |                         |                 |         |   | [cm]           |                |      |                  |      |    |
| Span 1   | 1.20                    | 0.69            | inst    | z | -0.03          | -0.03          | -0.1 | 0.4              | 0.15 | 8  |
|  | 1.20                    | 0.69            | net,fin | z | -0.1           | 0.0            | -0.1 | 0.5              | 0.13 | 10 |
|  | 1.20                    | 0.69            | fin     | z | -0.1           | -0.03          | -0.1 | 0.5              | 0.18 | 9  |
| Span 2   | 4.65                    | 2.69            | inst    | z | 0.6            | 0.5            | 1.0  | 1.6              | 0.66 | 8  |
|  | 4.65                    | 2.69            | net,fin | z | 1.1            | 0.0            | 1.1  | 1.9              | 0.60 | 10 |
|  | 4.65                    | 2.69            | fin     | z | 1.0            | 0.5            | 1.5  | 1.9              | 0.82 | 9  |
| l <sub>eff</sub> : Effective length<br>Position : Position of the deformation<br>typ : Start-/End deformation (direction)<br>W <sub>g</sub> : Deformation due to permanent load<br>W <sub>q</sub> : Deformation due to variable load<br>W : Deformation total<br>W <sub>lim</sub> : Permissible deformation<br>η : Degree of utilization<br>Lk : No. of the load combination |                         |                 |         |   |                |                |      |                  |      |    |

Support forces

Support forces per [m] - characteristic of each action

| No | x<br>[m] | Action                | R <sub>z,min</sub><br>[kN/m] | R <sub>z,max</sub><br>[kN/m] | M <sub>y,min</sub><br>[kNm/m] | M <sub>y,max</sub><br>[kNm/m] |
|----|----------|-----------------------|------------------------------|------------------------------|-------------------------------|-------------------------------|
| 1  | 0.00     | Permanent loads       | -2.37                        | -2.37                        |                               |                               |
|    |          | Wind loads            | -1.63                        | 3.09                         |                               |                               |
|    |          | Snow loads H < 1000 m | -1.79                        | 0.57                         |                               |                               |
| 2  | 1.20     | Permanent loads       | 10.12                        | 10.12                        |                               |                               |
|    |          | Wind loads            | -8.35                        | 2.09                         |                               |                               |
|    |          | Snow loads H < 1000 m |                              | 5.22                         |                               |                               |
| 3  | 5.85     | Permanent loads       | 3.60                         | 3.60                         |                               |                               |
|    |          | Wind loads            | -2.98                        | 0.76                         |                               |                               |
|    |          | Snow loads H < 1000 m | -0.01                        | 1.86                         |                               |                               |

Item: poz 104 - špirovec razpona 3,4m - na èopu - zadnji pred jeklenim nosilcem

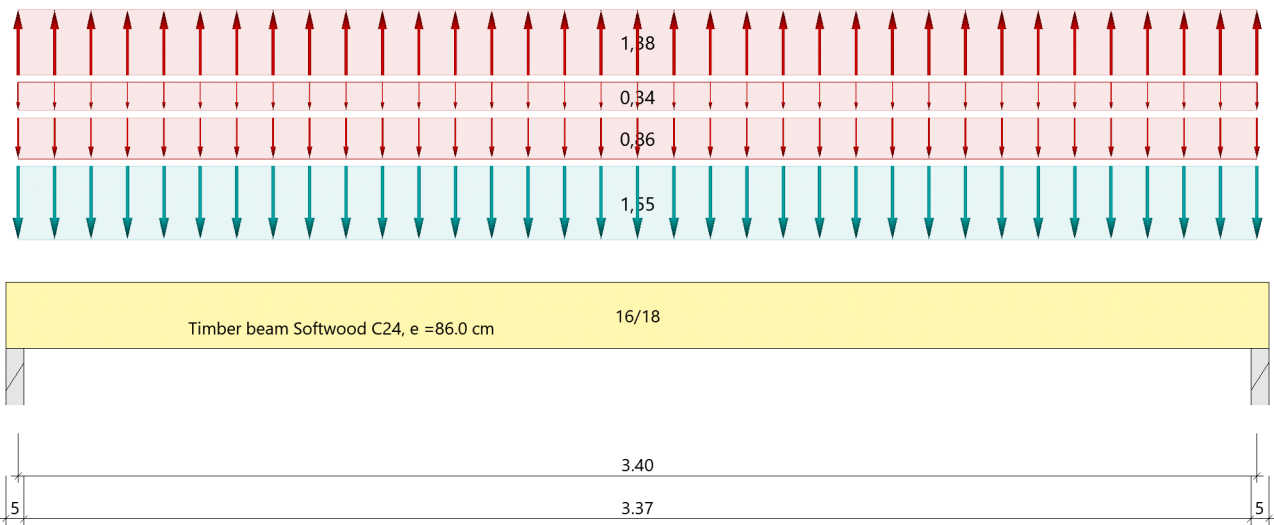
Continuous Beam Timber (x64) HTM+ 01/23D (FRILO R-2023-1/P04)

Basic Parameters

Timber beam (e = 86.0 cm) Softwood C24 DIN EN 1995-1-1/NA:2013-08

System

System Graphic



Material

Softwood C24, acc.to EN 338:2016

| $f_{m,k}$<br>$f_{v,k}$<br>[N/mm <sup>2</sup> ] | $f_{t,0,k}$<br>$f_{c,0,k}$<br>[N/mm <sup>2</sup> ] | $f_{t,90,k}$<br>$f_{c,90,k}$<br>[N/mm <sup>2</sup> ] | $E_{0,mean}$<br>$E_{0,05}$<br>[N/mm <sup>2</sup> ] | $E_{90,mean}$<br>$E_{90,05}$<br>[N/mm <sup>2</sup> ] | $G_{mean}$<br>$G_{05}$<br>[N/mm <sup>2</sup> ] | $\rho_k$<br>$\rho_m$<br>[kg/m <sup>3</sup> ] |
|--|--|--|--|--|--|--|
| 24.00<br>4.00                                  | 14.50<br>21.00                                     | 0.40<br>2.50   | 11000<br>7400                                      | 370<br>247   | 690<br>460                                     | 350<br>420                                   |

$f_{m,k}$  : characteristic value of bending strength  
 $f_{t,0,k}$  : characteristic value of tensile strength parallel to grain  
 $f_{t,90,k}$  : characteristic value of tensile strength perpendicular to the grain  
 $E_{0,mean}$  : Average value of modulus of elasticity parallel to the fiber  
 $E_{90,mean}$  : Average value of the modulus of elasticity perpendicular to the grain  
 $G_{mean}$  : Average value of the shear modulus  
 $\rho_k$  : Characteristic value of gross density  
 $f_{v,k}$  : characteristic value of shear strength  
 $f_{c,0,k}$  : characteristic value of compressive strength parallel to grain  
 $f_{c,90,k}$  : characteristic value of compressive strength perpendicular to the grain  
 $E_{0,05}$  : 5% fractile value of the modulus of elasticity parallel to grain  
 $E_{90,05}$  : 5% fractile value of the modulus of elasticity perpendicular to the grain  
 $G_{05}$  : 5% fractile value of the shear modulus  
 $\rho_m$  : Average value of the density

Geometry

Cross-sections

| Name  | $I_y$<br>[cm <sup>4</sup> ] | $I_z$<br>[cm <sup>4</sup> ] | $W_y$<br>[cm <sup>3</sup> ] | $W_z$<br>[cm <sup>3</sup> ] | A<br>[cm <sup>2</sup> ] |
|-------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------|
| 16/18 | 7776                        | 6144                        | 864                         | 768                         | 288.0                   |

Cross-section is constant over the entire length of the beam.

Support ( Bearing conditions)

| No | x<br>[m] | Width<br>[cm] | Depth<br>[cm] | k <sub>c90</sub> | u <sub>y</sub><br>[kN/m] | u <sub>z</sub><br>[kN/m] | Rotations <sup>*)</sup>     |                             |                             |
|----|----------|---------------|---------------|------------------|--------------------------|--------------------------|-----------------------------|-----------------------------|-----------------------------|
|    |          |               |               |                  |                          |                          | Φ <sub>x</sub><br>[kNm/rad] | Φ <sub>y</sub><br>[kNm/rad] | Φ <sub>z</sub><br>[kNm/rad] |
| 1  | 0.00     | 5.0           | 14.0          | 1.00             | -1                       | -1                       | -1                          | 0.0                         | 0.0                         |
| 2  | 3.40     | 5.0           | 14.0          | 1.00             | -1                       | -1                       | 0.0                         | 0.0                         | 0.0                         |

<sup>\*)</sup> -1 = fixed, 0 = free, > 0 = elastically restraint

Loads

Line loads from area loads

| Reference   | No   | Type | A<br>[m] | L1<br>[m] | L2<br>[m] | W1<br>[kN/m²] | W2<br>[kN/m²] | GF                                | Sim | Alt |
|---|--|------|----------|-----------|-----------|---------------|---------------|-----------------------------------|-----|-----|
| System  | 1  | GL   |          | 3.40      |           | 1.80          |               | Permanent<br>Snow<br>Wind<br>Wind |     |     |
|   | 2  | GL   |          | 3.40      |           | 1.00          |               |                                   |     |     |
|   | 3  | GL   |          | 3.40      |           | 0.40          |               |                                   |     |     |
|   | 4  | GL   |          | 3.40      |           | -1.60         |               |                                   |     |     |
| The load values are multiplied internally by the beam spacing e = 0.86 m. |  |      |          |           |           |               |               |                                   |     |     |
| Reference   | : System-related (front edge of beam) or span load   |      |          |           |           |               |               |                                   |     |     |
| Type  | : 1 - uniformly distributed load (GL), 4 - trapezoidal load (TL), 5 - triangular load (DL) |      |          |           |           |               |               |                                   |     |     |
| A   | : Distance to the load from the beginning of the span or the front edge of the beam        |      |          |           |           |               |               |                                   |     |     |
| GF  | : Load effect  |      |          |           |           |               |               |                                   |     |     |
| Sim   | : Simultaneous group   |      |          |           |           |               |               |                                   |     |     |
| Alt   | : Alternate group  |      |          |           |           |               |               |                                   |     |     |

- Load 1: Width 0.86 m
- Load 2: Width 0.86 m
- Load 3: Width 0.86 m
- Load 4: Width 0.86 m

Self-weight

Total weight = 41 kg taken into account with gamma = 4.20 kN/m³.

Overview of the actions used

Actions

| Designation           | ψ <sub>0</sub> | ψ <sub>1</sub> | ψ <sub>2</sub> | γ <sub>F,inf</sub> | γ <sub>F,sup</sub> | KLED             |
|-----------------------|----------------|----------------|----------------|--------------------|--------------------|------------------|
| Permanent loads       |                |                |                | 1.00               | 1.35               |                  |
| Wind loads            | 0.60           | 0.20           | 0.00           |                    | 1.50               | short/very short |
| Snow loads H < 1000 m | 0.50           | 0.20           | 0.00           |                    | 1.50               | short            |

Consequences class CC 2 according to EN 1990 Tab. B1 -> K<sub>FI</sub> = 1.0 Tab. B3

Results

Design parameter

|                                     |   |  |
|-------------------------------------|---|--|
| Design code                         | : | DIN EN 1995-1-1/NA:2013-08   |
| Basis                               | : | EN 1995-1-1/A2:2014  |
| Safety concept / load combinatorics | : | DIN EN 1990/NA:2010-12   |
| Consequence class                   | : | CC 2   |
| Ψ <sub>2</sub> = 0.5 for snow (AE)  | : | not considered   |
| Permanent loads                     | : | all equal γ <sub>F</sub> (γ <sub>G,sup</sub> or γ <sub>G,inf</sub> ) |
| CLED ati wind                       | : | Average of short and very short                                      |

Design parameter Timber

|                                 |                      |   |                         |                                    |
|---------------------------------|----------------------|---|-------------------------|------------------------------------|
| Service class                   | 2                    | : | roofed, open            |                                    |
|                                 |                      | : | Rel. air humidity ~ 85% | Equilibrium moisture content < 20% |
| Design situation serviceability | :                    |   | characteristic          |                                    |
| Shear stresses                  | =                    |   | Tau with red. Q         |                                    |
| Initial deflection              | W <sub>inst</sub>    | = | I/300                   |                                    |
| Final deflection                | W <sub>net,fin</sub> | = | I/250                   |                                    |
|                                 | W <sub>fin</sub>     | = | I/250                   |                                    |



## Summary

| Check                           | Design situation                       | $\eta_{\text{Bending}}$ | $\eta_{\text{Shear}}$ | $\eta_{c,90}$ | $\eta_{\text{Stabi}}$ | $\eta_{\text{Deformation}}$ |
|---------------------------------|--|-------------------------|-----------------------|---------------|-----------------------|-----------------------------|
| Load capacity<br>Serviceability | persistent/transient<br>characteristic | 0.36                    | 0.20                  | 0.31          | 1)                    | 0.61                        |

1) Stability check was not carried out because the upper chord is held continuously.

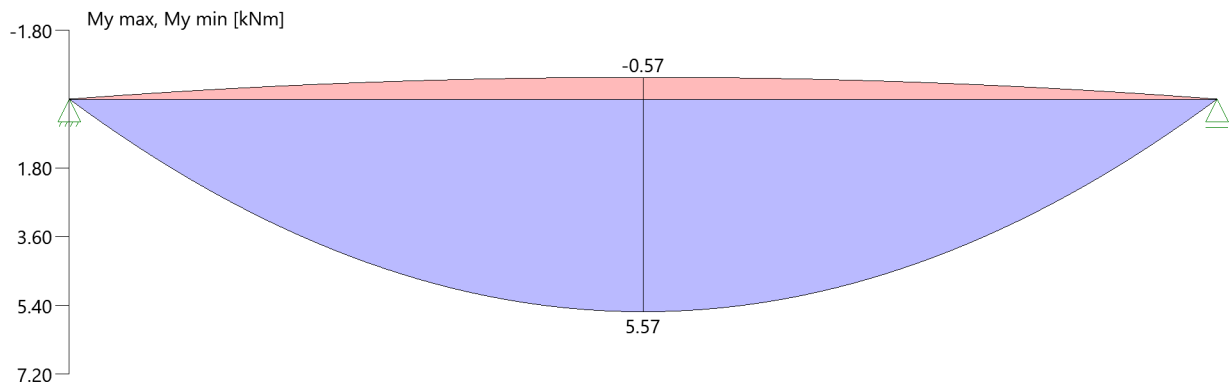
## Structural safety per cross-section (compact)

| Design situation     | Cross-section | $V_{z,Ed}$<br>[kN] | $M_{y,Ed}$<br>[kNm] | $\eta_{\text{Shear}}$ | $\eta_{\text{Bending}}$ | $\eta_{\text{Stabi}}$ |
|----------------------|---------------|--------------------|---------------------|-----------------------|-------------------------|-----------------------|
| persistent/transient | 16/18         | -5.3               | 5.12                | 0.20                  | 0.36                    |                       |

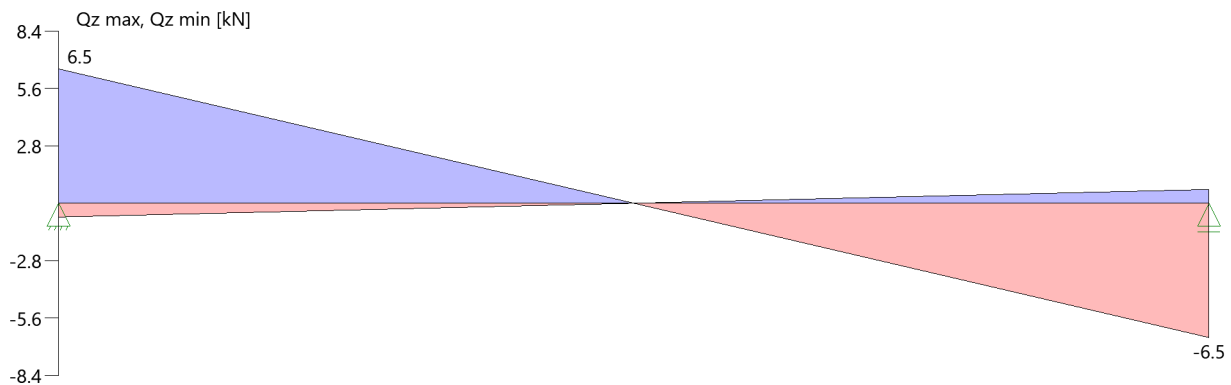
## Structural safety - Load combination persistent/transient

### Internal forces

#### Envelope of the moments



#### Envelope of the transverse forces



## Check of SLS

|        | $l_{\text{eff}}$<br>[m] | Position<br>[m] | typ     |   | $w_g$ | $w_q$ | $w$ | $w_{\text{lim}}$ | $\eta$ | Lk |
|--------|-------------------------|-----------------|---------|---|-------|-------|-----|------------------|--------|----|
|        |                         |                 |         |   | [cm]  |       |     |                  |        |    |
| Span 1 | 3.40                    | 1.70            | inst    | z | 0.3   | 0.2   | 0.6 | 1.1              | 0.49   | 7  |
|        | 3.40                    | 1.70            | net,fin | z | 0.6   | 0.0   | 0.6 | 1.4              | 0.45   | 6  |
|        | 3.40                    | 1.70            | fin     | z | 0.6   | 0.2   | 0.8 | 1.4              | 0.61   | 8  |

$l_{\text{eff}}$  : Effective length  
 Position : Position of the deformation  
 typ : Start-/End deformation (direction)  
 $w_g$  : Deformation due to permanent load  
 $w_q$  : Deformation due to variable load  
 $w$  : Deformation total  
 $w_{\text{lim}}$  : Permissible deformation  
 $\eta$  : Degree of utilization  
 Lk : No. of the load combination

**Support forces**

**Support forces per [m] - characteristic of each action**

| No | x<br>[m] | Action   | R <sub>z,min</sub><br>[kN/m] | R <sub>z,max</sub><br>[kN/m] | M <sub>y,min</sub><br>[kNm/m] | M <sub>y,max</sub><br>[kNm/m] |
|----|----------|--|------------------------------|------------------------------|-------------------------------|-------------------------------|
| 1  | 0.00     | Permanent loads<br>Wind loads<br>Snow loads H < 1000 m | 3.30<br>-2.72                | 3.30<br>0.68<br>1.70         |                               |                               |
| 2  | 3.40     | Permanent loads<br>Wind loads<br>Snow loads H < 1000 m | 3.30<br>-2.72                | 3.30<br>0.68<br>1.70         |                               |                               |

**2.5 RISBE**

# OSTREŠJE - DISPOZICIJSKA RISBA ELEMENTOV

- HEA260, JEKLO S275

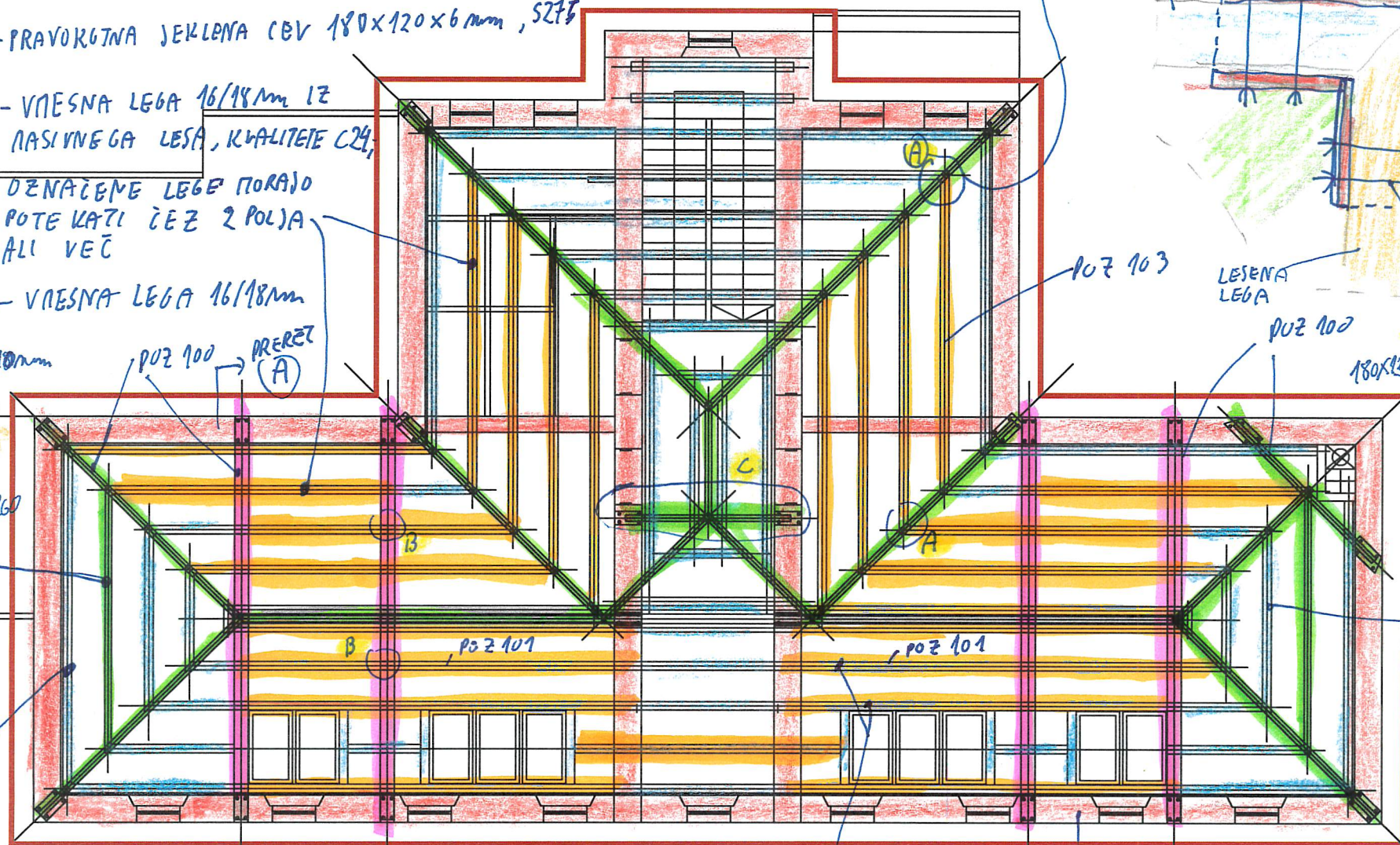
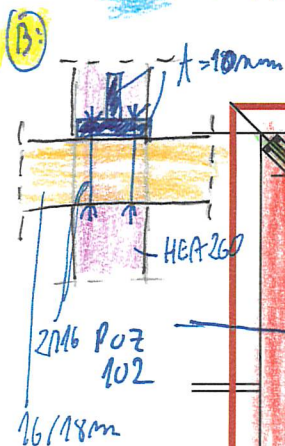
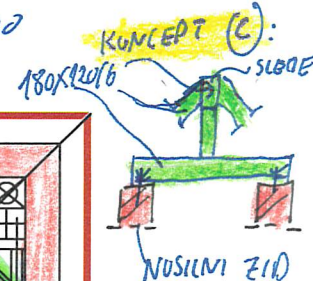
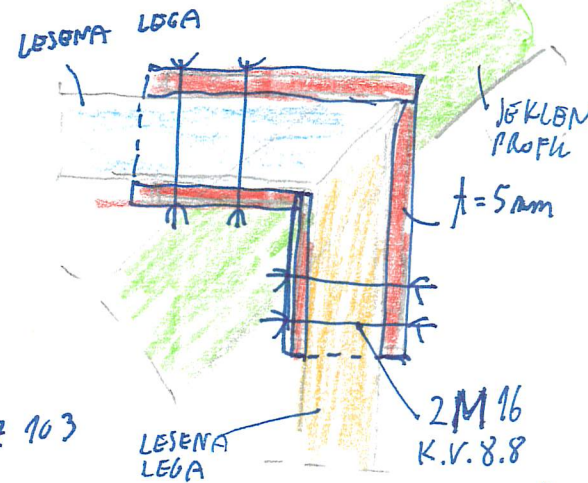
- PRAVOKOTNA JEKLENA CEV 180x120x6mm, S275

- VNESNA LEGA 16/18mm IZ  
NASIVNEGA LESA, KVALITE TE C24;

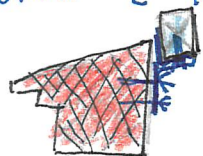
OZNAČENE LEGE PORAJO  
POTE KATI ČEZ 2 POLJA  
ALI VEČ

- VNESNA LEGA 16/18mm

PREDVIDEN SPOJ (A):



LEGE OB VENECU, DODATNO SPOJAMO V VENEC!  
(S POROČILO "L" KOTNIKA, NA POLŽIVNI, RASTRU CCA. 1,8m)



LEGE IZ ENEGA  
KOSA, KI GREDO  
PREKO DVEH POLJ,  
OZNAČENE Z

AB VENEC IN NOSILNI ZIDovi  
NA KATERE OPIRANO  
STRESNO KONSTRUKCijo



# PREREZ A-A

KONCEPT:

