



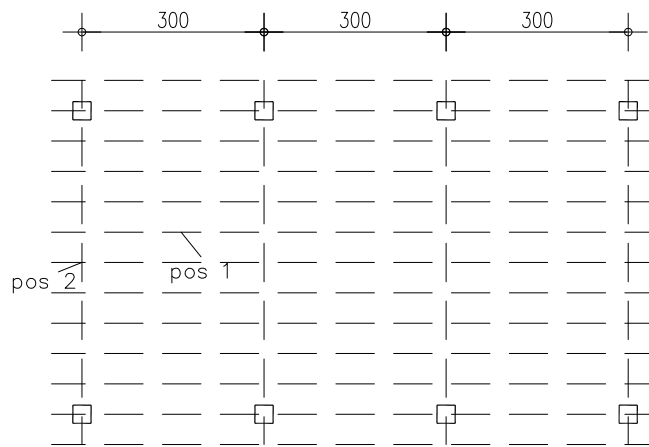
Dimenzionisati elemente drvene nadstrešnice (rožnjače, glavne nosače i stubove) za automobile, jednostranog nagiba  $12^\circ$ . Nadstrešnica je zatvorena sa tri strane.

Krovni pokrivač je aluminiski sendvič lim

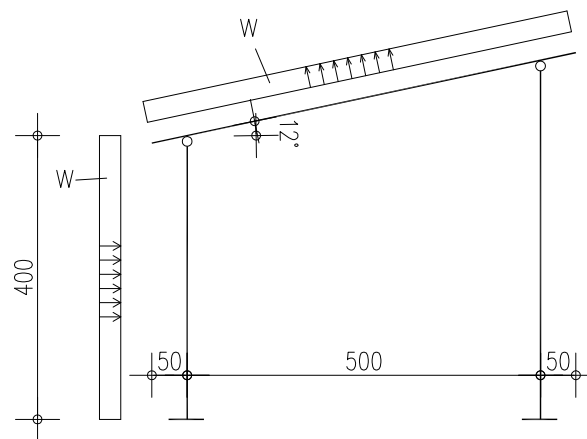
Građa: Četinari II klase

Opterećenje :

- vjetar -  $W=0.6kN / m^2$
- snijeg
- sopstvena težina



Skica-osnova



Skica-presjek



## RJEŠENJE ZADATKA

### Pos 1- rožnjače (pretpostavka $b/h = 8/10\text{cm}$ , $\lambda = 0.5\text{m}$ )

#### 1. Analiza opterećenja

sop. težina (pretpostavka).....  $g = 0.05\text{kN} / \text{m}^2$

težina krovnog pokrivača (pretpostavka) .....  $g_{kp} = 0.25\text{kN} / \text{m}^2$

snijeg .....  $g_{kp} = 1.00\text{kN} / \text{m}^2$

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$$g = 1.30\text{kN} / \text{m}^2$$

Vjetar nije mjerodavan za proračun rožnjače jer ima sišuće dejstvo.

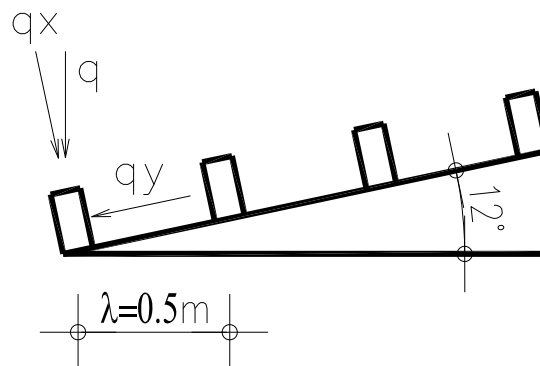
$$W = 0.6\text{kN} / \text{m}^2$$

$$q_x = \left( \frac{g_{kp}}{\cos \alpha} + g + s \right) \cdot \lambda \cdot \cos \alpha$$

$$q_y = \left( \frac{g_{kp}}{\cos \alpha} + g + s \right) \cdot \lambda \cdot \sin \alpha$$

$$\cos \alpha = 0.987$$

$$\sin \alpha = 0.208$$



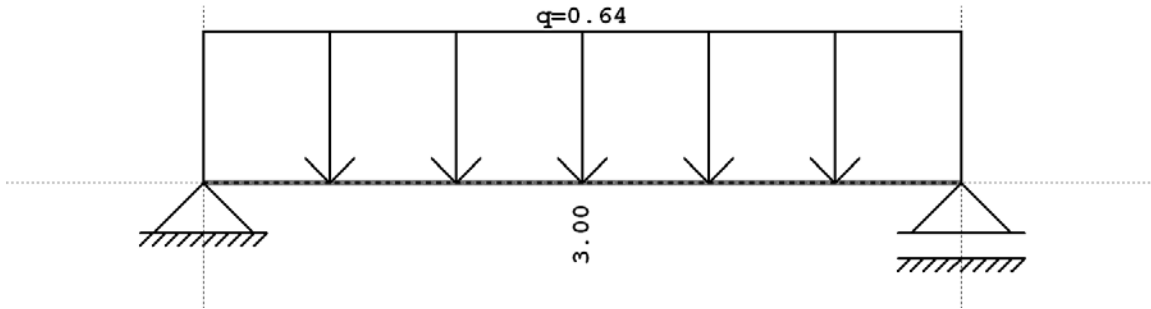
$$q_x = \left( \frac{0.25}{0.987} + 1.0 + 0.05 \right) \cdot 0.5 \cdot 0.987 = (0.255 + 1.0 + 0.05) \cdot 0.5 \cdot 0.987 = 0.643\text{kN} / \text{m}$$

$$q_y = \left( \frac{0.25}{0.987} + 1.0 + 0.05 \right) \cdot 0.5 \cdot 0.208 = 0.136\text{kN} / \text{m}^2$$

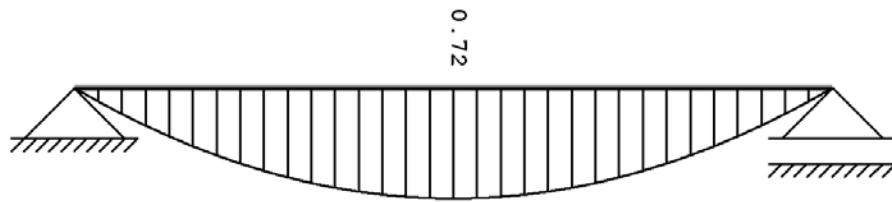


## 2. Statički uticaji

Za x-x pravac



Šema opterećenja za x-x pravac



Dijagram momenata za x-x pravac



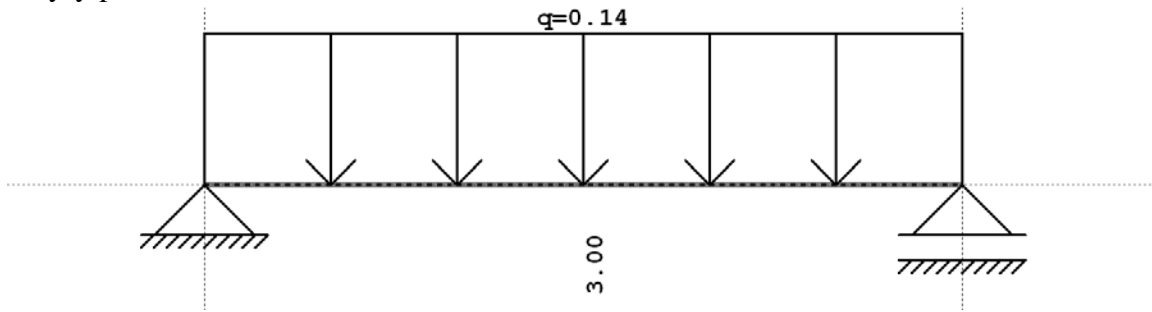
Dijagram transverzalnih sila za x-x pravac



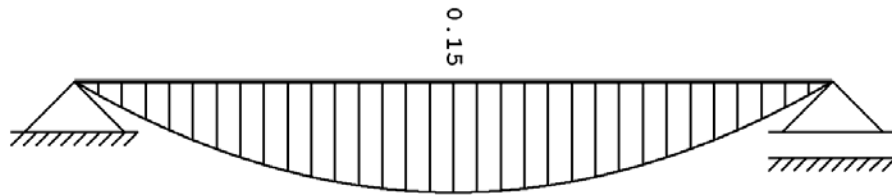
Reakcije za x-x pravac



Za y-y pravac



Šema opterećenja za y-y pravac



Dijagram momenata za y-y pravac



Dijagram transverzalnih sila za y-y pravac



Reakcije za y-y pravac

NAPOMENA 1: Ukupna reakcija je zbir reakcije u X i reakcije u Y pravcu, prema tome:

$R = \sqrt{R_x^2 + R_y^2} = \sqrt{0.92 + 0.04} = 0.98 kN$ . U nekim slučajevima reakcija u Y pravcu može da se zanemari (mala vrijednost-ne pravi velike uticaje) pa da se proračun nastavi samo sa reakcijom u x pravcu



### 3. Dimenzionisanje

Pretpostavka  $b/h = 8/10$

$$W_x = \frac{8 \cdot 10^2}{6} = 133.33 \text{ cm}^3$$

$$W_y = \frac{10 \cdot 8^2}{6} = 106.666 \text{ cm}^3$$

$$I_x = \frac{8 \cdot 10^3}{12} = 666.67 \text{ cm}^4$$

$$I_z = \frac{8^3 \cdot 10}{12} = 426.666 \text{ cm}^4$$

$$\sigma_{\max} = \frac{M_x}{W_x} + \frac{M_y}{W_y} = \frac{0.72 \cdot 100}{133.33} + \frac{0.15 \cdot 100}{106.666} = 0.540 + 0.141 = 0.681 \text{ kN/m}^2 < 1.0 \text{ kN/m}^2 = 10 \text{ MPa}$$

$$\max f_x = \frac{5}{384} \cdot \frac{q_x l^4}{EI} = 0.013 \cdot \frac{0.64 \cdot 10^{-2} \cdot 300^4}{1000 \cdot 666.67} = 1.01 \text{ cm}$$

$$\max f_y = \frac{5}{384} \cdot \frac{q_y l^4}{EI} = 0.013 \cdot \frac{0.14 \cdot 10^{-2} \cdot 300^4}{1000 \cdot 426.666} = 0.346 \text{ cm}$$

$$\max f = \sqrt{f_x^2 + f_y^2} = \sqrt{1.02^2 + 0.12^2} = 1.07 \text{ cm} < f_{\text{dop}} = \frac{l}{200} = 1.5 \text{ cm}$$

**Usvojeno Pos 1: b/h=8/10**



## Pos 2- glavni nosač

### 1. Analiza opterećenja

sop. težina (pretpostavka).....  $g = 0.05kN / m^2$

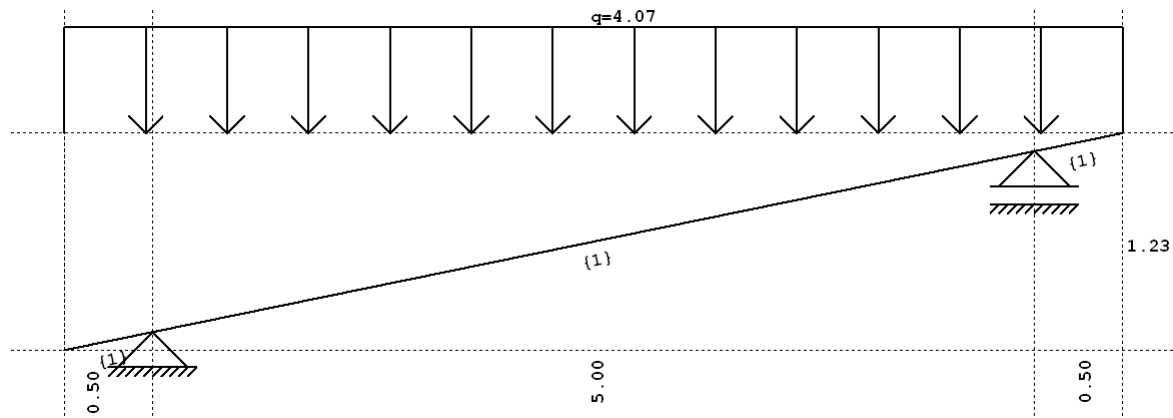
$$g = 0.05 \cdot 3.0 = 0.15kN / m$$

Reakcija sa Pos 1(vidjeti napomenu 1).....  $\frac{2 \cdot R}{\lambda} = \frac{2 \cdot 0.98}{0.5} = 3.92kN / m$

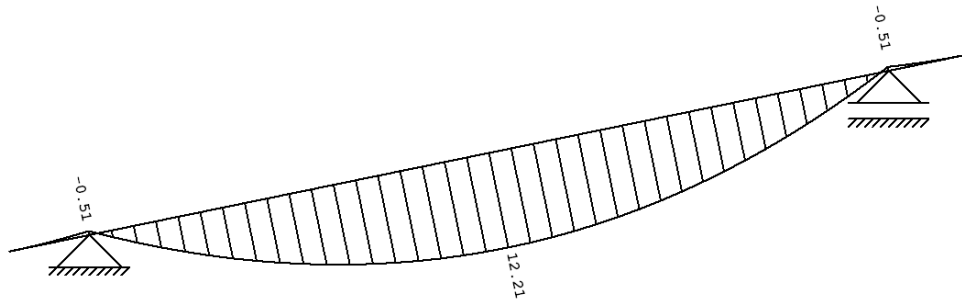
$$q = 4.07kN / m$$

NAPOMENA 2 :Reakcija sa Pos 1 je pomnožena sa 2 zato što se na Pos 2 oslanjaju dvije Pos 1 i podijeljena sa rastojanjem između Pos 1 da bi se dobilo jednakopodijeljeno opterećenje.

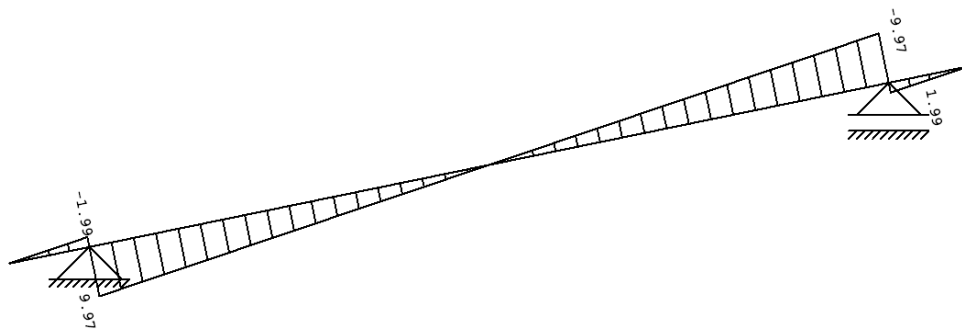
### 2. Statički utcaji



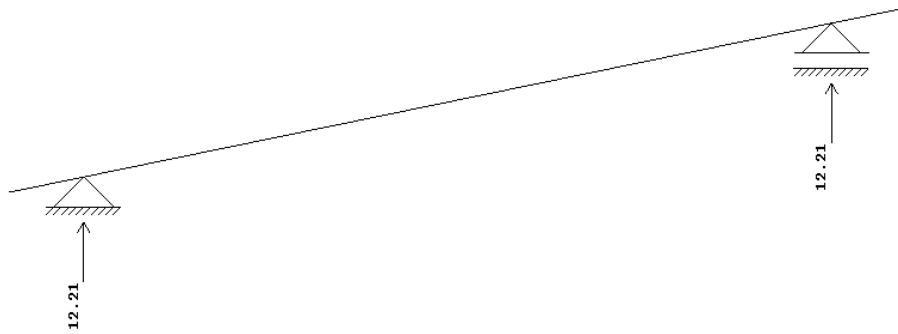
Šema opterećenja



Dijagram momenata M



Dijagram transverzalnih sila T



Reakcije R



### 3. Dimenzionisanje

Pretpostavka  $b/h = 18/24$  cm

$$W_x = \frac{24^2 \cdot 18}{6} = 1728 \text{ cm}^3$$

$$I_x = \frac{24^3 \cdot 18}{12} = 20736 \text{ cm}^4$$

$$\sigma_{\max} = \frac{M_x}{W_x} = \frac{12.21 \cdot 100}{1728} = 0.71 < 1.0 \text{ kN/cm}^2 = 10 \text{ MPa}$$

$$\max f_1 = \frac{5 \cdot q \cdot l^4}{385EI} \cdot \left(1 - \frac{24 \cdot c^2}{5 \cdot l^2}\right) = \frac{5 \cdot 4.07 \cdot 10^{-2} \cdot 500^4}{385 \cdot 1000 \cdot 20736} \cdot \left(1 - \frac{24 \cdot 50^2}{5 \cdot 500^2}\right) = 1.51 \text{ cm}$$

$$\max f_2 = \frac{-qc(l^3 - 2l)}{24EI} = \frac{-4.07 \cdot 10^{-2} \cdot 50 \cdot (500^3 - 2 \cdot 500)}{24 \cdot 1000 \cdot 20736} = 0.51 \text{ cm}$$

NAPOMENA 3 : Ugib  $f_1$  je ugib na sredini raspona, ugib  $f_2$  je ugib na krajevima prepusta. Za proračun je mjerodavan veći ugib.

$$\max f_1 = 1.51 \text{ cm} < f_{\text{dop}} = \frac{l}{300} = \frac{500}{300} = 1.67 \text{ cm}$$

**Usvojeno Pos 2: b/h=18/24**



## Pos 3- stub

### 1. Analiza opterećenja

sop. težina (pretpostavka).....  $g = 0.05kN / m^2$

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$$g = 0.05 \cdot 3.0 = 0.15kN / m$$

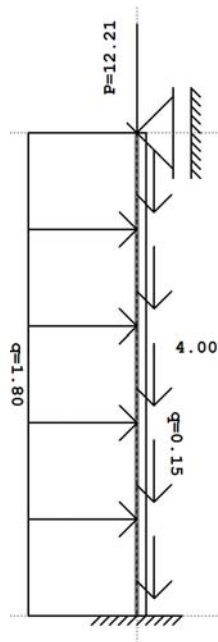
reakcija sa Pos 2.....  $R = 12.21kN$

vjetar.....  $g = 0.6kN / m^2$

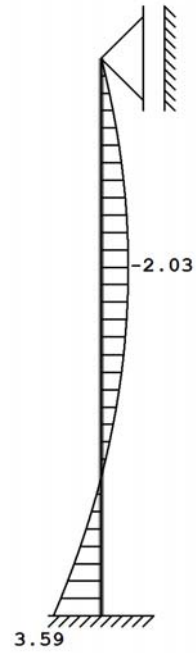
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$$g = 0.6 \cdot 3.0 = 1.8kN / m$$

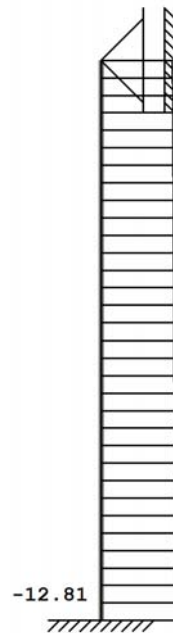
### 2. Statički utcaji



Šema opterećenja



Dijagram momenata M



Dijagram normalnih sila N



### 3. Dimenzionisanje

Pretpostavka  $b/h = 18/18 \text{ cm}$

$$W_x = \frac{18^2 \cdot 18}{6} = 972 \text{ cm}^3$$

$$I_x = \frac{18^3 \cdot 18}{12} = 8748 \text{ cm}^4$$

$$A = 324 \text{ cm}^2$$

$$i_x = \sqrt{\frac{8748}{324}} = 5.20 \text{ cm}$$

$$l = 400 \text{ cm}$$

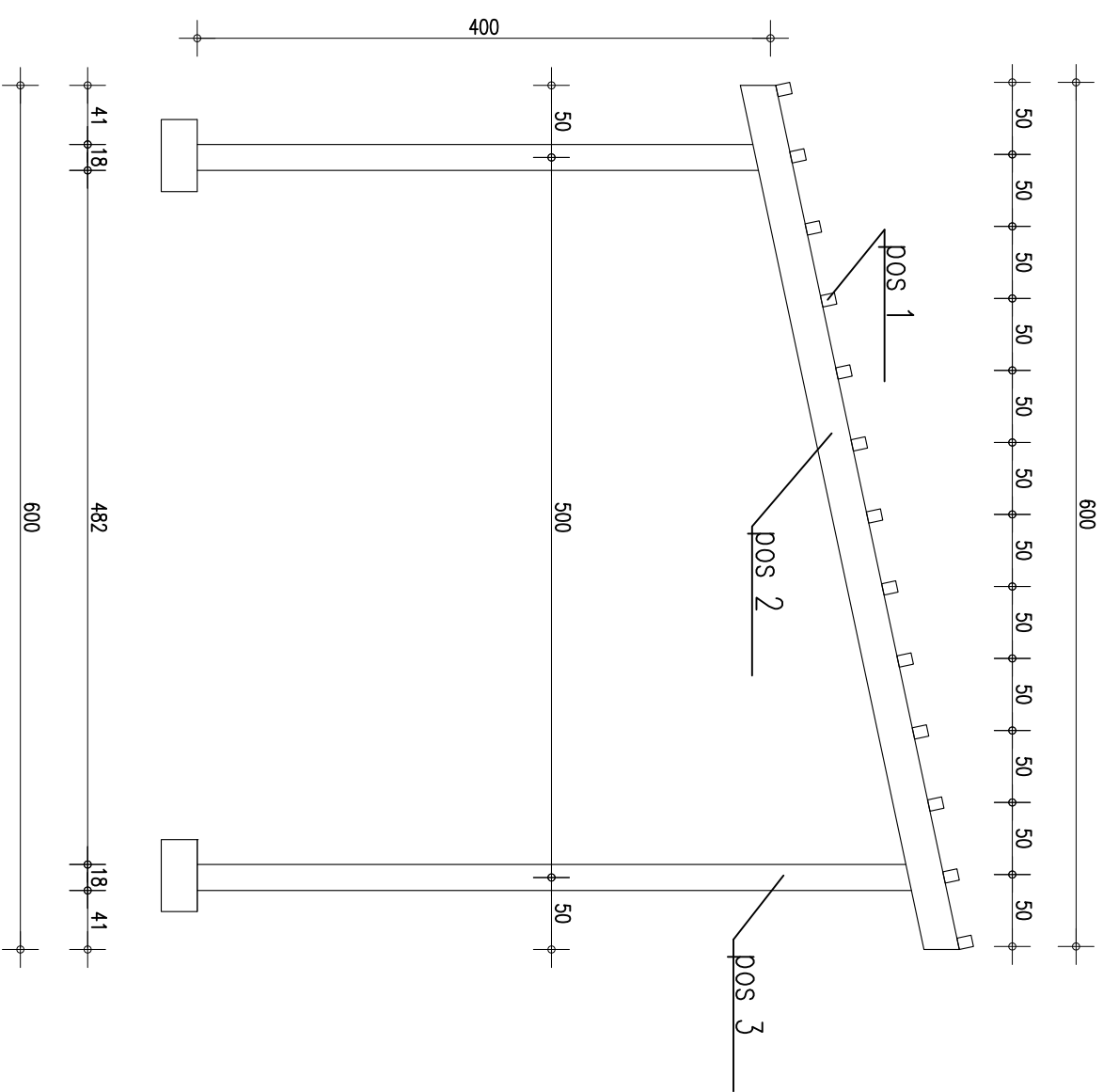
$$l_i = 0.8 \cdot 400 = 320 \text{ cm}$$

$$\lambda = \frac{l_i}{i_x} = 61.53 < 75 \Rightarrow \omega = \frac{1}{1 - 0.8 \left( \frac{\lambda}{100} \right)^2} = 1.61$$

$$\sigma_{\max} = \frac{N}{A} \cdot \omega + \frac{M_x}{W_x} \cdot \eta_c = \frac{12.21}{324} \cdot 1.61 + \frac{3.59 \cdot 100}{972} \cdot 0.85 = 0.375 < 0.85 \text{ kN / cm}^2 = 8.5 \text{ MPa}$$

**Usvojeno Pos 3: b/h=18/18**

Presjek 1-1  
R 1:50



Osnova  
R 1:50

