Univerzitet u Beogradu – Građevinski fakultet
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Studijski program: **GRAĐEVINARSTVO**

Modul: **PŽA, HVE, MTI**

Godina/Semestar: **III godina / V semestar**

Naziv predmeta (šifra): **Betonske konstrukcije 1**

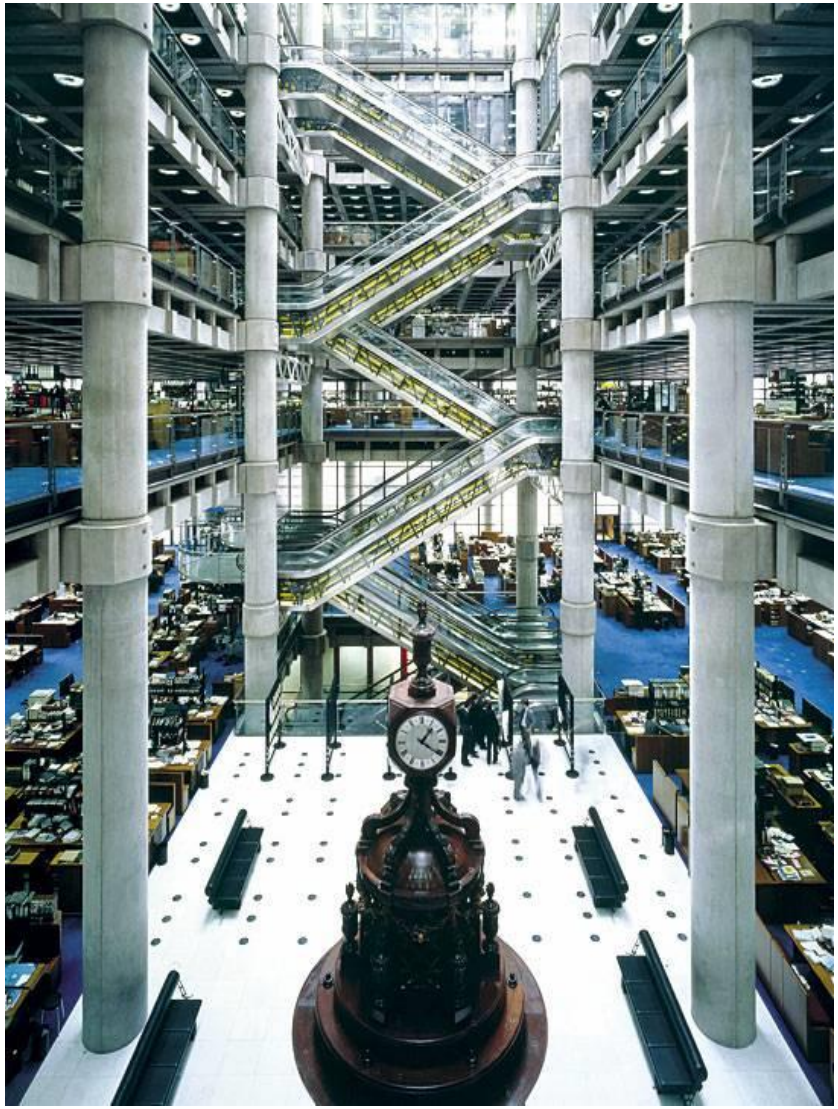
(B2S3BK, B2H3BK, B2M3BK, B1S3BK)

Nastavnik: **Jelena Dragaš**

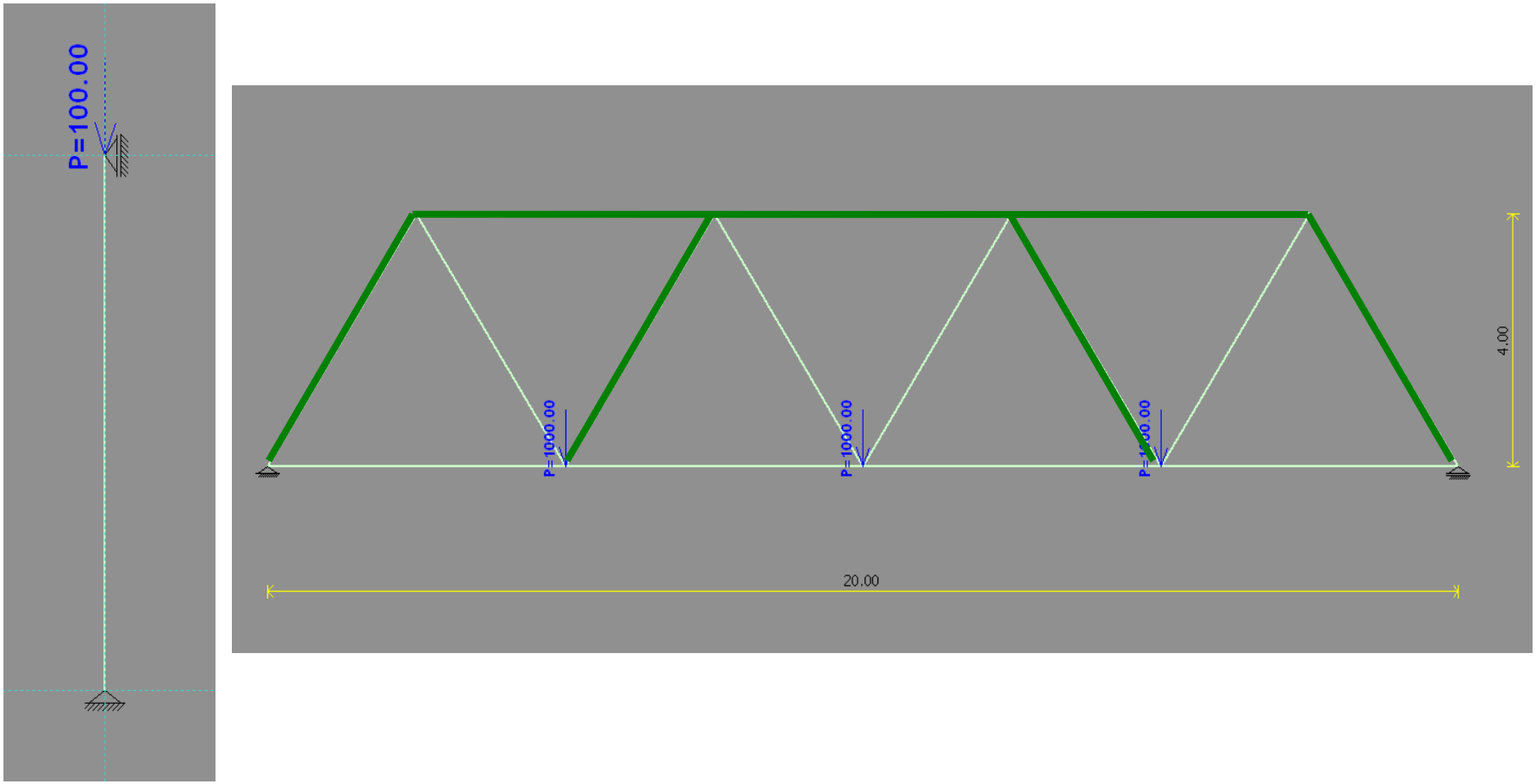
Naslov predavanja: **Centrično naprezanje.**

Datum : 03.11.2022.

Centrični pritisak



Centrični pritisak



Zadatak 13 – **CENTRIČNI PRITISAK**

Odrediti potrebnu površinu armature i dimenzije poprečnog preseka, pravougaonog oblika, centrično pritisnutog elementa.
Podaci za proračun:

N_G = 600 kN	C25/30	XD1
N_Q = 800 kN	B500 B	b = 35 cm

C25/30 ⇒ $f_{cd} = 0.85 \cdot 25/1.5 = 14.2 MPa = 1.42\ kN/cm^2$

B500 B ⇒ $f_{yd} = 500/1.15 = 435\ Mpa = 43.5\ kN/cm^2$

Zadatak 13 – CENTRIČNI PRITISAK

Granična sila pritiska:

$$N_{Ed} = 1.35 \cdot 600 + 1.5 \cdot 800 = 2010 kN$$

$$N_{Ed} = N_{Rd} = A_c \cdot f_{cd} + A_s \cdot \sigma_s$$

$$\sigma_s = \varepsilon_s \cdot E_s = 2 \cdot 200 = 400 MPa = 40 kN/cm^2 \neq f_{yd}$$

$$N_{Rd} = A_c \cdot f_{cd} \cdot (1 + \frac{A_s \cdot \sigma_s}{A_c \cdot f_{cd}}) = A_c \cdot f_{cd} \cdot (1 + \frac{A_s}{A_c} \cdot \frac{\sigma_s}{f_{cd}} \cdot \frac{f_{yd}}{f_{yd}}) = A_c \cdot f_{cd} \cdot (1 + \omega \cdot \frac{\sigma_s}{f_{yd}})$$

ω

Minimalni geometrijski procenat armiranja:

$$\rho_{l,\min} = 0.3\% \Rightarrow \omega = 0.3 \cdot \frac{43.5}{1.42} = 9.19\%$$

Zadatak 13 – CENTRIČNI PRITISAK

$$A_{c,pot} = \frac{N_{Ed}}{f_{cd} \cdot (1 + \omega \cdot \frac{\sigma_s}{f_{yd}})} = \frac{2010}{1.42 \cdot (1 + 0.0919 \cdot \frac{40.0}{43.5})} = 1305\ cm^2$$

$$h_{pot} = \frac{A_{c,pot}}{b} = \frac{1305}{35} = 37.3cm$$

Usvojeno h=40 cm

Zadatak 13 – CENTRIČNI PRITISAK

Usvajanje površine armature:

$$A_s = \max\begin{cases} 0.15 \cdot \dfrac{N_{Ed}}{f_{yd}} = 0.15 \cdot \dfrac{2010}{43.5} = 6.93 cm^2 \\ 0.003 \cdot A_c = 0.003 \cdot 40 \cdot 35 = 4.2 cm^2 \\ 4\phi 12 = 4 \cdot 1.12 = 4.48 cm^2 \\ 6Ø12 \text{ za kružne preseke} \end{cases}$$

Usvojeno: 8Ø12 (8.96 cm²)

Zadatak 13 – CENTRIČNI PRITISAK

Maksimalno rastojanje poprečne armature (**EC2**):

$$s_{cl,t\max} = \min\begin{Bmatrix} 20\varnothing_{\min} \\ \min(b,h) \\ 40cm \end{Bmatrix} = \min\begin{Bmatrix} 20\cdot 1.2 = 24cm \\ \min(b,h) = 35cm \\ 40cm \end{Bmatrix} = 24cm$$

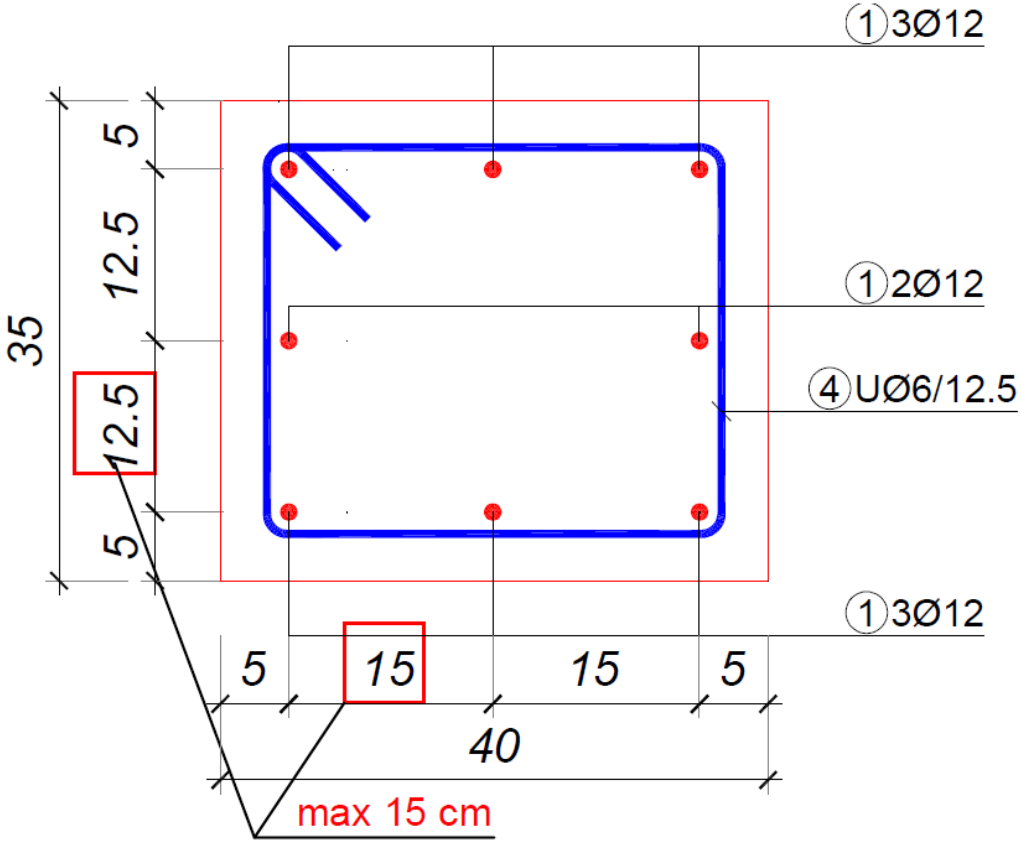
Maksimalno rastojanje poprečne armature (**EN1992-1-1/NA**):

$$s_{cl,t\max} = \min\begin{Bmatrix} 12\varnothing_{\min} \\ \min(b,h) \\ 30cm \end{Bmatrix} = \min\begin{Bmatrix} 12\cdot 1.2 = 14.4cm \\ \min(b,h) = 35cm \\ 30cm \end{Bmatrix} = 14.4cm$$

Zadatak 13 – CENTRIČNI PRITISAK

Usvojena podužna armatura: 8 Ø12 (8.96 cm^2)

Usvojena poprečna armatura: Ø6/12.5



Zadatak 14 – **CENTRIČNI PRITISAK**

Odrediti potrebnu površinu armature centrično pritisnutog elementa. Podaci za proračun:

N_G = 600 kN	C25/30	XD1
N_Q = 800 kN	B500 B	b/h = 30/35 cm

C25/30 ⇒ $f_{cd} = 0.85 \cdot 25/1.5 = 14.2 MPa = 1.42\ kN/cm^2$

B500 B ⇒ $f_{yd} = 500/1.15 = 435\ Mpa = 43.5\ kN/cm^2$

Zadatak 14 – CENTRIČNI PRITISAK

Granična sila pritiska:

$$N_{Ed} = 1.35 \cdot 600 + 1.5 \cdot 800 = 2010 kN$$

$$N_{Ed} = N_{Rd} = A_c \cdot f_{cd} + A_s \cdot \sigma_s$$

$$\sigma_s = \varepsilon_s \cdot E_s = 2 \cdot 200 = 400 MPa = 40 kN/cm^2 \neq f_{yd}$$

$$A_{s,pot} = \frac{N_{Ed} - A_c \cdot f_{cd}}{\sigma_s} = \frac{2010 - 30 \cdot 35 \cdot 1.42}{40} = 12.98 cm^2$$

Zadatak 14 – CENTRIČNI PRITISAK

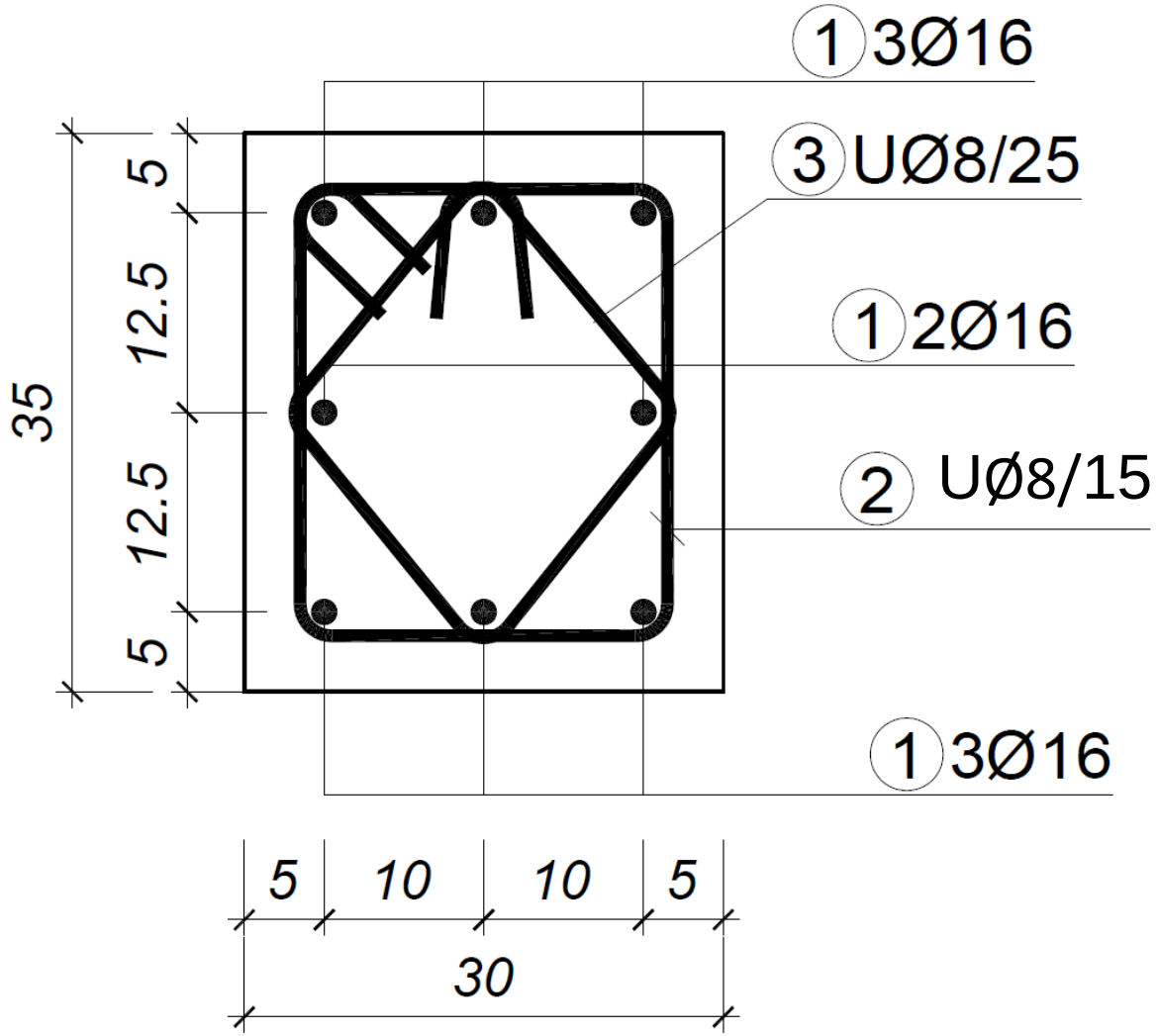
Usvajanje površine armature:

$$A_{s,min} = \begin{cases} 0.15 \cdot \dfrac{N_{Ed}}{f_{yd}} = 0.15 \cdot \dfrac{2010}{43.5} = 6.93\ cm^2 \\ 0.003 \cdot 30 \cdot 35 = 3.15\ cm^2 \\ 4Ø12 = 4.48\ cm^2 \end{cases}$$

$A_{s,min} = 6.93\ cm^2 < 12.98\ cm^2$

Usvojeno: 8Ø16 (16.08 cm²)

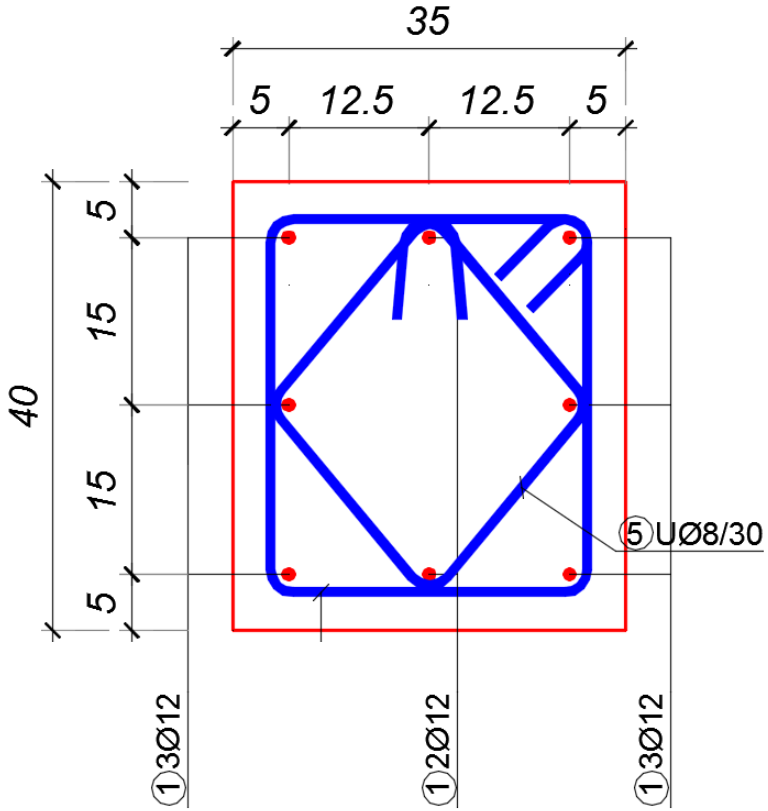
Zadatak 14 – **CENTRIČNI PRITISAK**



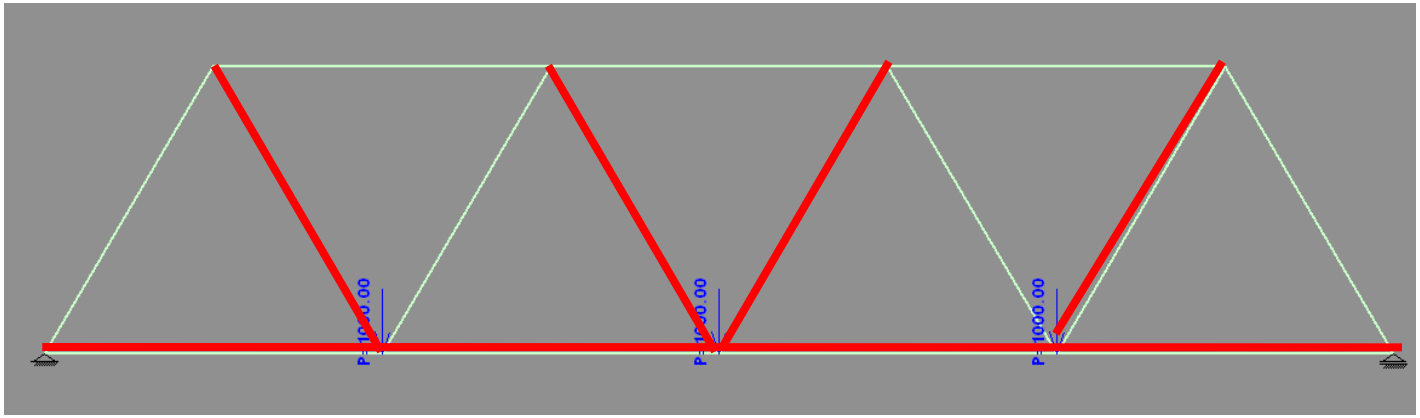
Zadatak 15 – **CENTRIČNI PRITISAK**

Odrediti normalnu silu pritiska usled promenljivog opterećenja, koju može da prihvati presek na skici. Podaci za proračun:

N_G = 600 kN C25/30 B500B



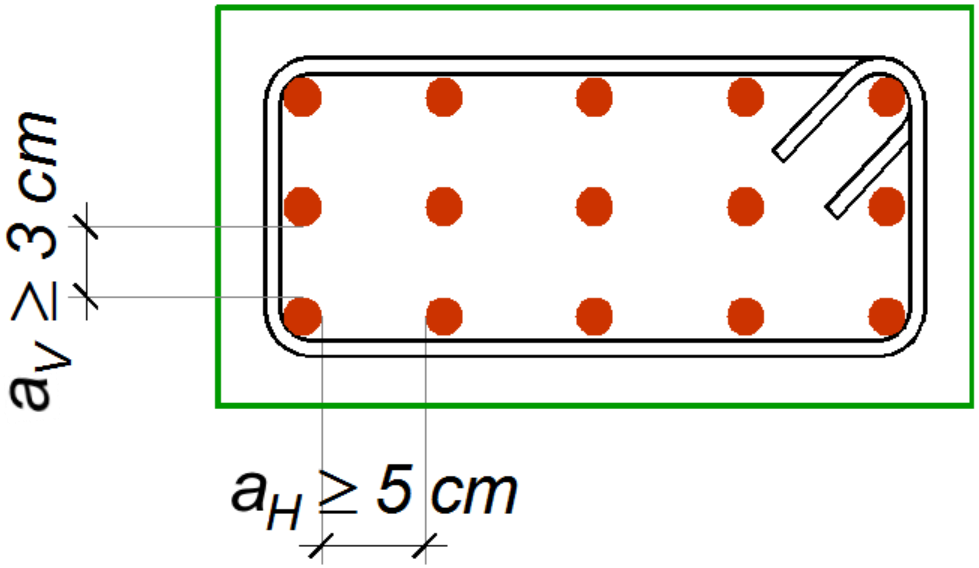
Centrično zatezanje



Centrično zatezanje

$$b \geq 2c_{nom} + 2Ø_s + m \times Ø + (m-1) \times a_H$$

$$h \geq 2c_{nom} + 2Ø_s + n \times Ø + (n-1) \times a_V$$



Zadatak 16 – **CENTRIČNO ZATEZANJE**

Odrediti potrebnu površinu armature i oblikovati poprečni presek, pravougaonog oblika, centrično zategnutog elementa.
Podaci za proračun:

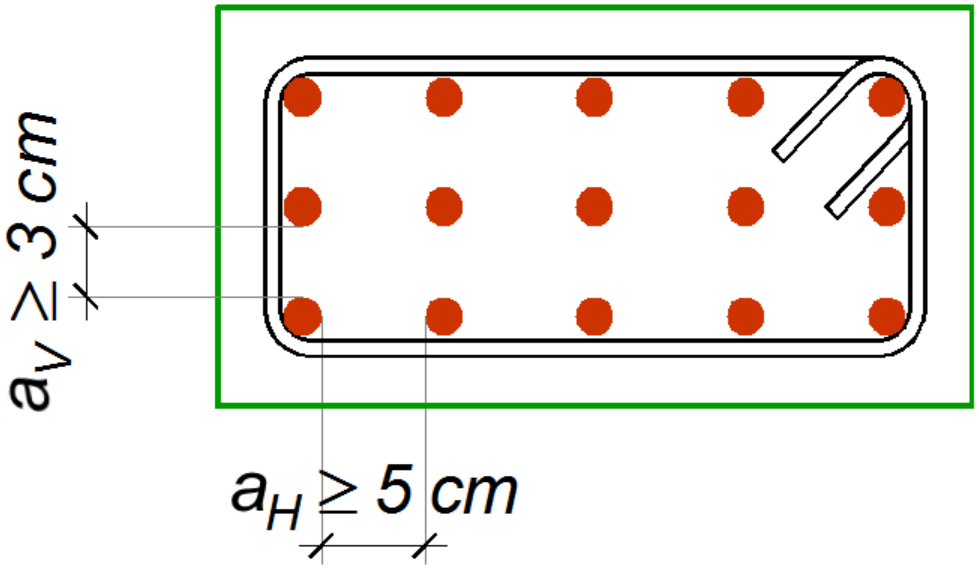
N_G = - 400 kN	C25/30	XD1
N_Q = - 500 kN	B500 B	

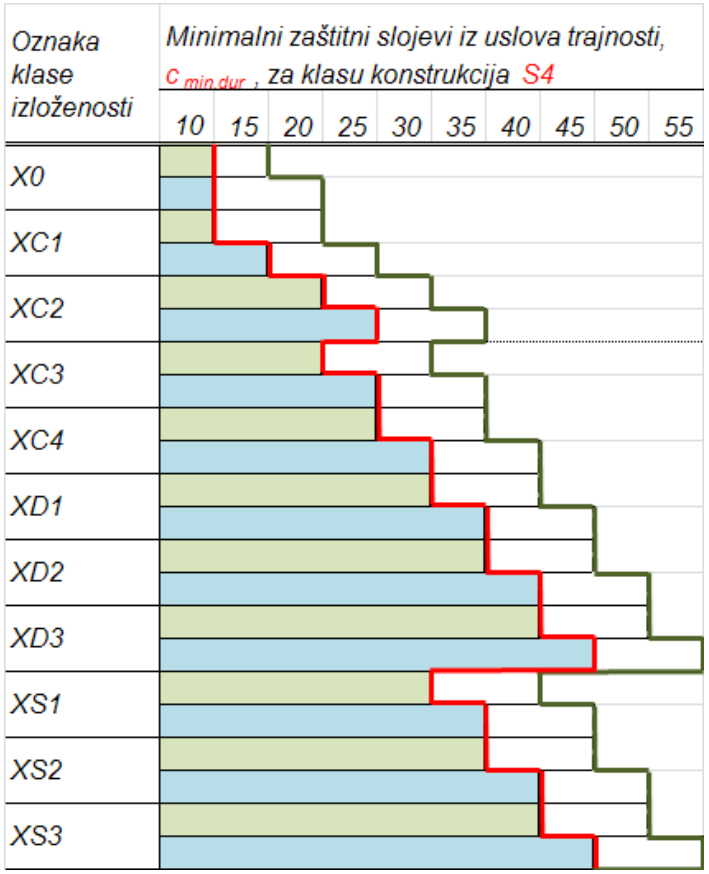
C25/30 ⇒ $f_{cd} = 0.85 \cdot 25/1.5 = 14.2 MPa = 1.42 kN/cm^2$

B500 B ⇒ $f_{yd} = 500/1.15 = 435 Mpa = 43.5 kN/cm^2$

Zadatak 16– CENTRIČNO ZATEZANJE

$$b \geq 2c_{nom} + 2\varnothing_s + m\times\varnothing + (m-1)\times a_H$$
$$h \geq 2c_{nom} + 2\varnothing_s + n\times\varnothing + (n-1)\times a_V$$





XD1 => c_{nom} = 35 +10 = 45 mm

Pretp. => $\varnothing_s$ = 8 mm

Zadatak 16 – **CENTRIČNO ZATEZANJE**

Granična sila zatezanja:

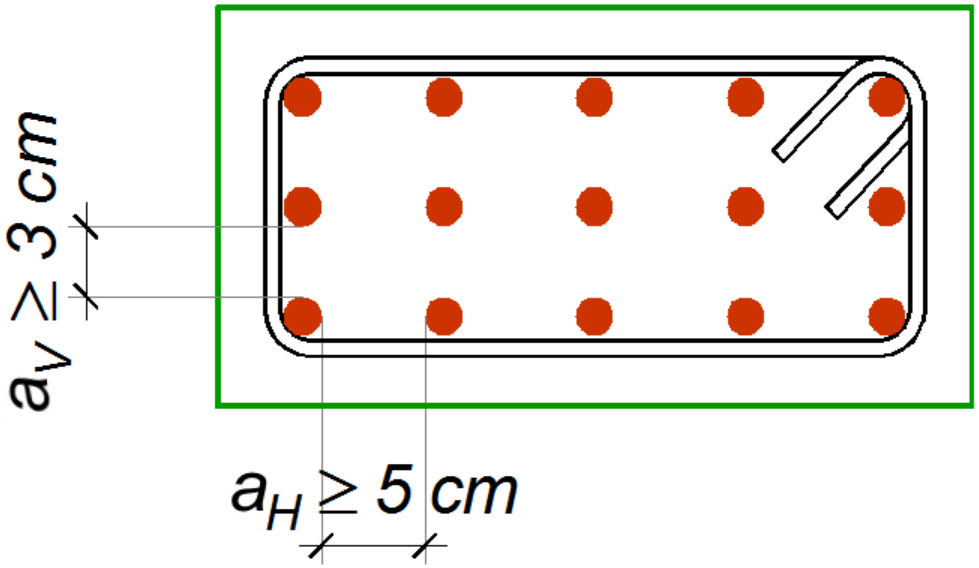
$$N_{Ed} = 1.35 \cdot (-400) + 1.5 \cdot (-500) = -1290 kN$$

$$A_{S1} = \frac{N_{Ed}}{f_{yd}} = \frac{1290}{43.5} = 29.7 cm^2$$

Usvojeno: 15Ø16 (30.15 cm^2)

Zadatak 16 – CENTRIČNO ZATEZANJE

$$b \geq 2c_{nom} + 2Ø_s + m \times Ø + (m-1) \times a_H$$
$$h \geq 2c_{nom} + 2Ø_s + n \times Ø + (n-1) \times a_V$$



$b \geq 2\times4.5 + 2\times0.8 + 5\times1.6 + (5-1)\times5.0 = 38.6$ cm $\Rightarrow$ b = 40 cm

$h \geq 2\times4.5 + 2\times0.8 + 3\times1.6 + (3-1)\times3.0 = 21.4$ cm $\Rightarrow$ h = 25 cm

Zadatak 16 – CENTRIČNO ZATEZANJE