

DIMENZIONISANJE CENTRIČNO PRITISNUTIH ELEMENATA

-MALI EKSCENTRICITET-

(bez uticaja izvijanja)

Zadatak

Dimenzionisati presek (stub) pravougaonog oblika dimenzije $b/h = 30/40$ cm u kojem deluju eksploatacioni uticaji od stalnog i promenljivog dejstva.

$$M_G = 95 \text{ kNm}; N_G = 280 \text{ kN}$$

$$M_Q = 95 \text{ kNm}; N_Q = 280 \text{ kN}$$

Karakteristike materijala:

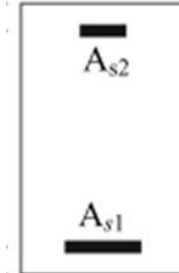
$$C30/37 \Rightarrow f_{cd} = \alpha_{cc} \cdot \frac{f_{ck}}{\gamma_c} = 0.85 \cdot \frac{30}{1.5} = 17 \text{ MPa} = 1.7 \frac{\text{kN}}{\text{cm}^2}$$

$$B500B \Rightarrow f_{yd} = \frac{f_{yk}}{\gamma_s} = \frac{500}{1.15} = 434.78 \text{ MPa} = 43.48 \frac{\text{kN}}{\text{cm}^2}$$

$$C_{nom} = 3 \text{ cm}$$

$$\text{simetrično armiranje: } \frac{A_{s2}}{A_{s1}} = 1.0$$

A_{s1} -površina armature u donjoj zoni preseka,
 A_{s2} - površina armature u gornjoj zoni preseka



Razmatrane kombinacije graničnih uticaja

1) nepovoljno dejstvo:

$$M_{Ed} = 1.35 \cdot M_G + 1.5 \cdot M_Q = 270.75 \text{ kNm}$$

$$N_{Ed} = 1.35 \cdot N_G + 1.5 \cdot N_Q = 798.0 \text{ kN}$$

2) povoljno dejstvo:

$$M_{Ed} = 1.0 \cdot M_G + 1.5 \cdot M_Q = 237.5 \text{ kNm}$$

$$N_{Ed} = 1.0 \cdot N_G + 1.5 \cdot N_Q = 700.0 \text{ kN}$$

pretpostavljeno: $\frac{d_1}{h} = 0.10$ tj. $d_1 = 0.1h \rightarrow d_1 = 4 \text{ cm}$

1) za nepovoljno dejstvo:

$$\left. \begin{aligned} m_{Ed} &= \frac{M_{Ed}}{b \cdot h^2 \cdot f_{cd}} = \frac{270,75 \cdot 10^2}{30 \cdot 40^2 \cdot 1,7} = 0.3318 \\ n_{Ed} &= \frac{N_{Ed}}{b \cdot h \cdot f_{cd}} = \frac{798,0}{30 \cdot 40 \cdot 1,7} = 0.3912 \end{aligned} \right\} \Rightarrow \begin{aligned} &\text{simetricno armiranje: } \frac{A_{s2}}{A_{s1}} = 1.0 \\ &\text{sa interacionog dijagrama. } \rightarrow \omega^I_1 = 0.27(\text{str.3}) \end{aligned}$$

2) za povoljno dejstvo:

$$\left. \begin{aligned} m_{Ed} &= \frac{M_{Ed}}{b \cdot h^2 \cdot f_{cd}} = \frac{237,5 \cdot 10^2}{30 \cdot 40^2 \cdot 1,7} = 0.2910 \\ n_{Ed} &= \frac{N_{Ed}}{b \cdot h \cdot f_{cd}} = \frac{700}{30 \cdot 40 \cdot 1,7} = 0.3431 \end{aligned} \right\} \Rightarrow \begin{aligned} &\text{simetricno armiranje: } \frac{A_{s2}}{A_{s1}} = 1.0 \\ &\text{sa interacionog dijagrama. } \rightarrow \omega^II_1 = 0.22(\text{str.3}) \end{aligned}$$

$\omega^I_1 > \omega^II_1 \rightarrow$ Merodavno je nepovoljno dejstvo.

Dimenzionisanje:

$$A_{s1} = \omega_1 \cdot \frac{f_{cd}}{f_{yd}} \cdot b \cdot h = 0.27 \cdot \frac{17.0 \text{MPa}}{434.78 \text{MPa}} \cdot 30 \text{cm} \cdot 40 \text{cm} = 12.67 \text{cm}^2$$

$$\omega_2 = \frac{A_{s2}}{A_{s1}} \cdot \omega_1 = 1.0 \cdot 0.27 = 0.27$$

$$A_{s2} = \omega_2 \cdot \frac{f_{cd}}{f_{yd}} \cdot b \cdot h = 0.27 \cdot \frac{17.0}{434.78} \cdot 30 \cdot 40 = 12.67 \text{cm}^2$$

usvaja se $\pm 7R\emptyset 16 (\pm 14.07 \text{cm}^2)$

Znak \pm znači da se $7R\emptyset 16$ ugrađuje i u gornjoj i u donjoj zoni preseka.

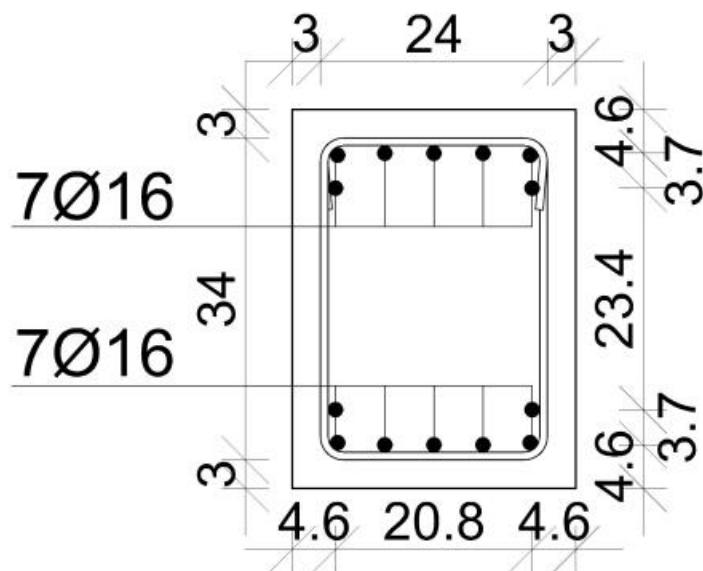
$$\left. \begin{aligned} A_{s,\min} &= \frac{0.1 \cdot N_{Ed}}{f_{yd}} \\ A_{s,\min} &= 0.002 \cdot b \cdot h \end{aligned} \right\} \max \leq A_s$$

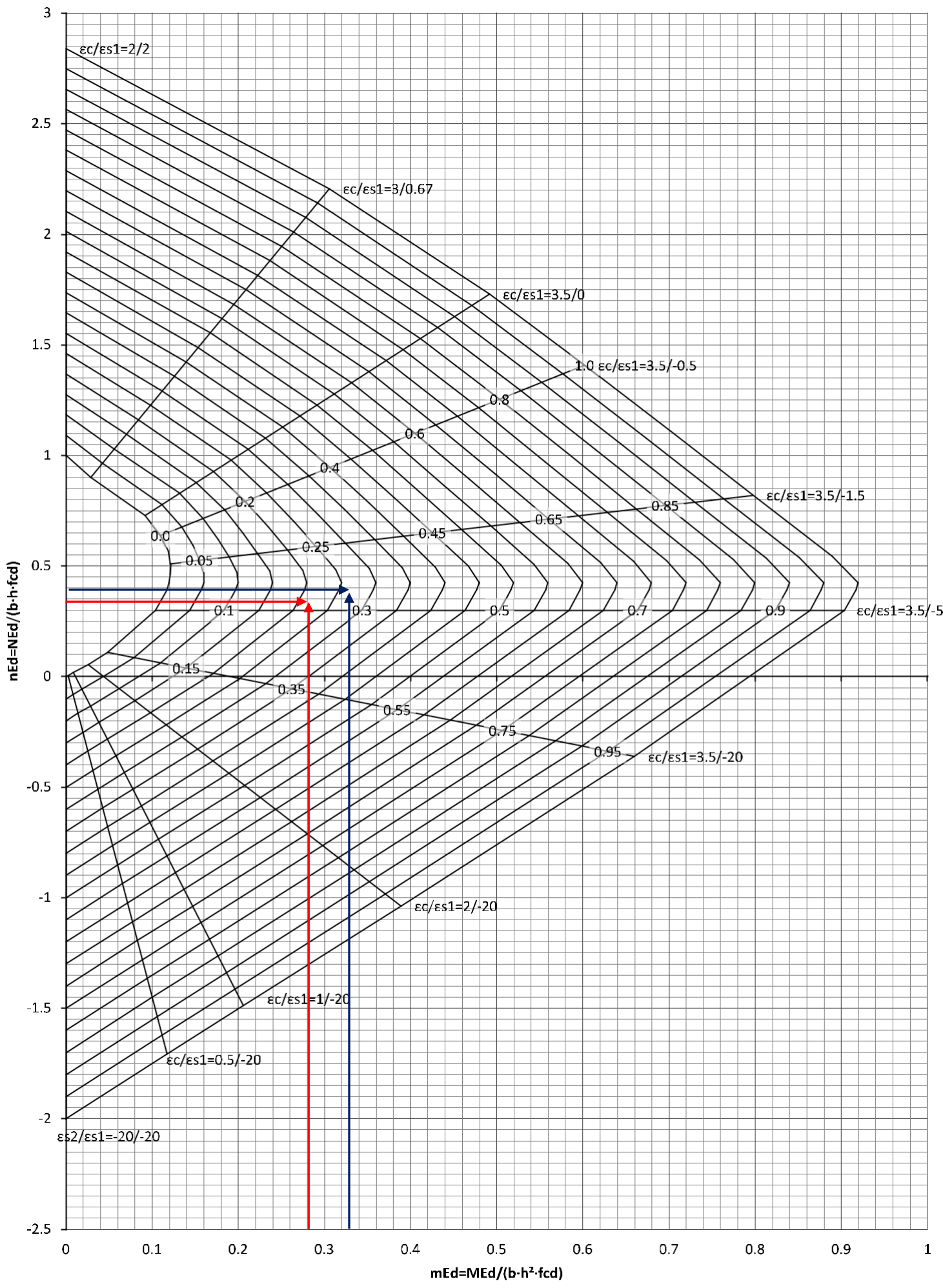
C30/37 $\rightarrow f_{ctm} = 2.9 \text{MPa}$ - srednja vrednost čvrstoće betona pri zatezanju (Tabela 3.1.- EC2)

$d = h - d_1 \rightarrow d = 40 - 4 = 36 \text{cm}$

$$\left. \begin{aligned} A_{s,\min} &= \frac{0.1 \cdot 798,0}{434,78} = 0,183 \text{cm}^2 \\ A_{s,\min} &= 0.002 \cdot 30 \cdot 40 = 2,40 \text{cm}^2 \end{aligned} \right\} \max \leq A_{s1}$$

$$A_{s1} = 12,67 \text{cm}^2 > A_{s,\min} = 2,40 \text{cm}^2$$





NAPOMENA:

U slučaju da se ω nalazi ispod dijagrama, onda se usvaja minimalna površina armature $A_{s,min}$

