

9.

$$l_1 = 500 \text{ cm}$$

$$\text{MB 40} \Rightarrow f_b = 25,5 \text{ MPa} = 2,55 \frac{\text{kN}}{\text{cm}^2}$$

$$l_2 = 560 \text{ cm}$$

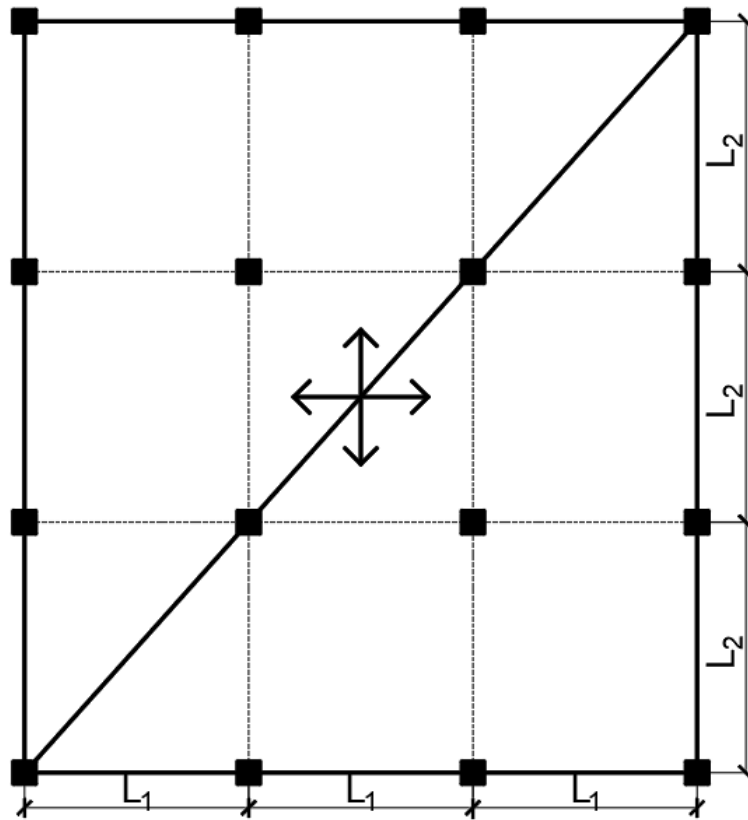
$$\text{B500Б} \Rightarrow \sigma_v = 500 \text{ MPa} = 50 \frac{\text{kN}}{\text{cm}^2}$$

$$c = 50 \text{ cm}$$

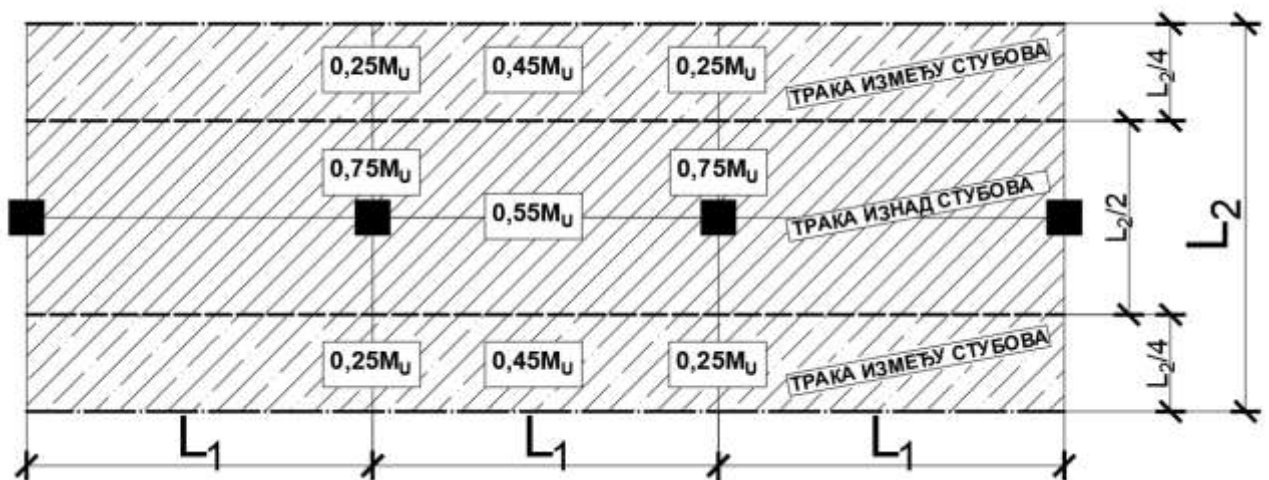
$$g = 5,50 \frac{\text{kN}}{\text{m}^2}$$

$$p = 1,50 \frac{\text{kN}}{\text{m}^2}$$

Агресивност средине је слаба  $\Rightarrow a_0 = 2,0 \text{ cm}$



### 1) Прорачунски модел



## 2) Анализа оптерећења

- стално оптерећење

$$g = 5,50 \frac{\text{kN}}{\text{m}^2}$$

- гранично оптерећење

$$q_U = 1,6 \cdot g + 1,8 \cdot p$$

$$q_U = 1,6 \cdot 5,50 + 1,8 \cdot 1,50 = 11,5 \frac{\text{kN}}{\text{m}^2}$$

**X – правац**

$$q_U^* = q_U \cdot l_2$$

$$q_U^* = 11,5 \cdot 5,6$$

$$q_U^* = 64,4 \frac{\text{kN}}{\text{m}}$$

- повремено оптерећење

$$p = 1,50 \frac{\text{kN}}{\text{m}^2}$$

**Y – правац**

$$q_U^* = q_U \cdot l_1$$

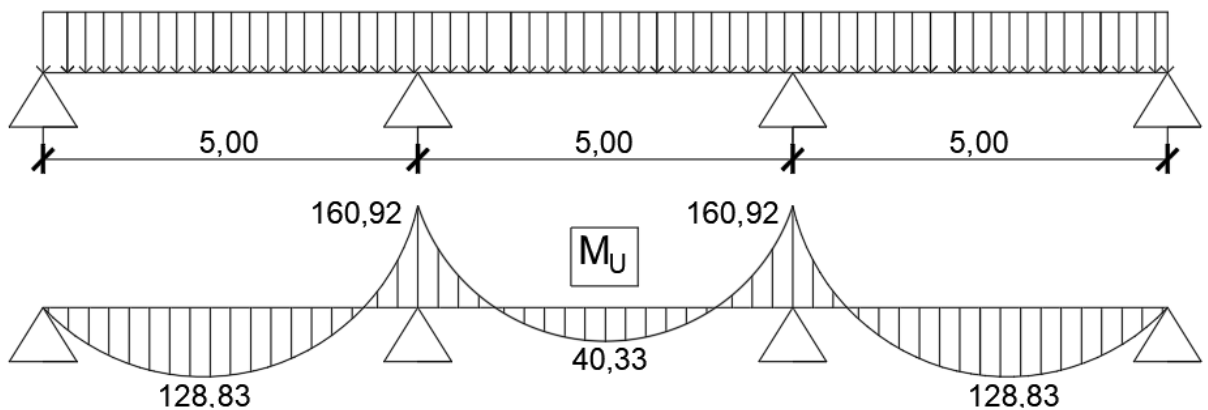
$$q_U^* = 11,5 \cdot 5,0$$

$$q_U^* = 57,5 \frac{\text{kN}}{\text{m}}$$

## 3) М утицаји

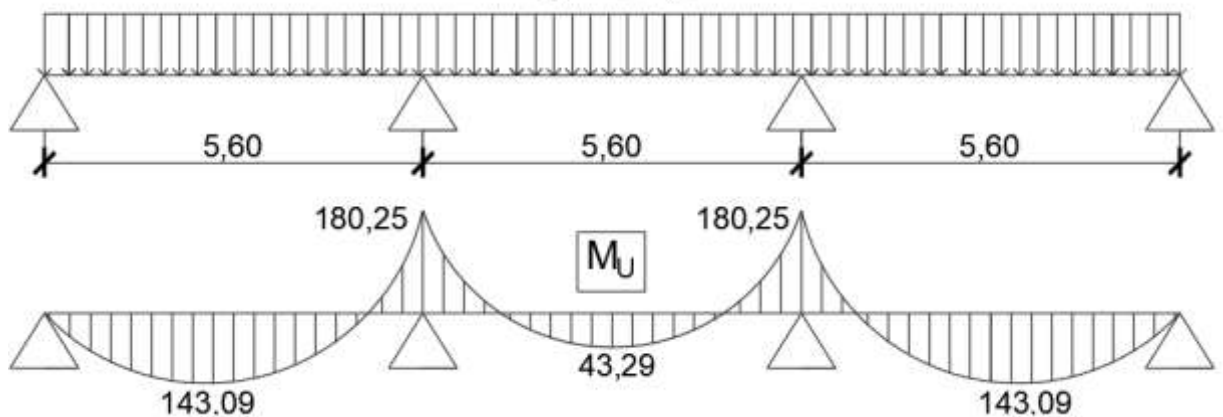
**X – правац**

$$q_U^* = 64,4$$



**Y – правац**

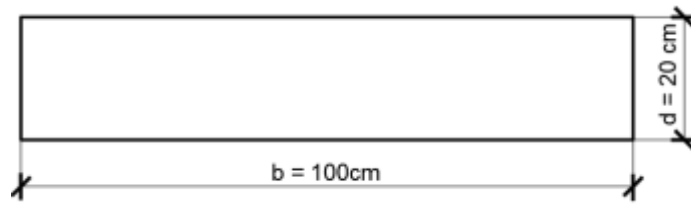
$$q_U^* = 57,5$$



#### 4) Димензионисање

-уважање дебљине плоче

$$d^{usv} = \frac{560}{35} = 16,0 \text{ cm} \Rightarrow d^{usv} = 20 \text{ cm}$$



X-правац

$$h_x = d - a_0 - \frac{\phi}{2} = 20 - 2 - \frac{1,4}{2} = 17,3 \text{ cm}$$

**ТРАКА ИЗНАД СТУБОВА**

-поље 1-2 (3-4)

$$\frac{0,55 \cdot M_U}{l_2/2} = \frac{0,55 \cdot 128,83}{5,6/2} = 25,31 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_u}{f_b \cdot b}}} \cdot \frac{17,3}{\sqrt{\frac{2531}{2,55 \cdot 100}}} = 5,491$$

$$k = 5,453$$

Очитано :  $\Rightarrow \bar{\mu} = 3,469 \%$  ,  $s = 0,087$ ;  $\epsilon_b = 0,950 \text{ ‰}$ ;  $\epsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_v} = 3,469 \cdot \frac{25,5}{500}$$

$$\mu = 0,18 \text{ \%} > \mu_{\min} = 0,1 \text{ \%} \Rightarrow \mu = 0,18 \text{ \%}$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,18 \cdot \frac{100 \cdot 17,3}{100} = 3,11 \text{ cm}^2$$

**Усвојено 10 ф 10 ( $A_a = 7,85 \text{ cm}^2$ )**

-поље 2-3

$$\frac{0,55 \cdot M_U}{l_2/2} = \frac{0,55 \cdot 40,33}{5,6/2} = 7,92 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_u}{f_b \cdot b}}} \cdot \frac{17,3}{\sqrt{\frac{792}{2,55 \cdot 100}}} = 9,816$$

$$k = 9,651$$

Очитано :  $\Rightarrow \bar{\mu} = 1,091 \%$  ,  $s = 0,048$ ;  $\epsilon_b = 0,500 \text{ ‰}$ ;  $\epsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_v} = 1,091 \cdot \frac{25,5}{500}$$

$$\mu = 0,06 \text{ \%} < \mu_{\min} = 0,10 \text{ \%} \Rightarrow \mu = 0,10 \text{ \%}$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,10 \cdot \frac{100 \cdot 17,3}{100} = 1,73 \text{ cm}^2$$

**Усвојено 10 ф 10 ( $A_a = 7,85 \text{ cm}^2$ )**

### -ослонац 2 (3)

$$\frac{0,75 \cdot M_U}{l_2/2} = \frac{0,75 \cdot 160,92}{5,6/2} = 43,10 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_u}{f_b \cdot b}}} \frac{17,3}{\sqrt{\frac{4310}{2,55 \cdot 100}}} = 4,208$$

$$k = 4,157$$

Очитано :  $\Rightarrow \bar{\mu} = 6,039 \%$  ,  $s = 0,117$ ;  $\varepsilon_b = 1,325 \text{ ‰}$ ;  $\varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_v} = 6,039 \cdot \frac{25,5}{500}$$

$$\mu = 0,31 \% > \mu_{\min} = 0,10 \% \Rightarrow \mu = 0,31 \%$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,31 \cdot \frac{100 \cdot 17,3}{100} = 5,36 \text{ cm}^2$$

Усвојено 10 ф 10 ( $A_a = 7,85 \text{ cm}^2$ )

### ТРАКА ИЗМЕЂУ СТУБОВА

#### -поље 1-2 (3-4)

$$\frac{0,45 \cdot M_U}{l_2/4} = \frac{0,45 \cdot M_U}{l_2/2} = \frac{0,45 \cdot 128,83}{5,6/2} = 20,70 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_u}{f_b \cdot b}}} \frac{17,3}{\sqrt{\frac{2070}{2,55 \cdot 100}}} = 6,072$$

$$k = 5,997$$

Очитано :  $\Rightarrow \bar{\mu} = 2,858 \%$  ,  $s = 0,078$ ;  $\varepsilon_b = 0,850 \text{ ‰}$ ;  $\varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_v} = 2,858 \cdot \frac{25,5}{500}$$

$$\mu = 0,15 \% > \mu_{\min} = 0,1 \% \Rightarrow \mu = 0,15 \%$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,15 \cdot \frac{100 \cdot 17,3}{100} = 2,60 \text{ cm}^2$$

Усвојено 10 ф 8 ( $A_a = 5,03 \text{ cm}^2$ )

#### -поље 2-3

$$\frac{0,45 \cdot M_U}{l_2/2} = \frac{0,45 \cdot 40,33}{5,6/2} = 6,48 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_u}{f_b \cdot b}}} \frac{17,3}{\sqrt{\frac{648}{2,55 \cdot 100}}} = 10,852$$

$$k = 10,641$$

Очитано :  $\Rightarrow \bar{\mu} = 0,896 \%$  ,  $s = 0,043$ ;  $\varepsilon_b = 0,450 \text{ ‰}$ ;  $\varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_v} = 0,896 \cdot \frac{25,5}{500}$$

$$\mu = 0,05 \% < \mu_{\min} = 0,10 \% \Rightarrow \mu = 0,10 \%$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,10 \cdot \frac{100 \cdot 17,3}{100} = 1,73 \text{ cm}^2$$

Усвојено 10 ф 8 ( $A_a = 5,03 \text{ cm}^2$ )

### -ослонац 2 (3)

$$\frac{0,25 \cdot M_U}{l_2/2} = \frac{0,25 \cdot 160,92}{5,6/2} = 14,37 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_u}{f_b \cdot b}}} \frac{17,3}{\sqrt{\frac{1437}{2,55 \cdot 100}}} = 7,288$$

$$k = 7,112$$

Очитано :  $\Rightarrow \bar{\mu} = 2,023 \% , \quad s = 0,065; \quad \varepsilon_b = 0,700 \text{ ‰}; \quad \varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_v} = 2,023 \cdot \frac{25,5}{500}$$

$$\mu = 0,103 \% > \mu_{\min} = 0,10 \% \Rightarrow \mu = 0,103 \%$$

$$Aa_1 = \mu \cdot \frac{b \cdot h}{100} = 0,103 \cdot \frac{100 \cdot 17,3}{100} = 1,78 \text{ cm}^2$$

Усвојено 10 ф 8 ( $Aa = 5,03 \text{ cm}^2$ )

### Y-правац

$$h_y = d - a_0 - \phi - \frac{\phi}{2} = 20 - 2 - 1,4 - \frac{1,4}{2} = 15,9 \text{ cm}$$

### ТРАКА ИЗНАД СТУБОВА

#### -поље 1-2 (3-4)

$$\frac{0,55 \cdot M_U}{l_1/2} = \frac{0,55 \cdot 143,09}{5,0/2} = 31,48 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_u}{f_b \cdot b}}} \frac{15,9}{\sqrt{\frac{3148}{2,55 \cdot 100}}} = 4,525$$

$$k = 4,496$$

Очитано :  $\Rightarrow \bar{\mu} = 5,143 \% , \quad s = 0,107; \quad \varepsilon_b = 1,200 \text{ ‰}; \quad \varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_v} = 5,143 \cdot \frac{25,5}{500}$$

$$\mu = 0,26 \% > \mu_{\min} = 0,1 \% \Rightarrow \mu = 0,26 \%$$

$$Aa_1 = \mu \cdot \frac{b \cdot h}{100} = 0,26 \cdot \frac{100 \cdot 15,9}{100} = 4,13 \text{ cm}^2$$

Усвојено 10 ф 10 ( $Aa = 7,85 \text{ cm}^2$ )

### -поље 2-3

$$\frac{0,55 \cdot M_U}{l_1/2} = \frac{0,55 \cdot 43,29}{5,0/2} = 9,52 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_U}{f_b \cdot b}}} \frac{15,9}{\sqrt{\frac{952}{2,55 \cdot 100}}} = 8,229$$

$$k = 8,169$$

Очитано :  $\Rightarrow \bar{\mu} = 1,528 \%$  ,  $s = 0,057$ ;  $\varepsilon_b = 0,600 \text{ ‰}$ ;  $\varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_V} = 1,528 \cdot \frac{25,5}{500}$$

$$\mu = 0,08 \% < \mu_{\min} = 0,1 \% \Rightarrow \mu = 0,1 \%$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,10 \cdot \frac{100 \cdot 15,9}{100} = 1,59 \text{ cm}^2$$

Усвојено 10 ф 10 ( $A_a = 7,85 \text{ cm}^2$ )

### -ослонац 2 (3)

$$\frac{0,75 \cdot M_U}{l_1/2} = \frac{0,75 \cdot 180,25}{5,0/2} = 54,08 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_U}{f_b \cdot b}}} \frac{15,9}{\sqrt{\frac{5408}{2,55 \cdot 100}}} = 3,453$$

$$k = 3,419$$

Очитано :  $\Rightarrow \bar{\mu} = 9,041 \%$  ,  $s = 0,147$ ;  $\varepsilon_b = 1,725 \text{ ‰}$ ;  $\varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_V} = 9,041 \cdot \frac{25,5}{500}$$

$$\mu = 0,46 \% > \mu_{\min} = 0,10 \% \Rightarrow \mu = 0,46 \%$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,46 \cdot \frac{100 \cdot 15,9}{100} = 7,31 \text{ cm}^2$$

Усвојено 10 ф 10 ( $A_a = 7,85 \text{ cm}^2$ )

### ТРАКА ИЗМЕЂУ СТУБОВА

#### -поље 1-2 (3-4)

$$\frac{0,45 \cdot M_U}{l_1/2} = \frac{0,45 \cdot 143,09}{5,0/2} = 25,76 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_U}{f_b \cdot b}}} \frac{15,9}{\sqrt{\frac{2576}{2,55 \cdot 100}}} = 5,003$$

$$k = 4,917$$

Очитано :  $\Rightarrow \bar{\mu} = 4,283 \%$  ,  $s = 0,097$ ;  $\varepsilon_b = 1,075 \text{ ‰}$ ;  $\varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_V} = 4,283 \cdot \frac{25,5}{500}$$

$$\mu = 0,22 \% > \mu_{\min} = 0,1 \% \Rightarrow \mu = 0,22 \%$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,22 \cdot \frac{100 \cdot 15,9}{100} = 3,50 \text{ cm}^2$$

Усвојено 10 ф 8 ( $A_a = 5,03 \text{ cm}^2$ )

### -поље 2-3

$$\frac{0,45 \cdot M_U}{l_1/2} = \frac{0,45 \cdot 43,29}{5,0/2} = 7,79 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_U}{f_b \cdot b}}} \frac{15,9}{\sqrt{\frac{779}{2,55 \cdot 100}}} = 9,097$$

$$k = 8,842$$

Очитано :  $\Rightarrow \bar{\mu} = 1,302 \% , \quad s = 0,052; \quad \varepsilon_b = 0,550 \text{ ‰}; \quad \varepsilon_a = 10 \text{ ‰}$

$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_V} = 1,302 \cdot \frac{25,5}{500}$$

$$\mu = 0,06 \% < \mu_{\min} = 0,10 \% \Rightarrow \mu = 0,10 \%$$

$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,10 \cdot \frac{100 \cdot 15,9}{100} = 1,59 \text{ cm}^2$$

Усвојено 10 ф 8 ( $A_a = 5,03 \text{ cm}^2$ )

### -ослонац 2 (3)

$$\frac{0,25 \cdot M_U}{l_1/2} = \frac{0,25 \cdot 180,25}{5,0/2} = 18,03 \text{ kNm}$$

$$k = \frac{h}{\sqrt{\frac{M_U}{f_b \cdot b}}} \frac{15,9}{\sqrt{\frac{1803}{2,55 \cdot 100}}} = 5,980$$

$$k = 5,849$$

Очитано :  $\Rightarrow \bar{\mu} = 3,007 \% , \quad s = 0,080; \quad \varepsilon_b = 0,875 \text{ ‰}; \quad \varepsilon_a = 10 \text{ ‰}$

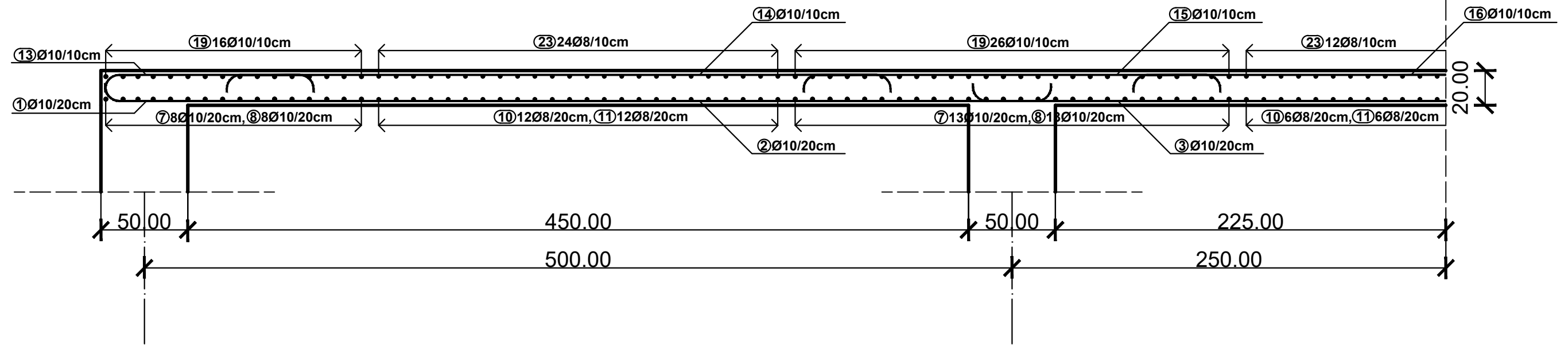
$$\mu = \bar{\mu} \cdot \frac{f_b}{\sigma_V} = 3,007 \cdot \frac{25,5}{500}$$

$$\mu = 0,15 \% > \mu_{\min} = 0,10 \% \Rightarrow \mu = 0,15 \%$$

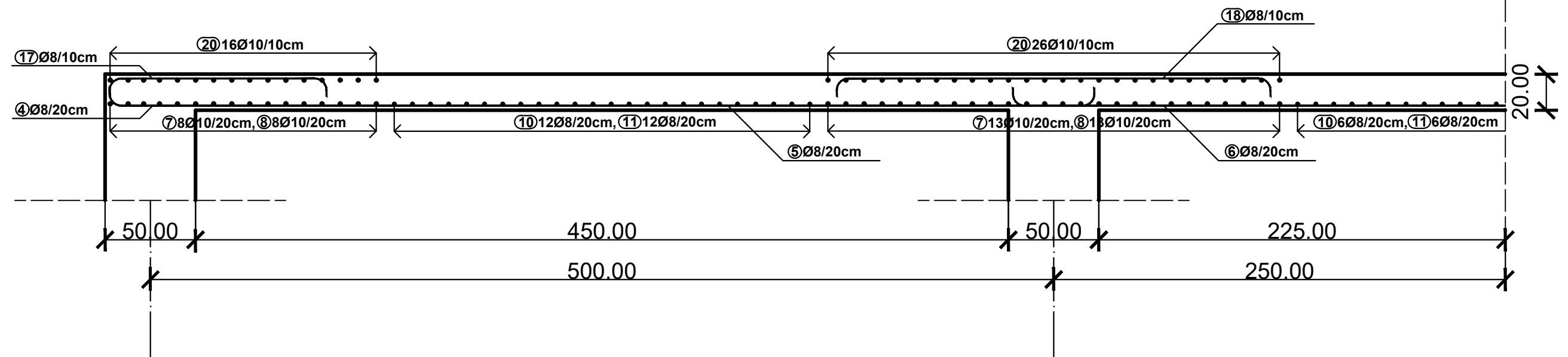
$$A_{a1} = \mu \cdot \frac{b \cdot h}{100} = 0,15 \cdot \frac{100 \cdot 15,9}{100} = 2,39 \text{ cm}^2$$

Усвојено 10 ф 8 ( $A_a = 5,03 \text{ cm}^2$ )

# A-A пресек изнад стубова

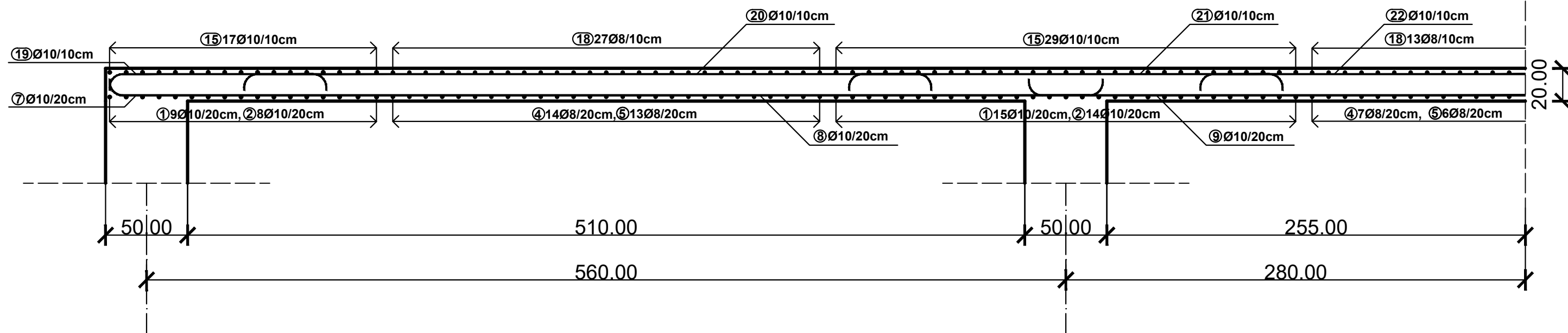


# B-B пресек између стубова

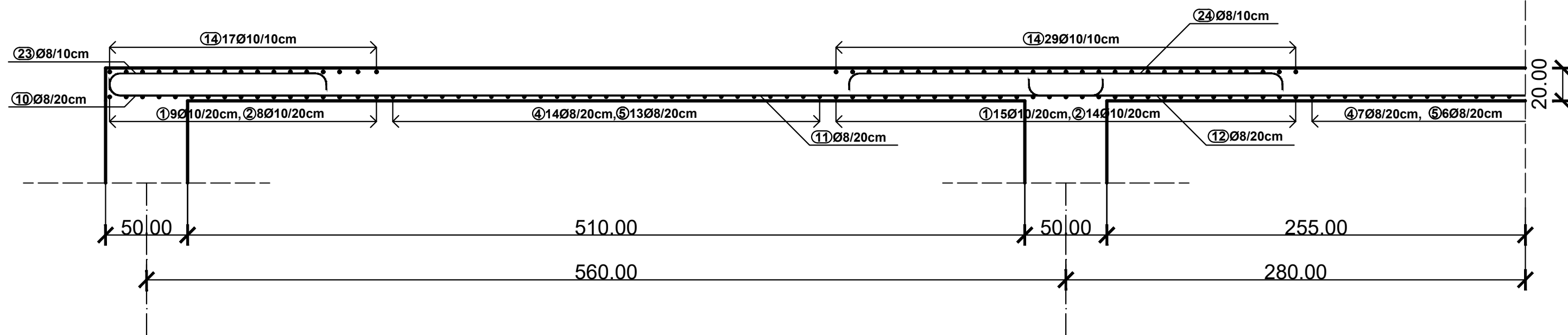




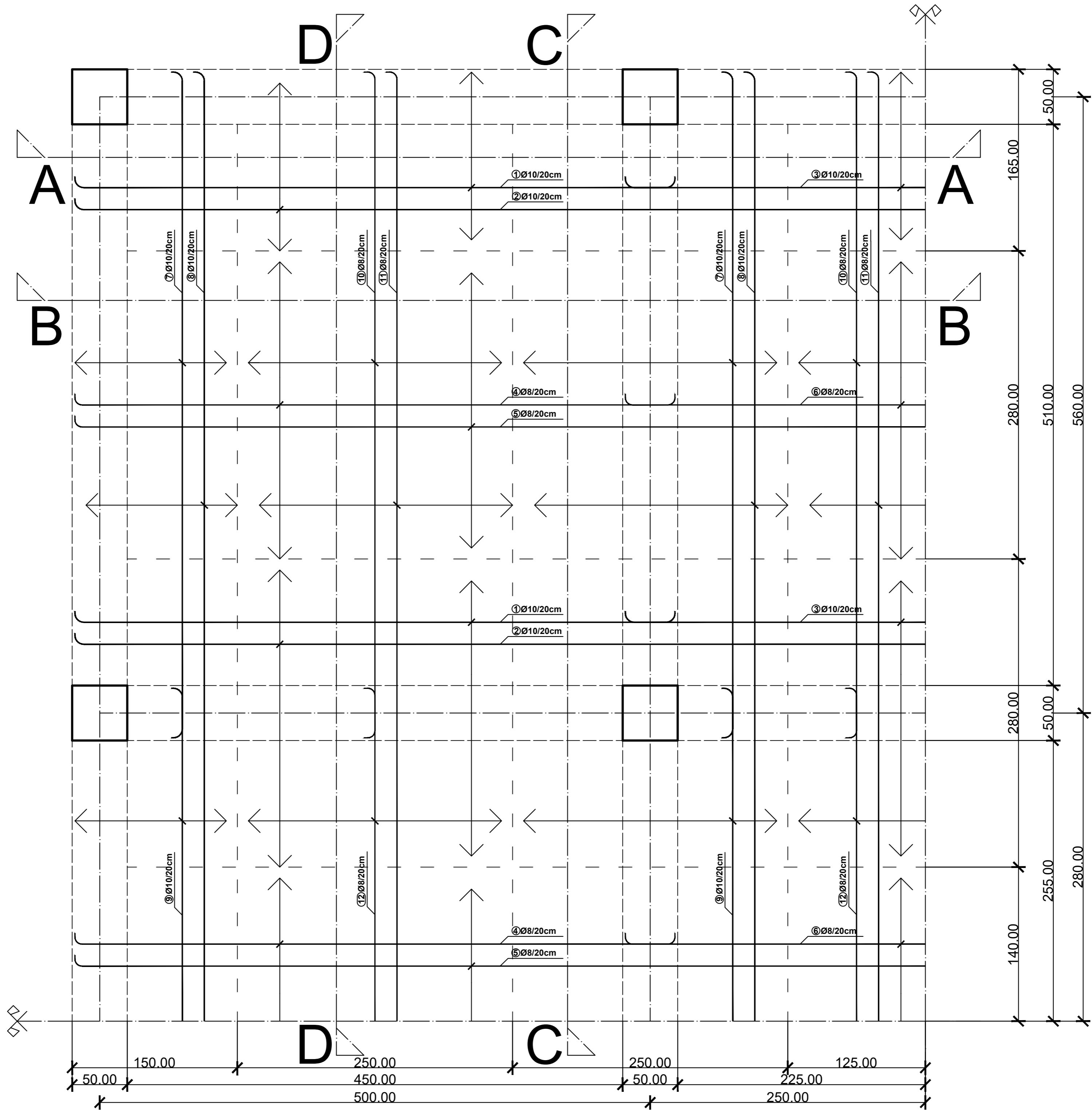
# C-C пресек изнад стубова



# D-D пресек између стубова



# ДОЊА ЗОНА



# ГОРЬБА ЗОНА

