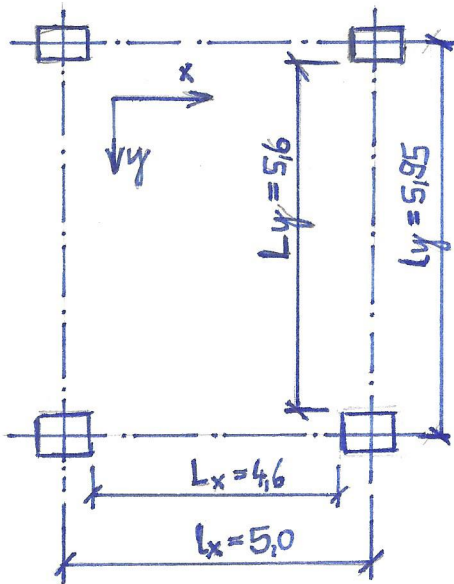


# PRELIMINARY DESIGN OF CONCRETE MEMBERS

## DESIGN OF SLAB THICKNESS



### DIMENSIONS

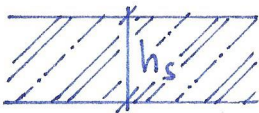
$$\left. \begin{array}{l} l_x = 5,0 \\ l_y = 5,95 \end{array} \right\} \text{AXIAL DISTANCES}$$

$$\left. \begin{array}{l} L_x = 4,6 \\ L_y = 5,6 \end{array} \right\} \text{CLEAR DISTANCES}$$

### MATERIAL

$$\begin{array}{lll} \text{CONCRETE C35/45:} & f_{ck} = 35 \text{ MPa} & f_{cd} = \frac{35}{1,5} = 23,333 \text{ MPa} \\ \text{STEEL B500B:} & f_{yk} = 500 \text{ MPa} & f_{pd} = \frac{500}{1,15} = 434,78 \text{ MPa} \end{array}$$

### CALCULATION



$$h_s \geq 160 \text{ mm}$$

$$h_s \geq 1,2 \cdot h_{s,min}$$

$$a) \quad h_s = \frac{l_y}{33} = \frac{5950}{33} = \underline{180 \text{ mm}}$$

$l_y$  ... LARGER AXIAL DISTANCE

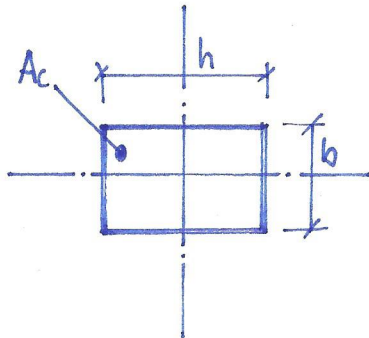
$$\begin{aligned} b) \quad h_{s,min} &= \frac{800 + 0,7 f_{yk}}{36 + 5 \epsilon_y} \cdot L_y = \\ &= \frac{800 + 0,7 \cdot 500}{36} \cdot 5,6 = 179 \text{ mm} \end{aligned}$$

$$h_s \geq 1,2 \cdot 179 = \underline{215 \text{ mm}}$$

$L_y$  ... LARGER CLEAR DISTANCE

# PRELIMINARY DESIGN OF CONCRETE MEMBERS

## DESIGN OF COLUMN DIMENSIONS



### LOADING

ROOF:

$$g_k = 9,906 \text{ kN/m}^2, q_k = 4 \text{ kN/m}^2$$

$$f_d = 1,35 \cdot 9,906 + 1,5 \cdot 4,000 = \underline{19,373 \text{ kN/m}^2}$$

FLOOR:

$$g_k = 8,532 \text{ kN/m}^2, q_k = 2,041 \text{ kN/m}^2$$

$$f_d = 1,35 \cdot 8,532 + 1,5 \cdot 2,041 = 14,580 \text{ kN/m}^2$$

$$\text{AND MASONRY } f_d = 14,58 + 63,484 / 20,625 = \underline{17,658 \text{ kN/m}^2}$$

### MATERIALS

CONCRETE C30/37:  $f_{ck} = 30 \text{ MPa}$   $f_{cd} = 20,00 \text{ MPa}$

STEEL B500B:  $f_{yk} = 500 \text{ MPa}$   $f_{yd} = 434,78 \text{ MPa}$

### CALCULATION

$$a) A_c = \sum_n [f_{id} \cdot A / (f_{cd} + \rho_s \cdot f_{yd})] =$$

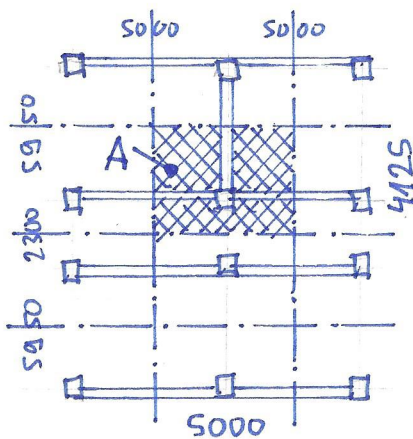
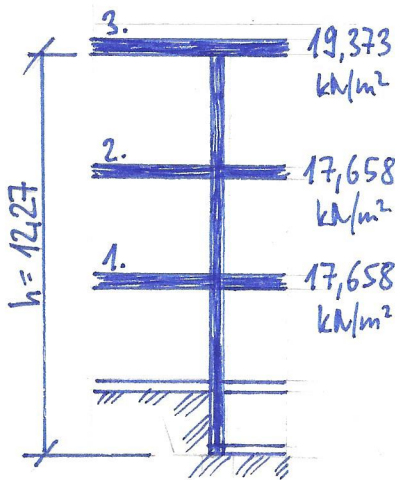
$$\begin{aligned} & 2 \cdot 17,658 \cdot 20,625 / (20,000 + 0,03 \cdot 434,783) + \\ & + 1 \cdot 19,373 \cdot 20,625 / (20,000 + 0,03 \cdot 434,783) = \\ & = 22,044 \cdot 10^{-3} + 12,092 \cdot 10^{-3} = 34,136 \cdot 10^{-3} \text{ m}^2 \end{aligned}$$

$$\Rightarrow \sqrt{A_c} = \underline{185 \text{ mm}}$$

### MASONRY WALL:

8,55 kN/m, 7,425 m

$$\Rightarrow 63,484 \text{ kN}$$



$$A = 20,625 \text{ m}^2$$

## PRELIMINARY DESIGN OF CONCRETE MEMBERS

$$b) A_c = \frac{N_{ed}}{f_{cd}} = a^2$$

CONCRETE  $\gamma = 24 \text{ kN/m}^3$

$$\begin{aligned} N_{ed} &= (2 \cdot 17,658 + 1 \cdot 19,373) \cdot 20,625 + \\ &\quad + A_c \cdot 24 \cdot 12,27 \cdot 1,35 = \\ &= 1127,961 + A_c \cdot 397,548 \end{aligned}$$

$$A_c = \frac{1127,961 + A_c \cdot 397,548}{20\,000}$$

$$A_c = 56,398 \cdot 10^{-3} + A_c \cdot 19,877 \cdot 10^{-3}$$

$$A_c = 57\,541 \text{ mm}^2 \Rightarrow \sqrt{A_c} = \underline{240 \text{ mm}}$$

### CONCLUSION

BY PRELIMINARY CALCULATION, THICKNESS OF THE SLAB WAS DESIGNED TO 250 mm AND DIMENSIONS OF COLUMNS TO 250 × 250 mm.

HOWEVER, AFTER CONSULTATION WITH STRUCTURAL ENGINEER SPECIALIZED IN CONCRETE CONSTRUCTIONS, THE DIMENSIONS OF COLUMNS WERE INCREASED TO 400 × 300 mm AND 400 × 400 mm DUE TO NEGLECTED BENDING MOMENTS BY STANDARD METHODS OF PRELIMINARY CALCULATION.