

### Reinforced concrete slabs:

Minimum thickness and axis distance of the reinforcement for different fire rates

Fire rate (min)	Minimum thickness of the slab $h_s$ (mm)	Axis distance of the reinforcement		
		Simply supported one way-slab	Continuous one-way slab Simply supported or continuous two-way slab $L_y/L_x \leq 1,5$	Simply supported two-way slab $1,5 < L_y/L_x \leq 2$
REI 30	60	10	10	10
REI 60	80	20	10	15
REI 90	100	30	15	20
REI 120	120	40	20	25
REI 180	180	55	30	40
REII 240	175	65	40	50

Minimum thickness of slab

$$\text{when } REI \leq 120 \text{ min } h_s = \left( 40 + \frac{2}{3} \cdot \frac{REI}{\text{min}} \right) \cdot \text{mm}$$

$$\text{when } 120 \leq REI \leq 240 \text{ min } h_s = \left( 60 + 0,5 \cdot \frac{REI}{\text{min}} \right) \cdot \text{mm}$$

### Reinforced concrete beams:

The minimum widths  $b_{\min}$  of reinforced concrete beams and mean axis distance  $a$  [mm] of reinforcement for different fire rates

	REI 30	REI 60	REI 90	REI 120	REI 180	REI 240
Simply supported	$b_{\min} = 80$ $a = 25$	$b_{\min} = 120$ $a = 40$	$b_{\min} = 150$ $a = 55$	$b_{\min} = 200$ $a = 65$	$b_{\min} = 240$ $a = 80$	$b_{\min} = 280$ $a = 90$
	$b = 120$ $a = 20$	$b = 160$ $a = 35$	$b = 200$ $a = 45$	$b = 240$ $a = 60$	$b = 300$ $a = 70$	$b = 350$ $a = 80$
	$b = 160$ $a = 15$	$b = 200$ $a = 30$	$b = 300$ $a = 40$	$b = 300$ $a = 55$	$b = 400$ $a = 65$	$b = 500$ $a = 75$
	$b \geq 200$ $a = 15$	$b \geq 300$ $a = 25$	$b \geq 400$ $a = 35$	$b \geq 500$ $a = 50$	$b \geq 600$ $a = 60$	$b \geq 700$ $a = 70$
Continuous	$b_{\min} = 80$ $a = 15$	$b_{\min} = 120$ $a = 25$	$b_{\min} = 150$ $a = 35$	$b_{\min} = 200$ $a = 45$	$b_{\min} = 240$ $a = 60$	$b_{\min} = 280$ $a = 75$
	$b \geq 160$ $a = 12$	$b \geq 200$ $a = 12$	$b \geq 250$ $a = 25$	$b = 300$ $a = 35$	$b = 400$ $a = 50$	$b = 500$ $a = 60$
				$b = 450$ $a = 35$	$b = 550$ $a = 50$	$b = 650$ $a = 60$
				$b \geq 500$ $a = 30$	$b \geq 600$ $a = 40$	$b \geq 700$ $a = 50$
Web width of I-beam $b_w$ (class WC)	80	100	100	120	140	160

If the reinforcement is in one layer the axis distance of the corner bars  $a_{sd} = a + 10$  mm

$$\text{The area of the concrete under the hole } A_c \geq 2 \cdot b_{\min}^2$$

$$\text{The height under the hole must be at least } h_r \geq \frac{2 \cdot b_{\min}^2}{b}$$

**Reinforced concrete columns:**

The minimum side dimensions  $b$  [mm] of reinforced concrete columns / axis distance  $a$  [mm] for different fire rates

Fire exposure to more than one side

Method A

	$b_{\min} / a$		
	Utilization degree under fire		
	$\mu_{Fi} = \frac{N_{Ed,Fi}}{N_{Rd}}$		
Fire rate [min]	$\mu_{Fi} = 0,2$	$\mu_{Fi} = 0,5$	$\mu_{Fi} = 0,7$
REI 30	200 / 25	200 / 25	200 / 32 300 / 27
REI 60	200 / 25	200 / 36 300 / 31	250 / 46 350 / 40
REI 90	200 / 31 300 / 25	300 / 45 400 / 38	350 / 53 450 / 40
REI 120	250 / 40 350 / 35	350 / 45 450 / 40	350 / 57 450 / 51
REI 180	350 / 45	350 / 63	450 / 70
REI 240	350 / 61	450 / 75	-

Usually the utilization degree  $\mu_{Fi}=0,7$  can be used