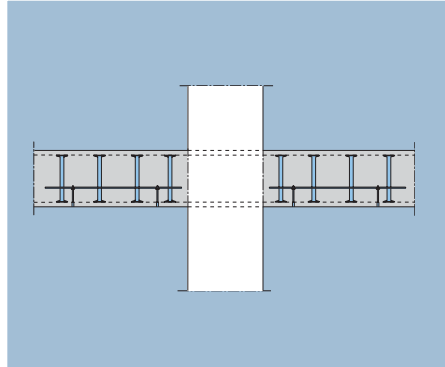
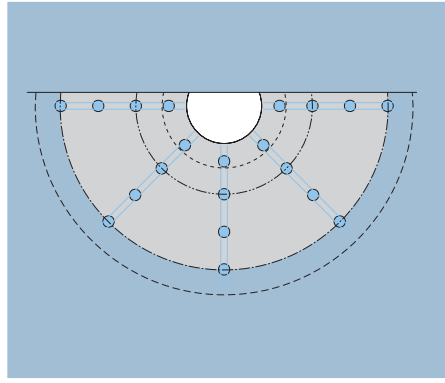
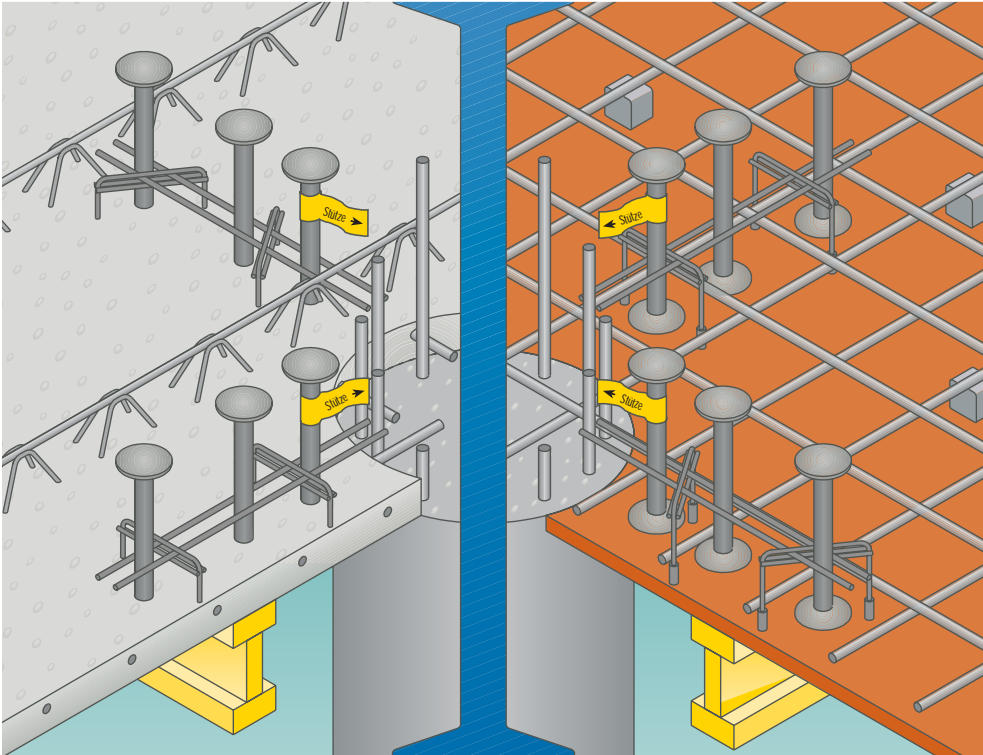


# TECHNICAL INFORMATION SCHÖCK BOLE®



# THE SCHÖCK BOLE® PUNCHING SHEAR REINFORCEMENT SYSTEM



## Schöck BOLE® on the construction site...

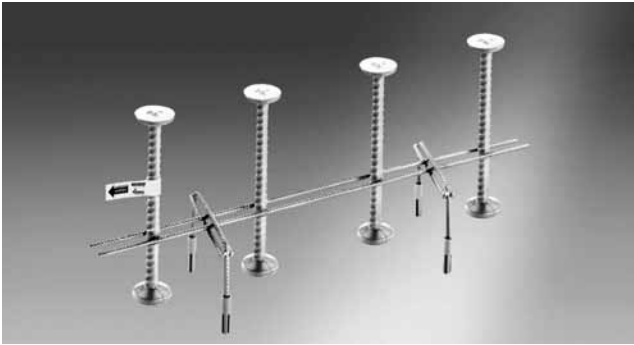
- ▶ Simple to install
- ▶ Installation between bottom and top mats without displacement of reinforcement
- ▶ Shear Stud Rail comes complete and ready to install
- ▶ Accurate positioning due to variable positioning capability of the adjustable support
- ▶ With incorporated spacers, the adjustable support ensure specified cover.

## ...and in the precasting plant

- ▶ Quick and easy to install
- ▶ The Schöck BOLE® is installed at the penultimate stage, just before pouring
- ▶ No interference with normal running time
- ▶ Accurate positioning due to variable positioning capability of the adjustable support
- ▶ Stable positioning on the formwork



## OUR SOLUTIONS TO YOUR PROBLEMS



### ► BOLE®-standard

Installation: between bottom and top mats

- Specified cover assured due to integrated spacers
- High check reliability
- Ready to install

For use on the construction site and in prefabricating plants

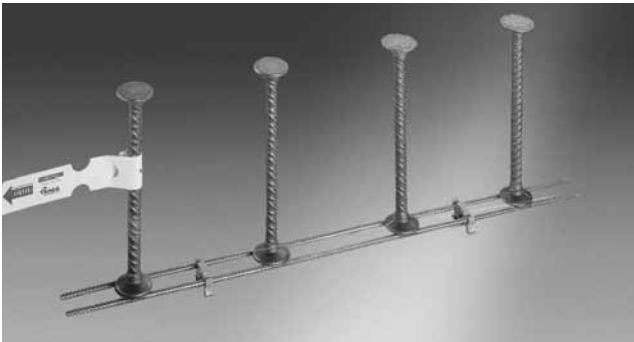


### ► BOLE®-O

Installation: after laying the complete reinforcement

- Analogous to other well known systems
- Slightly higher level of 'hands on' necessary
- Delivered ready to install

For use on the construction site

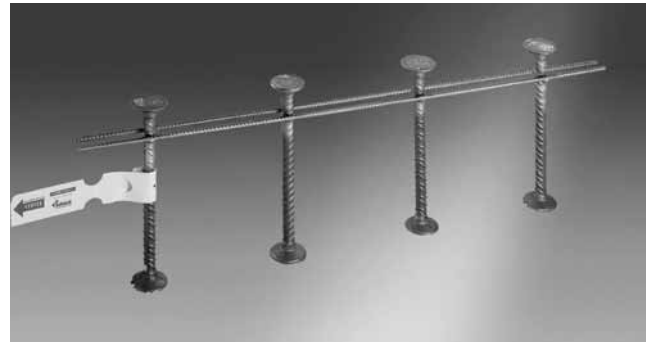


### ► BOLE®-U

Installation: prior to laying the reinforcement with special spacers

- Analogous to other well known systems
- 'Clip-on' free spacers
- Concrete cover from 20 - 35 mm

For use on the construction site and in prefabricating plants



### ► BOLE®-G

Installation: In precasting plants after laying the complete reinforcement.

- Simple to install, just seat on mat supports
- No extra work necessary when dismantling shuttering
- Delivered ready to install

For use in prefabricating plants

# PLANNING & ADVICE SERVICE

The engineers in the Schöck Application Technology Department are ready to help you with your design and construction questions. Our answers come complete with plans, project solutions and detailed equations.

Please send your design, requirements, etc and the proposed site address to:

Schöck Bauteile GmbH  
Vimbucher Straße 2  
D-76534 Baden-Baden



+49/7223/967-144



+49/7223/967-470



export@schoeck.com



www.schoeck.com

For your further assistance the Schöck CD-ROM has all the necessary data to help you achieve the optimum economic and design solutions relating to the Schöck Bole® system.

The contents and advantages of the CD-ROM on the following page.



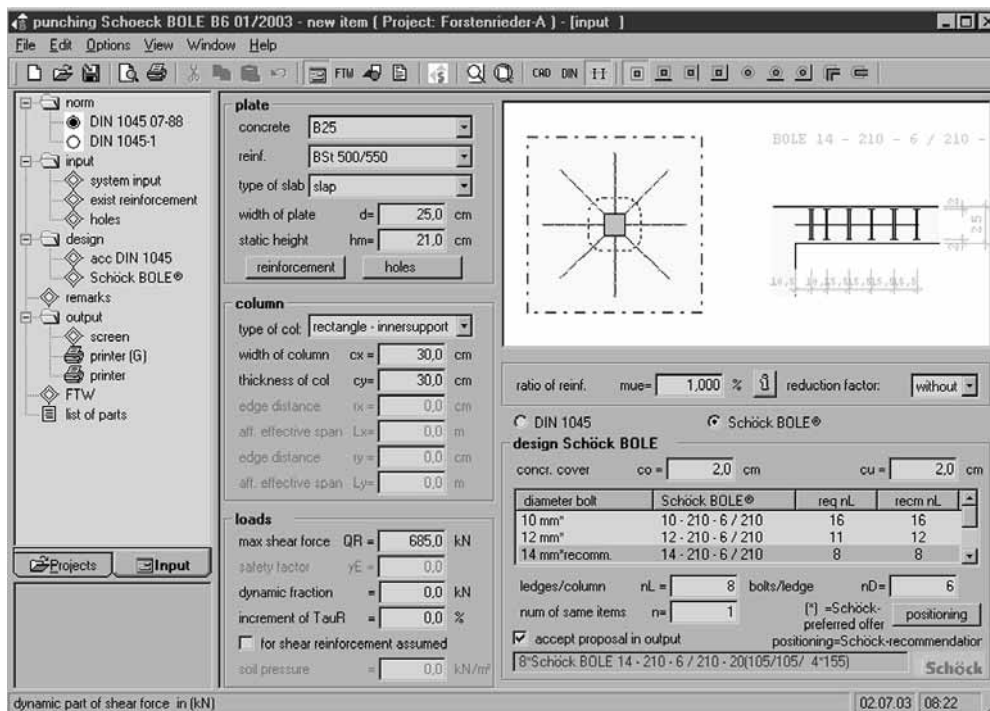
# Schöck BOLE®

## Calculation programme



The calculation programme helps you to work out your punching shear reinforcement requirements as regards flat slabs and foundation. Special features include:

- ▶ Input and output (end result) on one screen, for easy overview
- ▶ Re-calculation at every stage is possible, allowing you to work out multiple scenario's
- ▶ Extra comparison available with DIN 1045(88) i.e DIN 1045-1 as base complete with support head reinforcement.
- ▶ Reference section with sequential cross reference section for stud rails, support geometry, zoom and search function and export compatibility with CAD-programmes.
- ▶ Measurement of the Schöck BOLE® use in prefabricated slabs, taking into account mesh/mat and shear force bearing elements and all connecting shear/transverse force formulae, including those outside the immediate areas.



Please send me the calculation programme as CD-ROM for the Schöck BOLE® reinforcement system

Company: \_\_\_\_\_

Contact person: \_\_\_\_\_

Street: \_\_\_\_\_

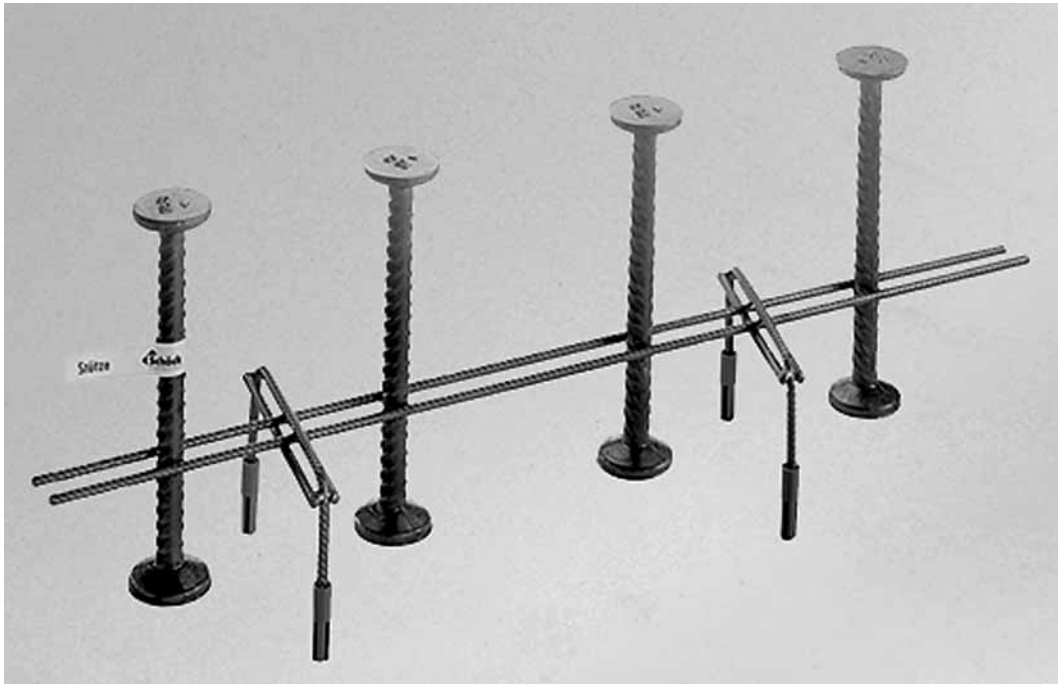
City: \_\_\_\_\_

Post/zip code: \_\_\_\_\_

Phone and fax nr.: \_\_\_\_\_

E-mail: \_\_\_\_\_

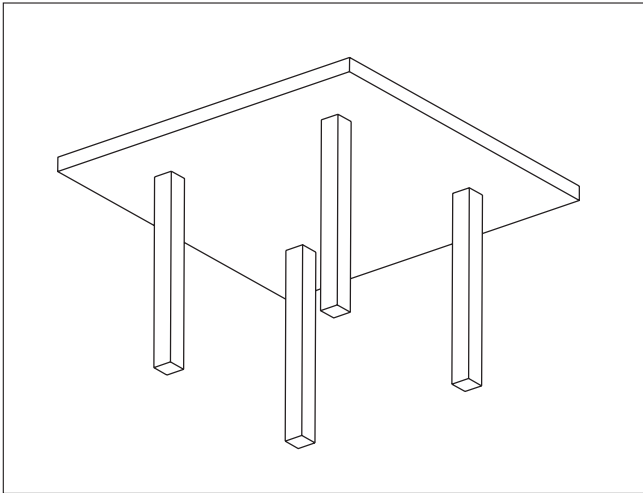




Schöck BOLE® 16-230-4/240

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Calculation example .....	16 - 19
Installation on site .....	20
Installation in prefabricated slabs .....	21
Delivery programme .....	22
Recommendations .....	23
Reference projects .....	24 - 25

### Advantages in flat slabs



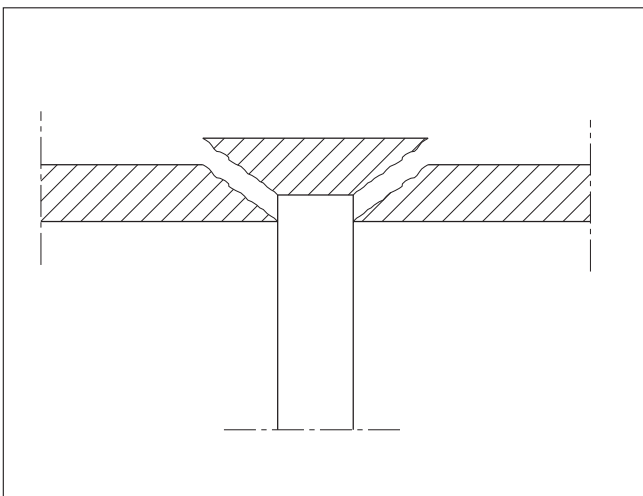
Flat slabs are concrete reinforced slabs which are not supported by downstand beams or wall, but only by columns.

Special plus points are:

- Minimisation of shuttering time
- Simplification of reinforcement work
- Ease of under slab work (e.g. air ducts)
- Minimisation of storey heights

Flat slabs are an economical form of floor construction. At the same time offering optimum use of space and unhindered extension possibilities.

### Punching failure in flat slabs

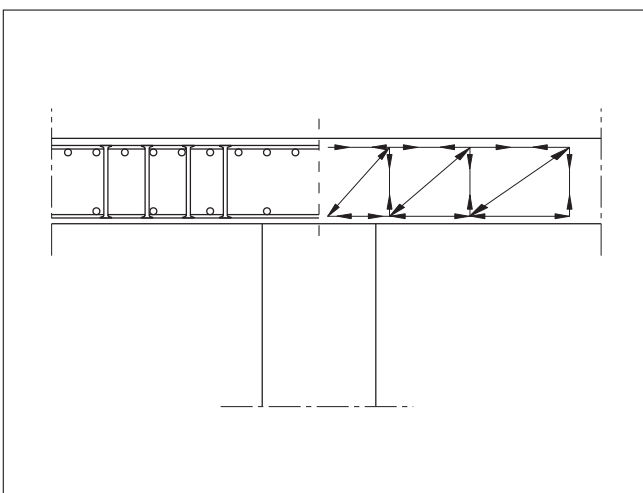


The risk of punching failure is often a determining factor when deciding the thickness of floors supported by columns.

Other options to consider when increasing the loads in the stress area are concrete quality, increasing the reinforcement content, enlarged columns head, etc.

The options detailed above are neither cost or time effective and often are not even capable of providing an improvement that justifies their use.

### The solution with Schöck BOLE®



The nature of Schöck BOLE's system prevents punching failure.

The two spacer rods which are welded to the vertical studs ensure the correct distance between uprights. The size of the studs heads also ensure a perfect finishing bond with the concrete.

Thus an increased shear force resistance of approx. 70 % can be achieved in comparison to the usual stirrup reinforcement system.

# Schöck BOLE®

A persuasive product

## Simple installation

The BOLE® reinforcement system is installed easily between bottom and top mats. The adjustable support stands make it very simple to insert and seat the BOLE® element through the matting directly onto the shuttering. The Schöck BOLE® system is delivered ready to install. No further assembly is necessary.

## Secure installation

The spacing of the studs is guaranteed exactly to your specifications. The specified cover is assured every time, due to the integrated spacers.

## Load absorption reliability

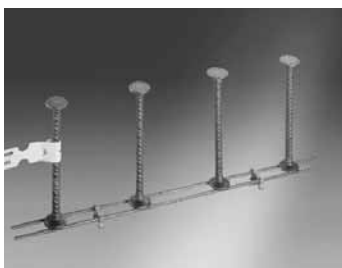
The double headed bolts guarantee an optimum and almost fail safe force transfer.

## Approved by the relevant construction authority

The Schöck BOLE® system is approved and recognised by the German Institute for Construction technology, Berlin nr. Z-15.1-178.



## Further types for special situations by request:



**Schöck BOLE®-U:**  
Position before laying lower reinforcement. Spacers are delivered loose.



**Schöck BOLE®-O:**  
Installation after laying the upper reinforcement.



**Schöck BOLE®-G:**  
Installation after laying the complete reinforcement in prefabricating plants by seating on mesh grid.

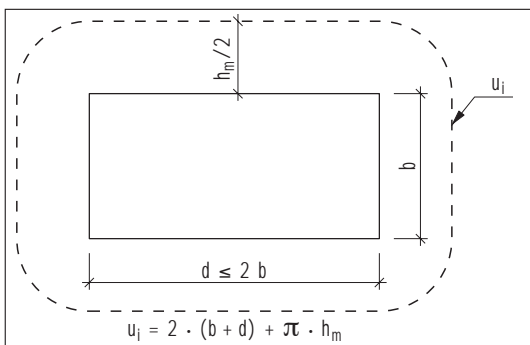
### Measurement methods

DIN 1045 (88) section 22.5 contains the methods needed to calculate the precautions necessary to prevent the punching shear effect in punctual supported flat slabs<sup>1)</sup>. If the calculable thrust force  $\tau_r$  in the radial area around the columns exceeds that of the permitted levels in DIN 1045 (88), then by using the Schöck BOLE® system the load bearing capability of the slab where the dowels are used can be increased.

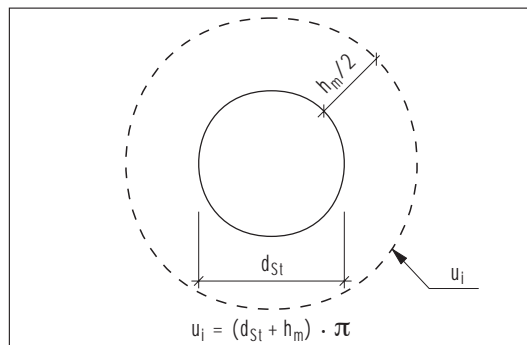
The measurement equations pertinent to the Schöck BOLE® system can be found in the general guidelines and allowable use of Schöck punching shear reinforcement, nr. Z-15.1-178. For verification and validation of the attainable protection against punching shear, the following mathematical factors must be determined <sup>1)2)</sup>:

- The greatest calculable punching shear force along the inner radial section ( $\tau_{r,ui}$ )
- The greatest calculable punching shear force along the outer radial section ( $\tau_{r,ua}$ )
- Estimation of the number of studs and their thickness
- Arrangement and order of studs according to rules contained within the guidelines

### Calculating punching shear $\tau_{r,ui}$ force along the inner radial section $u_i$



Right angled inner support



Circular inner support

Existing thrust  $\tau_{r,ui}$  :

$$\tau_{r,ui} = \frac{Q_r}{u_i \cdot h_m}$$

Equation:

$$\tau_{r,ui} \leq \kappa_2 \cdot \tau_{02} \quad \text{with} \quad \kappa_2 = 0,7 \cdot 1,4 \cdot \sqrt{\mu_g} \leq 1 \quad (\text{input } \mu_g \text{ in } \%)$$

Where:

$h_m$  Effective depth of slab in inner radial section, average from both directions

$Q_r$  Greatest shear force at edge of the inner radial section of the column

$\tau_{02}$  Permissible thrust according to DIN 1045(88) tab. 13

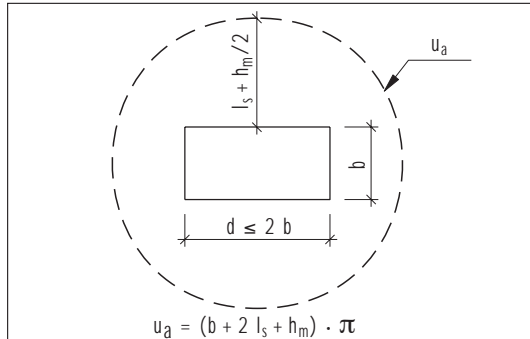
$\mu_g$  Degree of reinforcement according to DIN 1045 (88) 22.5.2

Further information on page 12.

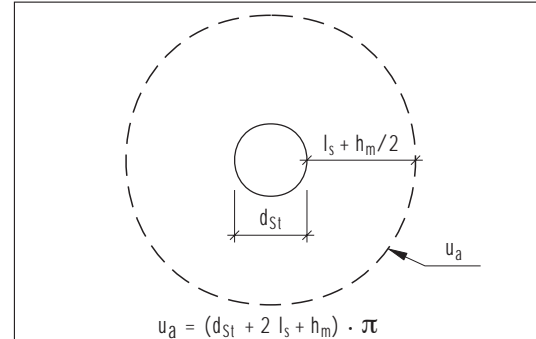
<sup>1)</sup> The equations necessary for evaluating the shear forces according to DIN 1045 (88) section 22.5 as well as for the Schöck BOLE® system allowable use tables can be worked out using the Schöck CD-ROM.

<sup>2)</sup> At the moment all producers of punching shear reinforcement use the benchmark DIN 1045 (88). As soon as DIN 1045-1 comes into force and is published in the DAFStb regulations, we will issue the formulae necessary to adjust, compensate and to allow for this.

Calculating shear forces  $\tau_{r,ua}$  along the outer radial section  $u_a$



Right angled inner support



Circular inner support

Existing punching shear force  $\tau_{r,ua}$  :

$$\tau_{r,ua} = \frac{Q_r}{u_a \cdot h_m}$$

Equation:

$$\tau_{r,ua} \leq \max \left\{ \begin{array}{l} \frac{1}{1 + 0,25 \cdot \frac{l_s}{h_m}} \cdot \kappa_1 \cdot \tau_{011} \\ \tau_{011} \end{array} \right.$$

Where:

$l_s$  Distance between supporting edge and middle line of the outer stud

$h_m$  Effective depth of slab in outer radial section, average from both directions

$Q_r$  Greatest shear force at the edge of the outer radial section

$\tau_{011}$  Permissible thrust force according to DIN 1045 (88), tab.13

$\kappa_1$  Proportional coefficient according to DIN 1045 (88) 22.5.2:  $\kappa_1 = 1,3 \cdot 1,4 \cdot \sqrt{\mu_g}$  (input  $\mu_g$  in %)

$\mu_g$  Degree of reinforcement according to DIN 1045 (88) 20.5.2

Equation:

Should the force limit  $\frac{1}{1 + 0,25 \cdot \frac{l_s}{h_m}} \cdot \kappa_1 \cdot \tau_{011}$  be so defined, then a validation for the thrust forces in slabs according

to DIN 1045(88) section 17.5 should be carried out. To take up the normal slab thrust extra anti thrust stirrups must then be used. To minimise this, the punching shear area over the distance  $l_s$  can be so determined that the force limit would be defined as  $\tau_{011}$ . Although the maximum value of  $l_s = 4 \cdot h_m$  must not be exceeded.

Further examples can be found in the section starting on page 12.

### Calculating the necessary amount of studs

In area „c“ (inside the critical radial section  $1,0 h_m$ )

Required number of studs: 
$$n_c = \frac{Q_r}{\text{perm. F}}$$

In area „d“ (outside area „c“ up to the edge of stud supported area)

Required number of stud: 
$$n_d = \frac{0,75 \cdot Q_r}{\text{perm. F}} \quad \text{for } 2,0 h_m < l_s \leq 4,0 h_m$$

$$n_d = \frac{0,5 \cdot Q_r}{\text{perm. F}} \quad \text{for } 1,0 h_m < l_s \leq 2,0 h_m$$

Where:

$Q_r$  Punching shear load

zul.F Permissible stud burden (see page 13)

$h_m$  Effective depth of slab in radial section. Average from both directions

$l_s$  Distance between support edge and middle line of the outermost studs

Further information can be found in the section starting on page 12.

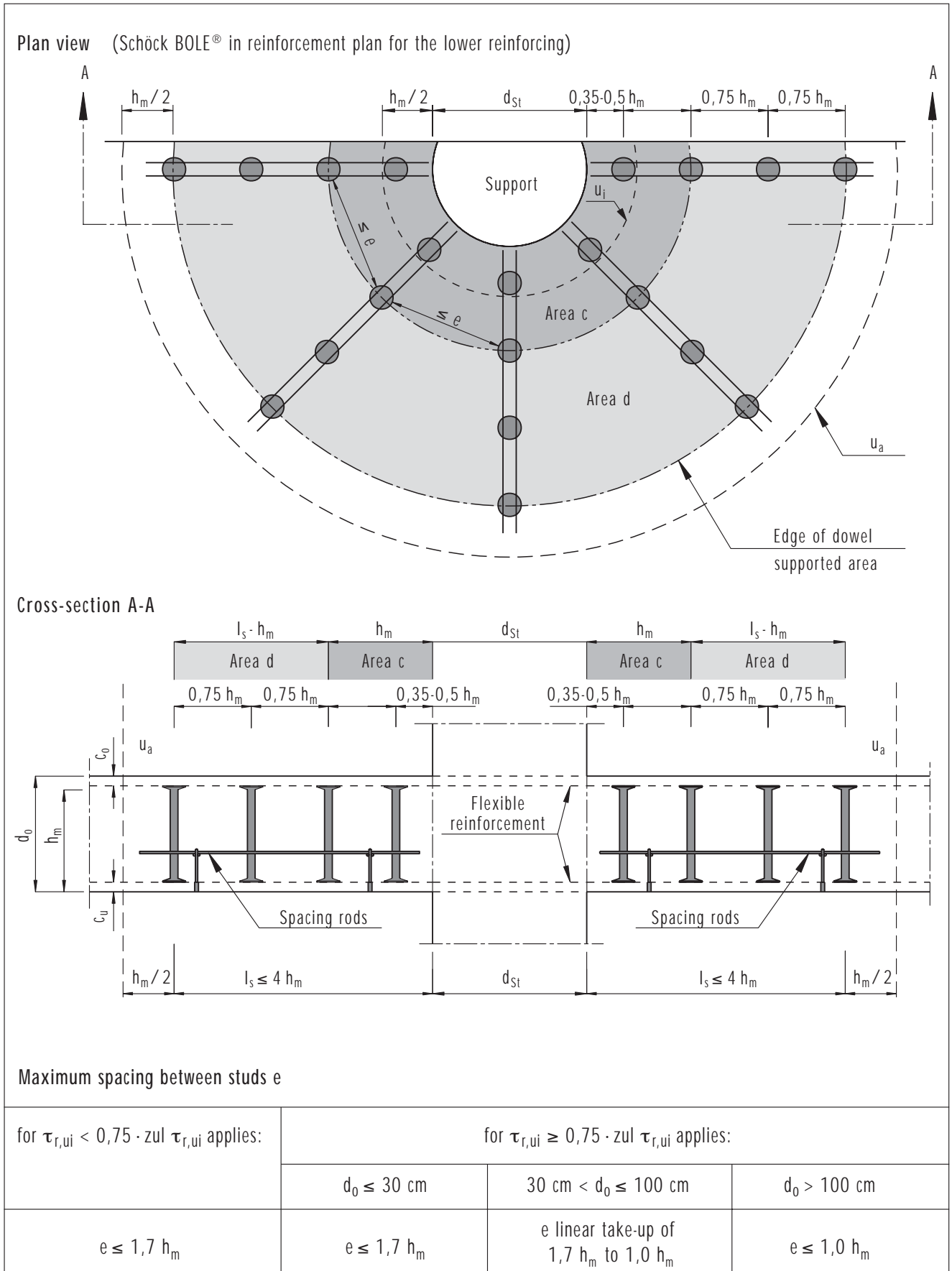
### Alignment of studs

in area „c“ (inside the critical radial section  $1,0 h_m$ )

- The thickness of the studs and the number of stud rails must be selected so that there are a minimum of two studs per rail.
- The distance between the supported edge and the first studs must be between  $0,35 h_m$  and  $0,5 h_m$ .
- The number of stud rails must be so calculated as to ensure the maximum stud spacing „e“ and the perimeter line „c“ is not exceeded (see following diagram).

In area „d“ (outside area „c“ and up to the edge of the dowel supported area)

- Stud thickness and amount of stud rails as in area „c“.
- The stud spacing may not exceed the maximum distance of  $0,75 h_m$  and must be laid over the  $(l_s - h_m)$  area.



Arrangement of Schöck BOLE® elements

## Calculating the input data

### Permissible thrust forces $\tau_{011}, \tau_{02}$

The calculation of the permissible thrust forces is done according to DIN 1045(88) tab. 13 cross matched with the necessary strength classification of the concrete to be used in the dowel rail reinforced slab.

Permissible thrust forces [N/mm <sup>2</sup> ]	Strength classification			
	B 25 (C 20/25)	B 35 (C 30/37)	B 45 (C 35/45)	B 55 (C 45/55)
$\tau_{011}$	0,50	0,60	0,70	0,80
$\tau_{02}$	1,80	2,40	2,70	3,00

### Punching shear load $Q_r$

The standard of punching shear load  $Q$  is the result of the maximum load borne by the slab.

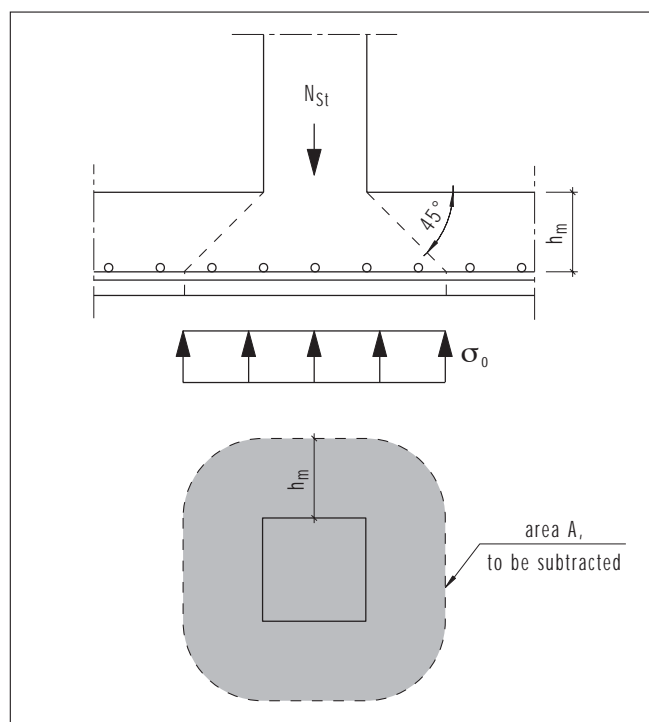
According to DIN 1045 (88), section 22.5.1 and the DAFStb. publication 240 the reaction of a non-rotational symmetrical load in the case of edge and corner support can be approximately extrapolated by using a standard formulae for increased load with an added 40 % (see pages 14 -15)

In the case of foundations and ground floor slabs, when working out the factor punching shear load  $Q$ , a calculable burden may be subtracted, that is, an amount equal to a 45° angle.(the load dispersion area):

$$Q_r = N_{St} - \sigma_0 \cdot A$$

Where:

- $N_{St}$  Support load
- $\sigma_0$  Ground pressure
- $A$  area to be subtracted

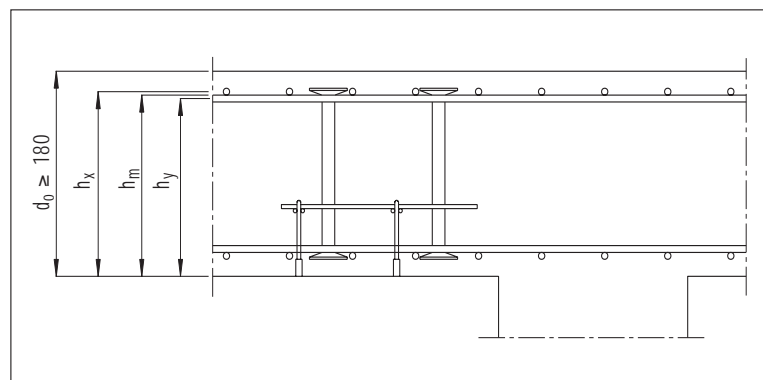


### Average effective slab depth $h_m$

The average effective slab depth  $h_m$  is the distance from the critical bending point of the flexible reinforcement to the outer (pressured) area of the slab:

$$h_m = \frac{h_x + h_y}{2}$$

The Schöck BOLE® can be used in slabs where the intended thickness exceeds  $d_0 = 18$  cm.



### Degree of reinforcement $\mu_g$

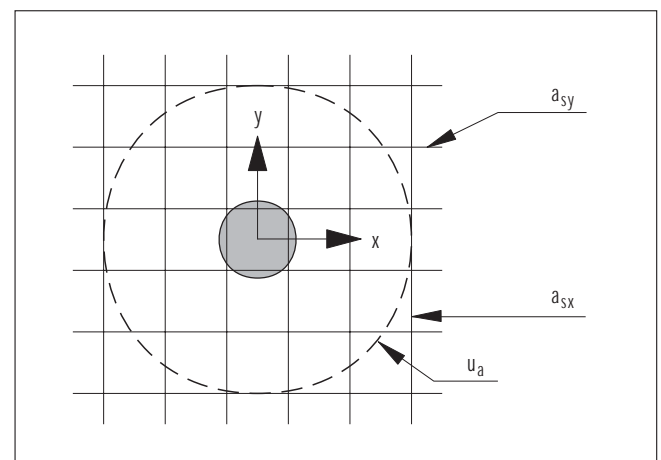
The degree of reinforcement is the relationship between the average reinforcement cross-section and effective slab depth  $h_m$ . For the middle cross-section in the outer radial section, an average value should be used.

The degree of reinforcement  $\mu_g$  has to, according to DIN 1045, be carried in every tension zone-crossing area by a minimum of 0.5 %. The maximum calculable value can be found in the table on this page.

$$a_s = \frac{a_{sx} + a_{sy}}{2}$$

$$\mu_g = \frac{a_s}{h_m}$$

Strength classification	B 25 (C 20/25)	≥ B 35 (C 30/37)
max. $\mu_g$ [%]	1,25	1,50



### Permissible stud load permissible F

For the Schöck BOLE® system double headed studs are used with thicknesses of: 10, 12, 14, 16, 20, 25 mm. The required height of the studs is calculable from the following factors: The necessary upper and lower concrete coverage subtracted from the required slab thickness. The head of the studs is three times the shaft thickness.

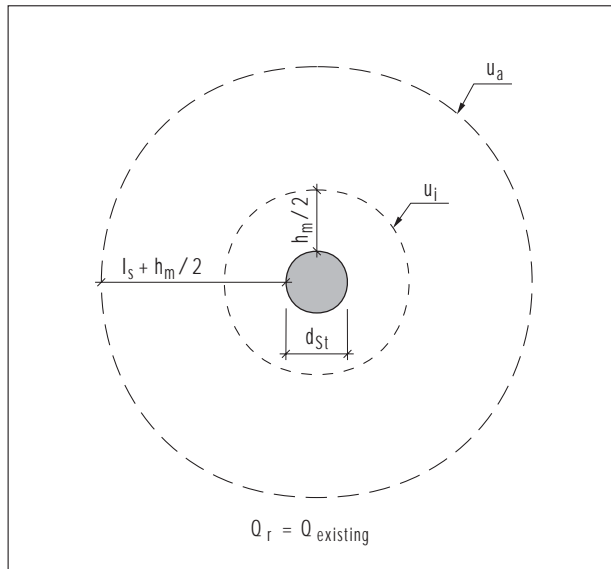
The permissible stud load according to this form is given in the table on this page.

Stud thickness [mm]	perm. F [kN]
10	22,4
12	32,3
14	44,0
16	57,5
20	89,8
25	140,4

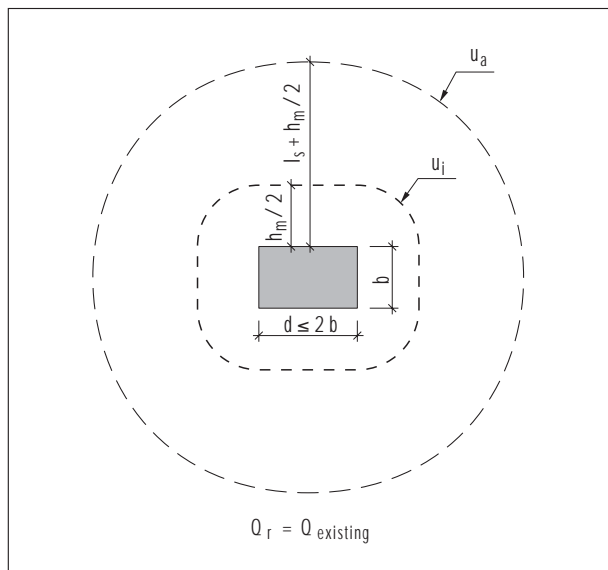
### Ground rules for calculating the radial section $u_i$ and $u_a$

The inner radial section  $u_i$  and the outer radial section  $u_a$  are formed when calculating the supporting geometry and the position of the support in the slab. This must be taken into consideration when working out the length of the circumference line.

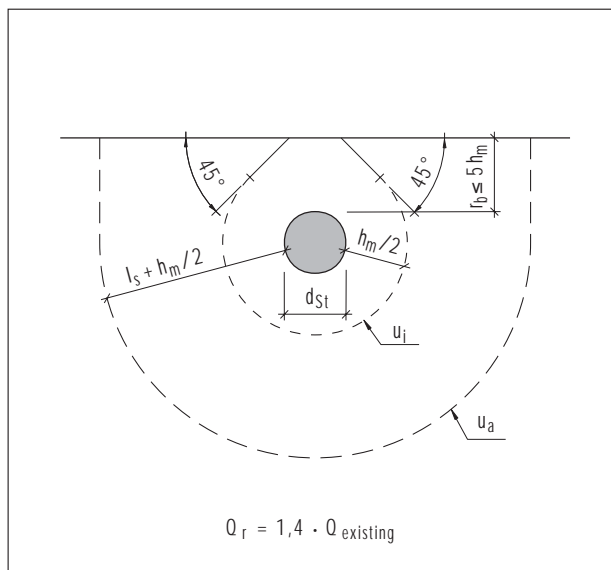
The effect of a non-rotative symmetrical load on edge and corner support areas can be worked out approximately by using an increased punching shear force figure of 40 % (see page 12).



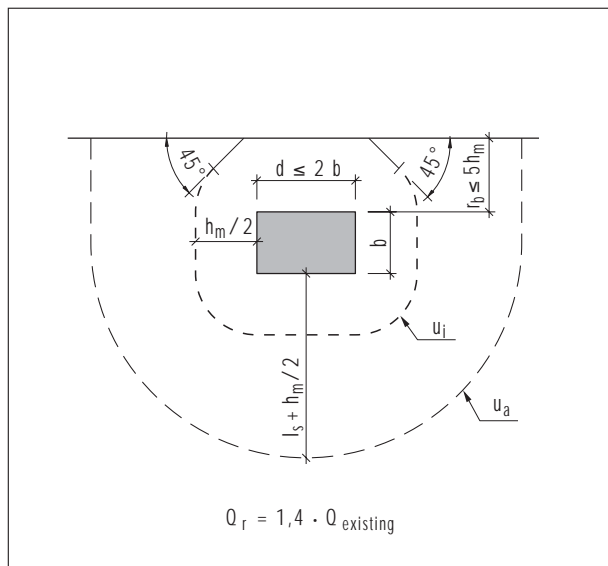
Circular inner support



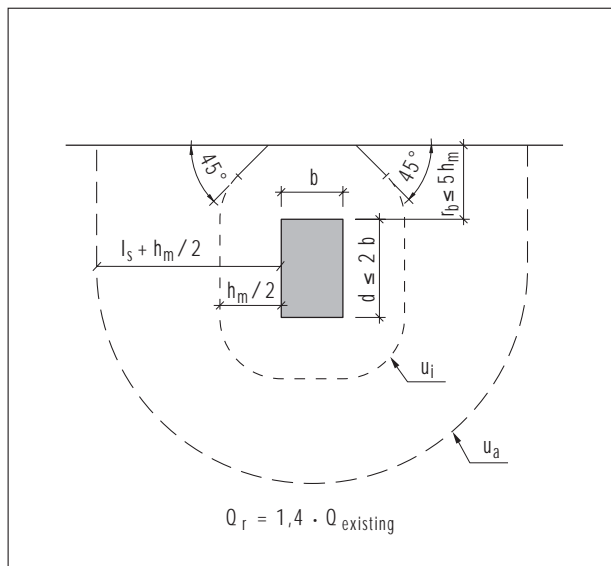
Rectangular inner support



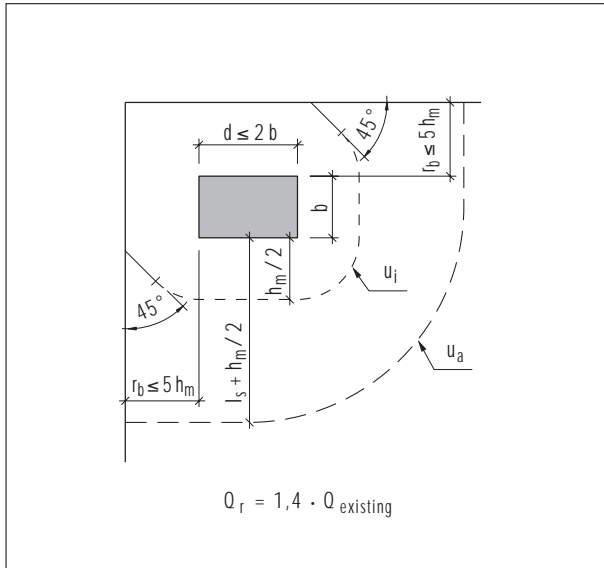
Circular edge support



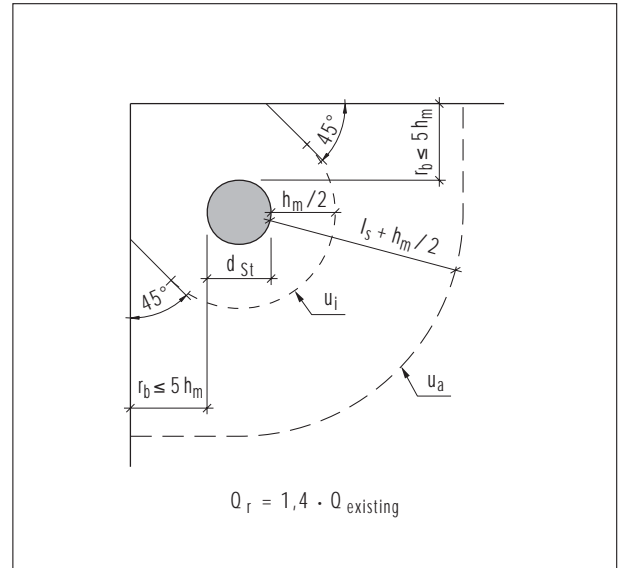
Rectangular edge support



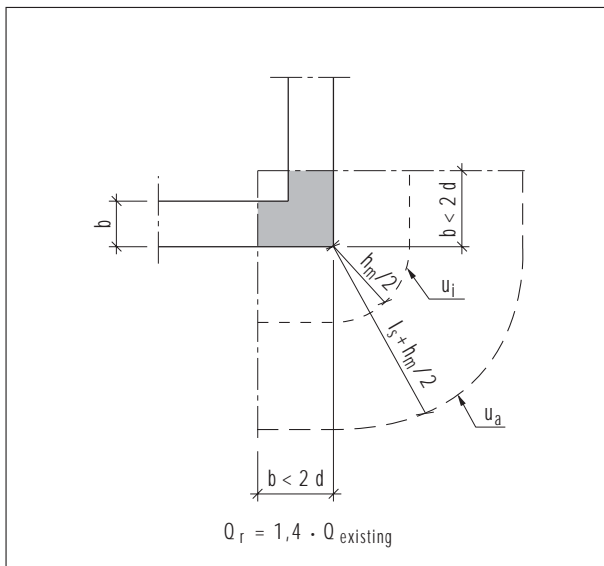
Rectangular edge support



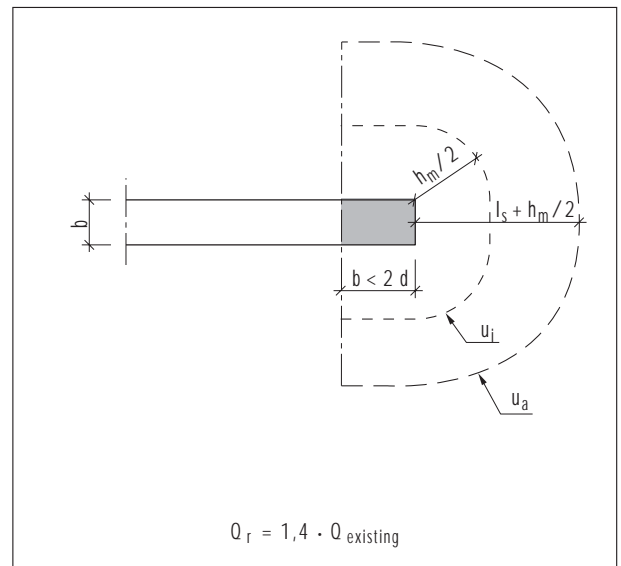
Right-angled corner support



Circular corner support



Inner corner



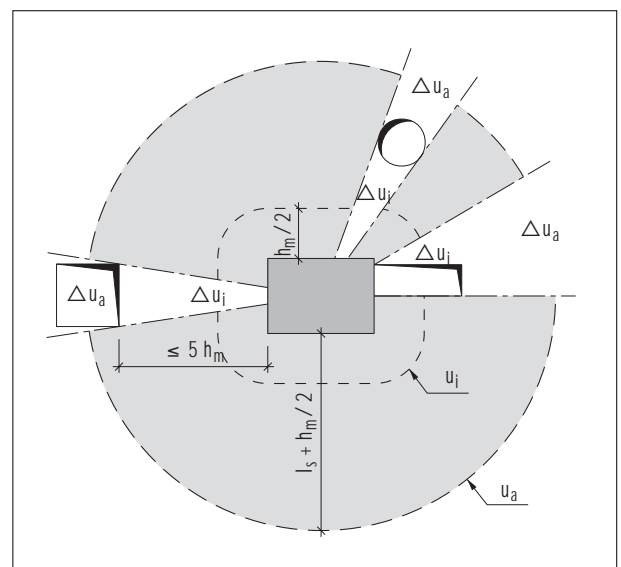
End of wall

### Holes

Holes that are less than  $5h_m$  from the supported edge must be incorporated into calculations when working out radial sections  $u_i$  and  $u_a$ . A section of the circumference border line must be subtracted, the tangential segment between the two support centres that lays on the running line which you can see in the drawing on this page.

$$\text{therefore: } u_i = u_i - \sum \Delta u_i$$

$$\text{therefore: } u_a = u_a - \sum \Delta u_a$$



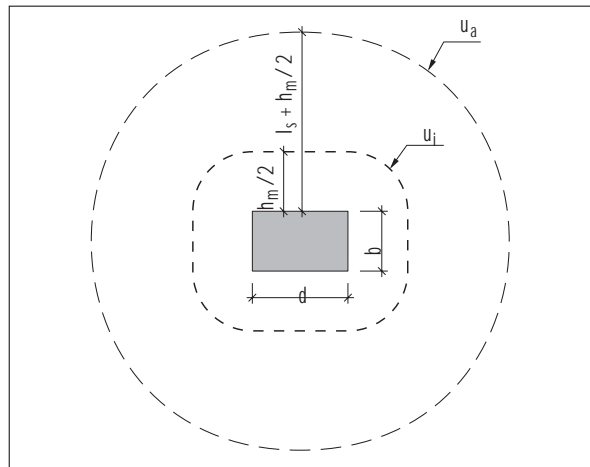
# Schöck BOLE®

## Calculation example

### The Schöck BOLE® punching shear reinforcement system, rectangular inner supported example

Concrete C 25, Steel BSt 500 S

Support cross section:  $b/d = 30/45$  cm    Support load: existing  $Q = 700$  kN  
 Slab thickness:  $d_0 = 28$  cm    Degree of reinforcement:  $\mu_g = 0,66$  %  
 Average effective depth:  $h_m = 24$  cm    Concrete coverage:  $c_o = c_u = 2,5$  cm



Equation when working out protection against punching shear forces as according to DIN 1045

$$\begin{aligned} \text{existing } \tau_r &= \frac{Q_r}{u \cdot h_m} = \frac{Q_r}{\pi \cdot (1,13 \cdot \sqrt{b \cdot d} + h_m) \cdot h_m} \\ &= \frac{700}{\pi \cdot (1,13 \cdot \sqrt{30 \cdot 45} + 24) \cdot 24} \cdot 10 = 1,42 \text{ N/mm}^2 \end{aligned}$$

$$\begin{aligned} \text{permissible } \tau_r &= \kappa_1 \cdot \tau_{011} = 1,3 \cdot a_s \cdot \sqrt{\mu_g} \cdot \tau_{011} \\ &= 1,3 \cdot 1,4 \cdot \sqrt{0,66} \cdot 0,50 = 0,74 \text{ N/mm}^2 ! \end{aligned}$$

The Schöck BOLE® punching shear reinforcement is necessary!

Equation when working out protection against punching shear forces using the Schöck BOLE® system

► Calculable thrust  $\tau_{r,ui}$  along the inner radial section  $u_i$

$$\text{existing } u_i = 2 \cdot (b + d) + \pi \cdot h_m = 2 \cdot (30 + 45) + \pi \cdot 24 = 225,4 \text{ cm}$$

$$\text{existing } \tau_{r,ui} = \frac{Q_r}{u_i \cdot h_m} = \frac{700}{225,4 \cdot 24} \cdot 10 = 1,29 \text{ N/mm}^2$$

$$\text{permissible } \tau_{r,ui} = \kappa_2 \cdot \tau_{02} = 0,80 \cdot 1,80 = 1,43 \text{ N/mm}^2 \quad \checkmark$$

permissible thrust force according to DIN 1045 (88):

$$\tau_{011} = 0,50 \text{ N/mm}^2 \quad \tau_{02} = 1,80 \text{ N/mm}^2$$

Given punching shear force load  $Q_r = Q_{\text{existing}}$  see p. 12

circumference line  $u_i$  see pages 8 and 14

Given punching shear force load  $Q_r = Q_{\text{exist.}}$  see page 12

permissible thrust force in inner radial section defined

by Schöck BOLE®,

$$\begin{aligned} \kappa_2 &= 0,70 \cdot 1,4 \cdot \sqrt{\mu_g} = 0,70 \cdot 1,4 \cdot \sqrt{0,66} \\ &= 0,80 < 1,0 \quad \checkmark \end{aligned}$$

► Calculable thrust  $\tau_{r,ua}$  along the inner radial section  $u_a$

$$\text{existing } u_a = (b + 2 \cdot \text{erf. } l_s + h_m) \cdot \pi$$

$$\text{exist. } \tau_{r,ua} = \frac{Q_r}{u_a \cdot h_m} = \frac{Q_r}{(b + 2 \cdot \text{erf. } l_s + h_m) \cdot \pi \cdot h_m}$$

$$\Rightarrow \text{req. } l_s = \min(\text{req. } l_{s,1}, \text{req. } l_{s,2})$$

$$\text{exist. } \tau_{r,ua} \leq \frac{1}{1 + 0,25 \cdot \frac{l_s}{h_m}} \cdot \kappa_1 \cdot \tau_{011}$$

$$\begin{aligned} \Rightarrow \text{req. } l_{s,1} &\geq \frac{Q_r - \kappa_1 \cdot \tau_{011} \cdot \pi \cdot h_m (b + h_m)}{2 \cdot \kappa_1 \cdot \tau_{011} \cdot \pi \cdot h_m - \frac{Q_r}{4 \cdot h_m}} \\ &\geq \frac{700 \cdot 10 - 1,48 \cdot 0,50 \cdot \pi \cdot 24 \cdot (30 + 24)}{2 \cdot 1,48 \cdot 0,50 \cdot \pi \cdot 24 - \frac{700 \cdot 10}{4 \cdot 24}} \\ &\geq 103,1 \text{ cm} \end{aligned}$$

$$\text{exist. } \tau_{r,ua} \leq \tau_{011}$$

$$\begin{aligned} \Rightarrow \text{req. } l_{s,2} &\geq \frac{Q_r - \tau_{011} \cdot \pi \cdot h_m \cdot (b + h_m)}{2 \cdot \tau_{011} \cdot \pi \cdot h_m} \\ &\geq \frac{700 \cdot 10 - 0,50 \cdot \pi \cdot 24 \cdot (30 + 24)}{2 \cdot 0,50 \cdot \pi \cdot 24} \\ &\geq \underline{\underline{65,8 \text{ cm}}} \hat{=} 2,74 \cdot h_m \end{aligned}$$

selected:  $l_s = 3,25 \cdot h_m = 78 \text{ cm}$

equation: exist.  $u_a = 659,7 \text{ cm}$

exist.  $\tau_{r,ua} = 0,44 \text{ N/mm}^2$

$$\text{perm. } \tau_{r,ua} = \max \begin{cases} 0,41 \text{ N/mm}^2 \\ 0,50 \text{ N/mm}^2 \end{cases} \checkmark$$

Circumference line  $u_a$  and given shear force load  $Q_r$ , see pages 9 and 12

Equation of required  $l_s$  from a formulae whereby the thrust force is shown with a sliding scale between the two possible force limits, see page 9.

$$\text{Case 1: perm. } \tau_{r,ua} = \frac{1}{1 + 0,25 \cdot \frac{l_s}{h_m}} \cdot \kappa_1 \cdot \tau_{011}$$

$$\kappa_1 = 1,3 \cdot 1,4 \cdot \sqrt{\mu_g} = 1,3 \cdot 1,4 \cdot \sqrt{0,66} = 1,48$$

$$\text{Case 2: perm. } \tau_{r,ua} = \tau_{011}$$

According to the permissible formulae Schöck BOLE®:  $l_s \leq 4 \cdot h_m$

In this example the force limits  $\tau_{011}$  are taken as standard. Therefore outside of the shear force reinforced area no anti-thrust reinforcement is necessary (see advice on page 9).

see page 19.

Formulae for calculable thrust forces in outer radial section see page 9.

# Schöck BOLE®

## Calculation example

### ► Working out the required number, thickness and arrangement of studs

Area „c“

Selected: studs  $\varnothing 14$  mm

$$\text{req. } n_c = \frac{Q_r}{\text{perm. } F} = \frac{700}{44,0} = 15,9$$

Selected: 16 studs in area „c“

Number and alignment of stud rails:

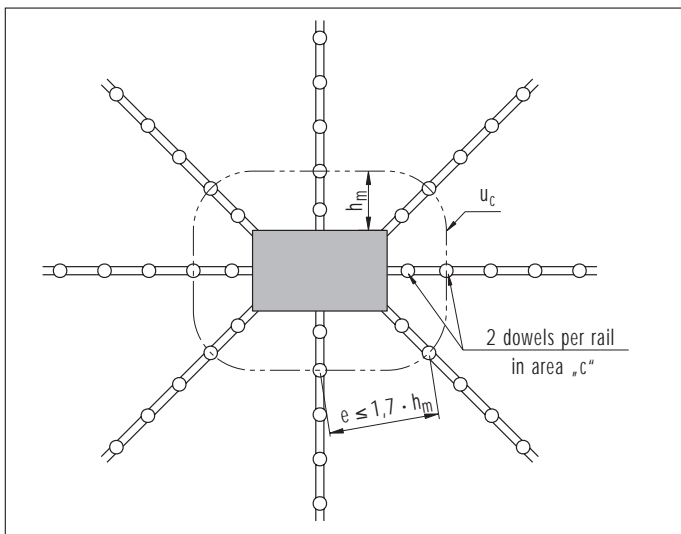
$$\frac{u_c}{1,7 \cdot h_m} = \frac{2 \cdot (b + d) + 2 \cdot \pi \cdot h_m}{1,7 \cdot h_m} = \frac{2 \cdot (30 + 45) + 2 \cdot \pi \cdot 24}{1,7 \cdot 24} = 7,4$$

selected: 8 stud rails with 2 studs each in area „c“

Permissible stud load perm.  $F = 44,0$  kN see page 13

Required number of studs see page 10

maximum spacing on radial section  $u_c$  of area „c“ see page 11:  $e = 1,7 h_m$



Selected alignment of punching shear reinforcement from the Schöck BOLE® system

Area d

$$\frac{l_s - h_m}{0,75 h_m} = \frac{65,8 - 24}{0,75 \cdot 24} = 2,3$$

selected: 3 studs per rail in area „d“

maximum stud spacing  
see page 10 and 11:  $0,75 \cdot h_m$

# Schöck BOLE®

## Calculation example

$$\text{req. } n_d = \frac{0,5 \cdot Q_r}{\text{perm. } F} = \frac{0,5 \cdot 700}{44,0} = 7,9$$

$$\text{per stud rail: } \frac{7,9}{8} = 0,99$$

Selected: 1 stud  $\varnothing 14$  mm in areas  $1,0 h_m < l_s \leq 2,0 h_m$

$$\text{req. } n_d = \frac{0,75 \cdot Q_r}{\text{perm. } F} = \frac{0,75 \cdot 700}{44,0} = 11,9$$

$$\text{per stud rail: } \frac{11,9}{8} = 1,49$$

Selected : 2 studs  $n \varnothing 14$  mm in areas  $2,0 h_m < l_s \leq 4,0 h_m$

### Compilation of selections for order purposes

Stud thickness:	$d_B = 14$ mm
Stud height:	$h_B = d_o - c_o - c_u = 230$ mm
Number of studs per rail:	$n_B = 5$
Effective depth:	$h_m = 240$ mm
Number of stud rails:	8 Stück
Lower concrete coverage :	$c_u = 25$ mm

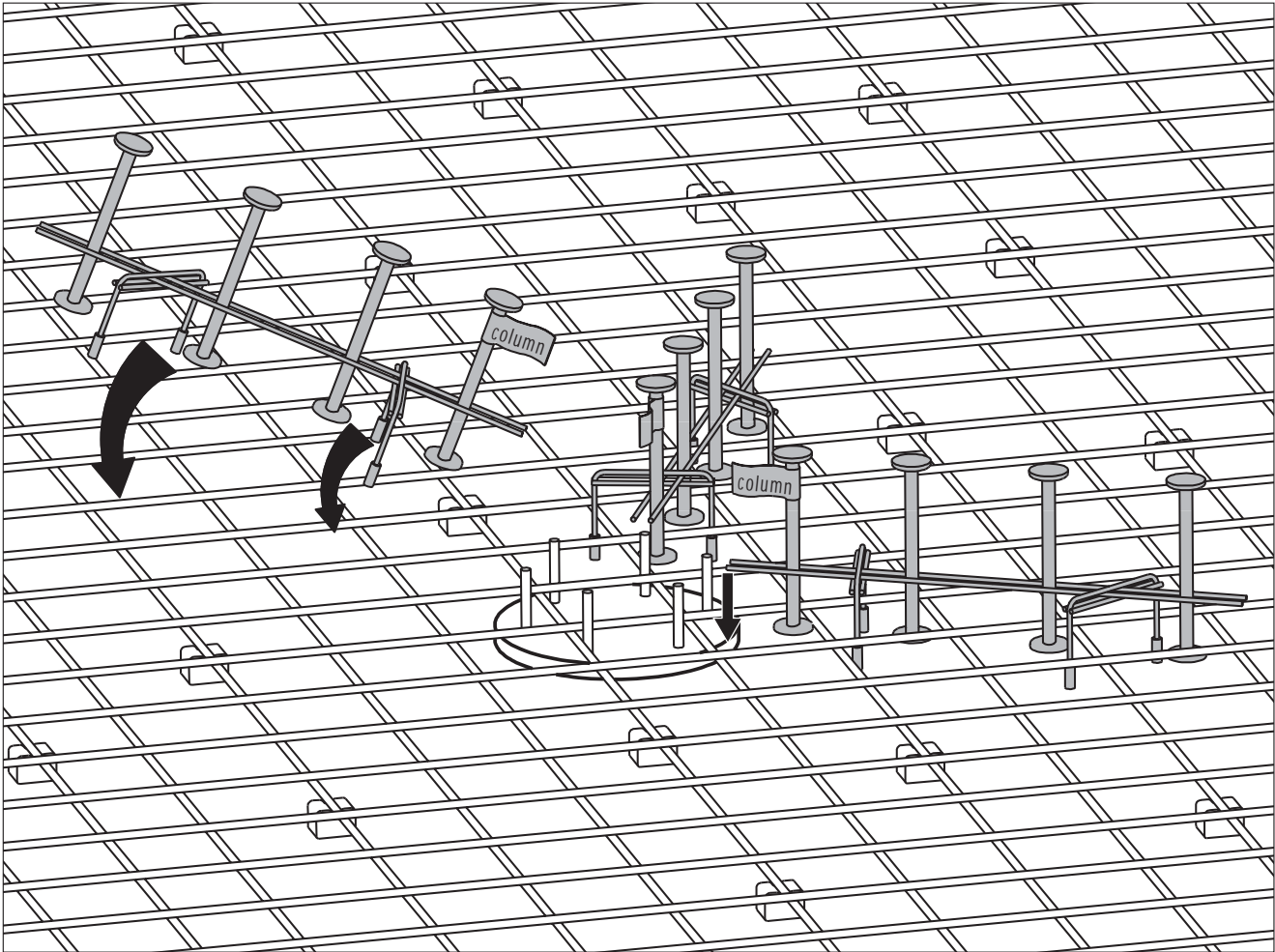
Selected: 8 x Schöck BOLE® 14-230-5/240  $c_u = 25$  mm

*Studs  $\varnothing 14$  mm as in area „c“, number and alignment sequence see page 10*

*For details of result equation see page 22*

# Schöck BOLE®

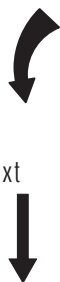
## Installation advice for insitu applications



1. Lay the bottom mat

2. Installation of Schöck BOLE®

- ▶ Position according to design
- ▶ Correctly position the bearer stand
- ▶ The stud with positioning marker must be aligned next to the column
- ▶ Fit with spacer flush to outermost edge of support
- ▶ The Schöck BOLE® element must stand on the formwork/shuttering base

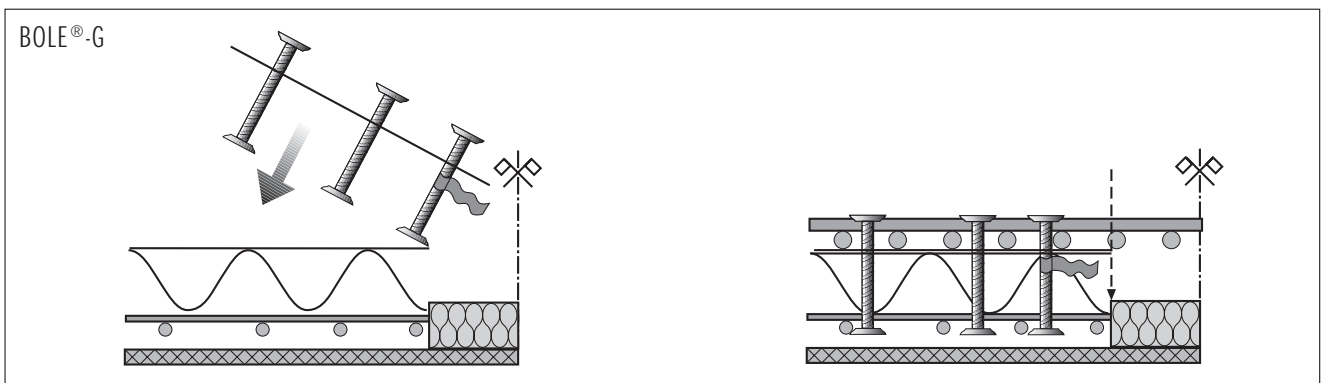
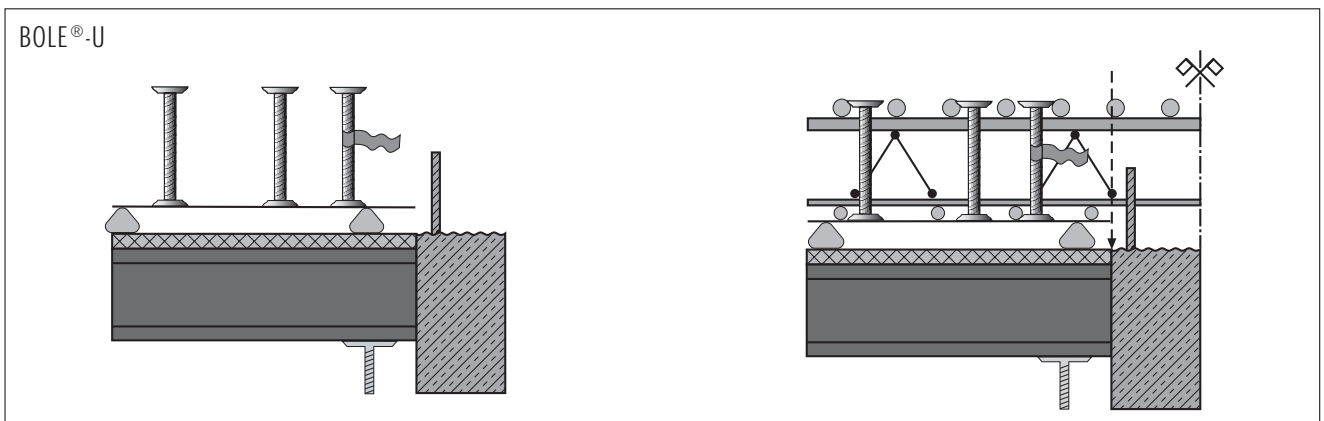
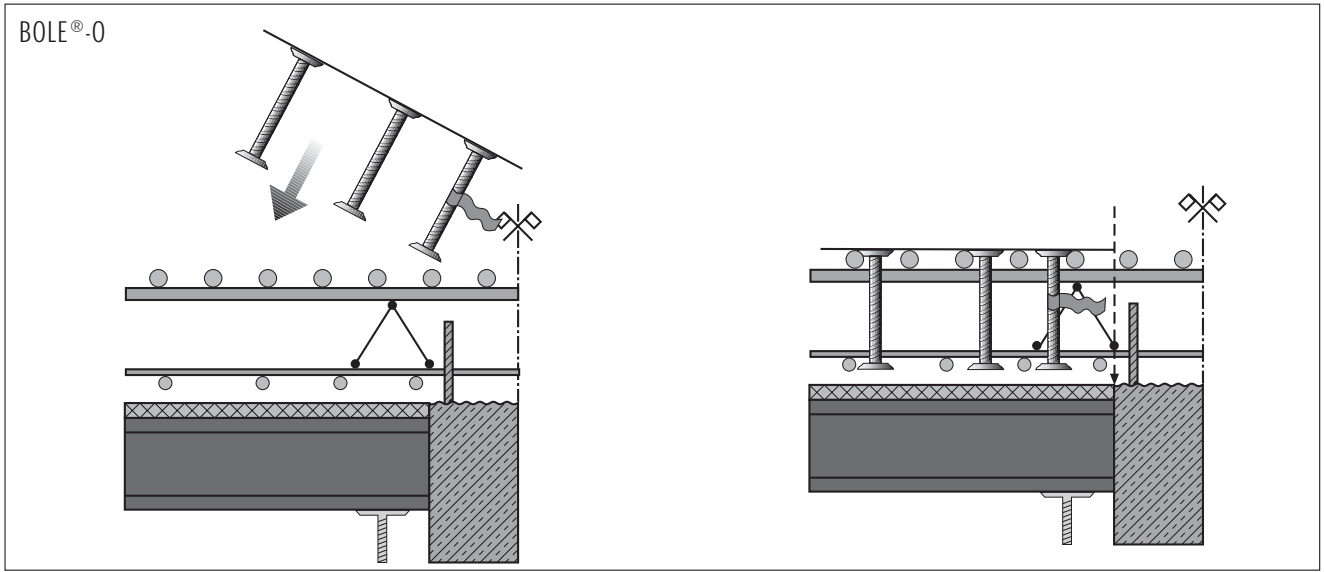


3. Lay the upper reinforcement



# Schöck BOLE®

Installation instructions



Precasting plant

# Schöck BOLE®

## Delivery programme

Stud height [mm]	Stud thickness [mm]					
	10	12	14	16	20	25
130						
140						
150						
160						
170						
180						
190						
200						
210						
220						
230						
240						
250						
260						
270						
280						
290						
300						
310						
320						
330						
340						
350						
360						
370						
380						
390						
400						
Further stud variations on request						

### Quick delivery with the BOLE® preference programme

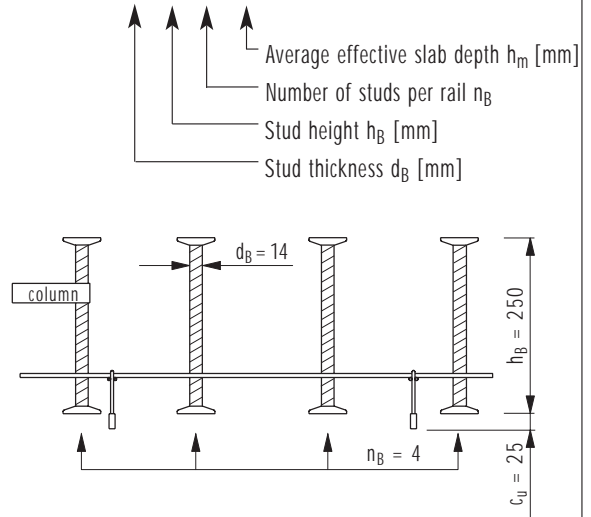
The Schöck BOLE® system is perfect from a design and practical construction viewpoint.

The BOLE® preference programme is shown in the list on this page used in conjunction with stud length (height) and stud thickness.

The grey background shows which Schöck BOLE® is available at short notice.

### Order example:

Schöck BOLE® 14-250-4/260



# Schöck BOLE®

Recommended tender method



## Recommended tender method for Schöck BOLE®

POSITION	AMOUNT	LIMIT		SINGLE UNIT PRICE	TOTAL PRICE
1.1			<b>Schöck BOLE®</b>		
1.1.1			<b>Construction type : Concrete and steel reinforced concrete</b>		
1.1.2		piece	Punching shear reinforcement elements for floor slabs and foundation slabs  Type Schöck BOLE® _____  Bottom concrete coverage: _____  Delivery and installation.		

# Schöck BOLE®

Reference objects

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Office development „Am Münchner Tor“, Germany



Schöck BOLE®  
Reference objects

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Media Park project Cologne, Germany



Subject to technical alterations

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**Schöck Bauteile GmbH**

Vimbucher Straße 2 · D-76534 Baden-Baden  
Telephone +49/7223/967-144 · Facsimile +49/7223/967-470  
Internet: [www.schoeck.com](http://www.schoeck.com)  
E-mail: [export@schoeck.com](mailto:export@schoeck.com)