PohlCon

# JORDAHL® JDA punching shear reinforcement

Technical information

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# JORDAHL®
# Punching shear reinforcement

Approvals and certificates

## European technical assessment (ETA)

The JORDAHL® double-headed anchor is a punching shear reinforcement element. The Deutsche Institut für Bautechnik (DIBt) (German institute for structural engineering) awarded JORDAHL the European Technical Assessment (ETA-13/0136) thanks to the continuous improvements made to the product. The ETA evaluates the technical and qualitative properties of products. It is based on a Europe-wide procedure for assessment that is fully valid in more than 30 countries and allows you to also plan your international projects with maximum reliability.

## National technical approval (abZ)

Currently, not all construction products have a harmonised technical specification (EAD). This is required in order to obtain a European Technical Assessment (ETA). However, we still want to guarantee our customers the assurance of the well-known JORDAHL® quality to give them a verified basis on which to plan their projects. To this end, the corresponding abZ confirms that JORDAHL® products, such as JORDAHL® JDA-S shear reinforcement (Z-15.1-268), can be safely installed and applied.


**JORDAHL® Information**
Are you interested in our certificates and approvals? You can download them from www.pohlcon.com → Downloads → Proofs of application

# Introduction to punching shear reinforcements

Point-supported flat slabs are the ideal solution for making optimum use of large halls or warehouse buildings.

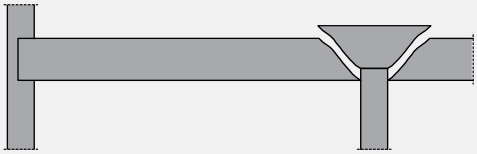


Figure 1: Punching shear situation

The problem of punching shear in areas around column heads (Fig. 1) was recognised even in the early days of concrete construction. Ceilings held up by large, mushroom-shaped capitals (Fig. 2) were introduced in around 1900 to eliminate the need for main and secondary beams obstructing the space.

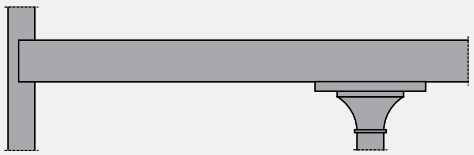


Figure 2: Ceilings held up by large, mushroom-shaped capitals

Only a short time later, the Kahn steel reinforcement system (Fig. 3) came into use for tensile reinforcement. It had upturned wings that resisted transverse forces in the ceiling support area. The inventor of the Kahn steel reinforcement system, Julius Kahn, and his brother, the famous architect Albert Kahn, enjoyed great success with this product in the reinforced steel concrete.

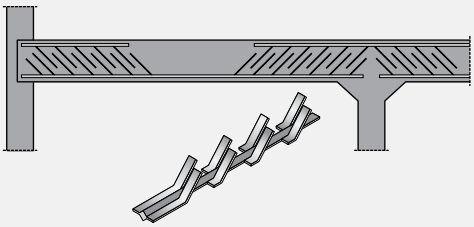


Figure 3: Kahn steel reinforcement system

Using conventional methods it is often not possible to achieve thin slabs and wide spans between supporting columns or large slab breakthroughs close to the supporting column heads (Fig. 4). As an alternative, Andrä et al. have developed a solution in which the area at risk of punching shear is dowelled using dowel strips.

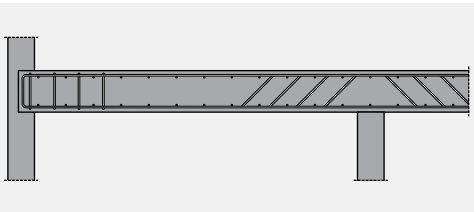


Figure 4: Flat ceiling with stirrups and rebar bent diagonally upwards

This solution was further developed into punching shear anchoring made of reinforcing steel, each with two swaged heads (Fig. 5). Following the introduction of the Eurocode, the assessment process had to be fundamentally revised. The current European Technical Assessment ETA-13/0136 corresponds to the latest state of knowledge and is successfully applied in multiple sectors.

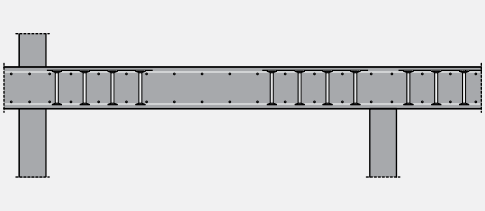


Figure 5: JORDAHL® JDA punching shear reinforcement with double-headed anchors

# Benefits of JDA punching shear reinforcements

JORDAHL® JDA punching shear reinforcement is used to transfer high shear forces and to ensure optimum usage of space. It is ideal for use in flat slabs and foundations and minimises formwork and rebar work. It can increase resistance to punching shear by 50% compared to foundations without punching shear reinforcement and by as much as 96% compared to ceiling slabs without punching shear reinforcement.

- European Technical Assessment for static and dynamic loads (ETA-13/0136)
- Concrete strength range C20/25 to C50/60
- Calculation according to the Eurocode safety concept
- Precise calculation of asymmetrical load transfers for all column positions
- Defined transition between punching shear and transverse force resistance
- Higher load-bearing capacity than slabs and foundations without punching shear reinforcement
- Suitable for slabs 18 cm thick and greater

- Flat lower ceiling surface
- Unobstructed area below the ceiling for installing fittings
- Optimum use of space
- Higher load-bearing capacity than conventional reinforcement techniques
- Low concrete slab depths

- Standard elements simply lined up for easier anchor strip installation
- Minimal formwork required
- Quick and easy installation from above or below
- Flexible production to suit specific static requirements

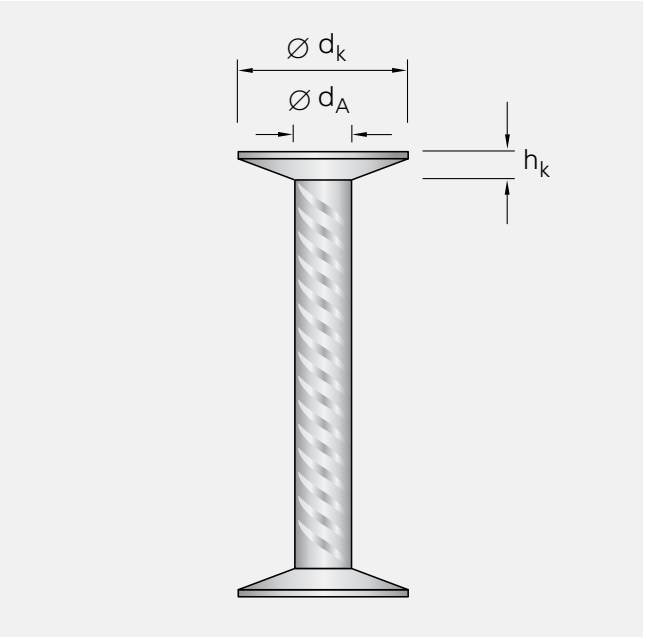
The JORDAHL® JDA punching shear reinforcement consists of double-headed anchors connected by a flat strip. Double-headed anchors secure the transition between punching shear and transverse force resistance.

## Material

The double-headed anchors are made of B500B round reinforcing steel, the flat strip is made of construction steel. Delivery subject to confirmation.

## Technical information

The JORDAHL® JDA punching shear reinforcement can be flexibly produced to suit the specific static requirements. The double-headed anchors are available in diameters $d_A$ = 10, 12, 14, 16, 20 and 25 mm (for product range, see Seite 8). The diameter of the head $d_k$ is always triple the diameter of the shaft $d_A$. This ensures near slip-free anchoring of the compression area and tension area.

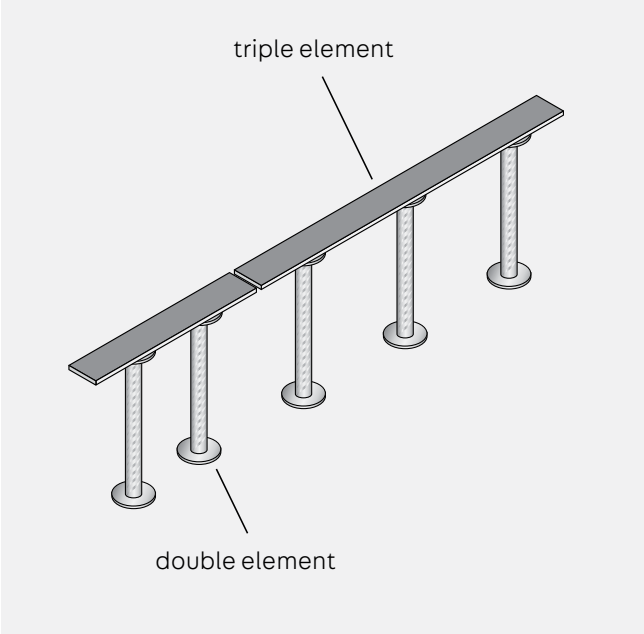



Ribbed, double-headed anchor

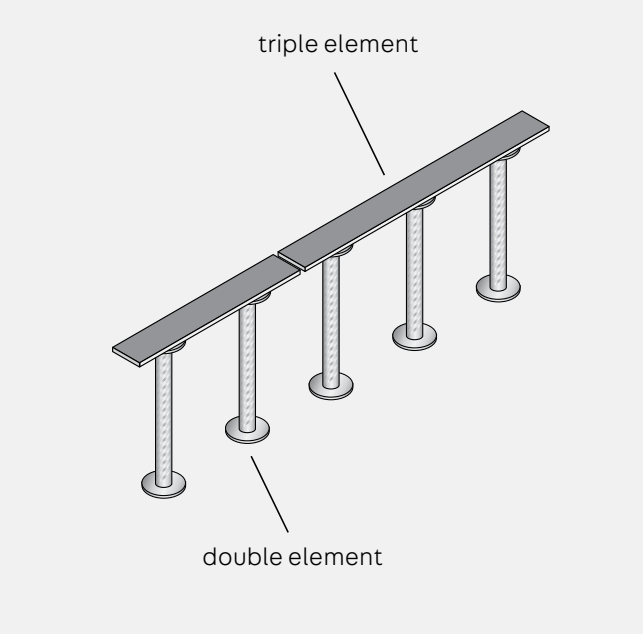
| $d_A$ mm | $d_k$ mm | $h_k$ mm | A mm² | $F_{RD}$ kN |
|---|---|---|---|---|
| **10** | 30 | 5 | 79 | 34.1 |
| **12** | 36 | 6 | 113 | 49.2 |
| **14** | 42 | 7 | 154 | 66.9 |
| **16** | 48 | 7 | 201 | 87.4 |
| **20** | 60 | 9 | 314 | 136.6 |
| **25** | 75 | 12 | 491 | 213.4 |

**$d_A$** Anchor diameter
**$d_k$** Head diameter
**$h_k$** Min. head thickness
**A** Anchor cross section
**$F_{RD}$** Load-bearing capacity

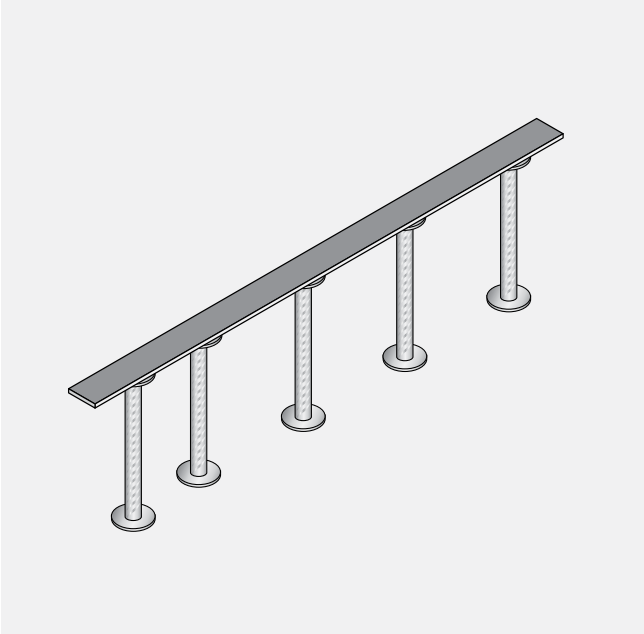
## Elements



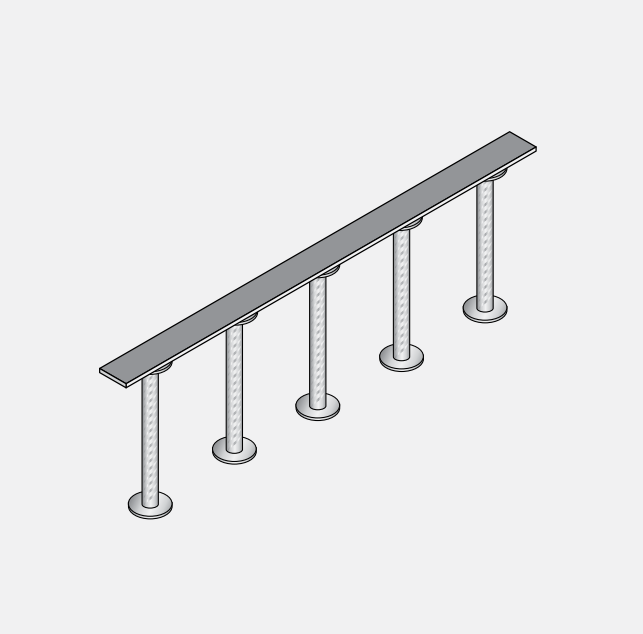

Optimised elements (separate elements)




JDA standard elements (separate elements)



Optimised elements (continuous)



JDA standard elements (continuous)

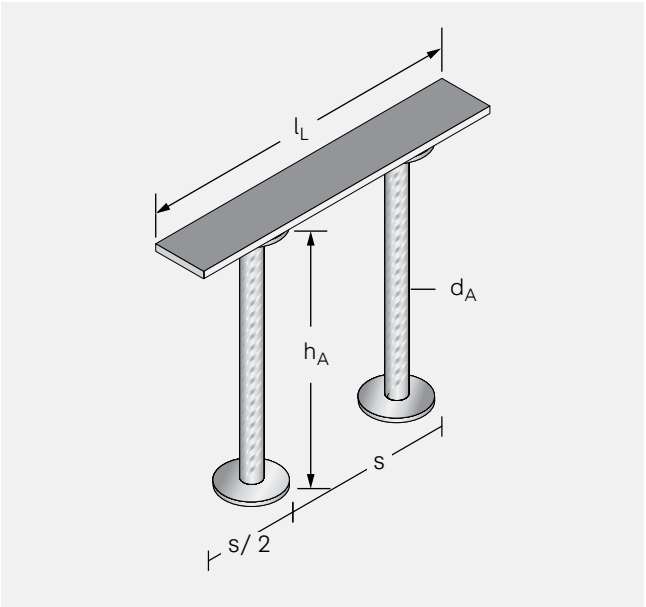
# Standard element product range

## Welded JDA element – product range[1)]

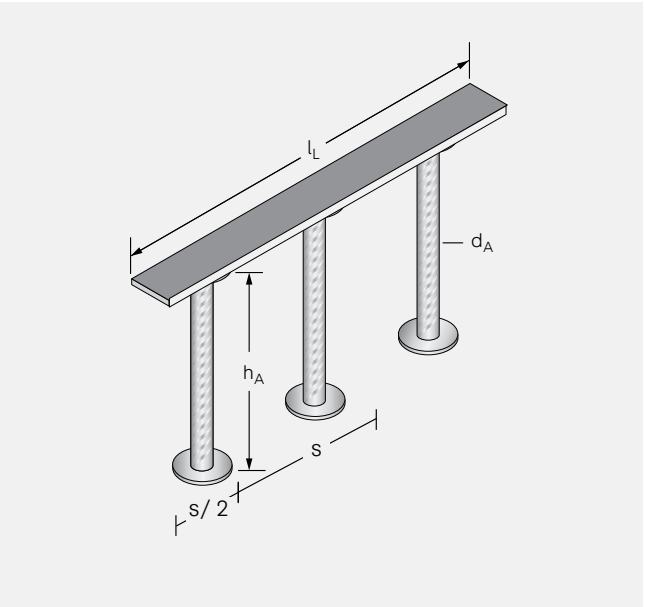
| Anchor length $h_A$ mm | For anchor diameter $d_A$ mm | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | | 12 | | 14 | | 16 | | 20 | | 25 | |
| | 2 anchors | 3 anchors | 2 anchors | 3 anchors | 2 anchors | 3 anchors | 2 anchors | 3 anchors | 2 anchors | 3 anchors | 2 anchors | 3 anchors |
| 125 | | | | | – | – | – | – | – | – | – | – |
| 135 | 200 | | | | | | – | – | – | – | – | – |
| 145 | 200 | 300 | | | | | – | – | – | – | – | – |
| 155 | 220 | 330 | 220 | 330 | | | | | – | – | – | – |
| | 240 | 360 | 240 | | | | | | – | – | – | – |
| 165 | 240 | 360 | 240 | 360 | | 360 | | | – | – | – | – |
| | | 390 | | | | | | | – | – | – | – |
| 175 | 240 | 360 | 240 | 360 | 240 | 360 | | | – | – | – | – |
| | 260 | 390 | 260 | | | | | | – | – | – | – |
| | 280 | 420 | | | | | | | – | – | – | – |
| 185 | 260 | | | 390 | | | | | | | – | – |
| | 280 | 420 | 280 | 420 | 280 | 420 | | | | | – | – |
| 195 | 280 | 420 | 280 | 420 | 280 | 420 | 280 | 420 | | | – | – |
| | 300 | 450 | 300 | 450 | | | | | | | – | – |
| 205 | 280 | 420 | 280 | 420 | 280 | 420 | 280 | 420 | | | – | – |
| | 300 | 450 | 300 | 450 | 300 | 450 | | | | | – | – |
| | | | 320 | | 320 | 480 | 320 | 480 | | | – | – |
| 215 | 300 | | 300 | 450 | 300 | 450 | 300 | | | | | |
| | | | | | 340 | | | | | | | |
| 225 | | | 320 | 480 | 320 | 480 | | | | | | |
| 235 | | | 340 | 510 | 340 | 510 | 340 | 510 | 340 | | | |
| | | | 340 | | 340 | | | | | | | |
| 245 | | | 360 | 540 | 360 | 540 | 360 | 540 | 360 | 540 | | |
| | | | | | | | 380 | | | | | |
| 255 | | | 360 | | 360 | 540 | 360 | 540 | 360 | 540 | | |
| | | | | | | | 400 | | | | | |
| 265 | | | | | 380 | 570 | 380 | 570 | | | | |
| | | | | | 400 | | 400 | 600 | 400 | 600 | | |
| 275 | | | | | 400 | 600 | 400 | 600 | 400 | 600 | | |
| 285 | | | | | 380 | | | | | | | |
| | | | | | 420 | | 420 | | 420 | 630 | | |
| 295 | | | | | | | | | 420 | 630 | | |
| | | | | | | | 440 | 660 | 440 | 660 | 440 | 660 |
| 305 | | | | | | | 440 | | 440 | | | |
| 315 | | | | | | | | | | | | |
| 325 | | | | | | | 480 | | 480 | | 480 | |
| 335 | | | | | | | | | 480 | | 480 | 720 |
| 345 | | | | | | | | | 500 | 750 | 500 | |
| | | | | | | | | | 520 | | 520 | |
| 385 | | | | | | | | | | | 560 | 840 |
| 435 | | | | | | | | | | | 640 | 960 |
| 585 | | | | | | | | | | | 860 | |

Standard range | On request | 200 $l_L$ = strip length

### JDA, double element, 2 anchors




### JDA, triple element, 3 anchors




### JDA-FT-KL for precast slabs – product range[1)]

| | For anchor diameter $d_A$ mm | | | |
|---|---|---|---|---|
| | **10** | **12** | **14** | **16** |
| **Anchor length $h_A$ mm minimum** | 125 | 125 | 135 | 155 |
| | ↓ | ↓ | ↓ | ↓ |
| | In 10-mm steps | | | |
| **Anchor length $h_A$ mm maximum** | 315 | 335 | 365 | 405 |

### Single elements for JDA – product range[1)]

| | For anchor diameter $d_A$ mm | | | | | |
|---|---|---|---|---|---|---|
| | **10** | **12** | **14** | **16** | **20** | **25** |
| **Anchor length $h_A$ mm minimum** | 125 | 125 | 135 | 155 | 185 | 215 |
| | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| | In 10-mm steps | | | | | |
| **Anchor length $h_A$ mm maximum** | 5505 | 5505 | 5505 | 5505 | 5505 | 5505 |

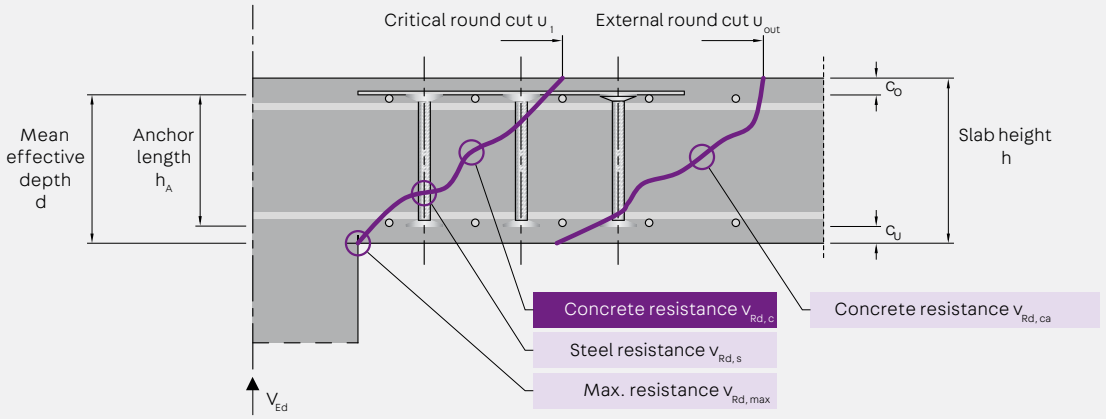
[1)] Additional anchor lengths available on request.

**JORDAHL® advice**
Can't find the size or design you need? No problem! Simply contact our JORDAHL® experts, e.g. by e-mail at **experten@jordahl.de**. They will provide you with friendly, fast and competent advice and will be happy to develop a customised solution for your very specific application.

# Design in line with ETA-13/0136

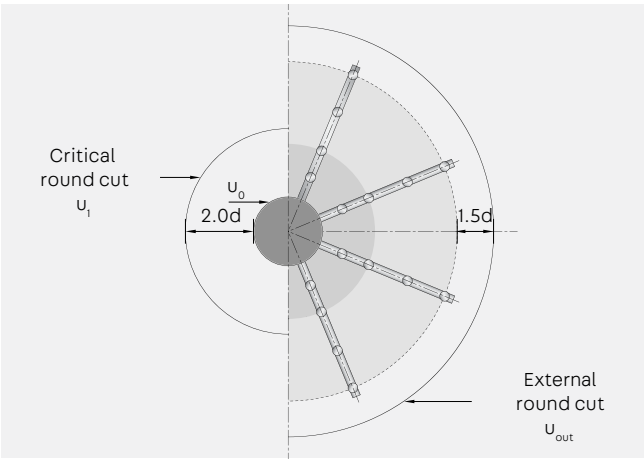
The basic principle when designing elements to resist punching shear is the clear separation of flat slabs and foundations.Design is regulated by European Technical Assessment ETA-13/0136.

## Summary of verifications

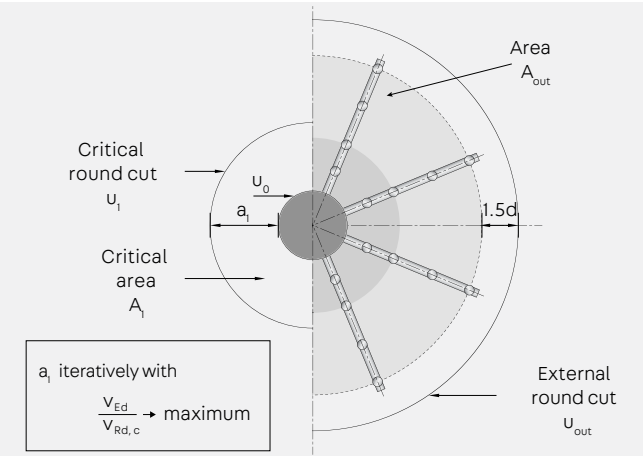



## Round cut-outs

### For flat slabs

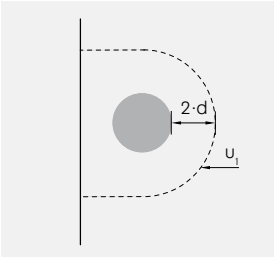


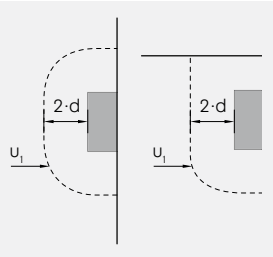

### For foundations

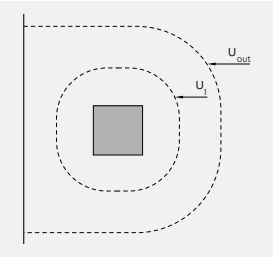



**Conditions:** $u_0 \leq 12\ d$ | $h \geq 180$ mm | $0.5 \leq a/b \leq 2.0$ for rectangular columns

For columns at the edge and in corners, round cut-outs must be made perpendicular to the free edge (see example on Seite 15).
However, the smallest critical round cut-out is the definitive measurement.



## Design load

### For flat slabs

$$v_{Ed} = \frac{\beta \times V_{Ed}}{u_1 \times d} \; [N/mm^2]$$

### For foundations

$$v_{Ed} = \frac{\beta \times V_{Ed,red}}{u_1 \times d} \; [N/mm^2]$$

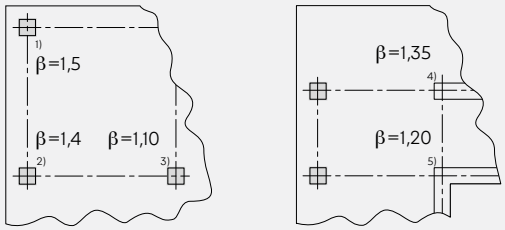
$$V_{Ed,red} = V_{Ed} - \sigma_{0d} \times A_1 = V_{Ed}\left(1 - \frac{A_1}{A_F}\right) \; [kN]$$

$\sigma_{0d}$: ground pressure
$A_F$: foundation contact area; for foundation slabs, the area delimited by the zero moment points running in the radial direction

### Load increase factor

Simplified values can be used for β column span ratios in adjacent fields in the range of
0.8, $l_1/l_2$, 1.25.

Alternatively, or if the column span ratio is higher than 25%, the more accurate method based on a fully plastic shear stress distribution specified in EN 1992-1-1 can be used. Procedures using a reduced critical round cut-out must not be used.




[1] Corner column, [2] Edge column, [3] Interior column, [4] Wall end, [5] Wall corner

## Punching shear resistance without punching shear reinforcement

### For flat slabs

$$v_{Rd,c} = C_{Rd,c} \times \kappa \times (100 \times \rho_l \times f_{ck})^{1/3} \geq v_{min} \; [N/mm^2]$$

### For foundations

$$v_{Rd,c} = C_{Rd,c} \times \kappa \times (100 \times \rho_l \times f_{ck})^{1/3} \times \frac{2d}{a_1} \geq v_{min} \times \frac{2d}{a_1} \; [N/mm^2]$$

Scale factor $\kappa = 1 + \sqrt{\frac{200\ mm}{d}} \leq 2.0$

Longitudinal reinforcement ratio $\rho_l = \sqrt{\rho_{lx} \times \rho_{ly}} \leq \begin{cases} 0{,}5 \times f_{cd}/f_{yd} \\ 0{,}02 \end{cases}$

Minimum resistance $v_{min} = \frac{0.0525}{\gamma_c} \times \sqrt{\kappa^3 \times f_{ck}}$ for $d \leq 600$ mm

$= \frac{0.0375}{\gamma_c} \sqrt{\kappa^3 \times f_{ck}}$ for $d > 800$ mm

### Empirical factor – flat slabs

$C_{Rd,c} = \frac{0.18}{\gamma_c}$ for $u_0 \geq 4d$

$C_{Rd,c} = \frac{0.18}{\gamma_c}\left(0.1 \times \frac{u_0}{d} + 0.6\right) \geq \frac{0.15}{\gamma_c}$ for $u_0 < 4d$

### Empirical factor – foundations

$C_{Rd,c} = \frac{0.15}{\gamma_c}$ for compact foundations with $a_\lambda \leq 2{,}0\,d$

$C_{Rd,c} = \frac{0.18}{\gamma_c}$ for slim foundations with $a_\lambda > 2{,}0\,d$

## Punching shear resistance with double-headed anchors

### For flat slabs

$$v_{Rd,max} = 1.96\, v_{Rd,c}\ N/mm^2$$

### For foundations

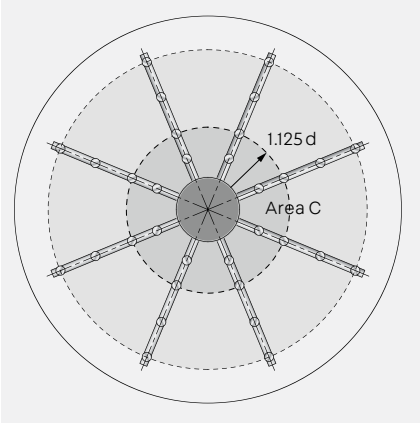
$$v_{Rd,max} = 1.50\, v_{Rd,c}\ N/mm^2$$

## Design in area C or 0.8d

### For flat slabs

$$V_{Rd,sy} = m_c \times n_c \times \frac{d^2_A \times \pi \times f_{yd}}{4 \times \eta}\ [kN]$$

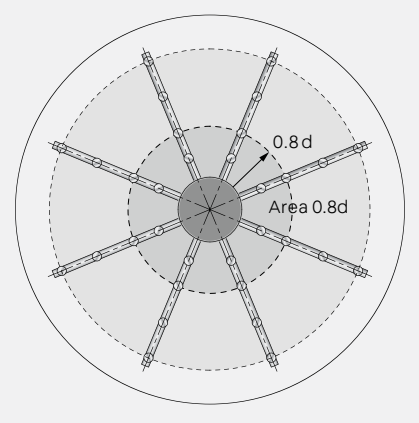
**Slab thickness factor:** $\eta = 1.0$ for $d \leq 200$mm
$\eta = 1.6$ for $d \geq 800$mm




### For foundations

$$V_{Rd,sy} = f_{yd} \times A_{s,0.8d}\ kN$$

$A_{s,0.8d}$: Steel cross-sectional area of double-headed anchor in area 0.8d
$f_{yd}$: Design yield strength of double-headed anchor




## External round cut-out

$$V_{Rd,ca} = \frac{0,15}{\gamma_c} \times \kappa \times (100 \times \rho_l \times f_{ck})^{1/3} \geq V_{min}\ [N/mm^2]$$

### Reduced load increase factor:

| Interior columns, wall ends, wall corners | Edge columns | Corner columns |
|---|---|---|
| $\beta_{red} = \beta \geq 1.10$ | $\beta_{red} = \frac{\beta}{1,2 + \beta/20 \times l_s/d} \geq 1,10$ | $\beta_{red} = \frac{\beta}{1,2 + \beta/15 \times l_s/d} \geq 1,10$ |

### For flat slabs

$$u_{out} = \frac{\beta_{red} \times V_{Ed}}{v_{Rd,ca} \times d}$$

### For foundations

$$u_{out} = \frac{\beta_{red} \times V_{Ed,red}}{v_{Rd,ca} \times d}$$

$$V_{Ed,red} = V_{Ed} - \sigma_{od} \times A_{out} = V_{Ed}\left(1 - \frac{A_{out}}{A_F}\right)\ [kN]$$

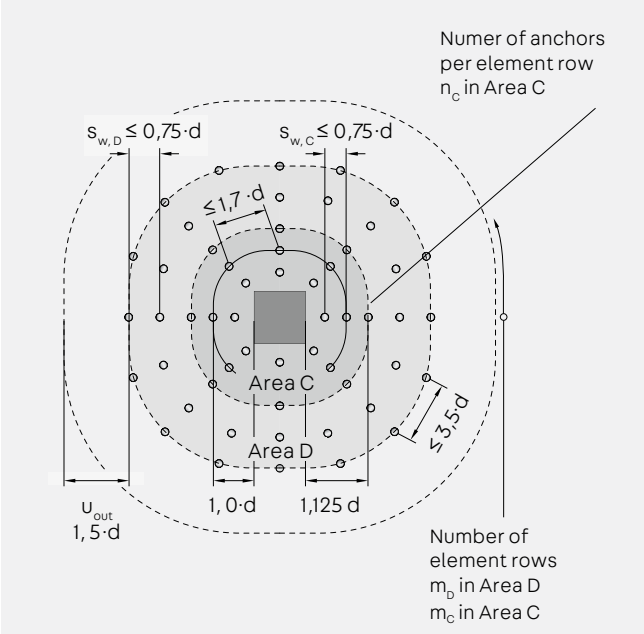
# Permissible anchor spacings

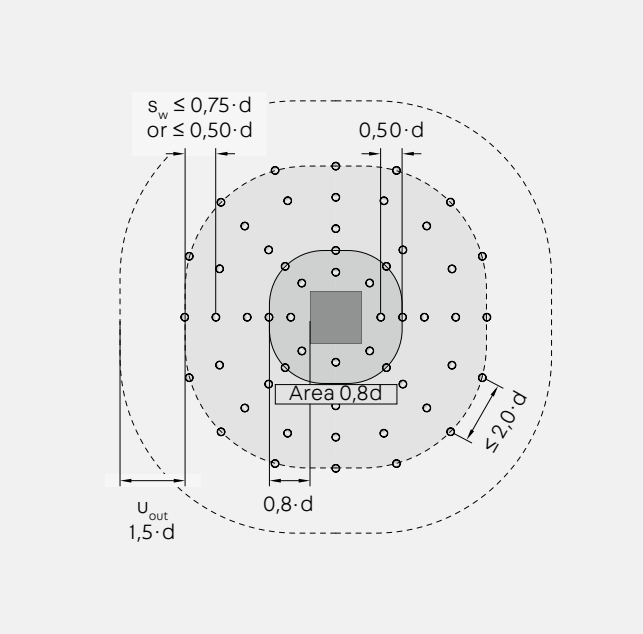
### For flat slabs

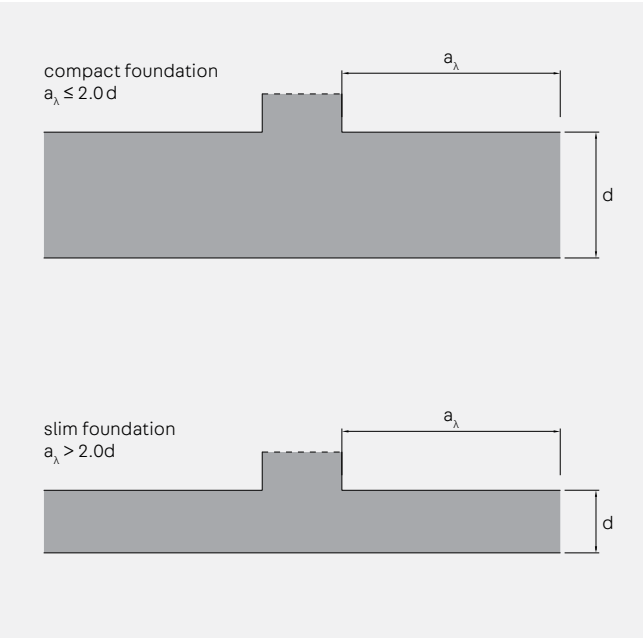
- The first anchor is between 0.35 d and 0.5 d from the column
- The radial anchor spacing must not exceed 0.75 d
- The maximum spacing of the anchors in a tangential direction at a distance of 1.0 d from the column must be ≤ 1.7
- The tangential anchor spacing in area D must not exceed 3.5 d

### For foundations

- The first anchor is 0.3 d and the second anchor 0.8 d from the column
- Radial anchor spacing must not exceed 0.75 d for slim and 0.5 d for compact foundations
- Tangential anchor spacing must not exceed 2.0 d

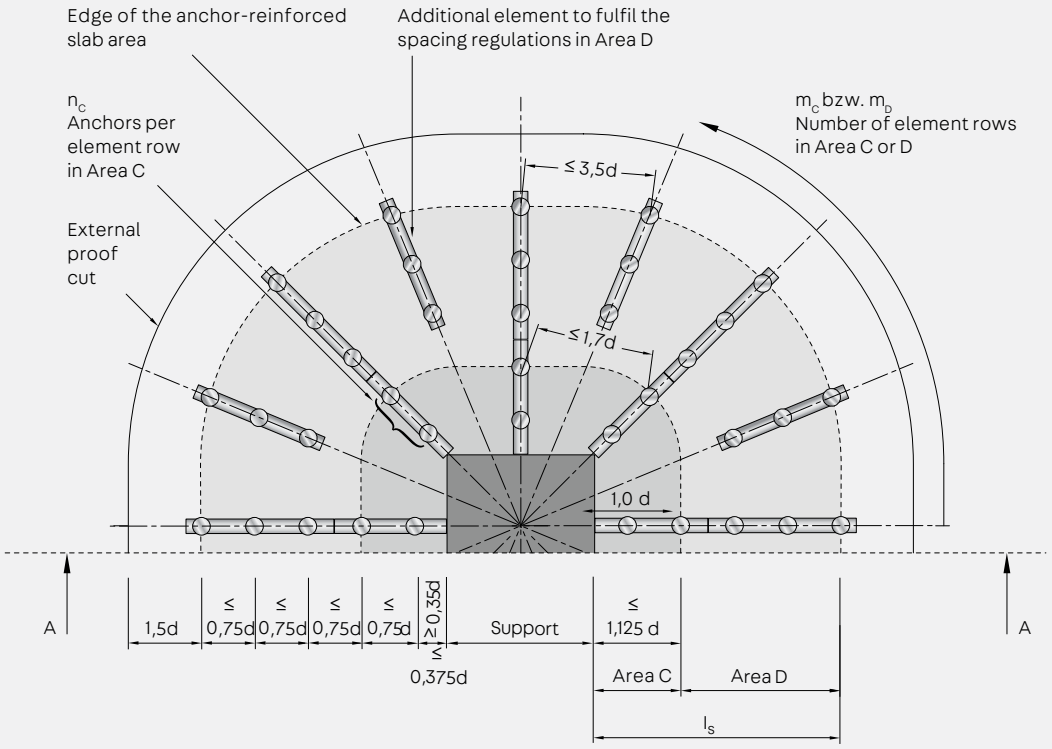


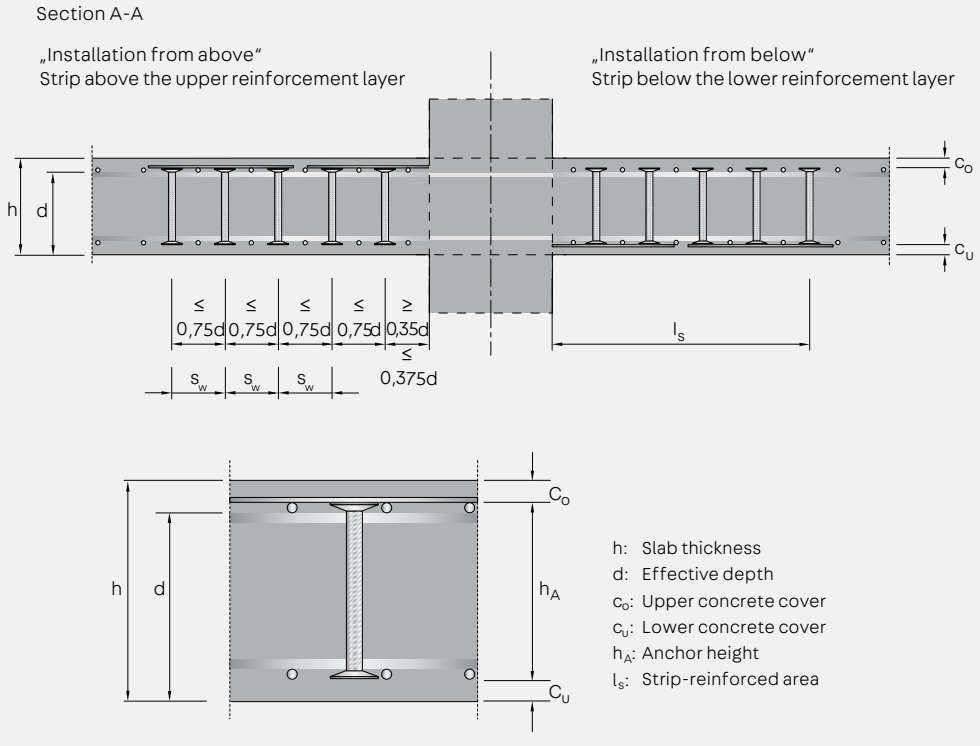



# Schematic diagram

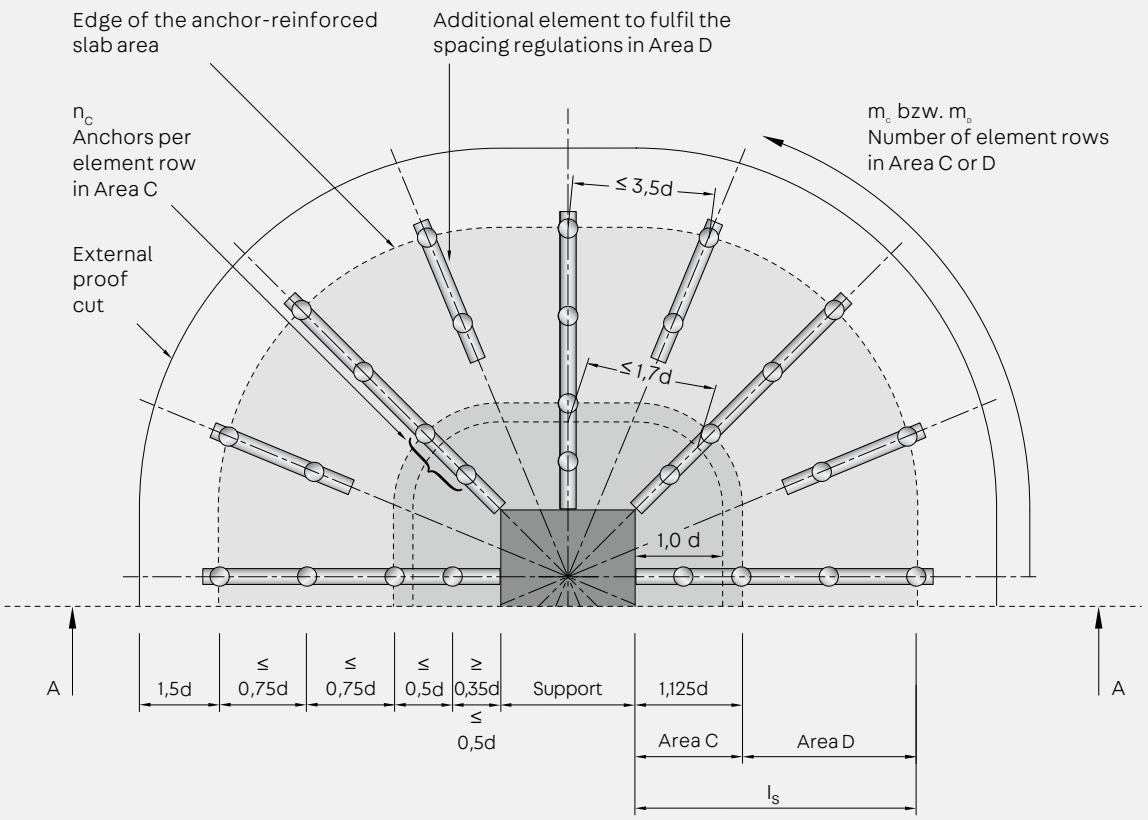
## Separate standard elements in ceiling slabs

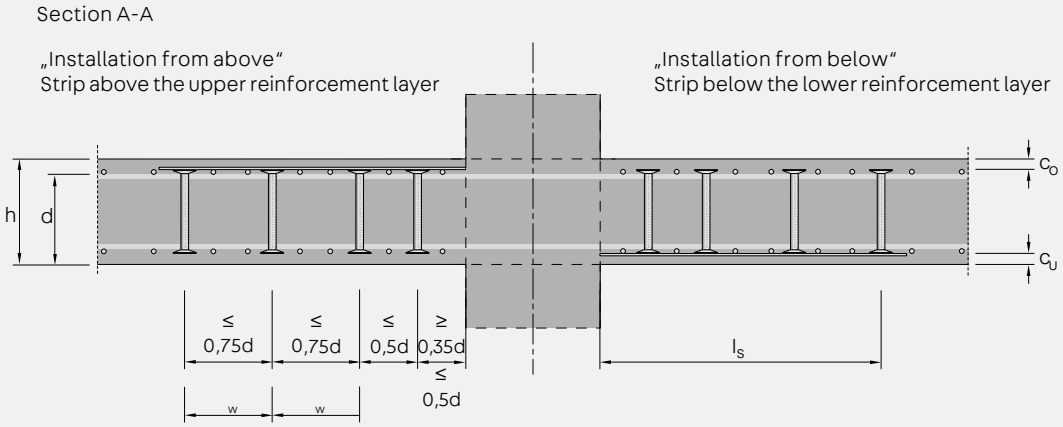


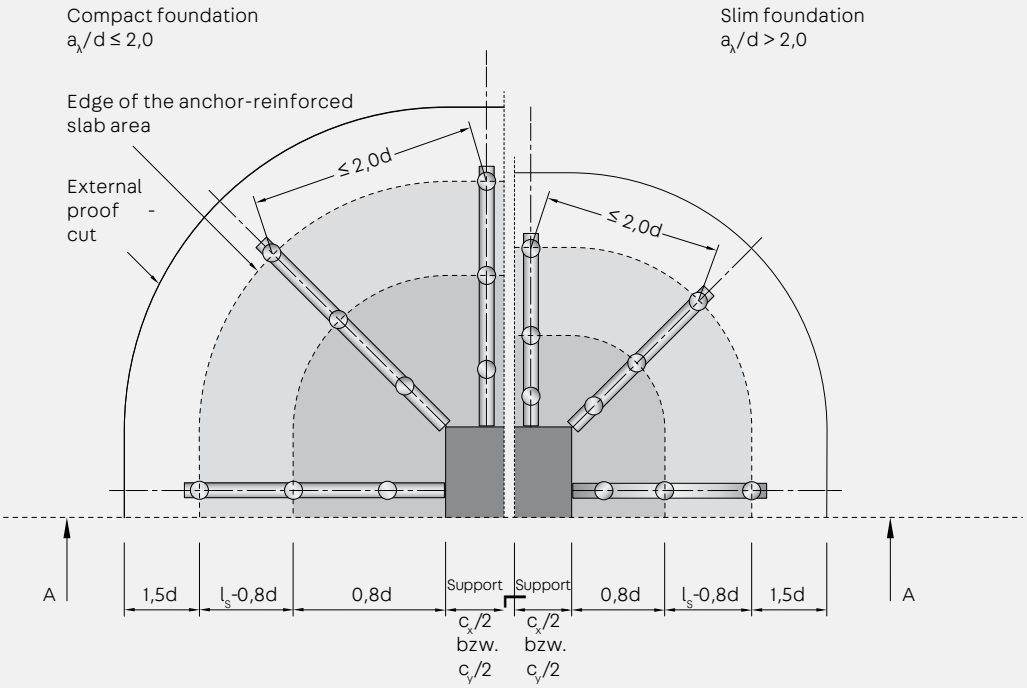

h: Slab thickness
d: Effective depth
$c_o$: Upper concrete cover
$c_u$: Lower concrete cover
$h_A$: Anchor height
$l_s$: Strip-reinforced area

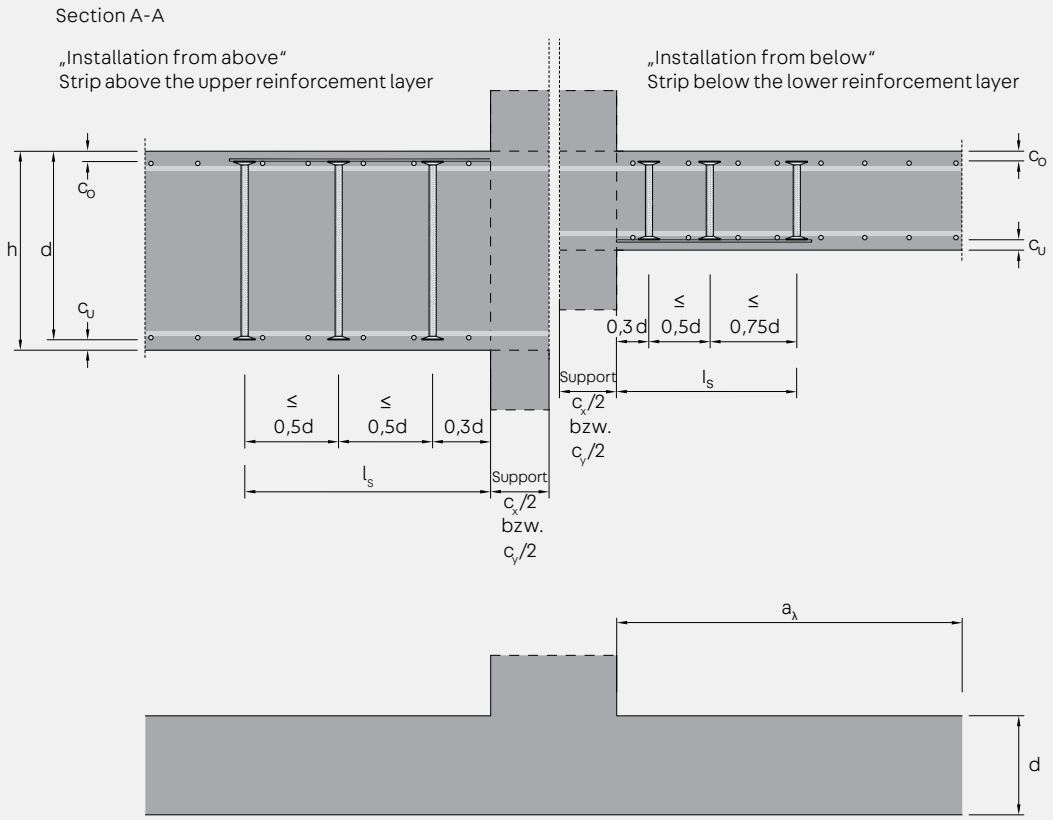
## Continuous elements in ceiling slabs



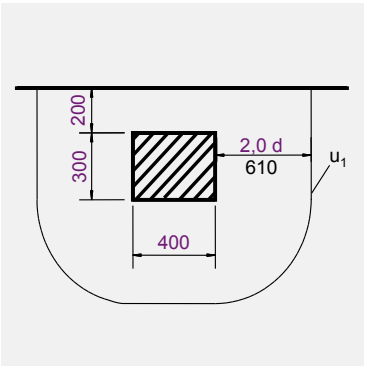
## Continuous elements in footings and floor slabs



# Sample calculation

**1. Given values:**
Slab depth h = 350 mm
Effective static depth d = 305 mm
Concrete C35/45
Reinforcement ratio ρ = 1.0%
Punching shear load $V_{Ed}$ = 800 kN




**Round cut-out perpendicular to the edge:**
$u_1 = 2 \cdot 300 + 400 + 2 \cdot 200 + 2.0 \cdot \pi \cdot 305 = 3316 \text{ mm} < 5233 \text{ mm}$
**Full round cut-out:**
$u_1 = 2 \cdot 300 + 2 \cdot 400 + 2 \cdot 2.0 \cdot \pi \cdot 305 = 5233 \text{ mm}$

**2. Punching shear verifications**

**2.1 Minimum resistance**

$v_{min}$ = 1/1.50 · √(1.81³ · 35.00 N/mm²) · 0.0525
= 0.50 N/mm²

**2.2 Critical round cut-out**

$v_{Ed}$ = 1.40 · 800.00 kN/(3316 mm · 305 mm)
= 1.11 N/mm²

$v_{Rd,c}$ = max [0.12 · 1.81 · (100 · 0.0100 · 35.00 N/mm²)^⅓ ; 0.50 N/mm²]
= 0.71 N/mm²

$v_{Rd,max}$ = 1.96 · 0.71 N/mm²
= 1.39 N/mm²

$v_{Ed} / v_{Rd,c}$ = 1.56 > 1 → **JDA required**

$v_{Ed} / v_{Rd,max}$ = 0.80 ≤ 1 → **OK**

**2.3 Area C**

$\beta \cdot V_{Ed}$ = 1120.00 kN

$V_{Rd,sy}$ = 4 · 2 · 490.87 mm² · 434.78 N/mm²/1.11
= 1545.15 kN

$\beta \cdot V_{Ed} / V_{Rd,sy}$ = 0.72 ≤ 1 → **OK**

**2.4 External round cut-out**

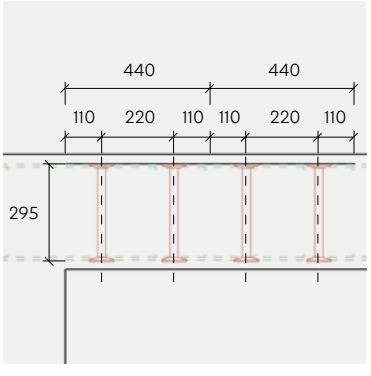
$l_s$ = 770 mm

$v_{Ed}$ = 1.10 · 800.00 kN / (5256 mm · 305 mm)
= 0.55 N/mm²

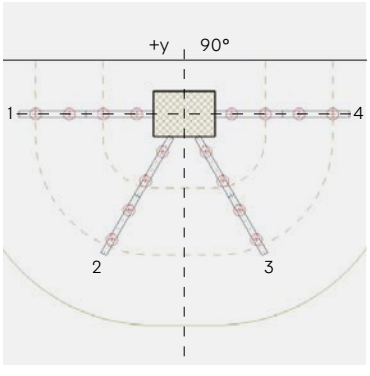
$v_{Rd,ca}$ = max [0.10 · 1.81 · (100 · 0.0100 · 35.00 N/mm²)^⅓ ; 0.50 N/mm²]
= 0.59 N/mm²

$v_{Ed} / v_{Rd,ca}$ = 0.93 ≤ 1 → **OK**

**3. Selected strip elements**
8 x JDA-2/25/295-440 (110/220/110)



Cross section (from JORDAHL® EXPERT software)



Top view (from JORDAHL® EXPERT software)

**Note**
Structural designs can be generated using the software JORDAHL® EXPERT JDA punching shear reinforcement.

# JORDAHL® EXPERT JDA punching shear reinforcement

The program is based on the European Technical Assessment ETA-13/0136 , which is regulated by Eurocode 2 (EN 1992-1-1).

## Benefits

- Most cost-effective solution is displayed first
- Quick and clear input of load specifications
- Easy project input and configuration
- Print out verifiable structural calculations
- Design earthquake load and fatigue load cases
- 3D view of columns
- Interactive edge insertion
- Effect of entered data is immediately shown and understandable
- For static calculation of cast-in-place concrete slabs, foundation slabs, precast slabs and footings

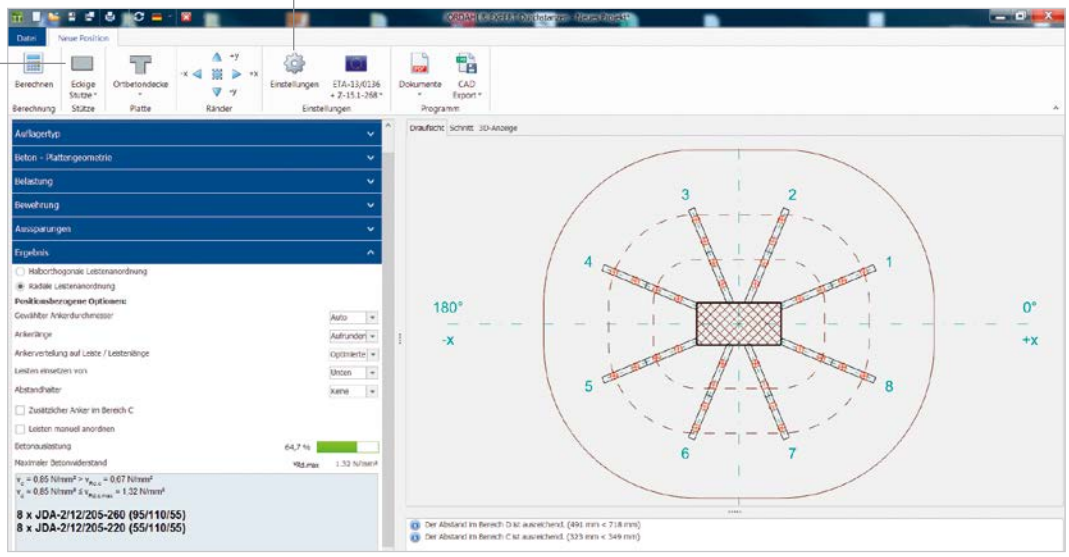
## Settings

Options/Settings can be used to define how the design result is determined:

- Separate standard elements
- Optimised continuous elements
- Optimised separate elements
- Continuous standard elements

## Column type

- Interior, edge and corner columns
- Wall ends and inner corners




## Load ► Load increase

There are three selection options for the load increase factor β:

- Constant factor in line with ETA-13/0136
- Fully plastic shear stress distribution
- User-defined input


## Load ► Earthquake

Calculates the minimum shear force reinforcement level according to DIN 4149 and provides detailed and comprehensible verification.

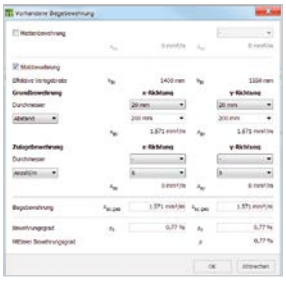
## Cut-outs

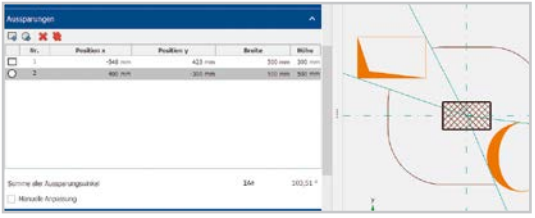
- Automatic inspection of the effects of cut-outs
- Cut-outs can be inserted and moved with a click of the mouse
- The program automatically recognises overlapping cut-outs
- Manual input of round cut-out deduction lengths
- Correct dimensions directly in the drawing
- Cut-out positions are listed in the final printout

## Reinforcement ratio

Reinforcement ratios in x and y directions are entered separately to determine the average reinforcement ratio ρ

- Reinforcement bars
- Mesh reinforcement with database of the most common mesh types





## Results

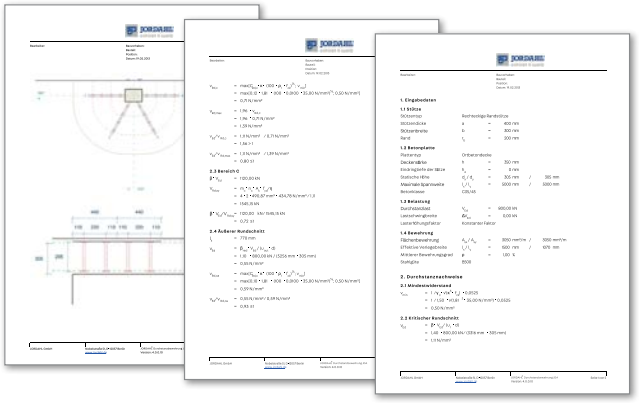
The punching shear area is displayed in plan and section views and immediately gives you an overview of how the JDA elements are arranged.

### Benefits:

- Verifiable printout of results
- Easily understandable intermediate results, final results and verifications (punching shear, earthquake load and composite material verification)
- Resulting graphics can be transferred as *.DXF or *.DWG files.

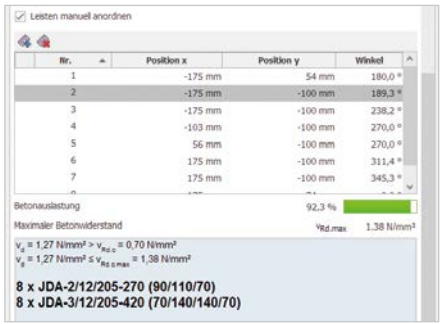
## Print results

Comprehensible and clear printout containing all test-relevant information.



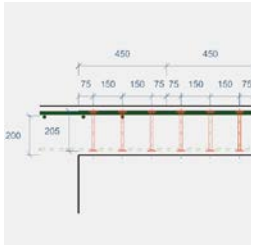
## Arrange manually

JDA elements can be moved manually with the click of a mouse.

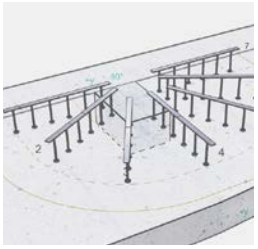



## Views

Cross section

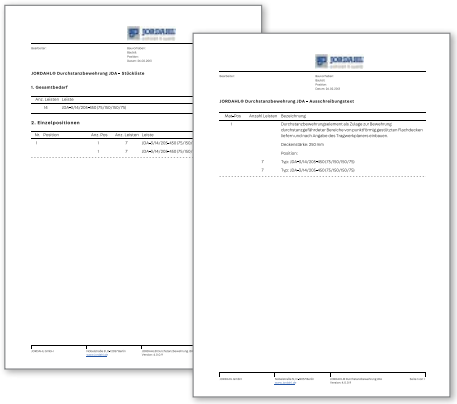



3D



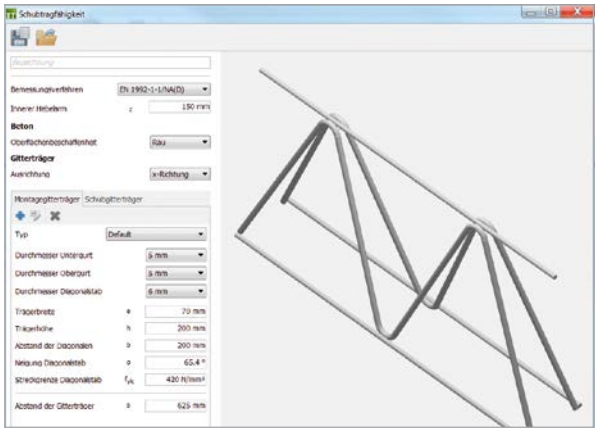
## Parts list / tender text

All calculated items can be added to the parts list, which can also be called up as an order list. Tender texts are also generated automatically.



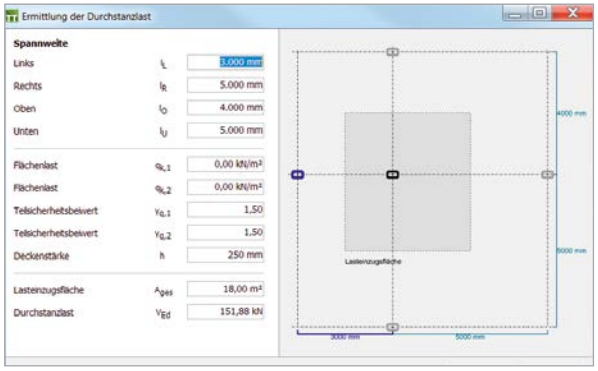
## Composite material verification

This function is used to calculate the load capacity of lattice girders and shear lattice girders. Composite material verifications are performed economically and factor in the double-headed anchors and lattice girders (in line with Eurocode 2). The results are then printed in a clear and comprehensible manner.




## Determine punching shear loads

The punching shear load can be estimated using the load application areas.



# Installation

## Arrangement on site

1

**Positioning the JDA reinforcement elements**
For cast-in-place concrete slabs, it is advisable to install the JDA elements from above. They can be positioned after laying all the flexural reinforcement.

2

**Aligning the projecting ends of the strips with the edge of the column**
This enables the position of the JDA elements to be checked and any necessary corrections made.

3

**Reliable height positioning**
Double-headed anchors extend between the reinforcement layers.

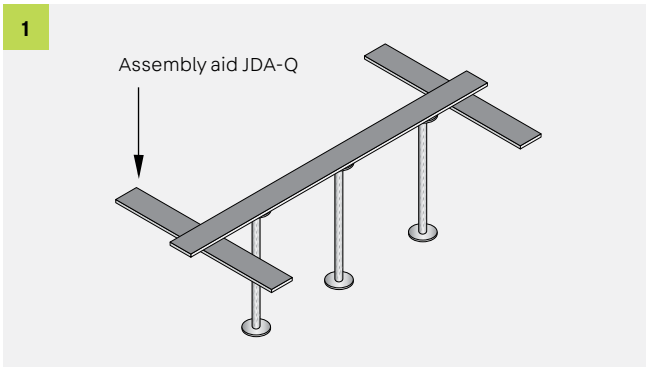
4

**Pouring the slab**
The slab can be poured after aligning the JDA elements.

# Installation in cast-in-place concrete

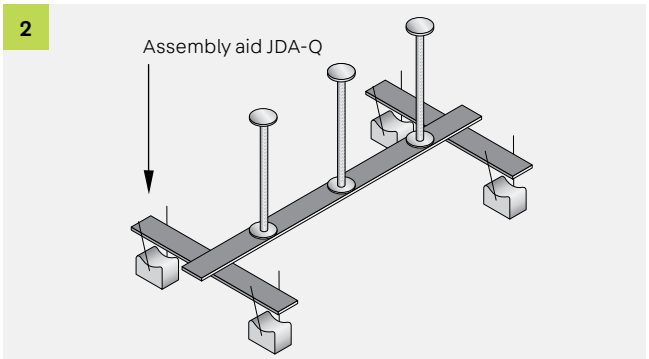
JDA elements can be used in cast-in-place concrete with the strips facing up or down. In either case, the heads of the JDA anchors must extend between both layers of flexural reinforcement.

1

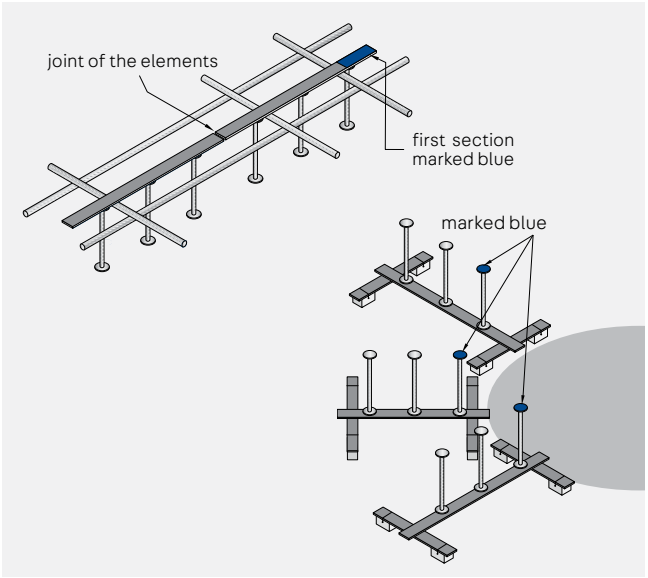



**Pre-assembly with JDA-Q assembly aids**
**Installation from above:** If the JDA reinforcement elements are arranged parallel to the upper reinforcement layer, use JDA-Q assembly aids and fastened them e.g. with tie wire.

2




**Pre-assembly with JDA-Q assembly aids**
**Installation from below:** JDA-Q assembly aids can also be used in this case to improve the stability of the elements. AH-DA spacers must be used to ensure that the required concrete cover thickness is maintained.




**Arrangement**
Position the reinforcement elements according to the plan. If asymmetrical elements are used, the section marked in blue must face towards the column.

Anchors arranged in the punching shear area of a column must all have the same diameter.

**AH-DA spacers**
Suitable AH-DA spacers must be used to mount JDA elements on the formwork. JORDAHL carries spacers for concrete coverings 20, 25, 30 and 35 mm thick.

**Note**
Before installation, compare the anchor diameters, anchor spacing and anchor height with the information in the formwork and reinforcement plans. The lower anchor heads must reach at least to the lower edge of the lowest reinforcement layer and the upper anchor heads at least to the upper reinforcement layer.

# Installation in precast slabs

The JDA-FT Klick system was developed specifically for precast slabs. The JDA elements are delivered unassembled, i.e. as a kit consisting of anchors + mounting strips + spacers. This prevents any obstruction of the automatic production process and avoids collisions between the flexural reinforcement, lattice girders and JDA elements. On the construction site, the upper reinforcement layer can simply be laid without any additional effort and without being impeded by mounting strips.

1

Strip

2

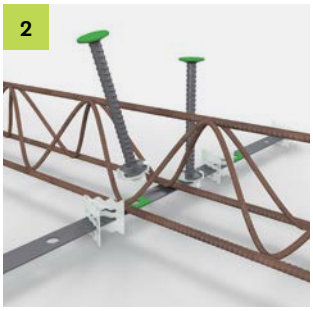
Fastening the strips to the formwork using spacers

3

Double anchors are clicked into place

1

2

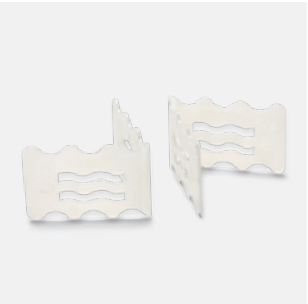


### FBA spacers

Suitable spacers must be used to install JDA elements in precast structures. JORDAHL carries fibre reinforced concrete spacers for concrete coverings 15, 20, 25 and 30 mm thick.

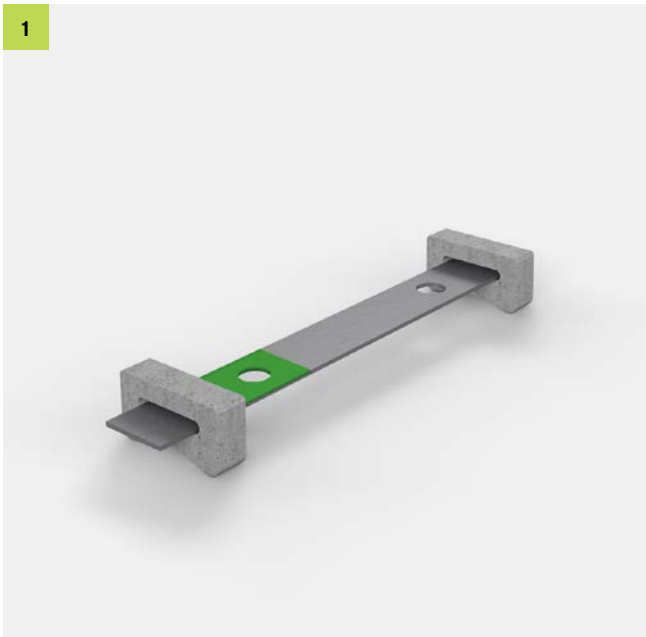
### AH-FT spacers

Alternatively, AH-FT plastic spacers are available for installing JDA elements in precast structures. These spacers can be used variably for concrete coverings of four different thicknesses (c = 15, 20, 25 and 30 mm). They offer optimum flexibility and take up minimal storage space.



# Installation

1



Mounting strips are positioned and fixed on spacers according to the planning specifications. These accommodate the double-headed anchors later on.

2

Lattice girders and lower flexural reinforcement are automatically positioned.

3

JDA double-headed anchors are clicked into pre-punched holes in the mounting strips using patented plastic connectors.

**Installation benefits**

- All element components provided as a kit
- Parts clearly colour-coded
- Easy click-in assembly even for greater distances
- Anchor spacing always corresponds exactly to the quality specifications
- No impermissible deviations in anchor spacing
- Universal spacers
- After pouring the concrete, the slab element is ready for transport without needing any further finishing work
- Perfect for storage
- Technical training provided by JORDAHL® employees and quality agreement

# Our synergy concept for you

**With us, you benefit from the collective experience of three established manufacturers who combine their products and expertise to form a truly comprehensive range. This is the PohlCon synergy concept.**

### Full-service consulting

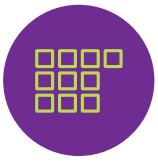
Our extensive network of advisors is available to answer all your questions about our products on site. You will enjoy personal support from our qualified staff right from the planning stage through to construction.

### Digital solutions

Our digital services give you targeted planning assistance when using our products. We provide tailor-made planning support from tender specifications to CAD details, BIM data and modern software solutions.

### Seven fields of application

We think in terms of holistic solutions. That is why we have grouped our products into seven fields of application in which you can benefit from the synergy of the PohlCon product range.



### Ten product categories

The products are divided into ten product categories to help you find the right product from our extensive range even faster. This allows you to navigate unerringly through our products.

### Custom solutions

Can't find a series product on the market that is suitable for your project? We master extraordinary challenges by harnessing the many years of expertise in the field of custom solutions of our three manufacturer brands. In this way, we can build unique construction projects together.

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