Designated according to The Construction Products (Amendment etc.) (EU Exit) Regulations 2020

UK Technical Assessment	UKTA-0836-22/6150 of 11/07/2022
Technical Assessment Body issuing the UK Technical Assessment:	British Board of Agrément
Trade name of the construction product:	JORDAHL punching reinforcement JDA
Product family to which the construction product belongs:	Reinforcing and prestressing steel for concrete (and ancillaries). Post tensioning kits.
Manufacturer:	PohlCon GmbH Nobelstrasse 51 12057 Berlin Germany
Manufacturing plant(s):	PohlCon GmbH Industriestrasse 5 14959 Trebbin Germany
This UK Technical Assessment contains:	22 pages including 3 annexes which form an integral part of this assessment
This UK Technical Assessment is issued in accordance with The Construction Products (Amendment etc.) (EU Exit) Regulations 2020 on the basis of:	EAD 160003-00-0301, Edition 05/2018 *Double headed studs for the increase of punching shear resistance of flat slabs or footings and ground slabs*

1 Technical description of the product

JORDAHL punching reinforcement JDA comprise JDA double headed studs manufactured of weldable structural steel or ribbed reinforcement bars with nominal characteristic yield strength of 500 MPa. The mechanical properties of the steel comply with the requirement according to EN 1992-1-1: 2004 + A1: 2014, Annex C.

The studs include a head at both ends with a diameter of three times the shaft diameter. The diameters of the shafts are 10, 12, 14, 16, 18 and 20 mm for studs with smooth shafts and 10, 12, 14, 16, 20 and 25 mm for studs with ribbed bars.

The studs are assembled to form reinforcement elements comprising at least two studs (see Annex A1). The studs are tack welded or clamped at one end to a non-structural steel rail or steel bars (reinforcing bars or round bars) for securing the position of the double headed studs when pouring the concrete. For use in semi-prefabricated slabs only, steel rails in connection with special plastic locks are used to secure the placement during casting. All studs of one of those reinforcement elements shall have the same diameter.

The bars used to secure the stud's position during casting (assembling bars or rails) are made of weldable reinforcing steel or structural steel (smooth steel bars) with ds = 6 mm to ds = 10 mm and the rails are manufactured from structural steel with a thickness of minimum t = 3 mm. The material for the structural steel (bars or rails) shall be No. 1.0037 or 1.0045 according to BS EN 10025-2: 2019 or non-corrosive steel No. 1.4401, 1.4404, 1.4439, 1.4571 according to BS EN 10088-5: 2009 or DD11 No. 1.0332 according to BS EN 10111 : 2008. The material of the plastic locks for use in semi-prefabricated slabs is specified within the technical documentation deposited with Deutsches Institut für Bautechnik.

The detailed product description is given in Annex A.

2 Specification of the intended use(s) in accordance with the applicable UK Assessment Document (hereinafter UKAD)

The performances given in Section 3 are only valid if the Product is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the Product of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristics	Performance
Increasing factor for punching shear resistance	$k_{pu,sl}$ = 1,96 $k_{pu,fo}$ = 1,50
Characteristic fatigue strength for N = $2 \cdot 10^6$ load cycles	$\Delta\sigma_{Rsk,n=2\cdot10^6}$ = 70 MPa

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	class A1

3.3 Health, hygiene, and the environment (BWR 3)

Not relevant

3.4 Safety and accessibility in use (BWR 4)

Not relevant

3.5 Protection against noise (BWR 5)

Not relevant

3.6 Energy economy and heat retention (BWR 6)

Not relevant

3.7 Sustainable use of natural resources (BWR 7)

No performance assessed.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied

4.1 System of assessment and verification of constancy of performance

According to UKAD No. 160003-00-0301 and Annex V of the Construction Products Regulation (Regulation (EU) 305/2011 as brought into UK law and amended, the system is: 1+.

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable UKAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

5.1 UKCA marking for the product/ system must contain the following information:

- Identification number of the Approved Body
- Name/address of the manufacturer of the product/ system
- Marking with intention of clarification of intended use
- Date of marking
- Number of certificate of constancy of performance
- UKTA number.

On behalf of the British Board of Agrément 	
Date of Issue: 11 July 2022	**Hardy Giesler** Chief Executive Officer

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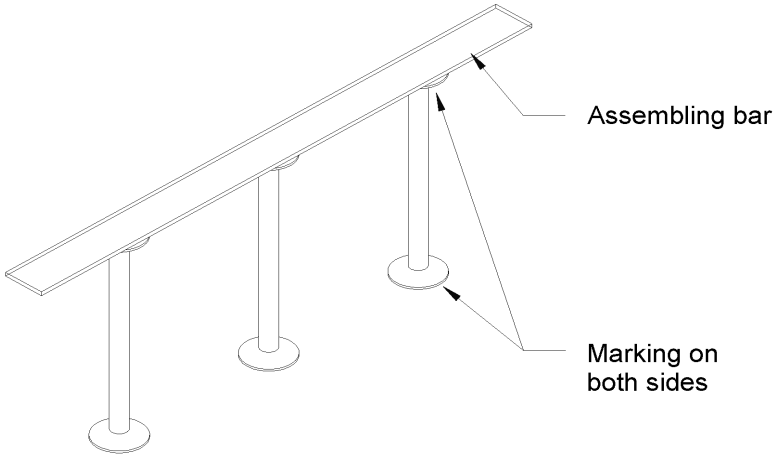
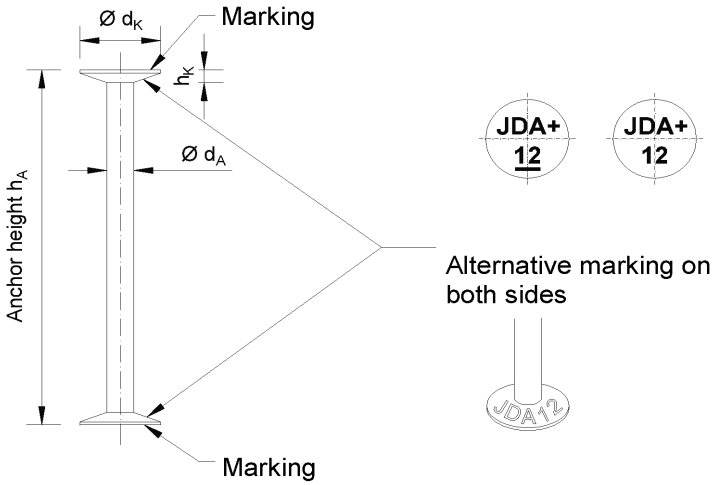
ANNEXES

These annexes apply to the product described in the main body of the UK Technical Assessment.

JORDAHL double headed stud elements with smooth shaft





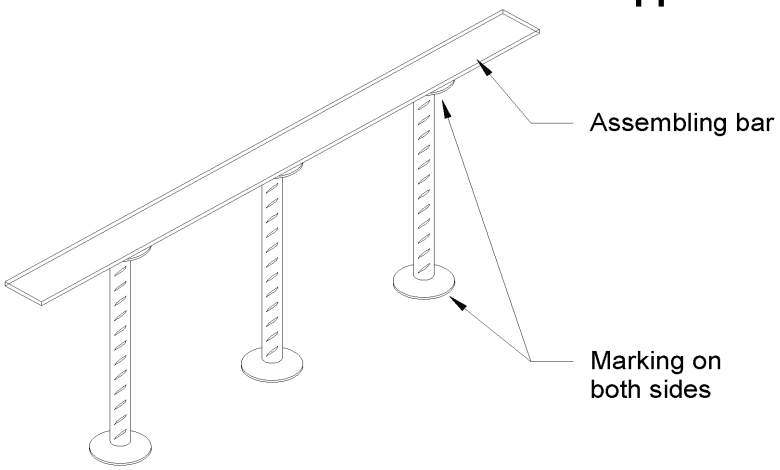
JDA: symbol of manufacturing plant

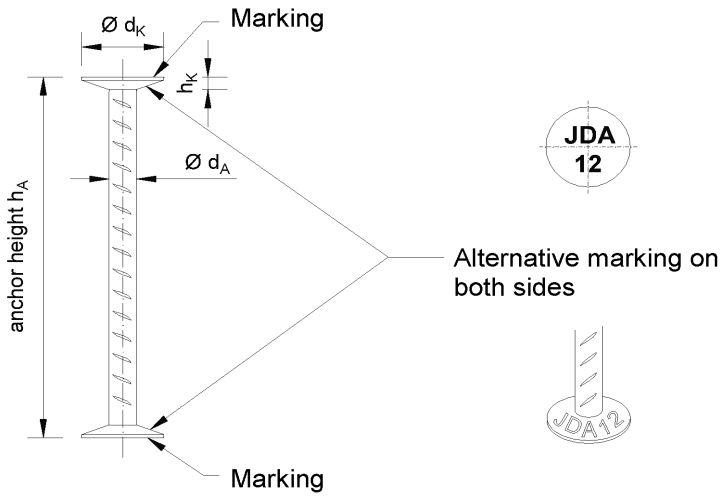
12: example for double headed stud d_A = 12 mm

Anchor diameter d_A [mm]	Head diameter d_K [mm]	Head height min. h_K [mm]	Anchor cross section A [mm²]	Characteristic value for yield strength f_{yk} [MPa]	Anchor height $h_A \leq 300$ mm [mm]
10	30	5	79	500	h_A = slab thickness - upper and lower concrete cover
12	36	6	113		
14	42	7	154		
16	48	7	201		
18	54	8	254		
20	60	9	314		

JORDAHL punching shear reinforcement JDA	Annex A1
Product description JDA stud dimensions and types	

JORDAHL double headed stud elements with ripped shaft





JDA: symbol of manufacturing plant

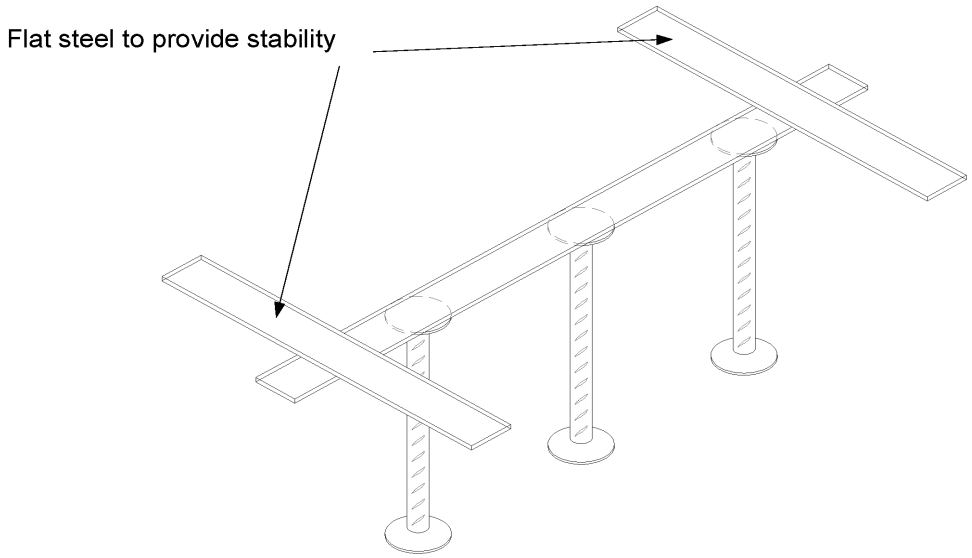
12: example for double headed stud d_A = 12 mm

Anchor diameter d_A [mm]	Head diameter d_K [mm]	Head height min. h_K [mm]	Anchor cross section A [mm²]	Characteristic value for yield strength f_{yk} [MPa]	Anchor height h_A [mm]
10	30	5	79	500	h_A = slab thickness - upper and lower concrete cover
12	36	6	113		
14	42	7	154		
16	48	7	201		
20	60	9	314		
25	75	12	491		

JORDAHL punching shear reinforcement JDA	Annex A2
Product description JDA stud dimensions and types	

Version with flat steel to provide stability

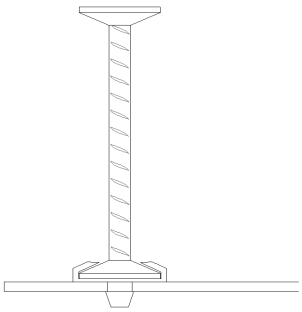
For use in-situ concrete

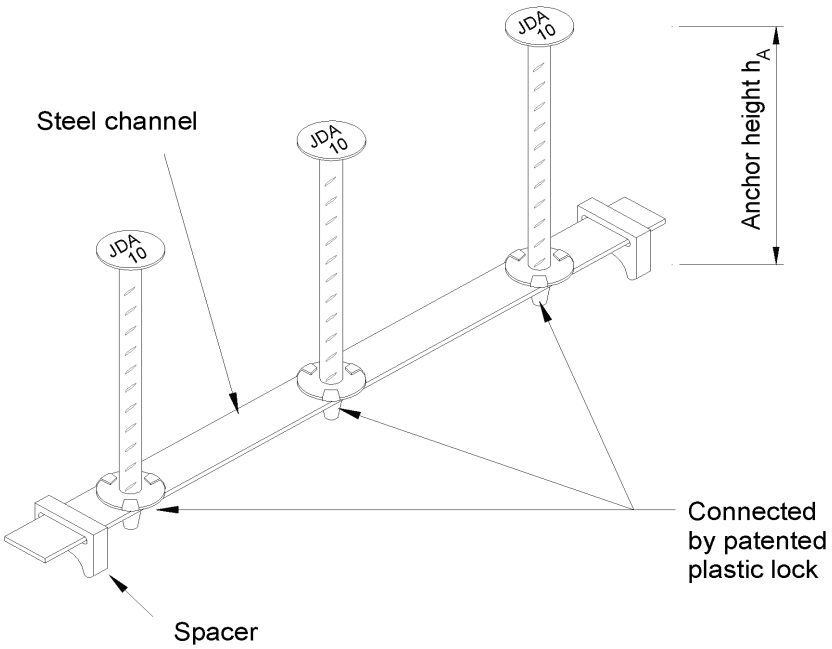


FT-KL version with patented plastic lock

For use in prefabricated slabs

Material of plastic lock:
plastic acc. to
provided data sheet

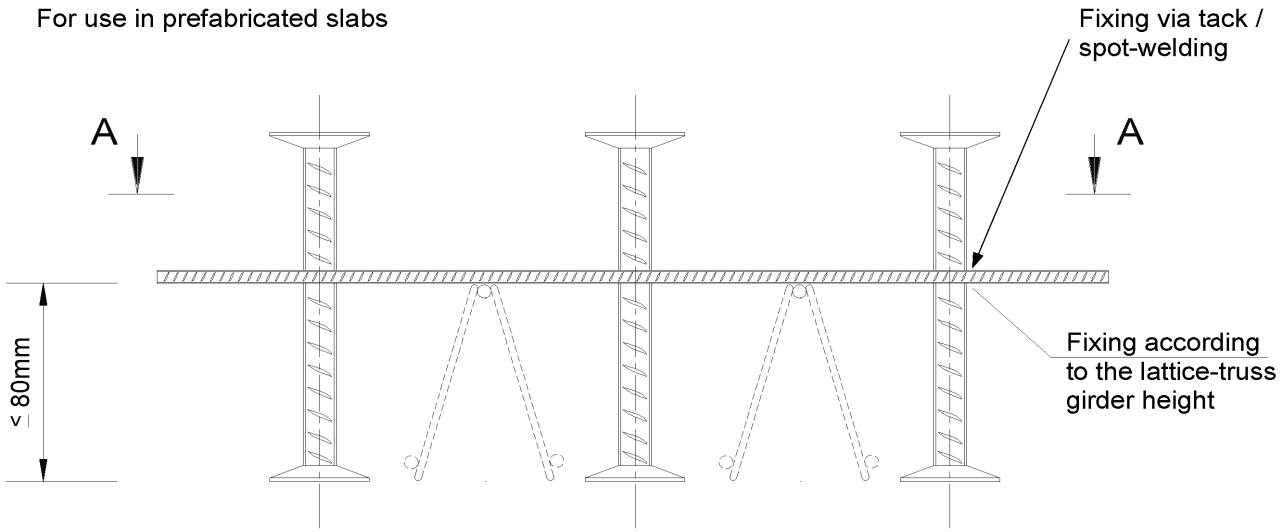




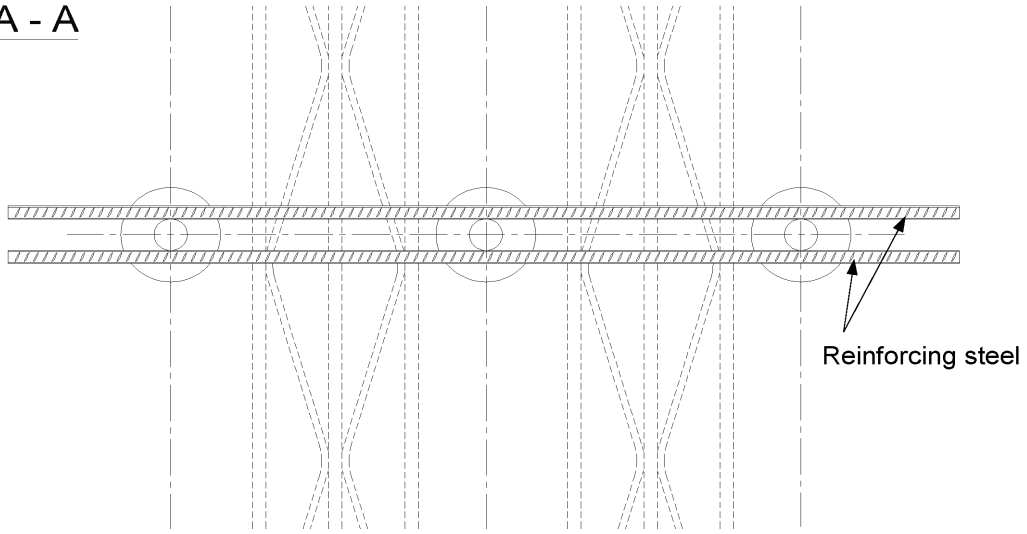
JORDAHL punching shear reinforcement JDA	Annex A3
Product description For use in-situ concrete and For use in prefabricated slabs	

Punching shear reinforcement with double headed studs
Version with attached positional stabilisation

For use in prefabricated slabs



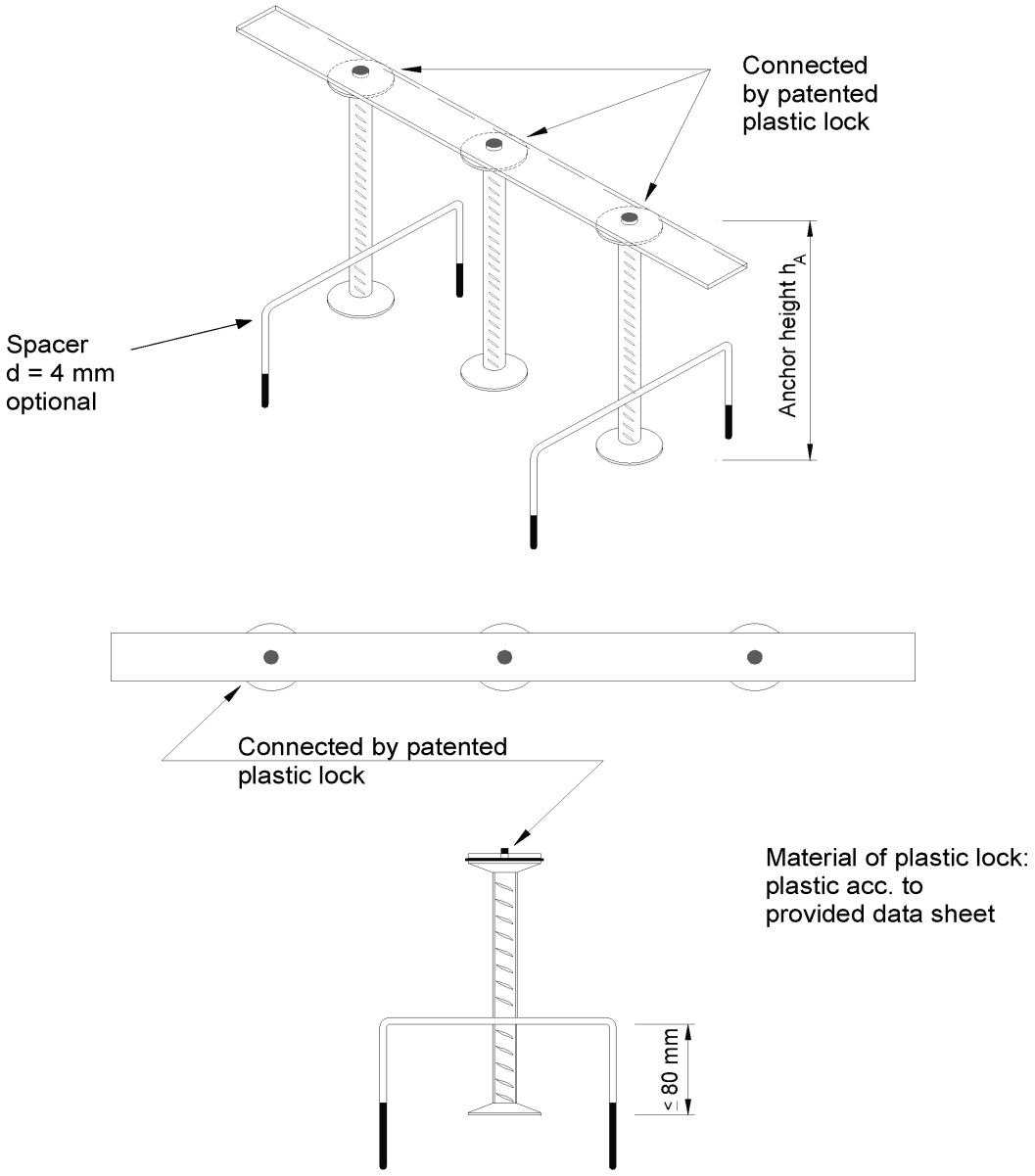
Section A - A



JORDAHL punching shear reinforcement JDA	Annex A4
Product description Version with attached positional stabilisation for use in prefabricated slabs	

Punching shear reinforcement with double headed studs
Version FT with patented plastic lock

For use in prefabricated slabs



JORDAHL punching shear reinforcement JDA	Annex A5
Product description FT version in prefabricated slabs	

Specification of intended of use

Double headed anchors are used to increase the puncture resistance of flat slabs, reinforced concrete slabs or footings and ground slabs under static, quasi-static and fatigue-relevant load.
Double headed anchors are arranged next to columns or concentrated single loads.
The design of the punching shear resistance of flat slabs, reinforced concrete slabs or footings and ground slabs is done in accordance with EOTA TR 060.
Double headed studs can also be used for semi-prefabricated slabs also in combination with lattice girders when the respective ETAs or national guidelines are observed.
Double headed studs installed as shear reinforcement are also effective as interface reinforcement between precast and in-situ concrete.
The intended use covers the following specifications:

- **flat slabs, reinforced concrete slabs or footings and ground slabs made of reinforced normal weight concrete of strength class C20/25 to C50/60 according to BS EN 206-1: 2013 + A2: 2021**
- flat slabs, reinforced concrete slabs or footings and ground slabs with a minimum height of h = 180 mm
- flat slabs, reinforced concrete slabs or footings and ground slabs with a maximum effective depth of d = 300 mm (only for double headed studs with smooth shafts)
- double headed anchors as reinforcing elements of the same diameter and type (ribbed or smooth) in punching area around supports or concentrated single load
- reinforcement elements with double headed studs installed in an upright (rail at the bottom of the slab) or hanging position
- reinforcement elements with double headed studs positioned so that the double headed bolts are perpendicular to the surface of the flat ceilings, reinforced concrete slabs or footings and ground slabs
- reinforcement elements with double headed studs directed radially towards the column of high concentrated load and distributed evenly in the critical punching area
- reinforcement elements with double headed studs positioned such that the upper heads of the studs reach at least to the outside of the uppermost layer of the flexural reinforcement
- reinforcement elements with double headed studs positioned such that the lower heads of the studs reach at least to the outside of the lowest layer of the flexural reinforcement
- **reinforcement elements with double headed studs positioned such that the concrete cover complies with the provisions according to BS EN 1992-1-1: 2004 + A1: 2014, section 4.4**
- reinforcement elements with double headed studs positioned so that the minimum and maximum distances between the double headed studs on an element and between the elements as arranged around a column or concentrated load area shall comply with the requirements of Annexes B3 to B8
- The provisions are kept on site with an accuracy of 0.1h (h = height of the slab)

Installation

- When installed correctly, the reinforcement elements have sufficient robustness to withstand usual actions before concreting.

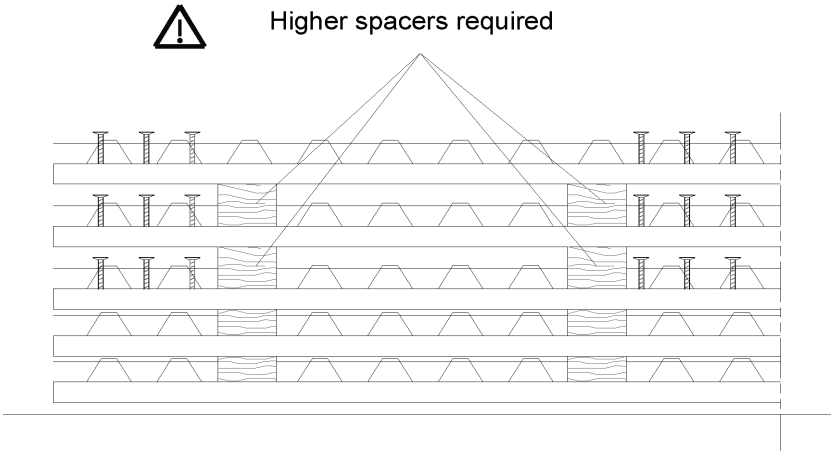
- In case the studs are intended for use in prefabricated slabs there are no requirements in terms of before mentioned robustness if there are other possibilities to ensure a safe transport and positioning.

JORDAHL punching shear reinforcement JDA	Annex B1
Intended use Specification	

Packing, transport and storage:

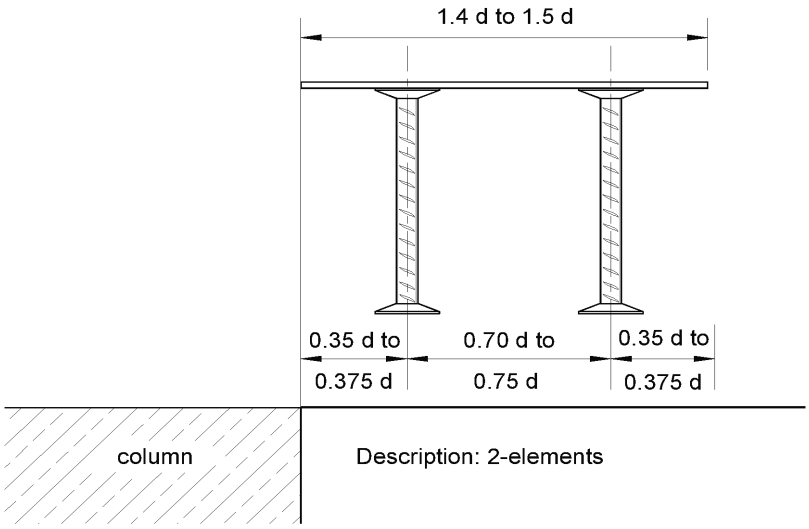
Special considerations shall be given to the transportation of the prefabricated elements to avoid any damage to the anchorage of the headed studs in the precast slab. When storing and transporting precast elements, the height of the double headed stud elements has to be considered. Higher spacers are required when stacking the precast elements.

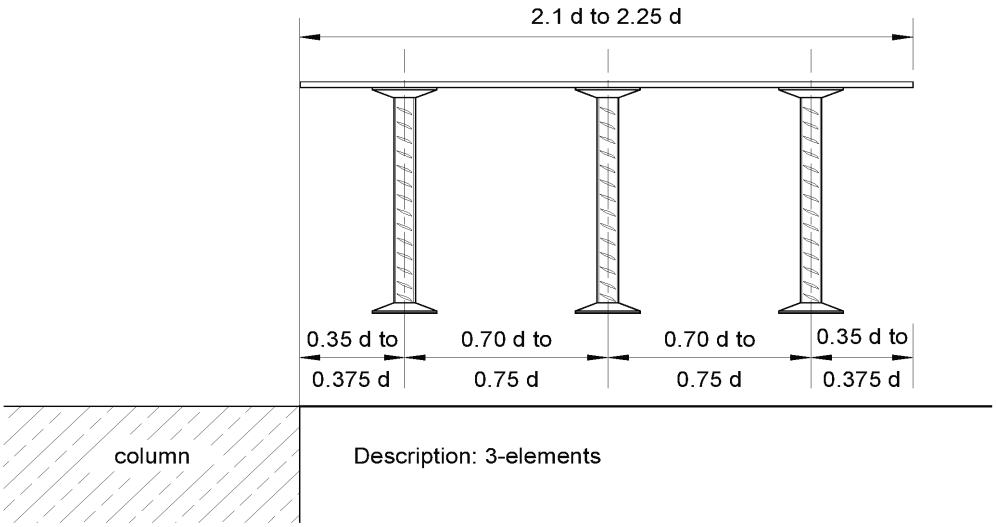
Positioning and transportation when used in semi-prefabricated slabs



JORDAHL punching shear reinforcement JDA	Annex B2
Intended use Specification	

Design of the JDA standard elements

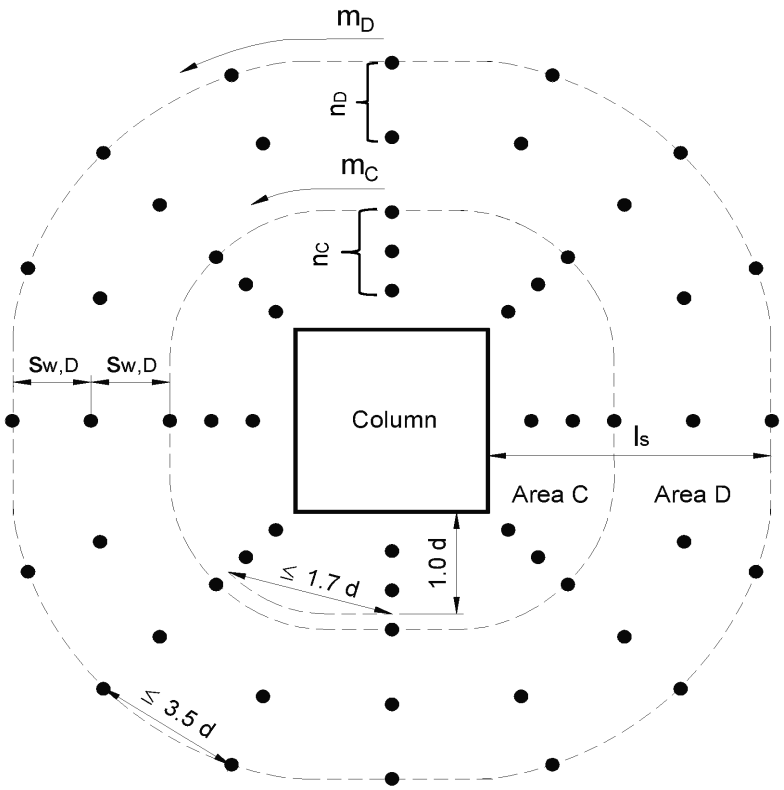




The symmetric overlap of the assembling bar is used to ensure correct spacing of the elements from the column. Furthermore, it ensures the right radial spacing between two adjacent stud elements.

JORDAHL punching shear reinforcement JDA	Annex B3
Intended use Standard system arrangement	

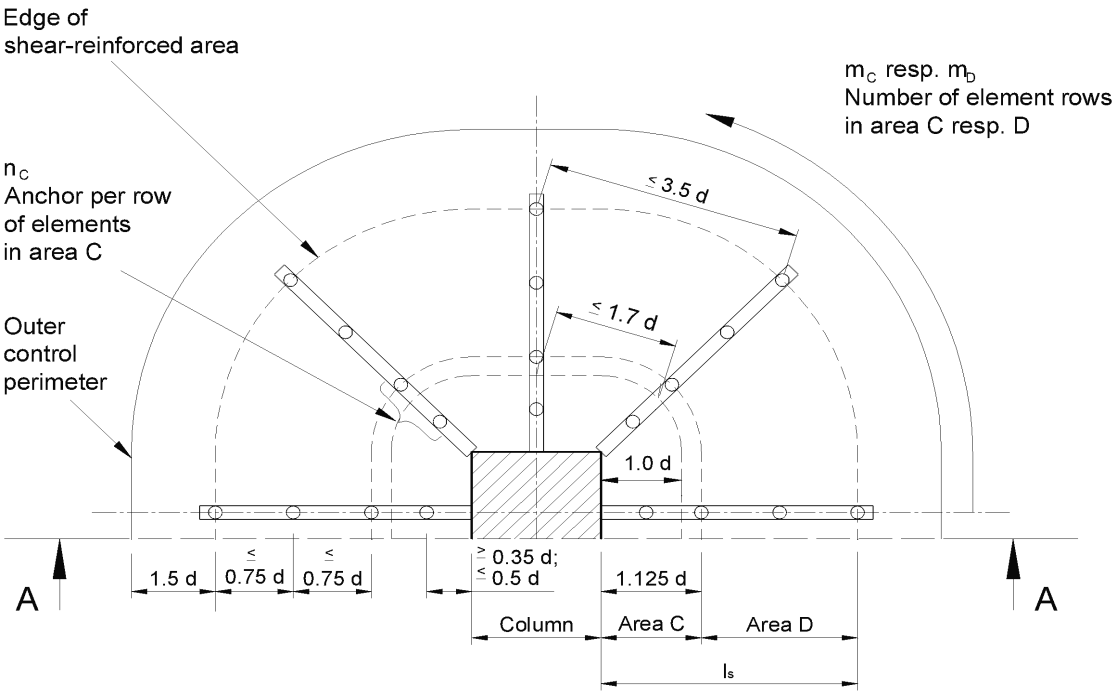
Principle arrangement of the JDA studs in slabs



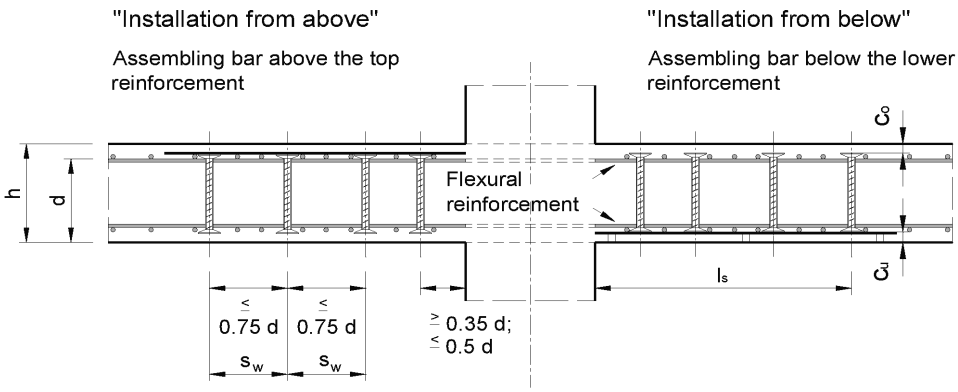
m_C	number of elements (rows) in area C
m_D	number of elements (rows) in area D
n_C	number of studs of each element (row) in area C
n_D	number of studs of each element (row) in area D
$s_{w,D}$	radial spacing in area D

JORDAHL punching shear reinforcement JDA	Annex B4
Intended use Principle arrangement of JDA studs in slabs	

Arrangement of punching shear reinforcement using continuous elements in slabs



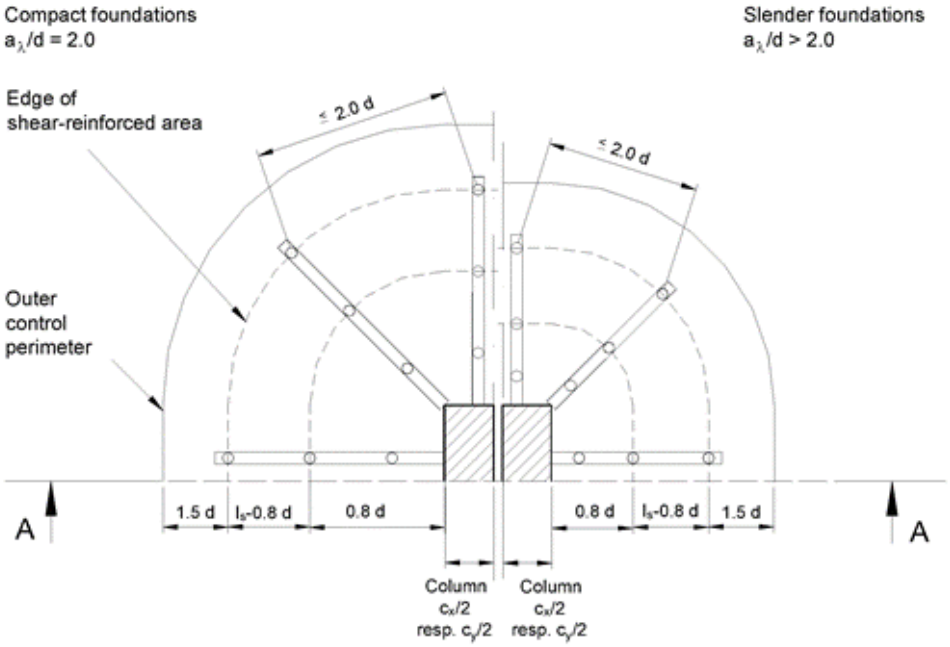
Section A-A



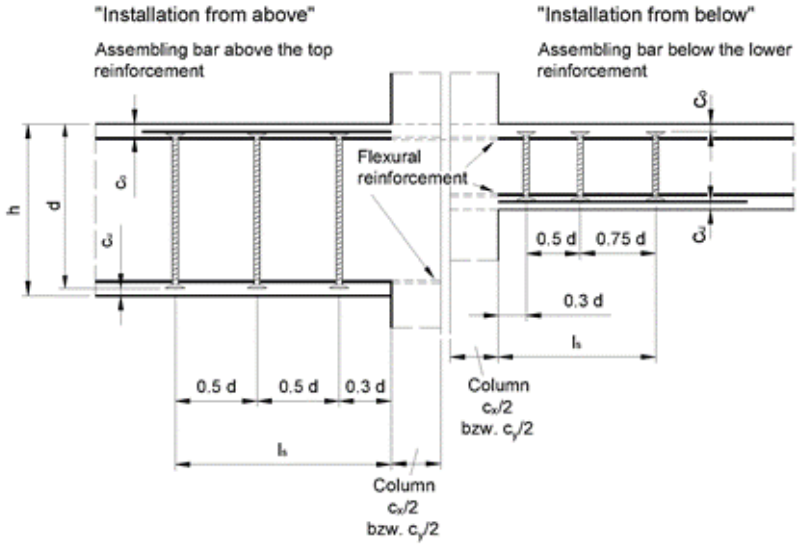
Concrete cover c_0 resp. c_u acc. to BS EN 1992-1-1: 2004 + A1: 2014, section 4.4

JORDAHL punching shear reinforcement JDA	Annex B5
Intended use Arrangement of punching shear reinforcement with continuous elements in slabs	

Arrangement of punching shear reinforcement using continuous elements in footings and ground slabs



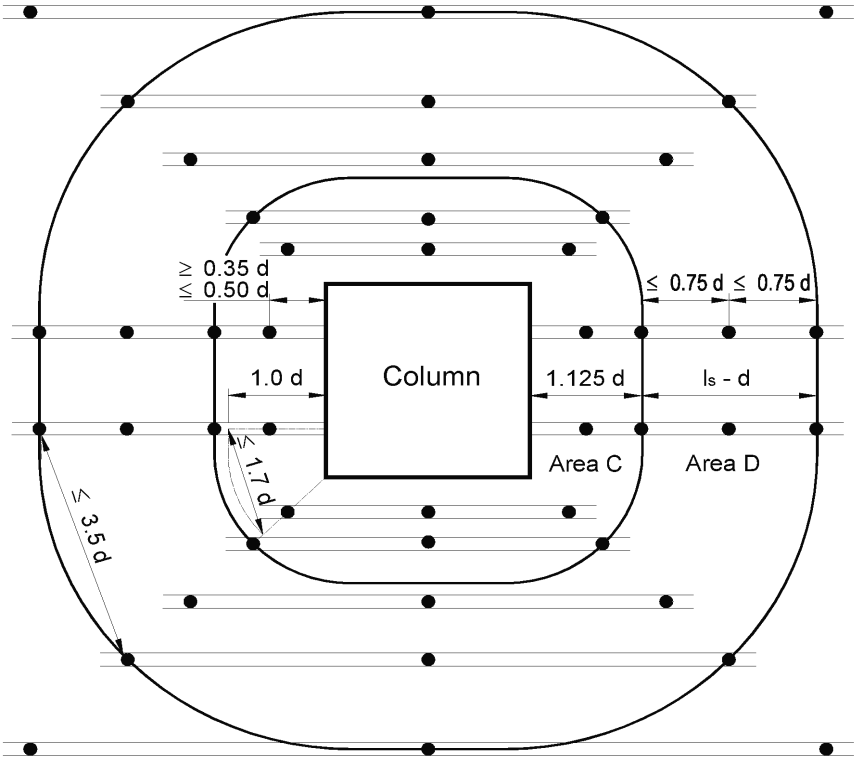
Section A-A



Concrete cover c_0 resp. c_u acc. to BS EN 1992-1-1: 2004 + A1: 2014, section 4.4

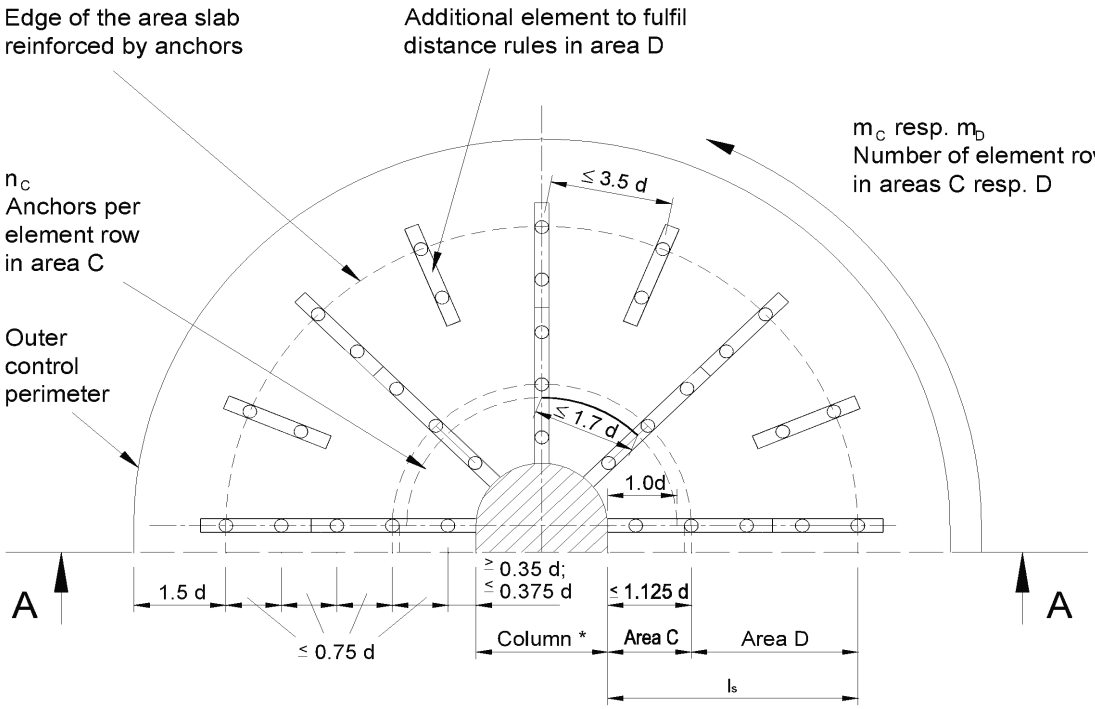
JORDAHL punching shear reinforcement JDA	Annex B6
Intended use Arrangement of punching shear reinforcement in footings and ground slabs	

Orthogonal arrangement of punching shear reinforcement in slabs

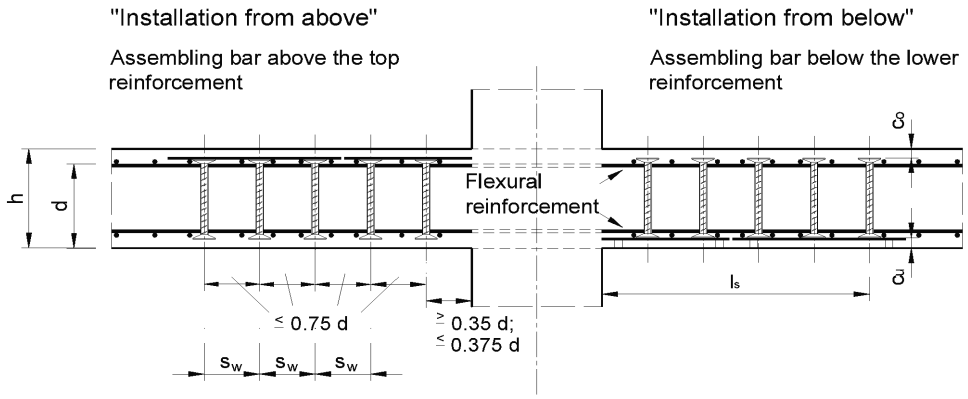


JORDAHL punching shear reinforcement JDA	Annex B7
Intended use Parallel arrangement of punching shear reinforcement	

Arrangement of punching shear reinforcement using shared standard elements in slabs



Section A-A



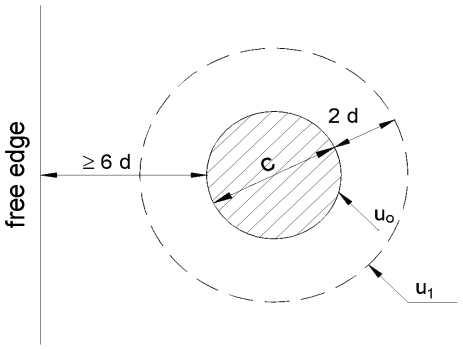
* Combination of shared standard elements analogous to rectangular columns

JORDAHL punching shear reinforcement JDA	Annex B8
Intended use Arrangement for shared standard elements in slabs	

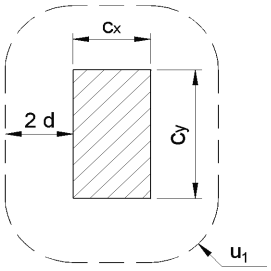
Defining the critical perimeter u_1 and outermost perimeter u_{out}

1. Critical perimeter u_1

a) Loaded areas (columns) are 6 d or more than 6 d of openings or slab free edges

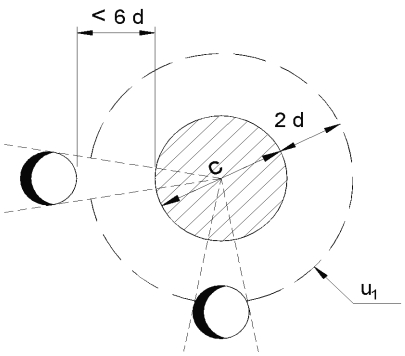


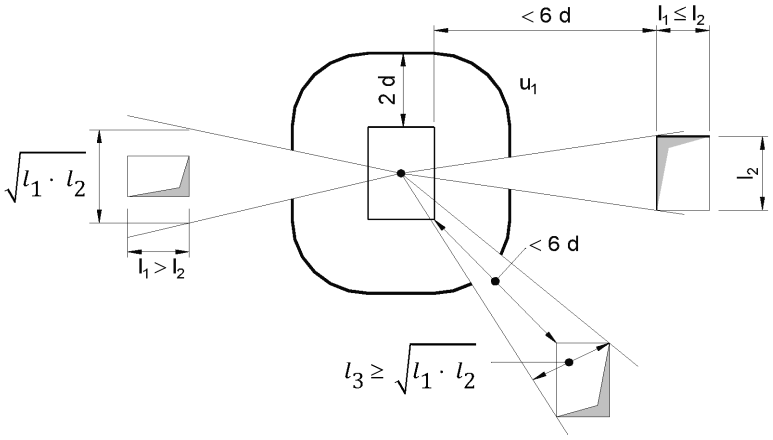
$u_1 = \pi\ (c + 4\ d)$



$u_1 = 2\ (c_x + c_y) + 4\ d\ \pi$

b) Loaded areas (columns) are less than 6 d from openings (voids) in the slab.

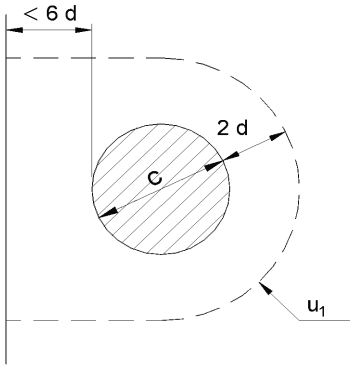


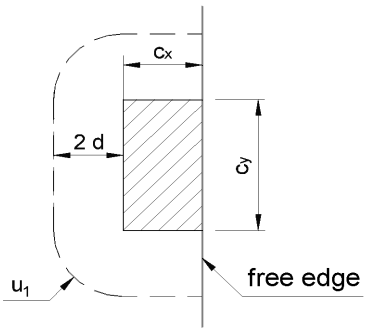


JORDAHL punching shear reinforcement JDA	Annex C1
Critical perimeter u_1 and outermost perimeter u_{out}	

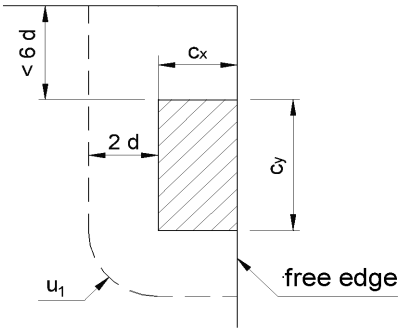
c) Loaded areas (columns) at distances less than 6 d from free edges

Edge columns





Corner columns



2. Outermost perimeter u_{out}

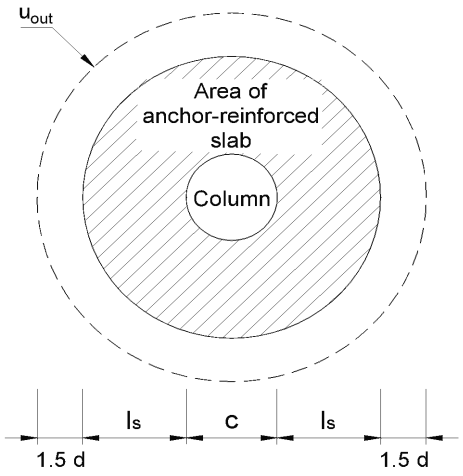
a) Loaded areas (columns) are more than 6 d from openings or slab free edges

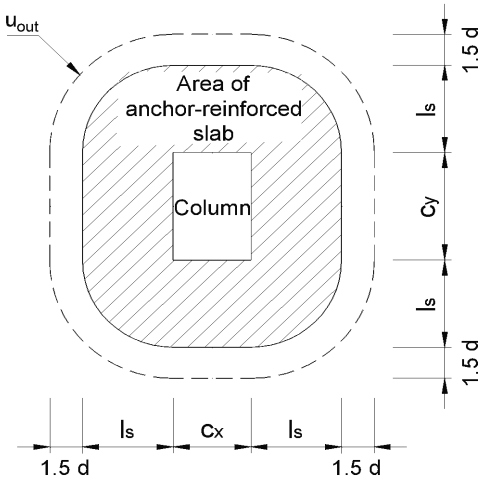
Circular column

$u_{out} = \pi (2 l_s + c + 3 d)$

Rectangular column

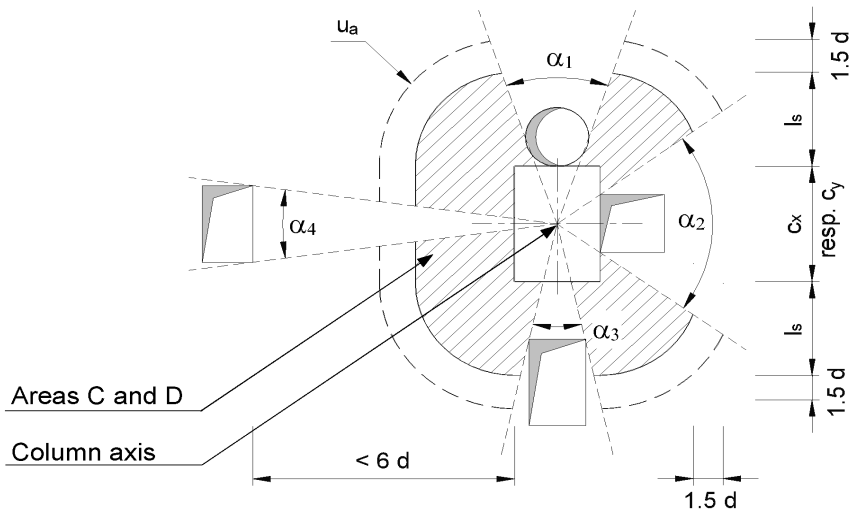
$u_{out} = 2 (c_x + c_y) + \pi (2 l_s + 3 d)$



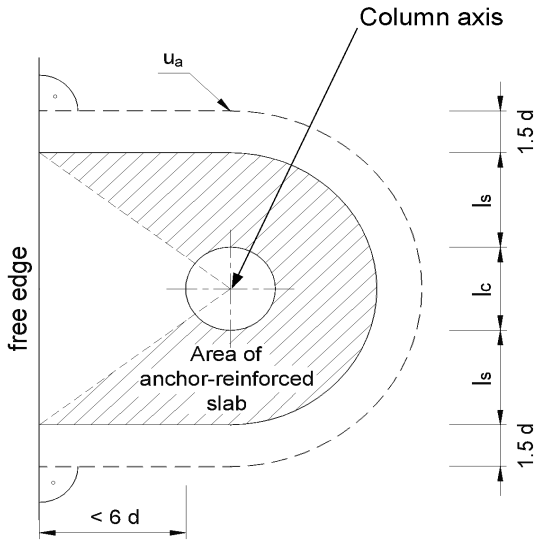


JORDAHL punching shear reinforcement JDA	Annex C2
Critical perimeter u_1 and outermost perimeter u_{out}	

b) Loaded areas (columns) are less than 6 d from opening in the slab



c) Loaded areas (columns) are less than 6 d from free edges



JORDAHL punching shear reinforcement JDA	Annex C3
Critical perimeter u_1 and outermost perimeter u_{out}	

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