

Approval body for construction products
and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and
Laender Governments



European Technical Assessment

ETA-13/0136
of 20 March 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the
European Technical Assessment:

Deutsches Institut für Bautechnik

Trade name of the construction product

JORDAHL punching reinforcement JDA

Product family
to which the construction product belongs

Double headed studs as punching reinforcement
for flat slabs and footings

Manufacturer

JORDAHL GmbH
Nobelstraße 51
12057 Berlin
DEUTSCHLAND

Manufacturing plant

JORDAHL Herstellwerke

This European Technical Assessment
contains

20 pages including 3 annexes which form an integral part
of this assessment

This European Technical Assessment is
issued in accordance with Regulation (EU)
No 305/2011, on the basis of

EAD 160003-00-0301

This version replaces

ETA-13/0136 issued on 27 March 2013

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Specific Part

1 Technical description of the product

The JDA double headed studs are made 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, Annex C.

They have 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 element 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 $d_s = 6$ mm to $d_s = 10$ mm and the rails are made of 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 acc. to EN 10025-2 or non-corrosive steel No. 1.4401, 1.4404, 1.4439, 1.4571 acc. to EN 10088-5 or DD11 No. 1.0332 acc. To EN 10111. 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 in accordance with the applicable European Assessment Document

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 characteristic	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	$\Delta\sigma_{Rsk,n=2 \cdot 10^6} = 70$ MPa

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	class A1

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 160003-00-0301 the applicable European legal act is: [97/597/EC(EU)].

The system(s) to be applied is (are): [1+]

In addition, with regard to reaction to fire for products covered by this EAD the applicable European legal act is: [2001/596/EC(EU)]

The system to be applied is: [4]

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

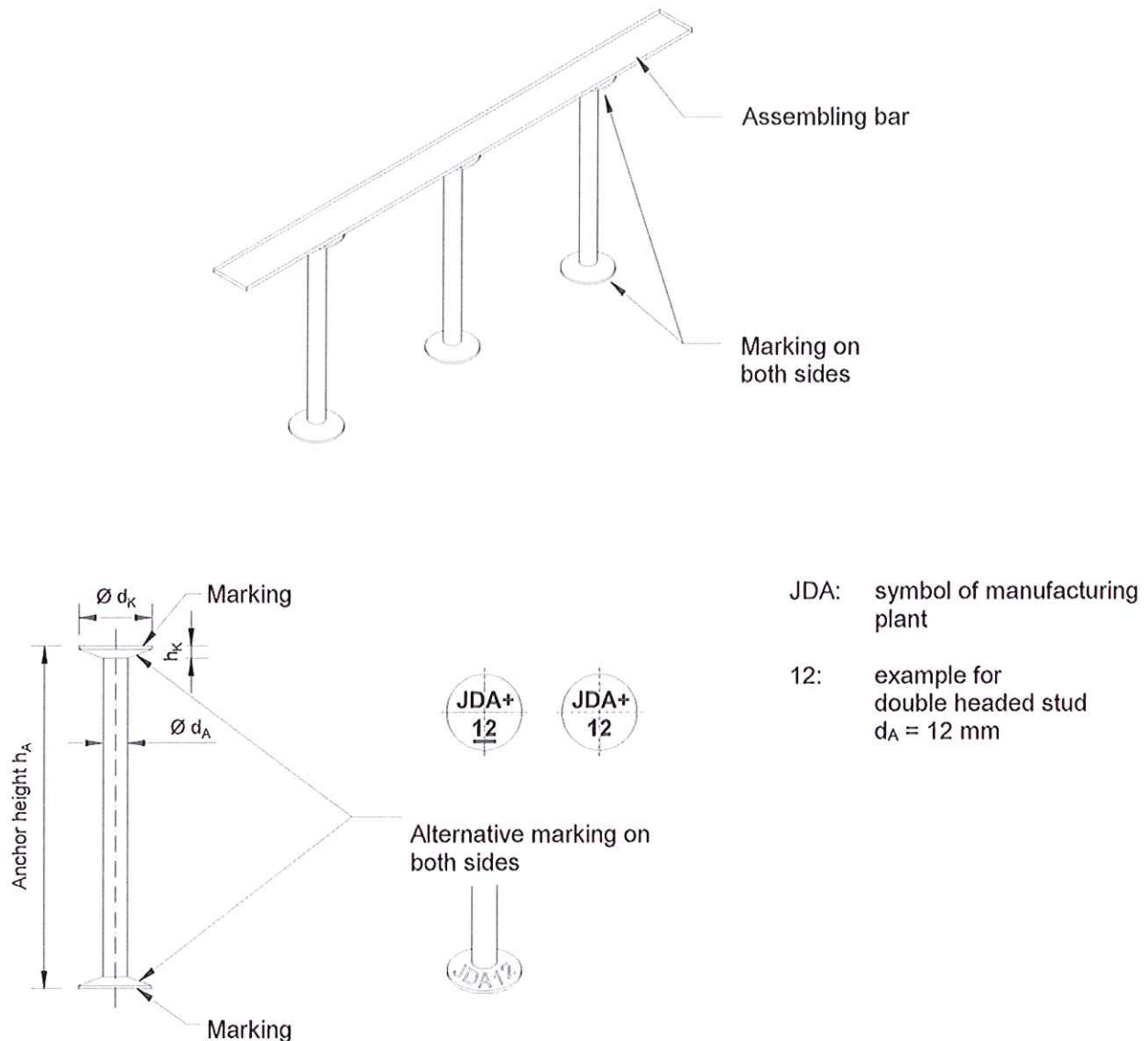
Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 20 March 2018 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Schüler

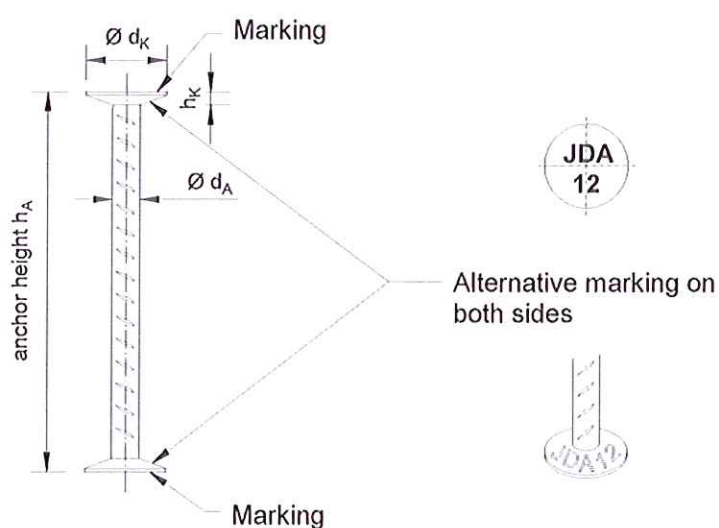
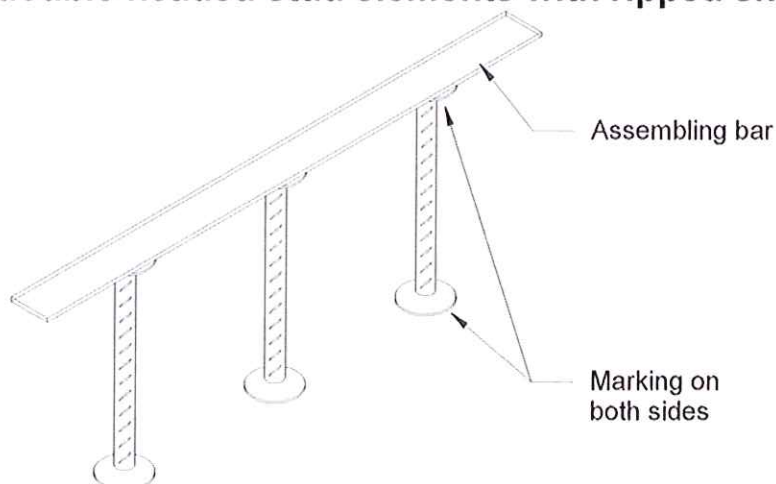
JORDAHL double headed stud elements with smooth shaft



Anchor diameter d_A [mm]	Head diameter d_K [mm]	Head height min. h_K [mm]	Anchor cross section A [mm ²]	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
 $d_A = 12 \text{ mm}$

Anchor diameter d_A [mm]	Head diameter d_k [mm]	Head height min. h_k [mm]	Anchor cross section A [mm ²]	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

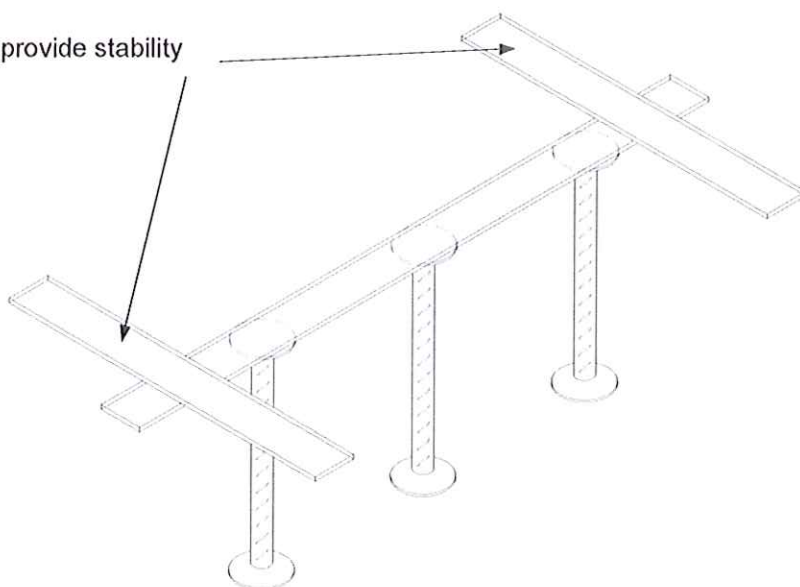
Product description
JDA stud dimensions and types

Annex A2

Version with flat steel to provide stability

For use in-situ concrete

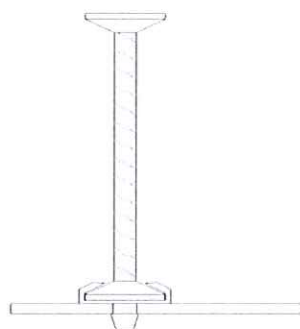
Flat steel to provide stability



FT-KL version with patented plastic lock

For use in prefabricated slabs

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



Steel channel

JDA 10

JDA 10

JDA 10

Anchor height h_A

Spacer

Connected
by patented
plastic lock

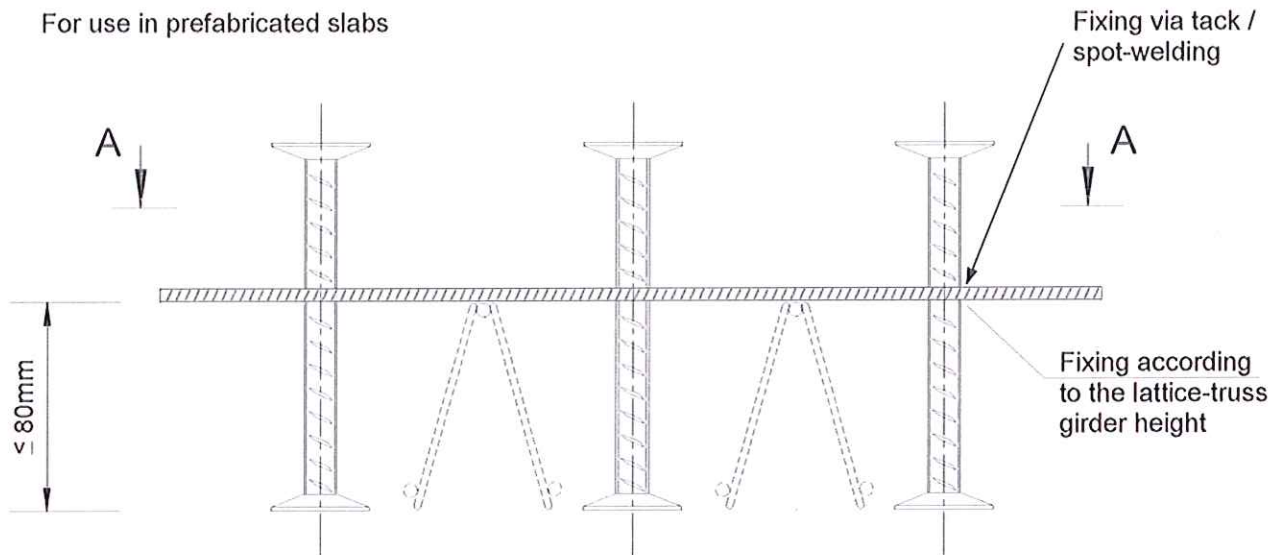
JORDAHL punching shear reinforcement JDA

Product description
For use in-situ concrete and
For use in prefabricated slabs

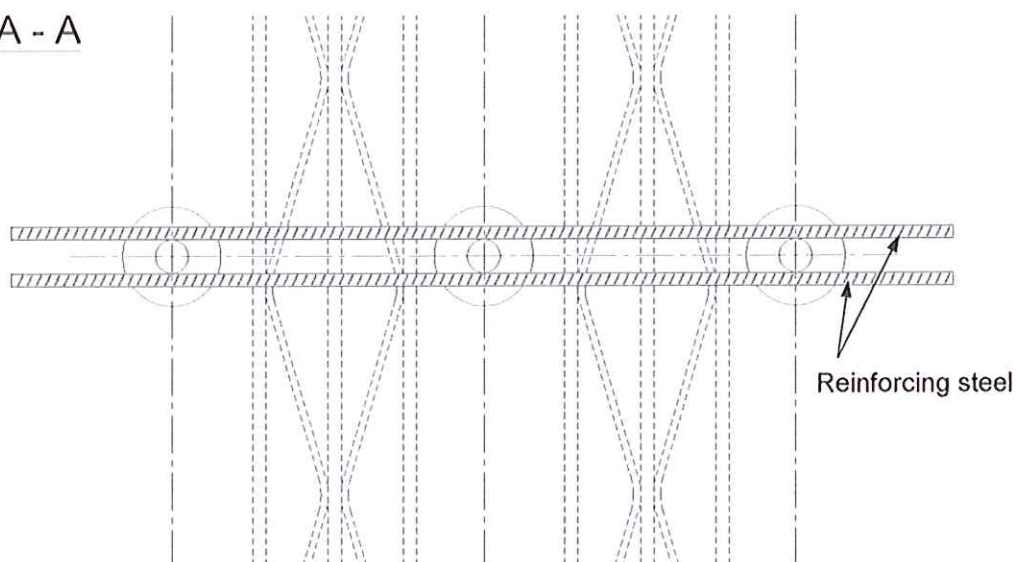
Annex A3

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

For use in prefabricated slabs



Section A - A



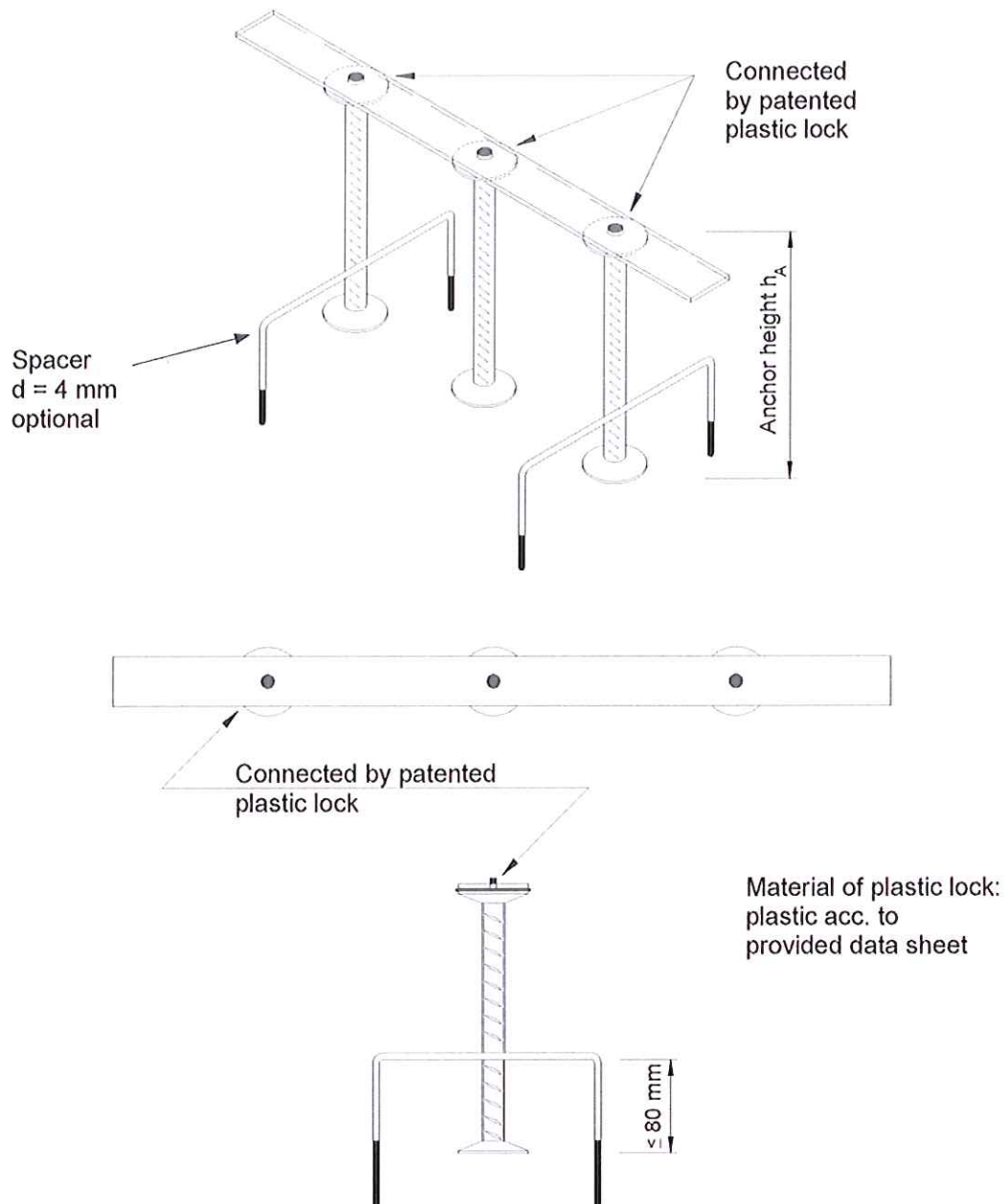
JORDAHL punching shear reinforcement JDA

Product description
Version with attached positional stabilisation for use in prefabricated slabs

Annex A4

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

For use in prefabricated slabs



JORDAHL punching shear reinforcement JDA

Product description
FT version in prefabricated slabs

Annex A5

Specification of intended 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 EN 206-1:2013
- flat slabs, reinforced concrete slabs or footings and ground slabs with a minimum height of $h = 180 \text{ mm}$
- flat slabs, reinforced concrete slabs or footings and ground slabs with a maximum effective depth of $d = 300 \text{ mm}$ (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 EN 1992-1-1
- 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 $0.1h$ ($h = \text{height of the slab}$)

Installation

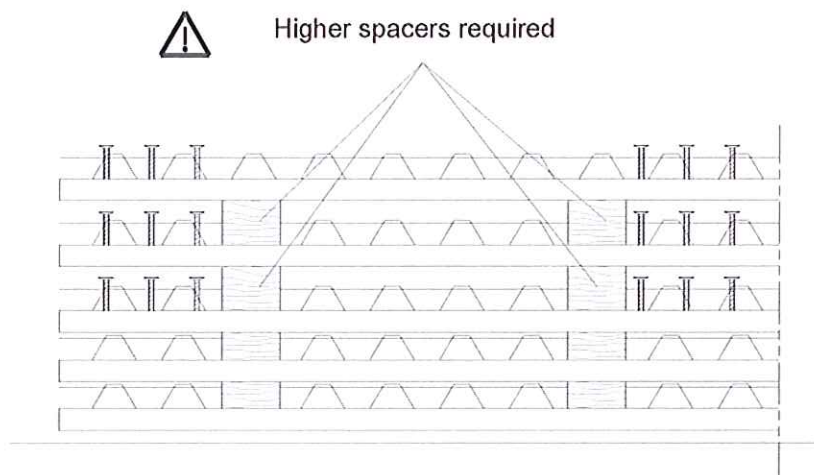
- When installed correctly, the reinforcement elements have sufficient robustness to withstand usual actions before concreting.
- In case the studs are intended for use in prefabricated slabs there are no requirements in terms of before mentioned robustness if there are other possibilities to ensure 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

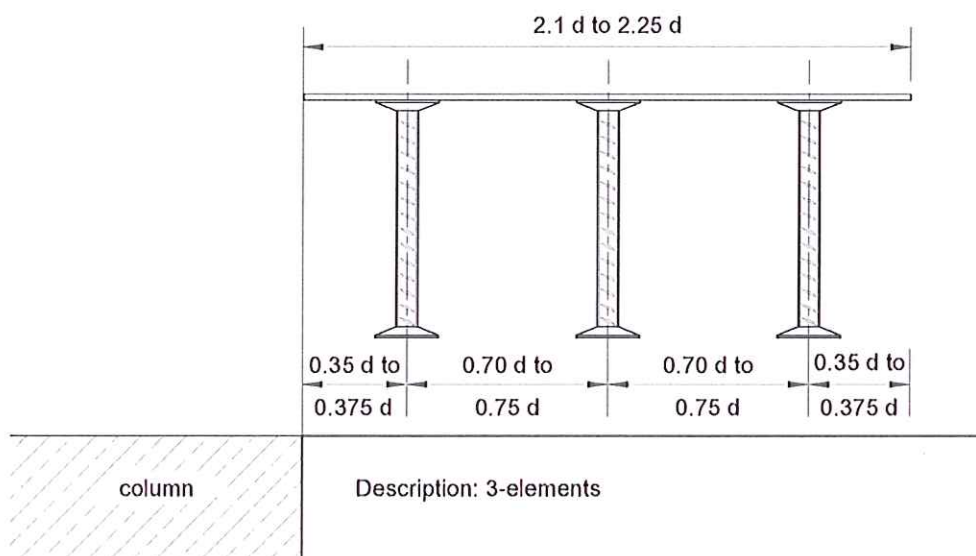
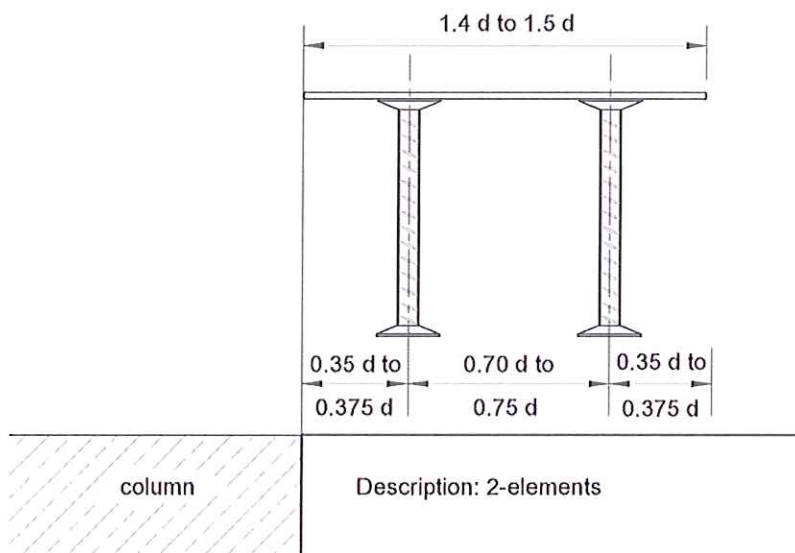


JORDAHL punching shear reinforcement JDA

Intended use
Specification

Annex B2

Design of the JDA standard elements



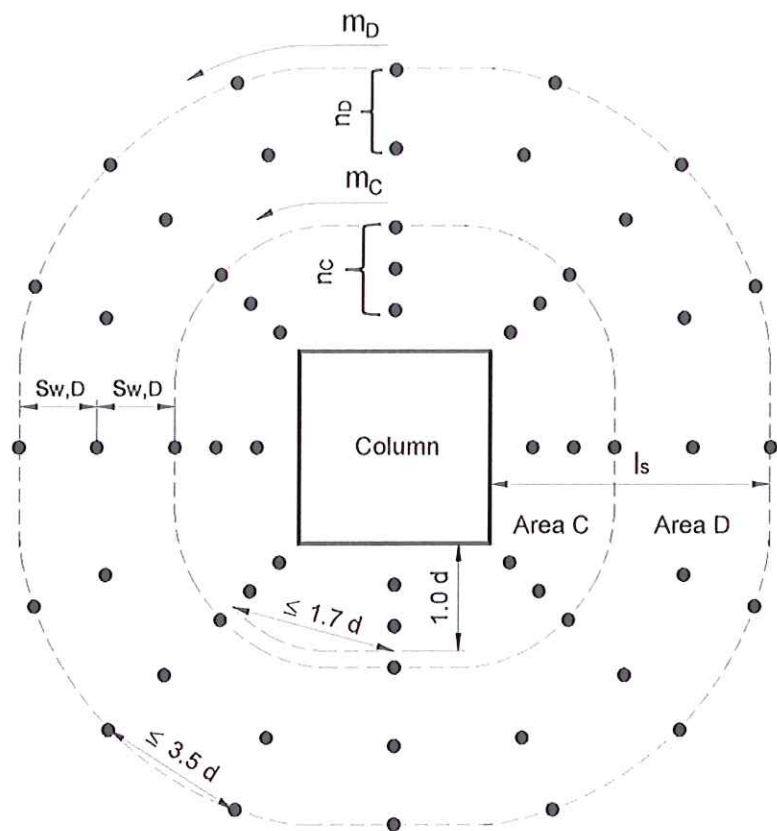
The symmetric overlap of the assembling bar is used to ensure correct spacing of the elements from the column. Furthermore, it ensures the right radial spacing between two adjacent stud elements.

JORDAHL punching shear reinforcement JDA

Intended use
Standard system arrangement

Annex B3

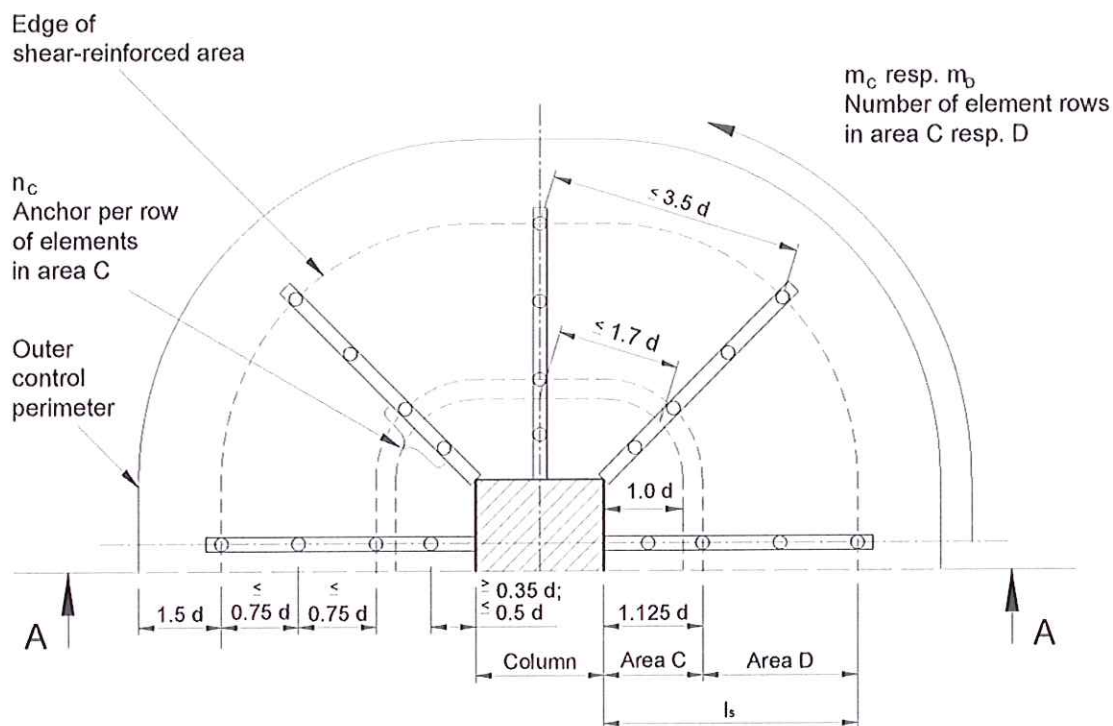
Principle arrangement of the JDA studs in slabs



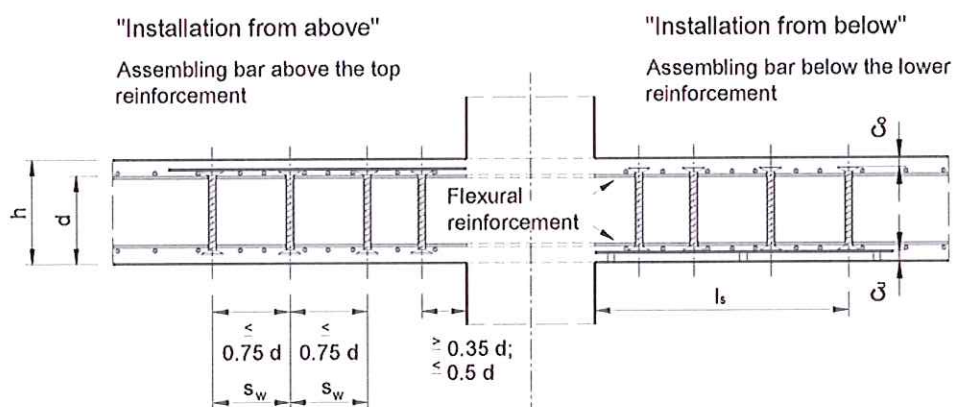
- m_C number of elements (rows) in area C
- m_D number of elements (rows) in area D
- n_C number of studs of each element (row) in area C
- n_D number of studs of each element (row) in area D
- $S_{w,D}$ radial spacing in area D

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



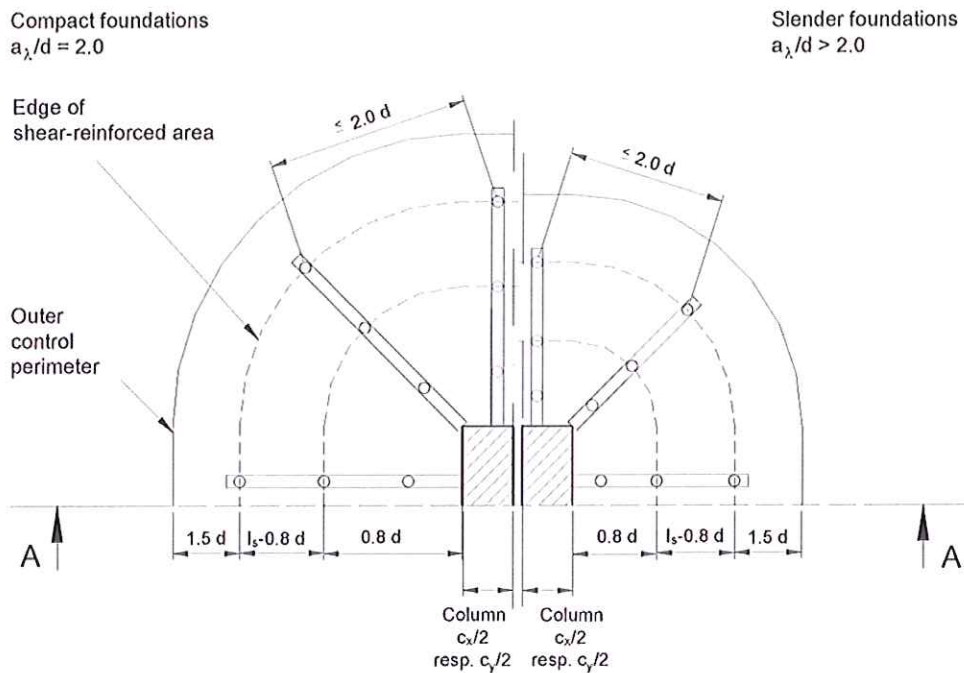
Concrete cover c_o resp. c_u acc. to EN1992-1-1 : 2004 + AC : 2010, section 4.4

JORDAHL punching shear reinforcement JDA

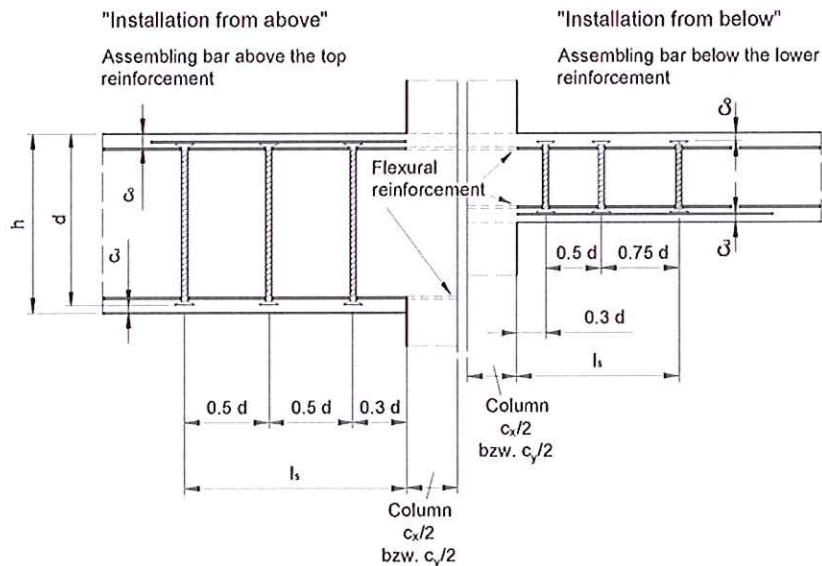
Intended use
Arrangement of punching shear reinforcement with continuous elements in slabs

Annex B5

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



Section A-A



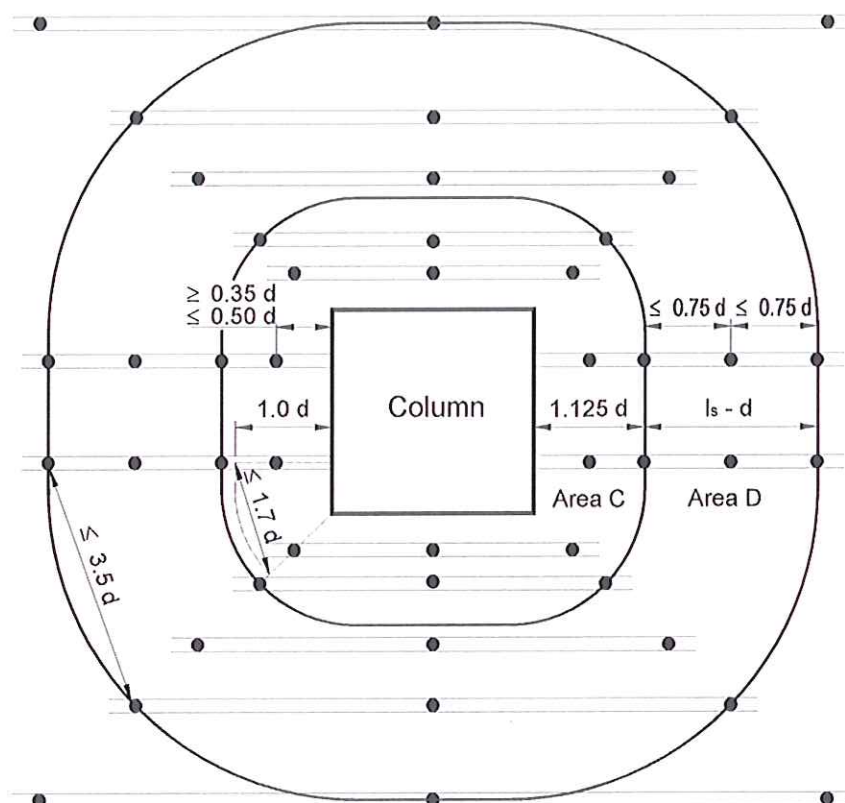
Concrete cover c_o resp. c_u acc. to EN1992-1-1 : 2004 + AC : 2010, section 4.4

JORDAHL punching shear reinforcement JDA

Intended use
Arrangement of punching shear reinforcement in footings and ground slabs

Annex B6

Orthogonal arrangement of punching shear reinforcement in slabs



JORDAHL punching shear reinforcement JDA

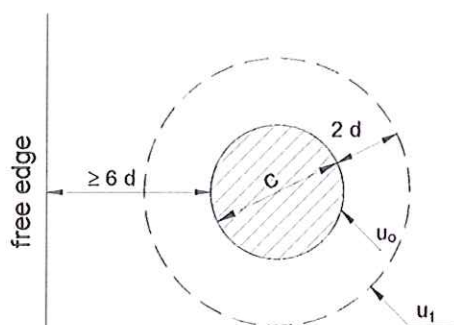
Intended use
Parallel arrangement of punching shear reinforcement

Annex B7

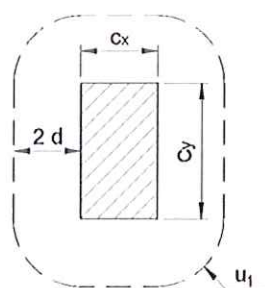
Defining the critical perimeter u_1 and outermost perimeter u_{out}

1. Critical perimeter u_1

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

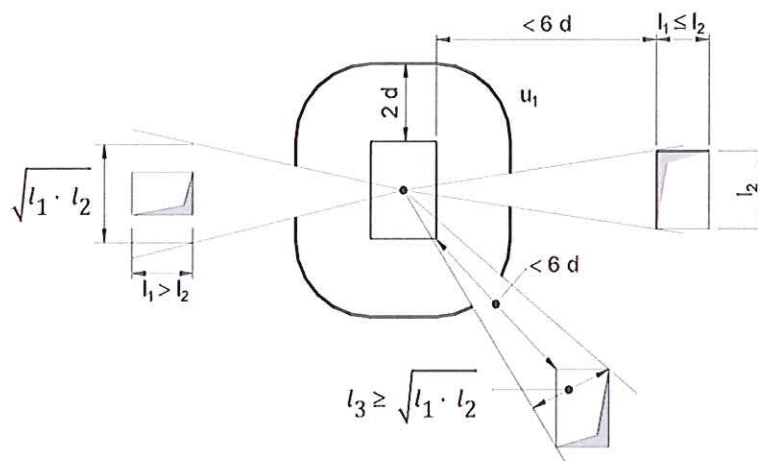
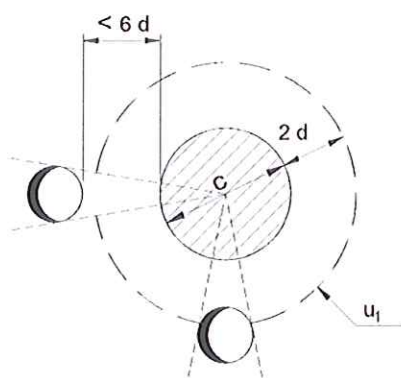


$$u_1 = \pi (c + 4 d)$$



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

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

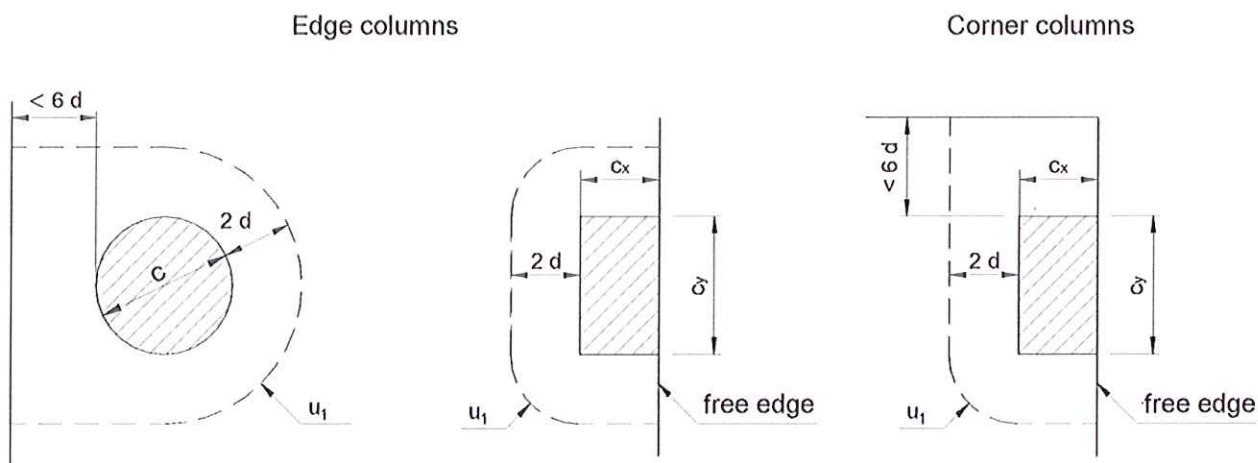


JORDAHL punching shear reinforcement JDA

Critical perimeter u_1 and outermost perimeter u_{out}

Annex C1

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



2. Outermost perimeter u_{out}

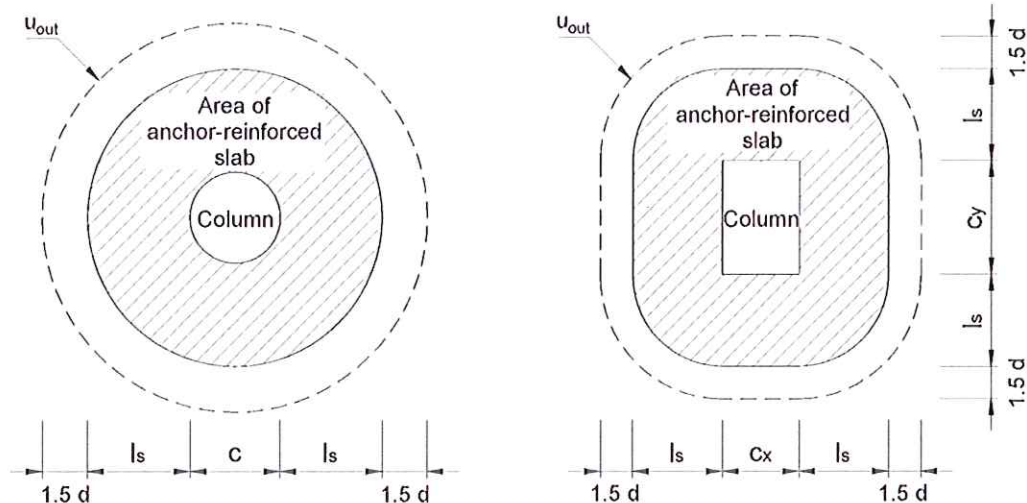
a) Loaded areas (columns) are more than 6 d from openings or slab free edges

Circular column

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

Rectangular column

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

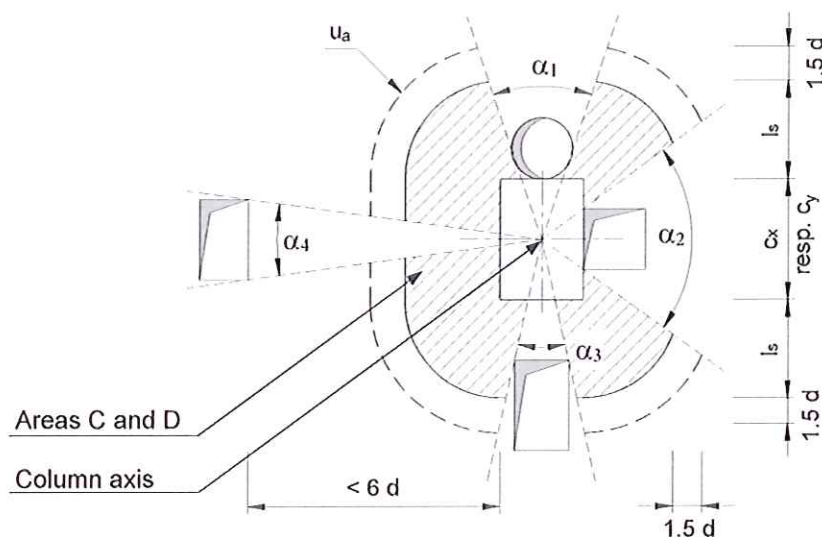


JORDAHL punching shear reinforcement JDA

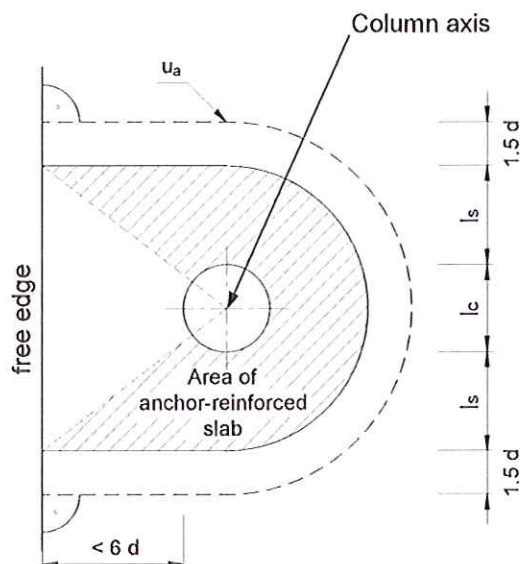
Critical perimeter u_1 and outermost perimeter u_{out}

Annex C2

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



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



JORDAHL punching shear reinforcement JDA

Critical perimeter u_1 and outermost perimeter u_{out}

Annex C3