



JORDAHL®



JORDAHL®

JDA Studrails

Deutsche Kahneisen
Gesellschaft mbH

Introduction

Flat ceiling structures with large spans between supporting columns allow optimum use of factory or warehouse buildings with a large floor space.

Advantages

- the underside of the ceiling has a flat appearance
- reduced formwork requirements
- optimum use of space

Even in the early days of concrete structures, the problem of punching shear at the column head area was already recognized (Fig. 1). Mushroom construction was introduced around 1900 as a way of avoiding the arrangement with main runners and downstand girders (Fig. 2).

Only a short time later the so-called Kahn steel reinforcements (Fig. 3) were used as tensile reinforcements. These components featured upturned wings which resisted transverse forces in the ceiling support area. The inventor was Julius Kahn, who came from one of the most important families of architects in the USA. The efforts to market this innovative shear reinforcement system coincided with the invention of the anchor rail and laid the foundations on which the company “Deutsche Kahneisen Gesellschaft JORDAHL® & Co.” was founded. This dedication of the Kahn brothers to find solutions to the problem of concrete reinforcement motivated us to add the JDA studrails to our product range.

With the aid of conventional methods it is often not possible to achieve thin ceilings, wide spans between supporting columns or large ceiling 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.

This solution was developed further to produce punching shear reinforcements known as studrails, which are made from reinforcing steel and each have 2 swaged heads (Fig. 5). Following the introduction of DIN 1045-1:2001, a fundamental reworking of the approval process became necessary. The current approval Z-15.1-214 corresponds to the latest state of knowledge and is successfully applied in several areas.

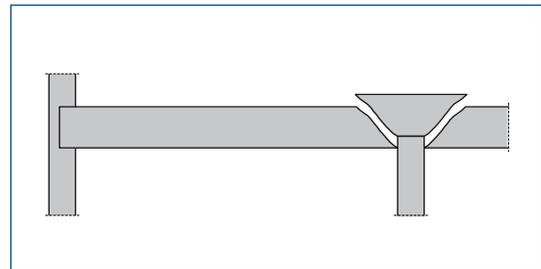


Fig. 1: punching shear situation

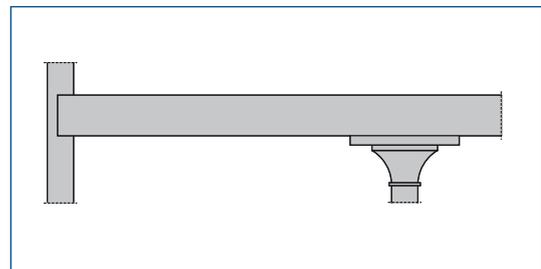


Fig. 2: mushroom construction

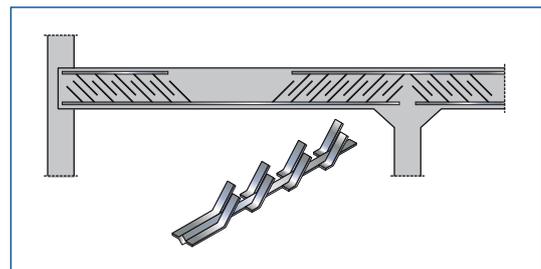


Fig. 3: “Kahn” steel reinforcements

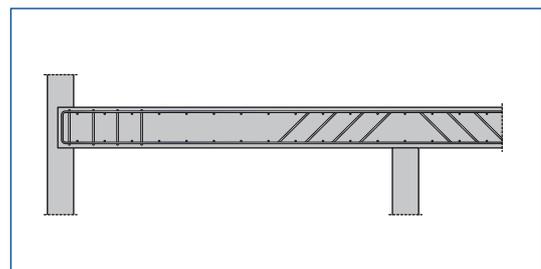


Fig. 4: flat ceiling with stirrups and bent-up rebar

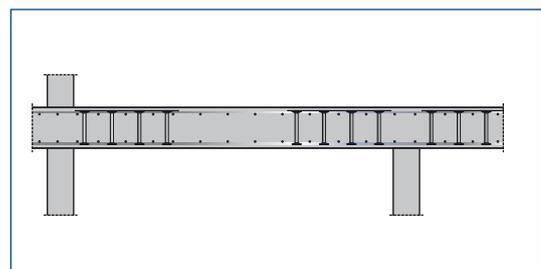


Fig. 5: JDA studrail with double-headed anchors

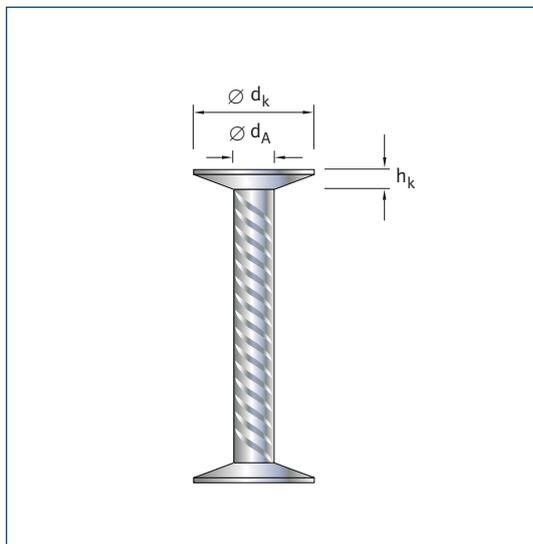
JDA Studrails

JDA studrails transfer high transverse forces and are ideal not only for flat ceiling structures with low formwork and reinforcement requirements, but also in order to optimise space usage. The resistance to punching shear failure can thus be increased by 90% in comparison to ceiling slabs without punching shear reinforcement.

The JORDAHL® JDA studrails are made of double-headed anchors which are connected by a perforated connecting strip. The double-headed anchors secure the transition between punching shear and transverse load-bearing capacity.

Technical Information

JORDAHL® JDA studrails are manufactured according to the particular static requirements. The double-headed anchors are available in the following sizes: $d_A = 10, 12, 14, 16, 20$ and 25 mm. The head diameter d_k is always equivalent to 3-times the shaft diameter d_A . This ensures slip-free anchoring of the compression area and tensile area.



double-headed anchor

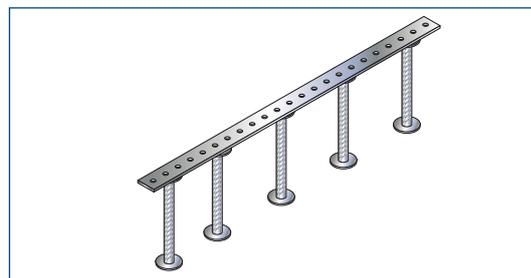
Advantages

- general technical approval granted for static and dynamic loads (approval no.: Z-15.1-214)
- for concrete strengths ranging from C20/25 to C50/60
- design according to the partial safety factor approach used in Europe
- separate partial safety factors for dead ($\gamma = 1.35$) and imposed loads ($\gamma = 1.5$)
- asymmetrical load applications are accurately taken into account for all support positions
- defined transition between punching shear and transverse load-bearing capacity
- 1.9-times increase in load-bearing capacity compared to ceiling slabs without punching shear reinforcement
- suitable for flat slabs from a slab thickness of 18 cm
- simplified arrangement of the connecting strips through arrangement of standard elements in a row
- reduced formwork requirements
- fast and easy installation
- can be installed from above or from below
- the underside of slab has a flat appearance
- optimum use of space
- fast and flexible delivery times
- intuitive and user-friendly software

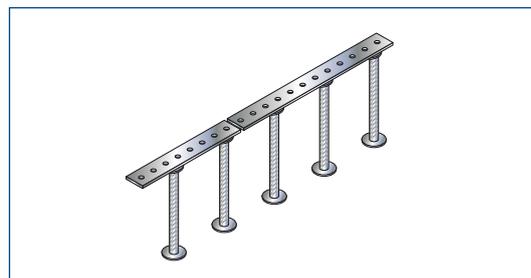
Material

The double-headed anchors are made of BSt 500 S steel, and the perforated connecting strip is also made of structural steel.

Elements



continuous elements



standard elements

JDA Software* – Version 3.1

JDA Software

In order to calculate the required JDA studrails, JORDAHL® Shear Reinforcement Systems can provide you with intuitive and user-friendly calculation software. The software is based on the general technical approval no. Z-15.1-214 and DIN 1045-01 (edition 08/2008).

Settings

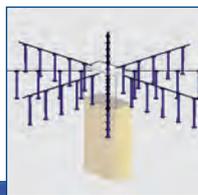
Via Options / Settings users can define how the results of the calculations are determined:

- split standard strips
- optimised continuous strips or
- optimised non-split strips

Support Type

- inner, edge and corner supports
- ends of walls and inner corners of walls
- long supports (length ratio > 1:2)

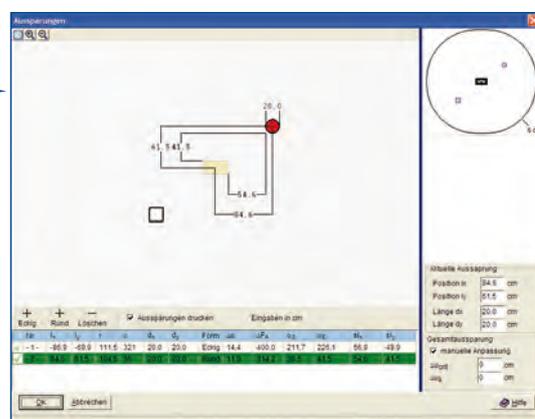
3D View



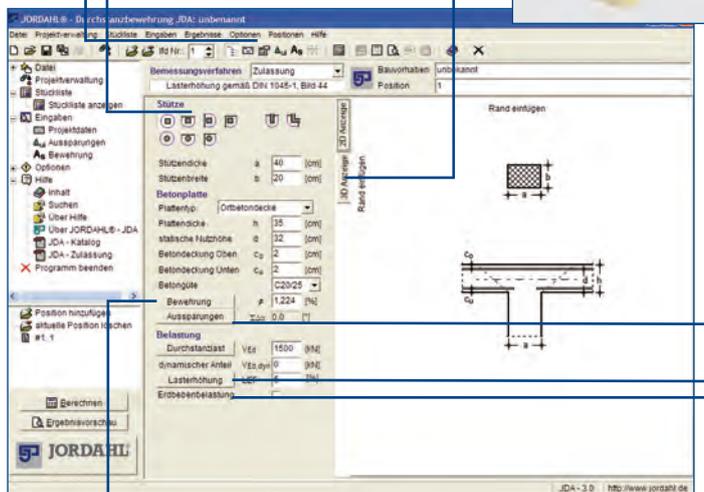
Advantages

- the most cost-effective solution is displayed first
- fast and clearly laid out input of load templates
- all entries are displayed on a single page
- simple entry and structuring of projects
- printout of a verifiable structural calculation
- calculation of the load scenario in an earthquake
- 3D-view of the support
- interactive insertion of edges
- influence of entered data is immediately visible and understandable

Cutouts



- the effectiveness of the cutout is checked automatically (distance $\lt; 6d$ from the edge of the support)
- cutouts can be easily inserted or moved at the click of a mouse
- the program automatically detects overlapping cutouts
- manual entry of lengths to be subtracted for critical circular sections
- direct correction of measured values within the drawing
- the locations of the cutouts are included on the printout of the results



Main Input Window

This window is displayed when the program is launched. All of the input fields are pre-filled with the default settings. Any number of additional items can be added.



Degree of Reinforcement

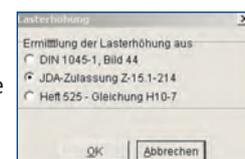
Separate entry of the degree of reinforcement in the x and y directions for determination of the average degree of reinforcement ρ

- reinforcing bars
- reinforcement mesh with database of the most commonly used mesh types

Load Increase

The fixed value β (Load Amplification Factor) can be determined. The following can be chosen:

- DIN 1045-1
- Approval Z-15.1-214
- Booklet 525



Earthquake

The minimum degree of reinforcement for transverse forces is calculated in accordance with DIN 4149, and detailed and easy to follow proof is provided.

Result

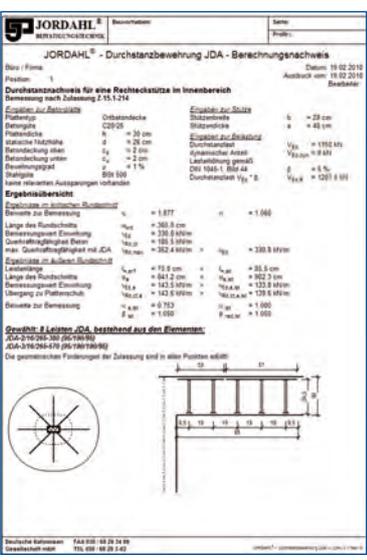
The presentation of the punching shear area in the plan view and the cross-sectional view provides an immediate overview of the arrangement of the JDA elements.

Advantages:

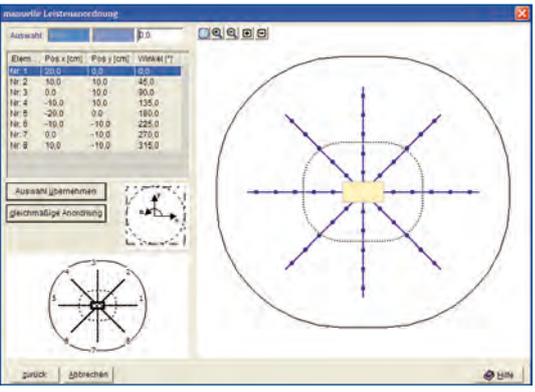
- the results printouts have been developed by inspecting structural engineers
- interim results, final results and proofs can be followed and understood very easily (punching shear, earthquake and bond proof)
- graphical results can be transmitted as a *.DXF file

Results Preview

The preview is identical to the final results printout. All of the entered data can be checked at a glance. Can be exported as a *.JPG file, as a *.PDF file or via the Windows clipboard.



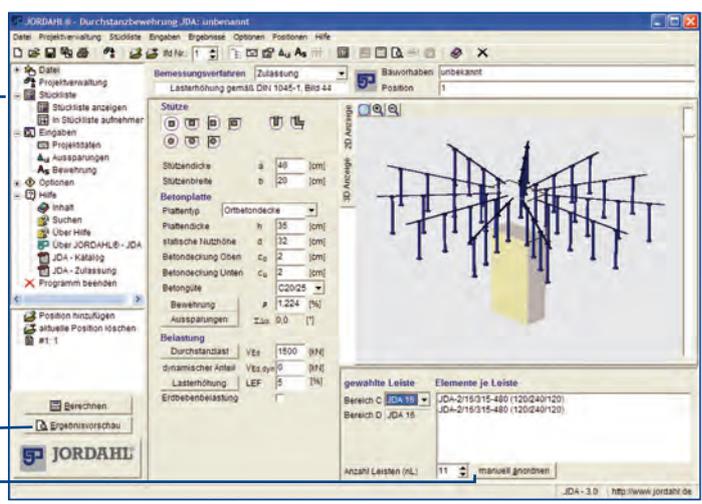
Manual Arrangement



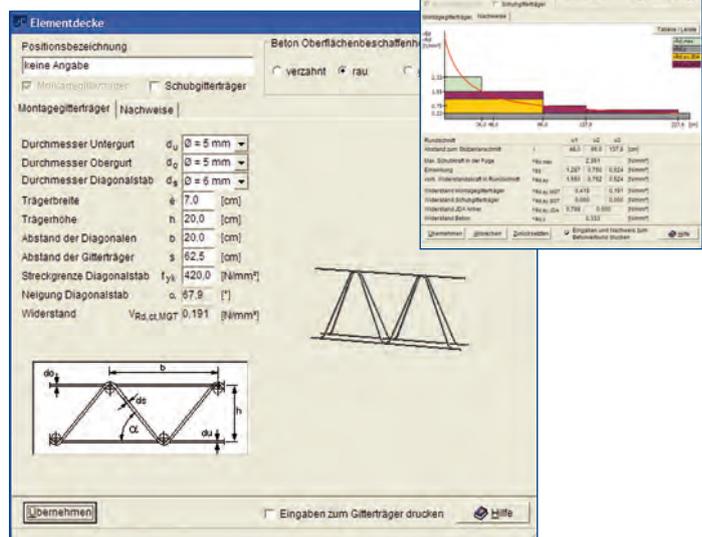
JDA elements can be moved manually at the click of a mouse.

Parts List / Ordering List / Invitation to Tender Form

All calculated items can be added to the parts list, which can also be called up as an ordering list. In addition, an invitation to tender form is automatically generated. Export as an *.XLS file or as a *.PDF file.



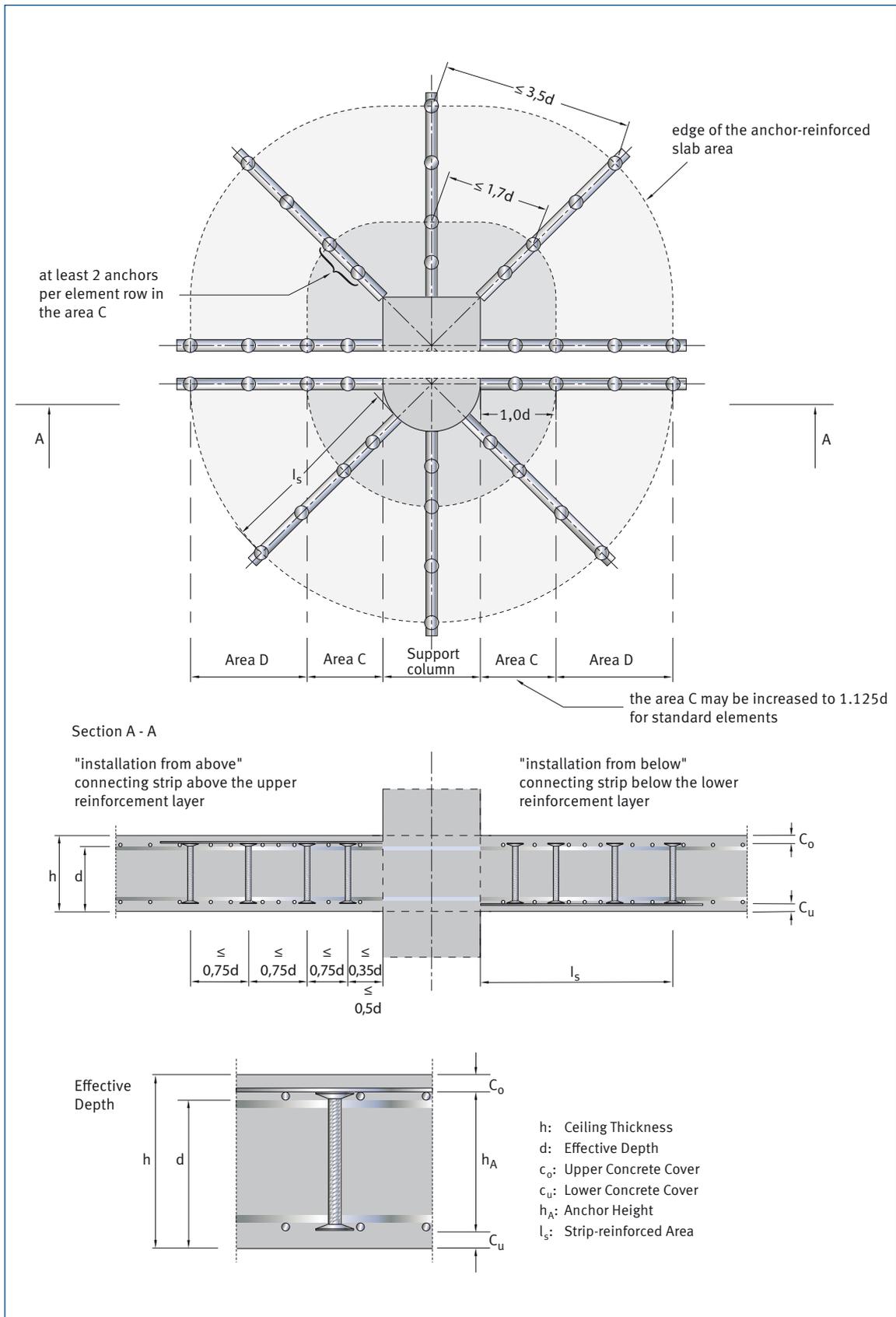
Bond Proof



The load-bearing capacity of the assembly grating supports and shear grating supports can be calculated. The bond proof is carried out cost-effectively taking into account the double-headed anchors and grating supports (expert report from RWTH Aachen). The provided output is a meaningful printout of the results.

* The JDA Software is currently available in German only – the English version will be released at the beginning of 2011.

Schematic Layout



Layout in Practice

Positioning of the JDA Reinforcing Elements



For site-placed concrete ceilings we recommend installing the JDA elements from above. They can be positioned after completion of the entire reinforcement assembly.

Alignment of the Strip Overhang to the Edge of the Supporting Column



It is possible to check the position of the JDA elements and to correct them as required.

Safe Height Positioning



The double-headed anchors extend through the reinforcement layers.

Concreting the Ceiling



After alignment of the JDA elements the slab can be concreted.

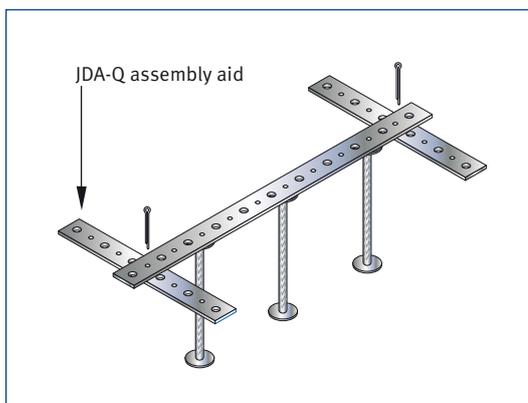
Installation in Site-placed Concrete

The JDA elements can be inserted in site-placed concrete optionally with the strips facing either up or down. In all cases the heads of the JDA anchors must extend through both layers of the bending reinforcement.

Pre-assembly with JDA-Q Installation Aids

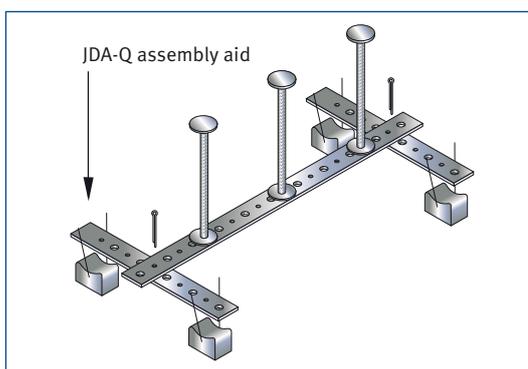
1) Installation from above:

If the JDA reinforcing elements are arranged parallel to the upper reinforcement layer then the JDA-Q installation aid should be used and fastened with cotter pins.



2) Installation from below:

JDA-Q installation aids can also be used here in order to improve the stability of the elements. The AH-DA spacers must be used in order to achieve the required concrete cover.



Note

Prior to installation, please compare the anchor diameters, anchor spacing and anchor height with the specifications in the formwork and reinforcement plans: the lower anchor heads must reach at least as far as the lower edge of the lowest reinforcement layer, the upper anchor heads at least

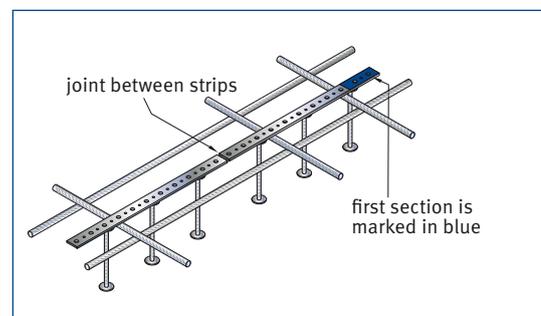
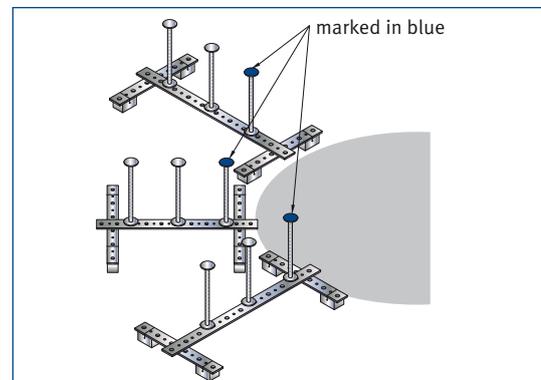
as far as the upper reinforcement layer (refer to the general technical approval no. 15.1-214). All of the anchors used in the punching shear area of a supporting column must have the same diameter.



Layout

The reinforcing elements should be positioned in accordance with the planning requirements. If asymmetrical elements are used then the section marked in blue must be positioned facing the support.

The first strip protrusion is positioned flush against the edge of the support. If several standard elements are arranged in a row then the strips must join up flush.

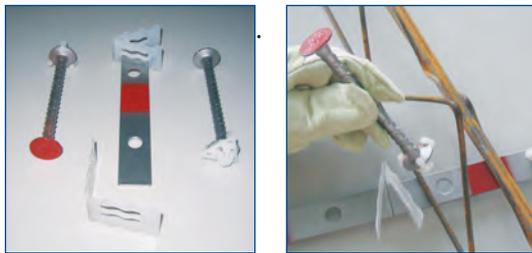


AH-DA Spacers

Suitable AH-DA spacers must be used for the installation of the JDA elements on the formwork. JORDAHL® offers spacers for concrete covers of 15, 20, 25, 30 and 35 mm.

Installation in Precast Plank / Topping Slabs

The JDA-FT-Click system has been specially developed for precast plank / topping slabs: the JDA elements are supplied unmounted, i.e. together as a kit comprising the anchors + connecting strips + spacers. This avoids any disruption of the automatic manufacturing process and prevents any clash between the bending reinforcement and lattice girder with the JDA elements. On the construction site, the upper reinforcing layer can be installed without additional work and without assembly strips which get in the way.



Advantages during Installation

- all parts of the element are supplied together as a kit
- colour coding is used to ensure clear assignment of components
- easy “click” installation even over longer distances
- anchor spacing always matches the quality requirements exactly
- no prohibited deviation in the anchor spacing
- spacers can be used universally
- the precast plank is ready for transport after concreting transport, no finishing is required
- perfect for keeping in storage
- technical training provided by JORDAHL® employees, quality agreement

FBA Spacers

Suitable spacers have to be used for installation of the JDA elements in the prefabricating plant. JORDAHL® offers fibre reinforced concrete spacers for concrete covers of 15, 20, 25 and 30 mm.



Installation

- 1) Assembly strips are positioned and secured according to the planning specifications on the spacers; these are required for subsequent mounting of the double-headed anchors.
- 2) Automatic arrangement of the grating supports and lower bending reinforcement
- 3) The JDA double-headed anchors are clicked with the patented plastic connectors into the pre-punched perforations in the assembly strip.



connecting strip



fastening of the connecting strips with spacers on the formwork



double-headed anchors are snapped in place

AH-FT Spacers

Alternatively, plastic AH-FT spacers are available for installation of the JDA elements in the prefabricating plant. Each spacer can be used variably for four different thicknesses of concrete cover ($c = 15, 20, 25$ and 30 mm). These components offer maximum flexibility whilst minimizing storage space requirements.



Service

Ordering Examples

Standard JDA

Type	Number of anchors	d _A	Anchor length	Connecting strip length
JDA	2	14	255	360

JDA Connecting Strip

Type	Number of anchors	d _A	Anchor length	Connecting strip length
JDA	4	14	255	760

JDA-FT-KL (for Precast Plank / Topping Slabs)

Type	Version	Number of anchors	d _A	Anchor length	Connecting strip length
JDA	FT-KL	2	14	255	380

AH-DA

Type	Concrete covering
AH-DA	20

Invitation to Tender Forms

To supply and install JORDAHL® JDA studrails as a supplementary punching shear reinforcement in areas at risk of punching shear on flat ceiling structures with large spans between supporting columns with a thickness of h = ■ cm according to the specifications of the structural planning engineer.

Punching shear reinforcement (studrails)
Type JDA- ■ / ■ / ■-■, ■ pieces

All of the invitation to tender forms can be found in the invitation to tender software at www.jordahl.de.

Price List

The latest prices can be requested by calling +49 (0) 30 68283-02 or downloaded as a PDF file from www.jordahl.de.

Technical Advice

On request we can also offer the services of our structural calculation engineers and technical consultants.

Calculation Software

We can provide user-friendly calculation software on CD-ROM to help you calculate the JDA studrails (refer to page 4).

- the calculations are carried out in accordance with general technical approval no. Z-15.1-214.
- punching shear proof according to DIN 1045-4-2001
- printout of ordering lists with drawings as the basis for invitations to tender
- export of the calculated reinforcement as a *.DXF file or as a *.DWG file

To place an order, call +49 (0) 30 68283-02 or send us an e-mail via info@jordahl.de. Alternatively, you can also download the software from our website at www.jordahl.de.

Contact Details

Deutsche Kahneisen Gesellschaft mbH
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D-12057 Berlin

Tel.: +49 (0) 30 68283-02
Fax: +49 (0) 30 68283-497
E-mail: info@jordahl.de
Internet: www.jordahl.de

Fax Request

JDA Studrails



JORDAHL®

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Gesellschaft mbH

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12057 Berlin
Germany

Tel +49 (0) 30 68283-02
Fax +49 (0) 30 68283-497
Internet www.jordahl.de

Sender: _____

Address: _____

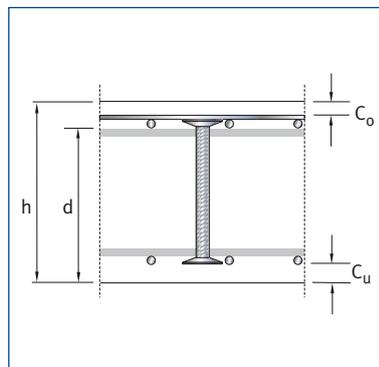
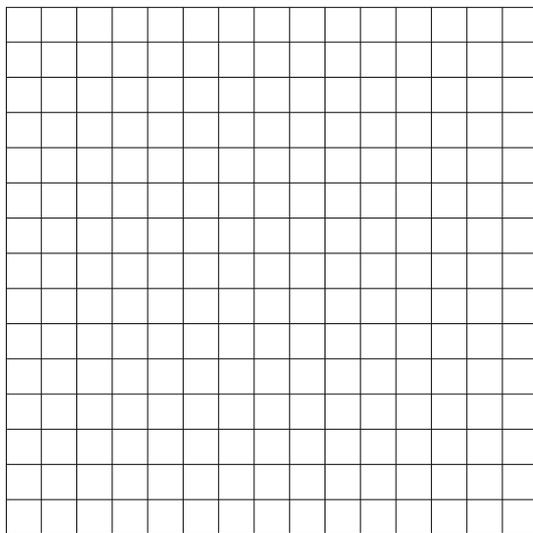
Company: _____

Contact Person: _____

Tel./Fax: _____

Construction Project: _____

Space for a Diagram of the Distances between Supporting Edges and the Type of Support



Request for a Design Proposal:

The following starting data are required in order to perform a verifiable calculation:

Concrete Strength C _____ / _____

Supporting Column dimensions a / b = _____ cm

Slab Dimensions h = _____ cm

c_o / c_u = _____ cm

d = _____ cm (where known)

Punching Shear Load: V_{Ed} = _____ kN

Dynamic Load Component $V_{Ed, dyn}$ = _____ kN

Degree of Reinforcement ρ = _____ %

Site-placed Concrete Covering

Semi-prefabricated Ceiling

Foundation Slab,
Bearing Load _____ kN/m²

or detailed reinforcement specifications: _____

Resulting moment load on the supporting column (where known): _____ kNm

Managing Directors:
Dipl.-Ing. G. Börner (Sprecher)
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