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MEMBER OF EOTA and UEAtc

NATIONAL TECHNICAL ASSESSMENT
ITB-KOT-2022/2146 revision 1

This National Technical Assessment has been issued in accordance with the regulation of the Minister of Infrastructure and Construction of 17 November 2016 on National Technical Assessments (Journal of Laws of 2016, item 1968) by Instytut Techniki Budowlanej in Warsaw, at the request of:

FORBUILD SA
ul. Górna 2a, 26-200 Końskie

This National Technical Assessment no. ITB-KOT-2022/2146, revision 1, constitutes a positive assessment of the performance of the following construction products when used for their intended purpose:

FBD steel pins for transferring shear forces at spot support points

This National Technical Assessment is valid until:

04 March 2027

Warsaw, 4 March 2022

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1. TECHNICAL DESCRIPTION OF THE PRODUCT

This National Technical Assessment covers FBD steel studs (product type designation), manufactured by FORBUILD SA, ul. Górna 2a, 26-200 Końskie, at a production facility in Poland.

FBD studs take the form of steel bars with disc-shaped heads formed at both ends (Figure A1). The studs are placed in reinforced concrete floor slabs, reinforced concrete foundation slabs and footings, at point supports. The studs are laid perpendicular to the surface of the slab and connected by mounting rods or mounting strips. The arrangement of the studs on the mounting elements is shown in Figure A2.

FBD studs are made from ribbed reinforcing steel bars that meet the requirements specified for ductility class B or C in EN 1992-1-1:2008 (Eurocode 2). The characteristic yield strength of the bars is $f_{yk} \geq$ 500 MPa and the characteristic tensile strength is $f_{uk} \geq 550$ MPa.

The mounting rods have diameters of Ø4 ÷ Ø10 and are made of smooth or ribbed steel, with a characteristic yield strength $f_{yk} \geq 235$ MPa. The mounting strips are made of steel with a characteristic yield strength $f_{yk} \geq 235$ MPa and have dimensions of (25 ÷ 50) x (3 ÷ 5) mm.

The shape and dimensions of the FBD steel studs are shown in Appendix A. The dimensional tolerances of the studs are shown in Figure A1.

2 INTENDED APPLICATION OF THE PRODUCT

FBD steel studs are designed to be used as elements of reinforcement carrying shear forces in reinforced concrete ceiling slabs, reinforced concrete foundation slabs and reinforced concrete foundation footings, in point support locations, in order to increase break-through load capacity.

FBD steel studs can be used in reinforced concrete floor slabs and reinforced concrete foundation slabs with a thickness of not less than 18 cm, made of concrete class C20/25 ÷ C50/60 according to EN 206+A2:2021.

The calculation of the number of FBD studs and the determination of their location at the point support should be carried out according to the principles given in clauses 6.4 and 9.4.3 of EN 1992-1-1:2008 or according to the principles given in EOTA TR 060. Applying the principles given in EN 1992-1-1:2008, it should be assumed that:

- FBD steel studs can be considered as vertical reinforcement stirrups,
- the values of β given in Figure 6.21N in clause 6.4.3 of EN 1992-1-1:2008 for supporting a reinforced concrete element on an internal, edge and corner column are supplemented by a value of 1.35 when supporting a reinforced concrete element at the end of the wall and by a value of 1.20 when supporting a reinforced concrete element at the corner of the walls,
- the rules for the location of studs in reinforced concrete floor slabs, reinforced concrete foundation slabs and reinforced concrete foundations are as shown in Figures B1 ÷ B3, Appendix B,
- the studs located on the perimeter closest to the support are separated from that support by a distance of not less than 0.35 d and not more than 0.5 d (d - useful section height of the slab).

Applying the principles given in EOTA TR 060, factors should be adopted to increase the punching resistance:

— $k_{pu,sl} = 1.8$ for stems with a diameter $d_A \leq 25$ mm,

— $k_{pu,sl}$ = 1.5 for stems with a diameter d_A > 25 mm,

— $k_{pu,fo}$ = 1.5.

In addition, it should be checked that inequality 6.53 of EN 1992-1-1:2008 is satisfied in the section adjacent to the column, taking $v_{Rd,max}$ determined by the formula:

$$v_{Rd,max} = 0{,}4 \cdot v \cdot f_{cd}$$

where:

$v = 0.60 \cdot (1 - f_{ck}/250)$,

f_{cd} - design compressive strength of concrete,

f_{ck} - the characteristic cylindrical strength of the concrete after 28 days.

The installation and location of the FBD studs in the reinforced concrete slab is shown in Appendix B.

FBD steel studs should be used in accordance with the technical design drawn up taking into account Polish building standards and regulations, the provisions of this National Technical Assessment and the manufacturer's instructions on the conditions for constructing reinforced concrete elements using the above mentioned studs.

3. PRODUCT PERFORMANCE AND ASSESSMENT METHODS

The performance characteristics of FBD steel studs and methods of assessment are given in Table 1.

Table 1

#	Essential characteristics	Performance	Assessment methods
1	*2*	*3*	*4*
1	Yield stress R_e, MPa	≥ 500	PN-EN ISO 6892-1:2016 (sample attachment according to p. D.3.2 EAD 160003-00-0301)
2	Tensile strength R_m, MPa	≥ 550	
3	Ratio R_m/R_e	≥ 1.05	
4	Total elongation at maximum tensile force A_{gt}, %	≥ 2.5	
5	Reaction to fire class	A1	PN-EN 13501-1:2019 Decision of the European Commission 96/603/WE (as amended)

4 PACKAGING, TRANSPORT, STORAGE AND PRODUCT MARKING METHODS

FBD steel studs should be delivered and stored and transported in such a way that their technical properties remain unchanged.

The method of designating the product with a construction mark shall comply with Regulation of the

Minister of Infrastructure and Construction of 17 November 2016 on the method of declaring the performance of construction products and methods of designating them with a construction mark (Journal of Laws of 2016, item 1966, as amended).

The product designation with a construction mark should be accompanied by:

- the last two digits of the year in which the construction label was first affixed to the construction product;
- name and address of registered office of the manufacturer or its identification mark clearly indicating the name and address of registered office of the manufacturer;
- name and type of the construction product;
- number and year of issue of the national technical assessment according to which the product's performance was declared (ITB-KOT-2022/2146 Revision 1);
- National Declaration of Performance number;
- the level or class of declared performance;
- name of the certification body involved in the assessment and verification of constancy of performance of the construction product;
- manufacturer's website address, if the National Declaration of Performance is published on that website.

A Safety Data Sheet and/or hazardous substances notice contained in a construction product referred to in Articles 31 or 33 of Regulation (EC) No. 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and establishing a European Chemicals Agency, should be provided or made available together with the National Declaration of Performance, as appropriate.

Furthermore, marking on a construction product constituting a hazardous mixture within the meaning of the REACH Regulation should comply with the requirements of Regulation (EC) No. 1272/2008 of the European Parliament and of the Council on Classification, Labelling and Packaging of Substances and Mixtures (CLP), amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No. 1907/2006.

5 ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

5.1. National system of assessment and verification of constancy of performance

In accordance with Regulation of the Minister of Infrastructure and Construction of 17 November 2016 on the method of declaring the performance of construction products and the method of designating them with a construction mark (Journal of Laws of 2016, item 1966, as amended), system 1+ of assessment and verification of constancy of performance applies.

5.2 Type examination

The performance assessed in Section 3 constitute product type examination until any changes in raw materials, components, production line or plant are made.

5.3. Internal production control

The manufacturer should have an internal production control system implemented at the production plant. All components of the system, requirements and provisions used by the manufacturer should be systematically documented in the form of rules and procedures, including records of performed tests. Internal production control should be adapted to the production technology and ensure that the declared performance of the product is maintained in serial production.

Internal production control includes specifications and raw material and component checks, control and test during production and control tests (according to item 5.4) performed by the manufacturer in accordance with the established test schedule and according to principles and procedures specified in the internal production control documentation.

Production control results should be systematically recorded. Records should confirm that the products meet the criteria for assessment and verification of constancy of performance. Individual products or product batches and relevant production details should be fully identifiable and reproducible.

5.4. Control tests

Control tests include checking:

a) the shape and dimensions of the studs,
b) performance characteristics of the studs, according to Table 1, items 1 ÷ 4.

5.5 Test frequency

Ongoing tests should be performed in accordance with the agreed test schedule, but in any case each batch of products must be tested. The size of a product batch should be specified in the internal production control documentation.

6 GUIDANCE

6.1. National Technical Assessment no. ITB-KOT-2022/2146 Revision 1 is a positive assessment of the performance of those essential characteristics of FBD steel studs which, in accordance with the intended use resulting from the provisions of the Assessment, have an impact on meeting the basic requirements by structures in which the product will be used.

6.2 National Technical Assessment no. ITB-KOT-2022/2146 Revision 1 is not an authorisation to mark a construction product with a construction label.

According to Act of 16 April 2004 on construction products (Journal of Laws of 2021, item 1213), the products covered by this National Technical Assessment may be marketed or made available on the national market, if the manufacturer has assessed and verified the constancy of performance, drawn up a National Declaration of Performance in accordance with the National Technical Assessment ITB-KOT-2022/2146 Revision 1 and designated the products with a construction mark in accordance with the applicable regulations.

6.3 The National Technical Assessment ITB-KOT-2022/2146 Revision 1 does not violate the rights resulting from the provisions on the protection of industrial property, in particular the Industrial Property Right Act of 30 June 2000 (Journal of Laws of 2021, item 324). Users of this National Technical Assessment of the Building Research Institute (ITB) are required to ensure compliance with those rights.

6.4. By issuing this National Technical Assessment, the Building Research Institute (ITB) assumes no responsibility for infringements of any exclusive and acquired rights.

6.5. This National Technical Assessment does not release the manufacturer of the products from responsibility for ensuring proper product quality, and contractors performing construction works from responsibility for their proper use.

6.6. The validity of this National Technical Assessment may be extended for further periods of no more than 5 years.

7. LIST OF DOCUMENTS USED IN THE PROCEDURE

7.1. Reports, test reports, assessments, classifications

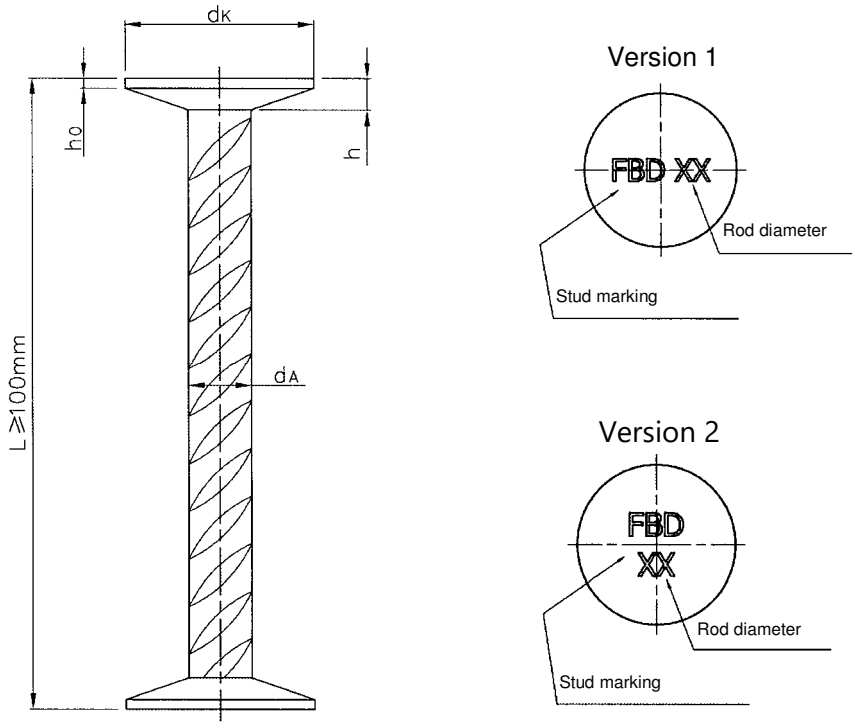
1) Test Report No. LZK00-03080/21/Z00NZK ITB Structures and Building Elements Department, Warsaw 2021.
2) Test Report No. LZK00-03081/21/Z00NZK ITB Structures and Building Elements Department, Warsaw 2021.

7.2 Associated Standards and Documents

PN-EN 22768-1:1999	*General Tolerances. Tolerances For Linear And Angular Dimensions Without Individual Tolerance Indications*
PN-EN 206+A2:2021	*Concrete. Part 1: Requirements, properties, production, conformity*
PN-EN 10025-1:2007	*Hot rolled products from construction steel. Part 1: General technical terms of delivery*
PN-EN 10088-1:2014	*Stainless steels. Part 1: List of stainless steels*
PN-EN 13501-1:2019	*Fire Classifications of Construction Products and Building Elements. Part 1: Classification based on fire reaction tests*
PN-EN 1992-1-1:2008	Eurocode 2. *Design of concrete structures. Part 1-1: General rules and rules for buildings*
PN-EN ISO 6892-1:2016	*Metals. Tensile testing. Part 1: Test method at room temperature*
EAD 160003-00-0301	
EOTA TR 60	

APPENDICES

Appendix A.



#	Stem diameter Ød$_A$, mm	Head diameter Ødκ, mm	Head height h, mm	Head height h_0, mm	Characteristic yield strength f_{yk}, MPa
1	2	3	*4*	5	6
1	10	30 (+ 2 / - 1)	5 (+ 1)	2 (+ 1)	500
2	12	36 (+ 2/- 1)	6 (+ 1.5)	2.5 (+ 1.5)	
3	14	42 (+ 3/- 1)	7 (+ 2.5)	3 (+ 2)	
4	16	48 (+ 3 / - 1)	8 (+ 2.5)	3 (+ 2.5)	
5	18	54 (+ 3/- 1)	8.5 (+ 3)	3 (+ 3)	
6	20	60 (+ 3 / - 1)	10 (+ 3)	3 (+ 3)	
7	22	66 (+ 4 / - 1)	11 (+ 3.5)	3 (+ 3)	
8	25	75 (+ 4 / - 1)	12 (+ 3.5)	3.5 (+ 3.5)	
9	28	84 (+ 5/- 1)	16 (+ 4)	4 (+ 4)	
10	32	96 (+ 5 / - 1)	17 (+ 4)	4.5 (+ 4)	
The nominal stud height (L) is variable and dependent on the application conditions. Length tolerance L: ± 5 mm. dκ = 3 • d_A					

Figure A1. Shape and dimensions of FBD studs

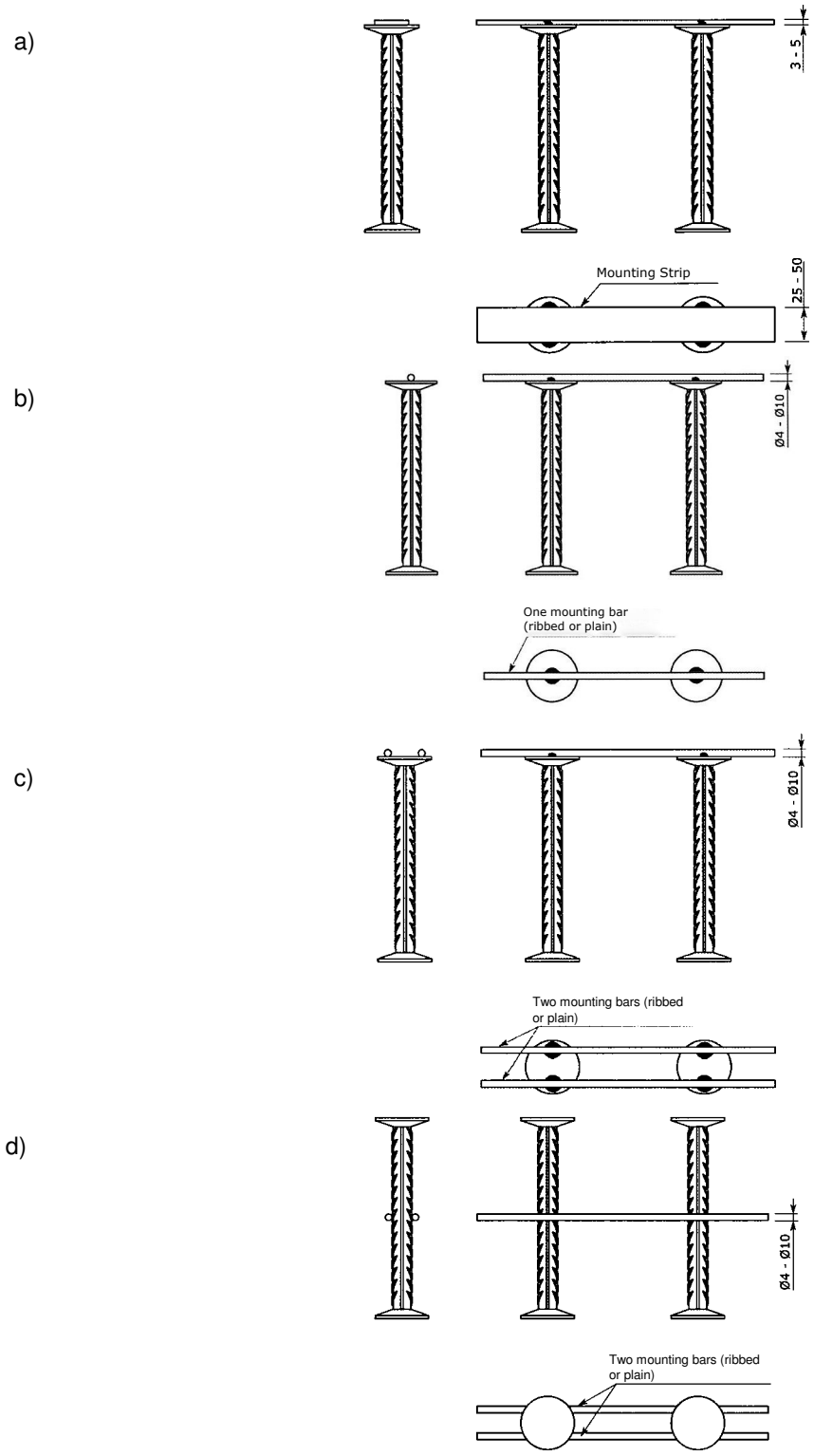
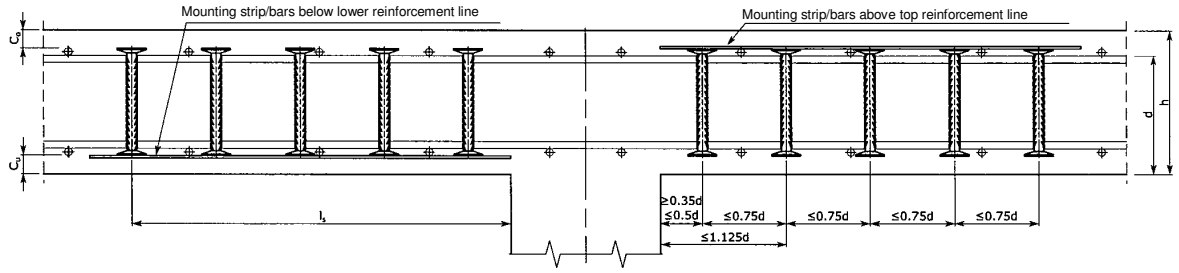


Figure A2. Arrangement of FBD studs on mounting parts

(a) assembly list; (b) one mounting rod; (c) two mounting rods on top of the studs;

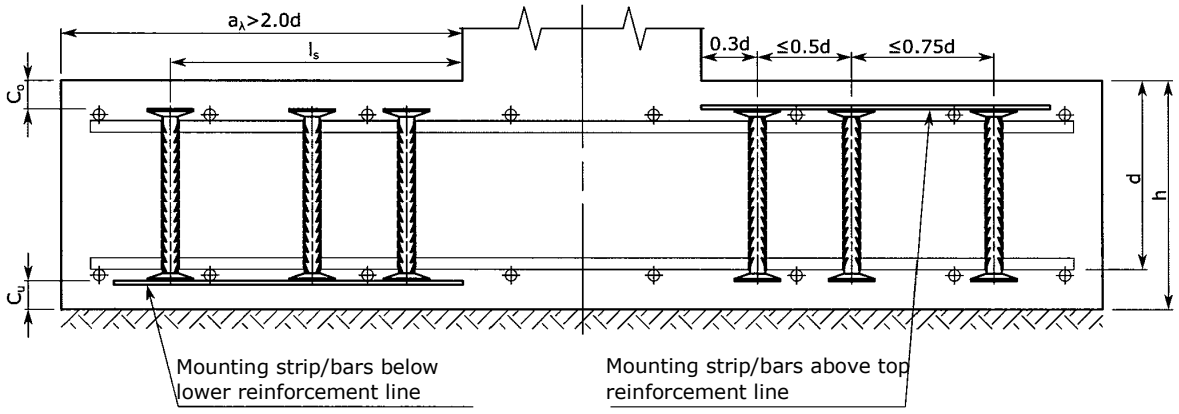
(d) two mounting rods in the middle of the stud height

Appendix B.



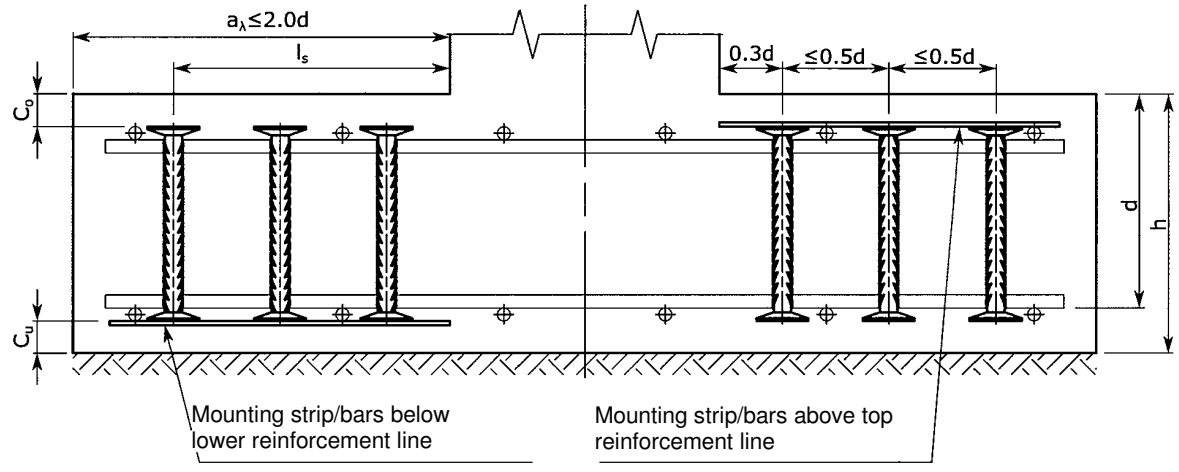
d - useful height of the plate section

Figure B1. FBD stud location in the floor slab



d - useful height of the plate section

Figure B2. FBD stud location in reinforced concrete foundation footings and slabs



d - useful height of the plate section

Figure B3. Arrangement of FBD studs in slender reinforced concrete foundation footings and slabs

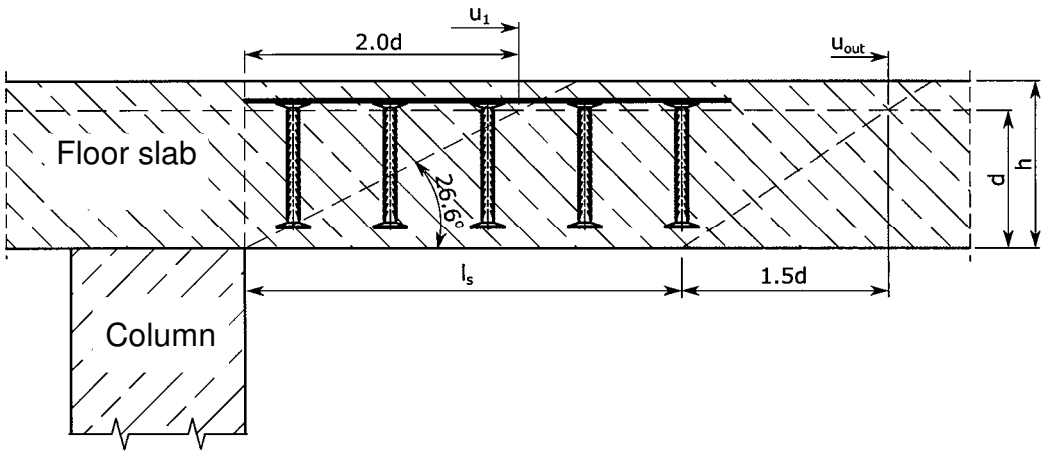


Figure B4. Principle of determining the control circuit u_1 and the external circuit u_{out} using the example of a floor slab

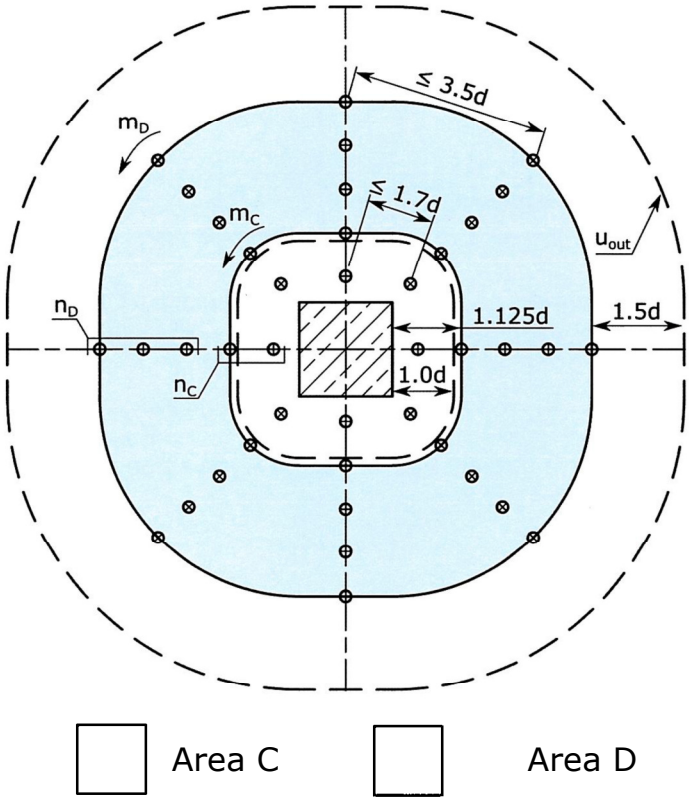


Figure B5. Marking the areas and positioning of the FBD studs in the reinforced concrete floor slab

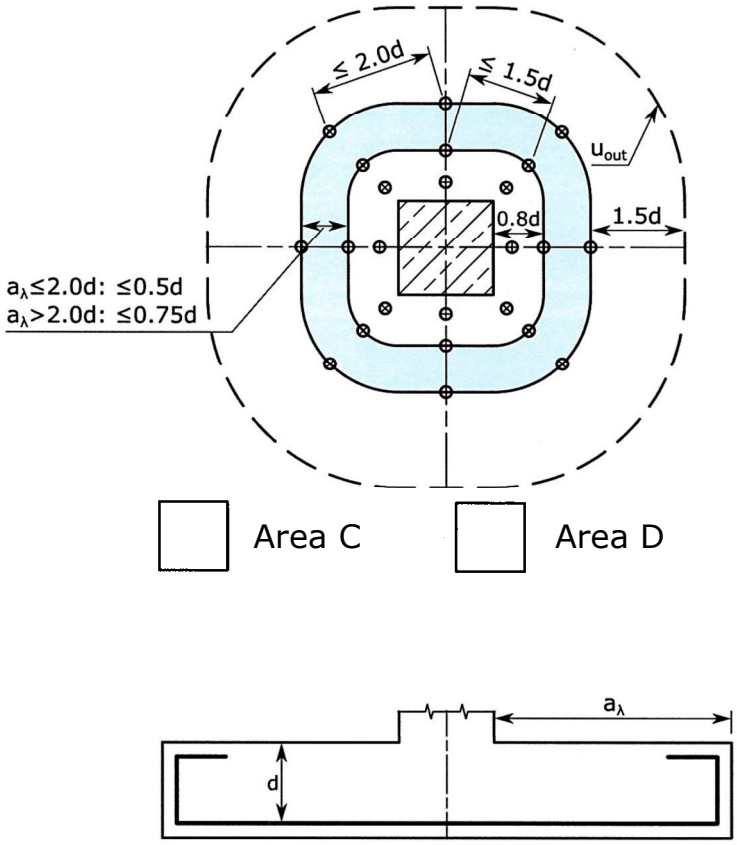


Figure B6. Designation of areas and positioning of FBD studs in a reinforced concrete slab or foundation

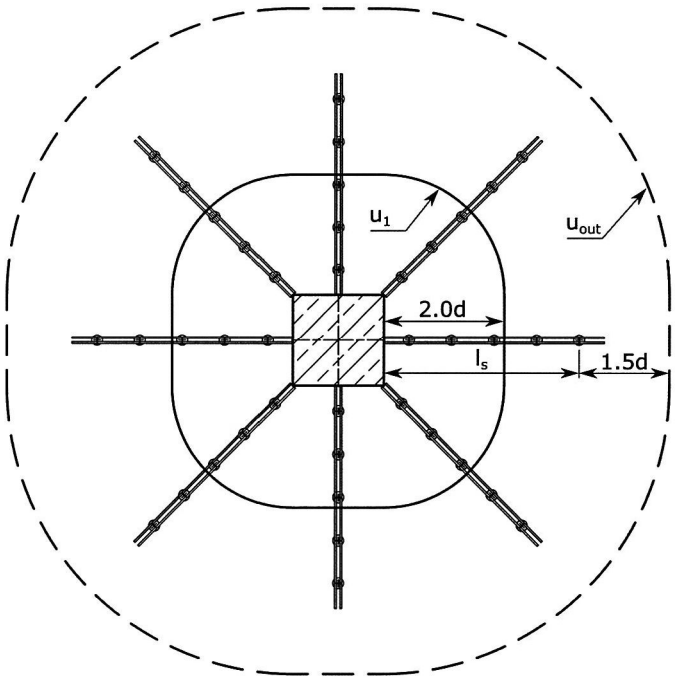


Figure B7. Example of FBD stud arrangement over an internal column

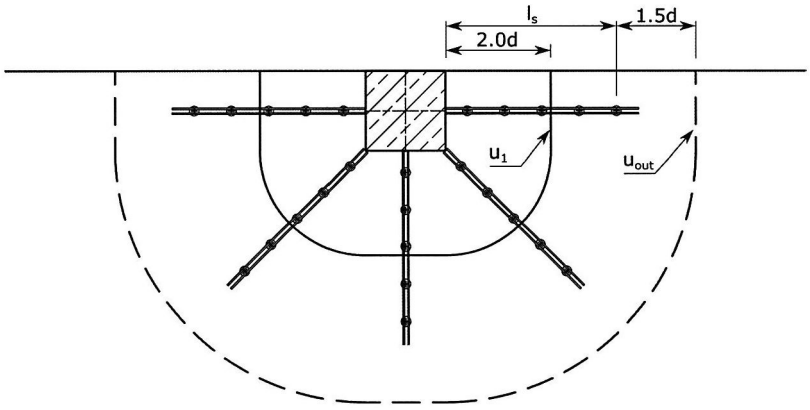


Figure B8. Example of FBD stud arrangement above edge column

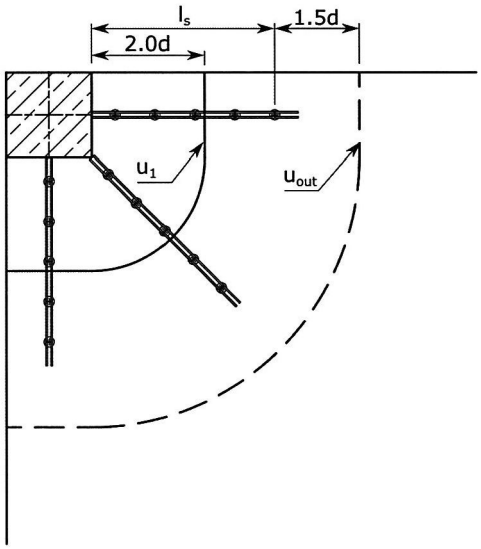


Figure B9. Example of FBD stud arrangement over a corner column

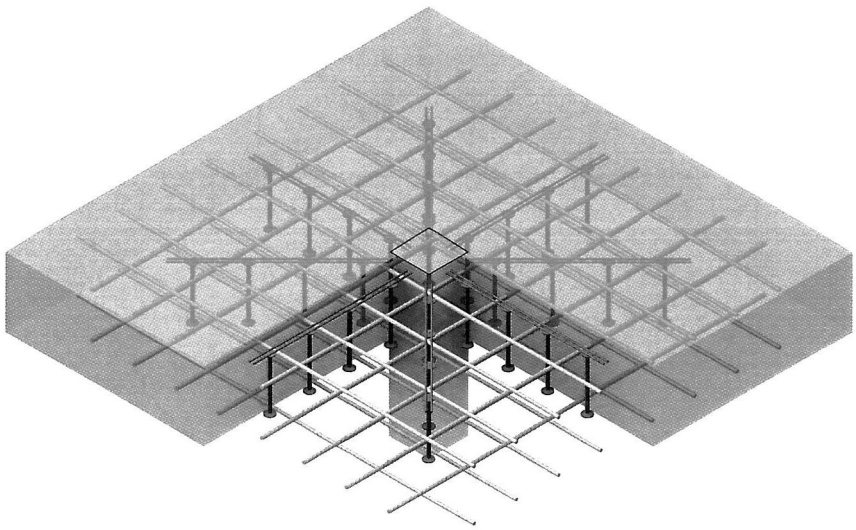


Figure B10. View of the FBD studs arranged around the point of support