



## European Technical Approval ETA-10/0113

English translation prepared by DIBt - Original version in German language

Handelsbezeichnung <i>Trade name</i>	Hoesch Additiv Decke
Zulassungsinhaber <i>Holder of approval</i>	Hoesch Bausysteme GmbH Hammerstraße 11 57223 Kreuztal DEUTSCHLAND
Zulassungsgegenstand und Verwendungszweck <i>Generic type and use of construction product</i>	Stahltrapezprofilblech zur Verwendung in Deckensystemen in Kombination mit Stahlbetonrippendecken <i>Profiled steel sheet for floor systems in combination with a ribbed reinforced concrete slab</i>
Geltungsdauer: <i>Validity:</i>	vom <i>from</i> bis <i>to</i> 28 May 2013 28 May 2018
Herstellwerk <i>Manufacturing plant</i>	Hoesch Bausysteme GmbH Hammerstraße 11 57223 Kreuztal DEUTSCHLAND

Diese Zulassung umfasst  
*This Approval contains*

22 Seiten einschließlich 11 Anhänge  
*22 pages including 11 annexes*

Diese Zulassung ersetzt  
*This Approval replaces*

ETA-10/0113 mit Geltungsdauer vom 31.05.2010 bis 31.05.2015  
*ETA-10/0113 with validity from 31.05.2010 to 31.05.2015*

## I LEGAL BASES AND GENERAL CONDITIONS

- 1 This European technical approval is issued by Deutsches Institut für Bautechnik in accordance with:
  - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products<sup>1</sup>, modified by Council Directive 93/68/EEC<sup>2</sup> and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council<sup>3</sup>;
  - *Gesetz über das In-Verkehr-Bringen von und den freien Warenverkehr mit Bauprodukten zur Umsetzung der Richtlinie 89/106/EWG des Rates vom 21. Dezember 1988 zur Angleichung der Rechts- und Verwaltungsvorschriften der Mitgliedstaaten über Bauprodukte und anderer Rechtsakte der Europäischen Gemeinschaften (Bauproduktengesetz - BauPG) vom 28. April 1998<sup>4</sup>, as amended by Article 2 of the law of 8 November 2011<sup>5</sup>;*
  - Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex to Commission Decision 94/23/EC<sup>6</sup>.
- 2 Deutsches Institut für Bautechnik is authorized to check whether the provisions of this European technical approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European technical approval and for their fitness for the intended use remains with the holder of the European technical approval.
- 3 This European technical approval is not to be transferred to manufacturers or agents of manufacturers other than those indicated on page 1, or manufacturing plants other than those indicated on page 1 of this European technical approval.
- 4 This European technical approval may be withdrawn by Deutsches Institut für Bautechnik, in particular pursuant to information by the Commission according to Article 5(1) of Council Directive 89/106/EEC.
- 5 Reproduction of this European technical approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Deutsches Institut für Bautechnik. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European technical approval.
- 6 The European technical approval is issued by the approval body in its official language. This version corresponds fully to the version circulated within EOTA. Translations into other languages have to be designated as such.

<sup>1</sup> Official Journal of the European Communities L 40, 11 February 1989, p. 12  
<sup>2</sup> Official Journal of the European Communities L 220, 30 August 1993, p. 1  
<sup>3</sup> Official Journal of the European Union L 284, 31 October 2003, p. 25  
<sup>4</sup> *Bundesgesetzblatt Teil I 1998*, p. 812  
<sup>5</sup> *Bundesgesetzblatt Teil I 2011*, p. 2178  
<sup>6</sup> Official Journal of the European Communities L 17, 20 January 1994, p. 34

## II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

### 1 Definition of the product and intended use

#### 1.1 Definition of the construction product

The product is a profiled steel sheet (trapezoidal sheet; see Annex 1). The upper flange is ribbed in transverse direction. The overall height is 205 mm and the nominal sheet thickness is 1.00 mm, 1.25 mm or 1.50 mm.

#### 1.2 Intended use

The profiled steel sheet (profiled sheet) is intended to be used for floor systems with ribbed reinforced concrete slabs according to EN 1992-1-1:2004<sup>7</sup> (Hoesch Additiv Decke, see Annex 2). During construction the profiled sheets act as a permanent formwork for the ribbed reinforced concrete slab which is installed on site. Additional supports during construction must not be used. The profiled sheets are supported by protruding steel cleats which are welded to the supporting steel beam.

The floor system is subjected to bending and/or shear forces.

The minimum thickness of the concrete slab is 80 mm.

In the end-use condition the overall load bearing capacity of the floor system is the addition of the load bearing capacities of both the profiled sheets and the ribbed reinforced concrete slab that means that no composite action between the profiled sheets and the ribbed reinforced concrete slab is taken into account.

The European technical approval is intended to be used in structures with predominantly static loads with live loads  $\leq 5.0$  kN/m<sup>2</sup>.

In every individual case of application the provisions of the Member State at the location where the product is incorporated in the works shall be taken into account. This applies in particular when the floor system is used for parking decks.

The construction product placed on the market with the CE marking is just the profiled sheet. Since the ribbed reinforced concrete slab is installed on site the profiled sheet is a single product with specific end-use conditions which is dealt within an approach similar to the assessment of a kit.

The provisions made in this European technical approval are based on an assumed working life of steel sheets for floor systems in combination with a ribbed reinforced concrete slab (Hoesch Additiv Decke) for the intended use of 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.

### 2 Characteristics of the product and methods of verification

#### 2.1 Characteristics of the product

##### 2.1.1 Dimensions

The dimensions of the profiled sheets shall correspond to the indications given in Annex 1. The upper flange of the profiled sheets is ribbed in transverse direction. The overall height is 205 mm and the nominal sheet thickness is 1.00 mm, 1.25 mm or 1.50 mm.

<sup>7</sup> In addition the corresponding National Annex and/or the national provisions of the Member State applicable for the location where the product is incorporated in the works shall be taken into account.

## 2.1.2 Material properties

For the manufacture of the profiled sheets a galvanized steel sheet suitable for cold forming of steel grade S 350 GD+Z according to EN 10346:2009 shall be used.

## 2.1.3 Section properties, characteristic values and design values of the resistance of the profiled sheet

The section properties as well as the characteristic values of the moment resistance under uniformly distributed load of the profiled sheets shall be taken from the following Table 1:

Table 1: Section properties and characteristic values of resistance of the profiled sheets

Section properties							Characteristic values of bending resistance
Nominal sheet thickness	Dead load	Moment of inertia	Axial force resistance <sup>1</sup>				Positive loads
			Gross cross-section		Effective cross-section <sup>2</sup>		
$t_N$	$g$	$I_{ef}$	$A_g$	$i_g$	$A_{eff}$	$i_{eff}$	$M_{PT,Rk}$
[mm]	[kN/m <sup>2</sup> ]	[cm <sup>4</sup> /m]	[cm <sup>2</sup> /m]	[cm]	[cm <sup>2</sup> /m]	[cm]	[kNm/m]
1.00	0.128	653	7.68	6.67	7.24	9.09	17.00
1.25	0.160	855	9.68	6.67	9.59	8.97	22.10
1.50	0.192	1030	11.70	6.67	11.70	8.79	26.50

<sup>1</sup> Calculation of the resistance value see EN 1993-1-3:2006, sections 6.1.2 und 6.1.3 considering the National Annex and/or the provisions of the Member State at the location where the product is incorporated in the works.  
<sup>2</sup> Effective section for constant compressive stress:  $f_{y,k} = 350 \text{ N/mm}^2$

The design values result from the division by the partial safety factor  $\gamma_M$ . A partial safety factor  $\gamma_M = 1.1$  is recommended. It should be used provided the values are not stated in the national provisions of that Member State in which the profiled sheet is used and/or in National Annexes to the corresponding Eurocodes.

## 2.1.4 Corrosion protection

The provisions given in EN ISO 12944:1998 and EN 1090-2:2008 shall apply.

## 2.1.5 Safety in case of fire

The profiled sheets satisfy the requirements of Class A1 of the reaction-to-fire performance according to EN 13501-1:2007.

## 2.2 Method of verification

### 2.2.1 General

The assessment of fitness for the intended use of the profiled sheets with regard to the requirements for mechanical resistance and stability, safety in case of fire and safety in use within the meaning of the essential requirements No 1, 2 and 4 has been made in accordance with sections 2.2.2 and 2.2.3.

### 2.2.2 Essential Requirement No 1: Mechanical resistance and stability

Essential Requirement No 4: Safety in use

The characteristic values of resistance of the profiled sheets were determined by tests following EN 1993-1-3:2006, Annex A.

### 2.2.3 Essential requirement No 2: Safety in case of fire

The profiled sheets are considered to satisfy the requirements of Class A1 according to EN 13501-1:2007 of the characteristic reaction to fire in accordance with the provisions of the Commission Decision 96/603/EC (as amended) without the need for testing on the basis of its listing in that Decision.

### 2.2.4 Verification of durability

EN 1090-2:2008 and EN ISO 12944:1998 shall be taken into account.

## 3 Evaluation and attestation of conformity and CE marking

### 3.1 System of attestation of conformity

According to the communication of the European Commission<sup>8</sup> system 2+ of the attestation of conformity applies.

This system of attestation of conformity is defined as follows:

System 2+: Declaration of conformity of the product by the manufacturer on the basis of:

- (a) Tasks for the manufacturer:
  - (1) initial type-testing of the product;
  - (2) factory production control;
  - (3) testing of samples taken at the factory in accordance with a prescribed test plan.
- (b) Tasks for the approved body:
  - (4) certification of factory production control on the basis of:
    - initial inspection of factory and of factory production control;
    - continuous surveillance, assessment and approval of factory production control.

Note: Approved bodies are also referred to as "notified bodies".

### 3.2 Responsibilities

#### 3.2.1 Tasks for the manufacturer

##### 3.2.1.1 Factory production control

The manufacturer shall exercise permanent internal control of production. All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic manner in the form of written policies and procedures, including records of results performed. This production control system shall insure that the product is in conformity with this European technical approval.

The manufacturer may only use raw materials stated in the technical documentation of this European technical approval.

The factory production control shall be in accordance with the control plan which is part of the technical documentation of this European technical approval. The control plan is laid down in the context of the factory production control system operated by the manufacturer and deposited with Deutsches Institut für Bautechnik.<sup>9</sup>

The results of factory production control shall be recorded and evaluated in accordance with the provisions of the control plan.

<sup>8</sup> Letter of the European Commission of 07. June 2006 to EOTA

<sup>9</sup> The control plan is a confidential part of the European technical approval and only handed over to the approved body involved in the procedure of attestation of conformity. See section 3.2.2.

#### 3.2.1.2 Other tasks for the manufacturer

The manufacturer shall, on the basis of a contract, involve a body which is approved for the tasks referred to in section 3.1 in the field of "Profiled steel sheets" in order to undertake the actions laid down in section 3.2.2. For this purpose, the control plan referred to in sections 3.2.1.1 and 3.2.2 shall be handed over by the manufacturer to the approved body involved.

The manufacturer shall make a declaration of conformity, stating that the construction product is in conformity with the provisions of this European technical approval.

#### 3.2.2 Tasks for the approved bodies

The approved body shall perform the

- initial inspection of factory and of factory production control,
- continuous surveillance, assessment and approval of factory production control

in accordance with the provisions laid down in the control plan.

The approved body shall retain the essential points of its actions referred to above and state the results obtained and conclusions drawn in a written report.

The approved certification body involved by the manufacturer shall issue an EC certificate of conformity of the factory production control stating the conformity with the provisions of this European technical approval.

In cases where the provisions of the European technical approval and its control plan are no longer fulfilled the certification body shall withdraw the certificate of conformity and inform Deutsches Institut für Bautechnik without delay.

### 3.3 CE marking

The CE marking shall be affixed on the profiled sheets or the label attached to the profiled sheets, packaging, accompanying commercial document, e.g. the EC declaration of conformity. The letters "CE" shall be followed by the identification number of the approved certification body, where relevant, and be accompanied by the following additional information:

- the name and address of the producer (legal entity responsible for the manufacture),
- the last two digits of the year in which the CE marking was affixed,
- the number of the EC certificate for the factory production control,
- the number of the European technical approval,
- the description of the product,
- the geometric data,
- the material properties.

#### **4 Assumptions under which the fitness of the product for the intended use was favourably assessed**

##### **4.1 Manufacturing**

The European technical approval is issued for the product on the basis of agreed data/information, deposited with Deutsches Institut für Bautechnik, which identifies the product that has been assessed and judged. Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to Deutsches Institut für Bautechnik before the changes are introduced. Deutsches Institut für Bautechnik will decide whether or not such changes affect the approval and consequently the validity of the CE marking on the basis of the approval and if so whether further assessment or alterations to the approval shall be necessary.

##### **4.2 Installation of the profiled sheets and of the floor system**

After laying every profiled sheet must be secured against lifting or displacement at the supports and fixed with powder-actuated fasteners on the cleats in accordance with Annexes 3 and 4.

For the execution of the welding of the cleats EN 1090-2:2008 shall apply.

The profiled sheets shall be fixed at the longitudinal joints and at the longitudinal edge with fastening elements with European technical approval at intervals of max. 666 mm.

Low-shrink concrete with a low water/cement ratio shall preferably be used.

For the execution of the concrete work the provisions given in FprEN13670:2009 taking into account the national provisions at the location where the product is incorporated in the works and the information given by the manufacturer shall apply.

When concreting in sections, it shall be taken into account that due to the different deformations of the floor girders no significant restraint will occur in the floor section which is in hardening process.

It shall be ensured that concrete accumulations whose weight exceed the relevant installation loading according to section 4.4.2 will be avoided.

##### **4.3 Concept design of the profiled sheets and of the floor system**

###### **4.3.1 General**

Unless otherwise specified in the following EN 1992-1-1:2004<sup>7</sup>, EN 1993-1-3:2006<sup>7</sup> and EN 1992-1-2:2004<sup>7</sup> shall apply for the concept design of both components of the floor system.

The European technical approval applies to the use of the "Hoesch Additiv Decke" as uniaxial, hinged supported single-span slabs with floor girder intervals of not more than 6.00 m. Concentrated point loads and linear loads are not provided.

The dimensions and material properties given in this European technical approval shall be taken into account.

###### **4.3.2 Profiled steel sheet**

The nominal sheet thickness shall be 1.00 mm, 1.25 mm or 1.50 mm.

###### **4.3.3 Concrete**

The concrete shall correspond to the strength classes C20/25 to C50/60 according to EN 206-1:2000. In addition, where applicable, the national provisions of the Member States shall be taken into account. The thickness of the flange plate of the ribbed concrete slab shall be at least 80 mm.

#### 4.3.4 Steel cleats

For the manufacture of the cleats steel of at least steel grade S235 according to EN 10025-2:2004 shall be used.

The design of the steel cleats and their fixing to the steel girders as well as the bearing of the profiled sheets on the steel cleats shall correspond to Annexes 3 and 4. The profiled sheets shall be fixed on each cleat with powder-actuated fasteners with European technical approval.

The floor edge parallel to the ribs shall be designed according to Annex 8.

#### 4.3.5 Constructive reinforcement of reinforcing steel

As constructive slab reinforcement for the reduction of the widths of shrinkage cracks and for the load distribution an orthogonal mesh reinforcement of at least 2.0 cm<sup>2</sup>/m per direction shall be placed in the flange plate taking into account the concrete cover according to EN 1992-1-1:2004<sup>7</sup>. This reinforcement may be considered for all structural design verifications. Concerning concrete cover the provisions of the Member State shall be taken into account.

As constructive support reinforcement double shear inclined stirrups with a diameter of 6 mm with an inclination of 45° shall be placed into the ends of the concrete ribs at the intermediate and end supports (see Annexes 6 and 7). Additional reinforcement (e.g. to carry the longitudinal shear) that is necessary for composite beams shall be verified separately.

Over internal girders an upper reinforcement for the limitation of crack widths shall be set up according to section 4.4.3.5.

#### 4.3.6 Load-bearing reinforcement of reinforcing steel

One obligatory lower located reinforced bar with a diameter of at least 8 mm shall be placed in the lower part of each concrete rib throughout the entire length of the profiled sheet. Its position in the cross section is shown in Annex 5.

Shear reinforcement shall not be taken into account.

#### 4.3.7 Verification of durability

For the ribbed reinforced concrete slab the rules given in EN 1992-1-1:2004<sup>7</sup> shall be taken into account. For the profiled sheet, EN 1090-2:2008<sup>7</sup> and EN ISO 12944:1998 shall apply.

Unless the floor system is used for parking decks a specific concept for securing the durability of the slab shall be compiled.

#### 4.3.8 Safety in case of fire

The ribbed concrete slab satisfies the requirements of Class A1 of the reaction-to-fire performance according to EN 13501-1:2007.

### 4.4 Structural design of the profiled sheets and of the floor system

#### 4.4.1 General

Unless otherwise specified in the following EN 1992-1-1:2004<sup>7</sup>, EN 1993-1-3:2006<sup>7</sup> and EN 1992-1-2:2004<sup>7</sup> shall apply to the structural design of both components of the floor system. For the verification of the ultimate limit state the safety concept in accordance with EN 1990:2002<sup>7</sup> shall be used. In addition the provisions of the Member States at the location where the product is incorporated in the works shall be taken into account. The values given in this European technical approval for the partial safety factors are recommended values. They should be used provided the values are not stated in the national provisions of that Member State in which "Hoesch Additiv Decke" is used and/or in the National Annexes to the corresponding Eurocodes.

In the final state the load bearing capacities of the profiled sheets and the ribbed reinforced concrete slab are added, i.e. no composite action between the profiled sheet and the ribbed reinforced concrete slab will be taken into account.

The arrangement of transverse ribs in accordance with EN 1992-1-1:2004, section 5.3.1 is not required.



For transmission of horizontal loads and for horizontal bracing of multi-story constructions only the flange plate may be used. Simultaneous loads parallel and perpendicular to the floor shall be superimposed.

The transmission of the horizontal loads to the substructure and/or the vertical bracing or diaphragms shall be verified.

#### 4.4.2 Design of the profiled sheet under construction as formwork

The load bearing capacity and the serviceability of the profiled sheet under construction as formwork shall be verified according to the provisions of the Member State at the location where the product is incorporated in the works.

Section properties and characteristic values of the load bearing capacity for the profiled sheet are given in section 2.1.3.

For structural design verifications of shear forces the shear resistance of the sheet in the zone of the cleat is decisive. The corresponding characteristic values  $A_{K,Rk}$  shall be taken from Table 2.

Table 2: Characteristic values of resistance of the profiled sheet support on a steel cleat

$t_N$ [mm]	1.00	1.25	1.50
$A_{K,Rk}$ [kN]	8.60	11.80	15.50

The design values result from the division by the partial safety factor  $\gamma_M$ . A partial safety factor  $\gamma_M = 1.1$  is recommended. It should be used provided the values are not stated in the national provisions of that Member State in which the profiled sheet is used and/or in National Annexes to the corresponding Eurocodes.

The fastening of the steel cleat to the steel girder is not part of this European technical approval and shall be verified separately.

The powder-actuated fastener which is used for the fastening of the profiled sheet to the steel cleat shall be verified for a horizontal shear force  $F_{Qd} = 0.25 \cdot A_{K,Ed}$ ;  $A_{K,Ed}$  is the design value of the support force on a steel cleat (see Table 2).

Possible torsion of the steel girders during concreting due to single-sided fresh concrete load shall be taken into account.

#### 4.4.3 Design of the floor system for the cold case

##### 4.4.3.1 General

For the verification of the load bearing capacity it is recommended to take the calculation model in accordance with Annex 9 as a basis. It is characterized by the fact that

- the bending moment  $M_{Ed,max}$  of the floor system is carried by the profiled sheet and the ribbed reinforced concrete slab together,
- the shear force  $V_{Ed,max}$  at the floor support is carried by the profiled sheet alone.

The effective span  $L$  of the profiled sheet ranges from the centre of support of the cleat to the centre of support of the cleat.

The effective floor span  $L_C$  of the ribbed reinforced concrete slab is smaller by  $2 \cdot L_R$  than the span  $L$  of the profiled sheet (see Annex 9); concerning the dimension of  $L_R$  see section 4.4.3.2.

#### 4.4.3.2 Verification of the ultimate limit states

The acceptable moment  $M_{Rd}$  results from the sum of the moment resistance of the profiled sheet and the ribbed reinforced concrete slab:

$$M_{Rd} = M_{PT,Rk} / \gamma_S + M_{C,Rk} / \gamma_C \quad (1)$$

Where:

$M_{PT,Rk}$ : characteristic values of the moment resistance of the profiled steel sheet in accordance with EN 1993-1-3:2006 (see section 2.1.3)

$M_{C,Rk}$ : characteristic values of the moment resistance of the ribbed concrete slab in accordance with EN 1992-1-1:2004<sup>7</sup>

$\gamma_S, \gamma_C$ : partial safety factor for the profiled sheet and/or the ribbed reinforced concrete slab; for  $\gamma_S$  factor 1.1 and for  $\gamma_C$  factor 1.5 is recommended (see section 4.4.1)

To determine  $M_{C,Rk}$  not more than 2,6 cm<sup>2</sup> per rib may be applied as approach for the sectional area of the reinforcement, even if, for example, more reinforcement is inserted in the ribs due to fire preventive reasons (see section 4.4.4).

For the determination of the shear resistance the following shall be taken into account:

It shall be verified that the profiled sheet support on the steel cleat can carry the support force of the slab alone. The relevant design value is  $A_{K,Rd}$  which is the design resistance of the profiled sheet support per cleat according to Table 2. The fixing of the cleat to the steel girder shall be verified separately.

The design value of the shear force acting on the ribbed reinforced concrete slab  $V_{C,Ed,max}$  shall be determined according to equation (2) with the effective span  $L_C$  of the ribbed reinforced concrete slab (see Annex 9).

As proportionate action  $q_{C,Ed}$  of the ribbed reinforced concrete slab the design values of the traffic load, of the dead load of the concrete without profiled sheet and of the live load shall be taken into account.

$$V_{C,Ed,max} = q_{C,Ed} \cdot L_C / 2 \quad (2)$$

$$L_C = L - 2 \cdot L_R$$

$L_R$  shall be determined according to the following equation:

$$\left(\frac{L_R}{L}\right)^2 - \frac{L_R}{L} + \frac{2 \cdot M_{PT,Rd} / L^2 - g_{PT,Ed} / 4}{q_{C,Ed}} = 0 \quad (3)$$

Thereby,  $g_{PT,Ed}$  is the design value of the dead load of the profiled sheet.

The shear resistance of the ribbed reinforced concrete slab shall be determined according to EN 1992-1-1:2004<sup>7</sup>, section 6.2.2 (1). As the smallest sectional width  $b_w$  the rib width at the height of the longitudinal reinforcement shall be applied (see Annex 5).

#### 4.4.3.3 Verification of the anchorage of the flexural tensile reinforcement in the rib

It shall be verified that

$$L_R \geq l_{b,eq} + d \quad (4)$$

Where:

$L_R$ : dimension determined according to equation (3) following Annex 9

$l_{b,eq}$ : anchorage length according to EN 1992-1-1:2004<sup>7</sup>, section 8.4

$d$ : effective depth of the reinforced concrete rib.

#### 4.4.3.4 Verification of the slab as a flange of steel composite girders

The verification shall be done according to EN 1992-1-1:2004<sup>7</sup> and/or EN 1994-1-1:2006<sup>7</sup>.

The cleats may not be used as shear connectors for the composite beams. A verification of the fastening of the cleats to the steel girders for an unintended contribution as shear connectors is not required unless the execution is done according to Annexes 3 and 4.

#### 4.4.3.5 Verification of the limit states of the serviceability

If no specific verification is carried out a minimum reinforcement that is designed for the crack moment shall be installed above inner girders (bearing moment) in case of predominantly bending forces.

In case of predominant bending restraint the reinforcement shall protrude the edge of the flange for at least 25 cm in both directions.

In case of predominantly tensile restraint a continuous minimum reinforcement is necessary if the tension exceeds the crack axial force.

The verification of limitation of the crack widths as well as the acceptance of the crack moment and the crack axial force shall be made according to EN 1992-1-1:2004<sup>7</sup>.

The deflections shall be limited in accordance with the provisions of the Member States.

#### 4.4.4 Design of the floor system in case of fire

The design moment resistance  $M_{C,Rd,fi}$  and the design shear resistance  $V_{C,Rd,fi}$  of the ribbed concrete slab in case of fire shall be determined for the required fire resistance according to EN 1992-1-2:2004<sup>7</sup>.

The moment and shear resistance of the floor system in case of fire are the moment resistance  $M_{C,Rd,fi}$  and the shear resistance  $V_{C,Rd,fi}$  of the ribbed concrete slab for the required fire resistance.

A partial safety factor  $\gamma_{M,fi} = 1.0$  is recommended (see section 4.4.1).

Regarding suspended fire protection reinforcement for taking up the shear force Annexes 10 and 11 shall be taken into account.

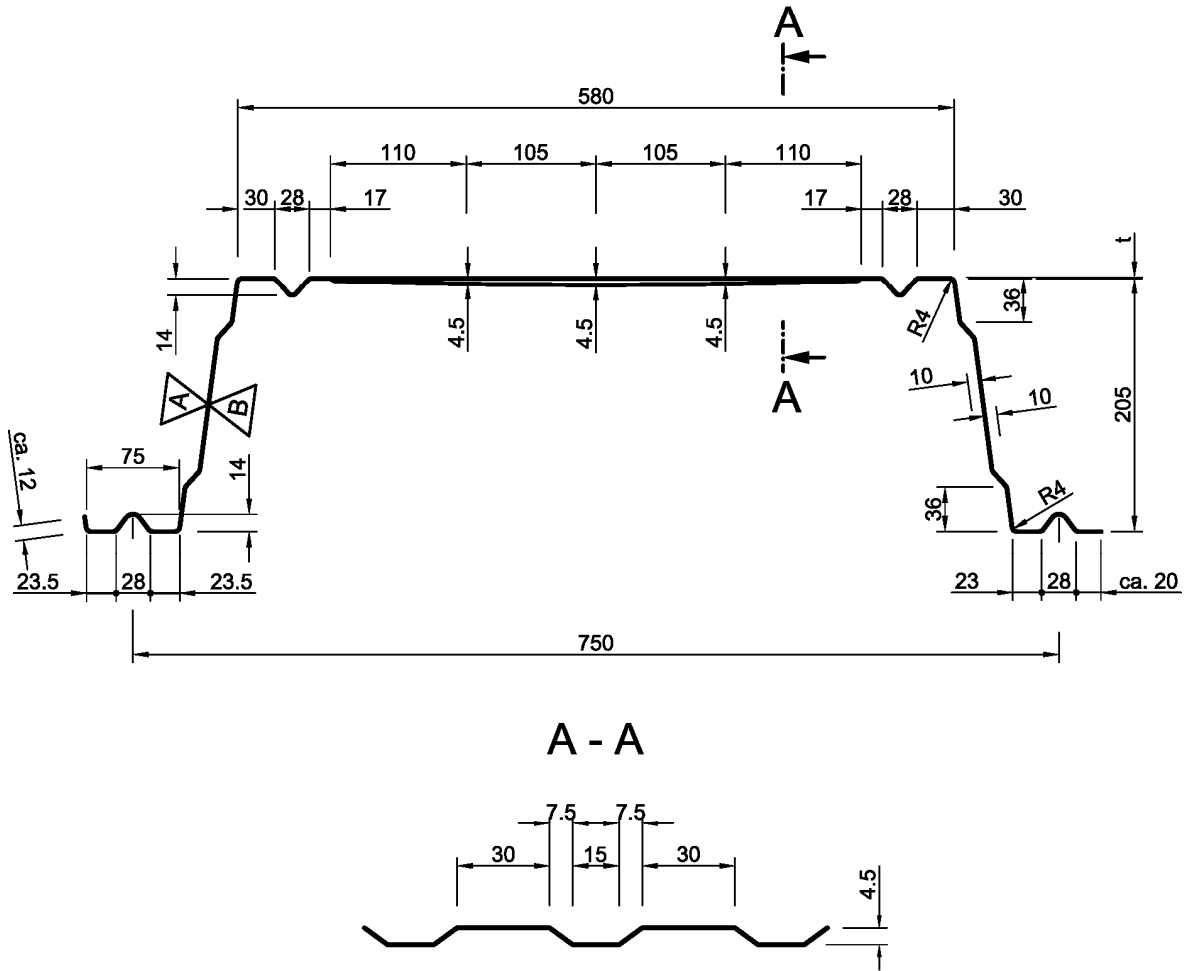
### 5 Indications to the manufacturer

The manufacturer shall ensure that the information on the specific conditions according to sections 1, 2 and 4 (including the Annexes referred to) is given to those who are concerned. This information may be given by reproduction of the European technical approval.

In addition all essential installation data shall be shown clearly on the package and/or on an enclosed instruction sheet, preferably using illustration(s).

Uwe Bender  
Head of Department

*beglaubigt:*  
Spohn

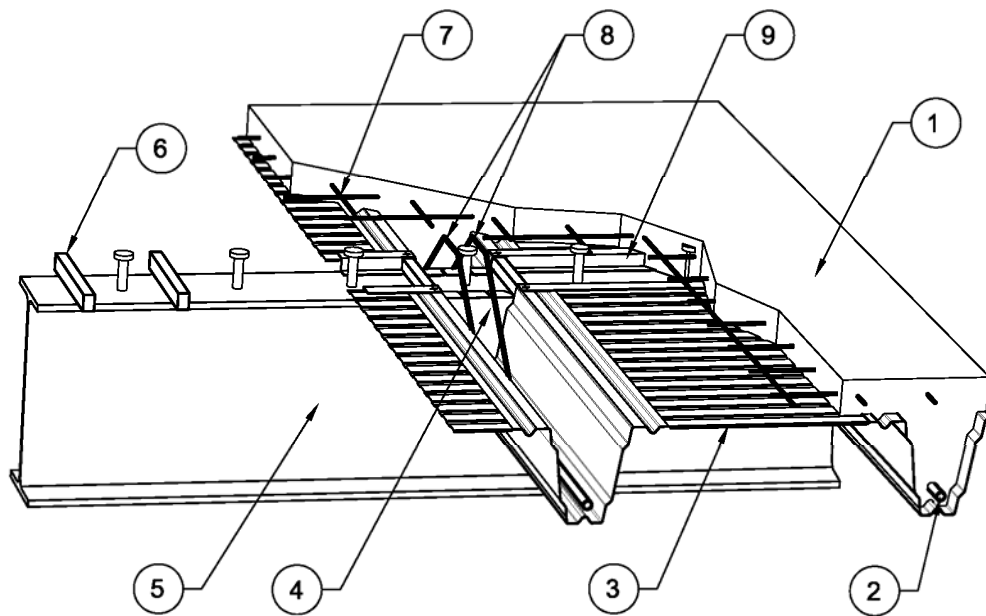


All dimensions in [mm]

Hoesch Additiv Decke

Profiled steel sheet

Annex 1

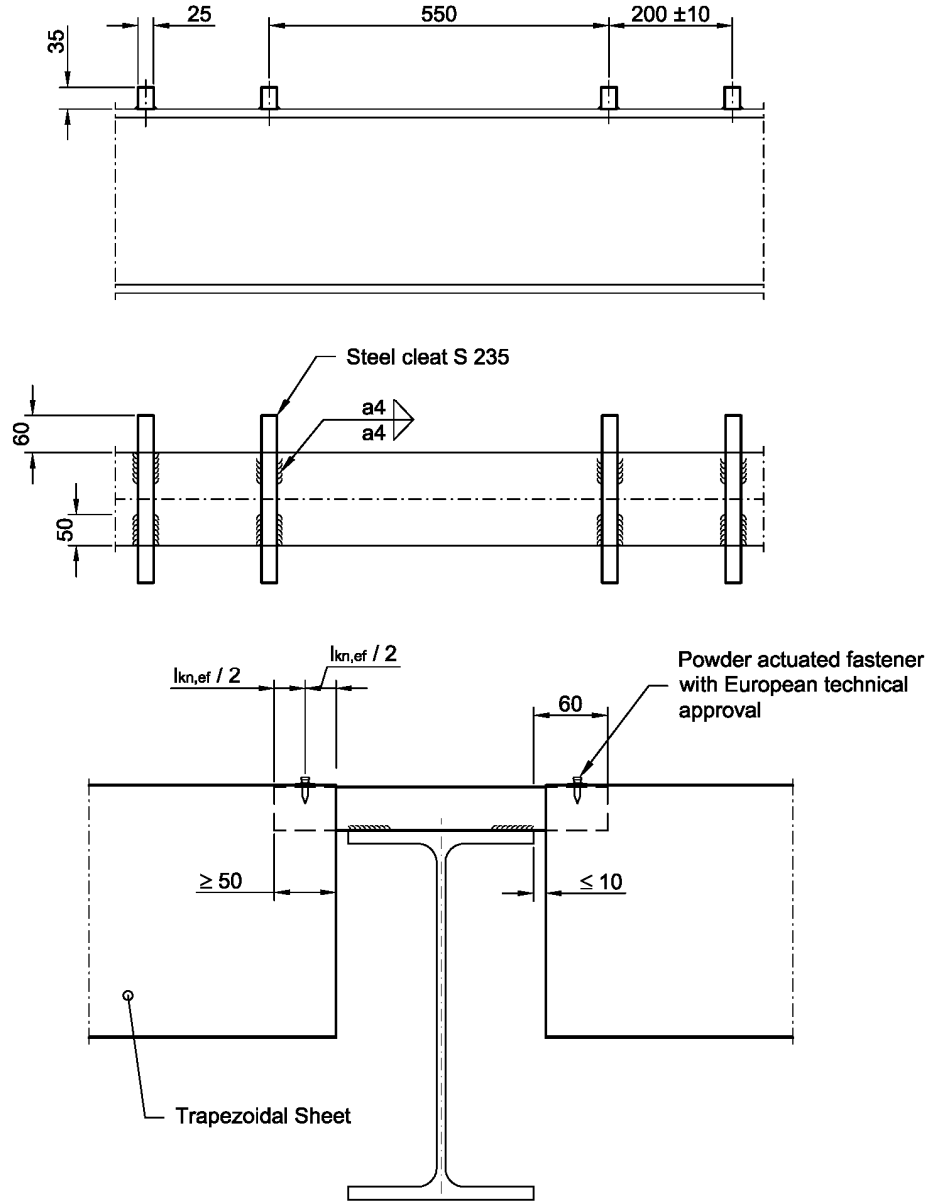


- 1 Ribbed reinforced concrete slab (min. C20/25)
- 2 Longitudinal rib reinforcement
- 3 Trapezoidal sheet
- 4 Plastic sealing cap
- 5 Steel composite girder
- 6 Steel cleats
- 7 Mesh reinforcement
- 8 Support reinforcement
- 9 Z-type profiled sheet

Hoesch Additiv Decke

System overview

Annex 2

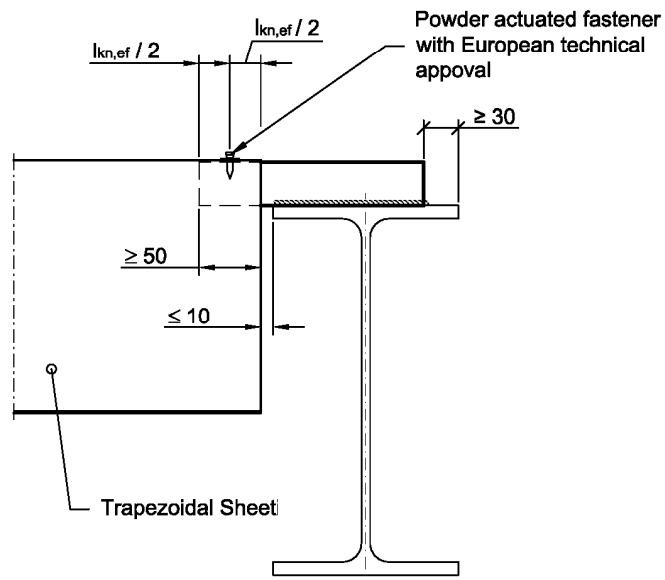
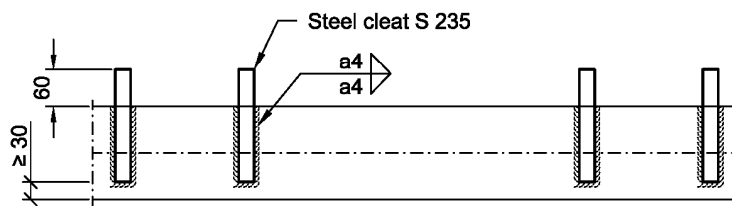
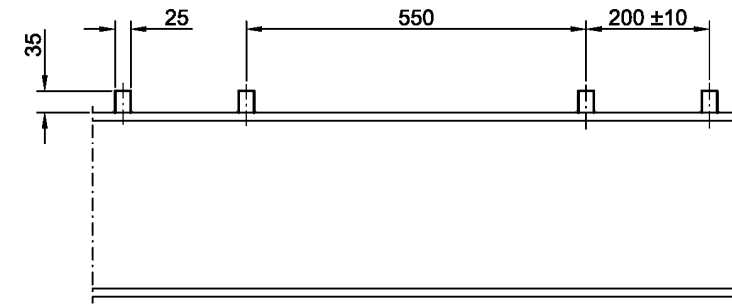


All dimensions in [mm]

Hoesch Additiv Decke

Steel cleats at intermediate support

Annex 3

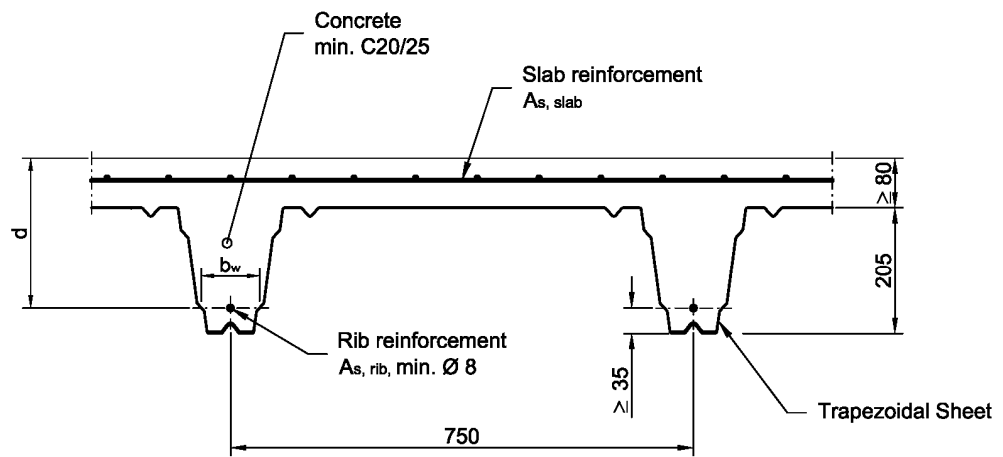


All dimensions in [mm]

Hoesch Additiv Decke

Steel cleats at end support

Annex 4



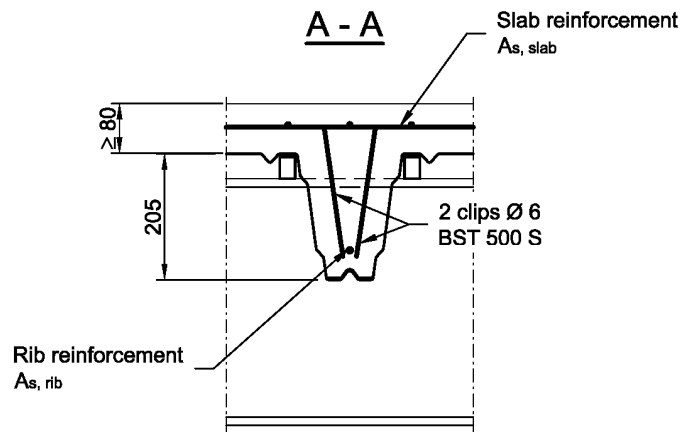
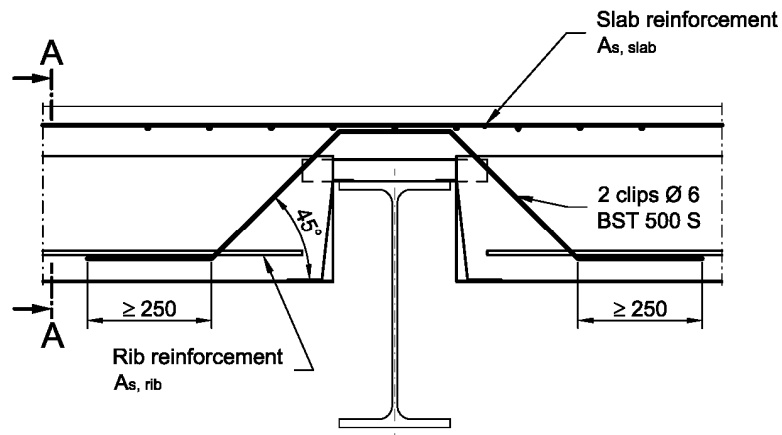
All dimensions in [mm]

Hoesch Additiv Decke

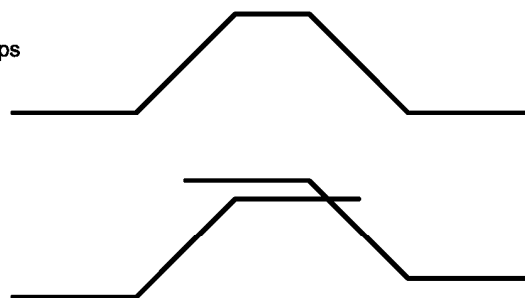
Floor cross section

Annex 5





Possible types of reinforcement clips

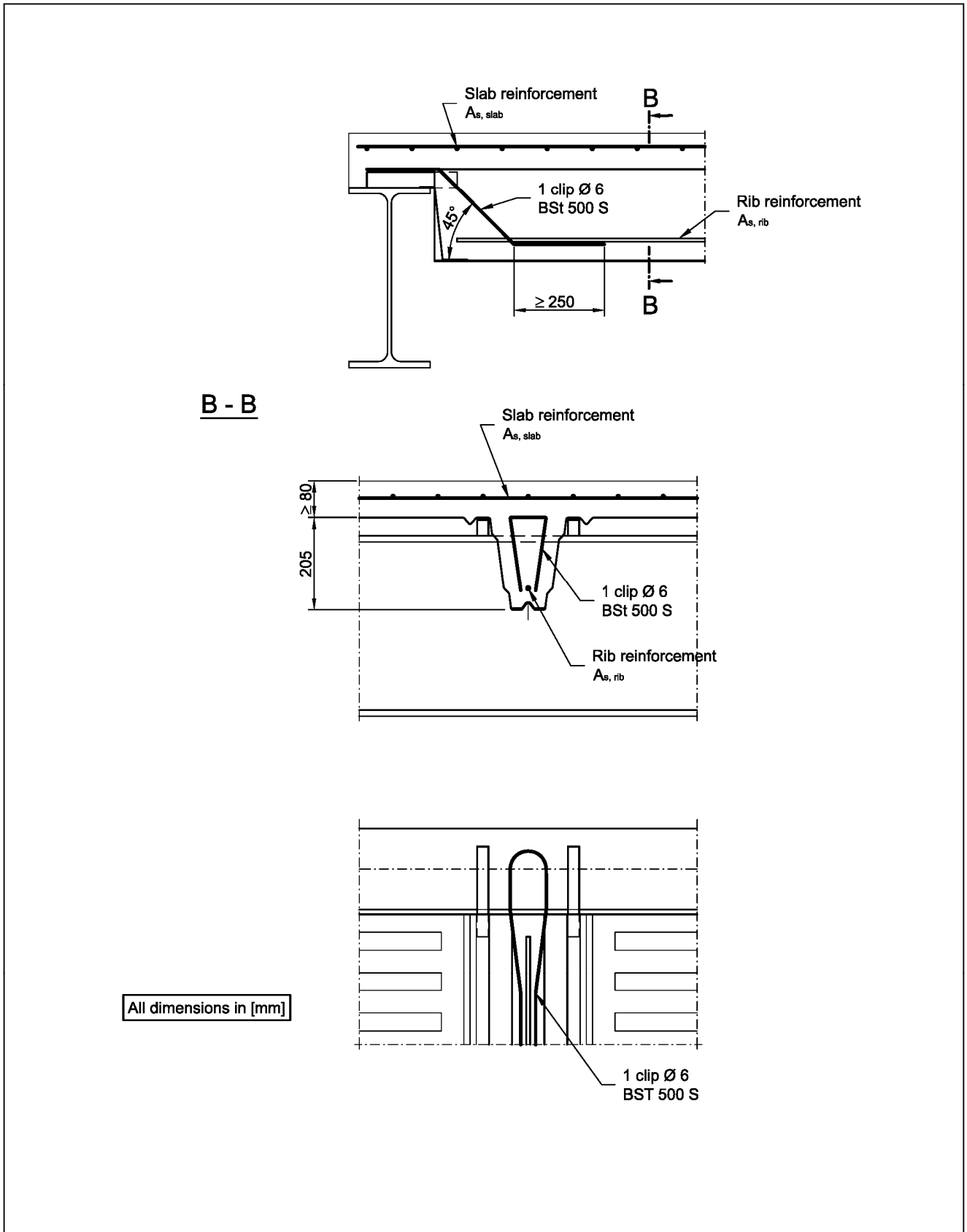


All dimensions in [mm]

Hoesch Additiv Decke

Constructional reinforcement at intermediate support

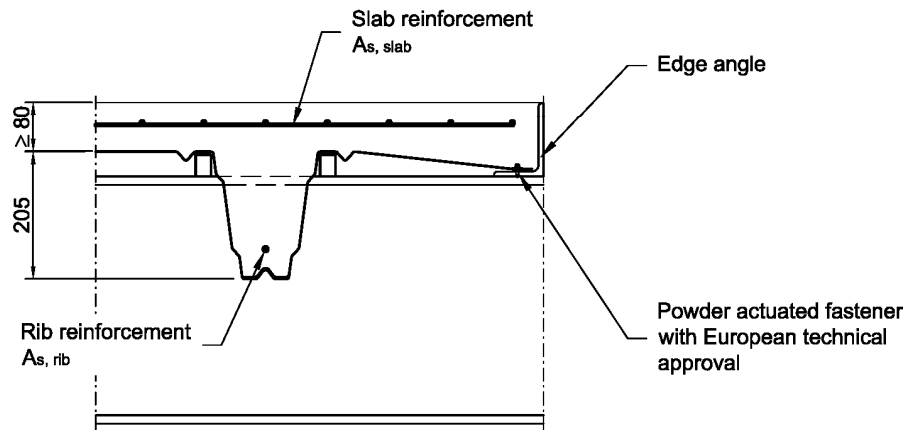
Annex 6



Hoesch Additiv Decke

Constructional reinforcement at end support

Annex 7

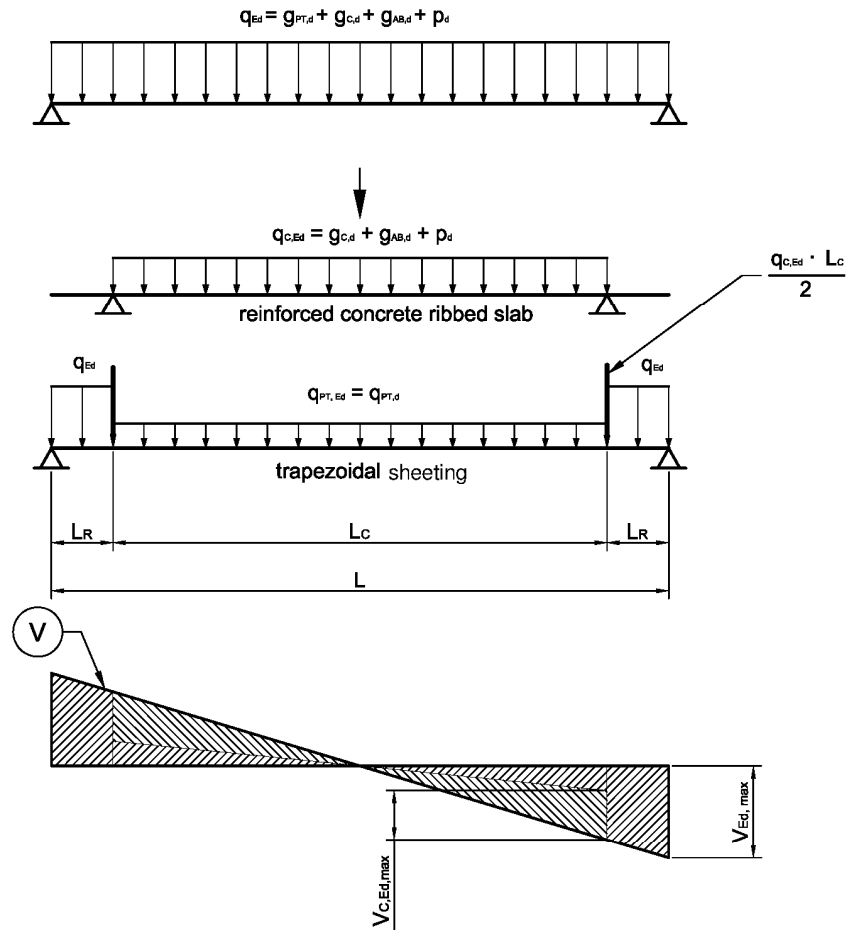


All dimensions in [mm]

Hoesch Additiv Decke

Edge design

Annex 8

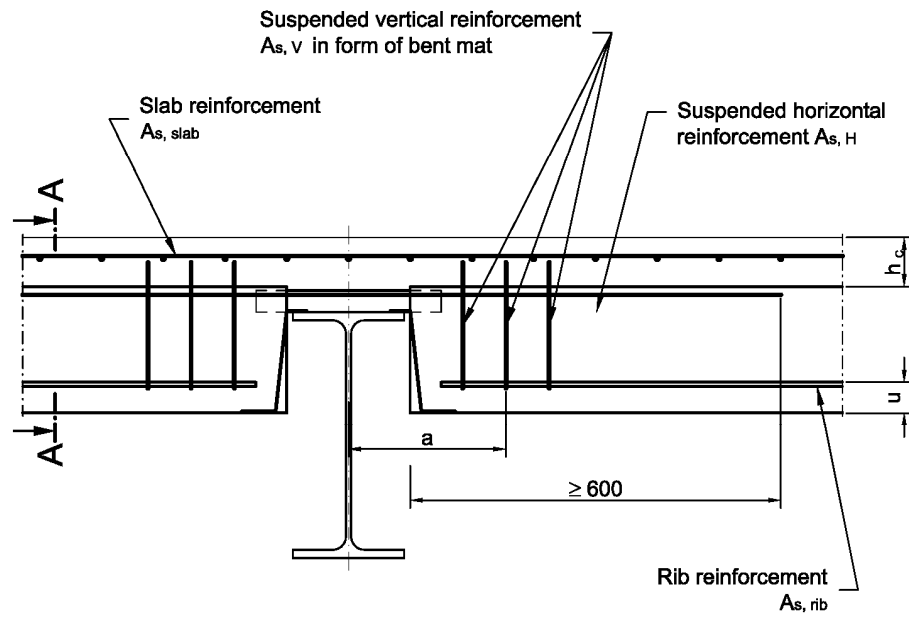


- Indices:  
 PT Trapezoidal sheeting  
 C Reinforced concrete ribbed slab  
 AB Additional load (e.g. mastic asphalt)

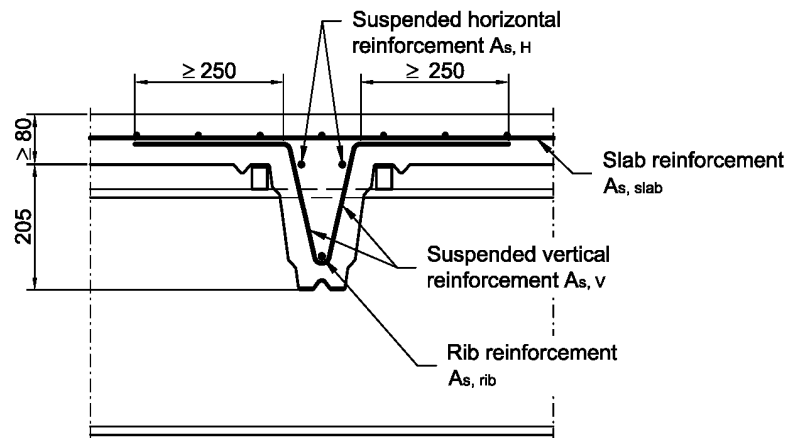
Hoesch Additiv Decke

Calculation model for the verification of the shear resistance

Annex 9



**A - A**

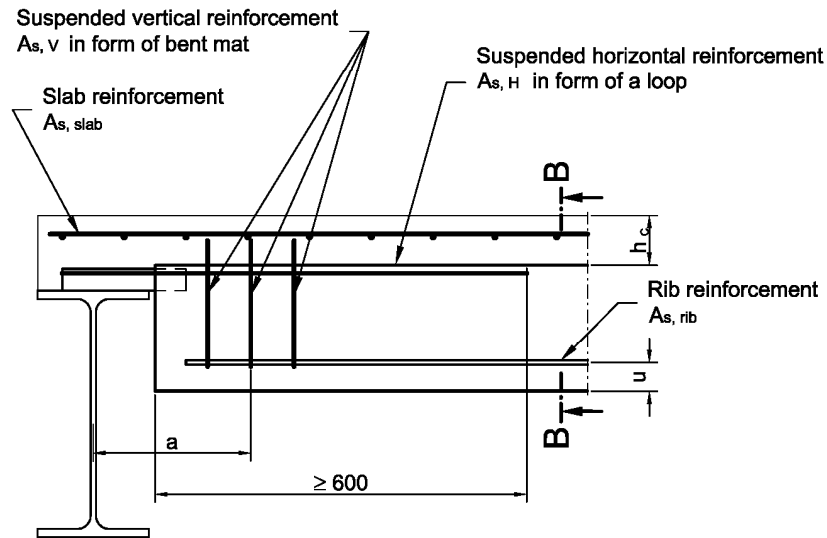


All dimensions in [mm]

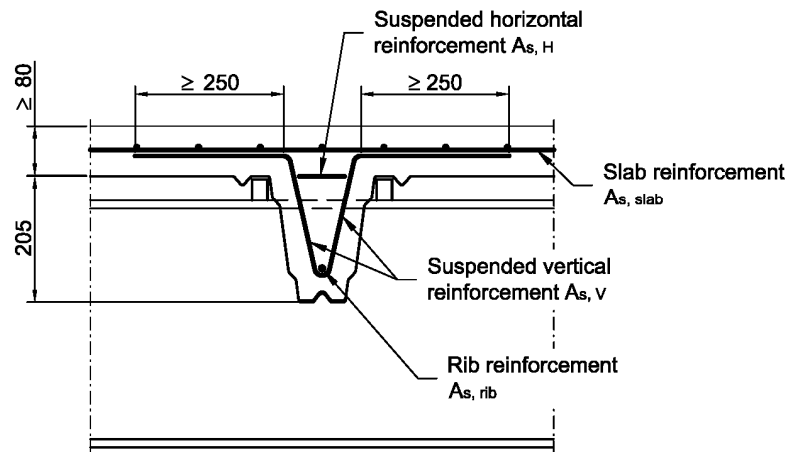
Hoesch Additiv Decke

Suspended fire protection reinforcement at intermediate support

Annex 10



**B - B**



All dimensions in [mm]