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Designated according to Article 29 of Regulation (EU) No 305/2011

Member of EOTA
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European Technical Assessment

ETA-18/0549
of 22.12.2018

General part

Technical Assessment Body issuing the European Technical Assessment	Austrian Institute of Construction Engineering (OIB)
Trade name of the construction product	Fahrbahnübergangskonstruktion Typ SP/FP
Product family to which the construction product belongs	Nosing expansion joints for road bridges
Manufacturer	Schreiber Brücken- Dehntechnik GmbH Am Moosbach 10 + 12 74535 Mainhardt Germany
Manufacturing plant(s)	Schreiber Brücken- Dehntechnik GmbH Am Moosbach 10 + 12 74535 Mainhardt Germany
This European Technical Assessment contains	24 pages including 4 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	Guideline for European technical approval (ETAG) No 032 “Expansion joints for road bridges Part 4: Nosing expansion joints”, edition May 2013, used as European Assessment Document (EAD)

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Specific parts

1 Technical description of the product

The nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** is a kit consisting of the following components:

- Flexible elastomeric sealing element “SP 150” (defined in the technical documentation, characteristics given in Table A.3.1 in Annex 3 in this ETA) according to Figures 1 to 4 (Position 6), Annex 1 and 3 in this ETA made of EPDM
- Edge profile of at least steel grade S355JR according to EN 10025-2 (Position 1 in Figures 1 and 2 in this ETA) for **Fahrbahnübergangskonstruktion Typ SP/FP**
- Edge profile (Position 1.1 in Figures 3 and 4) and connection for waterproof system (Position 1.2 in Figures 3 and 4) of at least steel grade 1.4571 according to EN 10088-1 for **Fahrbahnübergangskonstruktion Typ SP/FP-NR**
- Extension steel plate (for pavement thickness >75 mm up to 150 mm) of at least steel grade S235J2+N according to EN 10025-2 (Position 7 in Figure 2 and Figure 4 in this ETA)
- Connection plate for formwork for connection of the edge profile to the anchor plate of at least steel grade S235J2+N according to EN 10025-2 (Position 2 in Figures 1 to 4 in this ETA)
- Noise reduction plates of at least steel grade S355JR according to EN 10025-2 (Position 4 in Figures 1 to 4 in this ETA), 3 different types according to Annex 1
- Bolt M12 (10.9 HV according to EN 14399-4), nut (10 according to EN 14399-4) and washer (H according to EN 14399-6) for fixing of the noise reduction plates to the edge profile (Position 5 in Figures 1 to 4 in this ETA)
- Anchor loop and anchor plate of at least steel grade S235J2+N according to EN 10025-2 (Position 3 in Figures 1 to 4 of this ETA). The mechanical fixation of the nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** to the substructure is done by means of the anchor loop. Details of the anchorage system as well as relevant information regarding reinforcement and required concrete quality are given in Annex 3 of this ETA.
- Cover plate for the intended use footpath (optional), depicted in Annex 1 of this ETA, at least steel grade 1.4571 according to EN 10088-1, fixation according to Annex 1.9

The technical details of the components of the nosing expansion joint kit are deposited with the Technical Assessment Body Österreichisches Institut für Bautechnik.

The subject of this European Technical Assessment (ETA) is the complete nosing expansion joint kit **Fahrbahnübergangskonstruktion Typ SP/FP**.

A schematic representation of the nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** is shown in Figures 1 and 2 and for **Fahrbahnübergangskonstruktion Typ SP/FP-NR** in Figures 3 and 4 of this ETA and detailed drawings are depicted in Annex 1 of this ETA.

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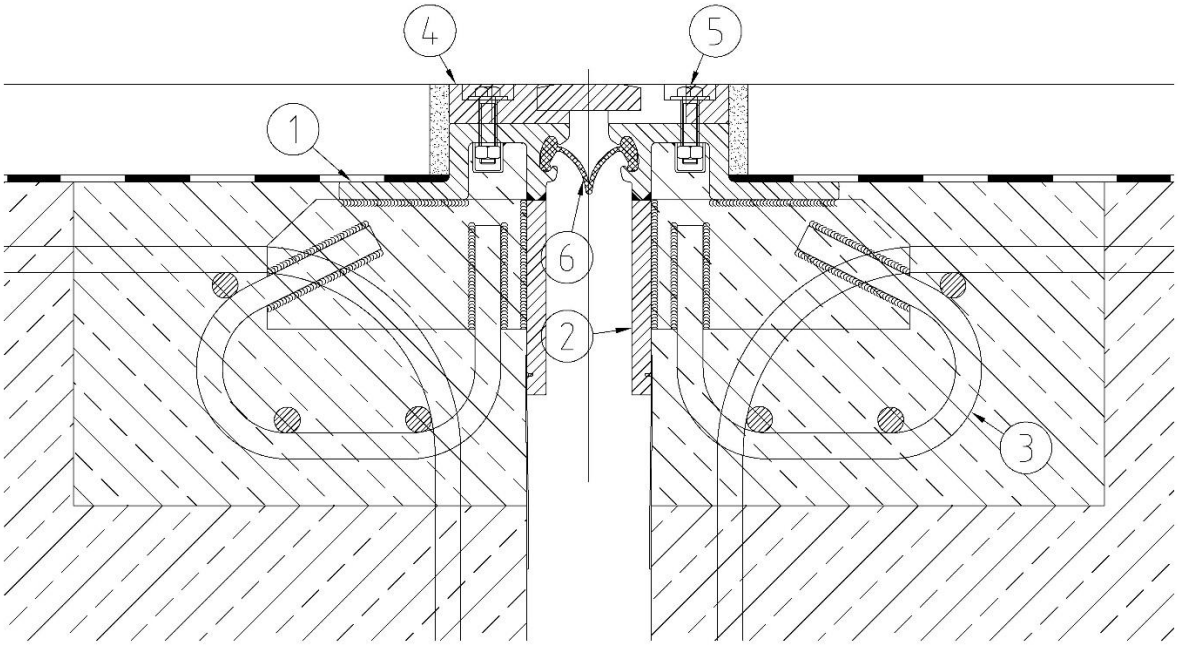

Figure 1: Exemplary cross section of the nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP**, including anchor loop, pavement thickness 75 mm

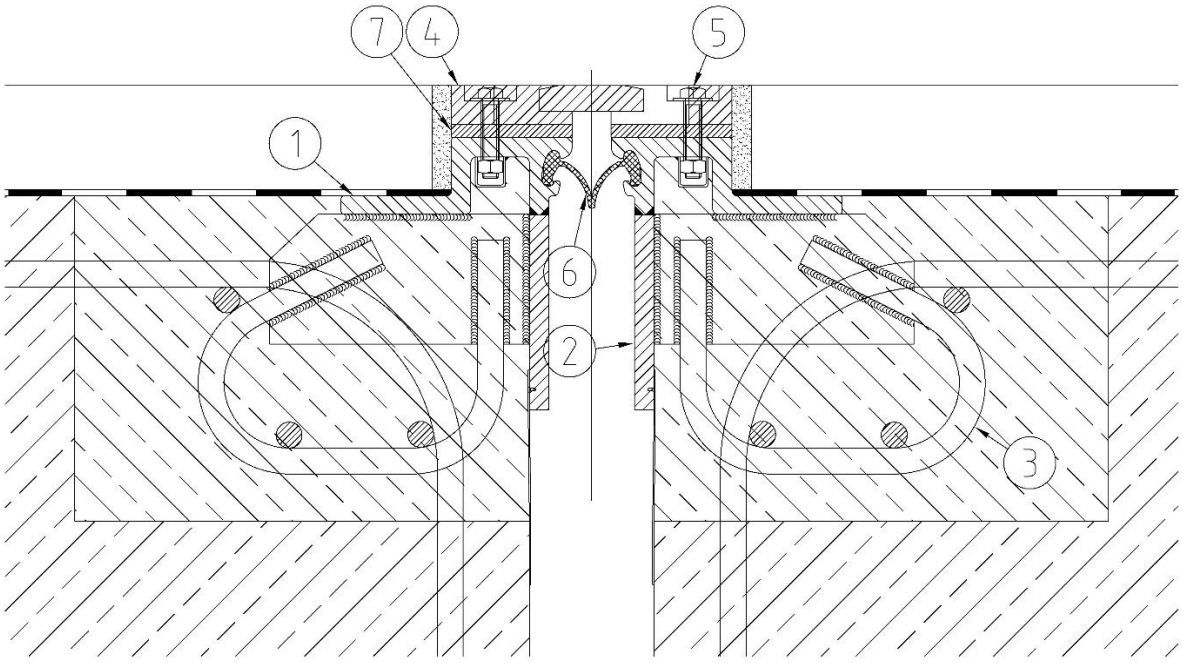

Figure 2: Exemplary cross section of the nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP-elevated**, including anchor loop, pavement thickness >75 mm – 150 mm

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Key for Figures 1 and 2:

Pos.1	Edge profile
Pos.2	Connection plate for formwork
Pos.3	Anchor loop
Pos.4	Noise reduction plate
Pos.5	Bolt, nut and washer for fixing of the noise reduction plate to the edge profile
Pos.6	Elastomeric sealing element made of EPDM
Pos.7	Extension steel plate

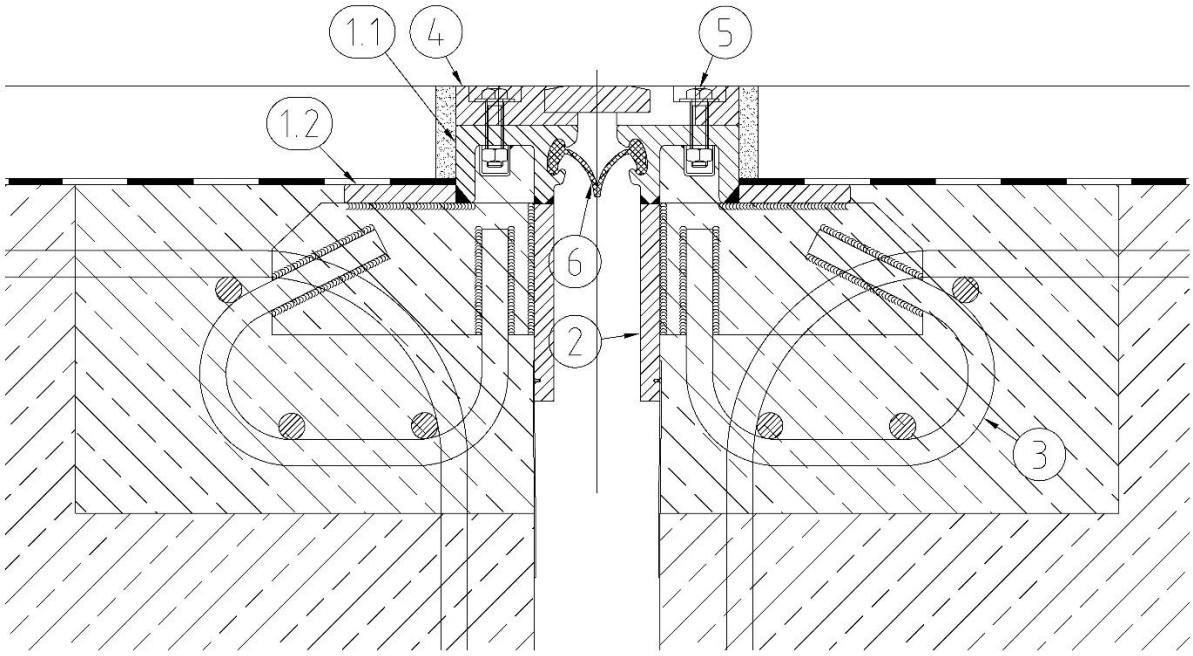

Figure 3: Exemplary cross section of the nosing expansion joint
Fahrbahnübergangskonstruktion Typ SP/FP-NR, including anchor loop,
pavement thickness 75 mm

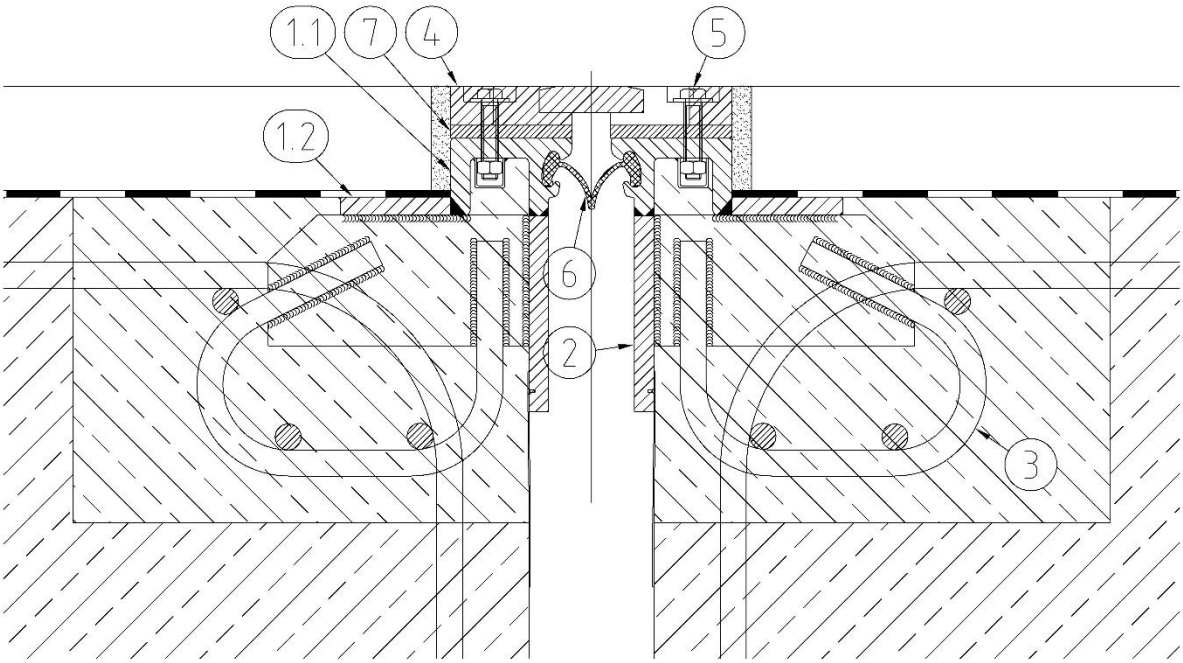

Figure 4: Exemplary cross section of the nosing expansion joint
Fahrbahnübergangskonstruktion Typ SP/FP-NR-elevated, including anchor loop,
pavement thickness >75 mm – 150 mm

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Key for Figures 3 and 4:

Pos.1.1 Edge profile
Pos.1.2 Connection for waterproof system
Pos.2 Connection plate for formwork
Pos.3 Anchor loop
Pos.4 Noise reduction plate
Pos.5 Bolt, nut and washer for fixing of the noise reduction plate to the edge profile
Pos.6 Elastomeric sealing element made of EPDM
Pos.7 Extension steel plate

The substructure, bridge deck waterproofing and adjacent pavement in Figures 1, 2, 3 and 4 are not part of the kit covered by this ETA.

The nominal movement capacities are given in Tables 1 to 4.

Table 1: Movement capacity of **Fahrbahnübergangskonstruktion Typ SP/FP** in different directions for a skew angle β of 90°

Movement range		
Maximum longitudinal movement	max u_x =	±57,5 mm (Σ 115 mm) *)
Maximum vertical movement	max u_z =	±20 mm
Maximum transversal movement	max u_y =	±75 mm
Maximum rotations	Limitation as given for transversal, longitudinal and vertical movement	

*) The maximum longitudinal movement with respect to the different skew angles, user categories and noise reduction plates is given in Table 2 to Table 4 in this ETA.

Maximum vertical and transversal movement is related to the opening of the joint and the skew angle and cannot be achieved for all possible situations.

The minimum opening of the nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** is 5 mm.

The values for the allowable skew angles and the values of the nominal movement capacity depending on the skew angel β (angle between traffic direction and joint axis) are given in Table 2 to Table 4.

Table 2: Standard geometry of nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** with noise reduction plate type 68/112 (see Annex 1) in respect to its movement capacity

User category	**Angle between traffic direction and joint axis**	**Minimal gap**	**Maximal gap**	**Total movement**
	β [°]	**[mm]**	**[mm]**	**[mm]**
Vehicles	90 ≥ x ≥ 80	5	120	115
Cyclists			95	90
Pedestrians			100 [1)]	95 [1)]
			120 [2)]	115 [2)]

[1)] without cover plate
[2)] including cover plate

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Table 3: Standard geometry of nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** with noise reduction plate type 50/90 (see Annex 1) in respect to its movement capacity

User category	**Angle between traffic direction and joint axis**	**Minimal gap**	**Maximal gap**	**Total movement**
	β [°]	**[mm]**	**[mm]**	**[mm]**
Vehicles	80 ≥ x ≥ 70	5	120	115
Cyclists	80		107	102
	70		62	57
Pedestrians	80 ≥ x ≥ 70		100 [1)]	95 [1)]
			120 [2)]	115 [2)]

[1)] without cover plate
[2)] including cover plate

Table 4: Standard geometry of nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** with noise reduction plate type 42/78 (see Annex 1) in respect to its movement capacity

User category	**Angle between traffic direction and joint axis**	**Minimal gap**	**Maximal gap**	**Total movement**
	β [°]	**[mm]**	**[mm]**	**[mm]**
Vehicles	70 ≥ x ≥ 60	5	120	115
Cyclists	70		92	87
	60		45	40
Pedestrians	70 ≥ x ≥ 60		100 [1)]	95 [1)]
			120 [2)]	115 [2)]

[1)] without cover plate
[2)] including cover plate

Table 5: Reaction forces:

Reaction forces	
Maximum tensile force – Horizontal direction	3,2 kN/m
Maximum compression force – Horizontal direction	- 0,4 kN/m
Maximum compression force – Horizontal direction (with maximum transversal movement according to Table 1)	- 2,2 kN/m
Maximum force – Transverse direction	± 2,5 kN/m

The height of the adjacent pavement is 75 mm for **Fahrbahnübergangskonstruktion Typ SP/FP** without extension steel plate and can be raised to a maximum of 150 mm using different extension steel plates (see Figure 2 and Figure 4, Position 7).

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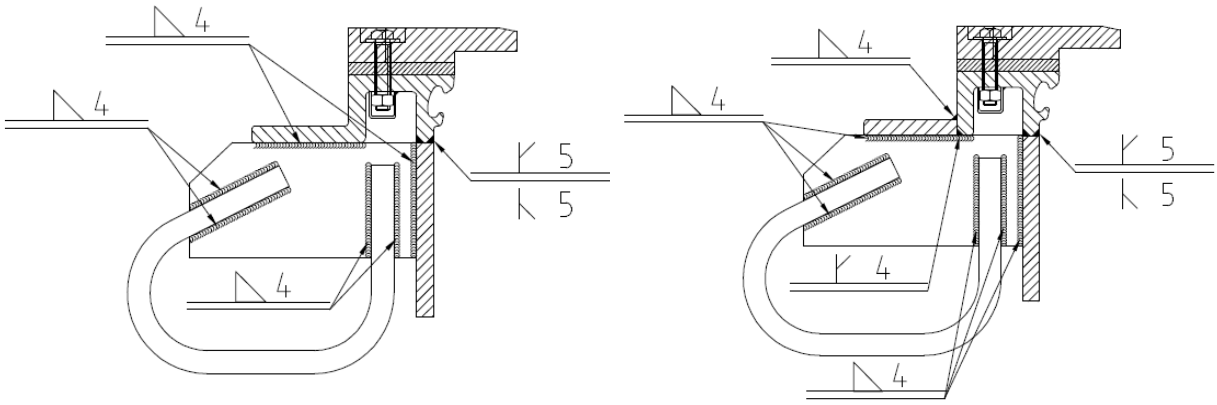

Fahrbahnübergangskonstruktion Typ SP/FP

Fahrbahnübergangskonstruktion Typ SP/FP-NR

Figure 5: Dimension and type of welds according to EN ISO 2553

In its longitudinal axis the nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** consists of the carriageway, cyclist areas, or footpath, or their possible combinations, as depicted in Annex 1 of this ETA.

Provisions for proper installation (installation manual) of the **Fahrbahnübergangskonstruktion Typ SP/FP** are provided for each delivered kit.

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

The nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** is to be used in road bridges. It is used for the use categories vehicles, cyclists and pedestrians. The expansion joint system is designated to be applied in new structures as well as for refurbishment of structures.

The essential characteristics of the nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** are assessed for operating temperature of -40° C up to +45° C. This has been assessed on basis of material characteristics of the elastomeric sealing element and the steel elements, whereas for the use of steel elements for low temperatures EN 1993-1-10, Table 2.1, is relevant.

The use of the nosing expansion joint **Fahrbahnübergangskonstruktion Typ SP/FP** according to this ETA is covering a maximum slope in traffic direction of 15%.

The use in moveable bridges (e.g. flap bridges, swing bridges) is not covered by this ETA.

The provisions made in this European Technical Assessment are based on a working life of the kit of 50 years (working life category 4 according to ETAG 032-1), provided that the kit is subject to appropriate use and maintenance as specified by the manufacturer in the maintenance instructions which follow every delivered kit. The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, but are to be regarded only as a means for choosing the right product in relation to the expected economically reasonable working life of the works.

The working life of the nosing expansion joint kit is based on the assessment of resistance to fatigue according to the fatigue load model 1 ($FLM1_{EJ}$), meaning the fatigue life may be considered as unlimited according to ETAG 032 Part 1, Annex G, G3.1.

For the replaceable component elastomeric sealing element made of EPDM a working life of 25 years is indicated.

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For corrosion protection the indications given in Table 6 of this ETA apply.

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

3.1 Performance of the product

Table 6: Performance of the product in relation to the essential characteristics

Basic requirements for construction works	Essential characteristics	Method of assessment	Performance
BWR 1	Mechanical resistance	ETAG 032-4, Clause 5.1.1.2	Mechanical resistance and stability is given for the product according to Clause 1 and Annex 1 in this ETA with the conditions given in Clause 3.1.1 in this ETA.
	Resistance to fatigue	ETAG 032-4, Clause 5.1.1.3	Resistance to fatigue is given for the product according to Clause 1 and Annex 1 in this ETA considering $FLM1_{EJ}$ (means unlimited fatigue life) with the conditions given in Clause 3.1.1 in this ETA.
	Seismic behaviour	ETAG 032-4, Clause 5.1.1.4	According to Table 8 in this ETA.
	Movement capacity	ETAG 032-4, Clause 5.1.1.5	According to Table 1 in this ETA.
	Cleanability	ETAG 032-4, Clause 5.1.1.6	The nosing expansion joint is able to extrude debris by its movement. The fixing of the elastomeric sealing element and the movement capacity is not influenced by the accumulation of debris.
	Watertightness	ETAG 032-4, Clause 5.1.1.8	Watertightness is given.
BWR 3	Content, emission and/or release of dangerous substances	ETAG 032-4, Clause 5.1.3	No performance assessed.

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Basic requirements for construction works	Essential characteristics	Method of assessment	Performance
BWR 4	Allowable surface gaps and voids	ETAG 032-4, Clause 5.1.4.1.1	Declaration of allowable gaps in respect to the user categories, noise reduction plates and the range of angle β between traffic direction and longitudinal axis of the nosing expansion joint: Tables 2 to 4 in this ETA
	Level differences in the running surface	ETAG 032-4, Clause 5.1.4.1.2	Unloaded conditions: no level differences (including steps) greater than 3 mm are occurring. After loading: maximum deflection under load: <1 mm
	Skid resistance	ETAG 032-4, Clause 5.1.4.2	Carriageway: No flat surfaces larger than a 150 mm x 150 mm square, therefore not relevant. Footpath (including cover plate): PTV value 51

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Basic requirements for construc-tion works	Essential characteristics	Method of assessment	Performance
Durability aspects	Corrosion	ETAG 032-4, Clause 5.1.7.1	Components made of steel: Corrosivity categories: C4, C5 according to EN ISO 9223, dependent on the intended use. Corrosion protection sys-tems: Durability range “high” (h) and “very high” (vh) acc. to EN ISO 12944-1 and EN ISO 12944-5 Exception: Components made of stain-less steel (cover plate and edge profile, according to Clause 1 in this ETA): CRC III (acc. to EN 1993-1-4, An-nex A) Bolts, nuts, washers: Hot dip galvanized acc. to EN ISO 10684
	Chemicals: Resistance to de-icing salts	ETAG 032-4, Clause 5.1.7.1	Elastomeric sealing element: Durable
	Ageing resulting from:	ETAG 032-4, Clause 5.1.7.1	
	Temperature		
	Ozone		

3.1.1 Mechanical resistance

Action categories covered by static calculation:
For the design situation ultimate limit state (ULS), the fundamental combinations of actions and the combination of actions for fatigue limit state (FLS) are considered.
For the design situation serviceability limit state (SLS) the characteristic combinations of actions and frequent combinations are considered.
Regarding optional actions, the accidental load on footway, the accidental load on kerb and the seismic design situations according to ETAG 032-1, Annex G, are considered and assessed.

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The static assessment applies for the following conditions:

Table 7: Preconditions for the static assessment

Partial safety factor γ_{M0} (EN 1993-2)	1.00
Partial safety factor γ_{M1} (EN 1993-2)	1.10
Partial safety factor γ_{M2} (EN 1993-2)	1.25
Partial safety factor γ_{M3} (EN 1993-2)	1.25
Partial safety factor γ_{Mf} (ETAG 032-8)	1.15
Partial safety factor γ_{Ff} (EN 1993-2)	1.00
Fatigue load model (ETAG 032-1)	FLM 1_{EJ}

Table 8: Seismic behaviour of **Fahrbahnübergangskonstruktion Typ SP/FP** – maximum gaps during earthquake according to ETAG 032-1, Clause 4.1.1.4 for β = 90°

Approach according to ETAG 032-1, Table 4.1.1.4	**Maximum gap during earthquake**
Approach A1	120 mm
Approach A2, B1, B2	144 mm
Approach B3	240 mm
Approach B4	After earthquake: max. gap 300 mm for emergency traffic

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

4.1 AVCP system

According to the decision 2001/19/EC[1] of the European Commission, as amended, the system(s) of assessment and verification of constancy of performance (see Annex V of Regulation (EU) No 305/2011) is 1.

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 in the control plan deposited by the Technical Assessment Body Österreichisches Institut für Bautechnik.

The notified product certification body shall visit the factory at least once a year for surveillance of the manufacturer.

Issued in Vienna on 22.12.2018
by Österreichisches Institut für Bautechnik

The original document is signed by:

Rainer Mikulits
Managing Director

[1] Official Journal of the European Communities N° L 005, 10.1.2001, p. 6-7

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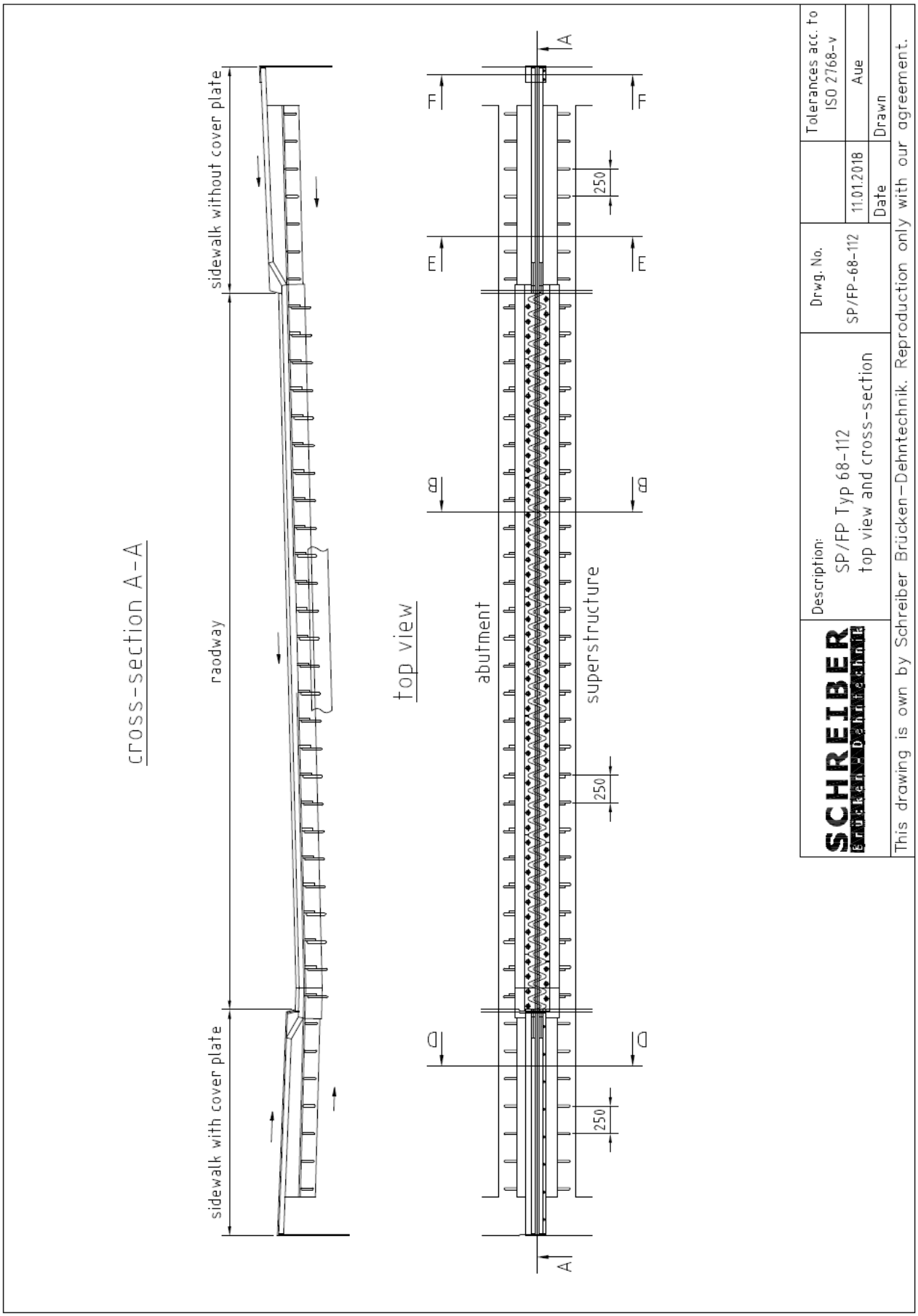

Fahrbahnübergangskonstruktion Typ SP/FP with noise reduction plate type 68/112 **Standard cross section and top view**	**Annex 1.1** of European Technical Assessment ETA-18/0549

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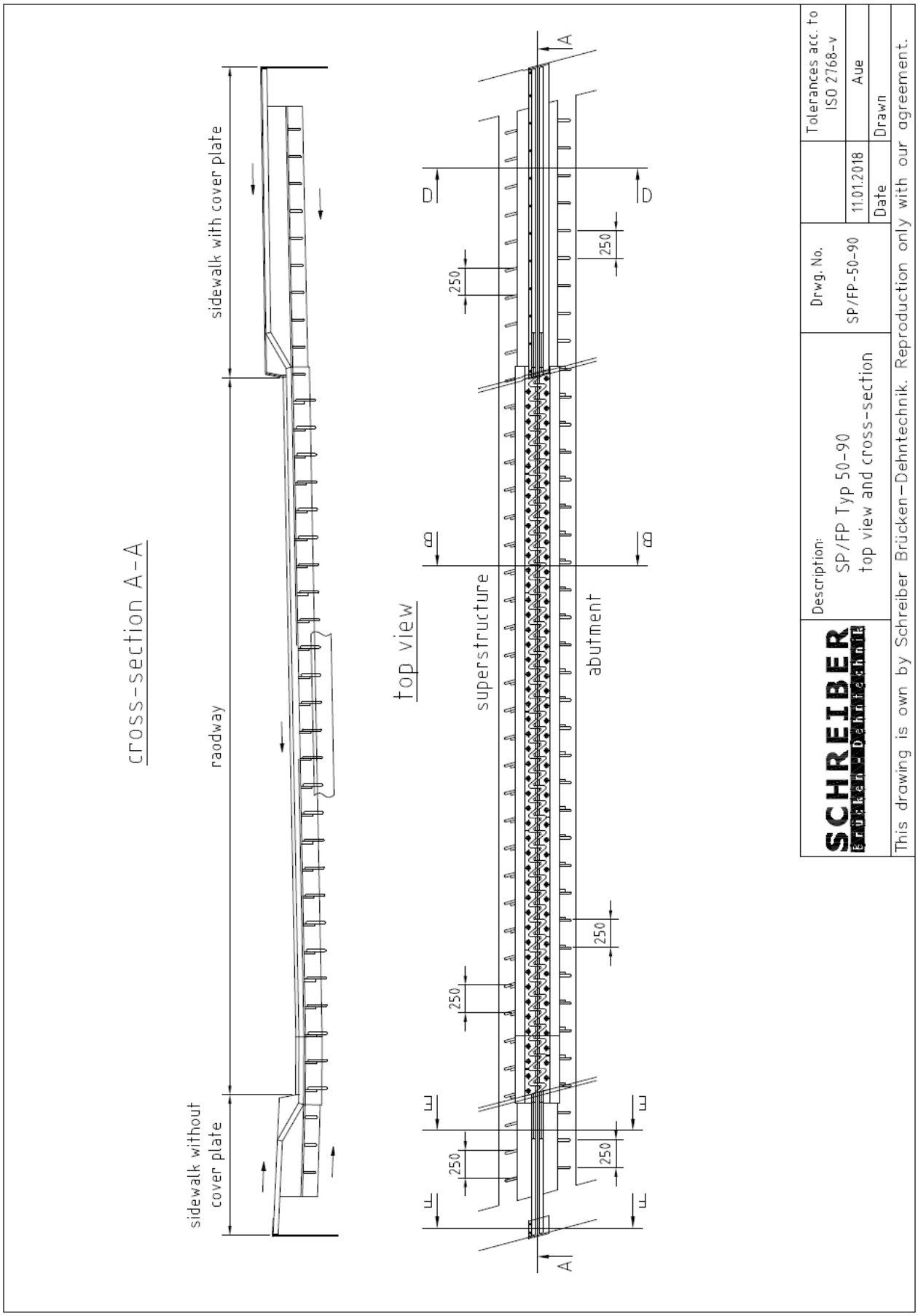

Fahrbahnübergangskonstruktion Typ SP/FP with noise reduction plate type 50/90 **Standard cross section and top view**	**Annex 1.2** of European Technical Assessment ETA-18/0549

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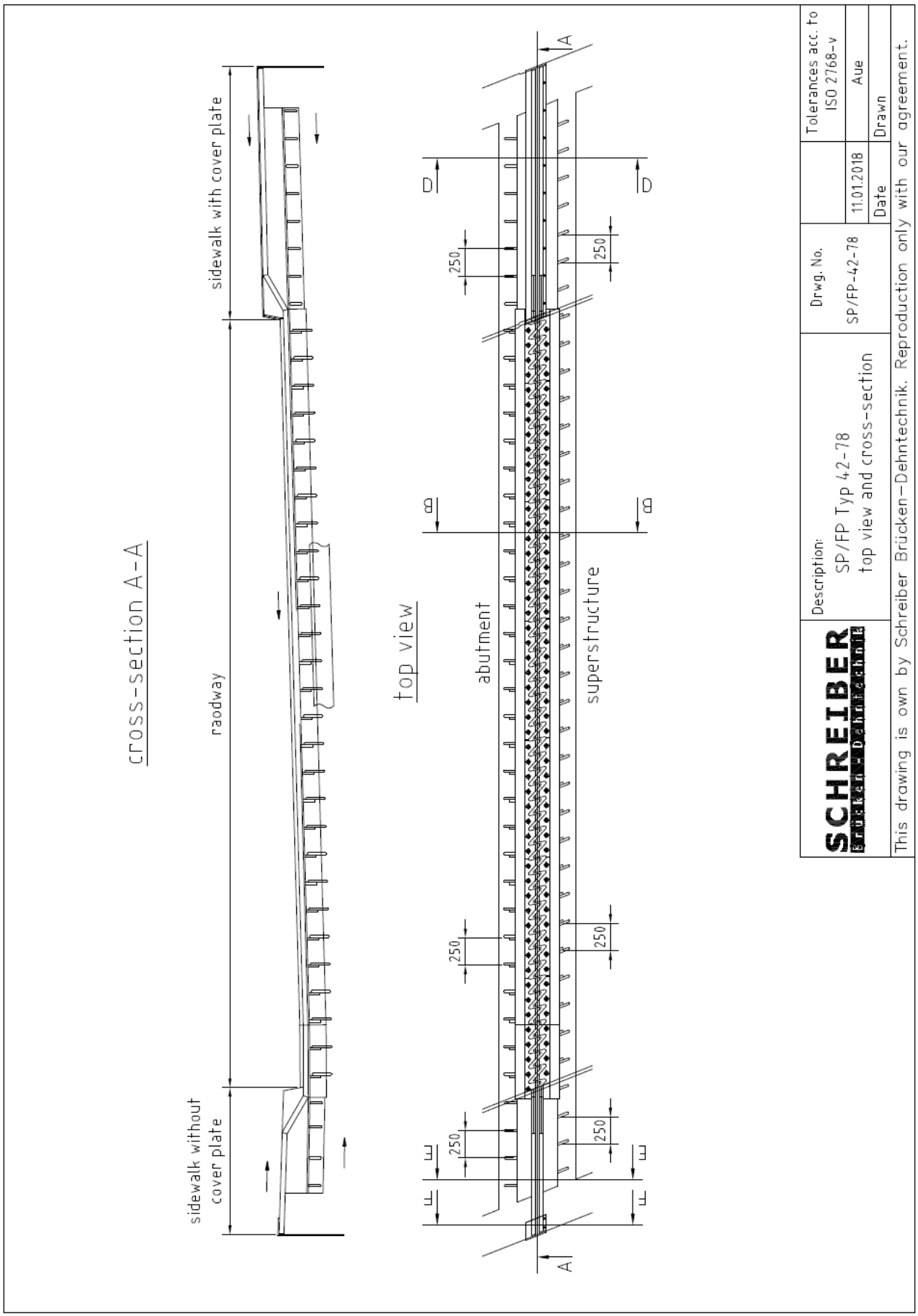

Fahrbahnübergangskonstruktion Typ SP/FP with noise reduction plate type 42/78 **Standard cross section and top view**	**Annex 1.3** of European Technical Assessment ETA-18/0549

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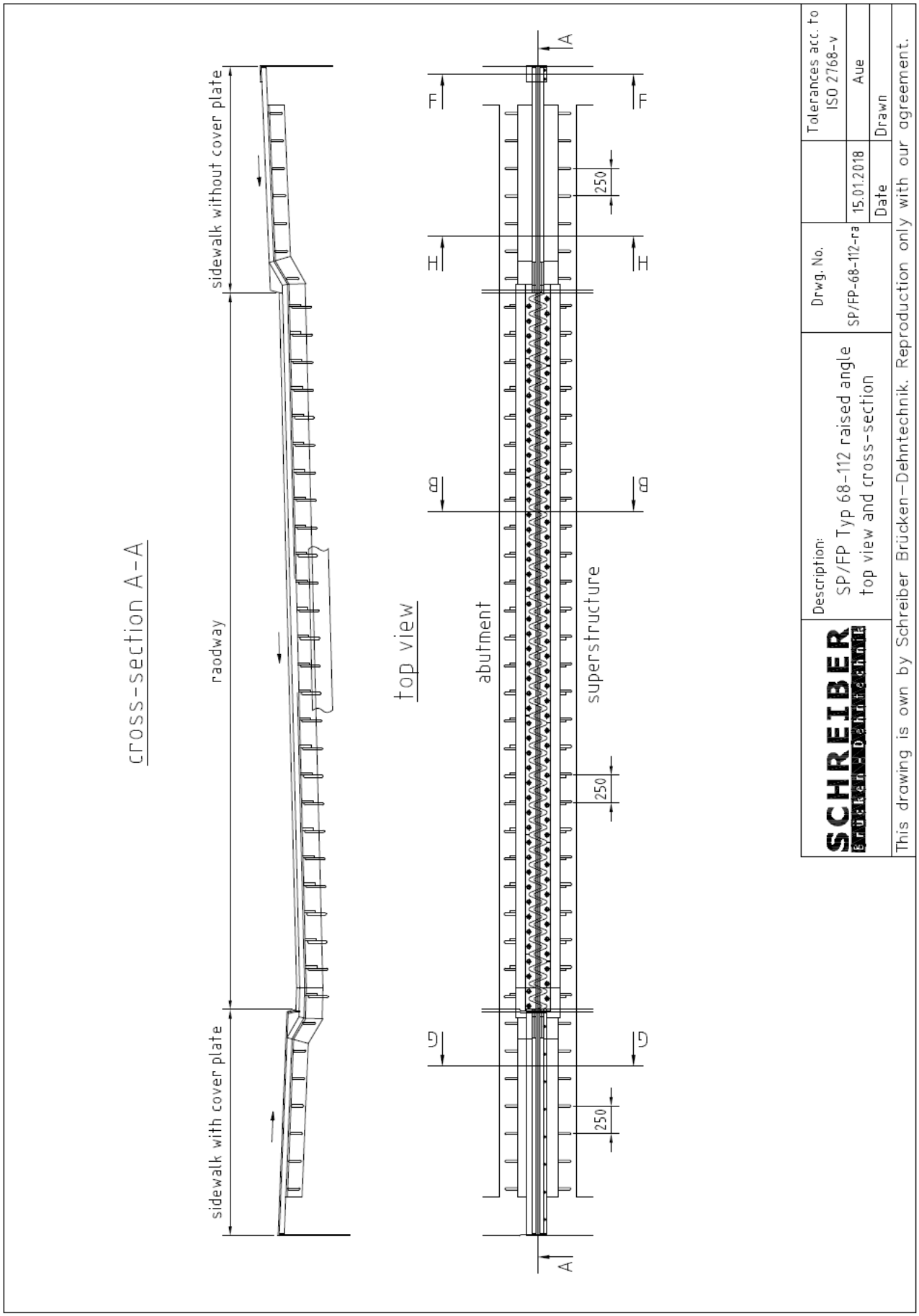

Fahrbahnübergangskonstruktion Typ SP/FP – raised angle **Standard cross section and top view**	**Annex 1.4** of European Technical Assessment ETA-18/0549

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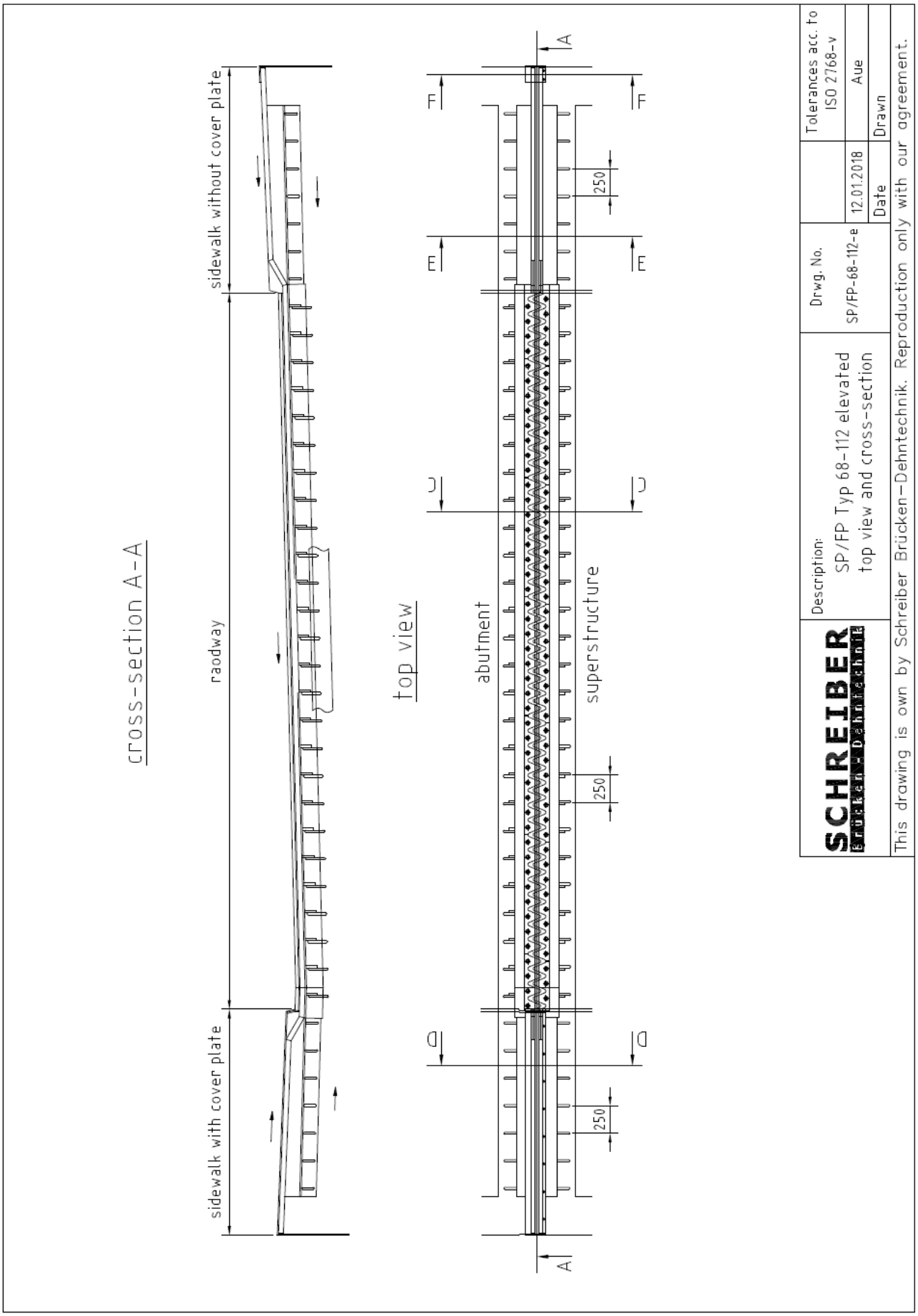

Fahrbahnübergangskonstruktion Typ SP/FP - elevated **Standard cross section and top view**	**Annex 1.5** of European Technical Assessment ETA-18/0549

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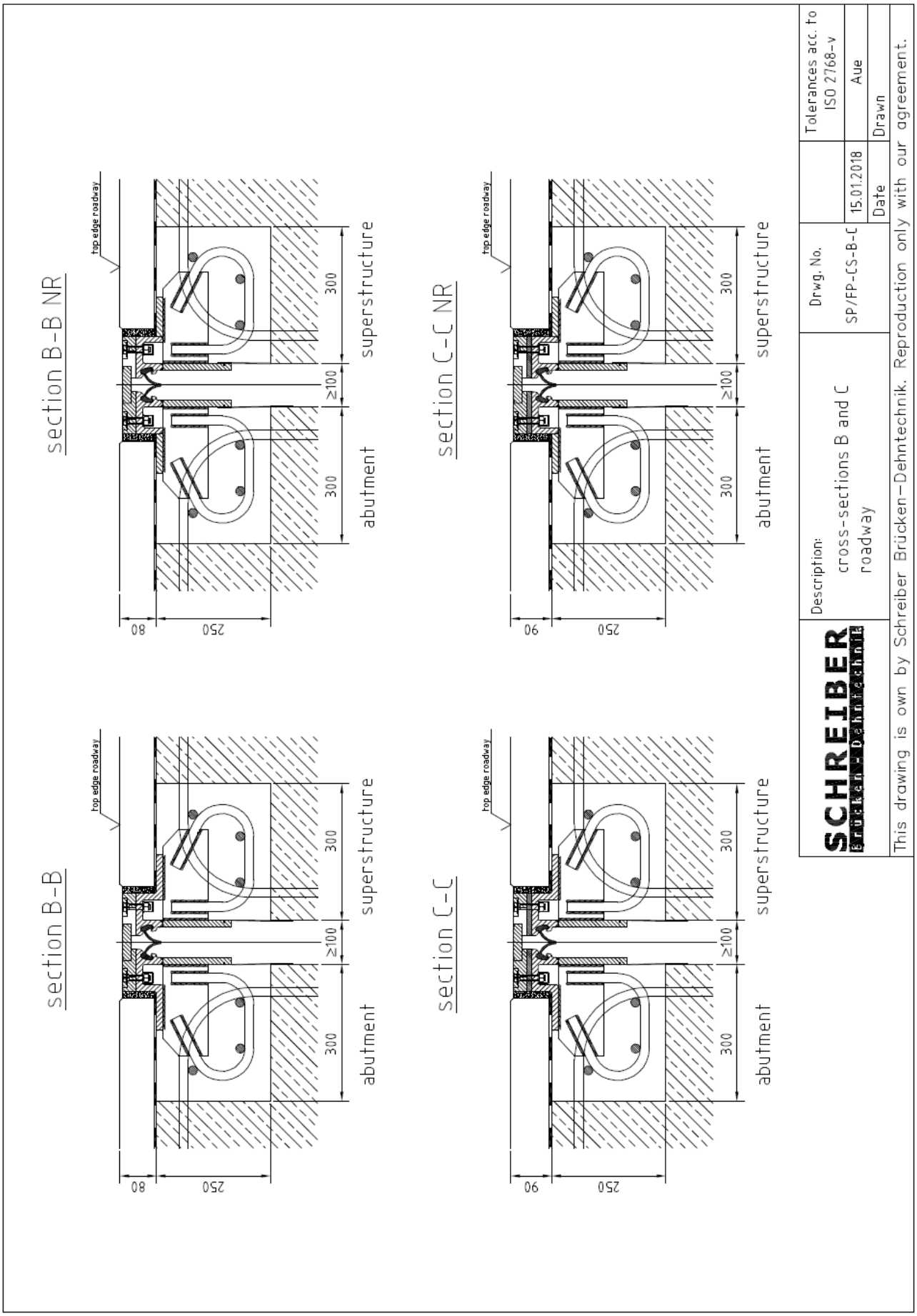

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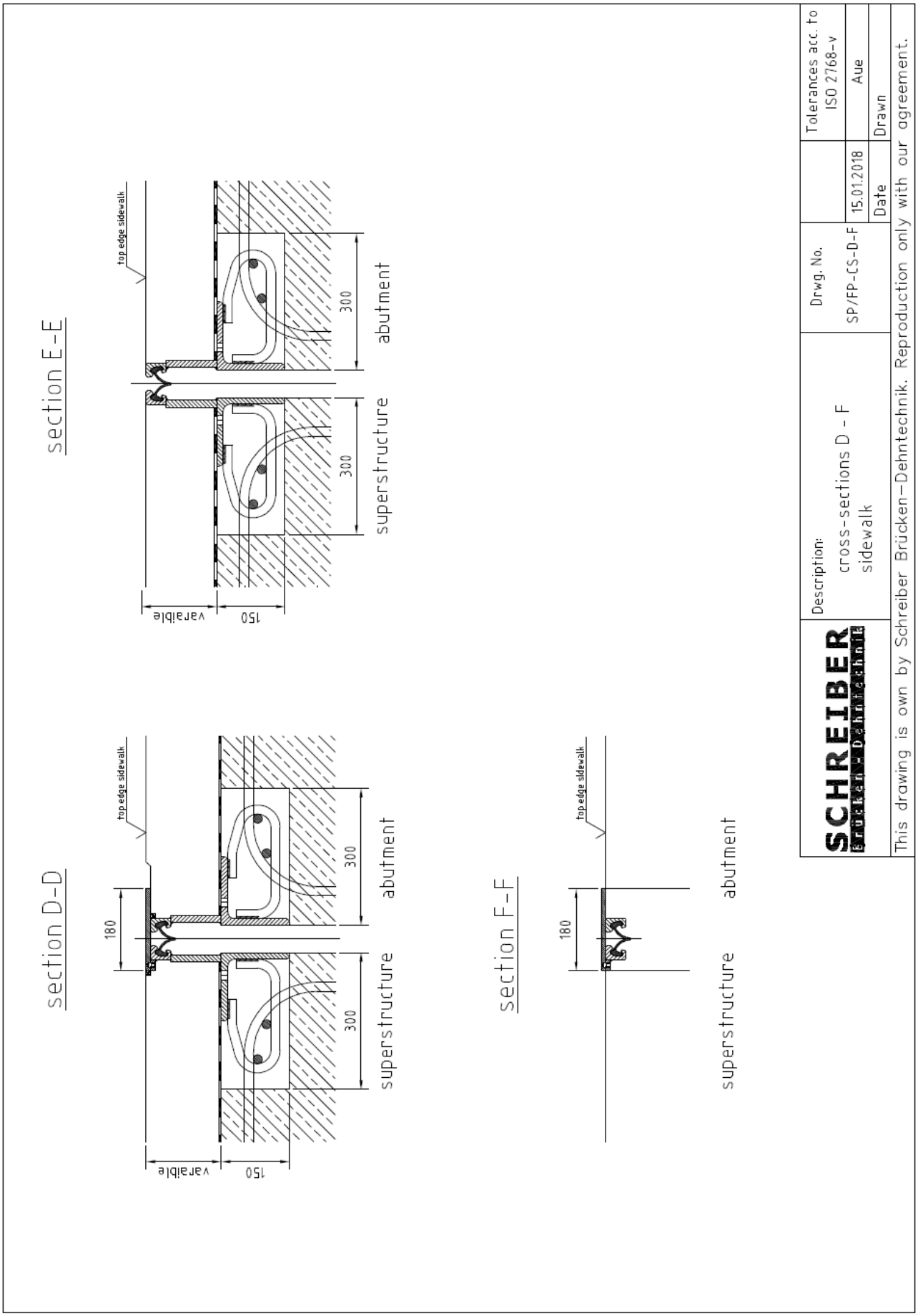

Fahrbahnübergangskonstruktion Typ SP/FP **Sections of footpath**	**Annex 1.7** of European Technical Assessment ETA-18/0549

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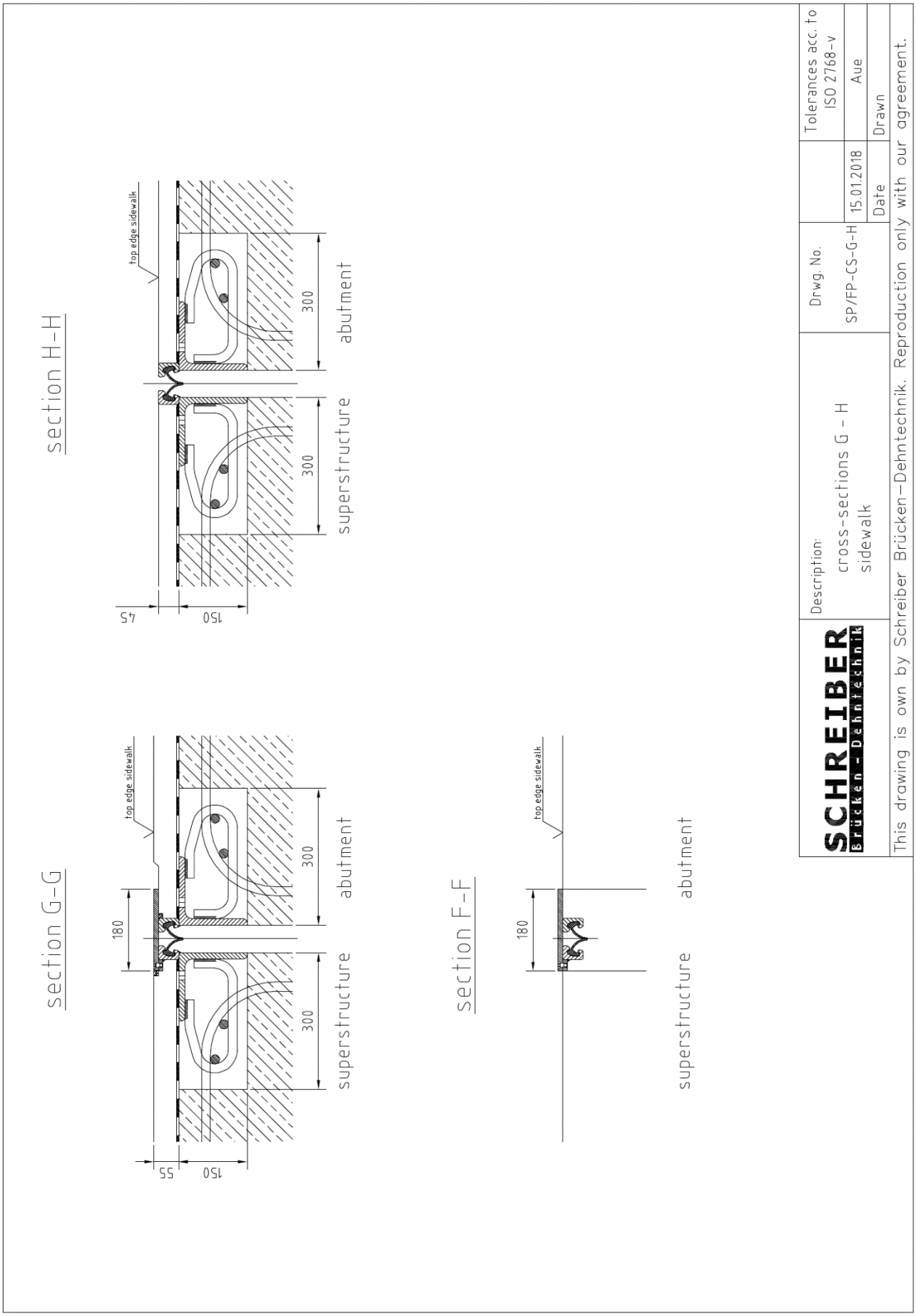

Fahrbahnübergangskonstruktion Typ SP/FP **Sections of footpath**	**Annex 1.8** of European Technical Assessment ETA-18/0549

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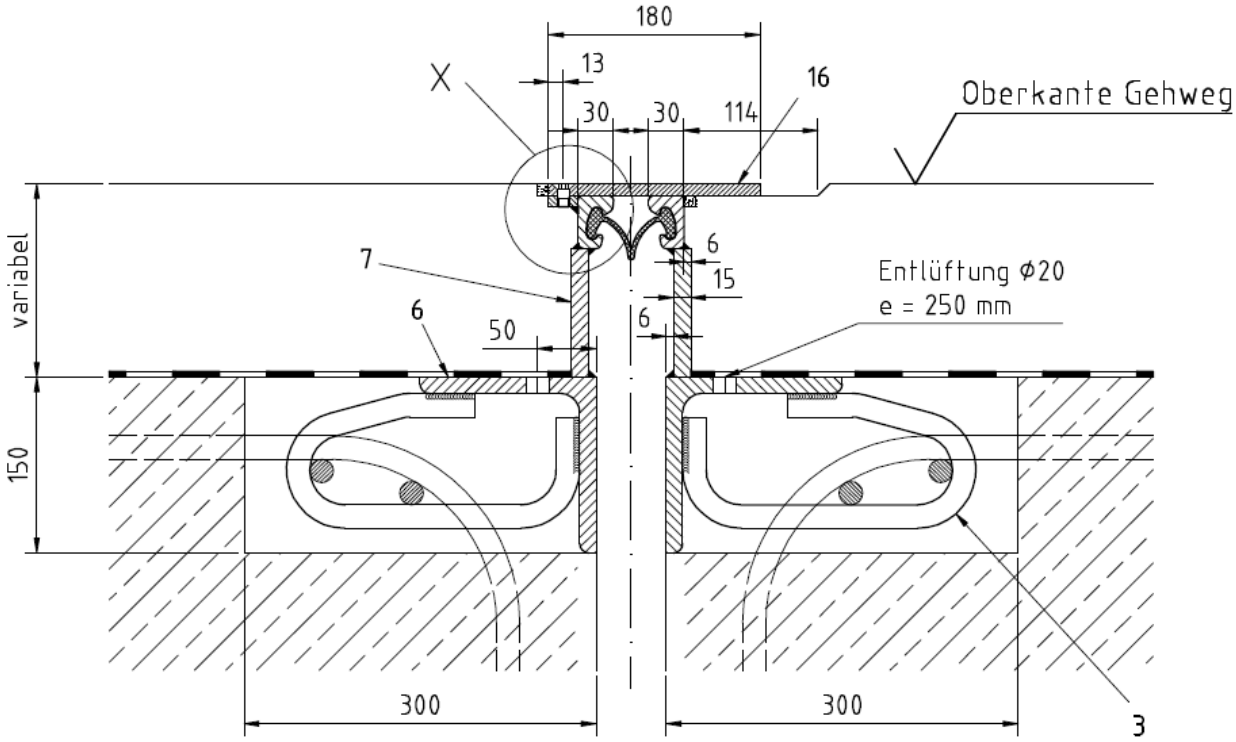
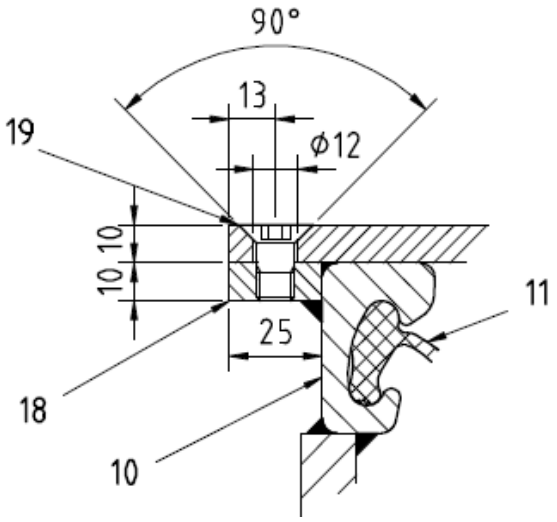
Gehwegquerschnitt



Detail X



No	Designation	Dimension	Material
3	Anchor loop footpath	d=20x520	S235J2+N
6	Angle	150x14xl	S235J2+N
7	Adjustment plate	t=15	S235J2+N
10	Edge profile footpath	45x30xl	S235J2+N
11	Sealing element	-	EPDM
16	Cover plate	180x10xl	1.4571
18	Flat steel	25x10xl	S235J2+N
19	Countersunk screw	DIN 7991 M10x20	1.4401

Translations	
Gehwegquerschnitt	Section of footpath
Oberkante Gehweg	Top edge footpath
Entlüftung	Aeration
Überbau	Superstructure
Widerlager	Abutment

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20. CONNECTIONS FORCES
longitudinal slope = 15 %, thickness of road surface = 150 mm

(1) Loads for Ultimate Limit state ULS1

R_V =	60,8 kN
R_H =	12,2 kN
F_{lk} =	4,3 kN

e_h= 17,3 cm
e_v= 28,4 cm
$e_{v,Flk}$= 17,0 cm

(2) Loads for Ultimate Limit state ULS2

R_V =	106,7 kN
R_H =	21,4 kN
F_{lk} =	4,3 kN

(3) Loads for Fatigue Limit state FLS1

R_V =	36,4 kN
R_H =	15,8 kN

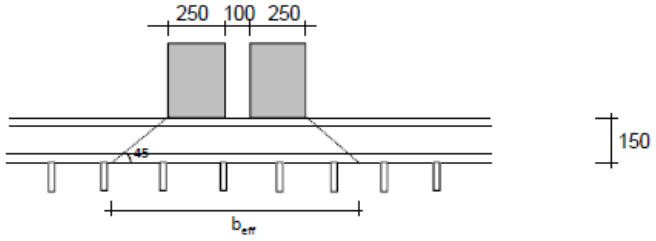
The internal load from the expansion of the sealing profile is not effecting fatigue.

(4) Loads for Fatigue Limit state FLS2

R_V =	67,4 kN
R_H =	29,4 kN

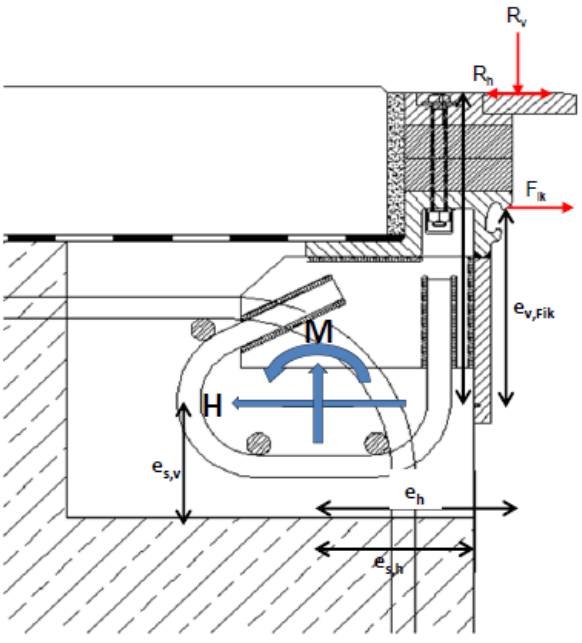
The internal load from the expansion of the sealing profile is not effecting fatigue.

participating width b_{eff}



b_{eff}= 90,00 cm
$e_{Ankerbügel}$= 25,00 cm
n_{eff}= 3,00
$e_{s,v}$= 10,10 cm
$e_{s,h}$= 13,40

width of recess A_b [mm]	height of recess A_h [mm]
350	250



Ultimate limit State - ULS1			Fatigue Limit State - FLS1		
M [kNcm]	D [kN]	H [kN]	ΔM [kNcm]	ΔD [kN]	ΔH [kN]
1471,8	60,8	16,5	1078,4	36,4	15,8
778,8	60,8	-12,2	181,0	36,4	-15,8
Ultimate limit State - ULS2			**Fatigue Limit State - FLS2**		
M [kNcm]	D [kN]	H [kN]	M [kNcm]	D [kN]	H [kN]
2527,1	106,7	25,7	2001,0	67,4	29,4
1311,6	106,7	-21,4	331,1	67,4	-29,4

Note: The two lines indicating the forces transferred to the anchorage are taking into account the horizontal loads acting in both directions.

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Table A.3.1: Material characteristics of the elastomeric sealing element “SP150” made of EPDM

Material characteristic	Technical specification	Declaration
Density	ISO 2781	Laid down in technical documentation deposited with the Technical Assessment Body Österreichisches Institut für Bautechnik (OIB)
Hardness IRHD	ISO 48	
Tensile strength	ISO 37	
Elongation at break	ISO 37	
Tear resistance	ISO 34-1, Method A	
Thermogravimetric characteristics (TGA)	ISO 9924-1	
Rheometric characteristics	ISO 6502	
Compression set	ISO 815-1 (conditions acc. to ETAG 032-4, Table 5.2)	
Brittleness test	ISO 812, procedure B	

Table A.3.2: Minimum quality of concrete for recess filling and reinforcement

Quality	Standard
Minimum C30/37, low shrinkage concrete	EN 206
Minimum reinforcement ø16, e = 250 mm	According to technical documentation

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Reference documents

ETAG 032-1 Guideline for European technical approval (ETAG) No 032 “Expansion joints for road bridges, Part 1: General”, edition May 2013, used as European Assessment Document (EAD)

ETAG 032-4 Guideline for European technical approval (ETAG) No 032 “Expansion joints for road bridges, Part 4: Nosing expansion joints”, edition May 2013, used as European Assessment Document (EAD)

ETAG 032-8 Guideline for European technical approval (ETAG) No 032 “Expansion joints for road bridges, Part 8: Modular expansion joints”, edition May 2013, used as European Assessment Document (EAD)

EN 206:2013+A1:2016 “Concrete - Specification, performance, production and conformity”

EN 1993-1-4: 2006+A1:2015 „Eurocode 3 - Design of steel structures - Part 1-4: General rules - Supplementary rules for stainless steels”

EN 1993-1-10:2005 + AC:2009 “Eurocode 3: Design of steel structures - Part 1-10: Material tough-ness and through-thickness properties”

EN 1993-2:2006 + AC:2009 “Eurocode 3: Design of steel structures - Part 2: Steel Bridges”

EN 10025-2:2004 “Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels”

EN 10088-1:2014 “Stainless steels - Part 1: List of stainless steels”

EN 14399-4:2015 “High-strength structural bolting assemblies for preloading - Part 4: System HV - Hexagon bolt and nut assemblies”

EN 14399-6:2015 “High-strength structural bolting assemblies for preloading - Part 6: Plain chamfered washers”

EN ISO 2553:2013 “Welding and allied processes - Symbolic representation on drawings - Welded joints”

EN ISO 9223:2012 “Corrosion of metals and alloys - Corrosivity of atmospheres - Classification, determination and estimation”

EN ISO 10684:2004+AC:2009 “Fasteners - Hot dip galvanized coatings”

EN ISO 12944-1:2017 “Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 1: General introduction”

EN ISO 12944-5:2018 “Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 5: Protective paint systems”

ISO 34-1:2015 “Rubber, vulcanized or thermoplastic - Determination of tear strength - Part 1: Trouser, angle and crescent test pieces”

ISO 37:2011 “Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties”

ISO 48:2010 “Rubber, vulcanized or thermoplastic - Determination of hardness (hardness between 10 IRHD and 100 IRHD)”

ISO 812:2017 “Rubber, vulcanized or thermoplastic - Determination of low-temperature brittleness”

ISO 815-1:2014 “Rubber, vulcanized or thermoplastic - Determination of compression set - Part 1: At ambient or elevated temperatures”

ISO 2781:2008 “Rubber, vulcanized or thermoplastic - Determination of density”

ISO 6502:2016 “Rubber - Guide to the use of curemeters”

ISO 9924-1:2016 “Rubber and rubber products - Determination of the composition of vulcanizates and uncured compounds by thermogravimetry - Part 1: Butadiene, ethylene-propylene copolymer and terpolymer, isobutene-isoprene, isoprene and styrene-butadiene rubbers”