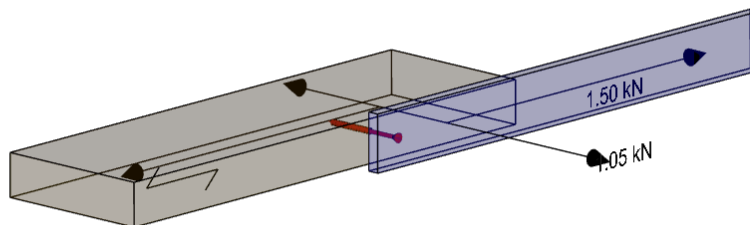


Load-bearing capacity of a connection subjected to shear and/or to axial tension

Design specification: DIN EN 1995-1-1:2010 + DIN EN 1995-1-1/NA:2013-08



Required fasteners

Hilti S-WCP-S 6,0x80/50 Z Countersunk head (2363625)

Geometry and material

component 1 - steel mounting plate (Head of connector)

Steel grade		=	S 235
Thickness / Height	t_1 / h_1	=	1,0 cm / 5,0 cm
Yield strength	$f_{y,k}$	=	235 N/mm ²

component 2

Material		=	Solid timber, Softwood
Strength class		=	C16
Thickness / Height	t_2 / h_2	=	14,0 cm / 3,8 cm
Force-grain angle	α_2	=	0,0°
Density	$\rho_{k,2}$	=	310 kg/m ³
Modification factor	$k_{mod,2}$	=	0,80
Holes not pre-drilled			

Minimum fastener spacings (mm)

a_1	a_2	$a_{3,t}$	$a_{3,c}$	$a_{4,t}$	$a_{4,c}$
150	21	150	150	30	18

Load action

Service class		=	1
Load-duration class		=	medium-term
Design value of shear force	$F_{V,Ed}$	=	1,50 kN
Design value of tensile force	$F_{ax,Ed}$	=	1,05 kN

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Fastener

Selected item number: Hilti S-WCP-S 6,0x80/50 Z Countersunk head
 Design specification: 2363625
 diameter: ETA-22/0772
 head diameter: d = 6,0 mm
 Length: d_h = 12,0 mm
 tensile strength: l = 80 mm
 yield moment: F_{tens,k} = 13,1 kN
 partial safety factor: M_{y,k} = 10,7 Nm
 γ_M = 1,30

Axial load bearing capacity of one fastener

component		1	2	
effective thread length	l _{ef,i}	---	50	mm
Angle fastener axis - grain direction	α _i	---	90,0	°
angle factor	k _{ax,i}	---	1,00	-
Withdrawal parameter	f _{ax,k,i}	---	13,0	N/mm ²
...Density - f _{ax,k,i}	ρ _{k,i}	---	310	kg/m ³
...related density - f _{ax,k,i}	ρ _{a,i}	---	350	kg/m ³

characteristic headside pull-through strength
 $F_{head,Rk1} = 3 \cdot f_{c,90,k,1} \cdot \pi / 4 \cdot (d_{ef}^2 - d^2) = 74,6 \text{ kN}$

Characteristic load bearing capacity of the thread
 $F_{ax,Rk,2} = k_{ax,2} \cdot f_{ax,k,2} \cdot d \cdot l_{ef,2} \cdot (\rho_{k,2} / \rho_{a,2})^{0,8} = 3,54 \text{ kN}$

Characteristic axial load bearing capacity
 $F_{ax,Rk} = \min\{F_{head,Rk}; F_{ax,Rk,2}; F_{tens,k}\} = 3,54 \text{ kN}$

Design value of axial load bearing capacity
 $F_{ax,Rd} = \min\{k_{mod,1} \cdot F_{head,Rk}; k_{mod,2} \cdot F_{ax,Rk,2}; F_{tens,k}\} / \gamma_M = 2,18 \text{ kN}$

Shear load bearing capacity per fastener and shear plane

component		1	2	
penetration depth	t _i	10	70	mm
Angle fastener axis - grain direction	α _i	---	90,0	°
Density	ρ _{k,i}	---	310	kg/m ³
Characteristic embedment strength	f _{h,k,i}	---	14,9	N/mm ²

Shear load-bearing capacity per shear plane, according to EN 1995-1-1, 8.2

$F_{1,v,Rk} = 6,24 = 6,24 \text{ kN} \quad (8.10 \text{ c})$
 $F_{2,v,Rk} = 2,80 + 0,885 = 3,68 \text{ kN} \quad (8.10 \text{ d})$
 $F_{3,v,Rk} = 2,25 + 0,885 = 3,13 \text{ kN} \quad (8.10 \text{ e})$

Allowable proportion from the rope effect:

$\Delta F_{v,Rk} = \min\{F_{1,v,Rk}; 0,25 \cdot F_{ax,Rk}\}$
 $F_{v,Rk} = \min F_{i,v,Rk} = 3,13 \text{ kN}$
 $F_{v,Rd} = k_{mod,2} / \gamma_M \cdot F_{v,Rk} = 1,93 \text{ kN}$

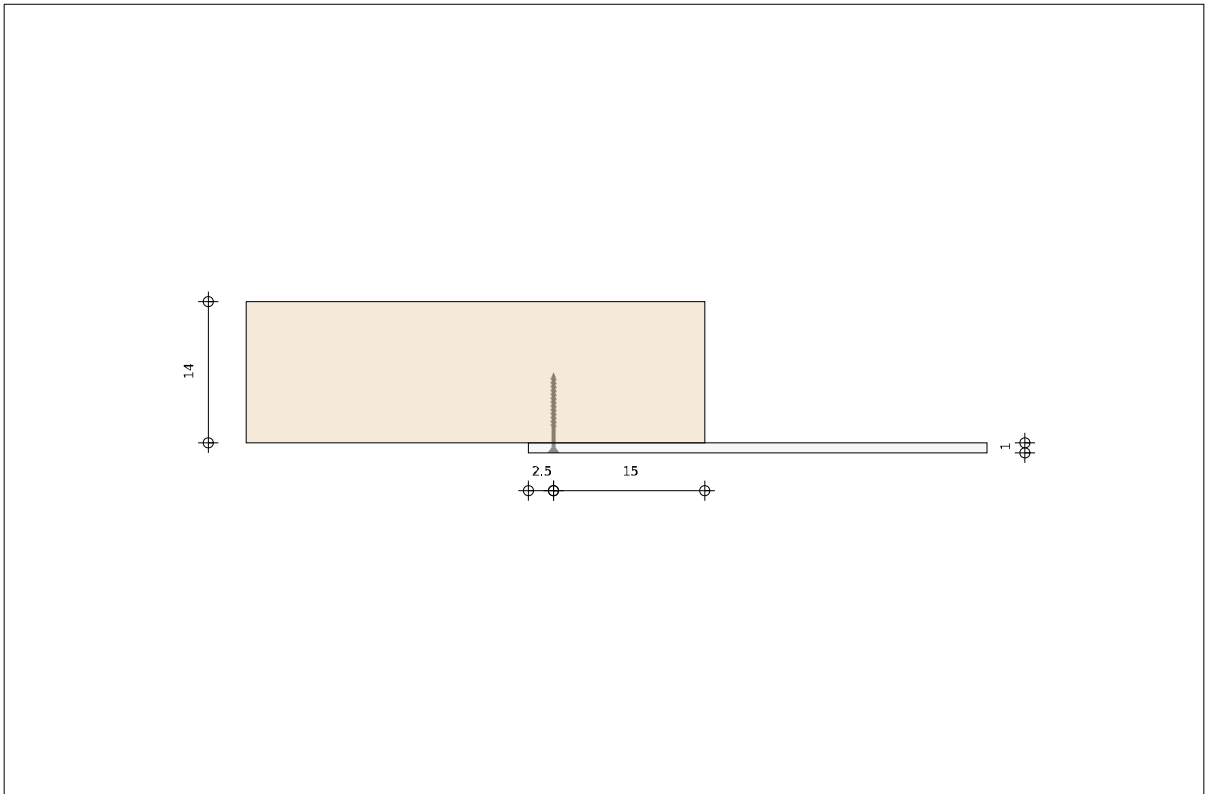
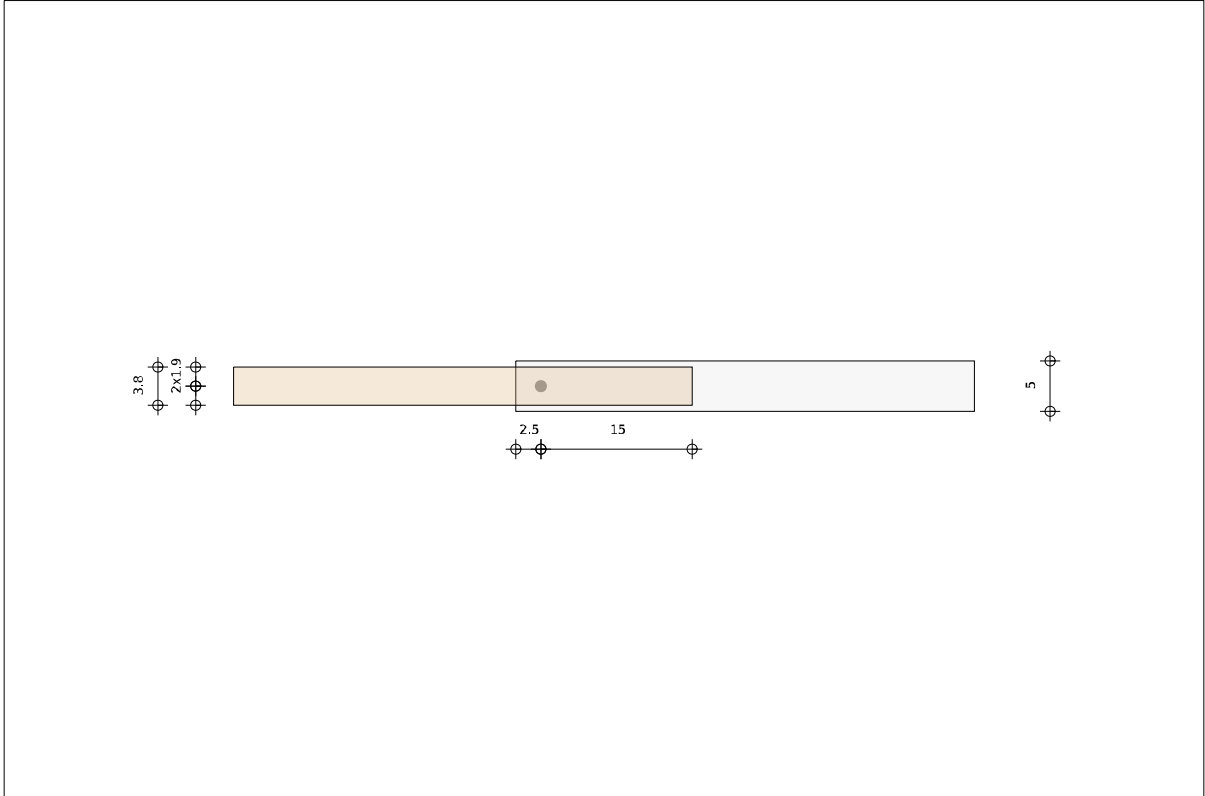
Effective number of connectors

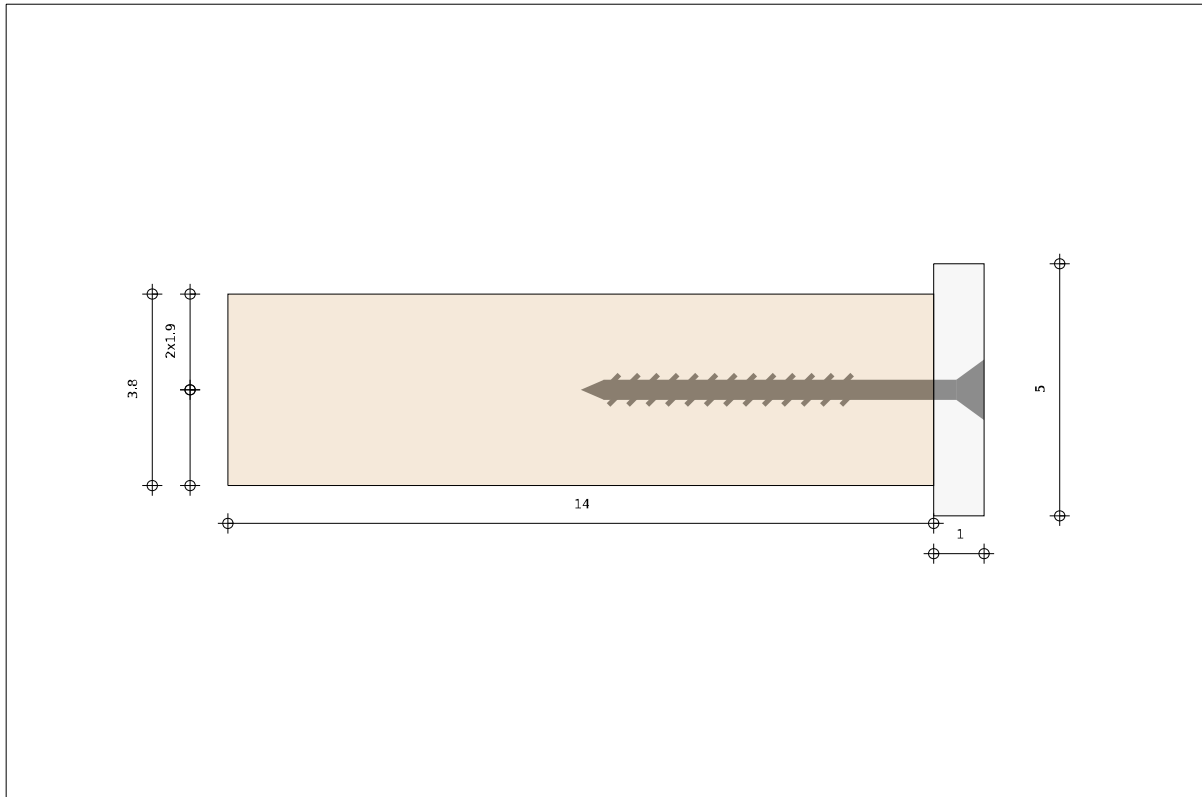
n_{v,ef} = 1
 n_{ax,ef} = 1

Verification

$F_{v,Ed} / (n_{v,ef} \cdot F_{v,Rd}) = 1,50 / 1,93 = 0,78 \leq 1,0$
 $F_{ax,Ed} / (n_{ax,ef} \cdot F_{ax,Rd}) = 1,05 / 2,18 = 0,48 \leq 1,0$
 $(F_{v,Ed} / (n_{v,ef} \cdot F_{v,Rd}))^2 + (F_{ax,Ed} / (n_{ax,ef} \cdot F_{ax,Rd}))^2 = 0,78^2 + 0,48^2 = 0,84 \leq 1,0$

Drawings



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Notes

1. The design basis of the Hilti Timber Screw Connections software is the assessment ETA-22/0772.
2. The design is based on the program settings according to the regulations of EN 1991-1-1/3/4 and EN 1995-1-1 (European standards in connection with the respective national annex)
3. Unless otherwise stated, the screws may be screwed in without pre-drilling the components.
4. The structural design, the arrangement, the number of screws and other contents refer to the use of Hilti timber screws which are calculated in the Hilti Timber Screw Connections software.
5. All calculations must be checked and released by the responsible structural engineer before execution.

IMPORTANT

The stated dimensions in the output file calculated with the Hilti Timber Screws Connections software must be checked for correctness.

The recommended values, type and number of screws are just considered as planning aid. The correctness must be checked by an authorized planner and/or architect.

The respectively valid user agreement, privacy statement and the terms and conditions form the basis and accepted by the user before starting the Hilti Timber Screw Connections software.