TITAN F

ETA 11/0496

ANGLE BRACKET FOR SHEAR FORCES

LOW HOLES
Ideal for TIMBER FRAME, designed for fastening on platform beams or on the stringers of the frame structures. It also has certified values for use with partial nailing.

FRAME
Thanks to the lowered position of the holes on the vertical flange, it offers excellent shear strength values even on low height platform beams. $R_{2,k}$ up to 42.5 kN on both timber and concrete.

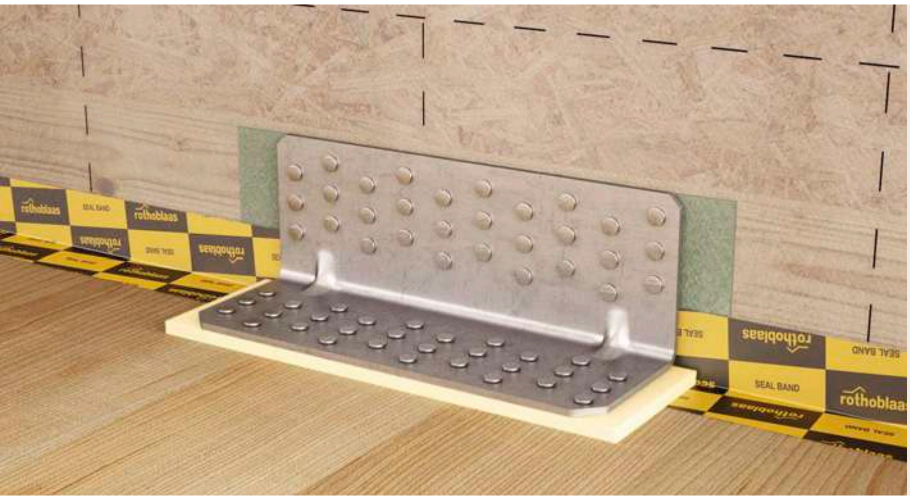
CONCRETE HOLES
The TITAN angle bracket are designed to offer two fastening possibilities, in order to avoid interference with the rods in the concrete support.

CHARACTERISTICS

FOCUS	shear joints
HEIGHT	71 mm
THICKNESS	3,0 mm
FASTENERS	LBA, LBS, VIN-FIX PRO, EPO-FIX PLUS, SKR, AB1

MATERIAL
Bright zinc plated carbon steel, three dimensional perforated plate.

FIELDS OF USE
Timber-to-concrete and timber-to-timber shear joints for panels and timber stringers.
- CLT, LVL
- solid timber and glulam
- framed structures (platform frame)
- timber based panels



TIMBER-TO-TIMBER

Ideal for shear joints between floor and wall and between wall and wall. The high shear strength allows to optimize the number of fastenings.

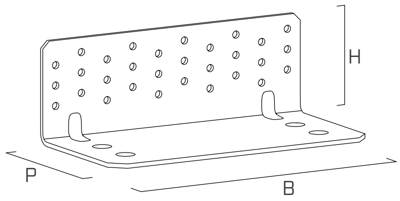
TITAN SILENT

Ideal in combination with XYLOFON PLATE to limit acoustic bridges and reduce walking vibrations of timber floors.

CODES AND DIMENSIONS

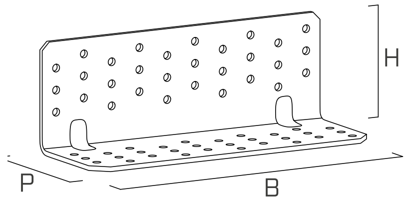
TITAN F - TCF | CONCRETE-TO-TIMBER JOINTS

CODE	B [mm]	P [mm]	H [mm]	holes [mm]	n_V Ø5 [pcs]	s [mm]		pcs
TCF200	200	103	71	Ø13	30	3	●	10



TITAN F - TTF | TIMBER-TO-TIMBER JOINTS

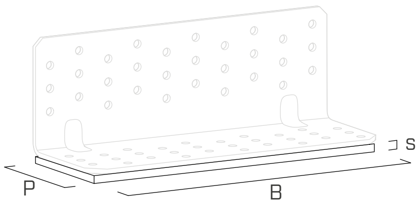
CODE	B [mm]	P [mm]	H [mm]	n_H Ø5 [pcs]	n_V Ø5 [pcs]	s [mm]		pcs
TTF200	200	71	71	30	30	3	●	10



ACOUSTIC PROFILE | TIMBER-TO-TIMBER JOINTS

CODE	type	B	P [mm]	s [mm]		pcs
XYL3570200	xylofon plate	200 mm	70	6	●	10
ALADIN95	soft	50 m(*)	95	5	●	10
ALADIN115	extra soft	50 m(*)	115	7	●	10

(*) To be cut on site



MATERIAL AND DURABILITY

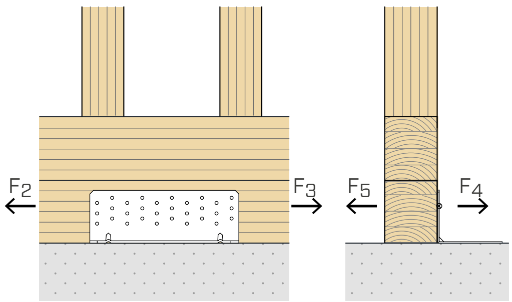
TITAN F: carbon steel DX51D+Z275.
To be used in service classes 1 and 2 (EN 1995-1-1).

XYLOFON PLATE: 35-shore polyurethane compound.
ALADIN STRIPE: Compact EPDM.

FIELD OF USE

- Timber-to-concrete joints
- Timber-to-timber joints
- Timber-to-steel joints

EXTERNAL LOADS

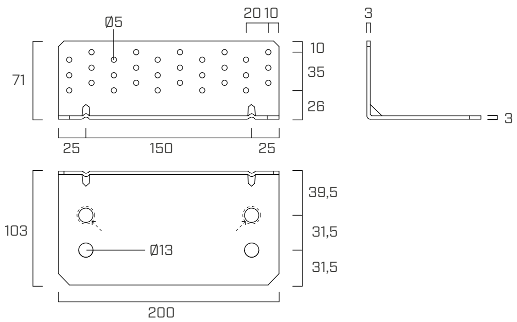


ADDITIONAL PRODUCTS - FASTENING

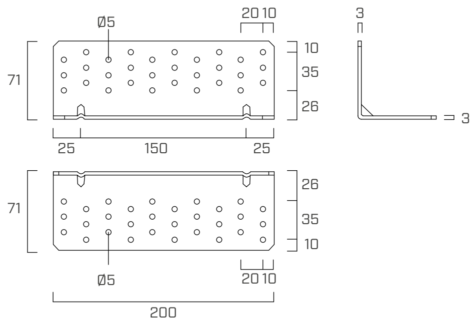
type	description		d [mm]	support	page
LBA	Anker nail		4		548
LBS	screw for plates		5		552
AB1	mechanical anchor		12		494
SKR	screw anchor		12		488
VIN-FIX PRO	chemical anchor		M12		511
EPO-FIX PLUS	chemical anchor		M12		517

GEOMETRY

TCF200



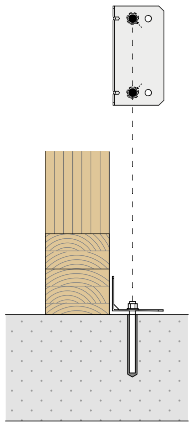
TTF200



INSTALLATION ON CONCRETE

To fix the **TITAN TCF200** angle bracket to the concrete, **2 anchors** must be used, according to one of the following installation modes:

IDEAL INSTALLATION

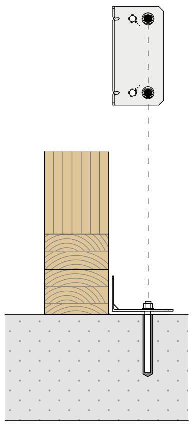


2 anchors positioned in the INTERNAL HOLES (**IN**)
(identified by a mark on the product)

Reduced stress on the anchor
(minimum e_y and k_t eccentricity)

Optimized connection strength

ALTERNATIVE INSTALLATION



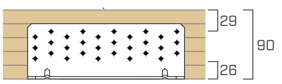
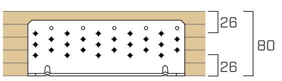
2 anchors placed in the EXTERNAL HOLES (**OUT**)
(e.g. interaction between the anchor and the concrete support reinforcement)

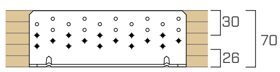
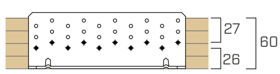
Maximum stress on the anchor
(maximum e_y and k_t eccentricity)

Reduced connection strength

TCF200 - TTF200 | PARTIAL FASTENING PATTERNS FOR STRESS $F_{2/3}$

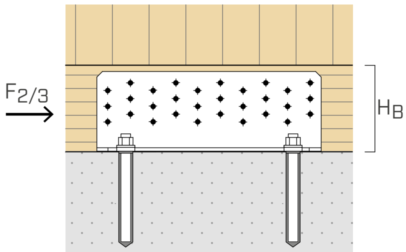
In the presence of design requirements such as $F_{2/3}$ stresses of different value or presence of sill or platform beam, it is possible to use partial fastening patterns, depending on the height H_B of the timber element:

configuration on timber	H_B	n_v pcs	fastening diagrams
full pattern	$H_B \geq 90$ mm	30	
pattern 3	$H_B \geq 80$ mm	25	

configuration on timber	H_B	n_v [pcs]	fastening diagrams
pattern 2	$H_B \geq 70$ mm	15	
pattern 1	$H_B \geq 60$ mm	10	

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-CONCRETE

TCF200



TIMBER STRENGTH

configuration on timber	TIMBER				CONCRETE			
	holes fastening Ø5			$R_{2/3,k\ timber}$	holes fastening Ø13		IN(1)	OUT(2)
	type	Ø x L [mm]	n_V [pcs]	[kN]	Ø [mm]	n_H [pcs]	$e_{y,IN}$ [mm]	$e_{y,OUT}$ [mm]
• full pattern $H_B \geq 90$ mm	LBA nails	Ø4,0 x 60	30	35,5	M12	2	38,5	70,0
	LBS screws	Ø5,0 x 50		42,5				
• pattern 3 $H_B \geq 80$ mm	LBA nails	Ø4,0 x 60	25	31,0				
	LBS screws	Ø5,0 x 50		37,2				
• pattern 2 $H_B \geq 70$ mm	LBA nails	Ø4,0 x 60	15	20,9				
	LBS screws	Ø5,0 x 50		25,1				
• pattern 1 $H_B \geq 60$ mm	LBA nails	Ø4,0 x 60	10	15,1				
	LBS screws	Ø5,0 x 50		18,1				

CONCRETE STRENGTH

Strength values of some of the possible fastening solutions for anchors installed in the inner (IN) or outer (OUT) holes.

configuration on concrete	holes fastening Ø13		$R_{2/3,d\ concrete}$	
	type	Ø x L [mm]	IN(1) [kN]	OUT(2) [kN]
• uncracked	VIN-FIX PRO 5.8	M12 x 130	29,7	24,4
	VIN-FIX PRO 8.8	M12 x 130	48,1	39,1
	SKR-E	12 x 90	38,3	31,3
	AB1	M12 x 100	35,4	28,9
• cracked	VIN-FIX PRO 5.8	M12 x 130	29,7	24,4
	VIN-FIX PRO 8.8	M12 x 130	35,1	28,9
	SKR-E	12 x 90	34,6	28,4
	AB1	M12 x 100	35,4	28,9
• seismic	EPO-FIX PLUS 5.8/8.8	M12 x 130	19,2	15,7
	SKR-E	12 x 90	8,8	7,2
	AB1	M12 x 100	10,6	8,7

installation	anchor type		t_{fix}	h_{ef}	h_{nom}	h_1	d_0	h_{min}
	type	Ø x L [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
TCF200	VIN-FIX PRO EPO-FIX PLUS 5.8/8.8	M12 x 130	3	112	112	120	14	200
	SKR-E	12 x 90	3	64	87	110	10	
	AB1	M12 x 100	3	70	80	85	12	

Precut INA threaded rod, with nut and washer: see page 520
MGS threaded rod class 8.8 to be cut to size: see page 534

t_{fix}	fastened plate thickness
h_{nom}	nominal anchoring depth
h_{ef}	effective anchor depth
h_1	minimum hole depth
d_0	hole diameter in the concrete support
h_{min}	concrete minimum thickness

NOTES:

(1) Installation of the anchors in the two internal holes (IN).
(2) Installation of the anchors in the two external holes (OUT).

TCF200 | VERIFICATION OF CONCRETE ANCHORS FOR STRESS $F_{2/3}$

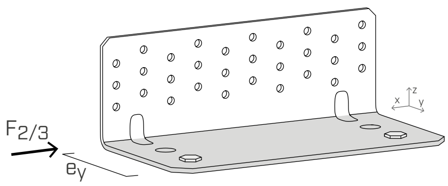
Fastening elements to the concrete through anchors shall be verified according to the load acting on the anchor, which can be evaluated through the geometric parameters on the table (e).

E_y calculation eccentricities vary depending on the type of installation selected: 2 internal anchors (IN) or 2 external anchors (OUT).

The anchor group must be verified for:

$V_{Sd,x} = F_{2/3,d}$

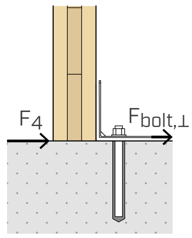
$M_{Sd,z} = F_{2/3,d} \times e_{y,IN/OUT}$



STATIC VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-CONCRETE

TCF200

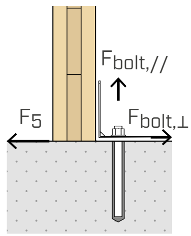
	TIMBER				STEEL		CONCRETE			
F_4	holes fastening Ø5			$R_{4,k\ timber}$	$R_{4,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}	Ø [mm]	n_H [pcs]	$k_{t\perp}$	$k_{t//}$
• full pattern	LBA nails	Ø4,0 x 60	30	**14,6**	**9,5**	γ_{M0}	M12	2	0,5	-
	LBS screws	Ø5,0 x 50								



The group of 2 anchors must be verified for:

$V_{Sd,y} = 2 \times k_{t\perp} \times F_{4,d}$

	TIMBER				STEEL		CONCRETE			
F_5	holes fastening Ø5			$R_{5,k\ timber}$	$R_{5,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}	Ø [mm]	n_H [pcs]	$k_{t\perp}$	$k_{t//}$
• full pattern	LBA nails	Ø4,0 x 60	30	**10,7**	**4,8**	γ_{M0}	M12	2	0,5	0,27
	LBS screws	Ø5,0 x 50								

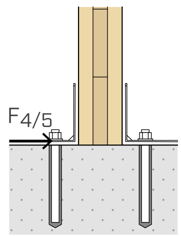


The group of 2 anchors must be verified for:

$V_{Sd,y} = 2 \times k_{t\perp} \times F_{5,d}$

$N_{Sd,z} = 2 \times k_{t//} \times F_{5,d}$

	TIMBER				STEEL		CONCRETE			
$F_{4/5}$ TWO ANGLE BRACKETS	holes fastening Ø5			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$		holes fastening		IN[1]	
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}	Ø [mm]	n_H [pcs]	$k_{t\perp}$	$k_{t//}$
• full pattern	LBA nails	Ø4,0x60	30 + 30	**23,8**	**12,3**	γ_{M0}	M12	2 + 2	0,31	0,10
	LBS screws	Ø5,0x50								



The group of 2 anchors must be verified for:

$V_{Sd,y} = 2 \times k_{t\perp} \times F_{4/5,d}$

$N_{Sd,z} = 2 \times k_{t//} \times F_{4/5,d}$

The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating).

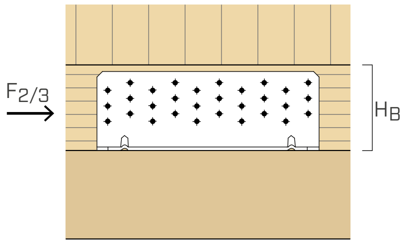
GENERAL PRINCIPLES:

For the general principles of calculation, see page 226.

STATIC VALUES | SHEAR JOINT $F_{2/3}$ | TIMBER-TO-TIMBER

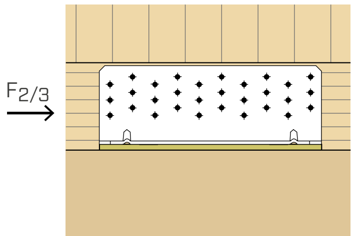
TTF200

SHEAR STRENGTH $R_{2/3}$



	TIMBER				
configuration on timber	**holes fastening Ø5**				**$R_{2/3,k}$ timber**
	type	**Ø x L** [mm]	**n_V** [pcs]	**n_H** [pcs]	[kN]
• full pattern $H_B \geq 90$ mm	LBA nails	Ø4,0 x 60	30	30	**35,5**
	LBS screws	Ø5,0 x 50			**42,5**
• pattern 3 $H_B \geq 80$ mm	LBA nails	Ø4,0 x 60	25	25	**31,0**
	LBS screws	Ø5,0 x 50			**37,2**
• pattern 2 $H_B \geq 70$ mm	LBA nails	Ø4,0 x 60	15	15	**20,9**
	LBS screws	Ø5,0 x 50			**25,1**
• pattern 1 $H_B \geq 60$ mm	LBA nails	Ø4,0 x 60	10	10	**15,1**
	LBS screws	Ø5,0 x 50			**18,1**

SHEAR STRENGTH $R_{2/3}$ WITH ACOUSTIC PROFILE



	TIMBER					
configuration on timber[(1)]	**holes fastening Ø5**				**profile**[(2)]	**$R_{2/3,k}$ timber**
	type	**Ø x L** [mm]	**n_V** [pcs]	**n_H** [pcs]	**s** [mm]	[kN]
TTF200 + XYLOFON	LBA nails	Ø4,0 x 60	30	30	6	**17,2**
	LBS screws	Ø5,0 x 50				**15,8**
TTF200 + ALADIN STRIPE SOFT	LBA nails	Ø4,0 x 60	30	30	5	**20,0**
	LBS screws	Ø5,0 x 50				**19,0**
TTF200 + ALADIN STRIPE EXTRA SOFT	LBA nails	Ø4,0 x 60	30	30	7	**19,0**
	LBS screws	Ø5,0 x 50				**17,9**

NOTES:

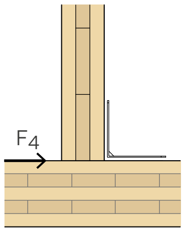
[(1)] The TTF200 angle bracket can be installed in combination with different resilient acoustic profiles inserted below the horizontal flange in full pattern configuration. The strength values in the table are given in ETA 11/0496 and calculated according to *"Blaß, H.J. und Laskewitz, B. (2000); Load-Carrying Capacity of Joints with Dowel-Type fasteners and Interlayers."*, conservatively disregarding the stiffness of the profile.

[(2)] Profile thickness: in the case of ALADIN profile, the calculation took into account the reduced thickness of the profile itself, due to the corrugated section and the consequent crushing induced by the nail head during insertion.

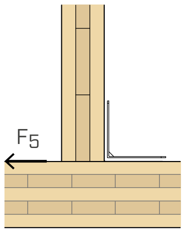
STATIC VALUES | SHEAR JOINT F_4 - F_5 - $F_{4/5}$ | TIMBER-TO-TIMBER

TTF200

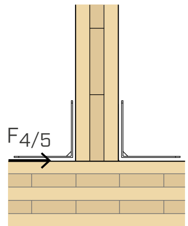
	TIMBER				STEEL	
F_4	holes fastening Ø5			$R_{4,k\ timber}$	$R_{4,k\ steel}$	
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
• full pattern	LBA nails	Ø4,0 x 60	30 + 30	**14,1**	**10,4**	γ_{M0}
	LBS screws	Ø5,0 x 50				



	TIMBER				STEEL	
F_5	holes fastening Ø5			$R_{5,k\ timber}$	$R_{5,k\ steel}$	
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
• full pattern	LBA nails	Ø4,0 x 60	30 + 30	**10,8**	**4,7**	γ_{M0}
	LBS screws	Ø5,0 x 50				



	TIMBER				STEEL	
$F_{4/5}$ TWO ANGLE BRACKETS	holes fastening Ø5			$R_{4/5,k\ timber}$	$R_{4/5,k\ steel}$	
	type	Ø x L [mm]	n_v [pcs]	[kN]	[kN]	γ_{steel}
• full pattern	LBA nails	Ø4,0 x 60	60+60	**21,0**	**14,2**	γ_{M0}
	LBS screws	Ø5,0 x 50				



The F_4, F_5, $F_{4/5}$ values in the table are valid for the acting stress calculation eccentricity e=0 (timber elements prevented from rotating).

GENERAL PRINCIPLES:

For the general principles of calculation, see page 226.

TCF200 - TTF200 | CONNECTION STIFFNESS FOR STRESS $F_{2/3}$

EVALUTATION OF SLIP MODULUS $K_{2/3,ser}$

- $K_{2/3,ser}$ experimental average value for TITAN joint on C24 CLT (Cross Laminated Timber) panels

type	fastening type Ø x L [mm]	n_V [pcs]	n_H [pcs]	$K_{2/3,ser}$ [N/mm]
TCF200	LBA nails Ø4,0 x 60	30	-	**8479**
TTF200	LBA nails Ø4,0 x 60	30	30	**8212**

- K_{ser} according to EN 1995-1-1 for timber-to-timber joint nails* GL24h/C24

Nails (without pre-drilling hole) $\frac{\rho_m^{1,5} \cdot d^{0,8}}{30}$ (EN 1995 § 7.1)

type	fastening type Ø x L [mm]	n_V [pcs]	K_{ser} [N/mm]
TCF200	LBA nails Ø4,0 x 60	30	**26093**
TTF200	LBA nails Ø4,0 x 60	30	**26093**

* For steel-to-timber connections the reference regulation indicates the possibility of doubling the value of K_{ser} listed in the table (7.1 (3)).

GENERAL PRINCIPLES:

- Characteristic values are consistent with EN 1995-1-1 and in accordance with ETA-11/0496. The design values of the anchors for concrete are calculated in accordance with the respective European Technical Assessments (see Chapter 6 ANCORS FOR CONCRETE). The connection design strength values are obtained from the values on the table as follows:

$$R_d = min \begin{cases} \frac{R_{k,\,timber} \cdot k_{mod}}{\gamma_M} \\ \frac{R_{k,\,steel}}{\gamma_{steel}} \\ R_{d,\,concrete} \end{cases}$$

  The coefficients k_{mod}, γ_M and γ_{steel} should be taken according to the current regulations used for the calculation.
- Dimensioning and verification of timber and concrete elements must be carried out separately. Verify that there are no brittle fractures before reaching the connection strength.
- Structural elements in timber, to which the connection devices are fastened, must be prevented from rotating.
- For the calculation process a timber density ρ_k = 350 kg/m^3 has been considered. For higher ρ_k values, the strength on timber side can be converted by the k_{dens} value:

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad for\ 350\ kg/m^3 \le \rho_k \le 420\ kg/m^3$$

$$k_{dens} = \left(\frac{\rho_k}{350}\right)^{0,5} \quad for\ LVL\ with\ \rho_k \le 500\ kg/m^3$$

- In the calculation phase, a strength class of C25/30 concrete with thin reinforcement was considered, in the absence of spacing and distances from the edge and minimum thickness indicated in the tables listing the installation parameters of the anchors used. The strength values are valid for the calculation hypotheses defined in the table; for boundary conditions different from the ones in the table (e.g. minimum distances from the edge or different concrete thickness), the concrete-side anchors can be verified using MyProject calculation software according to the design requirements.
- Seismic design in performance category C2, without ductility requirements on anchors (option a2) elastic design according to EOTA TR045. For chemical anchors subjected to shear stress it is assumed that the annular space between the anchor and the plate hole is filled (α_{gap}=1).