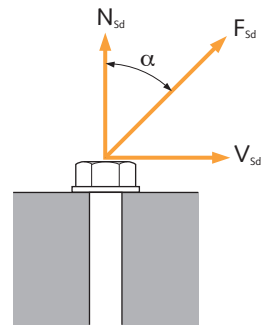


Combined load

The combined load F_{Sd} with an angle α is obtained by:

$$F_{Sd} = \sqrt{(N_{Sd})^2 + (V_{Sd})^2} \quad \alpha = \arctan\left(\frac{V_{Sd}}{N_{Sd}}\right)$$

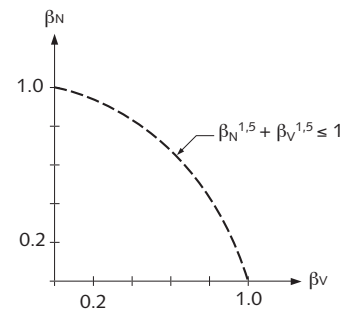
with N_{Sd} : action in tensile direction ($N_{Sd} = F_{Sd} \times \cos \alpha$)
 V_{Sd} : action in shear direction ($V_{Sd} = F_{Sd} \times \sin \alpha$)



To verify the resistance for a combined load with the method CC, we proceed as follows :

We must verify:

- the tensile resistance: $\beta_N = N_{Sd} / N_{Rd} \leq 1$
- the shear resistance: $\beta_V = V_{Sd} / V_{Rd} \leq 1$
- the combined load with the following interactive equation : $\beta_N^{1.5} + \beta_V^{1.5} \leq 1$



Using CC methodology

This simplified method is based on the principle of Method A from ETAG – Annex C, without taking into account splitting and pryout failure. This method was simplified to retain as much as possible of the ETAG method, whilst including as much of the latest approach as possible.

In this technical guide, for each product covered by the calculation method CC, you will find 4 pages:

- Pages 1/4 and 2/4 give the general technical data on the product and the performance of the product.
- Pages 3/4 and 4/4 contain data to design according to this method.

Page 3/4 gives the design resistance R_d for each type of failure, this data is calculated with the characteristic resistance (R_k) and the safety partial factor (γ_M) given in the ETA (if the anchor has CE marking), or from the product evaluation according to ETAG carried out by SPIT.

Page 4/4 gives the factors (Ψ_s , $\Psi_{C,N}$ et $\Psi_{S-C,V}$) to be used in the calculation for concrete cone failure in tensile and shear load to take into account the influence of spacing and distance from edge.

SPIT TRIGA Z
Zinc coated steel

SPIT CC- Method (values issued from ETA)

TENSILE (values issued from ETA)

Full-rod resistance
 $N_{Rk} = N_{t,Rk}$
 Anchor size: M6, M8, M10, M12, M16, M20, M24

Concrete edge resistance
 Design concrete edge resistance at an inner edge (distance e_{min})
 Anchor size: M6, M8, M10, M12, M16, M20, M24

Concrete cone resistance
 $N_{Rk} = N_{t,Rk} \cdot \Psi_s \cdot \Psi_{C,N}$

Design cone resistance
 Anchor size: M6, M8, M10, M12, M16, M20, M24

Steel resistance
 Steel design shear resistance
 Anchor size: M6, M8, M10, M12, M16, M20, M24

Steel resistance
 Steel design tensile resistance
 Anchor size: M6, M8, M10, M12, M16, M20, M24

$N_{Rd} = \min(N_{t,Rd}; N_{s,Rd}; N_{c,Rd})$
 $V_{Rd} = \min(V_{s,Rd}; V_{c,Rd})$
 $\beta_N = N_{Sd} / N_{Rd} \leq 1$
 $\beta_V = V_{Sd} / V_{Rd} \leq 1$
 $\beta_N^{1.5} + \beta_V^{1.5} \leq 1$

INFLUENCE OF CONCRETE

Concrete class	Ψ_s	Concrete class	$\Psi_{C,N}$
C16/20	0.85	M20	1.0
C20/25	1.0	M24	1.0
C25/30	1.15	M30	1.0

INFLUENCE OF SHEAR LOADING DIRECTION

Angle β :
 0°: 1.0
 45°: 0.85
 90°: 0.7

SPIT TRIGA Z
Zinc coated steel

SPIT CC- Method (values issued from ETA)

INFLUENCE OF SPACING FOR CONCRETE CONE RESISTANCE IN TENSILE LOAD

Anchor size	Relative factor Ψ_s	Concrete class	Relative factor $\Psi_{C,N}$
M6	0.75	M20	1.0
M8	0.75	M24	1.0
M10	0.75	M30	1.0
M12	0.75	M36	1.0
M16	0.75	M42	1.0
M20	0.75	M48	1.0
M24	0.75	M54	1.0
M30	0.75	M60	1.0
M36	0.75	M66	1.0
M42	0.75	M72	1.0
M48	0.75	M78	1.0
M54	0.75	M84	1.0
M60	0.75	M90	1.0
M66	0.75	M96	1.0
M72	0.75	M102	1.0
M78	0.75	M108	1.0
M84	0.75	M114	1.0
M90	0.75	M120	1.0
M96	0.75	M126	1.0
M102	0.75	M132	1.0
M108	0.75	M138	1.0
M114	0.75	M144	1.0
M120	0.75	M150	1.0
M126	0.75	M156	1.0
M132	0.75	M162	1.0
M138	0.75	M168	1.0
M144	0.75	M174	1.0
M150	0.75	M180	1.0
M156	0.75	M186	1.0
M162	0.75	M192	1.0
M168	0.75	M198	1.0
M174	0.75	M204	1.0
M180	0.75	M210	1.0
M186	0.75	M216	1.0
M192	0.75	M222	1.0
M198	0.75	M228	1.0
M204	0.75	M234	1.0
M210	0.75	M240	1.0
M216	0.75	M246	1.0
M222	0.75	M252	1.0
M228	0.75	M258	1.0
M234	0.75	M264	1.0
M240	0.75	M270	1.0
M246	0.75	M276	1.0
M252	0.75	M282	1.0
M258	0.75	M288	1.0
M264	0.75	M294	1.0
M270	0.75	M300	1.0
M276	0.75	M306	1.0
M282	0.75	M312	1.0
M288	0.75	M318	1.0
M294	0.75	M324	1.0
M300	0.75	M330	1.0
M306	0.75	M336	1.0
M312	0.75	M342	1.0
M318	0.75	M348	1.0
M324	0.75	M354	1.0
M330	0.75	M360	1.0
M336	0.75	M366	1.0
M342	0.75	M372	1.0
M348	0.75	M378	1.0
M354	0.75	M384	1.0
M360	0.75	M390	1.0
M366	0.75	M396	1.0
M372	0.75	M402	1.0
M378	0.75	M408	1.0
M384	0.75	M414	1.0
M390	0.75	M420	1.0
M396	0.75	M426	1.0
M402	0.75	M432	1.0
M408	0.75	M438	1.0
M414	0.75	M444	1.0
M420	0.75	M450	1.0
M426	0.75	M456	1.0
M432	0.75	M462	1.0
M438	0.75	M468	1.0
M444	0.75	M474	1.0
M450	0.75	M480	1.0
M456	0.75	M486	1.0
M462	0.75	M492	1.0
M468	0.75	M498	1.0
M474	0.75	M504	1.0
M480	0.75	M510	1.0
M486	0.75	M516	1.0
M492	0.75	M522	1.0
M498	0.75	M528	1.0
M504	0.75	M534	1.0
M510	0.75	M540	1.0
M516	0.75	M546	1.0
M522	0.75	M552	1.0
M528	0.75	M558	1.0
M534	0.75	M564	1.0
M540	0.75	M570	1.0
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M612	0.75	M642	1.0
M618	0.75	M648	1.0
M624	0.75	M654	1.0
M630	0.75	M660	1.0
M636	0.75	M666	1.0
M642	0.75	M672	1.0
M648	0.75	M678	1.0
M654	0.75	M684	1.0
M660	0.75	M690	1.0
M666	0.75	M696	1.0
M672	0.75	M702	1.0
M678	0.75	M708	1.0
M684	0.75	M714	1.0
M690	0.75	M720	1.0
M696	0.75	M726	1.0
M702	0.75	M732	1.0
M708	0.75	M738	1.0
M714	0.75	M744	1.0
M720	0.75	M750	1.0
M726	0.75	M756	1.0
M732	0.75	M762	1.0
M738	0.75	M768	1.0
M744	0.75	M774	1.0
M750	0.75	M780	1.0
M756	0.75	M786	1.0
M762	0.75	M792	1.0
M768	0.75	M798	1.0
M774	0.75	M804	1.0
M780	0.75	M810	1.0
M786	0.75	M816	1.0
M792	0.75	M822	1.0
M798	0.75	M828	1.0
M804	0.75	M834	1.0
M810	0.75	M840	1.0
M816	0.75	M846	1.0
M822	0.75	M852	1.0
M828	0.75	M858	1.0
M834	0.75	M864	1.0
M840	0.75	M870	1.0
M846	0.75	M876	1.0
M852	0.75	M882	1.0
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M870	0.75	M900	1.0
M876	0.75	M906	1.0
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M1326	0.75	M1356	1.0
M1332	0.75	M1362	1.0
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Using CC methodology

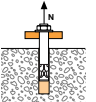
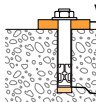
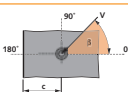

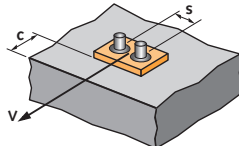
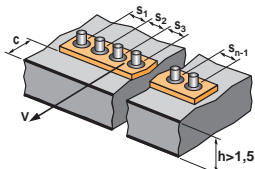
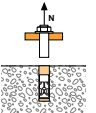
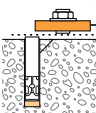
Photocopy this form and insert figures for your calculation

Project Description :

Anchor type :

Anchorage depth :

mm

TENSILE LOAD		SHEAR LOAD	
Ultimate design action N_{Sd}	kN	Ultimate design action V_{Sd}	kN
 Pull-out failure		 Edge concrete failure	
<input type="checkbox"/> Non cracked concrete		$V_{Rd,c}$	kN
<input type="checkbox"/> Cracked concrete		$C_{min} =$	
$N_{Rd,p}$	kN	Concrete class :	f_b
Concrete class :	f_b	shear direction: 	$f_{\beta,V}$
$N_{Rd,p} = N_{Rd,p}^0 \times f_b$	kN	Edge distance in the shear direction	
 Concrete cone failure		 $C1 =$	
$N_{Rd,c}^0$	kN	Spacing distance // to the edge distance	
Concrete class :	f_b	 $S1 =$ $S2 =$ $S3 =$	
$s1 =$	Ψ_{S1}	$C1/C_{min} =$	$\Psi_{S,C,V}$
$s2 =$	Ψ_{S2}	$S/C_{min} =$	
$s3 =$	Ψ_{S3}		
$C1 =$	$\Psi_{C1,N}$		
$C2 =$	$\Psi_{C2,N}$		
$C3 =$	$\Psi_{C3,N}$		
$C4 =$	$\Psi_{C4,N}$		
$N_{Rd,c} = N_{Rd,c}^0 \times f_b \times \Psi_{S1} \times \dots \times \Psi_{S3} \times \Psi_{C1,N} \times \dots \times \Psi_{C4,N}$	kN	$V_{Rd,c} = V_{Rd,c}^0 \times f_b \times f_{\beta,V} \times \Psi_{S,C,V}$	kN
 Steel failure		 Steel failure	
$N_{Rd,s}$	kN	$V_{Rd,s}$	kN
Ultimate design resistance N_{Rd}		Ultimate design resistance V_{Rd}	
$N_{Rd} = \min(N_{Rd,p} ; N_{Rd,c} ; N_{Rd,s})$	kN	$V_{Rd} = \min(V_{Rd,c} ; V_{Rd,s})$	kN
$\beta_N = N_{Sd} / N_{Rd} \leq 1$		$\beta_V = V_{Sd} / V_{Rd} \leq 1$	

COMBINED LOAD :

$$\beta_N^{1,5} + \beta_V^{1,5} \leq 1$$