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Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - 10 Nov 2022	Date:	10/11/2022
Fastening Point:			

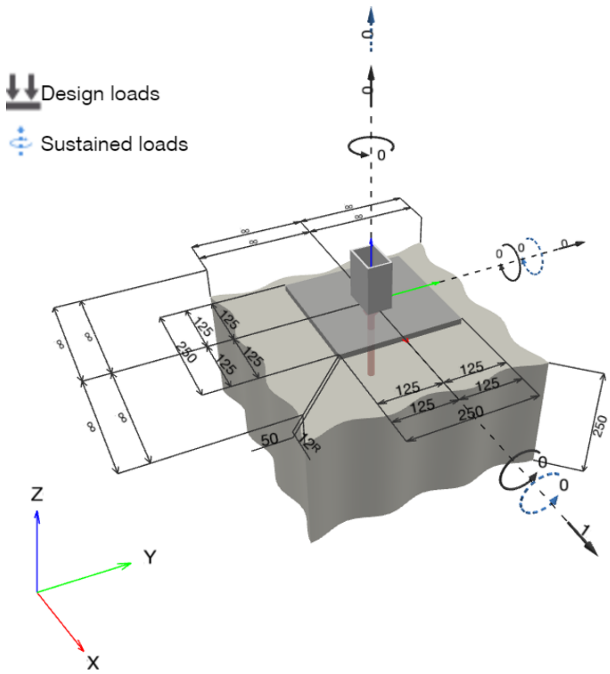
Specifier's comments:

1 Input data

Anchor type and size:	**HUS4-A Bonded Screw 14 M16**
Return period (service life in years):	50
Item number:	not available (insert) / not available (capsule)
Effective embedment depth:	h_{ef} = 115.0 mm, h_{nom} = 115.0 mm
Material:	1.5525
Approval No.:	ETA-18/1160
Issued I Valid:	27/7/2022 | -
Proof:	Design Method AS 5216:2021 ETA-18/1160
Stand-off installation:	without clamping (anchor); restraint level (baseplate): 1.00; e_b = 50.0 mm; t = 12.0 mm
Baseplate[R] :	l_x x l_y x t = 250.0 mm x 250.0 mm x 12.0 mm; (Recommended plate thickness: not calculated)
Profile:	Rectangular hollow section, 75x50x4RHS; (L x W x T) = 75.0 mm x 50.0 mm x 4.0 mm
Base material:	cracked concrete, 40MPa, f'_c = 40.00 N/mm^2; h = 250.0 mm, Temp. short/long: 0/0 °C, User-defined partial material safety factor γ_c = 1.500
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	No reinforcement or Reinforcement spacing >= 150 mm (any Ø) or >= 100 mm (Ø <= 10 mm)
	no longitudinal edge reinforcement
	Reinforcement to control splitting acc. to AS5216:2021 / SA TS 101:2015, 6.2.5.2 (b) present

[R] - The anchor calculation is based on a rigid baseplate assumption.

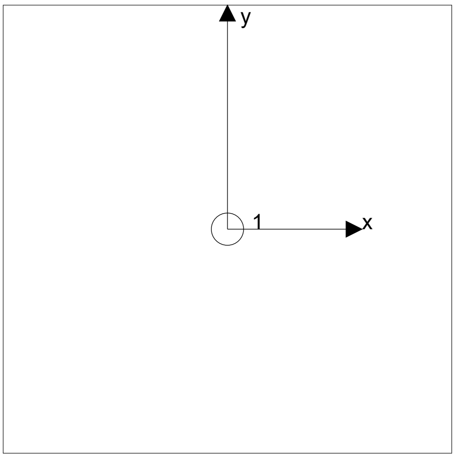
Geometry [mm] & Loading [kN, kNm]



1.1 Load combination

Case	Description	Forces [kN] / Moments [kNm]	Seismic	Fire	Max. Util. Anchor [%]
1	Combination 1	N = 0.000; V_x = 1.000; V_y = 0.000; M_x = 0.000; M_y = 0.000; M_z = 0.000;	no	no	43

2 Load case/Resulting anchor forces



Anchor reactions [kN]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0.000	1.000	1.000	0.000

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [N/mm^2]
resulting tension force in (x/y)=(0.0/0.0): 0.000 [kN]
resulting compression force in (x/y)=(0.0/0.0): 0.000 [kN]

Anchor forces are calculated based on the assumption of a rigid baseplate.

3 Tension load ((AS 5216:2021, Section 6.2))

	Load [kN]	Capacity [kN]	Utilization β_N [%]	Status
Steel failure*	N/A	N/A	N/A	N/A
Concrete Breakout failure**	N/A	N/A	N/A	N/A
Splitting failure**	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (anchors in tension)

4 Shear load ((AS 5216:2021, Section 7.2))

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel failure (without lever arm)*	1.000	49.600	3	OK
Steel failure (with lever arm)*	1.000	2.362	43	OK
Pryout failure**	1.000	79.196	2	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* highest loaded anchor **anchor group (relevant anchors)

4.1 Steel failure (without lever arm)

$V^* \leq V_{Rd,s} = \phi_{Ms,V} \cdot V_{Rk,s}$ AS 5216:2021, Table 3.4.3.1

$V_{Rk,s} = k_7 \cdot V^0_{Rk,s}$ AS 5216:2021, Eq. 7.2.2.2(1)

$V^0_{Rk,s}$ [kN]	k_7	$V_{Rk,s}$ [kN]	$\phi_{Ms,V}$	$V_{Rd,s}$ [kN]	V^* [kN]
62.000	0.800	62.000	0.800	49.600	1.000

4.2 Steel failure (with lever arm)

$V^* \leq V_{Rd,s,M} = \phi_{Ms,V} \cdot V_{Rk,s,M}$ AS 5216:2021, Table 3.4.3.1

$V_{Rk,s,M} = \frac{\alpha_M \cdot M_{Rk,s}}{l_a}$ AS 5216:2021, Eq. 7.2.2.3(1)

$M_{Rk,s} = M^0_{Rk,s} \cdot \left(1 - \frac{N^*}{N_{Rd,s}}\right)$ AS 5216:2021, Eq. 7.2.2.3(2)

$l_a = e_c + \frac{t}{2} + a_3$ AS 5216:2021, Eq. 4.2.2.1

l [mm]	α_M
63.0	1.00

$N^* / N_{Rd,s}$	$1 - N^* / N_{Rd,s}$	$M^0_{Rk,s}$ [kNm]	$M_{Rk,s} = M^0_{Rk,s} (1 - N^*/N_{Rd,s})$ [kNm]
0.000	1.000	0.186	0.186

$V^M_{Rk,s} = \alpha_M * M_{Rk,s} / l$ [kN]	$\phi_{Ms,V}$	$V^M_{Rd,s}$ [kN]	V^* [kN]
2.952	0.800	2.362	1.000

4.3 Pryout failure (bond relevant)

$V_{Ed} \leq V_{Rd,cp} = \frac{V_{Rk,cp}}{\gamma_{Mc,p}}$	EN 1992-4, Table 7.2
$V^0_{Rk,cp} = k_8 \cdot \min\{N_{Rk,c}; N_{Rk,p}\}$	EN 1992-4, Eq. (7.39c)
$N_{Rk,p} = N^0_{Rk,p} \cdot \frac{A_{p,N}}{A^0_{p,N}} \cdot \psi_{g,Np} \cdot \psi_{s,Np} \cdot \psi_{re,N} \cdot \psi_{ec1,Np} \cdot \psi_{ec2,Np}$	EOTA TR 075, Eq. (1)
$N^0_{Rk,p} = \psi_{sus} \cdot N'_{Rk,p}$	EOTA TR 075, Eq. (2)
$A^0_{p,N} = s_{cr,Np} \cdot s_{cr,Np}$	
$\psi_{sus} = 1$	EN 1992-4, Eq. (7.14a)
$s_{cr,Np} = 4.1 \cdot \left(\psi_{sus} \cdot \frac{d}{h_{ef}} \cdot N_{Rk,p,ucr,C20/25}\right)^{0.5} \leq 3 \cdot h_{ef}$	EOTA TR 075, Eq. (3)
$c_{cr,Np} = \frac{s_{cr,Np}}{2}$	
$\psi_{g,Np} = \psi^0_{g,Np} - \left(\frac{s}{s_{cr,Np}}\right)^{0.5} \cdot (\psi^0_{g,Np} - 1) \geq 1.00$	EOTA TR 075, Eq. (4)
$\psi^0_{g,Np} = \sqrt{n} - (\sqrt{n} - 1) \cdot \left(\frac{N'_{Rk,p}}{N_{Rk,c}}\right)^{1.5} \geq 1.00$	EOTA TR 075, Eq. (5)
$N_{Rk,c} = k_3 \cdot h_{ef}^{1.5} \cdot \sqrt{f_{ck}}$	EOTA TR 075, Eq. (6)
$\psi_{s,Np} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,Np}} \leq 1.00$	EN 1992-4, Eq.(7.20)
$\psi_{re,Np} = 0.5 + \frac{h_{ef}}{200} \leq 1.00$	EN 1992-4, Table 7.5
$\psi_{ec1,Np} = \frac{1}{1 + \frac{2 \cdot e_{1,N}}{s_{cr,Np}}} \leq 1.00$	EN 1992-4, Eq.(7.21)
$\psi_{ec2,Np} = \frac{1}{1 + \frac{2 \cdot e_{2,N}}{s_{cr,Np}}} \leq 1.00$	EN 1992-4, Eq.(7.21)

d [mm]	h_{ef} [mm]	$N_{Rk,p,ucr,C20/25}$ [kN]	$c_{cr,Np}$ [mm]	$s_{cr,Np}$ [mm]	$N'_{Rk,p}$ [kN]	ψ_{sus}
14.0	115.0	70.000	172.5	345.0	59.397	1.000

$N^0_{Rk,p}$ [kN]	$A^0_{p,N}$ [mm^2]	$A_{p,N}$ [mm^2]	k_3	f_{ck} [N/mm^2]	k_8	$N_{Rk,c}$ [kN]
59.397	119,025	119,025	7.700	40.00	2.0	0.000

n	$\psi^0_{g,Np}$	s [mm]	$\psi_{g,Np}$	c_{min} [mm]	$\psi_{s,Np}$	$\psi_{re,Np}$
1	1.000	-	1.000	10,000.0	1.000	1.000

$e_{1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{2,N}$ [mm]	$\psi_{ec2,Np}$
0.0	1.000	0.0	1.000

$V_{Rk,cp}$ [kN]	$\gamma_{Mc,p}$	$V_{Rd,cp}$ [kN]	V_{Ed} [kN]
118.794	1.500	79.196	1.000

Group anchor ID
1

5 Displacements (highest loaded anchor)

Short term loading:

N_{Sk}	=	0.000 [kN]	δ_N	=	0.0000 [mm]
V_{Sk}	=	0.741 [kN]	δ_V	=	0.0837 [mm]
			δ_{NV}	=	0.0837 [mm]

Long term loading:

N_{Sk}	=	0.000 [kN]	δ_N	=	0.0000 [mm]
V_{Sk}	=	0.741 [kN]	δ_V	=	0.1255 [mm]
			δ_{NV}	=	0.1255 [mm]

Comments: Tension displacements are valid with half of the required installation torque moment for uncracked concrete! Shear displacements are valid without friction between the concrete and the baseplate! The gap due to the drilled hole and clearance hole tolerances are not included in this calculation!

The acceptable anchor displacements depend on the fastened construction and must be defined by the designer!

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid baseplates per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the baseplate are not considered - the baseplate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required baseplate thickness with CBFEM to limit the stress of the baseplate based on the assumptions explained above. The proof if the rigid baseplate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- In general, the conditions given in ETAG 001, Annex C, section 4.2.2.1 and 4.2.2.3 b) are not fulfilled because the diameter of the clearance hole in the fixture acc. to Annex 3, Table 3 is greater than the values given in Annex C, Table 4.1 and AS5126 for the corresponding diameter of the anchor. Therefore the design resistance for anchor groups is limited to twice the steel resistance (of a single anchor) in accordance with the approval.
- Checking the transfer of loads into the base material is required in accordance with AS 5216:2021, Appendix C!
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 4.2.2.1 of AS 5216:2021! For larger diameters of the clearance hole, see section 2.2 of SA TS 101: 2015!
- The accessory list in this report is for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- For the determination of the $\psi_{re,v}$ (concrete edge failure) the minimum concrete cover defined in the design settings is used as the concrete cover of the edge reinforcement.
- Load transfer from supplementary reinforcement to the structural member shall be verified by the responsible structural engineer.
- With supplementary reinforcement and post-installed anchors, please ensure that in the jobsite the rebars are not drilled through.
- The characteristic bond resistances depend on the return period (service life in years): 50

Fastening meets the design criteria!

7 Installation data

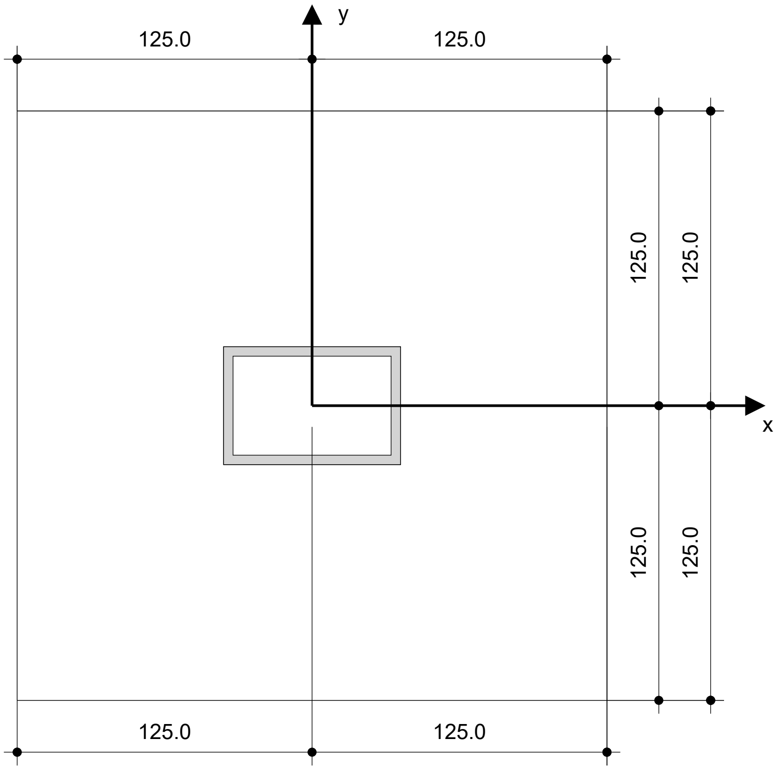
Baseplate, steel: Grade 300; E = 200,000.00 N/mm^2; f_{yk} = 310.00 N/mm^2
Profile: Rectangular hollow section, 75x50x4RHS; (L x W x T) = 75.0 mm x 50.0 mm x 4.0 mm
Hole diameter in the fixture: d_f = 18.0 mm
Plate thickness (input): 12.0 mm
Recommended plate thickness: not calculated
Drilling method: Hammer drilled
Cleaning: Clean the drill hole. Under the conditions - according to fastener size and drilling direction - given in the ETA and MPII (IFU), the cleaning of the drill hole may be omitted.

Anchor type and size: HUS4-A Bonded Screw 14 M16
Item number: not available (insert) / not available (capsule)
Maximum installation torque: 80 Nm
Hole diameter in the base material: 14.0 mm
Hole depth in the base material: 125.0 mm
Minimum thickness of the base material: 200.0 mm

Hilti HUS screw anchor with MAX capsule mortar with 115 mm embedment h_ef, 14 M16, Steel galvanized, Hammer drilling installation per ETA-18/1160

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Manual blow-out pump	• Hilti SIW 22T-A impact screw driver



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.0	0.0	-	-	-	-

8 Remarks; Your Cooperation Duties

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