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Company:
Address:
Phone I Fax: |
Design: Concrete - 6 Jun 2023 (1)
Fastening Point:

Specifier:
E-Mail:
Date: 6/6/2023

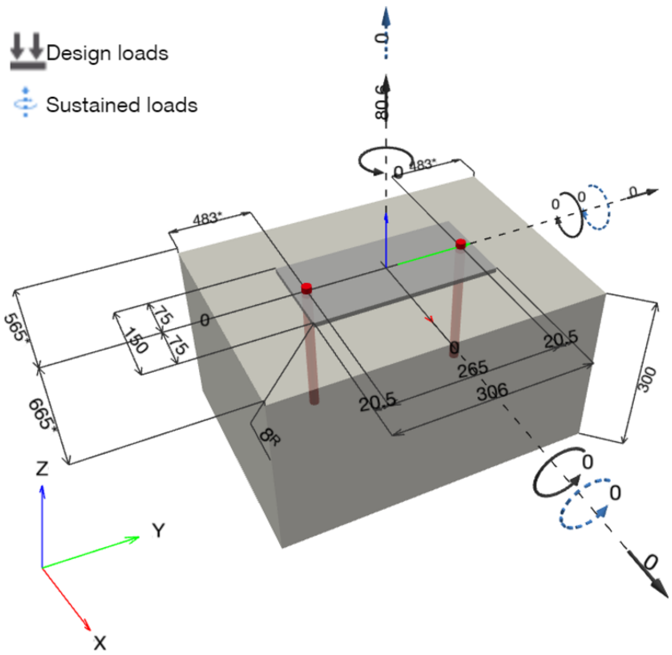
Specifier's comments:

1 Input data

Anchor type and size:	**HIT-RE 500 V3 100 years + Rebar 16mm**
Return period (service life in years):	100
Item number:	not available (insert) / 2123403 HIT-RE 500 V3 (mortar)
Effective embedment depth:	$h_{ef,act}$ = 220.0 mm ($h_{ef,limit}$ = - mm)
Material:	B500B
Approval No.:	ETA 16/0143
Issued I Valid:	14/5/2019 | -
Proof:	Design Method AS 5216:2021, Chemical
Stand-off installation:	e_b = 0.0 mm (no stand-off); t = 8.0 mm
Baseplate[R] :	l_x x l_y x t = 150.0 mm x 306.0 mm x 8.0 mm; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 32MPa, f'_c = 32.00 N/mm^2; h = 300.0 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	$N = 80.600$; $V_x = 0.000$; $V_y = 0.000$; $M_x = 0.000$; $M_y = 0.000$; $M_z = 0.000$; $N_{sus} = 0.000$; $M_{x,sus} = 0.000$; $M_{y,sus} = 0.000$;	no	no	79

2 Load case/Resulting anchor forces

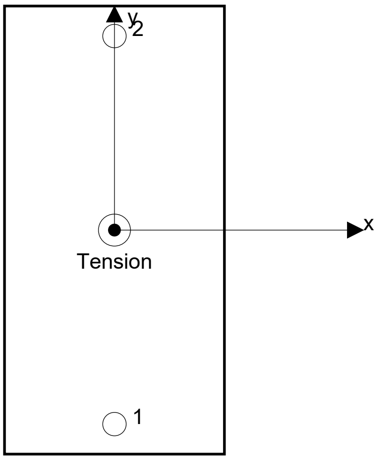
Anchor reactions [kN]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	40.300	0.000	0.000	0.000
2	40.300	0.000	0.000	0.000

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [N/mm^2]
resulting tension force in (x/y)=(0.0/0.0): 80.600 [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.



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

	Load [kN]	Capacity [kN]	Utilization β_N [%]	Status
Steel failure*	40.300	79.286	51	OK
Combined pullout-concrete cone failure**	80.600	102.536	79	OK
Concrete Breakout failure**	80.600	132.803	61	OK
Splitting failure**	N/A	N/A	N/A	N/A

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

3.1 Steel failure

$N^* \leq N_{Rd,s} = \phi_{Ms,N} \cdot N_{Rk,s}$ AS 5216:2021, Table 3.4.2.1

$N_{Rk,s}$ [kN]	$\phi_{Ms,N}$	$N_{Rd,s}$ [kN]	N^* [kN]
111.000	0.714	79.286	40.300

3.2 Combined pullout-concrete cone failure

$N^* \leq N_{Rd,p} = \phi_{Mp} \cdot N_{Rk,p}$	AS 5216:2021, Table 3.4.2.1
$N_{Rk,p} = N^0_{Rk,p} \cdot \frac{A_{p,N}}{A^0_{p,N}} \cdot \psi_{g,Np} \cdot \psi_{s,Np} \cdot \psi_{re,N} \cdot \psi_{ec1,Np} \cdot \psi_{ec2,Np}$	AS 5216:2021, Eq. 6.2.5.1
$N^0_{Rk,p} = \psi_{sus} \cdot \tau_{Rk} \cdot \pi \cdot d \cdot h_{ef}$	AS 5216:2021, Eq. 6.2.5.2
$\psi_{sus} = 1$	
$s_{cr,Np} = 7.3 \cdot d \cdot \sqrt{\psi_{sus} \cdot \tau_{Rk}} \leq 3 \cdot h_{ef}$	AS 5216:2021, Eq. 6.2.5.3(2)
$\psi_{g,Np} = \psi^0_{g,Np} - \left(\frac{s}{s_{cr,Np}}\right)^{0,5} \cdot \left(\psi^0_{g,Np} - 1\right) \geq 1.00$	AS 5216:2021, Eq. 6.2.5.5(1)
$\psi^0_{g,Np} = \sqrt{n} - (\sqrt{n} - 1) \cdot \left(\frac{\tau_{Rk}}{\tau_{Rk,c}}\right)^{1,5} \geq 1.00$	AS 5216:2021, Eq. 6.2.5.5(2)
$\tau_{Rk,c} = \frac{k_3}{\pi \cdot d} \cdot \sqrt{h_{ef} \cdot f'_c}$	AS 5216:2021, Eq. 6.2.5.5(3)
$\psi_{s,Np} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,Np}} \leq 1.00$	AS 5216:2021, Eq. 6.2.3.4
$\psi_{ec1,Np} = \frac{1}{1 + \left(\frac{2 \cdot e_{c1,N}}{s_{cr,Np}}\right)} \leq 1.00$	AS 5216:2021, Eq. 6.2.3.6
$\psi_{ec2,Np} = \frac{1}{1 + \left(\frac{2 \cdot e_{c2,N}}{s_{cr,Np}}\right)} \leq 1.00$	AS 5216:2021, Eq. 6.2.3.6

$A_{p,N}$ [mm^2]	$A^0_{p,N}$ [mm^2]	$\tau_{Rk,ucr,20}$ [N/mm^2]	$s_{cr,Np}$ [mm]	$c_{cr,Np}$ [mm]	c_{min} [mm]	$f_{c,cyl}$ [N/mm^2]
324,510	204,634	15.00	452.4	226.2	483.0	32.00

ψ_c	$\tau_{Rk,cr}$ [N/mm^2]	k_3	$\tau_{Rk,c}$ [N/mm^2]	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1.048	8.38	7.700	12.85	1.196	1.046

$e_{c1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,N}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
0.0	1.000	0.0	1.000	1.000	1.000

ψ^0_{sus}	α_{sus}	ψ_{sus}
0.600	0.000	1.000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	ϕ_{Mp}	$N_{Rd,p}$ [kN]	N^* [kN]
92.725	153.804	0.667	102.536	80.600

Group anchor ID
1, 2

3.3 Concrete Breakout failure

$N^* \leq N_{Rd,c} = \phi_{Mc} \cdot N_{Rk,c}$	AS 5216:2021, Table 3.4.2.1
$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{M,N}$	AS 5216:2021, Eq. 6.2.3.1
$N^0_{Rk,c} = k_1 \cdot \sqrt{f'_c} \cdot h_{ef}^{1,5}$	AS 5216:2021, Eq. 6.2.3.2
$A^0_{c,N} = s_{cr,N} \cdot s_{cr,N}$	AS 5216:2021, Eq. 6.2.3.3
$\psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} \leq 1.00$	AS 5216:2021, Eq. 6.2.3.4
$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{N,1}}{s_{cr,N}}\right)} \leq 1.00$	AS 5216:2021, Eq. 6.2.3.6
$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{N,2}}{s_{cr,N}}\right)} \leq 1.00$	AS 5216:2021, Eq. 6.2.3.6
$\psi_{M,N} = 1$	AS 5216:2021, Clause 6.2.3.7

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	$f_{c,cyl}$ [N/mm^2]
610,500	435,600	330.0	660.0	32.00

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
0.0	1.000	0.0	1.000	1.000	1.000

z [mm]	$\psi_{M,N}$	k_1	$N^0_{Rk,c}$ [kN]	ϕ_{Mc}	$N_{Rd,c}$ [kN]	N* [kN]
0.0	1.000	7.700	142.135	0.667	132.803	80.600

Group anchor ID
1, 2

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

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel failure (without lever arm)*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout failure*	N/A	N/A	N/A	N/A
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

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

5 Displacements (highest loaded anchor)

Short term loading:

N_{Sk} = 29.852 [kN] δ_N = 0.2699 [mm]

V_{Sk} = 0.000 [kN] δ_V = 0.0000 [mm]

δ_{NV} = 0.2699 [mm]

Long term loading:

N_{Sk} = 29.852 [kN] δ_N = 0.5129 [mm]

V_{Sk} = 0.000 [kN] δ_V = 0.0000 [mm]

δ_{NV} = 0.5129 [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!
- 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.
- Characteristic bond resistances depend on short- and long-term temperatures.
- Edge reinforcement is not required to avoid splitting failure
- 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): 100

Fastening meets the design criteria!

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7 Installation data

Baseplate, steel: Grade 300; E = 200,000.00 N/mm^2; f_{yk} = 320.00 N/mm^2

Profile: no profile

Hole diameter in the fixture: d_f = 16.0 mm

Plate thickness (input): 8.0 mm

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and size: HIT-RE 500 V3 100 years + Rebar 16mm

Item number: not available (insert) / 2123403 HIT-RE 500 V3 (mortar)

Maximum installation torque: -

Hole diameter in the base material: 20.0 mm

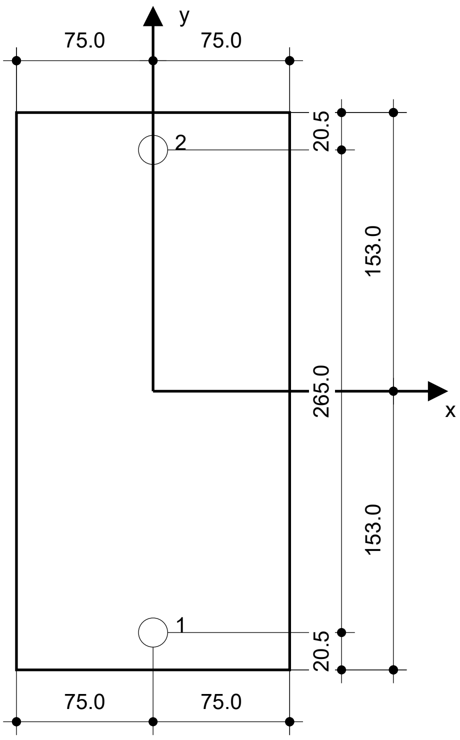
Hole depth in the base material: 220.0 mm

Minimum thickness of the base material: 260.0 mm

Rebar with HIT-RE 500 V3 injection mortar with 220 mm embedment h_ef, 16mm, Hammer drilling installation per ETA 16/0143

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush	• Dispenser including cassette and mixer • For deep installations, a piston plug is necessary • Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.0	-132.5	565.0	665.0	483.0	748.0
2	0.0	132.5	565.0	665.0	748.0	483.0

8 Remarks; Your Cooperation Duties

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AS4100 CLAUSE 7.2

AS4100 Cl. 7.2 Nominal section capacity

$$A_g := \pi \cdot \left(\frac{16\ mm}{2}\right)^2 = 201\ mm^2$$

$$f_y := 500\ MPa$$

$$k_t := 1$$

$$A_n := \pi \cdot \left(\frac{16\ mm}{2}\right)^2 = 201\ mm^2$$

$$f_u := 1.08 \cdot f_y = 540\ MPa$$

$$N_t := min\left(A_g \cdot f_y, 0.8 \cdot k_t \cdot A_n \cdot f_u\right) = 86.9\ kN$$

AS4100 CLAUSE 9.3.2.2

AS4100 Cl. 9.3.2.2 Nominal tension capacity of a bolt

$$f_{sy} := 500\ MPa$$

$$f_{uf} := f_{sy} \cdot 1.08 = 540\ MPa$$

$P := 2\ mm$ AS1275 Table 3.3

$$A_s := \frac{\pi}{4} \cdot \left(16\ mm - 0.9382 \cdot P\right)^2 = 157\ mm^2$$

$$N_{tf} := A_s \cdot f_{uf} = 84.6\ kN$$