Specifier's comments:

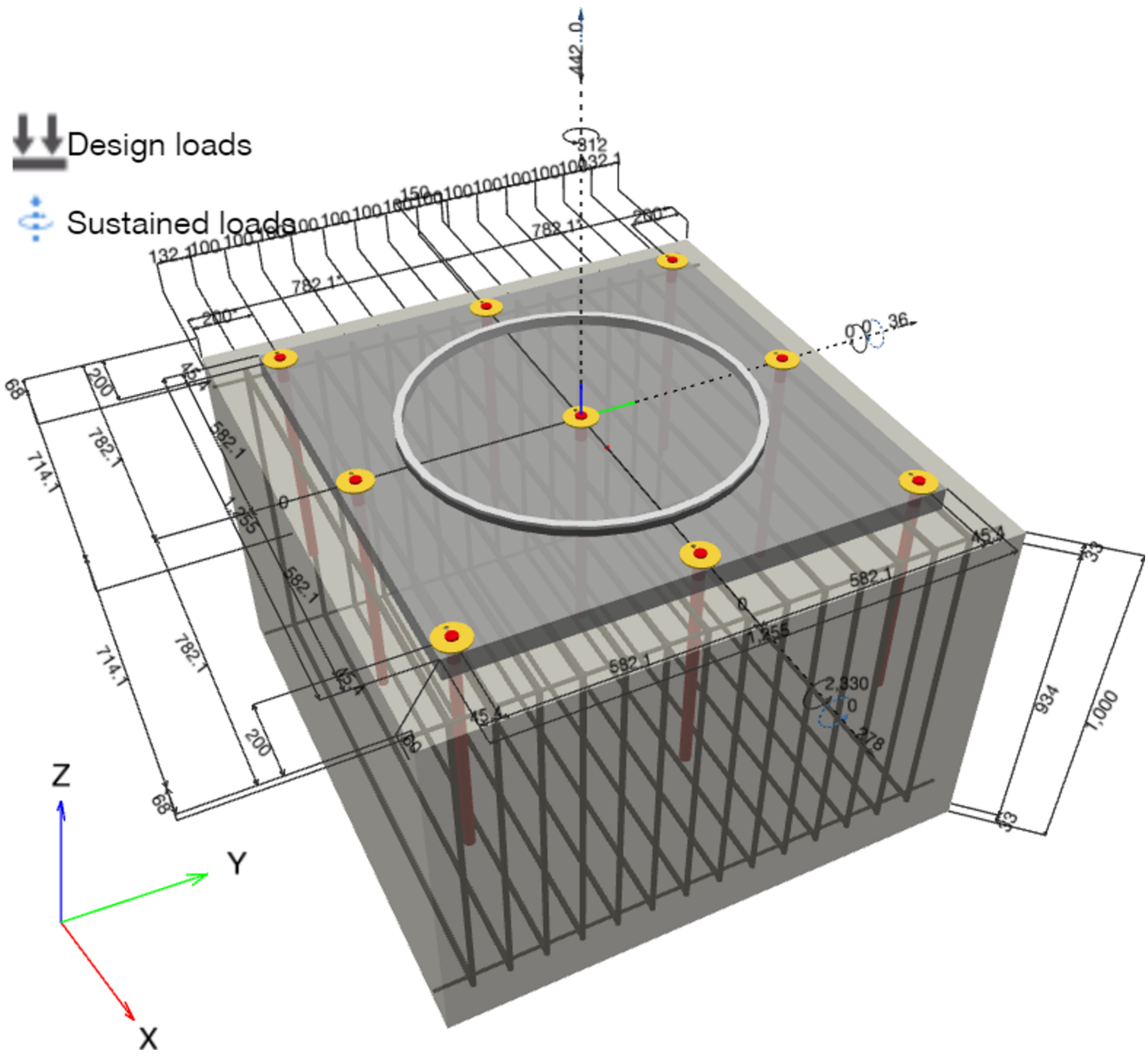
1 Anchor Design

1.1 Input data

Anchor type and size:	**HIT-HY 200-A + HAS-U 8.8 HDG M30**
Return period (service life in years):	50
Item number:	not available (insert) / 2022696 HIT-HY 200-A (mortar)
Hilti Filling Set or any suitable annular gap filling solution	
Effective embedment depth:	$h_{ef,act}$ = 600.0 mm ($h_{ef,limit}$ = - mm)
Material:	8.8
Approval No.:	ETA 11/0493
Issued I Valid:	10/12/2021 | -
Proof:	Design Method EN 1992-4, Chemical
Stand-off installation:	e_b = 0.0 mm (no stand-off); t = 60.0 mm
Baseplate^{CBFEM} :	l_x x l_y x t = 1,255.0 mm x 1,255.0 mm x 60.0 mm;
Profile:	Pipe, 914 x 20; (L x W x T) = 914.0 mm x 914.0 mm x 20.0 mm
Base material:	cracked concrete, C50/60, $f_{c,cyl}$ = 50.00 N/mm^2; h = 1,000.0 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 Supplementary reinforcement for tension : Closed stirrup Ø16.0 mm//100.0 mm, $f_{yk,re}$= 500.00 N/mm^2, β = 0% Surface reinforcement for tension : Ø10.0 mm, $f_{yk,re}$= 500.00 N/mm^2, β = 0% Direction of casting: z+ Tolerance: 0.0 mm Supplementary reinforcement for edge x+: Closed stirrup Ø16.0 mm//100.0 mm, $f_{yk,re}$= 500.00 N/mm^2, β = 0% Surface reinforcement for edge x+: Ø10.0 mm, $f_{yk,re}$= 500.00 N/mm^2, β = 0% Direction of casting: z+ Tolerance: 0.0 mm

^{CBFEM} - The anchor calculation is based on a component-based Finite Element Method (CBFEM)

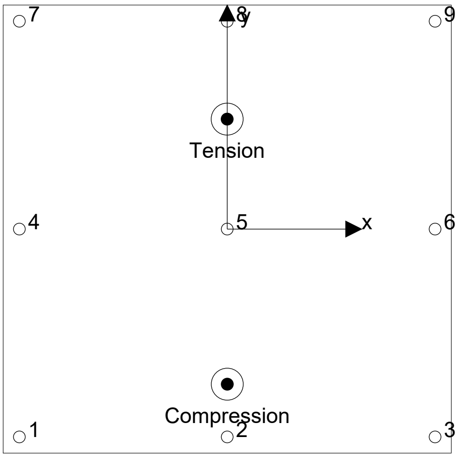
Geometry [mm] & Loading [kN, kNm]



1.1.1 Load combination

Case	Description	Forces [kN] / Moments [kNm]	Seismic	Fire	Max. Util. Anchor [%]
1	Combination 1	$N = -442.000$; $V_x = 278.000$; $V_y = 36.000$; $M_x = 2{,}330.000$; $M_y = 0.000$; $M_z = 312.000$; $N_{sus} = 0.000$; $M_{x,sus} = 0.000$; $M_{y,sus} = 0.000$;	no	no	1,522

1.2 Load case/Resulting anchor forces



Anchor reactions [kN]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	18.617	80.930	71.313	-38.265
2	-0.031	77.372	77.372	0.083
3	18.429	91.348	77.321	48.640
4	335.211	50.888	32.955	-38.777
5	624.544	31.413	31.385	1.313
6	335.073	61.234	29.558	53.628
7	204.208	40.452	-9.610	-39.293
8	1,166.866	14.936	-14.917	-0.756
9	203.833	52.396	-17.380	49.429

resulting tension force in (x/y)=(-0.1/308.0):	2,906.748 [kN]
resulting compression force in (x/y)=(0.2/-434.4):	3,378.466 [kN]

Anchor forces are calculated based on a component-based Finite Element Method (CBFEM)

Company:		Page:	4
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - 13 Sep 2023	Date:	15/09/2023
Fastening Point:			

1.3 Tension load (EN 1992-4, Section 7.2.1)

	Load [kN]	**Capacity [kN]**	**Utilization β_N [%]**	**Status**
Steel failure*	1,166.866	299.200	390	not recommended
Combined pullout-concrete cone failure**	2,906.780	651.881	446	not recommended
Concrete Breakout failure**	N/A	N/A	N/A	N/A
Splitting failure**	2,906.780	381.557	762	not recommended
Steel failure of longitudinal rebar**	64.326	34.148	189	not recommended
Steel failure of supplementary reinforcement, horizontal**	1,044.303	87.418	1,195	not recommended
Steel failure of supplementary reinforcement, vertical**	534.548	87.418	612	not recommended
Reinforcement anchorage inside of the breakout body, vertical**	534.548	138.386	387	not recommended

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

1.3.1 Steel failure

$N_{Ed} \leq N_{Rd,s} = \frac{N_{Rk,s}}{\gamma_{M,s}}$ EN 1992-4, Table 7.1

$N_{Rk,s}$ [kN]	$\gamma_{M,s}$	$N_{Rd,s}$ [kN]	N_{Ed} [kN]
448.800	1.500	299.200	1,166.866

1.3.2 Combined pullout-concrete cone failure

$N_{Ed} \leq N_{Rd,p} = \frac{N_{Rk,p}}{\gamma_{M,p}}$ EN 1992-4, Table 7.1

$N_{Rk,p} = N^0_{Rk,p} \cdot \frac{A_{p,N}}{A^0_{p,N}} \cdot \psi_{g,Np} \cdot \psi_{s,Np} \cdot \psi_{re,N} \cdot \psi_{ec1,Np} \cdot \psi_{ec2,Np}$ EN 1992-4, Eq. (7.13)

$N^0_{Rk,p} = \psi_{sus} \cdot \tau_{Rk} \cdot \pi \cdot d \cdot h_{ef}$ EN 1992-4, Eq. (7.14)

$\psi_{sus} = 1$ EN 1992-4, Eq. (7.14a)

$s_{cr,Np} = 7.3 \cdot d \cdot \sqrt{\psi_{sus} \cdot \tau_{Rk}} \leq 3 \cdot h_{ef}$ EN 1992-4, Eq. (7.15)

$\psi_{g,Np} = \psi^0_{g,Np} - \left(\frac{s}{s_{cr,Np}}\right)^{0,5} \cdot \left(\psi^0_{g,Np} - 1\right) \geq 1.00$ EN 1992-4, Eq. (7.17)

$\psi^0_{g,Np} = \sqrt{n} - (\sqrt{n} - 1) \cdot \left(\frac{\tau_{Rk}}{\tau_{Rk,c}}\right)^{1,5} \geq 1.00$ EN 1992-4, Eq. (7.18)

$\tau_{Rk,c} = \frac{k_3}{\pi \cdot d} \cdot \sqrt{h_{ef} \cdot f_{ck}}$ EN 1992-4, Eq. (7.19)

$\psi_{s,Np} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,Np}} \leq 1.00$ EN 1992-4, Eq. (7.20)

$\psi_{ec1,Np} = \frac{1}{1 + \left(\frac{2 \cdot e_{c1,N}}{s_{cr,Np}}\right)} \leq 1.00$ EN 1992-4, Eq. (7.21)

$\psi_{ec2,Np} = \frac{1}{1 + \left(\frac{2 \cdot e_{c2,N}}{s_{cr,Np}}\right)} \leq 1.00$ EN 1992-4, Eq. (7.21)

$A_{p,N}$ [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]
2,372,244	863,298	18.00	929.1	464.6	200.0	50.00

ψ_c	$\tau_{Rk,cr}$ [N/mm^2]	k_3	$\tau_{Rk,c}$ [N/mm^2]	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1.096	9.86	7.700	14.15	1.764	1.159

$e_{c1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,N}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
0.1	1.000	235.2	0.664	0.829	1.000

ψ^0_{sus}	α_{sus}	ψ_{sus}
0.740	0.000	1.000

$N^0_{Rk,p}$ [kN]	$N_{Rk,p}$ [kN]	$\gamma_{M,p}$	$N_{Rd,p}$ [kN]	N_{Ed} [kN]
557.775	977.821	1.500	651.881	2,906.780

Group anchor ID
1, 3-9

1.3.3 Splitting failure

$$N_{Ed} \leq N_{Rd,sp} = \frac{N_{Rk,sp}}{\gamma_{Msp}}$$ EN 1992-4, Table 7.1

$$N_{Rk,sp} = N^0_{Rk,sp} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{h,sp}$$ EN 1992-4, Eq. (7.23)

$$N^0_{Rk,sp} = \min\left(N^0_{Rk,p}, N^0_{Rk,c}\right)$$

$$A^0_{c,N} = s_{cr,sp} \cdot s_{cr,sp}$$ EN 1992-4, Eq. (7.3)

$$\psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,sp}} \leq 1.00$$ EN 1992-4, Eq. (7.4)

$$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{N,1}}{s_{cr,sp}}\right)} \leq 1.00$$ EN 1992-4, Eq. (7.6)

$$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{N,2}}{s_{cr,sp}}\right)} \leq 1.00$$ EN 1992-4, Eq. (7.6)

$$\psi_{h,sp} = \left(\frac{h}{h_{min}}\right)^{2/3} \leq \max\left\{1; \left(\frac{h_{ef} + 1.5 \cdot c_1}{h_{min}}\right)^{2/3}\right\} \leq 2.00$$ EN 1992-4, Eq. (7.24)

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,sp}$ [mm]	$s_{cr,sp}$ [mm]	$\psi_{h,sp}$	$f_{c,cyl}$ [N/mm^2]
2,161,046	338,875	960.0	1,920.0	1.217	50.00

h'_{ef} [mm]	$c'_{cr,sp}$ [mm]	$s'_{cr,sp}$ [mm]
181.9	291.1	582.1

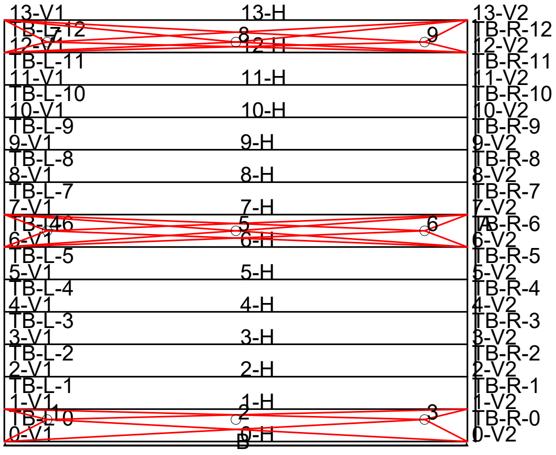
$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$	k_1
0.1	1.000	235.2	0.553	0.906	1.000	7.700

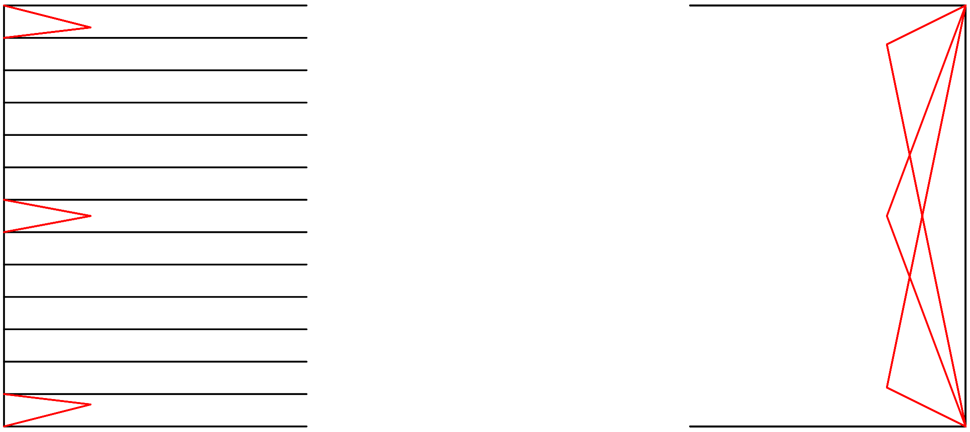
$N^0_{Rk,sp}$ [kN]	$\gamma_{M,sp}$	$N_{Rd,sp}$ [kN]	N_{Ed} [kN]
147.172	1.500	381.557	2,906.780

Group anchor ID
1, 3-9

1.3.4 Supplementary reinforcement - tension (EN 1992-4 section 7.2.1.2 and 7.2.1.9)

Strut and tie model





A

B

Rebar Forces

Rebar	Type	Orientation	Tension force [kN]
TB (surface reinforcement)	Straight	horizontal	64.326
0	Closed stirrup	vertical 1 (0-V1)	5.976
		vertical 2 (0-V2)	5.927
		horizontal (0-H)	7.272
1	Closed stirrup	vertical 1 (1-V1)	12.623

Rebar	Type	Orientation	Tension force [kN]
		vertical 2 (1-V2)	12.519
		horizontal (1-H)	9.350
2	Closed stirrup	vertical 1 (2-V1)	0.000
		vertical 2 (2-V2)	0.000
		horizontal (2-H)	0.000
3	Closed stirrup	vertical 1 (3-V1)	0.000
		vertical 2 (3-V2)	0.000
		horizontal (3-H)	0.000
4	Closed stirrup	vertical 1 (4-V1)	0.000
		vertical 2 (4-V2)	0.000
		horizontal (4-H)	0.000
5	Closed stirrup	vertical 1 (5-V1)	0.000
		vertical 2 (5-V2)	0.000
		horizontal (5-H)	0.000
6	Closed stirrup	vertical 1 (6-V1)	323.735
		vertical 2 (6-V2)	323.679
		horizontal (6-H)	567.983
7	Closed stirrup	vertical 1 (7-V1)	323.735
		vertical 2 (7-V2)	323.679
		horizontal (7-H)	567.983
8	Closed stirrup	vertical 1 (8-V1)	0.000
		vertical 2 (8-V2)	0.000
		horizontal (8-H)	0.000
9	Closed stirrup	vertical 1 (9-V1)	0.000
		vertical 2 (9-V2)	0.000
		horizontal (9-H)	0.000
10	Closed stirrup	vertical 1 (10-V1)	0.000

Rebar	Type	Orientation	Tension force [kN]
		vertical 2 (10-V2)	0.000
		horizontal (10-H)	0.000
11	Closed stirrup	vertical 1 (11-V1)	0.000
		vertical 2 (11-V2)	0.000
		horizontal (11-H)	0.000
12	Closed stirrup	vertical 1 (12-V1)	534.548
		vertical 2 (12-V2)	534.341
		horizontal (12-H)	1,044.303
13	Closed stirrup	vertical 1 (13-V1)	253.058
		vertical 2 (13-V2)	252.960
		horizontal (13-H)	699.257

Most unfavourable tolerance: 0.0 mm

1.3.4.1 Steel failure of longitudinal rebar

$$N_{Ed,re} \leq N_{Rd,re} = \frac{N_{Rk,re}}{\gamma_{Ms,re}}$$
$$N_{Rk,re} = A_{s,re} \cdot f_{yk,re}$$

$d_{s,re}$ [mm]	$A_{s,re}$ [mm^2]	$f_{yk,re}$ [N/mm^2]
10.0	79	500.00

$N_{Ed,re}$ [kN]	$N_{Rk,re}$ [kN]	$\gamma_{Ms,re}$	β_{re} [%]	$N_{Rd,re}$ [kN]
64.326	39.270	1.150	0	34.148

1.3.4.2 Steel failure of supplementary reinforcement, horizontal

$$N_{Ed,re} \leq N_{Rd,re} = \frac{N_{Rk,re}}{\gamma_{Ms,re}}$$
$$N_{Rk,re} = A_{s,re} \cdot f_{yk,re}$$

$d_{s,re}$ [mm]	$A_{s,re}$ [mm^2]	$f_{yk,re}$ [N/mm^2]
16.0	201	500.00

$N_{Ed,re}$ [kN]	$N_{Rk,re}$ [kN]	$\gamma_{Ms,re}$	β_{re} [%]	$N_{Rd,re}$ [kN]
1,044.303	100.531	1.150	0	87.418

1.3.4.3 Steel failure of supplementary reinforcement, vertical

$$N_{Ed,re} \leq N_{Rd,re} = \frac{N_{Rk,re}}{\gamma_{Ms,re}}$$

$$N_{Rk,re} = A_{s,re} \cdot f_{yk,re}$$

$d_{s,re}$ [mm]	$A_{s,re}$ [mm^2]	$f_{yk,re}$ [N/mm^2]
16.0	201	500.00

$N_{Ed,re}$ [kN]	$N_{Rk,re}$ [kN]	$\gamma_{Ms,re}$	β_{re} [%]	$N_{Rd,re}$ [kN]
534.548	100.531	1.150	0	87.418

1.3.4.4 Reinforcement anchorage inside of the breakout body, vertical

$$N_{ed,re} \leq N_{Rd,a}$$

$$N_{Rd,a} = \frac{l_1 \cdot \pi \cdot d_{s,re} \cdot f_{bd}}{\alpha_1 \cdot \alpha_2} \leq N_{Rd,re}$$

l_1 [mm]	$d_{s,re}$ [mm]	f_{bd} [N/mm^2]
487.0	16.0	4.28

α_1	α_2	β_{re} [%]
1.000	0.756	0

$N_{Ed,re}$ [kN]	$N_{Rd,a}$ [kN]
534.548	138.386

Splice length outside of the assumed failure cone, vertical

Load transfer from supplementary reinforcement to the structural member shall be verified by the responsible structural engineer.

$$l_0 = \alpha_1 \cdot \alpha_2 \cdot \alpha_{3,5} \cdot \alpha_6 \cdot l_{b,rqd} = \alpha_1 \cdot \alpha_2 \cdot \alpha_{3,5} \cdot \alpha_6 \cdot \frac{d_{s,re}}{4} \cdot \frac{\sigma_{sd,re}}{f_{bd}} \geq l_{0,min}$$

$$l_{0,min} = \max(0.3 \cdot \alpha_6 \cdot l_{b,rqd}\ ,\ 15 \cdot d_{s,re}\ ,\ 200.0\ \text{mm})$$

$$l_{b,rqd} = \frac{d_{s,re}}{4} \cdot \frac{\sigma_{sd,re}}{f_{bd}}$$

α_1	α_2	$\alpha_{3,5}$	α_6
0.700	0.700	1.000	1.500

$\sigma_{sd,re}$ [N/mm^2]	β_{re} [%]	l_0 [mm]	$l_{0,min}$ [mm]
2,658.63	0	1,828.3	1,119.4

1.4 Shear load (EN 1992-4, Section 7.2.2)

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel failure (without lever arm)*	91.348	179.520	51	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout failure*	91.348	94.898	97	OK
Concrete edge failure in direction x+**	354.050	57.329	618	not recommended

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

1.4.1 Steel failure (without lever arm)

$$V_{Ed} \leq V_{Rd,s} = \frac{V_{Rk,s}}{\gamma_{M,s}}$$ EN 1992-4, Table 7.2

$$V_{Rk,s} = k_7 \cdot V^0_{Rk,s}$$ EN 1992-4, Eq. (7.35)

$V^0_{Rk,s}$ [kN]	k_7	$V_{Rk,s}$ [kN]	$\gamma_{M,s}$	$V_{Rd,s}$ [kN]	V_{Ed} [kN]
224.400	1.000	224.400	1.250	179.520	91.348

1.4.2 Pryout failure (concrete cone relevant)

$V_{Ed} \le V_{Rd,cp} = \frac{V_{Rk,cp}}{\gamma_{M,c,p}}$	EN 1992-4, Table 7.2
$V_{Rk,cp} = k_8 \cdot \min\{N_{Rk,c}; N_{Rk,p}\}$	EN 1992-4, Eq. (7.39c)
$N_{Rk,c} = N^0_{Rk,c} \cdot \frac{A_{c,N}}{A^0_{c,N}} \cdot \psi_{s,N} \cdot \psi_{re,N} \cdot \psi_{ec1,N} \cdot \psi_{ec2,N} \cdot \psi_{M,N}$	EN 1992-4, Eq. (7.1)
$N^0_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1,5}$	EN 1992-4, Eq. (7.2)
$A^0_{c,N} = s_{cr,N} \cdot s_{cr,N}$	EN 1992-4, Eq. (7.3)
$\psi_{s,N} = 0.7 + 0.3 \cdot \frac{c}{c_{cr,N}} \le 1.00$	EN 1992-4, Eq. (7.4)
$\psi_{ec1,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{V,1}}{s_{cr,N}}\right)} \le 1.00$	EN 1992-4, Eq. (7.6)
$\psi_{ec2,N} = \frac{1}{1 + \left(\frac{2 \cdot e_{V,2}}{s_{cr,N}}\right)} \le 1.00$	EN 1992-4, Eq. (7.6)
$\psi_{M,N} = 1$	EN 1992-4, Eq. (7.7)
$h'_{ef} = \max\left(\frac{c_{max}}{c_{cr,N}}, \frac{s_{max}}{s_{cr,N}}\right) \cdot h_{ef}$	EN 1992-4, Eq. (7.9)

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	k_8	$f_{c,cyl}$ [N/mm^2]
241,145	338,875	900.0	1,800.0	1.500	50.00

h'_{ef} [mm]	$c'_{cr,N}$ [mm]	$s'_{cr,N}$ [mm]
194.0	291.1	582.1

$e_{c1,V}$ [mm]	$\psi_{ec1,N}$	$e_{c2,V}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$	$\psi_{M,N}$
0.0	1.000	0.0	1.000	0.906	1.000	1.000

k_1	$N^0_{Rk,c}$ [kN]	$\gamma_{M,c,p}$	$V_{Rd,cp}$ [kN]	V_{Ed} [kN]
7.700	147.172	1.500	94.898	91.348

Group anchor ID
3

1.4.3 Concrete edge failure in direction x+

$$V_{Ed} \leq V_{Rd,c} = \frac{V_{Rk,c}}{\gamma_{M,c}}$$ EN 1992-4, Table 7.2

$$V_{Rk,c} = k_T \cdot V^0_{Rk,c} \cdot \frac{A_{c,V}}{A^0_{c,V}} \cdot \psi_{s,V} \cdot \psi_{h,V} \cdot \psi_{\alpha,V} \cdot \psi_{ec,V} \cdot \psi_{re,V}$$ EN 1992-4, Eq. (7.40)

$$V^0_{Rk,c} = k_9 \cdot d^{\alpha}_{nom} \cdot l^{\beta}_f \cdot \sqrt{f_{ck}} \cdot c_1^{1,5}$$ EN 1992-4, Eq. (7.41)

$$\alpha = 0.1 \cdot \left(\frac{l_f}{c_1}\right)^{0,5}$$ EN 1992-4, Eq. (7.42)

$$\beta = 0.1 \cdot \left(\frac{d_{nom}}{c_1}\right)^{0,2}$$ EN 1992-4, Eq. (7.43)

$$A^0_{c,V} = 4.5 \cdot c_1^2$$ EN 1992-4, Eq. (7.44)

$$\psi_{s,V} = 0.7 + 0.3 \cdot \frac{c_2}{1.5 \cdot c_1} \leq 1.00$$ EN 1992-4, Eq. (7.45)

$$\psi_{h,V} = \left(\frac{1.5 \cdot c_1}{h}\right)^{0,5} \geq 1.00$$ EN 1992-4, Eq. (7.46)

$$\psi_{ec,V} = \frac{1}{1 + \left(\frac{2 \cdot e_V}{3 \cdot c_1}\right)} \leq 1.00$$ EN 1992-4, Eq. (7.47)

$$\psi_{\alpha,V} = \sqrt{\frac{1}{(\cos \alpha_V)^2 + (0.5 \cdot \sin \alpha_V)^2}} \geq 1.00$$ EN 1992-4, Eq. (7.48)

l_f [mm]	d_{nom} [mm]	k_9	α	β	$f_{c,cyl}$ [N/mm^2]
300.0	30.00	1.700	0.122	0.068	50.00

c_1 [mm]	$A_{c,V}$ [mm^2]	$A^0_{c,V}$ [mm^2]
200.0	469,278	180,000

$\psi_{s,V}$	$\psi_{h,V}$	α_V [°]	$\psi_{\alpha,V}$	$e_{c,V}$ [mm]	$\psi_{ec,V}$	$\psi_{re,V}$
0.900	1.000	25.37	1.077	371.6	0.447	1.000

$V^0_{Rk,c}$ [kN]	k_T	$\gamma_{M,c}$	$V_{Rd,c}$ [kN]	V_{Ed} [kN]
76.188	1.0	1.500	57.329	354.050

1.5 Combined tension and shear loads (EN 1992-4, Section 7.2.3)

Steel failure

β_N	β_V	α	Utilization $\beta_{N,V}$ [%]	Status
3.900	0.083	2.000	1,522	not recommended

$\beta_N^{\alpha} + \beta_V^{\alpha} \leq 1.0$

Concrete failure

β_N	β_V	α	Utilization $\beta_{N,V}$ [%]	Status
7.618	6.176	0.667	724	not recommended

$\beta_N^{\alpha} + \beta_V^{\alpha} \leq 1.0$

1.6 Warnings

- The anchor design methods in PROFIS Engineering require rigid baseplates as per current regulations (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 base plate 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 EN 1992-4, Annex A!
- Attention! In case of compressive anchor forces a buckling check as well as the proof of the local load transfer into and within the base material (incl. punching) has to be done separately.
- The design is only valid if the clearance hole in the fixture is not larger than the value given in Table 6.1 of EN 1992-4! For larger diameters of the clearance hole see section 6.2.2 of EN 1992-4!
- 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.
- Drilled hole cleaning must be performed according to instructions for use (blow twice with oil-free compressed air (min. 6 bar), brush twice, blow twice with oil-free compressed air (min. 6 bar)).
- Characteristic bond resistances depend on short- and long-term temperatures.
- Edge reinforcement is not required to avoid splitting failure
- Design is only valid if hole is filled to remove clearance, clearance as per EN 1992-4 Table 6.1
- The anchor design methods in PROFIS Engineering require rigid baseplates, as per current regulations (AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means that the baseplate should be sufficiently rigid to prevent load re-distribution to the anchors due to elastic/plastic displacements. The user accepts that the baseplate is considered close to rigid by engineering judgment."
- The characteristic bond resistances depend on the return period (service life in years): 50

1.7 Installation data

Baseplate, steel: S 355; E = 210,000.00 N/mm^2; f_{yk} = 355.00 N/mm^2

Profile: Pipe, 914 x 20; (L x W x T) = 914.0 mm x 914.0 mm x 20.0 mm

Hole diameter in the fixture: d_f = 33.0 mm

Plate thickness (input): 60.0 mm

Drilling method: Hammer drilled

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

Anchor type and size: HIT-HY 200-A + HAS-U 8.8 HDG M30

Item number: not available (insert) / 2022696 HIT-HY 200-A (mortar)

Maximum installation torque: 300 Nm

Hole diameter in the base material: 35.0 mm

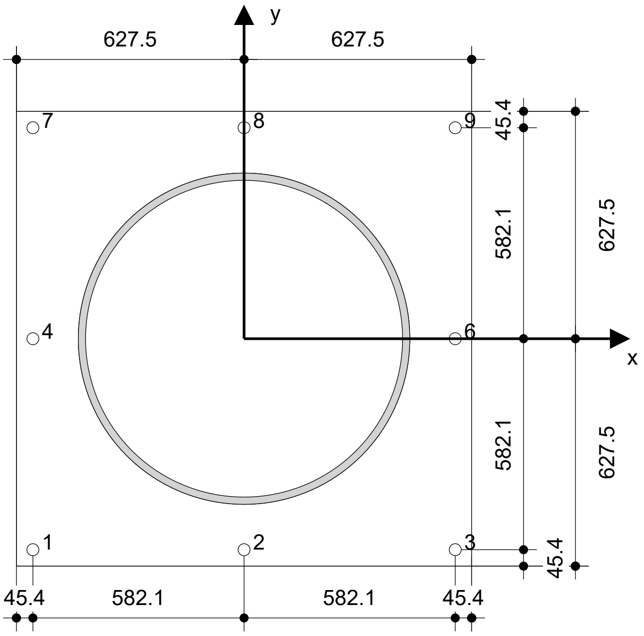
Hole depth in the base material: 600.0 mm

Minimum thickness of the base material: 670.0 mm

Hilti HAS-U threaded rod with HIT-HY 200 injection mortar with 600 mm embedment h_ef, M30, Hot dip galvanized, Hammer drilling installation per ETA 11/0493, with annular gaps filled with Hilti Filling Set or any suitable gap solutions

1.7.1 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 • Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-582.1	-582.1	200.0	1,364.3	200.0	1,364.3
2	0.0	-582.1	782.1	782.1	200.0	1,364.3
3	582.1	-582.1	1,364.3	200.0	200.0	1,364.3
4	-582.1	0.0	200.0	1,364.3	782.1	782.1
5	0.0	0.0	782.1	782.1	782.1	782.1

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
6	582.1	0.0	1,364.3	200.0	782.1	782.1
7	-582.1	582.1	200.0	1,364.3	1,364.3	200.0
8	0.0	582.1	782.1	782.1	1,364.3	200.0
9	582.1	582.1	1,364.3	200.0	1,364.3	200.0

Company:		Page:	16
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - 13 Sep 2023	Date:	15/09/2023
Fastening Point:			

2 Baseplate rigidity check

2.1 Input data

Baseplate:	Shape: Rectangular l_x x l_y x t = 1,255.0 mm x 1,255.0 mm x 60.0 mm Calculation: Baseplate Rigidity Check Material: S 355; F_y = 335.00 N/mm²; ε_{lim} = 5.00%
Anchor type and size:	HIT-HY 200-A + HAS-U 8.8 HDG M30, h_{ef} = 600.0 mm
Anchor stiffness:	The anchor is modelled considering stiffness values determined from load displacement curves tested in an independent laboratory. Please note that no simple replacement of the anchor is possible as the anchor stiffness has a major impact on the load distribution results.
Design method:	EN based design using component-based FEM
Stand-off installation:	e_b = 0.0 mm (No stand-off); t = 60.0 mm
Profile:	914 x 20; (L x W x T x FT) = 914.0 mm x 914.0 mm x 20.0 mm x - Material: S 355; F_y = 355.00 N/mm²; ε_{lim} = 5.00% Eccentricity x: 0.0 mm Eccentricity y: 0.0 mm
Base material:	Cracked concrete; C50/60; $f_{c,cyl}$ = 50.00 N/mm²; h = 1,000.0 mm; E = 37,000.00 N/mm²; G = 15,416.67 N/mm²; v = 0.20
Welds (profile to baseplate):	Type of redistribution: Plastic Material: S 235
Mesh size:	Number of elements on edge: 8 Min. size of element: 10.0 mm Max size of element: 50.0 mm

2.2 Baseplate plate classification

Results below are displayed for the decisive load combinations: Combination 1

Anchor tension forces	Equivalent rigid baseplate (CBFEM)	Component-based Finite Element Method (CBFEM) baseplate
Anchor 1	-0.030 kN	18.617 kN
Anchor 2	-0.030 kN	-0.031 kN
Anchor 3	-0.030 kN	18.429 kN
Anchor 4	188.574 kN	335.211 kN
Anchor 5	188.617 kN	624.544 kN
Anchor 6	188.612 kN	335.073 kN
Anchor 7	553.762 kN	204.208 kN
Anchor 8	553.860 kN	1,166.866 kN
Anchor 9	553.800 kN	203.833 kN

User accepted to consider the selected baseplate as rigid by his/her engineering judgement. This means the anchor design guidelines can be applied.

2.3 Warnings

- By using the CBFEM calculation functionality of PROFIS Engineering you may act outside the applicable design codes and your specified baseplate may not behave rigidly. Please, have the results validated by a professional designer and/or structural engineer to ensure suitability and adequacy for your specific jurisdiction and project requirements.
- The anchor is modelled considering stiffness values determined from load displacement curves tested in an independent laboratory. Please note that no simple replacement of the anchor is possible as the anchor stiffness has a major impact on the load distribution results.

Company:		Page:	18
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - 13 Sep 2023	Date:	15/09/2023
Fastening Point:			

3 Summary of results

	Load combination	Max. utilisation	Status
Anchors	Combination 1	1,522%	NOT OK

Fastening does not meet the design criteria!

4 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.