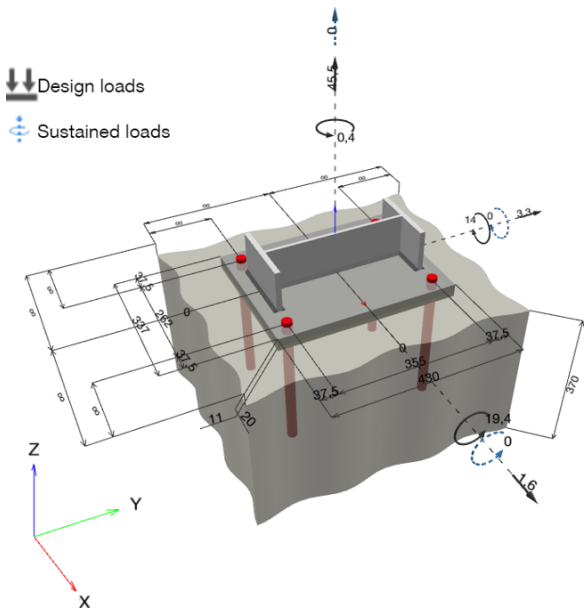
Specifier's comments: Hammer drilling is possible, too.

1 Input data

Anchor type and size:	**HIT-RE 500 V4 + HAS-U 8.8 M24**
Return period (service life in years):	50
Item number:	2237081 HAS-U 8.8 M24x450 (insert) / 2287552 HIT-RE 500 V4 (mortar)
Effective embedment depth:	$h_{ef,act}$ = 300.0 mm ($h_{ef,limit}$ = - mm)
Material:	8.8
Approval No.:	ETA 20/0541
Issued I Valid:	04.09.2021 | -
Proof:	Design Method EN 1992-4, Chemical+ Seismic (Section 9, Annex C)
Seismic performance category:	C2
Seismic proof type:	9.2(3) a2) elastic design
Seismic load percentage <=20%:	no
Required DLS displacements:	Tension load $\delta_{N,req(DLS)}$ = 0.400 mm, Shear load $\delta_{V,req(DLS)}$ = 3.500 mm
Stand-off installation:	without clamping (anchor); restraint level (baseplate): 2.00; e_b = 11.0 mm; t = 20.0 mm
	Hilti Grout: CB-G EG, epoxy, $f_{c,Grout}$ = 120.00 N/mm^2
Baseplate^{CBFEM}:	l_x x l_y x t = 337.0 mm x 430.0 mm x 20.0 mm;
Profile:	IPE, IPE 360 ; (L x W x T x FT) = 360.0 mm x 170.0 mm x 8.0 mm x 12.7 mm
Base material:	cracked concrete, C30/37, $f_{c,cyl}$ = 30.00 N/mm^2; h = 370.0 mm, Temp. short/long: 40/24 °C, User-defined partial material safety factor γ_c = 1.500
Installation:	**Diamond cored hole with roughening, Installation condition: Dry**
Reinforcement:	Reinforcement spacing < 150 mm (any Ø) or < 100 mm (Ø <= 10 mm)
	with longitudinal edge reinforcement d >= 12.0 [mm]
	Reinforcement to control splitting acc. to EN 1992-4, 7.2.1.7 (2) b) 2) present

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

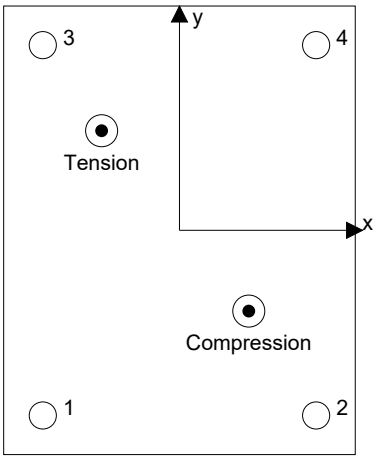
Geometry [mm] & Loading [kN, kNm]



1.1 Load combination

Case	Description	Forces [kN] / Moments [kNm]	Seismic	Fire	Max. Util. Anchor [%]
1	3	N = 45.500; V_x = 1.600; V_y = 3.300; M_x = 19.400; M_y = 14.000; M_z = 0.400; N_{sus} = 0.000; $M_{x,sus}$ = 0.000; $M_{y,sus}$ = 0.000;	C2	no	88
2	4	N = 0.800; V_x = 1.400; V_y = 3.100; M_x = 19.600; M_y = 14.000; M_z = 0.500; N_{sus} = 0.000; $M_{x,sus}$ = 0.000; $M_{y,sus}$ = 0.000;	C2	no	69

2 Load case/Resulting anchor forces



Controlling load case: 1 3

Anchor reactions [kN]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	26.842	0.931	0.767	0.527
2	-0.005	1.284	0.824	0.985
3	64.288	1.244	1.048	0.669
4	24.992	1.528	-1.040	1.119

resulting tension force in (x/y)=(-74.6/95.4): 116.116 [kN]
resulting compression force in (x/y)=(66.5/-77.4): 76.245 [kN]

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

3 Tension load (EN 1992-4, Section 7.2.1, Annex C, Section C.5)

	Load [kN]	Capacity [kN]	Utilization β_N [%]	Status
Steel failure*	64.288	188.267	35	OK
Combined pullout-concrete cone failure**	116.121	136.425	86	OK
Concrete Breakout failure**	116.121	159.917	73	OK
Splitting failure**	N/A	N/A	N/A	N/A

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

3.1 Steel failure

$N^0_{Rk,s,eq}$ [kN]	α_{gap}	α_{eq}	$N_{Rk,s,eq}$ [kN]
282.400	1.000	1.000	282.400

$\gamma_{M,s,eq}$	$N_{Rd,s,eq}$ [kN]	$N_{Ed,eq}$ [kN]	$\delta_{N,req(DLS)}$ [mm]	$\delta_{N,eq(DLS)}$ [mm]	$N_{Rd,s,eq,reduced}$ [kN]
1.500	188.267	64.288	0.400	0.400	188.267

3.2 Combined pullout-concrete cone failure

$A_{p,N}$ [mm²]	$A^0_{p,N}$ [mm²]	$\tau_{Rk,ucr,20}$ [N/mm²]	$s_{cr,Np}$ [mm]	$c_{cr,Np}$ [mm]	c_{min} [mm]	$f_{c,cyl}$ [N/mm²]
879,089	460,426	15.00	678.5	339.3	∞	30.00

$\psi_{c,eq}$	$\tau_{Rk,eq}$ [N/mm²]	k_3	$\tau_{Rk,c}$ [N/mm²]	$\psi^0_{g,Np}$	$\psi_{g,Np}$
1.000	6.00	7.700	9.69	1.375	1.122

$e_{c1,N}$ [mm]	$\psi_{ec1,Np}$	$e_{c2,N}$ [mm]	$\psi_{ec2,Np}$	$\psi_{s,Np}$	$\psi_{re,Np}$
30.9	0.916	36.3	0.903	1.000	1.000

ψ^0_{sus}	α_{sus}	ψ_{sus}
0.880	0.000	1.000

$N^0_{Rk,p}$ [kN]	α_{gap}	α_{eq}	$N_{Rk,p,eq}$ [kN]
135.717	1.000	0.850	204.638

$\gamma_{M,p,eq}$	$N_{Rd,p,eq}$ [kN]	$N_{Ed,eq}$ [kN]	$\delta_{N,req(DLS)}$ [mm]	$\delta_{N,eq(DLS)}$ [mm]	$N_{Rd,p,eq,reduced}$ [kN]
1.500	136.425	116.121	0.400	0.400	136.425

Group anchor ID
1, 3, 4

3.3 Concrete Breakout failure

$A_{c,N}$ [mm²]	$A^0_{c,N}$ [mm²]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	$f_{c,cyl}$ [N/mm²]
1,365,300	810,000	450.0	900.0	30.00

$e_{c1,N}$ [mm]	$\psi_{ec1,N}$	$e_{c2,N}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$
30.9	0.936	36.3	0.925	1.000	1.000

z [mm]	$\psi_{M,N}$	k_1	$N^0_{Rk,c}$ [kN]	α_{gap}	α_{eq}	$N_{Rk,c,eq}$ [kN]
223.1	1.000	7.700	219.146	1.000	0.750	239.875

$\gamma_{M,c,eq}$	$N_{Rd,c,eq}$ [kN]	$N_{Ed,eq}$ [kN]	$\delta_{N,req(DLS)}$ [mm]	$\delta_{N,eq(DLS)}$ [mm]	$N_{Rd,c,eq,reduced}$ [kN]
1.500	159.917	116.121	0.400	0.400	159.917

Group anchor ID
1, 3, 4

4 Shear load (EN 1992-4, Section 7.2.2, Annex C, Section C.5)

	Load [kN]	Capacity [kN]	Utilization β_V [%]	Status
Steel failure (without lever arm)*	1.528	30.600	5	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout failure**	3.667	146.465	3	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)

$V^0_{Rk,s,eq}$ [kN]	k_7	α_{gap}	α_{eq}	$V_{Rk,s,eq}$ [kN]
90.000	1.000	0.500	0.850	38.250

$\gamma_{M,s,eq}$	$V_{Rd,s,eq}$ [kN]	$V_{Ed,eq}$ [kN]	$\delta_{V,req(DLS)}$ [mm]	$\delta_{V,eq(DLS)}$ [mm]	$V_{Rd,s,eq,reduced}$ [kN]
1.250	30.600	1.528	3.500	3.500	30.600

4.2 Pryout failure (concrete cone relevant)

$A_{c,N}$ [mm^2]	$A^0_{c,N}$ [mm^2]	$c_{cr,N}$ [mm]	$s_{cr,N}$ [mm]	k_8	$f_{c,cyl}$ [N/mm^2]
1,458,310	810,000	450.0	900.0	2.000	30.00

$e_{c1,V}$ [mm]	$\psi_{ec1,N}$	$e_{c2,V}$ [mm]	$\psi_{ec2,N}$	$\psi_{s,N}$	$\psi_{re,N}$	$\psi_{M,N}$
98.1	0.821	47.6	0.904	1.000	1.000	1.000

k_1	$N^0_{Rk,c}$ [kN]	α_{gap}	α_{eq}	$V^0_{Rk,cp,eq}$ [kN]	$V_{Rk,cp,eq}$ [kN]
7.700	219.146	0.500	0.750	585.861	219.698

$\gamma_{M,c,p,eq}$	$V_{Rd,cp,eq}$ [kN]	$V_{Ed,eq}$ [kN]	$\delta_{V,req(DLS)}$ [mm]	$\delta_{V,eq(DLS)}$ [mm]	$V_{Rd,cp,eq,reduced}$ [kN]
1.500	146.465	3.667	3.500	3.500	146.465

Group anchor ID
1-4

5 Combined tension and shear loads (EN 1992-4, Section 7.2.3 Annex C, Section C.5 (3))

Steel failure

β_N	β_V	k_{15}	Utilization $\beta_{N,V}$ [%]	Status
0.341	0.041	1.000	39	OK

$\beta_N^{k15} + \beta_V^{k15} \leq 1.0$

Concrete failure

β_N	β_V	k_{15}	Utilization $\beta_{N,V}$ [%]	Status
0.851	0.025	1.000	88	OK

$\beta_N^{k15} + \beta_V^{k15} \leq 1.0$

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!
- Check your national regulations for proper selection of the seismic performance category!
- 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.
- 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 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
- Warning: The grout has to be applied on roughened concrete surface according to EN 1992-1-1, section 6.2.5

Fastening meets the design criteria!

7 Installation data

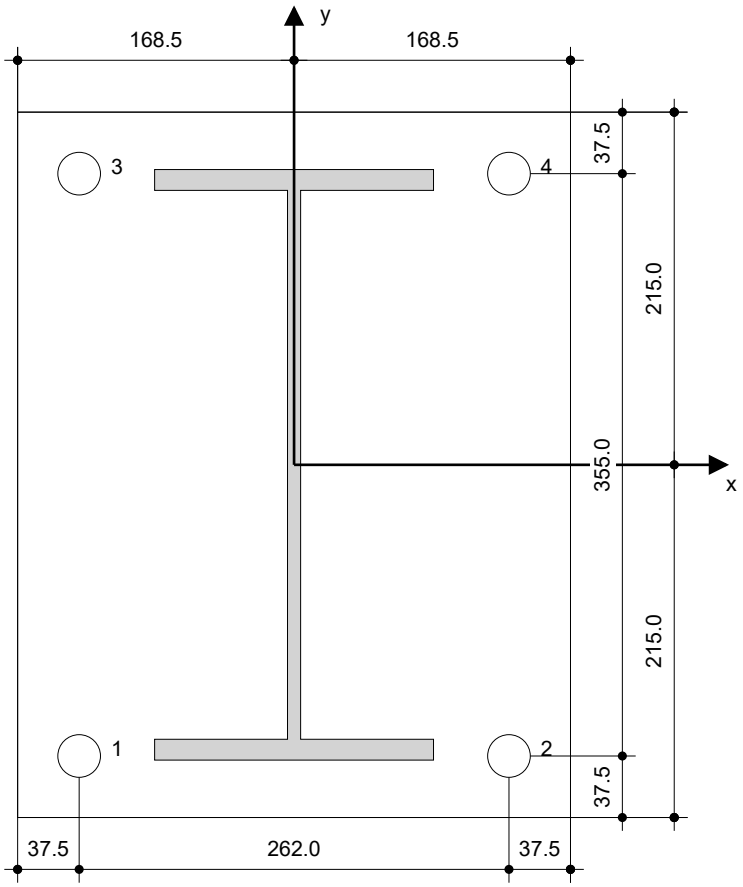
Baseplate, steel: S 355; E = 210,000.00 N/mm^2; f_{yk} = 355.00 N/mm^2
Profile: IPE, IPE 360 ; (L x W x T x FT) = 360.0 mm x 170.0 mm x 8.0 mm x 12.7 mm
Hole diameter in the fixture: d_f = 26.0 mm
Plate thickness (input): 20.0 mm
Drilling method: Core drilled + Roughening tool
Cleaning: Compressed air cleaning of the drilled hole according to instructions for use is required

Anchor type and size: HIT-RE 500 V4 + HAS-U 8.8 M24
Item number: 2237081 HAS-U 8.8 M24x450 (insert) / 2287552 HIT-RE 500 V4 (mortar)
Maximum installation torque: 200 Nm
Hole diameter in the base material: 28.0 mm
Hole depth in the base material: 300.0 mm
Minimum thickness of the base material: 356.0 mm

Hilti HAS-U threaded rod with HIT-RE 500 V4 injection mortar with 300 mm embedment h_ef, M24, Steel galvanized, Core drilled (with Roughening Tool) installation per ETA 20/0541

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Diamond core rig • Roughening tool	• Compressed air with required accessories to blow from the bottom of the hole	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [mm]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-131.0	-177.5	-	-	-	-
2	131.0	-177.5	-	-	-	-
3	-131.0	177.5	-	-	-	-
4	131.0	177.5	-	-	-	-

8 Remarks; Your Cooperation Duties

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