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Design:	Concrete - Oct 10, 2022	Date:	10/12/2022
Fastening point:			

Specifier's comments:

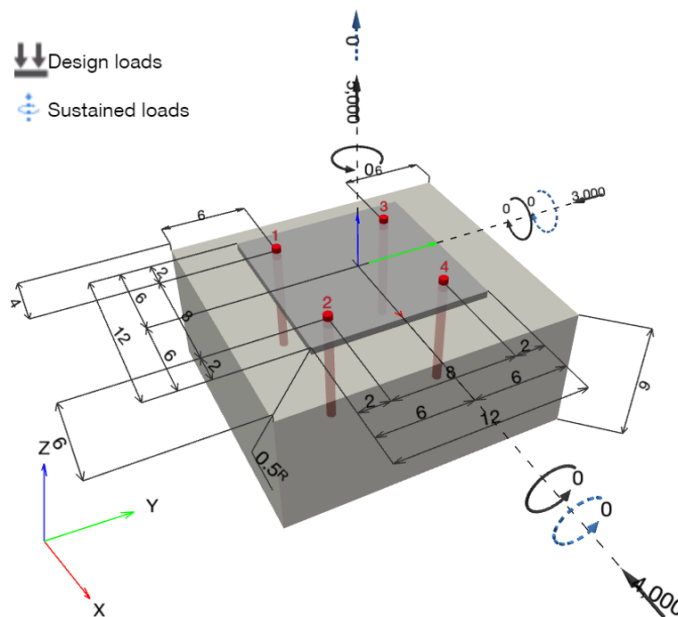
1 Input data



Anchor type and diameter:	HIT-HY 200 V3 + HAS-E 5/8
Item number:	385429 HAS 5.8 5/8"x9" (element) / 2334276 HIT-HY 200-R V3 (adhesive)
Effective embedment depth:	$h_{ef,act} = 7.500$ in. ($h_{ef,limit} = -$ in.)
Material:	5.8
Evaluation Service Report:	ESR-4868
Issued Valid:	11/1/2021 11/1/2022
Proof:	Design Method ACI 318-19 / Chem
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.
Anchor plate ^R :	$l_x \times l_y \times t = 12.000$ in. x 12.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	uncracked concrete, 2500, $f'_c = 2,500$ psi; $h = 9.000$ in., Temp. short/long: 32/32 °F
Installation:	hammer drilled hole, Installation condition: Dry
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar

^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 5,000; V _x = -4,000; V _y = -3,000; M _x = 0; M _y = 0; M _z = 0;	no	135

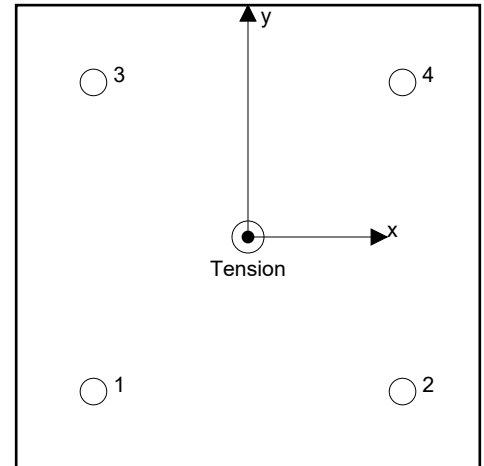
2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	1,250	1,250	-1,000	-750
2	1,250	1,250	-1,000	-750
3	1,250	1,250	-1,000	-750
4	1,250	1,250	-1,000	-750

max. concrete compressive strain: - [%]
 max. concrete compressive stress: - [psi]
 resulting tension force in (x/y)=(0.000/0.000): 5,000 [lb]
 resulting compression force in (x/y)=(0.000/0.000): 0 [lb]



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

3 Tension load

	Load N _{ua} [lb]	Capacity ϕ N _n [lb]	Utilization $\beta_N = N_{ua} / \phi N_n$	Status
Steel Strength*	1,250	10,650	12	OK
Bond Strength**	5,000	9,214	55	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	5,000	8,047	63	OK

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



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3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-4868
 $\phi N_{sa} \geq N_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,N}$ [in. ²]	f_{uta} [psi]
0.23	72,500

Calculations

N_{sa} [lb]
16,385

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
16,385	0.650	10,650	1,250

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3.2 Bond Strength

$$N_{ag} = \left(\frac{A_{Na}}{A_{Na0}} \right) \Psi_{ec1,Na} \Psi_{ec2,Na} \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} \quad \text{ACI 318-19 Eq. (17.6.5.1b)}$$

$$\phi N_{ag} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

 A_{Na} see ACI 318-19, Section 17.6.5.1, Fig. R 17.6.5.1(b)

$$A_{Na0} = (2 c_{Na})^2 \quad \text{ACI 318-19 Eq. (17.6.5.1.2a)}$$

$$c_{Na} = 10 d_a \sqrt{\frac{\tau_{uncr}}{1100}} \quad \text{ACI 318-19 Eq. (17.6.5.1.2b)}$$

$$\Psi_{ec,Na} = \left(\frac{1}{1 + \frac{e_N}{c_{Na}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.3.1)}$$

$$\Psi_{ed,Na} = 0.7 + 0.3 \left(\frac{c_{a,min}}{c_{Na}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.4.1b)}$$

$$\Psi_{cp,Na} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.5.5.1b)}$$

$$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \pi \cdot d_a \cdot h_{ef} \quad \text{ACI 318-19 Eq. (17.6.5.2.1)}$$

Variables

$\tau_{k,c,uncr}$ [psi]	d_a [in.]	h_{ef} [in.]	$c_{a,min}$ [in.]	$\alpha_{overhead}$	$\tau_{k,c}$ [psi]
2,220	0.625	7.500	4.000	1.000	2,220
$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	c_{ac} [in.]	λ_a		
0.000	0.000	19.627	1.000		

Calculations

c_{Na} [in.]	A_{Na} [in. ²]	A_{Na0} [in. ²]	$\Psi_{ed,Na}$
8.839	360.00	312.50	0.836
$\Psi_{ec1,Na}$	$\Psi_{ec2,Na}$	$\Psi_{cp,Na}$	N_{ba} [lb]
1.000	1.000	0.450	32,692

Results

N_{ag} [lb]	ϕ_{bond}	ϕN_{ag} [lb]	N_{ua} [lb]
14,175	0.650	9,214	5,000



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3.3 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}} \right) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \quad \text{ACI 318-19 Eq. (17.6.2.1b)}$$

$$\phi N_{cbg} \geq N_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

A_{Nc} see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-19 Eq. (17.6.2.1.4)}$$

$$\Psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.3.1)}$$

$$\Psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.4.1b)}$$

$$\Psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.6.1b)}$$

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \quad \text{ACI 318-19 Eq. (17.6.2.2.1)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\Psi_{c,N}$
4.000	0.000	0.000	4.000	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psij]	
19.627	24	1.000	2,500	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\Psi_{ec1,N}$	$\Psi_{ec2,N}$	$\Psi_{ed,N}$	$\Psi_{cp,N}$	N_b [lb]
360.00	144.00	1.000	1.000	0.900	0.573	9,600

Results

N_{cbg} [lb]	$\phi_{concrete}$	ϕN_{cbg} [lb]	N_{ua} [lb]
12,381	0.650	8,047	5,000



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4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	1,250	5,898	22	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Concrete Breakout Strength controls)**	5,000	17,333	29	OK
Concrete edge failure in direction y-**	5,000	5,034	100	OK

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

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-4868
 $\phi V_{steel} \geq V_{ua}$ ACI 318-19 Table 17.5.2

Variables

$A_{se,v}$ [in. ²]	f_{uta} [psi]
0.23	72,500

Calculations

V_{sa} [lb]
9,830

Results

V_{sa} [lb]	ϕ_{steel}	ϕV_{sa} [lb]	V_{ua} [lb]
9,830	0.600	5,898	1,250



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4.2 Pryout Strength (Concrete Breakout Strength controls)

$$V_{cp,g} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \right] \quad \text{ACI 318-19 Eq. (17.7.3.1b)}$$

$$\phi V_{cp,g} \geq V_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

A_{Nc} see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-19 Eq. (17.6.2.1.4)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.3.1)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.4.1b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.6.2.6.1b)}$$

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \quad \text{ACI 318-19 Eq. (17.6.2.2.1)}$$

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	4.000	0.000	0.000	4.000
$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	19.627	24	1.000	2,500

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
360.00	144.00	1.000	1.000	0.900	0.573	9,600

Results

$V_{cp,g}$ [lb]	$\phi_{concrete}$	$\phi V_{cp,g}$ [lb]	V_{ua} [lb]
24,761	0.700	17,333	5,000

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4.3 Concrete edge failure in direction y-

$$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}} \right) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} \Psi_{parallel,V} V_b \quad \text{ACI 318-19 Eq. (17.7.2.1b)}$$

$$\phi V_{cbg} \geq V_{ua} \quad \text{ACI 318-19 Table 17.5.2}$$

$$A_{Vc} \text{ see ACI 318-19, Section 17.7.2.1, Fig. R 17.7.2.1(b)}$$

$$A_{Vc0} = 4.5 c_{a1}^2 \quad \text{ACI 318-19 Eq. (17.7.2.1.3)}$$

$$\Psi_{ec,V} = \left(\frac{1}{1 + \frac{e_v}{1.5c_{a1}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.3.1)}$$

$$\Psi_{ed,V} = 0.7 + 0.3 \left(\frac{c_{a2}}{1.5c_{a1}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.4.1b)}$$

$$\Psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.6.1)}$$

$$V_b = \left(7 \left(\frac{l_e}{d_a} \right)^{0.2} \sqrt{d_a} \right) \lambda_a \sqrt{f'_c} c_{a1}^{1.5} \quad \text{ACI 318-19 Eq. (17.7.2.2.1a)}$$

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\Psi_{c,V}$	h_a [in.]
6.000	4.000	0.000	1.400	9.000
l_e [in.]	λ_a	d_a [in.]	f'_c [psi]	$\Psi_{parallel,V}$
5.000	1.000	0.625	2,500	1.000

Calculations

A_{Vc} [in. ²]	A_{Vc0} [in. ²]	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{h,V}$	V_b [lb]
162.00	162.00	1.000	0.833	1.000	6,164

Results

V_{cbg} [lb]	$\phi_{concrete}$	ϕV_{cbg} [lb]	V_{ua} [lb]
7,191	0.700	5,034	5,000

5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.621	0.993	1.000	135	not recommended

$$\beta_{NV} = (\beta_N + \beta_V) / 1.2 \leq 1$$



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6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates 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 anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor 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!
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- Design Strengths of adhesive anchor systems are influenced by the cleaning method. Refer to the INSTRUCTIONS FOR USE given in the Evaluation Service Report for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to <https://submittals.us.hilti.com/PROFISAnchorDesignGuide/>
- Installation of Hilti adhesive anchor systems shall be performed by personnel trained to install Hilti adhesive anchors. Reference ACI 318-19, Section 26.7.

Fastening does not meet the design criteria!

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7 Installation data

Profile: no profile

Hole diameter in the fixture: $d_f = 0.687$ in.

Plate thickness (input): 0.500 in.

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 diameter: HIT-HY 200 V3 + HAS-E 5/8
 Item number: 385429 HAS 5.8 5/8"x9" (element) / 2334276
 HIT-HY 200-R V3 (adhesive)

Maximum installation torque: 720 in.lb

Hole diameter in the base material: 0.750 in.

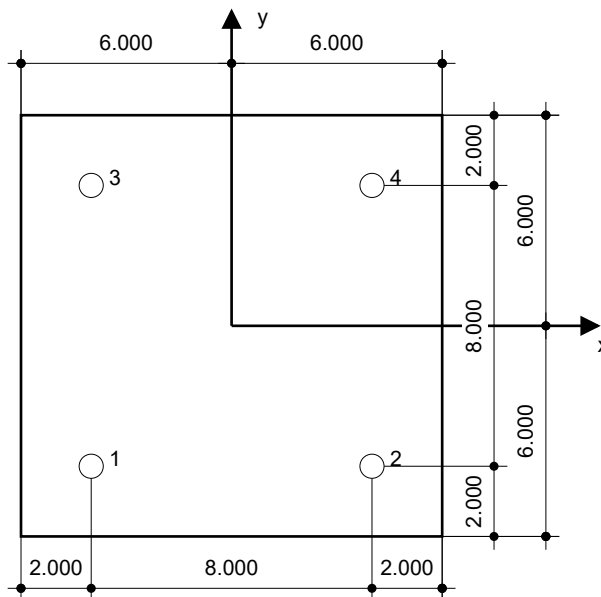
Hole depth in the base material: 7.500 in.

Minimum thickness of the base material: 9.000 in.

5/8 Hilti HAS Carbon steel threaded rod with Hilti HIT-HY 200 V3 Safe Set System

7.1 Recommended accessories

Drilling	Cleaning	Setting
<ul style="list-style-type: none"> • Suitable Rotary Hammer • Properly sized drill bit 	<ul style="list-style-type: none"> • Compressed air with required accessories to blow from the bottom of the hole • Proper diameter wire brush 	<ul style="list-style-type: none"> • Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [in.]

Anchor	x	y	C _{-x}	C _{+x}	C _{-y}	C _{+y}
1	-4.000	-4.000	4.000	14.000	6.000	14.000
2	4.000	-4.000	12.000	6.000	6.000	14.000
3	-4.000	4.000	4.000	14.000	14.000	6.000
4	4.000	4.000	12.000	6.000	14.000	6.000



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8 Remarks; Your Cooperation Duties

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