



Anchor Designer™  
Software  
Version 2.9.7376.4

Company:	Bay Area Retrofit	Date:	10/19/2020
Engineer:		Page:	1/5
Project:	Stemwall Examples		
Address:			
Phone:	510-418-1676		
E-mail:	howard@bayarearetrofit.com		

### 1. Project information

Customer company: Howard  
Customer contact name: Howard Cook M.A.  
Customer e-mail: howard@bayarearetrofit.com  
Comment:

Project description: Stemwall tension anchor examples  
Location:  
Fastening description:

### 2. Input Data & Anchor Parameters

#### General

Design method: ACI 318-14  
Units: Imperial units

#### Anchor Information:

Anchor type: Bonded anchor  
Material: F1554 Grade 36  
Diameter (inch): 0.625  
Effective Embedment depth,  $h_{ef}$  (inch): 12.000  
Code report: ICC-ES ESR-4057  
Anchor category: -  
Anchor ductility: Yes  
 $h_{min}$  (inch): 13.38  
 $c_{ac}$  (inch): 31.79  
 $C_{min}$  (inch): 1.75  
 $S_{min}$  (inch): 3.00

#### Base Material

Concrete: Normal-weight  
Concrete thickness,  $h$  (inch): 15.00  
State: Cracked  
Compressive strength,  $f'_c$  (psi): 2500  
 $\Psi_{c,v}$ : 1.0  
Reinforcement condition: B tension, B shear  
Supplemental reinforcement: Not applicable  
Reinforcement provided at corners: No  
Ignore concrete breakout in tension: No  
Ignore concrete breakout in shear: No  
Hole condition: Dry concrete  
Inspection: Periodic  
Temperature range, Short/Long: 176/110°F  
Ignore 6do requirement: Not applicable  
Build-up grout pad: No

#### Recommended Anchor

Anchor Name: SET-3G - SET-3G w/ 5/8"Ø F1554 Gr. 36  
Code Report: ICC-ES ESR-4057



Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

Simpson Strong-Tie Company Inc. 5956 W. Las Positas Boulevard Pleasanton, CA 94588 Phone: 925.560.9000 Fax: 925.847.3871 www.strongtie.com



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**Load and Geometry**

Load factor source: ACI 318 Section 5.3

Load combination:  $U = 0.9D + 1.0E$

Seismic design: Yes

Anchors subjected to sustained tension: No

Ductility section for tension: 17.2.3.4.3 (d) is satisfied

Ductility section for shear: 17.2.3.5.3 (c) is satisfied

$\Omega_0$  factor: 2.5

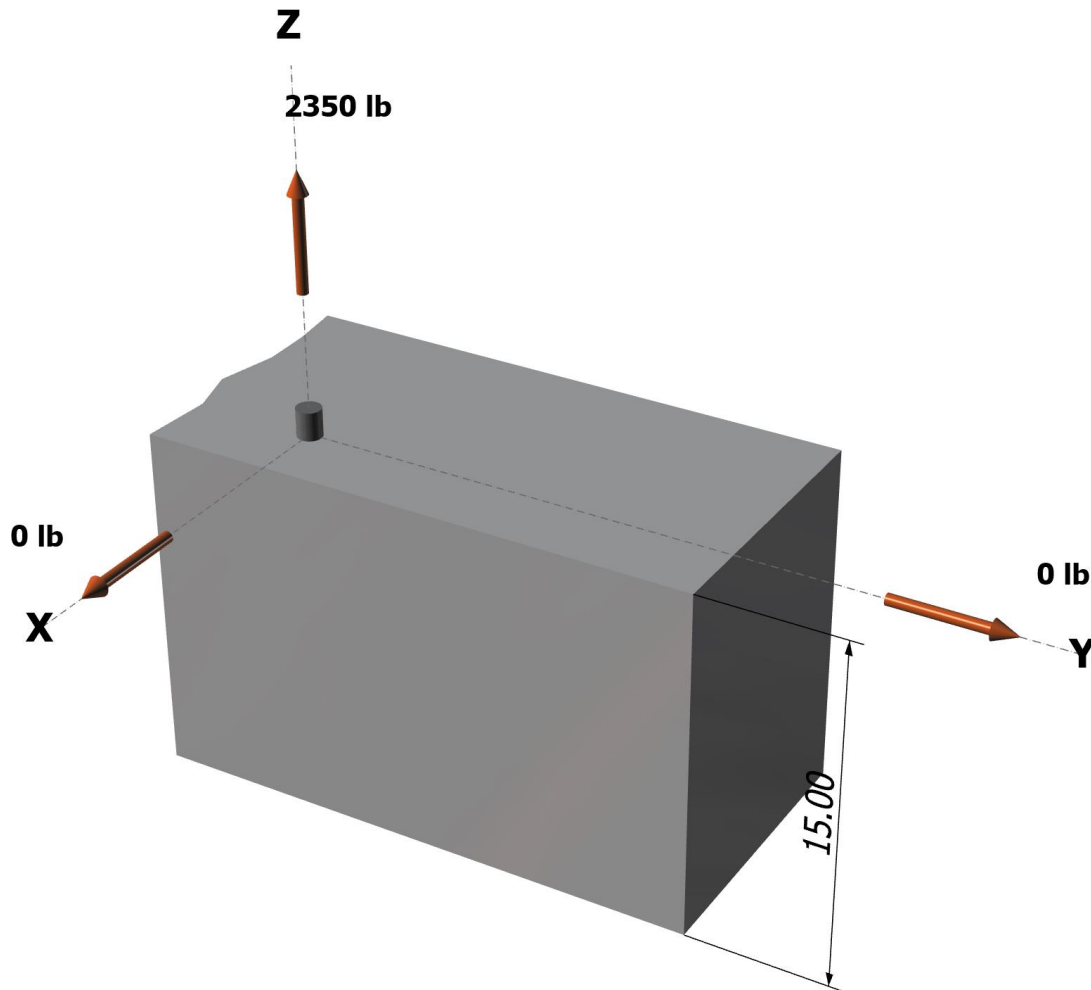
Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: Yes

Service level loads:

	D	E	Strength level loads
$N_a$ [lb]:	0	940	2350
$V_{ax}$ [lb]:	0	0	0
$V_{ay}$ [lb]:	0	0	0

<Figure 1>

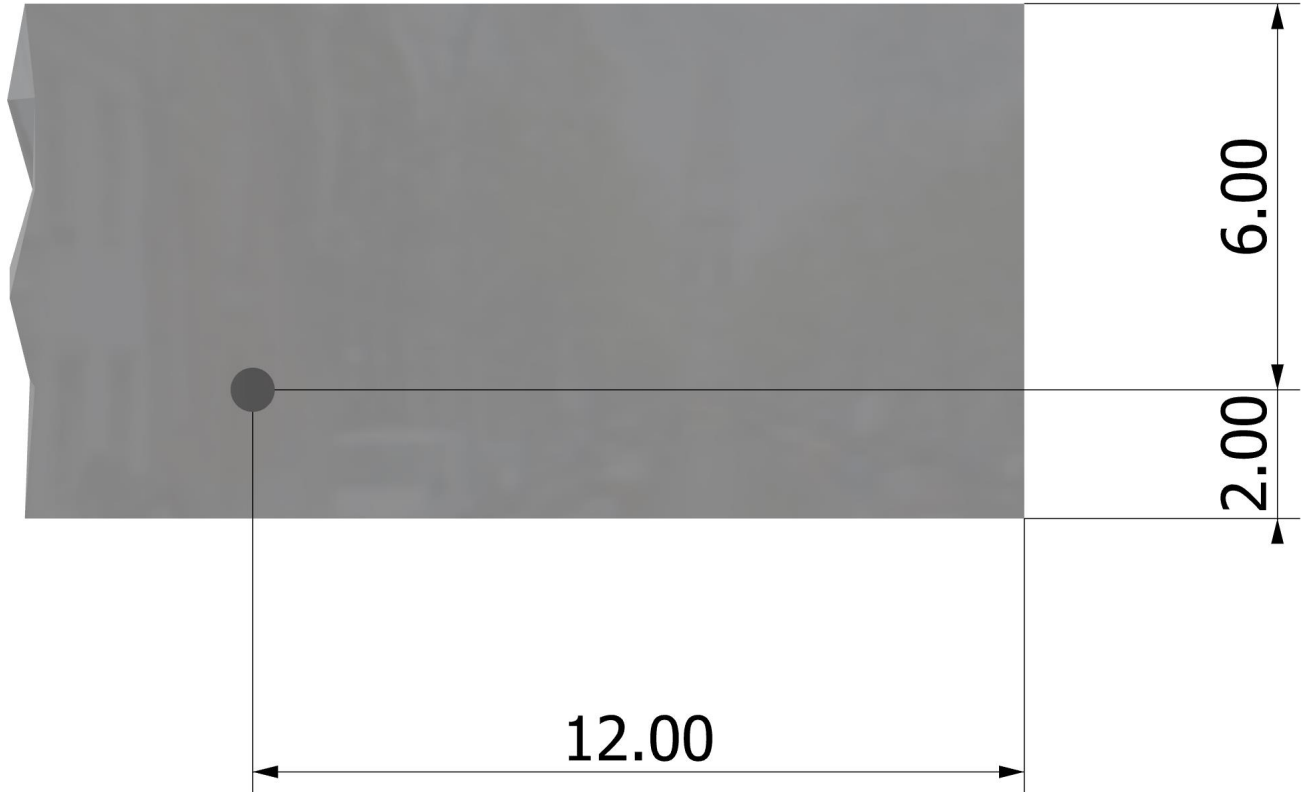


Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



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<Figure 2>





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### 3. Resulting Anchor Forces

Anchor	Tension load, N <sub>ua</sub> (lb)	Shear load x, V <sub>uax</sub> (lb)	Shear load y, V <sub>uay</sub> (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	2350.0	0.0	0.0	0.0
Sum	2350.0	0.0	0.0	0.0

Maximum concrete compression strain (%): 0.00  
 Maximum concrete compression stress (psi): 0  
 Resultant tension force (lb): 2350  
 Resultant compression force (lb): 0  
 Eccentricity of resultant tension forces in x-axis, e'<sub>Nx</sub> (inch): 0.00  
 Eccentricity of resultant tension forces in y-axis, e'<sub>Ny</sub> (inch): 0.00

### 4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N <sub>sa</sub> (lb)	φ	φN <sub>sa</sub> (lb)
13110	0.75	9833

### 5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

k <sub>c</sub>	λ <sub>a</sub>	f' <sub>c</sub> (psi)	h <sub>ef</sub> (in)	N <sub>b</sub> (lb)
17.0	1.00	2500	8.000	19233

$$0.75 \phi N_{cb} = 0.75 \phi (A_{Nc} / A_{Nco}) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. 17.3.1 \& Eq. 17.4.2.1a)}$$

A <sub>Nc</sub> (in <sup>2</sup> )	A <sub>Nco</sub> (in <sup>2</sup> )	c <sub>a,min</sub> (in)	Ψ <sub>ed,N</sub>	Ψ <sub>c,N</sub>	Ψ <sub>cp,N</sub>	N <sub>b</sub> (lb)	φ	0.75 φN <sub>cb</sub> (lb)
192.00	576.00	2.00	0.750	1.00	1.000	19233	0.65	2344

### 6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$$\tau_{k,cr} = \tau_{k,cr} f_{short-term} K_{sat} (f'_c / 2,500)^n \alpha_{N,seis}$$

τ <sub>k,cr</sub> (psi)	f <sub>short-term</sub>	K <sub>sat</sub>	α <sub>N,seis</sub>	f' <sub>c</sub> (psi)	n	τ <sub>k,cr</sub> (psi)
1125	1.00	1.00	1.00	2500	0.24	1125

$$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef} \text{ (Eq. 17.4.5.2)}$$

λ <sub>a</sub>	τ <sub>cr</sub> (psi)	d <sub>a</sub> (in)	h <sub>ef</sub> (in)	N <sub>ba</sub> (lb)
1.00	1125	0.63	12.000	26507

$$0.75 \phi N_a = 0.75 \phi (A_{Na} / A_{Na0}) \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} \text{ (Sec. 17.3.1 \& Eq. 17.4.5.1a)}$$

A <sub>Na</sub> (in <sup>2</sup> )	A <sub>Na0</sub> (in <sup>2</sup> )	c <sub>Na</sub> (in)	c <sub>a,min</sub> (in)	Ψ <sub>ed,Na</sub>	Ψ <sub>cp,Na</sub>	N <sub>a0</sub> (lb)	φ	0.75 φN <sub>a</sub> (lb)
127.74	254.97	7.98	2.00	0.775	1.000	26507	0.65	5018



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## 11. Results

### 11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Tension	Factored Load, $N_{ua}$ (lb)	Design Strength, $\phi N_n$ (lb)	Ratio	Status
Steel	2350	9833	0.24	Pass
<b>Concrete breakout</b>	<b>2350</b>	<b>2344</b>	<b>1.00</b>	<b>Pass (Governs)</b>
Adhesive	2350	5018	0.47	Pass

SET-3G w/ 5/8"Ø F1554 Gr. 36 with hef = 12.000 inch meets the selected design criteria.

## 12. Warnings

- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.
- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.
- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.


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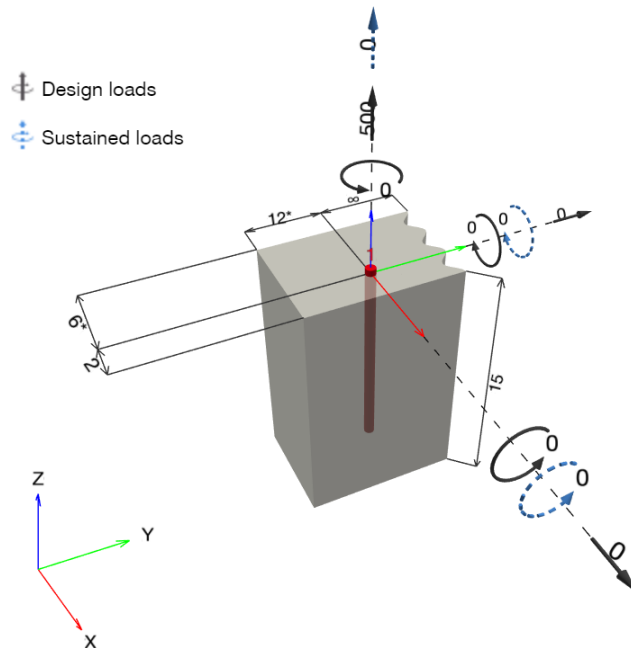
Page: 1  
 Specifier:  
 E-Mail:  
 Date: 10/26/2020

**Specifier's comments:**

**1 Input data**

<b>Anchor type and diameter:</b>	<b>HIT-HY 200 + HAS-V-36 (ASTM F1554 Gr.36) 5/8</b>	
Item number:	not available (element) / 2022793 HIT-HY 200-R (adhesive)	
Effective embedment depth:	$h_{ef,act} = 12.000$ in. ( $h_{ef,limit} = -$ in.)	
Material:	ASTM A 1554 Grade 36	
Evaluation Service Report:	ESR-3187	
Issued   Valid:	4/1/2020   3/1/2022	
Proof:	Design Method ACI 318-14 / Chem	
Stand-off installation:		
Profile:		
Base material:	cracked concrete, 2500, $f_c' = 2,500$ psi; $h = 15.000$ in., Temp. short/long: 32/32 °F	
<b>Installation:</b>	<b>hammer drilled hole, Installation condition: Dry</b>	
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present	
	edge reinforcement: none or < No. 4 bar	
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d)) Shear load: yes (17.2.3.5.3 (c))	

**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 = 500; V <sub>x</sub> = 0; V <sub>y</sub> = 0; M <sub>x</sub> = 0; M <sub>y</sub> = 0; M <sub>z</sub> = 0; N <sub>sus</sub> = 0; M <sub>x,sus</sub> = 0; M <sub>y,sus</sub> = 0;	yes	22

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	500	0	0	0

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

3 Tension load

	Load N <sub>ua</sub> [lb]	Capacity $\phi$ N <sub>n</sub> [lb]	Utilization $\beta_N = N_{ua} / \phi N_n$	Status
Steel Strength*	500	9,833	6	OK
Bond Strength**	500	4,623	11	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	500	2,344	22	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-3187  
 $\phi N_{sa} \geq N_{ua}$  ACI 318-14 Table 17.3.1.1

**Variables**

$A_{se,N}$ [in. <sup>2</sup> ]	$f_{uta}$ [psi]
0.23	58,000

**Calculations**

$N_{sa}$ [lb]
13,110

**Results**

$N_{sa}$ [lb]	$\phi_{steel}$	$\phi N_{sa}$ [lb]	$N_{ua}$ [lb]
13,110	0.750	9,833	500





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**3.2 Bond Strength**

$$N_a = \left( \frac{A_{Na}}{A_{Na0}} \right) \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} \quad \text{ACI 318-14 Eq. (17.4.5.1a)}$$

$$\phi N_a \geq N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$$A_{Na} \text{ see ACI 318-14, Section 17.4.5.1, Fig. R 17.4.5.1(b)}$$

$$A_{Na0} = (2 c_{Na})^2 \quad \text{ACI 318-14 Eq. (17.4.5.1c)}$$

$$c_{Na} = 10 d_a \sqrt{\frac{\tau_{uncr}}{1100}} \quad \text{ACI 318-14 Eq. (17.4.5.1d)}$$

$$\Psi_{ed,Na} = 0.7 + 0.3 \left( \frac{c_{a,min}}{c_{Na}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.5.4b)}$$

$$\Psi_{cp,Na} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{c_{Na}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.5.5b)}$$

$$N_{ba} = \lambda_a \cdot \tau_{k,c} \cdot \alpha_{N,seis} \cdot \pi \cdot d_a \cdot h_{ef} \quad \text{ACI 318-14 Eq. (17.4.5.2)}$$

**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	12.000	2.000	1.000	1,170
$c_{ac}$ [in.]	$\lambda_a$	$\alpha_{N,seis}$			
33.964	1.000	0.990			

**Calculations**

$c_{Na}$ [in.]	$A_{Na}$ [in. <sup>2</sup> ]	$A_{Na0}$ [in. <sup>2</sup> ]	$\Psi_{ed,Na}$
8.839	141.42	312.50	0.768
$\Psi_{cp,Na}$	$N_{ba}$ [lb]		
1.000	27,292		

**Results**

$N_a$ [lb]	$\phi_{bond}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi N_a$ [lb]	$N_{ua}$ [lb]
9,484	0.650	0.750	1.000	4,623	500

Input data and results must be checked for conformity with the existing conditions and for plausibility!  
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**3.3 Concrete Breakout Failure**

$$N_{cb} = \left( \frac{A_{Nc}}{A_{Nc0}} \right) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \quad \text{ACI 318-14 Eq. (17.4.2.1a)}$$

$$\phi N_{cb} \geq N_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$$A_{Nc} \text{ see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)}$$

$$A_{Nc0} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\Psi_{ed,N} = 0.7 + 0.3 \left( \frac{c_{a,min}}{1.5h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\Psi_{cp,N} = \text{MAX} \left( \frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

**Variables**

$h_{ef}$ [in.]	$c_{a,min}$ [in.]	$\Psi_{c,N}$	$c_{ac}$ [in.]	$k_c$	$\lambda_a$	$f_c$ [psi]
8.000	2.000	1.000	33.964	17	1.000	2,500

**Calculations**

$A_{Nc}$ [in. <sup>2</sup> ]	$A_{Nc0}$ [in. <sup>2</sup> ]	$\Psi_{ed,N}$	$\Psi_{cp,N}$	$N_b$ [lb]
192.00	576.00	0.750	1.000	19,233

**Results**

$N_{cb}$ [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi N_{cb}$ [lb]	$N_{ua}$ [lb]
4,808	0.650	0.750	1.000	2,344	500



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### 4 Shear load

	Load $V_{ua}$ [lb]	Capacity $\phi V_n$ [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Bond Strength controls)*	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 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (AS 5216:2018, 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/>
- An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-14, Chapter 17, Section 17.2.3.4.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.2.3.4.3 (b), Section 17.2.3.4.3 (c), or Section 17.2.3.4.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.2.3.5.3 (a), Section 17.2.3.5.3 (b), or Section 17.2.3.5.3 (c).
- Section 17.2.3.4.3 (b) / Section 17.2.3.5.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.2.3.4.3 (c) / Section 17.2.3.5.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.2.3.4.3 (d) / Section 17.2.3.5.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by  $\omega_0$ .
- Installation of Hilti adhesive anchor systems shall be performed by personnel trained to install Hilti adhesive anchors. Reference ACI 318-14, Section 17.8.1.

## Fastening meets the design criteria!



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## 6 Installation data

Profile: -

Hole diameter in the fixture: -

Plate thickness (input): -

Drilling method: Hammer drilled

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

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

Anchor type and diameter: HIT-HY 200 + HAS-V-36

(ASTM F1554 Gr.36) 5/8

Item number: not available (element) / 2022793 HIT-HY 200-R (adhesive)

Installation torque: 720 in.lb

Hole diameter in the base material: 0.750 in.

Hole depth in the base material: 12.000 in.

Minimum thickness of the base material: 13.500 in.

### 6.1 Recommended accessories

#### Drilling

- Suitable Rotary Hammer
- Properly sized drill bit

#### Cleaning

- Compressed air with required accessories to blow from the bottom of the hole
- Proper diameter wire brush

#### Setting

- Dispenser including cassette and mixer
- Torque wrench

#### Coordinates Anchor in.

Anchor	x	y	C <sub>-x</sub>	C <sub>+x</sub>	C <sub>-y</sub>	C <sub>+y</sub>
1	0.000	0.000	6.000	2.000	12.000	-



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## 7 Remarks; Your Cooperation Duties

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