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Company:	TYLin Silman Structural Solutions	Page:	1
Address:	9020 Stony Point Parkway, Suite 275, Richmond, VA	Specifier:	Jami Wilson
Phone Fax:	+1 804-204-2407	E-Mail:	jamison.wilson@tylin.com
Design:	Side Gate Wall - PC Conx to Top Slab	Date:	3/12/2024
Fastening point:	Existing top 22" conc slab		

Specifier's comments:

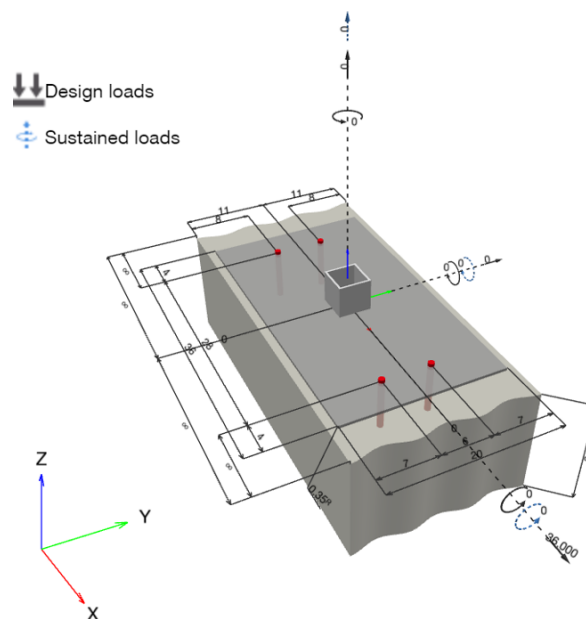
1 Input data



Anchor type and diameter:	HIT-HY 200 V3 + HIT-Z-R 3/4
Item number:	2018460 HIT-Z-R 3/4" x 8 1/2" (element) / 2334276 HIT-HY 200-R V3 (adhesive)
Effective embedment depth:	$h_{ef,act} = 6.000$ in. ($h_{ef,limit} = -$ in.)
Material:	A4
Evaluation Service Report:	ESR-4868
Issued Valid:	11/1/2022 11/1/2024
Proof:	Design Method ACI 318-14 / Chem
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.350$ in.
Anchor plate ^R :	$l_x \times l_y \times t = 36.000$ in. x 20.000 in. x 0.350 in.; (Recommended plate thickness: not calculated)
Profile:	Square HSS (AISC), HSS4X4X.25; (L x W x T) = 4.000 in. x 4.000 in. x 0.250 in.
Base material:	cracked concrete, 4000 , $f'_c = 4,000$ psi; $h = 36.000$ in., Temp. short/long: $32/32$ °F
Installation:	hammer drilled hole, Installation condition: Dry
Reinforcement:	tension: condition B, shear: condition B; 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]



$V_u = 36,000$ lbs

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1.1 Design results

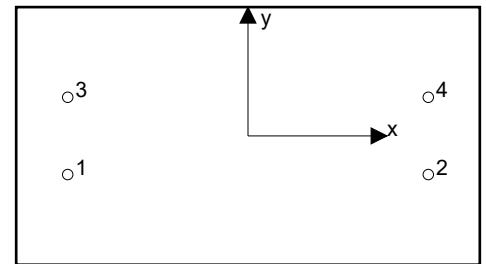
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V _x = 36,000; V _y = 0; M _x = 0; M _y = 0; M _z = 0; N _{sus} = 0; M _{x,sus} = 0; M _{y,sus} = 0;	no	100

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	0	9,000	9,000	0
2	0	9,000	9,000	0
3	0	9,000	9,000	0
4	0	9,000	9,000	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]

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*	N/A	N/A	N/A	N/A
Pullout Strength*	N/A	N/A	N/A	N/A
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	N/A	N/A	N/A	N/A

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



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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*	9,000	11,330	80	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Concrete Breakout Strength controls)**	36,000	52,275	69	OK
Concrete edge failure in direction y-**	36,000	36,063	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 318-14 Table 17.3.1.1

Variables

$A_{se,v}$ [in. ²]	f_{uta} [psi]
0.33	94,200

Calculations

V_{sa} [lb]
18,883

Results

V_{sa} [lb]	ϕ_{steel}	ϕV_{sa} [lb]	V_{ua} [lb]
18,883	0.600	11,330	9,000

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4.2 Pryout Strength (Concrete Breakout Strength controls)

$$V_{cp,g} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \right] \quad \text{ACI 318-14 Eq. (17.5.3.1b)}$$

$$\phi V_{cp,g} \geq V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

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

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

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.4)}$$

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

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

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

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	6.000	0.000	0.000	8.000
$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	9.000	17	1.000	4,000

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
792.00	324.00	1.000	1.000	0.967	1.000	15,802

Results

$V_{cp,g}$ [lb]	$\phi_{concrete}$	$\phi V_{cp,g}$ [lb]	V_{ua} [lb]
74,678	0.700	52,275	36,000

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4.3 Concrete edge failure in direction y-

$$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}} \right) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} \Psi_{parallel,V} V_b \quad \text{ACI 318-14 Eq. (17.5.2.1b)}$$

$$\phi V_{cbg} \geq V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$$A_{Vc} \text{ see ACI 318-14, Section 17.5.2.1, Fig. R 17.5.2.1(b)}$$

$$A_{Vc0} = 4.5 c_{a1}^2 \quad \text{ACI 318-14 Eq. (17.5.2.1c)}$$

$$\Psi_{ec,V} = \left(\frac{1}{1 + \frac{2e_v}{3c_{a1}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.5)}$$

$$\Psi_{ed,V} = 0.7 + 0.3 \left(\frac{c_{a2}}{1.5c_{a1}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.6b)}$$

$$\Psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0 \quad \text{ACI 318-14 Eq. (17.5.2.8)}$$

$$V_b = 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5} \quad \text{ACI 318-14 Eq. (17.5.2.2b)}$$

Variables

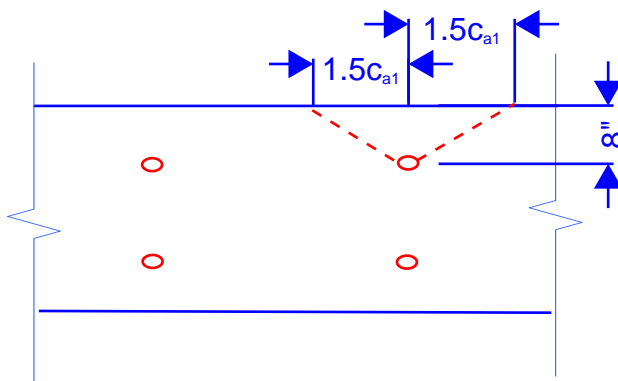
c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\Psi_{c,V}$	h_a [in.]
8.000	-	0.000	1.000	36.000
l_e [in.]	λ_a	d_a [in.]	f_c [psi]	$\Psi_{parallel,V}$
6.000	1.000	0.750	4,000	2.000

Calculations

A_{Vc} [in. ²]	A_{Vc0} [in. ²]	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{h,V}$	V_b [lb]
576.00	288.00	1.000	1.000	1.000	12,880

Results

V_{cbg} [lb]	$\phi_{concrete}$	ϕV_{cbg} [lb]	V_{ua} [lb]
51,519	0.700	36,063	36,000



$h_a > 1.5 c_{a1}$ use $1.5 c_{a1} = 1.5(8) = 12"$

$$A_{Vc} = 1.5c_{a1}(1.5c_{a1}+1.5c_{a1})$$

$$= 12(12+12)$$

$$= 288 \text{ (4 anchors)}$$

$$= 1152 \text{ in}^2$$

$A_{Vc} \text{ max} = 4A_{Vc0} = 4(288) = 1152 \text{ OK}$

$$\Phi V_{cbg} = 0.7(A_{Vc}/A_{Vc0})(2.0)(12880)$$

$$= 0.7(1152/288)(2.0)(12880)$$

$$= 72130 \text{ lbs}$$



Hilti PROFIS Engineering 3.0.91

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5 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 318-14, Section 17.8.1.

Fastening meets the design criteria!

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6 Installation data

Profile: Square HSS (AISC), HSS4X4X.25; (L x W x T) = 4.000 in. x 4.000 in. x 0.250 in.

Hole diameter in the fixture (pre-setting) : $d_f = 0.812$ in.

Hole diameter in the fixture (through fastening) : $d_f = 0.938$ in.

Plate thickness (input): 0.350 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 + HIT-Z-R 3/4

Item number: 2018460 HIT-Z-R 3/4" x 8 1/2" (element) /

2334276 HIT-HY 200-R V3 (adhesive)

Maximum installation torque: 1,947 in.lb

Hole diameter in the base material: 0.875 in.

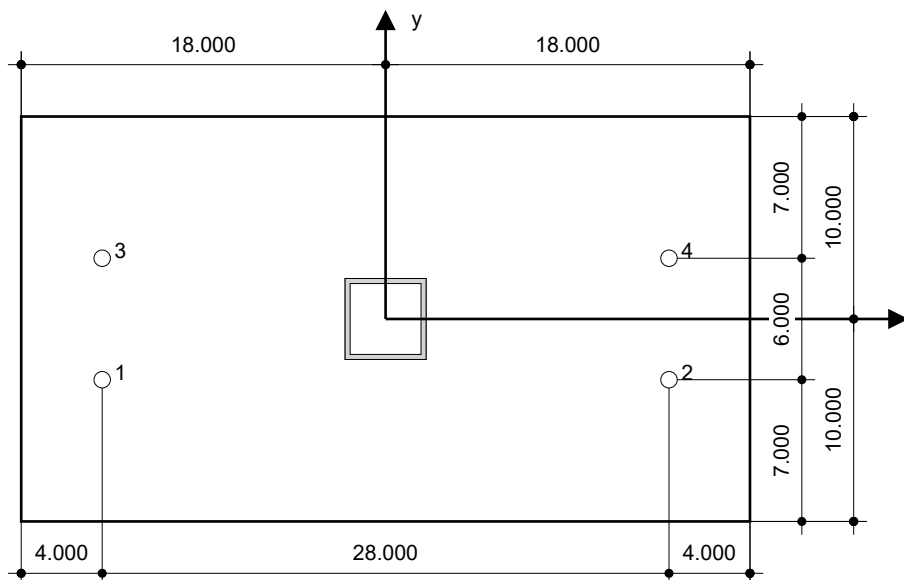
Hole depth in the base material: 8.250 in.

Minimum thickness of the base material: 10.000 in.

3/4 Hilti HIT-Z Stainless steel non-cleaning bonded expansion anchor with Hilti HIT-HY 200 V3 Safe Set System

6.1 Recommended accessories

Drilling	Cleaning	Setting
<ul style="list-style-type: none"> Suitable Rotary Hammer Properly sized drill bit 	<ul style="list-style-type: none"> - 	<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	-14.000	-3.000	-	-	8.000	14.000
2	14.000	-3.000	-	-	8.000	14.000
3	-14.000	3.000	-	-	14.000	8.000
4	14.000	3.000	-	-	14.000	8.000



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7 Remarks; Your Cooperation Duties

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