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Company:
 Address:
 Phone | Fax: |
 Design: 20" basket strainer
 Fastening point:

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 Specifier:
 E-Mail:
 Date: 10/5/2023

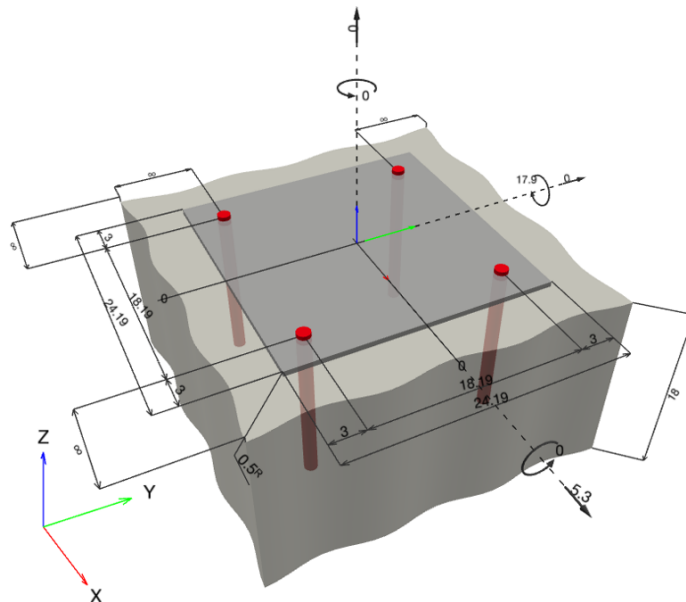
Specifier's comments:

1 Input data

Anchor type and diameter:	Heavy Hex Head ASTM F 1554 GR. 36 1 1/4	
Item number:	not available	
Effective embedment depth:	$h_{ef} = 15.000$ in.	
Material:	ASTM F 1554	
Evaluation Service Report:	Hilti Technical Data	
Issued Valid:	- -	
Proof:	Design Method ACI 318-19 / CIP	
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.	
Anchor plate ^R :	$l_x \times l_y \times t = 24.190$ in. x 24.190 in. x 0.500 in.; (Recommended plate thickness: not calculated)	
Profile:	no profile	
Base material:	cracked concrete, Custom, $f'_c = 4,500$ psi; $h = 18.000$ in.	
Reinforcement:	tension: not present, shear: not present; edge reinforcement: > No. 4 bar	
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.10.5.3 (a)) Shear load: yes (17.10.6.3 (c))	

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

Geometry [in.] & Loading [kip, ft.kip]



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1.1 Design results

Case	Description	Forces [kip] / Moments [ft.kip]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0.000; V _x = 5.300; V _y = 0.000; M _x = 0.00000; M _y = 17.90000; M _z = 0.00000;	yes	16

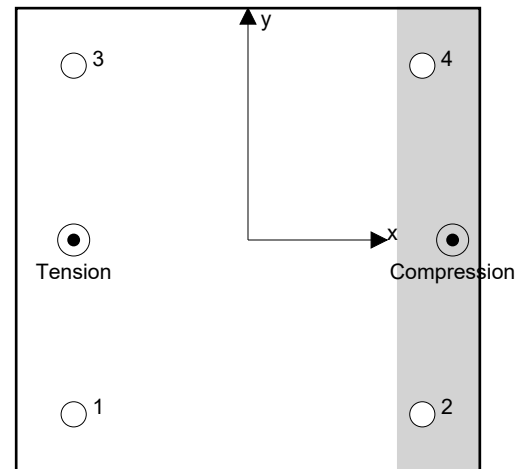
2 Load case/Resulting anchor forces

Anchor reactions [kip]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	5.432	1.325	1.325	0.000
2	0.000	1.325	1.325	0.000
3	5.432	1.325	1.325	0.000
4	0.000	1.325	1.325	0.000

max. concrete compressive strain: 0.05 [‰]
 max. concrete compressive stress: 211 [psi]
 resulting tension force in (x/y)=(-9.095/0.000): 10.864 [kip]
 resulting compression force in (x/y)=(10.677/-0.000): 10.864 [kip]



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

3 Tension load

	Load N _{ua} [kip]	Capacity ϕ N _n [kip]	Utilization $\beta_N = N_{ua} / \phi N_n$	Status
Steel Strength*	5.432	42.151	13	OK
Pullout Strength*	5.432	42.279	13	OK
Concrete Breakout Failure**	10.864	72.189	16	OK
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

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



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3.1 Steel Strength

$$N_{sa} = A_{se,N} f_{uta} \quad \text{ACI 318-19 Eq. (17.6.1.2)}$$

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

Variables

$A_{se,N} [\text{in.}^2]$	$f_{uta} [\text{psi}]$
0.97	58,000

Calculations

$N_{sa} [\text{kip}]$
56.202

Results

$N_{sa} [\text{kip}]$	ϕ_{steel}	$\phi N_{sa} [\text{kip}]$	$N_{ua} [\text{kip}]$
56.202	0.750	42.151	5.432

3.2 Pullout Strength

$$N_{pN} = \psi_{c,p} N_p \quad \text{ACI 318-19 Eq. (17.6.3.1)}$$

$$N_p = 8 A_{brg} f'_c \quad \text{ACI 318-19 Eq. (17.6.3.2.2a)}$$

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

Variables

$\psi_{c,p}$	$A_{brg} [\text{in.}^2]$	λ_a	$f'_c [\text{psi}]$
1.000	2.24	1.000	4,500

Calculations

$N_p [\text{kip}]$
80.532

Results

$N_{pn} [\text{kip}]$	ϕ_{concrete}	ϕ_{seismic}	$\phi N_{pn} [\text{kip}]$	$N_{ua} [\text{kip}]$
80.532	0.700	0.750	42.279	5.432

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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)

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

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

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

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

$$N_b = 16 \lambda_a \sqrt{f'_c} h_{ef}^{5/3} \quad \text{ACI 318-19 Eq. (17.6.2.2.3)}$$

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
15.000	0.000	0.000	∞	1.000
c_{ac} [in.]	k_c	λ_a	f'_c [psij]	
-	16	1.000	4,500	

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [kip]
2,843.55	2,025.00	1.000	1.000	1.000	1.000	97.922

Results

N_{cbg} [kip]	$\phi_{concrete}$	$\phi_{seismic}$	ϕN_{cbg} [kip]	N_{ua} [kip]
137.504	0.700	0.750	72.189	10.864



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4 Shear load

	Load V_{ua} [kip]	Capacity ϕV_n [kip]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	1.325	21.919	7	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	5.300	270.320	2	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

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

4.1 Steel Strength

$$V_{sa} = 0.6 A_{se,V} f_{uta} \quad \text{ACI 318-19 Eq. (17.7.1.2b)}$$

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

Variables

$A_{se,V}$ [in. ²]	f_{uta} [psi]
0.97	58,000

Calculations

V_{sa} [kip]
33.721

Results

V_{sa} [kip]	ϕ_{steel}	$\phi V_{sa,eq}$ [kip]	V_{ua} [kip]
33.721	0.650	21.919	1.325

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4.2 Pryout Strength

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

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

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

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

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

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

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

$$N_b = 16 \lambda_a \sqrt{f'_c} h_{ef}^{5/3} \quad \text{ACI 318-19 Eq. (17.6.2.2.3)}$$

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	15.000	0.000	0.000	∞
$\Psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	∞	16	1.000	4,500

Calculations

A_{Nc} [in. ²]	A_{Nc0} [in. ²]	$\Psi_{ec1,N}$	$\Psi_{ec2,N}$	$\Psi_{ed,N}$	$\Psi_{cp,N}$	N_b [kip]
3,992.98	2,025.00	1.000	1.000	1.000	1.000	97.922

Results

$V_{cp,g}$ [kip]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi V_{cp,g}$ [kip]	V_{ua} [kip]
386.171	0.700	1.000	1.000	270.320	5.300

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

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.150	0.060	5/3	6	OK

$$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} \leq 1$$



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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.
- 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 318-19, Chapter 17, Section 17.10.5.3 (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 17.10.5.3 (b), Section 17.10.5.3 (c), or Section 17.10.5.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.10.6.3 (a), Section 17.10.6.3 (b), or Section 17.10.6.3 (c)."
- Section 17.10.5.3 (b) / Section 17.10.6.3 (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 17.10.5.3 (c) / Section 17.10.6.3 (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 17.10.5.3 (d) / Section 17.10.6.3 (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 ω_0 .

Fastening meets the design criteria!

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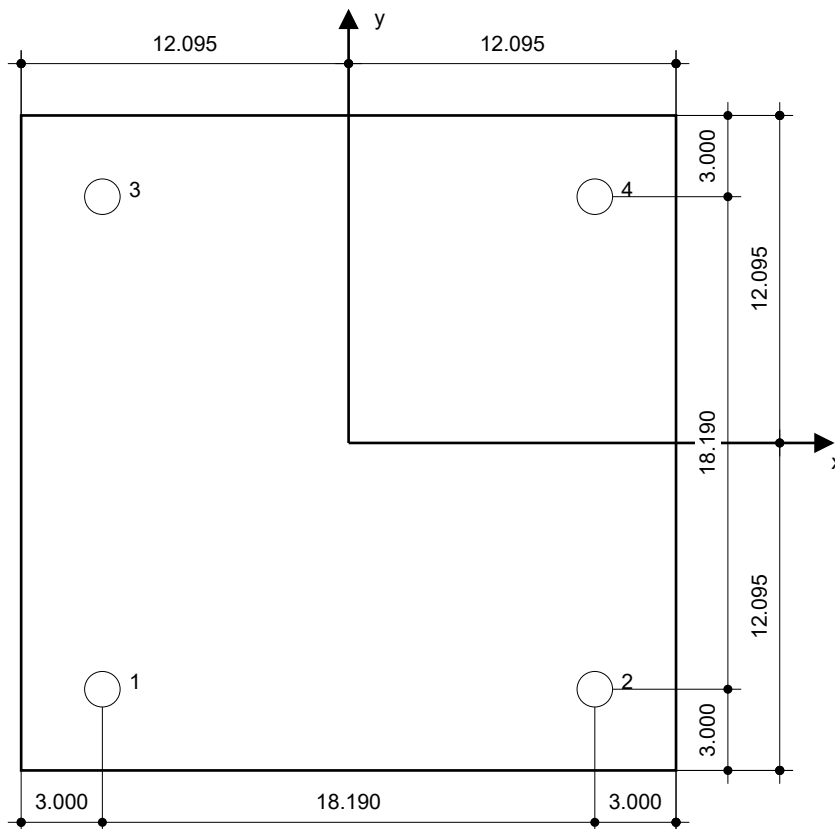
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7 Installation data

Profile: no profile
 Hole diameter in the fixture: $d_f = 1.312$ in.
 Plate thickness (input): 0.500 in.
 Recommended plate thickness: not calculated

Anchor type and diameter: Heavy Hex Head ASTM F 1554
 GR. 36 1 1/4
 Item number: not available
 Maximum installation torque: -
 Hole diameter in the base material: - in.
 Hole depth in the base material: 15.000 in.
 Minimum thickness of the base material: 16.344 in.

Hilti Heavy Hex Head headed stud anchor with 15 in embedment, 1 1/4, Steel galvanized, installation per instruction for use



Coordinates Anchor [in.]

Anchor	x	y	C _{-x}	C _{+x}	C _{-y}	C _{+y}
1	-9.095	-9.095	-	-	-	-
2	9.095	-9.095	-	-	-	-
3	-9.095	9.095	-	-	-	-
4	9.095	9.095	-	-	-	-



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8 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.
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