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Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Shearwall 1.B Anchor Design	Date:	1/8/2024
Fastening point:			

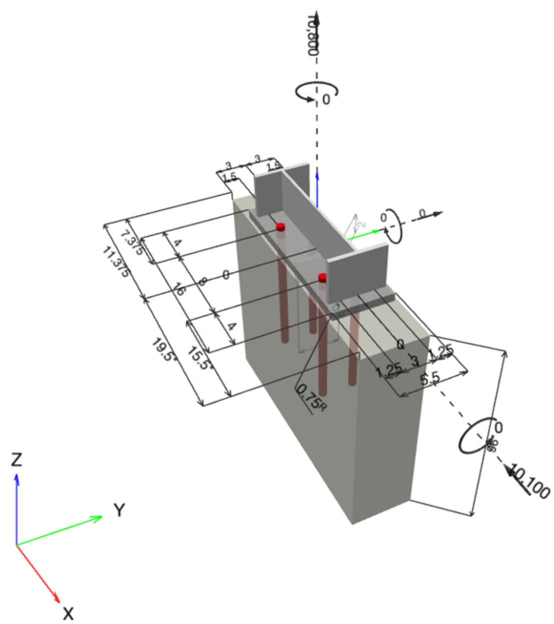
Specifier's comments:

1 Input data

Anchor type and diameter:	**Hex Head ASTM F 1554 GR. 36 3/4**
Item number:	not available
Effective embedment depth:	h_{ef} = 12.000 in.
Material:	ASTM F 1554
Evaluation Service Report:	Hilti Technical Data
Issued I Valid:	- | -
Proof:	Design Method ACI 318-19 / CIP
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.750 in.
Anchor plate[R] :	l_x x l_y x t = 16.000 in. x 5.500 in. x 0.750 in.; (Recommended plate thickness: not calculated)
Profile:	W shape (AISC), W14X26; (L x W x T x FT) = 13.900 in. x 5.030 in. x 0.255 in. x 0.420 in.
Shear Lug:	Rectangular plates and bars (AISC), 4 - 1/2, (L x W x D x T) = 4.000 in. x 0.500 in. x 2.000 in. x N/A, rotation angle: 270°
Base material:	uncracked concrete, Custom, f_c' = 3,500 psi; h = 96.000 in.
Reinforcement:	tension: present, shear: not present; anchor reinforcement: tension
	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]



1.1 Design results

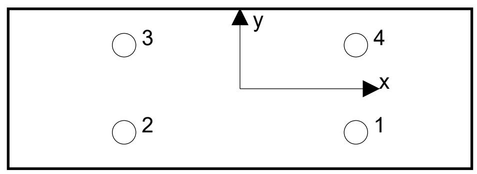
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 10{,}800$; $V_x = -10{,}100$; $V_y = 0$; $M_x = 0$; $M_y = 0$; $M_z = 0$;	no	427

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	2,700	0	0	0
2	2,700	0	0	0
3	2,700	0	0	0
4	2,700	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]

Shear lug reactions [lb]

Shear Lug	Shear force	Shear force x	Shear force y
	10,100	-10,100	0

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*	2,700	14,529	19	OK
Pullout Strength*	2,700	17,946	16	OK
Concrete Breakout Failure**[1]	N/A	N/A	N/A	N/A
Concrete Side-Face Blowout, direction y-**	5,400	16,267	34	OK

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

[1] Tension Anchor Reinforcement has been selected!

3.1 Steel Strength

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

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

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.33	58,000

Calculations

N_{sa} [lb]
19,372

Results

N_{sa} [lb]	ϕ_{steel}	$\phi\, N_{sa}$ [lb]	N_{ua} [lb]
19,372	0.750	14,529	2,700

3.2 Pullout Strength

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

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

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

Variables

$\psi_{c,p}$	A_{brg} [in.^{2}]	λ_a	f'_c [psi]
1.400	0.65	1.000	3,500

Calculations

N_p [lb]
18,312

Results

N_{pn} [lb]	$\phi_{concrete}$	$\phi\, N_{pn}$ [lb]	N_{ua} [lb]
25,637	0.700	17,946	2,700

3.3 Concrete Side-Face Blowout, direction y-

$N_{sb} = 160\ c_{a1} \sqrt{A_{brg}}\ \lambda_a \sqrt{f'_c}$ ACI 318-19 Eq. (17.6.4.1)

$N_{sbg} = \alpha_{group} N_{sb}$ ACI 318-19 Eq. (17.6.4.2)

$\phi\ N_{sbg} \geq N_{ua}$ ACI 318-19 Table 17.5.2

$\alpha_{group} = \left(1 + \frac{s}{6\ c_{a1}}\right)$ see ACI 318-19, Section 17.6.4.2, Eq. (17.6.4.2)

Variables

c_{a1} [in.]	c_{a2} [in.]	A_{brg} [in.^{2}]	λ_a	f'_c [psi]	s [in.]
1.500	7.375	0.65	1.000	3,500	8.000

Calculations

α_{group}	N_{sb} [lb]
1.889	11,482

Results

N_{sbg} [lb]	$\phi_{concrete}$	$\phi\ N_{sbg}$ [lb]	$N_{ua,edge}$ [lb]
21,689	0.750	16,267	5,400

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ 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*	N/A	N/A	N/A	N/A
Shear lug bearing strength	10,100	13,314	76	OK
Shear lug stress limit	N/A	N/A	N/A	N/A
Concrete breakout strength of shear lug in direction x-	10,100	2,367	427	not recommended

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

4.1 Bearing strength of attachments with shear lugs

$\phi\ V_{brg,sl} \geq V_u$	ACI 318-19 Table 17.5.2
$V_{brg,sl} = 1.7 \cdot f'_c \cdot A_{ef,sl} \cdot \psi_{brg,sl}$	ACI 318-19 Eq. (17.11.2.1)
$\psi_{brg,sl} = 1 + \frac{P_u}{n \cdot N_{sa}} \leq 1.0$	ACI 318-19 Eq. (17.11.2.2.1a)

Variables

$A_{ef,sl}$ [in.^{2}]	P_u [lb]	n	N_{sa} [lb]	A_{bp} [in.^{2}]	f'_c [psi]
4.00	-10,800	4	19,372	88.00	3,500

Calculations

$\psi_{brg,sl}$
0.861

Results

$V_{brg,sl}$ [lb]	ϕ	$\phi\ V_{brg,sl}$ [lb]	V_u [lb]
20,483	0.650	13,314	10,100

4.2 Concrete breakout strength of shear lug in direction x-

$V_{cb,sl} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ed,V} \ \psi_{c,V} \ \psi_{h,V} \ \psi_{parallel,V} \ V_b$ ACI 318-19 Eq. (17.7.2.1a)

$\phi \ V_{cb,sl} \geq V_u$ ACI 318-19 Table 17.5.2

A_{Vc} see ACI 318-19, Section 17.11.3.1.1, 17.11.3.4

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

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

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

$V_b = 9 \cdot \lambda_a \cdot \sqrt{f'_c} \cdot c_a^{1.5}$ ACI 318-19 Eq. (17.7.2.2.1b)

Variables

c_{a1} [in.]	c_{a2} [in.]	$\psi_{c,v}$	h_a [in.]	$\psi_{parallel,v}$	λ_a	f'_c [psi]
11.125	1.000	1.400	96.000	1.000	1.000	3,500

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
102.12	556.95	0.718	1.000	19,757

Results

$V_{cb,sl}$ [lb]	ϕ	$\phi \ V_{cb,sl}$ [lb]	V_{ua} [lb]
3,642	0.650	2,367	10,100

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.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- The design of Anchor Reinforcement is beyond the scope of PROFIS Engineering. Refer to ACI 318-19, Section 17.5.2.1 (a) for information about Anchor Reinforcement.
- Anchor Reinforcement has been selected as a design option, calculations should be compared with PROFIS Engineering calculations.

Fastening does not meet the design criteria!

6 Installation data

Profile: W shape (AISC), W14X26; (L x W x T x FT) = 13.900 in. x 5.030 in. x 0.255 in. x 0.420 in.

Hole diameter in the fixture: d_f = 0.812 in.

Plate thickness (input): 0.750 in.

Recommended plate thickness: not calculated

Anchor type and diameter: Hex Head ASTM F 1554 GR. 36 3/4

Item number: not available

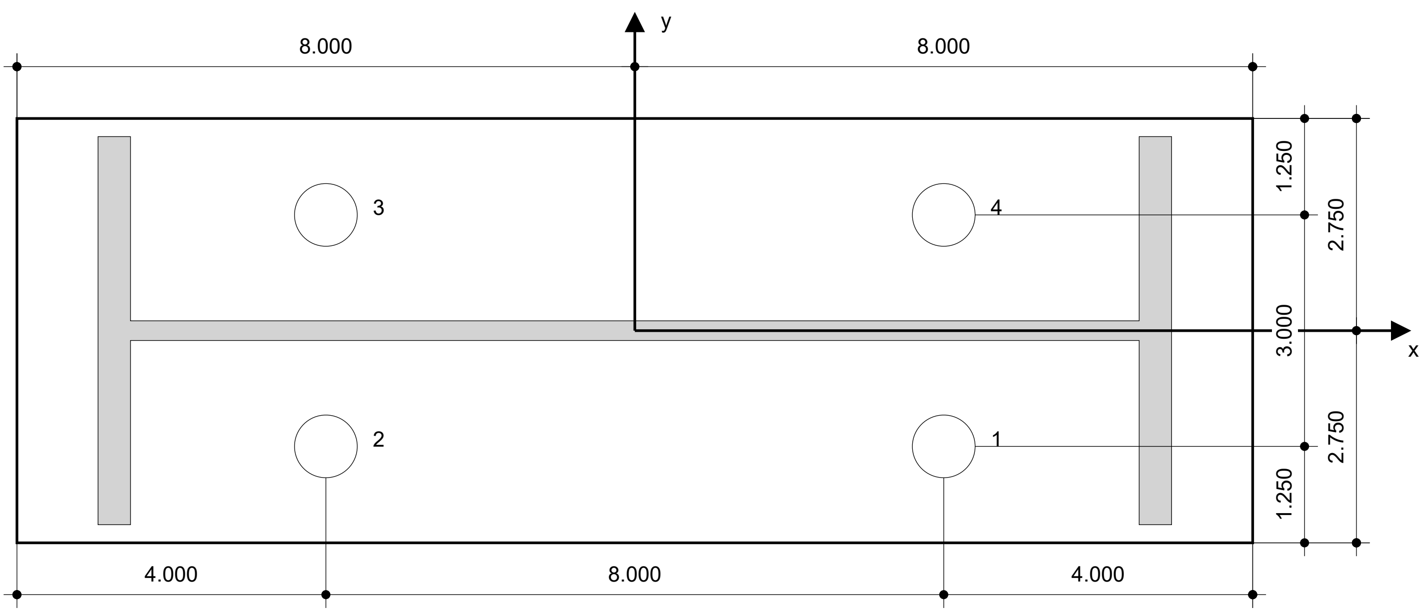
Maximum installation torque: -

Hole diameter in the base material: - in.

Hole depth in the base material: 12.000 in.

Minimum thickness of the base material: 13.000 in.

Hilti Hex Head headed stud anchor with 12 in embedment, 3/4, Steel galvanized, installation per instruction for use



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	4.000	-1.500	15.375	15.500	1.500	4.500
2	-4.000	-1.500	7.375	23.500	1.500	4.500
3	-4.000	1.500	7.375	23.500	4.500	1.500
4	4.000	1.500	15.375	15.500	4.500	1.500

7 Remarks; Your Cooperation Duties

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