ClearView GLASS RAILINGS

CONCRETE INSTALLATION

A

Make a wood jig to correct location of spigot holes. Make sure holes line up with desired spigot/glass panel alignment.

B

Drill holes in concrete using wood jig. Remove jig and confirm depth of each hole.

C

Clean debris from every hole. Install studs per stud manufacturer instructions.

D

Place spigot on studs. Install nuts and hand tighten.

E

Confirm all spigots are in alignment and level.

F

Confirm each panel's spigots are in alignment and properly spaced. Tighten all nuts. Install beauty ring. Install glass panel.

John,
CVGRailings spigot baseplate is about 4” diameter. With this, I have come up with the following:

I am specifying an adhesive anchor system by HILTI: 3/8” diameter HIT-Z anchor, with their HY200-R adhesive. Effective embedment = 2 3/8”. HILTI has many anchors and it is important that they use this exact anchor. I have attached the HILTI report that describes this design. It is important that they closely follow the installation steps, especially the hole preparation: the most common failure mechanism is a lack of bond between the adhesive and the concrete because the installer did not remove all dust within the hole before injecting the adhesive. A lack of correct preparation will void these calculations and HILTI’s support of their anchor. This is important.

This design assumes a 3.15” spacing between anchors, into a concrete slab. Anchors to be at least 6” from all embedded PT cables and from the edge of the concrete slab. The location of the cables to be determined by others.

Note that the loads shown in the report come from my computer modeling of a 200 pound/ft (plf) horizontal line load applied to the top of the 42” tall panel. As a reminder, the IBC requires guardrails be designed to resist a 50 plf horizontal line load @ the top of the panel; the code has increased this by a factor of 4 for all-glass panels such as yours, hence, the 200 plf.

You should be able to forward this directly to the installer of the PT deck. They can order the anchor and adhesive directly from HILTI through their website if they don’t have a local rep (Home Depot carries HILTI products).

Best regards,

Chris

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Design:	Concrete - Apr 5, 2021	Date:	4/5/2021
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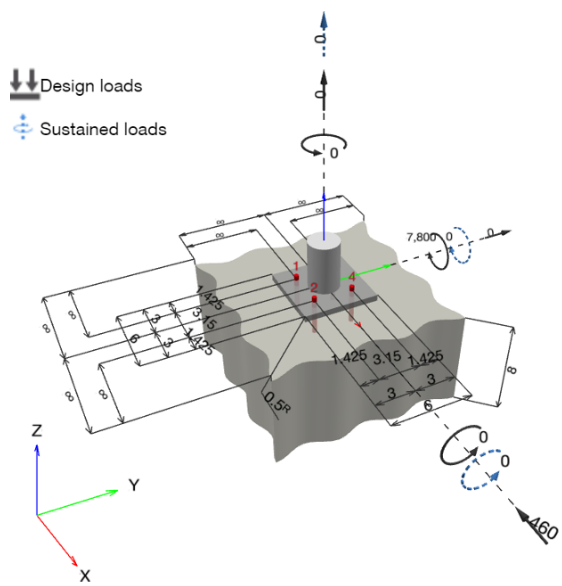
Specifier's comments:

1 Input data

Anchor type and diameter:	**HIT-HY 200 + HIT-Z 3/8**
Item number:	2018440 HIT-Z 3/8" x 4 3/8" (element) / 2022793 HIT-HY 200-R (adhesive)
Effective embedment depth:	$h_{ef,opti}$ = 2.375 in. ($h_{ef,limit}$ = 4.500 in.)
Material:	DIN EN ISO 4042
Evaluation Service Report:	ESR-3187
Issued I Valid:	4/1/2020 | 3/1/2022
Proof:	Design Method ACI 318-08 / Chem
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate^R :	l_x x l_y x t = 6.000 in. x 6.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	Round bars (AISC), 2 1/2; (L x W x T) = 2.500 in. x 2.500 in.
Base material:	cracked concrete, 4000, f_c' = 4,000 psi; h = 8.000 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
Seismic loads (cat. C, D, E, or F)	no

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

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



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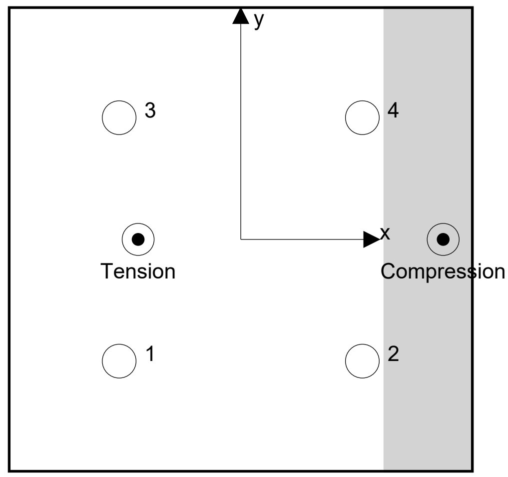
1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0; V_x = -460; V_y = 0;$ $M_x = 0; M_y = 7{,}800; M_z = 0;$ $N_{sus} = 0; M_{x,sus} = 0; M_{y,sus} = 0;$	no	51

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	910	115	-115	0
2	77	115	-115	0
3	910	115	-115	0
4	77	115	-115	0

max. concrete compressive strain:	0.13 [‰]
max. concrete compressive stress:	580 [psi]
resulting tension force in (x/y)=(-1.329/0.000):	1,974 [lb]
resulting compression force in (x/y)=(2.622/0.000):	1,974 [lb]

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

3 Tension load

	Load N_{ua} [lb]	Capacity $\phi\ N_n$ [lb]	Utilization $\beta_N = N_{ua}/\phi\ N_n$	Status
Steel Strength*	910	4,749	20	OK
Pullout Strength*	910	5,169	18	OK
Sustained Tension Load Bond Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	1,974	3,874	51	OK

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

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-3187
$\phi\ N_{sa} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.08	94,200

Calculations

N_{sa} [lb]
7,306

Results

N_{sa} [lb]	ϕ_{steel}	$\phi\ N_{sa}$ [lb]	N_{ua} [lb]
7,306	0.650	4,749	910

3.2 Pullout Strength

N_{pn} = N_p refer to ICC-ES ESR-3187
$\phi\ N_{pn} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

Variables

N_p [lb]
7,952

Calculations

-
-

Results

N_{pn} [lb]	$\phi_{concrete}$	$\phi\ N_{pn}$ [lb]	N_{ua} [lb]
7,952	0.650	5,169	910

3.3 Concrete Breakout Failure

$$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N} \; \psi_{ed,N} \; \psi_{c,N} \; \psi_{cp,N} \; N_b$$ ACI 318-08 Eq. (D-5)

$\phi \; N_{cbg} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9 \, h_{ef}^2$ ACI 318-08 Eq. (D-6)

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 \, e_N^{'}}{3 \, h_{ef}}}\right) \leq 1.0$$ ACI 318-08 Eq. (D-9)

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}}\right) \leq 1.0$$ ACI 318-08 Eq. (D-11)

$$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}}\right) \leq 1.0$$ ACI 318-08 Eq. (D-13)

$$N_b = k_c \; \lambda \; \sqrt{f_c^{'}} \; h_{ef}^{1.5}$$ ACI 318-08 Eq. (D-7)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
2.375	1.329	0.000	∞	1.000

c_{ac} [in.]	k_c	λ	$f_c^{'}$ [psi]
3.563	17	1	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]
105.58	50.77	0.728	1.000	1.000	1.000	3,935

Results

N_{cbg} [lb]	$\phi_{concrete}$	$\phi \; N_{cbg}$ [lb]	N_{ua} [lb]
5,960	0.650	3,874	1,974

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi\ V_n$	Status
Steel Strength*	115	1,929	6	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength (Concrete Breakout Strength controls)**	460	5,729	9	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} = ESR value refer to ICC-ES ESR-3187

$\phi\ V_{steel} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]	$\alpha_{V,seis}$
0.08	94,200	1.000

Calculations

V_{sa} [lb]
3,215

Results

V_{sa} [lb]	ϕ_{steel}	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
3,215	0.600	1,929	115

4.2 Pryout Strength (Concrete Breakout Strength controls)

$V_{cpg} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N}\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b\right]$ ACI 318-08 Eq. (D-31)

$\phi\ V_{cpg} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ ACI 318-08 Eq. (D-6)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\ e_N'}{3\ h_{ef}}}\right) \leq 1.0$ ACI 318-08 Eq. (D-9)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ ACI 318-08 Eq. (D-11)

$\psi_{cp,N} = \mathrm{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-08 Eq. (D-13)

$N_b = k_c\ \lambda\ \sqrt{f_c'}\ h_{ef}^{1.5}$ ACI 318-08 Eq. (D-7)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
1	2.375	0.000	0.000	∞

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ	f_c' [psi]
1.000	3.563	17	1	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]
105.58	50.77	1.000	1.000	1.000	1.000	3,935

Results

V_{cpg} [lb]	$\phi_{concrete}$	$\phi\ V_{cpg}$ [lb]	V_{ua} [lb]
8,184	0.700	5,729	460

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.510	0.080	5/3	35	OK

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

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6 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.
- The present version of the software does not account for special design provisions for overhead applications. Refer to related approval (e.g. section 4.1.1 of the ICC-ESR 2322) for details.
- For additional information about ACI 318 strength design provisions, please go to https://submittals.us.hilti.com/PROFISAnchorDesignGuide/

Fastening meets the design criteria!

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7 Installation data

Profile: Round bars (AISC), 2 1/2; (L x W x T) = 2.500 in. x 2.500 in.

Hole diameter in the fixture (pre-setting) : d_f = 0.438 in.

Hole diameter in the fixture (through fastening) : d_f = 0.500 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 + HIT-Z 3/8

Item number: 2018440 HIT-Z 3/8" x 4 3/8" (element) / 2022793 HIT-HY 200-R (adhesive)

Maximum installation torque: 177 in.lb

Hole diameter in the base material: 0.438 in.

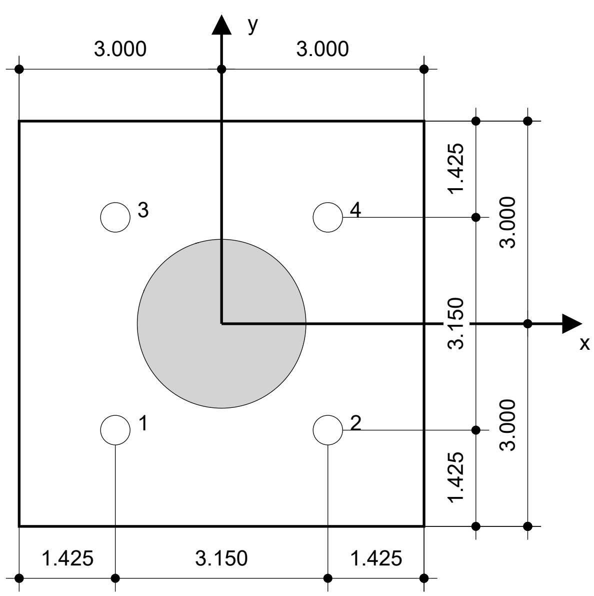
Hole depth in the base material: 2.375 in.

Minimum thickness of the base material: 4.625 in.

3/8 Hilti HIT-Z Carbon steel non-cleaning bonded expansion anchor with Hilti HIT-HY 200 Safe Set System

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• -	• Dispenser including cassette and mixer • Torque wrench



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-1.575	-1.575	-	-	-	-
2	1.575	-1.575	-	-	-	-
3	-1.575	1.575	-	-	-	-
4	1.575	1.575	-	-	-	-

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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.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.