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Company:	Apex Structural	Page:	1
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

**Specifier's comments:****1 Input data**

<b>Anchor type and diameter:</b>	<b>KWIK HUS-EZ (KH-EZ) (Carbon Steel) 1/2 (4 1/4)</b>	
Item number:	418076 KH-EZ 1/2"x5"	
Specification text:	Hilti $\varnothing$ 1/2 in KWIK HUS-EZ (KH-EZ) (Carbon Steel) with 4.25 in nominal embedment depth per ICC-ES ESR-3027, Hammer drill bit installation per MPII,	
Effective embedment depth:	$h_{ef,act} = 3.220$ in., $h_{nom} = 4.250$ in.	
Material:	Carbon Steel	
Evaluation Service Report:	ESR-3027	
Issued   Valid:	12/1/2023   12/1/2025	
Proof:	Design Method ACI 318-19 / Mech	
Shear edge breakout verification:	Row closest to edge (Case 3 only from ACI 318-19 Fig. R.17.7.2.1b)	
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.	
Anchor plate <sup>R</sup> :	$l_x \times l_y \times t = 12.000$ in. x $8.000$ in. x $0.500$ in.; (Recommended plate thickness: not calculated)	
Profile:	W shape (AISC), W10X22; (L x W x T x FT) = $10.200$ in. x $5.750$ in. x $0.240$ in. x $0.360$ in.	
Base material:	cracked concrete, 4000, $f'_c = 4,000$ psi; $h = 24.000$ in.	
<b>Installation:</b>	<b>Hammer drilled hole, Installation condition: Dry</b>	
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar	

**Application also possible with KWIK-X (Carbon Steel) 1/2 (3) hnom1 under the selected boundary conditions.  
More information in section Alternative fastening data of this report.**

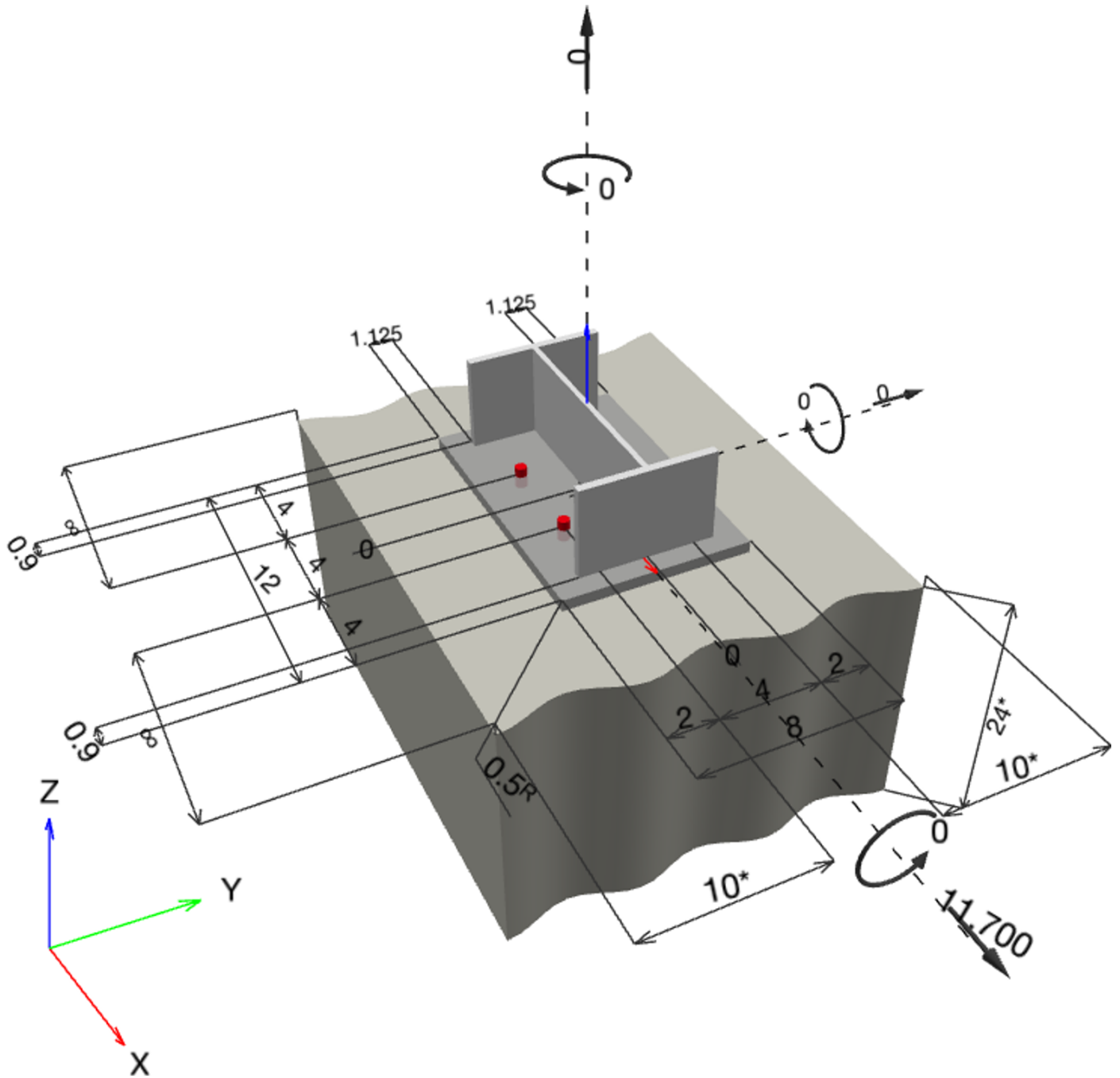
<sup>R</sup> - The anchor calculation is based on a rigid anchor plate assumption.

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Company: Apex Structural  
 Address: 373 Collins Rd. NE, 102  
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Page: 2  
 Specifier: Alex Miller  
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Geometry [in.] & Loading [lb, in.lb]



Input data and results must be checked for conformity with the existing conditions and for plausibility!  
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Company:	Apex Structural	Page:	3
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
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1.1 Design results

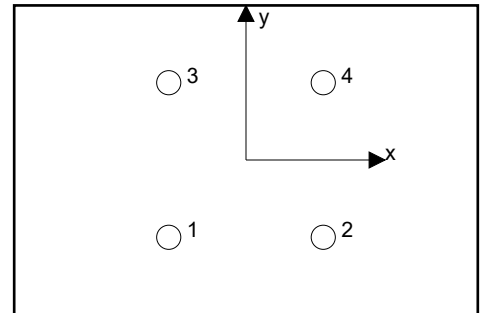
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V <sub>x</sub> = 11,700; V <sub>y</sub> = 0; M <sub>x</sub> = 0; M <sub>y</sub> = 0; M <sub>z</sub> = 0;	no	68

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	2,925	2,925	0
2	0	2,925	2,925	0
3	0	2,925	2,925	0
4	0	2,925	2,925	0



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

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

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*	N/A	N/A	N/A	N/A
Pullout 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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Company:	Apex Structural	Page:	4
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
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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*	2,925	5,547	53	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	11,700	17,392	68	OK
Concrete edge failure in direction y-**	11,700	22,797	52	OK

\* highest loaded anchor    \*\*anchor group (relevant anchors)  
 When the input edge distance is set to "infinity", edge breakout verification is not performed in that direction

### 4.1 Steel Strength

$V_{sa}$  = ESR value      refer to ICC-ES ESR-3027  
 $\phi V_{steel} \geq V_{ua}$       ACI 318-19 Table 17.5.2

#### Variables

$A_{se,v}$ [in. <sup>2</sup> ]	$f_{uta}$ [psi]
0.16	112,540

#### Calculations

$V_{sa}$ [lb]
9,245

#### Results

$V_{sa}$ [lb]	$\phi_{steel}$	$\phi V_{sa}$ [lb]	$V_{ua}$ [lb]
9,245	0.600	5,547	2,925

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Company:	Apex Structural	Page:	5
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
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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)

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

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

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

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

$$N_b = k_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \quad \text{ACI 318-19 Eq. (17.6.2.2.1)}$$

**Variables**

$k_{cp}$	$h_{ef}$ [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	3.220	0.000	0.000	10.000
$\psi_{c,N}$	$c_{ac}$ [in.]	$k_c$	$\lambda_a$	$f_c$ [psi]
1.000	5.250	17	1.000	4,000

**Calculations**

$A_{Nc}$ [in. <sup>2</sup> ]	$A_{Nc0}$ [in. <sup>2</sup> ]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	$N_b$ [lb]
186.60	93.32	1.000	1.000	1.000	1.000	6,212

**Results**

$V_{cp,g}$ [lb]	$\phi_{concrete}$	$\phi V_{cp,g}$ [lb]	$V_{ua}$ [lb]
24,845	0.700	17,392	11,700

www.hilti.com

Company:	Apex Structural	Page:	6
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
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Design:	Concrete - May 20, 2025	Date:	5/20/2025
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**4.3 Concrete edge failure in direction y-**

$$V_{cbg} = \left( \frac{A_{Vc}}{A_{Vc0}} \right) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} \Psi_{parallel,V} V_b \quad \text{ACI 318-19 Eq. (17.7.2.1b)}$$

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

$A_{Vc}$  see ACI 318-19, Section 17.7.2.1, Fig. R 17.7.2.1(b)\*

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

$$\Psi_{ec,V} = \left( \frac{1}{1 + \frac{e_v}{1.5c_{a1}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.3.1)}$$

$$\Psi_{ed,V} = 0.7 + 0.3 \left( \frac{c_{a2}}{1.5c_{a1}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.4.1b)}$$

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

$$V_b = \left( 7 \left( \frac{l_e}{d_a} \right)^{0.2} \sqrt{d_a} \right) \lambda_a \sqrt{f_c} c_{a1}^{1.5} \quad \text{ACI 318-19 Eq. (17.7.2.2.1a)}$$

**Variables**

$c_{a1}$ [in.]	$c_{a2}$ [in.]	$e_{cV}$ [in.]	$\Psi_{c,V}$	$h_a$ [in.]
10.000	-	0.000	1.000	24.000
$l_e$ [in.]	$\lambda_a$	$d_a$ [in.]	$f_c$ [psi]	$\Psi_{parallel,V}$
3.220	1.000	0.500	4,000	2.000

**Calculations**

$A_{Vc}$ [in. <sup>2</sup> ]	$A_{Vc0}$ [in. <sup>2</sup> ]	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{h,V}$	$V_b$ [lb]
510.00	450.00	1.000	1.000	1.000	14,368

**Results**

$V_{cbg}$ [lb]	$\phi_{concrete}$	$\phi V_{cbg}$ [lb]	$V_{ua}$ [lb]
32,567	0.700	22,797	11,700

\*Anchor row defined by: Anchor 1, 2; Case 3 controls

When the input edge distance is set to "infinity", edge breakout verification is not performed in that direction



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Company:	Apex Structural	Page:	7
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Design:	Concrete - May 20, 2025	Date:	5/20/2025
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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!
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- 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.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to <https://viewer.joomag.com/profis-design-guide-us-en-summer-2021/0841849001625154758?short&/>
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-19, Section 26.7.

**Fastening meets the design criteria!**

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Company:	Apex Structural	Page:	8
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
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Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

## 6 Installation data

Profile: W shape (AISC), W10X22; (L x W x T x FT) = 10.200 in. x 5.750 in. x 0.240 in. x 0.360 in.

Hole diameter in the fixture:  $d_f = 0.625$  in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: KWIK HUS-EZ (KH-EZ)  
(Carbon Steel) 1/2 (4 1/4)

Item number: 418076 KH-EZ 1/2"x5"

Maximum installation torque: 540 in.lb

Hole diameter in the base material: 0.500 in.

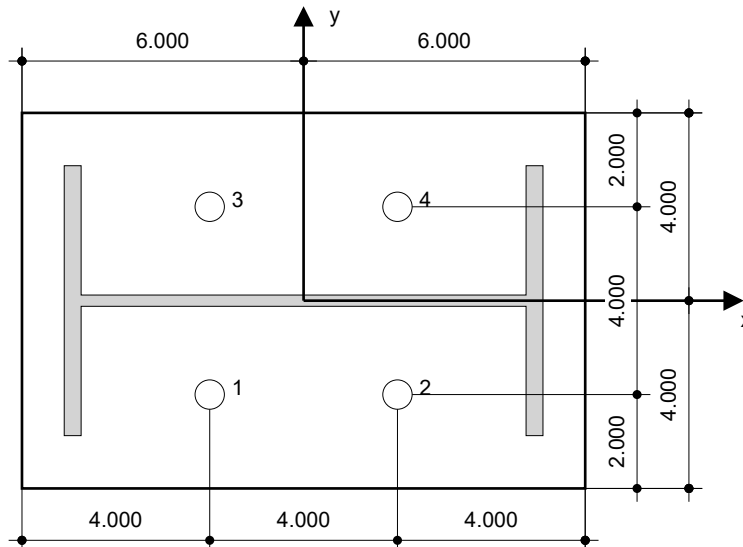
Hole depth in the base material: 4.625 in.

Minimum thickness of the base material: 6.750 in.

Hilti  $\varnothing$  1/2 in KWIK HUS-EZ (KH-EZ) (Carbon Steel) with 4.25 in nominal embedment depth per ICC-ES ESR-3027 , Hammer drill bit installation per MPII

### 6.1 Recommended accessories

Drilling	Cleaning	Setting
<ul style="list-style-type: none"> <li>• Suitable Rotary Hammer</li> <li>• Properly sized drill bit</li> </ul>	<ul style="list-style-type: none"> <li>• Manual blow-out pump</li> </ul>	<ul style="list-style-type: none"> <li>• Torque wrench</li> </ul>



#### Coordinates Anchor [in.]


Anchor	x	y	C <sub>-x</sub>	C <sub>+x</sub>	C <sub>-y</sub>	C <sub>+y</sub>
1	-2.000	-2.000	-	-	10.000	14.000
2	2.000	-2.000	-	-	10.000	14.000
3	-2.000	2.000	-	-	14.000	10.000
4	2.000	2.000	-	-	14.000	10.000

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Company:	Apex Structural	Page:	9
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

## 7 Alternative fastening

### 7.1 Alternative fastening data

<b>Anchor type and diameter:</b>	<b>KWIK-X (Carbon Steel) 1/2 (3) hnom1</b>	
Item number:	418073 KH-EZ 1/2"x4" (element) / 2346810 KHC 1/2" SMALL (capsule)	
Specification text:	Hilti Ø 1/2 in KWIK HUS-EZ (KH-EZ) (Carbon Steel) with 4.25 in nominal embedment depth per ICC-ES ESR-3027 , Hammer drill bit installation per MPII,	
Effective embedment depth:	$h_{ef,act} = 3.220$ in. ( $h_{ef,limit} = -$ in.), $h_{nom} = 3.220$ in.	
Material:	Carbon Steel	
Evaluation Service Report:	ESR-5065	
Issued   Valid:	12/1/2023   12/1/2025	
Proof:	Design Method ACI 318-19 / Chem	
Shear edge breakout verification:	Row closest to edge (Case 3 only from ACI 318-19 Fig. R.17.7.2.1b)	
Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.	
Anchor plate <sup>R</sup> :	$l_x \times l_y \times t = 12.000$ in. x $8.000$ in. x $0.500$ in.; (Recommended plate thickness: not calculated)	
Profile:	W shape (AISC), W10X22; (L x W x T x FT) = $10.200$ in. x $5.750$ in. x $0.240$ in. x $0.360$ in.	
Base material:	cracked concrete, $4000$ , $f_c' = 4,000$ psi; $h = 24.000$ in., Temp. short/long: 32/32 °F	
<b>Installation:</b>	<b>Hammer drilled hole, Installation condition: Dry</b>	
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar	

**Max. Utilization with KWIK-X (Carbon Steel) 1/2 (3) hnom1: 68 %  
Fastening meets the design criteria!**



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Company:	Apex Structural	Page:	10
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

**7.2 Installation data**

Profile: W shape (AISC), W10X22; (L x W x T x FT) = 10.200 in. x 5.750 in. x 0.240 in. x 0.360 in.

Hole diameter in the fixture:  $d_f = 0.625$  in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: No cleaning of the drilled hole is required

Anchor type and diameter: KWIK-X (Carbon Steel) 1/2 (3)

hnom1

Item number: 418073 KH-EZ 1/2"x4" (element) / 2346810

KHC 1/2" SMALL (capsule)

Maximum installation torque: -

Hole diameter in the base material: 0.500 in.

Hole depth in the base material: 3.970 in.

Minimum thickness of the base material: 5.220 in.

Hilti  $\varnothing$  1/2 in KWIK-X (Carbon Steel) with KH-EZ with KHC 1/2" SMALL with 3.22 in nominal embedment depth per ICC-ES ESR-5065, Hammer drill bit installation per MPII

**7.2.1 Recommended accessories**

Drilling	Cleaning	Setting
<ul style="list-style-type: none"> <li>• Suitable Rotary Hammer</li> <li>• Properly sized drill bit</li> </ul>	<ul style="list-style-type: none"> <li>• No accessory required</li> </ul>	<ul style="list-style-type: none"> <li>• SIW 6-A22 Impact Screw Driver</li> </ul>



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Company:	Apex Structural	Page:	11
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
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Design:	Concrete - May 20, 2025	Date:	5/20/2025
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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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Company:	Apex Structural	Page:	1
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
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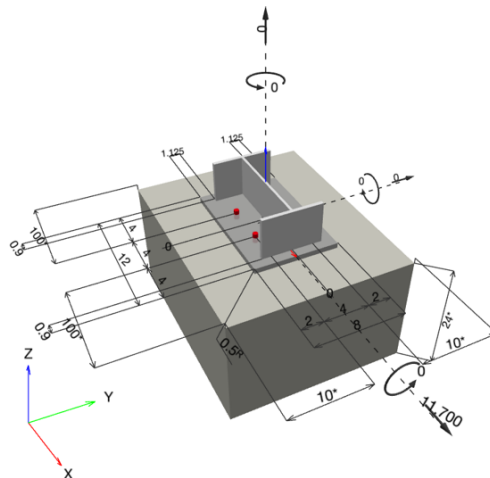
**Specifier's comments:**

**1 Input data**

<b>Anchor type and diameter:</b>	<b>KWIK HUS-EZ (KH-EZ) (Carbon Steel) 1/2 (4 1/4)</b>	
Item number:	418076 KH-EZ 1/2"x5"	
Specification text:	Hilti $\varnothing$ 1/2 in KWIK HUS-EZ (KH-EZ) (Carbon Steel) with 4.25 in nominal embedment depth per ICC-ES ESR-3027 , Hammer drill bit installation per MPII,	
Effective embedment depth:	$h_{ef,act} = 3.220$ in., $h_{nom} = 4.250$ in.	
Material:	Carbon Steel	
Evaluation Service Report:	ESR-3027	
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Proof:	Design Method ACI 318-19 / Mech	
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Stand-off installation:	$e_b = 0.000$ in. (no stand-off); $t = 0.500$ in.	
Anchor plate <sup>R</sup> :	$l_x \times l_y \times t = 12.000$ in. x $8.000$ in. x $0.500$ in.; (Recommended plate thickness: not calculated)	
Profile:	W shape (AISC), W10X22; (L x W x T x FT) = $10.200$ in. x $5.750$ in. x $0.240$ in. x $0.360$ in.	
Base material:	cracked concrete, 4000, $f'_c = 4,000$ psi; $h = 24.000$ in.	
<b>Installation:</b>	<b>Hammer drilled hole, Installation condition: Dry</b>	
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar	

<sup>R</sup> - The anchor calculation is based on a rigid anchor plate assumption.

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



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Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
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**1.1 Design results**

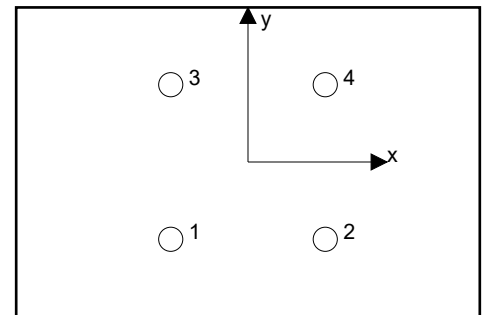
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V <sub>x</sub> = 11,700; V <sub>y</sub> = 0; M <sub>x</sub> = 0; M <sub>y</sub> = 0; M <sub>z</sub> = 0;	no	140

**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	2,925	2,925	0
2	0	2,925	2,925	0
3	0	2,925	2,925	0
4	0	2,925	2,925	0



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

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

**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*	N/A	N/A	N/A	N/A
Pullout 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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Company:	Apex Structural	Page:	3
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

## 4 Shear load

	Load $V_{ua}$ [lb]	Capacity $\phi V_n$ [lb]	Utilization $\beta_v = V_{ua} / \phi V_n$	Status
Steel Strength*	2,925	5,547	53	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	11,700	17,392	68	OK
Concrete edge failure in direction x+**	11,700	8,396	140	not recommended

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

### 4.1 Steel Strength

$V_{sa}$  = ESR value      refer to ICC-ES ESR-3027  
 $\phi V_{steel} \geq V_{ua}$       ACI 318-19 Table 17.5.2

#### Variables

$A_{se,V}$ [in. <sup>2</sup> ]	$f_{uta}$ [psi]
0.16	112,540

#### Calculations

$V_{sa}$ [lb]
9,245

#### Results

$V_{sa}$ [lb]	$\phi_{steel}$	$\phi V_{sa}$ [lb]	$V_{ua}$ [lb]
9,245	0.600	5,547	2,925

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Company:	Apex Structural	Page:	4
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

**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)

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

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

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

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

$$N_b = k_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \quad \text{ACI 318-19 Eq. (17.6.2.2.1)}$$

**Variables**

$k_{cp}$	$h_{ef}$ [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	3.220	0.000	0.000	10.000
$\psi_{c,N}$	$c_{ac}$ [in.]	$k_c$	$\lambda_a$	$f_c$ [psi]
1.000	5.250	17	1.000	4,000

**Calculations**

$A_{Nc}$ [in. <sup>2</sup> ]	$A_{Nc0}$ [in. <sup>2</sup> ]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	$N_b$ [lb]
186.60	93.32	1.000	1.000	1.000	1.000	6,212

**Results**

$V_{cp,g}$ [lb]	$\phi_{concrete}$	$\phi V_{cp,g}$ [lb]	$V_{ua}$ [lb]
24,845	0.700	17,392	11,700

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Company:	Apex Structural	Page:	5
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

**4.3 Concrete edge failure in direction x+**

$$V_{cbg} = \left( \frac{A_{Vc}}{A_{Vc0}} \right) \Psi_{ec,V} \Psi_{ed,V} \Psi_{c,V} \Psi_{h,V} \Psi_{parallel,V} V_b \quad \text{ACI 318-19 Eq. (17.7.2.1b)}$$

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

$$A_{Vc} \text{ see ACI 318-19, Section 17.7.2.1, Fig. R 17.7.2.1(b)*}$$

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

$$\Psi_{ec,V} = \left( \frac{1}{1 + \frac{e_v}{1.5c_{a1}}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.3.1)}$$

$$\Psi_{ed,V} = 0.7 + 0.3 \left( \frac{c_{a2}}{1.5c_{a1}} \right) \leq 1.0 \quad \text{ACI 318-19 Eq. (17.7.2.4.1b)}$$

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

$$V_b = \left( 7 \left( \frac{l_e}{d_a} \right)^{0.2} \sqrt{d_a} \right) \lambda_a \sqrt{f'_c} c_{a1}^{1.5} \quad \text{ACI 318-19 Eq. (17.7.2.2.1a)}$$

**Variables**

$c_{a1}$ [in.]	$c_{a2}$ [in.]	$e_{cV}$ [in.]	$\Psi_{c,V}$	$h_a$ [in.]
16.000	10.000	0.000	1.000	24.000
$l_e$ [in.]	$\lambda_a$	$d_a$ [in.]	$f'_c$ [psi]	$\Psi_{parallel,V}$
3.220	1.000	0.500	4,000	1.000

**Calculations**

$A_{Vc}$ [in. <sup>2</sup> ]	$A_{Vc0}$ [in. <sup>2</sup> ]	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{h,V}$	$V_b$ [lb]
576.00	1,152.00	1.000	0.825	1.000	29,078

**Results**

$V_{cbg}$ [lb]	$\phi_{concrete}$	$\phi V_{cbg}$ [lb]	$V_{ua}$ [lb]
11,995	0.700	8,396	11,700

\*Anchor row defined by: Anchor 2, 4; Case 3 controls



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Company:	Apex Structural	Page:	6
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

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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!
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- 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.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to <https://viewer.joomag.com/profis-design-guide-us-en-summer-2021/0841849001625154758?short&/>
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-19, Section 26.7.

**Fastening does not meet the design criteria!**

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Company:	Apex Structural	Page:	7
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

## 6 Installation data

Profile: W shape (AISC), W10X22; (L x W x T x FT) = 10.200 in. x 5.750 in. x 0.240 in. x 0.360 in.

Hole diameter in the fixture:  $d_f = 0.625$  in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: KWIK HUS-EZ (KH-EZ)  
(Carbon Steel) 1/2 (4 1/4)

Item number: 418076 KH-EZ 1/2"x5"

Maximum installation torque: 540 in.lb

Hole diameter in the base material: 0.500 in.

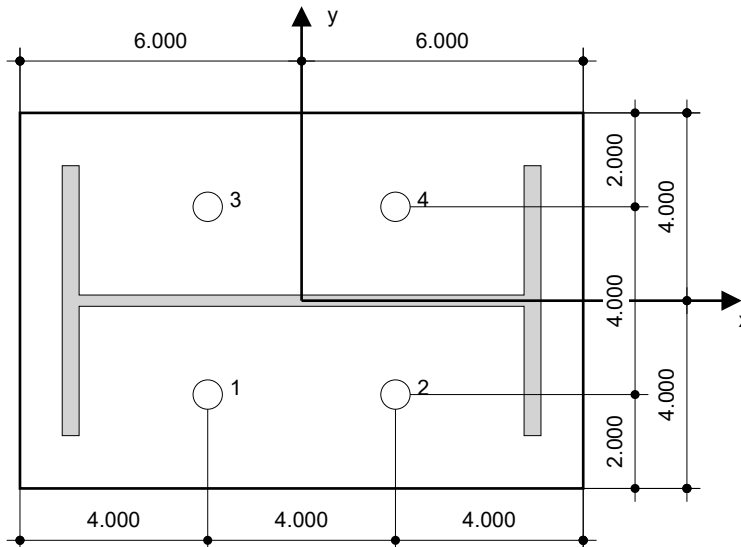
Hole depth in the base material: 4.625 in.

Minimum thickness of the base material: 6.750 in.

Hilti  $\varnothing$  1/2 in KWIK HUS-EZ (KH-EZ) (Carbon Steel) with 4.25 in nominal embedment depth per ICC-ES ESR-3027 , Hammer drill bit installation per MPII

### 6.1 Recommended accessories

Drilling	Cleaning	Setting
<ul style="list-style-type: none"> <li>• Suitable Rotary Hammer</li> <li>• Properly sized drill bit</li> </ul>	<ul style="list-style-type: none"> <li>• Manual blow-out pump</li> </ul>	<ul style="list-style-type: none"> <li>• Torque wrench</li> </ul>



### Coordinates Anchor [in.]

Anchor	x	y	C <sub>-x</sub>	C <sub>+x</sub>	C <sub>-y</sub>	C <sub>+y</sub>
1	-2.000	-2.000	100.000	104.000	10.000	14.000
2	2.000	-2.000	104.000	100.000	10.000	14.000
3	-2.000	2.000	100.000	104.000	14.000	10.000
4	2.000	2.000	104.000	100.000	14.000	10.000



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Company:	Apex Structural	Page:	8
Address:	373 Collins Rd. NE, 102	Specifier:	Alex Miller
Phone   Fax:	319-294-2739	E-Mail:	alex@apex-se.com
Design:	Concrete - May 20, 2025	Date:	5/20/2025
Fastening point:			

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## 7 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.