METTEMEYER ENGINEERING LLC

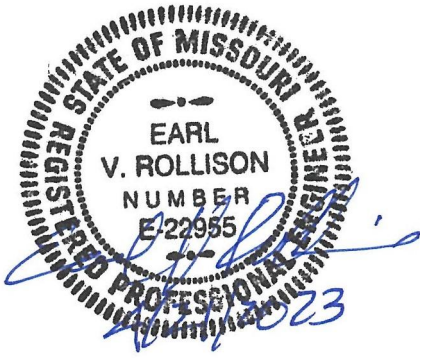
LBP V

Lee's Summit

Structural Calculations

Respectfully Submitted,

Mettemeyer Engineering, LLC



Earl V Rollison PE
Project Engineer

Davidson A+E

PROJECT #23-0333

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SPRINGDALE OFFICE: 3291 S. Thompson St., Suite E-105, Springdale, AR 72764 / 479.751.8002
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mett-engr.com

METTEMEYER ENGINEERING LLC

Project Number: 23-0333

Project Name: LBPV

Date: _____ Sheet ____ of ____

RAISE ONE EXISTING OVERHEAD DOOR FROM 10' TO 12' Ø

CODE IBC - 2018 RISK CAT II $I_{SNOW} = I_{GL} = 1.0$

DESIGN CRITERIA

1. GRAVITY:

PERLIN

DEAD LOAD = 8psf

COLLATERAL = 10psf

LIVE LOAD = 20psf

SNOW LOAD = 20psf

$P_f = 0.7 C_e C_t P_g I_s = 14 psf$ $\gamma = 16.6 pcf$

DRIFTING SNOW AT PARAPET: ℓ_{uo} 192

$\ell = 192.0$ $0.75 h_d = 0.75(3.96) = 2.59$ $P_g = 42.99$

$w_d = 10.36'$

2. WIND NOTE: ORIGINALLY DESIGNED USING $V_{ss} = 115$

2018 IEBC $V_{ss} = 109.6$

∴ USE SAME WIND AS ORIGINALLY DESIGNED

∴ WALL PRESSURES

AREA	Zone 4	Zone 5
10	20.35 / -22.11	20.35 / -27.29
20	20.03 / -21.39	20.03 / -25.56
50	18.65 / -20.03	18.65 / -22.97
100	17.27 / -19.52	17.25 / -21.24
200	16.58 / -18.65	16.58 / -19.52

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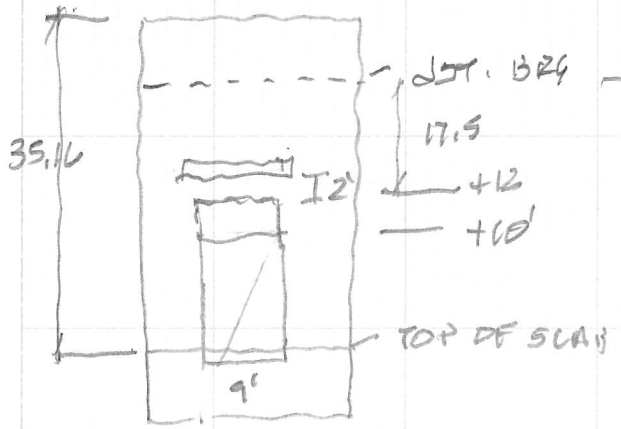
NEW CHANNEL



PROVIDE NEW CHANNEL TO SUPPORT GRAVITY & WIND

$A_{WIND} = 17.5/2 (9) = 78.75'$

$P_W = -22.10$ psf

$w_{WIND} = -22.10 (7.5/2) = -0.194^{k}/_{'}$

$w_{DL_{PANEL}} = 23.16 (0.091) = 2.11^{k}/_{'}$

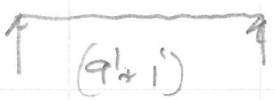
$w_{DL2P} = 8$ psf $(2.5) = 0.20^{k}/_{'}$

$w_{CDL} = 10$ psf $(2.5) = 0.25^{k}/_{'}$

$w_{SC} = 20$ psf $(2.5) = 0.50^{k}/_{'}$ } $0.72^{k}/_{'}$

$w_{DD} = 42.99 (10.36/2) = 0.22^{k}/_{'}$ }

$\Sigma w_{DL} = 2.56^{k}/_{'}$



$w_g = 3.20^{k}/_{'}$

$w_{DL} = 2.56^{k}/_{'}$

$w_w = .194^{k}/_{'}$

LC#1 DL + SL + DL $w = 3.20^{k}/_{'}$ $R = 16.0^{k}$

$M = 40.0'^{k}$ $S_2 = 20.0$

For $\Delta_{max} = \ell/500$ $I_{REQ} = .032\, w\ell^3 = 102.40\,in^4$

C12x25 IS OK. $S_x = 24.0$ $I_x = 144.0$

LC#2 DL + 0.75(SL + WL) $w_g = 2.94^{k}/_{'}$ $w_w = 0.146^{k}/_{'}$

C12x20.7 $S_x = 24.0$ $S_y = 1.87$

$R_g = 14.70^{k}$ $R_w = 0.73^{k}$

$M_g = 36.75'^{k}$ $M_w = 1.82'^{k}$

$F_{Dx} = 18.37S$ $F_{Dy} = 11.68$

$(F_{Dx} + F_{Dy})/24 = 1.25$ NG

2. Try A C15x33.9 $S_x = 42.0$ $S_y = 3.09$

$F_{Dx} = 10.50$ $F_{Dy} = 7.07$

$(F_{Dx} + F_{Dy})/24 = 0.732$ OK

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LC#3 DL + WL $w_D = 2.56^{k/'}$ $w_W = 0.194^{k/'}$

$R_G = 12.8^k$ $R_W = 0.97^k$

$M_G = 32.0^{'-k}$ $M_W = 2.42^{'-k}$

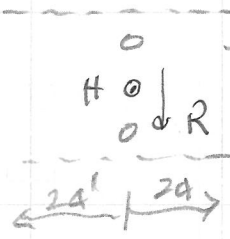
$F_{Dx} = 9.14$ $F_{Dy} = 9.40$

$\frac{F_{Dx} + F_{Dy}}{24} = 0.773$ OK ✓

∴ USE C15X 33.9

ANCHOR DESIGN

1. BETWEEN END SPACING 24" o.c.



$A_{conn} = 17.5/2(2) = 17.5^{in^2}$

$P_W = -25.56$ $H = 0.45^k$

$P_{DL} = 5.12^k$

$P_{SL+DL} = 6.44^k$

$P_{SL} = 1.0^k$

LC#1 $1.2D + 1.6L_r$ $R = 8.45^k$

LC#2 $1.2D + L_r + W/0.6$ $R = 7.59$ $H_{min} = 0.75^k$

2 - 3/4"ø TITEN HD OKAY

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.1.2303.1

Company:		Date:	4/21/2023
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

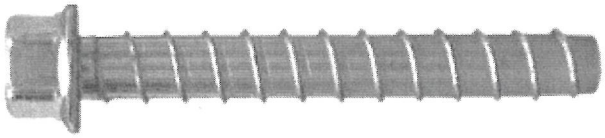
Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 4.500
Effective Embedment depth, h_{ef} (inch): 3.370
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 6.92
c_{ac} (inch): 6.13
C_{min} (inch): 1.75
S_{min} (inch): 2.83

Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:4.5" (114mm)
Code Report: ICC-ES ESR-2713



Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 7.25
State: Cracked
Compressive strength, f'_c (psi): 5000
$\Psi_{c,V}$: 1.0
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

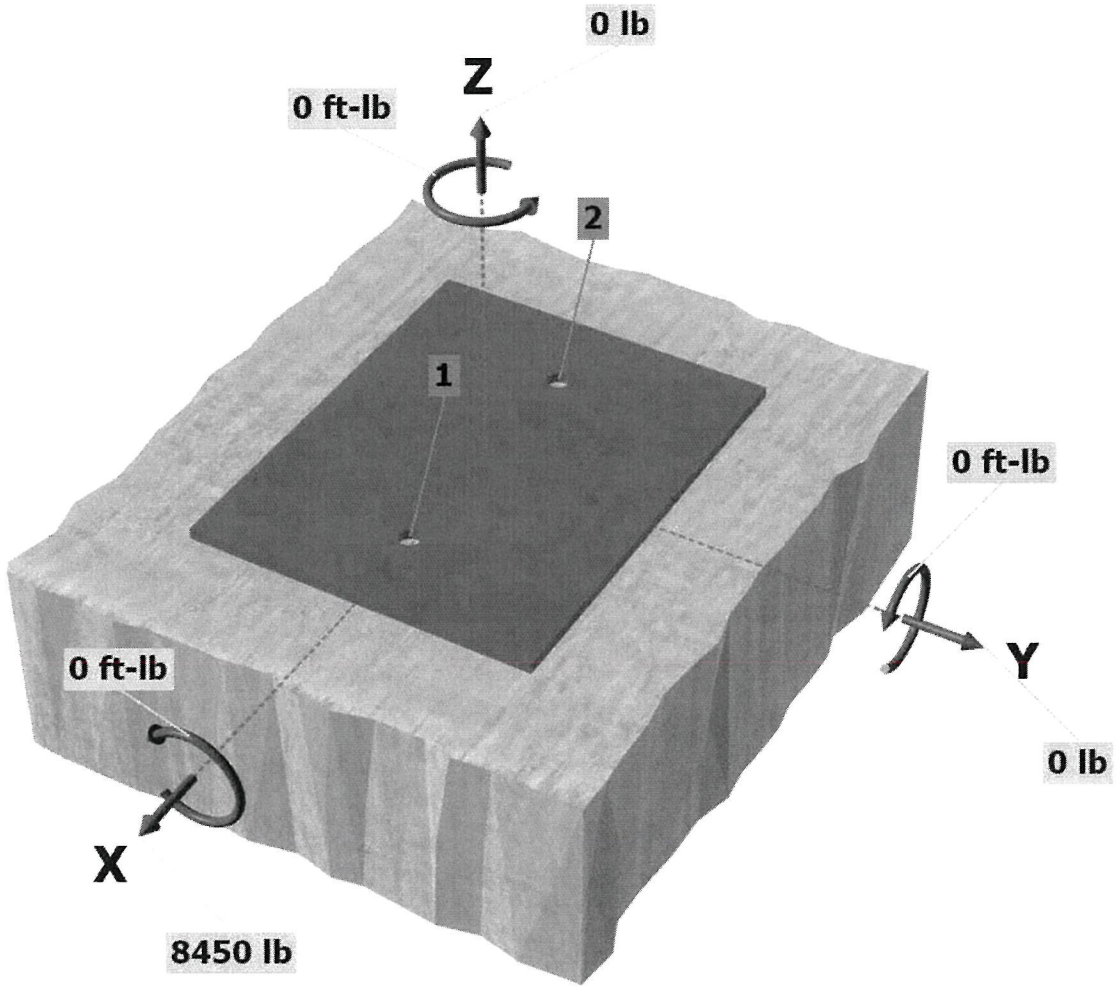
Base Plate
Length x Width x Thickness (inch): 15.00 x 12.00 x 0.38

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 0
V_{uax} [lb]: 8450
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



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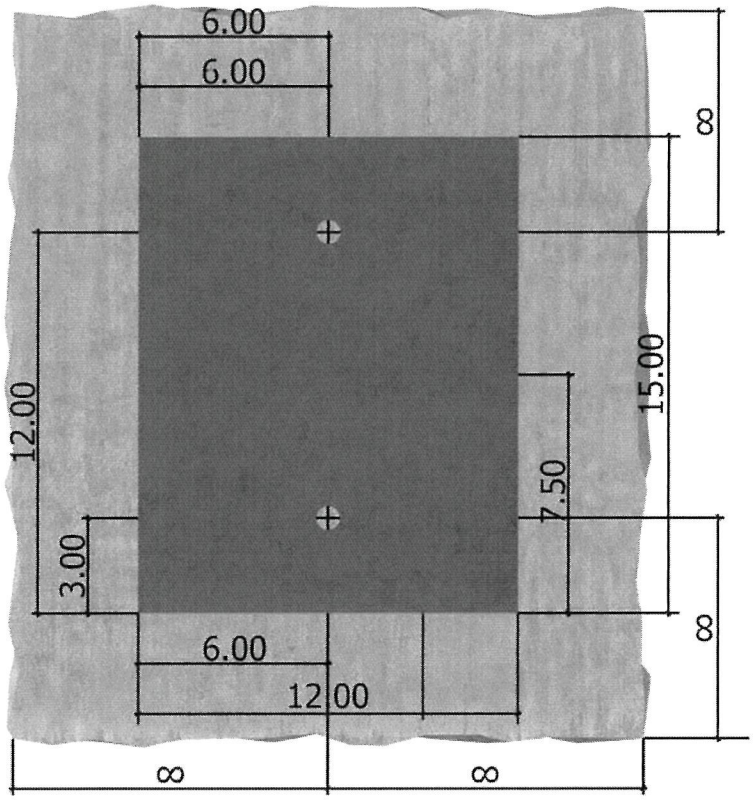
Phone:			
E-mail:			

<Figure 2>

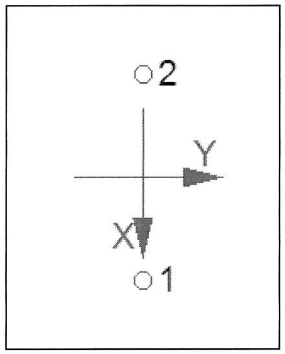


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	4225.0	0.0	4225.0
2	0.0	4225.0	0.0	4225.0
Sum	0.0	8450.0	0.0	8450.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 0
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
15582	1.0	0.60	9349

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco})\, \Psi_{ec,N}\, \Psi_{ed,N}\, \Psi_{c,N}\, \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	193.20	102.21	1.000	1.000	1.000	1.000	7437	0.70	19680

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	**4225**	**9349**	**0.45**	**Pass (Governs)**
Pryout	8450	19680	0.43	Pass

3/4"Ø Titen HD, hnom:4.5" (114mm) meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.1.2303.1

Company:		Date:	4/21/2023
Engineer:		Page:	1/5
Project:			
Address:			
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1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

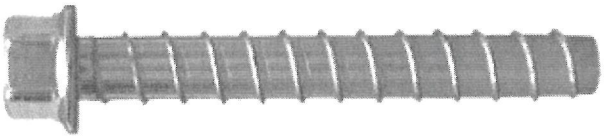
Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 4.500
Effective Embedment depth, h_{ef} (inch): 3.370
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 6.92
c_{ac} (inch): 6.13
C_{min} (inch): 1.75
S_{min} (inch): 2.83

Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:4.5" (114mm)
Code Report: ICC-ES ESR-2713



Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 7.25
State: Cracked
Compressive strength, f'_c (psi): 5000
$\Psi_{c,V}$: 1.0
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

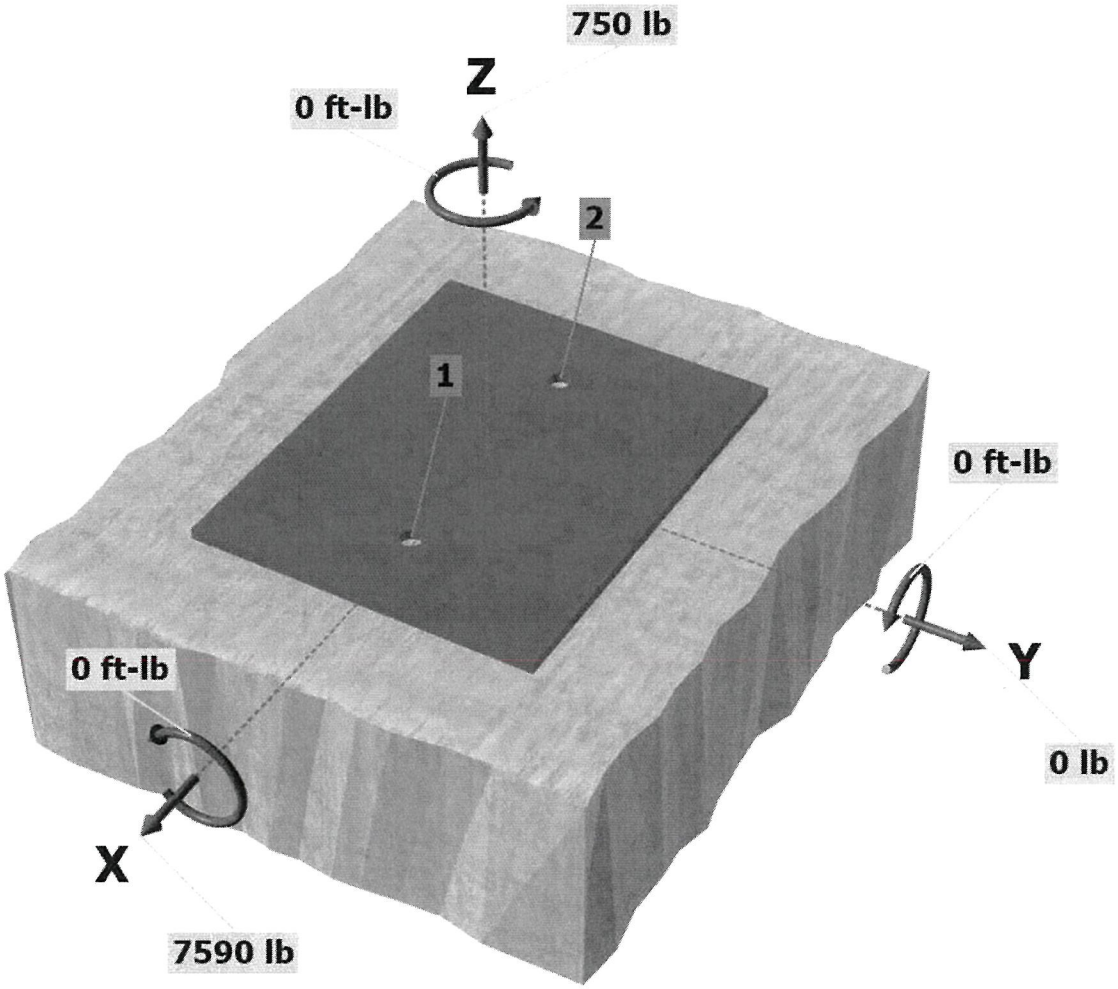
Base Plate
Length x Width x Thickness (inch): 15.00 x 12.00 x 0.38

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

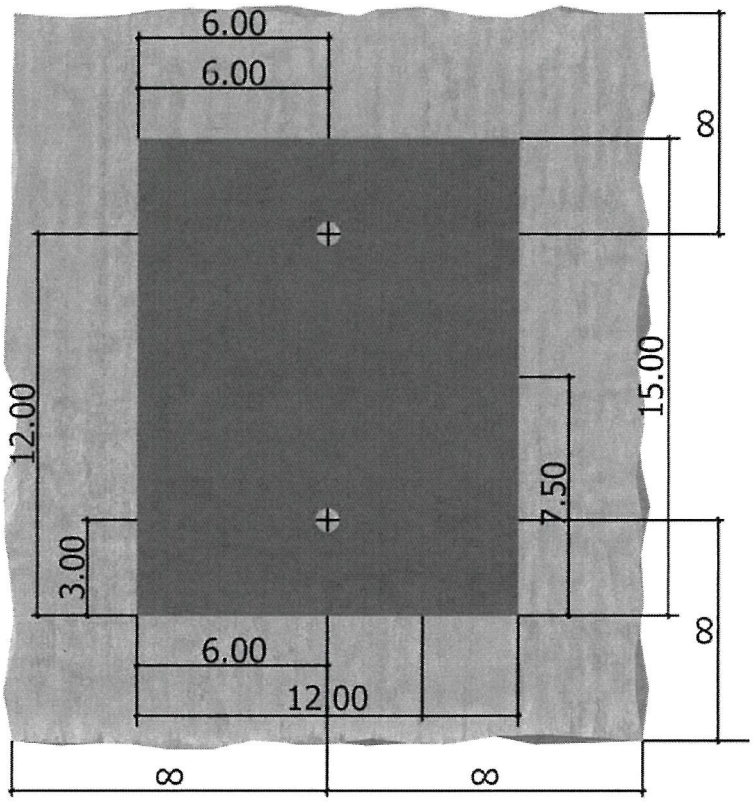
Strength level loads:

N_{ua} [lb]: 750
V_{uax} [lb]: 7590
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

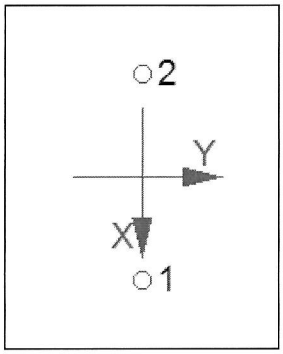


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	375.0	3795.0	0.0	3795.0
2	375.0	3795.0	0.0	3795.0
Sum	750.0	7590.0	0.0	7590.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 750
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
45540	0.65	29601

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	5000	3.370	7437

$\phi N_{cbg} = \phi \, (A_{Nc} / A_{Nco}) \, \Psi_{ec,N} \, \Psi_{ed,N} \, \Psi_{c,N} \, \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
193.20	102.21	-	1.000	1.000	1.00	1.000	7437	0.65	9137

6. Pullout Strength of Anchor in Tension (Sec. 17.6.3)

$\phi N_{pn} = \phi \Psi_{c,P} \lambda_a N_p (f'_c / 2{,}500)^n$ (Sec. 17.5.1.2, Eq. 17.6.3.1 & Code Report)

$\Psi_{c,P}$	λ_a	N_p (lb)	f'_c (psi)	n	ϕ	ϕN_{pn} (lb)
1.0	1.00	4883	5000	0.50	0.65	4489

8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
15582	1.0	0.60	9349

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	193.20	102.21	1.000	1.000	1.000	1.000	7437	0.70	19680

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, øN_n (lb)	Ratio	Status
Steel	375	29601	0.01	Pass
Concrete breakout	750	9137	0.08	Pass
Pullout	**375**	**4489**	**0.08**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	**3795**	**9349**	**0.41**	**Pass (Governs)**
Pryout	7590	19680	0.39	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.2	0.00	0.41	40.6%	1.0	Pass

3/4"Ø Titen HD, hnom:4.5" (114mm) meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

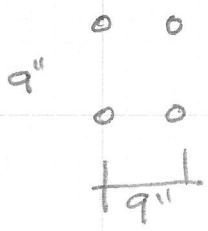
METTEMEYER ENGINEERING LLC

Project Number: _____

Project Name: LBP V

Date: _____ Sheet ____ of ____

2. ANCHOR AT ENDS



$R_{DL} = 1.2(2.56) * 5 = 15.36^K$

$R_{SL} = 1.6(1.0) * 5 = 8.0^K$

$R_{DL} = 1.6(0.22) 5 = 1.76$

$R_{WWW} = 0.73/0.6 = 1.22^K$

LC#1 $1.2DL + 1.6SL$ $R = 34.05$

LC#2 $1.2DL + SL + WL/0.6$ $R = 28.20$
$H = 1.22$

USE 1 - 3/4"Φ x 5" TITEN HD

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.1.2303.1

Company:		Date:	4/21/2023
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
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Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 4.500
Effective Embedment depth, h_{ef} (inch): 3.370
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 6.92
c_{ac} (inch): 6.13
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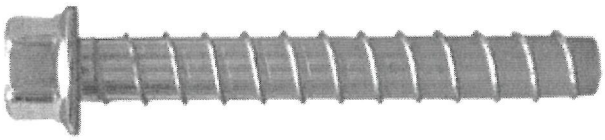
Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:4.5" (114mm)
Code Report: ICC-ES ESR-2713



Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 7.25
State: Cracked
Compressive strength, f'_c (psi): 5000
$\Psi_{c,V}$: 1.0
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

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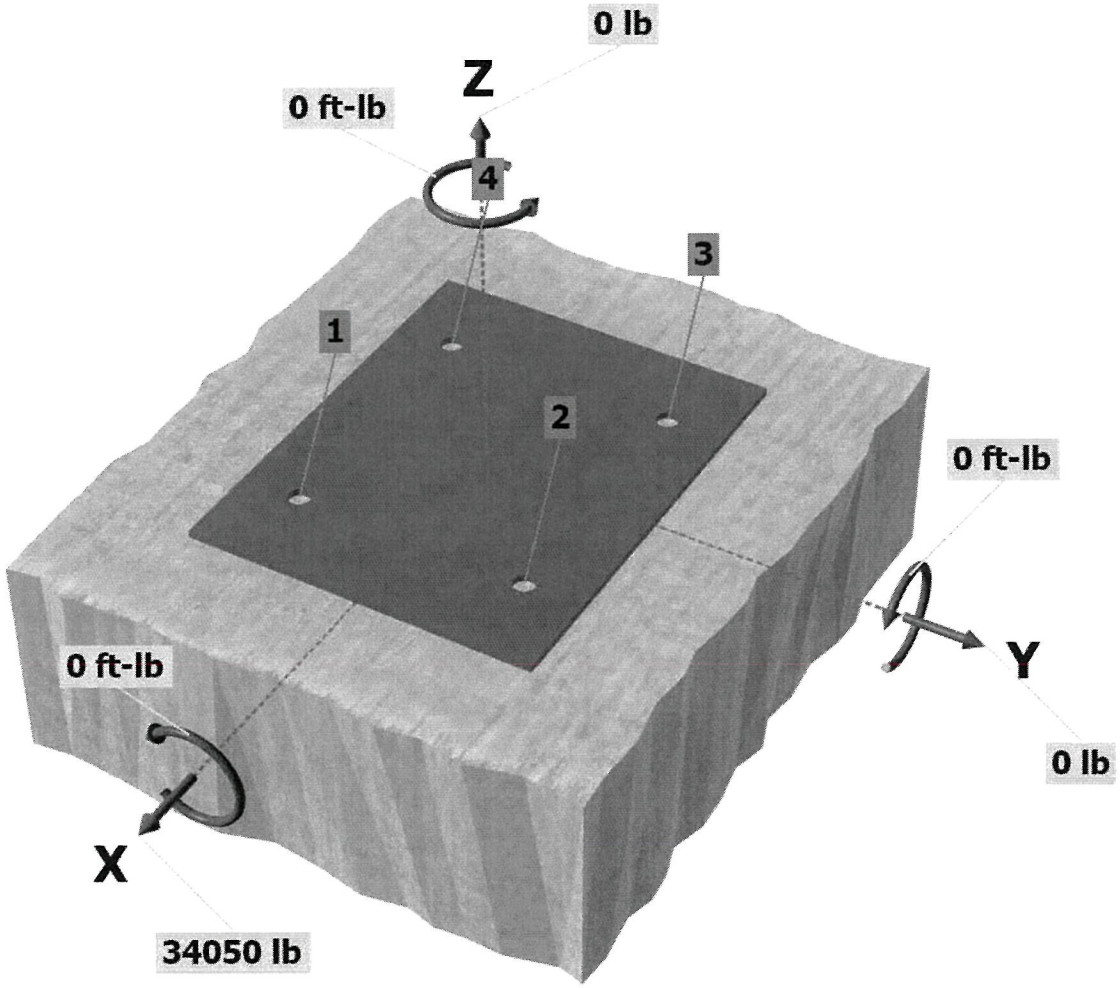
Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 0
V_{uax} [lb]: 34050
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



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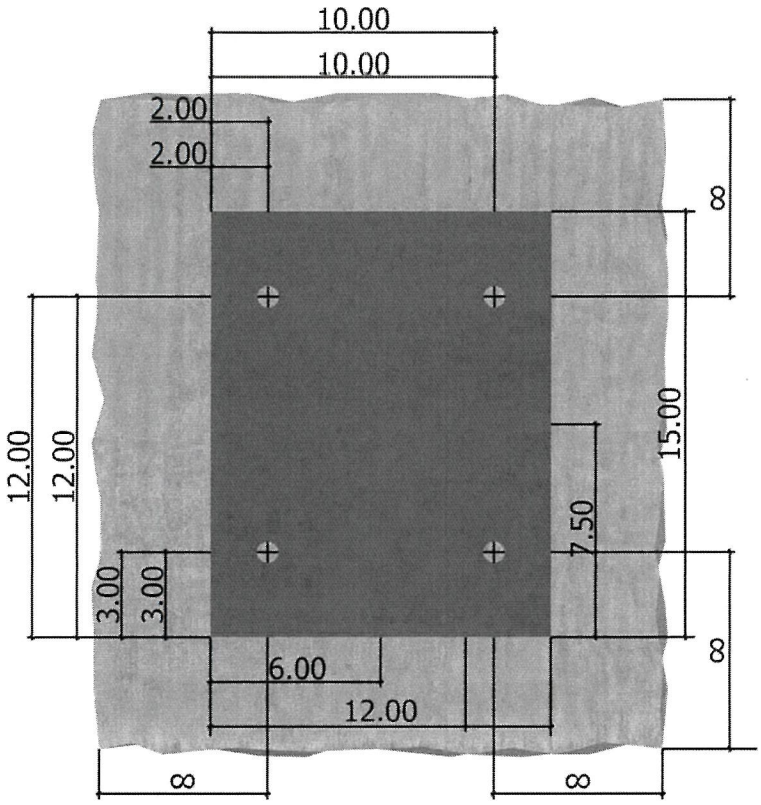

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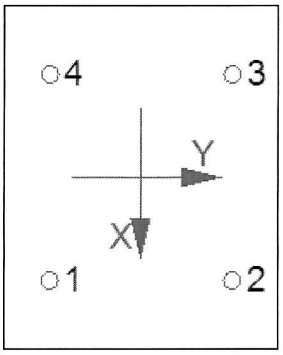
Engineer:		Page:	4/5
Project:			
Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	8512.5	0.0	8512.5
2	0.0	8512.5	0.0	8512.5
3	0.0	8512.5	0.0	8512.5
4	0.0	8512.5	0.0	8512.5
Sum	0.0	34050.0	0.0	34050.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 0
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
15582	1.0	0.60	9349

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco})\, \Psi_{ec,N}\, \Psi_{ed,N}\, \Psi_{c,N}\, \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	346.08	102.21	1.000	1.000	1.000	1.000	7437	0.70	35252

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	8513	9349	0.91	Pass
Pryout	**34050**	**35252**	**0.97**	**Pass (Governs)**

3/4"Ø Titen HD, hnom:4.5" (114mm) meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.1.2303.1

Company:		Date:	4/21/2023
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

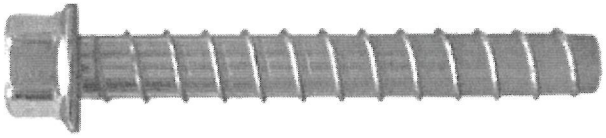
Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.750
Nominal Embedment depth (inch): 4.500
Effective Embedment depth, h_{ef} (inch): 3.370
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 6.92
c_{ac} (inch): 6.13
C_{min} (inch): 1.75
S_{min} (inch): 2.83

Recommended Anchor
Anchor Name: Titen HD® - 3/4"Ø Titen HD, hnom:4.5" (114mm)
Code Report: ICC-ES ESR-2713



Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 7.25
State: Cracked
Compressive strength, f'_c (psi): 5000
$\Psi_{c,V}$: 1.0
Reinforcement condition: Supplementary reinforcement not present
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: Not applicable
Build-up grout pad: No

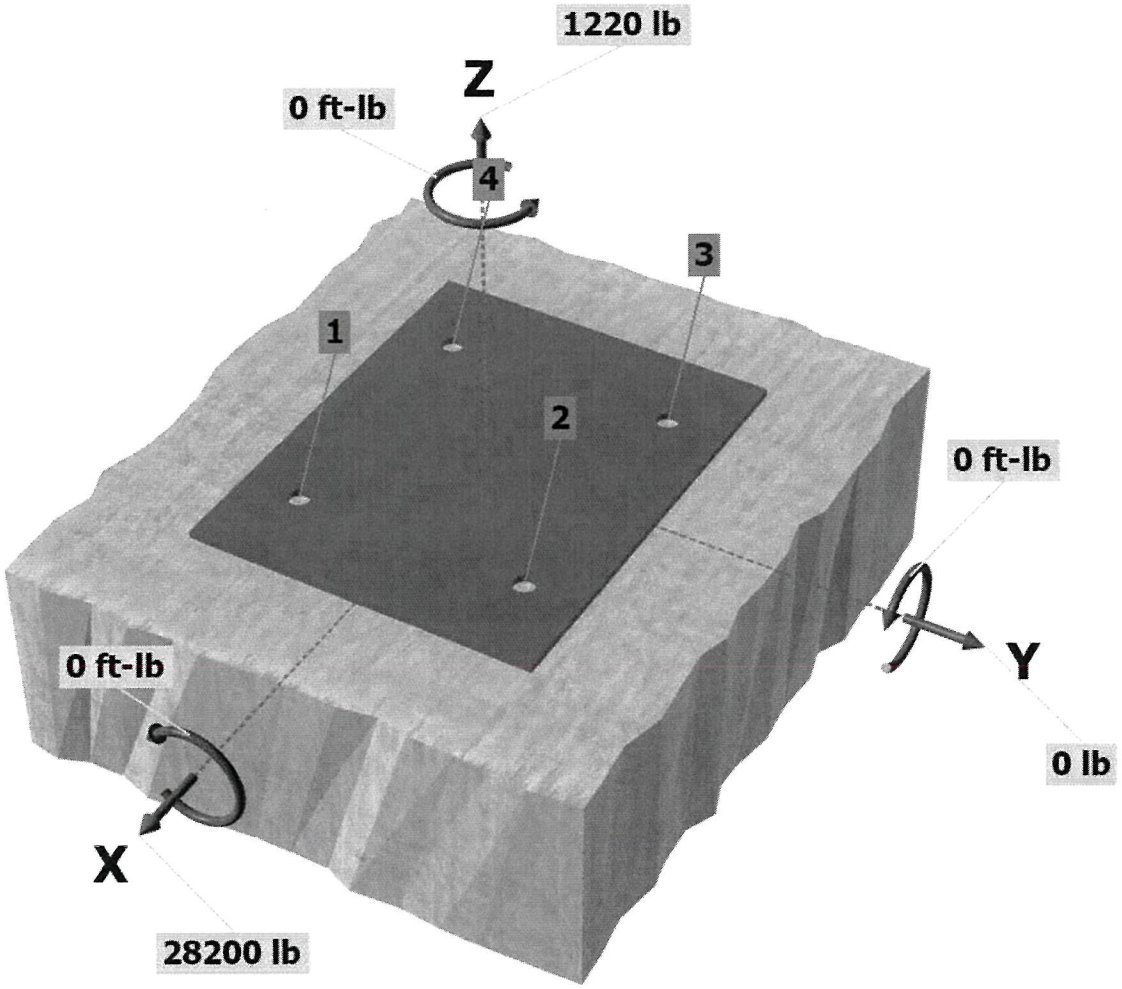
Base Plate
Length x Width x Thickness (inch): 15.00 x 12.00 x 0.25

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

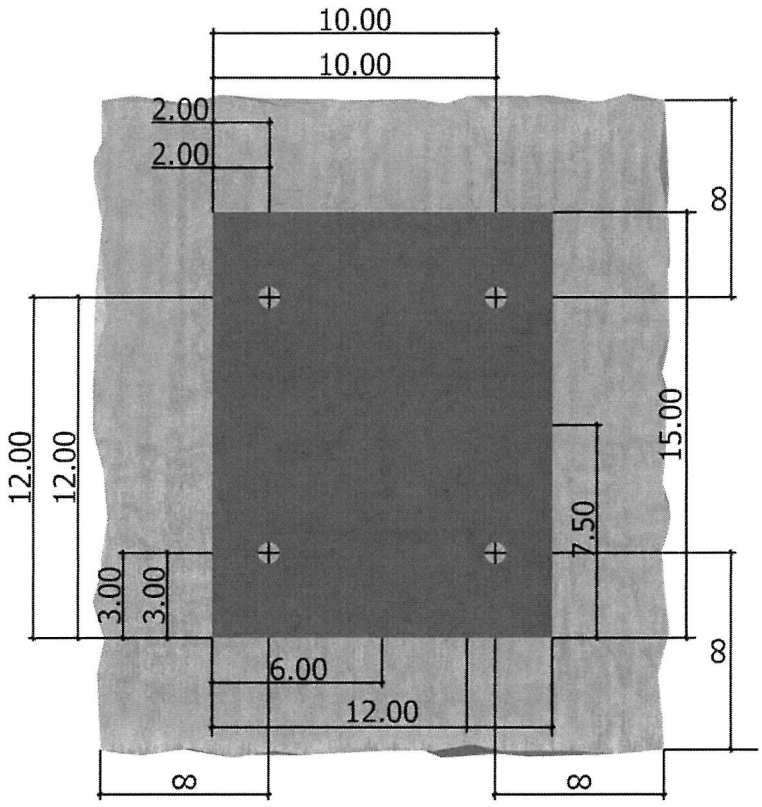
Strength level loads:

N_{ua} [lb]: 1220
V_{uax} [lb]: 28200
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

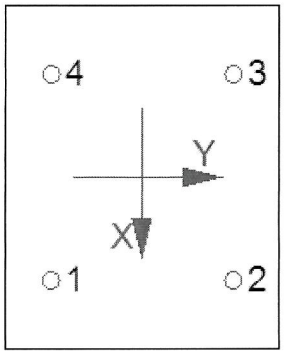


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	305.0	7050.0	0.0	7050.0
2	305.0	7050.0	0.0	7050.0
3	305.0	7050.0	0.0	7050.0
4	305.0	7050.0	0.0	7050.0
Sum	1220.0	28200.0	0.0	28200.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 1220
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.6.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
45540	0.65	29601

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.6.2.2.1)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	5000	3.370	7437

$\phi N_{cbg} = \phi \, (A_{Nc} / A_{Nco}) \, \Psi_{ec,N} \, \Psi_{ed,N} \, \Psi_{c,N} \, \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.6.2.1a)

A_{Nc} (in²)	A_{Nco} (in²)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
346.08	102.21	-	1.000	1.000	1.00	1.000	7437	0.65	16367

6. Pullout Strength of Anchor in Tension (Sec. 17.6.3)

$\phi N_{pn} = \phi \Psi_{c,P} \lambda_a N_p (f'_c / 2{,}500)^n$ (Sec. 17.5.1.2, Eq. 17.6.3.1 & Code Report)

$\Psi_{c,P}$	λ_a	N_p (lb)	f'_c (psi)	n	ϕ	ϕN_{pn} (lb)
1.0	1.00	4883	5000	0.50	0.65	4489

8. Steel Strength of Anchor in Shear (Sec. 17.7.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
15582	1.0	0.60	9349

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)

$\phi V_{cpg} = \phi k_{cp} N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.5.1.2 & Eq. 17.7.3.1b)

k_{cp}	A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cpg} (lb)
2.0	346.08	102.21	1.000	1.000	1.000	1.000	7437	0.70	35252

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, øN_n (lb)	Ratio	Status
Steel	305	29601	0.01	Pass
Concrete breakout	**1220**	**16367**	**0.07**	**Pass (Governs)**
Pullout	305	4489	0.07	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, øV_n (lb)	Ratio	Status
Steel	7050	9349	0.75	Pass
Pryout	**28200**	**35252**	**0.80**	**Pass (Governs)**

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.2	0.00	0.80	80.0%	1.0	Pass

3/4"Ø Titen HD, hnom:4.5" (114mm) meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.