STRUCTURAL CALCULATIONS

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DATE: May 26, 2022

PROJECT: 18-220 **PB POST BASE**

BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E. (OR and WA)
RON DERRICK, P.E., (CA)

FOR: **WOODSTONE STRUCTURES, LLC**

PROJECT DESCRIPTION & SCOPE OF SERVICES:
Structural design in accordance with the 2012 International Building Code (IBC) for the above referenced project as follows:

Wood-Bolted Connection Analysis	Steel Assembly Analysis
Concrete Anchor Analysis	

Should conditions differ from those depicted in this report or accompanying drawings, contact this office for further direction. The analyses contained herein is for the Post Base, included fasteners, and specified concrete anchors only. Branch Engineering, Inc. has not reviewed any framing or foundation elements for any structure considered to be supporting the above referenced product and/or the connected roof.

SPECIAL INSPECTION:
None

NOTES:
Analysis based upon measurements taken from Post Base bracket assembly, supplied by Woodstone Structures, LLC, October 2019.
No analysis of supporting structure or supporting framing has been conducted in conjunction with this report. Consult a local Engineer for each individual installation scenario.
See additional notes below "PB Allowable Loads" table.

REGISTERED PROFESSIONAL ENGINEER
RONALD J. DERRICK
NO. 46,576
CIVIL
STATE OF CALIFORNIA
Ronald J. Derrick
Digitally signed by Ronald J. Derrick
Date: 2022.05.27 14:15:30 -07'00'
DIGITALLY SIGNED
Expires: JUNE 30, 2023

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STRUCTURAL ENGINEERING REPORT

DATE: May 26, 2022
PROJECT: 18-220 PB POST BASE
CLIENT: WOODSTONE STRUCTURES, LLC
REPORT BY: BRANCH ENGINEERING, INC.

POST BASE BRACKET (PB)

DESCRIPTION:

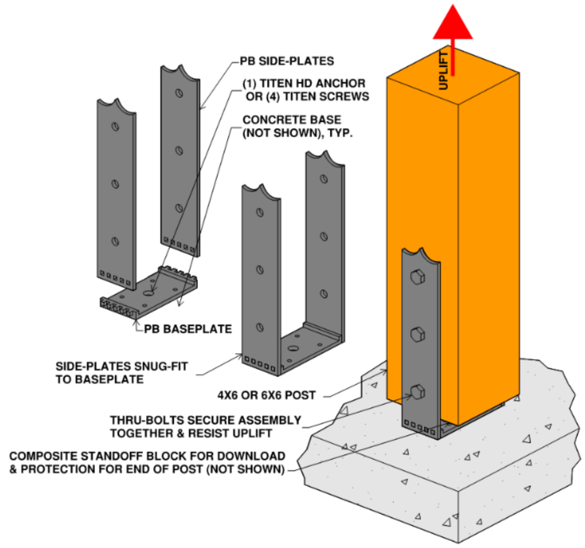
This structural engineering report has been requested by Woodstone Structures, LLC for preliminary analysis of a proprietary product called, “PB Post Base.” The objective of this analysis is to report the allowable capacity of the product, in its current configuration, for use in supporting vertical loading in both the downward direction and in uplift.

ASSUMED MATERIAL:

(1) BASEPLATE – 1/4” ASTM A36
(2) SIDE-PLATES – 1/4” ASTM A36
(3) 1/2” DIA. ASTM A307 BOLT
(1) 5/8” DIA. TITEN HD CONCRETE ANCHOR (NOT SUPPLIED)
OR (4) 3/8” DIA. TITEN HD CONCRETE SCREW (NOT SUPPLIED)
POST – SPECIES PER TABLE (NOT SUPPLIED)

OPTIONS:

POST SIZE MAY VARY PER TABLE.

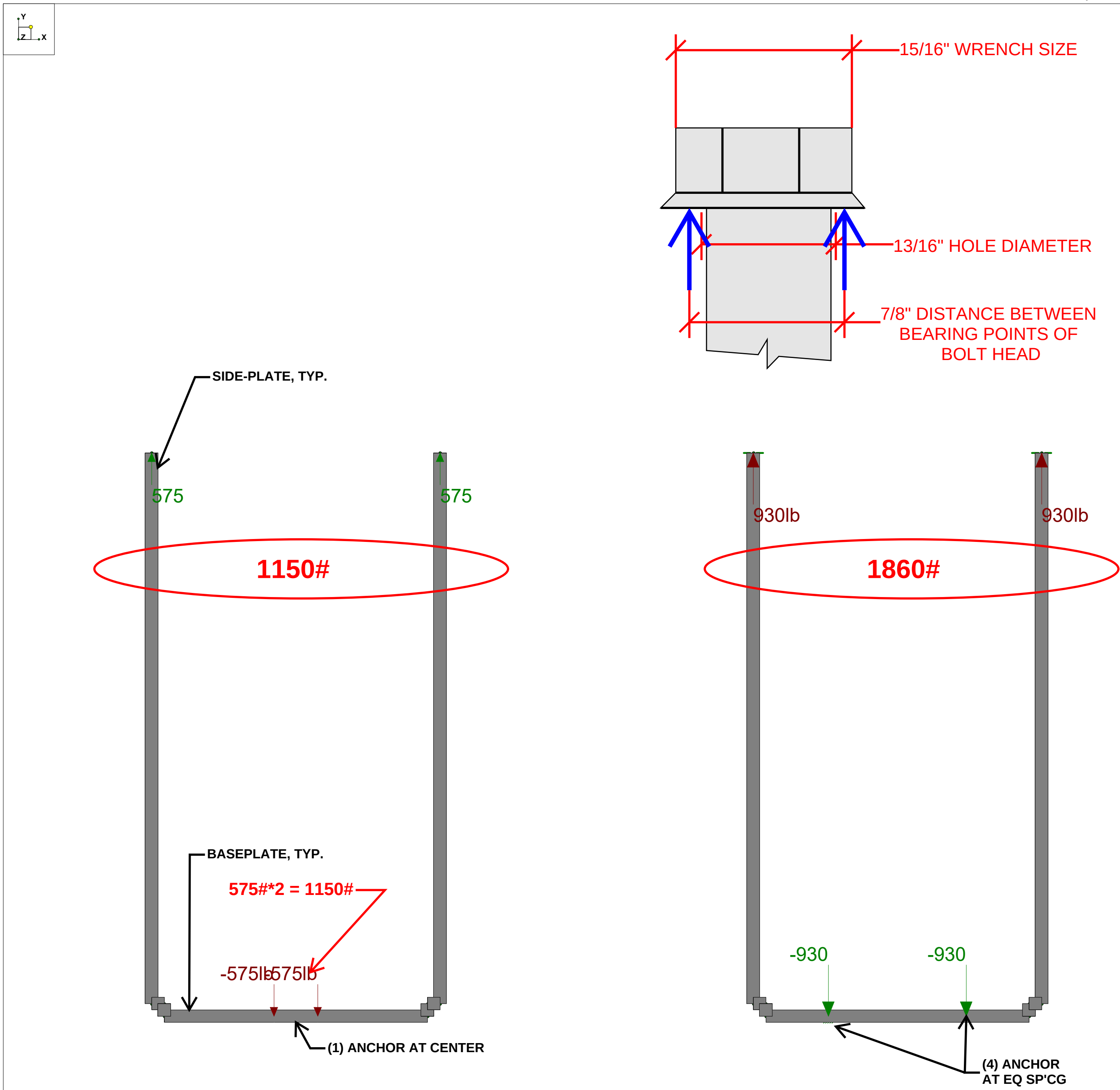


PB ALLOWABLE LOADS

MODEL & ANCHORAGE	POST SIZE (NOM.)	BASEPLATE THICKNESS	SIDE-PLATE THICKNESS	BASEPLATE FASTENER TO CONCRETE	MIN CONC. THICKNESS	MIN. EMBED	SIDE-PLATE FASTENER	DF/SP/HF DOWNLOAD	DF/SP/HF UPLIFT (160)
					(in)	(in)		(lb)	(lb)
PB w/ (1) ANCHOR BOLT AT CENTER	4x6 OR 6x6	1/4"	1/4"	(1) TITEN HD	6	4	(3) 1/2" BOLT	26114	690
PB w/ (4) CONCRETE SCREWS	4x6 OR 6x6	1/4"	1/4"	(4) TITEN 2	3 1/4"	1 3/4"	(3) 1/2" BOLT	26114	1116

NOTES:

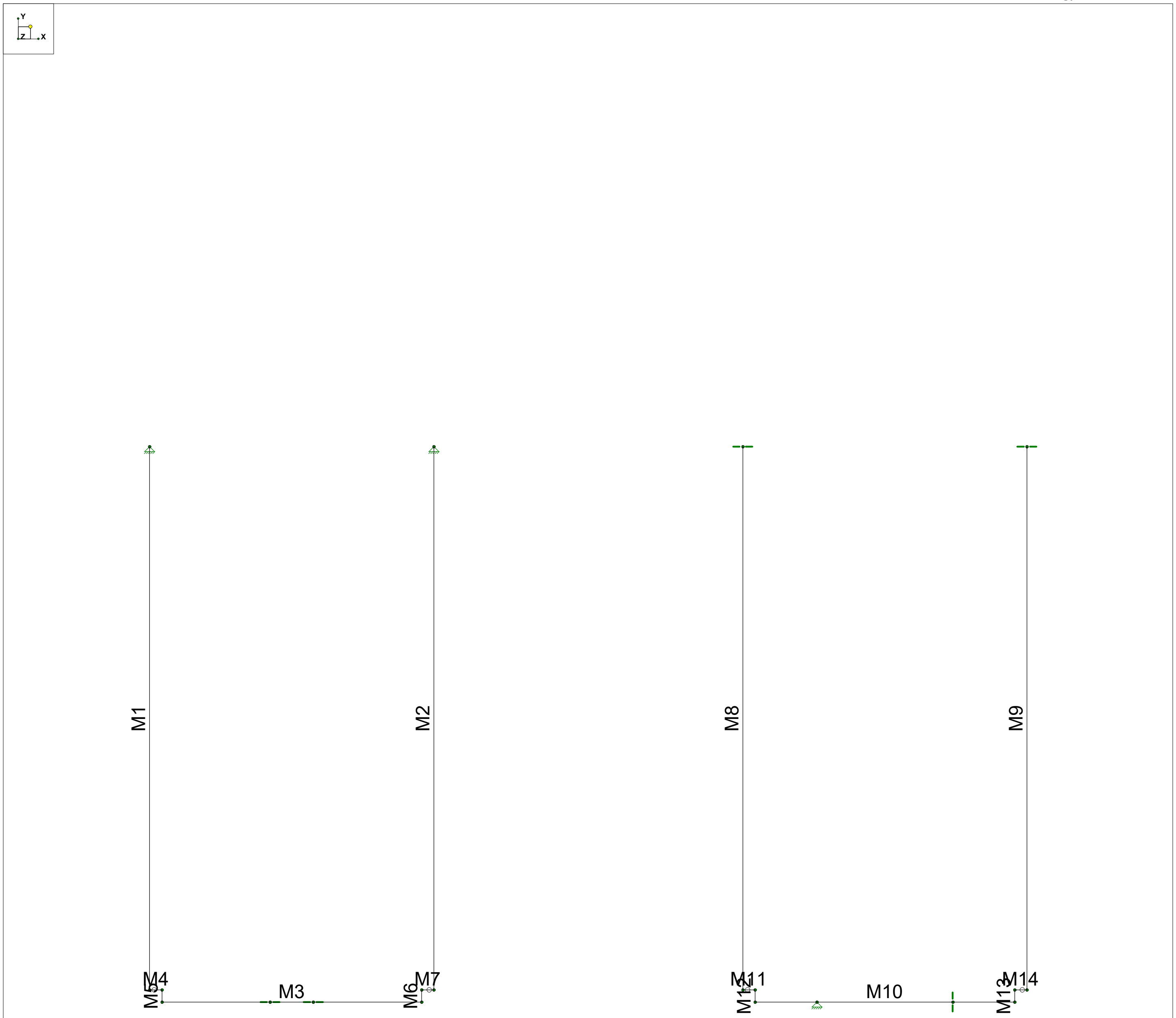
1. THE ABOVE STATED ALLOWABLE LOADS ASSUME WOOD POST SPECIES HEM-FIR OR BETTER (i.e. G>0.43).
2. DOWNLOADS SHALL BE REDUCED WHERE LIMITED BY CAPACITY OF THE POST OR FOUNDATION.
3. ALLOWABLE LOADS SHOWN ARE FOR A SINGLE PB INSTALLED ON A CONCRETE BASE HAVING AT LEAST THE ABOVE STATED THICKNESS.
4. ANALYSIS AND ALLOWABLE LOADS ARE FOR THE STEEL BRACKET, INCLUDED BOLTS, AND SPECIFIED CONCRETE ANCHORS ONLY.
5. CONSULT WITH A LOCAL ENGINEER FOR EACH INDIVIDUAL INSTALLATION.
6. NO DESIGN OF SUPPORTING OR SUPPORTED FRAMING OR FOUNDATION HAS BEEN CONDUCTED. CONSULT AN INDEPENDENT ENGINEER FOR DESIGN OF SUCH FRAMING OR FOUNDATION.
7. UPLIFT LOADS HAVE BEEN INCREASED FOR WIND OR SEISMIC LOADING, WITH NO FURTHER INCREASE ALLOWED.
8. ALLOWABLE LOADS ARE FOR VERTICAL LOADS ONLY. LATERAL BRACING MUST BE SUPPLIED BY OTHER LATERAL FORCE RESISTING SYSTEMS DESIGNED BY OTHERS. LATERAL BRACING SYSTEMS MUST BE INDEPENDENT FROM THE PB BRACKET & POSTS.
9. ALLOWABLE LOADS SHOWN ARE FOR WET-SERVICE CONDITIONS (MOISTURE CONTENT >19%). NO INCREASE ALLOWED FOR DRY-SERVICE.
10. PROVIDE THE FOLLOWING MINIMUMS FOR BOLTS THRU WOOD POST & STEEL PLATE:
    a. EDGE DISTANCE = CENTER COLUMN ON BRACKET EACH WAY.
    b. END DISTANCE = 3 ½ INCHES (END OF POST TO CENTER OF MIDDLE THRU-BOLT)
11. PROVIDE THE FOLLOWING MINIMUMS FOR TITEN HD CONCRETE ANCHORS:
    a. EDGE DISTANCE = 4½ INCHES ALL AROUND.
12. PROVIDE THE FOLLOWING MINIMUMS FOR TITEN 2/TITEN TURBO CONCRETE SCREWS:
    a. EDGE DISTANCE = 3 INCHES ALL AROUND.
13. BOLT HOLES SHALL BE A MINIMUM OF 1/32” AND A MAXIMUM OF 1/16" LARGER THAN THE BOLT DIAMETER (PER 2012 NDS SEC. 11.1.3.2)
14. POST & PB ARE ASSUMED TO BE INSTALLED IN A VERTICALLY PLUMB POSITION WITH POST BEING LOADED CONCENTRICALLY ABOUT ITS CENTER EACH WAY.
15. BASEPLATE MAY EXPERIENCE INELASTIC YIELDING AT THE ABOVE STATED UPLIFT CAPACITY. SUBSEQUENT REPLACEMENT MAY BE REQUIRED.



STRENGTH LEVEL LOADS CONVERT TO SERVICE LEVEL
WL(LRFD) * 0.6 = WL(ASD)
1150# * 0.6 = 690#
2 * 930# * 0.6 = 1116#

Loads: BLC 1, Uplift
Results for LC 2, Uplift
Y-direction Reaction Units are lb and lb-ft

BRANCH ENGINEERING,...		
JOSHUA ANNETT		Feb 18, 2020 at 3:45 PM
		Post Base.r2d



BRANCH ENGINEERING,...		
JOSHUA ANNETT		Feb 18, 2020 at 3:50 PM
		Post Base.r2d

Company : BRANCH ENGINEERING, INC.
Designer : JOSHUA ANNETT
Job Number :
Model Name :

May 26, 2022
10:47 AM
Checked By: RICK HERNANDEZ, P.E., S.E.

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E5 F)	Density[lb/ft^3]	Yield[ksi]
1	A36 Gr.36	29000	11154	.3	.65	490	36

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rules	A [in2]	I (90,270) [in4]	I (0,180) [in4]
1	HR1A	PL1/4x2.75	Beam	None	A36 Gr.36	Typical	.688	.004	.433
2	HR2	PL1/4x1.25	Beam	None	A36 Gr.36	Typical	.313	.002	.041

Member Primary Data

	Label	I Joint	J Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M1	N1	N2	90	HR1A	Beam	None	A36 Gr.36	Typical
2	M2	N3	N4	90	HR1A	Beam	None	A36 Gr.36	Typical
3	M3	N5	N6	90	HR1A	Beam	None	A36 Gr.36	Typical
4	M4	N2	N7	90	HR2	Beam	None	A36 Gr.36	Typical
5	M5	N7	N5	90	HR1A	Beam	None	A36 Gr.36	Typical
6	M6	N6	N8	90	HR1A	Beam	None	A36 Gr.36	Typical
7	M7	N8	N4	90	HR2	Beam	None	A36 Gr.36	Typical
8	M8	N10	N11	90	HR1A	Beam	None	A36 Gr.36	Typical
9	M9	N12	N13	90	HR1A	Beam	None	A36 Gr.36	Typical
10	M10	N14	N15	90	HR1A	Beam	None	A36 Gr.36	Typical
11	M11	N11	N16	90	HR2	Beam	None	A36 Gr.36	Typical
12	M12	N16	N14	90	HR1A	Beam	None	A36 Gr.36	Typical
13	M13	N15	N17	90	HR1A	Beam	None	A36 Gr.36	Typical
14	M14	N17	N13	90	HR2	Beam	None	A36 Gr.36	Typical

Member Advanced Data

	Label	I Release	J Release	I Offset[in]	J Offset[in]	T/C Only	Physical	Defl Rati...	TOM	Inactive
1	M1						Yes			
2	M2						Yes			
3	M3						Yes			
4	M4	PIN					Yes	Default		
5	M5						Yes			
6	M6						Yes			
7	M7		PIN				Yes	Default		
8	M8						Yes			
9	M9						Yes			
10	M10						Yes			
11	M11	PIN					Yes	Default		
12	M12						Yes			
13	M13						Yes			
14	M14		PIN				Yes	Default		

Hot Rolled Steel Design Parameters

	Label	Shape	Length[in]	Lb-out[in]	Lb-in[in]	Lcomp top[in]	Lcomp bot[in]	L-torq...	K-out	K-in	Cb	Function
1	M1	HR1A	10.995			Lb out						Lateral
2	M2	HR1A	10.995			Lb out						Lateral
3	M3	HR1A	5.25			Lb out						Lateral
4	M4	HR2	.25			Lb out						Lateral
5	M5	HR1A	.25			Lb out						Lateral
6	M6	HR1A	.25			Lb out						Lateral
7	M7	HR2	.25			Lb out						Lateral

Hot Rolled Steel Design Parameters (Continued)

	Label	Shape	Length[in]	Lb-out[in]	Lb-in[in]	Lcomp top[in]	Lcomp bot[in]	L-torq...	K-out	K-in	Cb	Function
8	M8	HR1A	10.995			Lb out						Lateral
9	M9	HR1A	10.995			Lb out						Lateral
10	M10	HR1A	5.25			Lb out						Lateral
11	M11	HR2	.25			Lb out						Lateral
12	M12	HR1A	.25			Lb out						Lateral
13	M13	HR1A	.25			Lb out						Lateral
14	M14	HR2	.25			Lb out						Lateral

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Joint	Point	Distributed
1	Uplift	WL			4		

Joint Loads and Enforced Displacements (BLC 1 : Uplift)

	Joint Label	L,D,M	Direction	Magnitude[(lb,lb-ft), (in,rad), (lb*s^2/in, lb*s^2*in)]
1	N10	L	Y	930
2	N12	L	Y	930
3	N1	L	Y	575
4	N3	L	Y	575

Load Combinations

	Description	So...	P...	S...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...
1	LRFD																							
2	Uplift		Y		WL	1																		

Joint Reactions

	LC	Joint Label	X [lb]	Y [lb]	MZ [lb-ft]
1	2	N1	-.364	0	0
2	2	N3	.364	0	0
3	2	N9	0	-575	0
4	2	N10	-.749	0	0
5	2	N12	.749	0	0
6	2	N18	0	-929.997	0
7	2	N19	0	-930.003	0
8	2	N20	0	-575	0
9	2	Totals:	0	-3010	
10	2	COG (in):	X: 10.29	Y: 11.245	

<1.0 = OK!

Member AISC 15th(360-16): LRFD Steel Code Checks

	LC	Member	Shape	UC Max	Loc[in]	Shear UC	Loc[in]	phi*Pnc[lb]	phi*Pnt[lb]	phi*Mn[lb-ft]	Cb	Eqn
1	2	M1	PL1/4x2.75	.013	0	.000	0	6691.459	22275	116.016	1	H1-1b
2	2	M2	PL1/4x2.75	.013	0	.000	0	6691.459	22275	116.016	1	H1-1b
3	2	M3	PL1/4x2.75	1.004	3.063	.043	0	16858.764	22275	116.016	1	H1-1b
4	2	M4	PL1/4x1.25	.227	.25	.095	0	10118.606	10125	52.734	1	H1-1b
5	2	M5	PL1/4x2.75	.116	0	.001	0	22260.933	22275	116.016	1	H1-1b
6	2	M6	PL1/4x2.75	.116	.25	.001	0	22260.933	22275	116.016	1	H1-1b
7	2	M7	PL1/4x1.25	.227	0	.095	0	10118.606	10125	52.734	1	H1-1b
8	2	M8	PL1/4x2.75	.021	0	.000	0	6691.459	22275	116.016	1	H1-1b
9	2	M9	PL1/4x2.75	.021	0	.000	0	6691.459	22275	116.016	1	H1-1b
10	2	M10	PL1/4x2.75	.996	3.992	.070	0	16858.764	22275	116.016	1	H1-1b

Company : BRANCH ENGINEERING, INC.
Designer : JOSHUA ANNETT
Job Number :
Model Name :

May 26, 2022
10:47 AM
Checked By: RICK HERNANDEZ, P.E., S.E.

Member AISC 15th(360-16): LRFD Steel Code Checks (Continued)

	LC	Member	Shape	UC Max	Loc[in]	Shear UC	Loc[in]	phi*Pnc[lb]	phi*Pnt[lb]	phi*Mn[lb-ft]	Cb	Eqn
11	2	M11	PL1/4x1.25	.367	.25	.153	0	10118.606	10125	52.734	1	H1-1b
12	2	M12	PL1/4x2.75	.188	0	.003	0	22260.933	22275	116.016	1	H1-1b
13	2	M13	PL1/4x2.75	.188	.25	.003	0	22260.933	22275	116.016	1	H1-1b
14	2	M14	PL1/4x1.25	.367	0	.153	0	10118.606	10125	52.734	1	H1-1b

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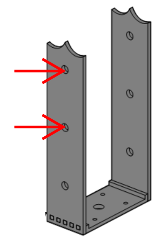
310 5th Street
Springfield, Oregon 97477
Telephone: (541) 746 0637

DATE: 5/26/2022

PROJECT: 18-220 WOODSTONE STRUCTURES
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: PLvert (Post Base)

Bolted Shear Connection Design for Bolts in Standard Holes

Steel thickness:	**0.25 in**	F_y:	36 ksi	
Steel width:	**2.75 in**	F_u:	58 ksi	
Steel specification:	**A36**	ϕF_{nv}:	20.25 ksi	
Bolt diameter, d:	**0.5 in**	A_{gv}:	0.69 in^2	Shear Yielding
Bolt specification:	**A307**	A_g:	0.69 in^2	Tensile Yielding
Thread condition:	**N**	A_{nv}:	1.86 in^2	Shear Rupture
Bolt Hole Preparation Method:	**Punch**	A_e:	0.53 in^2	Tensile Rupture
Threaded Part F_u:	**60 ksi**	A_{nv}:	1.86 in^2	Block Shear
Bolt spacing, s:	**3.75 in**	A_{gv}:	2.25 in^2	Block Shear
Edge distance, L_{ev}:	**1.5 in**	A_{nt}:	0.19 in^2	Block Shear
Side distance, L_{eh}:	**1.375 in**	U_{bs}:	1	Block Shear
Number of bolts in row:	**3**	U:	1	Shear Lag Factor
Number of rows:	**1**			



Shear Yielding: ϕR_n =	14.85 kip
Tensile Yielding: ϕR_n =	22.28 kip
Shear Rupture: ϕR_n =	48.53 kip
Tensile Rupture: ϕR_n =	23.11 kip
Block Shear Rupture: ϕR_n =	44.61 kip
Bolt Shear Strength: ϕR_n =	11.93 kip
Bearing Strength at Bolt Hole: ϕR_n =	39.15 kip

Connection Design Strength: 11.93 kips

CAPACITY OF SIDE PLATE AT BOLT HOLES
WL(ASD) = 2 * 0.6 WL = 9,540#

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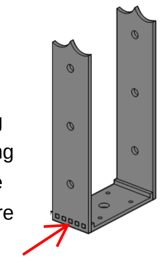
DATE: 5/26/2022

PROJECT: 18-220 WOODSTONE STRUCTURES
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: PLvert (Post Base at Baseplate)

Bolted Shear Connection Design for Bolts in Standard Holes



Steel thickness:	**0.25 in**	F_y:	36 ksi	
Steel width:	**2.75 in**	F_u:	58 ksi	
Steel specification:	**A36**	ϕF_{nv}:	20.25 ksi	
Bolt diameter, d:	**0.25 in**	A_{gv}:	0.47 in²	Shear Yielding
Bolt specification:	**A307**	A_g:	0.69 in²	Tensile Yielding
Thread condition:	**N**	A_{nv}:	0.23 in²	Shear Rupture
Bolt Hole Preparation Method:	**Punch**	A_e:	0.22 in²	Tensile Rupture
Threaded Part F_u:	**60 ksi**	A_{nv}:	0.14 in²	Block Shear
Bolt spacing, s:	**0.5 in**	A_{gv}:	0.09 in²	Block Shear
Edge distance, L_{ev}:	**0.375 in**	A_{nt}:	0.13 in²	Block Shear
Side distance, L_{eh}:	**0.375 in**	U_{bs}:	0.5	Block Shear
Number of bolts in row:	**1**	U:	1	Shear Lag Factor
Number of rows:	**5**			
Spacing between rows:	**0.5 in**			

Shear Yielding: ϕR_n =	10.13 kip
Tensile Yielding: ϕR_n =	22.28 kip
Shear Rupture: ϕR_n =	6.12 kip
Tensile Rupture: ϕR_n =	9.52 kip
Block Shear Rupture: ϕR_n =	4.24 kip
Bolt Shear Strength: ϕR_n =	
Bearing Strength at Bolt Hole: ϕR_n =	8.97 kip

Connection Design Strength: 4.24 kips

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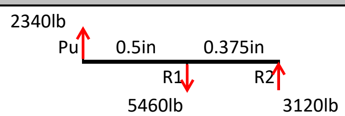
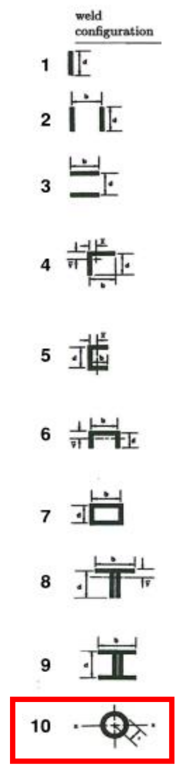
PROJECT: 18-220 WOODSTONE STRUCTURES
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: weld

Combined Strength of Weld in Axial, Shear, & Bending



Axial Force, P_u		**5460 lb**	
Design Shear, V_u		**0 lb**	
Design Moment, Mu		**0 lb-ft**	
Design Torque, T_u		**0 lb-ft**	
BASE METAL Thickness		**0.75 in**	
ATTACHED PART Thickness		**0.25 in**	
		FILLET	
Depth of Preparation, S			
Weld type		10	
d		0.125 in	Outside Diameter
b		0.125 in	Inside Diameter
Section Modulus of Weld		0.01 sq in	
Reduction Factor for Weld, ϕ		0.75	
F_{EXX}		70 ksi	
Minimum Weld Size		0.125 in	
Weld Size Specified		0.125 in	
Quantity of Welds		5	
Axial Stress in Weld	f_a	31.465 ksi	1.00
Shear Stress in Weld	f_v	0.000 ksi	0.00
Bending Stress in Weld	f_b	0.000 ksi	0.00
Torsional Stress in Weld	f_t	0.000 ksi	0.00
Allowable Stress in Weld	F_w	31.50 ksi	
Combined Unity Check		1.00	OK



SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.8.7094.1

Company:	BRANCH ENGINEERING, INC.	Date:	10/21/2019
Engineer:		Page:	1/5
Project:			
Address:	310 5TH STREET		
Phone:	(541) 746-0637		
E-mail:	JOSHA@BRANCHENGINEERING.COM		

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 318-11
Units: Imperial units

Anchor Information:
Anchor type: Concrete screw
Material: Carbon Steel
Diameter (inch): 0.625
Nominal Embedment depth (inch): 4.000
Effective Embedment depth, h_{ef} (inch): 2.970
Code report: ICC-ES ESR-2713
Anchor category: 1
Anchor ductility: No
h_{min} (inch): 6.00
c_{ac} (inch): 4.50
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 6.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental 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): 6.00 x 2.50 x 0.25

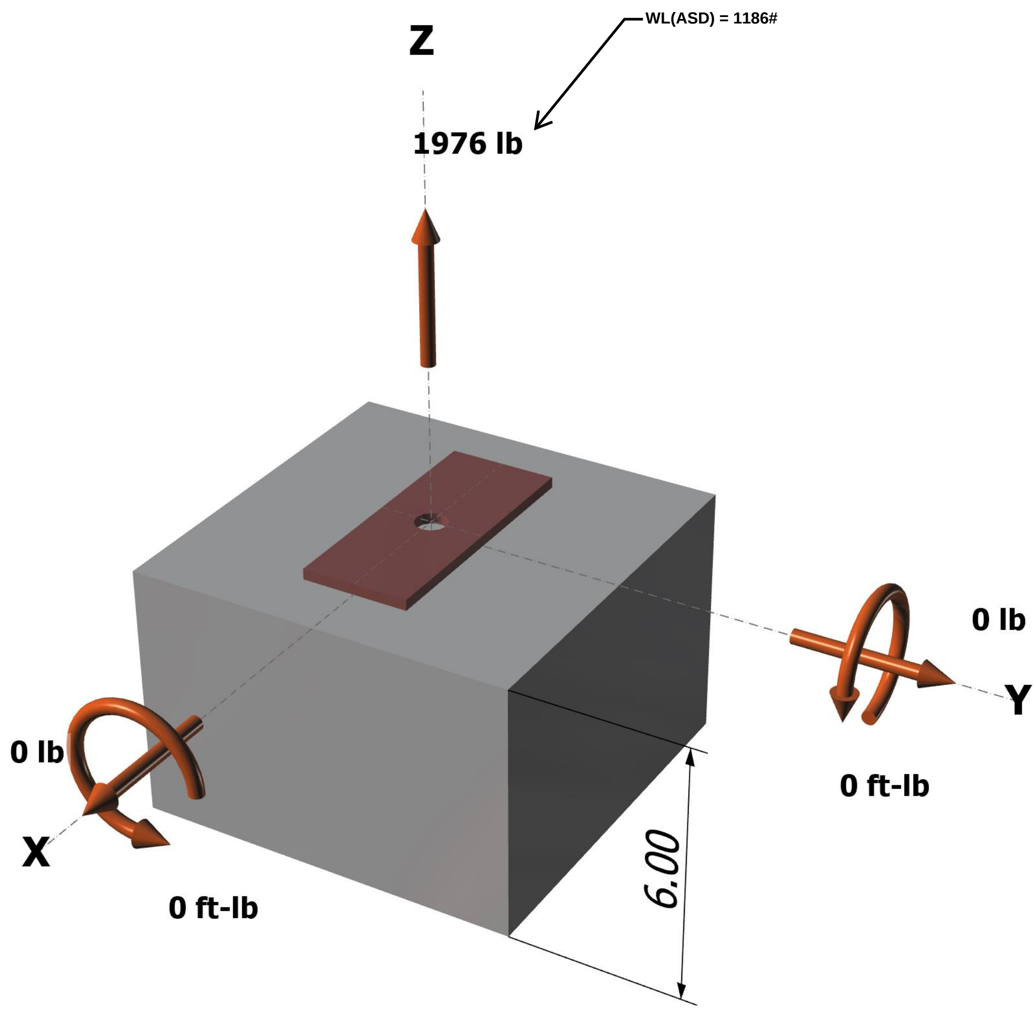
Recommended Anchor
Anchor Name: Titen HD® - 5/8"Ø Titen HD (THDB model), hnom:4" (102mm)
Code Report: ICC-ES ESR-2713

Load and Geometry
Load factor source: ACI 318 Section 9.2
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: Yes

Strength level loads:

N_{ua} [lb]: 1976
V_{uax} [lb]: 0
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0

<Figure 1>

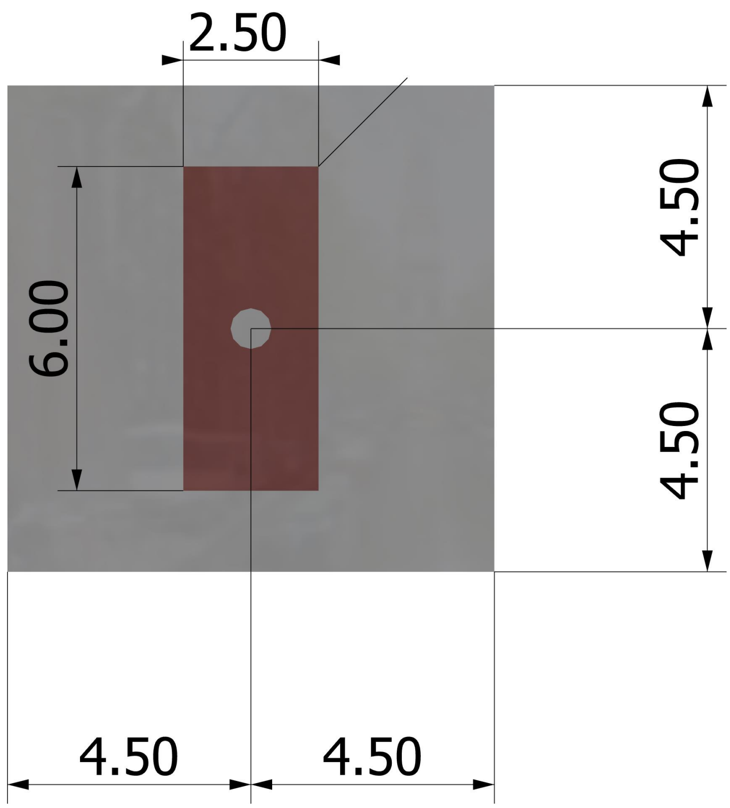


SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.8.7094.1

Company:	BRANCH ENGINEERING, INC.	Date:	10/21/2019
Engineer:		Page:	3/5
Project:			
Address:	310 5TH STREET		
Phone:	(541) 746-0637		
E-mail:	JOSHA@BRANCHENGINEERING.COM		

<Figure 2>

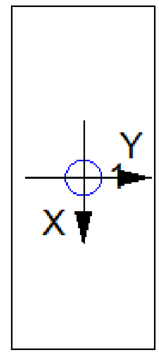


3. Resulting Anchor Forces

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	1976.0	0.0	0.0	0.0
Sum	1976.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 1976
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

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. D.5.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
30360	0.65	19734

5. Concrete Breakout Strength of Anchor in Tension (Sec. D.5.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. D-6)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	2.970	4351

$\phi N_{cb} = \phi\,(A_{Nc} / A_{Nco})\,\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. D.4.1 & Eq. D-3)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cb} (lb)
79.39	79.39	4.50	1.000	1.00	1.000	4351	0.65	2828

6. Pullout Strength of Anchor in Tension (Sec. D.5.3)

$\phi N_{pn} = \phi \Psi_{c,P} \lambda_a N_p (f'_c / 2{,}500)^n$ (Sec. D.4.1, Eq. D-13 & Code Report)

$\Psi_{c,P}$	λ_a	N_p (lb)	f'_c (psi)	n	ϕ	ϕN_{pn} (lb)
1.0	1.00	3040	2500	0.50	0.65	1976

SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.8.7094.1

Company:	BRANCH ENGINEERING, INC.	Date:	10/21/2019
Engineer:		Page:	5/5
Project:			
Address:	310 5TH STREET		
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E-mail:	JOSHA@BRANCHENGINEERING.COM		

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Tension	Factored Load, N_{ua} (lb)	Design Strength, $øN_n$ (lb)	Ratio	Status
Steel	1976	19734	0.10	Pass
Concrete breakout	1976	2828	0.70	Pass
Pullout	**1976**	**1976**	**1.00**	**Pass (Governs)**

5/8"Ø Titen HD (THDB model), hnom:4" (102mm) meets the selected design criteria.

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DATE: 5/26/2022

PROJECT: 18-220 WOODSTONE STRUCTURES
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: Fasteners (POST BASE)

FASTENER LATERAL DESIGN VALUES

QTY	FASTENER DIAMETER	TYPE	SINGLE/ DOUBLE SHEAR	STEEL SIDE MEMBER THICKNESS	MAIN MEMBER	ALLOWABLE LATERAL DESIGN VALUE: PARALLEL TO GRAIN	ALLOWABLE LATERAL DESIGN VALUE: PERP. TO GRAIN	PENETRATION LENGTH INTO MAIN MEMBER, p	p/8D	LOAD DURATION FACTOR, CD	WET SERVICE FACTOR, CM	TOTAL ADJUSTED ALLOWABLE SHEAR, Z'
2	0.5	BOLT	DOUBLE	0.25	3.5	1650		THRU	1	1.6	0.7	3696

			CRITICAL EDGE DIST, cac	EFFECTIVE EMBEDMENT DEPTH, hef	EFFECTIVENESS FACTOR, k	MODIFICATION FACTOR, ψcN	Φcb	Anc	Anco	BASIC CONCRETE BREAKOUT, Nb	CONCRETE BREAKOUT STRENGTH, ΦcbNcb	PULLOUT STRENGTH, ΦpNp	STEEL STRENGTH, ΦsaNsa
4	0.25	CONC SCREW	3	1.3	24	1	0.65	15.21	15.21	1778.674	4625	4940	5655

MIN WL = 4625# * 0.6 = 2775#

THE INFORMATION BELOW IS NOT A PART OF THIS REPORT - INCLUDED FOR REFERENCE ONLY.

NDS TABLE 12G

Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_{\parallel}$ lbs.	G=0.67 Red Oak $Z_{\perp}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.
3-1/2	1/4	1/2	1870	1240	1720	1100	1650	1030
		5/8	2740	1720	2510	1420	2410	1230
		3/4	3800	2070	3480	1550	3340	1370
		7/8	5060	2240	4630	1680	4290	1470
		1	6520	2380	5380	1790	4900	1580
		5/8	2740	1720	2510	1510	2410	1420

Titen Turbo Tension Strength Design Data[1]

IBC *

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.) ³⁄₁₆	¼
Anchor Category	1, 2 or 3	—	1	
Embedment Depth	h_{nom}	in.	1¾	1¾
Steel Strength in Tension				
Tension Resistance of Steel	N_{sa}	lb.	1,640	2,640
Strength Reduction Factor — Steel Failure	ϕ_{sa}	—	0.65[2]	
Concrete Breakout Strength in Tension				
Effective Embedment Depth	h_{ef}	in.	1.25	1.20
Critical Edge Distance	c_{ac}	in.	3	3
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	24	
Modification Factor	$\Psi_{c,N}$	—	1.0	
Strength Reduction Factor — Concrete Breakout Failure	ϕ_{cb}	—	0.65[3]	
Pullout Strength in Tension				
Pullout Resistance Uncracked Concrete (f'_c = 2,500 psi)[4]	$N_{p,uncr}$	lb.	1,515	1,515
Strength Reduction Factor — Pullout Failure	ϕ_p	—	0.65[5]	

Titen 2 Tension Strength Design Data[1]

IBC *

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.) ³⁄₁₆	¼
Anchor Category	1, 2 or 3	—	1	
Embedment Depth	h_{nom}	in.	1¾	1¾
Steel Strength in Tension				
Tension Resistance of Steel	N_{sa}	lb.	2,175	3,175
Strength Reduction Factor — Steel Failure	ϕ_{sa}	—	0.65[2]	
Concrete Breakout Strength in Tension[6]				
Effective Embedment Depth	h_{ef}	in.	1.30	1.30
Critical Edge Distance	c_{ac}	in.	3	3
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	24	
Modification Factor	$\Psi_{c,N}$		1.0	
Strength Reduction Factor — Concrete Breakout Failure	ϕ_{cb}	—	0.65[3]	
Pullout Strength in Tension[6]				
Pullout Resistance Uncracked Concrete (f'_c = 2,500 psi)[4]	$N_{p,uncr}$	lb.	1,900	1,900
Strength Reduction Factor — Pullout Failure	ϕ_p	—	0.65[5]	

USE 3/16" SCREW VALUES DUE TO SPACING OF SCREWS IN BRACKET

Titen Turbo Installation Information and Additional Data[1]

IBC *

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.) ³⁄₁₆	¼
Installation Information				
Drill Bit Diameter	d	in.	⁵⁄₃₂	³⁄₁₆
Minimum Baseplate Clearance Hole Diameter	d_c	in.	¼	⁵⁄₁₆
Minimum Hole Depth	h_{hole}	in.	2¼	2¼
Embedment Depth	h_{nom}	in.	1¾	1¾
Effective Embedment Depth	h_{ef}	in.	1.25	1.20
Critical Edge Distance	c_{ac}	in.	3	3
Minimum Edge Distance	c_{min}	in.	1¾	1¾
Minimum Spacing	s_{min}	in.	1	2
Minimum Concrete Thickness	h_{min}	in.	3¼	3¼
Additional Data				
Yield Strength	f_{ya}	psi	100,000	
Tensile Strength	f_{uta}	psi	125,000	
Minimum Tensile and Shear Stress Area	A_{se}	in.²	0.0131	0.0211

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

Titen 2 Installation Information and Additional Data[1]

IBC *

Characteristic	Symbol	Units	Nominal Anchor Diameter (in.) ³⁄₁₆	¼
Installation Information				
Drill Bit Diameter	d	in.	⁵⁄₃₂	³⁄₁₆
Minimum Baseplate Clearance Hole Diameter	d_c	in.	¼	⁵⁄₁₆
Minimum Hole Depth	h_{hole}	in.	2¼	2¼
Embedment Depth	h_{nom}	in.	1¾	1¾
Effective Embedment Depth	h_{ef}	in.	1.30	1.30
Critical Edge Distance	c_{ac}	in.	3	3
Minimum Edge Distance	c_{min}	in.	1¾	1¾
Minimum Spacing	s_{min}	in.	1	2
Minimum Concrete Thickness	h_{min}	in.	3¼	3¼
Additional Data				
Yield Strength	f_{ya}	psi	100,000	
Tensile Strength	f_{uta}	psi	125,000	
Minimum Tensile and Shear Stress Area	A_{se}	in.²	0.017	0.025

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 or ACI 318-11 Appendix D.

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UHMW STANDOFF BASE

NOT A PART OF THIS REPORT - INCLUDED FOR REFERENCE ONLY.

UHMW® Material Specifications

UHMW® is the ideal material for many wear parts in machinery and equipment. Polyethylenes are semi-crystalline materials with excellent chemical resistance, good fatigue and wear resistance, and a wide range of properties.

Physical Properties	Units	Test	UHMW®
Density	lb/in³ g/cm³	D792	0.034 0.93
Water Absorption, 24 hrs.	%	D570	< 0.01

Mechanical Properties	Units	Test	UHMW®
Tensile Strength	@ 72ºF psi	D638	5800
Tensile Strength	@ 150ºF psi	D638	400
Tensile Modules	psi	D638	80,000
Tensile Elongation at Break	%	D638	300
Flexural Strength at Yield	psi	D790	3500
Flexural Modulus	psi	D790	88,000
Compressive Strength	psi	D695	3000
Compressive Modulus	psi	D695	80,000
Shear Strength	psi	D732	3000
Hardness, Shore D	-	D785	D62 - D66
Izod Impact Notched	ft-lb/in	D256	No Break

Thermal Properties	Units	Test	UHMW®
Coefficient of Linear Thermal Expansion	X 10^{-5} in./in./°F	D696	11
Heat Deflection Temperature	@ 66 psi °F/°C @ 264 °F/°C	D648	203 / 95 180 / 82
Approx. Melting Temperature	ºF/ºC	D3418	275 / 136
Max. Operating Temperature	ºF/ºC	-	180 / 82
Thermal Conductivity	BTU- in/ft^2-hr.-°F x 10^{-4} cal/cm-sec-°C	C177	2.84 10.0
Flammability Rating	-	UL94	HB

Electrical Properties	Units	Test	UHMW®
Dielectric Strength	(V/mil) short time, 1/8" thick	D149	2300
Dielectric Constant	@1 MHz	D150	2.30 - 2.35
Dissipation Factor	@1 KHz	D150	0.0005
Surface Resistivity	ohm/square @ 50% RH	D257	>10^{15}
Arc Resistance	sec	D495	250 - 350

**The information provided in this table is a compilation of publicly available data. This information is provided for comparison purposes only, and is not intended to be warrantable. Further, *Technical Products, Inc.* disclaims any and all liability from errors, in accuracies, or omissions.

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DATE: 5/26/2022

PROJECT: 18-220 WOODSTONE STRUCTURES
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: Capacity Summary

FASTENER LATERAL DESIGN VALUES

COMPONENT	QTY	ALLOWABLE WIND UPLIFT LOAD w/ (1) ANCHOR AT CENTER	ALLOWABLE WIND UPLIFT LOAD w/ (4) ANCHORS AT EQ SPACING	
THRU-BOLTS IN WOOD COLUMN	1	3696 lb	3696 lb	
CONCRETE ANCHOR	1	1186 lb	2363 lb	
STEEL ASSEMBLY	2	690 lb	1116 lb	CONTROLS DESIGN
FILLET WELD IN HOLE	2	2808 lb	2808 lb	
BOLT HOLES IN STEEL	2	14314 lb	14314 lb	
SIDE-PLATE TO BASEPLATE CONNECTION	2	5085 lb	5085 lb	

			ALLOWABLE DOWN LOAD AT BASE	BEARING AREA
	f'_c=2500psi	CONCRETE	26114 lb	30.25sq in
SF=2	fc=3000psi	UHMW BASE	36681 lb	24.45sq in

CONTROLS DESIGN