SULLAWAY ENGINEERING

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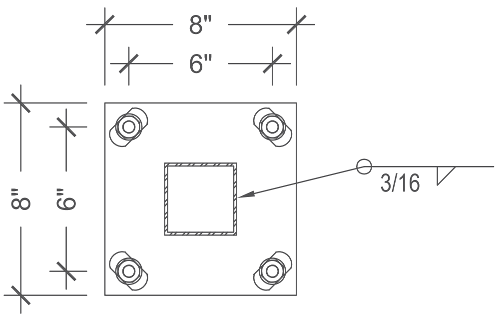
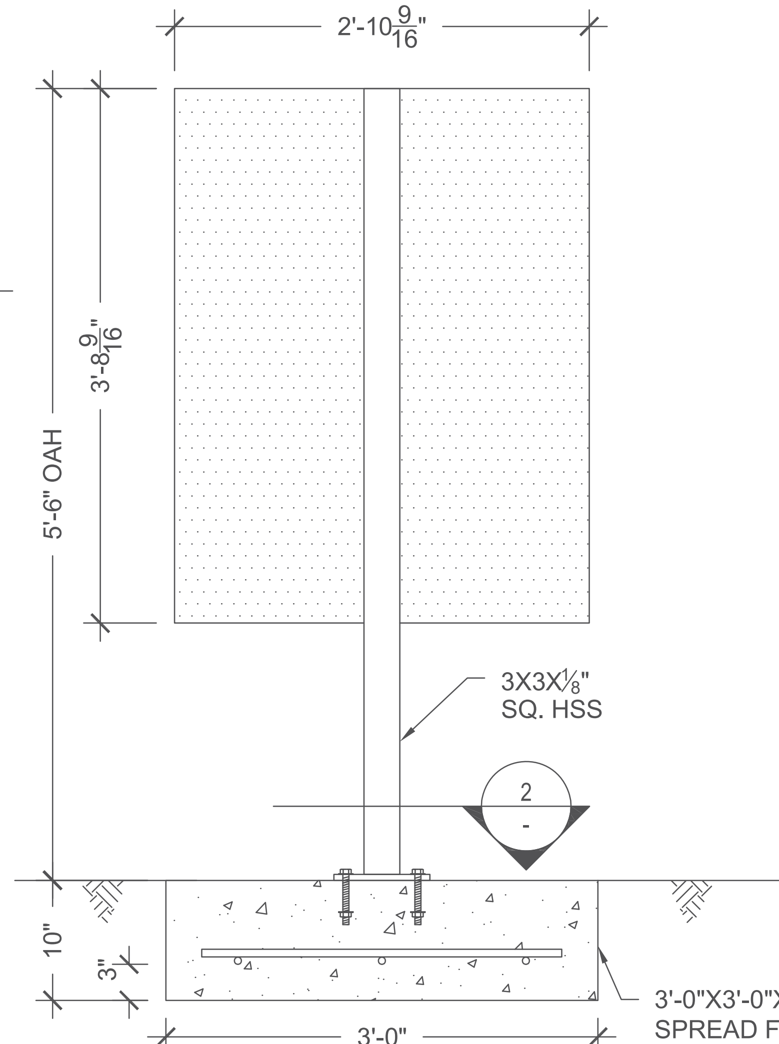
PROJECT: DUTCH BROS, CHIPMAN & WARD LEE'S SUMMIT, MO 64063
PROJECT #: 32261B
CLIENT: ES&A SIGN & AWNING CO.

DATE: 9/29/2021
ENGINEER: SB/RG
LAST REVISED:



8"x8"x½" STEEL PLATE
W/ (4) ½"Ø THREADED ANCHOR RODS
MIN. EMBED.=4" INTO CONCRETE
W/NUT/WASHER/NUT @ EMBED. END

2 / - BASE PLATE



3'-0"X3'-0"X10" DEEP
SPREAD FOOTING
W/ #5 REBAR @ 12" O.C.
EACH WAY

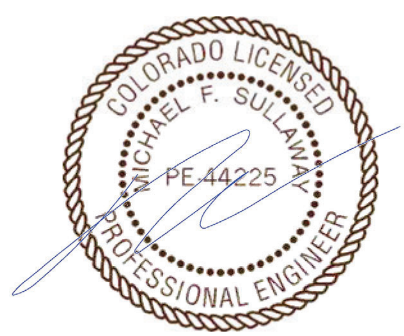
1 / - ELEVATION

mike F sullaway

Digitally signed by mike F sullaway
Date: 2021.10.06 15:27:34 -07'00'

GENERAL NOTES

1. DESIGN CODE: IBC 2018
2. DESIGN LOADS: ASCE 7-16
3. WIND VELOCITY 115 MPH EXPOSURE C
4. CONCRETE 2500 PSI MINIMUM
5. SQ. HSS STEEL ASTM A500 GR. B, F_y = 46 KSI MIN.
6. PLATE STEEL ASTM A36
7. WELDING STRENGTH, Fexx = 70 KSI
8. THREADED ANCHOR ROD STEEL ASTM F1554 GR. 36
9. STEEL REINFORCEMENT IN CONCRETE ASTM A615 GR 60
10. PROVIDE MIN. 3" CLEAR COVER ON ALL STEEL EMBEDDED IN CONCRETE WHEN CAST AGAINST SOIL
11. VERTICAL SOIL BEARING PER IBC CLASS 4 (2000 PSF)
12. PROVIDE PROTECTION AGAINST DISSIMILAR METALS
13. ALL DIMENSIONS TO BE VERIFIED PRIOR TO FABRICATION



9/29/2021

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V5.5 units; pounds, feet unless noted otherwise

Applied Wind Loads; from ASCE 7-16

$F=q_z*G*C_f*A_f$ with $q_z = 0.00256K_zK_{zt}K_dV^2$ (29.3.2 & 29.4)

C_f= 1.682 (Fig. 29.3-1) 1.00 0 max. height= 5.500

K_{zt}= 1.0 (26.8.2) (=1.0 unless unusual landscape)

K_z= from table 28.3-1 Exposure= c

K_d= 0.85 for signs (table 26.6-1)

V= 115 mph

G= 0.85 (26.9) weight= 0.111 kips

s/h= 0.675 M_{DL}= 0.00 k-ft

B/s= 0.78

Pole Loads	structure component	height at section c.g	K_z	q_z	pressure q_z*G*C_f	A_f	shear	Wind Moment M_W
	1	0.89	0.85	24.46	34.97	0.45	16	14
	2	3.64	0.85	24.46	34.97	10.70	374	1363
					sums:	11.14	390	1.38

(M_w) k-ft arm= 3.5

P_u= 0.13 kip M= 1.38 k-ft $M=sqrt(M_{DL}^2+M_w^2)$

$M_u=sqrt(1.2M_{DL}^2+1.0M_W^2)$ = 1.38 k-ft

Pole Design

section; tube

$M_u \leq \phi M_n$ with M_n = f f_y= 46 ksi ϕ= 0.9

H	M_u(k-ft)	Z req'd. (in)	Size(in)	t (in)	Z	Use
at grade	1.38	0.40	2	0.25	0.96	3x3x1/8 Std. Pipe, ϕMn = 4.82 k-ft

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Longitude Direction

applied shear at grade	v=	**0.244**	kip	unfactored load	0.390	k (factored)
applied moment at grade	m=	**0.86**	kip-ft	unfactored load	1.38	k-ft (factored)
depth of soil above footing	h_s=	**0.00**	ft			
allowable soil bearing	p=	**2.000**	ksf			
Signage Weight	w =	**0.111**	**k**	(See Previous Page)		

Spread Footing Design

moment m= 1.06 k-ft

Footing size (ft) b= **3.00** L= **3.00** h= **0.83** S= 4.5

Footing Weight= 1.1 k See Above ,w= **0.111** k soil 0.00 total= 1.24

Overturning; M_c= 1.85 M_c>1.5M 1.744 **ok**

soil pressure; max= 0.429 ksf **ok**

forces on concrete pad; V= 1.15 k V_r= 1.84 k (=1.6V)

M= 0.86 k-ft M_r= 1.38 k-ft

Check Slab;

ϕ= 0.9 f_y= 60 ksi f_c= 2.5 ksi 150 lbs/ft3

Flexure A_s= **0.150** d= 6.0 in

$\phi M_n=\phi A_s f_y(d-a/2)$= 48 k-in = 4.01 k-ft $M_r<\phi M_n$ **ok**

$a=A_s f_y/0.85 f_c b$= 0.118 in

Check minimum $A_{smin}=3sqrt(f_c)bd/f_y$ = 0.54 200bd/fy= 0.72 or $1.333A_s$= 0.20 in^2

ACI 10.3.1

Use A_s= 0.20 in^2

short direction $\gamma_s=2/(\beta+1)$ = 0.8 with β= 1.5 short direction; γA_s= 0.16 in^2

Use #5@12" each direction

Shear; $\phi V_n=\phi 2sqrt(f_c)bd$ ϕV_c= 16.2 ϕ= 0.75 $V_r<\phi V_n$ **ok**

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V5.5

units; pounds, feet unless noted otherwise

Loads on 0.375" dia. Threaded Anchor Rods, F1554 Gr.36:

Mu =	=	1.38	k-ft	(See Page #2)
Vu =	=	0.390	kips	

Check 8x8x0.5" Steel Base Plate, A36: ϕ= 0.9

arm =	1.575	in	t =	0.5	in	f_y =	36	ksi
b =	8	in	n =	2				
Mplate =			T per bolt * n * arm =	4.111	k-in	(Tu=1.305k, From Simpson)		
Z=			bt^2/4 =	0.500	in^3			
ϕMn =			ϕ*Fy*Z =	16.200	k-in			
Ratio check=			Mplate/ϕMn=	0.254	<1	**OK**		

Anchor Designer™ Software
Version 2.7.6990.14

Company:		Date:	9/7/2020
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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 318-14
Units: Imperial units

Anchor Information:
Anchor type: Cast-in-place
Material: AB
Diameter (inch): 0.500
Effective Embedment depth, h_{ef} (inch): 4.000
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 5.88
C_{min} (inch): 3.00
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 12.00
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: No
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 8.00 x 8.00 x 0.50
Yield stress: 34084 psi

Profile type/size: HSS3X3X1/8

Recommended Anchor
Anchor Name: PAB Pre-Assembled Anchor Bolt - PAB4 (1/2"Ø)

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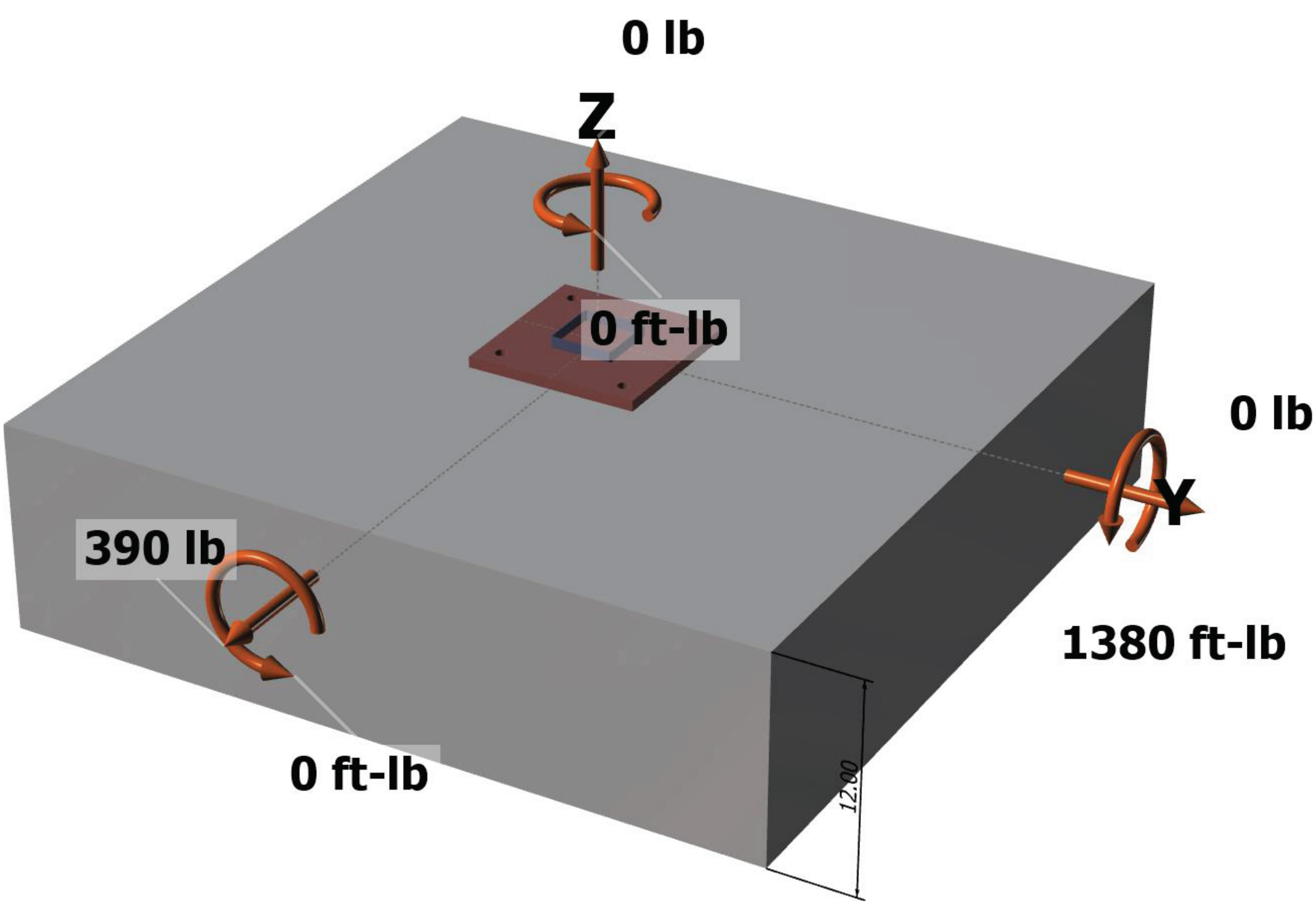
Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 0
V_{uax} [lb]: 390
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 1380
M_{uz} [ft-lb]: 0

<Figure 1>



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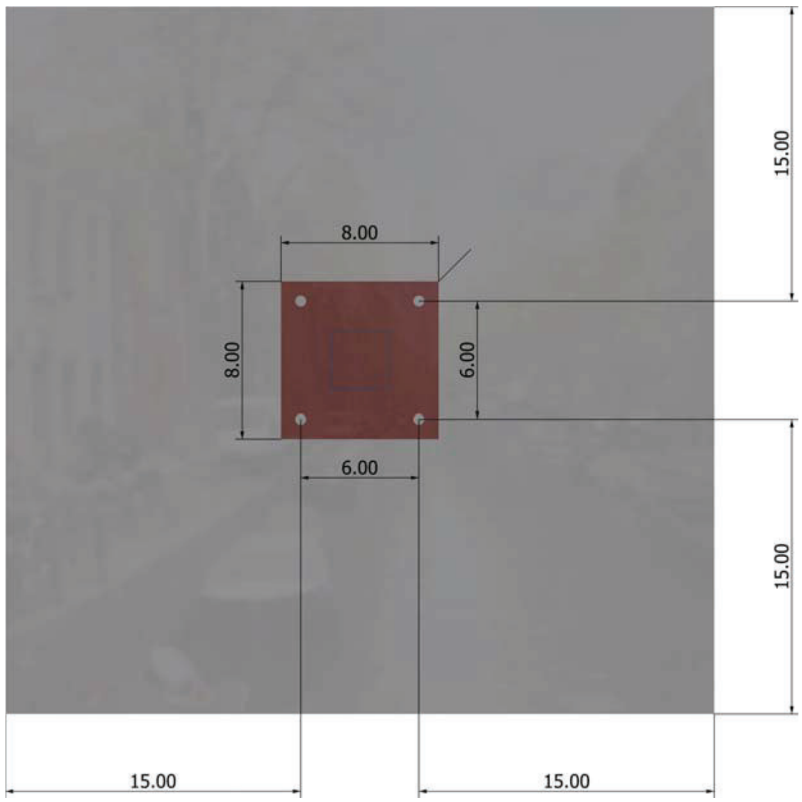
<Figure 2>



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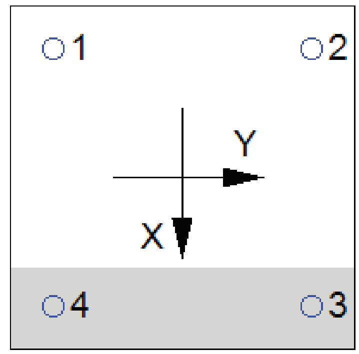
3. Resulting Anchor Forces

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	1302.0	97.5	0.0	97.5
2	1302.0	97.5	0.0	97.5
3	0.0	97.5	0.0	97.5
4	0.0	97.5	0.0	97.5
Sum	2604.1	390.0	0.0	390.0

Maximum concrete compression strain (‰): 0.08
Maximum concrete compression stress (psi): 340
Resultant tension force (lb): 2604
Resultant compression force (lb): 2604
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. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
8235	0.75	6176

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
24.0	1.00	2500	4.000	9600

$\phi N_{cbg} = \phi\,(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\,\Psi_{ed,N}\,\Psi_{c,N}\,\Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1b)

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)
263.25	144.00	15.00	1.000	1.000	1.00	1.000	9600	0.70	12285

6. Pullout Strength of Anchor in Tension (Sec. 17.4.3)

$\phi N_{pn} = \phi \Psi_{c,P} N_p = \phi \Psi_{c,P} 8 A_{brg} f'_c$ (Sec. 17.3.1, Eq. 17.4.3.1 & 17.4.3.4)

$\Psi_{c,P}$	A_{brg} (in^2)	f'_c (psi)	ϕ	ϕN_{pn} (lb)
1.0	1.57	2500	0.70	21994

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8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
4940	1.0	0.65	3211

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in x-direction:

$V_{bx} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
4.00	0.500	1.00	2500	10.00	11862

$\phi V_{cbgx} = \phi\,(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. 17.3.1 & Eq. 17.5.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
432.00	450.00	1.000	1.000	1.000	1.118	11862	0.70	8912

Shear parallel to edge in x-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
4.00	0.500	1.00	2500	10.00	11862

$\phi V_{cbgx} = \phi\,(2)(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.3.1, 17.5.2.1(c) & Eq. 17.5.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgx} (lb)
432.00	450.00	1.000	1.000	1.000	1.118	11862	0.70	17825

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cpg} = \phi k_{cp}N_{cbg} = \phi k_{cp}(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

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	380.25	144.00	1.000	1.000	1.000	1.000	9600	0.70	35490

11. Results

Interaction of Tensile and Shear Forces (Sec. 17.6.)

Tension	Factored Load, N_{ua} (lb)	Design Strength, $øN_n$ (lb)	Ratio	Status
Steel	1302	6176	0.21	Pass
Concrete breakout	**2604**	**12285**	**0.21**	**Pass (Governs)**
Pullout	1302	21994	0.06	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, $øV_n$ (lb)	Ratio	Status
Steel	98	3211	0.03	Pass
T Concrete breakout x+	**390**	**8912**	**0.04**	**Pass (Governs)**
|| Concrete breakout y-	**195**	**17825**	**0.01**	**Pass (Governs)**
Pryout	390	35490	0.01	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.6..1	0.21	0.00	21.2%	1.0	Pass

PAB4 (1/2"Ø) with hef = 4.000 inch meets the selected design criteria.

12. Warnings

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