PRCNC20240007

PCS Structural Solutions

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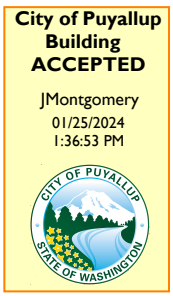
www.pcs-structural.com

STRUCTURAL CALCULATIONS

FOR

ARCO PUYALLUP CAR WASH
EQUIPMENT ANCHORAGE
1402 S MERIDIAN
PUYALLUP, WA 98371

PREPARED BY
PCS STRUCTURAL *SOLUTIONS*



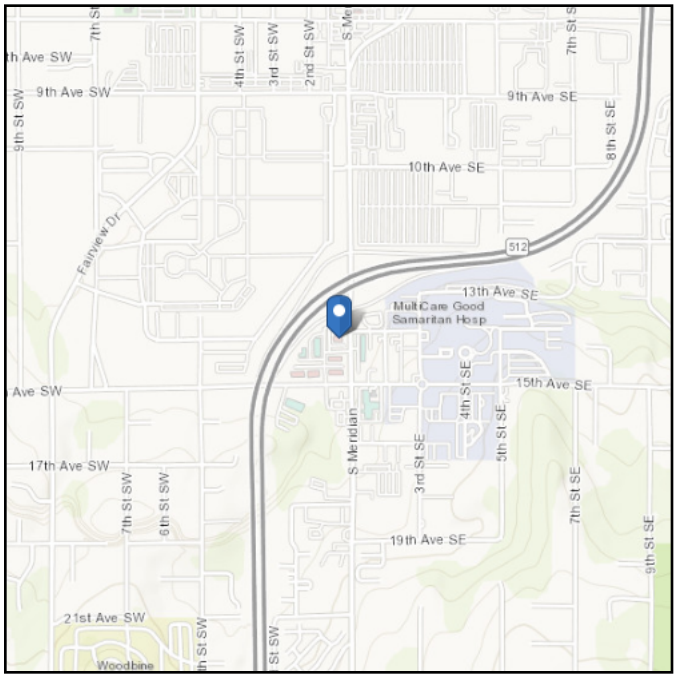
OCTOBER 25, 2023
23-703

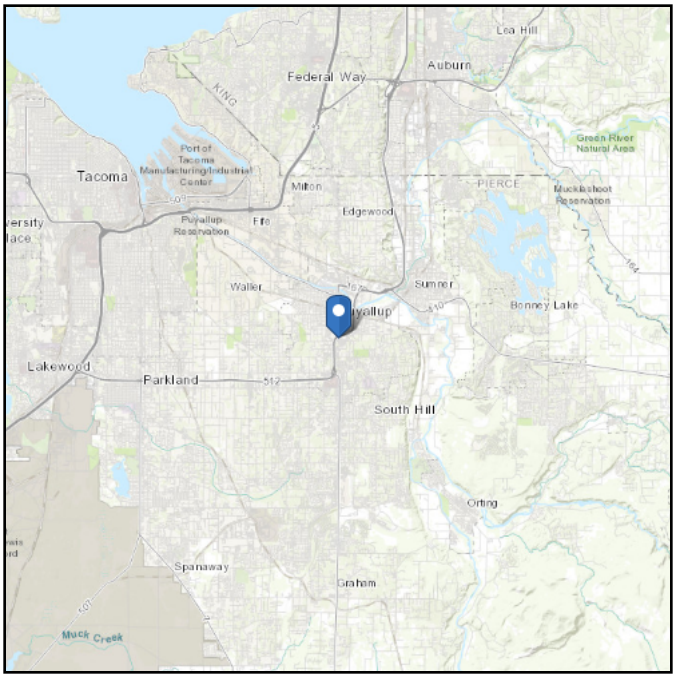
PRCNC20240007

ASCE 7 Hazards Report

Address:
1402 S Meridian
Puyallup, Washington
98371

Standard:	ASCE/SEI 7-16	**Latitude:**	47.178514
Risk Category:	II	**Longitude:**	-122.293971
Soil Class:	D - Stiff Soil	**Elevation:**	47.922924404268436 ft (NAVD 88)





AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.268	S_{D1} :	N/A
S_1 :	0.437	T_L :	6
F_a :	1	PGA :	0.5
F_v :	N/A	PGA_M :	0.55
S_{MS} :	1.268	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1
S_{DS} :	0.845	C_v :	1.354

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Mon Oct 23 2023

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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PCS Structural Solutions

Project: ARCO PUYALLUP Job No: 23-703
Subject: EQUIP. ANCHOR. Sheet Name: BRT
Originating Office: ☐ Seattle ☐ Tacoma ☒ Portland Date: 10-23-23

WASH MACHINE Wp = 4000#

HORIZONTAL: Fp = [(0.4*ap*Sds*Wp)/(Rp/Ip)] (1+(2z/h))

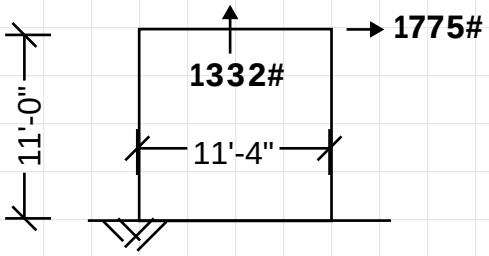
ap = 1.0
Rp = 1.5
I = 1.0
Sds = 1.664
Wp = 4000#
z/h = 0

Sds = 0.85, THEREFORE, THESE CALCS ARE CONSERVATIVE

Fp = [(0.4*1.0*1.664*4000)/(1.5)] (1+(2*0)) = 1775#

VERTICAL: Fp = +/- (0.2)(Sds)(Wp) = (0.2)(1.664)(4000#) = +/- 1332#

ANCHORAGE:



Mot = 0.7(1775#)(11') = 13668ft*#

Mr = [0.6(4000)-0.7(1332)] (11.33'/2)
Mr = 8313lb

T = (13668-8313)/11.33 = 473#

Tu = 473#/0.7 = 676#

omega*Tu = 676# * 2.5 = 1688# = **844#/rail**

omega*Vu = 1775#*2.5 / (4 locations*0.7) = **1585 #/rail**

USE 1/2" DIA. EXP. ANCHOR (EMBED 3-1/4")

SEE HILTI PROFIS OUTPUT FOR ANCHORAGE DESIGN

PRCNC20240007

Hilti PROFIS Engineering 3.0.88

www.hilti.com

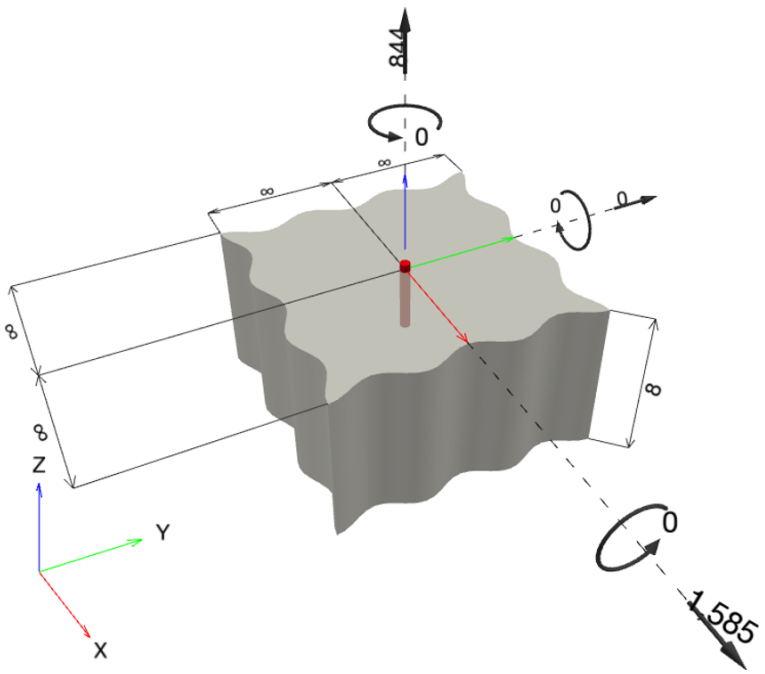
Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	ARCO Puyallup - Wash Machine Anchorage	Date:	10/23/2023
Fastening point:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - CS 1/2 (3 1/4)**
Item number:	2210255 KB-TZ2 1/2x4 1/2
Effective embedment depth:	$h_{ef,act}$ = 3.250 in., h_{nom} = 3.750 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/17/2021 | 12/1/2023
Proof:	Design Method ACI 318-14 / Mech
Stand-off installation:	
Profile:	
Base material:	cracked concrete, 2500, f_c' = 2,500 psi; h = 8.000 in.
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d)) Shear load: yes (17.2.3.5.3 (c))

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



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Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	ARCO Puyallup - Wash Machine Anchorage	Date:	10/23/2023
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 844; V_x = 1,585; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	yes	36

Company:		Page:	3
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	ARCO Puyallup - Wash Machine Anchorage	Date:	10/23/2023
Fastening point:			

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Concrete Breakout Failure	844	2,428	35 / -	OK
Shear	Steel Strength	1,585	4,471	- / 36	OK

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	0.348	0.355	5/3	35	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

Company:		Page:	4
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	ARCO Puyallup - Wash Machine Anchorage	Date:	10/23/2023
Fastening point:			

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PCS Structural Solutions

Project: ARCO PUYALLUP | Job No: 23-703
Subject: EQUIP. ANCHOR. | Sheet | Name: BRT
Originating Office: ☐ Seattle ☐ Tacoma ☒ Portland | Date: 10-23-23

DRYER SYSTEM Wp = 1500# (3 FAN DRYER)

HORIZONTAL: Fp = [(0.4*ap*Sds*Wp)/(Rp/Ip)] (1+(2z/h))

ap = 1.0
Rp = 1.5
I = 1.0
Sds = 1.664
Wp = 1500#
z/h = 7.92/11.17 = 0.71

Sds = 0.85, THEREFORE, THESE CALCS ARE CONSERVATIVE

Fp = [(0.4*1.0*1.664*1500)/(1.5)] (1+(2*0.71)) = 1611#

VERTICAL: Fp = +/- (0.2)(Sds)(Wp) = (0.2)(1.664)(1500#) = +/- 500#

ANCHORAGE TO STUD WALL:

Vx = 1611#/2 = 806# Vy = 500#/2 = 205#

1/2" DIA LAG INTO HEM-FIR --> Zperp = 260#, Zpara = 430#

PHI = ARCTAN(205/806) = 14.3 DEG

Zphi = (430*205)/(430*SIN^2(14.3) + 260*COS^2(14.3)) = 312#

Z'phi = 312*1.6 = 500# PER ANCHOR

Vu = 0.7*[(806^2)+(205^2)] / 2 = 292# < 500# OK

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PCS Structural Solutions

Project: ARCO PUYALLUP | Job No: 23-703
Subject: EQUIP. ANCHOR. | Sheet | Name: BRT
Originating Office: ☐ Seattle ☐ Tacoma ☒ Portland | Date: 10-23-23

GROUND-MOUNTED EQUIP. Wp = 500#

HORIZONTAL: Fp = [(0.4*ap*Sds*Wp)/(Rp/Ip)] (1+(2z/h))

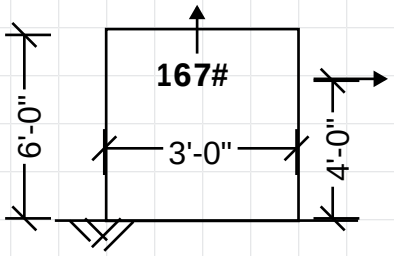
ap = 1.0
Rp = 1.5
I = 1.0
Sds = 1.664
Wp = 500#
z/h = 0

Sds = 0.85, THEREFORE, THESE CALCS ARE CONSERVATIVE

Fp = [(0.4*1.0*1.664*500)/(1.5)] (1+(2*0)) = 222#

VERTICAL: Fp = +/- (0.2)(Sds)(Wp) = (0.2)(1.664)(500#) = +/- 167#

ANCHORAGE:



Mot = 0.7(222#)(4') = 622ft*#

Mr = [0.6(500)-0.7(167)] (1.5'/2)
Mr = 138lb

T = (622-138)/3 = 162#

Tu = 473#/0.7 = 676#

omega*Tu = 162# * 2.5 = 404# = 202#/anchor

omega*Vu = 222#*2.5 / (4 locations) = 139#/rail

USE 1/2" DIA. EXP. ANCHOR (EMBED 2-1/2")

SEE HILTI PROFIS OUTPUT FOR ANCHORAGE DESIGN

PRCNC20240007

Hilti PROFIS Engineering 3.0.88

www.hilti.com

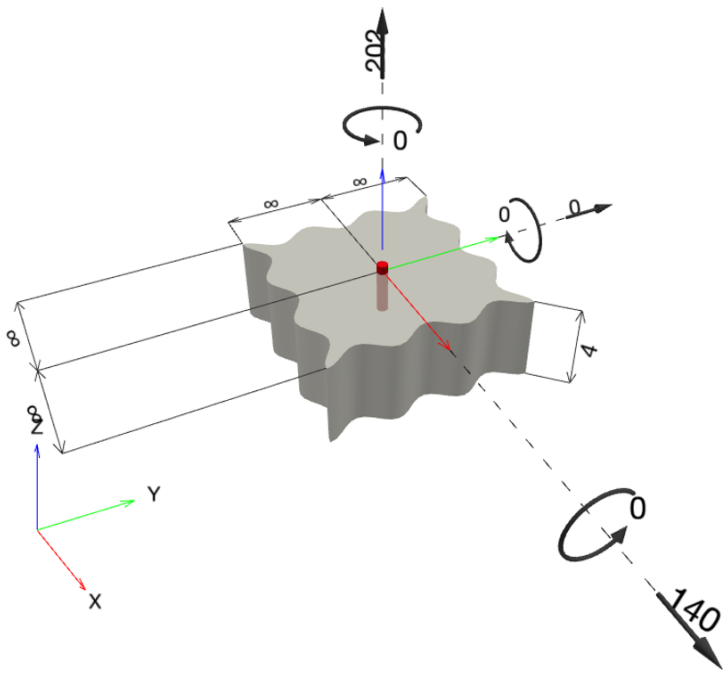
Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	ARCO Puyallup - Floor Mount Anchorage	Date:	10/23/2023
Fastening point:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - CS 1/2 (2) hnom2**
Item number:	2210254 KB-TZ2 1/2x3 3/4
Effective embedment depth:	$h_{ef,act}$ = 2.000 in., h_{nom} = 2.500 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/17/2021 | 12/1/2023
Proof:	Design Method ACI 318-14 / Mech
Stand-off installation:	
Profile:	
Base material:	cracked concrete, 2500, f_c' = 2,500 psi; h = 4.000 in.
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.2.3.4.3 (d)) Shear load: yes (17.2.3.5.3 (c))

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



Company:		Page:	2
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	ARCO Puyallup - Floor Mount Anchorage	Date:	10/23/2023
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 202; V_x = 140; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	yes	14

Company:		Page:	3
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	ARCO Puyallup - Floor Mount Anchorage	Date:	10/23/2023
Fastening point:			

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Concrete Breakout Failure	202	1,448	14 / -	OK
Shear	Pryout Strength	140	2,079	- / 7	OK

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	0.140	0.067	5/3	5	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

Company:		Page:	4
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	ARCO Puyallup - Floor Mount Anchorage	Date:	10/23/2023
Fastening point:			

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PCS Structural Solutions

Project: ARCO PUYALLUP Job No: 23-703

Subject: EQUIP. ANCHOR. Sheet Name: BRT

Originating Office: ☐ Seattle ☐ Tacoma ☒ Portland Date: 10-23-23

WALL-MOUNTED EQUIP. Wp = 300#

HORIZONTAL: Fp = [(0.4*ap*Sds*Wp)/(Rp/Ip)] (1+(2z/h))

ap = 1.0
Rp = 1.5
I = 1.0
Sds = 1.664
Wp = 300#
z/h = 6/11.17 = 0.54

Sds = 0.85, THEREFORE, THESE CALCS ARE CONSERVATIVE

Fp = [(0.4*1.0*1.664*300)/(1.5)] (1+(2*0.54)) = 277#

controls screw shear demand

VERTICAL: Fp = +/- (0.2)(Sds)(Wp) = (0.2)(1.664)(300#) = +/- 100#

ANCHORAGE:

Z' = (102#)(1.6) = 163#/ANCHOR > 277#/4 = 70# OK

w' = 121#/in(1.59in)(1.6) = 307#/ANCHOR > 277# OK

USE (4) 1/4" DIA. x 2-1/2" SCREWS

PRCNC20240007

PCS Structural Solutions

Project: ARCO PUYALLUP Job No: 23-703

Subject: EQUIP. ANCHOR. Sheet Name: BRT

Originating Office: ☐ Seattle ☐ Tacoma ☒ Portland Date: 10-23-23

WALL-MOUNTED TANK (165 GAL)

Wp = 1500#

HORIZONTAL: **Fp = [(0.4*ap*Sds*Wp)/(Rp/Ip)] (1+(2z/h))**

ap = 1.0
Rp = 1.5
I = 1.0
Sds = 0.85
Wp = 1500#
z/h = 4/11.17 = 0.36

Fp = [(0.4*1.0*0.85*1500)/(1.5)] (1+(2*0.36)) = 584#

VERTICAL: Fp = +/- (0.2)(Sds)(Wp) = (0.2)(0.85)(1500#) = +/- 255#

ANCHORAGE:

Zperp = (120#)(1.6) = 192#/ANCHOR > 584#/4 = 146# OK

Zpara = (180#)(1.6) = 288#/ANCHOR > 255#/4 = 64# OK

w' = 235#/in(3.93in)(1.6) = 1477#/ANCHOR > 584# OK

USE (4) 3/8" DIA. x 4" LAG SCREWS