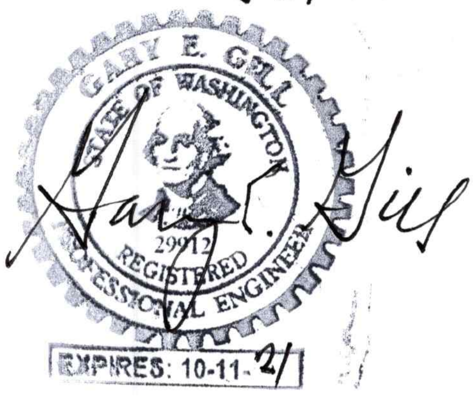
Louden Residence

3315 97th Ave SE
Mercer Island, WA 98040

SUPPLEMENTAL STRUCTURAL CALCULATIONS II

August 20, 2020

8-21-20



Prepared by

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Shear Walls

1st Level to 2nd Level

Shear Wall Redundancy

As long as twice the total shear wall length divided by the story height is greater than 2, a redundancy factor of 1.0 is allowed.

$LA := 2.5 + 2.5 + 4 + 4$ $\quad LA = 13$ $\quad NoBays := \frac{2 \cdot LA}{10}$ $\quad NoBays = 2.6$ $\quad$ OK

$LB := 7.66 + 12.5$ $\quad LB = 20.2$ $\quad NoBays := \frac{2 \cdot LB}{10}$ $\quad NoBays = 4$ $\quad$ OK

$LC := 23$ $\quad LC = 23$ $\quad NoBays := \frac{2 \cdot LC}{10}$ $\quad NoBays = 4.6$ $\quad$ OK

$LD := 20.57$ $\quad LD = 20.6$ $\quad NoBays := \frac{2 \cdot LD}{10}$ $\quad NoBays = 4.1$ $\quad$ OK

Shear Wall SWA1

$V := \frac{(Vwrlong + Vw2long)24.66 \cdot 2.5}{2 \cdot 50 \cdot LA}$ $\quad V = 1004.2$ $\quad L := 2.5$ $\quad v := \frac{V}{L}$ $\quad v = 401.7$

$Pdl := 42$ $\quad HDl := v \cdot 10 - Pdl \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $\quad HDl = 3851.6$ $\quad HDlu := 1.4 \cdot HDl$ $\quad HDlu = 5392.2$

$Pdr := 1100$ $\quad HDr := v \cdot 10 - Pdr \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $\quad HDr = 3153.3$ $\quad HDru := 1.4 \cdot HDr$ $\quad HDru = 4414.6$

This is an existing shear wall that was designed for a unit shear of 471 plf which is greater than the demand that exists in the new configuration. Therefore the existing wall is adequate.
The existing holdowns have also been evaluated for the worst case which is HDlu developed above. Please see anchor bolt calc following.

Shear Wall SWA2

$V := \frac{(Vwrlong + Vw2long)24.66 \cdot 2.5}{2 \cdot 50 \cdot LA}$ $\quad V = 1004.2$ $\quad L := 2.5$ $\quad v := \frac{V}{L}$ $\quad v = 401.7$

$Pdl := 2100$ $\quad HDl := v \cdot 10 - Pdl \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $\quad HDl = 2493.3$ $\quad HDlu := 1.4 \cdot HDl$ $\quad HDlu = 3490.6$

$Pdr := 6100$ $\quad HDr := v \cdot 10 - Pdr \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $\quad HDr = -146.7$ $\quad HDru := 1.4 \cdot HDr$ $\quad HDru = -205.4$

This is an existing shear wall that was designed for a unit shear of 471 plf which is greater than the demand that exists in the new configuration. Therefore the existing wall is adequate.
The existing holdowns are the same as those for SWA1 while the holdown tensions are less than those evaluated for SWA1 therefore, the existing shear wal and hold downs are adequate as is.

Shear Wall SWA3 (the 635 is the seismic from the patio roof)

$V := \frac{(Vwrlong + Vw2long)24.66 \cdot 4}{2 \cdot 50 \cdot LA} + \frac{635}{2}$ $V = 1924.2$ $L := 4$ $v := \frac{V}{L}$ $v = 481.1$

$Pdl := -100$ $HDl := v \cdot 10 - Pdl \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $HDl = 4656.6$

$Pdr := 5900$ $HDr := v \cdot 10 - Pdr \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $HDr = 696.6$

This is a new shear wall with a new footing. Use: SW3 per the shear wall schedule on Sheet S4.1 For the hold down use HD3 from hold down schedule on sheet S4.1 with SB 5/8 x 24 AB.

Shear Wall SWA4 (the 635 is the seismic from the patio roof)

$V := \frac{(Vwrlong + Vw2long)24.66 \cdot 4}{2 \cdot 50 \cdot LA} + \frac{635}{2}$ $V = 1924.2$ $L := 4$ $v := \frac{V}{L}$ $v = 481.1$

$Pdl := 4200$ $HDl := v \cdot 10 - Pdl \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $HDl = 1818.6$ $HDlu := 1.4 \cdot HDl$ $HDlu = 2546$

$Pdr := 300$ $HDr := v \cdot 10 - Pdr \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $HDr = 4392.6$ $HDru := 1.4 \cdot HDr$ $HDru = 6149.6$

To satisfy ductility requirements I will add a 2.5 overstrength factor to the seismic loading and check the anchor bolts with this pullout load.

$HDro := \frac{12321}{21175} v \cdot 10 \cdot 2.5 - Pdr - \frac{L}{2} \cdot 11 \cdot 10 - \frac{L}{2} \cdot 90$ $HDro = 6297.8$

At this amplified the anchor is overstressed 3% which in my judgement is acceptable

$HDlo := \frac{12321}{21175} v \cdot 10 \cdot 2.5 - Pdl - \frac{L}{2} \cdot 11 \cdot 10 - 2L \cdot 90$ $HDlo = 1857.8$

Since this load is less than HDlu the design as satisfies ductility requirements

This is a new shear wall with an existing footing. Use: SW3 per the shear wall schedule on Sheet S4.1 For the hold down at the corner (HDr) use HD4 from hold down schedule on sheet S4.1 with 3/4" dia x 15" emb epoxy AB with Simpson AT epoxy. See Anchor calc below. For other hold down (HDl) use HD2 from sched on sheet S4.1. See hold down anchor bolt calc belowl

Shear Wall SWB1

$V := \frac{(Vwrlong + Vw2long) \cdot 7.66}{2 \cdot LB}$ $V = 4022.9$ $L := 7.66$ $v := \frac{V}{L}$ $v = 525.2$

$Pdl := 100$ $HDl := v \cdot 10 - Pdl \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $HDl = 4764.5$

$Pdr := 500$ $HDr := v \cdot 10 - Pdr \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $HDr = 4500.5$

This is an existing shear wall that has an allowable unit shear of 640 plf which is greater than the demand that calculated above. The hold downs that are specified for this shear wall is an HTT22 with an allowable tension value of 5090pds which is greater than the calculated hold down above.

$Tall := 6 \cdot 1.6 \cdot 130 + 650$ $Tall = 1898$ Which is greater than the demand developed above

The blocking is also attached to both shear walls with 8d @ 6"

$Tall := 10 \cdot 220$ $Tall = 2200$ Which is also greater than the demand developed above

Shear Wall SWB2

$V := \frac{(Vwrlong + Vw2long) \cdot 12.5}{2 \cdot LB}$ $V = 6564.8$ $L := 12.5$ $v := \frac{V}{L}$ $v = 525.2$

$Pdl := 4000$ $HDl := v \cdot 10 - Pdl \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $HDl = 1924.3$

$Pdr := 3870$ $HDr := v \cdot 10 - Pdr \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10$ $HDr = 2010.1$

This is a new shear wall. Use: SW3 from the shear schedule on Sheet S4.1 and HD2 hold downs from the Hold Down Schedule on sheet S4.1,

Hold Down Anchor Lag Bolt

$Tall := 447 \cdot 1.6$ $Tall = 715.2$ pounds/inch $TEr := \frac{HDr}{Tall}$ $TEr = 2.8$

Use: 5/8" dia x 6" lag bolt

Plate Lag Bolts to Blocking

$Vbolt := \frac{V}{L}$ $Vbolt = 525.2$ $penet := 8 - 3.5 - .75$ $penet = 3.8$

$Fac := \frac{8 \cdot .625}{penet}$ $Fac = 1.3$ $Vall := 590 \cdot \frac{1.6}{Fac}$ $Vall = 708$ Use:5/8" dia x 8" Lag Bolts @ 12"

Drag Tie to Existing GLB BEL

$Tr := V - L \cdot 215$ $Tr = 3877.3$ Use: MSTI60

Check shear in diaphragm at existing PSL

$Lglb := 19$ $vdia := \frac{Tr}{Lglb}$ $vdia = 204.1$ allowable shear in an unblocked diaphragm = 430/2 = 215 plf ok

SWC

This is an existing shear wall for which the lateral load has not be changed and therefore is ok as is.

Shear Wall SWD

$V := \frac{(Vwrtrans + Vw2trans)\cdot(11.5 + 33.75)}{2\cdot 64}$ $V = 9581.9$ $L := 23$ $v := \frac{V}{L}$ $v = 416.6$

$Pdl := 4000$ $HDl := v\cdot 10 - Pdl\cdot .66 - \frac{L}{2}\cdot 11\cdot 10$ $HDl = 261$

$Pdr := 3870$ $HDr := v\cdot 10 - Pdr\cdot .66 - \frac{L}{2}\cdot 11\cdot 10$ $HDr = 346.8$

This is an existing shear wall. The allowable shear for this wall is 840 plf per the original calcs which is greater than the calculated value above. The existing hold downs are more than adequate for the hold downs calculated above.

Shear Wall SWE1

$V := \frac{(Vwrtrans + Vw2trans)\cdot(18.75 + 33.75)\cdot 5}{2\cdot 64\cdot LD}$ $V = 2702.3$ $L := 5$ $v := \frac{V}{L}$ $v = 540.5$

$Pdl := 314$ $HDl := v\cdot 10 - Pdl\cdot .66 - \frac{L}{2}\cdot 11\cdot 10 - \frac{L}{2}\cdot 171$ $HDl = 4494.8$

$Pdr := 3698$ $HDr := v\cdot 10 - Pdr\cdot .66 - \frac{L}{2}\cdot 11\cdot 10 - \frac{L}{2}\cdot 171$ $HDr = 2261.3$

Transfer Beam

With Overstrength Factor

$HDlo := \frac{Vsrtrans + Vs2trans}{Vwtrans}\cdot v\cdot 10\cdot 2.5 - Pdl - \frac{L}{2}\cdot 11\cdot 10 - \frac{L}{2}\cdot .171$ $HDlo = 5552.6$

$Mo := HDlo\cdot \frac{1.5\cdot 2.17}{2.66}$ $Mo = 6794.6$ $fb := \frac{Mo\cdot 12}{3.5\cdot \frac{14^2}{6}}$ $fb = 713.1$ OK

$Romax := \frac{HDlo\cdot 2.17}{3.66}$ $Romax = 3292.1$ $fvo := \frac{Romax\cdot 1.5}{3.5\cdot 14}$ $fvo = 100.8$ OK

Hold Downs

HD Left (HDl)

Use:MSTC66B3 Tall = 4490#

Hold Downs at ends of transfer beam

$RL := HDl\cdot \frac{1.5}{3.66}$ $RL = 1842.1$ Use: inverted MSTC48B3

$RR := HDl\cdot \frac{2.17}{3.66}$ $RR = 2664.9$ Use: inverted MSTC48B3

Hold Down to footing in basement

$HDu := RR \cdot 1.4 \qquad HDu = 3730.9$

HDU2-SDS w/5/8" dia x 8" emb epoxy ab per anchorage calc below

Check Ductility Requirements by add overstrength factor to seismic load case

$$HDo := HDlo \cdot \frac{2.17}{3.66} \qquad HDo = 3292.1$$

Since HDo is less than HDu the ductility requirements have been satisfied.

HD Right (HDr)

Use: CPT66Z Tall" 3565# OK

Lag Bolts with 2- 1/2" dia x 6" lag bolts Tall = 2 x 1.6 x 378 x 3.1875 = 3355# OK

This is a new shear wall. Use: SW3 from the shear schedule on Sheet S4.1 and hold downs as noted above.

Drag Tie to Existing 7x14 PSL

$Tr := V \qquad Tr = 2702.3$ Use: MSTI48

Check shear in diaphragm at existing PSL

$$Lpsl := 18.5 \qquad vdia := \frac{V}{Lpsl} \qquad vdia = 146.1$$

allowable shear in an unblocked diaphragm = 430/2 = 215 plf ok

Shear Wall SWE2

$$V := \frac{(Vwrtrans + Vw2trans) \cdot (18.75 + 33.75) \cdot 15.57}{2 \cdot 64 \cdot LD} \quad V = 8414.8 \qquad L := 15.57 \quad v := \frac{V}{L} \qquad v = 540.5$$

$$Pdl := 564 \quad HDl := v \cdot 10 - Pdl \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10 - \frac{L}{2} \cdot 191 \qquad HDl = 2689$$

$$Pdr := 1807 \quad HDr := v \cdot 10 - Pdr \cdot .66 - \frac{L}{2} \cdot 11 \cdot 10 - \frac{L}{2} \cdot 191 \qquad HDr = 1868.6$$

This is a existing shear wall. The original design shear for the wall was 640 plf so the new lateral load is less for this wall so the wall and it's hold downs are ok as is.

SWF

This is an existing shear wall for which the lateral load has not be changed and therefore is ok as is.

Double Beam on Line D

With W12x50 below and a W12x35 above:

$At := 10.3 \qquad It := 285 \qquad Dt := 12.5$

$Ab := 14.6 \qquad Ib := 391 \qquad Db := 12.2$

$$yb := \frac{At\cdot\frac{Dt}{2} + Ab\cdot\left(Dt + \frac{Db}{2}\right)}{At + Ab} \qquad yb = 13.491$$

$$It := It + Ib + At\cdot\left(yb - \frac{Dt}{2}\right)^2 + Ab\cdot\left(yb - Dt + \frac{Db}{2}\right)^2 \qquad It = 1950.302$$

$$Smin := \frac{It}{yb} \qquad Smin = 144.559$$

The beam in the Risa model is a W18x46 with I = 712 and S = 78.8. This composiste beam with It = 2025 and Smin = 137 is both stronger and stiffer than the beam used in the model and as such will perform better than the W18x46.

To calculate the weld required to make the two beams act as one beam I will calculate the shear flow between the beams for the masimum shear in the beam.

$$Mmax := \frac{Smin\cdot 50\cdot .66}{12} \qquad Mmax = 397.538 \qquad Vmax := \frac{Mmax\cdot 8}{25.5} \qquad Vmax = 124.718$$

$$Vdes := 16.5 + 11.8 \quad Vdes = 28.3 \qquad Q := At\cdot\frac{Dt}{2} \qquad q := \frac{Vmax\cdot Q}{It} \qquad q = 4.117$$

With welds 12" on center with 3" dble sided 5/16 fillet

$vall := 5\cdot .92\cdot 3 \qquad vall = 13.8$ Use: 3"x5/16 dbl sided fillet @ 12" on center

SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 2.8.7094.1

Company:		Date:	8/20/2020
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

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

Project description: Anchor Bolt for SWA4 corner hold down
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 15.000
Code report: IAPMO UES ER-263
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 16.50
c_{ac} (inch): 30.20
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 30.00
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
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: Yes

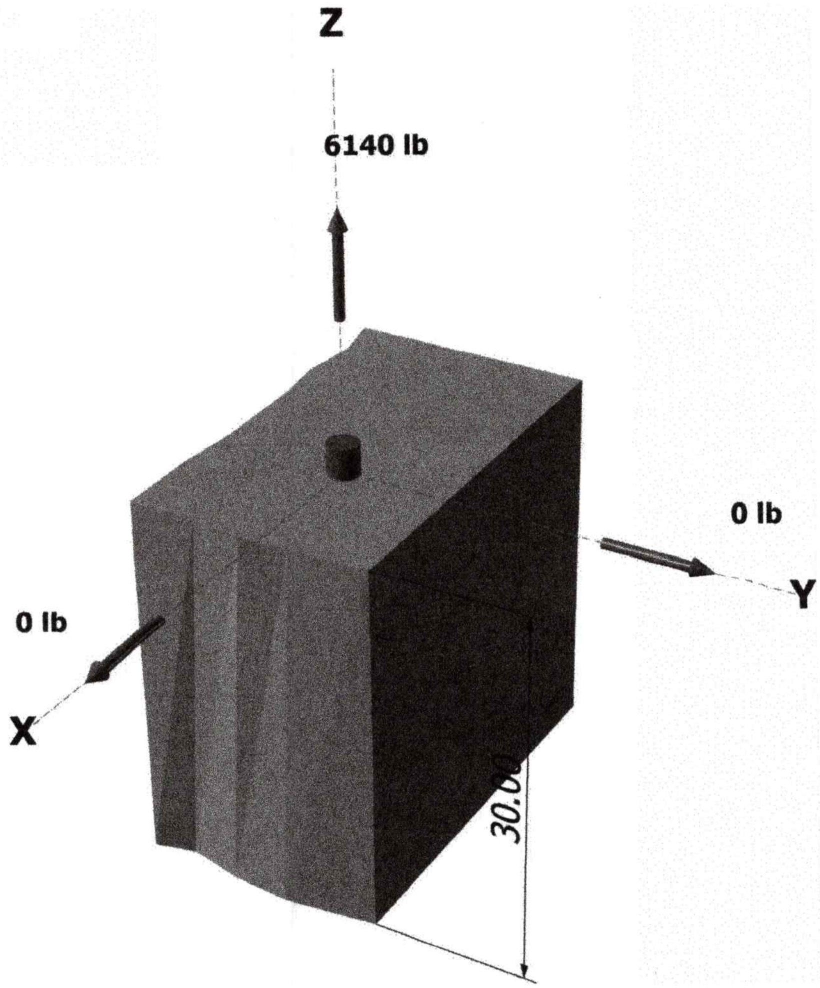
Recommended Anchor
Anchor Name: AT-XP® - AT-XP w/ 3/4"Ø F1554 Gr. 36
Code Report: IAPMO UES ER-263

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: No
Ductility section for tension: 17.2.3.4.3 (d) is satisfied
Ductility section for shear: 17.2.3.5.2 not applicable
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

Strength level loads:

N_{ua} [lb]: 6140
V_{uax} [lb]: 0
V_{uay} [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	6140.0	0.0	0.0	0.0
Sum	6140.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 6140
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

4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
19370	0.75	14528

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)
17.0	1.00	2500	15.000	49381

$0.75\phi N_{cb} = 0.75\phi\,(A_{Nc}/A_{Nco})\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1a)

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	$0.75\phi N_{cb}$ (lb)
744.88	2025.00	2.75	0.737	1.00	1.000	49381	0.65	6523

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} \alpha_{N.seis}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\alpha_{N.seis}$	$\tau_{k,cr}$ (psi)
950	1.00	1.00	0.85	808

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	808	0.75	15.000	28539

$0.75\phi N_a = 0.75\phi\,(A_{Na}/A_{Na0})\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1a)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ed,Na}$	$\Psi_{p,Na}$	N_{a0} (lb)	ϕ	$0.75\phi N_a$ (lb)
202.52	362.05	9.51	2.75	0.787	1.000	28539	0.65	6123

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	6140	14528	0.42	Pass
Concrete breakout	6140	6523	0.94	Pass
Adhesive	**6140**	**6123**	**1.00**	**Pass (Governs)**

AT-XP w/ 3/4"Ø F1554 Gr. 36 with hef = 15.000 inch meets the selected design criteria.

12. Warnings

- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.

- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.

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

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

1.Project information

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

Project description: Anchor Bolt for SWA4 corner hold down w/ overstrength factor applied to seismic load
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (inch): 15.000
Code report: IAPMO UES ER-263
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 16.50
c_{ac} (inch): 30.20
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 30.00
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
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: Yes

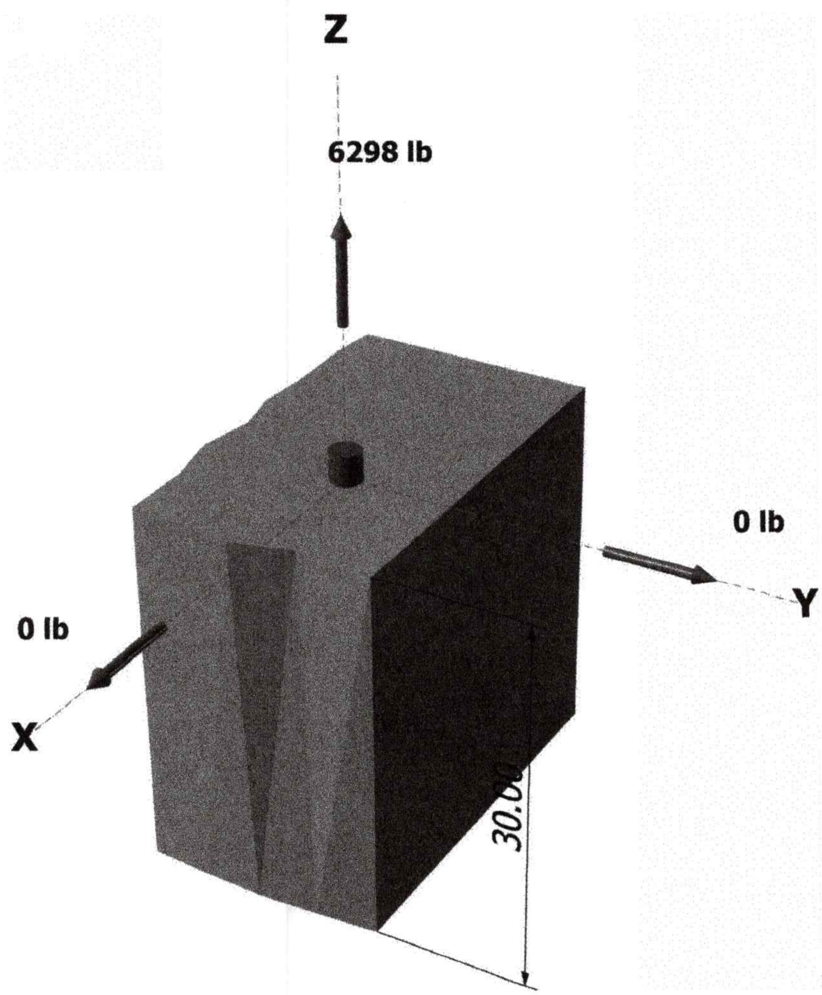
Recommended Anchor
Anchor Name: AT-XP® - AT-XP w/ 3/4"Ø F1554 Gr. 36
Code Report: IAPMO UES ER-263

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: No
Ductility section for tension: 17.2.3.4.3 (d) is satisfied
Ductility section for shear: 17.2.3.5.2 not applicable
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

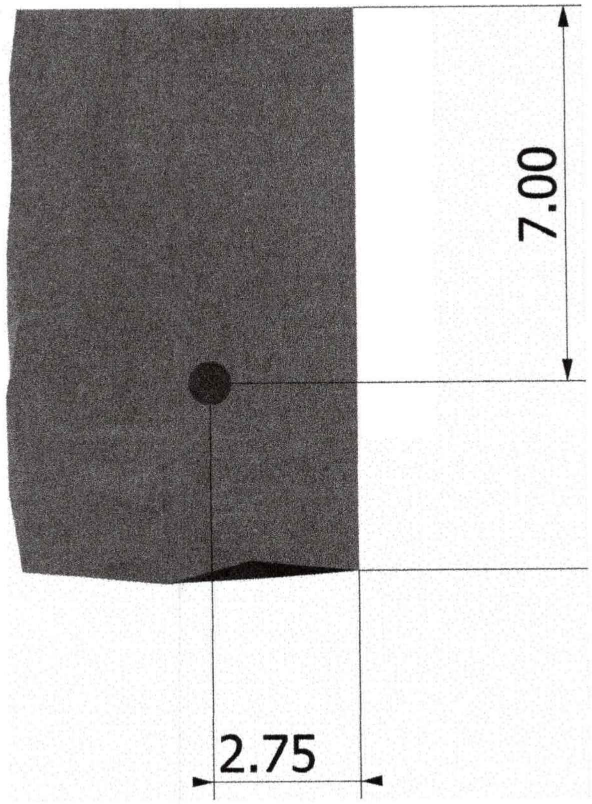
Strength level loads:

N_{ua} [lb]: 6298
V_{uax} [lb]: 0
V_{uay} [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	6298.0	0.0	0.0	0.0
Sum	6298.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 6298
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

4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
19370	0.75	14528

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)
17.0	1.00	2500	15.000	49381

$0.75\phi N_{cb} = 0.75\phi\, (A_{Nc} / A_{Nco})\, \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1a)

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	$0.75\phi N_{cb}$ (lb)
744.88	2025.00	2.75	0.737	1.00	1.000	49381	0.65	6523

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} \alpha_{N,seis}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\alpha_{N,seis}$	$\tau_{k,cr}$ (psi)
950	1.00	1.00	0.85	808

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	808	0.75	15.000	28539

$0.75\phi N_a = 0.75\phi\, (A_{Na} / A_{Na0})\, \Psi_{ed,Na} \Psi_{cp,Na} N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1a)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ed,Na}$	$\Psi_{p,Na}$	N_{a0} (lb)	ϕ	$0.75\phi N_a$ (lb)
202.52	362.05	9.51	2.75	0.787	1.000	28539	0.65	6123

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	6298	14528	0.43	Pass
Concrete breakout	6298	6523	0.97	Pass
Adhesive	**6298**	**6123**	**1.03**	**Fail (Governs)**

FAIL! Selected anchor type and embedment do not meet the selected design criteria.

12. Warnings

- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.

- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.

- 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 2.8.7094.1

Company:		Date:	8/20/2020
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

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

Project description: Anchor Bolt for SWA4 interior hold down
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 12.500
Code report: IAPMO UES ER-263
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 13.75
c_{ac} (inch): 20.75
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 30.00
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
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: Yes

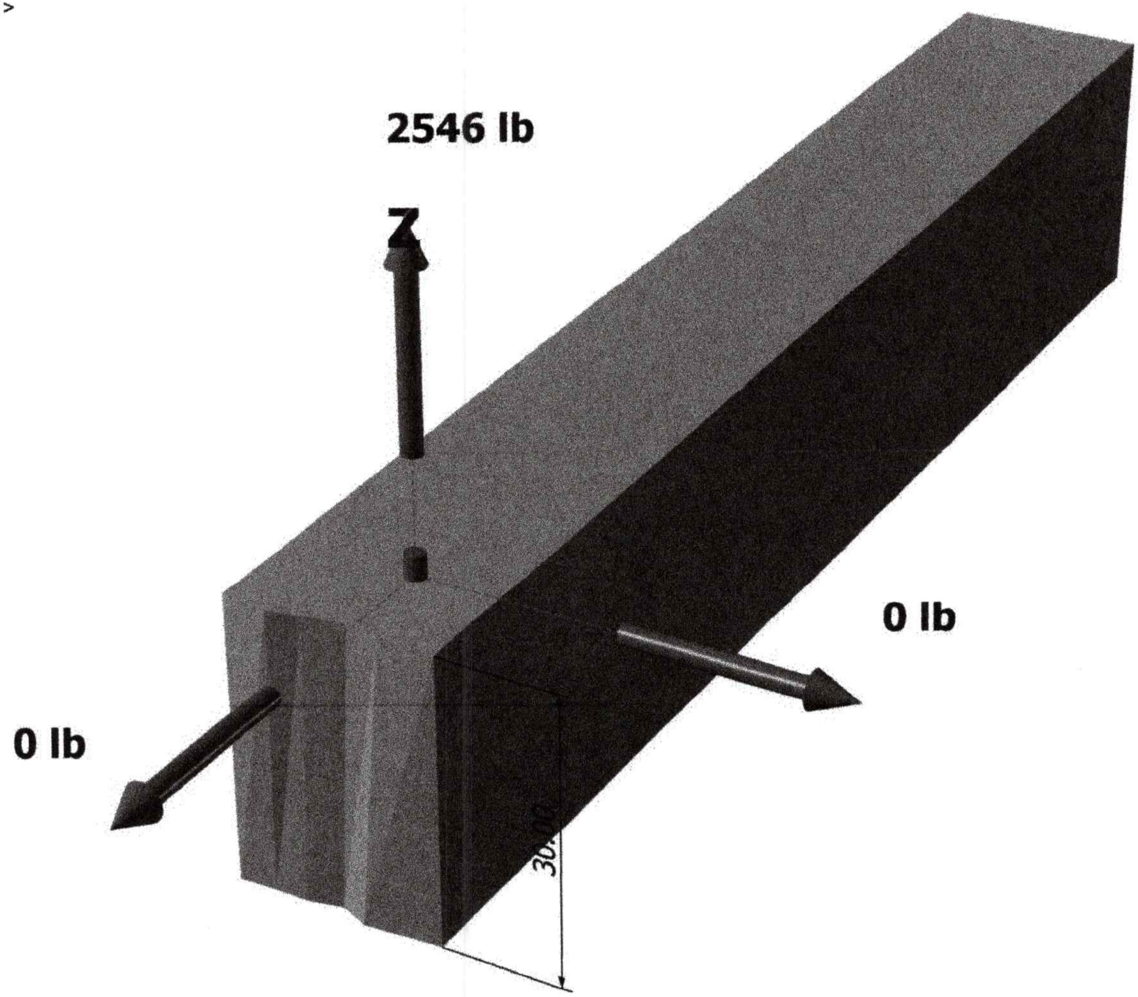
Recommended Anchor
Anchor Name: AT-XP® - AT-XP w/ 5/8"Ø F1554 Gr. 36
Code Report: IAPMO UES ER-263

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: No
Ductility section for tension: not satisfied
Ductility section for shear: not satisfied
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

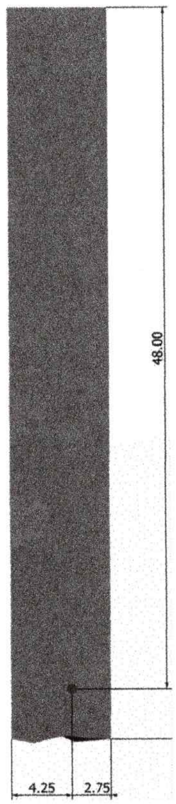
Strength level loads:

N_{ua} [lb]: 2546
V_{uax} [lb]: 0
V_{uay} [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	2546.0	0.0	0.0	0.0
Sum	2546.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 2546
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

4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
13110	0.75	9833

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)
17.0	1.00	2500	12.500	37565

$0.75\phi N_{cb} = 0.75\phi\ (A_{Nc} / A_{Nco}) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1a)

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	$0.75\phi N_{cb}$ (lb)
262.50	1406.25	2.75	0.744	1.00	1.000	37565	0.65	2543

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} \alpha_{N.seis}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\alpha_{N.seis}$	$\tau_{k,cr}$ (psi)
980	1.00	1.00	0.85	833

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	833	0.63	12.500	20445

$0.75\phi N_a = 0.75\phi\ (A_{Na} / A_{Na0}) \Psi_{ed,Na} \Psi_{cp,Na} N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1a)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ed,Na}$	$\Psi_{p,Na}$	N_{a0} (lb)	ϕ	$0.75\phi N_a$ (lb)
109.26	243.61	7.80	2.75	0.806	1.000	20445	0.65	3602

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	2546	9833	0.26	Pass
Concrete breakout	**2546**	**2543**	**1.00**	**Pass (Governs)**
Adhesive	2546	3602	0.71	Pass

AT-XP w/ 5/8"Ø F1554 Gr. 36 with hef = 12.500 inch meets the selected design criteria.

12. Warnings

- Brittle failure governs for tension. Governing anchor failure mode is brittle failure. Attachment shall be designed to satisfy the requirements of ACI 318-14 Section 17.2.3.4.3 for structures assigned to Seismic Design Category C, D, E, or F when the component of the strength level earthquake force applied to anchors exceeds 20 percent of the total factored anchor force associated with the same load combination. In case when ACI 318-14 Sections 17.2.3.4.3 (a)(iii) to (vi), (b), (c) or (d) is satisfied for tension loading, select appropriate checkbox from Inputs tab to disable this message. Alternatively, Ω0 factor can be entered to satisfy ACI 318-14 Section 17.2.3.4.3(d) to increase the earthquake portion of the loads as required.

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

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

Anchor Designer™ Software
Version 2.8.7094.1

Company:		Date:	8/20/2020
Engineer:		Page:	1/5
Project:			
Address:			
Phone:			
E-mail:			

1.Project information

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

Project description: Anchor Bolt for SWE1 Basement hold down
Location:
Fastening description:

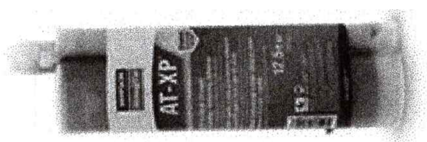
2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 8.000
Code report: IAPMO UES ER-263
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 9.25
c_{ac} (inch): 20.81
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 10.00
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
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: Yes

Recommended Anchor
Anchor Name: AT-XP® - AT-XP w/ 5/8"Ø F1554 Gr. 36
Code Report: IAPMO UES ER-263

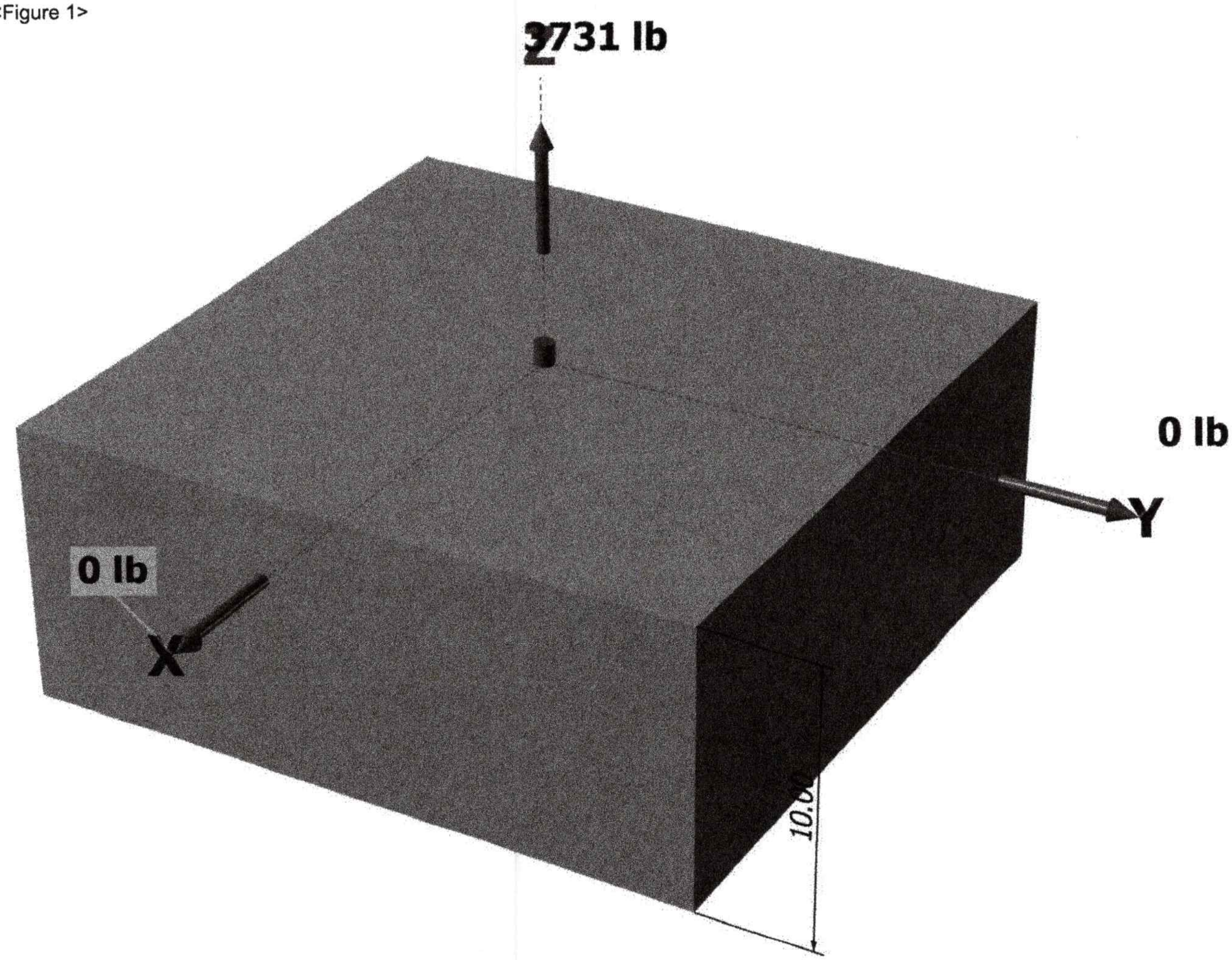


Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: No
Ductility section for tension: 17.2.3.4.2 not applicable
Ductility section for shear: 17.2.3.5.2 not applicable
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

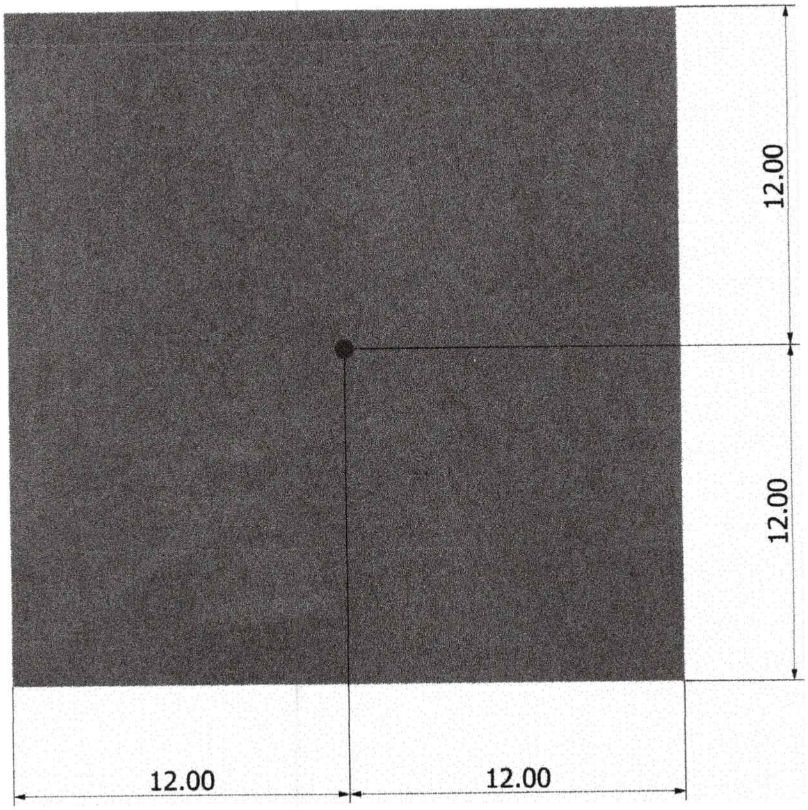
Strength level loads:

N_{ua} [lb]: 3731
V_{uax} [lb]: 0
V_{uay} [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	3731.0	0.0	0.0	0.0
Sum	3731.0	0.0	0.0	0.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 3731
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

4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
13110	0.75	9833

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)
17.0	1.00	2500	8.000	19233

$0.75\phi N_{cb} = 0.75\phi\,(A_{Nc}/A_{Nco})\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1a)

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	$0.75\phi N_{cb}$ (lb)
576.00	576.00	12.00	1.000	1.00	1.000	19233	0.65	9376

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} \alpha_{N,seis}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\alpha_{N,seis}$	$\tau_{k,cr}$ (psi)
980	1.00	1.00	0.85	833

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	833	0.63	8.000	13085

$0.75\phi N_a = 0.75\phi\,(A_{Na}/A_{Na0})\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1a)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ed,Na}$	$\Psi_{p,Na}$	N_{a0} (lb)	ϕ	$0.75\phi N_a$ (lb)
243.61	243.61	7.80	12.00	1.000	1.000	13085	0.65	6379

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	3731	9833	0.38	Pass
Concrete breakout	3731	9376	0.40	Pass
Adhesive	**3731**	**6379**	**0.58**	**Pass (Governs)**

AT-XP w/ 5/8"Ø F1554 Gr. 36 with hef = 8.000 inch meets the selected design criteria.

12. Warnings

- Per designer input, the tensile component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor tensile force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.4.2 for tension need not be satisfied – designer to verify.

- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of ACI 318 17.2.3.5.2 for shear need not be satisfied – designer to verify.

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

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