MALSAM TSANG
STRUCTURAL ENGINEERING

- [ ] REVIEWED AND NOTED FOR DESIGN INTENT ONLY
- [x] REVIEWED FOR LOADS IMPOSED ON BASIC STRUCTURE ONLY
- [x] NO EXCEPTION TAKEN
- [ ] NOTE MARKINGS
- [ ] SKETCHES ATTACHED
- [ ] REVISE AND RESUBMIT
- [ ] NOT REVIEWED

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JCM — REVIEWED BY
08/31/23 — DATE

Koneru Residence Stair

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Mercer Island, WA 98040

DAN J. SAY
STATE OF WASHINGTON
23000
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER

Prepared for: Dheeraj Koneru

Job #: 13221-2023-01

Date: August 31, 2023

KONERU RESIDENCE STAIR

SCOPE: DESIGN & DETAIL NEW HELICAL FEATURE STAIR FOR A NEW RESIDENCE. STRUCTURAL DESIGN OF THE MAIN HOUSE STRUCTURE PER BUILDING EOR.

CRITERIA: - CODE: 2018 IBC, AISC LRFD STEEL DESIGN

LOADING CRITERIA:

- DEAD - SELF-WEIGHT OF STRUCTURE
  - EXTERIOR GLASS STANCHION = 25 PLF
  - INTERIOR HANDRAIL = 5 PLF
  - 3½" THICK WOOD TREAD = 10 PSF
  - MISC WEIGHT / FINISHES = 5 PSF
  - STEEL SELF WEIGHT - CALCULATED BY SOFTWARE
- LIVE = 40 PSF
- SEISMIC - LOADS PER ASCE 7 CH. 13
  - $S_S = 1.45$, $S_1 = 0.50$, SITE CLASS E
  - $S_{DS} = 1.17$, $S_{D1} = 0.67$, $I_p = 1.5$
  - $a_p = 1.0$ (STAIR STRUCTURE)
    $= 2.5$ (CONNECTIONS TO STRUCTURE)
  - $R_p = 2.5$, $z/h = 0.25$ (AVG RELATIVE ELEVATION)
  - $\Omega_p = 2.5$ (POST-INSTALLED CONC ANCHORS)

SEISMIC LOAD CALCULATION

$$F_p = \frac{0.4 a_p S_{DS} W_p}{(R_p/I_p)}\left(1 + 2\,z/h\right) = \begin{cases} 0.281 & \text{FOR STAIR STRUCTURE} \\ 0.702 & \text{FOR CONNECTIONS} \end{cases} W_p$$

$$F_{p,min} = 0.3 S_{DS} I_p W_p = 0.351\,W_p$$

$\therefore F_p = 0.351\,W_p$ (FOR STAIR STRUCTURE)

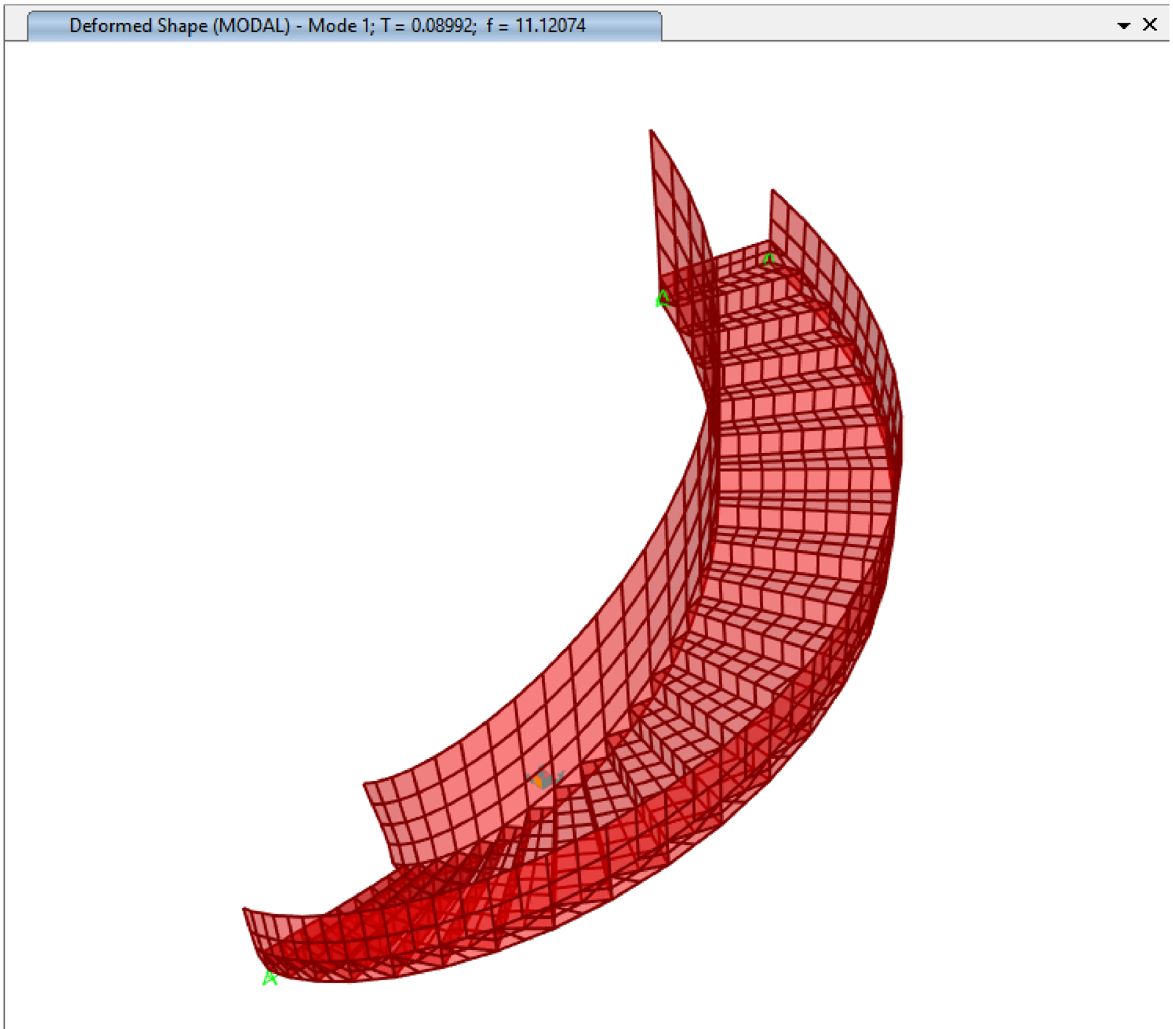
$= 0.702\,W_p$ (FOR CONNECTIONS)

SAP 2000 MODAL ANALYSIS

PRIMARY FREQUENCY = 11.12 Hz

- 10 Hz IS A STANDARD UPPER LIMIT WHERE A STEP FREQUENCY / ACCELERATION ANALYSIS SHOULD BE PERFORMED, THEREFORE, THIS STAIR IS RIGID ENOUGH TO OMIT THIS ANALYSIS.

Modal Periods and Frequencies



	OutputCase	StepType Text	StepNum Unitless	Period Sec	Frequency Cyc/sec	CircFreq rad/sec	Eigenvalue rad2/sec2
▸	MODAL	Mode	1	0.089922	11.1207420...	69.8736829...	4882.33157...
	MODAL	Mode	2	0.07222	13.8464996...	87.0001233...	7569.02145...
	MODAL	Mode	3	0.052303	19.1192092...	120.129534...	14431.1051...
	MODAL	Mode	4	0.04518	22.1338901...	139.071333...	19340.8357...
	MODAL	Mode	5	0.036999	27.0274908...	169.818733...	28838.4022...
	MODAL	Mode	6	0.034834	28.7076351...	180.375391...	32535.2818...
	MODAL	Mode	7	0.033212	30.1095360...	189.183794...	35790.5080...
	MODAL	Mode	8	0.030944	32.3163547...	203.049645...	41229.1584...
	MODAL	Mode	9	0.027825	35.9392792...	225.813151...	50991.5794...
	MODAL	Mode	10	0.02769	36.1139573...	226.910686...	51488.4595...
	MODAL	Mode	11	0.024723	40.4483521...	254.144491...	64589.4226...
	MODAL	Mode	12	0.021427	46.6694680...	293.232915...	85985.5428...

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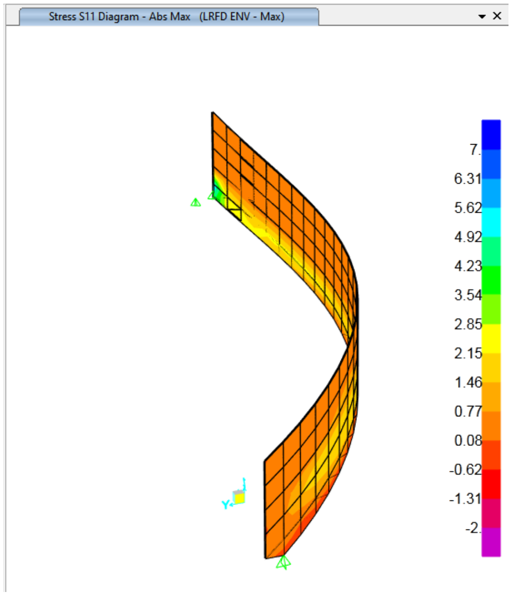
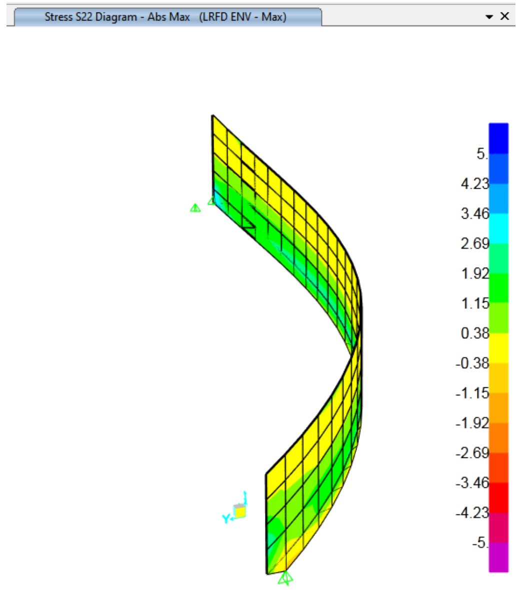
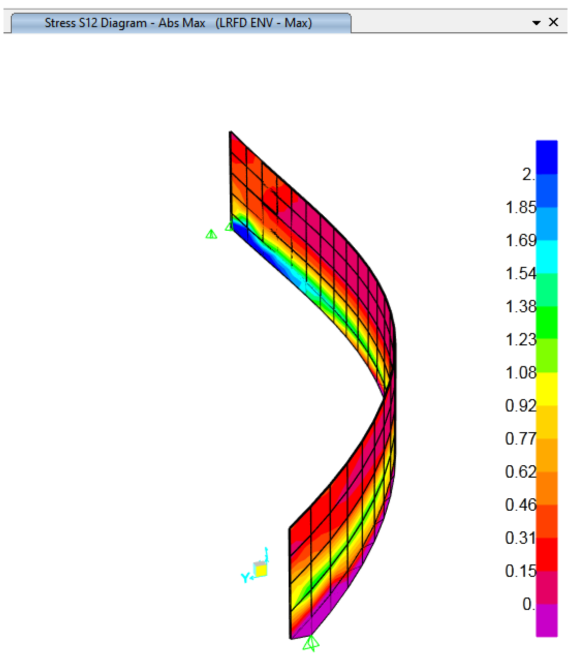
Inner Stringer Area Stresses



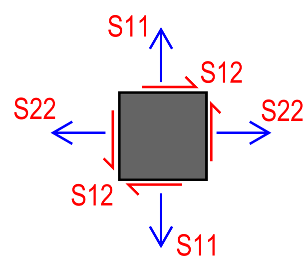
S11
Abs Max = 5.7 ksi



S22
Abs Max = 3.8 ksi



S12
Abs Max = 2.5 ksi



By Inspection, the maximum stresses are far below the maximum allowable axial and shear stresses of the steel.

$\phi\sigma$ = 32.4 ksi
$\phi\tau$ = 19.4 ksi

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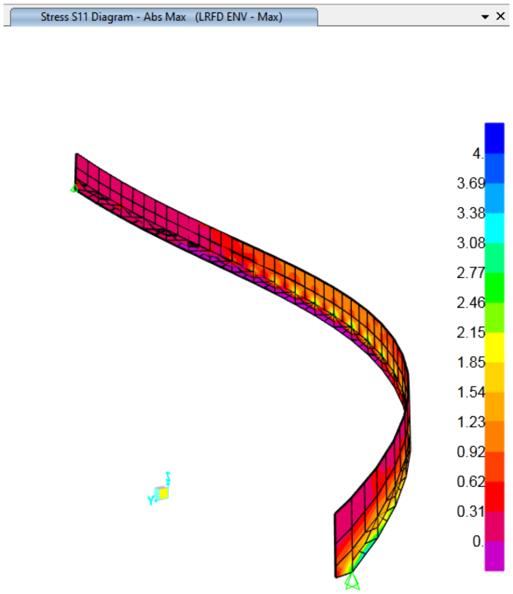
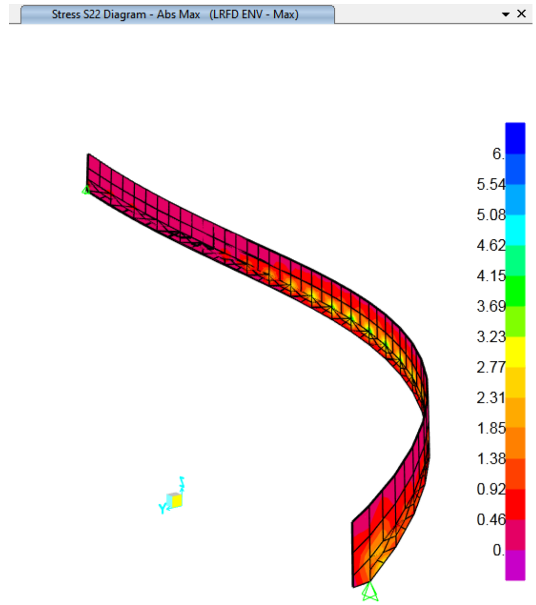
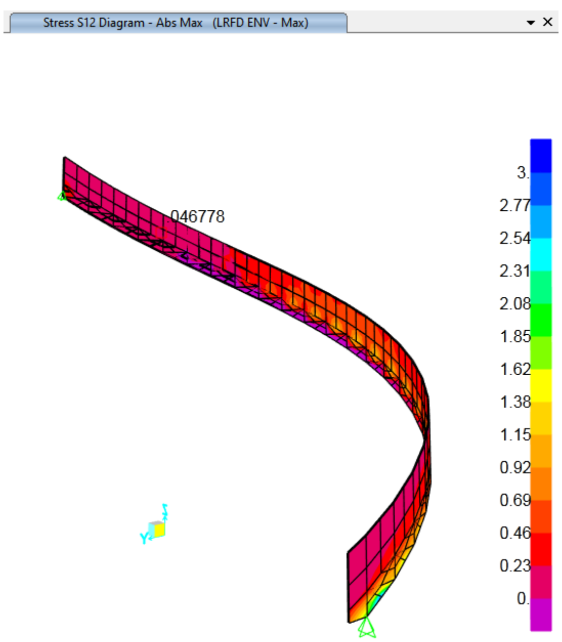
Outer Stringer Area Stresses



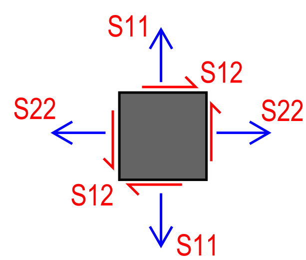
S11
Abs Max = 2.7 ksi



S22
Abs Max = 4.6 ksi



S12
Abs Max = 2.8 ksi



By Inspection, the maximum stresses are far below the maximum allowable axial and shear stresses of the steel.

$\phi\sigma = 32.4$ ksi
$\phi\tau = 19.4$ ksi

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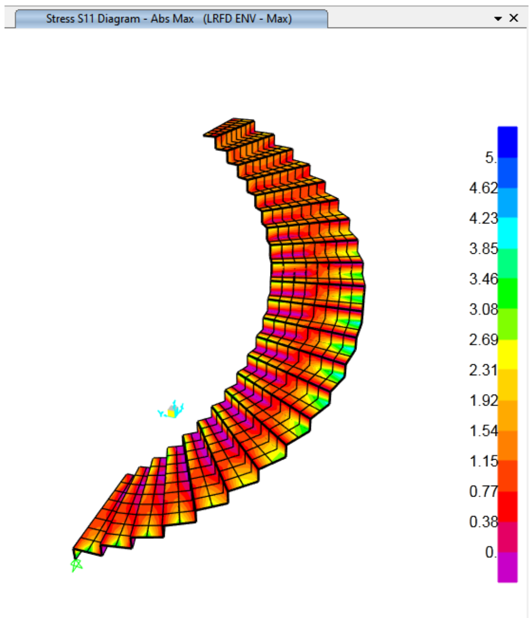
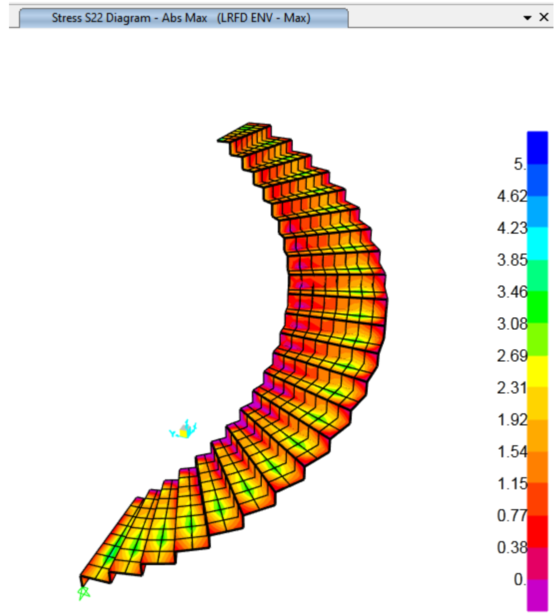
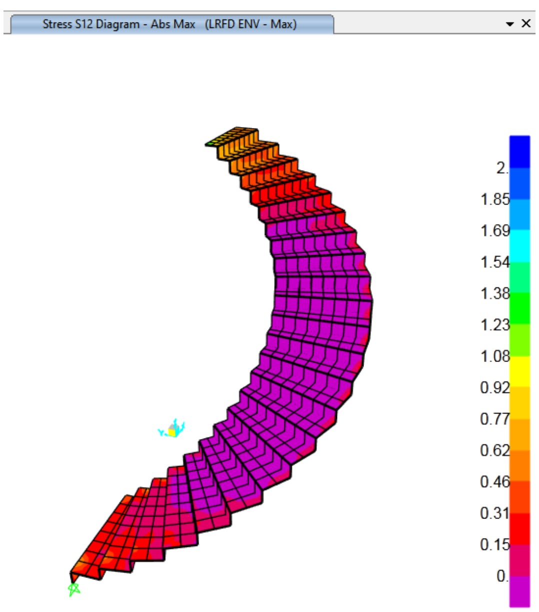
Tread Plate Area Stresses



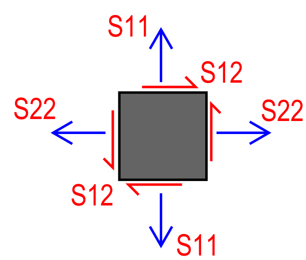
S11
Abs Max = 4.8 ksi



S22
Abs Max = 3.9 ksi



S12
Abs Max = 1.6 ksi



By Inspection, the maximum stresses are far below the maximum allowable axial and shear stresses of the steel.

$\phi\sigma = 32.4$ ksi
$\phi\tau = 19.4$ ksi

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Unfactored Loads Imposed on Structure

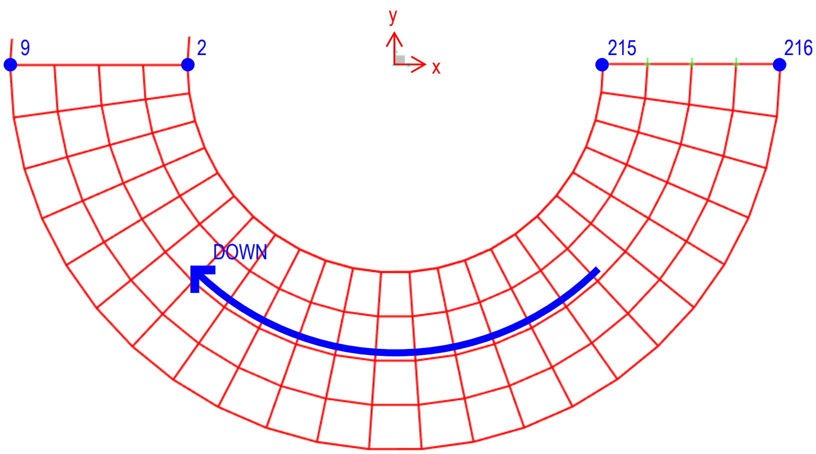

TABLE: Loads Imposed (lb)					
Joint	OutputCase	CaseType	FX	FY	FZ (Vert)
2	DEAD	LinStatic	-122	3742	-3591
2	LIVE	LinStatic	-28	2360	-2234
2	EX1	LinStatic	400	1386	-1099
2	EY1	LinStatic	-194	173	-328
2	EX2	LinStatic	799	2771	-2199
2	EY2	LinStatic	-389	346	-656
9	DEAD	LinStatic	181	-1762	744
9	LIVE	LinStatic	69	-1095	471
9	EX1	LinStatic	705	-1386	1347
9	EY1	LinStatic	-274	491	-201
9	EX2	LinStatic	1409	-2771	2694
9	EY2	LinStatic	-549	982	-402
215	DEAD	LinStatic	-369	-4864	-4606
215	LIVE	LinStatic	-235	-3136	-2964
215	EX1	LinStatic	207	-992	-676
215	EY1	LinStatic	138	663	371
215	EX2	LinStatic	413	-1984	-1351
215	EY2	LinStatic	277	1326	742
216	DEAD	LinStatic	310	2884	1312
216	LIVE	LinStatic	194	1871	851
216	EX1	LinStatic	846	992	428
216	EY1	LinStatic	330	829	158
216	EX2	LinStatic	1691	1984	856
216	EY2	LinStatic	661	1658	316

Summation of Imposed Loads (lb)						
Direction	D	L	EX1	EY2	EX1	EY2
FX	0	0	2156	0	4312	0
FY	0	0	0	2156	0	4312
FZ	-6142	-3875	0	0	0	0
			For Stair Structure Design		For Stair Connection Design	

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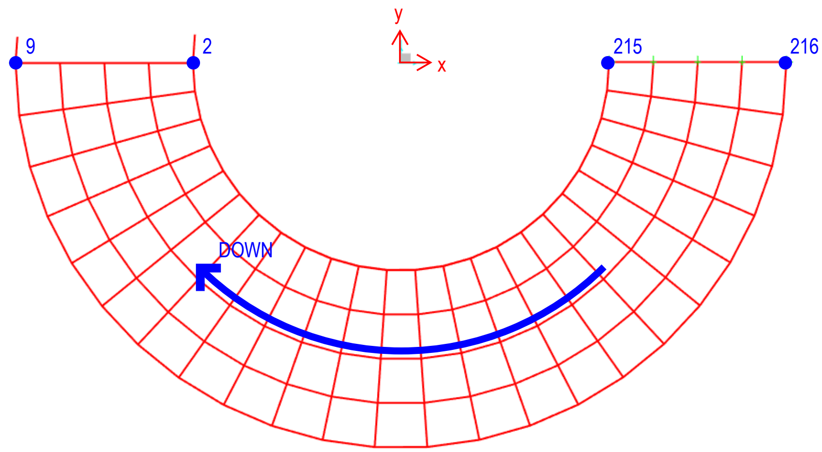
Koneru Residence Stair
PROJECT

7/30/23
DATE
13221-2023-01
PROJ #
SWJ
DESIGN
SHEET

Factored Base Connection Design Loads



Base Connection Design Loads

TABLE: Loads Imposed (lb)				
Joint	OutputCase	FX	FY	FZ (Vert)
2	1.4D	-321	11340	-10853
2	1.2D+1.6L	-192	8266	-7883
2	1.2D+0.5L+EX2 (OS)	1488	24813	-22617
2	1.2D+0.5L-EX2 (OS)	-2378	7883	-8654
2	1.2D+0.5L+EY2 (OS)	-229	19369	-18428
2	1.2D+0.5L-EY2 (OS)	194	10840	-9795
2	0.9D+EX2 (OS)	1534	16139	-14483
2	0.9D-EX2 (OS)	-2073	1936	-2834
2	0.9D+EY2 (OS)	-442	12674	-12497
2	0.9D-EY2 (OS)	-97	5401	-4821
9	1.4D	504	-5323	2256
9	1.2D+1.6L	328	-3866	1646
9	1.2D+0.5L+EX2 (OS)	4321	-15325	10294
9	1.2D+0.5L-EX2 (OS)	-2900	-12	-3788
9	1.2D+0.5L+EY2 (OS)	1158	-9233	4693
9	1.2D+0.5L-EY2 (OS)	1256	-7217	2261
9	0.9D+EX2 (OS)	3664	-10684	8332
9	0.9D-EX2 (OS)	-2834	2190	-4738
9	0.9D+EY2 (OS)	452	-4563	3487
9	0.9D-EY2 (OS)	378	-3930	107

Top Connection Design Loads

TABLE: Loads Imposed (lb)				
Joint	OutputCase	FX	FY	FZ (Vert)
215	1.4D	-1121	-14810	-14019
215	1.2D+1.6L	-819	-10854	-10270
215	1.2D+0.5L+EX2	-234	-10528	-9439
215	1.2D+0.5L-EX2	-1060	-6559	-6736
215	1.2D+0.5L+EY2	-626	-9448	-9198
215	1.2D+0.5L-EY2	-923	-9870	-8829
215	0.9D+EX2	167	-5224	-4419
215	0.9D-EX2	-659	-1255	-1717
215	0.9D+EY2	31	-1913	-2326
215	0.9D-EY2	-522	-4566	-3810
216	1.4D	938	8793	4000
216	1.2D+1.6L	683	6455	2937
216	1.2D+0.5L+EX2	2232	7056	3163
216	1.2D+0.5L-EX2	-1150	3087	1451
216	1.2D+0.5L+EY2	969	6836	2891
216	1.2D+0.5L-EY2	-120	3413	1991
216	0.9D+EX2	1897	3905	1730
216	0.9D-EX2	-1485	-63	18
216	0.9D+EY2	867	3579	1190
216	0.9D-EY2	-455	263	558

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SSF STRUCTURAL ENGINEERING

Koneru Residence Stair
PROJECT

7/30/23
DATE

13221-2023-01
PROJ #

SWJ
DESIGN

SHEET

SIMPSON Strong-Tie®

Anchor Designer™ Software
Version 3.0.7947.0

Company:		Date:	8/23/2023
Engineer:		Page:	1/6
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: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 1.000
Effective Embedment depth, h_{ef} (inch): 12.000
Code report: ICC-ES ESR-2508
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 17.63
c_{ac} (inch): 17.49
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 24.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 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: No

Base Plate
Length x Width x Thickness (inch): 12.00 x 12.00 x 0.53
Yield stress: 50000 psi

Profile type/size: MC12X10.6

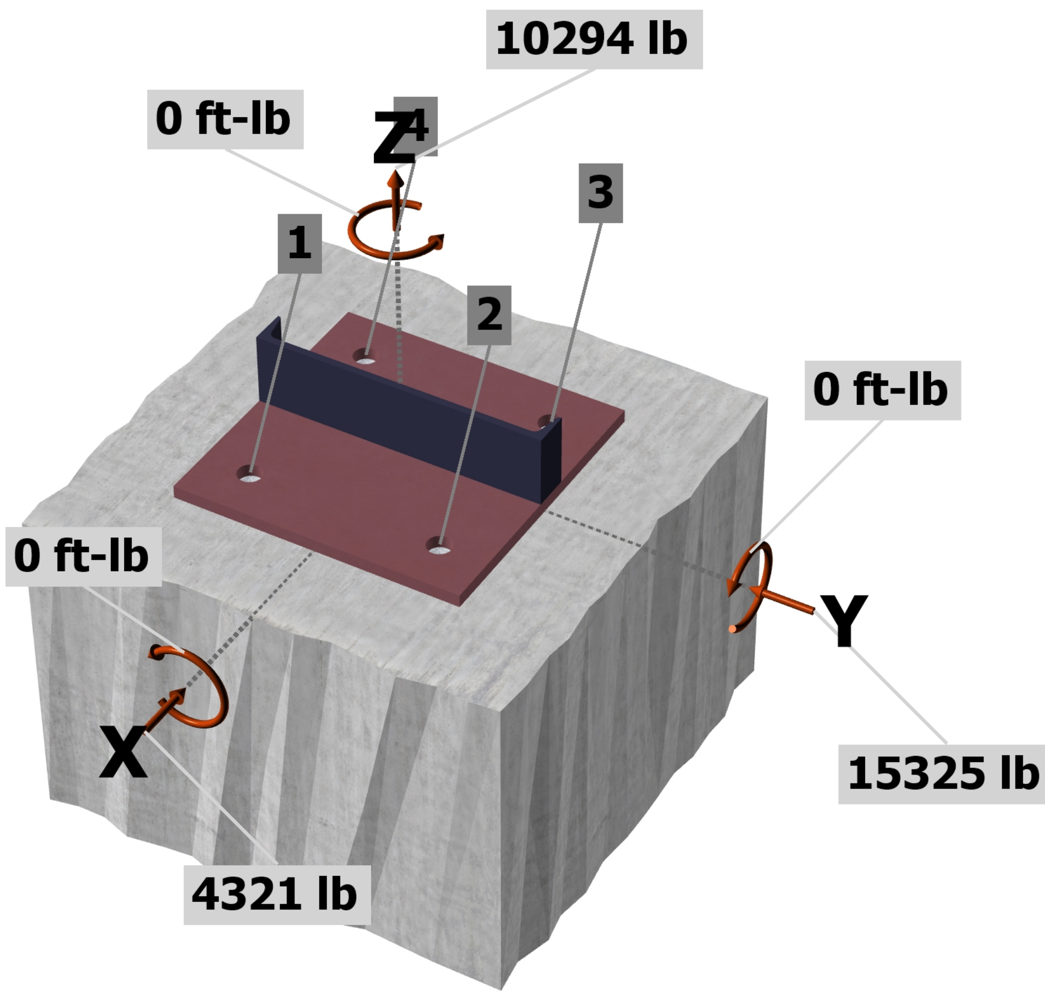
Recommended Anchor
Anchor Name: SET-XP® - SET-XP w/ 1"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-2508

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

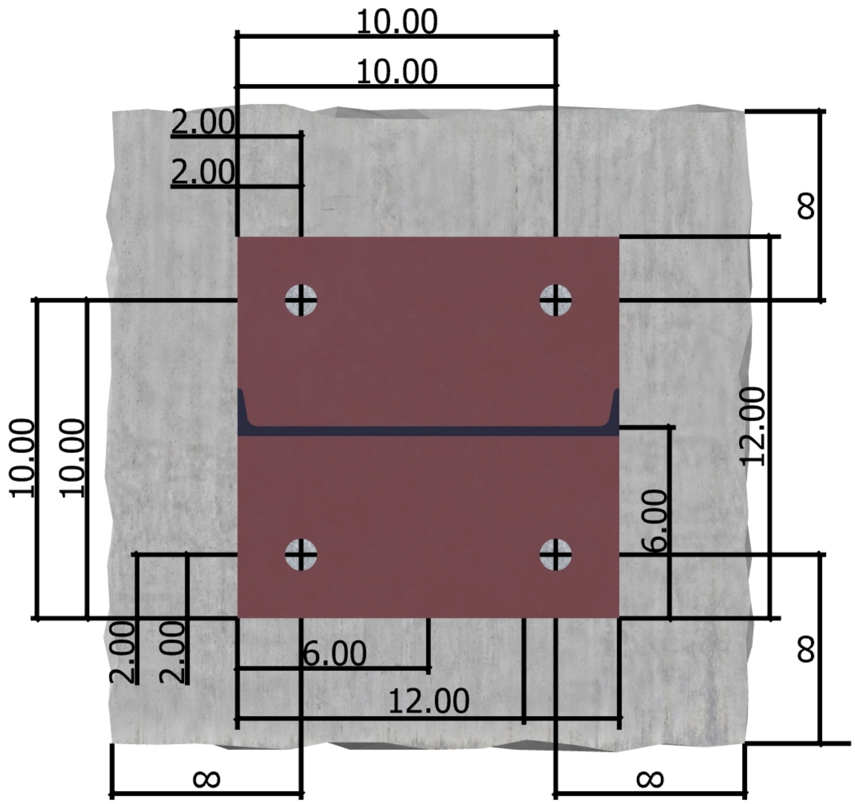
Strength level loads:

N_{ua} [lb]: 10294
V_{uax} [lb]: -4321
V_{uay} [lb]: -15325
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

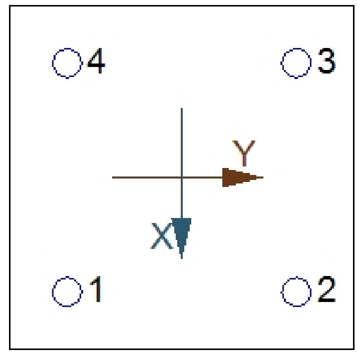


3. Resulting Anchor Forces

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	2573.5	-1080.3	-3831.3	3980.6
2	2573.5	-1080.3	-3831.3	3980.6
3	2573.5	-1080.3	-3831.3	3980.6
4	2573.5	-1080.3	-3831.3	3980.6
Sum	10294.0	-4321.0	-15325.0	15922.5

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 10294
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. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
35150	0.75	26363

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	12.000	35334

$\phi N_{cbg} = \phi\ (A_{Nc} / A_{Nco})\ \Psi_{ec,N}\ \Psi_{ed,N}\ \Psi_{c,N}\ \Psi_{cp,N} N_b$ (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)
1936.00	1296.00	-	1.000	1.000	1.00	1.000	35334	0.65	34309

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

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

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\tau_{k,cr}$ (psi)
345	1.00	1.00	345

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

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	345	1.00	12.000	13006

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

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba}(lb)	ϕ	ϕN_{ag} (lb)
622.46	287.27	8.47	-	1.000	1.000	1.000	13006	0.65	18318

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

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
21090	1.0	0.65	13709

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

$\phi V_{cpg} = \phi \min|k_{cp}N_{ag}\ ;\ k_{cp}N_{cbg}| = \phi \min|k_{cp}(A_{Na}/A_{Na0})\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}\ ;\ k_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Na} (in^2)	A_{Na0} (in^2)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	622.46	287.27	1.000	1.000	1.000	13006	28182

A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
1936.00	1296.00	1.000	1.000	1.000	1.000	35334	52783	0.70

ϕV_{cpg} (lb)
39454

11. Results

Interaction of Tensile and Shear Forces (Sec. R17.6)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	2574	26363	0.10	Pass
Concrete breakout	10294	34309	0.30	Pass
Adhesive	**10294**	**18318**	**0.56**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	3981	13709	0.29	Pass
Pryout	**15923**	**39454**	**0.40**	**Pass (Governs)**

Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.38	0.22	60.3%	1.0	Pass

SET-XP w/ 1"Ø F1554 Gr. 36 with hef = 12.000 inch meets the selected design criteria.

Base Plate Thickness

Required base plate thickness: 0.453 inch

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: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 1.000
Effective Embedment depth, h_{ef} (inch): 12.000
Code report: ICC-ES ESR-2508
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 17.63
c_{ac} (inch): 17.49
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 24.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 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: No

Base Plate
Length x Width x Thickness (inch): 12.00 x 12.00 x 0.53
Yield stress: 50 psi

Profile type/size: MC12X10.6

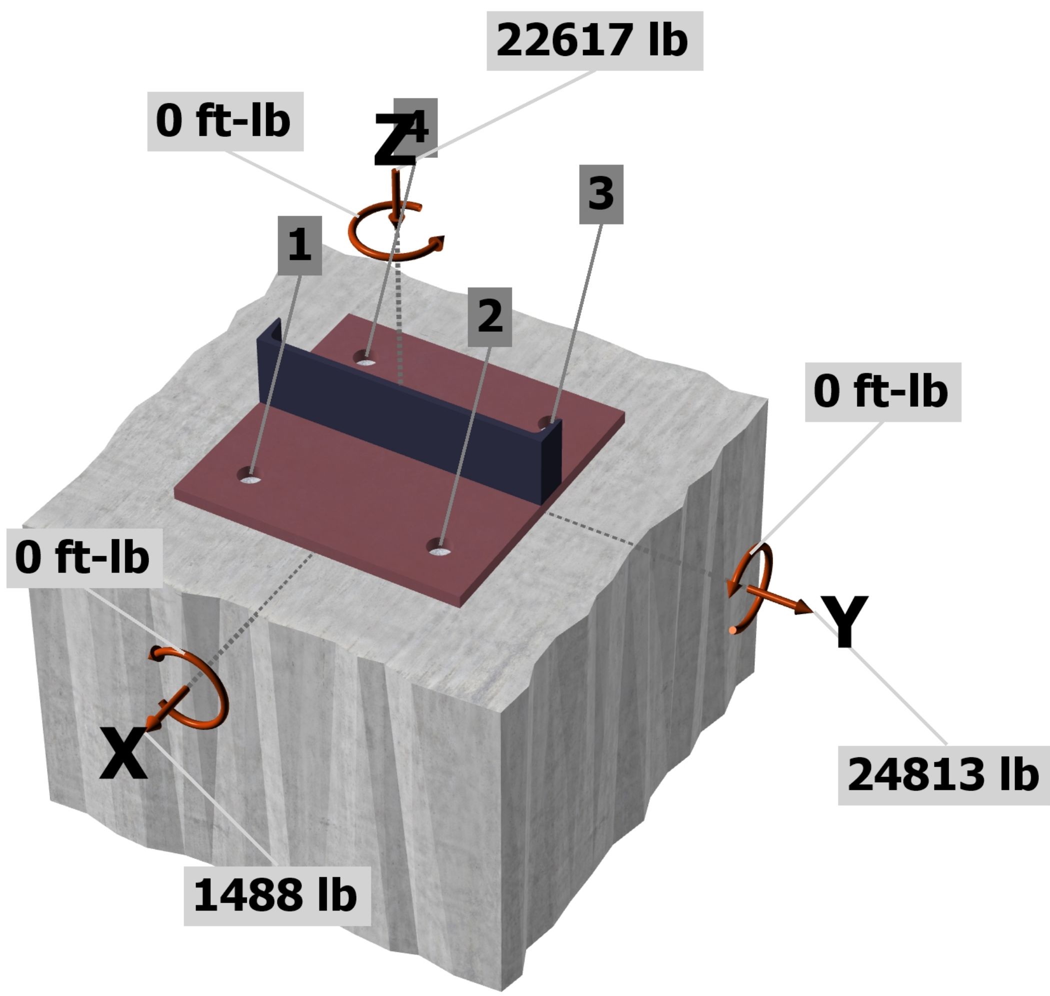
Recommended Anchor
Anchor Name: SET-XP® - SET-XP w/ 1"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-2508

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: No

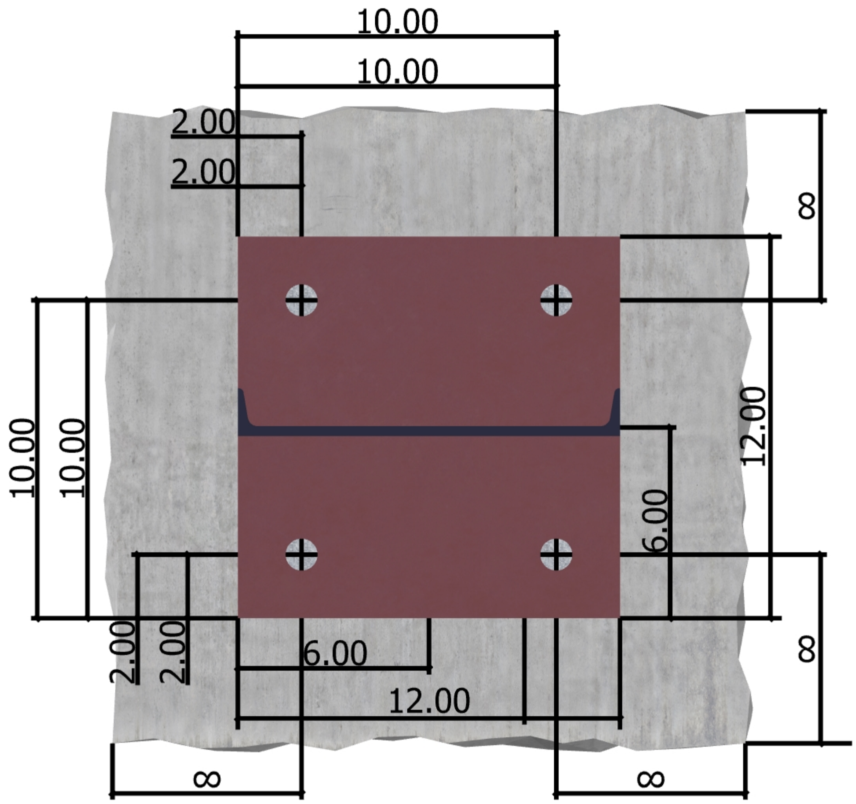
Strength level loads:

N_{ua} [lb]: -22617
V_{uax} [lb]: 1488
V_{uay} [lb]: 24813
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

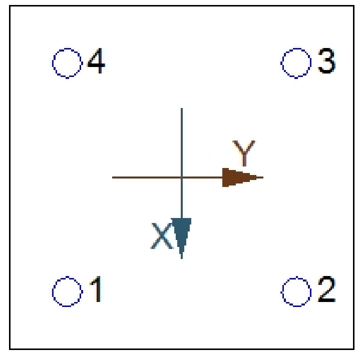


3. Resulting Anchor Forces

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	0.0	372.0	6203.3	6214.4
2	0.0	372.0	6203.3	6214.4
3	0.0	372.0	6203.3	6214.4
4	0.0	372.0	6203.3	6214.4
Sum	0.0	1488.0	24813.0	24857.6

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. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\alpha_{V,seis}$	$\phi_{grout}\alpha_{V,seis}\phi V_{sa}$ (lb)
21090	1.0	0.65	0.68	9322

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

$\phi V_{cpg} = \phi \min|k_{cp}N_{ag} ; k_{cp}N_{cbg}| = \phi \min|k_{cp}(A_{Na}/A_{Na0})\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba} ; k_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Na} (in^2)	A_{Na0} (in^2)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	622.46	287.27	1.000	1.000	1.000	11966	25927

A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
1936.00	1296.00	1.000	1.000	1.000	1.000	35334	52783	0.70

ϕV_{cpg} (lb)
36298

11. Results

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

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status

Steel	6214	9322	0.67	Pass
Pryout	**24858**	**36298**	**0.68**	**Pass (Governs)**

SET-XP w/ 1"Ø F1554 Gr. 36 with hef = 12.000 inch meets the selected design criteria.

12. Warnings

- When cracked concrete is selected, concrete compressive strength used in concrete breakout strength in tension, adhesive strength in tension and concrete pryout strength in shear for SET-XP adhesive anchor is limited to 2,500 psi per ICC-ES ESR-2508 Section 5.3.

- 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.