



Project Number: U2716-0217-201

April 6, 2021

Sunmodo
14800 NE 65th Street
Vancouver, WA 98682

**REFERENCE: Sunmodo Sunturf Ground Mount A7 (85x45)
Ground Mount PV Array Installation**

To Whom It May Concern:

Per request of Sunmodo, we have been asked to prepare the structural design of a ground-mounted PV solar array system with several foundation options as shown in the attached calculations. The adopted building code in this jurisdiction is the New York State Uniform Code, 2017 Edition (2015 IBC). Vector Structural Engineering requires that we review each site specific install, and we are not liable for installs at site specific locations we have not reviewed. The following design parameters are used in our analysis:

- Minimum Design Loads for Buildings and Other Structures (ASCE 7-10)
- Design wind speed for risk category I structures: 110 mph
- Wind exposure: C
- Ground snow load: 50 psf
- The ground screws and helical piers must be tested to 1.5 times uplift and 2.0 times lateral reactions found in the table below. A minimum of one ground screw or helical pier must be tested.

Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	3056	1.5	4584
LATERAL	2023	2	4046

Foundation concrete shall have a minimum compressive strength of 2500 psi at 28 days. Cement for all concrete shall be Type I or II with a minimum of 6% entrained air with a water/cement ratio of 0.50. Maximum aggregate size shall be 3/4". No special inspection of concrete strength is required.

Footings are designed based on an allowable soil bearing pressure of 1500 psf an allowable skin friction of 250 psf, an allowable lateral bearing pressure of 150 pcf, and a coefficient of friction of 0.3. Vector Structural Engineering strongly recommends independent soils testing be performed by a licensed geotechnical engineer to verify the assumed soil parameters.

All ground mounts are to be installed per manufacturer’s recommendations. The use of solar panel support span tables provided by the manufacturer is allowed only where the site conditions and solar panel configuration match the description of the span tables. Electrical engineering is beyond our scope. All work performed must be in accordance with accepted industry-wide methods and applicable safety standards. Vector Structural Engineering assumes no responsibility for improper installation of the solar panels.

Very truly yours,

VECTOR STRUCTURAL ENGINEERING, LLC
NY Firm License: COA0012807

Wells Holmes, P.E.
License: 90187 - Expires: 09/30/2023
Project Engineer

Enclosures

WLH/stb

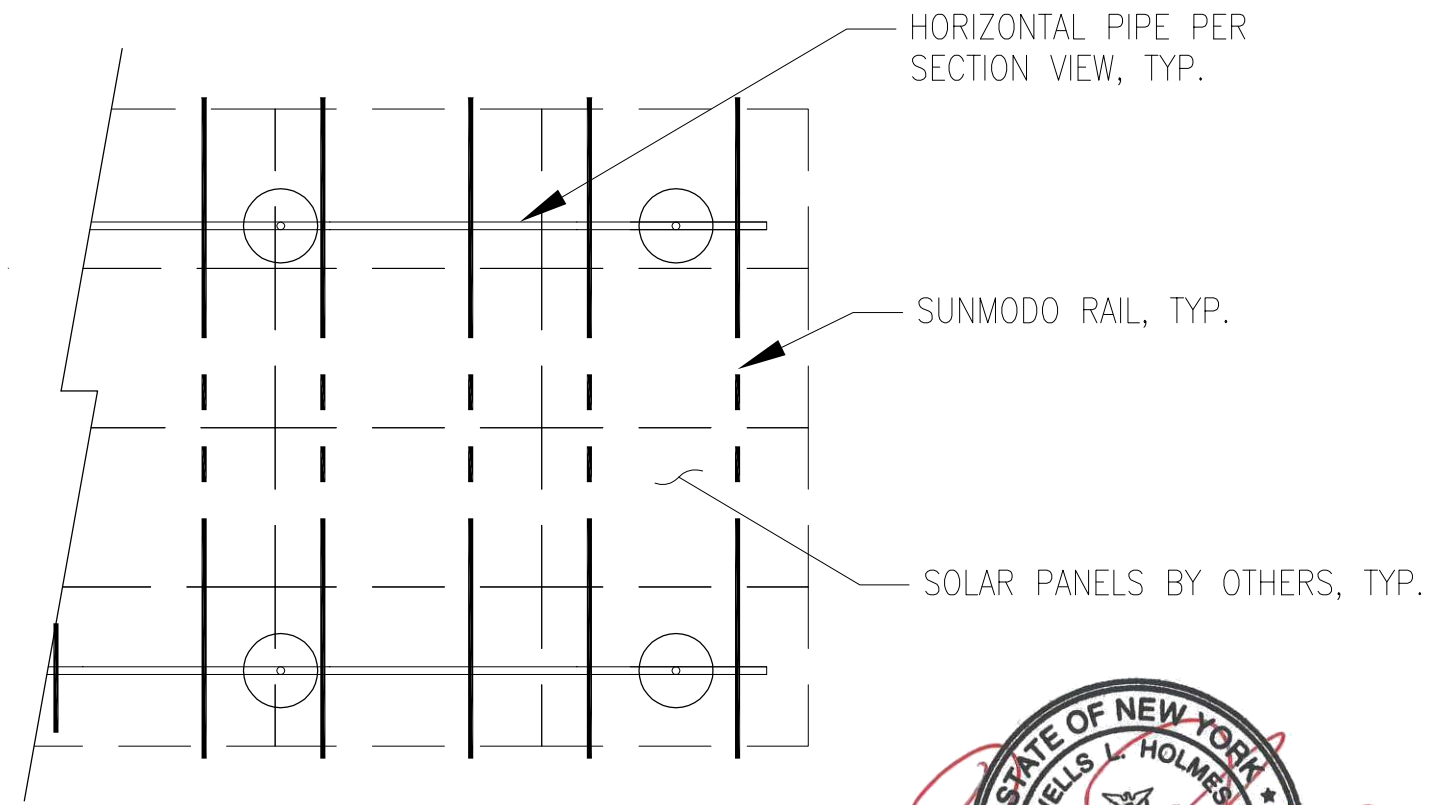
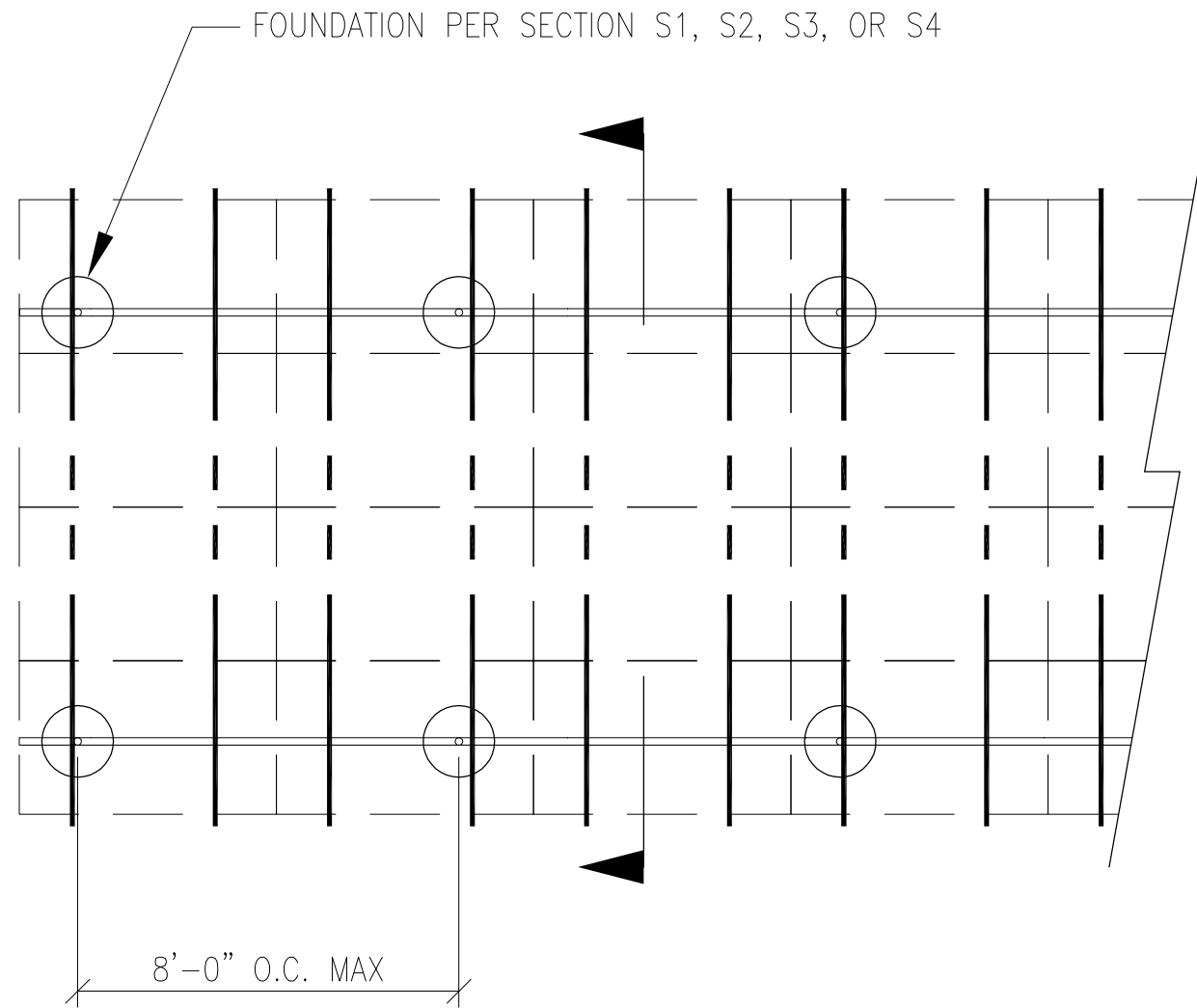


04/06/2021



JOB NO. U2716-0217-201
 PROJECT SUNMODO SUNTURF GROUND MOUNTS A7
 SUBJECT ALL OPTIONS

651 W GALENA PARK BLVD. #101 (801) 990-1775
 DRAPER, UTAH 84020 (801) 990-1776 FAX



04/06/2021

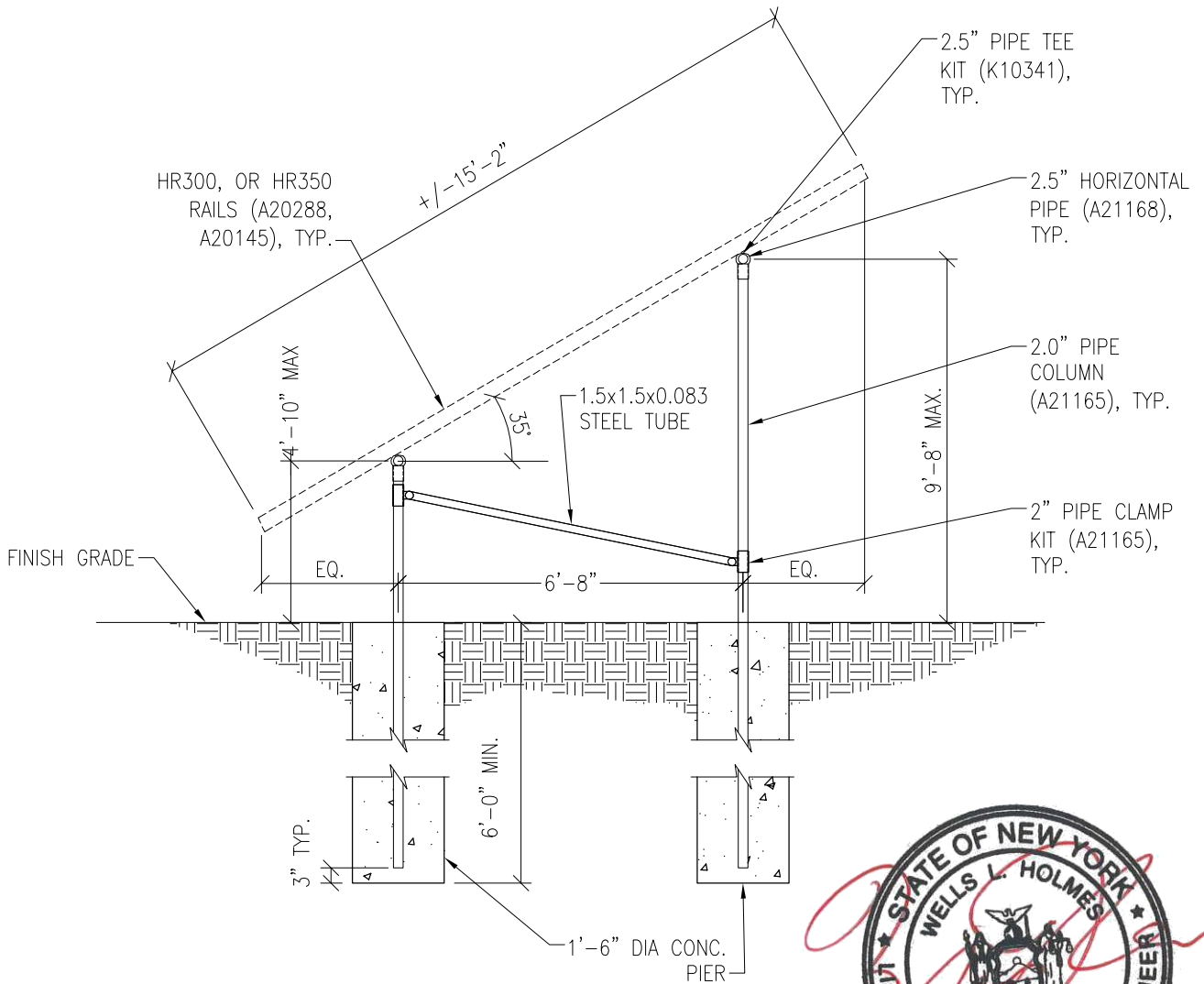
PV ARRAY PLAN

N.T.S.

P1

PROJECT SUNMODO SUNTURF GROUND MOUNTS A7

SUBJECT DRILLED PIER OPTION



04/06/2021

Vector Structural Engineering requires that we review each site specific install, and we are not liable for installs at site specific locations we have not reviewed

PV ARRAY SECTION

N.T.S.

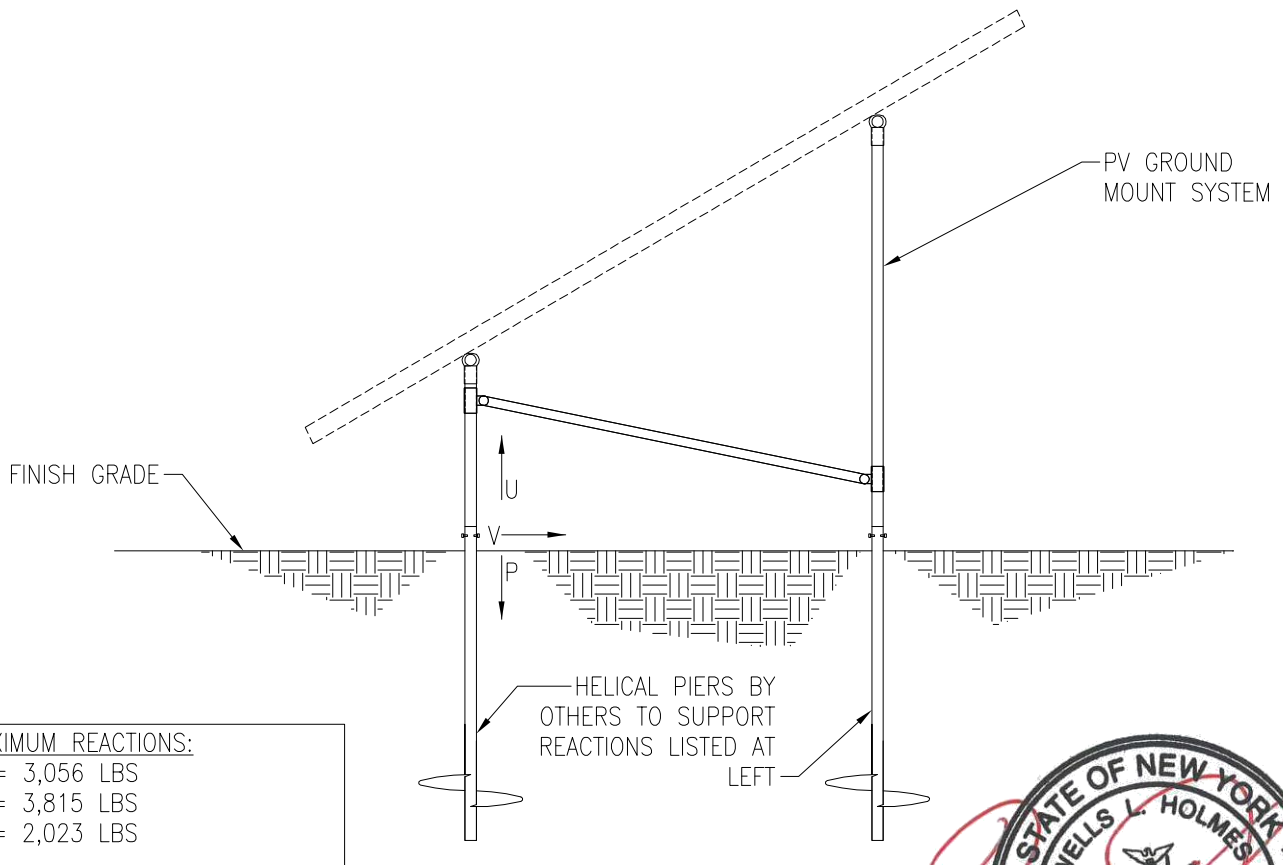
S1

PROJECT SUNMODO SUNTURF GROUND MOUNTS A7

SUBJECT HELICAL PIER OPTION

NOTES:

1. For ground mount components see Section S1.
2. A minimum of (1) installed helical pier must be tested as follows:
 - 2.1. Safety factor for uplift to be 1.5
 - 2.2. S.F. for lateral loads to be 2.0
 - 2.3. Upward deflection limit = 1/2"
 - 2.4. Lateral deflection limit = 1"
 - 2.5. The load tests must be performed by an approved contractor



MAXIMUM REACTIONS:
 U = 3,056 LBS
 P = 3,815 LBS
 V = 2,023 LBS



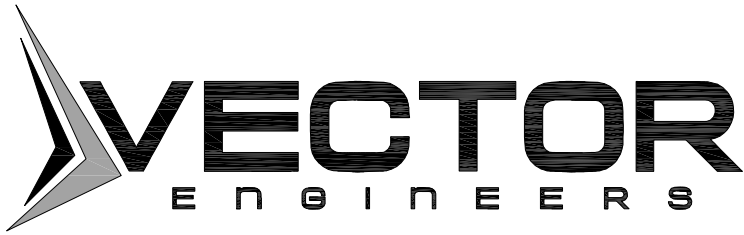
Vector Structural Engineering requires that we review each site specific install, and we are not liable for installs at site specific locations we have not reviewed

PV ARRAY SECTION

04/06/2021

N.T.S.

S2



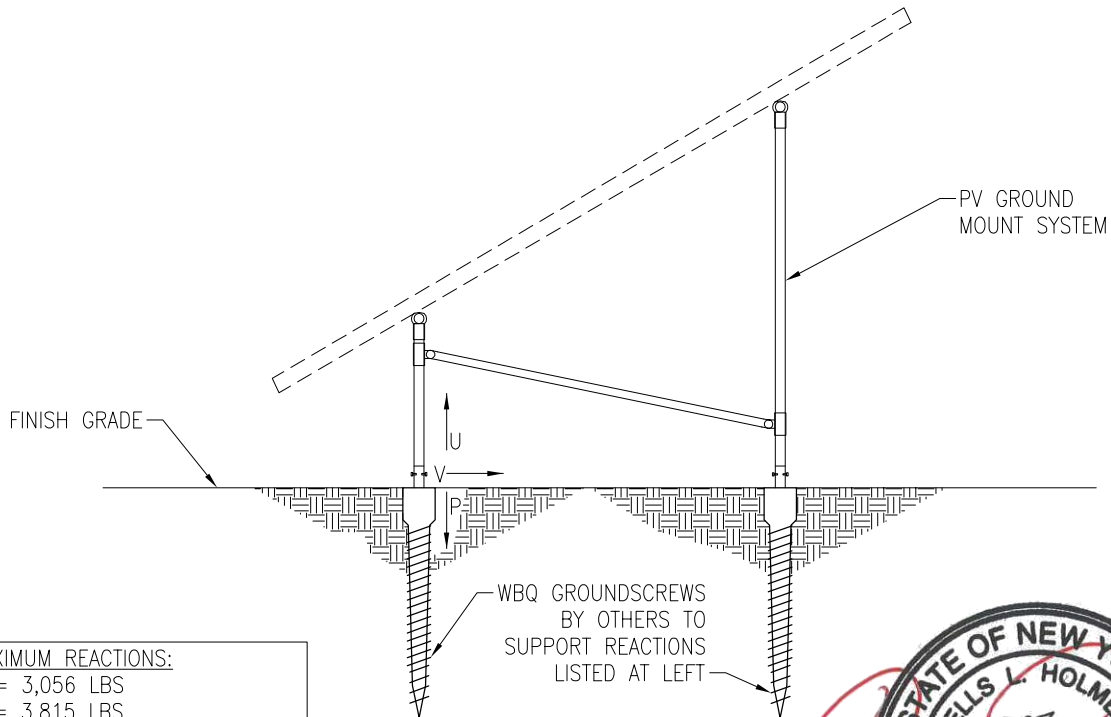
JOB NO. U2716-217-201

PROJECT SUNMODO SUNTURF GROUND MOUNTS A7

SUBJECT GROUND SCREW OPTION

NOTES:

- 1. For ground mount components see Section S1.
- 2. A minimum of (1) installed ground screw must be tested as follows:
 - 2.1. Safety factor for uplift to be 1.5
 - 2.2. S.F. for lateral loads to be 2.0
 - 2.3. Upward deflection limit = 1/2"
 - 2.4. Lateral deflection limit = 1"
 - 2.5. The load tests must be performed by an approved contractor



MAXIMUM REACTIONS:
 U = 3,056 LBS
 P = 3,815 LBS
 V = 2,023 LBS

Vector Structural Engineering requires that we review each site specific install, and we are not liable for installs at site specific locations we have not reviewed



PV ARRAY SECTION

N.T.S.

S3



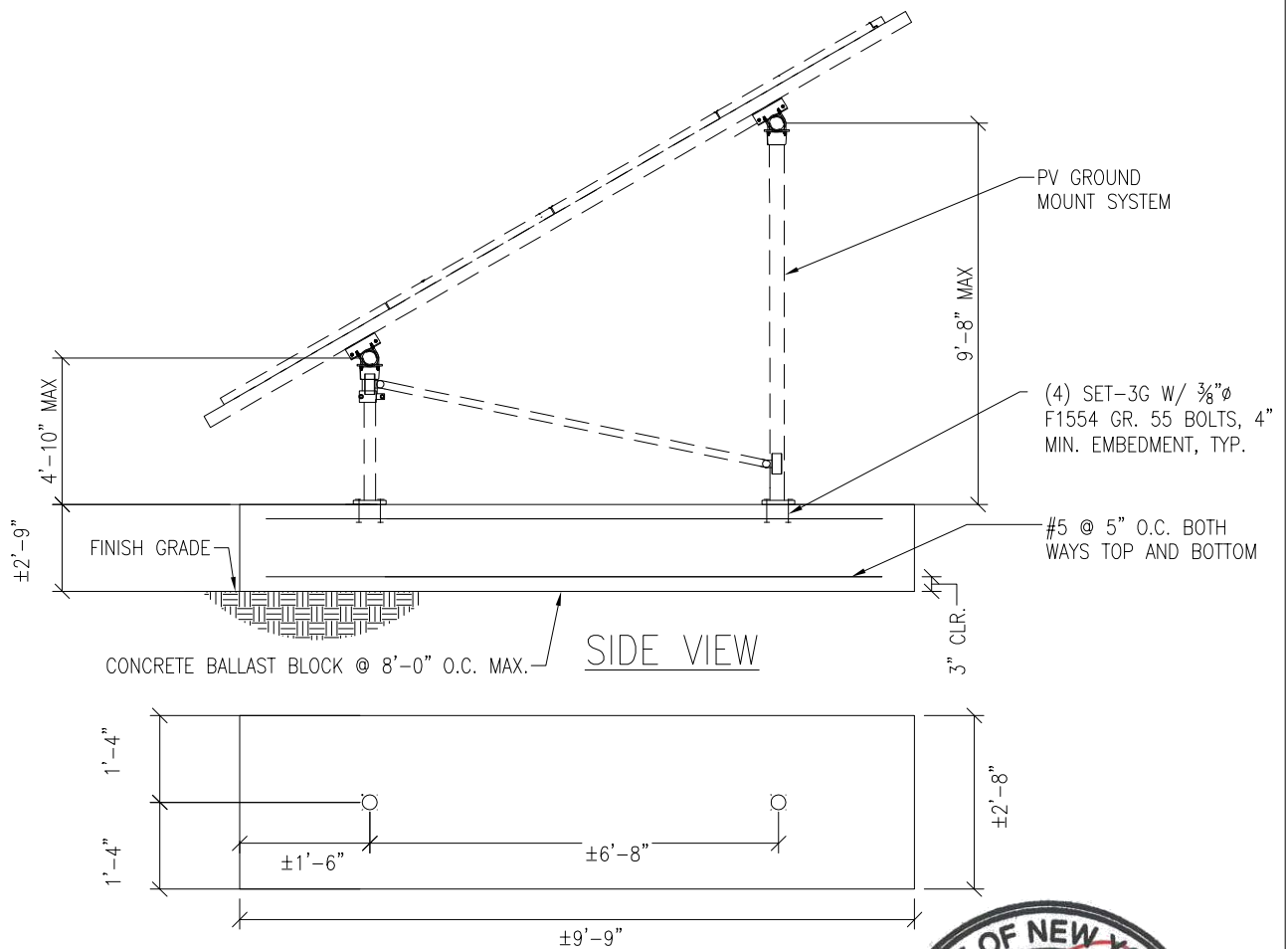
JOB NO. U2716-0217-201

PROJECT SUNMODO SUNTURF GROUND MOUNTS A7

SUBJECT BALLASTED BLOCK OPTION

NOTES:

1. For ground mount components see Section S1.



Vector Structural Engineering requires that we review each site specific install, and we are not liable for installs at site specific locations we have not reviewed



PV ARRAY SECTION

N.T.S.

S4

651 W GALENA PARK BLVD. #101
DRAPER, UTAH 84020

(801) 990-1775
(801) 990-1776 FAX

04/06/2021

WWW.VECTORSE.COM



JOB NO.: U2716-0217-201

DESIGNED: STB

DATE: 06/25/20

PROJECT: A7 – Sunmodo Sunturf GM

SUBJECT: Snow Load

SNOW LOAD (S):

ASCE 7 Standard:	10	
Panel Slope from Horizontal [°]:	35.0	
Snow Ground Load, p_g [psf]:	50.0	(Section 7.2)
Terrain Category:	C	(Table 7-2)
Exposure of Roof:	Fully Exposed	(Table 7-2)
Exposure Factor, C_e :	0.9	(Table 7-2)
Thermal Factor, C_t :	1.2	(Table 7-3)
Risk Category:	I	(Table 1.5-1)
Importance Factor, I_s :	0.8	(Table 1.5-2)
Flat Roof Snow Load, p_f [psf]:	30	(Equation 7.3-1)
Minimum Roof Snow Load, p_m [psf]:	0	(Section 7.3.4)
Unobstructed Slippery Surface?	Yes	(Section 7.4)
Slope Factor Figure:	Figure 7-2c	(Section 7.4)
Roof Slope Factor, C_s :	0.636	(Figure 7-2)
Sloped Roof Snow Load, p_s [psf]:	19	(Equation 7.4-1)
Design Snow Load, S [psf]:	19	



JOB NO.: U2716-0217-201 DESIGNED: STB
 DATE: 06/25/20

PROJECT: A7 – Sunmodo Sunturf GM

SUBJECT: Wind Pressure

Design Wind Load:

ASCE 7 Standard:	10	
Basic Wind Speed, V [mph]:	110	
Risk Category:	I	
Exposure Category	C	(Section 26.7.3)
Velocity Pressure Exposure Coefficient, K_h :	0.85	(Table 27.3-1)
Topographic Factor, K_{ht} :	1.0	(Section 26.8.2)
Wind Directionality Factor, K_d :	0.85	(Table 26.6-1)
Internal Pressure Coefficient, GC_{pi} :	0.00	(Table 26.11-1)
Velocity Pressure, q_h [psf]:	22.4	(Equation 27.3-1)
Gust Effect Factor, G:	0.85	(Section 26.9.1)
Panel Slope [degrees]:	35.0	

Net Pressure Coefficients (C_N) per: (Figure 27.4-4)

Clear Wind Flow	C_{NW}	C_{NL}
Case 1 ($\gamma = 0^\circ$, Load Case A)	-1.80	-1.80
Case 2 ($\gamma = 0^\circ$, Load Case B)	-2.43	-0.57
Case 3 ($\gamma = 180^\circ$, Load Case A)	2.10	2.17
Case 4 ($\gamma = 180^\circ$, Load Case B)	2.67	1.07

Design Wind Pressures (p) [psf] per: (Equation 27.4-3)

Clear Wind Flow	$q_h GC_{NW}$	$q_h GC_{NL}$
Case 1 ($\gamma = 0^\circ$, Load Case A)	-34.2	-34.2
Case 2 ($\gamma = 0^\circ$, Load Case B)	-46.3	-10.8
Case 3 ($\gamma = 180^\circ$, Load Case A)	39.9	41.2
Case 4 ($\gamma = 180^\circ$, Load Case B)	50.7	20.3



JOB NO.: U2716-0217-201

DESIGNED: STB

Foundation Option 1: Drilled Concrete Pier



PROJECT: A7 - Sunturf Ground Mount

DRILLED CONCRETE PIER DESIGN

Column Reactions:

Max. Shear, V [k]:	2.0	Max. Down, P _d [k]:	3.8
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P _u [k]:	3.1

Pier Properties:

Pier Shape:	Round	Volume of Concrete [ft ³]:	11
Pier Diameter, b [ft]:	1.5	Volume of Concrete [yd ³]:	0.4
Top of Pier Elevation [ft]:	0.00	Weight of Concrete [k]:	1.6
Pier Depth, d [ft]:	6.0		

Soil Properties:

Allow. Bearing Pressure [psf]:	1,500	<u>Optional Parameters for Uplift:</u>	
1/3 increase for short term loads?	No		
Lateral Bearing, S [pcf]:	150	Skin Friction* [psf]:	250
Max. Lateral Bearing (opt'l) [psf]:		Top Length to Ignore [ft]:	0
Top Depth to Ignore [ft]:	0	1/3 increase for short term loads?	No
1/3 increase for short term loads?	No	Combine w/ Bearing:	No
1/2" deflection at t/o pier allowed:	Yes		

*per IBC Section 1810.3.3.1.4

Check Bearing:

Bearing Capacity [k]:	7.1
-----------------------	-----

Bearing capacity OK.

Check Uplift:

Uplift Capacity [k]:	8.5
----------------------	-----

Uplift capacity OK.

Check Lateral Bearing:

Top of Pier Constrained?:	No
Applied Lateral Force, P [lb]:	2,023
Point of Application, h [ft]:	0.0
S _{max} [psf]:	
S [psf]:	600
A = 2.34*P/(Sb):	5.26
Required Pier Depth, d _{reqd} [ft]:	5.30

IBC Section 1807.3.2.1

IBC Eq. 18-1

Result: **Lateral bearing capacity OK.**

Foundation Option 2: Helical Pier

- The ground screws and helical piers must be tested to 1.5 times uplift and 2.0 times lateral reactions found in the table below. A minimum of one ground screw or helical pier must be tested.

Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	3056	1.5	4584
LATERAL	2023	2	4046

Foundation Option 3: Ground Screw

- The ground screws and helical piers must be tested to 1.5 times uplift and 2.0 times lateral reactions found in the table below. A minimum of one ground screw or helical pier must be tested.

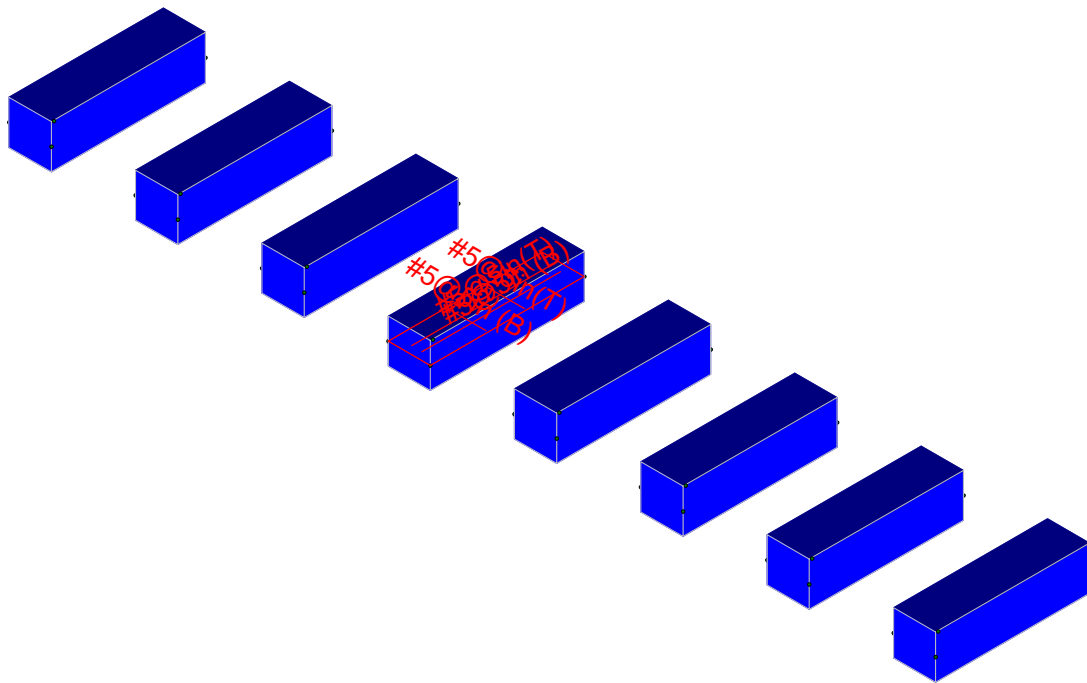
Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	3056	1.5	4584
LATERAL	2023	2	4046



JOB NO.: U2716-0217-201

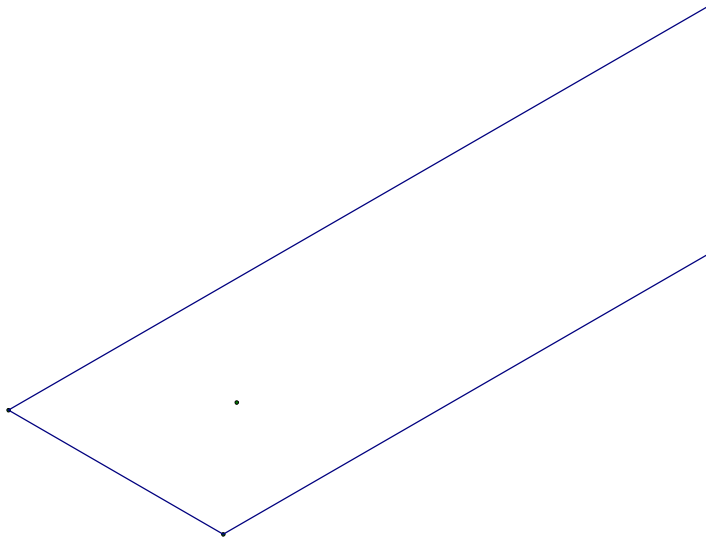
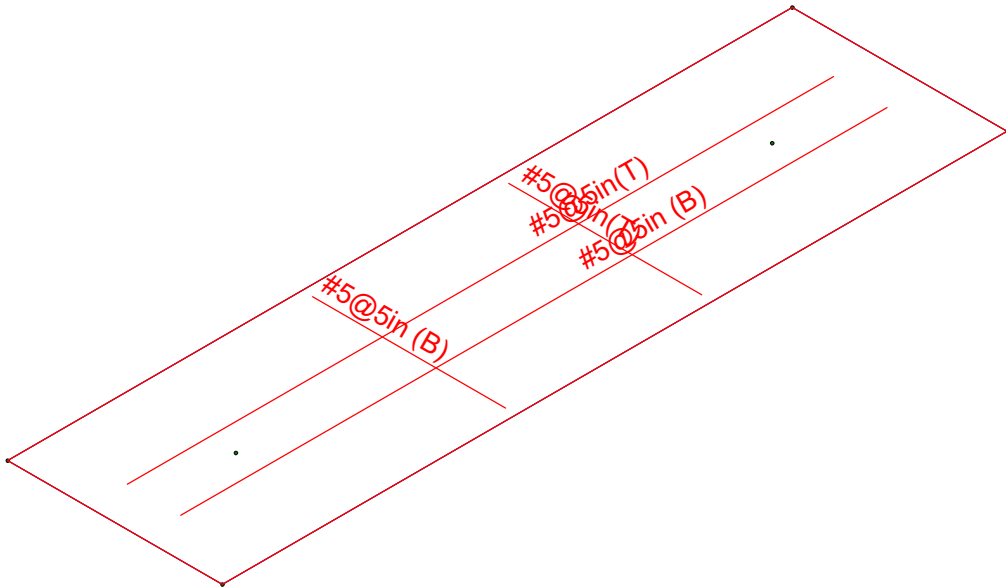
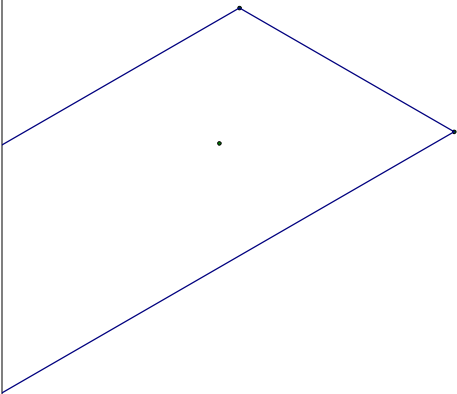
DESIGNED: STB

Foundation Option 4: Ballasted Block



Results for LC 2, 1.0 D

Vector Structural Engineeri..	Ground Mount	SK - 2
STB		Apr 6, 2021 at 10:50 AM
U2716.0219.201		Sunmodo Sunturf A7 v3 85x45.r3d



Results for LC 2, 1.0 D

Vector Structural Engineeri..	Ground Mount	SK - 1
STB		Apr 6, 2021 at 10:50 AM
U2716.0219.201		Sunmodo Sunturf A7 v3 85x45.r3d



(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	100
Mesh Size (in)	12
Max Iterations	10
Merge Tolerance (in)	.12
Solver	Sparse Accelerated
Coefficient of Friction	.3
No. of Shear Regions	4
Shear Region Spacing Increment (in)	4
Min 1 Bar Dia Spacing for Beams?	No
Optimize footings for OTM / Sliding?	Yes
Parme Beta Factor	.65
Pile Safety Factor	3
Concrete Stress Block	0
Concrete Rebar Set	Rectangular
Concrete Code	ASTM A615
HR Steel Pile Code	ACI 318-14
Wood Pile Code	AISC 14th (360-10): ASD AWC NDS-15: ASD

Concrete Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/...	Density[k/ft^3]	fc[psi]	Lambda	Flex Stee...	Shear St...
1	Conc3000NW	3156	1372	.15	.6	.145	3000	1	60000	60000
2	Conc3500NW	3409	1482	.15	.6	.145	3500	1	60000	60000
3	Conc4000NW	3644	1584	.15	.6	.145	4000	1	60000	60000
4	Conc3000LW	2085	907	.15	.6	.11	3000	.75	60000	60000
5	Conc3500LW	2252	979	.15	.6	.11	3500	.75	60000	60000
6	Conc4000LW	2408	1047	.15	.6	.11	4000	.75	60000	60000
7	Conc2500NW	3156	1372	.15	.6	.145	2500	1	60000	60000

General Design Parameters

	Label	Max Bending Chk	Max Shear Chk	Top Cover[in]	Bottom Cover[in]
1	Typical	1	1	3	3

Slab Rebar Parameters

	Label	Top Bar	Bottom Bar	Max Top Bar Sp...	Min Top Bar Sp...	Max Bot Bar Sp...	Min Bot Bar Sp...	Spacing Incr...	Rebar Options
1	Typical	#5	#5	18	5	18	5	1	Optimize

Soil Definitions

	Label	Subgrade Modulus[k/ft^3]	Allowable Bearing[psf]	Depth Properties	Default?
1	Default	172.8	1500	None	Yes

Point Loads and Moments (Cat 1 : DL)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	-8.369
2	R3D_N1_1	Y	153.254
3	R3D_N1_1	Z	1.179
4	R3D_N2_1	X	-11.628
5	R3D_N2_1	Y	120.698
6	R3D_N115	Y	255.869
7	R3D_N116	Y	235.09
8	R3D_N99	X	1.348

Point Loads and Moments (Cat 1 : DL) (Continued)

	Label	Direction	Magnitude[lb.-ft]
9	R3D_N99	Y	294.212
10	R3D_N99	Z	-2.415
11	R3D_N100	X	3.157
12	R3D_N100	Y	251.845
13	R3D_N105A	Y	255.891
14	R3D_N106A	Y	234.765
15	R3D_N111A_1	Y	263.32
16	R3D_N112A_1	Y	238.907
17	R3D_N117A_1	Y	263.298
18	R3D_N118A_1	Y	239.04
19	R3D_N123_1	X	-1.413
20	R3D_N123_1	Y	293.819
21	R3D_N123_1	Z	-2.465
22	R3D_N124_1	X	-3.294
23	R3D_N124_1	Y	251.679
24	R3D_N155	X	8.479
25	R3D_N155	Y	158.406
26	R3D_N155	Z	1.119
27	R3D_N156	X	11.497
28	R3D_N156	Y	125.155

Point Loads and Moments (Cat 6 : RLL)

	Label	Direction	Magnitude[lb.-ft]
1	R3D_N1_1	X	-31.762
2	R3D_N1_1	Y	438.164
3	R3D_N1_1	Z	4.818
4	R3D_N2_1	X	-48.023
5	R3D_N2_1	Y	415.874
6	R3D_N115	X	-1.034
7	R3D_N115	Y	940.77
8	R3D_N115	Z	3.439
9	R3D_N116	X	-3.401
10	R3D_N116	Y	895.756
11	R3D_N99	X	4.861
12	R3D_N99	Y	1058.007
13	R3D_N99	Z	-9.91
14	R3D_N100	X	13.223
15	R3D_N100	Y	968.632
16	R3D_N105A	Y	940.89
17	R3D_N105A	Z	2.765
18	R3D_N106A	X	3.511
19	R3D_N106A	Y	894.319
20	R3D_N111A_1	X	1.204
21	R3D_N111A_1	Y	966.504
22	R3D_N111A_1	Z	2.11
23	R3D_N112A_1	X	3.372
24	R3D_N112A_1	Y	912.607
25	R3D_N117A_1	Y	966.461
26	R3D_N117A_1	Z	2.352
27	R3D_N118A_1	X	-2.554
28	R3D_N118A_1	Y	913.188
29	R3D_N123_1	X	-5.172
30	R3D_N123_1	Y	1056.684
31	R3D_N123_1	Z	-10.149
32	R3D_N124_1	X	-13.937
33	R3D_N124_1	Y	967.947

Point Loads and Moments (Cat 17 : OL2)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	62.856
2	R3D_N1_1	Y	-2098.555
3	R3D_N1_1	Z	898.287
4	R3D_N2_1	X	-3.794
5	R3D_N2_1	Y	843.195
6	R3D_N2_1	Z	-80.362
7	R3D_N115	X	5.005
8	R3D_N115	Y	-4733.341
9	R3D_N115	Z	2057.154
10	R3D_N116	X	-10.017
11	R3D_N116	Y	1974.208
12	R3D_N116	Z	-133.563
13	R3D_N99	X	-11.517
14	R3D_N99	Y	-5410.174
15	R3D_N99	Z	2385.062
16	R3D_N100	X	-14.033
17	R3D_N100	Y	2308.797
18	R3D_N100	Z	-132.124
19	R3D_N105A	X	-4.705
20	R3D_N105A	Y	-4736.619
21	R3D_N105A	Z	2061.134
22	R3D_N106A	X	10.874
23	R3D_N106A	Y	1978.805
24	R3D_N106A	Z	-134.148
25	R3D_N111A_1	X	-4.984
26	R3D_N111A_1	Y	-4850.851
27	R3D_N111A_1	Z	2100.54
28	R3D_N112A_1	X	7.854
29	R3D_N112A_1	Y	2020.098
30	R3D_N112A_1	Z	-133.81
31	R3D_N117A_1	X	3.878
32	R3D_N117A_1	Y	-4849.158
33	R3D_N117A_1	Z	2098.328
34	R3D_N118A_1	X	-3.974
35	R3D_N118A_1	Y	2018.263
36	R3D_N118A_1	Z	-133.564
37	R3D_N123_1	X	12.938
38	R3D_N123_1	Y	-5403.971
39	R3D_N123_1	Z	2384.324
40	R3D_N124_1	X	13.057
41	R3D_N124_1	Y	2309.349
42	R3D_N124_1	Z	-133.098
43	R3D_N155	X	-64.44
44	R3D_N155	Y	-2207.854
45	R3D_N155	Z	945.35
46	R3D_N156	X	1.004
47	R3D_N156	Y	888.925
48	R3D_N156	Z	-82.64

Point Loads and Moments (Cat 18 : OL3)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1_1	X	-56.364
2	R3D_N1_1	Y	2256.14
3	R3D_N1_1	Z	-1277.541
4	R3D_N2_1	X	-72.095
5	R3D_N2_1	Y	-469.743



Point Loads and Moments (Cat 19 : OL4) (Continued)

	Label	Direction	Magnitude[lb.lb-ft]
12	R3D_N116	Z	164.852
13	R3D_N99	X	5.222
14	R3D_N99	Y	3904.718
15	R3D_N99	Z	-2936.851
16	R3D_N100	X	41.422
17	R3D_N100	Y	-96.064
18	R3D_N100	Z	161.956
19	R3D_N105A	X	2.63
20	R3D_N105A	Y	3395.642
21	R3D_N105A	Z	-2538.114
22	R3D_N106A	X	1.879
23	R3D_N106A	Y	22.419
24	R3D_N106A	Z	165.199
25	R3D_N111A_1	X	2.495
26	R3D_N111A_1	Y	3486.261
27	R3D_N111A_1	Z	-2607.885
28	R3D_N112A_1	X	4.367
29	R3D_N112A_1	Y	14.156
30	R3D_N112A_1	Z	166.334
31	R3D_N117A_1	X	-1.887
32	R3D_N117A_1	Y	3485.142
33	R3D_N117A_1	Z	-2606.725
34	R3D_N118A_1	X	-4.338
35	R3D_N118A_1	Y	15.908
36	R3D_N118A_1	Z	166.2
37	R3D_N123_1	X	-5.942
38	R3D_N123_1	Y	3899.026
39	R3D_N123_1	Z	-2934.623
40	R3D_N124_1	X	-42.684
41	R3D_N124_1	Y	-94.851
42	R3D_N124_1	Z	162.9
43	R3D_N155	X	29.159
44	R3D_N155	Y	1588.909
45	R3D_N155	Z	-1176.869
46	R3D_N156	X	113.493
47	R3D_N156	Y	52.663
48	R3D_N156	Z	103.091

Slabs

	Label	Thickness [in]	Material	Local Axis Angle ...	Analysis Offset [in]	Passive Pressur...	Soil Overburden [psf]
1	S1	33	Conc2500NW	0	0	0	0
2	S2	33	Conc2500NW	0	0	0	0
3	S3	33	Conc2500NW	0	0	0	0
4	S4	33	Conc2500NW	0	0	0	0
5	S5	33	Conc2500NW	0	0	0	0
6	S6	33	Conc2500NW	0	0	0	0
7	S7	33	Conc2500NW	0	0	0	0
8	S8	33	Conc2500NW	0	0	0	0

Load Combinations

	Label	Solve	Service A...	SF	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	Cat...Fa...	
1	ASD Loads																				
2	1.0 D	Yes	Yes	1.5	DL	1															
3	1.0 D + 1....	Yes	Yes	1.5	DL	1	RLL	1													
4	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL		OL1	.6											
5	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL		OL2	.6											



Load Combinations (Continued)

Label	Solve	Service	A...	SF	Cat..	Fa...	Cat..	Fa...	Cat..	Fa...	Cat..	Fa...	Cat..	Fa...	C...	F...	C...	F...
6	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL		OL3	.6								
7	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL		OL4	.6								
8	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL	.75	OL1	.45								
9	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL	.75	OL2	.45								
10	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL	.75	OL3	.45								
11	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL	.75	OL4	.45								
12	0.9 D + 0....	Yes	Yes		DL	.9	RLL		OL1	.6								
13	0.9 D + 0....	Yes	Yes		DL	.9	RLL		OL2	.6								
14	0.9 D + 0....	Yes	Yes		DL	.9	RLL		OL3	.6								
15	0.9 D + 0....	Yes	Yes		DL	.9	RLL		OL4	.6								
16																		
17	LRFD Loa...																	
18	1.4 D	Yes			DL	1.4	RLL											
19	1.2 D + 1....	Yes			DL	1.2	RLL	1.6	OL1	.5								
20	1.2 D + 1....	Yes			DL	1.2	RLL	1.6	OL2	.5								
21	1.2 D + 1....	Yes			DL	1.2	RLL	1.6	OL3	.5								
22	1.2 D + 1....	Yes			DL	1.2	RLL	1.6	OL4	.5								
23	1.2 D + 1....	Yes			DL	1.2	RLL		OL1	1								
24	1.2 D + 1....	Yes			DL	1.2	RLL		OL2	1								
25	1.2 D + 1....	Yes			DL	1.2	RLL		OL3	1								
26	1.2 D + 1....	Yes			DL	1.2	RLL		OL4	1								
27	1.0 D + 1....	Yes			DL	1	RLL		OL1	1								
28	1.0 D + 1....	Yes			DL	1	RLL		OL2	1								
29	1.0 D + 1....	Yes			DL	1	RLL		OL3	1								
30	1.0 D + 1....	Yes			DL	1	RLL		OL4	1								

Design Strips

	Label	Rebar Angle from Pl...	No. of Design Cuts	Design Rule
1	DS1	0	50	Typical
2	DS2	90	50	Typical

Load Categories

	Category	Point Loads	Line Loads	Area Loads
1	DL	28		
2	RLL	38		
3	OL1	47		
4	OL2	48		
5	OL3	47		
6	OL4	48		

Strip Reinforcing

Label	UC Top	LC	Top Bars	Governing ...	UC Bot	LC	Bot B...	Gover...	UC Shear	LC	Governing De...	
1	DS1	.009	21	#5@5in	DS1-X26	.009	28	#5@5in	DS1-...	.028	28	DS1-X15
2	DS2	0	27	#5@5in	DS2-X25	.002	21	#5@5in	DS2-...	.005	21	DS2-X25

Slab Overturning Safety Factors (By Combination)

LC	Slab	Angle[deg]	Mo-xx[lb-ft]	Ms-xx[lb-ft]	Mo-zz[lb-ft]	Ms-zz[lb-ft]	Ms-xx/Mo-xx	Ms-zz/Mo-zz
1	2	S1	0	0	51783.389	0	14243.621	9.999+
2	2	S2	0	0	53078.651	0	14539.045	9.999+
3	2	S3	0	0	52883.704	0	14477.565	9.999+
4	2	S4	0	0	52929.637	0	14492.992	9.999+
5	2	S5	0	0	52930.704	0	14493.141	9.999+
6	2	S6	0	0	52886.35	0	14477.969	9.999+
7	2	S7	0	0	53076.518	0	14563.633	9.999+
8	2	S8	0	0	51828.15	0	14146.507	9.999+



Company : Vector Structural Engineering
 Designer : STB
 Job Number : U2716.0219.201
 Model Name : Ground Mount

Apr 6, 2021
 10:50 AM
 Checked By: RNE

Slab Sliding Safety Factors (By Combination) (Continued)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
7	2	S7	0	4.707	3273.905	2.465	3273.905	9.999+	9.999+
8	2	S8	0	19.975	3195.324	1.119	3195.324	9.999+	9.999+
9	3	S1	0	99.783	3448.652	5.997	3448.652	9.999+	9.999+
10	3	S2	0	22.589	3882.064	12.325	3882.064	9.999+	9.999+
11	3	S3	0	3.511	3808.015	2.765	3808.015	9.999+	9.999+
12	3	S4	0	4.576	3824.656	2.11	3824.656	9.999+	9.999+
13	3	S5	0	2.554	3824.852	2.352	3824.852	9.999+	9.999+
14	3	S6	0	4.435	3808.501	3.439	3808.501	9.999+	9.999+
15	3	S7	0	23.817	3881.294	12.614	3881.294	9.999+	9.999+
16	3	S8	0	99.673	3463.562	5.699	3463.562	9.999+	9.999+
17	4	S1	0	45.605	2921.23	589.793	2921.23	9.999+	4.953
18	4	S2	0	18.95	2610.246	1607.795	2610.246	9.999+	1.623
19	4	S3	0	.265	2663.947	1377.072	2663.947	9.999+	1.935
20	4	S4	0	1.507	2652.547	1412.215	2652.547	9.999+	1.878
21	4	S5	0	1.783	2652.503	1411.288	2652.503	9.999+	1.879
22	4	S6	0	.152	2663.717	1375.605	2663.717	9.999+	1.936
23	4	S7	0	19.557	2611.133	1606.157	2611.133	9.999+	1.626
24	4	S8	0	47.448	2910.772	621.544	2910.772	9.999+	4.683
25	5	S1	0	15.44	2966.476	491.934	2966.476	9.999+	6.03
26	5	S2	0	10.825	2715.825	1349.348	2715.825	9.999+	2.013
27	5	S3	0	3.701	2761.046	1156.191	2761.046	9.999+	2.388
28	5	S4	0	1.722	2751.388	1180.038	2751.388	9.999+	2.332
29	5	S5	0	.058	2751.396	1178.858	2751.396	9.999+	2.334
30	5	S6	0	3.007	2760.899	1154.154	2760.899	9.999+	2.392
31	5	S7	0	10.889	2716.873	1348.271	2716.873	9.999+	2.015
32	5	S8	0	18.087	2957.916	518.745	2957.916	9.999+	5.702
33	6	S1	0	97.074	3513.993	696.702	3513.993	9.999+	5.044
34	6	S2	0	32.159	4061.302	1911.874	4061.302	9.999+	2.124
35	6	S3	0	.442	3961.19	1632.999	3961.19	9.999+	2.426
36	6	S4	0	1.678	3982.319	1674.466	3982.319	9.999+	2.378
37	6	S5	0	2.144	3982.443	1673.351	3982.443	9.999+	2.38
38	6	S6	0	.066	3961.66	1631.229	3961.66	9.999+	2.429
39	6	S7	0	33.306	4059.873	1910.053	4059.873	9.999+	2.126
40	6	S8	0	99.25	3532.703	734.49	3532.703	9.999+	4.81
41	7	S1	0	104.645	3474.339	610.338	3474.339	9.999+	5.692
42	7	S2	0	32.491	3959.63	1667.352	3959.63	9.999+	2.375
43	7	S3	0	2.705	3872.703	1423.749	3872.703	9.999+	2.72
44	7	S4	0	4.117	3890.998	1464.931	3890.998	9.999+	2.656
45	7	S5	0	3.735	3891.146	1464.315	3891.146	9.999+	2.657
46	7	S6	0	2.842	3873.152	1422.922	3873.152	9.999+	2.722
47	7	S7	0	33.883	3958.656	1665.498	3958.656	9.999+	2.377
48	7	S8	0	105.567	3490.807	643.147	3490.807	9.999+	5.428
49	8	S1	0	30.635	3181.191	446.253	3181.191	9.999+	7.129
50	8	S2	0	.476	3232.197	1197.81	3232.197	9.999+	2.698
51	8	S3	0	2.832	3225.245	1034.878	3225.245	9.999+	3.117
52	8	S4	0	2.302	3227.441	1060.744	3227.441	9.999+	3.043
53	8	S5	0	.578	3227.537	1060.23	3227.537	9.999+	3.044
54	8	S6	0	3.212	3225.392	1034.283	3225.392	9.999+	3.118
55	8	S7	0	.841	3232.367	1196.39	3232.367	9.999+	2.702
56	8	S8	0	29.181	3183.089	469.873	3183.089	9.999+	6.774
57	9	S1	0	53.259	3215.126	372.859	3215.126	9.999+	8.623
58	9	S2	0	6.57	3311.38	1003.974	3311.38	9.999+	3.298
59	9	S3	0	5.41	3298.069	869.218	3298.069	9.999+	3.794
60	9	S4	0	4.724	3301.571	886.611	3301.571	9.999+	3.724
61	9	S5	0	1.959	3301.707	885.907	3301.707	9.999+	3.727
62	9	S6	0	5.582	3298.278	868.195	3298.278	9.999+	3.799
63	9	S7	0	7.342	3311.673	1002.975	3311.673	9.999+	3.302



Company : Vector Structural Engineering
Designer : STB
Job Number : U2716.0219.201
Model Name : Ground Mount

Apr 6, 2021
10:50 AM
Checked By: RNE

Envelope Slab Soil Pressures (Continued)

	Label	UC	LC	Soil Pressure[psf]	Allowable Bearing[psf]	Point
5	S5	.538	6	807.615	1500	N254
6	S6	.531	6	797.197	1500	N261
7	S7	.572	6	858.334	1500	N268
8	S8	.392	6	587.647	1500	N275



Company:		Date:	5/14/2018
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 55
Diameter (inch): 0.375
Effective Embedment depth, h_{ef} (inch): 4.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
 h_{min} (inch): 5.25
 c_{ac} (inch): 7.12
 c_{min} (inch): 1.75
 s_{min} (inch): 3.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 33.00
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: Periodic
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): 4.75 x 4.75 x 0.31

Recommended Anchor

Anchor Name: SET-3G - SET-3G w/ 3/8"Ø F1554 Gr. 55
Code Report: ICC-ES ESR-4057





Company:		Date:	5/14/2018
Engineer:		Page:	2/6
Project:			
Address:			
Phone:			
E-mail:			

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]: 5106

V_{uax} [lb]: 250

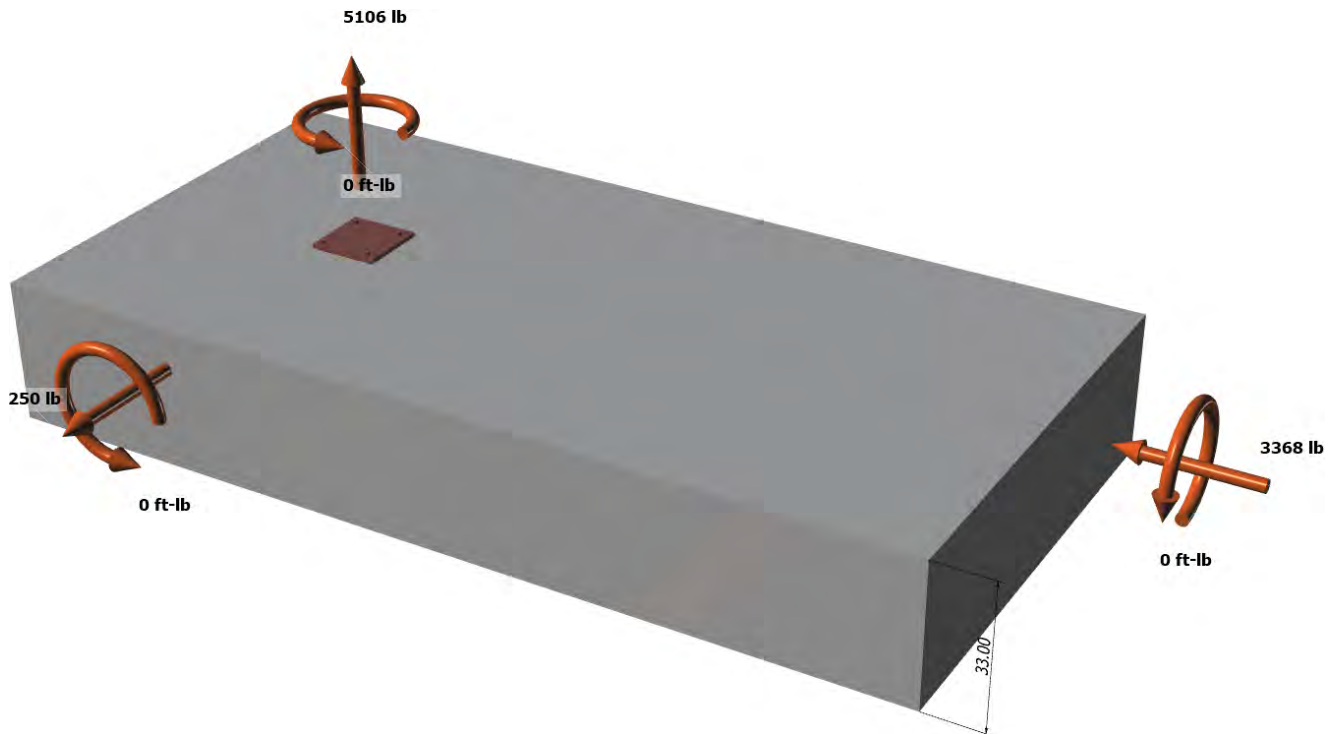
V_{uay} [lb]: -3368

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

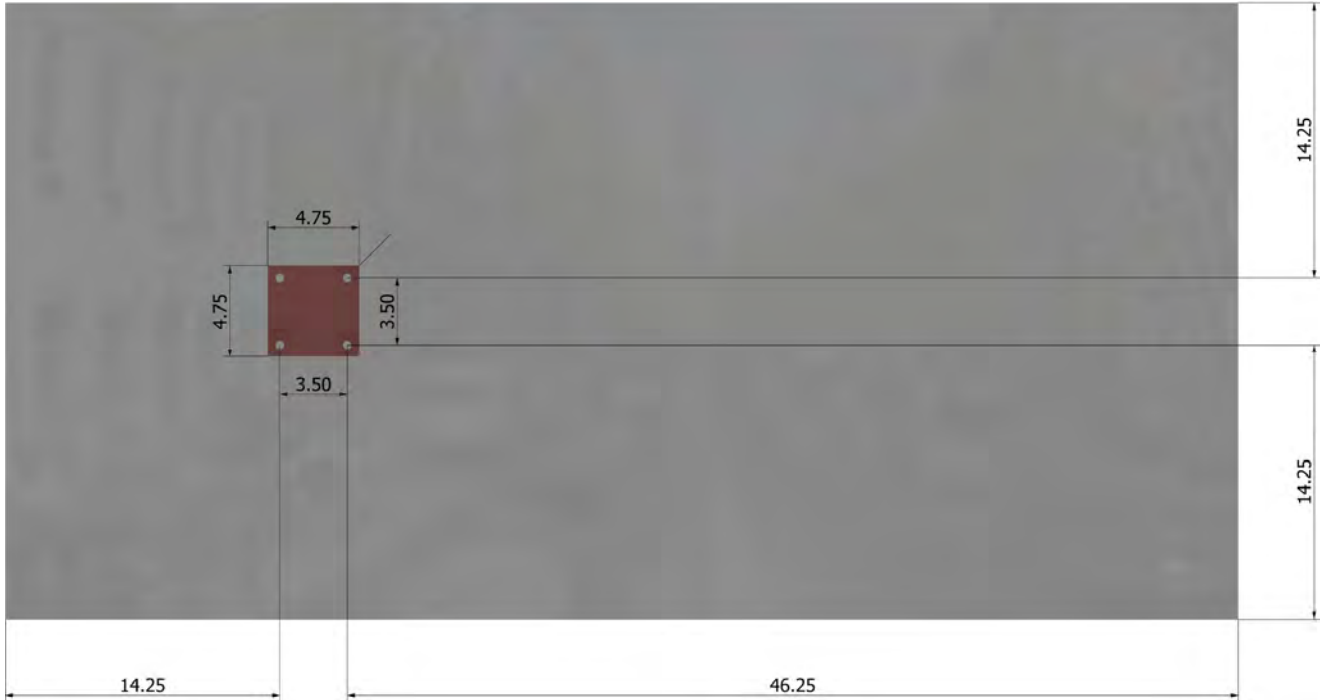
<Figure 1>





Company:		Date:	5/14/2018
Engineer:		Page:	3/6
Project:			
Address:			
Phone:			
E-mail:			

<Figure 2>





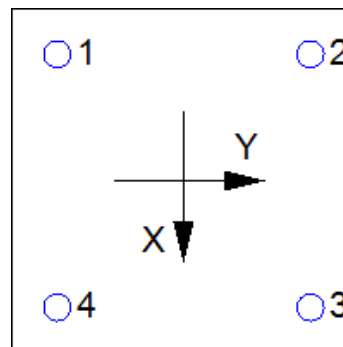
Company:		Date:	5/14/2018
Engineer:		Page:	4/6
Project:			
Address:			
Phone:			
E-mail:			

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	1276.5	62.5	-842.0	844.3
2	1276.5	62.5	-842.0	844.3
3	1276.5	62.5	-842.0	844.3
4	1276.5	62.5	-842.0	844.3
Sum	5106.0	250.0	-3368.0	3377.3

Maximum concrete compression strain (%): 0.00
 Maximum concrete compression stress (psi): 0
 Resultant tension force (lb): 5106
 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)
5850	0.75	4388

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

$$N_b = K_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

K _c	λ _a	f _c (psi)	h _{ef} (in)	N _b (lb)
17.0	1.00	2500	4.000	6800

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

A _{Nc} (in ²)	A _{Nco} (in ²)	C _{a,min} (in)	ψ _{ec,N}	ψ _{ed,N}	ψ _{c,N}	ψ _{cp,N}	N _b (lb)	φ	φN _{cbg} (lb)
240.25	144.00	14.25	1.000	1.000	1.00	1.000	6800	0.65	7374

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

$$\tau_{k,cr} = \tau_{k,cr,short-term} K_{sat} (f_c / 2,500)^n$$

τ _{k,cr} (psi)	f _{short-term}	K _{sat}	f _c (psi)	n	τ _{k,cr} (psi)
1346	1.00	1.00	2500	0.24	1346

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

λ _a	τ _{cr} (psi)	d _a (in)	h _{ef} (in)	N _{ba} (lb)
1.00	1346	0.38	4.000	6343

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

A _{Na} (in ²)	A _{Na0} (in ²)	C _{Na} (in)	C _{a,min} (in)	ψ _{ec,Na}	ψ _{ed,Na}	ψ _{cp,Na}	N _{ba} (lb)	φ	φN _{ag} (lb)
198.45	112.09	5.29	14.25	1.000	1.000	1.000	6343	0.55	6176



Company:		Date:	5/14/2018
Engineer:		Page:	5/6
Project:			
Address:			
Phone:			
E-mail:			

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

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
3510	1.0	0.65	2282

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)
3.00	0.375	1.00	2500	17.75	24294

$\phi V_{cbgx} = \phi (A_{vc} / A_{vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{bx}$ (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)
1181.48	1417.78	1.000	0.861	1.000	1.000	24294	0.70	12195

Shear perpendicular to edge in y-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)
3.00	0.375	1.00	2500	17.75	24294

$\phi V_{cbgy} = \phi (A_{vc} / A_{vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{by}$ (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_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
852.00	1417.78	1.000	0.861	1.000	1.000	24294	0.70	8794

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)
3.00	0.375	1.00	2500	14.25	17475

$\phi V_{cbgx} = \phi (2)(A_{vc} / A_{vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{by}$ (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)
684.00	913.78	1.000	1.000	1.000	1.000	17475	0.70	18313

Shear parallel to edge in y-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)
3.00	0.375	1.00	2500	14.25	17475

$\phi V_{cbgy} = \phi (2)(A_{vc} / A_{vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{bx}$ (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_{bx} (lb)	ϕ	ϕV_{cbgy} (lb)
836.30	913.78	1.000	1.000	1.000	1.000	17475	0.70	22391

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

$\phi V_{cp} = \phi \min|k_{cp}N_{ag}; k_{cp}N_{cbg}| = \phi \min|k_{cp}(A_{Na} / A_{Na0})\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}; k_{cp}(A_{Nc} / A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (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	198.45	112.09	1.000	1.000	1.000	6343	11230

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
240.25	144.00	1.000	1.000	1.000	1.000	6800	11345	0.70

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



Company:		Date:	5/14/2018
Engineer:		Page:	6/6
Project:			
Address:			
Phone:			
E-mail:			

ϕV_{cpq} (lb)
15722

11. Results

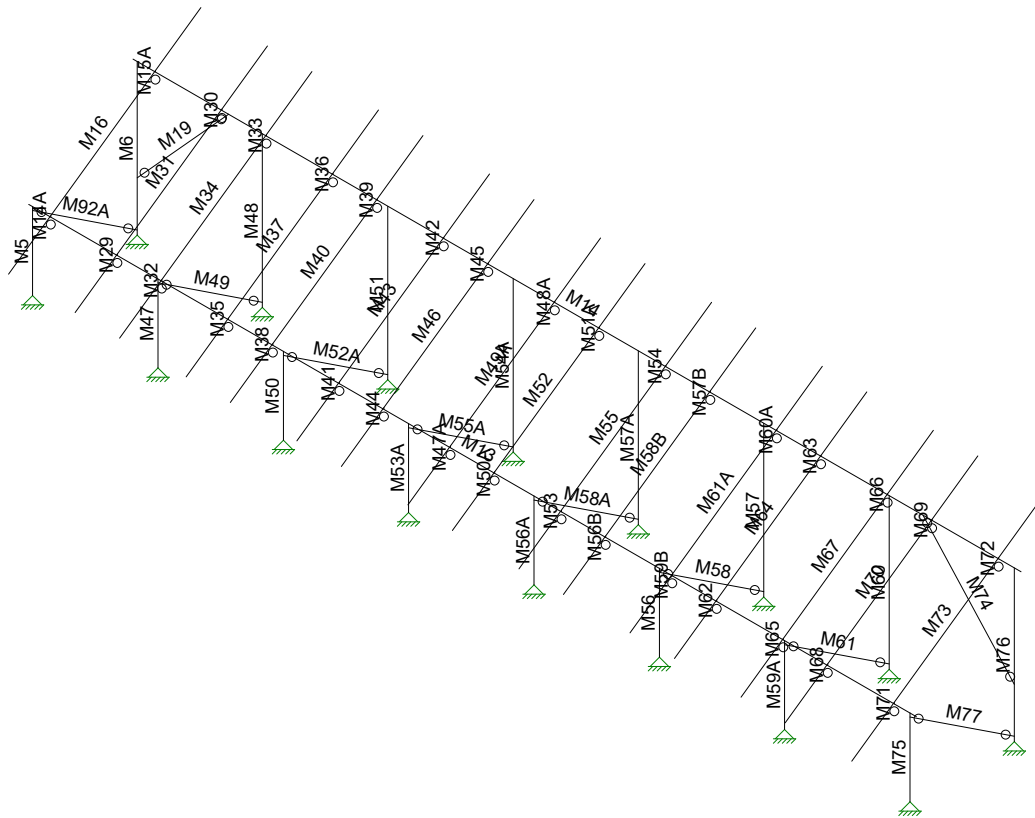
Interaction of Tensile and Shear Forces (Sec. R17.6)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status	
Steel	1277	4388	0.29	Pass	
Concrete breakout	5106	7374	0.69	Pass	
Adhesive	5106	6176	0.83	Pass (Governs)	
Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status	
Steel	844	2282	0.37	Pass	
T Concrete breakout x+	250	12195	0.02	Pass	
T Concrete breakout y-	3368	8794	0.38	Pass	
Concrete breakout y-	125	18313	0.01	Pass	
Concrete breakout x-	1684	22391	0.08	Pass	
Concrete breakout, combined	-	-	0.38	Pass (Governs)	
Pryout	3377	15722	0.21	Pass	
Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.73	0.20	93.1%	1.0	Pass

SET-3G w/ 3/8"Ø F1554 Gr. 55 with hef = 4.000 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.



Vector Structural Engineeri...

STB

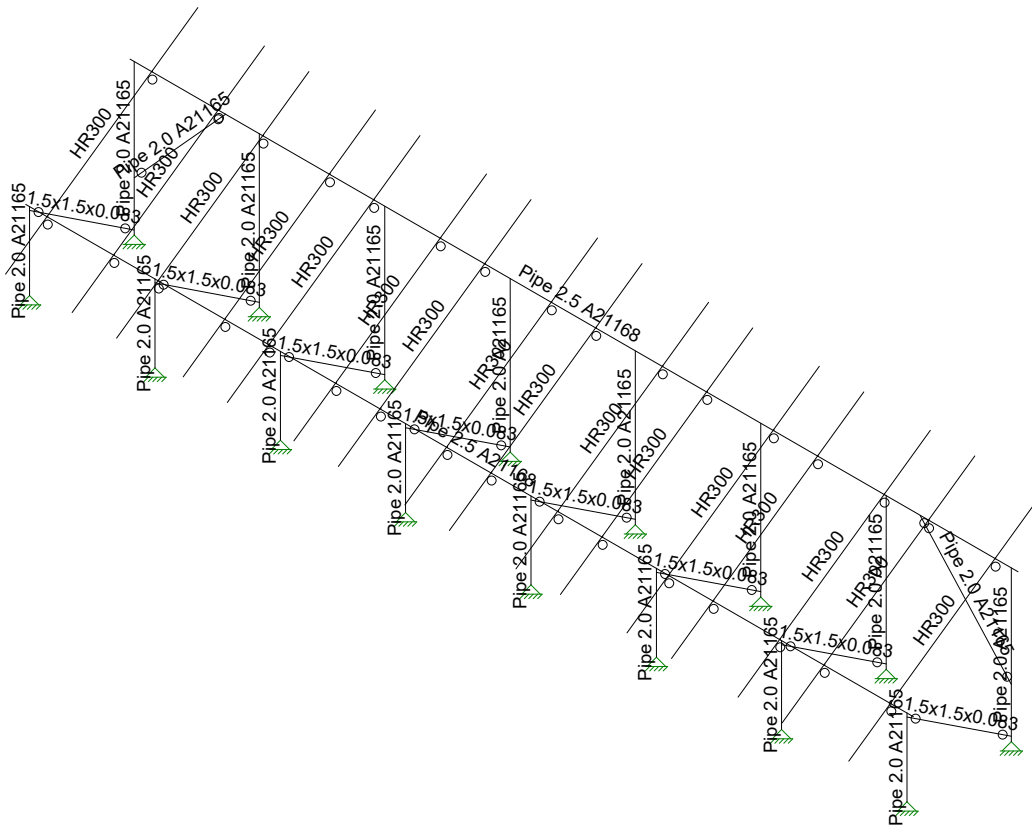
U2716-0217-201

Roof Mount

SK - 3

Apr 6, 2021 at 10:44 AM

Sunmodo Sunturf A7 v3 85x45.r3d



Vector Structural Engineeri...

STB

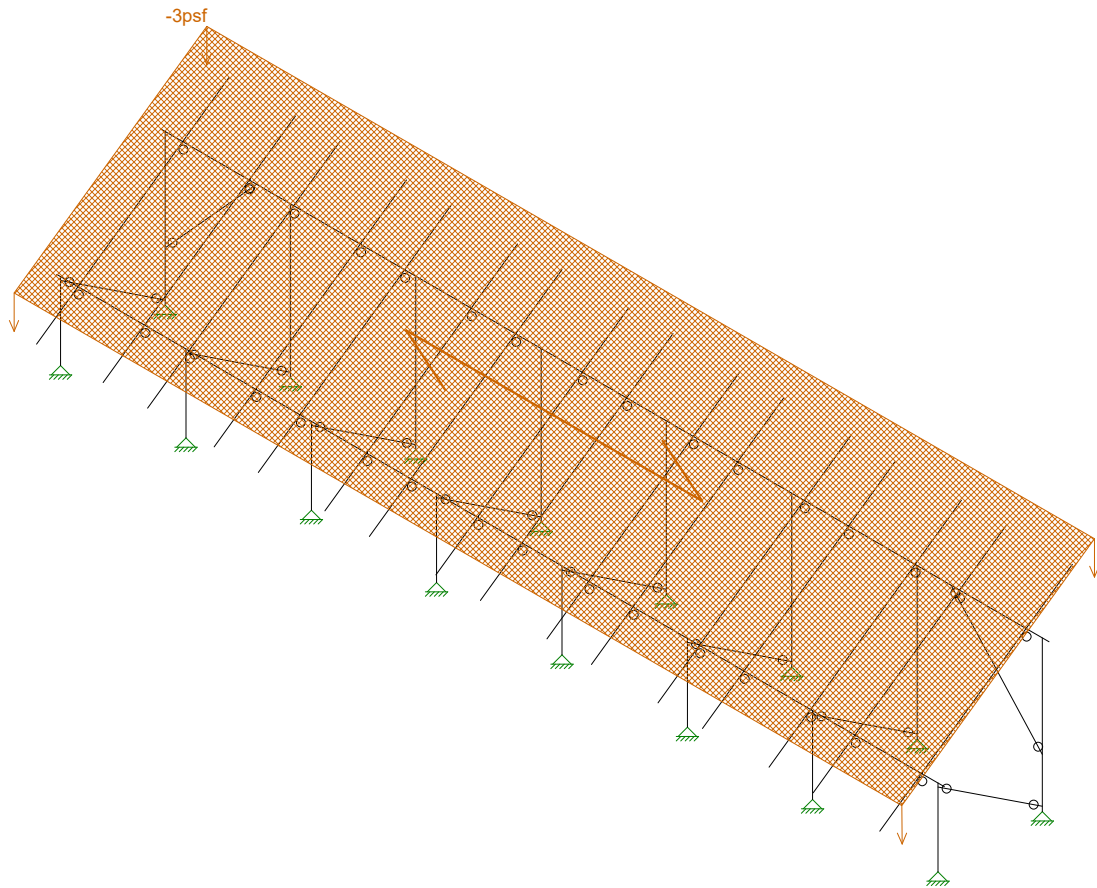
U2716-0217-201

Roof Mount

SK - 4

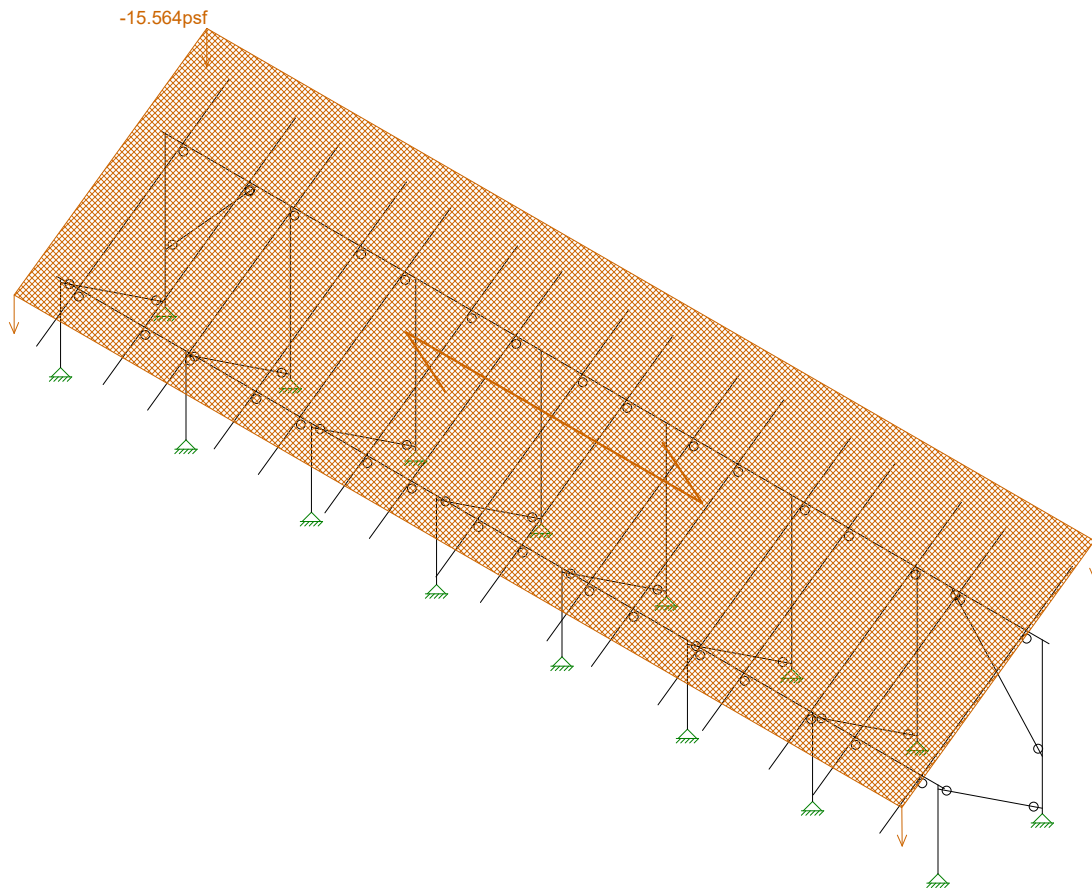
Apr 6, 2021 at 10:44 AM

Sunmodo Sunturf A7 v3 85x45.r3d



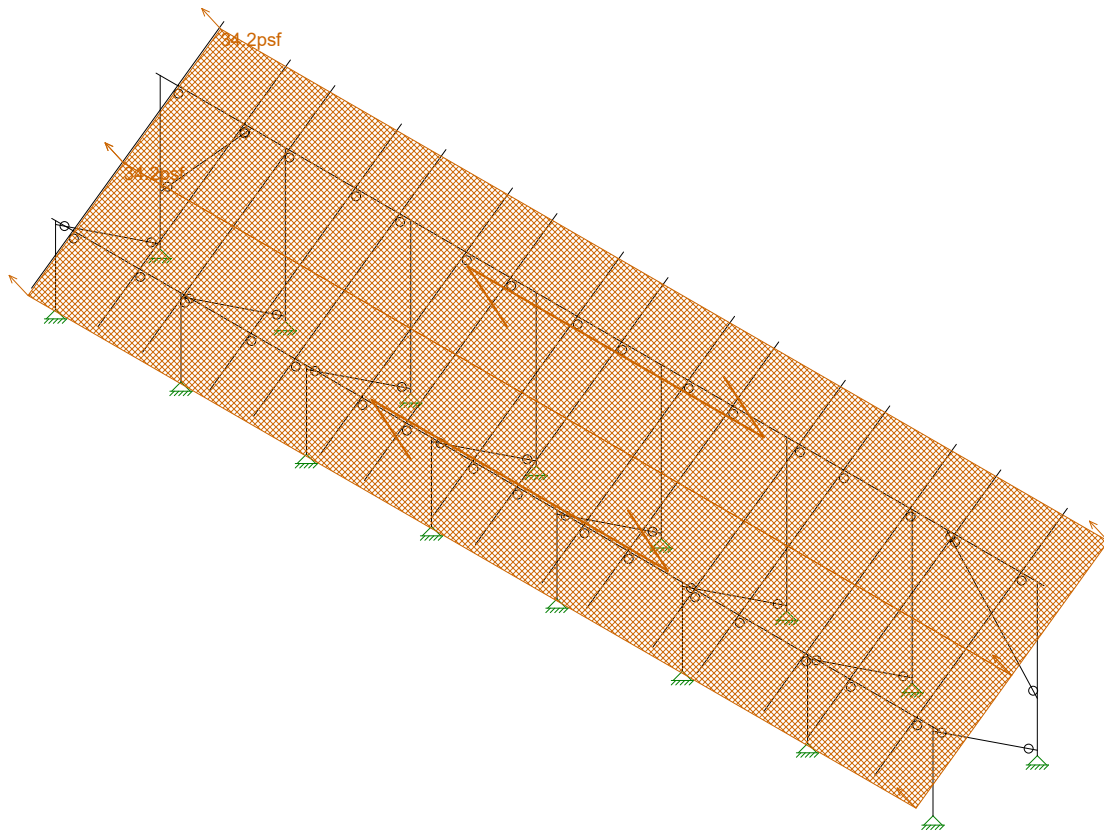
Loads: BLC 2, Solar Panel Weight

Vector Structural Engineeri..	Roof Mount	SK - 5
STB		Apr 6, 2021 at 10:44 AM
U2716-0217-201		Sunmodo Sunturf A7 v3 85x45.r3d



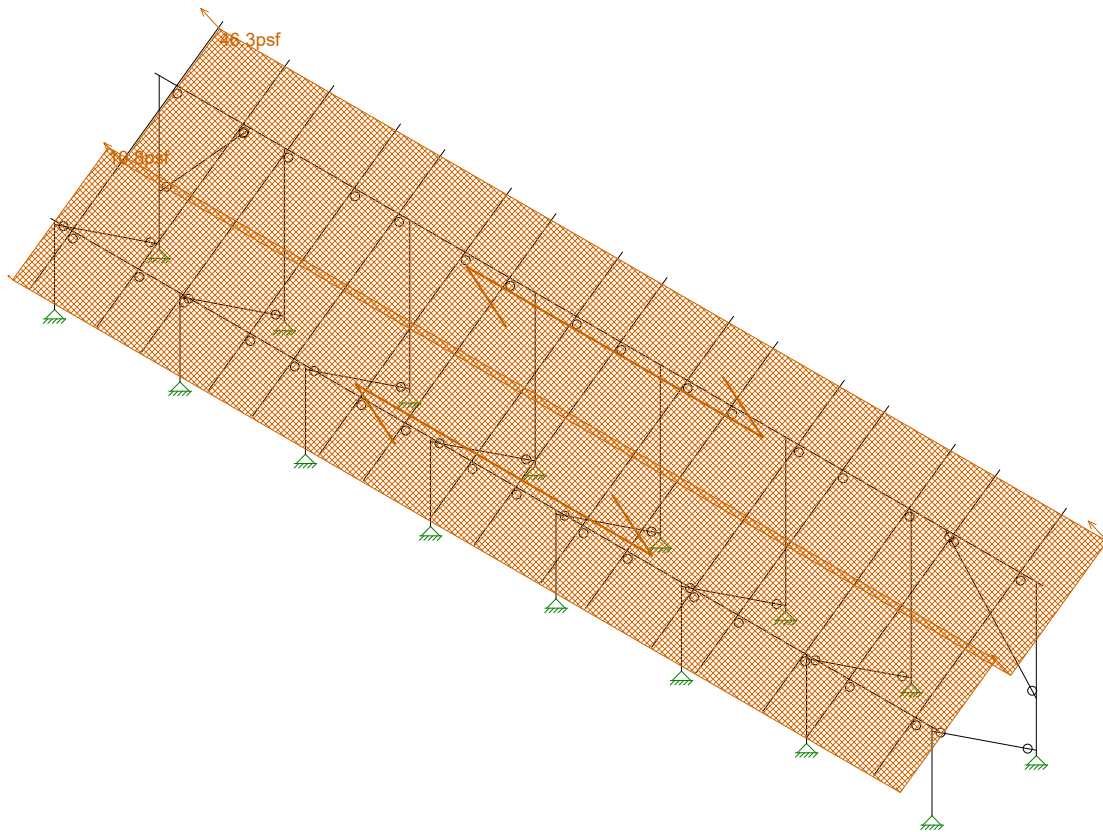
Loads: BLC 3, Roof Live/Snow

Vector Structural Engineeri..	Roof Mount	SK - 6
STB		Apr 6, 2021 at 10:44 AM
U2716-0217-201		Sunmodo Sunturf A7 v3 85x45.r3d



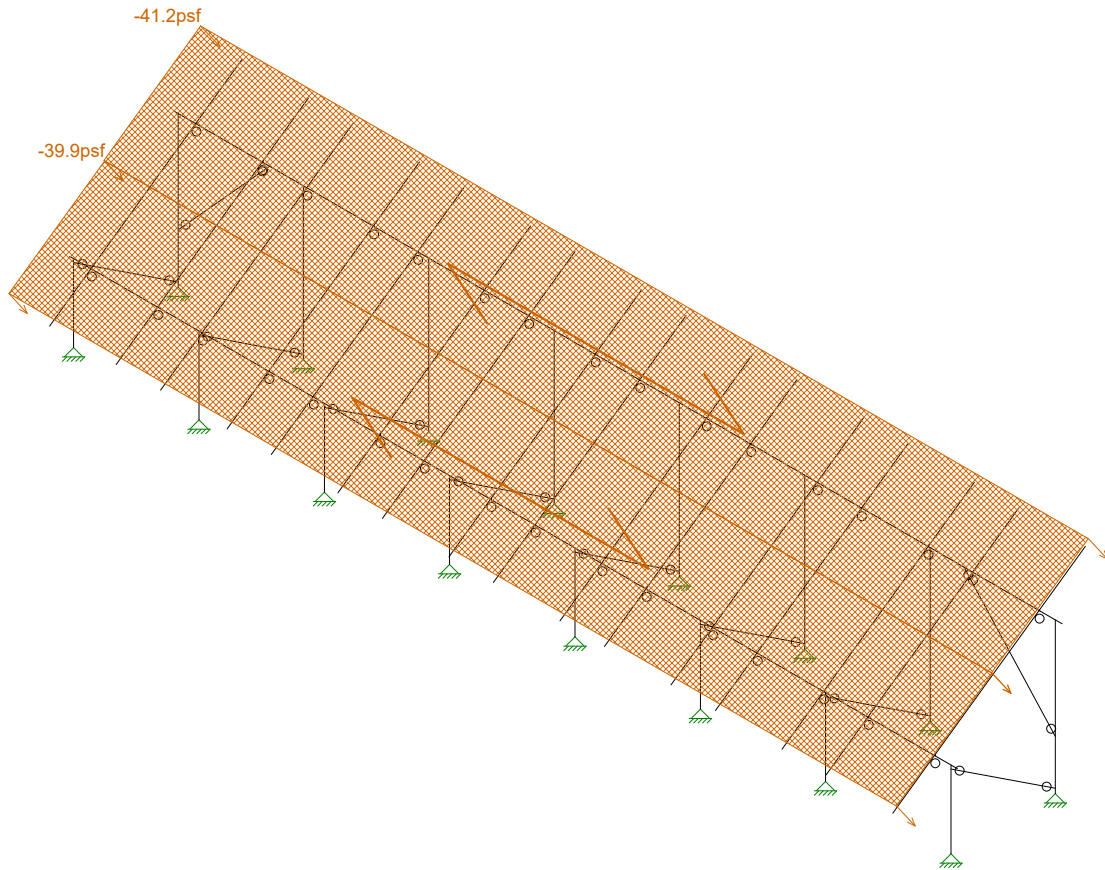
Loads: BLC 4, Wind 1

Vector Structural Engineeri..	Roof Mount	SK - 7
STB		Apr 6, 2021 at 10:45 AM
U2716-0217-201		Sunmodo Sunturf A7 v3 85x45.r3d



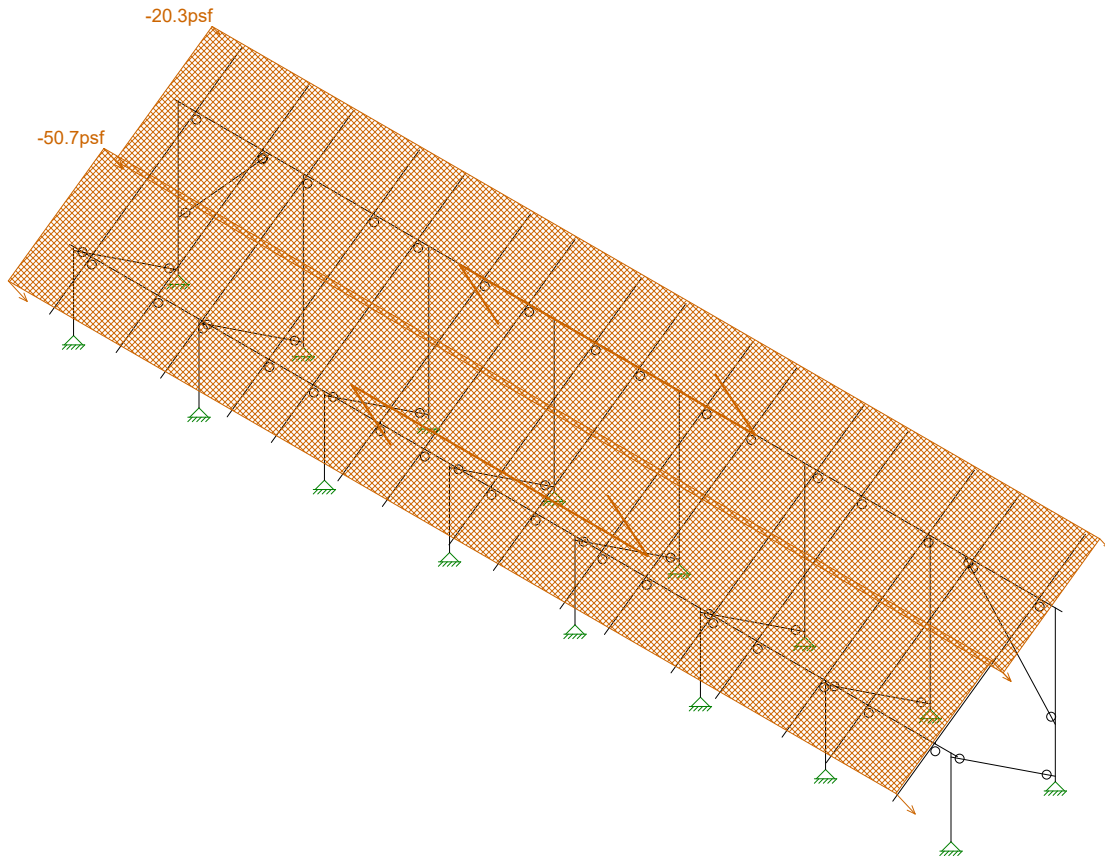
Loads: BLC 5, Wind 2

Vector Structural Engineeri..	Roof Mount	SK - 8
STB		Apr 6, 2021 at 10:45 AM
U2716-0217-201		Sunmodo Sunturf A7 v3 85x45.r3d



Loads: BLC 6, Wind 3

Vector Structural Engineeri..	Roof Mount	SK - 9
STB		Apr 6, 2021 at 10:45 AM
U2716-0217-201		Sunmodo Sunturf A7 v3 85x45.r3d



Loads: BLC 7, Wind 4

Vector Structural Engineeri...
STB
U2716-0217-201

Roof Mount

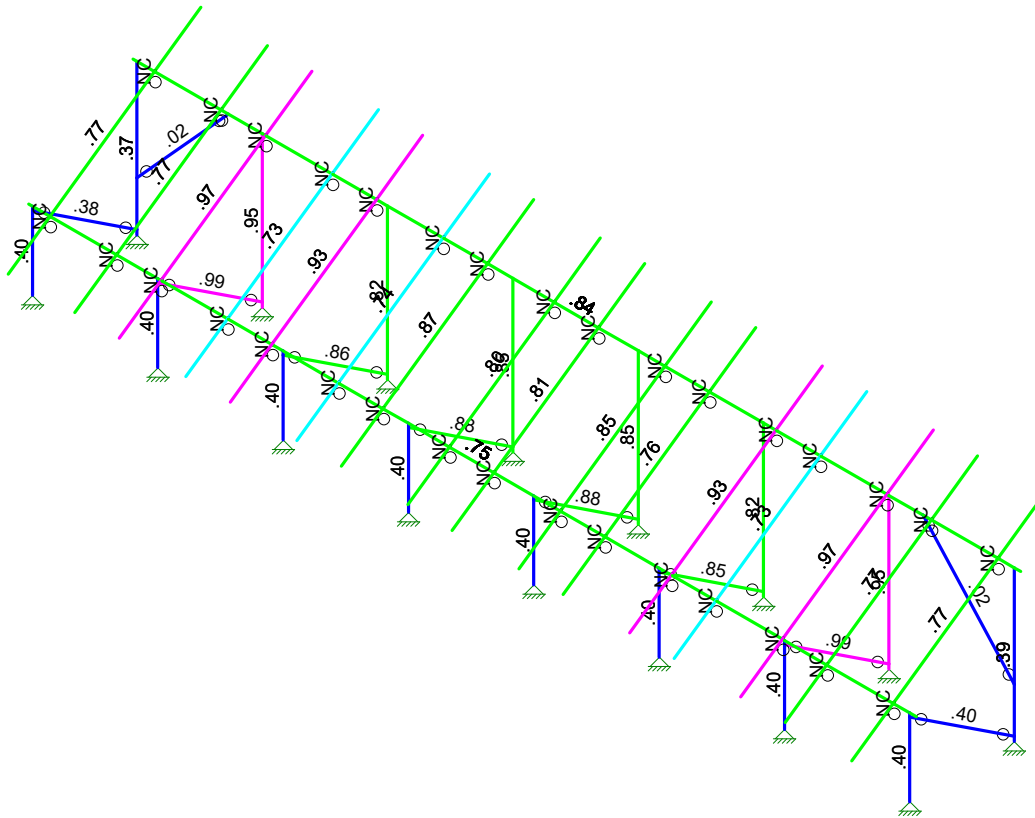
SK - 10

Apr 6, 2021 at 10:45 AM

Sunmodo Sunturf A7 v3 85x45.r3d



Code Check (Env)	
Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-.90
Cyan	.50-.75
Blue	0-.50



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Vector Structural Engineeri...

STB

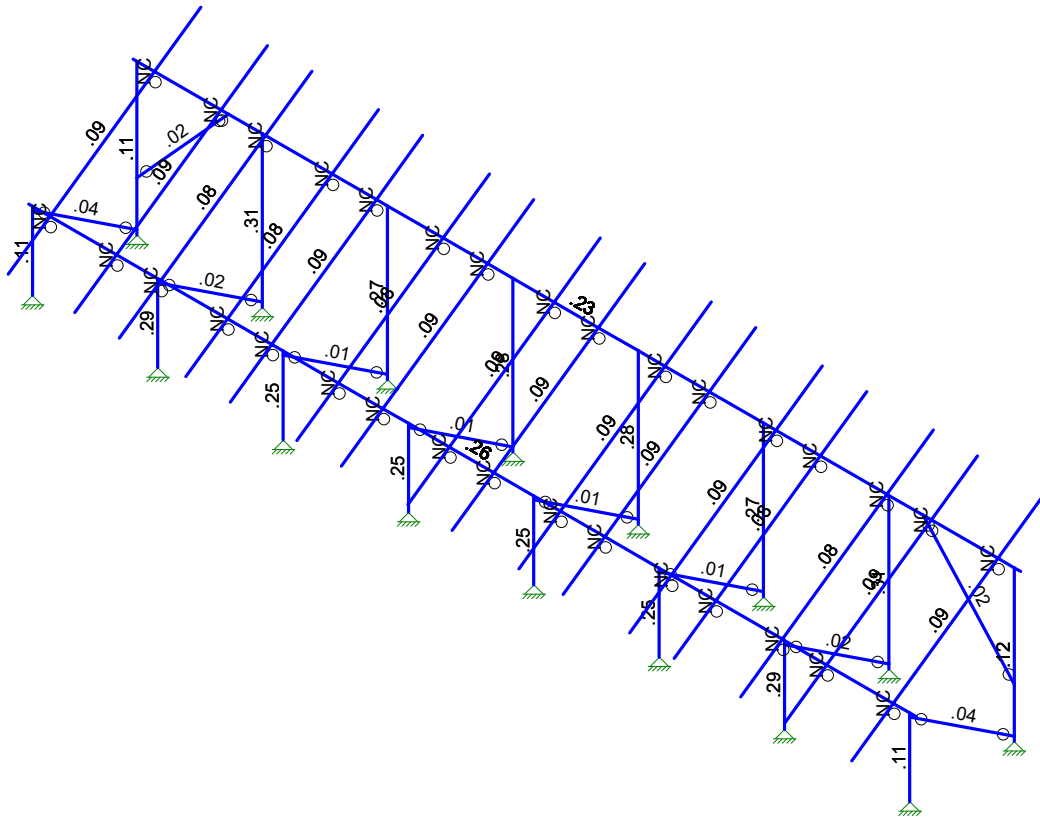
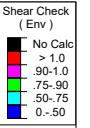
U2716-0217-201

Roof Mount

SK - 1

Apr 6, 2021 at 10:44 AM

Sunmodo Sunturf A7 v3 85x45.r3d



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

Vector Structural Engineeri...
STB
U2716-0217-201

Roof Mount

SK - 2

Apr 6, 2021 at 10:44 AM

Sunmodo Sunturf A7 v3 85x45.r3d



(Global) Model Settings, Continued

Seismic Code	ASCE 7-10
Seismic Base Elevation (in)	15600
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Drift Cat	Other
Om Z	1
Om X	1
Cd Z	4
Cd X	4
Rho Z	1
Rho X	1

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[k/ft^3]	Yield[psi]	Ry	Fu[psi]	Rt
1	A992	29000	11154	.3	.65	.49	50000	1.1	65000	1.1
2	A36 Gr.36	29000	11154	.3	.65	.49	36000	1.5	58000	1.2
3	A572 Gr.50	29000	11154	.3	.65	.49	50000	1.1	65000	1.1
4	A500 Gr.B R...	29000	11154	.3	.65	.527	42000	1.4	58000	1.3
5	A500 Gr.B Re...	29000	11154	.3	.65	.527	46000	1.4	58000	1.3
6	A53 Gr.B	29000	11154	.3	.65	.49	35000	1.6	60000	1.2
7	A1085	29000	11154	.3	.65	.49	50000	1.4	65000	1.3

Aluminum Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (...Density[... Table B.4	kt	Ftu[psi]	Fty[psi]	Fcy[psi]	Fsu[psi]	Ct
1	3003-H14	10100	3787.5	.33	1.3 .173 Table B.4-1	1	19000	16000	13000	12000	141
2	6061-T6	10100	3787.5	.33	1.3 .173 Table B.4-2	1	38000	35000	35000	24000	141
3	6063-T5	10100	3787.5	.33	1.3 .173 Table B.4-2	1	22000	16000	16000	13000	141
4	6063-T6	10100	3787.5	.33	1.3 .173 Table B.4-2	1	30000	25000	25000	19000	141
5	5052-H34	10200	3787.5	.33	1.3 .173 Table B.4-1	1	34000	26000	24000	20000	141
6	6061-T6 W	10100	3787.5	.33	1.3 .173 Table B.4-1	1	24000	15000	15000	15000	141
7	6005-T5	10100	3787.5	.33	1.3 .173 Table B.4-1	1	38000	35000	35000	24000	141

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Post	Pipe 2.0 A21165	Column	Pipe	A572 Gr.50	Typical	.776	.499	.499	.998
2	Cross Beam	Pipe 2.5 A21168	Beam	Wide Flange	A572 Gr.50	Typical	.947	.907	.907	1.814
3	Diagonal Brace	1.5x1.5x0.083	HBrace	SquareTube	A572 Gr.50	Typical	.47	.158	.158	.236



Company : Vector Structural Engineering
 Designer : STB
 Job Number : U2716-0217-201
 Model Name : Ground Mount

Apr 15, 2021
 2:50 PM
 Checked By: _____

Aluminum Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	AL Posts	2.375ODX0.188	Column	Pipe	6005-T5	Typical	1.29	.778	.778	1.54
2	AL Brace	RT1.5x2x0.15625	VBrace	Rectangular Tubes	6005-T5	Typical	.996	.327	.524	.602
3	AL Rails	HR300	Beam	Rectangular Tubes	6005-T5	Typical	.74	.253	.727	.578
4	AL Cross Beam	Cross Rail	Beam	Rectangular Tubes	6005-T5	Typical	1.909	1.97	4.366	4.017

Member Area Loads (BLC 2 : Solar Panel Weight)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N199	N196	Y	A-B	-3

Member Area Loads (BLC 3 : Roof Live/Snow)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N199	N196	PY	A-B	-19

Member Area Loads (BLC 4 : Wind 1)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N119B	N120B	N200	Perp	B-C	34.2
2	N119B	N196	N199	N120B	Perp	B-C	34.2

Member Area Loads (BLC 5 : Wind 2)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N119B	N120B	N200	Perp	B-C	46.3
2	N119B	N196	N199	N120B	Perp	B-C	10.8

Member Area Loads (BLC 6 : Wind 3)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N119B	N120B	N200	Perp	B-C	-41.2
2	N119B	N196	N199	N120B	Perp	B-C	-39.9

Member Area Loads (BLC 7 : Wind 4)

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N119B	N120B	N200	Perp	B-C	-20.3
2	N119B	N196	N199	N120B	Perp	B-C	-50.7

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(M...Surface...
1	Self Weight	DL		-1.05					
2	Solar Panel Weight	DL							1
3	Roof Live/Snow	RLL							1
4	Wind 1	OL1							2
5	Wind 2	OL2							2
6	Wind 3	OL3							2
7	Wind 4	OL4							2
8	BLC 2 Transient Area ...	None						40	
9	BLC 3 Transient Area ...	None						40	
10	BLC 4 Transient Area ...	None						192	
11	BLC 5 Transient Area ...	None						192	
12	BLC 6 Transient Area ...	None						192	
13	BLC 7 Transient Area ...	None						192	



Load Combinations

	Description	S...	PD...	SRSS	BLC	Fa...	BLC	Fa...	BLC	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	
1	ASD Loads		Y																					
2	1.0 D		Y		DL	1																		
3	1.0 D + 1.0 S		Y		DL	1	RLL	1																
4	1.0 D + 0.6 W1		Y		DL	1	RLL		OL1	.6														
5	1.0 D + 0.6 W2		Y		DL	1	RLL		OL2	.6														
6	1.0 D + 0.6 W3		Y		DL	1	RLL		OL3	.6														
7	1.0 D + 0.6 W4		Y		DL	1	RLL		OL4	.6														
8	1.0 D + 0.45 W1 + 0....		Y		DL	1	RLL	.75	OL1	.45														
9	1.0 D + 0.45 W2 + 0....		Y		DL	1	RLL	.75	OL2	.45														
10	1.0 D + 0.45 W3 + 0....		Y		DL	1	RLL	.75	OL3	.45														
11	1.0 D + 0.45 W4 + 0....		Y		DL	1	RLL	.75	OL4	.45														
12	0.6 D + 0.6 W1		Y		DL	.6	RLL		OL1	.6														
13	0.6 D + 0.6 W2		Y		DL	.6	RLL		OL2	.6														
14	0.6 D + 0.6 W3		Y		DL	.6	RLL		OL3	.6														
15	0.6 D + 0.6 W4		Y		DL	.6	RLL		OL4	.6														
16			Y																					
17	LRFD Loads		Y																					
18	1.4 D	Yes	Y		DL	1.4	RLL																	
19	1.2 D + 1.6 S + 0.5 W1	Yes	Y		DL	1.2	RLL	1.6	OL1	.5														
20	1.2 D + 1.6 S + 0.5 W2	Yes	Y		DL	1.2	RLL	1.6	OL2	.5														
21	1.2 D + 1.6 S + 0.5 W3	Yes	Y		DL	1.2	RLL	1.6	OL3	.5														
22	1.2 D + 1.6 S + 0.5 W4	Yes	Y		DL	1.2	RLL	1.6	OL4	.5														
23	1.2 D + 1.0 W1	Yes	Y		DL	1.2	RLL		OL1	1														
24	1.2 D + 1.0 W2	Yes	Y		DL	1.2	RLL		OL2	1														
25	1.2 D + 1.0 W3	Yes	Y		DL	1.2	RLL		OL3	1														
26	1.2 D + 1.0 W4	Yes	Y		DL	1.2	RLL		OL4	1														
27	0.9 D + 1.0 W1	Yes	Y		DL	.9	RLL		OL1	1														
28	0.9 D + 1.0 W2	Yes	Y		DL	.9	RLL		OL2	1														
29	0.9 D + 1.0 W3	Yes	Y		DL	.9	RLL		OL3	1														
30	0.9 D + 1.0 W4	Yes	Y		DL	.9	RLL		OL4	1														

Envelope Joint Reactions

	Joint	X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb...]	LC	MZ [lb-ft]	LC
1	N2	max 147.32	22	1234.43	20	96.487	23	0	30	0	30	0	30
2		min -51.776	27	-374.929	29	-115.7...	25	0	18	0	18	0	18
3	N1	max 64.09	21	2423.997	25	1277.3...	29	0	30	0	30	0	30
4		min -71.757	28	-1979.365	28	-1078....	23	0	18	0	18	0	18
5	N115	max 4.166	25	5416.672	25	2907.1...	25	0	30	0	30	0	30
6		min -5.315	28	-4493.794	28	-2455....	23	0	18	0	18	0	18
7	N116	max 11.048	20	2706.732	20	162.09	23	0	30	0	30	0	30
8		min -4.015	29	-990.273	29	-188.3...	25	0	18	0	18	0	18
9	N99	max 9.377	28	6247.139	25	3368.0...	25	0	30	0	30	0	30
10		min -15.601	21	-5106.329	28	-2842....	27	0	18	0	18	0	18
11	N100	max 27.282	27	3012.048	20	161.55	23	0	30	0	30	0	30
12		min -45.889	22	-1257.153	29	-182.9...	25	0	18	0	18	0	18
13	N105A	max 4.204	28	5418.56	25	2910.9...	25	0	30	0	30	0	30
14		min -5.309	25	-4497.223	28	-2457....	23	0	18	0	18	0	18
15	N106A	max 5.474	29	2705.74	20	162.59	23	0	30	0	30	0	30
16		min -11.434	20	-994.094	29	-188.93	25	0	18	0	18	0	18
17	N111A	max 4.185	28	5569.98	25	2978.7...	25	0	30	0	30	0	30
18		min -5.795	25	-4598.755	28	-2517....	23	0	18	0	18	0	18
19	N112A	max 1.803	29	2764.437	20	163.294	23	0	30	0	30	0	30
20		min -9.901	20	-1029.084	29	-189.2...	25	0	18	0	18	0	18
21	N117A	max 3.199	21	5569.058	25	2976.4...	25	0	30	0	30	0	30

