



Project Number: U2716-0335-221

April 7, 2022

Sunmodo
14800 NE 65th Street
Vancouver, WA 98682

**REFERENCE: Sunmodo Sunturf Ground Mount A12
Ground Mount PV Array Installation w/ Standard Panels**

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 International Building Code, 2018 Edition (2018 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 7-16)
- Design wind speed for risk category I structures: 120 mph
- Wind exposure: B
- Ground snow load: 90 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	1603	1.5	2405
LATERAL	1217	2	2434

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.

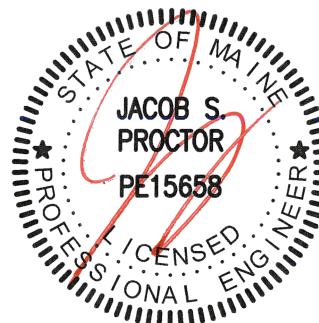
Very truly yours,

VECTOR STRUCTURAL ENGINEERING, LLC

Jacob Proctor, P.E.
License: PE15658 - Expires: 12/31/2023
Project Engineer

Enclosures

JSP/mih

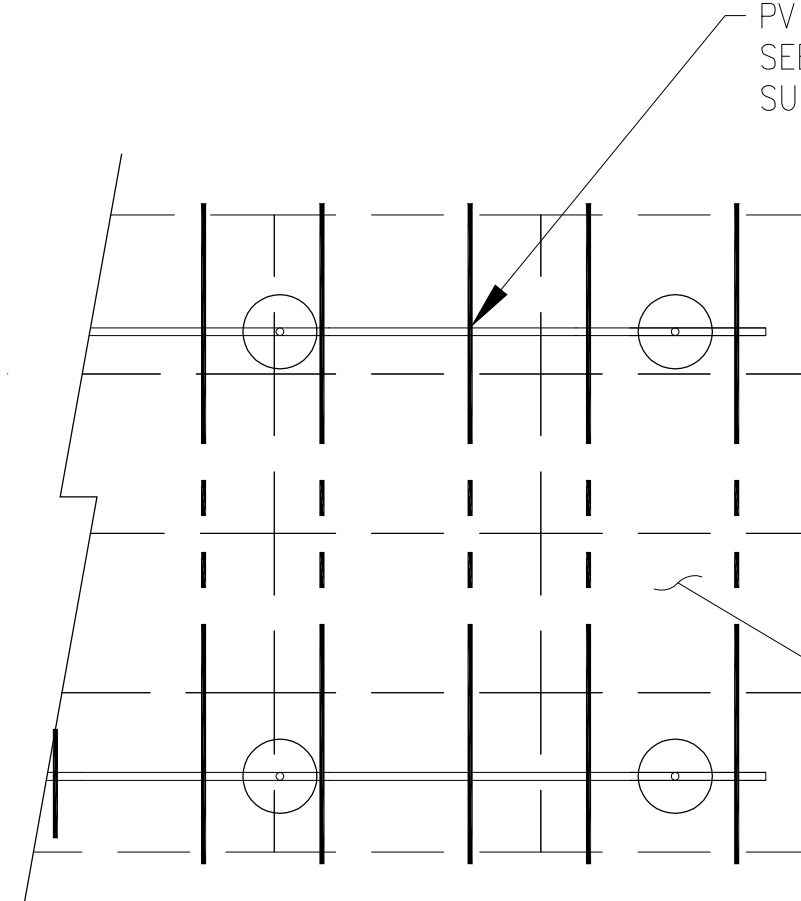
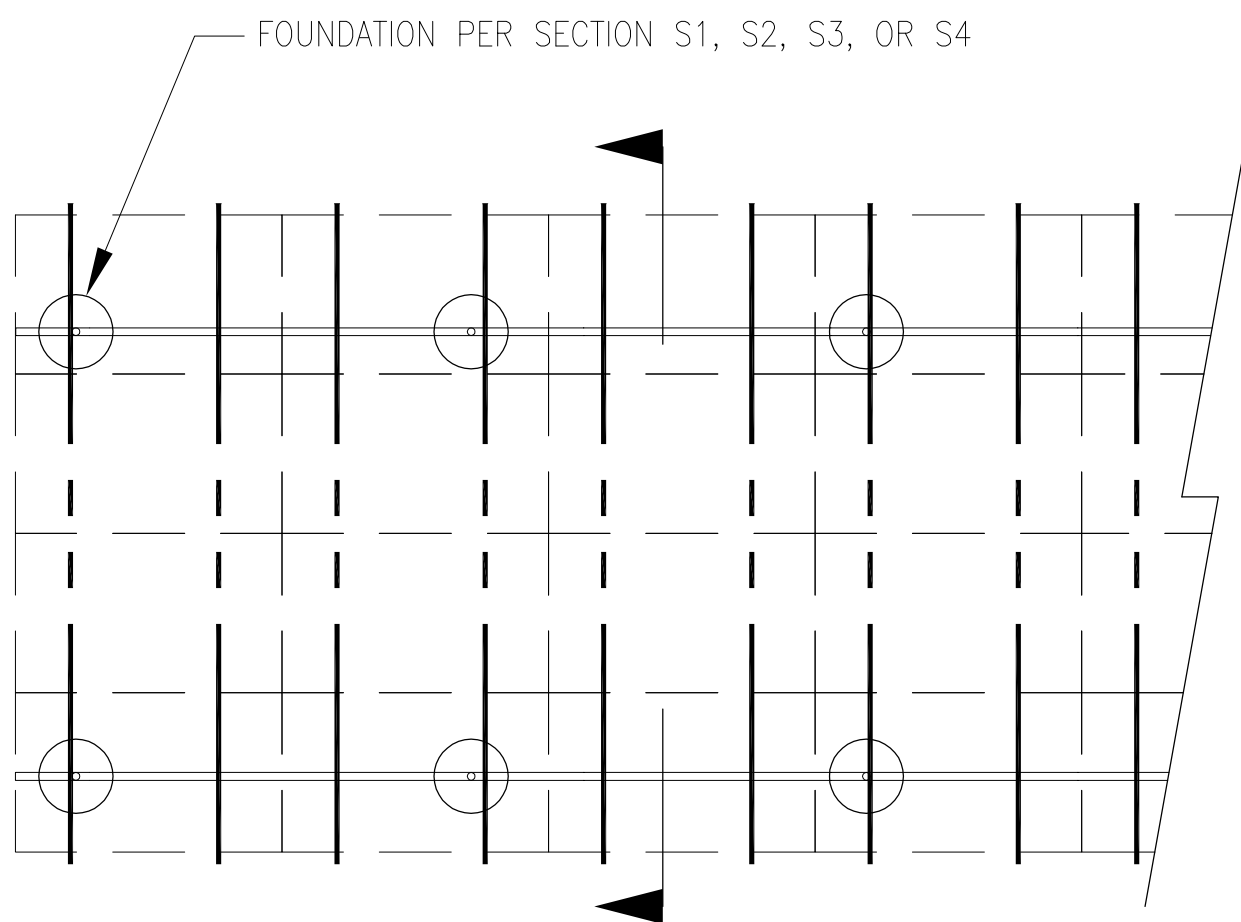


04/07/2022

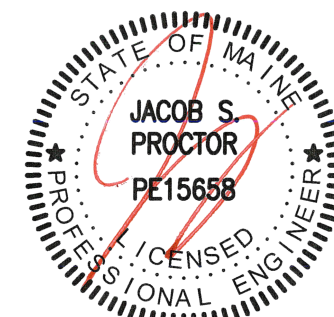


JOB NO. U2716-0335-221
PROJECT SUNMODO SUNTURF GROUND MOUNTS A12
SUBJECT ALL OPTIONS

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



SOLAR PANELS BY OTHERS, TYP.



04/07/2022

PV ARRAY PLAN

N.T.S.

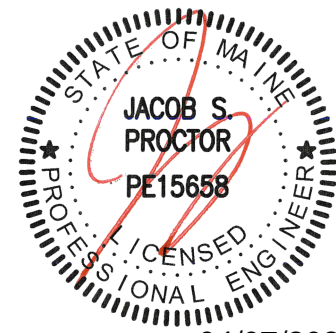
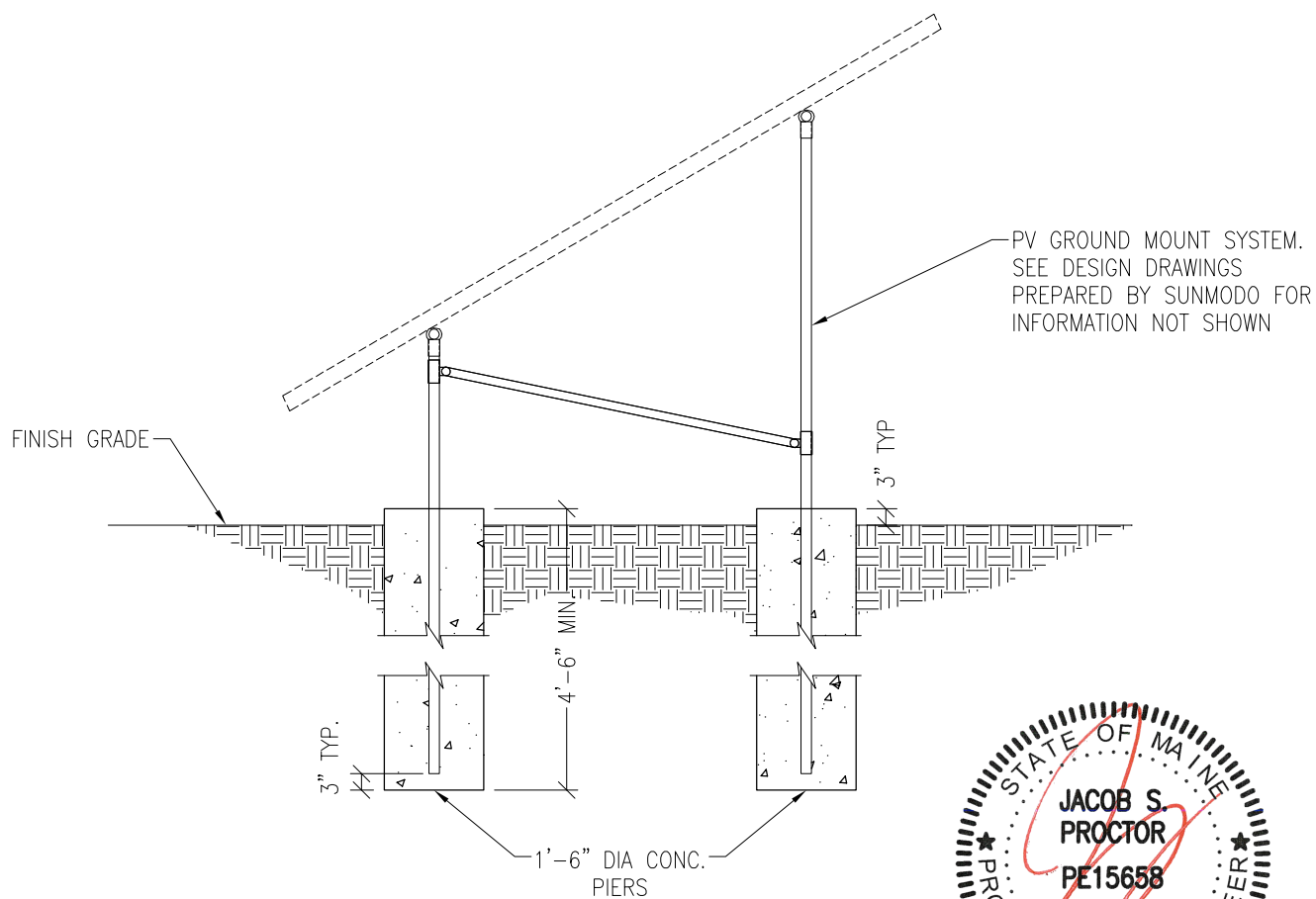
P1



JOB NO. U2716-0335-221

PROJECT SUNMODO SUNTURF GROUND MOUNTS A12

SUBJECT DRILLED PIER OPTION



04/07/2022

PV ARRAY SECTION

N.T.S.

S1



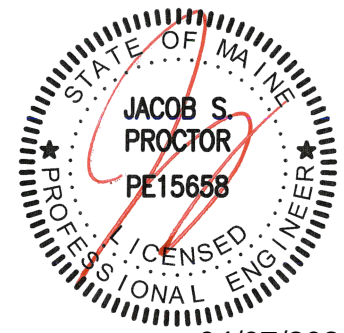
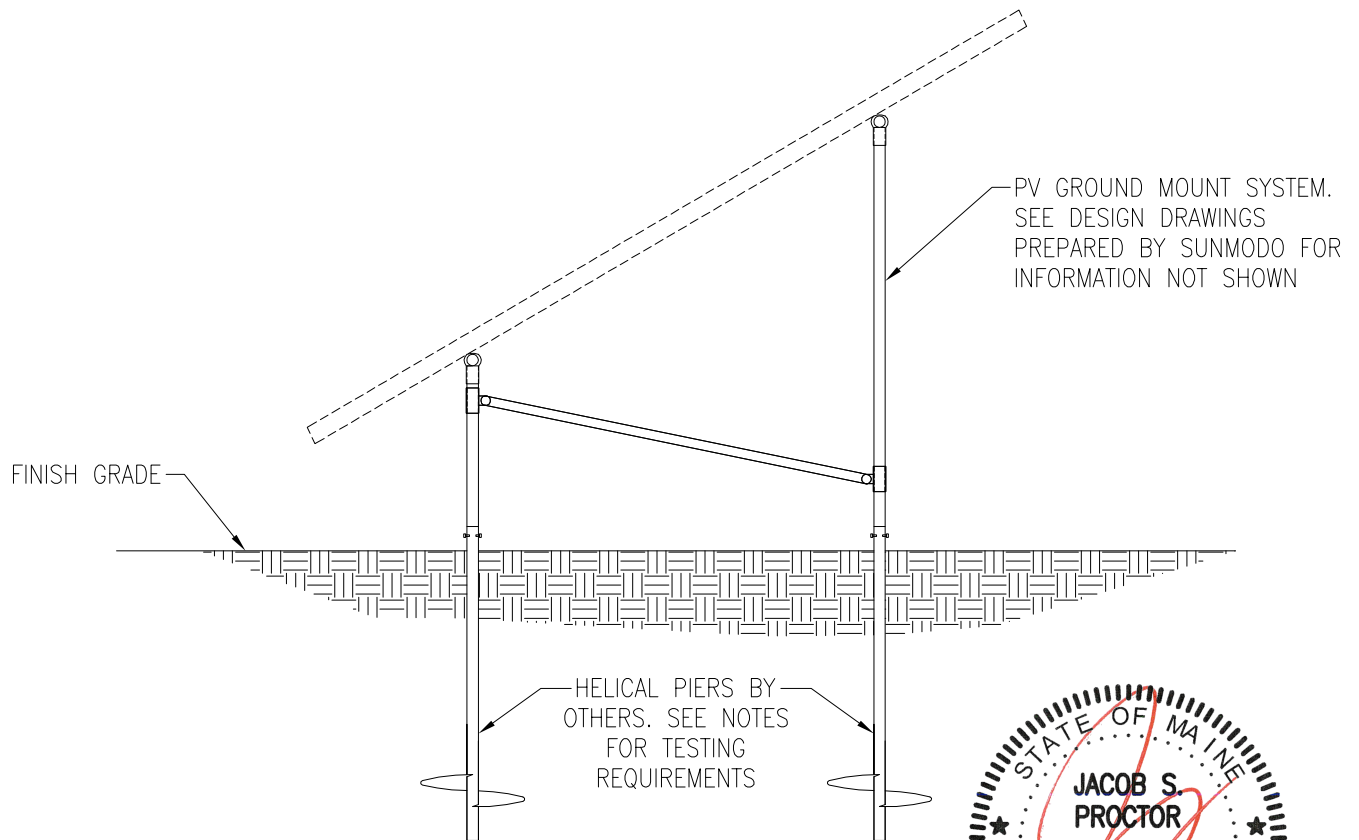
JOB NO. U2716-0335-221

PROJECT SUNMODO SUNTURF GROUND MOUNTS A12

SUBJECT HELICAL PIER OPTION

NOTES:

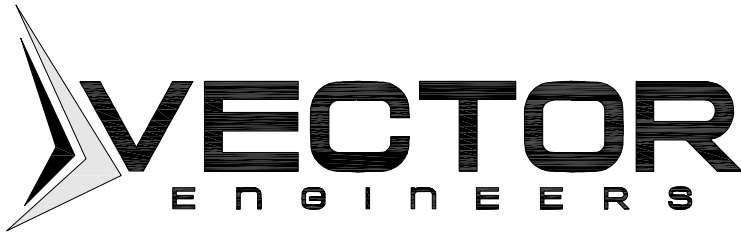
1. A minimum of (1) installed helical pier must be tested as follows:
 - 1.1. See cover page of this letter for test load values
 - 1.2. Safety factor for uplift to be 1.5
 - 1.3. Deflection limit for uplift load testing shall be 1/2"
 - 1.4. Safety factor for lateral loads to be 2.0
 - 1.5. Deflection limit for lateral load testing shall be 1"
 - 1.6. The load tests must be performed by an approved contractor



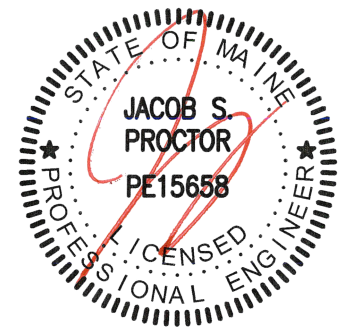
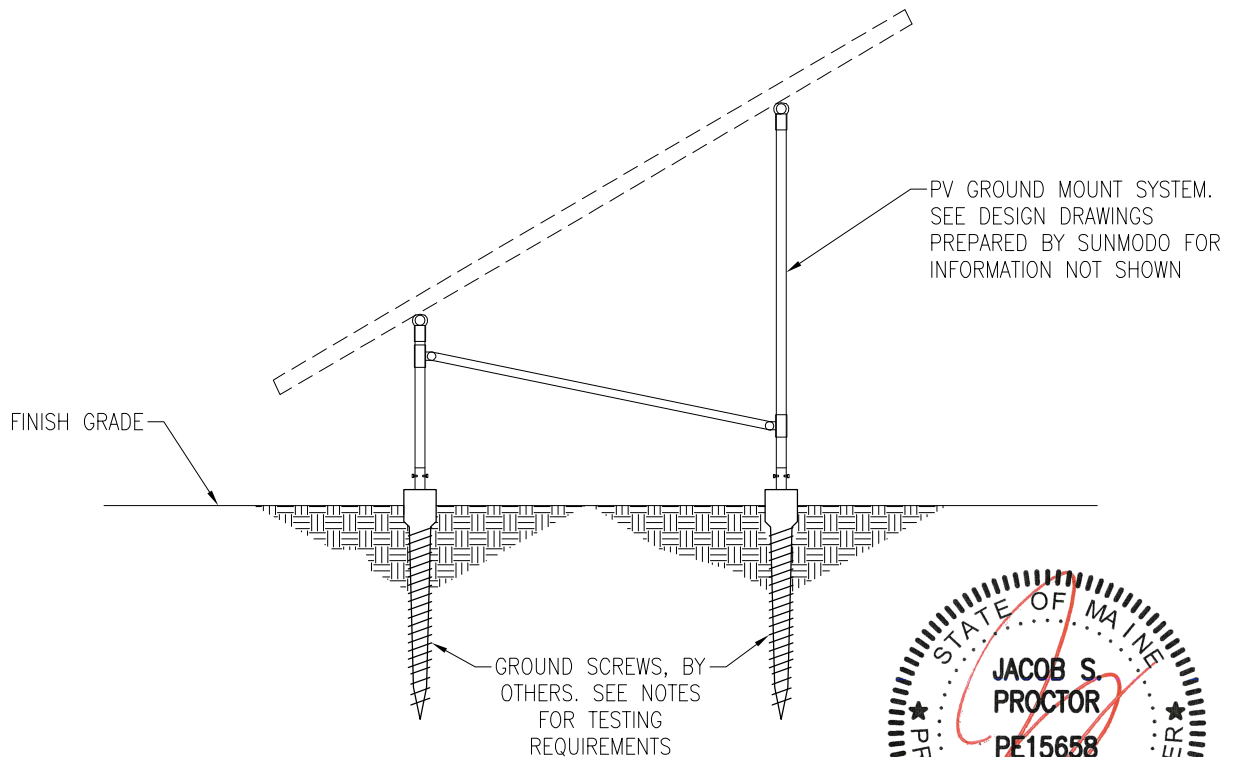
PV ARRAY SECTION

N.T.S.

S2

JOB NO. U2716-0335-221PROJECT SUNMODO SUNTURF GROUND MOUNTS A12SUBJECT GROUND SCREW OPTIONNOTES:

1. A minimum of (1) installed ground screw must be tested as follows:
 - 1.1. See cover page of this letter for test load values
 - 1.2. Safety factor for uplift to be 1.5
 - 1.3. Deflection limit for uplift load testing shall be 1/2"
 - 1.4. Safety factor for lateral loads to be 2.0
 - 1.5. Deflection limit for lateral load testing shall be 1"
 - 1.6. The load tests must be performed by an approved contractor



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PV ARRAY SECTION

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S3

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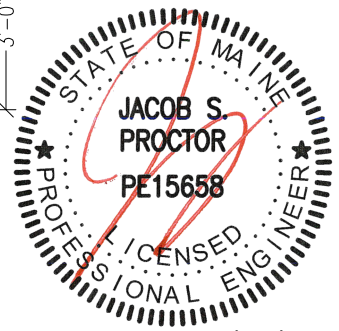
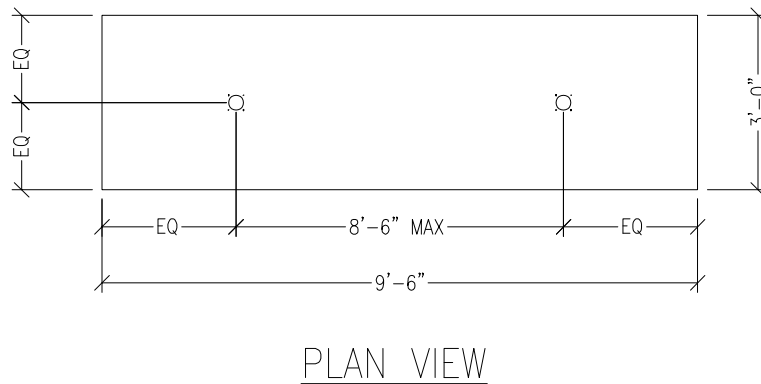
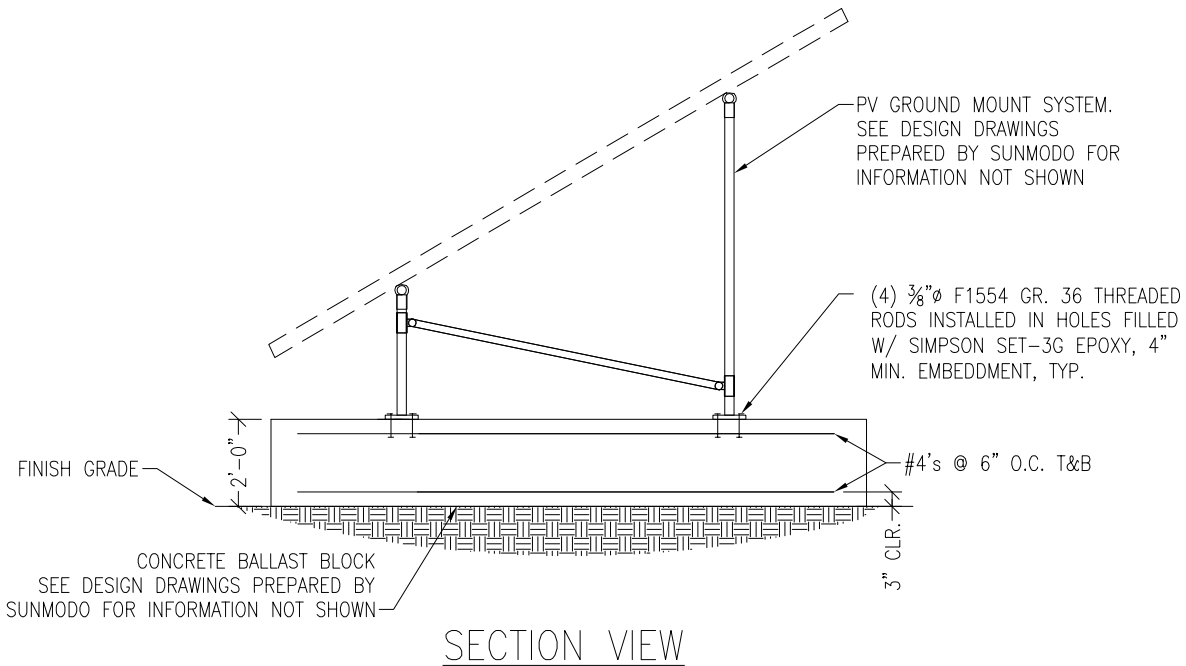
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JOB NO. U2716-0335-221

PROJECT SUNMODO SUNTURF GROUND MOUNTS A12

SUBJECT BALLASTED BLOCK OPTION



PV ARRAY SECTION

N.T.S.

S4

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JOB NO.: U2716.0330.221

PROJECT: Sunturf Package A7 - 2022

DESIGN LOADS



JOB NO.: U2716.0335.221
SUBJECT: SNOW LOADS

PROJECT: Sunturf Package A12 Ground Mount

SNOW LOADS

Calculations Per:	ASCE 7-16	
Snow Ground Load, p_g [psf]:	90.0	(Section 7.2)
Risk Category:	I	(Table 1.5-1)
Importance Factor, I_s :	0.8	(Table 1.5-2)
Terrain Category:	B	(Section 26.7)
Exposure of Roof:	Fully Exposed	(Table 7-3.1)
Exposure Factor, C_e :	0.9	(Table 7-3.1)
Thermal Factor, C_t :	1.2	(Table 7-3.2)
Flat Roof Snow Load, p_f [psf]:	54	(Equation 7.3-1)
Min. Roof Snow Load, p_m [psf]:	0	(Section 7.3.4)
Panel Slope from Horizontal [°]:	20.0	
Unobstructed Slippery Surface?	Yes	(Section 7.4)
Slope Factor Figure:	Figure 7-2c	(of Figure 7.4-1 - See Section 7.4)
Roof Slope Factor, C_s :	0.91	
Sloped Roof Snow Load, p_s [psf]:	49	(Equation 7.4-1)
Design Snow Load, S [psf]:	49	(1.0 Snow)



JOB NO.: U2716.0335.221
SUBJECT: WIND PRESSURES

PROJECT: Sunturf Package A12 Ground Mount

WIND PRESSURES

Calculations per:	ASCE 7-16	
Design Wind Speed, V [mph]:	120	
Risk Category:	I	(Table 1.5-1)
Exposure Category:	B	(Section 26.7)
Elevation [ft]:	1086	
Ground Elevation Factor, K_e :	0.96	(Table 26.9-1)
α :	7.0	(Table 26.11-1)
z_g [ft]:	1200	(Table 26.11-1)
Velocity Pressure Exposure Coefficient, K_h :	0.57	(Table 26.10-1)
Topographic Factor, K_{ht} :	1.0	(Section 26.8)
Wind Directionality Factor, K_d :	0.85	(Table 26.6-1)
Internal Pressure Coefficient, GC_{pi} :	0.00	(Figure 26.13-1)
Velocity Pressure, q_h [psf]:	17.31	(Equation 26.10-1)
Gust Effect Factor, G:	0.85	(Section 26.11.4)
Panel Slope [degrees]:	20.0	
Wind Flow:	Clear	
Roof Configuration:	Monoslope	

Wind Pressures in Transverse (N-S) Direction

Net Pressure Coefficients per Figure 27.3-4

Clear Wind Flow	C_{NW}	C_{NL}
Case 1 ($\gamma = 0^\circ$, Load Case A)	-1.3	-1.5
Case 2 ($\gamma = 0^\circ$, Load Case B)	-2.2	-0.2
Case 3 ($\gamma = 180^\circ$, Load Case A)	1.6	1.7
Case 4 ($\gamma = 180^\circ$, Load Case B)	2.1	0.7

Design Wind Pressures per Equation 27.3-2 [psf]

Clear Wind Flow	$q_h GC_{NW}$	$q_h GC_{NL}$
Case 1 ($\gamma = 0^\circ$, Load Case A)	-19.1	-22.1
Case 2 ($\gamma = 0^\circ$, Load Case B)	-32.4	-2.9
Case 3 ($\gamma = 180^\circ$, Load Case A)	23.5	25.0
Case 4 ($\gamma = 180^\circ$, Load Case B)	30.9	10.3
Case 5 ($\gamma = 0^\circ$, 16 psf Min. Horiz.)	-16.0	-16.0
Case 6 ($\gamma = 180^\circ$, 16 psf Min. Horiz.)	16.0	16.0



JOB NO.: U2716.0335.221
SUBJECT: SNOW LOADS

PROJECT: Sunturf Package A12 Ground Mount

SNOW LOADS

Calculations Per:	ASCE 7-16	
Snow Ground Load, p_g [psf]:	90.0	(Section 7.2)
Risk Category:	I	(Table 1.5-1)
Importance Factor, I_s :	0.8	(Table 1.5-2)
Terrain Category:	B	(Section 26.7)
Exposure of Roof:	Fully Exposed	(Table 7-3.1)
Exposure Factor, C_e :	0.9	(Table 7-3.1)
Thermal Factor, C_t :	1.2	(Table 7-3.2)
Flat Roof Snow Load, p_f [psf]:	54	(Equation 7.3-1)
Min. Roof Snow Load, p_m [psf]:	0	(Section 7.3.4)
Panel Slope from Horizontal [°]:	35.0	
Unobstructed Slippery Surface?	Yes	(Section 7.4)
Slope Factor Figure:	Figure 7-2c	(of Figure 7.4-1 - See Section 7.4)
Roof Slope Factor, C_s :	0.64	
Sloped Roof Snow Load, p_s [psf]:	35	(Equation 7.4-1)
Design Snow Load, S [psf]:	35	(1.0 Snow)



JOB NO.: U2716.0335.221
SUBJECT: WIND PRESSURES

PROJECT: Sunturf Package A12 Ground Mount

WIND PRESSURES

Calculations per:	ASCE 7-16	
Design Wind Speed, V [mph]:	120	
Risk Category:	I	(Table 1.5-1)
Exposure Category:	B	(Section 26.7)
Elevation [ft]:	1086	
Ground Elevation Factor, K_e :	0.96	(Table 26.9-1)
α :	7.0	(Table 26.11-1)
z_g [ft]:	1200	(Table 26.11-1)
Velocity Pressure Exposure Coefficient, K_h :	0.57	(Table 26.10-1)
Topographic Factor, K_{ht} :	1.0	(Section 26.8)
Wind Directionality Factor, K_d :	0.85	(Table 26.6-1)
Internal Pressure Coefficient, GC_{pi} :	0.00	(Figure 26.13-1)
Velocity Pressure, q_h [psf]:	17.31	(Equation 26.10-1)
Gust Effect Factor, G:	0.85	(Section 26.11.4)
Panel Slope [degrees]:	35.0	
Wind Flow:	Clear	
Roof Configuration:	Monoslope	

Wind Pressures in Transverse (N-S) Direction

Net Pressure Coefficients per Figure 27.3-4

Clear Wind Flow	C_{NW}	C_{NL}
Case 1 ($\gamma = 0^\circ$, Load Case A)	-1.8	-1.8
Case 2 ($\gamma = 0^\circ$, Load Case B)	-2.4	-0.6
Case 3 ($\gamma = 180^\circ$, Load Case A)	2.1	2.1
Case 4 ($\gamma = 180^\circ$, Load Case B)	2.7	1.1

Design Wind Pressures per Equation 27.3-2 [psf]

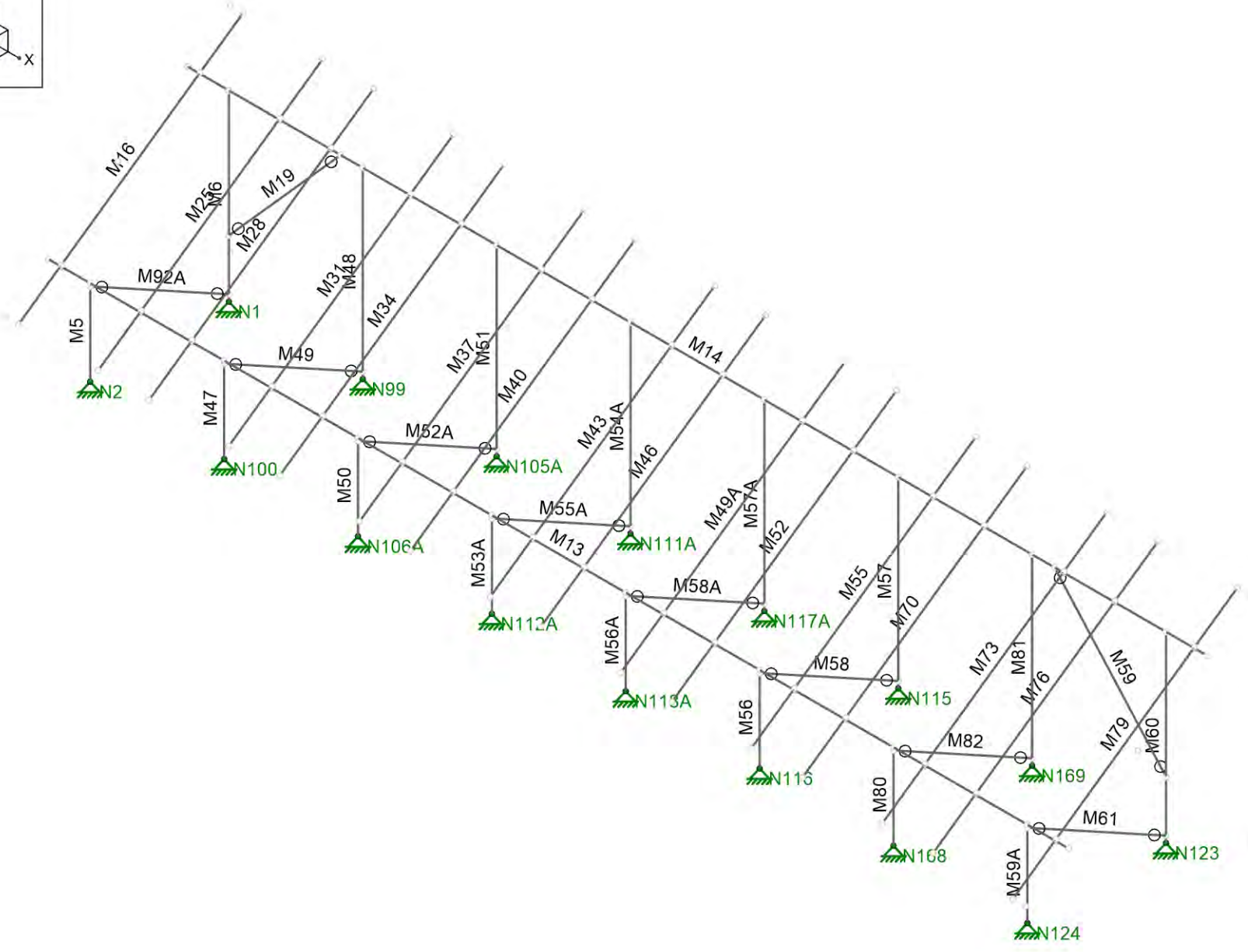
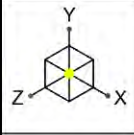
Clear Wind Flow	$q_h GC_{NW}$	$q_h GC_{NL}$
Case 1 ($\gamma = 0^\circ$, Load Case A)	-26.5	-26.5
Case 2 ($\gamma = 0^\circ$, Load Case B)	-35.3	-8.8
Case 3 ($\gamma = 180^\circ$, Load Case A)	30.9	30.9
Case 4 ($\gamma = 180^\circ$, Load Case B)	39.7	16.2
Case 5 ($\gamma = 0^\circ$, 16 psf Min. Horiz.)	-16.0	-16.0
Case 6 ($\gamma = 180^\circ$, 16 psf Min. Horiz.)	16.0	16.0



JOB NO.: U2716.0330.221

PROJECT: Sunturf Package A7 - 2022

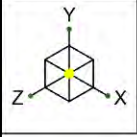
RACKING ANALYSIS 4L & 2P CONFIGURATION



Vector Structural Engineering
 MIH
 U2716.0335.221

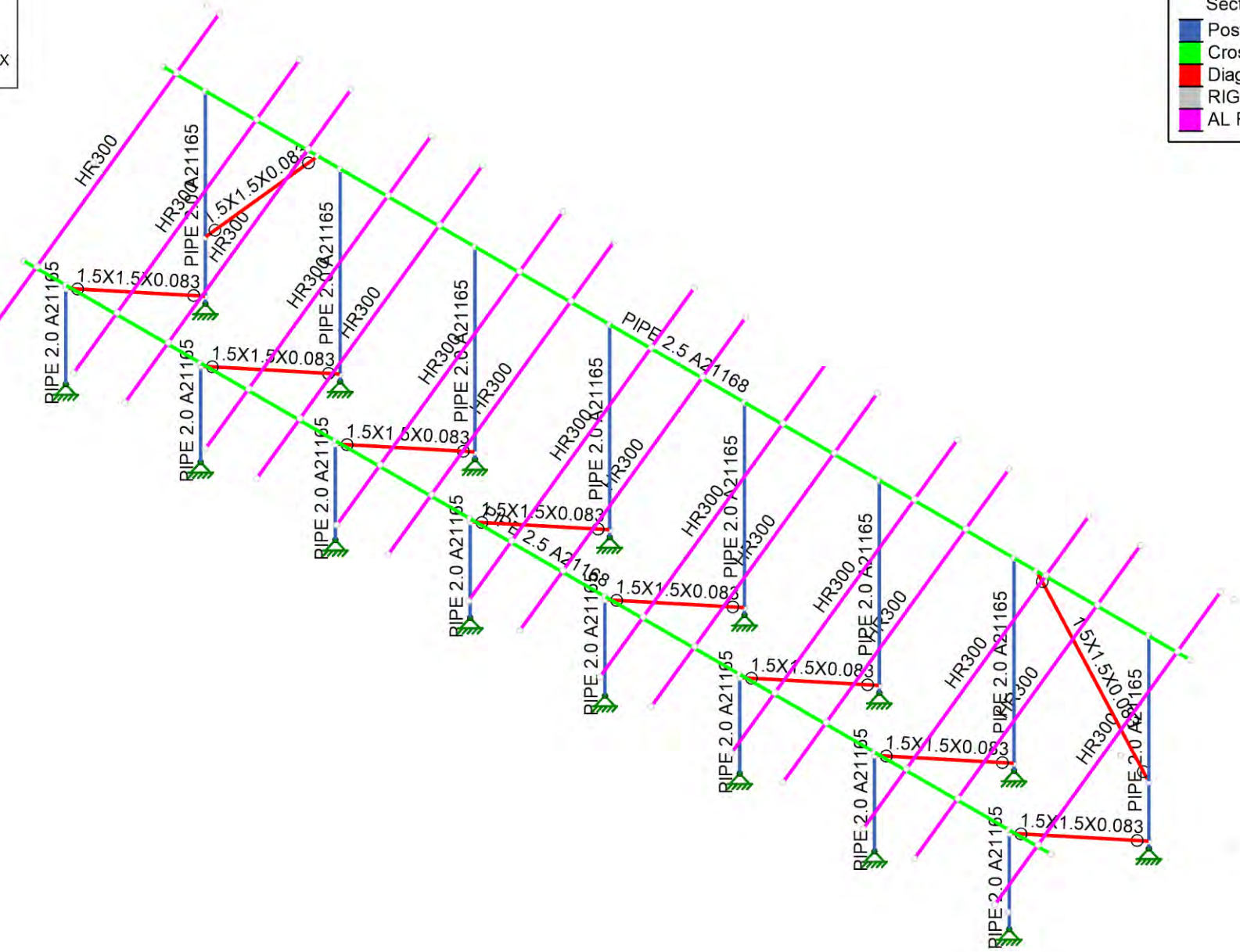
Standard Panels - 35 Degree Tilt - 4L

SK-1
 Mar 28, 2022
 Sunmodo Sunturf A12 - SP - 35 - 4L.r3d

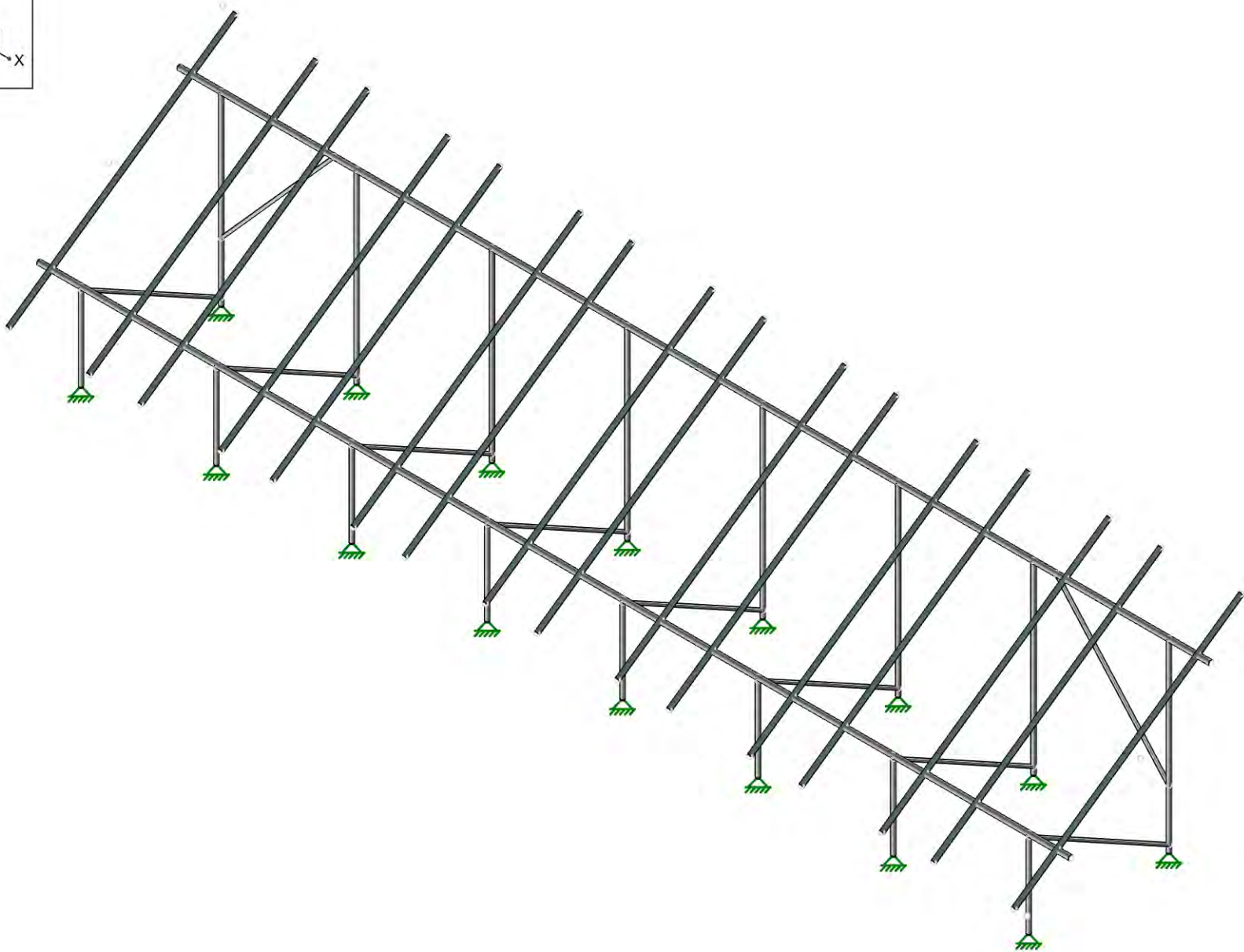
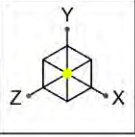


Section Sets

- █ Post
- █ Cross Beam
- █ Diagonal Brace
- █ RIGID
- █ AL Rails



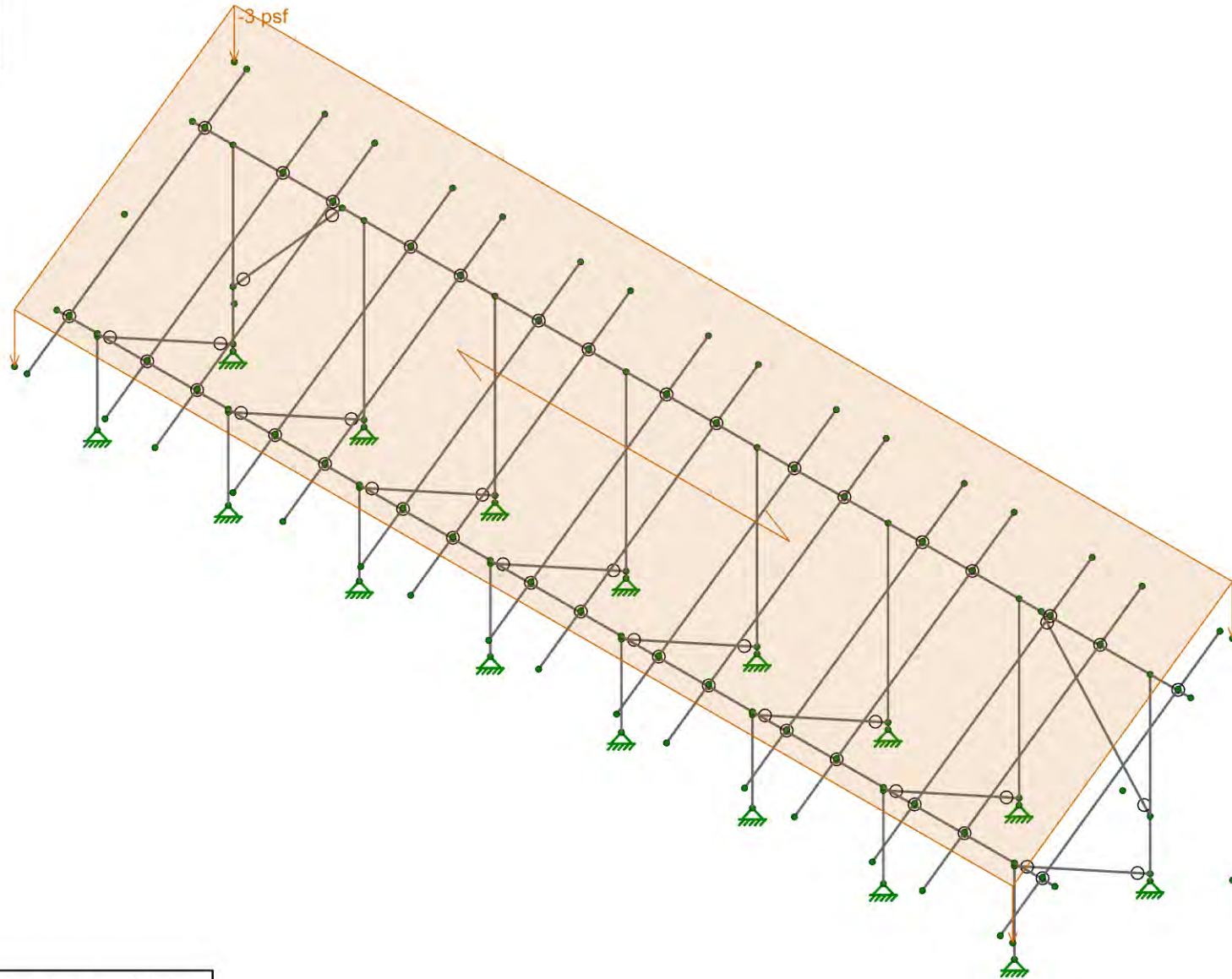
Vector Structural Engineering	Standard Panels - 35 Degree Tilt - 4L	SK-2
MIH		Mar 28, 2022
U2716.0335.221		Sunmodo Sunturf A12 - SP - 35 - 4L.r3d



Vector Structural Engineering
MIH
U2716.0335.221

Standard Panels - 35 Degree Tilt - 4L

SK-3
Mar 28, 2022
Sunmodo Sunturf A12 - SP - 35 - 4L.r3d



Loads: BLC 2, Solar Panel Weight

Vector Structural Engineering

MIH

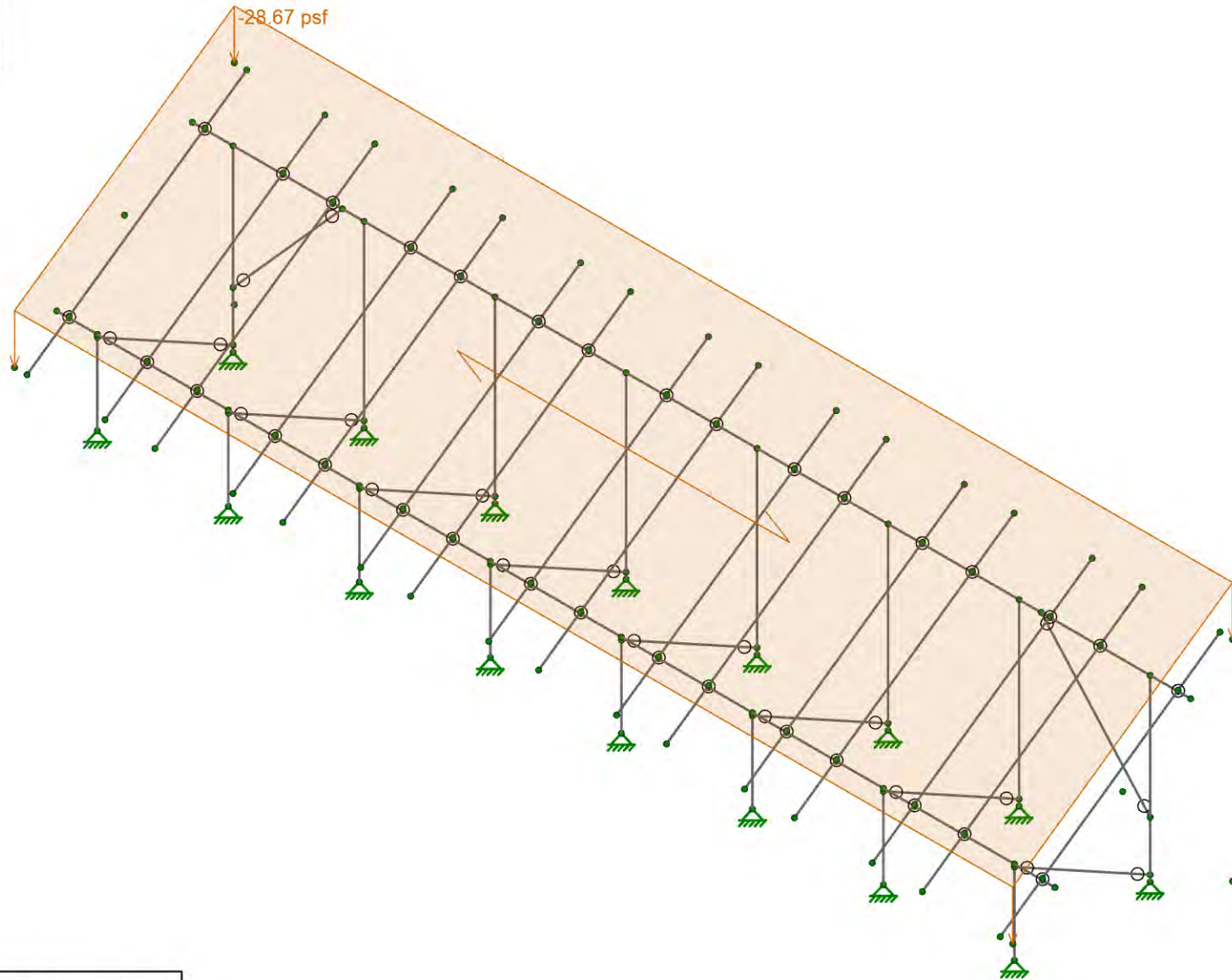
U2716.0335.221

Standard Panels - 35 Degree Tilt - 4L

SK-4

Mar 28, 2022

Sunmodo Sunturf A12 - SP - 35 - 4L.r3d



Loads: BLC 3, Roof Live/Snow

Vector Structural Engineering

MIH

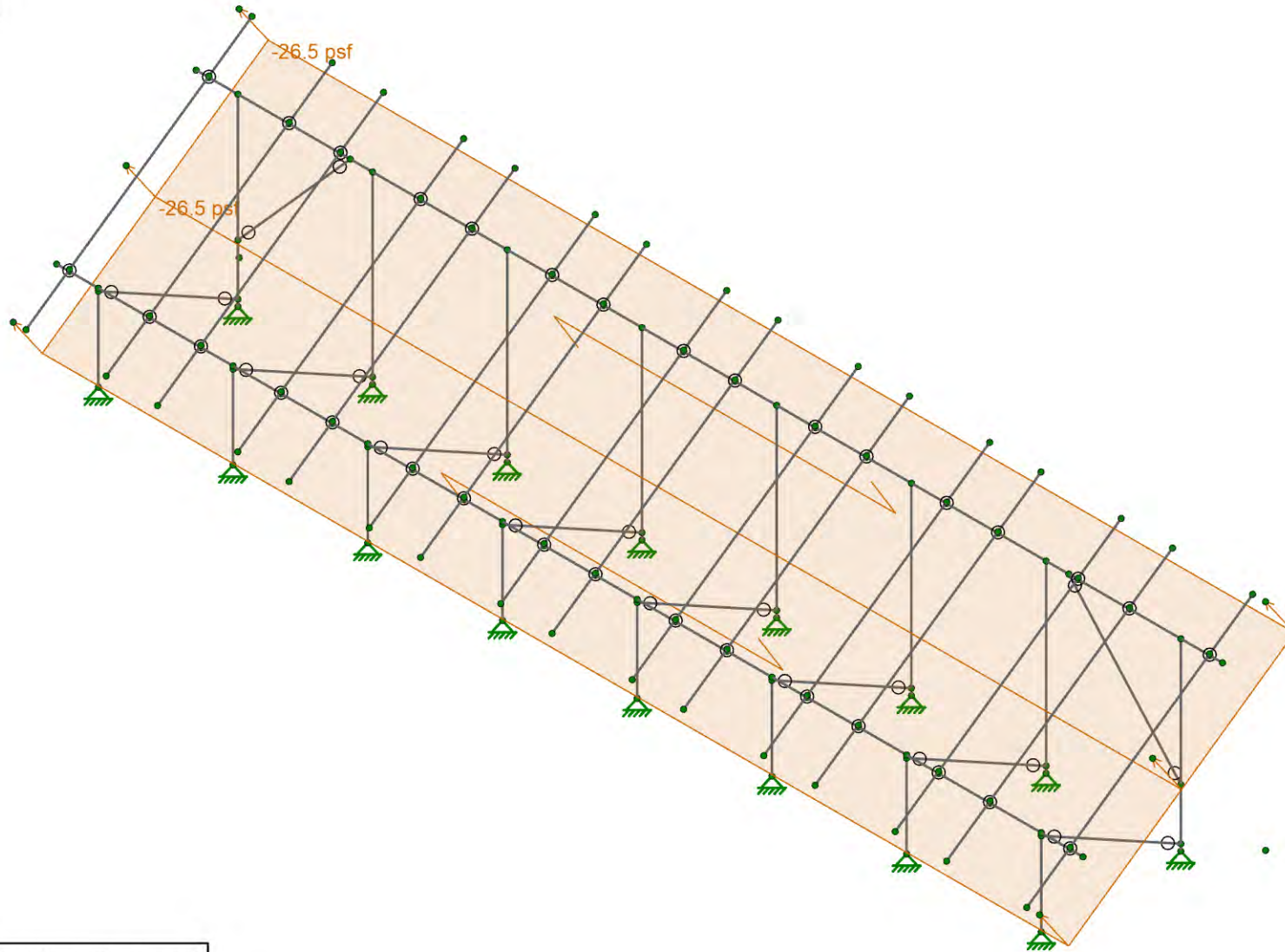
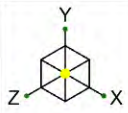
U2716.0335.221

Standard Panels - 35 Degree Tilt - 4L

SK-5

Mar 28, 2022

Sunmodo Sunturf A12 - SP - 35 - 4L.r3d

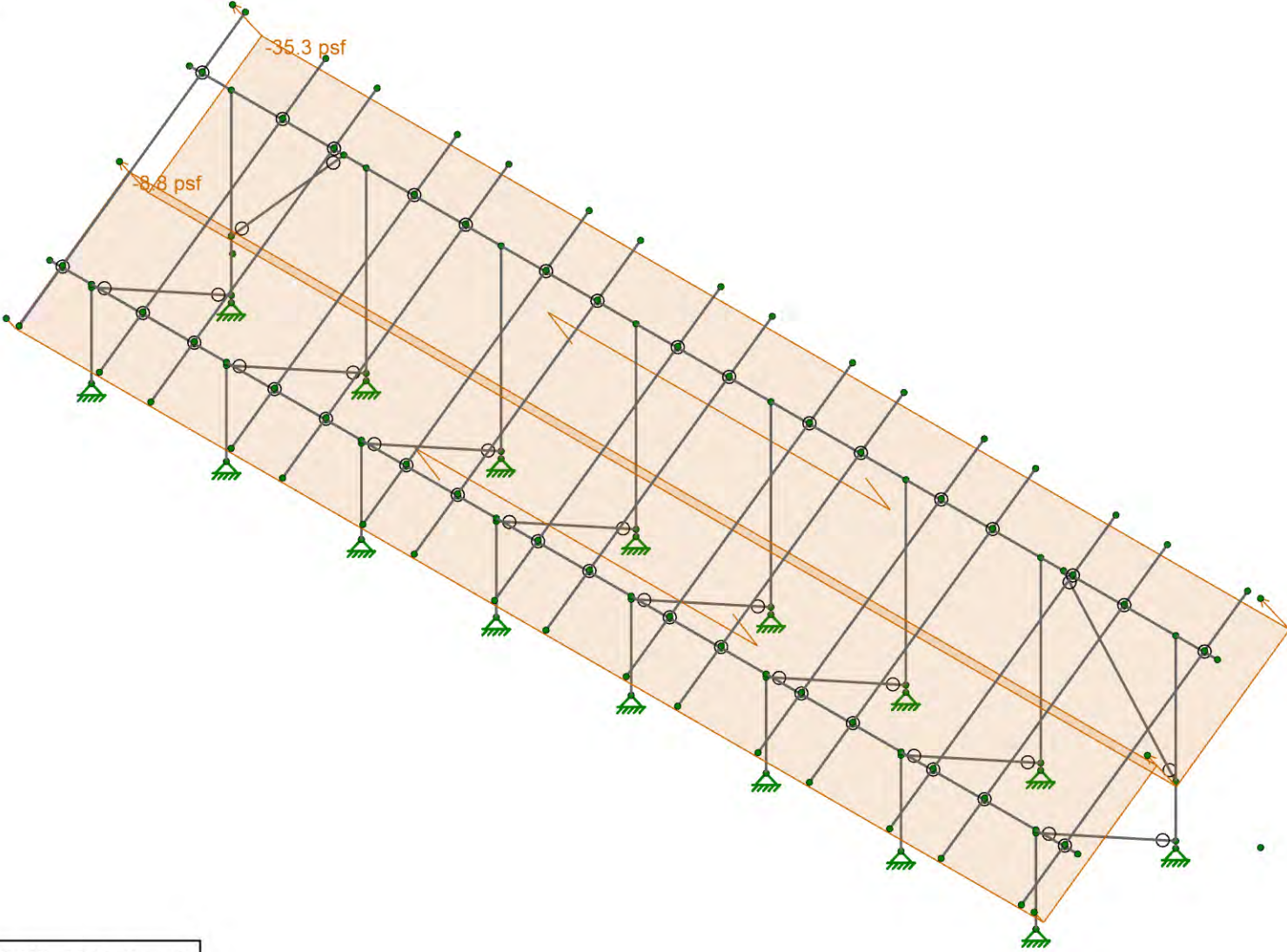


Loads: BLC 4, Wind 1: 0 Case A

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U2716.0335.221

Standard Panels - 35 Degree Tilt - 4L

SK-6
Mar 28, 2022
Sunmodo Sunturf A12 - SP - 35 - 4L.r3d



Loads: BLC 5, Wind 2: 0 Case B

Vector Structural Engineering

MIH

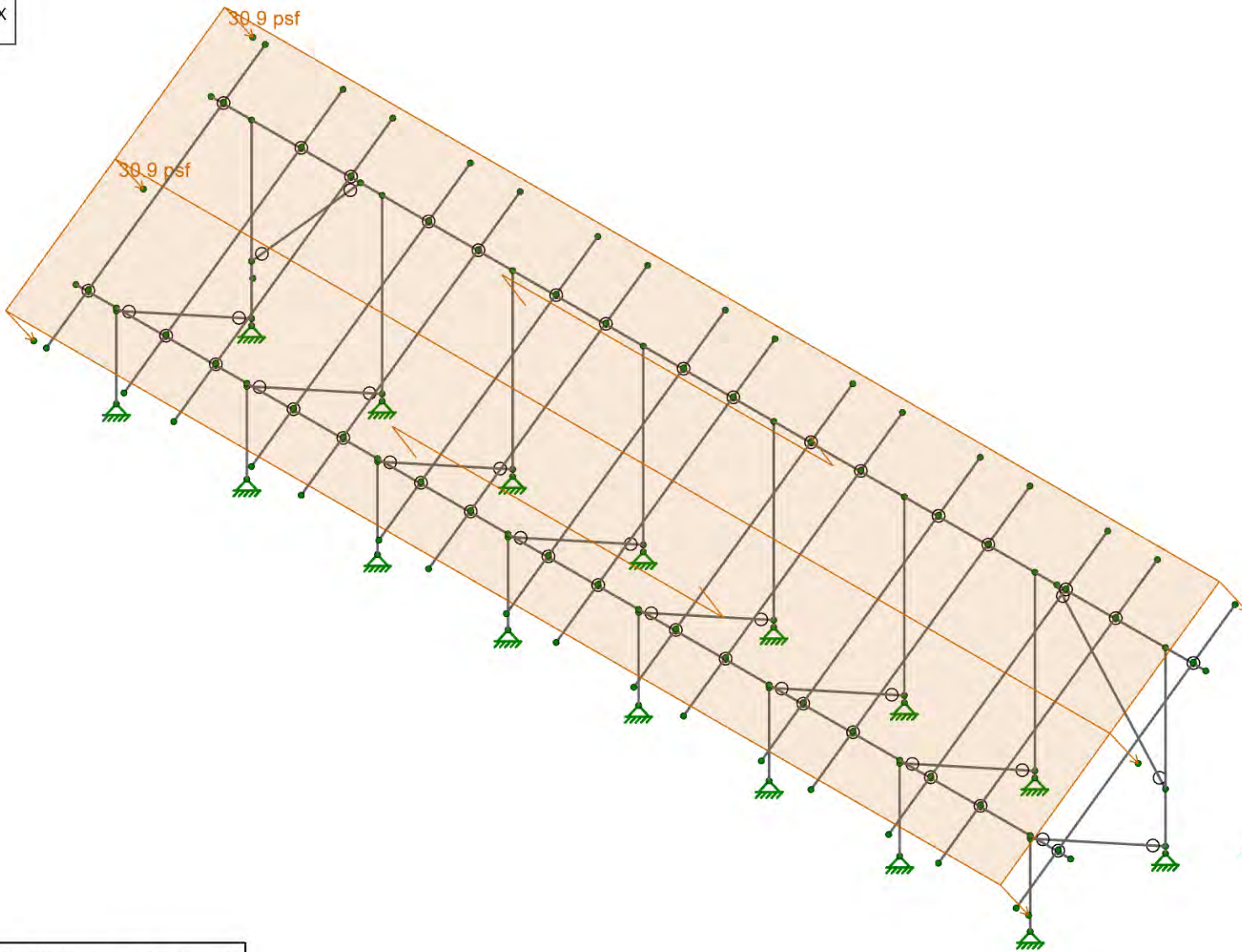
U2716.0335.221

Standard Panels - 35 Degree Tilt - 4L

SK-7

Mar 28, 2022

Sunmodo Sunturf A12 - SP - 35 - 4L.r3d



Loads: BLC 6, Wind 3: 180 Case A

Vector Structural Engineering

MIH

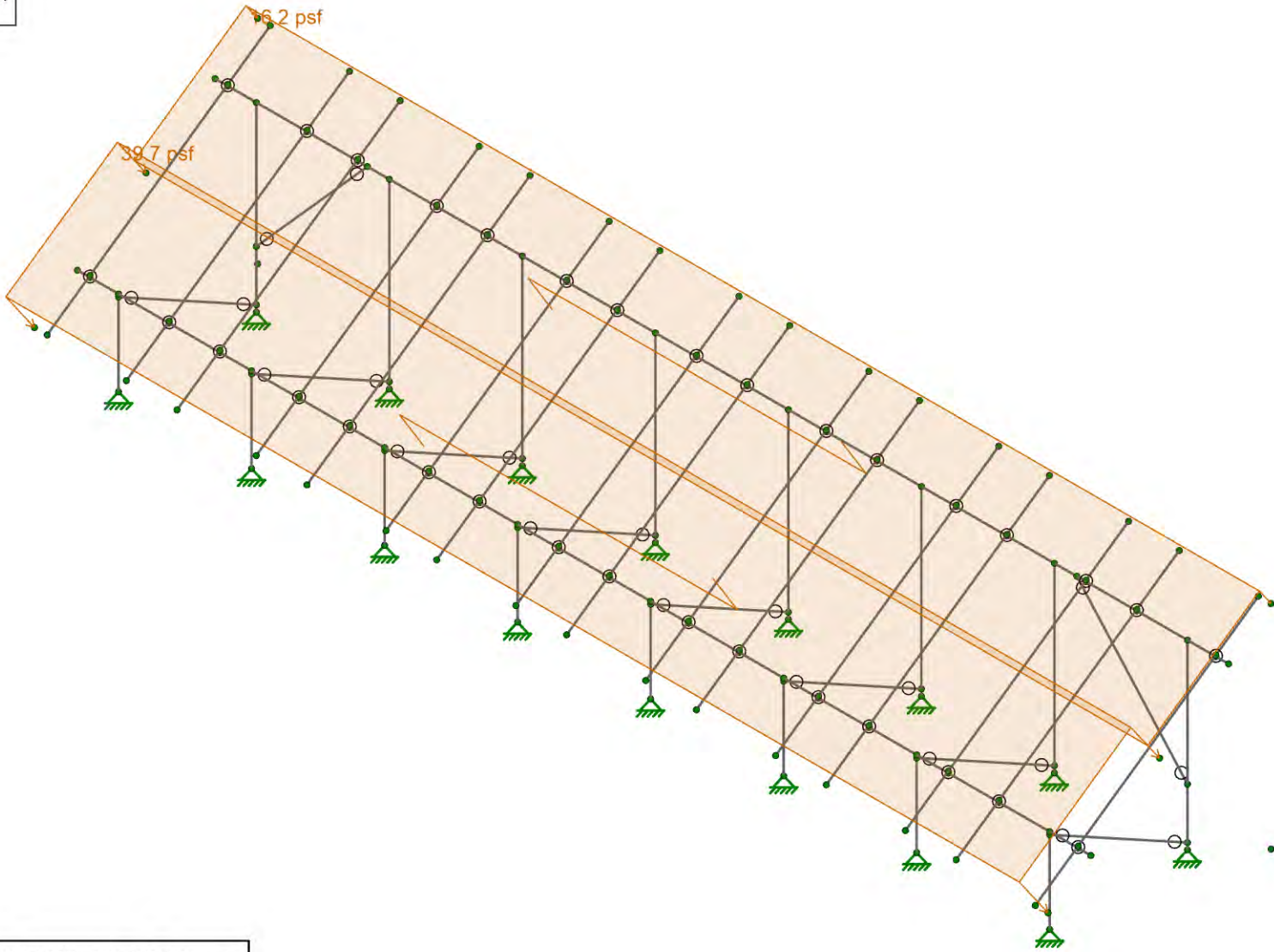
U2716.0335.221

Standard Panels - 35 Degree Tilt - 4L

SK-8

Mar 28, 2022

Sunmodo Sunturf A12 - SP - 35 - 4L.r3d



Loads: BLC 7, Wind 4: 180 Case B

Vector Structural Engineering

MIH

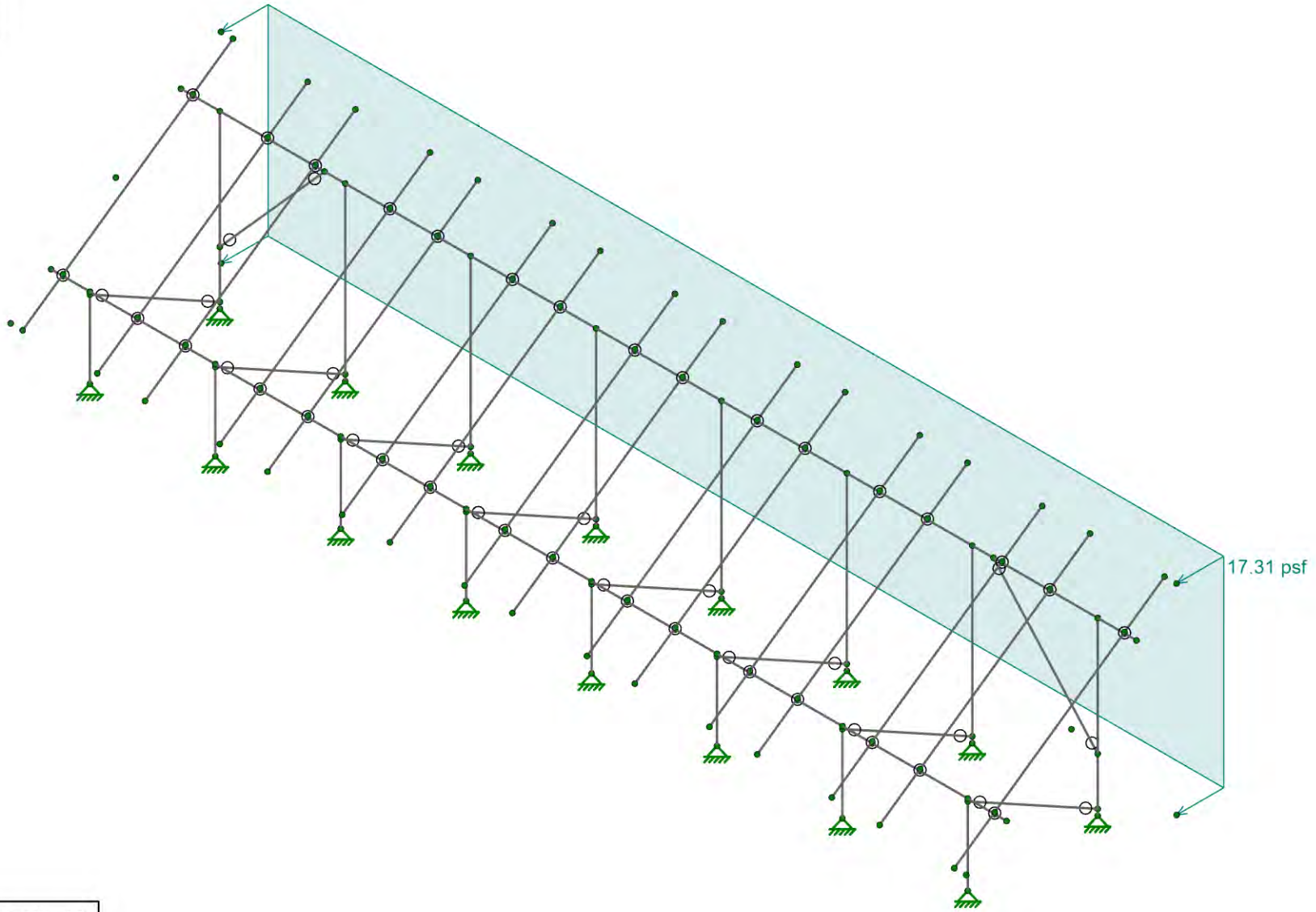
U2716.0335.221

Standard Panels - 35 Degree Tilt - 4L

SK-9

Mar 28, 2022

Sunmodo Sunturf A12 - SP - 35 - 4L.r3d



Loads: BLC 8, Wind Z

Vector Structural Engineering
MIH
U2716.0335.221

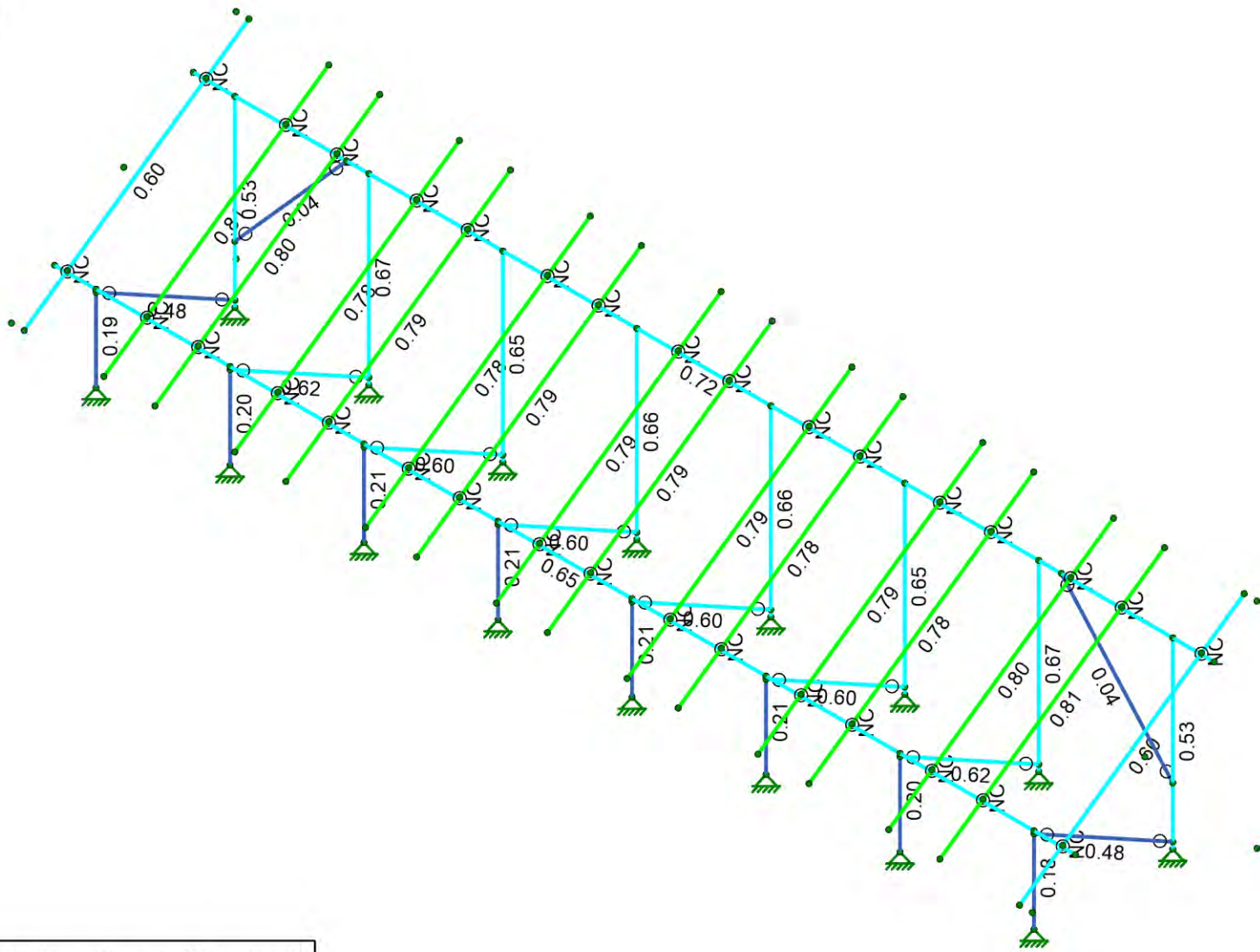
Standard Panels - 35 Degree Tilt - 4L

SK-10
Mar 28, 2022
Sunmodo Sunturf A12 - SP - 35 - 4L.r3d

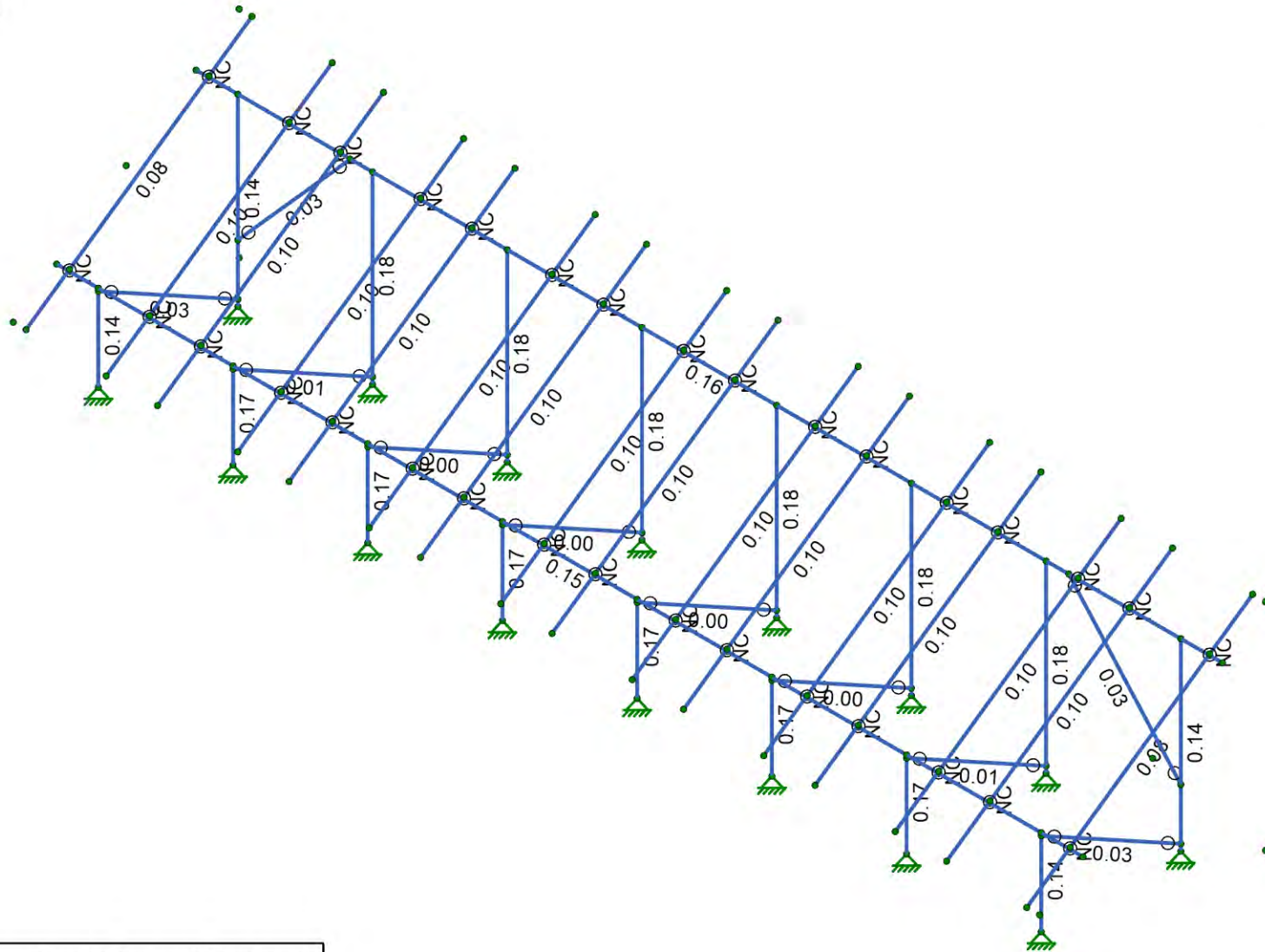
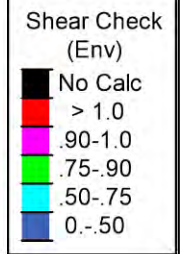


Code Check (Env)

- No Calc
- > 1.0
- .90-1.0
- .75-.90
- .50-.75
- 0-.50



Member Code Checks Displayed (Enveloped)		
Vector Structural Engineering	Standard Panels - 35 Degree Tilt - 4L	SK-11
MIH		Mar 28, 2022
U2716.0335.221		Sunmodo Sunturf A12 - SP - 35 - 4L.r3d



Member Shear Checks Displayed (Enveloped)		
Vector Structural Engineering	Standard Panels - 35 Degree Tilt - 4L	SK-12
MIH		Mar 28, 2022
U2716.0335.221		Sunmodo Sunturf A12 - SP - 35 - 4L.r3d

Model Settings

Solution

Members

Number of Reported Sections	5
Number of Internal Sections	100
Member Area Load Mesh Size (in ²)	144
Consider Shear Deformation	Yes
Consider Torsional Warping	Yes

Wall Panels

Approximate Mesh Size (in)	24
Transfer Forces Between Intersecting Wood Walls	Yes
Increase Wood Wall Nailing Capacity for Wind Loads	Yes
Include P-Delta for Walls	Yes
Optimize Masonry and Wood Walls	Yes
Maximum Number of Iterations	3

Processor Core Utilization

Single	No
Multiple (Optimum)	Yes
Maximum	No

Axis

Vertical Global Axis

Global Axis corresponding to vertical direction	Y
Convert Existing Data	Yes

Default Member Orientation

Default Global Plane for z-axis	XZ
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Plate Axis

Plate Local Axis Orientation	Nodal
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Codes

Hot Rolled Steel	AISC 15th (360-16): ASD
Stiffness Adjustment	Yes (Iterative)
Notional Annex	None
Connections	None
Cold Formed Steel	None
Stiffness Adjustment	Yes (Iterative)
Wood	None
Temperature	< 100F
Concrete	None
Masonry	None
Aluminum	AA ADM1-15: ASD
Structure Type	Building
Stiffness Adjustment	Yes (Iterative)
Stainless	None
Stiffness Adjustment	Yes (Iterative)

Concrete

Compression Stress Block	Rectangular Stress Block
Analyze using Cracked Sections	Yes
Leave room for horizontal rebar splices (2*d bar spacing)	No

Model Settings (Continued)

List forces which were ignored for design in the Detail Report	Yes
--	-----

Rebar

Column Min Steel	1
Column Max Steel	8
Rebar Material Spec	ASTM A615
Warn if beam-column framing arrangement is not understood	No

Shear Reinforcement

Number of Shear Regions	4
Region 2 & 3 Spacing Increase Increment (in)	4

Seismic

RISA-3D Seismic Load Options

Code	ASCE 7-16
Risk Category	I or II
Drift Cat	Other
Base Elevation (ft)	15600
Include the weight of the structure in base shear calcs	Yes

Site Parameters

S_1 (g)	1
SD_1 (g)	1
SD_s (g)	1
T_1 (sec)	5

Structure Characteristics

T Z (sec)	
T X (sec)	
C_x	0.02
$C_{Exp. Z}$	0.75
$C_{Exp. X}$	0.75
R Z	3
R X	3
Ω_z	1
Ω_x	1
$C_d Z$	4
$C_d X$	4
ρZ	1
ρX	1

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [$1e^{-5}F^{-1}$]	Density [k/ft ³]	Yield [psi]	Ry	Fu [psi]	Rt
1	A992	29000	11154	0.3	0.65	0.49	50000	1.1	65000	1.1
2	A36 Gr.36	29000	11154	0.3	0.65	0.49	36000	1.5	58000	1.2
3	A572 Gr.50	29000	11154	0.3	0.65	0.49	50000	1.1	65000	1.1
4	A500 Gr.B RND	29000	11154	0.3	0.65	0.527	42000	1.4	58000	1.3
5	A500 Gr.B Rect	29000	11154	0.3	0.65	0.527	46000	1.4	58000	1.3
6	A53 Gr.B	29000	11154	0.3	0.65	0.49	35000	1.6	60000	1.2
7	A1085	29000	11154	0.3	0.65	0.49	50000	1.4	65000	1.3

Aluminum Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [$1e^{-5}F^{-1}$]	Density [k/ft ³]	Table B.4	kt	Ftu [psi]	Fty [psi]	Fcy [psi]	Fsu [psi]	Ct
1	3003-H14	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	19000	16000	13000	12000	141
2	6061-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	38000	35000	35000	24000	141
3	6063-T5	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	22000	16000	16000	13000	141
4	6063-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	30000	25000	25000	19000	141
5	5052-H34	10200	3787.5	0.33	1.3	0.173	Table B.4-1	1	34000	26000	24000	20000	141
6	6061-T6 W	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	24000	15000	15000	15000	141
7	6005-T5	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	38000	35000	35000	24000	141

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in ²]	Iyy [in ⁴]	Izz [in ⁴]	J [in ⁴]
1	Post	Pipe 2.0 A21165	Column	Pipe	A572 Gr.50	Longitudinal	0.776	0.499	0.499	0.998
2	Cross Beam	Pipe 2.5 A21168	Beam	Wide Flange	A572 Gr.50	Longitudinal	0.947	0.907	0.907	1.814
3	Diagonal Brace	1.5x1.5x0.083	HBrace	Square Tube	A572 Gr.50	Longitudinal	0.47	0.158	0.158	0.236

Aluminum Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in ²]	Iyy [in ⁴]	Izz [in ⁴]	J [in ⁴]
1	AL Rails	HR300	Beam	Rectangular Tubes	6005-T5	Longitudinal	0.74	0.253	0.727	0.578

Member Area Loads (BLC 2 : Solar Panel Weight)

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

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N199	N196	PY	A-B	-35

Member Area Loads (BLC 4 : Wind 1: 0° Case A)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	-26.5
2	N119B	N120B	N199	N196	Perp	A-B	-26.5

Member Area Loads (BLC 5 : Wind 2: 0° Case B)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	-35.3
2	N119B	N120B	N199	N196	Perp	A-B	-8.8

Member Area Loads (BLC 6 : Wind 3: 180° Case A)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	30.9
2	N119B	N120B	N199	N196	Perp	A-B	30.9

Member Area Loads (BLC 7 : Wind 4: 180° Case B)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	16.2
2	N119B	N120B	N199	N196	Perp	A-B	39.7

Member Area Loads (BLC 8 : Wind Z)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N200	N166	N165	N197	Z	Open Structure	17.31

Basic Load Cases

	BLC Description	Category	Y Gravity	Distributed	Area(Member)
1	Self Weight	DL	-1.05		
2	Solar Panel Weight	DL			1
3	Roof Live/Snow	RLL			1
4	Wind 1: 0° Case A	OL1			2
5	Wind 2: 0° Case B	OL2			2
6	Wind 3: 180° Case A	OL3			2
7	Wind 4: 180° Case B	OL4			2
8	Wind Z	WLZ			1
9	BLC 2 Transient Area Loads	None		40	
10	BLC 3 Transient Area Loads	None		40	
11	BLC 4 Transient Area Loads	None		128	
12	BLC 5 Transient Area Loads	None		128	
13	BLC 6 Transient Area Loads	None		128	
14	BLC 7 Transient Area Loads	None		128	
15	BLC 8 Transient Area Loads	None		50	

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	ASD Loads										
2	1.0 D	Yes	Y	DL	1						
3	1.0 D + 1.0 S	Yes	Y	DL	1	RLL	1				
4	1.0 D + 0.6 W1	Yes	Y	DL	1			OL1	0.6	WLZ	0.6
5	1.0 D + 0.6 W2	Yes	Y	DL	1			OL2	0.6	WLZ	0.6
6	1.0 D + 0.6 W3	Yes	Y	DL	1			OL3	0.6	WLZ	-0.6
7	1.0 D + 0.6 W4	Yes	Y	DL	1			OL4	0.6	WLZ	-0.6
8	1.0 D + 0.45 W1 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL1	0.45	WLZ	0.6
9	1.0 D + 0.45 W2 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL2	0.45	WLZ	0.6
10	1.0 D + 0.45 W3 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL3	0.45	WLZ	-0.6
11	1.0 D + 0.45 W4 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL4	0.45	WLZ	-0.6
12	0.6 D + 0.6 W1	Yes	Y	DL	0.6			OL1	0.6	WLZ	0.6
13	0.6 D + 0.6 W2	Yes	Y	DL	0.6			OL2	0.6	WLZ	0.6
14	0.6 D + 0.6 W3	Yes	Y	DL	0.6			OL3	0.6	WLZ	-0.6
15	0.6 D + 0.6 W4	Yes	Y	DL	0.6			OL4	0.6	WLZ	-0.6
16			Y								
17	LRFD Loads		Y								

Load Combinations (Continued)

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
18	1.4 D		Y	DL	1.4						
19	1.2 D + 1.6 S + 0.5 W1		Y	DL	1.2	RLL	1.6	OL1	0.5	WLZ	0.5
20	1.2 D + 1.6 S + 0.5 W2		Y	DL	1.2	RLL	1.6	OL2	0.5	WLZ	0.5
21	1.2 D + 1.6 S + 0.5 W3		Y	DL	1.2	RLL	1.6	OL3	0.5	WLZ	-0.5
22	1.2 D + 1.6 S + 0.5 W4		Y	DL	1.2	RLL	1.6	OL4	0.5	WLZ	-0.5
23	1.2 D + 1.0 W1		Y	DL	1.2			OL1	1	WLZ	1
24	1.2 D + 1.0 W2		Y	DL	1.2			OL2	1	WLZ	1
25	1.2 D + 1.0 W3		Y	DL	1.2			OL3	1	WLZ	-1
26	1.2 D + 1.0 W4		Y	DL	1.2			OL4	1	WLZ	-1
27	0.9 D + 1.0 W1		Y	DL	0.9			OL1	1	WLZ	1
28	0.9 D + 1.0 W2		Y	DL	0.9			OL2	1	WLZ	1
29	0.9 D + 1.0 W3		Y	DL	0.9			OL3	1	WLZ	-1
30	0.9 D + 1.0 W4		Y	DL	0.9			OL4	1	WLZ	-1

Envelope Node Reactions

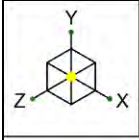
	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2	max	22.881	10	1407.924	9	47.05	4	0	15	0	15	0	15
2		min	-8.302	12	-160.069	14	-53.903	6	0	2	0	2	0	2
3	N1	max	36.101	10	2191.627	10	937.345	6	0	15	0	15	0	15
4		min	-27.987	13	-1289.779	13	-810.978	12	0	2	0	2	0	2
5	N115	max	1.2	10	2692.87	10	1178.921	6	0	15	0	15	0	15
6		min	-0.943	13	-1593.751	13	-1020.589	4	0	2	0	2	0	2
7	N116	max	3.748	9	1786.127	9	54.662	4	0	15	0	15	0	15
8		min	-0.964	14	-210.398	14	-62.558	6	0	2	0	2	0	2
9	N99	max	2.01	13	2740.884	10	1216.161	6	0	15	0	15	0	15
10		min	-4.236	10	-1602.647	13	-1051.622	4	0	2	0	2	0	2
11	N100	max	-0.184	12	1849.885	9	53.363	4	0	15	0	15	0	15
12		min	-12.343	11	-224.744	14	-61.035	6	0	2	0	2	0	2
13	N105A	max	0.886	13	2692.742	10	1178.9	6	0	15	0	15	0	15
14		min	-1.228	10	-1593.641	13	-1020.572	4	0	2	0	2	0	2
15	N106A	max	1.04	14	1786.078	9	54.662	4	0	15	0	15	0	15
16		min	-3.736	9	-210.372	14	-62.558	6	0	2	0	2	0	2
17	N111A	max	0.33	13	2709.186	10	1185.802	6	0	15	0	15	0	15
18		min	-0.634	10	-1600.44	13	-1026.05	4	0	2	0	2	0	2
19	N112A	max	0.062	14	1796.598	9	54.978	4	0	15	0	15	0	15
20		min	-1.716	9	-212.394	14	-62.88	6	0	2	0	2	0	2
21	N117A	max	0.598	10	2709.145	10	1185.808	6	0	15	0	15	0	15
22		min	-0.382	13	-1600.416	13	-1026.055	4	0	2	0	2	0	2
23	N118A	max	1.723	9	1796.579	9	54.979	4	0	15	0	15	0	15
24		min	0.013	14	-212.409	14	-62.88	6	0	2	0	2	0	2
25	N123	max	28.25	13	2192.495	10	937.417	6	0	15	0	15	0	15
26		min	-36.491	10	-1290.286	13	-811.021	12	0	2	0	2	0	2
27	N124	max	8.286	12	1407.855	9	47.051	4	0	15	0	15	0	15
28		min	-22.743	10	-160.297	14	-53.904	6	0	2	0	2	0	2
29	N168	max	12.419	11	1849.737	9	53.363	4	0	15	0	15	0	15
30		min	0.16	12	-224.712	14	-61.036	6	0	2	0	2	0	2
31	N169	max	4.181	10	2740.125	10	1216.139	6	0	15	0	15	0	15
32		min	-2.048	13	-1602.126	13	-1051.612	4	0	2	0	2	0	2
33	Totals:	max	0.001	13	28464.932	10	8555.741	14						
34		min	-0.002	10	-7964.693	12	-7398.219	12						

Envelope AISC 15TH (360-16): ASD Member Steel Code Checks

Member	Shape	Code Check	Loc[in]	LC	Shear Check	Loc[in]	Dir	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn
1	M14	Pipe 2.5 A21168	0.716	446.667	10	0.155	546.667	10	14032.946	28358.413	2081.747	2081.747	1	H1-1b
2	M48	Pipe 2.0 A21165	0.669	3.584	10	0.184	3.584	6	5705.311	23232.186	1397.505	1397.505	1.678	H1-1a
3	M81	Pipe 2.0 A21165	0.669	3.584	10	0.184	3.584	6	5705.311	23232.186	1397.505	1397.505	1.679	H1-1a
4	M54A	Pipe 2.0 A21165	0.659	3.584	10	0.179	3.584	6	5705.311	23232.186	1397.505	1397.505	1.655	H1-1a
5	M57A	Pipe 2.0 A21165	0.659	3.584	10	0.179	3.584	6	5705.311	23232.186	1397.505	1397.505	1.663	H1-1a
6	M57	Pipe 2.0 A21165	0.655	3.584	10	0.178	3.584	6	5705.311	23232.186	1397.505	1397.505	1.634	H1-1a
7	M51	Pipe 2.0 A21165	0.655	3.584	10	0.178	3.584	6	5705.311	23232.186	1397.505	1397.505	1.628	H1-1a
8	M13	Pipe 2.5 A21168	0.648	446.667	11	0.15	533.333	11	14032.946	28358.413	2081.747	2081.747	1	H1-1b
9	M49	1.5x1.5x0.083	0.617	51.691	6	0.007	99.247	y 3	2410.611	14085.15	624.421	624.421	1.136	H1-1a
10	M82	1.5x1.5x0.083	0.617	51.691	6	0.007	99.247	y 3	2410.611	14085.15	624.421	624.421	1.136	H1-1a
11	M58A	1.5x1.5x0.083	0.602	51.691	6	0.002	99.247	y 9	2410.611	14085.15	624.421	624.421	1.136	H1-1a
12	M55A	1.5x1.5x0.083	0.602	51.691	6	0.002	99.247	y 9	2410.611	14085.15	624.421	624.421	1.136	H1-1a
13	M58	1.5x1.5x0.083	0.599	51.691	6	0.004	99.247	y 9	2410.611	14085.15	624.421	624.421	1.136	H1-1a
14	M52A	1.5x1.5x0.083	0.599	51.691	6	0.004	99.247	y 9	2410.611	14085.15	624.421	624.421	1.136	H1-1a
15	M60	Pipe 2.0 A21165	0.53	3.584	10	0.141	3.584	6	5705.311	23232.186	1397.505	1397.505	1.561	H1-1a
16	M6	Pipe 2.0 A21165	0.53	3.584	10	0.141	3.584	6	5705.311	23232.186	1397.505	1397.505	1.555	H1-1a
17	M61	1.5x1.5x0.083	0.479	51.691	6	0.026	99.247	y 10	2410.611	14085.15	624.421	624.421	1.136	H1-1a
18	M92A	1.5x1.5x0.083	0.479	51.691	6	0.026	99.247	y 10	2410.611	14085.15	624.421	624.421	1.136	H1-1a
19	M56A	Pipe 2.0 A21165	0.209	51.789	6	0.169	53.46	6	16788.913	23232.186	1397.505	1397.505	1.62	H1-1b
20	M53A	Pipe 2.0 A21165	0.209	51.789	6	0.169	53.46	6	16788.913	23232.186	1397.505	1397.505	3	H1-1b
21	M50	Pipe 2.0 A21165	0.208	51.789	6	0.168	53.46	6	16788.913	23232.186	1397.505	1397.505	1.793	H1-1b
22	M56	Pipe 2.0 A21165	0.208	51.789	6	0.168	53.46	6	16788.913	23232.186	1397.505	1397.505	1.795	H1-1b
23	M80	Pipe 2.0 A21165	0.204	51.789	6	0.174	53.46	6	16788.913	23232.186	1397.505	1397.505	1.66	H1-1b
24	M47	Pipe 2.0 A21165	0.204	51.789	6	0.174	53.46	6	16788.913	23232.186	1397.505	1397.505	1.657	H1-1b
25	M5	Pipe 2.0 A21165	0.185	51.789	10	0.136	53.46	6	16788.913	23232.186	1397.505	1397.505	1.773	H1-1b
26	M59A	Pipe 2.0 A21165	0.185	51.789	10	0.136	53.46	6	16788.913	23232.186	1397.505	1397.505	1.774	H1-1b
27	M59	1.5x1.5x0.083	0.043	105.271	10	0.026	105.271	y 6	2142.617	14085.15	624.421	624.421	1.136	H1-1b*
28	M19	1.5x1.5x0.083	0.042	105.437	10	0.026	105.437	y 6	2135.884	14085.15	624.421	624.421	1.136	H1-1b*

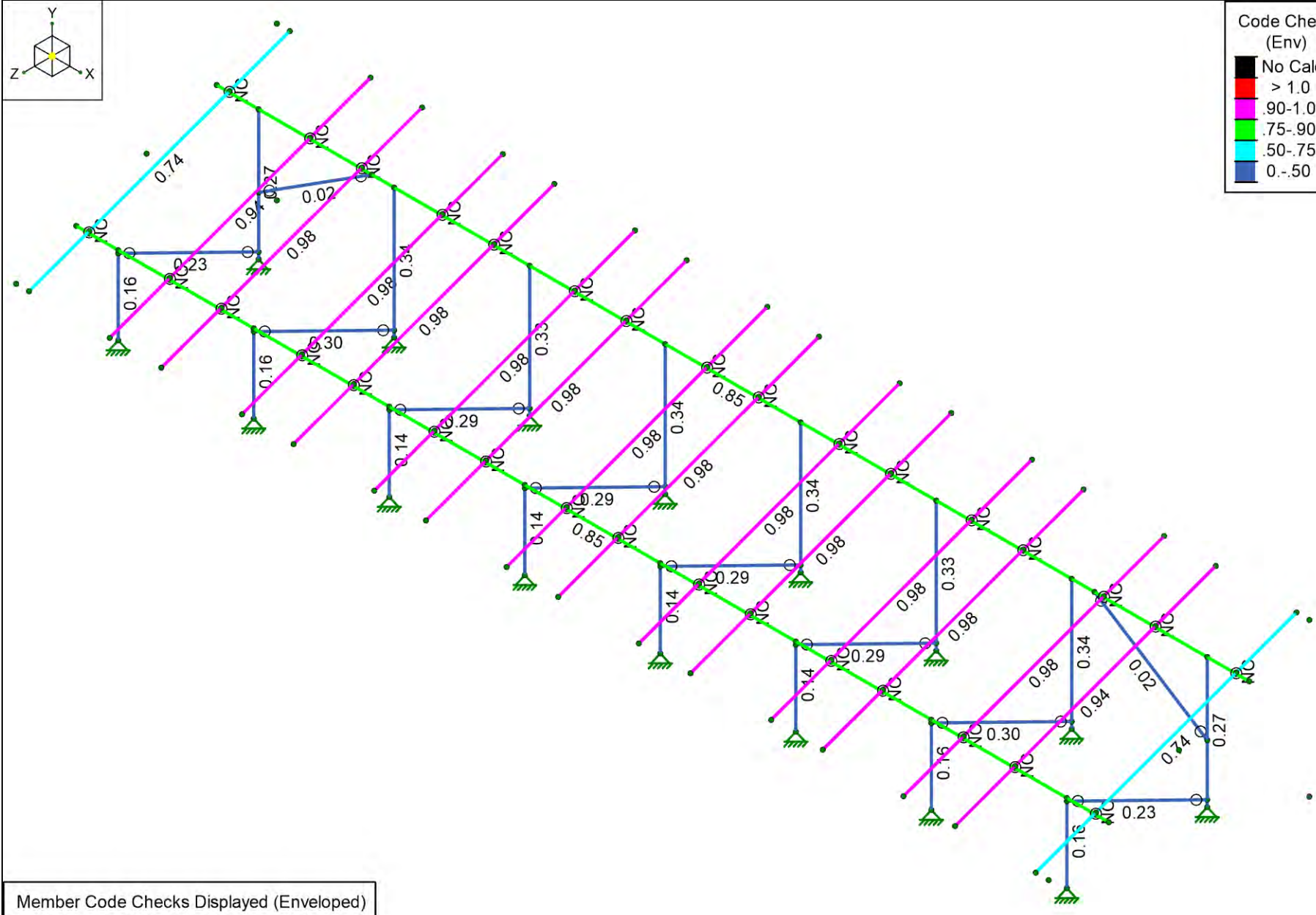
Envelope AA ADM1-15: ASD - BUILDING Member Aluminum Code Checks

Member	Shape	Code Check	Loc[in]	LC	Shear Check	Loc[in]	Dir	LC	Pnc/Om [lb]	Pnt/Om [lb]	Mny/Om [lb-ft]	Mnz/Om [lb-ft]	Vny/Om [lb]	Vnz/Om [lb]	Cb	Eqn
1	M25	HR300	0.814	86	10	0.104	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.875	H.1-1
2	M76	HR300	0.814	86	10	0.104	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.874	H.1-1
3	M73	HR300	0.795	87.792	10	0.101	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
4	M28	HR300	0.795	87.792	10	0.101	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
5	M55	HR300	0.791	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
6	M34	HR300	0.791	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
7	M49A	HR300	0.788	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
8	M40	HR300	0.788	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
9	M43	HR300	0.786	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
10	M46	HR300	0.786	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
11	M37	HR300	0.782	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
12	M52	HR300	0.782	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
13	M31	HR300	0.78	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
14	M70	HR300	0.78	87.792	10	0.1	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.815	H.1-1
15	M79	HR300	0.601	87.792	10	0.079	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.8	H.1-1
16	M16	HR300	0.601	87.792	10	0.079	34.042	y 11	3307.917	14429.594	560.36	934.132	5656.689	2605.145	1.8	H.1-1



Code Check (Env)

- No Calc
- > 1.0
- .90-1.0
- .75-.90
- .50-.75
- 0-.50

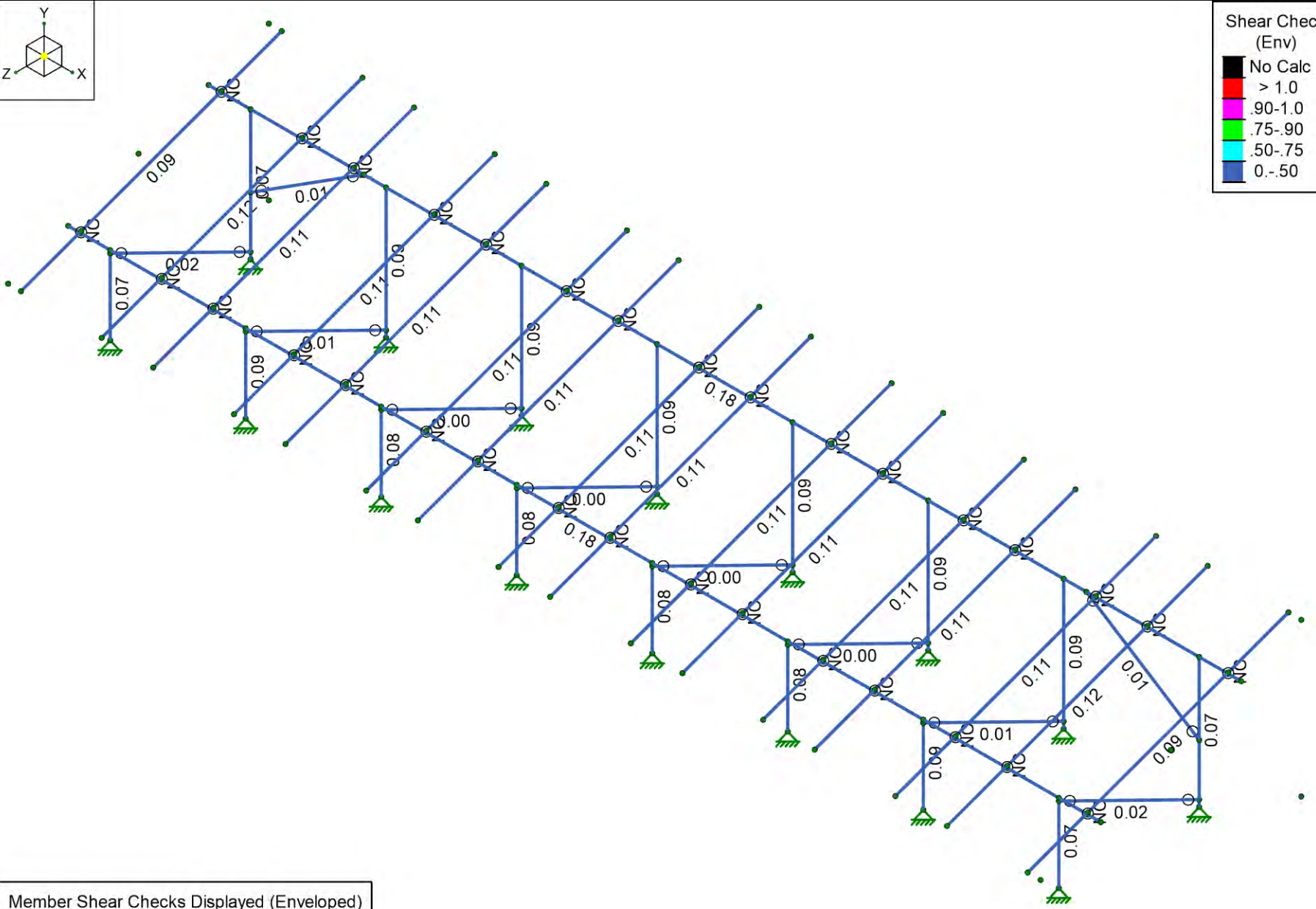


Member Code Checks Displayed (Enveloped)		
Vector Structural Engineering	Standard Panels - 20 Degree Tilt - 4L	SK-13
MIH		Mar 28, 2022
U2716.0335.221		Sunmodo Sunturf A12 - SP - 20 - 4L.r3d



Shear Check (Env)

- No Calc
- > 1.0
- .90-1.0
- .75-.90
- .50-.75
- 0-.50



Member Shear Checks Displayed (Enveloped)		
Vector Structural Engineering	Standard Panels - 20 Degree Tilt - 4L	SK-14
MIH		Mar 28, 2022
U2716.0335.221		Sunmodo Sunturf A12 - SP - 20 - 4L.r3d

Member Area Loads (BLC 2 : Solar Panel Weight)

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

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N199	N196	PY	A-B	-49

Member Area Loads (BLC 4 : Wind 1: 0° Case A)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	-19.1
2	N119B	N120B	N199	N196	Perp	A-B	-22.1

Member Area Loads (BLC 5 : Wind 2: 0° Case B)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	-32.4
2	N119B	N120B	N199	N196	Perp	A-B	-2.9

Member Area Loads (BLC 6 : Wind 3: 180° Case A)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	25
2	N119B	N120B	N199	N196	Perp	A-B	23.5

Member Area Loads (BLC 7 : Wind 4: 180° Case B)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	10.3
2	N119B	N120B	N199	N196	Perp	A-B	30.9

Member Area Loads (BLC 8 : Wind Z)

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N200	N166	N165	N197	Z	Open Structure	17.31

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2	max	32.117	3	1964.079	3	25.419	4	0	15	0	15	0	15
2		min	-5.989	12	-117.858	12	-30.306	6	0	2	0	2	0	2
3	N1	max	37.531	10	2248.148	10	460.803	6	0	15	0	15	0	15
4		min	-17.36	13	-891.563	13	-396.28	12	0	2	0	2	0	2
5	N115	max	2.362	10	2791.094	10	578.938	6	0	15	0	15	0	15
6		min	-1.039	13	-1113.274	13	-498.416	4	0	2	0	2	0	2
7	N116	max	5.248	3	2500.191	3	29.583	4	0	15	0	15	0	15
8		min	-0.571	12	-150.722	12	-35.477	6	0	2	0	2	0	2
9	N99	max	3.263	13	2853.823	10	596.94	6	0	15	0	15	0	15
10		min	-9.573	10	-1132.494	13	-514.249	4	0	2	0	2	0	2
11	N100	max	3.096	12	2582.615	3	28.93	4	0	15	0	15	0	15
12		min	-22.27	3	-151.421	12	-34.732	6	0	2	0	2	0	2
13	N105A	max	0.983	13	2790.965	10	578.932	6	0	15	0	15	0	15

Envelope Node Reactions (Continued)

Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC	
14		min	-2.328	10	-1113.22	13	-498.412	4	0	2	0	2	0	2
15	N106A	max	0.553	12	2500.128	3	29.583	4	0	15	0	15	0	15
16		min	-5.136	3	-150.723	12	-35.476	6	0	2	0	2	0	2
17	N111A	max	0.461	13	2807.499	10	582.371	6	0	15	0	15	0	15
18		min	-1.297	10	-1119.312	13	-501.41	4	0	2	0	2	0	2
19	N112A	max	0.369	12	2514.235	3	29.732	4	0	15	0	15	0	15
20		min	-2.806	3	-151.079	12	-35.659	6	0	2	0	2	0	2
21	N117A	max	1.324	10	2807.519	10	582.382	6	0	15	0	15	0	15
22		min	-0.515	13	-1119.322	13	-501.42	4	0	2	0	2	0	2
23	N118A	max	2.909	3	2514.255	3	29.732	4	0	15	0	15	0	15
24		min	-0.387	12	-151.078	12	-35.66	6	0	2	0	2	0	2
25	N123	max	17.618	13	2249.083	10	460.871	6	0	15	0	15	0	15
26		min	-38.081	10	-891.868	13	-396.317	12	0	2	0	2	0	2
27	N124	max	5.979	12	1963.661	3	25.42	4	0	15	0	15	0	15
28		min	-31.945	3	-117.776	12	-30.308	6	0	2	0	2	0	2
29	N168	max	22.335	3	2582.377	3	28.93	4	0	15	0	15	0	15
30		min	-3.114	12	-151.433	12	-34.733	6	0	2	0	2	0	2
31	N169	max	9.568	10	2852.954	10	596.919	6	0	15	0	15	0	15
32		min	-3.305	13	-1132.163	13	-514.238	4	0	2	0	2	0	2
33	Totals:	max	0.001	13	38436.962	3	4165.804	6						
34		min	-0.002	10	-6935.558	12	-3593.214	12						

Envelope AISC 15TH (360-16): ASD Member Steel Code Checks

Member	Shape	Code Check	Loc[in]	LC	Shear Check	Loc[in]	Dir	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn	
1	M13	Pipe 2.5 A21168	0.851	446.667	11	0.183	106.667	11	14032.946	28358.413	2081.747	2081.747	1	H1-1b	
2	M14	Pipe 2.5 A21168	0.85	446.667	10	0.177	546.667	10	14032.946	28358.413	2081.747	2081.747	1	H1-1b	
3	M48	Pipe 2.0 A21165	0.343	3.356	10	0.088	3.356	6	11115.323	23232.186	1397.505	1397.505	1.701	H1-1a	
4	M81	Pipe 2.0 A21165	0.343	3.356	10	0.088	3.356	6	11115.323	23232.186	1397.505	1397.505	1.701	H1-1a	
5	M57A	Pipe 2.0 A21165	0.337	3.356	10	0.086	3.356	6	11115.323	23232.186	1397.505	1397.505	1.695	H1-1a	
6	M54A	Pipe 2.0 A21165	0.337	3.356	10	0.086	3.356	6	11115.323	23232.186	1397.505	1397.505	1.692	H1-1a	
7	M57	Pipe 2.0 A21165	0.335	3.356	10	0.085	3.356	6	11115.323	23232.186	1397.505	1397.505	1.685	H1-1a	
8	M51	Pipe 2.0 A21165	0.335	3.356	10	0.085	3.356	6	11115.323	23232.186	1397.505	1397.505	1.683	H1-1a	
9	M49	1.5x1.5x0.083	0.296	50.48	6	0.01	96.922	y	3	2527.654	14085.15	624.421	624.421	1.136	H1-1a
10	M82	1.5x1.5x0.083	0.296	50.48	6	0.01	96.922	y	3	2527.654	14085.15	624.421	624.421	1.136	H1-1a
11	M58A	1.5x1.5x0.083	0.288	50.48	6	0.003	96.922	y	3	2527.654	14085.15	624.421	624.421	1.136	H1-1a
12	M55A	1.5x1.5x0.083	0.288	50.48	6	0.003	96.922	y	3	2527.654	14085.15	624.421	624.421	1.136	H1-1a
13	M58	1.5x1.5x0.083	0.287	50.48	6	0.004	96.922	y	3	2527.654	14085.15	624.421	624.421	1.136	H1-1a
14	M52A	1.5x1.5x0.083	0.287	50.48	6	0.004	96.922	y	9	2527.654	14085.15	624.421	624.421	1.136	H1-1a
15	M60	Pipe 2.0 A21165	0.27	3.356	10	0.068	3.356	6	11115.323	23232.186	1397.505	1397.505	1.352	H1-1a	
16	M6	Pipe 2.0 A21165	0.27	3.356	10	0.068	3.356	6	11115.323	23232.186	1397.505	1397.505	1.345	H1-1a	
17	M61	1.5x1.5x0.083	0.231	50.48	6	0.021	96.922	y	10	2527.654	14085.15	624.421	624.421	1.136	H1-1a
18	M92A	1.5x1.5x0.083	0.231	50.48	6	0.021	96.922	y	10	2527.654	14085.15	624.421	624.421	1.136	H1-1a
19	M5	Pipe 2.0 A21165	0.164	46.906	11	0.067	48.419	6	17798.04	23232.186	1397.505	1397.505	1.724	H1-1b	
20	M59A	Pipe 2.0 A21165	0.164	46.906	11	0.067	48.419	6	17798.04	23232.186	1397.505	1397.505	1.724	H1-1b	
21	M80	Pipe 2.0 A21165	0.16	46.906	11	0.086	48.419	6	17798.04	23232.186	1397.505	1397.505	1.696	H1-1b	
22	M47	Pipe 2.0 A21165	0.16	46.906	11	0.086	48.419	6	17798.04	23232.186	1397.505	1397.505	1.696	H1-1b	
23	M56A	Pipe 2.0 A21165	0.141	0	3	0.084	48.419	6	17798.04	23232.186	1397.505	1397.505	1.705	H1-1b*	
24	M53A	Pipe 2.0 A21165	0.141	0	3	0.084	48.419	6	17798.04	23232.186	1397.505	1397.505	1.701	H1-1b*	
25	M56	Pipe 2.0 A21165	0.14	0	3	0.083	48.419	6	17798.04	23232.186	1397.505	1397.505	1.703	H1-1b*	
26	M50	Pipe 2.0 A21165	0.14	0	3	0.083	48.419	6	17798.04	23232.186	1397.505	1397.505	1.7	H1-1b*	
27	M59	1.5x1.5x0.083	0.024	42.31	10	0.01	82.893	y	6	3455.596	14085.15	624.421	624.421	1.136	H1-1b
28	M19	1.5x1.5x0.083	0.024	42.418	10	0.01	83.104	y	6	3438.116	14085.15	624.421	624.421	1.136	H1-1b

Envelope AA ADM1-15: ASD - BUILDING Member Aluminum Code Checks

Member	Shape	Code	Check	Loc[in]	Lc	Shear	Check	Loc[in]	Dir	Lc	Pnc/Om[lb]	Pnt/Om[lb]	Mny/Om[lb-ft]	Mnz/Om[lb-ft]	Vny/Om[lb]	Vnz/Om[lb]	Cb	Eqn
1	M28	HR300	0.976	39.417	11	0.115	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
2	M73	HR300	0.976	39.417	11	0.115	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
3	M55	HR300	0.976	39.417	11	0.114	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
4	M34	HR300	0.976	39.417	11	0.114	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
5	M40	HR300	0.976	39.417	11	0.114	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
6	M49A	HR300	0.976	39.417	11	0.114	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
7	M46	HR300	0.976	39.417	11	0.114	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
8	M43	HR300	0.976	39.417	11	0.114	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
9	M52	HR300	0.976	39.417	11	0.113	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
10	M37	HR300	0.976	39.417	11	0.113	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
11	M70	HR300	0.976	39.417	11	0.113	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
12	M31	HR300	0.976	39.417	11	0.113	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.396	H.1-1	
13	M25	HR300	0.942	39.417	11	0.119	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.416	H.1-1	
14	M76	HR300	0.942	39.417	11	0.119	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.416	H.1-1	
15	M16	HR300	0.744	39.417	11	0.089	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.428	H.1-1	
16	M79	HR300	0.744	39.417	11	0.089	41.208	y	11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.428	H.1-1	



JOB NO.: U2716.0335.221

PROJECT: Sunturf Package A12

SUBJECT: SP CALCULATIONS

DESIGN APPROACH ASD

CONNECTION CAPACITY

Location: Column Base (set screws)

Connection Type: M16 Conical Set Screws

Tensile Capacity: 2600 lbs

Tension Load: 1603 lbs

Check Connection: 61.7%

Result: **Select M16 Conical Set Screws**Note: Uplift capacity. FOS of (2)

CONNECTION CAPACITY

Location: Column to Cross Beam

Connection Type: K10341-002

Tensile Capacity: 2195 lbs

Tension Load: 1132 lbs

Check Connection: 51.6%

Result: **Select K10341-002**Note: Uplift capacity. FOS of (2)



JOB NO.: U2716.0335.221

PROJECT: Sunturf Package A12

SUBJECT: SP CALCULATIONS

CONNECTION CAPACITY

Location: Brace to Column

Connection Type: K10219-001

Capacity: 1483 lbs

Tension Load: 1449 lbs

Check Connection: 97.7%

Result: **Select K10219-001**

Note: Axial capacity. FOS of (1.8)

BOLTED TENSION CONNECTION

Location: Rail to Cross Beam

Bolt Grade: A304 SS (A2-70)

Bolt Diameter: 0.375 in

Number of Bolts: 2

Bolt Capacity: 8410 lbs (AISC Equation J3-1)

Tension Load: 651 lbs

Check Bolt: 7.7%

Result: **Select (2) 0.375 in. dia. A304 SS (A2-70) bolts.**

Note:



JOB NO.: U2716.0330.221

PROJECT: Sunturf Package A7 - 2022

ALTERNATE FOUNDATION OPTION 1: DRILLED CONCRETE PIER



JOB NO.: U2716.0335.221
SUBJECT: CONC. PIER
 STD PANELS

PROJECT: Sunturf Package A12 Ground Mount

DRILLED CONCRETE PIER DESIGN

Column Reactions:

Max. Shear, V [k]:	1.2	Max. Down, P_d [k]:	2.7
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P_u [k]:	1.6

Pier Properties:

Pier Shape:	Round	Volume of Concrete [ft ³]:	8
Pier Diameter, b [ft]:	1.5	Volume of Concrete [yd ³]:	0.3
Top of Pier Elevation [ft]:	0.25	Weight of Concrete [k]:	1.3
Pier Depth, d [ft]:	4.5		

Soil Properties:

Allow. Bearing Pressure [psf]:	1,500
1/3 increase for short term loads?	No
Lateral Bearing, S [pcf]:	150
Max. Lateral Bearing (opt'l) [psf]:	
Top Depth to Ignore [ft]:	0
1/3 increase for short term loads?	No
1/2" deflection at t/o pier allowed:	Yes

Optional Parameters for Uplift:

Skin Friction* [psf]:	250
Top Length to Ignore [ft]:	0
1/3 increase for short term loads?	No
Combine w/ Bearing:	No

*per IBC Section 1810.3.3.1.4

Check Bearing:

Bearing Capacity [k]:	5.3
-----------------------	-----

Bearing capacity OK.

Check Uplift:

Uplift Capacity [k]:	6.4
----------------------	-----

Uplift capacity OK.

Check Lateral Bearing:

Top of Pier Constrained?:	No
Applied Lateral Force, P [lb]:	1,217
Point of Application, h [ft]:	0.3
S_{max} [psf]:	
S [psf]:	450
$A = 2.34 * P / (S_b)$:	4.22
Required Pier Depth, d_{reqd} [ft]:	4.50

IBC Section 1807.3.2.1

IBC Eq. 18-1

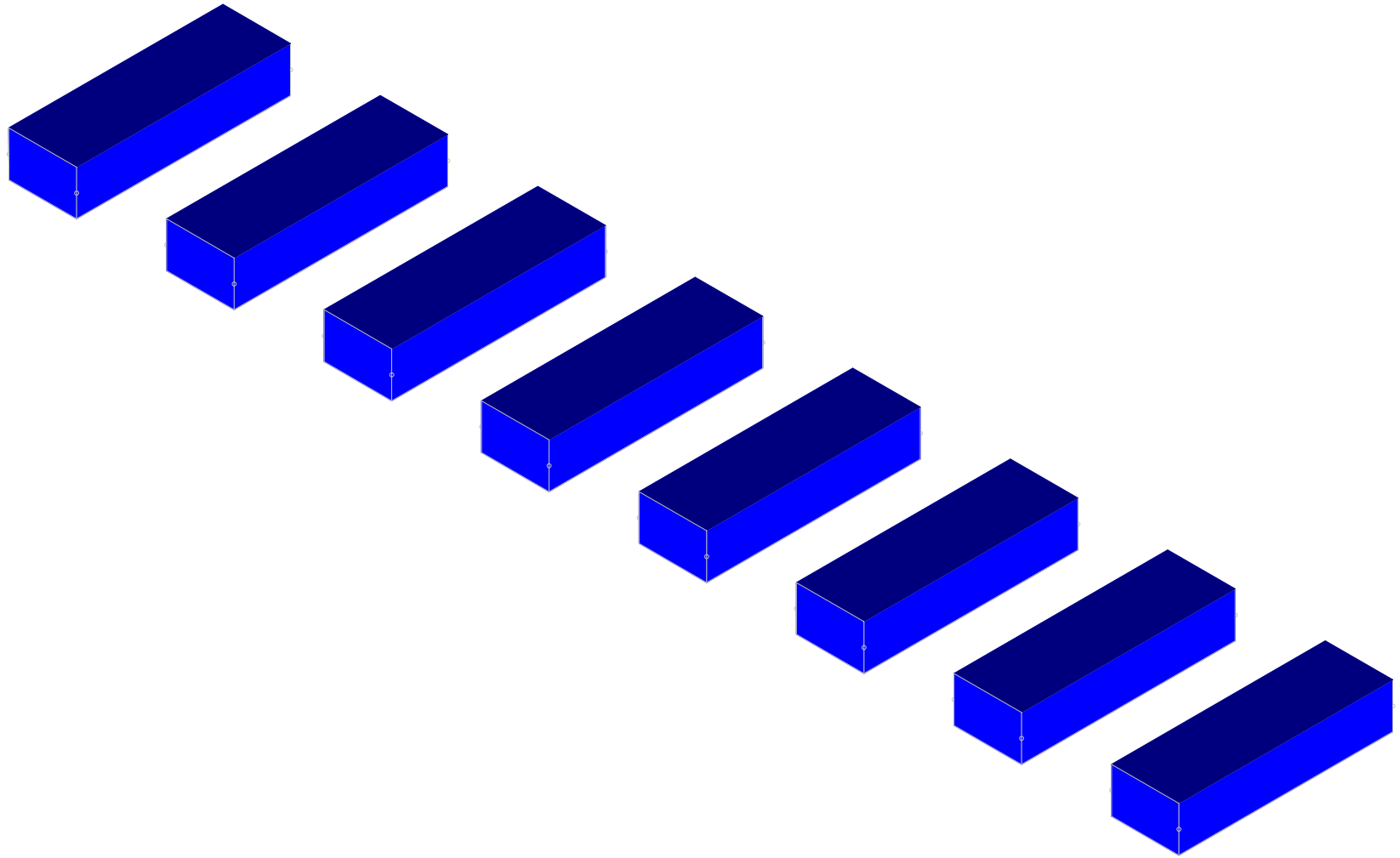
Result: **Lateral bearing capacity OK.**



JOB NO.: U2716.0330.221

PROJECT: Sunturf Package A7 - 2022

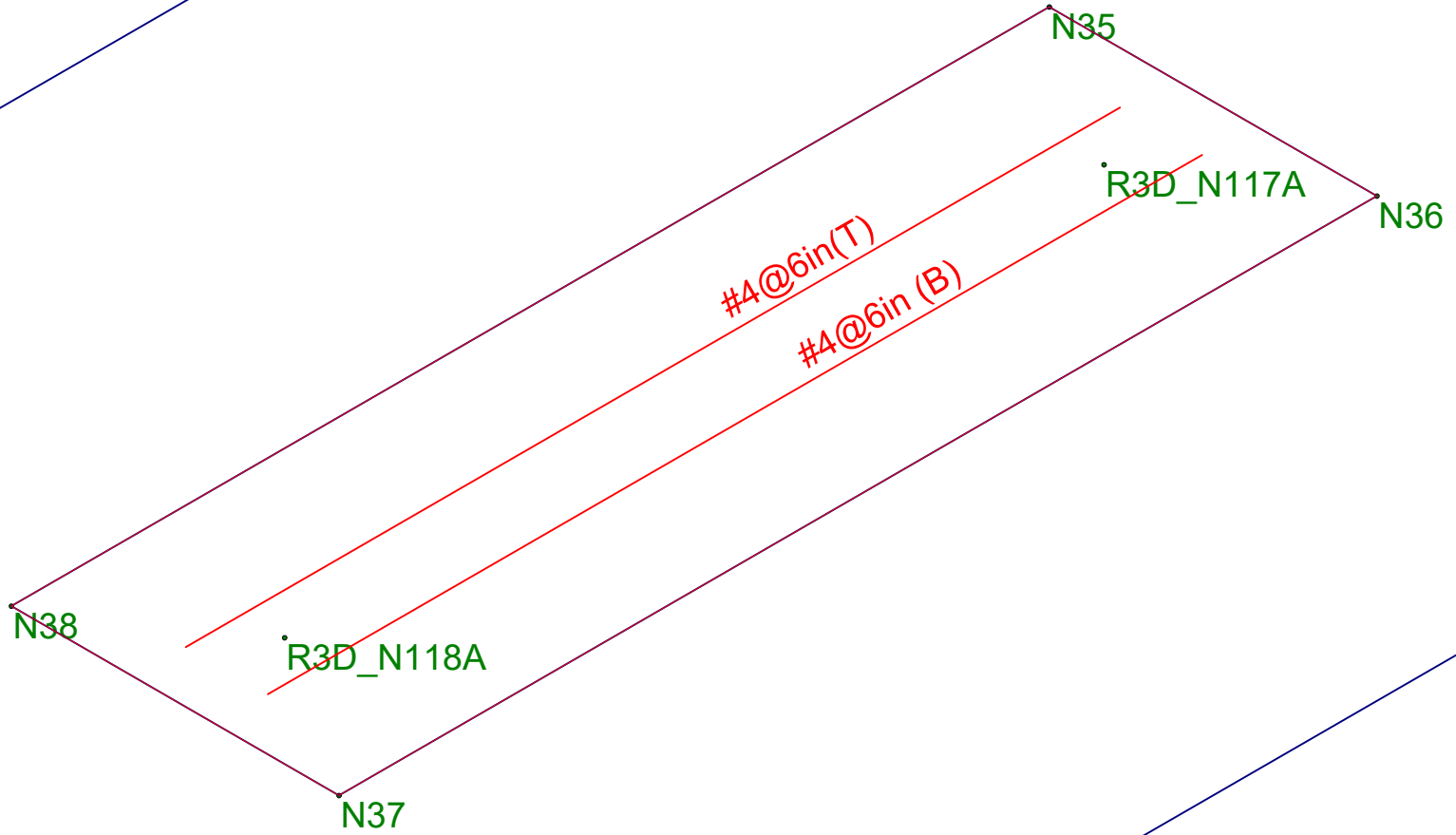
ALTERNATE FOUNDATION OPTION 2: CONCRETE BALLAST BLOCK



Vector Structural Engineering
MIH
U2716.0335.221

SunTurf A12

SK - 1
Mar 28, 2022 at 11:08 AM
Sunmodo Sunturf A12 - LF - 35 - 4L.r3d



Results for LC 2, 1.0 D

Vector Structural Engineering	SunTurf A12	SK - 2
MIH		Mar 28, 2022 at 11:08 AM
U2716.0335.221		Sunmodo Sunturf A12 - LF - 35 - 4L.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)	0.12
Solver	Sparse Accelerated
Coefficient of Friction	0.3
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	0.65
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 (/1...	Density[k/f...	f'c[psi]	Lambda	Flex Steel[...	Shear Ste...
1	Conc3000NW	3156	1372	0.15	0.6	0.145	3000	1	60000	60000
2	Conc3500NW	3409	1482	0.15	0.6	0.145	3500	1	60000	60000
3	Conc4000NW	3644	1584	0.15	0.6	0.145	4000	1	60000	60000
4	Conc3000LW	2085	907	0.15	0.6	0.11	3000	0.75	60000	60000
5	Conc3500LW	2252	979	0.15	0.6	0.11	3500	0.75	60000	60000
6	Conc4000LW	2408	1047	0.15	0.6	0.11	4000	0.75	60000	60000
7	Conc2500NW	2880	1253	0.15	0.6	0.145	2500	1	60000	60000

Slab Rebar Parameters

	Label	Top Bar Bottom ...	Max Top B...	Min Top Ba...	Max Bot Ba...	Min Bot Ba...	Spacing Incr...	Side Cover[in]	Rebar Options	
1	Longitu...	#4	#4	18	6	18	6	1	0	Optimize
2	Transve...	#4	#4	18	8	18	18	1	0	Optimize
3	Default	#5	#8	18	3	18	3	1	0	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.-ft]
1	R3D N1	X	-3.851
2	R3D N1	Y	206.902
3	R3D N2	X	-1.611
4	R3D N2	Y	179.144
5	R3D N115	Y	232.463
6	R3D N116	Y	219.552
7	R3D N99	Y	240.305
8	R3D N100	X	1.131
9	R3D N100	Y	224.341
10	R3D N105A	Y	232.454
11	R3D N106A	Y	219.57

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

	Label	Direction	Magnitude[lb,lb-ft]
12	R3D_N111A	Y	233.967
13	R3D_N112A	Y	220.468
14	R3D_N117A	Y	233.969
15	R3D_N118A	Y	220.472
16	R3D_N123	X	3.893
17	R3D_N123	Y	207.042
18	R3D_N124	X	1.633
19	R3D_N124	Y	179.008
20	R3D_N168	X	-1.155
21	R3D_N168	Y	224.448
22	R3D_N171	Y	240.151

Point Loads and Moments (Cat 6 : RLL)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1	X	-29.317
2	R3D_N1	Y	1252.377
3	R3D_N1	Z	-4.681
4	R3D_N2	X	-11.005
5	R3D_N2	Y	1216.024
6	R3D_N115	Y	1529.482
7	R3D_N116	X	-2.817
8	R3D_N116	Y	1539.8
9	R3D_N99	X	2.369
10	R3D_N99	Y	1527.688
11	R3D_N99	Z	3.396
12	R3D_N100	X	9.039
13	R3D_N100	Y	1575.442
14	R3D_N105A	Y	1529.353
15	R3D_N106A	X	2.727
16	R3D_N106A	Y	1539.965
17	R3D_N111A	Y	1535.796
18	R3D_N112A	X	1.253
19	R3D_N112A	Y	1546.117
20	R3D_N117A	Y	1535.797
21	R3D_N118A	X	-1.364
22	R3D_N118A	Y	1546.143
23	R3D_N123	X	29.623
24	R3D_N123	Y	1253.511
25	R3D_N123	Z	-4.72
26	R3D_N124	X	11.221
27	R3D_N124	Y	1214.768
28	R3D_N168	X	-9.246
29	R3D_N168	Y	1576.457
30	R3D_N171	X	-2.392
31	R3D_N171	Y	1526.613
32	R3D_N171	Z	3.338

Point Loads and Moments (Cat 21 : WLZ)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1	X	1.066
2	R3D_N1	Y	-77.893
3	R3D_N1	Z	81.936
4	R3D_N2	Y	75.977
5	R3D_N2	Z	-3.951
6	R3D_N115	Y	-92.697
7	R3D_N115	Z	98.853

Point Loads and Moments (Cat 21 : WLZ) (Continued)

	Label	Direction	Magnitude[lb,lb-ft]
8	R3D_N116	Y	92.681
9	R3D_N116	Z	-4.43
10	R3D_N99	Y	-94.146
11	R3D_N99	Z	101.972
12	R3D_N100	Y	95.995
13	R3D_N100	Z	-4.348
14	R3D_N105A	Y	-92.691
15	R3D_N105A	Z	98.85
16	R3D_N106A	Y	92.679
17	R3D_N106A	Z	-4.43
18	R3D_N111A	Y	-93.133
19	R3D_N111A	Z	99.419
20	R3D_N112A	Y	93.211
21	R3D_N112A	Z	-4.449
22	R3D_N117A	Y	-93.133
23	R3D_N117A	Z	99.42
24	R3D_N118A	Y	93.211
25	R3D_N118A	Z	-4.449
26	R3D_N123	X	-1.074
27	R3D_N123	Y	-77.902
28	R3D_N123	Z	81.932
29	R3D_N124	Y	75.975
30	R3D_N124	Z	-3.951
31	R3D_N168	Y	95.99
32	R3D_N168	Z	-4.348
33	R3D_N171	Y	-94.125
34	R3D_N171	Z	101.97

Point Loads and Moments (Cat 67 : OL1)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1	X	40.162
2	R3D_N1	Y	-2229.278
3	R3D_N1	Z	1356.025
4	R3D_N2	X	15.462
5	R3D_N2	Y	338.281
6	R3D_N2	Z	-74.519
7	R3D_N115	X	1.285
8	R3D_N115	Y	-2761.117
9	R3D_N115	Z	1709.817
10	R3D_N116	X	-1.376
11	R3D_N116	Y	438.996
12	R3D_N116	Z	-86.21
13	R3D_N99	X	-3.003
14	R3D_N99	Y	-2791.779
15	R3D_N99	Z	1761.772
16	R3D_N100	X	-1.447
17	R3D_N100	Y	461.435
18	R3D_N100	Z	-84.008
19	R3D_N105A	X	-1.235
20	R3D_N105A	Y	-2760.952
21	R3D_N105A	Z	1709.772
22	R3D_N106A	X	1.447
23	R3D_N106A	Y	438.943
24	R3D_N106A	Z	-86.209
25	R3D_N111A	Y	-2773.677
26	R3D_N111A	Z	1718.906

Point Loads and Moments (Cat 67 : OL1) (Continued)

	Label	Direction	Magnitude[lb.-lb-ft]
27	R3D_N112A	Y	441.218
28	R3D_N112A	Z	-86.711
29	R3D_N117A	Y	-2773.68
30	R3D_N117A	Z	1718.921
31	R3D_N118A	Y	441.224
32	R3D_N118A	Z	-86.712
33	R3D_N123	X	-40.543
34	R3D_N123	Y	-2229.955
35	R3D_N123	Z	1356.017
36	R3D_N124	X	-15.412
37	R3D_N124	Y	338.433
38	R3D_N124	Z	-74.518
39	R3D_N168	X	1.513
40	R3D_N168	Y	461.373
41	R3D_N168	Z	-84.007
42	R3D_N171	X	3.031
43	R3D_N171	Y	-2790.917
44	R3D_N171	Z	1761.732

Point Loads and Moments (Cat 68 : OL2)

	Label	Direction	Magnitude[lb.-lb-ft]
1	R3D_N1	X	49.608
2	R3D_N1	Y	-2460.24
3	R3D_N1	Z	1128.243
4	R3D_N2	X	10.879
5	R3D_N2	Y	863
6	R3D_N2	Z	-61.957
7	R3D_N115	X	1.549
8	R3D_N115	Y	-3021.77
9	R3D_N115	Z	1423.058
10	R3D_N116	X	-3.186
11	R3D_N116	Y	1089.465
12	R3D_N116	Z	-71.737
13	R3D_N99	X	-3.747
14	R3D_N99	Y	-3048.958
15	R3D_N99	Z	1465.885
16	R3D_N100	X	4.764
17	R3D_N100	Y	1133.166
18	R3D_N100	Z	-69.96
19	R3D_N105A	X	-1.487
20	R3D_N105A	Y	-3021.582
21	R3D_N105A	Z	1423.021
22	R3D_N106A	X	3.275
23	R3D_N106A	Y	1089.423
24	R3D_N106A	Z	-71.736
25	R3D_N111A	Y	-3035.803
26	R3D_N111A	Z	1430.02
27	R3D_N112A	X	1.046
28	R3D_N112A	Y	1095.631
29	R3D_N112A	Z	-72.137
30	R3D_N117A	Y	-3035.805
31	R3D_N117A	Z	1430.035
32	R3D_N118A	Y	1095.637
33	R3D_N118A	Z	-72.137
34	R3D_N123	X	-50.083
35	R3D_N123	Y	-2461.066

Point Loads and Moments (Cat 68 : OL2) (Continued)

	Label	Direction	Magnitude[lb,lb-ft]
36	R3D_N123	Z	1128.254
37	R3D_N124	X	-10.815
38	R3D_N124	Y	863.184
39	R3D_N124	Z	-61.956
40	R3D_N168	X	-4.682
41	R3D_N168	Y	1133.079
42	R3D_N168	Z	-69.959
43	R3D_N171	X	3.783
44	R3D_N171	Y	-3047.894
45	R3D_N171	Z	1465.842

Point Loads and Moments (Cat 69 : OL3)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1	X	-46.83
2	R3D_N1	Y	2599.422
3	R3D_N1	Z	-1581.176
4	R3D_N2	X	-18.029
5	R3D_N2	Y	-394.449
6	R3D_N2	Z	86.891
7	R3D_N115	X	-1.499
8	R3D_N115	Y	3219.566
9	R3D_N115	Z	-1993.711
10	R3D_N116	X	1.604
11	R3D_N116	Y	-511.886
12	R3D_N116	Z	100.524
13	R3D_N99	X	3.501
14	R3D_N99	Y	3255.32
15	R3D_N99	Z	-2054.292
16	R3D_N100	X	1.687
17	R3D_N100	Y	-538.051
18	R3D_N100	Z	97.957
19	R3D_N105A	X	1.44
20	R3D_N105A	Y	3219.374
21	R3D_N105A	Z	-1993.659
22	R3D_N106A	X	-1.688
23	R3D_N106A	Y	-511.824
24	R3D_N106A	Z	100.523
25	R3D_N111A	Y	3234.212
26	R3D_N111A	Z	-2004.309
27	R3D_N112A	Y	-514.477
28	R3D_N112A	Z	101.109
29	R3D_N117A	Y	3234.215
30	R3D_N117A	Z	-2004.327
31	R3D_N118A	Y	-514.483
32	R3D_N118A	Z	101.109
33	R3D_N123	X	47.275
34	R3D_N123	Y	2600.211
35	R3D_N123	Z	-1581.167
36	R3D_N124	X	17.971
37	R3D_N124	Y	-394.626
38	R3D_N124	Z	86.89
39	R3D_N168	X	-1.765
40	R3D_N168	Y	-537.978
41	R3D_N168	Z	97.956
42	R3D_N171	X	-3.534
43	R3D_N171	Y	3254.315



Point Loads and Moments (Cat 69 : OL3) (Continued)

	Label	Direction	Magnitude[lb.-ft]
44	R3D_N171	Z	-2054.246

Point Loads and Moments (Cat 70 : OL4)

	Label	Direction	Magnitude[lb.-ft]
1	R3D_N1	X	-28.002
2	R3D_N1	Y	1814.47
3	R3D_N1	Z	-1430.287
4	R3D_N2	X	-18.07
5	R3D_N2	Y	158.901
6	R3D_N2	Z	78.639
7	R3D_N115	Y	2269.881
8	R3D_N115	Z	-1803.052
9	R3D_N116	Y	179.187
10	R3D_N116	Z	90.924
11	R3D_N99	X	2.06
12	R3D_N99	Y	2300.737
13	R3D_N99	Z	-1858.207
14	R3D_N100	X	6.819
15	R3D_N100	Y	177.716
16	R3D_N100	Z	88.553
17	R3D_N105A	Y	2269.753
18	R3D_N105A	Z	-1803.006
19	R3D_N106A	Y	179.245
20	R3D_N106A	Z	90.923
21	R3D_N111A	Y	2279.953
22	R3D_N111A	Z	-1813.171
23	R3D_N112A	Y	180.671
24	R3D_N112A	Z	91.468
25	R3D_N117A	Y	2279.956
26	R3D_N117A	Z	-1813.185
27	R3D_N118A	Y	180.667
28	R3D_N118A	Z	91.468
29	R3D_N123	X	28.265
30	R3D_N123	Y	1814.951
31	R3D_N123	Z	-1430.262
32	R3D_N124	X	18.037
33	R3D_N124	Y	158.792
34	R3D_N124	Z	78.637
35	R3D_N168	X	-6.865
36	R3D_N168	Y	177.751
37	R3D_N168	Z	88.552
38	R3D_N171	X	-2.079
39	R3D_N171	Y	2300.136
40	R3D_N171	Z	-1858.175

Slabs

	Label	Thickness [in]	Material	Local Axis Angle ...	Analysis Offset [in]	Passive Pressure [psf]	Soil Overb...	Icr Factor
1	S1	24	Conc2500NW	0	0	0	0	0.25
2	S2	24	Conc2500NW	0	0	0	0	0.25
3	S3	24	Conc2500NW	0	0	0	0	0.25
4	S4	24	Conc2500NW	0	0	0	0	0.25
5	S5	24	Conc2500NW	0	0	0	0	0.25
6	S6	24	Conc2500NW	0	0	0	0	0.25
7	S7	24	Conc2500NW	0	0	0	0	0.25
8	S8	24	Conc2500NW	0	0	0	0	0.25



Load Combinations

Label	Solve	Service A...	SF	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...	Ca...Fa...
ASD Loads																	
1	1.0 D	Yes	Yes	1.5	DL	1											
3	1.0 D + 1.0 S	Yes	Yes	1.5	DL	1	RLL	1									
4	1.0 D + 0.6 W1	Yes	Yes	1.5	DL	1	RLL		OL1	0.6	WLZ	0.6					
5	1.0 D + 0.6 W2	Yes	Yes	1.5	DL	1	RLL		OL2	0.6	WLZ	0.6					
6	1.0 D + 0.6 W3	Yes	Yes	1.5	DL	1	RLL		OL3	0.6	WLZ	-0.6					
7	1.0 D + 0.6 W4	Yes	Yes	1.5	DL	1	RLL		OL4	0.6	WLZ	-0.6					
8	1.0 D + 0.45 ...	Yes	Yes	1.5	DL	1	RLL	0.75	OL1	0.45	WLZ	0.6					
9	1.0 D + 0.45 ...	Yes	Yes	1.5	DL	1	RLL	0.75	OL2	0.45	WLZ	0.6					
10	1.0 D + 0.45 ...	Yes	Yes	1.5	DL	1	RLL	0.75	OL3	0.45	WLZ	-0.6					
11	1.0 D + 0.45 ...	Yes	Yes	1.5	DL	1	RLL	0.75	OL4	0.45	WLZ	-0.6					
12	0.6 D + 0.6 W1	Yes	Yes		DL	0.6	RLL		OL1	0.6	WLZ	0.6					
13	0.6 D + 0.6 W2	Yes	Yes		DL	0.6	RLL		OL2	0.6	WLZ	0.6					
14	0.6 D + 0.6 W3	Yes	Yes		DL	0.6	RLL		OL3	0.6	WLZ	-0.6					
15	0.6 D + 0.6 W4	Yes	Yes		DL	0.6	RLL		OL4	0.6	WLZ	-0.6					
16																	
LRFD Loads																	
18	1.4 D	Yes			DL	1.4	RLL										
19	1.2 D + 1.6 S ...	Yes			DL	1.2	RLL	1.6	OL1	0.5							
20	1.2 D + 1.6 S ...	Yes			DL	1.2	RLL	1.6	OL2	0.5							
21	1.2 D + 1.6 S ...	Yes			DL	1.2	RLL	1.6	OL3	0.5							
22	1.2 D + 1.6 S ...	Yes			DL	1.2	RLL	1.6	OL4	0.5							
23	1.2 D + 1.0 W1	Yes			DL	1.2	RLL		OL1	1							
24	1.2 D + 1.0 W2	Yes			DL	1.2	RLL		OL2	1							
25	1.2 D + 1.0 W3	Yes			DL	1.2	RLL		OL3	1							
26	1.2 D + 1.0 W4	Yes			DL	1.2	RLL		OL4	1							
27	0.9 D + 1.0 W1	Yes			DL	0.9	RLL		OL1	1							
28	0.9 D + 1.0 W2	Yes			DL	0.9	RLL		OL2	1							
29	0.9 D + 1.0 W3	Yes			DL	0.9	RLL		OL3	1							
30	0.9 D + 1.0 W4	Yes			DL	0.9	RLL		OL4	1							

Design Strips

Label	Rebar Angle from PI...	No. of Design Cuts	Design Rule
1 DS1	0	50	Longitudinal

Load Categories

Category	Point Loads	Line Loads	Area Loads
1 DL	22		
2 RLL	32		
3 WLZ	34		
4 OL1	44		
5 OL2	45		
6 OL3	44		
7 OL4	40		

Strip Reinforcing

Label	UC Top	LC	Top Bars	Governin...	UC Bot	LC	Bot Bars/...	Governing D...	UC Shear	LC	Governin...
1 DS1	0.043	21	#4@6in	DS1-X25	0.021	28	#4@6in	DS1-X21	0.045	21	DS1-X10

Slab Overturning Safety Factors

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	40988.513	0	12987.515	9.99+	9.99+
2 2	S2	0	0	41406.088	0	13092.229	9.99+	9.99+
3 2	S3	0	0	41357.689	0	13075.558	9.99+	9.99+
4 2	S4	0	0	41366.835	0	13079.175	9.99+	9.99+



Slab Overturning Safety Factors (Continued)

	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
5	2	S5	0	0	41366.863	0	13079.182	9.99+	9.99+
6	2	S6	0	0	41357.542	0	13075.545	9.99+	9.99+
7	2	S7	0	0	41406.847	0	13096.731	9.99+	9.99+
8	2	S8	0	0	40987.499	0	12965.544	9.99+	9.99+
9	3	S1	0	0	52567.722	0	16770.761	9.99+	9.99+
10	3	S2	0	0	56331.814	0	17724.109	9.99+	9.99+
11	3	S3	0	0	55976.731	0	17674.081	9.99+	9.99+
12	3	S4	0	0	56044.612	0	17699.539	9.99+	9.99+
13	3	S5	0	0	56044.861	0	17704.82	9.99+	9.99+
14	3	S6	0	0	55975.314	0	17685.103	9.99+	9.99+
15	3	S7	0	0	56340.008	0	17774.613	9.99+	9.99+
16	3	S8	0	0	52557.092	0	16586.275	9.99+	9.99+
17	4	S1	0	13149.428	41196.704	1771.65	12987.515	3.133	7.331
18	4	S2	0	16514.251	41525.832	2102.649	13098.417	2.515	6.229
19	4	S3	0	16296.215	41454.325	2090.074	13075.558	2.544	6.256
20	4	S4	0	16372.703	41468.087	2099.213	13079.246	2.533	6.231
21	4	S5	0	16372.729	41468.103	2099.21	13079.253	2.533	6.231
22	4	S6	0	16297.11	41454.386	2090.031	13075.545	2.544	6.256
23	4	S7	0	16509.744	41524.629	2102.043	13098.41	2.515	6.231
24	4	S8	0	13152.821	41197.762	1772.538	12987.651	3.132	7.327
25	5	S1	0	13754.238	41196.704	1513.104	12987.515	2.995	8.583
26	5	S2	0	17084.613	41525.832	1725.432	13093.893	2.431	7.589
27	5	S3	0	16908.402	41454.325	1741.101	13075.558	2.452	7.51
28	5	S4	0	16987.72	41468.087	1747.411	13079.246	2.441	7.485
29	5	S5	0	16987.742	41468.103	1746.151	13079.253	2.441	7.49
30	5	S6	0	16909.416	41454.386	1741.054	13075.545	2.452	7.51
31	5	S7	0	17079.086	41524.629	1724.413	13093.789	2.431	7.593
32	5	S8	0	13758.394	41197.762	1514.193	12987.651	2.994	8.577
33	6	S1	0	2679.512	40988.513	0	15052.827	9.99+	9.99+
34	6	S2	0	3688.714	41406.088	1.664	15531.544	9.99+	9.99+
35	6	S3	0	3480.798	41357.689	0	15512.661	9.99+	9.99+
36	6	S4	0	3500.616	41366.835	0.07	15526.937	9.99+	9.99+
37	6	S5	0	3500.668	41366.863	0.071	15526.941	9.99+	9.99+
38	6	S6	0	3481.076	41357.542	0	15512.345	9.99+	9.99+
39	6	S7	0	3688.878	41406.847	1.679	15530.455	9.99+	9.99+
40	6	S8	0	2679.91	40987.499	0	14872.721	9.99+	9.99+
41	7	S1	0	434.329	41265.607	0	14821.84	9.99+	9.99+
42	7	S2	0	550.236	41569.293	1.664	15312.182	9.99+	9.99+
43	7	S3	0	530.35	41579.187	0	15279.668	9.99+	9.99+
44	7	S4	0	533.463	41590.179	0.07	15293.737	9.99+	9.99+
45	7	S5	0	533.464	41590.172	0.071	15293.743	9.99+	9.99+
46	7	S6	0	530.365	41578.763	0	15279.72	9.99+	9.99+
47	7	S7	0	550.223	41569.906	1.679	15311.476	9.99+	9.99+
48	7	S8	0	434.309	41264.354	0	14686.796	9.99+	9.99+
49	8	S1	0	9973.384	50099.685	1329.488	15824.95	5.023	9.99+
50	8	S2	0	12520.612	52441.38	1576.987	16606.551	4.188	9.99+
51	8	S3	0	12354.766	52358.972	1567.558	16524.45	4.238	9.99+
52	8	S4	0	12412.782	52418.425	1574.41	16544.519	4.223	9.99+
53	8	S5	0	12412.801	52418.462	1574.408	16544.389	4.223	9.99+
54	8	S6	0	12355.446	52359.735	1567.527	16524.262	4.238	9.99+
55	8	S7	0	12517.205	52434.174	1576.532	16606.821	4.189	9.99+
56	8	S8	0	9975.938	50107.089	1330.159	15825.731	5.023	9.99+
57	9	S1	0	10426.991	50099.685	1135.579	15824.95	4.805	9.99+
58	9	S2	0	12948.383	52441.38	1294.074	16567.803	4.05	9.99+
59	9	S3	0	12813.907	52358.972	1305.828	16524.45	4.086	9.99+
60	9	S4	0	12874.044	52418.425	1310.558	16544.519	4.072	9.99+
61	9	S5	0	12874.061	52418.462	1309.614	16544.389	4.072	9.99+

Slab Overturning Safety Factors (Continued)

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	
62	9	S6	0	12814.676	52359.735	1305.794	16524.262	4.086	9.99+
63	9	S7	0	12944.212	52434.174	1293.31	16567.286	4.051	9.99+
64	9	S8	0	10430.118	50107.089	1136.401	15825.731	4.804	9.99+
65	10	S1	0	2118.216	49672.92	0	17374.684	9.99+	9.99+
66	10	S2	0	2904.095	52600.383	1.664	18395.625	9.99+	9.99+
67	10	S3	0	2743.186	52321.97	0	18352.28	9.99+	9.99+
68	10	S4	0	2758.828	52375.168	0.07	18380.269	9.99+	9.99+
69	10	S5	0	2758.867	52375.362	0.071	18380.137	9.99+	9.99+
70	10	S6	0	2743.398	52320.871	0	18360.317	9.99+	9.99+
71	10	S7	0	2904.214	52606.718	1.679	18394.365	9.99+	9.99+
72	10	S8	0	2118.51	49664.694	0	17111.587	9.99+	9.99+
73	11	S1	0	434.329	49880.74	0	17201.444	9.99+	9.99+
74	11	S2	0	550.236	52722.787	1.664	18231.104	9.99+	9.99+
75	11	S3	0	530.35	52488.094	0	18177.535	9.99+	9.99+
76	11	S4	0	533.463	52542.676	0.07	18205.37	9.99+	9.99+
77	11	S5	0	533.464	52542.843	0.071	18205.238	9.99+	9.99+
78	11	S6	0	530.365	52486.787	0	18185.849	9.99+	9.99+
79	11	S7	0	550.223	52729.012	1.679	18230.131	9.99+	9.99+
80	11	S8	0	434.309	49872.335	0	16972.143	9.99+	9.99+
81	12	S1	0	13149.428	24718.022	1771.65	7792.509	1.88	4.398
82	12	S2	0	16514.251	24915.499	2102.649	7859.716	1.509	3.738
83	12	S3	0	16296.215	24872.595	2090.074	7845.335	1.526	3.754
84	12	S4	0	16372.703	24880.852	2099.213	7847.575	1.52	3.738
85	12	S5	0	16372.729	24880.862	2099.21	7847.58	1.52	3.738
86	12	S6	0	16297.11	24872.632	2090.031	7845.327	1.526	3.754
87	12	S7	0	16509.744	24914.777	2102.043	7859.717	1.509	3.739
88	12	S8	0	13152.821	24718.657	1772.538	7792.591	1.879	4.396
89	13	S1	0	13754.238	24718.022	1513.104	7792.509	1.797	5.15
90	13	S2	0	17084.613	24915.499	1725.432	7857.002	1.458	4.554
91	13	S3	0	16908.402	24872.595	1741.101	7845.335	1.471	4.506
92	13	S4	0	16987.72	24880.852	1747.411	7847.575	1.465	4.491
93	13	S5	0	16987.742	24880.862	1746.151	7847.58	1.465	4.494
94	13	S6	0	16909.416	24872.632	1741.054	7845.327	1.471	4.506
95	13	S7	0	17079.086	24914.777	1724.413	7856.945	1.459	4.556
96	13	S8	0	13758.394	24718.657	1514.193	7792.591	1.797	5.146
97	14	S1	0	2679.512	24593.108	0	9857.821	9.178	9.99+
98	14	S2	0	3688.714	24843.653	1.664	10294.652	6.735	9.99+
99	14	S3	0	3480.798	24814.613	0	10282.438	7.129	9.99+
100	14	S4	0	3500.616	24820.101	0.07	10295.267	7.09	9.99+
101	14	S5	0	3500.668	24820.118	0.071	10295.268	7.09	9.99+
102	14	S6	0	3481.076	24814.525	0	10282.127	7.128	9.99+
103	14	S7	0	3688.878	24844.108	1.679	10293.611	6.735	9.99+
104	14	S8	0	2679.91	24592.5	0	9686.504	9.177	9.99+
105	15	S1	0	434.329	24870.202	0	9626.834	9.99+	9.99+
106	15	S2	0	550.236	25006.858	1.664	10075.291	9.99+	9.99+
107	15	S3	0	530.35	25036.112	0	10049.445	9.99+	9.99+
108	15	S4	0	533.463	25043.445	0.07	10062.067	9.99+	9.99+
109	15	S5	0	533.464	25043.427	0.071	10062.07	9.99+	9.99+
110	15	S6	0	530.365	25035.747	0	10049.502	9.99+	9.99+
111	15	S7	0	550.223	25007.167	1.679	10074.632	9.99+	9.99+
112	15	S8	0	434.309	24869.354	0	9500.579	9.99+	9.99+

Slab Sliding Safety Factors

LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz	
1	2	S1	0	5.462	2595.318	0	2595.318	9.99+	9.99+
2	2	S2	0	1.131	2618.898	0	2618.898	9.99+	9.99+



Envelope Slab Soil Pressures

	Label	Max UC	Max LC	Soil Pressure[psf]	Allowable Bearing[psf]	Point
1	S1	0.352	10	527.722	1500	N230
2	S2	0.387	10	580.804	1500	N237
3	S3	0.386	10	578.831	1500	N244
4	S4	0.387	10	580.208	1500	N251
5	S5	0.387	10	580.208	1500	N258
6	S6	0.386	10	578.862	1500	N265
7	S7	0.387	10	580.596	1500	N272
8	S8	0.352	10	527.933	1500	N279



JOB NO.: U2716.0330.221

PROJECT: Sunturf Package A7 - 2022

ANCHORAGE DESIGN FOR CONCRETE BALLAST BLOCK

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
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	0.6	WLZ	0.6
5	1.0 D + 0.6 W2		Y	DL	1	RLL		OL2	0.6	WLZ	0.6
6	1.0 D + 0.6 W3		Y	DL	1	RLL		OL3	0.6	WLZ	-0.6
7	1.0 D + 0.6 W4		Y	DL	1	RLL		OL4	0.6	WLZ	-0.6
8	1.0 D + 0.45 W1 + 0.75 S		Y	DL	1	RLL	0.75	OL1	0.45	WLZ	0.6
9	1.0 D + 0.45 W2 + 0.75 S		Y	DL	1	RLL	0.75	OL2	0.45	WLZ	0.6
10	1.0 D + 0.45 W3 + 0.75 S		Y	DL	1	RLL	0.75	OL3	0.45	WLZ	-0.6
11	1.0 D + 0.45 W4 + 0.75 S		Y	DL	1	RLL	0.75	OL4	0.45	WLZ	-0.6
12	0.6 D + 0.6 W1		Y	DL	0.6	RLL		OL1	0.6	WLZ	0.6
13	0.6 D + 0.6 W2		Y	DL	0.6	RLL		OL2	0.6	WLZ	0.6
14	0.6 D + 0.6 W3		Y	DL	0.6	RLL		OL3	0.6	WLZ	-0.6
15	0.6 D + 0.6 W4		Y	DL	0.6	RLL		OL4	0.6	WLZ	-0.6
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	0.5	WLZ	0.5
20	1.2 D + 1.6 S + 0.5 W2	Yes	Y	DL	1.2	RLL	1.6	OL2	0.5	WLZ	0.5
21	1.2 D + 1.6 S + 0.5 W3	Yes	Y	DL	1.2	RLL	1.6	OL3	0.5	WLZ	-0.5
22	1.2 D + 1.6 S + 0.5 W4	Yes	Y	DL	1.2	RLL	1.6	OL4	0.5	WLZ	-0.5
23	1.2 D + 1.0 W1	Yes	Y	DL	1.2	RLL		OL1	1	WLZ	1
24	1.2 D + 1.0 W2	Yes	Y	DL	1.2	RLL		OL2	1	WLZ	1
25	1.2 D + 1.0 W3	Yes	Y	DL	1.2	RLL		OL3	1	WLZ	-1
26	1.2 D + 1.0 W4	Yes	Y	DL	1.2	RLL		OL4	1	WLZ	-1
27	0.9 D + 1.0 W1	Yes	Y	DL	0.9	RLL		OL1	1	WLZ	1
28	0.9 D + 1.0 W2	Yes	Y	DL	0.9	RLL		OL2	1	WLZ	1
29	0.9 D + 1.0 W3	Yes	Y	DL	0.9	RLL		OL3	1	WLZ	-1
30	0.9 D + 1.0 W4	Yes	Y	DL	0.9	RLL		OL4	1	WLZ	-1

Envelope Node Reactions

	Node Label	X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2	max	29.102	21	2645.773	20	79.857	23	0	30	0	30	30
2		min	-14.265	27	-323.704	29	-90.384	25	0	18	0	18	18
3	N1	max	50.284	21	3560.121	21	1661.008	25	0	30	0	30	30
4		min	-54.682	28	-2357.192	28	-1439.232	27	0	18	0	18	18
5	N115	max	1.641	21	4383.029	21	2090.595	25	0	30	0	30	30
6		min	-1.597	28	-2899.769	28	-1811.453	23	0	18	0	18	18
7	N116	max	6.454	20	3334.651	20	92.837	23	0	30	0	30	30
8		min	-1.551	29	-421.574	29	-105.061	25	0	18	0	18	18
9	N99	max	3.272	28	4456.989	21	2160.142	25	0	30	0	30	30
10		min	-6.66	21	-2906.915	28	-1865.501	23	0	18	0	18	18
11	N100	max	0.098	27	3424.757	20	90.655	23	0	30	0	30	30
12		min	-19.089	22	-451.684	29	-102.51	25	0	18	0	18	18
13	N105A	max	1.469	28	4382.857	21	2090.539	25	0	30	0	30	30
14		min	-2.05	21	-2899.555	28	-1811.402	23	0	18	0	18	18
15	N106A	max	1.73	29	3334.926	20	92.836	23	0	30	0	30	30
16		min	-6.377	20	-421.478	29	-105.061	25	0	18	0	18	18
17	N111A	max	0.529	28	4409.558	21	2103.778	25	0	30	0	30	30
18		min	-1.154	21	-2910.716	28	-1820.656	23	0	18	0	18	18
19	N112A	max	0.141	29	3350.598	20	93.403	23	0	30	0	30	30
20		min	-2.748	20	-426.778	29	-105.56	25	0	18	0	18	18
21	N117A	max	0.738	21	4409.598	21	2103.798	25	0	30	0	30	30

Envelope Node Reactions (Continued)

Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
22		min	28	-0.653	28	-2910.709	28	-1820.67	23	0	18	0	18
23	N118A	max	20	2.863	20	3350.651	20	93.403	23	0	30	0	30
24		min	29	0.039	29	-426.779	29	-105.561	25	0	18	0	18
25	N123	max	28	55.156	28	3560.648	21	1661.003	25	0	30	0	30
26		min	21	-50.389	21	-2358.054	28	-1439.22	27	0	18	0	18
27	N124	max	27	14.218	27	2643.602	20	79.856	23	0	30	0	30
28		min	22	-29.263	22	-324.086	29	-90.38	25	0	18	0	18
29	N168	max	22	19.634	22	3426.49	20	90.654	23	0	30	0	30
30		min	27	-0.112	27	-451.459	29	-102.511	25	0	18	0	18
31	N171	max	21	6.216	21	4456.416	21	2160.089	25	0	30	0	30
32		min	28	-3.367	28	-2905.801	28	-1865.456	23	0	18	0	18
33	Totals:	max	21	0.007	21	52079.071	21	15223.925	25				
34		min	28	-0.002	28	-14588.619	27	-13160.065	27				



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Software
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Company:	Vector Structural Engineers	Date:	3/17/2022
Engineer:	MIH	Page:	1/6
Project:	Sunturf Ground Mount A12		
Address:			
Phone:			
E-mail:			

1. Project information

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

Project description:
Location:
Fastening description: Anchorage to concrete ballast block

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): 0.375
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): 1.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 24.00
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. 36
Code Report: ICC-ES ESR-4057



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Address:			
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Load and Geometry

Load factor source: ACI 318 Section 5.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: No

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 2911

V_{uax} [lb]: 56

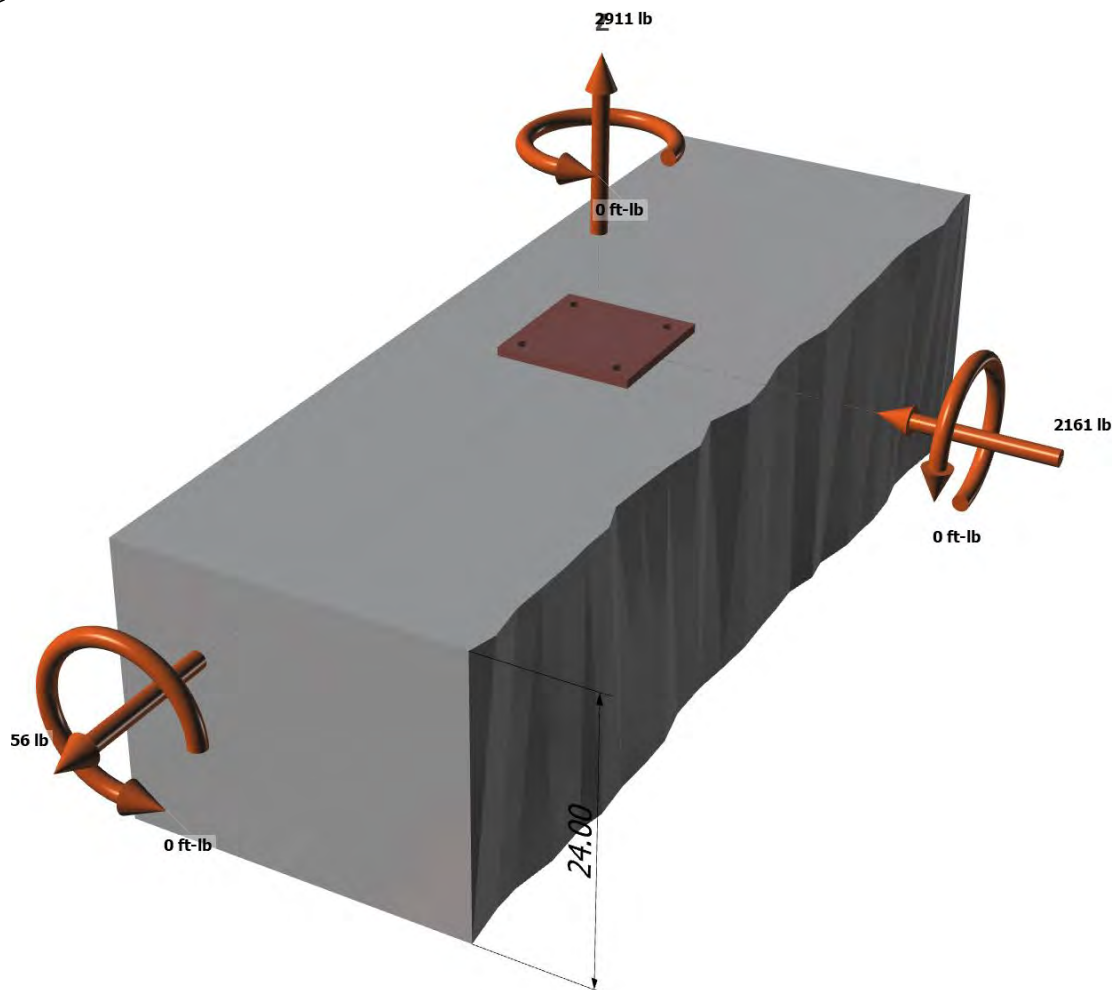
V_{uay} [lb]: -2161

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

<Figure 1>



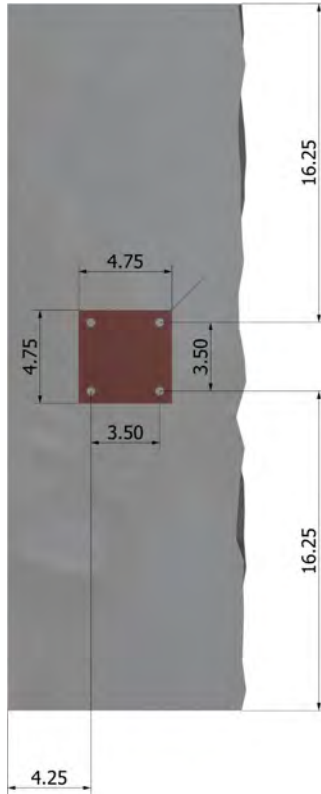
Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



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<Figure 2>





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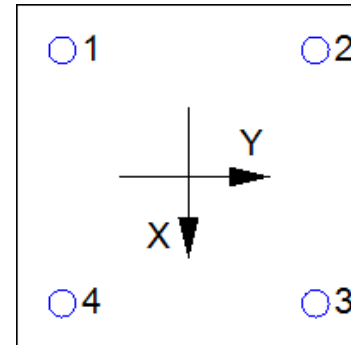
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3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	727.8	14.0	-540.3	540.4
2	727.8	14.0	-540.3	540.4
3	727.8	14.0	-540.3	540.4
4	727.8	14.0	-540.3	540.4
Sum	2911.0	56.0	-2161.0	2161.7

Maximum concrete compression strain (%): 0.00
 Maximum concrete compression stress (psi): 0
 Resultant tension force (lb): 2911
 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)
4525	0.75	3394

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)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cbg} (lb)
213.13	144.00	4.25	1.000	0.913	1.00	1.000	6800	0.65	5969

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

$$\tau_{k,cr} = \tau_{k,cr,short-term} K_{sat} (f'_c / 2,500)^0$$

$\tau_{k,cr}$ (psi)	$f_{short-term}$	K_{sat}	f'_c (psi)	n	$\tau_{k,cr}$ (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)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	ϕ	ϕN_{ag} (lb)
183.75	112.09	5.29	4.25	1.000	0.941	1.000	6343	0.55	5381

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



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

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
2715	1.0	0.65	1765

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

Shear perpendicular to edge in x-direction:

$$V_{bx} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f_c}c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.00	0.375	1.00	2500	19.75	28514

$$\phi V_{cbgx} = \phi (A_{vc}/A_{vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{bx} \text{ (Sec. 17.3.1 \& Eq. 17.5.2.1b)}$$

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)
897.00	1755.28	1.000	0.743	1.000	1.111	28514	0.70	8420

Shear perpendicular to edge in y-direction:

$$V_{by} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f_c}c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{by} (lb)
3.00	0.375	1.00	2500	4.25	2846

$$\phi V_{cbgy} = \phi (A_{vc}/A_{vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{by} \text{ (Sec. 17.3.1 \& Eq. 17.5.2.1b)}$$

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)
103.59	81.28	1.000	1.000	1.000	1.000	2846	0.70	2539

Shear parallel to edge in x-direction:

$$V_{by} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f_c}c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{by} (lb)
3.00	0.375	1.00	2500	4.25	2846

$$\phi V_{cbgx} = \phi (2)(A_{vc}/A_{vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{by} \text{ (Sec. 17.3.1, 17.5.2.1(c) \& Eq. 17.5.2.1b)}$$

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)
103.59	81.28	1.000	1.000	1.000	1.000	2846	0.70	5079

Shear parallel to edge in y-direction:

$$V_{bx} = \min[7(l_e/d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f_c}c_{a1}^{1.5}; 9\lambda_a\sqrt{f_c}c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.00	0.375	1.00	2500	16.25	21280

$$\phi V_{cbgy} = \phi (2)(A_{vc}/A_{vco})\Psi_{ec,v}\Psi_{ed,v}\Psi_{c,v}\Psi_{h,v}V_{bx} \text{ (Sec. 17.3.1, 17.5.2.1(c) \& Eq. 17.5.2.1b)}$$

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)
771.00	1188.28	1.000	1.000	1.000	1.008	21280	0.70	19481

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

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

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	183.75	112.09	0.941	1.000	1.000	6343	9783

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
213.13	144.00	1.000	0.913	1.000	1.000	6800	9184	0.70

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



Anchor Designer™
Software
Version 2.9.7376.0

Company:	Vector Structural Engineers	Date:	3/17/2022
Engineer:	MIH	Page:	6/6
Project:	Sunturf Ground Mount A12		
Address:			
Phone:			
E-mail:			

ϕV_{cpq} (lb)
12857

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	728	3394	0.21	Pass	
Concrete breakout	2911	5969	0.49	Pass	
Adhesive	2911	5381	0.54	Pass (Governs)	
Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status	
Steel	540	1765	0.31	Pass	
T Concrete breakout x+	56	8420	0.01	Pass	
T Concrete breakout y-	1081	2539	0.43	Pass	
Concrete breakout y-	28	5079	0.01	Pass	
Concrete breakout x-	1081	19481	0.06	Pass	
Concrete breakout, combined	-	-	0.43	Pass (Governs)	
Pryout	2162	12857	0.17	Pass	
Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.36	0.24	60.0%	1.0	Pass

SET-3G w/ 3/8"Ø F1554 Gr. 36 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.

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

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