



Project Number: U2716.0389.241

May 20, 2024

Sunmodo  
14800 NE 65<sup>th</sup> Street  
Vancouver, WA 98682

**REFERENCE: SunModo Sunturf Ground Mount D7 – Large Format Panels  
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 2023 Florida Building Code (2021 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. This document does not address site-specific installations. The following design parameters are used in our analysis:

- Minimum Design Loads for Buildings and Other Structures (ASCE 7-22)
- Design wind speed for risk category I structures: 120 mph
- Wind exposure: C
- Ground snow load: 0 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	2443	1.5	3665
LATERAL	1347	2	2694

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 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.

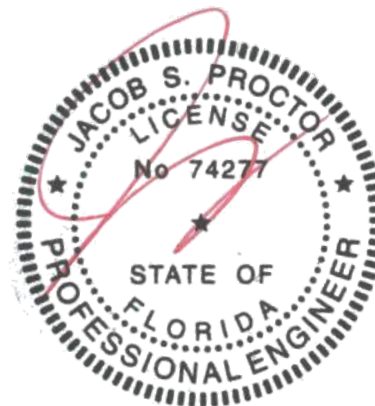
Very truly yours,

VECTOR STRUCTURAL ENGINEERING, LLC

\_\_\_\_\_  
Jacob Proctor, P.E.  
License: 74277 - Expires: 02/28/2025  
Project Engineer

Enclosures

JSP/cjt



05/20/2024

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No. 74277



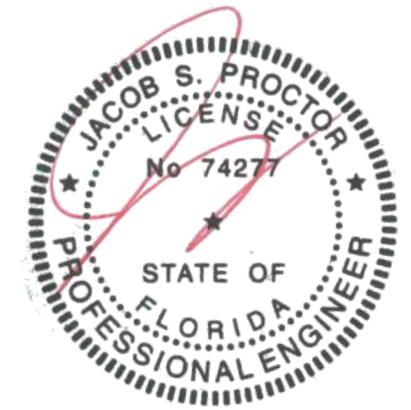
JOB NO. U2716.0389.241  
 PROJECT SUNMODO SUNTURF GROUND MOUNT D7  
 SUBJECT ALL OPTIONS

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

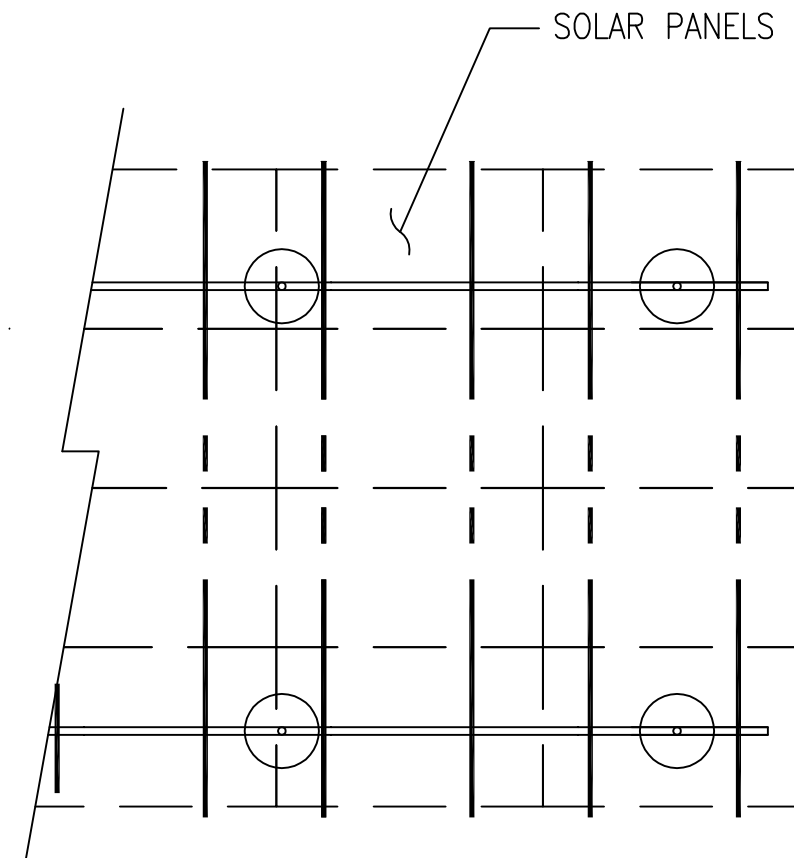
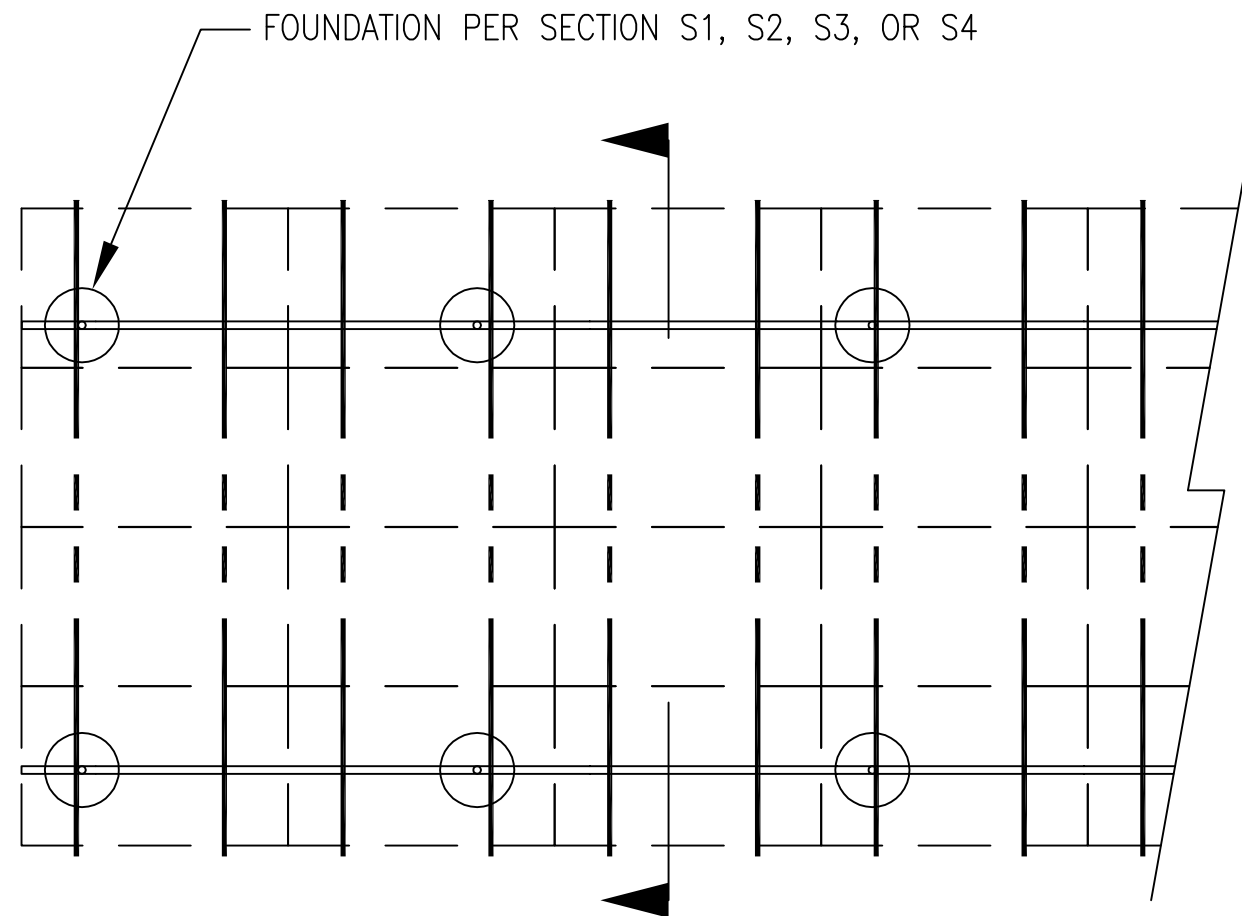
**NOTES:**

- SEE SUNMODO SHOP DRAWINGS FOR GROUND MOUNT MEMBER SIZES, GEOMETRY, AND POST SPACING

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. This document does not address site-specific installations.



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**PV ARRAY PLAN**

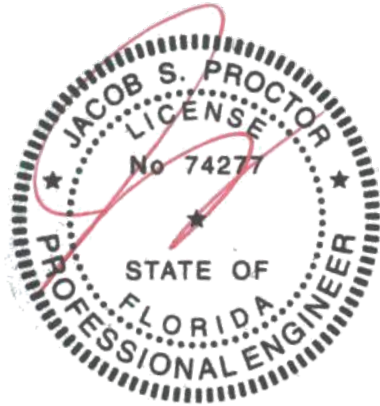
N.T.S.

PROJECT SUNMODO SUNTURF GROUND MOUNT D7

SUBJECT DRILLED PIER OPTION

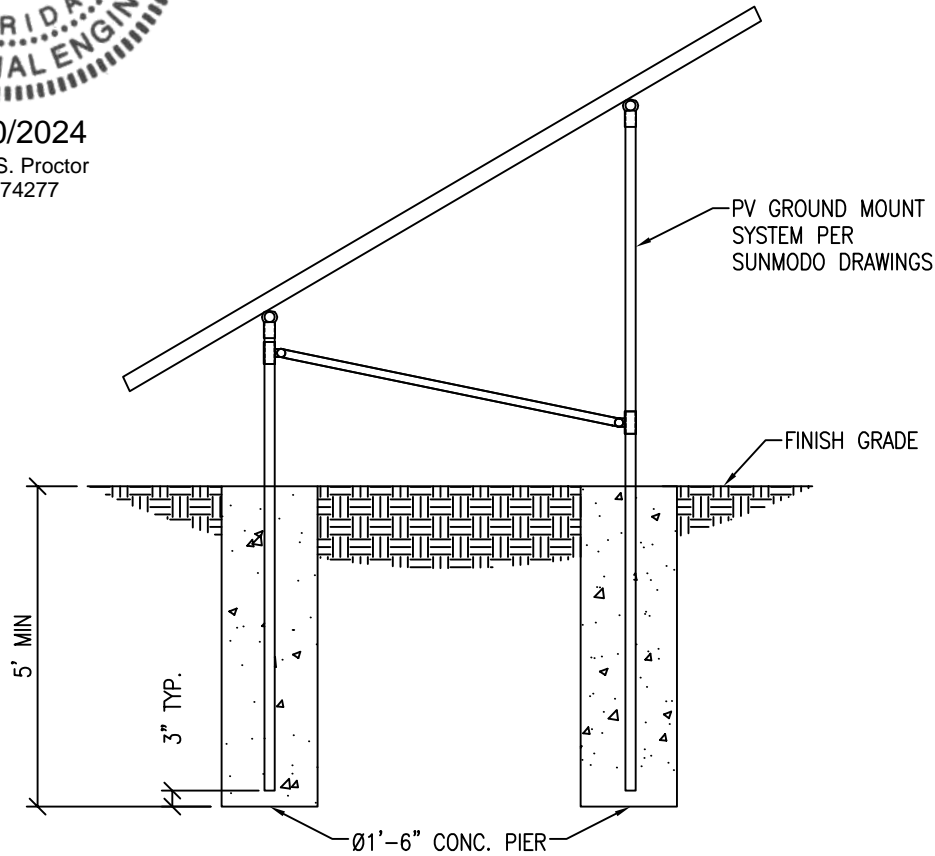
**NOTES:**

- SEE SUNMODO SHOP DRAWINGS FOR GROUND MOUNT MEMBER SIZES AND GEOMETRY



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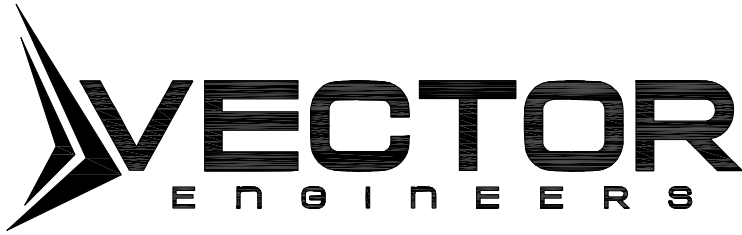
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**DRILLED PIER SECTION**

NTS.

**S1**



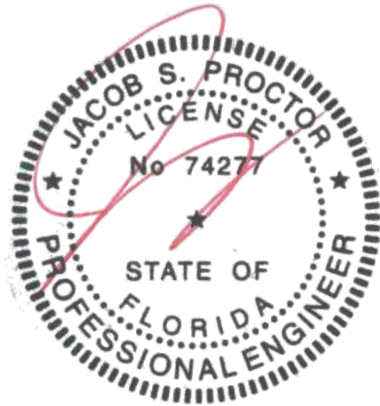
JOB NO. U2716.0389.241

PROJECT SUNMODO SUNTURF GROUND MOUNT D7

SUBJECT HELICAL PIER OPTION

NOTES:

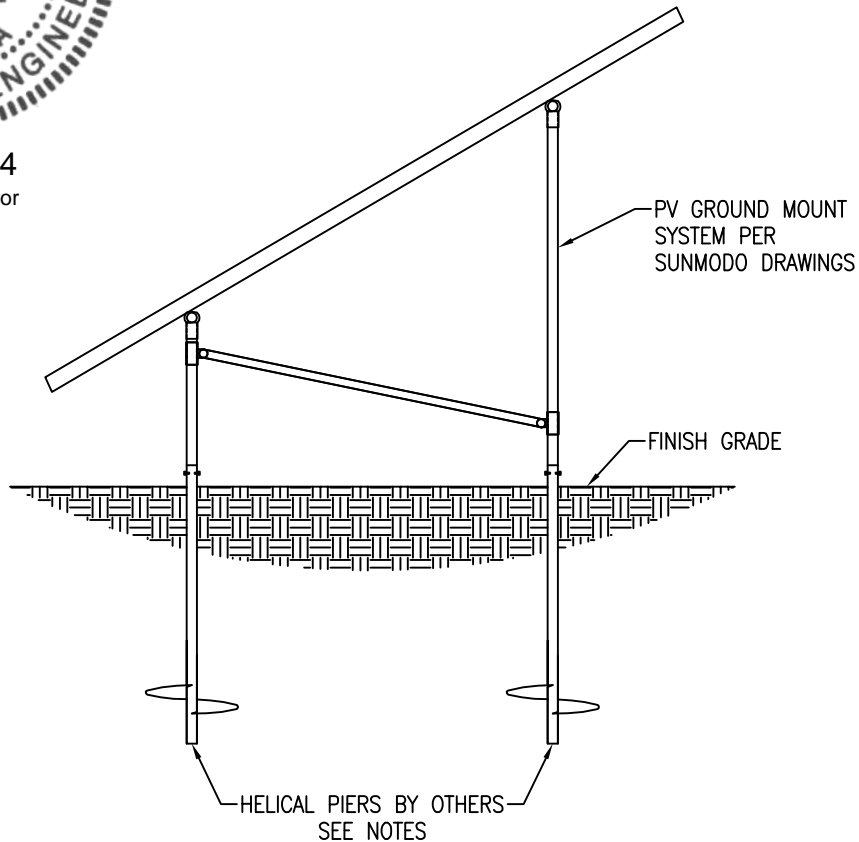
1. SEE SUNMODOD SHOP DRAWINGS FOR GROUND MOUNT MEMBER SIZES AND GEOMETRY
2. A MINIMUM OF (1) HELICAL PIER SHALL BE LOAD TESTED PER THE TEST LOADS LISTED ON THE COVER PAGE OF THIS LETTER. FAILURE CRITERIA IS AS FOLLOWS:
  - 2.1. LATERAL DEFLECTION OF 1" MEASURED AT GRADE UNDER LATERAL LOAD
  - 2.2. VERTICAL DEFLECTION OF 1/2" UNDER AXIAL LOAD
3. LOAD TESTS SHALL BE PERFORMED BY A LICENSED CONTRACTOR AS APPROVED BY THE AHJ



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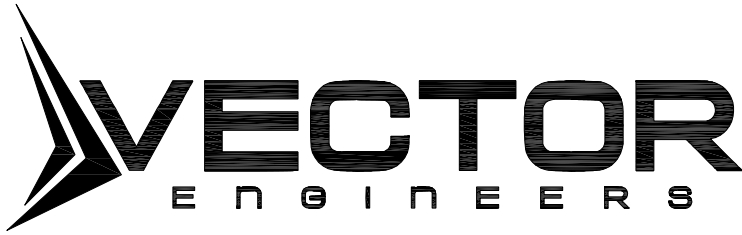
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**HELICAL PIER SECTION**

NTS.

**S2**



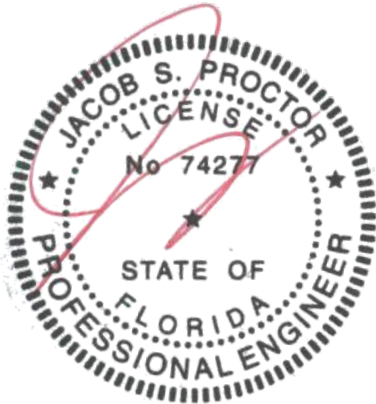
JOB NO. U2716.0389.241

PROJECT SUNMODO SUNTURF GROUND MOUNT D7

SUBJECT GROUND SCREW OPTION

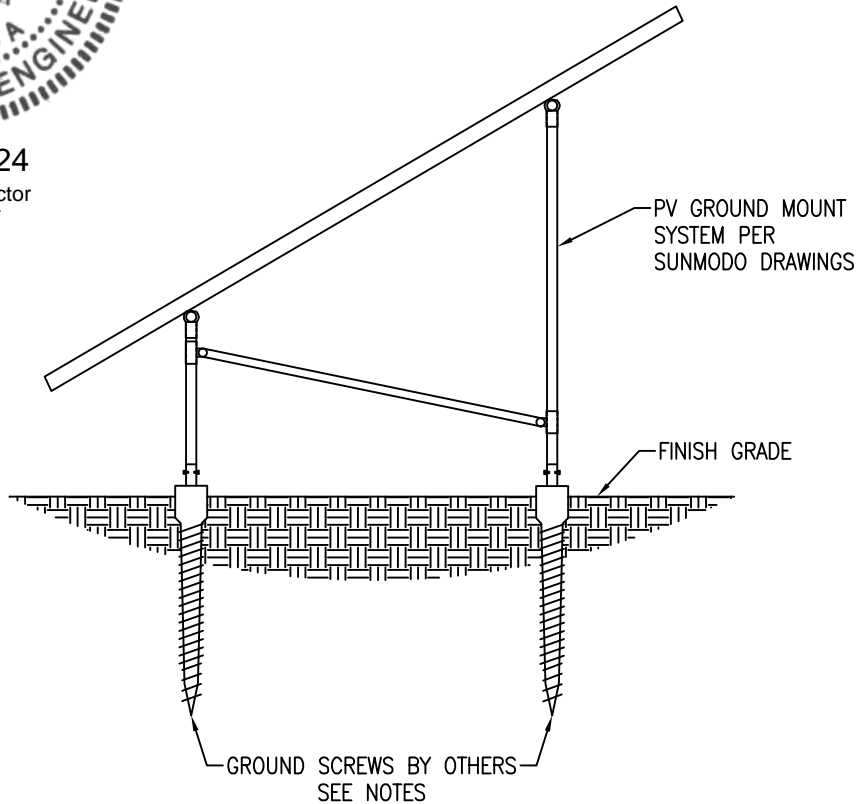
**NOTES:**

1. SEE SUNMODOD SHOP DRAWINGS FOR GROUND MOUNT MEMBER SIZES AND GEOMETRY
2. A MINIMUM OF (1) GROUND SCREW SHALL BE LOAD TESTED PER THE TEST LOADS LISTED ON THE COVER PAGE OF THIS LETTER. FAILURE CRITERIA IS AS FOLLOWS:
  - 2.1. LATERAL DEFLECTION OF 1" MEASURED AT GRADE UNDER LATERAL LOAD
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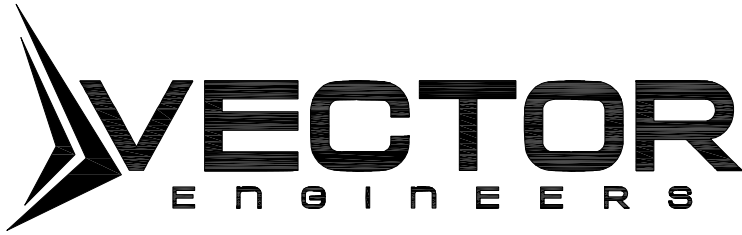
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**GROUND SCREW SECTION**

NTS.





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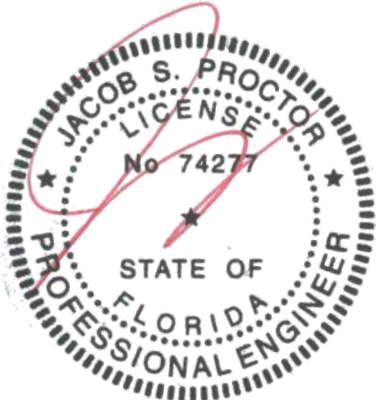
PROJECT SUNMODO SUNTURF GROUND MOUNT D7

SUBJECT BALLAST BLOCK OPTION

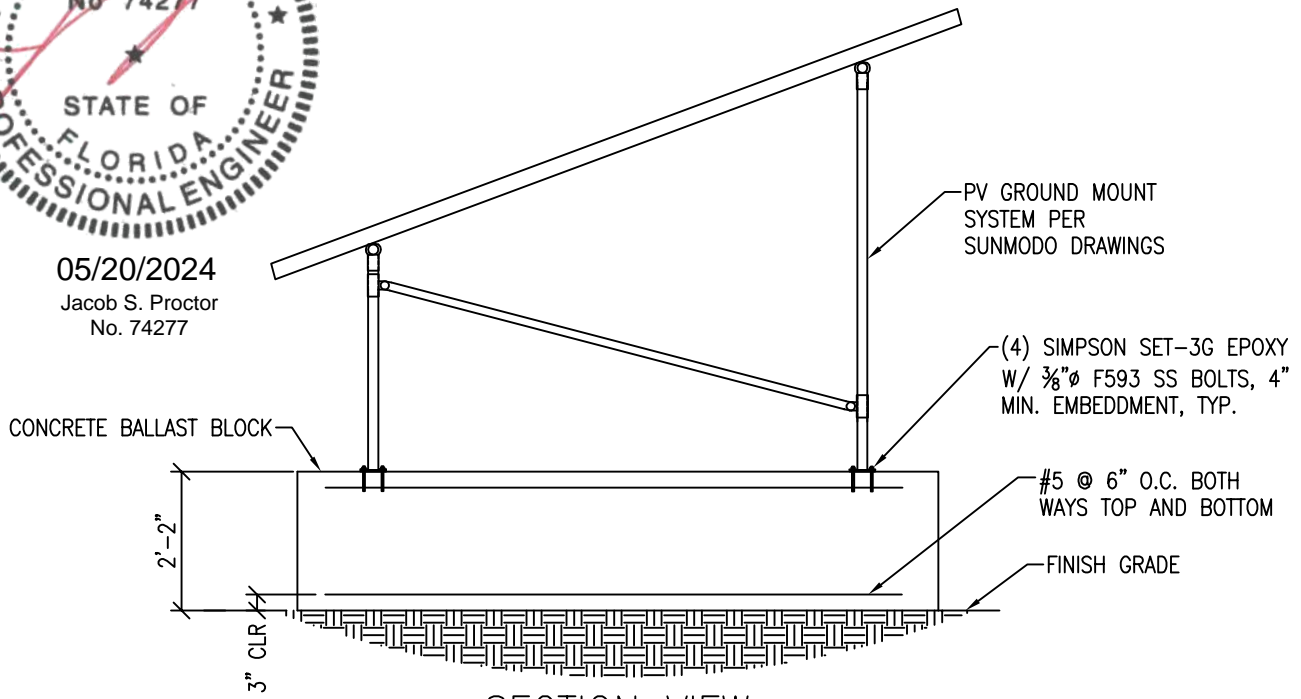
**NOTES:**

- SEE SUNMODO SHOP DRAWINGS FOR GROUND MOUNT MEMBER SIZES AND GEOMETRY

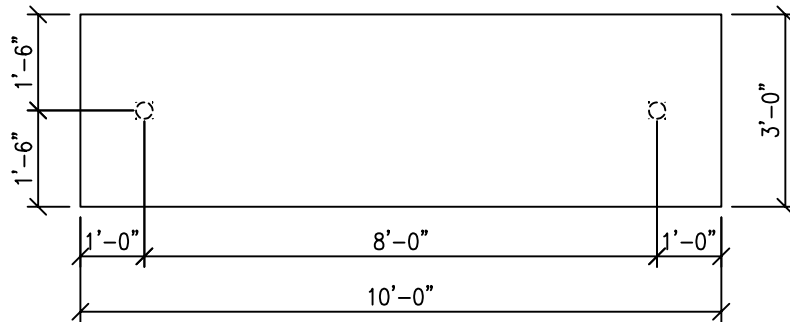
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SECTION VIEW



PLAN VIEW

**BALLAST BLOCK SECTION**

NTS.





**JOB NO.:** U2716.0389.241  
**SUBJECT:** WIND PRESSURES  
**CONDITION:** 20° TILT

**PROJECT:** Sunturf Package D7 Ground Mount

**WIND PRESSURES**

Calculations per:	ASCE 7-22	
Design Wind Speed, V [mph]:	120	
Risk Category:	I	(Table 1.5-1)
Exposure Category:	C	(Section 26.7)
Elevation [ft]:	-156.2	
Ground Elevation Factor, $K_e$ :		(Not applicable)
$\alpha$ :	9.8	(Table 26.11-1)
$z_g$ [ft]:	2460	(Table 26.11-1)
Velocity Pressure Exposure Coefficient, $K_h$ :	0.85	(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]:	31.38	(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	$k_d q_h GC_{NW}$	$k_d q_h GC_{NL}$
Case 1 ( $\gamma = 0^\circ$ , Load Case A)	-29.5	-34.0
Case 2 ( $\gamma = 0^\circ$ , Load Case B)	-49.9	-4.5
Case 3 ( $\gamma = 180^\circ$ , Load Case A)	36.3	38.5
Case 4 ( $\gamma = 180^\circ$ , Load Case B)	47.6	15.9
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



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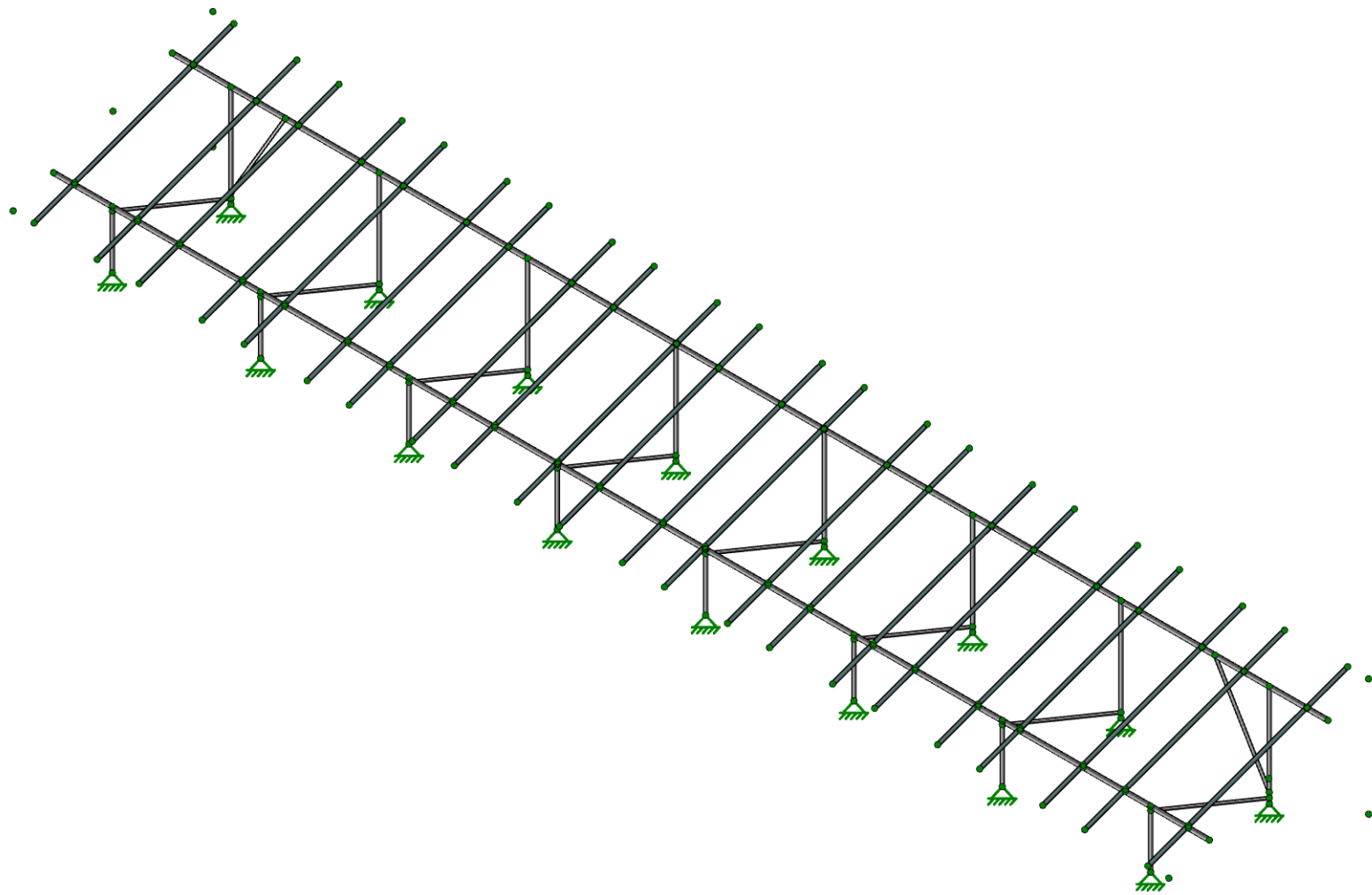
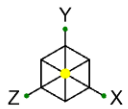
**PROJECT:** Sunturf Package D7 Ground Mount

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# Framing Analysis

## LF - 20 deg

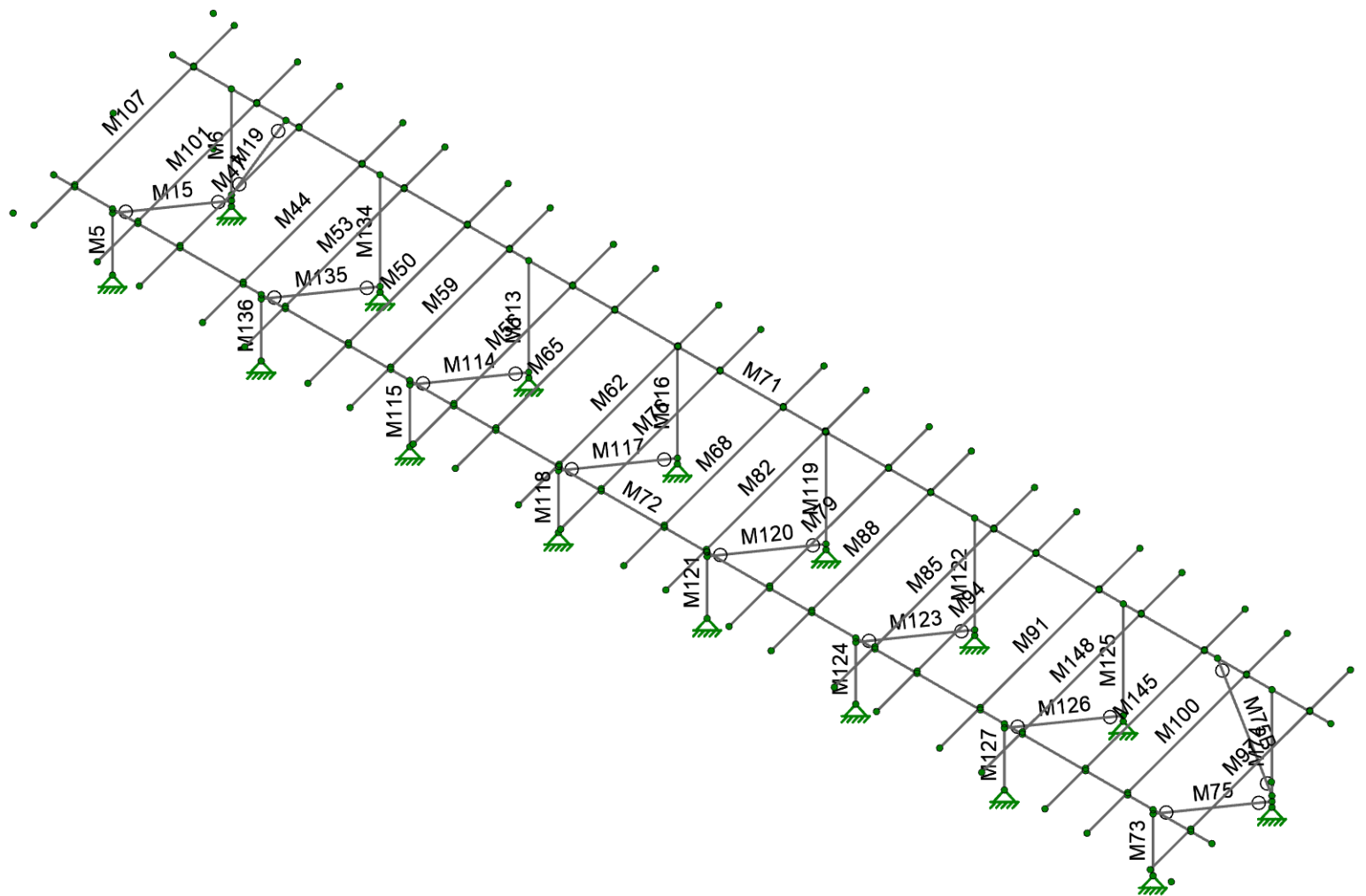
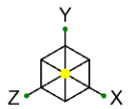




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D7 Large Format Panels - 20 Degree Tilt

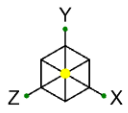
SK-1  
May 06, 2024  
Sunturf D7 - LF - 20deg.r3d



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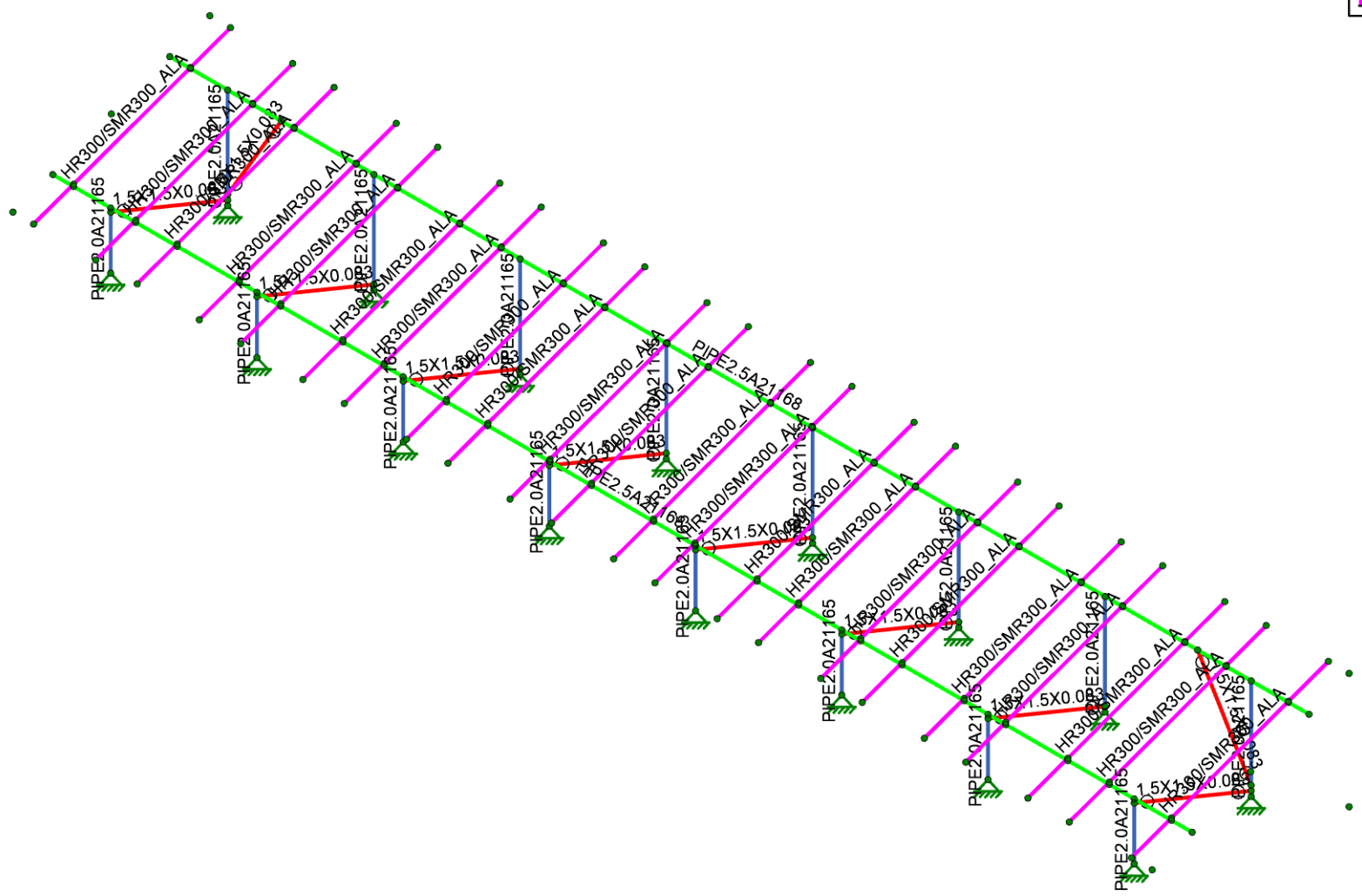
D7 Large Format Panels - 20 Degree Tilt

SK-2  
May 06, 2024  
Sunturf D7 - LF - 20deg.r3d



Section Sets

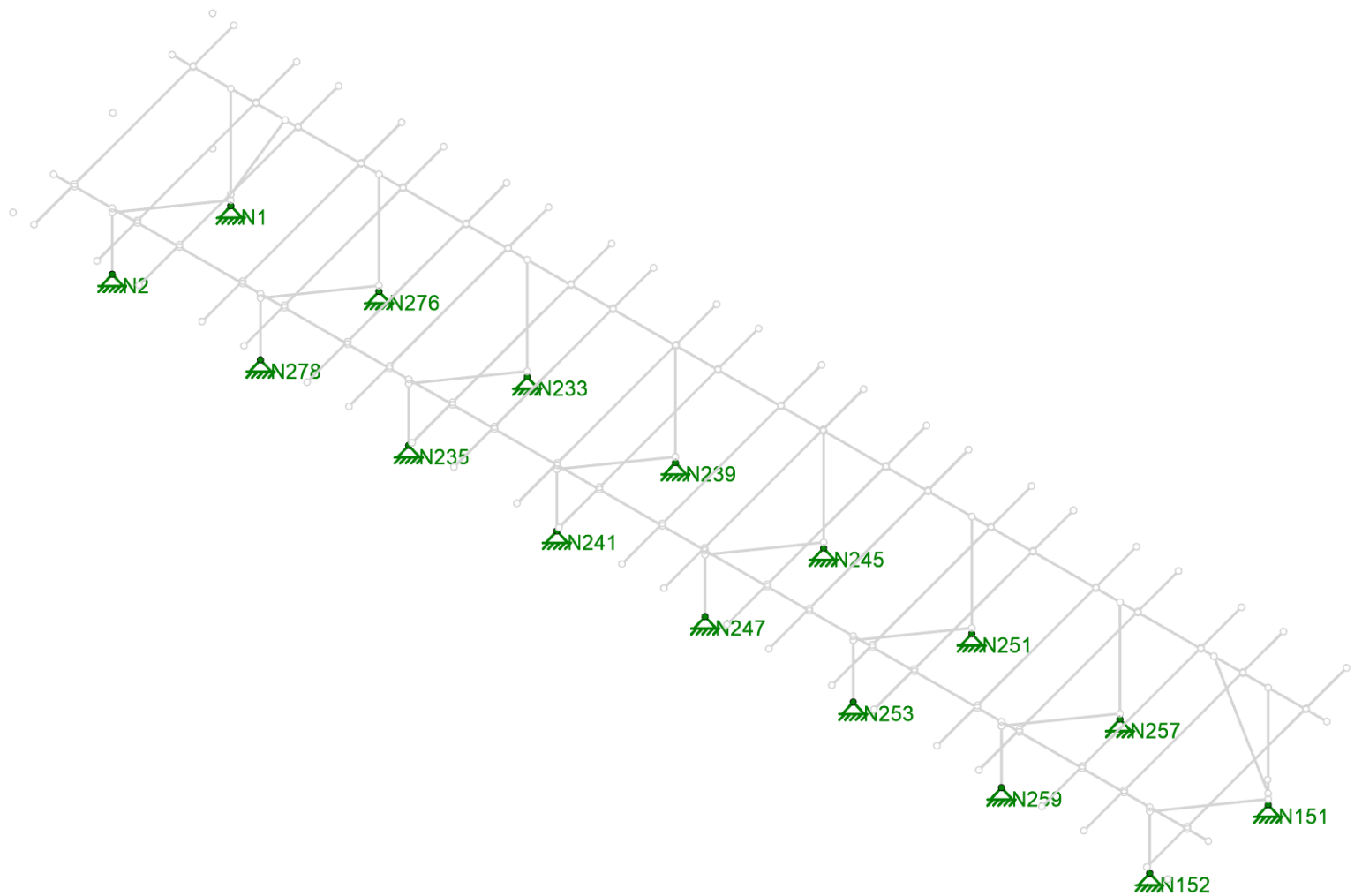
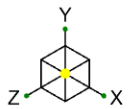
- █ Post
- █ Cross Beam
- █ Diagonal Brace
- █ RIGID
- █ AL Rails



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D7 Large Format Panels - 20 Degree Tilt

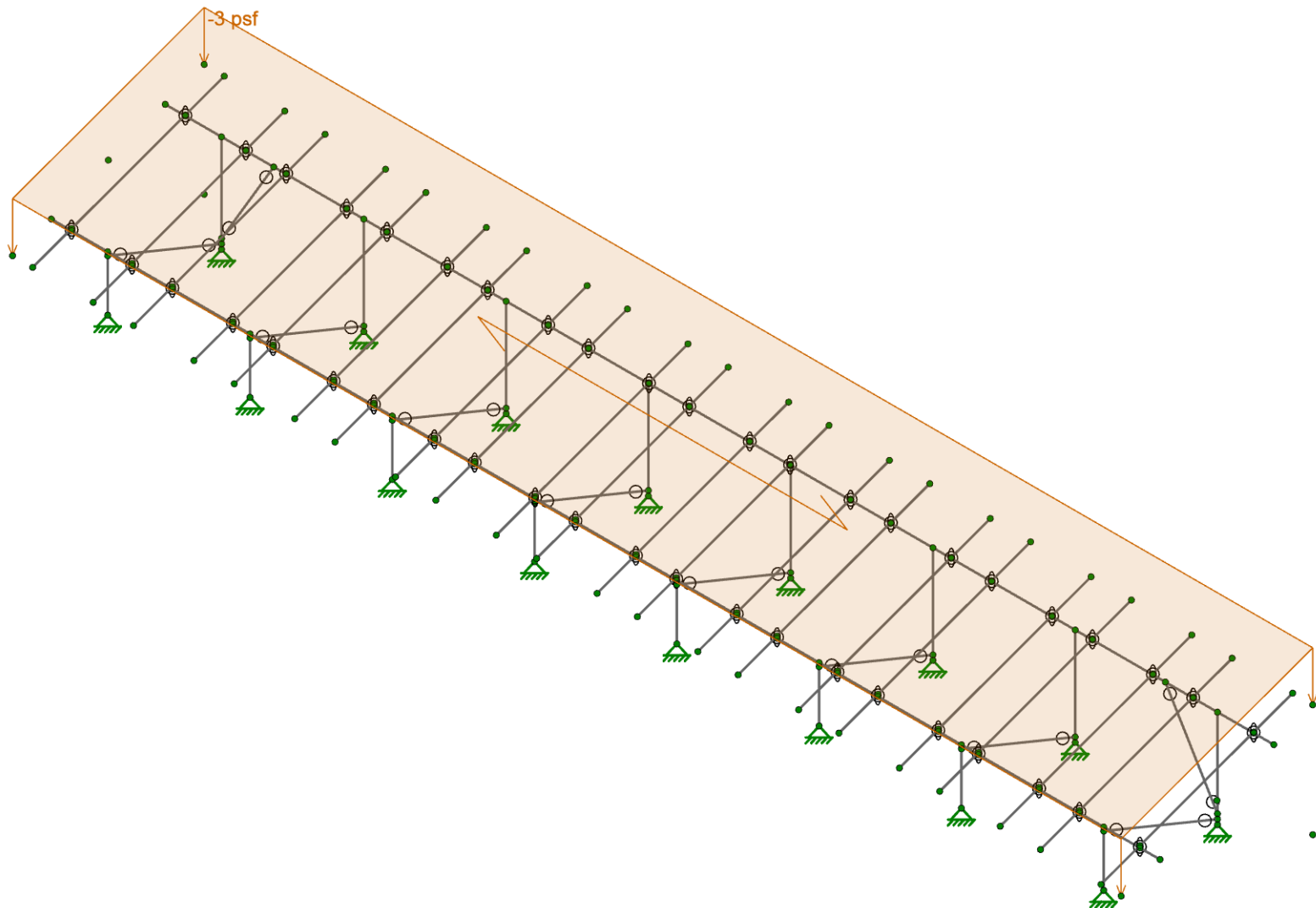
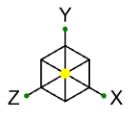
SK-3  
 May 06, 2024  
 Sunturf D7 - LF - 20deg.r3d




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D7 Large Format Panels - 20 Degree Tilt

SK-4  
May 06, 2024  
Sunturf D7 - LF - 20deg.r3d

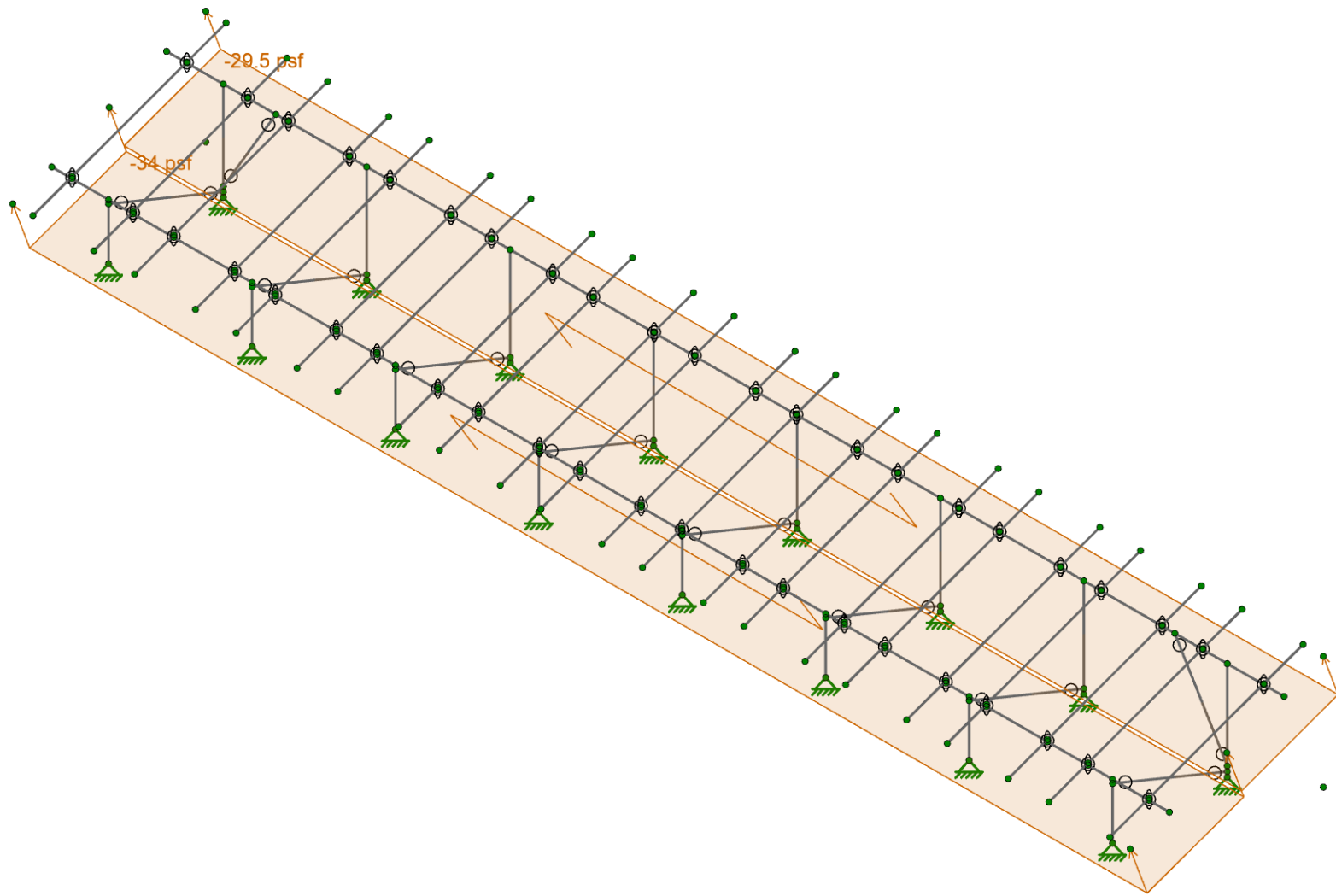
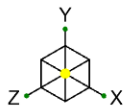


Loads: BLC 2, Solar Panel Weight

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D7 Large Format Panels - 20 Degree Tilt

SK-5
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Sunturf D7 - LF - 20deg.r3d



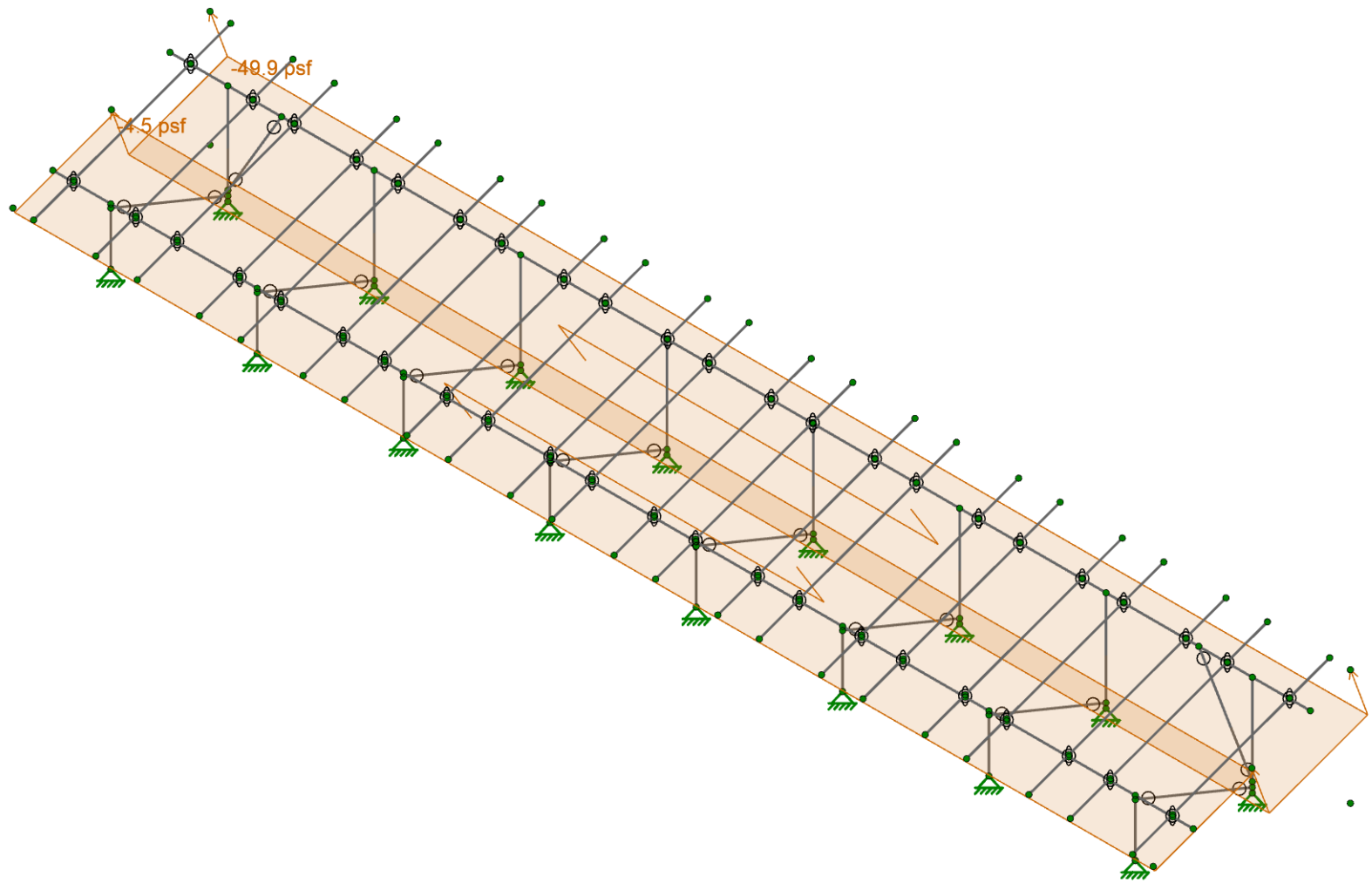
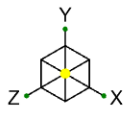
Loads: BLC 4, Wind A 0 deg



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D7 Large Format Panels - 20 Degree Tilt

SK-6  
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Sunturf D7 - LF - 20deg.r3d



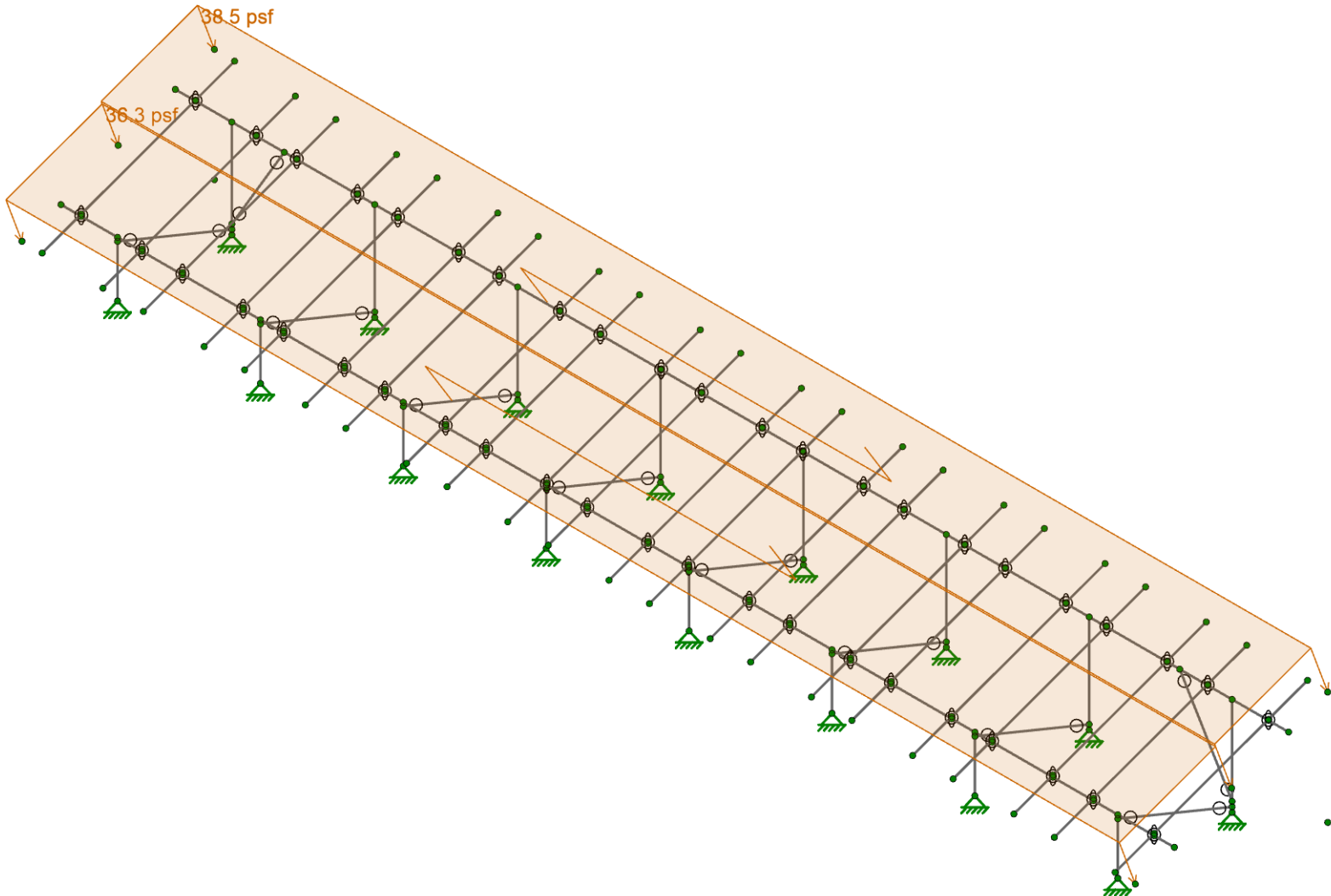
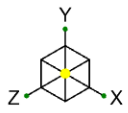
Loads: BLC 5, Wind B 0 deg




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D7 Large Format Panels - 20 Degree Tilt

SK-7  
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Sunturf D7 - LF - 20deg.r3d



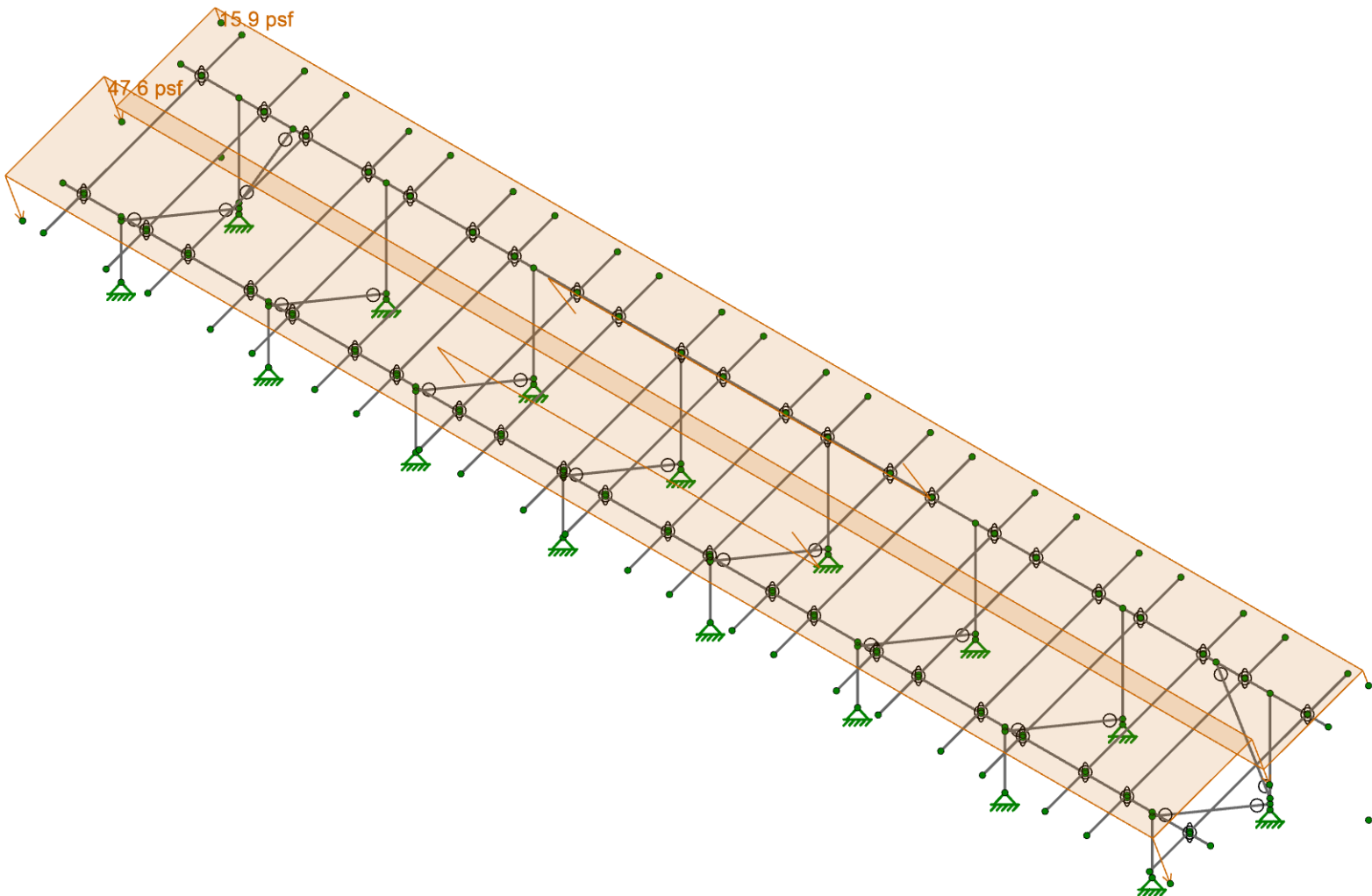
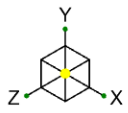
Loads: BLC 6, Wind A 180 deg

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D7 Large Format Panels - 20 Degree Tilt

SK-8
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Sunturf D7 - LF - 20deg.r3d





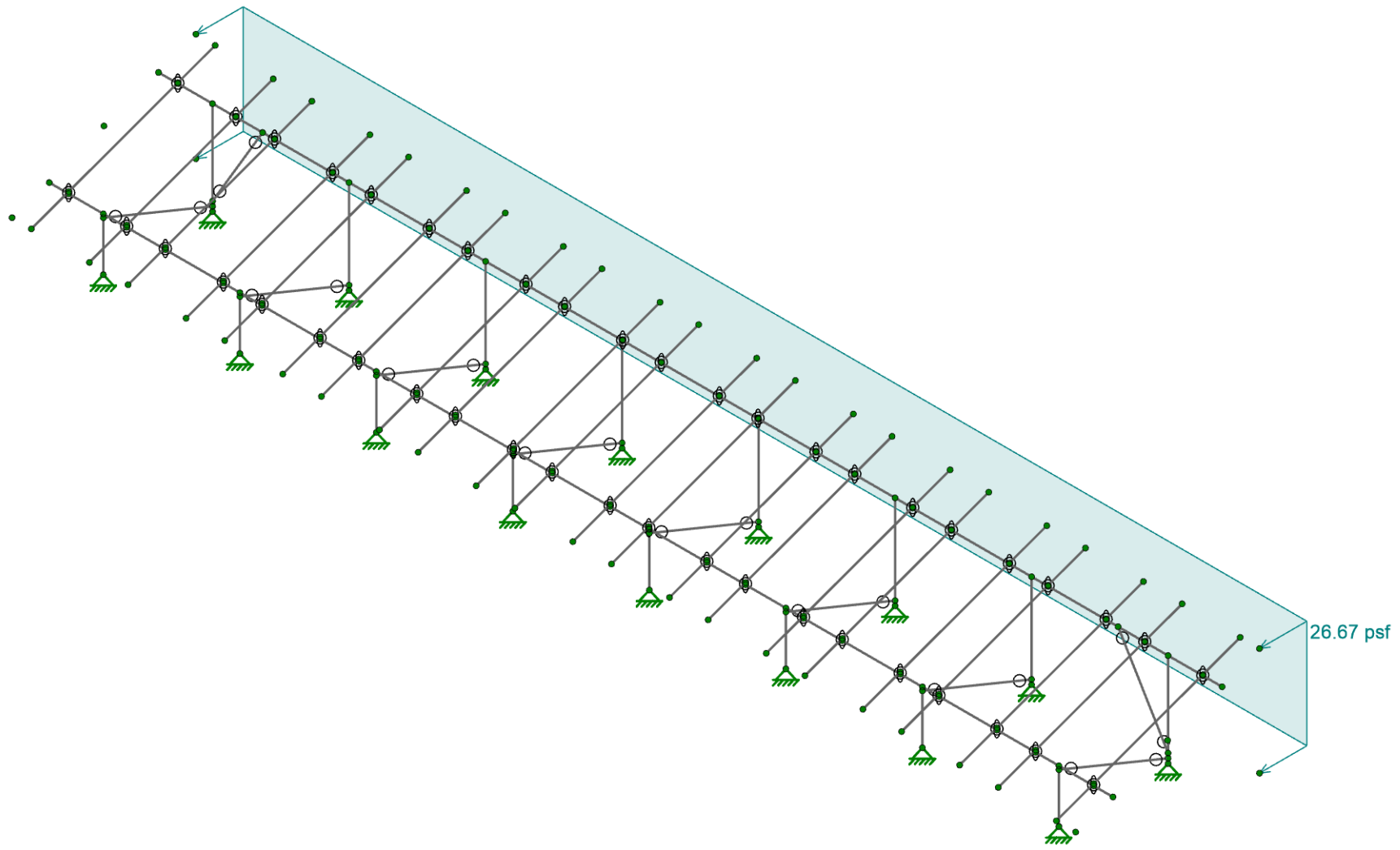
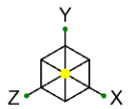
Loads: BLC 7, Wind B 180 deg



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D7 Large Format Panels - 20 Degree Tilt

SK-9  
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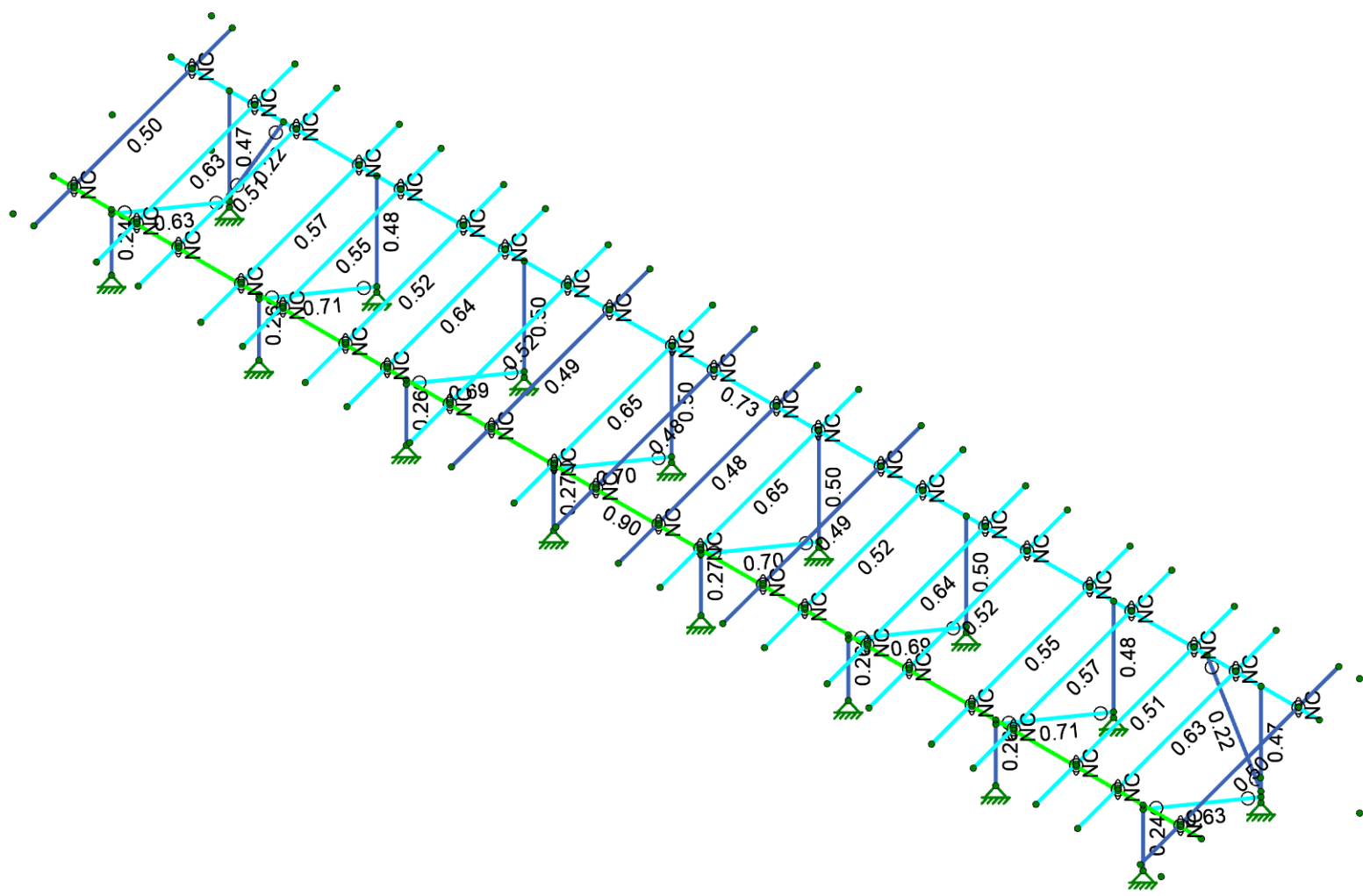
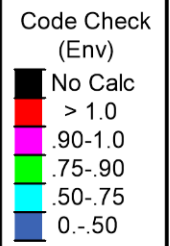
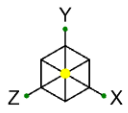
Loads: BLC 8, Wind Z



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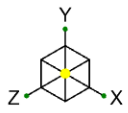
D7 Large Format Panels - 20 Degree Tilt

SK-10  
May 06, 2024  
Sunturf D7 - LF - 20deg.r3d



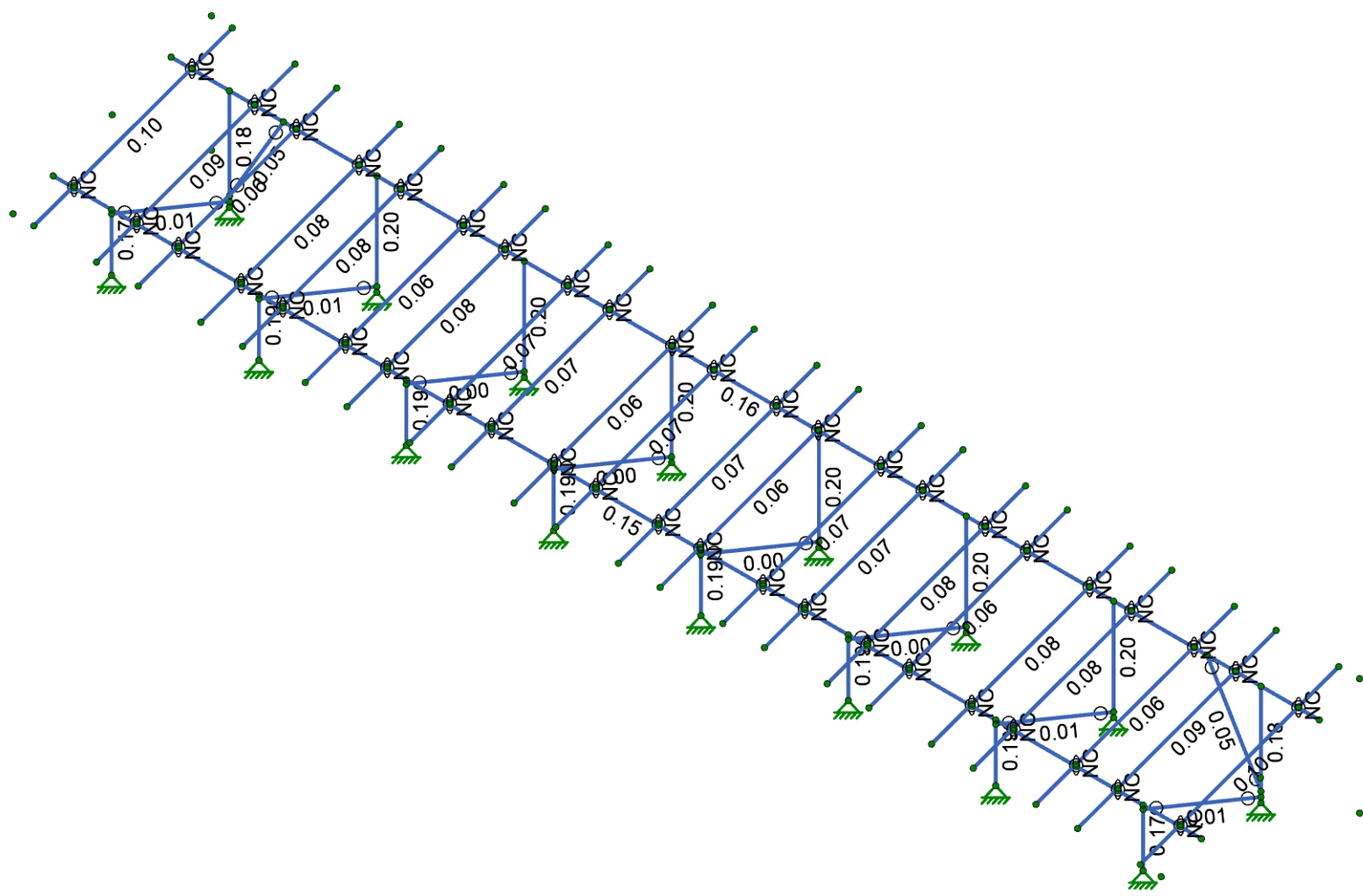
Member Code Checks Displayed (Enveloped)

	Vector Structural Engineering	D7 Large Format Panels - 20 Degree Tilt	SK-11
	CJT		May 06, 2024
	U2716.0389.241		Sunturf D7 - LF - 20deg.r3d




Shear Check (Env)

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



Member Shear Checks Displayed (Enveloped)

 <p>IRISA A NEMETSCHEK COMPANY</p>	Vector Structural Engineering	D7 Large Format Panels - 20 Degree Tilt	SK-12
	CJT		May 06, 2024
	U2716.0389.241		Sunturf D7 - LF - 20deg.r3d

**Model Settings**

Number of Reported Sections	5
Number of Internal Sections	100
Member Area Load Mesh Size (in <sup>2</sup> )	144
Consider Shear Deformation	Yes
Consider Torsional Warping	Yes
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
Single	No
Multiple (Optimum)	Yes
Maximum	No

Global Axis corresponding to vertical direction	Y
Convert Existing Data	Yes
Default Global Plane for z-axis	XZ
Plate Local Axis Orientation	Nodal

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	ACI 318-19
Masonry	None
Aluminum	AA ADM1-20: ASD
Structure Type	Building
Stiffness Adjustment	Yes (Iterative)
Stainless	None
Stiffness Adjustment	Yes (Iterative)

Compression Stress Block	Rectangular Stress Block
Analyze using Cracked Sections	No
Leave room for horizontal rebar splices (2*d bar spacing)	Yes
List forces which were ignored for design in the Detail Report	Yes

Column Min Steel	1
Column Max Steel	8
Rebar Material Spec	ASTM A615
Warn if beam-column framing arrangement is not understood	No
Number of Shear Regions	4
Region 2 & 3 Spacing Increase Increment (in)	3.999992



Company : Vector Structural Engineering  
Designer : CJT  
Job Number : U2716.0389.241  
Model Name : D7 Large Format Panels - 20 De...

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1:52:38 PM  
Checked By : MIH

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**Model Settings (Continued)**

T Z (sec)	
T X (sec)	
C <sub>Z</sub>	0.02
C <sub>X</sub>	0.02
R Z	3
R X	3

**Hot Rolled Steel Properties**

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e <sup>6</sup> F <sup>-1</sup> ]	Density [lb/ft <sup>3</sup> ]	Yield [psi]	Ry	Fu [psi]	Rt
1	A992	29000	11154	0.3	0.65	490	50000	1.1	65000	1.1
2	A36 Gr.36	29000	11154	0.3	0.65	490	36000	1.5	58000	1.2
3	A572 Gr.50	29000	11154	0.3	0.65	490	50000	1.1	65000	1.1
4	A500 Gr.B RND	29000	11154	0.3	0.65	527	42000	1.4	58000	1.3
5	A500 Gr.B Rect	29000	11154	0.3	0.65	527	46000	1.4	58000	1.3
6	A53 Gr.B	29000	11154	0.3	0.65	490	35000	1.6	60000	1.2
7	A1085	29000	11154	0.3	0.65	490	50000	1.4	65000	1.3

**Aluminum Properties**

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e <sup>6</sup> F <sup>-1</sup> ]	Density [lb/ft <sup>3</sup> ]	Table B.4	kt	Ftu [psi]	Fty [psi]	Fcy [psi]	Fsu [psi]	Ct
1	3003-H14	10100	3787.5	0.33	1.3	172.8	Table B.4-1	1	19000	16000	13000	12000	141
2	6061-T6	10100	3787.5	0.33	1.3	172.8	Table B.4-2	1	38000	35000	35000	24000	141
3	6063-T5	10100	3787.5	0.33	1.3	172.8	Table B.4-2	1	22000	16000	16000	13000	141
4	6063-T6	10100	3787.5	0.33	1.3	172.8	Table B.4-2	1	30000	25000	25000	19000	141
5	5052-H34	10200	3787.5	0.33	1.3	172.8	Table B.4-1	1	34000	26000	24000	20000	141
6	6061-T6 W	10100	3787.5	0.33	1.3	172.8	Table B.4-1	1	24000	15000	15000	15000	141
7	6005-T5	10100	3787.5	0.33	1.3	172.8	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 <sup>2</sup> ]	Iyy [in <sup>4</sup> ]	Izz [in <sup>4</sup> ]	J [in <sup>4</sup> ]
1	Post	PIPE2.0A21165	Column	Pipe	A572 Gr.50	Typical	0.776	0.499	0.499	0.998
2	Cross Beam	PIPE2.5A21168	Beam	Wide Flange	A572 Gr.50	Typical	0.947	0.907	0.907	1.814
3	Diagonal Brace	1.5X1.5X0.083	HBrace	SquareTube	A572 Gr.50	Typical	0.47	0.158	0.158	0.236

**Aluminum Section Sets**

	Label	Shape	Type	Design List	Material	Design Rule	Area [in <sup>2</sup> ]	Iyy [in <sup>4</sup> ]	Izz [in <sup>4</sup> ]	J [in <sup>4</sup> ]
1	AL Posts	2.375ODX0.188	Column	Pipe	6005-T5	Typical	1.29	0.778	0.778	1.54
2	AL Brace	RT1.5X2X0.15625	VBrace	Rectangular Tubes	6005-T5	Typical	0.996	0.327	0.524	0.602
3	AL Rails	HR300/SMR300 ALA	Beam	Rectangular Tubes	6005-T5	Typical	0.736	0.214	0.727	0.734
4	AL Cross Beam	CROSSRAIL	Beam	Rectangular Tubes	6005-T5	Typical	1.909	1.97	4.366	4.017

**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			
4	Wind A 0 deg	OL1			2
5	Wind B 0 deg	OL2			2
6	Wind A 180 deg	OL3			2
7	Wind B 180 deg	OL4			2
8	Wind Z	WLZ			1
9	BLC 2 Transient Area Loads	None		46	
10	BLC 4 Transient Area Loads	None		152	
11	BLC 5 Transient Area Loads	None		152	
12	BLC 6 Transient Area Loads	None		152	
13	BLC 7 Transient Area Loads	None		152	
14	BLC 8 Transient Area Loads	None		84	

**Member Area Loads (BLC 2 : Solar Panel Weight)**

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

**Member Area Loads (BLC 4 : Wind A 0 deg)**

Node A	Node B	Node C	Node D	Direction	Load Direction	A Magnitude [psf]	B Magnitude [psf]	C Magnitude [psf]	D Magnitude [psf]	Exclude Braces	
1	N197	N200	N201	N198	Perp	A-B	-29.5	-29.5	-29.5	-29.5	Yes
2	N198	N201	N199	N196	Perp	A-B	-34	-34	-34	-34	Yes

**Member Area Loads (BLC 5 : Wind B 0 deg)**

Node A	Node B	Node C	Node D	Direction	Load Direction	A Magnitude [psf]	B Magnitude [psf]	C Magnitude [psf]	D Magnitude [psf]	Exclude Braces	
1	N197	N200	N201	N198	Perp	A-B	-49.9	-49.9	-49.9	-49.9	Yes
2	N198	N201	N199	N196	Perp	A-B	-4.5	-4.5	-4.5	-4.5	Yes

**Member Area Loads (BLC 6 : Wind A 180 deg)**

Node A	Node B	Node C	Node D	Direction	Load Direction	A Magnitude [psf]	B Magnitude [psf]	C Magnitude [psf]	D Magnitude [psf]	Exclude Braces	
1	N197	N200	N201	N198	Perp	A-B	38.5	38.5	38.5	38.5	Yes
2	N198	N201	N199	N196	Perp	A-B	36.3	36.3	36.3	36.3	Yes

**Member Area Loads (BLC 7 : Wind B 180 deg)**

Node A	Node B	Node C	Node D	Direction	Load Direction	A Magnitude [psf]	B Magnitude [psf]	C Magnitude [psf]	D Magnitude [psf]	Exclude Braces	
1	N197	N200	N201	N198	Perp	A-B	15.9	15.9	15.9	15.9	Yes
2	N198	N201	N199	N196	Perp	A-B	47.6	47.6	47.6	47.6	Yes

**Member Area Loads (BLC 8 : Wind Z)**

Node A	Node B	Node C	Node D	Direction	Load Direction	A Magnitude [psf]	B Magnitude [psf]	C Magnitude [psf]	D Magnitude [psf]	Exclude Braces	
1	N200	N197	N307	N308	Z	Open Structure	26.67	26.67	26.67	26.67	Yes

**Load Combinations**

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	ASD Loads		Y								
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	RLL		OL1	0.6	WLZ	0.6
5	1.0 D + 0.6 W2	Yes	Y	DL	1	RLL		OL2	0.6	WLZ	0.6
6	1.0 D + 0.6 W3	Yes	Y	DL	1	RLL		OL3	0.6	WLZ	-0.6
7	1.0 D + 0.6 W4	Yes	Y	DL	1	RLL		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	0.45
9	1.0 D + 0.45 W2 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL2	0.45	WLZ	0.45
10	1.0 D + 0.45 W3 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL3	0.45	WLZ	-0.45
11	1.0 D + 0.45 W4 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL4	0.45	WLZ	-0.45
12	0.6 D + 0.6 W1	Yes	Y	DL	0.6	RLL		OL1	0.6	WLZ	0.6
13	0.6 D + 0.6 W2	Yes	Y	DL	0.6	RLL		OL2	0.6	WLZ	0.6
14	0.6 D + 0.6 W3	Yes	Y	DL	0.6	RLL		OL3	0.6	WLZ	-0.6
15	0.6 D + 0.6 W4	Yes	Y	DL	0.6	RLL		OL4	0.6	WLZ	-0.6
16			Y								
17	LRFD Loads		Y								
18	1.4 D		Y	DL	1.4	RLL					



**Load Combinations (Continued)**

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
19	1.2 D + 1.6 S + 0.5 W1		Y	DL	1.2	RLL	1.6	OL1	0.5		
20	1.2 D + 1.6 S + 0.5 W2		Y	DL	1.2	RLL	1.6	OL2	0.5		
21	1.2 D + 1.6 S + 0.5 W3		Y	DL	1.2	RLL	1.6	OL3	0.5		
22	1.2 D + 1.6 S + 0.5 W4		Y	DL	1.2	RLL	1.6	OL4	0.5		
23	1.2 D + 1.0 W1		Y	DL	1.2	RLL		OL1	1		
24	1.2 D + 1.0 W2		Y	DL	1.2	RLL		OL2	1		
25	1.2 D + 1.0 W3		Y	DL	1.2	RLL		OL3	1		
26	1.2 D + 1.0 W4		Y	DL	1.2	RLL		OL4	1		
27	0.9 D + 1.0 W1		Y	DL	0.9	RLL		OL1	1		
28	0.9 D + 1.0 W2		Y	DL	0.9	RLL		OL2	1		
29	0.9 D + 1.0 W3		Y	DL	0.9	RLL		OL3	1		
30	0.9 D + 1.0 W4		Y	DL	0.9	RLL		OL4	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	N257	max	22.515	13	2469.283	6	1346.009	6	0	15	0	15	0	15
2		min	-24.693	6	-2211.564	13	-1156.744	4	0	2	0	2	0	2
3	N276	max	24.726	6	2469.345	6	1345.949	6	0	15	0	15	0	15
4		min	-22.554	13	-2211.653	13	-1156.698	4	0	2	0	2	0	2
5	N239	max	3.443	6	2689.644	6	1330.987	6	0	15	0	15	0	15
6		min	-3.106	13	-2423.644	13	-1145.489	4	0	2	0	2	0	2
7	N245	max	3.079	13	2689.739	6	1330.973	6	0	15	0	15	0	15
8		min	-3.429	6	-2423.725	13	-1145.479	4	0	2	0	2	0	2
9	N251	max	9.917	6	2716.11	6	1306.891	6	0	15	0	15	0	15
10		min	-9.373	13	-2442.335	13	-1125.531	4	0	2	0	2	0	2
11	N233	max	9.379	13	2716.431	6	1306.876	6	0	15	0	15	0	15
12		min	-9.942	6	-2442.621	13	-1125.52	4	0	2	0	2	0	2
13	N1	max	255.02	6	2618.943	6	1177.777	6	0	15	0	15	0	15
14		min	-237.45	13	-2352.175	13	-1015.48	4	0	2	0	2	0	2
15	N151	max	237.5	13	2618.677	6	1177.74	6	0	15	0	15	0	15
16		min	-255.057	6	-2351.948	13	-1015.451	4	0	2	0	2	0	2
17	N241	max	6.769	7	1452.466	7	69.481	4	0	15	0	15	0	15
18		min	-4.321	12	-479.499	12	-87.646	6	0	2	0	2	0	2
19	N247	max	4.317	12	1452.477	7	69.481	4	0	15	0	15	0	15
20		min	-6.76	7	-479.51	12	-87.646	6	0	2	0	2	0	2
21	N259	max	4.84	13	1452.542	7	68.667	4	0	15	0	15	0	15
22		min	-2.962	6	-477.571	12	-86.927	6	0	2	0	2	0	2
23	N278	max	2.974	6	1452.57	7	68.665	4	0	15	0	15	0	15
24		min	-4.843	13	-477.606	12	-86.924	6	0	2	0	2	0	2
25	N253	max	6.75	7	1459.019	7	68.063	4	0	15	0	15	0	15
26		min	-2.198	12	-493.805	12	-86.288	6	0	2	0	2	0	2
27	N235	max	2.202	12	1459.014	7	68.062	4	0	15	0	15	0	15
28		min	-6.752	7	-493.806	12	-86.287	6	0	2	0	2	0	2
29	N2	max	11.638	7	1308.555	7	62.419	4	0	15	0	15	0	15
30		min	-3.781	12	-436.393	12	-78.728	6	0	2	0	2	0	2
31	N152	max	3.786	12	1308.57	7	62.417	4	0	15	0	15	0	15
32		min	-11.647	7	-436.406	12	-78.727	6	0	2	0	2	0	2
33	Totals:	max	0	12	28098.552	6	9644.028	14						
34		min	0	5	-17263.663	12	-8349.137	4						





JOB NO.: U2716.0389.241

PROJECT: SunTurf Package D7

SUBJECT: CALCULATIONS LF 20

DESIGN APPROACH ASD

CONNECTION CAPACITY

Location: Column Base (set screws)

Connection Type: M16 Conical Set Screws

Tensile Capacity: 2600 lbs

Tension Load: 2443 lbs

Check Connection: 94.0%

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: 2046 lbs

Check Connection: 93.2%

Result: **Select K10341-002**

Note: Uplift capacity. FOS of (2)



JOB NO.: U2716.0389.241

PROJECT: SunTurf Package D7

SUBJECT: CALCULATIONS LF 20

**CONNECTION CAPACITY**

Location: Brace to Column

Connection Type: K10219-001

Capacity: 1581 lbs

Tension Load: 1530 lbs

Check Connection: 96.8%

Result: **Select K10219-001**

Note: Axial capacity. FOS of (2)

**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: 908 lbs

Check Bolt: 10.8%

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

Note:



JOB NO.: U2716.0389.241

PROJECT: Sunturf Package D7 Ground Mount

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# ALTERNATE FOUNDATION OPTION 1: DRILLED CONCRETE PIER



PROJECT: Sunturf Package D7 Ground Mount

**DRILLED CONCRETE PIER DESIGN**

**Column Reactions:**

Max. Shear, V [k]:	1.4	Max. Down, P <sub>d</sub> [k]:	2.7
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P <sub>u</sub> [k]:	2.4

**Pier Properties:**

Pier Shape:	Round	Volume of Concrete [ft <sup>3</sup> ]:	9
Pier Diameter, b [ft]:	1.5	Volume of Concrete [yd <sup>3</sup> ]:	0.3
Top of Pier Elevation [ft]:	0.00	Weight of Concrete [k]:	1.3
Pier Depth, d [ft]:	5.0		

**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]:	5.9
-----------------------	-----

**Bearing capacity OK.**

**Check Uplift:**

Uplift Capacity [k]:	7.1
----------------------	-----

**Uplift capacity OK.**

**Check Lateral Bearing:**

Top of Pier Constrained?:	No
Applied Lateral Force, P [lb]:	1,400
Point of Application, h [ft]:	0.0
S <sub>max</sub> [psf]:	
S [psf]:	500
A = 2.34*P/(Sb):	4.37
Required Pier Depth, d <sub>reqd</sub> [ft]:	4.40

IBC Section 1807.3.2.1

IBC Eq. 18-1

Result: **Lateral bearing capacity OK.**

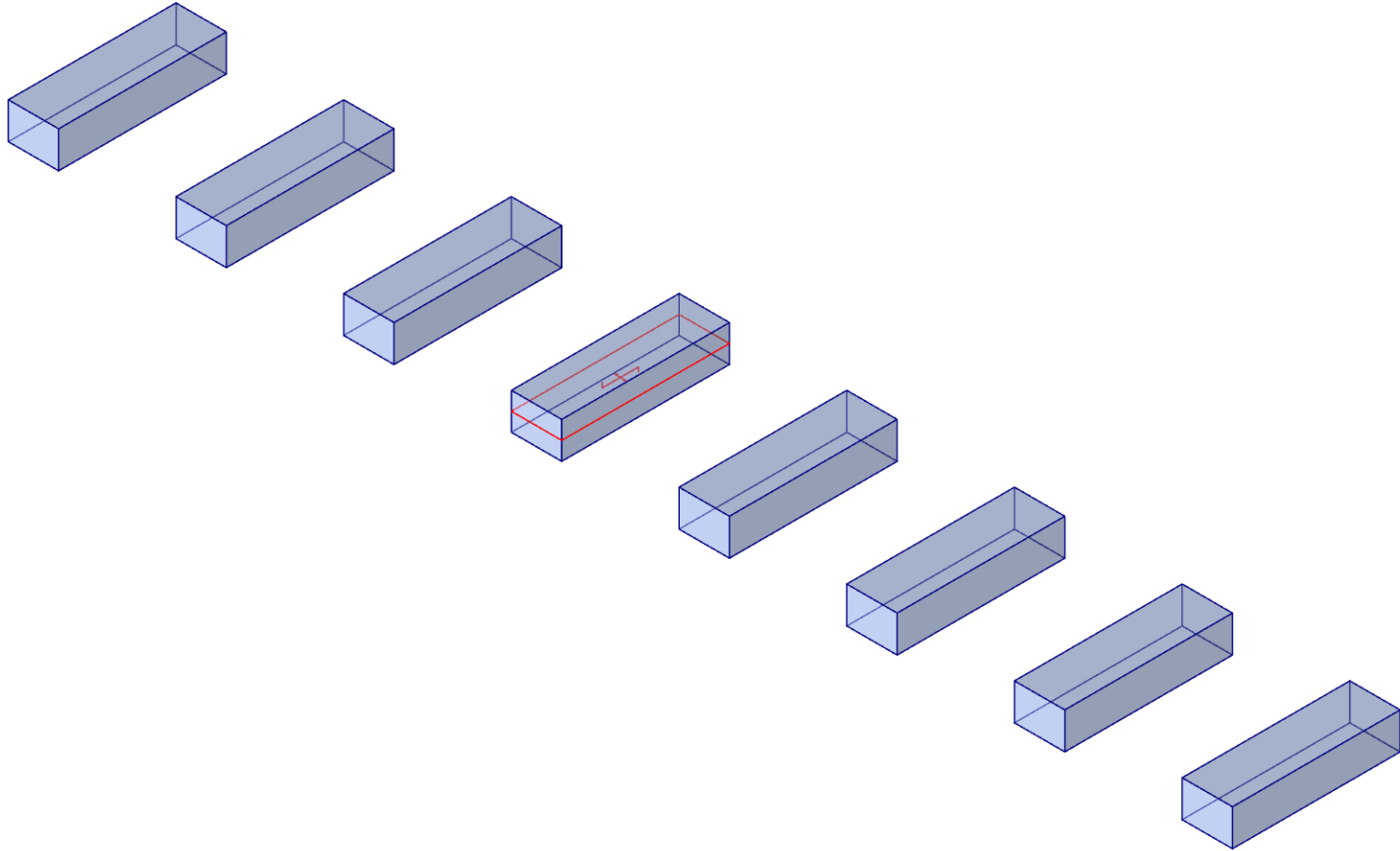


JOB NO.: U2716.0389.241

**PROJECT:** Sunturf Package D7 Ground Mount

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# ALTERNATE FOUNDATION OPTION 2: CONCRETE BALLAST BLOCK



Vector Structural Engineering  
CJT  
U2716.0389.241

Ground Mount

SK-1  
May 06, 2024  
Sunturf D7 - LF - 20deg.r3d



**Concrete Properties**

Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [ $1e^{-5}F^{-1}$ ]	Density [lb/ft <sup>3</sup> ]	f <sub>c</sub> [psi]	Lambda	Flex Steel [psi]	Shear Steel [psi]
1 Conc3000NW	3156	1372	0.15	0.6	145	3000	1	60000	60000
2 Conc3500NW	3409	1482	0.15	0.6	145	3500	1	60000	60000
3 Conc4000NW	3644	1584	0.15	0.6	145	4000	1	60000	60000
4 Conc3000LW	2085	907	0.15	0.6	109.999	3000	0.75	60000	60000
5 Conc3500LW	2252	979	0.15	0.6	109.999	3500	0.75	60000	60000
6 Conc4000LW	2408	1047	0.15	0.6	109.999	4000	0.75	60000	60000
7 Conc2500NW	3156	1372	0.15	0.6	145	2500	1	60000	60000

**Design Rules - Mat Slab**

Label	Max Bending Chk	Max Shear Chk	Top Bar	Bottom Bar	Min Top Bar Spacing [in]	Max Top Bar Spacing [in]	Min Bot Bar Spacing [in]	Max Bot Bar Spacing [in]	Spacing Increment [in]	Top Cover [in]	Bottom Cover [in]	Side Cover [in]	Rebar Options
1 Typical	1	1	#5	#5	3	12	3	12	1	3	3	0	Optimize

**Soil Definitions**

Label	Layers	Subgrade Modulus [lb/ft <sup>3</sup> ]	Allowable Bearing [psf]	Default
1 Default	Single	1e+5	1499.99999	Yes

**Slab**

Label	Thickness [in]	Material	Local Axis Angle [deg]	Analysis Offset [in]	Passive Pressure [psf]	Soil Overburden [psf]	Icr Factor
1 S3	26	Conc3000NW	0	0	0	0	0.25
2 S4	26	Conc3000NW	0	0	0	0	0.25
3 S6	26	Conc3000NW	0	0	0	0	0.25
4 S8	26	Conc3000NW	0	0	0	0	0.25
5 S9	26	Conc3000NW	0	0	0	0	0.25
6 S10	26	Conc3000NW	0	0	0	0	0.25
7 S12	26	Conc3000NW	0	0	0	0	0.25
8 S14	26	Conc3000NW	0	0	0	0	0.25

**Load Category**

Category	Node Loads
1 DL	24
2 WLZ	34
3 OL1	48
4 OL2	48
5 OL3	48
6 OL4	46

**Load Combination**

Label	Solve	Service	SF	Category	Factor	Category	Factor	Category	Factor
1 ASD Loads									
2 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
5 1.0 D + 0.6 W2	Yes	Yes	1.5	DL	1	RLL		OL2	0.6
6 1.0 D + 0.6 W3	Yes	Yes	1.5	DL	1	RLL		OL3	0.6
7 1.0 D + 0.6 W4	Yes	Yes	1.5	DL	1	RLL		OL4	0.6
8 1.0 D + 0.45 W1 + 0.75 S	Yes	Yes	1.5	DL	1	RLL	0.75	OL1	0.45
9 1.0 D + 0.45 W2 + 0.75 S	Yes	Yes	1.5	DL	1	RLL	0.75	OL2	0.45
10 1.0 D + 0.45 W3 + 0.75 S	Yes	Yes	1.5	DL	1	RLL	0.75	OL3	0.45

**Load Combination (Continued)**

	Label	Solve	Service	SF	Category	Factor	Category	Factor	Category	Factor
11	1.0 D + 0.45 W4 + 0.75 S	Yes	Yes	1.5	DL	1	RLL	0.75	OL4	0.45
12	0.6 D + 0.6 W1	Yes	Yes		DL	0.6	RLL		OL1	0.6
13	0.6 D + 0.6 W2	Yes	Yes		DL	0.6	RLL		OL2	0.6
14	0.6 D + 0.6 W3	Yes	Yes		DL	0.6	RLL		OL3	0.6
15	0.6 D + 0.6 W4	Yes	Yes		DL	0.6	RLL		OL4	0.6
16										
17	LRFD Loads									
18	1.4 D	Yes			DL	1.4	RLL			
19	1.2 D + 1.6 S + 0.5 W1	Yes			DL	1.2	RLL	1.6	OL1	0.5
20	1.2 D + 1.6 S + 0.5 W2	Yes			DL	1.2	RLL	1.6	OL2	0.5
21	1.2 D + 1.6 S + 0.5 W3	Yes			DL	1.2	RLL	1.6	OL3	0.5
22	1.2 D + 1.6 S + 0.5 W4	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 Plan Horizontal (deg)	No. of Design Cuts	Design Rule
1	DS1	0	50	Typical
2	DS2	90	50	Typical

**Strip Reinforcing**

	Label	UC	Top	LC	Top	Gov	Design Cut	UC	Top	UC	Bot	LC	Bot	Bars/Mid	Gov	Design Cut	UC	Bot	UC	Shear	LC	Gov	Design Cut	UC	Shear
1	DS1	0.02	25	#5@6in			DS1-X25	0.024	28					#5@6in		DS1-X25	0.04	28							DS1-X10
2	DS2	0.002	27	#5@6in			DS2-X25	0.003	25					#5@6in		DS2-X26	0.006	25							DS2-X50

**Slab Soil Pressures**

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
1	2	S3	0.223	334.611	1500	N132
2	2	S4	0.223	335.013	1500	N488
3	2	S6	0.223	334.301	1500	N495
4	2	S8	0.223	334.321	1500	N53
5	2	S9	0.223	335.008	1500	N514
6	2	S10	0.223	334.611	1500	N519
7	2	S12	0.225	337.135	1500	N69
8	2	S14	0.225	337.139	1500	N85
9	3	S3	0.223	334.611	1500	N132
10	3	S4	0.223	335.013	1500	N488
11	3	S6	0.223	334.301	1500	N495
12	3	S8	0.223	334.321	1500	N53
13	3	S9	0.223	335.008	1500	N514
14	3	S10	0.223	334.611	1500	N519
15	3	S12	0.225	337.135	1500	N69
16	3	S14	0.225	337.139	1500	N85
17	4	S3	0.219	328.515	1500	N36
18	4	S4	0.222	332.5	1500	N39
19	4	S6	0.222	333.434	1500	N47

**Slab Soil Pressures (Continued)**

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
20	4	S8	0.222	333.447	1500	N56
21	4	S9	0.222	332.493	1500	N60
22	4	S10	0.219	328.52	1500	N63
23	4	S12	0.223	335.085	1500	N72
24	4	S14	0.223	335.092	1500	N88
25	5	S3	0.316	474.274	1500	N132
26	5	S4	0.321	481.527	1500	N486
27	5	S6	0.322	482.58	1500	N493
28	5	S8	0.322	482.499	1500	N55
29	5	S9	0.321	481.516	1500	N512
30	5	S10	0.316	474.326	1500	N519
31	5	S12	0.316	473.72	1500	N71
32	5	S14	0.316	473.73	1500	N87
33	6	S3	0.358	536.342	1500	N481
34	6	S4	0.376	563.353	1500	N488
35	6	S6	0.374	561.141	1500	N495
36	6	S8	0.374	561.122	1500	N502
37	6	S9	0.376	563.318	1500	N514
38	6	S10	0.358	536.352	1500	N521
39	6	S12	0.373	559.154	1500	N69
40	6	S14	0.373	559.182	1500	N85
41	7	S3	0.281	420.763	1500	N132
42	7	S4	0.284	426.457	1500	N488
43	7	S6	0.284	425.331	1500	N495
44	7	S8	0.284	425.434	1500	N53
45	7	S9	0.284	426.438	1500	N514
46	7	S10	0.281	420.758	1500	N519
47	7	S12	0.284	426.502	1500	N69
48	7	S14	0.284	426.517	1500	N85
49	8	S3	0.22	330.036	1500	N36
50	8	S4	0.222	332.561	1500	N39
51	8	S6	0.222	333.348	1500	N47
52	8	S8	0.222	333.351	1500	N56
53	8	S9	0.222	332.556	1500	N60
54	8	S10	0.22	330.041	1500	N63
55	8	S12	0.222	333.606	1500	N72
56	8	S14	0.222	333.611	1500	N88
57	9	S3	0.293	439.358	1500	N132
58	9	S4	0.296	444.333	1500	N486
59	9	S6	0.297	445.209	1500	N493
60	9	S8	0.297	445.154	1500	N55
61	9	S9	0.296	444.325	1500	N512
62	9	S10	0.293	439.397	1500	N519
63	9	S12	0.292	437.619	1500	N71
64	9	S14	0.292	437.626	1500	N87
65	10	S3	0.323	484.923	1500	N481
66	10	S4	0.338	506.268	1500	N488
67	10	S6	0.336	504.431	1500	N495
68	10	S8	0.336	504.421	1500	N53
69	10	S9	0.337	506.241	1500	N514
70	10	S10	0.323	484.93	1500	N521
71	10	S12	0.336	503.649	1500	N69
72	10	S14	0.336	503.671	1500	N85
73	11	S3	0.266	399.225	1500	N132
74	11	S4	0.269	403.596	1500	N488

**Slab Soil Pressures (Continued)**

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
75	11	S6	0.268	402.573	1500	N495
76	11	S8	0.268	402.656	1500	N53
77	11	S9	0.269	403.58	1500	N514
78	11	S10	0.266	399.221	1500	N519
79	11	S12	0.269	404.161	1500	N69
80	11	S14	0.269	404.173	1500	N85
81	12	S3	0.13	194.677	1500	N36
82	12	S4	0.133	199.403	1500	N39
83	12	S6	0.133	200.198	1500	N48
84	12	S8	0.133	200.222	1500	N56
85	12	S9	0.133	199.395	1500	N60
86	12	S10	0.13	194.679	1500	N63
87	12	S12	0.136	203.417	1500	N72
88	12	S14	0.136	203.424	1500	N88
89	13	S3	0.246	369.727	1500	N35
90	13	S4	0.275	412.982	1500	N486
91	13	S6	0.274	410.722	1500	N493
92	13	S8	0.274	411.082	1500	N56
93	13	S9	0.275	412.92	1500	N512
94	13	S10	0.247	369.97	1500	N519
95	13	S12	0.261	391.256	1500	N71
96	13	S14	0.261	391.306	1500	N87
97	14	S3	0.269	404.075	1500	N481
98	14	S4	0.286	429.347	1500	N488
99	14	S6	0.285	427.421	1500	N495
100	14	S8	0.285	427.396	1500	N502
101	14	S9	0.286	429.315	1500	N514
102	14	S10	0.269	404.087	1500	N521
103	14	S12	0.283	424.3	1500	N69
104	14	S14	0.283	424.326	1500	N85
105	15	S3	0.191	286.919	1500	N132
106	15	S4	0.195	292.452	1500	N488
107	15	S6	0.194	291.61	1500	N495
108	15	S8	0.194	291.706	1500	N53
109	15	S9	0.195	292.434	1500	N514
110	15	S10	0.191	286.913	1500	N519
111	15	S12	0.194	291.648	1500	N69
112	15	S14	0.194	291.662	1500	N85

**Slab Stability - Overturning**

	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	S3	0	0	49963.419	0	14966.296	9.99+	9.99+
2	2	S4	0	0	49989.527	0	15009.184	9.99+	9.99+
3	2	S6	0	0	49989.602	0	15006.077	9.99+	9.99+
4	2	S8	0	0	49989.625	0	15006.099	9.99+	9.99+
5	2	S9	0	0	49989.491	0	15019.08	9.99+	9.99+
6	2	S10	0	0	49963.416	0	14951.403	9.99+	9.99+
7	2	S12	0	0	49742.313	0	14899.949	9.99+	9.99+
8	2	S14	0	0	49742.333	0	15064.179	9.99+	9.99+
9	3	S3	0	0	49963.419	0	14966.296	9.99+	9.99+
10	3	S4	0	0	49989.527	0	15009.184	9.99+	9.99+
11	3	S6	0	0	49989.602	0	15006.077	9.99+	9.99+
12	3	S8	0	0	49989.625	0	15006.099	9.99+	9.99+
13	3	S9	0	0	49989.491	0	15019.08	9.99+	9.99+
14	3	S10	0	0	49963.416	0	14951.403	9.99+	9.99+

**Slab Stability - Overturning (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
15	3	S12	0	0	49742.313	0	14899.949	9.99+	9.99+
16	3	S14	0	0	49742.333	0	15064.179	9.99+	9.99+
17	4	S3	0	17976.962	49762.279	3661.374	14966.296	2.768	4.088
18	4	S4	0	19383.42	50104.916	3905.643	15019.149	2.585	3.845
19	4	S6	0	19280.513	50050.91	3861.486	15006.077	2.596	3.886
20	4	S8	0	19281.053	50051.039	3861.547	15006.099	2.596	3.886
21	4	S9	0	19381.569	50104.519	3905.304	15019.08	2.585	3.846
22	4	S10	0	17976.52	49762.13	3661.181	14966.261	2.768	4.088
23	4	S12	0	18373.49	50138.005	4015.628	15064.146	2.729	3.751
24	4	S14	0	18374.965	50138.312	4015.767	15064.179	2.729	3.751
25	5	S3	0	22062.652	49762.279	3003.892	14966.296	2.255	4.982
26	5	S4	0	24316.306	50104.916	3372.499	15019.149	2.061	4.453
27	5	S6	0	24109.108	50050.91	3302.117	15006.077	2.076	4.544
28	5	S8	0	24109.915	50051.039	3302.211	15006.099	2.076	4.544
29	5	S9	0	24313.462	50104.519	3371.971	15019.08	2.061	4.454
30	5	S10	0	22061.882	49762.13	3003.599	14966.261	2.256	4.983
31	5	S12	0	23434.423	50138.005	3803.628	15064.146	2.14	3.96
32	5	S14	0	23436.781	50138.312	3803.879	15064.179	2.139	3.96
33	6	S3	0	0	56055.691	0	19259.001	9.99+	9.99+
34	6	S4	0	0	56510.254	0	19562.784	9.99+	9.99+
35	6	S6	0	0	56320.525	0	19553.812	9.99+	9.99+
36	6	S8	0	0	56320.77	0	19518.122	9.99+	9.99+
37	6	S9	0	0	56509.917	0	19623.353	9.99+	9.99+
38	6	S10	0	0	56055.176	0	19143.454	9.99+	9.99+
39	6	S12	0	0	55670.787	0	18737.354	9.99+	9.99+
40	6	S14	0	0	55670.833	0	19849.933	9.99+	9.99+
41	7	S3	0	0	60423.342	0	18702.212	9.99+	9.99+
42	7	S4	0	0	60653.49	0	18855.013	9.99+	9.99+
43	7	S6	0	0	60558.926	0	18870.87	9.99+	9.99+
44	7	S8	0	0	60559.083	0	18838.673	9.99+	9.99+
45	7	S9	0	0	60653.352	0	18909.847	9.99+	9.99+
46	7	S10	0	0	60423.016	0	18642.837	9.99+	9.99+
47	7	S12	0	0	59374.744	0	18212.166	9.99+	9.99+
48	7	S14	0	0	59374.693	0	18879.155	9.99+	9.99+
49	8	S3	0	13482.721	49762.279	2746.03	14966.296	3.691	5.45
50	8	S4	0	14537.565	50104.916	2929.232	15019.149	3.447	5.127
51	8	S6	0	14460.384	50050.91	2896.114	15006.077	3.461	5.181
52	8	S8	0	14460.79	50051.039	2896.16	15006.099	3.461	5.181
53	8	S9	0	14536.177	50104.519	2928.978	15019.08	3.447	5.128
54	8	S10	0	13482.39	49762.13	2745.886	14966.261	3.691	5.45
55	8	S12	0	13780.117	50138.005	3011.721	15064.146	3.638	5.002
56	8	S14	0	13781.224	50138.312	3011.825	15064.179	3.638	5.002
57	9	S3	0	16546.989	49762.279	2252.919	14966.296	3.007	6.643
58	9	S4	0	18237.23	50104.916	2529.374	15019.149	2.747	5.938
59	9	S6	0	18081.831	50050.91	2476.588	15006.077	2.768	6.059
60	9	S8	0	18082.436	50051.039	2476.658	15006.099	2.768	6.059
61	9	S9	0	18235.096	50104.519	2528.978	15019.08	2.748	5.939
62	9	S10	0	16546.412	49762.13	2252.699	14966.261	3.007	6.644
63	9	S12	0	17575.818	50138.005	2852.721	15064.146	2.853	5.281
64	9	S14	0	17577.586	50138.312	2852.909	15064.179	2.852	5.28
65	10	S3	0	0	54532.623	0	18185.825	9.99+	9.99+
66	10	S4	0	0	54880.072	0	18424.384	9.99+	9.99+
67	10	S6	0	0	54737.794	0	18416.878	9.99+	9.99+
68	10	S8	0	0	54737.984	0	18390.116	9.99+	9.99+
69	10	S9	0	0	54879.811	0	18472.285	9.99+	9.99+

**Slab Stability - Overturning (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
70	10	S10	0	0	54532.236	0	18095.441	9.99+	9.99+
71	10	S12	0	0	54188.668	0	17778.003	9.99+	9.99+
72	10	S14	0	0	54188.708	0	18653.494	9.99+	9.99+
73	11	S3	0	0	57808.361	0	17768.233	9.99+	9.99+
74	11	S4	0	0	57987.499	0	17893.555	9.99+	9.99+
75	11	S6	0	0	57916.595	0	17904.672	9.99+	9.99+
76	11	S8	0	0	57916.719	0	17880.53	9.99+	9.99+
77	11	S9	0	0	57987.387	0	17937.156	9.99+	9.99+
78	11	S10	0	0	57808.116	0	17719.979	9.99+	9.99+
79	11	S12	0	0	56966.636	0	17384.112	9.99+	9.99+
80	11	S14	0	0	56966.603	0	17925.411	9.99+	9.99+
81	12	S3	0	17976.962	29857.368	3661.374	8979.778	1.661	2.453
82	12	S4	0	19383.42	30062.95	3905.643	9011.49	1.551	2.307
83	12	S6	0	19280.513	30030.546	3861.486	9003.646	1.558	2.332
84	12	S8	0	19281.053	30030.623	3861.547	9003.66	1.558	2.332
85	12	S9	0	19381.569	30062.711	3905.304	9011.448	1.551	2.307
86	12	S10	0	17976.52	29857.278	3661.181	8979.757	1.661	2.453
87	12	S12	0	18373.49	30082.803	4015.628	9038.488	1.637	2.251
88	12	S14	0	18374.965	30082.987	4015.767	9038.507	1.637	2.251
89	13	S3	0	22062.652	29857.368	3003.892	8979.778	1.353	2.989
90	13	S4	0	24316.306	30062.95	3372.499	9011.49	1.236	2.672
91	13	S6	0	24109.108	30030.546	3302.117	9003.646	1.246	2.727
92	13	S8	0	24109.915	30030.623	3302.211	9003.66	1.246	2.727
93	13	S9	0	24313.462	30062.711	3371.971	9011.448	1.236	2.672
94	13	S10	0	22061.882	29857.278	3003.599	8979.757	1.353	2.99
95	13	S12	0	23434.423	30082.803	3803.628	9038.488	1.284	2.376
96	13	S14	0	23436.781	30082.987	3803.879	9038.507	1.284	2.376
97	14	S3	0	0	36070.324	0	13272.483	9.99+	9.99+
98	14	S4	0	0	36514.443	0	13559.111	9.99+	9.99+
99	14	S6	0	0	36324.684	0	13551.382	9.99+	9.99+
100	14	S8	0	0	36324.92	0	13515.682	9.99+	9.99+
101	14	S9	0	0	36514.121	0	13615.721	9.99+	9.99+
102	14	S10	0	0	36069.81	0	13162.892	9.99+	9.99+
103	14	S12	0	0	35773.862	0	12777.374	9.99+	9.99+
104	14	S14	0	0	35773.9	0	13824.261	9.99+	9.99+
105	15	S3	0	0	40437.974	0	12715.693	9.99+	9.99+
106	15	S4	0	0	40657.679	0	12851.339	9.99+	9.99+
107	15	S6	0	0	40563.085	0	12868.44	9.99+	9.99+
108	15	S8	0	0	40563.234	0	12836.234	9.99+	9.99+
109	15	S9	0	0	40657.556	0	12902.215	9.99+	9.99+
110	15	S10	0	0	40437.65	0	12662.276	9.99+	9.99+
111	15	S12	0	0	39477.818	0	12252.187	9.99+	9.99+
112	15	S14	0	0	39477.76	0	12853.484	9.99+	9.99+

**Slab Stability - Sliding**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
1	2	S3	0	3.435	2991.771	0	2991.771	9.99+	9.99+
2	2	S4	0	2.3	3002.833	0	3002.833	9.99+	9.99+
3	2	S6	0	0	3001.215	0	3001.215	9.99+	9.99+
4	2	S8	0	0	3001.22	0	3001.22	9.99+	9.99+
5	2	S9	0	2.298	3002.82	0	3002.82	9.99+	9.99+
6	2	S10	0	3.429	2991.766	0	2991.766	9.99+	9.99+
7	2	S12	0	37.892	2996.41	0	2996.41	9.99+	9.99+
8	2	S14	0	37.884	2996.419	0	2996.419	9.99+	9.99+
9	3	S3	0	3.435	2991.771	0	2991.771	9.99+	9.99+

**Slab Stability - Sliding (Continued)**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
10	3	S4	0	2.3	3002.833	0	3002.833	9.99+	9.99+
11	3	S6	0	0	3001.215	0	3001.215	9.99+	9.99+
12	3	S8	0	0	3001.22	0	3001.22	9.99+	9.99+
13	3	S9	0	2.298	3002.82	0	3002.82	9.99+	9.99+
14	3	S10	0	3.429	2991.766	0	2991.766	9.99+	9.99+
15	3	S12	0	37.892	2996.41	0	2996.41	9.99+	9.99+
16	3	S14	0	37.884	2996.419	0	2996.419	9.99+	9.99+
17	4	S3	0	14.369	2267.211	949.968	2267.211	9.99+	2.387
18	4	S4	0	7.79	2226.077	922.017	2226.077	9.99+	2.414
19	4	S6	0	7.115	2232.002	938.708	2232.002	9.99+	2.378
20	4	S8	0	7.094	2231.985	938.699	2231.985	9.99+	2.378
21	4	S9	0	7.779	2226.126	922.027	2226.126	9.99+	2.414
22	4	S10	0	14.345	2267.232	950.009	2267.232	9.99+	2.387
23	4	S12	0	134.63	2268.043	827.596	2268.043	9.99+	2.741
24	4	S14	0	134.599	2268.009	827.621	2268.009	9.99+	2.74
25	5	S3	0	26.507	2403.967	818.045	2403.967	9.99+	2.939
26	5	S4	0	5.748	2331.821	784.696	2331.821	9.99+	2.972
27	5	S6	0	5.472	2343.163	806.487	2343.163	9.99+	2.905
28	5	S8	0	5.443	2343.136	806.471	2343.136	9.99+	2.905
29	5	S9	0	5.732	2331.906	784.709	2331.906	9.99+	2.972
30	5	S10	0	26.467	2404.001	818.093	2404.001	9.99+	2.939
31	5	S12	0	212.248	2344.078	707.633	2344.078	9.99+	3.313
32	5	S14	0	212.198	2344.013	707.667	2344.013	9.99+	3.312
33	6	S3	0	26.644	3840.255	1119.66	3840.255	9.99+	3.43
34	6	S4	0	14.094	3918.664	1085.303	3918.664	9.99+	3.611
35	6	S6	0	8.287	3907.172	1106.104	3907.172	9.99+	3.532
36	6	S8	0	8.26	3907.204	1106.092	3907.204	9.99+	3.532
37	6	S9	0	14.076	3918.571	1085.314	3918.571	9.99+	3.611
38	6	S10	0	26.6	3840.217	1119.709	3840.217	9.99+	3.43
39	6	S12	0	256.699	3858.707	974.661	3858.707	9.99+	3.959
40	6	S14	0	256.642	3858.775	974.693	3858.775	9.99+	3.959
41	7	S3	0	13.688	3734.511	947.642	3734.511	9.99+	3.941
42	7	S4	0	12.718	3776.514	924.883	3776.514	9.99+	4.083
43	7	S6	0	7.46	3770.941	937.437	3770.941	9.99+	4.023
44	7	S8	0	7.444	3770.96	937.431	3770.96	9.99+	4.023
45	7	S9	0	12.707	3776.463	924.89	3776.463	9.99+	4.083
46	7	S10	0	13.667	3734.49	947.675	3734.49	9.99+	3.941
47	7	S12	0	153.898	3709.122	828.348	3709.122	9.99+	4.478
48	7	S14	0	153.865	3709.156	828.367	3709.156	9.99+	4.478
49	8	S3	0	9.918	2448.351	712.476	2448.351	9.99+	3.436
50	8	S4	0	5.267	2420.266	691.513	2420.266	9.99+	3.5
51	8	S6	0	5.337	2424.305	704.031	2424.305	9.99+	3.443
52	8	S8	0	5.32	2424.293	704.024	2424.293	9.99+	3.443
53	8	S9	0	5.26	2420.3	691.52	2420.3	9.99+	3.5
54	8	S10	0	9.902	2448.366	712.507	2448.366	9.99+	3.436
55	8	S12	0	91.5	2450.135	620.697	2450.135	9.99+	3.947
56	8	S14	0	91.478	2450.111	620.716	2450.111	9.99+	3.947
57	9	S3	0	19.021	2550.918	613.533	2550.918	9.99+	4.158
58	9	S4	0	3.736	2499.574	588.522	2499.574	9.99+	4.247
59	9	S6	0	4.104	2507.676	604.865	2507.676	9.99+	4.146
60	9	S8	0	4.082	2507.657	604.853	2507.657	9.99+	4.146
61	9	S9	0	3.725	2499.634	588.532	2499.634	9.99+	4.247
62	9	S10	0	18.993	2550.943	613.569	2550.943	9.99+	4.158
63	9	S12	0	149.713	2507.161	530.725	2507.161	9.99+	4.724
64	9	S14	0	149.678	2507.114	530.75	2507.114	9.99+	4.724

**Slab Stability - Sliding (Continued)**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
65	10	S3	0	20.841	3628.134	839.745	3628.134	9.99+	4.321
66	10	S4	0	11.145	3689.706	813.977	3689.706	9.99+	4.533
67	10	S6	0	6.215	3680.683	829.578	3680.683	9.99+	4.437
68	10	S8	0	6.195	3680.708	829.569	3680.708	9.99+	4.437
69	10	S9	0	11.132	3689.633	813.986	3689.633	9.99+	4.533
70	10	S10	0	20.807	3628.105	839.782	3628.105	9.99+	4.32
71	10	S12	0	201.997	3643.133	730.996	3643.133	9.99+	4.984
72	10	S14	0	201.953	3643.186	731.02	3643.186	9.99+	4.984
73	11	S3	0	11.125	3548.826	710.731	3548.826	9.99+	4.993
74	11	S4	0	10.113	3583.094	693.662	3583.094	9.99+	5.165
75	11	S6	0	5.595	3578.51	703.077	3578.51	9.99+	5.09
76	11	S8	0	5.583	3578.525	703.074	3578.525	9.99+	5.09
77	11	S9	0	10.105	3583.052	693.668	3583.052	9.99+	5.165
78	11	S10	0	11.107	3548.809	710.756	3548.809	9.99+	4.993
79	11	S12	0	124.896	3530.944	621.261	3530.944	9.99+	5.684
80	11	S14	0	124.87	3530.972	621.275	3530.972	9.99+	5.683
81	12	S3	0	15.743	1070.503	949.968	1070.503	9.99+	1.127
82	12	S4	0	8.71	1024.943	922.017	1024.943	9.99+	1.112
83	12	S6	0	7.115	1031.515	938.708	1031.515	9.99+	1.099
84	12	S8	0	7.094	1031.497	938.699	1031.497	9.99+	1.099
85	12	S9	0	8.698	1024.998	922.027	1024.998	9.99+	1.112
86	12	S10	0	15.717	1070.526	950.009	1070.526	9.99+	1.127
87	12	S12	0	149.787	1069.48	827.596	1069.48	7.14	1.292
88	12	S14	0	149.753	1069.441	827.621	1069.441	7.141	1.292
89	13	S3	0	27.881	1207.259	818.045	1207.259	9.99+	1.476
90	13	S4	0	6.668	1130.688	784.696	1130.688	9.99+	1.441
91	13	S6	0	5.472	1142.677	806.487	1142.677	9.99+	1.417
92	13	S8	0	5.443	1142.648	806.471	1142.648	9.99+	1.417
93	13	S9	0	6.652	1130.778	784.709	1130.778	9.99+	1.441
94	13	S10	0	27.838	1207.295	818.093	1207.295	9.99+	1.476
95	13	S12	0	227.404	1145.514	707.633	1145.514	5.037	1.619
96	13	S14	0	227.352	1145.445	707.667	1145.445	5.038	1.619
97	14	S3	0	25.27	2643.546	1119.66	2643.546	9.99+	2.361
98	14	S4	0	13.174	2717.531	1085.303	2717.531	9.99+	2.504
99	14	S6	0	8.287	2706.685	1106.104	2706.685	9.99+	2.447
100	14	S8	0	8.26	2706.716	1106.092	2706.716	9.99+	2.447
101	14	S9	0	13.157	2717.443	1085.314	2717.443	9.99+	2.504
102	14	S10	0	25.228	2643.511	1119.709	2643.511	9.99+	2.361
103	14	S12	0	241.543	2660.143	974.661	2660.143	9.99+	2.729
104	14	S14	0	241.489	2660.207	974.693	2660.207	9.99+	2.729
105	15	S3	0	12.314	2537.802	947.642	2537.802	9.99+	2.678
106	15	S4	0	11.798	2575.38	924.883	2575.38	9.99+	2.785
107	15	S6	0	7.46	2570.455	937.437	2570.455	9.99+	2.742
108	15	S8	0	7.444	2570.473	937.431	2570.473	9.99+	2.742
109	15	S9	0	11.788	2575.335	924.89	2575.335	9.99+	2.784
110	15	S10	0	12.295	2537.783	947.675	2537.783	9.99+	2.678
111	15	S12	0	138.741	2510.559	828.348	2510.559	9.99+	3.031
112	15	S14	0	138.711	2510.588	828.367	2510.588	9.99+	3.031





JOB NO.: U2716.0389.241

**PROJECT:** Sunturf Package D7 Ground Mount

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# 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	0.45
9	1.0 D + 0.45 W2 + 0.75 S		Y	DL	1	RLL	0.75	OL2	0.45	WLZ	0.45
10	1.0 D + 0.45 W3 + 0.75 S		Y	DL	1	RLL	0.75	OL3	0.45	WLZ	-0.45
11	1.0 D + 0.45 W4 + 0.75 S		Y	DL	1	RLL	0.75	OL4	0.45	WLZ	-0.45
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											
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		
20	1.2 D + 1.6 S + 0.5 W2	Yes	Y	DL	1.2	RLL	1.6	OL2	0.5		
21	1.2 D + 1.6 S + 0.5 W3	Yes	Y	DL	1.2	RLL	1.6	OL3	0.5		
22	1.2 D + 1.6 S + 0.5 W4	Yes	Y	DL	1.2	RLL	1.6	OL4	0.5		
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	0.9	RLL		OL1	1		
28	0.9 D + 1.0 W2	Yes	Y	DL	0.9	RLL		OL2	1		
29	0.9 D + 1.0 W3	Yes	Y	DL	0.9	RLL		OL3	1		
30	0.9 D + 1.0 W4	Yes	Y	DL	0.9	RLL		OL4	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	19.611	26	2185.042	26	100.53	23	0	30	0	30	0	30
2 min	-6.867	27	-874.661	27	-127.42	25	0	18	0	18	0	18
3 N1 max	405.329	25	4096.347	25	1750.737	25	0	30	0	30	0	30
4 min	-397.744	28	-3827.82	28	-1480.437	23	0	18	0	18	0	18
5 N151 max	397.828	28	4095.927	25	1750.68	25	0	30	0	30	0	30
6 min	-405.388	25	-3827.446	28	-1480.393	23	0	18	0	18	0	18
7 N152 max	6.877	27	2185.064	26	100.527	23	0	30	0	30	0	30
8 min	-19.625	26	-874.679	27	-127.418	25	0	18	0	18	0	18
9 N276 max	39.443	25	3856.06	25	2007.374	25	0	30	0	30	0	30
10 min	-37.784	28	-3576.458	28	-1692.386	23	0	18	0	18	0	18
11 N278 max	4.601	25	2426.362	26	109.755	23	0	30	0	30	0	30
12 min	-7.913	28	-961.792	27	-139.916	25	0	18	0	18	0	18
13 N233 max	15.499	28	4251.849	25	1947.709	25	0	30	0	30	0	30
14 min	-15.76	25	-3967.395	28	-1645.658	23	0	18	0	18	0	18
15 N235 max	4.49	27	2433.974	26	108.871	23	0	30	0	30	0	30
16 min	-11.423	26	-984.625	27	-138.958	25	0	18	0	18	0	18
17 N239 max	5.538	25	4207.909	25	1984.43	25	0	30	0	30	0	30
18 min	-5.251	28	-3932.559	28	-1675.533	23	0	18	0	18	0	18
19 N241 max	10.821	26	2425.386	26	110.998	23	0	30	0	30	0	30
20 min	-7.188	27	-963.957	27	-141.025	25	0	18	0	18	0	18
21 N245 max	5.205	28	4208.061	25	1984.408	25	0	30	0	30	0	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	25	-5.515	28	-3932.696	23	0	18	0	18	0	18
23	N247	max	27	7.181	26	2425.403	23	0	30	0	30	0	30
24		min	26	-10.807	27	-963.974	25	0	18	0	18	0	18
25	N251	max	25	15.721	25	4251.337	25	0	30	0	30	0	30
26		min	28	-15.488	28	-3966.916	23	0	18	0	18	0	18
27	N253	max	26	11.42	26	2433.984	23	0	30	0	30	0	30
28		min	27	-4.483	27	-984.624	25	0	18	0	18	0	18
29	N257	max	28	37.719	25	3855.956	25	0	30	0	30	0	30
30		min	25	-39.39	28	-3576.3	23	0	18	0	18	0	18
31	N259	max	28	7.909	26	2426.322	23	0	30	0	30	0	30
32		min	25	-4.582	27	-961.741	25	0	18	0	18	0	18
33	Totals:	max	27	0	25	44708.43	29						
34		min	24	-0.001	27	-29227.583	23						



**Anchor Designer™**  
**Software**  
Version 3.1.2303.1

Company:	Vector Structural Engineers	Date:	5/6/2024
Engineer:	CJT	Page:	1/6
Project:	Sunturf Ground Mount D7		
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 318-19  
Units: Imperial units

**Anchor Information:**

Anchor type: Bonded anchor  
Material: F593 304/316SS  
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): 26.00  
State: Cracked  
Compressive strength,  $f'_c$  (psi): 2500  
 $\Psi_{c,v}$ : 1.0  
Reinforcement condition: Supplementary reinforcement not present  
Supplemental edge 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  
Reduced installation torque (for AT-3G): Not applicable  
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 F593 CW (304/316SS)  
Code Report: ICC-ES ESR-4057





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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]: 3968

$V_{uax}$  [lb]: 406

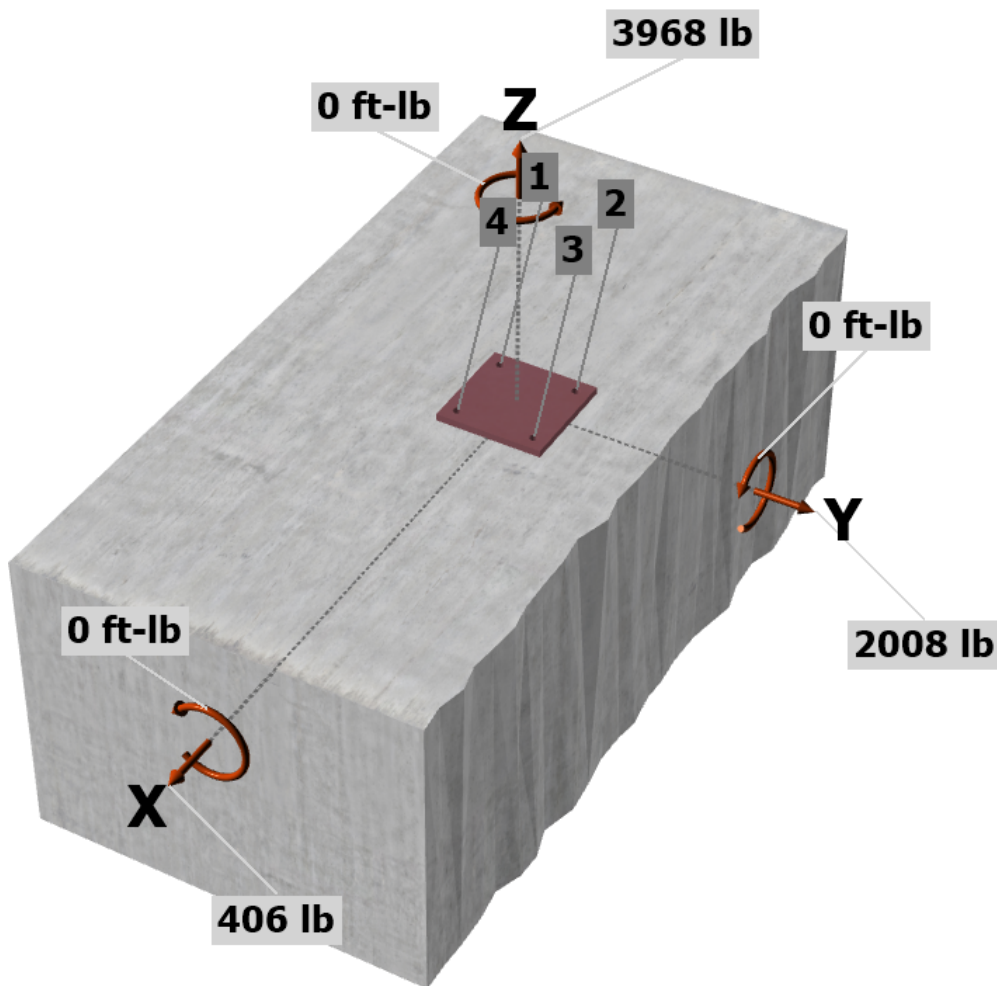
$V_{uay}$  [lb]: 2008

$M_{ux}$  [ft-lb]: 0

$M_{uy}$  [ft-lb]: 0

$M_{uz}$  [ft-lb]: 0

<Figure 1>

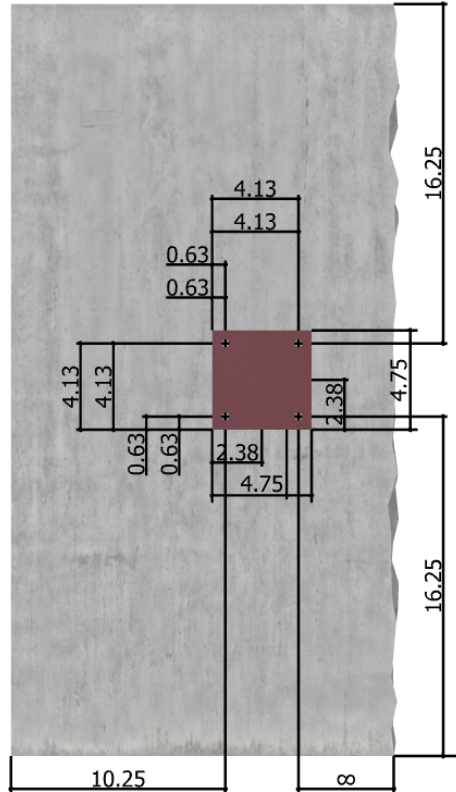


Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



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Engineer:	CJT	Page:	3/6
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Address:			
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<Figure 2>





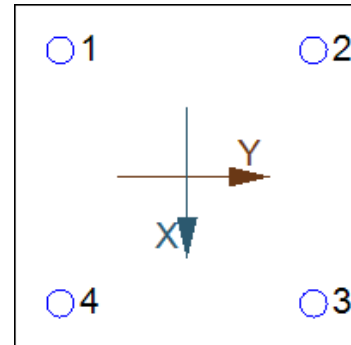
Company:	Vector Structural Engineers	Date:	5/6/2024
Engineer:	CJT	Page:	4/6
Project:	Sunturf Ground Mount D7		
Address:			
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### 3. Resulting Anchor Forces

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	992.0	101.5	502.0	512.2
2	992.0	101.5	502.0	512.2
3	992.0	101.5	502.0	512.1
4	992.0	101.5	502.0	512.1
Sum	3968.0	406.0	2008.0	2048.6

Maximum concrete compression strain (%): 0.00  
 Maximum concrete compression stress (psi): 0  
 Resultant tension force (lb): 3968  
 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. 17.6.1)

$N_{sa}$ (lb)	$\phi$	$\phi N_{sa}$ (lb)
7800	0.75	5850

### 5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.6.2)

$$N_b = K_c \lambda_a \sqrt{f_c} h_{ef}^{1.5} \text{ (Eq. 17.6.2.2.1)}$$

$K_c$	$\lambda_a$	$f_c$ (psi)	$h_{ef}$ (in)	$N_b$ (lb)
17.0	1.00	2500	4.000	6800

$$\phi N_{cbg} = \phi (A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. 17.5.1.2 \& Eq. 17.6.2.1a)}$$

$A_{Nc}$ (in <sup>2</sup> )	$A_{Nco}$ (in <sup>2</sup> )	$C_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	$N_b$ (lb)	$\phi$	$\phi N_{cbg}$ (lb)
240.25	144.00	10.25	1.000	1.000	1.00	1.000	6800	0.65	7374

### 6. Adhesive Strength of Anchor in Tension (Sec. 17.6.5)

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

$\tau_{k,cr}$ (psi)	$f_{short-term}$	$K_{sat}$	$f_c$ (psi)	$n$	$\tau_{k,cr}$ (psi)
1346	1.00	1.00	2500	0.24	1346

$$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef} \text{ (Eq. 17.6.5.2.1)}$$

$\lambda_a$	$\tau_{cr}$ (psi)	$d_a$ (in)	$h_{ef}$ (in)	$N_{ba}$ (lb)
1.00	1346	0.38	4.000	6343

$$\phi N_{ag} = \phi (A_{Na} / A_{Na0}) \Psi_{ec,Na} \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} \text{ (Sec. 17.5.1.2 \& Eq. 17.6.5.1b)}$$

$A_{Na}$ (in <sup>2</sup> )	$A_{Na0}$ (in <sup>2</sup> )	$C_{Na}$ (in)	$C_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	$N_{ba}$ (lb)	$\phi$	$\phi N_{ag}$ (lb)
198.45	112.09	5.29	10.25	1.000	1.000	1.000	6343	0.55	6176

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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Address:			
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E-mail:			

**8. Steel Strength of Anchor in Shear (Sec. 17.7.1)**

$V_{sa}$ (lb)	$\phi_{grout}$	$\phi$	$\phi_{grout}\phi V_{sa}$ (lb)
4680	1.0	0.65	3042

**9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.7.2)**

**Shear perpendicular to edge in x-direction:**

$$V_{bx} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}| \text{ (Eq. 17.7.2.2.1a \& Eq. 17.7.2.2.1b)}$$

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

$$\phi V_{cbgx} = \phi (A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{bx} \text{ (Sec. 17.5.1.2 \& Eq. 17.7.2.1b)}$$

$A_{vc}$ (in <sup>2</sup> )	$A_{vco}$ (in <sup>2</sup> )	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	$V_{bx}$ (lb)	$\phi$	$\phi V_{cbgx}$ (lb)
1127.75	1755.28	1.000	0.804	1.000	1.067	28514	0.70	11003

**Shear parallel to edge in y-direction:**

$$V_{by} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}| \text{ (Eq. 17.7.2.2.1a \& Eq. 17.7.2.2.1b)}$$

$l_e$ (in)	$d_a$ (in)	$\lambda_a$	$f_c$ (psi)	$c_{a1}$ (in)	$V_{by}$ (lb)
3.00	0.375	1.00	2500	10.25	10661

$$\phi V_{cbgy} = \phi (2)(A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{by} \text{ (Sec. 17.5.1.2, 17.7.2.1(c) \& Eq. 17.7.2.1b)}$$

$A_{vc}$ (in <sup>2</sup> )	$A_{vco}$ (in <sup>2</sup> )	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	$V_{by}$ (lb)	$\phi$	$\phi V_{cbgy}$ (lb)
526.59	472.78	1.000	1.000	1.000	1.000	10661	0.70	16624

**Shear parallel to edge in x-direction:**

$$V_{bx} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}| \text{ (Eq. 17.7.2.2.1a \& Eq. 17.7.2.2.1b)}$$

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

$$\phi V_{cbgx} = \phi (2)(A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{bx} \text{ (Sec. 17.5.1.2, 17.7.2.1(c) \& Eq. 17.7.2.1b)}$$

$A_{vc}$ (in <sup>2</sup> )	$A_{vco}$ (in <sup>2</sup> )	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	$V_{bx}$ (lb)	$\phi$	$\phi V_{cbgx}$ (lb)
929.30	1188.28	1.000	1.000	1.000	1.000	21280	0.70	23299

**10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.7.3)**

$$\phi V_{cp} = \phi \min|k_{cp} N_{ag}; k_{cp} N_{cbg}| = \phi \min|k_{cp} (A_{Na} / A_{Na0}) \psi_{ec,Na} \psi_{ed,Na} \psi_{cp,Na} N_{ba}; k_{cp} (A_{Nc} / A_{Nco}) \psi_{ec,N} \psi_{ed,N} \psi_{cp,N} N_{b}| \text{ (Sec. 17.5.1.2 \& Eq. 17.7.3.1b)}$$

$k_{cp}$	$A_{Na}$ (in <sup>2</sup> )	$A_{Na0}$ (in <sup>2</sup> )	$\psi_{ed,Na}$	$\psi_{ec,Na}$	$\psi_{cp,Na}$	$N_{ba}$ (lb)	$N_a$ (lb)
2.0	198.45	112.09	1.000	1.000	1.000	6343	11229

$A_{Nc}$ (in <sup>2</sup> )	$A_{Nco}$ (in <sup>2</sup> )	$\psi_{ec,N}$	$\psi_{ed,N}$	$\psi_{c,N}$	$\psi_{cp,N}$	$N_b$ (lb)	$N_{cb}$ (lb)	$\phi$
240.25	144.00	1.000	1.000	1.000	1.000	6800	11345	0.70

$$\phi V_{cp} = 15721$$

**11. Results**

**Interaction of Tension and Shear Forces (Sec. 17.8)**

Tension	Factored Load, $N_{ua}$ (lb)	Design Strength, $\phi N_n$ (lb)	Ratio	Status
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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 3.1.2303.1

Company:	Vector Structural Engineers	Date:	5/6/2024
Engineer:	CJT	Page:	6/6
Project:	Sunturf Ground Mount D7		
Address:			
Phone:			
E-mail:			

Steel	992	5850	0.17	Pass
Concrete breakout	3968	7374	0.54	Pass
<b>Adhesive</b>	<b>3968</b>	<b>6176</b>	<b>0.64</b>	<b>Pass (Governs)</b>

Shear	Factored Load, $V_{ua}$ (lb)	Design Strength, $\phi V_n$ (lb)	Ratio	Status
<b>Steel</b>	<b>512</b>	<b>3042</b>	<b>0.17</b>	<b>Pass (Governs)</b>
T Concrete breakout x+	406	11003	0.04	Pass
Concrete breakout y-	203	16624	0.01	Pass
Concrete breakout x-	1004	23299	0.04	Pass
Concrete breakout, combined	-	-	0.04	Pass
Pryout	2049	15721	0.13	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.1	0.64	0.00	64.2%	1.0	Pass

**SET-3G w/ 3/8"Ø F593 CW (304/316SS) 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.