



Project Number: U2716.0389.241

May 20, 2024

Sunmodo
14800 NE 65th Street
Vancouver, WA 98682

**REFERENCE: SunModo Sunturf Ground Mount D7 – Standard 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	2295	1.5	3443
LATERAL	1317	2	2634

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.

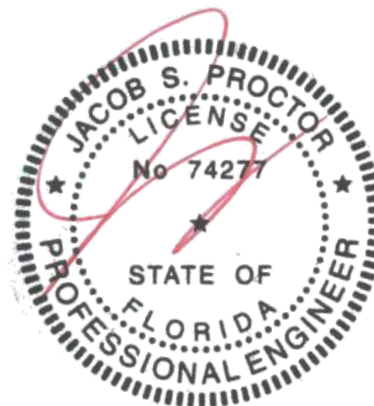
Very truly yours,

VECTOR STRUCTURAL ENGINEERING, LLC

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

Enclosures

JSP/cjt



05/20/2024

Jacob S. Proctor
No. 74277



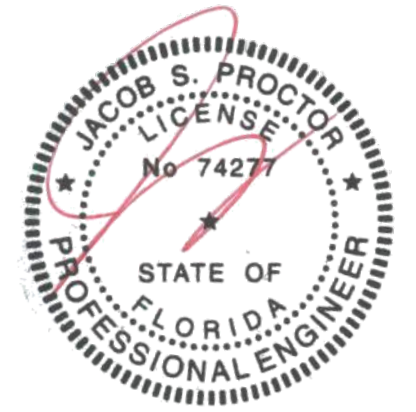
JOB NO. U2716.0389.241
 PROJECT SUNMODO SUNTURF GROUND MOUNT D7
 SUBJECT ALL OPTIONS

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

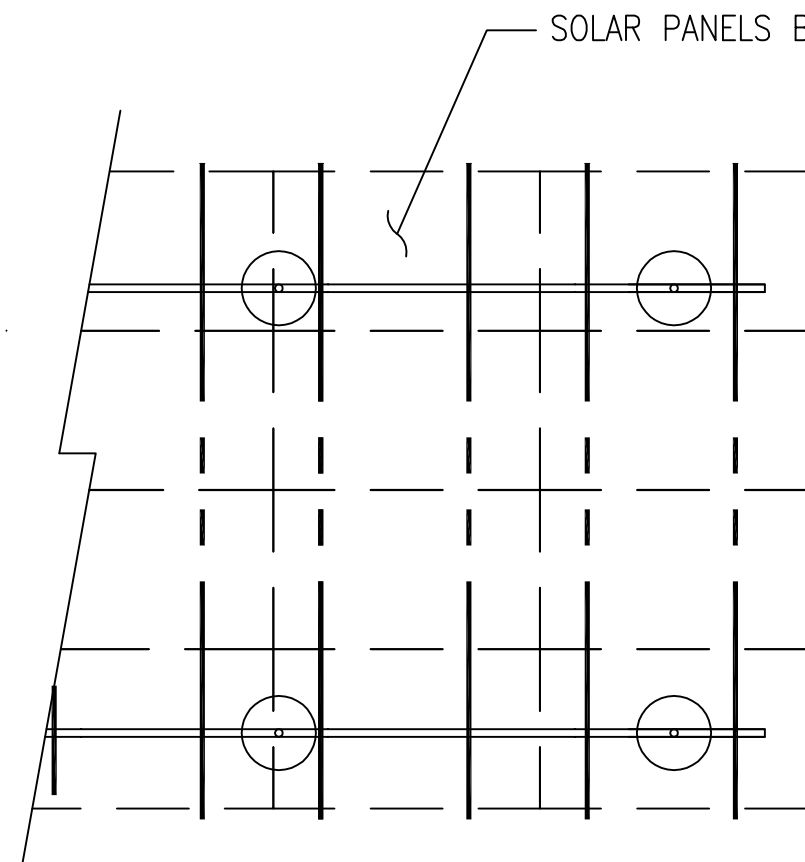
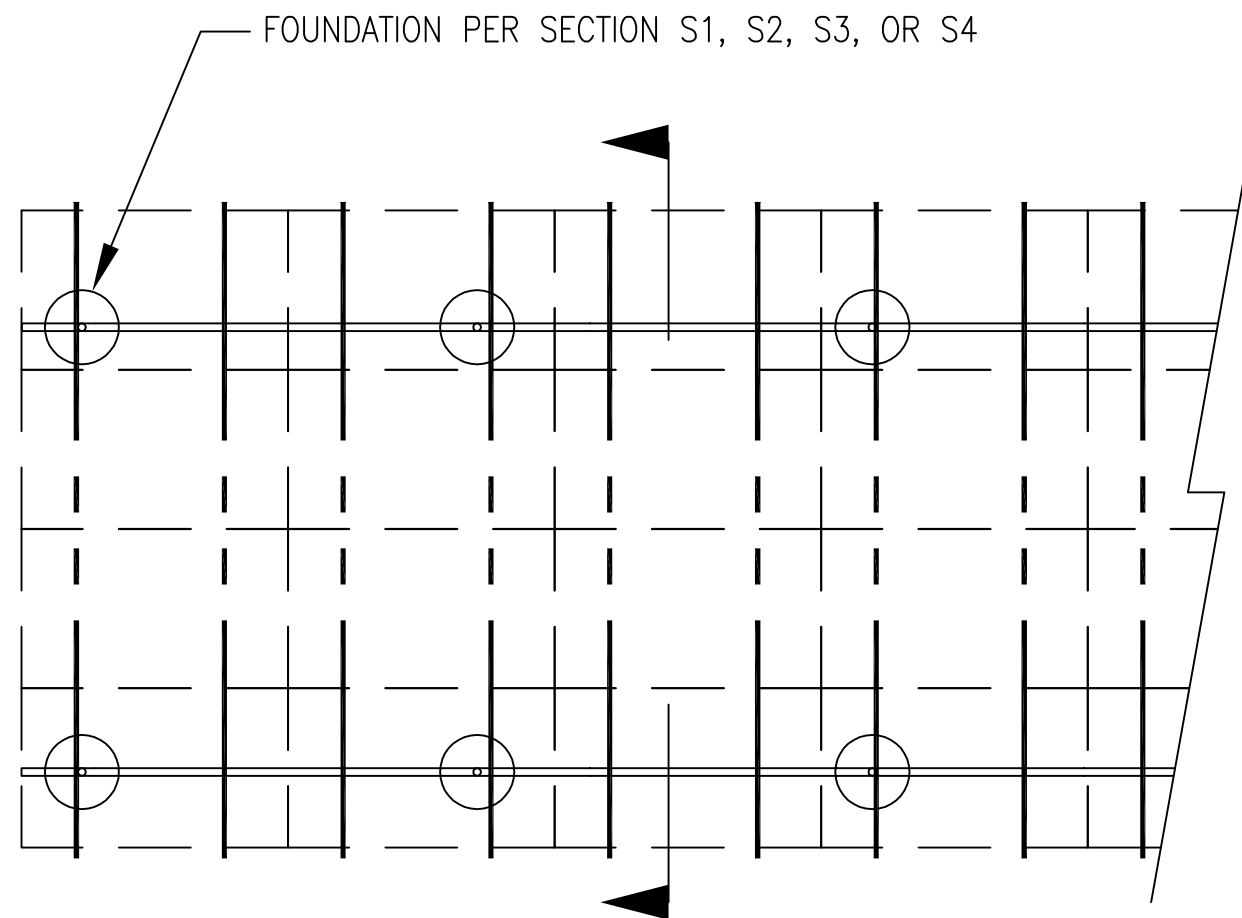
NOTES:

1. 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.

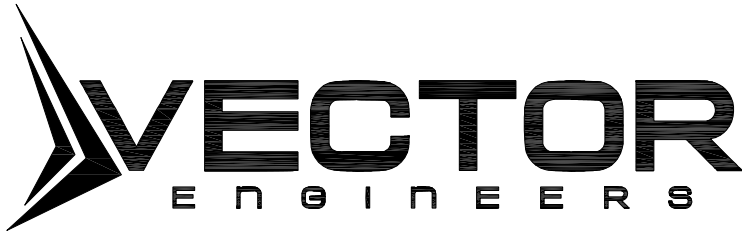


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PV ARRAY PLAN

N.T.S.



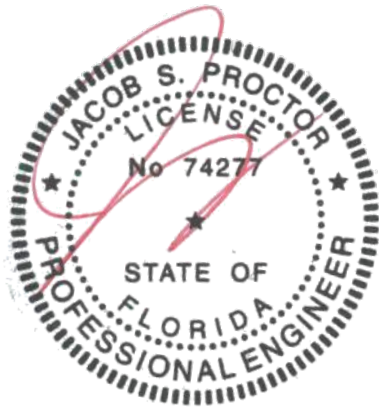
JOB NO. U2716.0389.241

PROJECT SUNMODO SUNTURF GROUND MOUNT D7

SUBJECT DRILLED PIER OPTION

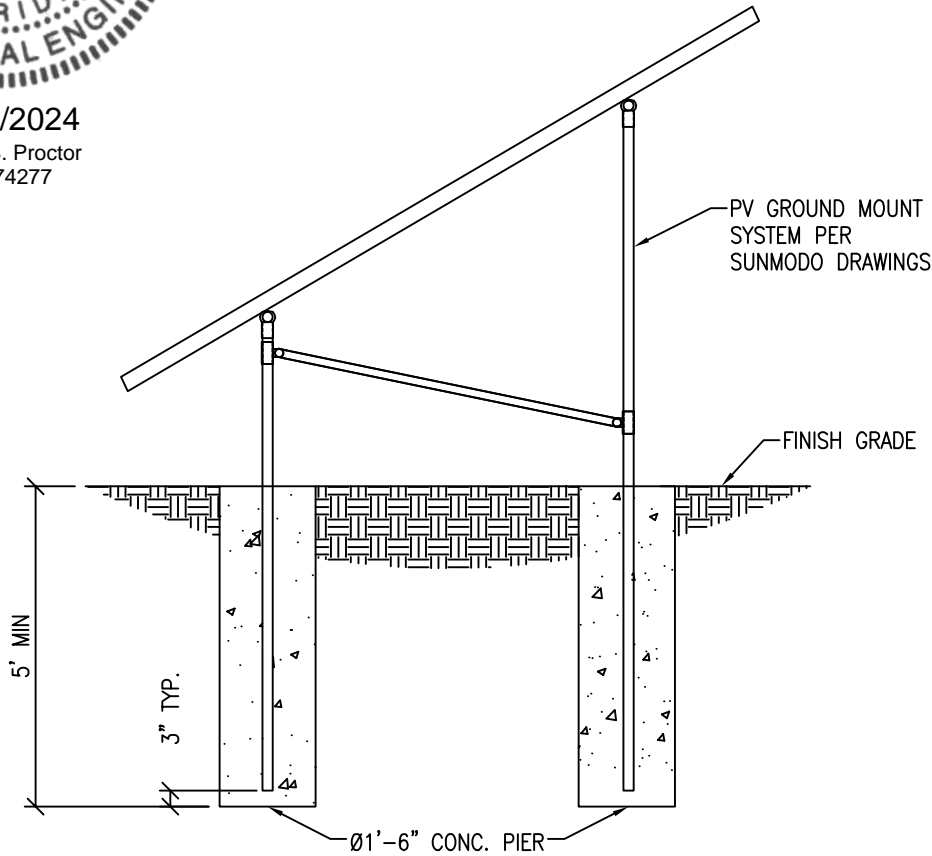
NOTES:

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



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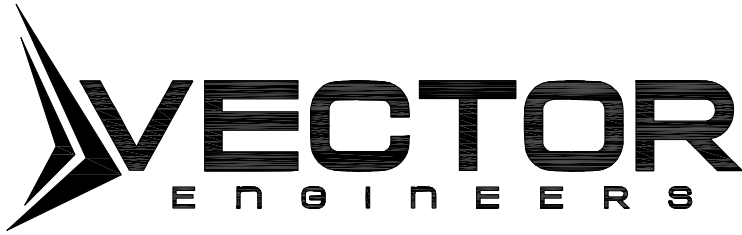
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DRILLED PIER SECTION

NTS.





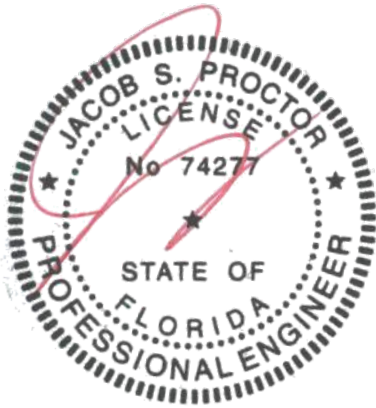
JOB NO. U2716.0389.241

PROJECT SUNMODO SUNTURF GROUND MOUNT D7

SUBJECT HELICAL PIER OPTION

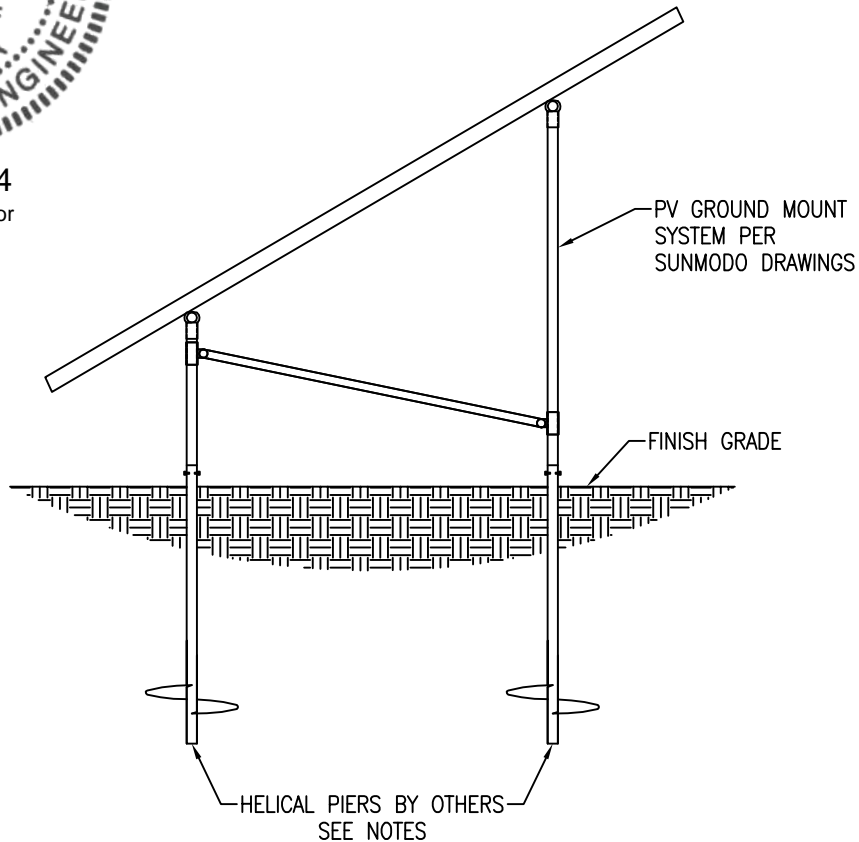
NOTES:

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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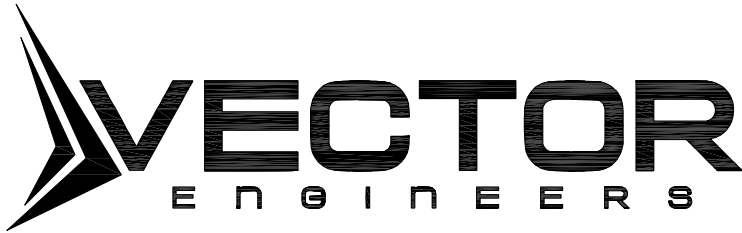
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HELICAL PIER SECTION

NTS.

S2



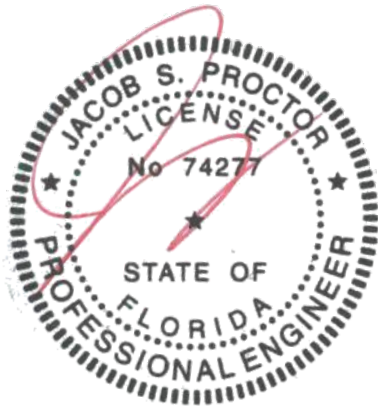
JOB NO. U2716.0389.241

PROJECT SUNMODO SUNTURF GROUND MOUNT D7

SUBJECT GROUND SCREW OPTION

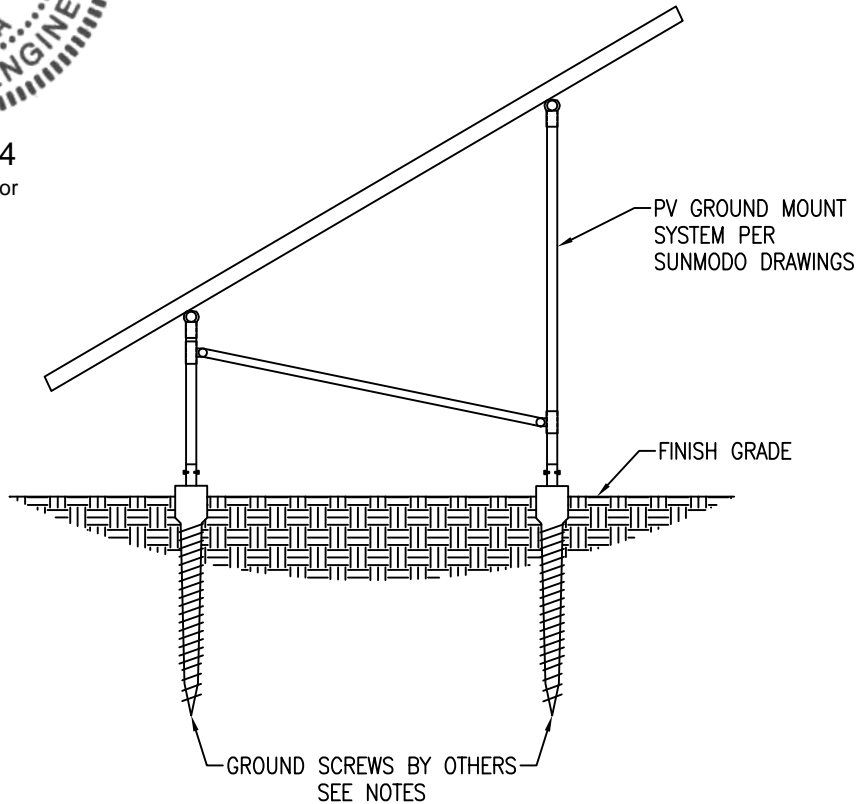
NOTES:

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:
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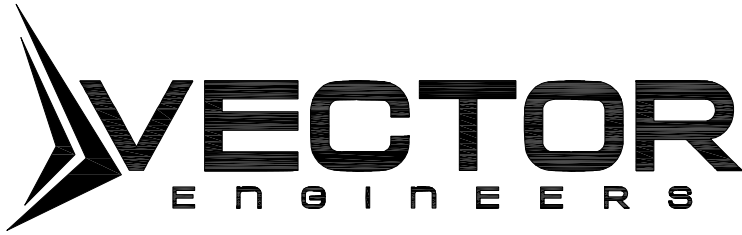
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GROUND SCREW SECTION

NTS.





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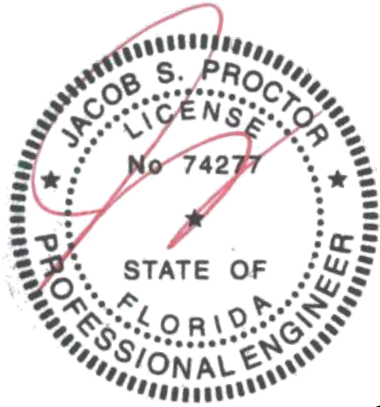
PROJECT SUNMODO SUNTURF GROUND MOUNT D7

SUBJECT BALLAST BLOCK OPTION

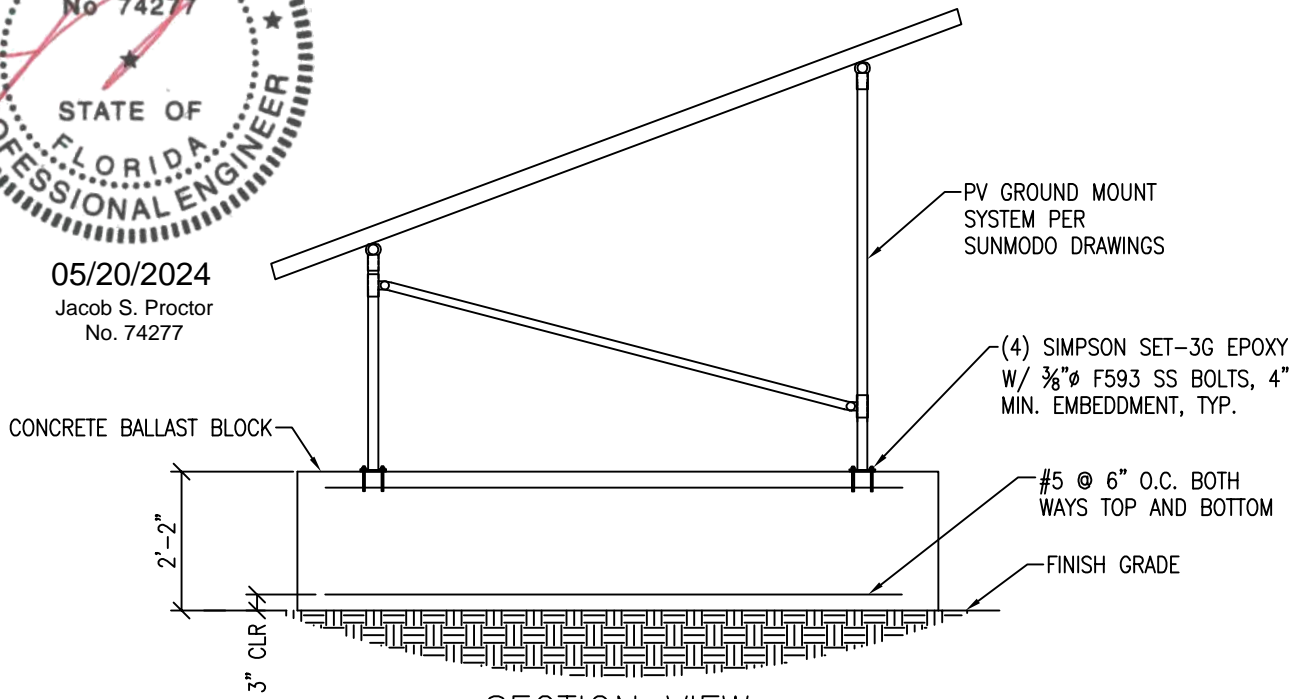
NOTES:

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

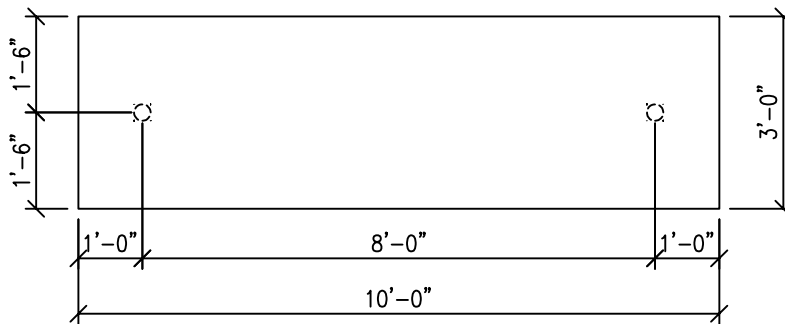
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SECTION VIEW



PLAN VIEW

BALLAST BLOCK SECTION
NTS.

S4



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)
α :	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

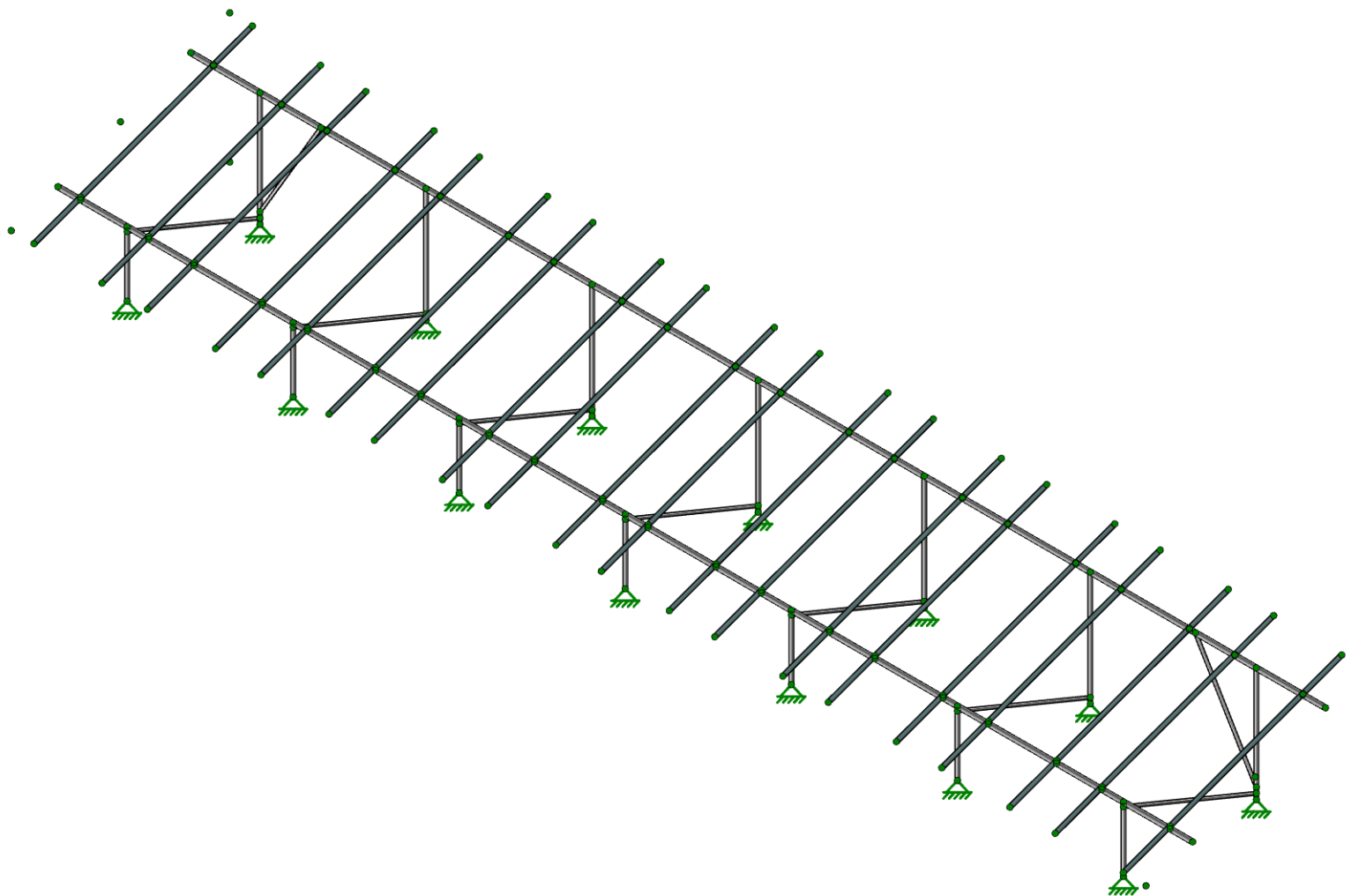
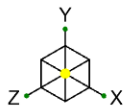


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PROJECT: Sunturf Package D7 Ground Mount

Framing Analysis

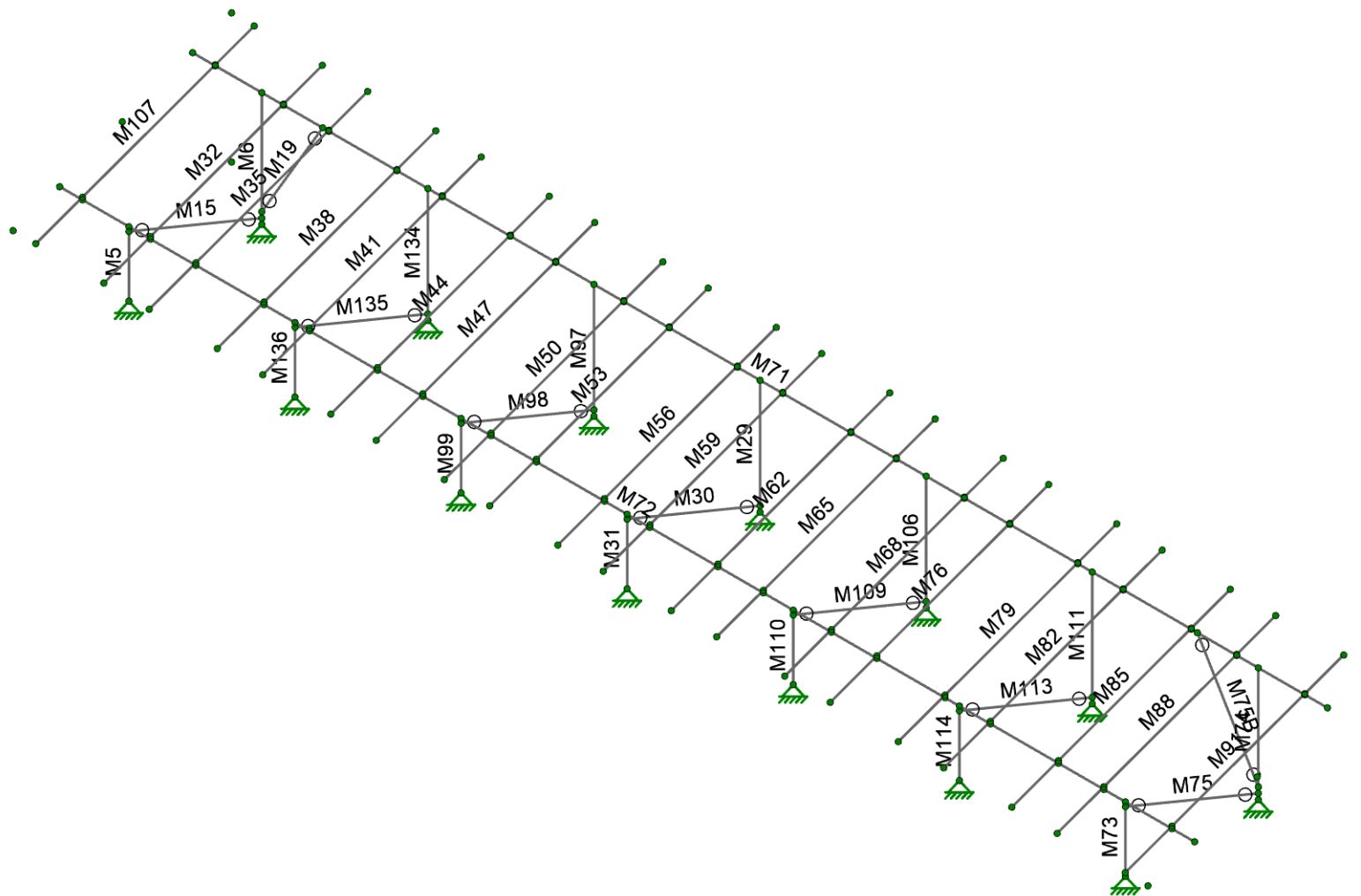
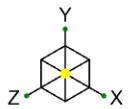
SP - 20 deg



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D7 Standard Panels - 20 Degree Tilt

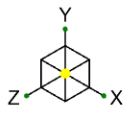
SK-1
May 06, 2024
Sunturf D7 - SP - 20deg.r3d



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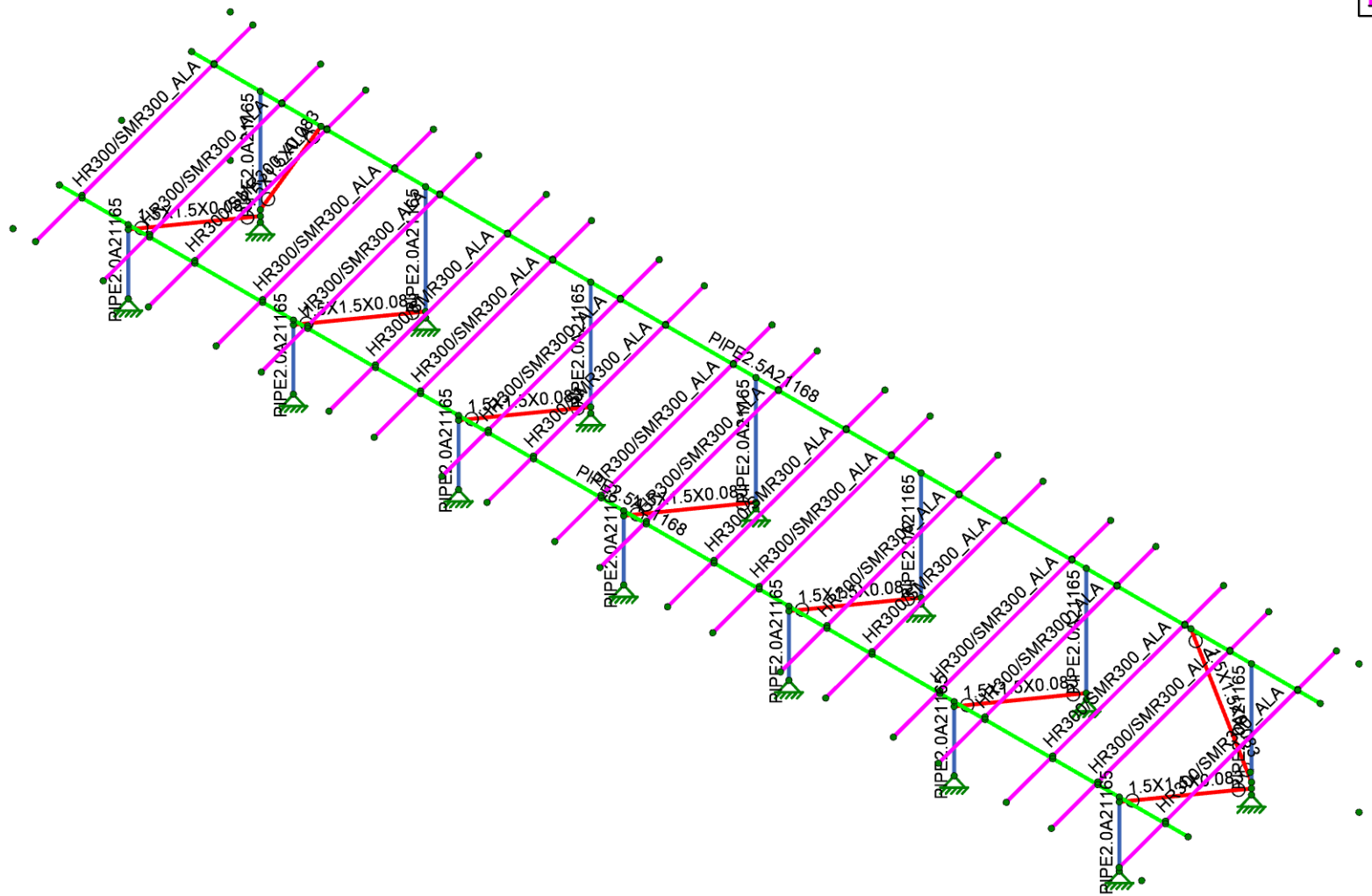
D7 Standard Panels - 20 Degree Tilt

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



Section Sets

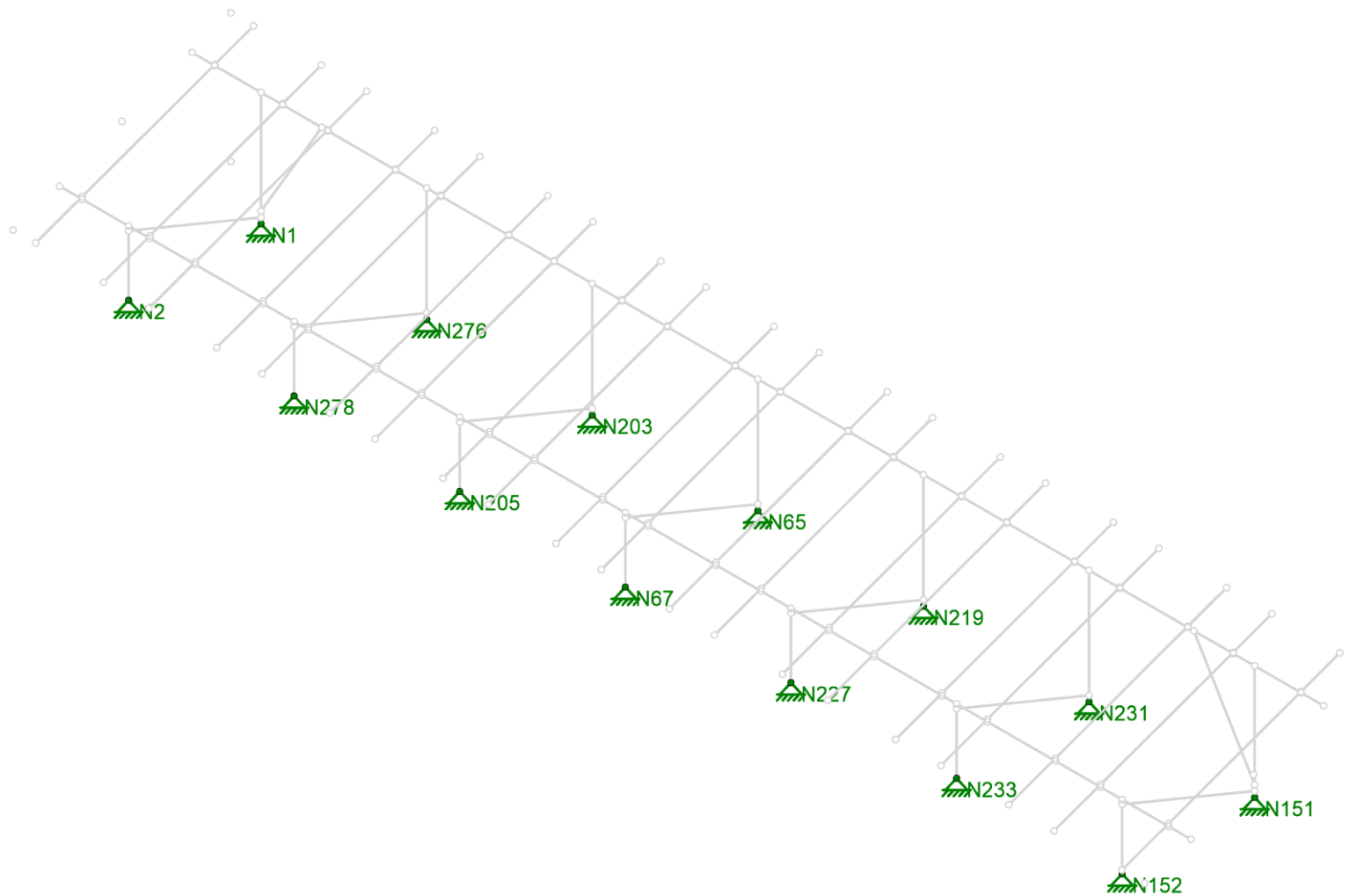
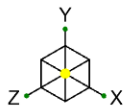
- █ Post
- █ Cross Beam
- █ Diagonal Brace
- █ RIGID
- █ AL Rails



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D7 Standard Panels - 20 Degree Tilt

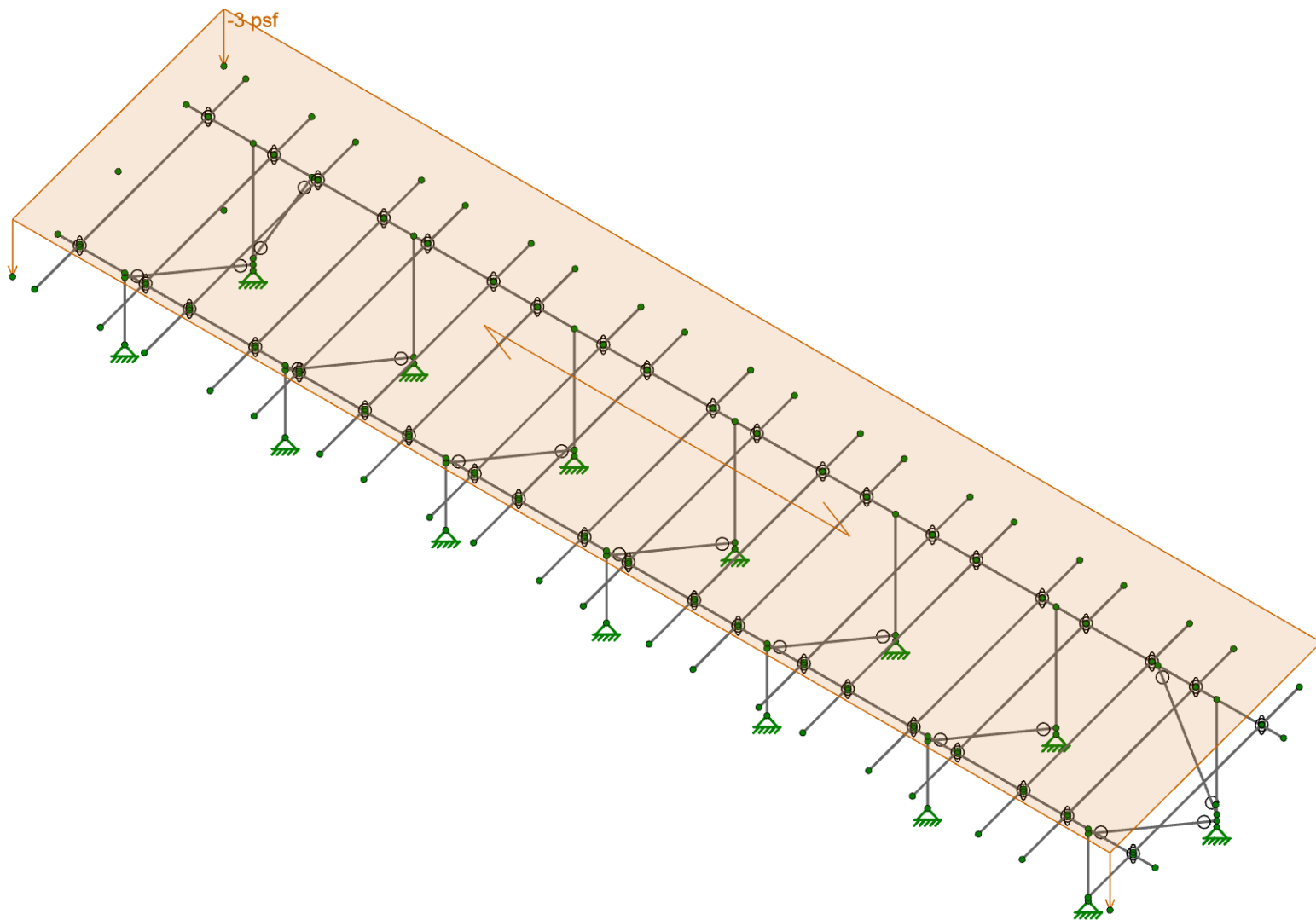
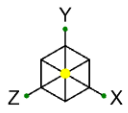
SK-3
 May 06, 2024
 Sunturf D7 - SP - 20deg.r3d



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D7 Standard Panels - 20 Degree Tilt

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



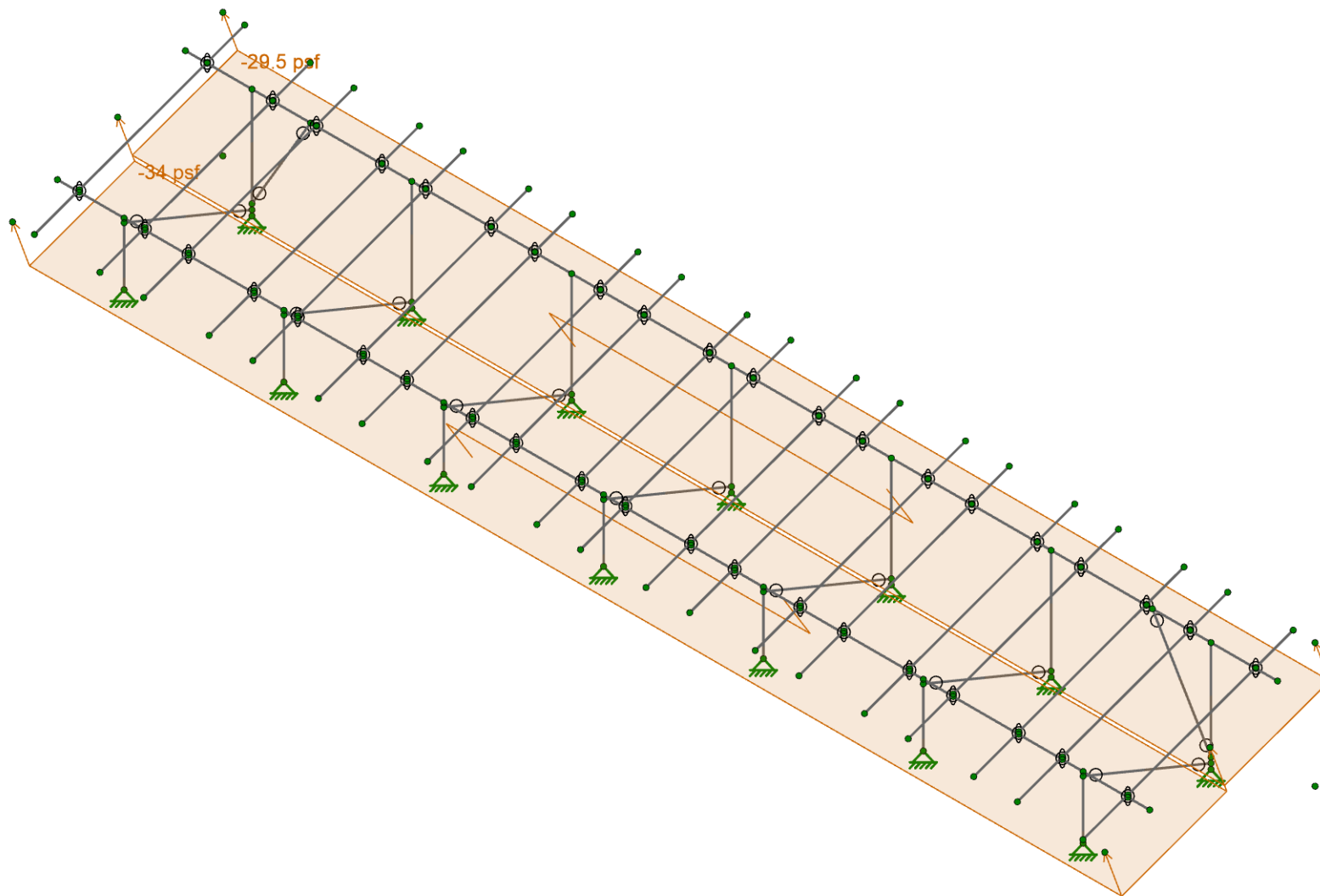
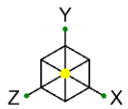
Loads: BLC 2, Solar Panel Weight



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D7 Standard Panels - 20 Degree Tilt

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



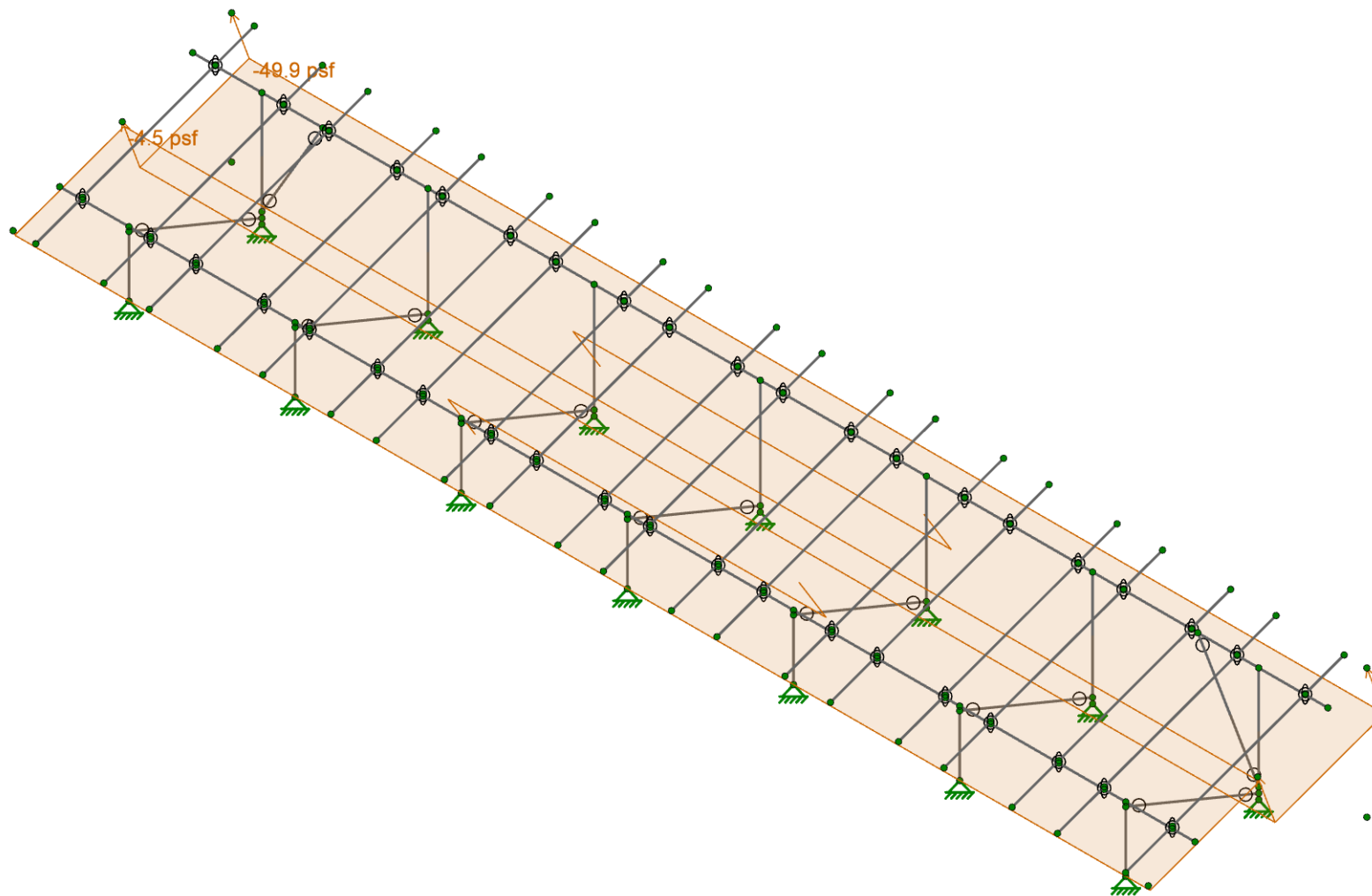
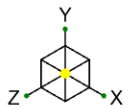
Loads: BLC 4, Wind A 0 deg



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D7 Standard Panels - 20 Degree Tilt

SK-6
May 06, 2024
Sunturf D7 - SP - 20deg.r3d



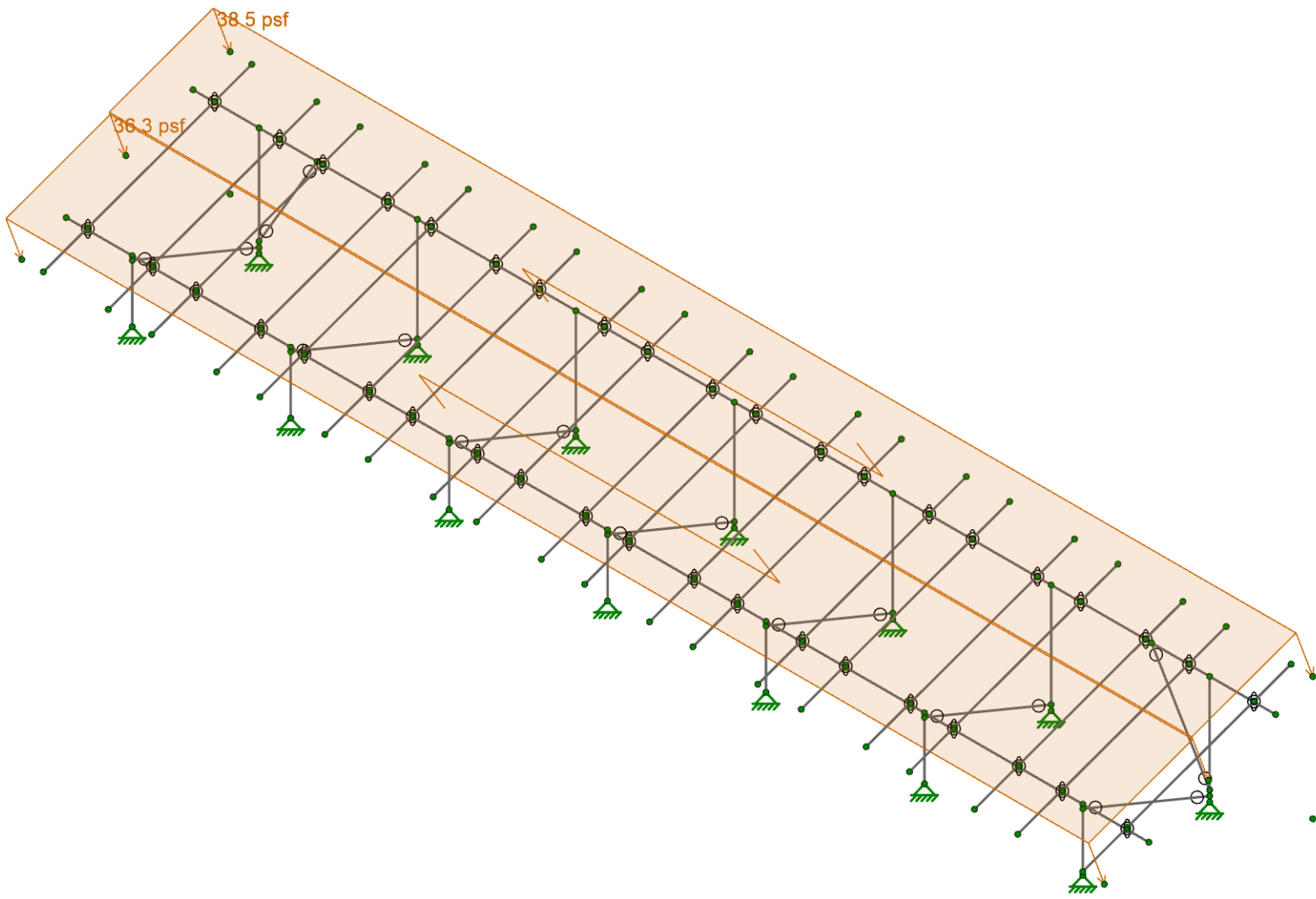
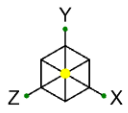
Loads: BLC 5, Wind B 0 deg



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D7 Standard Panels - 20 Degree Tilt

SK-7
May 06, 2024
Sunturf D7 - SP - 20deg.r3d

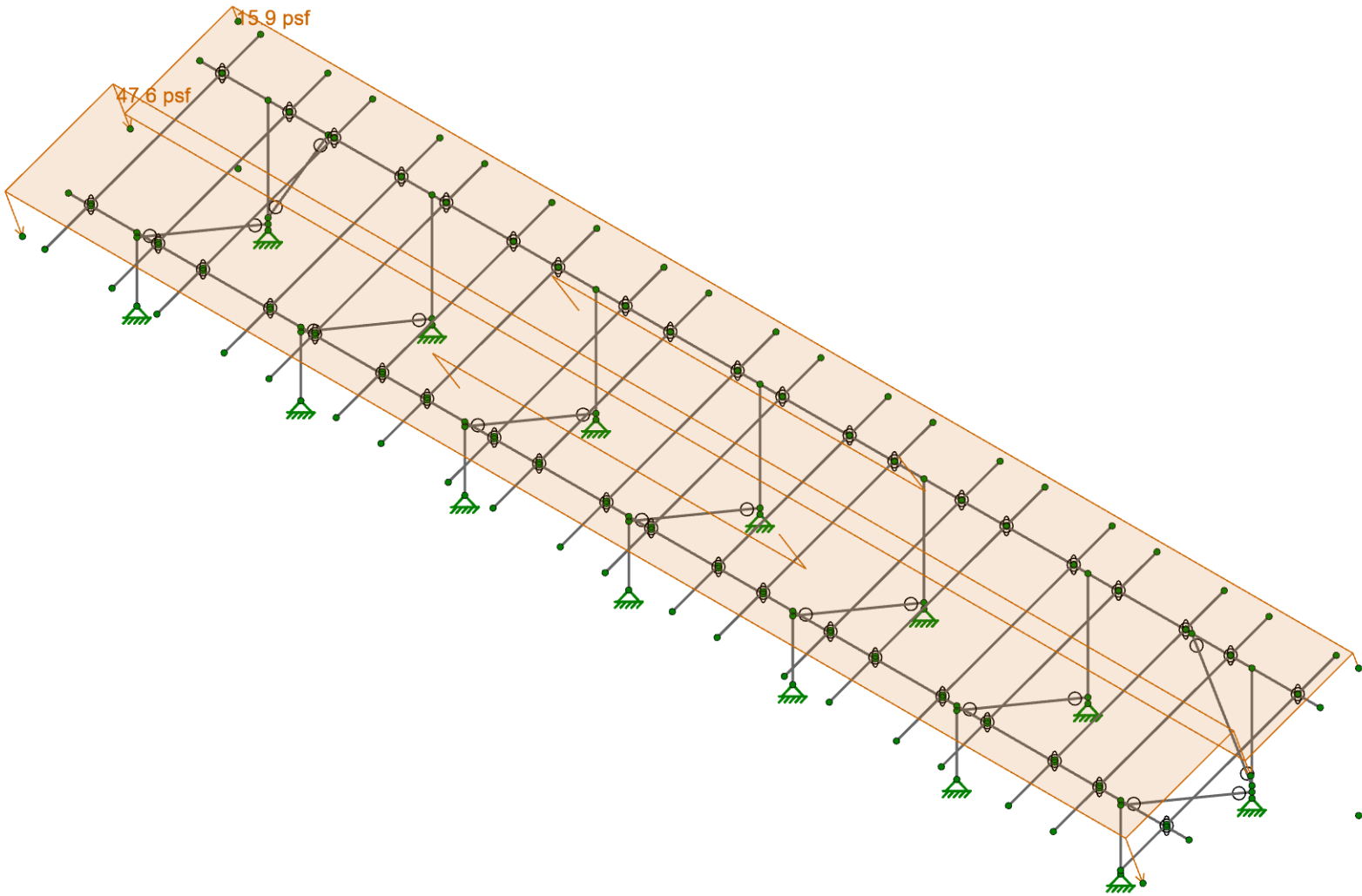
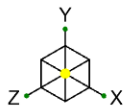


Loads: BLC 6, Wind A 180 deg

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D7 Standard Panels - 20 Degree Tilt

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



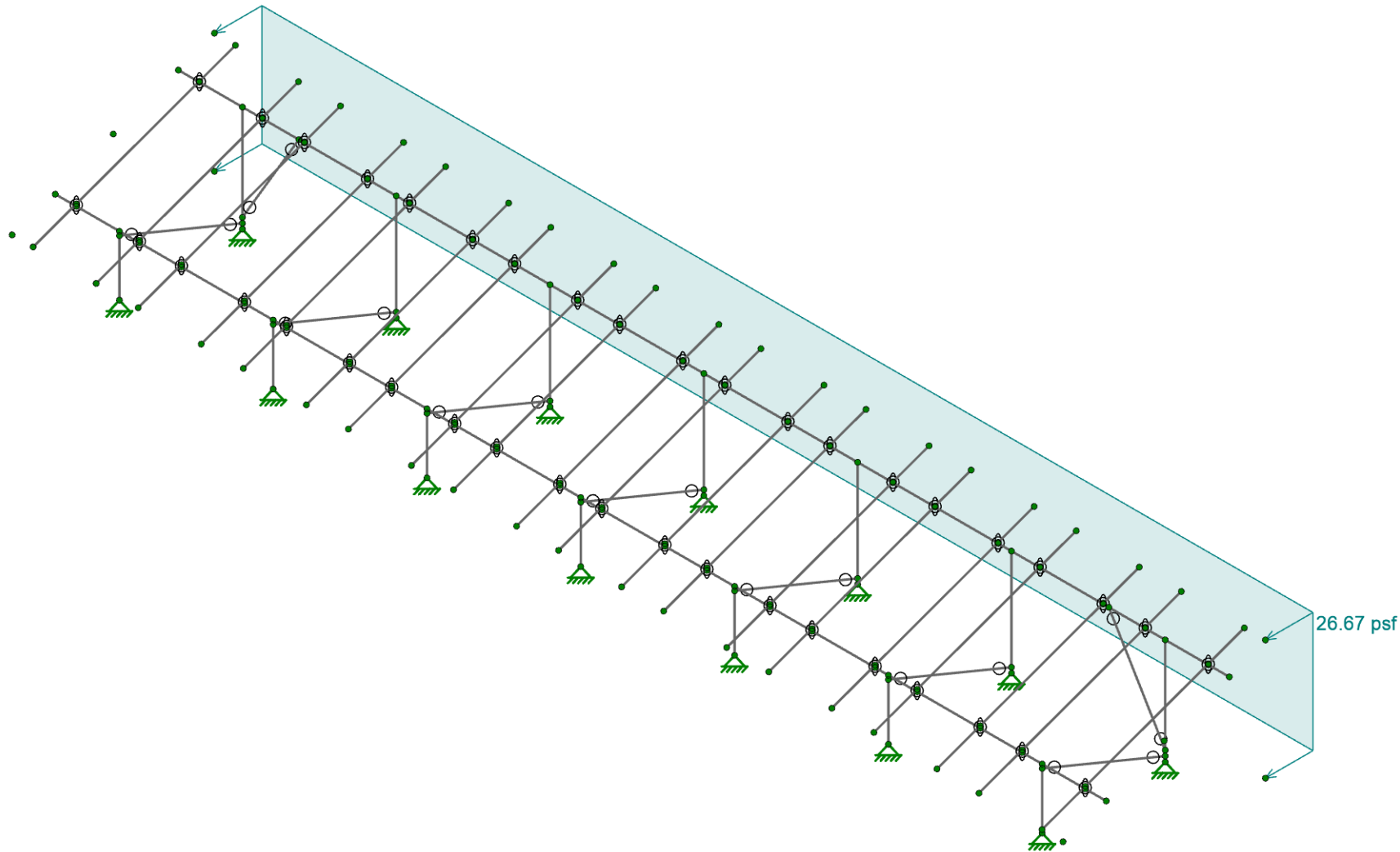
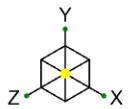
Loads: BLC 7, Wind B 180 deg



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D7 Standard Panels - 20 Degree Tilt

SK-9
May 06, 2024
Sunturf D7 - SP - 20deg.r3d



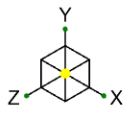
Loads: BLC 8, Wind Z



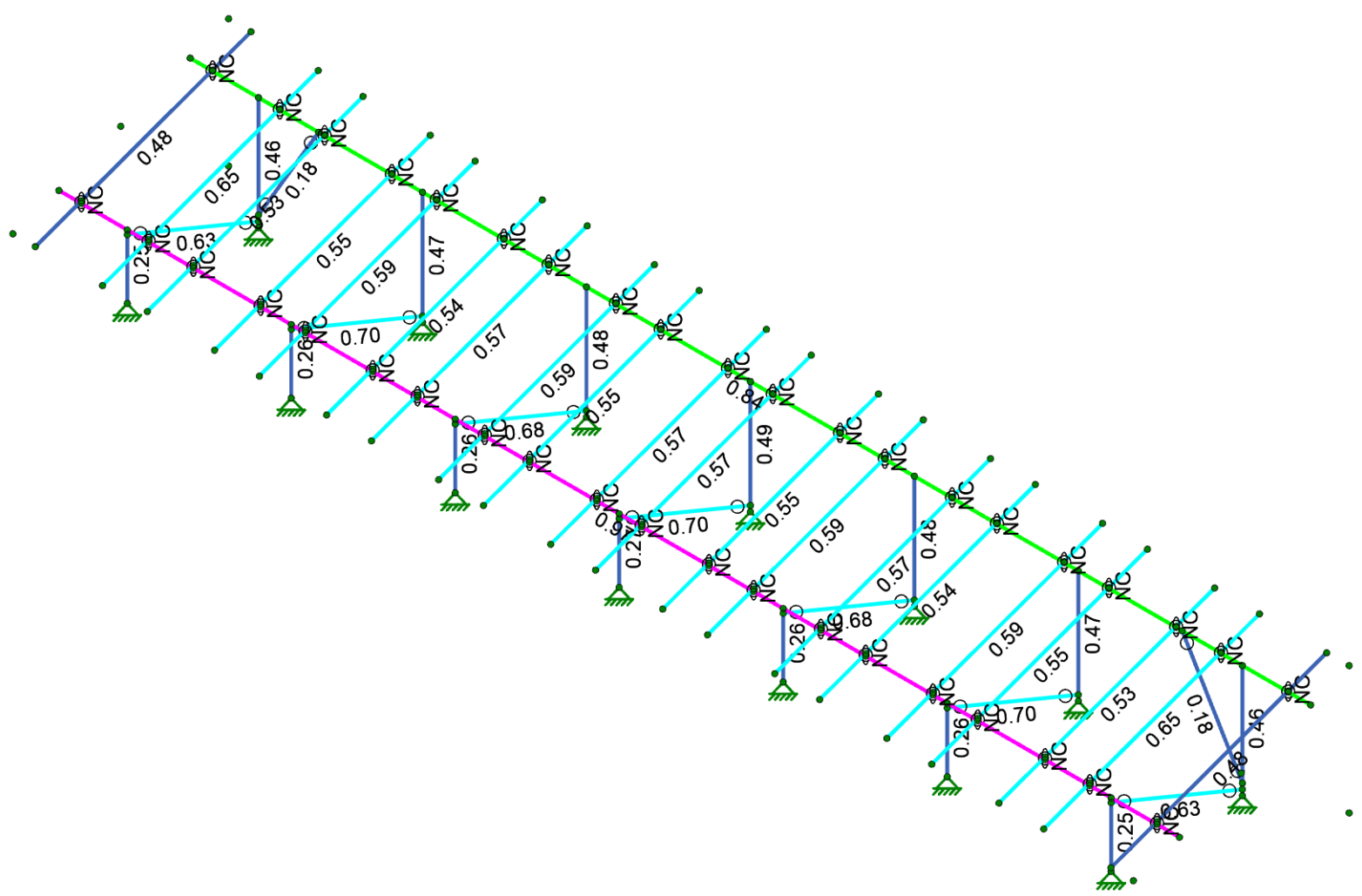
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D7 Standard Panels - 20 Degree Tilt

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

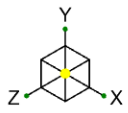


Code Check (Env)	
Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-.90
Cyan	.50-.75
Blue	0.-.50



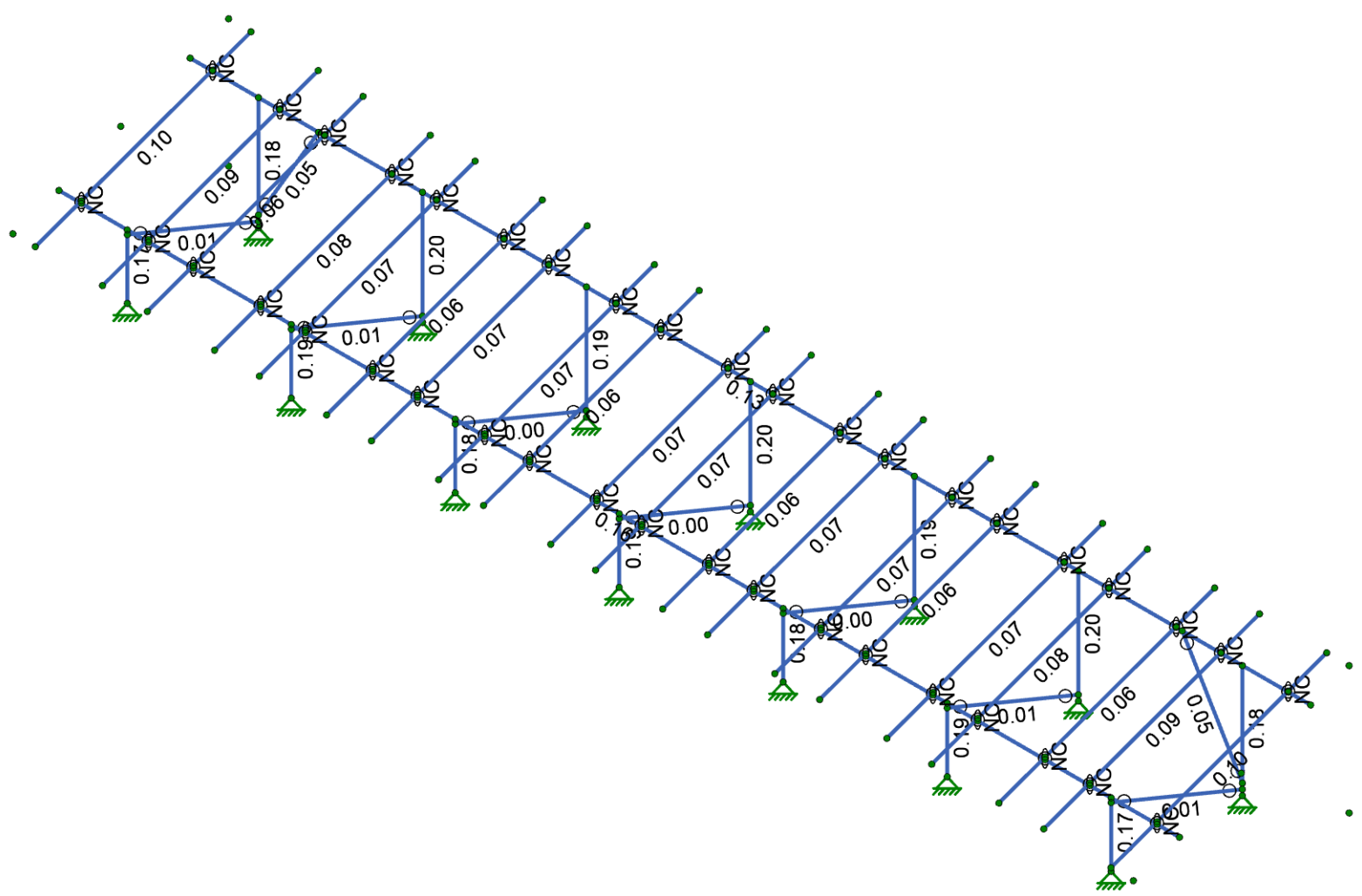
Member Code Checks Displayed (Enveloped)

	Vector Structural Engineering	D7 Standard Panels - 20 Degree Tilt	SK-11
	CJT		May 06, 2024
	U2716.0389.241		Sunturf D7 - SP - 20deg.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	D7 Standard Panels - 20 Degree Tilt	SK-12
	CJT		May 06, 2024
	U2716.0389.241		Sunturf D7 - SP - 20deg.r3d

Model Settings

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
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 Standard Panels - 20 Degree ...

5/6/2024
2:02:00 PM
Checked By : MIH

Model Settings (Continued)

T Z (sec)	
T X (sec)	
C _Z	0.02
C _X	0.02
R Z	3
R X	3

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e ⁵ F ⁻¹]	Density [lb/ft ³]	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 ⁵ F ⁻¹]	Density [lb/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	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 ²]	Iyy [in ⁴]	Izz [in ⁴]	J [in ⁴]
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 ²]	Iyy [in ⁴]	Izz [in ⁴]	J [in ⁴]
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		40	
10	BLC 4 Transient Area Loads	None		144	
11	BLC 5 Transient Area Loads	None		144	
12	BLC 6 Transient Area Loads	None		144	
13	BLC 7 Transient Area Loads	None		144	
14	BLC 8 Transient Area Loads	None		76	

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											
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	N203	max	2.54	13	2537.579	6	1273.735	6	0	15	0	15
2		min	-2.783	6	-2294.417	13	-1097.443	4	0	2	0	2
3	N219	max	2.771	6	2537.496	6	1273.715	6	0	15	0	15
4		min	-2.52	13	-2294.337	13	-1097.427	4	0	2	0	2
5	N65	max	0.003	13	2527.149	6	1316.568	6	0	15	0	15
6		min	0	2	-2291.56	13	-1132.265	4	0	2	0	2
7	N151	max	202.118	13	2495.959	6	1183.143	6	0	15	0	15
8		min	-211.699	6	-2248.513	13	-1020.16	4	0	2	0	2
9	N1	max	211.723	6	2495.587	6	1183.071	6	0	15	0	15
10		min	-202.146	13	-2248.185	13	-1020.107	4	0	2	0	2
11	N276	max	22.838	6	2326.917	6	1311.521	6	0	15	0	15
12		min	-21.264	13	-2099.422	13	-1127.306	4	0	2	0	2
13	N231	max	21.273	13	2326.726	6	1311.456	6	0	15	0	15
14		min	-22.842	6	-2099.263	13	-1127.256	4	0	2	0	2
15	N227	max	0.66	12	1504.494	7	65.659	4	0	15	0	15
16		min	-2.181	7	-551.425	12	-83.793	6	0	2	0	2
17	N205	max	2.192	7	1504.403	7	65.66	4	0	15	0	15
18		min	-0.668	12	-551.369	12	-83.794	6	0	2	0	2
19	N233	max	0.509	15	1501.698	7	66.479	4	0	15	0	15
20		min	-1.398	4	-538.03	12	-84.58	6	0	2	0	2
21	N278	max	1.405	4	1501.599	7	66.481	4	0	15	0	15
22		min	-0.524	15	-537.954	12	-84.581	6	0	2	0	2
23	N67	max	0.003	12	1496.336	7	67.466	4	0	15	0	15
24		min	-0.006	6	-531.083	12	-85.773	6	0	2	0	2
25	N2	max	6.406	15	1379.308	7	61.752	4	0	15	0	15
26		min	-4.326	4	-497.355	12	-78.238	6	0	2	0	2
27	N152	max	4.322	4	1379.278	7	61.754	4	0	15	0	15
28		min	-6.399	15	-497.298	12	-78.241	6	0	2	0	2
29	Totals:	max	0.002	6	24099.535	6	8274.209	6				
30		min	-0.002	13	-14769.572	12	-7166.714	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	M5	PIPE2.0A21165	0.245	43.714	6	0.168	43.714	6	18145.736	23232.186	1397.505	1397.505	1	H1-1b	
2	M6	PIPE2.0A21165	0.462	3.438	6	0.181	0	6	10718.271	23232.186	1397.505	1397.505	1	H1-1a	
3	M15	1.5X1.5X0.083	0.629	53.011	6	0.009	103.858	y	5	2201.334	14085.15	624.421	624.421	1.136	H1-1a
4	M19	1.5X1.5X0.083	0.181	86.525	6	0.05	86.525	y	6	3171.651	14085.15	624.421	624.421	1.136	H1-1b*
5	M73	PIPE2.0A21165	0.245	43.714	6	0.168	43.714	6	18145.736	23232.186	1397.505	1397.505	1	H1-1b	

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

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
6	M74	PIPE2.0A21165	0.462	3.438	6	0.181	0	6 10718.271	23232.186	1397.505	1397.505	1 H1-1a
7	M75	1.5X1.5X0.083	0.629	53.011	6	0.009	103.857	y 5 2201.346	14085.15	624.421	624.421	1.136 H1-1a
8	M75B	1.5X1.5X0.083	0.181	86.525	6	0.05	86.525	y 6 3171.651	14085.15	624.421	624.421	1.136 H1-1b*
9	M71	PIPE2.5A21168	0.838	290.417	6	0.13	170.833	6 20336.2	28358.413	2081.747	2081.747	1 H1-1b
10	M72	PIPE2.5A21168	0.966	529.583	7	0.159	51.25	7 20336.2	28358.413	2081.747	2081.747	1 H1-1b
11	M134	PIPE2.0A21165	0.466	3.438	6	0.196	0	6 10718.271	23232.186	1397.505	1397.505	1 H1-1a
12	M135	1.5X1.5X0.083	0.697	53.011	6	0.011	103.857	y 6 2201.346	14085.15	624.421	624.421	1.136 H1-1a
13	M136	PIPE2.0A21165	0.264	43.714	6	0.187	43.714	6 18145.736	23232.186	1397.505	1397.505	1 H1-1b
14	M97	PIPE2.0A21165	0.48	3.438	6	0.192	0	6 10718.271	23232.186	1397.505	1397.505	1 H1-1a
15	M98	1.5X1.5X0.083	0.677	53.011	6	0.004	103.857	y 5 2201.346	14085.15	624.421	624.421	1.136 H1-1a
16	M99	PIPE2.0A21165	0.262	43.714	6	0.181	43.714	6 18145.736	23232.186	1397.505	1397.505	1 H1-1b
17	M106	PIPE2.0A21165	0.48	3.438	6	0.192	0	6 10718.271	23232.186	1397.505	1397.505	1 H1-1a
18	M109	1.5X1.5X0.083	0.677	53.011	6	0.004	103.857	y 5 2201.346	14085.15	624.421	624.421	1.136 H1-1a
19	M110	PIPE2.0A21165	0.262	43.714	6	0.181	43.714	6 18145.736	23232.186	1397.505	1397.505	1 H1-1b
20	M111	PIPE2.0A21165	0.466	3.438	6	0.196	0	6 10718.271	23232.186	1397.505	1397.505	1 H1-1a
21	M113	1.5X1.5X0.083	0.697	53.011	6	0.011	103.857	y 6 2201.346	14085.15	624.421	624.421	1.136 H1-1a
22	M114	PIPE2.0A21165	0.264	43.714	6	0.187	43.714	6 18145.736	23232.186	1397.505	1397.505	1 H1-1b
23	M29	PIPE2.0A21165	0.487	3.438	6	0.198	0	6 10718.271	23232.186	1397.505	1397.505	1 H1-1a
24	M30	1.5X1.5X0.083	0.699	53.011	6	0.002	103.857	y 6 2201.346	14085.15	624.421	624.421	1.136 H1-1a
25	M31	PIPE2.0A21165	0.267	43.714	6	0.187	43.714	6 18145.736	23232.186	1397.505	1397.505	1 H1-1b

Envelope AA ADM1-20: 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	M107	HR300/SMR300_ALA	0.477	87.485	6	0.096	136.477	y 13 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.387 H.1-1
2	M32	HR300/SMR300_ALA	0.653	94.484	13	0.087	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.466 H.1-1
3	M35	HR300/SMR300_ALA	0.527	89.235	6	0.065	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.381 H.1-1
4	M38	HR300/SMR300_ALA	0.552	87.485	6	0.08	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.394 H.1-1
5	M41	HR300/SMR300_ALA	0.594	92.734	13	0.069	136.477	y 13 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.463 H.1-1
6	M44	HR300/SMR300_ALA	0.542	89.235	6	0.059	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.377 H.1-1
7	M47	HR300/SMR300_ALA	0.569	87.485	6	0.074	136.477	y 13 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.4 H.1-1
8	M50	HR300/SMR300_ALA	0.59	92.734	13	0.072	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.465 H.1-1
9	M53	HR300/SMR300_ALA	0.546	89.235	6	0.059	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.375 H.1-1
10	M56	HR300/SMR300_ALA	0.567	87.485	6	0.069	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.4 H.1-1
11	M59	HR300/SMR300_ALA	0.567	87.485	6	0.069	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.4 H.1-1
12	M62	HR300/SMR300_ALA	0.546	89.235	6	0.059	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.375 H.1-1
13	M65	HR300/SMR300_ALA	0.59	92.734	13	0.072	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.465 H.1-1
14	M68	HR300/SMR300_ALA	0.569	87.485	6	0.074	136.477	y 13 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.4 H.1-1
15	M76	HR300/SMR300_ALA	0.542	89.235	6	0.059	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.377 H.1-1
16	M79	HR300/SMR300_ALA	0.594	92.734	13	0.069	136.477	y 13 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.463 H.1-1
17	M82	HR300/SMR300_ALA	0.552	87.485	6	0.08	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.394 H.1-1
18	M85	HR300/SMR300_ALA	0.527	89.235	6	0.065	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.381 H.1-1
19	M88	HR300/SMR300_ALA	0.653	94.484	13	0.087	36.744	y 7 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.466 H.1-1
20	M91	HR300/SMR300_ALA	0.477	87.485	6	0.096	136.477	y 13 3578.312	14342.564	533.921	934.619	7307.692	3206.154	1.387 H.1-1



JOB NO.: U2716.0389.241

PROJECT: SunTurf Package D7

SUBJECT: CALCULATIONS SP 20

DESIGN APPROACH ASD

CONNECTION CAPACITY

Location: Column Base (set screws)

Connection Type: M16 Conical Set Screws

Tensile Capacity: 2600 lbs

Tension Load: 2295 lbs

Check Connection: 88.3%

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: 1906 lbs

Check Connection: 86.8%

Result: **Select K10341-002**

Note: Uplift capacity. FOS of (2)



JOB NO.: U2716.0389.241

PROJECT: SunTurf Package D7

SUBJECT: CALCULATIONS SP 20

CONNECTION CAPACITY

Location: Brace to Column

Connection Type: K10219-001

Capacity: 1577 lbs

Tension Load: 1497 lbs

Check Connection: 94.9%

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: 807 lbs

Check Bolt: 9.6%

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

Note:



JOB NO.: U2716.0389.241

PROJECT: Sunturf Package D7 Ground Mount

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_d [k]:	2.5
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P_u [k]:	2.3

Pier Properties:

Pier Shape:	Round	Volume of Concrete [ft ³]:	9
Pier Diameter, b [ft]:	1.5	Volume of Concrete [yd ³]:	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	Skin Friction* [psf]:	250
Lateral Bearing, S [pcf]:	150	Top Length to Ignore [ft]:	0
Max. Lateral Bearing (opt'l) [psf]:		1/3 increase for short term loads?	No
Top Depth to Ignore [ft]:	0	Combine w/ Bearing:	No
1/3 increase for short term loads?	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	IBC Section 1807.3.2.1
Applied Lateral Force, P [lb]:	1,400	
Point of Application, h [ft]:	0.0	
S_{max} [psf]:		
S [psf]:	500	
$A = 2.34 * P / (S_b)$:	4.37	
Required Pier Depth, d_{reqd} [ft]:	4.40	IBC Eq. 18-1

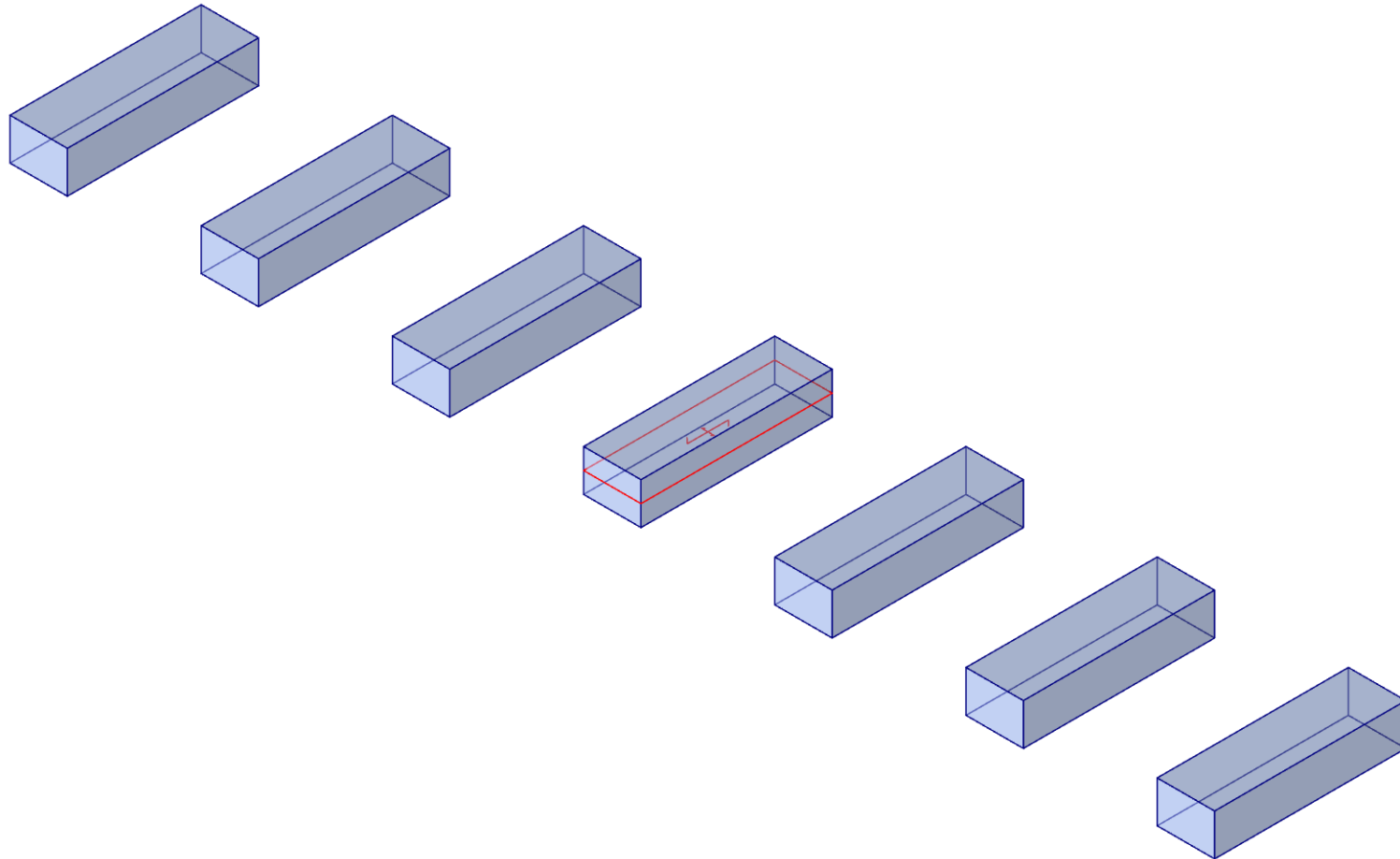
Result: **Lateral bearing capacity OK.**



JOB NO.: U2716.0389.241

PROJECT: Sunturf Package D7 Ground Mount

ALTERNATE FOUNDATION OPTION 2: CONCRETE BALLAST BLOCK



Vector Structural Engineering
CJT
U2716.0389.241

Ground Mount

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

Concrete Properties

Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e ⁵ F ⁻¹]	Density [lb/ft ³]	fc [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 ³]	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 S2	26	Conc3000NW	0	0	0	0	0.25
2 S3	26	Conc3000NW	0	0	0	0	0.25
3 S6	26	Conc3000NW	0	0	0	0	0.25
4 S7	26	Conc3000NW	0	0	0	0	0.25
5 S9	26	Conc3000NW	0	0	0	0	0.25
6 S11	26	Conc3000NW	0	0	0	0	0.25
7 S12	26	Conc3000NW	0	0	0	0	0.25

Load Category

Category	Node Loads
1 DL	20
2 WLZ	30
3 OL1	38
4 OL2	40
5 OL3	38
6 OL4	40

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
11 1.0 D + 0.45 W4 + 0.75 S	Yes	Yes	1.5	DL	1	RLL	0.75	OL4	0.45

Load Combination (Continued)

	Label	Solve	Service	SF	Category	Factor	Category	Factor	Category	Factor
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	90	50	Typical
2	DS2	0	50	Typical

Strip Reinforcing

Label	UC Top	LC Top	Top Bars	Gov Design Cut	UC Top	UC Bot	LC Bot	Bot Bars/Mid Bars	Gov Design Cut	UC Bot	UC Shear	LC Gov Design Cut	UC Shear
1	DS1	0.002	27	#5@6in	DS1-X28	0.003	25	#5@6in	DS1-X28	0.017	25	DS1-X36	
2	DS2	0.02	25	#5@6in	DS2-X24	0.02	28	#5@6in	DS2-X23	0.063	28	DS2-X9	

Slab Soil Pressures

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
1	2	S2	0.223	334.828	1500	N29
2	2	S3	0.224	336.106	1500	N328
3	2	S6	0.223	335.068	1500	N47
4	2	S7	0.223	334.546	1500	N368
5	2	S9	0.224	336.108	1500	N375
6	2	S11	0.223	334.815	1500	N384
7	2	S12	0.223	334.544	1500	N389
8	3	S2	0.223	334.828	1500	N29
9	3	S3	0.224	336.106	1500	N328
10	3	S6	0.223	335.068	1500	N47
11	3	S7	0.223	334.546	1500	N368
12	3	S9	0.224	336.108	1500	N375
13	3	S11	0.223	334.815	1500	N384
14	3	S12	0.223	334.544	1500	N389
15	4	S2	0.216	324.666	1500	N32
16	4	S3	0.212	318.098	1500	N36
17	4	S6	0.216	323.904	1500	N48
18	4	S7	0.214	321.456	1500	N52
19	4	S9	0.212	318.086	1500	N60
20	4	S11	0.216	324.65	1500	N68

Slab Soil Pressures (Continued)

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
21	4	S12	0.214	321.464	1500	N71
22	5	S2	0.306	459.289	1500	N31
23	5	S3	0.306	459.266	1500	N328
24	5	S6	0.313	469.248	1500	N47
25	5	S7	0.31	464.861	1500	N368
26	5	S9	0.306	459.254	1500	N375
27	5	S11	0.306	459.374	1500	N382
28	5	S12	0.31	464.866	1500	N389
29	6	S2	0.36	539.465	1500	N29
30	6	S3	0.344	516.407	1500	N330
31	6	S6	0.36	539.499	1500	N45
32	6	S7	0.36	539.278	1500	N370
33	6	S9	0.344	516.384	1500	N377
34	6	S11	0.36	539.506	1500	N384
35	6	S12	0.36	539.29	1500	N391
36	7	S2	0.276	413.639	1500	N29
37	7	S3	0.287	430.666	1500	N328
38	7	S6	0.284	425.75	1500	N47
39	7	S7	0.284	425.813	1500	N368
40	7	S9	0.287	430.681	1500	N375
41	7	S11	0.276	413.564	1500	N384
42	7	S12	0.284	425.801	1500	N389
43	8	S2	0.218	326.39	1500	N32
44	8	S3	0.215	322.598	1500	N36
45	8	S6	0.218	326.651	1500	N48
46	8	S7	0.216	324.726	1500	N52
47	8	S9	0.215	322.59	1500	N60
48	8	S11	0.218	326.386	1500	N68
49	8	S12	0.216	324.732	1500	N71
50	9	S2	0.285	427.371	1500	N31
51	9	S3	0.286	428.476	1500	N328
52	9	S6	0.29	435.703	1500	N47
53	9	S7	0.288	432.282	1500	N368
54	9	S9	0.286	428.467	1500	N375
55	9	S11	0.285	427.43	1500	N382
56	9	S12	0.288	432.286	1500	N389
57	10	S2	0.326	488.306	1500	N29
58	10	S3	0.313	469.474	1500	N330
59	10	S6	0.325	487.581	1500	N45
60	10	S7	0.325	487.587	1500	N370
61	10	S9	0.313	469.455	1500	N377
62	10	S11	0.326	488.333	1500	N384
63	10	S12	0.325	487.597	1500	N391
64	11	S2	0.263	393.937	1500	N29
65	11	S3	0.271	407.026	1500	N328
66	11	S6	0.269	403.08	1500	N47
67	11	S7	0.269	402.996	1500	N368
68	11	S9	0.271	407.038	1500	N375
69	11	S11	0.263	393.877	1500	N384
70	11	S12	0.269	402.987	1500	N389
71	12	S2	0.128	192.039	1500	N32
72	12	S3	0.122	183.659	1500	N36
73	12	S6	0.127	189.948	1500	N48
74	12	S7	0.125	187.641	1500	N52
75	12	S9	0.122	183.646	1500	N60

Slab Soil Pressures (Continued)

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
76	12	S11	0.128	192.014	1500	N68
77	12	S12	0.125	187.65	1500	N71
78	13	S2	0.238	356.301	1500	N31
79	13	S3	0.227	340.943	1500	N328
80	13	S6	0.248	371.454	1500	N47
81	13	S7	0.244	366.066	1500	N368
82	13	S9	0.227	340.913	1500	N375
83	13	S11	0.238	356.261	1500	N382
84	13	S12	0.244	366.085	1500	N389
85	14	S2	0.27	405.534	1500	N29
86	14	S3	0.257	384.938	1500	N330
87	14	S6	0.271	406.767	1500	N45
88	14	S7	0.271	406.272	1500	N370
89	14	S9	0.257	384.915	1500	N377
90	14	S11	0.27	405.58	1500	N384
91	14	S12	0.271	406.284	1500	N391
92	15	S2	0.187	279.877	1500	N31
93	15	S3	0.197	296.224	1500	N328
94	15	S6	0.194	291.723	1500	N47
95	15	S7	0.195	291.995	1500	N368
96	15	S9	0.197	296.238	1500	N375
97	15	S11	0.187	279.775	1500	N382
98	15	S12	0.195	291.984	1500	N389

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	S2	0	0	49865.104	0	15048.337	9.99+	9.99+
2	2	S3	0	0	50015.527	0	14954.572	9.99+	9.99+
3	2	S6	0	0	50053.042	0	14991.362	9.99+	9.99+
4	2	S7	0	0	50046.845	0	14998.52	9.99+	9.99+
5	2	S9	0	0	50015.603	0	14941.043	9.99+	9.99+
6	2	S11	0	0	49865.175	0	14919.917	9.99+	9.99+
7	2	S12	0	0	50046.756	0	14998.518	9.99+	9.99+
8	3	S2	0	0	49865.104	0	15048.337	9.99+	9.99+
9	3	S3	0	0	50015.527	0	14954.572	9.99+	9.99+
10	3	S6	0	0	50053.042	0	14991.362	9.99+	9.99+
11	3	S7	0	0	50046.845	0	14998.52	9.99+	9.99+
12	3	S9	0	0	50015.603	0	14941.043	9.99+	9.99+
13	3	S11	0	0	49865.175	0	14919.917	9.99+	9.99+
14	3	S12	0	0	50046.756	0	14998.518	9.99+	9.99+
15	4	S2	0	17645.955	50028.815	3924.888	15048.337	2.835	3.834
16	4	S3	0	17052.129	49636.583	3597.398	14954.572	2.911	4.157
17	4	S6	0	18252.275	49889.37	3756.685	14991.362	2.733	3.991
18	4	S7	0	18223.829	49943.288	3785.394	14998.52	2.741	3.962
19	4	S9	0	17051.042	49636.411	3597.349	14954.561	2.911	4.157
20	4	S11	0	17648.189	50029.178	3925.123	15048.389	2.835	3.834
21	4	S12	0	18224.311	49943.367	3785.394	14998.518	2.74	3.962
22	5	S2	0	22497.8	50028.815	3687.388	15048.337	2.224	4.081
23	5	S3	0	21022.346	49636.583	2958.063	14954.572	2.361	5.056
24	5	S6	0	22890.089	49889.37	3209.085	14991.362	2.18	4.672
25	5	S7	0	22932.271	49943.288	3276.73	14998.52	2.178	4.577
26	5	S9	0	21020.722	49636.411	2957.915	14954.561	2.361	5.056
27	5	S11	0	22501.041	50029.178	3687.719	15048.389	2.223	4.081
28	5	S12	0	22933.042	49943.367	3276.857	14998.518	2.178	4.577
29	6	S2	0	0	56488.999	0	19721.157	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
30	6	S3	0	0	56796.577	0	19173.007	9.99+	9.99+
31	6	S6	0	0	56940.066	0	19415.152	9.99+	9.99+
32	6	S7	0	0	57205.212	0	19462.684	9.99+	9.99+
33	6	S9	0	0	56797.442	0	19075.821	9.99+	9.99+
34	6	S11	0	0	56488.662	0	18807.714	9.99+	9.99+
35	6	S12	0	0	57204.539	0	19456.318	9.99+	9.99+
36	7	S2	0	0	59944.66	0	18793.771	9.99+	9.99+
37	7	S3	0	0	60816.04	0	18619.528	9.99+	9.99+
38	7	S6	0	0	60884.928	0	18753.15	9.99+	9.99+
39	7	S7	0	0	60991.864	0	18765.243	9.99+	9.99+
40	7	S9	0	0	60816.868	0	18569.272	9.99+	9.99+
41	7	S11	0	0	59944.597	0	18269.647	9.99+	9.99+
42	7	S12	0	0	60991.072	0	18769.695	9.99+	9.99+
43	8	S2	0	13234.466	50028.815	2943.666	15048.337	3.78	5.112
44	8	S3	0	12789.097	49636.583	2698.049	14954.572	3.881	5.543
45	8	S6	0	13689.207	49889.37	2817.514	14991.362	3.644	5.321
46	8	S7	0	13667.872	49943.288	2839.045	14998.52	3.654	5.283
47	8	S9	0	12788.282	49636.411	2698.012	14954.561	3.881	5.543
48	8	S11	0	13236.142	50029.178	2943.843	15048.389	3.78	5.112
49	8	S12	0	13668.233	49943.367	2839.046	14998.518	3.654	5.283
50	9	S2	0	16873.35	50028.815	2765.541	15048.337	2.965	5.441
51	9	S3	0	15766.76	49636.583	2218.547	14954.572	3.148	6.741
52	9	S6	0	17167.567	49889.37	2406.814	14991.362	2.906	6.229
53	9	S7	0	17199.203	49943.288	2457.548	14998.52	2.904	6.103
54	9	S9	0	15765.542	49636.411	2218.436	14954.561	3.148	6.741
55	9	S11	0	16875.781	50029.178	2765.789	15048.389	2.965	5.441
56	9	S12	0	17199.781	49943.367	2457.643	14998.518	2.904	6.103
57	10	S2	0	0	54833.025	0	18552.952	9.99+	9.99+
58	10	S3	0	0	55101.315	0	18118.398	9.99+	9.99+
59	10	S6	0	0	55218.31	0	18309.205	9.99+	9.99+
60	10	S7	0	0	55415.62	0	18346.643	9.99+	9.99+
61	10	S9	0	0	55101.982	0	18042.127	9.99+	9.99+
62	10	S11	0	0	54832.79	0	17835.765	9.99+	9.99+
63	10	S12	0	0	55415.094	0	18341.868	9.99+	9.99+
64	11	S2	0	0	57424.771	0	17857.413	9.99+	9.99+
65	11	S3	0	0	58115.912	0	17703.289	9.99+	9.99+
66	11	S6	0	0	58176.957	0	17812.703	9.99+	9.99+
67	11	S7	0	0	58255.609	0	17823.562	9.99+	9.99+
68	11	S9	0	0	58116.552	0	17662.215	9.99+	9.99+
69	11	S11	0	0	57424.742	0	17432.215	9.99+	9.99+
70	11	S12	0	0	58254.993	0	17826.901	9.99+	9.99+
71	12	S2	0	17645.955	30017.289	3924.888	9029.002	1.701	2.3
72	12	S3	0	17052.129	29781.95	3597.398	8972.743	1.747	2.494
73	12	S6	0	18252.275	29933.622	3756.685	8994.817	1.64	2.394
74	12	S7	0	18223.829	29965.973	3785.394	8999.112	1.644	2.377
75	12	S9	0	17051.042	29781.847	3597.349	8972.736	1.747	2.494
76	12	S11	0	17648.189	30017.507	3925.123	9029.033	1.701	2.3
77	12	S12	0	18224.311	29966.02	3785.394	8999.111	1.644	2.377
78	13	S2	0	22497.8	30017.289	3687.388	9029.002	1.334	2.449
79	13	S3	0	21022.346	29781.95	2958.063	8972.743	1.417	3.033
80	13	S6	0	22890.089	29933.622	3209.085	8994.817	1.308	2.803
81	13	S7	0	22932.271	29965.973	3276.73	8999.112	1.307	2.746
82	13	S9	0	21020.722	29781.847	2957.915	8972.736	1.417	3.033
83	13	S11	0	22501.041	30017.507	3687.719	9029.033	1.334	2.448
84	13	S12	0	22933.042	29966.02	3276.857	8999.111	1.307	2.746

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
85	14	S2	0	0	36542.957	0	13701.822	9.99+	9.99+
86	14	S3	0	0	36790.366	0	13191.179	9.99+	9.99+
87	14	S6	0	0	36918.849	0	13418.607	9.99+	9.99+
88	14	S7	0	0	37186.473	0	13463.276	9.99+	9.99+
89	14	S9	0	0	36791.201	0	13099.404	9.99+	9.99+
90	14	S11	0	0	36542.592	0	12839.747	9.99+	9.99+
91	14	S12	0	0	37185.837	0	13456.91	9.99+	9.99+
92	15	S2	0	0	39998.618	0	12774.436	9.99+	9.99+
93	15	S3	0	0	40809.829	0	12637.7	9.99+	9.99+
94	15	S6	0	0	40863.712	0	12756.605	9.99+	9.99+
95	15	S7	0	0	40973.126	0	12765.835	9.99+	9.99+
96	15	S9	0	0	40810.627	0	12592.855	9.99+	9.99+
97	15	S11	0	0	39998.527	0	12301.68	9.99+	9.99+
98	15	S12	0	0	40972.369	0	12770.288	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	S2	0	29.654	2996.818	0	2996.818	9.99+	9.99+
2	2	S3	0	3.118	2989.563	0	2989.563	9.99+	9.99+
3	2	S6	0	0	2998.272	0	2998.272	9.99+	9.99+
4	2	S7	0	0	2999.704	0	2999.704	9.99+	9.99+
5	2	S9	0	3.119	2989.56	0	2989.56	9.99+	9.99+
6	2	S11	0	29.647	2996.831	0	2996.831	9.99+	9.99+
7	2	S12	0	0	2999.704	0	2999.704	9.99+	9.99+
8	3	S2	0	29.654	2996.818	0	2996.818	9.99+	9.99+
9	3	S3	0	3.118	2989.563	0	2989.563	9.99+	9.99+
10	3	S6	0	0	2998.272	0	2998.272	9.99+	9.99+
11	3	S7	0	0	2999.704	0	2999.704	9.99+	9.99+
12	3	S9	0	3.119	2989.56	0	2989.56	9.99+	9.99+
13	3	S11	0	29.647	2996.831	0	2996.831	9.99+	9.99+
14	3	S12	0	0	2999.704	0	2999.704	9.99+	9.99+
15	4	S2	0	112.366	2273.382	829.357	2273.382	9.99+	2.741
16	4	S3	0	11.911	2276.596	923.399	2276.596	9.99+	2.465
17	4	S6	0	0	2246.935	925.891	2246.935	9.99+	2.427
18	4	S7	0	0.812	2242.977	896.053	2242.977	9.99+	2.503
19	4	S9	0	11.915	2276.605	923.354	2276.605	9.99+	2.466
20	4	S11	0	112.347	2273.337	829.404	2273.337	9.99+	2.741
21	4	S12	0	0.815	2242.978	896.067	2242.978	9.99+	2.503
22	5	S2	0	183.726	2351.805	708.985	2351.805	9.99+	3.317
23	5	S3	0	20.96	2408.384	795.96	2408.384	9.99+	3.026
24	5	S6	0	0	2356.455	800.799	2356.455	9.99+	2.943
25	5	S7	0	4.05	2346.113	760.448	2346.113	9.99+	3.085
26	5	S9	0	20.97	2408.416	795.903	2408.416	9.99+	3.026
27	5	S11	0	183.701	2351.738	709.057	2351.738	9.99+	3.317
28	5	S12	0	4.066	2346.094	760.461	2346.094	9.99+	3.085
29	6	S2	0	210.912	3852.836	976.712	3852.836	9.99+	3.945
30	6	S3	0	22.399	3824.895	1088.465	3824.895	9.99+	3.514
31	6	S6	0	0	3883.03	1091.812	3883.03	9.99+	3.557
32	6	S7	0	1.467	3891.901	1054.413	3891.901	9.99+	3.691
33	6	S9	0	22.408	3824.874	1088.409	3824.874	9.99+	3.514
34	6	S11	0	210.875	3852.922	976.772	3852.922	9.99+	3.945
35	6	S12	0	1.473	3891.902	1054.429	3891.902	9.99+	3.691
36	7	S2	0	121.027	3706.309	830.196	3706.309	9.99+	4.464
37	7	S3	0	11.587	3718.885	920.698	3718.885	9.99+	4.039
38	7	S6	0	0	3750.63	921.697	3750.63	9.99+	4.069

Slab Stability - Sliding (Continued)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
39	7	S7	0	1.041	3753.5	900.026	3753.5	9.99+	4.17
40	7	S9	0	11.605	3718.883	920.664	3718.883	9.99+	4.039
41	7	S11	0	121.001	3706.363	830.225	3706.363	9.99+	4.464
42	7	S12	0	1.044	3753.487	900.039	3753.487	9.99+	4.17
43	8	S2	0	76.861	2454.241	622.018	2454.241	9.99+	3.946
44	8	S3	0	8.154	2454.838	692.549	2454.838	9.99+	3.545
45	8	S6	0	0	2434.77	694.418	2434.77	9.99+	3.506
46	8	S7	0	0.609	2432.159	672.04	2432.159	9.99+	3.619
47	8	S9	0	8.156	2454.844	692.516	2454.844	9.99+	3.545
48	8	S11	0	76.849	2454.21	622.053	2454.21	9.99+	3.945
49	8	S12	0	0.612	2432.16	672.05	2432.16	9.99+	3.619
50	9	S2	0	130.381	2513.058	531.739	2513.058	9.99+	4.726
51	9	S3	0	14.941	2553.679	596.97	2553.679	9.99+	4.278
52	9	S6	0	0	2516.91	600.599	2516.91	9.99+	4.191
53	9	S7	0	3.037	2509.511	570.336	2509.511	9.99+	4.4
54	9	S9	0	14.947	2553.702	596.927	2553.702	9.99+	4.278
55	9	S11	0	130.364	2513.011	531.793	2513.011	9.99+	4.726
56	9	S12	0	3.049	2509.496	570.346	2509.496	9.99+	4.4
57	10	S2	0	165.597	3638.831	732.534	3638.831	9.99+	4.967
58	10	S3	0	17.579	3616.062	816.349	3616.062	9.99+	4.43
59	10	S6	0	0	3661.841	818.859	3661.841	9.99+	4.472
60	10	S7	0	1.1	3668.852	790.809	3668.852	9.99+	4.639
61	10	S9	0	17.586	3616.046	816.307	3616.046	9.99+	4.43
62	10	S11	0	165.568	3638.899	732.579	3638.899	9.99+	4.967
63	10	S12	0	1.105	3668.852	790.822	3668.852	9.99+	4.639
64	11	S2	0	98.183	3528.936	622.647	3528.936	9.99+	5.668
65	11	S3	0	9.47	3536.554	690.524	3536.554	9.99+	5.122
66	11	S6	0	0	3562.541	691.272	3562.541	9.99+	5.154
67	11	S7	0	0.781	3565.051	675.02	3565.051	9.99+	5.281
68	11	S9	0	9.483	3536.552	690.498	3536.552	9.99+	5.122
69	11	S11	0	98.163	3528.98	622.669	3528.98	9.99+	5.668
70	11	S12	0	0.783	3565.041	675.029	3565.041	9.99+	5.281
71	12	S2	0	124.227	1074.655	829.357	1074.655	8.651	1.296
72	12	S3	0	13.158	1080.771	923.399	1080.771	9.99+	1.17
73	12	S6	0	0	1047.626	925.891	1047.626	9.99+	1.131
74	12	S7	0	0.812	1043.095	896.053	1043.095	9.99+	1.164
75	12	S9	0	13.162	1080.781	923.354	1080.781	9.99+	1.17
76	12	S11	0	124.206	1074.605	829.404	1074.605	8.652	1.296
77	12	S12	0	0.815	1043.097	896.067	1043.097	9.99+	1.164
78	13	S2	0	195.587	1153.077	708.985	1153.077	5.895	1.626
79	13	S3	0	22.207	1212.559	795.96	1212.559	9.99+	1.523
80	13	S6	0	0	1157.146	800.799	1157.146	9.99+	1.445
81	13	S7	0	4.05	1146.231	760.448	1146.231	9.99+	1.507
82	13	S9	0	22.217	1212.592	795.903	1212.592	9.99+	1.524
83	13	S11	0	195.56	1153.005	709.057	1153.005	5.896	1.626
84	13	S12	0	4.066	1146.213	760.461	1146.213	9.99+	1.507
85	14	S2	0	199.051	2654.109	976.712	2654.109	9.99+	2.717
86	14	S3	0	21.152	2629.07	1088.465	2629.07	9.99+	2.415
87	14	S6	0	0	2683.721	1091.812	2683.721	9.99+	2.458
88	14	S7	0	1.467	2692.02	1054.413	2692.02	9.99+	2.553
89	14	S9	0	21.16	2629.05	1088.409	2629.05	9.99+	2.415
90	14	S11	0	199.016	2654.19	976.772	2654.19	9.99+	2.717
91	14	S12	0	1.473	2692.021	1054.429	2692.021	9.99+	2.553
92	15	S2	0	109.165	2507.582	830.196	2507.582	9.99+	3.02
93	15	S3	0	10.34	2523.059	920.698	2523.059	9.99+	2.74



Company : Vector Structural Engineering
Designer : CJT
Job Number : U2716.0389.241
Model Name : Ground Mount

5/6/2024
2:18:06 PM
Checked By : MIH

Slab Stability - Sliding (Continued)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
94	15	S6	0	0	2551.321	921.697	2551.321	9.99+	2.768
95	15	S7	0	1.041	2553.618	900.026	2553.618	9.99+	2.837
96	15	S9	0	10.357	2523.059	920.664	2523.059	9.99+	2.74
97	15	S11	0	109.142	2507.631	830.225	2507.631	9.99+	3.02
98	15	S12	0	1.044	2553.605	900.039	2553.605	9.99+	2.837



JOB NO.: U2716.0389.241

PROJECT: Sunturf Package D7 Ground Mount

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 N1 max	336.76	25	3893.599	25	1753.276	25	0	30	0	30	0	30
2 min	-338.758	28	-3649.285	28	-1481.936	23	0	18	0	18	0	18
3 N151 max	338.71	28	3894.185	25	1753.384	25	0	30	0	30	0	30
4 min	-336.723	25	-3649.823	28	-1482.014	23	0	18	0	18	0	18
5 N231 max	35.503	28	3625.279	25	1951.229	25	0	30	0	30	0	30
6 min	-36.333	25	-3387.566	28	-1644.712	23	0	18	0	18	0	18
7 N276 max	36.326	25	3625.577	25	1951.328	25	0	30	0	30	0	30
8 min	-35.489	28	-3387.823	28	-1644.786	23	0	18	0	18	0	18
9 N2 max	11.548	30	2300.126	26	99.24	23	0	30	0	30	0	30
10 min	-7.109	23	-982.201	27	-126.369	25	0	18	0	18	0	18
11 N152 max	7.1	23	2300.085	26	99.242	23	0	30	0	30	0	30
12 min	-11.535	30	-982.118	27	-126.374	25	0	18	0	18	0	18
13 N203 max	4.328	28	3962.489	25	1892.068	25	0	30	0	30	0	30
14 min	-4.471	25	-3718.496	28	-1598.593	23	0	18	0	18	0	18
15 N219 max	4.452	25	3962.357	25	1892.038	25	0	30	0	30	0	30
16 min	-4.295	28	-3718.364	28	-1598.569	23	0	18	0	18	0	18
17 N205 max	3.789	26	2505.803	26	105.047	23	0	30	0	30	0	30
18 min	-1.393	27	-1081.459	27	-134.875	25	0	18	0	18	0	18
19 N227 max	1.38	27	2505.949	26	105.045	23	0	30	0	30	0	30
20 min	-3.772	26	-1081.553	27	-134.873	25	0	18	0	18	0	18
21 N278 max	1.529	23	2504.148	26	106.309	23	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	-0.537	30	-1062.759	27	-136.115	25	0	18	0	18	0	18
23	N233	max	0.513	30	2504.301	26	106.307	23	0	30	0	30	0	30
24		min	-1.516	23	-1062.88	27	-136.113	25	0	18	0	18	0	18
25	N67	max	0.004	27	2496.369	26	107.717	23	0	30	0	30	0	30
26		min	-0.009	25	-1052.787	27	-137.886	25	0	18	0	18	0	18
27	N65	max	0.004	28	3943.701	25	1957.641	25	0	30	0	30	0	30
28		min	-0.001	22	-3708.522	28	-1650.833	23	0	18	0	18	0	18
29	Totals:	max	0.004	25	38333.52	25	12218.359	25						
30		min	-0.003	28	-25008.6	27	-10372.536	27						



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





Company:	Vector Structural Engineers	Date:	5/6/2024
Engineer:	CJT	Page:	2/6
Project:	Sunturf Ground Mount D7		
Address:			
Phone:			
E-mail:			

Load and Geometry

Load factor source: ACI 318 Section 5.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: No

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 3719

V_{uax} [lb]: 339

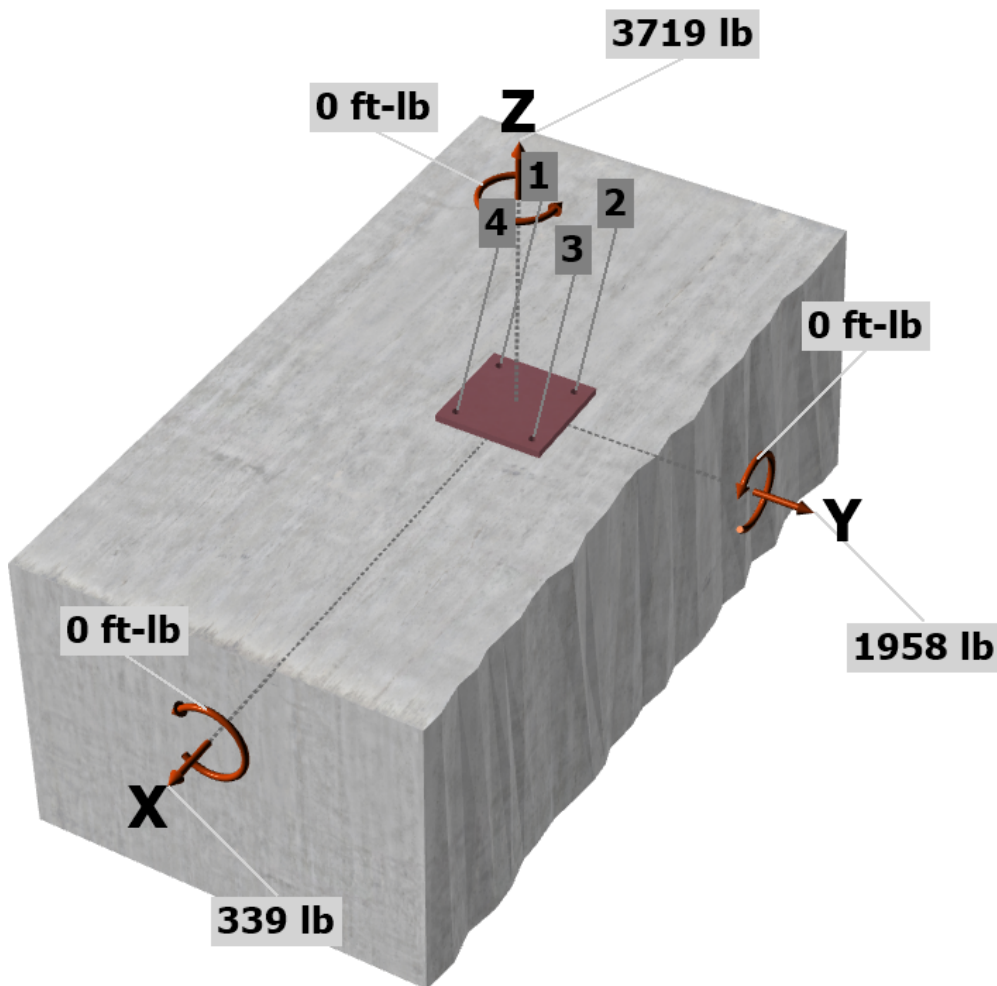
V_{uay} [lb]: 1958

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

<Figure 1>

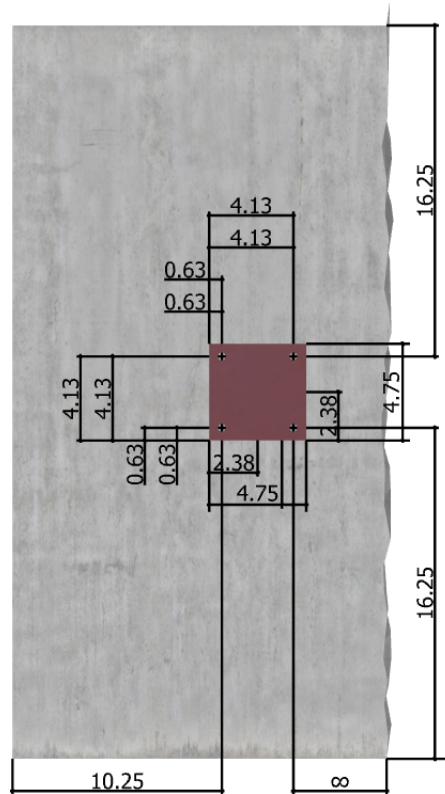


Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



Company:	Vector Structural Engineers	Date:	5/6/2024
Engineer:	CJT	Page:	3/6
Project:	Sunturf Ground Mount D7		
Address:			
Phone:			
E-mail:			

<Figure 2>





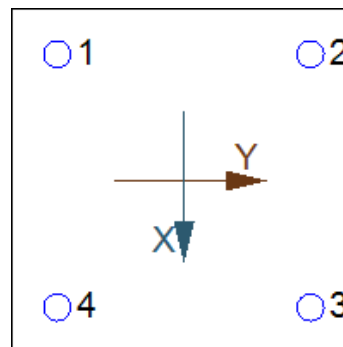
Company:	Vector Structural Engineers	Date:	5/6/2024
Engineer:	CJT	Page:	4/6
Project:	Sunturf Ground Mount D7		
Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N _{ua} (lb)	Shear load x, V _{uax} (lb)	Shear load y, V _{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	929.8	84.7	489.5	496.8
2	929.8	84.8	489.5	496.8
3	929.8	84.8	489.5	496.8
4	929.8	84.7	489.5	496.7
Sum	3719.0	339.0	1958.0	1987.1

Maximum concrete compression strain (%): 0.00
 Maximum concrete compression stress (psi): 0
 Resultant tension force (lb): 3719
 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)	φ	φN _{sa} (lb)
7800	0.75	5850

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

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

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

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

A _{Nc} (in ²)	A _{Nco} (in ²)	C _{a,min} (in)	Ψ _{ec,N}	Ψ _{ed,N}	Ψ _{c,N}	Ψ _{cp,N}	N _b (lb)	φ	φN _{cbg} (lb)
240.25	144.00	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)

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

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

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

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

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

A _{Na} (in ²)	A _{Na0} (in ²)	C _{Na} (in)	C _{a,min} (in)	Ψ _{ec,Na}	Ψ _{ed,Na}	Ψ _{cp,Na}	N _{ba} (lb)	φ	φN _{ag} (lb)
198.45	112.09	5.29	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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E-mail:			

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

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (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)	λ_a	f_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.00	0.375	1.00	2500	19.75	28514

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

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)
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)	λ_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 ²)	A_{vco} (in ²)	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	V_{by} (lb)	ϕ	ϕV_{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)	λ_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 ²)	A_{vco} (in ²)	$\psi_{ec,v}$	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	V_{bx} (lb)	ϕ	ϕV_{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 ²)	A_{Na0} (in ²)	$\psi_{ed,Na}$	$\psi_{ec,Na}$	$\psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	198.45	112.09	1.000	1.000	1.000	6343	11229

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

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

11. Results

Interaction of Tension and Shear Forces (Sec. 17.8)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_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.



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Steel	930	5850	0.16	Pass
Concrete breakout	3719	7374	0.50	Pass
Adhesive	3719	6176	0.60	Pass (Governs)

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	497	3042	0.16	Pass (Governs)
T Concrete breakout x+	339	11003	0.03	Pass
Concrete breakout y-	169	16624	0.01	Pass
Concrete breakout x-	979	23299	0.04	Pass
Concrete breakout, combined	-	-	0.04	Pass
Pryout	1987	15721	0.13	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.1	0.60	0.00	60.2%	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.