



Project Number: U2716.0387.241

April 8, 2024

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

**REFERENCE: SunModo Sunturf Ground Mount D5 – 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. 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: 170 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	2529	1.5	3794
LATERAL	1448	2	2896

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.

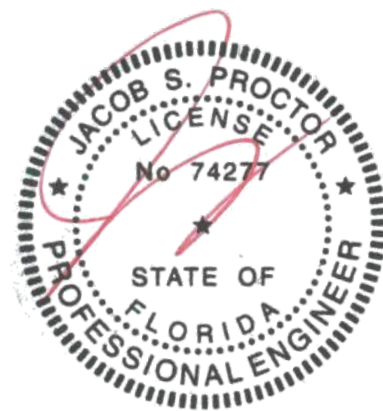
Very truly yours,

VECTOR STRUCTURAL ENGINEERING, LLC

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

Enclosures

JSP/cjt



04/09/2024

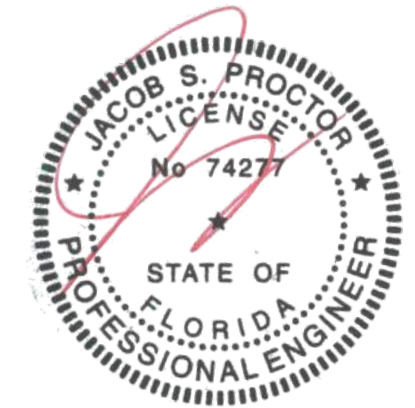
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No. 74277



JOB NO. U2716.0387.241  
 PROJECT SUNMODO SUNTURF GROUND MOUNT D5  
 SUBJECT ALL OPTIONS

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

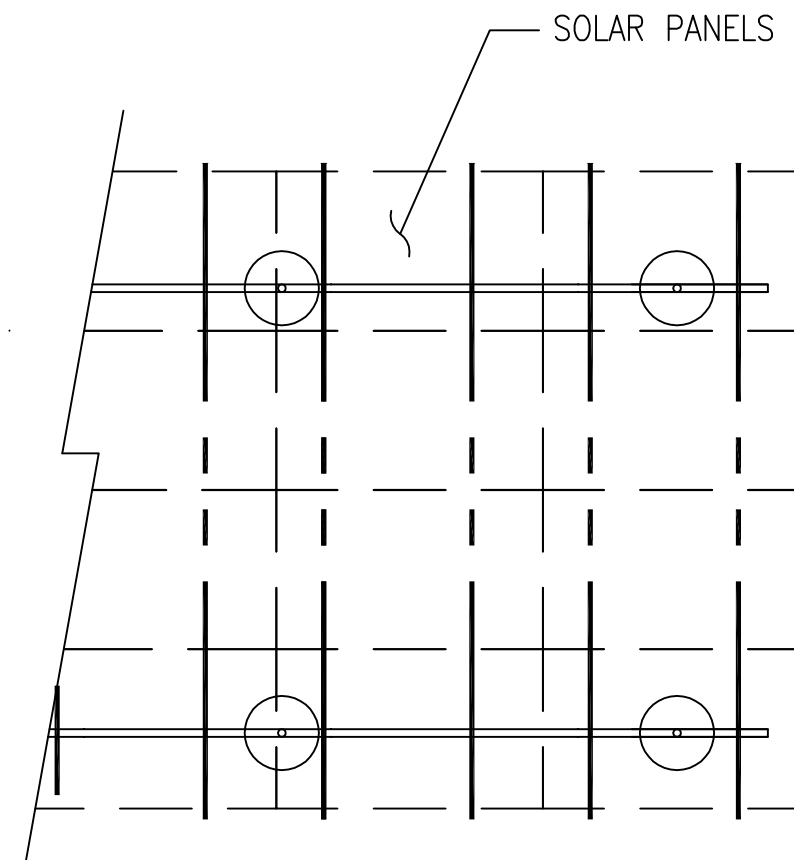
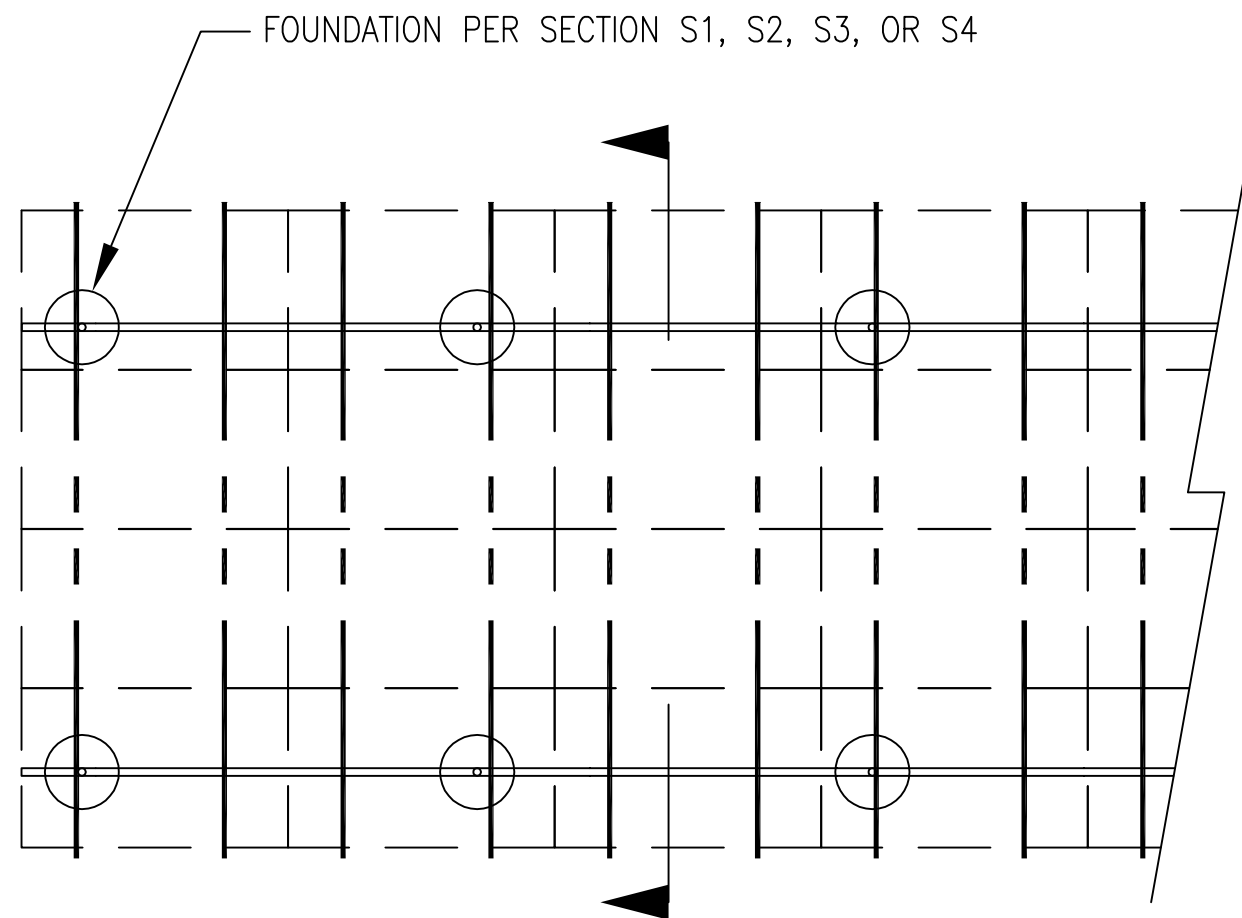
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 No. 74277

**NOTES:**

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



**PV ARRAY PLAN**

N.T.S.



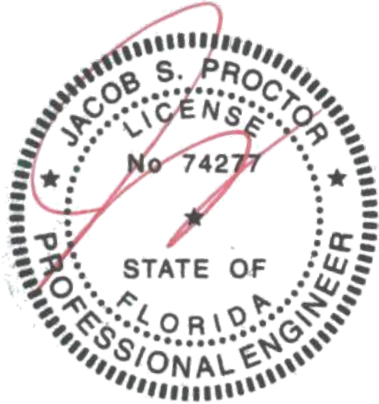
JOB NO. U2716.0387.241

PROJECT SUNMODO SUNTURF GROUND MOUNT D5

SUBJECT DRILLED PIER OPTION

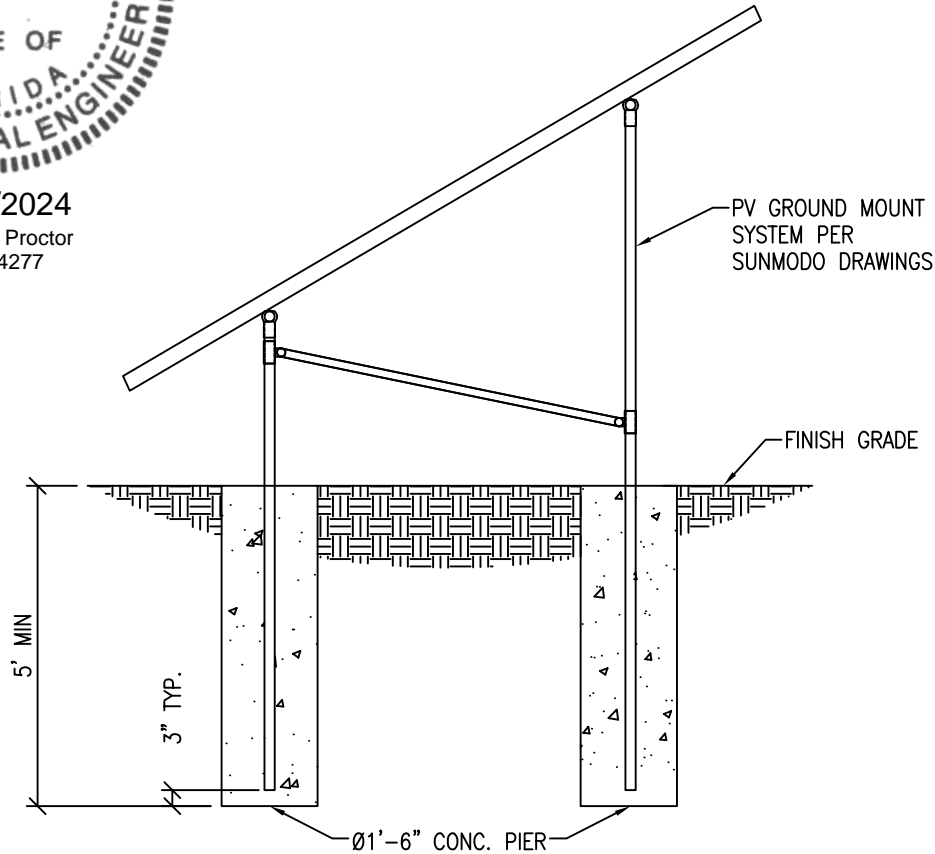
**NOTES:**

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



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**DRILLED PIER SECTION**

NTS.





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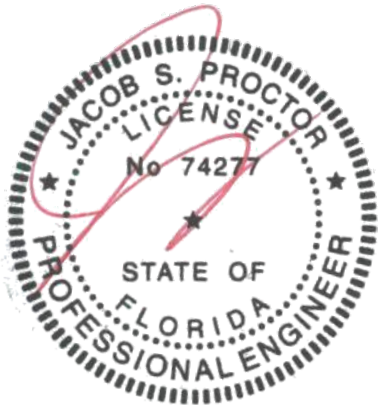
PROJECT SUNMODO SUNTURF GROUND MOUNT D5

SUBJECT HELICAL PIER OPTION

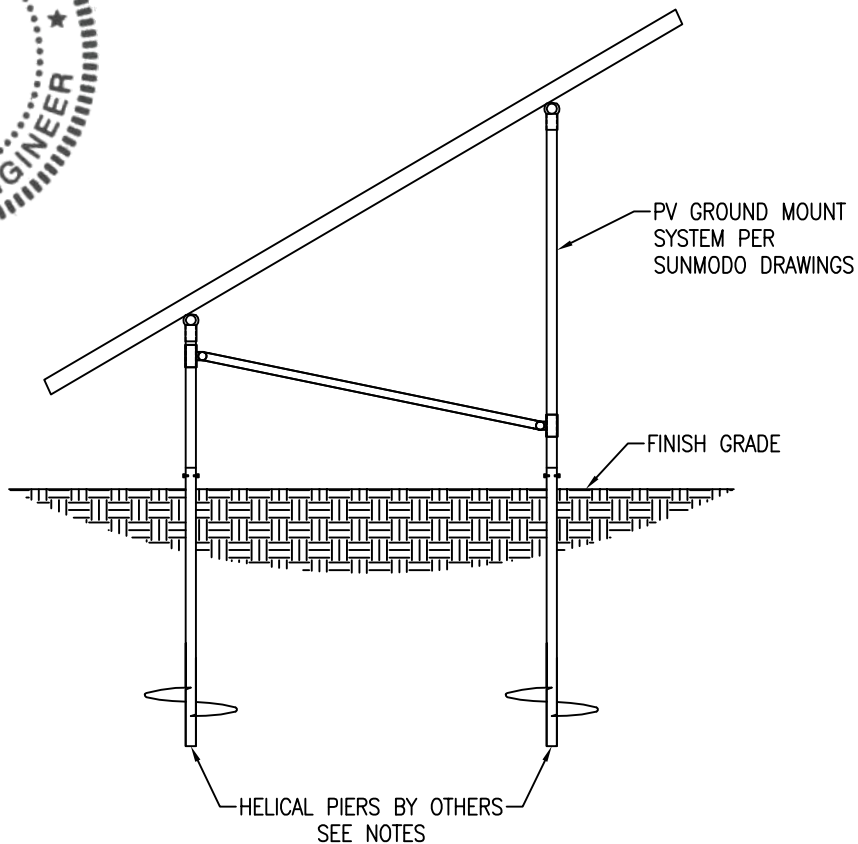
**NOTES:**

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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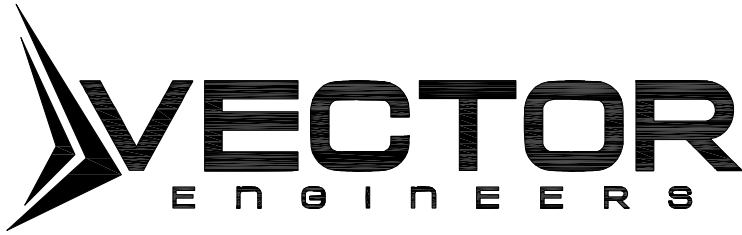
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**HELICAL PIER SECTION**

NTS.

**S2**



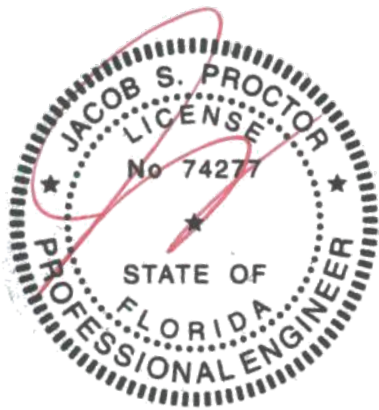
JOB NO. U2716.0387.241

PROJECT SUNMODO SUNTURF GROUND MOUNT D5

SUBJECT GROUND SCREW OPTION

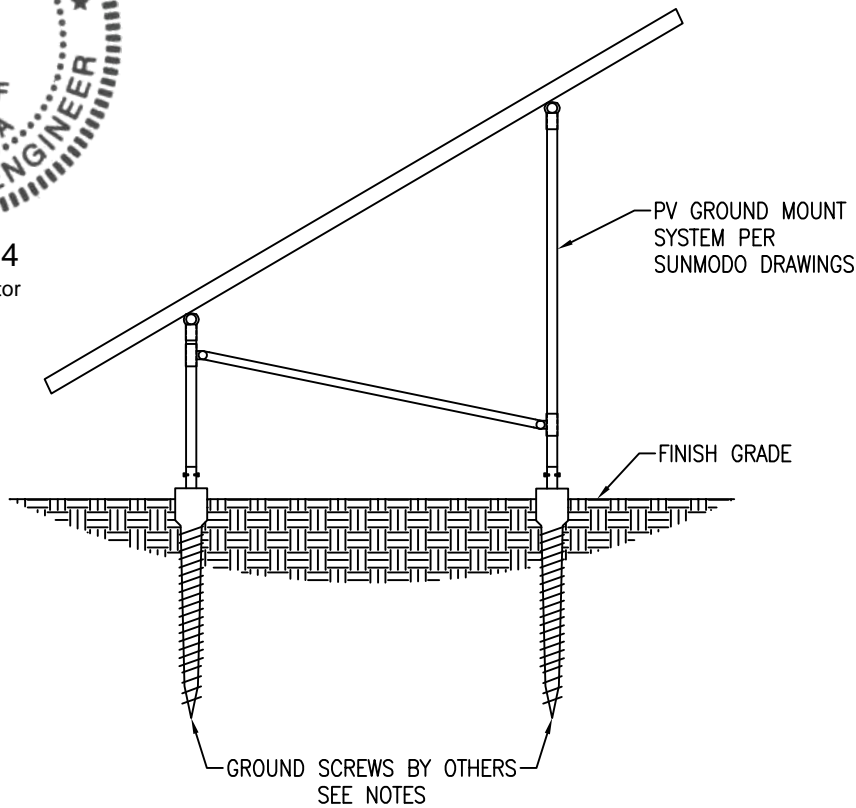
**NOTES:**

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
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**GROUND SCREW SECTION**

NTS.

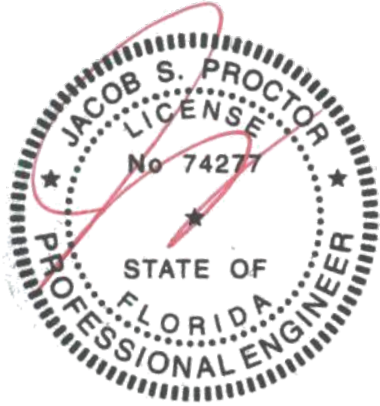
**S3**

PROJECT SUNMODO SUNTURF GROUND MOUNT D5

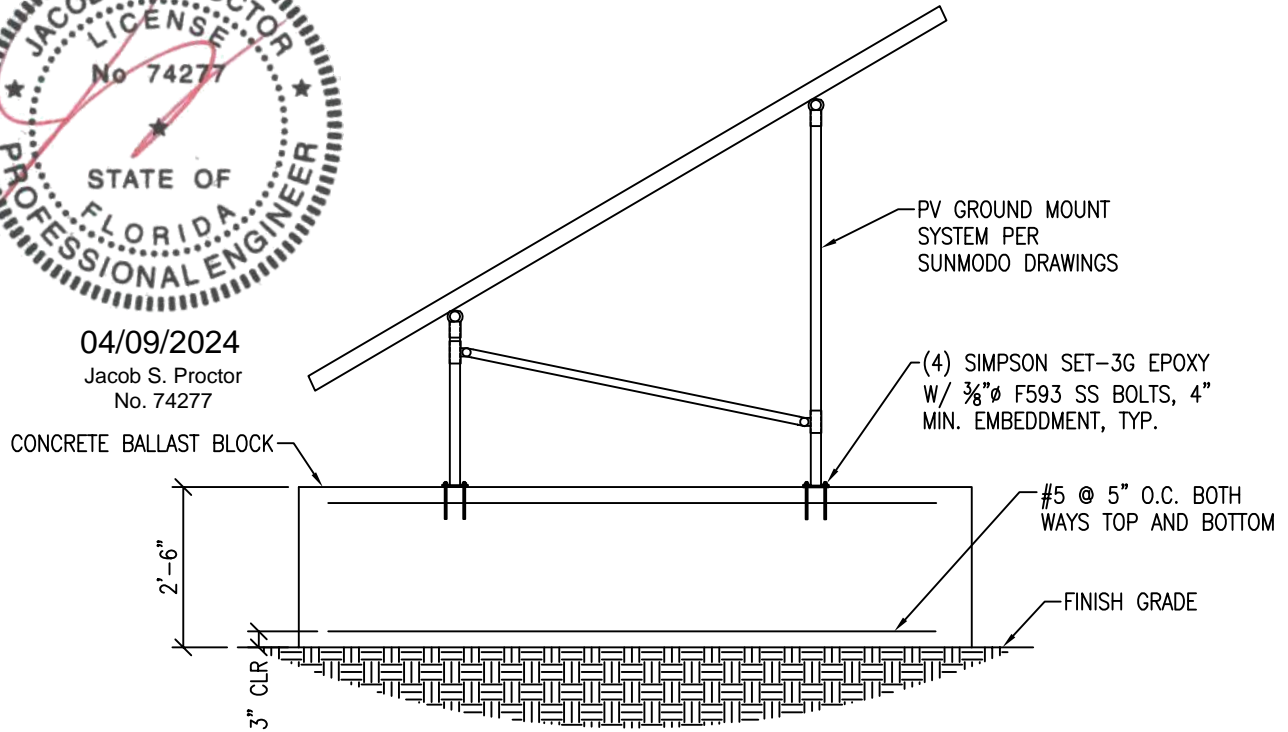
SUBJECT BALLAST BLOCK OPTION

**NOTES:**

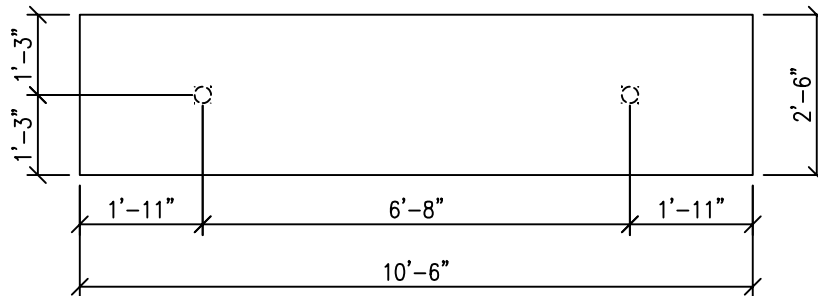
- SEE SUNMODO SHOP DRAWINGS FOR GROUND MOUNT MEMBER SIZES AND GEOMETRY



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SECTION VIEW



PLAN VIEW

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**BALLAST BLOCK SECTION**

NTS.

**S4**



**JOB NO.:** U2716.0387.241  
**SUBJECT:** WIND PRESSURES  
**CONDITION:** 20° TILT

**PROJECT:** Sunturf Package D5 Ground Mount

**WIND PRESSURES**

Calculations per:	ASCE 7-22	
Design Wind Speed, V [mph]:	170	
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]:	62.97	(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)	-59.1	-68.2
Case 2 ( $\gamma = 0^\circ$ , Load Case B)	-100.1	-9.1
Case 3 ( $\gamma = 180^\circ$ , Load Case A)	72.8	77.3
Case 4 ( $\gamma = 180^\circ$ , Load Case B)	95.5	31.8
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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**SUBJECT:** WIND PRESSURES  
**CONDITION:** 20° TILT

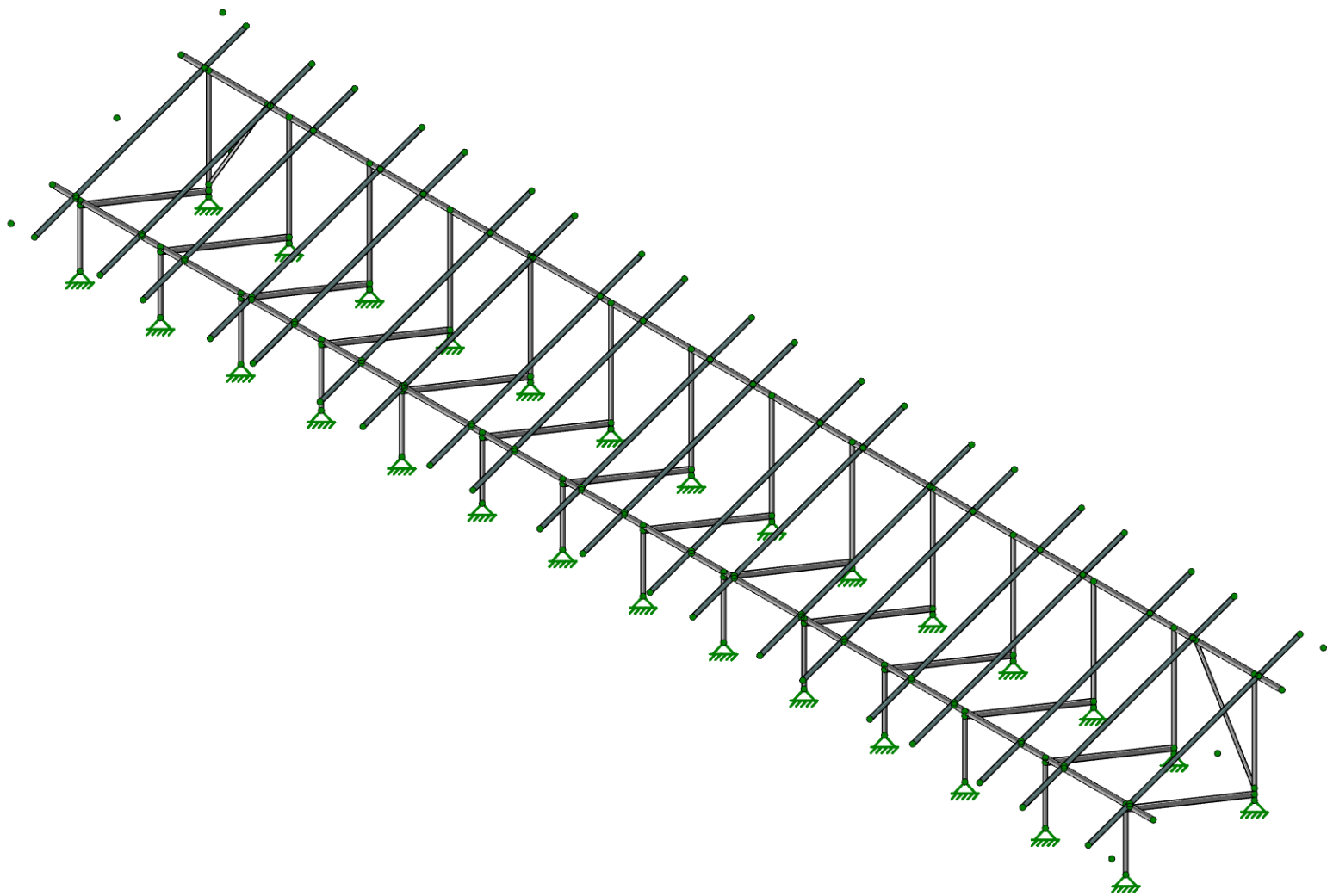
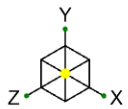
**PROJECT:** Sunturf Package D5 Ground Mount

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# Framing Analysis

## SP - 20 deg

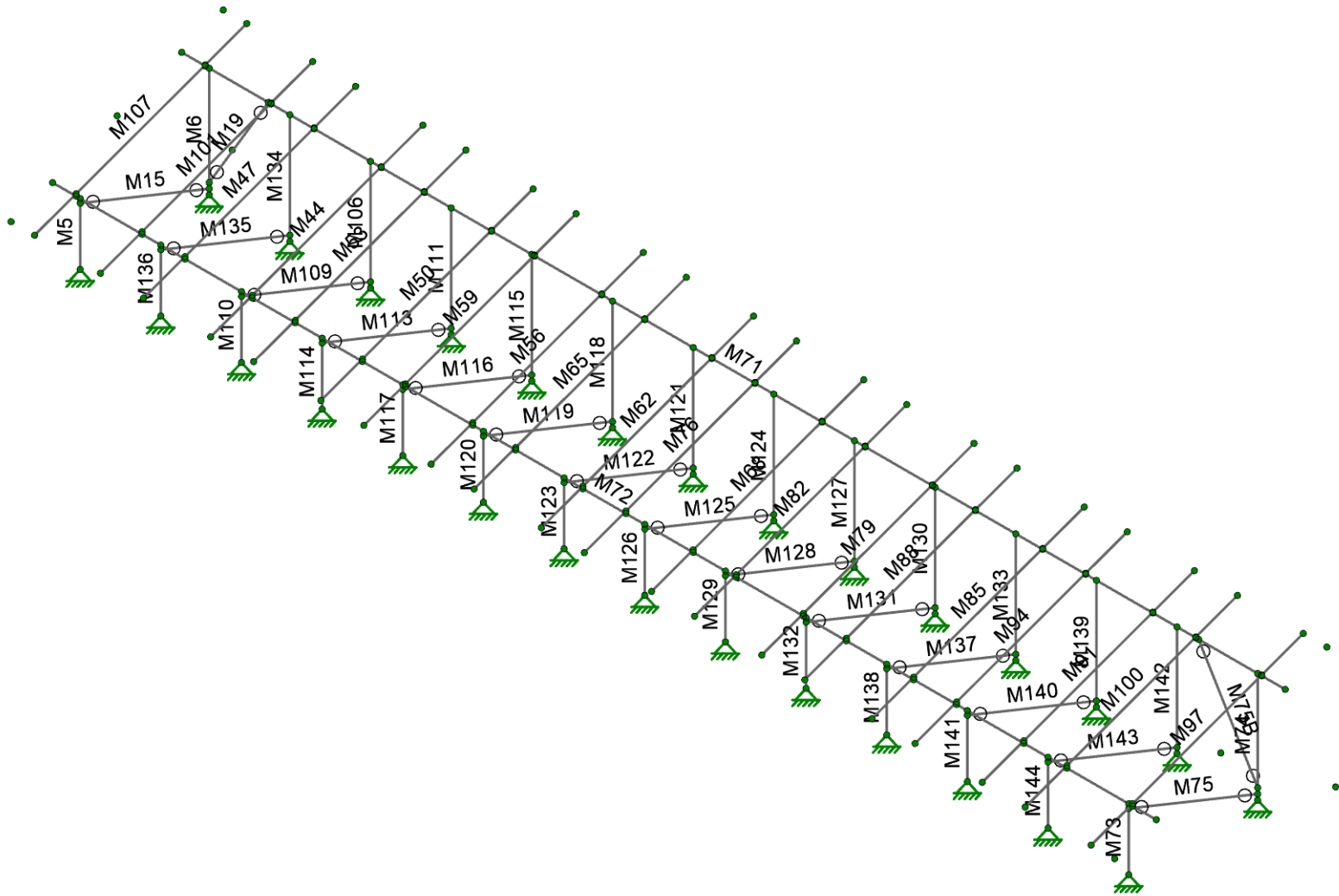
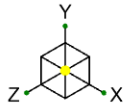




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D5 Standard Panels - 20 Degree Tilt

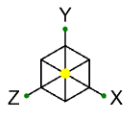
SK-1  
Mar 27, 2024  
Sunturf D5 - SP - 20deg - double brace....



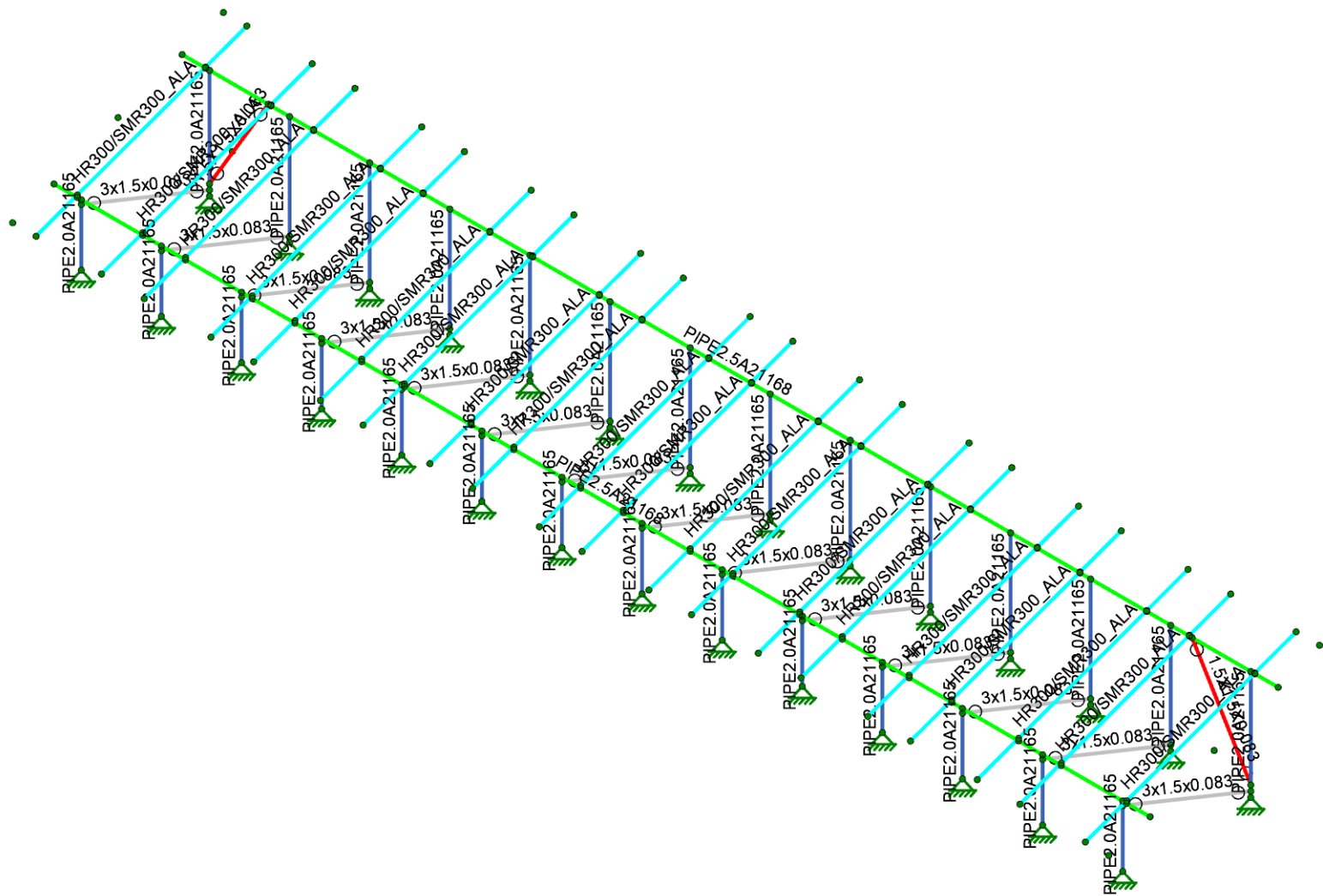
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D5 Standard Panels - 20 Degree Tilt

SK-2  
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 Sunturf D5 - SP - 20deg - double brace...



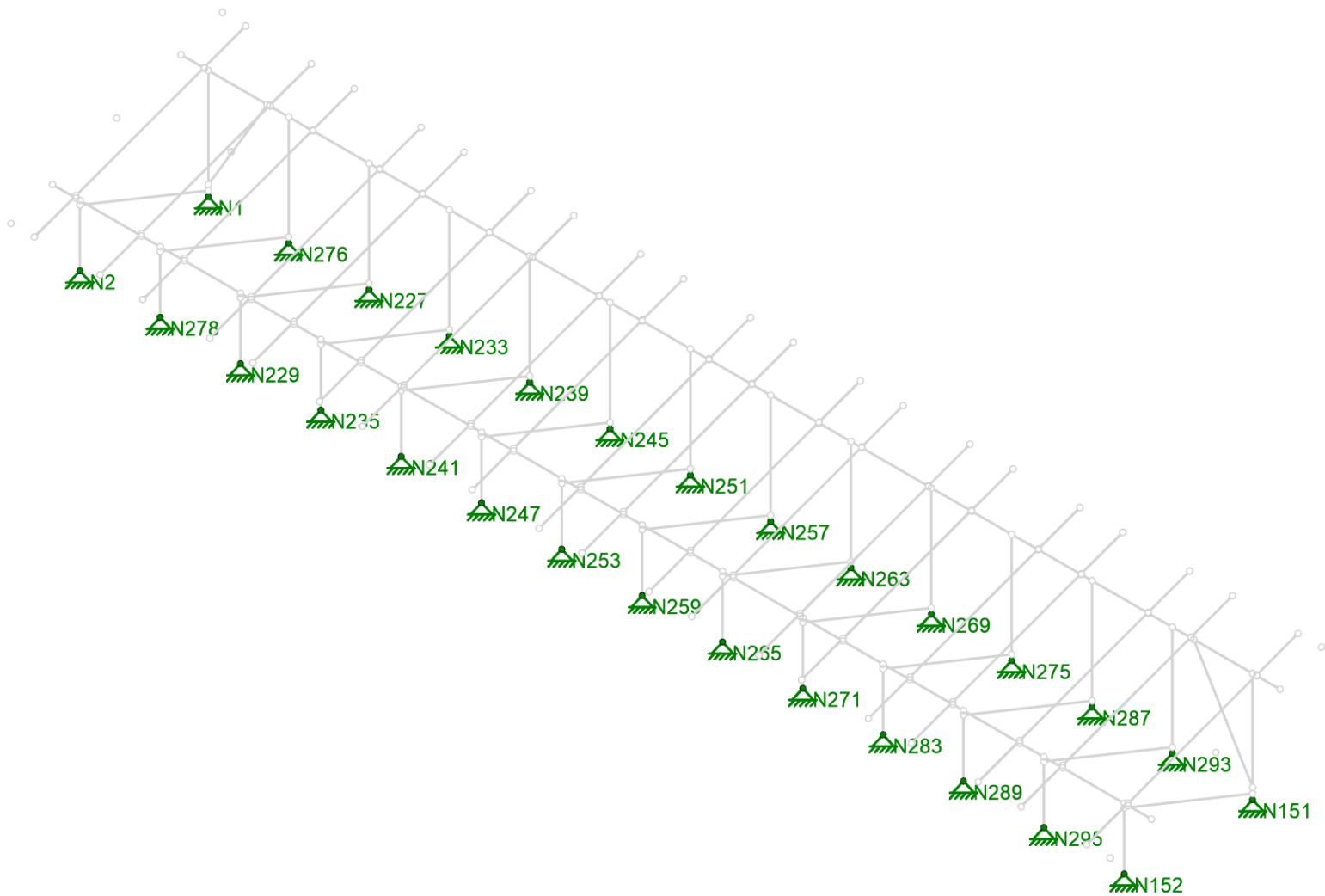
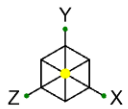
Section Sets	
<span style="color: blue;">█</span>	Post
<span style="color: green;">█</span>	Cross Beam
<span style="color: red;">█</span>	Diagonal Brace
<span style="color: grey;">█</span>	Double Brace
<span style="color: magenta;">█</span>	RIGID
<span style="color: cyan;">█</span>	AL Rails



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D5 Standard Panels - 20 Degree Tilt

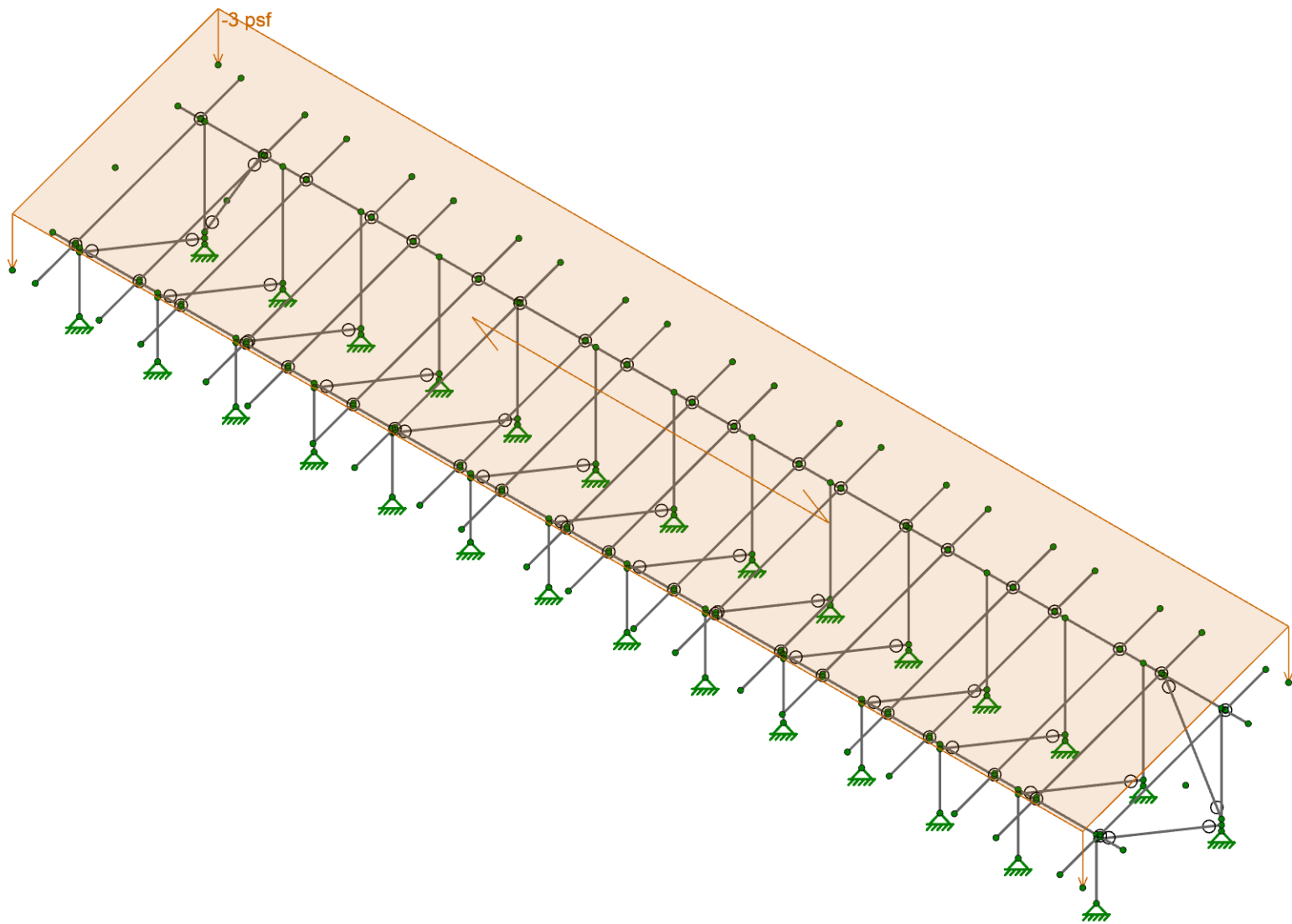
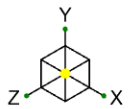
SK-3  
 Mar 27, 2024  
 Sunturf D5 - SP - 20deg - double brace...



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D5 Standard Panels - 20 Degree Tilt

SK-4  
 Mar 27, 2024  
 Sunturf D5 - SP - 20deg - double brace....



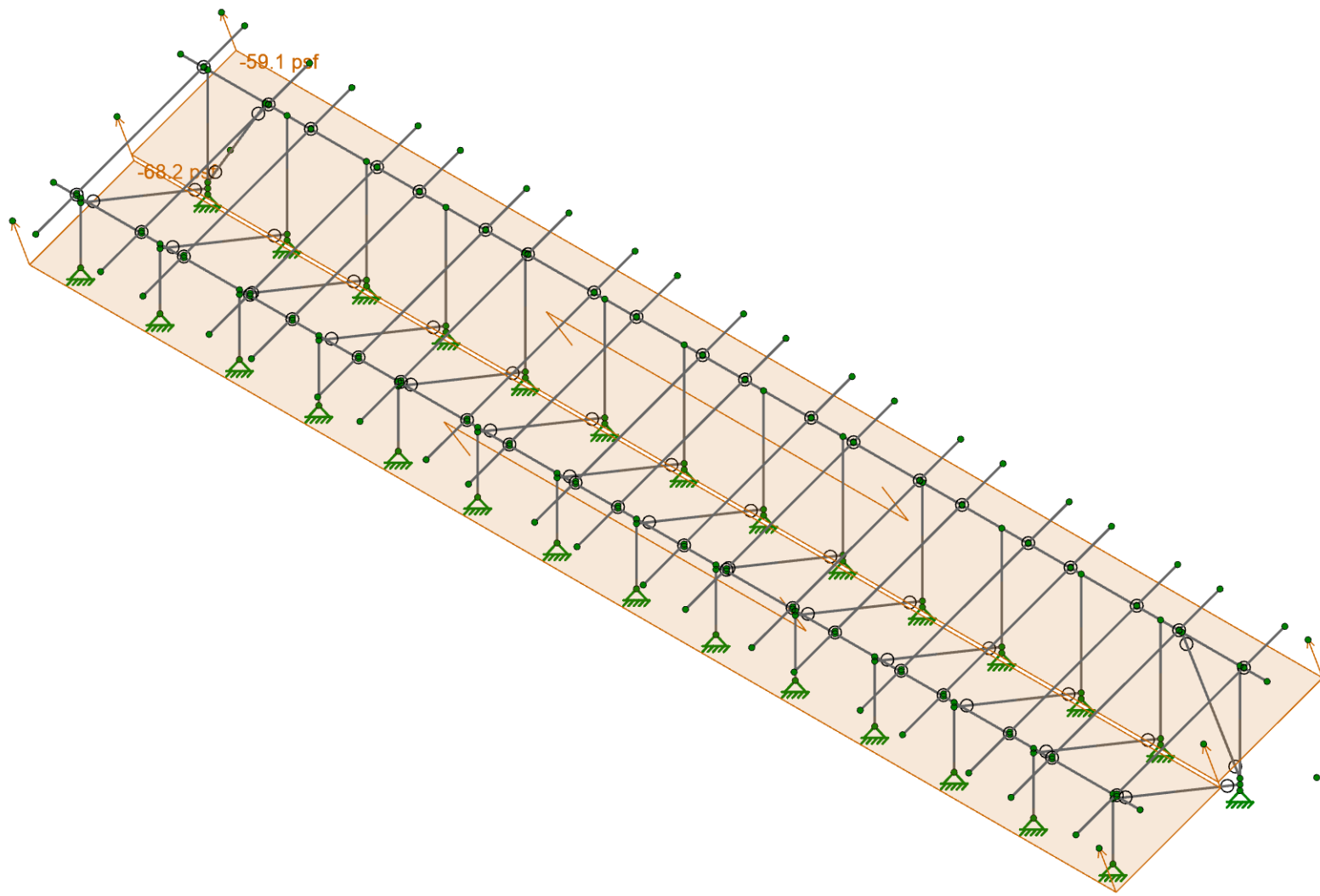
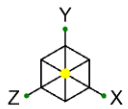
Loads: BLC 2, Solar Panel Weight




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D5 Standard Panels - 20 Degree Tilt

SK-5  
Mar 27, 2024  
Sunturf D5 - SP - 20deg - double brace...

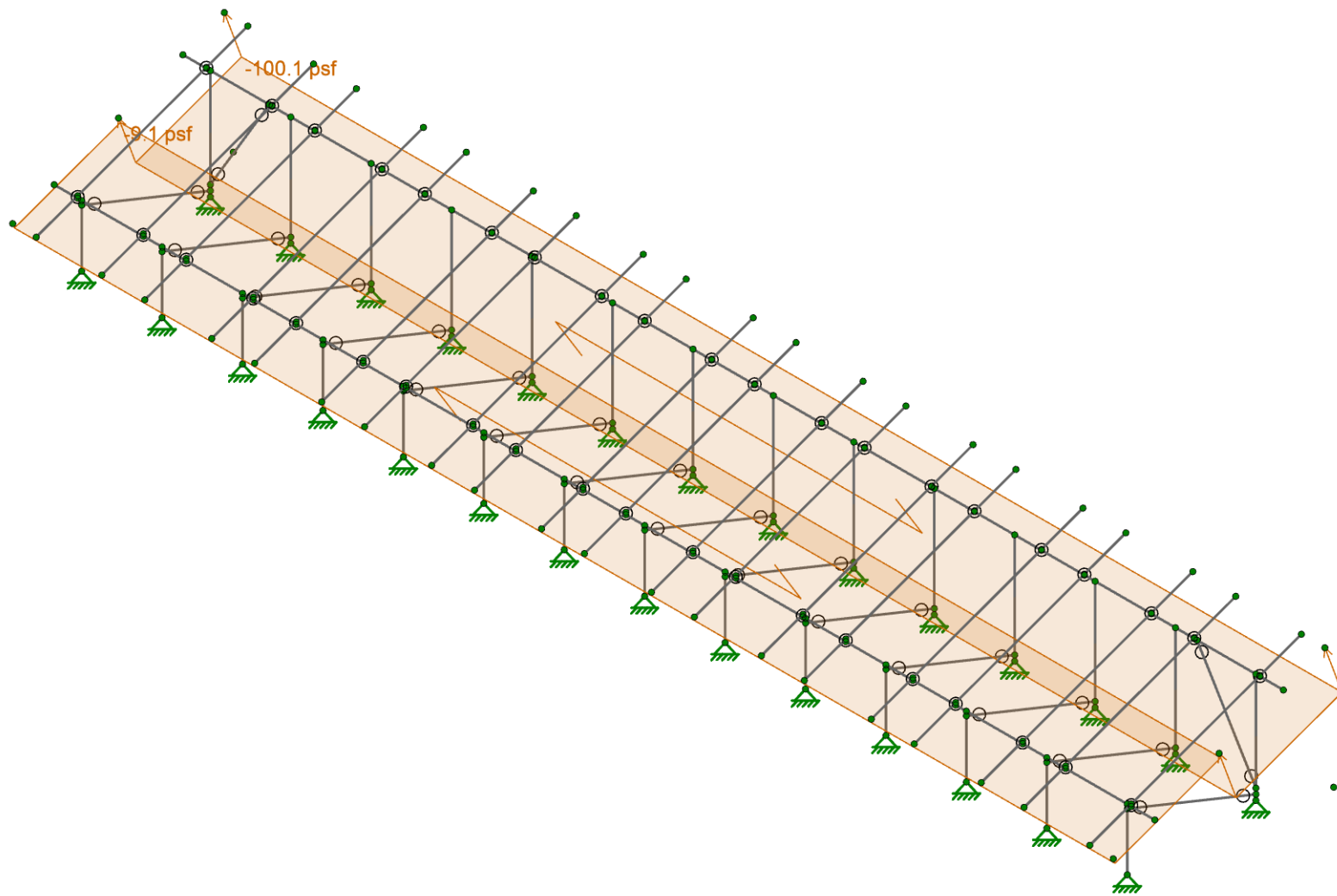
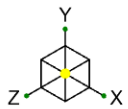


Loads: BLC 4, Wind A 0 deg

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D5 Standard Panels - 20 Degree Tilt

SK-6
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Sunturf D5 - SP - 20deg - double brace....



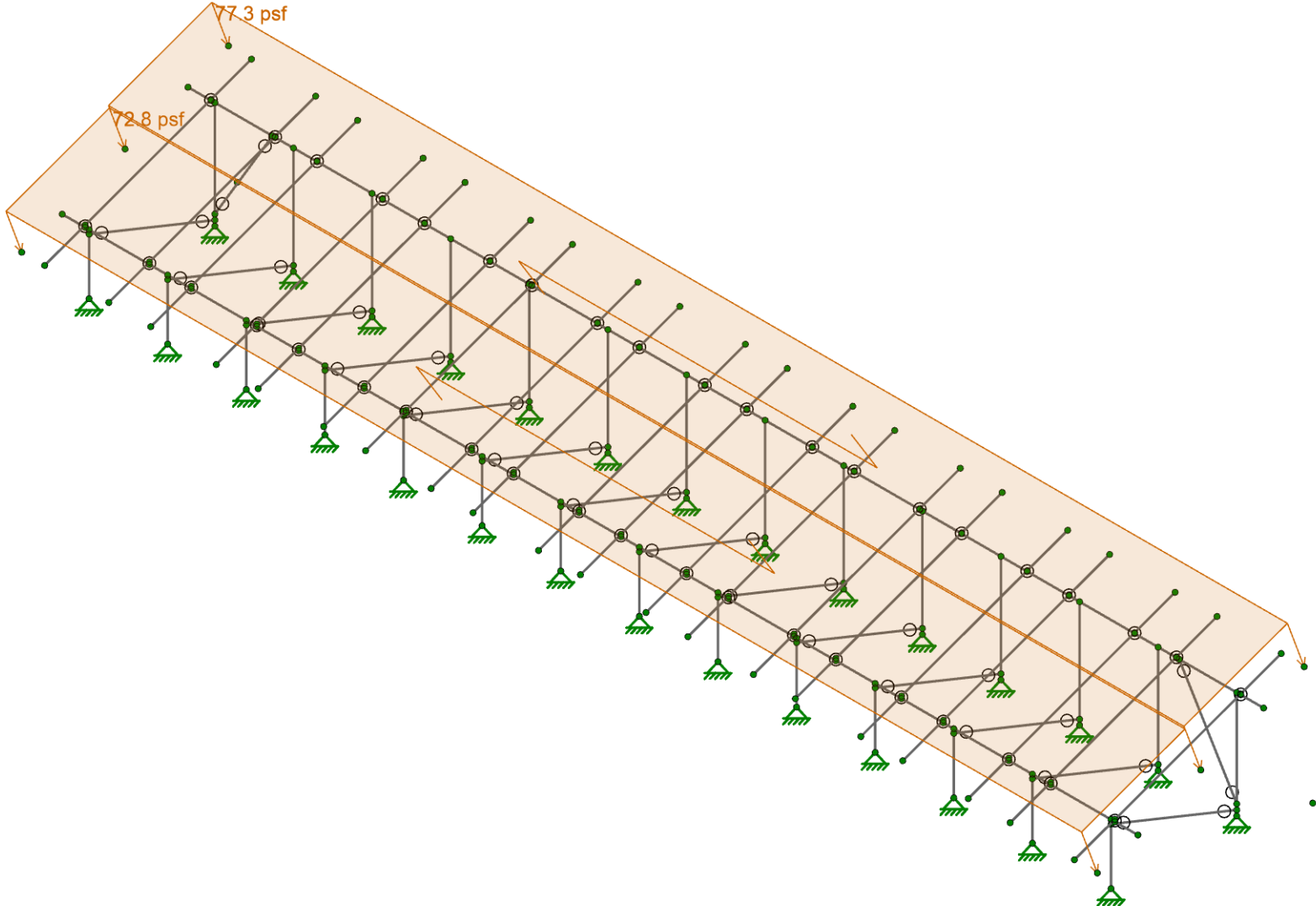
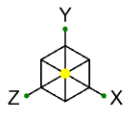
Loads: BLC 5, Wind B 0 deg



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D5 Standard Panels - 20 Degree Tilt

SK-7  
Mar 27, 2024  
Sunturf D5 - SP - 20deg - double brace....



Loads: BLC 6, Wind A 180 deg

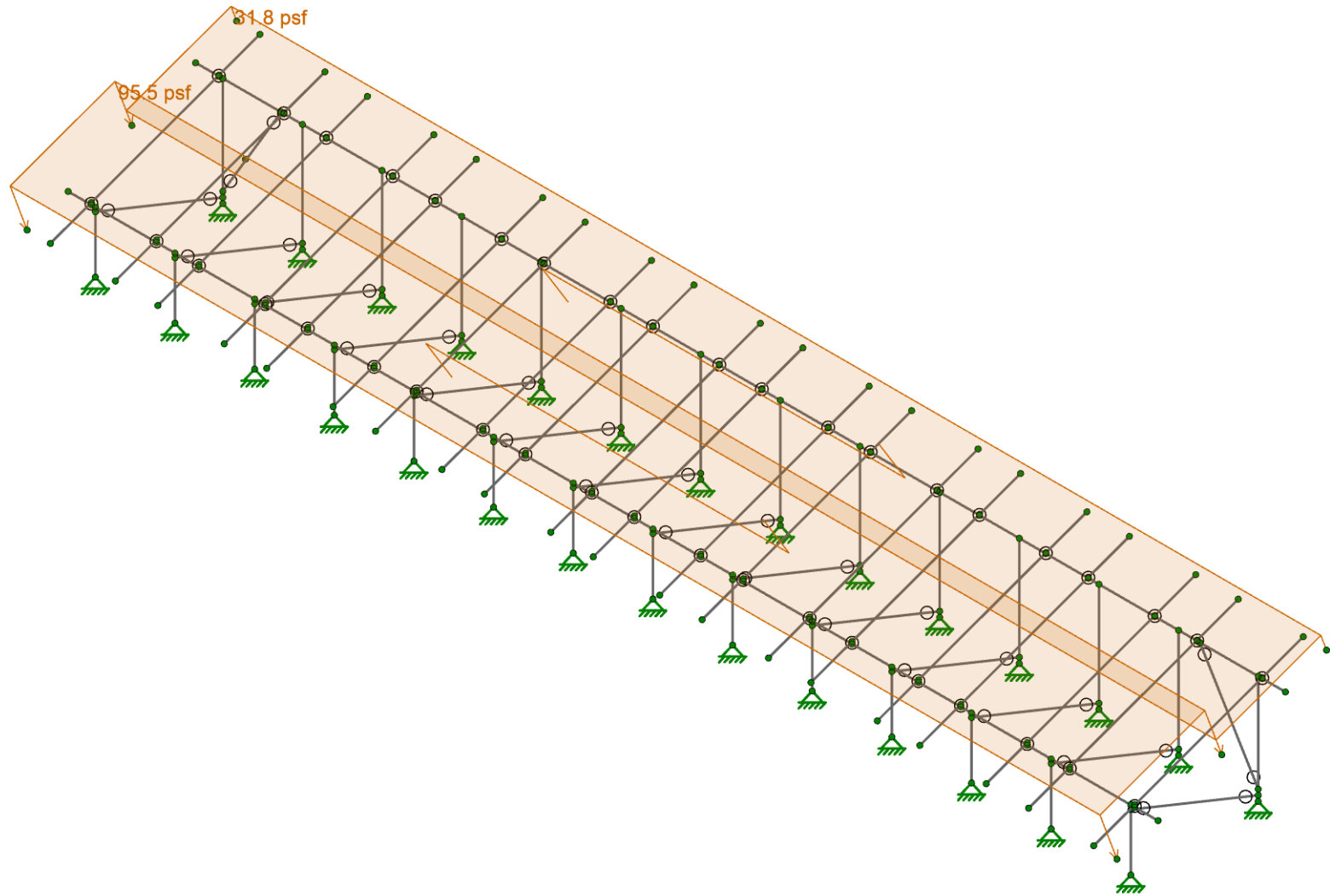
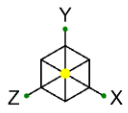


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D5 Standard Panels - 20 Degree Tilt

SK-8  
Mar 27, 2024  
Sunturf D5 - SP - 20deg - double brace...





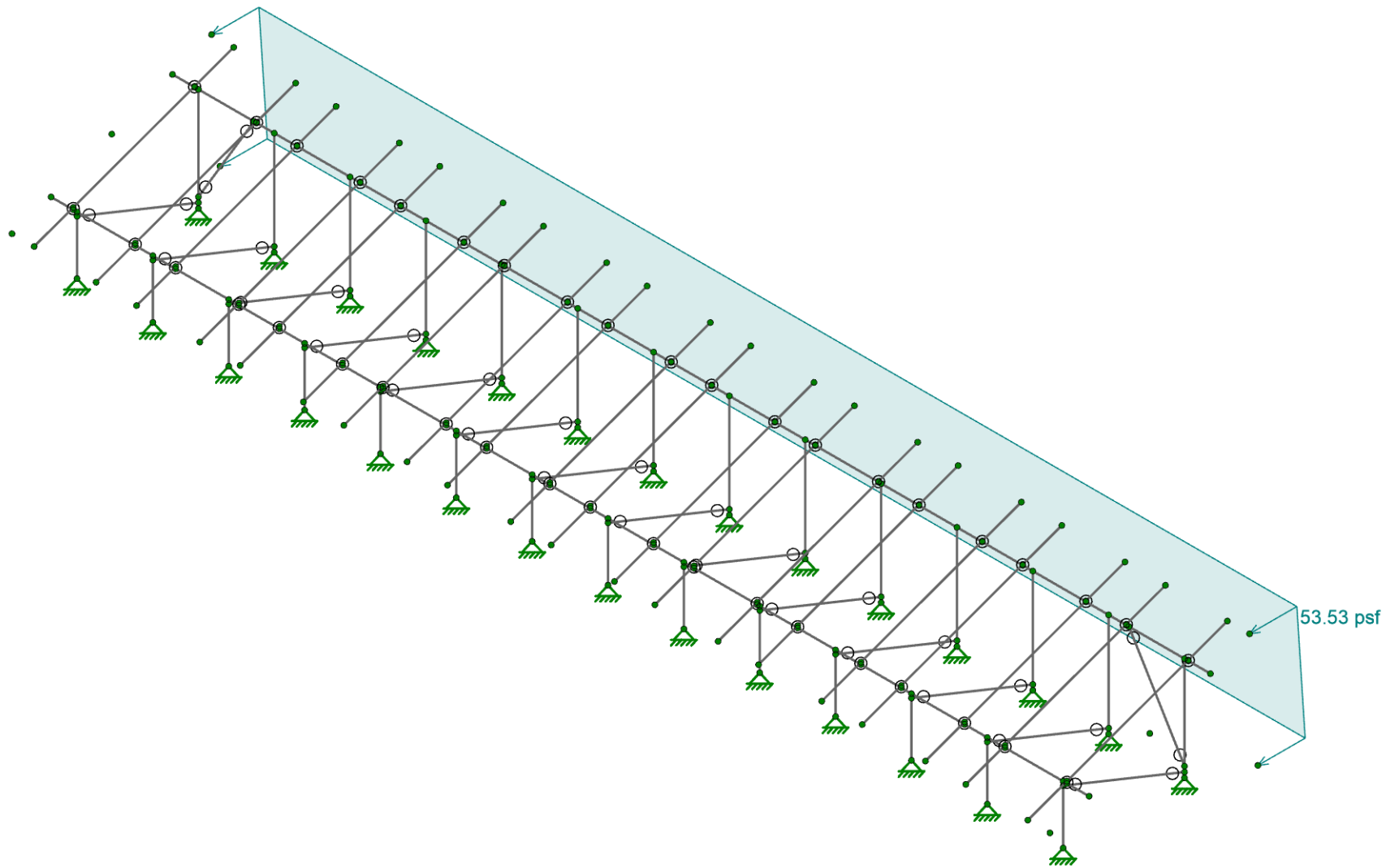
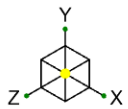
Loads: BLC 7, Wind B 180 deg



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D5 Standard Panels - 20 Degree Tilt

SK-9  
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Sunturf D5 - SP - 20deg - double brace....



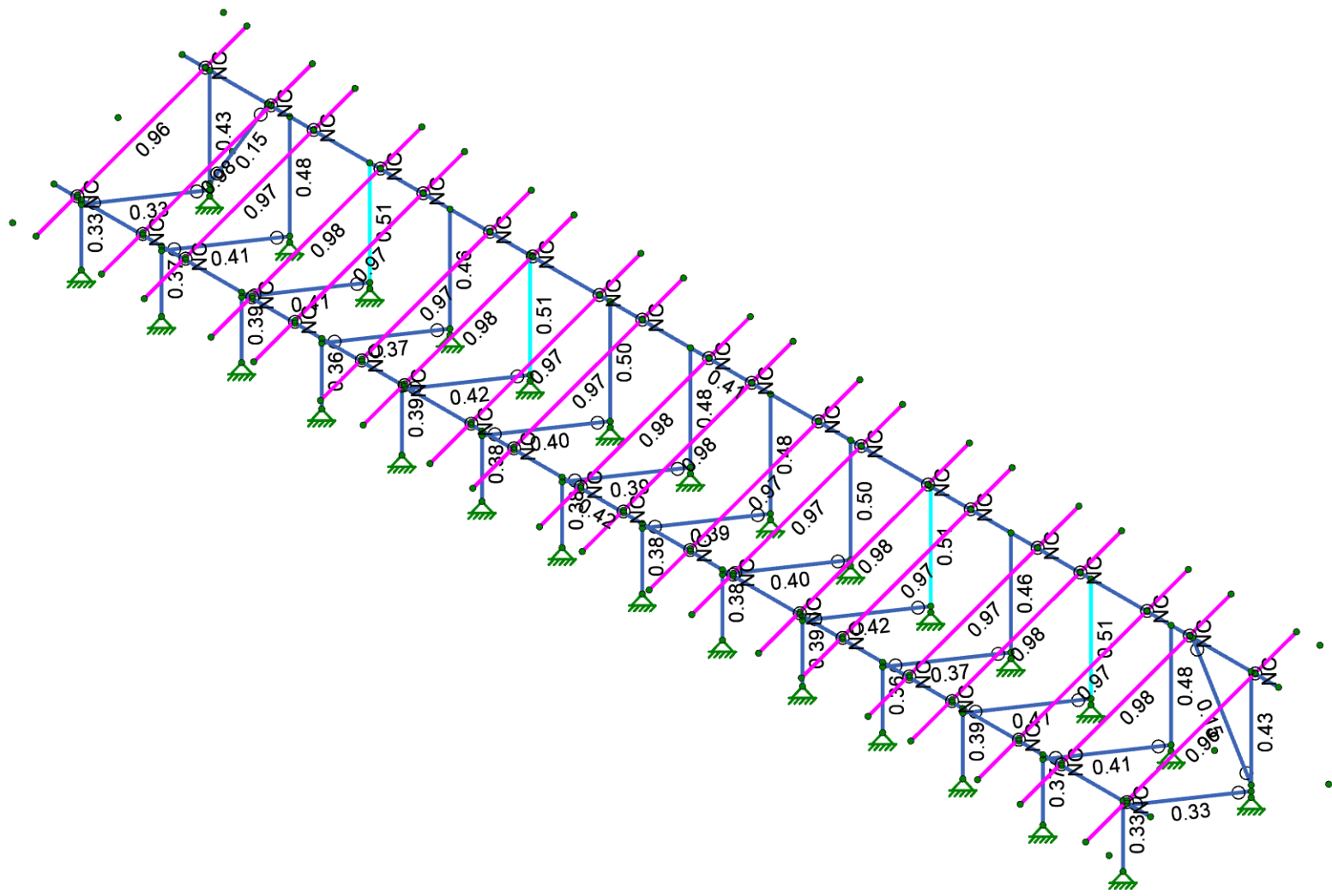
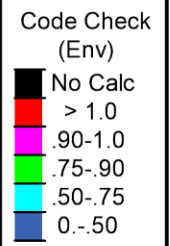
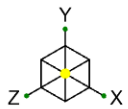
Loads: BLC 8, Wind Z



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D5 Standard Panels - 20 Degree Tilt

SK-10  
Mar 27, 2024  
Sunturf D5 - SP - 20deg - double brace....

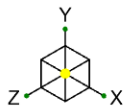


Member Code Checks Displayed (Enveloped)

	Vector Structural Engineering
	CJT
	U2716.0387.241

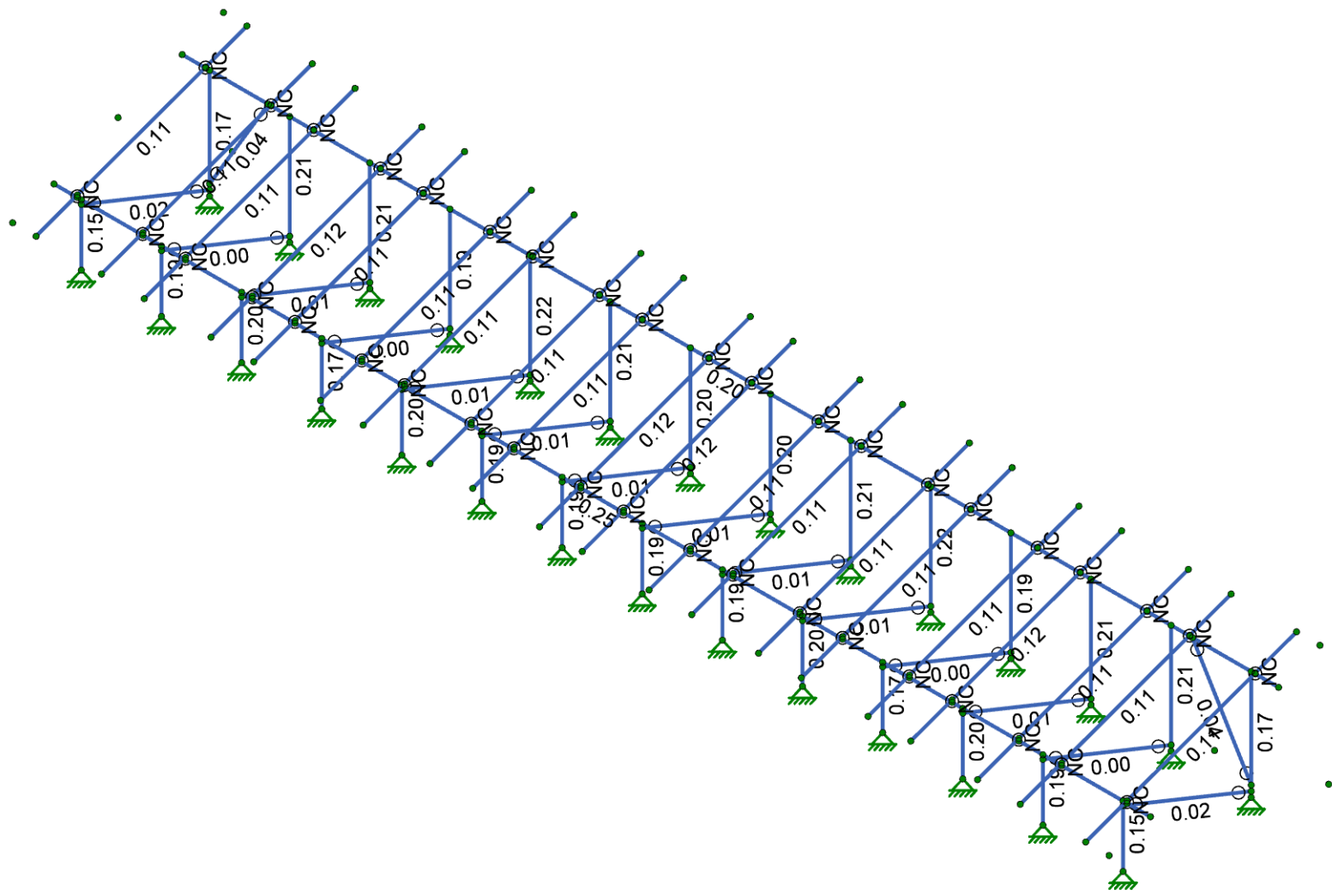
D5 Standard Panels - 20 Degree Tilt

SK-11
Mar 27, 2024
Sunturf D5 - SP - 20deg - double brace...



Shear Check (Env)

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



Member Shear Checks Displayed (Enveloped)

	Vector Structural Engineering	D5 Standard Panels - 20 Degree Tilt	SK-12
	CJT		Mar 27, 2024
	U2716.0387.241		Sunturf D5 - SP - 20deg - double brace....

**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 : U2716.0387.241  
Model Name : D5 Standard Panels - 20 Degree ...

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3:58:26 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>5</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>5</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
4	Double Brace	3x1.5x0.083	HBrace	Tube	A572 Gr.50	Typical	0.719	0.283	0.845	0.654

**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		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		90	

**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	-59.1	-59.1	-59.1	-59.1	Yes
2	N198	N201	N199	N196	Perp	A-B	-68.2	-68.2	-68.2	-68.2	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	-100.1	-100.1	-100.1	-100.1	Yes
2	N198	N201	N199	N196	Perp	A-B	-9.1	-9.1	-9.1	-9.1	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	77.3	77.3	77.3	77.3	Yes
2	N198	N201	N199	N196	Perp	A-B	72.8	72.8	72.8	72.8	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	31.8	31.8	31.8	31.8	Yes
2	N198	N201	N199	N196	Perp	A-B	95.5	95.5	95.5	95.5	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	53.53	53.53	53.53	53.53	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	N2	max	2.184	12	991.217	7	89.567	4	0	15	0	15	0	15
2		min	-2.899	6	-396.181	12	-111.677	6	0	2	0	2	0	2
3	N1	max	212.953	6	2351.045	6	1126.735	6	0	15	0	15	0	15
4		min	-223.149	13	-2299.393	13	-973.177	4	0	2	0	2	0	2
5	N151	max	223.15	13	2351.113	6	1126.697	6	0	15	0	15	0	15
6		min	-212.957	6	-2299.368	13	-973.146	4	0	2	0	2	0	2
7	N152	max	2.899	6	991.107	7	89.564	4	0	15	0	15	0	15
8		min	-2.185	12	-396.125	12	-111.674	6	0	2	0	2	0	2
9	N276	max	4.97	6	2306.352	6	1419.79	6	0	15	0	15	0	15
10		min	-5.458	13	-2195.646	13	-1224.104	4	0	2	0	2	0	2
11	N278	max	2.697	12	1406.451	7	99.852	4	0	15	0	15	0	15
12		min	-4.772	7	-616.584	12	-126.411	6	0	2	0	2	0	2
13	N227	max	15.963	6	2574.645	6	1424.064	6	0	15	0	15	0	15
14		min	-15.81	13	-2506.099	13	-1225.216	4	0	2	0	2	0	2
15	N229	max	39.504	7	1235.423	7	103.208	4	0	15	0	15	0	15
16		min	-23.866	12	-497.009	12	-129.868	6	0	2	0	2	0	2
17	N233	max	6.944	13	2371.919	6	1278.941	6	0	15	0	15	0	15
18		min	-6.712	6	-2281.86	13	-1106.011	4	0	2	0	2	0	2
19	N235	max	9.051	12	1257.393	7	97.386	4	0	15	0	15	0	15
20		min	-15.184	7	-562.972	12	-123.184	6	0	2	0	2	0	2
21	N239	max	10.942	13	2597.4	6	1447.174	6	0	15	0	15	0	15
22		min	-10.705	6	-2528.842	13	-1244.259	4	0	2	0	2	0	2
23	N241	max	16.4	12	1285.046	7	106.327	4	0	15	0	15	0	15
24		min	-25.751	7	-522.904	12	-133.835	6	0	2	0	2	0	2
25	N245	max	5.424	6	2550.378	6	1389.017	6	0	15	0	15	0	15
26		min	-5.398	13	-2477.538	13	-1197.362	4	0	2	0	2	0	2
27	N247	max	13.578	7	1322.864	7	103.917	4	0	15	0	15	0	15
28		min	-8.84	12	-567.316	12	-131.119	6	0	2	0	2	0	2
29	N251	max	13.425	6	2466.089	6	1356.308	6	0	15	0	15	0	15
30		min	-13.584	13	-2384.965	13	-1169.251	4	0	2	0	2	0	2
31	N253	max	29.667	7	1248.961	7	100.574	4	0	15	0	15	0	15
32		min	-17.708	12	-530.744	12	-126.992	6	0	2	0	2	0	2
33	N257	max	13.585	13	2466.043	6	1356.306	6	0	15	0	15	0	15
34		min	-13.425	6	-2384.917	13	-1169.249	4	0	2	0	2	0	2
35	N259	max	17.708	12	1248.967	7	100.574	4	0	15	0	15	0	15
36		min	-29.666	7	-530.748	12	-126.992	6	0	2	0	2	0	2
37	N263	max	5.396	13	2550.344	6	1389.014	6	0	15	0	15	0	15
38		min	-5.423	6	-2477.502	13	-1197.359	4	0	2	0	2	0	2
39	N265	max	8.84	12	1322.871	7	103.917	4	0	15	0	15	0	15
40		min	-13.578	7	-567.321	12	-131.119	6	0	2	0	2	0	2

**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	
41	N269	max	10.705	6	2597.403	6	1447.184	6	0	15	0	15	0	15
42		min	-10.941	13	-2528.845	13	-1244.267	4	0	2	0	2	0	2
43	N271	max	25.751	7	1285.041	7	106.328	4	0	15	0	15	0	15
44		min	-16.4	12	-522.9	12	-133.836	6	0	2	0	2	0	2
45	N275	max	6.714	6	2372.02	6	1278.964	6	0	15	0	15	0	15
46		min	-6.946	13	-2281.962	13	-1106.03	4	0	2	0	2	0	2
47	N283	max	15.184	7	1257.374	7	97.388	4	0	15	0	15	0	15
48		min	-9.051	12	-562.954	12	-123.186	6	0	2	0	2	0	2
49	N287	max	15.811	13	2574.69	6	1424.076	6	0	15	0	15	0	15
50		min	-15.964	6	-2506.15	13	-1225.226	4	0	2	0	2	0	2
51	N289	max	23.865	12	1235.416	7	103.209	4	0	15	0	15	0	15
52		min	-39.502	7	-497.002	12	-129.869	6	0	2	0	2	0	2
53	N293	max	5.457	13	2306.387	6	1419.793	6	0	15	0	15	0	15
54		min	-4.968	6	-2195.629	13	-1224.106	4	0	2	0	2	0	2
55	N295	max	4.769	7	1406.379	7	99.853	4	0	15	0	15	0	15
56		min	-2.695	12	-616.531	12	-126.412	6	0	2	0	2	0	2
57	Totals:	max	0.001	13	44872.527	6	17117.889	6						
58		min	0	6	-31768.174	12	-14877.099	4						

**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]	Mnny/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn	
1	M5	PIPE2.0A21165	0.329	42.814	6	0.154	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
2	M6	PIPE2.0A21165	0.432	3.402	6	0.172	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
3	M15	3x1.5x0.083	0.327	53.904	6	0.015	103.495	y	6	3972.751	21540.24	952.461	1737.715	1.136	H1-1a
4	M19	1.5X1.5X0.083	0.154	85.785	6	0.039	85.785	y	6	3226.56	14085.15	624.421	624.421	1.136	H1-1b*
5	M73	PIPE2.0A21165	0.329	42.814	6	0.154	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
6	M74	PIPE2.0A21165	0.432	3.402	6	0.172	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
7	M75	3x1.5x0.083	0.327	53.904	6	0.015	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
8	M75B	1.5X1.5X0.083	0.154	85.785	6	0.039	85.785	y	6	3226.56	14085.15	624.421	624.421	1.136	H1-1b*
9	M71	PIPE2.5A21168	0.409	230.906	13	0.196	675.615	13	20336.2	28358.413	2081.747	2081.747	1	H1-1b	
10	M72	PIPE2.5A21168	0.418	590.094	7	0.253	675.615	7	20336.2	28358.413	2081.747	2081.747	1	H1-1b	
11	M134	PIPE2.0A21165	0.478	3.402	6	0.212	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
12	M135	3x1.5x0.083	0.412	53.904	6	0.004	103.495	y	5	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
13	M136	PIPE2.0A21165	0.372	42.814	6	0.194	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
14	M106	PIPE2.0A21165	0.505	3.402	6	0.214	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
15	M109	3x1.5x0.083	0.414	53.904	6	0.01	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
16	M110	PIPE2.0A21165	0.387	42.814	6	0.196	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
17	M111	PIPE2.0A21165	0.459	3.402	6	0.192	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
18	M113	3x1.5x0.083	0.371	53.904	6	0.005	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
19	M114	PIPE2.0A21165	0.363	42.814	6	0.173	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
20	M115	PIPE2.0A21165	0.511	3.402	6	0.217	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
21	M116	3x1.5x0.083	0.42	53.904	6	0.01	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
22	M117	PIPE2.0A21165	0.393	42.814	6	0.2	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
23	M118	PIPE2.0A21165	0.496	3.402	6	0.209	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
24	M119	3x1.5x0.083	0.403	53.904	6	0.007	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
25	M120	PIPE2.0A21165	0.384	42.814	6	0.19	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
26	M121	PIPE2.0A21165	0.482	3.402	6	0.204	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
27	M122	3x1.5x0.083	0.394	53.904	6	0.008	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
28	M123	PIPE2.0A21165	0.376	42.814	6	0.186	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
29	M124	PIPE2.0A21165	0.482	3.402	6	0.204	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
30	M125	3x1.5x0.083	0.394	53.904	6	0.008	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
31	M126	PIPE2.0A21165	0.376	42.814	6	0.186	42.814	6	18329.391	23232.186	1397.505	1397.505	1	H1-1b	
32	M127	PIPE2.0A21165	0.496	3.402	6	0.209	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
33	M128	3x1.5x0.083	0.403	53.904	6	0.007	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
34	M129	PIPE2.0A21165	0.384	42.814	6	0.19	42.814	6	18329.391	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				
35	M130	PIPE2.0A21165	0.511	3.402	6		0.217	0	6	10891.619	23232.186	1397.505	1397.505	1	H1-1a	
36	M131	3x1.5x0.083	0.42	53.904	6		0.01	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
37	M132	PIPE2.0A21165	0.393	42.814	6		0.2	42.814		6	18329.391	23232.186	1397.505	1397.505	1	H1-1b
38	M133	PIPE2.0A21165	0.459	3.402	6		0.192	0		6	10891.619	23232.186	1397.505	1397.505	1	H1-1a
39	M137	3x1.5x0.083	0.371	53.904	6		0.005	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
40	M138	PIPE2.0A21165	0.363	42.814	6		0.173	42.814		6	18329.391	23232.186	1397.505	1397.505	1	H1-1b
41	M139	PIPE2.0A21165	0.505	3.402	6		0.214	0		6	10891.619	23232.186	1397.505	1397.505	1	H1-1a
42	M140	3x1.5x0.083	0.414	53.904	6		0.01	103.495	y	6	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
43	M141	PIPE2.0A21165	0.387	42.814	6		0.196	42.814		6	18329.391	23232.186	1397.505	1397.505	1	H1-1b
44	M142	PIPE2.0A21165	0.478	3.402	6		0.212	0		6	10891.619	23232.186	1397.505	1397.505	1	H1-1a
45	M143	3x1.5x0.083	0.412	53.904	6		0.004	103.495	y	5	3972.772	21540.24	952.461	1737.715	1.136	H1-1a
46	M144	PIPE2.0A21165	0.372	42.814	6		0.194	42.814		6	18329.391	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	M101	HR300/SMR300_ALA	0.981	134.75	13		0.115	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.914	H.1-1
2	M107	HR300/SMR300_ALA	0.961	134.75	13		0.106	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.857	H.1-1
3	M44	HR300/SMR300_ALA	0.984	84	6		0.116	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
4	M47	HR300/SMR300_ALA	0.969	84	6		0.11	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
5	M50	HR300/SMR300_ALA	0.969	84	6		0.111	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
6	M53	HR300/SMR300_ALA	0.974	84	6		0.115	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
7	M56	HR300/SMR300_ALA	0.975	84	6		0.11	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
8	M59	HR300/SMR300_ALA	0.977	84	6		0.11	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
9	M62	HR300/SMR300_ALA	0.98	84	6		0.116	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
10	M65	HR300/SMR300_ALA	0.968	84	6		0.109	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
11	M68	HR300/SMR300_ALA	0.968	84	6		0.109	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
12	M76	HR300/SMR300_ALA	0.98	84	6		0.116	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
13	M79	HR300/SMR300_ALA	0.977	84	6		0.11	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
14	M82	HR300/SMR300_ALA	0.975	84	6		0.11	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
15	M85	HR300/SMR300_ALA	0.974	84	6		0.115	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
16	M88	HR300/SMR300_ALA	0.969	84	6		0.111	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
17	M91	HR300/SMR300_ALA	0.969	84	6		0.11	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
18	M94	HR300/SMR300_ALA	0.984	84	6		0.116	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.397	H.1-1
19	M97	HR300/SMR300_ALA	0.961	134.75	13		0.106	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.857	H.1-1
20	M100	HR300/SMR300_ALA	0.981	134.75	13		0.115	33.25	y	7	3577.006	14342.564	533.921	934.619	7307.692	3206.154	1.914	H.1-1



JOB NO.: U2716.0387.241

PROJECT: SunTurf Package D5

SUBJECT: CALCULATIONS

DESIGN APPROACH ASD

CONNECTION CAPACITY

Location: Column Base (set screws)

Connection Type: M16 Conical Set Screws

Tensile Capacity: 2600 lbs

Tension Load: 2529 lbs

Check Connection: 97.3%

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: 2084 lbs

Check Connection: 94.9%

Result: **Select K10341-002**

Note: Uplift capacity. FOS of (2)



JOB NO.: U2716.0387.241

PROJECT: SunTurf Package D5

SUBJECT: CALCULATIONS

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**CONNECTION CAPACITY**

Location: Brace to Column

Connection Type: K10219-001

Capacity: 3161 lbs

Tension Load: 1629 lbs

Check Connection: 51.5%

Result: **Select K10219-001**

Note: Axial capacity. FOS of (2)

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**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: 1427 lbs

Check Bolt: 17.0%

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

Note:

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**JOB NO.:** U2716.0387.241  
**SUBJECT:** WIND PRESSURES  
**CONDITION:** 20° TILT

**PROJECT:** Sunturf Package D5 Ground Mount

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# ALTERNATE FOUNDATION OPTION 1: DRILLED CONCRETE PIER



PROJECT: Sunturf Package D5 Ground Mount

**DRILLED CONCRETE PIER DESIGN**

**Column Reactions:**

Max. Shear, V [k]:	1.5	Max. Down, P <sub>d</sub> [k]:	2.6
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P <sub>u</sub> [k]:	2.5

**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
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**Bearing capacity OK.**

**Check Uplift:**

Uplift Capacity [k]:	7.1
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**Uplift capacity OK.**

**Check Lateral Bearing:**

Top of Pier Constrained?:	No	IBC Section 1807.3.2.1
Applied Lateral Force, P [lb]:	1,500	
Point of Application, h [ft]:	0.0	
S <sub>max</sub> [psf]:		
S [psf]:	500	
A = 2.34*P/(S <sub>b</sub> ):	4.68	
Required Pier Depth, d <sub>reqd</sub> [ft]:	4.70	IBC Eq. 18-1

Result: **Lateral bearing capacity OK.**



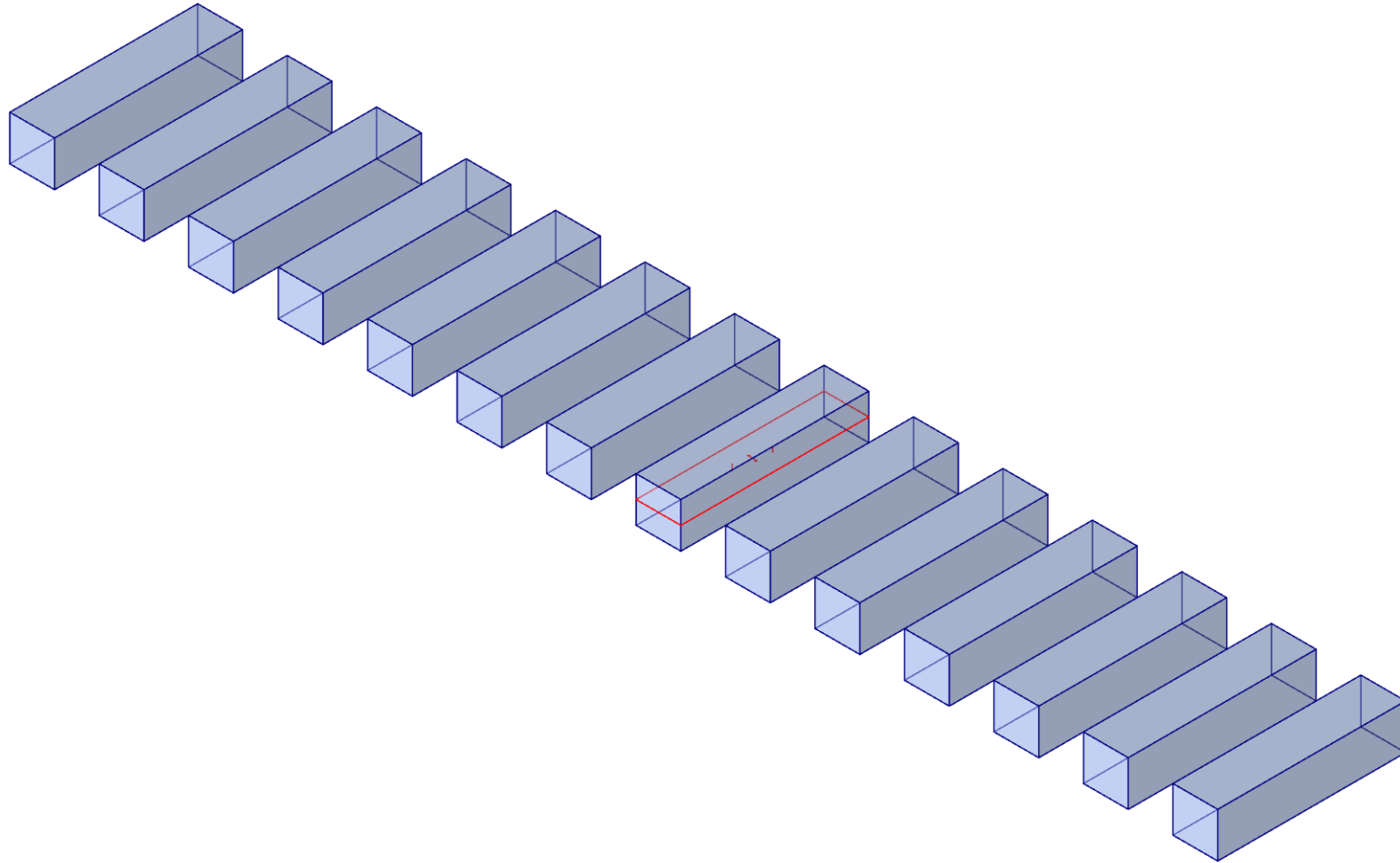
**JOB NO.:** U2716.0387.241  
**SUBJECT:** WIND PRESSURES  
**CONDITION:** 20° TILT

**PROJECT:** Sunturf Package D5 Ground Mount

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# ALTERNATE FOUNDATION OPTION 2: CONCRETE BALLAST BLOCK





Vector Structural Engineering  
CJT  
U2716.0387.241

Ground Mount

SK-1  
Mar 27, 2024 at 05:33 PM  
Sunturf D5 - SP - 20deg - double brace....

**Concrete Properties**

Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e <sup>5</sup> F <sup>-1</sup> ]	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 S1	30	Conc3000NW	0	0	0	0	0.25
2 S2	30	Conc3000NW	0	0	0	0	0.25
3 S3	30	Conc3000NW	0	0	0	0	0.25
4 S4	30	Conc3000NW	0	0	0	0	0.25
5 S5	30	Conc3000NW	0	0	0	0	0.25
6 S6	30	Conc3000NW	0	0	0	0	0.25
7 S7	30	Conc3000NW	0	0	0	0	0.25
8 S8	30	Conc3000NW	0	0	0	0	0.25
9 S9	30	Conc3000NW	0	0	0	0	0.25
10 S10	30	Conc3000NW	0	0	0	0	0.25
11 S11	30	Conc3000NW	0	0	0	0	0.25
12 S12	30	Conc3000NW	0	0	0	0	0.25
13 S13	30	Conc3000NW	0	0	0	0	0.25
14 S14	30	Conc3000NW	0	0	0	0	0.25

**Load Category**

Category	Node Loads
1 DL	40
2 WLZ	58
3 OL1	84
4 OL2	80
5 OL3	84
6 OL4	84

**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

**Load Combination (Continued)**

	Label	Solve	Service	SF	Category	Factor	Category	Factor	Category	Factor
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
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	Top Bars	Gov Design Cut	UC Top	UC Bot	LC Bot	Bot Bars	Gov Design Cut	UC Bot	UC Shear	LC Gov Design Cut	UC Shear
1	DS1	0.014	25	#5@5in	DS1-X25	0.017	28	#5@5in	DS1-X21	0.05	28	DS1-X10		
2	DS2	0.001	27	#5@5in	DS2-X25	0.002	25	#5@5in	DS2-X26	0.009	25	DS2-X50		

**Slab Soil Pressures**

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
1	2	S1	0.252	377.256	1500	N26
2	2	S2	0.25	375.558	1500	N32
3	2	S3	0.25	375.504	1500	N34
4	2	S4	0.25	375.007	1500	N38
5	2	S5	0.25	375.434	1500	N41
6	2	S6	0.25	375.398	1500	N45
7	2	S7	0.25	375.171	1500	N49
8	2	S8	0.25	375.171	1500	N53
9	2	S9	0.25	375.398	1500	N57
10	2	S10	0.25	375.435	1500	N62
11	2	S11	0.25	375.006	1500	N65
12	2	S12	0.25	375.504	1500	N70
13	2	S13	0.25	375.559	1500	N82

**Slab Soil Pressures (Continued)**

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
14	2	S14	0.252	377.256	1500	N84
15	3	S1	0.252	377.256	1500	N26
16	3	S2	0.25	375.558	1500	N32
17	3	S3	0.25	375.504	1500	N34
18	3	S4	0.25	375.007	1500	N38
19	3	S5	0.25	375.434	1500	N41
20	3	S6	0.25	375.398	1500	N45
21	3	S7	0.25	375.171	1500	N49
22	3	S8	0.25	375.171	1500	N53
23	3	S9	0.25	375.398	1500	N57
24	3	S10	0.25	375.435	1500	N62
25	3	S11	0.25	375.006	1500	N65
26	3	S12	0.25	375.504	1500	N70
27	3	S13	0.25	375.559	1500	N82
28	3	S14	0.252	377.256	1500	N84
29	4	S1	0.254	380.35	1500	N27
30	4	S2	0.236	353.345	1500	N404
31	4	S3	0.25	375.459	1500	N411
32	4	S4	0.241	362.24	1500	N418
33	4	S5	0.249	372.998	1500	N425
34	4	S6	0.244	366.633	1500	N432
35	4	S7	0.246	368.514	1500	N439
36	4	S8	0.246	368.514	1500	N446
37	4	S9	0.244	366.633	1500	N453
38	4	S10	0.249	372.999	1500	N460
39	4	S11	0.241	362.241	1500	N467
40	4	S12	0.25	375.462	1500	N474
41	4	S13	0.236	353.355	1500	N481
42	4	S14	0.254	380.361	1500	N87
43	5	S1	0.34	509.925	1500	N27
44	5	S2	0.343	515.067	1500	N32
45	5	S3	0.355	532.264	1500	N36
46	5	S4	0.339	508.252	1500	N40
47	5	S5	0.356	534.556	1500	N43
48	5	S6	0.351	526.59	1500	N47
49	5	S7	0.347	520.156	1500	N51
50	5	S8	0.347	520.156	1500	N55
51	5	S9	0.351	526.59	1500	N59
52	5	S10	0.356	534.557	1500	N64
53	5	S11	0.339	508.252	1500	N67
54	5	S12	0.355	532.268	1500	N72
55	5	S13	0.343	515.068	1500	N82
56	5	S14	0.34	509.921	1500	N87
57	6	S1	0.408	611.413	1500	N26
58	6	S2	0.394	590.753	1500	N30
59	6	S3	0.42	629.824	1500	N34
60	6	S4	0.402	603.152	1500	N38
61	6	S5	0.421	631.012	1500	N41
62	6	S6	0.416	623.539	1500	N45
63	6	S7	0.41	615.478	1500	N49
64	6	S8	0.41	615.477	1500	N53
65	6	S9	0.416	623.538	1500	N57
66	6	S10	0.421	631.016	1500	N62
67	6	S11	0.402	603.15	1500	N65
68	6	S12	0.42	629.828	1500	N70

**Slab Soil Pressures (Continued)**

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
69	6	S13	0.394	590.761	1500	N81
70	6	S14	0.408	611.426	1500	N84
71	7	S1	0.318	477.498	1500	N26
72	7	S2	0.324	485.394	1500	N32
73	7	S3	0.322	482.713	1500	N34
74	7	S4	0.313	469.581	1500	N38
75	7	S5	0.321	482.055	1500	N41
76	7	S6	0.318	477.658	1500	N45
77	7	S7	0.317	475.55	1500	N49
78	7	S8	0.317	475.55	1500	N53
79	7	S9	0.318	477.658	1500	N57
80	7	S10	0.321	482.058	1500	N62
81	7	S11	0.313	469.58	1500	N65
82	7	S12	0.322	482.716	1500	N70
83	7	S13	0.324	485.381	1500	N82
84	7	S14	0.318	477.519	1500	N84
85	8	S1	0.252	377.847	1500	N27
86	8	S2	0.239	358.898	1500	N404
87	8	S3	0.25	375.008	1500	N411
88	8	S4	0.243	365.049	1500	N418
89	8	S5	0.249	373.265	1500	N425
90	8	S6	0.246	368.516	1500	N432
91	8	S7	0.247	369.789	1500	N439
92	8	S8	0.247	369.789	1500	N446
93	8	S9	0.246	368.516	1500	N453
94	8	S10	0.249	373.266	1500	N460
95	8	S11	0.243	365.049	1500	N467
96	8	S12	0.25	375.01	1500	N474
97	8	S13	0.239	358.906	1500	N481
98	8	S14	0.252	377.856	1500	N87
99	9	S1	0.317	475.028	1500	N27
100	9	S2	0.32	480.19	1500	N32
101	9	S3	0.328	492.612	1500	N36
102	9	S4	0.316	474.557	1500	N40
103	9	S5	0.33	494.434	1500	N43
104	9	S6	0.326	488.483	1500	N47
105	9	S7	0.322	483.521	1500	N51
106	9	S8	0.322	483.521	1500	N55
107	9	S9	0.326	488.484	1500	N59
108	9	S10	0.33	494.435	1500	N64
109	9	S11	0.316	474.558	1500	N67
110	9	S12	0.328	492.615	1500	N72
111	9	S13	0.32	480.191	1500	N82
112	9	S14	0.317	475.025	1500	N87
113	10	S1	0.369	552.873	1500	N26
114	10	S2	0.358	536.338	1500	N30
115	10	S3	0.377	566.244	1500	N34
116	10	S4	0.364	546.115	1500	N38
117	10	S5	0.378	567.117	1500	N41
118	10	S6	0.374	561.504	1500	N45
119	10	S7	0.37	555.401	1500	N49
120	10	S8	0.37	555.4	1500	N53
121	10	S9	0.374	561.503	1500	N57
122	10	S10	0.378	567.121	1500	N62
123	10	S11	0.364	546.114	1500	N65

**Slab Soil Pressures (Continued)**

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
124	10	S12	0.377	566.247	1500	N70
125	10	S13	0.358	536.344	1500	N81
126	10	S14	0.369	552.883	1500	N84
127	11	S1	0.302	452.438	1500	N26
128	11	S2	0.305	457.935	1500	N32
129	11	S3	0.304	455.911	1500	N34
130	11	S4	0.297	445.937	1500	N38
131	11	S5	0.304	455.4	1500	N41
132	11	S6	0.301	452.093	1500	N45
133	11	S7	0.3	450.455	1500	N49
134	11	S8	0.3	450.455	1500	N53
135	11	S9	0.301	452.093	1500	N57
136	11	S10	0.304	455.402	1500	N62
137	11	S11	0.297	445.937	1500	N65
138	11	S12	0.304	455.913	1500	N70
139	11	S13	0.305	457.925	1500	N82
140	11	S14	0.302	452.454	1500	N84
141	12	S1	0.155	232.214	1500	N397
142	12	S2	0.135	203.122	1500	N404
143	12	S3	0.151	225.997	1500	N411
144	12	S4	0.142	212.851	1500	N418
145	12	S5	0.149	223.37	1500	N425
146	12	S6	0.145	216.967	1500	N432
147	12	S7	0.146	219.068	1500	N439
148	12	S8	0.146	219.068	1500	N446
149	12	S9	0.145	216.967	1500	N453
150	12	S10	0.149	223.372	1500	N460
151	12	S11	0.142	212.852	1500	N467
152	12	S12	0.151	226	1500	N474
153	12	S13	0.135	203.132	1500	N481
154	12	S14	0.155	232.226	1500	N488
155	13	S1	0.258	387.619	1500	N27
156	13	S2	0.255	381.925	1500	N32
157	13	S3	0.294	441.39	1500	N35
158	13	S4	0.255	382.961	1500	N40
159	13	S5	0.299	448.041	1500	N44
160	13	S6	0.286	429.215	1500	N47
161	13	S7	0.271	406.595	1500	N51
162	13	S8	0.271	406.594	1500	N55
163	13	S9	0.286	429.215	1500	N59
164	13	S10	0.299	448.05	1500	N63
165	13	S11	0.255	382.958	1500	N67
166	13	S12	0.294	441.4	1500	N72
167	13	S13	0.255	381.925	1500	N83
168	13	S14	0.258	387.612	1500	N87
169	14	S1	0.307	460.51	1500	N26
170	14	S2	0.294	441.516	1500	N30
171	14	S3	0.32	479.622	1500	N34
172	14	S4	0.302	453.149	1500	N38
173	14	S5	0.321	480.838	1500	N41
174	14	S6	0.316	473.38	1500	N45
175	14	S7	0.31	465.409	1500	N49
176	14	S8	0.31	465.408	1500	N53
177	14	S9	0.316	473.379	1500	N58
178	14	S10	0.321	480.842	1500	N62

**Slab Soil Pressures (Continued)**

	LC	Label	UC	Soil Pressure[psf]	Allowable Bearing[psf]	Node
179	14	S11	0.302	453.147	1500	N65
180	14	S12	0.32	479.627	1500	N70
181	14	S13	0.294	441.524	1500	N81
182	14	S14	0.307	460.523	1500	N84
183	15	S1	0.218	326.596	1500	N26
184	15	S2	0.223	335.171	1500	N32
185	15	S3	0.222	332.512	1500	N34
186	15	S4	0.213	319.578	1500	N38
187	15	S5	0.221	331.881	1500	N41
188	15	S6	0.218	327.499	1500	N45
189	15	S7	0.217	325.482	1500	N49
190	15	S8	0.217	325.481	1500	N53
191	15	S9	0.218	327.499	1500	N57
192	15	S10	0.221	331.884	1500	N62
193	15	S11	0.213	319.578	1500	N65
194	15	S12	0.222	332.514	1500	N70
195	15	S13	0.223	335.157	1500	N82
196	15	S14	0.218	326.617	1500	N84

**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	S1	0	0	51339.668	0	12303.417	9.99+	9.99+
2	2	S2	0	0	51631.674	0	12279.501	9.99+	9.99+
3	2	S3	0	0	51565.366	0	12296.756	9.99+	9.99+
4	2	S4	0	0	51526.296	0	12274.217	9.99+	9.99+
5	2	S5	0	0	51600.124	0	12289.296	9.99+	9.99+
6	2	S6	0	0	51607.344	0	12294.344	9.99+	9.99+
7	2	S7	0	0	51546.727	0	12286.621	9.99+	9.99+
8	2	S8	0	0	51546.729	0	12276.801	9.99+	9.99+
9	2	S9	0	0	51607.347	0	12294.343	9.99+	9.99+
10	2	S10	0	0	51600.126	0	12297.438	9.99+	9.99+
11	2	S11	0	0	51526.296	0	12279.218	9.99+	9.99+
12	2	S12	0	0	51565.362	0	12278.802	9.99+	9.99+
13	2	S13	0	0	51631.719	0	12279.505	9.99+	9.99+
14	2	S14	0	0	51339.615	0	12221.207	9.99+	9.99+
15	3	S1	0	0	51339.668	0	12303.417	9.99+	9.99+
16	3	S2	0	0	51631.674	0	12279.501	9.99+	9.99+
17	3	S3	0	0	51565.366	0	12296.756	9.99+	9.99+
18	3	S4	0	0	51526.296	0	12274.217	9.99+	9.99+
19	3	S5	0	0	51600.124	0	12289.296	9.99+	9.99+
20	3	S6	0	0	51607.344	0	12294.344	9.99+	9.99+
21	3	S7	0	0	51546.727	0	12286.621	9.99+	9.99+
22	3	S8	0	0	51546.729	0	12276.801	9.99+	9.99+
23	3	S9	0	0	51607.347	0	12294.343	9.99+	9.99+
24	3	S10	0	0	51600.126	0	12297.438	9.99+	9.99+
25	3	S11	0	0	51526.296	0	12279.218	9.99+	9.99+
26	3	S12	0	0	51565.362	0	12278.802	9.99+	9.99+
27	3	S13	0	0	51631.719	0	12279.505	9.99+	9.99+
28	3	S14	0	0	51339.615	0	12221.207	9.99+	9.99+
29	4	S1	0	17880.528	51663.773	3137.772	12303.417	2.889	3.921
30	4	S2	0	18593.454	51516.135	3061.567	12279.501	2.771	4.011
31	4	S3	0	20175.974	51651.983	3237.97	12296.756	2.56	3.798
32	4	S4	0	18646.144	51598.141	3061.596	12279.22	2.767	4.011
33	4	S5	0	20410.805	51664.147	3266.398	12297.435	2.531	3.765
34	4	S6	0	20059.51	51665.143	3244.628	12294.344	2.576	3.789

**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
35	4	S7	0	19368.771	51619.649	3151.563	12286.621	2.665	3.899
36	4	S8	0	19368.726	51619.64	3151.553	12286.62	2.665	3.899
37	4	S9	0	20059.49	51665.134	3244.617	12294.343	2.576	3.789
38	4	S10	0	20411.04	51664.17	3266.433	12297.438	2.531	3.765
39	4	S11	0	18646.039	51598.123	3061.566	12279.218	2.767	4.011
40	4	S12	0	20176.206	51651.978	3237.964	12296.755	2.56	3.798
41	4	S13	0	18593.813	51516.119	3061.546	12279.505	2.771	4.011
42	4	S14	0	17881.098	51663.781	3137.777	12303.411	2.889	3.921
43	5	S1	0	22682.456	51663.773	3146.221	12303.417	2.278	3.911
44	5	S2	0	22003.336	51516.135	2402.798	12279.501	2.341	5.111
45	5	S3	0	24874.705	51651.983	2768.013	12296.756	2.076	4.442
46	5	S4	0	22713.952	51598.141	2617.522	12279.22	2.272	4.691
47	5	S5	0	25105.278	51664.147	2777.961	12297.435	2.058	4.427
48	5	S6	0	24600.004	51665.143	2763.895	12294.344	2.1	4.448
49	5	S7	0	23714.801	51619.649	2682.761	12286.621	2.177	4.58
50	5	S8	0	23714.707	51619.64	2682.742	12286.62	2.177	4.58
51	5	S9	0	24599.927	51665.134	2763.874	12294.343	2.1	4.448
52	5	S10	0	25105.644	51664.17	2778.015	12297.438	2.058	4.427
53	5	S11	0	22713.733	51598.123	2617.471	12279.218	2.272	4.691
54	5	S12	0	24874.966	51651.978	2768.004	12296.755	2.076	4.442
55	5	S13	0	22003.255	51516.119	2402.774	12279.505	2.341	5.111
56	5	S14	0	22682.247	51663.781	3146.21	12303.411	2.278	3.911
57	6	S1	0	0	56765.886	0	16073.248	9.99+	9.99+
58	6	S2	0	0	58775.002	0	15854.964	9.99+	9.99+
59	6	S3	0	0	57781.49	0	16113.187	9.99+	9.99+
60	6	S4	0	0	58466.363	0	15799.249	9.99+	9.99+
61	6	S5	0	0	58078.511	0	15992.949	9.99+	9.99+
62	6	S6	0	0	58609.42	0	16117.109	9.99+	9.99+
63	6	S7	0	0	58113.299	0	15999.613	9.99+	9.99+
64	6	S8	0	0	58113.253	0	15825.405	9.99+	9.99+
65	6	S9	0	0	58609.347	0	16041.525	9.99+	9.99+
66	6	S10	0	0	58078.551	0	16145.206	9.99+	9.99+
67	6	S11	0	0	58466.203	0	15887.831	9.99+	9.99+
68	6	S12	0	0	57781.168	0	15884.309	9.99+	9.99+
69	6	S13	0	0	58774.449	0	15846.879	9.99+	9.99+
70	6	S14	0	0	56765.274	0	15032.627	9.99+	9.99+
71	7	S1	0	0	59752.576	0	15189.985	9.99+	9.99+
72	7	S2	0	0	63190.876	0	15464.553	9.99+	9.99+
73	7	S3	0	0	61850.195	0	15540.015	9.99+	9.99+
74	7	S4	0	0	61971.442	0	15250.476	9.99+	9.99+
75	7	S5	0	0	62306.899	0	15419.093	9.99+	9.99+
76	7	S6	0	0	62649.589	0	15549.691	9.99+	9.99+
77	7	S7	0	0	61926.306	0	15449.048	9.99+	9.99+
78	7	S8	0	0	61926.294	0	15263.167	9.99+	9.99+
79	7	S9	0	0	62649.56	0	15471.521	9.99+	9.99+
80	7	S10	0	0	62306.903	0	15577.124	9.99+	9.99+
81	7	S11	0	0	61971.342	0	15345.419	9.99+	9.99+
82	7	S12	0	0	61849.991	0	15292.466	9.99+	9.99+
83	7	S13	0	0	63190.17	0	15477.159	9.99+	9.99+
84	7	S14	0	0	59751.613	0	14628.691	9.99+	9.99+
85	8	S1	0	13410.396	51663.773	2353.329	12303.417	3.853	5.228
86	8	S2	0	13945.09	51516.135	2296.175	12279.501	3.694	5.348
87	8	S3	0	15131.981	51651.983	2428.478	12296.756	3.413	5.064
88	8	S4	0	13984.608	51598.141	2296.197	12279.22	3.69	5.348
89	8	S5	0	15308.103	51664.147	2449.799	12297.435	3.375	5.02



**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
90	8	S6	0	15044.632	51665.143	2433.471	12294.344	3.434	5.052
91	8	S7	0	14526.578	51619.649	2363.672	12286.621	3.553	5.198
92	8	S8	0	14526.545	51619.64	2363.664	12286.62	3.553	5.198
93	8	S9	0	15044.617	51665.134	2433.463	12294.343	3.434	5.052
94	8	S10	0	15308.28	51664.17	2449.825	12297.438	3.375	5.02
95	8	S11	0	13984.529	51598.123	2296.174	12279.218	3.69	5.348
96	8	S12	0	15132.154	51651.978	2428.473	12296.755	3.413	5.064
97	8	S13	0	13945.36	51516.119	2296.159	12279.505	3.694	5.348
98	8	S14	0	13410.823	51663.781	2353.332	12303.411	3.852	5.228
99	9	S1	0	17011.842	51663.773	2359.666	12303.417	3.037	5.214
100	9	S2	0	16502.502	51516.135	1802.098	12279.501	3.122	6.814
101	9	S3	0	18656.029	51651.983	2076.01	12296.756	2.769	5.923
102	9	S4	0	17035.464	51598.141	1963.142	12279.22	3.029	6.255
103	9	S5	0	18828.959	51664.147	2083.47	12297.435	2.744	5.902
104	9	S6	0	18450.003	51665.143	2072.921	12294.344	2.8	5.931
105	9	S7	0	17786.101	51619.649	2012.071	12286.621	2.902	6.106
106	9	S8	0	17786.03	51619.64	2012.057	12286.62	2.902	6.106
107	9	S9	0	18449.946	51665.134	2072.906	12294.343	2.8	5.931
108	9	S10	0	18829.233	51664.17	2083.511	12297.438	2.744	5.902
109	9	S11	0	17035.3	51598.123	1963.103	12279.218	3.029	6.255
110	9	S12	0	18656.224	51651.978	2076.003	12296.755	2.769	5.923
111	9	S13	0	16502.441	51516.119	1802.081	12279.505	3.122	6.814
112	9	S14	0	17011.685	51663.781	2359.658	12303.411	3.037	5.214
113	10	S1	0	0	55409.331	0	15130.791	9.99+	9.99+
114	10	S2	0	0	56989.17	0	14961.098	9.99+	9.99+
115	10	S3	0	0	56227.459	0	15159.079	9.99+	9.99+
116	10	S4	0	0	56731.346	0	14917.991	9.99+	9.99+
117	10	S5	0	0	56458.915	0	15067.036	9.99+	9.99+
118	10	S6	0	0	56858.901	0	15161.417	9.99+	9.99+
119	10	S7	0	0	56471.656	0	15071.365	9.99+	9.99+
120	10	S8	0	0	56471.622	0	14938.254	9.99+	9.99+
121	10	S9	0	0	56858.847	0	15104.729	9.99+	9.99+
122	10	S10	0	0	56458.945	0	15183.264	9.99+	9.99+
123	10	S11	0	0	56731.226	0	14985.678	9.99+	9.99+
124	10	S12	0	0	56227.217	0	14982.932	9.99+	9.99+
125	10	S13	0	0	56988.767	0	14955.035	9.99+	9.99+
126	10	S14	0	0	55408.859	0	14329.772	9.99+	9.99+
127	11	S1	0	0	57649.349	0	14468.343	9.99+	9.99+
128	11	S2	0	0	60301.075	0	14668.29	9.99+	9.99+
129	11	S3	0	0	59278.987	0	14729.201	9.99+	9.99+
130	11	S4	0	0	59360.156	0	14506.411	9.99+	9.99+
131	11	S5	0	0	59630.205	0	14636.644	9.99+	9.99+
132	11	S6	0	0	59889.028	0	14735.854	9.99+	9.99+
133	11	S7	0	0	59331.411	0	14658.441	9.99+	9.99+
134	11	S8	0	0	59331.402	0	14516.575	9.99+	9.99+
135	11	S9	0	0	59889.007	0	14677.226	9.99+	9.99+
136	11	S10	0	0	59630.209	0	14757.202	9.99+	9.99+
137	11	S11	0	0	59360.08	0	14578.869	9.99+	9.99+
138	11	S12	0	0	59278.834	0	14539.05	9.99+	9.99+
139	11	S13	0	0	60300.557	0	14677.746	9.99+	9.99+
140	11	S14	0	0	57648.614	0	14026.82	9.99+	9.99+
141	12	S1	0	17880.528	30998.264	3137.772	7382.05	1.734	2.353
142	12	S2	0	18593.454	30909.681	3061.567	7367.701	1.662	2.407
143	12	S3	0	20175.974	30991.19	3237.97	7378.054	1.536	2.279
144	12	S4	0	18646.144	30958.885	3061.596	7367.532	1.66	2.406

**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
145	12	S5	0	20410.805	30998.488	3266.398	7378.461	1.519	2.259
146	12	S6	0	20059.51	30999.086	3244.628	7376.606	1.545	2.273
147	12	S7	0	19368.771	30971.789	3151.563	7371.973	1.599	2.339
148	12	S8	0	19368.726	30971.784	3151.553	7371.972	1.599	2.339
149	12	S9	0	20059.49	30999.081	3244.617	7376.606	1.545	2.273
150	12	S10	0	20411.04	30998.502	3266.433	7378.463	1.519	2.259
151	12	S11	0	18646.039	30958.874	3061.566	7367.531	1.66	2.406
152	12	S12	0	20176.206	30991.187	3237.964	7378.053	1.536	2.279
153	12	S13	0	18593.813	30909.671	3061.546	7367.703	1.662	2.407
154	12	S14	0	17881.098	30998.269	3137.777	7382.047	1.734	2.353
155	13	S1	0	22682.456	30998.264	3146.221	7382.05	1.367	2.346
156	13	S2	0	22003.336	30909.681	2402.798	7367.701	1.405	3.066
157	13	S3	0	24874.705	30991.19	2768.013	7378.054	1.246	2.665
158	13	S4	0	22713.952	30958.885	2617.522	7367.532	1.363	2.815
159	13	S5	0	25105.278	30998.488	2777.961	7378.461	1.235	2.656
160	13	S6	0	24600.004	30999.086	2763.895	7376.606	1.26	2.669
161	13	S7	0	23714.801	30971.789	2682.761	7371.973	1.306	2.748
162	13	S8	0	23714.707	30971.784	2682.742	7371.972	1.306	2.748
163	13	S9	0	24599.927	30999.081	2763.874	7376.606	1.26	2.669
164	13	S10	0	25105.644	30998.502	2778.015	7378.463	1.235	2.656
165	13	S11	0	22713.733	30958.874	2617.471	7367.531	1.363	2.815
166	13	S12	0	24874.966	30991.187	2768.004	7378.053	1.246	2.665
167	13	S13	0	22003.255	30909.671	2402.774	7367.703	1.405	3.066
168	13	S14	0	22682.247	30998.269	3146.21	7382.047	1.367	2.346
169	14	S1	0	0	36230.019	0	11151.882	9.99+	9.99+
170	14	S2	0	0	38122.332	0	10943.163	9.99+	9.99+
171	14	S3	0	0	37155.344	0	11194.484	9.99+	9.99+
172	14	S4	0	0	37855.845	0	10889.562	9.99+	9.99+
173	14	S5	0	0	37438.462	0	11077.23	9.99+	9.99+
174	14	S6	0	0	37966.482	0	11199.371	9.99+	9.99+
175	14	S7	0	0	37494.608	0	11084.965	9.99+	9.99+
176	14	S8	0	0	37494.561	0	10914.684	9.99+	9.99+
177	14	S9	0	0	37966.409	0	11123.788	9.99+	9.99+
178	14	S10	0	0	37438.501	0	11226.231	9.99+	9.99+
179	14	S11	0	0	37855.684	0	10976.144	9.99+	9.99+
180	14	S12	0	0	37155.023	0	10972.788	9.99+	9.99+
181	14	S13	0	0	38121.762	0	10935.077	9.99+	9.99+
182	14	S14	0	0	36229.428	0	10144.144	9.99+	9.99+
183	15	S1	0	0	39216.709	0	10268.618	9.99+	9.99+
184	15	S2	0	0	42538.206	0	10552.753	9.99+	9.99+
185	15	S3	0	0	41224.048	0	10621.313	9.99+	9.99+
186	15	S4	0	0	41360.924	0	10340.789	9.99+	9.99+
187	15	S5	0	0	41666.849	0	10503.374	9.99+	9.99+
188	15	S6	0	0	42006.652	0	10631.954	9.99+	9.99+
189	15	S7	0	0	41307.615	0	10534.399	9.99+	9.99+
190	15	S8	0	0	41307.602	0	10352.446	9.99+	9.99+
191	15	S9	0	0	42006.622	0	10553.783	9.99+	9.99+
192	15	S10	0	0	41666.853	0	10658.149	9.99+	9.99+
193	15	S11	0	0	41360.823	0	10433.731	9.99+	9.99+
194	15	S12	0	0	41223.846	0	10380.945	9.99+	9.99+
195	15	S13	0	0	42537.483	0	10565.357	9.99+	9.99+
196	15	S14	0	0	39215.767	0	9740.208	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	S1	0	16.441	2942.955	0	2942.955	9.99+	9.99+
2	2	S2	0	0	2947.08	0	2947.08	9.99+	9.99+
3	2	S3	0	3.591	2949.067	0	2949.067	9.99+	9.99+
4	2	S4	0	1.001	2946.413	0	2946.413	9.99+	9.99+
5	2	S5	0	1.628	2950.408	0	2950.408	9.99+	9.99+
6	2	S6	0	0	2950.642	0	2950.642	9.99+	9.99+
7	2	S7	0	1.964	2947.611	0	2947.611	9.99+	9.99+
8	2	S8	0	1.964	2947.611	0	2947.611	9.99+	9.99+
9	2	S9	0	0	2950.642	0	2950.642	9.99+	9.99+
10	2	S10	0	1.628	2950.408	0	2950.408	9.99+	9.99+
11	2	S11	0	1.001	2946.412	0	2946.412	9.99+	9.99+
12	2	S12	0	3.591	2949.067	0	2949.067	9.99+	9.99+
13	2	S13	0	0	2947.081	0	2947.081	9.99+	9.99+
14	2	S14	0	16.441	2942.954	0	2942.954	9.99+	9.99+
15	3	S1	0	16.441	2942.955	0	2942.955	9.99+	9.99+
16	3	S2	0	0	2947.08	0	2947.08	9.99+	9.99+
17	3	S3	0	3.591	2949.067	0	2949.067	9.99+	9.99+
18	3	S4	0	1.001	2946.413	0	2946.413	9.99+	9.99+
19	3	S5	0	1.628	2950.408	0	2950.408	9.99+	9.99+
20	3	S6	0	0	2950.642	0	2950.642	9.99+	9.99+
21	3	S7	0	1.964	2947.611	0	2947.611	9.99+	9.99+
22	3	S8	0	1.964	2947.611	0	2947.611	9.99+	9.99+
23	3	S9	0	0	2950.642	0	2950.642	9.99+	9.99+
24	3	S10	0	1.628	2950.408	0	2950.408	9.99+	9.99+
25	3	S11	0	1.001	2946.412	0	2946.412	9.99+	9.99+
26	3	S12	0	3.591	2949.067	0	2949.067	9.99+	9.99+
27	3	S13	0	0	2947.081	0	2947.081	9.99+	9.99+
28	3	S14	0	16.441	2942.954	0	2942.954	9.99+	9.99+
29	4	S1	0	133.355	2279.768	731.384	2279.768	9.99+	3.117
30	4	S2	0	0.622	2212.678	951.183	2212.678	9.99+	2.326
31	4	S3	0	34.126	2194.584	945.327	2194.584	9.99+	2.322
32	4	S4	0	13.912	2220.577	846.974	2220.577	9.99+	2.622
33	4	S5	0	23.869	2181.77	960.079	2181.77	9.99+	2.272
34	4	S6	0	13.357	2179.946	921.317	2179.946	9.99+	2.366
35	4	S7	0	27.32	2208.806	899.212	2208.806	9.99+	2.456
36	4	S8	0	27.32	2208.808	899.217	2208.808	9.99+	2.456
37	4	S9	0	13.357	2179.948	921.324	2179.948	9.99+	2.366
38	4	S10	0	23.87	2181.763	960.078	2181.763	9.99+	2.272
39	4	S11	0	13.911	2220.583	846.986	2220.583	9.99+	2.622
40	4	S12	0	34.125	2194.585	945.359	2194.585	9.99+	2.321
41	4	S13	0	0.623	2212.684	951.196	2212.684	9.99+	2.326
42	4	S14	0	133.356	2279.766	731.373	2279.766	9.99+	3.117
43	5	S1	0	209.74	2323.571	635.302	2323.571	9.99+	3.657
44	5	S2	0	6.23	2374.147	801.684	2374.147	9.99+	2.961
45	5	S3	0	13.92	2295.25	832.056	2295.25	9.99+	2.759
46	5	S4	0	6.058	2322.442	694.899	2322.442	9.99+	3.342
47	5	S5	0	12.142	2291.959	845.526	2291.959	9.99+	2.711
48	5	S6	0	7.338	2291.71	789.982	2291.71	9.99+	2.901
49	5	S7	0	12.012	2312.134	766.641	2312.134	9.99+	3.016
50	5	S8	0	12.012	2312.138	766.647	2312.138	9.99+	3.016
51	5	S9	0	7.338	2291.715	789.99	2291.715	9.99+	2.901
52	5	S10	0	12.143	2291.947	845.524	2291.947	9.99+	2.711
53	5	S11	0	6.055	2322.453	694.912	2322.453	9.99+	3.342
54	5	S12	0	13.919	2295.252	832.09	2295.252	9.99+	2.758
55	5	S13	0	6.23	2374.153	801.697	2374.153	9.99+	2.961

**Slab Stability - Sliding (Continued)**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
56	5	S14	0	209.738	2323.571	635.291	2323.571	9.99+	3.657
57	6	S1	0	208.123	3732.706	863.597	3732.706	9.99+	4.322
58	6	S2	0	1.612	3804.224	1119.347	3804.224	9.99+	3.399
59	6	S3	0	45.775	3839.7	1117.898	3839.7	9.99+	3.435
60	6	S4	0	17.725	3802.455	993.792	3802.455	9.99+	3.826
61	6	S5	0	30.442	3856.573	1135.418	3856.573	9.99+	3.397
62	6	S6	0	15.114	3859.037	1086.277	3859.037	9.99+	3.553
63	6	S7	0	34.839	3819.004	1059.537	3819.004	9.99+	3.604
64	6	S8	0	34.839	3819	1059.544	3819	9.99+	3.604
65	6	S9	0	15.114	3859.034	1086.285	3859.034	9.99+	3.553
66	6	S10	0	30.444	3856.583	1135.416	3856.583	9.99+	3.397
67	6	S11	0	17.723	3802.445	993.807	3802.445	9.99+	3.826
68	6	S12	0	45.774	3839.698	1117.936	3839.698	9.99+	3.435
69	6	S13	0	1.612	3804.218	1119.362	3804.218	9.99+	3.399
70	6	S14	0	208.124	3732.705	863.584	3732.705	9.99+	4.322
71	7	S1	0	112.257	3578.242	727.014	3578.242	9.99+	4.922
72	7	S2	0	2.525	3713.008	959.062	3713.008	9.99+	3.872
73	7	S3	0	49.51	3699.897	933.645	3699.897	9.99+	3.963
74	7	S4	0	18.992	3671.51	864.463	3671.51	9.99+	4.247
75	7	S5	0	31.601	3719.543	947.947	3719.543	9.99+	3.924
76	7	S6	0	15.634	3722.546	921.504	3722.546	9.99+	4.04
77	7	S7	0	37.176	3685.466	901.818	3685.466	9.99+	4.087
78	7	S8	0	37.175	3685.465	901.823	3685.465	9.99+	4.087
79	7	S9	0	15.633	3722.545	921.51	3722.545	9.99+	4.04
80	7	S10	0	31.603	3719.548	947.946	3719.548	9.99+	3.924
81	7	S11	0	18.992	3671.505	864.474	3671.505	9.99+	4.247
82	7	S12	0	49.509	3699.897	933.674	3699.897	9.99+	3.963
83	7	S13	0	2.524	3713.004	959.073	3713.004	9.99+	3.871
84	7	S14	0	112.26	3578.242	727.004	3578.242	9.99+	4.922
85	8	S1	0	95.906	2445.565	548.538	2445.565	9.99+	4.458
86	8	S2	0	0.467	2396.278	713.388	2396.278	9.99+	3.359
87	8	S3	0	24.697	2383.205	708.995	2383.205	9.99+	3.361
88	8	S4	0	10.184	2402.036	635.23	2402.036	9.99+	3.781
89	8	S5	0	17.495	2373.93	720.059	2373.93	9.99+	3.297
90	8	S6	0	10.018	2372.62	690.988	2372.62	9.99+	3.434
91	8	S7	0	19.999	2393.507	674.409	2393.507	9.99+	3.549
92	8	S8	0	19.999	2393.509	674.413	2393.509	9.99+	3.549
93	8	S9	0	10.017	2372.622	690.993	2372.622	9.99+	3.434
94	8	S10	0	17.496	2373.925	720.059	2373.925	9.99+	3.297
95	8	S11	0	10.183	2402.04	635.24	2402.04	9.99+	3.781
96	8	S12	0	24.696	2383.205	709.019	2383.205	9.99+	3.361
97	8	S13	0	0.467	2396.283	713.397	2396.283	9.99+	3.359
98	8	S14	0	95.907	2445.563	548.53	2445.563	9.99+	4.458
99	9	S1	0	153.195	2478.417	476.476	2478.417	9.99+	5.202
100	9	S2	0	4.672	2517.38	601.263	2517.38	9.99+	4.187
101	9	S3	0	9.542	2458.705	624.042	2458.705	9.99+	3.94
102	9	S4	0	4.293	2478.435	521.174	2478.435	9.99+	4.755
103	9	S5	0	8.699	2456.571	634.145	2456.571	9.99+	3.874
104	9	S6	0	5.503	2456.443	592.487	2456.443	9.99+	4.146
105	9	S7	0	8.518	2471.003	574.981	2471.003	9.99+	4.298
106	9	S8	0	8.518	2471.006	574.985	2471.006	9.99+	4.298
107	9	S9	0	5.503	2456.447	592.492	2456.447	9.99+	4.146
108	9	S10	0	8.7	2456.562	634.143	2456.562	9.99+	3.874
109	9	S11	0	4.291	2478.442	521.184	2478.442	9.99+	4.755
110	9	S12	0	9.542	2458.706	624.067	2458.706	9.99+	3.94

**Slab Stability - Sliding (Continued)**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
111	9	S13	0	4.672	2517.385	601.273	2517.385	9.99+	4.187
112	9	S14	0	153.193	2478.417	476.468	2478.417	9.99+	5.202
113	10	S1	0	160.203	3535.268	647.698	3535.268	9.99+	5.458
114	10	S2	0	1.209	3589.938	839.51	3589.938	9.99+	4.276
115	10	S3	0	35.229	3617.042	838.423	3617.042	9.99+	4.314
116	10	S4	0	13.544	3588.444	745.344	3588.444	9.99+	4.814
117	10	S5	0	23.238	3630.032	851.563	3630.032	9.99+	4.263
118	10	S6	0	11.336	3631.939	814.707	3631.939	9.99+	4.458
119	10	S7	0	26.62	3601.155	794.653	3601.155	9.99+	4.532
120	10	S8	0	26.62	3601.153	794.658	3601.153	9.99+	4.532
121	10	S9	0	11.335	3631.936	814.714	3631.936	9.99+	4.458
122	10	S10	0	23.24	3630.04	851.562	3630.04	9.99+	4.263
123	10	S11	0	13.543	3588.437	745.355	3588.437	9.99+	4.814
124	10	S12	0	35.228	3617.041	838.452	3617.041	9.99+	4.314
125	10	S13	0	1.209	3589.934	839.522	3589.934	9.99+	4.276
126	10	S14	0	160.203	3535.267	647.688	3535.267	9.99+	5.458
127	11	S1	0	88.303	3419.42	545.26	3419.42	9.99+	6.271
128	11	S2	0	1.894	3521.526	719.296	3521.526	9.99+	4.896
129	11	S3	0	38.03	3512.19	700.234	3512.19	9.99+	5.016
130	11	S4	0	14.494	3490.235	648.347	3490.235	9.99+	5.383
131	11	S5	0	24.108	3527.259	710.96	3527.259	9.99+	4.961
132	11	S6	0	11.725	3529.57	691.128	3529.57	9.99+	5.107
133	11	S7	0	28.373	3501.002	676.364	3501.002	9.99+	5.176
134	11	S8	0	28.372	3501.001	676.367	3501.001	9.99+	5.176
135	11	S9	0	11.725	3529.569	691.132	3529.569	9.99+	5.107
136	11	S10	0	24.109	3527.263	710.96	3527.263	9.99+	4.961
137	11	S11	0	14.494	3490.232	648.355	3490.232	9.99+	5.383
138	11	S12	0	38.029	3512.19	700.256	3512.19	9.99+	5.016
139	11	S13	0	1.893	3521.523	719.305	3521.523	9.99+	4.896
140	11	S14	0	88.305	3419.42	545.253	3419.42	9.99+	6.271
141	12	S1	0	139.931	1102.585	731.384	1102.585	7.879	1.508
142	12	S2	0	0.622	1033.845	951.183	1033.845	9.99+	1.087
143	12	S3	0	35.563	1014.958	945.327	1014.958	9.99+	1.074
144	12	S4	0	14.312	1042.012	846.974	1042.012	9.99+	1.23
145	12	S5	0	24.52	1001.607	960.079	1001.607	9.99+	1.043
146	12	S6	0	13.357	999.689	921.317	999.689	9.99+	1.085
147	12	S7	0	28.105	1029.762	899.212	1029.762	9.99+	1.145
148	12	S8	0	28.105	1029.764	899.217	1029.764	9.99+	1.145
149	12	S9	0	13.357	999.691	921.324	999.691	9.99+	1.085
150	12	S10	0	24.521	1001.6	960.078	1001.6	9.99+	1.043
151	12	S11	0	14.311	1042.018	846.986	1042.018	9.99+	1.23
152	12	S12	0	35.561	1014.958	945.359	1014.958	9.99+	1.074
153	12	S13	0	0.623	1033.852	951.196	1033.852	9.99+	1.087
154	12	S14	0	139.933	1102.584	731.373	1102.584	7.879	1.508
155	13	S1	0	216.316	1146.389	635.302	1146.389	5.3	1.804
156	13	S2	0	6.23	1195.314	801.684	1195.314	9.99+	1.491
157	13	S3	0	15.356	1115.624	832.056	1115.624	9.99+	1.341
158	13	S4	0	6.458	1143.877	694.899	1143.877	9.99+	1.646
159	13	S5	0	12.793	1111.796	845.526	1111.796	9.99+	1.315
160	13	S6	0	7.338	1111.453	789.982	1111.453	9.99+	1.407
161	13	S7	0	12.797	1133.089	766.641	1133.089	9.99+	1.478
162	13	S8	0	12.798	1133.094	766.647	1133.094	9.99+	1.478
163	13	S9	0	7.338	1111.458	789.99	1111.458	9.99+	1.407
164	13	S10	0	12.794	1111.784	845.524	1111.784	9.99+	1.315
165	13	S11	0	6.455	1143.888	694.912	1143.888	9.99+	1.646

**Slab Stability - Sliding (Continued)**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
166	13	S12	0	15.356	1115.625	832.09	1115.625	9.99+	1.341
167	13	S13	0	6.23	1195.321	801.697	1195.321	9.99+	1.491
168	13	S14	0	216.314	1146.389	635.291	1146.389	5.3	1.805
169	14	S1	0	201.547	2555.524	863.597	2555.524	9.99+	2.959
170	14	S2	0	1.612	2625.392	1119.347	2625.392	9.99+	2.345
171	14	S3	0	44.339	2660.073	1117.898	2660.073	9.99+	2.38
172	14	S4	0	17.325	2623.89	993.792	2623.89	9.99+	2.64
173	14	S5	0	29.791	2676.41	1135.418	2676.41	9.99+	2.357
174	14	S6	0	15.114	2678.78	1086.277	2678.78	9.99+	2.466
175	14	S7	0	34.054	2639.959	1059.537	2639.959	9.99+	2.492
176	14	S8	0	34.053	2639.956	1059.544	2639.956	9.99+	2.492
177	14	S9	0	15.114	2678.777	1086.285	2678.777	9.99+	2.466
178	14	S10	0	29.792	2676.42	1135.416	2676.42	9.99+	2.357
179	14	S11	0	17.323	2623.881	993.807	2623.881	9.99+	2.64
180	14	S12	0	44.338	2660.072	1117.936	2660.072	9.99+	2.379
181	14	S13	0	1.612	2625.386	1119.362	2625.386	9.99+	2.345
182	14	S14	0	201.547	2555.523	863.584	2555.523	9.99+	2.959
183	15	S1	0	105.681	2401.06	727.014	2401.06	9.99+	3.303
184	15	S2	0	2.525	2534.176	959.062	2534.176	9.99+	2.642
185	15	S3	0	48.074	2520.271	933.645	2520.271	9.99+	2.699
186	15	S4	0	18.592	2492.945	864.463	2492.945	9.99+	2.884
187	15	S5	0	30.95	2539.38	947.947	2539.38	9.99+	2.679
188	15	S6	0	15.634	2542.289	921.504	2542.289	9.99+	2.759
189	15	S7	0	36.39	2506.422	901.818	2506.422	9.99+	2.779
190	15	S8	0	36.389	2506.421	901.823	2506.421	9.99+	2.779
191	15	S9	0	15.633	2542.288	921.51	2542.288	9.99+	2.759
192	15	S10	0	30.952	2539.385	947.946	2539.385	9.99+	2.679
193	15	S11	0	18.592	2492.94	864.474	2492.94	9.99+	2.884
194	15	S12	0	48.073	2520.27	933.674	2520.27	9.99+	2.699
195	15	S13	0	2.524	2534.171	959.073	2534.171	9.99+	2.642
196	15	S14	0	105.684	2401.06	727.004	2401.06	9.99+	3.303



**JOB NO.:** U2716.0387.241  
**SUBJECT:** WIND PRESSURES  
**CONDITION:** 20° TILT

**PROJECT:** Sunturf Package D5 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			Y								
17	LRFD Loads		Y								
18	1.4 D	Yes	Y	DL	1.4	RLL					
19	1.2 D + 1.6 S + 0.5 W1	Yes	Y	DL	1.2	RLL	1.6	OL1	0.5		
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	3.716	27	1727.579	26	148.659	23	0	30	0	30	0	30
2 min	-4.806	25	-805.973	27	-185.009	25	0	18	0	18	0	18
3 N1 max	341.505	25	3696.551	25	1623.556	25	0	30	0	30	0	30
4 min	-367.92	28	-3707.315	28	-1367.976	23	0	18	0	18	0	18
5 N151 max	367.916	28	3696.676	25	1623.532	25	0	30	0	30	0	30
6 min	-341.505	25	-3707.277	28	-1367.957	23	0	18	0	18	0	18
7 N152 max	4.806	25	1727.375	26	148.658	23	0	30	0	30	0	30
8 min	-3.717	27	-805.857	27	-185.008	25	0	18	0	18	0	18
9 N276 max	7.972	25	3625.83	25	2074.324	25	0	30	0	30	0	30
10 min	-8.961	28	-3526.823	28	-1749.295	23	0	18	0	18	0	18
11 N278 max	4.6	27	2428.506	26	164.338	23	0	30	0	30	0	30
12 min	-7.931	26	-1201.061	27	-207.832	25	0	18	0	18	0	18
13 N227 max	25.885	25	4049.461	25	2075.986	25	0	30	0	30	0	30
14 min	-26.221	28	-4029.7	28	-1744.81	23	0	18	0	18	0	18
15 N229 max	65.771	26	2152.501	26	169.167	23	0	30	0	30	0	30
16 min	-41.19	27	-1005.548	27	-213.042	25	0	18	0	18	0	18
17 N233 max	11.508	28	3737.073	25	1859.388	25	0	30	0	30	0	30
18 min	-10.871	25	-3678.807	28	-1572.174	23	0	18	0	18	0	18
19 N235 max	15.693	27	2168.283	26	160.722	23	0	30	0	30	0	30
20 min	-25.34	26	-1092.429	27	-202.913	25	0	18	0	18	0	18
21 N239 max	18.174	28	4085.814	25	2111.53	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	-17.377	25	-4066.557	28	-1773.931	23	0	18	0	18	0	18
23	N241	max	27.92	27	2236.143	26	173.847	23	0	30	0	30	0	30
24		min	-42.554	26	-1051.74	27	-219.093	25	0	18	0	18	0	18
25	N245	max	8.807	25	4016.343	25	2025.058	25	0	30	0	30	0	30
26		min	-8.964	28	-3989.969	28	-1706.2	23	0	18	0	18	0	18
27	N247	max	22.363	26	2290.351	26	170.348	23	0	30	0	30	0	30
28		min	-14.959	27	-1117.409	27	-214.973	25	0	18	0	18	0	18
29	N251	max	21.74	25	3881.235	25	1974.81	25	0	30	0	30	0	30
30		min	-22.501	28	-3838.958	28	-1663.837	23	0	18	0	18	0	18
31	N253	max	49.501	26	2165.103	26	165.348	23	0	30	0	30	0	30
32		min	-30.702	27	-1050.707	27	-208.681	25	0	18	0	18	0	18
33	N257	max	22.502	28	3881.221	25	1974.823	25	0	30	0	30	0	30
34		min	-21.74	25	-3838.94	28	-1663.847	23	0	18	0	18	0	18
35	N259	max	30.702	27	2165.104	26	165.349	23	0	30	0	30	0	30
36		min	-49.5	26	-1050.705	27	-208.682	25	0	18	0	18	0	18
37	N263	max	8.964	28	4016.334	25	2025.073	25	0	30	0	30	0	30
38		min	-8.806	25	-3989.954	28	-1706.212	23	0	18	0	18	0	18
39	N265	max	14.959	27	2290.348	26	170.349	23	0	30	0	30	0	30
40		min	-22.363	26	-1117.403	27	-214.974	25	0	18	0	18	0	18
41	N269	max	17.379	25	4085.873	25	2111.529	25	0	30	0	30	0	30
42		min	-18.175	28	-4066.621	28	-1773.93	23	0	18	0	18	0	18
43	N271	max	42.555	26	2236.139	26	173.848	23	0	30	0	30	0	30
44		min	-27.92	27	-1051.739	27	-219.094	25	0	18	0	18	0	18
45	N275	max	10.867	25	3737.041	25	1859.417	25	0	30	0	30	0	30
46		min	-11.504	28	-3678.765	28	-1572.197	23	0	18	0	18	0	18
47	N283	max	25.341	26	2168.271	26	160.724	23	0	30	0	30	0	30
48		min	-15.694	27	-1092.415	27	-202.916	25	0	18	0	18	0	18
49	N287	max	26.22	28	4049.501	25	2076.057	25	0	30	0	30	0	30
50		min	-25.884	25	-4029.738	28	-1744.868	23	0	18	0	18	0	18
51	N289	max	41.189	27	2152.474	26	169.171	23	0	30	0	30	0	30
52		min	-65.769	26	-1005.513	27	-213.047	25	0	18	0	18	0	18
53	N293	max	8.962	28	3625.903	25	2074.355	25	0	30	0	30	0	30
54		min	-7.971	25	-3526.807	28	-1749.319	23	0	18	0	18	0	18
55	N295	max	7.927	26	2428.366	26	164.341	23	0	30	0	30	0	30
56		min	-4.597	27	-1200.953	27	-207.836	25	0	18	0	18	0	18
57	Totals:	max	0.001	25	72761.074	25	24586.337	25						
58		min	-0.001	28	-53381.192	27	-20851.679	23						



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Engineer:	CJT	Page:	1/6
Project:	Sunturf Ground Mount D5		
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): 30.00  
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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**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]: 4067

$V_{uax}$  [lb]: 368

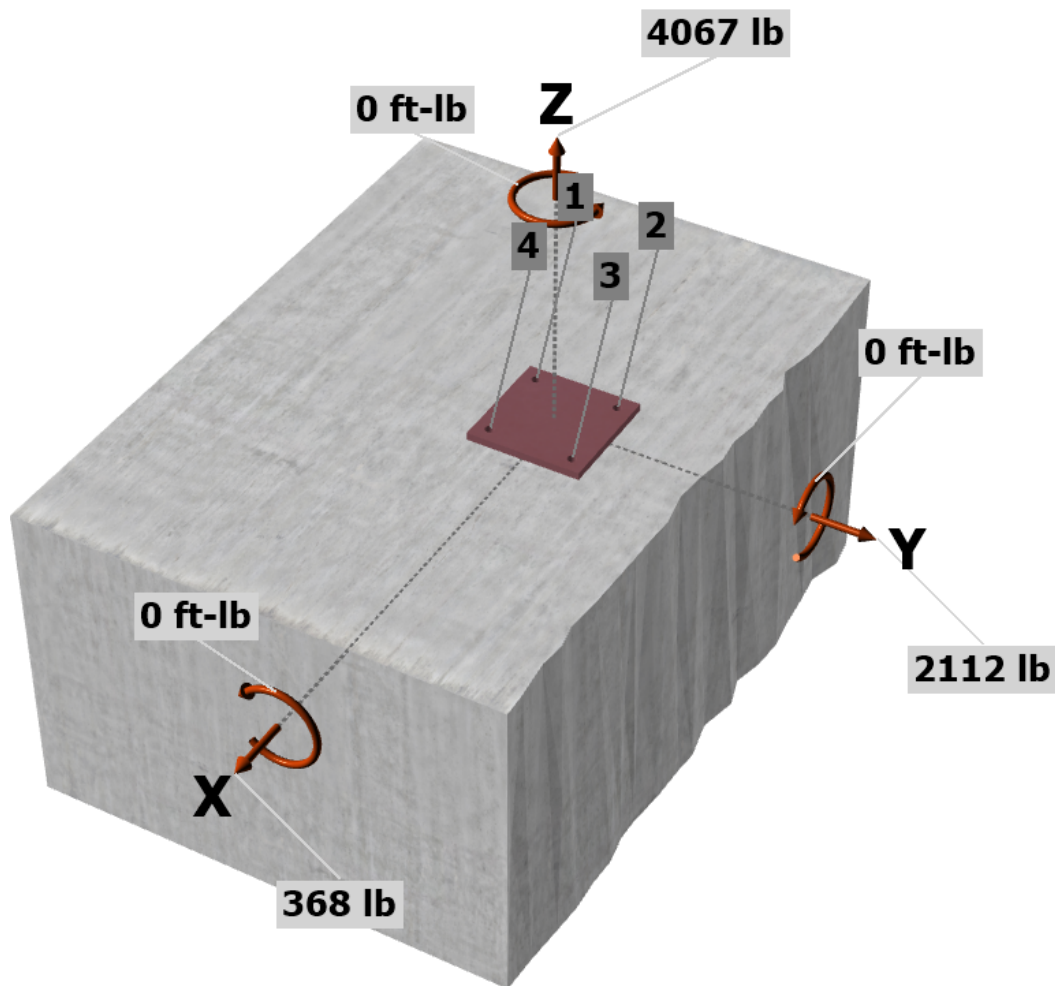
$V_{uay}$  [lb]: 2112

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

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

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

<Figure 1>

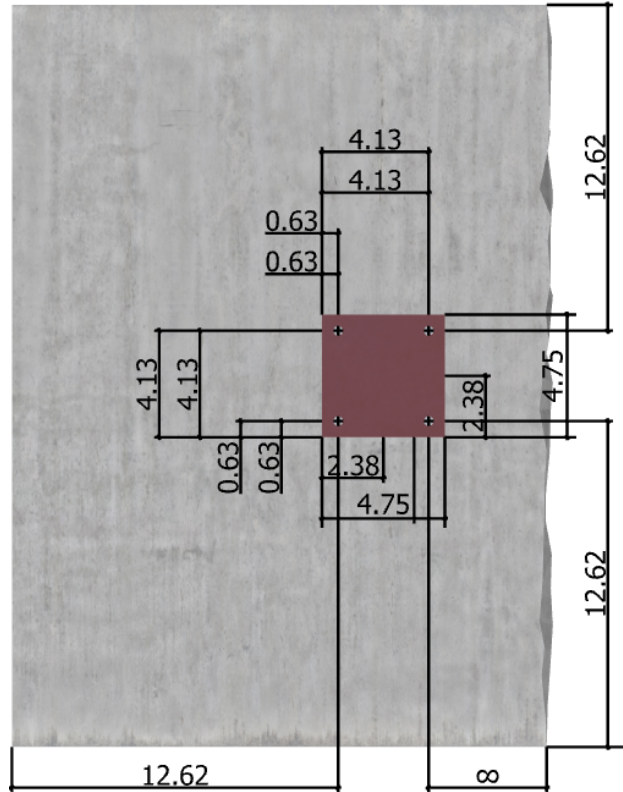


Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.



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<Figure 2>





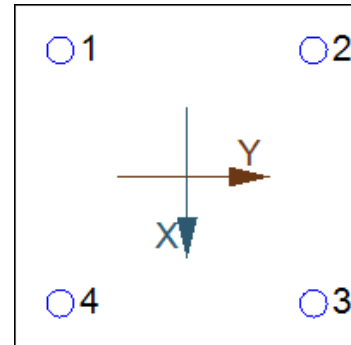
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### 3. Resulting Anchor Forces

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	1016.8	92.0	528.0	536.0
2	1016.8	92.0	528.0	536.0
3	1016.8	92.0	528.0	535.9
4	1016.8	92.0	528.0	535.9
Sum	4067.0	368.0	2112.0	2143.8

Maximum concrete compression strain (%): 0.00  
 Maximum concrete compression stress (psi): 0  
 Resultant tension force (lb): 4067  
 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)

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

$K_c$	$\lambda_a$	$f_c$ (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	12.62	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	12.62	1.000	1.000	1.000	6343	0.55	6176



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**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:**

$V_{bx} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}|$  (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	16.12	21026

$\phi V_{cbgx} = \phi (A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{bx}$  (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)
974.45	1169.34	1.000	0.857	1.000	1.000	21026	0.70	10506

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

$V_{by} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}|$  (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	12.62	14564

$\phi V_{cbgy} = \phi (2)(A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{by}$  (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)
544.05	716.69	1.000	1.000	1.000	1.000	14564	0.70	15478

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

$V_{bx} = \min|7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}|$  (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	12.62	14564

$\phi V_{cbgx} = \phi (2)(A_{vc} / A_{vco}) \psi_{ec,v} \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{bx}$  (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)
663.50	716.69	1.000	1.000	1.000	1.000	14564	0.70	18877

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

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

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Engineer:	CJT	Page:	6/6
Project:	Sunturf Ground Mount D5		
Address:			
Phone:			
E-mail:			

Steel	1017	5850	0.17	Pass
Concrete breakout	4067	7374	0.55	Pass
<b>Adhesive</b>	<b>4067</b>	<b>6176</b>	<b>0.66</b>	<b>Pass (Governs)</b>

Shear	Factored Load, $V_{ua}$ (lb)	Design Strength, $\phi V_n$ (lb)	Ratio	Status
<b>Steel</b>	<b>536</b>	<b>3042</b>	<b>0.18</b>	<b>Pass (Governs)</b>
T Concrete breakout x+	368	10506	0.04	Pass
Concrete breakout y-	184	15478	0.01	Pass
Concrete breakout x-	1056	18877	0.06	Pass
Concrete breakout, combined	-	-	0.06	Pass
Pryout	2144	15721	0.14	Pass

Interaction check	$N_{ua}/\phi N_n$	$V_{ua}/\phi V_n$	Combined Ratio	Permissible	Status
Sec. 17.8.1	0.66	0.00	65.8%	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.