



Project Number: U2716-0342-221

May 3, 2024

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

**REFERENCE: Sunmodo Sunturf Ground Mount A13 – 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 International Building Code, 2018 Edition (2018 IBC). Vector Structural Engineering requires that we review each site-specific install, and we are not liable for installs at site specific locations we have not reviewed. The following design parameters are used in our analysis:

- Minimum Design Loads for Buildings and Other Structures (ASCE 7-16)
- Design wind speed for risk category I structures: 105 mph
- Wind exposure: C
- Ground snow load: 80 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	1916	1.5	2874
LATERAL	1557	2	3114

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

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

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

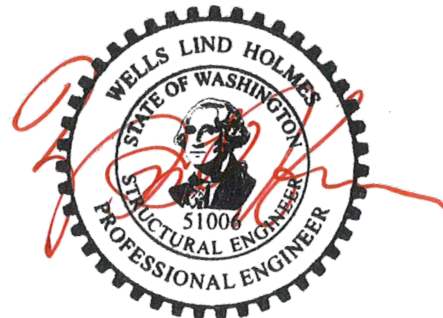
Very truly yours,

VECTOR STRUCTURAL ENGINEERING, LLC  
WA FIRM LICENSE #: 2202

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Wells Holmes, S.E.  
License: 51006 - Expires: 10/06/2024  
Project Engineer

Enclosures

WLH/mih



05/03/2024



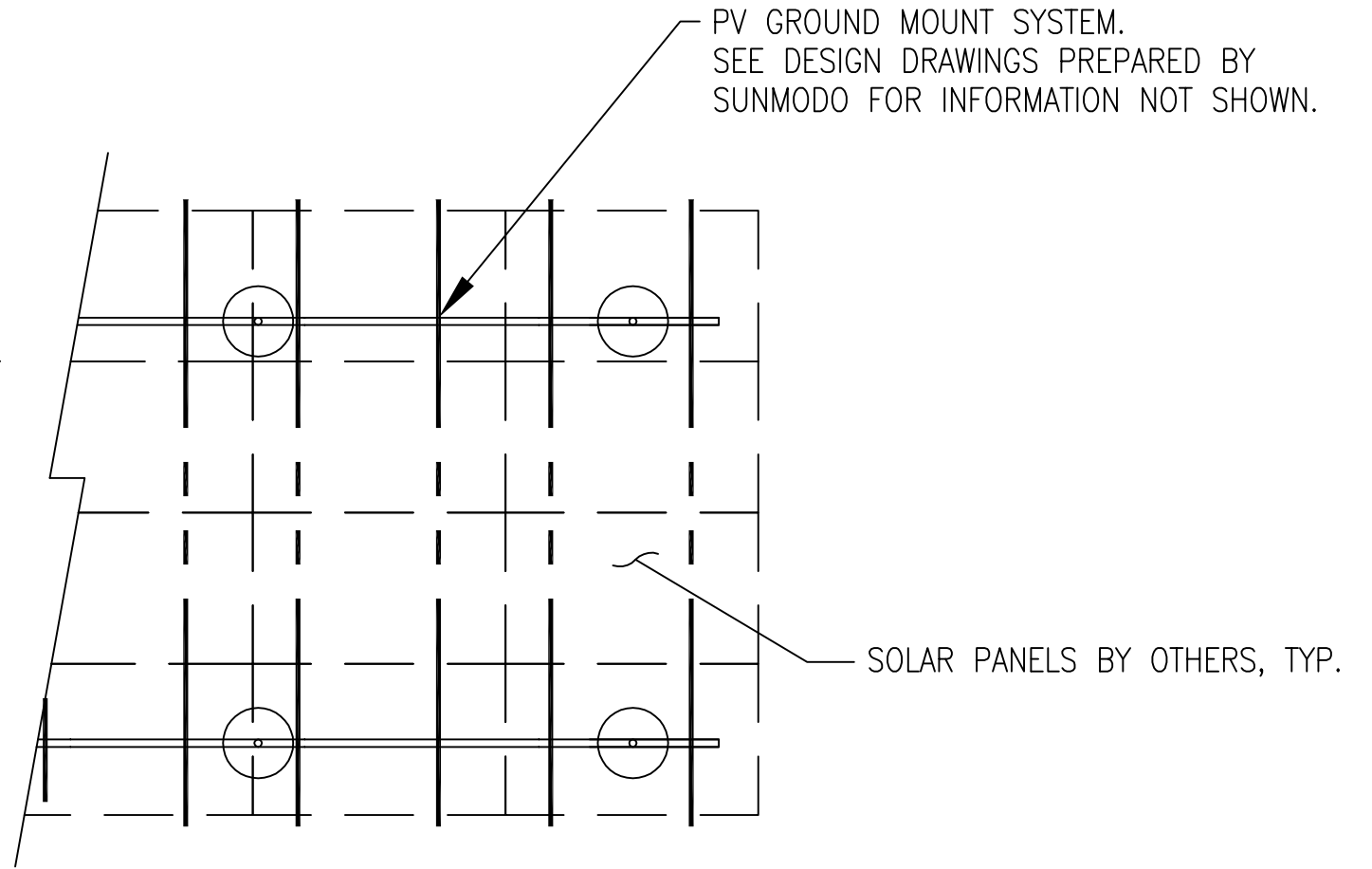
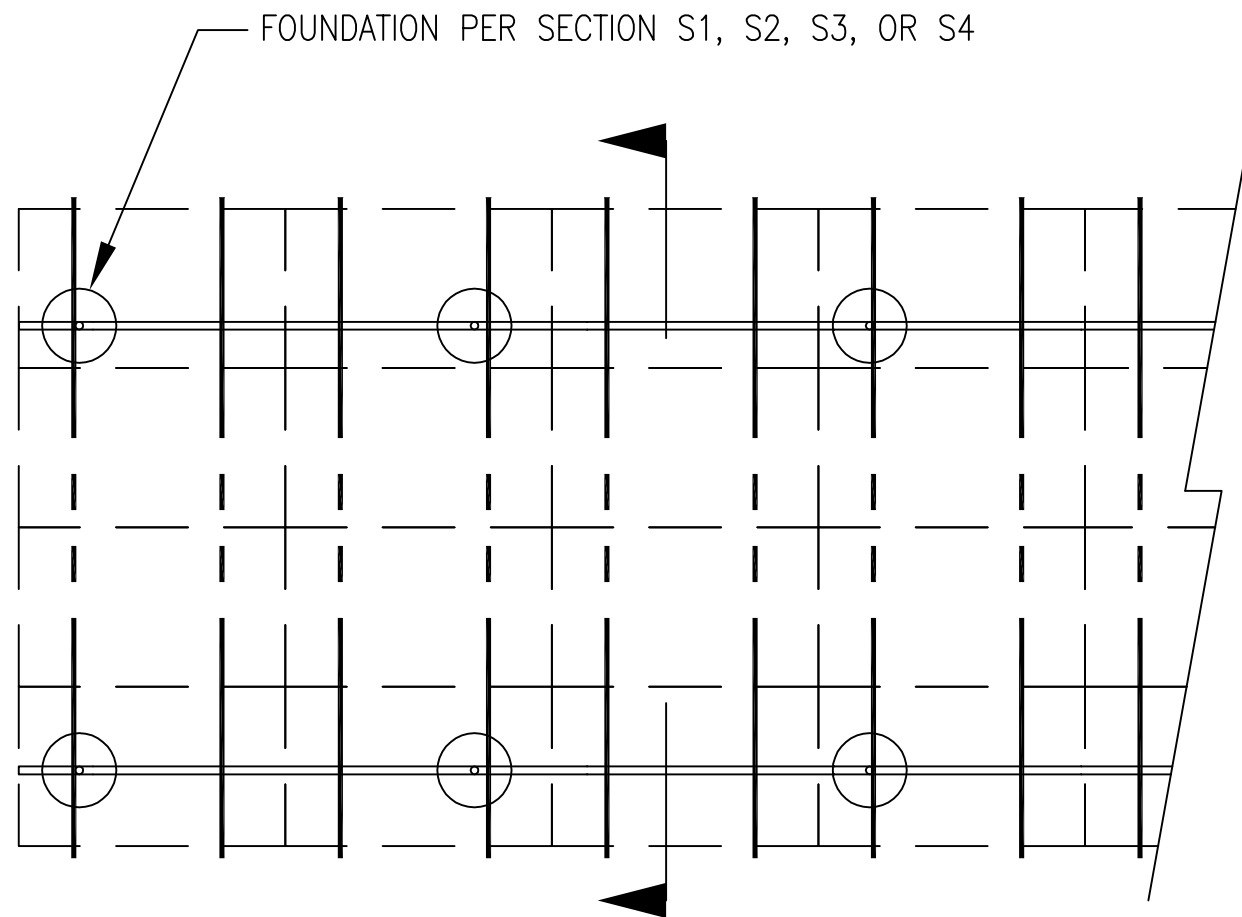
JOB NO. U2716-0342-221  
 PROJECT SUNMODO SUNTURF GROUND MOUNTS A13  
 SUBJECT ALL OPTIONS

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



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PV ARRAY PLAN

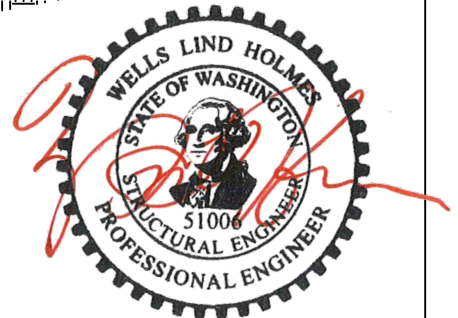
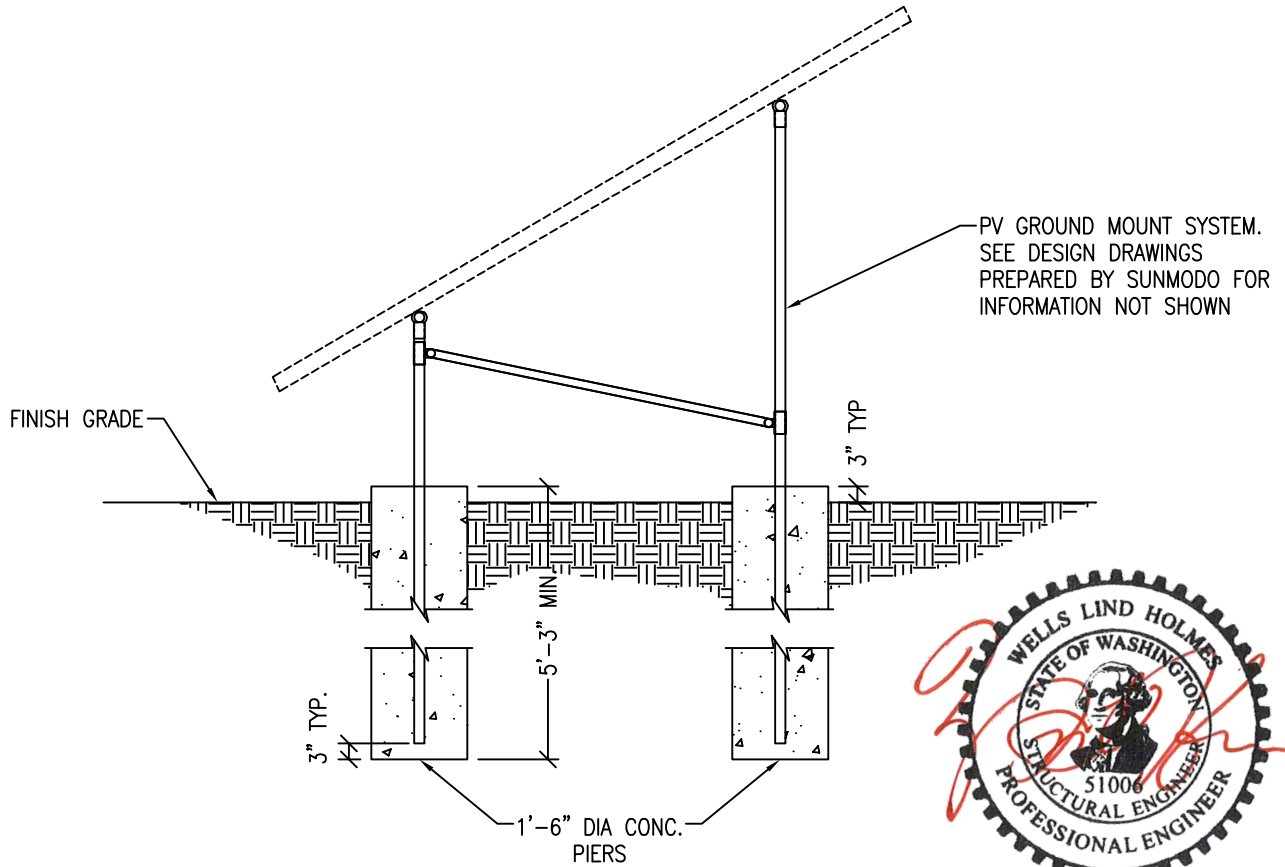
N.T.S.



JOB NO. U2716-0342-221

PROJECT SUNMODO SUNTURF GROUND MOUNTS A13

SUBJECT DRILLED PIER OPTION



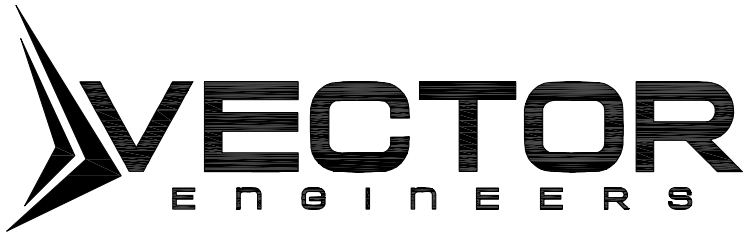
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PV ARRAY SECTION

N.T.S.

S1



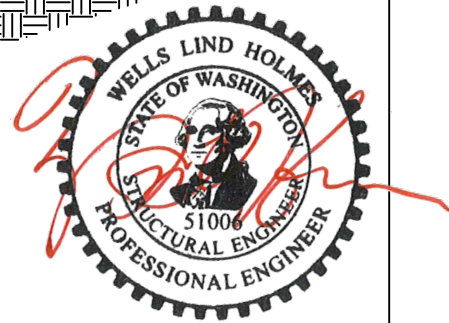
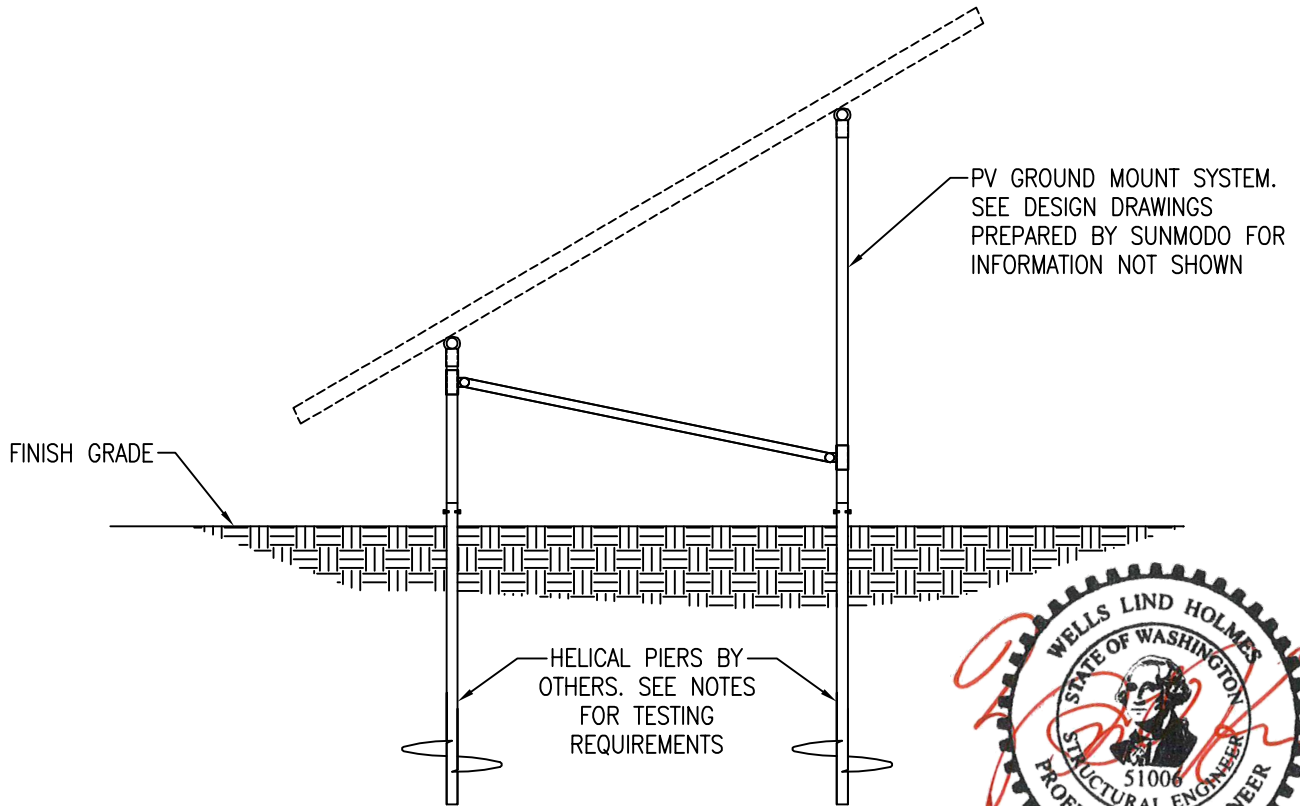
JOB NO. U2716-0342-221

PROJECT SUNMODO SUNTURF GROUND MOUNTS A13

SUBJECT HELICAL PIER OPTION

NOTES:

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

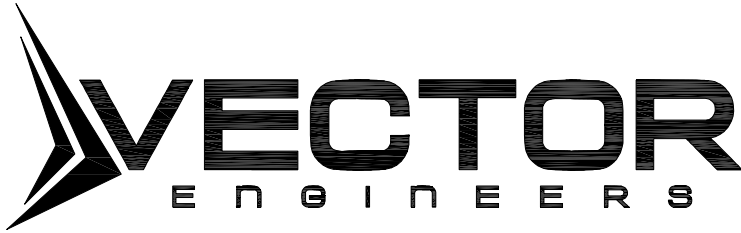


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PV ARRAY SECTION  
N.T.S.

S2



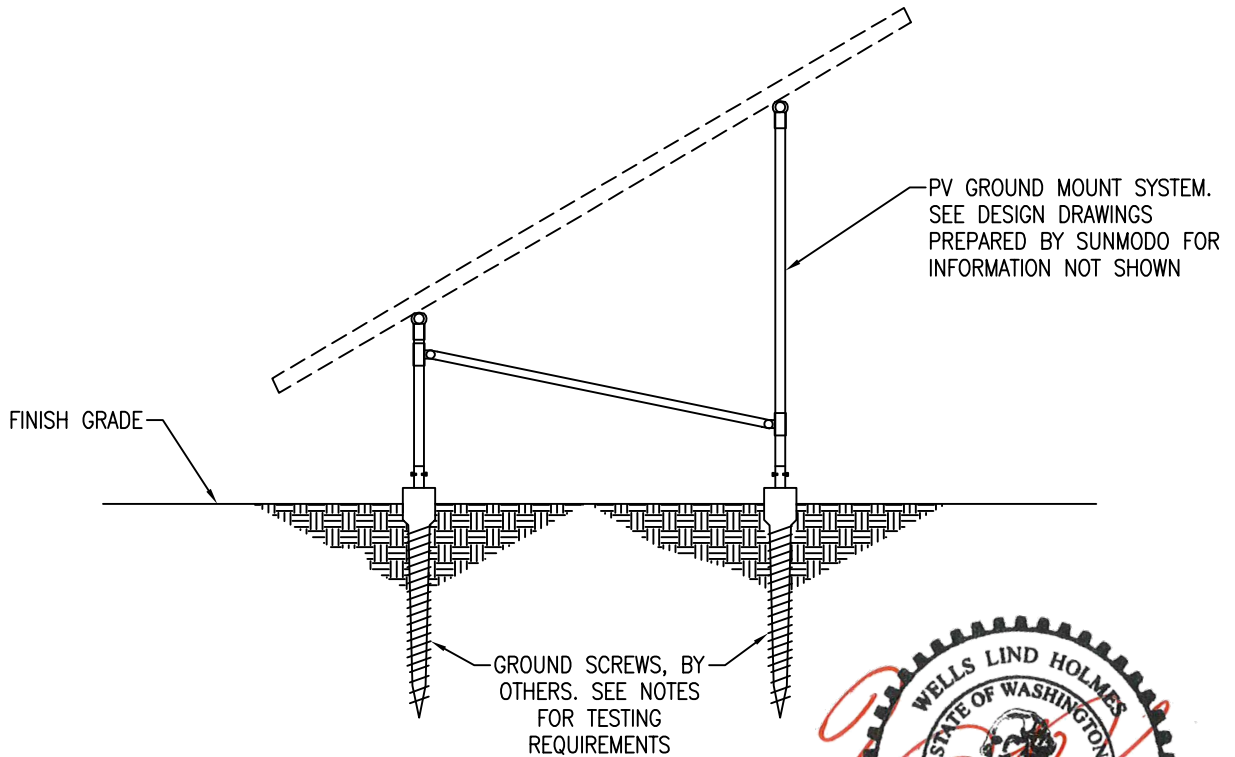
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PROJECT SUNMODO SUNTURF GROUND MOUNTS A13

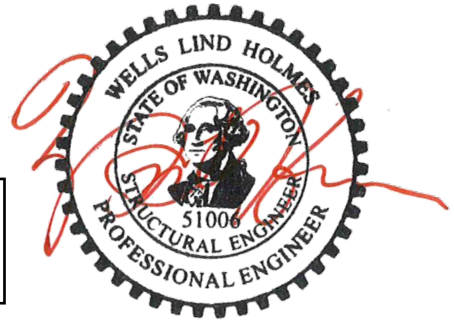
SUBJECT GROUND SCREW OPTION

NOTES:

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



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PV ARRAY SECTION

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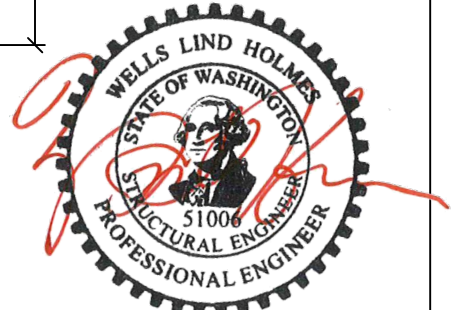
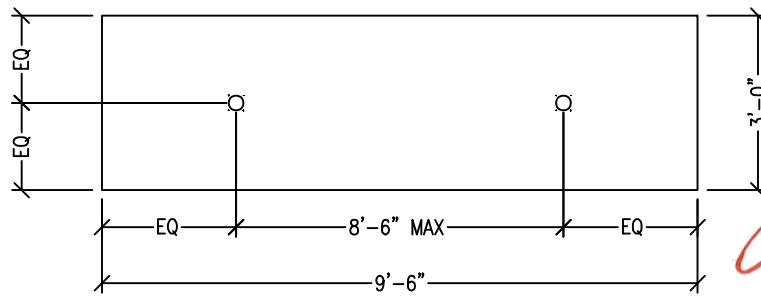
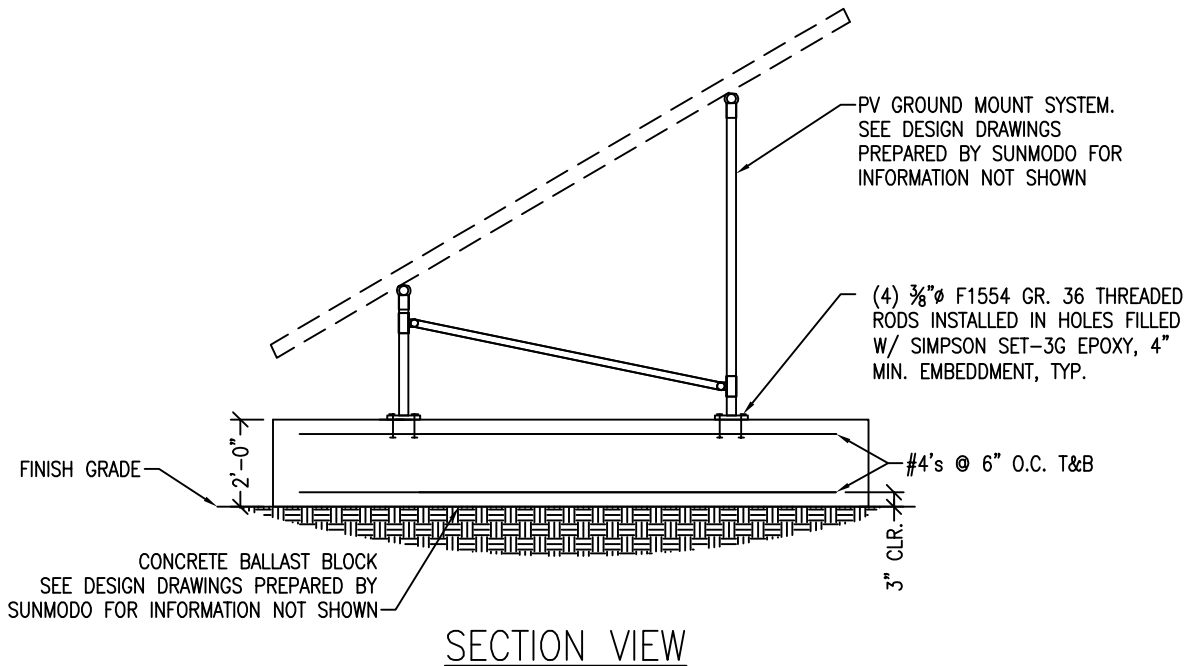
S3



JOB NO. U2716-0342-221

PROJECT SUNMODO SUNTURF GROUND MOUNTS A13

SUBJECT BALLASTED BLOCK OPTION



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.

PV ARRAY SECTION  
N.T.S.

05/03/2024

S4



JOB NO.: U2716.0342.221

PROJECT: Sunturf Package A13 Ground Mount

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# DESIGN LOADS



**PROJECT:** Sunturf Package A13 Ground Mount

**SNOW LOADS**

Calculations Per:	ASCE 7-10	
Snow Ground Load, $p_g$ [psf]:	80.0	(Section 7.2)
Risk Category:	I	(Table 1.5-1)
Importance Factor, $I_s$ :	0.8	(Table 1.5-2)
Terrain Category:	C	(Section 26.7)
Exposure of Roof:	Fully Exposed	(Table 7-2)
Exposure Factor, $C_e$ :	0.9	(Table 7-2)
Thermal Factor, $C_t$ :	1.2	(Table 7-3)
Flat Roof Snow Load, $p_f$ [psf]:	48	(Equation 7.3-1)
Min. Roof Snow Load, $p_m$ [psf]:	0	(Section 7.3.4)
Panel Slope from Horizontal [°]:	20.0	
Unobstructed Slippery Surface?	Yes	(Section 7.4)
Slope Factor Figure:	Figure 7-2c	(Section 7.4)
Roof Slope Factor, $C_s$ :	0.91	
Sloped Roof Snow Load, $p_s$ [psf]:	44	(Equation 7.4-1)
Design Snow Load, $S$ [psf]:	44	(1.0 Snow)





**PROJECT:** Sunturf Package A13 Ground Mount

**WIND PRESSURES**

Calculations per:	ASCE 7-10	
Design Wind Speed, V [mph]:	105	
Risk Category:	I	(Table 1.5-1)
Exposure Category:	C	(Section 26.7)
Elevation [ft]:	3529.7	
Ground Elevation Factor, $K_e$ :		(Not applicable)
$\alpha$ :	9.5	(Table 26.9.1)
$z_g$ [ft]:	900	(Table 26.9.1)
Velocity Pressure Exposure Coefficient, $K_h$ :	0.85	(Table 27.3-1)
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 26.11-1)
Velocity Pressure, $q_h$ [psf]:	20.37	(Equation 27.3-1)
Gust Effect Factor, G:	0.85	(Section 26.9.1)
Panel Slope [degrees]:	20.0	
Wind Flow:	Clear	
Roof Configuration:	Monoslope	

Wind Pressures in Transverse (N-S) Direction

Net Pressure Coefficients per Figure 27.4-4

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 27.4-3 [psf]

Clear Wind Flow	$q_h GC_{NW}$	$q_h GC_{NL}$
Case 1 ( $\gamma = 0^\circ$ , Load Case A)	-22.5	-26.0
Case 2 ( $\gamma = 0^\circ$ , Load Case B)	-38.1	-3.5
Case 3 ( $\gamma = 180^\circ$ , Load Case A)	27.7	29.4
Case 4 ( $\gamma = 180^\circ$ , Load Case B)	36.4	12.1
Case 5 ( $\gamma = 0^\circ$ , 16 psf Min. Horiz.)	-16.0	-16.0
Case 6 ( $\gamma = 180^\circ$ , 16 psf Min. Horiz)	16.0	16.0



**JOB NO.:** U2716.0342.221  
**SUBJECT:** SNOW LOADS

**PROJECT:** Sunturf Package A13 Ground Mount

**SNOW LOADS**

Calculations Per:	ASCE 7-10	
Snow Ground Load, $p_g$ [psf]:	80.0	(Section 7.2)
Risk Category:	I	(Table 1.5-1)
Importance Factor, $I_s$ :	0.8	(Table 1.5-2)
Terrain Category:	C	(Section 26.7)
Exposure of Roof:	Fully Exposed	(Table 7-2)
Exposure Factor, $C_e$ :	0.9	(Table 7-2)
Thermal Factor, $C_t$ :	1.2	(Table 7-3)
Flat Roof Snow Load, $p_f$ [psf]:	48	(Equation 7.3-1)
Min. Roof Snow Load, $p_m$ [psf]:	0	(Section 7.3.4)
Panel Slope from Horizontal [°]:	27.5	
Unobstructed Slippery Surface?	Yes	(Section 7.4)
Slope Factor Figure:	Figure 7-2c	(Section 7.4)
Roof Slope Factor, $C_s$ :	0.77	
Sloped Roof Snow Load, $p_s$ [psf]:	37	(Equation 7.4-1)
Design Snow Load, $S$ [psf]:	37	(1.0 Snow)



**PROJECT:** Sunturf Package A13 Ground Mount

**WIND PRESSURES**

Calculations per:	ASCE 7-10	
Design Wind Speed, V [mph]:	105	
Risk Category:	I	(Table 1.5-1)
Exposure Category:	C	(Section 26.7)
Elevation [ft]:	3529.7	
Ground Elevation Factor, $K_e$ :		(Not applicable)
$\alpha$ :	9.5	(Table 26.9.1)
$z_g$ [ft]:	900	(Table 26.9.1)
Velocity Pressure Exposure Coefficient, $K_h$ :	0.85	(Table 27.3-1)
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 26.11-1)
Velocity Pressure, $q_h$ [psf]:	20.37	(Equation 27.3-1)
Gust Effect Factor, G:	0.85	(Section 26.9.1)
Panel Slope [degrees]:	27.5	
Wind Flow:	Clear	
Roof Configuration:	Monoslope	

Wind Pressures in Transverse (N-S) Direction

Net Pressure Coefficients per Figure 27.4-4

Clear Wind Flow	$C_{NW}$	$C_{NL}$
Case 1 ( $\gamma = 0^\circ$ , Load Case A)	-1.7	-1.7
Case 2 ( $\gamma = 0^\circ$ , Load Case B)	-2.5	-0.4
Case 3 ( $\gamma = 180^\circ$ , Load Case A)	2.0	2.0
Case 4 ( $\gamma = 180^\circ$ , Load Case B)	2.5	0.9

Design Wind Pressures per Equation 27.4-3 [psf]

Clear Wind Flow	$q_h GC_{NW}$	$q_h GC_{NL}$
Case 1 ( $\gamma = 0^\circ$ , Load Case A)	-29.4	-29.4
Case 2 ( $\gamma = 0^\circ$ , Load Case B)	-43.3	-6.9
Case 3 ( $\gamma = 180^\circ$ , Load Case A)	34.6	34.6
Case 4 ( $\gamma = 180^\circ$ , Load Case B)	43.3	15.6
Case 5 ( $\gamma = 0^\circ$ , 16 psf Min. Horiz.)	-16.0	-16.0
Case 6 ( $\gamma = 180^\circ$ , 16 psf Min. Horiz)	16.0	16.0



**JOB NO.:** U2716.0342.221  
**SUBJECT:** SNOW LOADS

**PROJECT:** Sunturf Package A13 Ground Mount

**SNOW LOADS**

Calculations Per:	ASCE 7-10	
Snow Ground Load, $p_g$ [psf]:	80.0	(Section 7.2)
Risk Category:	I	(Table 1.5-1)
Importance Factor, $I_s$ :	0.8	(Table 1.5-2)
Terrain Category:	C	(Section 26.7)
Exposure of Roof:	Fully Exposed	(Table 7-2)
Exposure Factor, $C_e$ :	0.9	(Table 7-2)
Thermal Factor, $C_t$ :	1.2	(Table 7-3)
Flat Roof Snow Load, $p_f$ [psf]:	48	(Equation 7.3-1)
Min. Roof Snow Load, $p_m$ [psf]:	0	(Section 7.3.4)
Panel Slope from Horizontal [°]:	35.0	
Unobstructed Slippery Surface?	Yes	(Section 7.4)
Slope Factor Figure:	Figure 7-2c	(Section 7.4)
Roof Slope Factor, $C_s$ :	0.64	
Sloped Roof Snow Load, $p_s$ [psf]:	31	(Equation 7.4-1)
Design Snow Load, $S$ [psf]:	31	(1.0 Snow)



**PROJECT:** Sunturf Package A13 Ground Mount

**WIND PRESSURES**

Calculations per:	ASCE 7-10	
Design Wind Speed, V [mph]:	105	
Risk Category:	I	(Table 1.5-1)
Exposure Category:	C	(Section 26.7)
Elevation [ft]:	3529.7	
Ground Elevation Factor, $K_e$ :		(Not applicable)
$\alpha$ :	9.5	(Table 26.9.1)
$z_g$ [ft]:	900	(Table 26.9.1)
Velocity Pressure Exposure Coefficient, $K_h$ :	0.85	(Table 27.3-1)
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 26.11-1)
Velocity Pressure, $q_h$ [psf]:	20.37	(Equation 27.3-1)
Gust Effect Factor, G:	0.85	(Section 26.9.1)
Panel Slope [degrees]:	35.0	
Wind Flow:	Clear	
Roof Configuration:	Monoslope	

Wind Pressures in Transverse (N-S) Direction

Net Pressure Coefficients per Figure 27.4-4

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

Design Wind Pressures per Equation 27.4-3 [psf]

Clear Wind Flow	$q_h GC_{NW}$	$q_h GC_{NL}$
Case 1 ( $\gamma = 0^\circ$ , Load Case A)	-31.2	-31.2
Case 2 ( $\gamma = 0^\circ$ , Load Case B)	-41.5	-10.4
Case 3 ( $\gamma = 180^\circ$ , Load Case A)	36.4	36.4
Case 4 ( $\gamma = 180^\circ$ , Load Case B)	46.7	19.0
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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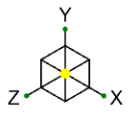
PROJECT: Sunturf Package A13 Ground Mount

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# RACKING ANALYSIS 4L CONFIGURATION

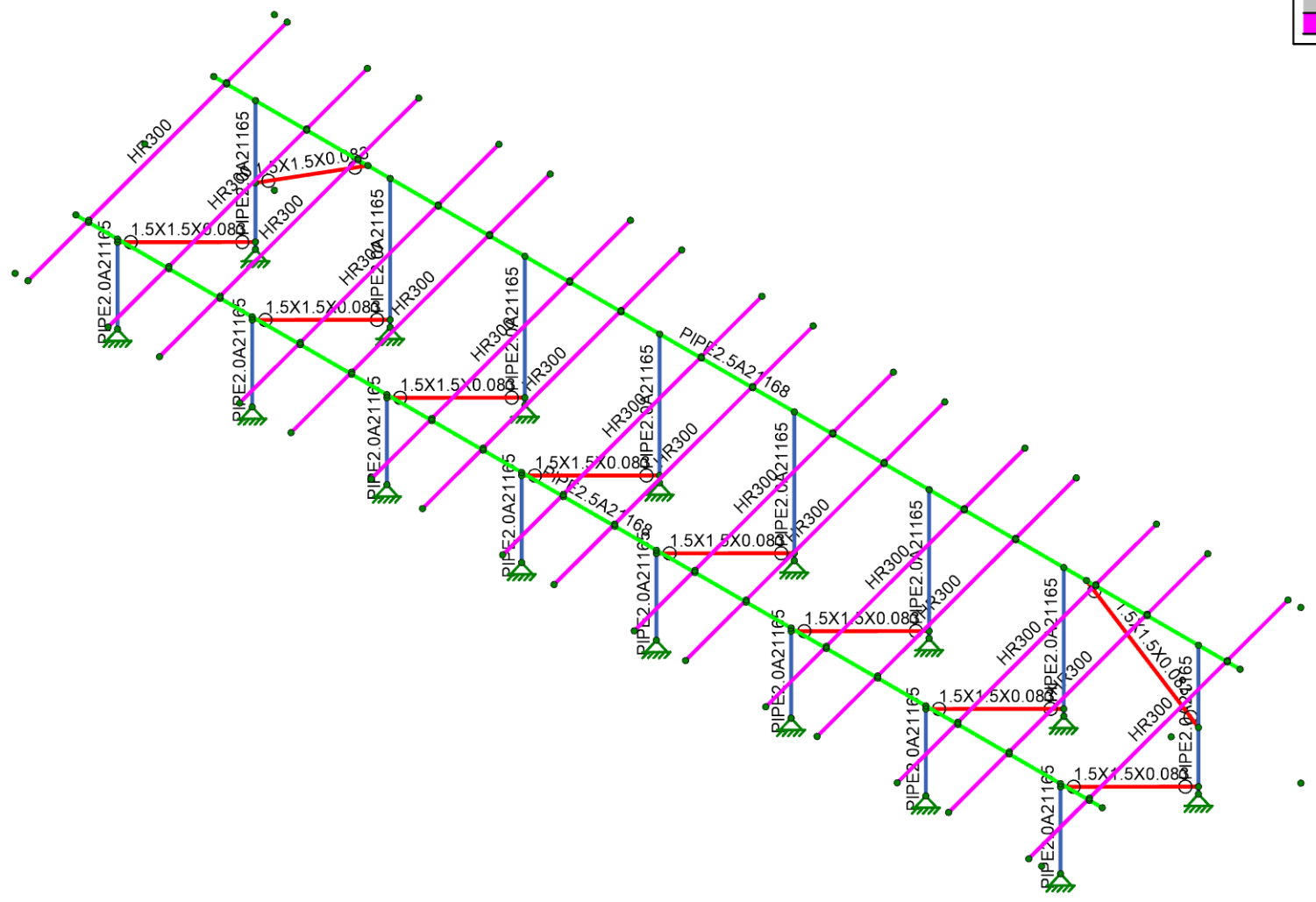
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Section Sets

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

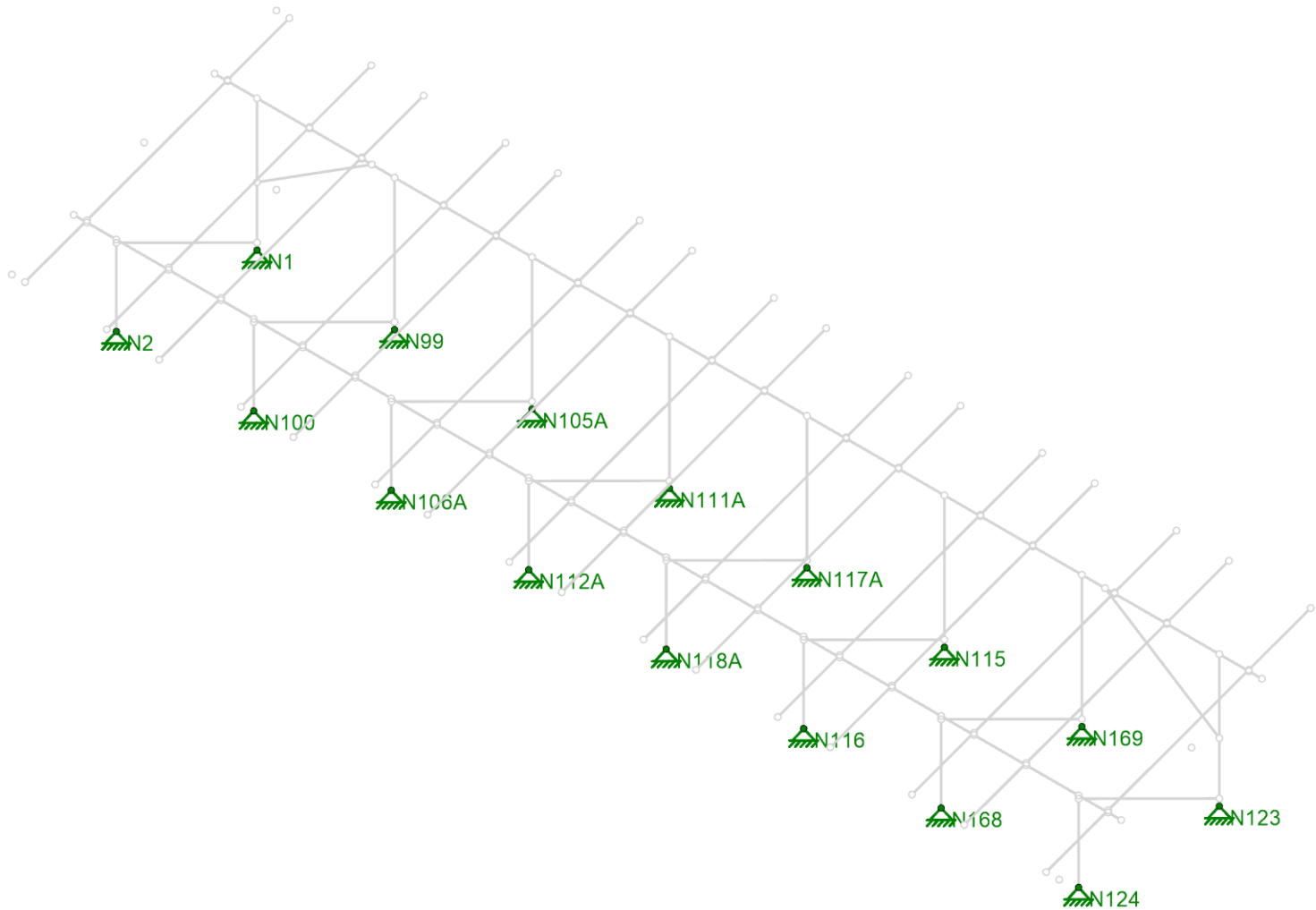
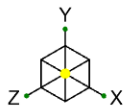


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Standard Panels - 20 Degree Tilt - 4L

SK-18  
 Jun 23, 2022  
 Sunmodo Sunturf A13 - SP - 20 - 4L.r3d

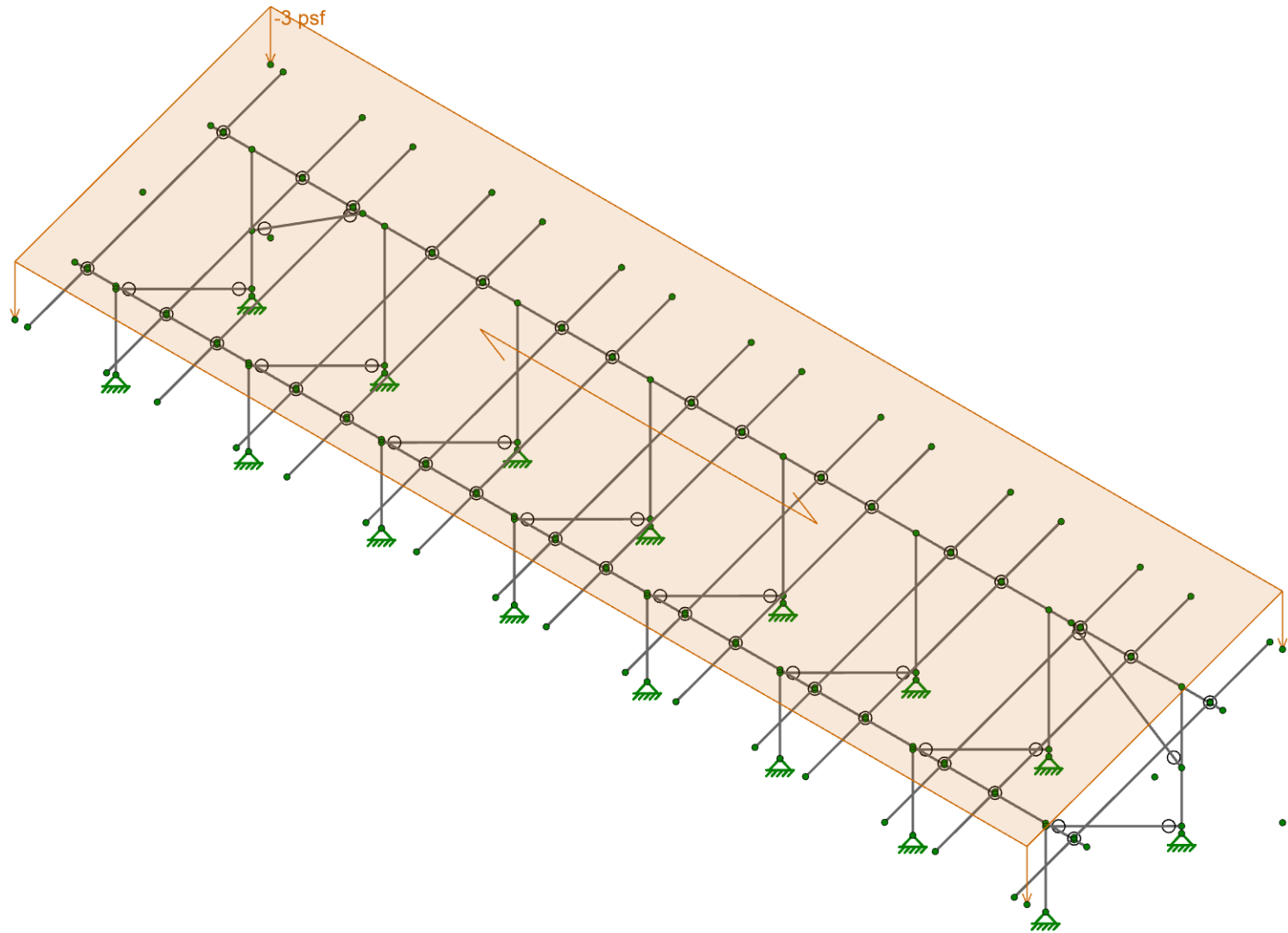
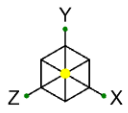




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Standard Panels - 20 Degree Tilt - 4L

SK-19  
Jun 23, 2022  
Sunmodo Sunturf A13 - SP - 20 - 4L.r3d



Loads: BLC 2, Solar Panel Weight

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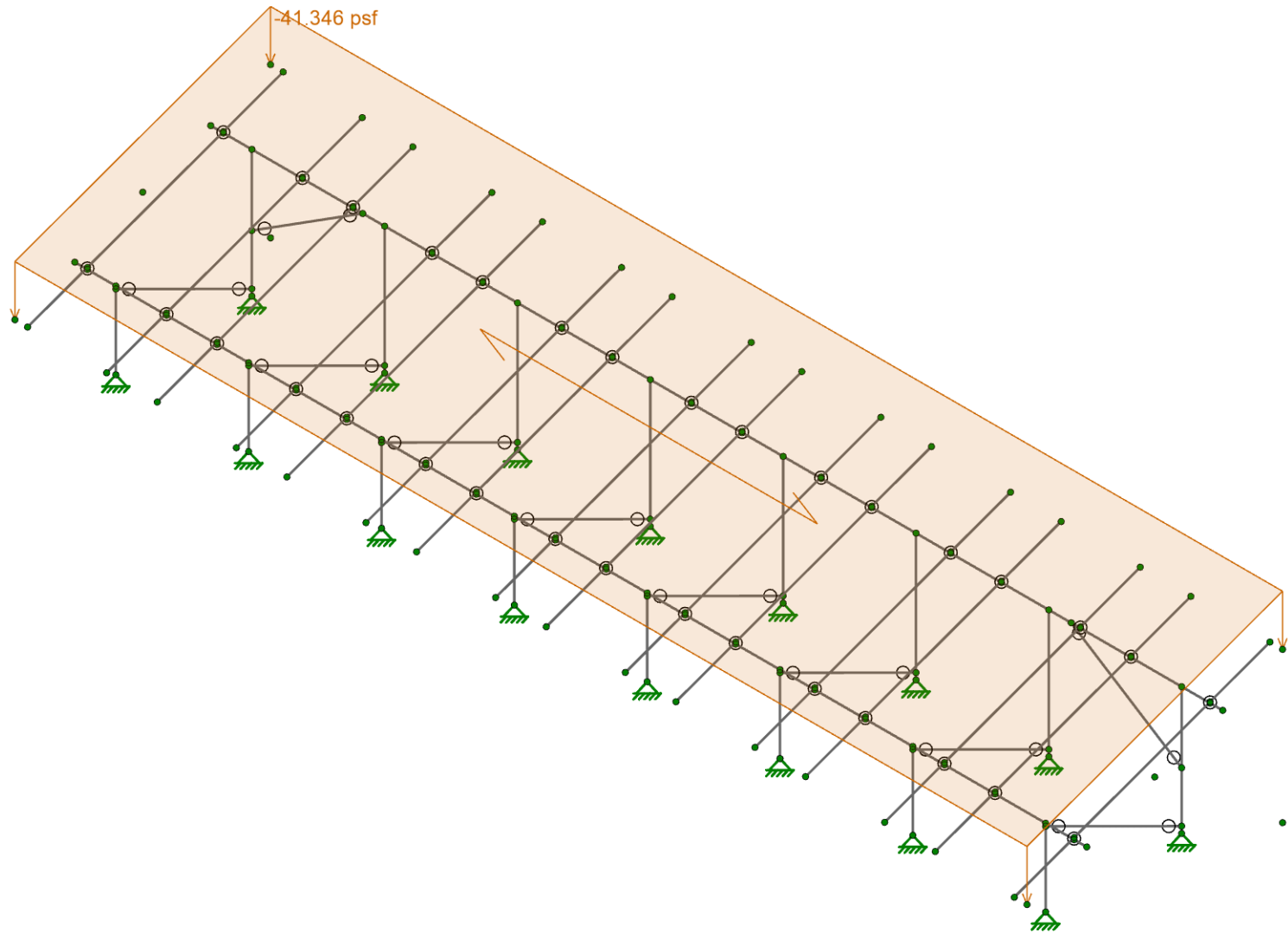
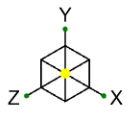
U2716.0342.221

Standard Panels - 20 Degree Tilt - 4L

SK-20

Jun 23, 2022

Sunmodo Sunturf A13 - SP - 20 - 4L.r3d



Loads: BLC 3, Roof Live/Snow

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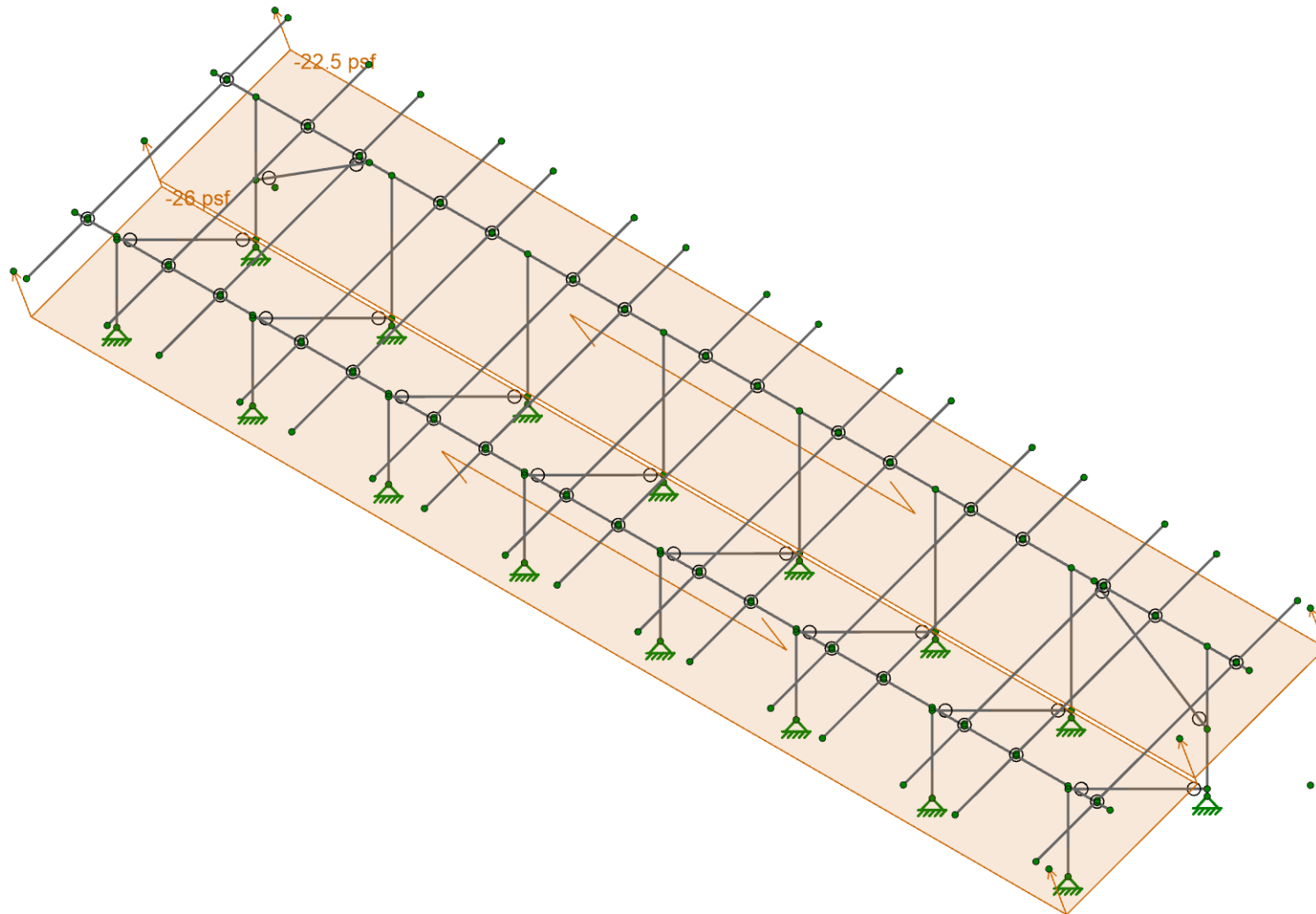
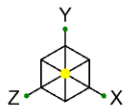
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Standard Panels - 20 Degree Tilt - 4L

SK-21

Jun 23, 2022

Sunmodo Sunturf A13 - SP - 20 - 4L.r3d



Loads: BLC 4, Wind 1: 0 Case A

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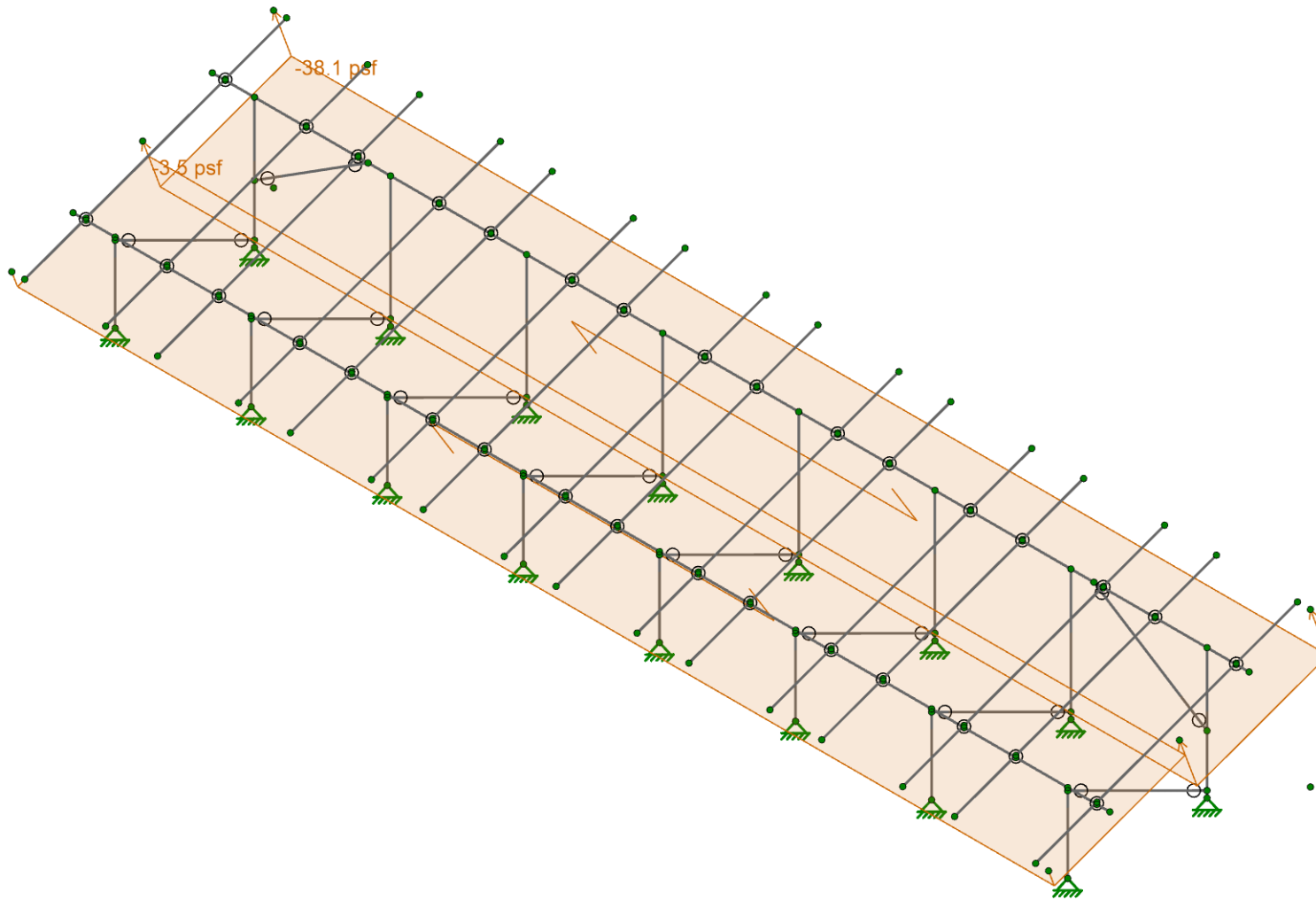
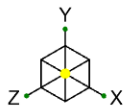
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Standard Panels - 20 Degree Tilt - 4L

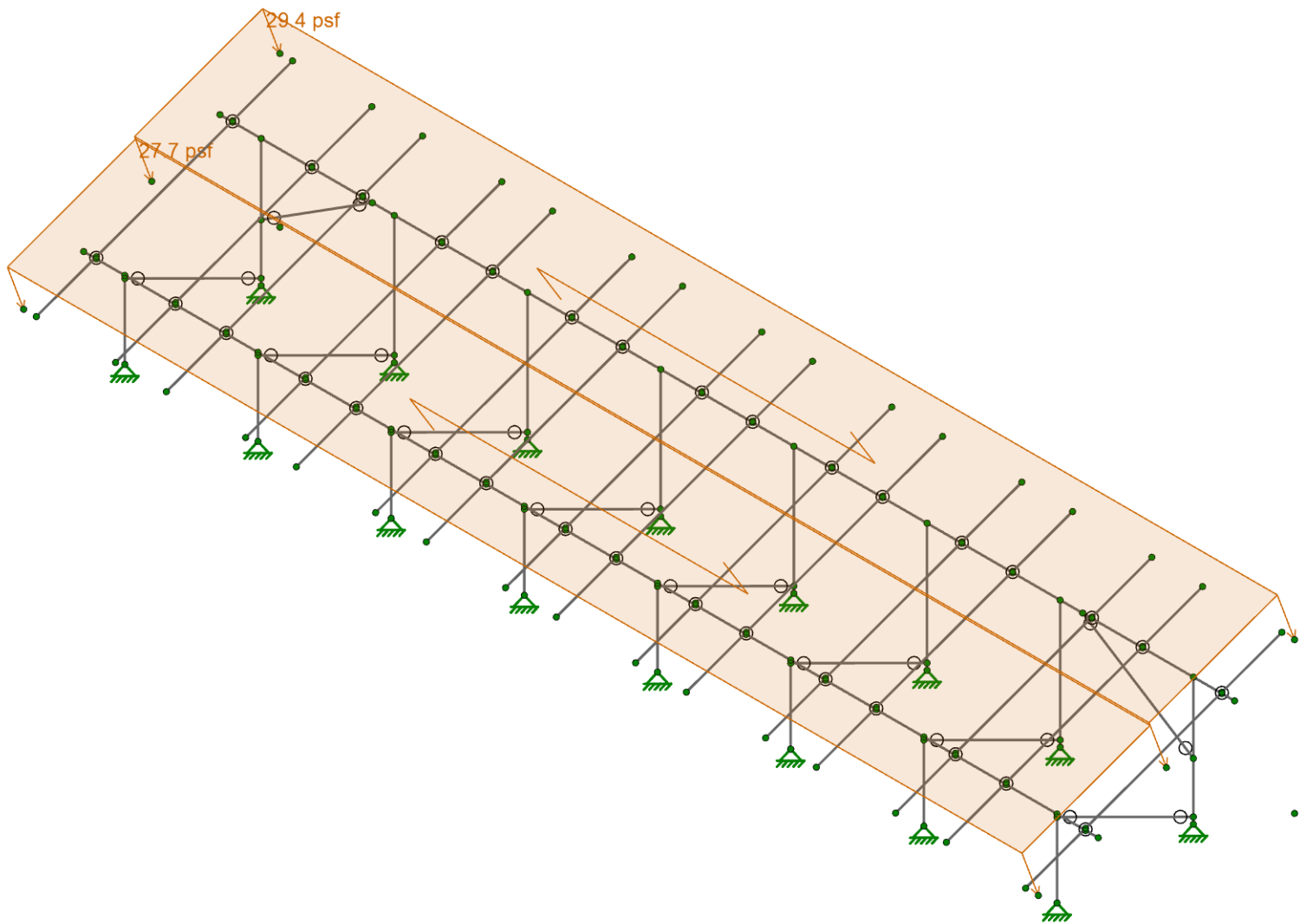
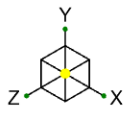
SK-22

Jun 23, 2022

Sunmodo Sunturf A13 - SP - 20 - 4L.r3d



Loads: BLC 5, Wind 2: 0 Case B		
Vector Structural Engineering	Standard Panels - 20 Degree Tilt - 4L	SK-23
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Loads: BLC 6, Wind 3: 180 Case A

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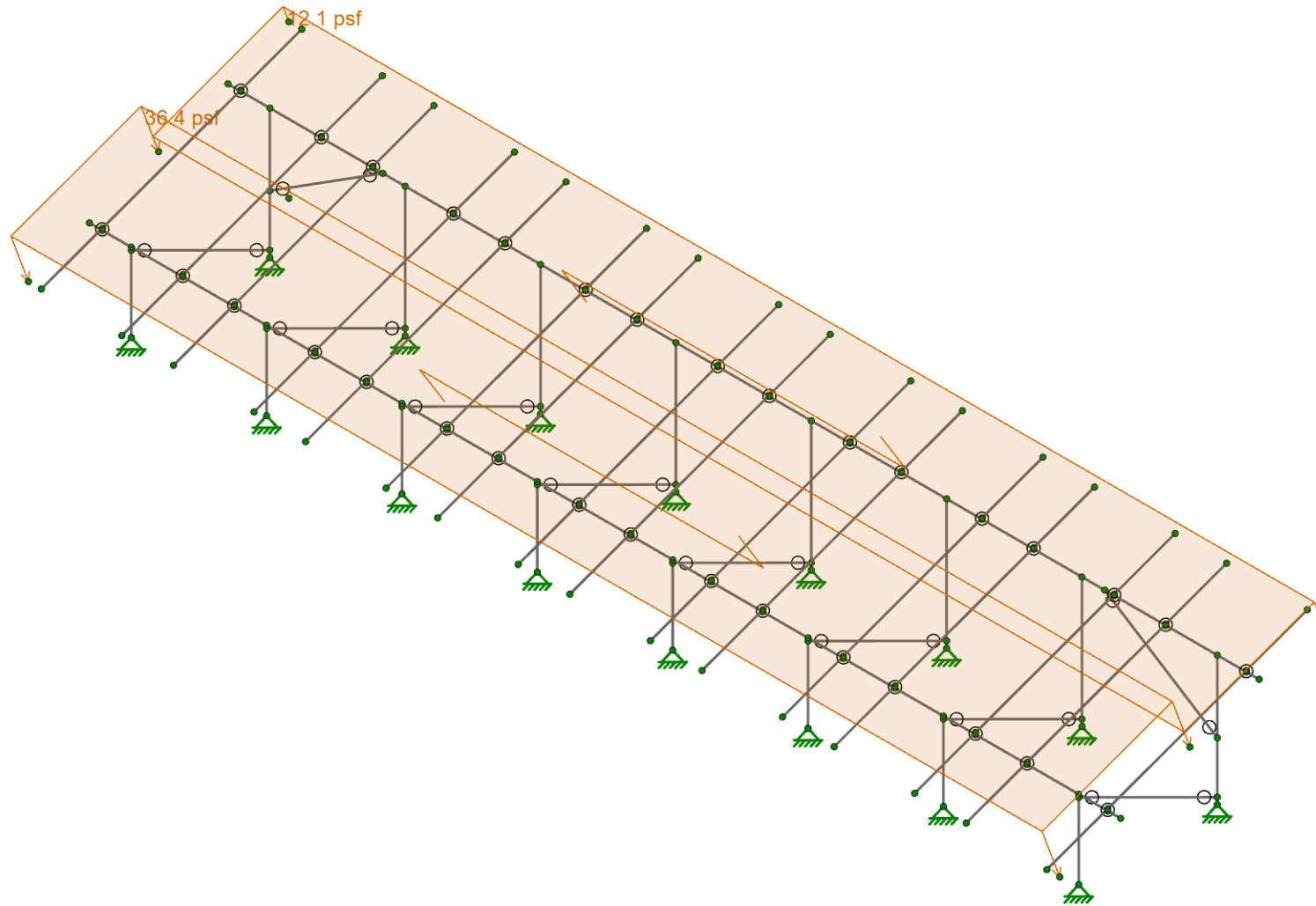
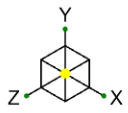
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Standard Panels - 20 Degree Tilt - 4L

SK-24

Jun 23, 2022

Sunmodo Sunturf A13 - SP - 20 - 4L.r3d



Loads: BLC 7, Wind 4: 180 Case B

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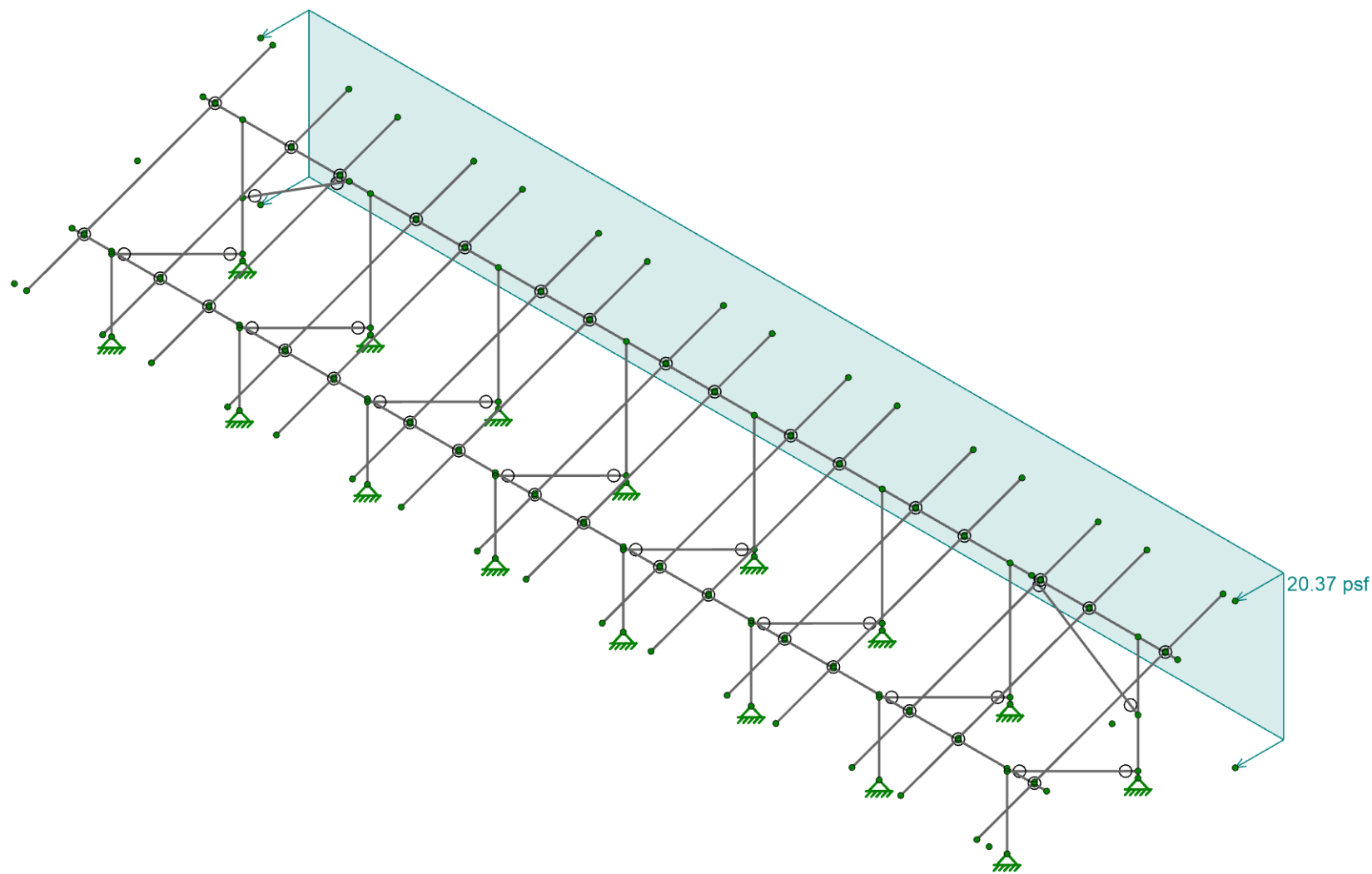
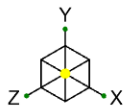
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Standard Panels - 20 Degree Tilt - 4L

SK-25

Jun 23, 2022

Sunmodo Sunturf A13 - SP - 20 - 4L.r3d



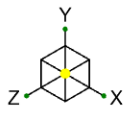
Loads: BLC 8, Wind Z

Vector Structural Engineering  
LKN  
U2716.0342.221

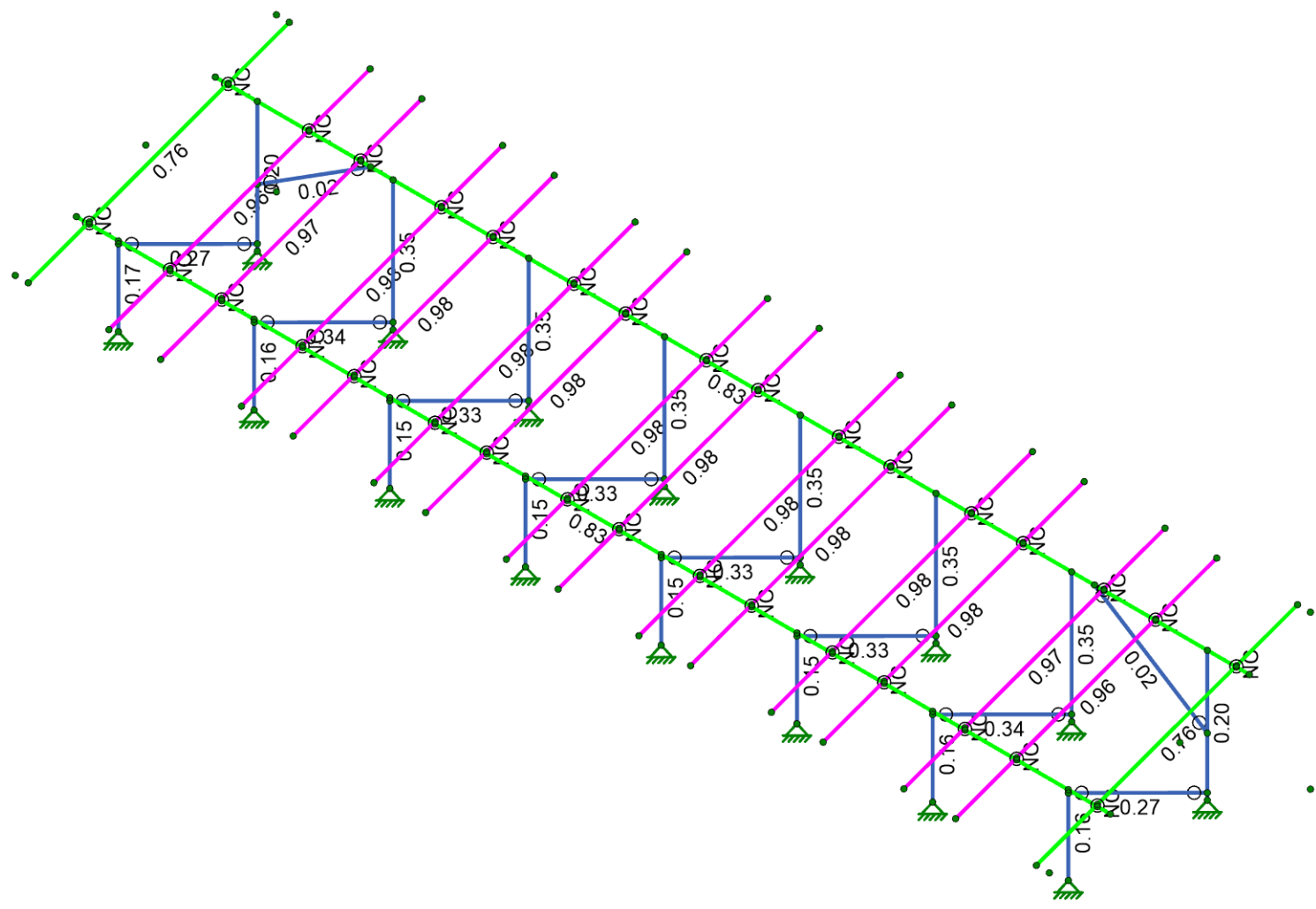
Standard Panels - 20 Degree Tilt - 4L

SK-26  
Jun 23, 2022  
Sunmodo Sunturf A13 - SP - 20 - 4L.r3d

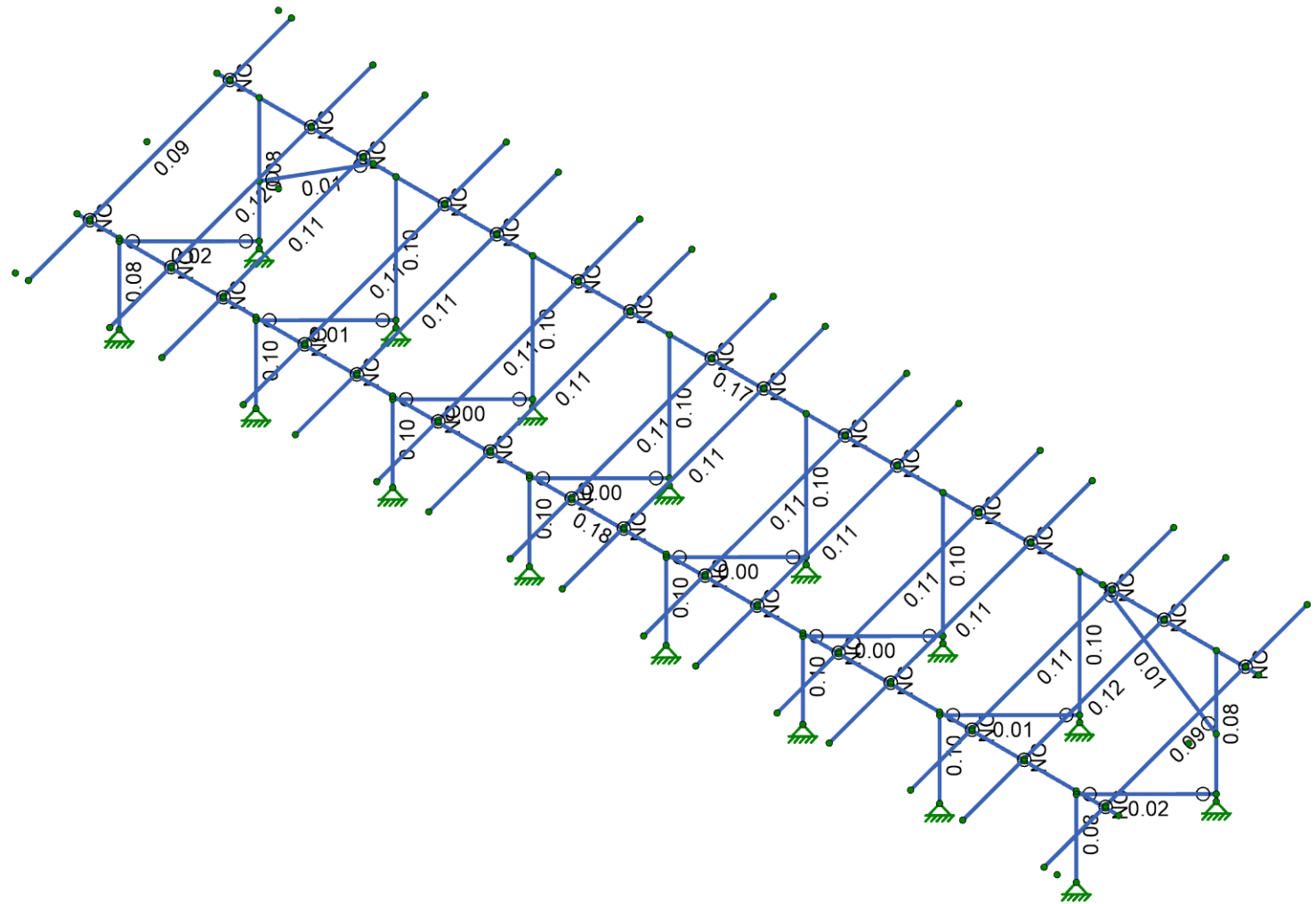
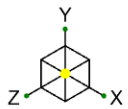




Code Check (Env)	
Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-90
Cyan	.50-75
Blue	0.-.50



Member Code Checks Displayed (Enveloped)		
Vector Structural Engineering	Standard Panels - 20 Degree Tilt - 4L	SK-11
LKN		Jul 07, 2022
U2716.0342.221		Sunmodo Sunturf A13 - SP - 20 - 4L.r3d



Shear Check (Env)

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

Member Shear Checks Displayed (Enveloped)		
Vector Structural Engineering	Standard Panels - 20 Degree Tilt - 4L	SK-12
LKN		Jul 07, 2022
U2716.0342.221		Sunmodo Sunturf A13 - SP - 20 - 4L.r3d

### Model Settings

#### Solution Members

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

#### Wall Panels

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

#### Processor Core Utilization

Single	No
Multiple (Optimum)	Yes
Maximum	No

#### Axis

##### Vertical Global Axis

Global Axis corresponding to vertical direction	Y
Convert Existing Data	Yes

#### Default Member Orientation

Default Global Plane for z-axis	XZ
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#### Plate Axis

Plate Local Axis Orientation	Nodal
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#### Codes

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

#### Concrete

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

**Model Settings (Continued)**

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

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

Shear Reinforcement

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

Seismic

RISA-3D Seismic Load Options

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

Site Parameters

$S_1$ (g)	1
$SD_1$ (g)	1
$SD_s$ (g)	1
$T_L$ (sec)	5

Structure Characteristics

T Z (sec)	
T X (sec)	
C <sub>1</sub> X	0.02
C <sub>1</sub> Exp. Z	0.75
C <sub>1</sub> Exp. X	0.75
R Z	3
R X	3
$\Omega_n$ Z	1
$\Omega_n$ X	1
C <sub>2</sub> Z	4
C <sub>2</sub> X	4
$\rho$ Z	1
$\rho$ X	1

**Hot Rolled Steel Properties**

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

**Aluminum Properties**

	Label	E [ksj]	G [ksj]	Nu	Therm. Coeff. [1e <sup>5</sup> F <sup>-1</sup> ]	Density [k/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	0.173	Table B.4-1	1	19000	16000	13000	12000	141
2	6061-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	38000	35000	35000	24000	141
3	6063-T5	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	22000	16000	16000	13000	141
4	6063-T6	10100	3787.5	0.33	1.3	0.173	Table B.4-2	1	30000	25000	25000	19000	141
5	5052-H34	10200	3787.5	0.33	1.3	0.173	Table B.4-1	1	34000	26000	24000	20000	141
6	6061-T6 W	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	24000	15000	15000	15000	141
7	6005-T5	10100	3787.5	0.33	1.3	0.173	Table B.4-1	1	38000	35000	35000	24000	141

**Hot Rolled Steel Section Sets**

	Label	Shape	Type	Design List	Material	Design Rule	Area [in <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	Longitudinal	0.776	0.499	0.499	0.998
2	Cross Beam	PIPE2.5A21168	Beam	Wide Flange	A572 Gr.50	Longitudinal	0.947	0.907	0.907	1.814
3	Diagonal Brace	1.5X1.5X0.083	HBrace	SquareTube	A572 Gr.50	Longitudinal	0.47	0.158	0.158	0.236

**Aluminum Section Sets**

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

**Basic Load Cases**

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

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

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

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N199	N196	PY	A-B	-44

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	-22.5
2	N119B	N120B	N199	N196	Perp	A-B	-26

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	-38.1
2	N119B	N120B	N199	N196	Perp	A-B	-3.5

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	29.4
2	N119B	N120B	N199	N196	Perp	A-B	27.7

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	12.1
2	N119B	N120B	N199	N196	Perp	A-B	36.4

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N200	N166	N165	N197	Z	Open Structure	20.37

**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			OL1	0.6	WLZ	0.6
5	1.0 D + 0.6 W2	Yes	Y	DL	1			OL2	0.6	WLZ	0.6
6	1.0 D + 0.6 W3	Yes	Y	DL	1			OL3	0.6	WLZ	-0.6
7	1.0 D + 0.6 W4	Yes	Y	DL	1			OL4	0.6	WLZ	-0.6
8	1.0 D + 0.45 W1 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL1	0.45	WLZ	0.6
9	1.0 D + 0.45 W2 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL2	0.45	WLZ	0.6
10	1.0 D + 0.45 W3 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL3	0.45	WLZ	-0.6
11	1.0 D + 0.45 W4 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL4	0.45	WLZ	-0.6
12	0.6 D + 0.6 W1	Yes	Y	DL	0.6			OL1	0.6	WLZ	0.6
13	0.6 D + 0.6 W2	Yes	Y	DL	0.6			OL2	0.6	WLZ	0.6

**Load Combinations (Continued)**

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
14	0.6 D + 0.6 W3	Yes	Y	DL	0.6			OL3	0.6	WLZ	-0.6
15	0.6 D + 0.6 W4	Yes	Y	DL	0.6			OL4	0.6	WLZ	-0.6
16			Y								
17	LRFD Loads		Y								
18	1.4 D		Y	DL	1.4						
19	1.2 D + 1.6 S + 0.5 W1		Y	DL	1.2	RLL	1.6	OL1	0.5	WLZ	0.5
20	1.2 D + 1.6 S + 0.5 W2		Y	DL	1.2	RLL	1.6	OL2	0.5	WLZ	0.5
21	1.2 D + 1.6 S + 0.5 W3		Y	DL	1.2	RLL	1.6	OL3	0.5	WLZ	-0.5
22	1.2 D + 1.6 S + 0.5 W4		Y	DL	1.2	RLL	1.6	OL4	0.5	WLZ	-0.5
23	1.2 D + 1.0 W1		Y	DL	1.2			OL1	1	WLZ	1
24	1.2 D + 1.0 W2		Y	DL	1.2			OL2	1	WLZ	1
25	1.2 D + 1.0 W3		Y	DL	1.2			OL3	1	WLZ	-1
26	1.2 D + 1.0 W4		Y	DL	1.2			OL4	1	WLZ	-1
27	0.9 D + 1.0 W1		Y	DL	0.9			OL1	1	WLZ	1
28	0.9 D + 1.0 W2		Y	DL	0.9			OL2	1	WLZ	1
29	0.9 D + 1.0 W3		Y	DL	0.9			OL3	1	WLZ	-1
30	0.9 D + 1.0 W4		Y	DL	0.9			OL4	1	WLZ	-1

**Envelope Node Reactions**

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2	max	30.739	11	1779.797	3	29.553	4	0	15	0	15	0	15
2		min	-7.266	12	-152.882	12	-35.39	6	0	2	0	2	0	2
3	N1	max	36.887	10	2230.462	10	542.128	6	0	15	0	15	0	15
4		min	-21.048	13	-1076.493	13	-466.155	12	0	2	0	2	0	2
5	N115	max	2.335	10	2769.461	10	681.212	6	0	15	0	15	0	15
6		min	-1.249	13	-1342.15	13	-586.22	4	0	2	0	2	0	2
7	N116	max	4.898	11	2265.195	3	34.37	4	0	15	0	15	0	15
8		min	-0.703	12	-194.808	12	-41.446	6	0	2	0	2	0	2
9	N99	max	3.956	13	2832.456	10	702.483	6	0	15	0	15	0	15
10		min	-9.361	10	-1365.901	13	-604.821	4	0	2	0	2	0	2
11	N100	max	3.785	12	2339.913	3	33.61	4	0	15	0	15	0	15
12		min	-21.015	11	-196.103	12	-40.58	6	0	2	0	2	0	2
13	N105A	max	1.178	13	2769.387	10	681.212	6	0	15	0	15	0	15
14		min	-2.3	10	-1342.111	13	-586.221	4	0	2	0	2	0	2
15	N106A	max	0.681	12	2265.116	3	34.37	4	0	15	0	15	0	15
16		min	-4.803	11	-194.799	12	-41.446	6	0	2	0	2	0	2
17	N111A	max	0.555	13	2785.876	10	685.292	6	0	15	0	15	0	15
18		min	-1.269	10	-1349.504	13	-589.756	4	0	2	0	2	0	2
19	N112A	max	0.45	12	2277.967	3	34.544	4	0	15	0	15	0	15
20		min	-2.653	11	-195.318	12	-41.662	6	0	2	0	2	0	2
21	N117A	max	1.298	10	2785.812	10	685.28	6	0	15	0	15	0	15
22		min	-0.623	13	-1349.469	13	-589.747	4	0	2	0	2	0	2
23	N118A	max	2.743	11	2277.984	3	34.543	4	0	15	0	15	0	15
24		min	-0.472	12	-195.331	12	-41.662	6	0	2	0	2	0	2
25	N123	max	21.364	13	2231.4	10	542.191	6	0	15	0	15	0	15
26		min	-37.436	10	-1076.872	13	-466.187	12	0	2	0	2	0	2
27	N124	max	7.253	12	1779.395	3	29.554	4	0	15	0	15	0	15
28		min	-30.604	11	-152.787	12	-35.392	6	0	2	0	2	0	2
29	N168	max	21.073	11	2339.681	3	33.61	4	0	15	0	15	0	15
30		min	-3.807	12	-196.114	12	-40.58	6	0	2	0	2	0	2
31	N169	max	9.363	10	2831.62	10	702.457	6	0	15	0	15	0	15
32		min	-4.01	13	-1365.494	13	-604.806	4	0	2	0	2	0	2
33	Totals:	max	0.001	10	36171.431	10	4904.097	14						
34		min	0	13	-8509.276	12	-4229.573	12						

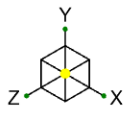
**Envelope AISC 15TH (360-16): ASD Member Steel Code Checks**

Member	Shape	Code Check	Loc[in]	Lc	Shear Check	Loc[in]	Dir	Lc	Pnc/om [lb]	Pnt/om [lb]	Mny/om [lb-ft]	Mnz/om [lb-ft]	Cb	Eqn
1	M13	PIPE2.5A21168	0.832	446.667	11	0.18	106.667	11	14032.946	28358.413	2081.747	2081.747	1	H1-1b
2	M14	PIPE2.5A21168	0.828	446.667	10	0.172	546.667	10	14032.946	28358.413	2081.747	2081.747	1	H1-1b
3	M48	PIPE2.0A21165	0.355	3.347	10	0.104	3.347	6	11156.045	23232.186	1397.505	1397.505	1	H1-1a
4	M81	PIPE2.0A21165	0.355	3.347	10	0.104	3.347	6	11156.045	23232.186	1397.505	1397.505	1	H1-1a
5	M54A	PIPE2.0A21165	0.349	3.347	10	0.101	3.347	6	11156.045	23232.186	1397.505	1397.505	1	H1-1a
6	M57A	PIPE2.0A21165	0.349	3.347	10	0.101	3.347	6	11156.045	23232.186	1397.505	1397.505	1	H1-1a
7	M57	PIPE2.0A21165	0.346	3.347	10	0.1	3.347	6	11156.045	23232.186	1397.505	1397.505	1	H1-1a
8	M51	PIPE2.0A21165	0.346	3.347	10	0.1	3.347	6	11156.045	23232.186	1397.505	1397.505	1	H1-1a
9	M49	1.5X1.5X0.083	0.34	50.06	6	0.009	96.115	y 3	2570.303	14085.15	624.421	624.421	1.136	H1-1a
10	M82	1.5X1.5X0.083	0.34	50.06	6	0.009	96.115	y 3	2570.303	14085.15	624.421	624.421	1.136	H1-1a
11	M55A	1.5X1.5X0.083	0.332	50.06	6	0.003	96.115	y 3	2570.303	14085.15	624.421	624.421	1.136	H1-1a
12	M58A	1.5X1.5X0.083	0.332	50.06	6	0.003	96.115	y 3	2570.303	14085.15	624.421	624.421	1.136	H1-1a
13	M52A	1.5X1.5X0.083	0.33	50.06	6	0.004	96.115	y 9	2570.303	14085.15	624.421	624.421	1.136	H1-1a
14	M58	1.5X1.5X0.083	0.33	50.06	6	0.004	96.115	y 9	2570.303	14085.15	624.421	624.421	1.136	H1-1a
15	M61	1.5X1.5X0.083	0.265	50.06	6	0.021	96.115	y 10	2570.303	14085.15	624.421	624.421	1.136	H1-1a
16	M92A	1.5X1.5X0.083	0.265	50.06	6	0.021	96.115	y 10	2570.303	14085.15	624.421	624.421	1.136	H1-1a
17	M60	PIPE2.0A21165	0.204	35.148	10	0.08	3.347	6	11156.045	23232.186	1397.505	1397.505	1	H1-1b
18	M6	PIPE2.0A21165	0.203	35.148	10	0.08	3.347	6	11156.045	23232.186	1397.505	1397.505	1	H1-1b
19	M5	PIPE2.0A21165	0.165	47.1	11	0.079	48.619	6	17758.825	23232.186	1397.505	1397.505	1	H1-1b
20	M59A	PIPE2.0A21165	0.165	47.1	11	0.079	48.619	6	17758.825	23232.186	1397.505	1397.505	1	H1-1b
21	M80	PIPE2.0A21165	0.164	47.1	11	0.102	48.619	6	17758.825	23232.186	1397.505	1397.505	1	H1-1b
22	M47	PIPE2.0A21165	0.164	47.1	11	0.102	48.619	6	17758.825	23232.186	1397.505	1397.505	1	H1-1b
23	M56A	PIPE2.0A21165	0.147	47.1	10	0.099	48.619	6	17758.825	23232.186	1397.505	1397.505	1	H1-1b
24	M53A	PIPE2.0A21165	0.147	47.1	10	0.099	48.619	6	17758.825	23232.186	1397.505	1397.505	1	H1-1b
25	M56	PIPE2.0A21165	0.147	47.1	10	0.098	48.619	6	17758.825	23232.186	1397.505	1397.505	1	H1-1b
26	M50	PIPE2.0A21165	0.147	47.1	10	0.098	48.619	6	17758.825	23232.186	1397.505	1397.505	1	H1-1b
27	M59	1.5X1.5X0.083	0.024	42.255	10	0.012	82.786	y 6	3464.57	14085.15	624.421	624.421	1.136	H1-1b
28	M19	1.5X1.5X0.083	0.024	42.363	10	0.012	82.997	y 6	3446.999	14085.15	624.421	624.421	1.136	H1-1b

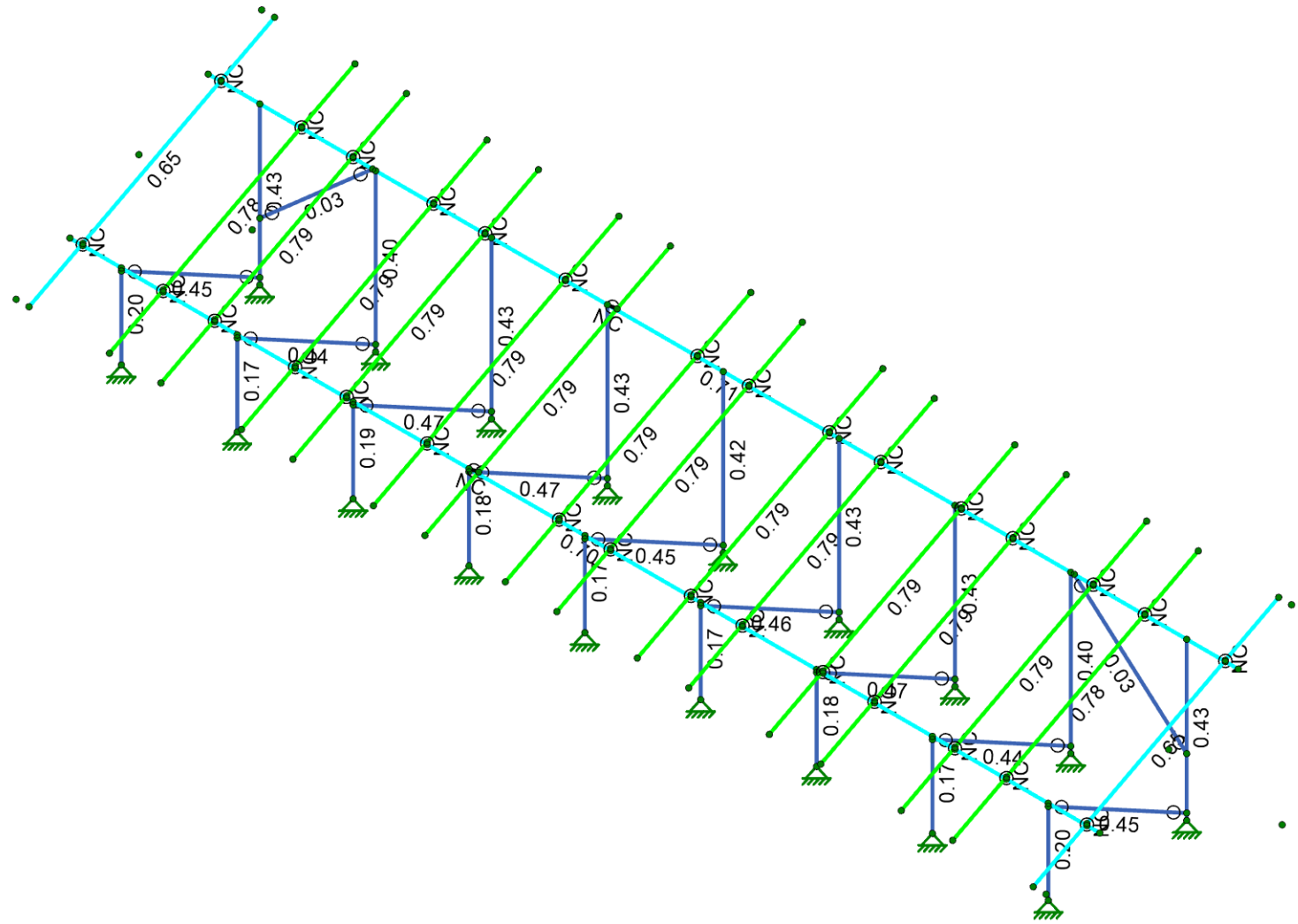
**Envelope AA ADM1-15: ASD - BUILDING Member Aluminum Code Checks**

Member	Shape	Code Check	Loc[in]	Lc	Shear Check	Loc[in]	Dir	Lc	Pnc/om [lb]	Pnt/om [lb]	Mny/om [lb-ft]	Mnz/om [lb-ft]	Vny/om [lb]	Vnz/om [lb]	Cb	Eqn
1	M37	HR300	0.98	41.208	11	0.112	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
2	M43	HR300	0.98	41.208	11	0.113	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
3	M52	HR300	0.979	41.208	11	0.112	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
4	M49A	HR300	0.979	41.208	11	0.113	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
5	M46	HR300	0.979	41.208	11	0.113	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
6	M40	HR300	0.979	41.208	11	0.113	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
7	M31	HR300	0.979	41.208	11	0.112	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
8	M70	HR300	0.978	41.208	11	0.112	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
9	M55	HR300	0.978	41.208	11	0.113	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
10	M34	HR300	0.978	41.208	11	0.113	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
11	M73	HR300	0.974	41.208	11	0.114	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
12	M28	HR300	0.974	41.208	11	0.114	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.248	H.1-1
13	M25	HR300	0.959	41.208	11	0.117	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	2.926	H.1-1
14	M76	HR300	0.958	41.208	11	0.117	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	2.928	H.1-1
15	M16	HR300	0.756	41.208	11	0.088	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.143	H.1-1
16	M79	HR300	0.756	41.208	11	0.088	41.208	y 11	4454.908	14429.594	560.36	934.132	5656.689	2605.145	3.142	H.1-1





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	Standard Panels - 27.5 Degree Tilt - 4L & 2P	SK-13
LKN		Jul 07, 2022
U2716.0342.221		Sunmodo Sunturf A13 - SP - 27.5 - 4L.r3d



**Basic Load Cases**

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

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

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

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N199	N196	PY	A-B	-37

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	-29.4
2	N119B	N120B	N199	N196	Perp	A-B	-29.4

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	-43.3
2	N119B	N120B	N199	N196	Perp	A-B	-6.9

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	34.6
2	N119B	N120B	N199	N196	Perp	A-B	34.6

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197	N200	N120B	N119B	Perp	A-B	15.6
2	N119B	N120B	N199	N196	Perp	A-B	43.3

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N200	N166	N165	N197	Z	Open Structure	20.37

**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			OL1	0.6	WLZ	0.6
5	1.0 D + 0.6 W2	Yes	Y	DL	1			OL2	0.6	WLZ	0.6
6	1.0 D + 0.6 W3	Yes	Y	DL	1			OL3	0.6	WLZ	-0.6
7	1.0 D + 0.6 W4	Yes	Y	DL	1			OL4	0.6	WLZ	-0.6
8	1.0 D + 0.45 W1 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL1	0.45	WLZ	0.6
9	1.0 D + 0.45 W2 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL2	0.45	WLZ	0.6
10	1.0 D + 0.45 W3 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL3	0.45	WLZ	-0.6
11	1.0 D + 0.45 W4 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL4	0.45	WLZ	-0.6
12	0.6 D + 0.6 W1	Yes	Y	DL	0.6			OL1	0.6	WLZ	0.6
13	0.6 D + 0.6 W2	Yes	Y	DL	0.6			OL2	0.6	WLZ	0.6
14	0.6 D + 0.6 W3	Yes	Y	DL	0.6			OL3	0.6	WLZ	-0.6
15	0.6 D + 0.6 W4	Yes	Y	DL	0.6			OL4	0.6	WLZ	-0.6
16			Y								
17	LRFD Loads		Y								
18	1.4 D		Y	DL	1.4						
19	1.2 D + 1.6 S + 0.5 W1		Y	DL	1.2	RLL	1.6	OL1	0.5	WLZ	0.5
20	1.2 D + 1.6 S + 0.5 W2		Y	DL	1.2	RLL	1.6	OL2	0.5	WLZ	0.5
21	1.2 D + 1.6 S + 0.5 W3		Y	DL	1.2	RLL	1.6	OL3	0.5	WLZ	-0.5
22	1.2 D + 1.6 S + 0.5 W4		Y	DL	1.2	RLL	1.6	OL4	0.5	WLZ	-0.5
23	1.2 D + 1.0 W1		Y	DL	1.2			OL1	1	WLZ	1
24	1.2 D + 1.0 W2		Y	DL	1.2			OL2	1	WLZ	1
25	1.2 D + 1.0 W3		Y	DL	1.2			OL3	1	WLZ	-1
26	1.2 D + 1.0 W4		Y	DL	1.2			OL4	1	WLZ	-1
27	0.9 D + 1.0 W1		Y	DL	0.9			OL1	1	WLZ	1
28	0.9 D + 1.0 W2		Y	DL	0.9			OL2	1	WLZ	1
29	0.9 D + 1.0 W3		Y	DL	0.9			OL3	1	WLZ	-1
30	0.9 D + 1.0 W4		Y	DL	0.9			OL4	1	WLZ	-1

**Envelope Node Reactions**

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2	max	11.585	12	1541.783	9	42.334	4	0	15	0	15	0	15
2		min	-36.623	11	93.729	12	-50.111	6	0	2	0	2	0	2
3	N1	max	19.679	10	2436.897	10	911.116	6	0	15	0	15	0	15
4		min	-12.394	13	-1488.464	13	-780.672	12	0	2	0	2	0	2
5	N115	max	9.027	10	2463.061	10	942.613	6	0	15	0	15	0	15
6		min	-4.977	13	-1526.031	13	-809.381	4	0	2	0	2	0	2
7	N116	max	23.517	11	1628.435	9	44.626	4	0	15	0	15	0	15
8		min	-5.169	12	104.417	12	-52.844	6	0	2	0	2	0	2
9	N99	max	5.038	13	2453.411	10	937.53	6	0	15	0	15	0	15
10		min	-9.276	10	-1523.295	13	-804.304	12	0	2	0	2	0	2
11	N100	max	5.51	12	1624.114	9	44.19	4	0	15	0	15	0	15
12		min	-25.105	11	102.627	12	-52.68	6	0	2	0	2	0	2
13	N105A	max	0.3	14	2458.72	10	937.391	6	0	15	0	15	0	15
14		min	-1	9	-1511.531	13	-803.497	4	0	2	0	2	0	2
15	N106A	max	3.544	12	1623.837	9	48.132	13	0	15	0	15	0	15

**Envelope Node Reactions (Continued)**

Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC	
16		min	-5.934	10	96.943	12	-51.858	6	0	2	0	2	0	2
17	N111A	max	0.46	10	2410.156	10	913.03	6	0	15	0	15	0	15
18		min	-0.28	13	-1476.389	13	-783.352	4	0	2	0	2	0	2
19	N112A	max	1.012	11	1587.593	3	42.577	4	0	15	0	15	0	15
20		min	-0.34	12	80.581	12	-50.827	6	0	2	0	2	0	2
21	N117A	max	2.091	3	2440.821	10	931.188	6	0	15	0	15	0	15
22		min	-0.391	13	-1508.256	13	-798.901	4	0	2	0	2	0	2
23	N118A	max	8.325	10	1617.239	9	44.095	4	0	15	0	15	0	15
24		min	-4.198	12	95.228	12	-52.292	6	0	2	0	2	0	2
25	N123	max	11.928	13	2439.94	10	911.125	6	0	15	0	15	0	15
26		min	-21.064	10	-1487.86	13	-780.666	12	0	2	0	2	0	2
27	N124	max	35.943	11	1542.183	9	42.363	4	0	15	0	15	0	15
28		min	-11.494	12	93.551	12	-50.119	6	0	2	0	2	0	2
29	N168	max	13.705	9	1557.894	9	43.024	4	0	15	0	15	0	15
30		min	0.401	14	86.635	12	-51.2	6	0	2	0	2	0	2
31	N169	max	5.869	10	2280.673	10	886.058	14	0	15	0	15	0	15
32		min	-4.024	13	-1402.488	13	-760.238	4	0	2	0	2	0	2
33	N175	max	3.915	13	2285.072	10	886.985	14	0	15	0	15	0	15
34		min	-5.756	10	-1404.132	13	-761.045	4	0	2	0	2	0	2
35	N182	max	-0.653	14	1560.171	9	42.919	4	0	15	0	15	0	15
36		min	-14.119	9	86.847	12	-51.163	6	0	2	0	2	0	2
37	Totals:	max	0.003	11	32702.901	10	7793.413	14						
38		min	-0.001	12	-9963.854	12	-6692.153	12						

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

Member	Shape	Code Check	Loc[in]	LC	Shear Check	Loc[in]	Dir	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn	
1	M14	PIPE2.5A21168	0.712	33.333	10	0.193	173.333	10	14032.946	28358.413	2081.747	2081.747	1	H1-1b	
2	M13	PIPE2.5A21168	0.695	606.667	11	0.207	173.333	11	14032.946	28358.413	2081.747	2081.747	1	H1-1b	
3	M58	1.5X1.5X0.083	0.469	50.927	6	0.01	97.78	y	3	2483.478	14085.15	624.421	624.421	1.136	H1-1a
4	M49	1.5X1.5X0.083	0.466	50.927	6	0.011	97.78	y	3	2483.478	14085.15	624.421	624.421	1.136	H1-1a
5	M52A	1.5X1.5X0.083	0.466	50.927	6	0.005	97.78	y	10	2483.478	14085.15	624.421	624.421	1.136	H1-1a
6	M58A	1.5X1.5X0.083	0.463	50.927	6	0.006	97.78	y	10	2483.478	14085.15	624.421	624.421	1.136	H1-1a
7	M55A	1.5X1.5X0.083	0.454	50.927	6	0.002	97.78	y	10	2483.478	14085.15	624.421	624.421	1.136	H1-1a
8	M61	1.5X1.5X0.083	0.454	50.927	6	0.008	97.78	y	11	2483.478	14085.15	624.421	624.421	1.136	H1-1a
9	M92A	1.5X1.5X0.083	0.454	50.927	6	0.008	97.78	y	11	2483.478	14085.15	624.421	624.421	1.136	H1-1a
10	M85	1.5X1.5X0.083	0.442	50.927	6	0.007	97.78	y	9	2483.478	14085.15	624.421	624.421	1.136	H1-1a
11	M82	1.5X1.5X0.083	0.441	50.927	6	0.007	97.78	y	9	2483.478	14085.15	624.421	624.421	1.136	H1-1a
12	M57	PIPE2.0A21165	0.434	3.045	10	0.14	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
13	M51	PIPE2.0A21165	0.433	3.045	10	0.139	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
14	M48	PIPE2.0A21165	0.433	3.045	10	0.139	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
15	M60	PIPE2.0A21165	0.43	3.045	10	0.136	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
16	M6	PIPE2.0A21165	0.43	3.045	10	0.136	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
17	M57A	PIPE2.0A21165	0.43	3.045	10	0.138	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
18	M54A	PIPE2.0A21165	0.424	3.045	10	0.136	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
19	M89	PIPE2.0A21165	0.403	3.045	10	0.132	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
20	M81	PIPE2.0A21165	0.402	3.045	10	0.131	3.045		6	7901.229	23232.186	1397.505	1397.505	1	H1-1a
21	M5	PIPE2.0A21165	0.202	50.597	11	0.131	52.23		6	17038.876	23232.186	1397.505	1397.505	1	H1-1b
22	M59A	PIPE2.0A21165	0.199	50.597	11	0.131	52.23		6	17038.876	23232.186	1397.505	1397.505	1	H1-1b
23	M47	PIPE2.0A21165	0.19	50.597	10	0.135	52.23		6	17038.876	23232.186	1397.505	1397.505	1	H1-1b
24	M56	PIPE2.0A21165	0.184	50.597	10	0.135	52.23		6	17038.876	23232.186	1397.505	1397.505	1	H1-1b
25	M50	PIPE2.0A21165	0.181	50.597	10	0.135	52.23		6	17038.876	23232.186	1397.505	1397.505	1	H1-1b
26	M56A	PIPE2.0A21165	0.175	50.597	6	0.134	52.23		6	17038.876	23232.186	1397.505	1397.505	1	H1-1b
27	M80	PIPE2.0A21165	0.17	50.597	6	0.126	52.23		14	17038.876	23232.186	1397.505	1397.505	1	H1-1b
28	M88	PIPE2.0A21165	0.17	50.597	6	0.127	52.23		14	17038.876	23232.186	1397.505	1397.505	1	H1-1b
29	M53A	PIPE2.0A21165	0.169	50.597	6	0.13	52.23		6	17038.876	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		
30	M59	1.5X1.5X0.083	0.035	93.089	10	0.031	93.089	y 6	2740.095	14085.15	624.421	624.421	1.136	H1-1b*
31	M19	1.5X1.5X0.083	0.034	93.277	10	0.031	93.277	y 6	2729.093	14085.15	624.421	624.421	1.136	H1-1b*

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

Member	Shape	Code Check	Loc[in]	LC Shear Check	Loc[in]	Dir	LC Pnc/Om[lb]	Pnt/Om[lb]	Mny/Om[lb-ft]	Mnz/Om[lb-ft]	Vny/Om[lb]	Vnz/Om[lb]	Cb	Eqn		
1	M34	HR300	0.794	37.625	11	0.103	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
2	M55	HR300	0.794	37.625	11	0.104	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
3	M73	HR300	0.794	37.625	11	0.104	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
4	M28	HR300	0.794	37.625	11	0.104	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
5	M46	HR300	0.793	37.625	11	0.103	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
6	M37	HR300	0.793	37.625	11	0.102	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
7	M52	HR300	0.793	37.625	11	0.102	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
8	M43	HR300	0.793	37.625	11	0.103	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
9	M49A	HR300	0.793	37.625	11	0.102	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
10	M31	HR300	0.793	37.625	11	0.102	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
11	M70	HR300	0.793	37.625	11	0.102	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
12	M40	HR300	0.793	37.625	11	0.101	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.452	H.1-1
13	M25	HR300	0.781	37.625	11	0.109	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.473	H.1-1
14	M76	HR300	0.781	37.625	11	0.109	39.417	y 11	7923.859	14429.594	560.36	934.132	5656.689	2605.145	2.473	H.1-1
15	M79	HR300	0.647	134.375	10	0.088	39.417	y 11	3969.401	14429.594	560.36	934.132	5656.689	2605.145	1.909	H.1-1
16	M16	HR300	0.646	134.375	10	0.088	39.417	y 11	3969.401	14429.594	560.36	934.132	5656.689	2605.145	1.91	H.1-1







**Basic Load Cases**

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

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197_1	N200_1	N199_1	N196_1	Y	A-B	-3

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197_1	N200_1	N199_1	N196_1	PY	A-B	-31

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197_1	N200_1	N120B_1	N119B_1	Perp	A-B	-31.2
2	N119B_1	N120B_1	N199_1	N196_1	Perp	A-B	-31.2

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197_1	N200_1	N120B_1	N119B_1	Perp	A-B	-41.5
2	N119B_1	N120B_1	N199_1	N196_1	Perp	A-B	-10.4

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197_1	N200_1	N120B_1	N119B_1	Perp	A-B	36.4
2	N119B_1	N120B_1	N199_1	N196_1	Perp	A-B	36.4

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N197_1	N200_1	N120B_1	N119B_1	Perp	A-B	19
2	N119B_1	N120B_1	N199_1	N196_1	Perp	A-B	46.7

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

	Node A	Node B	Node C	Node D	Direction	Load Direction	Magnitude [psf]
1	N200 1	N166 1	N165 1	N197 1	Z	Open Structure	20.37

**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	0.6
9	1.0 D + 0.45 W2 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL2	0.45	WLZ	0.6
10	1.0 D + 0.45 W3 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL3	0.45	WLZ	-0.6
11	1.0 D + 0.45 W4 + 0.75 S	Yes	Y	DL	1	RLL	0.75	OL4	0.45	WLZ	-0.6
12	0.6 D + 0.6 W1	Yes	Y	DL	0.6	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					
19	1.2 D + 1.6 S + 0.5 W1		Y	DL	1.2	RLL	1.6	OL1	0.5	WLZ	0.5
20	1.2 D + 1.6 S + 0.5 W2		Y	DL	1.2	RLL	1.6	OL2	0.5	WLZ	0.5
21	1.2 D + 1.6 S + 0.5 W3		Y	DL	1.2	RLL	1.6	OL3	0.5	WLZ	-0.5
22	1.2 D + 1.6 S + 0.5 W4		Y	DL	1.2	RLL	1.6	OL4	0.5	WLZ	-0.5
23	1.2 D + 1.0 W1		Y	DL	1.2	RLL		OL1	1	WLZ	1
24	1.2 D + 1.0 W2		Y	DL	1.2	RLL		OL2	1	WLZ	1
25	1.2 D + 1.0 W3		Y	DL	1.2	RLL		OL3	1	WLZ	-1
26	1.2 D + 1.0 W4		Y	DL	1.2	RLL		OL4	1	WLZ	-1
27	0.9 D + 1.0 W1		Y	DL	0.9	RLL		OL1	1	WLZ	1
28	0.9 D + 1.0 W2		Y	DL	0.9	RLL		OL2	1	WLZ	1
29	0.9 D + 1.0 W3		Y	DL	0.9	RLL		OL3	1	WLZ	-1
30	0.9 D + 1.0 W4		Y	DL	0.9	RLL		OL4	1	WLZ	-1

**Envelope Node Reactions**

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N2 1	max	10.069	12	1459.638	9	149.163	4	0	15	0	15	0	15
2		min	-30.188	11	-241.579	14	-172.587	6	0	2	0	2	0	2
3	N1 1	max	17.565	10	2449.074	10	1279.963	6	0	15	0	15	0	15
4		min	-11.62	13	-1623.281	13	-1109.364	12	0	2	0	2	0	2
5	N115 1	max	6.201	10	2474.598	10	1322.283	6	0	15	0	15	0	15
6		min	-3.743	13	-1669.229	13	-1146.518	4	0	2	0	2	0	2
7	N116 1	max	17.848	11	1544.138	9	154.331	4	0	15	0	15	0	15
8		min	-2.93	12	-258.246	14	-179.294	6	0	2	0	2	0	2
9	N99 1	max	3.921	13	2467.816	10	1317.802	6	0	15	0	15	0	15
10		min	-6.38	10	-1660.784	13	-1138.849	12	0	2	0	2	0	2
11	N100 1	max	2.575	12	1530.506	9	152.569	4	0	15	0	15	0	15
12		min	-18.566	11	-252.956	14	-178.95	6	0	2	0	2	0	2
13	N105A 1	max	0.86	14	2471.655	10	1318.515	6	0	15	0	15	0	15
14		min	-0.979	9	-1662.48	13	-1137.827	4	0	2	0	2	0	2
15	N106A 1	max	5.554	12	1552.513	9	149.419	12	0	15	0	15	0	15

**Envelope Node Reactions (Continued)**

Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC	
16		min	-7.284	10	-257.652	14	-178.287	6	0	2	0	2	0	2
17	N111A 1	max	0.259	10	2431.151	10	1296.978	6	0	15	0	15	0	15
18		min	-0.113	13	-1611.811	13	-1117.359	12	0	2	0	2	0	2
19	N112A 1	max	1.152	11	1486.041	9	150.425	4	0	15	0	15	0	15
20		min	-0.7	12	-226.358	14	-176.774	6	0	2	0	2	0	2
21	N117A 1	max	1.254	3	2456.517	10	1315.824	6	0	15	0	15	0	15
22		min	-0.227	14	-1648.486	13	-1136.315	4	0	2	0	2	0	2
23	N118A 1	max	8.508	10	1530.294	9	153.546	4	0	15	0	15	0	15
24		min	-5.603	12	-250.224	14	-178.838	6	0	2	0	2	0	2
25	N123 1	max	12.737	13	2454.068	10	1279.338	6	0	15	0	15	0	15
26		min	-19.681	10	-1625.178	13	-1108.855	12	0	2	0	2	0	2
27	N124 1	max	29.919	11	1459.802	9	149.261	4	0	15	0	15	0	15
28		min	-10.453	12	-241.407	14	-172.553	6	0	2	0	2	0	2
29	N168 1	max	13.331	9	1473.676	9	149.568	4	0	15	0	15	0	15
30		min	-4.499	14	-242.033	14	-175.598	6	0	2	0	2	0	2
31	N169 1	max	4.671	10	2309.705	10	1267.683	6	0	15	0	15	0	15
32		min	-3.539	13	-1534.79	13	-1086.209	4	0	2	0	2	0	2
33	N163	max	4.745	14	1475.251	9	149.136	4	0	15	0	15	0	15
34		min	-14.062	9	-241.497	14	-175.541	6	0	2	0	2	0	2
35	N165	max	3.589	13	2314.76	10	1268.083	6	0	15	0	15	0	15
36		min	-4.568	10	-1537.729	13	-1086.483	4	0	2	0	2	0	2
37	Totals:	max	0.004	14	28183.204	10	10078.049	14						
38		min	-0.007	8	-9702.217	12	-8710.088	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	M51 1	PIPE2.0A21165	0.814	5.935	6	0.204	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
2	M57 1	PIPE2.0A21165	0.814	5.935	6	0.204	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
3	M48 1	PIPE2.0A21165	0.81	5.935	6	0.204	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
4	M57A 1	PIPE2.0A21165	0.809	5.935	6	0.203	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
5	M60 1	PIPE2.0A21165	0.798	5.935	6	0.2	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
6	M6 1	PIPE2.0A21165	0.797	5.935	6	0.2	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
7	M54A 1	PIPE2.0A21165	0.796	5.935	6	0.2	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
8	M77	PIPE2.0A21165	0.773	5.935	6	0.196	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
9	M81 1	PIPE2.0A21165	0.772	5.935	6	0.195	5.935	6	5777.835	23232.186	1397.505	1397.505	1	H1-1a
10	M14 1	PIPE2.5A21168	0.681	33.333	10	0.19	173.333	10	14032.946	28358.413	2081.747	2081.747	1	H1-1b
11	M58 1	1.5X1.5X0.083	0.618	49.788	6	0.008	95.593	y 3	2598.424	14085.15	624.421	624.421	1.136	H1-1a
12	M13 1	PIPE2.5A21168	0.618	606.667	11	0.186	466.667	11	14032.946	28358.413	2081.747	2081.747	1	H1-1b
13	M49 1	1.5X1.5X0.083	0.615	49.788	6	0.008	95.593	y 10	2598.424	14085.15	624.421	624.421	1.136	H1-1a
14	M58A 1	1.5X1.5X0.083	0.615	49.788	6	0.005	95.593	y 10	2598.424	14085.15	624.421	624.421	1.136	H1-1a
15	M52A 1	1.5X1.5X0.083	0.614	49.788	6	0.005	95.593	y 6	2598.424	14085.15	624.421	624.421	1.136	H1-1a
16	M55A 1	1.5X1.5X0.083	0.605	49.788	6	0.002	95.593	y 3	2598.424	14085.15	624.421	624.421	1.136	H1-1a
17	M92A 1	1.5X1.5X0.083	0.6	49.788	6	0.005	95.593	y 3	2598.424	14085.15	624.421	624.421	1.136	H1-1a
18	M61 1	1.5X1.5X0.083	0.6	49.788	6	0.005	95.593	y 9	2598.424	14085.15	624.421	624.421	1.136	H1-1a
19	M82 1	1.5X1.5X0.083	0.593	49.788	6	0.006	95.593	y 9	2598.424	14085.15	624.421	624.421	1.136	H1-1a
20	M78	1.5X1.5X0.083	0.593	49.788	6	0.006	95.593	y 9	2598.424	14085.15	624.421	624.421	1.136	H1-1a
21	M56 1	PIPE2.0A21165	0.518	47.642	14	0.178	53.808	6	16717.835	23232.186	1397.505	1397.505	1	H1-1b
22	M47 1	PIPE2.0A21165	0.516	47.642	6	0.177	53.808	6	16717.835	23232.186	1397.505	1397.505	1	H1-1b
23	M56A 1	PIPE2.0A21165	0.516	47.642	14	0.177	53.808	6	16717.835	23232.186	1397.505	1397.505	1	H1-1b
24	M50 1	PIPE2.0A21165	0.515	47.642	6	0.177	53.808	6	16717.835	23232.186	1397.505	1397.505	1	H1-1b
25	M53A 1	PIPE2.0A21165	0.509	47.642	6	0.174	53.808	6	16717.835	23232.186	1397.505	1397.505	1	H1-1b
26	M80 1	PIPE2.0A21165	0.507	47.642	14	0.17	53.808	6	16717.835	23232.186	1397.505	1397.505	1	H1-1b
27	M79	PIPE2.0A21165	0.506	47.642	14	0.17	53.808	6	16717.835	23232.186	1397.505	1397.505	1	H1-1b
28	M59A 1	PIPE2.0A21165	0.5	47.642	14	0.173	53.808	6	16717.835	23232.186	1397.505	1397.505	1	H1-1b
29	M5 1	PIPE2.0A21165	0.5	47.642	14	0.173	53.808	6	16717.835	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]	DirLC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn		
30	M59 1	1.5X1.5X0.083	0.037	104.732	10	0.067	104.732	y 6	2164.724	14085.15	624.421	624.421	1.136	H1-1b*
31	M19 1	1.5X1.5X0.083	0.034	104.899	10	0.068	104.899	y 6	2157.852	14085.15	624.421	624.421	1.136	H1-1b*

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

Member	Shape	Code Check	Loc[in]	LC Shear Check	Loc[in]	DirLC	Pnc/Om[lb]	Pnt/Om[lb]	Mny/Om[lb-ft]	Mnz/Om[lb-ft]	Vny/Om[lb]	Vnz/Om[lb]	Cb	Eqn		
1	M25 1	HR300	0.785	87.792	10	0.106	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.761	H.1-1
2	M76 1	HR300	0.785	87.792	10	0.106	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.761	H.1-1
3	M34 1	HR300	0.762	87.792	10	0.101	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
4	M55 1	HR300	0.761	87.792	10	0.101	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
5	M40 1	HR300	0.76	137.958	10	0.119	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.514	H.1-1
6	M73 1	HR300	0.758	86	10	0.101	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
7	M28 1	HR300	0.758	87.792	10	0.101	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
8	M49A 1	HR300	0.757	86	10	0.099	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
9	M43 1	HR300	0.749	86	10	0.1	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
10	M46 1	HR300	0.748	87.792	10	0.101	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
11	M70 1	HR300	0.739	86	10	0.1	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
12	M31 1	HR300	0.739	86	10	0.1	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.713	H.1-1
13	M52 1	HR300	0.736	86	10	0.1	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.714	H.1-1
14	M37 1	HR300	0.736	86	10	0.1	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.714	H.1-1
15	M79 1	HR300	0.567	87.792	10	0.085	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.671	H.1-1
16	M16 1	HR300	0.567	87.792	10	0.084	34.042	y 11	3385.262	14429.594	560.36	934.132	5656.689	2605.145	1.671	H.1-1



JOB NO.: U2716.0342.221

PROJECT: Sunturf Package A13

SUBJECT: CALCULATIONS

DESIGN APPROACH ASD

CONNECTION CAPACITY

Location: Column Base (set screws)

Connection Type: M16 Conical Set Screws

Tensile Capacity: 2600 lbs

Tension Load: 1669 lbs

Check Connection: 64.2%

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: 806 lbs

Check Connection: 36.7%

Result: **Select K10341-002**

Note: Uplift capacity. FOS of (2)



JOB NO.: U2716.0342.221

PROJECT: Sunturf Package A13

SUBJECT: CALCULATIONS

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**CONNECTION CAPACITY**

Location: Brace to Column

Connection Type: K10219-001

Capacity: 1571 lbs

Tension Load: 1565 lbs

Check Connection: 99.6%

Result: **Select K10219-001**

Note: Axial capacity. FOS of (1.7)

---

**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: 1194 lbs

Check Bolt: 14.2%

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

Note:

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JOB NO.: U2716.0342.221

PROJECT: Sunturf Package A13 Ground Mount

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# ALTERNATE FOUNDATION OPTION 1: DRILLED CONCRETE PIER

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PROJECT: Sunturf Package A13 Ground Mount

**DRILLED CONCRETE PIER DESIGN**

**Column Reactions:**

Max. Shear, V [k]:	1.3	Max. Down, P <sub>d</sub> [k]:	2.5
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P <sub>u</sub> [k]:	1.7

**Pier Properties:**

Pier Shape:	Round	Volume of Concrete [ft <sup>3</sup> ]:	10
Pier Diameter, b [ft]:	1.5	Volume of Concrete [yd <sup>3</sup> ]:	0.4
Top of Pier Elevation [ft]:	0.25	Weight of Concrete [k]:	1.5
Pier Depth, d [ft]:	5.25		

**Soil Properties:**

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

**Optional Parameters for Uplift:**

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

\*per IBC Section 1810.3.3.1.4

**Check Bearing:**

Bearing Capacity [k]:	6.2
-----------------------	-----

**Bearing capacity OK.**

**Check Uplift:**

Uplift Capacity [k]:	7.5
----------------------	-----

**Uplift capacity OK.**

**Check Lateral Bearing:**

Top of Pier Constrained?:	No
Applied Lateral Force, P [lb]:	1,322
Point of Application, h [ft]:	0.3
S <sub>max</sub> [psf]:	
S [psf]:	525
A = 2.34*P/(Sb):	3.93
Required Pier Depth, d <sub>reqd</sub> [ft]:	4.20

IBC Section 1807.3.2.1

IBC Eq. 18-1

Result: **Lateral bearing capacity OK.**



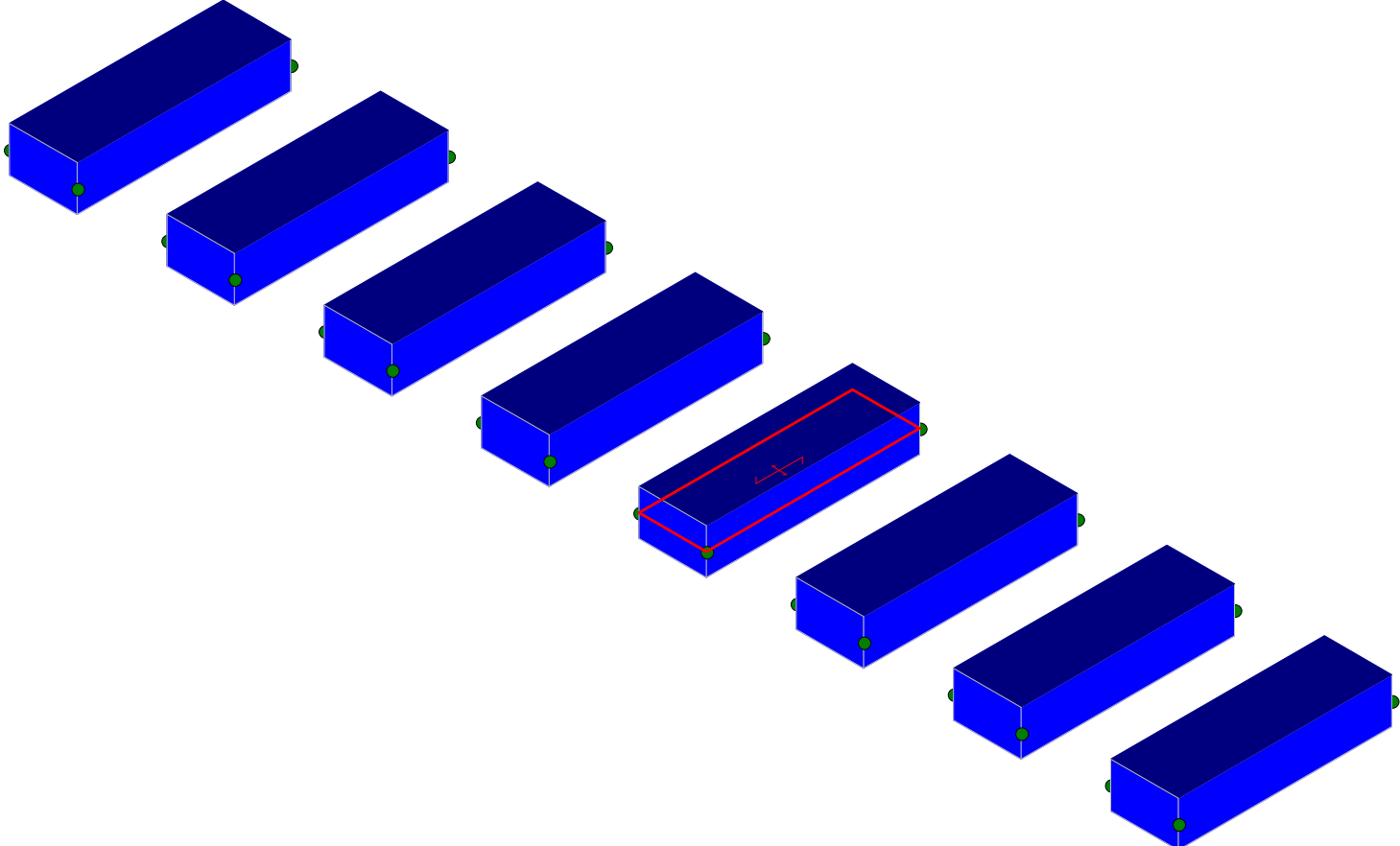
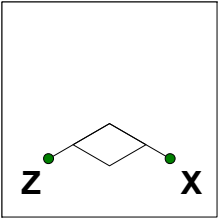


JOB NO.: U2716.0342.221

PROJECT: Sunturf Package A13 Ground Mount

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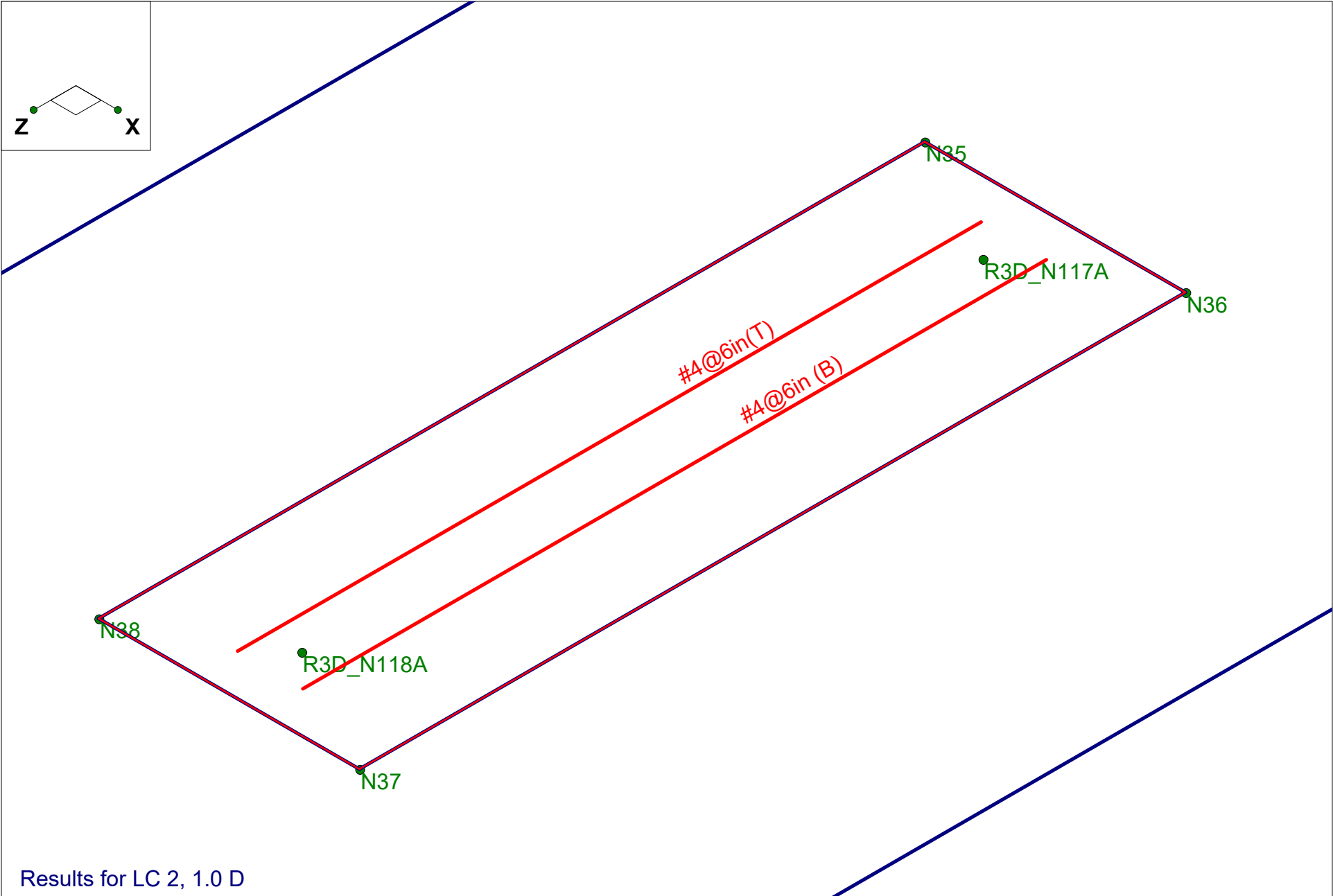
# ALTERNATE FOUNDATION OPTION 2: CONCRETE BALLAST BLOCK



Vector Structural Engineering  
MIH  
U2716.0335.221

SunTurf A12

SK - 1  
June 30, 2022 at 7:52 AM  
Sunmodo Sunturf A13 - LF - 35 - 4L.r3d



Results for LC 2, 1.0 D

Vector Structural Engineering	SunTurf A12	SK - 2
MIH		June 30, 2022 at 7:53 AM
U2716.0335.221		Sunmodo Sunturf A13 - LF - 35 - 4L.r3d







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

	Label	Direction	Magnitude[lb,lb-ft]
7	R3D_N115	Z	129.051
8	R3D_N116	Y	99.948
9	R3D_N116	Z	-17.621
10	R3D_N99	Y	-100.493
11	R3D_N99	Z	131.614
12	R3D_N100	Y	102.604
13	R3D_N100	Z	-17.357
14	R3D_N105A	Y	-99.934
15	R3D_N105A	Z	129.04
16	R3D_N106A	Y	99.937
17	R3D_N106A	Z	-17.62
18	R3D_N111A	Y	-100.13
19	R3D_N111A	Z	129.391
20	R3D_N112A	Y	100.224
21	R3D_N112A	Z	-17.696
22	R3D_N117A	Y	-100.134
23	R3D_N117A	Z	129.399
24	R3D_N118A	Y	100.229
25	R3D_N118A	Z	-17.697
26	R3D_N123	X	-1.322
27	R3D_N123	Y	-84.334
28	R3D_N123	Z	107.706
29	R3D_N124	Y	82.114
30	R3D_N124	Z	-15.569
31	R3D_N168	Y	102.596
32	R3D_N168	Z	-17.357
33	R3D_N171	Y	-100.467
34	R3D_N171	Z	131.607

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

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1	X	48.162
2	R3D_N1	Y	-2504.669
3	R3D_N1	Z	1787.207
4	R3D_N2	X	21.115
5	R3D_N2	Y	280.193
6	R3D_N2	Z	-270.806
7	R3D_N115	X	1.65
8	R3D_N115	Y	-3094.024
9	R3D_N115	Z	2233.333
10	R3D_N116	X	-2.043
11	R3D_N116	Y	359.915
12	R3D_N116	Z	-315.55
13	R3D_N99	X	-3.886
14	R3D_N99	Y	-3108.952
15	R3D_N99	Z	2271.331
16	R3D_N100	X	-1.462
17	R3D_N100	Y	363.334
18	R3D_N100	Z	-308.733
19	R3D_N105A	X	-1.586
20	R3D_N105A	Y	-3093.682
21	R3D_N105A	Z	2233.161
22	R3D_N106A	X	2.125
23	R3D_N106A	Y	359.736
24	R3D_N106A	Z	-315.538
25	R3D_N111A	Y	-3102.735



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

	Label	Direction	Magnitude[lb,lb-ft]
26	R3D_N111A	Z	2237.868
27	R3D_N112A	Y	356.515
28	R3D_N112A	Z	-317.283
29	R3D_N117A	Y	-3102.794
30	R3D_N117A	Z	2238.004
31	R3D_N118A	Y	356.603
32	R3D_N118A	Z	-317.292
33	R3D_N123	X	-48.611
34	R3D_N123	Y	-2505.346
35	R3D_N123	Z	1787.117
36	R3D_N124	X	-21.055
37	R3D_N124	Y	280.332
38	R3D_N124	Z	-270.795
39	R3D_N168	X	1.534
40	R3D_N168	Y	363.208
41	R3D_N168	Z	-308.725
42	R3D_N171	X	3.923
43	R3D_N171	Y	-3107.97
44	R3D_N171	Z	2271.203

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

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1	X	58.202
2	R3D_N1	Y	-2762.597
3	R3D_N1	Z	1486.392
4	R3D_N2	X	14.843
5	R3D_N2	Y	886.514
6	R3D_N2	Z	-225.196
7	R3D_N115	X	1.953
8	R3D_N115	Y	-3387.199
9	R3D_N115	Z	1857.927
10	R3D_N116	X	-4.458
11	R3D_N116	Y	1113.304
12	R3D_N116	Z	-262.474
13	R3D_N99	X	-4.749
14	R3D_N99	Y	-3402.388
15	R3D_N99	Z	1889.102
16	R3D_N100	X	6.707
17	R3D_N100	Y	1143.78
18	R3D_N100	Z	-256.841
19	R3D_N105A	X	-1.874
20	R3D_N105A	Y	-3386.839
21	R3D_N105A	Z	1857.775
22	R3D_N106A	X	4.556
23	R3D_N106A	Y	1113.141
24	R3D_N106A	Z	-262.463
25	R3D_N111A	Y	-3398.622
26	R3D_N111A	Z	1861.022
27	R3D_N112A	X	1.489
28	R3D_N112A	Y	1115.217
29	R3D_N112A	Z	-263.856
30	R3D_N117A	Y	-3398.67
31	R3D_N117A	Z	1861.145
32	R3D_N118A	X	-1.396
33	R3D_N118A	Y	1115.298
34	R3D_N118A	Z	-263.865



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

	Label	Direction	Magnitude[lb.-lb-ft]
35	R3D_N123	X	-58.75
36	R3D_N123	Y	-2763.427
37	R3D_N123	Z	1486.343
38	R3D_N124	X	-14.772
39	R3D_N124	Y	886.677
40	R3D_N124	Z	-225.189
41	R3D_N168	X	-6.619
42	R3D_N168	Y	1143.654
43	R3D_N168	Z	-256.834
44	R3D_N171	X	4.794
45	R3D_N171	Y	-3401.226
46	R3D_N171	Z	1888.987

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

	Label	Direction	Magnitude[lb.-lb-ft]
1	R3D_N1	X	-56.189
2	R3D_N1	Y	2922.114
3	R3D_N1	Z	-2085.075
4	R3D_N2	X	-24.634
5	R3D_N2	Y	-326.892
6	R3D_N2	Z	315.941
7	R3D_N115	X	-1.925
8	R3D_N115	Y	3609.695
9	R3D_N115	Z	-2605.555
10	R3D_N116	X	2.384
11	R3D_N116	Y	-419.9
12	R3D_N116	Z	368.142
13	R3D_N99	X	4.534
14	R3D_N99	Y	3627.11
15	R3D_N99	Z	-2649.886
16	R3D_N100	X	1.706
17	R3D_N100	Y	-423.89
18	R3D_N100	Z	360.189
19	R3D_N105A	X	1.85
20	R3D_N105A	Y	3609.296
21	R3D_N105A	Z	-2605.355
22	R3D_N106A	X	-2.479
23	R3D_N106A	Y	-419.692
24	R3D_N106A	Z	368.128
25	R3D_N111A	Y	3619.857
26	R3D_N111A	Z	-2610.846
27	R3D_N112A	Y	-415.935
28	R3D_N112A	Z	370.163
29	R3D_N117A	Y	3619.927
30	R3D_N117A	Z	-2611.005
31	R3D_N118A	Y	-416.036
32	R3D_N118A	Z	370.174
33	R3D_N123	X	56.713
34	R3D_N123	Y	2922.904
35	R3D_N123	Z	-2084.97
36	R3D_N124	X	24.564
37	R3D_N124	Y	-327.054
38	R3D_N124	Z	315.928
39	R3D_N168	X	-1.789
40	R3D_N168	Y	-423.742
41	R3D_N168	Z	360.179





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

	Label	Direction	Magnitude[lb,lb-ft]
42	R3D_N171	X	-4.577
43	R3D_N171	Y	3625.965
44	R3D_N171	Z	-2649.737

**Point Loads and Moments (Cat 70 : OL4)**

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1	X	-34.548
2	R3D_N1	Y	2032.015
3	R3D_N1	Z	-1881.796
4	R3D_N2	X	-24.653
5	R3D_N2	Y	287.017
6	R3D_N2	Z	285.165
7	R3D_N115	X	-1.221
8	R3D_N115	Y	2532.816
9	R3D_N115	Z	-2351.09
10	R3D_N116	Y	346.018
11	R3D_N116	Z	332.219
12	R3D_N99	X	2.741
13	R3D_N99	Y	2546.062
14	R3D_N99	Z	-2391.479
15	R3D_N100	X	8.597
16	R3D_N100	Y	367.029
17	R3D_N100	Z	325.008
18	R3D_N105A	X	1.175
19	R3D_N105A	Y	2532.523
20	R3D_N105A	Z	-2350.917
21	R3D_N106A	Y	346.194
22	R3D_N106A	Z	332.207
23	R3D_N111A	Y	2538.265
24	R3D_N111A	Z	-2356.468
25	R3D_N112A	Y	353.82
26	R3D_N112A	Z	334.095
27	R3D_N117A	Y	2538.329
28	R3D_N117A	Z	-2356.602
29	R3D_N118A	Y	353.735
30	R3D_N118A	Z	334.105
31	R3D_N123	X	34.866
32	R3D_N123	Y	2032.49
33	R3D_N123	Z	-1881.679
34	R3D_N124	X	24.61
35	R3D_N124	Y	286.914
36	R3D_N124	Z	285.152
37	R3D_N168	X	-8.646
38	R3D_N168	Y	367.144
39	R3D_N168	Z	324.999
40	R3D_N171	X	-2.767
41	R3D_N171	Y	2545.337
42	R3D_N171	Z	-2391.353

**Slabs**

	Label	Thickness [in]	Material	Local Axis Angle	Analysis Offset [in]	Passive Pressure [psf]	Soil Overburd...	lcr Fact...
1	S1	24	Conc2500NW	0	0	0	0	0.25
2	S2	24	Conc2500NW	0	0	0	0	0.25
3	S3	24	Conc2500NW	0	0	0	0	0.25
4	S4	24	Conc2500NW	0	0	0	0	0.25
5	S5	24	Conc2500NW	0	0	0	0	0.25



**Slabs (Continued)**

	Label	Thickness [in]	Material	Local Axis Angle	Analysis Offset [in]	Passive Pressure [psf]	Soil Overburd...lcr Fact...
6	S6	24	Conc2500NW	0	0	0	0.25
7	S7	24	Conc2500NW	0	0	0	0.25
8	S8	24	Conc2500NW	0	0	0	0.25

**Load Combinations**

	Label	Solve	Service A...	SF	Cat..Fa...	Cat..Fa...	Cat..Fa...	Cat..Fa...	Cat..Fa...	Cat..Fa...	Cat..Fa...	Cat..Fa...	Cat..Fa...	Cat..Fa...	Cat..Fa...
1	ASD Lo...		Yes												
2	1.0 D	Yes	Yes	1.5	DL 1										
3	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL 1									
4	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL	OL1 0.6	WLZ 0.6							
5	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL	OL2 0.6	WLZ 0.6							
6	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL	OL3 0.6	WLZ -0.6							
7	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL	OL4 0.6	WLZ -0.6							
8	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL 0.75	OL1 0.45	WLZ 0.6							
9	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL 0.75	OL2 0.45	WLZ 0.6							
10	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL 0.75	OL3 0.45	WLZ -0.6							
11	1.0 D + ...	Yes	Yes	1.5	DL 1	RLL 0.75	OL4 0.45	WLZ -0.6							
12	0.6 D + ...	Yes	Yes		DL 0.6	RLL	OL1 0.6	WLZ 0.6							
13	0.6 D + ...	Yes	Yes		DL 0.6	RLL	OL2 0.6	WLZ 0.6							
14	0.6 D + ...	Yes	Yes		DL 0.6	RLL	OL3 0.6	WLZ -0.6							
15	0.6 D + ...	Yes	Yes		DL 0.6	RLL	OL4 0.6	WLZ -0.6							
16															
17	LRFD L...														
18	1.4 D	Yes			DL 1.4	RLL									
19	1.2 D + ...	Yes			DL 1.2	RLL 1.6	OL1 0.5								
20	1.2 D + ...	Yes			DL 1.2	RLL 1.6	OL2 0.5								
21	1.2 D + ...	Yes			DL 1.2	RLL 1.6	OL3 0.5								
22	1.2 D + ...	Yes			DL 1.2	RLL 1.6	OL4 0.5								
23	1.2 D + ...	Yes			DL 1.2	RLL	OL1 1								
24	1.2 D + ...	Yes			DL 1.2	RLL	OL2 1								
25	1.2 D + ...	Yes			DL 1.2	RLL	OL3 1								
26	1.2 D + ...	Yes			DL 1.2	RLL	OL4 1								
27	0.9 D + ...	Yes			DL 0.9	RLL	OL1 1								
28	0.9 D + ...	Yes			DL 0.9	RLL	OL2 1								
29	0.9 D + ...	Yes			DL 0.9	RLL	OL3 1								
30	0.9 D + ...	Yes			DL 0.9	RLL	OL4 1								

**Design Strips**

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

**Load Categories**

	Category	Point Loads	Line Loads	Area Loads
1	DL	22		
2	RLL	32		
3	WLZ	34		
4	OL1	44		
5	OL2	46		
6	OL3	44		
7	OL4	42		



Company : Vector Structural Engineering  
 Designer : MIH  
 Job Number : U2716.0335.221  
 Model Name : SunTurf A12

June 30, 2022  
 7:55 AM  
 Checked By: STB

### Strip Reinforcing

Label	UC Top	LC	Top Bars	Governin...	UC Bot	LC	Bot Bars/...	Governin...	UC Shear	LC	Governin...	
1	DS1	0.04	21	#4@6in	DS1-X25	0.03	28	#4@6in	DS1-X21	0.047	21	DS1-X10

### Slab Overturning Safety Factors (By Combination)

LC	Slab	Angle[deg]	Mo-xx[lb-ft]	Ms-xx[lb-ft]	Mo-zz[lb-ft]	Ms-zz[lb-ft]	Ms-xx/Mo-xx	Ms-zz/Mo-zz
1	2	S1	0	0	40972.65	0	12984.416	9.99+
2	2	S2	0	0	41389.886	0	13088.657	9.99+
3	2	S3	0	0	41343.996	0	13072.563	9.99+
4	2	S4	0	0	41352.388	0	13076.104	9.99+
5	2	S5	0	0	41352.412	0	13076.107	9.99+
6	2	S6	0	0	41343.867	0	13072.554	9.99+
7	2	S7	0	0	41390.643	0	13093.958	9.99+
8	2	S8	0	0	40971.54	0	12961.598	9.99+
9	3	S1	0	0	51228.9	0	16336.772	9.99+
10	3	S2	0	0	54607.229	0	17188.936	9.99+
11	3	S3	0	0	54296.072	0	17145.085	9.99+
12	3	S4	0	0	54353.102	0	17168.206	9.99+
13	3	S5	0	0	54353.309	0	17173.693	9.99+
14	3	S6	0	0	54294.932	0	17156.859	9.99+
15	3	S7	0	0	54614.491	0	17241.131	9.99+
16	3	S8	0	0	51218.507	0	16164.726	9.99+
17	4	S1	0	15211.911	41190.345	2088.724	12984.416	2.708
18	4	S2	0	18948.406	41521.862	2477.474	13095.854	2.191
19	4	S3	0	18811.853	41449.05	2461.199	13072.566	2.203
20	4	S4	0	18865.297	41463.08	2471.597	13076.188	2.198
21	4	S5	0	18865.741	41463.077	2471.572	13076.192	2.198
22	4	S6	0	18813.82	41449.122	2461.171	13072.554	2.203
23	4	S7	0	18943.082	41520.82	2476.835	13095.875	2.192
24	4	S8	0	15215.293	41191.354	2089.698	12984.534	2.707
25	5	S1	0	15943.727	41190.345	1779.693	12984.416	2.583
26	5	S2	0	19687.64	41521.862	2035.097	13090.557	2.109
27	5	S3	0	19572.783	41449.05	2049.546	13072.566	2.118
28	5	S4	0	19636.453	41463.08	2056.851	13076.188	2.112
29	5	S5	0	19636.826	41463.077	2056.711	13076.192	2.111
30	5	S6	0	19574.832	41449.122	2049.513	13072.554	2.117
31	5	S7	0	19681.39	41520.82	2034.004	13090.479	2.11
32	5	S8	0	15947.936	41191.354	1780.887	12984.534	2.583
33	6	S1	0	2857.18	40972.65	0	15420.667	9.99+
34	6	S2	0	3758.72	41389.886	1.9	15964.067	9.99+
35	6	S3	0	3665.841	41343.996	0.003	15943.962	9.99+
36	6	S4	0	3646.894	41352.388	0.085	15959.634	9.99+
37	6	S5	0	3647.596	41352.412	0.086	15959.608	9.99+
38	6	S6	0	3667.01	41343.867	0	15942.82	9.99+
39	6	S7	0	3758.324	41390.643	1.916	15962.924	9.99+
40	6	S8	0	2857.472	40971.54	0	15200.742	9.99+
41	7	S1	0	495.43	41565.181	0	15146.15	9.99+
42	7	S2	0	620.403	42091.695	1.9	15696.834	9.99+
43	7	S3	0	603.411	41988.006	0.003	15661.999	9.99+
44	7	S4	0	605.135	42034.527	0.085	15678.979	9.99+
45	7	S5	0	605.165	42033.993	0.086	15678.964	9.99+
46	7	S6	0	603.471	41986.916	0	15664.971	9.99+
47	7	S7	0	620.369	42092.826	1.916	15696.1	9.99+
48	7	S8	0	495.387	41563.897	0	14978.102	9.99+
49	8	S1	0	11535.938	49070.537	1567.434	15498.683	4.254
50	8	S2	0	14363.397	51195.312	1858.106	16205.831	3.564
51	8	S3	0	14259.737	51107.132	1845.899	16126.958	3.584
52	8	S4	0	14300.122	51162.584	1853.698	16145.265	3.578

**Slab Overturning Safety Factors (By Combination) (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	
53	8	S5	0	14300.461	51162.492	1853.679	16145.125	3.578	8.71
54	8	S6	0	14261.234	51107.878	1845.879	16126.806	3.584	8.737
55	8	S7	0	14359.37	51189.893	1857.626	16206.254	3.565	8.724
56	8	S8	0	11538.48	49076.961	1568.169	15499.284	4.253	9.884
57	9	S1	0	12084.799	49070.537	1335.661	15498.683	4.061	9.99+
58	9	S2	0	14917.824	51195.312	1526.323	16165.766	3.432	9.99+
59	9	S3	0	14830.435	51107.132	1537.16	16126.958	3.446	9.99+
60	9	S4	0	14878.489	51162.584	1542.638	16145.265	3.439	9.99+
61	9	S5	0	14878.775	51162.492	1542.533	16145.125	3.439	9.99+
62	9	S6	0	14831.993	51107.878	1537.135	16126.806	3.446	9.99+
63	9	S7	0	14913.101	51189.893	1525.503	16165.445	3.433	9.99+
64	9	S8	0	12087.963	49076.961	1336.561	15499.284	4.06	9.99+
65	10	S1	0	2266.742	48664.837	0	17326.763	9.99+	9.99+
66	10	S2	0	2974.141	51302.893	1.9	18320.424	9.99+	9.99+
67	10	S3	0	2900.234	51058.053	0.003	18280.503	9.99+	9.99+
68	10	S4	0	2886.454	51102.924	0.085	18307.828	9.99+	9.99+
69	10	S5	0	2886.988	51103.085	0.086	18307.665	9.99+	9.99+
70	10	S6	0	2901.125	51057.165	0	18288.482	9.99+	9.99+
71	10	S7	0	2973.835	51308.529	1.916	18319.299	9.99+	9.99+
72	10	S8	0	2266.95	48656.765	0	17043.405	9.99+	9.99+
73	11	S1	0	495.43	49109.236	0	17120.875	9.99+	9.99+
74	11	S2	0	620.403	51829.25	1.9	18119.998	9.99+	9.99+
75	11	S3	0	603.411	51541.061	0.003	18069.031	9.99+	9.99+
76	11	S4	0	605.135	51614.528	0.085	18097.337	9.99+	9.99+
77	11	S5	0	605.165	51614.271	0.086	18097.182	9.99+	9.99+
78	11	S6	0	603.471	51539.452	0	18080.095	9.99+	9.99+
79	11	S7	0	620.369	51835.166	1.916	18119.181	9.99+	9.99+
80	11	S8	0	495.387	49101.033	0	16876.425	9.99+	9.99+
81	12	S1	0	15211.911	24714.207	2088.724	7790.65	1.625	3.73
82	12	S2	0	18948.406	24913.117	2477.474	7858.272	1.315	3.172
83	12	S3	0	18811.853	24869.43	2461.199	7843.541	1.322	3.187
84	12	S4	0	18865.297	24877.848	2471.597	7845.747	1.319	3.174
85	12	S5	0	18865.741	24877.846	2471.572	7845.75	1.319	3.174
86	12	S6	0	18813.82	24869.473	2461.171	7843.533	1.322	3.187
87	12	S7	0	18943.082	24912.492	2476.835	7858.291	1.315	3.173
88	12	S8	0	15215.293	24714.812	2089.698	7790.72	1.624	3.728
89	13	S1	0	15943.727	24714.207	1779.693	7790.65	1.55	4.378
90	13	S2	0	19687.64	24913.117	2035.097	7855.094	1.265	3.86
91	13	S3	0	19572.783	24869.43	2049.546	7843.541	1.271	3.827
92	13	S4	0	19636.453	24877.848	2056.851	7845.747	1.267	3.814
93	13	S5	0	19636.826	24877.846	2056.711	7845.75	1.267	3.815
94	13	S6	0	19574.832	24869.473	2049.513	7843.533	1.27	3.827
95	13	S7	0	19681.39	24912.492	2034.004	7855.054	1.266	3.862
96	13	S8	0	15947.936	24714.812	1780.887	7790.72	1.55	4.375
97	14	S1	0	2857.18	24583.59	0	10226.901	8.604	9.99+
98	14	S2	0	3758.72	24833.931	1.9	10728.605	6.607	9.99+
99	14	S3	0	3665.841	24806.397	0.003	10714.937	6.767	9.99+
100	14	S4	0	3646.894	24811.433	0.085	10729.192	6.803	9.99+
101	14	S5	0	3647.596	24811.447	0.086	10729.165	6.802	9.99+
102	14	S6	0	3667.01	24806.32	0	10713.798	6.765	9.99+
103	14	S7	0	3758.324	24834.386	1.916	10727.499	6.608	9.99+
104	14	S8	0	2857.472	24582.924	0	10016.103	8.603	9.99+
105	15	S1	0	495.43	25176.121	0	9952.383	9.99+	9.99+
106	15	S2	0	620.403	25535.741	1.9	10461.371	9.99+	9.99+
107	15	S3	0	603.411	25450.408	0.003	10432.973	9.99+	9.99+
108	15	S4	0	605.135	25493.572	0.085	10448.538	9.99+	9.99+
109	15	S5	0	605.165	25493.028	0.086	10448.521	9.99+	9.99+



Company : Vector Structural Engineering  
 Designer : MIH  
 Job Number : U2716.0335.221  
 Model Name : SunTurf A12

June 30, 2022  
 7:55 AM  
 Checked By: STB

**Slab Overturning Safety Factors (By Combination) (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
110	15	S6	0	603.471	25449.369	0	10435.949	9.99+
111	15	S7	0	620.369	25536.569	1.916	10460.675	9.99+
112	15	S8	0	495.387	25175.281	0	9793.463	9.99+

**Slab Sliding Safety Factors**

LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
1	2	S1	0	5.667	2594.616	0	2594.616	9.99+
2	2	S2	0	1.324	2618.261	0	2618.261	9.99+
3	2	S3	0	0	2614.513	0	2614.513	9.99+
4	2	S4	0	0	2615.221	0	2615.221	9.99+
5	2	S5	0	0	2615.221	0	2615.221	9.99+
6	2	S6	0	0	2614.511	0	2614.511	9.99+
7	2	S7	0	1.349	2618.252	0	2618.252	9.99+
8	2	S8	0	5.734	2594.613	0	2594.613	9.99+
9	3	S1	0	42.65	3250.294	4.168	3250.294	9.99+
10	3	S2	0	12.914	3442.953	2.87	3442.953	9.99+
11	3	S3	0	2.908	3430.18	0	3430.18	9.99+
12	3	S4	0	1.318	3434.168	0	3434.168	9.99+
13	3	S5	0	1.419	3434.171	0	3434.171	9.99+
14	3	S6	0	2.992	3430.175	0	3430.175	9.99+
15	3	S7	0	13.153	3442.965	2.823	3442.965	9.99+
16	3	S8	0	43.202	3250.226	4.207	3250.226	9.99+
17	4	S1	0	36.687	2193.813	965.127	2193.813	9.99+
18	4	S2	0	1.885	2124.43	1246.113	2124.43	9.99+
19	4	S3	0	0.324	2122.403	1217.426	2122.403	9.99+
20	4	S4	0	0	2120.918	1219.368	2120.918	9.99+
21	4	S5	0	0	2120.924	1219.448	2120.924	9.99+
22	4	S6	0	0.236	2122.371	1217.527	2122.371	9.99+
23	4	S7	0	1.925	2124.578	1246.038	2124.578	9.99+
24	4	S8	0	36.859	2193.711	965.075	2193.711	9.99+
25	5	S1	0	38.948	2256.524	812.005	2256.524	9.99+
26	5	S2	0	2.499	2212.092	1047.911	2212.092	9.99+
27	5	S3	0	1.609	2205.248	1024.039	2205.248	9.99+
28	5	S4	0	0.893	2204.225	1025.317	2204.225	9.99+
29	5	S5	0	0.838	2204.231	1025.389	2204.231	9.99+
30	5	S6	0	1.503	2205.21	1024.13	2205.21	9.99+
31	5	S7	0	2.444	2212.272	1047.842	2212.272	9.99+
32	5	S8	0	39.172	2256.398	811.974	2256.398	9.99+
33	6	S1	0	54.949	3062.154	1116.767	3062.154	9.99+
34	6	S2	0	5.068	3194.461	1442.373	3194.461	9.99+
35	6	S3	0	0.378	3188.641	1409.188	3188.641	9.99+
36	6	S4	0	0	3191.91	1411.427	3191.91	9.99+
37	6	S5	0	0	3191.905	1411.519	3191.905	9.99+
38	6	S6	0	0.275	3188.674	1409.306	3188.674	9.99+
39	6	S7	0	5.169	3194.269	1442.286	3194.269	9.99+
40	6	S8	0	55.294	3062.266	1116.707	3062.266	9.99+
41	7	S1	0	41.976	3012.44	1013.266	3012.44	9.99+
42	7	S2	0	8.127	3142.238	1308.437	3142.238	9.99+
43	7	S3	0	0.705	3132.681	1278.078	3132.681	9.99+
44	7	S4	0	0	3135.779	1280.441	3135.779	9.99+
45	7	S5	0	0	3135.776	1280.519	3135.776	9.99+
46	7	S6	0	0.733	3132.701	1278.18	3132.701	9.99+
47	7	S7	0	8.197	3142.115	1308.363	3142.115	9.99+
48	7	S8	0	42.213	3012.505	1013.198	3012.505	9.99+
49	8	S1	0	1.442	2785.673	734.541	2785.673	9.99+
50	8	S2	0	7.609	2866.501	953.876	2866.501	9.99+



**Slab Sliding Safety Factors (Continued)**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
51	8	S3	0	2.424	2857.181	929.782	2857.181	9.99+	3.073
52	8	S4	0	0.988	2858.709	931.281	2858.709	9.99+	3.07
53	8	S5	0	1.064	2858.715	931.341	2858.715	9.99+	3.069
54	8	S6	0	2.421	2857.154	929.86	2857.154	9.99+	3.073
55	8	S7	0	7.747	2866.627	953.783	2866.627	9.99+	3.006
56	8	S8	0	1.692	2785.546	734.471	2785.546	9.99+	3.793
57	9	S1	0	0.254	2832.706	619.699	2832.706	9.99+	4.571
58	9	S2	0	10.898	2932.248	805.224	2932.248	9.99+	3.642
59	9	S3	0	3.388	2919.315	784.742	2919.315	9.99+	3.72
60	9	S4	0	1.658	2921.189	785.742	2921.189	9.99+	3.718
61	9	S5	0	1.693	2921.195	785.797	2921.195	9.99+	3.717
62	9	S6	0	3.371	2919.283	784.812	2919.283	9.99+	3.72
63	9	S7	0	11.023	2932.398	805.136	2932.398	9.99+	3.642
64	9	S8	0	0.043	2832.562	619.646	2832.562	9.99+	4.571
65	10	S1	0	70.563	3437.127	854.523	3437.127	9.99+	4.022
66	10	S2	0	12.824	3668.835	1096.766	3668.835	9.99+	3.345
67	10	S3	0	1.898	3656.859	1073.604	3656.859	9.99+	3.406
68	10	S4	0	0.988	3661.944	1075.325	3661.944	9.99+	3.405
69	10	S5	0	1.064	3661.942	1075.395	3661.942	9.99+	3.405
70	10	S6	0	2.038	3656.881	1073.694	3656.881	9.99+	3.406
71	10	S7	0	13.067	3668.703	1096.735	3668.703	9.99+	3.345
72	10	S8	0	71.203	3437.162	854.506	3437.162	9.99+	4.022
73	11	S1	0	60.833	3399.842	776.897	3399.842	9.99+	4.376
74	11	S2	0	15.118	3629.667	996.314	3629.667	9.99+	3.643
75	11	S3	0	2.71	3614.89	975.272	3614.89	9.99+	3.707
76	11	S4	0	0.988	3619.846	977.085	3619.846	9.99+	3.705
77	11	S5	0	1.064	3619.845	977.145	3619.845	9.99+	3.705
78	11	S6	0	2.794	3614.902	975.35	3614.902	9.99+	3.706
79	11	S7	0	15.338	3629.588	996.292	3629.588	9.99+	3.643
80	11	S8	0	61.392	3399.842	776.874	3399.842	9.99+	4.376
81	12	S1	0	38.954	1155.967	965.127	1155.967	9.99+	1.198
82	12	S2	0	2.415	1077.125	1246.113	1077.125	9.99+	0.864
83	12	S3	0	0.324	1076.598	1217.426	1076.598	9.99+	0.884
84	12	S4	0	0	1074.83	1219.368	1074.83	9.99+	0.881
85	12	S5	0	0	1074.835	1219.448	1074.835	9.99+	0.881
86	12	S6	0	0.236	1076.567	1217.527	1076.567	9.99+	0.884
87	12	S7	0	2.465	1077.277	1246.038	1077.277	9.99+	0.865
88	12	S8	0	39.153	1155.866	965.075	1155.866	9.99+	1.198
89	13	S1	0	41.215	1218.677	812.005	1218.677	9.99+	1.501
90	13	S2	0	1.97	1164.787	1047.911	1164.787	9.99+	1.112
91	13	S3	0	1.609	1159.443	1024.039	1159.443	9.99+	1.132
92	13	S4	0	0.893	1158.136	1025.317	1158.136	9.99+	1.13
93	13	S5	0	0.838	1158.143	1025.389	1158.143	9.99+	1.129
94	13	S6	0	1.503	1159.405	1024.13	1159.405	9.99+	1.132
95	13	S7	0	1.904	1164.972	1047.842	1164.972	9.99+	1.112
96	13	S8	0	41.466	1218.553	811.974	1218.553	9.99+	1.501
97	14	S1	0	52.682	2024.307	1116.767	2024.307	9.99+	1.813
98	14	S2	0	4.539	2147.156	1442.373	2147.156	9.99+	1.489
99	14	S3	0	0.378	2142.836	1409.188	2142.836	9.99+	1.521
100	14	S4	0	0	2145.822	1411.427	2145.822	9.99+	1.52
101	14	S5	0	0	2145.816	1411.519	2145.816	9.99+	1.52
102	14	S6	0	0.275	2142.87	1409.306	2142.87	9.99+	1.521
103	14	S7	0	4.629	2146.968	1442.286	2146.968	9.99+	1.489
104	14	S8	0	53	2024.421	1116.707	2024.421	9.99+	1.813
105	15	S1	0	39.709	1974.593	1013.266	1974.593	9.99+	1.949
106	15	S2	0	7.597	2094.933	1308.437	2094.933	9.99+	1.601
107	15	S3	0	0.705	2086.876	1278.078	2086.876	9.99+	1.633



**Slab Sliding Safety Factors (Continued)**

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
108	15	S4	0	0	2089.691	1280.441	2089.691	9.99+	1.632
109	15	S5	0	0	2089.687	1280.519	2089.687	9.99+	1.632
110	15	S6	0	0.733	2086.897	1278.18	2086.897	9.99+	1.633
111	15	S7	0	7.657	2094.815	1308.363	2094.815	9.99+	1.601
112	15	S8	0	39.919	1974.66	1013.198	1974.66	9.99+	1.949

**Envelope Slab Soil Pressures**

	Label	Max UC	Max LC	Soil Pressure[psf]	Allowable Bearing[psf]	Point
1	S1	0.362	10	542.319	1500	N230
2	S2	0.398	10	597.406	1500	N237
3	S3	0.398	10	596.57	1500	N244
4	S4	0.398	10	597.581	1500	N251
5	S5	0.398	10	597.585	1500	N258
6	S6	0.398	10	596.615	1500	N265
7	S7	0.398	10	597.218	1500	N272
8	S8	0.362	10	542.516	1500	N279



JOB NO.: U2716.0342.221

PROJECT: Sunturf Package A13 Ground Mount

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# ANCHORAGE DESIGN FOR CONCRETE BALLAST BLOCK





Company:	Vector Structural Engineers	Date:	6/30/2022
Engineer:	LKN	Page:	1/6
Project:	Sunturf Ground Mount A13		
Address:			
Phone:			
E-mail:			

**1. Project information**

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

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

**2. Input Data & Anchor Parameters**

**General**

Design method: ACI 318-14  
Units: Imperial units

**Anchor Information:**

Anchor type: Bonded anchor  
Material: F1554 Grade 36  
Diameter (inch): 0.375  
Effective Embedment depth,  $h_{ef}$  (inch): 4.000  
Code report: ICC-ES ESR-4057  
Anchor category: -  
Anchor ductility: Yes  
 $h_{min}$  (inch): 5.25  
 $c_{ac}$  (inch): 7.12  
 $C_{min}$  (inch): 1.75  
 $S_{min}$  (inch): 1.00

**Base Material**

Concrete: Normal-weight  
Concrete thickness,  $h$  (inch): 24.00  
State: Cracked  
Compressive strength,  $f'_c$  (psi): 2500  
 $\Psi_{c,v}$ : 1.0  
Reinforcement condition: B tension, B shear  
Supplemental reinforcement: Not applicable  
Reinforcement provided at corners: No  
Ignore concrete breakout in tension: No  
Ignore concrete breakout in shear: No  
Hole condition: Dry concrete  
Inspection: Periodic  
Temperature range, Short/Long: 150/110°F  
Ignore 6do requirement: Not applicable  
Build-up grout pad: No

**Base Plate**

Length x Width x Thickness (inch): 4.75 x 4.75 x 0.31

**Recommended Anchor**

Anchor Name: SET-3G - SET-3G w/ 3/8"Ø F1554 Gr. 36  
Code Report: ICC-ES ESR-4057





Company:	Vector Structural Engineers	Date:	6/30/2022
Engineer:	LKN	Page:	2/6
Project:	Sunturf Ground Mount A13		
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]: 3276

$V_{uax}$  [lb]: 2794

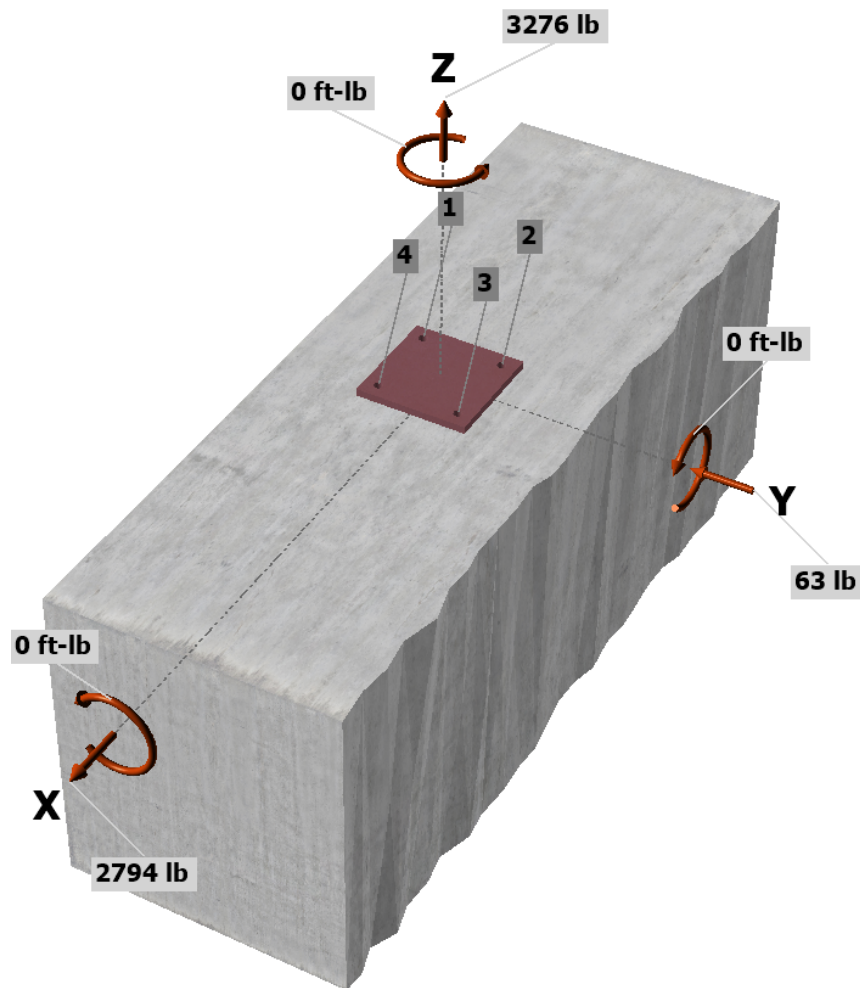
$V_{uay}$  [lb]: -63

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

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

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

<Figure 1>

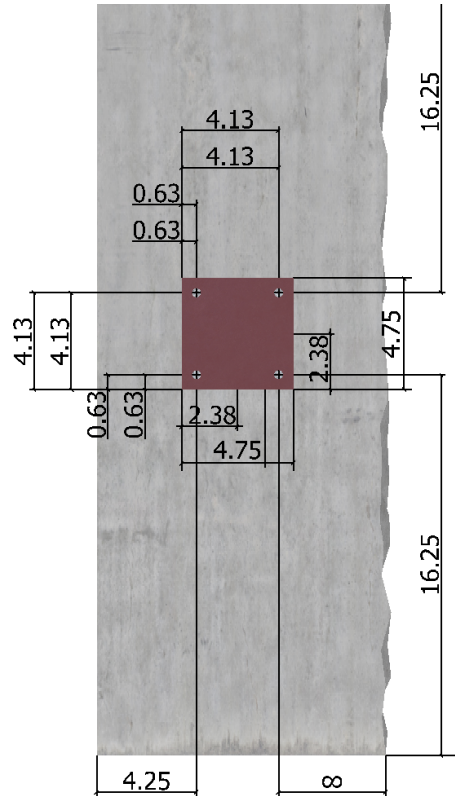




Anchor Designer™  
Software  
Version 3.0.7947.0

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<Figure 2>





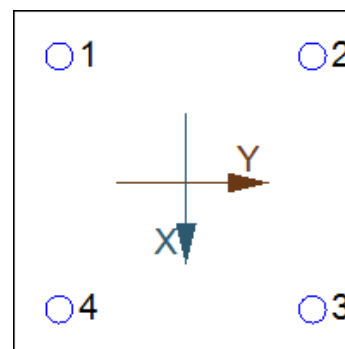
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### 3. Resulting Anchor Forces

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	819.0	698.5	-15.7	698.6
2	819.0	698.5	-15.7	698.7
3	819.0	698.5	-15.8	698.7
4	819.0	698.5	-15.8	698.6
Sum	3276.0	2794.0	-63.0	2794.7

Maximum concrete compression strain (%): 0.00  
 Maximum concrete compression stress (psi): 0  
 Resultant tension force (lb): 3276  
 Resultant compression force (lb): 0  
 Eccentricity of resultant tension forces in x-axis,  $e'_{Nx}$  (inch): 0.00  
 Eccentricity of resultant tension forces in y-axis,  $e'_{Ny}$  (inch): 0.00  
 Eccentricity of resultant shear forces in x-axis,  $e'_{Vx}$  (inch): 0.00  
 Eccentricity of resultant shear forces in y-axis,  $e'_{Vy}$  (inch): 0.00

<Figure 3>



### 4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

$N_{sa}$ (lb)	$\phi$	$\phi N_{sa}$ (lb)
4525	0.75	3394

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

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

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

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

$A_{Nc}$ (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)
213.13	144.00	4.25	1.000	0.913	1.00	1.000	6800	0.65	5969

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

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

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

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

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

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

$A_{Na}$ (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)
183.75	112.09	5.29	4.25	1.000	0.941	1.000	6343	0.55	5381

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



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

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

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

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

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

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

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

$A_{Vc}$ (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)
897.00	1755.28	1.000	0.743	1.000	1.111	28514	0.70	8420

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

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

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

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

$A_{Vc}$ (in <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)
103.59	81.28	0.999	1.000	1.000	1.000	2846	0.70	2538

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

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

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

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

$A_{Vc}$ (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)	$\phi$	$\phi V_{cbgx}$ (lb)
771.00	1188.28	1.000	1.000	1.000	1.008	21280	0.70	19481

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

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

$l_e$ (in)	$d_a$ (in)	$\lambda_a$	$f_c$ (psi)	$c_{a1}$ (in)	$V_{bx}$ (lb)
3.00	0.375	1.00	2500	4.25	2846

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

$A_{Vc}$ (in <sup>2</sup> )	$A_{Vco}$ (in <sup>2</sup> )	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	$V_{bx}$ (lb)	$\phi$	$\phi V_{cbgy}$ (lb)
103.59	81.28	1.000	1.000	1.000	1.000	2846	0.70	5079

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

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

$k_{cp}$	$A_{Na}$ (in <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	183.75	112.09	0.941	1.000	1.000	6343	9782

$A_{Nc}$ (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)	$\phi$
213.13	144.00	1.000	0.913	1.000	1.000	6800	9183	0.70

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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$\phi V_{cp\bar{g}}$  (lb)  
12857

## 11. Results

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

Tension	Factored Load, $N_{ua}$ (lb)	Design Strength, $\phi N_n$ (lb)	Ratio	Status	
Steel	819	3394	0.24	Pass	
Concrete breakout	3276	5969	0.55	Pass	
<b>Adhesive</b>	<b>3276</b>	<b>5381</b>	<b>0.61</b>	<b>Pass (Governs)</b>	
Shear	Factored Load, $V_{ua}$ (lb)	Design Strength, $\phi V_n$ (lb)	Ratio	Status	
<b>Steel</b>	<b>699</b>	<b>1765</b>	<b>0.40</b>	<b>Pass (Governs)</b>	
T Concrete breakout x+	2794	8420	0.33	Pass	
T Concrete breakout y-	31	2538	0.01	Pass	
Concrete breakout x+	32	19481	0.00	Pass	
Concrete breakout y-	1397	5079	0.28	Pass	
Concrete breakout, combined	-	-	0.33	Pass	
Pryout	2795	12857	0.22	Pass	
Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.44	0.21	65.1%	1.0	Pass

**SET-3G w/ 3/8"Ø F1554 Gr. 36 with hef = 4.000 inch meets the selected design criteria.**

## 12. Warnings

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