



Project Number: U2716-0277-211

May 20, 2024

Sunmodo
14800 NE 65th Street
Vancouver, WA 98682

**REFERENCE: Sunmodo Sunturf Ground Mount D3 – 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, 2021 Edition (2021 IBC). Vector Structural Engineering requires that we review each site-specific install, and we are not liable for installs at site specific locations we have not reviewed. This document does not address site-specific installations. The following design parameters are used in our analysis:

- Minimum Design Loads for Buildings and Other Structures (ASCE 7-16)
- Design wind speed for risk category I structures: 170 mph
- Wind exposure: C
- Ground snow load: 0 psf
- The ground screws and helical piers must be tested to 1.5 times uplift and 2.0 times lateral reactions found in the table below. A minimum of one ground screw or helical pier must be tested.

Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	2410	1.5	3615
LATERAL	1160	2	2320

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

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

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

Very truly yours,

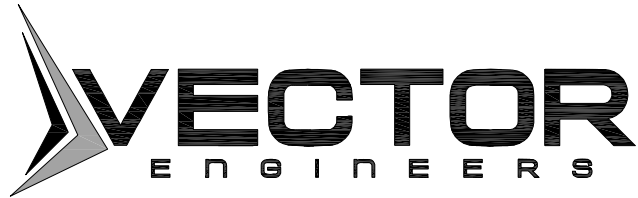
VECTOR STRUCTURAL ENGINEERING, LLC
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Eric Sumsion, P.E.
License: 56167 - Expires: 10/31/2025
Project Engineer

Enclosures

ESS/mih



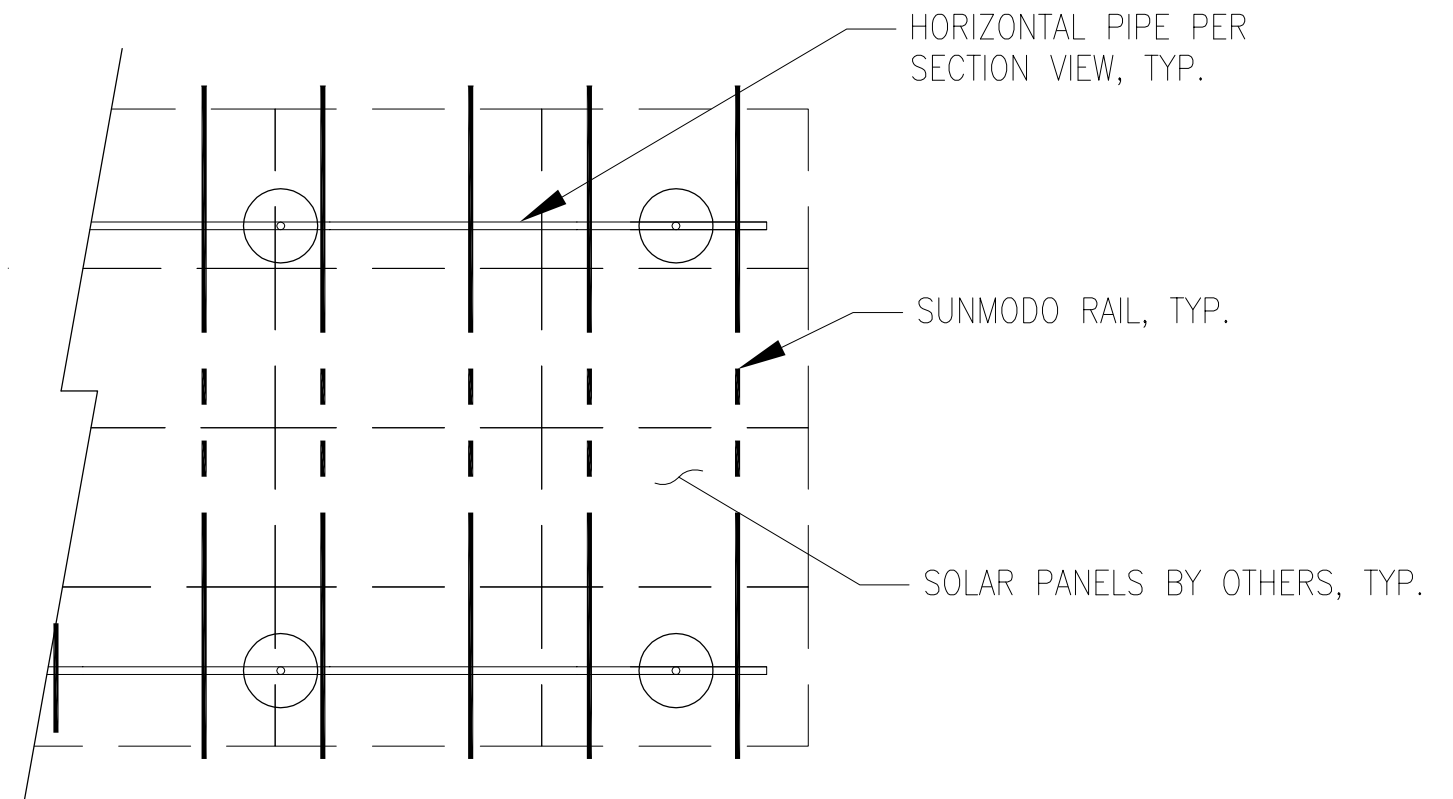
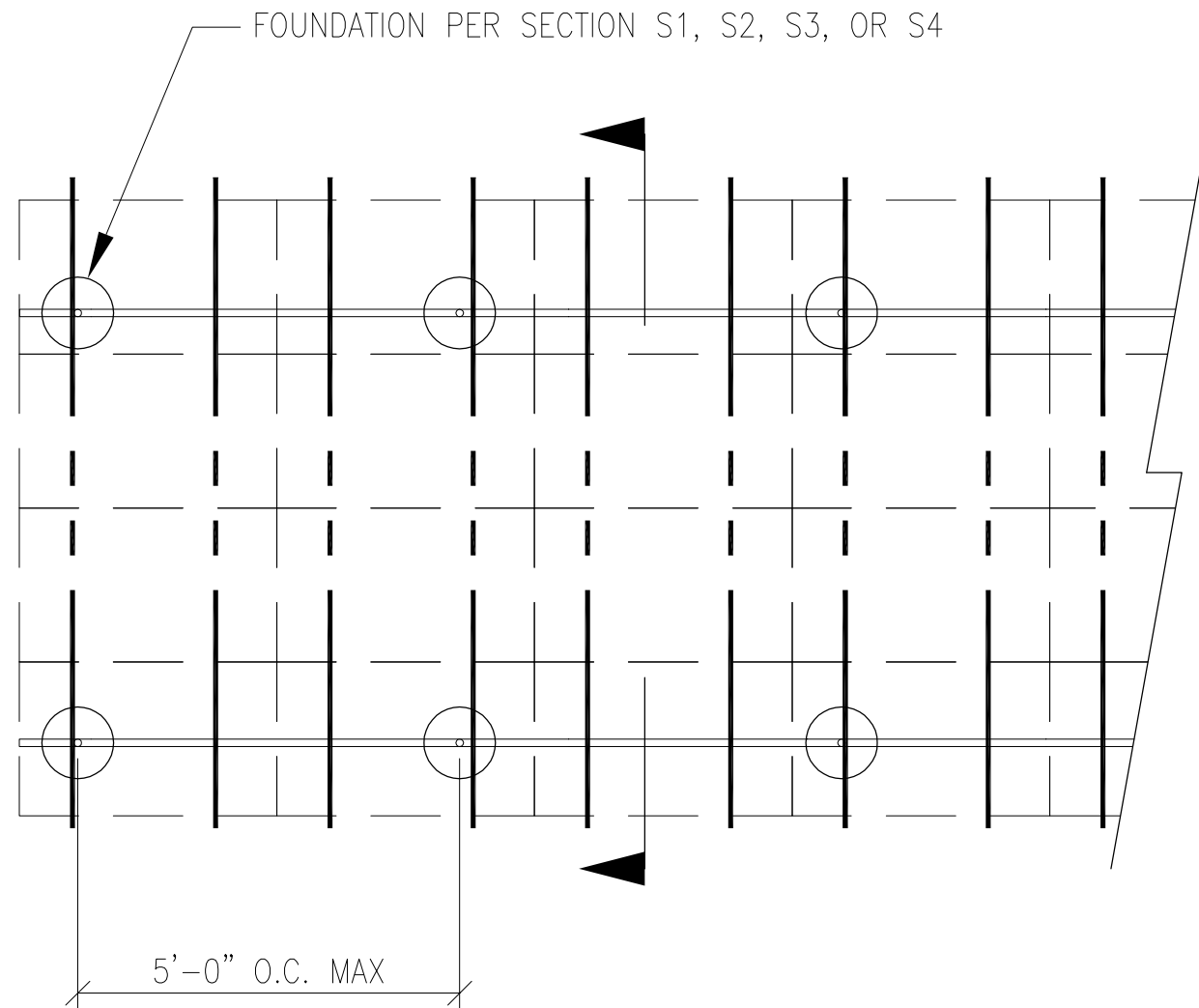


JOB NO. U2716-0277-211
PROJECT SUNMODO SUNTURF GROUND MOUNTS D3
SUBJECT ALL OPTIONS

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



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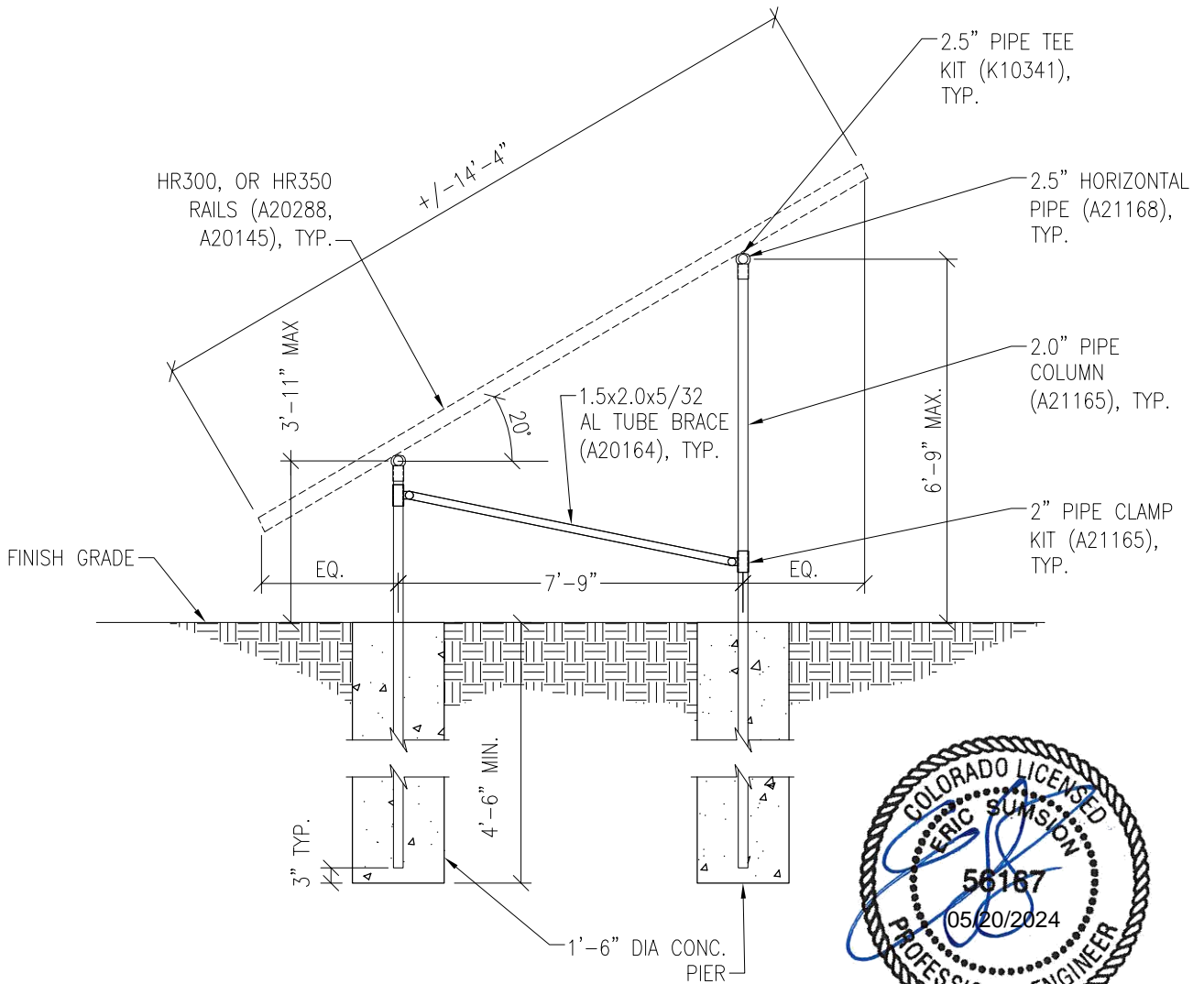


PV ARRAY PLAN

N.T.S.

PROJECT SUNMODO SUNTURF GROUND MOUNTS D3

SUBJECT DRILLED PIER OPTION



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PV ARRAY SECTION

N.T.S.

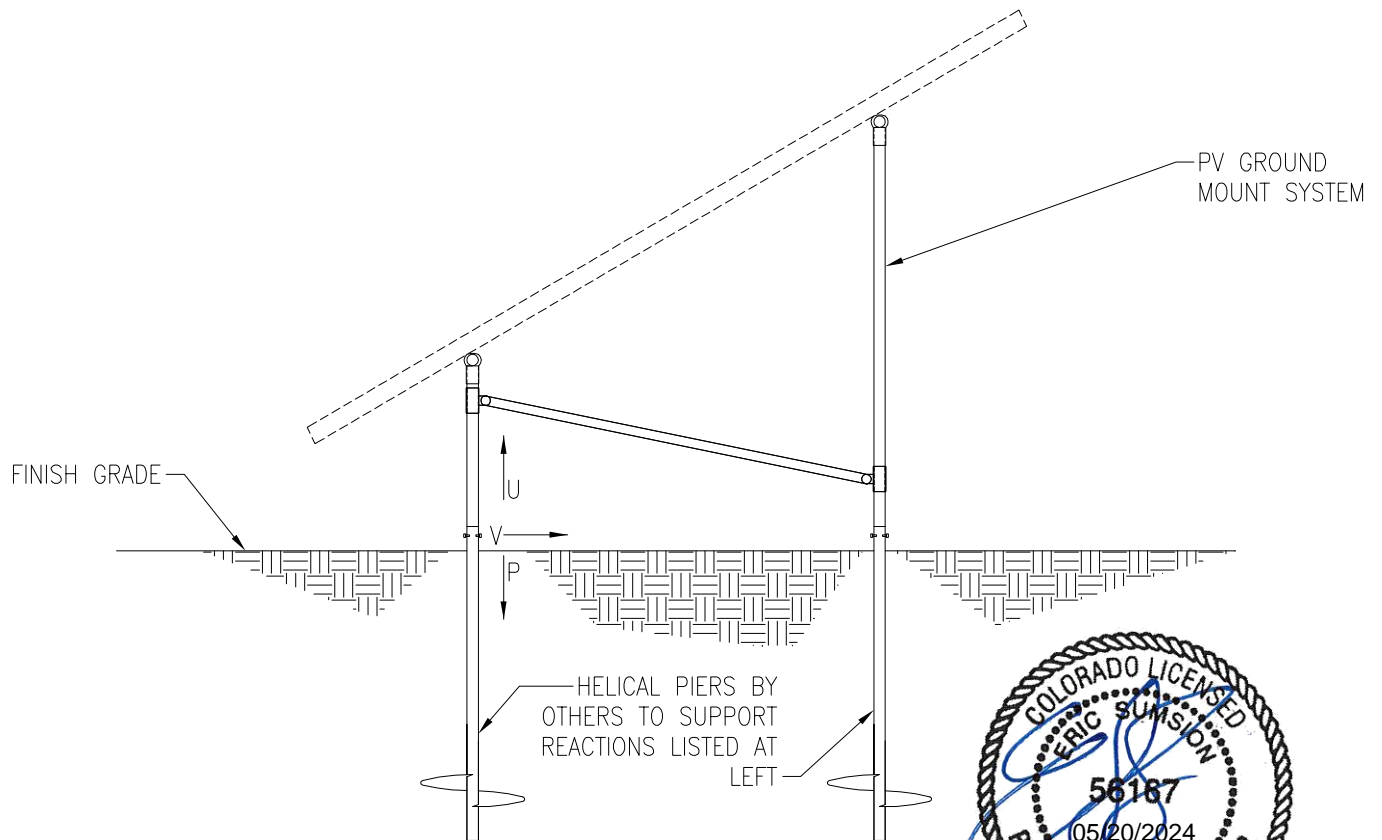
S1

PROJECT SUNMODO SUNTURF GROUND MOUNTS D3

SUBJECT HELICAL PIER OPTION

NOTES:

1. For ground mount components see Section S1.
2. A minimum of (1) helical pier must be load-tested as follows:
 - 2.1. Safety factor for uplift = 1.5,
 - 2.2. Safety factor for lateral loads = 2.0
 - 2.3. Upward deflection limit = 1/2"
 - 2.4. Lateral deflection limit = 1"
 - 2.5. The load tests must be performed by an approved contractor.

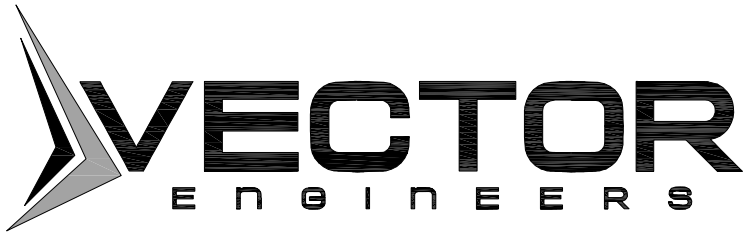


MAXIMUM REACTIONS:
 U = 2,410 LBS
 P = 2,520 LBS
 V = 1,160 LBS

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PV ARRAY SECTION

N.T.S.



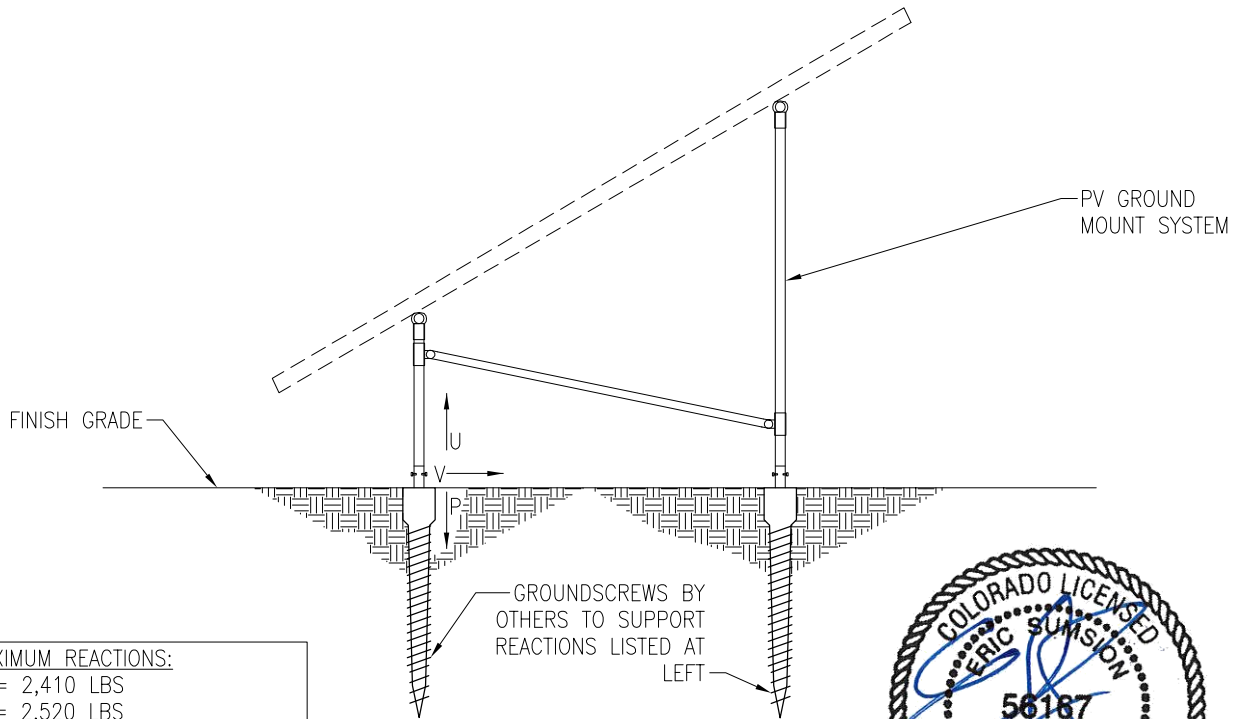
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PROJECT SUNMODO SUNTURF GROUND MOUNTS D3

SUBJECT GROUND SCREW OPTION

NOTES:

1. For ground mount components see Section S1.
2. A minimum of (1) ground screw must be load-tested as follows:
 - 2.1. Safety factor for uplift = 1.5,
 - 2.2. Safety factor for lateral loads = 2.0
 - 2.3. Upward deflection limit = 1/2"
 - 2.4. Lateral deflection limit = 1"
 - 2.5. The load tests must be performed by an approved contractor.



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PV ARRAY SECTION

N.T.S.



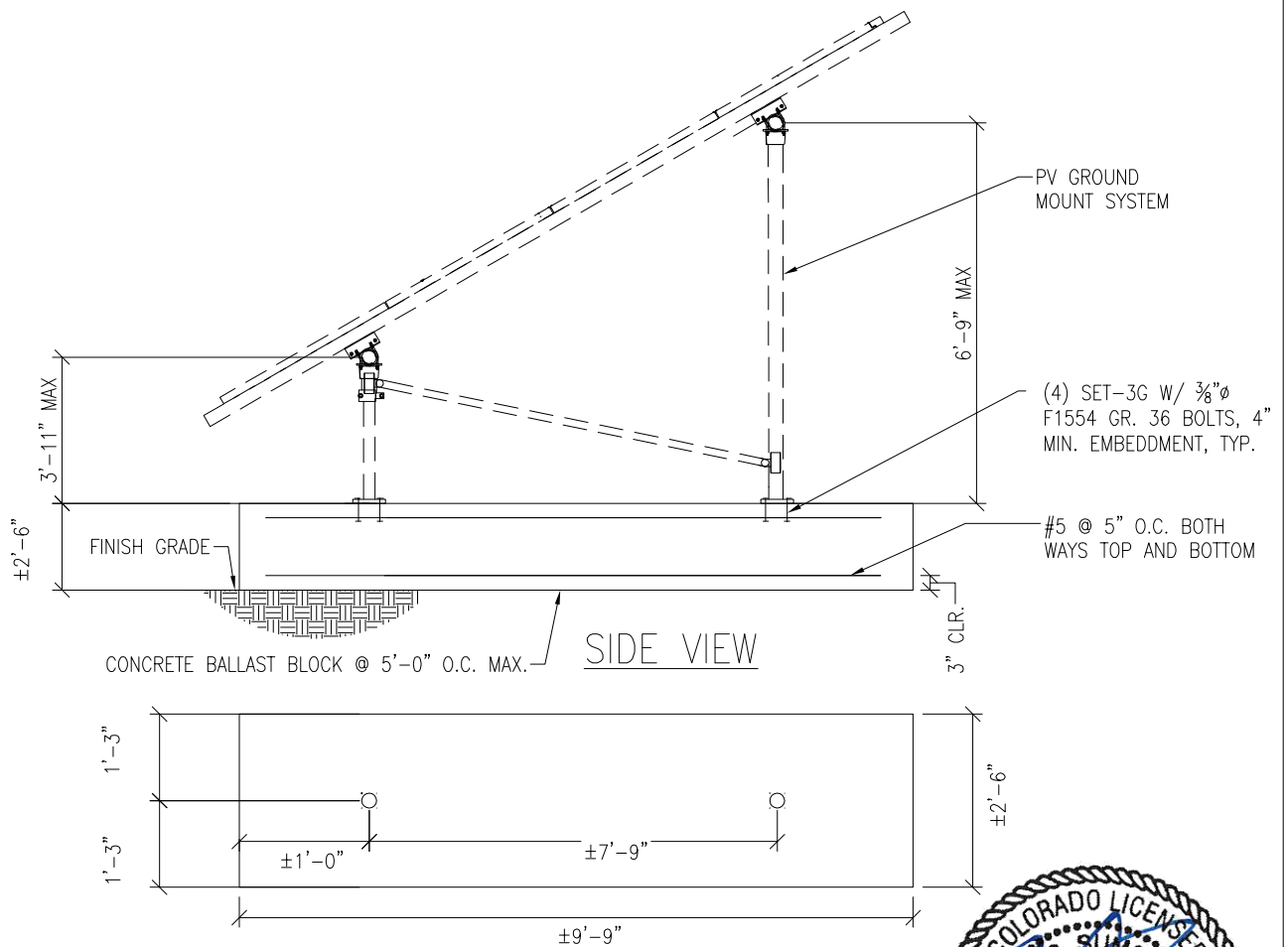
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PROJECT SUNMODO SUNTURF GROUND MOUNTS D3

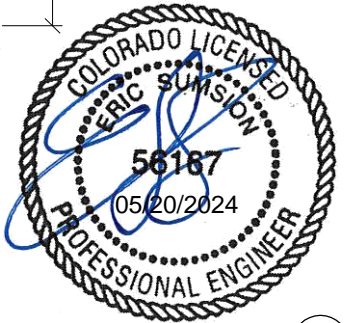
SUBJECT BALLASTED BLOCK OPTION

NOTES:

1. For ground mount components see Section S1.



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PV ARRAY SECTION

N.T.S.

S4



PROJECT: Sunturf Package D3 Ground Mount

WIND PRESSURES

Calculations per:	ASCE 7-16	
Design Wind Speed, V [mph]:	170	
Risk Category:	I	(Table 1.5-1)
Exposure Category:	C	(Section 26.7)
Elevation [ft]:	7.9	
Ground Elevation Factor, K_e :	1.00	(Table 26.9-1)
α :	9.5	(Table 26.11-1)
z_g [ft]:	900	(Table 26.11-1)
Velocity Pressure Exposure Coefficient, K_h :	0.85	(Table 26.10-1)
Topographic Factor, K_{ht} :	1.0	(Section 26.8)
Wind Directionality Factor, K_d :	0.85	(Table 26.6-1)
Internal Pressure Coefficient, GC_{pi} :	0.00	(Figure 26.13-1)
Velocity Pressure, q_h [psf]:	53.37	(Equation 26.10-1)
Gust Effect Factor, G:	0.85	(Section 26.11.4)
Panel Slope [degrees]:	20.0	
Wind Flow:	Clear	
Roof Configuration:	Monoslope	

Wind Pressures in Transverse (N-S) Direction

Net Pressure Coefficients per Figure 27.3-4

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

Design Wind Pressures per Equation 27.3-2 [psf]

Clear Wind Flow	$q_h GC_{NW}$	$q_h GC_{NL}$
Case 1 ($\gamma = 0^\circ$, Load Case A)	-59.0	-68.0
Case 2 ($\gamma = 0^\circ$, Load Case B)	-99.8	-9.1
Case 3 ($\gamma = 180^\circ$, Load Case A)	72.6	77.1
Case 4 ($\gamma = 180^\circ$, Load Case B)	95.3	31.8
Case 5 ($\gamma = 0^\circ$, 16 psf Min. Horiz.)	-16.0	-16.0
Case 6 ($\gamma = 180^\circ$, 16 psf Min. Horiz.)	16.0	16.0



JOB NO.: U2716-0277-211

DESIGNED: STB

Foundation Option 1: Drilled Concrete Pier



PROJECT: Sunturf Package D3 Ground Mount

DRILLED CONCRETE PIER DESIGN

Column Reactions:

Max. Shear, V [k]:	1.2	Max. Down, P_d [k]:	2.5
Max. Moment, M [k-ft]:	0.0	Max. Uplift, P_u [k]:	2.4

Pier Properties:

Pier Shape:	Round	Volume of Concrete [ft ³]:	8
Pier Diameter, b [ft]:	1.5	Volume of Concrete [yd ³]:	0.3
Top of Pier Elevation [ft]:	0.00	Weight of Concrete [k]:	1.2
Pier Depth, d [ft]:	4.5		

Soil Properties:

Allow. Bearing Pressure [psf]:	1,500	<u>Optional Parameters for Uplift:</u>	
1/3 increase for short term loads?	No		
Lateral Bearing, S [pcf]:	150	Skin Friction* [psf]:	250
Max. Lateral Bearing (opt'l) [psf]:		Top Length to Ignore [ft]:	0
Top Depth to Ignore [ft]:	0	1/3 increase for short term loads?	No
1/3 increase for short term loads?	No	Combine w/ Bearing:	No
1/2" deflection at t/o pier allowed:	Yes		

*per IBC Section 1810.3.3.1.4

Check Bearing:

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

Bearing capacity OK.

Check Uplift:

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

Uplift capacity OK.

Check Lateral Bearing:

Top of Pier Constrained?:	No
Applied Lateral Force, P [lb]:	1,160
Point of Application, h [ft]:	0.0
S_{max} [psf]:	
S [psf]:	450
$A = 2.34 * P / (S_b)$:	4.02
Required Pier Depth, d_{reqd} [ft]:	4.00

IBC Section 1807.3.2.1

IBC Eq. 18-1

Result: **Lateral bearing capacity OK.**

Foundation Option 2: Helical Pier

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.

Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	2410	1.5	3615
LATERAL	1160	2	2320

Foundation Option 3: Ground Screw

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.

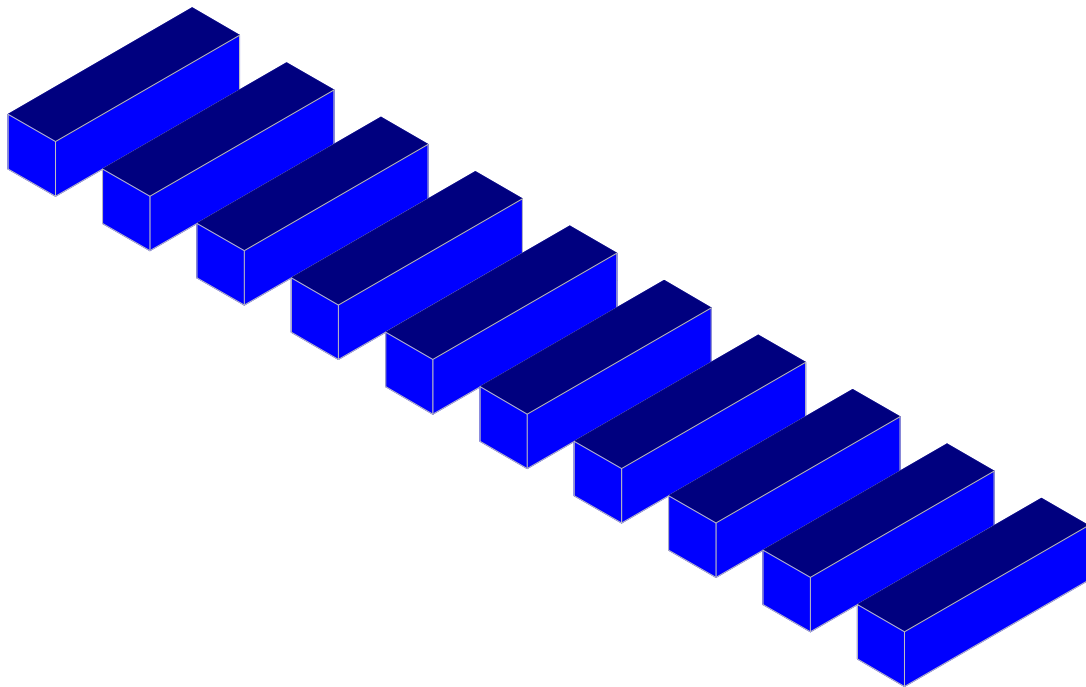
Load (ASD)	Value (lbs)	Factor of Safety	Test Value (lbs)
UPLIFT	2410	1.5	3615
LATERAL	1160	2	2320



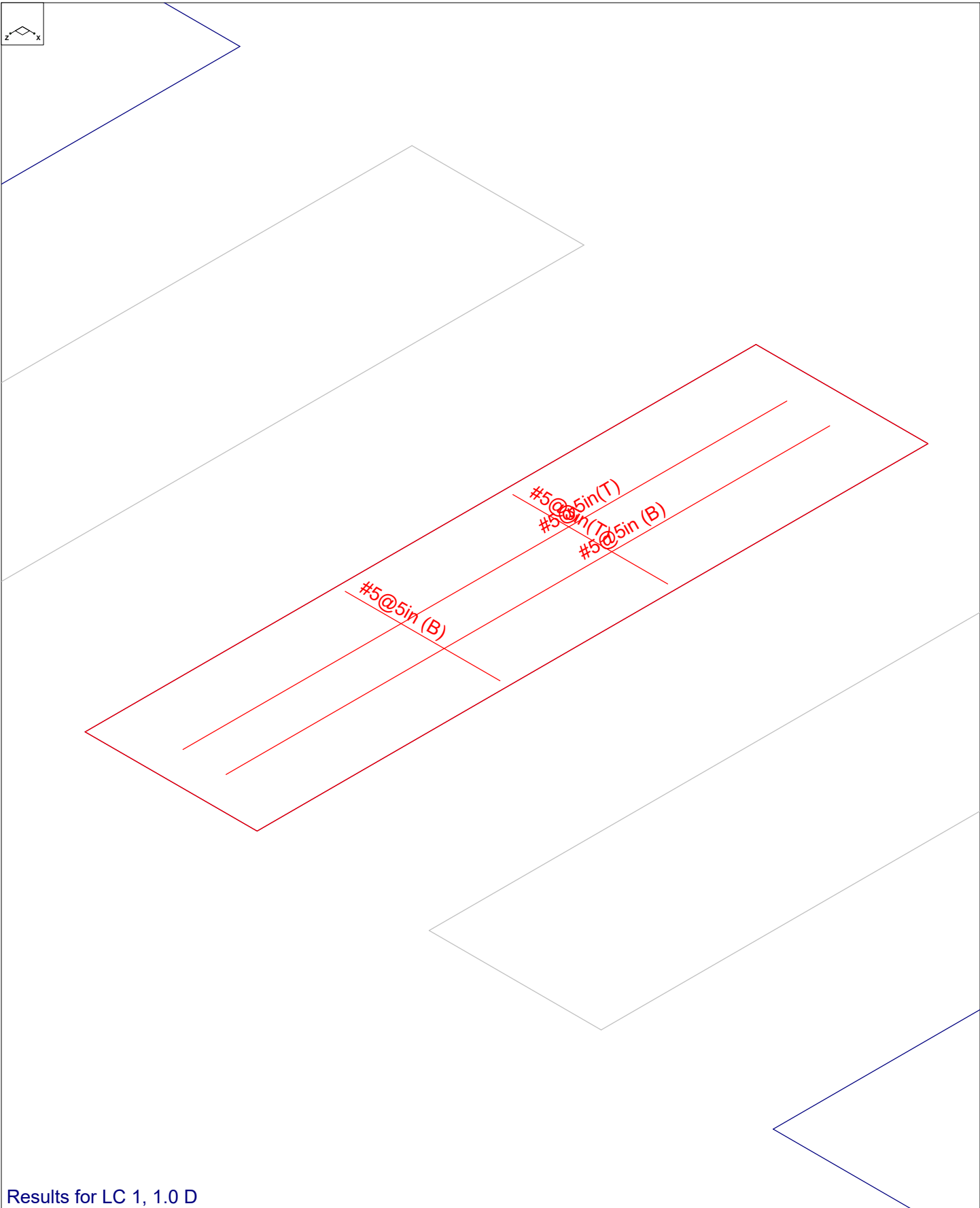
JOB NO.: U2716-0277-211

DESIGNED: STB

Foundation Option 4: Ballasted Block



Vector Structural Engineeri..	Ground Mount	SK - 1
STB		Jan 20, 2021 at 1:02 PM
U2716.0277.211		Sunmodo Sunturf D3 GM.r3d



Results for LC 1, 1.0 D

Vector Structural Engineeri..	Ground Mount	SK - 2
STB		Jan 20, 2021 at 1:03 PM
U2716.0277.211		Sunmodo Sunturf D3 GM.r3d

(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	100
Mesh Size (in)	12
Max Iterations	10
Merge Tolerance (in)	.12
Solver	Sparse Accelerated
Coefficient of Friction	.3
No. of Shear Regions	4
Shear Region Spacing Increment (in)	4
Min 1 Bar Dia Spacing for Beams?	No
Optimize footings for OTM / Sliding?	Yes
Parame Beta Factor	.65
Pile Safety Factor	3
Concrete Stress Block	0
Concrete Rebar Set	Rectangular
Concrete Code	ASTM A615
HR Steel Pile Code	ACI 318-14
Wood Pile Code	AISC 14th (360-10): ASD AWC NDS-15: ASD

Concrete Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/...	Density[lb/ft^3]	fc[psi]	Lambda	Flex Stee...	Shear St...
1	Conc3000NW	3156	1372	.15	.6	145	3000	1	60000	60000
2	Conc3500NW	3409	1482	.15	.6	145	3500	1	60000	60000
3	Conc4000NW	3644	1584	.15	.6	145	4000	1	60000	60000
4	Conc3000LW	2085	907	.15	.6	109.999	3000	.75	60000	60000
5	Conc3500LW	2252	979	.15	.6	109.999	3500	.75	60000	60000
6	Conc4000LW	2408	1047	.15	.6	109.999	4000	.75	60000	60000
7	Conc2500NW	3156	1372	.15	.6	145	2500	1	60000	60000

General Design Parameters

	Label	Max Bending Chk	Max Shear Chk	Top Cover[in]	Bottom Cover[in]
1	Typical	1	1	3	3

Slab Rebar Parameters

	Label	Top Bar	Bottom Bar	Max Top Bar Sp...	Min Top Bar Sp...	Max Bot Bar Sp...	Min Bot Bar Sp...	Spacing Incr...	Rebar Options
1	Typical	#5	#5	5	3	5	3	1	Optimize

Soil Definitions

	Label	Subgrade Modulus[lb/ft^3]	Allowable Bearing[psf]	Depth Properties	Default?
1	Default	1e+5	1500	None	Yes

Point Loads and Moments (Cat 1 : DL)

	Label	Direction	Magnitude[lb.-ft]
1	R3D_N1	X	-4.177
2	R3D_N1	Y	126.281
3	R3D_N2	Y	106.254
4	R3D_N132	Y	157.078
5	R3D_N133	X	1.368
6	R3D_N133	Y	146.866
7	R3D_N109	Y	162.028
8	R3D_N109	Z	-1.409

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

	Label	Direction	Magnitude[lb,lb-ft]
9	R3D_N110A	Y	153.878
10	R3D_N121	X	-1.449
11	R3D_N121	Y	156.925
12	R3D_N121	Z	-2.003
13	R3D_N122	X	-3.42
14	R3D_N122	Y	146.385
15	R3D_N122	Z	2.61
16	R3D_N133B	Y	148.348
17	R3D_N134B	X	1.303
18	R3D_N134B	Y	136.199
19	R3D_N151	Y	156.26
20	R3D_N152	Y	146.025
21	R3D_N157A_1	Y	151.823
22	R3D_N158A_1	X	-1.294
23	R3D_N158A_1	Y	140.169
24	R3D_N155B_1	Y	152.031
25	R3D_N156B_1	X	2.485
26	R3D_N156B_1	Y	140.533
27	R3D_N167	Y	164.093
28	R3D_N168	Y	156.874
29	R3D_N179	X	4.252
30	R3D_N179	Y	126.073
31	R3D_N180	X	1.008
32	R3D_N180	Y	106.21

Point Loads and Moments (Cat 16 : OL1)

	Label	Direction	Magnitude[lb,lb-ft]
1	R3D_N1	X	60.657
2	R3D_N1	Y	-2154.958
3	R3D_N1	Z	1108.744
4	R3D_N2	X	8.926
5	R3D_N2	Y	-742.184
6	R3D_N2	Z	-77.356
7	R3D_N132	X	-9.274
8	R3D_N132	Y	-3059.096
9	R3D_N132	Z	1620.767
10	R3D_N133	X	-24.689
11	R3D_N133	Y	-1124.378
12	R3D_N133	Z	-93.729
13	R3D_N109	X	-3.252
14	R3D_N109	Y	-3183.599
15	R3D_N109	Z	1707.23
16	R3D_N110A	X	-10.47
17	R3D_N110A	Y	-1208.306
18	R3D_N110A	Z	-99.221
19	R3D_N121	X	27.552
20	R3D_N121	Y	-3075.757
21	R3D_N121	Z	1666.667
22	R3D_N122	X	57.552
23	R3D_N122	Y	-1106.569
24	R3D_N122	Z	-133.506
25	R3D_N133B	X	-10.25
26	R3D_N133B	Y	-2789.379
27	R3D_N133B	Z	1487.332
28	R3D_N134B	X	-20.207
29	R3D_N134B	Y	-1041.83

Point Loads and Moments (Cat 17 : OL2) (Continued)

	Label	Direction	Magnitude[lb.-ft]
25	R3D_N133B	Y	-3710.951
26	R3D_N133B	Z	1213.103
27	R3D_N134B	Y	488.862
28	R3D_N134B	Z	-85.135
29	R3D_N151	X	11.795
30	R3D_N151	Y	-4081.194
31	R3D_N151	Z	1377.148
32	R3D_N152	X	2.485
33	R3D_N152	Y	613.347
34	R3D_N152	Z	-77.969
35	R3D_N157A_1	X	16.934
36	R3D_N157A_1	Y	-3820.587
37	R3D_N157A_1	Z	1218.164
38	R3D_N158A_1	Y	487.345
39	R3D_N158A_1	Z	-71.839
40	R3D_N155B_1	X	-27.416
41	R3D_N155B_1	Y	-3944.406
42	R3D_N155B_1	Z	1344.33
43	R3D_N156B_1	X	-1.821
44	R3D_N156B_1	Y	596.643
45	R3D_N156B_1	Z	-74.423
46	R3D_N167	Y	-4313.99
47	R3D_N167	Z	1431.508
48	R3D_N168	X	-1.714
49	R3D_N168	Y	635.627
50	R3D_N168	Z	-73.116
51	R3D_N179	X	-95.255
52	R3D_N179	Y	-2907.624
53	R3D_N179	Z	925.59
54	R3D_N180	Y	425.889
55	R3D_N180	Z	-61.778

Point Loads and Moments (Cat 18 : OL3)

	Label	Direction	Magnitude[lb.-ft]
1	R3D_N1	X	-77.569
2	R3D_N1	Y	2703.777
3	R3D_N1	Z	-1304.229
4	R3D_N2	X	-9.298
5	R3D_N2	Y	711.124
6	R3D_N2	Z	91.288
7	R3D_N132	X	11.765
8	R3D_N132	Y	3833.193
9	R3D_N132	Z	-1908.421
10	R3D_N133	X	26.562
11	R3D_N133	Y	1083.688
12	R3D_N133	Z	110.501
13	R3D_N109	X	4.022
14	R3D_N109	Y	3985.638
15	R3D_N109	Z	-2007.175
16	R3D_N110A	X	11.25
17	R3D_N110A	Y	1166.253
18	R3D_N110A	Z	117.557
19	R3D_N121	X	-34.906
20	R3D_N121	Y	3849.09
21	R3D_N121	Z	-1965.992
22	R3D_N122	X	-60.96



Point Loads and Moments (Cat 18 : OL3) (Continued)

	Label	Direction	Magnitude[lb.-lb-ft]
23	R3D_N122	Y	1069.193
24	R3D_N122	Z	160.328
25	R3D_N133B	X	12.962
26	R3D_N133B	Y	3490.458
27	R3D_N133B	Z	-1743.621
28	R3D_N134B	X	21.228
29	R3D_N134B	Y	1015.855
30	R3D_N134B	Z	113.261
31	R3D_N151	X	-10.094
32	R3D_N151	Y	3817.027
33	R3D_N151	Z	-1907.324
34	R3D_N152	X	-20.044
35	R3D_N152	Y	1063.558
36	R3D_N152	Z	108.321
37	R3D_N157A_1	X	-14.587
38	R3D_N157A_1	Y	3587.028
39	R3D_N157A_1	Z	-1755.207
40	R3D_N158A_1	X	-22.563
41	R3D_N158A_1	Y	1081.122
42	R3D_N158A_1	Z	101.693
43	R3D_N155B_1	X	24.039
44	R3D_N155B_1	Y	3693.826
45	R3D_N155B_1	Z	-1861.978
46	R3D_N156B_1	X	43.353
47	R3D_N156B_1	Y	993.772
48	R3D_N156B_1	Z	104.209
49	R3D_N167	Y	4054.953
50	R3D_N167	Z	-2020.022
51	R3D_N168	Y	1196.366
52	R3D_N168	Z	102.85
53	R3D_N179	X	83.559
54	R3D_N179	Y	2705.932
55	R3D_N179	Z	-1296.664
56	R3D_N180	X	11.698
57	R3D_N180	Y	710.23
58	R3D_N180	Z	86.529

Point Loads and Moments (Cat 19 : OL4)

	Label	Direction	Magnitude[lb.-lb-ft]
1	R3D_N1	X	-38.814
2	R3D_N1	Y	1566.443
3	R3D_N1	Z	-1119.328
4	R3D_N2	X	-13.346
5	R3D_N2	Y	1333.257
6	R3D_N2	Z	77.037
7	R3D_N132	X	6.277
8	R3D_N132	Y	2241.648
9	R3D_N132	Z	-1629.409
10	R3D_N133	X	33.867
11	R3D_N133	Y	1996.869
12	R3D_N133	Z	93.734
13	R3D_N109	X	2.573
14	R3D_N109	Y	2345.732
15	R3D_N109	Z	-1727.351
16	R3D_N110A	X	14.411
17	R3D_N110A	Y	2139.892

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...	C...	F...	C...	F...
1	1.0 D	Yes	Yes	1.5	DL	1											
2	1.0 D + 1....	Yes	Yes	1.5	DL	1	RLL	1									
3	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL		OL1	.6							
4	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL		OL2	.6							
5	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL		OL3	.6							
6	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL		OL4	.6							
7	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL	.75	OL1	.45							
8	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL	.75	OL2	.45							
9	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL	.75	OL3	.45							
10	1.0 D + 0....	Yes	Yes	1.5	DL	1	RLL	.75	OL4	.45							
11	0.9 D + 0....	Yes	Yes		DL	.9	RLL		OL1	.6							
12	0.9 D + 0....	Yes	Yes		DL	.9	RLL		OL2	.6							
13	0.9 D + 0....	Yes	Yes		DL	.9	RLL		OL3	.6							
14	0.9 D + 0....	Yes	Yes		DL	.9	RLL		OL4	.6							
15																	
16	1.4D	Yes			DL	1.4											
17	1.2D+1.6SL	Yes			DL	1.2	RLL	1.6									
18	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL1	.5							
19	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL2	.5							
20	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL3	.5							
21	1.2D+1.6S...	Yes			DL	1.2	RLL	1.6	OL4	.5							
22	1.2D+1.0...	Yes			DL	1.2			OL1	1							
23	1.2D-1.0Wx	Yes			DL	1.2			OL2	1							
24	1.2D+1.0...	Yes			DL	1.2			OL3	1							
25	1.2D-1.0Wz	Yes			DL	1.2			OL4	1							
26	.9D+1.0Wx	Yes			DL	.9			OL1	1							
27	.9D-1.0Wx	Yes			DL	.9			OL2	1							
28	.9D+1.0Wz	Yes			DL	.9			OL3	1							
29	.9D-1.0Wz	Yes			DL	.9			OL4	1							

Design Strips

Label	Rebar Angle from Pl...	No. of Design Cuts	Design Rule	
1	DS1	0	50	Typical
2	DS2	90	50	Typical

Load Categories

Category	Point Loads	Line Loads	Area Loads
1	DL	32	
2	OL1	58	
3	OL2	55	
4	OL3	58	
5	OL4	59	

Strip Reinforcing

Label	UC Top	LC	Top Bars	Governing ...	UC Bot	LC	Bot B...	Gover...	UC Shear	LC	Governing De...	
1	DS1	.015	24	#5@5in	DS1-X21	.024	27	#5@5in	DS1-...	.046	27	DS1-X10
2	DS2	.001	26	#5@5in	DS2-X8	.002	24	#5@5in	DS2-...	.006	24	DS2-X7

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	1	S1	0	0	44064.359	0	11346.052	9.999+
2	1	S2	0	0	44488.484	0	11439.824	9.999+
3	1	S3	0	0	44426.628	0	11436.25	9.999+
4	1	S4	0	0	44332.94	0	11397.366	9.999+
5	1	S5	0	0	44429.271	0	11421.45	9.999+



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
6	1	S6	0	0	44421.577	0	11422.796	9.999+
7	1	S7	0	0	44368.963	0	11413.166	9.999+
8	1	S8	0	0	44372.186	0	11404.433	9.999+
9	1	S9	0	0	44518.771	0	11446.15	9.999+
10	1	S10	0	0	44063.831	0	11322.144	9.999+
11	2	S1	0	0	44064.359	0	11346.052	9.999+
12	2	S2	0	0	44488.484	0	11439.824	9.999+
13	2	S3	0	0	44426.628	0	11436.25	9.999+
14	2	S4	0	0	44332.94	0	11397.366	9.999+
15	2	S5	0	0	44429.271	0	11421.45	9.999+
16	2	S6	0	0	44421.577	0	11422.796	9.999+
17	2	S7	0	0	44368.963	0	11413.166	9.999+
18	2	S8	0	0	44372.186	0	11404.433	9.999+
19	2	S9	0	0	44518.771	0	11446.15	9.999+
20	2	S10	0	0	44063.831	0	11322.144	9.999+
21	3	S1	0	13777.637	44353.552	2277.231	11346.052	3.219
22	3	S2	0	20570.151	44742.299	3314.511	11439.824	2.175
23	3	S3	0	19794.137	44681.335	3264.401	11436.25	2.257
24	3	S4	0	17983.63	44592.078	2919.092	11403.881	2.48
25	3	S5	0	19709.232	44684.87	3188.55	11428.291	2.267
26	3	S6	0	19629.636	44676.387	3154.493	11422.796	2.276
27	3	S7	0	18473.671	44628.647	3026.802	11413.166	2.416
28	3	S8	0	18994.663	44631.006	3079.546	11416.859	2.35
29	3	S9	0	20932.678	44761.356	3356.855	11446.15	2.138
30	3	S10	0	13788.962	44351.617	2289.393	11348.445	3.216
31	4	S1	0	16689.714	44353.552	2000.129	11346.052	2.658
32	4	S2	0	24433.066	44742.299	2711.059	11439.824	1.831
33	4	S3	0	23596.84	44681.335	2699.042	11436.25	1.894
34	4	S4	0	21340.04	44592.078	2438.35	11403.881	2.09
35	4	S5	0	23616.632	44684.87	2647.349	11428.291	1.892
36	4	S6	0	23496.582	44676.387	2622.304	11422.796	1.901
37	4	S7	0	21960.82	44628.647	2525.331	11413.166	2.032
38	4	S8	0	22727.384	44631.006	2554.678	11416.859	1.964
39	4	S9	0	24824.681	44761.356	2761.343	11446.15	1.803
40	4	S10	0	16656.207	44351.617	2004.184	11348.445	2.663
41	5	S1	0	0	47052.813	0	14037.526	9.999+
42	5	S2	0	0	49337.156	0	15280.834	9.999+
43	5	S3	0	0	48849.633	0	15268.761	9.999+
44	5	S4	0	0	48588.162	0	14725.816	9.999+
45	5	S5	0	0	48929.941	0	15051.62	9.999+
46	5	S6	0	0	48811.688	0	15128.442	9.999+
47	5	S7	0	0	48962.508	0	14970.004	9.999+
48	5	S8	0	0	48416.289	0	14819.044	9.999+
49	5	S9	0	0	49509.378	0	15384.64	9.999+
50	5	S10	0	0	47052.949	0	13741.38	9.999+
51	6	S1	0	0	49938.764	0	13599.066	9.999+
52	6	S2	0	0	53905.177	0	14778.566	9.999+
53	6	S3	0	0	53014.941	0	14758.656	9.999+
54	6	S4	0	0	52247.326	0	14244.258	9.999+
55	6	S5	0	0	53218.679	0	14540.121	9.999+
56	6	S6	0	0	53079.588	0	14625.515	9.999+
57	6	S7	0	0	52737.427	0	14481.938	9.999+
58	6	S8	0	0	52491.238	0	14316.642	9.999+
59	6	S9	0	0	54097.362	0	14874.856	9.999+
60	6	S10	0	0	49922.411	0	13408.592	9.999+
61	7	S1	0	10333.228	44353.552	1707.923	11346.052	4.292
62	7	S2	0	15427.613	44742.299	2485.884	11439.824	2.9

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	
63	7	S3	0	14845.603	44681.335	2448.301	11436.25	3.01	4.671
64	7	S4	0	13487.722	44592.078	2189.319	11403.881	3.306	5.209
65	7	S5	0	14781.924	44684.87	2391.412	11428.291	3.023	4.779
66	7	S6	0	14722.227	44676.387	2365.87	11422.796	3.035	4.828
67	7	S7	0	13855.254	44628.647	2270.102	11413.166	3.221	5.028
68	7	S8	0	14245.997	44631.006	2309.659	11416.859	3.133	4.943
69	7	S9	0	15699.508	44761.356	2517.641	11446.15	2.851	4.546
70	7	S10	0	10341.721	44351.617	1717.045	11348.445	4.289	6.609
71	8	S1	0	12517.286	44353.552	1500.097	11346.052	3.543	7.564
72	8	S2	0	18324.8	44742.299	2033.294	11439.824	2.442	5.626
73	8	S3	0	17697.63	44681.335	2024.282	11436.25	2.525	5.65
74	8	S4	0	16005.03	44592.078	1828.763	11403.881	2.786	6.236
75	8	S5	0	17712.474	44684.87	1985.511	11428.291	2.523	5.756
76	8	S6	0	17622.437	44676.387	1966.728	11422.796	2.535	5.808
77	8	S7	0	16470.615	44628.647	1893.998	11413.166	2.71	6.026
78	8	S8	0	17045.538	44631.006	1916.009	11416.859	2.618	5.959
79	8	S9	0	18618.511	44761.356	2071.008	11446.15	2.404	5.527
80	8	S10	0	12492.155	44351.617	1503.138	11348.445	3.55	7.55
81	9	S1	0	0	46305.699	0	13364.658	9.999+	9.999+
82	9	S2	0	0	48124.988	0	14320.582	9.999+	9.999+
83	9	S3	0	0	47743.882	0	14310.633	9.999+	9.999+
84	9	S4	0	0	47524.356	0	13893.704	9.999+	9.999+
85	9	S5	0	0	47804.774	0	14144.078	9.999+	9.999+
86	9	S6	0	0	47714.16	0	14202.03	9.999+	9.999+
87	9	S7	0	0	47814.122	0	14080.794	9.999+	9.999+
88	9	S8	0	0	47405.264	0	13965.391	9.999+	9.999+
89	9	S9	0	0	48261.726	0	14400.018	9.999+	9.999+
90	9	S10	0	0	46305.67	0	13136.571	9.999+	9.999+
91	10	S1	0	0	48470.163	0	13035.813	9.999+	9.999+
92	10	S2	0	0	51551.004	0	13943.881	9.999+	9.999+
93	10	S3	0	0	50867.863	0	13928.054	9.999+	9.999+
94	10	S4	0	0	50268.73	0	13532.535	9.999+	9.999+
95	10	S5	0	0	51021.327	0	13760.453	9.999+	9.999+
96	10	S6	0	0	50915.085	0	13824.835	9.999+	9.999+
97	10	S7	0	0	50645.311	0	13714.745	9.999+	9.999+
98	10	S8	0	0	50461.475	0	13588.59	9.999+	9.999+
99	10	S9	0	0	51702.714	0	14017.68	9.999+	9.999+
100	10	S10	0	0	48457.766	0	12886.98	9.999+	9.999+
101	11	S1	0	13777.637	39918.197	2277.231	10211.446	2.897	4.484
102	11	S2	0	20570.151	40268.069	3314.511	10295.842	1.958	3.106
103	11	S3	0	19794.137	40213.201	3264.401	10292.625	2.032	3.153
104	11	S4	0	17983.63	40132.87	2919.092	10263.493	2.232	3.516
105	11	S5	0	19709.232	40216.383	3188.55	10285.462	2.04	3.226
106	11	S6	0	19629.636	40208.748	3154.493	10280.517	2.048	3.259
107	11	S7	0	18473.671	40165.782	3026.802	10271.85	2.174	3.394
108	11	S8	0	18994.663	40167.906	3079.546	10275.173	2.115	3.337
109	11	S9	0	20932.678	40285.22	3356.855	10301.535	1.925	3.069
110	11	S10	0	13788.962	39916.455	2289.393	10213.6	2.895	4.461
111	12	S1	0	16689.714	39918.197	2000.129	10211.446	2.392	5.105
112	12	S2	0	24433.066	40268.069	2711.059	10295.842	1.648	3.798
113	12	S3	0	23596.84	40213.201	2699.042	10292.625	1.704	3.813
114	12	S4	0	21340.04	40132.87	2438.35	10263.493	1.881	4.209
115	12	S5	0	23616.632	40216.383	2647.349	10285.462	1.703	3.885
116	12	S6	0	23496.582	40208.748	2622.304	10280.517	1.711	3.92
117	12	S7	0	21960.82	40165.782	2525.331	10271.85	1.829	4.068
118	12	S8	0	22727.384	40167.906	2554.678	10275.173	1.767	4.022
119	12	S9	0	24824.681	40285.22	2761.343	10301.535	1.623	3.731

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
120	12	S10	0	16656.207	39916.455	2004.184	10213.6	2.396	5.096
121	13	S1	0	0	42646.377	0	12902.921	9.999+	9.999+
122	13	S2	0	0	44888.308	0	14136.851	9.999+	9.999+
123	13	S3	0	0	44406.97	0	14125.136	9.999+	9.999+
124	13	S4	0	0	44154.868	0	13586.08	9.999+	9.999+
125	13	S5	0	0	44487.014	0	13909.475	9.999+	9.999+
126	13	S6	0	0	44369.53	0	13986.162	9.999+	9.999+
127	13	S7	0	0	44525.611	0	13828.687	9.999+	9.999+
128	13	S8	0	0	43979.071	0	13678.601	9.999+	9.999+
129	13	S9	0	0	45057.501	0	14240.025	9.999+	9.999+
130	13	S10	0	0	42646.566	0	12609.165	9.999+	9.999+
131	14	S1	0	0	45532.328	0	12464.461	9.999+	9.999+
132	14	S2	0	0	49456.329	0	13634.584	9.999+	9.999+
133	14	S3	0	0	48572.278	0	13615.031	9.999+	9.999+
134	14	S4	0	0	47814.032	0	13104.522	9.999+	9.999+
135	14	S5	0	0	48775.752	0	13397.976	9.999+	9.999+
136	14	S6	0	0	48637.431	0	13483.235	9.999+	9.999+
137	14	S7	0	0	48300.531	0	13340.622	9.999+	9.999+
138	14	S8	0	0	48054.02	0	13176.198	9.999+	9.999+
139	14	S9	0	0	49645.485	0	13730.241	9.999+	9.999+
140	14	S10	0	0	45516.028	0	12276.378	9.999+	9.999+

Slab Sliding Safety Factors (By Combination)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
1	1	S1	0	4.177	2720.546	0	2720.546	9.999+	9.999+
2	1	S2	0	0	2745.558	1.409	2745.558	9.999+	9.999+
3	1	S3	0	4.869	2741.779	.607	2741.779	9.999+	9.999+
4	1	S4	0	1.303	2736.15	0	2736.15	9.999+	9.999+
5	1	S5	0	1.368	2741.969	0	2741.969	9.999+	9.999+
6	1	S6	0	0	2741.471	0	2741.471	9.999+	9.999+
7	1	S7	0	1.294	2738.383	0	2738.383	9.999+	9.999+
8	1	S8	0	2.485	2738.555	0	2738.555	9.999+	9.999+
9	1	S9	0	0	2747.076	0	2747.076	9.999+	9.999+
10	1	S10	0	5.26	2720.471	0	2720.471	9.999+	9.999+
11	2	S1	0	4.177	2720.546	0	2720.546	9.999+	9.999+
12	2	S2	0	0	2745.558	1.409	2745.558	9.999+	9.999+
13	2	S3	0	4.869	2741.779	.607	2741.779	9.999+	9.999+
14	2	S4	0	1.303	2736.15	0	2736.15	9.999+	9.999+
15	2	S5	0	1.368	2741.969	0	2741.969	9.999+	9.999+
16	2	S6	0	0	2741.471	0	2741.471	9.999+	9.999+
17	2	S7	0	1.294	2738.383	0	2738.383	9.999+	9.999+
18	2	S8	0	2.485	2738.555	0	2738.555	9.999+	9.999+
19	2	S9	0	0	2747.076	0	2747.076	9.999+	9.999+
20	2	S10	0	5.26	2720.471	0	2720.471	9.999+	9.999+
21	3	S1	0	37.573	2199.061	618.833	2199.061	9.999+	3.554
22	3	S2	0	8.233	1955.015	963.396	1955.015	9.999+	2.029
23	3	S3	0	46.194	1988.96	920.503	1988.96	9.999+	2.161
24	3	S4	0	16.971	2046.532	834.989	2046.532	9.999+	2.451
25	3	S5	0	19.01	1988.944	916.223	1988.944	9.999+	2.171
26	3	S6	0	16.013	1994.001	916.562	1994.001	9.999+	2.176
27	3	S7	0	18.586	2023.879	846.641	2023.879	9.999+	2.39
28	3	S8	0	33.559	2021.091	895.509	2021.091	9.999+	2.257
29	3	S9	0	0	1941.431	979.065	1941.431	9.999+	1.983
30	3	S10	0	40.905	2198.715	617.433	2198.715	9.999+	3.561
31	4	S1	0	50.753	2273.473	519.703	2273.473	9.999+	4.375
32	4	S2	0	3.536	2097.025	803.198	2097.025	9.999+	2.611



Slab Sliding Safety Factors (By Combination) (Continued)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
33	4	S3	0	21.524	2109.844	783.404	2109.844	9.999+	2.693
34	4	S4	0	7.41	2156.174	676.781	2156.174	9.999+	3.186
35	4	S5	0	9.436	2113.088	777.587	2113.088	9.999+	2.717
36	4	S6	0	8.568	2117.259	779.507	2117.259	9.999+	2.716
37	4	S7	0	8.866	2138.4	687.795	2138.4	9.999+	3.109
38	4	S8	0	15.057	2135.958	761.945	2135.958	9.999+	2.803
39	4	S9	0	1.028	2084.971	815.036	2084.971	9.999+	2.558
40	4	S10	0	51.893	2273.758	518.287	2273.758	9.999+	4.387
41	5	S1	0	56.296	3335.229	727.765	3335.229	9.999+	4.583
42	5	S2	0	9.163	3672.898	1135.18	3672.898	9.999+	3.236
43	5	S3	0	62.388	3627.07	1082.792	3627.07	9.999+	3.35
44	5	S4	0	21.817	3547.286	978.216	3547.286	9.999+	3.626
45	5	S5	0	24.364	3627.007	1078.752	3627.007	9.999+	3.362
46	5	S6	0	18.083	3619.976	1079.402	3619.976	9.999+	3.354
47	5	S7	0	23.584	3578.65	992.108	3578.65	9.999+	3.607
48	5	S8	0	42.92	3582.323	1054.662	3582.323	9.999+	3.397
49	5	S9	0	0	3692.314	1150.303	3692.314	9.999+	3.21
50	5	S10	0	62.414	3335.38	726.081	3335.38	9.999+	4.594
51	6	S1	0	35.472	3242.492	625.374	3242.492	9.999+	5.185
52	6	S2	0	10.19	3552.97	979.54	3552.97	9.999+	3.627
53	6	S3	0	65.602	3502.716	923.334	3502.716	9.999+	3.794
54	6	S4	0	23.295	3432.599	857.354	3432.599	9.999+	4.004
55	6	S5	0	25.455	3504.902	921.405	3504.902	9.999+	3.804
56	6	S6	0	18.885	3498.793	920.842	3498.793	9.999+	3.8
57	6	S7	0	25.314	3460.477	868.45	3460.477	9.999+	3.985
58	6	S8	0	45.958	3463.569	899.502	3463.569	9.999+	3.851
59	6	S9	0	1.18	3569.257	993.398	3569.257	9.999+	3.593
60	6	S10	0	41.588	3243.015	624.092	3243.015	9.999+	5.196
61	7	S1	0	27.136	2329.432	464.125	2329.432	9.999+	5.019
62	7	S2	0	6.175	2152.651	722.195	2152.651	9.999+	2.981
63	7	S3	0	33.428	2177.165	690.529	2177.165	9.999+	3.153
64	7	S4	0	12.403	2218.937	626.242	2218.937	9.999+	3.543
65	7	S5	0	13.915	2177.2	687.167	2177.2	9.999+	3.168
66	7	S6	0	12.01	2180.868	687.422	2180.868	9.999+	3.173
67	7	S7	0	13.616	2202.505	634.981	2202.505	9.999+	3.469
68	7	S8	0	24.548	2200.457	671.632	2200.457	9.999+	3.276
69	7	S9	0	0	2142.842	734.299	2142.842	9.999+	2.918
70	7	S10	0	29.364	2329.154	463.074	2329.154	9.999+	5.03
71	8	S1	0	37.021	2385.241	389.777	2385.241	9.999+	6.12
72	8	S2	0	2.652	2259.158	602.046	2259.158	9.999+	3.752
73	8	S3	0	14.926	2267.828	587.704	2267.828	9.999+	3.859
74	8	S4	0	5.232	2301.168	507.586	2301.168	9.999+	4.534
75	8	S5	0	6.735	2270.308	583.19	2270.308	9.999+	3.893
76	8	S6	0	6.426	2273.312	584.63	2273.312	9.999+	3.888
77	8	S7	0	6.326	2288.396	515.846	2288.396	9.999+	4.436
78	8	S8	0	10.672	2286.607	571.459	2286.607	9.999+	4.001
79	8	S9	0	.771	2250.497	611.277	2250.497	9.999+	3.682
80	8	S10	0	37.605	2385.437	388.715	2385.437	9.999+	6.137
81	9	S1	0	43.266	3181.558	545.823	3181.558	9.999+	5.829
82	9	S2	0	6.873	3441.063	851.737	3441.063	9.999+	4.04
83	9	S3	0	48.008	3405.747	811.942	3405.747	9.999+	4.195
84	9	S4	0	16.688	3344.502	733.662	3344.502	9.999+	4.559
85	9	S5	0	18.615	3405.748	809.064	3405.748	9.999+	4.209
86	9	S6	0	13.562	3400.35	809.552	3400.35	9.999+	4.2
87	9	S7	0	18.012	3368.584	744.081	3368.584	9.999+	4.527
88	9	S8	0	32.811	3371.381	790.996	3371.381	9.999+	4.262
89	9	S9	0	0	3456.004	862.727	3456.004	9.999+	4.006



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Slab Sliding Safety Factors (By Combination) (Continued)

	LC	Slab	Angle[deg]	Va-xx[lb]	Vr-xx[lb]	Va-zz[lb]	Vr-zz[lb]	SR-xx	SR-zz
90	9	S10	0	48.126	3181.652	544.561	3181.652	9.999+	5.843
91	10	S1	0	27.648	3112.006	469.031	3112.006	9.999+	6.635
92	10	S2	0	7.643	3351.117	735.007	3351.117	9.999+	4.559
93	10	S3	0	50.418	3312.482	692.349	3312.482	9.999+	4.784
94	10	S4	0	17.797	3258.487	643.016	3258.487	9.999+	5.068
95	10	S5	0	19.433	3314.169	691.054	3314.169	9.999+	4.796
96	10	S6	0	14.164	3309.462	690.632	3309.462	9.999+	4.792
97	10	S7	0	19.309	3279.953	651.337	3279.953	9.999+	5.036
98	10	S8	0	35.09	3282.315	674.626	3282.315	9.999+	4.865
99	10	S9	0	.885	3363.712	745.048	3363.712	9.999+	4.515
100	10	S10	0	32.506	3112.379	468.069	3112.379	9.999+	6.649
101	11	S1	0	37.991	1927.006	618.833	1927.006	9.999+	3.114
102	11	S2	0	8.233	1680.459	963.537	1680.459	9.999+	1.744
103	11	S3	0	46.681	1714.782	920.442	1714.782	9.999+	1.863
104	11	S4	0	17.102	1772.917	834.989	1772.917	9.999+	2.123
105	11	S5	0	19.146	1714.747	916.223	1714.747	9.999+	1.872
106	11	S6	0	16.013	1719.854	916.562	1719.854	9.999+	1.876
107	11	S7	0	18.715	1750.04	846.641	1750.04	9.999+	2.067
108	11	S8	0	33.808	1747.235	895.509	1747.235	9.999+	1.951
109	11	S9	0	0	1666.723	979.065	1666.723	9.999+	1.702
110	11	S10	0	41.431	1926.668	617.433	1926.668	9.999+	3.12
111	12	S1	0	51.171	2001.418	519.703	2001.418	9.999+	3.851
112	12	S2	0	3.536	1822.469	803.339	1822.469	9.999+	2.269
113	12	S3	0	22.011	1835.666	783.343	1835.666	9.999+	2.343
114	12	S4	0	7.54	1882.559	676.781	1882.559	9.999+	2.782
115	12	S5	0	9.572	1838.891	777.587	1838.891	9.999+	2.365
116	12	S6	0	8.568	1843.112	779.507	1843.112	9.999+	2.364
117	12	S7	0	8.995	1864.562	687.795	1864.562	9.999+	2.711
118	12	S8	0	15.306	1862.102	761.945	1862.102	9.999+	2.444
119	12	S9	0	1.028	1810.263	815.036	1810.263	9.999+	2.221
120	12	S10	0	52.419	2001.711	518.287	2001.711	9.999+	3.862
121	13	S1	0	55.879	3063.174	727.765	3063.174	9.999+	4.209
122	13	S2	0	9.163	3398.342	1135.039	3398.342	9.999+	2.994
123	13	S3	0	61.901	3352.892	1082.852	3352.892	9.999+	3.096
124	13	S4	0	21.687	3273.671	978.216	3273.671	9.999+	3.347
125	13	S5	0	24.228	3352.811	1078.752	3352.811	9.999+	3.108
126	13	S6	0	18.083	3345.829	1079.402	3345.829	9.999+	3.1
127	13	S7	0	23.455	3304.812	992.108	3304.812	9.999+	3.331
128	13	S8	0	42.672	3308.467	1054.662	3308.467	9.999+	3.137
129	13	S9	0	0	3417.606	1150.303	3417.606	9.999+	2.971
130	13	S10	0	61.888	3063.333	726.081	3063.333	9.999+	4.219
131	14	S1	0	35.055	2970.438	625.374	2970.438	9.999+	4.75
132	14	S2	0	10.19	3278.414	979.399	3278.414	9.999+	3.347
133	14	S3	0	65.115	3228.538	923.395	3228.538	9.999+	3.496
134	14	S4	0	23.164	3158.984	857.354	3158.984	9.999+	3.685
135	14	S5	0	25.318	3230.705	921.405	3230.705	9.999+	3.506
136	14	S6	0	18.885	3224.645	920.842	3224.645	9.999+	3.502
137	14	S7	0	25.185	3186.638	868.45	3186.638	9.999+	3.669
138	14	S8	0	45.709	3189.713	899.502	3189.713	9.999+	3.546
139	14	S9	0	1.18	3294.55	993.398	3294.55	9.999+	3.316
140	14	S10	0	41.062	2970.968	624.092	2970.968	9.999+	4.76

Envelope Slab Soil Pressures

	Label	UC	LC	Soil Pressure[psf]	Allowable Bearing[psf]	Point
1	S1	.393	5	588.77	1500	N282
2	S2	.46	5	689.423	1500	N289



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Envelope Slab Soil Pressures (Continued)

	Label	UC	LC	Soil Pressure[psf]	Allowable Bearing[psf]	Point
3	S3	.453	5	679.98	1500	N296
4	S4	.433	5	649.818	1500	N303
5	S5	.452	5	678.207	1500	N310
6	S6	.452	5	677.297	1500	N317
7	S7	.438	5	656.632	1500	N324
8	S8	.446	5	668.277	1500	N331
9	S9	.463	5	694.712	1500	N338
10	S10	.393	5	588.952	1500	N345



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1. Project information

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

Project description:
Location:
Fastening description:

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): 3.00

Base Material

Concrete: Normal-weight
Concrete thickness, h (inch): 30.00
State: Cracked
Compressive strength, f'_c (psi): 2500
 $\Psi_{c,v}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Periodic
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate

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

Recommended Anchor

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





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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]: 4150

V_{uax} [lb]: 100

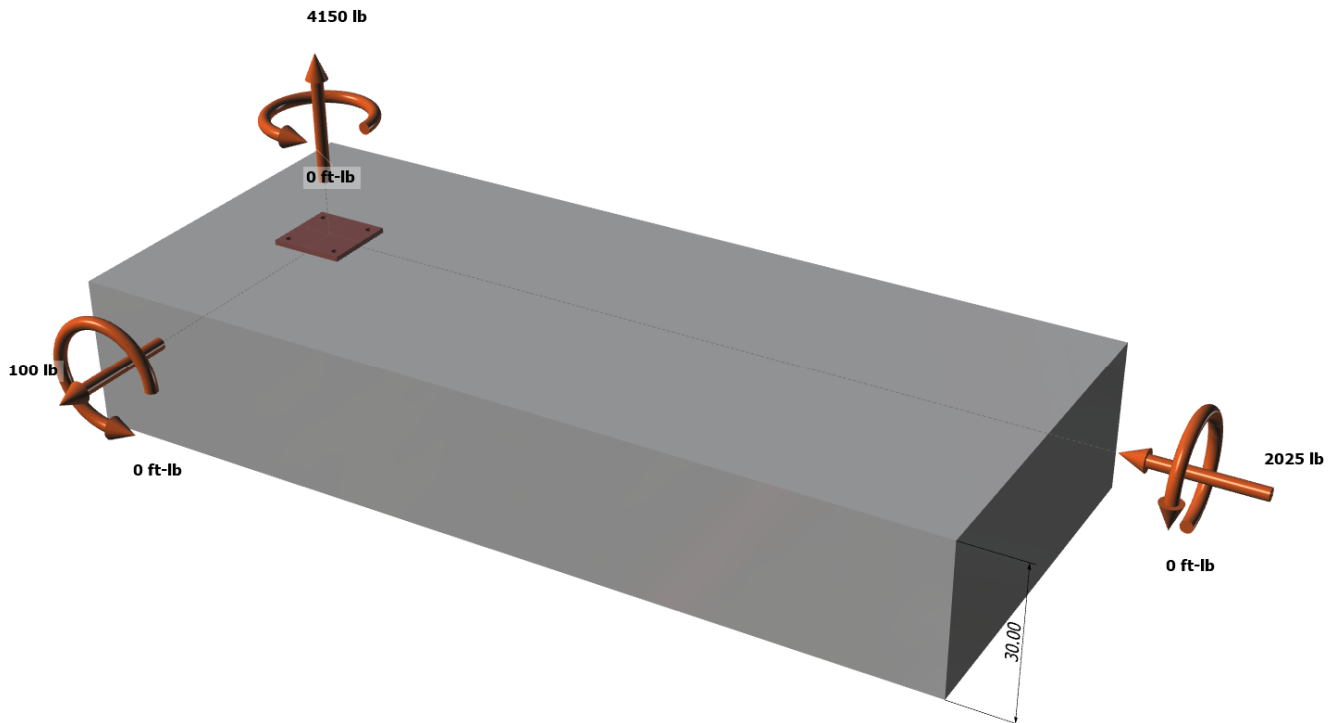
V_{uay} [lb]: -2025

M_{ux} [ft-lb]: 0

M_{uy} [ft-lb]: 0

M_{uz} [ft-lb]: 0

<Figure 1>





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<Figure 2>





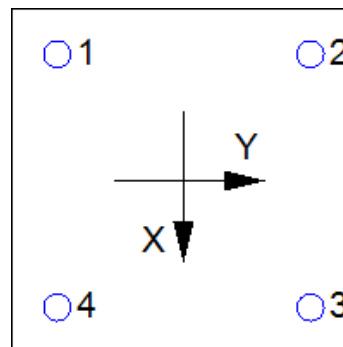
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3. Resulting Anchor Forces

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	1037.5	25.0	-506.3	506.9
2	1037.5	25.0	-506.3	506.9
3	1037.5	25.0	-506.3	506.9
4	1037.5	25.0	-506.3	506.9
Sum	4150.0	100.0	-2025.0	2027.5

Maximum concrete compression strain (%): 0.00
 Maximum concrete compression stress (psi): 0
 Resultant tension force (lb): 4150
 Resultant compression force (lb): 0
 Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
 Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
 Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
 Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



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

N _{sa} (lb)	φ	φN _{sa} (lb)
4525	0.75	3394

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

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

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

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

A _{Nc} (in ²)	A _{Nco} (in ²)	c _{a,min} (in)	ψ _{ec,N}	ψ _{ed,N}	ψ _{c,N}	ψ _{cp,N}	N _b (lb)	φ	φN _{cbg} (lb)
240.25	144.00	7.25	1.000	1.000	1.00	1.000	6800	0.65	7374

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

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

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

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

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

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

A _{Na} (in ²)	A _{Na0} (in ²)	c _{Na} (in)	c _{a,min} (in)	ψ _{ec,Na}	ψ _{ed,Na}	ψ _{cp,Na}	N _{ba} (lb)	φ	φN _{ag} (lb)
198.45	112.09	5.29	7.25	1.000	1.000	1.000	6343	0.55	6176



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

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

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

Shear perpendicular to edge in x-direction:

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

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.00	0.375	1.00	2500	13.75	16564

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

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
647.11	850.78	1.000	0.805	1.000	1.000	16564	0.70	7103

Shear perpendicular to edge in y-direction:

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

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{by} (lb)
3.00	0.375	1.00	2500	10.75	11450

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

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
387.00	520.03	1.000	0.891	1.000	1.000	11450	0.70	5313

Shear parallel to edge in x-direction:

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

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{by} (lb)
3.00	0.375	1.00	2500	7.25	6342

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

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgx} (lb)
261.00	236.53	1.000	1.000	1.000	1.000	6342	0.70	9797

Shear parallel to edge in y-direction:

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

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.00	0.375	1.00	2500	10.25	10661

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

A_{Vc} (in ²)	A_{Vco} (in ²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgy} (lb)
401.67	472.78	1.000	1.000	1.000	1.000	10661	0.70	12680

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

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

k_{cp}	A_{Na} (in ²)	A_{Na0} (in ²)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	198.45	112.09	1.000	1.000	1.000	6343	11230

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

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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ϕV_{cpq} (lb)
15722

11. Results

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

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status	
Steel	1038	3394	0.31	Pass	
Concrete breakout	4150	7374	0.56	Pass	
Adhesive	4150	6176	0.67	Pass (Governs)	
Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status	
Steel	507	1765	0.29	Pass	
T Concrete breakout x+	100	7103	0.01	Pass	
T Concrete breakout y-	2025	5313	0.38	Pass	
Concrete breakout y-	50	9797	0.01	Pass	
Concrete breakout x-	1013	12680	0.08	Pass	
Concrete breakout, combined	-	-	0.38	Pass (Governs)	
Pryout	2027	15722	0.13	Pass	
Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.52	0.20	71.6%	1.0	Pass

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

12. Warnings

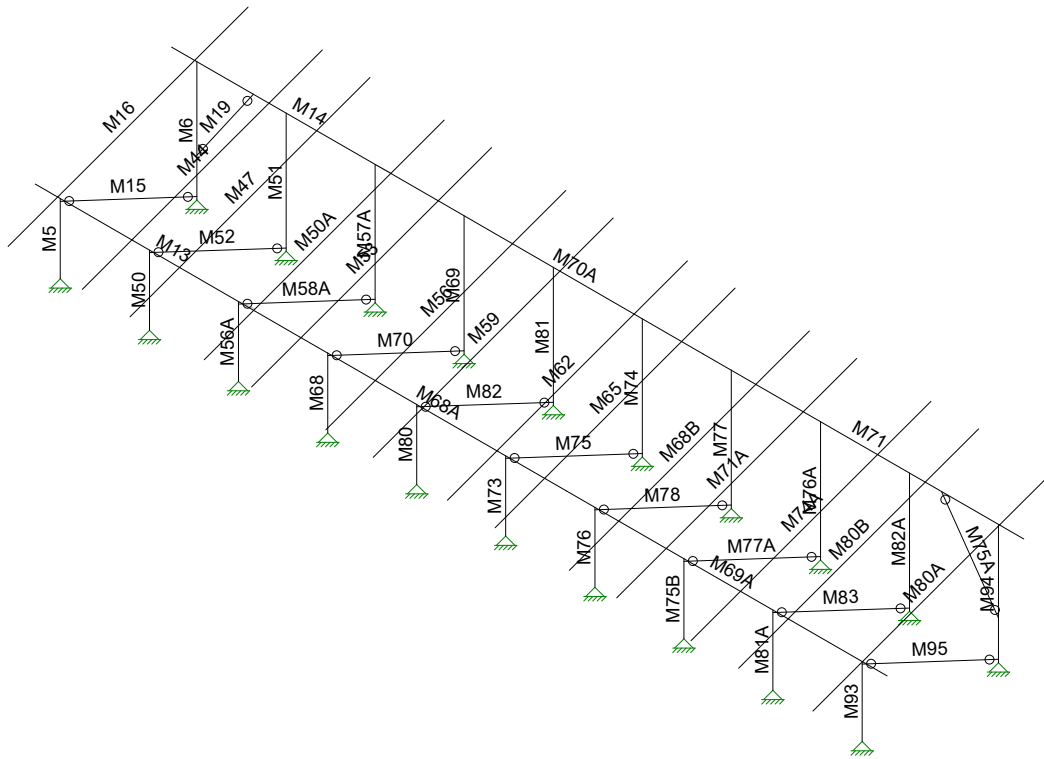
- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.



JOB NO.: U2716-0277-211

DESIGNED: STB

Framing Analysis



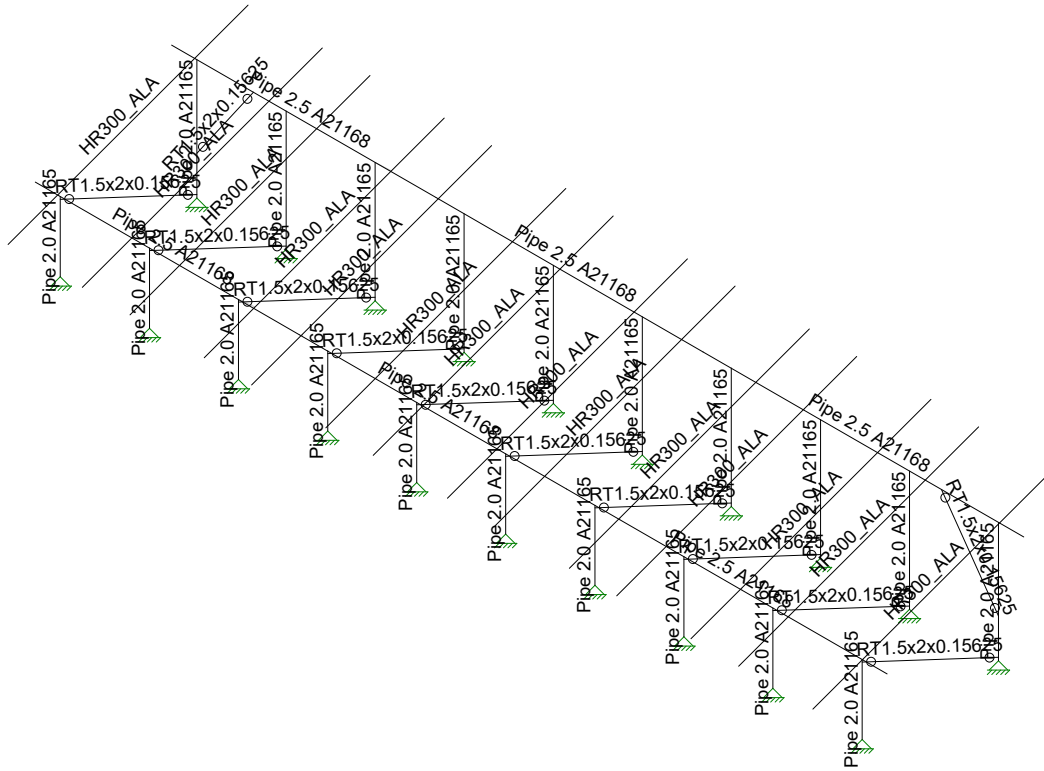
Vector Structural Engineeri...
STB
U2716.0277.211

Ground Mount

SK - 3

Jan 21, 2021 at 12:06 PM

Sunmodo Sunturf D3 GM.r3d



Vector Structural Engineeri...

STB

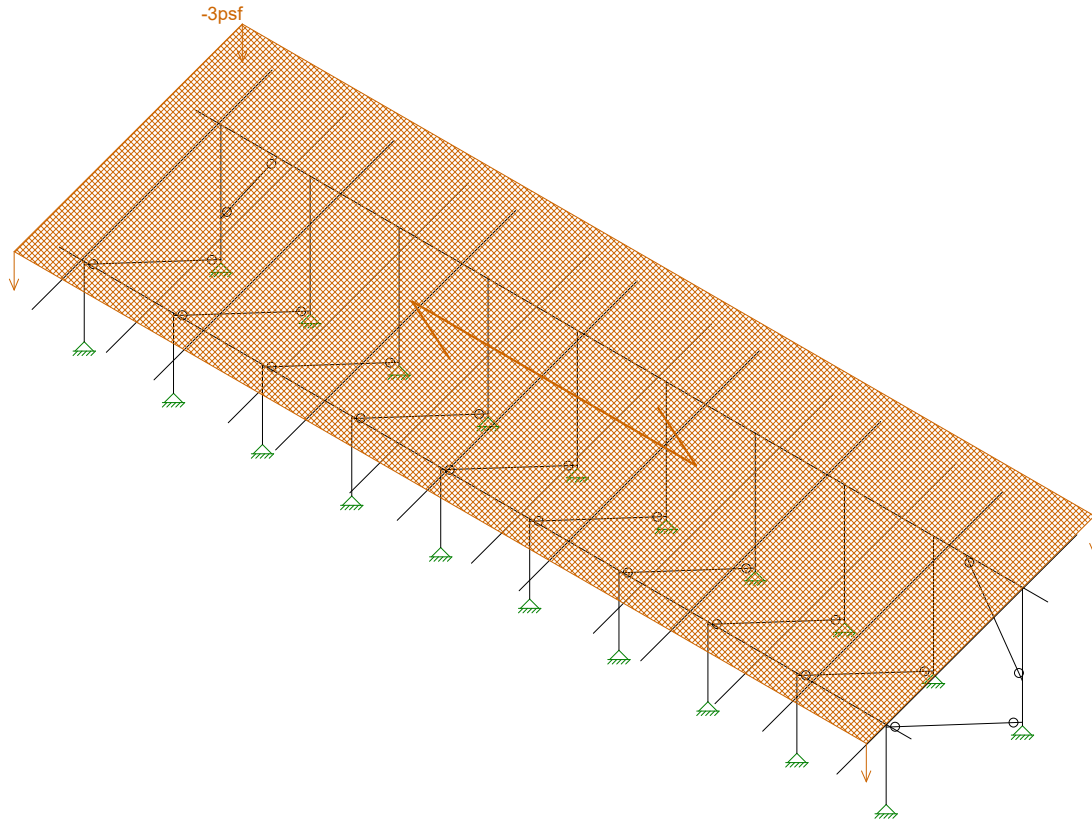
U2716.0277.211

Ground Mount

SK - 4

Jan 21, 2021 at 12:06 PM

Sunmodo Sunturf D3 GM.r3d



Loads: BLC 2, Solar Panel Weight

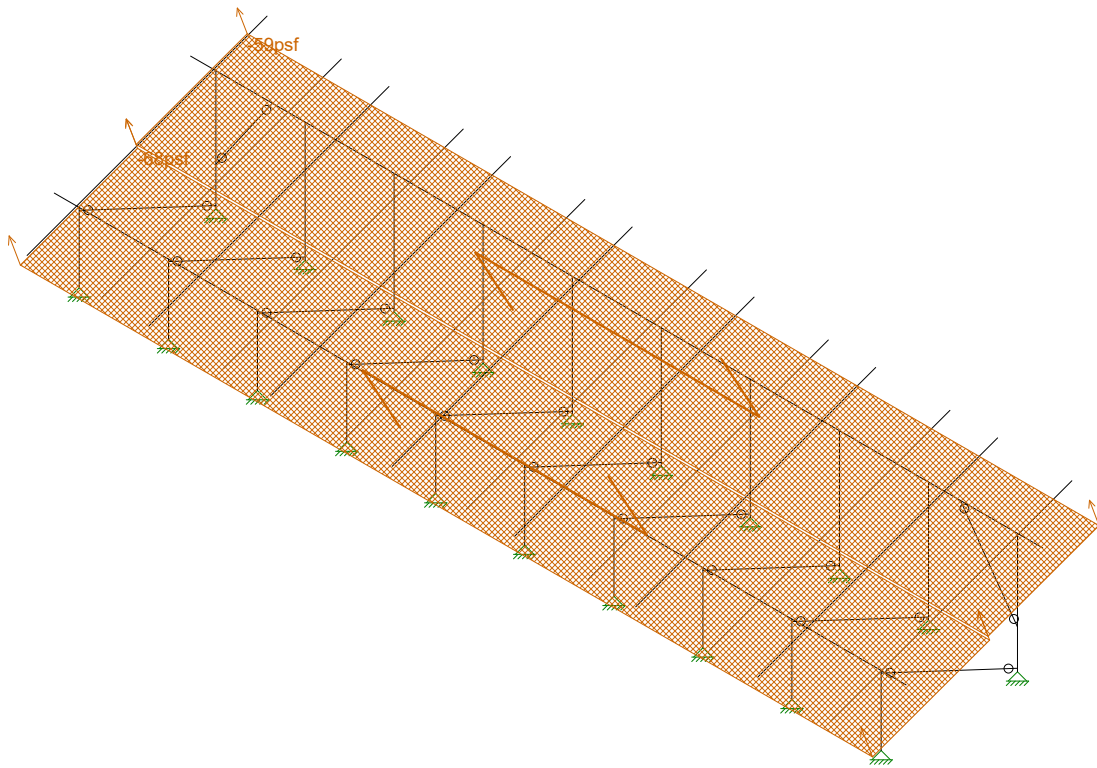
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STB
U2716.0277.211

Ground Mount

SK - 5

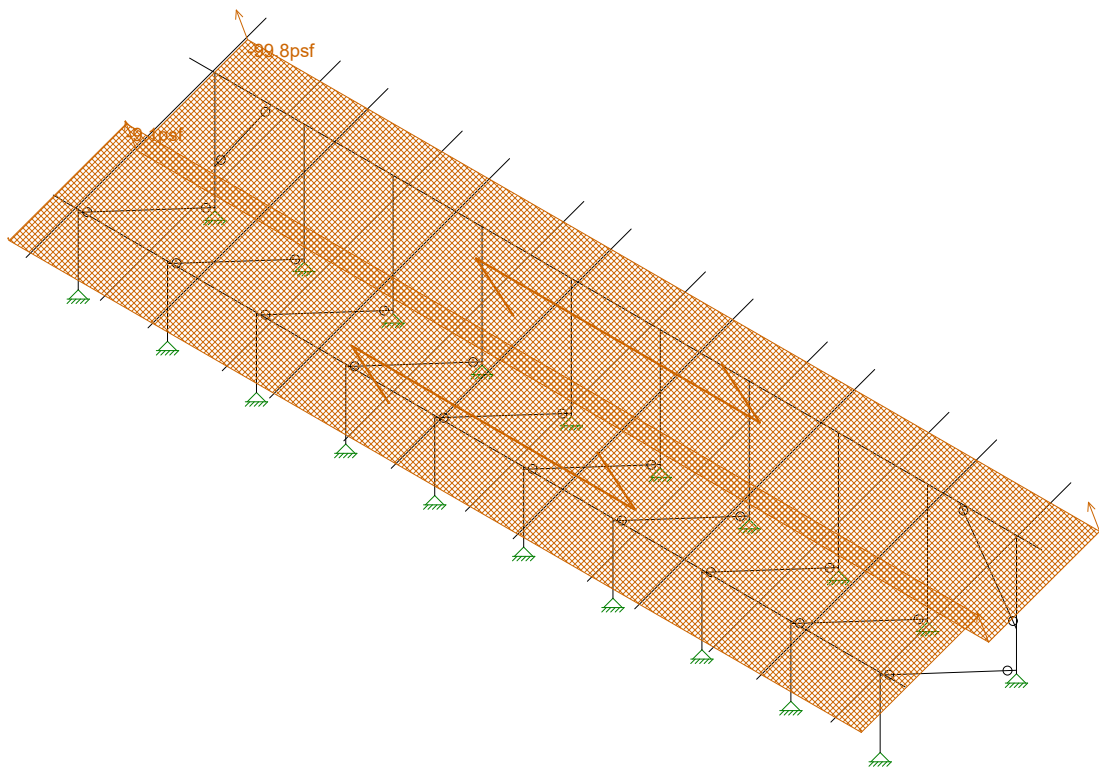
Jan 21, 2021 at 12:06 PM

Sunmodo Sunturf D3 GM.r3d



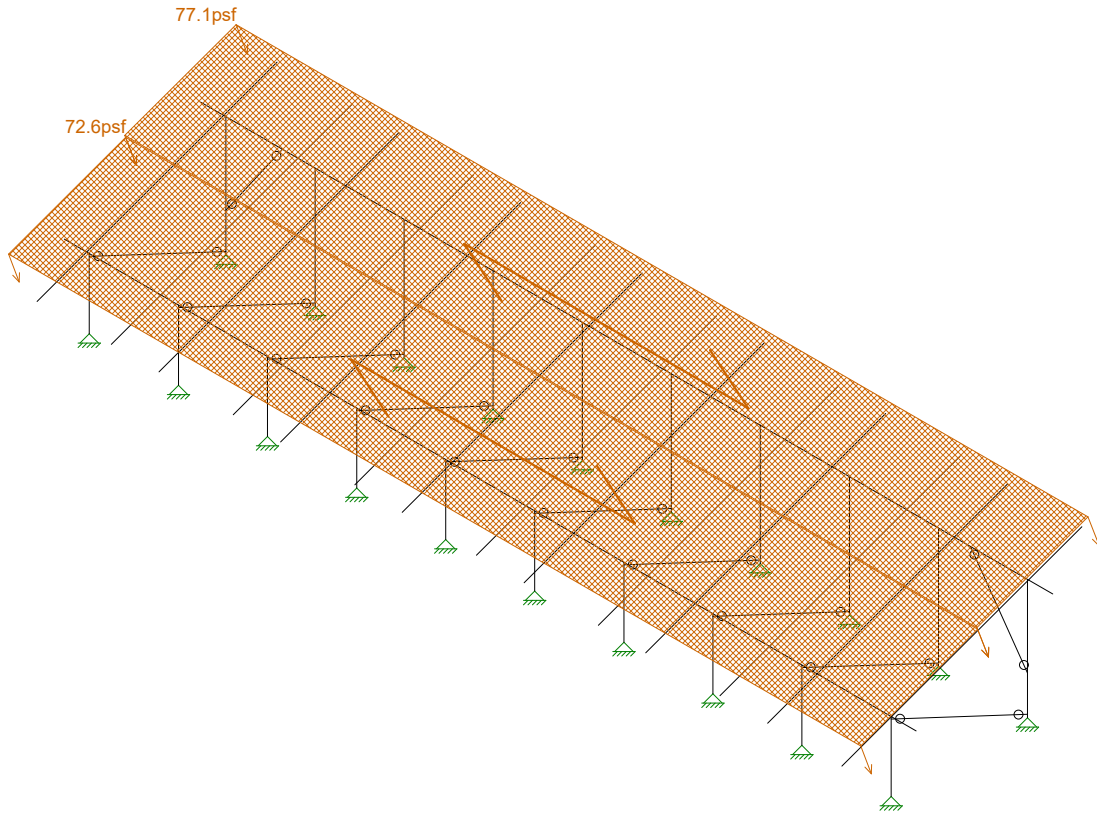
Loads: BLC 4, Wind A 0 deg

Vector Structural Engineeri..	Ground Mount	SK - 6
STB		Jan 21, 2021 at 12:07 PM
U2716.0277.211		Sunmodo Sunturf D3 GM.r3d



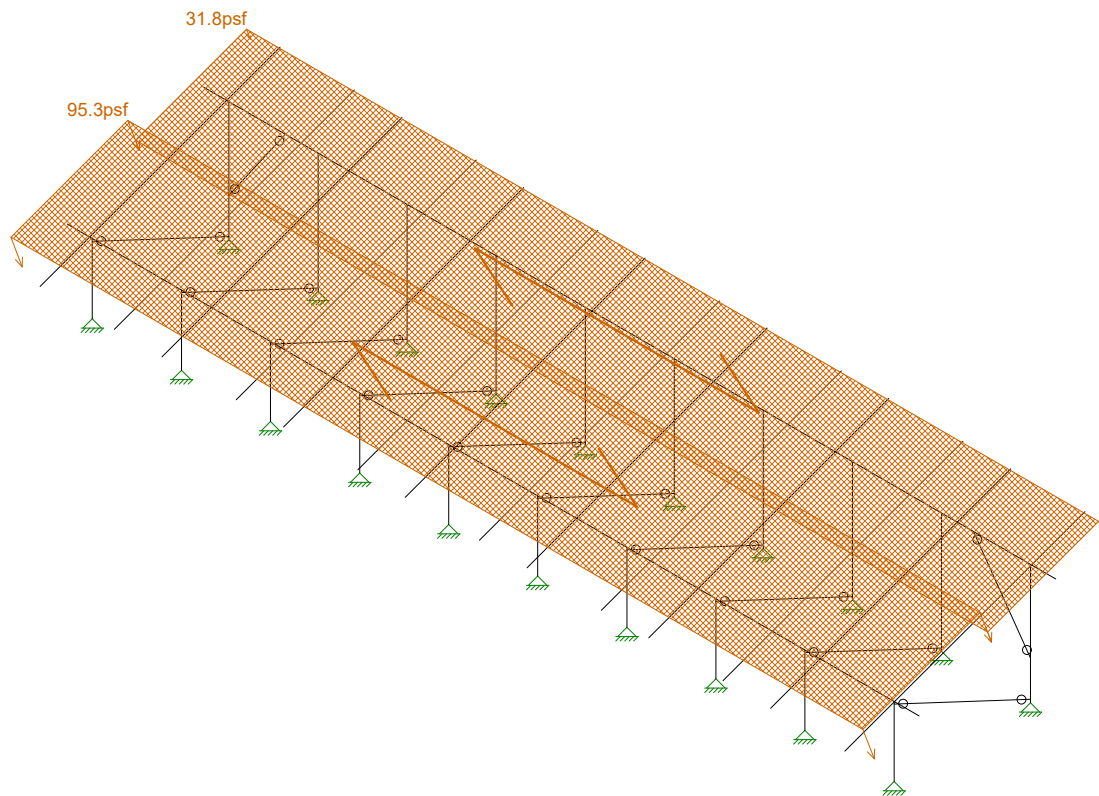
Loads: BLC 5, Wind B 0 deg

Vector Structural Engineeri..	Ground Mount	SK - 7
STB		Jan 21, 2021 at 12:07 PM
U2716.0277.211		Sunmodo Sunturf D3 GM.r3d



Loads: BLC 6, Wind A 180 deg

Vector Structural Engineeri..	Ground Mount	SK - 8
STB		Jan 21, 2021 at 12:07 PM
U2716.0277.211		Sunmodo Sunturf D3 GM.r3d



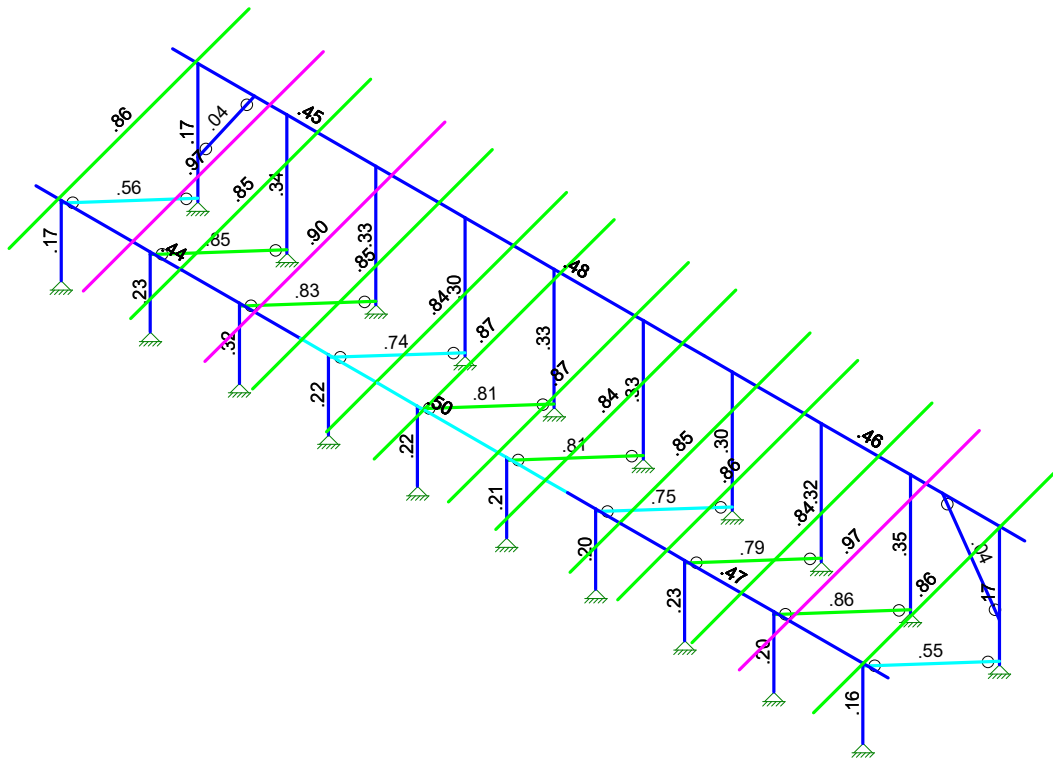
Loads: BLC 7, Wind B 180 deg

Vector Structural Engineeri..	Ground Mount	SK - 9
STB		Jan 21, 2021 at 12:07 PM
U2716.0277.211		Sunmodo Sunturf D3 GM.r3d



Code Check (Env)

Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-.90
Cyan	.50-.75
Blue	0-.50



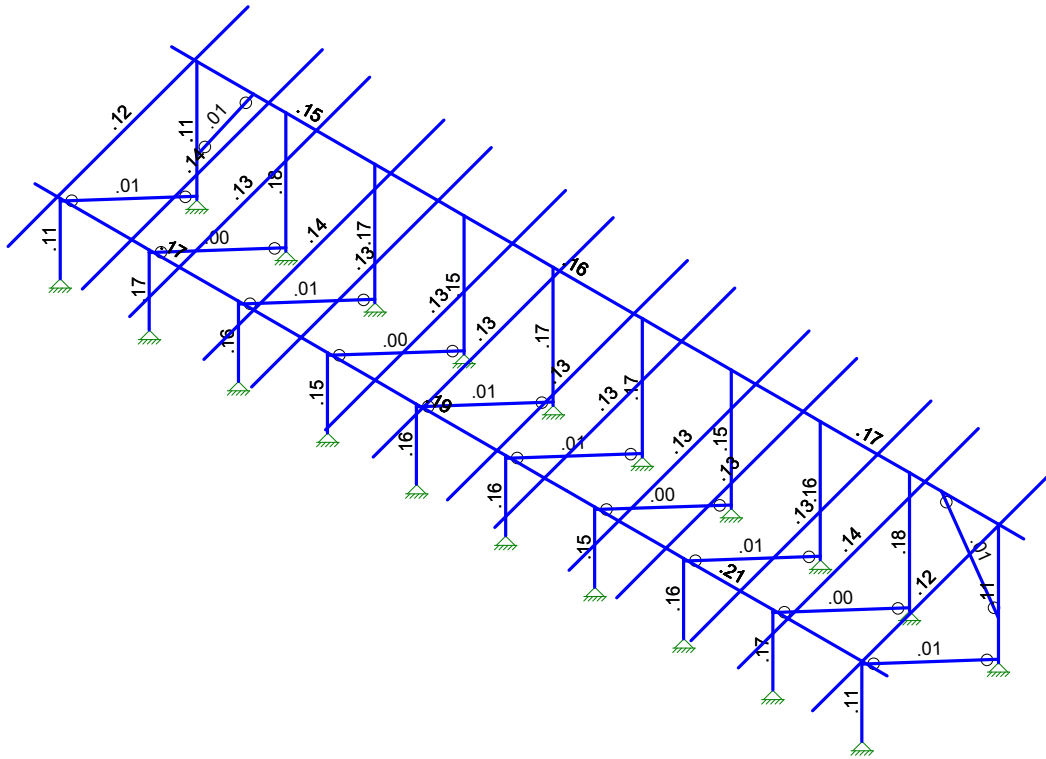
Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Vector Structural Engineeri...	Ground Mount	SK - 1
STB		Jan 21, 2021 at 12:06 PM
U2716.0277.211		Sunmodo Sunturf D3 GM.r3d



Shear Check
(Env)

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



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

Vector Structural Engineeri...

STB

U2716.0277.211

Ground Mount

SK - 2

Jan 21, 2021 at 12:06 PM

Sunmodo Sunturf D3 GM.r3d

(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (in/sec^2)	386.4
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 15th(360-16): ASD
Adjust Stiffness?	Yes(Iterative)
RISACONNECTION CODE	AISC 15th(360-16): ASD
Cold Formed Steel Code	AISI S100-16: ASD
Wood Code	AWC NDS-18: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-14
Masonry Code	None
Aluminum Code	AA ADM1-15: ASD - Building
Stainless Steel Code	AISC 14th(360-10): ASD
Adjust Stiffness?	Yes(Iterative)

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parame Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR SET ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8



(Global) Model Settings, Continued

Seismic Code	ASCE 7-16
Seismic Base Elevation (in)	15600
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Drift Cat	Other
Om Z	1
Om X	1
Cd Z	4
Cd X	4
Rho Z	1
Rho X	1

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (/1E5 F)	Density[lb/ft^3]	Yield[psi]	Ry	Fu[psi]	Rt
1	A992	29000	11154	.3	.65	490	50000	1.1	65000	1.1
2	A36 Gr.36	29000	11154	.3	.65	490	36000	1.5	58000	1.2
3	A572 Gr.50	29000	11154	.3	.65	490	50000	1.1	65000	1.1
4	A500 Gr.B R...	29000	11154	.3	.65	527	42000	1.4	58000	1.3
5	A500 Gr.B Re...	29000	11154	.3	.65	527	46000	1.4	58000	1.3
6	A53 Gr.B	29000	11154	.3	.65	490	35000	1.6	60000	1.2
7	A1085	29000	11154	.3	.65	490	50000	1.4	65000	1.3

Aluminum Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (...Density[... Table B.4	kt	Ftu[psi]	Fty[psi]	Fcy[psi]	Fsu[psi]	Ct
1	3003-H14	10100	3787.5	.33	1.3 172.8 Table B.4-1	1	19000	16000	13000	12000	141
2	6061-T6	10100	3787.5	.33	1.3 172.8 Table B.4-2	1	38000	35000	35000	24000	141
3	6063-T5	10100	3787.5	.33	1.3 172.8 Table B.4-2	1	22000	16000	16000	13000	141
4	6063-T6	10100	3787.5	.33	1.3 172.8 Table B.4-2	1	30000	25000	25000	19000	141
5	5052-H34	10200	3787.5	.33	1.3 172.8 Table B.4-1	1	34000	26000	24000	20000	141
6	6061-T6 W	10100	3787.5	.33	1.3 172.8 Table B.4-1	1	24000	15000	15000	15000	141
7	6005-T5	10100	3787.5	.33	1.3 172.8 Table B.4-1	1	38000	35000	35000	24000	141

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Post	Pipe 2.0 A21165	Column	Pipe	A572 Gr.50	Typical	.776	.499	.499	.998
2	Cross Beam	Pipe 2.5 A21168	Beam	Wide Flange	A572 Gr.50	Typical	.947	.907	.907	1.814



Aluminum Section Sets

	Label	Shape	Type	Design List	Material	Design R...	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	AL Posts	2.375ODX0.188	Column	Pipe	6005-T5	Typical	1.29	.778	.778	1.54
2	AL Brace	RT1.5x2x0.15625	VBrace	Rectangular Tubes	6005-T5	Typical	.996	.327	.524	.602
3	AL Rails	HR300 ALA	Beam	Rectangular Tubes	6005-T5	Typical	.736	.214	.727	.614
4	AL Cross Beam	Cross Rail	Beam	Rectangular Tubes	6005-T5	Typical	1.909	1.97	4.366	4.017

Member Area Loads (BLC 2 : Solar Panel Weight)

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

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

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N199	N196	PY	A-B	0

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

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N201	N198	Perp	A-B	-59
2	N198	N201	N199	N196	Perp	A-B	-68

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

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N201	N198	Perp	A-B	-99.8
2	N198	N201	N199	N196	Perp	A-B	-9.1

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

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N201	N198	Perp	A-B	77.1
2	N198	N201	N199	N196	Perp	A-B	72.6

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

	Joint A	Joint B	Joint C	Joint D	Direction	Distribution	Magnitude[psf]
1	N197	N200	N201	N198	Perp	A-B	31.8
2	N198	N201	N199	N196	Perp	A-B	95.3

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(M...Surface...
1	Self Weight	DL		-1.05					
2	Solar Panel Weight	DL							1
3	Roof Live/Snow	RLL							1
4	Wind A 0 deg	OL1							2
5	Wind B 0 deg	OL2							2
6	Wind A 180 deg	OL3							2
7	Wind B 180 deg	OL4							2
8	BLC 2 Transient Area ...	None						38	
9	BLC 3 Transient Area ...	None							
10	BLC 4 Transient Area ...	None						120	
11	BLC 5 Transient Area ...	None						120	
12	BLC 6 Transient Area ...	None						120	
13	BLC 7 Transient Area ...	None						120	

Load Combinations

	Description	S...	PD...	SRSS	BLC	Fa...	BLC	Fa...	BLC	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	Fa...	B...	
1	1.0 D	Yes	Y		DL	1																
2	1.0 D + 1.0 S	Yes	Y		DL	1	RLL	1														
3	1.0 D + 0.6 W1	Yes	Y		DL	1	RLL		OL1	.6												
4	1.0 D + 0.6 W2	Yes	Y		DL	1	RLL		OL2	.6												
5	1.0 D + 0.6 W3	Yes	Y		DL	1	RLL		OL3	.6												
6	1.0 D + 0.6 W4	Yes	Y		DL	1	RLL		OL4	.6												
7	1.0 D + 0.45 W1 + 0....	Yes	Y		DL	1	RLL	.75	OL1	.45												
8	1.0 D + 0.45 W2 + 0....	Yes	Y		DL	1	RLL	.75	OL2	.45												
9	1.0 D + 0.45 W3 + 0....	Yes	Y		DL	1	RLL	.75	OL3	.45												
10	1.0 D + 0.45 W4 + 0....	Yes	Y		DL	1	RLL	.75	OL4	.45												
11	0.6 D + 0.6 W1	Yes	Y		DL	.6	RLL		OL1	.6												
12	0.6 D + 0.6 W2	Yes	Y		DL	.6	RLL		OL2	.6												
13	0.6 D + 0.6 W3	Yes	Y		DL	.6	RLL		OL3	.6												
14	0.6 D + 0.6 W4	Yes	Y		DL	.6	RLL		OL4	.6												

Envelope Joint Reactions

	Joint		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb...	LC	MZ [lb-ft]	LC
1	N2	max	8.724	6	904.762	6	45.691	11	0	14	0	14	0	14
2		min	-4.925	11	-382.691	11	-55.945	5	0	1	0	1	0	1
3	N1	max	47.357	5	1744.353	5	783.561	5	0	14	0	14	0	14
4		min	-55.461	12	-1676.744	12	-664.6...	3	0	1	0	1	0	1
5	N132	max	7.881	12	2459.532	5	1146.8...	5	0	14	0	14	0	14
6		min	-7.198	5	-2366.689	12	-971.3...	3	0	1	0	1	0	1
7	N133	max	13.948	11	1343.123	6	55.089	3	0	14	0	14	0	14
8		min	-21.704	6	-588.379	11	-68.128	5	0	1	0	1	0	1
9	N109	max	2.306	12	2563.013	5	1207.4...	5	0	14	0	14	0	14
10		min	-2.405	5	-2443.913	12	-1022....	11	0	1	0	1	0	1
11	N110A	max	5.803	11	1435.813	6	57.984	11	0	14	0	14	0	14
12		min	-9.392	6	-634.756	11	-73.042	5	0	1	0	1	0	1
13	N121	max	22.688	5	2469.385	5	1183.4...	5	0	14	0	14	0	14
14		min	-22.64	12	-2360.706	12	-997.6...	11	0	1	0	1	0	1
15	N122	max	52.688	6	1317.363	6	78.843	12	0	14	0	14	0	14
16		min	-32.566	11	-578.431	11	-100.5...	5	0	1	0	1	0	1
17	N133B	max	8.536	12	2246.575	5	1048.4...	5	0	14	0	14	0	14
18		min	-7.972	5	-2135.08	12	-890.96	11	0	1	0	1	0	1
19	N134B	max	11.283	11	1219.186	6	56.011	11	0	14	0	14	0	14
20		min	-19.129	6	-545.47	11	-70.235	5	0	1	0	1	0	1
21	N151	max	6.796	5	2449.011	5	1146.14	5	0	14	0	14	0	14
22		min	-6.686	12	-2353.589	12	-970.7...	3	0	1	0	1	0	1
23	N152	max	16.641	6	1326.79	6	54.211	3	0	14	0	14	0	14
24		min	-10.763	11	-577.652	11	-66.655	5	0	1	0	1	0	1
25	N157A	max	9.614	5	2307.882	5	1054.51	5	0	14	0	14	0	14
26		min	-9.685	12	-2198.742	12	-897.7...	3	0	1	0	1	0	1
27	N158A	max	20.673	6	1277.646	6	51.002	3	0	14	0	14	0	14
28		min	-12.314	11	-580.39	11	-62.622	5	0	1	0	1	0	1
29	N155B	max	15.962	12	2371.137	5	1119.0...	5	0	14	0	14	0	14
30		min	-15.079	5	-2274.032	12	-947.5...	3	0	1	0	1	0	1
31	N156B	max	23.135	11	1254.625	6	52.249	3	0	14	0	14	0	14
32		min	-38.351	6	-539.726	11	-64.09	5	0	1	0	1	0	1
33	N167	max	.461	5	2603.92	5	1213.5...	5	0	14	0	14	0	14
34		min	.044	1	-2483.62	12	-1030...	3	0	1	0	1	0	1
35	N168	max	1.212	6	1459.86	6	51.484	3	0	14	0	14	0	14
36		min	-.418	11	-649.461	11	-63.435	5	0	1	0	1	0	1
37	N179	max	57.222	12	1747.977	5	778.87	5	0	14	0	14	0	14



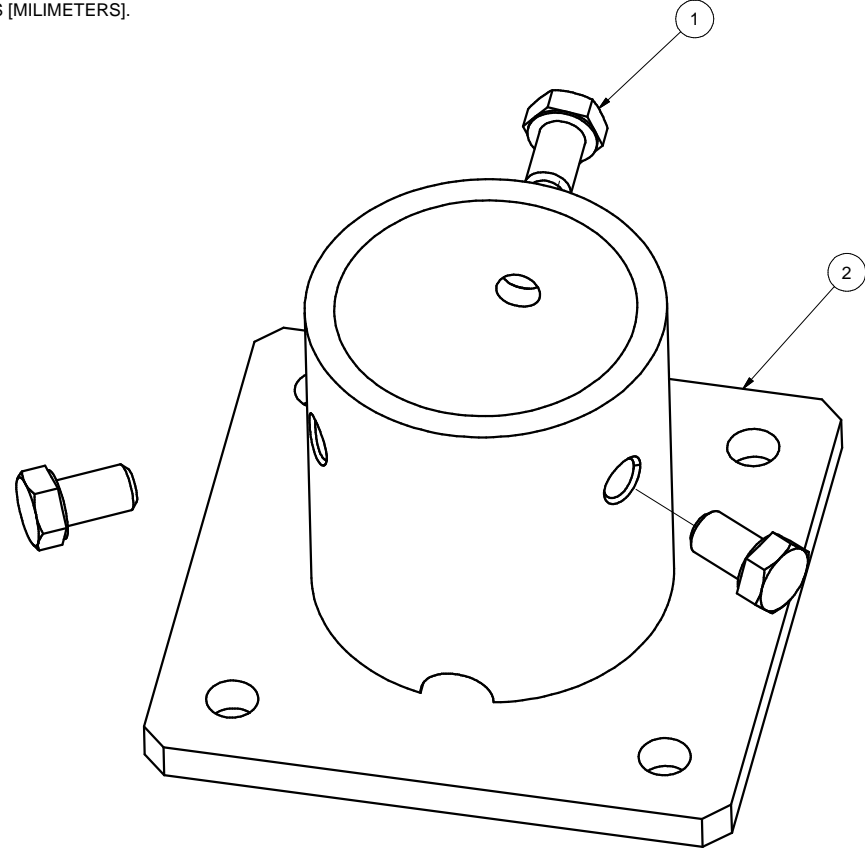
Company : Vector Structural Engineering
 Designer : STB
 Job Number : U2716.0277.211
 Model Name : Ground Mount

Jan 21, 2021
 12:08 PM
 Checked By: _____

Envelope AA ADM1-15: ASD - Building Aluminum Code Checks (Continued)

Member	Shape	Code C...	Loc[fin]	LC Shear ...	Loc[fin]	Dir	LC Pnc/O...	Pnt/Om...	Mny/O...	Mnz/O...	Vny/O...	Vnz/O...	Cb Eqn				
18	M56	HR300_A...	.836	132.6...	12	.126	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	1...	H.1-1
19	M59	HR300_A...	.869	132.6...	12	.126	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	1...	H.1-1
20	M62	HR300_A...	.869	132.6...	12	.126	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	1...	H.1-1
21	M65	HR300_A...	.842	132.6...	12	.126	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	1...	H.1-1
22	M68B	HR300_A...	.846	132.6...	12	.132	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	1...	H.1-1
23	M71A	HR300_A...	.858	132.6...	12	.133	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	1...	H.1-1
24	M74A	HR300_A...	.843	132.6...	12	.127	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	1...	H.1-1
25	M80A	HR300_A...	.863	132.6...	12	.115	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	2...	H.1-1
26	M80B	HR300_A...	.971	132.6...	12	.137	37.631	y	6	3894.812	14342....	494.953	934.619	6030.769	2749.538	2...	H.1-1

NOTES: UNLESS OTHERWISE SPECIFIED
 1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].



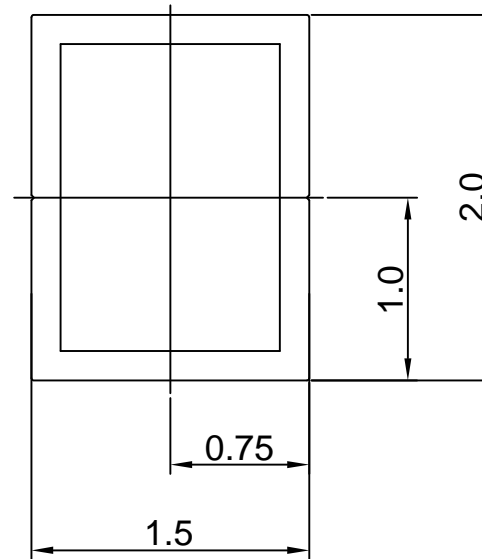
REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	10/20/2016

2	A21120-001	2" PIPE BASE	1
1	B15018-011	HEX CAP SCREW 3/8-16 X 5/8	3
ITEM	PART NUMBER	DESCRIPTION	QTY
MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS		Sunmodo Corp. 1905 E 5TH STREET, STE A, VANCOUVER, WA 98661	
Tolerances		TITLE	
X.XXX ±0.01 [0.25mm]		2" PIPE BASE KIT	
X.XX ±0.02 [0.50mm]		DRAWING NUMBER	
X.X ±0.039 [1.0mm]		B K10268-001	
Unless otherwise spec'd		SCALE: NONE	
DRAWN BY		SHEET 1 of 1	
LWF		DATE	
CHECKED BY		10/20/2016	
APPROVALS			

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NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
2. MATERIAL: ALUMINUM 6005-T5.
FINISH: CLEAR ANODIZED 10 μ m THICK.
3. THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.



Section properties:

Weight: 1.156 lbs/ft

Area: 0.992 in²

Perimeter: 12.601 in

Bounding Box: X: -1.000,1.000

Y: -0.750, 0.750

Centroid:(0.000,0.000)

Moments of Inertia(in⁴): I_x=0.506,I_y=0.322

Section modulus in bending(in³): W_x=0.675,W_y=0.322

Radii of Gyration: X: 0.714, Y: 0.570

MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS			
All Dimensions in inches [millimeters]			
Tolerances			
X.XXX ± 0.01 [0.25mm]	Break all sharp edges		
X.XX ± 0.02 [0.50mm]	.010-.020 unless		
X.X ± 0.039 [1.0mm]	otherwise specified.		
DRAWN BY		DATE	
zcg		03/12/2014	
CHECKED BY			
APPROVALS			
		1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661	
		TITLE	
		1.5X2 AL TUBE BRACE EXTRUSION	
		DRAWING NUMBER	
		A20164	
		SCALE: NONE	
		SHEET 1 of 1	

REVISIONS			
REV	DESCRIPTION	BY	DATE
A	ADDED BOTTOM CHANNEL & CHANGED ONE 3/8 CHANNEL TO 1/4	zcg	02/21/2013

NOTES: UNLESS OTHERWISE SPECIFIED

- DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
- MATERIAL: ALUMINUM 6005-T5.
FINISH: CLEAR ANODIZED 15 μm THICK.
- THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.

2X 1/4 BOLT SLOT



Section properties:

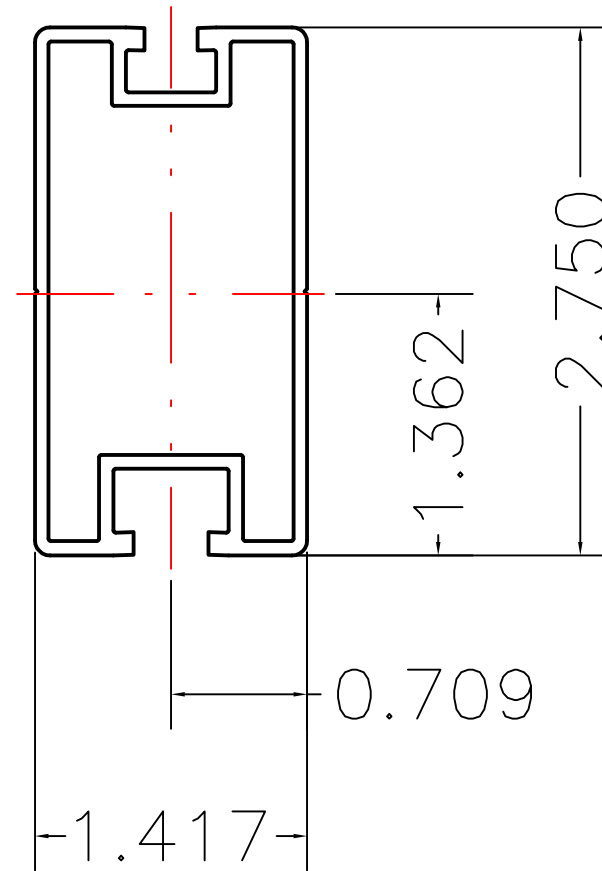
Weight: 0.850 lbs/ft
 Area: 0.723 in²
 Perimeter: 17.325 in
 Bounding Box: X: -0.500,0.500
 Y: -1.243,1.257

Centroid:(0.000,0.000)
 Moments of Inertia(in⁴): I_x=0.486,I_y=0.095
 Section modulus in bending(in³): W_x=0.387,W_y=0.190
 Radii of Gyration: X: 0.820, Y: 0.363

MATERIAL SEE NOTES		Sunmodo Corp.	
Third Angle Projection:			
GENERAL SPECIFICATIONS All Dimensions in inches [millimeters]		1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661	
Tolerances: X.XXX ± 0.01 [0.25mm] X.XX ± 0.02 [0.50mm] X.X ± 0.039 [1.0mm] Unless otherwise spec'd		TITLE HELIO STANDARD RAIL	
DRAWN BY zcg	DATE 02/21/2013	DRAWING NUMBER A20144	
CHECKED BY		SCALE: NONE SHEET 1 of 1	
APPROVALS			

NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
2. MATERIAL: 6005-T5.
FINISH: CLEAR ANODIZED 10um THICK.
3. THE UNSPECIFIED RADII ARE .02" MAX.
4. THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.



Section properties:

Weight: 0.862 lbs/ft
 Area: 0.736 in²
 Perimeter: 19.824 in
 Bounding Box: X: -0.709,0.709
 Y: -1.362,1.388
 Centroid:(0.000,0.000)
 Moments of Inertia(in⁴): I_x=0.727,I_y=0.214
 Section modulus in bending(in³): W_x=0.524,W_y=0.302
 Radii of Gyration: X: 0.994, Y: 0.539

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MATERIAL SEE NOTES	
Third Angle Projection:	
GENERAL SPECIFICATIONS All Dimensions in inches [millimeters]	
Tolerances	
X.XXX ±0.01 [0.25mm]	Break all sharp edges .010-.020 unless otherwise specified.
X.XX ±0.02 [0.50mm]	
X.X ±0.039 [1.0mm]	
Unless otherwise spec'd	
DRAWN BY KYY	DATE 01/18/2018
CHECKED BY	
APPROVALS	

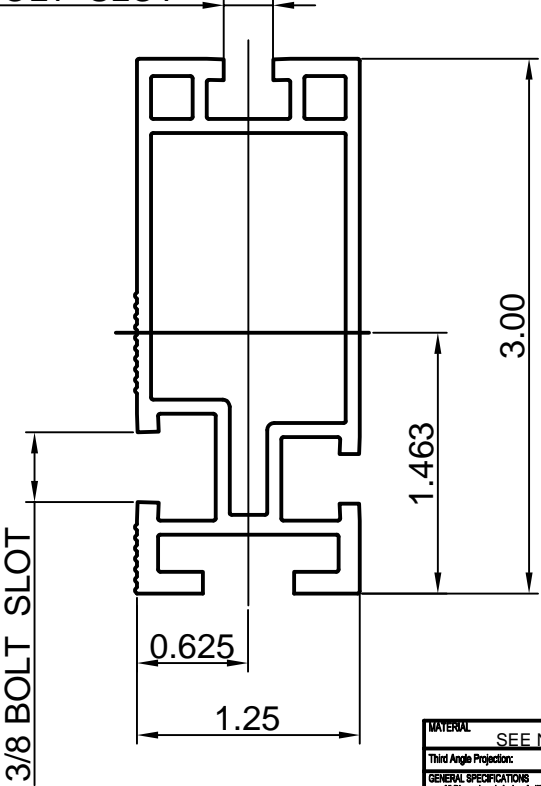
SunModo Corp.	
14800 NE 65TH STREET, VANCOUVER WA 98682	
TITLE RAIL, HR300 (SUNRAY), EXTRUSION	
B	DRAWING NUMBER A20288
SCALE: NONE	SHEET 1 of 1

REV	DESCRIPTON	BY	DATE
A	0.44 WAS 0.41, 0.44 WAS 0.33	LWF	11/30/2015

NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS SHOWN ARE INCHES [MILIMETERS].
2. MATERIAL: ALUMINUM 6005-T5.
FINISH: CLEAR ANODIZED 15 μ m THICK.
3. THE UNSPECIFIED DIMENSIONS ARE SPECIFIED BY 2D CAD FILE.

2X 1/4 BOLT SLOT



Section properties:

Weight: 1.151 lbs/ft
 Area: 0.980 in²
 Perimeter: 22.104 in
 Bounding Box: X: -0.625,0.625
 Y: -1.463,1.537
 Centroid:(0.000,0.000)
 Moments of Inertia(in⁴): Ix=1.047,Iy=0.207
 Section modulus in bending(in³): Wx=0.681,Wy=0.331
 Radii of Gyration: X: 1.034, Y: 0.460

MATERIAL		SEE NOTES	
Third Angle Projection			
GENERAL SPECIFICATIONS			
All Dimensions in Inches [millimeters]			
Tolerances			
XXX ±0.01 (0.25mm)			
XX ±0.02 (0.50mm)			
X ±0.03 (1.0mm)			
Unless otherwise specified.			
Break all sharp edges 0.10-0.25 unless otherwise specified.			
DRAWN BY		DATE	
ZCG		02/21/2013	
CHECKED BY		B	
APPROVALS		DRAWING NUMBER	
		A20145	
SCALE:		SHEET	
NONE		1 of 1	

Sunmodo Corp.

1905 E 5TH STREET, SUITE A, VANCOUVER, WA 98661

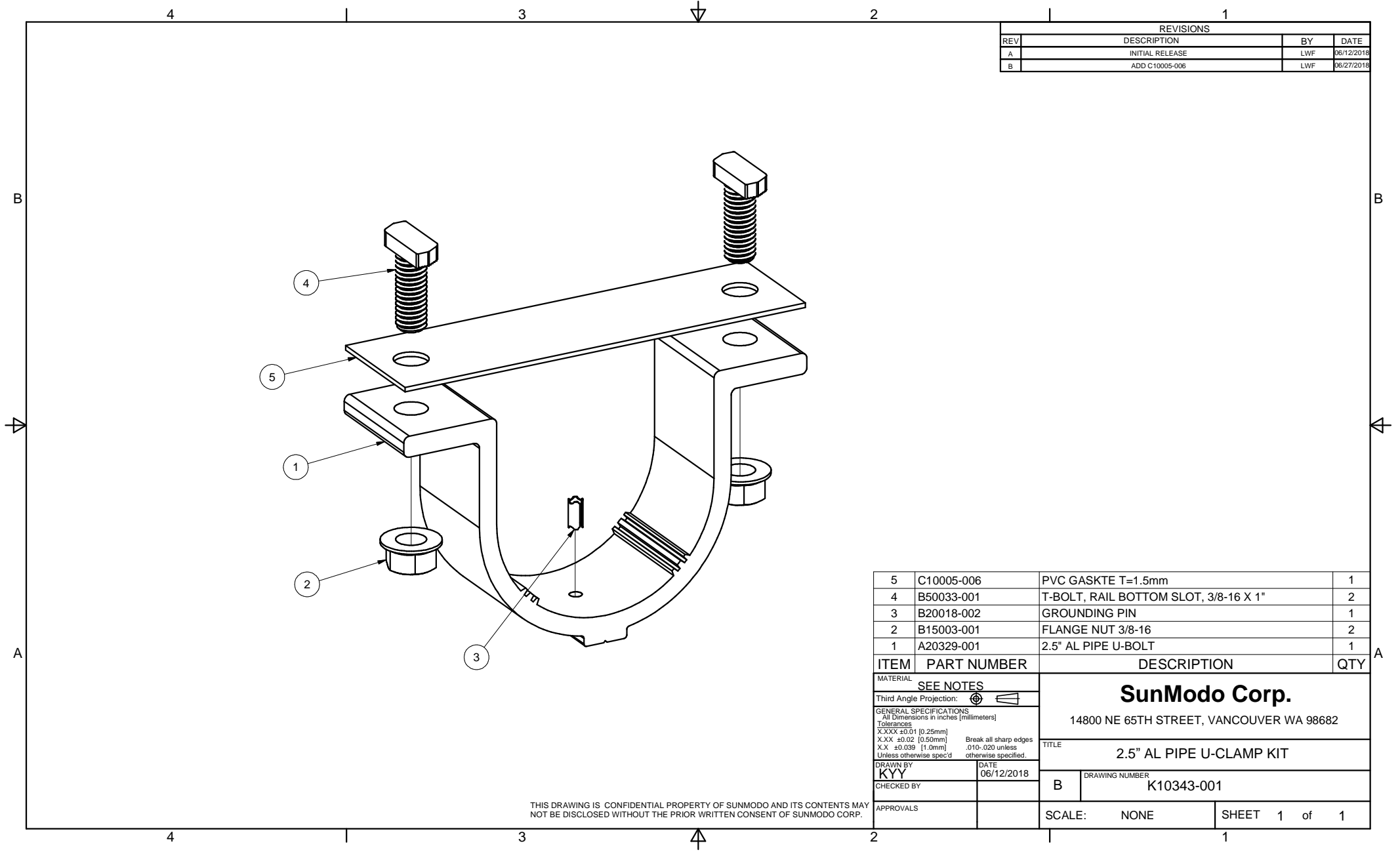
HELIO HEAVY RAIL



7	B10001-002	SET SCREW M10X10	2
6	B15048-001	STAR WASHER FOR 3/8 BOLT	1
5	B15018-004	HEX CAP SCREW 3/8-16 X2.5	1
4	B15003-001	FLANGE NUT 3/8-16	2
3	B15018-002	HEX CAP SCREW 3/8-16 X 1.25	1
2	A20236-001	2 AL PIPE CLAMP, FEMALE	1
1	A20235-001	2 AL PIPE CLAMP, MALE	1

ITEM	PART NUMBER	DESCRIPTION	QTY
MATERIAL		SEE BOM	
Third Angle Projection:			
GENERAL SPECIFICATIONS All Dimensions in inches (millimeters) Tolerances X.XXX ±0.01 [0.25mm] X.XX ±0.02 [0.50mm] X.X ±0.039 [1.0mm] Unless otherwise spec'd			
DRAWN BY		DATE	
zcg		08/12/2015	
CHECKED BY		TITLE	
		2 AL PIPE CLAMP KIT	
APPROVALS		DRAWING NUMBER	
		B K10219-001	
SCALE:		NONE	SHEET 1 of 1

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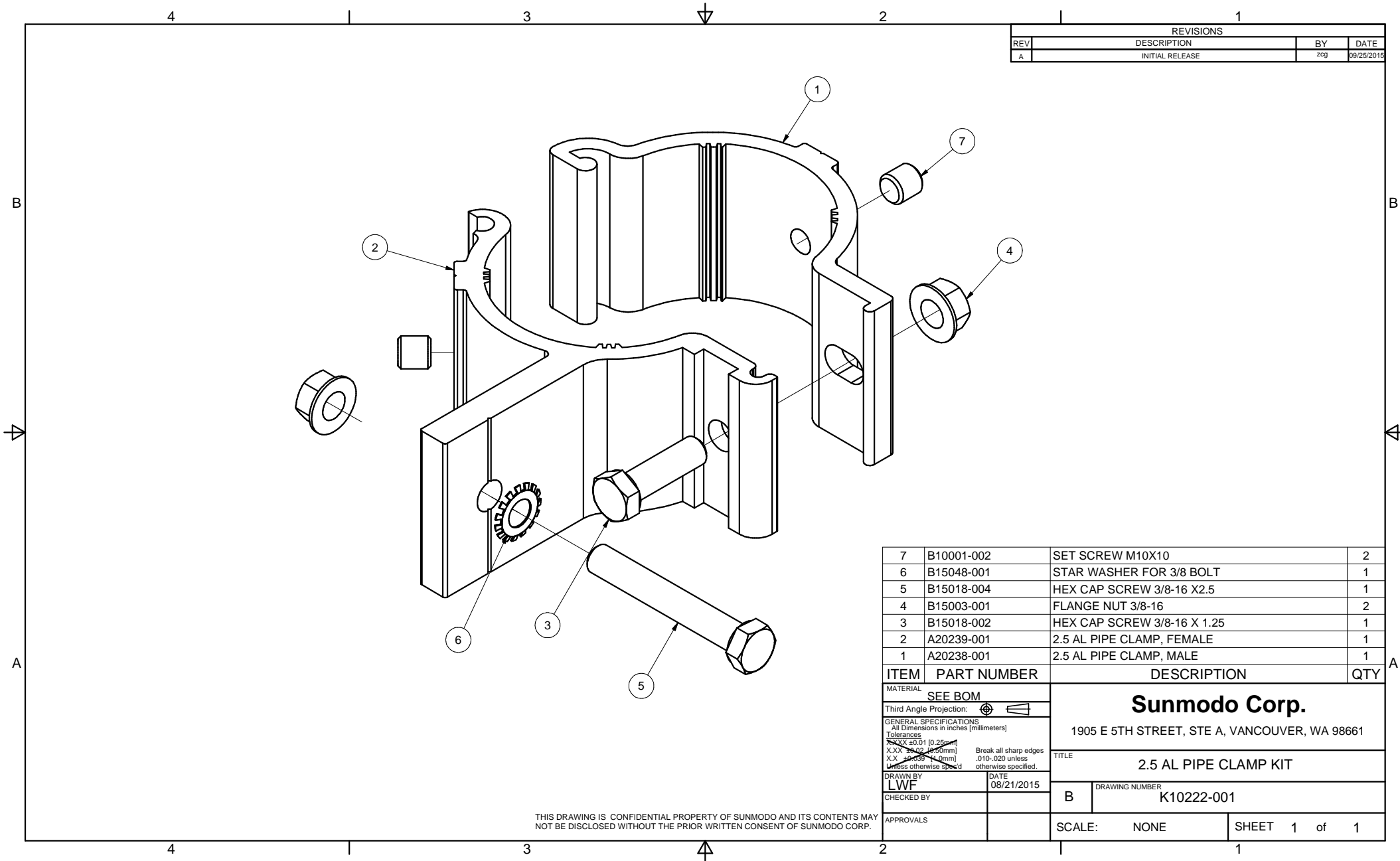


REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	06/12/2018
B	ADD C10005-006	LWF	06/27/2018

ITEM	PART NUMBER	DESCRIPTION	QTY
5	C10005-006	PVC GASKTE T=1.5mm	1
4	B50033-001	T-BOLT, RAIL BOTTOM SLOT, 3/8-16 X 1"	2
3	B20018-002	GROUNDING PIN	1
2	B15003-001	FLANGE NUT 3/8-16	2
1	A20329-001	2.5" AL PIPE U-BOLT	1

MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS		<p>SunModo Corp. 14800 NE 65TH STREET, VANCOUVER WA 98682</p>	
All Dimensions in inches [millimeters] Tolerances X.XXX ±0.01 [0.25mm] X.XX ±0.02 [0.50mm] X.X ±0.039 [1.0mm] Unless otherwise spec'd			
TITLE		2.5" AL PIPE U-CLAMP KIT	
DRAWN BY	DATE	DRAWING NUMBER	
KYY	06/12/2018	B K10343-001	
CHECKED BY			
APPROVALS		SCALE: NONE	SHEET 1 of 1

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REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	zcg	09/25/2015

ITEM	PART NUMBER	DESCRIPTION	QTY
7	B10001-002	SET SCREW M10X10	2
6	B15048-001	STAR WASHER FOR 3/8 BOLT	1
5	B15018-004	HEX CAP SCREW 3/8-16 X2.5	1
4	B15003-001	FLANGE NUT 3/8-16	2
3	B15018-002	HEX CAP SCREW 3/8-16 X 1.25	1
2	A20239-001	2.5 AL PIPE CLAMP, FEMALE	1
1	A20238-001	2.5 AL PIPE CLAMP, MALE	1

MATERIAL		SEE BOM	
Third Angle Projection:			
GENERAL SPECIFICATIONS All Dimensions in inches [millimeters] Tolerances X.XX ±0.01 [0.25mm] X.X ±0.02 [0.5mm] X.X ±0.03 [0.75mm] Unless otherwise specified, Break all sharp edges .010-.020 unless otherwise specified.			
DRAWN BY	DATE	Sunmodo Corp. 1905 E 5TH STREET, STE A, VANCOUVER, WA 98661 TITLE 2.5 AL PIPE CLAMP KIT	
LWF	08/21/2015		
CHECKED BY		B	DRAWING NUMBER K10222-001
APPROVALS		SCALE:	NONE SHEET 1 of 1

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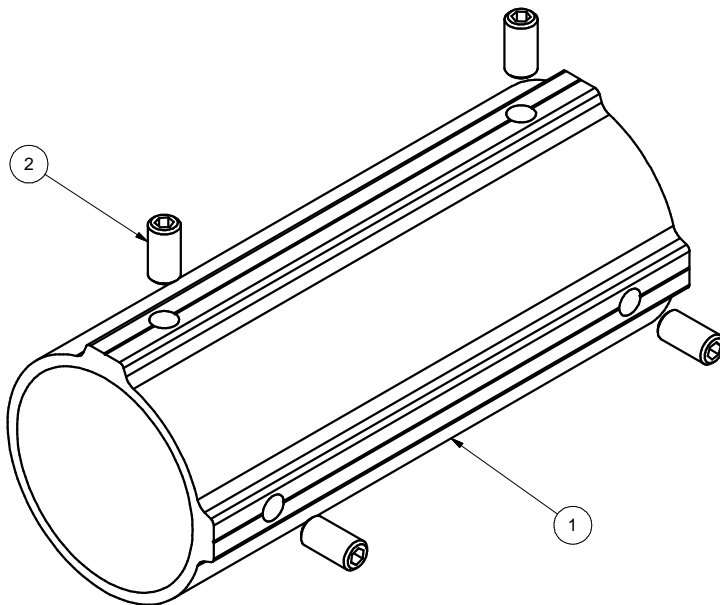
REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	06/12/2018

5	B10001-001	SET SCREW M10X20	5
4	B15020-001	FLANGE NUT 1/2-13	1
3	B15014-005	HEX CAP SCREW 1/2-13 X 1.25", 304 SS	1
2	A20327-001	2.5" AL PIPE TEE, FEMALE	1
1	A20326-001	2.5" AL PIPE TEE, MALE	1
ITEM	PART NUMBER	DESCRIPTION	QTY

MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS		<p>SunModo Corp. 14800 NE 65TH STREET, VANCOUVER WA 98682</p>	
<p>All Dimensions in inches [millimeters]</p> <p>Tolerances</p> <p>X.XXX ±0.01 [0.25mm]</p> <p>X.XX ±0.02 [0.50mm]</p> <p>X.X ±0.039 [1.0mm]</p> <p>Unless otherwise spec'd</p>			
TITLE		2.5" PIPE TEE KIT	
DRAWN BY	DATE	DRAWING NUMBER	
LWF	06/12/2018	B K10341-001	
CHECKED BY			
APPROVALS		SCALE:	NONE SHEET 1 of 1

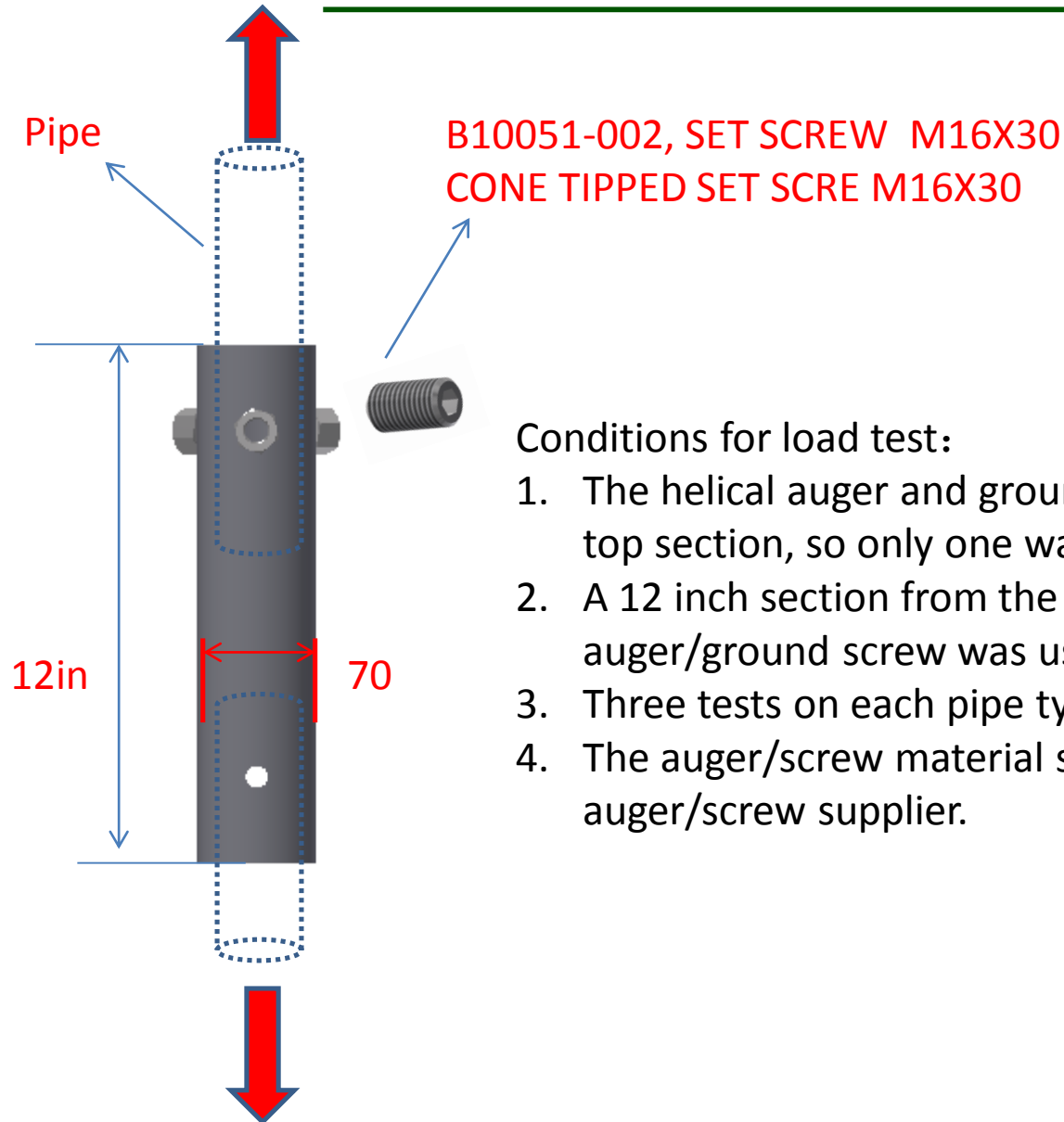
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REVISIONS			
REV	DESCRIPTION	BY	DATE
A	INITIAL RELEASE	LWF	06/12/2018



2	B10001-001	SET SCREW M10X20	4
1	A20328-001	2.5" PIPE SPLICE	1
ITEM	PART NUMBER	DESCRIPTION	QTY
MATERIAL		SEE NOTES	
Third Angle Projection:			
GENERAL SPECIFICATIONS		SunModo Corp. 14800 NE 65TH STREET, VANCOUVER WA 98682	
All Dimensions in inches [millimeters] Tolerances X.XXX ±0.01 [0.25mm] X.XX ±0.02 [0.50mm] X.X ±0.039 [1.0mm] Unless otherwise spec'd		Break all sharp edges .010-.020 unless otherwise specified.	
DRAWN BY		TITLE	
LWF		2.5" PIPE SPLICE KIT	
DATE		DRAWING NUMBER	
06/12/2018		B K10342-001	
CHECKED BY		SCALE: NONE	
APPROVALS		SHEET 1 of 1	

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Conditions for load test:

1. The helical auger and ground screw use the same top section, so only one was used for testing
2. A 12 inch section from the top of the auger/ground screw was used
3. Three tests on each pipe type was used
4. The auger/screw material supplied by the auger/screw supplier.