Robinson+Cole

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Also admitted in Massachusetts
and New York

June 20, 2023

VIA HAND DELIVERY

Melanie A. Bachman, Esq.
Executive Director/Staff Attorney
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Petition No. 1508 - Enfield Solar One, LLC and VCP, LLC d/b/a Verogy – Petition for a Declaratory Ruling that a Certificate of Environmental Compatibility and Public Need is not Required for the Construction, Operation and Maintenance of a 4.0 MWAC Solar Photovoltaic Project at 110 North Street, Enfield, Connecticut**

Dear Ms. Bachman:

In accordance with Condition Nos. 5 and 6 of the Siting Council's July 21, 2022 approval of Petition No. 1508, enclosed are fifteen (15) copies of the Stormwater General Permit- Notice of Permit Authorization from the Department of Energy and Environmental Protection; and the Final Structural Calculations and Design Drawings for the Enfield Solar One, LLC facility, stamped and signed by a Connecticut professional engineer licensed. Also, as requested by Condition No. 3 and as mentioned in the Spill Prevention Control and Countermeasure Plan ("SPCC") included in the Petition No. 1508 record, the spill response contractor for the project will be Clean Harbors Environmental (860) 583-6866.

Please feel free to contact me if you have any questions. Thank you in advance for your assistance and cooperation.

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Ellen Zoppo-Sassu, Enfield Town Manager

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

NOTICE OF PERMIT AUTHORIZATION

Date: 6/13/23

ATTN: Bradley Parsons, Director of Design and Permitting

Mailing Address:
Verogy
124 LaSalle Road, 2nd Floor
West Hartford, CT 06107

Site Information:
Enfield One Solar, LLC
110 North Street
Enfield, CT 06082

RE: General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities
Permit No. GSN003845, issued to Verogy
Application No. 202207691

Dear Mr. Parsons:

The Department of Energy and Environmental Protection, Water Permitting and Enforcement Division of the Bureau of Materials Management and Compliance Assurance, has completed the review of the Enfield Solar One (located at 110 North Road) registration for the **General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, effective 12/31/2020 (general permit)**. The project is compliant with the requirements of the general permit and the discharge(s) associated with this project is (are) authorized to commence as of the date of this letter. Permit No. GSN003845 has been assigned to authorize the stormwater discharge(s) from this project.

Should you have any questions about this letter or any other question concerning the general permit, please feel free to contact Christopher Stone, P.E. at 860-424-3850 or chris.stone@ct.gov.

Sincerely,
Karen L. Allen, PE
Supervising Sanitary Engineer
Water Permitting and Enforcement Division
Bureau of Materials Management and Compliance Assurance

Prepared For:

Verogy

Enfield Solar One

SFDC ID# 17071

1x78,52 FTS - Structural Calculations
41°59'42.02"N, 72°31'32.12"W Enfield, CT 06082

STATE OF CONNECTICUT
BRIAN M. FLOOD
29323
LICENSED PROFESSIONAL ENGINEER

A product of Northern States Metals (NSM)

3207 Innovation Place, Youngstown, Ohio, 44509-4023

Prepared By: JRD

Checked By: JS

Rev 0

Solar FlexRack Engineering Analysis

Table of Contents

Customer:	Verogy
SFDC ID #:	17071
Project/Location:	Enfield Solar One - Enfield, CT 06082
Date/Engineer:	02/01/23 - Nomiki Zembillas

SOLAR FLEXRACK
A Division of Northern States Metals

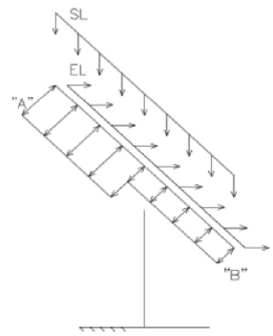
Solar Flexrack Loading Analysis

Configuration Data

Configuration 1:	1x78 FTS	Configuration 2:	1x52 FTS
Horiz. Length (N-S):	294.84 ft	Horiz. Length (N-S):	197.02 ft
Array Surface Area:	2203.53 ft²	Array Surface Area:	1472.47 ft²
Number of Posts:	13	Number of Posts:	9

Design Data Summary

Module Length:	7.47 ft
Solar Panel Dead Load:	**2.21 psf**
Max Stow Wind Speed:	107 mph
Max Operation:	35 mph
Snow Load:	35 psf
Ground Clearance:	48.52 in
Exposure Category:	C
Building Classification:	I
Hurricane Region?:	0



Snow Load Parameters

Flat Roof Snow Load, P_f:	Pf=0.7*Ce*Ct*I*Pg
Sloped Roof Snow Load, P_s:	Ps = Pf*Cs
Snow Exposure Category, Ce:	0.9
Snow Thermal Factor, Ct:	1.2
Snow Importance Factor, I:	0.8
P_f:	**21.17 psf**
Snow Density:	18.55 pcf
Snow Height:	22.64 in

Snow Load Design

Tilt Angle	C_s	P_s psf
0 - 15	1.00	**21.17**
20	0.91	**19.26**
25	0.82	**17.36**
30	0.73	**15.45**
35	0.64	**13.55**
40	0.55	**11.64**
45	0.46	**9.74**
50	0.37	**7.83**
55	0.28	**5.93**

Wind Load Parameters

Exposure Coefficient, Kz:	0.85	Wind Load: qh = 0.00256*kz*kzt*kd*V²		n:	2.9	Hz	
Topographic Factor, Kzt:	1.00	qh_{Vult}	21.04 psf	Damping Ratio	2.50	%	
Wind Directionality Factor, Kd:	0.85	qh_{35}	3.75 psf	nL/Vult:	0.178		
				nL/V35:	0.422		
Elevation Factor, Ke:	0.993433256						

Wind Load Design

Perimeter Loading

Stow Position

	Static								Inertial									
Tilt Angle	A Distribution	B Distribution	GCp Up	GCp Dn	A*qz*GCp Up	B*qz*GCp Up	A*qz*GCp Dn	B*qz*GCp Dn	A Distribution	B Distribution	Mod. Factor	GCp Up	GCp Dn	A*qz*GCp Up	B*qz*GCp Up	A*qz*GCp Dn	B*qz*GCp Dn
0	2.00	0.00	-0.38	0.27	**-15.84**	**0.00**	**11.28**	**0.00**	1.15	0.85	0.54	-0.91	0.81	**-22.12**	**-16.34**	**19.50**	**14.40**

Tilted Position (35 mph max)

	Static								Inertial									
Tilt Angle	A Distribution	B Distribution	GCp Up	GCp Dn	A*qz*GCp Up	B*qz*GCp Up	A*qz*GCp Dn	B*qz*GCp Dn	A Distribution	B Distribution	Mod. Factor	GCp Up	GCp Dn	A*qz*GCp Up	B*qz*GCp Up	A*qz*GCp Dn	B*qz*GCp Dn
5	1.95	0.05	-0.56	0.54	**-4.12**	**-0.12**	**3.91**	**0.11**	1.72	0.28	0.30	-0.87	0.84	**-5.59**	**-0.91**	**5.40**	**0.88**
10	1.89	0.11	-0.76	0.68	**-5.41**	**-0.31**	**4.81**	**0.28**	1.72	0.28	0.30	-1.07	0.98	**-6.86**	**-1.12**	**6.32**	**1.03**
15	1.84	0.17	-0.71	0.89	**-4.88**	**-0.44**	**6.14**	**0.55**	2.00	0.00	0.06	-0.77	0.95	**-5.77**	**0.00**	**7.15**	**0.00**
20	1.78	0.22	-0.79	0.92	**-5.30**	**-0.65**	**6.10**	**0.75**	2.00	0.00	0.06	-0.86	0.98	**-6.41**	**0.00**	**7.32**	**0.00**
25	1.73	0.28	-0.79	0.84	**-5.13**	**-0.82**	**5.46**	**0.87**	2.00	0.00	0.06	-0.86	0.91	**-6.41**	**0.00**	**6.79**	**0.00**
30	1.67	0.33	-0.80	0.78	**-5.03**	**-0.99**	**4.91**	**0.97**	2.00	0.00	0.06	-0.87	0.85	**-6.49**	**0.00**	**6.33**	**0.00**
35	1.62	0.39	-0.81	0.93	**-4.90**	**-1.17**	**5.65**	**1.35**	2.00	0.00	0.06	-0.87	0.99	**-6.53**	**0.00**	**7.45**	**0.00**
40	1.56	0.44	-0.88	0.87	**-5.17**	**-1.46**	**5.07**	**1.43**	2.00	0.00	0.06	-0.95	0.93	**-7.09**	**0.00**	**6.96**	**0.00**
45	1.51	0.50	-0.90	0.92	**-5.07**	**-1.67**	**5.20**	**1.71**	2.00	0.00	0.06	-0.96	0.98	**-7.19**	**0.00**	**7.36**	**0.00**
50	1.45	0.55	-0.90	0.92	**-4.88**	**-1.85**	**5.01**	**1.90**	2.00	0.00	0.06	-0.96	0.98	**-7.19**	**0.00**	**7.36**	**0.00**
55	1.40	0.61	-0.98	1.02	**-5.14**	**-2.23**	**5.36**	**2.32**	2.00	0.00	0.06	-1.04	1.09	**-7.82**	**0.00**	**8.14**	**0.00**

Seismic Load Parameters / Design

S_S:	0.172	S_{DS}: $S_{DS} = (2/3) \times F_a \times S_S$		Site Class:	D	
S_1:	0.055	S_{DS}:	0.183	Seismic Design Category:	B	
Site Coefficient, F_a:	1.600	S_{D1}: $S_{D1} = (2/3) \times F_V \times S_S$				
Site Coefficient, F_V:	2.400	S_{D1}:	0.088	Seismic Response Coefficient, Cs:	0.092	
Response Modification Coefficent, R:	2	Cu =	1.7	Panel Seismic Load,V =	Cs x (Panel DL)	
Importance Factor, I_e:	1	TL =	6	V =	**0.203**	**psf**

This Base Shear Value represents the seismic effect of the panel weight on the rack. This Base Shear includes 20% of the design snow load when the flat roof snow load exceeds 30 psf per ASCE. A separate term in the Risa load combination accounts for the remaining Dead Load caused by member self-weight.

Note: GCp values for 20° and 45° were not given in results from RWDI and are assumed to be the higher value of the two adjacent values.

Loading analysis and design in accordance with wind and snow load information obtained from ASCE 7-16 Minimum Design Loads for Building and Other Structures

Model Settings

Solution
Members

Number of Reported Sections	20
Number of Internal Sections	200
Member Area Load Mesh Size (in^2)	1
Consider Shear Deformation	Yes
Consider Torsional Warping	Yes

Wall Panels

Approximate Mesh Size (in)	12
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

Plate Axis

Plate Local Axis Orientation	Nodal

Codes

Hot Rolled Steel	AISC 15th (360-16): ASD
Stiffness Adjustment	Yes (Iterative)
Notional Annex	None
Connections	AISC 15th (360-16): ASD
Cold Formed Steel	AISI S100-16: ASD
Stiffness Adjustment	Yes (Iterative)
Wood	None
Temperature	< 100F
Concrete	None
Masonry	None
Aluminum	None
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

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)	
Include the weight of the structure in base shear calcs	Yes

Site Parameters

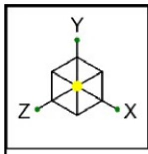
S_1 (g)	0.055
SD_1 (g)	0.088
SD_S (g)	0.183
T_L (sec)	6

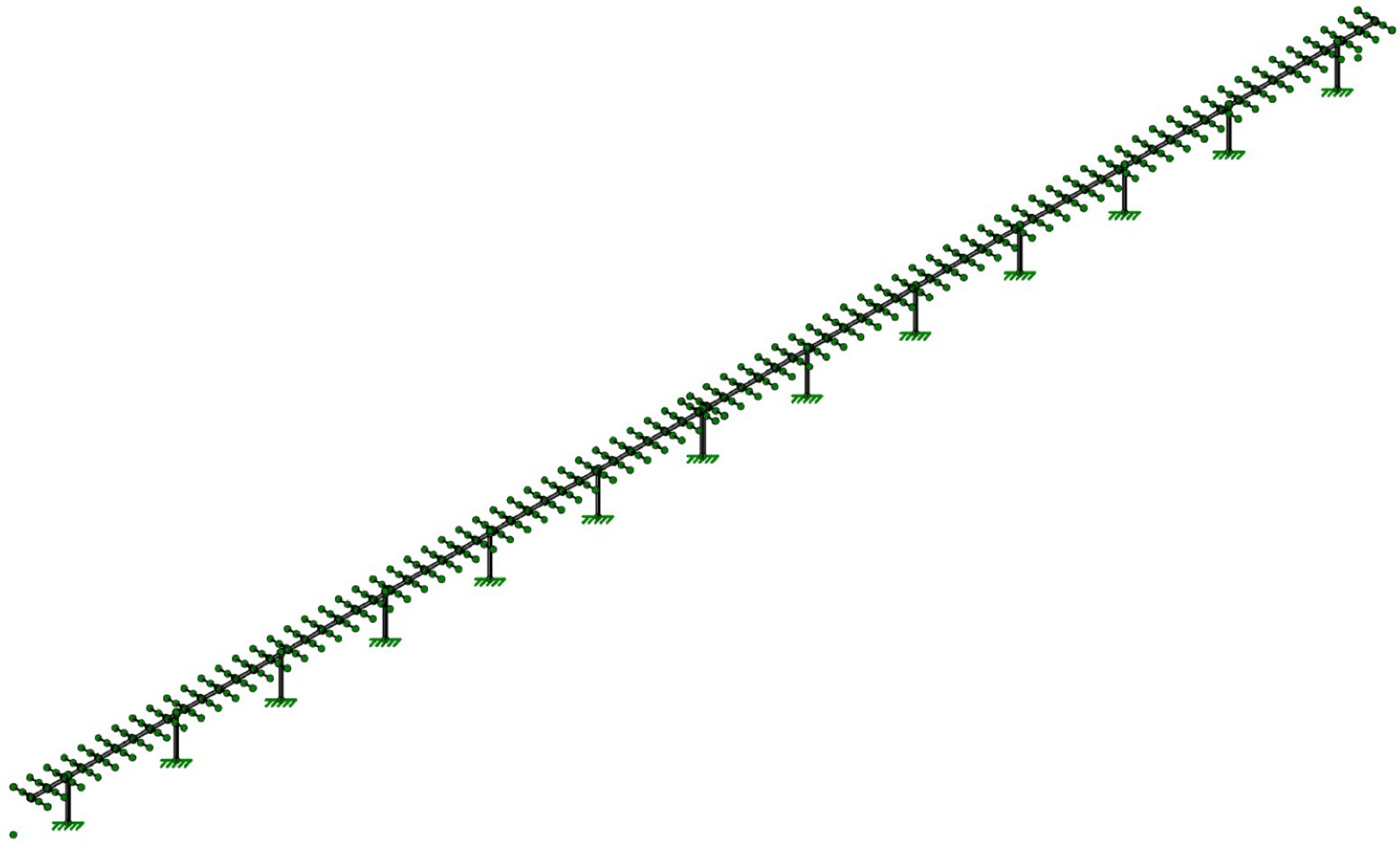
Structure Characteristics

T Z (sec)	
T X (sec)	
C_tX	0.02
C_tExp. Z	0.75
C_tExp. X	0.75
R Z	2
R X	2
Ω_0Z	2
Ω_0X	2
C_dZ	2
C_dX	2
ρ Z	1
ρ X	1

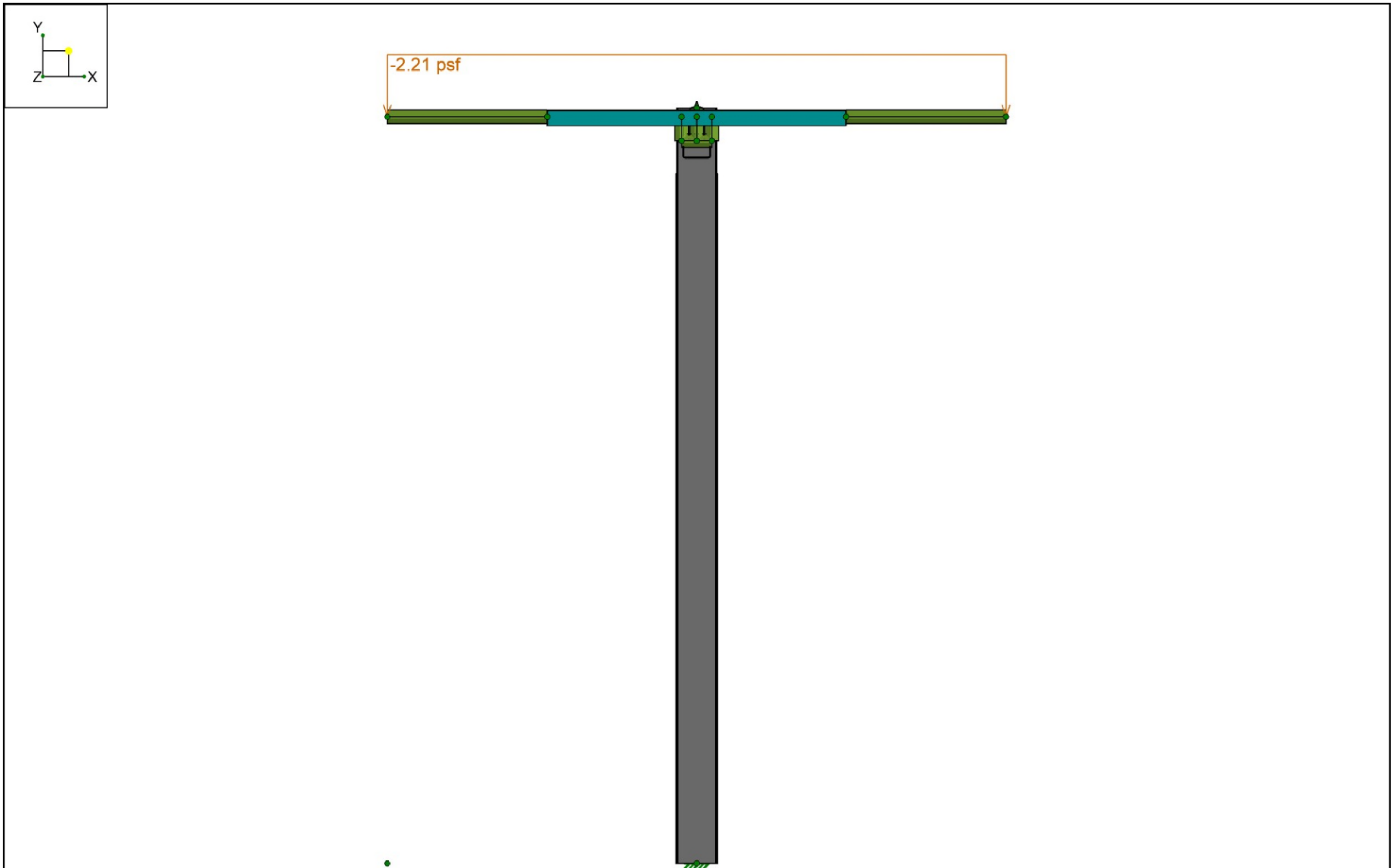
Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1		Yes	Y	DL	1						
2	IBC 16-10	Yes	Y	DL	1	SL	1				
3	IBC 16-12 (A)	Yes	Y	DL	1	WL+X	0.6	OL3	0.6		
4	IBC 16-12 (B)	Yes	Y	DL	1	WL-X	0.6	OL3	0.6		
5	IBC 16-13 (A) (static wind)	Yes	Y	DL	1	OL1	0.45	SL	0.75	OL3	0.45
6	IBC 16-13 (B) (static wind)	Yes	Y	DL	1	OL2	0.45	SL	0.75	OL3	0.45
7	Total WL + 0.25 SL	Yes	Y	DL	1	WL+X	0.45	SL	0.25		
8	Total WL + 0.25 SL	Yes	Y	DL	1	WL-X	0.45	SL	0.25		
9	IBC 16-15 (A)	Yes	Y	DL	0.6	WL+X	0.6	OL3	0.6		
10	IBC 16-15 (B)	Yes	Y	DL	0.6	WL-X	0.6	OL3	0.6		
11	Seismic										
12	IBC 16-12 C (A)	Yes	Y	DL	1	ELX	0.7			Sds*DL	0.14
13	IBC 16-12 C (B)	Yes	Y	DL	1	ELX	-0.7			Sds*DL	0.14
14	IBC 16-12 (D) (A)	Yes	Y	DL	1	ELZ	0.7			Sds*DL	0.14
15	IBC 16-12 (D) (B)	Yes	Y	DL	1	ELZ	-0.7			Sds*DL	0.14
16	IBC 16-14 (A) (A)	Yes	Y	DL	1	ELX	0.525	SL	0.75	Sds*DL	0.105
17	IBC 16-14 (A) (B)	Yes	Y	DL	1	ELX	-0.525	SL	0.75	Sds*DL	0.105
18	IBC 16-14 (B) (A)	Yes	Y	DL	1	ELZ	0.525	SL	0.75	Sds*DL	0.105
19	IBC 16-14 (B) (B)	Yes	Y	DL	1	ELZ	-0.525	SL	0.75	Sds*DL	0.105
20	IBC 16-16 (A) (A)	Yes	Y	DL	0.6	ELX	0.7			Sds*DL	-0.14
21	IBC 16-16 (A) (B)	Yes	Y	DL	0.6	ELX	-0.7			Sds*DL	-0.14
22	IBC 16-16 (B) (A)	Yes	Y	DL	0.6	ELZ	0.7			Sds*DL	-0.14
23	IBC 16-16 (B) (B)	Yes	Y	DL	0.6	ELZ	-0.7			Sds*DL	-0.14



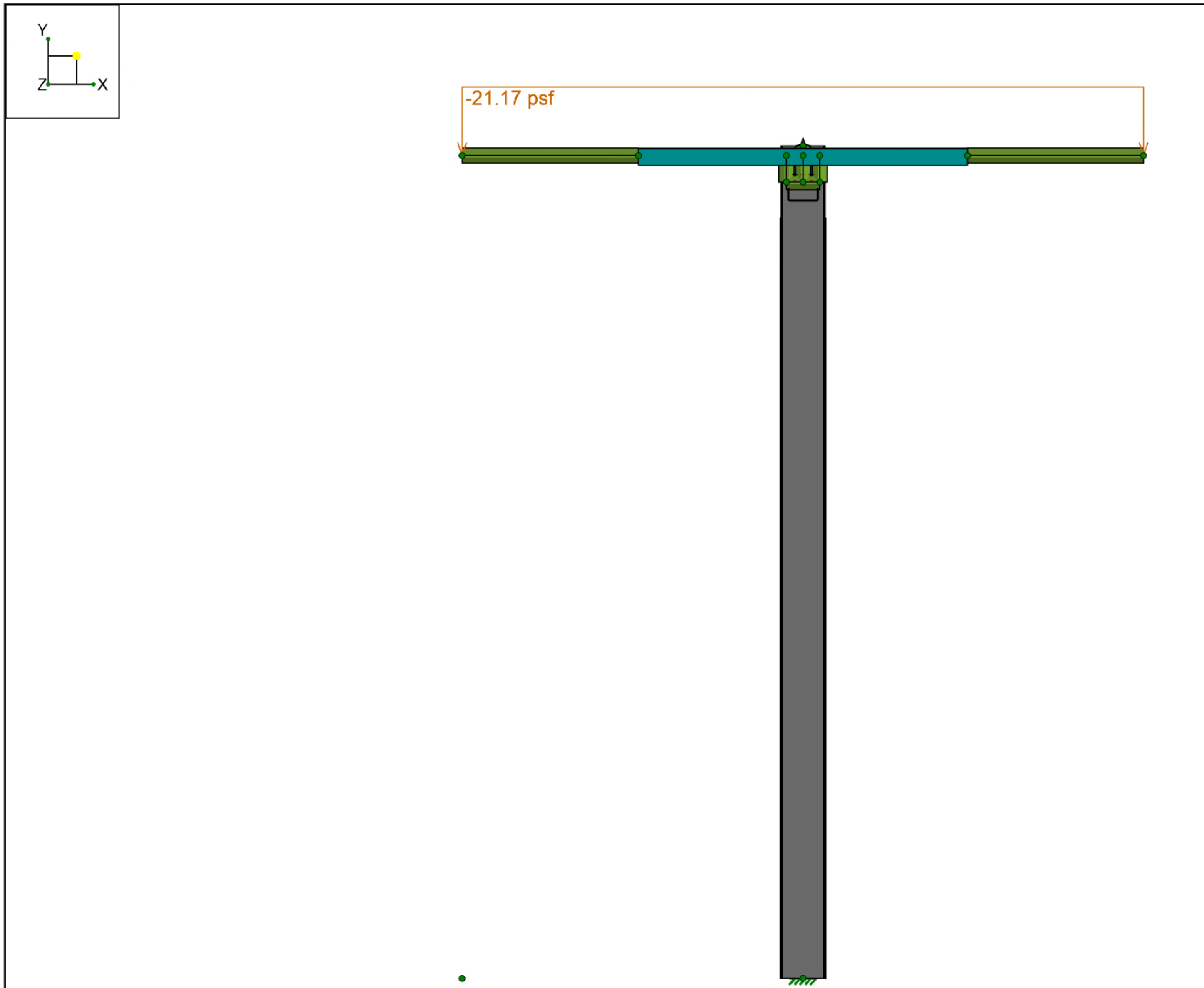


Verogy	Enfield Solar One	SK-1
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d



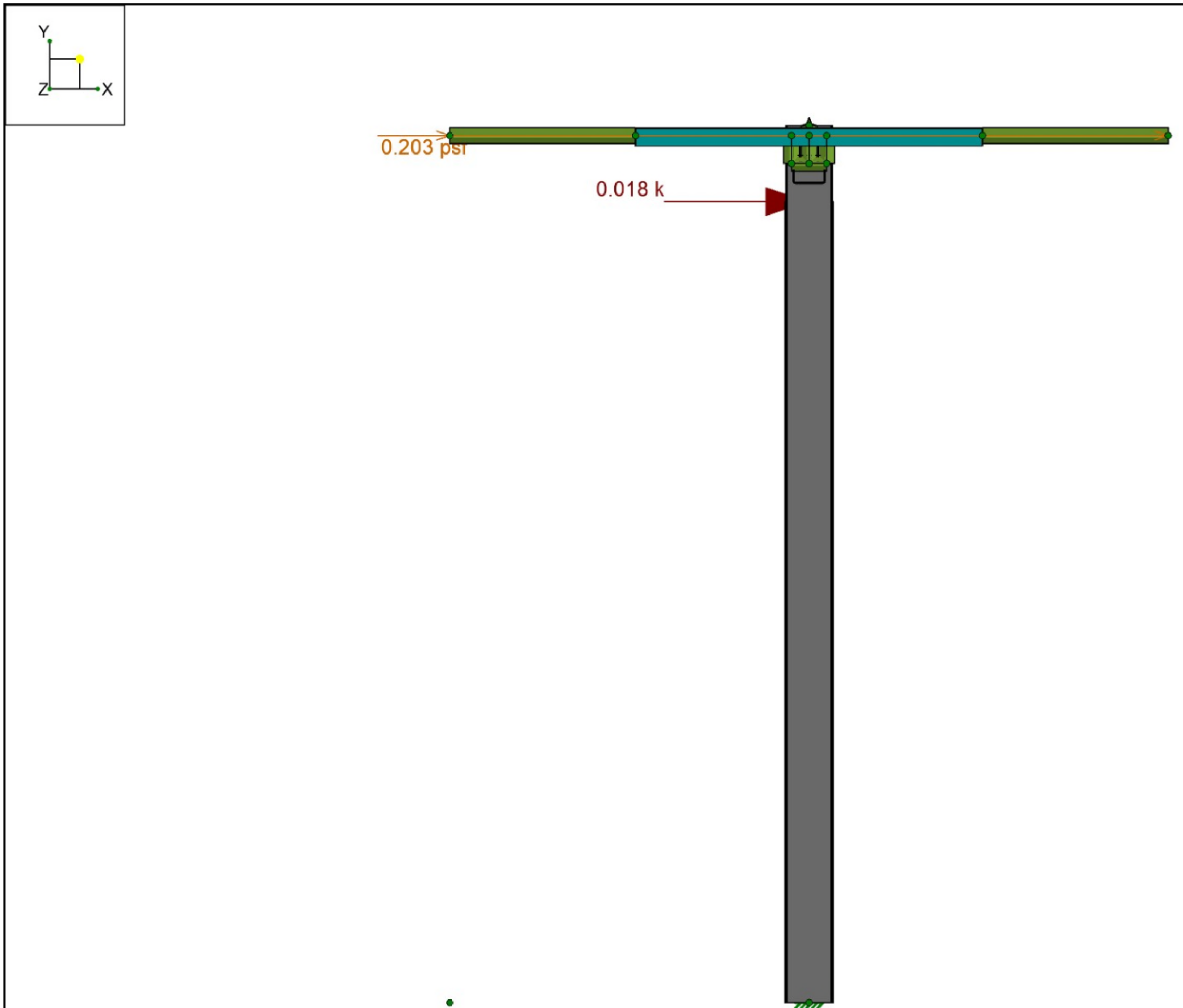
Loads: BLC 2, Solar Panels

Verogy	Enfield Solar One	SK-2
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d



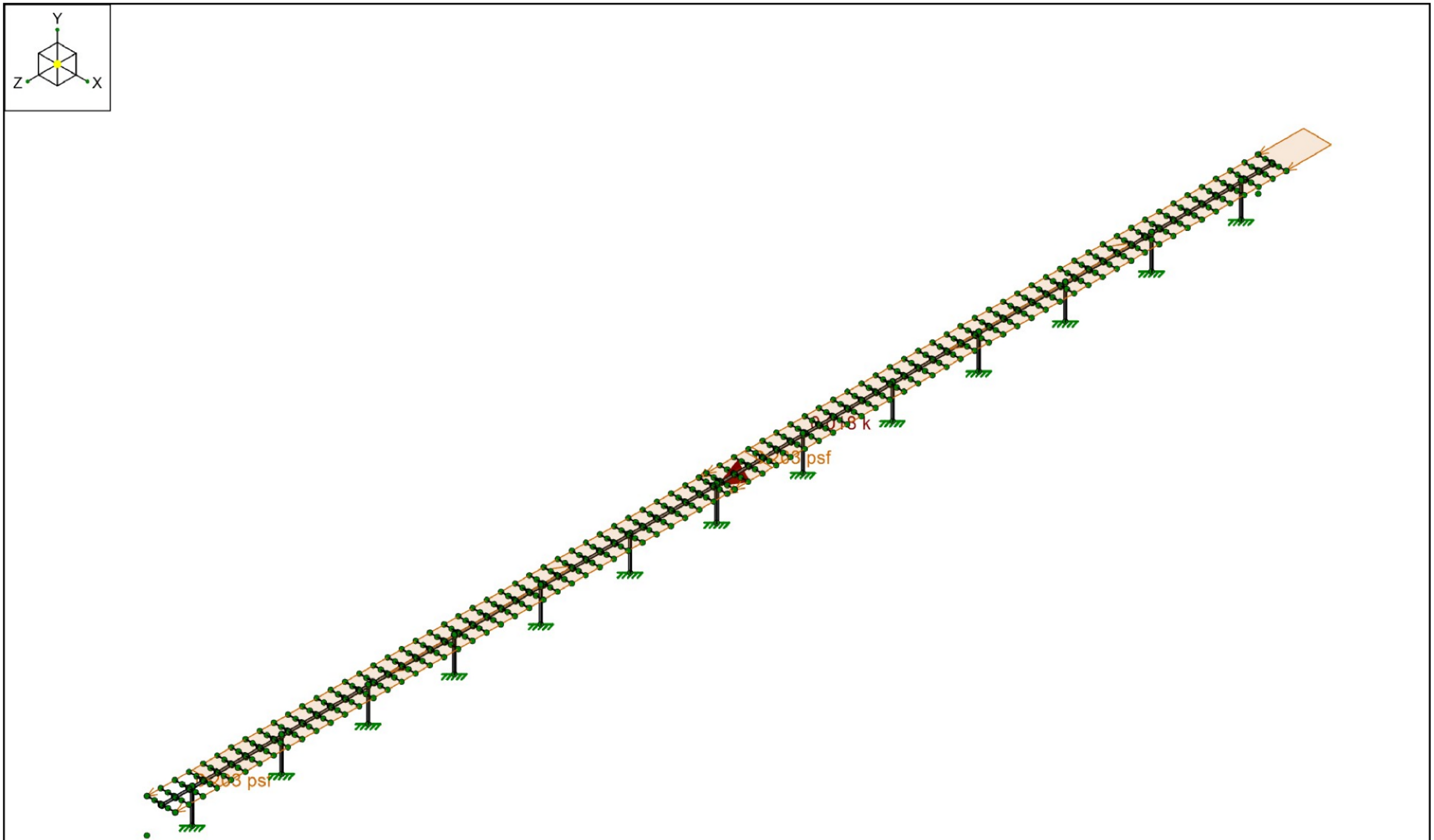
Loads: BLC 3, Snow

Verogy	Enfield Solar One	SK-3
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d



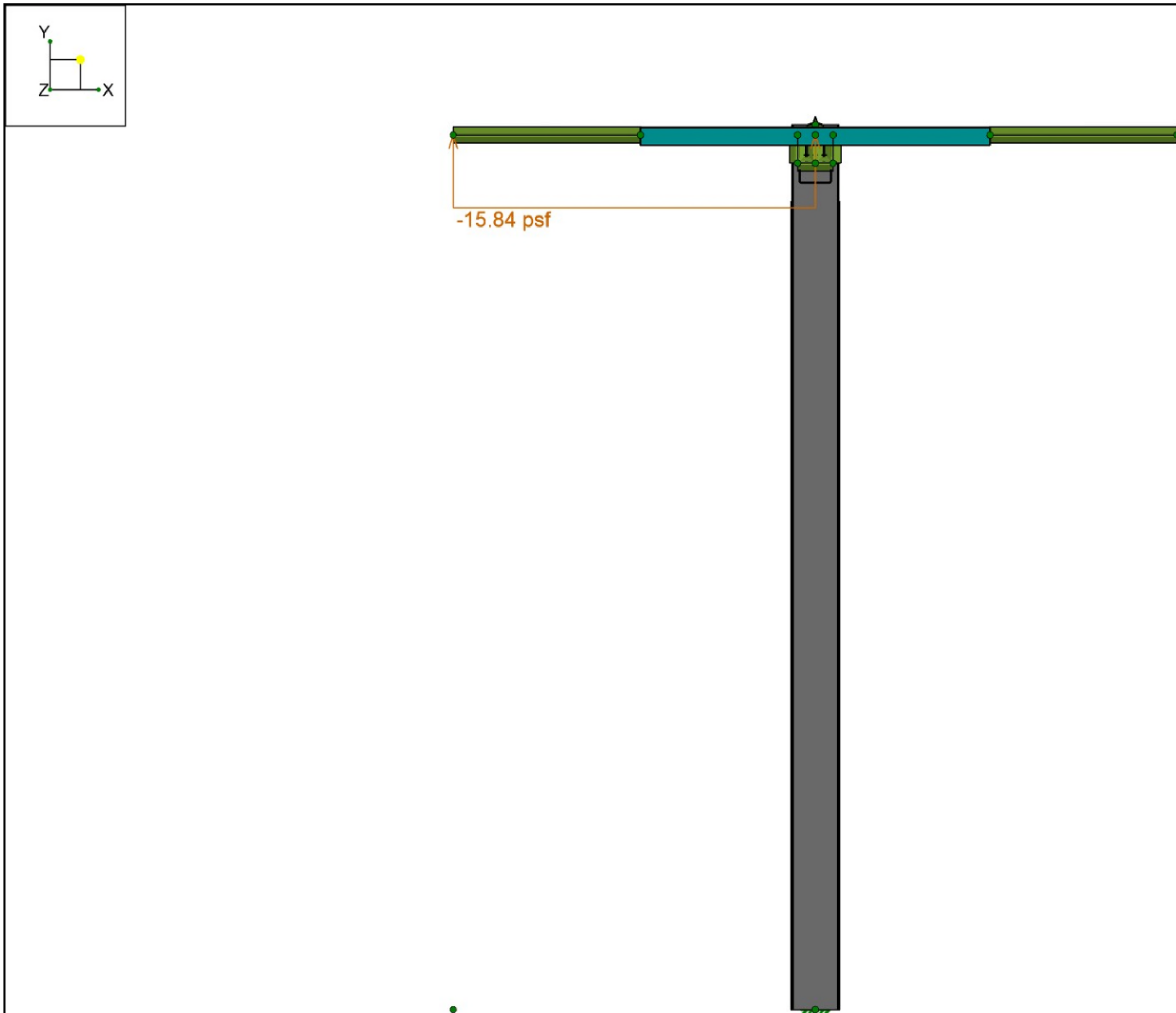
Loads: BLC 4, Seismic X

Verogy	Enfield Solar One	SK-4
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d



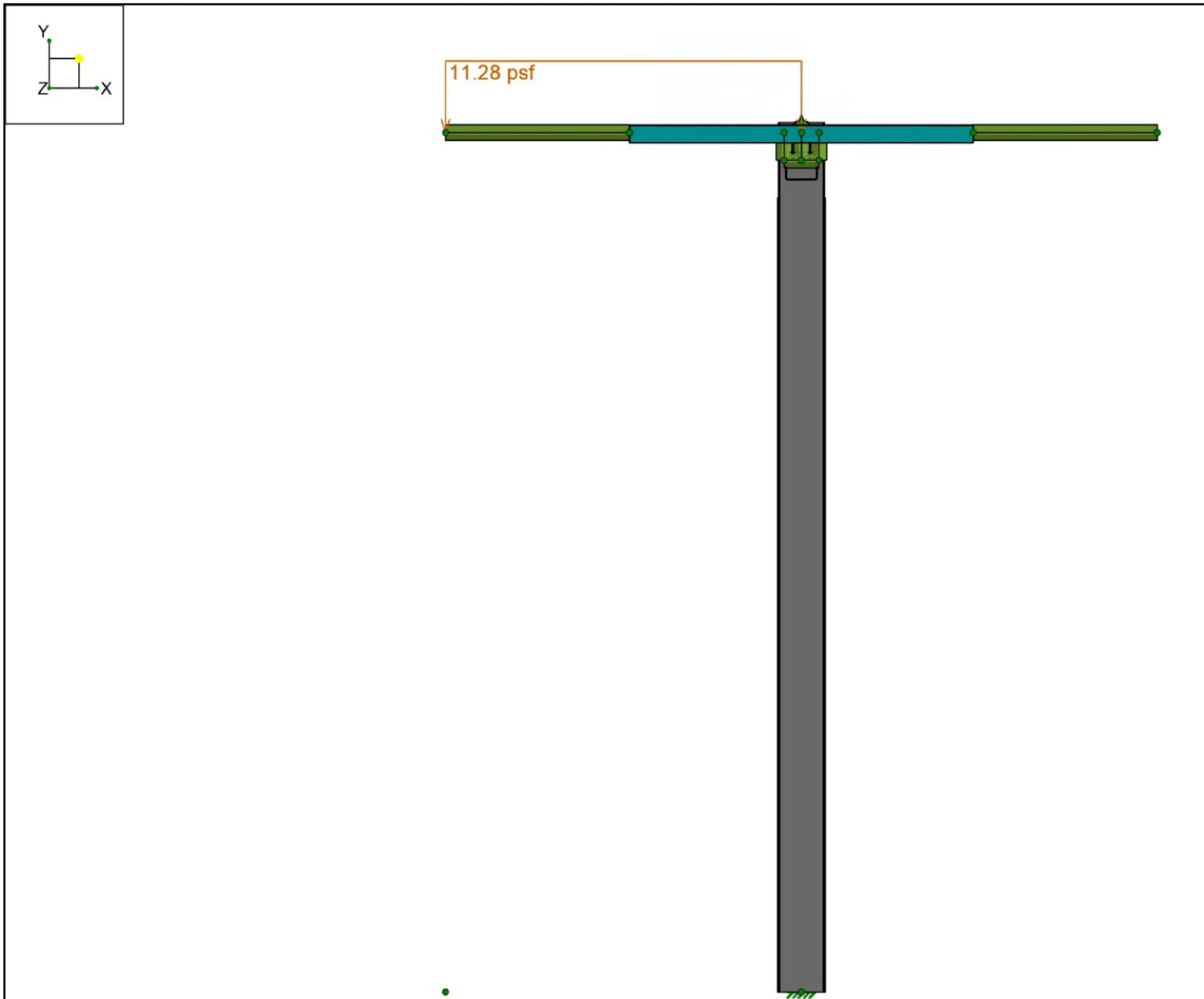
Loads: BLC 5, Seismic Z

Verogy	Enfield Solar One	SK-5
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d



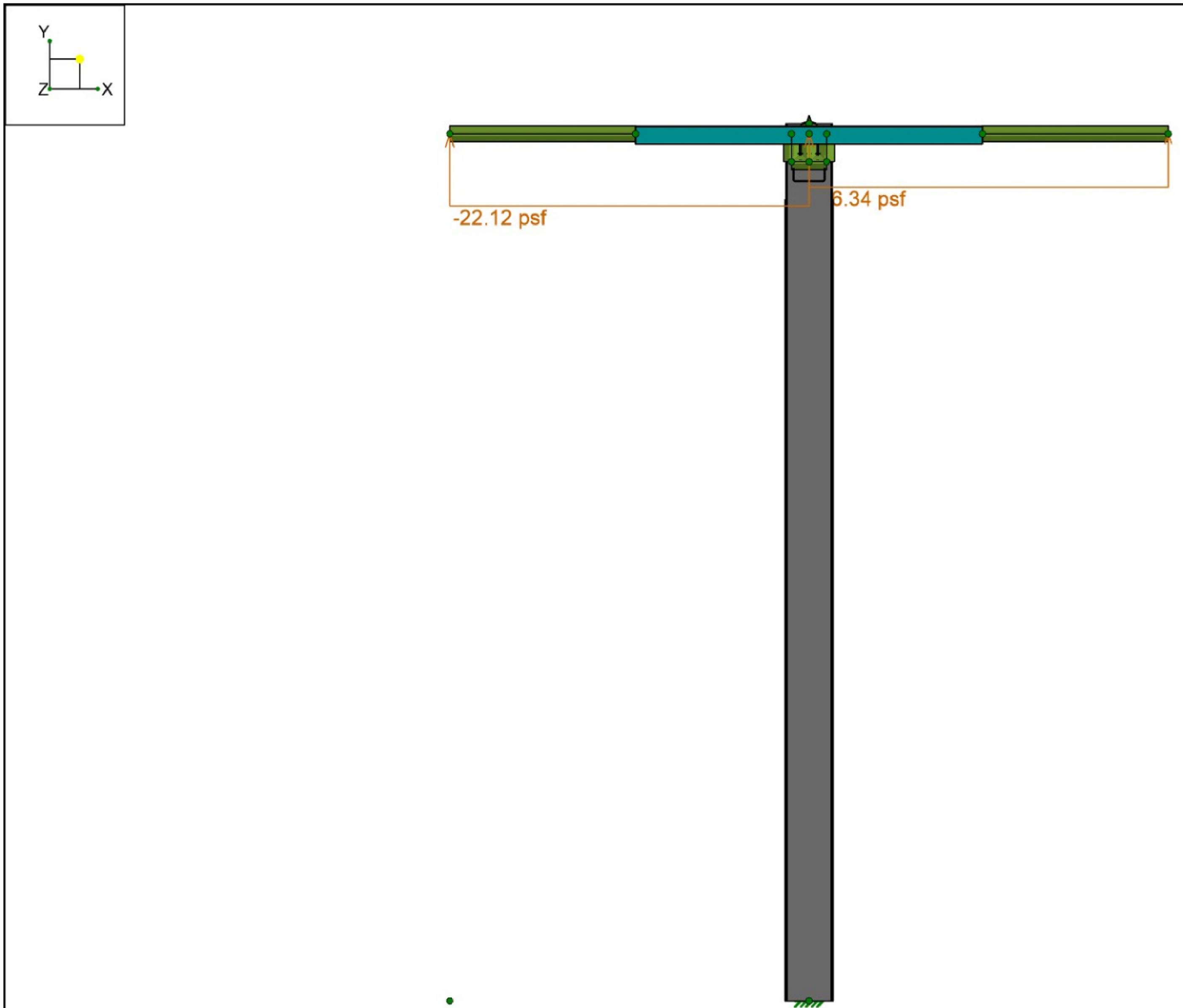
Loads: BLC 6, Wind Uplift - Static

Verogy	Enfield Solar One	SK-6
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d



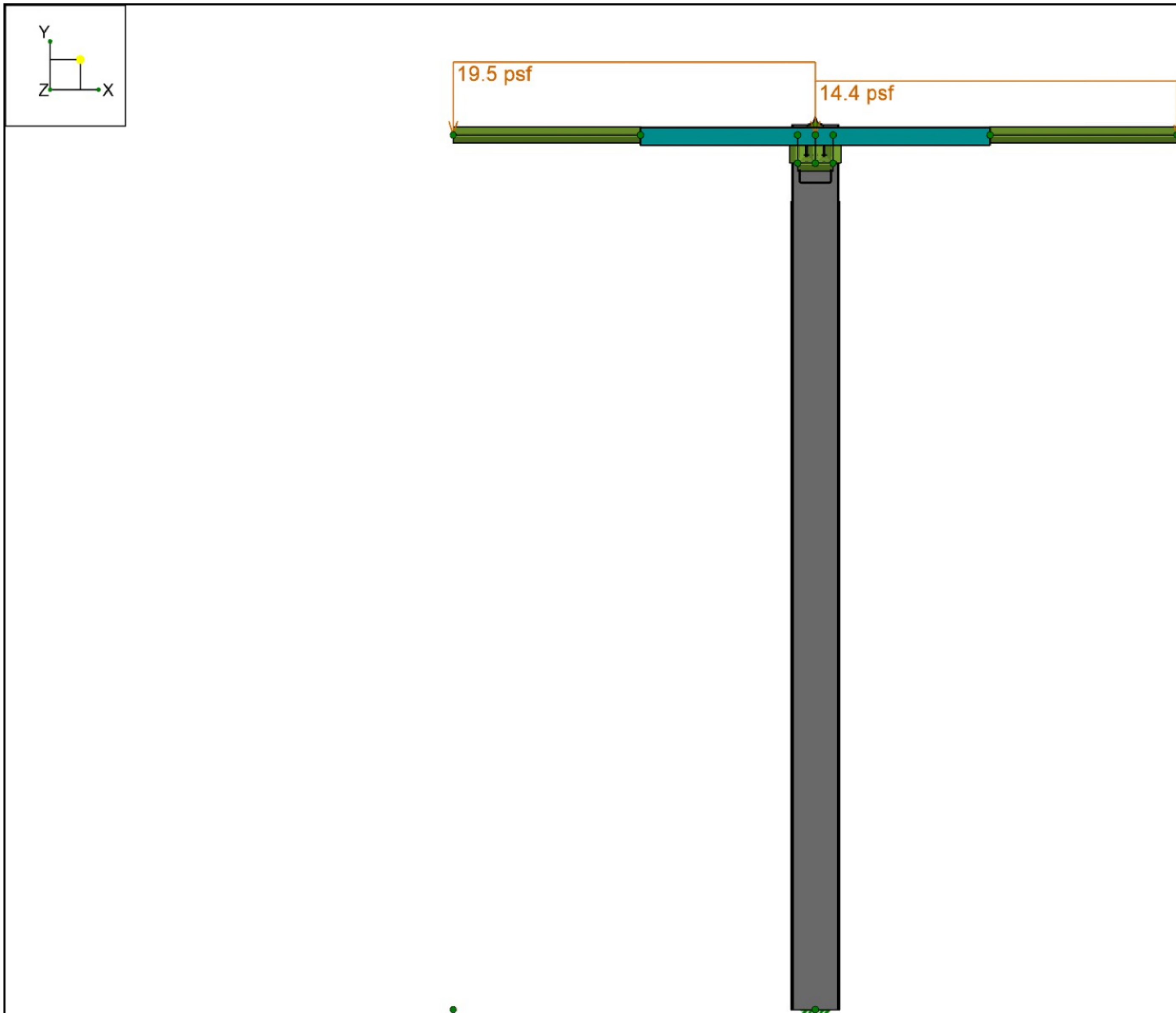
Loads: BLC 7, Wind Downforce - Static

Verogy	Enfield Solar One	SK-7
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d



Loads: BLC 8, Wind Uplift - Dynamic

Verogy	Enfield Solar One	SK-8
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d



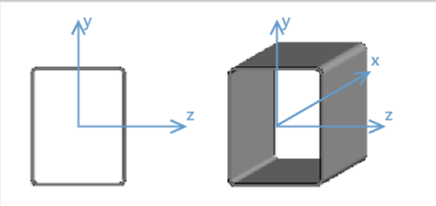
Loads: BLC 9, Wind Downforce - Dynamic

Verogy	Enfield Solar One	SK-9
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 0°.r3d

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 [k]	Pnt/om [k]	Mnyy/om [k-in]	Mnzz/om [k-in]	Cb	Eqn
1	DP1	W6X15	0.52	100	5	0.009	0	z	14	93.696	132.635	130.007	289.457	1	H1-1b
2	Tube 1	5X4X.134	0.966	9.277	5	0.703	9.277	y	5	11.417	84.078	106.058	139.548	1	H3-6
3	Tube 2	5X4X.134	0.965	9.277	5	0.703	9.277	y	5	11.417	84.078	106.058	139.548	1	H3-6
4	Idler Post 6	W6X7	0.208	0	5	0.007	109.513	y	5	21.092	59.947	35.079	84.074	1	H1-1b
5	Idler Post 7	W6X7	0.208	0	5	0.007	109.513	y	5	21.092	59.947	35.079	84.074	1	H1-1b
6	Idler Post 5	W6X7	0.208	0	2	0.003	0	y	12	21.092	59.947	35.079	84.074	1	H1-1a*
7	Idler Post 4	W6X7	0.202	0	2	0.003	0	y	13	21.092	59.947	35.079	84.074	1	H1-1a*
8	Idler Post 3	W6X7	0.2	0	2	0.003	0	y	12	21.092	59.947	35.079	84.074	1	H1-1a*
9	Idler Post 2	W6X7	0.214	0	2	0.003	0	y	12	21.092	59.947	35.079	84.074	1	H1-1a*
10	Idler Post 1	W6X7	0.174	0	2	0.003	0	y	12	21.092	59.947	35.079	84.074	1	H1-1b*
11	Idler Post 8	W6X7	0.208	0	2	0.003	0	y	12	21.092	59.947	35.079	84.074	1	H1-1a*
12	Idler Post 9	W6X7	0.202	0	2	0.003	0	y	13	21.092	59.947	35.079	84.074	1	H1-1a*
13	Idler Post 10	W6X7	0.2	0	2	0.003	0	y	13	21.092	59.947	35.079	84.074	1	H1-1a*
14	Idler Post 11	W6X7	0.214	0	2	0.003	0	y	13	21.092	59.947	35.079	84.074	1	H1-1a*
15	Idler Post 12	W6X7	0.174	0	2	0.002	0	y	13	21.092	59.947	35.079	84.074	1	H1-1b*

Detail Report: Tube 1 | **Unity Check:** 0.966 (axial/bending) | **Load Combination:** LC 5: IBC 16-13 (A) (static wind)



Input Data:

Shape:	5X4X.134	I Node:	GA
Member Type:	Beam	J Node:	VX1E
Length (in):	1762.539	I Release:	Fixed
Material Type:	Hot Rolled Steel	J Release:	Fixed
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	191	J Offset (in):	N/A

Material Properties:

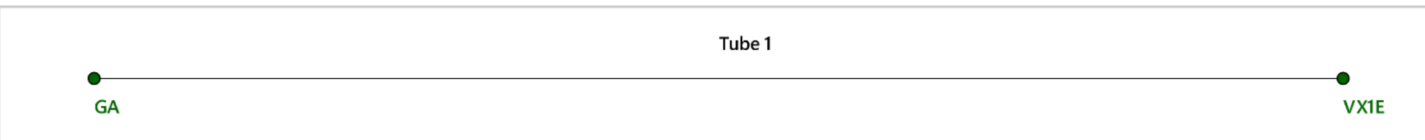
Material:	A500 Gr. 60	Therm. Coeff. ($1e^5 °F^{-1}$):	0.65	R_y:	1.5
E (ksi):	29000	Density (k/ft^3):	0.49	F_u (ksi):	70
G (ksi):	11154	F_y (ksi):	60	R_t:	1.2
Nu:	0.3				

Shape Properties:

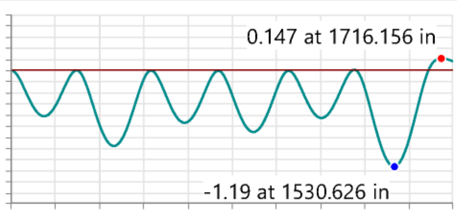
d (in):	5	I_{yy} (in^4):	6.17	Area (in^2):	2.34
b_f (in):	4	I_{zz} (in^4):	8.714	J (in^4):	10.861
t (in):	0.134				

Design Properties:

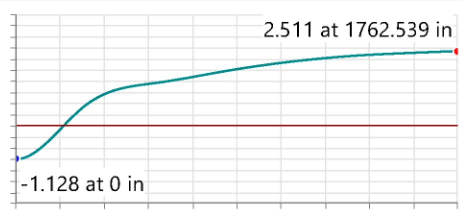
$L_{b\ y\text{-}y}$ (in):	285	$K_{y\text{-}y}$:	1	Max Defl Ratio:	L/1371
$L_{b\ z\text{-}z}$ (in):	285	$K_{z\text{-}z}$:	1	Max Defl Location:	1530.626
$L_{comp\ top}$ (in):	Lbyy	y sway:	No	Span:	1
$L_{comp\ bot}$ (in):	285	z sway:	No		
L_{torque} (in):	N/A	Function:	Lateral		
		Seismic DR:	None		



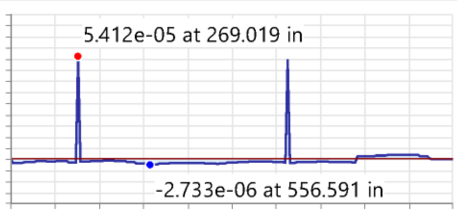
Diagrams:



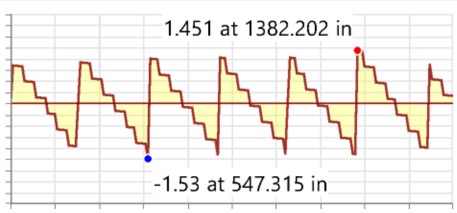
y Deflection (in)



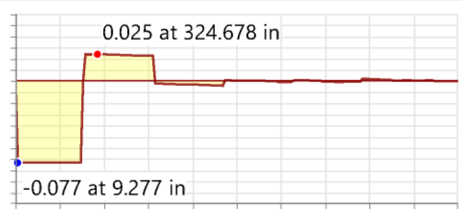
z Deflection (in)



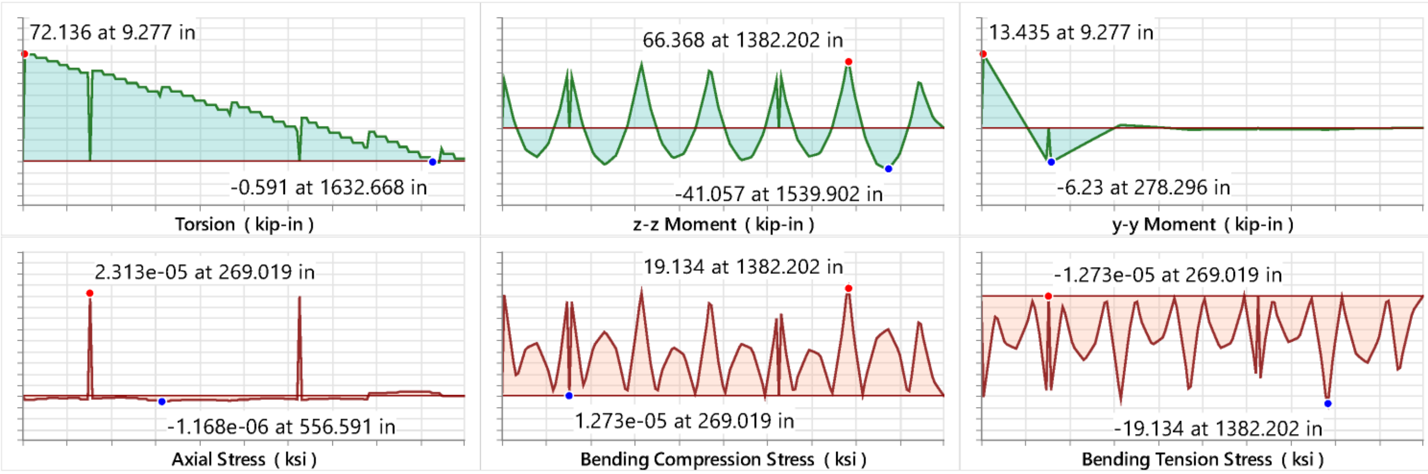
Axial Force (kips)



y Shear Force (kips)



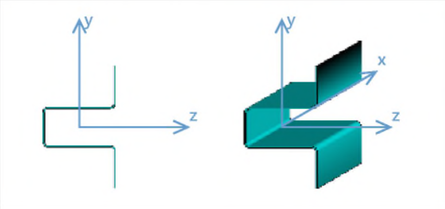
z Shear Force (kips)



AISC 15th (360-16): ASD Code Check

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion	-	-	-	-
Axial Tension Analysis	0.000 k	84.078 k	-	-
Axial Compression Analysis	0.000 k	11.417 k	-	-
Flexural Analysis (Strong Axis)	47.13 k-in	139.548 k-in	-	-
Flexural Analysis (Weak Axis)	13.435 k-in	106.058 k-in	-	-
Shear Analysis (Major Axis y)	18.677 k	26.564 k	0.703	Pass
Shear Analysis (Minor Axis z)	13.873 k	20.787 k	0.667	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.966	Pass
Torsional Analysis	72.136 k-in	108.481 k-in	0.665	Pass

Detail Report: VP 6 **Unity Check:** 0.943 (axial/bending) **Load Combination:** LC 2: IBC 16-10



Input Data:

Shape:	V-HU-2.25X0.055X1.25	I Node:	V6B
Member Type:	Beam	J Node:	V6C
Length (in):	43.307	I Release:	Fixed
Material Type:	Cold Formed Steel	J Release:	Fixed
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	191	J Offset (in):	N/A

Material Properties:

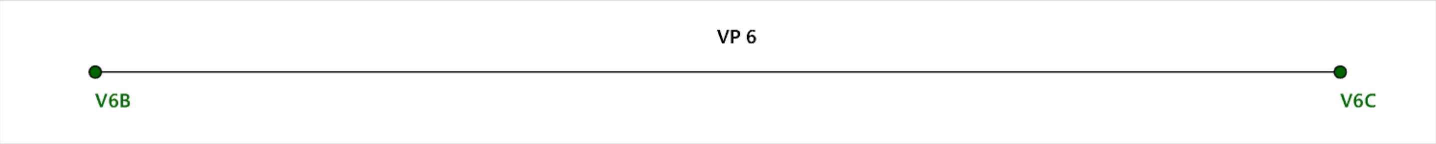
Material:	A653 Grade 50	Nu:	0.3	F_y (ksi):	50
E (ksi):	29500	Therm. Coeff. ($1e^5 °F^{-1}$):	0.65	F_u (ksi):	70
G (ksi):	11346	Density (k/ft^3):	0.49		

Shape Properties:

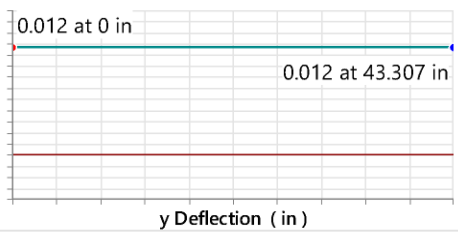
D (in):	2.25	C_w (in^6):	0.21	$S_{e,z}$ (in^3):	0.258
B (in):	1.25	r_o (in):	1.875	$S_{et,z}$ (in^3):	0.13
t (in):	0.055	X_c (in):	1.274	S_{fz} (in^3):	0.166
R (in):	0.112	m (in):	0.172	$S_{fy,z}$ (in^3):	0.166
d (in):	1.25	j (in):	1.589	$S_{e,y}$ (in^3):	0.237
I_{yy} (in^4):	0.308	r_z (in):	0.84	$S_{et,y}$ (in^3):	0.237
I_{zz} (in^4):	0.303	r_y (in):	0.848	S_{fy} (in^3):	0.237
Area (in^2):	0.428	x_0 (in):	-1.446	$S_{fy,y}$ (in^3):	0.325
J (in^4):	0.000432				

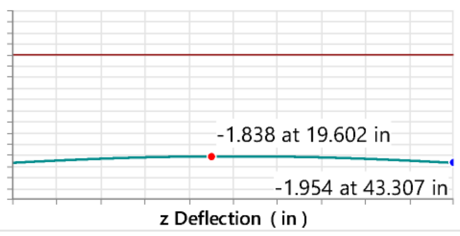
Design Properties:

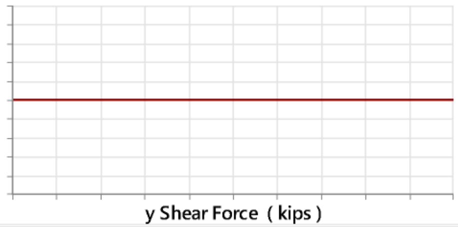
$L_{b\ y\text{-}y}$ (in) :	N/A	$K_{y\text{-}y}$:	1	Max Defl Ratio:	L/10000
$L_{b\ z\text{-}z}$ (in) :	N/A	$K_{z\text{-}z}$:	1	Max Defl Location:	0
$L_{comp\ top}$ (in) :	Lbyy	R:	N/A	Span:	N/A
$L_{comp\ bot}$ (in) :	N/A	y sway:	No		
C_b:	1	z sway:	No		
$C_{m\ y\text{-}y}$:	N/A	a (in) :	N/A		
$C_{m\ z\text{-}z}$:	N/A	Function:	Lateral		

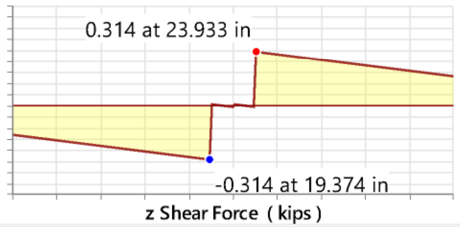


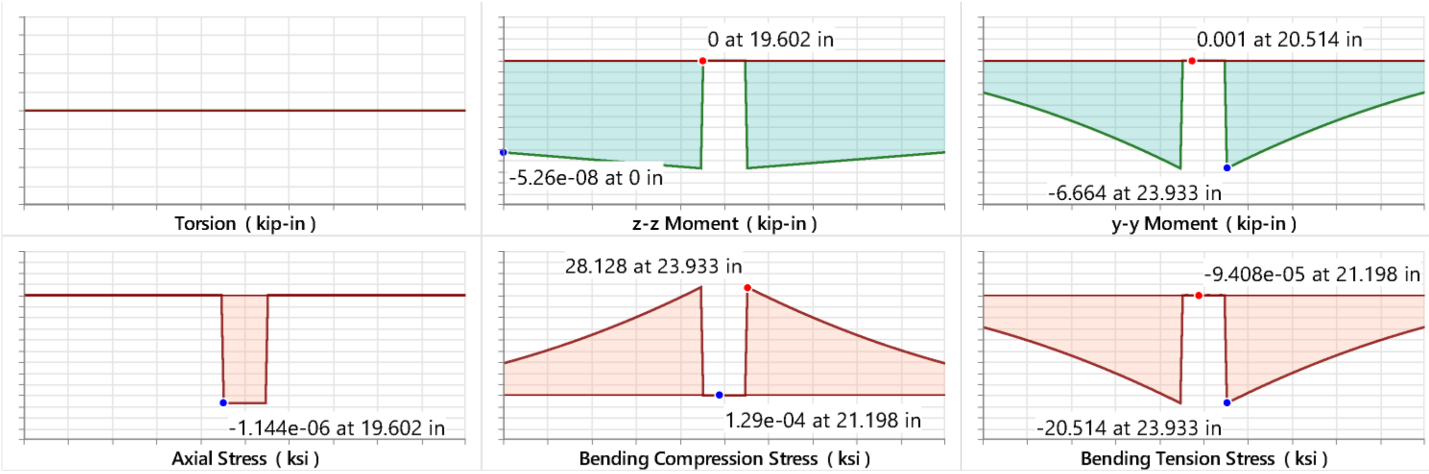
Diagrams:







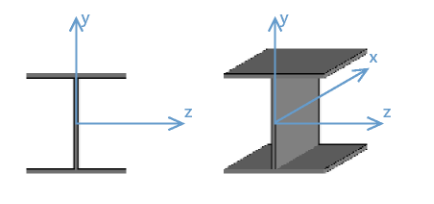




AISI S100-16: ASD Code Check

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion				
Axial Tension Analysis	0.000 k	12.829 k	-	-
Axial Compression Analysis	0.000 k	4.413 k	-	-
Flexural Analysis (Strong Axis)	0.000 k-in	3.903 k-in	-	-
Flexural Analysis (Weak Axis)	6.664 k-in	7.094 k-in	-	-
Shear Analysis (Major Axis y)	0.000 k	0.945 k	0.000	Pass
Shear Analysis (Minor Axis z)	0.314 k	3.952 k	0.08	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.943	Pass

Detail Report: DP1 **Unity Check:** 0.52 (axial/bending) **Load Combination:** LC 5: IBC 16-13 (A) (static wind)



Input Data:

Shape:	W6X15	**I Node:**	D1
Member Type:	Column	**J Node:**	D2
Length (in):	100	**I Release:**	Fixed
Material Type:	Hot Rolled Steel	**J Release:**	Fixed
Design Rule:	Typical	**I Offset (in):**	N/A
Number of Internal Sections:	191	**J Offset (in):**	N/A

Material Properties:

Material:	A992	**Therm. Coeff. ($1e^{5}$°F^{-1}):**	0.65	**R_y:**	1.1
E (ksi):	29000	**Density (k/ft^3):**	0.49	**F_u (ksi):**	65
G (ksi):	11154	**F_y (ksi):**	50	**R_t:**	1.1
Nu:	0.3				

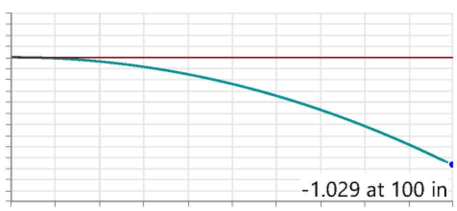
Shape Properties:

d (in):	5.99	**Area (in^2):**	4.43	**S_w (in^4):**	3.34
b_f (in):	5.99	**Z_{yy} (in^3):**	4.75	**r_T (in):**	1.61
t_f (in):	0.26	**Z_{zz} (in^3):**	10.8	**J (in^4):**	0.101
t_w (in):	0.23	**C_w (in^6):**	76.5	**k_{det} (in):**	0.75
I_{yy} (in^4):	9.32	**W_{no} (in^2):**	8.58	**k_{des} (in):**	0.51
I_{zz} (in^4):	29.1				

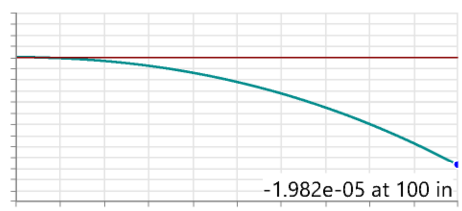
Design Properties:

$L_{b\ y\text{-}y}$ (in) :	N/A	**$K_{y\text{-}y}$:**	1	**Max Defl Ratio:**	L/97
$L_{b\ z\text{-}z}$ (in) :	N/A	**$K_{z\text{-}z}$:**	1	**Max Defl Location:**	0
$L_{comp\ top}$ (in) :	Lbyy	**y sway:**	No	**Span:**	N/A
$L_{comp\ bot}$ (in) :	N/A	**z sway:**	No		
L_{torque} (in) :	N/A	**Function:**	Lateral		
		Seismic DR:	None		

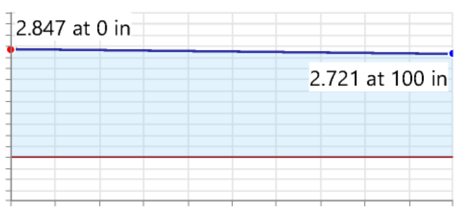
Diagrams:



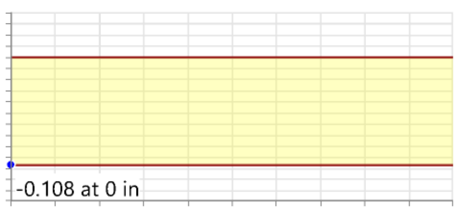
y Deflection (in)



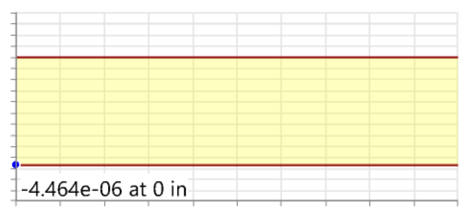
z Deflection (in)



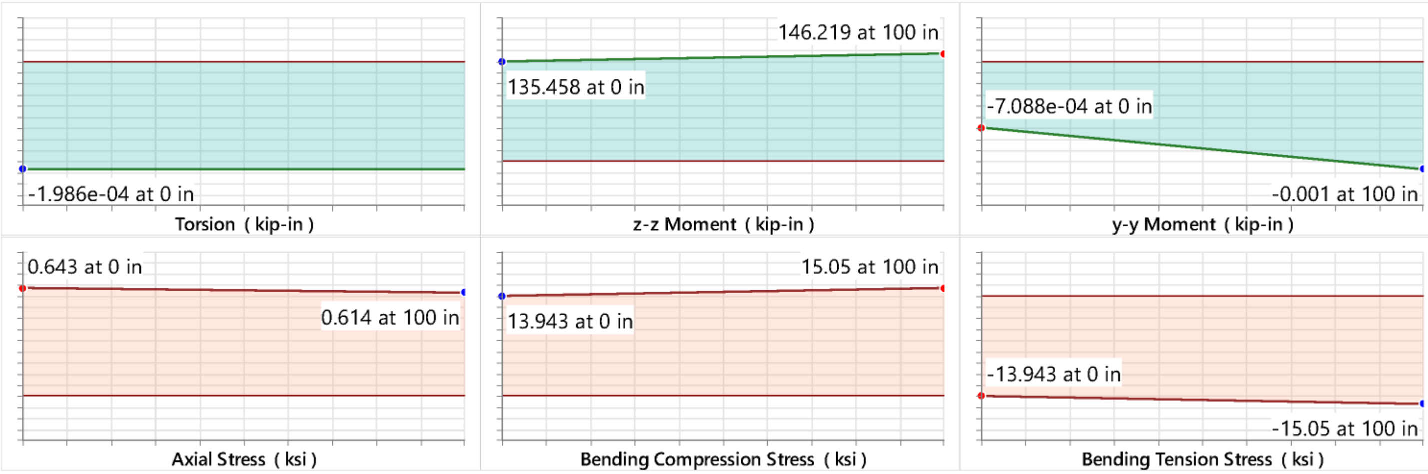
Axial Force (kips)



y Shear Force (kips)



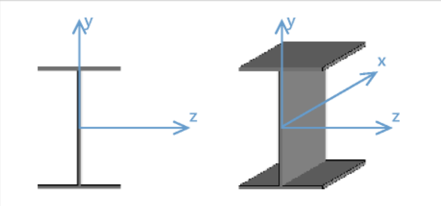
z Shear Force (kips)



AISC 15th (360-16): ASD Code Check

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion	-	-	-	-
Axial Tension Analysis	0.000 k	132.635 k	-	-
Axial Compression Analysis	2.721 k	93.696 k	-	-
Flexural Analysis (Strong Axis)	146.219 k-in	289.457 k-in	-	-
Flexural Analysis (Weak Axis)	0.003 k-in	130.007 k-in	-	-
Shear Analysis (Major Axis y)	0.108 k	27.554 k	0.004	Pass
Shear Analysis (Minor Axis z)	0.001 k	55.954 k	0.000	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.52	Pass

Detail Report: Idler Post 2 **Unity Check:** 0.214 (axial/bending) **Load Combination:** LC 2: IBC 16-10



Input Data:

Shape:	W6X7	I Node:	N918
Member Type:	Column	J Node:	N917
Length (in):	109.513	I Release:	Fixed
Material Type:	Hot Rolled Steel	J Release:	Custom
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	191	J Offset (in):	N/A

Material Properties:

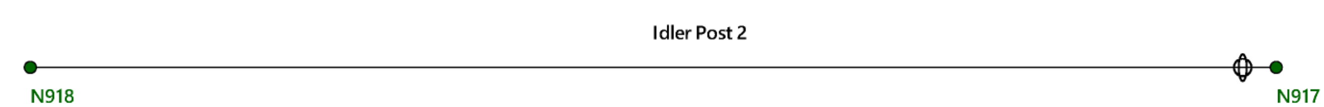
Material:	A992	Therm. Coeff. ($1e^{5}$°F^{-1}):	0.65	R_y:	1.1
E (ksi):	29000	Density (k/ft^3):	0.49	F_u (ksi):	65
G (ksi):	11154	F_y (ksi):	50	R_t:	1.1
Nu:	0.3				

Shape Properties:

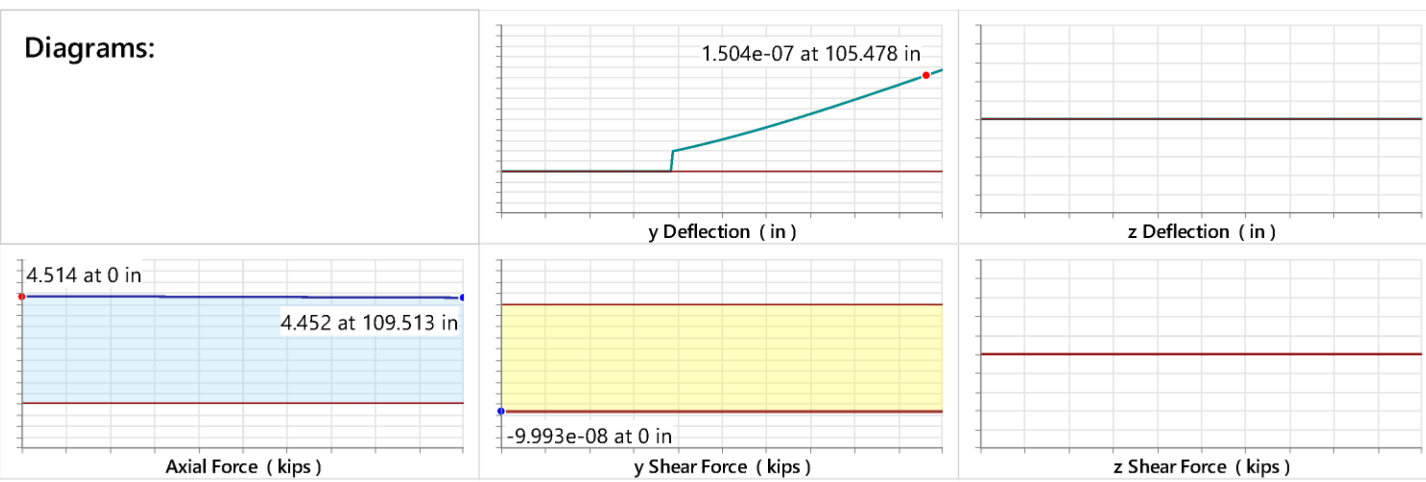
d (in):	5.772	Area (in^2):	2.002	S_w (in^4):	0.898
b_f (in):	3.94	Z_{yy} (in^3):	1.303	r_T (in):	1.047
t_f (in):	0.165	Z_{zz} (in^3):	4.6	J (in^4):	0.016
t_w (in):	0.129	C_w (in^6):	13.227	k_{det} (in):	0.69
I_{yy} (in^4):	1.683	W_{no} (in^2):	5.523	k_{des} (in):	0.46
I_{zz} (in^4):	11.955				

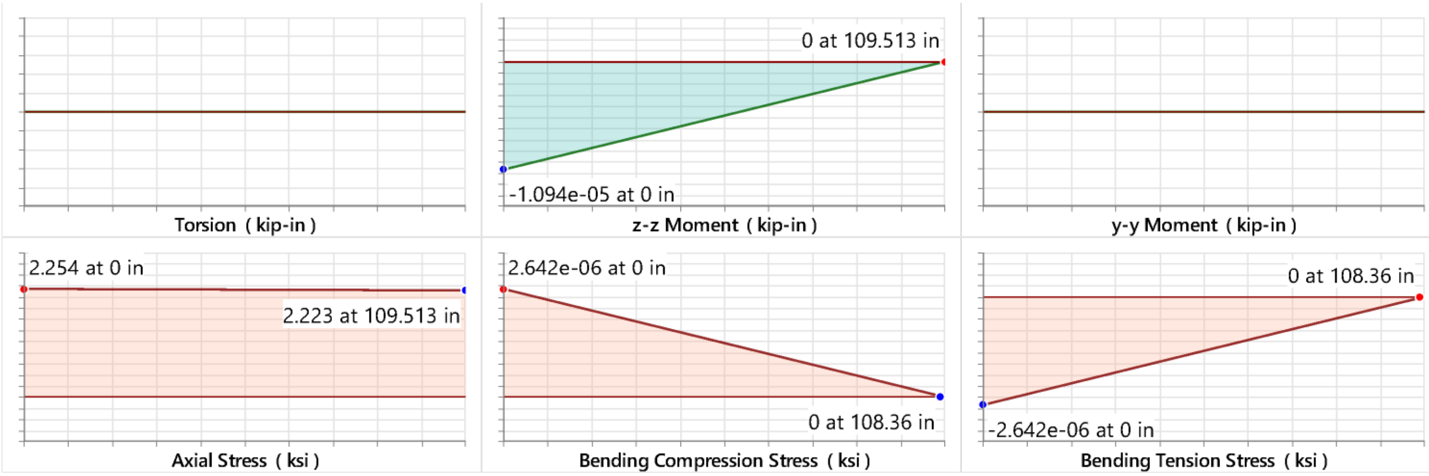
Design Properties:

$L_{b\ y\text{-}y}$ (in) :	N/A	$K_{y\text{-}y}$:	1	Max Defl Ratio:	L/10000
$L_{b\ z\text{-}z}$ (in) :	N/A	$K_{z\text{-}z}$:	1	Max Defl Location:	0
$L_{comp\ top}$ (in) :	Lbyy	y sway:	No	Span:	N/A
$L_{comp\ bot}$ (in) :	N/A	z sway:	No		
L_{torque} (in) :	N/A	Function:	Lateral		
		Seismic DR:	None		



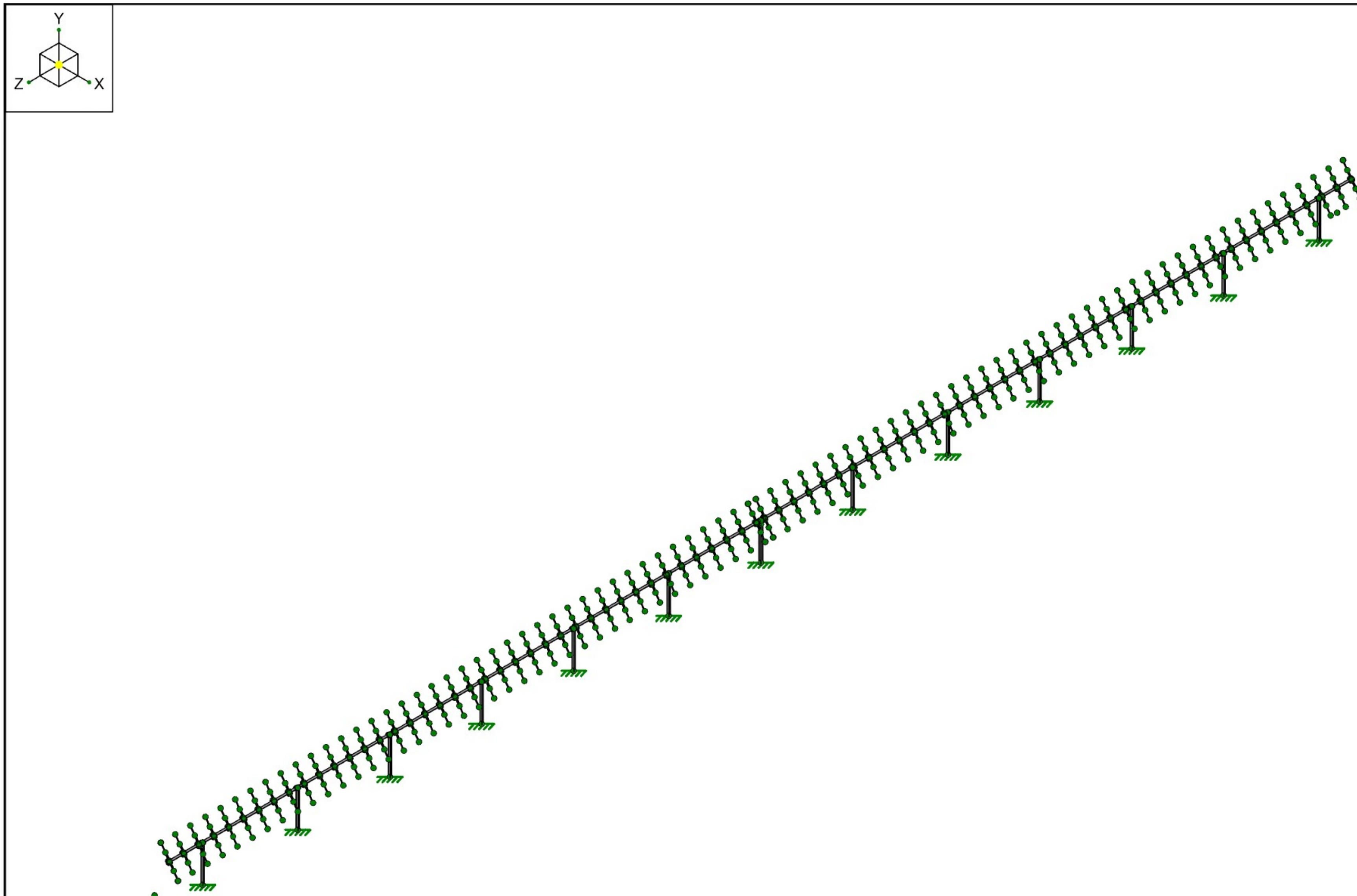
Diagrams:



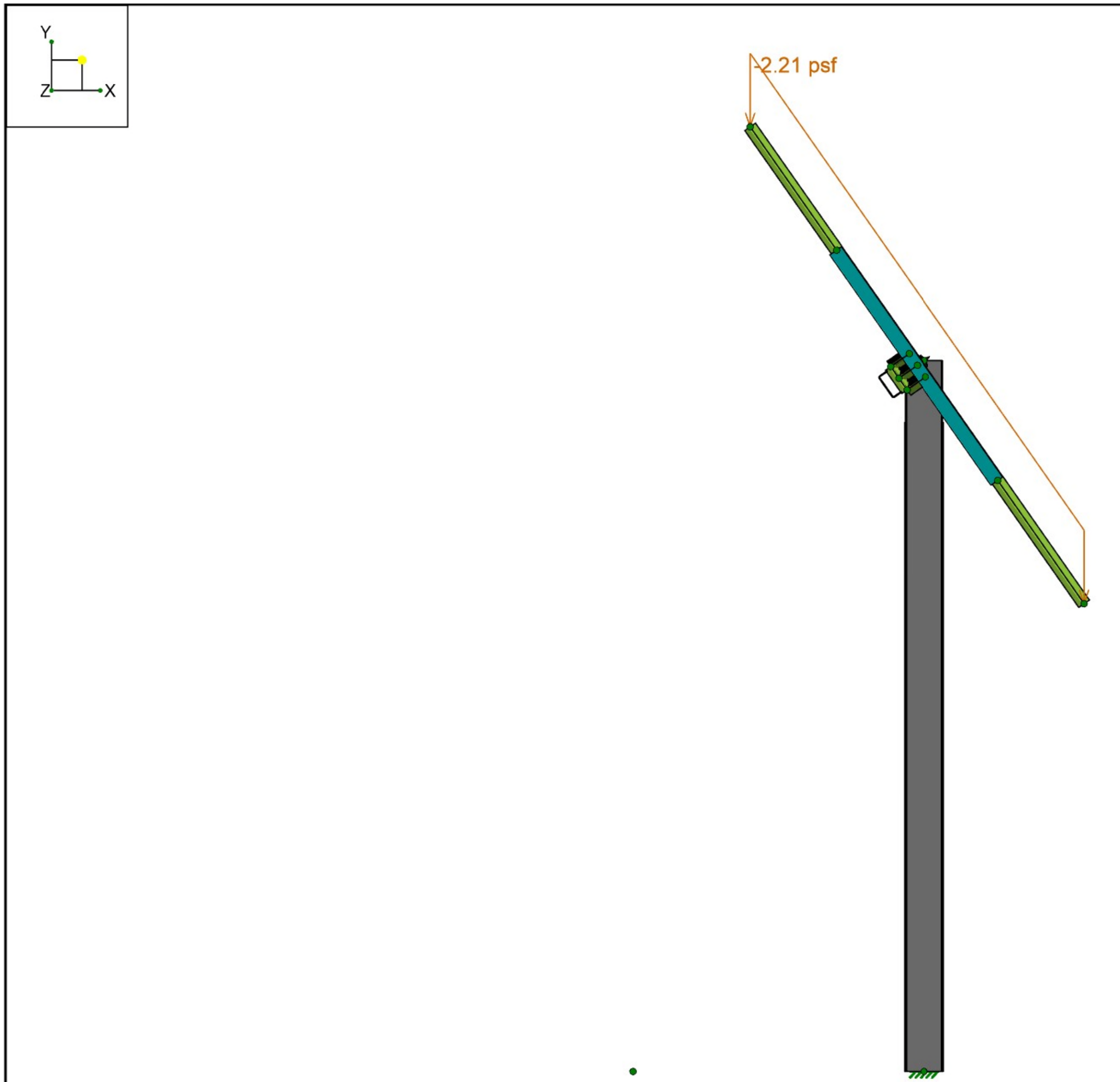


AISC 15th (360-16): ASD Code Check

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion	-	-	-	-
Axial Tension Analysis	0.000 k	59.947 k	-	-
Axial Compression Analysis	4.514 k	21.092 k	-	-
Flexural Analysis (Strong Axis)	0.000 k-in	84.074 k-in	-	-
Flexural Analysis (Weak Axis)	0.000 k-in	35.079 k-in	-	-
Shear Analysis (Major Axis y)	0.000 k	14.892 k	0.000	Pass
Shear Analysis (Minor Axis z)	0.000 k	23.357 k	0.000	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.214	Pass

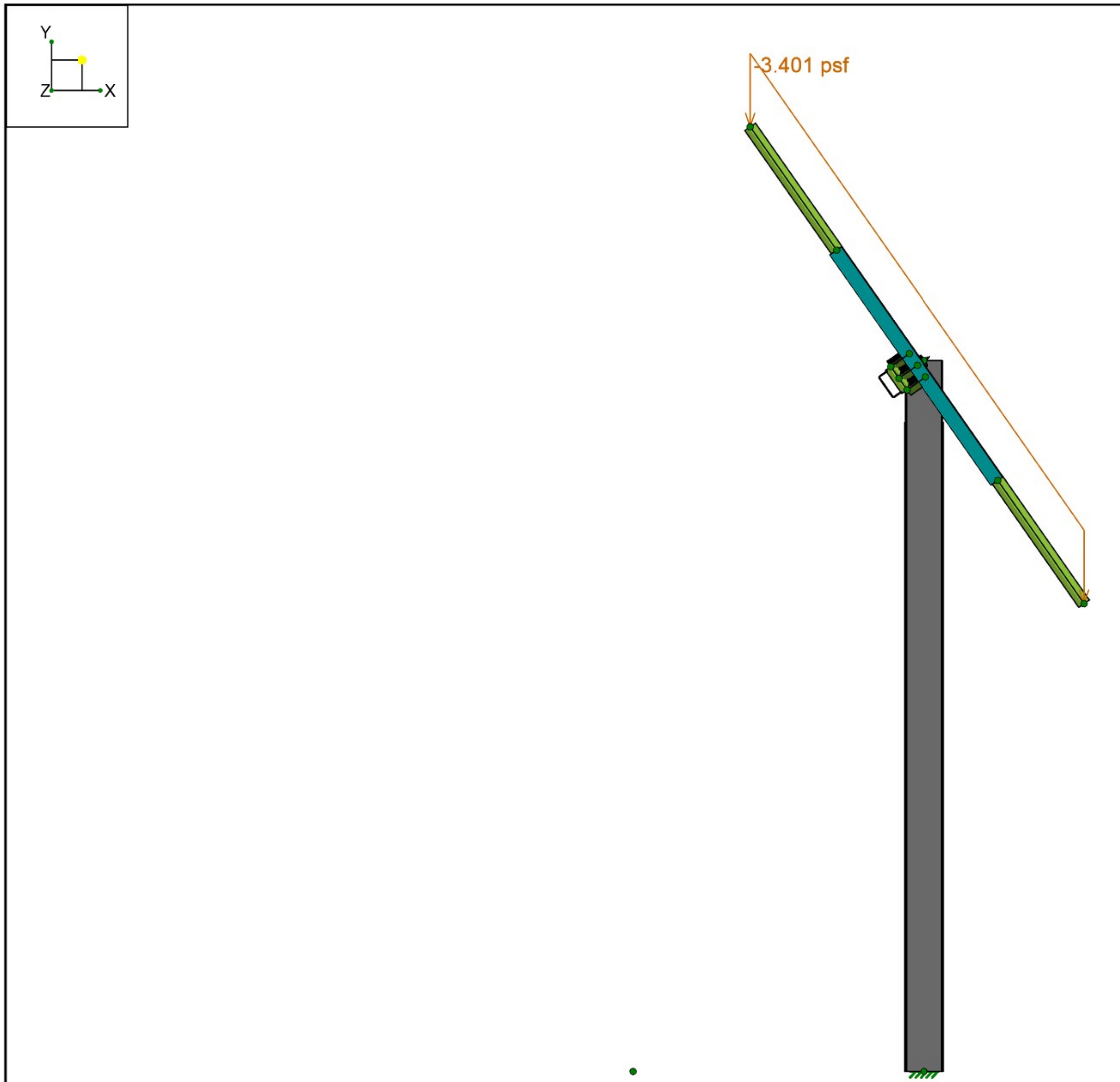


Verogy	Enfield Solar One	SK-10
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d



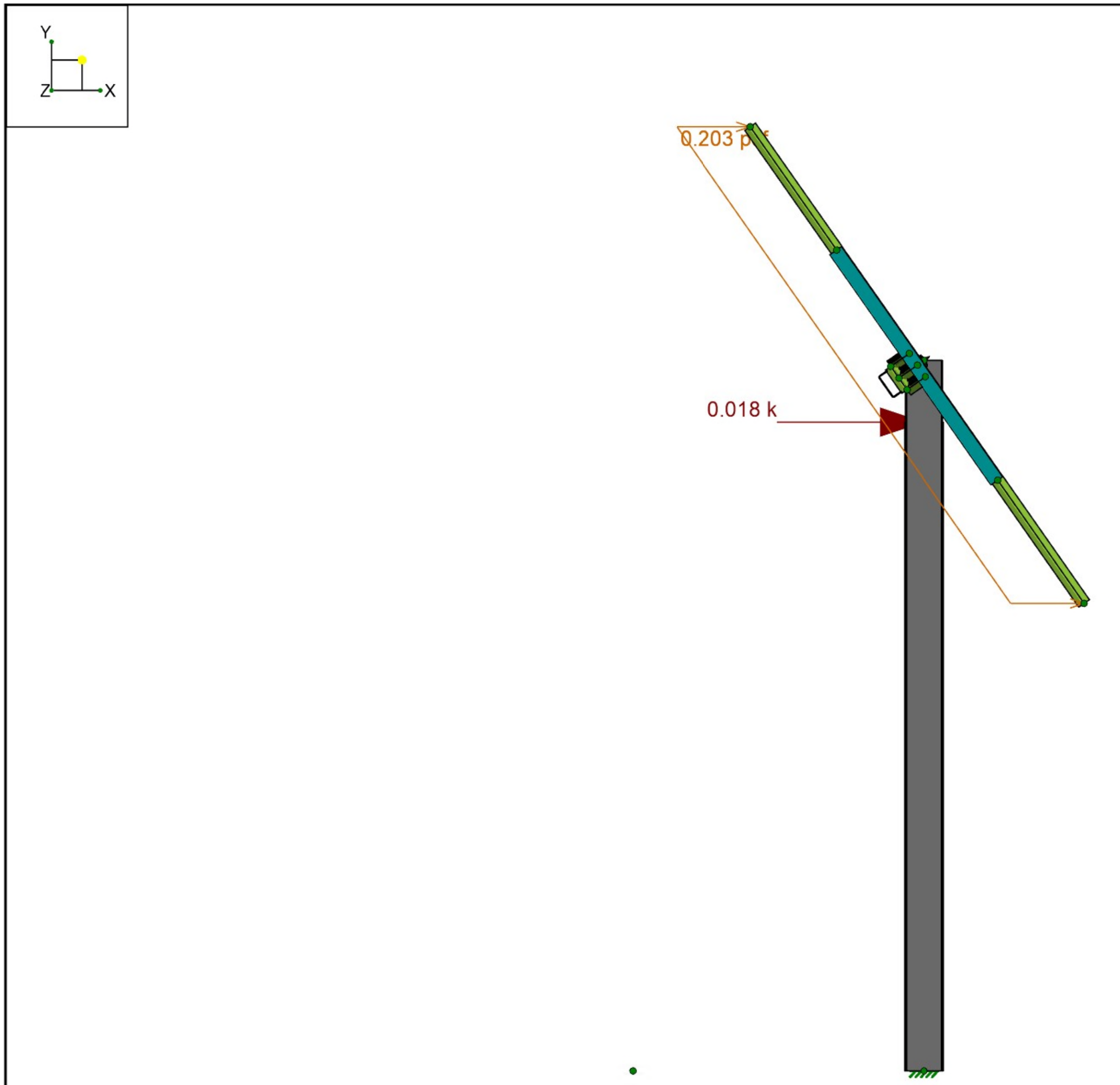
Loads: BLC 2, Solar Panels

Verogy	Enfield Solar One	SK-11
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d



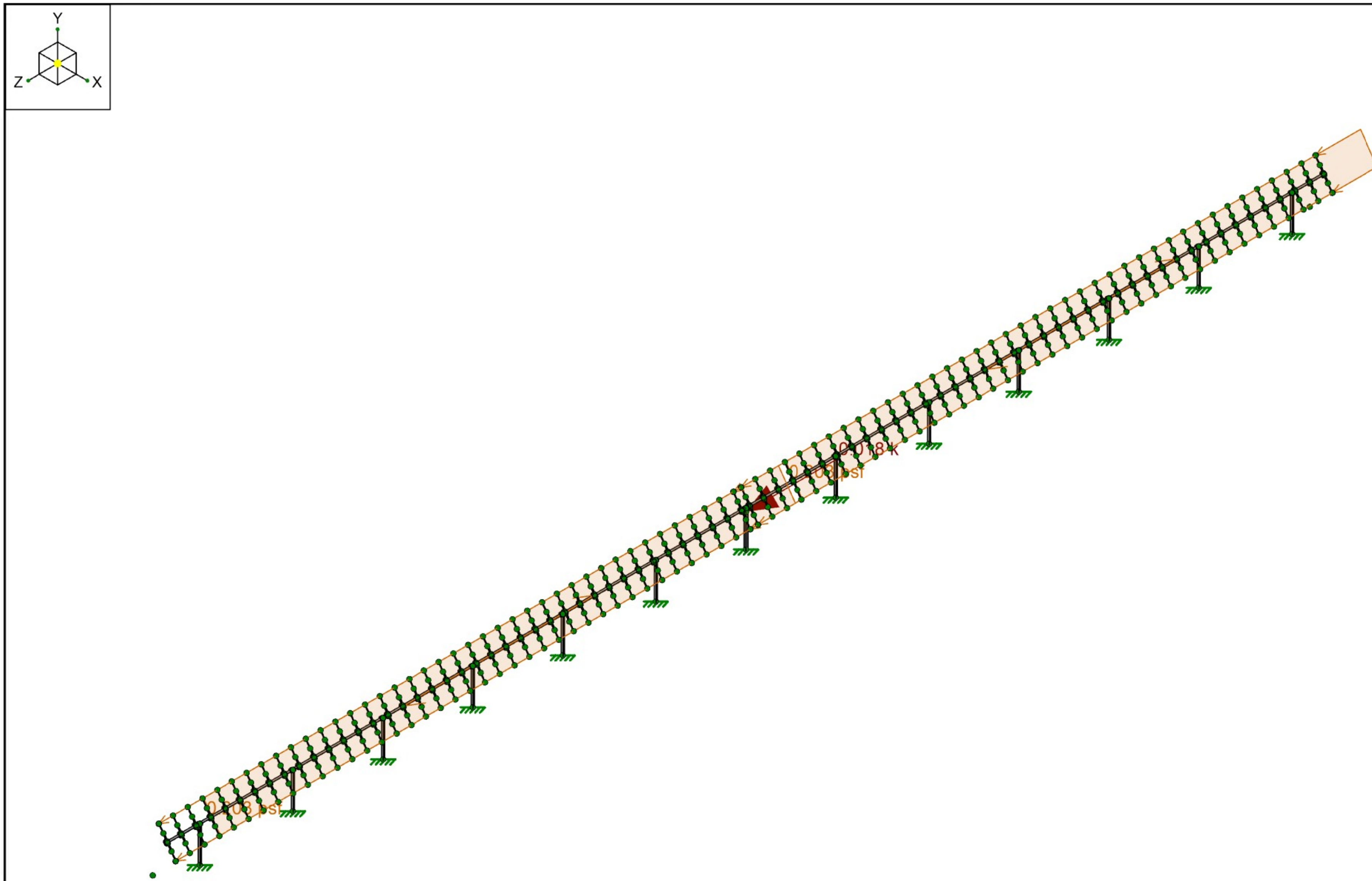
Loads: BLC 3, Snow

Verogy	Enfield Solar One	SK-12
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d



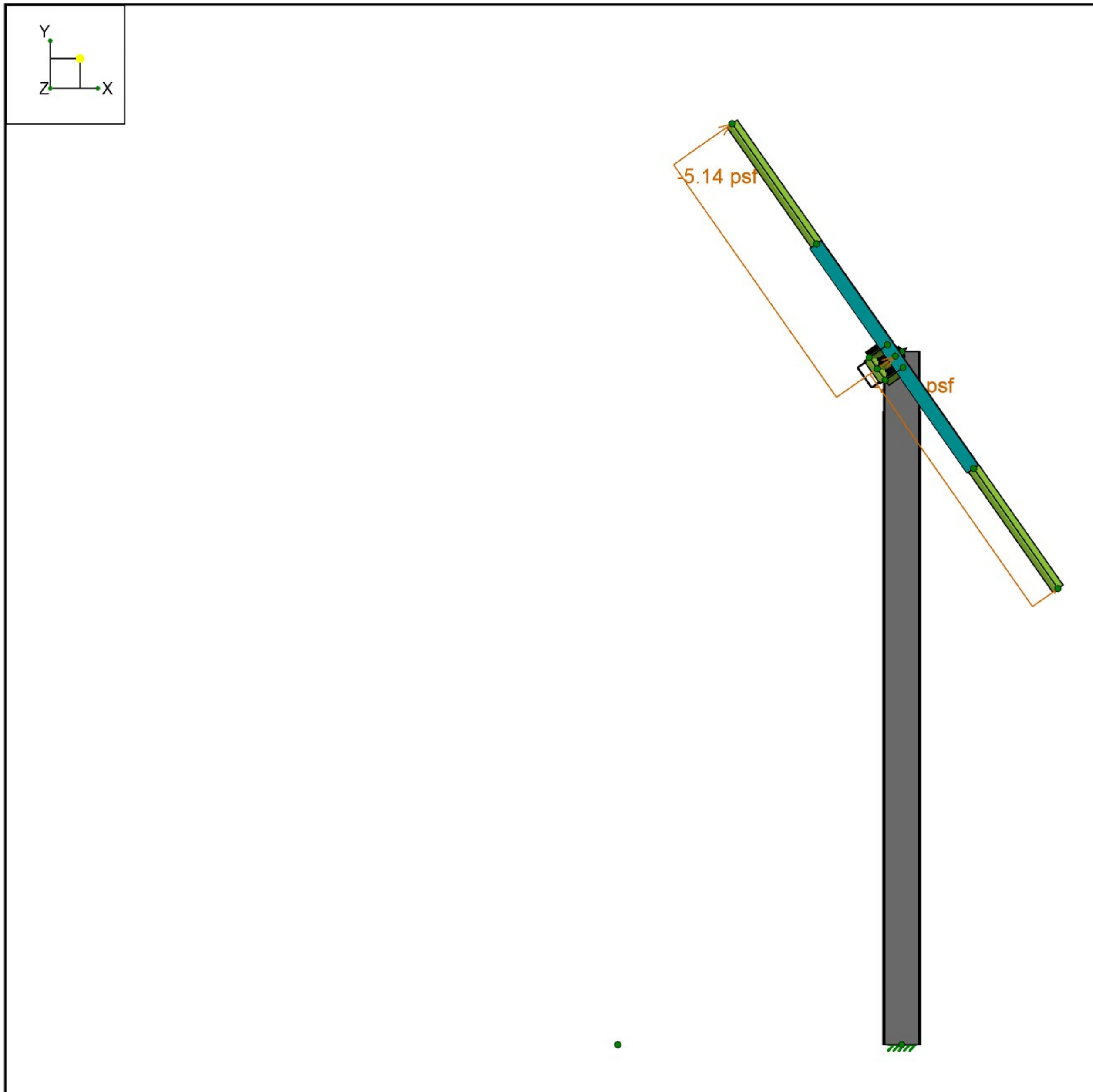
Loads: BLC 4, Seismic X

Verogy	Enfield Solar One	SK-13
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d



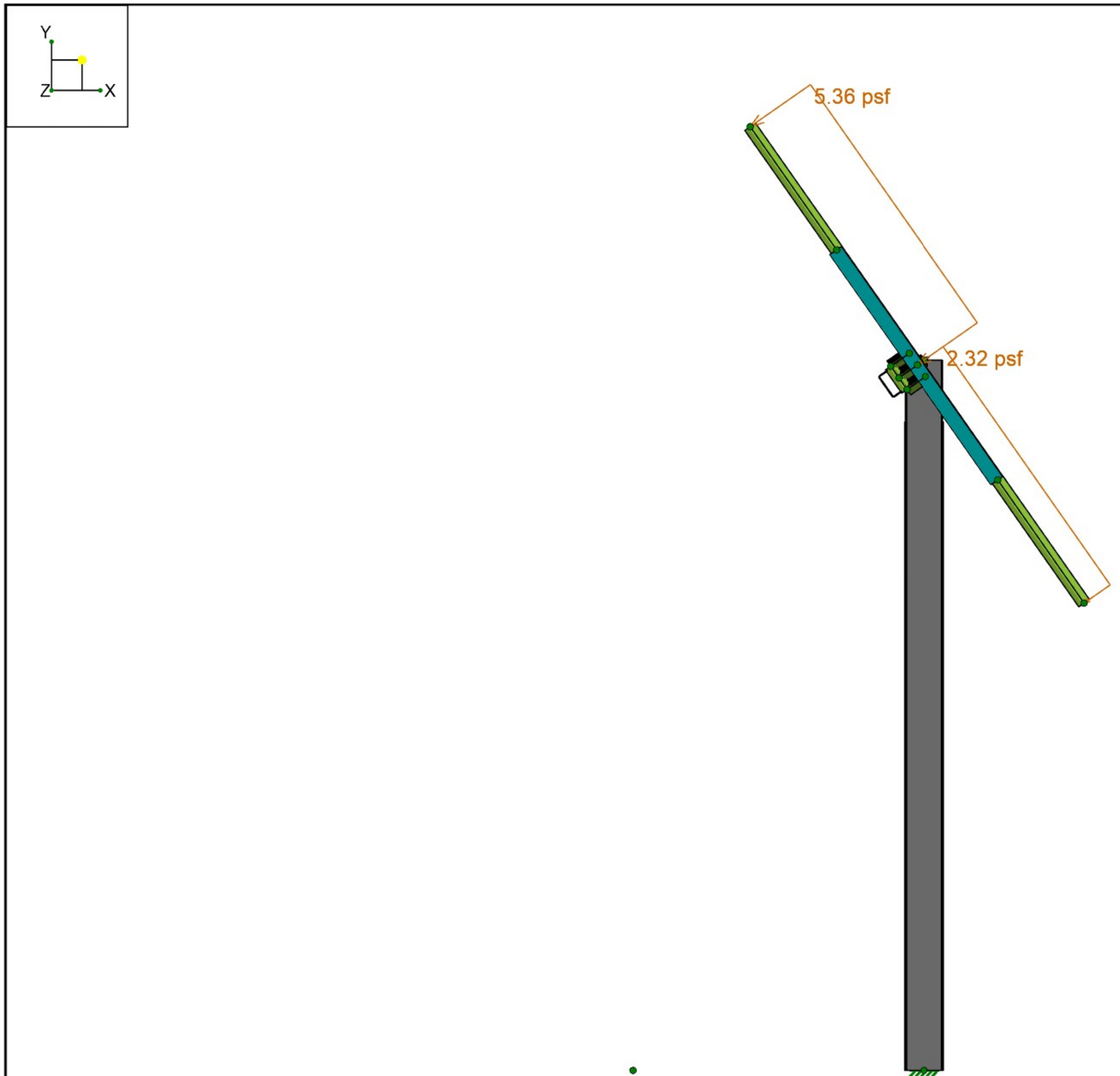
Loads: BLC 5, Seismic Z

Verogy	Enfield Solar One	SK-14
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d



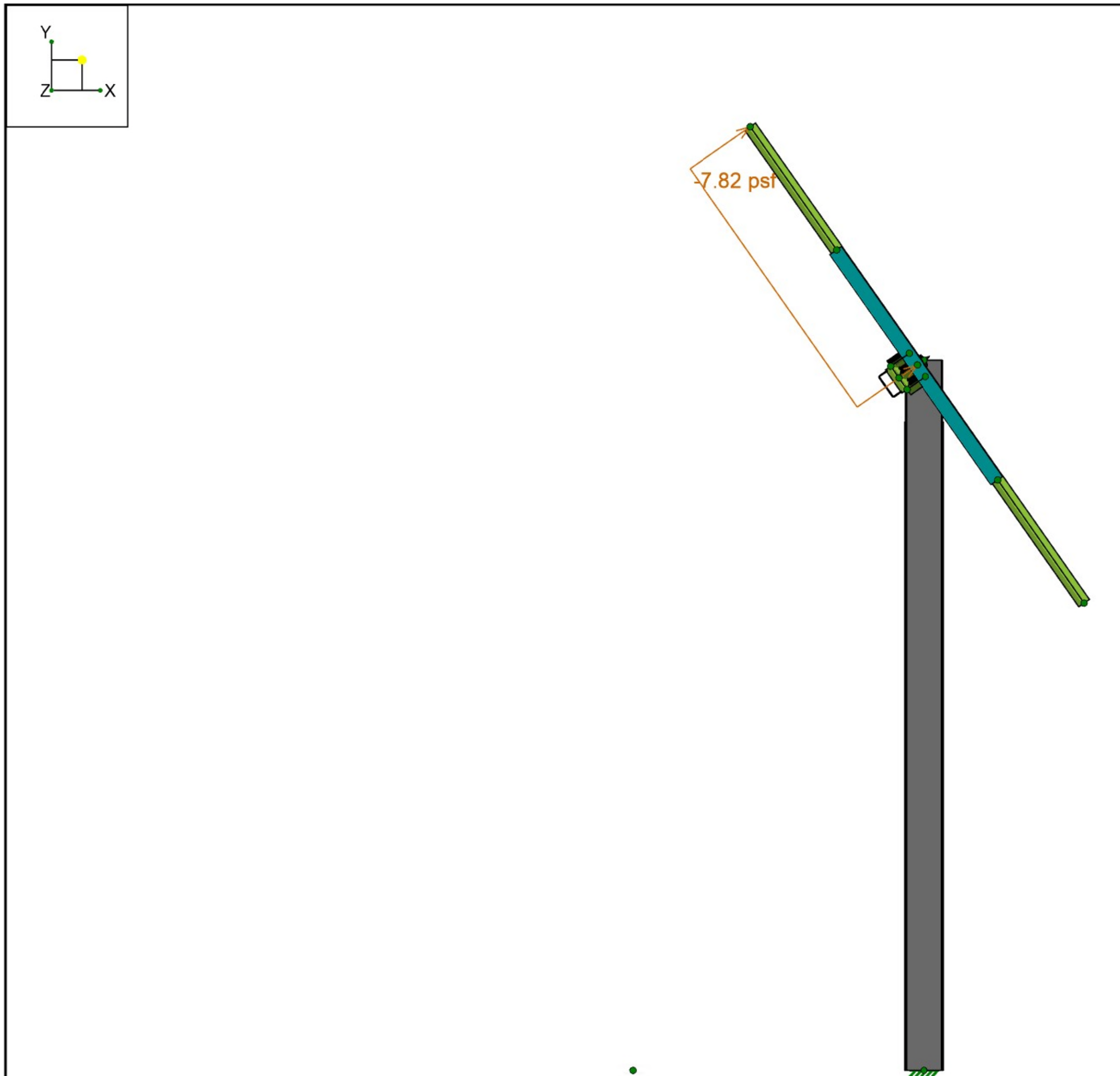
Loads: BLC 6, Wind Uplift - Static

Verogy	Enfield Solar One	SK-15
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d



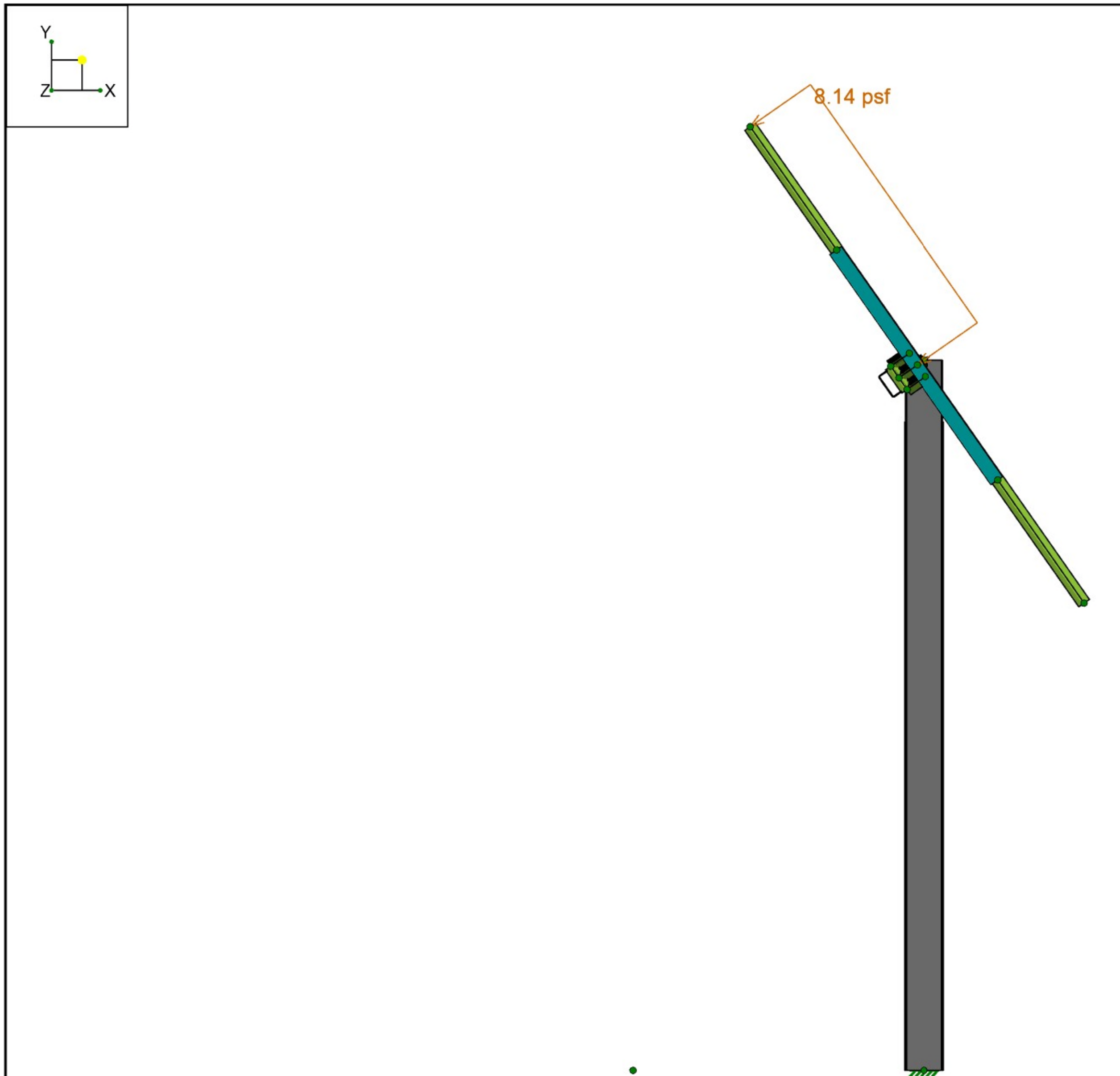
Loads: BLC 7, Wind Downforce - Static

Verogy	Enfield Solar One	SK-16
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d



Loads: BLC 8, Wind Uplift - Dynamic

Verogy	Enfield Solar One	SK-17
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d



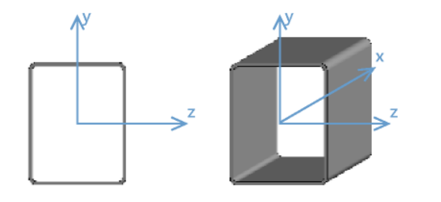
Loads: BLC 9, Wind Downforce - Dynamic

Verogy	Enfield Solar One	SK-18
NZ		Mar 23, 2023
17071		23_0201 - 1x78 FTS - Phono 545W - 55°.r3d

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 [k]	Pnt/om [k]	Mnyy/om [k-in]	Mnzz/om [k-in]	Cb	Eqn
1	DP1	W6X15	0.534	0	4	0.012	53.684	z	15	93.696	132.635	130.007	289.457	1	H1-1b
2	Tube 1	5X4X.134	0.547	9.277	4	0.576	9.277	z	4	11.417	84.078	106.058	139.548	1	H3-6
3	Tube 2	5X4X.134	0.547	9.277	4	0.576	9.277	z	4	11.417	84.078	106.058	139.548	1	H3-6
4	Idler Post 6	W6X7	0.57	0	4	0.028	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
5	Idler Post 7	W6X7	0.57	0	4	0.028	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
6	Idler Post 5	W6X7	0.464	0	4	0.023	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
7	Idler Post 4	W6X7	0.476	0	4	0.023	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
8	Idler Post 3	W6X7	0.474	0	4	0.023	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
9	Idler Post 2	W6X7	0.497	0	4	0.024	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
10	Idler Post 1	W6X7	0.407	0	4	0.02	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
11	Idler Post 8	W6X7	0.464	0	4	0.023	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
12	Idler Post 9	W6X7	0.476	0	4	0.023	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
13	Idler Post 10	W6X7	0.474	0	4	0.023	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
14	Idler Post 11	W6X7	0.497	0	4	0.024	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b
15	Idler Post 12	W6X7	0.407	0	4	0.02	109.513	y	4	21.092	59.947	35.079	84.074	1	H1-1b

Detail Report: Tube 1 | **Unity Check:** 0.576 (shear) | **Load Combination:** LC 4: IBC 16-12 (B)



Input Data:

Shape:	5X4X.134	I Node:	GA
Member Type:	Beam	J Node:	VX1E
Length (in):	1762.539	I Release:	Fixed
Material Type:	Hot Rolled Steel	J Release:	Fixed
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	191	J Offset (in):	N/A

Material Properties:

Material:	A500 Gr. 60	Therm. Coeff. ($1e^5 °F^{-1}$):	0.65	R_y:	1.5
E (ksi):	29000	Density (k/ft^3):	0.49	F_u (ksi):	70
G (ksi):	11154	F_y (ksi):	60	R_t:	1.2
Nu:	0.3				

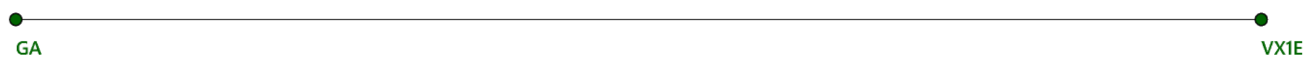
Shape Properties:

d (in):	5	I_{yy} (in^4):	6.17	Area (in^2):	2.34
b_f (in):	4	I_{zz} (in^4):	8.714	J (in^4):	10.861
t (in):	0.134				

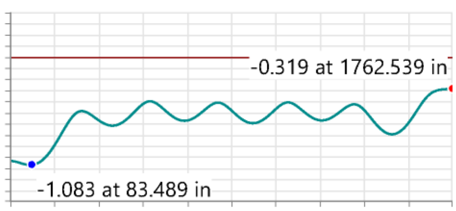
Design Properties:

$L_{b\ y\text{-}y}$ (in):	285	$K_{y\text{-}y}$:	1	Max Defl Ratio:	L/4568
$L_{b\ z\text{-}z}$ (in):	285	$K_{z\text{-}z}$:	1	Max Defl Location:	278.296
$L_{comp\ top}$ (in):	Lbyy	y sway:	No	Span:	1
$L_{comp\ bot}$ (in):	285	z sway:	No		
L_{torque} (in):	N/A	Function:	Lateral		
		Seismic DR:	None		

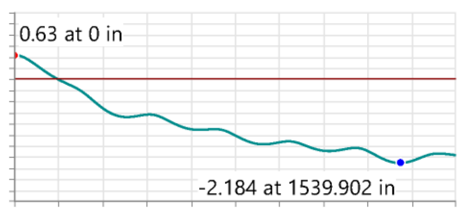
Tube 1



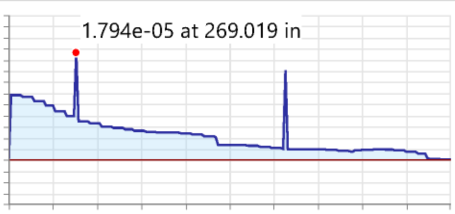
Diagrams:



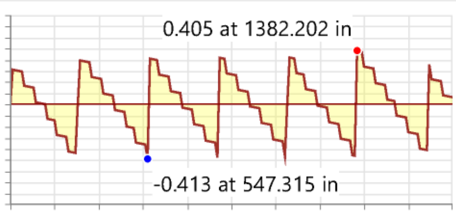
y Deflection (in)



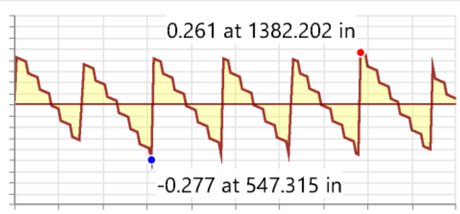
z Deflection (in)



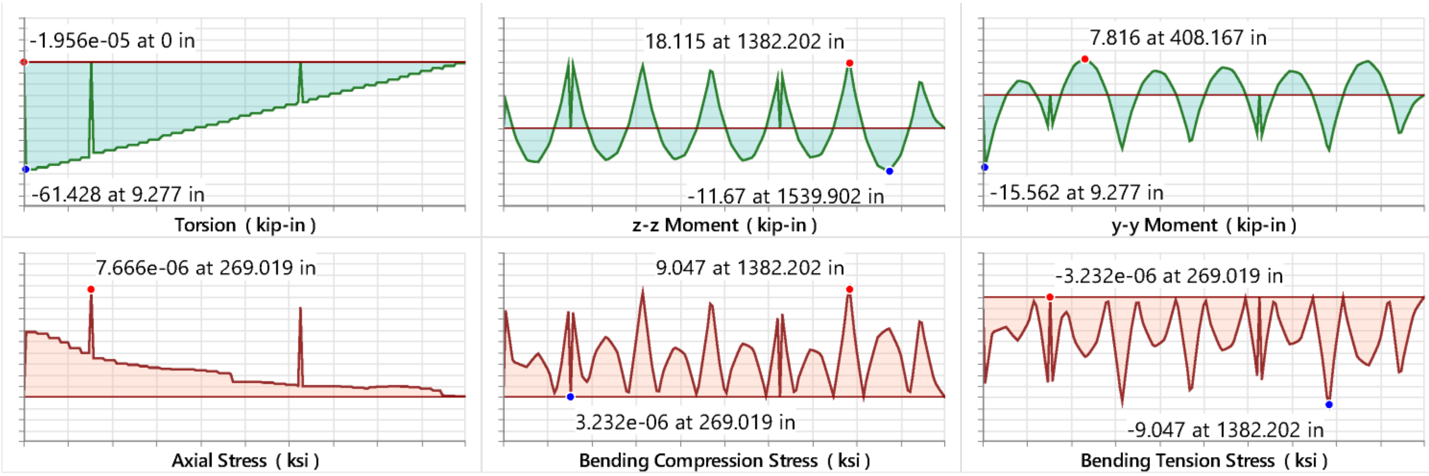
Axial Force (kips)



y Shear Force (kips)



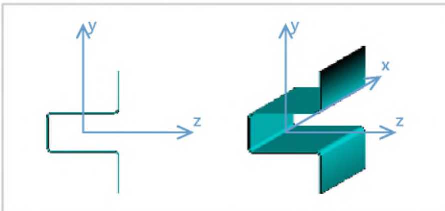
z Shear Force (kips)



AISC 15th (360-16): ASD Code Check

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion	-	-	-	-
Axial Tension Analysis	0.000 k	84.078 k	-	-
Axial Compression Analysis	0.000 k	11.417 k	-	-
Flexural Analysis (Strong Axis)	7.63 k-in	139.548 k-in	-	-
Flexural Analysis (Weak Axis)	15.562 k-in	106.058 k-in	-	-
Shear Analysis (Major Axis y)	15.278 k	26.564 k	0.575	Pass
Shear Analysis (Minor Axis z)	11.983 k	20.787 k	0.576	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.547	Pass
Torsional Analysis	61.428 k-in	108.481 k-in	0.566	Pass

Detail Report: VP 4 **Unity Check:** 0.309 (axial/bending) **Load Combination:** LC 4: IBC 16-12 (B)



Input Data:

Shape:	V-HU-2.25X0.055X1.25	I Node:	V4B
Member Type:	Beam	J Node:	V4C
Length (in):	43.307	I Release:	Fixed
Material Type:	Cold Formed Steel	J Release:	Fixed
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	191	J Offset (in):	N/A

Material Properties:

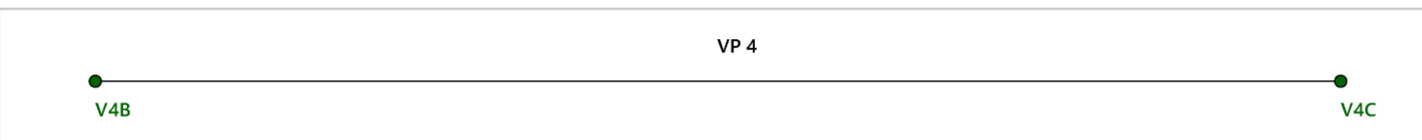
Material:	A653 Grade 50	Nu:	0.3	F_y (ksi):	50
E (ksi):	29500	Therm. Coeff. ($1e^{5}$°F^{-1}):	0.65	F_u (ksi):	70
G (ksi):	11346	Density (k/ft^3):	0.49		

Shape Properties:

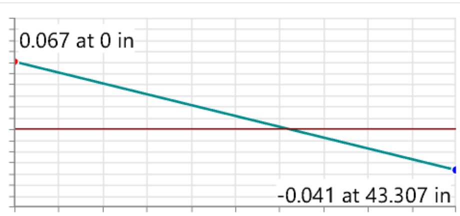
D (in):	2.25	C_w (in^6):	0.21	$S_{e,z}$ (in^3):	0.258
B (in):	1.25	r_o (in):	1.875	$S_{et,z}$ (in^3):	0.13
t (in):	0.055	X_c (in):	1.274	S_{fz} (in^3):	0.166
R (in):	0.112	m (in):	0.172	$S_{fy,z}$ (in^3):	0.166
d (in):	1.25	j (in):	1.589	$S_{e,y}$ (in^3):	0.237
I_{yy} (in^4):	0.308	r_z (in):	0.84	$S_{et,y}$ (in^3):	0.237
I_{zz} (in^4):	0.303	r_y (in):	0.848	S_{fy} (in^3):	0.237
Area (in^2):	0.428	x_0 (in):	-1.446	$S_{fy,y}$ (in^3):	0.325
J (in^4):	0.000432				

Design Properties:

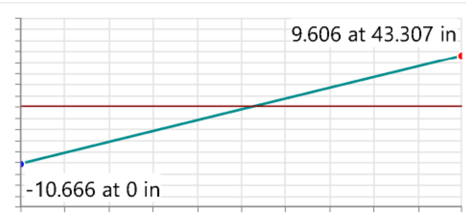
$L_{b\,y-y}$ (in):	N/A	K_{y-y}:	1	Max Defl Ratio:	L/10000
$L_{b\,z-z}$ (in):	N/A	K_{z-z}:	1	Max Defl Location:	0
$L_{comp\,top}$ (in):	Lbyy	R:	N/A	Span:	N/A
$L_{comp\,bot}$ (in):	N/A	y sway:	No		
C_b:	1	z sway:	No		
$C_{m\,y-y}$:	N/A	a (in):	N/A		
$C_{m\,z-z}$:	N/A	Function:	Lateral		



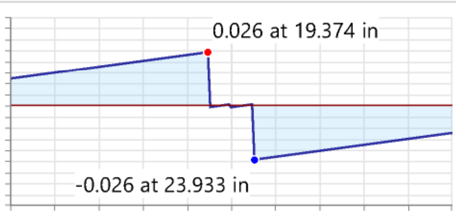
Diagrams:



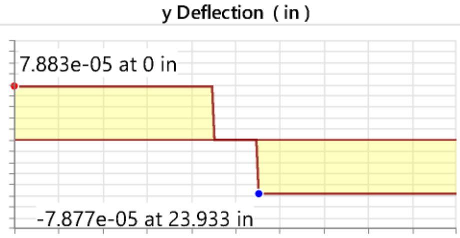
y Deflection (in)



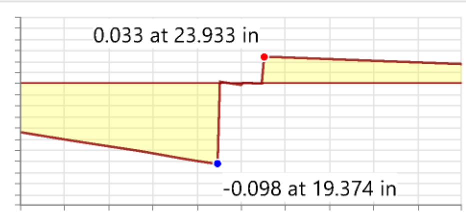
z Deflection (in)



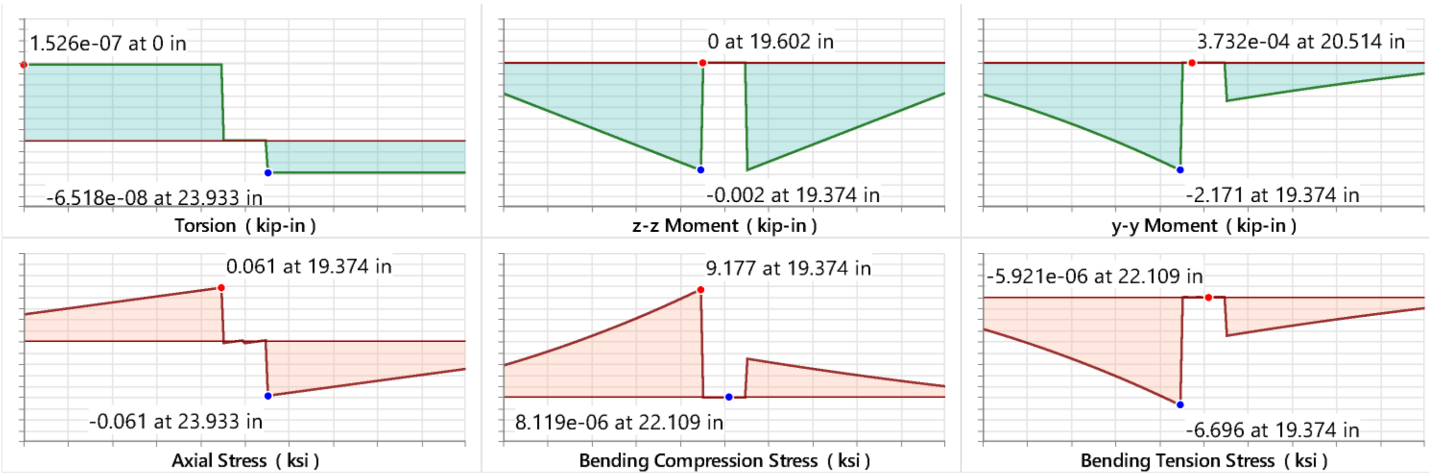
Axial Force (kips)



y Shear Force (kips)



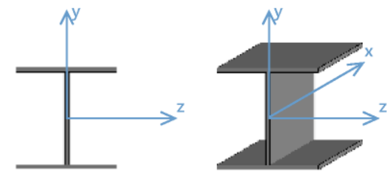
z Shear Force (kips)



AISI S100-16: ASD Code Check

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion				
Axial Tension Analysis	0.000 k	12.829 k	-	-
Axial Compression Analysis	0.026 k	10.351 k	-	-
Flexural Analysis (Strong Axis)	0.002 k-in	3.903 k-in	-	-
Flexural Analysis (Weak Axis)	2.171 k-in	7.093 k-in	-	-
Shear Analysis (Major Axis y)	0.000 k	0.945 k	0.000	Pass
Shear Analysis (Minor Axis z)	0.098 k	3.952 k	0.025	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.309	Pass

Detail Report: DP1 **Unity Check:** 0.534 (axial/bending) **Load Combination:** LC 4: IBC 16-12 (B)



Input Data:

Shape:	W6X15	I Node:	D1
Member Type:	Column	J Node:	D2
Length (in):	100	I Release:	Fixed
Material Type:	Hot Rolled Steel	J Release:	Fixed
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	191	J Offset (in):	N/A

Material Properties:

Material:	A992	Therm. Coeff. ($1e^5 °F^{-1}$):	0.65	R_y:	1.1
E (ksi):	29000	Density (k/ft^3):	0.49	F_u (ksi):	65
G (ksi):	11154	F_y (ksi):	50	R_t:	1.1
Nu:	0.3				

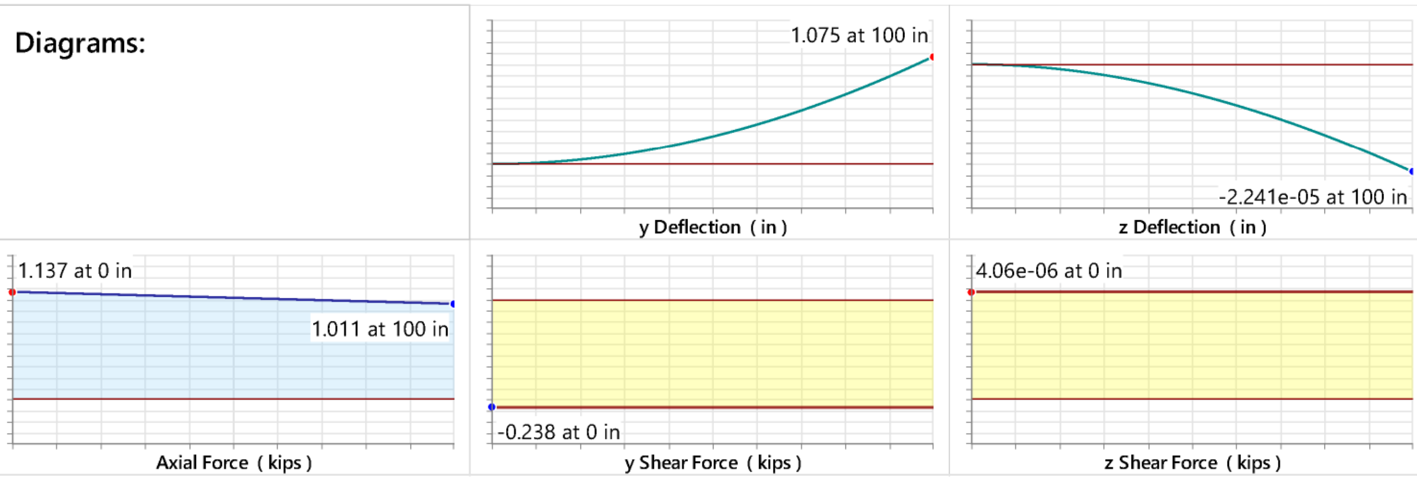
Shape Properties:

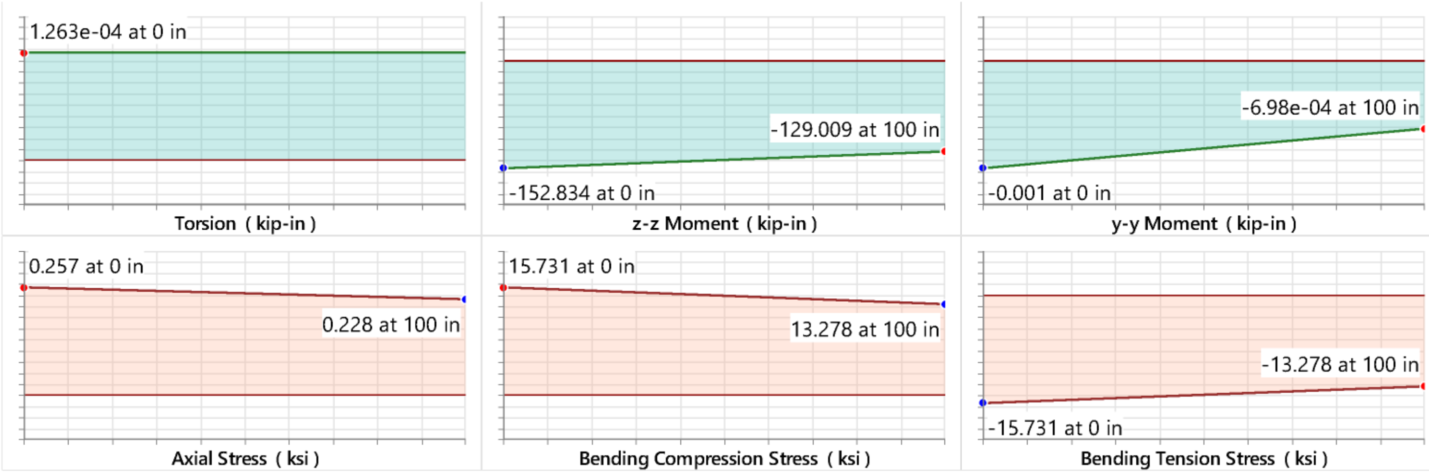
d (in):	5.99	Area (in^2):	4.43	S_w (in^4):	3.34
b_f (in):	5.99	Z_{yy} (in^3):	4.75	r_T (in):	1.61
t_f (in):	0.26	Z_{zz} (in^3):	10.8	J (in^4):	0.101
t_w (in):	0.23	C_w (in^6):	76.5	k_{det} (in):	0.75
I_{yy} (in^4):	9.32	W_{no} (in^2):	8.58	k_{des} (in):	0.51
I_{zz} (in^4):	29.1				

Design Properties:

$L_{b\ y-y}$ (in) :	N/A	K_{y-y}:	1	Max Defl Ratio:	L/93
$L_{b\ z-z}$ (in) :	N/A	K_{z-z}:	1	Max Defl Location:	0
$L_{comp\ top}$ (in) :	Lbyy	y sway:	No	Span:	N/A
$L_{comp\ bot}$ (in) :	N/A	z sway:	No		
L_{torque} (in) :	N/A	Function:	Lateral		
		Seismic DR:	None		

Diagrams:

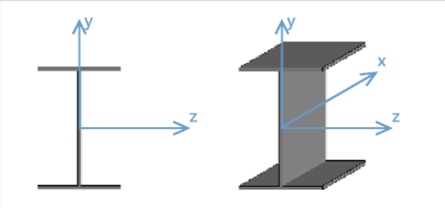




AISC 15th (360-16): ASD Code Check

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion	-	-	-	-
Axial Tension Analysis	0.000 k	132.635 k	-	-
Axial Compression Analysis	1.137 k	93.696 k	-	-
Flexural Analysis (Strong Axis)	152.834 k-in	289.457 k-in	-	-
Flexural Analysis (Weak Axis)	0.003 k-in	130.007 k-in	-	-
Shear Analysis (Major Axis y)	0.238 k	27.554 k	0.009	Pass
Shear Analysis (Minor Axis z)	0.001 k	55.954 k	0.000	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.534	Pass

Detail Report: Idler Post 6 | **Unity Check:** 0.57 (axial/bending) | **Load Combination:** LC 4: IBC 16-12 (B)



Input Data:

Shape:	W6X7	I Node:	I6A
Member Type:	Column	J Node:	I6B
Length (in):	109.513	I Release:	Fixed
Material Type:	Hot Rolled Steel	J Release:	Custom
Design Rule:	Typical	I Offset (in):	N/A
Number of Internal Sections:	191	J Offset (in):	N/A

Material Properties:

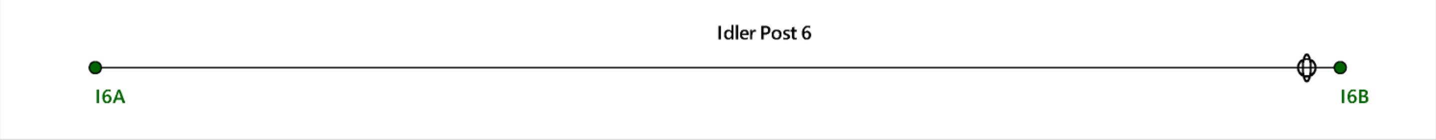
Material:	A992	Therm. Coeff. ($1e^{5}$°F^{-1}):	0.65	R_y:	1.1
E (ksi):	29000	Density (k/ft^3):	0.49	F_u (ksi):	65
G (ksi):	11154	F_y (ksi):	50	R_t:	1.1
Nu:	0.3				

Shape Properties:

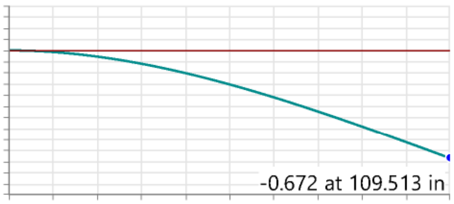
d (in):	5.772	Area (in^2):	2.002	S_w (in^4):	0.898
b_f (in):	3.94	Z_{yy} (in^3):	1.303	r_T (in):	1.047
t_f (in):	0.165	Z_{zz} (in^3):	4.6	J (in^4):	0.016
t_w (in):	0.129	C_w (in^6):	13.227	k_{det} (in):	0.69
I_{yy} (in^4):	1.683	W_{no} (in^2):	5.523	k_{des} (in):	0.46
I_{zz} (in^4):	11.955				

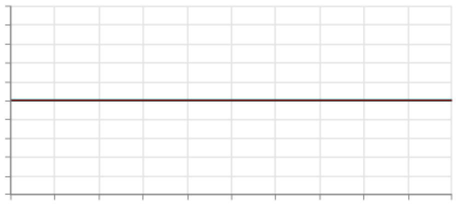
Design Properties:

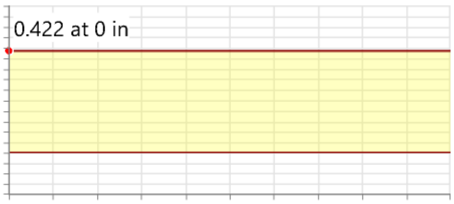
$L_{b\ y\text{-}y}$ (in):	N/A	$K_{y\text{-}y}$:	1	Max Defl Ratio:	L/163
$L_{b\ z\text{-}z}$ (in):	N/A	$K_{z\text{-}z}$:	1	Max Defl Location:	0
$L_{comp\ top}$ (in):	Lbyy	y sway:	No	Span:	N/A
$L_{comp\ bot}$ (in):	N/A	z sway:	No		
L_{torque} (in):	N/A	Function:	Lateral		
		Seismic DR:	None		

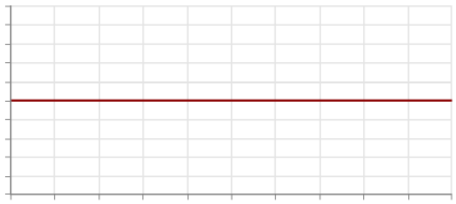


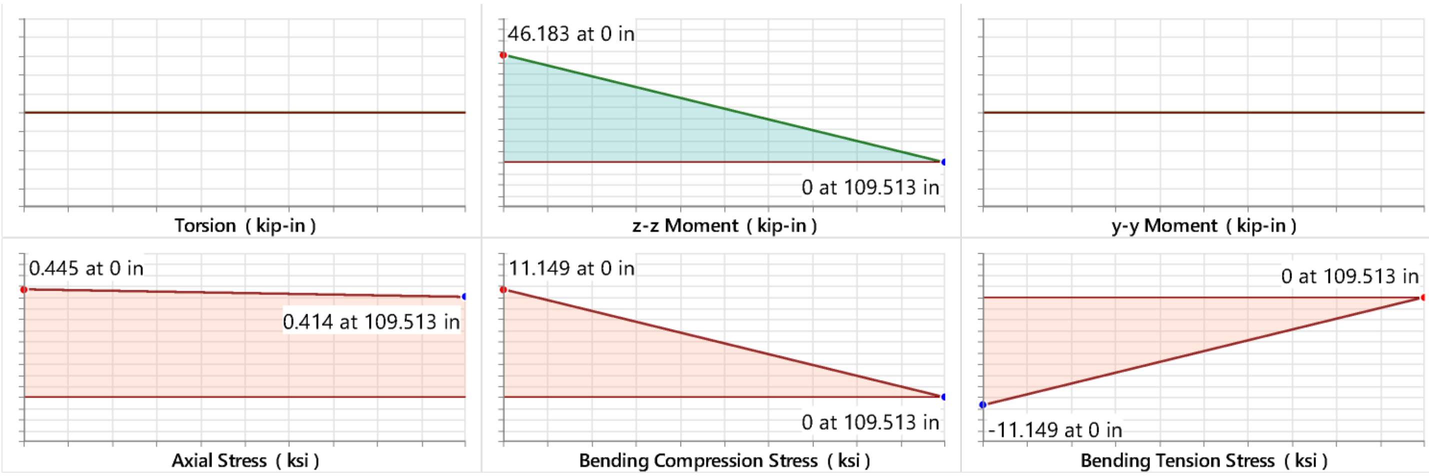
Diagrams:











AISC 15th (360-16): ASD Code Check

Limit State	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial				
Applied Loading - Shear + Torsion	-	-	-	-
Axial Tension Analysis	0.000 k	59.947 k	-	-
Axial Compression Analysis	0.89 k	21.092 k	-	-
Flexural Analysis (Strong Axis)	46.183 k-in	84.074 k-in	-	-
Flexural Analysis (Weak Axis)	0.000 k-in	35.079 k-in	-	-
Shear Analysis (Major Axis y)	0.422 k	14.892 k	0.028	Pass
Shear Analysis (Minor Axis z)	0.000 k	23.357 k	0.000	Pass
Bending & Axial Interaction Check (UC Bending Max)	-	-	0.57	Pass

SOLAR FLEXRACK

ENFIELD SOLAR ONE FOUNDATION CALCULATIONS

General Design Basis

Foundation design was derived in part from a review by SFR's in-house professional geotechnical foundation engineer of published soil and geologic mapping, noting local geohazards known to exist in proximity of the site. Foundation design parameters were developed based on applying experience and generally accepted geotechnical foundation engineering principles and practices to an independent review and evaluation of the field and laboratory data (borehole logs and laboratory index, strength, and settlement data) appended to a geotechnical evaluation report prepared by others. While due consideration was given to the opinions and interpretations expressed by the consultant who prepared the report, SFR formulated its own professional opinions surrounding the gathered data and assumes full responsibility for its independent interpretation and evaluation of the provided field and laboratory information, and its application of this information to the design of foundations to support SFR's unique racking system.

Axial Design Basis

Experience and available field and laboratory strength information were used to develop a multilayer geologic model which was used to evaluate the response of a W6x15 and a W6x7 to the design axial load. The governing axial loads considered and the corresponding ASCE 7 basic load combinations (as applicable) are shown in Table 1.

Table 1: Design Axial Loads

Section	Load	ASCE 7 Basic Load Combination
W6x15	Axial Down: 4,244 lb.	D + S
	Axial Up: 709 lb.	0.6D + 0.6W
	Axial (Frost): 6,758 lb.	N/A
W6x7	Axial Down: 4,005 lb.	D + 0.45O + 0.75S + 0.75L
	Axial Up: 1,695 lb.	0.6D + 0.6W
	Axial (Frost): 5,469 lb.	N/A

The subsurface investigation program included nine boreholes. In each borehole, measurements of Standard penetration resistance with depth (following ASTM D1586) were made. Individual and averaged penetration resistance values are plotted with depth on Figure 1, attached to these calculations for reference. Under a total stress analysis, an averaged unit frictional resistance for each layer was estimated from empirical correlations contained in published literature. From the available geotechnical information and records of nearby soil climate, a 2.5-foot frost depth was considered, and frost action forces were calculated using an averaged tangential frost stress (adfreeze bond) of 9.4 pounds per square inch (psi) across the upper 30 inches of subsurface material. Classical soil mechanics were applied to the subsurface materials below 30 inches.

Axial Calculations

From the multilayer analysis, an averaged allowable unit frictional resistance ($f_{s,\,all}$) of 55 pounds per square foot (psf) was considered for the subsurface materials to a depth of 4 feet, and 320 psf thereafter to a depth of 15 feet below ground surface. These values include a minimum safety factor of 2.0. In the calculation of axial capacity, post tip resistance was not considered. From this information, the minimum axial embedment depth requirement for a given section was computed from the following relationship:

$$d_{e,axial} = \frac{P_{max,axial}}{\sum_1^n f_{s,all,i}\ x\ A_{s,i}} + 2.5\ ft.$$

Where:

$d_{e,\ axial}$ = minimum axial embedment depth requirement
$P_{max,\ axial}$ = maximum axial load (lb.)
$f_{s,all,i}$ = allowable side unit frictional resistance applied over the i^{th} layer
$A_{s,i}$ = section unit surface area (ft.^{2}/ft.) across the ith layer
n = total number of layers
h_i = thickness of i^{th} layer

In the calculation of drive post (W6x15) axial capacity, the contribution to axial resistance from the upper 30 inches of subsurface material was neglected. The axial calculation is as follows.

Layer 1: 0 ft. – 4 ft. $P_1 = f_{s,i} x\ A_{s,i} x\ h_i =\ 55$ lb./ft^2 x 1.997 ft.^{2}/ft. x 1.5 ft. = 165 lb.

∴ $P_{max,\ axial} - P_1$ = 6,758 lb. – 165 lb. = 6,593 lb.

Where P_1 = load transfer to i^{th} layer

Layer 2 4 ft. – 15 ft.: $d_{e,axial} = \frac{P_{net,axial}}{f_{s,i}A_{s,i}} = \frac{6{,}593\ lb.}{320\frac{lb.}{ft^2} x\ 1.997\ \frac{ft^2}{ft}}$ = 10.3 ft.

Where $P_{net,\ axial}$ = remaining net load to be transferred to soil.

∴ $d_{e,\ axial}$ = 2.5 ft. + 1.5 ft. + 10.3 ft. = 14 ft. 4 in.

In the calculation of idler post (W6x7) axial capacity, the contribution to axial resistance from the upper 30 inches of subsurface material was neglected. The axial calculation is as follows.

Layer 1: 0 ft. – 4 ft. $P_1 = f_{s,i} x\ A_{s,i} x\ h_i =\ 55$ lb./ft^2 x 1.616 ft.^{2}/ft. x 1.5 ft. = 133 lb.

∴ $P_{max,\ axial} - P_1$ = 5,469 lb. – 133 lb. = 5,336 lb.

Where P_1 = load transfer to i^{th} layer

Layer 2 4 ft. – 15 ft.: $d_{e,axial} = \frac{P_{net,axial}}{f_{s,i}A_{s,i}} = \frac{5{,}336\ lb.}{320\frac{lb.}{ft^2} x\ 1.616\ \frac{ft^2}{ft}}$ = 10.3 ft.

Where $P_{net,\ axial}$ = remaining net load to be transferred to soil.

∴ $d_{e,\ axial}$ = 2.5 ft. + 1.5 ft. + 10.3 ft. = 14 ft. 4 in.

Lateral Design Basis

Experience and the averaged records of penetration resistance and undrained strength with depth and the site-specific subsurface conditions were used to develop a model in LPILE to evaluate the lateral response of the driven W6x15 and W6x7 to the design loads. The design loads (ASCE 7) considered are shown in Table 2.

Table 2: Loads Used in the Lateral Analysis (ASCE 7)

SECTION	AXIAL (D +S) (1)	LATERAL LOADS			
		STRONG AXIS SHEAR (D + 0.6W)	STRONG AXIS MOMENT (D + 0.6W)	WEAK AXIS SHEAR (D – 0.7E) (N/A)	WEAK AXIS MOMENT (D + 0.7E)
W6x15	4,244 lb.*. (down)	244 lb.**	148,301 lb. in.**	-510 lb.*	28,302 lb.-in.**
W6x7	4,005 lb.*. (down)	-403 lb.**	34,869 lb.-in.**	50 lb.	140 lb.-in.*

*0 deg. slew ** 55 deg. slew (1) D +0.45O + 0.25S + 0.75L

In the application of lateral loading to the post, SFR conservatively applied the largest loads from select load cases regardless of whether the loads occurred together. Further, in the estimation of the post response to the design axial and lateral loads, the contribution to lateral resistance from the upper 12 inches of subsurface material was neglected. The input parameters used in the multilayer model are shown in Table 3.

Table 3: Modeled Subsurface Conditions

LAYER	DEPTH	p-y RELATIONSHIP	UNIT WEIGHT γ	COHESION C_u	ANGLE OF SHEARING RESISTANCE ϕ	STRAIN AT 50 % STRESS ε_{50}	LATERAL SUBGRADE MODULUS k
1	0 – 4 ft.	Sand	100 pcf	--	28°	--	0*
2	4 – 15 ft.		115 pcf	--	28°	--	0*

*LPILE Default Value

Lateral Calculations

Finite difference numerical methods (LPILE) were applied to calculate the response of the W6x15 and W6x7 posts to the design axial and lateral loads. The result of these calculations is contained in Table 4 below. As stated above, to model the loss of the upper 12 inches of subsurface material, the design loads were applied to each section modeled 12 inches above ground surface.

Table 4: Lateral Analysis of W6x15 and W6x7 Post

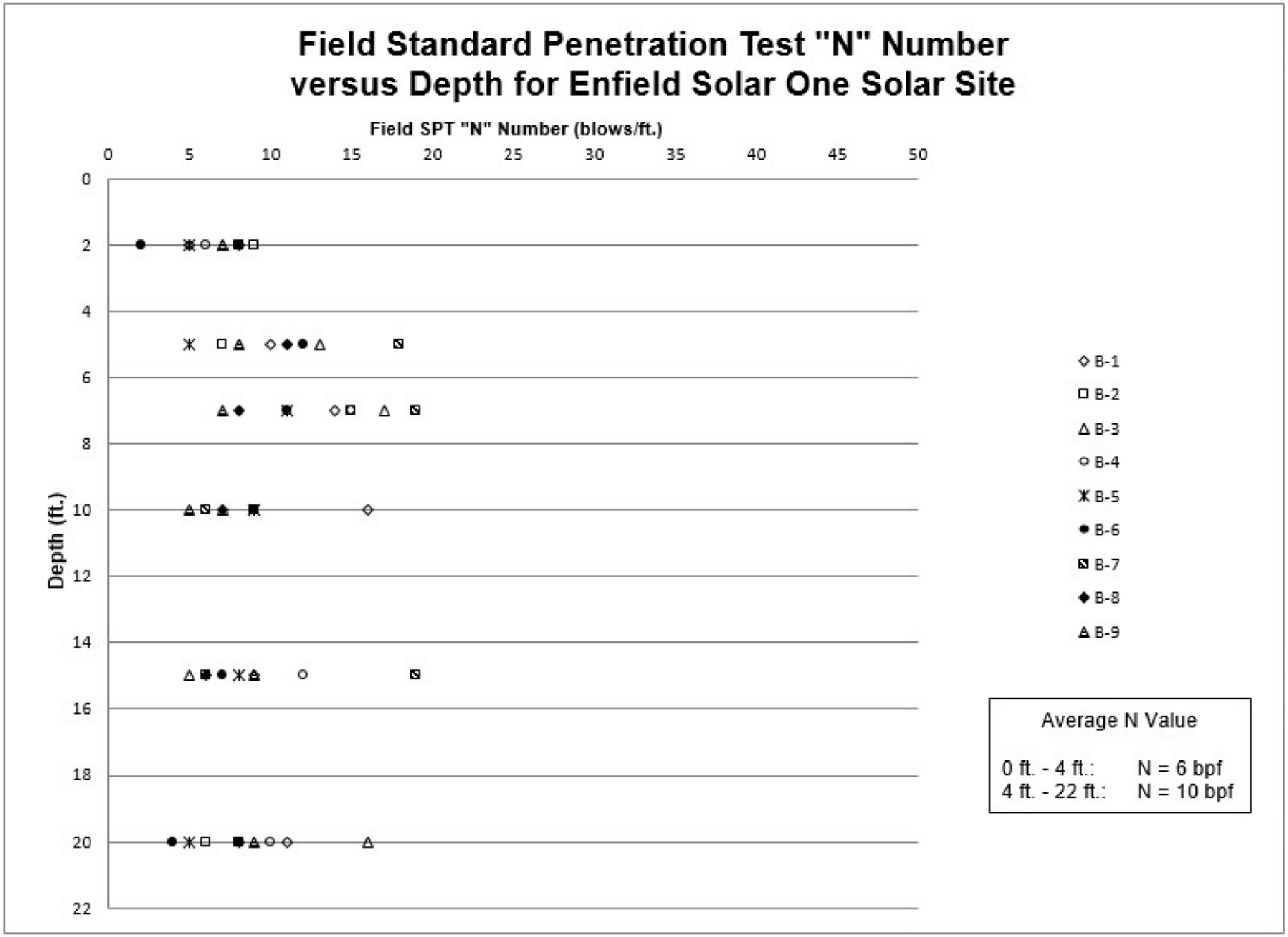
SECTION	MIN EMBEDMENT DEPTH	DEFLECTION AT GRADE (STRONG AXIS)	DEFLECTION AT GRADE (WEAK AXIS)	MAXIMUM MOMENT (STRONG AXIS)	MAXIMUM MOMENT (WEAK AXIS)
W6x15	10 ft. 0 in.	0.60 in.	0.39 in.	154,665 lb.-in.	42,441 lb.-in.
W6x7	8 ft. 6 in.	0.35 in.	0.041 in.	46,519 lb.-in.	1,359 lb.-in.

LPILE outputs are attached to these design calculations for reference.

Conclusion

From a comparison of the minimum embedment depth requirements to satisfy axial and lateral stability, axial stability governs the design and **the minimum design embedment depth required for a W6x15 to resist the design axial and lateral loads is 14 ft. 4 in. and the minimum embedment depth required for the W6x7 post to resist the design axial and lateral loads is 14 ft. 4 in.**

FIGURES



PROJECT	ENFIELD SOLAR ONE SOLAR SITE				
TITLE	PENETRATION RESISTANCE WITH DEPTH				
CLIENT	VEROGY				
	SOLAR FLEXRACK				
DESIGNED BY	SFR	LOCATION	PROJECT NUMBER	FIGURE NUMBER	REVISION
DRAWN BY	SFR	2023		1	0
ACTIVITY CODE	N/A	XREF NUMBER	N/A		

LPILE OUTPUTS

W6X15 DRIVE POST

DEFLECTION WITH DISTANCE FROM 12 IN ABOVE GRADE

```
================================================================================
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                    LPile for Windows, Version 2019-11.007

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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================================================================================
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--------------------------------------------------------------------------------
--
                             Files Used for Analysis
--------------------------------------------------------------------------------
--

Path to file locations:
\Quoting\SOLAR PRODUCTS\Verogy\2023\Enfield Solar One - Enfield, CT
06082\Geotech\Design\LPILE\Year 0\

Name of input data file:
Enfield_1 ft_W6x15_Avg_SA.lp11d

Name of output report file:
Enfield_1 ft_W6x15_Avg_SA.lp11o

Name of plot output file:
Enfield_1 ft_W6x15_Avg_SA.lp11p

Name of runtime message file:
Enfield_1 ft_W6x15_Avg_SA.lp11r



--------------------------------------------------------------------------------
--
```

Date and Time of Analysis

--

Date: February 9, 2023   Time: 11:40:15

--

Problem Title

--

Project Name: Enfield Solar One

Location: Enfield, CT

Client: Verogy

Engineer: K. Dy

Description: Lateral analysis of W6x15 post (strong axis)

--

Program Options and Settings

--

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 50

Loading Type and Number of Cycles of Loading:
- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Input of side resistance moment along pile not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 14.300 ft
Depth of ground surface below top of pile = 1.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over
the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	5.9900
2	14.300	5.9900

Input Structural Properties for Pile Sections:

```
Pile Section No. 1:

   Section 1 is an elastic pile
   Cross-sectional Shape                                 = Strong H-Pile
   Length of section                                     =    14.300000 ft
   Flange Width                                          =     5.990000 in
   Section Depth                                         =     5.990000 in
   Flange Thickness                                      =     0.260000 in
   Web Thickness                                         =     0.230000 in
   Section Area                                          =     4.372900 sq. in
   Moment of Inertia                                     =    28.721483 in^4
   Elastic Modulus                                       =    29000000. psi



------------------------------------------------------------------------------
--
                       Ground Slope and Pile Batter Angles
------------------------------------------------------------------------------
--

Ground Slope Angle                                       =        0.000 degrees
                                                         =        0.000 radians

Pile Batter Angle                                        =        0.000 degrees
                                                         =        0.000 radians


------------------------------------------------------------------------------
--
                       Soil and Rock Layering Information
------------------------------------------------------------------------------
--

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer             =     1.000000 ft
   Distance from top of pile to bottom of layer          =     4.000000 ft
   Effective unit weight at top of layer                 =   100.000000 pcf
   Effective unit weight at bottom of layer              =   100.000000 pcf
   Friction angle at top of layer                        =    28.000000 deg.
   Friction angle at bottom of layer                     =    28.000000 deg.
   Subgrade k at top of layer                            =    25.000000 pci
   Subgrade k at bottom of layer                         =    25.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer             =     4.000000 ft
```

Distance from top of pile to bottom of layer = 15.000000 ft
Effective unit weight at top of layer = 115.000000 pcf
Effective unit weight at bottom of layer = 115.000000 pcf
Friction angle at top of layer = 30.000000 deg.
Friction angle at bottom of layer = 30.000000 deg.
Subgrade k at top of layer = 0.0000 pci
Subgrade k at bottom of layer = 0.0000 pci

NOTE: Default values for subgrade k will be computed for this layer.

(Depth of the lowest soil layer extends 0.700 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Angle of Friction deg.	kpy pci
1	Sand	1.0000	100.0000	28.0000	25.0000
	(Reese, et al.)	4.0000	100.0000	28.0000	25.0000
2	Sand	4.0000	115.0000	30.0000	default
	(Reese, et al.)	15.0000	115.0000	30.0000	default

---

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	2.500	0.7000	1.0000
2	15.000	1.0000	1.0000

--

Static Loading Type

--

Static loading criteria were used when computing p-y curves for all analyses.

--

Pile-head Loading and Pile-head Fixity Conditions

--

Number of loads specified = 1

```
Load    Load         Condition               Condition            Axial Thrust
     Compute Top y     Run Analysis
 No.    Type            1                       2                   Force, lbs
    vs. Pile Length
-----   ----   --------------------   -----------------------
----------------   ---------------    ------------
   1     1     V =   244.000000 lbs   M =      148301. in-lbs
4224.          No                Yes
```

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

--

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

----
--

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	1.0000	0.00	N.A.	No	0.00	1936.
2	4.0000	2.8148	Yes	No	1936.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 244.0 lbs
Applied moment at pile head = 148301.0 in-lbs
Axial thrust load on pile head = 4224.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.6017	148301.	244.0000	-0.01465	16430.	8.33E+08	0.00	0.00	0.00
0.2860	0.5525	149346.	244.0000	-0.01404	16539.	8.33E+08	0.00	0.00	0.00
0.5720	0.5053	150383.	244.0000	-0.01342	16647.	8.33E+08			

0.00	0.00	0.00				
0.8580	0.4604	151410.	244.0000	-0.01280	16755.	8.33E+08
0.00	0.00	0.00				
1.1440	0.4175	152429.	236.2465	-0.01217	16861.	8.33E+08
-4.5184	37.1426	0.00				
1.4300	0.3768	153385.	202.7773	-0.01154	16961.	8.33E+08
-14.9859	136.4934	0.00				
1.7160	0.3383	154155.	133.6525	-0.01091	17041.	8.33E+08
-25.2966	256.6458	0.00				
2.0020	0.3019	154618.	30.9054	-0.01027	17089.	8.33E+08
-34.5793	393.0534	0.00				
2.2880	0.2678	154665.	-100.7038	-0.00963	17094.	8.33E+08
-42.1161	539.7912	0.00				
2.5740	0.2358	154206.	-233.8199	-0.00900	17046.	8.33E+08
-35.4574	516.0663	0.00				
2.8600	0.2060	153321.	-364.6968	-0.00836	16954.	8.33E+08
-40.8112	679.8851	0.00				
3.1460	0.1784	151946.	-511.6475	-0.00774	16810.	8.33E+08
-44.8245	862.3762	0.00				
3.4320	0.1529	150033.	-673.6305	-0.00711	16611.	8.33E+08
-49.5712	1113.	0.00				
3.7180	0.1296	147528.	-851.5833	-0.00650	16350.	8.33E+08
-54.1309	1434.	0.00				
4.0040	0.1083	144377.	-1049.	-0.00590	16021.	8.33E+08
-61.1035	1936.	0.00				
4.2900	0.08907	140497.	-1267.	-0.00531	15617.	8.33E+08
-66.0252	2544.	0.00				
4.5760	0.07183	135831.	-1500.	-0.00474	15130.	8.33E+08
-69.3977	3316.	0.00				
4.8620	0.05651	130339.	-1741.	-0.00419	14557.	8.33E+08
-70.8680	4304.	0.00				
5.1480	0.04304	124005.	-1983.	-0.00367	13897.	8.33E+08
-70.1233	5592.	0.00				
5.4340	0.03132	116838.	-2208.	-0.00317	13149.	8.33E+08
-61.2316	6710.	0.00				
5.7200	0.02125	108942.	-2390.	-0.00271	12326.	8.33E+08
-44.6211	7206.	0.00				
6.0060	0.01272	100514.	-2515.	-0.00228	11447.	8.33E+08
-28.5842	7710.	0.00				
6.2920	0.00562	91744.	-2587.	-0.00188	10533.	8.33E+08
-13.4566	8222.	0.00				
6.5780	-1.92E-04	82810.	-2610.	-0.00152	9601.	8.33E+08
0.4893	8742.	0.00				
6.8640	-0.00483	73876.	-2586.	-0.00120	8670.	8.33E+08
13.0448	9269.	0.00				
7.1500	-0.00842	65092.	-2523.	-9.13E-04	7754.	8.33E+08
24.0623	9804.	0.00				
7.4360	-0.01110	56587.	-2424.	-6.62E-04	6867.	8.33E+08
33.4520	10347.	0.00				
7.7220	-0.01297	48473.	-2296.	-4.46E-04	6021.	8.33E+08
41.1770	10897.	0.00				
8.0080	-0.01416	40841.	-2144.	-2.62E-04	5225.	8.33E+08
47.2481	11455.	0.00				

8.2940	-0.01476	33763.	-1974.	-1.08E-04	4487.	8.33E+08	51.7167	12021.	0.00
8.5800	-0.01490	27292.	-1792.	1.78E-05	3812.	8.33E+08	54.6687	12595.	0.00
8.8660	-0.01464	21463.	-1602.	1.18E-04	3204.	8.33E+08	56.2169	13176.	0.00
9.1520	-0.01409	16296.	-1408.	1.96E-04	2665.	8.33E+08	56.4940	13765.	0.00
9.4380	-0.01330	11793.	-1216.	2.54E-04	2196.	8.33E+08	55.6460	14362.	0.00
9.7240	-0.01234	7944.	-1028.	2.95E-04	1794.	8.33E+08	53.8248	14966.	0.00
10.0100	-0.01128	4729.	-847.6179	3.21E-04	1459.	8.33E+08	51.1830	15578.	0.00
10.2960	-0.01014	2117.	-677.6463	3.35E-04	1187.	8.33E+08	47.8680	16198.	0.00
10.5820	-0.00898	68.0977	-519.9718	3.39E-04	973.0504	8.33E+08	44.0169	16826.	0.00
10.8680	-0.00781	-1462.	-376.2229	3.36E-04	1118.	8.33E+08	39.7529	17461.	0.00
11.1540	-0.00667	-2524.	-247.6353	3.28E-04	1229.	8.33E+08	35.1816	18104.	0.00
11.4400	-0.00556	-3171.	-135.1157	3.16E-04	1297.	8.33E+08	30.3892	18754.	0.00
11.7260	-0.00450	-3461.	-39.3125	3.03E-04	1327.	8.33E+08	25.4402	19413.	0.00
12.0120	-0.00348	-3450.	39.3100	2.89E-04	1326.	8.33E+08	20.3771	20079.	0.00
12.2980	-0.00252	-3199.	100.3961	2.75E-04	1300.	8.33E+08	15.2208	20753.	0.00
12.5840	-0.00160	-2769.	143.6258	2.63E-04	1255.	8.33E+08	9.9713	21434.	0.00
12.8700	-7.15E-04	-2221.	168.6474	2.52E-04	1198.	8.33E+08	4.6101	22124.	0.00
13.1560	1.35E-04	-1619.	175.0196	2.44E-04	1135.	8.33E+08	-0.8967	22820.	0.00
13.4420	9.62E-04	-1027.	162.1655	2.39E-04	1073.	8.33E+08	-6.5940	23525.	0.00
13.7280	0.00177	-512.4276	129.3445	2.36E-04	1019.	8.33E+08	-12.5325	24237.	0.00
14.0140	0.00258	-145.7266	75.6443	2.34E-04	981.1454	8.33E+08	-18.7614	24958.	0.00
14.3000	0.00338	0.00	0.00	2.34E-04	965.9494	8.33E+08	-25.3204	12843.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =     0.60168976 inches
Computed slope at pile head       =    -0.01464993 radians
Maximum bending moment            =        154665. inch-lbs
```

```
Maximum shear force               =         -2610. lbs
Depth of maximum bending moment  =     2.28800000 feet below pile head
Depth of maximum shear force     =     6.57800000 feet below pile head
Number of iterations             =            10
Number of zero deflection points =             2


------------------------------------------------------------------------------
--
            Summary of Pile-head Responses for Conventional Analyses
------------------------------------------------------------------------------
--

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R,
in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M,
in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S,
radians


Load Load                Load                  Axial    Pile-head  Pile-head
Max Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation
in Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians
  lbs      in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  V, lb   244.0000  M, in-lb     148301.      4224.     0.6017   -0.01465
  -2610.    154665.


Maximum pile-head deflection = 0.6016897617 inches
Maximum pile-head rotation   = -0.0146499345 radians = -0.839379 deg.

The analysis ended normally.
```

```
================================================================================
==

                     LPile for Windows, Version 2019-11.007

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
--
                             Files Used for Analysis
--------------------------------------------------------------------------------
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Path to file locations:
\Quoting\SOLAR PRODUCTS\Verogy\2023\Enfield Solar One - Enfield, CT
06082\Geotech\Design\LPILE\Year 0\

Name of input data file:
Enfield_1 ft_W6x15_Avg_WA.lp11d

Name of output report file:
Enfield_1 ft_W6x15_Avg_WA.lp11o

Name of plot output file:
Enfield_1 ft_W6x15_Avg_WA.lp11p

Name of runtime message file:
Enfield_1 ft_W6x15_Avg_WA.lp11r


--------------------------------------------------------------------------------
--
```

Date and Time of Analysis

--

Date: February 9, 2023   Time: 11:42:55

--

Problem Title

--

Project Name: Enfield Solar One

Location: Enfield, CT

Client: Verogy

Engineer: K. Dy

Description: Lateral analysis of W6x15 post (weak axis)

--

Program Options and Settings

--

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed = 500
 - Deflection tolerance for convergence = 1.0000E-05 in
 - Maximum allowable deflection = 100.0000 in
 - Number of pile increments = 50

```
Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Input of side resistance moment along pile not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats




------------------------------------------------------------------------------
--
                     Pile Structural Properties and Geometry
------------------------------------------------------------------------------
--

Number of pile sections defined                              =            1
Total length of pile                                         =       14.300 ft
Depth of ground surface below top of pile                    =       1.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth
over
the length of the pile. A summary of values of pile diameter vs. depth
follows.

           Depth Below          Pile
Point       Pile Head         Diameter
 No.          feet             inches
-----     -------------     -------------
  1           0.000            5.9900
  2          14.300            5.9900


Input Structural Properties for Pile Sections:
----------------------------------------------
```

```
Pile Section No. 1:

   Section 1 is an elastic pile
   Cross-sectional Shape                                  =   Weak H-Pile
   Length of section                                      =    14.300000 ft
   Flange Width                                           =     5.990000 in
   Section Depth                                          =     5.990000 in
   Flange Thickness                                       =     0.260000 in
   Web Thickness                                          =     0.230000 in
   Section Area                                           =     4.372900 sq. in
   Moment of Inertia                                      =     9.318824 in^4
   Elastic Modulus                                        =    29000000. psi



--------------------------------------------------------------------------------
--
                       Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------
--

Ground Slope Angle                                        =        0.000 degrees
                                                          =        0.000 radians

Pile Batter Angle                                         =        0.000 degrees
                                                          =        0.000 radians


--------------------------------------------------------------------------------
--
                       Soil and Rock Layering Information
--------------------------------------------------------------------------------
--

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer              =     1.000000 ft
   Distance from top of pile to bottom of layer           =     4.000000 ft
   Effective unit weight at top of layer                  =   100.000000 pcf
   Effective unit weight at bottom of layer               =   100.000000 pcf
   Friction angle at top of layer                         =    28.000000 deg.
   Friction angle at bottom of layer                      =    28.000000 deg.
   Subgrade k at top of layer                             =    25.000000 pci
   Subgrade k at bottom of layer                          =    25.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer              =     4.000000 ft
```

```
   Distance from top of pile to bottom of layer        =    15.000000 ft
   Effective unit weight at top of layer               =   115.000000 pcf
   Effective unit weight at bottom of layer            =   115.000000 pcf
   Friction angle at top of layer                      =    30.000000 deg.
   Friction angle at bottom of layer                   =    30.000000 deg.
   Subgrade k at top of layer                          =       0.0000 pci
   Subgrade k at bottom of layer                       =       0.0000 pci

   NOTE: Default values for subgrade k will be computed for this layer.

 (Depth of the lowest soil layer extends 0.700 ft below the pile tip)
```

```
------------------------------------------------------------------------------
--
                        Summary of Input Soil Properties
------------------------------------------------------------------------------
--
```

Layer Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Angle of Friction deg.	kpy pci
1	Sand	1.0000	100.0000	28.0000	25.0000
	(Reese, et al.)	4.0000	100.0000	28.0000	25.0000
2	Sand	4.0000	115.0000	30.0000	default
	(Reese, et al.)	15.0000	115.0000	30.0000	default

```
------------------------------------------------------------------------------
--
                    p-y Modification Factors for Group Action
------------------------------------------------------------------------------
--
```

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	2.500	0.7000	1.0000
2	15.000	1.0000	1.0000

```
--------------------------------------------------------------------------------
--
                              Static Loading Type
--------------------------------------------------------------------------------
--

Static loading criteria were used when computing p-y curves for all analyses.



--------------------------------------------------------------------------------
--
               Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------
--

Number of loads specified = 1

Load    Load        Condition              Condition           Axial Thrust
     Compute Top y     Run Analysis
 No.    Type            1                      2                 Force, lbs
    vs. Pile Length
-----   ----   --------------------   -----------------------
----------------   ---------------    ------------
   1     1     V =   510.000000 lbs   M =       28302. in-lbs
4224.          No                Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.



--------------------------------------------------------------------------------
--
     Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------
--

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------
Moment-curvature properties were derived from elastic section properties
```

--
Layering Correction Equivalent Depths of Soil & Rock Layers

--

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	1.0000	0.00	N.A.	No	0.00	1936.
2	4.0000	2.8148	Yes	No	1936.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

--
Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

--

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 510.0 lbs
Applied moment at pile head = 28302.0 in-lbs
Axial thrust load on pile head = 4224.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.3930	28302.	510.0000	-0.01041	10062.	2.70E+08	0.00	0.00	0.00
0.2860	0.3579	30201.	510.0000	-0.01004	10672.	2.70E+08	0.00	0.00	0.00
0.5720	0.3241	32094.	510.0000	-0.00964	11281.	2.70E+08			

0.00	0.00	0.00				
0.8580	0.2917	33981.	510.0000	-0.00922	11887.	2.70E+08
0.00	0.00	0.00				
1.1440	0.2608	35862.	502.2464	-0.00878	12492.	2.70E+08
-4.5184	59.4620	0.00				
1.4300	0.2314	37683.	468.7770	-0.00831	13077.	2.70E+08
-14.9860	222.2289	0.00				
1.7160	0.2037	39321.	401.6670	-0.00782	13603.	2.70E+08
-24.1224	406.3729	0.00				
2.0020	0.1777	40667.	307.4170	-0.00732	14036.	2.70E+08
-30.8019	594.8032	0.00				
2.2880	0.1535	41643.	194.8518	-0.00679	14350.	2.70E+08
-34.7955	777.9669	0.00				
2.5740	0.1311	42201.	89.8478	-0.00626	14529.	2.70E+08
-26.3956	691.0517	0.00				
2.8600	0.1105	42441.	-3.5163	-0.00572	14606.	2.70E+08
-28.0124	869.8863	0.00				
3.1460	0.09180	42343.	-102.1217	-0.00519	14575.	2.70E+08
-29.4500	1101.	0.00				
3.4320	0.07492	41890.	-206.8949	-0.00465	14429.	2.70E+08
-31.6066	1448.	0.00				
3.7180	0.05987	41058.	-318.7667	-0.00412	14162.	2.70E+08
-33.5868	1925.	0.00				
4.0040	0.04661	39822.	-439.1553	-0.00361	13764.	2.70E+08
-36.5698	2693.	0.00				
4.2900	0.03508	38148.	-566.2114	-0.00312	13226.	2.70E+08
-37.4722	3666.	0.00				
4.5760	0.02522	36026.	-693.5386	-0.00264	12544.	2.70E+08
-36.7278	4998.	0.00				
4.8620	0.01693	33464.	-805.1532	-0.00220	11721.	2.70E+08
-28.3157	5740.	0.00				
5.1480	0.01010	30563.	-885.1474	-0.00180	10789.	2.70E+08
-18.3010	6221.	0.00				
5.4340	0.00459	27441.	-931.9661	-0.00143	9785.	2.70E+08
-8.9826	6710.	0.00				
5.7200	2.89E-04	24208.	-948.4209	-0.00110	8746.	2.70E+08
-0.6065	7206.	0.00				
6.0060	-0.00296	20963.	-938.0436	-8.14E-04	7703.	2.70E+08
6.6539	7710.	0.00				
6.2920	-0.00530	17793.	-904.8422	-5.68E-04	6684.	2.70E+08
12.6942	8222.	0.00				
6.5780	-0.00686	14768.	-853.0743	-3.61E-04	5712.	2.70E+08
17.4735	8742.	0.00				
6.8640	-0.00778	11947.	-787.0433	-1.92E-04	4806.	2.70E+08
21.0061	9269.	0.00				
7.1500	-0.00817	9372.	-710.9239	-5.62E-05	3978.	2.70E+08
23.3526	9804.	0.00				
7.4360	-0.00816	7069.	-628.6190	4.82E-05	3238.	2.70E+08
24.6106	10347.	0.00				
7.7220	-0.00784	5055.	-543.6500	1.25E-04	2591.	2.70E+08
24.9051	10897.	0.00				
8.0080	-0.00730	3334.	-459.0794	1.78E-04	2037.	2.70E+08
24.3785	11455.	0.00				

```
   8.2940   -0.00662      1899.  -377.4648   2.12E-04      1576.   2.70E+08
 23.1825     12021.       0.00
   8.5800   -0.00585   737.0207  -300.8412   2.28E-04      1203.   2.70E+08
 21.4700     12595.       0.00
   8.8660   -0.00505  -172.4022  -230.7271   2.32E-04      1021.   2.70E+08
 19.3890     13176.       0.00
   9.1520   -0.00426  -853.4177  -168.1521   2.26E-04      1240.   2.70E+08
 17.0766     13765.       0.00
   9.4380   -0.00350     -1333.  -113.6995   2.12E-04      1394.   2.70E+08
 14.6556     14362.       0.00
   9.7240   -0.00280     -1640.   -67.5612   1.93E-04      1493.   2.70E+08
 12.2315     14966.       0.00
  10.0100   -0.00218     -1802.   -29.5991   1.71E-04      1545.   2.70E+08
  9.8910     15578.       0.00
  10.2960   -0.00163     -1848.     0.5895   1.48E-04      1560.   2.70E+08
  7.7014     16198.       0.00
  10.5820   -0.00117     -1803.    23.6062   1.25E-04      1545.   2.70E+08
  5.7116     16826.       0.00
  10.8680  -7.77E-04     -1690.    40.1894   1.02E-04      1509.   2.70E+08
  3.9523     17461.       0.00
  11.1540  -4.62E-04     -1530.    51.1564   8.19E-05      1458.   2.70E+08
  2.4387     18104.       0.00
  11.4400  -2.14E-04     -1341.    57.3524   6.37E-05      1397.   2.70E+08
  1.1720     18754.       0.00
  11.7260  -2.51E-05     -1138.    59.6067   4.80E-05      1332.   2.70E+08
  0.1418     19413.       0.00
  12.0120   1.15E-04  -933.1771    58.6980   3.48E-05      1266.   2.70E+08
 -0.6713     20079.       0.00
  12.2980   2.14E-04  -736.0980    55.3267   2.42E-05      1203.   2.70E+08
 -1.2933     20753.       0.00
  12.5840   2.81E-04  -554.1169    50.0965   1.60E-05      1144.   2.70E+08
 -1.7546     21434.       0.00
  12.8700   3.24E-04  -392.7000    43.5035   1.00E-05      1092.   2.70E+08
 -2.0875     22124.       0.00
  13.1560   3.50E-04  -255.7989    35.9321   5.89E-06      1048.   2.70E+08
 -2.3247     22820.       0.00
  13.4420   3.64E-04  -146.2331    27.6582   3.34E-06      1013.   2.70E+08
 -2.4969     23525.       0.00
  13.7280   3.73E-04   -66.0499    18.8591   1.99E-06   987.1773   2.70E+08
 -2.6308     24237.       0.00
  14.0140   3.78E-04   -16.8419     9.6288   1.46E-06   971.3622   2.70E+08
 -2.7481     24958.       0.00
  14.3000   3.83E-04       0.00       0.00   1.35E-06   965.9494   2.70E+08
 -2.8631     12843.       0.00

* The above values of total stress are combined axial and bending stresses.


Output Summary for Load Case No. 1:

Pile-head deflection              =     0.39301705 inches
Computed slope at pile head       =    -0.01041092 radians
Maximum bending moment            =         42441. inch-lbs
```

```
Maximum shear force              =  -948.42090565 lbs
Depth of maximum bending moment  =     2.86000000 feet below pile head
Depth of maximum shear force     =     5.72000000 feet below pile head
Number of iterations             =            10
Number of zero deflection points =             2


------------------------------------------------------------------------------
--
            Summary of Pile-head Responses for Conventional Analyses
------------------------------------------------------------------------------
--

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R,
in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M,
in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S,
radians


Load Load               Load                  Axial    Pile-head  Pile-head
Max Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation
in Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians
  lbs      in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  V, lb   510.0000  M, in-lb      28302.      4224.     0.3930   -0.01041
-948.4209     42441.


Maximum pile-head deflection = 0.3930170458 inches
Maximum pile-head rotation   = -0.0104109192 radians = -0.596502 deg.

The analysis ended normally.
```

W6X7 IDLER POST

DEFLECTION WITH DISTANCE FROM 12 IN ABOVE GRADE

```
================================================================================
==

                     LPile for Windows, Version 2019-11.007

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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--------------------------------------------------------------------------------
--
                             Files Used for Analysis
--------------------------------------------------------------------------------
--

Path to file locations:
\Quoting\SOLAR PRODUCTS\Verogy\2023\Enfield Solar One - Enfield, CT
06082\Geotech\Design\LPILE\Year 0\

Name of input data file:
Enfield_1 ft_W6x7_Avg_SA.lp11d

Name of output report file:
Enfield_1 ft_W6x7_Avg_SA.lp11o

Name of plot output file:
Enfield_1 ft_W6x7_Avg_SA.lp11p

Name of runtime message file:
Enfield_1 ft_W6x7_Avg_SA.lp11r



--------------------------------------------------------------------------------
--
```

```
                           Date and Time of Analysis
-------------------------------------------------------------------------------
--

            Date:  February 9, 2023           Time:  11:51:42


-------------------------------------------------------------------------------
--
                                 Problem Title
-------------------------------------------------------------------------------
--

Project Name: Enfield Solar One


Location: Enfield, CT


Client: Verogy


Engineer: K. Dy


Description: Lateral analysis of W6x7 post (strong axis)




-------------------------------------------------------------------------------
--
                         Program Options and Settings
-------------------------------------------------------------------------------
--

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed                =         500
 - Deflection tolerance for convergence                =   1.0000E-05 in
 - Maximum allowable deflection                        =     100.0000 in
 - Number of pile increments                           =          50
```

Loading Type and Number of Cycles of Loading:
- Static loading specified

- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Input of side resistance moment along pile not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:
- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

Number of pile sections defined = 1
Total length of pile = 14.300 ft
Depth of ground surface below top of pile = 1.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	3.9050
2	14.300	3.9050

Input Structural Properties for Pile Sections:

```
Pile Section No. 1:

   Section 1 is an elastic pile
   Cross-sectional Shape                               = Strong H-Pile
   Length of section                                   =    14.300000 ft
   Flange Width                                        =     3.905000 in
   Section Depth                                       =     5.790000 in
   Flange Thickness                                    =     0.160000 in
   Web Thickness                                       =     0.135000 in
   Section Area                                        =     1.988050 sq. in
   Moment of Inertia                                   =    11.746035 in^4
   Elastic Modulus                                     =    29000000. psi



------------------------------------------------------------------------------
--
                       Ground Slope and Pile Batter Angles
------------------------------------------------------------------------------
--

Ground Slope Angle                                     =        0.000 degrees
                                                       =        0.000 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians


------------------------------------------------------------------------------
--
                       Soil and Rock Layering Information
------------------------------------------------------------------------------
--

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =     1.000000 ft
   Distance from top of pile to bottom of layer        =     4.000000 ft
   Effective unit weight at top of layer               =   100.000000 pcf
   Effective unit weight at bottom of layer            =   100.000000 pcf
   Friction angle at top of layer                      =    28.000000 deg.
   Friction angle at bottom of layer                   =    28.000000 deg.
   Subgrade k at top of layer                          =    25.000000 pci
   Subgrade k at bottom of layer                       =    25.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =     4.000000 ft
```

Distance from top of pile to bottom of layer = 15.000000 ft
Effective unit weight at top of layer = 115.000000 pcf
Effective unit weight at bottom of layer = 115.000000 pcf
Friction angle at top of layer = 30.000000 deg.
Friction angle at bottom of layer = 30.000000 deg.
Subgrade k at top of layer = 0.0000 pci
Subgrade k at bottom of layer = 0.0000 pci

NOTE: Default values for subgrade k will be computed for this layer.

(Depth of the lowest soil layer extends 0.700 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Angle of Friction deg.	kpy pci
1	Sand	1.0000	100.0000	28.0000	25.0000
	(Reese, et al.)	4.0000	100.0000	28.0000	25.0000
2	Sand	4.0000	115.0000	30.0000	default
	(Reese, et al.)	15.0000	115.0000	30.0000	default

---

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	2.500	0.7000	1.0000
2	15.000	1.0000	1.0000

--
Static Loading Type

--

Static loading criteria were used when computing p-y curves for all analyses.

--
Pile-head Loading and Pile-head Fixity Conditions

--

Number of loads specified = 1

```
Load    Load         Condition              Condition            Axial Thrust
     Compute Top y     Run Analysis
 No.    Type            1                      2                   Force, lbs
    vs. Pile Length
-----   ----   --------------------   -----------------------
----------------   ---------------    ------------
   1     1     V =   403.000000 lbs   M =       34869. in-lbs
4005.          No                Yes
```

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

--
Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
----
--

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

---

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	1.0000	0.00	N.A.	No	0.00	1631.
2	4.0000	2.8258	Yes	No	1631.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 403.0 lbs
Applied moment at pile head = 34869.0 in-lbs
Axial thrust load on pile head = 4005.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.3529	34869.	403.0000	-0.00933	7811.	3.41E+08	0.00	0.00	0.00
0.2860	0.3214	36378.	403.0000	-0.00897	8062.	3.41E+08	0.00	0.00	0.00
0.5720	0.2913	37882.	403.0000	-0.00860	8311.	3.41E+08			

0.00	0.00	0.00				
0.8580	0.2624	39381.	403.0000	-0.00821	8561.	3.41E+08
0.00	0.00	0.00				
1.1440	0.2349	40874.	397.7367	-0.00780	8809.	3.41E+08
-3.0672	44.8076	0.00				
1.4300	0.2089	42325.	375.4154	-0.00739	9050.	3.41E+08
-9.9405	163.3500	0.00				
1.7160	0.1842	43654.	331.1027	-0.00695	9271.	3.41E+08
-15.8827	295.8688	0.00				
2.0020	0.1611	44789.	268.0333	-0.00651	9460.	3.41E+08
-20.8711	444.5481	0.00				
2.2880	0.1396	45672.	186.3553	-0.00605	9606.	3.41E+08
-26.7269	657.2041	0.00				
2.5740	0.1196	46234.	100.9421	-0.00559	9700.	3.41E+08
-23.0477	661.4109	0.00				
2.8600	0.1012	46519.	14.0115	-0.00512	9747.	3.41E+08
-27.6112	936.2618	0.00				
3.1460	0.08444	46471.	-88.0298	-0.00465	9739.	3.41E+08
-31.8535	1295.	0.00				
3.4320	0.06928	46042.	-203.6983	-0.00419	9668.	3.41E+08
-35.5524	1761.	0.00				
3.7180	0.05570	45188.	-321.5452	-0.00373	9526.	3.41E+08
-33.1229	2041.	0.00				
4.0040	0.04370	43938.	-451.7787	-0.00328	9318.	3.41E+08
-42.7707	3359.	0.00				
4.2900	0.03320	42177.	-601.1885	-0.00284	9026.	3.41E+08
-44.2979	4579.	0.00				
4.5760	0.02417	39889.	-740.8603	-0.00243	8645.	3.41E+08
-37.0959	5267.	0.00				
4.8620	0.01652	37159.	-851.9300	-0.00204	8191.	3.41E+08
-27.6301	5740.	0.00				
5.1480	0.01015	34098.	-930.9221	-0.00168	7683.	3.41E+08
-18.4026	6221.	0.00				
5.4340	0.00496	30815.	-979.1528	-0.00136	7137.	3.41E+08
-9.7039	6710.	0.00				
5.7200	8.40E-04	27414.	-998.8321	-0.00106	6572.	3.41E+08
-1.7642	7206.	0.00				
6.0060	-0.00234	23989.	-992.8575	-8.04E-04	6002.	3.41E+08
5.2459	7710.	0.00				
6.2920	-0.00468	20621.	-964.6121	-5.80E-04	5442.	3.41E+08
11.2141	8222.	0.00				
6.5780	-0.00631	17383.	-917.7729	-3.88E-04	4904.	3.41E+08
16.0815	8742.	0.00				
6.8640	-0.00735	14333.	-856.1359	-2.28E-04	4397.	3.41E+08
19.8376	9269.	0.00				
7.1500	-0.00788	11513.	-783.4609	-9.82E-05	3928.	3.41E+08
22.5138	9804.	0.00				
7.4360	-0.00802	8958.	-703.3418	4.95E-06	3504.	3.41E+08
24.1757	10347.	0.00				
7.7220	-0.00785	6685.	-619.1000	8.37E-05	3126.	3.41E+08
24.9162	10897.	0.00				
8.0080	-0.00744	4706.	-533.7062	1.41E-04	2797.	3.41E+08
24.8471	11455.	0.00				

8.2940	-0.00688	3018.	-449.7251	1.80E-04	2516.	3.41E+08	24.0929	12021.	0.00
8.5800	-0.00621	1614.	-369.2856	2.03E-04	2283.	3.41E+08	22.7833	12595.	0.00
8.8660	-0.00548	477.7616	-294.0711	2.14E-04	2094.	3.41E+08	21.0479	13176.	0.00
9.1520	-0.00474	-410.5061	-225.3298	2.14E-04	2083.	3.41E+08	19.0111	13765.	0.00
9.4380	-0.00401	-1075.	-163.8988	2.07E-04	2193.	3.41E+08	16.7879	14362.	0.00
9.7240	-0.00332	-1541.	-110.2417	1.94E-04	2271.	3.41E+08	14.4808	14966.	0.00
10.0100	-0.00268	-1837.	-64.4947	1.77E-04	2320.	3.41E+08	12.1782	15578.	0.00
10.2960	-0.00211	-1989.	-26.5185	1.57E-04	2345.	3.41E+08	9.9525	16198.	0.00
10.5820	-0.00160	-2023.	4.0474	1.37E-04	2351.	3.41E+08	7.8599	16826.	0.00
10.8680	-0.00117	-1965.	27.7294	1.17E-04	2341.	3.41E+08	5.9408	17461.	0.00
11.1540	-8.00E-04	-1836.	45.1663	9.79E-05	2320.	3.41E+08	4.2205	18104.	0.00
11.4400	-4.96E-04	-1657.	57.0598	8.03E-05	2290.	3.41E+08	2.7104	18754.	0.00
11.7260	-2.49E-04	-1447.	64.1299	6.46E-05	2255.	3.41E+08	1.4096	19413.	0.00
12.0120	-5.24E-05	-1219.	67.0753	5.12E-05	2217.	3.41E+08	0.3068	20079.	0.00
12.2980	1.02E-04	-987.5923	66.5414	4.01E-05	2179.	3.41E+08	-0.6179	20753.	0.00
12.5840	2.23E-04	-763.3435	63.0950	3.13E-05	2141.	3.41E+08	-1.3906	21434.	0.00
12.8700	3.17E-04	-555.3677	57.2052	2.46E-05	2107.	3.41E+08	-2.0417	22124.	0.00
13.1560	3.92E-04	-371.3636	49.2334	1.99E-05	2076.	3.41E+08	-2.6039	22820.	0.00
13.4420	4.54E-04	-217.9780	39.4293	1.70E-05	2051.	3.41E+08	-3.1095	23525.	0.00
13.7280	5.08E-04	-101.1875	27.9357	1.54E-05	2031.	3.41E+08	-3.5885	24237.	0.00
14.0140	5.59E-04	-26.6502	14.8007	1.47E-05	2019.	3.41E+08	-4.0659	24958.	0.00
14.3000	6.09E-04	0.00	0.00	1.46E-05	2015.	3.41E+08	-4.5592	12843.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection            =     0.35286507 inches
Computed slope at pile head     =    -0.00933136 radians
Maximum bending moment          =         46519. inch-lbs
```

```
Maximum shear force              =  -998.83210457 lbs
Depth of maximum bending moment  =     2.86000000 feet below pile head
Depth of maximum shear force     =     5.72000000 feet below pile head
Number of iterations             =             9
Number of zero deflection points =             2


-----------------------------------------------------------------------------
--
            Summary of Pile-head Responses for Conventional Analyses
-----------------------------------------------------------------------------
--

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R,
in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M,
in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S,
radians


Load Load               Load                  Axial    Pile-head  Pile-head
Max Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation
in Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians
  lbs      in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  V, lb   403.0000  M, in-lb      34869.      4005.     0.3529   -0.00933
-998.8321     46519.


Maximum pile-head deflection = 0.3528650652 inches
Maximum pile-head rotation   = -0.0093313622 radians = -0.534648 deg.

The analysis ended normally.
```

```
===============================================================================
==

                     LPile for Windows, Version 2019-11.007

                 Analysis of Individual Piles and Drilled Shafts
                Subjected to Lateral Loading Using the p-y Method
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-------------------------------------------------------------------------------
--
                             Files Used for Analysis
-------------------------------------------------------------------------------
--

Path to file locations:
\Quoting\SOLAR PRODUCTS\Verogy\2023\Enfield Solar One - Enfield, CT
06082\Geotech\Design\LPILE\Year 0\

Name of input data file:
Enfield_1 ft_W6x7_Avg_WA.lp11d

Name of output report file:
Enfield_1 ft_W6x7_Avg_WA.lp11o

Name of plot output file:
Enfield_1 ft_W6x7_Avg_WA.lp11p

Name of runtime message file:
Enfield_1 ft_W6x7_Avg_WA.lp11r



-------------------------------------------------------------------------------
--
```

```
                           Date and Time of Analysis
--------------------------------------------------------------------------------
--

              Date:  February 9, 2023           Time:  12:13:17


--------------------------------------------------------------------------------
--
                                 Problem Title
--------------------------------------------------------------------------------
--

Project Name: Enfield Solar One


Location: Enfield, CT


Client: Verogy


Engineer: K. Dy


Description: Lateral analysis of W6x7 post (weak axis)




--------------------------------------------------------------------------------
--
                         Program Options and Settings
--------------------------------------------------------------------------------
--

Computational Options:
 - Conventional Analysis
Engineering Units Used for Data Input and Computations:
 - US Customary System Units (pounds, feet, inches)

Analysis Control Options:
 - Maximum number of iterations allowed                =         500
 - Deflection tolerance for convergence                =   1.0000E-05 in
 - Maximum allowable deflection                        =     100.0000 in
 - Number of pile increments                           =          50
```

```
Loading Type and Number of Cycles of Loading:
 - Static loading specified

 - Analysis uses p-y modification factors for p-y curves
 - Analysis uses layering correction (Method of Georgiadis)
 - No distributed lateral loads are entered
 - Loading by lateral soil movements acting on pile not selected
 - Input of shear resistance at the pile tip not selected
 - Input of moment resistance at the pile tip not selected
 - Input of side resistance moment along pile not selected
 - Computation of pile-head foundation stiffness matrix not selected
 - Push-over analysis of pile not selected
 - Buckling analysis of pile not selected

Output Options:
 - Output files use decimal points to denote decimal symbols.
 - Values of pile-head deflection, bending moment, shear force, and
   soil reaction are printed for full length of pile.
 - Printing Increment (nodal spacing of output points) = 1
 - No p-y curves to be computed and reported for user-specified depths
 - Print using wide report formats




------------------------------------------------------------------------------
--
                     Pile Structural Properties and Geometry
------------------------------------------------------------------------------
--

Number of pile sections defined                              =           1
Total length of pile                                         =       14.300 ft
Depth of ground surface below top of pile                    =       1.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth
over
the length of the pile. A summary of values of pile diameter vs. depth
follows.

            Depth Below          Pile
Point        Pile Head         Diameter
 No.           feet             inches
-----      -------------     -------------
  1            0.000            5.7900
  2           14.300            5.7900


Input Structural Properties for Pile Sections:
----------------------------------------------
```

```
Pile Section No. 1:

   Section 1 is an elastic pile
   Cross-sectional Shape                               =   Weak H-Pile
   Length of section                                   =    14.300000 ft
   Flange Width                                        =     3.905000 in
   Section Depth                                       =     5.790000 in
   Flange Thickness                                    =     0.160000 in
   Web Thickness                                       =     0.135000 in
   Section Area                                        =     1.988050 sq. in
   Moment of Inertia                                   =     1.589053 in^4
   Elastic Modulus                                     =    29000000. psi



--------------------------------------------------------------------------------
--
                      Ground Slope and Pile Batter Angles
--------------------------------------------------------------------------------
--

Ground Slope Angle                                     =        0.000 degrees
                                                       =        0.000 radians

Pile Batter Angle                                      =        0.000 degrees
                                                       =        0.000 radians


--------------------------------------------------------------------------------
--
                      Soil and Rock Layering Information
--------------------------------------------------------------------------------
--

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =     1.000000 ft
   Distance from top of pile to bottom of layer        =     4.000000 ft
   Effective unit weight at top of layer               =   100.000000 pcf
   Effective unit weight at bottom of layer            =   100.000000 pcf
   Friction angle at top of layer                      =    28.000000 deg.
   Friction angle at bottom of layer                   =    28.000000 deg.
   Subgrade k at top of layer                          =    25.000000 pci
   Subgrade k at bottom of layer                       =    25.000000 pci


Layer 2 is sand, p-y criteria by Reese et al., 1974

   Distance from top of pile to top of layer           =     4.000000 ft
```

Distance from top of pile to bottom of layer = 15.000000 ft
Effective unit weight at top of layer = 115.000000 pcf
Effective unit weight at bottom of layer = 115.000000 pcf
Friction angle at top of layer = 30.000000 deg.
Friction angle at bottom of layer = 30.000000 deg.
Subgrade k at top of layer = 0.0000 pci
Subgrade k at bottom of layer = 0.0000 pci

NOTE: Default values for subgrade k will be computed for this layer.

(Depth of the lowest soil layer extends 0.700 ft below the pile tip)

Summary of Input Soil Properties

Layer Num.	Soil Type Layer Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Angle of Friction deg.	kpy pci
1	Sand	1.0000	100.0000	28.0000	25.0000
	(Reese, et al.)	4.0000	100.0000	28.0000	25.0000
2	Sand	4.0000	115.0000	30.0000	default
	(Reese, et al.)	15.0000	115.0000	30.0000	default

----

p-y Modification Factors for Group Action

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	2.500	0.7000	1.0000
2	15.000	1.0000	1.0000

```
--------------------------------------------------------------------------------
--
                               Static Loading Type
--------------------------------------------------------------------------------
--

Static loading criteria were used when computing p-y curves for all analyses.



--------------------------------------------------------------------------------
--
                Pile-head Loading and Pile-head Fixity Conditions
--------------------------------------------------------------------------------
--

Number of loads specified = 1

Load    Load         Condition              Condition           Axial Thrust
     Compute Top y     Run Analysis
 No.    Type            1                      2                  Force, lbs
    vs. Pile Length
-----   ----   --------------------   -----------------------
----------------   ---------------    ------------
   1     1     V =    50.000000 lbs   M =   140.000000 in-lbs
4005.          No                Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with
specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.



--------------------------------------------------------------------------------
--
     Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness
--------------------------------------------------------------------------------
--

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:
-------------------
Moment-curvature properties were derived from elastic section properties
```

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	1.0000	0.00	N.A.	No	0.00	1901.
2	4.0000	2.8163	Yes	No	1901.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 50.0 lbs
Applied moment at pile head = 140.0 in-lbs
Axial thrust load on pile head = 4005.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.04072	140.0000	50.0000	-0.00128	2270.	4.61E+07	0.00	0.00	0.00
0.2860	0.03636	329.0738	50.0000	-0.00126	2614.	4.61E+07	0.00	0.00	0.00
0.5720	0.03208	517.8107	50.0000	-0.00123	2958.	4.61E+07			

0.00	0.00	0.00				
0.8580	0.02793	706.0176	50.0000	-0.00118	3301.	4.61E+07
0.00	0.00	0.00				
1.1440	0.02397	893.5017	48.2234	-0.00112	3642.	4.61E+07
-1.0353	148.2624	0.00				
1.4300	0.02023	1068.	41.9692	-0.00105	3960.	4.61E+07
-2.6093	442.7280	0.00				
1.7160	0.01676	1210.	31.3129	-9.64E-04	4220.	4.61E+07
-3.6006	737.1936	0.00				
2.0020	0.01361	1309.	18.1151	-8.71E-04	4400.	4.61E+07
-4.0904	1032.	0.00				
2.2880	0.01079	1359.	3.9437	-7.71E-04	4490.	4.61E+07
-4.1680	1326.	0.00				
2.5740	0.00831	1358.	-7.9358	-6.70E-04	4488.	4.61E+07
-2.7548	1137.	0.00				
2.8600	0.00619	1323.	-16.8611	-5.70E-04	4424.	4.61E+07
-2.4464	1357.	0.00				
3.1460	0.00440	1258.	-24.5360	-4.74E-04	4306.	4.61E+07
-2.0261	1581.	0.00				
3.4320	0.00293	1167.	-30.6640	-3.84E-04	4141.	4.61E+07
-1.5450	1809.	0.00				
3.7180	0.00176	1058.	-35.1142	-3.01E-04	3941.	4.61E+07
-1.0483	2041.	0.00				
4.0040	8.65E-04	934.5282	-38.7908	-2.27E-04	3717.	4.61E+07
-1.0943	4343.	0.00				
4.2900	2.05E-04	797.5942	-41.1615	-1.62E-04	3468.	4.61E+07
-0.2872	4801.	0.00				
4.5760	-2.50E-04	656.4607	-40.9954	-1.08E-04	3211.	4.61E+07
0.3840	5267.	0.00				
4.8620	-5.38E-04	519.1784	-38.7924	-6.45E-05	2960.	4.61E+07
0.8998	5740.	0.00				
5.1480	-6.93E-04	391.9627	-35.0928	-3.06E-05	2729.	4.61E+07
1.2562	6221.	0.00				
5.4340	-7.48E-04	279.1421	-30.4281	-5.59E-06	2523.	4.61E+07
1.4621	6710.	0.00				
5.7200	-7.31E-04	183.2576	-25.2839	1.16E-05	2348.	4.61E+07
1.5357	7206.	0.00				
6.0060	-6.68E-04	105.2737	-20.0733	2.24E-05	2206.	4.61E+07
1.5008	7710.	0.00				
6.2920	-5.78E-04	44.8595	-15.1225	2.80E-05	2096.	4.61E+07
1.3842	8222.	0.00				
6.5780	-4.76E-04	0.7038	-10.6663	2.97E-05	2016.	4.61E+07
1.2126	8742.	0.00				
6.8640	-3.74E-04	-29.1692	-6.8512	2.86E-05	2068.	4.61E+07
1.0106	9269.	0.00				
7.1500	-2.80E-04	-47.1090	-3.7456	2.58E-05	2100.	4.61E+07
0.7992	9804.	0.00				
7.4360	-1.97E-04	-55.5874	-1.3532	2.19E-05	2116.	4.61E+07
0.5950	10347.	0.00				
7.7220	-1.29E-04	-57.0006	0.3716	1.77E-05	2118.	4.61E+07
0.4102	10897.	0.00				
8.0080	-7.56E-05	-53.5244	1.5082	1.36E-05	2112.	4.61E+07
0.2522	11455.	0.00				

8.2940	-3.56E-05	-47.0228	2.1551	9.89E-06	2100.	4.61E+07	0.1248	12021.	0.00
8.5800	-7.71E-06	-39.0033	2.4178	6.68E-06	2086.	4.61E+07	0.02829	12595.	0.00
8.8660	1.02E-05	-30.6107	2.3989	4.09E-06	2070.	4.61E+07	-0.03931	13176.	0.00
9.1520	2.04E-05	-22.6497	2.1913	2.11E-06	2056.	4.61E+07	-0.08166	13765.	0.00
9.4380	2.47E-05	-15.6274	1.8739	6.81E-07	2043.	4.61E+07	-0.1033	14362.	0.00
9.7240	2.50E-05	-9.8062	1.5092	-2.66E-07	2032.	4.61E+07	-0.1092	14966.	0.00
10.0100	2.29E-05	-5.2608	1.1438	-8.27E-07	2024.	4.61E+07	-0.1038	15578.	0.00
10.2960	1.94E-05	-1.9325	0.8089	-1.10E-06	2018.	4.61E+07	-0.09134	16198.	0.00
10.5820	1.53E-05	0.3219	0.5231	-1.16E-06	2015.	4.61E+07	-0.07524	16826.	0.00
10.8680	1.14E-05	1.6897	0.2942	-1.08E-06	2018.	4.61E+07	-0.05812	17461.	0.00
11.1540	7.93E-06	2.3712	0.1227	-9.29E-07	2019.	4.61E+07	-0.04184	18104.	0.00
11.4400	5.05E-06	2.5575	0.00359	-7.46E-07	2019.	4.61E+07	-0.02757	18754.	0.00
11.7260	2.81E-06	2.4163	-0.07104	-5.60E-07	2019.	4.61E+07	-0.01592	19413.	0.00
12.0120	1.20E-06	2.0852	-0.1104	-3.93E-07	2018.	4.61E+07	-0.00702	20079.	0.00
12.2980	1.18E-07	1.6693	-0.1237	-2.53E-07	2018.	4.61E+07	-7.12E-04	20753.	0.00
12.5840	-5.37E-07	1.2434	-0.1191	-1.45E-07	2017.	4.61E+07	0.00335	21434.	0.00
12.8700	-8.74E-07	0.8556	-0.1037	-6.63E-08	2016.	4.61E+07	0.00563	22124.	0.00
13.1560	-9.92E-07	0.5334	-0.08271	-1.46E-08	2016.	4.61E+07	0.00660	22820.	0.00
13.4420	-9.74E-07	0.2883	-0.05992	1.60E-08	2015.	4.61E+07	0.00668	23525.	0.00
13.7280	-8.83E-07	0.1217	-0.03776	3.12E-08	2015.	4.61E+07	0.00623	24237.	0.00
14.0140	-7.60E-07	0.02829	-0.01758	3.68E-08	2015.	4.61E+07	0.00553	24958.	0.00
14.3000	-6.30E-07	0.00	0.00	3.79E-08	2015.	4.61E+07	0.00472	12843.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```
Pile-head deflection              =     0.04071970 inches
Computed slope at pile head       =    -0.00127648 radians
Maximum bending moment            =          1359. inch-lbs
```

```
Maximum shear force              =    50.00000000 lbs
Depth of maximum bending moment  =     2.28800000 feet below pile head
Depth of maximum shear force     =     0.28600000 feet below pile head
Number of iterations             =              6
Number of zero deflection points =              3


------------------------------------------------------------------------------
--
            Summary of Pile-head Responses for Conventional Analyses
------------------------------------------------------------------------------
--

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R,
in-lbs/rad.
Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M,
in-lbs
Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S,
radians


Load Load                Load                  Axial    Pile-head  Pile-head
Max Shear Max Moment
Case Type   Pile-head    Type     Pile-head   Loading  Deflection  Rotation
in Pile    in Pile
 No.  1      Load 1       2        Load 2       lbs      inches     radians
  lbs      in-lbs
---- ----- ---------- ---------- ---------- ---------- ---------- ----------
---------- ----------
  1  V, lb    50.0000  M, in-lb    140.0000      4005.    0.04072   -0.00128
 50.0000      1359.


Maximum pile-head deflection = 0.0407197009 inches
Maximum pile-head rotation   = -0.0012764825 radians = -0.073137 deg.

The analysis ended normally.
```

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A Division of Northern States Metals

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YOUNGSTOWN, OH 44509
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Verogy
150 Trumbull Street
Hartford, CT 06103

April 3, 2023

SUBJECT: Corrosion Evaluation for Enfield Solar One Solar Project in Enfield, Hartford County, Connecticut

To Whom it Concerns,

Solar FlexRack (SFR) has reviewed gathered information and has completed a site-specific corrosion hazard evaluation to estimate metal loss for metal exposed to the atmosphere at the subject solar site. A summary of SFR's methodologies and results is presented in this letter.

Basis of Buried Metal Corrosion Evaluation

In the development of a methodology to evaluate the corrosion hazard of a ground-mount solar site, SFR has reviewed methodologies applicable to buried metal advocated by various industry corrosion experts including the American Water Works Association (AWWA), the National Association of Corrosion Engineers (NACE), the American Association of State Highway Transportation Officials (AASHTO), and the Federal Highway Administration (FHWA). Each of these entities routinely uses buried metal in the construction and maintenance of infrastructure.

Each of the above entities generally classifies a corrosion hazard based on measured geochemical and electrochemical properties using a numerical ranking scheme which results in a qualitative ranking ranging from "mildly/moderately corrosive" to "highly corrosive." Some of the readily measurable geochemical and electrochemical properties commonly considered in the evaluation of corrosion potential include:

- apparent minimum electrical resistivity,
- soil pH,
- water-soluble chlorides,
- water-soluble sulfates,
- oxidation-reduction (redox) potential, and,
- gravimetric water content.

Owing to the relatively light steel sections which commonly serve as foundations for SFR solar projects; corrosion hazard evaluation guidelines and associated metal loss rates developed by FHWA and adopted by AASHTO from research conducted on buried galvanized steel reinforcement strips were adopted internally by SFR for application to its solar projects. These guidelines can be found in Technical Publication No. FHWA-NHI-00-044. For the subject site, the soil chemistry data contained in Table 1 was available and was considered.

Table 1: Laboratory Corrosion Suite Results

LOCATION	DEPTH (ft.)	pH	SULFATES (mg/kg)	SULFIDES (mg/kg)	CHLORIDES (mg/kg)	REDOX (mV)	MIN SOIL RESISTIVITY (Ω-cm)
B-2	0 – 4	8.3	18	NR	NR	NR	31,560
B-4	0 – 4	6.9	9	NR	NR	NR	63,020
B-9	0 – 4	8.7	23	NR	NR	NR	33,580

NR = Not Reported

Based mainly on the measured soil parameters, a mildly corrosive environment to buried steel was considered by SFR. Other metrics suggest a mildly corrosive to non-corrosive environment.

Buried Metal Loss Calculations

From SFR's review of FHWA guidelines developed from the above-described studies, for galvanized steel in moderately corrosive environments, the suggested zinc metal loss rate is 0.58 mil/yr. for the first 2 years and 0.16 mil/yr. thereafter until depletion, and the loss rate for unprotected carbon steel is 0.47 mil/yr. To account for increasingly corrosive environments (on a qualitative basis), the FHWA suggests an incremental 25 percent increase be applied to these metal loss rates for corresponding incremental increases in corrosion potential. Accordingly, given the available information, the above metal loss rates as prescribed by FHWA were utilized in the analysis.

Using the factored loss rates for zinc metal, a 3-mil hot-dipped galvanic coating will be depleted in approximately 14 years, after which time, consumption of the carbon steel will begin (both sides). Table 2 shows the estimated stress utilization ratio in the new and corroded sections (expressed as a percent) for a design event occurring at year 0 and for a design event occurring at year 35 for a W6x7 post extending 67 inches above ground surface, and a W6x15 post extending approximately 70 inches above ground surface. This analysis accounts for minor terrain irregularities.

Table 2: Steel Thickness with Time and Resultant Percent Utilization at Year 35

Section	Element	Steel Thickness at Year 0 (in.)	Steel Thickness at Year 35 (in.)	Percent Loss	Utilization Ratio at Year 0 (%)	Utilization Ratio at Year 35 (%)
W6x7	Web	0.129	0.109	15.3	57.0	68.0
	Flange	0.165	0.145	12.0		
W6x15	Web	0.230	0.210	8.6	53.4	59.0
	Flange	0.260	0.240	7.6		

The stress utilization ratio is the ratio of the applied stress to the available stress capacity (compression and flexure) of a given steel section. A stress utilization ratio of 100 percent indicates that the applied stress in the section has reached its allowable limit. A stress utilization ratio exceeding 100 percent indicates the section is overstressed. The controlling state of stress in the section arising from the design event occurring at year 0 and that in the corroded section at year 35 result from the controlling ASCE 7 basic load combination shown below in Table 3.

Table 3: Controlling ASCE Load Combination

Year 0	W6x7	D + 0.6W
Year 35		
Year 0	W6x15	D + 0.6W
Year 35		

In Table 3, as applicable, D is the dead load, W is the wind load, S is the snow load and E is the earthquake load. Buried metal loss for the section considered is plotted with time on Figure 1 attached to this letter.

Basis of Atmospheric Corrosion Evaluation

In the adoption of a methodology to evaluate the long-term corrosion hazard to the portions of the rack and foundation exposed to the atmosphere, SFR applied International Organization for Standardization (ISO) guidelines. These guidelines can be found in ISO publications ISO 8044-2020, ISO 9223-2012, ISO 9224-2012, ISO 9225-2012, ISO 9226-2012, and ISO 11303-2002. Computations used to evaluate metal loss with time consider mainly averaged annual climatic conditions and specific exposure to suspended atmospheric salts (excluding direct saltwater spray and/or road-deicing solutions), and exposure to atmospheric sulfur compounds (urban and industrial air pollution).

Atmospheric Metal Loss Calculations

Pursuant to ISO 9223, the zinc metal loss rate in the first year may be calculated using the following relationship:

$$\boldsymbol{r_{corr}} = 0.0129P_d^{0.44}e^{0.46RH+f_{Zn}} + 0.0175S_d^{0.57}e^{0.008RH+0.085T}$$

Where

r_{corr}	is first-year corrosion rate of zinc metal (μ/yr.)
T	is the average annual ambient temperature (°C)
RH	is the average annual relative humidity (%)
P_d	is the average annual sulfur dioxide (SO_2 deposition rate ($^{mg}/_{m^2 d}$)
S_d	is the average annual chloride ion (Cl^-) deposition rate ($^{mg}/_{m^2 d}$)
f_{Zn}	is a temperature factor = -0.071(T-10) for T > 10 °C

The proportion of the variance (R^2) in the dependent variable that is predictable (from the independent variable) is 0.82. An R^2 of 1.0 indicates that the regression predictions perfectly fit the data.

In the estimation of the atmospheric corrosion potential to exposed metal, field testing on galvanized steel coupons was not available to estimate the first-year metal loss and so a cursory review of available geographic, physiographic, and climatic information was undertaken. The region is mapped by the Köppen climate classification as a humid, subtropical climate. From a brief review of the past 10 years of wind direction information from local meteorological stations, the prevailing direction appears to be from southeasterly direction. The nearest mapped point-sources of industrial fossil fuel emissions appear to include the Berkshire Power gas power plant located approximately 7 miles northwest, the Essential Power Massachusetts LLC gas power plant located approximately 8 miles northwest, the Masspower gas power plant located approximately 11 miles north, the Pepperidge Farm Bloomfield gas power plant located approximately 13 miles southwest, and the Stony Brook oil power plant located approximately 14 miles north. A US Environmental Protection Agency monitored point-source of sulfur dioxide emissions was not identified. The nearest mapped source of urban emissions appear to be the city of Hartford, located approximately 18 miles northeast of the site. The project site location is inland and rural in nature, and a source of direct salt spray was not apparent. Soil chemistry results indicate a low concentration of chloride ions. According to United States Geological Survey (USGS) quadrangles, the area of interest sits at an elevation of approximately 180 feet above mean sea level. According to the US Department of Agriculture Natural Resources Conservation Service (NRCS), the average annual precipitation ranges between 36 and 71 inches and the area is reported to be well drained. The extreme-event (100 year) air freezing index is mapped by the National Oceanic and Atmospheric Administration to be up to 1,000 degree-Fahrenheit days.

Available National Atmospheric Deposition Program (NADP) mapping was reviewed for annual chloride and sulfur deposition rates for the subject site. An average annual sulfur dioxide (SO_2) deposition rate of 1.09 milligrams per square meter per day ($^{mg}/_{m^2}/_{d}$) and an average annual chloride (Cl^-) deposition rate of 0.66 $^{mg}/_{m^2}/_{d}$ were considered in the analysis. From available meteorological data, an average annual air temperature of 10.8 Celsius degrees, and an average annual relative humidity of 70.1 percent were considered. SFR also considered the estimated ISO corrosivity mapping from the Whole Building Design Group (WBDG), which indicated a Corrosivity Category of C2. As the NADP mapped values indicated a C2 environment from analysis, SFR considered the upper bound zinc loss rate values from ISO. From this information and the relationship above, a first-year zinc metal loss rate on the order of 0.028 mil/yr. was utilized in the analysis. These calculations assume that the panels are installed and provide the rack with some shelter from direct meteoric water.

Pursuant to ISO 9224-2012, from the first-year metal loss rate, the total future metal loss can be computed beyond year 20 using the following relationship:

$$D = r_{corr}(20^b + b(20^{b-1})(t-20))$$

Where

D	is the total metal loss (μ)
r_{corr}	is the first-year corrosion rate of zinc metal (μ/yr.)
t	is the exposure time (yr.)
b	is the metal-environment-specific time component (dimensionless, usually < 1)

It is understood that zinc coating performance up to year 35 (t > 20 yr.) is desired. Given this extended exposure time and uncertainties involved with estimations of metal loss made beyond year 20, the short-term b-factor in the above expression was increased from the suggested t < 20 yr. value (0.813) by two standard deviations to achieve a 95 percent confidence interval in the statistical data.

Using the above long-term loss relationship for zinc metal, up to 0.60 mil of zinc electroplating will be lost by year 35. The minimum thickness of zinc electroplating associated with G90 protection is 0.76 mil. Following depletion of the zinc electroplating, bare carbon steel will be consumed at a rate of 0.98 mil/yr. Zinc metal loss is plotted with time on Figure 2 attached to this letter.

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Conclusions

From the buried metal loss calculations and the calculated utilization ratios shown in Table 2, it is not unreasonable to conclude that galvanized steel post foundations at the subject solar site will perform in a satisfactory manner during a design event occurring up to at least year 35.

From the atmospheric metal loss calculations, a G-90 galvanic coating may be expected to provide corrosion protection up to year 35 and the racking members may be expected to perform in a satisfactory manner during a design event occurring up to year 35.

Limitations

The above analyses were based on best practices as adopted internally by SFR. Other methodologies or practices by other engineering professionals may yield different results. The analyses were based upon a reasonable effort to identify corrosion hazards to buried metal and to metal exposed to the conditions at the subject site. A more comprehensive approach to estimate metal loss rates could include field testing of buried hot-dipped zinc-coated steel coupons and unburied electroplated zinc-coated steel coupons in general accordance with ISO 9225. Direct atmospheric gas sampling and analysis in accordance with ISO 9226 could also be considered. The above analyses are provided at the customer's request for informational purposes in lieu of these options, and SFR's Standard Warranty as agreed to by contract remains in full-effect and is unchanged.

Closure

SFR appreciates the opportunity to be of service to you and we look forward to working with you in the future. Please do not hesitate to contact us if there are questions or further need.

Respectfully Submitted,

Prepared by:

Kuchanda I. Dy, PE
Geotechnical Engineer

Reviewed by:

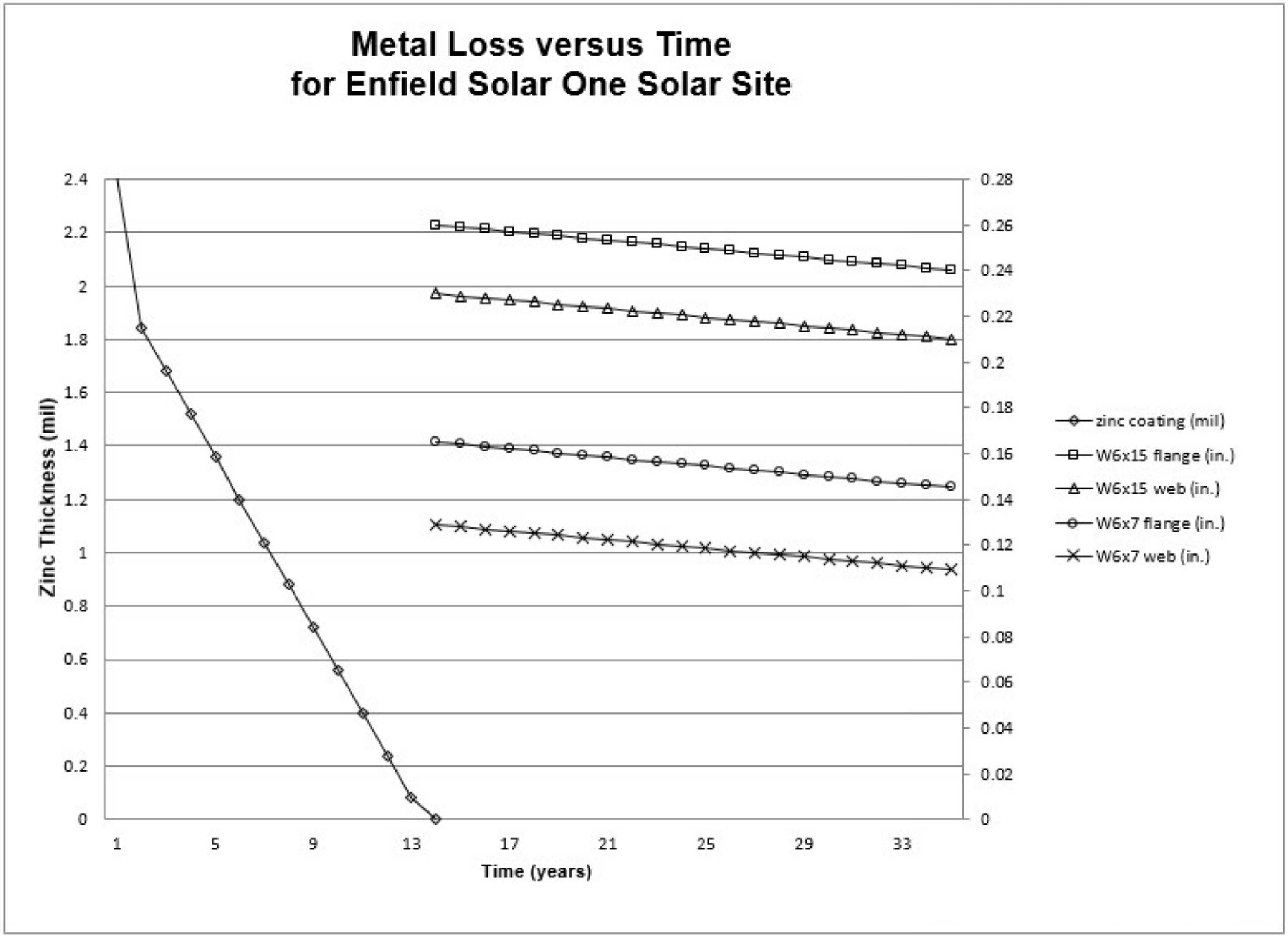
Greg Huzyak, PE
Director of Engineering

Approved by:

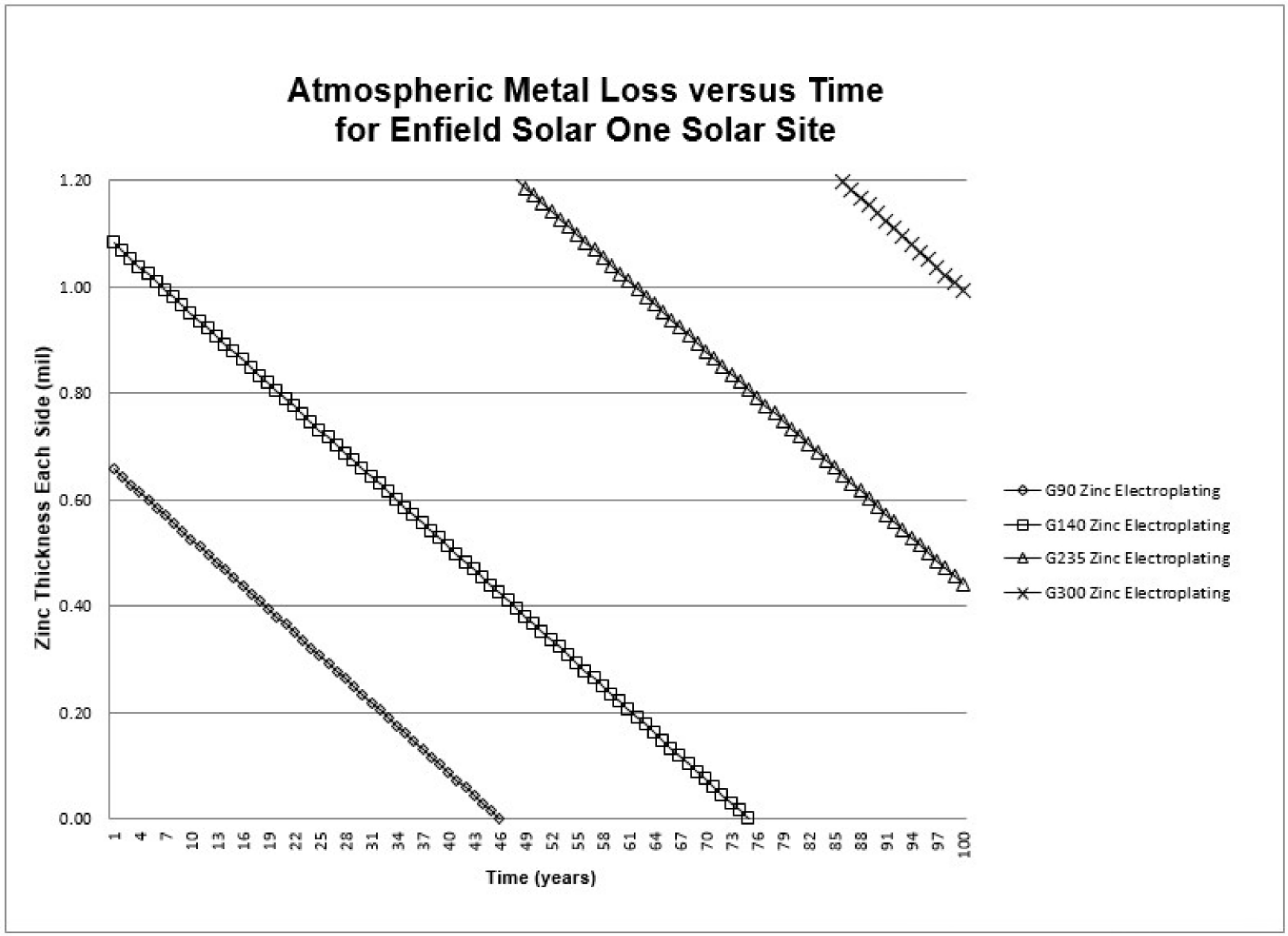
Michael Herman
Director of Renewable Energy

Attachments
Figure 1: Buried Metal Loss with Time
Figure 2: Atmospheric Metal Loss with Time

FIGURES



PROJECT	ENFIELD SOLAR ONE SOLAR SITE				
TITLE	BURIED METAL LOSS VERSUS TIME				
CLIENT	VEROGY				
SOLAR FLEXRACK					
DESIGNED BY	SFR	LOCATION	PROJECT NUMBER	FIGURE NUMBER	REVISION
DRAWN BY	SFR	2023	-	1	0
ACTIVITY CODE	N/A	XREF NUMBER	N/A		



PROJECT	ENFIELD SOLAR ONE SOLAR SITE				
TITLE	ATMOSPHERIC METAL LOSS VERSUS TIME				
CLIENT	VEROGY				
DESIGNED BY	SFR	LOCATION	PROJECT NUMBER	FIGURE NUMBER	REVISION
DRAWN BY	SFR	2023	-	2	0
ACTIVITY CODE	N/A	XREF NUMBER	N/A		

PROPOSED SOLAR POWER SITE:

ENFIELD SOLAR ONE
41°59'42.02"N, 72°31'32.12"W
110 NORTH STREET
ENFIELD, CT 06082

PREPARED FOR:

VEROGY
150 TRUMBULL STREET
HARTFORD, CT 06103

PREPARED BY:

SOLAR FLEXRACK
A DIVISION OF NORTHERN STATES METALS
3207 INNOVATION PLACE
YOUNGSTOWN, OHIO 44509
PHONE: 1-888-380-8138

ARRAY LOCATION

PROJECT SITE

NORTH

SHEET INDEX: FLEXTRACK S-SERIES

		SIGN-OFF MAR. 13, 2023	STAMPED SET April 6, 2023		
S1	PV MODULE SPECIFICATION SHEETS	●	●		
S2	1X78 RACK PLAN VIEW, ELEVATION, & NOTES	●	●		
S3	1X52 RACK PLAN VIEW, ELEVATION, & NOTES	●	●		
S4	ISO VIEW, BILL OF MATERIAL, & HARDWARE DETAILS	○	●		
S5	TRACKER CONNECTIONS – DRIVE POST & SPLICE CONNECTION DETAILS	○	●		
S6	TRACKER CONNECTIONS – IDLER POST & VERTICAL RAIL CONNECTION DETAILS	○	●		
S7	TRACKER CONNECTIONS – DAMPER & PANEL CONNECTION DETAILS	○	●		

ISSUANCE/REVISION

LEGEND:
● ISSUED
○ REVISED, BUT NOT ISSUED

GENERAL NOTES:

1. CODES AND STANDARDS:
IBC 2021
NEC 2020
AISC 360-16
AISI S100-16
ASCE 7-16

2. WIND DESIGN PARAMETERS:
ULTIMATE DESIGN WIND SPEED, V – 107 MPH
RISK CATEGORY – I
WIND EXPOSURE CATEGORY C, K_z – 0.85
TOPOGRAPHICAL FACTOR, K_{zt} – 1.00
WIND DIRECTIONALITY FACTOR, K_d – 0.85
GUST FACTOR & NET PRESSURE COEFFICIENT, GCN
–GCN COEFFICIENTS DETERMINED BASED ON RWDI WIND TUNNEL TESTING (RWDI PROJECT NO. 1401529)
–SEE SFR STRUCTURAL REPORT FOR PROJECT SPECIFIC GCN COEFFICIENTS.

3. SNOW DESIGN PARAMETERS:
GROUND SNOW LOAD – 35 PSF
EXPOSURE CATEGORY, Ce – 0.90
SNOW THERMAL FACTOR, Ct – 1.20
SNOW IMPORTANCE FACTOR, I – 0.80
SNOW REDUCTION FACTOR SLIPPERY SURFACES, Cs

TILT ANGLE	Cs VALUE
0°-15°	1.00
20°	0.91
25°	0.82
30°	0.73
35°	0.64
40°	0.55
45°	0.46
50°	0.37
55°	0.28

4. EARTHQUAKE DESIGN PARAMETERS – EQUIVALENT LATERAL FORCE:
RISK CATEGORY – I
SITE CLASS – D
SEISMIC IMPORTANCE FACTOR, Ie – 1.0
RESPONSE MODIFICATION COEFFICIENT, R – 2
SPECTRAL RESPONSE ACCELERATION PARAMETERS

MAPPED	DESIGN
S_S – 0.172g	S_{DS} – 0.183g
S_1 – 0.055g	S_{D1} – 0.088g

SEISMIC DESIGN CATEGORY – D
SEISMIC RESPONSE COEFFICIENT, Cs – 0.092

5. FOUNDATIONS:
FOUNDATION DESIGN DERIVED FROM GEOTECHNICAL REPORT PROVIDED BY DOWN TO EARTH CONSULTING DATED MAR. 2022 (FILE NO. 0032-060.00)

6. APPLICABLE INSTALLATION TOLERANCES (PER SINGLE TRACKER):
N-S POST SPACING: ±1 ½"
N-S SLOPE: 5%
E-W POST ALIGNMENT: ±¾"
IDLER POST HEIGHT OUT OF STRING-LINE: ±1"
POST PLUMB: ±1°
POST TWIST: ±3°
TUBE TWIST: ±2°

POST TOLERANCES ARE REFERENCED AT TOP-OF-POST LOCATION.
DRIVE POST HEIGHT ABOVE GRADE IS 3" ABOVE IDLER POSTS
MINIMUM RECOMMENDED CLEARANCE BETWEEN TRACKERS NO LESS THAN 12".

POST EMBEDMENT AND ABOVE GRADE TOLERANCES ARE SHOWN ON S2-S3. S2-S3 TOLERANCES GIVEN TO ASSIST WITH VARIATIONS IN GRADE.

7. CONNECTIONS:
A. SNUG TIGHT: ALL CONNECTIONS TO BE SNUG TIGHT PER THE RESEARCH COUNCIL OF STRUCTURAL CONNECTIONS (AISC RCSC) UNLESS OTHERWISE NOTED PERFORM VISUAL INSPECTION TO ENSURE PLIES IN THE CONNECTION HAVE BEEN PULLED INTO FIRM CONTACT

B. TURN-OF-NUT: SOME ASTM F3125 GRADE A325 BOLTS MUST BE FASTENED BY TURN OF THE NUT METHOD PER THE RESEARCH COUNCIL OF STRUCTURAL CONNECTIONS (AISC RCSC). FIRST ENSURE FASTENER IS SNUG TIGHT. THEN TURN NUT TO ANGLE BEYOND INITIAL TORQUE MARK AS CALLED OUT IN RESPECTIVE CONNECTION DETAIL(S).

DESIGN ACCOUNTS FOR COMPLETE INSTALLATION PRIOR TO A CLIMATIC OR DESIGN EVENT PER CONTRACT DOCUMENTS. MEANS AND METHODS FALL UNDER THE RESPONSIBILITY OF THE CONTRACTOR.

8. PV MODULE INFORMATION:
NAME/MODEL: MONO-PERC BM6-10B-T 545W
DIMENSIONS: 89.685" LONG X 44.646" WIDE X 1.378" TALL
WEIGHT: 61.29 LBS
VERSION: UL-EN-VERSION 2022.11.18

9. MATERIALS AND COATINGS:
A. PILES:
I. W-SECTIONS: A992 STEEL HOT DIPPED GALVANIZED PER ASTM A123.
B. HARDWARE:
I. ¾"ø TO BE F3125 GRADE A325 HOT DIPPED GALVANIZED PER ASTM A153.
II. ⅝"ø TO BE F3125 GRADE A325 HOT DIPPED GALVANIZED PER ASTM A153.
III. ½"ø TO BE F3125 GRADE A325 HOT DIPPED GALVANIZED PER ASTM A153.
IV. ⅜"ø TO BE A449 MECHANICAL GALVANIZED PER MAGNI 560.
V. 5/16"ø TO BE A449 MECHANICAL GALVANIZED PER MAGNI 560 OR STAINLESS STEEL.
VI. ¼"ø TO BE A449 MECHANICAL GALVANIZED PER MAGNI 560 OR STAINLESS STEEL.
C. COLD FORMED STEEL:
I. ALL COLD FORM STEEL TO BE PRE GALVANIZED PER A653 UNLESS OTHERWISE NOTED.

10. SPECIAL INSPECTIONS:
THE FOLLOWING SPECIAL INSPECTIONS MAY BE REQUIRED PER IBC CHAPTER 17. CHECK WITH LOCAL BUILDING OFFICIAL FOR APPLICABILITY.
DRIVEN PILES..(CONTINUOUS)
–SEE IBC 2021, TABLE 1705.7, ITEMS 1-5
ASTM A325 BOLTS AND FASTENERS.........................(PERIODIC)
–SEE AISC 360-16, SECTION N5.6
ASTM A307 BOLTS AND FASTENERS
–NOT REQUIRED

ABBREVIATIONS

MIN	MINIMUM	BC	BEARING CRADLE
MAX	MAXIMUM	C-C	CENTER TO CENTER
OH	OVERHANG	CD	CRITICAL DIMENSION
PAG	POST ABOVE GRADE	CTA	CENTRAL TUBE AXIS
REF	REFERENCE	DIM	DIMENSION
DIA	DIAMETER	EOP	END OF PANEL
TYP	TYPICAL	HORIZ	HORIZONTAL
VERT	VERTICAL	HDG	HOT DIPPED GALVANIZED
STD	STANDARD	PLN	PLAIN
RV	RECEIVER	SWG	SWAGED
CP	CLAMP	EOT	END OF TUBE
S/C	STOCK CODE		

CUSTOMER: VEROGY
ENFIELD SOLAR ONE
ENFIELD, CT 06082

DATE: 04/06/2023 | JOB #: 17071 | PAGE: S0 of S7
DRAWN BY: NSZ | CHECK BY: JRD

COVER SHEET

Sheet S0

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A Division of Northern States Metals
3207 Innovation Place
Youngstown, OH 44509-4023
Phone (888) 380-8138

REV	DESCRIPTION	CHG. BY	DATE

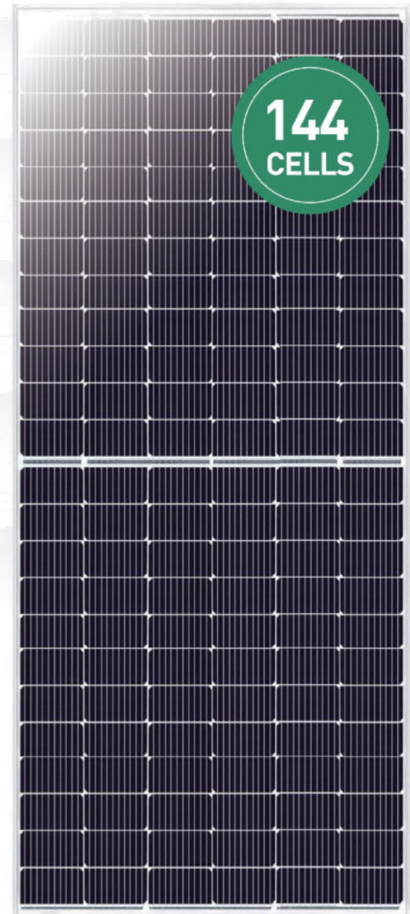
STATE OF CONNECTICUT
BRIAN M. FLOOD
LICENSED PROFESSIONAL ENGINEER
29923

Phono® Solar

BIFACIAL TWINPLUS MODULE SERIES

HIGH EFFICIENCY MONO-PERC BM6-10B-T

535-555W



EXTRAORDINARY PRODUCT PERFORMANCE

- Up to 25% additional power yield benefited from bifacial technology
- Lower power loss in cell connection and under shading conditions
- Competitive high-temperature performance with ameliorated temperature coefficient
- Higher power generation with multi-busbar and half-cut technology

HIGH QUALITY RELIABILITY

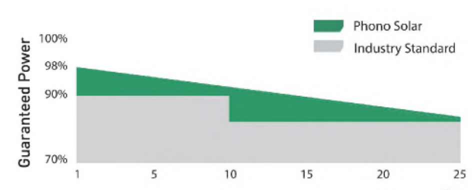
- Optimized electrical design lowers hot spot risk and operating current
- Corrosion resistance guarantees enhanced reliability in harsh environments
- Minimized Risk of microcrack and snail trail

EASY INSTALLATION

- Framed design improves mounting and racking method compatibility
- Safer and easier handling during transportation and installation

PID RESISTANT

- Industry-leading cell processing techonology and electrical design ensures solid PID resistance



12-year Product Warranty | **25-year** Linear Performance Warranty

MANAGEMENT SYSTEM CERTIFICATES

IEC 61215, IEC 61730, UL 61730
ISO 9001:2015 / Quality management system
ISO 14001:2015 / Standards for environmental management system
ISO 45001:2018 / International standards for occupational health & safety

Bloomberg NEW ENERGY FINANCE Tier 1

TOP PERFORMER 2022 PVEL PV MODULE RELIABILITY SCORECARD

www.phonosolar.com   info@phonosolar.com

ELECTRICAL TYPICAL VALUES

Model	1000V	PS535M8-24/THB		PS540M8-24/THB		PS545M8-24/THB		PS550M8-24/THB		PS555M8-24/THB	
	1500V	PS535M8H-24/THB		PS540M8H-24/THB		PS545M8H-24/THB		PS550M8H-24/THB		PS555M8H-24/THB	
Testing Condition		STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Rated Power (Pmpp)		535	398	540	402	545	405	550	409	555	413
Rated Current (Impp)		12.97	10.48	13.06	10.55	13.15	10.63	13.24	10.70	13.33	10.77
Rated Voltage (Vmpp)		41.25	37.98	41.35	38.07	41.45	38.16	41.55	38.25	41.64	38.34
Short Circuit Current (Isc)		13.52	10.92	13.62	11.00	13.72	11.09	13.82	11.17	13.92	11.25
Open Circuit Voltage (Voc)		49.29	46.53	49.39	46.62	49.49	46.72	49.59	46.81	49.69	46.91
Module Efficiency (%)		20.71		20.90		21.10		21.29		21.48	

STC(Standard Testing Conditions):Irrandance 1000W/m², AM 1.5, Cell Temerature 25°C
NOCT (Nominal Operation Cell Temperature): Irradiance 800W/m², Ambient Temperature 20°C, Spectra at AM1.5, Wind at 1m/S

BIFACIAL ELECTRICAL VALUES

5%	Maximum Power (W)	554	559	564	569	574
	Module Efficiency (%)	21.44	21.64	21.84	22.04	22.24
15%	Maximum Power (W)	591	597	602	608	613
	Module Efficiency (%)	22.88	23.10	23.31	23.53	23.74
25%	Maximum Power (W)	629	635	640	646	652
	Module Efficiency (%)	24.33	24.56	24.79	25.02	25.24

MECHANICAL CHARACTERISTICS

Cell Type	Monocrystalline 182mm x 91mm
Dimension (L× W × H)	Length: 2278mm (89.69 inch) Width: 1134mm (44.65 inch) Height: 35mm (1.38 inch)
Weight	27.8kg (61.29 lbs)
Front Glass	3.2mm Toughened Glass
Frame	Anodized Aluminium Alloy
Cable	4mm² (IEC), (+):450mm,(-):250mm or Customized Length
Junction Box	IP 68 Rated

TEMPERATURE RATINGS

Voltage Temperature Coefficient	-0.28%/°C
Current Temperature Coefficient	+0.05%/°C
Power Temperature Coefficient	-0.35%/°C
Tolerance	0~+5w
NOCT	45±2°C
Bifaciality	70±5%

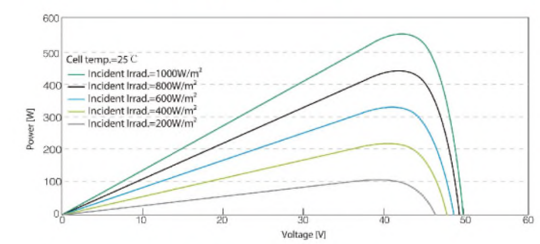
ABSOLUTE MAXIMUM RATING

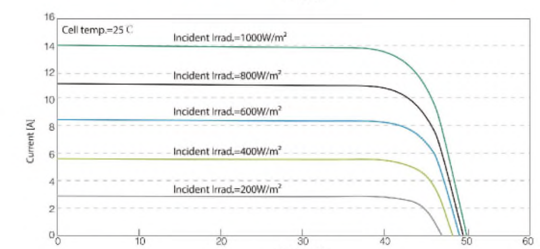
Operating Temperature	From -40 to +85°C
Hail Diameter @ 80km/h	Up to 25mm
Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Maximum Series Fuse Rating	30A
PV Module Classification	II
Module Fire Performance(UL 61730)	Type 4
Maximum System Voltage	DC 1000V/1500V

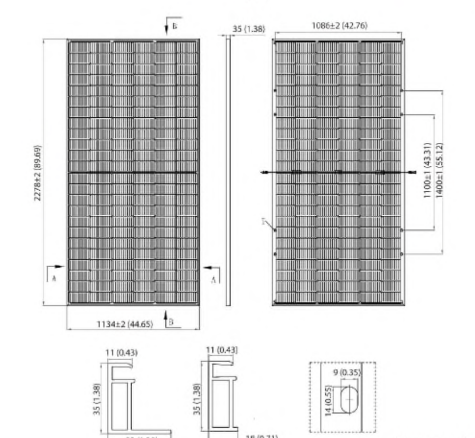
PACKING CONFIGURATION

Container	20' GP	40' HQ
Pieces/Container	155	620

ELECTRICAL CHARACTERISTICS







Phono® Solar

PHONO SOLAR TECHNOLOGY CO.,LTD reserves the right to make necessary adjustments to the information described herein at any time without further notice. The specifications and certificates contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. Please be sure to use the most recent version of data.

REV	DESCRIPTION	CHG. BY	DATE

SOLAR FLEXRACK A Division of Northern States Metals
3207 Innovation Place
Youngstown, OH 44509-4023
Phone (888) 380-8138

PV MODULE SPECIFICATION SHEETS

CUSTOMER: VEROGY
ENFIELD SOLAR ONE
ENFIELD, CT 06082

DATE: 04/06/2023	JOB #: 17071
DRAWN BY: NSZ	CHECK BY: JRD
PAGE: S1 of S7	Sheet S1

STATE OF CONNECTICUT BRIAN M. FLOOD 29323 LICENSED PROFESSIONAL ENGINEER

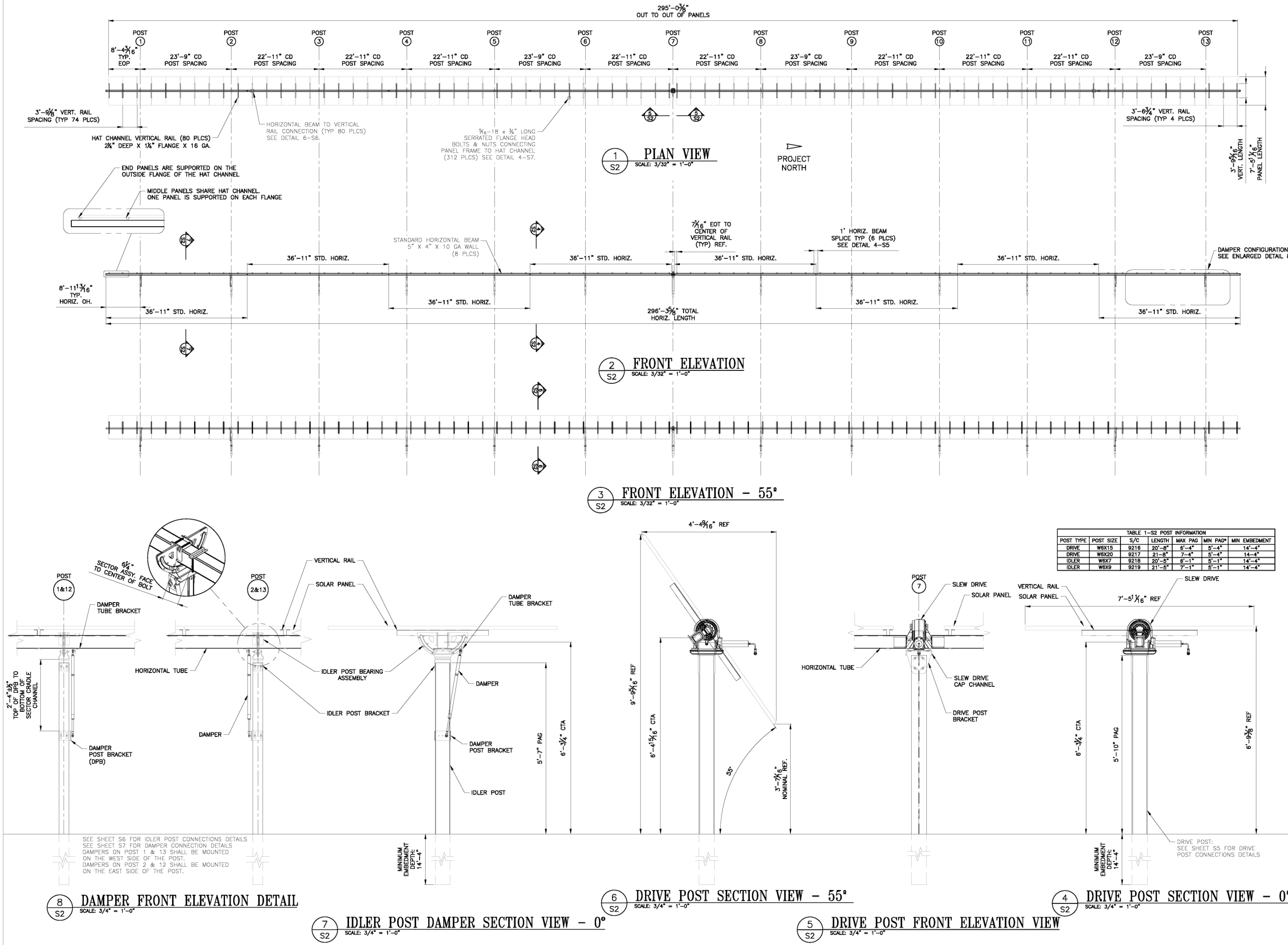


TABLE 1-S2 POST INFORMATION

POST TYPE	POST SIZE	S/C	LENGTH	MAX PAG	MIN PAG*	MIN EMBEDMENT
DRIVE	W6X15	9216	20'-8"	6'-4"	5'-4"	14'-4"
DRIVE	W6X20	9217	21-8"	7-4"	5'-4"	14-4"
IDLER	W6X7	9218	20'-5"	6'-1"	5'-1"	14'-4"
IDLER	W6X9	9219	21'-5"	7'-1"	5'-1"	14'-4"

VEROGY
ENFIELD SOLAR ONE
ENFIELD, CT 06082

DATE: 04/06/2023 · DRAWN BY: NSZ · JOB #: 17071 · CHECK BY: JRD · PAGE: S2 of S7 · SHEET: S2

MONO-PERC BM6-10B-T 545W
1X78 FLEXTRACK S-SERIES
TRACKER QUANTITY: 116

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3207 Innovation Place
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REV | DESCRIPTION | CHK BY | DATE

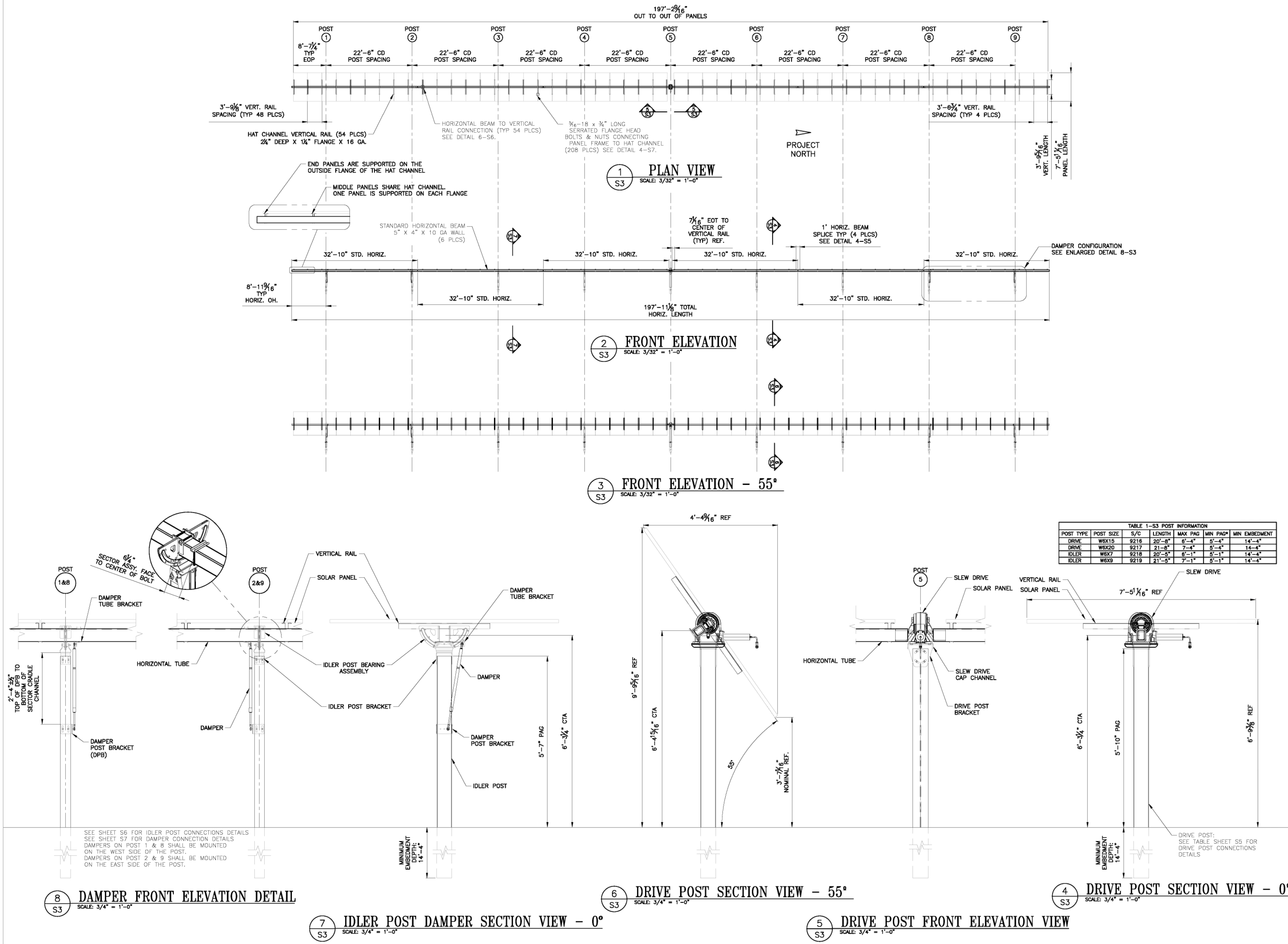

TABLE 1-S3 POST INFORMATION

POST TYPE	POST SIZE	S/C	LENGTH	MAX PAG	MIN PAG*	MIN EMBEDMENT
DRIVE	W6X15	9216	20'-8"	6'-4"	5'-4"	14'-4"
DRIVE	W6X20	9217	21-8"	7-4"	5'-4"	14-4"
IDLER	W6X7	9218	20'-5"	6'-1"	5'-1"	14'-4"
IDLER	W6X9	9219	21'-5"	7'-1"	5'-1"	14'-4"

CUSTOMER: VEROGY
ENFIELD SOLAR ONE
ENFIELD, CT 06082

DATE: 04/06/2023 | JOB #: 17071 | SHEET: S3
DRAWN BY: NSZ | CHECK BY: JRD | PAGE: S3 of S7

MONO-PERC BM6-10B-T 545W
1X52 FLEXTRACK S-SERIES
TRACKER QUANTITY: 27

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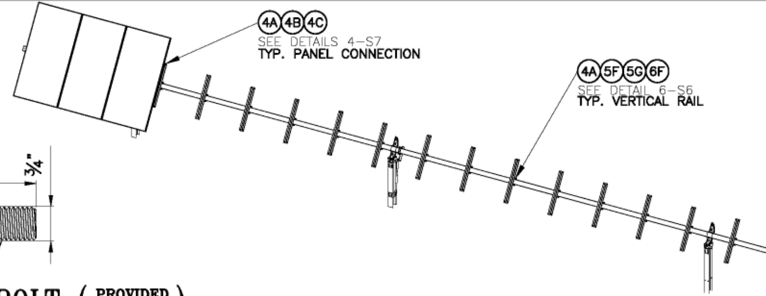
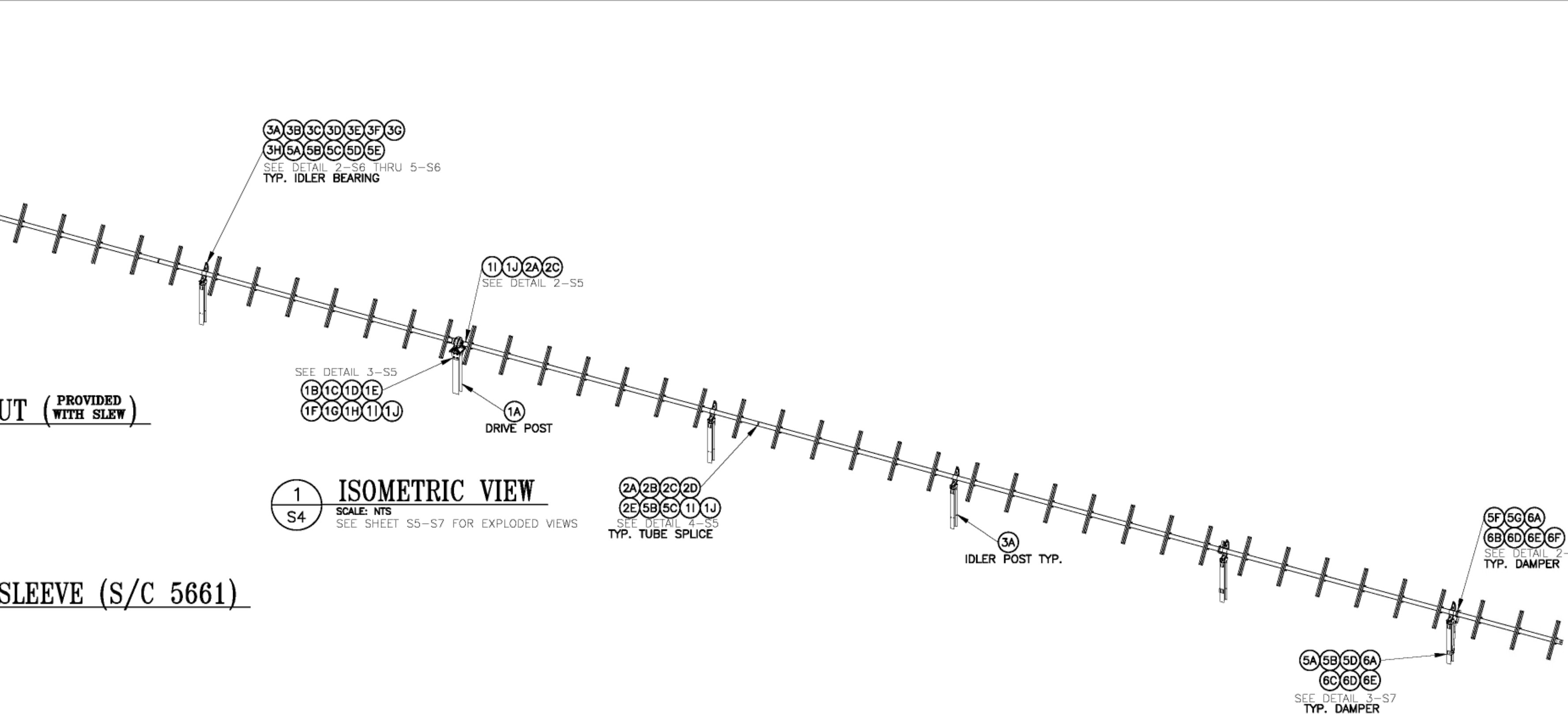
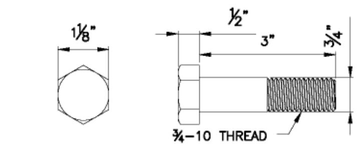
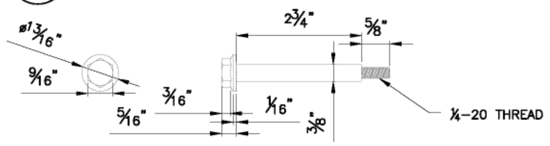
REV	DESCRIPTION	CHG BY	DATE

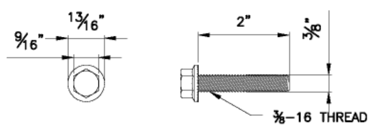
1 / S4 ISOMETRIC VIEW
SCALE: NTS
SEE SHEET S5-S7 FOR EXPLODED VIEWS



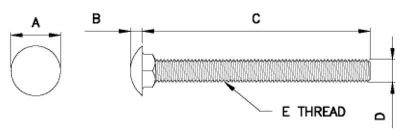
11 / S4 3/4"-10 X 3" BOLT (PROVIDED WITH SLEW)
SCALE: 6" = 1'-0"



12 / S4 3/8" X 2.75" SHOULDER BOLT (S/C 5662)
SCALE: 6" = 1'-0"

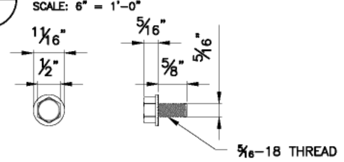


13 / S4 3/8-16 X 2" SERRATED BOLT (S/C 58)
SCALE: 6" = 1'-0"

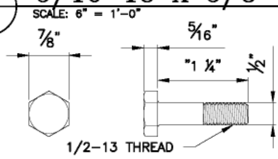


CARRIAGE BOLTS					
S/C	A	B	C	D	E
8291	1-1/16"	1/4"	6"	1/2"	1/2-13
8293	1-1/16"	1/4"	6"	3/8"	3/8-16
3746	1-1/16"	1/4"	5"	1/2"	1/2-13

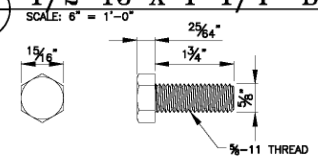
14 / S4 CARRIAGE BOLT
SCALE: 6" = 1'-0"



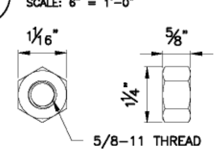
15 / S4 5/16-18 X 5/8" BOLT (S/C 4602)
SCALE: 6" = 1'-0"



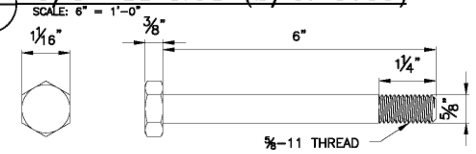
16 / S4 1/2-13 X 1-1/4" BOLT (S/C: 39)
SCALE: 6" = 1'-0"



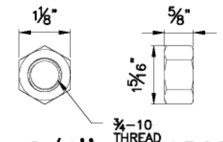
17 / S4 5/8"-11 X 1-3/4" BOLT (S/C: 8449)
SCALE: 6" = 1'-0"



18 / S4 5/8"-11 NUT (S/C: 5799)
SCALE: 6" = 1'-0"

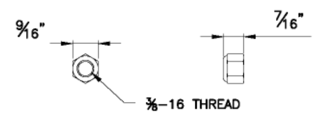


19 / S4 5/8"-11 X 6" (S/C: 8294)
SCALE: 6" = 1'-0"

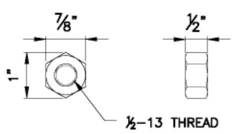


2 / S4 3/4"-10 A563 NUT (PROVIDED WITH SLEW)
SCALE: 6" = 1'-0"

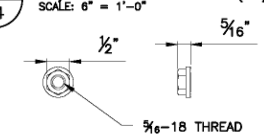
3 / S4 SHOULDER BOLT SLEEVE (S/C 5661)
SCALE: 6" = 1'-0"



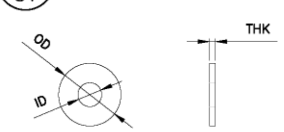
4 / S4 3/8-16 NYLON LOCK NUT (S/C 78)
SCALE: 6" = 1'-0"



5 / S4 1/2-13 NUT (S/C 83)
SCALE: 6" = 1'-0"

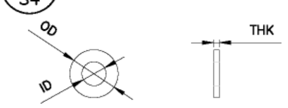


6 / S4 5/16-18 NUT (S/C 84)
SCALE: 6" = 1'-0"



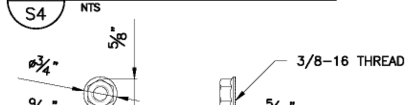
S/C	OD	ID	THK
126	1-1/2"	1/2"	1/8"
5800	1-1/2"	5/8"	1/8"

7 / S4 FENDER WASHER
NTS

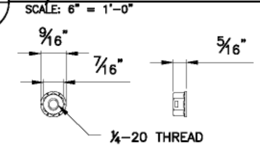


S/C	OD	ID	THK
N/A (1D)	1-1/2"	13/16"	3/16"
105	1-1/16"	1/2"	1/8"

8 / S4 STD F436 WASHER
NTS



9 / S4 3/8-16 SERRATED NUT (S/C 75)
SCALE: 6" = 1'-0"



10 / S4 1/4-20 LOCKNUT (S/C 7356)
SCALE: 6" = 1'-0"

BILL OF MATERIALS - FLEXTRACK S-SERIES COMPONENTS								
ITEM		QTY 1X78	QTY 1X52	PART DETAILS				
GROUP	SUB			S/C	PART DESCRIPTION	MATERIAL	FINISH
1	A	1	1	SEE TABLE 1-S2/1-S3	DRIVE POST	ASTM A992 GR. 50 STEEL	HDG PER ASTM A123
	B	1	1	8239	SLEW DRIVE - 24V	+/-55° ROTATION	ACRYLIC URETHANE COATING
	C	4	4	PROVIDED WITH SLEW DRIVE	3/4IN -10 x 3IN LONG	ASTM A325	HDG PER ASTM F2329
	D	8	8		1.469IN OD x 0.812IN ID x .122IN THK	ASTM F436	ASTM B695 MECH GALV.
	E	4	4		3/4IN -10 NUT	ASTM A194 2H	HDG PER ASTM F2329
	F	1	1	5796	SLEW POST CAP CHANNEL (2-1/4IN RETURN) - G90	ASTM A572 (GR50 STEEL)	PREGALVANIZED G90
	G	2	2	5797	SLEW POST ANGLE BRACKET (5/8IN HARDWARE)	ASTM A572 (GR50 STEEL)	HDG PER ASTM A123
	H	8	8	8449	5/8-11 X 1-3/4IN	ASTM A325	HDG PER ASTM F2329
	I	24	20	5799	5/8 -11 A563 NUT	ASTM A563	HDG PER ASTM F2329
	J	24	20	5800	5/8 HARDENED STEEL WASHER	ASTM F436	ASTM B695 MECH GALV.
2	A	8	6	-	STD. TUBE - 5X4IN HSS	ASTM A500 GR.C GR. 60 STEEL	COATED PER ASTM A1057 ZT 60
	B	24	16	8291	1/2-13 X 6IN CARRIAGE BOLT, HDG	GRADE 5 STEEL	HDG PER ASTM F2329
	C	16	12	8294	5/8-11 X 6IN BOLT	ASTM A325	HDG PER ASTM F2329
	D	6	4	8295	5X4 TT SPLICE CHANNEL	ASTM A500 GR.C	PREGALVANIZED G90
	E	6	4	8296	5X4 TT SPLICE CLAMP	ASTM A500 GR.C	PREGALVANIZED G90
3	A	12	8	SEE TABLE 1-S2/1-S3	IDLER POST	ASTM A992 GR. 50 STEEL	HDG PER ASTM A123
	B	12	8	5337	BEARING CRADLE SUPPORT POST CLAMP (I-BEAM 2.0 IDLER) - G90	ASTM A572 (GR50 STEEL)	PREGALVANIZED G90
	C	12	8	5647	SECTOR CRADLE CHANNEL 0.180IN THK. DACROMET	ASTM A572 (GR50 STEEL)	PREGALVANIZED G90
	D	12	8	5333	SECTOR CLAMP 0.134IN THK. SPRING PLATE - G90	ASTM A572 (GR50 STEEL)	PREGALVANIZED G90
	E	12	8	6886	(2) SECTOR PLATES AND (1) PLASTIC SECTOR BEARING RIVETED	-	-
	E1	24	16	5331	SECTOR PLATE 0.180IN THK. DACROMET	ASTM A572 (GR50 STEEL)	PREGALVANIZED G90
	E2	12	8	6885	PLASTIC SECTOR BEARING	ACETAL-RTP 0899X88199	BLACK WITH UV PROTECTION
	E3	96	64	5858	1/4-20 FOR 0.625-0.75 MATERIAL THICKNESS (RIVET)	ALUMINUM	ALUMINUM
	F	24	16	5661	0.75 X 2.25IN TDP2.0 SHOULDER BOLT SLEEVE	FC-0208-50 PER MPIF STD 35	BLACK ZN-NI (ASTM B841 TYPE D&E GR. 8)
	G	24	16	5662	3/8IN X 2 3/4IN SHOULDER BOLT WITH 1/4-20 THREADS	ASTM A449 (SAE J429) GRADE 5	BLACK ZN-NI (NINKLAD 1000B)
	H	48	32	7356	1/4-20 REGULAR FLANGEHEAD NUT	GRADE G STEEL	MAGNI 560
4	A	80	54	9215	TRACKER VERTICAL RAIL - HAT CHANNEL	ASTM A653 SS GR.50	PREGALVANIZED G90
	B	312	208	4602	5/16-18 X 5/8IN LONG FLANGEHEAD BOLT	ASTM A449 GRADE 5	MAGNI 560
	C	312	208	84	5/16-18 SERRATED FLANGEHEAD NUT	GRADE 2 STEEL	MAGNI 560
5	A	112	80	39	1/2 - 13 X 1 1/4IN BOLT	ASTM A325	HDG PER ASTM F2329
	B	160	112	83	1/2 - 13 HEAVY HEX NUT	ASTM A563	HDG PER ASTM F2329
	C	144	96	105	1/2IN STD WASHER (1.063IN OD X .531IN ID X .117IN THK)	ASTM F436	ASTM B695 MECH GALV.
	D	64	48	126	1/2IN FENDER WASHER (1.5IN OD X 0.531IN ID X .117IN THK)	1035/1065 SPRING STEEL	ASTM B695 MECH GALV.
	E	24	16	3746	1/2-13 X 5IN CARRIAGE BOLT	GRADE 5 STEEL	HDG PER ASTM F2329
	F	168	116	8293	3/8-16 X 6IN CARRIAGE BOLT W/1/2" HEAD	GRADE 5 STEEL	HDG PER ASTM F2329
	G	168	116	75	3/8-16 SERRATED FLANGEHEAD NUT	ASME B18.16.4	MAGNI 560
6	A	4	4	4862	STABILUS DAMPENER - 071965	-	-
	B	4	4	7527	3/8 DAMPENER TUBE BRACKET - 7.0 IN CTA (2.0) - L2X2X1/4 X 11.25IN	ASTM A36 (GR 36 STEEL)	HDG PER ASTM A123
	C	4	4	5389	DAMPENER POST LOWER BRACKET - G90	ASTM A36 (GR 36 STEEL)	PREGALVANIZED G90
	D	8	8	58	3/8-16 X 2IN LONG SERRATED FLANGEHEAD BOLT	ASTM A449 GRADE 5	MAGNI 560
	E	16	16	78	3/8-16 - NYLON LOCKNUT	NE SERIES STEEL	MAGNI 560
	F	84	58	7307	VERTICAL RAIL CONNECTION CHANNEL LT G90	ASTM A653 SS GR. 50 STEEL	PREGALVANIZED G90

CUSTOMER: VEROGY
ENFIELD SOLAR ONE
ENFIELD, CT 06082
DATE: 04/06/2023
DRAWN BY: NSZ
JOB #: 17071
CHECK BY: JRD
PAGE: S4 of S7

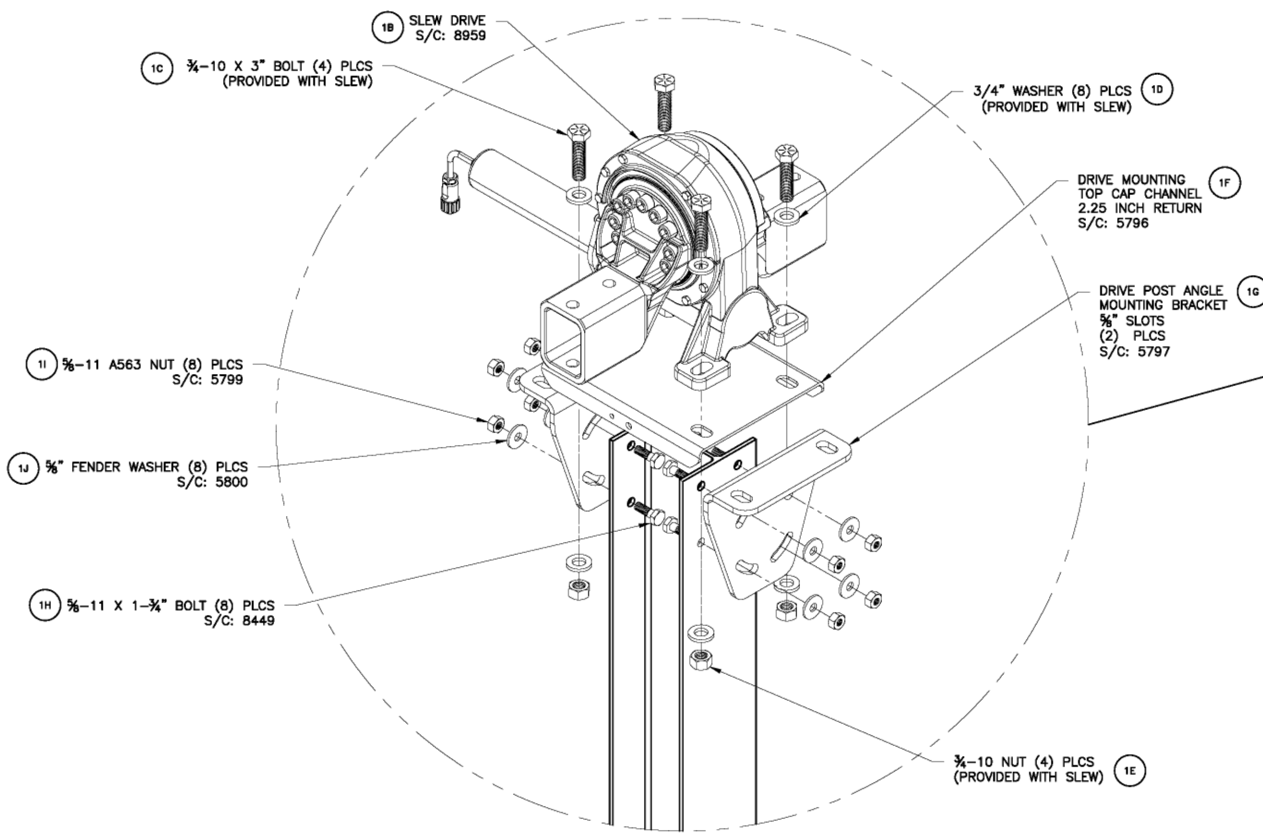
ISO VIEW, BILL OF MATERIAL, & HARDWARE DETAILS

Sheet S4

SOLAR FLEXRACK
A Division of Northern States Metals
3207 Innovation Place
Youngstown, OH 44509-4023
Phone (888) 380-8138

REV	DESCRIPTION	CHG BY	DATE

STATE OF CONNECTICUT LICENSED PROFESSIONAL ENGINEER

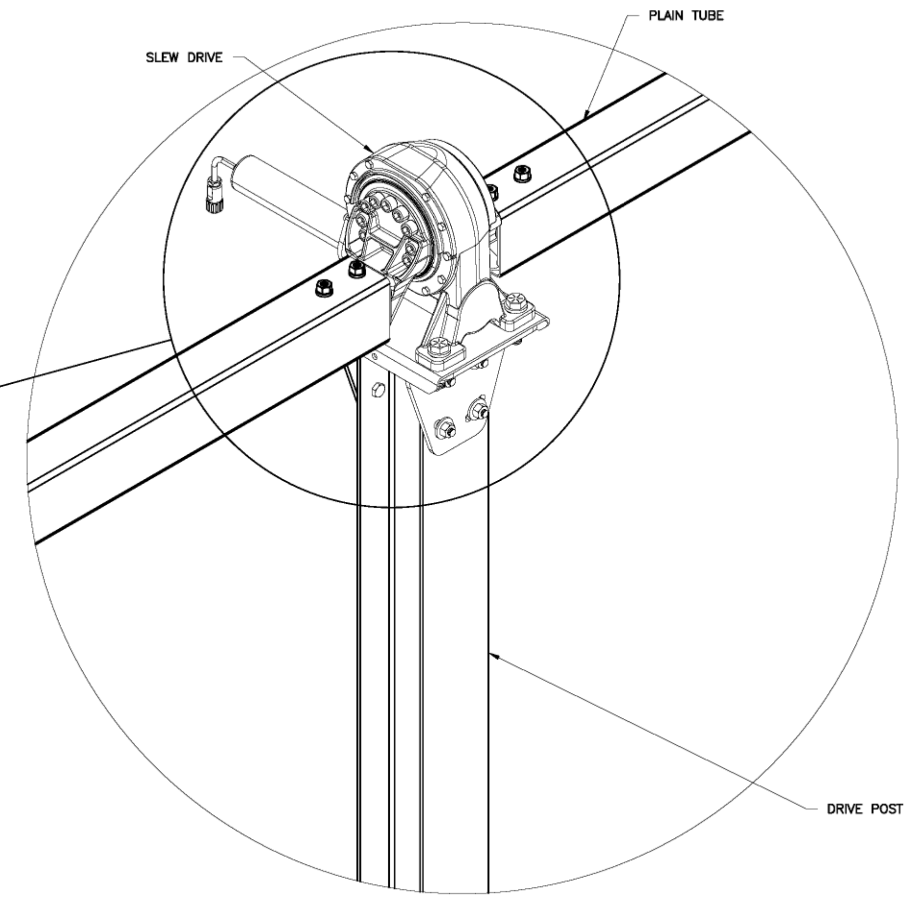


3 / S5 **DRIVE POST SLEW DRIVE CONNECTION**

SCALE: NTS

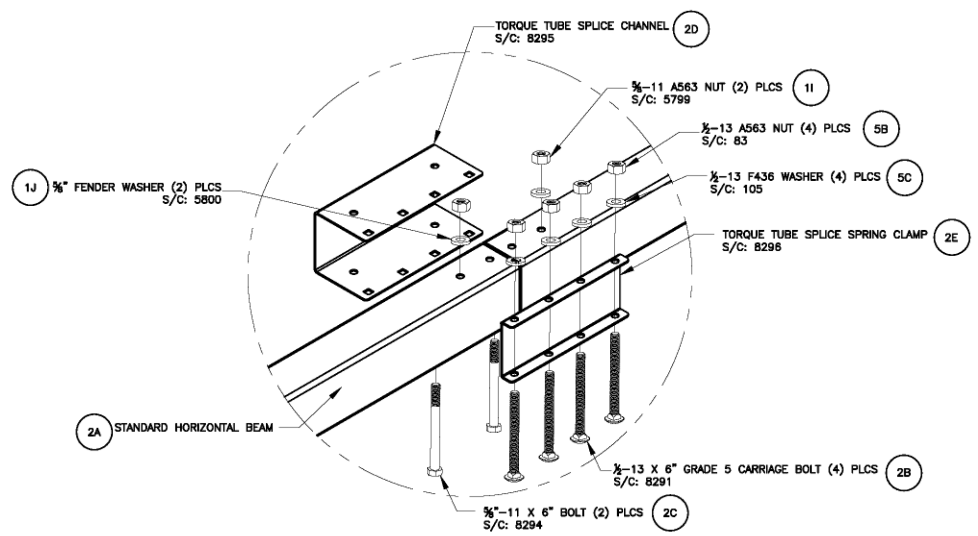
*⅝-11 BOLTS CONNECTING POST BRACKET TO POST MUST BE FASTENED BY TURN OF THE NUT METHOD PER THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC) ⅓ TURN PAST SNUG TIGHT)

*¾-10 BOLTS CONNECTING SLEW DRIVE TO DRIVE POST MOUNTING TOP CAP CHANNEL & ANGLE MOUNTING BRACKET MUST BE FASTENED BY TURN OF THE NUT METHOD PER THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC) ⅓ TURN PAST SNUG TIGHT)



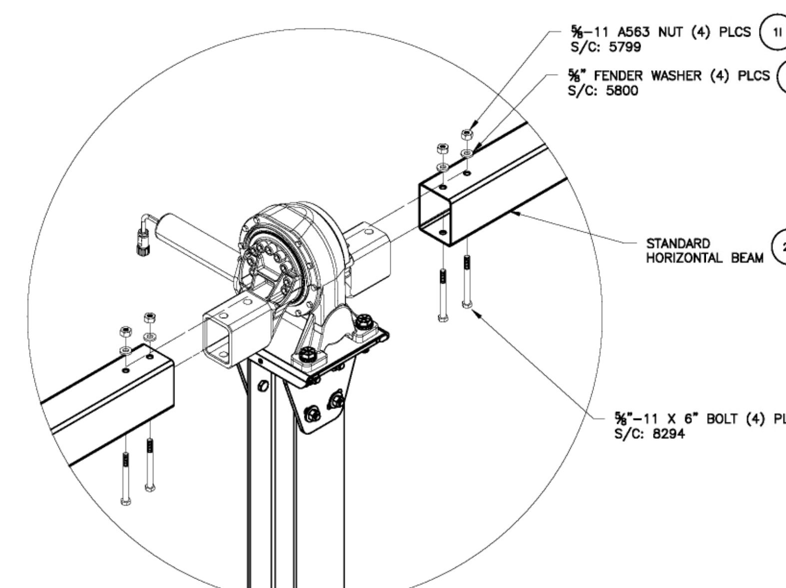
1 / S5 **DRIVE POST ISOMETRIC VIEW**

SCALE: NTS



4 / S5 **HORIZ. BEAM SPLICE EXPLODED**

SCALE: NTS
HORIZONTAL BEAM SPLICE MUST BE ORIENTED WITH THE BOLT INSTALLED VERTICALLY.
TORQUE VALUE: 50-60 FT-LBS FOR ½" HARDWARE
100-120 FT-LBS FOR ⅝" HARDWARE



2 / S5 **BEAM TO SLEW CONNECTION EXPLODED**

SCALE: NTS
CONNECTION MUST BE ORIENTED WITH THE BOLT INSTALLED VERTICALLY.
TORQUE VALUE: 100-120 FT-LBS FOR ⅝" HARDWARE

CUSTOMER: VEROGY
ENFIELD SOLAR ONE
ENFIELD, CT 06082

Sheet: S5

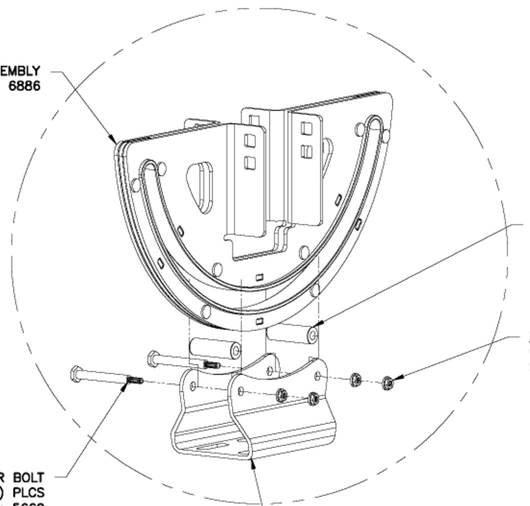
DATE:	JOB #:	PAGE:
04/06/2023	17071	S5 of S7
DRAWN BY: NSZ	CHECK BY: JRD	

DRIVE POST & SPLICE CONNECTION DETAILS

SOLAR FLEXRACK
A Division of Northern States Metals
3207 Innovation Place
Youngstown, OH 44509-4023
Phone (888) 380-8138

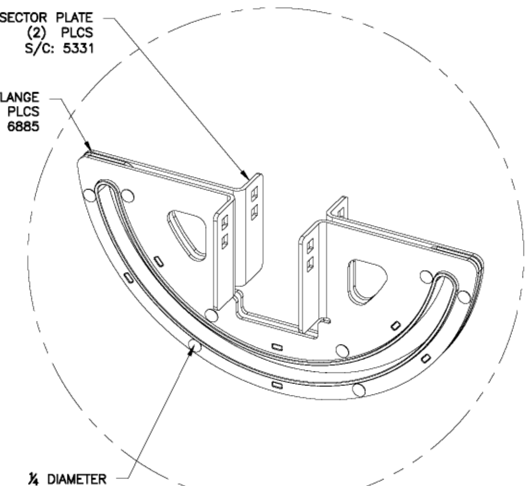
REV	DESCRIPTION	CHG BY	DATE

STATE OF CONNECTICUT · BRIAN M. FLOOD · 29923 · LICENSED PROFESSIONAL ENGINEER



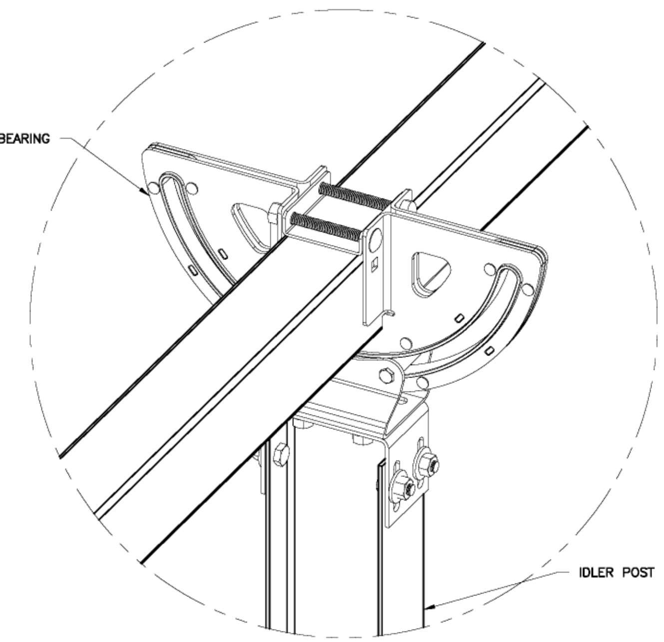
5 / S6 BEARING CRADLE ASSEMBLY EXPLODED

SCALE: NTS
SHOULDER OF BOLT MUST EXTEND THROUGH BOTH FACES OF THE SECTOR CRADLE CHANNEL, SUCH THAT NO FORCE IS BEING EXERTED VERTICALLY ON THE THREADS.



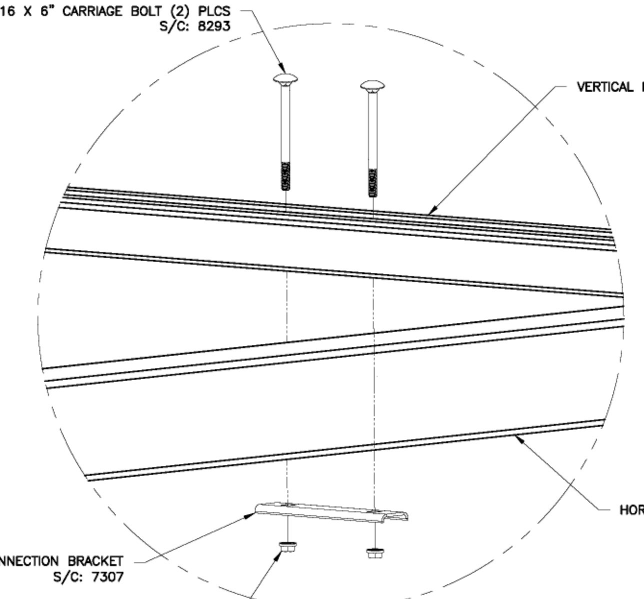
3 / S6 SECTOR PLATE PRE-ASSEMBLY

SCALE: NTS
PRE-ASSEMBLY (S/C: 6886)



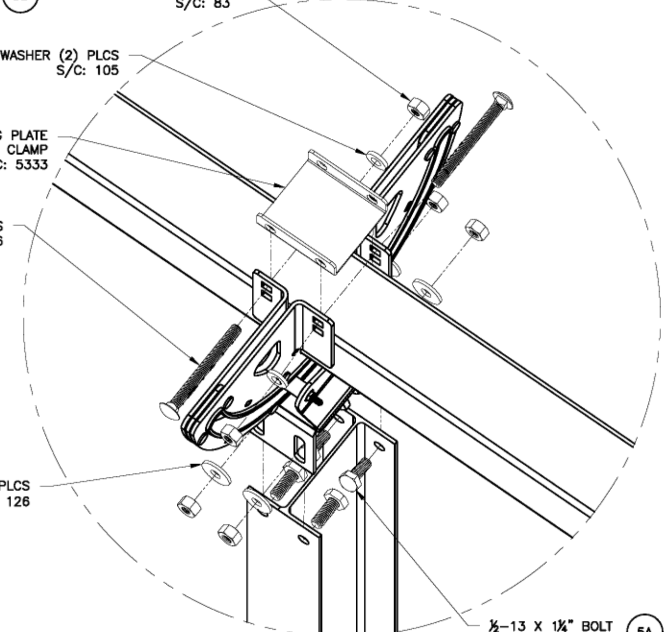
1 / S6 IDLER POST ISOMETRIC VIEW

SCALE: NTS



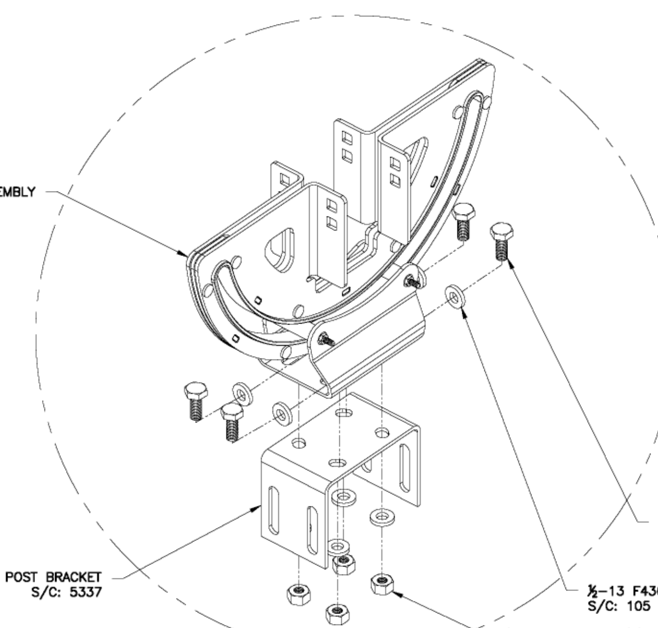
6 / S6 VERT. RAIL TO HORIZ. BEAM EXPLODED

SCALE: NTS
TORQUE VALUE:
20-25 FT-LBS FOR 3/8-16 HARDWARE



4 / S6 IDLER POST TO BEARING ASSEMBLY EXPLODED

SCALE: NTS
*1/2-13 X 1-1/4" BOLTS CONNECTING POST BRACKET TO POST MUST BE FASTENED BY TURN OF THE NUT METHOD
PER THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC) (1/3 TURN PAST SNUG TIGHT)
*TIGHTEN 1/2-13 X 5" CARRAIGE BOLT HARDWARE TO 25-30 FT-LBS
*SPRING PLATE TO BE INSTALLED IN TOP SET OF HOLES



2 / S6 IDLER BEARING ASSEMBLY EXPLODED

SCALE: NTS
*1/2-13 X 1-1/4" BOLTS CONNECTING SECTOR CRADLE CHANNEL TO IDLER POST BRACKET MUST BE TIGHTENED TO TORQUE VALUE: 50-60 FT-LBS

CUSTOMER: VEROGY
ENFIELD SOLAR ONE
ENFIELD, CT 06082

DATE: 04/06/2023	JOB #: 17071
DRAWN BY: NSZ	CHECK BY: JRD
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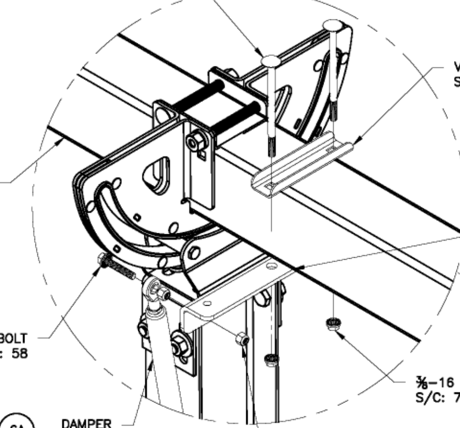
IDLER POST & VERTICAL RAIL CONNECTION DETAILS

SOLAR FLEXRACK
A Division of Northern States Metals
3207 Innovation Place
Youngstown, OH 44509-4023
Phone (888) 380-8138

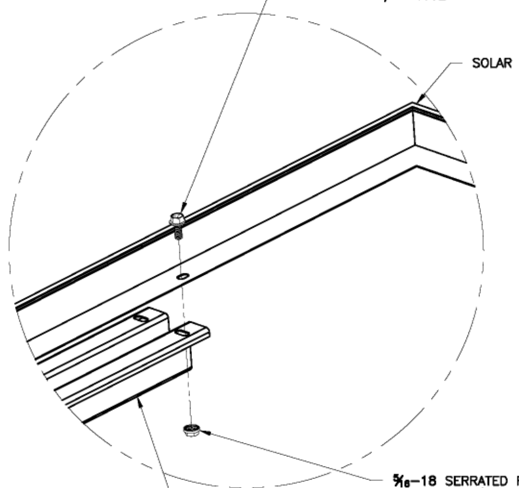
REV	DESCRIPTION	CHG BY	DATE



2/S7 DAMPER CONNECTION TO TUBE EXPLODED

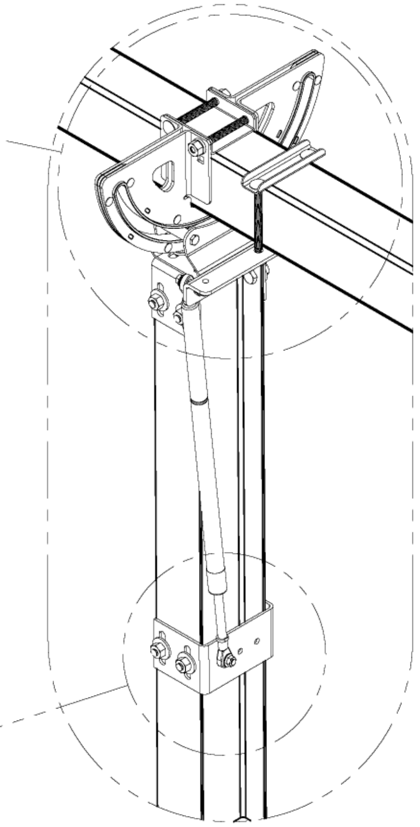
SCALE: NTS

TORQUE VALUE:
-10-12 FT-LBS FOR 3/8-16 SERRATED BOLT
-20-25 FT-LBS FOR 3/8-16 CARRIAGE BOLT



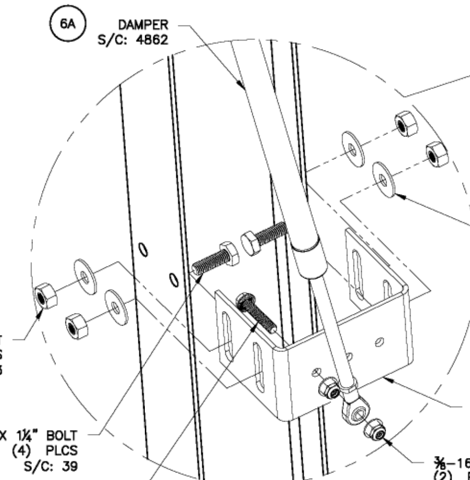
4/S7 SOLAR PANEL TO VERT. RAIL CONN. EXPLODED

SCALE: NTS
TORQUE VALUE: 8-14 FT-LBS



1/S7 DAMPER CONNECTION ISOMETRIC VIEW

SCALE: NTS



3/S7 DAMPER CONNECTION TO POST EXPLODED

SCALE: NTS

*1/2-13 X 1-1/4" BOLTS CONNECTING POST BRACKET TO POST MUST BE FASTENED BY TURN OF THE NUT METHOD PER THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC) (1/3 TURN PAST SNUG TIGHT)

TORQUE VALUE:
-10-12 FT-LBS FOR 3/8-16 HARDWARE

FIRST 3/8"-16 NYLON LOCK NUT MUST BE TIGHTENED TO SNUG TIGHT PRIOR TO THE INSTALLATION OF THE DAMPENER IN THE POST BRACKET.

CUSTOMER: VEROGY
ENFIELD SOLAR ONE
ENFIELD, CT 06082

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SHEET: S7

DAMPER & PANEL CONNECTION DETAILS

SOLAR FLEXRACK
A Division of Northern States Metals
3207 Innovation Place
Youngstown, OH 44509-4023
Phone (888) 380-8138

REV	DESCRIPTION	CHG BY	DATE

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