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STRUCTURAL CALCULATIONS, NOTES, & SPECIFICATIONS

PREPARED FOR:

PROJECT TYPE:

Everest Crossrail Solar Ground Mount - Virginia

DESIGNER:

Everest Solar Systems
3809 Ocean Ranch Blvd., Suite 111
Oceanside, CA 92056

PROJECT ENGINEER:

Pedro Asuncion-Velasco

PROJECT MANAGER:

Joel. J. Neal, P.E., LEED AP

Exp. 07.31.2021
Date Signed: 02.02.2021

T&S Job No.: 21028
January 27, 2021

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Job No.: *21028*
Job Name: *VA Ground Mount - Everest*

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Summary Letter

Date: January 27, 2021

To: Ryan Estrada

From: Pedro Asuncion-Velasco
Taylor & Syfan Consulting Engineers, Inc.

Project: Everest Ground Mount System - Virginia

T&S Job No.: 21028

Subject: Summary Letter for Everest Ground Mount System

INTRODUCTION

This Project Summary Letter is in reference to the Structural Calculation Packet for the Everest Ground Mount System, dated January 27, 2021. The calculations have been performed in accordance with the 2018 *International Building Code* (IBC). The 2018 IBC references the 2016 *Minimum Design Loads for Buildings and Other Structures*, by the American Society of Civil Engineers (ASCE), referred to as ASCE 7-16. The system has been designed to withstand code-prescribed forces due to the self-weight of the racking system, weight of the solar panels, snow loads, wind loads, and seismic loads.

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Summary Letter

SUMMARY CHARTS & LOADS

The attached pages of this summary contain charts relating the solar array's overall size and tilt angle with varying wind speeds and snow loads. Along with the Structural Notes & Specifications, these charts may be used as a quick reference for looking up maximum allowed span conditions on the array location and site conditions; however, varying site and loading conditions must be determined by a registered professional engineer who can evaluate the exact topographic conditions for the specific site and exact loading conditions for that array prior to construction. Array span charts are only valid for the various site-specific conditions noted for which they were designed.

SITE-SPECIFIC ANALYSIS

Each racking configuration summarized and labeled within the following chart has been analyzed. Because there are many different possible configurations, a common case has been provided in this report as an example calculation. A registered, professional engineer is required to verify the site conditions and local code requirements to ensure the values listed herein are applicable to the site and unique project before construction. Taylor & Syfan may provide these services upon request.

Note that further analysis may be required if the location of the solar panel installation or configuration corresponds to any of the following criteria (but not limited to):

- The pitch of the solar panels (solar panel pitch) exceeds 35 degrees above the horizontal.
- A topographic factor applies to the location. Topographic factors apply, for general purposes, when the structure is on the upper one-half of a hill, or escarpment (mesa or bluff). For complete descriptions of topographic factors, please refer to ASCE 7-16 Section 26.8.2.

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- The site specific ground snow load is greater than 50 psf.
- The site specific design wind speed is greater than 130 mph (3 second gust speed). Note that ASCE 7-16 uses a Mean Recurrence Interval (MRI) of 300 years and this design wind speed should not be compared to those provided in previous versions of ASCE 7.
- Soil conditions other than those described in the Structural Specifications.
- Adjacent to a body of water or other flat surface (such as salt flats) that exceeds 5,000 ft. (Exposure "D" per ASCE 7-16 26.7.2)
- A combination of loads and/or site conditions applies that is not addressed in the attached span and foundation charts.
- Risk Category II, III or IV.
- Seismic Design Category "F."

If one or more of these factors applies to the project location, please contact Taylor & Syfan, and we will be able to analyze the site conditions and recommend a custom engineered configuration for each specific site. A registered professional engineer must address site-specific features and factors, for wind speeds greater than 130 mph (3 sec. gust), for sites is in a wind borne debris region (as defined by ASCE 7-16 Section 26.12.3.1) or Special Wind Region (per ASCE 7-16 Figure 26.5-1A). These charts are for estimation purposes only. Sites with topographic factors shall have a licensed engineer calculate the exact design factors prior to construction. (Taylor & Syfan may be retained for this evaluation; however, they or another registered structural engineer should evaluate the site.)

The Risk Category was assigned as Category I based on the following assumed conditions:

- The open nature of the ground mount construction and confined (fenced-in) nature of the site qualify the installation as 'uninhabitable' and therefore, the

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installation "represents a low hazard to human life in event of failure." (IBC Table 1604.5)

- Failure of the ground mount would not represent a loss of functionality to any receiving facilities or disrupt daily civilian life, in addition to the lower chance of complete structural failure due to the redundant nature of the array.
- The Client is willing to accept the risk accompanying a lower wind speed, which represents a lower Mean Recurrence Interval (MRI) than a higher Risk Category assignment (700 yr. MRI, etc.).

The seismic forces used in these calculation charts are based on values for Seismic Design Category "C" and assume Site Class D. These values incorporate the full range of short period spectral accelerations present in Virginia as outlined in the IBC Figure 1613.2.1.

The ground snow load in these calculations assumes a value of 50 psf or less. Where ground snow loads exceed this value, a registered professional engineer shall evaluate the site specific ground snow loads and design prior to construction.

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REFERENCES AND LIMITATIONS

Please note that all sizes, material specifications, and weights of the racking components have been provided by Everest and are assumed to be accurate and correct. Installation must be in accordance with Everest's drawings and specifications. Everest shall notify Taylor & Syfan regarding any inaccuracies or changes in the materials, specifications, or details.

All waterproofing, ice effects, corrosion protection, module (panel) connections, modules, electrical components, flood effects, egress and access pathways, fire protection, setbacks, drainage issues, and all non-structural issues are the responsibility of Everest's customer, known as the contractor, professional solar installer, or owner. This summary letter discusses the structural adequacy of the solar racking system itself only and does not investigate or validate the adequacy of the panels or panel attachments. It is also the responsibility of Everest's customer to verify the site specific design forces (wind speed, topography, ground snow load, etc.) before using the charts contained in this document. Construction of any and all structures is under the jurisdiction of the local building official and building enforcement agency, which shall review and approve all projects prior to commencement of construction.

Please feel free to contact us with any questions or concerns. Thank you.

Sincerely,
Taylor & Syfan Consulting Engineers, Inc.

Pedro Asuncion-Velasco
Project Engineer

Project: **21028 – VA Solar Ground Mount – Everest**

See Appendix A for Manufacturer Details & Specifications.

INSTALLATION DIMENSIONS

G	Wind Speed	Snow	Tie-Brace	Pipe Data		A*	A1**	*Concrete Depth (A)*		*Concrete Depth (A1)*	
TILT ANGLE	ASCE 7-10 (mph)	Ground Snow Load	Required?	Pipe Size	Pipe Specification	Post Spacing	Post Spacing w/ V-Brace	*Front*	*Back*	*Front*	*Back*
20°	105	10 psf	Yes	1.5”	Sch. 40	7'-3”	11'-9”	2'-0”	4'-0”	2'-6”	5'-0”
			Yes		Sch. 80	7'-9”	13'-0”	2'-0”	4'-0”	3'-0”	5'-0”
			Yes	2”	Sch. 40	8'-3”	14'-6”	2'-0”	4'-0”	2'-9”	5'-3”
			Yes		Sch. 80	10'-0”	15'-0”	2'-3”	4'-6”	3'-0”	5'-3”
30° - 35°	105	30 psf	Yes	1.5”	Sch. 40	5'-9”	9'-0”	2'-0”	4'-0”	3'-0”	6'-0”
			Yes		Sch. 80	6'-6”	10'-6”	2'-3”	4'-3”	3'-0”	6'-0”
			Yes	2”	Sch. 40	7'-0”	12'-0”	2'-3”	4'-3”	3'-3”	6'-6”
			Yes		Sch. 80	8'-0”	13'-6”	2'-9”	5'-0”	3'-9”	7'-0”
20°	110	20 psf	Yes	1.5”	Sch. 40	6'-0”	11'-0”	2'-0”	4'-0”	3'-0”	5'-0”
			Yes		Sch. 80	6'-9”	12'-0”	2'-0”	4'-0”	3'-0”	5'-3”
			Yes	2”	Sch. 40	7'-6”	13'-0”	2'-0”	4'-0”	3'-3”	5'-3”
			Yes		Sch. 80	8'-6”	14'-0”	2'-6”	4'-6”	3'-9”	5'-6”
30° - 35°	110	20 psf	Yes	1.5”	Sch. 40	6'-0”	9'-0”	2'-0”	4'-0”	3'-0”	6'-0”
			Yes		Sch. 80	6'-6”	10'-6”	2'-0”	4'-3”	3'-0”	6'-6”
			Yes	2”	Sch. 40	7'-0”	12'-0”	2'-3”	4'-6”	3'-0”	7'-0”
			Yes		Sch. 80	8'-0”	13'-6”	2'-6”	5'-0”	3'-3”	7'-0”
20°	115	25 psf	Yes	1.5”	Sch. 40	5'-6”	10'-6”	2'-0”	4'-0”	3'-0”	5'-0”
			Yes		Sch. 80	6'-6”	11'-0”	2'-0”	4'-0”	3'-3”	5'-3”
			Yes	2”	Sch. 40	7'-0”	10'-6”	2'-3”	4'-0”	3'-3”	5'-3”
			Yes		Sch. 80	8'-0”	14'-0”	2'-6”	4'-6”	4'-3”	6'-0”
30° - 35°	115	25 psf	Yes	1.5”	Sch. 40	5'-6”	9'-0”	2'-0”	4'-0”	3'-0”	6'-3”
			Yes		Sch. 80	6'-3”	10'-6”	2'-3”	4'-6”	3'-0”	7'-0”
			Yes	2”	Sch. 40	6'-5”	11'-0”	2'-3”	4'-6”	3'-0”	7'-0”
			Yes		Sch. 80	7'-6”	12'-0”	2'-9”	5'-0”	3'-3”	7'-0”

NOTES:

* Spacing “A” Indicates East-West Spacing for Arrays without V-Braces

** Spacing “A1” Indicates East-West Spacing for Arrays with V-Braces

***Increased Span Assumes Modified Bracing Support (See Page A3) and ¼” TekScrews with Hollaendar Fittings. See Page A8 for Installation Example. Construction Drawings and Attachment Details are per Everest.

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STRUCTURAL SPECIFICATIONS

GENERAL

1. Do not scale drawings. Contractor shall use dimensions on plans to lay out array, foundations and other elements. If dimensional questions occur, Everest Solar Systems (Everest) must be consulted.

2. All construction and materials shall comply and be installed in accordance with all the requirements of all legally constituted public authorities having jurisdiction, including all county, government, and local ordinances, and the Safety Orders of the State Industrial Accident Commission, OSHA.

3. The Contractor shall be responsible for shoring and providing bracing during construction and/or erection to support all loads to which the structure may be subjected.

4. The Engineer will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the construction delineated by these plans. It should be understood that the contractor or his/her agent(s) shall supervise and direct all work and shall be solely and completely responsible for all construction means, methods, techniques, sequences, procedures, and conditions on the job site, including safety of all persons and property during the entire period of construction. Periodic observations by Taylor & Syfan Consulting Engineers Incorporated (or "Taylor & Syfan" typ.) personnel or representatives are not intended to include verification of dimensions or review the adequacy of the contractors safety measures on or near the construction site.

5. No deviations are allowed from the structural details, specifications, or notes without the written approval of the Engineer. Approval by Building Enforcement Agency, Inspector, Special Inspector, or any other party does not constitute authority to deviate from plans or specifications. All plan changes or addenda are subject to approval of the Building Enforcement Agency. Prior to construction, the Building Official shall review and approve the structural specifications, calculations, details, notes and design methodology contained herein. The processing of changes, assembly of permit documents, and acquisition of permits is the responsibility of the Contractor.

6. Special Inspectors shall obtain Building Enforcement Agency clearance prior to any work commencement. Copies of the inspection report(s) to be filed by the special inspector(s) shall be given to the Engineer. The Contractor is responsible for scheduling, coordination, and expenses involved in any and all inspections.

7. Taylor & Syfan's drawings are prepared to convey only the specific structural aspects of each detail. Additionally, impact loads or other effects from flying debris are not included. Non-structural information, including but not limited to fenestrations, fire-resistance, corrosion protection, foundations, insulation, finishes, panels, panel attachments, waterproofing, ice effects, drainage and flashing may not be included on the structural plans. Taylor & Syfan is not responsible for non-structural information. The Contractor shall obtain all non-structural information from Everest and Others.

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STRUCTURAL SPECIFICATIONS

8. The Building Inspector shall inspect and approve all construction for conformance to the construction documents and building code. Additionally, structural observation by Taylor & Syfan or another structural engineer is recommended to verify general conformance.

9. All construction projects require inspection and maintenance following completion. Operation, inspection, and maintenance are the sole responsibility of the Owner. The Engineer shall have no responsibility for any failures due to deviance from or neglect of the proper installation procedures, or for any failures by the Owner of Others to properly operate, inspect, or maintain the project. Ensure, and notify the Owner, that workers, equipment, storage, and other loading are not to be applied on the PV modules or racking throughout the life of the structure. Also, vegetation and debris shall be kept down to prevent snow build-up from affecting the system. In the event that the array or a portion thereof is displaced, due to seismic shaking, wind loads, or other reasons, the Owner shall re-position the array into its original design location.

10. Crossrail 80 PV Mounting Rail, Universal Pipe L-Brackets, Hollaender brace fittings, tie-braces, V-braces, pipe couplers, T-fittings, T-bolts, hex flange nuts, U-bolts, H-nuts, set screws, mid-clamps, end-clamps, modules, splice connectors, and module clamps are per Everest.

11.

MATERIAL REQUIREMENTS

1. Taylor & Syfan must be notified if the equipment or existing conditions are found to differ from what has been referenced or assumed in Everest's plans or the “Structural Calculations, Notes, & Specifications” in drawings dated 01/27/2021.

2. Cold-formed metal, other steel, and hardware exposed to weather, soil, or moisture shall be hot-dip galvanized, stainless steel, or have other corrosion protection appropriate for the installed environment specified by Everest. Finishing requirements for exposed steel and hardware are by others. Combining the aluminum connection hardware with the stainless steel hardware in a moist environment may promote corrosion between the two materials. Protection/isolation of differing metals is by others.

3. Pipe sections shall conform to ASTM A53 Grades B, Type E or S. “Sch. 40” indicates Standard Weight and “Sch. 80” indicates Extra Strong.

4. Embedment into soil is contingent upon the following: soil shall be firm, well graded, free of deleterious materials, non-expansive, not subject to erosion, free from foreign bodies and anything that hinders interaction between the pile and the soil surface. Where existing conditions do not match preceding qualifications, pile must be deepened such that embedment starts at competent soil.

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STRUCTURAL SPECIFICATIONS

CONCRETE & ANCHORAGE REQUIREMENTS

1. Soils values are per Table 1806.2 of the 2018 International Building Code (IBC) for Soil Type 4 (SW, SP, SM, SC, GM, & GC) minimum.

2. Concrete shall have a strength of 2500 psi at 28 days, a maximum slump of 5", a maximum W/C ratio of 0.45, and 6% +/- 1.5% air entrainment except where required by code, or specified by the local authority having jurisdiction. In an area requiring special freeze/thaw protection, concrete shall have a strength of 4500 psi at 28 days, a maximum slump of 5", a maximum W/C ratio of 0.45, and 6% +/- 1.5% air entrainment. A licensed professional engineer shall determine the Concrete Exposure Classes for the site and adjust the concrete mix specification as required. Special Inspection is not required, except where specified herein, on the plans, or by the Building Department.

3. Reinforcing steel shall be to ASTM A615, deformed, clean, and free of rust. Bars shall be 60 grade minimum (unless specified otherwise).

4. Aggregates shall be per ASTM C33. Maximum size 1½" for footings and 1" for all other work. Reduce maximum aggregate size as required to conform to ACI 318 Section 3.3.2. Coarse aggregate shall be crushed rock.

5. Reinforcing clearances for foundations shall be 3" min. when against earth and 2" min. when against a formed surface UNO. Other reinforcing clearances shall be 1 1/2" minimum UNO.

6. Removal of forms (formwork) supporting vertical surfaces shall be after 2 days min. and supporting beams or girders shall be after 15 days minimum.

7. Prevent surface and ground water from entering excavated shafts. Dewater excavated shafts before concreting. Conduct water to site drainage facilities. "Tremie Method" may be used, per Geotechnical recommendations. Place concrete in a dry shaft, unless placement underwater or by slurry displacement is approved by Engineer.

8. Excavate shafts for drilled foundation elements to indicated elevations. Excavate bottom of drilled shaft to level plane and remove loose material from bottom of excavation. Do not excavate shafts deeper than elevations indicated, unless approved by Engineer.

9. Excavate shafts for closely spaced drilled foundations and those occurring in fragile or sand strata, only after adjacent drilled foundations are filled with concrete and allowed to set. Contact Engineer if temporary casings are required.

10. Back-filling soil around piles is not allowed without prior approval & direction of soils engineer.

11. Screed concrete at cutoff elevation level. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

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STRUCTURAL SPECIFICATIONS

12. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by excavations.

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2019 CBC Solar Panel Wind Analysis - Version 1.1

Project: **21028 – VA Solar Ground Mount – Everest**

Basic Wind Speed (V): ***105*** mph

Design Assumptions:
Surface Roughness Category: C (See ASCE 26.7.2)
No Topographic Effect (See ASCE 26.8.2)
Wind Forces Calculated by Main Wind Force-Resisting System for Open Structures (See ASCE 27.3.2)
Net Pressure Coefficient, C_N, from ASCE Figure 27.3-4 for Monoslope Free Roofs with a 45 Degree Max. Slope
15 ft Max. Height of Solar Panel Structure
Analysis for Ground Mount Panels Only

Velocity Pressure (q)

V (mph)	Kd	Ke	--	Kz	Kzt	q (psf)
105	**0.85**	**1.00**	**1.00**	**0.85**	**1.00**	**20.39**

Panel Data

Joist Wind Trib	
2.75	**ft**

Design Pressure (p)

Panel Angle	Load Case	Wind Direction	G	C_{NW}	C_{NL}	p_W (psf)	p_L (psf)	w_W (plf)	w_L (plf)
15°	*A*	*0°*	*0.85*	*-1.1*	*-1.5*	*-19.1*	*-26.0*	*-52.4*	*-71.5*
15°	*B*	*0°*	*0.85*	*-1.9*	*0.0*	*-32.9*	*0.0*	*-90.6*	*0.0*
15°	*A*	*180°*	*0.85*	*1.3*	*1.6*	*22.5*	*27.7*	*62.0*	*76.3*
15°	*B*	*180°*	*0.85*	*1.2*	*-0.3*	*20.8*	*-5.2*	*57.2*	*-14.3*
20°	**A**	**0°**	**0.85**	**-1.3**	**-1.6**	**-23.1**	**-27.7**	**-63.6**	**-76.3**
20°	**B**	**0°**	**0.85**	**-2.1**	**-0.2**	**-36.4**	**-2.9**	**-100.1**	**-7.9**
20°	**A**	**180°**	**0.85**	**1.6**	**1.8**	**27.2**	**30.6**	**74.7**	**84.2**
20°	**B**	**180°**	**0.85**	**1.7**	**0.1**	**28.9**	**2.3**	**79.4**	**6.4**
30°	*A*	*0°*	*0.85*	*-1.8*	*-1.8*	*-31.2*	*-31.2*	*-85.8*	*-85.8*
30°	*B*	*0°*	*0.85*	*-2.5*	*-0.5*	*-43.3*	*-8.7*	*-119.2*	*-23.8*
30°	*A*	*180°*	*0.85*	*2.1*	*2.1*	*36.4*	*36.4*	*100.1*	*100.1*
30°	*B*	*180°*	*0.85*	*2.6*	*1.0*	*45.1*	*17.3*	*123.9*	*47.7*

*Note: C_{NW} and C_{NL} are Worst Case for Either **Clear OR Obstructed** Wind Flow*

Note: Values in grey were used for interpolation of the 20-degree wind pressure values.

Symbols and Notation
V = Basic Wind Speed (mph) per ASCE (see Figure 26.5-1A)
Kd = Wind Directionality Factor (per ASCE Table 26.6-1)
Ke = Ground Elevation Factor (per ASCE Section 26.9)
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)
Kzt = Topographic factor as defined in ASCE Section 26.8
q = velocity pressure in (psf) (q = 0.00256*Kz*Kzt*Kd*V^2 per ASCE 27.3.2)
p_W = Windward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
p_L = Leeward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
G = Guest effect factor
C_{NW} = Windward Net Pressure Coefficient for open buildings (See Figure 27.4-4)
C_{NL} = Leeward Net Pressure Coefficient for open buildings (See Figure 27.4-4)

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2019 CBC Solar Panel Wind Analysis - Version 1.1

Project: **21028 – VA Solar Ground Mount – Everest**

Basic Wind Speed (V): ***105*** mph

Design Assumptions:
Surface Roughness Category: C (See ASCE 26.7.2)
No Topographic Effect (See ASCE 26.8.2)
Wind Forces Calculated by Main Wind Force-Resisting System for Open Structures (See ASCE 27.3.2)
Net Pressure Coefficient, C_N, from ASCE Figure 27.3-4 for Monoslope Free Roofs with a 45 Degree Max. Slope
15 ft Max. Height of Solar Panel Structure
Analysis for Ground Mount Panels Only

Velocity Pressure (q)

V (mph)	Kd	Ke	--	Kz	Kzt	q (psf)
105	**0.85**	**1.00**	**1.00**	**0.85**	**1.00**	**20.39**

Panel Data

Joist Wind Trib	
2.75	**ft**

Design Pressure (p)

Panel Angle	Load Case	Wind Direction	G	C_{NW}	C_{NL}	p_W (psf)	p_L (psf)	w_W (plf)	w_L (plf)
30°	**A**	**0°**	**0.85**	**-1.8**	**-1.8**	**-31.2**	**-31.2**	**-85.8**	**-85.8**
30°	**B**	**0°**	**0.85**	**-2.5**	**-0.5**	**-43.3**	**-8.7**	**-119.2**	**-23.8**
30°	**A**	**180°**	**0.85**	**2.1**	**2.1**	**36.4**	**36.4**	**100.1**	**100.1**
30°	**B**	**180°**	**0.85**	**2.6**	**1.0**	**45.1**	**17.3**	**123.9**	**47.7**
35°	**A**	**0°**	**0.85**	**-1.7**	**-1.8**	**-30.0**	**-31.2**	**-82.6**	**-85.8**
35°	**B**	**0°**	**0.85**	**-2.4**	**-0.6**	**-42.2**	**-9.8**	**-116.0**	**-27.0**
35°	**A**	**180°**	**0.85**	**2.1**	**2.2**	**37.0**	**38.7**	**101.7**	**106.5**
35°	**B**	**180°**	**0.85**	**2.4**	**0.8**	**42.2**	**13.9**	**116.0**	**38.1**

*Note: C_{NW} and C_{NL} are Worst Case for Either **Clear OR Obstructed** Wind Flow*

Symbols and Notation
V = Basic Wind Speed (mph) per ASCE (See per Figure 26.5-1A)
Kd = Wind Directionality Factor (per table 26.6-1)
Ke = Ground Elevation Factor (per ASCE Section 26.9)
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)
Kzt = Topographic factor as defined in ASCE Section 26.8
q = velocity pressure in (psf) (q = 0.00256*Kz*Kzt*Kd*V^2 per ASCE 27.3.2)
p_W = Windward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
p_L = Leeward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
G = Guest effect factor
C_{NW} = Windward Net Pressure Coefficient for open buildings (See Figure 27.4-4)
C_{NL} = Leeward Net Pressure Coefficient for open buildings (See Figure 27.4-4)

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2019 CBC Solar Panel Wind Analysis - Version 1.1

Project: **21028 – VA Solar Ground Mount – Everest**

Basic Wind Speed (V): ***110*** mph

Design Assumptions:
Surface Roughness Category: C (See ASCE 26.7.2)
No Topographic Effect (See ASCE 26.8.2)
Wind Forces Calculated by Main Wind Force-Resisting System for Open Structures (See ASCE 27.3.2)
Net Pressure Coefficient, C_N, from ASCE Figure 27.3-4 for Monoslope Free Roofs with a 45 Degree Max. Slope
15 ft Max. Height of Solar Panel Structure
Analysis for Ground Mount Panels Only

Velocity Pressure (q)

V (mph)	Kd	Ke	--	Kz	Kzt	q (psf)
110	**0.85**	**1.00**	**1.00**	**0.85**	**1.00**	**22.38**

Panel Data

Joist Wind Trib	
2.75	**ft**

Design Pressure (p)

Panel Angle	Load Case	Wind Direction	G	C_{NW}	C_{NL}	p_W (psf)	p_L (psf)	w_W (plf)	w_L (plf)
15°	*A*	*0°*	*0.85*	*-1.1*	*-1.5*	*-20.9*	*-28.5*	*-57.5*	*-78.5*
15°	*B*	*0°*	*0.85*	*-1.9*	*0.0*	*-36.1*	*0.0*	*-99.4*	*0.0*
15°	*A*	*180°*	*0.85*	*1.3*	*1.6*	*24.7*	*30.4*	*68.0*	*83.7*
15°	*B*	*180°*	*0.85*	*1.2*	*-0.3*	*22.8*	*-5.7*	*62.8*	*-15.7*
20°	**A**	**0°**	**0.85**	**-1.3**	**-1.6**	**-25.4**	**-30.4**	**-69.8**	**-83.7**
20°	**B**	**0°**	**0.85**	**-2.1**	**-0.2**	**-39.9**	**-3.2**	**-109.9**	**-8.7**
20°	**A**	**180°**	**0.85**	**1.6**	**1.8**	**29.8**	**33.6**	**82.0**	**92.4**
20°	**B**	**180°**	**0.85**	**1.7**	**0.1**	**31.7**	**2.5**	**87.2**	**7.0**
30°	*A*	*0°*	*0.85*	*-1.8*	*-1.8*	*-34.2*	*-34.2*	*-94.2*	*-94.2*
30°	*B*	*0°*	*0.85*	*-2.5*	*-0.5*	*-47.6*	*-9.5*	*-130.8*	*-26.2*
30°	*A*	*180°*	*0.85*	*2.1*	*2.1*	*39.9*	*39.9*	*109.9*	*109.9*
30°	*B*	*180°*	*0.85*	*2.6*	*1.0*	*49.5*	*19.0*	*136.0*	*52.3*

*Note: C_{NW} and C_{NL} are Worst Case for Either **Clear OR Obstructed** Wind Flow*

Note: Values in grey were used for interpolation of the 20-degree wind pressure values.

Symbols and Notation
V = Basic Wind Speed (mph) per ASCE (see Figure 26.5-1A)
Kd = Wind Directionality Factor (per ASCE Table 26.6-1)
Ke = Ground Elevation Factor (per ASCE Section 26.9)
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)
Kzt = Topographic factor as defined in ASCE Section 26.8
q = velocity pressure in (psf) (q = 0.00256*Kz*Kzt*Kd*V^2 per ASCE 27.3.2)
p_W = Windward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
p_L = Leeward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
G = Guest effect factor
C_{NW} = Windward Net Pressure Coefficient for open buildings (See Figure 27.4-4)
C_{NL} = Leeward Net Pressure Coefficient for open buildings (See Figure 27.4-4)

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2019 CBC Solar Panel Wind Analysis - Version 1.1

Project: **21028 – VA Solar Ground Mount – Everest**

Basic Wind Speed (V): ***110*** mph

Design Assumptions:
Surface Roughness Category: C (See ASCE 26.7.2)
No Topographic Effect (See ASCE 26.8.2)
Wind Forces Calculated by Main Wind Force-Resisting System for Open Structures (See ASCE 27.3.2)
Net Pressure Coefficient, C_N, from ASCE Figure 27.3-4 for Monoslope Free Roofs with a 45 Degree Max. Slope
15 ft Max. Height of Solar Panel Structure
Analysis for Ground Mount Panels Only

Velocity Pressure (q)

V (mph)	Kd	Ke	--	Kz	Kzt	q (psf)
110	**0.85**	**1.00**	**1.00**	**0.85**	**1.00**	**22.38**

Panel Data

Joist Wind Trib	
2.75	**ft**

Design Pressure (p)

Panel Angle	Load Case	Wind Direction	G	C_{NW}	C_{NL}	p_W (psf)	p_L (psf)	w_W (plf)	w_L (plf)
30°	**A**	**0°**	**0.85**	**-1.8**	**-1.8**	**-34.2**	**-34.2**	**-94.2**	**-94.2**
30°	**B**	**0°**	**0.85**	**-2.5**	**-0.5**	**-47.6**	**-9.5**	**-130.8**	**-26.2**
30°	**A**	**180°**	**0.85**	**2.1**	**2.1**	**39.9**	**39.9**	**109.9**	**109.9**
30°	**B**	**180°**	**0.85**	**2.6**	**1.0**	**49.5**	**19.0**	**136.0**	**52.3**
35°	**A**	**0°**	**0.85**	**-1.7**	**-1.8**	**-33.0**	**-34.2**	**-90.7**	**-94.2**
35°	**B**	**0°**	**0.85**	**-2.4**	**-0.6**	**-46.3**	**-10.8**	**-127.3**	**-29.6**
35°	**A**	**180°**	**0.85**	**2.1**	**2.2**	**40.6**	**42.5**	**111.6**	**116.8**
35°	**B**	**180°**	**0.85**	**2.4**	**0.8**	**46.3**	**15.2**	**127.3**	**41.9**

*Note: C_{NW} and C_{NL} are Worst Case for Either **Clear OR Obstructed** Wind Flow*

Symbols and Notation
V = Basic Wind Speed (mph) per ASCE (See per Figure 26.5-1A)
Kd = Wind Directionality Factor (per table 26.6-1)
Ke = Ground Elevation Factor (per ASCE Section 26.9)
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)
Kzt = Topographic factor as defined in ASCE Section 26.8
q = velocity pressure in (psf) (q = 0.00256*Kz*Kzt*Kd*V^2 per ASCE 27.3.2)
p_W = Windward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
p_L = Leeward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
G = Guest effect factor
C_{NW} = Windward Net Pressure Coefficient for open buildings (See Figure 27.4-4)
C_{NL} = Leeward Net Pressure Coefficient for open buildings (See Figure 27.4-4)

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2019 CBC Solar Panel Wind Analysis - Version 1.1

Project: **21028 – VA Solar Ground Mount – Everest**

Basic Wind Speed (V): ***115*** mph

Design Assumptions:
Surface Roughness Category: C (See ASCE 26.7.2)
No Topographic Effect (See ASCE 26.8.2)
Wind Forces Calculated by Main Wind Force-Resisting System for Open Structures (See ASCE 27.3.2)
Net Pressure Coefficient, C_N, from ASCE Figure 27.3-4 for Monoslope Free Roofs with a 45 Degree Max. Slope
15 ft Max. Height of Solar Panel Structure
Analysis for Ground Mount Panels Only

Velocity Pressure (q)

V (mph)	Kd	Ke	--	Kz	Kzt	q (psf)
115	**0.85**	**1.00**	**1.00**	**0.85**	**1.00**	**24.46**

Panel Data

Joist Wind Trib	
2.75	**ft**

Design Pressure (p)

Panel Angle	Load Case	Wind Direction	G	C_{NW}	C_{NL}	p_W (psf)	p_L (psf)	w_W (plf)	w_L (plf)
15°	*A*	*0°*	*0.85*	*-1.1*	*-1.5*	*-22.9*	*-31.2*	*-62.9*	*-85.8*
15°	*B*	*0°*	*0.85*	*-1.9*	*0.0*	*-39.5*	*0.0*	*-108.6*	*0.0*
15°	*A*	*180°*	*0.85*	*1.3*	*1.6*	*27.0*	*33.3*	*74.3*	*91.5*
15°	*B*	*180°*	*0.85*	*1.2*	*-0.3*	*25.0*	*-6.2*	*68.6*	*-17.2*
20°	**A**	**0°**	**0.85**	**-1.3**	**-1.6**	**-27.7**	**-33.3**	**-76.2**	**-91.5**
20°	**B**	**0°**	**0.85**	**-2.1**	**-0.2**	**-43.7**	**-3.5**	**-120.1**	**-9.5**
20°	**A**	**180°**	**0.85**	**1.6**	**1.8**	**32.6**	**36.7**	**89.6**	**101.0**
20°	**B**	**180°**	**0.85**	**1.7**	**0.1**	**34.7**	**2.8**	**95.3**	**7.6**
30°	*A*	*0°*	*0.85*	*-1.8*	*-1.8*	*-37.4*	*-37.4*	*-102.9*	*-102.9*
30°	*B*	*0°*	*0.85*	*-2.5*	*-0.5*	*-52.0*	*-10.4*	*-142.9*	*-28.6*
30°	*A*	*180°*	*0.85*	*2.1*	*2.1*	*43.7*	*43.7*	*120.1*	*120.1*
30°	*B*	*180°*	*0.85*	*2.6*	*1.0*	*54.1*	*20.8*	*148.7*	*57.2*

*Note: C_{NW} and C_{NL} are Worst Case for Either **Clear OR Obstructed** Wind Flow*

Note: Values in grey were used for interpolation of the 20-degree wind pressure values.

Symbols and Notation
V = Basic Wind Speed (mph) per ASCE (see Figure 26.5-1A)
Kd = Wind Directionality Factor (per ASCE Table 26.6-1)
Ke = Ground Elevation Factor (per ASCE Section 26.9)
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)
Kzt = Topographic factor as defined in ASCE Section 26.8
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p_L = Leeward Design Pressure (psf) (p = q*G*C_N per ACSC 27.4-3)
G = Guest effect factor
C_{NW} = Windward Net Pressure Coefficient for open buildings (See Figure 27.4-4)
C_{NL} = Leeward Net Pressure Coefficient for open buildings (See Figure 27.4-4)

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2019 CBC Solar Panel Wind Analysis - Version 1.1

Project: **21028 – VA Solar Ground Mount – Everest**

Basic Wind Speed (V): ***115*** mph

Design Assumptions:
Surface Roughness Category: C (See ASCE 26.7.2)
No Topographic Effect (See ASCE 26.8.2)
Wind Forces Calculated by Main Wind Force-Resisting System for Open Structures (See ASCE 27.4.3)
Net Pressure Coefficient, C_N, from ASCE Figure 27.3-4 for Monoslope Free Roofs with a 45 Degree Max. Slope.
15 ft Max. Height of Solar Panel Structure
Analysis for Ground Mount Panels Only

Velocity Pressure (q)

V (mph)	Kd	Ke	--	Kz	Kzt	q (psf)
115	**0.85**	**1.00**	**1.00**	**0.85**	**1.00**	**24.46**

Panel Data

Joist Wind Trib	
2.75	**ft**

Design Pressure (p)

Panel Angle	Load Case	Wind Direction	G	C_{NW}	C_{NL}	p_W (psf)	p_L (psf)	w_W (plf)	w_L (plf)
30°	**A**	**0°**	**0.85**	**-1.8**	**-1.8**	**-37.4**	**-37.4**	**-102.9**	**-102.9**
30°	**B**	**0°**	**0.85**	**-2.5**	**-0.5**	**-52.0**	**-10.4**	**-142.9**	**-28.6**
30°	**A**	**180°**	**0.85**	**2.1**	**2.1**	**43.7**	**43.7**	**120.1**	**120.1**
30°	**B**	**180°**	**0.85**	**2.6**	**1.0**	**54.1**	**20.8**	**148.7**	**57.2**
35°	**A**	**0°**	**0.85**	**-1.7**	**-1.8**	**-36.0**	**-37.4**	**-99.1**	**-102.9**
35°	**B**	**0°**	**0.85**	**-2.4**	**-0.6**	**-50.6**	**-11.8**	**-139.1**	**-32.4**
35°	**A**	**180°**	**0.85**	**2.1**	**2.2**	**44.4**	**46.4**	**122.0**	**127.7**
35°	**B**	**180°**	**0.85**	**2.4**	**0.8**	**50.6**	**16.6**	**139.1**	**45.7**

*Note: C_{NW} and C_{NL} are Worst Case for Either **Clear OR Obstructed** Wind Flow*

Symbols and Notation
V = Basic Wind Speed (mph) per ASCE (See per Figure 26.5-1A)
Kd = Wind Directionality Factor (per table 26.6-1)
Ke = Ground Elevation Factor (per ASCE Section 26.9)
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)
Kzt = Topographic factor as defined in ASCE Section 26.8
q = velocity pressure in (psf) (q = 0.00256*Kz*Kzt*Kd*V^2 per ASCE 27.3.2)
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2019 CBC Solar Panel Wind Analysis - Version 1.1

Project: **21028 – VA Solar Ground Mount – Everest**

SNOW LOAD CALCULATIONS PER ASCE 7-16 CH. 7

Ground Snow Load, Pg

LC1 = 10 psf
LC2 = 20 psf
LC3 = 25 psf
LC4 = 30 psf

Flat Roof Snow Load, Pf

$$P_f = 0.7\, C_e\, C_t\, I_s\, P_g$$ Eq. 7.3-1

	15 deg.	20 deg.	30 deg.	35 deg.	
C_e	0.90	0.90	0.90	0.90	Table 7.3-1
C_t	1.20	1.20	1.20	1.20	Table 7.3-2
I_s	0.80	0.80	0.80	0.80	Table 1.5-2

Sloped Roof Snow Load, Ps

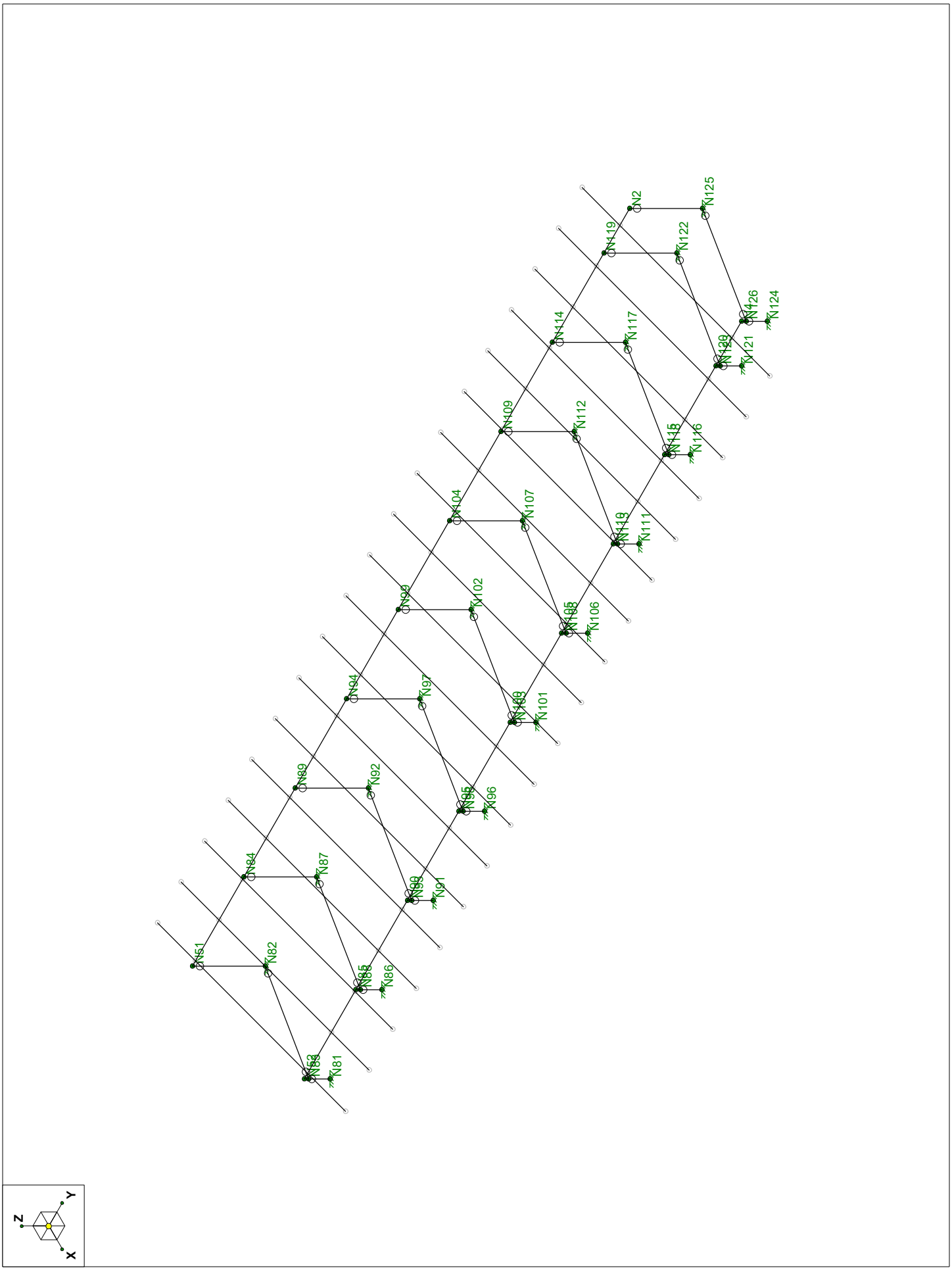
$$P_s = C_s\, P_f$$ Eq. 7.4-1

	15 deg.	20 deg.	30 deg.	35 deg.	
Cs	1.00	0.92	0.73	0.64	Figure 7.4-1

Panel Data	
Rail Trib. Width	
2.75	ft

PV Snow Load (psf)				
pg (psf)	Tilt			
	15 deg.	20 deg.	30 deg.	35 deg.
10	8.64	7.95	6.31	5.53
20	17.28	15.90	12.61	11.06
25	21.60	19.87	15.77	13.82
30	25.92	23.85	18.92	16.59

PV Snow Load (plf)				
pg (psf)	Tilt			
	15 deg.	20 deg.	30 deg.	35 deg.
10	23.76	21.86	17.34	15.21
20	47.52	43.72	34.69	30.41
25	59.40	54.65	43.36	38.02
30	71.28	65.58	52.03	45.62


N2
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N122
N125
N114
N117
N120
N123
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N124
N121
N109
N112
N115
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N107
N110
N111
N99
N102
N105
N106
N94
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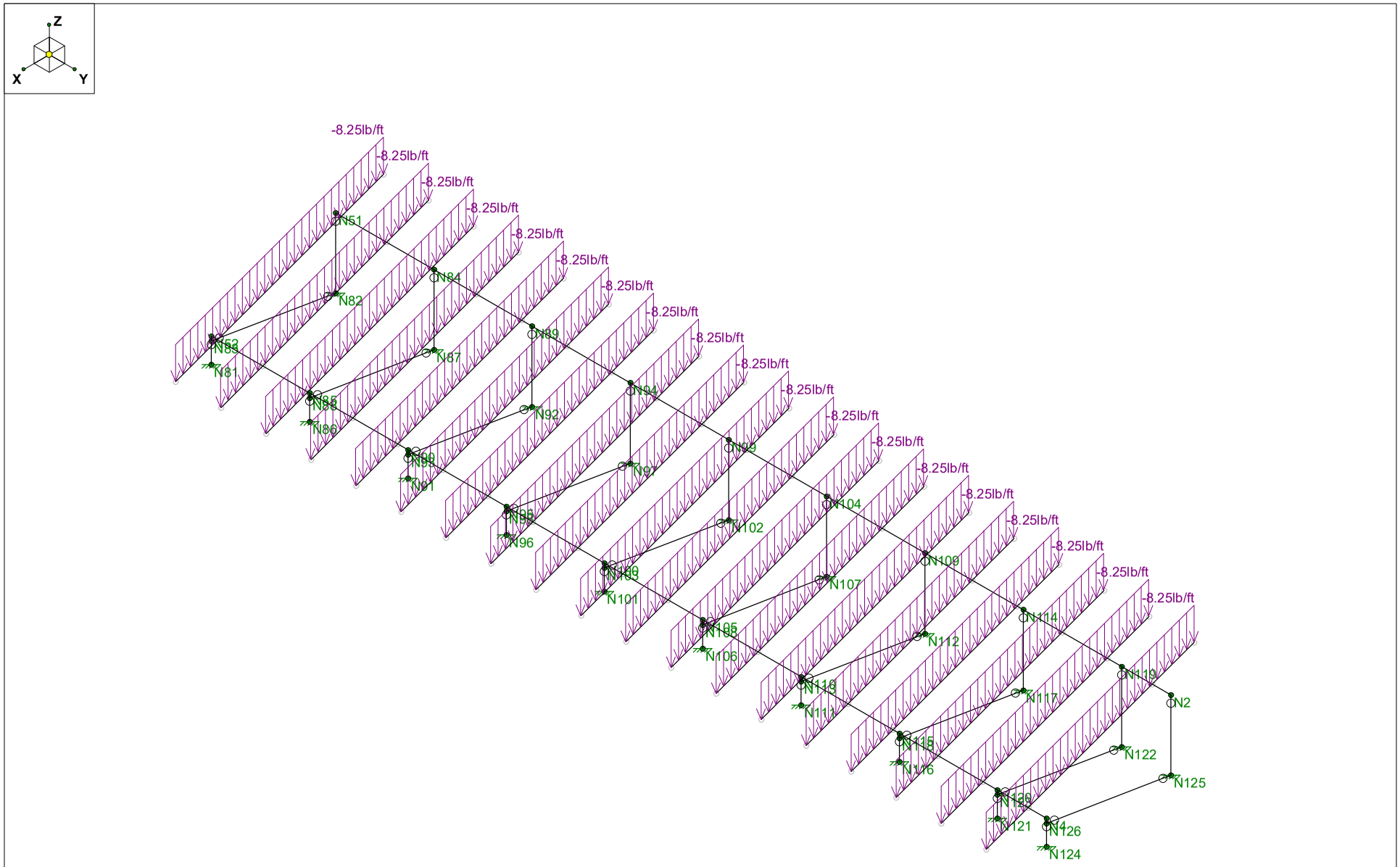
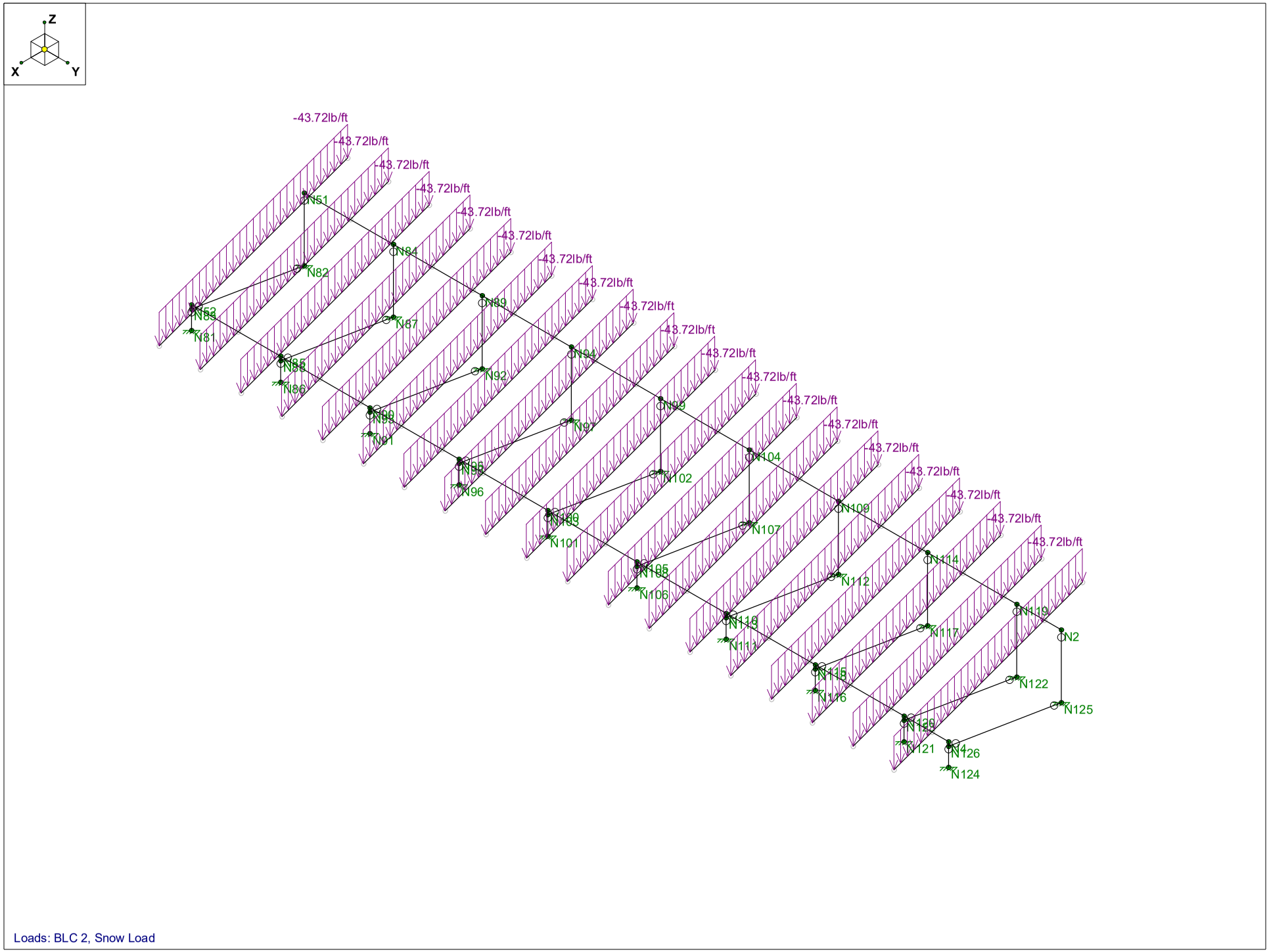
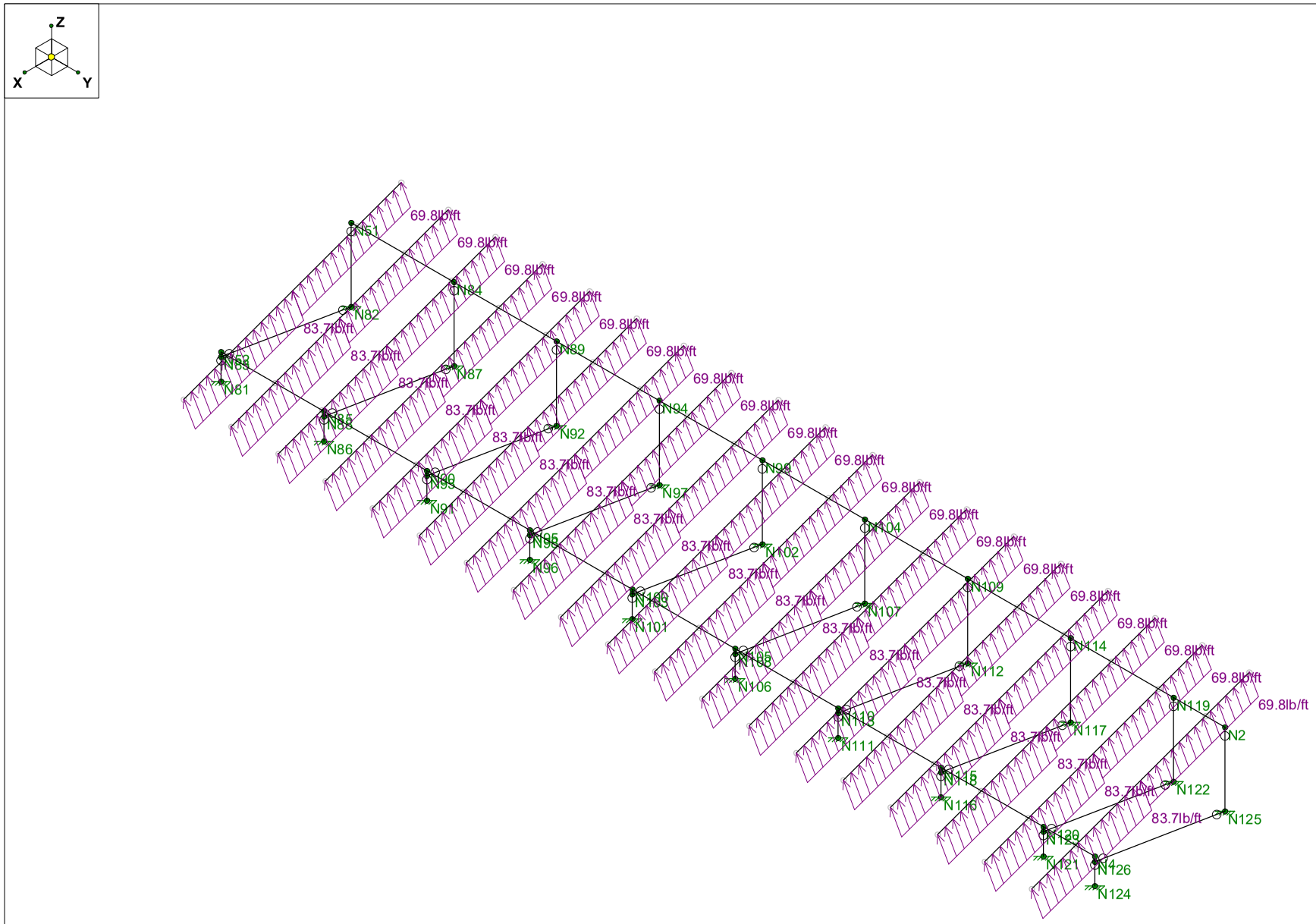


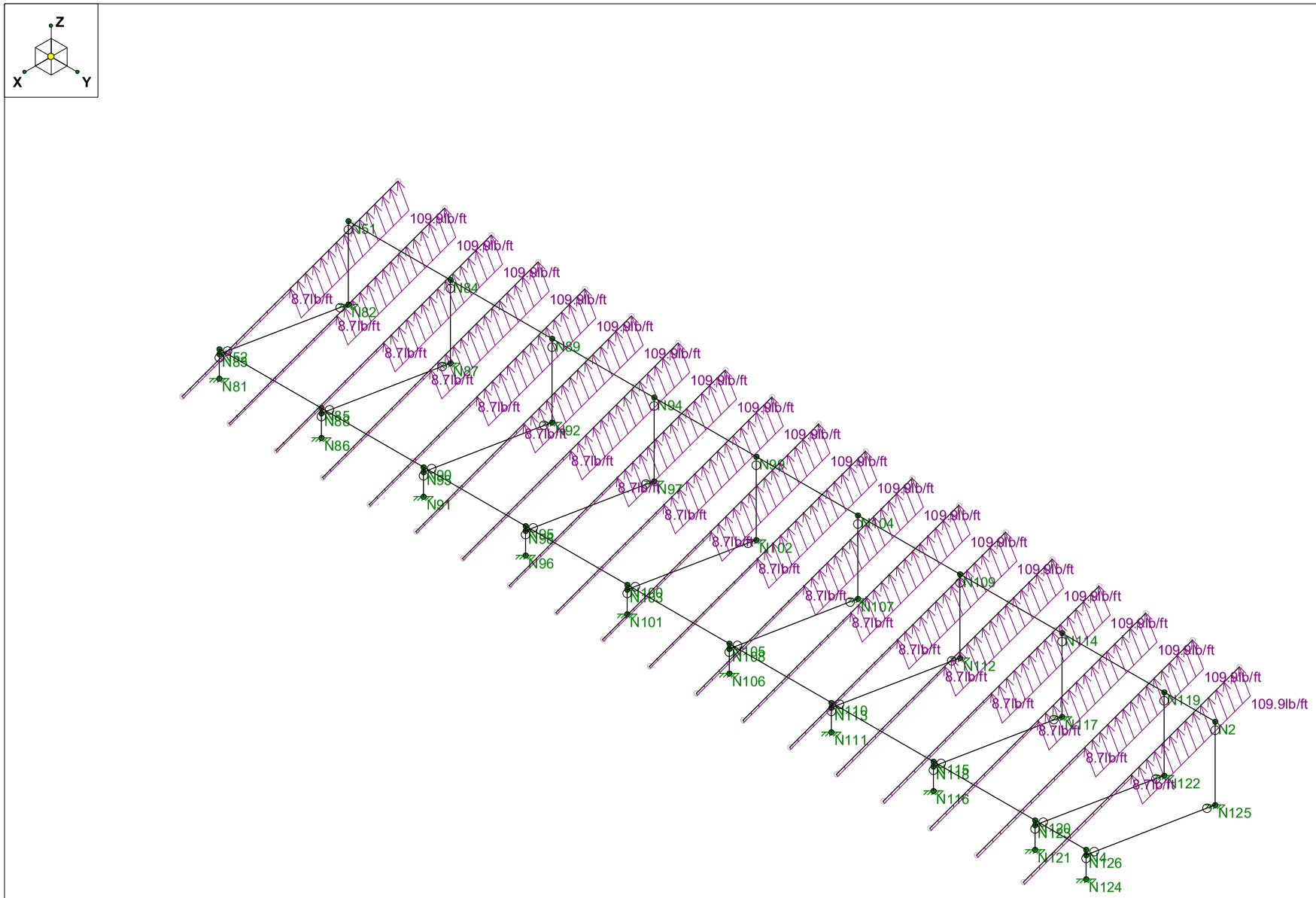
Loads: BLC 1, Dead Load



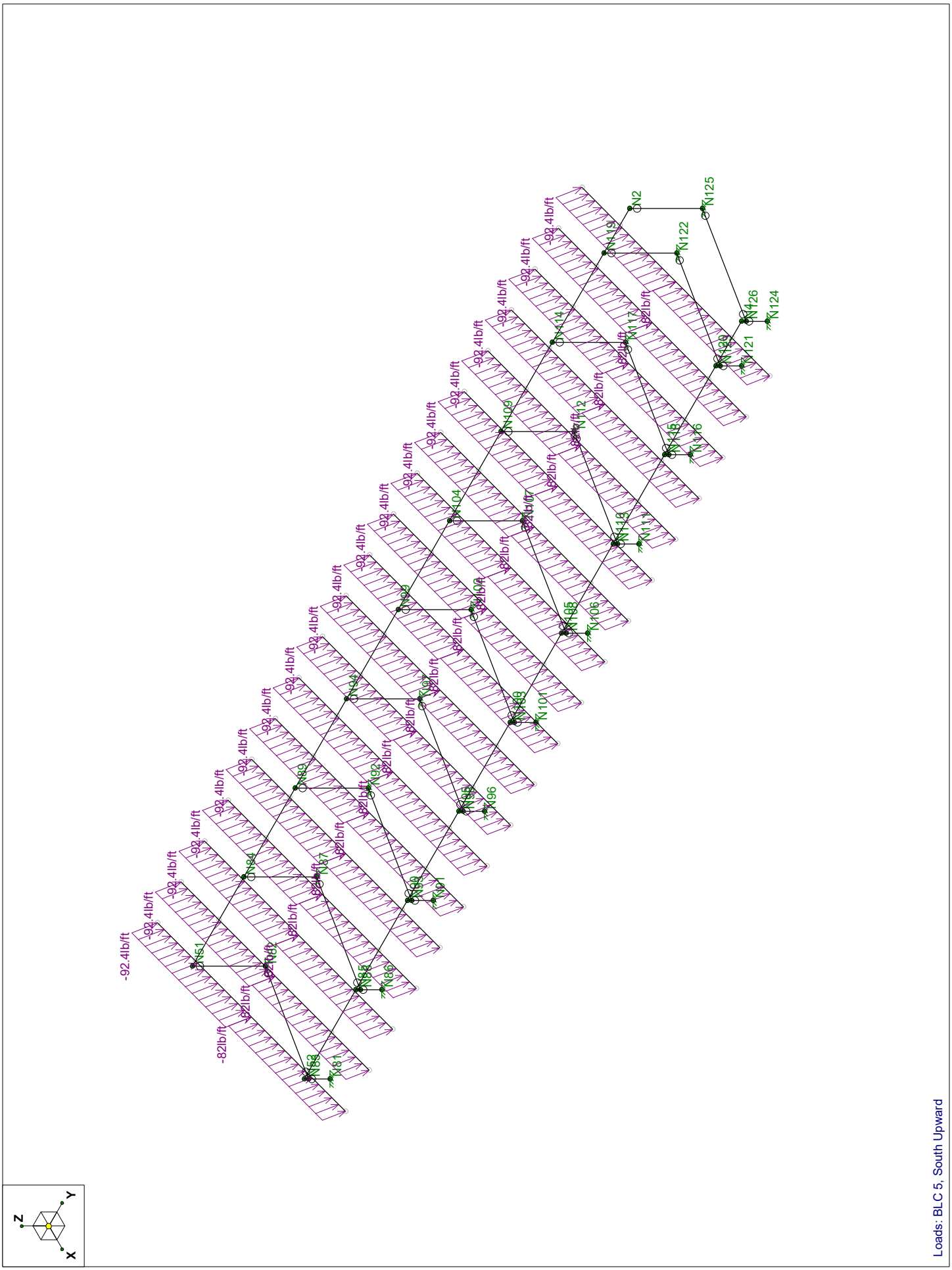
Loads: BLC 2, Snow Load



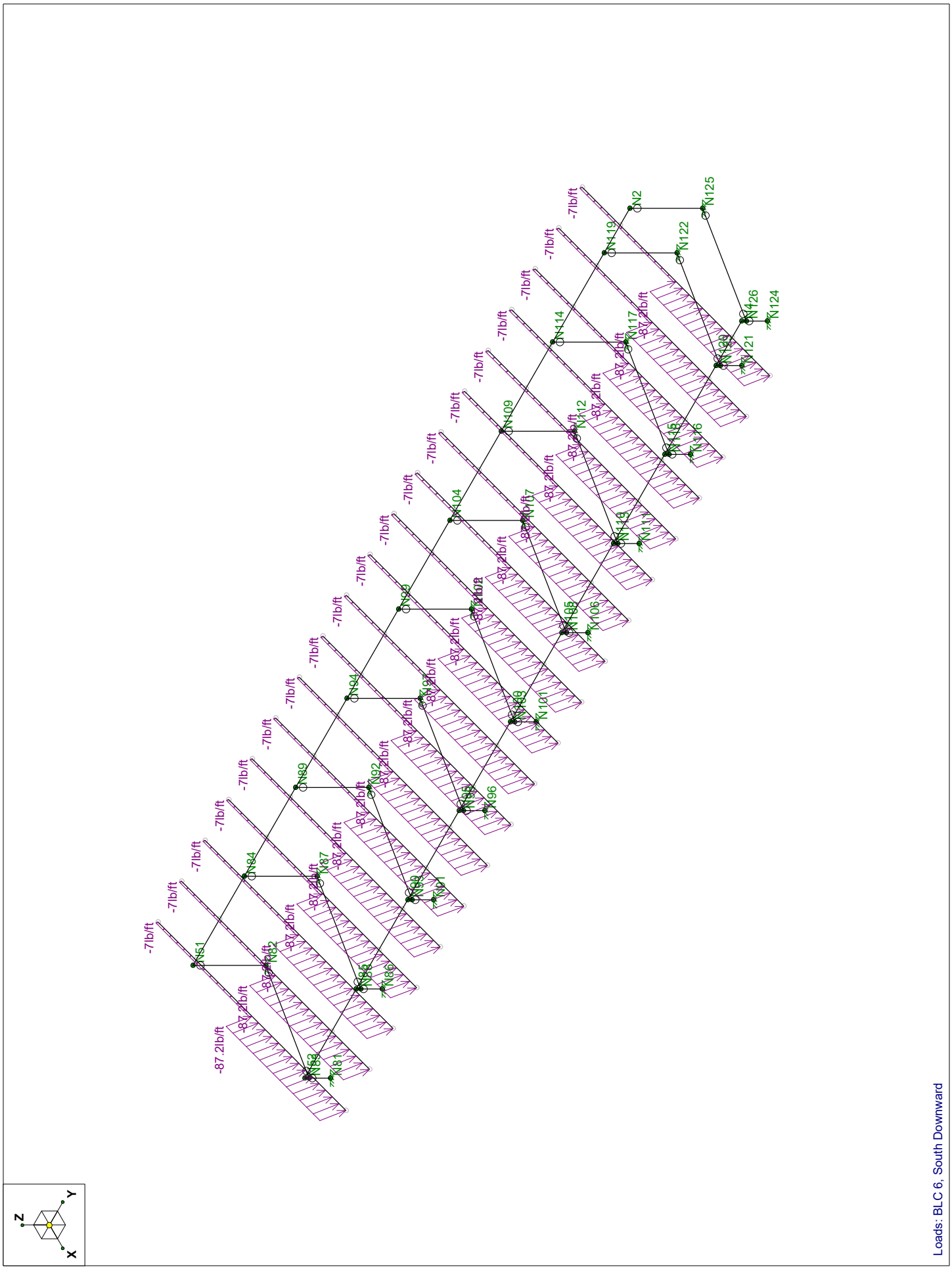
Loads: BLC 3, North Upward



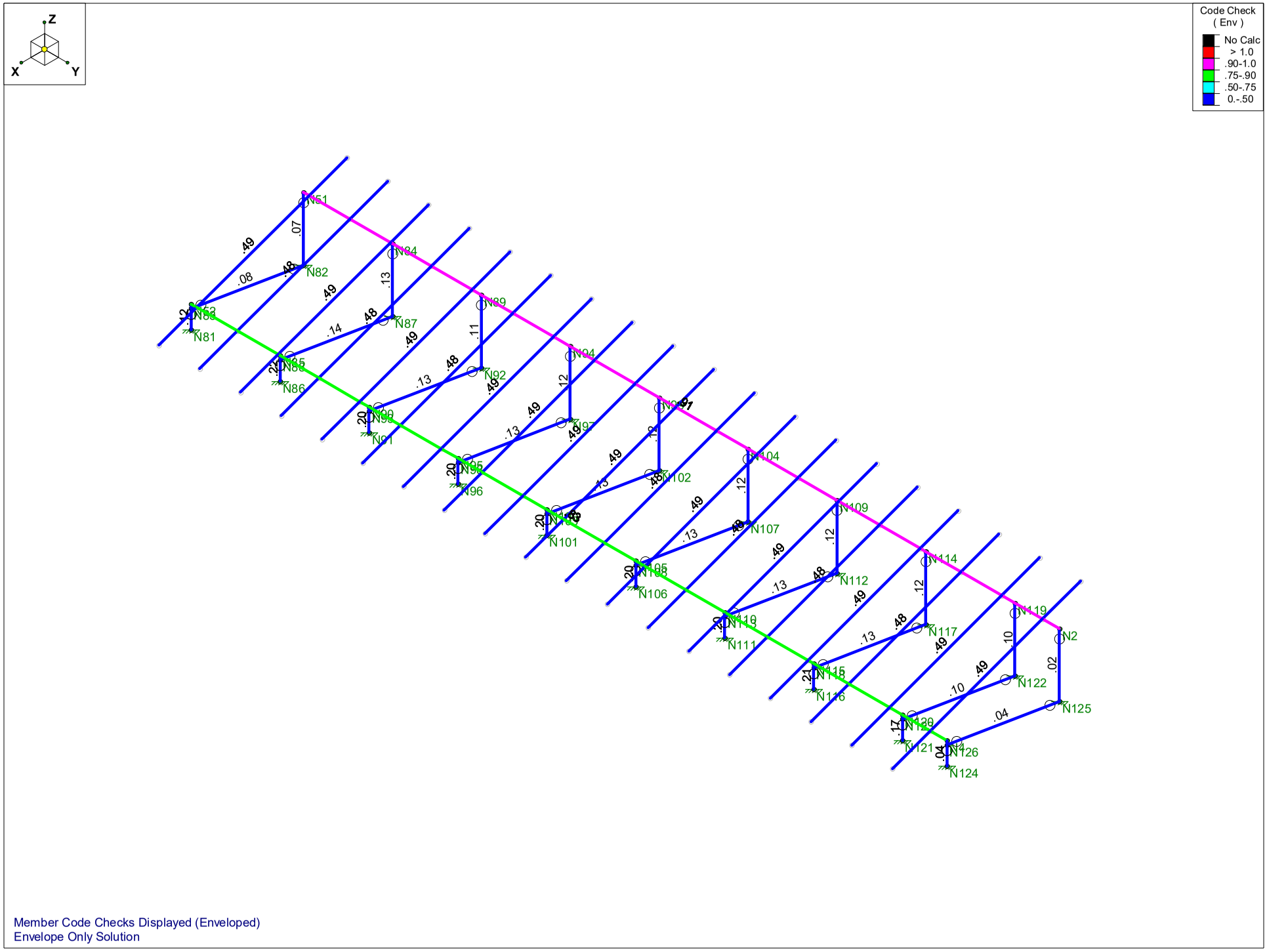
Loads: BLC 4, North Downward



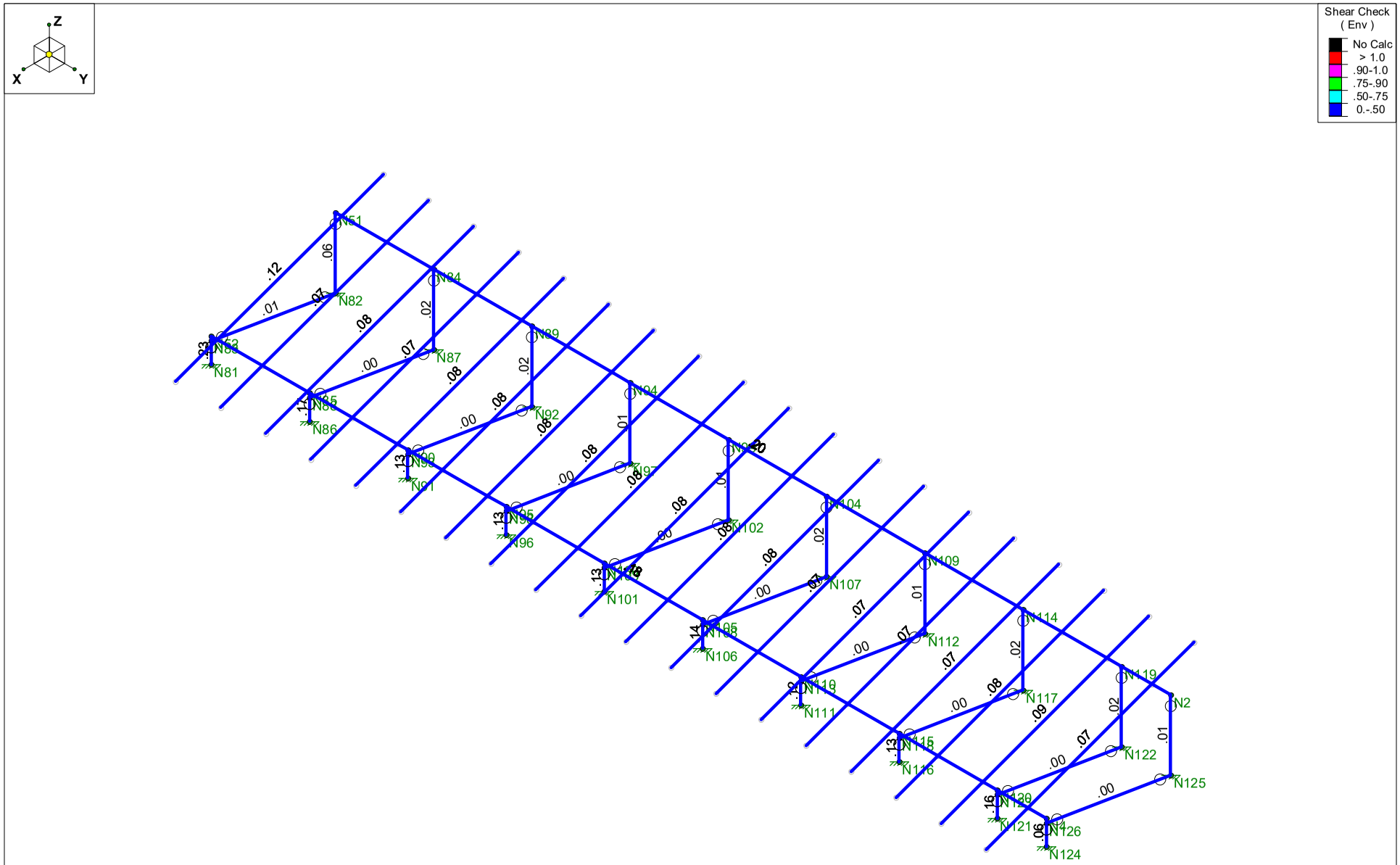
Loads: BLC 5, South Upward



Loads: BLC 6, South Downward



Member Code Checks Displayed (Enveloped)
Envelope Only Solution



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

RISA A NEMETSCHEK COMPANY

Company : Everest Solar
Designer : PAV
Job Number : 21028
Model Name : Everest Ground Mount

Checked By: JJN

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E..	Density[lb/f...	Yield[psi]	Ry	Fu[psi]	Rt
1	A36 Gr.36	29000	11154	.3	.65	490	36000	1.5	58000	1.2
2	A992	29000	11154	.3	.65	490	50000	1.1	58000	1.2
3	Pipe - 35ksi	29000	11154	.3	.65	490	35000	1.5	58000	1.2
4	T6061 Alum.	10600	4077	.3	1.29	173	36000	1.5	58000	1.2

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rules	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	Pipe 1.5	PIPE_1.5	VBrace	Pipe	Pipe - 35ksi	Typical	.749	.293	.293	.586
2	Pipe 2.0	PIPE_2.0	VBrace	Pipe	Pipe - 35ksi	Typical	1.02	.627	.627	1.25
3	Pipe 1.5X	PIPE_1.5X	VBrace	Pipe	Pipe - 35ksi	Typical	1	.372	.372	.744
4	Pipe 2.0X	PIPE_2.0X	VBrace	Pipe	Pipe - 35ksi	Typical	1.4	.827	.827	1.65

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Memb...	Surface(Plate/Wall)
1	Dead Load	DL			-1			38		
2	Snow Load	SL						38		
3	North Upward	WL						76		
4	North Downward	WL						76		
5	South Upward	WL						76		
6	South Downward	WL						76		
7	Earthquake X-dir...	ELX	.8							
8	Earthquake Y-dir...	ELY		.8						

Load Combinations

	Description	Solve	PDelta	S...	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact..	BLC	Fact...
1	IBC 16-8	Yes	Y		DL	1	NL	1																
2	IBC 16-9	Yes	Y		DL	1	LL	1	LLS	1	NL	1												
3	IBC 16-10...	Yes	Y		DL	1	NL	1																
4	IBC 16-10...	Yes	Y		DL	1	SL	1	SLN	1	NL	1												
5	IBC 16-11...	Yes	Y		DL	1	LL	.75	LLS	.75	SL	.75	SLN	.75	NL	1								
6	IBC 16-12...	Yes	Y		DL	1	3	.6	NL	1														
7	IBC 16-13...	Yes	Y		DL	1	3	.45	LL	.75	LLS	.75	NL	1										
8	IBC 16-13...	Yes	Y		DL	1	3	.45	LL	.75	LLS	.75	SL	.75	SLN	.75	NL	1						
9	IBC 16-15	Yes	Y		DL	.6	3	.6	NL	1														
10	IBC 16-12...	Yes	Y		DL	1	4	.6	NL	1														
11	IBC 16-13...	Yes	Y		DL	1	4	.45	LL	.75	LLS	.75	NL	1										
12	IBC 16-13...	Yes	Y		DL	1	4	.45	LL	.75	LLS	.75	SL	.75	SLN	.75	NL	1						
13	IBC 16-15	Yes	Y		DL	.6	4	.6	NL	1														
14	IBC 16-12...	Yes	Y		DL	1	5	.6	NL	1														
15	IBC 16-13...	Yes	Y		DL	1	5	.45	LL	.75	LLS	.75	NL	1										
16	IBC 16-13...	Yes	Y		DL	1	5	.45	LL	.75	LLS	.75	SL	.75	SLN	.75	NL	1						
17	IBC 16-15	Yes	Y		DL	.6	5	.6	NL	1														
18	IBC 16-12...	Yes	Y		DL	1	6	.6	NL	1														
19	IBC 16-13...	Yes	Y		DL	1	6	.45	LL	.75	LLS	.75	NL	1										
20	IBC 16-13...	Yes	Y		DL	1	6	.45	LL	.75	LLS	.75	SL	.75	SLN	.75	NL	1						
21	IBC 16-15	Yes	Y		DL	.6	6	.6	NL	1														

Load Combinations (Continued)

	Description	Solve	PDelta	S...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...	BLC	Fact...
22	IBC 16-12...	Yes	Y		DL	1	EL	.7																
23	IBC 16-12...	Yes	Y		DL	1	EL	-.7																
24	IBC 16-14...	Yes	Y		DL	1	EL	.525	LL	.75	LLS	.75												
25	IBC 16-14...	Yes	Y		DL	1	EL	-.525	LL	.75	LLS	.75												
26	IBC 16-14...	Yes	Y		DL	1	EL	.525	LL	.75	LLS	.75	SL	.75	SLN	.75								
27	IBC 16-14...	Yes	Y		DL	1	EL	-.525	LL	.75	LLS	.75	SL	.75	SLN	.75								
28	IBC 16-16...	Yes	Y		DL	.6	EL	.7																
29	IBC 16-16...	Yes	Y		DL	.6	EL	-.7																

Envelope Joint Reactions

	Joint		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
1	N81	max	71.351	6	3.342	16	648.713	20	1.037	9	18.997	6	86.953	9
2		min	-80.125	17	-2.175	9	-221.698	9	-2.201	16	-21.437	17	-108.123	14
3	N82	max	395.591	17	.182	9	807.403	16	1.495	9	7.541	17	27.869	13
4		min	-354.101	6	-.377	16	-525.02	13	-1.412	17	-10.437	10	-40.677	16
5	N86	max	125.662	9	.526	6	1238.318	20	.11	17	33.576	9	35.565	16
6		min	-147.03	14	-.57	17	-454.317	9	-.528	8	-39.437	14	-22.657	9
7	N87	max	722	14	.192	9	1573.788	16	2.696	16	8.457	14	10.951	16
8		min	-623.678	9	-.303	16	-1010.71	13	-1.297	9	-6.963	13	-5.612	13
9	N91	max	115.002	6	.529	12	1088.273	20	-.031	9	30.662	9	13.944	17
10		min	-131.523	14	-.192	17	-385.813	9	-.518	4	-35.259	14	-16.652	10
11	N92	max	648.868	17	.189	9	1360.477	16	2.029	16	17.675	14	10.862	13
12		min	-572.531	6	-.317	16	-887.764	13	-.995	13	-17.378	13	-9.887	14
13	N96	max	116.315	6	.245	12	1128.61	20	.069	13	31.051	9	10.895	14
14		min	-133.734	14	-.099	17	-407.846	9	-.348	4	-35.869	14	-9.347	13
15	N97	max	661.109	17	.19	9	1413.074	16	2.018	16	29.338	14	4.339	10
16		min	-581.361	6	-.31	16	-914.024	13	-.922	9	-30.159	13	-3.496	17
17	N101	max	115.902	6	.493	16	1118.433	20	.347	13	30.925	9	9.096	13
18		min	-132.987	14	-.4	13	-402.405	9	-.498	16	-35.665	14	-9.89	14
19	N102	max	657.718	17	.191	9	1398.167	16	1.544	16	29.197	14	3.883	17
20		min	-579.283	6	-.31	16	-906.847	13	-.528	9	-30.053	10	-4.627	10
21	N106	max	116.694	6	.733	14	1120.868	20	.515	13	31.159	9	18.287	13
22		min	-134.318	14	-.671	13	-402.195	9	-.567	14	-36.017	14	-19.95	14
23	N107	max	661.941	14	.193	9	1407.169	16	1.309	16	17.983	14	7.548	17
24		min	-580.981	9	-.307	16	-912.332	13	-.338	9	-17.688	13	-9.117	10
25	N111	max	116.809	9	.385	14	1107.629	20	.424	13	31.187	9	6.081	13
26		min	-134.706	14	-.405	13	-394.416	9	-.408	17	-36.11	14	-5.762	14
27	N112	max	662.057	14	.194	9	1396.31	16	1.621	16	7.817	14	2.937	17
28		min	-579.573	9	-.305	16	-906.922	13	-.609	9	-6.463	9	-3.436	10
29	N116	max	119.682	9	.093	21	1146.166	20	.323	8	31.96	9	10.791	14
30		min	-138.319	14	-.148	8	-411.976	9	-.241	17	-37.086	14	-13.726	13
31	N117	max	680.379	14	.195	9	1444.908	16	1.954	16	12.022	14	9.546	10
32		min	-594.694	9	-.297	16	-936.364	13	-.928	13	-10.95	13	-8.395	17
33	N121	max	94.815	9	.552	9	980.529	20	.445	12	25.348	9	42.837	14
34		min	-108.647	14	-.885	16	-361.037	9	.048	9	-29.18	14	-35.978	9
35	N122	max	536.168	14	.194	9	1220.664	16	2.696	16	17.326	14	10.315	14
36		min	-472.294	9	-.312	16	-782.015	13	-1.633	9	-17.877	13	-9.291	13
37	N124	max	24.122	6	.2	9	176.156	20	.375	12	6.396	6	24.415	17
38		min	-27.109	17	-.323	16	-41.673	9	-.161	17	-7.227	17	-22.261	6
39	N125	max	135.108	17	.18	9	227.167	16	2.128	16	6.324	17	2.709	17

Envelope Joint Reactions (Continued)

	Joint		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC
40		min	-120.473	6	-.391	16	-133.904	13	-1.275	9	-6.419	10	-3.203	10
41	M81	max	83.638	6	3.306	16	757.294	20	.816	9	22.266	6	93.417	9
42		min	-94.481	17	-2.12	9	-256.919	9	-2.108	16	-25.273	17	-112.995	14
43	M82	max	465.909	17	-.031	17	945.874	16	2.579	6	7.217	17	34.915	13
44		min	-414.909	6	-.428	12	-614.484	13	-2.653	17	-8.55	10	-41.131	16
45	M86	max	156.695	9	.58	8	1565.101	20	.146	17	41.874	9	21.615	20
46		min	-183.044	14	-.356	21	-572.762	9	-.779	8	-49.107	14	-12.648	9
47	M87	max	899.408	14	-.023	17	1972.879	16	2.272	20	23.149	14	11.469	16
48		min	-781.053	9	-.421	12	-1265.1...	13	-.176	9	-22.242	13	-10.943	13
49	M91	max	142.778	6	.666	12	1360.718	20	.033	17	38.065	9	6.972	17
50		min	-163.639	14	-.138	17	-480.294	9	-.725	12	-43.871	14	-10.907	10
51	M92	max	805.345	17	-.024	17	1699.197	16	1.684	4	18.059	14	4.607	13
52		min	-710.535	6	-.416	12	-1105.8...	13	.018	9	-17.236	13	-4.353	14
53	M96	max	148.235	9	.378	12	1411.914	20	.049	17	39.578	9	6.763	14
54		min	-171.389	14	-.143	17	-500.549	9	-.484	12	-45.944	14	-5.204	13
55	M97	max	841.005	14	-.022	17	1775.075	16	1.791	20	9.496	14	1.275	12
56		min	-736.066	9	-.411	12	-1149.9...	13	.028	9	-7.867	9	-.332	17
57	M101	max	145.897	6	.431	16	1398.751	20	.083	9	38.939	9	14.067	13
58		min	-168.17	14	-.239	9	-496.718	9	-.308	20	-45.088	14	-15.091	14
59	M102	max	826.226	14	-.021	17	1753.061	16	1.891	12	15.066	14	2.355	17
60		min	-725.42	6	-.407	12	-1136.6...	13	-.257	17	-13.881	13	-3.328	12
61	M106	max	144.874	6	.129	12	1402.972	20	.024	9	38.677	9	.586	6
62		min	-166.917	14	-.027	9	-502.321	9	-.185	12	-44.763	14	-.573	21
63	M107	max	821.177	14	-.02	17	1757.181	16	1.697	4	21.884	14	.117	8
64		min	-721.734	6	-.403	12	-1135.1...	13	.101	17	-21.299	13	-.117	21
65	M111	max	143.826	9	.479	13	1410.709	20	.272	16	38.417	9	18.954	14
66		min	-167.242	14	-.456	14	-504.307	9	-.309	13	-44.849	14	-15.656	13
67	M112	max	821.667	14	-.02	17	1773.088	16	1.844	20	15.579	14	4.211	10
68		min	-715.411	9	-.399	12	-1147.86	13	-.228	9	-14.667	13	-2.484	17
69	M114	max	50.379	6	1.585	9	465.444	20	.869	14	13.41	6	77.475	14
70		min	-56.368	17	-1.898	14	-155.88	9	-.66	9	-15.09	17	-67.615	9
71	M115	max	282.859	17	-.023	17	580.667	16	2.907	16	25.524	17	7.03	16
72		min	-253.649	6	-.394	12	-359.732	13	-1.566	9	-30.838	10	-3.872	9
73	Totals:	max	9179.764	14	0	9	42508....	16						
74		min	-8079.6...	9	0	16	-18137....	9						

Envelope AISC 14th(360-10): ASD Steel Code Checks

	Member	Shape	Code C...	Loc[ft]	LC	Shear ...	Loc[ft]	Dir	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om ...	Mnzz/om ...	Cb	Eqn
1	M35	PIPE_1.5	.487	6.75	16	.069	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
2	M36	PIPE_1.5	.487	6.75	16	.101	2.813		13	4778.659	15697.605	735.279	735.279	1	H1-1b
3	M37	PIPE_1.5	.490	6.75	16	.077	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
4	M38	PIPE_1.5	.490	6.75	16	.068	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
5	M39	PIPE_1.5	.490	6.75	16	.077	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
6	M40	PIPE_1.5	.486	6.75	16	.082	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
7	M41	PIPE_1.5	.485	6.75	16	.074	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
8	M42	PIPE_1.5	.492	6.75	16	.069	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
9	M43	PIPE_1.5	.483	6.75	16	.077	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
10	M45	PIPE_1.5	.484	6.75	16	.081	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
11	M46	PIPE_1.5	.491	6.75	16	.076	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
12	M47	PIPE_1.5	.489	6.75	16	.069	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b

Envelope AISC 14th(360-10): ASD Steel Code Checks (Continued)

	Member	Shape	Code C...	Loc[ft]	LC	Shear ...	Loc[ft]	Dir	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om ...	Mnzz/om ...	Cb	Eqn
13	M48	PIPE_1.5	.488	6.75	16	.082	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
14	M39A	PIPE_2.0	.999	7.438	16	.157	44.625		16	13883.389	21377.246	1245.259	1245.259	1	H1-1b
15	M40A	PIPE_2.0	.924	7.438	16	.140	30.281		20	13883.389	21377.246	1245.259	1245.259	1	H1-1b
16	M45B	PIPE_1.5	.488	6.75	16	.125	2.813		13	4778.659	15697.605	735.279	735.279	1	H1-1b
17	M46B	PIPE_1.5	.488	6.75	16	.083	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
18	M138	PIPE_1.5	.489	6.75	16	.069	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
19	M139A	PIPE_1.5	.491	6.75	16	.077	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
20	M140B	PIPE_1.5	.483	6.75	16	.079	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
21	M141A	PIPE_1.5	.486	6.75	16	.082	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
22	M51	PIPE_1.5	.484	6.75	16	.073	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
23	M52A	PIPE_1.5	.491	6.75	16	.076	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
24	M53A	PIPE_1.5	.484	6.75	16	.070	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
25	M54A	PIPE_1.5	.489	6.75	16	.077	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
26	M55A	PIPE_1.5	.483	6.75	16	.076	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
27	M56	PIPE_1.5	.488	6.75	16	.084	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
28	M57	PIPE_1.5	.485	6.75	16	.082	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
29	M58	PIPE_1.5	.485	6.75	16	.082	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
30	M59	PIPE_1.5	.487	6.75	16	.083	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
31	M60	PIPE_1.5	.483	6.75	16	.076	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
32	M61	PIPE_1.5	.489	6.75	16	.079	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
33	M62	PIPE_1.5	.484	6.75	16	.070	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
34	M63	PIPE_1.5	.490	6.75	16	.069	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
35	M64	PIPE_1.5	.913	18.063	16	.200	36.125		16	7966.511	15697.605	735.279	735.279	1	H1-1b
36	M65	PIPE_1.5	.835	18.063	16	.179	36.125		20	7966.511	15697.605	735.279	735.279	1	H1-1b
37	M66	PIPE_1.5	.487	6.75	16	.122	2.813		13	4778.659	15697.605	735.279	735.279	1	H1-1b
38	M67	PIPE_1.5	.485	6.75	16	.069	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
39	M81	PIPE_1.5	.490	6.75	16	.072	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
40	M82	PIPE_1.5	.483	6.75	16	.076	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
41	M83	PIPE_1.5	.487	6.75	16	.087	10.688		20	4778.659	15697.605	735.279	735.279	1	H1-1b
42	M84	PIPE_1.5	.486	6.75	16	.069	2.813		16	4778.659	15697.605	735.279	735.279	1	H1-1b
43	M142	PIPE_1.5	.121	1.25	14	.234	1.25		14	15046.072	15697.605	735.279	735.279	1...	H1-1b
44	M143	PIPE_1.5	.067	0	16	.062	0		16	11156.947	15697.605	735.279	735.279	1...	H1-1b*
45	M144	PIPE_1.5	.077	7.677	17	.006	0		16	5188.632	15697.605	735.279	735.279	1...	H1-1b*
46	M118A	PIPE_1.5	.224	1.25	14	.171	1.25		14	15046.072	15697.605	735.279	735.279	1...	H1-1b
47	M119A	PIPE_1.5	.132	0	16	.017	0		16	11156.947	15697.605	735.279	735.279	1...	H1-1b*
48	M120A	PIPE_1.5	.141	7.677	14	.003	0		16	5188.632	15697.605	735.279	735.279	1...	H1-1b*
49	M121A	PIPE_1.5	.200	1.25	14	.131	1.25		17	15046.072	15697.605	735.279	735.279	1...	H1-1b
50	M122A	PIPE_1.5	.114	0	16	.018	0		13	11156.947	15697.605	735.279	735.279	1...	H1-1b*
51	M123A	PIPE_1.5	.126	7.677	14	.003	7.677		10	5188.632	15697.605	735.279	735.279	1...	H1-1b*
52	M124A	PIPE_1.5	.204	1.25	14	.128	1.25		14	15046.072	15697.605	735.279	735.279	1...	H1-1b
53	M125B	PIPE_1.5	.119	0	16	.008	0		10	11156.947	15697.605	735.279	735.279	1...	H1-1b*
54	M126B	PIPE_1.5	.128	7.677	14	.002	7.677		14	5188.632	15697.605	735.279	735.279	1...	H1-1b*
55	M127B	PIPE_1.5	.203	1.25	14	.126	1.25		14	15046.072	15697.605	735.279	735.279	2...	H1-1b
56	M128B	PIPE_1.5	.117	0	16	.009	0		10	11156.947	15697.605	735.279	735.279	1...	H1-1b*
57	M129B	PIPE_1.5	.128	7.677	14	.002	7.677		14	5188.632	15697.605	735.279	735.279	1...	H1-1b*
58	M130B	PIPE_1.5	.204	1.25	14	.143	1.25		14	15046.072	15697.605	735.279	735.279	2...	H1-1b
59	M131B	PIPE_1.5	.118	0	16	.015	0		10	11156.947	15697.605	735.279	735.279	1...	H1-1b*
60	M132A	PIPE_1.5	.129	7.677	14	.003	7.677		14	5188.632	15697.605	735.279	735.279	1...	H1-1b*
61	M133A	PIPE_1.5	.205	1.25	14	.121	1.25		14	15046.072	15697.605	735.279	735.279	2...	H1-1b
62	M134A	PIPE_1.5	.117	0	16	.006	0		10	11156.947	15697.605	735.279	735.279	1...	H1-1b*
63	M135A	PIPE_1.5	.129	7.677	14	.002	7.677		10	5188.632	15697.605	735.279	735.279	1...	H1-1b*
64	M136A	PIPE_1.5	.210	1.25	14	.132	1.25		14	15046.072	15697.605	735.279	735.279	1...	H1-1b

Envelope AISC 14th(360-10): ASD Steel Code Checks (Continued)

	Member	Shape	Code C...	Loc[ft]	LC	Shear ...	Loc[ft]	Dir	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om ...	Mnzz/om ...	Cb	Eqn
65	M137A	PIPE_1.5	.121	0	16	.015	0		10	11156.947	15697.605	735.279	735.279	1....	H1-1b*
66	M138B	PIPE_1.5	.133	7.677	14	.003	7.677		10	5188.632	15697.605	735.279	735.279	1....	H1-1b*
67	M139B	PIPE_1.5	.167	1.25	14	.157	1.25		14	15046.072	15697.605	735.279	735.279	1....	H1-1b
68	M140A	PIPE_1.5	.103	0	16	.017	0		14	11156.947	15697.605	735.279	735.279	1....	H1-1b*
69	M141B	PIPE_1.5	.104	7.677	14	.004	7.677		14	5188.632	15697.605	735.279	735.279	1....	H1-1b*
70	M142A	PIPE_1.5	.040	1.25	14	.061	1.25		17	15046.072	15697.605	735.279	735.279	1....	H1-1b
71	M143A	PIPE_1.5	.018	0	16	.005	0		10	11156.947	15697.605	735.279	735.279	1....	H1-1b*
72	M144A	PIPE_1.5	.038	3.839	14	.003	7.677		14	5188.632	15697.605	735.279	735.279	1....	H1-1b
73	M76	PIPE_1.5	.143	1.25	14	.254	1.25		14	15046.072	15697.605	735.279	735.279	1....	H1-1b
74	M77	PIPE_1.5	.079	0	16	.063	0		16	11156.947	15697.605	735.279	735.279	1....	H1-1b*
75	M78	PIPE_1.5	.091	7.677	17	.007	7.677		14	5188.632	15697.605	735.279	735.279	1....	H1-1b*
76	M76A	PIPE_1.5	.280	1.25	14	.176	1.25		14	15046.072	15697.605	735.279	735.279	1....	H1-1b
77	M77A	PIPE_1.5	.166	0	16	.019	0		14	11156.947	15697.605	735.279	735.279	1....	H1-1b*
78	M78A	PIPE_1.5	.175	7.677	14	.003	7.677		20	5188.632	15697.605	735.279	735.279	1....	H1-1b*
79	M79	PIPE_1.5	.249	1.25	14	.147	1.25		17	15046.072	15697.605	735.279	735.279	1....	H1-1b
80	M80	PIPE_1.5	.143	0	16	.008	0		13	11156.947	15697.605	735.279	735.279	1....	H1-1b*
81	M81A	PIPE_1.5	.157	7.677	14	.003	7.677		10	5188.632	15697.605	735.279	735.279	1....	H1-1b*
82	M82A	PIPE_1.5	.260	1.25	14	.153	1.25		14	15046.072	15697.605	735.279	735.279	1....	H1-1b
83	M83A	PIPE_1.5	.149	0	16	.002	0		12	11156.947	15697.605	735.279	735.279	1....	H1-1b*
84	M84A	PIPE_1.5	.164	7.677	14	.002	7.677		14	5188.632	15697.605	735.279	735.279	1....	H1-1b*
85	M85	PIPE_1.5	.256	1.25	14	.163	1.25		14	15046.072	15697.605	735.279	735.279	1....	H1-1b
86	M86	PIPE_1.5	.147	0	16	.006	0		10	11156.947	15697.605	735.279	735.279	1....	H1-1b*
87	M87	PIPE_1.5	.161	7.677	14	.003	7.677		14	5188.632	15697.605	735.279	735.279	1....	H1-1b*
88	M88	PIPE_1.5	.254	1.25	14	.140	1.25		14	15046.072	15697.605	735.279	735.279	2....	H1-1b
89	M89	PIPE_1.5	.148	0	16	.001	0		17	11156.947	15697.605	735.279	735.279	1....	H1-1b*
90	M90	PIPE_1.5	.160	7.677	14	.002	7.677		18	5188.632	15697.605	735.279	735.279	1....	H1-1b*
91	M91	PIPE_1.5	.255	1.25	14	.168	1.25		14	15046.072	15697.605	735.279	735.279	1....	H1-1b
92	M92	PIPE_1.5	.149	0	16	.007	0		10	11156.947	15697.605	735.279	735.279	1....	H1-1b*
93	M93	PIPE_1.5	.160	7.677	14	.003	7.677		14	5188.632	15697.605	735.279	735.279	1....	H1-1b*
94	M94	PIPE_1.5	.085	1.25	14	.167	1.25		14	15046.072	15697.605	735.279	735.279	1....	H1-1b
95	M95	PIPE_1.5	.054	0	14	.011	0		16	11156.947	15697.605	735.279	735.279	1....	H1-1b
96	M96	PIPE_1.5	.054	7.677	17	.005	7.677		14	5188.632	15697.605	735.279	735.279	1....	H1-1b*

TAYLOR & SYFAN CONSULTING ENGINEERS, INC

SAN LUIS OBISPO
PASADENA
SANTA ROSA

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	Axial	Uplift	Moment (y)	Shear (x)
Front	1,238 lb	-454 lb	-39 ft-lb	-147 lb
Back	1,574 lb	-1,011 lb	-30 ft-lb	722 lb

	Joint		X		Y		Z		Mx		My		Mz
	N81	max	71.35	6	3.34	16	648.71	20	1.04	9	19	6	86.95
	N81	min	-80.13	17	-2.18	9	-221.7	9	-2.2	16	-21.44	17	-108.12
B	N82	max	395.59	17	0.18	9	807.4	16	1.5	9	7.54	17	27.87
	N82	min	-354.1	6	-0.38	16	-525.02	13	-1.41	17	-10.44	10	-40.68
	N86	max	125.66	9	0.53	6	1238.32	20	0.11	17	33.58	9	35.57
	N86	min	-147.03	14	-0.57	17	-454.32	9	-0.53	8	-39.44	14	-22.66
B	N87	max	722	14	0.19	9	1573.79	16	2.7	16	8.46	14	10.95
	N87	min	-623.68	9	-0.3	16	-1010.71	13	-1.3	9	-6.96	13	-5.61
	N91	max	115	6	0.53	12	1088.27	20	-0.03	9	30.66	9	13.94
	N91	min	-131.52	14	-0.19	17	-385.81	9	-0.52	4	-35.26	14	-16.65
B	N92	max	648.87	17	0.19	9	1360.48	16	2.03	16	17.68	14	10.86
	N92	min	-572.53	6	-0.32	16	-887.76	13	-1	13	-17.38	13	-9.89
	N96	max	116.32	6	0.25	12	1128.61	20	0.07	13	31.05	9	10.9
	N96	min	-133.73	14	-0.1	17	-407.85	9	-0.35	4	-35.87	14	-9.35
B	N97	max	661.11	17	0.19	9	1413.07	16	2.02	16	29.34	14	4.34
	N97	min	-581.36	6	-0.31	16	-914.02	13	-0.92	9	-30.16	13	-3.5
	N101	max	115.9	6	0.49	16	1118.43	20	0.35	13	30.93	9	9.1
	N101	min	-132.99	14	-0.4	13	-402.41	9	-0.5	16	-35.67	14	-9.89
B	N102	max	657.72	17	0.19	9	1398.17	16	1.54	16	29.2	14	3.88
	N102	min	-579.28	6	-0.31	16	-906.85	13	-0.53	9	-30.05	10	-4.63
	N106	max	116.69	6	0.73	14	1120.87	20	0.52	13	31.16	9	18.29
	N106	min	-134.32	14	-0.67	13	-402.2	9	-0.57	14	-36.02	14	-19.95
B	N107	max	661.94	14	0.19	9	1407.17	16	1.31	16	17.98	14	7.55
	N107	min	-580.98	9	-0.31	16	-912.33	13	-0.34	9	-17.69	13	-9.12
	N111	max	116.81	9	0.39	14	1107.63	20	0.42	13	31.19	9	6.08
	N111	min	-134.71	14	-0.41	13	-394.42	9	-0.41	17	-36.11	14	-5.76
B	N112	max	662.06	14	0.19	9	1396.31	16	1.62	16	7.82	14	2.94
	N112	min	-579.57	9	-0.31	16	-906.92	13	-0.61	9	-6.46	9	-3.44
	N116	max	119.68	9	0.09	21	1146.17	20	0.32	8	31.96	9	10.79
	N116	min	-138.32	14	-0.15	8	-411.98	9	-0.24	17	-37.09	14	-13.73
B	N117	max	680.38	14	0.2	9	1444.91	16	1.95	16	12.02	14	9.55
	N117	min	-594.69	9	-0.3	16	-936.36	13	-0.93	13	-10.95	13	-8.4
	N121	max	94.82	9	0.55	9	980.53	20	0.45	12	25.35	9	42.84
	N121	min	-108.65	14	-0.89	16	-361.04	9	0.05	9	-29.18	14	-35.98
B	N122	max	536.17	14	0.19	9	1220.66	16	2.7	16	17.33	14	10.32
	N122	min	-472.29	9	-0.31	16	-782.02	13	-1.63	9	-17.88	13	-9.29
	N124	max	24.12	6	0.2	9	176.16	20	0.38	12	6.4	6	24.42
	N124	min	-27.11	17	-0.32	16	-41.67	9	-0.16	17	-7.23	17	-22.26
B	N125	max	135.11	17	0.18	9	227.17	16	2.13	16	6.32	17	2.71
	N125	min	-120.47	6	-0.39	16	-133.9	13	-1.28	9	-6.42	10	-3.2
B													

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INNOVATIVE STRUCTURAL DESIGNS

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Page:
Job No:21028
Engr:

Friction Pile Design

Version 12.35 - 2018 IBC

INPUT DATA:

Name: Pipe1.5_F_Full

V = 0.15 kips @ H = 0.00 ft above grade

M = 0.04 ft-kips @ H = 0.00 ft above grade

Axial = 1.24 kips

Creep = 0.00 plf/ft for D = 0.00 ft of soil

Pile is unconstrained

1.33x Short-term Stress Increase

2x Isolated Pile Increase

Pile Width = 12.00 inches

Passive = 150.00 psf/ft to a Maximum = 1500.00 psf

Friction = 250.00 psf/ft End Bearing = 2000.00 psf

SOLUTION:

Required Embedment Depths into Firm Soils:

Axial = 1.00 ft Lateral = 2.00

Required = 2.00 ft total embedment

Soil Pressures:

S1 = 266.67 psf at D/3

S3 = 4000.00 psf at full depth

Moments:

M = 0.14 ft-kips unfactored

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Project: **21028 – VA Solar Ground Mount – Everest**

PILE UPLIFT CALCULATION *(FRONT PILE)*

SYSTEM INFORMATION

Pile Diameter	**12**	**inches**
Depth of Pile	**2**	**feet**
Distance Discounted	**1**	**feet**
Skin Friction	**250**	**psf/ft**
Concrete Density	**150**	**pcf**

LOADING INFORMATION

Uplift Demand *(ASD Level)*	**454**	**pounds**

UPLIFT CAPACITY

From Skin Friction

*Skin friction = Allowed Skin Friction * Circumference * Allowed Pile Depth*

785 **pounds**

From Concrete Weight

141 **pounds** *Concrete weight = 0.6 * Concrete Density * Pile Area * Full Pile Height*

TOTAL UPLIFT RESISTANCE

927 **pounds**

Pile Design is Acceptable for Uplift Demand

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INNOVATIVE STRUCTURAL DESIGNS

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Page:
Job No:21028
Engr:

Friction Pile Design

Version 12.35 - 2018 IBC

INPUT DATA:

Name: Pipe1.5_B_Full

V = 0.72 kips @ H = 0.00 ft above grade

M = 0.03 ft-kips @ H = 0.00 ft above grade

Axial = 1.57 kips

Creep = 0.00 plf/ft for D = 0.00 ft of soil

Pile is unconstrained

1.33x Short-term Stress Increase

2x Isolated Pile Increase

Pile Width = 12.00 inches

Passive = 150.00 psf/ft to a Maximum = 1500.00 psf

Friction = 250.00 psf/ft End Bearing = 2000.00 psf

SOLUTION:

Required Embedment Depths into Firm Soils:

Axial = 2.00 ft Lateral = 4.00

Required = 4.00 ft total embedment

Soil Pressures:

S1 = 533.33 psf at D/3

S3 = 4000.00 psf at full depth

Moments:

M = 0.99 ft-kips unfactored

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Project: **21028 – VA Solar Ground Mount – Everest**

PILE UPLIFT CALCULATION *(BACK PILE)*

SYSTEM INFORMATION

Pile Diameter	**12**	**inches**
Depth of Pile	**4**	**feet**
Distance Discounted	**1**	**feet**
Skin Friction	**250**	**psf/ft**
Concrete Density	**150**	**pcf**

LOADING INFORMATION

Uplift Demand *(ASD Level)*	**1011**	**pounds**

UPLIFT CAPACITY

From Skin Friction

*Skin friction = Allowed Skin Friction * Circumference * Allowed Pile Depth*

2356 **pounds**

From Concrete Weight

283 **pounds** *Concrete weight = 0.6 * Concrete Density * Pile Area * Full Pile Height*

TOTAL UPLIFT RESISTANCE

2639 **pounds**

Pile Design is Acceptable for Uplift Demand