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STRUCTURAL CALCULATIONS, NOTES, & SPECIFICATIONS

PREPARED FOR:

PROJECT TYPE:

K2 Systems Ground Mount - North Carolina

DESIGNER:

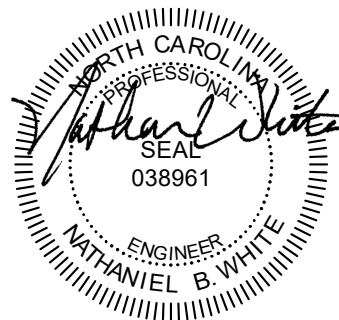
K2 Systems LLC
2835 La Mirada Dr Suite A
Vista, CA 92081

PROJECT ENGINEER:

Pedro Asuncion-Velasco

PROJECT MANAGER:

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



PRINCIPAL
Firm License: C-3895
Exp. 12/31/21
Date Signed: 09.20.2021



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Job No.: 20496
Job Name: NC Ground Mount - Everest

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Summary Letter

Date: February 26, 2021
 To: Ryan Estrada
 Product Development Engineer
 K2 Systems LLC
 From: Pedro Asuncion-Velasco
 Taylor & Syfan Consulting Engineers, Inc.
 Project: K2 Systems Ground Mount - North Carolina
 T&S Job No.: 20496
 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 February 26, 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 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 140 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 140 mph (3 sec. gust), for sites 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 registered professional 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 "D" 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

INSTALLATION DIMENSIONS

G	Wind Speed ASCE 7-16 (mph)	Snow Ground Snow Load	Tie-Brace Required?	Pipe Data		A*	A1**	Concrete Depth (A)		Concrete Depth (A1)	
				Pipe Size	Pipe Specification			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"	3'-0"	5'-3"
20°	105	20 psf	Yes	1.5"	Sch. 40	10'-0"	15'-0"	2'-3"	4'-6"	3'-0"	5'-3"
			Yes		Sch. 40	6'-6"	11'-0"	2'-0"	3'-6"	3'-0"	5'-0"
			Yes	2"	Sch. 80	7'-3"	12'-0"	2'-0"	4'-0"	3'-3"	5'-0"
30° - 35°	105	20 psf	Yes	1.5"	Sch. 40	9'-3"	13'-6"	2'-6"	4'-6"	3'-6"	5'-0"
			Yes		Sch. 40	6'-0"	9'-6"	2'-0"	4'-6"	3'-0"	6'-0"
			Yes	2"	Sch. 80	7'-0"	11'-0"	2'-3"	5'-0"	3'-0"	6'-0"
20°	110	10 psf	Yes	1.5"	Sch. 40	8'-0"	13'-6"	2'-3"	5'-3"	3'-0"	7'-0"
			Yes		Sch. 40	9'-6"	14'-0"	2'-6"	6'-0"	3'-3"	7'-0"
			Yes	2"	Sch. 80	8'-0"	13'-6"	2'-0"	4'-3"	3'-0"	5'-6"
30° - 35°	110	10 psf	Yes	1.5"	Sch. 40	9'-6"	14'-6"	2'-3"	5'-0"	3'-3"	6'-0"
			Yes		Sch. 40	6'-0"	9'-0"	2'-3"	5'-0"	3'-0"	6'-0"
			Yes	2"	Sch. 80	7'-0"	10'-6"	2'-6"	5'-0"	3'-0"	6'-3"
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			Yes	2"	Sch. 80	9'-6"	14'-0"	3'-0"	6'-0"	3'-3"	7'-3"
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			Yes	2"	Sch. 80	9'-0"	14'-0"	2'-3"	4'-6"	3'-9"	6'-0"
20°	140	10 psf	Yes	1.5"	Sch. 40	6'-0"	9'-0"	2'-3"	5'-0"	3'-0"	6'-0"
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			Yes	2"	Sch. 80	9'-0"	13'-0"	3'-0"	6'-3"	3'-3"	7'-6"
20°	140	10 psf	Yes	1.5"	Sch. 40	5'-6"	9'-6"	2'-3"	4'-6"	3'-0"	6'-0"
			Yes		Sch. 40	6'-6"	11'-0"	2'-6"	5'-0"	3'-3"	6'-3"
			Yes	2"	Sch. 40	7'-0"	12'-0"	2'-6"	5'-0"	3'-3"	6'-6"
30° - 35°	140	10 psf	Yes	1.5"	Sch. 40	8'-0"	13'-6"	2'-6"	5'-6"	3'-6"	7'-0"
			Yes		Sch. 40	5'-0"	6'-6"	2'-6"	5'-6"	3'-0"	6'-6"
			Yes	2"	Sch. 80	6'-0"	7'-6"	3'-0"	6'-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



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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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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 or 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. The drawings, calculations, notes and specifications contained herein and provided herewith are the exclusive property of Taylor & Syfan, Copyright © 2021. The use of these calculations and specifications shall be restricted to the solar array design and layout, provided by Everest, for which they were prepared and publication thereof is expressly limited to such use. Reproduction or publication by any method, in whole or in part, is prohibited without written permission of Taylor & Syfan. Title to these drawings, calculations, notes and specifications shall remain with Taylor & Syfan without prejudice.

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 02/26/2021.
 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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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 registered 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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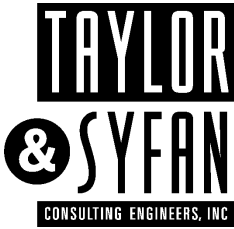
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12. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by excavations.
-



2018 IBC Solar Panel Wind Analysis - Version 1.1

Project: **20496 – NC 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)

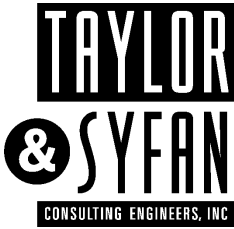
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)

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 = Gust 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)



2018 IBC Solar Panel Wind Analysis - Version 1.1

Project: **20496 – NC 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)

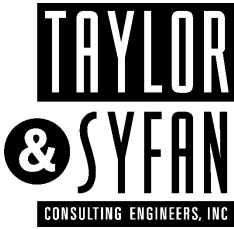
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)

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 = Gust 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)



2018 IBC Solar Panel Wind Analysis - Version 1.1

Project: **20496 – NC Ground Mount – Everest****Basic Wind Speed (V): 120 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)
120	0.85	1.00	1.00	0.85	1.00	26.63

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	-24.9	-34.0	-68.5	-93.4
15°	B	0°	0.85	-1.9	0.0	-43.0	0.0	-118.3	0.0
15°	A	180°	0.85	1.3	1.6	29.4	36.2	80.9	99.6
15°	B	180°	0.85	1.2	-0.3	27.2	-6.8	74.7	-18.7
20°	A	0°	0.85	-1.3	-1.6	-30.2	-36.2	-83.0	-99.6
20°	B	0°	0.85	-2.1	-0.2	-47.5	-3.8	-130.7	-10.4
20°	A	180°	0.85	1.6	1.8	35.5	40.0	97.5	110.0
20°	B	180°	0.85	1.7	0.1	37.7	3.0	103.8	8.3
30°	A	0°	0.85	-1.8	-1.8	-40.8	-40.8	-112.1	-112.1
30°	B	0°	0.85	-2.5	-0.5	-56.6	-11.3	-155.6	-31.1
30°	A	180°	0.85	2.1	2.1	47.5	47.5	130.7	130.7
30°	B	180°	0.85	2.6	1.0	58.9	22.6	161.9	62.3

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)

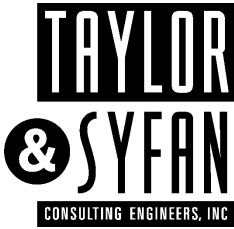
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)

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 = Gust 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)



2018 IBC Solar Panel Wind Analysis - Version 1.1

Project: **20496 – NC Ground Mount – Everest****Basic Wind Speed (V): 140 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)
140	0.85	1.00	1.00	0.85	1.00	36.25

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	-33.9	-46.2	-93.2	-127.1
15°	B	0°	0.85	-1.9	0.0	-58.5	0.0	-161.0	0.0
15°	A	180°	0.85	1.3	1.6	40.1	49.3	110.2	135.6
15°	B	180°	0.85	1.2	-0.3	37.0	-9.2	101.7	-25.4
20°	A	0°	0.85	-1.3	-1.6	-41.1	-49.3	-113.0	-135.6
20°	B	0°	0.85	-2.1	-0.2	-64.7	-5.1	-178.0	-14.1
20°	A	180°	0.85	1.6	1.8	48.3	54.4	132.8	149.7
20°	B	180°	0.85	1.7	0.1	51.4	4.1	141.2	11.3
30°	A	0°	0.85	-1.8	-1.8	-55.5	-55.5	-152.5	-152.5
30°	B	0°	0.85	-2.5	-0.5	-77.0	-15.4	-211.8	-42.4
30°	A	180°	0.85	2.1	2.1	64.7	64.7	178.0	178.0
30°	B	180°	0.85	2.6	1.0	80.1	30.8	220.3	84.7

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)

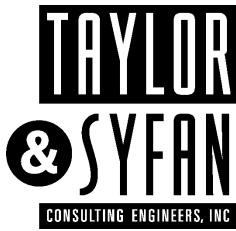
Kz = Velocity pressure exposure coefficient evaluated at height z (per ASCE Section 27.3.1)

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 = Gust 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)



SNOW LOAD CALCULATIONS PER ASCE 7-16 CH. 7

Ground Snow Load, P_g

LC1 =	10	psf
LC2 =	15	psf
LC3 =	20	psf

Flat Roof Snow Load, P_f

$$P_f = 0.7 C_e C_t I_s P_g$$

Eq. 7.3-1

	15 deg.	20 deg.	30 deg.	35 deg.
C_e	0.90	0.90	0.90	0.90
C_t	1.20	1.20	1.20	1.20
I_s	0.80	0.80	0.80	0.80

Table 7.3-1

Table 7.3-2

Table 1.5-2

Sloped Roof Snow Load, P_s

$$P_s = C_s P_f$$

Eq. 7.4-1

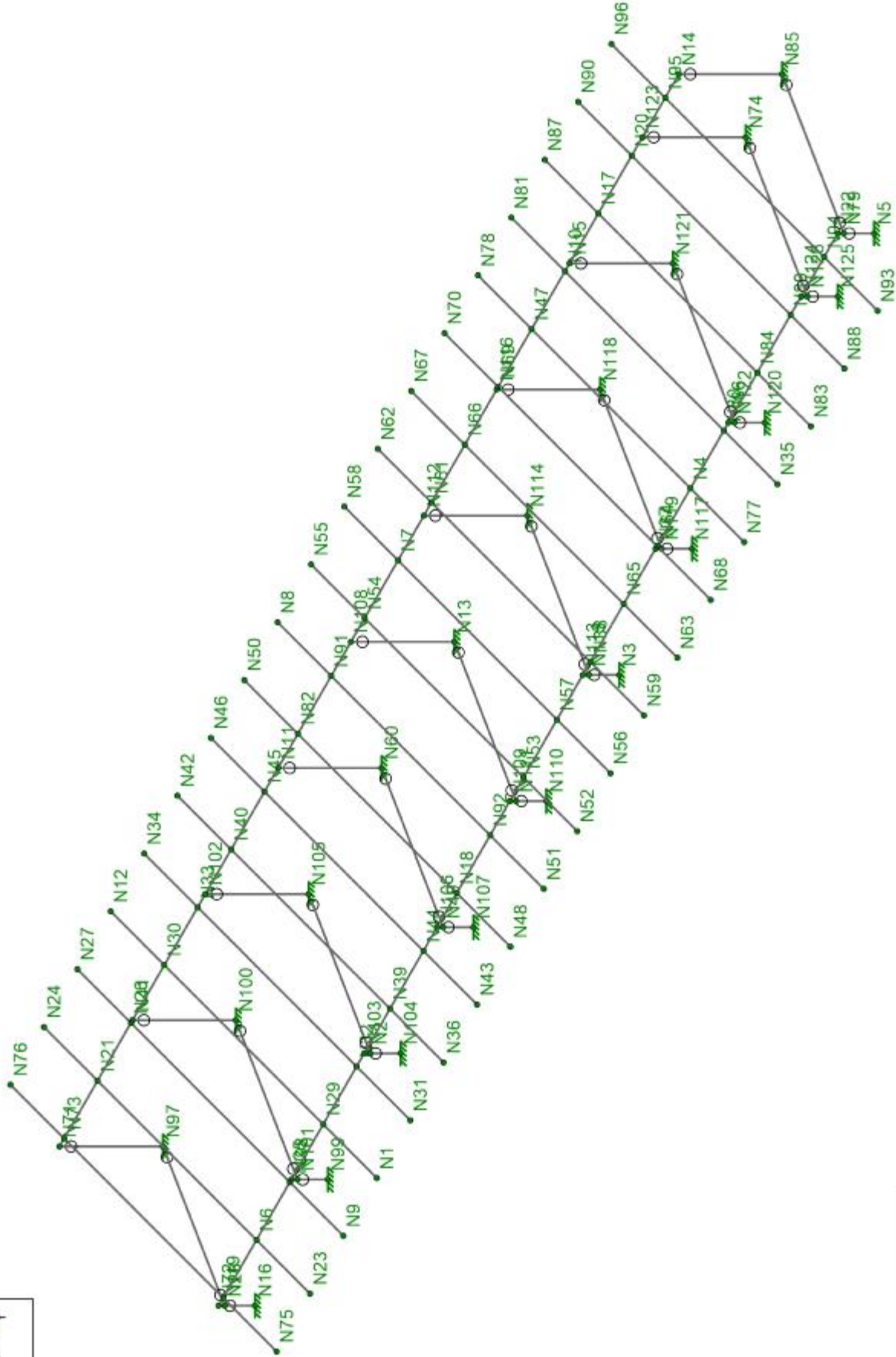
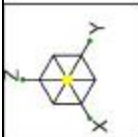
	15 deg.	20 deg.	30 deg.	35 deg.
C_s	1.00	0.92	0.73	0.64

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
15	12.96	11.92	9.46	8.29
20	17.28	15.90	12.61	11.06

PV Snow Load (plf)				
pg (psf)	Tilt			
	15 deg.	20 deg.	30 deg.	35 deg.
10	23.76	21.86	17.34	15.21
15	35.64	32.79	26.02	22.81
20	47.52	43.72	34.69	30.41



Envelope Only Solution

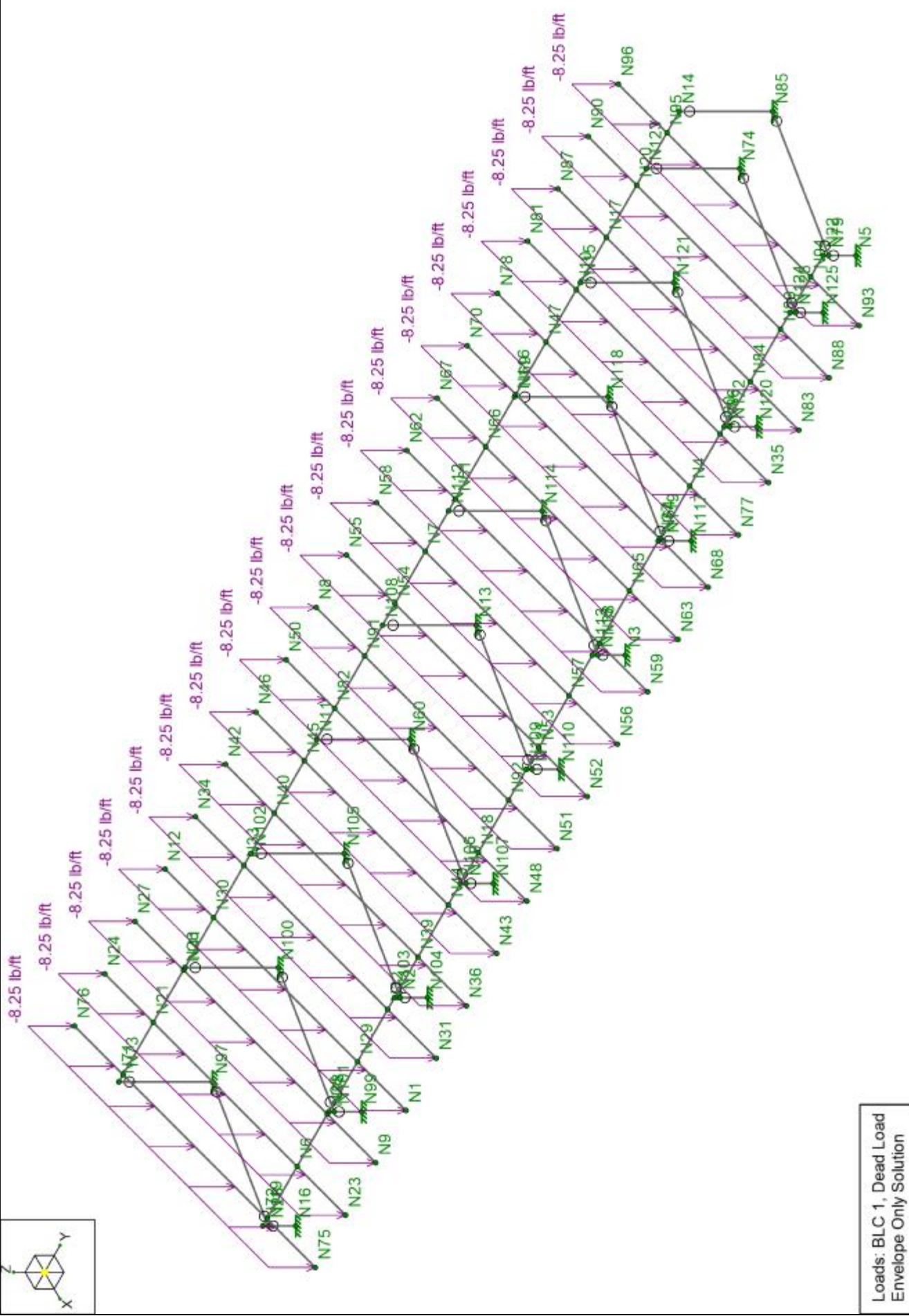
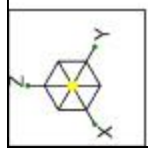
Everest Solar

PAV

20496

Everest Ground Mount

20deg_110MPH_15SL_1.5 Sch. 40 Pipe.r3d



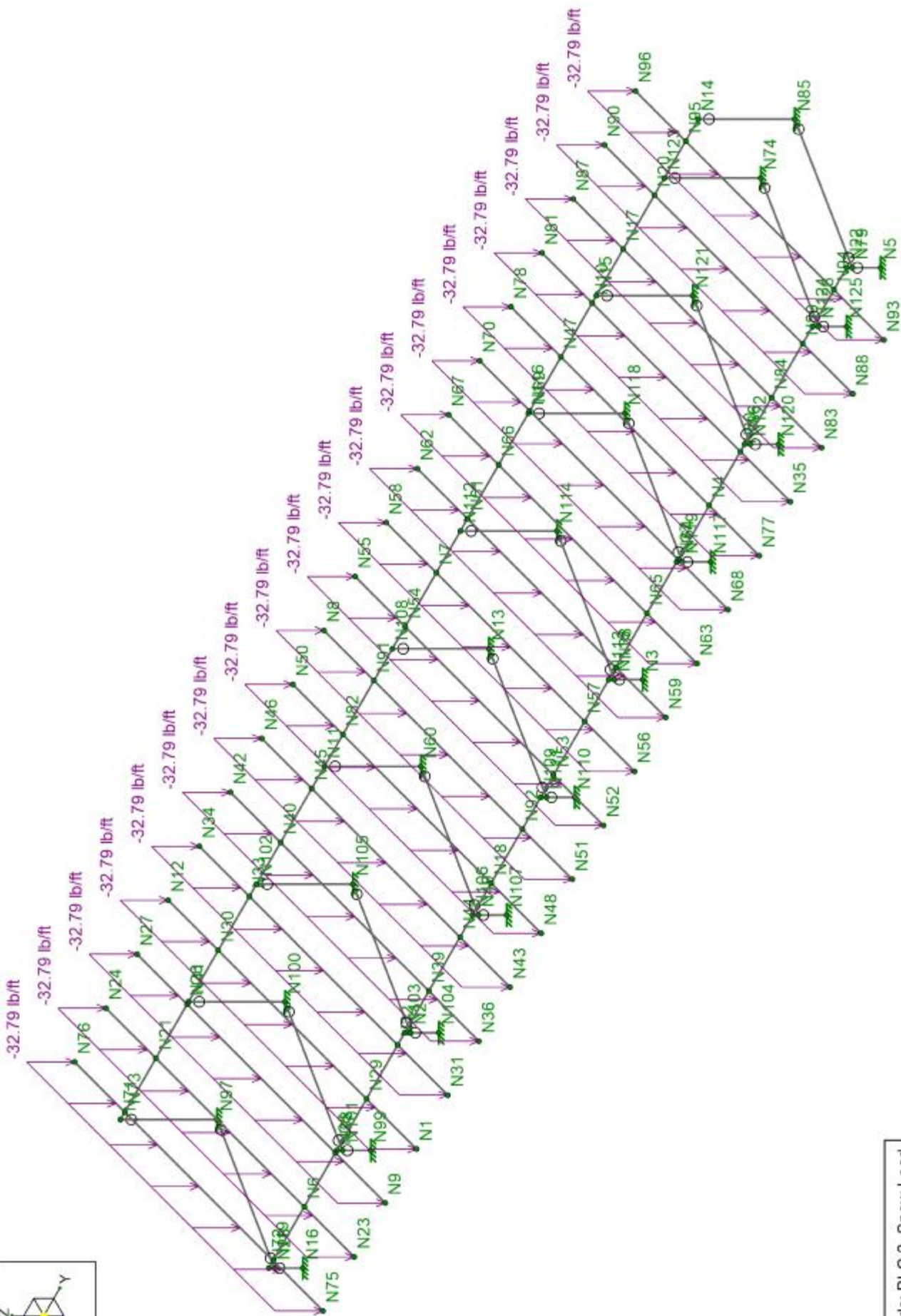
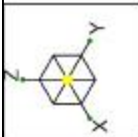
Loads: BLC 1, Dead Load
Envelope Only Solution

Everest Solar

Everest Ground Mount

PAV

20496



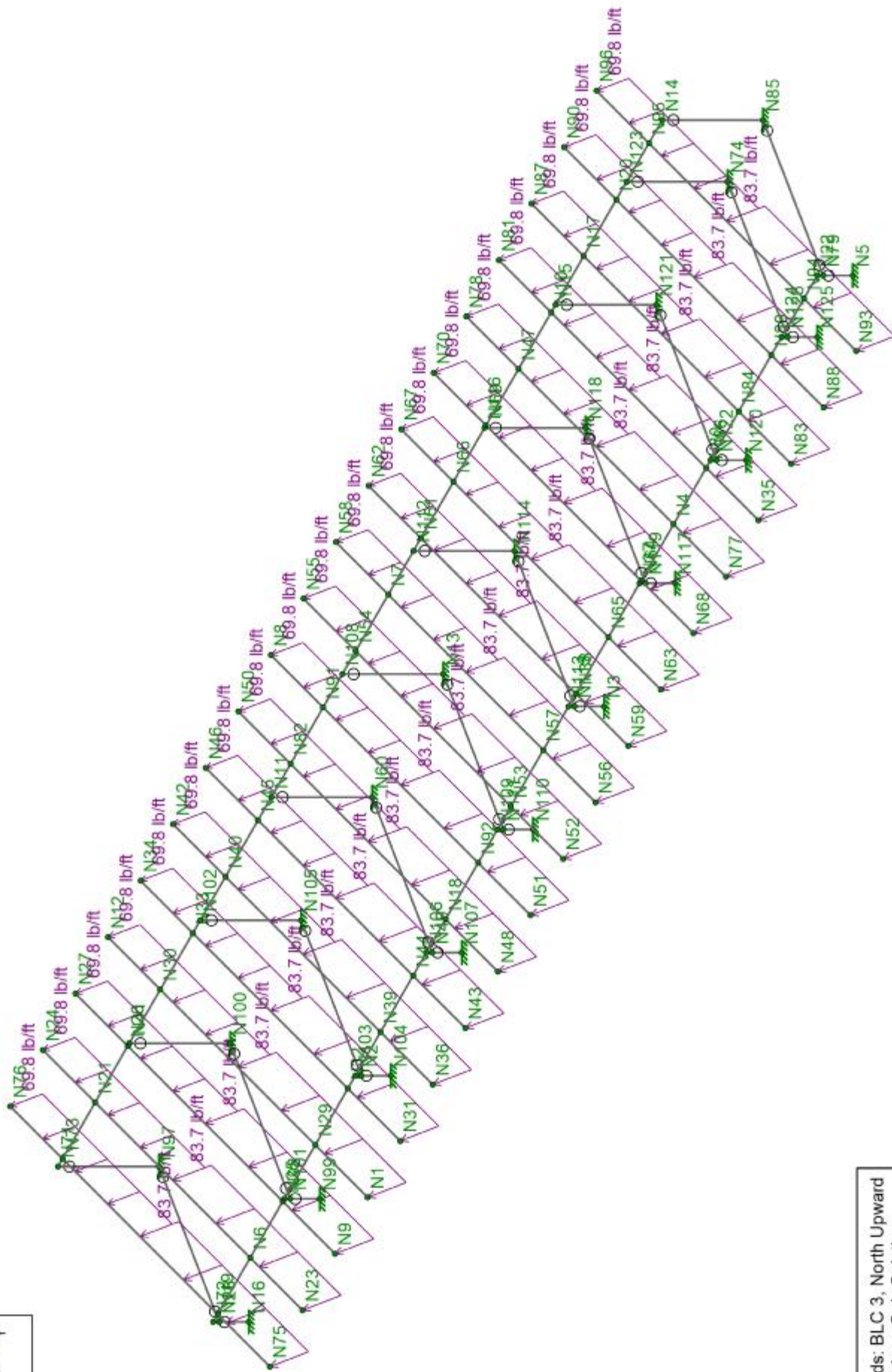
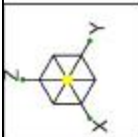
Loads: BLC 2, Snow Load
Envelope Only Solution

Everest Solar

PAV

20496

Everest Ground Mount



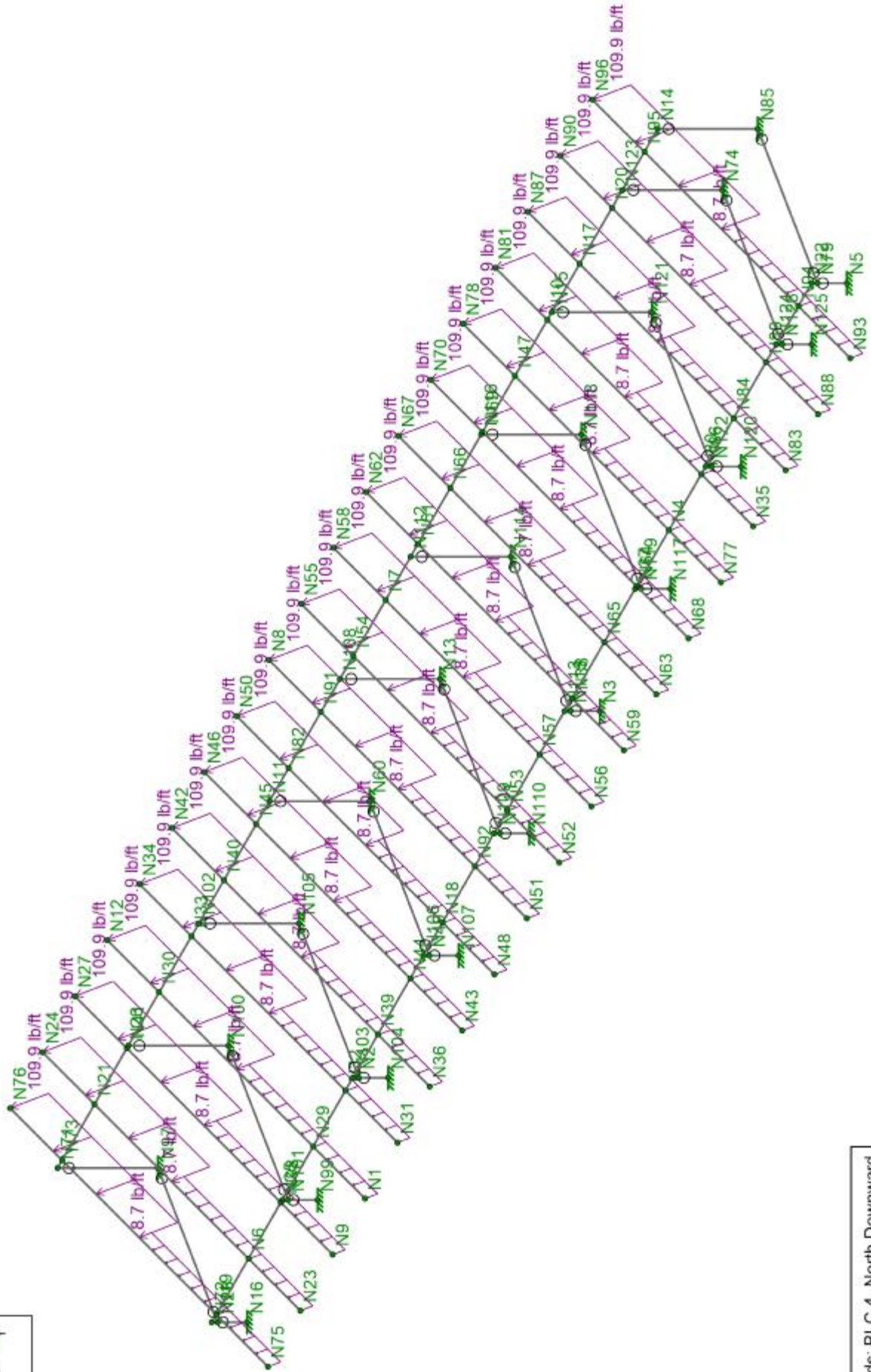
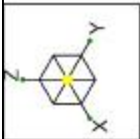
Loads: BLC 3, North Upward
Envelope Only Solution

Everest Solar

Everest Ground Mount

PAV

20496



Loads: BLC 4, North Downward
Envelope Only Solution

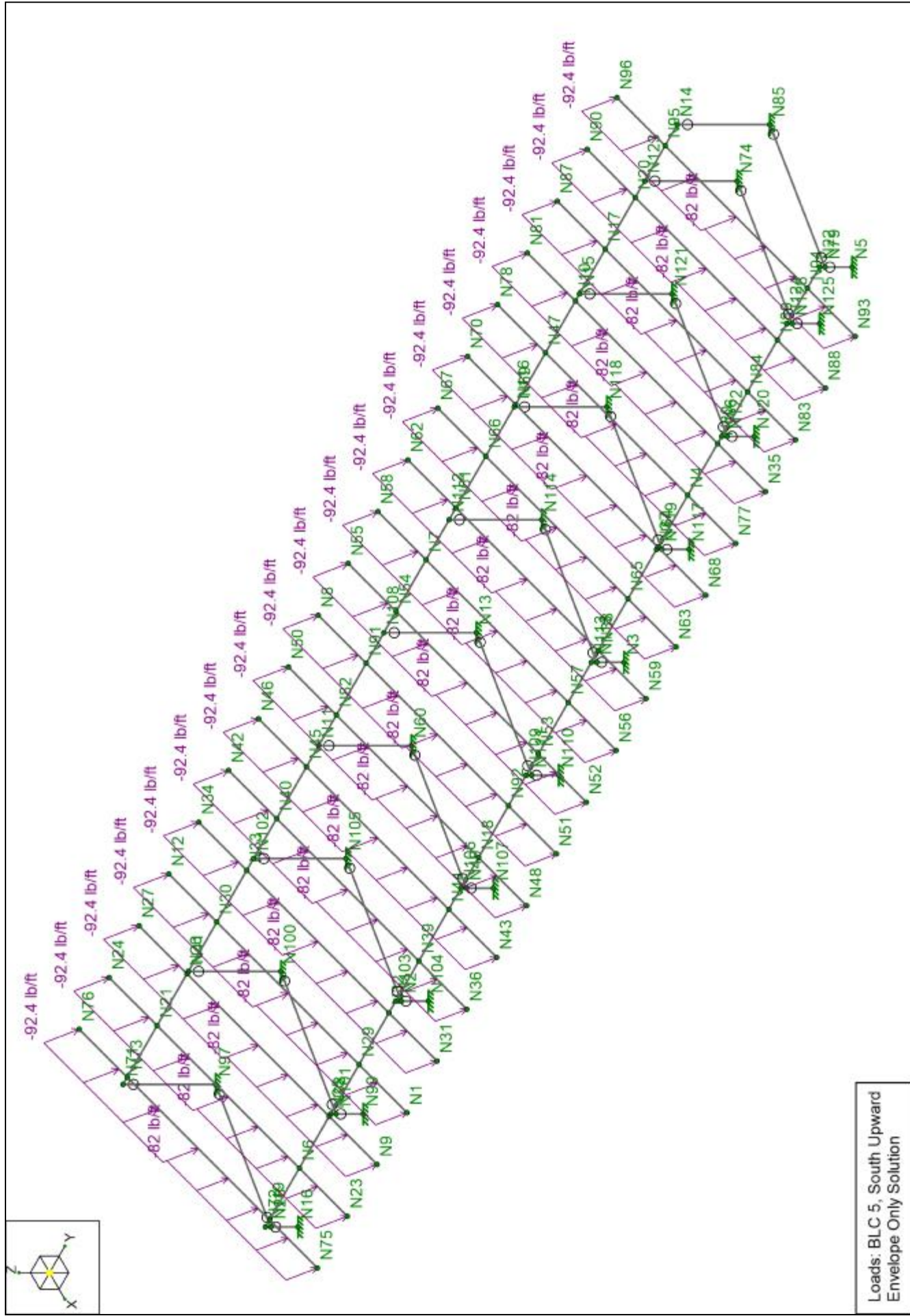
Everest Solar

Everest Ground Mount

PAV

20496

20deg_110MPH_15SL_1.5 Sch. 40 Pipe.r3d



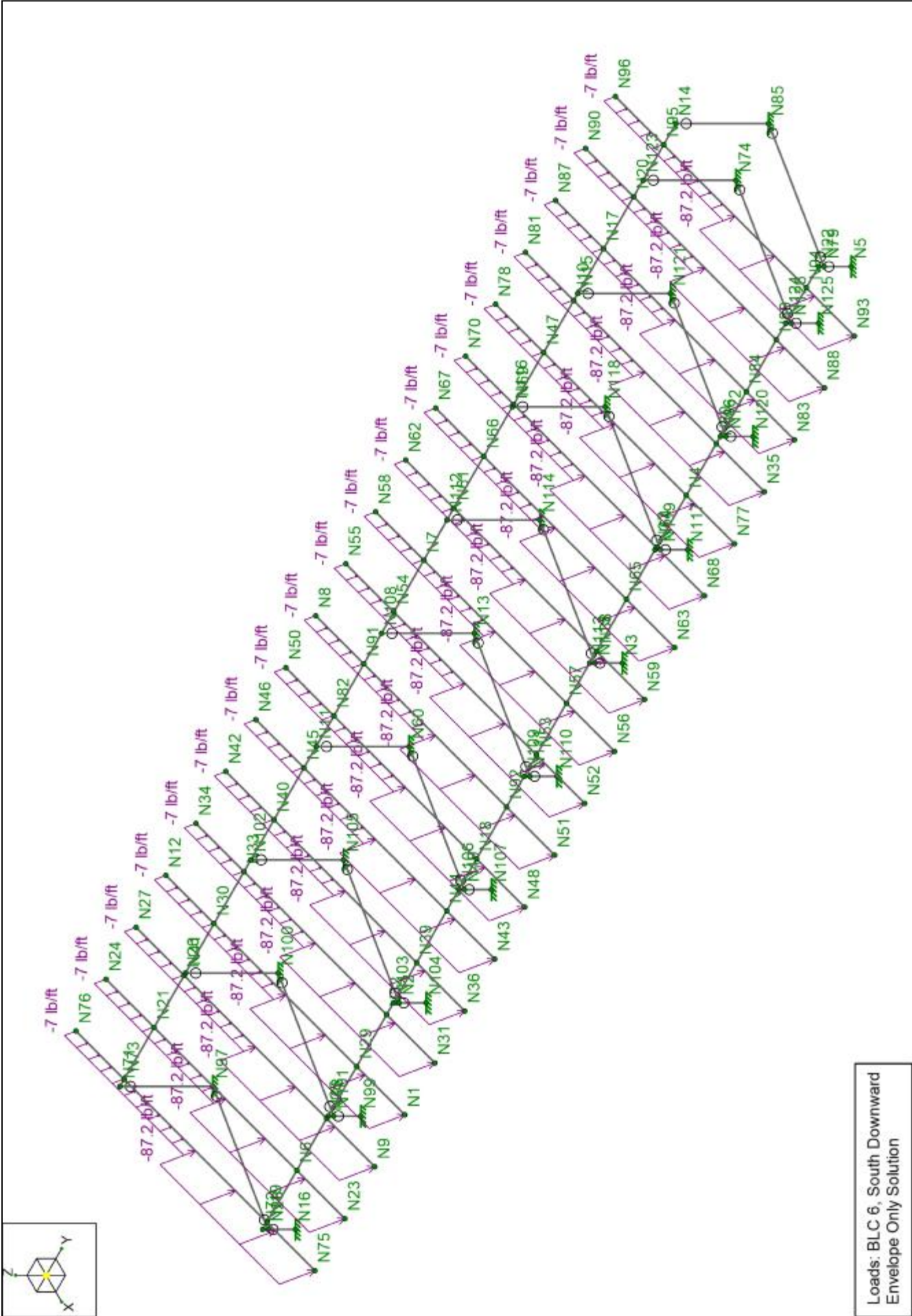
Loads: BLC 5, South Upward
Envelope Only Solution

Everest Ground Mount

Everest Solar

PAV

20496



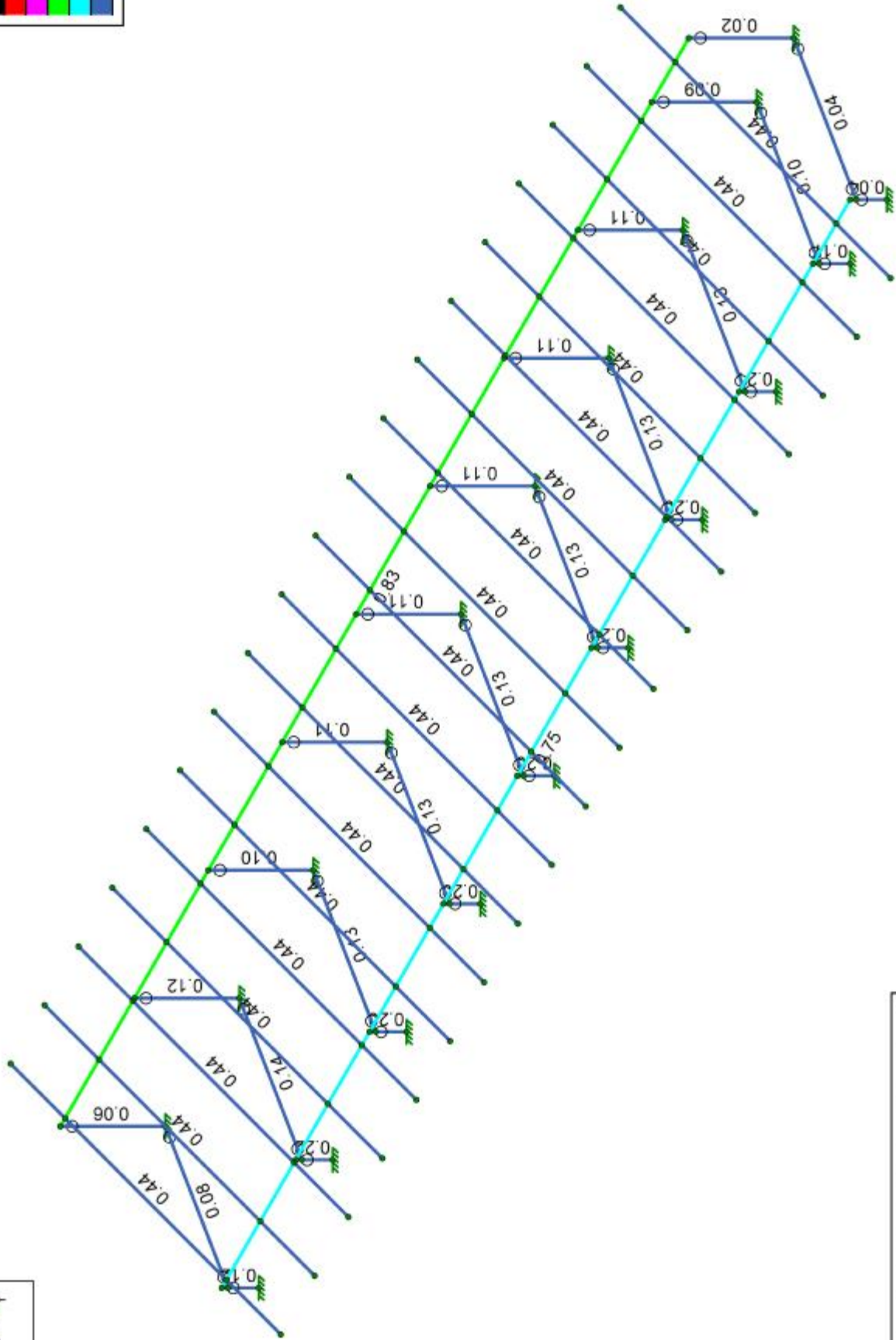
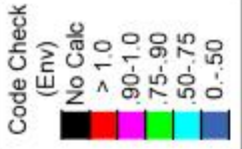
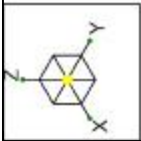
Loads: BLC 6, South Downward
Envelope Only Solution

Everest Ground Mount

Everest Solar

PAV

20496



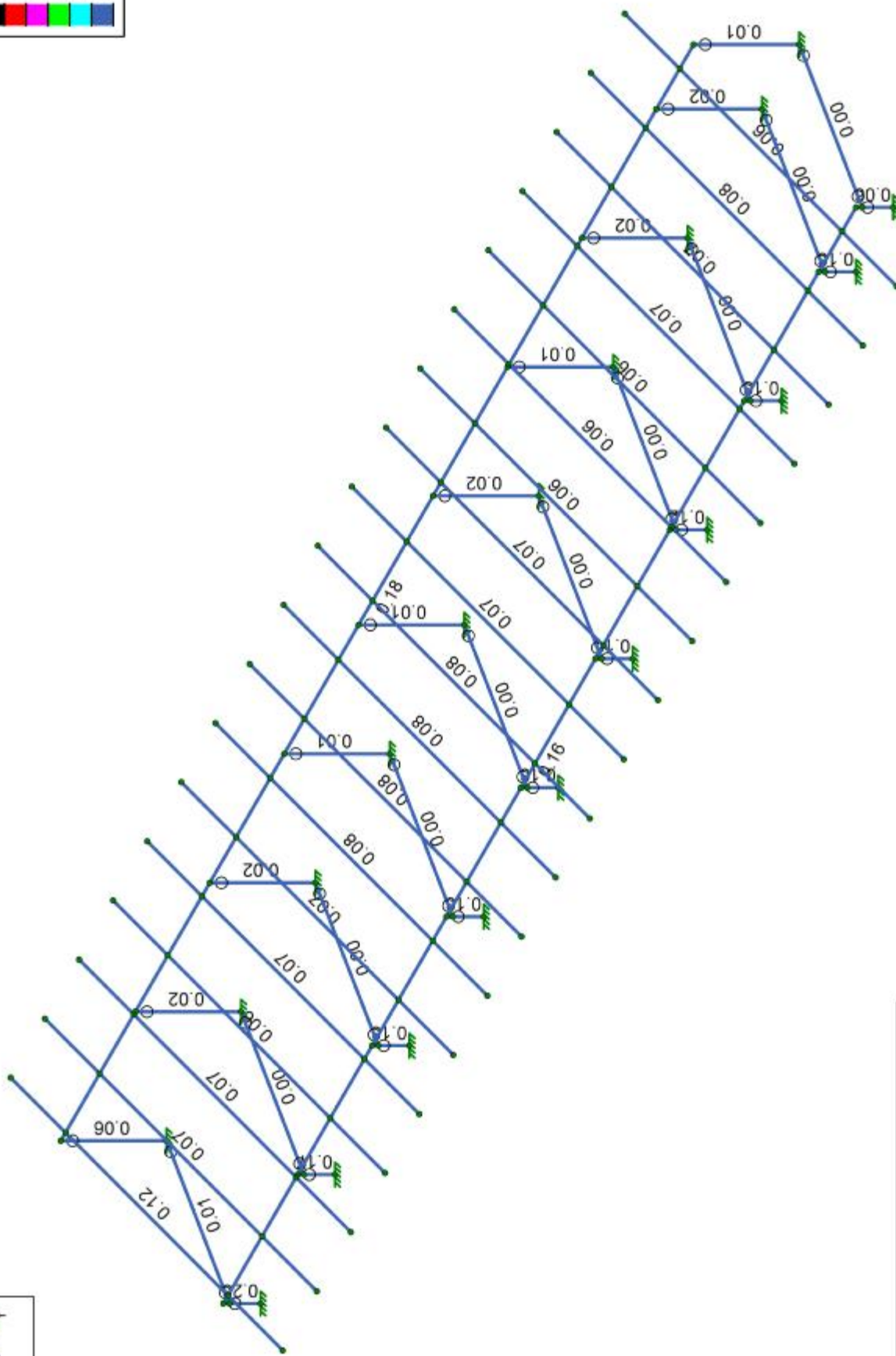
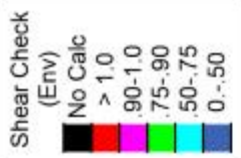
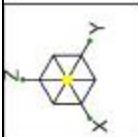
Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Everest Ground Mount

Everest Solar

PAV

20496



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

Everest Ground Mount

Everest Solar

PAV

20496

20deg_110MPH_15SL_1.5 Sch. 40 Pipe.r3d



Company : Everest Solar
 Designer : PAV
 Job Number : 20496
 Model Name : Everest Ground Mount

Checked By : JJN

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e ⁵ F ⁻¹]	Density [lb/ft ³]	Yield [psi]	Ry	Fu [psi]	Rt
1	A36 Gr.36	29000	11154	0.3	0.65	490	36000	1.5	58000	1.2
2	A992	29000	11154	0.3	0.65	490	50000	1.1	58000	1.2
3	Pipe - 35ksi	29000	11154	0.3	0.65	490	35000	1.5	58000	1.2
4	T6061 Alum.	10600	4077	0.3	1.29	173	36000	1.5	58000	1.2

Hot Rolled Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rule	Area [in ²]	Iyy [in ⁴]	Izz [in ⁴]	J [in ⁴]
1	Pipe 1.5	PIPE 1.5	VBrace	Pipe	Pipe - 35ksi	Typical	0.749	0.293	0.293	0.586
2	Pipe 2.0	PIPE 2.0	VBrace	Pipe	Pipe - 35ksi	Typical	1.02	0.627	0.627	1.25
3	Pipe 1.5X	PIPE 1.5X	VBrace	Pipe	Pipe - 35ksi	Typical	1	0.372	0.372	0.744
4	Pipe 2.0X	PIPE 2.0X	VBrace	Pipe	Pipe - 35ksi	Typical	1.4	0.827	0.827	1.65

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Distributed
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-direction	ELX	0.8			
8	Earthquake Y-direction	ELY		0.8		

Load Combinations

	Description	Solve	PDelta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	IBC 16-8	Yes	Y	DL	1	NL	1	LLS	1	NL	1						
2	IBC 16-9	Yes	Y	DL	1	LL	1	LLS	1	NL	1						
3	IBC 16-10 (a)	Yes	Y	DL	1	NL	1										
4	IBC 16-10 (b)	Yes	Y	DL	1	SL	1	SLN	1	NL	1						
5	IBC 16-11 (b)	Yes	Y	DL	1	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75	NL	1		
6	IBC 16-12 (a)	Yes	Y	DL	1	3	0.6	NL	1								
7	IBC 16-13 (a)	Yes	Y	DL	1	3	0.45	LL	0.75	LLS	0.75	NL	1				
8	IBC 16-13 (b)	Yes	Y	DL	1	3	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75	NL	1
9	IBC 16-15	Yes	Y	DL	0.6	3	0.6	NL	1								
10	IBC 16-12 (a)	Yes	Y	DL	1	4	0.6	NL	1								
11	IBC 16-13 (a)	Yes	Y	DL	1	4	0.45	LL	0.75	LLS	0.75	NL	1				
12	IBC 16-13 (b)	Yes	Y	DL	1	4	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75	NL	1
13	IBC 16-15	Yes	Y	DL	0.6	4	0.6	NL	1								
14	IBC 16-12 (a)	Yes	Y	DL	1	5	0.6	NL	1								
15	IBC 16-13 (a)	Yes	Y	DL	1	5	0.45	LL	0.75	LLS	0.75	NL	1				
16	IBC 16-13 (b)	Yes	Y	DL	1	5	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75	NL	1
17	IBC 16-15	Yes	Y	DL	0.6	5	0.6	NL	1								
18	IBC 16-12 (a)	Yes	Y	DL	1	6	0.6	NL	1								
19	IBC 16-13 (a)	Yes	Y	DL	1	6	0.45	LL	0.75	LLS	0.75	NL	1				
20	IBC 16-13 (b)	Yes	Y	DL	1	6	0.45	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75	NL	1
21	IBC 16-15	Yes	Y	DL	0.6	6	0.6	NL	1								
22	IBC 16-12 (b) (a)	Yes	Y	DL	1	EL	0.7										
23	IBC 16-12 (b) (b)	Yes	Y	DL	1	EL	-0.7										
24	IBC 16-14 (a) (a)	Yes	Y	DL	1	EL	0.525	LL	0.75	LLS	0.75						
25	IBC 16-14 (a) (b)	Yes	Y	DL	1	EL	-0.525	LL	0.75	LLS	0.75						
26	IBC 16-14 (b) (a)	Yes	Y	DL	1	EL	0.525	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75		
27	IBC 16-14 (b) (b)	Yes	Y	DL	1	EL	-0.525	LL	0.75	LLS	0.75	SL	0.75	SLN	0.75		
28	IBC 16-16 (a)	Yes	Y	DL	0.6	EL	0.7										
29	IBC 16-16 (b)	Yes	Y	DL	0.6	EL	-0.7										



Company : Everest Solar
 Designer : PAV
 Job Number : 20496
 Model Name : Everest Ground Mount

Checked By : JJN

Load Combination Design

	Description	CD	Service	Hot Rolled	Cold Formed	Wood	Concrete	Masonry	Aluminum	Stainless	Connection
1	IBC 16-8	0.9	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	IBC 16-9		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	IBC 16-10 (a)	1.25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	IBC 16-10 (b)	1.15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	IBC 16-11 (b)	1.15	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	IBC 16-12 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	IBC 16-13 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	IBC 16-13 (b)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	IBC 16-15	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	IBC 16-12 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	IBC 16-13 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12	IBC 16-13 (b)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13	IBC 16-15	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
14	IBC 16-12 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15	IBC 16-13 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
16	IBC 16-13 (b)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
17	IBC 16-15	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
18	IBC 16-12 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
19	IBC 16-13 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
20	IBC 16-13 (b)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
21	IBC 16-15	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
22	IBC 16-12 (b) (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
23	IBC 16-12 (b) (b)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
24	IBC 16-14 (a) (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
25	IBC 16-14 (a) (b)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
26	IBC 16-14 (b) (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
27	IBC 16-14 (b) (b)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
28	IBC 16-16 (a)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
29	IBC 16-16 (b)	1.6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Envelope Node Reactions

Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC	
1	N16	max	71.351	6	3.088	16	578.671	20	1.037	9	18.997	6	86.953	9
2		min	-80.125	17	-2.175	9	-221.698	9	-1.982	16	-21.437	17	-108.123	14
3	N97	max	395.591	17	0.182	9	739.091	16	1.495	9	7.541	17	27.869	13
4		min	-354.101	6	-0.342	16	-525.02	13	-1.412	17	-10.437	10	-37.623	16
5	N99	max	125.662	9	0.526	6	1104.802	20	0.11	17	33.576	9	32.808	16
6		min	-147.03	14	-0.57	17	-454.317	9	-0.451	8	-39.437	14	-22.657	9
7	N100	max	722	14	0.192	9	1437.608	16	2.435	16	8.457	14	9.842	16
8		min	-623.678	9	-0.281	16	-1010.71	13	-1.297	9	-6.963	13	-5.612	13
9	N104	max	115.002	6	0.47	12	970.761	20	-0.031	9	30.662	9	13.944	17
10		min	-131.523	14	-0.192	17	-385.813	9	-0.42	4	-35.259	14	-16.652	10
11	N105	max	648.868	17	0.189	9	1243.861	16	1.843	16	17.675	14	10.862	13
12		min	-572.531	6	-0.292	16	-887.764	13	-0.995	13	-17.378	13	-9.887	14
13	N107	max	116.315	6	0.212	12	1006.677	20	0.069	13	31.051	9	10.895	14
14		min	-133.734	14	-0.099	17	-407.846	9	-0.283	4	-35.869	14	-9.347	13
15	N60	max	661.109	17	0.19	9	1291.359	16	1.821	16	29.338	14	4.339	10
16		min	-581.361	6	-0.286	16	-914.024	13	-0.922	9	-30.159	13	-3.496	17
17	N110	max	115.902	6	0.462	16	997.635	20	0.347	13	30.925	9	9.096	13
18		min	-132.987	14	-0.4	13	-402.405	9	-0.46	16	-35.665	14	-9.89	14
19	N13	max	657.718	17	0.191	9	1277.873	16	1.364	16	29.197	14	3.883	17
20		min	-579.283	6	-0.286	16	-906.847	13	-0.528	9	-30.053	10	-4.627	10
21	N3	max	116.694	6	0.733	14	999.812	20	0.515	13	31.159	9	18.287	13
22		min	-134.318	14	-0.671	13	-402.195	9	-0.567	14	-36.017	14	-19.95	14
23	N114	max	661.941	14	0.193	9	1286.165	16	1.139	16	17.983	14	7.548	17
24		min	-580.981	9	-0.285	16	-912.332	13	-0.338	9	-17.688	13	-9.117	10
25	N117	max	116.809	9	0.385	14	988.066	20	0.424	13	31.187	9	6.081	13
26		min	-134.706	14	-0.405	13	-394.416	9	-0.408	17	-36.11	14	-5.762	14



Company : Everest Solar
 Designer : PAV
 Job Number : 20496
 Model Name : Everest Ground Mount

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Envelope Node Reactions (Continued)

Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC	MX [lb-ft]	LC	MY [lb-ft]	LC	MZ [lb-ft]	LC	
27	N118	max	662.057	14	0.194	9	1276.444	16	1.44	16	7.817	14	2.937	17
28		min	-579.573	9	-0.282	16	-906.922	13	-0.609	9	-6.463	9	-3.436	10
29	N120	max	119.682	9	0.093	21	1022.444	20	0.301	6	31.96	9	10.791	14
30		min	-138.319	14	-0.13	8	-411.976	9	-0.241	17	-37.086	14	-13.726	13
31	N121	max	680.379	14	0.195	9	1320.604	16	1.769	16	12.022	14	9.546	10
32		min	-594.694	9	-0.276	16	-936.364	13	-0.928	13	-10.95	13	-8.395	17
33	N125	max	94.815	9	0.552	9	874.995	20	0.387	12	25.348	9	42.837	14
34		min	-108.647	14	-0.813	16	-361.037	9	0.048	9	-29.18	14	-35.978	9
35	N74	max	536.168	14	0.194	9	1115.212	16	2.481	16	17.326	14	10.315	14
36		min	-472.294	9	-0.288	16	-782.015	13	-1.633	9	-17.877	13	-9.291	13
37	N5	max	24.122	6	0.2	9	158.047	20	0.339	12	6.396	6	24.415	17
38		min	-27.109	17	-0.299	14	-41.673	9	-0.161	17	-7.227	17	-22.261	6
39	N85	max	135.108	17	0.18	9	209.809	16	1.961	16	6.324	17	2.709	17
40		min	-120.473	6	-0.352	16	-133.904	13	-1.275	9	-6.419	10	-3.203	10
41	M95	max	83.638	6	3.051	16	675.627	20	0.816	9	22.266	6	93.417	9
42		min	-94.481	17	-2.12	9	-256.919	9	-1.878	16	-25.273	17	-112.995	14
43	M93	max	465.909	17	-0.031	17	865.843	16	2.579	6	7.217	17	34.915	13
44		min	-414.909	6	-0.37	12	-614.484	13	-2.653	17	-8.55	10	-40.213	14
45	M90	max	156.695	9	0.533	8	1396.753	20	0.146	17	41.874	9	19.938	20
46		min	-183.044	14	-0.356	21	-572.762	9	-0.672	8	-49.107	14	-12.648	9
47	M6	max	899.408	14	-0.023	17	1802.284	16	1.958	20	23.149	14	11.372	14
48		min	-781.053	9	-0.371	12	-1265.175	13	-0.176	9	-22.242	13	-10.943	13
49	M103	max	142.778	6	0.595	12	1214.168	20	0.033	17	38.065	9	6.972	17
50		min	-163.639	14	-0.138	17	-480.294	9	-0.628	12	-43.871	14	-10.907	10
51	M77	max	805.345	17	-0.024	17	1553.619	16	1.387	20	18.059	14	4.607	13
52		min	-710.535	6	-0.364	12	-1105.828	13	0.018	9	-17.236	13	-4.353	14
53	M94	max	148.235	9	0.343	12	1259.753	20	0.049	17	39.578	9	6.763	14
54		min	-171.389	14	-0.143	17	-500.549	9	-0.425	12	-45.944	14	-5.204	13
55	M106	max	841.005	14	-0.022	17	1622.752	16	1.514	20	9.496	14	1.132	12
56		min	-736.066	9	-0.361	12	-1149.981	13	0.028	9	-7.867	9	-0.332	17
57	M23	max	145.897	6	0.403	16	1248.065	20	0.083	9	38.939	9	14.067	13
58		min	-168.17	14	-0.239	9	-496.718	9	-0.273	20	-45.088	14	-15.091	14
59	M89	max	826.226	14	-0.021	17	1602.607	16	1.656	12	15.066	14	2.355	17
60		min	-725.42	6	-0.358	12	-1136.626	13	-0.257	17	-13.881	13	-3.275	10
61	M110	max	144.874	6	0.121	12	1251.841	20	0.024	9	38.677	9	0.586	6
62		min	-166.917	14	-0.027	9	-502.321	9	-0.174	12	-44.763	14	-0.573	21
63	M111	max	821.177	14	-0.02	17	1606.111	16	1.435	12	21.884	14	0.11	6
64		min	-721.734	6	-0.354	12	-1135.121	13	0.101	17	-21.299	13	-0.117	21
65	M79	max	143.826	9	0.479	13	1259.078	20	0.239	16	38.417	9	18.954	14
66		min	-167.242	14	-0.456	14	-504.307	9	-0.309	13	-44.849	14	-15.656	13
67	M92	max	821.667	14	-0.02	17	1620.633	16	1.573	20	15.579	14	4.211	10
68		min	-715.411	9	-0.351	12	-1147.86	13	-0.228	9	-14.667	13	-2.484	17
69	M114	max	50.379	6	1.585	9	415.849	20	0.869	14	13.41	6	77.475	14
70		min	-56.368	17	-1.898	14	-155.88	9	-0.66	9	-15.09	17	-67.615	9
71	M115	max	282.859	17	-0.023	17	532.041	16	2.612	16	25.524	17	6.449	16
72		min	-253.649	6	-0.34	12	-359.732	13	-1.566	9	-30.838	10	-3.872	9
73	Totals:	max	9179.764	14	0	9	38302.97	16						
74		min	-8079.666	9	0	16	-18137.435	9						

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

Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn	
1	M35	PIPE_1.5	0.441	6.75	16	0.063	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
2	M36	PIPE_1.5	0.441	6.75	16	0.101	2.813	13	4778.659	15697.605	735.279	735.279	1	H1-1b
3	M37	PIPE_1.5	0.443	6.75	16	0.071	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
4	M38	PIPE_1.5	0.443	6.75	16	0.062	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
5	M39	PIPE_1.5	0.443	6.75	16	0.07	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
6	M40	PIPE_1.5	0.439	6.75	16	0.076	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
7	M41	PIPE_1.5	0.439	6.75	16	0.068	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b



Company : Everest Solar
 Designer : PAV
 Job Number : 20496
 Model Name : Everest Ground Mount

Checked By : JJN

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

Member	Shape	Code	Check	Loc[ft]	LC	Shear	Check	Loc[ft]	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn
8	M42	PIPE	1.5	0.445	6.75	16	0.063	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
9	M43	PIPE	1.5	0.437	6.75	16	0.07	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
10	M45	PIPE	1.5	0.438	6.75	16	0.074	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
11	M46	PIPE	1.5	0.444	6.75	16	0.07	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
12	M47	PIPE	1.5	0.442	6.75	16	0.063	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
13	M48	PIPE	1.5	0.442	6.75	16	0.076	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
14	M39A	PIPE	2.0	0.905	7.438	16	0.143	44.625	16	13883.389	21377.246	1245.259	1245.259	1	H1-1b
15	M40A	PIPE	2.0	0.833	7.438	16	0.126	30.281	20	13883.389	21377.246	1245.259	1245.259	1	H1-1b
16	M45B	PIPE	1.5	0.441	6.75	16	0.125	2.813	13	4778.659	15697.605	735.279	735.279	1	H1-1b
17	M46B	PIPE	1.5	0.442	6.75	16	0.076	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
18	M138	PIPE	1.5	0.442	6.75	16	0.063	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
19	M139A	PIPE	1.5	0.445	6.75	16	0.07	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
20	M140B	PIPE	1.5	0.437	6.75	16	0.072	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
21	M141A	PIPE	1.5	0.44	6.75	16	0.076	2.813	13	4778.659	15697.605	735.279	735.279	1	H1-1b
22	M51	PIPE	1.5	0.438	6.75	16	0.066	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
23	M52A	PIPE	1.5	0.444	6.75	16	0.07	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
24	M53A	PIPE	1.5	0.438	6.75	16	0.064	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
25	M54A	PIPE	1.5	0.443	6.75	16	0.07	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
26	M55A	PIPE	1.5	0.437	6.75	16	0.07	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
27	M56	PIPE	1.5	0.441	6.75	16	0.078	2.813	13	4778.659	15697.605	735.279	735.279	1	H1-1b
28	M57	PIPE	1.5	0.439	6.75	16	0.075	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
29	M58	PIPE	1.5	0.439	6.75	16	0.075	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
30	M59	PIPE	1.5	0.441	6.75	16	0.077	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
31	M60	PIPE	1.5	0.437	6.75	16	0.07	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
32	M61	PIPE	1.5	0.443	6.75	16	0.073	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
33	M62	PIPE	1.5	0.438	6.75	16	0.063	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
34	M63	PIPE	1.5	0.443	6.75	16	0.063	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
35	M64	PIPE	1.5	0.828	18.063	16	0.182	36.125	16	7966.511	15697.605	735.279	735.279	1	H1-1b
36	M65	PIPE	1.5	0.753	18.063	16	0.162	36.125	20	7966.511	15697.605	735.279	735.279	1	H1-1b
37	M66	PIPE	1.5	0.441	6.75	16	0.122	2.813	13	4778.659	15697.605	735.279	735.279	1	H1-1b
38	M67	PIPE	1.5	0.439	6.75	16	0.062	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
39	M81	PIPE	1.5	0.443	6.75	16	0.066	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
40	M82	PIPE	1.5	0.437	6.75	16	0.069	10.688	20	4778.659	15697.605	735.279	735.279	1	H1-1b
41	M83	PIPE	1.5	0.441	6.75	16	0.084	2.813	13	4778.659	15697.605	735.279	735.279	1	H1-1b
42	M84	PIPE	1.5	0.439	6.75	16	0.063	2.813	16	4778.659	15697.605	735.279	735.279	1	H1-1b
43	M142	PIPE	1.5	0.121	1.25	14	0.234	1.5	14	15046.072	15697.605	735.279	735.279	1.822	H1-1b
44	M143	PIPE	1.5	0.061	0	16	0.058	4.257	16	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
45	M144	PIPE	1.5	0.077	7.677	17	0.006	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
46	M118A	PIPE	1.5	0.224	1.25	14	0.171	1.5	14	15046.072	15697.605	735.279	735.279	1.552	H1-1b
47	M119A	PIPE	1.5	0.12	0	16	0.015	4.257	16	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
48	M120A	PIPE	1.5	0.141	7.677	14	0.003	7.677	16	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
49	M121A	PIPE	1.5	0.2	1.25	14	0.131	1.5	17	15046.072	15697.605	735.279	735.279	1.277	H1-1b
50	M122A	PIPE	1.5	0.104	0	16	0.018	4.257	13	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
51	M123A	PIPE	1.5	0.126	7.677	14	0.003	7.677	10	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
52	M124A	PIPE	1.5	0.204	1.25	14	0.128	1.5	14	15046.072	15697.605	735.279	735.279	1.16	H1-1b
53	M125B	PIPE	1.5	0.108	0	16	0.008	4.257	10	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
54	M126B	PIPE	1.5	0.128	7.677	14	0.002	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
55	M127B	PIPE	1.5	0.203	1.25	14	0.126	1.5	14	15046.072	15697.605	735.279	735.279	2.206	H1-1b
56	M128B	PIPE	1.5	0.106	0	16	0.009	4.257	10	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
57	M129B	PIPE	1.5	0.128	7.677	14	0.002	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
58	M130B	PIPE	1.5	0.204	1.25	14	0.143	1.5	14	15046.072	15697.605	735.279	735.279	2.262	H1-1b
59	M131B	PIPE	1.5	0.107	0	16	0.015	4.257	10	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
60	M132A	PIPE	1.5	0.129	7.677	14	0.003	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
61	M133A	PIPE	1.5	0.205	1.25	14	0.121	1.5	14	15046.072	15697.605	735.279	735.279	2.161	H1-1b
62	M134A	PIPE	1.5	0.106	0	16	0.006	4.257	10	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
63	M135A	PIPE	1.5	0.129	7.677	14	0.002	7.677	10	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
64	M136A	PIPE	1.5	0.21	1.25	14	0.132	1.5	14	15046.072	15697.605	735.279	735.279	1.029	H1-1b
65	M137A	PIPE	1.5	0.11	0	16	0.015	4.257	10	11156.947	15697.605	735.279	735.279	1.667	H1-1b*



Company : Everest Solar
 Designer : PAV
 Job Number : 20496
 Model Name : Everest Ground Mount

Checked By : JJN

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

Member	Shape	Code	Check	Loc[ft]	LC	Shear	Check	Loc[ft]	LC	Pnc/om [lb]	Pnt/om [lb]	Mnyy/om [lb-ft]	Mnzz/om [lb-ft]	Cb	Eqn
66	M138B	PIPE	1.5	0.133	7.677	14	0.003	7.677	10	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
67	M139B	PIPE	1.5	0.167	1.25	14	0.157	1.5	14	15046.072	15697.605	735.279	735.279	1.554	H1-1b
68	M140A	PIPE	1.5	0.093	0	16	0.017	4.257	14	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
69	M141B	PIPE	1.5	0.104	7.677	14	0.004	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
70	M142A	PIPE	1.5	0.04	1.25	14	0.061	1.5	17	15046.072	15697.605	735.279	735.279	1.307	H1-1b
71	M143A	PIPE	1.5	0.017	0	16	0.005	4.257	10	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
72	M144A	PIPE	1.5	0.038	3.839	14	0.003	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b
73	M76	PIPE	1.5	0.143	1.25	14	0.254	1.5	14	15046.072	15697.605	735.279	735.279	1.829	H1-1b
74	M77	PIPE	1.5	0.072	0	16	0.062	4.257	14	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
75	M78	PIPE	1.5	0.091	7.677	17	0.007	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
76	M76A	PIPE	1.5	0.28	1.25	14	0.176	1.5	14	15046.072	15697.605	735.279	735.279	1.69	H1-1b
77	M77A	PIPE	1.5	0.151	0	16	0.019	4.257	14	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
78	M78A	PIPE	1.5	0.175	7.677	14	0.003	7.677	18	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
79	M79	PIPE	1.5	0.249	1.25	14	0.147	1.5	17	15046.072	15697.605	735.279	735.279	1.377	H1-1b
80	M80	PIPE	1.5	0.13	0	16	0.008	4.257	13	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
81	M81A	PIPE	1.5	0.157	7.677	14	0.003	7.677	10	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
82	M82A	PIPE	1.5	0.26	1.25	14	0.153	1.5	14	15046.072	15697.605	735.279	735.279	1.568	H1-1b
83	M83A	PIPE	1.5	0.135	0	16	0.002	4.257	12	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
84	M84A	PIPE	1.5	0.164	7.677	14	0.002	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
85	M85	PIPE	1.5	0.256	1.25	14	0.163	1.5	14	15046.072	15697.605	735.279	735.279	1.829	H1-1b
86	M86	PIPE	1.5	0.134	0	16	0.006	4.257	10	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
87	M87	PIPE	1.5	0.161	7.677	14	0.003	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
88	M88	PIPE	1.5	0.254	1.25	14	0.14	1.5	14	15046.072	15697.605	735.279	735.279	2.206	H1-1b
89	M89	PIPE	1.5	0.134	0	16	0.001	4.257	17	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
90	M90	PIPE	1.5	0.16	7.677	14	0.002	7.677	18	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
91	M91	PIPE	1.5	0.255	1.25	14	0.168	1.5	14	15046.072	15697.605	735.279	735.279	1.836	H1-1b
92	M92	PIPE	1.5	0.135	0	16	0.007	4.257	10	11156.947	15697.605	735.279	735.279	1.667	H1-1b*
93	M93	PIPE	1.5	0.16	7.677	14	0.003	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*
94	M94	PIPE	1.5	0.085	1.25	14	0.167	1.5	14	15046.072	15697.605	735.279	735.279	1.834	H1-1b
95	M95	PIPE	1.5	0.054	0	14	0.01	4.257	16	11156.947	15697.605	735.279	735.279	1.667	H1-1b
96	M96	PIPE	1.5	0.054	7.677	17	0.005	7.677	14	5188.632	15697.605	735.279	735.279	1.136	H1-1b*



San Luis Obispo - Pasadena - Santa Rosa
www.TaylorSyfan.com

INNOVATIVE STRUCTURAL DESIGNS

800.579.3881
800.617.2235 fax

Page: _____

Job No: 20497

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 = 1.11 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

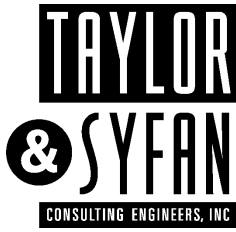
Soil Pressures:

S1 = 266.67 psf at D/3

S3 = 4000.00 psf at full depth

Moments:

M = 0.14 ft-kips unfactored



Project: **20496 – NC 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 *Concrete weight = 0.6 * Concrete Density * Pile Area * Full Pile Height*
141 pounds

TOTAL UPLIFT RESISTANCE

927 pounds

Pile Design is Acceptable for Uplift Demand



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Job No: 20497

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 = 1.44 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 = 4.00

Required = 4.00 ft total embedment

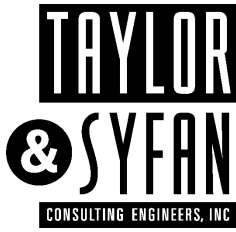
Soil Pressures:

S1 = 533.33 psf at D/3

S3 = 4000.00 psf at full depth

Moments:

M = 0.99 ft-kips unfactored

Project: **20496 – NC 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****2356** pounds*Skin friction = Allowed Skin Friction * Circumference * Allowed Pile Depth***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***