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STRUCTURAL CALCULATIONS, **NOTES, & SPECIFICATIONS**

PREPARED FOR:

PROJECT TYPE:

Everest Crossrail Solar Ground Mount - Arizona

DESIGNER:

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

PROJECT ENGINEERS:

Garrett Parkinson

PROJECT MANAGER:

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

T&S Job No. 19057



*This stamped approval packet is valid for the attached,
numbered 40-page document. Production of this
document in part is not valid..*

Expires: 06-30-2021

Date Signed: 02/11/2019

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AZ Firm Reg. #15823
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Job No.: 19057
Job Name: AZ Solar Ground Mount - Everest

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Summary Letter

Date: February 11, 2019

To: Tyler Wiggins
 Manager of Certification & Compliance
 Lead Product Engineer
 Everest Solar Systems

From: Garrett Parkinson
 Taylor & Syfan Consulting Engineers, Inc.

Project: Everest Ground Mount System - Arizona

T&S Job No.: 19057

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 11, 2019. The calculations have been performed in accordance with the 2015 *International Building Code* (IBC). The 2015 IBC references the 2010 *Minimum Design Loads for Buildings and Other Structures*, including Supplement No. 1 and Errata, by the American Society of Civil Engineers (ASCE), referred to as ASCE 7-10. 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. Site-specific racking configurations with calculations producing the overall results shown in the following charts can be provided upon request.

A site-specific 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 30 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 7-10 Section 26.8.1.
 - The site specific ground snow load is greater than 60 psf.
-



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- The site specific design wind speed is greater than 105 mph (3 second gust speed). Note that ASCE 7-10 uses a Mean Recurrence Interval (MRI) of 700 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 7-10 26.7.3.)
- 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 105 mph (3 sec. gust), for sites in a wind borne debris region (as defined by ASCE 7-10 Section 26.10.3) or Special Wind Region (per ASCE 7-10 Figure 26.5-1B). 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 installation "represents a low risk to human life in event of failure." (IBC Table 1.5-1)
-



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- 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 Reoccurrence 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 "E" and assume Site Class D. These values incorporate the full range of short period spectral accelerations present in Arizona as outlined in the IBC Figure 1613.5.

The ground snow load in these calculations assumes a value of 60 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 connections, modules, 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, 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.

A handwritten signature in black ink, appearing to read 'Garrett Parkinson', with a long horizontal flourish extending to the right.

Garrett Parkinson
 Project Engineer



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Project: **19057 – Everest Ground Mount - ESS**

INSTALLATION DIMENSIONS

| G | Wind Speed | Snow | Tie-Brace | Pipe Data | | A | Concrete Depth (A) | |
|---------------|--------------------|---------------------|-----------|-----------|-----------------------|--------------|--------------------|-------|
| TILT ANGLE | ASCE 7-10 (mph) | Ground Snow Load | Required? | Pipe Size | Pipe Specification | Post Spacing | Front | Back |
| 20° | 105 | 0 psf | Yes | 1.5" | Sch. 40 | 6'-9" | 2'-0" | 4'-0" |
| | | | Yes | | Sch. 80 | 8'-0" | 2'-0" | 4'-0" |
| | | | Yes | 2" | Sch. 40 | 9'-3" | 2'-0" | 4'-3" |
| | | | Yes | | Sch. 80 | 10'-9" | 2'-0" | 4'-6" |
| 20° | 105 | 20 psf | Yes | 1.5" | Sch. 40 | 6'-6" | 2'-0" | 3'-6" |
| | | | Yes | | Sch. 80 | 7'-3" | 2'-0" | 4'-0" |
| | | | Yes | 2" | Sch. 40 | 8'-0" | 2'-0" | 4'-0" |
| | | | Yes | | Sch. 80 | 9'-3" | 2'-6" | 4'-3" |
| 30° | 105 | 40 psf | Yes | 1.5" | Sch. 40 | 5'-3" | 2'-0" | 4'-3" |
| | | | Yes | | Sch. 80 | 6'-3" | 2'-0" | 4'-6" |
| | | | Yes | 2" | Sch. 40 | 7'-6" | 2'-3" | 5'-0" |
| | | | Yes | | Sch. 80 | 8'-9" | 2'-6" | 5'-6" |
| 30° | 105 | 60 psf | Yes | 1.5" | Sch. 40 | 5'-3" | 2'-0" | 4'-3" |
| | | | Yes | | Sch. 80 | 5'-9" | 2'-3" | 4'-6" |
| | | | Yes | 2" | Sch. 40 | 7'-0" | 2'-6" | 5'-0" |
| | | | Yes | | Sch. 80 | 8'-0" | 3'-0" | 5'-0" |



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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 © 2019. 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 02/11/2019.
 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 2015 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. 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.
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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Project: **19057 – Everest Ground Mount - ESS**

WIND & SNOW LOADS

**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 27.4.3)

Net Pressure Coefficient, $C_{N'}$, from ASCE Figure 27.4-4 for Monoslope Free Roofs with a 45 Degree Max. Slope.

Height of Solar Panel Structure Limited by Geometry Specified on Sheet A3

Analysis for Ground Mount Panels Only

Velocity Pressure (q)

| V (mph) | Kd | -- | Kz | Kzt | q (psf) |
|---------|------|------|------|------|---------|
| 105 | 0.85 | 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 per Figure 26.5-1A)

Kd = Wind Directionality Factor (per table 26.6-1)

Kz = Velocity pressure exposure coefficient evaluated at height z (IBC Table 1609.6.2.1)

Kzt = Topographic factor as defined in Section 26.8.2

q = velocity pressure in (psf) ($q = 0.00256 \cdot Kz \cdot Kzt \cdot Kd \cdot V^2$ per ASCE 27.3.2) p_w = Windward Design Pressure (psf) ($p = q \cdot G \cdot C_{N'}$ per ACSC 27.4-3) p_L = Leeward Design Pressure (psf) ($p = q \cdot G \cdot C_{N'}$ 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)



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2015 IBC Solar Panel Wind Analysis - Version 1.1

Project: **19057 – Everest GM Solar – ESS**

SNOW LOAD CALCULATIONS PER ASCE 7-10 CH. 7

Ground Snow Load, P_g

LC1 = 0 psf
 LC2 = 20 psf
 LC3 = 40 psf
 LC4 = 60 psf

Flat Roof Snow Load, P_f

$$P_f = 0.7 C_e C_t I P_g$$

Eq. 7-1

| | 20 deg. | 30 deg. | 35 deg. |
|----|---------|---------|---------|
| Ce | 0.90 | 0.90 | 0.90 |
| Ct | 1.20 | 1.20 | 1.20 |
| I | 0.80 | 0.80 | 0.80 |

Table 7-2

Table 7-3

Table 7-4

Sloped Roof Snow Load, P_s

$$P_s = C_s P_f$$

Eq. 7-2

| | 20 deg. | 30 deg. | 35 deg. |
|----|---------|---------|---------|
| Cs | 0.92 | 0.73 | 0.60 |

Figure 7-2c

| Panel Data | |
|------------------|----|
| Rail Trib. Width | |
| 2.75 | ft |

| PV Snow Load (psf) | | | |
|--------------------|---------|---------|---------|
| pg (psf) | Tilt | | |
| | 20 deg. | 30 deg. | 35 deg. |
| 0 | 0.00 | 0.00 | 0.00 |
| 20 | 15.90 | 12.61 | 10.37 |
| 40 | 31.80 | 25.23 | 20.74 |
| 60 | 47.69 | 37.84 | 31.10 |

| PV Snow Load (plf) | | | |
|--------------------|---------|---------|---------|
| pg (psf) | Tilt | | |
| | 20 deg. | 30 deg. | 35 deg. |
| 0 | 0.00 | 0.00 | 0.00 |
| 20 | 43.72 | 34.69 | 28.51 |
| 40 | 87.44 | 69.38 | 57.02 |
| 60 | 131.16 | 104.07 | 85.54 |

Project: **19057 – Everest Ground Mount - ESS**

EXAMPLE RISA AND FOUNDATION ANALYSIS

Parameters for Example

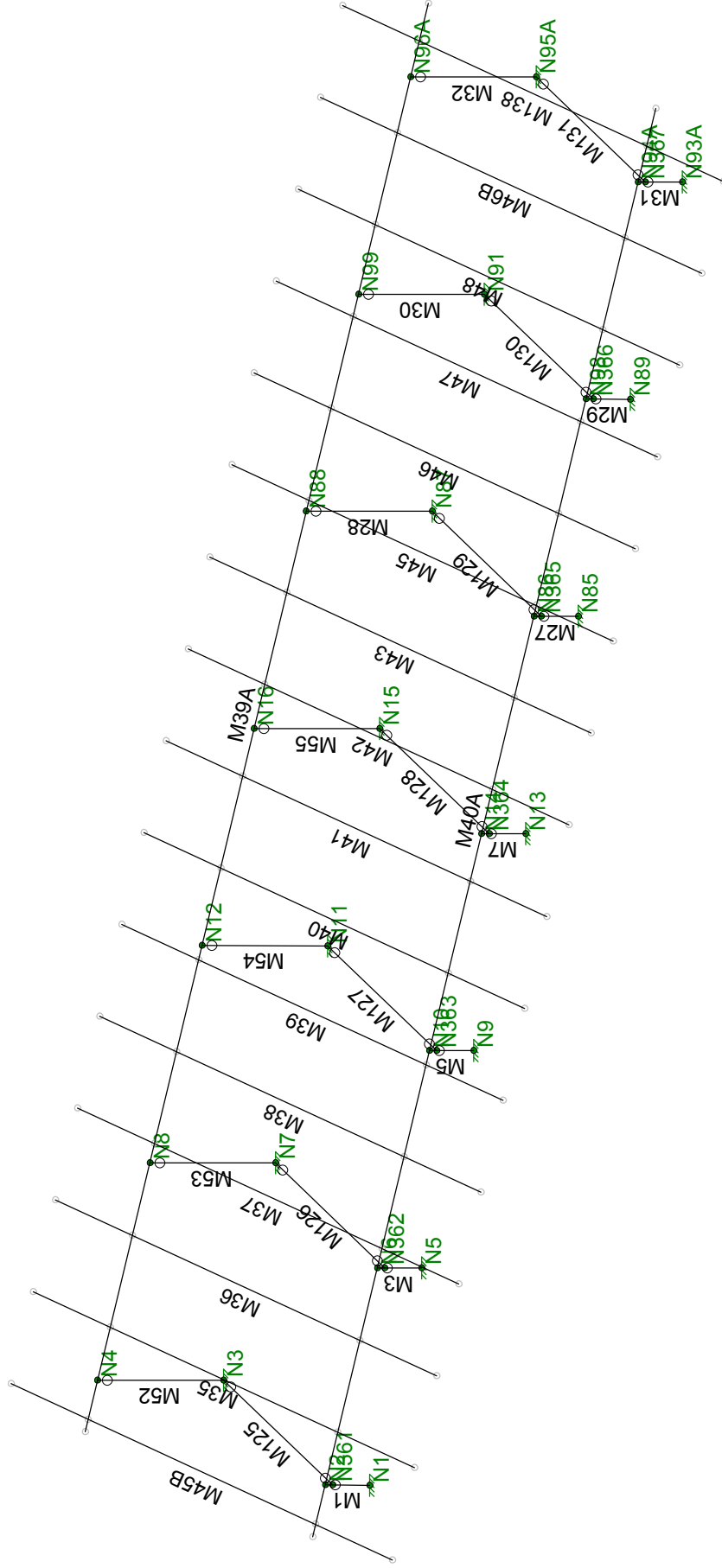
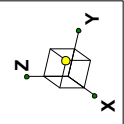
Tilt: 20 Degrees

Wind Speed: 105 MPH (3-sec. Gust)

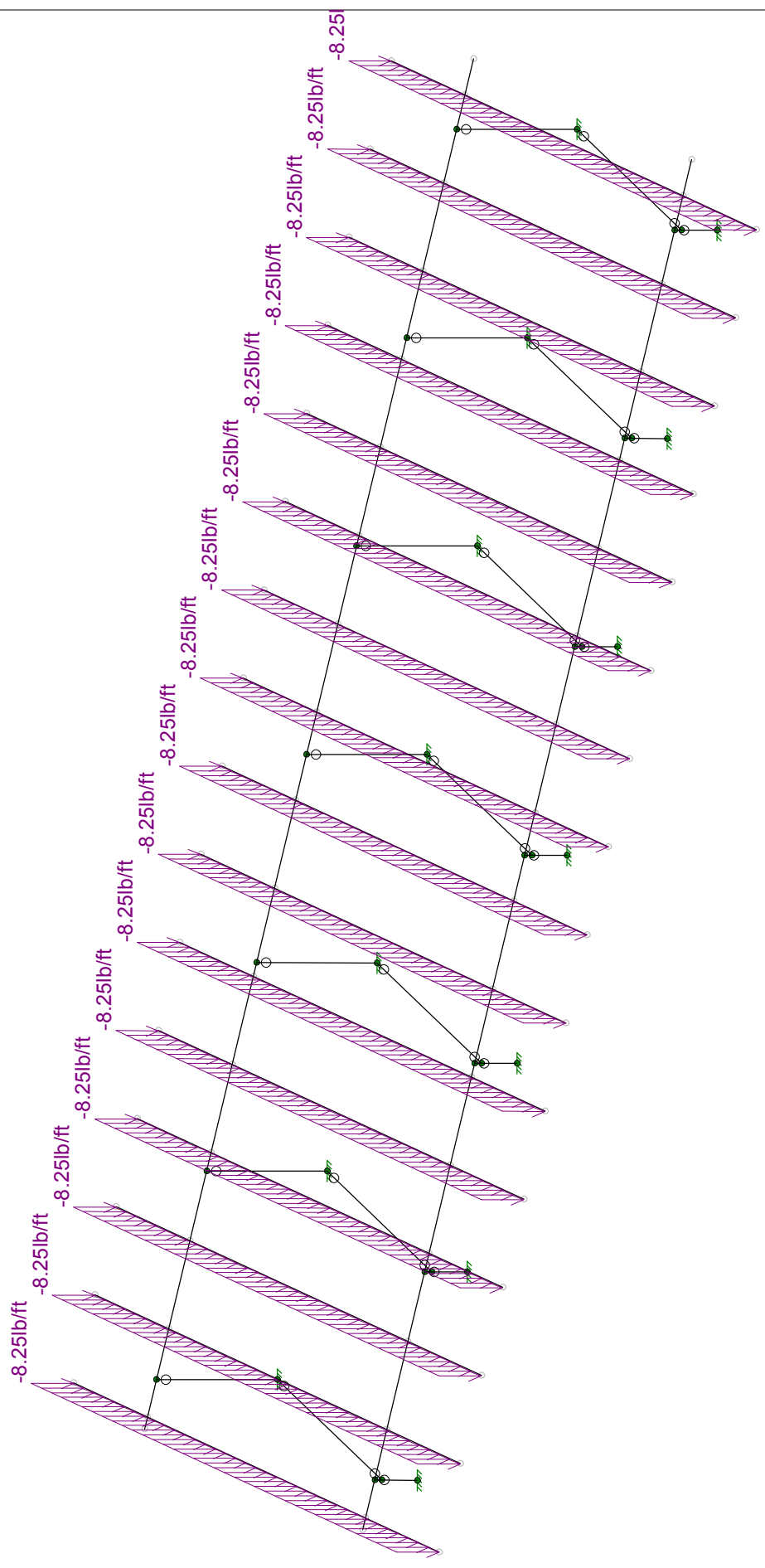
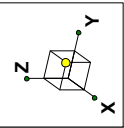
Exposure Category "C"

Snow Load: 20 psf

1.5"Ø Sch. 40 Pipe

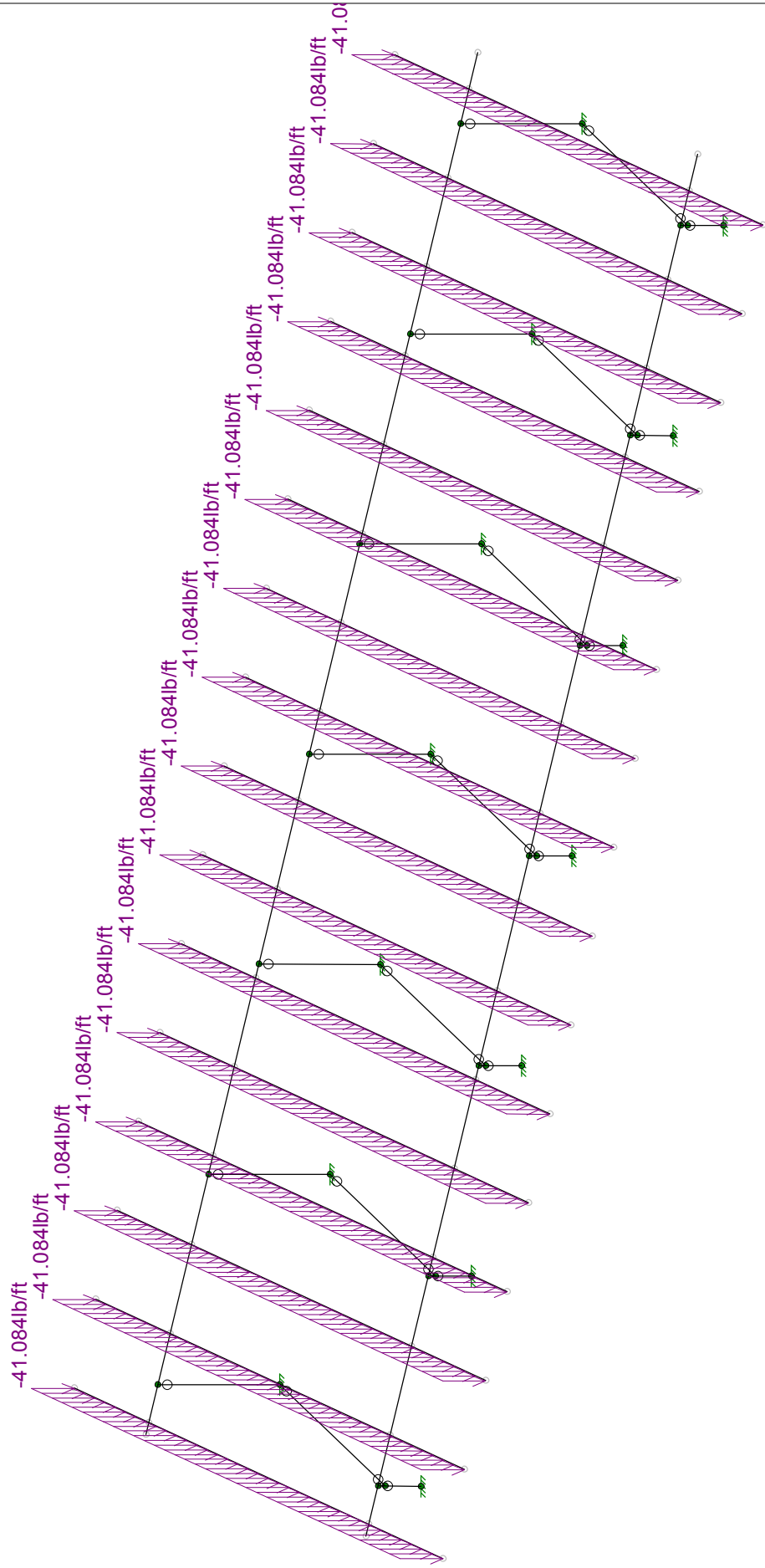
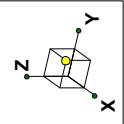


| | | |
|---------------|----------------------|----------------------------------|
| Everest Solar | SK - 1 | |
| GMP | Everest Ground Mount | |
| 19057 | Member & Node Labels | |
| | | 20deg_105MPH_20SL - PIPE_1.5.r3d |



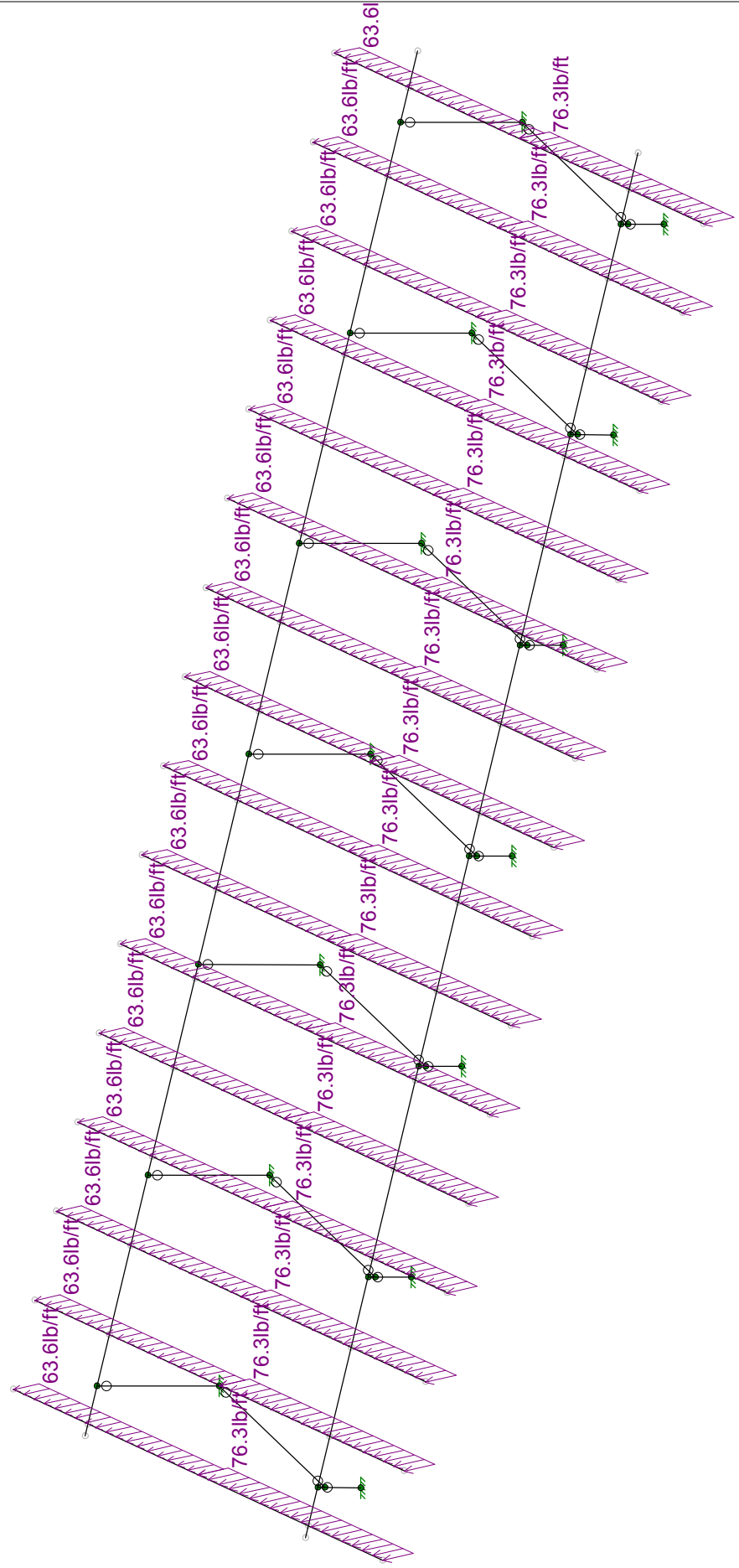
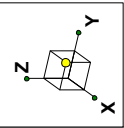
Loads: BLC 1, Dead Load

| | | |
|---------------|----------------------------------|--|
| Everest Solar | SK - 2 | |
| GMP | Everest Ground Mount | |
| 19057 | Applied Dead Load | |
| | 20deg_105MPH_20SL - PIPE_1.5.r3d | |



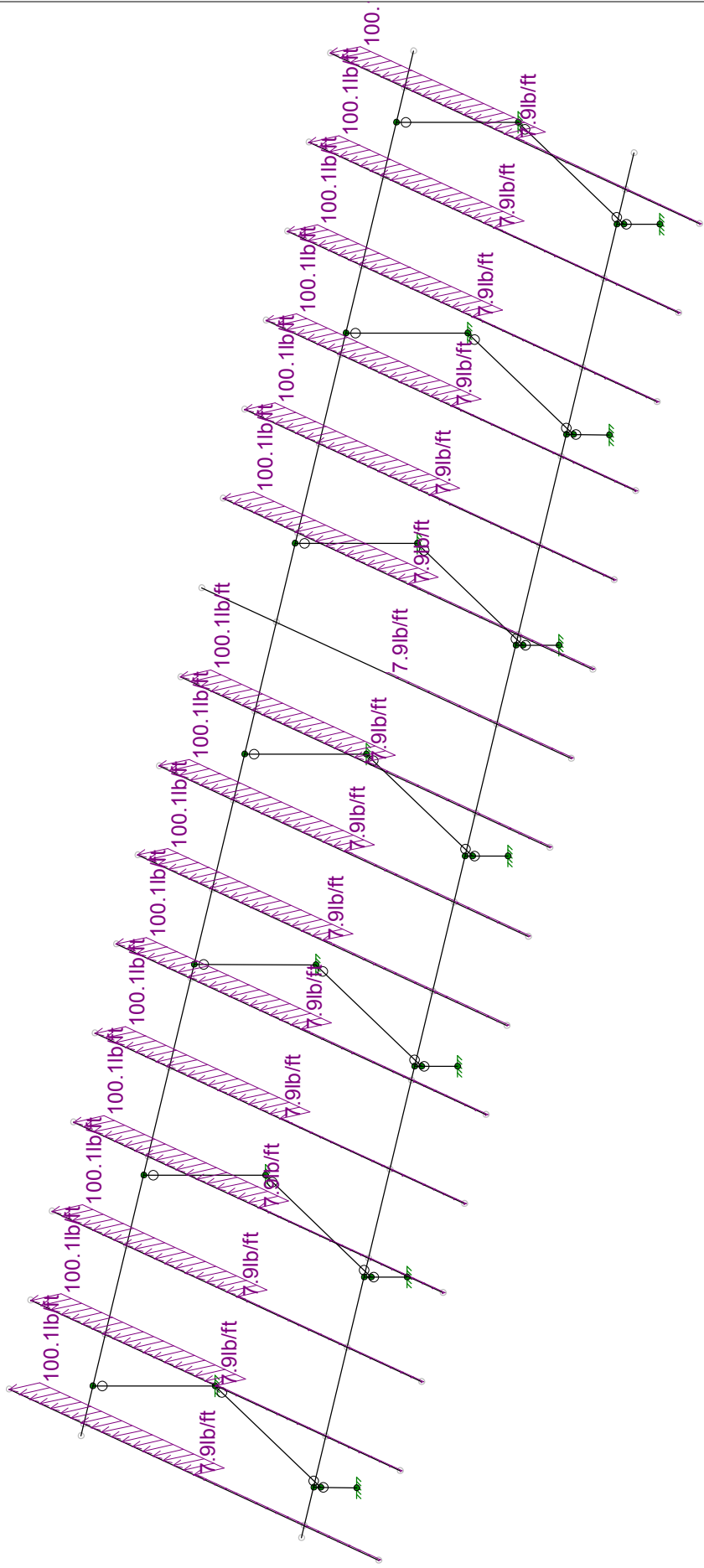
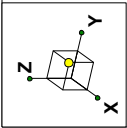
Loads: BLC 2, Snow Load

| | | |
|----------------------------------|---|--------|
| Everest Solar | Everest Ground Mount Applied Snow Load | SK - 3 |
| GMP | | |
| 19057 | | |
| 20deg_105MPH_20SL - PIPE_1.5.r3d | | |



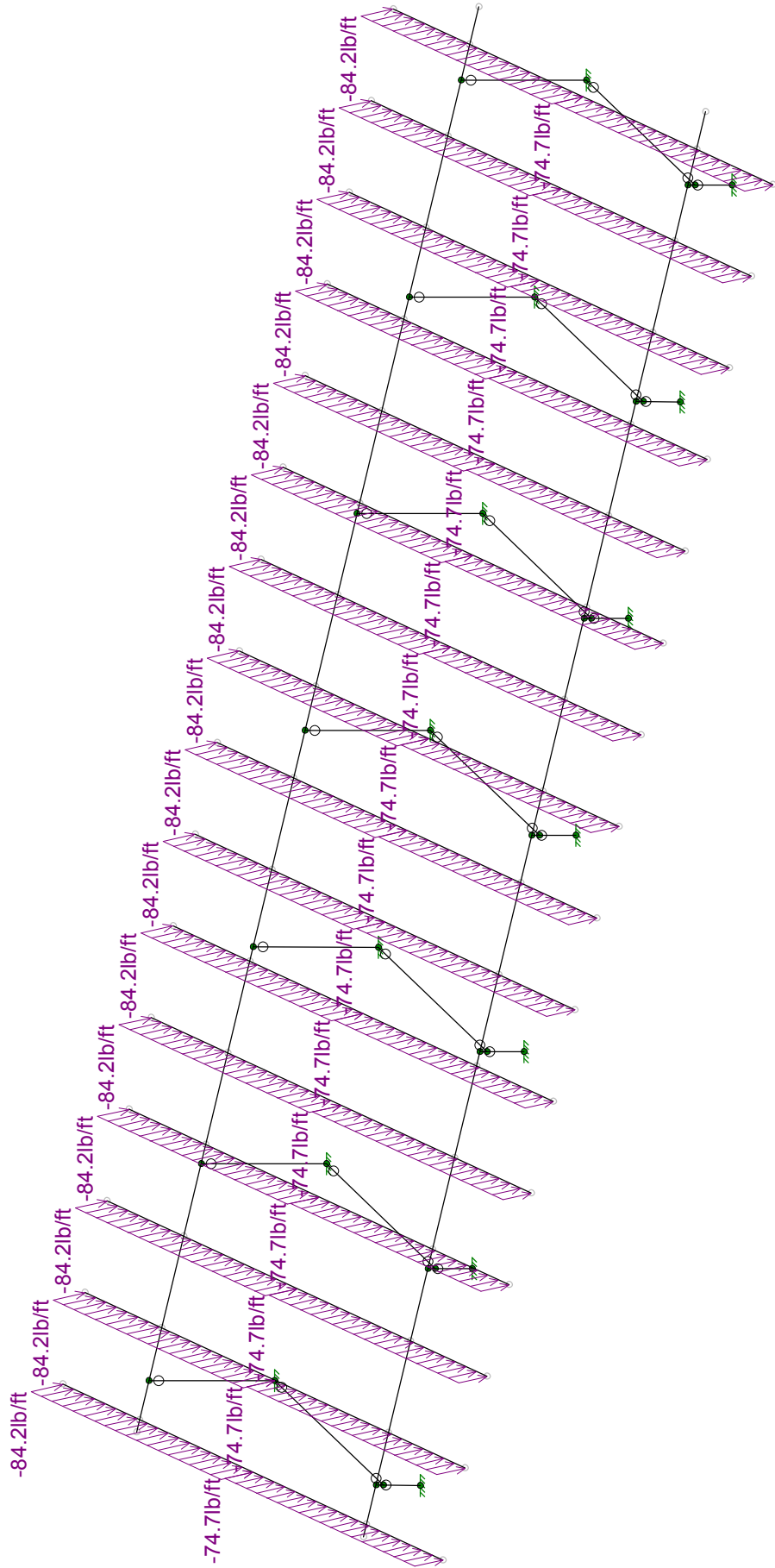
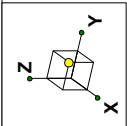
Loads: BLC 3, North Upward

| | | |
|---------------|----------------------------------|--|
| Everest Solar | SK - 4 | |
| GMP | Everest Ground Mount | |
| 19057 | Wind Load - North Upward Case | |
| | 20deg_105MPH_20SL - PIPE_1.5.r3d | |



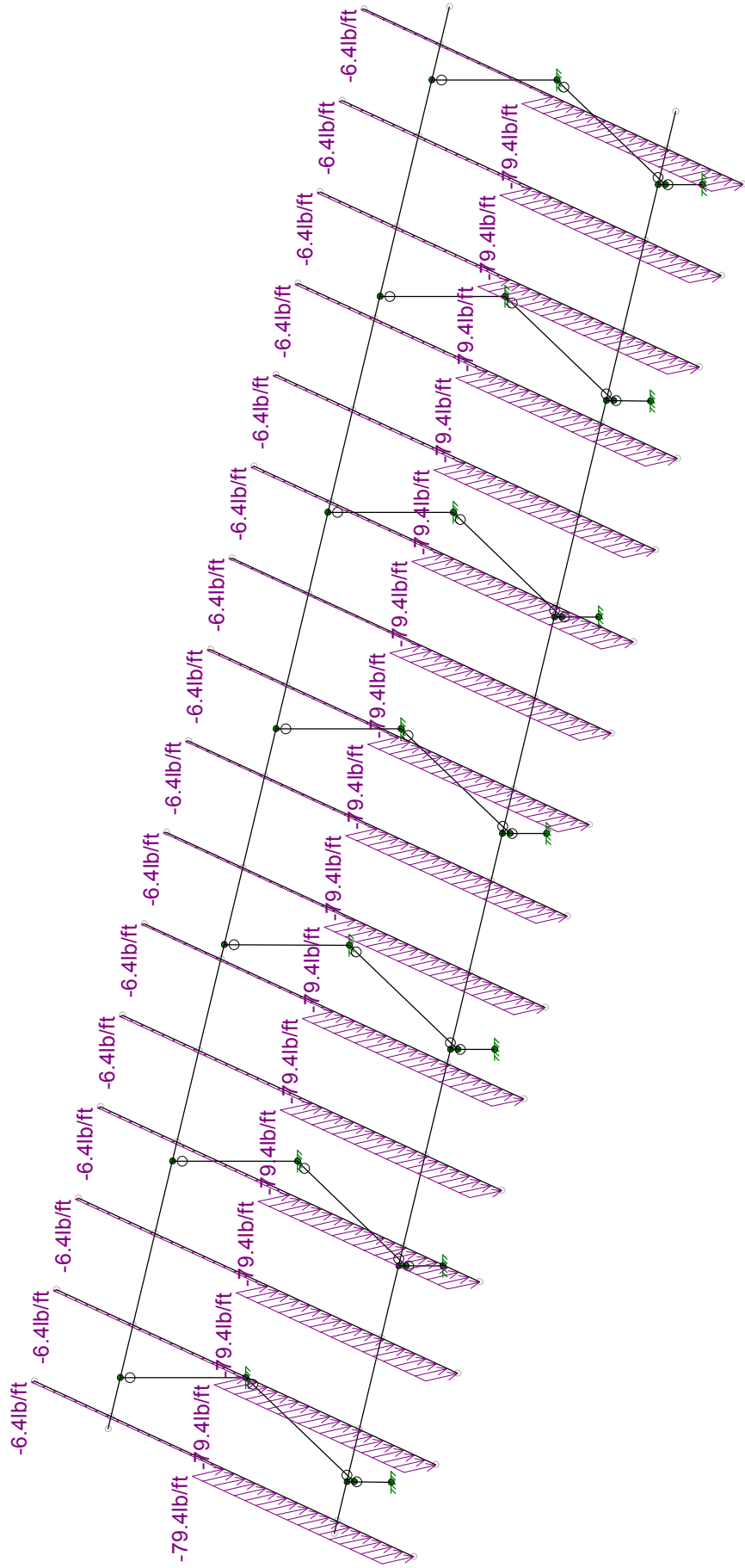
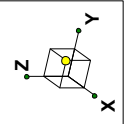
Loads: BLC 4, North Downward

| | | |
|---------------|----------------------------------|--|
| Everest Solar | SK - 5 | |
| GMP | Everest Ground Mount | |
| 19057 | Wind Load - North Downward Case | |
| | 20deg_105MPH_20SL - PIPE_1.5.r3d | |



Loads: BLC 5, South Upward

| | | |
|---------------|---|--------|
| Everest Solar | Everest Ground Mount Wind Load - South Upward Case | SK - 6 |
| GMP | | |
| 19057 | | |



Loads: BLC 6, South Downward

Everest Solar

GMP

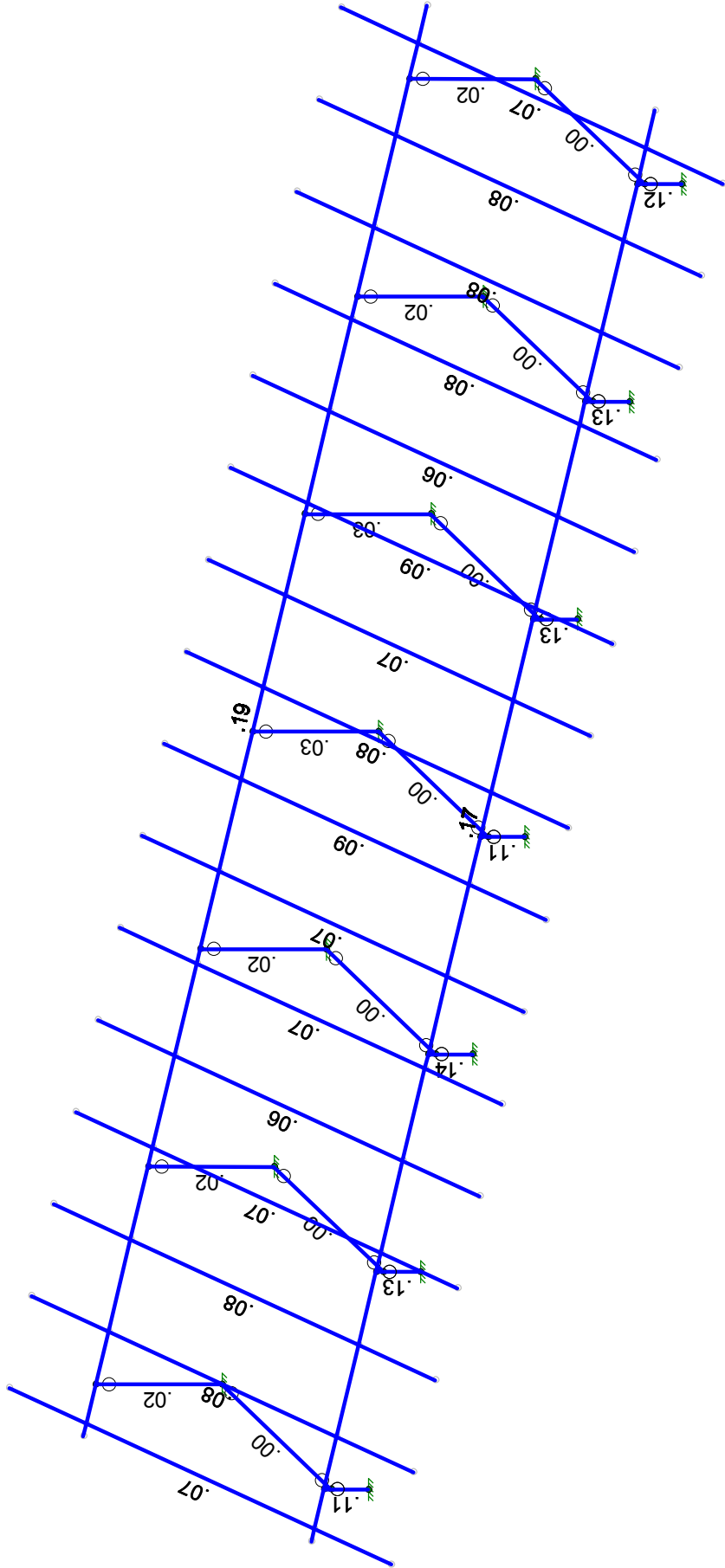
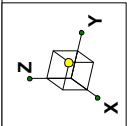
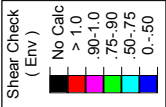
19057

Everest Ground Mount

Wind Load - South Downward Case

SK - 7

20deg_105MPH_20SL - PIPE_1.5.r3d



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

| | | |
|---------------|----------------------------------|--|
| Everest Solar | SK - 9 | |
| GMP | Everest Ground Mount | |
| 19057 | Shear Unity Code Check | |
| | 20deg_105MPH_20SL - PIPE_1.5.r3d | |



Checked By: JJN

Hot Rolled Steel Properties

| | Label | E [ksi] | G [ksi] | Nu | Therm (1/E...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 Rul... | A [in2] | lyy [in4] | lzz [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 | Distribu... | Area(M... | Surface... |
|---|----------------------|----------|-----------|-----------|-----------|-------|-------|-------------|-----------|------------|
| 1 | Dead Load | DL | | | -1 | | | 16 | | |
| 2 | Snow Load | SL | | | | | | 16 | | |
| 3 | North Upward | WL | | | | | | 32 | | |
| 4 | North Downward | WL | | | | | | 32 | | |
| 5 | South Upward | WL | | | | | | 32 | | |
| 6 | South Downward | WL | | | | | | 32 | | |
| 7 | Earthquake X-dire... | ELX | .8 | | | | | | | |
| 8 | Earthquake Y-dire... | ELY | | .8 | | | | | | |

Load Combinations

[illegible]



Company : Everest Solar
 Designer : GMP
 Job Number : 19057
 Model Name : Everest Ground Mount

Checked By: JJN

Load Combinations (Continued)

| | Description | Sol... | PD... | SR... | BLC Fact... | BLC Fact... | BLC Fact... | BLC Fact... | BLC Fact... | BLC Fact... | 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 | N1 | max | 100.355 | 6 | .45 | 18 | 994.897 | 20 | .229 | 9 | 26.766 | 9 | 10.631 | 9 |
| 2 | | min | -114.742 | 14 | -.341 | 9 | -341.412 | 9 | -.367 | 16 | -30.786 | 14 | -15.878 | 18 |
| 3 | N3 | max | 568.982 | 17 | .116 | 12 | 1237.729 | 16 | .253 | 9 | 30.139 | 14 | 9.791 | 13 |
| 4 | | min | -502.3 | 6 | -.004 | 17 | -777.662 | 13 | -.677 | 20 | -31.253 | 10 | -9.104 | 14 |
| 5 | N5 | max | 116.995 | 9 | .452 | 14 | 1158.351 | 20 | .379 | 13 | 31.235 | 9 | 15.003 | 13 |
| 6 | | min | -135.174 | 14 | -.519 | 13 | -393.661 | 9 | -.318 | 14 | -36.259 | 14 | -13.655 | 14 |
| 7 | N7 | max | 665.69 | 14 | .116 | 12 | 1449.434 | 16 | .228 | 9 | 16.464 | 14 | 9.358 | 17 |
| 8 | | min | -582.231 | 9 | -.003 | 17 | -897.1 | 13 | -.584 | 16 | -15.789 | 13 | -11.686 | 10 |
| 9 | N9 | max | 116.204 | 9 | .23 | 9 | 1125.961 | 20 | .131 | 16 | 31.014 | 9 | 15.269 | 14 |
| 10 | | min | -134.219 | 14 | -.326 | 16 | -379.266 | 9 | -.074 | 9 | -35.987 | 14 | -12.964 | 13 |
| 11 | N11 | max | 660.504 | 14 | .118 | 12 | 1413.545 | 16 | .374 | 17 | 12.663 | 14 | 11.827 | 10 |
| 12 | | min | -577.534 | 9 | 0 | 17 | -923.176 | 13 | -.659 | 12 | -11.962 | 13 | -6.884 | 17 |
| 13 | N13 | max | 112.97 | 6 | .073 | 13 | 1144.832 | 20 | .088 | 12 | 30.117 | 9 | 1.292 | 9 |
| 14 | | min | -128.722 | 17 | -.071 | 8 | -394.755 | 9 | -.037 | 17 | -34.55 | 14 | -6.392 | 10 |
| 15 | N15 | max | 636.957 | 17 | .114 | 12 | 1415.052 | 16 | .022 | 9 | 28.738 | 17 | .775 | 17 |
| 16 | | min | -564.644 | 6 | .002 | 17 | -706.512 | 13 | -.615 | 12 | -24.673 | 10 | -17.492 | 10 |
| 17 | N85 | max | 116.587 | 9 | .278 | 14 | 1123.152 | 20 | .304 | 10 | 31.113 | 9 | 20.189 | 13 |
| 18 | | min | -134.831 | 14 | -.547 | 13 | -376.759 | 9 | -.102 | 17 | -36.146 | 14 | -12.635 | 14 |
| 19 | N87 | max | 663.17 | 14 | .112 | 12 | 1412.145 | 16 | .23 | 13 | 10.655 | 14 | 17.715 | 13 |
| 20 | | min | -579.026 | 9 | .002 | 9 | -625.353 | 9 | -.591 | 16 | -8.633 | 9 | -5.003 | 6 |
| 21 | N89 | max | 117.027 | 9 | .467 | 13 | 1167.403 | 20 | .366 | 16 | 31.249 | 9 | 11.676 | 14 |
| 22 | | min | -135.076 | 14 | -.415 | 16 | -399.934 | 9 | -.207 | 13 | -36.24 | 14 | -19.376 | 13 |
| 23 | N91 | max | 665.616 | 14 | .119 | 12 | 1459.436 | 16 | .277 | 17 | 19.046 | 14 | 8.004 | 6 |
| 24 | | min | -582.918 | 9 | 0 | 9 | -956.842 | 13 | -.838 | 12 | -19.45 | 13 | -10.307 | 17 |
| 25 | N93A | max | 98.296 | 6 | .416 | 9 | 972.581 | 20 | .553 | 16 | 26.214 | 9 | 21.655 | 18 |
| 26 | | min | -112.399 | 14 | -.729 | 20 | -329.846 | 9 | -.234 | 9 | -30.156 | 14 | -15.048 | 9 |
| 27 | N95A | max | 557.285 | 17 | .12 | 12 | 1209.554 | 16 | .455 | 18 | 28.744 | 14 | 14.352 | 14 |
| 28 | | min | -491.808 | 6 | 0 | 9 | -749.078 | 13 | -.408 | 8 | -29.447 | 10 | -12.62 | 13 |
| 29 | Totals: | max | 3521.643 | 17 | 0 | 9 | 16702.826 | 16 | | | | | | |
| 30 | | min | -3100.553 | 9 | 0 | 12 | -6844.922 | 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 | M1 | PIPE 1.5 | .175 | 1.25 | 14 | .114 | 1.25 | | 14 | 15046.072 | 15697.605 | 735.279 | 735.279 | 2.... H1-1b |
| 2 | M3 | PIPE 1.5 | .206 | 1.25 | 14 | .134 | 1.25 | | 14 | 15046.072 | 15697.605 | 735.279 | 735.279 | 2.... H1-1b |
| 3 | M5 | PIPE 1.5 | .204 | 1.25 | 14 | .135 | 1.25 | | 14 | 15046.072 | 15697.605 | 735.279 | 735.279 | 1.... H1-1b |
| 4 | M7 | PIPE 1.5 | .197 | 1.25 | 14 | .110 | 1.25 | | 17 | 15046.072 | 15697.605 | 735.279 | 735.279 | 1.... H1-1b |
| 5 | M52 | PIPE 1.5 | .104 | 0 | 16 | .017 | 0 | | 13 | 11156.947 | 15697.605 | 735.279 | 735.279 | 1.... H1-1b* |



Company : Everest Solar
 Designer : GMP
 Job Number : 19057
 Model Name : Everest Ground Mount

Checked By: JJN

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 |
|--------|-------|-----------|---------|-------|-----------|---------|--------|----|-------------|-------------|-------------|-------------|------|--------|
| 6 | M53 | PIPE 1.5 | .122 | 0 | 16 | .019 | 0 | 10 | 11156.947 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 7 | M54 | PIPE 1.5 | .118 | 0 | 16 | .019 | 0 | 10 | 11156.947 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 8 | M55 | PIPE 1.5 | .119 | 0 | 16 | .028 | 0 | 10 | 11156.947 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 9 | M35 | PIPE 1.5 | .454 | 6.75 | 16 | .084 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 10 | M36 | PIPE 1.5 | .451 | 6.75 | 16 | .079 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 11 | M37 | PIPE 1.5 | .457 | 6.75 | 16 | .074 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 12 | M38 | PIPE 1.5 | .454 | 6.75 | 16 | .064 | 2.813 | 16 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 13 | M39 | PIPE 1.5 | .457 | 6.75 | 16 | .071 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 14 | M40 | PIPE 1.5 | .451 | 6.75 | 16 | .074 | 2.813 | 13 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 15 | M41 | PIPE 1.5 | .454 | 6.75 | 16 | .086 | 2.813 | 13 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 16 | M42 | PIPE 1.5 | .455 | 6.75 | 16 | .083 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 17 | M43 | PIPE 1.5 | .451 | 6.75 | 16 | .072 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 18 | M45 | PIPE 1.5 | .458 | 6.75 | 16 | .090 | 2.813 | 13 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 19 | M46 | PIPE 1.5 | .454 | 6.75 | 16 | .065 | 2.813 | 16 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 20 | M47 | PIPE 1.5 | .457 | 6.75 | 16 | .078 | 2.813 | 13 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 21 | M48 | PIPE 1.5 | .451 | 6.75 | 16 | .081 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 22 | M39A | PIPE 1.5 | .956 | 8.016 | 16 | .189 | 27.609 | 16 | 7966.511 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 23 | M40A | PIPE 1.5 | .888 | 8.016 | 16 | .171 | 27.609 | 20 | 7966.511 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 24 | M45B | PIPE 1.5 | .454 | 6.75 | 16 | .070 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 25 | M46B | PIPE 1.5 | .453 | 6.75 | 16 | .083 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |
| 26 | M27 | PIPE 1.5 | .205 | 1.25 | 14 | .132 | 1.25 | 14 | 15046.072 | 15697.605 | 735.279 | 735.279 | 1.8 | H1-1b |
| 27 | M28 | PIPE 1.5 | .118 | 0 | 16 | .028 | 0 | 13 | 11156.947 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 28 | M29 | PIPE 1.5 | .206 | 1.25 | 14 | .130 | 1.25 | 14 | 15046.072 | 15697.605 | 735.279 | 735.279 | 2... | H1-1b |
| 29 | M30 | PIPE 1.5 | .123 | 0 | 16 | .017 | 0 | 17 | 11156.947 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 30 | M31 | PIPE 1.5 | .172 | 1.25 | 14 | .119 | 1.25 | 14 | 15046.072 | 15697.605 | 735.279 | 735.279 | 2... | H1-1b |
| 31 | M32 | PIPE 1.5 | .101 | 0 | 16 | .024 | 0 | 14 | 11156.947 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 32 | M125 | PIPE 1.5 | .110 | 7.677 | 14 | .003 | 7.677 | 18 | 5188.632 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 33 | M126 | PIPE 1.5 | .130 | 7.677 | 14 | .003 | 7.677 | 10 | 5188.632 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 34 | M127 | PIPE 1.5 | .129 | 7.677 | 14 | .003 | 7.677 | 14 | 5188.632 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 35 | M128 | PIPE 1.5 | .124 | 7.677 | 17 | .002 | 7.677 | 10 | 5188.632 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 36 | M129 | PIPE 1.5 | .129 | 7.677 | 14 | .003 | 7.677 | 10 | 5188.632 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 37 | M130 | PIPE 1.5 | .130 | 7.677 | 14 | .003 | 7.677 | 10 | 5188.632 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 38 | M131 | PIPE 1.5 | .108 | 7.677 | 14 | .003 | 7.677 | 20 | 5188.632 | 15697.605 | 735.279 | 735.279 | 1... | H1-1b* |
| 39 | M138 | PIPE 1.5 | .454 | 6.75 | 16 | .065 | 10.688 | 20 | 4778.659 | 15697.605 | 735.279 | 735.279 | 1 | H1-1b |

| Axial Uplift Moment (y) Shear (x) | | | |
|-----------------------------------|-----------------|----------------|------------------|
| Front | 1,167 lb | -400 lb | -36 ft-lb |
| Back | 1,459 lb | -957 lb | -29 ft-lb |

| | Joint | | X | | Y | | Z | | Mx | | My | | Mz |
|---|-------|-----|---------|----|-------|----|---------|----|-------|----|--------|----|--------|
| | N1 | max | 100.36 | 6 | 0.45 | 18 | 994.9 | 20 | 0.23 | 9 | 26.77 | 9 | 10.63 |
| | | min | -114.74 | 14 | -0.34 | 9 | -341.41 | 9 | -0.37 | 16 | -30.79 | 14 | -15.88 |
| B | N3 | max | 568.98 | 17 | 0.12 | 12 | 1237.73 | 16 | 0.25 | 9 | 30.14 | 14 | 9.79 |
| | | min | -502.3 | 6 | 0 | 17 | -777.66 | 13 | -0.68 | 20 | -31.25 | 10 | -9.1 |
| | N5 | max | 117 | 9 | 0.45 | 14 | 1158.35 | 20 | 0.38 | 13 | 31.24 | 9 | 15 |
| | | min | -135.17 | 14 | -0.52 | 13 | -393.66 | 9 | -0.32 | 14 | -36.26 | 14 | -13.66 |
| B | N7 | max | 665.69 | 14 | 0.12 | 12 | 1449.43 | 16 | 0.23 | 9 | 16.46 | 14 | 9.36 |
| | | min | -582.23 | 9 | 0 | 17 | -897.1 | 13 | -0.58 | 16 | -15.79 | 13 | -11.69 |
| | N9 | max | 116.2 | 9 | 0.23 | 9 | 1125.96 | 20 | 0.13 | 16 | 31.01 | 9 | 15.27 |
| | | min | -134.22 | 14 | -0.33 | 16 | -379.27 | 9 | -0.07 | 9 | -35.99 | 14 | -12.96 |
| B | N11 | max | 660.5 | 14 | 0.12 | 12 | 1413.55 | 16 | 0.37 | 17 | 12.66 | 14 | 11.83 |
| | | min | -577.53 | 9 | 0 | 17 | -923.18 | 13 | -0.66 | 12 | -11.96 | 13 | -6.88 |
| | N13 | max | 112.97 | 6 | 0.07 | 13 | 1144.83 | 20 | 0.09 | 12 | 30.12 | 9 | 1.29 |
| | | min | -128.72 | 17 | -0.07 | 8 | -394.76 | 9 | -0.04 | 17 | -34.55 | 14 | -6.39 |
| B | N15 | max | 636.96 | 17 | 0.11 | 12 | 1415.05 | 16 | 0.02 | 9 | 28.74 | 17 | 0.78 |
| | | min | -564.64 | 6 | 0 | 17 | -706.51 | 13 | -0.62 | 12 | -24.67 | 10 | -17.49 |
| | N85 | max | 116.59 | 9 | 0.28 | 14 | 1123.15 | 20 | 0.3 | 10 | 31.11 | 9 | 20.19 |
| | | min | -134.83 | 14 | -0.55 | 13 | -376.76 | 9 | -0.1 | 17 | -36.15 | 14 | -12.64 |
| B | N87 | max | 663.17 | 14 | 0.11 | 12 | 1412.15 | 16 | 0.23 | 13 | 10.66 | 14 | 17.72 |
| | | min | -579.03 | 9 | 0 | 9 | -625.35 | 9 | -0.59 | 16 | -8.63 | 9 | -5 |
| | N89 | max | 117.03 | 9 | 0.47 | 13 | 1167.4 | 20 | 0.37 | 16 | 31.25 | 9 | 11.68 |
| | | min | -135.08 | 14 | -0.42 | 16 | -399.93 | 9 | -0.21 | 13 | -36.24 | 14 | -19.38 |
| B | N91 | max | 665.62 | 14 | 0.12 | 12 | 1459.44 | 16 | 0.28 | 17 | 19.05 | 14 | 8 |
| | | min | -582.92 | 9 | 0 | 9 | -956.84 | 13 | -0.84 | 12 | -19.45 | 13 | -10.31 |
| | N93A | max | 98.3 | 6 | 0.42 | 9 | 972.58 | 20 | 0.55 | 16 | 26.21 | 9 | 21.66 |
| | | min | -112.4 | 14 | -0.73 | 20 | -329.85 | 9 | -0.23 | 9 | -30.16 | 14 | -15.05 |
| B | N95A | max | 557.29 | 17 | 0.12 | 12 | 1209.55 | 16 | 0.46 | 18 | 28.74 | 14 | 14.35 |
| | | min | -491.81 | 6 | 0 | 9 | -749.08 | 13 | -0.41 | 8 | -29.45 | 10 | -12.62 |

NOTE:

1. The foundation results that follow do not combine friction and end bearing.

2. The top 12" of foundation depth was not discounted for lateral force resistance. A soils engineer or local building department may require this approach. Contact Taylor & Syfan for further analysis if this applies.



San Luis Obispo - Pasadena
www.TaylorSyfan.com

INNOVATIVE STRUCTURAL DESIGNS

800.579.3881
800.617.2235 fax

Page: _____

Job No: 19057

Engr: _____

Friction Pile Design

Version 12.35 - 2012 IBC

INPUT DATA:

Name: Pipe1.5_F_Full - Nevada

V = 0.14 kips @ H = 0.00 ft above grade

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

Axial = 1.17 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

Required = 2.00 ft total embedment

Soil Pressures:

S1 = 266.67 psf at D/3

S3 = 4000.00 psf at full depth

Moments:

M = 0.13 ft-kips unfactored

Lateral = 2.00

Minimum Embedment into
Approved, Competent Soil
per Material Requirements
on Sheet S10.



San Luis Obispo | Pasadena | www.taylorsyfan.com

Project: **19057 – Everest Ground Mount - ESS**

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) | 400 | 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

**2'-0" Pile Depth Acceptable
for Front Pile**



San Luis Obispo - Pasadena
www.TaylorSyfan.com

INNOVATIVE STRUCTURAL DESIGNS

800.579.3881
 800.617.2235 fax

Page: _____

Job No: 19057

Engr: _____

Friction Pile Design

Version 12.35 - 2012 IBC

INPUT DATA:

Name: Pipe1.5_B_Full - Nevada

V = 0.67 kips @ H = 0.00 ft above grade

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

Axial = 1.46 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 = 3.40

Required = 3.40 ft total embedment

Soil Pressures:

S1 = 453.33 psf at D/3

S3 = 4000.00 psf at full depth

Moments:

M = 0.78 ft-kips unfactored

Minimum Embedment into
 Approved, Competent Soil
 per Material Requirements
 on Sheet S10.



San Luis Obispo | Pasadena | www.taylorsyfan.com

Project: **19057 – Everest Ground Mount - ESS**

PILE UPLIFT CALCULATION

(BACK PILE)

SYSTEM INFORMATION

| | | |
|---------------------|-----|--------|
| Pile Diameter | 12 | inches |
| Depth of Pile | 3.5 | feet |
| Distance Discounted | 1 | feet |
| Skin Friction | 250 | psf/ft |
| Concrete Density | 150 | pcf |

LOADING INFORMATION

| | | |
|------------------------------|-----|--------|
| Uplift Demand (ASD Level) | 957 | pounds |
|------------------------------|-----|--------|

UPLIFT CAPACITY

From Skin Friction

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

1963 pounds

From Concrete Weight

247 pounds

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

TOTAL UPLIFT RESISTANCE

2211 pounds

Pile Design is Acceptable for Uplift Demand

***3'-6" Pile Depth Acceptable
for Back Pile***



San Luis Obispo | Pasadena | www.taylorsyfan.com

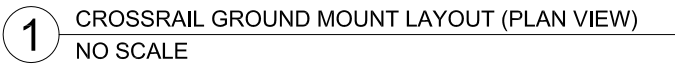
Project: **19037 - Everest Ground Mount - ESS**

APPENDIX A

(Reference Documents from Everest Solar Systems)

For Reference Only

NOTE
PIPE COUPLERS
ALLOWED FOR
HORIZONTAL PIPE
RUNS ONLY.



EVEREST
solar systems

S100

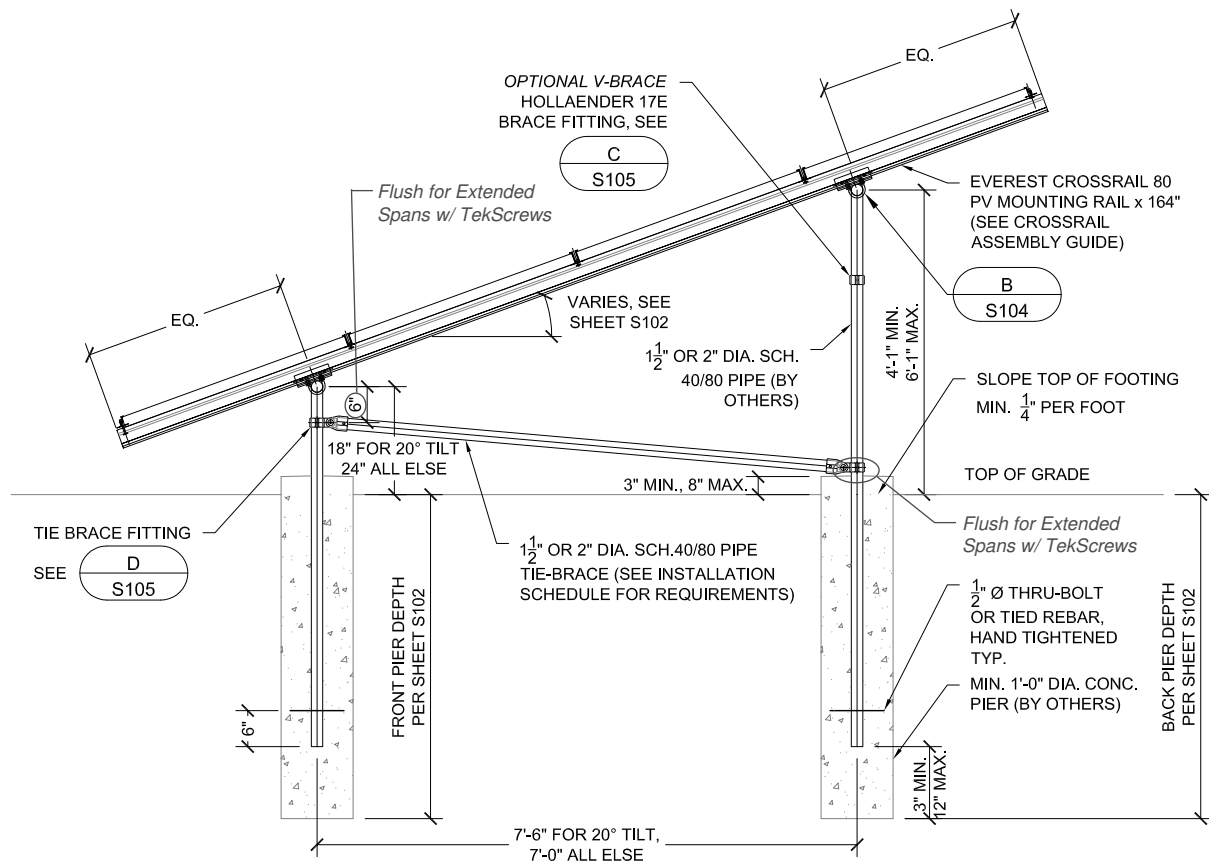
SHEET 1 OF 1

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For Reference Only

NOTE
REFER TO CROSSRAIL
ASSEMBLY GUIDE FOR
RAIL TO PV PANEL
CONNECTION

NOTE
PIPE COUPLERS
ALLOWED FOR
HORIZONTAL PIPE
RUNS ONLY.



1 CROSSRAIL GROUND MOUNT LAYOUT (ELEVATION VIEW)
NO SCALE

NOTE
REFER TO STRUCTURAL
CALCULATIONS, NOTES, &
DETAILS BY TAYLOR &
SYFAN DATED 2019 FOR
ADD'L SPECIFICATIONS &
REQUIREMENTS.



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

DATA SHEET:
CROSSRAIL GROUND MOUNT ELEVATION

S101

PART NUMBER: N/A

ALL DIMENSIONS
FT. & INCHES

K2 REFERENCE NUMBER: N/A

SCALE: NTS

SERIES:

SHEET 1 OF 1

For Reference Only

**For Reference Only,
Do Not Use**

INSTALLATION DIMENSIONS

| G | Wind Speed* | Snow* | Tie-Brace | Pipe Data | | A | A1 | CONCRETE DEPTH (A) | | CONCRETE DEPTH (A1) | |
|---------------|---------------------------|---------------------|-----------|-----------|-----------------------|--------------|----------------------------|--------------------|-------|---------------------|-------|
| TILT ANGLE | ASCE 7-05 / 7-10 (mph) | Ground Snow Load | Required? | Pipe Size | Pipe Specification | Post Spacing | Post Spacing w/ V-Brace | Front | Back | Front | Back |
| 20° | 85 / 100 | 0 psf | Yes | 1.5" | Sch. 40 | 7'-9" | 11'-9" | 2'-0" | 4'-0" | 2'-4" | 5'-0" |
| | | | Yes | | Sch. 80 | 8'-9" | 13'-6" | 2'-0" | 4'-0" | 2'-4" | 5'-0" |
| | | | Yes | 2" | Sch. 40 | 9'-9" | 15'-0" | 2'-0" | 4'-0" | 2'-3" | 5'-0" |
| | | | Yes | | Sch. 80 | 10'-9" | 16'-0" | 2'-0" | 4'-3" | 2'-9" | 5'-3" |
| 30°-35° | 90 / 105 | 30 psf | Yes | 1.5" | Sch. 40 | 5'-6" | 9'-0" | 2'-0" | 4'-4" | 3'-0" | 6'-0" |
| | | | Yes | | Sch. 80 | 6'-3" | 10'-9" | 3'-0" | 5'-0" | 3'-0" | 6'-0" |
| | | | Yes | 2" | Sch. 40 | 7'-0" | 10'-0" | 3'-0" | 5'-4" | 3'-3" | 7'-0" |
| | | | Yes | | Sch. 80 | 8'-0" | 11'-0" | 3'-0" | 6'-0" | 3'-9" | 7'-0" |
| 30°-35° | 90 / 105 | 50 psf | Yes | 1.5" | Sch. 40 | 4'-6" | 6'-3" | 3'-0" | 6'-0" | 3'-3" | 6'-0" |
| | | | Yes | | Sch. 80 | 5'-6" | 7'-3" | 3'-0" | 6'-0" | 3'-3" | 7'-0" |
| | | | Yes | 2" | Sch. 40 | 6'-0" | 8'-9" | 3'-0" | 6'-0" | 3'-4" | 6'-4" |
| | | | Yes | | Sch. 80 | 7'-0" | 11'-0" | 3'-0" | 6'-6" | 4'-8" | 8'-3" |
| 30°-35° | 105 / 130 | 30 psf | Yes | 1.5" | Sch. 40 | 5'-6" | 8'-3" | 3'-0" | 6'-0" | 3'-6" | 7'-3" |
| | | | Yes | | Sch. 80 | 5'-9" | 8'-3" | 3'-0" | 6'-0" | 3'-6" | 7'-3" |
| | | | Yes | 2" | Sch. 40 | 7'-0" | 9'-0" | 3'-0" | 6'-6" | 3'-4" | 7'-6" |
| | | | Yes | | Sch. 80 | 8'-0" | 10'-6" | 3'-0" | 7'-0" | 3'-6" | 8'-0" |
| 30°-35° | 105 / 130 | 50 psf | Yes | 1.5" | Sch. 40 | 4'-6" | 6'-3" | 3'-0" | 6'-0" | 3'-3" | 6'-6" |
| | | | Yes | | Sch. 80 | 5'-6" | 7'-3" | 3'-0" | 6'-0" | 3'-3" | 7'-0" |
| | | | Yes | 2" | Sch. 40 | 6'-0" | 8'-9" | 3'-0" | 6'-0" | 3'-4" | 7'-4" |
| | | | Yes | | Sch. 80 | 7'-0" | 11'-0" | 3'-0" | 6'-6" | 4'-8" | 8'-3" |

* TO BE VERIFIED BY A REGISTERED PROFESSIONAL ENGINEER OR BUILDING OFFICIAL

NOTE
REFER TO STRUCTURAL
CALCULATIONS, NOTES, &
DETAILS BY TAYLOR &
SYFAN DATED 2019 FOR
ADD'L SPECIFICATIONS &
REQUIREMENTS.



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

DATA SHEET:

CROSSRAIL GROUND MOUNT
INSTALLATION SCHEDULE

S102

PART NUMBER: N/A

ALL DIMENSIONS
FT. & INCHES

K2 REFERENCE NUMBER: N/A

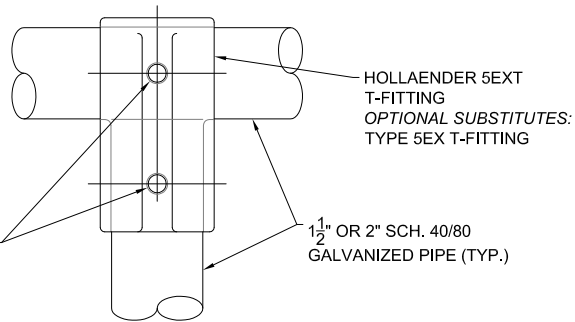
SCALE: NTS

SERIES:

SHEET 1 OF 1

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TIGHTEN SET-SCREW TO
17 FT. LBS. (TYP.)



A GROUND MOUNT T-FITTING
NO SCALE

NOTE
REFER TO MANUF.
SPECIFICATIONS FOR
FITTINGS & 3D PARTY
ACCESSORIES

NOTE
REFER TO STRUCTURAL
CALCULATIONS, NOTES, &
DETAILS BY TAYLOR &
SYFAN DATED 2019 FOR
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REQUIREMENTS.



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Oceanside, CA 92056

| | |
|-------------|------------------------------|
| DATA SHEET: | CROSSRAIL GROUND MOUNT PARTS |
|-------------|------------------------------|

S103

ALL DIMENSIONS
FT. & INCHES

| | |
|--------------|-----|
| PART NUMBER: | N/A |
|--------------|-----|

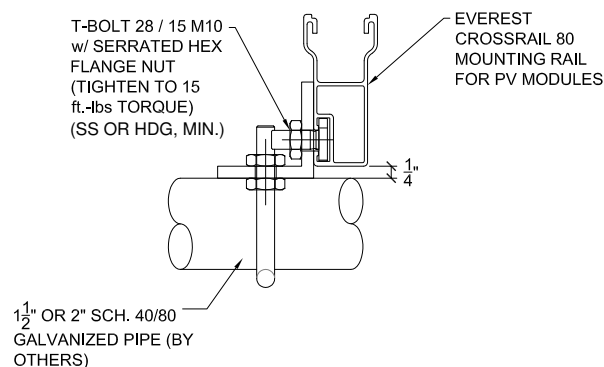
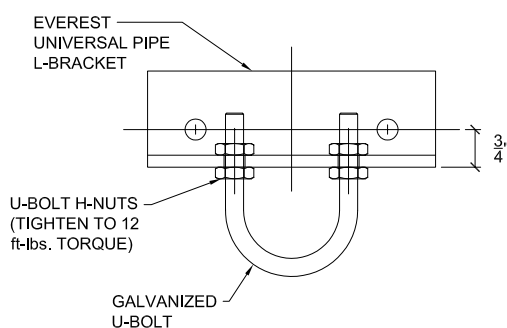
| | |
|----------------------|-----|
| K2 REFERENCE NUMBER: | N/A |
|----------------------|-----|

| | |
|------------|---------------|
| SCALE: NTS | SERIES: PARTS |
|------------|---------------|

SHEET 1 OF 1

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For Reference Only



B EVEREST 1.5" PIPE L-BRACKET
NO SCALE

NOTE
REFER TO MANUF.
SPECIFICATIONS FOR
FITTINGS & 3D PARTY
ACCESSORIES

NOTE
REFER TO STRUCTURAL
CALCULATIONS, NOTES, &
DETAILS BY TAYLOR &
SYFAN DATED 2019 FOR
ADD'L SPECIFICATIONS &
REQUIREMENTS.



Everest Solar Systems, LLC
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Oceanside, CA 92056

DATA SHEET:
CROSSRAIL GROUND MOUNT PARTS

S104

PART NUMBER: N/A

ALL DIMENSIONS
FT. & INCHES

K2 REFERENCE NUMBER: N/A

SCALE: NTS SERIES: PARTS

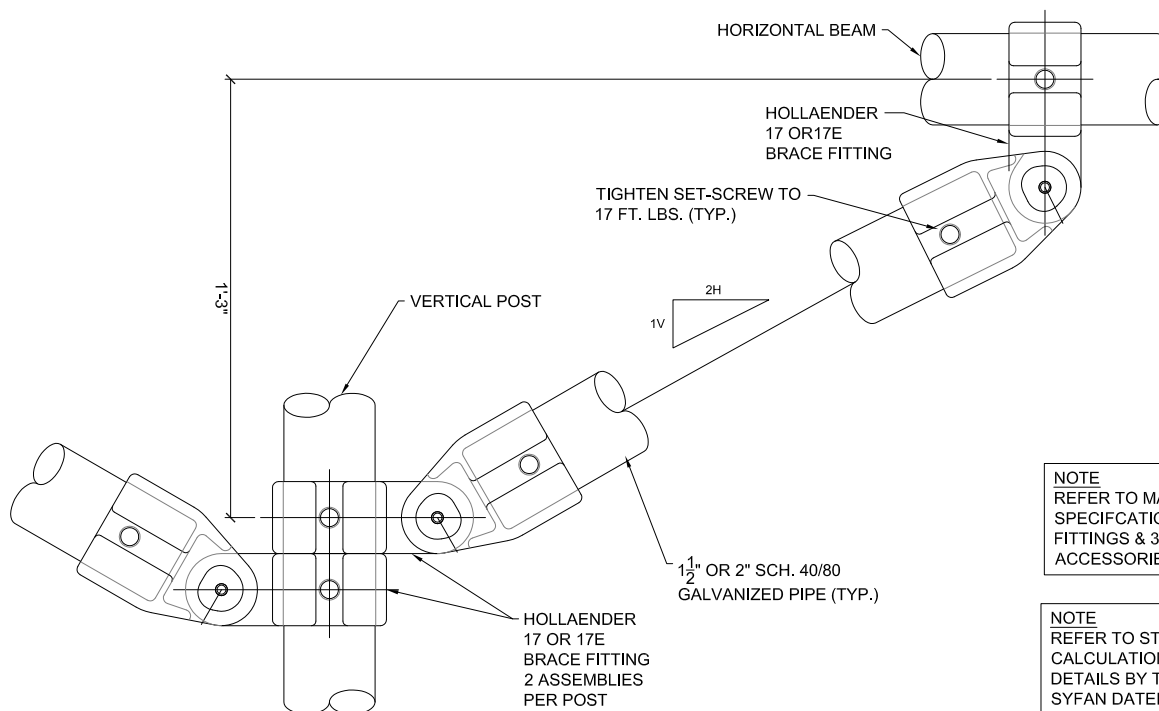
SHEET 1 OF 1

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Technical drawing showing the rear view of the telescope mount. The drawing includes the following labels:

- HOLLAENDER 17 OR 17E BRACE FITTING
- FRONT VERT. POST
- REAR VERT. POST

TITLE



NOTE
REFER TO MANUF.
SPECIFICATIONS FOR
FITTINGS & 3D PARTY
ACCESSORIES

NOTE
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CALCULATIONS, NOTES, &
DETAILS BY TAYLOR &
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REQUIREMENTS.



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| | |
|-------------|------------------------------|
| DATA SHEET: | CROSSRAIL GROUND MOUNT PARTS |
|-------------|------------------------------|

S105

ALL DIMENSIONS
FT. & INCHES

| | |
|--------------|-----|
| PART NUMBER: | N/A |
|--------------|-----|

| | |
|----------------------|-----|
| K2 REFERENCE NUMBER: | N/A |
|----------------------|-----|

| | |
|------------|---------------|
| SCALE: NTS | SERIES: PARTS |
|------------|---------------|

SHEET 1 OF 1

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For Reference Only

#17E-8
ADJ. ELBOW OR TEE

PIPE

PIPE

SETSCREWS

#3 DRILL BIT (.213)
PILOT HOLE.

1/4"-20x2-1/2" LG.
HWH ITW BUILD EX
TEKS SCREW

A8 of A8



| | |
|-------------|----------|
| DATE | 05-01-17 |
| DESIGNED BY | NTS |
| CHECKED BY | NTS |
| NOTED | 10502-S |
| SCALE | 1 |

Hollaender MFG.
10285 WAYNE AVENUE
CINCINNATI, OH 45215-6399
PH: (800) 772-8800
FX: (800) 772-8800
WWW.HOLLAENDER.COM

Hollaender[®]
STRUCTURAL ENGINEERING GROUP

| NO. | REVISIONS | DATE | APPROVED |
|-----|-----------------------|----------|----------|
| 0 | RELEASED FOR APPROVAL | 05-01-17 | BW |
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