# SAL UNITAH RIDGE

**5G L-SUB6 CARRIER ADD PROJECT**

## STRUCTURAL ANALYSIS
**REVISION 1**

**IBC 2018 / ASCE 7-16**

**60'-0" BELL TOWER**

**OGDEN, UT**
**WEBER COUNTY**
**N41°08'56.45" W111°55'57.36"**

REVIEWED FOR CODE COMPLIANCE
FOR COMPLIANCE WITH THE APPLICABLE CONSTRUCTION CODES IDENTIFIED BELOW.
[X] BUILDING [X] STRUCTURAL
[X] MECHANICAL [X] PLUMBING
[X] ELECTRICAL [X] ENERGY
[X] ACCESSIBILITY [ ] FIRE

PLAN REVIEW ACCEPTANCE OF DOCUMENTS DOES NOT AUTHORIZE CONSTRUCTION TO PROCEED IN VIOLATION OF ANY FEDERAL, STATE, OR LOCAL REGULATIONS.
BY: _____ DATE: 10/22/21
WEST COAST CODE CONSULTANTS, INC.

**PREPARED BY: DANH HO, E.I.T.**

PROFESSIONAL ENGINEER
No. 8723528-2202
ERIC V. RAWLINS
STATE OF UTAH

March 18, 2021

**MAXIMUM ANTICIPATED STRESS LEVEL & RESULTS**

| STRUCTURAL COMPONENT | RESULTS |
|---|---|
| Bell Tower | **69%** |

**REVISION CHART**

| REVISION | DATE ISSUED | DESCRIPTION |
|---|---|---|
| 0 | 02/04/2020 | Initial Report |
| 1 | 03/18/2021 | 5G L-Sub6 Carrier Add Project |

J5 INFRASTRUCTURE PARTNERS

***J5 INFRASTRUCTURE PARTNERS***
2030 Main Street, Suite 200, Irvine, CA 92614 (949) 247-7767
*Albuquerque, NM • Boise, ID • El Paso, TX • Las Vegas, NV • Denver, CO • Irvine, CA*

## PURPOSE

At the request of Verizon, J5 Infrastructure Partners performed a revised Structural Analysis of the SAL Unitah Ridge 60'-0" Bell Tower located in Ogden, Utah. The analysis was performed to determine the Bell Tower's capability of supporting Verizon's proposed appurtenance modifications.

## EXECUTIVE SUMMARY

J5 Infrastructure Partners concludes the existing 60'-0" Bell Tower structure is capable of supporting Verizon's proposed antenna. Please refer to the "Conclusion & Recommendations" portion of this report for further information.

## TOWER & ANTENNA DESCRIPTIONS

The original manufacturer of the structure is unknown. The tower consists of 3-legged steel pipe tower w/ steel wide flange horizontal bracing and steel square tube top secondary bracing. Please refer to the tower mapping report for further information pertaining to the tower's structural elements and geometry.

***DOCUMENTS PROVIDED:***

- Tower Mapping Report, dated January 22, 2020 provided by GeoStructural
- RFDS, dated November 13, 2010 provided by Verizon

***VERIZON ANTENNA MODIFICATIONS*:**

Verizon proposes the following:

- Install (2) new Panel Antennas at the 55'-6" level.

This will result in the following final tower antenna configuration:

| ATTACH LEVEL (COR) | AZIMUTH (deg., TN) | ANTENNA TYPE | ANTENNA QUANTITY | MOUNT TYPE | COAX (QTY.) SIZE (Nominal) |
|---|---|---|---|---|---|
| 55'-6" | 30° | JMA X7CQAP-FRO-860-VR4<br>8' Panel Antenna | 2 | Pipe-Mounted (behind Screen Wall Panels) | (2)1-1/4: Hybrid Cables |
| | 290° | JMA X7CQAP-FRO-845-VR4<br>8' Panel Antenna | 2 | | |
| | - | Ericsson 4449<br>Remote Radio Head | 2 | | |
| | - | Ericsson 8843<br>Remote Radio Head | 2 | | |
| | - | Raycap RRODC-3315-PF-48<br>Main OVP | 2 | | |
| | 30°<br>290° | **5G L-Sub6 Antenna<br>3' Panel Antenna** | **2** | | |

***Notes*:**

1. ***New Verizon appurtenances are shown in "BOLD".***

## STRUCTURAL ANALYSIS

Our Structural Analysis was performed in accordance with the requirements set forth in the following:

- Jurisdiction: Ogden City, Utah
- TIA-222-H, Structural Standard for Antenna Supporting Structures and Antennas
- International Building Code (IBC) 2018, §1609, §1613, §3108.1, and Referenced Standards
- ASCE 7-16, Minimum Design Loads for Buildings and Other Structures, Chapter 29

Our analysis results are based on the following parameters:

- $V_{ULT}$ =103 mph (3-sec. gust)
- $V_{ICE}$ = 50 mph
- Radial Ice = 1/4"
- Structure Class = II
- Topography Category = 2, Crest Height 300ft
- Exposure = C
- Soil Site Class = *D*
- Seismic Design Category = *D*
- $S_{DS}$ = 1.060

The material properties of the tower are based on following:

Tower Steel Grades (assumed for the purpose of structural analysis):

- Pipe: Fy = 35 ksi.
- Wide Flange: Fy = 36 ksi.
- HSS Tube: Fy = 46 ksi
- Structural bolts: A325.
- Anchor Bolt: F1554 Gr.55

## ANALYSIS ASSUMPTIONS

- All tower components including tower members, bolts, connections and welds are in good and reliable structural condition with no structural defect.
- All tower components, including any modifications were properly designed, detailed, fabricated, erected and maintained throughout the lifetime of the tower.
- Structural members and materials used for construction in accordance with original design documents.
- Foundation installed in accordance with original design documents.
- All new antennas and coax to be installed according to recommendations (if any).

**DISCLAIMERS:**

1. Due to limited data and access to the existing tower, J5 Infrastructure Partners made certain assumptions regarding the structural analysis. All existing structural elements of the tower structures are presumed to be properly fastened and in good and reliable structural condition without structural damages at the time of the analysis. Should any existing structural elements be deemed to not be in good and reliable structural condition, J5 Infrastructure Partners shall not be held liable for any structural deficiencies. As such, J5 Infrastructure Partners shall be notified of the structural deficiencies in which any necessary upgrades or remedies can be determined as required at that time.
2. J5 Infrastructure Partners made certain assumption pertaining to the material properties of the tower. It should be noted that if any structural elements are of lower material grades than what was assumed for this analysis, additional capacity may not exist. As such, J5 Infrastructure Partners will be notified in which a revised structural analysis will be required.
3. Due to limited data, all information pertaining to the existing tower are taken from the field visit dated 1/22/2020 by Geostructural. Confirmation of the aforementioned data is beyond the scope of this project. It should be noted that any structural element for which an alteration can change the result of this analysis will void this analysis and require re-evaluation. In no event shall J5 Infrastructure Partners be liable for the accuracy of the information.

***STRESS USAGE TABLE:***

The following table outlines the maximum anticipated tower stresses (expressed as a percentage of overall capacity) as a result of the associated Load Combination.

| LOAD COMBINATION | % USAGE | |
|---|---|---|
| | MAXIMUM MEMBER STRESS | TOWER MEMBER (SECTION) |
| Existing Antennas + Verizon Antenna Modifications | 69% | Legs (Section 2) |
| | 35% | Horizontal (Section 2) |
| | 46% | Secondary Horizontal (Section 1) |
| | 18% | Baseplate and Bolts |

Stress usage in excess of 104% represents a condition in which the applied tower loading exceeds the code-allowable tower loading limits. Stress usage at or below 104% represents a structurally safe and allowable condition.

***FOUNDATION ANALYSIS:***

Information pertaining to the existing tower foundation was not made available to J5 Infrastructure Partners at the time of our analysis. It is accepted engineering practice that foundation systems be conservatively designed to resist the maximum allowable tower forces. However, it is our opinion that the existing foundation appear to have adequate capacity to support Verizon's proposed load modification due to the fact that the critical elements of the tower are within the maximum allowable loading of the limits tower.

Due to the lack of information about the existing foundation, our opinion about the existing foundation is based on the accepted engineering practice. It should not be used as a substitution for obtaining a true allowable capacity through in-depth investigation and structural analysis.

Should foundation information become available please forward the information to our office for review and analysis. J5 Infrastructure Partners advises that an investigation of the foundation be conducted prior to commencing the structural analysis of the foundation.

## CONCLUSION & RECOMMENDATIONS

J5 Infrastructure Partners concludes the existing SAL Unitah Ridge 60'-0" Bell Tower located in Ogden, Utah is capable of supporting Verizon's proposed antenna modifications.

| | | | |
|---|---|---|---|
| INFRASTRUCTURE PARTNERS<br>2030 Main Street, Suite 200<br>Irvine, CA 92614 | Project Name:<br>SAL Unitah Ridge | Prepared by:<br>DVH | Reviewer:<br>EVR |
| | Project Description:<br>Seismic Force Calculation | Date:<br>3/18/2021 | |

## Seismic Load Calculation

| | | | |
|---|---|---|---|
| Tower Height | H = | 60.00 | ft |
| Tower Weight (Including Appurtenance) | W = | 39.20 | kips |
| Top 5% Weight *Structure+Appurt.* | $W_2$ | 2.80 | kips |
| Tower Properties: | | | |
| | Kf = | 4540 | |
| Top Face Width | $w_{TOP}$ = | 16 | ft |
| Base Face Width | $w_0$ = | 16 | ft |
| Average Face Width | $w_a$ = | 16 | ft |
| $W_1$= W[($w_a$/$w_0$)^2+0.15] | $W_1$ = | 45.08 | kips |

Fundamental Frequency of Structure

$$f_1 = \frac{K_f(w_a)}{h^2}\sqrt{\frac{W_1}{W_1+W_2}}$$

$f_1$ = 19.58 Hertz

Fundamental Perior of Structure

$T=1/f_1$ = 0.05 s

* Site Specific Seismic coeficients Ss & S1, Site Class, and SDC can be obtained from ASCE website Below:

https://asce7hazardtool.online/

| | | | | |
|---|---|---|---|---|
| Ss = | 1.325 | Fa = | 1.2 | |
| S1 = | 0.487 | Fv = | N/A | |
| $S_{DS}$ = 2/3* Ss*Fa = | 1.060 | | | |
| $S_{D1}$ =2/3 S1* Fv = | N/A | | | |
| $T_L$ = | 8 | s | ASCE 7 Hazards Report | |
| I = | 1 | | Table 2-3 | |
| R = | 1.5 | | | |

Seismic Response Coeffcient Cs

Cs= $S_{DS}$*I/R = 0.707

Cs <= $C_s = \frac{S_{D1}\,I}{T\,R}$ when $T \le T_L$; $C_s = \frac{S_{D1}\,T_L\,I}{T^2\,R}$ when $T > T_L$ N/A

Cs >= 0.044*$S_{DS}$*I or 0.03 0.047

Cs >= 0.8*S1*I/R if S1>=0.6

Cs = 0.707

| | | | |
|---|---|---|---|
| INFRASTRUCTURE PARTNERS<br>2030 Main Street, Suite 200<br>Irvine, CA 92614 | Project Name:<br>SAL Unitah Ridge | Prepared by:<br>DVH | Reviewer:<br>EVR |
| | Project Description:<br>Seismic Force Calculation | Date:<br>3/18/2021 | |

Total Seismic Shear Force:

Vs= Cs*W= 27.701 kips

Vertical Distribution of Seismic Force:

$$F_{sz} = \frac{w_z h_z^{k_e}}{\sum_{i=1}^{n} w_i h_i^{k_e}} Vs$$

ke= 1

| Appurtenances / Pole Sections Elev. | wx (kip) | hx (ft) | wx hx ^ k | Eh Fsz (kips) | Ev=0.2*SDS*D (kips) |
|---|---|---|---|---|---|
| VZW App. | 2.3 | 55.5 | 127.65 | 2.494 | 0.4876 |
| Top Shroud | 3.6 | 50 | 180.00 | 3.517 | 0.7632 |
| Middle Shroud | 0.9 | 22.5 | 20.25 | 0.396 | 0.1908 |
| Section 1 | 12.2 | 50 | 610.00 | 11.917 | 2.5864 |
| Section 2 | 13.9 | 30 | 417.00 | 8.147 | 2.9468 |
| Section 3 | 6.3 | 10 | 63.00 | 1.231 | 1.3356 |
| Total | 39.2 | | 1417.90 | 27.701 | |

**TOWER BASE REACTION:**

| | Wind *(From Tnx)* | Seismic *(From Tnx)* | |
|---|---|---|---|
| Axial: (unfactor) | 47.000 | 55.000 | kips |
| Shear: | 38.000 | 28.000 | kips |
| Moment: | 1600.000 | 1196.000 | k-ft |

***Wind Control***

| Section | T1 | T2 | T3 |
|---|---|---|---|
| Legs | | P20x.5 | |
| Leg Grade | | A53-B-35 | |
| Diagonals | | N.A. | |
| Diagonal Grade | | N.A. | |
| Top Girts | W8x35 | | N.A. |
| Mid Girts | TS3.5x3.5x.25 | | N.A. |
| Bottom Girts | W12x79 | W14x159 | N.A. |
| Face Width (ft) | | 16 | |
| # Panels @ (ft) | 2 @ 9.5 | 1 @ 19 | 1 @ 20 |
| Weight (K) | 12.2 | 13.9 | 6.3 |

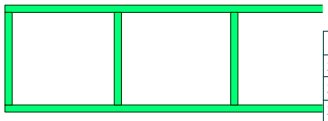
32.4

61.0 ft

41.0 ft

21.0 ft

1.0 ft



## DESIGNED APPURTENANCE LOADING

| TYPE | ELEVATION | TYPE | ELEVATION |
|---|---|---|---|
| 20'x18' Shroud Face | 61 - 41 | RAYCAP RxxDC-3315-PF-48 | 56.5 |
| 20'x18' Shroud Face | 61 - 41 | 5G L-SUB6 VZE01 | 56.5 |
| 20'x18' Shroud Face | 61 - 41 | 5G L-SUB6 VZE01 | 56.5 |
| Platform 16' w/ Rails | 56.5 | Verizon App. | 56.5 |
| JMA X7CQAP-FRO-845-V | 56.5 | Top Shroud | 51 |
| JMA X7CQAP-FRO-845-V | 56.5 | Section 1 | 51 |
| Ericsson Radio 4449 | 56.5 | Section 2 | 31 |
| Ericsson Radio 8843 | 56.5 | 5'x18' Shroud Face | 26 - 21 |
| RAYCAP RxxDC-3315-PF-48 | 56.5 | 5'x18' Shroud Face | 26 - 21 |
| JMA X7CQAP-FRO-845-V | 56.5 | 5'x18' Shroud Face | 26 - 21 |
| JMA X7CQAP-FRO-845-V | 56.5 | Middle Shroud | 23.5 |
| Ericsson Radio 4449 | 56.5 | Section 3 | 11 |
| Ericsson Radio 8843 | 56.5 | | |

## MATERIAL STRENGTH

| GRADE | Fy | Fu | GRADE | Fy | Fu |
|---|---|---|---|---|---|
| A53-B-35 | 35 ksi | 63 ksi | | | |

## TOWER DESIGN NOTES

1. Tower is located in Weber County, Utah.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 103 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 50 mph basic wind with 0.25 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Risk Category II.
7. Topographic Category 2 with Crest Height of 300.00 ft
8. TOWER RATING: 69.2%

△

*ALL REACTIONS ARE FACTORED*

*MAX. CORNER REACTIONS AT BASE:*
*DOWN: 131 K*
*SHEAR: 14 K*

*UPLIFT: -101 K*
*SHEAR: 16 K*

*AXIAL 55 K*
*SHEAR 28 K* *MOMENT 1196 kip-ft*

*TORQUE 0 kip-ft*
*SEISMIC*

*AXIAL 54 K*
*SHEAR 10 K* *MOMENT 403 kip-ft*

*TORQUE 1 kip-ft*
*50 mph WIND - 0.2500 in ICE*

*AXIAL 47 K*
*SHEAR 38 K* *MOMENT 1600 kip-ft*

*TORQUE 2 kip-ft*
*REACTIONS - 103 mph WIND*


*J5 Infrastructure Partners*
2030 Main Street, Suite 200
Irvine, CA 92614
Phone: (949) 247-7767
FAX:


| | | | |
|---|---|---|---|
| Job: **SAL UNITAH RIDGE** | | | |
| Project: ***Structural Analysis - Rev-0*** | | | |
| Client: Verizon | Drawn by: Danh Ho | App'd: | |
| Code: TIA-222-H | Date: 03/18/21 | Scale: NTS | |
| Path: C:\Users\danh\Desktop\VZW\VZW_Uintah Ridge\Rev-1\SAL Unitah Ridge_Rev-1 (Add Seismic).eri | | Dwg No. E-1 | |

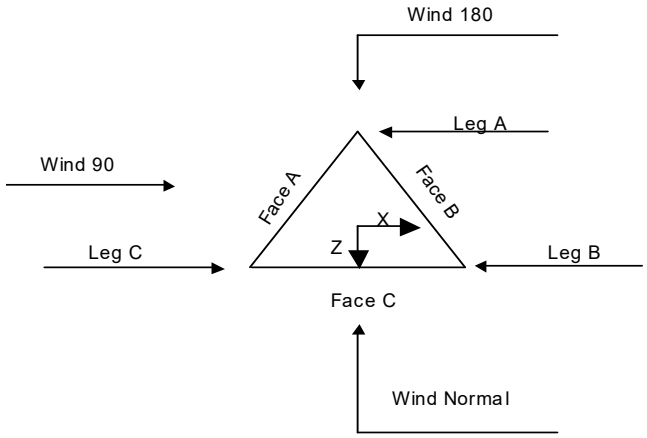
# Tower Input Data

The main tower is a 3x free standing tower with an overall height of 61.00 ft above the ground line.
The base of the tower is set at an elevation of 1.00 ft above the ground line.
The face width of the tower is 16.00 ft at the top and 16.00 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

Tower is located in Weber County, Utah.
Tower base elevation above sea level: 4811.00 ft.
Basic wind speed of 103 mph.
Risk Category II.
Exposure Category C.
Simplified Topographic Factor Procedure for wind speed-up calculations is used.
Topographic Category: 2.
Crest Height: 300.00 ft.
Nominal ice thickness of 0.2500 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

# Options

| | | |
|---|---|---|
| √ Consider Moments - Legs | √ Distribute Leg Loads As Uniform | Use ASCE 10 X-Brace Ly Rules |
| √ Consider Moments - Horizontals | Assume Legs Pinned | √ Calculate Redundant Bracing Forces |
| Consider Moments - Diagonals | Assume Rigid Index Plate | √ Ignore Redundant Members in FEA |
| Use Moment Magnification | √ Use Clear Spans For Wind Area | SR Leg Bolts Resist Compression |
| √ Use Code Stress Ratios | √ Use Clear Spans For KL/r | All Leg Panels Have Same Allowable |
| √ Use Code Safety Factors - Guys | Retension Guys To Initial Tension | Offset Girt At Foundation |
| Escalate Ice | Bypass Mast Stability Checks | √ Consider Feed Line Torque |
| Always Use Max Kz | √ Use Azimuth Dish Coefficients | √ Include Angle Block Shear Check |
| Use Special Wind Profile | √ Project Wind Area of Appurt. | Use TIA-222-H Bracing Resist. Exemption |
| Include Bolts In Member Capacity | Autocalc Torque Arm Areas | Use TIA-222-H Tension Splice Exemption |
| √ Leg Bolts Are At Top Of Section | Add IBC .6D+W Combination | Poles |
| Secondary Horizontal Braces Leg | √ Sort Capacity Reports By Component | Include Shear-Torsion Interaction |
| Use Diamond Inner Bracing (4 Sided) | Triangulate Diamond Inner Bracing | Always Use Sub-Critical Flow |
| SR Members Have Cut Ends | Treat Feed Line Bundles As Cylinder | Use Top Mounted Sockets |
| SR Members Are Concentric | Ignore KL/ry For 60 Deg. Angle Legs | Pole Without Linear Attachments |
| | | Pole With Shroud Or No Appurtenances |
| | | Outside and Inside Corner Radii Are Known |




***Triangular Tower***

## Tower Section Geometry

| Tower Section | Tower Elevation | Assembly Database | Description | Section Width | Number of Sections | Section Length |
|---|---|---|---|---|---|---|
| | ft | | | ft | | ft |
| T1 | 61.00-41.00 | | | 16.00 | 1 | 20.00 |
| T2 | 41.00-21.00 | | | 16.00 | 1 | 20.00 |
| T3 | 21.00-1.00 | | | 16.00 | 1 | 20.00 |

## Tower Section Geometry *(cont'd)*

| Tower Section | Tower Elevation | Diagonal Spacing | Bracing Type | Has K Brace End Panels | Has Horizontals | Top Girt Offset | Bottom Girt Offset |
|---|---|---|---|---|---|---|---|
| | ft | ft | | | | in | in |
| T1 | 61.00-41.00 | 9.50 | Portal | No | Yes | 12.0000 | 0.0000 |
| T2 | 41.00-21.00 | 19.00 | Portal | No | Yes | 0.0000 | 12.0000 |
| T3 | 21.00-1.00 | 20.00 | Portal | No | Yes | 0.0000 | 0.0000 |

## Tower Section Geometry *(cont'd)*

| Tower Elevation ft | Leg Type | Leg Size | Leg Grade | Diagonal Type | Diagonal Size | Diagonal Grade |
|---|---|---|---|---|---|---|
| T1 61.00-41.00 | Pipe | P20x.5 | A53-B-35 (35 ksi) | Solid Round | | A572-50 (50 ksi) |
| T2 41.00-21.00 | Pipe | P20x.5 | A53-B-35 (35 ksi) | Solid Round | | A572-50 (50 ksi) |
| T3 21.00-1.00 | Pipe | P20x.5 | A53-B-35 (35 ksi) | Solid Round | | A572-50 (50 ksi) |

## Tower Section Geometry *(cont'd)*

| Tower Elevation ft | Top Girt Type | Top Girt Size | Top Girt Grade | Bottom Girt Type | Bottom Girt Size | Bottom Girt Grade |
|---|---|---|---|---|---|---|
| T1 61.00-41.00 | Wide Flange | W8x35 | A36 (36 ksi) | Wide Flange | W12x79 | A36 (36 ksi) |
| T2 41.00-21.00 | Wide Flange | | A36 (36 ksi) | Wide Flange | W14x159 | A572-50 (50 ksi) |

## Tower Section Geometry *(cont'd)*

| Tower Elevation ft | No. of Mid Girts | Mid Girt Type | Mid Girt Size | Mid Girt Grade | Horizontal Type | Horizontal Size | Horizontal Grade |
|---|---|---|---|---|---|---|---|
| T1 61.00-41.00 | 1 | Tube | TS3.5x3.5x.25 | A500-46 (46 ksi) | Wide Flange | * | A572-50 (50 ksi) |
| T2 41.00-21.00 | None | Solid Round | | A572-50 (50 ksi) | Wide Flange | * | A572-50 (50 ksi) |
| T3 21.00-1.00 | None | Solid Round | | A572-50 (50 ksi) | Wide Flange | * | A572-50 (50 ksi) |

## Tower Section Geometry *(cont'd)*

| Tower Elevation ft | Redundant Bracing Grade | | Redundant Type | Redundant Size | K Factor |
|---|---|---|---|---|---|
| T1 61.00-41.00 | A36 (36 ksi) | Horizontal (1) | Double Equal Angle | * | 1 |
| | | Horizontal (2) | | * | |
| | | Horizontal (3) | | * | |
| | | Diagonal (1) | Double Equal Angle | * | 1 |
| | | Diagonal (2) | | * | |
| | | Diagonal (3) | | * | |
| | | Sub-Diagonal | Double Equal Angle | * | 1 |
| | | Sub-Horizontal | Double Equal Angle | * | 1 |
| | | Hip (1) | Double Equal Angle | * | 1 |
| | | Hip (2) | | * | |
| | | Hip (3) | | * | |

| Tower Elevation ft | Redundant Bracing Grade | | Redundant Type | Redundant Size | K Factor |
|---|---|---|---|---|---|
| T2 | A36 | Horizontal (1) | Double Equal Angle | * | 1 |
| 41.00-21.00 | (36 ksi) | Horizontal (2) | | * | |
| | | Horizontal (3) | | * | |
| | | Diagonal (1) | Double Equal Angle | * | 1 |
| | | Diagonal (2) | | * | |
| | | Diagonal (3) | | * | |
| | | Sub-Diagonal | Double Equal Angle | * | 1 |
| | | Sub-Horizontal | Double Equal Angle | * | 1 |
| | | Hip (1) | Double Equal Angle | * | 1 |
| | | Hip (2) | | * | |
| | | Hip (3) | | * | |
| T3 21.00-1.00 | A36 | Horizontal (1) | Double Equal Angle | * | 1 |
| | (36 ksi) | Horizontal (2) | | * | |
| | | Horizontal (3) | | * | |
| | | Diagonal (1) | Double Equal Angle | * | 1 |
| | | Diagonal (2) | | * | |
| | | Diagonal (3) | | * | |
| | | Sub-Diagonal | Double Equal Angle | * | 1 |
| | | Sub-Horizontal | Double Equal Angle | * | 1 |
| | | Hip (1) | Double Equal Angle | * | 1 |
| | | Hip (2) | | * | |
| | | Hip (3) | | * | |

## Tower Section Geometry *(cont'd)*

| Tower Elevation ft | Gusset Area (per face) $ft^2$ | Gusset Thickness in | Gusset Grade | Adjust. Factor $A_f$ | Adjust. Factor $A_r$ | Weight Mult. | Double Angle Stitch Bolt Spacing Diagonals in | Double Angle Stitch Bolt Spacing Horizontals in | Double Angle Stitch Bolt Spacing Redundants in |
|---|---|---|---|---|---|---|---|---|---|
| T1 61.00-41.00 | 0.00 | 0.0000 | A36 (36 ksi) | 1 | 1 | 1 | 36.0000 | 36.0000 | 36.0000 |
| T2 41.00-21.00 | 0.00 | 0.0000 | A36 (36 ksi) | 1 | 1 | 1 | 36.0000 | 36.0000 | 36.0000 |
| T3 21.00-1.00 | 0.00 | 0.0000 | A36 (36 ksi) | 1 | 1 | 1 | 36.0000 | 36.0000 | 36.0000 |

## Tower Section Geometry *(cont'd)*

| Tower Elevation ft | Calc K Single Angles | Calc K Solid Rounds | K Factors[1] Legs | X Brace Diags X Y | K Brace Diags X Y | Single Diags X Y | Girts X Y | Horiz. X Y | Sec. Horiz. X Y | Inner Brace X Y |
|---|---|---|---|---|---|---|---|---|---|---|
| T1 | No | No | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 61.00-41.00 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| T2 | No | No | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 41.00-21.00 | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| T3 21.00-1.00 | No | No | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

[1]*Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.*

## Tower Section Geometry *(cont'd)*

| Tower Elevation ft | Leg | | Diagonal | | Top Girt | | Bottom Girt | | Mid Girt | | Long Horizontal | | Short Horizontal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Net Width Deduct in | U | Net Width Deduct in | U | Net Width Deduct in | U | Net Width Deduct in | U | Net Width Deduct in | U | Net Width Deduct in | U | Net Width Deduct in | U |
| T1 61.00-41.00 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 |
| T2 41.00-21.00 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 |
| T3 21.00-1.00 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 | 0.0000 | 0.75 |

## Tower Section Geometry *(cont'd)*

| Tower Elevation ft | Leg Connection Type | Leg | | Diagonal | | Top Girt | | Bottom Girt | | Mid Girt | | Long Horizontal | | Short Horizontal | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bolt Size in | No. | Bolt Size in | No. | Bolt Size in | No. | Bolt Size in | No. | Bolt Size in | No. | Bolt Size in | No. | Bolt Size in | No. |
| T1 61.00-41.00 | Flange | 0.0000 A325N | 0 | 0.6250 A325N | 0 | 0.7500 A325N | 10 | 1.0000 A325N | 10 | 0.6250 A325N | 4 | 0.6250 A325N | 0 | 0.6250 A325N | 0 |
| T2 41.00-21.00 | Flange | 0.0000 A325N | 0 | 0.6250 A325N | 0 | 0.0000 A325N | 0 | 1.0000 A325N | 10 | 0.0000 A325N | 0 | 0.6250 A325N | 0 | 0.6250 A325N | 0 |
| T3 21.00-1.00 | Flange | 1.2500 A325N | 12 | 0.6250 A325N | 0 | 0.0000 A325N | 0 | 0.0000 A325N | 0 | 0.0000 A325N | 0 | 0.6250 A325N | 0 | 0.6250 A325N | 0 |

## Feed Line/Linear Appurtenances - Entered As Area

| Description | Face or Leg | Allow Shield | Exclude From Torque Calculation | Component Type | Placement ft | Total Number | | $C_AA_A$ $ft^2/ft$ | Weight plf |
|---|---|---|---|---|---|---|---|---|---|
| * EXISTING * LDF6-50A (1-1/4 FOAM) | C | No | No | CaAa (In Face) | 56.00 - 1.00 | 2 | No Ice<br>1/2" Ice | 0.16<br>0.25 | 0.66<br>1.91 |

## Feed Line/Linear Appurtenances Section Areas

| Tower Section | Tower Elevation ft | Face | $A_R$ $ft^2$ | $A_F$ $ft^2$ | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|
| T1 | 61.00-41.00 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | B | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | C | 0.000 | 0.000 | 4.650 | 0.000 | 0.02 |

| Tower Section | Tower Elevation ft | Face | $A_R$ $ft^2$ | $A_F$ $ft^2$ | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|
| T2 | 41.00-21.00 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | B | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | C | 0.000 | 0.000 | 6.200 | 0.000 | 0.03 |
| T3 | 21.00-1.00 | A | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | B | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | C | 0.000 | 0.000 | 6.200 | 0.000 | 0.03 |

## Feed Line/Linear Appurtenances Section Areas - With Ice

| Tower Section | Tower Elevation ft | Face or Leg | Ice Thickness in | $A_R$ $ft^2$ | $A_F$ $ft^2$ | $C_AA_A$ In Face $ft^2$ | $C_AA_A$ Out Face $ft^2$ | Weight K |
|---|---|---|---|---|---|---|---|---|
| T1 | 61.00-41.00 | A | 0.322 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | B | | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | C | | 0.000 | 0.000 | 6.581 | 0.000 | 0.04 |
| T2 | 41.00-21.00 | A | 0.311 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | B | | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | C | | 0.000 | 0.000 | 8.688 | 0.000 | 0.06 |
| T3 | 21.00-1.00 | A | 0.285 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | B | | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 |
| | | C | | 0.000 | 0.000 | 8.480 | 0.000 | 0.05 |

## Feed Line Center of Pressure

| Section | Elevation ft | $CP_X$ in | $CP_Z$ in | $CP_X$ Ice in | $CP_Z$ Ice in |
|---|---|---|---|---|---|
| T1 | 61.00-41.00 | 0.0000 | 1.8397 | 0.0000 | 2.2409 |
| T2 | 41.00-21.00 | 0.0000 | 2.8397 | 0.0000 | 3.3146 |
| T3 | 21.00-1.00 | 0.0000 | 4.1225 | 0.0000 | 4.2193 |

## Shielding Factor Ka

| Tower Section | Feed Line Record No. | Description | Feed Line Segment Elev. | $K_a$ No Ice | $K_a$ Ice |
|---|---|---|---|---|---|
| T1 | 2 | LDF6-50A (1-1/4 FOAM) | 41.00 - 56.00 | 1.0000 | 1.0000 |
| T2 | 2 | LDF6-50A (1-1/4 FOAM) | 21.00 - 41.00 | 1.0000 | 1.0000 |
| T3 | 2 | LDF6-50A (1-1/4 FOAM) | 1.00 - 21.00 | 1.0000 | 1.0000 |

## User Defined Loads - Seismic

| Description | Elevation | Offset From Centroid | Azimuth Angle | $E_v$ | $E_{hx}$ | $E_{hz}$ | $E_h$ |
|---|---|---|---|---|---|---|---|
| | ft | ft | ° | K | K | K | K |
| Verizon App. | 56.50 | 0.00 | 0.0000 | 0.49 | 0.00 | 0.00 | 2.49 |
| Top Shroud | 51.00 | 0.00 | 0.0000 | 0.76 | 0.00 | 0.00 | 3.52 |
| Middle Shroud | 23.50 | 0.00 | 0.0000 | 0.19 | 0.00 | 0.00 | 0.40 |
| Section 1 | 51.00 | 0.00 | 0.0000 | 2.59 | 0.00 | 0.00 | 11.92 |
| Section 2 | 31.00 | 0.00 | 0.0000 | 2.95 | 0.00 | 0.00 | 8.15 |
| Section 3 | 11.00 | 0.00 | 0.0000 | 1.34 | 0.00 | 0.00 | 1.23 |

## Discrete Tower Loads

| Description | Face or Leg | Offset Type | Offsets: Horz Lateral<br>Vert | Azimuth Adjustment | Placement | | $C_AA_A$ Front | $C_AA_A$ Side | Weight |
|---|---|---|---|---|---|---|---|---|---|
| | | | ft<br>ft<br>ft | ° | ft | | $ft^2$ | $ft^2$ | K |
| * EXISTING + PROPOSED* | | | | | | | | | |
| 20'x18' Shroud Face | A | From Face | 0.00 | 0.0000 | 61.00 - 41.00 | No Ice | 432.00 | 3.33 | 1.20 |
| | | | 0.00 | | | 1/2" Ice | 434.54 | 5.57 | 2.91 |
| | | | 0.00 | | | | | | |
| 20'x18' Shroud Face | B | From Face | 0.00 | 0.0000 | 61.00 - 41.00 | No Ice | 432.00 | 3.33 | 1.20 |
| | | | 0.00 | | | 1/2" Ice | 434.54 | 5.57 | 2.91 |
| | | | 0.00 | | | | | | |
| 20'x18' Shroud Face | C | From Face | 0.00 | 0.0000 | 61.00 - 41.00 | No Ice | 432.00 | 3.33 | 1.20 |
| | | | 0.00 | | | 1/2" Ice | 434.54 | 5.57 | 2.91 |
| | | | 0.00 | | | | | | |
| 5'x18' Shroud Face | A | From Face | 0.00 | 0.0000 | 26.00 - 21.00 | No Ice | 108.00 | 6.56 | 0.30 |
| | | | 0.00 | | | 1/2" Ice | 109.54 | 6.95 | 0.84 |
| | | | 0.00 | | | | | | |
| 5'x18' Shroud Face | B | From Face | 0.00 | 0.0000 | 26.00 - 21.00 | No Ice | 108.00 | 6.56 | 0.30 |
| | | | 0.00 | | | 1/2" Ice | 109.54 | 6.95 | 0.84 |
| | | | 0.00 | | | | | | |
| 5'x18' Shroud Face | C | From Face | 0.00 | 0.0000 | 26.00 - 21.00 | No Ice | 108.00 | 6.56 | 0.30 |
| | | | 0.00 | | | 1/2" Ice | 109.54 | 6.95 | 0.84 |
| | | | 0.00 | | | | | | |
| Platform 16' w/ Rails | A | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 1.50 |
| | | | -1.00 | | | 1/2" Ice | 0.00 | 0.00 | 1.80 |
| | | | 0.00 | | | | | | |
| JMA X7CQAP-FRO-845-V | A | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.07 |
| | | | -1.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.07 |
| | | | 0.00 | | | | | | |
| JMA X7CQAP-FRO-845-V | A | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.07 |
| | | | 1.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.07 |
| | | | 0.00 | | | | | | |
| Ericsson Radio 4449 | A | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.07 |
| | | | -1.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.07 |
| | | | 0.00 | | | | | | |
| Ericsson Radio 8843 | A | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.08 |
| | | | 1.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.08 |
| | | | 0.00 | | | | | | |
| RAYCAP | C | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.03 |
| RxxDC-3315-PF-48 | | | 8.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.03 |
| | | | 0.00 | | | | | | |
| JMA X7CQAP-FRO-845-V | C | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.07 |
| | | | -1.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.07 |

| Description | Face or Leg | Offset Type | Offsets: Horz Lateral<br>Vert<br>ft<br>ft<br>ft | Azimuth Adjustment<br>° | Placement<br>ft | | $C_AA_A$ Front<br>$ft^2$ | $C_AA_A$ Side<br>$ft^2$ | Weight<br>K |
|---|---|---|---|---|---|---|---|---|---|
| | | | 0.00 | | | | | | |
| JMA X7CQAP-FRO-845-V | C | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.07 |
| | | | 1.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.07 |
| | | | 0.00 | | | | | | |
| Ericsson Radio 4449 | C | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.07 |
| | | | -1.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.07 |
| | | | 0.00 | | | | | | |
| Ericsson Radio 8843 | C | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.08 |
| | | | 1.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.08 |
| | | | 0.00 | | | | | | |
| RAYCAP<br>RxxDC-3315-PF-48 | C | From Face | 0.00<br>8.00<br>0.00 | 0.0000 | 56.50 | No Ice<br>1/2" Ice | 0.00<br>0.00 | 0.00<br>0.00 | 0.03<br>0.03 |
| 5G L-SUB6 VZE01 | A | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 0.00 | 0.00 | 0.08 |
| | | | 0.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.08 |
| | | | 0.00 | | | | | | |
| 5G L-SUB6 VZE01 | C | From Face | 0.00 | 0.0000 | 56.50 | No Ice | 4.03 | 0.00 | 0.08 |
| | | | 0.00 | | | 1/2" Ice | 0.00 | 0.00 | 0.08 |
| | | | 0.00 | | | | | | |

## Dishes

| Description | Face or Leg | Dish Type | Offset Type | Offsets: Horz Lateral<br>Vert<br>ft | Azimuth Adjustment<br>° | 3 dB Beam Width<br>° | Elevation<br>ft | Outside Diameter<br>ft | Aperture Area<br>$ft^2$ | Weight<br>K |
|---|---|---|---|---|---|---|---|---|---|---|
| * EXISTING * | | | | | | | | | | |

## Load Combinations

| Comb. No. | Description |
|---|---|
| 1 | Dead Only |
| 2 | 1.2 Dead+1.0 Wind 0 deg - No Ice |
| 3 | 0.9 Dead+1.0 Wind 0 deg - No Ice |
| 4 | 1.2 Dead+1.0 Wind 30 deg - No Ice |
| 5 | 0.9 Dead+1.0 Wind 30 deg - No Ice |
| 6 | 1.2 Dead+1.0 Wind 60 deg - No Ice |
| 7 | 0.9 Dead+1.0 Wind 60 deg - No Ice |
| 8 | 1.2 Dead+1.0 Wind 90 deg - No Ice |
| 9 | 0.9 Dead+1.0 Wind 90 deg - No Ice |
| 10 | 1.2 Dead+1.0 Wind 120 deg - No Ice |
| 11 | 0.9 Dead+1.0 Wind 120 deg - No Ice |
| 12 | 1.2 Dead+1.0 Wind 150 deg - No Ice |
| 13 | 0.9 Dead+1.0 Wind 150 deg - No Ice |
| 14 | 1.2 Dead+1.0 Wind 180 deg - No Ice |
| 15 | 0.9 Dead+1.0 Wind 180 deg - No Ice |

| Comb. No. | Description |
|---|---|
| 16 | 1.2 Dead+1.0 Wind 210 deg - No Ice |
| 17 | 0.9 Dead+1.0 Wind 210 deg - No Ice |
| 18 | 1.2 Dead+1.0 Wind 240 deg - No Ice |
| 19 | 0.9 Dead+1.0 Wind 240 deg - No Ice |
| 20 | 1.2 Dead+1.0 Wind 270 deg - No Ice |
| 21 | 0.9 Dead+1.0 Wind 270 deg - No Ice |
| 22 | 1.2 Dead+1.0 Wind 300 deg - No Ice |
| 23 | 0.9 Dead+1.0 Wind 300 deg - No Ice |
| 24 | 1.2 Dead+1.0 Wind 330 deg - No Ice |
| 25 | 0.9 Dead+1.0 Wind 330 deg - No Ice |
| 26 | 1.2 Dead+1.0 Ice+1.0 Temp |
| 27 | 1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp |
| 28 | 1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp |
| 29 | 1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp |
| 30 | 1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp |
| 31 | 1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp |
| 32 | 1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp |
| 33 | 1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp |
| 34 | 1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp |
| 35 | 1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp |
| 36 | 1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp |
| 37 | 1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp |
| 38 | 1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp |
| 39 | Dead+Wind 0 deg - Service |
| 40 | Dead+Wind 30 deg - Service |
| 41 | Dead+Wind 60 deg - Service |
| 42 | Dead+Wind 90 deg - Service |
| 43 | Dead+Wind 120 deg - Service |
| 44 | Dead+Wind 150 deg - Service |
| 45 | Dead+Wind 180 deg - Service |
| 46 | Dead+Wind 210 deg - Service |
| 47 | Dead+Wind 240 deg - Service |
| 48 | Dead+Wind 270 deg - Service |
| 49 | Dead+Wind 300 deg - Service |
| 50 | Dead+Wind 330 deg - Service |
| 51 | 1.2 Dead+1.0 Ev+1.0 Eh 0 deg |
| 52 | 0.9 Dead-1.0 Ev+1.0 Eh 0 deg |
| 53 | 1.2 Dead+1.0 Ev+1.0 Eh 30 deg |
| 54 | 0.9 Dead-1.0 Ev+1.0 Eh 30 deg |
| 55 | 1.2 Dead+1.0 Ev+1.0 Eh 60 deg |
| 56 | 0.9 Dead-1.0 Ev+1.0 Eh 60 deg |
| 57 | 1.2 Dead+1.0 Ev+1.0 Eh 90 deg |
| 58 | 0.9 Dead-1.0 Ev+1.0 Eh 90 deg |
| 59 | 1.2 Dead+1.0 Ev+1.0 Eh 120 deg |
| 60 | 0.9 Dead-1.0 Ev+1.0 Eh 120 deg |
| 61 | 1.2 Dead+1.0 Ev+1.0 Eh 150 deg |
| 62 | 0.9 Dead-1.0 Ev+1.0 Eh 150 deg |
| 63 | 1.2 Dead+1.0 Ev+1.0 Eh 180 deg |
| 64 | 0.9 Dead-1.0 Ev+1.0 Eh 180 deg |
| 65 | 1.2 Dead+1.0 Ev+1.0 Eh 210 deg |
| 66 | 0.9 Dead-1.0 Ev+1.0 Eh 210 deg |
| 67 | 1.2 Dead+1.0 Ev+1.0 Eh 240 deg |
| 68 | 0.9 Dead-1.0 Ev+1.0 Eh 240 deg |
| 69 | 1.2 Dead+1.0 Ev+1.0 Eh 270 deg |
| 70 | 0.9 Dead-1.0 Ev+1.0 Eh 270 deg |
| 71 | 1.2 Dead+1.0 Ev+1.0 Eh 300 deg |
| 72 | 0.9 Dead-1.0 Ev+1.0 Eh 300 deg |
| 73 | 1.2 Dead+1.0 Ev+1.0 Eh 330 deg |
| 74 | 0.9 Dead-1.0 Ev+1.0 Eh 330 deg |

# Maximum Member Forces

| Section No. | Elevation ft | Component Type | Condition | Gov. Load Comb. | Axial K | Major Axis Moment kip-ft | Minor Axis Moment kip-ft |
|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | Leg | Max Tension | 15 | 5.62 | 0.00 | 41.74 |
| | | | Max. Compression | 18 | -12.66 | 69.63 | -40.31 |
| | | | Max. Mx | 18 | -12.66 | 69.63 | -40.31 |
| | | | Max. My | 2 | -12.17 | 0.01 | 80.93 |
| | | | Max. Vy | 8 | 9.93 | -69.25 | -17.75 |
| | | | Max. Vx | 2 | -11.24 | 0.01 | 80.93 |
| | | Top Girt | Max Tension | 3 | 1.54 | -1.07 | 0.02 |
| | | | Max. Compression | 14 | -1.68 | -0.42 | 0.00 |
| | | | Max. Mx | 4 | -0.08 | -29.91 | -0.00 |
| | | | Max. My | 8 | -0.08 | -29.80 | -0.06 |
| | | | Max. Vy | 4 | 3.97 | -29.91 | -0.00 |
| | | | Max. Vx | 10 | -0.01 | -26.05 | -0.06 |
| | | Bottom Girt | Max Tension | 3 | 5.38 | -4.49 | 0.06 |
| | | | Max. Compression | 14 | -5.42 | 1.24 | 0.02 |
| | | | Max. Mx | 16 | -0.00 | -146.83 | -0.11 |
| | | | Max. My | 20 | -0.01 | -146.46 | -0.21 |
| | | | Max. Vy | 4 | 18.88 | -146.82 | -0.11 |
| | | | Max. Vx | 20 | 0.02 | 142.77 | 0.14 |
| | | Mid Girt | Max Tension | 2 | 1.00 | 0.00 | 0.00 |
| | | | Max. Compression | 15 | -0.95 | 0.00 | 0.00 |
| | | | Max. Mx | 26 | 0.07 | 0.45 | 0.00 |
| | | | Max. Vy | 26 | -0.11 | 0.00 | 0.00 |
| T2 | 41 - 21 | Leg | Max Tension | 23 | 103.22 | -262.16 | -151.32 |
| | | | Max. Compression | 18 | -128.60 | -258.24 | 149.04 |
| | | | Max. Mx | 8 | -110.14 | 281.42 | 44.17 |
| | | | Max. My | 2 | -128.26 | 0.03 | -312.38 |
| | | | Max. Vy | 18 | -16.20 | 155.94 | -89.91 |
| | | | Max. Vx | 2 | -18.75 | 0.01 | 180.63 |
| | | Bottom Girt | Max Tension | 14 | 5.01 | 47.35 | 0.16 |
| | | | Max. Compression | 3 | -5.33 | -52.66 | 0.11 |
| | | | Max. Mx | 16 | 0.83 | -351.93 | 0.14 |
| | | | Max. My | 23 | -1.96 | 273.46 | -0.36 |
| | | | Max. Vy | 16 | -45.22 | -351.93 | 0.14 |
| | | | Max. Vx | 22 | 0.04 | -327.73 | 0.30 |
| T3 | 21 - 1 | Leg | Max Tension | 23 | 103.16 | -249.57 | -144.04 |
| | | | Max. Compression | 18 | -131.00 | 0.00 | 0.00 |
| | | | Max. Mx | 20 | -111.57 | -269.30 | 42.16 |
| | | | Max. My | 2 | -128.36 | 0.03 | -298.98 |
| | | | Max. Vy | 20 | -13.87 | 0.00 | 0.00 |
| | | | Max. Vx | 2 | -15.35 | -0.00 | 0.00 |

# Maximum Reactions

| Location | Condition | Gov. Load Comb. | Vertical K | Horizontal, X K | Horizontal, Z K |
|---|---|---|---|---|---|
| Leg C | Max. Vert | 18 | 131.15 | 12.13 | -6.99 |
| | Max. $H_x$ | 20 | 114.20 | 12.75 | -2.09 |
| | Max. $H_z$ | 3 | -45.27 | -2.07 | 11.95 |
| | Min. Vert | 7 | -100.16 | -13.67 | 7.88 |
| | Min. $H_x$ | 9 | -85.47 | -14.53 | 2.02 |
| | Min. $H_z$ | 14 | 72.82 | 2.14 | -10.69 |
| Leg B | Max. Vert | 10 | 129.85 | -12.14 | -6.99 |
| | Max. $H_x$ | 21 | -86.45 | 14.54 | 2.02 |

| Location | Condition | Gov. Load Comb. | Vertical K | Horizontal, X K | Horizontal, Z K |
|---|---|---|---|---|---|
| Leg A | Max. $H_z$ | 3 | -46.26 | 2.07 | 11.96 |
| | Min. Vert | 23 | -101.14 | 13.68 | 7.88 |
| | Min. $H_x$ | 8 | 112.90 | -12.77 | -2.09 |
| | Min. $H_z$ | 14 | 71.52 | -2.15 | -10.70 |
| | Max. Vert | 2 | 131.00 | -0.00 | 14.04 |
| | Max. $H_x$ | 21 | 11.82 | 9.98 | 0.05 |
| | Max. $H_z$ | 2 | 131.00 | -0.00 | 14.04 |
| | Min. Vert | 15 | -100.98 | 0.00 | -15.83 |
| | Min. $H_x$ | 9 | 11.82 | -9.98 | 0.05 |
| | Min. $H_z$ | 15 | -100.98 | 0.00 | -15.83 |

## Tower Mast Reaction Summary

| Load Combination | Vertical K | $Shear_x$ K | $Shear_z$ K | Overturning Moment, $M_x$ kip-ft | Overturning Moment, $M_z$ kip-ft | Torque kip-ft |
|---|---|---|---|---|---|---|
| Dead Only | 39.24 | 0.00 | 0.00 | -0.71 | 8.71 | 0.00 |
| 1.2 Dead+1.0 Wind 0 deg - No Ice | 47.09 | -0.00 | -37.94 | -1597.66 | 10.46 | -0.00 |
| 0.9 Dead+1.0 Wind 0 deg - No Ice | 35.31 | -0.00 | -37.94 | -1594.50 | 7.85 | -0.00 |
| 1.2 Dead+1.0 Wind 30 deg - No Ice | 47.09 | 18.63 | -32.39 | -1363.67 | -772.60 | 1.19 |
| 0.9 Dead+1.0 Wind 30 deg - No Ice | 35.31 | 18.63 | -32.39 | -1360.95 | -773.77 | 1.19 |
| 1.2 Dead+1.0 Wind 60 deg - No Ice | 47.09 | 32.11 | -18.61 | -783.80 | -1339.17 | 2.07 |
| 0.9 Dead+1.0 Wind 60 deg - No Ice | 35.31 | 32.11 | -18.61 | -782.14 | -1339.30 | 2.07 |
| 1.2 Dead+1.0 Wind 90 deg - No Ice | 47.09 | 37.26 | -0.00 | -0.83 | -1555.70 | 2.39 |
| 0.9 Dead+1.0 Wind 90 deg - No Ice | 35.31 | 37.26 | -0.00 | -0.62 | -1555.43 | 2.39 |
| 1.2 Dead+1.0 Wind 120 deg - No Ice | 47.09 | 32.74 | 18.97 | 797.56 | -1365.95 | 2.07 |
| 0.9 Dead+1.0 Wind 120 deg - No Ice | 35.31 | 32.74 | 18.97 | 796.30 | -1366.02 | 2.07 |
| 1.2 Dead+1.0 Wind 150 deg - No Ice | 47.09 | 18.63 | 32.39 | 1361.95 | -772.64 | 1.20 |
| 0.9 Dead+1.0 Wind 150 deg - No Ice | 35.31 | 18.63 | 32.39 | 1359.65 | -773.81 | 1.19 |
| 1.2 Dead+1.0 Wind 180 deg - No Ice | 47.09 | -0.00 | 37.21 | 1565.05 | 10.46 | 0.00 |
| 0.9 Dead+1.0 Wind 180 deg - No Ice | 35.31 | -0.00 | 37.21 | 1562.38 | 7.85 | 0.00 |
| 1.2 Dead+1.0 Wind 210 deg - No Ice | 47.09 | -18.63 | 32.39 | 1361.95 | 793.56 | -1.19 |
| 0.9 Dead+1.0 Wind 210 deg - No Ice | 35.31 | -18.63 | 32.39 | 1359.65 | 789.50 | -1.19 |
| 1.2 Dead+1.0 Wind 240 deg - No Ice | 47.09 | -32.74 | 18.97 | 797.56 | 1386.87 | -2.07 |
| 0.9 Dead+1.0 Wind 240 deg - No Ice | 35.31 | -32.74 | 18.97 | 796.30 | 1381.71 | -2.07 |
| 1.2 Dead+1.0 Wind 270 deg - No Ice | 47.09 | -37.26 | -0.00 | -0.83 | 1576.63 | -2.39 |
| 0.9 Dead+1.0 Wind 270 deg - No Ice | 35.31 | -37.26 | -0.00 | -0.62 | 1571.12 | -2.39 |

| Load Combination | Vertical | $Shear_x$ | $Shear_z$ | Overturning Moment, $M_x$ | Overturning Moment, $M_z$ | Torque |
|---|---|---|---|---|---|---|
| | K | K | K | kip-ft | kip-ft | kip-ft |
| 1.2 Dead+1.0 Wind 300 deg - No Ice | 47.09 | -32.11 | -18.61 | -783.80 | 1360.10 | -2.07 |
| 0.9 Dead+1.0 Wind 300 deg - No Ice | 35.31 | -32.11 | -18.61 | -782.14 | 1354.99 | -2.07 |
| 1.2 Dead+1.0 Wind 330 deg - No Ice | 47.09 | -18.63 | -32.39 | -1363.67 | 793.52 | -1.20 |
| 0.9 Dead+1.0 Wind 330 deg - No Ice | 35.31 | -18.63 | -32.39 | -1360.95 | 789.47 | -1.20 |
| 1.2 Dead+1.0 Ice+1.0 Temp | 54.03 | 0.00 | 0.00 | -0.74 | 11.33 | 0.00 |
| 1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp | 54.03 | 0.00 | -9.50 | -394.32 | 11.34 | -0.00 |
| 1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp | 54.03 | 4.68 | -8.12 | -336.92 | -182.44 | 0.39 |
| 1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp | 54.03 | 8.07 | -4.67 | -193.94 | -322.75 | 0.68 |
| 1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp | 54.03 | 9.37 | 0.00 | -0.75 | -376.23 | 0.79 |
| 1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp | 54.03 | 8.22 | 4.75 | 196.05 | -328.98 | 0.68 |
| 1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp | 54.03 | 4.68 | 8.12 | 335.43 | -182.45 | 0.39 |
| 1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp | 54.03 | 0.00 | 9.33 | 385.64 | 11.34 | 0.00 |
| 1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp | 54.03 | -4.68 | 8.12 | 335.43 | 205.12 | -0.39 |
| 1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp | 54.03 | -8.22 | 4.75 | 196.05 | 351.65 | -0.68 |
| 1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp | 54.03 | -9.37 | 0.00 | -0.75 | 398.91 | -0.79 |
| 1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp | 54.03 | -8.07 | -4.67 | -193.94 | 345.42 | -0.68 |
| 1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp | 54.03 | -4.68 | -8.12 | -336.92 | 205.12 | -0.39 |
| Dead+Wind 0 deg - Service | 39.24 | 0.00 | -12.87 | -541.90 | 8.72 | -0.00 |
| Dead+Wind 30 deg - Service | 39.24 | 6.32 | -10.99 | -462.60 | -256.68 | 0.40 |
| Dead+Wind 60 deg - Service | 39.24 | 10.90 | -6.31 | -266.07 | -448.71 | 0.70 |
| Dead+Wind 90 deg - Service | 39.24 | 12.64 | 0.00 | -0.71 | -522.09 | 0.81 |
| Dead+Wind 120 deg - Service | 39.24 | 11.11 | 6.44 | 269.89 | -457.78 | 0.70 |
| Dead+Wind 150 deg - Service | 39.24 | 6.32 | 10.99 | 461.18 | -256.69 | 0.41 |
| Dead+Wind 180 deg - Service | 39.24 | 0.00 | 12.63 | 530.02 | 8.72 | 0.00 |
| Dead+Wind 210 deg - Service | 39.24 | -6.32 | 10.99 | 461.18 | 274.13 | -0.40 |
| Dead+Wind 240 deg - Service | 39.24 | -11.11 | 6.44 | 269.89 | 475.21 | -0.70 |
| Dead+Wind 270 deg - Service | 39.24 | -12.64 | 0.00 | -0.71 | 539.53 | -0.81 |
| Dead+Wind 300 deg - Service | 39.24 | -10.90 | -6.31 | -266.07 | 466.15 | -0.70 |
| Dead+Wind 330 deg - Service | 39.24 | -6.32 | -10.99 | -462.60 | 274.12 | -0.41 |
| 1.2 Dead+1.0 Ev+1.0 Eh 0 deg | 55.40 | -0.00 | -27.70 | -1186.87 | 10.46 | -0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 0 deg | 27.00 | -0.00 | -27.70 | -1181.27 | 7.85 | -0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 30 deg | 55.40 | 13.85 | -23.99 | -1027.96 | -582.53 | -0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 30 deg | 27.00 | 13.85 | -23.99 | -1023.09 | -582.45 | -0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 60 deg | 55.40 | 23.99 | -13.85 | -593.84 | -1016.64 | -0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 60 deg | 27.00 | 23.99 | -13.85 | -590.94 | -1014.59 | -0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 90 deg | 55.40 | 27.70 | -0.00 | -0.84 | -1175.54 | 0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 90 deg | 27.00 | 27.70 | -0.00 | -0.62 | -1172.77 | 0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 120 deg | 55.40 | 23.99 | 13.85 | 592.16 | -1016.66 | 0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 120 deg | 27.00 | 23.99 | 13.85 | 589.68 | -1014.61 | 0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 150 deg | 55.40 | 13.85 | 23.99 | 1026.25 | -582.55 | 0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 150 deg | 27.00 | 13.85 | 23.99 | 1021.80 | -582.47 | 0.00 |

| Load Combination | Vertical | $Shear_x$ | $Shear_z$ | Overturning Moment, $M_x$ | Overturning Moment, $M_z$ | Torque |
|---|---|---|---|---|---|---|
| | K | K | K | kip-ft | kip-ft | kip-ft |
| 1.2 Dead+1.0 Ev+1.0 Eh 180 deg | 55.40 | -0.00 | 27.70 | 1185.14 | 10.46 | 0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 180 deg | 27.00 | -0.00 | 27.70 | 1179.97 | 7.85 | 0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 210 deg | 55.40 | -13.85 | 23.99 | 1026.25 | 603.48 | 0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 210 deg | 27.00 | -13.85 | 23.99 | 1021.80 | 598.16 | 0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 240 deg | 55.40 | -23.99 | 13.85 | 592.16 | 1037.58 | 0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 240 deg | 27.00 | -23.99 | 13.85 | 589.68 | 1030.30 | 0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 270 deg | 55.40 | -27.70 | -0.00 | -0.84 | 1196.47 | -0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 270 deg | 27.00 | -27.70 | -0.00 | -0.62 | 1188.46 | -0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 300 deg | 55.40 | -23.99 | -13.85 | -593.84 | 1037.56 | -0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 300 deg | 27.00 | -23.99 | -13.85 | -590.94 | 1030.28 | -0.00 |
| 1.2 Dead+1.0 Ev+1.0 Eh 330 deg | 55.40 | -13.85 | -23.99 | -1027.96 | 603.45 | -0.00 |
| 0.9 Dead-1.0 Ev+1.0 Eh 330 deg | 27.00 | -13.85 | -23.99 | -1023.09 | 598.14 | -0.00 |

# Solution Summary

| | Sum of Applied Forces | | | Sum of Reactions | | | |
|---|---|---|---|---|---|---|---|
| Load Comb. | PX | PY | PZ | PX | PY | PZ | % Error |
| | K | K | K | K | K | K | |
| 1 | 0.00 | -39.24 | 0.00 | 0.00 | 39.24 | 0.00 | 0.000% |
| 2 | 0.00 | -47.09 | -37.94 | 0.00 | 47.09 | 37.94 | 0.000% |
| 3 | 0.00 | -35.31 | -37.94 | 0.00 | 35.31 | 37.94 | 0.000% |
| 4 | 18.63 | -47.09 | -32.39 | -18.63 | 47.09 | 32.39 | 0.000% |
| 5 | 18.63 | -35.31 | -32.39 | -18.63 | 35.31 | 32.39 | 0.000% |
| 6 | 32.11 | -47.09 | -18.61 | -32.11 | 47.09 | 18.61 | 0.000% |
| 7 | 32.11 | -35.31 | -18.61 | -32.11 | 35.31 | 18.61 | 0.000% |
| 8 | 37.26 | -47.09 | 0.00 | -37.26 | 47.09 | 0.00 | 0.000% |
| 9 | 37.26 | -35.31 | 0.00 | -37.26 | 35.31 | 0.00 | 0.000% |
| 10 | 32.74 | -47.09 | 18.97 | -32.74 | 47.09 | -18.97 | 0.000% |
| 11 | 32.74 | -35.31 | 18.97 | -32.74 | 35.31 | -18.97 | 0.000% |
| 12 | 18.63 | -47.09 | 32.39 | -18.63 | 47.09 | -32.39 | 0.000% |
| 13 | 18.63 | -35.31 | 32.39 | -18.63 | 35.31 | -32.39 | 0.000% |
| 14 | 0.00 | -47.09 | 37.21 | 0.00 | 47.09 | -37.21 | 0.000% |
| 15 | 0.00 | -35.31 | 37.21 | 0.00 | 35.31 | -37.21 | 0.000% |
| 16 | -18.63 | -47.09 | 32.39 | 18.63 | 47.09 | -32.39 | 0.000% |
| 17 | -18.63 | -35.31 | 32.39 | 18.63 | 35.31 | -32.39 | 0.000% |
| 18 | -32.74 | -47.09 | 18.97 | 32.74 | 47.09 | -18.97 | 0.000% |
| 19 | -32.74 | -35.31 | 18.97 | 32.74 | 35.31 | -18.97 | 0.000% |
| 20 | -37.26 | -47.09 | 0.00 | 37.26 | 47.09 | 0.00 | 0.000% |
| 21 | -37.26 | -35.31 | 0.00 | 37.26 | 35.31 | 0.00 | 0.000% |
| 22 | -32.11 | -47.09 | -18.61 | 32.11 | 47.09 | 18.61 | 0.000% |
| 23 | -32.11 | -35.31 | -18.61 | 32.11 | 35.31 | 18.61 | 0.000% |
| 24 | -18.63 | -47.09 | -32.39 | 18.63 | 47.09 | 32.39 | 0.000% |
| 25 | -18.63 | -35.31 | -32.39 | 18.63 | 35.31 | 32.39 | 0.000% |
| 26 | 0.00 | -54.03 | 0.00 | 0.00 | 54.03 | 0.00 | 0.000% |
| 27 | 0.00 | -54.03 | -9.50 | 0.00 | 54.03 | 9.50 | 0.000% |
| 28 | 4.68 | -54.03 | -8.12 | -4.68 | 54.03 | 8.12 | 0.000% |

| | Sum of Applied Forces | | | Sum of Reactions | | | |
|---|---|---|---|---|---|---|---|
| Load Comb. | PX K | PY K | PZ K | PX K | PY K | PZ K | % Error |
| 29 | 8.07 | -54.03 | -4.67 | -8.07 | 54.03 | 4.67 | 0.000% |
| 30 | 9.37 | -54.03 | 0.00 | -9.37 | 54.03 | 0.00 | 0.000% |
| 31 | 8.22 | -54.03 | 4.75 | -8.22 | 54.03 | -4.75 | 0.000% |
| 32 | 4.68 | -54.03 | 8.12 | -4.68 | 54.03 | -8.12 | 0.000% |
| 33 | 0.00 | -54.03 | 9.33 | 0.00 | 54.03 | -9.33 | 0.000% |
| 34 | -4.68 | -54.03 | 8.12 | 4.68 | 54.03 | -8.12 | 0.000% |
| 35 | -8.22 | -54.03 | 4.75 | 8.22 | 54.03 | -4.75 | 0.000% |
| 36 | -9.37 | -54.03 | 0.00 | 9.37 | 54.03 | 0.00 | 0.000% |
| 37 | -8.07 | -54.03 | -4.67 | 8.07 | 54.03 | 4.67 | 0.000% |
| 38 | -4.68 | -54.03 | -8.12 | 4.68 | 54.03 | 8.12 | 0.000% |
| 39 | 0.00 | -39.24 | -12.87 | 0.00 | 39.24 | 12.87 | 0.000% |
| 40 | 6.32 | -39.24 | -10.99 | -6.32 | 39.24 | 10.99 | 0.000% |
| 41 | 10.90 | -39.24 | -6.31 | -10.90 | 39.24 | 6.31 | 0.000% |
| 42 | 12.64 | -39.24 | 0.00 | -12.64 | 39.24 | 0.00 | 0.000% |
| 43 | 11.11 | -39.24 | 6.44 | -11.11 | 39.24 | -6.44 | 0.000% |
| 44 | 6.32 | -39.24 | 10.99 | -6.32 | 39.24 | -10.99 | 0.000% |
| 45 | 0.00 | -39.24 | 12.63 | 0.00 | 39.24 | -12.63 | 0.000% |
| 46 | -6.32 | -39.24 | 10.99 | 6.32 | 39.24 | -10.99 | 0.000% |
| 47 | -11.11 | -39.24 | 6.44 | 11.11 | 39.24 | -6.44 | 0.000% |
| 48 | -12.64 | -39.24 | 0.00 | 12.64 | 39.24 | 0.00 | 0.000% |
| 49 | -10.90 | -39.24 | -6.31 | 10.90 | 39.24 | 6.31 | 0.000% |
| 50 | -6.32 | -39.24 | -10.99 | 6.32 | 39.24 | 10.99 | 0.000% |
| 51 | 0.00 | -55.40 | -27.70 | 0.00 | 55.40 | 27.70 | 0.000% |
| 52 | 0.00 | -27.00 | -27.70 | 0.00 | 27.00 | 27.70 | 0.000% |
| 53 | 13.85 | -55.40 | -23.99 | -13.85 | 55.40 | 23.99 | 0.000% |
| 54 | 13.85 | -27.00 | -23.99 | -13.85 | 27.00 | 23.99 | 0.000% |
| 55 | 23.99 | -55.40 | -13.85 | -23.99 | 55.40 | 13.85 | 0.000% |
| 56 | 23.99 | -27.00 | -13.85 | -23.99 | 27.00 | 13.85 | 0.000% |
| 57 | 27.70 | -55.40 | 0.00 | -27.70 | 55.40 | 0.00 | 0.000% |
| 58 | 27.70 | -27.00 | 0.00 | -27.70 | 27.00 | 0.00 | 0.000% |
| 59 | 23.99 | -55.40 | 13.85 | -23.99 | 55.40 | -13.85 | 0.000% |
| 60 | 23.99 | -27.00 | 13.85 | -23.99 | 27.00 | -13.85 | 0.000% |
| 61 | 13.85 | -55.40 | 23.99 | -13.85 | 55.40 | -23.99 | 0.000% |
| 62 | 13.85 | -27.00 | 23.99 | -13.85 | 27.00 | -23.99 | 0.000% |
| 63 | 0.00 | -55.40 | 27.70 | 0.00 | 55.40 | -27.70 | 0.000% |
| 64 | 0.00 | -27.00 | 27.70 | 0.00 | 27.00 | -27.70 | 0.000% |
| 65 | -13.85 | -55.40 | 23.99 | 13.85 | 55.40 | -23.99 | 0.000% |
| 66 | -13.85 | -27.00 | 23.99 | 13.85 | 27.00 | -23.99 | 0.000% |
| 67 | -23.99 | -55.40 | 13.85 | 23.99 | 55.40 | -13.85 | 0.000% |
| 68 | -23.99 | -27.00 | 13.85 | 23.99 | 27.00 | -13.85 | 0.000% |
| 69 | -27.70 | -55.40 | 0.00 | 27.70 | 55.40 | 0.00 | 0.000% |
| 70 | -27.70 | -27.00 | 0.00 | 27.70 | 27.00 | 0.00 | 0.000% |
| 71 | -23.99 | -55.40 | -13.85 | 23.99 | 55.40 | 13.85 | 0.000% |
| 72 | -23.99 | -27.00 | -13.85 | 23.99 | 27.00 | 13.85 | 0.000% |
| 73 | -13.85 | -55.40 | -23.99 | 13.85 | 55.40 | 23.99 | 0.000% |
| 74 | -13.85 | -27.00 | -23.99 | 13.85 | 27.00 | 23.99 | 0.000% |

## Non-Linear Convergence Results

| Load Combination | Converged? | Number of Cycles | Displacement Tolerance | Force Tolerance |
|---|---|---|---|---|
| 1 | Yes | 4 | 0.00000001 | 0.00000001 |
| 2 | Yes | 4 | 0.00000001 | 0.00000001 |
| 3 | Yes | 4 | 0.00000001 | 0.00000001 |
| 4 | Yes | 4 | 0.00000001 | 0.00000001 |
| 5 | Yes | 4 | 0.00000001 | 0.00000001 |

| | | | | |
|---|---|---|---|---|
| 6 | Yes | 4 | 0.00000001 | 0.00000001 |
| 7 | Yes | 4 | 0.00000001 | 0.00000001 |
| 8 | Yes | 4 | 0.00000001 | 0.00000001 |
| 9 | Yes | 4 | 0.00000001 | 0.00000001 |
| 10 | Yes | 4 | 0.00000001 | 0.00000001 |
| 11 | Yes | 4 | 0.00000001 | 0.00000001 |
| 12 | Yes | 4 | 0.00000001 | 0.00000001 |
| 13 | Yes | 4 | 0.00000001 | 0.00000001 |
| 14 | Yes | 4 | 0.00000001 | 0.00000001 |
| 15 | Yes | 4 | 0.00000001 | 0.00000001 |
| 16 | Yes | 4 | 0.00000001 | 0.00000001 |
| 17 | Yes | 4 | 0.00000001 | 0.00000001 |
| 18 | Yes | 4 | 0.00000001 | 0.00000001 |
| 19 | Yes | 4 | 0.00000001 | 0.00000001 |
| 20 | Yes | 4 | 0.00000001 | 0.00000001 |
| 21 | Yes | 4 | 0.00000001 | 0.00000001 |
| 22 | Yes | 4 | 0.00000001 | 0.00000001 |
| 23 | Yes | 4 | 0.00000001 | 0.00000001 |
| 24 | Yes | 4 | 0.00000001 | 0.00000001 |
| 25 | Yes | 4 | 0.00000001 | 0.00000001 |
| 26 | Yes | 4 | 0.00000001 | 0.00000001 |
| 27 | Yes | 4 | 0.00000001 | 0.00000001 |
| 28 | Yes | 4 | 0.00000001 | 0.00000001 |
| 29 | Yes | 4 | 0.00000001 | 0.00000001 |
| 30 | Yes | 4 | 0.00000001 | 0.00000001 |
| 31 | Yes | 4 | 0.00000001 | 0.00000001 |
| 32 | Yes | 4 | 0.00000001 | 0.00000001 |
| 33 | Yes | 4 | 0.00000001 | 0.00000001 |
| 34 | Yes | 4 | 0.00000001 | 0.00000001 |
| 35 | Yes | 4 | 0.00000001 | 0.00000001 |
| 36 | Yes | 4 | 0.00000001 | 0.00000001 |
| 37 | Yes | 4 | 0.00000001 | 0.00000001 |
| 38 | Yes | 4 | 0.00000001 | 0.00000001 |
| 39 | Yes | 4 | 0.00000001 | 0.00000001 |
| 40 | Yes | 4 | 0.00000001 | 0.00000001 |
| 41 | Yes | 4 | 0.00000001 | 0.00000001 |
| 42 | Yes | 4 | 0.00000001 | 0.00000001 |
| 43 | Yes | 4 | 0.00000001 | 0.00000001 |
| 44 | Yes | 4 | 0.00000001 | 0.00000001 |
| 45 | Yes | 4 | 0.00000001 | 0.00000001 |
| 46 | Yes | 4 | 0.00000001 | 0.00000001 |
| 47 | Yes | 4 | 0.00000001 | 0.00000001 |
| 48 | Yes | 4 | 0.00000001 | 0.00000001 |
| 49 | Yes | 4 | 0.00000001 | 0.00000001 |
| 50 | Yes | 4 | 0.00000001 | 0.00000001 |
| 51 | Yes | 4 | 0.00000001 | 0.00000001 |
| 52 | Yes | 4 | 0.00000001 | 0.00000001 |
| 53 | Yes | 4 | 0.00000001 | 0.00000001 |
| 54 | Yes | 4 | 0.00000001 | 0.00000001 |
| 55 | Yes | 4 | 0.00000001 | 0.00000001 |
| 56 | Yes | 4 | 0.00000001 | 0.00000001 |
| 57 | Yes | 4 | 0.00000001 | 0.00000001 |
| 58 | Yes | 4 | 0.00000001 | 0.00000001 |
| 59 | Yes | 4 | 0.00000001 | 0.00000001 |
| 60 | Yes | 4 | 0.00000001 | 0.00000001 |
| 61 | Yes | 4 | 0.00000001 | 0.00000001 |
| 62 | Yes | 4 | 0.00000001 | 0.00000001 |
| 63 | Yes | 4 | 0.00000001 | 0.00000001 |
| 64 | Yes | 4 | 0.00000001 | 0.00000001 |
| 65 | Yes | 4 | 0.00000001 | 0.00000001 |
| 66 | Yes | 4 | 0.00000001 | 0.00000001 |
| 67 | Yes | 4 | 0.00000001 | 0.00000001 |
| 68 | Yes | 4 | 0.00000001 | 0.00000001 |
| 69 | Yes | 4 | 0.00000001 | 0.00000001 |

| | | | | |
|---|---|---|---|---|
| 70 | Yes | 4 | 0.00000001 | 0.00000001 |
| 71 | Yes | 4 | 0.00000001 | 0.00000001 |
| 72 | Yes | 4 | 0.00000001 | 0.00000001 |
| 73 | Yes | 4 | 0.00000001 | 0.00000001 |
| 74 | Yes | 4 | 0.00000001 | 0.00000001 |

## Maximum Tower Deflections - Service Wind

| Section No. | Elevation ft | Horz. Deflection in | Gov. Load Comb. | Tilt ° | Twist ° |
|---|---|---|---|---|---|
| T1 | 61 - 41 | 1.485 | 39 | 0.0079 | 0.0016 |
| T2 | 41 - 21 | 1.163 | 39 | 0.0076 | 0.0013 |
| T3 | 21 - 1 | 0.808 | 39 | 0.0055 | 0.0009 |

## Critical Deflections and Radius of Curvature - Service Wind

| Elevation ft | Appurtenance | Gov. Load Comb. | Deflection in | Tilt ° | Twist ° | Radius of Curvature ft |
|---|---|---|---|---|---|---|
| 61.00 | 20'x18' Shroud Face | 39 | 1.485 | 0.0079 | 0.0016 | 150363 |
| 56.50 | Platform 16' w/ Rails | 39 | 1.408 | 0.0079 | 0.0015 | 150363 |
| 56.00 | 20'x18' Shroud Face | 39 | 1.399 | 0.0079 | 0.0015 | 150363 |
| 51.00 | 20'x18' Shroud Face | 39 | 1.316 | 0.0078 | 0.0014 | 75181 |
| 46.00 | 20'x18' Shroud Face | 39 | 1.236 | 0.0077 | 0.0014 | 50121 |
| 41.00 | 20'x18' Shroud Face | 39 | 1.163 | 0.0076 | 0.0013 | 54890 |
| 31.00 | Section 2 | 39 | 1.022 | 0.0069 | 0.0011 | 16473 |
| 26.00 | 5'x18' Shroud Face | 39 | 0.930 | 0.0063 | 0.0010 | 9583 |
| 23.50 | 5'x18' Shroud Face | 39 | 0.874 | 0.0060 | 0.0010 | 8032 |
| 21.00 | 5'x18' Shroud Face | 39 | 0.808 | 0.0055 | 0.0009 | 7431 |
| 11.00 | Section 3 | 39 | 0.448 | 0.0031 | 0.0005 | 13513 |

## Maximum Tower Deflections - Design Wind

| Section No. | Elevation ft | Horz. Deflection in | Gov. Load Comb. | Tilt ° | Twist ° |
|---|---|---|---|---|---|
| T1 | 61 - 41 | 4.381 | 2 | 0.0230 | 0.0047 |
| T2 | 41 - 21 | 3.432 | 2 | 0.0221 | 0.0038 |
| T3 | 21 - 1 | 2.384 | 2 | 0.0162 | 0.0026 |

## Critical Deflections and Radius of Curvature - Design Wind

| Elevation ft | Appurtenance | Gov. Load Comb. | Deflection in | Tilt ° | Twist ° | Radius of Curvature ft |
|---|---|---|---|---|---|---|
| 61.00 | 20'x18' Shroud Face | 2 | 4.381 | 0.0230 | 0.0047 | 50948 |

| Elevation<br>ft | Appurtenance | Gov. Load Comb. | Deflection<br>in | Tilt<br>° | Twist<br>° | Radius of Curvature<br>ft |
|---|---|---|---|---|---|---|
| 56.50 | Platform 16' w/ Rails | 2 | 4.154 | 0.0229 | 0.0045 | 50948 |
| 56.00 | 20'x18' Shroud Face | 2 | 4.129 | 0.0229 | 0.0045 | 50948 |
| 51.00 | 20'x18' Shroud Face | 2 | 3.883 | 0.0228 | 0.0042 | 25474 |
| 46.00 | 20'x18' Shroud Face | 2 | 3.649 | 0.0225 | 0.0040 | 16983 |
| 41.00 | 20'x18' Shroud Face | 2 | 3.432 | 0.0221 | 0.0038 | 18605 |
| 31.00 | Section 2 | 2 | 3.016 | 0.0203 | 0.0033 | 5575 |
| 26.00 | 5'x18' Shroud Face | 2 | 2.746 | 0.0186 | 0.0030 | 3244 |
| 23.50 | 5'x18' Shroud Face | 2 | 2.579 | 0.0175 | 0.0028 | 2719 |
| 21.00 | 5'x18' Shroud Face | 2 | 2.384 | 0.0162 | 0.0026 | 2516 |
| 11.00 | Section 3 | 2 | 1.323 | 0.0090 | 0.0014 | 4575 |

## Bolt Design Data

| Section No. | Elevation<br>ft | Component Type | Bolt Grade | Bolt Size<br>in | Number Of Bolts | Maximum Load per Bolt<br>K | Allowable Load per Bolt<br>K | Ratio Load / Allowable | Allowable Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| T1 | 61 | Top Girt | A325N | 0.7500 | 10 | 0.17 | 19.88 | 0.008 ✔ | 1 | Bolt Shear |
| | | Bottom Girt | A325N | 1.0000 | 10 | 0.54 | 35.34 | 0.015 ✔ | 1 | Bolt Shear |
| | | Mid Girt | A325N | 0.6250 | 4 | 0.25 | 13.81 | 0.018 ✔ | 1 | Bolt Shear |
| T2 | 41 | Bottom Girt | A325N | 1.0000 | 10 | 0.53 | 35.34 | 0.015 ✔ | 1 | Bolt Shear |
| T3 | 21 | Leg | A325N | 1.2500 | 12 | 8.60 | 87.22 | 0.099 ✔ | 1 | Bolt Tension |

## *Compression Checks*

## Leg Design Data (Compression)

| Section No. | Elevation<br>ft | Size | $L$<br>ft | $L_u$<br>ft | $Kl/r$ | $A$<br>$in^2$ | $P_u$<br>K | $\phi P_n$<br>K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | P20x.5 | 20.00 | 9.50 | 16.5<br>K=1.00 | 30.6305 | -12.17 | 951.46 | 0.013 |
| T2 | 41 - 21 | P20x.5 | 20.00 | 1.00 | 1.7<br>K=1.00 | 30.6305 | -128.36 | 964.71 | 0.133 |
| T3 | 21 - 1 | P20x.5 | 20.00 | 20.00 | 34.8<br>K=1.00 | 30.6305 | -129.60 | 906.87 | 0.143 |

## Leg Bending Design Data (Compression)

| Section No. | Elevation<br>ft | Size | $M_{ux}$<br>kip-ft | $\phi M_{nx}$<br>kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$<br>kip-ft | $\phi M_{ny}$<br>kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|

| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | P20x.5 | 80.93 | 499.19 | 0.162 | 0.00 | 499.19 | 0.000 |
| T2 | 41 - 21 | P20x.5 | 312.38 | 499.19 | 0.626 | 0.00 | 499.19 | 0.000 |
| T3 | 21 - 1 | P20x.5 | 298.98 | 499.19 | 0.599 | 0.00 | 499.19 | 0.000 |

## Leg Interaction Design Data (Compression)

| Section No. | Elevation ft | Size | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | P20x.5 | 0.013 | 0.162 | 0.000 | 0.169 ✔ | 1.000 | 4.8.1 ✔ |
| T2 | 41 - 21 | P20x.5 | 0.133 | 0.626 | 0.000 | 0.692 ✔ | 1.000 | 4.8.1 ✔ |
| T3 | 21 - 1 | P20x.5 | 0.143 | 0.599 | 0.000 | 0.670 ✔ | 1.000 | 4.8.1 ✔ |

## Top Girt Design Data (Compression)

| Section No. | Elevation ft | Size | $L$ ft | $L_u$ ft | $Kl/r$ | $A$ $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W8x35 | 16.00 | 10.75 | 63.5<br>K=1.00 | 10.3000 | -0.08 | 269.81 | 0.000 |

## Top Girt Bending Design Data

| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W8x35 | -29.80 | 86.45 | 0.345 | -0.06 | 42.93 | 0.001 |

## Top Girt Interaction Design Data

| Section No. | Elevation ft | Size | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W8x35 | 0.000 | 0.345 | 0.001 | 0.346 ✔ | 1.000 | 4.8.1 ✔ |

## Bottom Girt Design Data (Compression)

| Section No. | Elevation | Size | L | $L_u$ | Kl/r | A | $P_u$ | $\phi P_n$ | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| | ft | | ft | ft | | $in^2$ | K | K | |
| T1 | 61 - 41 | W12x79 | 16.00 | 10.75 | 47.0<br>K=1.00 | 23.2000 | -0.00 | 669.25 | 0.000 |
| T2 | 41 - 21 | W14x159 | 16.00 | 10.75 | 36.6<br>K=1.00 | 46.7000 | -1.96 | 1905.52 | 0.001 |

## Bottom Girt Bending Design Data

| Section No. | Elevation | Size | $M_{ux}$ | $\phi M_{nx}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ | $\phi M_{ny}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| | ft | | kip-ft | kip-ft | | kip-ft | kip-ft | |
| T1 | 61 - 41 | W12x79 | -146.83 | 316.62 | 0.464 | -0.11 | 144.99 | 0.001 |
| T2 | 41 - 21 | W14x159 | -329.07 | 1074.91 | 0.306 | 0.18 | 541.13 | 0.000 |

## Bottom Girt Interaction Design Data

| Section No. | Elevation | Size | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| | ft | | | | | | | |
| T1 | 61 - 41 | W12x79 | 0.000 | 0.464 | 0.001 | 0.464 ✔ | 1.000 | 4.8.1 ✔ |
| T2 | 41 - 21 | W14x159 | 0.001 | 0.306 | 0.000 | 0.307 ✔ | 1.000 | 4.8.1 ✔ |

## Mid Girt Design Data (Compression)

| Section No. | Elevation | Size | L | $L_u$ | Kl/r | A | $P_u$ | $\phi P_n$ | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| | ft | | ft | ft | | $in^2$ | K | K | |
| T1 | 61 - 41 | TS3.5x3.5x.25 | 16.00 | 14.33 | 131.3<br>K=1.00 | 3.0900 | -0.95 | 40.49 | 0.023 |

## Mid Girt Bending Design Data

| Section No. | Elevation | Size | $M_{ux}$ | $\phi M_{nx}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ | $\phi M_{ny}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| | ft | | kip-ft | kip-ft | | kip-ft | kip-ft | |
| T1 | 61 - 41 | TS3.5x3.5x.25 | 0.40 | 12.74 | 0.032 | 0.00 | 12.74 | 0.000 |

## Mid Girt Interaction Design Data

| Section No. | Elevation ft | Size | Ratio $P_u/\phi P_n$ | Ratio $M_{ux}/\phi M_{nx}$ | Ratio $M_{uy}/\phi M_{ny}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | TS3.5x3.5x.25 | 0.023 | 0.032 | 0.000 | 0.043 ✔ | 1.000 | 4.8.1 ✔ |

## *Tension Checks*

## Leg Design Data (Tension)

| Section No. | Elevation ft | Size | $L$ ft | $L_u$ ft | $Kl/r$ | $A$ $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $P_u/\phi P_n$ |
|---|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | P20x.5 | 20.00 | 9.50 | 16.5 | 30.6305 | 2.64 | 964.86 | 0.003 |
| T2 | 41 - 21 | P20x.5 | 20.00 | 1.00 | 1.7 | 30.6305 | 103.05 | 964.86 | 0.107 |
| T3 | 21 - 1 | P20x.5 | 20.00 | 20.00 | 34.8 | 30.6305 | 103.00 | 964.86 | 0.107 |

## Leg Bending Design Data (Tension)

| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $M_{ux}/\phi M_{nx}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $M_{uy}/\phi M_{ny}$ |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | P20x.5 | 77.57 | 499.19 | 0.155 | 0.00 | 499.19 | 0.000 |
| T2 | 41 - 21 | P20x.5 | 303.55 | 499.19 | 0.608 | 0.00 | 499.19 | 0.000 |
| T3 | 21 - 1 | P20x.5 | 288.97 | 499.19 | 0.579 | 0.00 | 499.19 | 0.000 |

## Leg Interaction Design Data (Tension)

| Section No. | Elevation ft | Size | Ratio $P_u/\phi P_n$ | Ratio $M_{ux}/\phi M_{nx}$ | Ratio $M_{uy}/\phi M_{ny}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | P20x.5 | 0.003 | 0.155 | 0.000 | 0.157 ✔ | 1.000 | 4.8.1 ✔ |
| T2 | 41 - 21 | P20x.5 | 0.107 | 0.608 | 0.000 | 0.661 ✔ | 1.000 | 4.8.1 ✔ |
| T3 | 21 - 1 | P20x.5 | 0.107 | 0.579 | 0.000 | 0.632 ✔ | 1.000 | 4.8.1 ✔ |

## Top Girt Design Data (Tension)

| Section No. | Elevation ft | Size | L ft | $L_u$ ft | Kl/r | A $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W8x35 | 16.00 | 10.75 | 63.5 | 7.5216 | 0.71 | 327.19 | 0.002 |

## Top Girt Bending Design Data

| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W8x35 | -26.17 | 86.45 | 0.303 | -0.01 | 42.93 | 0.000 |

## Top Girt Interaction Design Data

| Section No. | Elevation ft | Size | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W8x35 | 0.002 | 0.303 | 0.000 | 0.304 ✔ | 1.000 | 4.8.1 ✔ |

## Bottom Girt Design Data (Tension)

| Section No. | Elevation ft | Size | L ft | $L_u$ ft | Kl/r | A $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W12x79 | 16.00 | 10.75 | 42.3 | 17.0034 | 0.01 | 739.65 | 0.000 |
| T2 | 41 - 21 | W14x159 | 16.00 | 10.75 | 32.3 | 34.3964 | 0.83 | 1676.82 | 0.000 |

## Bottom Girt Bending Design Data

| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W12x79 | -146.19 | 316.62 | 0.462 | -0.11 | 144.99 | 0.001 |
| T2 | 41 - 21 | W14x159 | -351.93 | 1074.91 | 0.327 | 0.14 | 541.13 | 0.000 |

## Bottom Girt Interaction Design Data

| Section No. | Elevation ft | Size | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | W12x79 | 0.000 | 0.462 | 0.001 | 0.462 | 1.000 | 4.8.1 ✔ |

| Section No. | Elevation ft | Size | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| T2 | 41 - 21 | W14x159 | 0.000 | 0.327 | 0.000 | 0.328 ✔ | 1.000 | 4.8.1 ✔ |

## Mid Girt Design Data (Tension)

| Section No. | Elevation ft | Size | $L$ ft | $L_u$ ft | $Kl/r$ | $A$ $in^2$ | $P_u$ K | $\phi P_n$ K | Ratio $\frac{P_u}{\phi P_n}$ |
|---|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | TS3.5x3.5x.25 | 16.00 | 14.33 | 131.3 | 3.0900 | 0.30 | 127.93 | 0.002 |

## Mid Girt Bending Design Data

| Section No. | Elevation ft | Size | $M_{ux}$ kip-ft | $\phi M_{nx}$ kip-ft | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | $M_{uy}$ kip-ft | $\phi M_{ny}$ kip-ft | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | TS3.5x3.5x.25 | 0.45 | 12.74 | 0.035 | 0.00 | 12.74 | 0.000 |

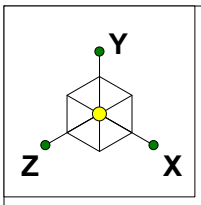
## Mid Girt Interaction Design Data

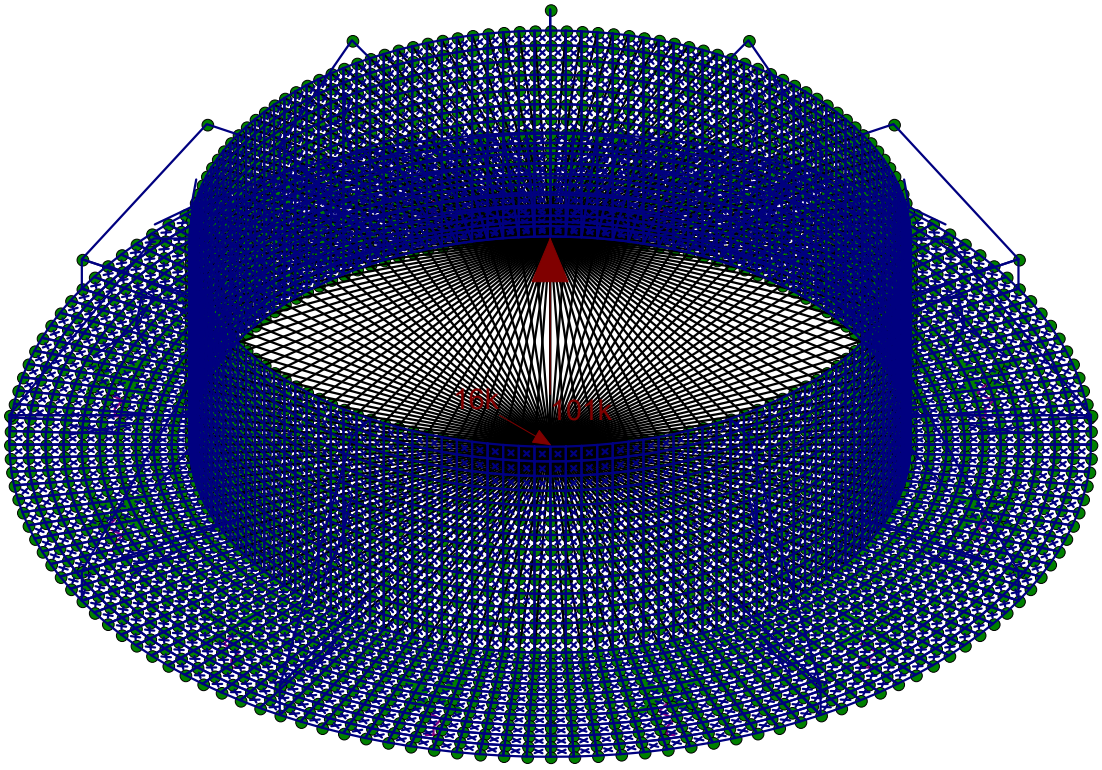
| Section No. | Elevation ft | Size | Ratio $\frac{P_u}{\phi P_n}$ | Ratio $\frac{M_{ux}}{\phi M_{nx}}$ | Ratio $\frac{M_{uy}}{\phi M_{ny}}$ | Comb. Stress Ratio | Allow. Stress Ratio | Criteria |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | TS3.5x3.5x.25 | 0.002 | 0.035 | 0.000 | 0.037 ✔ | 1.000 | 4.8.1 ✔ |

## Section Capacity Table

| Section No. | Elevation ft | Component Type | Size | Critical Element | P K | $\phi P_{allow}$ K | % Capacity | Pass Fail |
|---|---|---|---|---|---|---|---|---|
| T1 | 61 - 41 | Leg | P20x.5 | 3 | -12.17 | 951.46 | 16.9 | Pass |
| T2 | 41 - 21 | Leg | P20x.5 | 15 | -128.36 | 964.71 | 69.2 | Pass |
| T3 | 21 - 1 | Leg | P20x.5 | 21 | -129.60 | 906.87 | 67.0 | Pass |
| T1 | 61 - 41 | Top Girt | W8x35 | 4 | 0.71 | 327.19 | 34.6 | Pass |
| T1 | 61 - 41 | Bottom Girt | W12x79 | 9 | 0.01 | 739.65 | 46.4 | Pass |
| T2 | 41 - 21 | Bottom Girt | W14x159 | 18 | -1.96 | 1905.52 | 32.8 | Pass |
| T1 | 61 - 41 | Mid Girt | TS3.5x3.5x.25 | 10 | -0.95 | 40.49 | 4.3 | Pass |
| | | | | | | | Summary | |
| | | | | | | Leg (T2) | 69.2 | Pass |
| | | | | | | Top Girt (T1) | 34.6 | Pass |
| | | | | | | Bottom Girt (T1) | 46.4 | Pass |

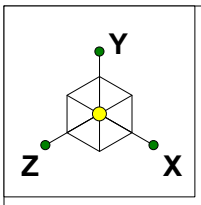
| Section No. | Elevation ft | Component Type | Size | Critical Element | P K | $øP_{allow}$ K | % Capacity | Pass Fail |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Mid Girt (T1) | 4.3 | Pass |
| | | | | | | Bolt Checks | 9.9 | Pass |
| | | | | | | **RATING =** | **69.2** | **Pass** |

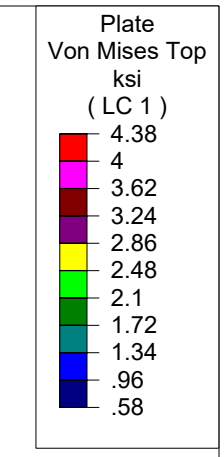


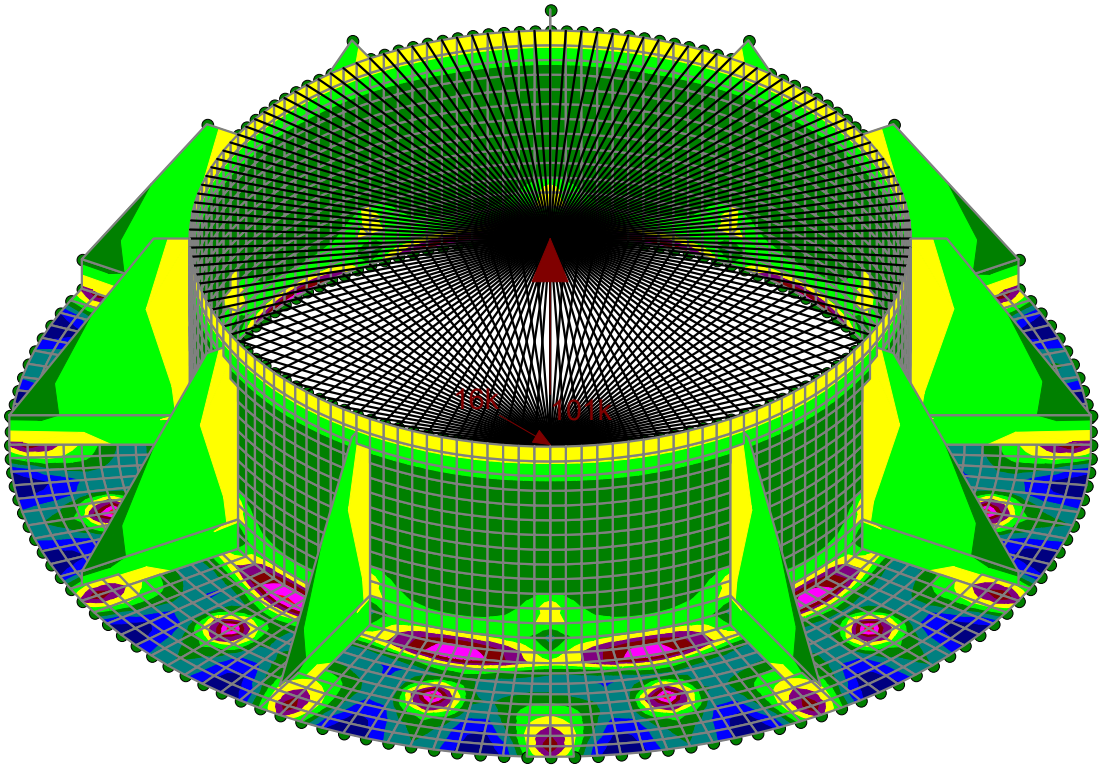




Loads: LC 1, Wind

| | | |
|---|---|---|
| J5 Infrastructure Partners | Tower Leg Baseplate | SK - 1 |
| Danh Ho, E.I.T | | Mar 18, 2021 at 6:51 AM |
| SAL Unitah Ridge | | SAL Unitah Baseplate Model.r3d |




Loads: LC 1, Wind
Results for LC 1, Wind

| | | |
|---|---|---|
| J5 Infrastructure Partners | Tower Leg Baseplate | SK - 2 |
| Danh Ho, E.I.T | | Mar 18, 2021 at 6:52 AM |
| SAL Unitah Ridge | | SAL Unitah Baseplate Model.r3d |

## Joint Boundary Conditions

| | Joint Label | X [k/in] | Y [k/in] | Z [k/in] | X Rot.[k-ft/rad] | Y Rot.[k-ft/rad] | Z Rot.[k-ft/rad] |
|---|---|---|---|---|---|---|---|
| 1 | N798 | Reaction | S2964 | Reaction | | | |
| 2 | N786 | Reaction | S2964 | Reaction | | | |
| 3 | N774 | Reaction | S2964 | Reaction | | | |
| 4 | N762 | Reaction | S2964 | Reaction | | | |
| 5 | N750 | Reaction | S2964 | Reaction | | | |
| 6 | N738 | Reaction | S2964 | Reaction | | | |
| 7 | N726 | Reaction | S2964 | Reaction | | | |
| 8 | N858 | Reaction | S2964 | Reaction | | | |
| 9 | N846 | Reaction | S2964 | Reaction | | | |
| 10 | N834 | Reaction | S2964 | Reaction | | | |
| 11 | N822 | Reaction | S2964 | Reaction | | | |
| 12 | N810 | Reaction | S2964 | Reaction | | | |

## Plate Primary Data

| | Label | A Joint | B Joint | C Joint | D Joint | Material | Thickness[in] |
|---|---|---|---|---|---|---|---|
| 1 | P1 | N1 | N2 | N147 | N146 | gen_Steel | 1.5 |
| 2 | P2 | N2 | N3 | N148 | N147 | gen_Steel | 1.5 |
| 3 | P3 | N3 | N4 | N149 | N148 | gen_Steel | 1.5 |
| 4 | P4 | N4 | N5 | N150 | N149 | gen_Steel | 1.5 |
| 5 | P5 | N5 | N6 | N151 | N150 | gen_Steel | 1.5 |
| 6 | P6 | N6 | N7 | N152 | N151 | gen_Steel | 1.5 |
| 7 | P7 | N7 | N8 | N153 | N152 | gen_Steel | 1.5 |
| 8 | P8 | N8 | N9 | N154 | N153 | gen_Steel | 1.5 |
| 9 | P9 | N9 | N10 | N155 | N154 | gen_Steel | 1.5 |
| 10 | P10 | N10 | N11 | N156 | N155 | gen_Steel | 1.5 |
| 11 | P11 | N11 | N12 | N157 | N156 | gen_Steel | 1.5 |
| 12 | P12 | N12 | N13 | N158 | N157 | gen_Steel | 1.5 |
| 13 | P13 | N13 | N14 | N159 | N158 | gen_Steel | 1.5 |
| 14 | P14 | N14 | N15 | N160 | N159 | gen_Steel | 1.5 |
| 15 | P15 | N15 | N16 | N161 | N160 | gen_Steel | 1.5 |
| 16 | P16 | N16 | N17 | N162 | N161 | gen_Steel | 1.5 |
| 17 | P17 | N17 | N18 | N163 | N162 | gen_Steel | 1.5 |
| 18 | P18 | N18 | N19 | N164 | N163 | gen_Steel | 1.5 |
| 19 | P19 | N19 | N20 | N165 | N164 | gen_Steel | 1.5 |
| 20 | P20 | N20 | N21 | N166 | N165 | gen_Steel | 1.5 |
| 21 | P21 | N21 | N22 | N167 | N166 | gen_Steel | 1.5 |
| 22 | P22 | N22 | N23 | N168 | N167 | gen_Steel | 1.5 |
| 23 | P23 | N23 | N24 | N169 | N168 | gen_Steel | 1.5 |
| 24 | P24 | N24 | N25 | N170 | N169 | gen_Steel | 1.5 |
| 25 | P25 | N25 | N26 | N171 | N170 | gen_Steel | 1.5 |
| 26 | P26 | N26 | N27 | N172 | N171 | gen_Steel | 1.5 |
| 27 | P27 | N27 | N28 | N173 | N172 | gen_Steel | 1.5 |
| 28 | P28 | N28 | N29 | N174 | N173 | gen_Steel | 1.5 |
| 29 | P29 | N29 | N30 | N175 | N174 | gen_Steel | 1.5 |
| 30 | P30 | N30 | N31 | N176 | N175 | gen_Steel | 1.5 |
| 31 | P31 | N31 | N32 | N177 | N176 | gen_Steel | 1.5 |
| 32 | P32 | N32 | N33 | N178 | N177 | gen_Steel | 1.5 |
| 33 | P33 | N33 | N34 | N179 | N178 | gen_Steel | 1.5 |
| 34 | P34 | N34 | N35 | N180 | N179 | gen_Steel | 1.5 |
| 35 | P35 | N35 | N36 | N181 | N180 | gen_Steel | 1.5 |
| 36 | P36 | N36 | N37 | N182 | N181 | gen_Steel | 1.5 |
| 37 | P37 | N37 | N38 | N183 | N182 | gen_Steel | 1.5 |
| 38 | P38 | N38 | N39 | N184 | N183 | gen_Steel | 1.5 |
| 39 | P39 | N39 | N40 | N185 | N184 | gen_Steel | 1.5 |

## Plate Primary Data (Continued)

| | Label | A Joint | B Joint | C Joint | D Joint | Material | Thickness[in] |
|---|---|---|---|---|---|---|---|
| 1408 | P1408 | N1417 | N1418 | N1563 | N1562 | gen_Steel | 1.5 |
| 1409 | P1409 | N1418 | N1419 | N1564 | N1563 | gen_Steel | 1.5 |
| 1410 | P1410 | N1419 | N1420 | N1565 | N1564 | gen_Steel | 1.5 |
| 1411 | P1411 | N1420 | N1421 | N1566 | N1565 | gen_Steel | 1.5 |
| 1412 | P1412 | N1421 | N1422 | N1567 | N1566 | gen_Steel | 1.5 |
| 1413 | P1413 | N1422 | N1423 | N1568 | N1567 | gen_Steel | 1.5 |
| 1414 | P1414 | N1423 | N1424 | N1569 | N1568 | gen_Steel | 1.5 |
| 1415 | P1415 | N1424 | N1425 | N1570 | N1569 | gen_Steel | 1.5 |
| 1416 | P1416 | N1425 | N1426 | N1571 | N1570 | gen_Steel | 1.5 |
| 1417 | P1417 | N1426 | N1427 | N1572 | N1571 | gen_Steel | 1.5 |
| 1418 | P1418 | N1427 | N1428 | N1573 | N1572 | gen_Steel | 1.5 |
| 1419 | P1419 | N1428 | N1429 | N1574 | N1573 | gen_Steel | 1.5 |
| 1420 | P1420 | N1429 | N1430 | N1575 | N1574 | gen_Steel | 1.5 |
| 1421 | P1421 | N1430 | N1431 | N1576 | N1575 | gen_Steel | 1.5 |
| 1422 | P1422 | N1431 | N1432 | N1577 | N1576 | gen_Steel | 1.5 |
| 1423 | P1423 | N1432 | N1433 | N1578 | N1577 | gen_Steel | 1.5 |
| 1424 | P1424 | N1433 | N1434 | N1579 | N1578 | gen_Steel | 1.5 |
| 1425 | P1425 | N1434 | N1435 | N1580 | N1579 | gen_Steel | 1.5 |
| 1426 | P1426 | N1435 | N1436 | N1581 | N1580 | gen_Steel | 1.5 |
| 1427 | P1427 | N1436 | N1437 | N1582 | N1581 | gen_Steel | 1.5 |
| 1428 | P1428 | N1437 | N1438 | N1583 | N1582 | gen_Steel | 1.5 |
| 1429 | P1429 | N1438 | N1439 | N1584 | N1583 | gen_Steel | 1.5 |
| 1430 | P1430 | N1439 | N1440 | N1585 | N1584 | gen_Steel | 1.5 |
| 1431 | P1431 | N1440 | N1441 | N1586 | N1585 | gen_Steel | 1.5 |
| 1432 | P1432 | N1441 | N1442 | N1587 | N1586 | gen_Steel | 1.5 |
| 1433 | P1433 | N1442 | N1443 | N1588 | N1587 | gen_Steel | 1.5 |
| 1434 | P1434 | N1443 | N1444 | N1589 | N1588 | gen_Steel | 1.5 |
| 1435 | P1435 | N1444 | N1445 | N1590 | N1589 | gen_Steel | 1.5 |
| 1436 | P1436 | N1445 | N1446 | N1591 | N1590 | gen_Steel | 1.5 |
| 1437 | P1437 | N1446 | N1447 | N1592 | N1591 | gen_Steel | 1.5 |
| 1438 | P1438 | N1447 | N1448 | N1593 | N1592 | gen_Steel | 1.5 |
| 1439 | P1439 | N1448 | N1449 | N1594 | N1593 | gen_Steel | 1.5 |
| 1440 | P1440 | N1449 | N1306 | N1451 | N1594 | gen_Steel | 1.5 |
| 1441 | P1441 | N2018 | N2019 | N2 | N1 | gen_Steel | .5 |
| 1442 | P1442 | N2019 | N2020 | N3 | N2 | gen_Steel | .5 |
| 1443 | P1443 | N2020 | N2021 | N4 | N3 | gen_Steel | .5 |
| 1444 | P1444 | N2021 | N2022 | N5 | N4 | gen_Steel | .5 |
| 1445 | P1445 | N2022 | N2023 | N6 | N5 | gen_Steel | .5 |
| 1446 | P1446 | N2023 | N2024 | N7 | N6 | gen_Steel | .5 |
| 1447 | P1447 | N2024 | N2025 | N8 | N7 | gen_Steel | .5 |
| 1448 | P1448 | N2025 | N2026 | N9 | N8 | gen_Steel | .5 |
| 1449 | P1449 | N2026 | N2027 | N10 | N9 | gen_Steel | .5 |
| 1450 | P1450 | N2027 | N2028 | N11 | N10 | gen_Steel | .5 |
| 1451 | P1451 | N2028 | N2029 | N12 | N11 | gen_Steel | .5 |
| 1452 | P1452 | N2029 | N2030 | N13 | N12 | gen_Steel | .5 |
| 1453 | P1453 | N2030 | N2031 | N14 | N13 | gen_Steel | .5 |
| 1454 | P1454 | N2031 | N2032 | N15 | N14 | gen_Steel | .5 |
| 1455 | P1455 | N2032 | N2033 | N16 | N15 | gen_Steel | .5 |
| 1456 | P1456 | N2033 | N2034 | N17 | N16 | gen_Steel | .5 |
| 1457 | P1457 | N2034 | N2035 | N18 | N17 | gen_Steel | .5 |
| 1458 | P1458 | N2035 | N2036 | N19 | N18 | gen_Steel | .5 |
| 1459 | P1459 | N2036 | N2037 | N20 | N19 | gen_Steel | .5 |
| 1460 | P1460 | N2037 | N2038 | N21 | N20 | gen_Steel | .5 |
| 1461 | P1461 | N2038 | N2039 | N22 | N21 | gen_Steel | .5 |
| 1462 | P1462 | N2039 | N2040 | N23 | N22 | gen_Steel | .5 |
| 1463 | P1463 | N2040 | N2041 | N24 | N23 | gen_Steel | .5 |
| 1464 | P1464 | N2041 | N2042 | N25 | N24 | gen_Steel | .5 |

## Plate Primary Data (Continued)

| | Label | A Joint | B Joint | C Joint | D Joint | Material | Thickness[in] |
|---|---|---|---|---|---|---|---|
| 3460 | P3460 | N4328 | N2169 | N3909 | N4330 | gen_Steel | .5 |
| 3461 | P3461 | N1469 | N19 | N2181 | N4334 | gen_Steel | .5 |
| 3462 | P3462 | N4334 | N2181 | N3921 | N4336 | gen_Steel | .5 |
| 3463 | P3463 | N1481 | N31 | N2193 | N4340 | gen_Steel | .5 |
| 3464 | P3464 | N4340 | N2193 | N3933 | N4342 | gen_Steel | .5 |
| 3465 | P3465 | N1493 | N43 | N2205 | N4346 | gen_Steel | .5 |
| 3466 | P3466 | N4346 | N2205 | N3945 | N4348 | gen_Steel | .5 |
| 3467 | P3467 | N1505 | N55 | N2217 | N4352 | gen_Steel | .5 |
| 3468 | P3468 | N4352 | N2217 | N3957 | N4354 | gen_Steel | .5 |
| 3469 | P3469 | N1517 | N67 | N2229 | N4358 | gen_Steel | .5 |
| 3470 | P3470 | N4358 | N2229 | N3969 | N4360 | gen_Steel | .5 |
| 3471 | P3471 | N1529 | N79 | N2241 | N4364 | gen_Steel | .5 |
| 3472 | P3472 | N4364 | N2241 | N3981 | N4366 | gen_Steel | .5 |
| 3473 | P3473 | N1541 | N91 | N2253 | N4370 | gen_Steel | .5 |
| 3474 | P3474 | N4370 | N2253 | N3993 | N4372 | gen_Steel | .5 |
| 3475 | P3475 | N1553 | N103 | N2265 | N4376 | gen_Steel | .5 |
| 3476 | P3476 | N4376 | N2265 | N4005 | N4378 | gen_Steel | .5 |
| 3477 | P3477 | N1565 | N115 | N2277 | N4382 | gen_Steel | .5 |
| 3478 | P3478 | N4382 | N2277 | N4017 | N4384 | gen_Steel | .5 |
| 3479 | P3479 | N1577 | N127 | N2289 | N4388 | gen_Steel | .5 |
| 3480 | P3480 | N4388 | N2289 | N4029 | N4390 | gen_Steel | .5 |

## Joint Loads and Enforced Displacements (BLC 1 : Leg Reaction)

| | Joint Label | L,D,M | Direction | Magnitude[(k,k-ft), (in,rad), (k*s^2/in, k*s^2*in)] |
|---|---|---|---|---|
| 1 | N1585A | L | X | 16 |
| 2 | N4033A | L | Y | 101 |

## Member Point Loads

| Member Label | Direction | Magnitude[k,k-ft] | Location[in,%] |
|---|---|---|---|
| No Data to Print ... | | | |

## Basic Load Cases

| | BLC Description | Category | X Gr... | Y Gr... | Z Gr... | Joint | Point | Distributed | Area... | Surface(... |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Leg Reaction | None | | | | 2 | | | | |

## Load Combinations

| | Description | Solve | PDelta | S... | B... | Fa... | B... | Fa... | B... | Factor | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... | B... | Fa... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Wind | Yes | | | | | 1 | 1 | | | | | | | | | | | | | | | | |

## Joint Reactions (By Combination)

| | LC | Joint Label | X [k] | Y [k] | Z [k] | MX [k-ft] | MY [k-ft] | MZ [k-ft] |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | N834 | -1.773 | -8.417 | 0 | 0 | 0 | 0 |
| 2 | 1 | N846 | -1.601 | -8.417 | .333 | 0 | 0 | 0 |
| 3 | 1 | N822 | -1.601 | -8.417 | -.333 | 0 | 0 | 0 |
| 4 | 1 | N858 | -1.243 | -8.417 | .381 | 0 | 0 | 0 |
| 5 | 1 | N810 | -1.243 | -8.417 | -.381 | 0 | 0 | 0 |
| 6 | 1 | N726 | -1.023 | -8.417 | .13 | 0 | 0 | 0 |
| 7 | 1 | N798 | -1.023 | -8.417 | -.13 | 0 | 0 | 0 |
| 8 | 1 | N738 | -1.113 | -8.417 | -.156 | 0 | 0 | 0 |

## Joint Reactions (By Combination) (Continued)

| | LC | Joint Label | X [k] | Y [k] | Z [k] | MX [k-ft] | MY [k-ft] | MZ [k-ft] |
|---|---|---|---|---|---|---|---|---|
| 9 | 1 | N786 | -1.113 | -8.417 | .156 | 0 | 0 | 0 |
| 10 | 1 | N750 | -1.376 | -8.417 | -.203 | 0 | 0 | 0 |
| 11 | 1 | N774 | -1.376 | -8.417 | .203 | 0 | 0 | 0 |
| 12 | 1 | N762 | -1.513 | -8.417 | 0 | 0 | 0 | 0 |
| 13 | 1 | Totals: | -16 | -101 | 0 | | | |
| 14 | 1 | COG (in): | X: 0 | Y: 7 | Z: 0 | | | |

## Plate Principal Stresses (By Combination)

| | LC | Plate Label | Loc | Sigma1[ksi] | Sigma2[ksi] | Tau Max[ksi] | Angle[rad] | Von Mises[ksi] |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | P108 | T | 5.681 | 1.47 | 2.106 | 1.608 | 5.107 |
| 2 | | | B | -1.433 | -5.26 | 1.913 | .03 | 4.71 |
| 3 | 1 | P109 | T | 5.681 | 1.47 | 2.106 | 1.534 | 5.107 |
| 4 | | | B | -1.433 | -5.26 | 1.913 | -.03 | 4.71 |
| 5 | 1 | P96 | T | 5.655 | 1.458 | 2.098 | 1.624 | 5.085 |
| 6 | | | B | -1.442 | -5.291 | 1.924 | .012 | 4.738 |
| 7 | 1 | P121 | T | 5.655 | 1.458 | 2.098 | 1.518 | 5.085 |
| 8 | | | B | -1.442 | -5.291 | 1.924 | -.012 | 4.738 |
| 9 | 1 | P97 | T | 5.64 | 1.468 | 2.086 | 1.551 | 5.068 |
| 10 | | | B | -1.434 | -5.304 | 1.935 | -.048 | 4.752 |
| 11 | 1 | P120 | T | 5.64 | 1.468 | 2.086 | 1.59 | 5.068 |
| 12 | | | B | -1.434 | -5.304 | 1.935 | .048 | 4.752 |
| 13 | 1 | P84 | T | 5.568 | 1.436 | 2.066 | 1.636 | 5.007 |
| 14 | | | B | -1.46 | -5.387 | 1.964 | 0 | 4.826 |
| 15 | 1 | P133 | T | 5.568 | 1.436 | 2.066 | 1.506 | 5.007 |
| 16 | | | B | -1.46 | -5.387 | 1.964 | 0 | 4.826 |
| 17 | 1 | P85 | T | 5.542 | 1.453 | 2.045 | 1.565 | 4.977 |
| 18 | | | B | -1.446 | -5.41 | 1.982 | -.062 | 4.852 |
| 19 | 1 | P132 | T | 5.542 | 1.453 | 2.045 | 1.577 | 4.977 |
| 20 | | | B | -1.446 | -5.41 | 1.982 | .062 | 4.852 |
| 21 | 1 | P72 | T | 5.441 | 1.413 | 2.014 | 1.64 | 4.89 |
| 22 | | | B | -1.484 | -5.521 | 2.019 | -.003 | 4.949 |
| 23 | 1 | P1 | T | 5.441 | 1.413 | 2.014 | 1.502 | 4.89 |
| 24 | | | B | -1.484 | -5.521 | 2.019 | .003 | 4.949 |
| 25 | 1 | P107 | T | 5.437 | 1.46 | 1.988 | 1.674 | 4.874 |
| 26 | | | B | -1.432 | -5.071 | 1.819 | .082 | 4.528 |
| 27 | 1 | P110 | T | 5.437 | 1.46 | 1.988 | 1.467 | 4.874 |
| 28 | | | B | -1.432 | -5.071 | 1.819 | -.082 | 4.528 |
| 29 | 1 | P95 | T | 5.426 | 1.439 | 1.993 | 1.691 | 4.869 |
| 30 | | | B | -1.448 | -5.088 | 1.82 | .064 | 4.541 |
| 31 | 1 | P122 | T | 5.426 | 1.439 | 1.993 | 1.451 | 4.869 |
| 32 | | | B | -1.448 | -5.088 | 1.82 | -.064 | 4.541 |
| 33 | 1 | P73 | T | 5.412 | 1.431 | 1.991 | 1.572 | 4.858 |
| 34 | | | B | -1.467 | -5.548 | 2.041 | -.067 | 4.98 |
| 35 | 1 | P144 | T | 5.412 | 1.431 | 1.991 | 1.57 | 4.858 |
| 36 | | | B | -1.467 | -5.548 | 2.041 | .067 | 4.98 |
| 37 | 1 | P98 | T | 5.386 | 1.467 | 1.959 | 1.486 | 4.823 |
| 38 | | | B | -1.425 | -5.122 | 1.849 | -.102 | 4.579 |
| 39 | 1 | P119 | T | 5.386 | 1.467 | 1.959 | 1.656 | 4.823 |
| 40 | | | B | -1.425 | -5.122 | 1.849 | .102 | 4.579 |
| 41 | 1 | P83 | T | 5.356 | 1.413 | 1.972 | 1.702 | 4.808 |
| 42 | | | B | -1.471 | -5.168 | 1.849 | .053 | 4.612 |
| 43 | 1 | P134 | T | 5.356 | 1.413 | 1.972 | 1.44 | 4.808 |
| 44 | | | B | -1.471 | -5.168 | 1.849 | -.053 | 4.612 |
| 45 | 1 | P60 | T | 5.308 | 1.394 | 1.957 | 1.635 | 4.767 |
| 46 | | | B | -1.508 | -5.656 | 2.074 | .004 | 5.073 |

## Plate Principal Stresses (By Combination) (Continued)

| | LC | Plate Label | Loc | Sigma1[ksi] | Sigma2[ksi] | Tau Max[ksi] | Angle[rad] | Von Mises[ksi] |
|---|---|---|---|---|---|---|---|---|
| 6944 | | | B | .222 | -.384 | .303 | 1.087 | .531 |
| 6945 | 1 | P1396 | T | .347 | -.266 | .306 | .538 | .532 |
| 6946 | | | B | .197 | -.419 | .308 | 1.993 | .545 |
| 6947 | 1 | P1413 | T | .347 | -.266 | .306 | -.538 | .532 |
| 6948 | | | B | .197 | -.419 | .308 | 1.149 | .545 |
| 6949 | 1 | P1432 | T | .359 | -.247 | .303 | .504 | .528 |
| 6950 | | | B | .211 | -.403 | .307 | 2.025 | .54 |
| 6951 | 1 | P1377 | T | .359 | -.247 | .303 | -.504 | .528 |
| 6952 | | | B | .211 | -.403 | .307 | 1.116 | .54 |
| 6953 | 1 | P1408 | T | .342 | -.266 | .304 | .542 | .528 |
| 6954 | | | B | .197 | -.423 | .31 | 1.99 | .549 |
| 6955 | 1 | P1401 | T | .342 | -.266 | .304 | -.542 | .528 |
| 6956 | | | B | .197 | -.423 | .31 | 1.152 | .549 |
| 6957 | 1 | P1420 | T | .347 | -.259 | .303 | .529 | .526 |
| 6958 | | | B | .202 | -.417 | .31 | 2.002 | .547 |
| 6959 | 1 | P1389 | T | .347 | -.259 | .303 | -.529 | .526 |
| 6960 | | | B | .202 | -.417 | .31 | 1.14 | .547 |

| | | | |
|---|---|---|---|
| JS INFRASTRUCTURE PARTNERS<br>2030 Main Street, Suite 200<br>Irvine, CA 92614 | Project Name:<br>SAL Unitah Ridge | Prepared by:<br>DVH | Reviewer:<br>EVR |
| | Project Description:<br>BASE PLATE & ANCHOR BOLTS | Date:<br>3/18/2021 | |

**Base Reactions** :

| | | |
|---|---|---|
| Uplift: | 110.93 | k |
| Shear: | 18.09 | k |
| Moment: | 0 | k-ft |

**Base Plate Check**

| BASEPLATE DESIGN | |
|---|---|
| THICKNESS (in) | 1.5 |
| STEEL GRADE (KSI) | 36.00 |
| fmax (KSI) | 5.11 |
| ADJUSTMENT PLASTIC SECTION(KSI) | 3.40 |
| fall (0.9Fy)(KSI) | 32.40 |
| PLATE STRESS | 10.5% |

Refer to Risa3D For Base Plate Max. Stress

**Anchor Bolts Check**

| ANCHOR BOLT DESIGN | |
|---|---|
| QUANTITY | 12 |
| DIAMETER (in) | 1.25 |
| ULTIMATE STRENGTH (ksi) | 75 |
| MAX TENSION (K) | 8.417 |
| EFFECTIVE AREA (in^2) | 0.981748 |
| ALLOWABLE TENSION | 58.90486 |
| η = 0.55 (GROUTED); 0.50 (ELEVATED) | 0.55 |
| MAX SHEAR (K) | 16 |
| INTERACTION CHECK | 18.4% |

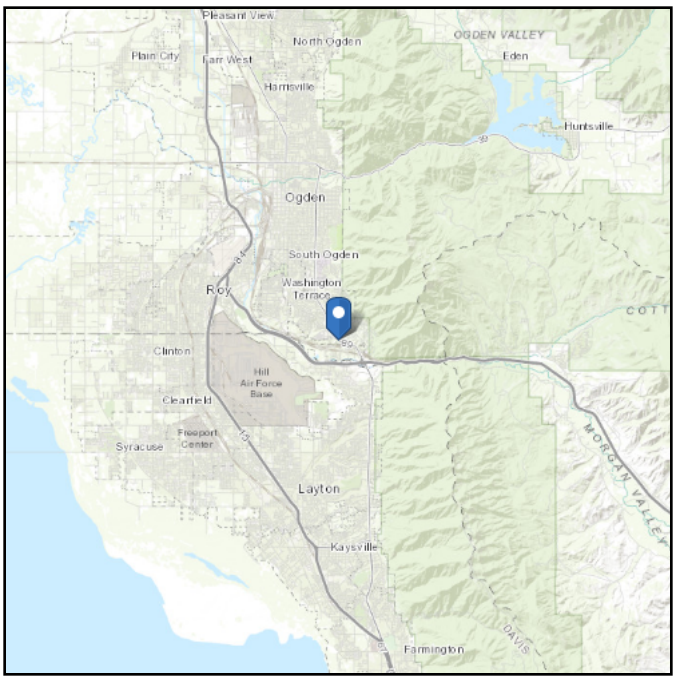
Refer Risa Reaction for Anchor Bolt Max Reaction

# ASCE 7 Hazards Report

**Address:**
No Address at This Location

**Standard:** ASCE/SEI 7-16
**Risk Category:** II
**Soil Class:** D - Default (see Section 11.4.3)

**Elevation:** 4810.42 ft (NAVD 88)
**Latitude:** 41.14901
**Longitude:** -111.9326


## Wind

**Results:**

| | |
|---|---|
| Wind Speed: | 103 Vmph |
| 10-year MRI | 74 Vmph |
| 25-year MRI | 80 Vmph |
| 50-year MRI | 84 Vmph |
| 100-year MRI | 89 Vmph |

| | |
|---|---|
| Data Source: | ASCE/SEI 7-16, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2 |
| Date Accessed: | Mon Mar 15 2021 |

Value provided is 3-second gust wind speeds at 33 ft above ground for Exposure C Category, based on linear interpolation between contours. Wind speeds are interpolated in accordance with the 7-16 Standard. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (annual exceedance probability = 0.00143, MRI = 700 years).

Site is not in a hurricane-prone region as defined in ASCE/SEI 7-16 Section 26.2.

# Seismic

**Site Soil Class:** D - Default (see Section 11.4.3)

**Results:**

| | | | |
|---|---|---|---|
| $S_S$ : | 1.325 | $S_{D1}$ : | N/A |
| $S_1$ : | 0.487 | $T_L$ : | 8 |
| $F_a$ : | 1.2 | PGA : | 0.607 |
| $F_v$ : | N/A | $PGA_M$ : | 0.729 |
| $S_{MS}$ : | 1.59 | $F_{PGA}$ : | 1.2 |
| $S_{M1}$ : | N/A | $I_e$ : | 1 |
| $S_{DS}$ : | 1.06 | $C_v$ : | 1.365 |

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

**Data Accessed:** Mon Mar 15 2021

**Date Source:** USGS Seismic Design Maps

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