



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"

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



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

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 8' Panel Antenna	2	Pipe-Mounted (behind Screen Wall Panels)	(2)1-1/4: Hybrid Cables
	290°	JMA X7CQAP-FRO-845-VR4 8' Panel Antenna	2		
	-	Ericsson 4449 Remote Radio Head	2		
	-	Ericsson 8843 Remote Radio Head	2		
	-	Raycap RRODC-3315-PF-48 Main OVP	2		
	30° 290°	5G L-Sub6 Antenna 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: $F_y = 35$ ksi.
- Wide Flange: $F_y = 36$ ksi.
- HSS Tube: $F_y = 46$ 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.

 2030 Main Street, Suite 200 Irvine, CA 92614	Project Name: SAL Utah Ridge	Prepared by: DVH	Reviewer: EVR
	Project Description: Seismic Force Calculation	Date: 3/18/2021	

Seismic Load Calculation

Tower Height $H = 60.00$ ft
Tower Weight $W = 39.20$ kips
(Including Appurtenance)
Top 5% Weight $W_2 = 2.80$ kips

Structure+Appurt.

Tower Properties:

$K_f = 4540$
Top Face Width $w_{TOP} = 16$ ft
Base Face Width $w_0 = 16$ ft
Average Face Width $w_a = 16$ ft
 $W_1 = W[(w_a/w_0)^2 + 0.15] = 45.08$ kips
Fundamental Frequency of Structure

$$f_1 = \frac{K_f(w_a)}{h^2} \sqrt{\frac{W_1}{W_1 + W_2}} = 19.58 \text{ Hertz}$$

Fundamental Perior of Structure

$$T = 1/f_1 = 0.05 \text{ s}$$

* Site Specific Seismic coefficients S_s & S_1 , Site Class, and SDC can be obtained from ASCE website Below:

<https://asce7hazardtool.online/>

$$\begin{aligned}
S_s &= 1.325 & F_a &= 1.2 \\
S_1 &= 0.487 & F_v &= N/A \\
S_{DS} &= 2/3 * S_s * F_a = 1.060 \\
S_{D1} &= 2/3 S_1 * F_v = N/A
\end{aligned}$$

$$\begin{aligned}
T_L &= 8 \text{ s} \\
I &= 1 \\
R &= 1.5
\end{aligned}$$

ASCE 7 Hazards Report

Table 2-3

Seismic Response Coefficient C_s

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

$$\begin{aligned}
C_s &\leq \frac{S_{D1} I}{T R} \text{ when } T \leq T_L \\
C_s &= \frac{S_{D1} T_L I}{T^2 R} \text{ when } T > T_L
\end{aligned}$$

N/A

$$C_s \geq 0.044 * S_{DS} * I \text{ or } 0.03 \quad 0.047$$

$$C_s \geq 0.8 * S_1 * I / R \text{ if } S_1 \geq 0.6$$

$$C_s = 0.707$$

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

Total Seismic Shear Force:

$$V_s = C_s * W = 27.701 \text{ kips}$$

Vertical Distribution of Seismic Force:

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

$$k_e = 1$$

Appurtenances / Pole Sections Elev.	w _x (kip)	h _x (ft)	w _x h _x ^ k	E _h F _{sz} (kips)	E _v =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

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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.

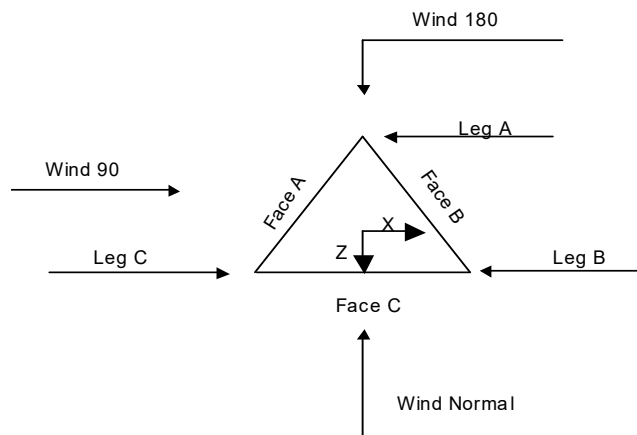
Stress ratio used in tower member design is 1.

Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.

Options

- | | | |
|--|---|---|
| <ul style="list-style-type: none"> √ Consider Moments - Legs √ Consider Moments - Horizontals Consider Moments - Diagonals Use Moment Magnification √ Use Code Stress Ratios √ Use Code Safety Factors - Guys Escalate Ice Always Use Max Kz Use Special Wind Profile Include Bolts In Member Capacity √ Leg Bolts Are At Top Of Section Secondary Horizontal Braces Leg Use Diamond Inner Bracing (4 Sided) SR Members Have Cut Ends SR Members Are Concentric | <ul style="list-style-type: none"> √ Distribute Leg Loads As Uniform Assume Legs Pinned Assume Rigid Index Plate √ Use Clear Spans For Wind Area √ Use Clear Spans For KL/r Retension Guys To Initial Tension Bypass Mast Stability Checks √ Use Azimuth Dish Coefficients √ Project Wind Area of Appurt. Autocalc Torque Arm Areas Add IBC .6D+W Combination √ Sort Capacity Reports By Component Triangulate Diamond Inner Bracing Treat Feed Line Bundles As Cylinder Ignore KL/ry For 60 Deg. Angle Legs | <ul style="list-style-type: none"> Use ASCE 10 X-Brace Ly Rules √ Calculate Redundant Bracing Forces √ Ignore Redundant Members in FEA SR Leg Bolts Resist Compression All Leg Panels Have Same Allowable Offset Girt At Foundation √ Consider Feed Line Torque √ Include Angle Block Shear Check Use TIA-222-H Bracing Resist. Exemption Use TIA-222-H Tension Splice Exemption <div style="background-color: #e0e0e0; text-align: center; padding: 2px;">Poles</div> <ul style="list-style-type: none"> Include Shear-Torsion Interaction Always Use Sub-Critical Flow Use Top Mounted Sockets Pole Without Linear Attachments Pole With Shroud Or No Appurtenances Outside and Inside Corner Radii Are Known |
|--|---|---|

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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)

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<i>Tower Elevation ft</i>	<i>Leg Type</i>	<i>Leg Size</i>	<i>Leg Grade</i>	<i>Diagonal Type</i>	<i>Diagonal Size</i>	<i>Diagonal Grade</i>
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)

<i>Tower Elevation ft</i>	<i>Top Girt Type</i>	<i>Top Girt Size</i>	<i>Top Girt Grade</i>	<i>Bottom Girt Type</i>	<i>Bottom Girt Size</i>	<i>Bottom Girt Grade</i>
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)

<i>Tower Elevation ft</i>	<i>No. of Mid Girts</i>	<i>Mid Girt Type</i>	<i>Mid Girt Size</i>	<i>Mid Girt Grade</i>	<i>Horizontal Type</i>	<i>Horizontal Size</i>	<i>Horizontal Grade</i>
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)

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

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

Tower Section Geometry (cont'd)

Tower Elevation	Gusset Area (per face)	Gusset Thickness	Gusset Grade	Adjust. Factor A _f	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals	Double Angle Stitch Bolt Spacing Horizontals	Double Angle Stitch Bolt Spacing Redundants
ft	ft ²	in					in	in	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	Calc K Single Angles	Calc K Solid Rounds	K Factors ¹							
			Legs	X Brace Diags	K Brace Diags	Single Diags	Girts	Horiz.	Sec. Horiz.	Inner Brace
				X Y	X Y	X Y	X Y	X Y	X Y	X Y
T1 61.00-41.00	No	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 41.00-21.00	No	No	1	1 1	1 1	1 1	1 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

¹Note: 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.

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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	0	0.6250	0	0.7500	10	1.0000	10	0.6250	4	0.6250	0	0.6250	0
		A325N		A325N		A325N		A325N		A325N		A325N		A325N	
T2 41.00-21.00	Flange	0.0000	0	0.6250	0	0.0000	0	1.0000	10	0.0000	0	0.6250	0	0.6250	0
		A325N		A325N		A325N		A325N		A325N		A325N		A325N	
T3 21.00-1.00	Flange	1.2500	12	0.6250	0	0.0000	0	0.0000	0	0.0000	0	0.6250	0	0.6250	0
		A325N		A325N		A325N		A325N		A325N		A325N		A325N	

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		$C_A A_A$ 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 1/2" Ice	0.16 0.25	0.66 1.91

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R	A_F	$C_A A_A$ In Face ft ²	$C_A A_A$ Out Face ft ²	Weight K
			ft ²	ft ²	ft ²	ft ²	
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

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Tower Section	Tower Elevation ft	Face	A _R ft ²	A _F ft ²	C _A A _A In Face ft ²	C _A A _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 _A A _A In Face ft ²	C _A A _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

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

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

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft	Aperture Area ft ²	Weight 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

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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

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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
		Top Girt	Max. Vx	2	-11.24	0.01	80.93
			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
		Bottom Girt	Max. Vy	4	3.97	-29.91	-0.00
			Max. Vx	10	-0.01	-26.05	-0.06
			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
		Mid Girt	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
			Max Tension	2	1.00	0.00	0.00
			Max. Compression	15	-0.95	0.00	0.00
T2	41 - 21	Leg	Max. Mx	26	0.07	0.45	0.00
			Max. Vy	26	-0.11	0.00	0.00
			Max Tension	23	103.22	-262.16	-151.32
			Max. Compression	18	-128.60	-258.24	149.04
		Bottom Girt	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
			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
T3	21 - 1	Leg	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
			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

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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	Overturing Moment, M _x kip-ft	Overturing 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

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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
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

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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
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

Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ 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%

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Load Comb.	Sum of Applied Forces			Sum of Reactions			% Error
	PX K	PY K	PZ K	PX K	PY K	PZ K	
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

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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

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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

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Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	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	Component Type	Bolt Grade	Bolt Size	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load Allowable	Allowable Ratio	Criteria
	ft			in						
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	Size	L	L _u	Kl/r	A	P _u	φP _n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in ²	K	K	
T1	61 - 41	P20x.5	20.00	9.50	16.5 K=1.00	30.6305	-12.17	951.46	0.013
T2	41 - 21	P20x.5	20.00	1.00	1.7 K=1.00	30.6305	-128.36	964.71	0.133
T3	21 - 1	P20x.5	20.00	20.00	34.8 K=1.00	30.6305	-129.60	906.87	0.143

Leg Bending Design Data (Compression)

Section No.	Elevation	Size	M _{ux}	φM _{nx}	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M _{uy}	φM _{ny}	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
	ft		kip-ft	kip-ft		kip-ft	kip-ft	

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Section No.	Elevation ft	Size	M_{ux} kip-ft	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{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	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	61 - 41	W8x35	16.00	10.75	63.5 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	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{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 ✓

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Bottom Girt Design Data (Compression)

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

Bottom Girt Bending Design Data

Section No.	Elevation	Size	M _{ux}	φM _{nx}	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M _{uy}	φM _{ny}	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
	ft		kip-ft	kip-ft	$\frac{M_{ux}}{\phi M_{nx}}$	kip-ft	kip-ft	$\frac{M_{uy}}{\phi M_{ny}}$
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
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	φP _n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in ²	K	K	$\frac{\phi P_n}{\phi P_n}$
T1	61 - 41	TS3.5x3.5x.25	16.00	14.33	131.3 K=1.00	3.0900	-0.95	40.49	0.023

Mid Girt Bending Design Data

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

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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	0.023	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	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
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	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{ny} kip-ft	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
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 $\frac{P_u}{\phi P_n}$	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	0.003	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)

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Section No.	Elevation	Size	L	L _u	Kl/r	A	P _u	φP _n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in ²	K	K	
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	Size	M _{ux}	φM _{nx}	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M _{uy}	φM _{ny}	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
	ft		kip-ft	kip-ft		kip-ft	kip-ft	
T1	61 - 41	W8x35	-26.17	86.45	0.303	-0.01	42.93	0.000

Top 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	W8x35	0.002	0.303	0.000	0.304 ✓	1.000	4.8.1 ✓

Bottom Girt Design Data (Tension)

Section No.	Elevation	Size	L	L _u	Kl/r	A	P _u	φP _n	Ratio $\frac{P_u}{\phi P_n}$
	ft		ft	ft		in ²	K	K	
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	Size	M _{ux}	φM _{nx}	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M _{uy}	φM _{ny}	Ratio $\frac{M_{uy}}{\phi M_{ny}}$
	ft		kip-ft	kip-ft		kip-ft	kip-ft	
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	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	0.462	0.001	0.462	1.000	4.8.1 ✓

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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	ϕP_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	ϕM_{nx} kip-ft	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	M_{uy} kip-ft	ϕM_{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

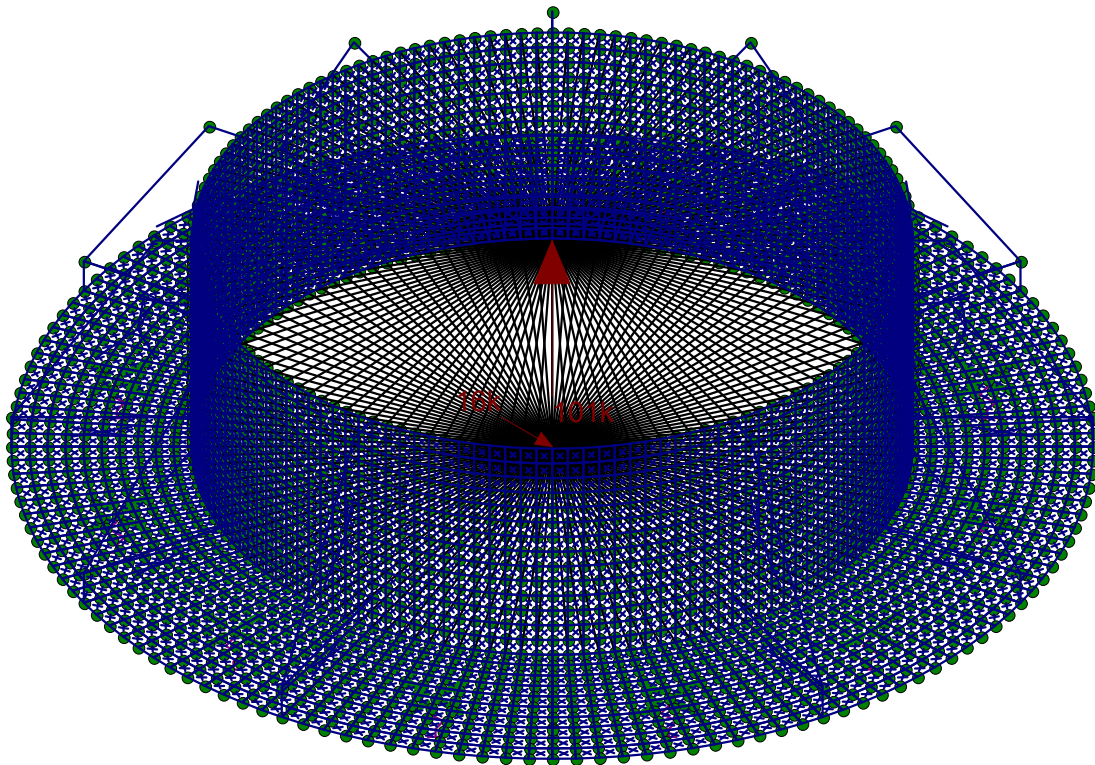
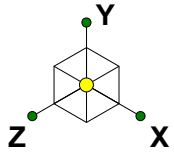
Section No.	Elevation ft	Size	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
T1	61 - 41	TS3.5x3.5x.25	0.002	0.035	0.000	0.037 ✓	1.000	4.8.1 ✓

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{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

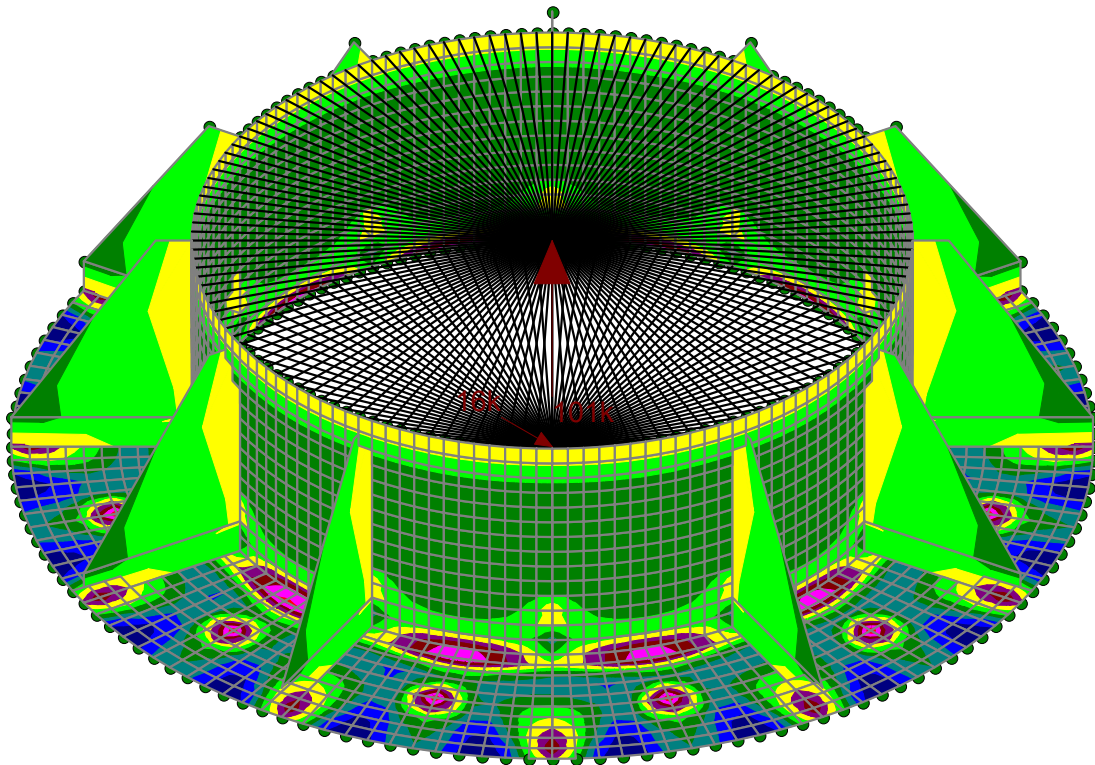
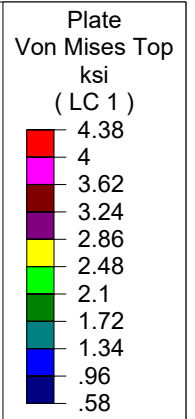
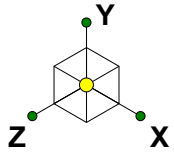
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Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
						Mid Girt (T1)	4.3	Pass
						Bolt Checks	9.9	Pass
						RATING =	69.2	Pass



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
Danh Ho, E.I.T
SAL Unitah Ridge

Tower Leg Baseplate

SK - 2

Mar 18, 2021 at 6:52 AM

SAL Unitah Baseplate Model.r3d

Joint Boundary Conditions

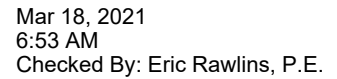
	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N798	Reaction	S2964	Reaction			
2	N786	Reaction	S2964	Reaction			
3	N774	Reaction	S2964	Reaction			
4	N762	Reaction	S2964	Reaction			
5	N750	Reaction	S2964	Reaction			
6	N738	Reaction	S2964	Reaction			
7	N726	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



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

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

[illegible]

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
2	1	N846	-1.601	-8.417	.333	0	0
3	1	N822	-1.601	-8.417	-.333	0	0
4	1	N858	-1.243	-8.417	.381	0	0
5	1	N810	-1.243	-8.417	-.381	0	0
6	1	N726	-1.023	-8.417	.13	0	0
7	1	N798	-1.023	-8.417	-.13	0	0
8	1	N738	-1.113	-8.417	-.156	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
10	1	N750	-1.376	-8.417	-.203	0	0
11	1	N774	-1.376	-8.417	.203	0	0
12	1	N762	-1.513	-8.417	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	T	.347	-.266	.306	.538	.532
6946		B	.197	-.419	.308	1.993	.545
6947	1	T	.347	-.266	.306	-.538	.532
6948		B	.197	-.419	.308	1.149	.545
6949	1	T	.359	-.247	.303	.504	.528
6950		B	.211	-.403	.307	2.025	.54
6951	1	T	.359	-.247	.303	-.504	.528
6952		B	.211	-.403	.307	1.116	.54
6953	1	T	.342	-.266	.304	.542	.528
6954		B	.197	-.423	.31	1.99	.549
6955	1	T	.342	-.266	.304	-.542	.528
6956		B	.197	-.423	.31	1.152	.549
6957	1	T	.347	-.259	.303	.529	.526
6958		B	.202	-.417	.31	2.002	.547
6959	1	T	.347	-.259	.303	-.529	.526
6960		B	.202	-.417	.31	1.14	.547



2030 Main Street, Suite 200
Irvine, CA 92614

Project Name:
SAL Unitah Ridge

Project Description:
BASE PLATE & ANCHOR BOLTS

Prepared by:
DVH

Reviewer:
EVR

Date:
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
f _{all} (0.9F _y)(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
$\eta = 0.55$ (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

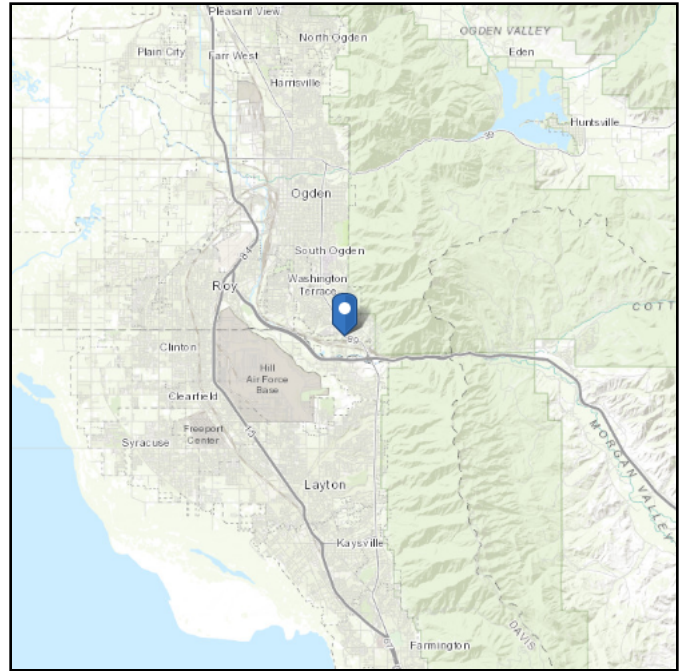
Risk Category: II**Soil Class:**

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.

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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