Date: **February 10, 2023**

Tower Engineering Professionals
326 Tryon Road
Raleigh, NC 27603
(919) 661-6351

Subject: Structural Modification Analysis Report

Carrier Designation:	***T-Mobile* Co-Locate**	
	Site Number:	SE02525A
	Site Name:	N/A
Crown Castle Designation:	**BU Number:**	880416
	Site Name:	SEATTLE QWEST - SEA155
	JDE Job Number:	677116
	Work Order Number:	2200969
	Order Number:	578276 Rev. 8
Engineering Firm Designation:	**TEP Project Number:**	151934.819073
Site Data:	**8477 SE 68th Street, Mercer Island, King County, WA 98040** **Latitude *47° 32' 30.00"*, Longitude *-122° 13' 25.00"*** **130 Foot - Concealment Tower**	

Tower Engineering Professionals is pleased to submit this **"Structural Modification Analysis Report"** to determine the structural integrity of the above-mentioned tower.

The purpose of the analysis is to determine acceptability of the tower stress level including the proposed modifications as outlined in the attached drawings, "Appendix D". Based on our analysis we have determined the tower stress level for the structure and foundation, under the following load case, to be:

LC4: Modified Structure w/ Proposed Equipment Configuration **Sufficient Capacity**

This analysis has been performed in accordance with the 2018 Washington State Building Code based upon an ultimate 3-second gust wind speed of 98 mph. Applicable Standard references and design criteria are listed in Section 2 - Analysis Criteria.

Structural analysis prepared by: Matthew Crispi, E.I. / RKE

Respectfully submitted by:

Ronnie E. Glover, P.E., S.E.

02/10/2023

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1) INTRODUCTION

This is a 130-ft concealment tower designed by Rohn and mapped by CMC Communications in January of 2015 and FDH, Inc. in October 2014. The base tower is 100-ft and the concealment spine extends from 100-ft to 130-ft. The tower has been modified per reinforcement drawings prepared by GPD Group in September of 2018. A proposed canister expansion was considered in this analysis, enlarging the 110-ft to 130-ft canister sections from 40.0-in to 60.0-in diameter.

2) ANALYSIS CRITERIA

TIA-222 Revision:	TIA-222-H
Risk Category:	II
Wind Speed:	98 mph
Exposure Category:	B
Topographic Factor:	1.182
Ice Thickness:	1.0 in
Wind Speed with Ice:	30 mph
Seismic Ss:	1.461
Seismic S1:	0.505
Service Wind Speed:	60 mph

Table 1 - Proposed Equipment Configuration

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
125.0	128.0	3	Nokia	AEHC w/ Mount Pipe	-	-
	125.0	1	Generic	60" Dia. x 10' Long Ventilated Concealment Canister		
	124.0	3	Nokia	AHLOA_T-MOBILE		
		3	Nokia	AHFIG_TMO		
	121.0	2	Commscope	HCS 2.0		
117.0	117.0	3	Commscope	FFVV-65C-R3-V1_TMO w/ Mount Pipe	2	1-1/2
115.0	115.0	1	Generic	60" Dia. x 10' Long Ventilated Concealment Canister	-	-

Table 2 - Other Considered Equipment

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)
130.0	130.0	1	GPS	GPS_A	1	1/2
105.0	107.0	3	Commscope	NHH-65A-R2B w/ Mount Pipe	6	7/8
		3	JMA Wireless	TBC-67C-A-P-2SF		
	105.0	1	Generic	40" Dia. x 10' Long Concealment Canister		

3) ANALYSIS PROCEDURE

Table 3 - Documents Provided

Document	Reference	Source
Geotechnical Report	1584043	CCISites
Tower Foundation Drawings	2030381	CCISites
Tower Manufacturer Drawings	2030383	CCISites
Tower Mapping Report		
Tower Reinforcement Drawings	7839688	CCISites
Post-Modification Inspection	8856717	CCISites

3.1) Analysis Method

tnxTower (version 8.1.1.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A. When applicable, Crown Castle has calculated and provided the effective area for panel antennas using approved methods following the intent of the TIA-222 Standard.

RISA-3D, a commercially available analysis software package, was used to run a modal analysis for the seismic loading on the tower. Selected output from the analysis is included in Appendix C.

SolidWorks, a commercially available analysis software package, was used to create a finite element model of the canister spine flange connection at the 100-ft level. Selected output from the analysis is included in Appendix C - Additional Calculations.

3.2) Assumptions

1) The tower and structures were maintained in accordance with the TIA-222 Standard.
2) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2, and the referenced drawings.
3) Base and flange plate design methodology of the manufacturer has been reviewed and found to be an acceptable means of designing to resist the full capacity of the bolts and shaft.

This analysis may be affected if any assumptions are not valid or have been made in error. Tower Engineering Professionals should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 4 - Section Capacity (Summary)

Section No.	Elevation (ft)	Component Type	Size	Critical Element	P (k)	ϕP_{allow} (k)	% Capacity	Pass / Fail
L1	130 - 120	Pole	P6.625x0.432	1	-1.487	333.592	13.1	Pass
L2	120 - 110	Pole	P6.625x0.432	2	-3.100	333.592	49.3	Pass
L3	110 - 100	Pole	P8.625x0.5	3	-4.664	506.553	50.0	Pass
L4	100 - 60	Pole	P36x0.375	4	-12.714	1564.605	14.7	Pass
L5	60 - 20	Pole	P36x0.375	5	-19.926	1564.605	28.4	Pass
L6	20 - 0	Pole	P36x0.375	6	-23.519	1564.605	36.1	Pass
							Summary	
						Pole (L3)	50.0	Pass
						RATING =	**50.0**	**Pass**

Table 5 - Tower Component Stresses vs. Capacity - LC4

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
1,2	Flange Connection	120.0	6.5	Pass
1,2	Flange Connection	110.0	23.8	Pass
1	Flange Connection (Stiffener Welds)	100.0	Sufficient	Pass
1,2	Flange Bolts	100.0	25.4	Pass
1,2,3	Flange Connection	60.0	14.7	Pass
1,2,3	Flange Connection	20.0	28.4	Pass
1,2	Anchor Rods	-	33.4	Pass
1,2,3	Base Plate	-	36.1	Pass
1,2	Base Foundation Structural	-	15.2	Pass
1,2	Base Foundation Soil Interaction	-	23.8	Pass

Structure Rating (max from all components) =	**50.0%**

Notes:
1) See additional documentation in "Appendix C - Additional Calculations" for calculations supporting the % capacity listed.
2) Rating per TIA-222-H Section 15.5
3) Base/Flange plates are assumed to have the same capacity as their respective splice bolts or shaft.

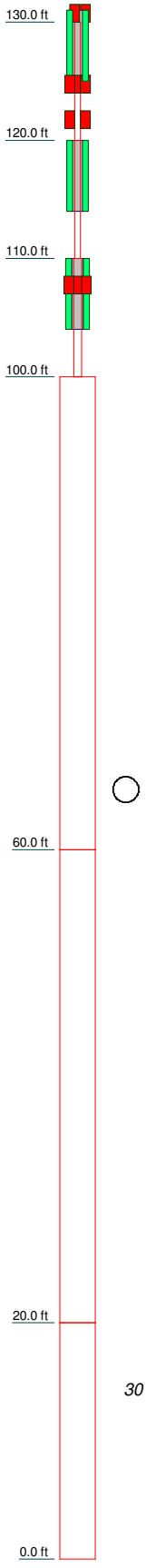
4.1) Recommendations

1) The modifications depicted in “Appendix D – Structural Design Drawings” shall be installed and, upon completion, inspected. The tower and its foundation have sufficient capacity to carry the proposed load configuration once the proposed modifications are installed.

APPENDIX A

TNXTOWER OUTPUT

Section	Size	Length (ft)	Grade	Weight (K)
1	P6.625x0.432	10.00	A53-B-42	0.3
2	P6.625x0.432	10.00		0.3
3	P8.625x0.5	10.00		0.4
4	P36x0.375	40.00		5.7
5	P36x0.375	40.00		5.7
6	P36x0.375	20.00		2.9
				15.3



MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A53-B-42	42 ksi	63 ksi			

TOWER DESIGN NOTES

1. Tower is located in King County, Washington.
2. Tower designed for Exposure B to the TIA-222-H Standard.
3. Tower designed for a 98 mph basic wind in accordance with the TIA-222-H Standard.
4. Tower is also designed for a 30 mph basic wind with 1.00 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 5 with Crest Height of 360.00 ft
8. TOWER RATING: 50%

ALL REACTIONS ARE FACTORED

AXIAL 31 K

SHEAR 1 K *MOMENT 87 kip-ft*

TORQUE 0 kip-ft

30 mph WIND - 1.0000 in ICE

AXIAL 24 K

SHEAR 5 K *MOMENT 487 kip-ft*

TORQUE 0 kip-ft

REACTIONS - 98 mph WIND

Tower Engineering Professionals, Inc.

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326 Tryon Rd.
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Phone: (909) 661-6351
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Job: ***SEATTLE QWEST - SEA155 (BU 880416)***			
Project: ***TEP No. 151934.819073***			
Client: Crown Castle	Drawn by: mcrispi	App'd:	
Code: TIA-222-H	Date: 01/31/23	Scale: NTS	
Path:		Dwg No. E-1	

Tower Input Data

The tower is a monopole.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

Tower is located in King County, Washington.
Tower base elevation above sea level: 349.00 ft.
Basic wind speed of 98 mph.
Risk Category II.
Exposure Category B.
Crest Height: 360.00 ft.
Rigorous Topographic Factor Procedure for wind speed-up calculations is used.
Topographic Feature: Continuous Escarpment.
Slope Distance L: 2360.00 ft.
Distance from Crest x: 2945.00 ft.
Horizontal Distance Downwind: No.
Nominal ice thickness of 1.0000 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 30 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 pole design is 1.
Tower analysis based on target reliabilities in accordance with Annex S.
Load Modification Factors used: $K_{es}(F_w) = 0.95$, $K_{es}(t_i) = 0.85$.
Maximum demand-capacity ratio is: 1.05.
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

Pole Section Geometry

Section	Elevation ft	Section Length ft	Pole Size	Pole Grade	Socket Length ft
L1	130.00-120.00	10.00	P6.625x0.432	A53-B-42 (42 ksi)	
L2	120.00-110.00	10.00	P6.625x0.432	A53-B-42 (42 ksi)	
L3	110.00-100.00	10.00	P8.625x0.5	A53-B-42 (42 ksi)	
L4	100.00-60.00	40.00	P36x0.375	A53-B-42 (42 ksi)	
L5	60.00-20.00	40.00	P36x0.375	A53-B-42 (42 ksi)	
L6	20.00-0.00	20.00	P36x0.375	A53-B-42 (42 ksi)	

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
L1 130.00-120.00				1	0	1			
L2 120.00-110.00				1	0	1			
L3 110.00-100.00				1	0	1			
L4 100.00-60.00				1	1	1			
L5 60.00-20.00				1	1	1			
L6 20.00-0.00				1	1	1			

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number	Number Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
***											
***											

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
3/4" Lighting Cable	C	No	No	Inside Pole	130.00 - 0.00	1	No Ice	0.00	0.35
							1/2" Ice	0.00	0.35

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
							1" Ice	0.00	0.35
***									
***									
***									
LDF4-50A(1/2)	C	No	No	Inside Pole	130.00 - 0.00	1	No Ice	0.00	0.15
							1/2" Ice	0.00	0.15
							1" Ice	0.00	0.15
1" Rigid Conduit	C	No	No	Inside Pole	130.00 - 0.00	1	No Ice	0.00	1.13
							1/2" Ice	0.00	1.13
							1" Ice	0.00	1.13
***									
***									
HCS 2.0 Part 3(1-1/2)	B	No	No	Inside Pole	117.00 - 0.00	2	No Ice	0.00	1.71
							1/2" Ice	0.00	1.71
							1" Ice	0.00	1.71
AVA5-50 (7/8")	B	No	No	Inside Pole	105.00 - 0.00	6	No Ice	0.00	0.30
							1/2" Ice	0.00	0.30
							1" Ice	0.00	0.30
***									

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
L1	130.00-120.00	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.000
		C	0.000	0.000	0.000	0.000	0.016
L2	120.00-110.00	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.024
		C	0.000	0.000	0.000	0.000	0.016
L3	110.00-100.00	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.043
		C	0.000	0.000	0.000	0.000	0.016
L4	100.00-60.00	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.209
		C	0.000	0.000	0.000	0.000	0.065
L5	60.00-20.00	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.209
		C	0.000	0.000	0.000	0.000	0.065
L6	20.00-0.00	A	0.000	0.000	0.000	0.000	0.000
		B	0.000	0.000	0.000	0.000	0.104
		C	0.000	0.000	0.000	0.000	0.033

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
L1	130.00-120.00	A	0.971	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.000

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft²	A_F ft²	C_AA_A In Face ft²	C_AA_A Out Face ft²	Weight K
		C		0.000	0.000	0.000	0.000	0.016
L2	120.00-110.00	A	0.963	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.024
		C		0.000	0.000	0.000	0.000	0.016
L3	110.00-100.00	A	0.954	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.043
		C		0.000	0.000	0.000	0.000	0.016
L4	100.00-60.00	A	0.929	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.209
		C		0.000	0.000	0.000	0.000	0.065
L5	60.00-20.00	A	0.868	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.209
		C		0.000	0.000	0.000	0.000	0.065
L6	20.00-0.00	A	0.754	0.000	0.000	0.000	0.000	0.000
		B		0.000	0.000	0.000	0.000	0.104
		C		0.000	0.000	0.000	0.000	0.033

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
L1	130.00-120.00	0.0000	0.0000	0.0000	0.0000
L2	120.00-110.00	0.0000	0.0000	0.0000	0.0000
L3	110.00-100.00	0.0000	0.0000	0.0000	0.0000
L4	100.00-60.00	0.0000	0.0000	0.0000	0.0000
L5	60.00-20.00	0.0000	0.0000	0.0000	0.0000
L6	20.00-0.00	0.0000	0.0000	0.0000	0.0000

Note: For pole sections, center of pressure calculations do not consider feed line shielding.

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft²	C_AA_A Side ft²	Weight K
(2) 9"x5"x3.5" Sidelight	C	From Leg	0.00 0.00	0.0000	130.00	No Ice 1/2" Ice	0.38 0.46	0.26 0.34	0.002 0.006
			0.00			1" Ice	0.55	0.42	0.011
***									
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GPS_A	B	From Face	0.50 0.00	0.0000	130.00	No Ice 1/2" Ice	0.13 0.21	0.13 0.21	0.001 0.004
			0.00			1" Ice	0.28	0.28	0.008
125									
AEHC w/ Mount Pipe	A	From Leg	0.50 0.00	0.0000	125.00	No Ice 1/2" Ice	0.00 0.00	0.00 0.00	0.114 0.165

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			3.00			1" Ice	0.00	0.00	0.223
AEHC w/ Mount Pipe	B	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.114
			0.00			1/2" Ice	0.00	0.00	0.165
			3.00			1" Ice	0.00	0.00	0.223
AEHC w/ Mount Pipe	C	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.114
			0.00			1/2" Ice	0.00	0.00	0.165
			3.00			1" Ice	0.00	0.00	0.223
(2) AHLOA_T-MOBILE	A	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.084
			0.00			1/2" Ice	0.00	0.00	0.107
			-1.00			1" Ice	0.00	0.00	0.133
AHLOA_T-MOBILE	B	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.084
			0.00			1/2" Ice	0.00	0.00	0.107
			-1.00			1" Ice	0.00	0.00	0.133
AHFIG_TMO	A	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.071
			0.00			1/2" Ice	0.00	0.00	0.092
			-1.00			1" Ice	0.00	0.00	0.116
AHFIG_TMO	B	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.071
			0.00			1/2" Ice	0.00	0.00	0.092
			-1.00			1" Ice	0.00	0.00	0.116
AHFIG_TMO	C	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.071
			0.00			1/2" Ice	0.00	0.00	0.092
			-1.00			1" Ice	0.00	0.00	0.116
HCS 2.0	B	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.001
			0.00			1/2" Ice	0.00	0.00	0.010
			-4.00			1" Ice	0.00	0.00	0.020
HCS 2.0	C	From Leg	0.50	0.0000	125.00	No Ice	0.00	0.00	0.001
			0.00			1/2" Ice	0.00	0.00	0.010
			-4.00			1" Ice	0.00	0.00	0.020
***									
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FFVV-65C-R3-V1_TMO w/ Mount Pipe	A	From Leg	0.50	0.0000	117.00	No Ice	0.00	0.00	0.157
			0.00			1/2" Ice	0.00	0.00	0.292
			0.00			1" Ice	0.00	0.00	0.442
FFVV-65C-R3-V1_TMO w/ Mount Pipe	B	From Leg	0.50	0.0000	117.00	No Ice	0.00	0.00	0.157
			0.00			1/2" Ice	0.00	0.00	0.292
			0.00			1" Ice	0.00	0.00	0.442
FFVV-65C-R3-V1_TMO w/ Mount Pipe	C	From Leg	0.50	0.0000	117.00	No Ice	0.00	0.00	0.157
			0.00			1/2" Ice	0.00	0.00	0.292
			0.00			1" Ice	0.00	0.00	0.442
***									
NHH-65A-R2B w/ Mount Pipe	A	From Leg	0.50	0.0000	105.00	No Ice	0.00	0.00	0.069
			0.00			1/2" Ice	0.00	0.00	0.118
			2.00			1" Ice	0.00	0.00	0.177
NHH-65A-R2B w/ Mount Pipe	B	From Leg	0.50	0.0000	105.00	No Ice	0.00	0.00	0.069
			0.00			1/2" Ice	0.00	0.00	0.118
			2.00			1" Ice	0.00	0.00	0.177
NHH-65A-R2B w/ Mount Pipe	C	From Leg	0.50	0.0000	105.00	No Ice	0.00	0.00	0.069
			0.00			1/2" Ice	0.00	0.00	0.118
			2.00			1" Ice	0.00	0.00	0.177
TBC-67C-A-P-2SF	A	From Leg	0.50	0.0000	105.00	No Ice	0.00	0.00	0.011
			0.00			1/2" Ice	0.00	0.00	0.015
			2.00			1" Ice	0.00	0.00	0.020
TBC-67C-A-P-2SF	B	From Leg	0.50	0.0000	105.00	No Ice	0.00	0.00	0.011
			0.00			1/2" Ice	0.00	0.00	0.015
			2.00			1" Ice	0.00	0.00	0.020
TBC-67C-A-P-2SF	C	From Leg	0.50	0.0000	105.00	No Ice	0.00	0.00	0.011
			0.00			1/2" Ice	0.00	0.00	0.015

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			2.00			1" Ice	0.00	0.00	0.020
***									
60" Dia. x 10' Long Ventilated Concealment Canister	C	None		0.0000	125.00	No Ice	0.00	0.00	0.000
						1/2" Ice	0.00	0.00	0.000
						1" Ice	0.00	0.00	0.000
60" Dia. x 10' Long Ventilated Concealment Canister	C	None		0.0000	115.00	No Ice	0.00	0.00	0.000
						1/2" Ice	0.00	0.00	0.000
						1" Ice	0.00	0.00	0.000
40" Dia. x 10' Long Concealment Canister	C	None		0.0000	105.00	No Ice	0.00	0.00	0.000
						1/2" Ice	0.00	0.00	0.000
						1" Ice	0.00	0.00	0.000
***									
Canister Load1	C	None		0.0000	130.00	No Ice	23.75	23.75	0.157
						1/2" Ice	27.96	27.96	0.342
						1" Ice	28.42	28.42	0.530
Canister Load2	C	None		0.0000	120.00	No Ice	47.50	47.50	0.574
						1/2" Ice	55.92	55.92	0.944
						1" Ice	56.83	56.83	1.319
Canister Load3	C	None		0.0000	110.00	No Ice	31.25	31.25	0.551
						1/2" Ice	46.75	46.75	0.860
						1" Ice	47.67	47.67	1.174
Canister Load4	C	None		0.0000	100.00	No Ice	7.50	7.50	0.730
						1/2" Ice	49.29	49.29	0.854
						1" Ice	50.25	50.25	0.981

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
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

Comb. No.	*Description*
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

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*
L1	130 - 120	Pole	Max Tension	27	0.000	0.000	-0.000
			Max. Compression	26	-2.632	-0.104	0.164
			Max. Mx	8	-1.487	-6.879	0.144
			Max. My	2	-1.488	-0.094	6.899
			Max. Vy	8	0.719	-6.879	0.144
			Max. Vx	2	-0.716	-0.094	6.899
			Max. Torque	22			-0.007
L2	120 - 110	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-5.911	-0.110	0.174
			Max. Mx	8	-3.100	-26.457	0.175
			Max. My	2	-3.101	-0.123	26.447
			Max. Vy	8	1.977	-14.697	0.156
			Max. Vx	2	-1.974	-0.106	14.705
			Max. Torque	22			-0.007
L3	110 - 100	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-8.496	-0.110	0.174
			Max. Mx	8	-4.664	-53.545	0.202
			Max. My	2	-4.664	-0.150	53.506
			Max. Vy	8	2.729	-29.184	0.178
			Max. Vx	2	-2.726	-0.126	29.172
			Max. Torque	22			-0.007
L4	100 - 60	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-18.471	-0.110	0.174
			Max. Mx	8	-12.714	-194.899	0.310
			Max. My	2	-12.715	-0.256	194.741

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vy	8	4.164	-194.899	0.310
			Max. Vx	2	-4.161	-0.256	194.741
			Max. Torque	22			-0.007
L5	60 - 20	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-27.219	-0.110	0.174
			Max. Mx	8	-19.926	-381.226	0.417
			Max. My	2	-19.926	-0.363	380.948
			Max. Vy	8	5.089	-381.226	0.417
			Max. Vx	2	-5.086	-0.363	380.948
			Max. Torque	22			-0.007
L6	20 - 0	Pole	Max Tension	1	0.000	0.000	0.000
			Max. Compression	26	-31.488	-0.110	0.174
			Max. Mx	8	-23.551	-486.293	0.468
			Max. My	2	-23.551	-0.414	485.956
			Max. Vy	8	5.414	-486.293	0.468
			Max. Vx	2	-5.411	-0.414	485.956
			Max. Torque	22			-0.007

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	26	31.488	-0.000	0.000
	Max. H_x	20	23.552	5.410	-0.002
	Max. H_z	2	23.552	-0.002	5.407
	Max. M_x	2	485.956	-0.002	5.407
	Max. M_z	8	486.293	-5.410	0.002
	Max. Torsion	10	0.007	-4.684	-2.701
	Min. Vert	13	17.664	-2.703	-4.681
	Min. H_x	8	23.552	-5.410	0.002
	Min. H_z	14	23.552	0.002	-5.407
	Min. M_x	14	-485.698	0.002	-5.407
	Min. M_z	20	-486.144	5.410	-0.002
	Min. Torsion	22	-0.007	4.684	2.701

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	19.626	0.000	0.000	-0.100	-0.058	0.000
1.2 Dead+1.0 Wind 0 deg - No Ice	23.552	0.002	-5.407	-485.956	-0.414	0.003
0.9 Dead+1.0 Wind 0 deg - No Ice	17.664	0.002	-5.407	-481.315	-0.389	0.002
1.2 Dead+1.0 Wind 30 deg - No Ice	23.552	2.707	-4.684	-421.037	-243.477	-0.001
0.9 Dead+1.0 Wind 30 deg - No Ice	17.664	2.707	-4.684	-417.010	-241.148	-0.001
1.2 Dead+1.0 Wind 60 deg - No Ice	23.552	4.686	-2.706	-243.336	-421.321	-0.004
0.9 Dead+1.0 Wind 60 deg - No	17.664	4.686	-2.706	-240.994	-417.305	-0.003

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*
Ice						
1.2 Dead+1.0 Wind 90 deg - No Ice	23.552	5.410	-0.002	-0.468	-486.293	-0.006
0.9 Dead+1.0 Wind 90 deg - No Ice	17.664	5.410	-0.002	-0.429	-481.661	-0.005
1.2 Dead+1.0 Wind 120 deg - No Ice	23.552	4.684	2.701	242.491	-420.983	-0.007
0.9 Dead+1.0 Wind 120 deg - No Ice	17.664	4.684	2.701	240.226	-416.971	-0.005
1.2 Dead+1.0 Wind 150 deg - No Ice	23.552	2.703	4.681	420.441	-242.891	-0.006
0.9 Dead+1.0 Wind 150 deg - No Ice	17.664	2.703	4.681	416.488	-240.568	-0.004
1.2 Dead+1.0 Wind 180 deg - No Ice	23.552	-0.002	5.407	485.698	0.264	-0.003
0.9 Dead+1.0 Wind 180 deg - No Ice	17.664	-0.002	5.407	481.126	0.280	-0.002
1.2 Dead+1.0 Wind 210 deg - No Ice	23.552	-2.707	4.684	420.779	243.328	0.001
0.9 Dead+1.0 Wind 210 deg - No Ice	17.664	-2.707	4.684	416.822	241.038	0.001
1.2 Dead+1.0 Wind 240 deg - No Ice	23.552	-4.686	2.706	243.078	421.172	0.004
0.9 Dead+1.0 Wind 240 deg - No Ice	17.664	-4.686	2.706	240.806	417.196	0.003
1.2 Dead+1.0 Wind 270 deg - No Ice	23.552	-5.410	0.002	0.209	486.144	0.006
0.9 Dead+1.0 Wind 270 deg - No Ice	17.664	-5.410	0.002	0.240	481.552	0.005
1.2 Dead+1.0 Wind 300 deg - No Ice	23.552	-4.684	-2.701	-242.750	420.833	0.007
0.9 Dead+1.0 Wind 300 deg - No Ice	17.664	-4.684	-2.701	-240.415	416.862	0.005
1.2 Dead+1.0 Wind 330 deg - No Ice	23.552	-2.703	-4.681	-420.699	242.741	0.006
0.9 Dead+1.0 Wind 330 deg - No Ice	17.664	-2.703	-4.681	-416.676	240.459	0.004
1.2 Dead+1.0 Ice+1.0 Temp	31.488	0.000	-0.000	-0.174	-0.110	0.000
1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp	31.488	0.000	-1.061	-87.214	-0.158	0.001
1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp	31.488	0.531	-0.919	-75.573	-43.686	0.000
1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp	31.488	0.919	-0.531	-43.734	-75.541	-0.001
1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp	31.488	1.061	-0.000	-0.227	-87.187	-0.001
1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp	31.488	0.919	0.530	43.289	-75.504	-0.002
1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp	31.488	0.530	0.919	75.156	-43.621	-0.001
1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp	31.488	-0.000	1.061	86.834	-0.083	-0.001
1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp	31.488	-0.531	0.919	75.194	43.446	-0.000
1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp	31.488	-0.919	0.531	43.355	75.301	0.001
1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp	31.488	-1.061	0.000	-0.152	86.947	0.001
1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp	31.488	-0.919	-0.530	-43.669	75.263	0.002
1.2 Dead+1.0 Wind 330	31.488	-0.530	-0.919	-75.536	43.381	0.001

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
deg+1.0 Ice+1.0 Temp						
Dead+Wind 0 deg - Service	19.626	0.001	-1.909	-170.580	-0.180	0.001
Dead+Wind 30 deg - Service	19.626	0.956	-1.654	-147.800	-85.469	-0.000
Dead+Wind 60 deg - Service	19.626	1.655	-0.955	-85.445	-147.874	-0.001
Dead+Wind 90 deg - Service	19.626	1.910	-0.001	-0.224	-170.672	-0.002
Dead+Wind 120 deg - Service	19.626	1.654	0.954	85.028	-147.755	-0.002
Dead+Wind 150 deg - Service	19.626	0.954	1.653	147.469	-85.264	-0.002
Dead+Wind 180 deg - Service	19.626	-0.001	1.909	170.368	0.057	-0.001
Dead+Wind 210 deg - Service	19.626	-0.956	1.654	147.588	85.347	0.000
Dead+Wind 240 deg - Service	19.626	-1.655	0.955	85.234	147.751	0.001
Dead+Wind 270 deg - Service	19.626	-1.910	0.001	0.013	170.549	0.002
Dead+Wind 300 deg - Service	19.626	-1.654	-0.954	-85.240	147.633	0.002
Dead+Wind 330 deg - Service	19.626	-0.954	-1.653	-147.681	85.141	0.002

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	0.000	-19.626	0.000	0.000	19.626	0.000	0.000%
2	0.002	-23.552	-5.407	-0.002	23.552	5.407	0.000%
3	0.002	-17.664	-5.407	-0.002	17.664	5.407	0.000%
4	2.707	-23.552	-4.684	-2.707	23.552	4.684	0.000%
5	2.707	-17.664	-4.684	-2.707	17.664	4.684	0.000%
6	4.686	-23.552	-2.706	-4.686	23.552	2.706	0.000%
7	4.686	-17.664	-2.706	-4.686	17.664	2.706	0.000%
8	5.410	-23.552	-0.002	-5.410	23.552	0.002	0.000%
9	5.410	-17.664	-0.002	-5.410	17.664	0.002	0.000%
10	4.684	-23.552	2.701	-4.684	23.552	-2.701	0.000%
11	4.684	-17.664	2.701	-4.684	17.664	-2.701	0.000%
12	2.703	-23.552	4.681	-2.703	23.552	-4.681	0.000%
13	2.703	-17.664	4.681	-2.703	17.664	-4.681	0.000%
14	-0.002	-23.552	5.407	0.002	23.552	-5.407	0.000%
15	-0.002	-17.664	5.407	0.002	17.664	-5.407	0.000%
16	-2.707	-23.552	4.684	2.707	23.552	-4.684	0.000%
17	-2.707	-17.664	4.684	2.707	17.664	-4.684	0.000%
18	-4.686	-23.552	2.706	4.686	23.552	-2.706	0.000%
19	-4.686	-17.664	2.706	4.686	17.664	-2.706	0.000%
20	-5.410	-23.552	0.002	5.410	23.552	-0.002	0.000%
21	-5.410	-17.664	0.002	5.410	17.664	-0.002	0.000%
22	-4.684	-23.552	-2.701	4.684	23.552	2.701	0.000%
23	-4.684	-17.664	-2.701	4.684	17.664	2.701	0.000%
24	-2.703	-23.552	-4.681	2.703	23.552	4.681	0.000%
25	-2.703	-17.664	-4.681	2.703	17.664	4.681	0.000%
26	0.000	-31.488	0.000	-0.000	31.488	0.000	0.000%
27	0.000	-31.488	-1.061	-0.000	31.488	1.061	0.000%
28	0.531	-31.488	-0.919	-0.531	31.488	0.919	0.000%
29	0.919	-31.488	-0.531	-0.919	31.488	0.531	0.000%
30	1.061	-31.488	-0.000	-1.061	31.488	0.000	0.000%
31	0.919	-31.488	0.530	-0.919	31.488	-0.530	0.000%
32	0.530	-31.488	0.919	-0.530	31.488	-0.919	0.000%
33	-0.000	-31.488	1.061	0.000	31.488	-1.061	0.000%
34	-0.531	-31.488	0.919	0.531	31.488	-0.919	0.000%
35	-0.919	-31.488	0.531	0.919	31.488	-0.531	0.000%
36	-1.061	-31.488	0.000	1.061	31.488	-0.000	0.000%
37	-0.919	-31.488	-0.530	0.919	31.488	0.530	0.000%
38	-0.530	-31.488	-0.919	0.530	31.488	0.919	0.000%
39	0.001	-19.626	-1.909	-0.001	19.626	1.909	0.000%

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
40	0.956	-19.626	-1.654	-0.956	19.626	1.654	0.000%
41	1.655	-19.626	-0.955	-1.655	19.626	0.955	0.000%
42	1.910	-19.626	-0.001	-1.910	19.626	0.001	0.000%
43	1.654	-19.626	0.954	-1.654	19.626	-0.954	0.000%
44	0.954	-19.626	1.653	-0.954	19.626	-1.653	0.000%
45	-0.001	-19.626	1.909	0.001	19.626	-1.909	0.000%
46	-0.956	-19.626	1.654	0.956	19.626	-1.654	0.000%
47	-1.655	-19.626	0.955	1.655	19.626	-0.955	0.000%
48	-1.910	-19.626	0.001	1.910	19.626	-0.001	0.000%
49	-1.654	-19.626	-0.954	1.654	19.626	0.954	0.000%
50	-0.954	-19.626	-1.653	0.954	19.626	1.653	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	0.00013097
3	Yes	4	0.00000001	0.00005574
4	Yes	4	0.00000001	0.00096224
5	Yes	4	0.00000001	0.00067798
6	Yes	4	0.00000001	0.00096579
7	Yes	4	0.00000001	0.00068011
8	Yes	4	0.00000001	0.00013160
9	Yes	4	0.00000001	0.00005618
10	Yes	4	0.00000001	0.00094303
11	Yes	4	0.00000001	0.00066699
12	Yes	4	0.00000001	0.00094923
13	Yes	4	0.00000001	0.00066996
14	Yes	4	0.00000001	0.00012977
15	Yes	4	0.00000001	0.00005528
16	Yes	4	0.00000001	0.00094794
17	Yes	4	0.00000001	0.00067062
18	Yes	4	0.00000001	0.00094619
19	Yes	4	0.00000001	0.00066972
20	Yes	4	0.00000001	0.00013059
21	Yes	4	0.00000001	0.00005562
22	Yes	4	0.00000001	0.00095484
23	Yes	4	0.00000001	0.00067308
24	Yes	4	0.00000001	0.00094685
25	Yes	4	0.00000001	0.00066888
26	Yes	4	0.00000001	0.00000537
27	Yes	4	0.00000001	0.00057770
28	Yes	4	0.00000001	0.00058350
29	Yes	4	0.00000001	0.00058284
30	Yes	4	0.00000001	0.00057564
31	Yes	4	0.00000001	0.00057482
32	Yes	4	0.00000001	0.00057050
33	Yes	4	0.00000001	0.00056363
34	Yes	4	0.00000001	0.00056658
35	Yes	4	0.00000001	0.00056774
36	Yes	4	0.00000001	0.00056673
37	Yes	4	0.00000001	0.00057434
38	Yes	4	0.00000001	0.00057815
39	Yes	4	0.00000001	0.00001799
40	Yes	4	0.00000001	0.00004377

41	Yes	4	0.00000001	0.00004401
42	Yes	4	0.00000001	0.00001801
43	Yes	4	0.00000001	0.00004239
44	Yes	4	0.00000001	0.00004292
45	Yes	4	0.00000001	0.00001781
46	Yes	4	0.00000001	0.00004249
47	Yes	4	0.00000001	0.00004233
48	Yes	4	0.00000001	0.00001790
49	Yes	4	0.00000001	0.00004337
50	Yes	4	0.00000001	0.00004276

Maximum Tower Deflections - Service Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load Comb.*	*Tilt*	*Twist*
	ft	*in*		°	°
L1	130 - 120	10.925	40	1.2529	0.0002
L2	120 - 110	8.361	41	1.1672	0.0002
L3	110 - 100	6.268	41	0.7519	0.0001
L4	100 - 60	5.046	41	0.3728	0.0000
L5	60 - 20	2.166	41	0.3008	0.0000
L6	20 - 0	0.283	41	0.1299	0.0000

Critical Deflections and Radius of Curvature - Service Wind

Elevation	*Appurtenance*	*Gov. Load Comb.*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft			*in*	°	°	*ft*
130.00	(2) 9"x5"x3.5" Sidelight	40	10.925	1.2529	0.0002	5738
125.00	AEHC w/ Mount Pipe	41	9.617	1.2429	0.0002	5738
120.00	Canister Load2	41	8.361	1.1672	0.0002	2697
117.00	FFVV-65C-R3-V1_TMO w/ Mount Pipe	41	7.656	1.0681	0.0001	1871
115.00	60" Dia. x 10' Long Ventilated Concealment Canister	41	7.217	0.9844	0.0001	1524
110.00	Canister Load3	41	6.268	0.7519	0.0001	1184
105.00	NHH-65A-R2B w/ Mount Pipe	41	5.574	0.5399	0.0000	1792
100.00	Canister Load4	41	5.046	0.3728	0.0000	4612

Maximum Tower Deflections - Design Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load Comb.*	*Tilt*	*Twist*
	ft	*in*		°	°
L1	130 - 120	31.105	6	3.5569	0.0007
L2	120 - 110	23.827	6	3.3192	0.0006
L3	110 - 100	17.871	6	2.1429	0.0002
L4	100 - 60	14.387	6	1.0629	0.0000
L5	60 - 20	6.174	6	0.8577	0.0000
L6	20 - 0	0.807	6	0.3704	0.0000

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
130.00	(2) 9"x5"x3.5" Sidelight	6	31.105	3.5569	0.0007	2076
125.00	AEHC w/ Mount Pipe	6	27.394	3.5315	0.0007	2076
120.00	Canister Load2	6	23.827	3.3192	0.0006	971
117.00	FFVV-65C-R3-V1_TMO w/ Mount Pipe	6	21.821	3.0393	0.0005	668
115.00	60" Dia. x 10' Long Ventilated Concealment Canister	6	20.571	2.8025	0.0004	541
110.00	Canister Load3	6	17.871	2.1429	0.0002	418
105.00	NHH-65A-R2B w/ Mount Pipe	6	15.891	1.5395	0.0001	631
100.00	Canister Load4	6	14.387	1.0629	0.0000	1621

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
L1	130 - 120 (1)	P6.625x0.432	10.00	0.00	0.0	8.4049	-1.487	317.707	0.005
L2	120 - 110 (2)	P6.625x0.432	10.00	0.00	0.0	8.4049	-3.100	317.707	0.010
L3	110 - 100 (3)	P8.625x0.5	10.00	0.00	0.0	12.7627	-4.664	482.431	0.010
L4	100 - 60 (4)	P36x0.375	40.00	0.00	0.0	41.9697	-12.714	1490.100	0.009
L5	60 - 20 (5)	P36x0.375	40.00	0.00	0.0	41.9697	-19.926	1490.100	0.013
L6	20 - 0 (6)	P36x0.375	20.00	0.00	0.0	41.9697	-23.551	1490.100	0.016

Pole 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 $\frac{M_{uy}}{\phi M_{ny}}$
L1	130 - 120 (1)	P6.625x0.432	6.948	52.276	0.133	0.000	52.276	0.000
L2	120 - 110 (2)	P6.625x0.432	26.539	52.276	0.508	0.000	52.276	0.000
L3	110 - 100 (3)	P8.625x0.5	53.643	104.106	0.515	0.000	104.106	0.000
L4	100 - 60 (4)	P36x0.375	195.058	1338.808	0.146	0.000	1338.808	0.000
L5	60 - 20 (5)	P36x0.375	381.447	1338.808	0.285	0.000	1338.808	0.000
L6	20 - 0 (6)	P36x0.375	486.543	1338.808	0.363	0.000	1338.808	0.000

Pole Shear Design Data

Section No.	Elevation ft	Size	Actual V_u K	ϕV_n K	Ratio $\frac{V_u}{\phi V_n}$	Actual T_u kip-ft	ϕT_n kip-ft	Ratio $\frac{T_u}{\phi T_n}$
L1	130 - 120 (1)	P6.625x0.432	0.720	95.312	0.008	0.001	51.895	0.000
L2	120 - 110 (2)	P6.625x0.432	1.947	95.312	0.020	0.004	51.895	0.000
L3	110 - 100 (3)	P8.625x0.5	2.682	144.729	0.019	0.004	103.386	0.000
L4	100 - 60 (4)	P36x0.375	4.166	454.187	0.009	0.004	1094.275	0.000
L5	60 - 20 (5)	P36x0.375	5.090	454.187	0.011	0.004	1094.275	0.000
L6	20 - 0 (6)	P36x0.375	5.416	454.187	0.012	0.004	1094.275	0.000

Pole Interaction Design Data

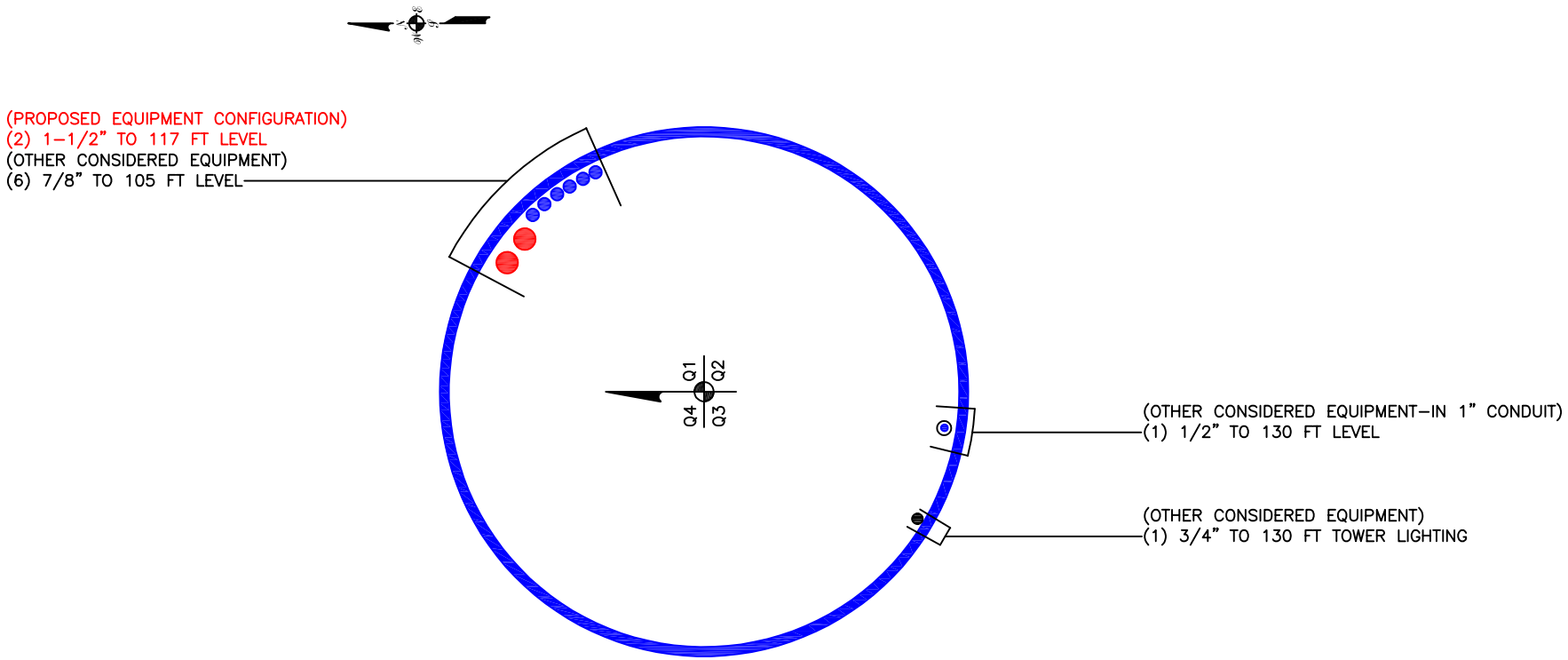
Section No.	Elevation ft	Ratio $\frac{P_u}{\phi P_n}$	Ratio $\frac{M_{ux}}{\phi M_{nx}}$	Ratio $\frac{M_{uy}}{\phi M_{ny}}$	Ratio $\frac{V_u}{\phi V_n}$	Ratio $\frac{T_u}{\phi T_n}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	130 - 120 (1)	0.005	0.133	0.000	0.008	0.000	0.138	1.050	4.8.2
L2	120 - 110 (2)	0.010	0.508	0.000	0.020	0.000	0.518	1.050	4.8.2
L3	110 - 100 (3)	0.010	0.515	0.000	0.019	0.000	0.525	1.050	4.8.2
L4	100 - 60 (4)	0.009	0.146	0.000	0.009	0.000	0.154	1.050	4.8.2
L5	60 - 20 (5)	0.013	0.285	0.000	0.011	0.000	0.298	1.050	4.8.2
L6	20 - 0 (6)	0.016	0.363	0.000	0.012	0.000	0.379	1.050	4.8.2

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
L1	130 - 120	Pole	P6.625x0.432	1	-1.487	333.592	13.1	Pass
L2	120 - 110	Pole	P6.625x0.432	2	-3.100	333.592	49.3	Pass
L3	110 - 100	Pole	P8.625x0.5	3	-4.664	506.553	50.0	Pass
L4	100 - 60	Pole	P36x0.375	4	-12.714	1564.605	14.7	Pass
L5	60 - 20	Pole	P36x0.375	5	-19.926	1564.605	28.4	Pass
L6	20 - 0	Pole	P36x0.375	6	-23.551	1564.605	36.1	Pass
							Summary	
						Pole (L3)	50.0	Pass
						RATING =	**50.0**	**Pass**

APPENDIX B

BASE LEVEL DRAWING


(PROPOSED EQUIPMENT CONFIGURATION)
(2) 1-1/2" TO 117 FT LEVEL
(OTHER CONSIDERED EQUIPMENT)
(6) 7/8" TO 105 FT LEVEL
Q1
Q2
Q4
Q3
(OTHER CONSIDERED EQUIPMENT-IN 1" CONDUIT)
(1) 1/2" TO 130 FT LEVEL
(OTHER CONSIDERED EQUIPMENT)
(1) 3/4" TO 130 FT TOWER LIGHTING

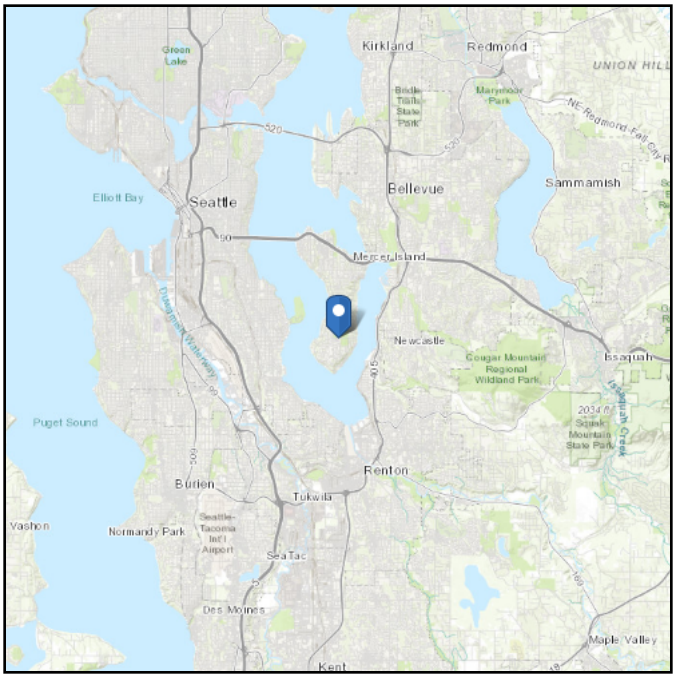
APPENDIX C

ADDITIONAL CALCULATIONS

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Latitude:**	47.541667
Risk Category:	II	**Longitude:**	-122.223611
Soil Class:	D - Default (see Section 11.4.3)	**Elevation:**	348.55 ft (NAVD 88)



Wind

Results:

Wind Speed	98 Vmph
10-year MRI	67 Vmph
25-year MRI	74 Vmph
50-year MRI	78 Vmph
100-year MRI	83 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 Jan 30 2023

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 :	1.461	S_{D1} :	N/A
S_1 :	0.505	T_L :	6
F_a :	1.2	PGA :	0.625
F_v :	N/A	PGA_M :	0.75
S_{MS} :	1.753	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.168	C_v :	1.392

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

Data Accessed: Mon Jan 30 2023

Date Source: USGS Seismic Design Maps

Ice

Results:

Ice Thickness:	1.00 in.
Concurrent Temperature:	25 F
Gust Speed	30 mph
Data Source:	Standard ASCE/SEI 7-16, Figs. 10-2 through 10-8
Date Accessed:	Mon Jan 30 2023

Ice thicknesses on structures in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

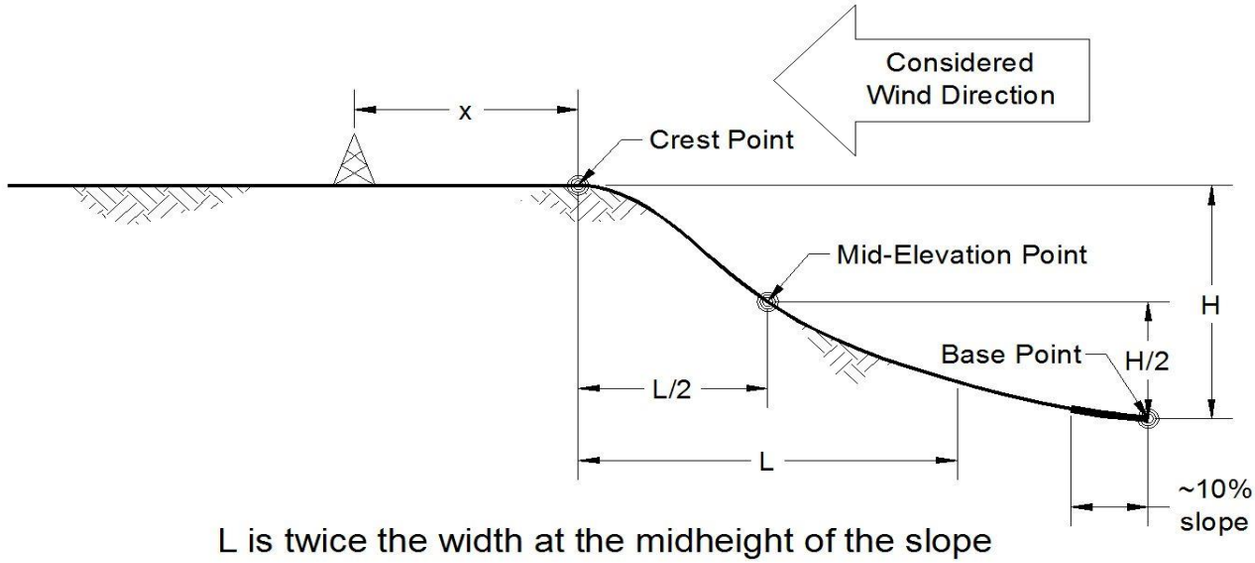
Values provided are equivalent radial ice thicknesses due to freezing rain with concurrent 3-second gust speeds, for a 500-year mean recurrence interval, and temperatures concurrent with ice thicknesses due to freezing rain. Thicknesses for ice accretions caused by other sources shall be obtained from local meteorological studies. Ice thicknesses in exposed locations at elevations higher than the surrounding terrain and in valleys and gorges may exceed the mapped values.

Topographic Factors for use in tnxTower

(V. 3.2.3, Effecitve 09-06-2018)

per SEAW RSM-03 Figure 3-3 & ANSI/TIA-222-H Section 2.6.6.2.2

BU:	880416
Site Name:	SEATTLE QWEST - SEA155
Order:	578276 Rev. 8



L is twice the width at the midheight of the slope

Topographic Feature

- ○ Continuous Ridge
- ○ Flat Topped Ridge
- ○ Hill
- ○ Flat Topped Hill
- ◉ Continuous Escarpment

☑ Tower is downwind from crest point

Exposure Category

- ◉ Exposure B
- ○ Exposure C
- ○ Exposure D

Notes:

1) Feature is assumed to be isolated per section 1.8 of the Crown Castle standard for the Determination of Topographic Factors (ENG-PRC-10040).

2) Base Kzt may differ slightly from TNX value due to differences in where the base line is established. This does not effect the results in anyway.

Topographic Input	
Crest Point Elevation (ft. AMSL)	380
Base Point Elevation (ft. AMSL)	20
Mid-Height Elevation (ft. AMSL)	200
Crest to Mid-Height Distance (L/2) (ft.)	1180
Tower Point Elevation (ft. AMSL)	380
Structure Distance from Crest Line (x)(ft.)	2945

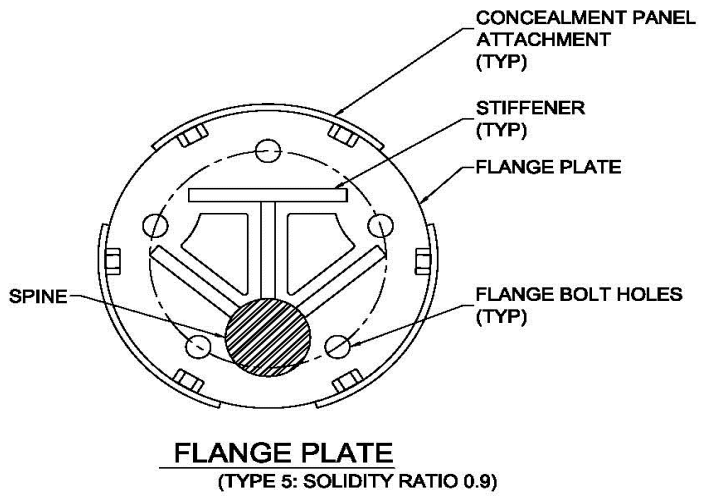
tnxTower Input		K_{ZT} (RSM-03)
Topographic Category	Rigorous Procedure / Category 5	**At Base: 1.182²**
Crest Height, H (ft.)	360	
Slope Distance, L (ft.)	2360	
Distance from Crest, x (ft.)	2945	

CCI Flagpole Tool

Site Data	
BU#:	880416
Site Name:	SEATTLE QWEST -SEA155
Order #:	578276 Rev. 8

Code		
Code:	TIA-222-H	
Ice Thickness:	1	in
Windspeed (V):	30	mph
Ice Wind Speed (V):	98	mph
Exposure Category:	B	
Topographic Feature:	Continuous Escarpment	
Distance From Crest (x):	2945	ft
Slope Distance (L):	2360	ft
Crest Height (H):	360	ft
Risk Category:	II	

Tower Information		
Total Tower Height:	130	ft
Base Tower Height:	100	ft
Total Canister Length:	30	ft
Number of Canister Assembly Sections:	3	



FLANGE PLATE
(TYPE 5: SOLIDITY RATIO 0.9)

Canister Section Number[1]:	Canister Assembly Length (ft):	Canister Assembly Diameter (in):	Ventilated Canister:	Manufacturer[2]:	Number of Sides Canister Section	Plate Type:	Mating Flange Plate Thickness (in)[3]:	Mating Flange Plate Diameter (in):	Solidity Ratio	Plate Weight (Kip):	Canister Weight (Kip)	Vent Length (ft):
1	10	60	Yes	Generic	Round	5	2.00	18	0.9	0.260	0.314	0-10
2	10	60	Yes	Generic	Round	5	2.00	19	0.9	0.289	0.314	0-10
3	10	40	No		Round	1	2.00	39.5	0.45	0.625	0.209	0-0

[1] Sections are numbered from the top of the tower down

[2] Select manufacturer if available for vented canister. Leave blank to autocalculate Cf values.

[3] Mating Flange Plate Thickness at the bottom of canister section

Flag on Tower:	**No**

Truck Ball on Tower:	**No**

Geometry : Base Tower + Spine 880416_2200969_LC4 OG.eri *(last saved 01/31 9:05 am)*

Pole Height Above Base (ft)	Section Length (ft)	Lap Splice Length (ft)	Number of Sides	Top Diameter (in)	Bottom Diameter (in)	Wall Thickness (in)	Bend Radius (in)	Pole Material	Delete
130	10		0	6.625	6.625	0.432	n/a	A53-B-42	[x]
120	10		0	6.625	6.625	0.432	n/a	A53-B-42	[x]
110	10		0	8.625	8.625	0.5	n/a	A53-B-42	[x]
100	40		0	36	36	0.375	n/a	A53-B-42	[x]
60	40		0	36	36	0.375	n/a	A53-B-42	[x]
20	20		0	36	36	0.375	n/a	A53-B-42	[x]

Discrete Loads : C_FA_F for Canister Assembly								
Canister Loading	Apply C_FA_F at Elevation(z) (ft)	C_FA_F No Ice (ft^2)	C_FA_F 1/2" Ice (ft^2)	C_FA_F 1" Ice (ft^2)	C_FA_F 2" Ice (ft^2)	C_FA_F 4" Ice (ft^2)	Canister Assembly Weight No Ice (Kip)	Canister Assembly Weight 1/2" Ice (Kip)
Canister Load 1	130	23.750	27.958	28.417	29.333	31.167	0.157	0.342
Canister Load 2	120	47.500	55.917	56.833	58.667	62.333	0.574	0.944
Canister Load 3	110	31.250	46.750	47.667	49.500	53.167	0.551	0.860
Canister Load 4	100	7.500	49.292	50.250	52.167	56.000	0.730	0.854

Deflection Check Required:	**Yes**	Import Deflection Results

3% Spine Deflection Check		
Allowable (3%) Horizontal Spine Deflection (inches)	Actual Deflection[1] (inches)	Sufficient/ Insufficient
10.800	5.879	Sufficient

[1] Relative deflection under service level wind speed

Monopole Flange Plate Connection

Elevation = 120 ft.

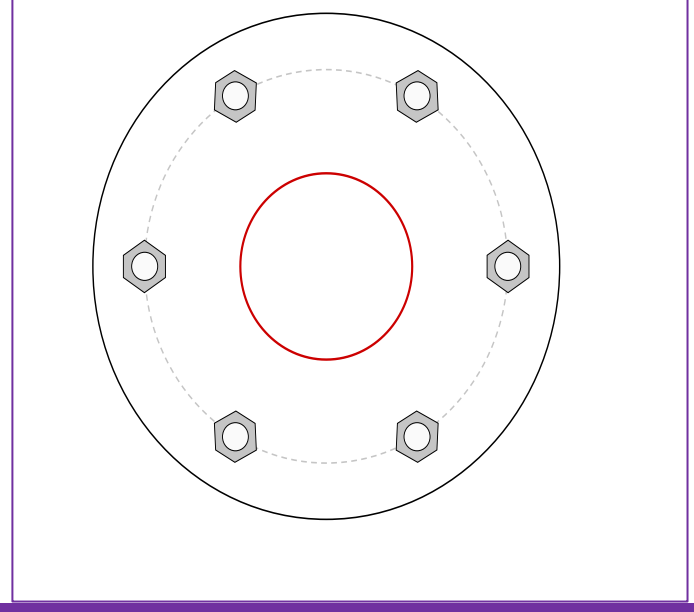
BU #	880416
Site Name	EATTLE QWEST - SEA15
Order #	578276 Rev. 8

TIA-222 Revision	H

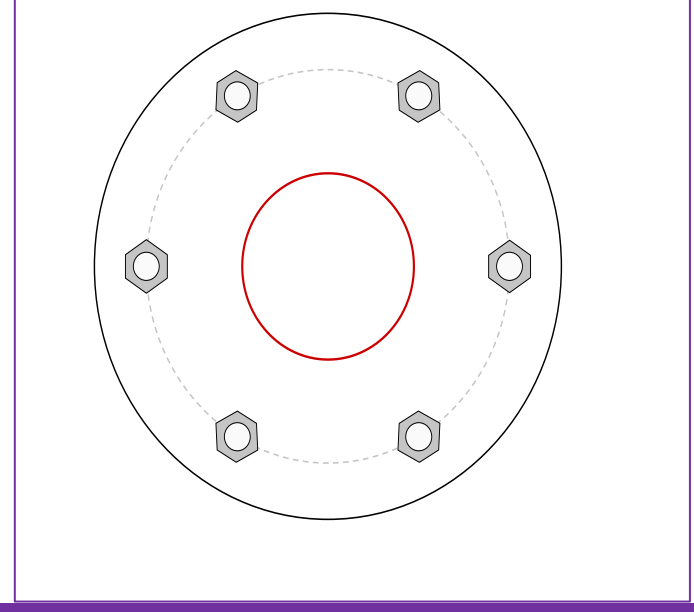
Applied Loads	
Moment (kip-ft)	6.95
Axial Force (kips)	1.49
Shear Force (kips)	0.72

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(6) 1" ø bolts (A325 N; Fy=92 ksi, Fu=120 ksi) on 14" BC

Top Plate Data

18" OD x 2" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Bottom Plate Data

18" OD x 2" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Top Stiffener Data

N/A

Bottom Stiffener Data

N/A

Top Pole Data

6.625" x 0.432" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Bottom Pole Data

6.625" x 0.432" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	3.71	
Allowable (kips)	54.54	
Stress Rating:	**6.5%**	**Pass**

Top Plate Capacity

Max Stress (ksi):	1.64	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	**3.5%**	**Pass**
Tension Side Stress Rating:	**3.3%**	**Pass**

Bottom Plate Capacity

Max Stress (ksi):	1.64	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	**3.5%**	**Pass**
Tension Side Stress Rating:	**3.3%**	**Pass**

Monopole Flange Plate Connection

Elevation = 110 ft.

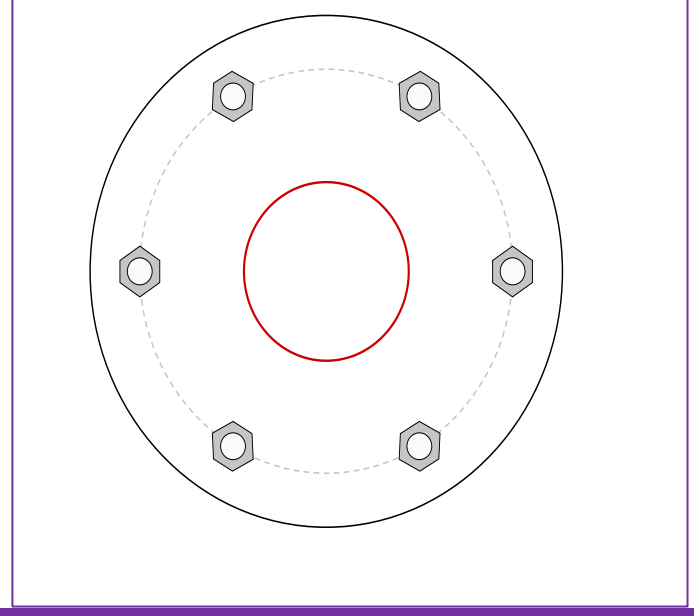
BU #	880416
Site Name	EATTLE QWEST - SEA15
Order #	578276 Rev. 8

TIA-222 Revision	H

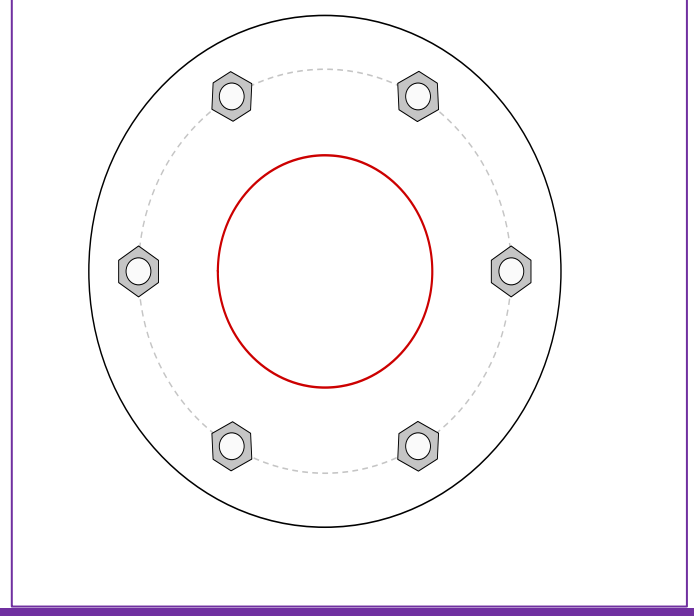
Applied Loads	
Moment (kip-ft)	26.54
Axial Force (kips)	3.10
Shear Force (kips)	1.95

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(6) 1" ø bolts (A325 N; Fy=92 ksi, Fu=120 ksi) on 15" BC

Top Plate Data

19" OD x 2" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Bottom Plate Data

19" OD x 2" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Top Stiffener Data

N/A

Bottom Stiffener Data

N/A

Top Pole Data

6.625" x 0.432" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Bottom Pole Data

8.625" x 0.5" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	13.61	
Allowable (kips)	54.54	
Stress Rating:	**23.8%**	**Pass**

Top Plate Capacity

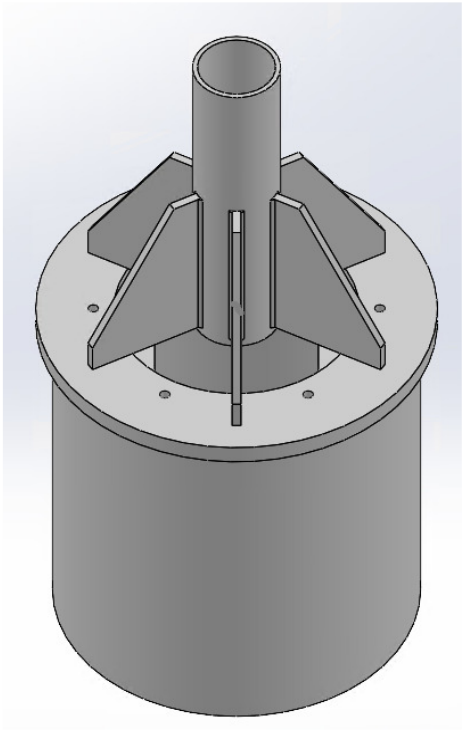
Max Stress (ksi):	6.03	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	**12.8%**	**Pass**
Tension Side Stress Rating:	**13.9%**	**Pass**

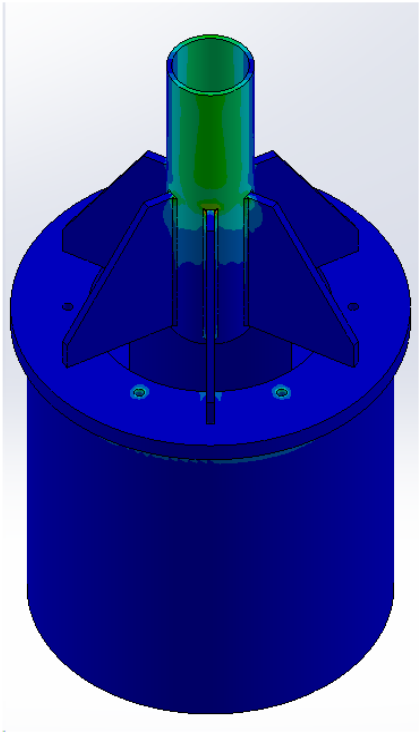
Bottom Plate Capacity

Max Stress (ksi):	4.54	(Flexural)
Allowable Stress (ksi):	45.00	
Stress Rating:	**9.6%**	**Pass**
Tension Side Stress Rating:	**7.5%**	**Pass**

Client Site Name:	SEATTLE QWEST-SEA155			**Engineer:**	MEC
Client Site Number:	BU 880416			**Check:**	RKE
Client Order Number:	578276 Rev. 8			**Date:**	2/10/2023
TEP Project Number:	151934.819073		Tower Engineering Professionals	**Page:**	1

Simulation of Concealment Flange - 100-ft Elevation





Model Loads

Axial	4,664	lb
Shear	2,682	lb
Moment	53,643	lb-ft
Self-Weight Factor	1.2	

Overall Results

Sufficient

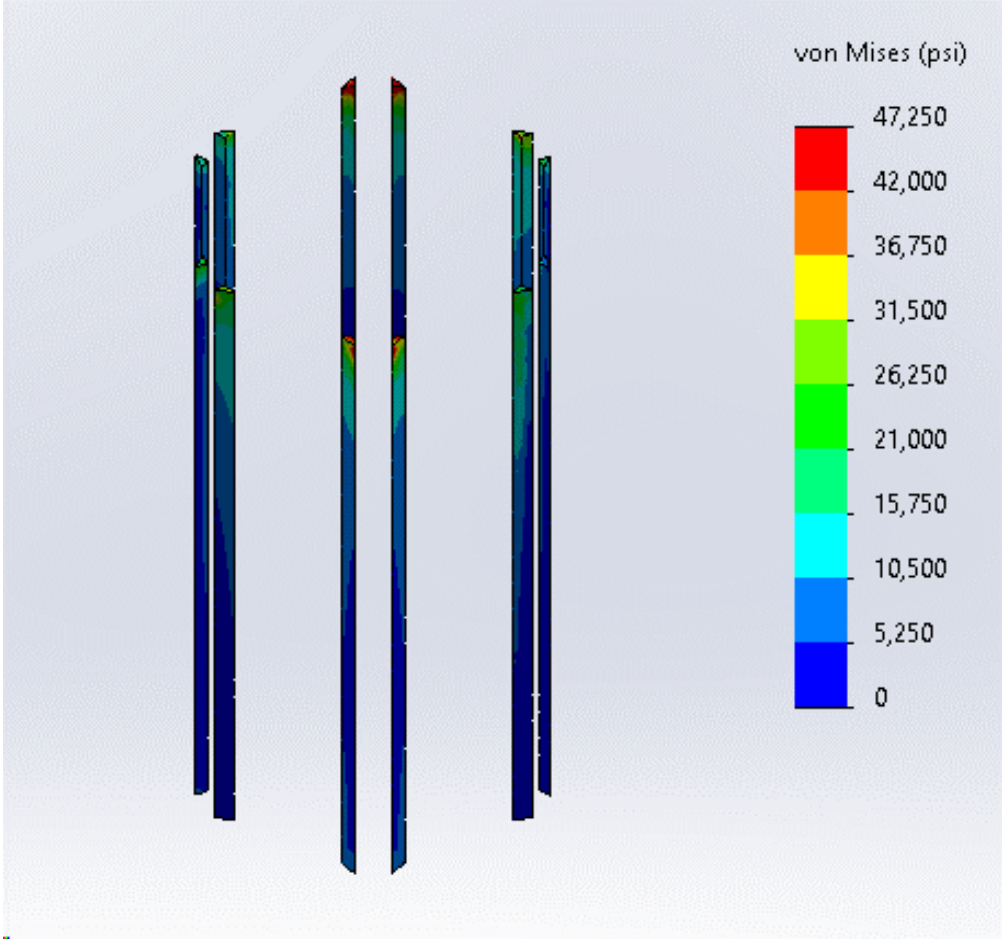
Model Part Information

Part	Part Grade
Spine Stub Section	A53-B-42
Spine to Top Flange Welds	E70XX
Stiffeners	A572-50
Top Flange	A572-50
Bottom Flange	A36
Tower Stub Section	A53-B-42

Client Site Name:	SEATTLE QWEST-SEA155			**Engineer:**	MEC
Client Site Number:	BU 880416			**Check:**	RKE
Client Order Number:	578276 Rev. 8			**Date:**	2/10/2023
TEP Project Number:	151934.819073		Tower Engineering Professionals	**Page:**	2

Study: 0 Degree

Spine to Top Flange Welds



Assumptions

N/A

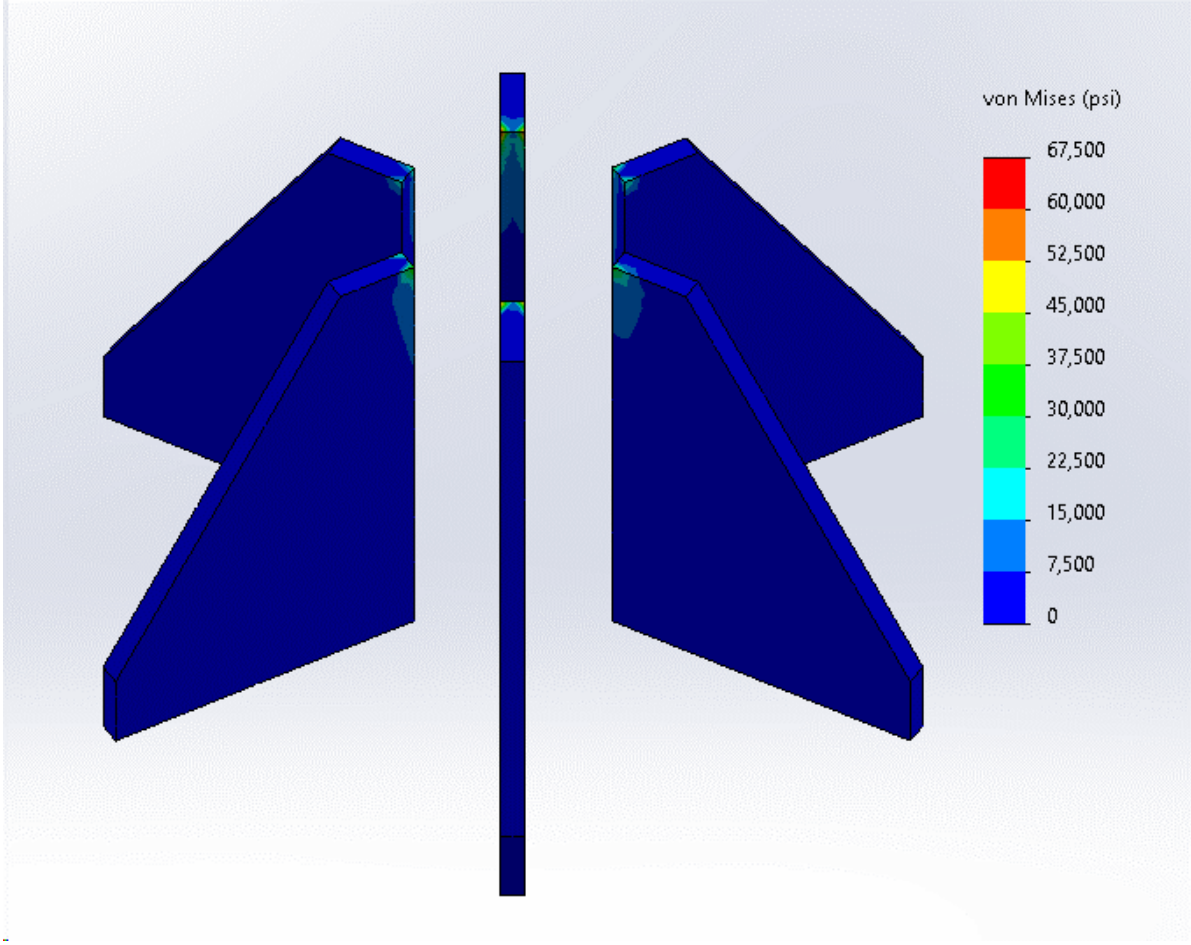
Results

Sufficient

Client Site Name:	SEATTLE QWEST-SEA155			**Engineer:**	MEC
Client Site Number:	BU 880416			**Check:**	RKE
Client Order Number:	578276 Rev. 8			**Date:**	2/10/2023
TEP Project Number:	151934.819073		Tower Engineering Professionals	**Page:**	3

Study: 0 Degree

Stiffeners



Assumptions

N/A

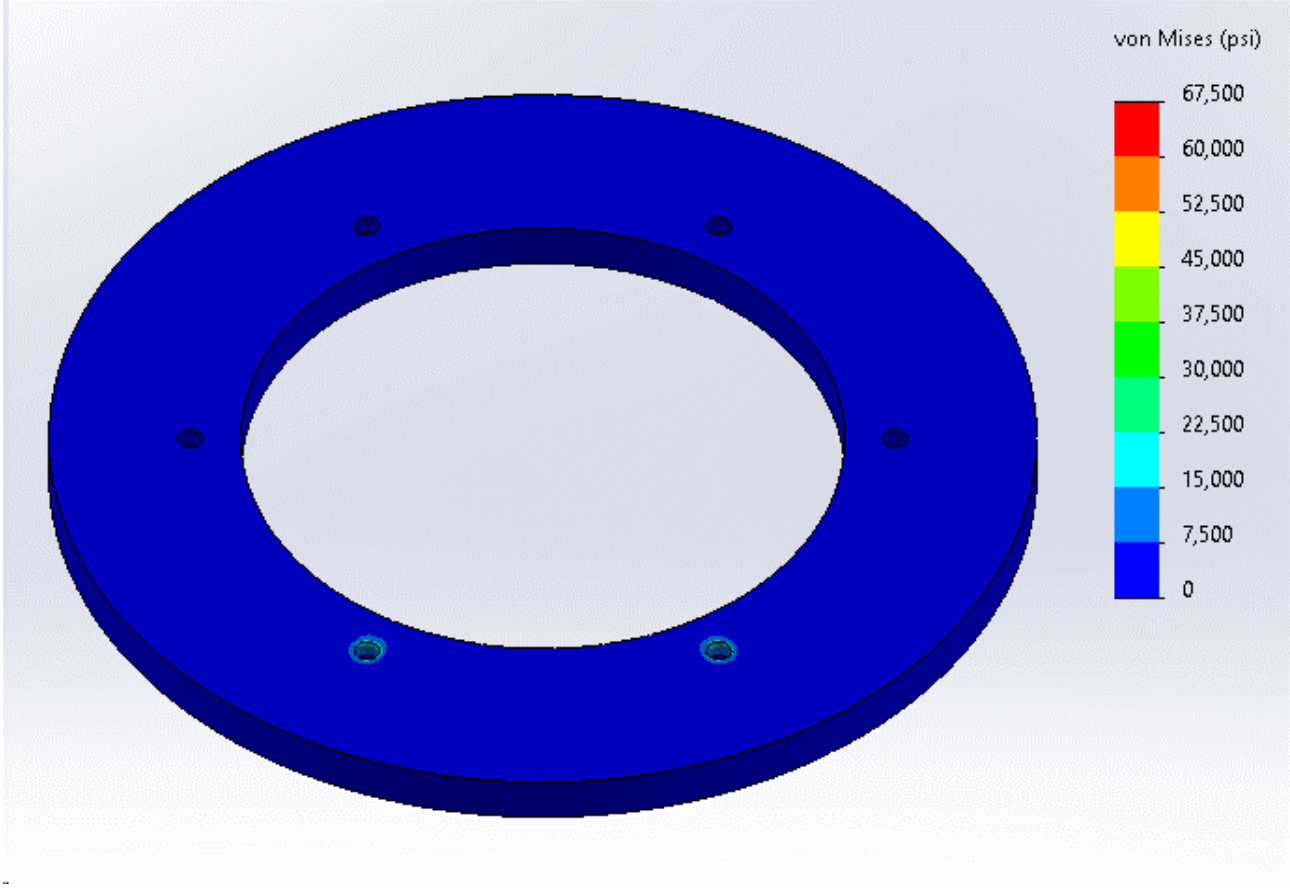
Results

Sufficient

Client Site Name:	SEATTLE QWEST-SEA155		**Engineer:**	MEC
Client Site Number:	BU 880416		**Check:**	RKE
Client Order Number:	578276 Rev. 8		**Date:**	2/10/2023
TEP Project Number:	151934.819073	Tower Engineering Professionals	**Page:**	4

Study: 0 Degree

Top Flange



Assumptions

N/A

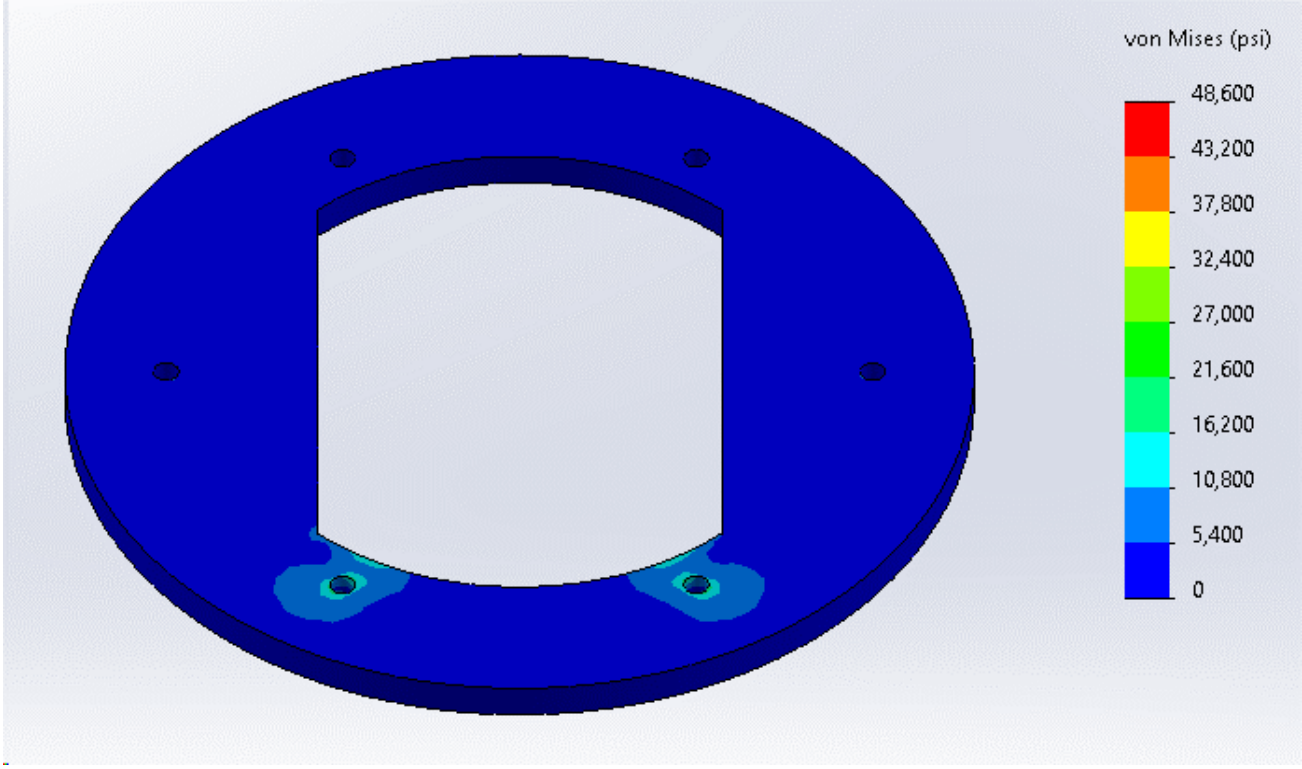
Results

Sufficient

Client Site Name:	SEATTLE QWEST-SEA155			**Engineer:**	MEC
Client Site Number:	BU 880416			**Check:**	RKE
Client Order Number:	578276 Rev. 8			**Date:**	2/10/2023
TEP Project Number:	151934.819073		Tower Engineering Professionals	**Page:**	5

Study: 0 Degree

Bottom Flange



Assumptions

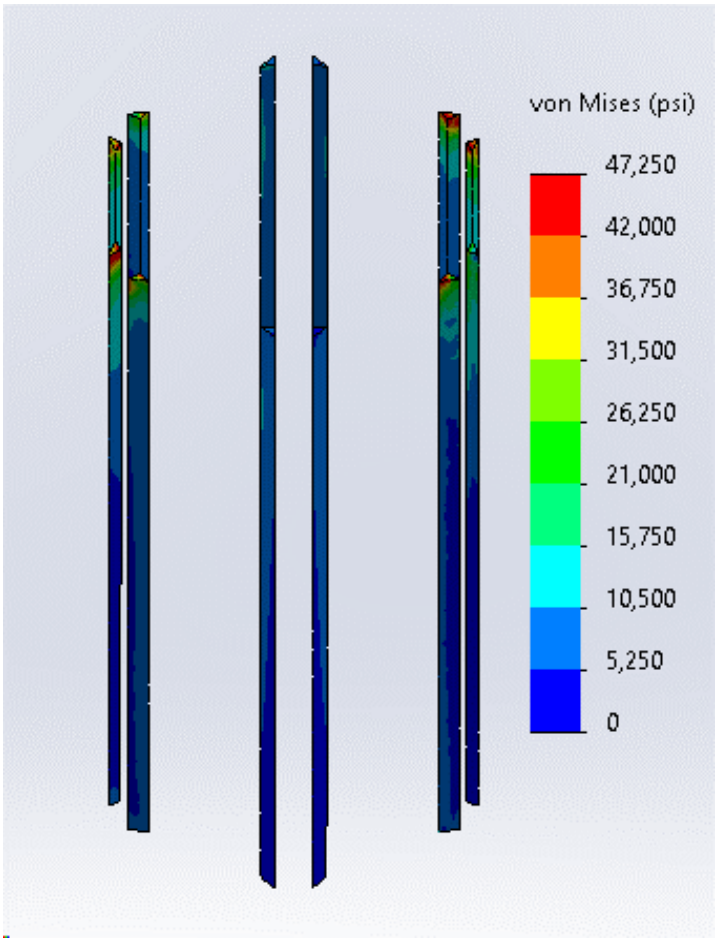
N/A

Results

Sufficient

Study: 30 Degree

Spine to Top Flange Welds



Assumptions

N/A

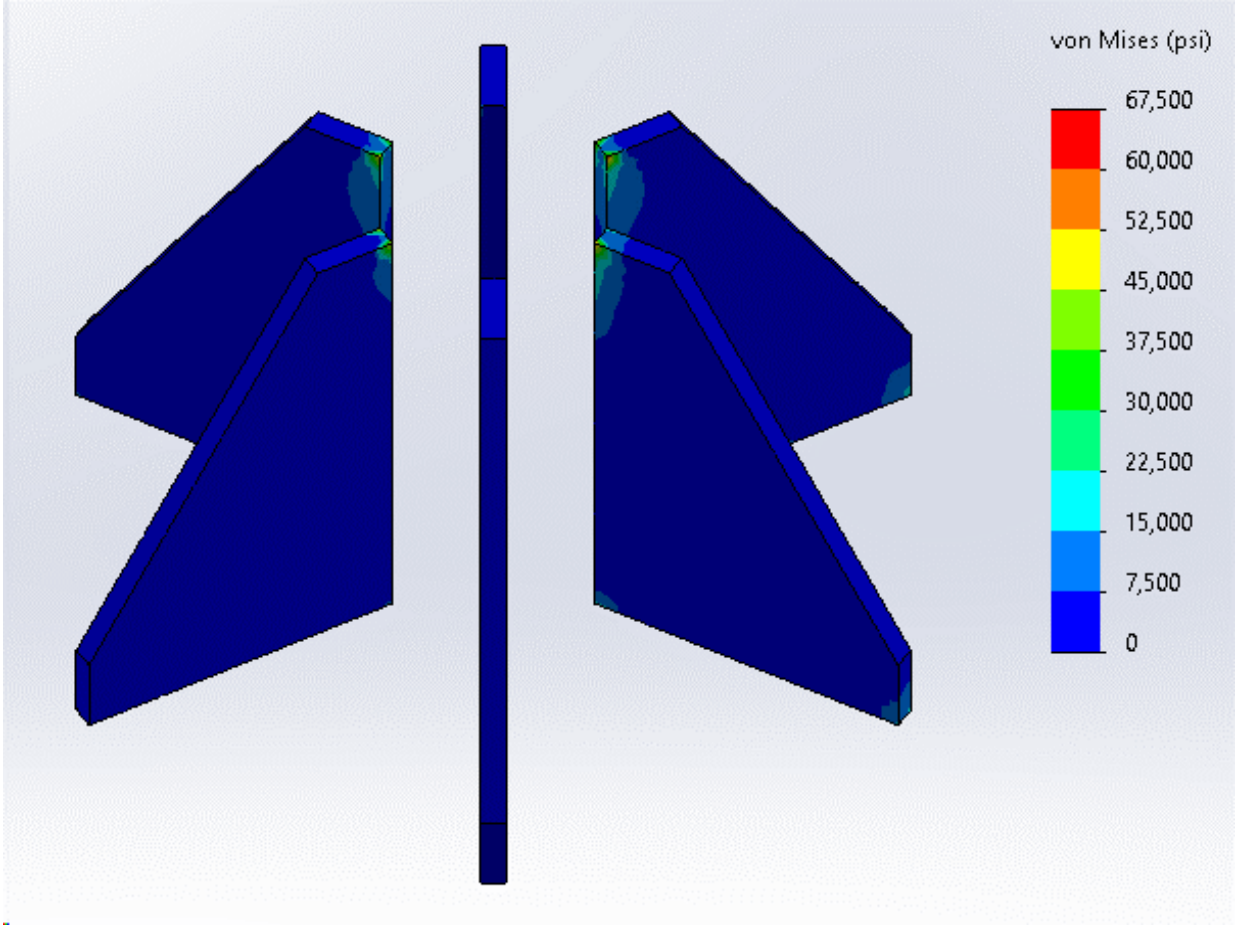
Results

Sufficient

Client Site Name:	SEATTLE QWEST-SEA155			**Engineer:**	MEC
Client Site Number:	BU 880416			**Check:**	RKE
Client Order Number:	578276 Rev. 8			**Date:**	2/10/2023
TEP Project Number:	151934.819073		Tower Engineering Professionals	**Page:**	7

Study: 30 Degree

Stiffeners



Assumptions

N/A

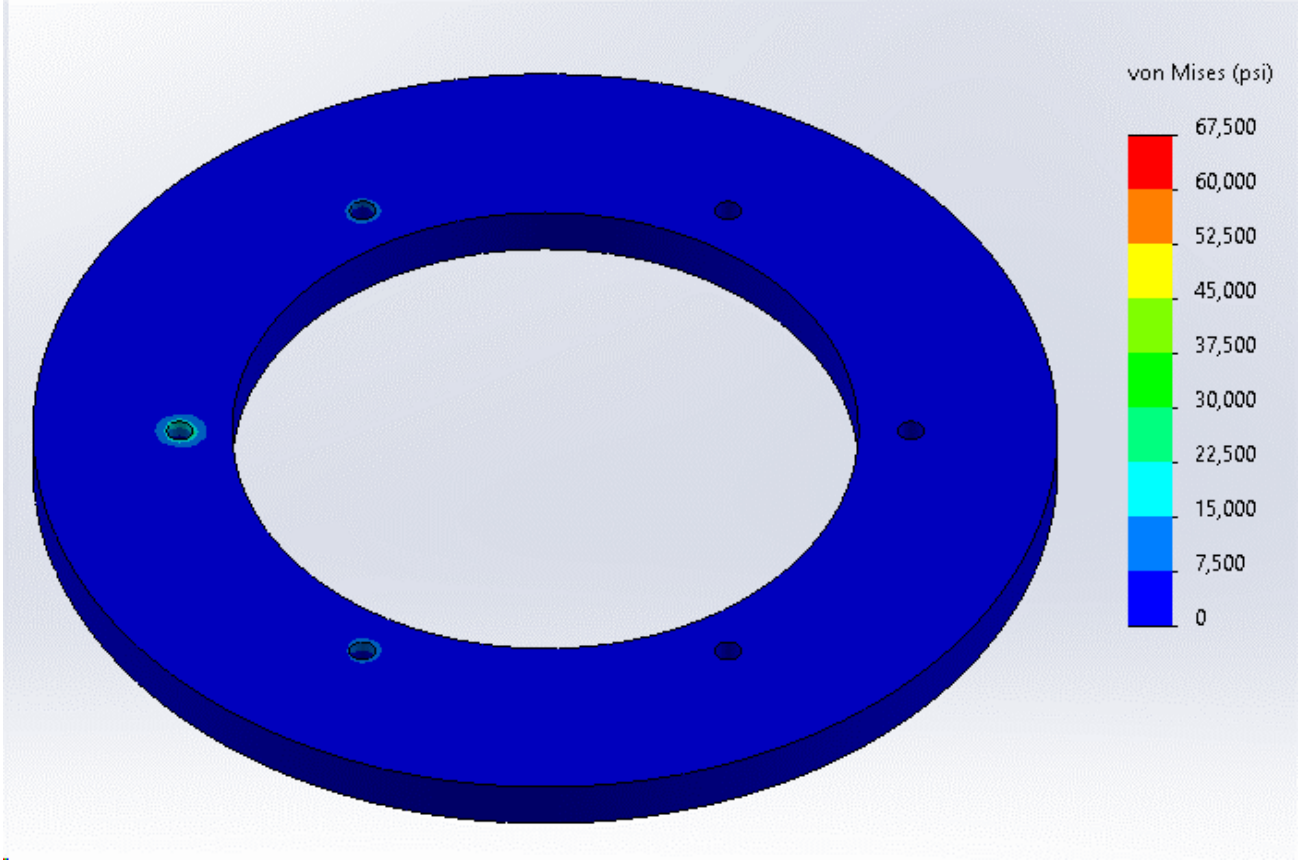
Results

Sufficient

Client Site Name:	SEATTLE QWEST-SEA155		**Engineer:**	MEC
Client Site Number:	BU 880416		**Check:**	RKE
Client Order Number:	578276 Rev. 8		**Date:**	2/10/2023
TEP Project Number:	151934.819073	Tower Engineering Professionals	**Page:**	8

Study: 30 Degree

Top Flange



Assumptions

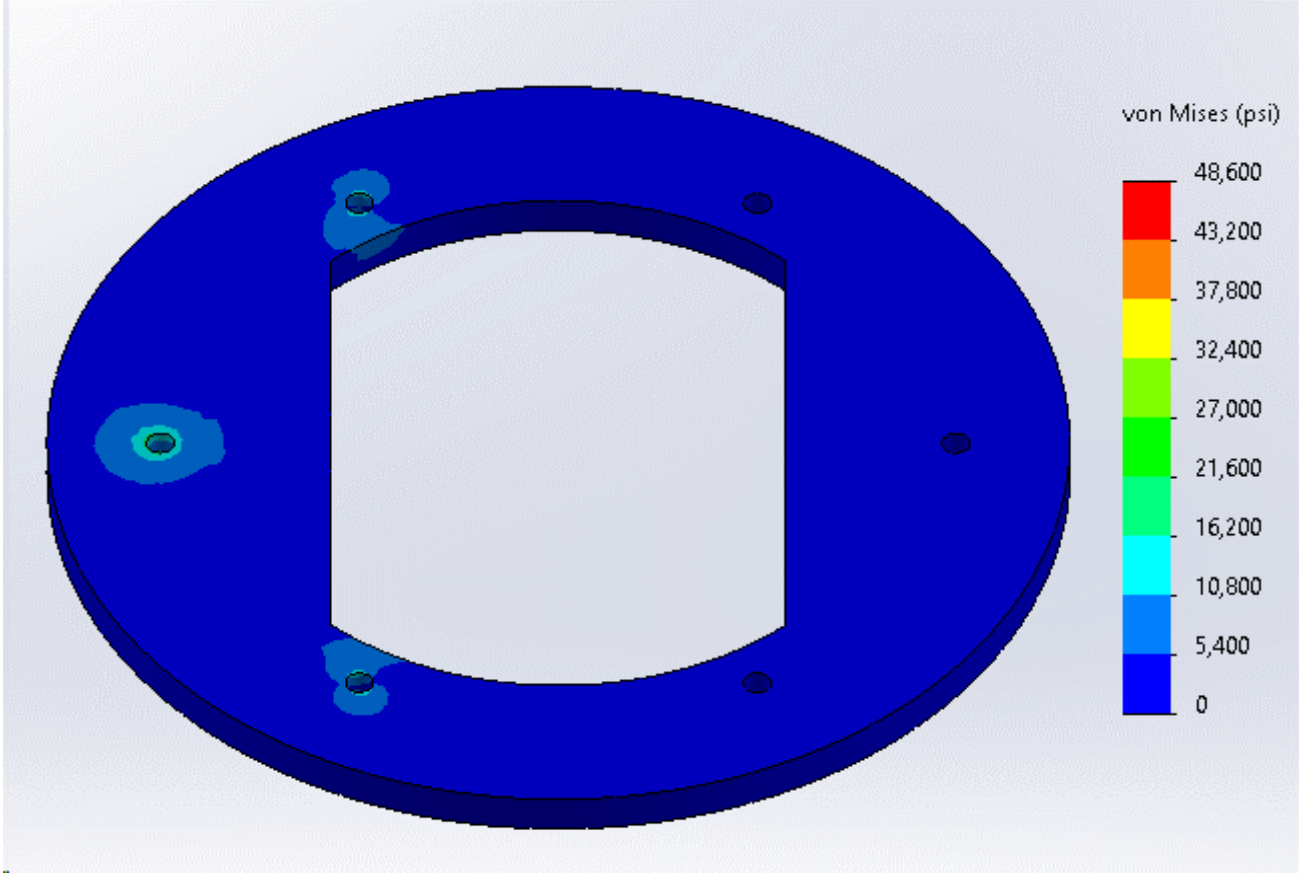
N/A

Results

Sufficient

Study: 30 Degree

Bottom Flange



Assumptions

N/A

Results

Sufficient

Monopole Flange Plate Connection

Elevation = 100 ft.

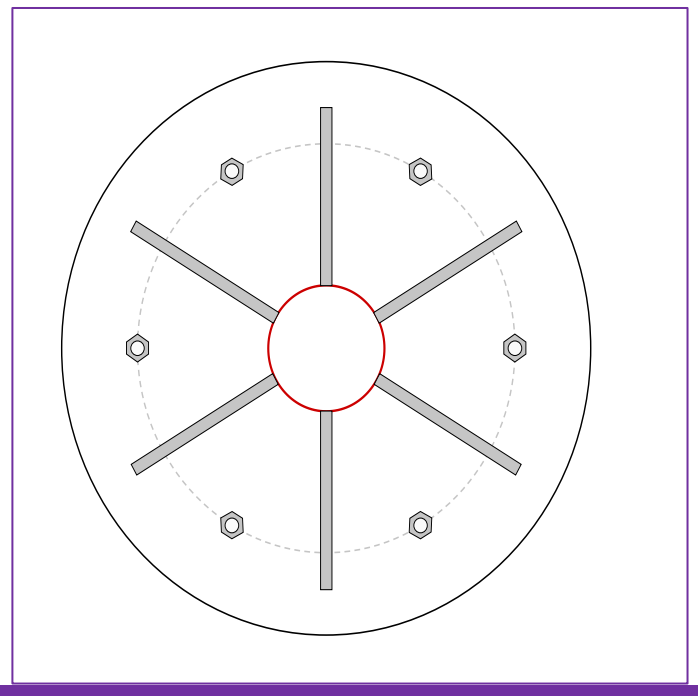
BU #	880416
Site Name	EATTLE QWEST - SEA15
Order #	578276 Rev. 8

TIA-222 Revision	H

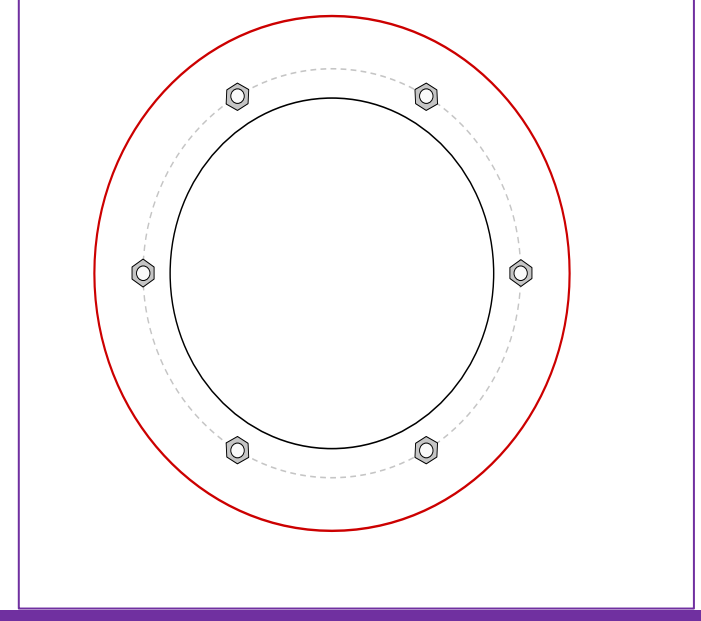
Applied Loads	
Moment (kip-ft)	53.64
Axial Force (kips)	4.66
Shear Force (kips)	2.68

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - Internal



Connection Properties

Bolt Data

(6) 1" ø bolts (A325 N; Fy=92 ksi, Fu=120 ksi) on 28" BC

Top Plate Data

39.25" OD x 2" Plate (A572-50; Fy=50 ksi, Fu=65 ksi)

Bottom Plate Data

24" ID x 1.5" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Top Stiffener Data

(6) 18"H x 12.1875"W x 0.875"T, Notch: 0"
plate: Fy= 50 ksi ; weld: Fy= 70 ksi
horiz. weld: 0.25" fillet
vert. weld: 0.5" fillet

Bottom Stiffener Data

N/A

Top Pole Data

8.625" x 0.5" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Bottom Pole Data

36" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	14.54	
Allowable (kips)	54.54	
Stress Rating:	**25.4%**	**Pass**

Monopole Flange Plate Connection

Elevation = 60 ft.

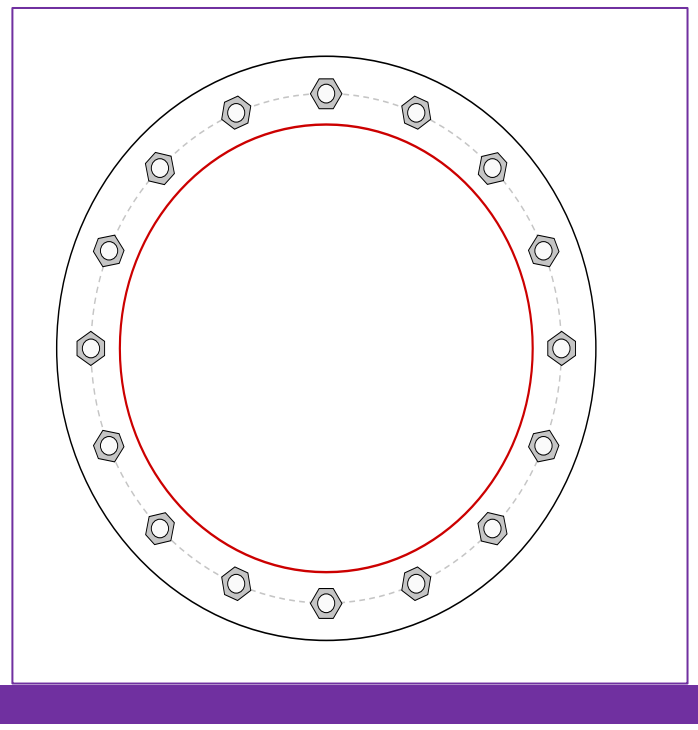
BU #	880416
Site Name	EATTLE QWEST - SEA15
Order #	578276 Rev. 8

TIA-222 Revision	H

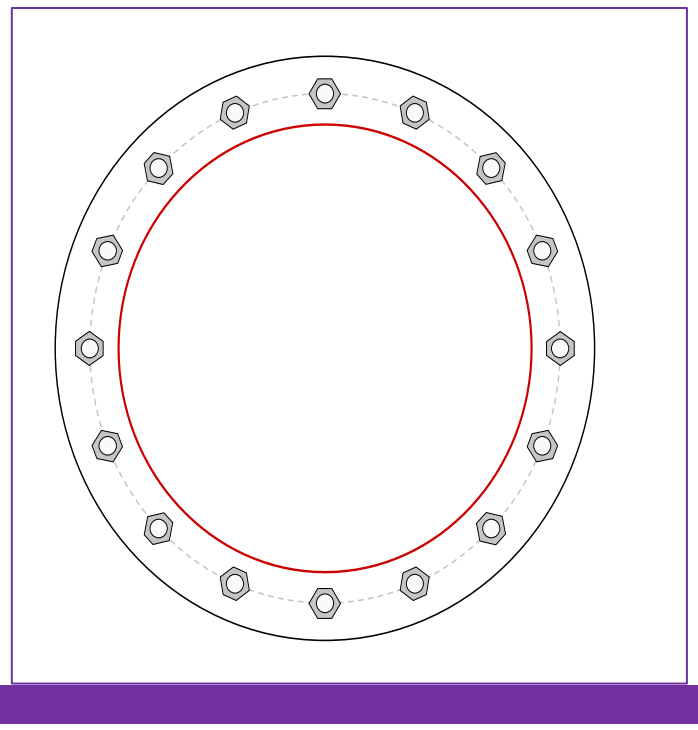
Applied Loads	
Moment (kip-ft)	195.06
Axial Force (kips)	12.71
Shear Force (kips)	4.17

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(16) 1-1/2" ø bolts (A325 N; Fy=81 ksi, Fu=120 ksi) on 41" BC

Top Plate Data

47" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Top Stiffener Data

N/A

Top Pole Data

36" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Bottom Plate Data

47" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

36" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	13.47	
Allowable (kips)	126.90	
Stress Rating:	**10.1%**	**Pass**

Monopole Flange Plate Connection

Elevation = 20 ft.

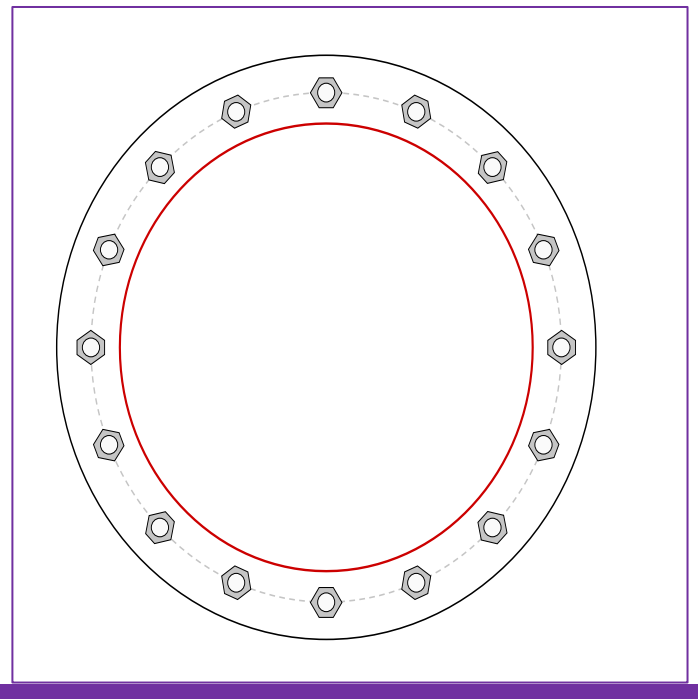
BU #	880416
Site Name	EATTLE QWEST - SEA15
Order #	578276 Rev. 8

TIA-222 Revision	H

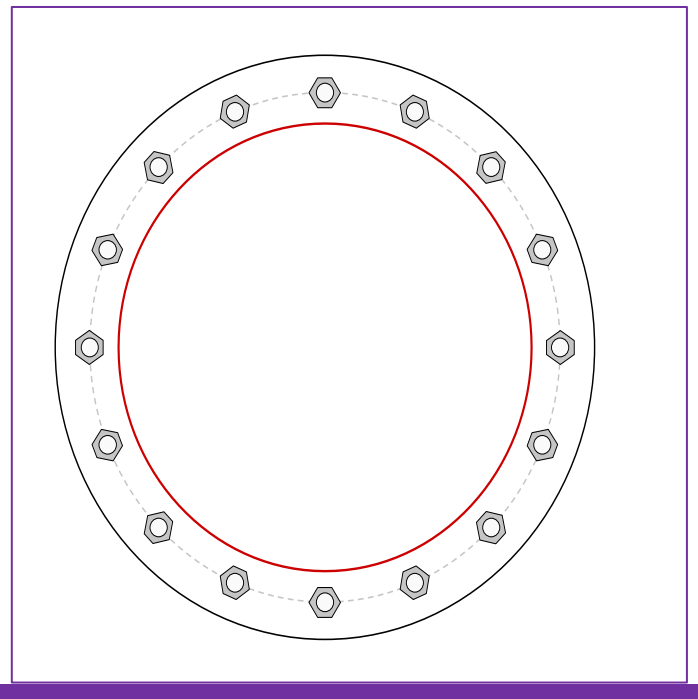
Applied Loads	
Moment (kip-ft)	381.45
Axial Force (kips)	19.93
Shear Force (kips)	5.09

**TIA-222-H Section 15.5 Applied*

Top Plate - External



Bottom Plate - External



Connection Properties

Bolt Data

(16) 1-1/2" ø bolts (A325 N; Fy=81 ksi, Fu=120 ksi) on 41" BC

Top Plate Data

47" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Top Stiffener Data

N/A

Top Pole Data

36" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Bottom Plate Data

47" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Bottom Stiffener Data

N/A

Bottom Pole Data

36" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Bolt Capacity

Max Load (kips)	26.65	
Allowable (kips)	126.90	
Stress Rating:	**20.0%**	**Pass**

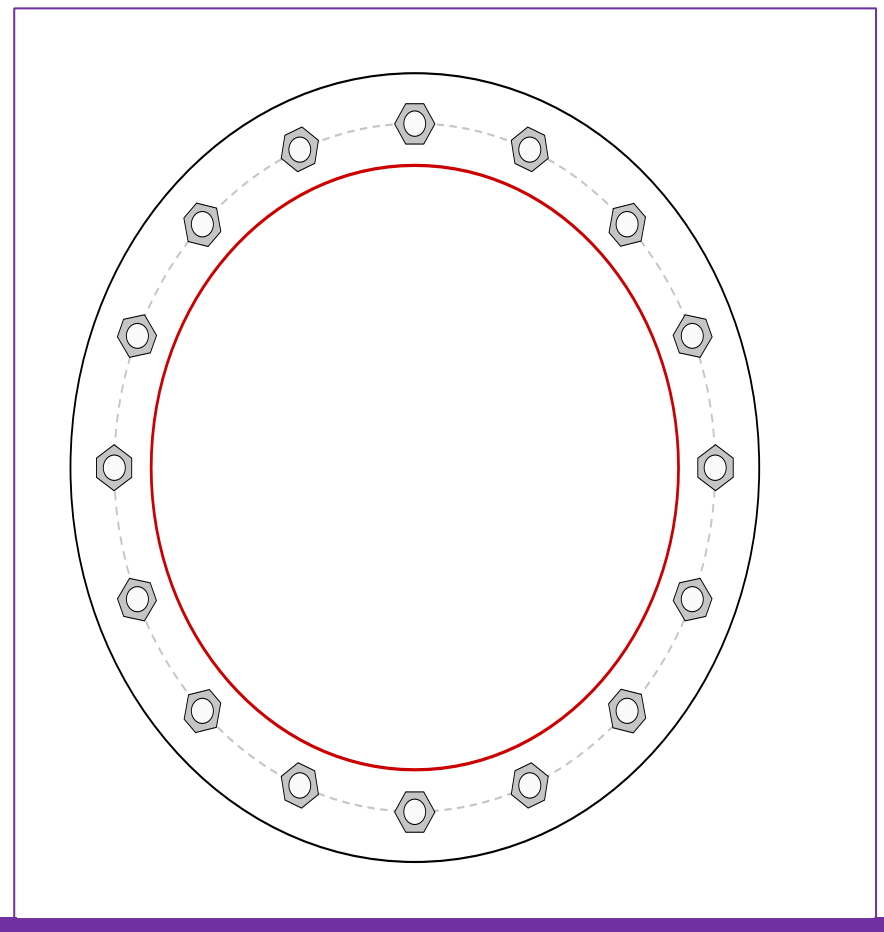
Monopole Base Plate Connection

Site Info	
BU #	880416
Site Name	CATTLE QWEST - SEA15
Order #	578276 Rev. 8

Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
l_{ar} (in)	1.5

Applied Loads	
Moment (kip-ft)	486.54
Axial Force (kips)	23.55
Shear Force (kips)	5.42

**TIA-222-H Section 15.5 Applied*



Connection Properties

Anchor Rod Data

(16) 1-1/2" ø bolts (A354-BC N; Fy=109 ksi, Fu=125 ksi) on 41" BC

Base Plate Data

47" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Stiffener Data

N/A

Pole Data

36" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Anchor Rod Summary *(units of kips, kip-in)*

Pu_t = 34.11	ϕPn_t = 132.19	**Stress Rating**
Vu = 0.34	ϕVn = 82.83	**24.6%**
Mu = n/a	ϕMn = n/a	**Pass**

Drilled Pier Foundation

BU # :	880416
Site Name:	SEATTLE QWEST - SEA15
Order Number:	578276 Rev. 8
TIA-222 Revison:	H
Tower Type:	Monopole

Applied Loads	Comp.	Uplift
Moment (kip-ft)	486.54	
Axial Force (kips)	23.55	
Shear Force (kips)	5.41	

Material Properties		
Concrete Strength, f'c:	3	ksi
Rebar Strength, Fy:	60	ksi
Tie Yield Strength, Fyt:	60	ksi

Pier Design Data		
Depth	20	ft
Ext. Above Grade	0.5	ft
Pier Section 1		
From 0.5' above grade to 20' below grade		
Pier Diameter	6	ft
Rebar Quantity	24	
Rebar Size	9	
Rebar Cage Diameter	63	in
Tie Size	5	
Tie Spacing	12	in

Rebar & Pier Options
Embedded Pole Inputs
Belled Pier Inputs

Analysis Results		
Soil Lateral Check	*Compression*	*Uplift*
$D_{v=0}$ (ft from TOC)	5.26	-
Soil Safety Factor	5.32	-
Max Moment (kip-ft)	517.17	-
Rating*	*23.8%*	-
Soil Vertical Check	*Compression*	*Uplift*
Skin Friction (kips)	168.23	-
End Bearing (kips)	1908.52	-
Weight of Concrete (kips)	104.33	-
Total Capacity (kips)	2076.75	-
Axial (kips)	127.88	-
Rating*	*5.9%*	-
Reinforced Concrete Flexure	*Compression*	*Uplift*
Critical Depth (ft from TOC)	4.99	-
Critical Moment (kip-ft)	517.03	-
Critical Moment Capacity	3249.41	-
Rating*	*15.2%*	-
Reinforced Concrete Shear	*Compression*	*Uplift*
Critical Depth (ft from TOC)	13.98	-
Critical Shear (kip)	62.85	-
Critical Shear Capacity	521.99	-
Rating*	*11.5%*	-

Structural Foundation Rating*	**15.2%**
Soil Interaction Rating*	**23.8%**

*Rating per TIA-222-H Section 15.5

Check Limitation	
Apply TIA-222-H Section 15.5:	☑
N/A	☐
Additional Longitudinal Rebar	
Input Effective Depths (else Actual):	☐
Shear Design Options	
Check Shear along Depth of Pier:	☑
Utilize Shear-Friction Methodology:	☐
Override Critical Depth:	☐

Go to Soil Calculations

Soil Profile

Groundwater Depth	N/A	# of Layers	2

Layer	Top (ft)	Bottom (ft)	Thickness (ft)	γ_{soil} (pcf)	$\gamma_{concrete}$ (pcf)	Cohesion (ksf)	Angle of Friction (degrees)	Calculated Ultimate Skin Friction Comp (ksf)	Calculated Ultimate Skin Friction Uplift (ksf)	Ultimate Skin Friction Comp Override (ksf)	Ultimate Skin Friction Uplift Override (ksf)	Ult. Gross Bearing Capacity (ksf)	SPT Blow Count	Soil Type
1	0	3	3	100	150	0	0	0.000	0.000	0.00	0.00			Cohesionless
2	3	20	17	100	150	0	23.58	0.000	0.000	0.70	0.70	90		Cohesionless

CROWN CASTLE

BU:	880416	Structure:	A
WO:	2200969		
Order:	578276	Rev:	8

Location

	Decimal Degrees		Deg	Min	Sec
Lat:	47.541667	+	47	32	30.00
Long:	-122.223611	-	122	13	25.00

Code and Site Parameters

Seismic Design Code:	TIA-222-H-1	
Site Soil:	D (Default)	Default
Risk Category:	II	

USGS Seismic Reference			
	S_S:	1.4610	g
	S_1:	0.5050	g
	T_L:	6	s

Seismic Design Category Determination

Importance Factor, I_e:	1	
Acceleration-based site coefficient, F_a:	1.2000	
Velocity-based site coefficient, F_v:	1.7950	
Design spectral response acceleration short period, S_{DS}:	1.1688	g
Design spectral response acceleration 1 s period, S_{D1}:	0.6043	g
T_s:	0.5170	
Seismic Design Category Based on S_{DS}:	D	
Seismic Design Category Based on S_{D1}:	D	
Seismic Design Category Based on S_1:	N/A	
Controlling Seismic Design Category:	D	

BU:	880416	Structure:	A
WO:	2200969		
Order:	578276	Rev:	8

Tower Details

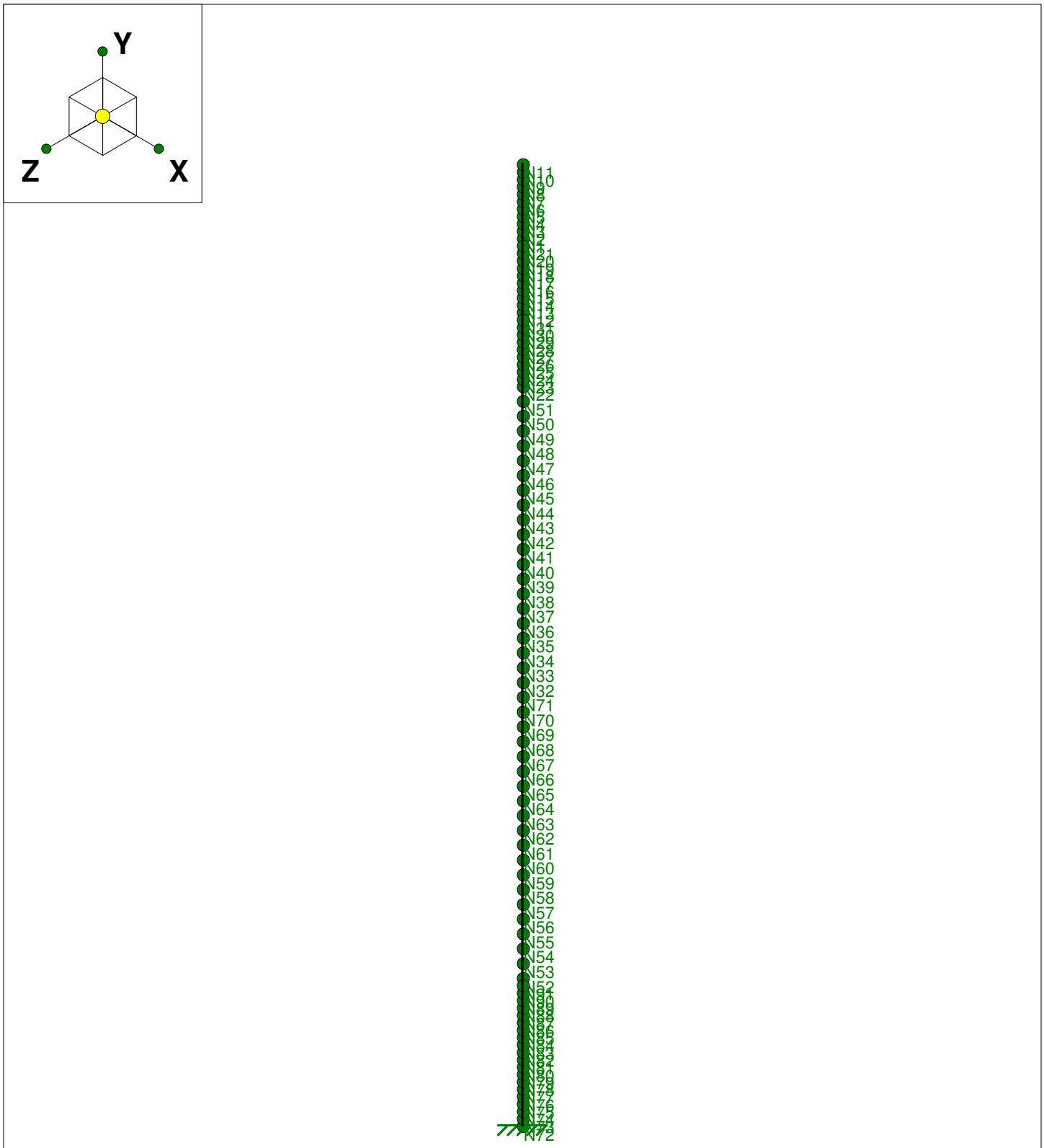
Tower Type:	Stepped Monopole		
Height, h:	150	ft	
Effective Seismic Weight, W:	19.63	kips	
Amplification Factor, A_s:	1.0		2.7.8.1

Seismic Base Shear

Response Modification Factor, R:	1.5		
Fundamental Period, T:	1.8920	s	
Seismic Response Coefficient, C_s	0.3194		Table 2-12 Note 3
Seismic Response Coefficient Max 1, C_{smax}	N/A		
Seismic Response Coefficient Max 2, C_{smax}	N/A		
Seismic Response Coefficient Min 1, C_{smin}	0.0514		2.7.7.1.1
Seismic Response Coefficient Min 2, C_{smin}	N/A		2.7.7.1.1
Controlling Seismic Response Coefficient, C_{sc}	0.3194		
Seismic Base Shear, V	6.269	kips	2.7.7.1.1

Vertical Distribution Factors

Period Related Exponent, k:	1.696
Sum of $w_i h_i^k$	28114.87



Tower Engineering Profes...	SEATTLE QWEST - SEA155 (BU 880416)	SK - 1
mcrispi		Feb 10, 2023 at 11:20 AM
TEP No. 151934.819073		Modal.rt3

(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	No
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Standard Solver

Hot Rolled Steel Code	AISC 15th(360-16): LRFD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	AISC 14th(360-10): ASD
Cold Formed Steel Code	None
Wood Code	None
Wood Temperature	< 100F
Concrete Code	None
Masonry Code	TMS 402-16: ASD
Aluminum Code	AA ADM1-15: ASD - Building
Stainless Steel Code	AISC 14th(360-10): ASD
Adjust Stiffness?	Yes(Iterative)

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	No
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

Company : Tower Engineering Professionals
Designer : mcrispi
Job Number : TEP No. 151934.819073
Model Name : SEATTLE QWEST - SEA155 (BU 880416)

Feb 10, 2023
11:22 AM
Checked By: RKE

(Global) Model Settings, Continued

Seismic Code	ASCE 7-16
Seismic Base Elevation (ft)	0
Add Base Weight?	Yes
Ct X	1
Ct Z	1
T X (sec)	1.892
T Z (sec)	1.892
R X	1.5
R Z	1.5
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	.604
SDS	1.169
S1	.505
TL (sec)	6
Risk Cat	I or II
Drift Cat	Other
Om Z	1
Om X	1
Cd Z	4
Cd X	4
Rho Z	1
Rho X	1

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(d...	Section/Shape	Type	Design List	Material	Design Rul...
1	M1	N1	N11			ANT_LEG_L1	Column	Pipe	A53-B-42	Typical
2	M2	N12	N1			ANT_LEG_L2	Column	Pipe	A53-B-42	Typical
3	M3	N22	N12			ANT_LEG_L3	Column	Pipe	A53-B-42	Typical
4	M4	N32	N22			ANT_LEG_L4	Column	Pipe	A53-B-42	Typical
5	M5	N52	N32			ANT_LEG_L5	Column	Pipe	A53-B-42	Typical
6	M6	N72	N52			ANT_LEG_L6	Column	Pipe	A53-B-42	Typical

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distributed	Area(Me...	Surface(P...
1	Dead Load	None		-1			61	6		

Load Combinations

	Description	Solve	PDel...	SR...	BLC	Factor	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...
1	Dead Only	Yes	Y		1	1		1		1	0		0		0		0		0		0	
2	(1.2+0.2S...	Yes	Y		1	1.2	1	.234	SX*...	1	0		0		0		0		0		0	

Spectra Scaling Factor

Scaling Factor Z:	1	Scaling Factor X:	1	

Dynamics Input

Number of Modes	14
Load Combination Number	1 - Dead Only
Acceleration of Gravity	32.2 (ft/sec^2)
Convergence Tolerance	0.0001

Member Section Forces

	LC	Member Label	Sec	Axial[k]	y Shear[k]	z Shear[k]	Torque[k-ft]	y-y Moment[k-ft]	z-z Moment[k-ft]
1	2	M1	1	1.824	1.622	0	0	-.143	10.439
2			2	1.716	1.589	0	0	-.141	6.468
3			3	1.607	1.536	0	0	-.14	2.719
4			4	.341	.537	0	0	0	1.172
5			5	.232	.421	0	0	0	0
6	2	M2	1	3.792	2.241	0	0	-.15	29.994
7			2	3.675	2.225	0	0	-.149	24.769
8			3	3.558	2.201	0	0	-.147	19.702
9			4	2.764	1.94	0	0	-.145	14.931
10			5	2.647	1.91	0	0	-.143	10.439
11	2	M3	1	5.634	2.666	0	0	-.153	52.408
12			2	5.457	2.642	0	0	-.152	46.52
13			3	5.28	2.612	0	0	-.152	40.817
14			4	4.759	2.487	0	0	-.151	35.29
15			5	4.582	2.446	0	0	-.15	29.994
16	2	M4	1	15.265	4.125	0	0	-.158	174.705
17			2	13.119	3.897	0	0	-.156	140.961
18			3	10.973	3.685	0	0	-.155	108.432
19			4	8.827	3.412	0	0	-.154	78.291
20			5	6.681	2.944	0	0	-.153	52.408
21	2	M5	1	23.848	5.977	0	0	-.162	334.515
22			2	21.702	5.649	0	0	-.162	288.722
23			3	19.556	5.142	0	0	-.16	247.416
24			4	17.41	4.626	0	0	-.159	209.831
25			5	15.265	4.195	0	0	-.158	174.705
26	2	M6	1	28.14	6.269	0	0	-.163	438.106
27			2	27.067	6.265	0	0	-.163	411.04
28			3	25.994	6.233	0	0	-.163	384.645
29			4	24.921	6.156	0	0	-.163	359.086
30			5	23.848	6.026	0	0	-.162	334.515

Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	2	N72	-6.269	28.14	0	.163	0	-437.917
2	2	Totals:	-6.269	28.14	0			
3	2	COG (ft):	X: 0	Y: 65.245	Z: 0			

Member AISC 15th(360-16): LRFD Steel Code Checks (By Combination)

	LC	Member	Shape	UC Max	Loc[ft]	Shear UC	Loc[ft]	Dir	phi*Pnc[k]	phi*Pnt[k]	phi*Mnyy[k-ft]	phi*Mnzz[k-ft]	Cb	Eqn
1	2	M1	P6.625x0...	.203	0	.017	0		317.707	317.707	52.276	52.276	1	H1-1b
2	2	M2	P6.625x0...	.580	0	.024	0		317.707	317.707	52.276	52.276	1	H1-1b
3	2	M3	P8.625x0.5	.509	0	.018	0		482.431	482.431	104.106	104.106	1	H1-1b
4	2	M4	P36x0.375	.135	0	.009	0		1491.236	1586.455	1341.322	1341.322	1	H1-1b
5	2	M5	P36x0.375	.257	0	.013	0		1491.236	1586.455	1341.322	1341.322	1	H1-1b
6	2	M6	P36x0.375	.336	0	.013	0		1491.236	1586.455	1341.322	1341.322	1	H1-1b

Company : Tower Engineering Professionals
Designer : mcrispi
Job Number : TEP No. 151934.819073
Model Name : SEATTLE QWEST - SEA155 (BU 880416)

Feb 10, 2023
11:22 AM
Checked By: RKE

Response Spectra Data

X Direction Spectra	ASCE 2016, Parametric Design Spectra
Modes Used	All 14 modes
Mode No. for Signs	
Modal Combination Method	CQC
Damping Ratio	5 Percent

Y Direction Spectra	ASCE 2016, Parametric Design Spectra
Modes Used	All 14 modes
Mode No. for Signs	
Modal Combination Method	CQC
Damping Ratio	5 Percent

Z Direction Spectra	ASCE 2016, Parametric Design Spectra
Modes Used	All 14 modes
Mode No. for Signs	
Modal Combination Method	CQC
Damping Ratio	5 Percent

Frequencies / Participation

Mode Number	Frequency (Hz)	Period (Sec)	Percent Modal Participation X Spectra	Y Spectra	Z Spectra
1	.528	1.892	41.337		15.582
2	.528	1.892	15.582		41.337
3	1.548	.646	7.994		3.504
4	1.548	.646	3.504		7.994
5	4.658	.215	7.996		4.857
6	4.658	.215	4.857		7.996
7	7.648	.131	2.029		1.081
8	7.648	.131	1.081		2.029
9	14.186	.07			4.083
10	14.186	.07	4.083		
11	18.884	.053			1.285
12	18.884	.053	1.285		
13	28.577	.035			1.669
14	28.577	.035	1.669		
Totals :			91.417		91.417

Monopole Base Plate Connection - Seismic

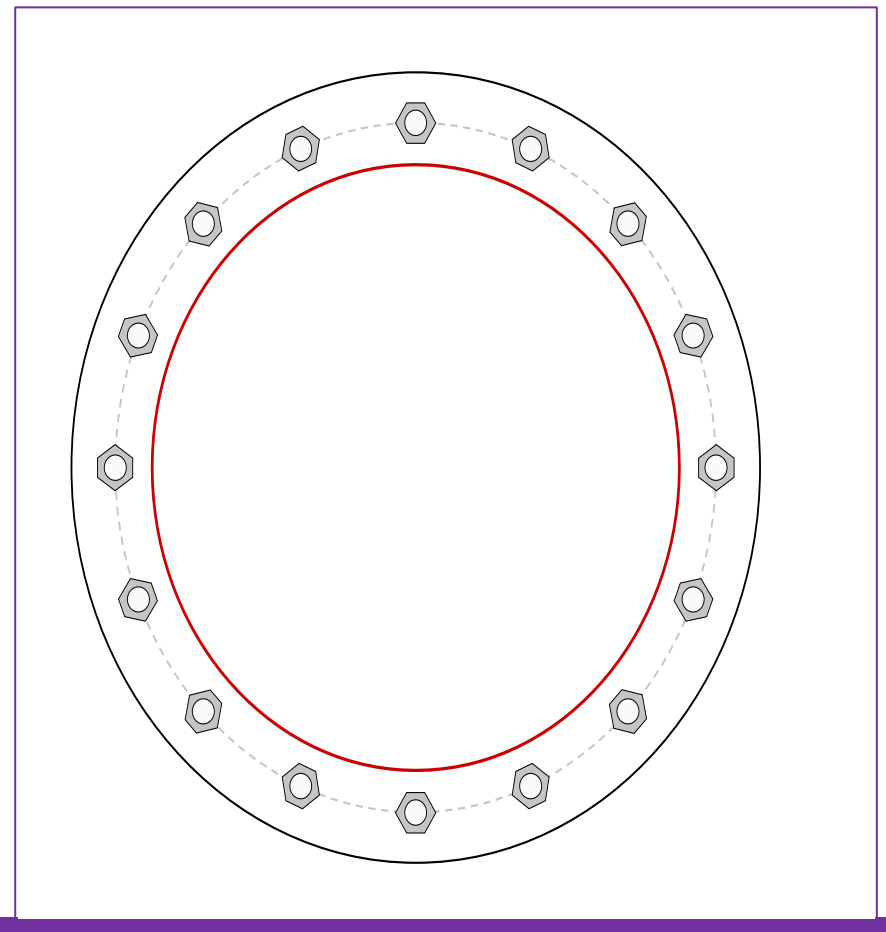
Site Info	
BU #	880416
Site Name	ATTLE QWEST - SEA1
Order #	578276 Rev. 8

Analysis Considerations	
TIA-222 Revision	H
Grout Considered:	No
l_{ar} (in)	1.5

Applied Loads	
Moment (kip-ft)	438.10
Axial Force (kips)	28.14
Shear Force (kips)	6.27

**TIA-222-H Section 15.5 Applied*

**1.5 Overstrength Factor Applied*



Connection Properties

Anchor Rod Data

(16) 1-1/2" ø bolts (A354-BC N; Fy=109 ksi, Fu=125 ksi) on 41" BC

Base Plate Data

47" OD x 2" Plate (A36; Fy=36 ksi, Fu=58 ksi)

Stiffener Data

N/A

Pole Data

36" x 0.375" round pole (A53-B-42; Fy=42 ksi, Fu=63 ksi)

Analysis Results

Anchor Rod Summary *(units of kips, kip-in)*

Pu_t = 46.3	ϕPn_t = 132.19	**Stress Rating**
Vu = 0.59	ϕVn = 82.83	**33.4%**
Mu = n/a	ϕMn = n/a	**Pass**

APPENDIX D

STRUCTURAL DESIGN DRAWINGS

STRUCTURAL DESIGN DRAWINGS

SITE NAME:

SEATTLE QWEST - SEA 155

CROWN CASTLE BU NUMBER:

880416

SITE ADDRESS:

8477 SE 68TH STREET
MERCER ISLAND, WA 98040
(KING COUNTY)
N 47°32'30.00", W 122°13'25.00"

HOT WORK INCLUDED	
NA	BASE GRINDING ONLY
NA	BASE WELDING (AND GRINDING)
NA	AERIAL GRINDING ONLY
NA	AERIAL WELDING (AND GRINDING)

MODIFICATION PROVISIONS

THE MODIFICATIONS DEPICTED ON THESE DRAWINGS ARE BASED ON THE RECOMMENDATIONS OUTLINED IN THE STRUCTURAL MODIFICATION ANALYSIS REPORT COMPLETED BY TEP, JOB NO.: 151934.819073 DATED FEBRUARY 10, 2023 (REV 0).

ATTENTION ALL CONTRACTORS, ANYTIME YOU ACCESS A CROWN SITE FOR ANY REASON YOU ARE TO CALL THE CROWN NOC UPON ARRIVAL AND DEPARTURE, DAILY AT 800-788-7011.

QUALIFIED ENGINEERING SERVICES ARE AVAILABLE FROM TEP TO ASSIST CONTRACTORS IN CLASS IV RIGGING PLAN REVIEWS. FOR REQUESTED QUALIFIED ENGINEERING SERVICES, CONTACT TEP FOR QUOTE AT RIGGING@TEPGROUP.NET

SAFETY CLIMB: 'LOOK UP'

LOOK UP!

THE INTEGRITY OF THE WIRE ROPE SAFETY CLIMB SYSTEM SHALL BE CONSIDERED DURING ALL STAGES OF DESIGN, INSTALLATION, AND INSPECTION. TOWER REINFORCEMENTS AND EQUIPMENT INSTALLATIONS SHALL NOT COMPROMISE THE INTEGRITY OR FUNCTIONAL USE OF ANY WIRE ROPE SAFETY CLIMB ON THE STRUCTURE. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO: PINCHING OF THE WIRE ROPE, BENDING OF THE WIRE ROPE FROM ITS SUPPORTS, DIRECT CONTACT OR CLOSE PROXIMITY TO THE WIRE ROPE WHICH MAY CAUSE FRICTIONAL WEAR, OR IMPACT TO THE ANCHORAGE POINTS IN ANY WAY. ANY COMPROMISED SAFETY CLIMB MUST BE REPORTED TO YOUR CROWN POC FOR RESOLUTION, INCLUDING EXISTING CONDITIONS.

INDEX OF SHEETS

NO.	SHEET TITLE	REV
T-1	TITLE SHEET	0
N-1	MI CHECKLIST AND NOTES	0
N-2	GENERAL NOTES	0
N-3	PROJECT NOTES	0
S-1	TOWER ELEVATION AND MODIFICATION SCHEDULE	0
S-2	CONCEALMENT INSTALLATION DETAILS	0

PROJECT INFORMATION

TOWER HEIGHT:	130-FT
TOWER MANUFACTURER:	ROHN CCI DOCUMENT: 2030383
WORK ORDER NO.:	2200969
ORDER NO.:	578276 REV. 8
DESIGN BUILDING CODE:	2018 WASHINGTON STATE BUILDING CODE
DESIGN STANDARD:	TIA-222-H

PROJECT TEAM

CCI MODIFICATION PROJECT MANAGER:

NAME	CROWN CASTLE
CONTACT	RYAN QUINTEL
PHONE	(615) 771-1569
EMAIL	RYAN.QUINTEL@CROWNCASTLE.COM

ENGINEERING FIRM PROJECT MANAGER:

NAME	TOWER ENGINEERING PROFESSIONALS, INC.
CONTACT	RILEY K. EATON, P.E.
PHONE	(919) 661-6351
EMAIL	CMRP@TEPGROUP.NET

PLANS PREPARED FOR:

CROWN CASTLE

PLANS PREPARED BY:

TOWER ENGINEERING PROFESSIONALS
326 TRYON ROAD
RALEIGH, NC 27603
OFFICE: (919) 661-6351
www.tepgroup.net

SEAL:

RONALD EDRIDGE GLOVER, JR. STATE OF WASHINGTON 52921 STRUCTURAL ENGINEER PROFESSIONAL ENGINEER

Electronic Copy

February 10, 2023

REV	DATE	ISSUED FOR:
0	02-10-23	MODIFICATION DRAWINGS

DRAWN BY: EAJ CHECKED BY: RKE

SHEET TITLE:

TITLE SHEET

SHEET NUMBER: **T-1**

REVISION: **0**

TEP#: 151934.819073

CED-FRM-10354 MI CHECKLIST

REQUIRED	REPORT ITEM	APPLICABLE CROWN DOC #	BRIEF DESCRIPTION
		PRE-CONSTRUCTION	
X	MI CHECKLIST DRAWING	CED-SOW-10007	THIS CHECKLIST SERVES AS A GUIDELINE FOR THE REQUIRED CONSTRUCTION DOCUMENTS AND INSPECTIONS FOR THIS MODIFICATION.
NA	EOR APPROVED SHOP DRAWINGS	CED-SOW-10007	ONCE THE PRE-MODIFICATION MAPPING IS COMPLETE AND PRIOR TO FABRICATION, THE CONTRACTOR SHALL PROVIDE DETAILED ASSEMBLY DRAWINGS AND/OR SHOP DRAWINGS. THESE INCLUDE, BUT ARE NOT LIMITED TO, A VISUAL LAYOUT OF NEW REINFORCEMENT, EXISTING REINFORCEMENT CONFIGURATION, PORTHOLES, MOUNTS, STEP PEGS, SAFETY CLIMBS AND ANY OTHER MISCELLANEOUS ITEMS WHICH MAY AFFECT SUCCESSFUL INSTALLATION OF MODIFICATIONS ON THE TOWER. THESE DRAWINGS SHALL BE SUBMITTED TO THE EOR FOR APPROVAL. SHOP DRAWING SUBMISSION SHALL INCLUDE THE EOR RFI FORM DETAILING ANY CHANGES FROM THE ORIGINAL DESIGN.
NA	FABRICATION INSPECTION	CED-SOW-10007	A LETTER FROM THE FABRICATOR, STATING THAT THE WORK WAS PERFORMED IN ACCORDANCE WITH INDUSTRY STANDARDS AND THE CONTRACT DOCUMENTS, SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	FABRICATOR CERTIFIED WELD INSPECTION	CED-SOW-10007 CED-STD-10069	A CWI SHALL INSPECT ALL WELDING PERFORMED ON STRUCTURAL MEMBERS DURING FABRICATION. A WRITTEN REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	MATERIAL TEST REPORTS (MTR)	CED-SOW-10007	MATERIAL TEST REPORTS SHALL BE PROVIDED FOR MATERIAL USED AS REQUIRED PER SECTION 9.2.5 OF CED-SOW-10007. MTRS SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	FABRICATOR NDE INSPECTION REPORT	CED-SOW-10066 CED-STD-10069	CRITICAL SHOP WELDS THAT REQUIRE TESTING ARE NOTED ON THESE CONTRACT DRAWINGS. A CERTIFIED NDT INSPECTOR SHALL PERFORM NON-DESTRUCTIVE EXAMINATION AND A REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	NDE OF MONOPOLE BASE PLATE	ENG-SOW-10033	A NDE OF THE POLE TO BASE PLATE CONNECTION IS REQUIRED AND A WRITTEN REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
X	PACKING SLIPS	CED-SOW-10007	PACKING/SHIPPING LIST FOR ALL MATERIAL USED DURING CONSTRUCTION OF THE MODIFICATION.
ADDITIONAL TESTING AND INSPECTIONS:			
NA			
		CONSTRUCTION	
NA	FOUNDATION INSPECTIONS	CED-SOW-10144	A VISUAL OBSERVATION OF THE EXCAVATION AND REBAR SHALL BE PERFORMED BEFORE PLACING THE CONCRETE. A VISUAL OBSERVATION OF THE REBAR SHALL BE PERFORMED BEFORE PLACING THE EPOXY. A SEALED WRITTEN REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	CONCRETE COMP. STRENGTH AND SLUMP TESTS	CED-SOW-10144	THE CONCRETE MIX DESIGN, SLUMP TEST, AND COMPRESSIVE STRENGTH TESTS SHALL BE PROVIDED AS PART OF THE FOUNDATION REPORT.
NA	EARTHWORK	CED-SOW-10144	FOUNDATION SUB-GRADES SHALL BE INSPECTED AND APPROVED BY AN APPROVED FOUNDATION INSPECTOR AND RESULTS INCLUDED AS PART OF THE FOUNDATION REPORT.
NA	MICROPILE/ROCK ANCHOR	CED-SOW-10144	MICROPILES/ROCK ANCHORS SHALL BE INSPECTED BY THE FOUNDATION INSPECTION VENDOR AND SHALL BE INCLUDED AS PART OF THE FOUNDATION INSPECTION REPORT, ADDITIONAL TESTING AND/OR INSPECTION REQUIREMENTS ARE NOTED IN THESE CONTRACT DOCUMENTS.
NA	POST-INSTALLED ANCHOR ROD VERIFICATION	CED-SOW-10007	POST-INSTALLED ANCHOR ROD VERIFICATION SHALL BE PERFORMED IN ACCORDANCE WITH CROWN REQUIREMENTS AND A REPORT SHALL BE PROVIDED TO THE MI INSPECTOR FOR INCLUSION IN THE MI REPORT.
NA	BASE PLATE GROUT VERIFICATION	ENG-STD-10323	THE GENERAL CONTRACTOR SHALL PROVIDE DOCUMENTATION TO THE MI INSPECTOR THAT CERTIFIES THAT THE GROUT WAS REMOVED AND/OR INSTALLED IN ACCORDANCE WITH CROWN REQUIREMENTS FOR INCLUSION IN THE MI REPORT.
NA	FIELD CERTIFIED WELD INSPECTION	CED-SOW-10066 CED-STD-10069	A CROWN APPROVED CERTIFIED WELD INSPECTOR SHALL INSPECT AND TEST FIELD WELDS, FOLLOWING ALL PROCEDURES SPECIFIED IN CROWN STANDARD DOCUMENTS APPLICABLE TO WELD INSPECTIONS. A REPORT SHALL BE PROVIDED. NDE OF FIELD WELDS SHALL BE PERFORMED AS REQUIRED BY CROWN STANDARDS AND CONTRACT DOCUMENTS. THE NDE REPORT SHALL BE INCLUDED IN THE CWI REPORT.
X	ON-SITE COLD GALVANIZING VERIFICATION	ENG-STD-10149	THE GENERAL CONTRACTOR SHALL PROVIDE WRITTEN AND PHOTOGRAPHIC DOCUMENTATION TO THE MI INSPECTOR VERIFYING THAT ANY ON-SITE COLD GALVANIZING WAS APPLIED PER MANUFACTURER SPECIFICATIONS AND APPLICABLE STANDARDS.
NA	TENSION TWIST AND PLUMB	CED-PRC-10182 CED-STD-10261	THE GENERAL CONTRACTOR SHALL PROVIDE A REPORT IN ACCORDANCE WITH APPLICABLE STANDARDS DOCUMENTING TENSION TWIST AND PLUMB.
X	GC AS-BUILT DOCUMENTS	CED-SOW-10007	THE GENERAL CONTRACTOR SHALL SUBMIT A LEGIBLE COPY OF THE ORIGINAL DESIGN DRAWINGS EITHER STATING "INSTALLED AS DESIGNED" OR NOTING ANY CHANGES THAT WERE REQUIRED AND APPROVED BY THE ENGINEER OF RECORD. EOR/RFI FORMS APPROVING ALL CHANGES SHALL BE SUBMITTED.
ADDITIONAL TESTING AND INSPECTIONS:			
X	CANISTER DRAWINGS	NA	THE GC SHALL SUBMIT A LEGIBLE COPY OF ANY FINAL FABRICATION OR PARTS DRAWINGS PROVIDED BY THE CANISTER VENDOR.
X	TOWER PLUMB DELIVERABLES	NA	THE GENERAL CONTRACTOR SHALL PROVIDE WRITTEN AND PHOTOGRAPHIC DOCUMENTATION TO THE MI INSPECTOR VERIFYING THE TOWER PLUMB CONDITION. SEE REQUIREMENTS ON SHEET N-3.
		POST-CONSTRUCTION	
X	CONSTRUCTION COMPLIANCE LETTER	CED-SOW-10007	A LETTER FROM THE GENERAL CONTRACTOR STATING THAT THE WORKMANSHIP WAS PERFORMED IN ACCORDANCE WITH INDUSTRY STANDARDS AND THESE CONTRACT DRAWINGS, INCLUDING LISTING ADDITIONAL PARTIES TO THE MODIFICATION PROCESS.
NA	POST-INSTALLED ANCHOR ROD PULL TESTS	CED-PRC-10119	POST-INSTALLED ANCHOR RODS SHALL BE TESTED BY A CROWN APPROVED PULL TEST INSPECTOR AND A REPORT SHALL BE PROVIDED INDICATING TESTING RESULTS.
X	PHOTOGRAPHS	CED-SOW-10007	PHOTOGRAPHS SHALL BE SUBMITTED TO THE MI. PHOTOS SHALL DOCUMENT ALL PHASES OF THE CONSTRUCTION. THE PHOTOS SHALL BE ORGANIZED IN A MANNER THAT EASILY IDENTIFIES THE EXACT LOCATION OF THE PHOTO.
NA	BOLT HOLE INSTALLATION AND VERIFICATION REPORT	CED-SOW-10007	THE MI INSPECTOR SHALL VERIFY THE INSTALLATION AND TIGHTNESS 10% OF ALL NON PRE-TENSIONED BOLTS INSTALLED AS PART OF THE MODIFICATION. THE MI INSPECTOR SHALL LOOSEN THE NUT AND VERIFY THE BOLT HOLE SIZE AND CONDITION. THE MI REPORT SHALL CONTAIN THE COMPLETED BOLT INSTALLATION VERIFICATION REPORT, INCLUDING THE SUPPORTING PHOTOGRAPHS.
X	PUNCH LIST DEVELOPMENT AND CORRECTION DOCUMENTATION	CED-PRC-10283 CED-FRM-10285	FINAL PUNCHLIST INDICATING ALL NONCONFORMANCE(S) IDENTIFIED AND THE FINAL RESOLUTION AND APPROVAL.
X	MI INSPECTOR REDLINE OR RECORD DRAWING(S)	CED-SOW-10007	THE MI INSPECTOR SHALL OBSERVE AND REPORT ANY DISCREPANCIES BETWEEN THE CONTRACTOR'S REDLINE DRAWING AND THE ACTUAL COMPLETED INSTALLATION.
ADDITIONAL TESTING AND INSPECTIONS:			
NA			

THE MI CHECKLIST SHALL BE REVIEWED PRIOR TO THE START OF CONSTRUCTION. ALL PARTIES TO THE MODIFICATION SHALL UNDERSTAND CROWN REQUIREMENTS AND INSPECTION/DOCUMENTATION THAT IS APPLICABLE TO THE SCOPE OF THE WORK THEY ARE PERFORMING. ERRORS ON THE MI CHECKLIST DO NOT ABSOLVE THE GC OR MI INSPECTOR FROM PERFORMING/COLLECTING DOCUMENTATION.

MODIFICATION INSPECTION NOTES:

GENERAL

THE MI IS AN ON-SITE VISUAL AND HANDS-ON INSPECTION OF TOWER MODIFICATIONS INCLUDING A REVIEW OF CONSTRUCTION REPORTS AND ADDITIONAL PERTINENT DOCUMENTATION PROVIDED BY THE GENERAL CONTRACTOR (GC), AS WELL AS ANY INSPECTION DOCUMENTS PROVIDED BY 3RD PARTY INSPECTORS. THE MI IS TO ENSURE THE INSTALLATION WAS CONSTRUCTED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS, NAMELY THE MODIFICATION DRAWINGS; IN ACCORDANCE WITH APPLICABLE CROWN STANDARDS; AND AS DESIGNED BY THE ENGINEER OF RECORD (EOR).

NO DOCUMENT, CODE OR POLICY CAN ANTICIPATE EVERY SITUATION THAT MAY ARISE. ACCORDINGLY, THIS CHECKLIST IS INTENDED TO SERVE AS A SOURCE OF GUIDING PRINCIPLES IN ESTABLISHING GUIDELINES FOR MODIFICATION INSPECTION.

THE MI IS TO CONFIRM INSTALLATION CONFIGURATION AND WORKMANSHIP ONLY AND IS NOT A REVIEW OF THE MODIFICATION DESIGN ITSELF, AND THE MI INSPECTOR DOES NOT TAKE OWNERSHIP OF THE MODIFICATION DESIGN. OWNERSHIP OF THE STRUCTURAL MODIFICATION DESIGN EFFECTIVENESS AND INTEGRITY RESIDES WITH THE EOR AT ALL TIMES. THE MI INSPECTOR SHALL INSPECT AND NOTE CONFORMANCE/NONCONFORMANCE AND PROVIDE TO THE CROWN POINT OF CONTACT (CROWN POC) FOR EVALUATION.

ALL MI'S SHALL BE CONDUCTED BY A CROWN APPROVED MI INSPECTOR, WORKING FOR A CROWN APPROVED MI VENDOR. SEE CROWN CED-LST-10173, "APPROVED MI VENDORS".

TO ENSURE THAT THE REQUIREMENTS OF THE MI ARE MET, IT IS VITAL THAT THE GENERAL CONTRACTOR (GC) AND THE MI INSPECTOR BEGIN COMMUNICATING AND COORDINATING AS SOON AS A PURCHASE ORDER (PO) IS RECEIVED. IT IS EXPECTED THAT EACH PARTY WILL BE PROACTIVE IN REACHING OUT TO THE OTHER PARTY. IF CONTACT INFORMATION IS NOT KNOWN THE GC AND/OR INSPECTOR SHALL CONTACT THE CROWN POINT OF CONTACT (CROWN POC).

REFER TO CROWN CED-SOW-10007, "MODIFICATION INSPECTION SOW", FOR FURTHER DETAILS AND REQUIREMENTS.

SERVICE LEVEL COMMITMENT

THE FOLLOWING RECOMMENDATIONS AND SUGGESTIONS ARE OFFERED TO ENHANCE THE EFFICIENCY AND EFFECTIVENESS OF DELIVERING AN MI REPORT:

- THE GC SHALL PROVIDE A MINIMUM OF 5 BUSINESS DAYS NOTICE, PREFERABLY 10, TO THE MI INSPECTOR AS TO WHEN THE SITE WILL BE READY FOR THE MI TO BE CONDUCTED.
- THE GC AND MI INSPECTOR COORDINATE CLOSELY THROUGHOUT THE ENTIRE PROJECT.
- WHEN POSSIBLE, IT IS PREFERRED TO HAVE THE GC AND MI INSPECTOR ON-SITE SIMULTANEOUSLY FOR ANY GUY WIRE TENSIONING OR RE-TENSIONING OPERATIONS.
- WHEN POSSIBLE, IT IS PREFERRED TO HAVE THE GC AND MI INSPECTOR ON-SITE DURING THE MI TO HAVE ANY MINOR DEFICIENCIES CORRECTED DURING THE INITIAL MI. THEREFORE, THE GC MAY CHOOSE TO COORDINATE THE MI CAREFULLY TO ENSURE ALL CONSTRUCTION FACILITIES ARE AT THEIR DISPOSAL WHEN THE MI INSPECTOR IS ON SITE.

REQUIRED PHOTOS

BETWEEN THE GC AND THE MI INSPECTOR THE FOLLOWING PHOTOGRAPHS, AT A MINIMUM, ARE TO BE TAKEN AND INCLUDED IN THE MI REPORT:

- PRE-CONSTRUCTION GENERAL SITE CONDITION
- PHOTOGRAPHS DURING THE REINFORCEMENT MODIFICATION CONSTRUCTION / ERECTION AND INSPECTION
  - RAW MATERIALS
  - PHOTOS OF ALL CRITICAL DETAILS
  - FOUNDATION MODIFICATIONS
  - WELD PREPARATION
  - BOLT INSTALLATION
  - FINAL INSTALLED CONDITION
  - SURFACE COATING REPAIR
- POST CONSTRUCTION PHOTOGRAPHS
  - FINAL INFIELD CONDITION

PHOTOS OF ELEVATED MODIFICATIONS TAKEN ONLY FROM THE GROUND SHALL BE CONSIDERED INADEQUATE.

THIS IS NOT A COMPLETE LIST OF REQUIRED PHOTOS. FOR A COMPLETE LIST OF PHOTOS SEE CED-SOW-10007.

NOTE:

X DENOTES A DOCUMENT NEEDED FOR THE PMI REPORT
NA DENOTES A DOCUMENT THAT IS NOT REQUIRED FOR THE PMI REPORT

PLANS PREPARED FOR:

CROWN CASTLE

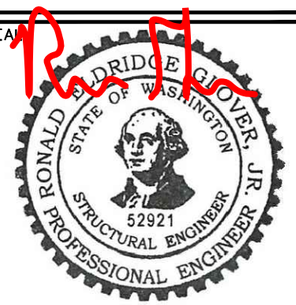
PROJECT INFORMATION:

SEATTLE QWEST - SEA 155
BU #: 880416
8477 SE 68TH STREET
MERCER ISLAND, WA 98040
(KING COUNTY)

PLANS PREPARED BY:

TOWER ENGINEERING PROFESSIONALS
326 TRYON ROAD
RALEIGH, NC 27603
OFFICE: (919) 661-6351
www.tepgroup.net

SEAL



Electronic Copy

February 10, 2023

REV	DATE	ISSUED FOR:
0	02-10-23	MODIFICATION DRAWINGS

DRAWN BY: EAJ | CHECKED BY: RKE

SHEET TITLE:

MI CHECKLIST AND NOTES

SHEET NUMBER: **N-1**

REVISION: **0**

TEP#: 151934.819073

GENERAL NOTES:

1. The General Contractor (GC) shall reference CON–STD–10159, "Tower Modification Construction Specifications", as a continuation of the following General Notes. The GC shall keep a printed or electronic copy of this document with the Structural Design Drawings (SDD) at all times, in a location accessible to all Contractor Personnel, and shall ensure that all Contractor Personnel are aware of the information enclosed within the General Notes and CON–STD–10159.

2. The Contract Documents are the property of Crown Castle (Crown). They are provided to the GC and its Lower Tier Contractors and material suppliers for the limited purpose of use in completing the Work for this Site, and shall be kept in strict confidence and not disclosed to any third parties. The Contract Documents shall not be used for any other purpose whatsoever without the prior written consent of Crown.

3. Detail drawings, including notes and tables, shall govern over general notes and typical details. Contact the Crown Point of Contact (POC) and Engineer of Record (EOR) for clarification as needed.

4. Do not scale drawings.

5. Any Work performed without a prefabrication mapping is done at the risk of the GC and/or fabricator. All dimensions of existing structural elements are assumed based on the available documentation and are preliminary until field–verified by the GC, unless noted otherwise (UNO). Where discrepancies are found, GC shall contact the Crown POC and EOR through RFI.

6. For this analysis and modification, the tower has been assumed to be in good condition without any structural defects, UNO. If the GC discovers any indication of an existing structural defect, contact the Crown POC and EOR immediately.

7. All construction means and methods, including but not limited to erection plans, rigging plans, climbing plans, and rescue plans, shall be the responsibility of the GC responsible for the execution of the Work contained herein, and shall meet ANSI/ASSE A10.48 (latest edition); federal, state, and local regulations; and any applicable industry consensus standards related to the construction activities being performed. All rigging plans shall adhere to ANSI/ASSE A10.48 (latest edition) and Crown standard CED–STD–10253, "Rigging Program", including the required involvement of a qualified engineer for class IV construction to certify the supporting structure(s) in accordance with the ANSI/TIA–322 (latest edition).

8. Hoisting grips used for feed line installation shall follow manufacturer guidelines for maximum installed spacing intervals and pull load capacity restrictions.

9. The structural integrity of the modification design extends to the complete condition only. The GC must be cognizant that the removal of any structural component of an existing tower has the potential to cause the partial or complete collapse of the structure. All necessary precautions must be taken to ensure structural integrity, including, but not limited to, engineering assessment of construction stresses with installation maximum wind speed and/or temporary bracing and shoring.

10. Aerial and underground utilities and facilities may or may not be shown on the drawings. The GC shall take every precaution to preserve and protect these items, which may include aerial or underground power lines, telephone lines, water lines, sewer lines, cable television facilities, pipelines, structures and other public and private improvements within or adjacent to the work area. The responsibility for determining the actual on–site location of these items shall rest exclusively with the GC.

11. All manufacturer's hardware assembly instructions shall be followed, UNO. Conflicting notes shall be brought to the attention of the EOR and the Crown POC.

12. The GC shall fabricate all required items per the materials specified below, UNO on the detail drawing sheets. If the GC finds for any component that the materials have not been clearly specified, the GC shall submit an RFI to the EOR to confirm the required material.

    All structural elements shall be new and shall conform to the following requirements, UNO:

    Monopoles:

–Structural shapes and plates:	ASTM A572 Grade 65 (FY = 65 KSI)
–Welding electrodes, SMAW:	E80XX
–Welding electrodes, FCAW:	E8XT–XX
–Welding electrodes, GMAW:	ER80S–X

    Self–Support and Guyed Towers:

–Structural shapes and plates:	ASTM A572 Grade 50 (FY = 50 KSI)
–Welding electrodes, SMAW:	E70XX
–Welding electrodes, FCAW:	E7XT–XX
–Welding electrodes, GMAW:	ER70S–X

    All tower types:

–Steel angle:	ASTM A572 Grade 50 (FY = 50 KSI)
–Solid rod:	ASTM A36 (FY = 36 KSI)
–Pipe/tube (round):	ASTM A500 Grade C (FY = 46 KSI)
–Pipe/tube (square):	ASTM A500 Grade C (FY = 50 KSI)
–Bolts:	ASTM F3125 Grade A325 Type 1
–U–bolts:	ASTM A307 Grade A, OR SAE J429 Grade 2
–Nuts:	ASTM A563 Grade DH
–Washers:	ASTM F436 Type 1
–Guy wires:	ASTM A475 Grade EHS
–Bridge strand:	ASTM A586 Grade 1

13. After fabrication, hot–dip galvanize all steel items, UNO. Galvanize per ASTM A123, ASTM A153/A153M, OR ASTM A653 G90, as applicable. ASTM A490 bolts shall not be hot–dip galvanized, but shall instead be coated with Magni 565 or EOR approved equivalent, per ASTM F2833.

14. Contractor Personnel shall not drill holes in any new or existing structural members, other than those drilled holes shown on structural drawings, without the approval of the EOR.

15. For a list of Crown–approved cold galvanizing compounds, refer to OPS–STD–10149, "Tower Protective Coatings Guidelines".

16. All exposed structural steel as the result of this scope of Work including welds (after final inspection of the weld by the CWI), field drilled holes, and shaft interiors (where accessible), shall be cleaned and two (2) coats cold galvanizing shall be applied by brush in accordance with OPS–STD–10149, "Tower Protective Coatings Guidelines". Photo documentation is required to be submitted to the MI Inspector.

17. If removal of existing modifications is required per the modification scope, the GC shall clean and cold galvanize any existing empty bolt holes, UNO. If additional unexpected, oversized, or slotted holes are found, the GC shall contact the EOR and Crown POC for guidance prior to proceeding with the modifications.

18. All Work involving base plate grout scope items or resulting in disturbance of base plate grout shall reference ENG–STD–10323, "Base Plate Grout", and shall follow any Base Plate Grout Removal notes contained herein.

19. If scope of modification involves bark removal or installation, the GC shall reference CED–SOW–10265, "Tree Concealment for Monopoles", as well as CED–STD–10395, "Installation Guidelines for Bark Surfaces".

20. If scope of modification involves concealment components including branching, the GC shall reference CED–CAT–10398, "Monopole Concealed Decorative Structures (CDS) Approved Components". All new branch installations require tethering.

21. If scope of modification involves cathodic protection, the GC shall reference CED–SOW–10397, "Cathodic Protection Installation, Replacement, and Enhancement".

22. All tower grounding affected by the Work shall be repaired or replaced in accordance with OPS–STD–10090, "Tower Grounding", and OPS–BUL–10133, "Grounding Repair Recommendation".

23. If scope of modification requires removal or covering of tower ID tag, the tag must be replaced.

24. Any hardware removed from the existing tower shall be replaced with new hardware of equal size and quality, UNO. No existing fasteners shall be reused.

25. All joints using ASTM A325 or A490 bolts, U–bolts, V–bolts, and threaded rods shall be snug tightened, UNO.

26. A nut locking device shall be installed on all proposed and/or replaced snug tightened ASTM A325 or A490 bolts, U–bolts, V–bolts, and threaded rods.

27. All joints are bearing type connections UNO. If no bolt length is given in the Bill of Materials, the connection may include threads in the shear planes, and the GC is responsible for sizing the length of the bolt.

28. Blind bolts shall be installed per the installation specifications on the corresponding Approved Fastener sheets contained in CON–CAT–10300, "Monopole Standard Drawings and Approved Reinforcement Components".

29. If ASTM A325 or A490 bolts, and/or threaded rods are specified to be pre–tensioned, these shall be installed and tightened to the pretensioned condition according to the requirements of the RCSC Specification for Structural Joints Using ASTM High Strength Bolts.

30. All proposed and/or replaced bolts shall be of sufficient length such that the end of the bolt be at least flush with the face of the nut. It is not permitted for the bolt end to be below the face of the nut after tightening is completed.

PLANS PREPARED FOR:

CROWN CASTLE

PROJECT INFORMATION:

SEATTLE QWEST - SEA 155
BU #: 880416
8477 SE 68TH STREET
MERCER ISLAND, WA 98040
(KING COUNTY)

PLANS PREPARED BY:

TOWER ENGINEERING PROFESSIONALS
326 TRYON ROAD
RALEIGH, NC 27603
OFFICE: (919) 661-6351
www.tepgroup.net

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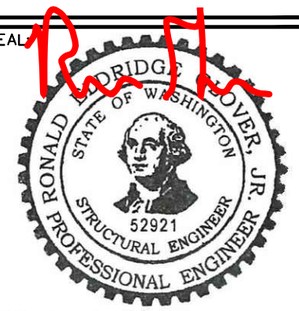

Electronic Copy

February 10, 2023

REV	DATE	ISSUED FOR:
0	02-10-23	MODIFICATION DRAWINGS

DRAWN BY: EAJ | CHECKED BY: RKE

SHEET TITLE:

GENERAL NOTES

SHEET NUMBER: **N-2**

REVISION: **0**

TEP#: 151934.819073

TOWER PLUMB REQUIREMENTS:

1. CHECK OF VERTICAL ALIGNMENT AND LEVEL OF BASE TOWER AND CANISTER ASSEMBLY SECTIONS FOR CONFORMANCE TO A PLUMB CONDITION IN ACCORDANCE WITH ANSI/TIA-222-H STANDARDS. PLUMB CONDITION IS TO BE DOCUMENTED WITH THE PROPER NOTES AND PICTURES TO PROVE, AT MINIMUM, THE FOLLOWING:

   1.1. DEFLECTION CALCULATIONS PER ANSI/TIA-222-H STANDARDS

   1.2. MINIMUM AND MAXIMUM (I.E. HOT AND COLD) SURFACE TEMPERATURE READINGS ON BASE MONOPOLE

   1.3. TIME OF DAY MEASURE WAS TAKEN (E.G. DAWN, NOON, DUSK)

   1.4. PICTURES OF A LEVEL OR DIGITAL INCLINOMETER MEASURED AT A MINIMUM OF (3) EQUIDISTANT LOCATIONS AROUND THE BASE PLATE TO PROVE LEVEL CONDITIONS

   1.5. AZIMUTH OR MONOPOLE FLAT NUMBER OF THE DIRECTION OF THE OUT-OF-PLUMB DEFLECTION

PLANS PREPARED FOR:

CROWN CASTLE

PROJECT INFORMATION:

SEATTLE QWEST - SEA 155

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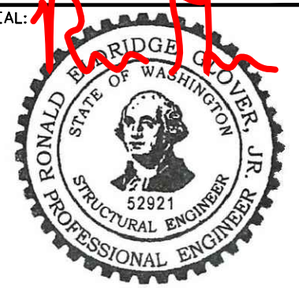

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February 10, 2023

REV	DATE	ISSUED FOR:
0	02-10-23	MODIFICATION DRAWINGS

DRAWN BY: EAJ | CHECKED BY: RKE

SHEET TITLE:

PROJECT NOTES

SHEET NUMBER: **N-3**

REVISION: **0**

TEP#: 151934.819073

MANUFACTURER POLE SPECIFICATIONS

TAPER:	–
BASE PLATE STEEL (Fy):	ASTM A36 (36 KSI)
ANCHOR RODS:	1 1/2"ø ASTM A354

MANUFACTURER SHAFT SECTION DATA

SHAFT SECTION	SECTION SHAPE	SECTION LENGTH (FT.)	SECTION THICKNESS (IN.)	SECTION GRADE Fy (KSI)	FLANGE PLATE GRADE Fy (KSI)	LAP SPLICE (IN.)	DIAMETER ACROSS FLATS OR OF ROUND SECTION (IN.)	
							TOP	BOTTOM
1	ROUND	10.00	0.4320	42	50	–	6.625	6.625
2	ROUND	10.00	0.4320	42	50	–	6.625	6.625
3	ROUND	10.00	0.5000	42	50	–	8.625	8.625
4	ROUND	40.00	0.3750	42	36	–	36.000	36.000
5	ROUND	40.00	0.3750	42	36	–	36.000	36.000
6	ROUND	20.00	0.3750	42	–	–	36.000	36.000

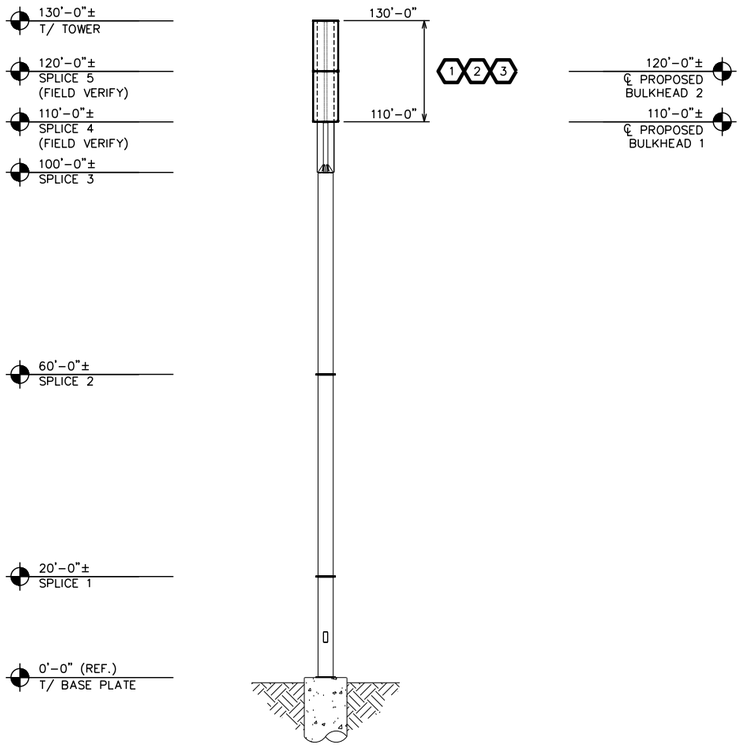
NOTE: DIMENSIONS SHOWN DO NOT INCLUDE GALVANIZING TOLERANCES

MODIFICATION SCHEDULE

NO.	MODIFICATION DESCRIPTION	ELEVATION (FT.)	SHEET
1	REMOVE EXISTING CONCEALMENT CANISTERS, ASSEMBLIES AND HARDWARE.	110.00 – 130.00	S-2
2	INSTALL PROPOSED CONCEALMENT CANISTERS, ASSEMBLIES AND HARDWARE PER CONCEALMENT REINFORCEMENT SOLUTION OPS-PRC-10127.	110.00 – 130.00	S-2
3	(2) NEW 60" NOMINAL DIAMETER VENTED CONCEALMENT ASSEMBLIES SHALL BE PROVIDED BY APPROVED VENTED CANISTER VENDOR. REFERENCE ITB EMAIL FOR MORE INFORMATION	110.00 – 130.00	S-2
4	PAINT PROPOSED MODIFICATIONS TO MATCH TOWER SHAFT.	–	–
5	CONTRACTOR TO PLUMB TOWER PER SECTION 13.3.3 OF ANSI/TIA-222-H.	–	–
6	CROWN CASTLE WILL CONTRACT WITH A THIRD PARTY VENDOR TO PERFORM THE MODIFICATION INSPECTION. THE CONTRACTOR SHALL COORDINATE THE INSPECTION WITH THE MODIFICATION INSPECTOR AND CROWN CASTLE PROJECT MANAGER. SEE SHEET N-1 FOR DETAILS.	–	–

NOTES:

1. PRIOR TO FABRICATION AND INSTALLATION, CONTRACTOR SHALL FIELD VERIFY ALL LENGTHS AND QUANTITIES GIVEN. LENGTH AND QUANTITIES PROVIDED ARE FOR QUOTING PURPOSES ONLY, AND SHALL NOT BE USED FOR FABRICATION.
2. FOR PARTS NOT DETAILED WITHIN THE DRAWING AND STARTING WITH "CCI-", SEE THE FOLLOWING CATALOG FOR DETAILS: CON-CAT-10300, MONOPOLE STANDARD DRAWINGS AND APPROVED REINFORCEMENT COMPONENTS.



TOWER ELEVATION

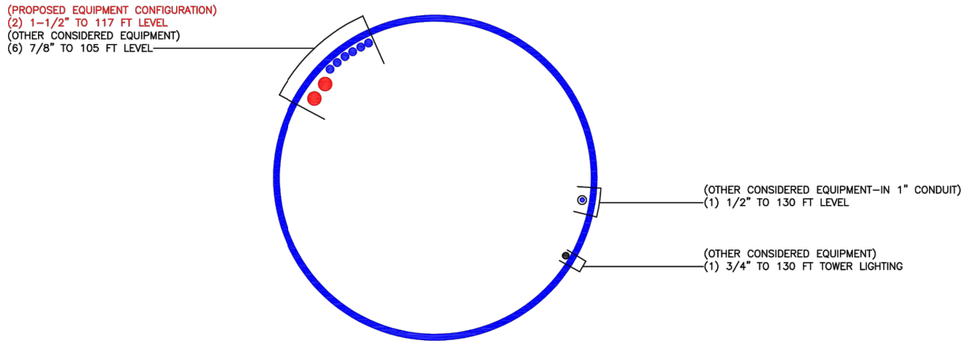
SCALE: 1" = 30'

0 30 60

SCALE IN FEET

NOTE:

BASE LEVEL DRAWING PROVIDED BY CROWN CASTLE.



BASE LEVEL DRAWING

SCALE: N.T.S.

PLANS PREPARED FOR:

CROWN CASTLE

PROJECT INFORMATION:

SEATTLE QWEST - SEA 155

BU #: 880416

8477 SE 68TH STREET
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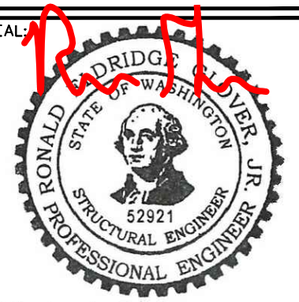

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February 10, 2023

REV	DATE	ISSUED FOR:
0	02-10-23	MODIFICATION DRAWINGS

DRAWN BY: EAJ CHECKED BY: RKE

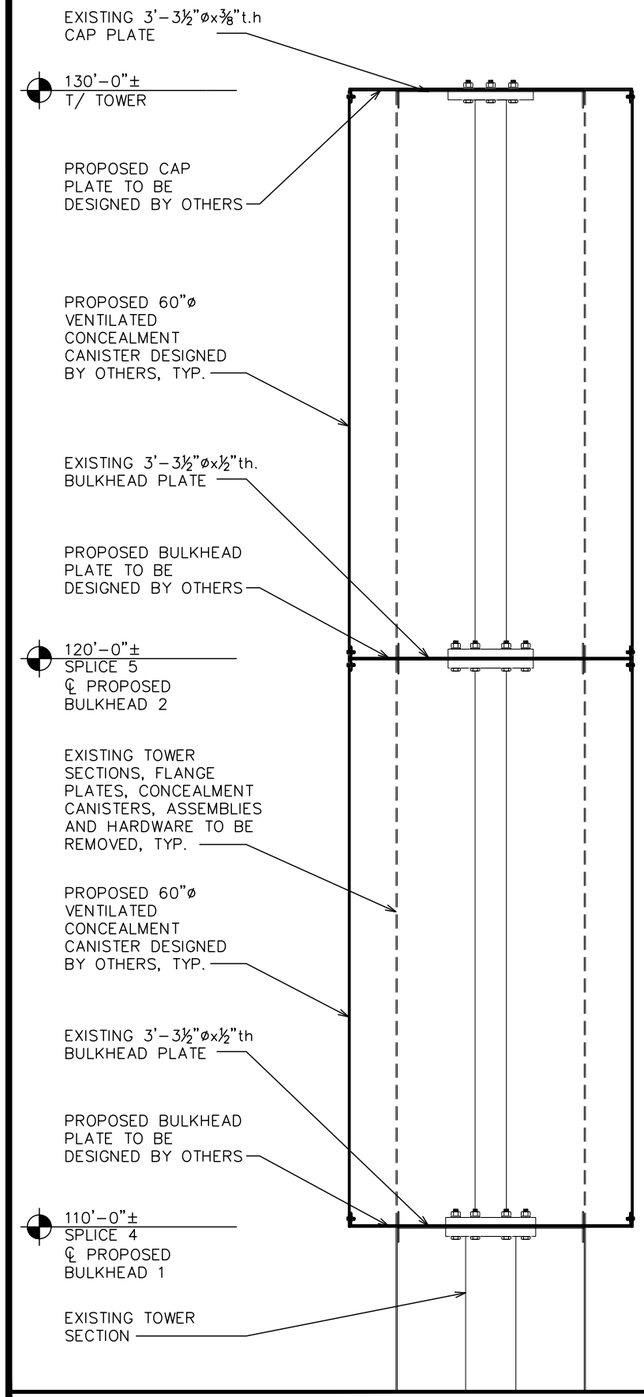
SHEET TITLE:

TOWER ELEVATION AND MODIFICATION SCHEDULE

SHEET NUMBER: **S-1**

REVISION: **0**

TEP#: 151934.819073



PARTIAL ELEVATION

SCALE: ½" = 1'-0"

0 1 2

SCALE IN FEET

PLANS PREPARED FOR:

CROWN CASTLE

PROJECT INFORMATION:

SEATTLE QWEST - SEA 155

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SEAL

RONALD ELDRIDGE GLOVER, JR. STATE OF WASHINGTON 52921 STRUCTURAL ENGINEER PROFESSIONAL ENGINEER

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February 10, 2023

REV	DATE	ISSUED FOR:
0	02-10-23	MODIFICATION DRAWINGS

DRAWN BY: EAJ | CHECKED BY: RKE

SHEET TITLE:

CONCEALMENT INSTALLATION DETAILS

SHEET NUMBER: **S-2**

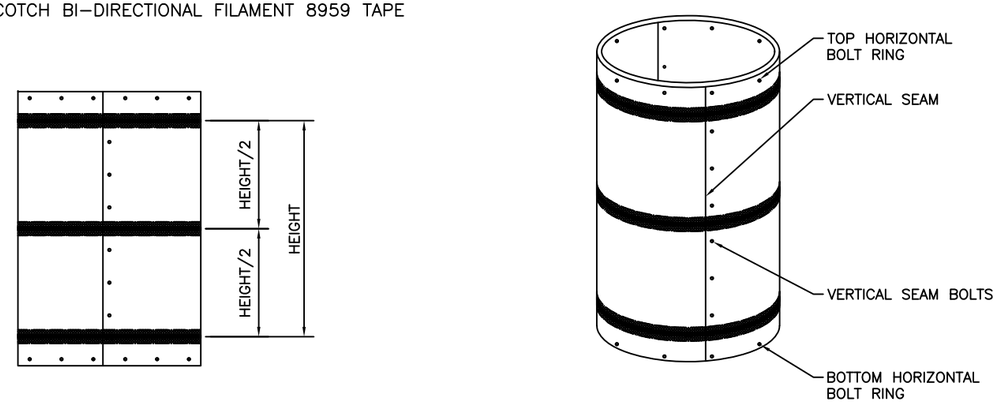
REVISION: **0**

TEP#: 151934.819073

CONCEALMENT REINFORCEMENT SOLUTION – PARTS LIST

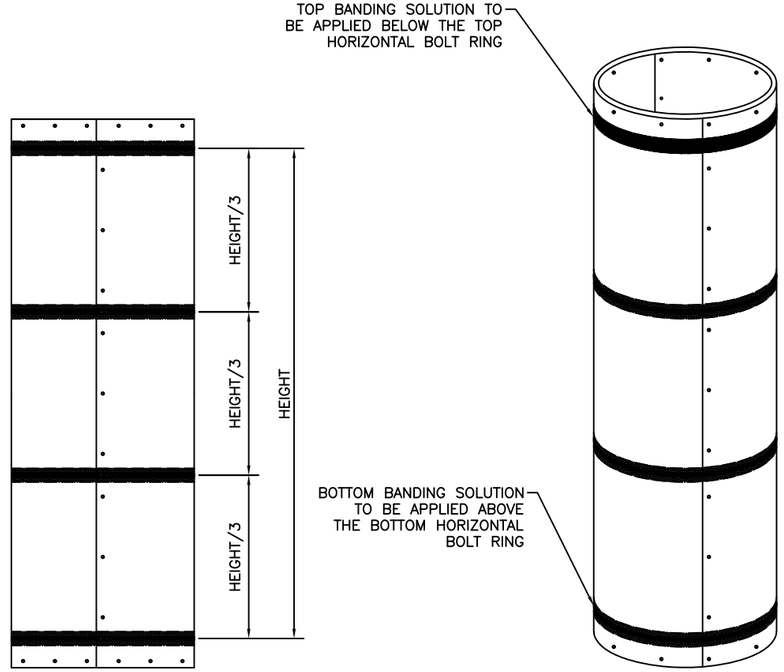
NO.	MANUFACTURER	DESCRIPTION	SIZE	PRODUCT NO.
(1)	USA STRAPPING	WOVEN POLYESTER STRAPPING	3/4"x250 FT. COIL	2700-34
(2)	MCNETT GEAR AID	DUAL-ADJUST BUCKLE	3/4" SIZE	80355
(3)	BUNKER INDUSTRIES	HURRICANE TAPE ***	3"x60 YD. ROLL	00101
(4)	RUST-OLEUM	GLOSS CLEAR SPRAY	12 OZ.	249117

*** NOTE: HURRICANE TAPE CAN BE SUBSTITUTED BY 3M SCOTCH BI-DIRECTIONAL FILAMENT 8959 TAPE



≤ 10'-0" CONCEALMENT COVER LEVEL HEIGHT

NOT TO SCALE



> 10'-0" CONCEALMENT COVER LEVEL HEIGHT

NOT TO SCALE

GENERAL:

1.) THE REINFORCEMENT SOLUTION IS ONLY TO BE APPLIED TO VERTICALLY-FASTENED MULTI-PANEL OR "SECTORIZED" CONCEALMENT COVERS. SOLID ONE-PIECE CONCEALMENT COVERS ARE NOT TO BE TREATED WITH THIS SOLUTION.

2.) FOR CONCEALMENT COVER LEVELS MEASURING 10 FT. IN HEIGHT OR LESS, (3) EQUALLY-SPACED BANDING APPLICATIONS ARE TO BE INSTALLED AT THE TOP, MID-SPAN, AND BOTTOM REGIONS. FOR LEVELS GREATER THAN 10 FT. IN HEIGHT, (4) EQUALLY-SPACED BANDING APPLICATIONS ARE TO BE INSTALLED, AT THE TOP, UPPER MIDDLE, LOWER MIDDLE, AND BOTTOM REGIONS.

3.) FOR CONCEALMENT COVERS OF ALL HEIGHTS, THE TOP BANDING APPLICATION IS TO BE POSITIONED DIRECTLY BELOW THE TOP CONCEALMENT COVER HORIZONTAL BOLT RING AND THE BOTTOM BANDING APPLICATION DIRECTLY ABOVE THE BOTTOM HORIZONTAL BOLT RING.

4.) BANDING APPLICATION SHALL NOT COVER ANY VERTICAL OR HORIZONTAL FASTENERS.

INSTALLATION:

1.) STRAPPING IS TO BE LOOPED AROUND THE CONCEALMENT COVER AND EACH CUT END OF THE STRAPPING FED AROUND A CROSS BAR ON EACH END OF THE DUAL-ADJUST BUCKLE.

2.) STRAPPING IS TO BE HAND-TIGHTENED USING THE BUCKLE SUCH THAT THE STRAPPING LIES FLAT, UNTWISTED, AND SQUARE TO THE CONCEALMENT COVER.

3.) AT LEAST (2) CONTINUOUS LAYERS OF HURRICANE (OR 3M 8959) TAPE ARE TO BE APPLIED ON TOP OF THE TIGHTENED STRAPPING SUCH THAT NO TAIL OF THE STRAPPING IS SHOWING OUTSIDE THE LAYERS OF TAPE.

4.) THE CURRENT DATE IS TO BE MARKED WITH PERMANENT INK ON THE TOP LAYER OF TAPE TO RECORD INSTALLATION DATE.

5.) ENSURE THAT THE SURFACE OF THE CANISTER IS FREE FROM OIL, GREASE, SOIL, DIRT, AND OTHER FOREIGN MATTER. THE SURFACE SHALL BE CLEAN, DRY AND SMOOTH TO RECEIVE THE STRAPPING AND THE TAPE.

6.) HURRICANE (OR 3M 8959) TAPE SHALL BE TACKED DOWN BY APPLYING (2) COATS OF NON-YELLOWING CLEAR COAT SPRAY OVER THE TAIL END OF THE TAPE AFTER IT IS SECURELY TAPED DOWN. SECOND COAT SHALL BE APPLIED ONCE THE FIRST COAT IS DRY TO TOUCH.

PAINTING HURRICANE (OR 3M 8959) TAPE [IF REQUIRED]:

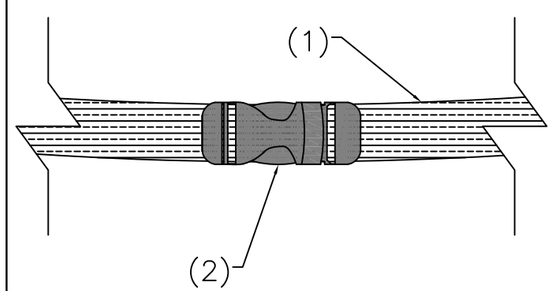
1.) AFTER FULL INSTALLATION OF THE THE REINFORCEMENT SOLUTION, THE TAPE SHALL BE COATED TO MATCH THE COLOR OF THE EXISTING CONCEALMENT CANISTER

1.1) AS AN EXAMPLE, IF THE EXISTING CONCEALMENT CANISTER IS WHITE, PAINTING WOULD NOT BE REQUIRED SINCE THE TAPE COLOR IS ALSO WHITE. HOWEVER, IF THE CANISTER IS BLACK, PAINT THE TAPE TO MATCH THE CANISTER COLOR.

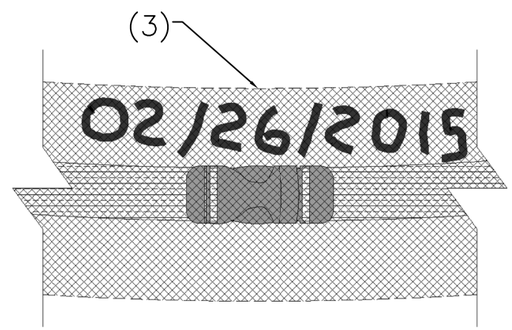
2.) PAINT SHALL BE APPLIED WITH A BRUSH FOR A CLEAN EDGE ON THE TAPE. SPRAY PAINT IS PERMISSIBLE PROVIDED THAT PAINTER'S TAPE IS UTILIZED TO AVOID PAINTING THE CANISTER. SECOND COAT SHALL BE APPLIED AFTER THE FIRST COAT IS DRY. THE SHEEN OF THE PAINT SHALL MATCH THE CANISTER

3.) THE INSTALLATION DATE SHALL BE MARKED ON TOP OF THE COATED SURFACE.

STRAPPING INSTALLATION DETAIL



TAPE INSTALLATION DETAIL



CROWN CASTLE CONCEALMENT REINFORCEMENT SOLUTION

SCALE: N.T.S.

REV D

PLOT DATE: PLOTDATE FILE NAME: FILEN

CARRIERS LOGO

CROWN CASTLE

2000 CORPORATE DRIVE
CANONSBURG PA, 15317

SPACE RESERVED FOR PROFESSIONAL SEALS

REVISIONS NO.	DATE	DESCRIPTION	BY
A	02/08/15	CONCEALMENT SOLUTION	MAJ
B	02/04/16	CONCEALMENT SOLUTION	MAJ
C	01/09/17	CONCEALMENT SOLUTION	JYK
D	06/29/20	ADDED SUBSTITUTE FOR HURRICANE TAPE	

DRAWN BY: **MAJ**
CHECKED BY: **JYK**
DRAWING DATE: **06/29/20**

SHEET TITLE

TYPE

SHEET NUMBER

OPS-PRC-10127