Structural Calculations

For

T-Mobile USA, Inc.

SE02629A
Mercer Island Water Tank

Proposed Wireless Tower Installation
Mount Analysis Report
4350 88th Ave SE
Mercer Island, WA 98040

Digitally signed by Peter Lundquist
Date: 2025.01.17 14:33:55-08'00'

Engineer of Record: **Peter Lundquist, PE**
Date: 1/17/2025

Prepared by: *David Terry, PE*

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The purpose of this report is to summarize the results of the mount analysis completed for a proposed upgrade to an existing wireless installation mounted on an existing self-supported tower located at 4350 88th Ave SE, Mercer Island, WA 98040. The proposed installation includes replacing the existing sector frames, maintaining all the existing equipment, and adding (3) proposed antennas to the new sector frames. See Table 2 for a complete list of equipment considered in this analysis. This report was commissioned by T-Mobile USA, Inc.

Applicable Codes:

- TIA-222-H Structural Standards for Antenna Supporting Structures, Antennas, …
- AISC 360-16 Specification for Structural Steel Buildings

Design Criteria:

- Risk Category — II
  - Earthquake Demands, I_e — 1.00
  - Ice Demands, I_i — 1.00
  - Wind Demands — Per ASCE, Fig. 26.5-1B
- Dead
  - Self-weight of members and appurtenances
- Live, Snow, Rain
  - Does not control
- Ice
  - Design Ice Thickness, T_i — 1.00 in
  - Concurrent Design Wind Speed — 30 mph (3-Sec Gust)
  - Escalated Ice Thickness, t_{iz} — 1.265 in
- Seismic
  - Soil Site Class — D (Default)
  - Short Spectral Response, S_S — 1.421 g
  - 1-Second Spectral Response, S_1 — 0.494 g
  - Response Modification Factor, R — 2.0 (TIA 16.7)
  - Seismic Response Coefficient, C_s — 0.568
- Wind
  - Special Wind Region — No
  - Design Wind Speed — 98 mph (Per the City of Sultan)
  - Exposure — B
  - Topographic Factor, k_{zt} — 1.46 (Flat Ridge)
  - Design Wind Pressure, q_z — 34.07 psf

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Analysis Documentation:

All relevant project information was obtained from the documents provided or made available to TAEC as part of this project. See Table 1 for a complete list of relevant documents.

Table 1 – Available Documentation

Document	Produced by	Dated	Source
RFDS	T-Mobile	Dec 20, 2024	Client
Proposed Tower Structural Analysis	NorthWest Tower Engineering	Jan 13, 2025	Client
Proposed Construction Drawings	TAEC	In production	Self
VFA8-HD Frame Engineering Letter	Site Pro 1	Jul 8, 2020	SP1

Equipment Loading:

The existing antenna frames were analyzed for the proposed equipment loading as summarized in Table 2.

Table 2 – Equipment Considered in Frame Analysis

Location	Existing & Proposed[1] Equipment
Alpha Sector (Az = 45°) Northeast	(1) VFA12-HD @ 84-ft, Supporting: (1) Commscope FFVV-65C-R3-V1 (1) Nokia AHLOA (1) Nokia AHFIG (1) Nokia AEHC
Beta Sector (Az = 180°) South	(1) VFA12-HD @ 84-ft, Supporting: (1) Commscope FFVV-65C-R3-V1 (1) Nokia AHLOA (1) Nokia AHFIG (1) Nokia AEHC
Delta Sector (Az = 330°) Northwest	(1) VFA12-HD @ 84-ft, Supporting: (1) Commscope FFVV-65C-R3-V1 (1) Nokia AHLOA (1) Nokia AHFIG (1) Nokia AEHC

[1] Underlined equipment is proposed. All other equipment is existing.

Results:

The maximum member demands (percent utilization) for the proposed mounting frame is summarized in Table 3.

Table 3 – Proposed Member Utilization Summary

Member	Each Sector Frame[1]		
	Capacity	Utilization	Program Used
Extreme Wind	2400 lb	25.0 %	Excel
Extreme Ice	2800 lb	19.6 %	Excel

[1] The capacity of the proposed Site Pro 1 VFA8-HD is based on the engineering letter provided by the manufacturer, Site Pro 1.

Conclusions & Recommendations:

Based on this analysis and the information provided, the **proposed mounts and frames ARE ADEQUATE to support the proposed installations** as described in this report. The controlling member stress ratio for the VFA8-HD is 25% controlled by the maximum force supported at any one antenna position per the associated engineering letter provided by Site Pro 1.

The proposed mounting frame and associated connections were determined to be acceptable based solely on the TIA-5053 mount classification procedure as given in the engineering letter provided by Site Pro 1. The supporting structure was not analyzed as part of this Mount Analysis Report and was previously analyzed as part of the passing Structural Analysis Report completed by NorthWest Tower Engineers and dated January 13, 2025. See Table 2 and Appendix B for all reference information used as part of this report.

This analysis assumes all existing structure components are in adequate condition to carry their required design occupancy loads. The contractor must verify all dimensions, materials, elevations, equipment specifications, and other assumptions in this analysis before installation. Any discrepancies in the assumptions may invalidate this report and are subject to further review.

Disclaimer of Warranties:

The engineering services rendered by TAEC in connection with this design are limited to the analysis and capacity of its members. TAEC does not analyze the fabrication and quality of construction, except as included in this report.

TAEC makes no warranties, expressed or implied, in connection with this report and disclaims any liability arising from material, fabrication, and construction of this structure. TAEC will not be responsible whatsoever for, or on account of, consequential or incidental damages sustained by any person, firm, or organization as a result of any data or conclusions contained in this report. The maximum liability of TAEC pursuant to this report will be limited to the total fee received for preparation of this report.

Appendix A

Design Criteria and Calculations

Seattle Office
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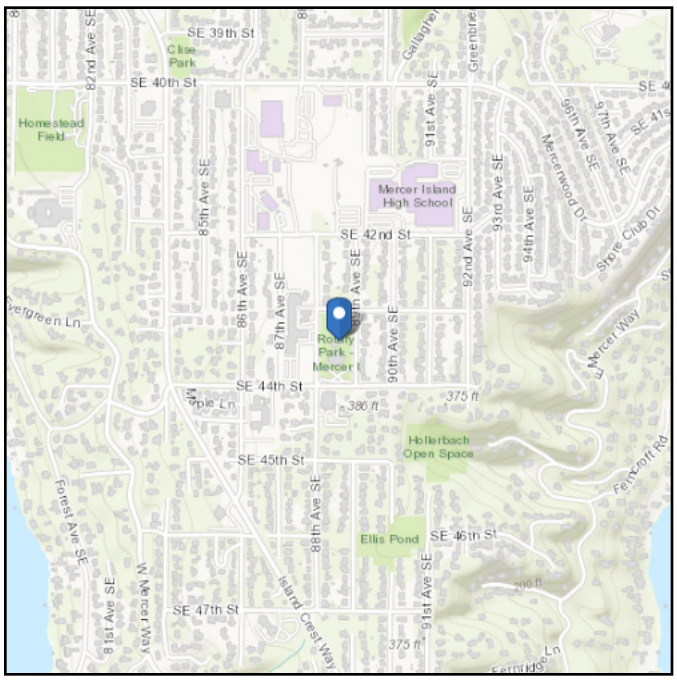
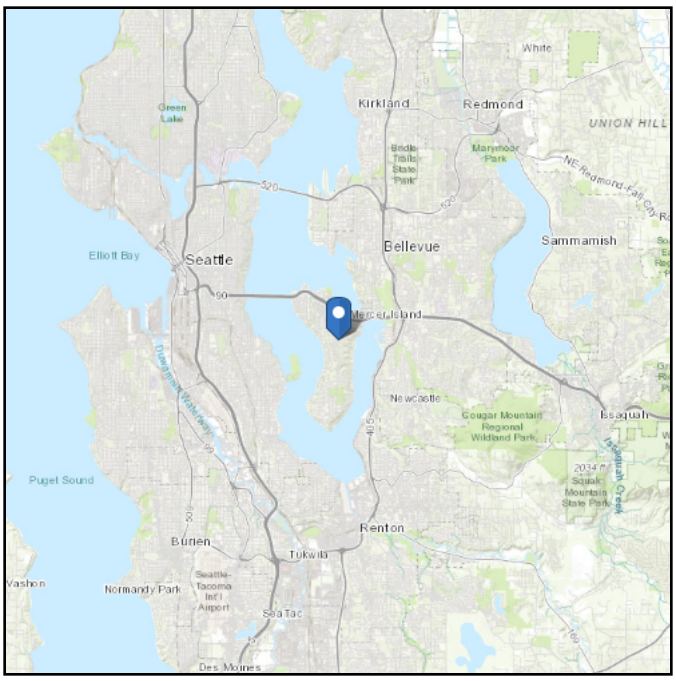
ASCE Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Latitude:**	47.568369
Risk Category:	II	**Longitude:**	-122.220783
Soil Class:	D - Default (see Section 11.4.3)	**Elevation:**	375.6101733482653 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:	Fri Jan 17 2025

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 :	1.421	S_{D1} :	N/A
S_1 :	0.494	T_L :	6
F_a :	1.2	PGA :	0.608
F_v :	N/A	PGA_M :	0.73
S_{MS} :	1.706	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.137	C_v :	1.384

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

Data Accessed: Fri Jan 17 2025

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:	Fri Jan 17 2025

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.

Snow

Results:

Ground Snow Load, p_g:	16 lb/ft^2
Mapped Elevation:	375.6 ft
Data Source:	
Date Accessed:	Fri Jan 17 2025

Statutory requirements of the Authority Having Jurisdiction are not included.

Snow load values are mapped to a 0.5 mile resolution. This resolution can create a mismatch between the mapped elevation and the site-specific elevation in topographically complex areas. Engineers should consult the local authority having jurisdiction in locations where the reported ‘elevation’ and ‘mapped elevation’ differ significantly from each other.

The ASCE Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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Technology Associates

Project Information

Site #:	SE02629A	Date:	1/17/2025
Site Name:	Mercer Island Water Tank	Design by:	DET

Formats: **Input** | **Design** | **Calc.** | **Result**

TIA-222-H Design Wind Loads

Ultimate Wind speed	V=	98	mph	TIA Fig. B-2			Rooftop Wind Speedup, 2.6.7		
Ultimate Wind speed, ice	V.i=	30	mph	TIA Fig. B-9			On Roof?	Yes	-
Design ice thickness	t_i =	1	in	TIA Fig. B-9			h_{roof}	84.0	ft
Ice Importance Factor	I =	1.00	-	TIA 2-3			$h_{parapet}$	2.7	ft
Escalated ice thickness	t_{iz} =	1.25	in	TIA 2.6.10	To appurt centroid		$X_{b,min}$	15.0	ft
Type of Analysis		Appurt	-		Max Building Width		$W_{s,max}$	150.0	ft
Gust Effect Factor	G_H=	1.00	-	TIA 16.6			H_s	86.7	ft
Wind Direction Factor	K_d=	0.95	-	TIA 16.6			H_1	5.7	ft
Risk Category		II	-	TIA Table 2-1			z_r	0.0	ft
Exposure Category		B	-	TIA 2.6.5.1			H_2	89.4	ft
Avg. Equipment Height	z=	84.00	ft						
Velocity Pressure Coefficient	K_z=	0.94	-	TIA 2.6.5.2			Topographic (K_{zt}) Inputs		
Topographic Coefficient	K_{zt}=	1.46	-	TIA 2.6.6			Feature	Flat Ridge (4)	
Ground Elevation	z_s=	383	ft	TIA 2.6.8			H_{crest}	387	ft
Ground Elevation Factor	K_e=	0.99	-	TIA 2.6.8			H_{base}	16	ft
Rooftop Wind Speed-Up factor	K_s =	1.00	-	TIA 2.6.7, 1.00 due to H1>Zr			L	3104	ft
Velocity Pressure	q=	31.55	psf	$0.00256K_z K_{zt} K_s K_d K_e V^2$			x	285	ft
Lateral Wind Pressure	F= qG_H	31.55	psf	TIA 2.6.11			Dir	Downwind	-
Appurtenance Shielding Factor	K_a =	0.90	-	TIA 16.6					
	F' = K_aF	28.39	psf	TIA 2.6.11.2					
Pressure To Apply to **RISA AREA LOAD**, C_aF'	q =	34.07	psf	Ca = 1.20	Round	Member/Structure Specific L/b =			33.391

Appurtenance Loading

Description	Qty	C_aA_a		C_aA_a w/ ice		Wind - No Ice		Wind - W/ Ice	
-	-	Front	Side	Front	Side	Front	Side	Front	Side
-	-	ft^2	ft^2	ft^2	ft^2	lb	lb	lb	lb
Commscope FFVV-65C-R3-V1	1	20.89	9.25	23.57	12.05	593.0	262.5	62.7	32.1
Nokia AHLOA	1	2.23	1.39	2.99	2.07	63.3	39.5	8.0	5.5
Nokia AHFIG	1	3.08	1.40	3.99	2.22	87.5	39.9	10.6	5.9
Nokia AEHC	1	6.84	2.15	8.14	3.27	194.3	61.2	21.7	8.7
Position 1	Totals:	20.89	9.25	23.57	12.05	593.0	262.5	62.7	32.1
Position 2	Totals:	5.31	2.79	6.98	4.29	150.8	79.3	18.6	11.4
Position 3	Totals:	6.84	2.15	8.14	3.27	194.3	61.2	21.7	8.7

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Project Information			
Site #:	SE02629A	Date:	1/17/2025
Site Name:	Mercer Island Water Tank	Design by:	DET

Formats: **Input** | **Design** | **Calc.** | **Result**

TIA-222-H Seismic Analysis Inputs (2.7.7.1 - ELF Method)

0.2s Spectral Response Acceleration	S_s=	1.421	g	ASCE 7-16 Hazard Tool
1.0S Spectral Response Acceleration	S_1=	0.494	g	ASCE 7-16 Hazard Tool
Site Class		D (Default)	-	
Site Coefficient Per Ss and Site Class	F_a=	1.200	-	TIA Table 2-11
Site Coefficient Per S1 and Site Class	F_v=	1.806	-	TIA Table 2-12
Long-period transition period	T_L=	6	s	ASCE 7-16 Hazard Tool
Short period Mapped MCE_R, F_a * S_s	S_{MS}=	1.705	g	F_aS_s
1s period Mapped MCE_R, F_v * S_1	S_{M1}=	0.892	g	F_vS_1
Design Spectral Acceleration at 0.2s, 2/3 * S_{MS}	**S_{DS}=**	1.137	g	TIA 2.7.5
Design Spectral Acceleration at 1s, 2/3 * S_{M1}	**S_{D1}=**	0.595	g	TIA 2.7.5
Risk Category	=	II	-	TIA Tablei 2-1
Seismic Importance Factor	I_e=	1.00	-	Table 2-3
Type of Analysis	R=	Appurt	-	TIA 16.7 Pipe members
Response Modification Factor	R=	2.00	-	TIA 2.7.7.1
Appurtenance/Tower Height	h=	8.00	ft	TIA 2.7.8.1
Appurtenance Bracket (Tieback) Height	H_b=	0.00	ft	TIA 2.7.8.1, H_b = 0 signifies no tieback
Rooftop Factor	A_s=	1.00	-	TIA 2.7.8.1, h ≤ 100-ft, As = 1.0
Approximate Period	f_1=	1.031	Hz	ASCE 12.8.2.1
Fundamental Period	T_a=	0.970	s	No C.s,max per TIA 16.7
Min Seismic Design Acceleration	$C_{s.min}$ =	0.050	g	TIA 2.7.7.1
Max Seismic Design Acceleration	$C_{s.max}$ =	10.000	g	No C.s,max per TIA 16.7
Lateral Seismic Design Acceleration	C_s =	0.568	g	TIA 2.7.7.1
Vertical Seismic Design Acceleration	C_{sv} =	0.227	g	TIA 2.7.6

F_a/F_v Overrides	
F_a=	
F_v=	

Appurtenance Loading

Description	Qty	Weight		Seismic	
-	-	No ice	W/ Ice	Horiz	Vert
-	-	lb	lb	lb	lb
Commscope FFVV-65C-R3-V1	1	127.6	439.5	72.5	29.0
Nokia AHLOA	1	83.8	135.1	47.6	19.0
Nokia AHFIG	1	79.4	138.0	45.1	18.1
Nokia AEHC	1	108.0	217.1	61.4	24.6
Position 1	Totals:	127.6	439.5	72.5	29.0
Position 2	Totals:	163.2	273.1	92.8	37.1
Position 3	Totals:	108.0	217.1	61.4	24.6

Required Mount Classification - TIA-5053, Section 4.0

4.0(1.) Section 2.3 Requirements

	Actual	Allowed		DCR	
Structure Height	84.0	400	ft	0.210	
Structure Class	II	II	-	OK	
Exposure Category	B	C	-	OK	
Topographic Category, K_{zt}	1.457	1	-	-	
Basic Wind Speed[1]	98	140.0	mph	-	
Effective Wind Speed	35.8	50.2		0.714	q_z, $0.00256*K_{zt}*V^2$
Design Ice Thickness	1	1	in	1.000	
Basic Ice Wind Speed[1]	30	60	mph	0.500	

1) Basic Wind Speed is the 3-second gust, including risk-category

4.0(2.) Maximum Position Wind Area

Maximum Mount Position Loading	New	-	
EPA_{max}	20.9	ft^2	Per Lateral DC
$EPA_{max,side}$	9.2	ft^2	Per Lateral DC
$EPA_{max,ice}$	23.6	ft^2	Per Lateral DC
$EPA_{max,ice,side}$	12.0	ft^2	Per Lateral DC

4.0(3.) Maximum Position Forces - Including Pipe

Maximum Mount Position Loading		New	-	
Design wind pressure, Extreme wind	q_z	28.4	psf	
Factored normal force, Extreme wind	F_{no}	593	lb	1.0W
Factored transverse force, Extreme wind	F_{to}	263	lb	1.0W
Factored vertical force, Extreme wind	F_{zo}	196	lb	1.2D
Design wind pressure, Extreme ice	q_{zi}	2.7	psf	
Factored normal force, Extreme ice	F_{ni}	63	lb	1.0W
Factored transverse force, Extreme ice	F_{ti}	32	lb	1.0W
Factored vertical ice force, Extreme ice	P_{ice}	312	lb	1.0Di
Factored vertical force, Extreme ice	F_{zi}	508	lb	1.2D+1.0Di

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Mount Classification Requirements

Mercer Island Water Tank
Mercer Island, Washington

PREPARED FOR
T-Mobile Wireless

Sheet No.	**1**
Project No.	SE02629A
Engineer:	DET
Date:	1/17/2025
Scale:	None

Required Mount Classification - TIA-5053, Section 4.0

4.0(4.) Mount Category

Mount Category	R	-

4.0(5.) Required Mount Classification

Proposed (New position)

F_{fno}	593	lb	$1.0F_{no}$
F_{fto}	263	lb	$1.0F_{to}$
F_{fni}	251	lb	$4.0F_{ni}$
F_{fti}	128	lb	$4.0F_{ti}$
F_{fzo}	392	lb	$2.F_{zo}$
F	593	lb	Max of the above
F_{zi}	508	lb	

Mount Classification Comparison

		M2400R(2800)-3[6]	Provided	DCR	
$F^{[1]}$	600	2400	lb	0.250	Extreme Wind
$F_{zi}^{[1]}$	550	2800	lb	0.196	Extreme Ice
Pipes/Sector	3	3	-	1.000	
Eccentricity	6	6	in	1.000	
Required	M600R(550)-3[6]				

[1] Rounded up to nearest 50 lb

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Mount Classification Determination	
Mercer Island Water Tank	
Mercer Island, Washington	
PREPARED FOR	
T-Mobile Wireless	

Sheet No.	**2**
Project No.	SE02629A
Engineer:	DET
Date:	1/17/2025
Scale:	None

Appendix B

Reference Documents

Seattle Office
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SITE PRO 1
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Phone: 574.936.4221
Fax: 574.936.8925
Email: SP1Engineering@valmont.com
www.sitepro1.com

July 8, 2020

Site Pro 1 / Valmont Mounting System:

Part Number = VFA8-HD
Part Description = 8' Heavy Duty V-Frame
Tie-Back Position = Position 1

Mount EPA (no antenna pipes / tie-back full length @ 20 deg):

EPA_N = 11.6 Sq-Ft	$EPA_{N\ (0.5"\ Ice)}$ = 16.9 Sq-Ft	$EPA_{N\ (1"\ Ice)}$ = 20.9 Sq-Ft
EPA_T = 9.2 Sq-Ft	$EPA_{T\ (0.5"\ Ice)}$ = 14.6 Sq-Ft	$EPA_{T\ (1"\ Ice)}$ = 19.5 Sq-Ft
Weight = 610 lb	$Weight_{(0.5"\ Ice)}$ =741 lb	$Weight_{(1"\ Ice)}$ = 930 lb

Classification Rating:

M2400R (2800)-3[6]

Design Standards

ANSI/TIA-222-G-2012
ANSI/TIA-222-H-2018
ASCE 7-16
International Building Code 2018
TIA-5053
Verizon Network Standard NSTD-445 1/16/17

Analysis and Modeling Technique

An elastic, three-dimensional, frame, truss model was developed to examine the structural behavior of the mount. All orientations in the engineering model correspond with the assembly drawing constraints. The mount was analyzed with Three (3) mounting locations (antenna, radio etc. + pipe) evenly spaced across the face of the mount, with a six inch (6) vertical eccentricity. Wind directions considered were perpendicular (normal) to the face of the frame and at 30 degree increments up to 90 degrees (tangential) to the face of the frame. Wind, dead weight and ice weight on the mount was also included in the model.

Modeling Software

Autodesk Inventor
RISA-3D
ANSYS Workbench

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www.sitepro1.com

Analysis Design Criteria

Maximum Mount Height	400'
Maximum Ultimate Wind Speed, no Ice	180 mph 3 sec gust
Maximum Design Wind Speed, no Ice	140 mph 3 sec gust
Maximum Design Wind Speed on Ice	60 mph 3 sec gust
Structure Class	I or II
Exposure Category	B or C
Topographic Category	I
Maximum Design Ice Thickness, t_i	1" (2.75" factored ice)
Wind Direction Probability Factor, K_d	0.95
Gust Effect Factor, G_h	1.0

Capacity Results

The following factored loads at each mounting location represent the capacity of the mount based on the criteria and modeling technique described above.

Normal Wind Load (no ice), F_{no}	.....2400 lb	[1500 lb Non-Factored]
Tangential Wind Load (no ice), F_{to}	.....2400 lb	[1500 lb Non-Factored]
Vertical (Dead) Load, F_{zo}	.....1200 lb	[1000 lb Non-Factored]
Normal Wind on Ice, F_{ni}	.....700 lb	
Tangential Wind on Ice, F_{ti}	.....700 lb	
Vertical (Dead + Ice) Load, F_{zi}	.....2800 lb	
Normal Maintenance Wind Load, F_{nm}	.....240 lb	
Tangential Maintenance Wind Load, F_{tm}	.....240 lb	
Vertical Dead Load, F_{zm}	.....1200 lb	[1000 lb Non-Factored]
Vertical Live Load, L_M*	.....750 lb	[500 lb Non-Factored]

* In addition to a nominal Live Load of two (2) 250 lb concentrated on either side of a mounting location to provide access for climbers.

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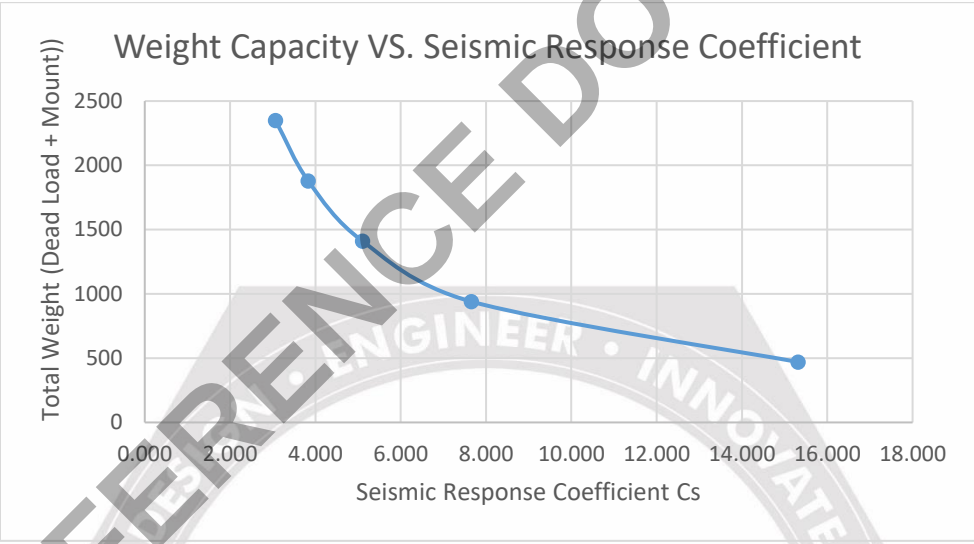
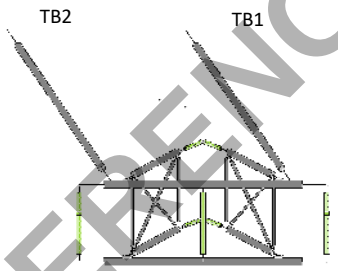
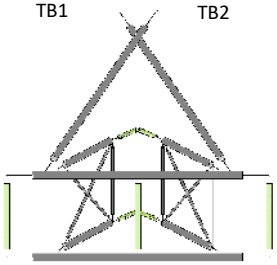
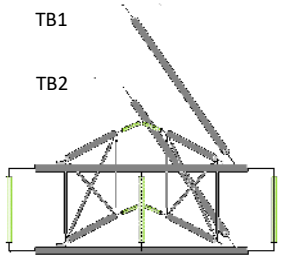
Seismic Results

The following Seismic Response Coefficient chart below represent the allowable weight capacity of the bracket based on the criteria and modeling technique described in TIA-222-H Section 2.7.7.1.1. Total allowable seismic shear must be less than or equal to the Capacity Results (F_{no}) stated above.



Frame P/N	Classification	Ice Condition	Mount Capacity	Tie-Back Position	Tie-Back Reaction (Max Axial Force)		Max Leg Reactions Total Frame Reaction (lbs)		
			Offset (Neg - Pos)		TB1 (Lbs)	TB2 (Lbs)	Vertical Load	Normal Load	Tangential Load
VFA8-HD	M3400A(2800)-3[6]	No Ice	100% - 77%	1	4950	4744	1845	9103	5216
	M3400A(2800)-3[6]	No Ice	100% - 76%	2	6833	6833	1832	9102	8656
	M2800A(3800)-3[6]	No Ice	94% - 98%	3	5481	5466	1668	9765	5507
	M3400A(2800)-3[6]	Ice	100% - 84%	1	4950	4744	9334	9103	5216
	M3400A(2800)-3[6]	Ice	100% -83%	2	6833	6833	9334	9102	8656
	M2800A(2800)-3[6]	Ice	94% - 98%	3	5481	5466	7239	9765	5507
	M2400R(2800)-3[6]	No Ice	94% - 72%	1	4978	4104	2374	7882	4957
	M2400R(2800)-3[6]	No Ice	94% - 86%	2	6707	6707	2319	7882	10001
	M2400R(2800)-3[6]	No Ice	98% - 98%	3	7430	7455	3239	11144	7575
	M2400R(2800)-3[6]	Ice	94% - 88%	1	4978	4104	9334	7882	4957
	M2400R(2800)-3[6]	Ice	100% - 85%	2	6707	6707	9334	7882	10001
	M2400R(2800)-3[6]	Ice	100% - 98%	3	7430	7455	7249	11144	7585
	Tie -Back Position 1 -20 deg + 20 deg Top Parallel			Tie-Back Position 2 -20 deg - 20 deg Top Cross			Tie-Back Position 3 -20 deg Same Side Stacked		
									

T-Mobile

ZONING JURISDICTION:

CITY OF MERCER ISLAND

SITE ID: SE02629A

SITE NAME: MERCER ISLAND WATER TANK

PROJECT TYPE: ANCHOR

SITE LOCATION: 4350 88TH AVE SE MERCER ISLAND, WA 98040

FSA: TAEC

LEGAL DESCRIPTION:

LUCAS HEIGHTS ADD
PLAT BLOCK: 5
PLAT LOT: 1 THRU 16

UTILITY COMPANIES:

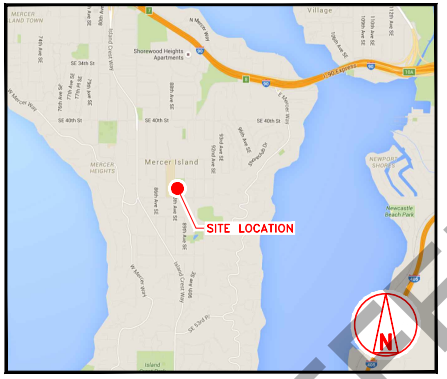
POWER:

COMPANY: PUGET SOUND ENERGY
CONTACT:
PHONE: (866) 831-5161
EMAIL:

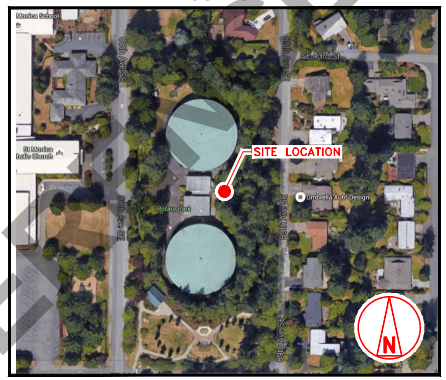
BACKHAUL/AAV:

COMPANY: CENTURYLINK
CONTACT:
PHONE: (866) 476-9909
EMAIL:

VICINITY MAP



LOCATION MAP



DRIVING DIRECTIONS:

FROM LOCAL T-MOBILE OFFICE (19807 NORTH CREEK PKWY N, BOTHELL, WA 98011)

1. HEAD EAST ON NORTH CREEK PKWY N
2. TURN RIGHT ONTO 120TH AVE NE
3. TURN RIGHT ONTO NE 195TH ST
4. USE THE LEFT 2 LANES TO TURN LEFT ONTO THE INTERSTATE 405 S RAMP TO RENTON
5. MERGE ONTO I-405 S
6. USE THE RIGHT 3 LANES TO TAKE EXIT 11 TO MERGE ONTO I-90 W TOWARD SEATTLE
7. TAKE EXIT 8 FOR EAST MERCER WAY
8. TURN LEFT ONTO 100TH AVE SE/E MERCER WAY
9. CONTINUE TO FOLLOW E MERCER WAY
10. TURN RIGHT ONTO SE 36TH ST
11. CONTINUE ONTO GALLAGHER HILL RD
12. TURN LEFT ONTO SE 40TH ST
13. TURN RIGHT ONTO 92ND AVE SE
14. TURN RIGHT ONTO SE 42ND ST
15. TURN LEFT ONTO 88TH AVE SE
16. DESTINATION WILL BE ON THE LEFT

REVIEWERS SHALL CLEARLY PLACE INITIALS ADJACENT TO EACH REDLINE NOTE AS DRAWINGS ARE BEING REVIEWED

APPROVED BY:	DATE:	SIGNATURE:	APPROVED BY:	DATE:	SIGNATURE:
PROJECT MANAGER:			RF ENGINEER:		
SITE ACQUISITION:			OPERATIONS MANAGER:		
ZONING:			DEVELOPMENT MANAGER:		
CONSTRUCTION MANAGER:			REGULATORY:		
CONSTRUCTION MANAGER:					

811 Know what's **BELOW.** Call before you dig. www.call811.com

PROJECT CONTACT LIST:

APPLICANT:

T-MOBILE USA, INC.
19807 NORTH CREEK PKWY N
BOTHELL, WA 98011
PHONE: 425-641-1140

PROPERTY & TOWER OWNER:

CITY OF MERCER ISLAND
9611 SE 36TH STREET
MERCER ISLAND, WA 98040

PERMITTING:

COMPANY: TAEC
CONTACT: CHRISTINE CONTRERAS
PHONE: (425) 351-3392
EMAIL: christine.contreras@taec.net

RF ENGINEER

T-MOBILE USA, INC.
CONTACT: FRANCISCO MONROY
EMAIL: Francisco.Monroy9@T-Mobile.com

PROJECT A&E:

COMPANY: TAEC
CONTACT: PETER LUNDQUIST, PE
PHONE: (206) 713-9915
EMAIL: peter.lundquist@taec.net

SITE ACQUISITION:

COMPANY: TAEC
CONTACT: MAX KVERN
PHONE: (206) 434-7019
EMAIL: max.kvern@taec.net

PROJECT MANAGER:

COMPANY: TAEC
CONTACT: BREE SONCRANT
PHONE: (206) 714-7101
EMAIL: bree.soncrant@taec.net

CONSTRUCTION MANAGER:

COMPANY: TAEC
CONTACT: STEPHEN PALACHUK
PHONE: (509) 961-4150
EMAIL: stephen.palachuk@taec.net

PROJECT INFORMATION:

CODE INFORMATION:

ZONING CLASSIFICATION:	R-9.6
BUILDING CODE:	IBC 2021
CONSTRUCTION TYPE:	IIB
OCCUPANCY:	U, S-2
JURISDICTION:	CITY OF MERCER ISLAND
PROPOSED BUILDING USE:	UNMANNED TELECOM

SITE LOCATION (NAD83):

LATITUDE:	47° 34' 06.2" N
LONGITUDE:	122° 13' 14.7" W
TOP OF STRUCTURE:	476.5' AMSL 100.7' AGL
BASE OF STRUCTURE:	375.8' AMSL 0.0' AGL

PROJECT LEASE AREA:

±88 SF

PARCEL NUMBER:

4457300325

NEW IMPERVIOUS AREA:

0 SF

AREA OF PARCEL:

3.55 ACRES

GENERAL INFORMATION:

PARKING REQUIREMENTS ARE UNCHANGED
TRAFFIC IS UNAFFECTED
SIGNAGE IS PROPOSED

DRAWING INDEX:

SH #	SHEET DESCRIPTION
T-1	TITLE SHEET
T-2	NOTES & LEGEND
SV1	EXISTING SITE SURVEY
A-1	SITE PLAN & ENLARGED SITE PLAN
A-2	ANTENNA PLAN
A-3	EQUIPMENT PLAN
A-4	ELEVATIONS
A-5	ELEVATIONS
A-6	DETAILS
A-7	DETAILS
A-8	ANTENNA MOUNTING SPECIFICATIONS
A-9	HYBRID TRUNK CABLE SPECIFICATIONS
G-1	GROUNDING PLANS
G-2	GROUNDING DETAILS
RF-1	RF DETAILS
RF-2	RF DIAGRAM

PROJECT DESCRIPTION:

T-MOBILE PROPOSES (PER RFDS V8, 12/23/2024) TO MODIFY AN EXISTING UNMANNED TELECOMMUNICATIONS FACILITY WITH:

THE REMOVAL OF:
- (3) ANTENNA MOUNTS
- (1) EXPANSION CABINET
- (1) PURCELL CABINET
- (1) EXPANSION CABINET
- (8) BATTERIS IN PURCELL
- (1) VOLTAGE BOOSTER W/ (3) MODULES IN PURCELL
- (1) ±8' ICE BRIDGE PORTION
- (1) H-FRAME

THE ADDITION OF:
- (3) DUAL MOUNTS
- (3) (AEHC) ANTENNAS
- (2) CABINETS
- (16) BATTERIES IN LB3
- (1) ABIA IN HPL3.1 CABINET
- (1) ABIO IN HPL3.1 CABINET
- (1) HYBRID TRUNK 6x24 (40m)
- (9) JUMPER CABLES (15')
- (1) ICE CANOPY (10' x 8')
- (1) ICE BRIDGE (±10')

THE RELOCATION OF:
- (3) AHLOA ON TOWER
- (3) AHFIG ON TOWER
- (8) BATTERIES IN PURCELL
- (1) ROUTER IN PURCELL
- (1) ASIB IN EXPANSION CABINET
- (2) ASIL IN EXPANSION CABINET
- (1) FSMF IN EXPANSION CABINET
- (2) ABIA IN EXPANSION CABINET
- (5) ABIL IN EXPANSION CABINET
- (2) AMIA IN EXPANSION CABINET
- (1) HCS 2.0 JUNCTION BOX

ANTI-THEFT FORTIFICATION:
- PUCK LOCKS ON CUBE & PPC
- BINGAMIN LOCKS ON CABINETS
- SLEEVE HYBRIDS IN 3" CONDUIT 15' UP TOWER RUN AND WEATHERPROOF
- INSTALL & GROUND JUNCTION BOX TO SUPPORT SLACK OF HYBRID UNDER NEW ICE BRIDGE
- SUPPORT POWER AND FIBER SLACK INDIVIDUALLY
- SLEEVE CABLING FROM JUNCTION TO HPL3.1 IN 2" CONDUIT

NOTE: THE ORIGINAL SIZE OF THIS PLAN IS 24" X 36". SCALE RATIO IS NOT VALID FOR REDUCED OR ENLARGED SHEET SIZES

PLANS PREPARED FOR:

T-Mobile
19807 NORTH CREEK PKWY N
BOTHELL, WA 98011

PLANS PREPARED BY:

Technology Associates
SEATTLE MARKET OFFICE
9725 3RD AVENUE NE, STE. 410
SEATTLE, WA 98115

JURISDICTION APPROVAL SEAL:

ENGINEERING SEAL:

NOT FOR CONSTRUCTION

DRAWING NOTICE:

REVISIONS:

DESCRIPTION	DATE	BY	REV
ISSUED FOR 90% ANCHOR CD REVIEW	11/12/2024	RKS	A
ISSUED FOR 100% ANCHOR CD REVIEW	12/27/2024	RKS	0

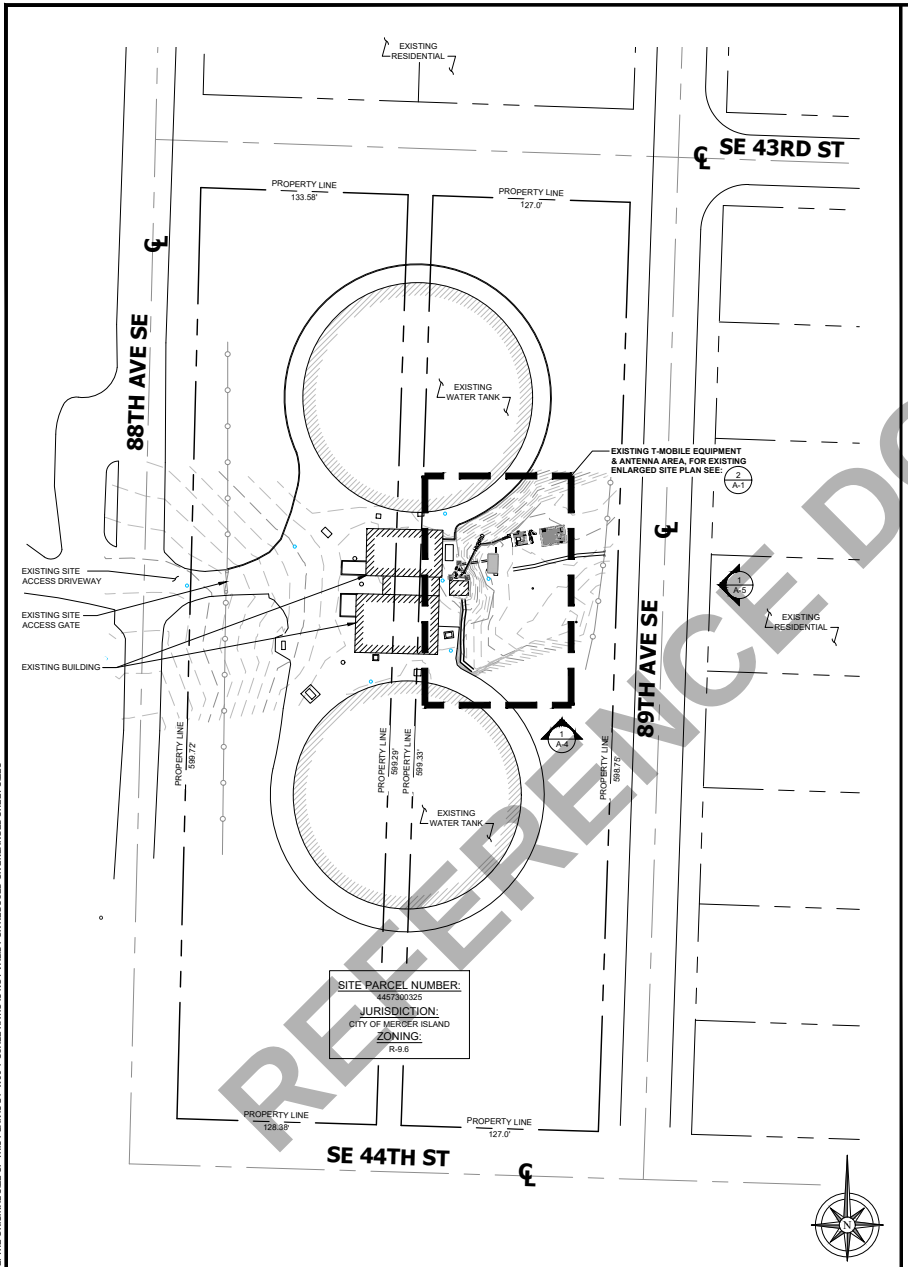
SITE NAME: MERCER ISLAND WATER TANK

SITE NUMBER: SE02629A

SITE ADDRESS: 4350 88TH AVE SE MERCER ISLAND, WA 98040

SHEET DESCRIPTION: **TITLE SHEET**

SHEET NUMBER: **T-1**

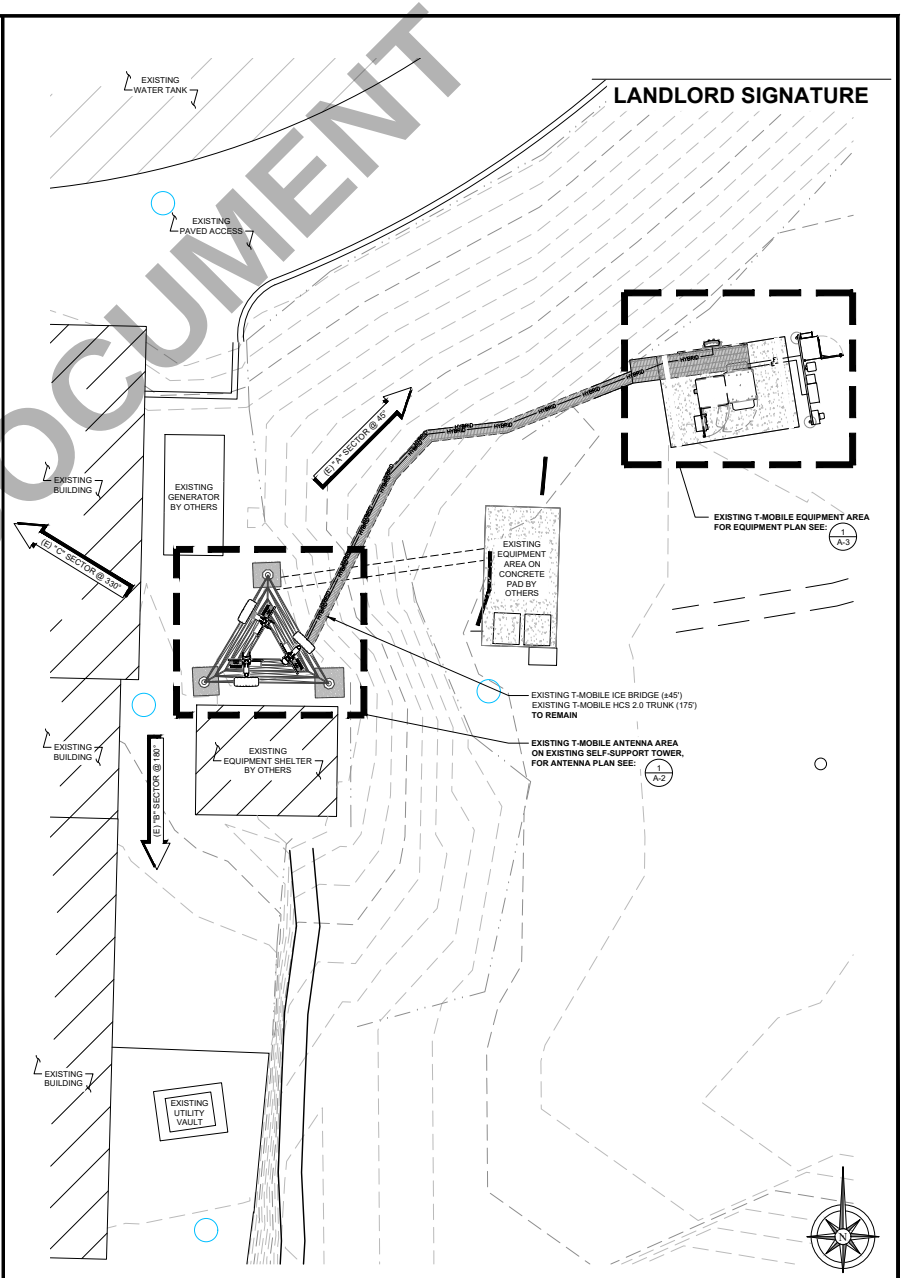


SITE PLAN

40' 0 20' 40'

SCALE: 1" = 40'-0" (24x36)
(OR) 1/2" = 40'-0" (11x17)

1



ENLARGED SITE PLAN

0 1.5' 3' 5'

SCALE: 3/16" = 1'-0" (24x36)
(OR) 3/32" = 1'-0" (11x17)

2

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19807 NORTH CREEK PKWY N
BOTHELL, WA 98011

PLANS PREPARED BY:

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SEATTLE, WA 98115

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ENGINEERING SEAL:

NOT FOR CONSTRUCTION

DRAWING NOTICE:

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DESCRIPTION	DATE	BY	REV
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ISSUED FOR 100% ANCHOR CD REVIEW	12/27/2024	RKS	0

SITE NAME:

MERCER ISLAND
WATER TANK

SITE NUMBER:

SE02629A

SITE ADDRESS:

4350 88TH AVE SE
MERCER ISLAND, WA 98040

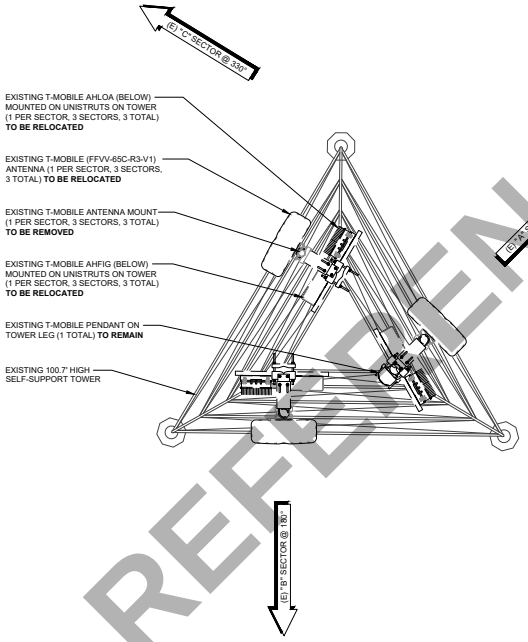
SHEET DESCRIPTION:

SITE PLAN

SHEET NUMBER:

A-1

LANDLORD SIGNATURE



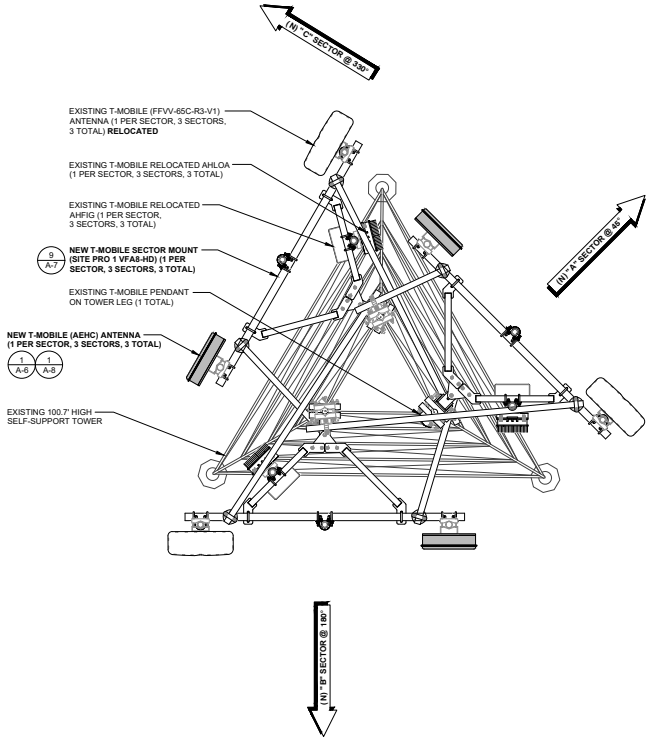
ANTENNA PLAN (EXISTING)

0 3"6" 1' | SCALE: 3/4 = 1'-0" (24x36) (OR) 3/8" = 1'-0" (11x17) | 1

TOWER: FINAL EQUIPMENT INVENTORY

SCOPE OF WORK	QUANTITY	TECHNOLOGY	MANUFACTURER	MODEL	DIMENSIONS (LxWxD)	WEIGHT (LBS)
REMOVE EXISTING	(3)	ANTENNA MOUNT	-	-	-	-
ADD NEW	**(3)**	**SECTOR MOUNT**	**SITE PRO 1**	**VFA8-HD**	**8' WIDE**	**670.51**
EXISTING TO BE RELOCATED	(3)	ANTENNA	COMMSCOPE	FFVV-65C-R3-V1	95.9" x 25.2" x 9.2"	118.6
ADD NEW	**(3)**	**ANTENNA**	**NOKIA**	**AEHC**	**38.2" x 21.5" x 5.9"**	**108.0**
EXISTING TO BE RELOCATED	(3)	RRU	NOKIA	AHLOA	22.05" x 12.13" x 7.44"	83.78
EXISTING TO BE RELOCATED	(3)	RRU	NOKIA	AHFIG	27.6" x 5.6" x 13.4"	79.4
EXISTING TO REMAIN	(1)	PENDANT	COMMSCOPE	PENDANT BREAKOUT	6.7" x 16.9" x 4.7"	0.970 LB/FT
EXISTING TO REMAIN	(1)	HYBRID TRUNK	COMMSCOPE	HCS 2.0	1.5"Ø AT 175'	0.970 LB/FT
ADD NEW	**(1)**	**HYBRID TRUNK**	**RFS**	**6x24 HYBRID**	**1-5/8"Ø AT 40m**	**2.5 LB/FT**

NOTE:
1. ANTENNA CLEARANCE AND MOUNTING TO BE FIELD VERIFIED PRIOR TO CONSTRUCTION WITH FINAL ANTENNA SPECIFICATIONS, MOUNTING HARDWARE, AND RF DESIGN.
2. REFER TO FINAL CONFIGURATION ANTENNA SCHEDULE ON SHEET RF-1.



ANTENNA PLAN (FINAL)

0 3"6" 1' | SCALE: 3/4 = 1'-0" (24x36) (OR) 3/8" = 1'-0" (11x17) | 1

NOTE: THE ORIGINAL SIZE OF THIS PLAN IS 24" X 36". SCALE RATIO IS NOT VALID FOR REDUCED OR ENLARGED SHEET SIZES

PLANS PREPARED FOR:

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BOTHELL, WA 98011

PLANS PREPARED BY:

Technology Associates

SEATTLE MARKET OFFICE
9725 3RD AVENUE NE, STE. 410
SEATTLE, WA 98115

JURISDICTION APPROVAL SEAL:

ENGINEERING SEAL:

NOT FOR CONSTRUCTION

DRAWING NOTICE:

REVISIONS:

DESCRIPTION	DATE	BY	REV
ISSUED FOR 90% ANCHOR CD REVIEW	11/12/2024	RKS	A
ISSUED FOR 100% ANCHOR CD REVIEW	12/27/2024	RKS	0

SITE NAME:
MERCER ISLAND
WATER TANK

SITE NUMBER:
SE02629A

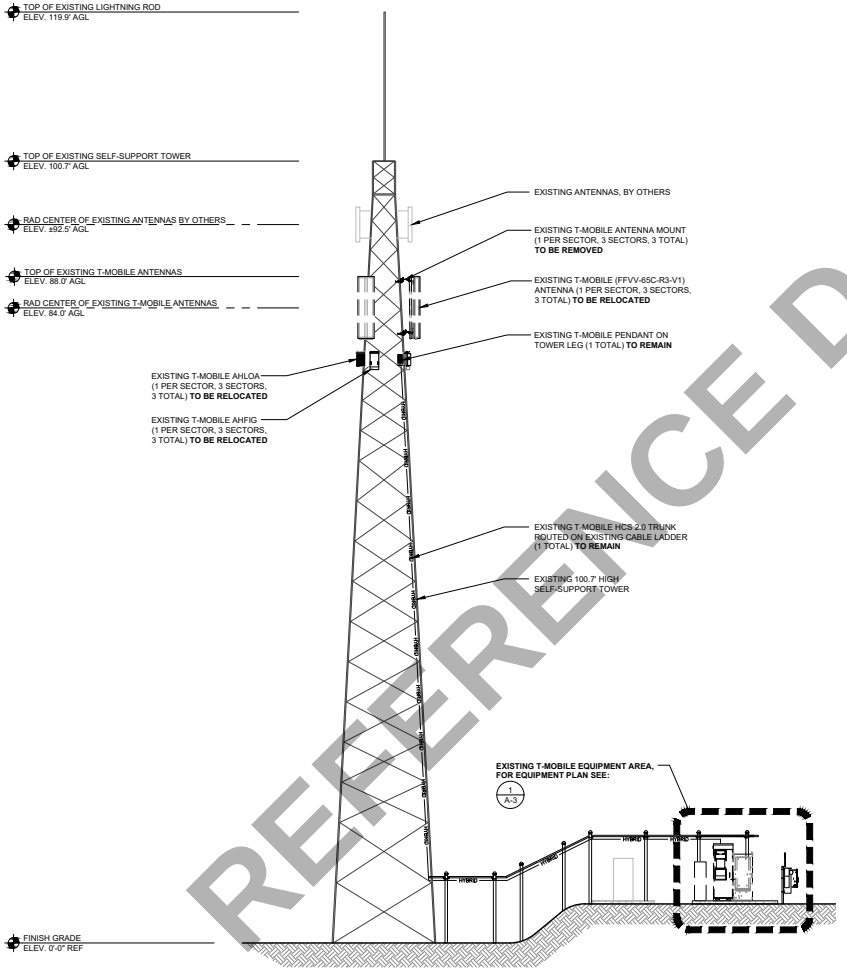
SITE ADDRESS:
4350 88TH AVE SE
MERCER ISLAND, WA 98040

SHEET DESCRIPTION:
ANTENNA PLAN

SHEET NUMBER:
A-2

DISCLAIMER:

1. EXISTING TOWER HEIGHT PER 1A SURVEY DATED: 06/01/16 PROVIDED BY AMBIT CONSULTING.
2. THE CAPACITY OF THE TOWER TO SUPPORT PROPOSED LOADS IS TO BE DETERMINED BY OTHERS.



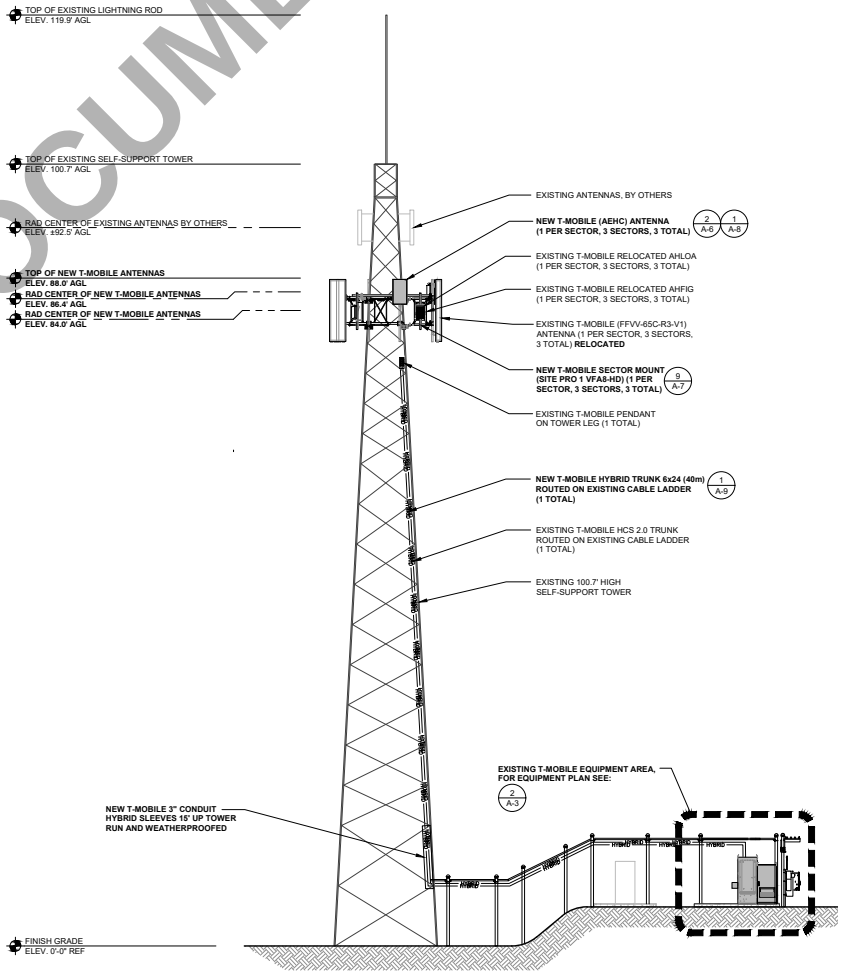
SOUTH ELEVATION (EXISTING)

0 2' 4' 8'

SCALE: 1/8" = 1'-0" (24x36)
(OR) 1/16" = 1'-0" (11x17)

1

LANDLORD SIGNATURE



SOUTH ELEVATION (FINAL)

0 2' 4' 8'

SCALE: 1/8" = 1'-0" (24x36)
(OR) 1/16" = 1'-0" (11x17)

2

NOTE: THE ORIGINAL SIZE OF THIS PLAN IS 24" X 36". SCALE RATIO IS NOT VALID FOR REDUCED OR ENLARGED SHEET SIZES

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T-Mobile

19807 NORTH CREEK PKWY N
BOTHELL, WA 98011

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Technology Associates

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9725 3RD AVENUE NE, STE. 410
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ISSUED FOR 90% ANCHOR CD REVIEW	11/12/2024	RKS	A
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MERCER ISLAND
WATER TANK

SITE NUMBER:

SE02629A

SITE ADDRESS:

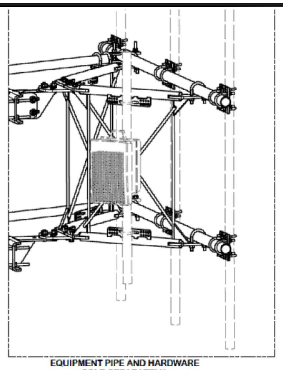
4350 88TH AVE SE
MERCER ISLAND, WA 98040

SHEET DESCRIPTION:

ELEVATIONS

SHEET NUMBER:

A-4

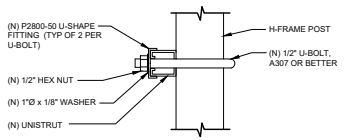


EQUIPMENT PIPE AND HARDWARE SOLD SEPARATELY.

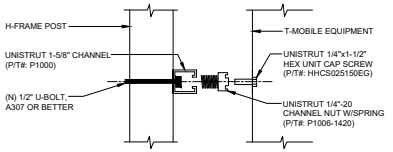
REQUIRES 1/2" HARDWARE AND 2-3/8" TO 4-1/2" O.D. PIPE

RRU MOUNTING

SCALE N.T.S. 10



UNISTRUT TO H-FRAME POST MOUNTING



EQUIPMENT TO UNISTRUT MOUNTING

UNISTRUT MOUNTING

SCALE N.T.S. 7

WB-BS

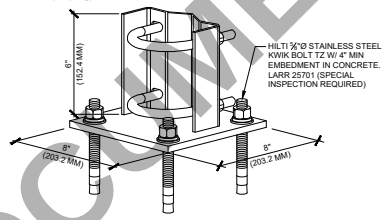
BASE SHOE FOR 3-1/2" OD PIPE, HARDWARE INCLUDED

DIMENSIONS

WIDTH	203.2MM | 8.0 IN
HEIGHT	152.4MM | 6.0 IN
LENGTH	203.2MM | 8.0 IN
WEIGHT	8.7KG | 19.2 LB

GENERAL SPECIFICATIONS

PRODUCT TYPE	BASE SHOES
APPLICATION	BASE SHOE
INCLUDES	HARDWARE | MOUNT
MATERIAL TYPE	HOT DIP GALVANIZED STEEL
MOUNTING	PIPE, 88.9 MM (3-1/2") OD
PACKAGE QUANTITY	1



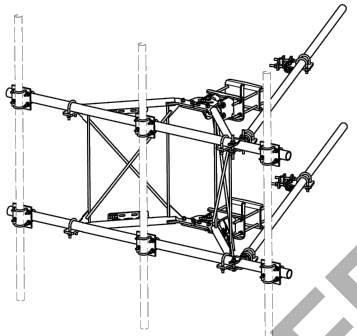
BASE PLATE MOUNTING

SCALE N.T.S. 6

LANDLORD SIGNATURE

NOT USED

SCALE N.T.S. 1



ITEM	QTY	PART NO.	PART DESCRIPTION	LENGTH	UNIT WT.	NET WT.
1	2	X-VFAW	SUPPORT ARM		71.41	142.81
2	1	X-HDCAMTBW	CLAMP WELDMENT FOR BCAM-HD		33.86	33.86
3	1	X-MHTPHD	MULTI-HOLE TAPER PLATE WELDMENT		36.24	36.24
4	2	X-VFAPL4	VFA-HD PIVOT PLATE	12 in	12.88	31.77
5	2	X-LCBP4	BENT BACKING PLATE	13 in	19.00	38.01
6	1	X-HDCAMSS	ANGLE ADJUSTMENT WELDMENT FOR BCAM-HD		16.39	16.39
7	4	X-SPTB	SLIDING PIPE TIE BACK PLATE	5 1/2 in	5.87	23.49
8	1	X-HDCAMSP	POSITIONING PLATE WELDMENT FOR BCAM-HD		2.58	2.58
9	4	X-TBCA	TIE BACK CLIP ANGLE		2.01	8.02
10	6	SCX2	CROSSOVER PLATE	7 in	4.80	28.78
11	4	MCP	CLAMP HALF 1/2" THICK, 11-5/8" LONG	12 1/16 in	3.59	14.37
12	8	DCP	1/2" THICK, 5-3/4" CENTER TO CENTER CLAMP HALF	6 1/8 in	2.36	18.90
13	2	P30108	2-7/8" O.D. X 108" SCH. 40 PIPE	108 in	52.32	104.63
14	2	P2126	2-3/8" X 126" (3" SCH. 40) GALVANIZED PIPE	126 in	40.75	81.50
15	4	A342*2	3/4" x 2-1/2" UNC HEX BOLT (A325)	2 1/2 in	0.48	1.92
16	4	G34FW	3/4" HDG USS FLATWASHER		0.06	0.24
17	4	G34LW	3/4" HDG LOCKWASHER		0.04	0.17
18	4	G34NUT	3/4" HDG HEAVY 2H HEX NUT		0.21	0.85
19	8	G58R-10	5/8" x 10" THREADED ROD (HDG.)		1.57	12.54
20	4	G58R-12	5/8" x 12" THREADED ROD (HDG.)		1.05	4.18
21	6	G58R-8	5/8" x 8" THREADED ROD (HDG.)		0.70	4.18
22	4	X-UB0300	5/8" X 3"Ø 5-1/4" X 2-1/2" U-BOLT (HDG.)		1.15	4.60
23	8	X-UB0258	5/8" X 2-5/8" X 4-1/2" X 2" U-BOLT (HDG.)		1.00	8.00
24	2	G5807	5/8"-8 7"-HDG HEX BOLT GR5 FULL THREAD	7 in	0.70	1.41
25	1	G5806	5/8" x 6" HDG HEX BOLT GR5 FULL THREAD	6 in	0.62	0.62
26	8	G5804	5/8" x 4" HDG HEX BOLT GR5		0.44	3.55
27	8	A562114	5/8" x 3-1/4" HDG A325 HEX BOLT	2 1/4 in	0.31	2.50
28	4	G5802	5/8" x 2" HDG HEX BOLT GR5		0.27	1.08
29	55	G58FW	5/8" HDG USS FLATWASHER	1/8 in	0.07	1.76
30	59	G58LW	5/8" HDG LOCKWASHER		0.03	1.77
31	73	G58NUT	5/8" HDG HEAVY 2H HEX NUT		0.13	9.48
32	24	X-UB1300	1/2" X 3" X 5" X 2" GALV U-BOLT		0.74	17.73
33	12	X-UB1212	1/2" X 2-1/2" X 4-1/2" X 2" U-BOLT (HDG.)		0.60	7.17
34	48	G12FW	1/2" HDG USS FLATWASHER	3/32 in	0.03	1.64
35	49	G12LW	1/2" HDG LOCKWASHER	1/8 in	0.01	0.67
36	49	G12NUT	1/2" HDG HEAVY 2H HEX NUT		0.07	3.44
					TOTAL WT. #	670.91

TOLERANCE NOTES

TOLERANCES ON DIMENSIONS, UNLESS OTHERWISE NOTED ARE: SAWED, SHEARED AND GAS CUT EDGES *(± 0.030")* DRILLED AND GAS CUT HOLES *(± 0.005")* - NO CONING OF HOLES LASER CUT EDGES AND HOLES *(± 0.010")* - NO CONING OF HOLES BENDS ARE ± 1/2 DEGREE ALL OTHER MACHINING *(± 0.005")* ALL OTHER ASSEMBLY *(± 0.060")*

DESCRIPTION: 8' HEAVY DUTY V-FRAME ASSEMBLY WITH TWO STIFF ARMS

SITE PRO 1 — Engineering Support Team: 1-888-750-7448 — Locations: New York, NY; Atlanta, GA; Los Angeles, CA; Fort Myers, FL; Edison, NJ; Dallas, TX

CPD NO.	DRAWN BY	END. APPROVAL	PART NO.
	CEK 1/25/2017		VFA8-HD
CLASS	SUB	DRAWING USAGE	CHECKED BY	DWG. NO.
81	02	CUSTOMER	BMC 12/13/2017	VFA8-HD

SHEET 1 OF 5

REV	DESCRIPTION OF REVISIONS	CPD	BY	DATE
C	UPDATED BCAM VERSION 1 TO BCAM VERSION 2		CEK	6/29/2018
B	UPDATED PIN LEG CONNECTION TO BCAM CONNECTION		CEK	12/13/2017
A	CHANGED TIE-BACK BACK CONNECTION		CEK	7/27/2017

REVISION HISTORY

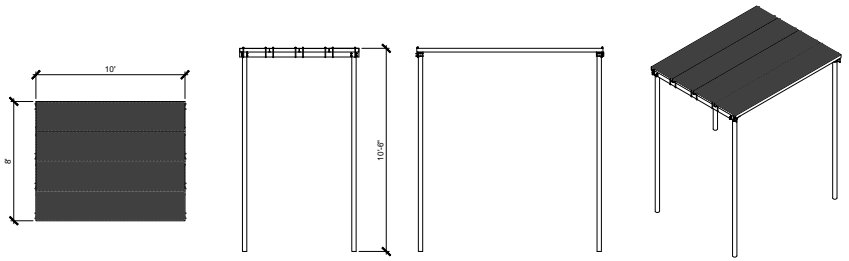
PROPRIETARY NOTE: THIS DRAWING AND THE INFORMATION CONTAINED IN THIS DRAWING ARE PROPRIETARY INFORMATION OF VALMONT INDUSTRIES, INC. ANY USE OR DISCLOSURE WITHOUT THE CONSENT OF VALMONT INDUSTRIES IS STRICTLY PROHIBITED.

SECTOR MOUNT SPECIFICATIONS

SCALE N.T.S. 9

PERFECT VISION: WEATHER CANOPY

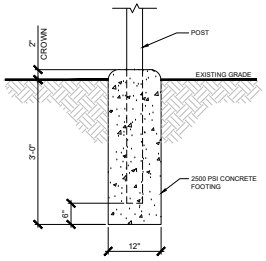
MODEL: PV-WC0810-B
SIZE (EACH): 8' W x 10' L x 126" HIGH
WEIGHT: 895 LBS



PLAN VIEW FRONT VIEW SIDE VIEW ISOMETRIC VIEW

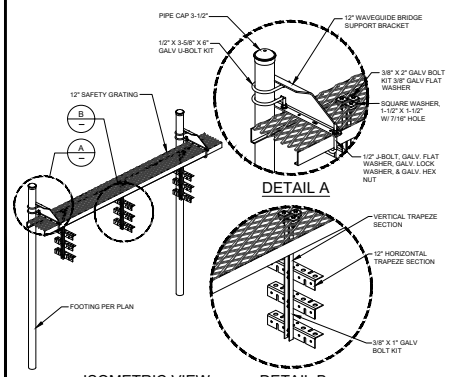
WEATHER CANOPY

SCALE N.T.S. 2



POST FOOTING DETAIL

SCALE N.T.S. 6



ICE BRIDGE DETAIL

SCALE N.T.S. 3

NOTE: THE ORIGINAL SIZE OF THIS PLAN IS 24" X 36". SCALE RATIO IS NOT VALID FOR REDUCED OR ENLARGED SHEET SIZES

PLANS PREPARED FOR:

T-Mobile

19807 NORTH CREEK PKWY N
BOTHELL, WA 98011

PLANS PREPARED BY:

Technology Associates

SEATTLE MARKET OFFICE
9725 3RD AVENUE NE, STE. 410
SEATTLE, WA 98115

JURISDICTION APPROVAL SEAL:

ENGINEERING SEAL:

NOT FOR CONSTRUCTION

DRAWING NOTICE:

REVISIONS:

DESCRIPTION	DATE	BY	REV
ISSUED FOR 90% ANCHOR CD REVIEW	11/12/2024	RKS	A
ISSUED FOR 100% ANCHOR CD REVIEW	12/27/2024	RKS	0

SITE NAME:

MERCER ISLAND
WATER TANK

SITE NUMBER:

SE02629A

SITE ADDRESS:

4350 88TH AVE SE
MERCER ISLAND, WA 98040

SHEET DESCRIPTION:

DETAILS

SHEET NUMBER:

A-7

NWTE **NorthWest Tower Engineering**

SE02629A Mercer Island WT, WA

100-ft Self-Supporting Tower

TAEC / T-Mobile

Structural Analysis Report No. 251538.11
January 13, 2025

Analysis and Report by: Harvey Carlisle, S.E.

Checked by: Steven Diamond, P.E.

Approved by: Harvey Carlisle, S.E.

Mercer Island WT Report No. 251538.11 January 13, 2025

Introduction

NorthWest Tower Engineering (NWTE) has completed a structural analysis of the 100-foot self-supporting tower at the water tank site on Mercer Island, Washington. The analysis was performed at the request of Technology Associates EC (TAEC) to determine the ability of the tower to support proposed T-Mobile equipment.

Tower Information

NWTE visited the site on 06-16-15. The tower is a Rohn Industries model SSV-100ft. Tower and foundation drawings were not provided. A Subsurface Exploration Report dated 04-05-12 and a Nondestructive Foundation Mapping report dated 04-17-12 by Tower Engineering Professionals (TEP) were provided. The tower has been structurally modified multiple times. Construction drawings for the original modifications were not provided. Original modifications include the installation of mid bay horizontals at one bay above 40ft and completing the "X" bracing above 80ft for 5 bays. The tower was structurally modified again per NWTE construction drawings dated 05-20-21 (Project No. 211538.09). Modifications consist of installation of mid-bay horizontal bracing between 0'-20' (3 bays) and between 44'-60' (4 bays). NWTE visited the site again on 03-09-22 to make observations of the structural modifications.

Assessed Condition

This analysis was performed to determine the ability of the tower to support the following load conditions:

Existing Appurtenance Configuration

Elev.	Location	Appurtenance	Tx Line	Tx Line No.
26'	Leg A	(2) GPS	½" Coax	# 26
63'	Leg A	Empty Mount	N/A	N/A
66'	Leg C	10' Omni on 3-ft Stand-off Mount	7/8" Coax	# 20
84'	Leg A,B,C	**T-Mobile** (3) Commscope FFVV-65C-R3-V1 Panels (3) Nokia AHFIG RRU (3) Nokia AHLOA RRU (1) HCS 2.0 Pendant (3) Site Pro 1 TAM-2U Universal Sliding Tapered Pipe Mount with 8' Pipe	HCS 2.0 Hybrid	# 30
99'	Face C	10ft Face Frame 10ft 2-bay Single Dipole 10ft 4-bay Dual Dipole 4ft Yagi Antenna	(2) 7/8" Coax ¼" coax	# 16,17 #25
99'	Leg B	18" Standoff Mount 10ft 4-bay Dual Dipole	7/8" Coax	# 18
110'	Leg C	10ft Omni Antenna	7/8" Coax	# 19

Proposed Appurtenance Configuration

All existing antennas and the following:

Elev.	Location	Appurtenance	Tx Line	Tx Line No.
84’	Leg A,B,C	**Remove** (3) Site Pro 1 TAM-2U Universal Sliding Tapered Pipe Mount with 8’ Pipe **Retain** (3) Commscope FFVV-65C-R3-V1 Panels (3) Nokia AHFIG RRU (3) Nokia AHLOA RRU (1) HCS 2.0 Pendant **Proposed** (3) Nokia AEHC Panels (86.4’) (3) Site Pro 1 VFA8-HD Sector Frames	**Retain** HCS 2.0 Hybrid **Proposed** 6x24 Hybrid	# 30 # 31

Antenna center elevations are listed for microwave, yagi, and panel type antennas. Base elevations are listed for other antenna types.

Information on tower geometry, structural member sizes, and existing appurtenances was gathered during NWTE’s site visit. Information on proposed appurtenances was provided by TAEC in in preliminary construction drawings dated 01-09-25 and in T-Mobile’s RFDS dated 12-20-24.

Steel yield strengths for structural members are assumed standard Rohn as follows:

- Pipe Legs 50 ksi
- Angle Bracing 36 ksi

The attached drawing shows tower geometry, structural member sizes, existing and proposed antennas, feed lines, and other supported appurtenances.

Wind Load Specifications

A comprehensive structural analysis was performed using the provisions of the current design standard, TIA-222-H, “Structural Standard for Antenna Supporting Structures, Antennas, and Small Wind Turbine Support Structures.” This standard is referenced in the 2021 International Building Code (IBC). The minimum basic wind speed of **109 mph** (V_{ult}, 3-second gust) as listed in the standard for Risk Category IV structures at this location was used. A basic wind speed of 30 mph in combination with a design ice thickness of 1” as listed in the TIA-222-H standard was also considered. Exposure Category B (suburban area) was considered. The rigorous topographic factor procedure was used (flat topped hill with crest height, H=365’; slope distance, L=3300’; and distance from crest, x=760’). A base elevation above sea level of 380’ was considered.

Analysis Method

A three-dimensional finite element model of the tower was created using *tnxTower Version 8.2.1.0 (Tower Numerics, 2023)*. This computer software program calculates and distributes wind and ice loads in the model. It calculates the resulting forces (required strength) in all structural members and determines tower deflections and foundation loads. Required strength of each structural member is compared to each member's design strength determined using the TIA-222-H standard.

Analysis Results

The following ratios of required strength to design strength for the tower's structural members were found:

MEMBER DEMAND-CAPACITY RATIO

Elevation (ft)	Member	Existing Configuration Maximum % Capacity	Proposed Configuration Maximum % Capacity
100 - 0	Leg	70	87
	Diagonal	43	67
	Horizontal	13	16

The attached tables contain more detailed lists of member forces and capacities. Capacities of all structural members were found to be adequate.

Calculations show anchor bolts and bolts in leg splice and bracing connections to be adequate. Welds, plates, and other elements of the connections are assumed to develop the full strengths of the members.

According to the TEP foundation mapping report, each leg of the tower rests on a concrete pier. Pier dimensions are listed as approximately 2'-6" square at top and 3'-6" square at bottom with a depth of 11'-6". Calculations confirm that the foundations are adequate.

Seismic calculations were performed using the equivalent lateral force procedure in accordance with the TIA-222-H standard. Seismic forces were distributed over the height of the tower in accordance with the TIA-222-H standard. Resulting values for shear forces in the tower were then calculated at multiple levels and compared with shear forces generated from wind loads. Wind load was found to govern over the full height of the structure.

Conclusion

The tower meets the requirements of the TIA-222-H standard for the antenna configurations considered. Structural modifications are not required.

Conditions of Analysis

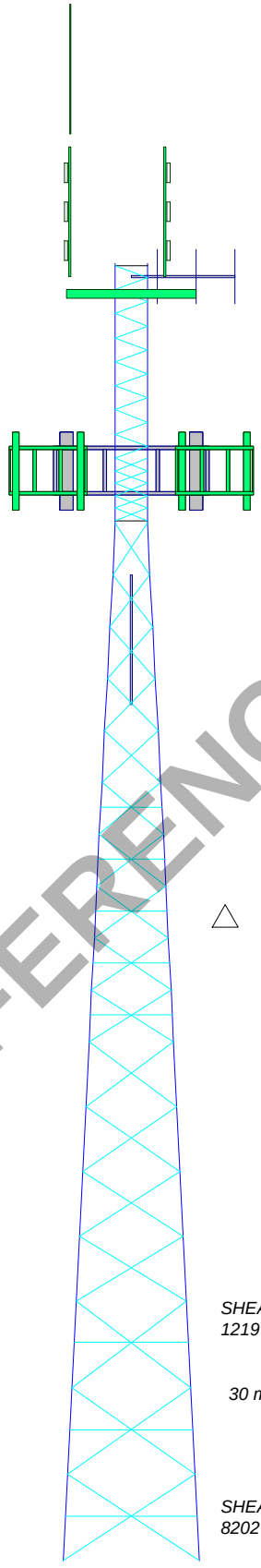
The analysis performed and the conclusions contained herein are based on the following assumptions:

- The tower has been properly installed and maintained.
- Steel grades for structural members are as listed above.
- Any deficiencies noted during the field visit have been or will be corrected.
- No x-ray, subsurface excavation, or other similar examination of the tower, foundation system, or welded connections was conducted. For portions of the tower and foundation system that were not visually accessible, no determination regarding the condition or adequacy was made.
- All structural components of the tower including, but not limited to, structural members (legs, bracing, etc.), connection components (gusset plates, welds, bolts), and foundations are in good condition.
- Feed lines are arranged as shown in the attached cross section.
- Existing and proposed T-Mobile antennas and equipment will be installed on new sector frames.

Deviations to these assumptions may affect the analysis results.

Section		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14
Legs		SR 1 7/16		ROHN 2 STD (2.375"x.154)										ROHN 2.5 X-STR (2.875"x.276)	
Leg Grade		A572-50													
Diagonals		SR 5/8		L1 1/2x1 1/2x1 1/2x1/8										L1 1/2x1 1/2x3/16	L1 3/4x1 3/4x3/16
Diagonal Grade		A36													
Top Girts		SR 5/8		N.A.											
Bottom Girts		N.A.	SR 5/8											N.A.	
Sec. Horizontals	2.5	N.A.		L2x2x1/4										N.A.	L2x2x1/4
Face Width (ft)		16 @ 0.927083	A	10 @ 4	2.90365	3.30729	3.71354	4.11719	4.52083	4.92448	5.32812	5.73438	6.13802	4 @ 5	3 @ 6.66667
# Panels @ (ft)	10.5625												6.54167		8.55208
Weight (lb)	3890.6	415.2	194.1	84.4	86.2	88.1	90.1	92.2	139.6	145.7	152.0	158.3	164.7	876.8	1203.9

100.0 ft
85.0 ft
80.0 ft
76.0 ft
72.0 ft
68.0 ft
64.0 ft
60.0 ft
56.0 ft
52.0 ft
48.0 ft
44.0 ft
40.0 ft
20.0 ft
0.0 ft



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Mast 10'x1"	110	Commscope FFVV-65C-R3 (T-Mobile)	84
Small Yagi	99	Commscope FFVV-65C-R3 (T-Mobile)	84
Face Frame	99	Commscope FFVV-65C-R3 (T-Mobile)	84
10' Dipole Antenna with Mount	99	AHLOA RRU (T-Mobile)	84
10' Dipole Antenna with Mount	99	AHLOA RRU (T-Mobile)	84
10' Dipole Antenna with Mount	99	AHLOA RRU (T-Mobile)	84
Nokia AEHC (T-Mobile)	86	Nokia AHFIG (T-Mobile)	84
Nokia AEHC (T-Mobile)	86	Nokia AHFIG (T-Mobile)	84
Nokia AEHC (T-Mobile)	86	Nokia AHFIG (T-Mobile)	84
Site Pro 1 VFA8-HD V-Frame (T-Mobile)	84	HCS 2.0 Pendant (T-Mobile)	84
		Mast 10'x1"	66
Site Pro 1 VFA8-HD V-Frame (T-Mobile)	84	3-ft Stand-Off Mount	66
		3-ft Stand-Off Mount	63
Site Pro 1 VFA8-HD V-Frame (T-Mobile)	84	GPS	21 - 11

SYMBOL LIST

MARK	SIZE	MARK	SIZE
A	5 @ 0.966667		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 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 109 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 IV.
7. Topographic Category 5 with Crest Height of 365'
8. TOWER RATING: 86.5%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 57223 lb
SHEAR: 5419 lb

UPLIFT: -48900 lb
SHEAR: 4605 lb

AXIAL 25287 lb
SHEAR 1219 lb *MOMENT 79342 lb-ft*
TORQUE 322 lb-ft
30 mph WIND - 1.0000 in ICE

AXIAL 9212 lb
SHEAR 8202 lb *MOMENT 495355 lb-ft*
TORQUE 2597 lb-ft
REACTIONS - 109 mph WIND

NorthWest Tower Engineering
3426 Broadway Suite 302
Everett, WA 98201
Phone: 425 258 4248
FAX: 425 258 4289
NWTE

Job:	***100-ft SS Mercer Island, WA 251538.11***	
Project:	***Proposed, V =109 mph & 30 mph with 1" Ice***	
Client: TAEC/ T-Mobile	Drawn by: Steven Diamond	App'd:
Code: TIA-222-H	Date: 01/13/25	Scale: NTS
Path:		Dwg No. E-1

RAN Template:	A&L Template:
56791EZ_SR_6x24	56791EZ_SR _6x24

SE02629A_Anchor_8

Print Name:
Standard
Project IDs with associated PORs:
SE02629A-0002437718
Anchor_Phase 3

Section 1 - Site Information

Site ID: SE02629A
Status: Final
Version: 8
Project Type: Anchor
Approved: 12/20/2024 11:13:48 AM
Approved By: Francisco.Monroy9@T-Mobile.com
Last Modified: 12/20/2024 11:13:56 AM
Last Modified By: Francisco.Monroy9@T-Mobile.com

Site Name: Mercer Island Watertank
Site Class: Watertank
Site Type: Structure Non Building
Plan Year:
Market: SEATTLE WA
Vendor: Nokia
Landlord: TCI Cablevision

Latitude: 47.5686937
Longitude: -122.2208503
Address: 4350 88th Ave SE
City, State: Mercer Island, WA
Region: WEST

RAN Template: 56791EZ_SR_6x24			**AL Template:** 56791EZ_SR _6x24	
Sector Count: 3	**Antenna Count:** 6	**Coax Line Count:** 0	**TMA Count:** 0	**RRU Count:** 6

Section 2 - Existing Template Images

6791B_SR_1Pend_NoLAWS3_NoUMTS - Copy.jpg

RAN Template:	A&L Template:
56791EZ_SR_6x24	56791EZ_SR _6x24

SE02629A_Anchor_8

Print Name:
Standard
Project IDs with associated PORs:
SE02629A-0002437718
Anchor_Phase 3

Section 5 - RAN Equipment

Existing RAN Equipment

Template: 6791B_SR

Enclosure	1	2	3	4
Enclosure Type	Tower Top Mount (Nokia)	Purcell Expansion cabinet - No DC	2G Purcell support	Ancillary Equipment (Nokia)
Radio	AHFIG (x 3): N1900, N2100 (DARK), L1900, L2100, U1900 (DECOMMISSIONED), G1900 AHLOA (x 3): N600, L600, L700			
Baseband		ASIB: L600, L700, L1900, L2100 ASIL (x 2): N600, N1900, N2100 (DARK) FSMF: U1900 (DECOMMISSIONED), G1900		
Hybrid Cable System				15' HCS 2.0 Jumper Cable - 10AWG 2PR Airscale (x 3) 15' HCS 2.0 Jumper Cable - 2x6AWG 2PR AHFIG (x 3) 175' HCS 2.0 Trunk - 12#6AWG 24 SM FIBER PR
Baseband Submodule		ABIA: L1900, L2100 ABIA: L600, L700 ABIL (x 3): N1900, N2100 (DARK) ABIL (x 2): N600		
Baseband Subrack		AMIA (x 2)		
Power subsystem			Batteries *Select size* Breakers *Select size* Rectifier Shelf *Select size*	
Transport System			CSR IXRe V2 (Gen2)	
Power			Extra Amplifier Module for Raycap PowerPlus Voltage Booster Raycap PowerPlus Voltage Booster w/ 2 Modules (Version 1 Model, Do Not Order)	
Junction Box				Nokia HCS 2.0 Tower Junction Box

Proposed RAN Equipment

Template: 56791EZ_SR_6x24

Enclosure	1	2	3	4

Enclosure Type	Tower Top Mount (Nokia)	Purcell HPL3.1 600A Site Support Cabinet	Ancillary Equipment (Nokia)	Purcell LB3 Battery Cabinet (4 strings)
Radio	AHFIG (x 3): N1900, N2100 (DARK), L1900, L2100, G1900 AHLOA (x 3): N600, L600, L700			
Baseband		ASIB: L600, L700, L1900, L2100 ASIL (x 2): N600, N1900, N2100 (DARK) FSMF: G1900		
Hybrid Cable System			15' HCS 2.0 Jumper Cable - 10AWG 2PR Airscale (x 3) 15' HCS 2.0 Jumper Cable - 2x6AWG 2PR AHFIG (x 3) 175' HCS 2.0 Trunk - 12#6AWG 24 SM FIBER PR Hybrid Trunk 6/24 4AWG 40m	
Baseband Submodule		ABIA (x 2): L1900, L2100 ABIA: L600, L700 ABIL (x 3): N1900, N2100 (DARK) ABIL (x 2): N600 ABIO: N2500		
Baseband Subrack		AMIA (x 2)		
Power subsystem		Breakers *Select size* Rectifier Shelf *Select size*		Batteries *Select size*
Transport System		CSR IXRe V2 (Gen2)		
Junction Box			Nokia HCS 2.0 Tower Junction Box	

RAN Scope of Work:

12/17/2024: RAD center updated as per market request for AEHC.

09/17/2024: RFDS created as per market guidelines,
• AHFIG/AHLOA as existing RFDS.
• HCS 2.0 as existing.
• [1]Hybrid Trunk 6x24 added.
• Cabinets HPL3.1/LB3.
• AEHC and N25 added for all sectors.
• PH2Y design updated.

RAN Template:	A&L Template:
56791EZ_SR_6x24	56791EZ_SR _6x24

SE02629A_Anchor_8

Print Name:
Standard
Project IDs with associated PORs:
SE02629A-0002437718
Anchor_Phase 3

Section 6 - A&L Equipment

Existing Template: 6791B_SR
Proposed Template: 56791EZ_SR _6x24

Sector 1 (Existing) view from front (Note: the images show view from behind)				
Coverage Type	A - Outdoor Macro			
Antenna	1			
Antenna Model	FFVV-65C-R3-V1 (Octo)			
Azimuth	45			
M. Tilt	0			
RAD Center (ft.)	84			
Ports	**P1**	**P2**	**P3**	**P4**
Active Tech	L700 L600 N600	L700 L600 N600	L2100 L1900 N1900 G1900	L2100 L1900 G1900 N1900
Dark Tech			N2100	N2100
Restricted Tech				
Decomm. Tech			U1900	U1900
E. Tilt				
Cables				
TMAs				
Diplexer / Combiners				
Radio				
Sector Equipment				

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56791EZ_SR_6x24	56791EZ_SR _6x24

SE02629A_Anchor_8

Print Name:
Standard
Project IDs with associated PORs:
SE02629A-0002437718
Anchor_Phase 3

Sector 1 (Proposed) view from front (Note: the images show view from behind)					
Coverage Type	A - Outdoor Macro				
Antenna	1				2
Antenna Model	FFVV-65C-R3-V1 (Octo)				AEHC (Active Antenna - Massive MIMO)
Azimuth	45				45
M. Tilt	0				
RAD Center (ft.)	84				86.4
Ports	P1	P2	P3	P4	P5
Active Tech	L700 L600 N600	L700 L600 N600	L2100 L1900 N1900 G1900	L2100 L1900 G1900 N1900	N2500
Dark Tech			N2100	N2100	
Restricted Tech					
Decomm. Tech					
E. Tilt					
Cables					
TMAs					
Diplexer / Combiners					
Radio					
Sector Equipment					

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56791EZ_SR_6x24	56791EZ_SR _6x24

SE02629A_Anchor_8

Print Name:
Standard
Project IDs with associated PORs:
SE02629A-0002437718
Anchor_Phase 3

Sector 2 (Existing) view from front (Note: the images show view from behind)				
Coverage Type	A - Outdoor Macro			
Antenna	1			
Antenna Model	FFVV-65C-R3-V1 (Octo)			
Azimuth	180			
M. Tilt	0			
RAD Center (ft.)	84			
Ports	**P1**	**P2**	**P3**	**P4**
Active Tech	L700 L600 N600	L700 L600 N600	L2100 L1900 G1900 N1900	L1900 L2100 G1900 N1900
Dark Tech			N2100	N2100
Restricted Tech				
Decomm. Tech			U1900	U1900
E. Tilt				
Cables				
TMAs				
Diplexer / Combiners				
Radio				
Sector Equipment				

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56791EZ_SR_6x24	56791EZ_SR _6x24

SE02629A_Anchor_8

Print Name:
Standard
Project IDs with associated PORs:
SE02629A-0002437718
Anchor_Phase 3

Sector 2 (Proposed) view from front (Note: the images show view from behind)					
Coverage Type	A - Outdoor Macro				
Antenna	1				2
Antenna Model	FFVV-65C-R3-V1 (Octo)				AEHC (Active Antenna - Massive MIMO)
Azimuth	180				180
M. Tilt	0				
RAD Center (ft.)	84				86.4
Ports	**P1**	**P2**	**P3**	**P4**	**P5**
Active Tech	L700 L600 N600	L700 L600 N600	L2100 L1900 G1900 N1900	L1900 L2100 G1900 N1900	N2500
Dark Tech			N2100	N2100	
Restricted Tech					
Decomm. Tech					
E. Tilt					
Cables					
TMAs					
Diplexer / Combiners					
Radio					
Sector Equipment					

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56791EZ_SR_6x24	56791EZ_SR _6x24

SE02629A_Anchor_8

Print Name:
Standard
Project IDs with associated PORs:
SE02629A-0002437718
Anchor_Phase 3

Sector 3 (Existing) view from front (Note: the images show view from behind)				
Coverage Type	A - Outdoor Macro			
Antenna	1			
Antenna Model	FFVV-65C-R3-V1 (Octo)			
Azimuth	330			
M. Tilt	0			
RAD Center (ft.)	84			
Ports	**P1**	**P2**	**P3**	**P4**
Active Tech	L700 L600 N600	N600 L700 L600	L2100 L1900 G1900 N1900	L2100 L1900 G1900 N1900
Dark Tech			N2100	N2100
Restricted Tech				
Decomm. Tech			U1900	U1900
E. Tilt				
Cables				
TMAs				
Diplexer / Combiners				
Radio				
Sector Equipment				

Unconnected Equipment:

Scope of Work:

RAN Template:	A&L Template:
56791EZ_SR_6x24	56791EZ_SR _6x24

SE02629A_Anchor_8

Print Name:
Standard
Project IDs with associated PORs:
SE02629A-0002437718
Anchor_Phase 3

Sector 3 (Proposed) view from front (Note: the images show view from behind)					
Coverage Type	A - Outdoor Macro				
Antenna	1				2
Antenna Model	FFVV-65C-R3-V1 (Octo)				AEHC (Active Antenna - Massive MIMO)
Azimuth	330				330
M. Tilt	0				
RAD Center (ft.)	84				86.4
Ports	**P1**	**P2**	**P3**	**P4**	**P5**
Active Tech	L700 L600 N600	N600 L700 L600	L2100 L1900 G1900 N1900	L2100 L1900 G1900 N1900	N2500
Dark Tech			N2100	N2100	
Restricted Tech					
Decomm. Tech					
E. Tilt					
Cables					
TMAs					
Diplexer / Combiners					
Radio					
Sector Equipment					

Unconnected Equipment:

Scope of Work: