

Structural Analysis Report

AT&T – 5G NR

April 6, 2022

Site Name	East Channel
Site Number	SD28
FA #	10092497
PTN #	3801A0YFOH
Pace #	MRWOR052432
Client	Mastec
Proposed Carrier	AT&T
Site Location	P.O. Box 614 Bothell, WA 98041 47.57669° N NAD83 122.20937° W NAD83
Structure Type	Rooftop
Structural Usage Ratio	91.6%
Overall Result	Pass
Recommendation	--

Upon reviewing the results of this analysis, it is our opinion that the antenna supporting structure does meet the specified IBC/ASCE/TIA code and minimum design requirements. The existing structure is therefore deemed adequate to support the existing and proposed loading as listed in this report.



Summary of Contents

- Introduction
 - Opening Statement
 - Project Description
 - Criteria
 - Conclusion
- Calculations
- Appendix A
 - Design Tables & Resources Used

Assumptions and Limitations

Our structural calculations are completed assuming all information provided to CORE ONE CONSULTING USA is accurate and applicable to this site. For the purposes of calculations, we assume an overall structure condition of “like new” and all members and connections to be free of corrosion and/or structural defects. The structure owner and/or contractor shall verify the structure’s condition prior to installation of any proposed equipment. If actual conditions differ from those described in this report CORE ONE CONSULTING USA should be notified immediately to complete a revised evaluation.

Our evaluation is completed using standard TIA, AISC, ACI, and ASCE methods and procedures. Our structural results are proprietary and should not be used by others as their own. CORE ONE CONSULTING USA is not responsible for decisions made by others that are or are not based on our supplied assumptions and conclusions.

This report is an evaluation of the rooftop structure only and does not reflect adequacy of the existing mounts, other mounts, or coax mounting attachments. These elements are assumed to be adequate for the purposes of this analysis and are assumed to have been installed per their manufacturer requirements.

INTRODUCTION

At the request of **AT&T**, CORE ONE CONSULTING USA has performed a structural analysis on the existing antenna mount supporting structure. All supporting documents have been obtained from the client and are assumed to be accurate and applicable to this site. The Rooftop was analyzed using RISA 3D Version 17.0.4 engineering software.

Supporting Documentation

Construction Drawing	CORE ONE CONSULTING USA Job Site SD28, Dated 04/06/22
-----------------------------	---

Analysis Code Requirements

Wind Speed	98 mph (3-Second Gust, Vult)
Wind Speed w/ ice	30 mph (3-Second Gust) w/ 1" Ice
TIA/ASCE Revision	ANSI/TIA-222-H / ASCE 7-16
Structure Class	II
Exposure Category	C
Topographic Category	Kzt=1.00
Calculated Crest Height	0 ft
Site Class	D- Stiff Soil
Spectral Response	Ss=1.399g, S1=0.487g

CONCLUSION

Upon reviewing the results of this analysis, it is our opinion that the antenna supporting structure does meet the specified IBC/ASCE/TIA code and minimum design requirements. The existing structure is therefore deemed adequate to support the existing and proposed loading as listed in this report.

Fathullah Zamani

Structural Engineering Lead | [Core One Consulting USA](#)

3100 W Ray Road, Suite 201, Chandler, AZ 85224

(O) 1+(855) 708-2195 | (M) (518) 892-0471

alex.bazeley@coreoneconsultants.com | info@coreoneconsulting.com

Existing Configuration

Mount Height (ft)	Qty.	Appurtenance	Mount type	Carrier
36.0	3	Commscope SBNHH-1D65C	Pipe	AT&T
35.0	3	Commscope NNH4-65D-R6		
	3	Cellmax CMA-UBTULBULBHH-6516-16-21-21		
	3	AirScale Dual RRH 4T4R B12/14		
	3	Airscale Dual RRH 4T4R B5		
	3	AirScale Dual RRH 4T4R B25/66		
	3	Alcatel Lucent RRH4x25-WCS-4R		
	9	Raycap DC2		
	3	Raycap FC12		

Loading to be Removed

Mount Height (ft)	Qty.	Appurtenance	Mount type	Carrier
--	--	--	--	AT&T

Proposed Loading

Mount Height (ft)	Qty.	Appurtenance	Mount type	Carrier
36.9	3	Nokia AEQK	Tripod	AT&T
	2	Raycap DC6		

Final Configuration

Mount Height (ft)	Qty.	Appurtenance	Mount type	Carrier
36.9	3	Nokia AEQK	Tripod	AT&T
	2	Raycap DC6		
36.0	3	Commscope SBNHH-1D65C	Pipe	
35.0	3	Commscope NNH4-65D-R6		
	3	Cellmax CMA-UBTULBULBHH-6516-16-21-21		
	3	AirScale Dual RRH 4T4R B12/14		
	3	Airscale Dual RRH 4T4R B5		
	3	AirScale Dual RRH 4T4R B25/66		
	3	Alcatel Lucent RRH4x25-WCS-4R		
	9	Raycap DC2		
3	Raycap FC12			

Structure Usages

Summary		
Rooftop*	91.6%	Pass
RATING =	91.6%	Pass

*ASSUMED 2X12 ROOF JOISTS SPAED 16" O.C. WITH A MAXIMUM LENGTH OF 20'

Site Name	SD28
Client	Mastec
Carrier	ATT
Date	4/6/2022

Wind Loading Inputs:

Design Wind Velocity: 98 ultimate 3-second gust

Exposure Category: C

Adopted Building Code: ASCE 7-16

Antenna Load Standard: ASCE 7-16

Wind Centerline (ft): 36.90 ft

K_d : 0.90

K_z : 1.02

K_{zt} : 1.38

K_d : 0.85

K_e : 1.00

q_z = 29.35

Ice Wind 30

C_f = 1.20

Ice Thickness 1

G_h = 0.85

Fst_Ice(psf) 4.98

Fst (psf)= 29.94

F_p = 0.56

Wind Force

Seismic Force

Appurtenance Name	Total Quantity	Weight(lbs)	F-Norm (lbs)	F-Perp (lbs)	F-Norm (lbs)	F-Perp (lbs)
COMMSCOPE_SBNHH-1D65C	3	49.6	336.8	226.5	27.8	27.8
Cellmax CMA-UBTMLBMLBHH-6516-16-21-21	3	85.0	484.6	168.2	47.6	47.6
Nokia AEQK	3	99.2	127.7	70.1	55.5	55.5
COMMSCOPE_NNH4-65D-R6	3	88.2	561.7	272.3	49.4	49.4
Airscale_4T4R B5 160W AHCA	3	35.3	37.7	21.1	19.7	19.7
Airscale Dual 4T4R B12/14_AHLBA_	3	101.4	108.1	68.6	56.7	56.7
Airscale Dual 4T4R B25/66_AHFIB_	3	86.0	108.1	68.6	48.1	48.1
ALCATEL LUCENT_RRH4X25-WCS_4R	3	91.0	112.6	97.9	50.9	50.9
RAYCAP_DC2	9	16.0	27.3	16.5	9.0	9.0
RAYCAP_FC12-PC6-10E	3	20.4	61.6	25.2	11.4	11.4
RAYCAP_DC6	2	38.0	55.8	24.6	21.3	21.3

Seismic Loads

Latitude and longitude were determined from existing as-builts, customer records, and confirmed using GoogleEarth. Design spectral acceleration parameters were obtained using NSHMP Hazard, a program by USGS for determining seismic values within the continental US. Input data and program output are provided at the end of this report.

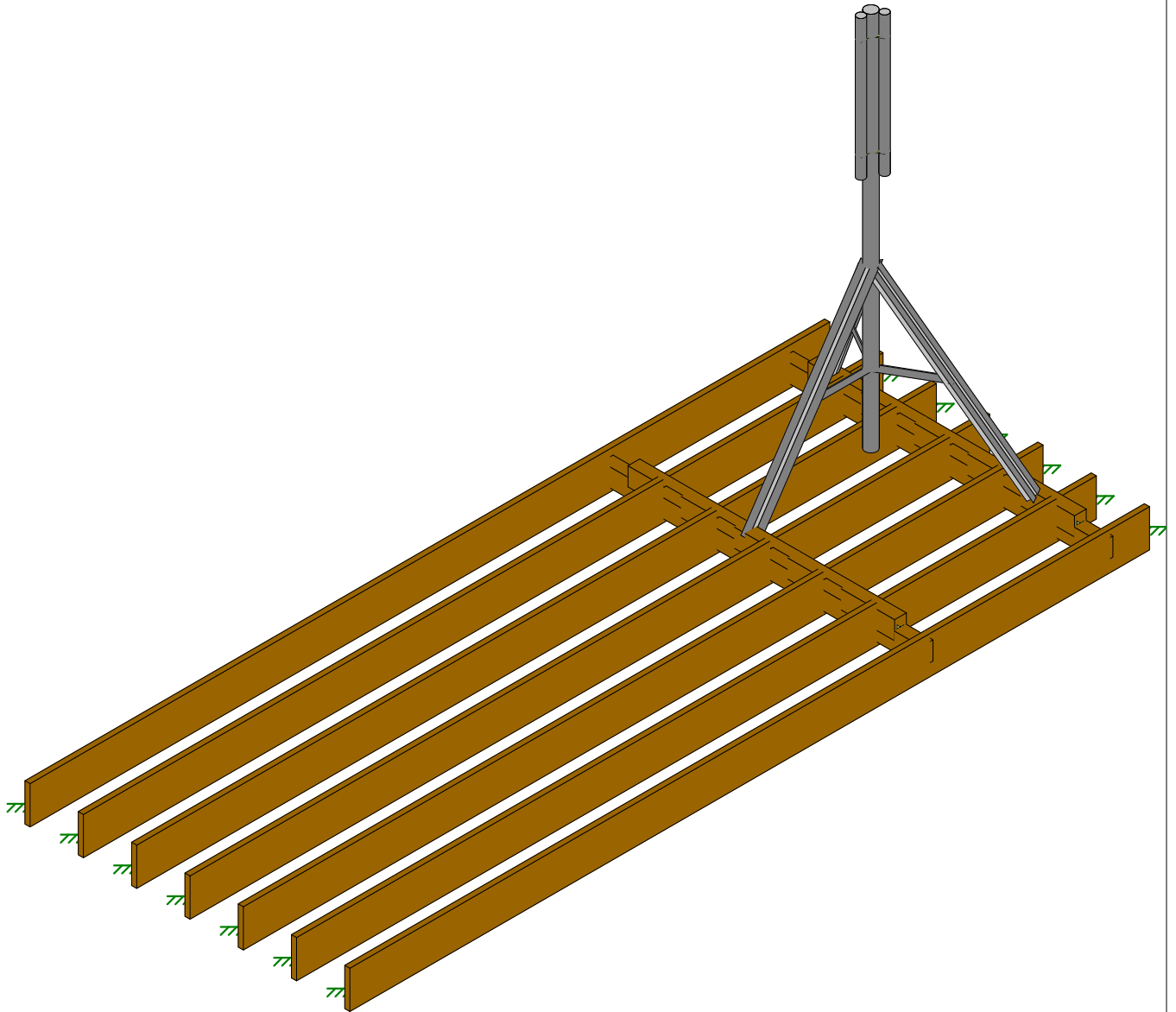
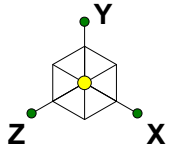
Latitude: 47.57669 °

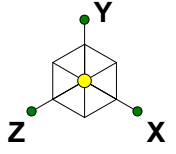
Longitude: -122.2094 °

$S_s =$	1.399	g	Site Class:	D
$F_a =$	1.00		Occupancy Category:	II
$S_{MS} =$	1.399		Importance Factor, I:	1.00
$S_{DS} =$	0.933		Seismic Design Category:	D
$S_1 =$	0.487	g	Amplification Factor, a_p :	1.0
$F_v =$	1.81		Response Factor, R_p :	2.0
$S_{M1} =$	0.883		$z =$	36.9 ft
$S_{D1} =$	0.589		$h =$	36.9 ft

Telecommunication cabinets and radio equipment are non-structural components to be designed under the provisions of ASCE 7-16 chapter 13.

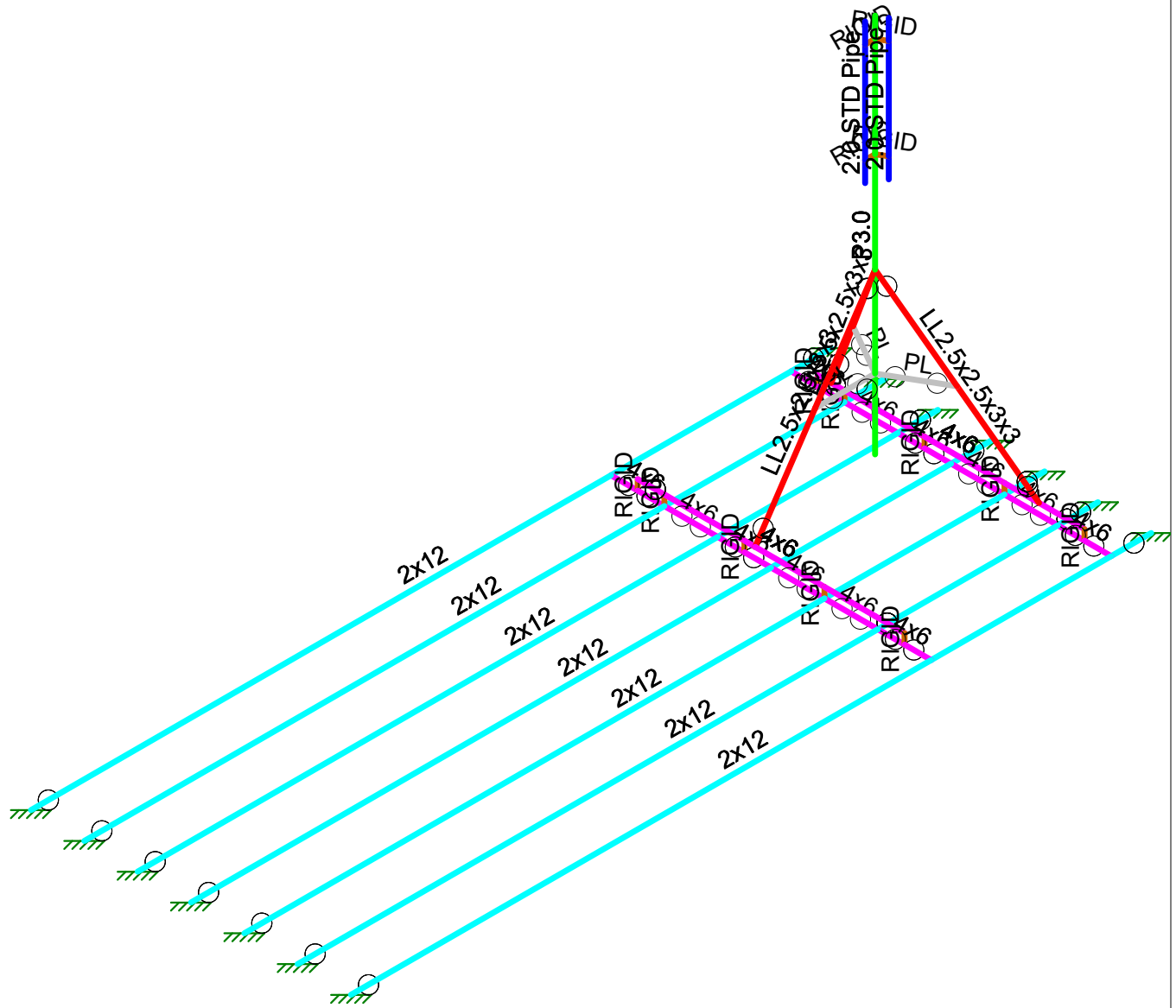
(ASCE 7-16 13.3-3)	$F_{p,\min} = 0.3S_{DS} I_p W_p$	=	0.280 w_p	} Use $F_p =$ 0.560 w_p
(ASCE 7-16 13.3-1)	$F_p = \frac{0.4a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)} \left(1 + 2\frac{z}{h}\right)$	=	0.560 w_p	
(ASCE 7-16 13.3-2)	$F_{p,\max} = 1.6S_{DS} I_p W_p$	=	1.492 w_p	

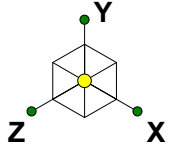




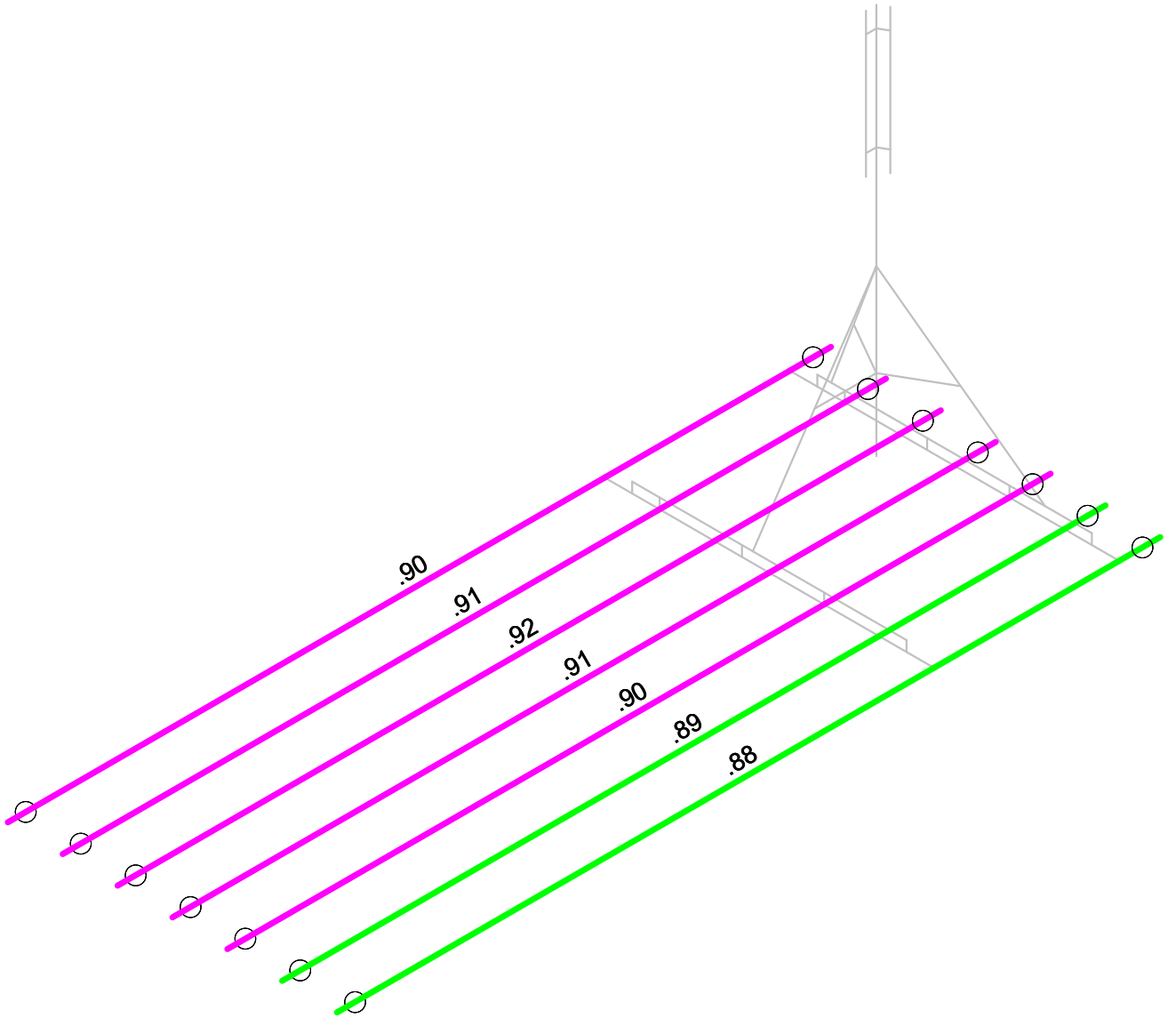
Section Sets

- 2.0 STD Pipe
- P3.0
- LL2.5x2.5x3x3
- PL
- 4x6
- 2x12
- RIGID



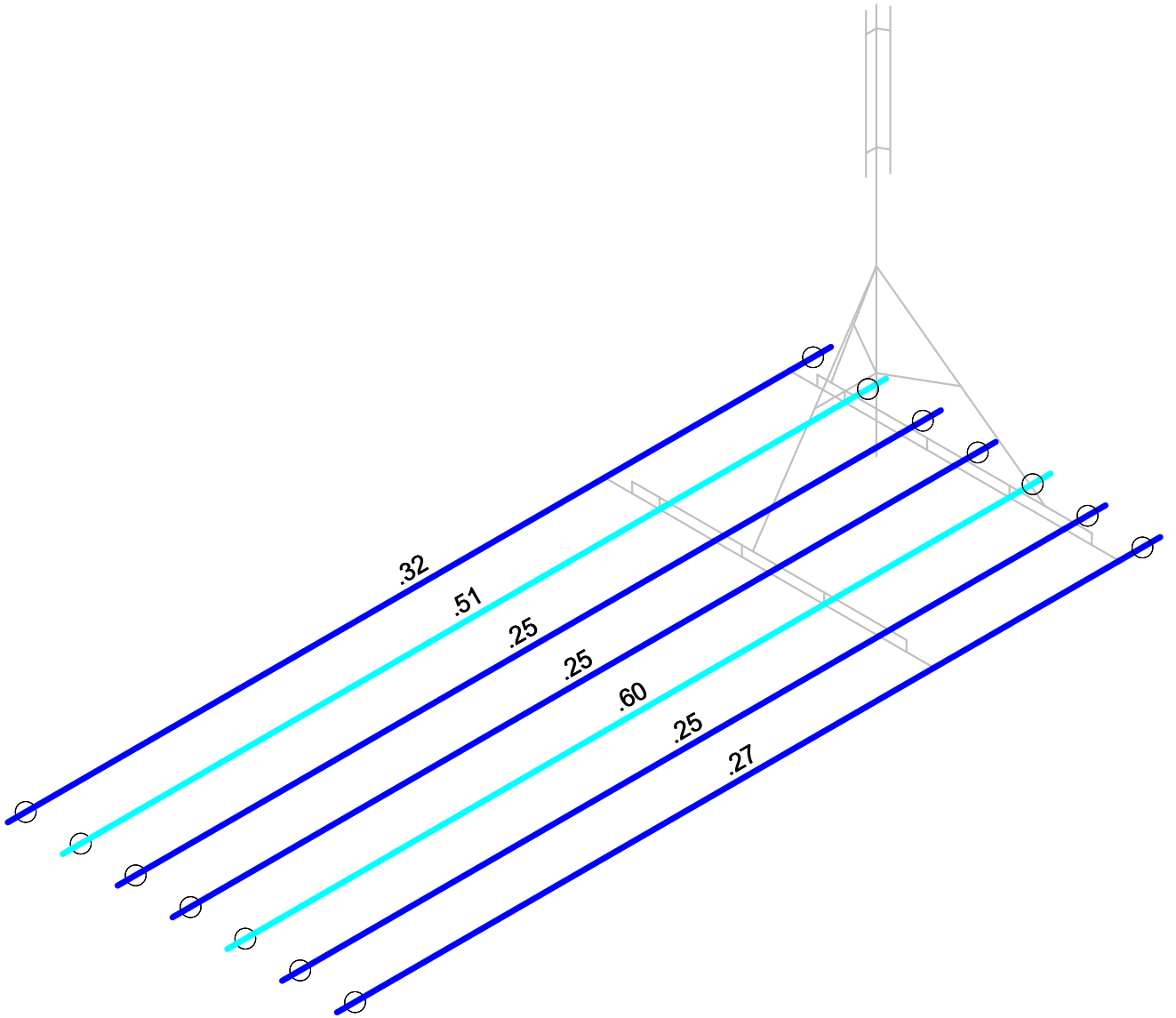
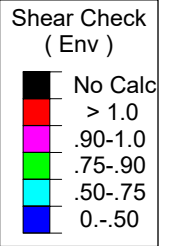
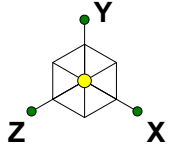


Code Check (Env)	
Black	No Calc
Red	> 1.0
Magenta	.90-1.0
Green	.75-.90
Cyan	.50-.75
Blue	0.-.50



Member Code Checks Displayed (Enveloped)
Results for LC 1, 1.0D

Core One Consulting USA	SD28	
		Apr 6, 2022 at 4:32 PM
		SD28_Tripod with full roof.r3d



Member Shear Checks Displayed (Enveloped)
Results for LC 1, 1.0D

Core One Consulting USA	SD28	
		Apr 6, 2022 at 4:32 PM
		SD28_Tripod with full roof.r3d

9bj YcdY>c]bh8]gd'UWw Ybtg f'f' cbh]bi YXL

	R̄ã c	Ȳã á	SÔ	Ȳã á	SÔ	Z̄ã á	SÔ	ȲÁU[cæq̄)	ÄHESÔ	ȲÁU[cæq̄)	ÄHESÔ	Z̄ÁU[cæq̄)	ÄHESÔ		
GG		{ a	€	F	€	F	€	F	€	F	€	F	€	F	
GH	p̄i	{ æ	EH	I	EH	F	EF	I	EH	J	EH	IG	EH	I	
G		{ a	EGJ	IG	EH	J	EE	I	H	F	EH	FI	EH	G	
G	p̄iJCE	{ æ	€	I	€	I	€	I	€	I	€	I	€	I	
G		{ a	€	F	€	F	€	F	€	F	€	F	€	F	
G	p̄iECE	{ æ	€	I	€	I	€	I	€	I	€	I	€	I	
G		{ a	€	F	€	F	€	F	€	F	€	F	€	F	
GJ	p̄iFCE	{ æ	€	I	€	I	€	I	€	I	€	I	€	I	
HE		{ a	€	F	€	F	€	F	€	F	€	F	€	F	
HF	p̄iGCE	{ æ	€	I	€	I	€	I	€	I	€	I	€	I	
HG		{ a	€	F	€	F	€	F	€	F	€	F	€	F	
HH	p̄iF	{ æ	EH	FF	EH	G	EH	I	J	EH	I	F	EH	FI	
HI		{ a	EH	FI	EH	FF	I	EH	FI	EH	G	EH	FI	EH	
H	p̄iGCE	{ æ	EH	FF	EH	G	EH	I	J	EH	I	F	EH	FI	
H		{ a	EH	FI	EH	FG	I	EH	G	EH	J	EH	FI	EH	
H	p̄iHCE	{ æ	EH	FF	EH	GH	FI	EH	I	J	EH	I	F	EH	
H		{ a	EH	FI	EH	FH	I	EH	FI	EH	J	EH	FI	EH	
HJ	p̄iICE	{ æ	EH	FF	EH	G	FI	EH	J	EH	I	F	EH	FI	
I€		{ a	EH	FI	EH	FF	I	EH	FI	EH	J	EH	FI	EH	
IF	p̄iICE	{ æ	EH	FF	EH	G	FI	EH	I	J	EH	I	F	EH	
IG		{ a	EH	FI	EH	G	J	EH	I	H	EH	FI	EH	G	
I	p̄iI	{ æ	EH	FF	EH	GH	FI	EH	H	I	EH	I	F	EH	
I		{ a	EH	FI	EH	EG	H	EH	FI	EH	J	EH	FI	EH	
I	p̄iJ	{ æ	EH	I	EH	G	FI	EH	I	J	EH	I	F	EH	
I		{ a	EH	I	EH	GH	I	EH	FI	EH	J	EH	FI	EH	
I	p̄iE	{ æ	EH	I	EH	FI	FI	EH	I	J	EH	I	F	EH	
I		{ a	EH	I	EH	HG	I	EH	FI	EH	J	EH	FI	EH	
I	p̄iF	{ æ	EH	I	EH	FI	EH	I	J	EH	I	F	EH	FI	
I€		{ a	EH	IG	EH	I	EH	FI	EH	J	EH	I	F	EH	
I	p̄iG	{ æ	EH	I	EH	FI	EH	I	J	EH	I	F	EH	FI	
I		{ a	EH	IG	EH	HF	I	EH	FI	EH	J	EH	FI	EH	
I	p̄iH	{ æ	EH	I	EH	HG	FI	EH	I	H	EH	I	F	EH	
I		{ a	EH	IG	EH	G	J	EH	I	H	EH	I	F	EH	
I	p̄iI	{ æ	EH	I	EH	FI	EH	H	I	EH	I	F	EH	FI	
I		{ a	EH	IG	EH	H	H	EH	I	H	EH	I	F	EH	
I	p̄iHJ	{ æ	€	I	€	I	€	I	€	I	€	I	€	I	
I		{ a	€	F	€	F	€	F	€	F	€	F	€	F	
I	p̄iE	{ æ	€	I	€	I	€	I	€	I	€	I	€	I	
I€		{ a	€	F	€	F	€	F	€	F	€	F	€	F	
I	p̄iF	{ æ	EH	FF	EH	FI	€	I	EH	H	EH	I	€	I	
I		{ a	EH	FI	EH	FF	H	€	I	J	EH	I	€	F	
I	p̄iG	{ æ	EH	I	EH	FI	€	I	I	EH	H	I	€	I	
I		{ a	EH	I	EH	J	H	€	I	J	EH	I	€	F	
I	p̄iICE	{ æ	EH	FF	EH	FI	€	I	I	EH	H	EH	I	€	I
I		{ a	EH	FI	EH	FF	H	€	I	J	EH	I	€	F	
I	p̄iICE	{ æ	EH	I	EH	FI	€	I	I	EH	H	I	€	I	
I		{ a	EH	I	EH	H	€	I	J	EH	I	€	F		
I	p̄iICE	{ æ	EH	FF	EH	FI	€	FI	I	EH	H	I	€	I	
I€		{ a	EH	FI	EH	EG	H	€	FG	EH	FI	EH	H	G	
I	p̄iECE	{ æ	EH	I	EH	FI	€	I	I	EH	H	I	€	I	
I		{ a	EH	I	EH	H	€	I	I	EH	H	I	€	I	
I	p̄iFCE	{ æ	EH	FF	EH	FI	€	J	I	EH	J	I	€	I	

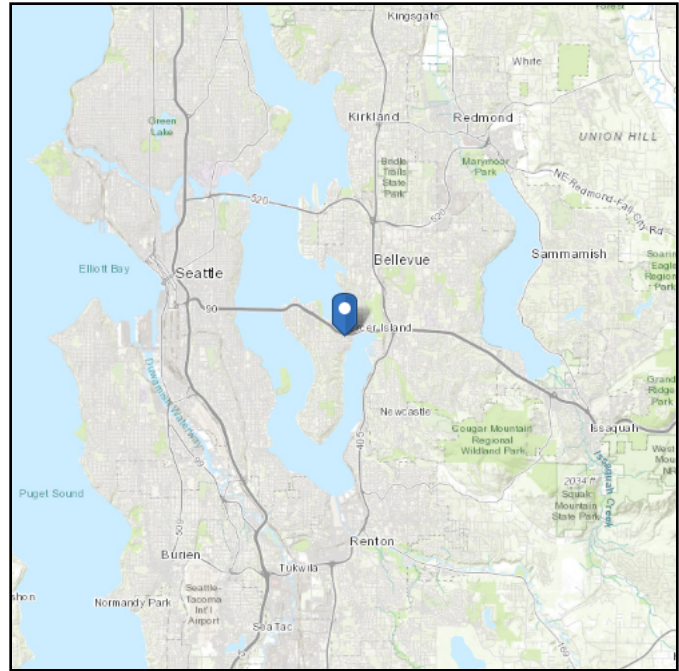
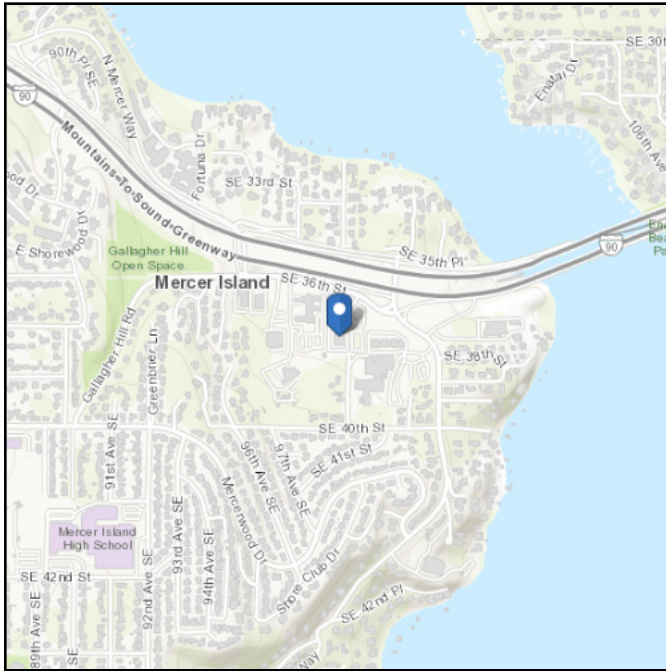
APPENDIX A
Design Tables & Resources

ASCE 7 Hazards Report

Address:
No Address at This Location

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

Elevation: 99.33 ft (NAVD 88)
Latitude: 47.57669
Longitude: -122.20937



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 Apr 04 2022

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

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

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

Results:

S_s :	1.399	S_{D1} :	N/A
S_1 :	0.487	T_L :	6
F_a :	1.2	PGA :	0.599
F_v :	N/A	PGA _M :	0.718
S_{MS} :	1.679	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.119	C_v :	1.38

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

Data Accessed: Mon Apr 04 2022

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 Apr 04 2022

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.

The ASCE 7 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 7 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.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE 7 standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.