



May 19, 2022

Melanie A. Bachman
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: Exempt Modification Application – AT&T Site 13682689
AT&T Mobility Telecommunications Facility @ 125 Washington Ave., North Haven, CT

Dear Ms. Bachman,

New Cingular Wireless, PCS, LLC (dba AT&T) currently maintains antennas on a wireless telecommunications facility on an existing American Tower Corporation (ATC) telecommunications tower at the above referenced address. AT&T desires to modify its existing equipment as described in the attached Construction Drawings:

- Remove three (3) antennas, three (3) RRHs and six (6) TMAs;
- Install twelve (12) antennas, nine (9) RRHs, three (3) Y cables, One (1) DC-9 squid, one (1) fiber and three (3) DC trunks;
- Ground work includes decommissioning an UMTS BBU and diplexers, and the installation of three (3) RRUs, one (1) BB6630 and IDLe and one (1) fronthaul gateway.
- There are currently nine (9) AT&T antennas at one hundred twenty two (122) feet AGL. AT&T proposes a total of twelve (12) antennas at the 122 elevation and a second array consisting of six (6) antennas at the one hundred twelve (112) elevation AGL.

Please accept this letter as notification pursuant to R.C.S.A §16-50j-73 for construction that constitutes an exempt modification pursuant to R.C.S.A §16-50j-72(b)(2). In accordance with R.C.S.A §16-50j-73, a copy of this letter is being sent to the following individuals: American Tower Corporation as Tower Operator/Owner; Candid Associates LLC as Property Owner; the Honorable Michael J. Freda, First Selectman of North Haven, and Laura Magaraci, Zoning Enforcement Officer.

The applicant's proposal falls squarely within those activities explicitly provided for in R.C.S.A. §16-50j-89. Specifically:

1. The proposed modifications will NOT result in an increase in the height of the existing structure.
2. The proposed modifications will NOT require an extension of the site boundary.
3. The proposed modifications will NOT increase noise levels at the facility by six decibels or more, or to levels that exceed state and local criteria.
4. The operation of the modified facility will NOT increase radio frequency emissions at the facility to a level at or above the Federal Communications Commission (FCC) safety standard. Please see the RF emissions calculation for AT&T's modified facility enclosed herewith.

Jack Andrews, Zoning Manager 10130 Donleigh Drive, Columbia, MD 21046 (443) 677-0144
Centerline Communications • 750 W Center Street, Suite 301, W Bridgewater, MA 02379



5. The proposed modifications will NOT cause an ineligible change or alteration in the physical or environmental characteristics of the site.
6. The existing structure and its foundation can support the proposed loading. Please see the structural analysis enclosed herewith.

For the foregoing reasons, AT&T respectfully requests that the Council approve this Exempt Modification request for this tower located at 125 Washington Ave., North Haven, CT 06473. If you have any questions, please feel free to contact me.

Sincerely,

A handwritten signature in blue ink, appearing to read 'Jack Andrews', is written over a circular blue stamp or watermark.

Jack Andrews
Zoning Manager, Centerline Communications
443-677-0144

Enclosures: Exhibit 1 – Letter of Authorization from tower owner
Exhibit 2 – Property Card and GIS
Exhibit 3 – Construction Drawings
Exhibit 4 – Structural Analysis Report
Exhibit 5 – Antenna Mount Analysis Report
Exhibit 6 – EME Study Report
Exhibit 7 – Four (4) Notice Confirmations

cc: American Tower Corporation - Tower Operator/Owner
Candid Associates LLC - Property Owner
The Honorable Michael J. Freda - First Selectman of North Haven
Laura Magaraci - Zoning Enforcement Officer, North Haven



LETTER OF AUTHORIZATION

SITE NO: See Site List Below

SITE NAME: See Site List Below

ADDRESS: See Site List Below

I, Margaret Robinson, Senior Counsel, US Tower Division on behalf of American Tower*, owner and/or operator of the tower facilities located at the addresses identified below (the “Tower Facilities”), do hereby authorize Centerline Communications, LLC (“Centerline”), its agents, successors and assigns, to act as American Tower’s non-exclusive agent for the purpose of filing and securing any zoning, land-use, building permit and/or electrical permit application(s) and approvals of the applicable jurisdiction for and to conduct the construction of the installation of antennas and related telecommunications equipment owned and operated by AT&T on the Tower Facilities located at the addresses identified below. This installation shall not affect adjoining lands and will occur only within the areas leased or owned by American Tower.

American Tower understands that the applications may be denied, modified or approved with conditions. The above authorization is limited to the acceptance by American Tower of conditions related to American Tower’s installations. Any such conditions of approval or modifications will not be effective unless approved in writing by American Tower.

The above authorization does not permit Centerline to modify or alter any existing permit(s) and/or zoning or land-use conditions or impose any additional conditions unrelated to American Tower’s installations of telecommunications equipment without the prior written approval of American Tower.

Site Authorized:

ATC Project #	ATC Asset #	Address
13682691	302483	286 Beckley Road, Berlin, CT 06037
13682687	302469	1069 Connecticut Ave. Bridgeport, CT 06607
13682699	383598	1000 Truumball Ave. Bridgeport, CT 06606
13682693	302468	99 Meadow St. Harftford, CT 06114
13682696	370627	605 Willard Ave. Newington, CT 06111
13682689	370629	125 Washington Ave. North Haven, CT 06473
13683386	283418	50 Devine St. North Haven, CT 06473
13683396	88018	168 Catoona Lane, Stamford, CT 06902
13682841	243036	668 Jones Hill Rd. West Haven, CT 06516
13958523	283422	171 Short Beach Rd. Brandford, CT 06405
13958547	302516	438 Bridgeport Ave. Milford, CT 06460
13683394	302479	699 West St. Rocky Hill, CT 06067
13958510	302511	20 Post Office Lane. Westport, CT 06880



AMERICAN TOWER®
CORPORATION

Signature: _____

Margaret Robinson, Senior Counsel
US Tower Division

NOTARY BLOCK

COMMONWEALTH OF MASSACHUSETTS
County of Middlesex

This instrument was acknowledged before me by Margaret Robinson, Senior Counsel of American Tower (owner and/or operator of the above referenced Tower Facilities), personally known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same.

WITNESS my hand and official seal, this 22nd day of April, 2022.

NOTARY SEAL



GERARD T. HEFFRON
Notary Public
Commonwealth of Massachusetts
My Commission Expires
August 9, 2024

Notary Public _____

My Commission Expires: August 9th, 2024

* American Tower as used herein is defined as American Tower Corporation and any of its affiliates or subsidiaries.

125 Washington Ave Site# 13682689



Property Information

Property ID 73/14
Location 133 WASHINGTON AVE
Owner CANDID ASSOCIATES LLC



**MAP FOR REFERENCE ONLY
NOT A LEGAL DOCUMENT**

Town of North Haven, CT makes no claims and no warranties, expressed or implied, concerning the validity or accuracy of the GIS data presented on this map.

Geometry updated 3/24/2021
Data updated daily

Print map scale is approximate. Critical layout or measurement activities should not be done using this resource.



Radio Frequency Emissions Analysis Report

March 16, 2022

American Tower on behalf of AT&T

Site Name: NORTH HAVEN RAILROAD TRACKS

Site Address: 127 WASHINGTON AVENUE, NORTH HAVEN, CT 06473

FA#: 10035221

USID: 61197

Site Compliance Summary

Compliance Status:	Compliant
Carrier MPE%	4.89806300%
of FCC General Population Allowable Limit:	
Composite MPE%	4.89835000%
of FCC General Population Allowable Limit:	



March 16, 2022

AT&T New England
Attn: John Benedetto, RF Manager
5050 Cochituate Road Suite 550 - 13&14
Framingham, MA 01701

Emissions Analysis for Site: **NORTH HAVEN RAILROAD TRACKS**

Centerline Communications, LLC ("Centerline") was directed to analyze the proposed AT&T facility to be located on a monopole near **127 WASHINGTON AVENUE, NORTH HAVEN CT 06473** for the purpose of determining whether the emissions from the proposed facility are within specified federal limits.

All information used in this report was analyzed as a percentage of current Maximum Permissible Exposure (% MPE) as listed in the FCC OET Bulletin 65 Edition 97-01 and ANSI/IEEE Std C95.1. The FCC regulates Maximum Permissible Exposure in units of microwatts per square centimeter ($\mu\text{W}/\text{cm}^2$). The number of $\mu\text{W}/\text{cm}^2$ calculated at each sample point is called the power density. The exposure limit for power density varies depending upon the frequencies being utilized. Wireless Carriers and Paging Services use different frequency bands each with different exposure limits, therefore it is necessary to report results and limits in terms of percent MPE rather than power density.

All results were compared to the FCC (Federal Communications Commission) radio frequency exposure rules, 47 CFR 1.1307(b)(1) – (b)(3), to determine compliance with the Maximum Permissible Exposure (MPE) limits for General Population/Uncontrolled environments as defined below.

General population/uncontrolled exposure limits apply to situations in which the general population may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general population would always be considered under this category when exposure is not employment related, for example, in the case of a telecommunications tower that exposes persons in a nearby residential area.

Population exposure to radio frequencies is regulated and enforced in units of microwatts per square centimeter ($\mu\text{W}/\text{cm}^2$). The general population exposure limits for the 700 MHz (LTE) band is 467 $\mu\text{W}/\text{cm}^2$, 850 (5G) band is 567 $\mu\text{W}/\text{cm}^2$, 1900 MHz (PCS), 2100 (AWS), 2300 (WCS) and 5 GHz (B46) bands is 1000 $\mu\text{W}/\text{cm}^2$.

Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits, as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Additional details can be found in FCC OET 65.



Calculations

Calculations were performed for the proposed facility using the equipment information listed below. All calculations were performed per the specifications under FCC OET 65. Since AT&T is proposing focused omnidirectional antennas, which project most of the emitted energy out toward the horizon, all calculations were performed assuming a lobe representing the maximum gain of the antenna per the antenna manufactures supplied specifications, minus 10 dB, was focused at the base of the tower. This is a very conservative estimate since the gain reduction in actual applications is typically greater than 10 dB in the direction of ground immediately surrounding the facility. Real world emissions values from this facility are expected to be lower than values listed in this report at ground level. For this report the sample point is the top of a 6-foot person standing at the base of the tower.

Per FCC OET Bulletin No. 65 - Edition 97-01 recommendations to achieve the maximum anticipated value at each sample point, all power levels emitting from the proposed antenna installation are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. All power values expressed and analyzed are maximum power levels expected to be used on all radios.

For each sector the following channel counts, frequency bands and power levels were utilized as shown in *Table 1*:

RRH #	Frequency Band	Technology	Channel Count	Transmit Power per Channel (W)
1	700	LTE	2	30
2	700	LTE	4	30
3	1900	LTE	4	30
4	2100	AWS	4	30
5	3700	5G C-Band	1	108.4
6	3450	5G DoD	1	54.2
6	3450	5G DoD	1	54.2
7	700	LTE	4	30
7	850	5G	4	30
8	2300	WCS	4	18

Table 1: Channel Data Table



The following antennas listed in Table 2 were used in the modeling for transmission in the 700 MHz (LTE), 850 MHz (5G), 1900 MHz (PCS), 2100 MHz (AWS), 2300 MHz (WCS) and 5 GHz (Band 46) frequency bands. This is based on information from the carrier with regard to anticipated antenna selection.

Sector	Antenna Number	Make / Model	Centerline (ft)
A	1	QUINTEL QD6616-7 V1	122
A	1	QUINTEL QD6616-7 V1	122
A	1	QUINTEL QD6616-7 V1	122
A	1	QUINTEL QD6616-7 V1	122
A	2	ERICSSON AIR6449	120
A	3	ERICSSON AIR6419	124
A	3	ERICSSON AIR6419	124
A	4	CCI DMP65R-BU6D	122
A	4	CCI DMP65R-BU6D	122
A	4	CCI DMP65R-BU6D	122
B	5	QUINTEL QD6616-7 V1	122
B	5	QUINTEL QD6616-7 V1	122
B	5	QUINTEL QD6616-7 V1	122
B	5	QUINTEL QD6616-7 V1	122
B	6	ERICSSON AIR6449	120
B	7	ERICSSON AIR6419	124
B	7	ERICSSON AIR6419	124
B	8	CCI DMP65R-BU6D	122
B	8	CCI DMP65R-BU6D	122
B	8	CCI DMP65R-BU6D	122
G	9	QUINTEL QD6616-7 V1	122
G	9	QUINTEL QD6616-7 V1	122
G	9	QUINTEL QD6616-7 V1	122
G	9	QUINTEL QD6616-7 V1	122
G	10	ERICSSON AIR6449	120
G	11	ERICSSON AIR6419	124
G	11	ERICSSON AIR6419	124
G	12	CCI DMP65R-BU6D	122
G	12	CCI DMP65R-BU6D	122
G	12	CCI DMP65R-BU6D	122

Table 2: Antenna Data

All calculations were done with respect to uncontrolled / general population threshold limits.



Results

Per the calculations completed for the proposed AT&T configurations *Table 3* shows resulting emissions power levels and percentages of the FCC's allowable general population limit.

ID	Make / Model	Frequency Band	Gain (dBd)	Centerline (ft)	Channel Count	TX Power (W)	ERP (W)	MPE %
AT&T A 1	QUINTEL QD6616-7 V1	700	11.5122	122.0	2	30	849.9067	0.000072000
AT&T A 1	QUINTEL QD6616-7 V1	700	11.5122	122.0	4	30	1699.8134	0.000145000
AT&T A 1	QUINTEL QD6616-7 V1	1900	15.1381	122.0	4	30	3917.3398	0.000030000
AT&T A 1	QUINTEL QD6616-7 V1	2100	15.4987	122.0	4	30	4256.4864	0.000035000
AT&T A 2	ERICSSON AIR6449	3700	23.55	120.0	1	108.4	24548.7443	0.000172000
AT&T A 3	ERICSSON AIR6419	3450	22.85	124.0	1	54.2	10447.1850	0.816100000
AT&T A 3	ERICSSON AIR6419	3450	22.85	124.0	1	54	10408.6345	0.816100000
AT&T A 4	CCI DMP65R-BU6D	700	11.25	122.0	4	30	1600.2257	0.000145000
AT&T A 4	CCI DMP65R-BU6D	850	11.35	122.0	4	30	1637.4998	0.000112000
AT&T A 4	CCI DMP65R-BU6D	2300	14.65	122.0	4	18	2100.5475	0.000013000
AT&T B 5	QUINTEL QD6616-7 V1	700	11.9711	122.0	2	30	944.6289	0.000020000
AT&T B 5	QUINTEL QD6616-7 V1	700	11.9711	122.0	4	30	1889.2579	0.000039000
AT&T B 5	QUINTEL QD6616-7 V1	1900	15.2682	122.0	4	30	4036.4655	0.000023000
AT&T B 5	QUINTEL QD6616-7 V1	2100	15.4013	122.0	4	30	4162.0879	0.000021000
AT&T B 6	ERICSSON AIR6449	3700	23.55	120.0	1	108.4	24548.7443	0.000172000
AT&T B 7	ERICSSON AIR6419	3450	22.85	124.0	1	54.2	10447.1850	0.816108000
AT&T B 7	ERICSSON AIR6419	3450	22.85	124.0	1	54	10408.6345	0.816108000
AT&T B 8	CCI DMP65R-BU6D	700	11.75	122.0	4	30	1795.4828	0.000038000
AT&T B 8	CCI DMP65R-BU6D	850	11.45	122.0	4	30	1675.6420	0.000029000
AT&T B 8	CCI DMP65R-BU6D	2300	14.65	122.0	4	18	2100.5475	0.000013000
AT&T G 9	QUINTEL QD6616-7 V1	700	11.9711	122.0	2	30	944.6289	0.000020000
AT&T G 9	QUINTEL QD6616-7 V1	700	11.9711	122.0	4	30	1889.2579	0.000039000
AT&T G 9	QUINTEL QD6616-7 V1	1900	15.1762	122.0	4	30	3951.8572	0.000018000
AT&T G 9	QUINTEL QD6616-7 V1	2100	15.3631	122.0	4	30	4125.6392	0.000017000
AT&T G 10	ERICSSON AIR6449	3700	23.55	120.0	1	108.4	24548.7443	0.000172000
AT&T G 11	ERICSSON AIR6419	3450	22.85	124.0	1	54.2	10447.1850	0.816109000
AT&T G 11	ERICSSON AIR6419	3450	22.85	124.0	1	54	10408.6345	0.816109000
AT&T G 12	CCI DMP65R-BU6D	700	11.75	122.0	4	30	1795.4828	0.000038000
AT&T G 12	CCI DMP65R-BU6D	850	11.45	122.0	4	30	1675.6420	0.000029000
AT&T G 12	CCI DMP65R-BU6D	2300	15.25	122.0	4	18	2411.7512	0.000017000
AT&T MPE%								4.89806300 %

Table 3: AT&T Antenna Inventory & Power Level



FCC OET 65 specifies that for carriers utilizing directional antennas that the highest recorded sector value be used for composite site MPE values due to their greatly reduced emissions contributions in the directions of the adjacent sectors. *Table 4* below details a breakdown by frequency band and technology for the MPE power values for the maximum calculated AT&T sector(s).

Frequency Band	Technology	Centerline (ft.)	# of Channels	ERP W (Per Channel)	Total Power Density ($\mu\text{W}/\text{cm}^2$)	Allowable MPE ($\mu\text{W}/\text{cm}^2$)	MPE %
700	LTE	122.0	2	424.9533475	0.0003380	467	0.00007200
700	LTE	122.0	4	424.9533475	0.0006760	467	0.00014500
1900	LTE	122.0	4	979.3349524	0.0003050	1000	0.00003000
2100	AWS	122.0	4	1064.12159	0.0003520	1000	0.00003500
3700	5G C-Band	120.0	1	24548.74429	0.0017220	1000	0.00017200
3450	5G DoD	124.0	1	10447.18503	8.1609980	1000	0.81610000
3450	5G DoD	124.0	1	10408.63453	8.1609980	1000	0.81610000
700	LTE	122.0	4	400.0564296	0.0006780	467	0.00014500
850	5G	122.0	4	409.374941	0.0006360	567	0.00011200
2300	WCS	122.0	4	525.1368625	0.0001270	1000	0.00001300
Alpha MPE%							1.63292400
700	LTE	122.0	2	472.3144741	0.0000910	467	0.00002000
700	LTE	122.0	4	472.3144741	0.0001820	467	0.00003900
1900	LTE	122.0	4	1009.116378	0.0002330	1000	0.00002300
2100	AWS	122.0	4	1040.52197	0.0002080	1000	0.00002100
3700	5G C-Band	120.0	1	24548.74429	0.0017210	1000	0.00017200
3450	5G DoD	124.0	1	10447.18503	8.1610840	1000	0.81610800
3450	5G DoD	124.0	1	10408.63453	8.1610840	1000	0.81610800
700	LTE	122.0	4	448.8706968	0.0001780	467	0.00003800
850	5G	122.0	4	418.9105083	0.0001650	567	0.00002900
2300	WCS	122.0	4	525.1368625	0.0001270	1000	0.00001300
Beta MPE%							1.63257100
700	LTE	122.0	2	472.3144741	0.0000910	467	0.00002000
700	LTE	122.0	4	472.3144741	0.0001820	467	0.00003900
1900	LTE	122.0	4	987.9643069	0.0001830	1000	0.00001800
2100	AWS	122.0	4	1031.409803	0.0001660	1000	0.00001700
3700	5G C-Band	120.0	1	24548.74429	0.0017210	1000	0.00017200
3450	5G DoD	124.0	1	10447.18503	8.1610910	1000	0.81610900
3450	5G DoD	124.0	1	10408.63453	8.1610910	1000	0.81610900
700	LTE	122.0	4	448.8706968	0.0001780	467	0.00003800
850	5G	122.0	4	418.9105083	0.0001650	567	0.00002900



2300	WCS	122.0	4	602.9377905	0.0001660	1000	0.00001700
Gamma MPE%							1.63256800
AT&T MPE%							4.89806300 %

Table 4: AT&T Maximum Sector MPE Power Values



Summary

All calculations performed for this analysis yielded results that were **within** the allowable limits for general population exposure to RF Emissions.

The anticipated maximum composite contributions from the AT&T facility as well as the site composite emissions value with regards to compliance with FCC's allowable limits for general population exposure to RF Emissions are shown here:

Carrier	Predicted MPE %
AT&T	4.89806300%
T-Mobile	0.00028700%
Composite	4.89835000%

Table 5: Total Predicted MPE(%) by Carrier

Compliance Status:

The anticipated composite MPE value for this site assuming all carriers present is **4.89835000%** of the allowable FCC established general population limit sampled at the ground level.

FCC guidelines state that if a site is found to be out of compliance (over allowable thresholds), that carriers over a 5% contribution to the composite value will require measures to bring the site into compliance. For this facility, the composite values calculated were well within the allowable 100% threshold standard per the federal government.

Katrina Styx
RF Compliance Consultant
Centerline Communications, LLC
750 West Center St. Suite 301
West Bridgewater, MA 02379

A handwritten signature in black ink, appearing to read 'Katrina Styx', is positioned below the contact information.



AMERICAN TOWER®
CORPORATION

This report was prepared for American Tower Corporation by



**TOWER
ENGINEERING
PROFESSIONALS**

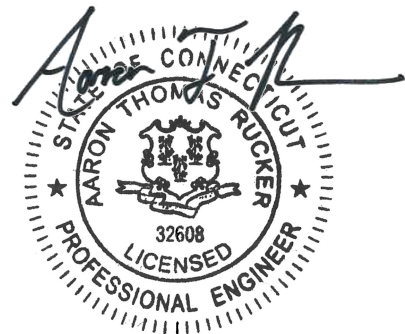
Structural Analysis Report

Structure : 120 ft Monopole
ATC Site Name : Northhaven I,CT
ATC Site Number : 370629
Engineering Number : 13682689_C3_02
Proposed Carrier : AT&T MOBILITY
Carrier Site Name : MRCTB050982
Carrier Site Number : MRCTB050982
Site Location : 125 Washington Ave
North Haven, CT 06473-0000
41.3978, -72.8567
County : New Haven
Date : November 9, 2021
Max Usage : 48%
Result : Pass

Prepared By:

Ayoub Sabor
TEP

Reviewed By:



11/09/2021

COA : PEC.0001553



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Introduction

The purpose of this report is to summarize results of a structural analysis performed on the 120 ft Monopole to reflect the change in loading by AT&T MOBILITY.

Supporting Documents

Tower Drawings	Valmont Project #F177, dated September 30, 1998
Foundation Drawing	Valmont Drawing #2652-F, dated October 9, 1998
Geotechnical Report	CTB Project #98143, dated September 30, 1998
Mount Analysis	CLS Engineering For ATC Engineering #13682689_C8_01, dated November 8, 2021

Analysis

The tower was analyzed using American Tower Corporation's tower analysis software. This program considers an elastic three-dimensional model and second-order effects per ANSI/TIA-222.

Basic Wind Speed:	120 mph (3-second gust)
Basic Wind Speed w/ Ice:	50 mph (3-second gust) w/ 1.00" radial ice concurrent
Code:	ANSI/TIA-222-H / 2015 IBC / 2018 Connecticut State Building Code
Exposure Category:	B
Risk Category:	II
Topographic Factor Procedure:	Method 1
Topographic Category:	1
Spectral Response:	$S_s = 0.20, S_i = 0.05$
Site Class:	D - Stiff Soil - Default

Conclusion

Based on the analysis results, the structure meets the requirements per the applicable codes listed above. The tower and foundation can support the equipment as described in this report.

If you have any questions or require additional information, please contact American Tower via email at Engineering@americantower.com. Please include the American Tower site name, site number, and engineering number in the subject line for any questions.



Existing and Reserved Equipment

Elev. ¹ (ft)	Qty	Equipment	Mount Type	Lines	Carrier
122.0	3	CCI HPA-65R-BUU-H6	Platform with Handrails	(6) 1 5/8" Coax	AT&T MOBILITY
	3	Quintel QS66512-2			
	3	Ericsson RRUS 32 B2			
109.0	3	Ericsson Air6449 B41	Sector Frame with Patform	(3) 1 5/8" (1.63"-41.3mm) Fiber (1) 1.99" (50.7mm) Hybrid	T-MOBILE
	3	Ericsson 4460 BAND 2/25			
	3	RFS APXVAARR24_43-U-NA20			
	3	Ericsson Radio 4449 B71 B85A			

Equipment to be Removed

Elev. ¹ (ft)	Qty	Equipment	Mount Type	Lines	Carrier
123.0	-	-			
122.0	6	Powerwave Allgon LGP21401	-	(4) 0.78" (19.7mm) 8 AWG 6 (2) 0.39" (10mm) Fiber Trunk (6) 1 5/8" Coax (3) 3" conduit (2) 3/8" (0.38"-9.5mm) RET Control Cable	AT&T MOBILITY
	2	Raycap DC6-48-60-18-8F ("Squid")			
	3	Ericsson RRUS 32 B66			
	3	Ericsson RRUS-32 (77 lbs)			
	3	Powerwave Allgon 7770.00			
	6	Powerwave Allgon 7020.00 Dual Band RET			
	3	Ericsson RRUS 11 (Band 12)			

Proposed Equipment

Elev. ¹ (ft)	Qty	Equipment	Mount Type	Lines	Carrier
122.0	2	Raycap DC6-48-60-18-8F	Platform with Handrails	(3) 0.41" (10.3mm) Fiber (4) 0.82" (20.8mm) 8 AWG 6 (3) 0.92" (23.4mm) Cable (4) 2" conduit	AT&T MOBILITY
	3	Ericsson RRUS 4478 B14			
	3	Ericsson Radio 2012 B29			
	3	Ericsson RRUS 4449 B5, B12			
	3	Ericsson RRUS 32 B66A			
	3	Ericsson RRUS 32 B30			
	3	Ericsson AIR 6419 N77G			
	3	Ericsson AIR 6449 n77D			
	1	Raycap DC9-48-60-24-8C-EV			
	3	CCI DMP65R-BU6DA			
3	Quintel QD6616-7				

¹ Contracted elevations are shown for appurtenances within contracted installation tolerances. Appurtenances outside of contract limits are shown at installed elevations.

Install proposed lines inside the pole shaft.



Structure Usages

Structural Component	Controlling Usage	Pass/Fail
Anchor Bolts	36%	Pass
Shaft	41%	Pass
Base Plate	15%	Pass

Foundations

Reaction Component	Original Design Reactions	Factored Design Reactions*	Analysis Reactions	% of Design
Moment (Kips-Ft)	4149.0	5601.2	2144.4	38%
Shear (Kips)	37.1	50.1	24.2	48%

* The design reactions are factored by 1.35 per ANSI/TIA-222-H, Sec. 15.6.2

The structure base reactions resulting from this analysis are acceptable when compared to those shown on the original structure drawings, therefore no modification or reinforcement of the foundation will be required.

Deflection, Twist and Sway*

Antenna Elevation (ft)	Antenna	Carrier	Deflection (ft)	Sway (Rotation) (°)
122.0	Raycap DC6-48-60-18-8F	AT&T MOBILITY	0.539	0.440
	Ericsson RRUS 4478 B14			
	Ericsson Radio 2012 B29			
	Ericsson RRUS 4449 B5, B12			
	Ericsson RRUS 32 B66A			
	Quintel QD6616-7			
	Ericsson AIR 6419 N77G			
	Ericsson AIR 6449 n77D			
	Raycap DC9-48-60-24-8C-EV			
	CCI DMP65R-BU6DA			
	Ericsson RRUS 32 B30			

*Deflection, Twist and Sway was evaluated considering a design wind speed of 60 mph (3-Second Gust) per ANSI/TIA-222-H



Standard Conditions

All engineering services performed by A.T. Engineering Service, PLLC are prepared on the basis that the information used is current and correct. This information may consist of, but is not limited to the following:

- Information supplied by the client regarding antenna, mounts and feed line loading
- Information from drawings, design and analysis documents, and field notes in the possession of A.T. Engineering Service, PLLC

It is the responsibility of the client to ensure that the information provided to A.T. Engineering Service, PLLC and used in the performance of our engineering services is correct and complete.

All assets of American Tower Corporation, its affiliates, and subsidiaries (collectively "American Tower") are inspected at regular intervals. Based upon these inspections and in the absence of information to the contrary, American Tower assumes that all structures were constructed in accordance with the drawings and specifications.

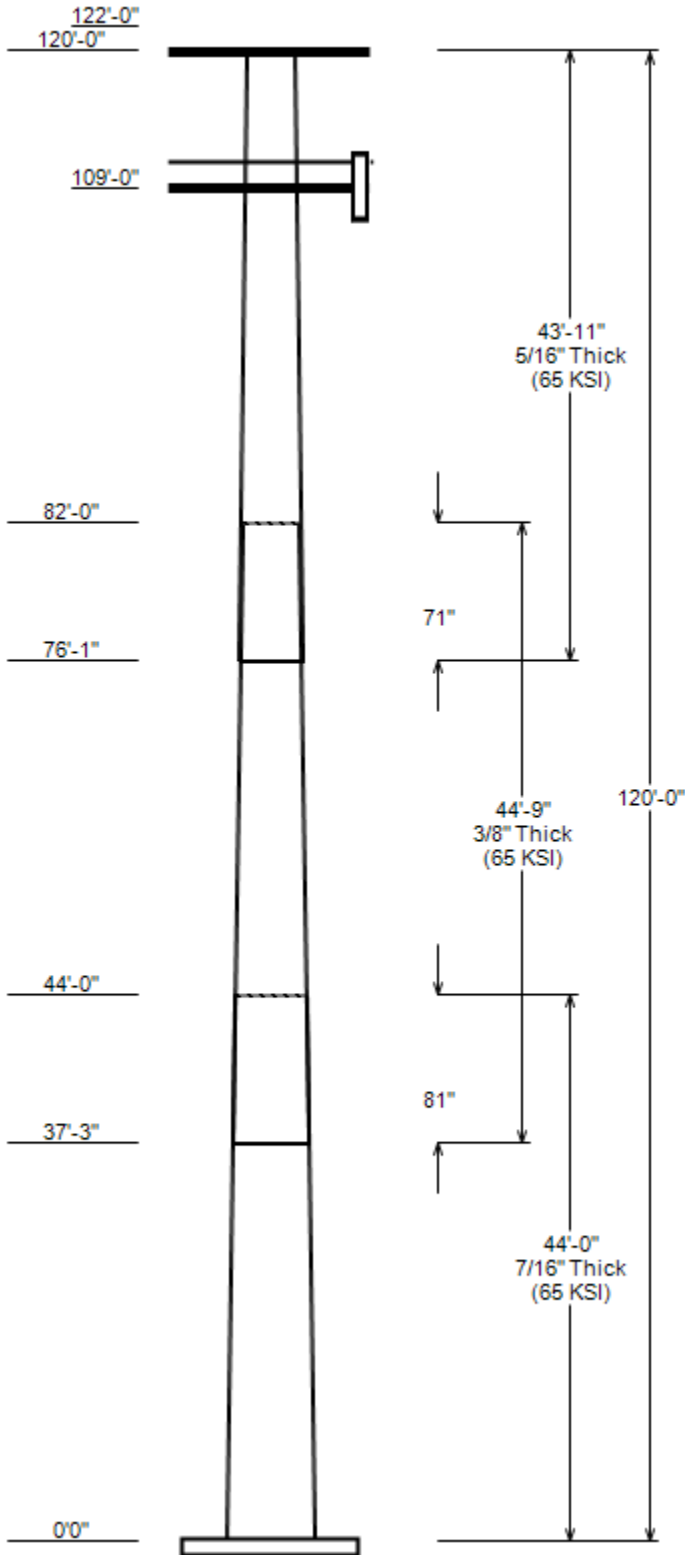
Unless explicitly agreed by both the client and A.T. Engineering Service, PLLC, all services will be performed in accordance with the current revision of ANSI/TIA-222.

All services are performed, results obtained, and recommendations made in accordance with generally accepted engineering principles and practices. A.T. Engineering Service, PLLC is not responsible for the conclusions, opinions and recommendations made by others based on the information supplied herein.

JOB INFORMATION

Asset : 370629, Northhaven I
 Client : AT&T MOBILITY
 Code : ANSI/TIA-222-H

Height : 120 ft
 Base Width : 54.5
 Shape : 12 Sides



SITE PARAMETERS

Base Elev (ft): 0.00 Structure Class: II
 Taper : 0.20000 (In/ft) Exposure : B
 Topographic Category : 1 Topographic Feature:
 Topo Method : Method 1

SECTION PROPERTIES

Shaft Section	Length (ft)	Diameter (in) Across Flats		Thick (in)	Overlap Length (in)	Steel Grade (ksi)
		Top	Bottom			
1	44.000	45.70	54.50	0.438	0.000	65
2	44.750	38.85	47.80	0.375	81.000	65
3	43.917	31.87	40.66	0.312	71.000	65

DISCRETE APPURTENANCE

Attach Elev (ft)	Force Elev (ft)	Qty	Description
122.0	122.0	2	Raycap DC6-48-60-18-8F
122.0	122.0	3	Ericsson RRUS 4478 B14
122.0	122.0	3	Ericsson Radio 2012 B29
122.0	122.0	3	Ericsson RRUS 4449 B5, B12
122.0	122.0	3	Ericsson RRUS 32 B66A
122.0	122.0	3	Ericsson RRUS 32 B30
122.0	123.0	3	Ericsson RRUS 32 B2
122.0	122.0	3	Ericsson AIR 6419 N77G
122.0	122.0	3	Ericsson AIR 6449 n77D
122.0	122.0	1	Raycap DC9-48-60-24-8C-EV
122.0	123.0	3	Quintel QS66512-2
122.0	123.0	3	CCI HPA-65R-BUU-H6
122.0	122.0	3	CCI DMP65R-BU6DA
122.0	122.0	3	Quintel QD6616-7
120.0	120.0	1	Flat Platform w/ Handrails
109.0	109.0	3	Ericsson Radio 4449 B71 B85A
109.0	109.0	3	Ericsson 4460 BAND 2/25
109.0	109.0	3	Ericsson Air6449 B41
109.0	109.0	3	Sector Frame (Perfect Vision P
109.0	109.0	3	RFS APXVAARR24_43-U-NA20

LINEAR APPURTENANCE

Elev From (ft)	Elev To (ft)	Description	Exp To Wind
5.0	122.0	1 5/8" Coax	No
0.0	122.0	2" conduit	No
0.0	122.0	0.92" (23.4mm) Cable	No
0.0	122.0	0.82" (20.8mm) 8 AWG 6	No
0.0	122.0	0.41" (10.3mm) Fiber	No
0.0	109.0	1.99" (50.7mm) Hybrid	No
0.0	109.0	1 5/8" (1.63"-41.3mm) Fiber	No

LOAD CASES

1.2D + 1.0W 120 mph wind with no ice
 0.9D + 1.0W 120 mph wind with no ice
 1.2D + 1.0Di + 1.0Wi 50 mph wind with 1" radial ice
 1.2D + 1.0Ev + 1.0Eh Seismic
 0.9D - 1.0Ev + 1.0Eh Seismic (Reduced DL)
 1.0D + 1.0W 60 mph Wind with No Ice

REACTIONS

Load Case	Moment (kip-ft)	Shear (Kip)	Axial (Kip)
1.2D + 1.0W	2144.42	24.19	44.92
0.9D + 1.0W	2131.68	24.18	33.68

JOB INFORMATION

Asset : 370629, Northhaven I
 Client : AT&T MOBILITY
 Code : ANSI/TIA-222-H

Height : 120 ft
 Base Width : 54.5
 Shape : 12 Sides

REACTIONS

Load Case	Moment (kip-ft)	Shear (Kip)	Axial (Kip)
1.2D + 1.0Di + 1.0Wi	477.28	5.39	57.69
1.2D + 1.0Ev + 1.0Eh	136.18	1.38	44.81
0.9D - 1.0Ev + 1.0Eh	135.19	1.38	30.86
1.0D + 1.0W	477.83	5.41	37.45

DISH DEFLECTIONS

Load Case	Attach Elev (ft)	Deflection (in)	Rotation (deg)
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ASSET: 370629, Northhaven I
CUSTOMER: AT&T MOBILITY

CODE: ANSI/TIA-222-H
ENG NO: 13682689_C3_02

ANALYSIS PARAMETERS

Location:	New Haven County,CT	Height:	120 ft
Type and Shape:	Taper, 12 Sides	Base Diameter:	54.50 in
Manufacturer:	Valmont	Top Diameter:	31.87 in
K _d (non-service):	0.95	Taper:	0.2000 in/ft
K _e :	1.00	Rotation:	0.000°

ICE & WIND PARAMETERS

Exposure Category:	B	Design Wind Speed w/o Ice:	120 mph
Risk Category:	II	Design Wind Speed w/Ice:	50 mph
Topo Factor Procedure:	Method 1	Operational Wind Speed:	60 mph
Topographic Category:	1	Design Ice Thickness:	1.00 in
Crest Height:	0 ft	HMSL:	36.00 ft

SEISMIC PARAMETERS

Analysis Method:	Equivalent Lateral Force Method				
Site Class:	D - Stiff Soil	Period Based on Rayleigh Method (sec):	1.56		
T _L (sec):	6	P:	1	C _s :	0.037
S _s :	0.204	S ₁ :	0.054	C _s Max:	0.037
F _a :	1.600	F _v :	2.400	C _s Min:	0.030
S _{ds} :	0.218	S _{d1} :	0.086		

LOAD CASES

1.2D + 1.0W	120 mph wind with no ice
0.9D + 1.0W	120 mph wind with no ice
1.2D + 1.0Di + 1.0Wi	50 mph wind with 1" radial ice
1.2D + 1.0Ev + 1.0Eh	Seismic
0.9D - 1.0Ev + 1.0Eh	Seismic (Reduced DL)
1.0D + 1.0W	60 mph Wind with No Ice

ASSET: 370629, Northhaven I
 CUSTOMER: AT&T MOBILITY

CODE: ANSI/TIA-222-H
 ENG NO: 13682689_C3_02

SHAFT SECTION PROPERTIES

Sect Info	Length (ft)	Thick (in)	Fy (ksi)	Joint Type	Slip Joint len (in)	Bottom							Top						
						Weight (lb)	Dia (in)	Elev (ft)	Area (in ²)	Ix (in ⁴)	W/t Ratio	D/t Ratio	Dia (in)	Elev (in)	Area (in ²)	Ix (in ⁴)	W/t Ratio	D/t Ratio	Taper (in/ft)
1-12	44.00	0.4375	65		0.00	10,475	54.50	0.000	76.16	28,412.4	30.70	124.57	45.70	44.00	63.76	16,673.4	25.31	104.46	0.2000
2-12	44.75	0.3750	65	Slip	81.00	7,897	47.80	37.250	57.27	16,439.4	31.47	127.47	38.85	82.00	46.46	8,777.8	25.08	103.60	0.2000
3-12	43.92	0.3125	65	Slip	71.00	5,406	40.66	76.083	40.60	8,434.7	32.18	130.11	31.87	120.00	31.76	4,038.0	24.65	102.00	0.2000

Shaft Weight 23,778

DISCRETE APPURTENANCE PROPERTIES

Attach Elev (ft)	Description	Qty	Ka	Vert Ecc (ft)	No Ice			Ice		
					Weight (lb)	EPAA (sf)	Orientation Factor	Weight (lb)	EPAA (sf)	Orientation Factor
122.00	Ericsson RRUS 4449 B5, B12	3	0.75	0.000	71.00	1.969	0.50	113.02	2.577	0.50
122.00	CCI DMP65R-BU6DA	3	0.75	0.000	79.40	12.709	0.63	247.33	14.527	0.63
122.00	CCI HPA-65R-BUU-H6	3	0.75	1.000	51.00	9.658	0.69	194.03	11.465	0.69
122.00	Quintel QS66512-2	3	0.75	1.000	111.00	8.133	0.74	240.91	9.950	0.74
122.00	Raycap DC9-48-60-24-8C-EV	1	0.75	0.000	16.00	4.788	1.00	100.16	5.747	1.00
122.00	Ericsson AIR 6449 n77D	3	0.75	0.000	81.60	4.028	0.65	148.86	4.923	0.65
122.00	Raycap DC6-48-60-18-8F	2	0.75	0.000	20.00	1.260	1.00	54.33	1.689	1.00
122.00	Ericsson RRUS 4478 B14	3	0.75	0.000	59.90	1.842	0.50	95.95	2.427	0.50
122.00	Ericsson Radio 2012 B29	3	0.75	0.000	43.20	1.856	0.50	75.34	2.443	0.50
122.00	Quintel QD6616-7	3	0.75	0.000	130.00	51.400	0.64	320.70	58.403	0.64
122.00	Ericsson RRUS 32 B66A	3	0.75	0.000	50.70	2.720	0.67	98.48	3.478	0.67
122.00	Ericsson RRUS 32 B30	3	0.75	0.000	60.00	2.743	0.67	107.96	3.505	0.67
122.00	Ericsson RRUS 32 B2	3	0.75	1.000	53.00	2.743	0.67	100.95	3.505	0.67
122.00	Ericsson AIR 6419 N77G	3	0.75	0.000	70.00	3.925	0.57	131.13	4.809	0.57
120.00	Flat Platform w/ Handrails	1	1.00	0.000	2000.00	42.400	1.00	2926.49	56.072	1.00
109.00	RFS APXVAARR24_43-U-NA20	3	0.80	0.000	127.90	20.243	0.63	381.45	22.638	0.63
109.00	Sector Frame (Perfect Vision P	3	0.75	0.000	1362.00	18.980	0.67	2023.83	29.313	0.67
109.00	Ericsson Air6449 B41	3	0.80	0.000	104.00	5.682	0.63	192.02	6.707	0.63
109.00	Ericsson 4460 BAND 2/25	3	0.80	0.000	109.00	2.564	0.67	166.09	3.245	0.67
109.00	Ericsson Radio 4449 B71 B85A	3	0.80	0.000	75.00	1.650	0.50	113.84	2.199	0.50
Totals	Num Loadings: 20	55			9,972.10			17,390.98		

LINEAR APPURTENANCE PROPERTIES

Load Case Azimuth (deg) : _

Elev From (ft)	Elev To (ft)	Qty	Description	Coax Dia (in)	Coax Wt (lb/ft)	Max Coax/ Row	Dist Between Rows (in)	Dist Between Cols (in)	Azimuth (deg)	Dist From Face (in)	Exposed To Wind	Carrier
5.00	122.00	6	1 5/8" Coax	1.98	0.82	N	0	0	0	0	N	AT&T MOBILITY
0.00	122.00	4	2" conduit	2.38	3.65	N	0	0	0	0	N	AT&T MOBILITY
0.00	122.00	4	0.82" (20.8mm) 8 AWG	0.82	0.62	N	0	0	0	0	N	AT&T MOBILITY
0.00	122.00	3	0.92" (23.4mm) Cable	0.92	0.89	N	0	0	0	0	N	AT&T MOBILITY
0.00	122.00	3	0.41" (10.3mm) Fiber	0.41	0.09	N	0	0	0	0	N	AT&T MOBILITY
0.00	109.00	3	1 5/8" (1.63"-41.3mm)	1.63	1.61	N	0	0	0	0	N	T-MOBILE
0.00	109.00	1	1.99" (50.7mm) Hybrid	1.99	1.9	N	0	0	0	0	N	T-MOBILE

SEGMENT PROPERTIES

(Max Len: 5.ft)

Seg Top Elev (ft)	Description	Thick (in)	Flat Dia (in)	Area (in ²)	Ix (in ⁴)	W/t Ratio	D/t Ratio	F'y (ksi)	S (in ³)	Z (in ³)	Weight (lb)
0.00		0.4375	54.500	76.161	28,412.40	30.70	124.57	71.2	1007.1	0.0	0.0
5.00		0.4375	53.500	74.752	26,864.70	30.09	122.29	71.9	970.1	0.0	1,283.8
10.00		0.4375	52.500	73.343	25,374.20	29.47	120.00	72.6	933.7	0.0	1,259.8
15.00		0.4375	51.500	71.934	23,939.90	28.86	117.71	73.2	898.0	0.0	1,235.9
20.00		0.4375	50.500	70.525	22,560.70	28.25	115.43	73.9	863.1	0.0	1,211.9
25.00		0.4375	49.500	69.117	21,235.50	27.64	113.14	74.6	828.8	0.0	1,187.9
30.00		0.4375	48.500	67.708	19,963.30	27.02	110.86	75.2	795.2	0.0	1,164.0
35.00		0.4375	47.500	66.299	18,742.90	26.41	108.57	75.9	762.3	0.0	1,140.0
37.25	Bot - Section 2	0.4375	47.050	65.665	18,210.40	26.14	107.54	76.2	747.7	0.0	505.2
40.00		0.4375	46.500	64.890	17,573.30	25.80	106.28	76.6	730.1	0.0	1,143.6
44.00	Top - Section 1	0.3750	46.450	55.635	15,075.10	30.51	123.87	71.4	627.0	0.0	1,639.4
45.00		0.3750	46.250	55.394	14,879.60	30.37	123.33	71.6	621.5	0.0	188.9
50.00		0.3750	45.250	54.186	13,927.50	29.65	120.67	72.4	594.6	0.0	932.2
55.00		0.3750	44.250	52.979	13,017.00	28.94	118.00	73.2	568.3	0.0	911.6
60.00		0.3750	43.250	51.771	12,147.00	28.22	115.33	73.9	542.6	0.0	891.1
65.00		0.3750	42.249	50.563	11,316.70	27.51	112.67	74.7	517.5	0.0	870.6
70.00		0.3750	41.249	49.356	10,525.10	26.79	110.00	75.5	492.9	0.0	850.0
75.00		0.3750	40.249	48.148	9,771.40	26.08	107.33	76.3	469.0	0.0	829.5
76.08	Bot - Section 3	0.3750	40.033	47.887	9,612.90	25.93	106.75	76.4	463.9	0.0	177.0
80.00		0.3750	39.249	46.941	9,054.50	25.37	104.66	77	445.7	0.0	1,167.7
82.00	Top - Section 2	0.3125	39.474	39.407	7,714.00	31.17	126.32	70.7	377.5	0.0	587.4
85.00		0.3125	38.874	38.803	7,364.80	30.65	124.40	71.3	366.0	0.0	399.2
90.00		0.3125	37.874	37.797	6,806.60	29.80	121.20	72.2	347.2	0.0	651.6
95.00		0.3125	36.874	36.790	6,277.30	28.94	118.00	73.2	328.9	0.0	634.5
100.00		0.3125	35.874	35.784	5,776.10	28.08	114.80	74.1	311.1	0.0	617.4
105.00		0.3125	34.874	34.778	5,302.40	27.22	111.60	75	293.7	0.0	600.3
109.00		0.3125	34.074	33.973	4,942.70	26.54	109.04	75.8	280.2	0.0	467.9
110.00		0.3125	33.874	33.771	4,855.30	26.37	108.40	76	276.9	0.0	115.3
115.00		0.3125	32.874	32.765	4,434.10	25.51	105.20	76.9	260.6	0.0	566.0
120.00		0.3125	31.874	31.759	4,038.00	24.65	102.00	77.8	244.7	0.0	548.9

Totals: 23,778.6

Load Case: 1.2D + 1.0W	120 mph wind with no ice	18 Iterations
Gust Response Factor:	1.10	
Dead load Factor:	1.20	
Wind Load Factor:	1.00	

CALCULATED FORCES

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (ft-kips)	Phi Mn (ft-kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-44.92	-24.19	0.00	-2,144.4	0.00	2,144.42	4,882.59	1,336.62	6,816.40	5,380.53	0	0	0.408
5.00	-43.18	-23.68	0.00	-2,023.4	0.00	2,023.45	4,837.22	1,311.89	6,566.62	5,231.13	0.06	-0.1	0.396
10.00	-41.43	-23.17	0.00	-1,905.1	0.00	1,905.06	4,790.15	1,287.17	6,321.51	5,081.80	0.22	-0.21	0.384
15.00	-39.72	-22.67	0.00	-1,789.2	0.00	1,789.21	4,741.38	1,262.44	6,081.05	4,932.64	0.5	-0.31	0.371
20.00	-38.04	-22.17	0.00	-1,675.9	0.00	1,675.88	4,690.93	1,237.72	5,845.26	4,783.76	0.88	-0.41	0.359
25.00	-36.39	-21.67	0.00	-1,565.0	0.00	1,565.05	4,638.77	1,212.99	5,614.14	4,635.26	1.37	-0.52	0.346
30.00	-34.77	-21.18	0.00	-1,456.7	0.00	1,456.69	4,584.93	1,188.27	5,387.67	4,487.24	1.96	-0.62	0.333
35.00	-33.20	-20.80	0.00	-1,350.8	0.00	1,350.82	4,529.39	1,163.55	5,165.87	4,339.82	2.67	-0.72	0.319
37.25	-32.49	-20.54	0.00	-1,304.0	0.00	1,304.01	4,503.84	1,152.42	5,067.57	4,273.70	3.02	-0.76	0.313
40.00	-30.99	-20.18	0.00	-1,247.5	0.00	1,247.51	4,472.15	1,138.82	4,948.72	4,193.09	3.47	-0.82	0.305
44.00	-28.86	-19.88	0.00	-1,166.8	0.00	1,166.80	3,577.05	976.40	4,243.67	3,359.27	4.19	-0.9	0.356
45.00	-28.58	-19.57	0.00	-1,146.9	0.00	1,146.92	3,569.30	972.16	4,206.91	3,337.32	4.38	-0.92	0.352
50.00	-27.25	-19.02	0.00	-1,049.1	0.00	1,049.09	3,529.49	950.97	4,025.55	3,227.58	5.4	-1.02	0.333
55.00	-25.94	-18.46	0.00	-954.0	0.00	954.01	3,488.00	929.77	3,848.17	3,117.96	6.52	-1.12	0.314
60.00	-24.67	-17.89	0.00	-861.7	0.00	861.73	3,444.81	908.58	3,674.80	3,008.57	7.76	-1.22	0.294
65.00	-23.42	-17.32	0.00	-772.3	0.00	772.28	3,399.92	887.39	3,505.42	2,899.51	9.09	-1.32	0.274
70.00	-22.19	-16.75	0.00	-685.7	0.00	685.68	3,353.35	866.20	3,340.04	2,790.89	10.52	-1.41	0.253
75.00	-21.00	-16.38	0.00	-602.0	0.00	601.95	3,305.07	845.00	3,178.65	2,682.80	12.04	-1.5	0.231
76.08	-20.75	-16.10	0.00	-584.2	0.00	584.21	3,294.39	840.41	3,144.21	2,659.46	12.39	-1.52	0.226
80.00	-19.19	-15.73	0.00	-521.2	0.00	521.15	3,255.11	823.81	3,021.26	2,575.36	13.66	-1.58	0.209
82.00	-18.41	-15.43	0.00	-489.7	0.00	489.69	2,508.23	691.59	2,554.80	2,002.42	14.33	-1.61	0.252
85.00	-17.81	-14.97	0.00	-443.4	0.00	443.41	2,489.39	680.99	2,477.13	1,956.70	15.35	-1.66	0.234
90.00	-16.84	-14.39	0.00	-368.6	0.00	368.56	2,456.65	663.33	2,350.35	1,880.48	17.13	-1.74	0.203
95.00	-15.89	-13.81	0.00	-296.6	0.00	296.61	2,422.21	645.67	2,226.90	1,804.35	18.99	-1.8	0.171
100.00	-14.97	-13.24	0.00	-227.5	0.00	227.54	2,386.07	628.01	2,106.78	1,728.40	20.91	-1.86	0.138
105.00	-14.07	-12.72	0.00	-161.3	0.00	161.34	2,348.24	610.35	1,989.99	1,652.75	22.89	-1.91	0.104
109.00	-7.06	-9.33	0.00	-110.5	0.00	110.46	2,316.76	596.22	1,898.96	1,592.51	24.51	-1.94	0.073
110.00	-6.90	-9.01	0.00	-101.1	0.00	101.12	2,308.72	592.69	1,876.53	1,577.49	24.92	-1.95	0.067
115.00	-6.09	-8.45	0.00	-56.1	0.00	56.09	2,267.51	575.03	1,766.40	1,502.74	26.97	-1.97	0.040
120.00	0.00	-8.23	0.00	-13.9	0.00	13.86	2,224.60	557.37	1,659.60	1,428.59	29.04	-1.98	0.010

Load Case: 0.9D + 1.0W	120 mph wind with no ice	18 Iterations
Gust Response Factor:	1.10	
Dead load Factor:	0.90	
Wind Load Factor:	1.00	

CALCULATED FORCES

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (ft-kips)	Phi Mn (ft-kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-33.68	-24.18	0.00	-2,131.7	0.00	2,131.68	4,882.59	1,336.62	6,816.40	5,380.53	0	0	0.403
5.00	-32.37	-23.65	0.00	-2,010.8	0.00	2,010.77	4,837.22	1,311.89	6,566.62	5,231.13	0.06	-0.1	0.391
10.00	-31.05	-23.12	0.00	-1,892.5	0.00	1,892.53	4,790.15	1,287.17	6,321.51	5,081.80	0.22	-0.21	0.379
15.00	-29.76	-22.60	0.00	-1,776.9	0.00	1,776.92	4,741.38	1,262.44	6,081.05	4,932.64	0.49	-0.31	0.367
20.00	-28.49	-22.09	0.00	-1,663.9	0.00	1,663.92	4,690.93	1,237.72	5,845.26	4,783.76	0.87	-0.41	0.354
25.00	-27.24	-21.58	0.00	-1,553.5	0.00	1,553.48	4,638.77	1,212.99	5,614.14	4,635.26	1.36	-0.51	0.341
30.00	-26.02	-21.07	0.00	-1,445.6	0.00	1,445.59	4,584.93	1,188.27	5,387.67	4,487.24	1.95	-0.61	0.328
35.00	-24.83	-20.69	0.00	-1,340.2	0.00	1,340.24	4,529.39	1,163.55	5,165.87	4,339.82	2.65	-0.71	0.315
37.25	-24.30	-20.43	0.00	-1,293.7	0.00	1,293.68	4,503.84	1,152.42	5,067.57	4,273.70	3	-0.76	0.308
40.00	-23.17	-20.06	0.00	-1,237.5	0.00	1,237.50	4,472.15	1,138.82	4,948.72	4,193.09	3.45	-0.81	0.301
44.00	-21.57	-19.77	0.00	-1,157.3	0.00	1,157.27	3,577.05	976.40	4,243.67	3,359.27	4.16	-0.89	0.351
45.00	-21.36	-19.44	0.00	-1,137.5	0.00	1,137.50	3,569.30	972.16	4,206.91	3,337.32	4.35	-0.91	0.347
50.00	-20.35	-18.88	0.00	-1,040.3	0.00	1,040.30	3,529.49	950.97	4,025.55	3,227.58	5.36	-1.01	0.328
55.00	-19.37	-18.32	0.00	-945.9	0.00	945.88	3,488.00	929.77	3,848.17	3,117.96	6.48	-1.12	0.309
60.00	-18.41	-17.75	0.00	-854.3	0.00	854.29	3,444.81	908.58	3,674.80	3,008.57	7.7	-1.21	0.290
65.00	-17.47	-17.17	0.00	-765.6	0.00	765.55	3,399.92	887.39	3,505.42	2,899.51	9.02	-1.31	0.270
70.00	-16.55	-16.60	0.00	-679.7	0.00	679.67	3,353.35	866.20	3,340.04	2,790.89	10.44	-1.4	0.249
75.00	-15.65	-16.24	0.00	-596.7	0.00	596.68	3,305.07	845.00	3,178.65	2,682.80	11.96	-1.49	0.228
76.08	-15.46	-15.95	0.00	-579.1	0.00	579.09	3,294.39	840.41	3,144.21	2,659.46	12.3	-1.5	0.223
80.00	-14.29	-15.59	0.00	-516.6	0.00	516.61	3,255.11	823.81	3,021.26	2,575.36	13.56	-1.57	0.205
82.00	-13.70	-15.29	0.00	-485.4	0.00	485.43	2,508.23	691.59	2,554.80	2,002.42	14.22	-1.6	0.248
85.00	-13.26	-14.83	0.00	-439.6	0.00	439.56	2,489.39	680.99	2,477.13	1,956.70	15.24	-1.64	0.230
90.00	-12.53	-14.25	0.00	-365.4	0.00	365.40	2,456.65	663.33	2,350.35	1,880.48	17.01	-1.72	0.200
95.00	-11.82	-13.68	0.00	-294.1	0.00	294.13	2,422.21	645.67	2,226.90	1,804.35	18.85	-1.79	0.168
100.00	-11.12	-13.11	0.00	-225.7	0.00	225.73	2,386.07	628.01	2,106.78	1,728.40	20.76	-1.85	0.136
105.00	-10.45	-12.60	0.00	-160.2	0.00	160.19	2,348.24	610.35	1,989.99	1,652.75	22.72	-1.9	0.102
109.00	-5.22	-9.27	0.00	-109.8	0.00	109.80	2,316.76	596.22	1,898.96	1,592.51	24.32	-1.93	0.071
110.00	-5.10	-8.94	0.00	-100.5	0.00	100.53	2,308.72	592.69	1,876.53	1,577.49	24.73	-1.93	0.066
115.00	-4.50	-8.39	0.00	-55.8	0.00	55.81	2,267.51	575.03	1,766.40	1,502.74	26.76	-1.96	0.039
120.00	0.00	-8.23	0.00	-13.9	0.00	13.86	2,224.60	557.37	1,659.60	1,428.59	28.82	-1.97	0.010

Load Case: 1.2D + 1.0Di + 1.0Wi	50 mph wind with 1" radial ice		17 Iterations
Gust Response Factor: 1.10	Ice Dead Load Factor	1.00	
Dead load Factor: 1.20			Ice Importance Factor 1.00
Wind Load Factor: 1.00			

CALCULATED FORCES

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (ft-kips)	Phi Mn (ft-kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-57.69	-5.39	0.00	-477.3	0.00	477.28	4,882.59	1,336.62	6,816.40	5,380.53	0	0	0.101
5.00	-55.72	-5.28	0.00	-450.3	0.00	450.31	4,837.22	1,311.89	6,566.62	5,231.13	0.01	-0.02	0.098
10.00	-53.71	-5.17	0.00	-423.9	0.00	423.89	4,790.15	1,287.17	6,321.51	5,081.80	0.05	-0.05	0.095
15.00	-51.73	-5.06	0.00	-398.0	0.00	398.03	4,741.38	1,262.44	6,081.05	4,932.64	0.11	-0.07	0.092
20.00	-49.77	-4.95	0.00	-372.7	0.00	372.73	4,690.93	1,237.72	5,845.26	4,783.76	0.2	-0.09	0.089
25.00	-47.84	-4.84	0.00	-348.0	0.00	347.97	4,638.77	1,212.99	5,614.14	4,635.26	0.3	-0.12	0.085
30.00	-45.94	-4.73	0.00	-323.8	0.00	323.75	4,584.93	1,188.27	5,387.67	4,487.24	0.44	-0.14	0.082
35.00	-44.06	-4.65	0.00	-300.1	0.00	300.08	4,529.39	1,163.55	5,165.87	4,339.82	0.59	-0.16	0.079
37.25	-43.23	-4.59	0.00	-289.6	0.00	289.62	4,503.84	1,152.42	5,067.57	4,273.70	0.67	-0.17	0.077
40.00	-41.58	-4.51	0.00	-277.0	0.00	276.99	4,472.15	1,138.82	4,948.72	4,193.09	0.77	-0.18	0.075
44.00	-39.21	-4.45	0.00	-258.9	0.00	258.94	3,577.05	976.40	4,243.67	3,359.27	0.93	-0.2	0.088
45.00	-38.88	-4.37	0.00	-254.5	0.00	254.50	3,569.30	972.16	4,206.91	3,337.32	0.97	-0.2	0.087
50.00	-37.26	-4.25	0.00	-232.6	0.00	232.62	3,529.49	950.97	4,025.55	3,227.58	1.2	-0.23	0.083
55.00	-35.66	-4.13	0.00	-211.4	0.00	211.37	3,488.00	929.77	3,848.17	3,117.96	1.45	-0.25	0.078
60.00	-34.10	-4.00	0.00	-190.7	0.00	190.74	3,444.81	908.58	3,674.80	3,008.57	1.72	-0.27	0.073
65.00	-32.57	-3.87	0.00	-170.8	0.00	170.76	3,399.92	887.39	3,505.42	2,899.51	2.02	-0.29	0.068
70.00	-31.06	-3.74	0.00	-151.4	0.00	151.42	3,353.35	866.20	3,340.04	2,790.89	2.34	-0.31	0.064
75.00	-29.59	-3.65	0.00	-132.7	0.00	132.73	3,305.07	845.00	3,178.65	2,682.80	2.68	-0.33	0.058
76.08	-29.27	-3.59	0.00	-128.8	0.00	128.78	3,294.39	840.41	3,144.21	2,659.46	2.75	-0.34	0.057
80.00	-27.49	-3.50	0.00	-114.7	0.00	114.72	3,255.11	823.81	3,021.26	2,575.36	3.03	-0.35	0.053
82.00	-26.60	-3.43	0.00	-107.7	0.00	107.71	2,508.23	691.59	2,554.80	2,002.42	3.18	-0.36	0.064
85.00	-25.83	-3.33	0.00	-97.4	0.00	97.41	2,489.39	680.99	2,477.13	1,956.70	3.41	-0.37	0.060
90.00	-24.58	-3.20	0.00	-80.8	0.00	80.76	2,456.65	663.33	2,350.35	1,880.48	3.81	-0.38	0.053
95.00	-23.36	-3.06	0.00	-64.8	0.00	64.78	2,422.21	645.67	2,226.90	1,804.35	4.22	-0.4	0.046
100.00	-22.16	-2.93	0.00	-49.5	0.00	49.48	2,386.07	628.01	2,106.78	1,728.40	4.64	-0.41	0.038
105.00	-20.99	-2.81	0.00	-34.8	0.00	34.84	2,348.24	610.35	1,989.99	1,652.75	5.08	-0.42	0.030
109.00	-11.11	-2.02	0.00	-23.6	0.00	23.61	2,316.76	596.22	1,898.96	1,592.51	5.44	-0.43	0.020
110.00	-10.89	-1.94	0.00	-21.6	0.00	21.59	2,308.72	592.69	1,876.53	1,577.49	5.53	-0.43	0.018
115.00	-9.82	-1.81	0.00	-11.9	0.00	11.89	2,267.51	575.03	1,766.40	1,502.74	5.98	-0.44	0.012
120.00	0.00	-1.73	0.00	-2.8	0.00	2.84	2,224.60	557.37	1,659.60	1,428.59	6.44	-0.44	0.002

ASSET: 370629, Northhaven I
 CUSTOMER: AT&T MOBILITY

CODE: ANSI/TIA-222-H
 ENG NO: 13682689_C3_02

Load Case: 1.0D + 1.0W	60 mph Wind with No Ice	17 Iterations
Gust Response Factor: 1.10		
Dead load Factor: 1.00		
Wind Load Factor: 1.00		

CALCULATED FORCES

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (ft-kips)	Mu MX (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (ft-kips)	Phi Mn (ft-kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-37.45	-5.41	0.00	-477.8	0.00	477.83	4,882.59	1,336.62	6,816.40	5,380.53	0	0	0.096
5.00	-36.03	-5.29	0.00	-450.8	0.00	450.78	4,837.22	1,311.89	6,566.62	5,231.13	0.01	-0.02	0.094
10.00	-34.61	-5.18	0.00	-424.3	0.00	424.32	4,790.15	1,287.17	6,321.51	5,081.80	0.05	-0.05	0.091
15.00	-33.22	-5.06	0.00	-398.4	0.00	398.44	4,741.38	1,262.44	6,081.05	4,932.64	0.11	-0.07	0.088
20.00	-31.84	-4.95	0.00	-373.1	0.00	373.14	4,690.93	1,237.72	5,845.26	4,783.76	0.2	-0.09	0.085
25.00	-30.50	-4.83	0.00	-348.4	0.00	348.41	4,638.77	1,212.99	5,614.14	4,635.26	0.3	-0.12	0.082
30.00	-29.17	-4.72	0.00	-324.2	0.00	324.25	4,584.93	1,188.27	5,387.67	4,487.24	0.44	-0.14	0.079
35.00	-27.87	-4.64	0.00	-300.6	0.00	300.64	4,529.39	1,163.55	5,165.87	4,339.82	0.59	-0.16	0.075
37.25	-27.29	-4.58	0.00	-290.2	0.00	290.21	4,503.84	1,152.42	5,067.57	4,273.70	0.67	-0.17	0.074
40.00	-26.06	-4.50	0.00	-277.6	0.00	277.62	4,472.15	1,138.82	4,948.72	4,193.09	0.77	-0.18	0.072
44.00	-24.30	-4.43	0.00	-259.6	0.00	259.64	3,577.05	976.40	4,243.67	3,359.27	0.93	-0.2	0.084
45.00	-24.08	-4.36	0.00	-255.2	0.00	255.21	3,569.30	972.16	4,206.91	3,337.32	0.98	-0.2	0.083
50.00	-22.98	-4.23	0.00	-233.4	0.00	233.42	3,529.49	950.97	4,025.55	3,227.58	1.2	-0.23	0.079
55.00	-21.91	-4.11	0.00	-212.2	0.00	212.25	3,488.00	929.77	3,848.17	3,117.96	1.45	-0.25	0.074
60.00	-20.86	-3.98	0.00	-191.7	0.00	191.70	3,444.81	908.58	3,674.80	3,008.57	1.73	-0.27	0.070
65.00	-19.83	-3.85	0.00	-171.8	0.00	171.80	3,399.92	887.39	3,505.42	2,899.51	2.02	-0.29	0.065
70.00	-18.82	-3.72	0.00	-152.5	0.00	152.53	3,353.35	866.20	3,340.04	2,790.89	2.34	-0.31	0.060
75.00	-17.84	-3.64	0.00	-133.9	0.00	133.91	3,305.07	845.00	3,178.65	2,682.80	2.68	-0.33	0.055
76.08	-17.62	-3.58	0.00	-130.0	0.00	129.96	3,294.39	840.41	3,144.21	2,659.46	2.76	-0.34	0.054
80.00	-16.33	-3.50	0.00	-115.9	0.00	115.94	3,255.11	823.81	3,021.26	2,575.36	3.04	-0.35	0.050
82.00	-15.68	-3.43	0.00	-108.9	0.00	108.94	2,508.23	691.59	2,554.80	2,002.42	3.19	-0.36	0.061
85.00	-15.19	-3.33	0.00	-98.6	0.00	98.65	2,489.39	680.99	2,477.13	1,956.70	3.42	-0.37	0.057
90.00	-14.38	-3.20	0.00	-82.0	0.00	82.00	2,456.65	663.33	2,350.35	1,880.48	3.81	-0.39	0.049
95.00	-13.58	-3.07	0.00	-66.0	0.00	66.01	2,422.21	645.67	2,226.90	1,804.35	4.23	-0.4	0.042
100.00	-12.81	-2.94	0.00	-50.6	0.00	50.65	2,386.07	628.01	2,106.78	1,728.40	4.66	-0.41	0.035
105.00	-12.05	-2.83	0.00	-35.9	0.00	35.93	2,348.24	610.35	1,989.99	1,652.75	5.1	-0.43	0.027
109.00	-6.13	-2.08	0.00	-24.6	0.00	24.62	2,316.76	596.22	1,898.96	1,592.51	5.46	-0.43	0.018
110.00	-5.99	-2.01	0.00	-22.5	0.00	22.54	2,308.72	592.69	1,876.53	1,577.49	5.55	-0.43	0.017
115.00	-5.30	-1.88	0.00	-12.5	0.00	12.51	2,267.51	575.03	1,766.40	1,502.74	6	-0.44	0.011
120.00	0.00	-1.84	0.00	-3.1	0.00	3.10	2,224.60	557.37	1,659.60	1,428.59	6.47	-0.44	0.002

EQUIVALENT LATERAL FORCES METHOD ANALYSIS
(Based on ASCE7-16 Chapters 11, 12 and 15)

Spectral Response Acceleration for Short Period (S_S):	0.204
Spectral Response Acceleration at 1.0 Second Period (S_1):	0.054
Long-Period Transition Period (T_L – Seconds):	6
Importance Factor (I_e):	1.000
Site Coefficient F_a :	1.600
Site Coefficient F_v :	2.400
Response Modification Coefficient (R):	1.500
Design Spectral Response Acceleration at Short Period (S_{ds}):	0.218
Design Spectral Response Acceleration at 1.0 Second Period (S_{d1}):	0.086
Seismic Response Coefficient (C_s):	0.037
Upper Limit C_s :	0.037
Lower Limit C_s :	0.030
Period based on Rayleigh Method (sec):	1.560
Redundancy Factor (ρ):	1.000
Seismic Force Distribution Exponent (k):	1.530
Total Unfactored Dead Load:	37.450 k
Seismic Base Shear (E):	1.380 k

1.2D + 1.0Ev + 1.0Eh Seismic

Segment	Height Above Base (ft)	Weight (lb)	W_z (lb-ft)	C_{vx}	Horizontal Force (lb)	Vertical Force (lb)
29	117.5	674	990	0.036	50	838
28	112.5	691	950	0.034	48	859
27	109.5	140	185	0.007	9	174
26	107	595	757	0.027	38	739
25	102.5	759	905	0.033	45	943
24	97.5	776	857	0.031	43	965
23	92.5	793	808	0.029	41	986
22	87.5	810	758	0.028	38	1,007
21	83.5	494	431	0.016	22	615
20	81	651	541	0.020	27	809
19	78.0417	1,292	1,015	0.037	51	1,606
18	75.5417	211	158	0.006	8	263
17	72.5	988	693	0.025	35	1,228
16	67.5	1,008	635	0.023	32	1,254
15	62.5	1,029	576	0.021	29	1,279
14	57.5	1,049	517	0.019	26	1,305
13	52.5	1,070	458	0.017	23	1,331
12	47.5	1,091	401	0.014	20	1,356
11	44.5	221	73	0.003	4	274
10	42	1,766	538	0.020	27	2,196
9	38.625	1,231	330	0.012	17	1,530
8	36.125	576	139	0.005	7	717
7	32.5	1,298	267	0.010	13	1,615
6	27.5	1,322	211	0.008	11	1,644
5	22.5	1,346	158	0.006	8	1,674
4	17.5	1,370	109	0.004	5	1,704
3	12.5	1,394	66	0.002	3	1,734
2	7.5	1,418	31	0.001	2	1,764
1	2.5	1,418	6	0.000	0	1,763
Raycap DC6-48-60-18-8F	120	40	61	0.002	3	50
Ericsson RRUS 4478 B14	120	180	273	0.010	14	223
Ericsson Radio 2012 B29	120	130	197	0.007	10	161
Ericsson RRUS 4449 B5, B12	120	213	323	0.012	16	265
Ericsson RRUS 32 B66A	120	152	231	0.008	12	189

Segment	Height Above Base (ft)	Weight (lb)	W _z (lb-ft)	C _{vx}	Horizontal Force (lb)	Vertical Force (lb)
Ericsson RRUS 32 B30	120	180	273	0.010	14	224
Ericsson RRUS 32 B2	120	159	241	0.009	12	198
Ericsson AIR 6419 N77G	120	210	319	0.012	16	261
Ericsson AIR 6449 n77D	120	245	371	0.014	19	304
Raycap DC9-48-60-24-8C-EV	120	16	24	0.001	1	20
Quintel QS66512-2	120	333	505	0.018	25	414
CCI HPA-65R-BUU-H6	120	153	232	0.008	12	190
CCI DMP65R-BU6DA	120	238	361	0.013	18	296
Quintel QD6616-7	120	390	592	0.022	30	485
Flat Platform w/ Handrails	120	2,000	3,035	0.110	152	2,487
Ericsson Radio 4449 B71 B85A	109	225	295	0.011	15	280
Ericsson 4460 BAND 2/25	109	327	428	0.016	21	407
Ericsson Air6449 B41	109	312	409	0.015	20	388
Sector Frame (Perfect Vision PV-MPM-SFA10-12-278X96) w/work platform	109	4,086	5,352	0.194	268	5,081
RFS APXVAARR24_43-U-NA20	109	384	503	0.018	25	477
		37,452	27,587	1.000	1,383	46,573

0.9D - 1.0Ev + 1.0Eh Seismic (Reduced DL)

Segment	Height Above Base (ft)	Weight (lb)	W _z (lb-ft)	C _{vx}	Horizontal Force (lb)	Vertical Force (lb)
29	117.5	674	990	0.036	50	577
28	112.5	691	950	0.034	48	592
27	109.5	140	185	0.007	9	120
26	107	595	757	0.027	38	509
25	102.5	759	905	0.033	45	650
24	97.5	776	857	0.031	43	664
23	92.5	793	808	0.029	41	679
22	87.5	810	758	0.028	38	694
21	83.5	494	431	0.016	22	423
20	81	651	541	0.020	27	557
19	78.0417	1,292	1,015	0.037	51	1,106
18	75.5417	211	158	0.006	8	181
17	72.5	988	693	0.025	35	846
16	67.5	1,008	635	0.023	32	864
15	62.5	1,029	576	0.021	29	881
14	57.5	1,049	517	0.019	26	899
13	52.5	1,070	458	0.017	23	916
12	47.5	1,091	401	0.014	20	934
11	44.5	221	73	0.003	4	189
10	42	1,766	538	0.020	27	1,513
9	38.625	1,231	330	0.012	17	1,054
8	36.125	576	139	0.005	7	494
7	32.5	1,298	267	0.010	13	1,112
6	27.5	1,322	211	0.008	11	1,133
5	22.5	1,346	158	0.006	8	1,153
4	17.5	1,370	109	0.004	5	1,174
3	12.5	1,394	66	0.002	3	1,194
2	7.5	1,418	31	0.001	2	1,215
1	2.5	1,418	6	0.000	0	1,214
Raycap DC6-48-60-18-8F	120	40	61	0.002	3	34
Ericsson RRUS 4478 B14	120	180	273	0.010	14	154
Ericsson Radio 2012 B29	120	130	197	0.007	10	111
Ericsson RRUS 4449 B5, B12	120	213	323	0.012	16	182
Ericsson RRUS 32 B66A	120	152	231	0.008	12	130
Ericsson RRUS 32 B30	120	180	273	0.010	14	154
Ericsson RRUS 32 B2	120	159	241	0.009	12	136
Ericsson AIR 6419 N77G	120	210	319	0.012	16	180
Ericsson AIR 6449 n77D	120	245	371	0.014	19	210
Raycap DC9-48-60-24-8C-EV	120	16	24	0.001	1	14
Quintel QS66512-2	120	333	505	0.018	25	285
CCI HPA-65R-BUU-H6	120	153	232	0.008	12	131

Segment	Height Above Base (ft)	Weight (lb)	W _z (lb-ft)	C _{vx}	Horizontal Force (lb)	Vertical Force (lb)
CCI DMP65R-BU6DA	120	238	361	0.013	18	204
Quintel QD6616-7	120	390	592	0.022	30	334
Flat Platform w/ Handrails	120	2,000	3,035	0.110	152	1,713
Ericsson Radio 4449 B71 B85A	109	225	295	0.011	15	193
Ericsson 4460 BAND 2/25	109	327	428	0.016	21	280
Ericsson Air6449 B41	109	312	409	0.015	20	267
Sector Frame (Perfect Vision PV-MPM-SFA10-12-278X96) w/work platform	109	4,086	5,352	0.194	268	3,500
RFS APXVAARR24_43-U-NA20	109	384	503	0.018	25	329
		37,452	27,587	1.000	1,383	32,077

1.2D + 1.0Ev + 1.0Eh Seismic

CALCULATED FORCES

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (fr-kips)	Mu Mx (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (kips)	Phi Mn (kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-44.81	-1.38	0.00	-136.18	0.00	136.18	4,882.59	1,336.62	6,816	5,380.53	0.00	0.00	0.03
5.00	-43.05	-1.39	0.00	-129.26	0.00	129.26	4,837.22	1,311.89	6,567	5,231.13	0.00	-0.01	0.03
10.00	-41.31	-1.39	0.00	-122.32	0.00	122.32	4,790.15	1,287.17	6,322	5,081.80	0.01	-0.01	0.03
15.00	-39.61	-1.39	0.00	-115.37	0.00	115.37	4,741.38	1,262.44	6,081	4,932.64	0.03	-0.02	0.03
20.00	-37.93	-1.38	0.00	-108.44	0.00	108.44	4,690.93	1,237.72	5,845	4,783.76	0.06	-0.03	0.03
25.00	-36.29	-1.38	0.00	-101.52	0.00	101.52	4,638.77	1,212.99	5,614	4,635.26	0.09	-0.03	0.03
30.00	-34.67	-1.37	0.00	-94.64	0.00	94.64	4,584.93	1,188.27	5,388	4,487.24	0.13	-0.04	0.03
35.00	-33.96	-1.36	0.00	-87.81	0.00	87.81	4,529.39	1,163.55	5,166	4,339.82	0.17	-0.05	0.03
37.25	-32.43	-1.35	0.00	-84.75	0.00	84.75	4,503.84	1,152.42	5,068	4,273.70	0.19	-0.05	0.03
40.00	-30.23	-1.32	0.00	-81.05	0.00	81.05	4,472.15	1,138.82	4,949	4,193.09	0.22	-0.05	0.03
44.00	-29.96	-1.32	0.00	-75.77	0.00	75.77	3,577.05	976.40	4,244	3,359.27	0.27	-0.06	0.03
45.00	-28.60	-1.30	0.00	-74.46	0.00	74.46	3,569.30	972.16	4,207	3,337.32	0.28	-0.06	0.03
50.00	-27.27	-1.28	0.00	-67.97	0.00	67.97	3,529.49	950.97	4,026	3,227.58	0.35	-0.07	0.03
55.00	-25.96	-1.25	0.00	-61.60	0.00	61.60	3,488.00	929.77	3,848	3,117.96	0.42	-0.07	0.03
60.00	-24.69	-1.22	0.00	-55.34	0.00	55.34	3,444.81	908.58	3,675	3,008.57	0.50	-0.08	0.03
65.00	-23.43	-1.19	0.00	-49.22	0.00	49.22	3,399.92	887.39	3,505	2,899.51	0.59	-0.09	0.02
70.00	-22.20	-1.16	0.00	-43.26	0.00	43.26	3,353.35	866.20	3,340	2,790.89	0.68	-0.09	0.02
75.00	-21.94	-1.15	0.00	-37.48	0.00	37.48	3,305.07	845.00	3,179	2,682.80	0.78	-0.10	0.02
76.08	-20.33	-1.10	0.00	-36.23	0.00	36.23	3,294.39	840.41	3,144	2,659.46	0.80	-0.10	0.02
80.00	-19.52	-1.07	0.00	-31.93	0.00	31.93	3,255.11	823.81	3,021	2,575.36	0.88	-0.10	0.02
82.00	-18.91	-1.05	0.00	-29.79	0.00	29.79	2,508.23	691.59	2,555	2,002.42	0.92	-0.10	0.02
85.00	-17.90	-1.01	0.00	-26.64	0.00	26.64	2,489.39	680.99	2,477	1,956.70	0.99	-0.11	0.02
90.00	-16.92	-0.97	0.00	-21.59	0.00	21.59	2,456.65	663.33	2,350	1,880.48	1.10	-0.11	0.02
95.00	-15.95	-0.93	0.00	-16.75	0.00	16.75	2,422.21	645.67	2,227	1,804.35	1.22	-0.11	0.02
100.00	-15.01	-0.88	0.00	-12.13	0.00	12.13	2,386.07	628.01	2,107	1,728.40	1.34	-0.12	0.01
105.00	-14.27	-0.84	0.00	-7.73	0.00	7.73	2,348.24	610.35	1,990	1,652.75	1.47	-0.12	0.01
109.00	-7.46	-0.47	0.00	-4.37	0.00	4.37	2,316.76	596.22	1,899	1,592.51	1.57	-0.12	0.01
110.00	-6.60	-0.42	0.00	-3.91	0.00	3.91	2,308.72	592.69	1,877	1,577.49	1.60	-0.12	0.01
115.00	-5.77	-0.37	0.00	-1.83	0.00	1.83	2,267.51	575.03	1,766	1,502.74	1.72	-0.12	0.00
120.00	0.00	-0.35	0.00	0.00	0.00	0.00	2,224.60	557.37	1,660	1,428.59	1.85	-0.12	0.00

0.9D - 1.0Ev + 1.0Eh Seismic (Reduced DL)

CALCULATED FORCES

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (fr-kips)	Mu Mx (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (kips)	Phi Mn (kips)	Total Deflect (in)	Rotation (deg)	Ratio
0.00	-30.86	-1.38	0.00	-135.19	0.00	135.19	4,882.59	1,336.62	6,816	5,380.53	0.00	0.00	0.03
5.00	-29.65	-1.39	0.00	-128.27	0.00	128.27	4,837.22	1,311.89	6,567	5,231.13	0.00	-0.01	0.03
10.00	-28.45	-1.39	0.00	-121.34	0.00	121.34	4,790.15	1,287.17	6,322	5,081.80	0.01	-0.01	0.03
15.00	-27.28	-1.38	0.00	-114.42	0.00	114.42	4,741.38	1,262.44	6,081	4,932.64	0.03	-0.02	0.03
20.00	-26.13	-1.38	0.00	-107.50	0.00	107.50	4,690.93	1,237.72	5,845	4,783.76	0.06	-0.03	0.03
25.00	-24.99	-1.37	0.00	-100.62	0.00	100.62	4,638.77	1,212.99	5,614	4,635.26	0.09	-0.03	0.03
30.00	-23.88	-1.36	0.00	-93.77	0.00	93.77	4,584.93	1,188.27	5,388	4,487.24	0.13	-0.04	0.03
35.00	-23.39	-1.35	0.00	-86.98	0.00	86.98	4,529.39	1,163.55	5,166	4,339.82	0.17	-0.05	0.03
37.25	-22.33	-1.34	0.00	-83.94	0.00	83.94	4,503.84	1,152.42	5,068	4,273.70	0.19	-0.05	0.03

ASSET: 370629, Northhaven I
 CUSTOMER: AT&T MOBILITY

CODE: ANSI/TIA-222-H
 ENG NO: 13682689_C3_02

Seg Elev (ft)	Pu FY (-) (kips)	Vu FX (-) (kips)	Tu MY (ft-kips)	Mu MZ (fr-kips)	Mu Mx (ft-kips)	Resultant Moment (ft-kips)	Phi Pn (kips)	Phi Vn (kips)	Phi Tn (kips)	Phi Mn (kips)	Total Deflect (in)	Rotation (deg)	Ratio
40.00	-20.82	-1.31	0.00	-80.27	0.00	80.27	4,472.15	1,138.82	4,949	4,193.09	0.22	-0.05	0.02
44.00	-20.63	-1.31	0.00	-75.03	0.00	75.03	3,577.05	976.40	4,244	3,359.27	0.27	-0.06	0.03
45.00	-19.70	-1.29	0.00	-73.72	0.00	73.72	3,569.30	972.16	4,207	3,337.32	0.28	-0.06	0.03
50.00	-18.78	-1.27	0.00	-67.29	0.00	67.29	3,529.49	950.97	4,026	3,227.58	0.34	-0.07	0.03
55.00	-17.88	-1.24	0.00	-60.97	0.00	60.97	3,488.00	929.77	3,848	3,117.96	0.42	-0.07	0.03
60.00	-17.00	-1.21	0.00	-54.76	0.00	54.76	3,444.81	908.58	3,675	3,008.57	0.50	-0.08	0.02
65.00	-16.14	-1.18	0.00	-48.70	0.00	48.70	3,399.92	887.39	3,505	2,899.51	0.58	-0.08	0.02
70.00	-15.29	-1.15	0.00	-42.80	0.00	42.80	3,353.35	866.20	3,340	2,790.89	0.67	-0.09	0.02
75.00	-15.11	-1.14	0.00	-37.07	0.00	37.07	3,305.07	845.00	3,179	2,682.80	0.77	-0.10	0.02
76.08	-14.00	-1.09	0.00	-35.84	0.00	35.84	3,294.39	840.41	3,144	2,659.46	0.79	-0.10	0.02
80.00	-13.45	-1.06	0.00	-31.58	0.00	31.58	3,255.11	823.81	3,021	2,575.36	0.87	-0.10	0.02
82.00	-13.02	-1.04	0.00	-29.46	0.00	29.46	2,508.23	691.59	2,555	2,002.42	0.92	-0.10	0.02
85.00	-12.33	-1.00	0.00	-26.35	0.00	26.35	2,489.39	680.99	2,477	1,956.70	0.98	-0.11	0.02
90.00	-11.65	-0.96	0.00	-21.35	0.00	21.35	2,456.65	663.33	2,350	1,880.48	1.09	-0.11	0.02
95.00	-10.99	-0.91	0.00	-16.56	0.00	16.56	2,422.21	645.67	2,227	1,804.35	1.21	-0.11	0.01
100.00	-10.34	-0.87	0.00	-11.99	0.00	11.99	2,386.07	628.01	2,107	1,728.40	1.33	-0.12	0.01
105.00	-9.83	-0.83	0.00	-7.65	0.00	7.65	2,348.24	610.35	1,990	1,652.75	1.46	-0.12	0.01
109.00	-5.14	-0.46	0.00	-4.33	0.00	4.33	2,316.76	596.22	1,899	1,592.51	1.56	-0.12	0.01
110.00	-4.55	-0.41	0.00	-3.87	0.00	3.87	2,308.72	592.69	1,877	1,577.49	1.58	-0.12	0.00
115.00	-3.97	-0.36	0.00	-1.81	0.00	1.81	2,267.51	575.03	1,766	1,502.74	1.71	-0.12	0.00
120.00	0.00	-0.35	0.00	0.00	0.00	0.00	2,224.60	557.37	1,660	1,428.59	1.84	-0.12	0.00

ANALYSIS SUMMARY

Load Case	Reactions						Max Usage	
	Shear FX (kips)	Shear FZ (kips)	Axial FY (kips)	Moment MX (ft-kips)	Moment MY (ft-kips)	Moment MZ (ft-kips)	Elev (ft)	Interaction Ratio
1.2D + 1.0W	24.19	0.00	44.92	0.00	0.00	2144.42	0.00	0.41
0.9D + 1.0W	24.18	0.00	33.68	0.00	0.00	2131.68	0.00	0.4
1.2D + 1.0Di + 1.0Wi	5.39	0.00	57.69	0.00	0.00	477.28	0.00	0.1
1.2D + 1.0Ev + 1.0Eh	1.39	0.00	44.81	0.00	0.00	136.18	0.00	0.03
0.9D - 1.0Ev + 1.0Eh	1.39	0.00	30.86	0.00	0.00	135.19	0.00	0.03
1.0D + 1.0W	5.41	0.00	37.45	0.00	0.00	477.83	0.00	0.1

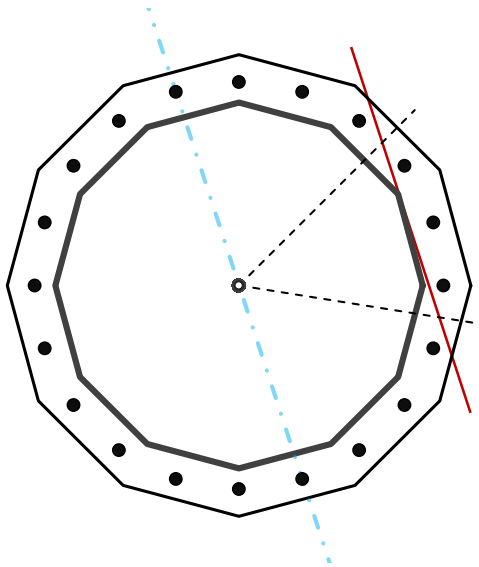
Base Plate & Anchor Rod Analysis

Pole Dimensions		
Number of Sides	12	-
Diameter	54.5	in
Thickness	7/16	in
Orientation Offset		°

Base Reactions		
Moment, Mu	2,144.4	k-ft
Axial, Pu	44.9	k
Shear, Vu	24.2	k
Neutral Axis	288	°

Report Capacities		
Component	Capacity	Result
Base Plate	15%	Pass
Anchor Rods	36%	Pass
Dwyidag	-	-

Base Plate		
Number of Sides	12	-
Diameter, ϕ	68.92	in
Thickness	2 3/4	in
Grade	A871-60	
Yield Strength, Fy	60	ksi
Tensile Strength, Fu	75	ksi
Clip	N/A	in
Orientation Offset	0	°
Anchor Rod Detail	c	$\eta=0.55$
Clear Distance	N/A	in
Applied Moment, Mu	503.7	k
Bending Stress, ϕMn	3305.4	k



Original Anchor Rods		
Arrangement	Radial	-
Quantity	20	-
Diameter, ϕ	2 1/4	in
Bolt Circle	62.92	in
Grade	A615-75	
Yield Strength, Fy	75	ksi
Tensile Strength, Fu	100	ksi
Spacing	9.9	in
Orientation Offset	0	°
Applied Force, Pu	87.2	k
Anchor Rods, ϕPn	243.6	k

Calculations for Monopole Base Plate & Anchor Rod Analysis

Reaction Distribution

Reaction	Shear Vu	Moment Mu	Factor
-	k	k-ft	-
Base Forces	24.2	2144.4	1.00
Anchor Rod Forces	24.2	2144.4	1.00
Additional Bolt (Grp1) Forces	0.0	0.0	0.00
Additional Bolt (Grp2) Forces	0.0	0.0	0.00
Dywidag Forces	0.0	0.0	0.00
Stiffener Forces	0.0	0.0	0.00

Geometric Properties

Section	Gross Area	Net Area	Individual Inertia	Threads per Inch	Moment of Inertia
-	in ²	in ²	in ⁴	#	in ⁴
Pole	73.4601	6.1217	0.3922		26842.94
Bolt	3.9761	3.2477	0.8393	4.5	29779.40
Bolt1	0.0000	0.0000	0.0000	0	0.00
Bolt2	0.0000	0.0000	0.0000	0	0.00
Dywidag	0.0000	0.0000	0.0000		0.00
Stiffener	0.0000	0.0000	0.0000		0.00

Base Plate		
Shape	12	-
Width, W	68.92	in
Thickness, t	2.75	in
Yield Strength, Fy	60	ksi
Tensile Strength, Fu	75	ksi
Base Plate Chord	42.187	in
Detail Type	c	-
Detail Factor	0.55	-
Clear Distance	N/A	-

Anchor Rods		
Anchor Rod Quantity, N	20	-
Rod Diameter, d	2.25	in
Bolt Circle, BC	62.92	in
Yield Strength, Fy	75	ksi
Tensile Strength, Fu	100	ksi
Applied Axial, Pu	87.2	k
Applied Shear, Vu	0.6	k
Compressive Capacity, φPn	243.6	k
Tensile Capacity, φRnt	0.358	OK
Interaction Capacity	0.362	OK

External Base Plate		
Chord Length AA	42.843	in
Additional AA	5.500	in
Section Modulus, Z	91.398	in ³
Applied Moment, Mu	503.7	k-ft
Bending Capacity, φMn	4935.5	k-ft
Capacity, Mu/φMn	0.102	OK
Chord Length AB	40.916	in
Additional AB	5.500	in
Section Modulus, Z	87.755	in ³
Applied Moment, Mu	259.6	k-ft
Bending Capacity, φMn	4738.7	k-ft
Capacity, Mu/φMn	0.055	OK
Bend Line Length	32.376	in
Additional Bend Line	0.000	in
Section Modulus, Z	61.211	in ³
Applied Moment, Mu	503.7	k-ft
Bending Capacity, φMn	3305.4	k-ft
Capacity, Mu/φMn	0.152	OK

Internal Base Plate		
Arc Length	0.000	in
Section Modulus, Z	0.000	in ³
Moment Arm	0.000	in
Applied Moment, Mu	0.0	k-ft
Bending Capacity, φMn	0.0	k-ft
Capacity, Mu/φMn		

About 20,800,000 results (0.44 seconds)

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Data provided by USPS

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Delivered

May 20, 12:48PM The Honorable Michael J. Freda - First Selectman of North Haven
North Haven, CT

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Tracking number 9505510391972138705422

Delivered

May 20, 12:12PM
North Haven, CT

Laura Magaraci - Zoning Enforcement Officer, North Haven

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About 21,500,000 results (0.49 seconds)

Track your package

Data provided by USPS



Tracking number 9505510391972138705415

Delivered ✓

May 20, 10:11AM

Woburn, MA

American Tower Corporation - Tower Operator/Owner

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Delivered

May 20, 12:48PM
North Haven, CT

Candid Associates LLC - Property Owner

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May 19, 2022

Jacqueline Hall
Project Manager, Site Development
American Tower Corporation
10 Presidential Way
Woburn, MA 01801

Re: Exempt Modification Application – AT&T Site 13682689
AT&T Mobility Telecommunications Facility @ 125 Washington Ave., North Haven, CT

Dear Ms. Hall:

New Cingular Wireless, PCS, LLC (dba AT&T) currently maintains antennas on a wireless telecommunications facility on an existing American Tower Corporation (ATC) telecommunications tower at the above referenced address. AT&T desires to modify its existing equipment as described in the attached Construction Drawings:

- Remove three (3) antennas, three (3) RRHs and six (6) TMAs;
- Install twelve (12) antennas, nine (9) RRHs, three (3) Y cables, One (1) DC-9 squid, one (1) fiber and three (3) DC trunks;
- Ground work includes decommissioning an UMTS BBU and diplexers, and the installation of three (3) RRUs, one (1) BB6630 and IDLe and one (1) fronthaul gateway.
- There are currently nine (9) AT&T antennas at one hundred twenty two (122) feet AGL. AT&T proposes a total of twelve (12) antennas at the 122 elevation and a second array consisting of six (6) antennas at the one hundred twelve (112) elevation AGL.

This letter is intended to serve as the required notice to the tower owner. As required by Regulations of Connecticut State Agencies (“RCSA”) 16-50j-73 the Connecticut Siting Council (“CSC”) has been notified of this proposal and will review this application. Please accept this letter as notification pursuant to RSCA 16-50j-73.

The enclosed letter and attachments to the CSC fully describe AT&T’s proposal for the site. However, if you have any questions or require any additional information concerning our plans or the CSC procedures, please contact me at 443-677-0144 or contact Melanie Bachmann, Acting Executive Director of the CSC at 860-972-2935.

Respectfully Submitted,

A handwritten signature in blue ink, appearing to read 'Jack Andrews', is written over the printed name and title.

Jack Andrews
Zoning Manager, Centerline Communications
10130 Donleigh Drive
Columbia, MD 21046
443-677-0144

Enclosures

Jack Andrews, Zoning Manager 10130 Donleigh Drive, Columbia, MD 21046 (443) 677-0144
Centerline Communications • 750 W Center Street, Suite 301, W Bridgewater, MA 02379



May 19, 2022

Candid Associates LLC
110 Washington Ave.
North Haven, CT 06473

Re: Exempt Modification Application – AT&T Site 13682689
AT&T Mobility Telecommunications Facility @ 125 Washington Ave., North Haven, CT

Dear Property Owner:

New Cingular Wireless, PCS, LLC (dba AT&T) currently maintains antennas on a wireless telecommunications facility on an existing American Tower Corporation (ATC) telecommunications tower at the above referenced address. AT&T desires to modify its existing equipment as described in the attached Construction Drawings:

- Remove three (3) antennas, three (3) RRHs and six (6) TMAs;
- Install twelve (12) antennas, nine (9) RRHs, three (3) Y cables, One (1) DC-9 squid, one (1) fiber and three (3) DC trunks;
- Ground work includes decommissioning an UMTS BBU and diplexers, and the installation of three (3) RRUs, one (1) BB6630 and IDLe and one (1) fronthaul gateway.
- There are currently nine (9) AT&T antennas at one hundred twenty two (122) feet AGL. AT&T proposes a total of twelve (12) antennas at the 122 elevation and a second array consisting of six (6) antennas at the one hundred twelve (112) elevation AGL.

This letter is intended to serve as the required notice to the property owner. As required by Regulations of Connecticut State Agencies (“RCSA”) 16-50j-73 the Connecticut Siting Council (“CSC”) has been notified of this proposal and will review this application. Please accept this letter as notification pursuant to RSCA 16-50j-73.

The enclosed letter and attachments to the CSC fully describe AT&T’s proposal for the site. However, if you have any questions or require any additional information concerning our plans or the CSC procedures, please contact me at 443-677-0144 or contact Melanie Bachmann, Acting Executive Director of the CSC at 860-972-2935.

Respectfully Submitted,

A handwritten signature in blue ink, appearing to read 'Jack Andrews', is written over a circular stamp or watermark.

Jack Andrews
Zoning Manager, Centerline Communications
10130 Donleigh Drive
Columbia, MD 21046
443-677-0144

Enclosures



May 19, 2022

The Honorable Michael J. Freda
Town of North Haven
18 Church St.
North Haven, CT 06473

Re: Exempt Modification Application – AT&T Site 13682689
AT&T Mobility Telecommunications Facility @ 125 Washington Ave., North Haven, CT

Dear First Selectman Freda:

New Cingular Wireless, PCS, LLC (dba AT&T) currently maintains antennas on a wireless telecommunications facility on an existing American Tower Corporation (ATC) telecommunications tower at the above referenced address. AT&T desires to modify its existing equipment as described in the attached Construction Drawings:

- Remove three (3) antennas, three (3) RRHs and six (6) TMAs;
- Install twelve (12) antennas, nine (9) RRHs, three (3) Y cables, One (1) DC-9 squid, one (1) fiber and three (3) DC trunks;
- Ground work includes decommissioning an UMTS BBU and diplexers, and the installation of three (3) RRUs, one (1) BB6630 and IDLe and one (1) fronthaul gateway.
- There are currently nine (9) AT&T antennas at one hundred twenty two (122) feet AGL. AT&T proposes a total of twelve (12) antennas at the 122 elevation and a second array consisting of six (6) antennas at the one hundred twelve (112) elevation AGL.

This letter is intended to serve as the required notice to the chief elected official of the municipality. As required by Regulations of Connecticut State Agencies (“RCSA”) 16-50j-73 the Connecticut Siting Council (“CSC”) has been notified of this proposal and will review this application. Please accept this letter as notification pursuant to RSCA 16-50j-73.

The enclosed letter and attachments to the CSC fully describe AT&T’s proposal for the site. However, if you have any questions or require any additional information concerning our plans or the CSC procedures, please contact me at 443-677-0144 or contact Melanie Bachmann, Acting Executive Director of the CSC at 860-972-2935.

Respectfully Submitted,

A handwritten signature in blue ink, appearing to read 'Jack Andrews', is written over the typed name.

Jack Andrews
Zoning Manager, Centerline Communications
10130 Donleigh Drive
Columbia, MD 21046
443-677-0144

Enclosures



May 19, 2022

Laura Magaraci, Zoning Enforcement Officer
Town of North Haven
18 Church St.
North Haven, CT 06473

Re: Exempt Modification Application – AT&T Site 13682689
AT&T Mobility Telecommunications Facility @ 125 Washington Ave., North Haven, CT

Dear Ms. Magaraci:

New Cingular Wireless, PCS, LLC (dba AT&T) currently maintains antennas on a wireless telecommunications facility on an existing American Tower Corporation (ATC) telecommunications tower at the above referenced address. AT&T desires to modify its existing equipment as described in the attached Construction Drawings:

- Remove three (3) antennas, three (3) RRHs and six (6) TMAs;
- Install twelve (12) antennas, nine (9) RRHs, three (3) Y cables, One (1) DC-9 squid, one (1) fiber and three (3) DC trunks;
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- There are currently nine (9) AT&T antennas at one hundred twenty two (122) feet AGL. AT&T proposes a total of twelve (12) antennas at the 122 elevation and a second array consisting of six (6) antennas at the one hundred twelve (112) elevation AGL.

This letter is intended to serve as the required notice to the municipal planning agency. As required by Regulations of Connecticut State Agencies ("RCSA") 16-50j-73 the Connecticut Siting Council ("CSC") has been notified of this proposal and will review this application. Please accept this letter as notification pursuant to RSCA 16-50j-73.

The enclosed letter and attachments to the CSC fully describe AT&T's proposal for the site. However, if you have any questions or require any additional information concerning our plans or the CSC procedures, please contact me at 443-677-0144 or contact Melanie Bachmann, Acting Executive Director of the CSC at 860-972-2935.

Respectfully Submitted,

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Jack Andrews
Zoning Manager, Centerline Communications
443-677-0144

Enclosures