STATE OF CONNECTICUT

CONNECTICUT SITING COUNCIL

Ten Franklin Square, New Britain, CT 06051
Phone: (860) 827-2935 Fax: (860) 827-2950
E-Mail: siting.council@ct.gov
www.ct.gov/csc

August 28, 2009

Thomas J. Regan, Esq.
Brown Rudnick LLP
CityPlace I, 185 Asylum Street
Hartford, CT 06103

RE: **EM-T-MOBILE-007-090731** – T-Mobile USA, Inc. (T-Mobile) notice of intent to modify an existing telecommunications facility located at 240 Kensington Road, Berlin, Connecticut.

Dear Attorney Regan:

The Connecticut Siting Council (Council) hereby acknowledges your notice to modify this existing telecommunications facility, pursuant to Section 16-50j-73 of the Regulations of Connecticut State Agencies with the following conditions:

- The feed lines shall be installed inside the pole if reasonably feasible;
- In the event that the feed lines must be installed outside of the pole, an updated structural analysis (and plans to reinforce if necessary) shall be submitted to the Council prior to such installation; and
- Not more than 45 days after completion of construction, the Council shall be notified that the feed lines were installed as specified.

The proposed modifications are to be implemented as specified here and in your notice dated July 31, 2009, including the placement of all necessary equipment and shelters within the tower compound. The modifications are in compliance with the exception criteria in Section 16-50j-72 (b) of the Regulations of Connecticut State Agencies as changes to an existing facility site that would not increase tower height, extend the boundaries of the tower site, increase noise levels at the tower site boundary by six decibels, and increase the total radio frequencies electromagnetic radiation power density measured at the tower site boundary to or above the standard adopted by the State Department of Environmental Protection pursuant to General Statutes § 22a-162. This facility has also been carefully modeled to ensure that radio frequency emissions are conservatively below State and federal standards applicable to the frequencies now used on this tower.

This decision is under the exclusive jurisdiction of the Council. Please be advised that the validity of this action shall expire one year from the date of this letter. Any additional change to this facility will require explicit notice to this agency pursuant to Regulations of Connecticut State Agencies Section 16-50j-73. Such notice shall include all relevant information regarding the proposed change with cumulative worst-case modeling of radio frequency exposure at the closest point of uncontrolled access to the tower base, consistent with Federal Communications Commission, Office of Engineering and Technology, Bulletin 65. Any deviation from this format may result in the Council implementing enforcement proceedings pursuant to General Statutes § 16-50u including, without limitation, imposition of expenses resulting from such failure and of civil penalties in an amount not less than one thousand dollars per day for each day of construction or operation in material violation.

Thank you for your attention and cooperation.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/MP/laf

c: The Honorable Adam P. Salina, Mayor, Town of Berlin
Denise McNair, Interim Town Manager, Town of Berlin
Hellyn Riggins, Town Planner, Town of Berlin

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CONNECTICUT SITING COUNCIL
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August 3, 2009

The Honorable Adam P. Salina
Mayor
Town of Berlin
240 Kensington Road
Kensington, CT 06037

RE: **EM-T-MOBILE-007-090731** – Omnipoint Communications, as subsidiary of T-Mobile USA, Inc. notice of intent to modify an existing telecommunications facility located at 240 Kensington Road, Berlin, Connecticut.

Dear Mayor Salina:

The Connecticut Siting Council (Council) received this request to modify an existing telecommunications facility, pursuant to Regulations of Connecticut State Agencies Section 16-50j-72.

If you have any questions or comments regarding this proposal, please call me or inform the Council by August 17, 2009.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/jb

Enclosure: Notice of Intent

c: Hellyn Riggins, Town Planner, Town of Berlin
Denise McNair, Interim Town Manager, Town of Berlin

CSC
CONNECTICUT SITING COUNCIL

BROWNRUDNICK

THOMAS J. REGAN
Direct Dial: (860) 509-6522
tregan@brownrudnick.com

CityPlace I
185 Asylum
Street
Hartford
Connecticut
06103
tel 860.509.6500
fax 860.509.6501

Via Hand Delivery

July 31, 2009

Daniel F. Caruso, Chairman
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

RE: T-Mobile USA, Inc - Exempt Modification

Dear Mr. Caruso:

On behalf of T-Mobile USA, Inc., enclosed for filing is an original and five (5) copies of a Notice to Make an Exempt Modification to an Existing Facility at 240 Kensington Road in Berlin.

I have also enclosed a sixth copy of the Notice which I would like to have date-stamped and returned to the courier delivering this package.

Also enclosed is a check in the amount of $500.00 to cover the filing fee. If you have any questions, please feel free to contact me.

Very truly yours,

BROWN RUDNICK BERLACK ISRAELS LLP

By: _____
Thomas J. Regan

TJR/bh
Enclosures

40262714 v1 - REGANTJ - 025064/0016

cc/encls: via 1st Class Mail:

The Honorable Adam P. Salina, Mayor
Town of Berlin
240 Kensington Road
Berlin, CT 06037

EM-T-MOBILE-007-090731

CONNECTICUT SITING COUNCIL

In re:

T-Mobile USA, Inc. Notice to Make an Exempt Modification to an Existing Facility at 240 Kensington Road, Berlin, Connecticut.	:	**EXEMPT MODIFICATION NO. _____**
	:	
	:	July 31, 2009

ORIGINAL

NOTICE OF EXEMPT MODIFICATION

Pursuant to Conn. Agencies Regs. §§ 16-50j-73 and 16-50j-72(b), T-Mobile USA, Inc. ("T-Mobile") hereby gives notice to the Connecticut Siting Council ("Council") and the Town of Berlin of T-Mobile's intent to make an exempt modification to an existing monopole tower (the "Tower") located at 240 Kensington Road in Berlin, Connecticut. Specifically, T-Mobile plans to upgrade its wireless system in Connecticut by implementing its Universal Mobile Telecommunications System ("UMTS"). UMTS is a third-generation ("3G") technology that utilizes a code division multiple access ("CDMA") base to allow for fast and large data transfers. To accomplish this upgrade, T-Mobile must modify its antenna and equipment configurations at many of its existing sites.

Once the UMTS upgrade is complete, T-Mobile will operate on a more unified communication system, allowing international wireless telephones to function world-wide. Furthermore, UMTS will enhance Global Positioning System ("GPS") navigation capabilities and provide emergency responders with more advanced tracking capabilities. The proposed UMTS technology is compatible with the existing second-generation ("2G") Global System for Mobile Communication ("GSM") currently on the Tower and the

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HARTFORD, CT 06103
(860) 509-6500

proposed upgrade is expected to enhance the existing 2G system. At this site T-Mobile proposes to add UMTS technology and install associated equipment at the base of the Tower.

Under the Council's regulations (Conn. Agencies Regs. § 16-50j-72(b)), T-Mobile's plans do not constitute a modification subject to the Council's review because T-Mobile will not change the height of the Tower, will not extend the boundaries of the compound, will not increase the noise levels at the site, and will not increase the total radio frequency electromagnetic radiation power density at the site to levels above applicable standards.

The Tower is a 190-foot monopole tower located at 240 Kensington Road in Berlin Connecticut (41.6262, -72.7756). There are multiple carriers located on the Tower. The Tower is owned by the Town of Berlin. Currently, T-Mobile has 6 antennas and 6 Tower Mounted Amplifiers ("TMA") located on the Tower with a centerline of 180 feet. A site plan with Tower specifications is attached.

T-Mobile plans to add 3 UMTS antennas and 3 UMTS Twin TMA to the Tower. The proposed antennas and TMA will have the same centerline as the existing antennas and TMA – 180 feet. To confirm the Tower can support these changes, T-Mobile commissioned Armor Tower to perform a structural analysis of the Tower (attached). According to the structural analysis, dated July 27, 2009, the Tower was found "... to be adequate ... to support the proposed loading" (Page 1, Structural Analysis).

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(860) 509-6500

In addition, T-Mobile plans to run 6, 1-5/8 inch coax cables inside the Tower. T-Mobile plans to install the UMTS equipment cabinet on its existing 21-foot by 32-foot (approximately) concrete pad. Hence, no increase in the size of the concrete pad is necessary. T-Mobile plans to install power and telephone wiring to run inside the existing underground conduit to the proposed UMTS equipment cabinet.

Therefore, excluding brief, minor, construction-related noise during the addition of the antennas and the installation of the equipment cabinet, T-Mobile's changes to the Tower will not increase noise levels at the site.

The proposed antennas and TMA will not adversely impact the health and safety of the surrounding community or the people working on the Tower. The total radio frequency exposure measured around the Tower will be below the National Council on Radiation Protection and Measurements' ("NCRP") standard adopted by the Federal Communications Commission ("FCC"). The worst-case power density analysis measured at the base of the Tower indicates that T-Mobile's antennas will emit 2.53% of the NCRP's standard for maximum permissible exposure. A cumulative power density analysis indicates that together, all of the antennas on the Tower will emit only 87.46 % of the NCRP's standard for maximum permissible exposure. Therefore, the power density levels will be below the FCC mandated radio frequency exposure limits in all locations around the Tower, even with extremely conservative assumptions. The power density analysis is attached.

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In conclusion, T-Mobile's proposed plan to add antennas and TMA at this site does not constitute a modification subject to the Council's jurisdiction because T-Mobile will not increase the height of the Tower, will not extend the boundaries of the site, will not increase the noise levels at the site, and the total radio frequency electromagnetic radiation power density will stay within all applicable standards. *See* Conn. Agencies Regs. § 16-50j-72.

T-Mobile USA, Inc.

By: _____

Thomas J. Regan
Brown Rudnick LLP
185 Asylum Street, CityPlace I
Hartford, CT 06103-3402
Email - tregan@brownrudnick.com
Phone - 860.509.6522
Fax - 860.509.6622

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(860) 509-6500

Certificate of Service

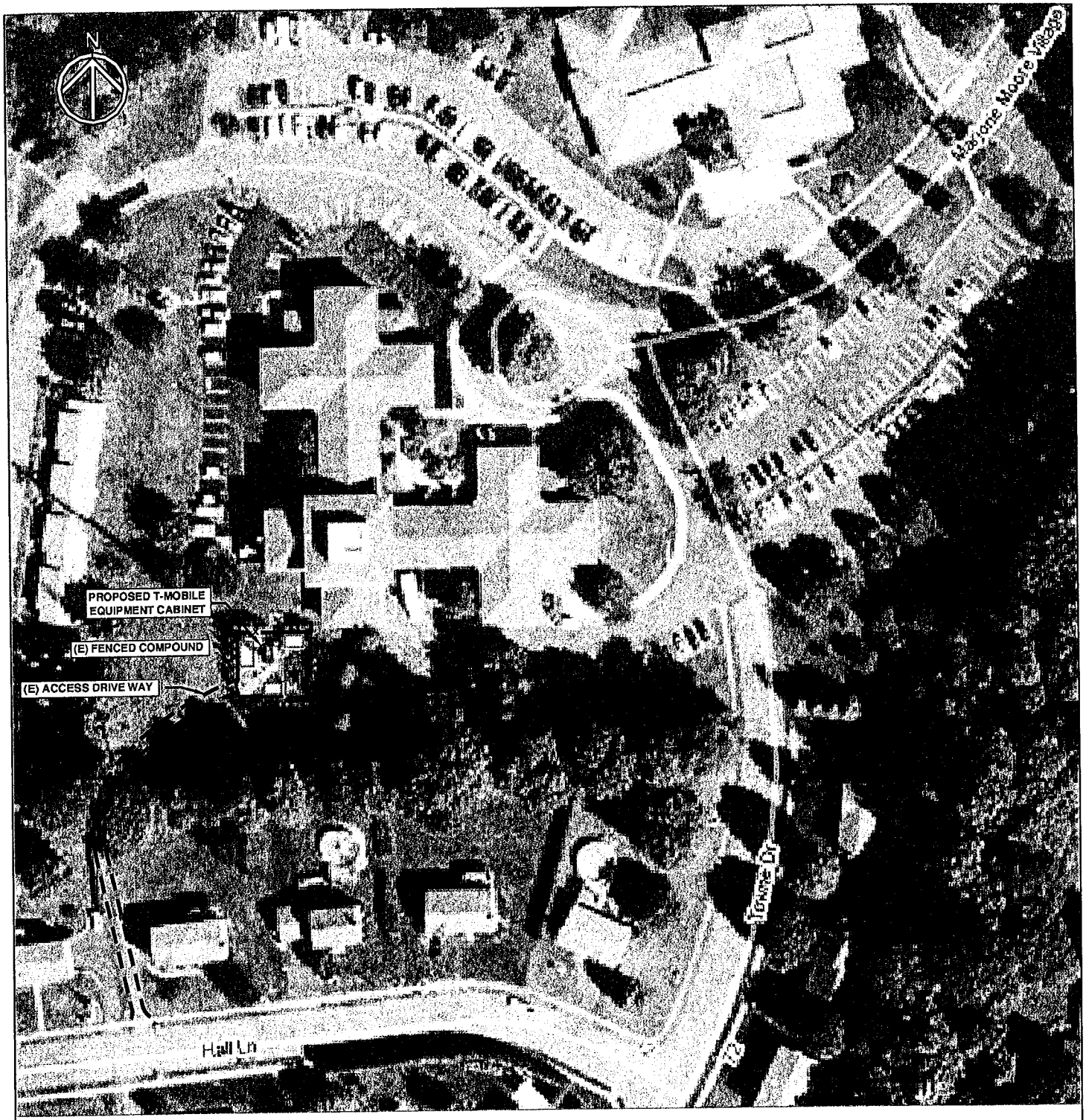
This is to certify that on this 31st day of July, 2009, the foregoing Notice of Exempt Modification was sent, via first class mail, to the following:

Town of Berlin
Mayor Adam P. Salina
240 Kensington Road
Berlin, CT 06037

By: _____
Thomas J. Regan

40262711 v1 - 025064/0016

BROWN RUDNICK LLP
CITYPLACE I
185 ASYLUM STREET
HARTFORD, CT 06103
(860) 509-6500



ALL EQUIPMENT LOCATIONS ARE APPROXIMATE AND ARE SUBJECT TO APPROVAL BY LESSEE/LICENSEE'S STRUCTURAL & RF ENGINEERS. LOCATIONS OF POWER & TELEPHONE FACILITIES ARE SUBJECT TO APPROVAL BY UTILITY COMPANIES.

OVERALL SITE PLAN

N.T.S.

TRANSCEND WIRELESS, LLC
10 INDUSTRIAL AVE.
MAHWAH, NJ 07430
OFFICE: (201) 684-0055
FAX:(201) 684-0066

FOR

OMNIPOINT COMMUNICATIONS, INC. DBA T-MOBILE USA, INC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 692-7100
FAX:(860) 692-7159

ATLANTIS GROUP
15 Cypress St., Suite 300
Newton Centre, MA 02459
Office: 617-965-0789
Fax: 617-663-6032

DRAWING TITLE:	OVERALL SITE PLAN
SITE NAME:	NEWINGTON 1
SITE NUMBER:	CT11004B
ADDRESS:	240 KENSINGTON ROAD BERLIN, CT 06037

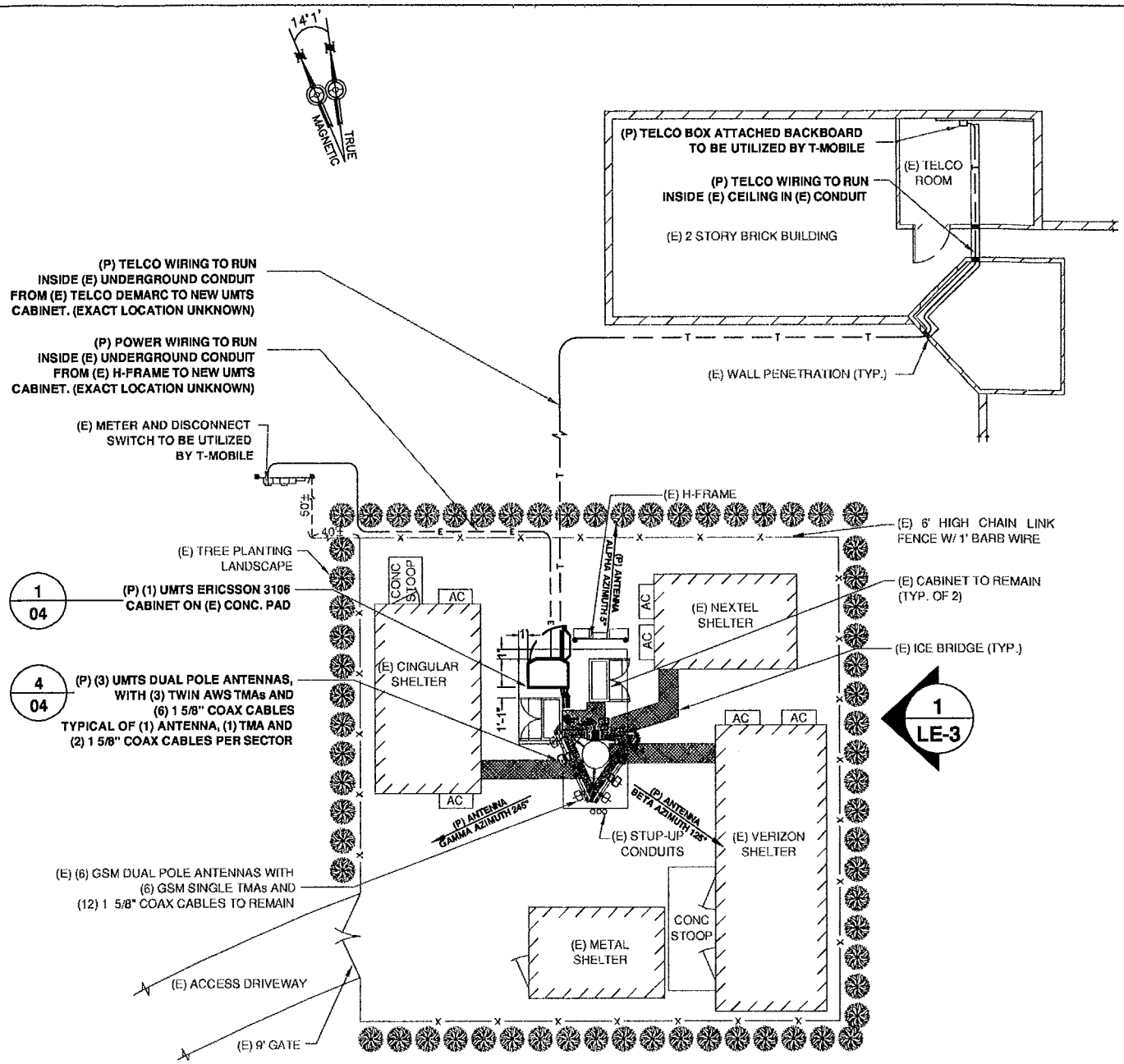
REVISION	DATE
3: REVISED	07-31-09
2: REVISED	07-28-09
1: FINAL LE	03-13-09
0: REVIEW	01-21-09

DRAWN BY	S.B.
APPROVED/CHECKED BY	S.M.
DRAWING NO:	LE-1

APPROVALS

Site Owner	Date
Construction Manager	Date
RF Engineer	Date
Site Acquisition	Date

The above parties hereby approve and accept these documents and authorize the contractor to proceed with the construction described herein, all construction documents are subject to review by the local building department and any changes or modifications they may impose.



SITE PLAN

SCALE: 1/16" = 1'-0"

16 0 16 32 48

ALL EQUIPMENT LOCATIONS ARE APPROXIMATE AND ARE SUBJECT TO APPROVAL BY LESSEE/LICENSEE'S STRUCTURAL & RF ENGINEERS. LOCATIONS OF POWER & TELEPHONE FACILITIES ARE SUBJECT TO APPROVAL BY UTILITY COMPANIES.

TRANSCEND WIRELESS, LLC
10 INDUSTRIAL AVE.
MAHWAH, NJ 07430
OFFICE: (201) 684-0055
FAX:(201) 684-0066

FOR

OMNIPOINT COMMUNICATIONS, INC. DBA T-MOBILE USA, INC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 692-7100
FAX:(860) 692-7159

ATLANTIS GROUP
15 Cypress St., Suite 300
Newton Centre, MA 02459
Office: 617-965-0769
Fax: 617-663-6032

DRAWING TITLE:	SITE PLAN
SITE NAME:	NEWINGTON 1
SITE NUMBER:	CT11004B
ADDRESS:	240 KENSINGTON ROAD BERLIN, CT 06037

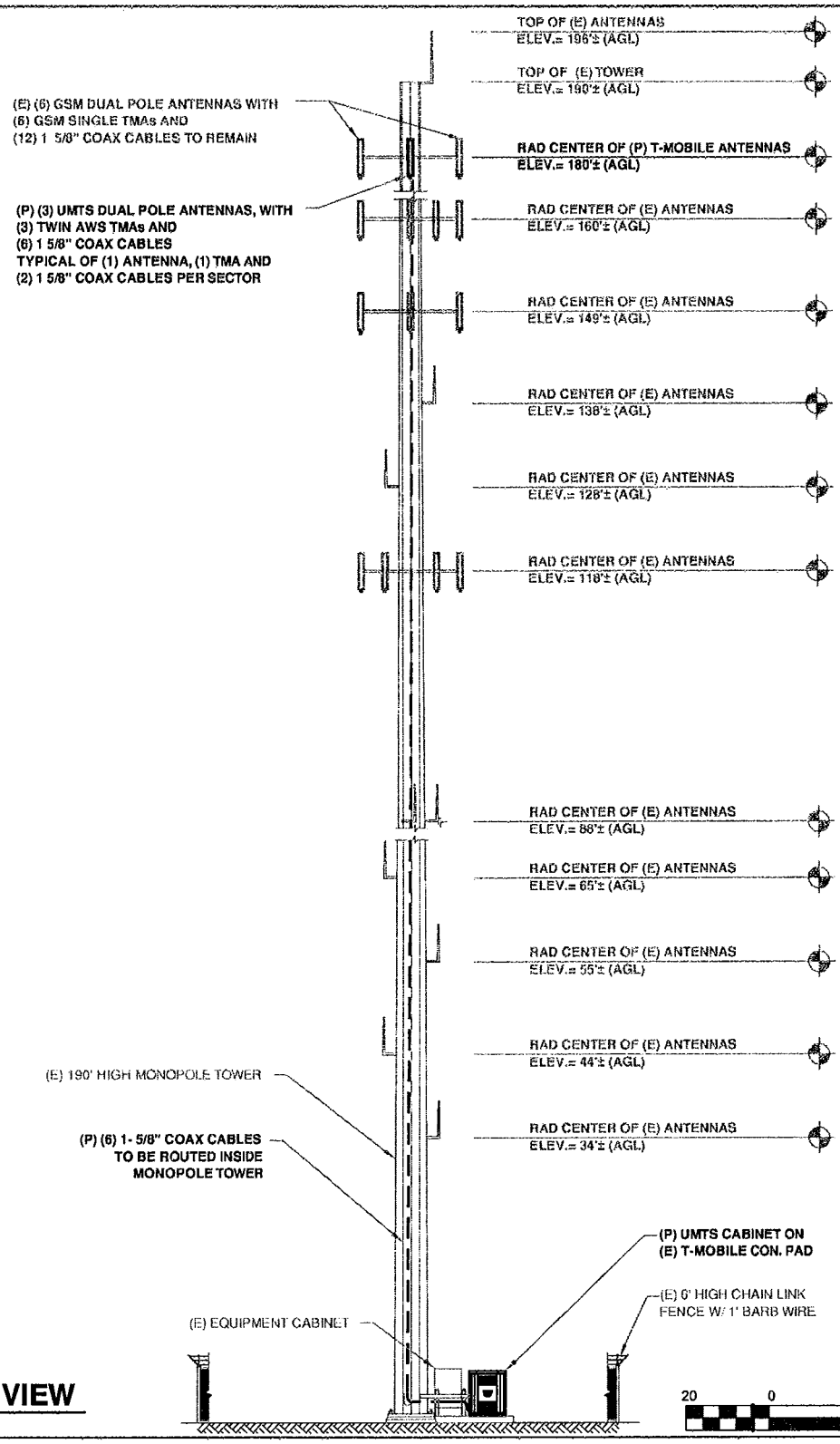
REVISION	DATE
3: REVISED	07-31-09
2: REVISED	07-28-09
1: FINAL LE	03-13-09
0: REVIEW	01-21-09

DRAWN BY	S.B.
APPROVED/CHECKED BY	S.M.
DRAWING NO:	LE-2

APPROVALS

Site Owner	Date
Construction Manager	Date
RF Engineer	Date
Site Acquisition	Date

The above parties hereby approve and accept these documents and authorize the contractor to proceed with the construction described herein, all construction documents are subject to review by the local building department and any changes or modifications they may impose.



EAST ELEVATION VIEW

SCALE: 1" = 20'-0"

TRANSCEND WIRELESS, LLC
10 INDUSTRIAL AVE.
MAHWAH, NJ 07430
OFFICE: (201) 684-0055
FAX:(201) 684-0066

FOR

OMNIPOINT COMMUNICATIONS, INC.
DBA T-MOBILE USA, INC
35 GRIFFIN ROAD SOUTH
BLOOMFIELD, CT 06002
OFFICE: (860) 692-7100
FAX:(860) 692-7159

ATLANTIS GROUP
15 Cypress St., Suite 300
Newton Centre, MA 02459
Office: 617-965-0789
Fax: 617-663-6032

DRAWING TITLE:	ELEVATION VIEW
SITE NAME:	NEWINGTON 1
SITE NUMBER:	CT11004B
ADDRESS:	240 KENSINGTON ROAD BERLIN, CT 06037

REVISION	DATE
3: REVISED	07-31-09
2: REVISED	07-28-09
1: FINAL LE	03-13-09
0: REVIEW	01-21-09

DRAWN BY	S.B.
APPROVED/CHECKED BY	S.M.
DRAWING NO:	LE-3

APPROVALS

Site Owner	Date
Construction Manager	Date
RF Engineer	Date
Site Acquisition	Date

The above parties hereby approve and accept these documents and authorize the contractor to proceed with the construction described herein, all construction documents are subject to review by the local building department and any changes or modifications they may impose.

T-Mobile

T-Mobile USA Inc.
35 Griffin Rd South, Bloomfield, CT 06002-1853
Phone: (860) 692-7100
Fax: (860) 692-7159

Technical Memo

To: Transcend
From: Farid Marbouh - Radio Frequency Engineer
cc: Jason Overbey
Subject: Power Density Report for CT11004B
Date: July 30, 2009

1. Introduction:

This report is the result of an Electromagnetic Field Intensities (EMF - Power Densities) study for the T-Mobile antenna installation on a Monopole at 240 Kensington Road, Berlin, CT. This study incorporates the most conservative consideration for determining the practical combined worst case power density levels that would be theoretically encountered from locations surrounding the transmitting location.

2. Discussion:

The following assumptions were used in the calculations:

1) The emissions from T-Mobile transmitters are in the (1935-1944.8), (2140-2145), (2110-2120)MHz frequency Band.
2) The antenna array consists of three sectors, with 3 antennas per sector.
3) The model number for GSM antenna is RR90-17-02DP.
3) The model number for UMTS antenna is APXV18-206516.
4) GSM antenna center line height is 180 ft.
4) UMTS antenna center line height is 180 ft.
5) The maximum transmit power from any GSM sector is 1530.66 Watts Effective Radiated Power (EiRP) assuming 8 channels per sector.
5) The maximum transmit power from any UMTS sector is 1967.21 Watts Effective Radiated Power (EiRP) assuming 2 channels per sector.
6) All the antennas are simultaneously transmitting and receiving, 24 hours a day.
7) Power levels emitting from the antennas are increased by a factor of 2.56 to account for possible in-phase reflections from the surrounding environment. This is rarely the case, and if so, is never continuous.
8) The average ground level of the studied area does not change significantly with respect to the transmitting location.

Equations given in "FCC OET Bulletin 65, Edition 97-01" were then used with the above information to perform the calculations.

3. Conclusion:

Based on the above worst case assumptions, the power density calculation from the T-Mobile antenna installation on a Monopole at 240 Kensington Road, Berlin, CT, is 0.02535 mW/cm^2. This value represents 2.535% of the Maximum Permissible Exposure (MPE) standard of 1 milliwatt per square centimeter (mW/cm^2) set forth in the FCC/ANSI/IEEE C95.1-1991. Furthermore, the proposed antenna location for T-Mobile will not interfere with existing public safety communications, AM or FM radio broadcasts, TV, Police Communications, HAM Radio communications or any other signals in the area.
The combined Power Density from other carriers is 84.93%. The combined Power Density for the site is 87.465% of the M.P.E. standard.

Connecticut Market

T-Mobile

Worst Case Power Density

Site:	**CT11004B**
Site Address:	**240 Kensington Road**
Town:	**Berlin**
Tower Height:	**190 ft.**
Tower Style:	**Monopole**

GSM Data		**UMTS Data**	
Base Station TX output	20 W	**Base Station TX output**	40 W
Number of channels	8	**Number of channels**	2
Antenna Model	RR90-17-02DP	**Antenna Model**	APXV18-206516
Cable Size	1 5/8 in.	**Cable Size**	1 5/8 in.
Cable Length	189 ft.	**Cable Length**	189 ft.
Antenna Height	180.0 ft.	**Antenna Height**	180.0 ft.
Ground Reflection	1.6	**Ground Reflection**	1.6
Frequency	1945.0 MHz	**Frequency**	2.1 GHz
Jumper & Connector loss	4.50 dB	**Jumper & Connector loss**	1.50 dB
Antenna Gain	16.5 dBi	**Antenna Gain**	17.6 dBi
Cable Loss per foot	0.0116 dB	**Cable Loss per foot**	0.0116 dB
Total Cable Loss	2.1924 dB	**Total Cable Loss**	2.1924 dB
Total Attenuation	6.6924 dB	**Total Attenuation**	3.6924 dB
Total EIRP per Channel	52.82 dBm	**Total EIRP per Channel**	59.93 dBm
(In Watts)	191.33 W	**(In Watts)**	983.60 W
Total EIRP per Sector	61.85 dBm	**Total EIRP per Sector**	62.94 dBm
(In Watts)	1530.66 W	**(In Watts)**	1967.21 W
nsg	9.8076	**nsg**	13.9076
Power Density (S) =	**0.011092 mW/cm^2**	**Power Density (S) =**	**0.014255 mW/cm^2**
T-Mobile Worst Case % MPE =		**2.5347%**	

Equation Used :

$$S = \frac{(1000)(grf)^2 (Power) * 10^{(nsg/10)}}{4\pi (R)^2}$$

Office of Engineering and Technology (OET) Bulletin 65, Edition 97-01, August 1997

Co-Location Total

Carrier	**% of Standard**
Verizon	9.2700 %
Cingular	9.3000 %
Sprint	
AT&T Wireless	
Nextel	4.2400 %
MetroPCS	
Pocket	6.0600 %
Other Antenna Systems	56.0600 %
Total Excluding T-Mobile	**84.9300 %**
T-Mobile	2.5347
Total % MPE for Site	**87.4647%**

ARMOR TOWER

Re-Analysis of 190 ft Monopole Tower

Site Number: CT11004B

Site Name: Newington
County: Hartford
Location: 240 Kensington Rd, Berlin, CT

Checked By:

Derek Hartzell
Structural Engineer

ATLANTIS GROUP
15 Cypress Street
Suite 300
Newton Centre, MA 02459

July 2009

ARMOR TOWER

July 27, 2009

Mr. Hans Fiedler
T-Mobile USA
35 Griffin Road South
Bloomfield, CT 06002

RE: T-Mobile – CT11004B – Newington
240 Kensington Rd, Berlin, CT

Hans,

We have completed the structural analysis of the subject tower and **have found it to be adequate within the scope of this analysis to support the proposed antenna loading**. The tower was analyzed according to the requirements of EIA 222-F standard for Hartford County, CT for 80 mph (fastest mile) wind speed with no ice and 69 mph wind with ½" ice.

The tower we analyzed is a 190' PiRod Monopole consisting of stepped pole sections with bolted flanges. Tower diameters range from 1'-6" at the top to 5'-0" at the base. Foundation details were obtained from the PiRod design calculation and drawings.

The antenna loading used in the analysis consisted of all existing antennas and transmission lines with the exception of the following:

- Add (3) RFS APX18-206516S-C-A20 (50.15 lbs ea), (3) Twin AWS TMAs (13 lbs ea.), (6) 1-5/8" coax @ 180' for T-Mobile on an existing platform.

Proposed feed lines were assumed to be located inside the pole.

The results of the analysis showed all tower elements loaded within their allowable stresses. The maximum tower loading is 99.9% of its allowable stress. The proposed feed lines will likely fit inside the pole, however this must be field verified. It is likely that new ports will be required for the additional feed lines.

We appreciate the opportunity to provide our services to Atlantis Group and T-Mobile and if you have any questions concerning this analysis, please contact us.

Sincerely,

ARMOR TOWER, INC.

Jeff Triezenberg, P.E.
Structural Engineer

1 North Main Street, Ste 312 Cortland, NY 13045 607.591.5381 Fax: 866.870.0840 www.armortower.com

PRIMARY ASSUMPTIONS USED IN THE ANALYSIS

1. Allowable steel stresses are defined by AISC-ASD 9th Edition and all welds conform to AWS D1.1 specifications.

2. Armor Tower has been commissioned to analyze this tower according to the requirements of TIA/EIA 222-F for Hartford County, CT. Per this code, a basic wind speed of 80 mph (fastest-mile) without ice and 69 mph with ½" ice has been considered. It is the client's responsibility to check with local authorities or the tower owner if a greater wind or ice loading is required to be considered in the analysis. Note that Section 3108.4 of the International Building Code states that "Towers shall be designed to resist wind loads according to TIA/EIA-222."

3. The acceptability of the analyzed antenna loading is the responsibility of Atlantis Group and its affiliates to confirm with the respective carriers or tower owner.

4. Any deviation from the analyzed antenna loading will require a re-analysis of the tower for verification of structural integrity. Proposed feed lines were assumed to be routed inside the pole.

5. This analysis assumes all tower members galvanized adequately to prevent corrosion of the steel and that all tower members are in "like new" condition with no physical deterioration. This analysis also assumes the tower has been maintained properly per TIA/EIA-222-F Annex E recommended inspection and maintenance procedures for tower owners and is in a plumb condition.

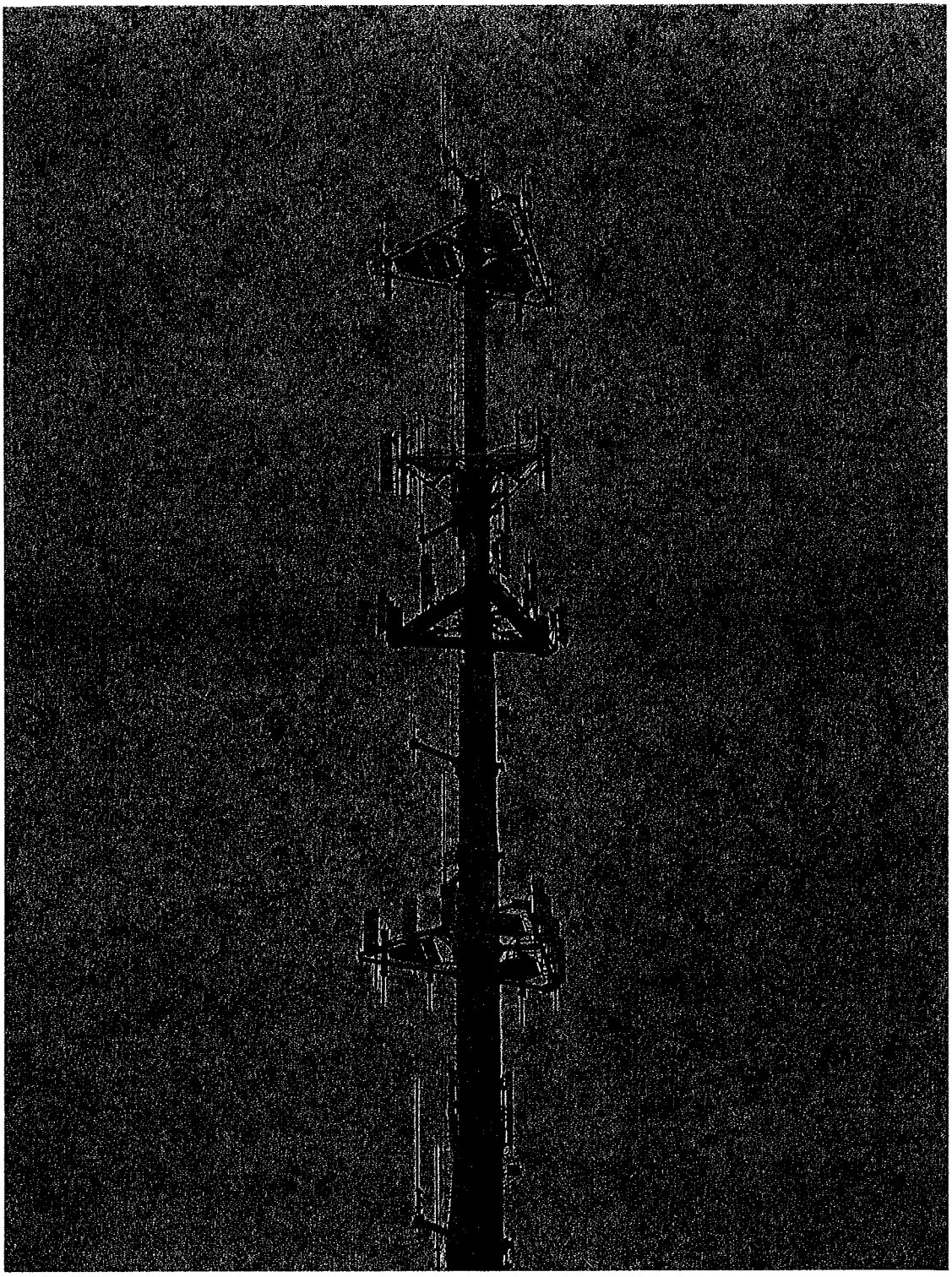
6. No accounting for residual stresses due to incorrect tower erection can be made. This analysis assumes all bolts are appropriately tightened providing necessary connection continuity and that the installation of the tower was performed by a qualified tower erector.

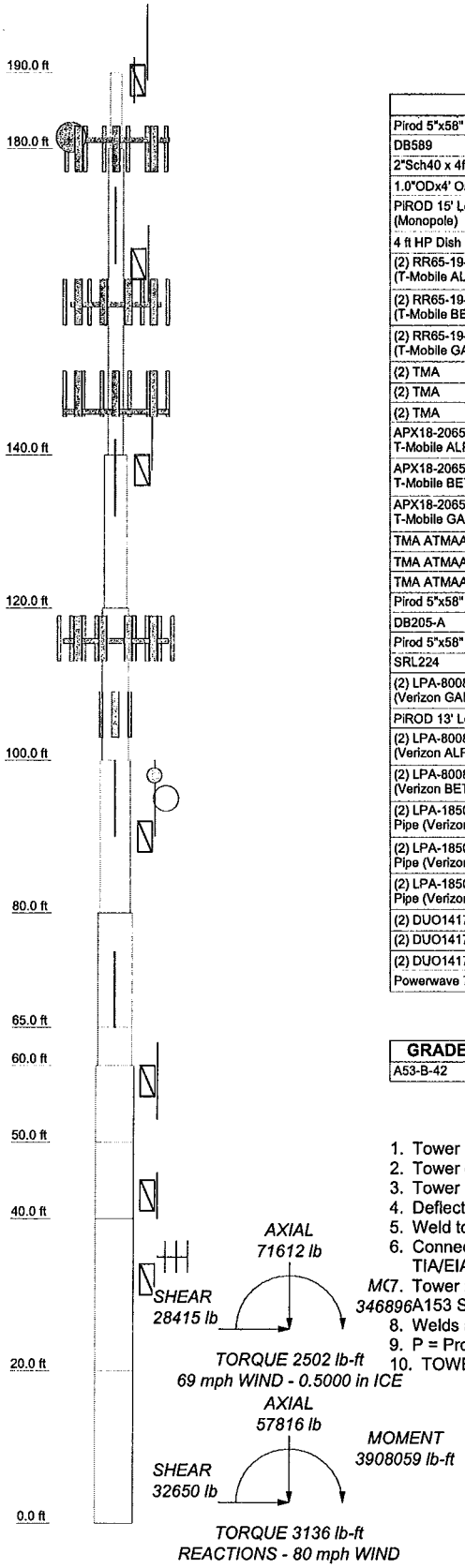
7. Foundation capacities are based on foundation details and soil parameters from the PiRod design calculations dated February 1999. It is assumed the tower and its foundations were built according to the design drawings.

8. No conclusions, expressed or implied, shall indicate that Armor Tower has made an evaluation of the original design, materials, fabrication, or potential erection deficiencies. Any information contrary to that assumed for the purpose of preparing this analysis could alter the findings and conclusions as stated.

9. Tower member sizes and geometry are based on PiRod tower drawings and tower calculations dated February 1999. Existing antenna loading are based on a tower analysis by Natcomm dated October 2008. Armor Tower has made no attempt to verify the accuracy of this information.

10. The investigation of the load-carrying capacities of the antenna supporting frames/mounts is outside the scope of this analysis. We recommend that material of adequate size and strength be utilized for this purpose.





DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Pirod 5"x58" Standoff	189	Powerwave 7770.00 w. MtgPipe (att)	148
DB589	189	Powerwave 7770.00 w. MtgPipe (att)	148
2"Sch40 x 4ft	189	(2) TMA (att)	148
1.0"ODx4' Omni	189	(2) TMA (att)	148
PiROD 15' Low Profile Platform (Monopole)	181.5	(2) TMA (att)	148
		Diplexer - Crossband Coupler (att)	148
4 ft HP Dish	181.5	Diplexer - Crossband Coupler (att)	148
(2) RR65-19-00DP w/Mount Pipe (T-Mobile ALPHA)	180	Diplexer - Crossband Coupler (att)	148
(2) RR65-19-00DP w/Mount Pipe (T-Mobile BETA)	180	PiROD 15' Low Profile Platform (Monopole)	146
(2) RR65-19-00DP w/Mount Pipe (T-Mobile GAMMA)	180	Pirod 5"x58" Standoff	138
(2) TMA	180	SRL233	138
(2) TMA	180	Pirod 5"x58" Standoff	132
(2) TMA	180	DB205-A	132
APX18-206516S-C-A20 w. Pipe (P T-Mobile ALPHA)	180	(4) 844G90VTA-SX w/Mount Pipe (Sprint)	116
APX18-206516S-C-A20 w. Pipe (P T-Mobile BETA)	180	(4) 844G90VTA-SX w/Mount Pipe (Sprint)	116
APX18-206516S-C-A20 w. Pipe (P T-Mobile GAMMA)	180	PiROD 15' Low Profile Platform (Monopole)	116
TMA ATMAA1412D-1A20 (P T-Mobile)	180	(4) 844G90VTA-SX w/Mount Pipe (Sprint)	116
TMA ATMAA1412D-1A20 (P T-Mobile)	180	Kathrein 742 213 w. Mtg Pipe (Pocket PCS)	106
TMA ATMAA1412D-1A20 (P T-Mobile)	180	Kathrein 742 213 w. Mtg Pipe (Pocket PCS)	106
Pirod 5"x58" Standoff	165	Kathrein 742 213 w. Mtg Pipe (Pocket PCS)	106
DB205-A	165	2 ft Grid Dish	98
Pirod 5"x58" Standoff	165	Pirod 5"x58" Standoff	90
SRL224	165	DB205-A	90
(2) LPA-80080/6CF w/Mount Pipe (Verizon GAMMA)	160	Pirod 5"x58" Standoff	90
PiROD 13' Low Profile Platform	160	DB205-A	90
(2) LPA-80080/6CF w/Mount Pipe (Verizon ALPHA)	160	2.5" Tube x 2' Standoff	87
(2) LPA-80080/6CF w/Mount Pipe (Verizon BETA)	160	GPS	87
(2) LPA-185080/12CF w/84"Mount Pipe (Verizon ALPHA)	160	2.5" Tube x 2' Standoff	87
(2) LPA-185080/12CF w/84"Mount Pipe (Verizon ALPHA)	160	GPS	87
(2) LPA-185080/12CF w/84"Mount Pipe (Verizon ALPHA)	160	Pirod 5"x58" Standoff	70
(2) DUO1417-8686 w/Mount Pipe (att)	148	SRL233	70
(2) DUO1417-8686 w/Mount Pipe (att)	148	Pirod 5"x58" Standoff	58
(2) DUO1417-8686 w/Mount Pipe (att)	148	DB583	58
Powerwave 7770.00 w. MtgPipe (att)	148	Pirod 5"x58" Standoff	43
		3"ODx5' Omni	43
		MYA4505	35
		Pirod 5"x58" Standoff	32

MATERIAL STRENGTH

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

TOWER DESIGN NOTES

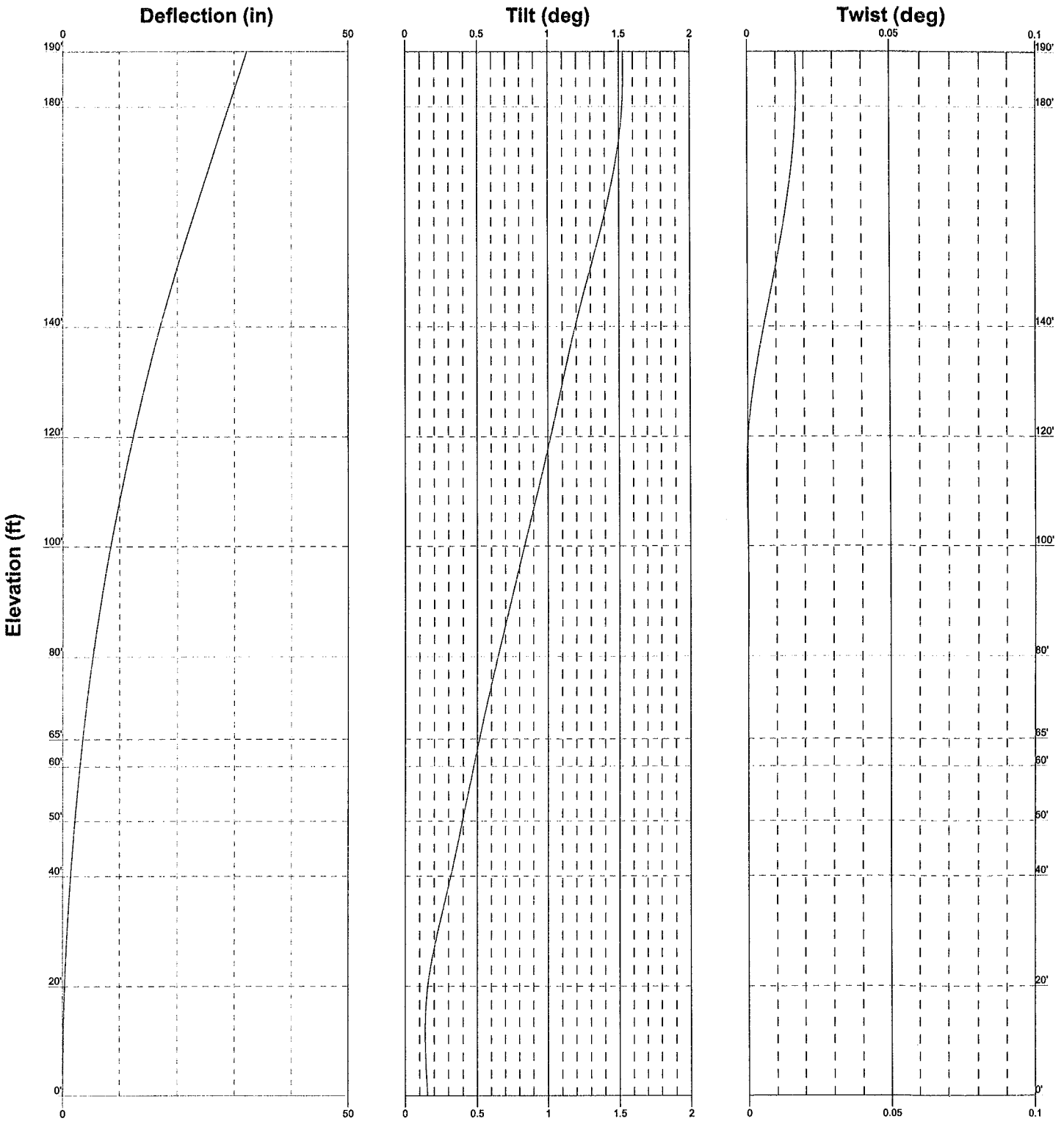
1. Tower is located in Hartford County, Connecticut.
2. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
3. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
4. Deflections are based upon a 50 mph wind.
5. Weld together tower sections have flange connections.
6. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
7. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
8. Welds are fabricated with ER-70S-6 electrodes.
9. P = Proposed
10. TOWER RATING: 99.9%

MC 346896

ARMOR TOWER	*Armor Tower* 1 North Main St Cortland, NY Phone: 607-591-5381 FAX: 866-870-0840	Job: ***190' Monopole Analysis***	
		Project: ***T-Mobile CT11004B Newington 1, Berlin, C***	
		Client: Atlantis Group	Drawn by: JT / App'd:
		Code: TIA/EIA-222-F	Date: 07/27/09 / Scale: NTS
		Path: Z:\Atlantis Group\T-Mobile\CT11004B\RISA\190' M.eri	Dwg No. E-1

TIA/EIA-222-F - Service - 50 mph

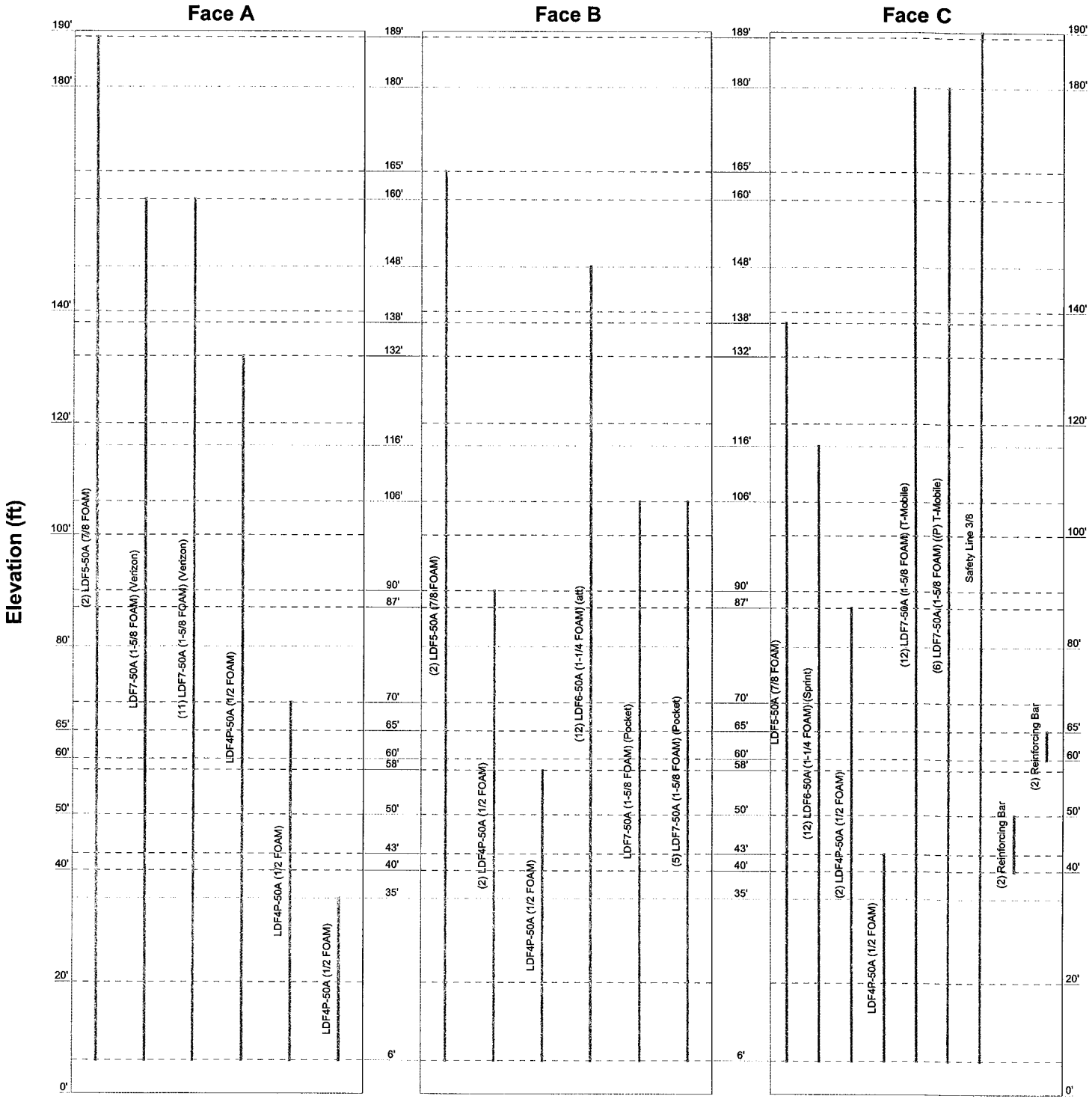
Maximum Values



ARMOR TOWER	*Armor Tower* 1 North Main St Cortland, NY Phone: 607-591-5381 FAX: 866-870-0840	Job: ***190' Monopole Analysis***	
		Project: ***T-Mobile CT11004B Newington 1, Berlin, C***	
		Client: Atlantis Group	Drawn by: JT / App'd:
		Code: TIA/EIA-222-F	Date: 07/27/09 / Scale: NTS
		Path: Z:\Atlantis Group\T-Mobile\CT11004B\RISA\190' M.eri	Dwg No. E-5

Feedline Distribution Chart
0' - 190'

Round Flat App In Face App Out Face Truss Leg



ARMOR TOWER
Armor Tower
1 North Main St
Cortland, NY
Phone: 607-591-5381
FAX: 866-870-0840

Job: ***190' Monopole Analysis***			
Project: ***T-Mobile CT11004B Newington 1, Berlin, C***			
Client: Atlantis Group	Drawn by: JT	App'd:	
Code: TIA/EIA-222-F	Date: 07/27/09	Scale: NTS	
Path: Z:\Atlantis Group\T-Mobile\CT11004B\RISA\190' M.eri		Dwg No. E-7	

ARMOR TOWER	Job	Page
	190' Monopole Analysis	1 of 7
Armor Tower *1 North Main St* *Cortland, NY* *Phone: 607-591-5381* *FAX: 866-870-0840*	**Project** T-Mobile CT11004B Newington 1, Berlin, CT	**Date** 12:10:31 07/27/09
	Client Atlantis Group	**Designed by** JT

Force Totals

Load Case	*Vertical Forces* lb	*Sum of Forces X* lb	*Sum of Forces Z* lb	*Sum of Overturning Moments, M_x* lb-ft	*Sum of Overturning Moments, M_z* lb-ft	*Sum of Torques* lb-ft
Leg Weight	40246.33					
Bracing Weight	0.00					
Total Member Self-Weight	40246.33			-1001.41	-4709.63	
Total Weight	57815.88			-1001.41	-4709.63	
Wind 0 deg - No Ice		265.08	-32438.64	-3776951.58	-34667.19	-789.40
Wind 30 deg - No Ice		16411.36	-28225.23	-3286048.96	-1913489.85	891.87
Wind 60 deg - No Ice		28160.23	-16448.89	-1914920.50	-3280856.40	2334.16
Wind 90 deg - No Ice		32363.59	-265.08	-30958.97	-3770382.06	3151.02
Wind 120 deg - No Ice		27895.15	15989.75	1861029.67	-3250898.84	3123.56
Wind 150 deg - No Ice		15952.23	27960.14	3254088.59	-1861601.83	2259.15
Wind 180 deg - No Ice		-265.08	32438.64	3774948.77	25247.94	789.40
Wind 210 deg - No Ice		-16411.36	28225.23	3284046.15	1904070.60	-891.87
Wind 240 deg - No Ice		-28160.23	16448.89	1912917.69	3271437.15	-2334.16
Wind 270 deg - No Ice		-32363.59	265.08	28956.15	3760962.81	-3151.02
Wind 300 deg - No Ice		-27895.15	-15989.75	-1863032.49	3241479.58	-3123.56
Wind 330 deg - No Ice		-15952.23	-27960.14	-3256091.40	1852182.58	-2259.15
Member Ice	5152.65					
Total Weight Ice	71612.01			-5046.71	-7225.90	
Wind 0 deg - Ice		223.37	-28237.76	-3321576.67	-32487.70	730.24
Wind 30 deg - Ice		14280.20	-24566.30	-2889876.81	-1682989.26	1832.36
Wind 60 deg - Ice		24510.66	-14312.32	-1685189.05	-2884471.38	2443.51
Wind 90 deg - Ice		28173.51	-223.37	-30308.51	-3314997.90	2399.92
Wind 120 deg - Ice		24287.29	13925.44	1631340.90	-2859209.58	1713.28
Wind 150 deg - Ice		13893.31	24342.93	2854521.59	-1639234.53	567.56
Wind 180 deg - Ice		-223.37	28237.76	3311483.25	18035.91	-730.24
Wind 210 deg - Ice		-14280.20	24566.30	2879783.39	1668537.47	-1832.36
Wind 240 deg - Ice		-24510.66	14312.32	1675095.64	2870019.59	-2443.51
Wind 270 deg - Ice		-28173.51	223.37	20215.10	3300546.11	-2399.92
Wind 300 deg - Ice		-24287.29	-13925.44	-1641434.32	2844757.79	-1713.28
Wind 330 deg - Ice		-13893.31	-24342.93	-2864615.00	1624782.74	-567.56
Total Weight	57815.88			-1001.41	-4709.63	
Wind 0 deg - Service		103.55	-12671.34	-1473830.85	-15919.97	-308.36
Wind 30 deg - Service		6410.69	-11025.48	-1282072.01	-749835.08	348.39
Wind 60 deg - Service		11000.09	-6425.35	-746474.96	-1283962.63	911.78
Wind 90 deg - Service		12642.03	-103.55	-10552.48	-1475183.60	1230.87
Wind 120 deg - Service		10896.54	6246.00	728505.58	-1272260.46	1220.14
Wind 150 deg - Service		6231.34	10921.93	1272669.22	-729566.32	882.48
Wind 180 deg - Service		-103.55	12671.34	1476130.22	7484.37	308.36
Wind 210 deg - Service		-6410.69	11025.48	1284371.39	741399.47	-348.39
Wind 240 deg - Service		-11000.09	6425.35	748774.33	1275527.03	-911.78
Wind 270 deg - Service		-12642.03	103.55	12851.86	1466747.99	-1230.87
Wind 300 deg - Service		-10896.54	-6246.00	-726206.20	1263824.86	-1220.14
Wind 330 deg - Service		-6231.34	-10921.93	-1270369.84	721130.72	-882.48

Load Combinations

Comb. No.	*Description*
1	Dead Only
2	Dead+Wind 0 deg - No Ice

Comb. No.	*Description*
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 60 deg - No Ice
5	Dead+Wind 90 deg - No Ice
6	Dead+Wind 120 deg - No Ice
7	Dead+Wind 150 deg - No Ice
8	Dead+Wind 180 deg - No Ice
9	Dead+Wind 210 deg - No Ice
10	Dead+Wind 240 deg - No Ice
11	Dead+Wind 270 deg - No Ice
12	Dead+Wind 300 deg - No Ice
13	Dead+Wind 330 deg - No Ice
14	Dead+Ice+Temp
15	Dead+Wind 0 deg+Ice+Temp
16	Dead+Wind 30 deg+Ice+Temp
17	Dead+Wind 60 deg+Ice+Temp
18	Dead+Wind 90 deg+Ice+Temp
19	Dead+Wind 120 deg+Ice+Temp
20	Dead+Wind 150 deg+Ice+Temp
21	Dead+Wind 180 deg+Ice+Temp
22	Dead+Wind 210 deg+Ice+Temp
23	Dead+Wind 240 deg+Ice+Temp
24	Dead+Wind 270 deg+Ice+Temp
25	Dead+Wind 300 deg+Ice+Temp
26	Dead+Wind 330 deg+Ice+Temp
27	Dead+Wind 0 deg - Service
28	Dead+Wind 30 deg - Service
29	Dead+Wind 60 deg - Service
30	Dead+Wind 90 deg - Service
31	Dead+Wind 120 deg - Service
32	Dead+Wind 150 deg - Service
33	Dead+Wind 180 deg - Service
34	Dead+Wind 210 deg - Service
35	Dead+Wind 240 deg - Service
36	Dead+Wind 270 deg - Service
37	Dead+Wind 300 deg - Service
38	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	*Elevation ft*	*Component Type*	*Condition*	*Gov. Load Comb.*	*Force lb*	*Major Axis Moment lb-ft*	*Minor Axis Moment lb-ft*
L1	190 - 180	Pole	Max Tension	2	0.00	-1.65	-0.05
			Max. Compression	14	-3306.49	143.98	-271.85
			Max. Mx	5	-2381.61	-7917.27	591.07
			Max. My	8	-2385.79	100.88	-7369.97
			Max. Vy	5	2354.07	-7917.27	591.07
			Max. Vx	2	-2298.10	-774.13	7273.33
			Max. Torque	13			4636.29
L2	180 - 140	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-16644.09	-780.78	-121.12
			Max. Mx	5	-11429.76	-360673.15	3510.68
			Max. My	8	-11430.40	2794.12	-358769.06
			Max. Vy	5	14945.96	-360673.15	3510.68
			Max. Vx	8	14943.43	2794.12	-358769.06
			Max. Torque	13			4636.28
L3	140 - 120	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-21602.65	-1523.18	95.36
			Max. Mx	5	-15522.73	-682059.99	6036.26

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
			Max. My	8	-15520.50	5030.96	-680066.39
			Max. Vy	5	16921.25	-682059.99	6036.26
			Max. Vx	2	-16968.92	-7897.49	679074.14
			Max. Torque	12			3632.66
L4	120 - 100	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-30127.57	-1627.84	989.36
			Max. Mx	5	-21888.70	-1089839.65	9220.21
			Max. My	8	-21886.46	7881.50	-1088447.01
			Max. Vy	5	22286.30	-1089839.65	9220.21
			Max. Vx	2	-22334.63	-10847.42	1088078.96
			Max. Torque	6			-3595.65
L5	100 - 80	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-37050.41	-2988.18	1057.74
			Max. Mx	5	-27641.22	-1561710.79	12071.54
			Max. My	8	-27637.57	10291.73	-1561328.15
			Max. Vy	5	24740.55	-1561710.79	12071.54
			Max. Vx	2	-24843.15	-14911.64	1560212.10
			Max. Torque	6			-3564.31
L6	80 - 65	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-42280.05	-3375.74	751.58
			Max. Mx	5	-32016.97	-1944892.00	14159.70
			Max. My	8	-32011.96	12781.24	-1946872.23
			Max. Vy	5	26356.20	-1944892.00	14159.70
			Max. Vx	2	-26542.86	-17701.70	1944652.62
			Max. Torque	6			-3807.85
L7	65 - 60	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-44183.01	-3368.53	905.02
			Max. Mx	5	-33651.27	-2077906.65	15040.86
			Max. My	8	-33646.66	13741.00	-2080897.19
			Max. Vy	5	26896.12	-2077906.65	15040.86
			Max. Vx	2	-27082.77	-18497.71	2078688.14
			Max. Torque	6			-3809.58
L8	60 - 50	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-48028.44	-4560.96	1943.71
			Max. Mx	5	-36888.22	-2353622.34	17676.97
			Max. My	8	-36885.07	14912.86	-2356686.81
			Max. Vy	5	28020.05	-2353622.34	17676.97
			Max. Vx	2	-28167.13	-21380.71	2355707.84
			Max. Torque	6			-3809.52
L9	50 - 40	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-52331.46	-5475.59	2822.02
			Max. Mx	5	-40580.51	-2639911.66	20298.63
			Max. My	8	-40578.50	16544.59	-2643335.96
			Max. Vy	5	29184.28	-	20298.63

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force lb	Major Axis Moment lb-ft	Minor Axis Moment lb-ft
						2639911.66	
			Max. Vx	2	-29294.74	-24119.45	2643239.64
			Max. Torque	6			-3576.72
L10	40 - 20	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-61472.73	-6904.42	4347.44
			Max. Mx	5	-48587.71	- 3242048.91	26222.28
			Max. My	2	-48586.83	-30200.81	3247015.40
			Max. Vy	5	30906.07	- 3242048.91	26222.28
			Max. Vx	2	-30982.10	-30200.81	3247015.40
			Max. Torque	5			-3247.26
L11	20 - 0	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	14	-71612.01	-7306.33	5069.82
			Max. Mx	5	-57809.84	- 3875111.03	31812.24
			Max. My	2	-57809.81	-35679.57	3881696.29
			Max. Vy	5	32374.38	- 3875111.03	31812.24
			Max. Vx	2	-32449.47	-35679.57	3881696.29
			Max. Torque	5			-3147.66

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical lb	Horizontal, X lb	Horizontal, Z lb
Pole	Max. Vert	15	71612.01	-223.37	28237.79
	Max. H_x	11	57815.88	32363.59	-265.08
	Max. H_z	2	57815.88	-265.08	32438.65
	Max. M_x	2	3881696.28	-265.08	32438.65
	Max. M_z	5	3875111.03	-32363.59	265.08
	Max. Torsion	11	3134.72	32363.59	-265.08
	Min. Vert	30	57815.88	-12642.03	103.55
	Min. H_x	5	57815.88	-32363.59	265.08
	Min. H_z	8	57815.88	265.08	-32438.64
	Min. M_x	8	-3879713.64	265.08	-32438.64
	Min. M_z	11	-3865391.22	32363.59	-265.08
	Min. Torsion	5	-3135.55	-32363.59	265.08

Tower Mast Reaction Summary

Load Combination	Vertical lb	$Shear_x$ lb	$Shear_z$ lb	Overturning Moment, M_x lb-ft	Overturning Moment, M_z lb-ft	Torque lb-ft
Dead Only	57815.88	0.00	0.00	-996.18	-4733.17	-0.13
Dead+Wind 0 deg - No Ice	57815.88	265.08	-32438.65	-3881696.28	-35679.61	-658.59
Dead+Wind 30 deg - No Ice	57815.88	16411.36	-28225.23	-3377159.41	-1966651.79	997.58
Dead+Wind 60 deg - No Ice	57815.88	28160.23	-16448.89	-1968015.49	-3371969.23	2386.28
Dead+Wind 90 deg - No Ice	57815.88	32363.59	-265.08	-31812.42	-3875111.03	3135.55
Dead+Wind 120 deg - No Ice	57815.88	27895.15	15989.75	1912680.80	-3341228.23	3044.46
Dead+Wind 150 deg - No Ice	57815.88	15952.23	27960.14	3344410.71	-1913339.77	2137.23
Dead+Wind 180 deg - No Ice	57815.88	-265.08	32438.64	3879713.64	25927.89	657.40

ARMOR TOWER
Armor Tower
1 North Main St
Cortland, NY
Phone: 607-591-5381
FAX: 866-870-0840

Job	Page
190' Monopole Analysis	5 of 7
Project	**Date**
T-Mobile CT11004B Newington 1, Berlin, CT	12:10:31 07/27/09
Client	**Designed by**
Atlantis Group	JT

Load Combination	Vertical	$Shear_x$	$Shear_z$	Overturning Moment, M_x	Overturning Moment, M_z	Torque
	lb	lb	lb	lb-ft	lb-ft	lb-ft
Dead+Wind 210 deg - No Ice	57815.88	-16411.36	28225.23	3375178.19	1956920.89	-997.99
Dead+Wind 240 deg - No Ice	57815.88	-28160.23	16448.89	1966019.36	3362254.32	-2385.72
Dead+Wind 270 deg - No Ice	57815.88	-32363.59	265.08	29795.27	3865391.22	-3134.72
Dead+Wind 300 deg - No Ice	57815.88	-27895.15	-15989.75	-1914704.04	3331487.53	-3044.34
Dead+Wind 330 deg - No Ice	57815.88	-15952.23	-27960.14	-3346419.04	1903583.08	-2138.14
Dead+Ice+Temp	71612.01	0.00	-0.00	-5069.82	-7306.33	-0.12
Dead+Wind 0 deg+Ice+Temp	71612.01	223.37	-28237.79	-3445425.36	-33740.72	876.11
Dead+Wind 30 deg+Ice+Temp	71612.01	14280.20	-24566.30	-2997614.13	-1745850.53	1950.07
Dead+Wind 60 deg+Ice+Temp	71612.01	24510.66	-14312.32	-1748010.10	-2992179.29	2501.60
Dead+Wind 90 deg+Ice+Temp	71612.01	28173.54	-223.37	-31417.28	-3438795.91	2382.75
Dead+Wind 120 deg+Ice+Temp	71612.01	24287.29	13925.44	1692229.83	-2966006.97	1625.12
Dead+Wind 150 deg+Ice+Temp	71612.01	13893.31	24342.93	2961060.72	-1700468.32	431.77
Dead+Wind 180 deg+Ice+Temp	71612.01	-223.37	28237.79	3435067.46	18702.01	-877.06
Dead+Wind 210 deg+Ice+Temp	71612.01	-14280.20	24566.30	2987256.60	1730831.70	-1950.34
Dead+Wind 240 deg+Ice+Temp	71612.01	-24510.66	14312.32	1737635.65	2977170.86	-2500.80
Dead+Wind 270 deg+Ice+Temp	71612.01	-28173.54	223.37	21025.55	3423777.98	-2381.55
Dead+Wind 300 deg+Ice+Temp	71612.01	-24287.29	-13925.44	-1702621.94	2950969.14	-1624.60
Dead+Wind 330 deg+Ice+Temp	71612.01	-13893.31	-24342.93	-2971435.91	1685420.10	-432.33
Dead+Wind 0 deg - Service	57815.88	103.55	-12671.35	-1517549.19	-16906.72	-260.63
Dead+Wind 30 deg - Service	57815.88	6410.69	-11025.48	-1320388.13	-771528.08	389.41
Dead+Wind 60 deg - Service	57815.88	11000.09	-6425.35	-769697.06	-1320723.62	935.11
Dead+Wind 90 deg - Service	57815.88	12642.03	-103.55	-13032.62	-1517337.30	1230.20
Dead+Wind 120 deg - Service	57815.88	10896.54	6246.00	746860.33	-1308690.17	1195.60
Dead+Wind 150 deg - Service	57815.88	6231.34	10921.93	1306367.68	-750680.65	840.58
Dead+Wind 180 deg - Service	57815.88	-103.55	12671.35	1515565.32	7170.06	260.35
Dead+Wind 210 deg - Service	57815.88	-6410.69	11025.48	1318405.19	761794.60	-389.59
Dead+Wind 240 deg - Service	57815.88	-11000.09	6425.35	767711.84	1310992.58	-935.12
Dead+Wind 270 deg - Service	57815.88	-12642.03	103.55	11044.19	1507605.53	-1230.14
Dead+Wind 300 deg - Service	57815.88	-10896.54	-6246.00	-748849.70	1298955.18	-1195.64
Dead+Wind 330 deg - Service	57815.88	-6231.34	-10921.93	-1308354.77	740943.21	-840.79

Maximum Tower Deflections - Service Wind

Section No.	Elevation	Horz. Deflection	Gov. Load Comb.	Tilt	Twist
	ft	in		°	°
L1	190 - 180	32.211	29	1.5322	0.0163
L2	180 - 140	29.007	29	1.5267	0.0160
L3	140 - 120	17.058	29	1.1945	0.0043
L4	120 - 100	12.384	29	1.0195	0.0027
L5	100 - 80	8.472	29	0.8341	0.0018
L6	80 - 65	5.346	28	0.6476	0.0011
L7	65 - 60	3.508	28	0.5179	0.0008
L8	60 - 50	2.988	28	0.4743	0.0007
L9	50 - 40	2.076	28	0.3948	0.0005
L10	40 - 20	1.332	28	0.3149	0.0004
L11	20 - 0	0.335	28	0.1554	0.0002

Critical Deflections and Radius of Curvature - Service Wind

Elevation	Appurtenance	Gov. Load Comb.	Deflection	Tilt	Twist	Radius of Curvature
ft			in	°	°	ft
189'	Pirod 5"x58" Standoff	29	31.891	1.5325	0.0163	192695

Elevation	*Appurtenance*	*Gov. Load Comb.*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft			*in*	°	°	*ft*
181'6"	4 ft HP Dish	29	29.487	1.5296	0.0161	98027
180'	(2) RR65-19-00DP w/Mount Pipe	29	29.007	1.5267	0.0160	69446
165'	Pirod 5"x58" Standoff	29	24.261	1.4418	0.0123	10170
160'	PiROD 13' Low Profile Platform	29	22.726	1.3970	0.0105	7834
148'	Powerwave 7770.00 w. MtgPipe	29	19.216	1.2753	0.0063	5050
146'	PiROD 15' Low Profile Platform (Monopole)	29	18.661	1.2546	0.0057	4767
138'	Pirod 5"x58" Standoff	29	16.547	1.1756	0.0039	4314
132'	Pirod 5"x58" Standoff	29	15.077	1.1220	0.0032	4989
116'	PiROD 15' Low Profile Platform (Monopole)	29	11.544	0.9840	0.0026	7069
106'	Kathrein 742 213 w. Mtg Pipe	29	9.567	0.8912	0.0021	6219
98'	2 ft Grid Dish	29	8.123	0.8150	0.0017	5863
90'	Pirod 5"x58" Standoff	28	6.809	0.7391	0.0014	6042
87'	2.5" Tube x 2' Standoff	28	6.350	0.7112	0.0013	6119
70'	Pirod 5"x58" Standoff	28	4.074	0.5612	0.0009	6388
58'	Pirod 5"x58" Standoff	28	2.792	0.4576	0.0007	7106
43'	Pirod 5"x58" Standoff	28	1.538	0.3401	0.0004	7735
35'	MYA4505	28	1.017	0.2696	0.0003	7345
32'	Pirod 5"x58" Standoff	28	0.848	0.2421	0.0003	6939

Maximum Tower Deflections - Design Wind

Section No.	*Elevation*	*Horz. Deflection*	*Gov. Load Comb.*	*Tilt*	*Twist*
	ft	*in*		°	°
L1	190 - 180	82.164	4	3.9063	0.0420
L2	180 - 140	74.002	4	3.8950	0.0410
L3	140 - 120	43.559	3	3.0493	0.0109
L4	120 - 100	31.634	3	2.6034	0.0070
L5	100 - 80	21.646	3	2.1307	0.0045
L6	80 - 65	13.660	3	1.6550	0.0029
L7	65 - 60	8.964	3	1.3237	0.0021
L8	60 - 50	7.635	3	1.2122	0.0018
L9	50 - 40	5.305	3	1.0088	0.0014
L10	40 - 20	3.403	3	0.8046	0.0010
L11	20 - 0	0.856	3	0.3971	0.0005

Critical Deflections and Radius of Curvature - Design Wind

Elevation	*Appurtenance*	*Gov. Load Comb.*	*Deflection*	*Tilt*	*Twist*	*Radius of Curvature*
ft			*in*	°	°	*ft*
189'	Pirod 5"x58" Standoff	4	81.347	3.9074	0.0420	82511
181'6"	4 ft HP Dish	4	75.225	3.9021	0.0414	41388
180'	(2) RR65-19-00DP w/Mount Pipe	4	74.002	3.8950	0.0410	28891
165'	Pirod 5"x58" Standoff	3	61.908	3.6801	0.0315	4042
160'	PiROD 13' Low Profile Platform	3	58.000	3.5662	0.0270	3107
148'	Powerwave 7770.00 w. MtgPipe	3	49.058	3.2554	0.0162	1996
146'	PiROD 15' Low Profile Platform (Monopole)	3	47.643	3.2025	0.0147	1884
138'	Pirod 5"x58" Standoff	3	42.254	3.0011	0.0100	1703

ARMOR TOWER *Armor Tower* *1 North Main St* *Cortland, NY* *Phone: 607-591-5381* *FAX: 866-870-0840*	**Job** 190' Monopole Analysis	**Page** 7 of 7
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	Client Atlantis Group	**Designed by** JT

Elevation *ft*	*Appurtenance*	*Gov. Load Comb.*	*Deflection* *in*	*Tilt* °	*Twist* °	*Radius of Curvature* *ft*
132'	Pirod 5"x58" Standoff	3	38.506	2.8644	0.0083	1967
116'	PiROD 15' Low Profile Platform (Monopole)	3	29.490	2.5130	0.0066	2781
106'	Kathrein 742 213 w. Mtg Pipe	3	24.442	2.2765	0.0052	2444
98'	2 ft Grid Dish	3	20.755	2.0820	0.0043	2303
90'	Pirod 5"x58" Standoff	3	17.400	1.8885	0.0036	2372
87'	2.5" Tube x 2' Standoff	3	16.226	1.8171	0.0034	2402
70'	Pirod 5"x58" Standoff	3	10.409	1.4343	0.0023	2504
58'	Pirod 5"x58" Standoff	3	7.135	1.1696	0.0017	2783
43'	Pirod 5"x58" Standoff	3	3.931	0.8674	0.0011	3028
35'	MYA4505	3	2.599	0.6968	0.0009	2875
32'	Pirod 5"x58" Standoff	3	2.167	0.6319	0.0008	2716

Section Capacity Table

Section No.	*Elevation ft*	*Component Type*	*Critical Element*	*P lb*	*SF*P_{allow} lb*	*% Capacity*	*Pass Fail*
L1	190 - 180	Pole	1	-3181.19	697494.89	3.3	Pass
L2	180 - 140	Pole	2	-11419.70	934939.50	74.1	Pass
L3	140 - 120	Pole	3	-15511.30	1325677.78	71.7	Pass
L4	120 - 100	Pole	4	-21877.90	1484548.71	87.5	Pass
L5	100 - 80	Pole	5	-27631.10	1643282.34	98.9	Pass
L6	80 - 65	Pole	6	-32005.50	1801922.67	99.7	Pass
L7	65 - 60	Pole	7	-33640.60	2116950.54	90.9	Pass
L8	60 - 50	Pole	8	-36879.10	1960483.01	99.9	Pass
L9	50 - 40	Pole	9	-40573.00	2259061.67	97.4	Pass
L10	40 - 20	Pole	10	-48583.80	2780331.29	97.4	Pass
L11	20 - 0	Pole	11	-57809.70	3682439.01	88.3	Pass
						Summary	
					Pole (L8)	99.9	Pass
					RATING =	**99.9**	**Pass**

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Calculated By: JST
Date: July 2009

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This analysis is based on the Pirod foundation design dated February 1999. The design is assumed to be the as-built condition. All soil and site conditions assumed in this analysis were taken from that report including the note stating that the foundation is to bear directly on the hard shale 9' below grade.

Tower Reactions

Shear := 32.65kip = 32650 lbf

OTM := 3908.059ft·kip

DL := 57.816kip

Properties

Concrete: fc := 4000psi $\gamma_c := 150\frac{lbf}{ft^3}$ Cover := 3in

Steel: fy := 60000psi

Soil: ϕ := 36deg $\gamma := 130\frac{lbf}{ft^3}$ c := 0ksf

Bearing Capacity: $B_c := 16ksf$

Passive Pressure: $K_p := 3.85$

Footing Dimensions

Pier Diameter: dia := 7ft

Pad Thickness: T := 2.5ft

Pad Depth: D := 9ft

Pad Width: W := 20.5ft

Elevation above grade: E := 6in

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Resisting Moment (Moments about the edge of the footing)

Concrete Weight: $W_c := \left[W^2 \cdot T + \frac{dia^2 \cdot \pi}{4} \cdot (D + E - T) \right] \cdot \gamma_c = 198 \cdot kip$

Soil above footing: $W_s := \left[W^2 \cdot (D - T) - \frac{dia^2 \pi}{4} \cdot (D - T) \right] \cdot \gamma = 322.6 \cdot kip$

Soil Wedge: $W_{sw} := (D - T) \cdot \frac{1}{2} \cdot [(D - T) \tan(\phi)] \cdot W \cdot \gamma = 40.9 \cdot kip$

Passive pressure: $P_{pt} := (D - T) \cdot K_p \cdot \gamma + 2 \cdot c \cdot \sqrt{K_p} = 3.3 \cdot ksf$

$P_{pb} := D \cdot K_p \cdot \gamma + 2 \cdot c \cdot \sqrt{K_p} = 4.5 \cdot ksf$

Ultimate Shear: $Shear_u := \left(\frac{T \cdot W}{2} \right) \cdot \left(P_{pt} + P_{pb} \right) = 198.8 \cdot kip$

Resisting Moment: $M_{rtw} := \left(W_c + W_s + DL \right) \cdot \frac{W}{2} = 5928.7 \cdot ft \cdot kip$

$M_{rp} := Shear_u \cdot \frac{T}{3} = 165.7 \cdot ft \cdot kip$

$M_{rsw} := W_{sw} \cdot \left(W + D \cdot \frac{\sin(\phi)}{3} \right) = 910.6 \cdot ft \cdot kip$

$M_r := M_{rtw} + M_{rp} + M_{rsw} = 7005 \cdot ft \cdot kip$

Overturning Moment: $M_o := OTM + [Shear \cdot (D + E)] = 4218.2 \cdot ft \cdot kip$

Factor of Safety: $FS := \frac{M_r}{M_o} = 1.66$ 1.5 required by TIA-222

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Compression Exerted by foundation

Total Weight: $P := W_c + W_s + DL = 578.4 \cdot kip$

Area of mat: $Area := W^2 = 420.3\,ft^2$

Section Modulus: $S_x := \frac{W^3}{6} = 1435.9 \cdot ft^3$

$$P_{pos} := \frac{P}{Area} + \frac{M_o}{S_x} = 4.3 \cdot ksf$$

$$P_{neg} := \frac{P}{Area} - \frac{M_o}{S_x} = -1.6 \cdot ksf$$

Tension, must re-adjust the compression area.

$$e := \frac{M_o}{P} = 7.3\,ft$$

$$q_{max} := \frac{2 \cdot P}{3W \cdot \left(\frac{W}{2} - e\right)} = 6.4 \cdot ksf \qquad q_{min} := 0ksf$$

Concrete Shear Strength:

One way beam actions at d from the column face. (ACI 11.3.1.1)

Effective Depth: $d_c := T - Cover - .5in = 2.2\,ft$

Adjusted Factored Load Intensity (ACI 9.2.2) $q_s := 1.3 \cdot q_{max} = 8.3 \cdot ksf$

Dist from edge to dc from face $dd := \frac{W}{2} - \frac{dia}{2} - d_c$

Dist to qs=0 $L := \left(\frac{W}{2} - e\right) \cdot 3 = 8.9\,ft$

slope of qs $s := \frac{q_s}{L} = 0.9 \cdot \frac{kip}{ft^3}$

Required Shear: $V_n := \frac{\left[\left(q_s - dd \cdot s\right) + \frac{dd}{2} \cdot s\right] \cdot dd \cdot W}{.85} = 673.9 \cdot kip$

Available Shear (ACI 11.3.1.1) $V_c := 2 \cdot \sqrt{fc} \cdot \sqrt{psi} \cdot W \cdot d_c = 824.6 \cdot kip$

$$\frac{V_n}{V_c} = 81.7 \cdot \%$$

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Pad Bending Capacity

$\phi := .9$

$M_u := 1.3 \cdot M_o - \left[K_p \cdot (D - T) \cdot \gamma\right] \cdot (D - T) \cdot dia \cdot \frac{(D - T)}{3} = 5163 \cdot kip \cdot ft$

use passive earth pressure against the pier shaft to reduce the moment.

$A_s := 30 \cdot 1.56in^2 = 46.8 \cdot in^2$

$a := \frac{A_s \cdot fy}{.85 \cdot fc \cdot W} = 3.4 \cdot in$

$\phi M_n := \phi \cdot A_s \cdot fy \cdot \left(d_c - \frac{a}{2}\right) = 5227.4 \cdot ft \cdot kip$

$\frac{M_u}{\phi M_n} = 98.8 \cdot \%$ OK

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Anchor Bolt and Base Plate Analysis

Input Data

Tower Reactions

Overturning Moment	$OM := 3908.059ft \cdot kip$
Shear Force	$Shear := 32.65kip$
Axial Force	$Axial := 57.816kip$

Anchor Bolt Data

Number of Anchor Bolts	$N := 52$
Diameter of Bolt Circle	$D_{bc} := 67in$
Bolt "Column" Distance	$l := 2.75in$
Bolt Ultimate Strength	$F_u := 150ksi$
Bolt Yield Strength	$F_y := 105ksi$
Bolt Modulus	$E := 29000ksi$
Thickness of Anchor Bolt	$D := 1.25in$
Threads per inch	$n := 4.5$

Base Plate Data

Plate Yield Strength	$Fy_{bp} := 36ksi$
Base Plate Thickness	$PlateThickness := 1in$
Base Plate Diameter	$D_{bp} := 70in$
Outer Pole Diameter	$D_{pole} := 60in$
Gusset Plate Thickness	$t_{gusset} := .625in$
Gusset Plate Height	$H_{gusset} := 5in$

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Geometric Layout Data:

Distance from the center of gravity of the group to bolt in question = d(i)

Radius of Bolt Circle: $R_{bc} := \frac{D_{bc}}{2}$

Distance to Bolts: $i := 1 .. N$

$$d_i := \left| \begin{array}{l} \theta \leftarrow 2\pi\left(\frac{i}{N}\right) \\ d \leftarrow R_{bc} \cdot \sin(\theta) \end{array} \right.$$

$d_1 = 4 \cdot in$
$d_2 = 8 \cdot in$
$d_3 = 11.9 \cdot in$
$d_4 = 15.6 \cdot in$
$d_5 = 19 \cdot in$

Critical Distances for Bending in Plate:

Outer Pole Raduis: $R_{pole} := \frac{D_{pole}}{2} = 30 \cdot in$

Moment Arms of Bolts about NA: $MA_i := if\left(d_i \geq R_{pole}, d_i - R_{pole}, 0in\right)$

$MA_1 = 0 \cdot in$ $MA_7 = 0 \cdot in$
$MA_2 = 0 \cdot in$ $MA_8 = 0 \cdot in$
$MA_3 = 0 \cdot in$ $MA_9 = 0 \cdot in$
$MA_4 = 0 \cdot in$ $MA_{10} = 1.3 \cdot in$
$MA_5 = 0 \cdot in$ $MA_{11} = 2.5 \cdot in$
$MA_6 = 0 \cdot in$ $MA_{12} = 3.3 \cdot in$

Effective Width of Baseplate for Bending: $EffectiveWidth := 2\sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} = 36.1 \cdot in$

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Anchor Bolt Analysis

Polar Moment of Inertia Ip:

$$I_p := \sum_i \left(d_i\right)^2 = 29178.5 \cdot in^2$$

Gross Area of Bolt:

$$A_g := \frac{\pi}{4} \cdot D^2 = 1.2 \cdot in^2$$

Net Area of Bolt:

$$A_n := \frac{\pi}{4} \cdot \left(D - \frac{.9743in}{n}\right)^2 = 0.8 \cdot in^2$$

Net Diameter:

$$D_n := \frac{2 \cdot \sqrt{A_n}}{\sqrt{\pi}} = 1 \cdot in$$

Radius of Gyration of Bolt:

$$r := \frac{D_n}{4} = 0.3 \cdot in$$

Section Modulus of Bolt:

$$S_x := \frac{\pi \cdot D_n^{\,3}}{32} = 0.1 \cdot in^3$$

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$$M_x := \left(\frac{Shear}{N}\right) \cdot l = 0.1 \cdot ft \cdot kip$$

$$f_{bx} := \frac{M_x}{S_x} = 15.9 \cdot ksi$$

Allowable Bending

$$F_{bx} := 1.33 \cdot .6 \cdot F_y = 83.8 \cdot ksi$$

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Check Tensile Forces

Allowable Tensile Force:

$$\text{AllowableTension} := 1.33 \cdot \left(.33 \cdot A_g \cdot F_u\right) = 80.8 \cdot \text{kip}$$

Applied Tension

$$\text{MaxTension} := \frac{OM \cdot R_{bc}}{I_p} - \frac{\text{Axial}}{N} = 52.7 \cdot \text{kip}$$

Check Stresses:

$$\frac{\text{MaxTension}}{\text{AllowableTension}} = 65.3 \cdot \%$$

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Check Compression & Combined Stresses

Note: ASCE Manual 72 States "If the clearance between the base plate and concrete does not exceed two times the bolt diameter a bending stress analysis of the bolts is NOT normally required."

Set the clear space between the plate and the bolt to zero and remove bending stresses if a combined stress analysis is not required.

$$l := \begin{cases} l & \text{if } l > 2 \cdot D_n \\ 0.0\,in & \text{otherwise} \end{cases} \quad = 2.8 \cdot in \qquad f_{bx} := \begin{cases} f_{bx} & \text{if } l > 2D_n \\ (0\,ksi) & \text{otherwise} \end{cases} \quad = 15.9 \cdot ksi$$

Allowable Compressive Force

$K := .65$

$$C_c := \sqrt{\frac{2\pi^2 E}{F_y}} = 73.8$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2C_c^{\,2}}\right] \cdot F_y}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8C_c^{\,3}}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12\pi^2 E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} \quad = 61.4 \cdot ksi$$

$F_a := 1.33 \cdot F_a = 81.7 \cdot ksi$

Applied Compressive Force

$$MaxCompression := \frac{OM \cdot R_{bc}}{I_p} + \frac{Axial}{N} = 55 \cdot kip \qquad f_a := \frac{MaxCompression}{A_n} = 65.5 \cdot ksi$$

Check Combined Stresses:

$$\frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} = 99.2 \cdot \%$$

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Base Plate Analysis

Force from Bolts:

$$C_i := \frac{OM \cdot d_i}{I_p} + \frac{Axial}{N}$$

$C_1 = 7.6 \cdot kip$ $C_5 = 31.7 \cdot kip$ $C_9 = 48.8 \cdot kip$

$C_2 = 14 \cdot kip$ $C_6 = 36.8 \cdot kip$ $C_{10} = 51.5 \cdot kip$

$C_3 = 20.2 \cdot kip$ $C_7 = 41.4 \cdot kip$

$C_4 = 26.1 \cdot kip$ $C_8 = 45.4 \cdot kip$

$\max(C) = 55 \cdot kip$

Bending Stress in Plate:

$$f_{bp} := \sum_i \frac{\left(6 \cdot C_i \cdot MA_i\right)}{EffectiveWidth \cdot PlateThickness^2 + 8\left(t_{gusset} \cdot H_{gusset}^2\right)} = 35.5 \cdot ksi$$

Check Stresses

$$\frac{f_{bp}}{1.33 \cdot .75 Fy_{bp}} = 98.9 \cdot \%$$