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

Internet: ct.gov/csc

Daniel F. Caruso
Chairman

July 25, 2008

Kenneth C. Baldwin, Esq.
Robinson & Cole LLP
280 Trumbull Street
Hartford, CT 06103-3597

RE: **EM-VER-005-080612** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 127 New Hartford Turnpike, Barkhamsted, Connecticut.

Dear Attorney Baldwin:

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 condition that all remaining antenna mounts at the 104-foot level of the tower be removed within one year of the date of this letter unless they can be utilized by another carrier within that time period.

The proposed modifications are to be implemented as specified here and in your notice dated June 12, 2008, 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/cm

c: The Honorable Donald S. Stein, First Selectman, Town of Barkhamsted
Karl Nilsen, Zoning Enforcement Officer, Town of Barkhamsted

ROBINSON & COLE LLP

KENNETH C. BALDWIN

280 Trumbull Street
Hartford, CT 06103-3597
Main (860) 275-8200
Fax (860) 275-8299
kbaldwin@rc.com
Direct (860) 275-8345

EM-VER-005-080612

June 12, 2008

Via Hand Delivery

S. Derek Phelps
Executive Director
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: **Notice of Exempt Modification – Antenna Swap**
127 New Hartford Turnpike, Barkhamsted, Connecticut

Dear Mr. Phelps:

Cellco Partnership d/b/a Verizon Wireless ("Cellco") currently maintains a wireless telecommunications facility at the above-referenced address. The Council approved Cellco's shared use of this facility on February 4, 2004. Cellco currently maintains twelve PCS antennas at the 104-foot level on the 145-foot tower. Alltel Communications ("Alltel") maintains nine antennas and three tower mounted amplifiers ("TMAs") at the 133-foot level on the tower.

On May 30, 2008, Cellco acquired Alltel's CT-1 RSA cellular license for Litchfield County Connecticut. Cellco now intends to remove its twelve antennas and Alltel's nine antenna and three TMAs and install four (4) LPA-80063/4CF cellular antennas; two (2) LPA80080/4CF cellular antennas; four DB948F65E-M PCS antennas; and two (2) DB948G85E-M PCS antennas all at the 133-foot level on the tower. The tower is owned by Cellco. Attached behind Tab 1 are the specifications for the proposed replacement antennas.

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 Donald S. Stein, First Selectman of the Town of Barkhamsted. Pursuant to a Council directive, a copy of this letter is also being sent to Stanley J. Slater, Paul Slater and Everett Slater, the owners of the property on which the tower is located.

The planned modifications to the facility fall squarely within those activities explicitly provided for in R.C.S.A. § 16-50j-72(b)(2).

1. The proposed modifications will not result in the increase in the overall height of the existing structure. Cellco's replacement antennas will be located at the 133-foot level of the 145-foot tower.

2. The proposed antenna modifications will not require the extension of the site boundaries. Alltel's ground-mounted equipment will be removed from the existing site compound.

3. The proposed modifications will not increase noise levels at the facility by six decibels or more.

4. The operation of the replacement antennas will not increase radio frequency (RF) power density levels at the facility to a level at or above the Federal Communications Commission (FCC) adopted safety standard. A cumulative power density table for the facility is included behind Tab 2.

Also attached is a Structural Analysis Report confirming that the tower can support the proposed modifications. (See Tab 3).

For the foregoing reasons, Cellco respectfully submits that the proposed modifications to the above-referenced telecommunications facility constitutes an exempt modification under R.C.S.A. § 16-50j-72(b)(2).

Sincerely,

Kenneth C. Baldwin

Enclosures
Copy to:
Donald S. Stein, Barkhamsted First Selectman
Stanley J. Slater, Paul Slater and Everett Slater
Sandy M. Carter

Vertically Polarized, Log Periodic 63° / 13 dBd

LPA-80063/4CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	1205 mm	47.4 in
Width	386 mm	15.2 in
Depth	335 mm	13.2 in
Depth with z-bracket	375 mm	14.8 in
[4] Weight	9.1 kg	20.0 lbs
Wind Area		
Fore/Aft	0.47 m^2	5.0 ft^2
Side	0.40 m^2	4.4 ft^2
Rated Wind Velocity (Safety factor 2.0)	>351 km/hr	>218 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	665 N	149.5 lbs
Side	577 N	129.6 lbs

Antenna consisting of aluminum alloy with brass feedlines covered by a UV safe fiberglass radome.

Mounting and Downtilting

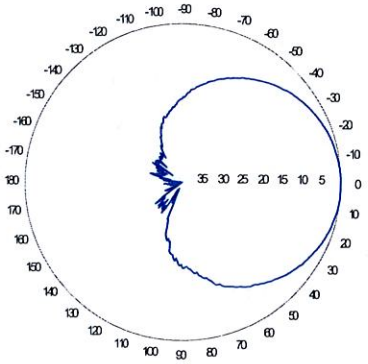
Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in). If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in)

Mounting Bracket and Downtilt Bracket Kit #21699999

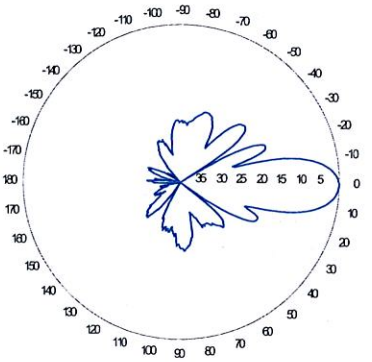
Electrical specifications

	Frequency Range	806-960 MHz
	Impedance	50Ω
[3]	Connector(s)	NE or E-DIN 1 port / center
[1]	VSWR	≤ 1.4:1
	Polarization	Vertical
[1]	Gain	13 dBd
[2]	Power Rating	500 W
[1]	Half Power Angle	
	H-Plane	63°
	E-Plane	15°
[1]	Electrical Downtilt	0°
[1]	Null Fill	10%
	Lightning Protection	Direct Ground

Radiation pattern[1]



Horizontal

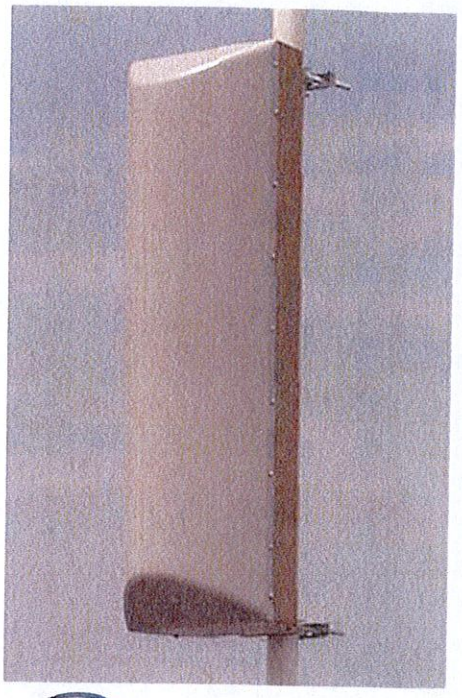


Vertical

Featuring upper side lobe suppression.

Radiation patterns for all antennas are measured with the antenna mounted on a fiberglass pole.

Mounting on a metal pole will typically improve the Front-to-Back ratio.



Amphenol Antel's Exclusive 3T (True Transmission Line Technology) Antenna Design:

- True log-periodic design allows for superior front-to-side characteristics to minimize sector overlap.
- Unique feedline design eliminates the need for conventional solder joints in the signal path.
- A non-collinear system with access to every radiating element for broad band-width and superior performance.
- Air as insulation for virtually no internal signal loss.

This Amphenol Antel antenna is under a five-year limited warranty for repair or replacement.

Antenna available with center-fed connector only.

1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) The antenna weight listed above does not include the bracket weight.

Improvements to mechanical and/or electrical performance of the antenna may be made without notice.

CF Denotes a Center-Fed Connector.

806-960 MHz

Amphenol Antel, Inc. 1300 Capital Drive Rockford, Illinois 61109 USA Tel. (815) 399-0001
Toll-Free (888) 417-9562 Fax. (815) 399-0156 antel@antelinc.com www.antelinc.com

Amphenol Antel, Inc. The Antenna Technology Company

Revision Date: 7/5/07

Vertically Polarized, Log Periodic 80° / 12.5 dBd

LPA-80080/4CF ___

When ordering replace "___" with connector type.

Mechanical specifications

Length	1200 mm	47.2 in
Width	140 mm	5.5 in
Depth	335 mm	13.2 in
Depth with z-bracket	375 mm	14.8 in
[4] Weight	5.4 kg	12.0 lbs
Wind Area		
Fore/Aft	0.17 m^2	1.8 ft^2
Side	0.40 m^2	4.3 ft^2
Rated Wind Velocity (Safety factor 2.0)	>369 km/hr	>229 mph
Wind Load @ 100 mph (161 km/hr)		
Fore/Aft	254 N	57.1 lbs
Side	574 N	129.0 lbs

Antenna consisting of aluminum alloy with brass feedlines covered by a UV safe fiberglass radome.

Mounting and Downtilting

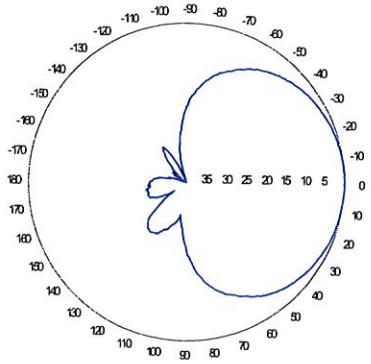
Mounting brackets attach to a pipe diameter of Ø50-102 mm (2.0-4.0 in). If the lock-down brace is used, the maximum diameter is Ø88.9 mm (3.5 in).

Mounting Bracket & Downtilt Bracket Kit #21699999

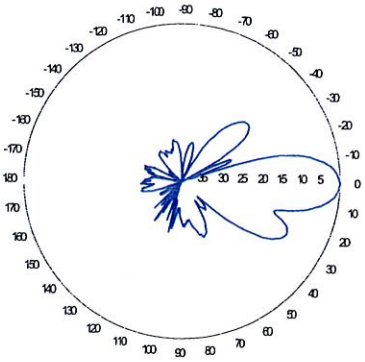
Electrical specifications

Frequency Range	806-960 MHz
Impedance	50Ω
[3] Connector(s)	NE or E-DIN 1 port / center
[1] VSWR	≤ 1.4:1
Polarization	Vertical
[1] Gain	12.5 dBd
[2] Power Rating	500 W
[1] Half Power Angle	
H-Plane	80°
E-Plane	15°
[1] Electrical Downtilt	0°
[1] Null Fill	15%
Lightning Protection	Direct Ground

Radiation pattern[1]



Horizontal

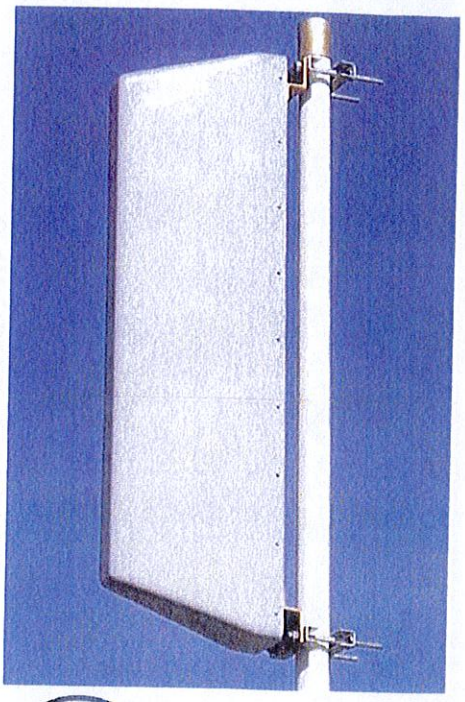


Vertical

Featuring upper side lobe suppression.

Radiation patterns for all antennas are measured with the antenna mounted on a fiberglass pole.

Mounting on a metal pole will typically improve the Front-to-Back ratio.



Amphenol Antel's Exclusive 3T (True Transmission Line Technology) Antenna Design:

- True log-periodic design allows for superior front-to-side characteristics to minimize sector overlap.
- Unique feedline design eliminates the need for conventional solder joints in the signal path.
- A non-collinear system with access to every radiating element for broad band-width and superior performance.
- Air as insulation for virtually no internal signal loss.

This Amphenol Antel antenna is under a five-year limited warranty for repair or replacement.

Antenna available with center-fed connector only.

1) Typical values.
2) Power rating limited by connector only.
3) NE indicates an elongated N connector. E-DIN indicates an elongated DIN connector.
4) The antenna weight listed above does not include the bracket weight.

Improvements to mechanical and/or electrical performance of the antenna may be made without notice.

CF Denotes a Center-Fed Connector.

806-960 MHz

Amphenol Antel, Inc. 1300 Capital Drive Rockford, Illinois 61109 USA Tel. (815) 399-0001
Toll-Free (888) 417-9562 Fax. (815) 399-0156 antel@antelinc.com www.antelinc.com

Amphenol Antel, Inc. The Antenna Technology Company

Revision Date: 7/5/07

ANDREW®

Vertically Polarized Directed Dipole® Panel Antennas

1710 - 2170 MHz

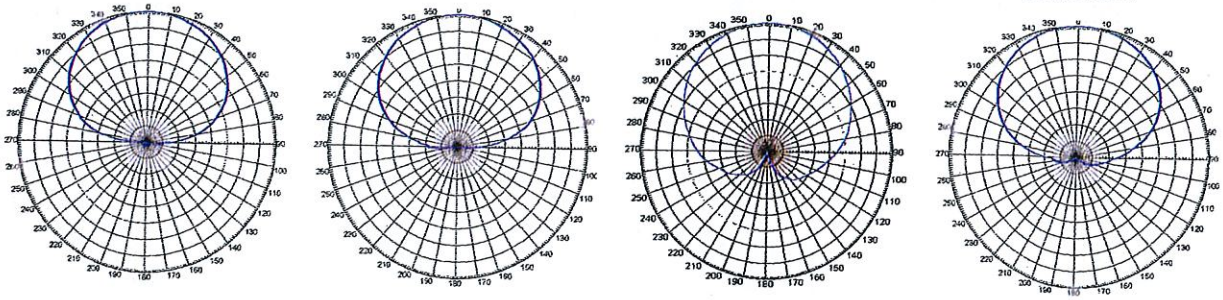
65° HORIZONTAL BEAMWIDTH

HORIZONTAL BEAMWIDTH	65°	65°	65°	65°
FREQUENCY RANGE	1850-1990 MHz	1850-1990 MHz	1850-1990 MHz	1850-1990 MHz
	17.2 dBi / 0° Tilt	17.6 dBi / 0° Tilt	17.2 dBi / 2° Tilt	17.5 dBi / 4° Tilt
MODEL	DB948F65E-M	DB948G65E-M	948F65T2ZE-M	948G65T4E-M
TYPE	Directed Dipole®	Directed Dipole®	Directed Dipole®, No Screen	Directed Dipole®
ELECTRICAL SPECIFICATIONS				
Frequency Range (MHz)	1850-1990	1850-1990	1850-1990	1850-1990
Gain (dBd/dBi)	15.1 / 17.2	15.5 / 17.6	15.1 / 17.2	15.4 / 17.5
Horizontal Beamwidth (Deg.)	65	65	65	65
Elevation Beamwidth (Deg.)	8	7	8	7
USLS (dB)	>15	N/A	>16	N/A
Null Fill (dB) – Below Peak	10	N/A	15	N/A
Beam Tilt (Deg.)	0	0	2	4
VSWR	<1.33:1	<1.33:1	<1.33:1	<1.33:1
Front-To-Back Ratio (dB)	40	40	40	40
Isolation (dB)	N/A	N/A	N/A	N/A
Max. Input Power (Watts)	250	250	250	250
Polarization	Vertical	Vertical	Vertical	Vertical
Connector Location	Bottom	Bottom	Bottom	Bottom
Connector Type	7-16 DIN - Female	7-16 DIN - Female	7-16 DIN - Female	7-16 DIN - Female
MECHANICAL SPECIFICATIONS				
Length (inch/mm)	48 / 1,219	48 / 1,219	48 / 1,219	48 / 1,219
Width (inch/mm)	10.5 / 267	10.5 / 267	6.5 / 165	10.5 / 267
Depth (inch/mm)	7 / 178	7 / 178	4 / 102	7 / 178
Net Weight (lbs/kg)	11 / 5	14 / 6.3	9.5 / 4.3	14 / 6.3
Max. Flat Plate Area (ft^2/m^2)	2.26 / 0.21	2.26 / 0.21	1.18 / 0.11	2.26 / 0.21
Max. Wind Load at 100 mph (lbf/N)	127 / 565	127 / 565	67 / 299	127 / 565
Max. Wind Speed (mph/kmh)	125 / 201	125 / 201	125 / 201	125 / 201
Radome Material	ABS, UV Resistant	ABS, UV Resistant	ABS, UV Resistant	ABS, UV Resistant
Reflector Material	Pass. Aluminum	Pass. Aluminum	Pass. Aluminum	Pass. Aluminum
Radiator Material	Low Loss Circuit Board	Low Loss Circuit Board	Low Loss Circuit Board	Low Loss Circuit Board
Hardware Material	Galvanized Steel	Galvanized Steel	Galvanized Steel	Galvanized Steel
Color	Light Gray	Light Gray	Light Gray	Light Gray
Std. Mounting Hardware	DB390	DB390	DB390	DB390
Optional Downtilt Kit	DB5098	DB5098	DB5098	DB5098
Optional Special Mounting	DB5094-AZ	DB5094-AZ	DB5094-AZ	DB5094-AZ

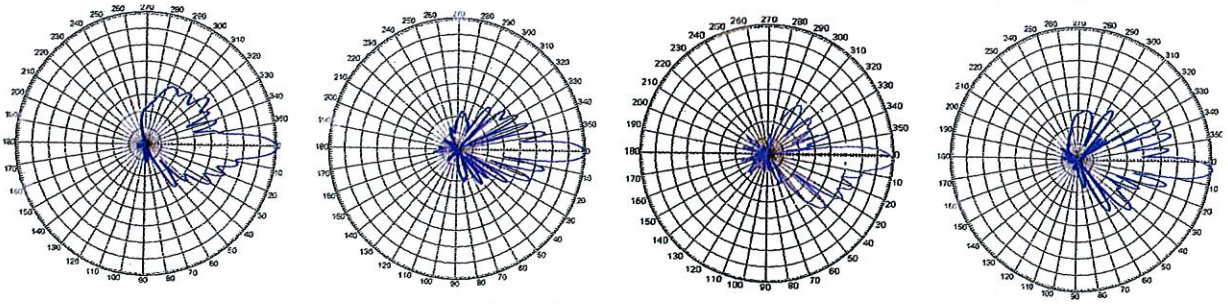
Specifications are subject to change. Please see our website for the latest information.
*TELETILT® compatible.

DB948F65E-M | **DB948G65E-M** | **948F65T2ZE-M** | **948G65T4E-M**

Azimuth Pattern



Elevation Pattern



Scale: 10° radials, 5 dB per division

ANDREW CORPORATION PHONE 1-800-676-5342 • (214) 631-0310 FAX 1-800-229-4706 • (214) 631-4706 WWW.ANDREW.COM

Vertically Polarized Directed Dipole® Panel Antennas

85° HORIZONTAL BEAMWIDTH

ANDREW®

1710 - 2170 MHz

HORIZONTAL BEAMWIDTH	85°	85°	85°	85°
FREQUENCY RANGE	1850-1990 MHz	1850-1990 MHz	1850-1990 MHz	1850-1990 MHz
	16.2 dBi / 0° Tilt	16.6 dBi / 0° Tilt	16.1 dBi / 2° Tilt	16 dBi / 4° Tilt
MODEL	DB948F85E-M	DB948G85E-M	948F85T2E-M	948F85T4E-M
TYPE	Directed Dipole®	Directed Dipole®	Directed Dipole®	Directed Dipole®
ELECTRICAL SPECIFICATIONS				
Frequency Range (MHz)	1850-1990	1850-1990	1850-1990	1850-1990
Gain (dBd/dBi)	14.1 / 16.2	14.5 / 16.6	14 / 16.1	13.9 / 16
Horizontal Beamwidth (Deg.)	85	85	85	85
Elevation Beamwidth (Deg.)	8	7	8	8
USLS (dB)	>18	N/A	>18	>18
Null Fill (dB) – Below Peak	15	N/A	15	15
Beam Tilt (Deg.)	0	0	2	4
VSWR	<1.33:1	<1.33:1	<1.33:1	<1.33:1
Front-To-Back Ratio (dB)	40	40	40	40
Isolation (dB)	N/A	N/A	N/A	N/A
Max. Input Power (Watts)	250	250	250	250
Polarization	Vertical	Vertical	Vertical	Vertical
Connector Location	Bottom	Bottom	Bottom	Bottom
Connector Type	7-16 DIN - Female	7-16 DIN - Female	7-16 DIN - Female	7-16 DIN - Female
MECHANICAL SPECIFICATIONS				
Length (inch/mm)	48 / 1,219	48 / 1,219	48 / 1,219	48 / 1,219
Width (inch/mm)	3.5 / 89	3.5 / 89	3.5 / 89	3.5 / 89
Depth (inch/mm)	7 / 178	7 / 178	7 / 178	7 / 178
Net Weight (lbs/kg)	8.5 / 3.9	8.5 / 3.9	8.5 / 3.9	8.5 / 3.9
Max. Flat Plate Area (ft^2/m^2)	1.18 / 0.11	1.18 / 0.11	1.18 / 0.11	1.18 / 0.11
Max. Wind Load at 100 mph (lbf/N)	65 / 285	65 / 285	65 / 285	65 / 285
Max. Wind Speed (mph/kmh)	125 / 201	125 / 201	125 / 201	125 / 201
Radome Material	ABS, UV Resistant	ABS, UV Resistant	ABS, UV Resistant	ABS, UV Resistant
Reflector Material	Pass. Aluminum	Pass. Aluminum	Pass. Aluminum	Pass. Aluminum
Radiator Material	Low Loss Circuit Board	Low Loss Circuit Board	Low Loss Circuit Board	Low Loss Circuit Board
Hardware Material	Galvanized Steel	Galvanized Steel	Galvanized Steel	Galvanized Steel
Color	Light Gray	Light Gray	Light Gray	Light Gray
Std. Mounting Hardware	DB390	DB390	DB390	DB390
Optional Downtilt Kit	DB5098	DB5098	DB5098	DB5098
Optional Special Mounting	DB5094-AZ	DB5094-AZ	DB5094-AZ	DB5094-AZ

Specifications are subject to change. Please see our website for the latest information.
*TELETILT® compatible.

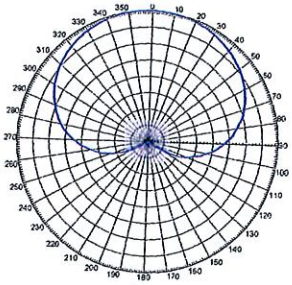
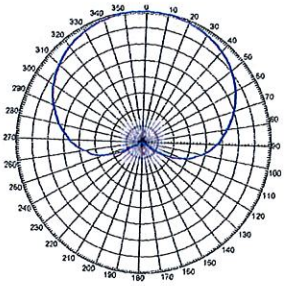
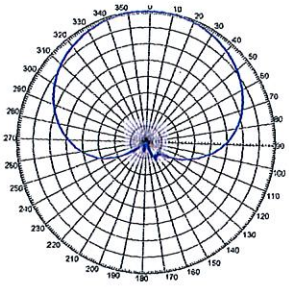
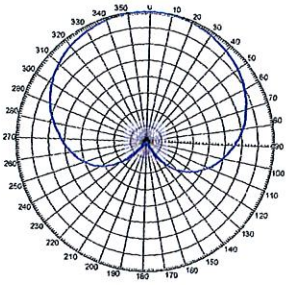
DB948F85E-M

DB948G85E-M

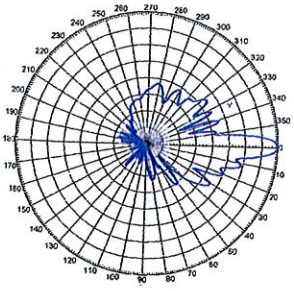
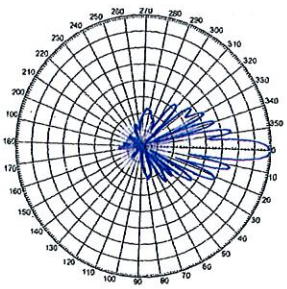
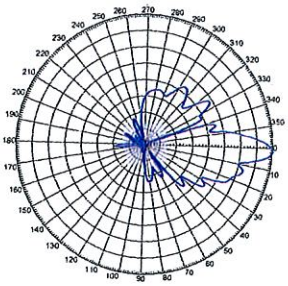
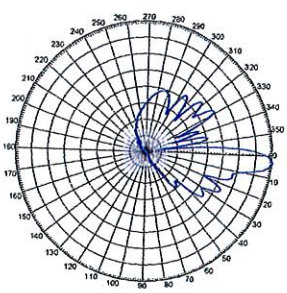
948F85T2E-M

948F85T4E-M

Azimuth Pattern

Elevation Pattern

Scale: 10° radials, 5 dB per division

XPol

VERTICAL Directed Dipole®

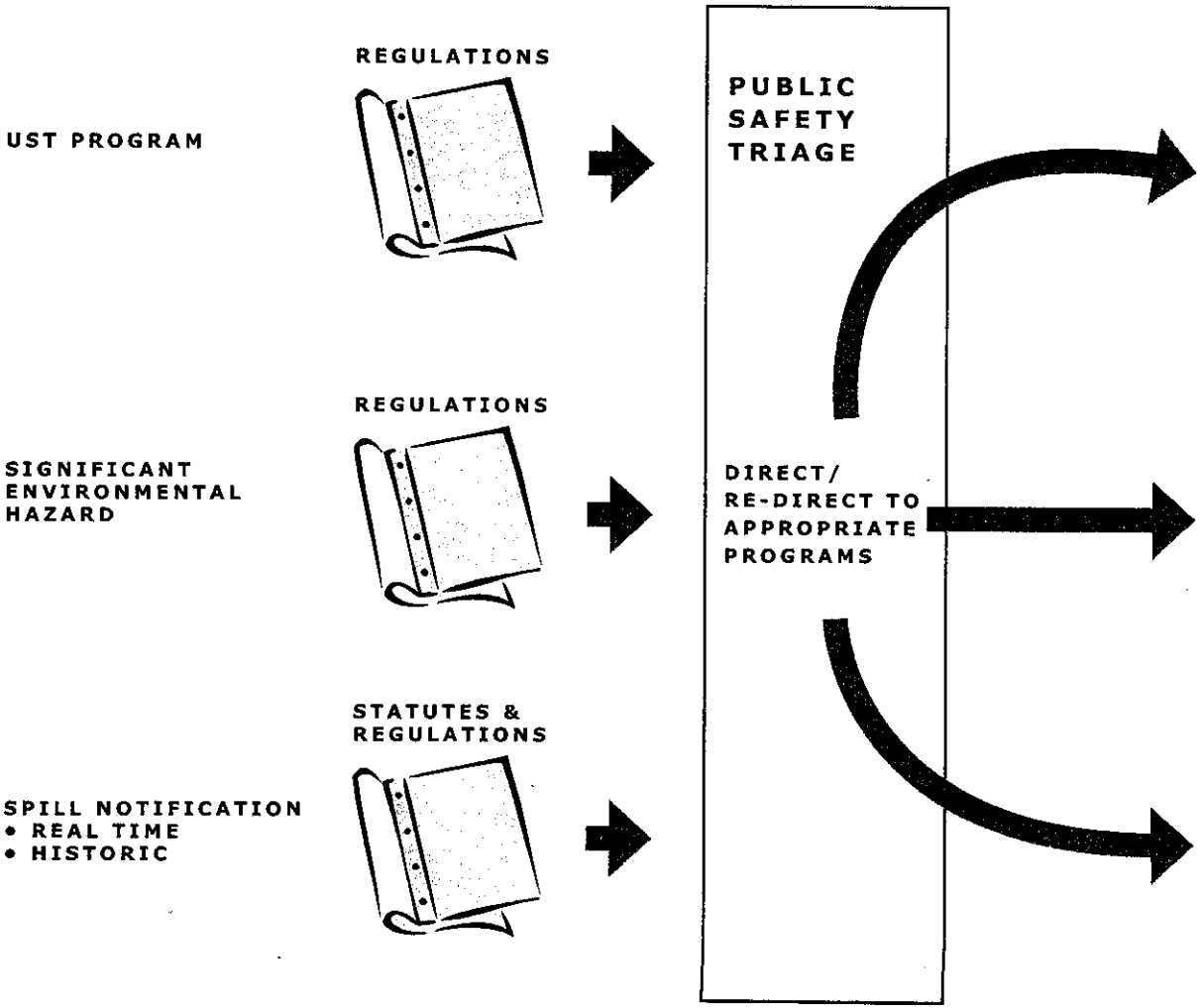
VERTICAL Panel

Omni

	General	Power	Density					
Site Name: Barkhamsted South								
Tower Height: Verizon @ 133Ft.								
CARRIER	**# OF CHAN.**	**WATTS ERP**	**HEIGHT**	**CALC. POWER DENS**	**FREQ.**	**MAX. PERMISS. EXP.**	**FRACTION MPE**	**Total**
Cingular TDMA	16	100	114	0.0443	880	0.5867	7.55%	
Cingular GSM	2	296	114	0.0164	880	0.5867	2.79%	
Cingular GSM	2	427	114	0.0236	1930	1.0000	2.36%	
Sprint	11	338.55	154	0.0565	1962.5	1.0000	5.65%	
AT&T	21	100	120	0.0524	1945	1.0000	5.24%	
AT&T	2	150	120	0.0075	1945	1.0000	0.75%	
Nextel	9	100	127	0.0201	851	0.5673	3.54%	
Verizon	**9**	**485**	**133**	**0.0887**	**1970**	**1.0000**	**8.87%**	
Verizon	**9**	**200**	**133**	**0.0366**	**875**	**0.5830**	**6.28%**	
								43.02%
* Source: Siting Council								

For Discussion:

Reporting Model



TIE SIZE AND SPACING IN COLUMN

Minimum Tie Size:

$Tie_{min} := if(BSpier \le 10, 3, 4)$ $\quad Tie_{min} = 4$

Used #3 Ties $\quad d_{Tie} := 3$

Seismic factor:
(ACI 21.10.5)

$z := if(Z \le 2, 1, 0.5)$ $\quad z = 1$

$s_{lim1} := 16 \cdot d_{bpier} \cdot z$ $\quad s_{lim1} = 22.56 \cdot in$

$s_{lim2} := \frac{48 \cdot d_{Tie} \cdot in}{8} \cdot z$ $\quad s_{lim2} = 18 \cdot in$

$s_{lim3} := D_f \cdot z$ $\quad s_{lim3} = 108 \cdot in$

$s_{lim4} := 18in$ $\quad s_{lim4} = 18 \cdot in$

Maximum Spacing:

$$s_{tie} := \min\left(\begin{pmatrix} s_{lim1} \\ s_{lim2} \\ s_{lim3} \\ s_{lim4} \end{pmatrix}\right) \quad s_{tie} = 18 \cdot in$$

Number of Ties Required:

$$n_{tie} := \frac{L_{pier} - 3 \cdot in}{s_{tie}} + 1 \quad n_{tie} = 4.3333$$

DEVELOPMENT LENGTH OF PIER REINFORCEMENT

TENSION (ACI 12.2.3)

Factors for development:

Reinforcement Location Factor $\alpha := 1.0$

Coating Factor $\beta := 1.0$

Concrete strength Factor $\lambda := 1.0$

Reinforcement Size Factor $\pi := 1.0$

Spacing or Cover Dimension: $c := if\left(Cvr_{pier} < \frac{B_{sPier}}{2}, Cvr_{pier}, \frac{B_{sPier}}{2}\right)$ $c = 1.8083 \cdot in$

Transverse Reinforcement: As allowed by ACI 12.2.4 $k_{tr} := 0$

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \pi \cdot \lambda}{\frac{c + k_{tr}}{d_{bpier}}} \cdot d_{bpier} \qquad L_{dbt} = 90.3287 \cdot in$$

Minimum Development Length: (ACI 12.2.1) $L_{dbmin} := 12 \cdot in$

Pier reinforcement bars are standard 90 degree hooks and therefore developement in the pad is computed as follows:

$$L_{dh} := \frac{1200 \cdot d_{bpier}}{\sqrt{\frac{f'c}{psi}}} \cdot .7 \qquad L_{dh} = 21.6241 \cdot in$$

$$L_{db} := \max\left(L_{dbt}, L_{dbmin}\right) \qquad L_{db} = 90.3287 \cdot in$$

COMPRESSION: (ACI 12.3.2)

$$L_{dbc1} := \frac{.02 \cdot d_{bpier} \cdot fy}{\sqrt{f'c \cdot psi}} \qquad L_{dbc1} = 30.8916 \cdot in$$

$$L_{dbmin} := 0.0003 \cdot \frac{in^2}{lb} \cdot \left(d_{bpier} \cdot fy\right) \qquad L_{dbmin} = 25.38 \cdot in$$

$$L_{dbc} := if\left(L_{dbc1} \geq L_{dbmin}, L_{dbc1}, L_{dbmin}\right) \qquad L_{dbc} = 30.8916 \cdot in$$

Available Length in Foundation:

$L_{pier} := L_p - Cvr_{pier}$ $L_{pier} = 63 \cdot in$

$L_{pad} := T_f - Cvr_{pad}$ $L_{pad} = 45 \cdot in$

$L_{tension} := if\left(L_{pier} + L_{pad} > L_{dbt}, "Okay", "No\ Good"\right) = "Okay"$ $L_{tension} = "Okay"$

$L_{compression} := if\left(L_{pier} + L_{pad} > L_{dbc}, "Okay", "No\ Good"\right)$ $L_{compression} = "Okay"$

NOTE: Anchor bolts and plate provided, OK

REINFORCEMENT IN PIER

Pier Area: $A_{pier} := \frac{\pi \cdot d_p^2}{4}$ $A_p = 7238.2295 \cdot in^2$

(ACI 10.8.4 and 10.9.1) $A_{smin} := 0.01 \cdot 0.05 \cdot A_p$ $A_{smin} = 3.6191 \cdot in^2$

$A_{sprov} := NBpier \cdot A_{bpier}$ $A_{sprov} = 93.6 \cdot in^2$

$SteelAreaCheck := if(A_{sprov} > A_{smin}, "Okay", "No Good")$ $SteelAreaCheck = "Okay"$

NOTE: Anchor Bolts are not accounted for in reinforcement calculation and will provide additional reinforcement to satisfy minimum requirement of steel.

Bar Spacing In Pier: $B_{sPier} := \frac{d_p \cdot \pi}{NBpier} - d_{bpier}$ $B_{sPier} = 3.6165 \cdot in$

Diamter of Reinforcement Cage: $Diam_{cage} := d_p - 2 \cdot Cvr_{pier}$ $Diam_{cage} = 90 \cdot in$

Maximum Moment in Pier: $M_p := \left[M_t + S_t \cdot \left(L_p + \frac{A_{BP}}{2} \right) \right] \cdot LF$ $M_p = 85690.572 \cdot in \cdot kips$

Pier Check evaluated from outside program and results are listed below;

(defined variables) $(f_c \ f_y \ cl \ Spiral) = (3 \ 60 \ 3 \ 0)$

The required input is column diameter in inches, number of reinforcing bars, bar size number, factored axial load in kips and moment in kip inches: $(D \ N \ n \ P_u \ M_{xu}) := (96 \ 60 \ 11 \ 67 \ 85691)$

Clears any previous output: $(\Sigma P_n \ \Sigma M_{xn} \ f_{sp} \ \rho) := (0 \ 0 \ 0 \ 0)$

$(\Sigma P_n \ \Sigma M_{xn} \ f_{sp} \ \rho) := \Sigma P'_n(D, N, n, P_u, M_{xu})^T$

The Output is given as useable axial load in kips, moment capacity in kip inches, splicing stress in ksi, and reinforcement ratio: $(\Sigma P_n \ \Sigma M_{xn} \ f_{sp} \ \rho) = (148.9689 \ 190526.8271 \ -60 \ 0.0129)$

Column size and reinforcement may be changed to match capacity to the applied load.

$AxialLoadCheck := if(\Sigma P_n \geq P_u, "Okay", "No Good")$ $AxialLoadCheck = "Okay"$

$BendingCheck := if(\Sigma M_{xn} \geq M_{xu}, "Okay", "No Good")$ $BendingCheck = "Okay"$

URS

Job	145' Summit Monopole - Barkhamsted, CT	Project No.	VZ4-037	Page / Sheet	of / 6 of 9
Description	Spread Footing w/ Pier Analysis	Computed by	JRM	Date	01/06/08
		Checked by		Date	

Temperature and Shrinkage: $\rho_{sh} := if(fy \geq 60000 \cdot psi, 0.0018, 0.0020)$ $\rho_{sh} = 0.0018$

(ACI 7.12.2.1b)

FOR BOTTOM BARS: $As := \max(\rho\rho_{min}, \rho_{sh}) \cdot W_f \cdot d$ $As = 29.6586 \cdot in^2$

$As_{prov} := A_{bot} \cdot NB_{bot}$ $As_{prov} = 74.88 \cdot in^2$

$PadReinforcement := if(As_{prov} > As, "Okay", "No Good")$ $PadReinforcement = "Okay"$

FOR TOP BARS: $As := \rho_{sh} \cdot (W_f \cdot d)$ $As = 29.6586 \cdot in^2$

$As_{prov} := A_{btop} \cdot NB_{top}$ $As_{prov} = 74.88 \cdot in^2$

$PadReinforcement := if(As_{prov} > As, "Okay", "No Good")$ $PadReinforcement = "Okay"$

TENSION (ACI 12.2.3) **DEVELOPMENT LENGTH OF PAD REINFORCEMENT**

Bar Spacing: $B_{sPad} := \frac{W_f - 2 \cdot Cvr_{pad} - NB_{bot} \cdot d_{bbot}}{NB_{bot} - 1}$ $B_{sPad} = 6.4749 \cdot in$

Development Length Factors:

Reinforcement Location Factor	$\alpha := 1.0$	
Coating Factor	$\beta := 1.0$	
Concrete strength Factor	$\lambda := 1.0$	
Reinforcement Size Factor	$\pi := 1.0$	

Spacing or Cover Dimension: $c := if\left(Cvr_{pad} < \frac{B_{sPad}}{2}, Cvr_{pad}, \frac{B_{sPad}}{2}\right)$ $c = 3 \cdot in$

Transverse Reinforcement Index As allowed by ACI 12.2.4 $k_{tr} := 0$

$$L_{dbt} := \frac{3}{40} \cdot \frac{fy}{\sqrt{f'c \cdot psi}} \cdot \frac{\alpha \cdot \beta \cdot \pi \cdot \lambda}{\frac{c + k_{tr}}{d_{bbot}}} \cdot d_{bbot} \qquad L_{dbt} = 54.4464 \cdot in$$

$L_{dbmin} := 12 \cdot in$

Minimum Development Length: (ACI 12.2.1) $L_{dbtCheck} := if(L_{dbt} \geq L_{dbmin}, "Use\ L.dbt", "Use\ L.dbmin")$ $L_{dbtCheck} = "Use\ L.dbt"$

Available Length in Pad: $L_{Pad} := \frac{W_f}{2} - \frac{d_p}{2} - Cvr_{pad}$ $L_{Pad} = 138 \cdot in$

$LpadTension := if(L_{Pad} > L_{dbt}, "Okay", "No Good")$ $LpadTension = "Okay"$

Guess Value: $v_u := 1ksf$ (From "Foundation Analysis and design", By Joseph Bowles, Eq. 8-9)

Given $d^2 + d_p \cdot d = \frac{WT_{tot}}{\pi \cdot v_u}$

$v_u := Find(v_u)$ $v_u = 7.459 \cdot ksf$

$V_u := v_u \cdot d \cdot W_f$ $V_u = 853.4838 \cdot kips$

$V_{req} := LF \cdot V_u$ $V_{req} = 1137.6939 \cdot kips$

$V_{Avail} := \Sigma_c \cdot 4 \cdot \sqrt{fc \cdot psi} \cdot b_o \cdot d$ $V_{Avail} = 3559.8409 \cdot kips$

$PunchingShearCheck := if(V_{req} < V_{Avail}, "Okay", "No Good")$ $PunchingShearCheck = "Okay"$

STEEL REINFORCEMENT IN THE PAD $\Sigma_m := .90$ ACI 9.3.2.2

Take Maximum Bending at face of Pier:

$q_b := q_{adj} - d_1 \cdot Slope$ $q_b = 1.2673 \cdot ksf$

$M_n := \frac{1}{LF \cdot \Sigma_m} \cdot \left[(q_{adj} - q_b) \cdot \frac{d_1^2}{3} + q_b \cdot \frac{d_1^2}{2} \right] \cdot W_f$ $M_n = 3257.2577 \cdot kip \cdot ft$

ACI 10.2.7.3 $\beta := if\left[fc \le 4000 \cdot psi, .85, if\left[fc \ge 8000 \cdot psi, .65, .85 - \left(\frac{\frac{fc}{psi} - 4000}{1000} \right) \cdot .05 \right] \right]$ $\beta = 0.85$

$R_u := \frac{M_n}{\Sigma_m \cdot W_f \cdot d^2}$ $R_u = 8707.4\ lbf$

$\rho := \frac{0.85 \cdot fc}{fy} \left(1 - \sqrt{1 - \frac{2 \cdot R_u}{0.85 \cdot fc}} \right)$ $\rho = 0.001$

$\rho_{min} := 1.333 \cdot \rho$ $\rho_{min} = 0.00136$

CONCRETE BEARING CAPACITY (ACI 10.17)

$\Sigma_c := 0.75$ (ACI 9.3.2.2)

$P_b := \Sigma_c \cdot 0.85 \cdot fc \cdot \frac{d_p^2 \cdot \pi}{4}$ $P_b = 13843.1139 \cdot kip$

$BearingCheck := if(P_b > LF \cdot C_t, "Okay", "No Good")$ $BearingCheck = "Okay"$

SHEAR STRENGTH OF CONCRETE

Beam Shear: (Critical section located at a distance d from the face of Pier) (ACI 11.3.1.1)

$\Sigma_{ss} := .85$ (ACI 9.3.2.3)

$d := T_f - Cvr_{pad} - d_{bbot}$ $d = 43.59 \cdot in$

$d_1 := \frac{W_f}{2} - \frac{d_p}{2}$ $d_1 = 11.75 \cdot ft$

$d_2 := d_1 - d$ $d_2 = 8.1175 \cdot ft$

$L := \left(\frac{W_f}{2} - e\right) \cdot 3$ $L = 30.4892 \cdot ft$

$Slope := if\left(L > W_f, \frac{P_{max} - P_{min}}{W_f}, \frac{q_{adj}}{L}\right)$ $Slope = 0.0676 \cdot kcf$

$V_{req} := LF \cdot \left[\left(q_{adj} - Slope \cdot d_1\right) + \left(\frac{Slope \cdot d_1}{2}\right)\right] \cdot W_f \cdot d_1$ $V_{req} = 821.2961 \cdot kip$

ACI 11.3.1.1 $V_{Avail} := \Sigma_c \cdot 2 \cdot \sqrt{fc \cdot psi} \cdot W_f \cdot d$ $V_{Avail} = 1534.222 \cdot kip$

$BeamShearCheck := if(V_{req} < V_{Avail}, "Okay", "No Good")$ $BeamShearCheck = "Okay"$

Punching Shear: (Critical Section Located at a distance of d/2 from the face of pier) (ACI 11.12.2.1)

$b_o := (d_p + d) \cdot \pi$ $b_o = 36.5446 \cdot ft$

Area included inside bo: $A_{bo} := \frac{\pi \cdot (d_p + d)^2}{4}$ $A_{bo} = 106.2762 \cdot ft^2$

Area outside of bo: $A_{out} := A_{mat} - A_{bo}$ $A_{out} = 885.9738 \cdot ft^2$

SHEAR CAPACITY IN PIER

$FS := 2$

$$S_p := \frac{P_{ave} \cdot A_p + \mu \cdot WT_{tot}}{FS}$$

$S_p = 304.8132 \cdot kips$

$ShearCheck := if(S_p > S_t, "Okay", "No Good")$

$ShearCheck = "Okay"$

BEARING PRESSURE CAUSED BY FOOTING

$A_{mat} := W_f^2$ $\quad A_{mat} = 992.25 \cdot ft^2$

$S := \frac{W_f^3}{6}$ $\quad S = 5209.3125 \cdot ft^3$

$P_{max} := \frac{WT_{tot}}{A_{mat}} + \frac{M_{ot}}{S}$ $\quad P_{max} = 2.0598 \cdot ksf$

$P_{min} := \frac{WT_{tot}}{A_{mat}} - \frac{M_{ot}}{S}$ $\quad P_{min} = -0.064 \cdot ksf$

$MaxPressure := if(P_{max} < q_s, "Okay", "No Good")$ $\quad MaxPressure = "Okay"$

$MinPressure := if[(P_{min} \geq 0) \cdot (P_{min} < q_s), "Okay", "No Good"]$ $\quad MinPressure = "No Good"$

Distance to Resultant of Pressure Distribution:

$$X_p := \frac{P_{max}}{\frac{P_{max} - P_{min}}{W_f}} \cdot \frac{1}{3}$$

$X_p = 10.1834 \cdot ft$

Distance to Kern: $X_k := \frac{W_f}{6}$ $\quad X_k = 5.25 \cdot ft$

Since Resultant Force is Not in Kern, Area to which Pressure is Applied Must be Reduced.

Eccentricity: $e := \frac{M_{ot}}{WT_{tot}}$ $\quad e = 5.5869$

Adjusted Soil Pressure: $P_a := \frac{2 \cdot WT_{tot}}{3 \cdot W_f \cdot \left(\frac{W_f}{2} - e\right)}$ $\quad P_a = 2.062 \cdot ksf$

$q_{adj} := if\left(P_{min} < 0, P_a, \frac{P_{max}}{ft^2}\right)$ $\quad q_{adj} = 2.062 \cdot ksf$

$PressureCheck := if(q_{adj} < q_s, "Okay", "No Good")$ $\quad PressureCheck = "Okay"$

URS

Job	145' Summit Monopole - Barkhamsted, CT	Project No.	VZ4-037	Page / Sheet	of / 2 of 9
Description	Spread Footing w/ Pier Analysis	Computed by	JRM	Date	01/06/08
		Checked by		Date	

CHECK ANCHOR STEEL EMBEDMENT

Depth:

$D_{ab} := L_{st} - A_{BP}$ $D_{ab} = 7 \cdot ft$ $L_{anchor} := \frac{(0.11 \cdot fya) \cdot in}{\sqrt{f'c \cdot psi}}$ $L_{anchor} = 12.552 \cdot ft$

$DepthCheck := if(D_{ab} \geq L_{anchor}, "Okay", "No Good")$

$DepthCheck = "No Good"$ **Note:** anchor plate is provided

STABILITY OF FOOTING

Passive Pressure:

$P_{pn} := K_p \cdot \pi_s \cdot n + c \cdot 2 \cdot \sqrt{K_p}$ $P_{pn} = 0.186 \cdot ksf$

$P_{pt} := K_p \cdot \pi_s \cdot (D_f - T_f) + c \cdot 2 \cdot \sqrt{K_p}$ $P_{pt} = 0.93 \cdot ksf$

$P_{top} := if[n < (D_f - T_f), P_{pt}, P_{pn}]$ $P_{top} = 0.93 \cdot ksf$

$P_{bot} := K_p \cdot \pi_s \cdot D_f + c \cdot 2 \cdot \sqrt{K_p}$ $P_{bot} = 1.674 \cdot ksf$

$P_{ave} := \frac{P_{top} + P_{bot}}{2}$ $P_{ave} = 1.302 \cdot ksf$

$T_p := if[n < (D_f - T_f), T_f, (D_f - n)]$ $T_p = 4 \cdot ft$

$A_p := W_f \cdot T_p$ $A_p = 126 \cdot ft^2$

Ultimate Shear:

$S_u := P_{ave} \cdot A_p$ $S_u = 164.052 \cdot kip$

Weight of Concrete Pad:

$WT_c := [(W_f^2 \cdot T_f) + d_p^2 L_p] \cdot \pi_c$ $WT_c = 648.15 \cdot kip$

Weight of Soil: above Footing:

$WT_{s1} := \left[W_f^2 \cdot (|L_p - L_{pag}|) - \frac{d_p^2 \cdot \pi}{4} \cdot (|L_p - L_{pag}|) \right] \cdot \pi_s$ $WT_{s1} = 292.0152 \cdot kip$

Weight of Soil Wedge at back face:

$WT_{s2} := \left(\frac{D_f^2 \cdot \tan(\Sigma_s)}{2} \cdot W_f \right) \cdot \pi_s$ $WT_{s2} = 45.6664 \cdot kip$

Total Weight:

$WT_{tot} := WT_c + WT_{s1} + C_t$ $WT_{tot} = 990.1652 \cdot kip$

Resisting Moment:

$M_r := (WT_{tot}) \cdot \frac{W_f}{2} + S_u \cdot \frac{T_f}{3} + WT_{s2} \cdot \left(W_f + \frac{D_f \cdot \tan(\Sigma_s)}{3} \right)$ $M_r = 17331.4256 \cdot kip \cdot ft$

Overturning Moment:

$M_{ot} := M_t + S_t \cdot (L_p + T_f)$ $M_{ot} = 5532 \cdot kip \cdot ft$

Factor of Safety:

$FS := \frac{M_r}{M_{ot}}$ $FS_{req} := 2$ $FS = 3.13$

$SafetyCheck := if(FS > FS_{req}, "Okay", "No Good")$ $SafetyCheck = "Okay"$

URS

Job	145' Summit Monopole - Barkhamsted, CT	Project No.	VZ4-037	Page / Sheet	of / 1 of 9
Description	Spread Footing w/ Pier Analysis	Computed by	JRM	Date	01/06/08
		Checked by		Date	

MONOPOLE FOUNDATION ANALYSIS

TOWER FORCES:

Moment Caused by Tower	$M_t := 5057 \cdot ft \cdot kips$
Shear at Base of Tower	$S_t := 50.0kip$
Max Compressive Force	$C_t := 50.0 \cdot kip$
Height of Tower	$H_t := 145 \cdot ft$
Base Plate Bolt Circle	$MP := 74.0in$

FOOTING DIMENSIONS:

Overall Depth of Footing	$D_f := 9.0ft$
Length of Pier	$L_p := 5.5 \cdot ft$
Extension of Pier Above Grade	$L_{pag} := 0.5 \cdot ft$
Diameter of Pier	$d_p := 8.0 \cdot ft$
Thickness of Footing	$T_f := 4.0 \cdot ft$
Width of Footing:	$W_f := 31.5ft$
Length of Anchor Bolts:	$L_{st} := 96.0in$
Projection of anchor bolts above pier	$A_{BP} := 12.0 \cdot in$

PROPERTIES:

Compressive Strength of Concrete	$f'c := 3000psi$
Yield Strength of Steel Reinforcement	$fy := 60000 \cdot psi$
Yield Strength of Anchor Bolt	$fya := 75000 \cdot psi$
Internal Friction Angle of Soil	$\Sigma_s := 30 \cdot deg$
Allowable Bearing Capacity	$q_s := 4000 \cdot psf$
Unit Weight of Soil	$\pi_s := 62 \cdot pcf$
Unit Weight of Concrete	$\pi_c := 150 \cdot pcf$
Depth to Neglect	$n := 1.0ft$
Cohesion of Clay Type Soil Note: Use 0 for Sandy Soil	$c := 0 \cdot ksf$
Seismic Zone Factor: UBC Fig 23-2	$Z := 2$
Coefficient of Friction between Concrete:	$\mu := 0.45$
Clear Cover of Reinforcement Pier:	$Cvr_{pier} := 3 \cdot in$
Clear Cover of Reinforcement Pad:	$Cvr_{pad} := 3 \cdot in$
Anchor Bolt Diameter	$d_{anchor} := 2.25in$
Anchor bolt area	$A_{anchor} := 3.98 \cdot in^2$

PIER REINFORCEMENT:

Bar Size	$BSpier := 11$	Bar Diameter	$d_{bpier} := 1.410 \cdot in$
Number of Bars	$NBpier := 60$	Bar Area	$A_{bpier} := 1.560 \cdot in^2$

PAD REINFORCEMENT:

TOP:	Bar Size	$BS_{top} := 11$	Bar Diameter	$d_{btop} := 1.410 \cdot in$
	Number of Bars	$NB_{top} := 48$	Bar Area	$A_{btop} := 1.560 \cdot in^2$
BOTTOM:	Bar Size	$BS_{bot} := 11$	Bar Diameter	$d_{bbot} := 1.410 \cdot in$
	Number of Bars	$NB_{bot} := 48$	Bar Area	$A_{bot} := 1.560 \cdot in^2$

Coefficient of Lateral Soil Pressure: $K_p := \frac{1 + \sin(\Sigma_s)}{1 - \sin(\Sigma_s)}$ $K_p = 3$

Load Factor (EIA 3.1.1): $LF := if\left[H_t \le 700 \cdot ft, 1.333, if\left[H_t \ge 1200, 1.7, 1.333 + \left(\frac{H_t - 700}{1200 - 700}\right) \cdot 0.4\right]\right]$ $LF = 1.333$

FOUNDATION ANALYSIS

Flange Plate Analysis:

Force From Bolt(s):

$$C_1 := \frac{OM \cdot d_3}{\mu d} + \frac{Axial}{N} \qquad C_1 = 26\,kips$$

Minimum Plate Thickness Required:

$$PlateThicknessRequired := \sqrt{\frac{(C_1 \cdot MomentArm_1) \cdot 6}{1.333 \cdot 0.75 \cdot Fy_{bp} \cdot EffectiveWidth}}$$

Note: 1.333 increase allowed per TIA/EIA

PlateThicknessRequired = 0.53 in

Check Stresses

$$PercentStressed := \frac{PlateThicknessRequired}{PlateThicknessProvide} \cdot 100$$

BasePlateStress := if(PercentStressed < 100, "OK - Understressed", "No Good - Overstressed")

BasePlateStress = "OK - Understressed"

PercentStressed = 42.4

Flange Bolt Analysis:

Polar Moment of Inertia (J) divided by Area (A) = μd

$\mu d := (d_1)^2 \cdot 4 + (d_2)^2 \cdot 4 + (d_3)^2 \cdot 2$ $\quad \mu d = 2053.50\ in^2$

Gross Area of Bolt:

$A_g := \frac{\pi}{4} \cdot D^2$ $\quad A_g = 0.79\ in^2$

Maximum Tensile Force:

$AllowableTension := 1.333 \cdot (0.33 \cdot A_g \cdot F_u)$ $\quad AllowableTension = 41.46\ kips$

Note: 1.333 increase allowed per TIA/EIA

$MaxTension := \frac{OM \cdot d_3}{\mu d} - \frac{Axial}{N}$ $\quad MaxTension = 24.16\ kips$

Check Stresses:

$AnchorBoltStress := if(AllowableTension > MaxTension, "Not Overstressed", "Overstressed")$

$AnchorBoltStress = "Not Overstressed"$

$PercentStressed := 100 \cdot \frac{MaxTension}{AllowableTension}$

$PercentStressed = 58.3$

Note: Shear Stress is negligible

Geometric Layout Data:

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

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

Number of Spaces in Quadrant: $N_q := \frac{N}{4}$

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

$$d_i := \left| \begin{array}{l} \Sigma \leftarrow \frac{360}{N} \cdot \frac{\pi}{180} \\ \text{for } j \in i \\ \quad \left| \begin{array}{l} \Sigma \leftarrow \Sigma \mathrm{l} \\ d \leftarrow R \cdot \sin(\Sigma) \end{array} \right. \end{array} \right. \qquad d = \begin{pmatrix} 9.25 \\ 16.02 \\ 18.50 \end{pmatrix} \text{in}$$

Critical Distances For Bending in Plate:

$$\text{MomentArm}_1 := d_3 - \frac{D_{pole}}{2} \qquad \text{MomentArm}_1 = 2.25\,\text{in}$$

$$\text{EffectiveWidth} := 2 \cdot \sqrt{\left(\frac{D_{bp}}{2}\right)^2 - \left(\frac{D_{pole}}{2}\right)^2} \qquad \text{EffectiveWidth} = 24.98\,\text{in}$$

FLANGE BOLT AND PLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	$OM := 232 \cdot kips \cdot ft$	*user input*
Shear Force:	$Shear := 17 \cdot kips$	*user input*
Axial Force:	$Axial := 11 \cdot kips$	*user input*

Flange Bolt Data:

Use ASTM A325

Number of Flange Bolts = N	$N := 12$	*user input*
Diameter of Bolt Circle:	$D_{bc} := 37.0in$	*user input*
Bolt Ultimate Strength:	$F_u := 120 \cdot \frac{kips}{in^2}$	*user input*
Bolt Allowable Strength:	$Fy := 92 \cdot \left(1000 \cdot \frac{lb}{in^2}\right)$	*user input*
Thickness Of Anchor Bolts	$D := 1.00in$	*user input*

Flange Plate Data:

Plate Allowable Strength:	$Fy_{bp} := 50 \cdot 10^3 \cdot \frac{lb}{in^2}$	*user input*
Flange Plate Thickness:	$PlateThicknessProvide := 1.25 \cdot in$	*user input*
Flange Plate Diameter:	$D_{bp} := 41.0 \cdot in$	*user input*
Outer Pole Diameter:	$D_{pole} := 32.508in$	*user input*

FLANGE PLATE ANALYSIS

Base Plate Analysis:

Force From Bolt(s):

$$C_1 := \frac{OM \cdot d_1}{\Sigma d} + \frac{Axial}{N} \qquad C_1 = 138.8 \cdot kips$$

$$C_2 := \frac{OM \cdot d_2}{\Sigma d} + \frac{Axial}{N} \qquad C_2 = 134.45 \cdot kips$$

$$C_3 := \frac{OM \cdot d_3}{\Sigma d} + \frac{Axial}{N} \qquad C_3 = 128.14 \cdot kips$$

Bending Stress In Plate:

$$f_{bp} := \frac{6 \cdot \left(2C_1 \cdot MomentArm_1 + 2C_2 \cdot MomentArm_2 + 2C_3 \cdot MomentArm_3\right)}{EffectiveWidth \cdot PlateThicknessProvide^2} \qquad f_{bp} = 33.46 \cdot ksi$$

Check Stresses:

$$BasePlateRatio := \frac{f_{bp}}{1.333 \cdot 0.75 Fy_{bp}} \qquad BasePlateRatio = 0.61$$

BasePlateStress := if(BasePlateRatio < 1, "Not Over Stress", "Is Over Stress")

BasePlateStress = "Not Over Stress"

Check Compression & Combined Stresses (if required):

Check to see if a complete combined stress analysis is required:

Per ASCE Manual 72: "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 bolt to zero if a combined stress analysis is not required and set the bending stress to zero:

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

Allowable Compressive Force:

$$K := 0.65$$

$$C_c := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{Fy}} \qquad C_c = 87.36$$

$$F_a := \begin{cases} \dfrac{\left[1 - \dfrac{\left(\frac{K \cdot l}{r}\right)^2}{2 \cdot C_c^{\,2}}\right] \cdot Fy}{\dfrac{5}{3} + \dfrac{3 \cdot \left(\frac{K \cdot l}{r}\right)}{8 \cdot C_c} - \dfrac{\left(\frac{K \cdot l}{r}\right)^3}{8 \cdot C_c^{\,3}}} & \text{if } \dfrac{K \cdot l}{r} \le C_c \\ \dfrac{12 \cdot \pi^2 \cdot E}{23 \cdot \left(\frac{K \cdot l}{r}\right)^2} & \text{if } \dfrac{K \cdot l}{r} > C_c \end{cases} \qquad F_a = 45 \cdot ksi$$

$F_a := 1.333 \cdot F_a$ Note: 1.333 increase allowed per TIA/EIA $\qquad F_a = 59.98 \cdot ksi$

Applied Compressive Force:

$$MaxCompression := \frac{OM \cdot d_l}{\Sigma d} + \frac{Axial}{N} \qquad MaxCompression = 138.8 \cdot kips$$

$$f_a := \frac{MaxCompression}{A_{net}} \qquad f_a = 42.74 \cdot ksi$$

Check Combined Stresses:

$$StressRatio := \frac{f_a}{F_a} + \frac{f_{bx}}{F_{bx}} \qquad StressRatio = 0.71$$

Condition := if(StressRatio ≤ 1.0, "Not Overstressed", "Overstressed")

Condition = "Not Overstressed"

Anchor Bolt Tensile Stress Check:

Maximum Tensile Force (Gross Area):

$AllowableTension := 1.333 \cdot (0.33 \cdot A_g \cdot F_u)$ $AllowableTension = 174.9 \cdot kips$

Note: 1.333 increase allowed per TIA/EIA

Maximum Tensile Force (Net Area):

$F_{net.area} := 1.333 \cdot (0.60 \cdot A_{net} \cdot Fy)$ $F_{net.area} = 194.81 \cdot kips$

Note: 1.333 increase allowed per TIA/EIA

Maximum Applied Tension:

$$MaxTension := \frac{OM \cdot d_1}{\Sigma d} - \frac{Axial}{N} \qquad MaxTension = 134.64 \cdot kips$$

Check Stresses:

Note: Bolts supplied are "upset bolts." Use net area for checking per AISC.

$AnchorBoltStress := if(F_{net.area} > MaxTension, "Not Overstressed", "Overstressed")$

$AnchorBoltStress = "Not Overstressed"$

$$PercentStressed := 100 \cdot \frac{MaxTension}{F_{net.area}}$$

$PercentStressed = 69.1$

Note: Shear Stress is negligible

Anchor Bolt Section Properties:

Polar Moment of Inertia (J) divided by Area (A) = Σd

$$\Sigma d := (d_1)^2 \cdot 4 + (d_2)^2 \cdot 4 + (d_3)^2 \cdot 4 + (d_4)^2 4 + (d_5)^2 \cdot 4 + (d_6)^2 \cdot 4 \qquad \Sigma d = 1.64 \times 10^4 \cdot in^2$$

Gross Area of Bolt:

$$A_g := \frac{\pi}{4} \cdot D^2 \qquad A_g = 3.98 \cdot in^2$$

Net Area of Bolt:

$$A_{net} := \frac{\pi}{4} \cdot \left(D - \frac{0.9743 \cdot in}{n} \right)^2 \qquad A_{net} = 3.25 \cdot in^2$$

Net Diameter:

$$D_n := \frac{2 \cdot \sqrt{A_{net}}}{\sqrt{\pi}} \qquad D_n = 2.03 \cdot in$$

Radius of Gyration of Bolt:

$$r := \frac{D_n}{4} \qquad r = 0.51 \cdot in$$

Section Modulus of Bolt:

$$S_x := \frac{\pi \cdot D_n^{\ 3}}{32} \qquad S_x = 0.83 \cdot in^3$$

Anchor Bolt Bending Stress:

Maximum Applied Bending:

$$M_x := \left(\frac{Shear}{N} \right) \cdot 1 \qquad M_x = 0.52 \cdot kips \cdot ft$$

$$f_{bx} := \frac{M_x}{S_x} \qquad f_{bx} = 7.57 \cdot ksi$$

Allowable Bending

$$F_{bx} := 1.333 \cdot 0.60 \cdot Fy \qquad F_{bx} = 59.98 \cdot ksi$$

Note: 1.333 increase allowed per TIA/EIA

Geometric Layout Data:

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

Distances for loading condition (see detail):

$d_1 := 36.8784 \cdot in$ *user input*

$d_2 := 35.7038 \cdot in$ *user input*

$d_3 := 34.0009 \cdot in$ *user input*

$d_4 := 14.5925 \cdot in$ *user input*

$d_5 := 8.9115 \cdot in$ *user input*

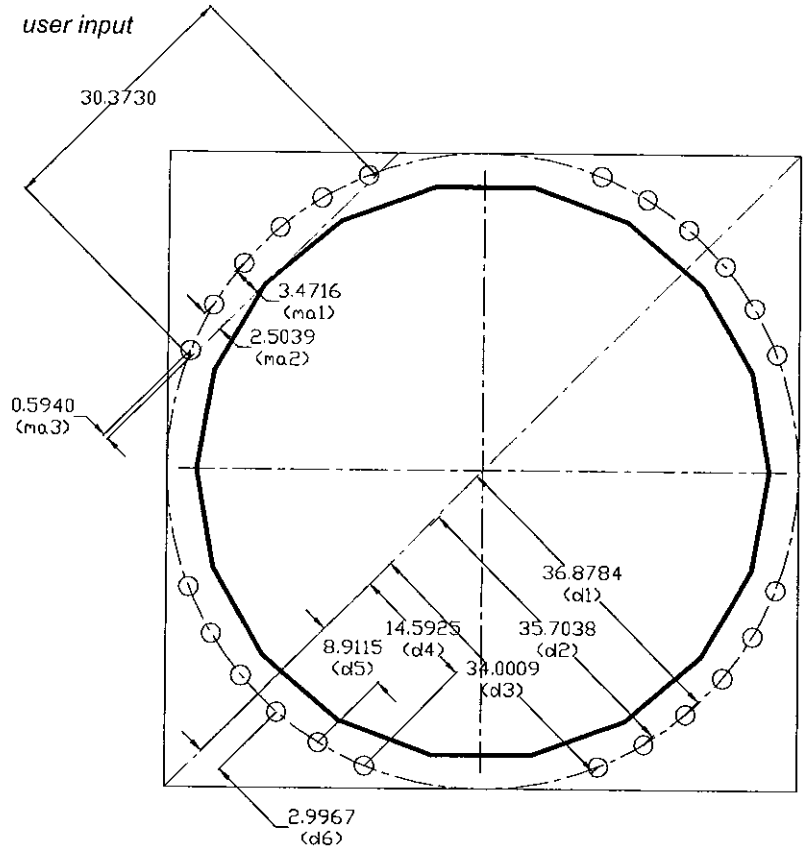
$d_6 := 2.9967 \cdot in$ *user input*

$MomentArm_1 := 3.4716 \cdot in$ *user input*

$MomentArm_2 := 2.5039 \cdot in$ *user input*

$MomentArm_3 := 0.5940 \cdot in$ *user input*

$EffectiveWidth := 30.3730 \cdot in$ *user input*



DETAIL - ANCHOR BOLT AND PLATE

ANCHOR BOLT AND BASEPLATE ANALYSIS

Input Data

Tower Reactions:

Overturning Moment:	$OM := 5057 \cdot kips \cdot ft$	*user input*
Shear Force:	$Shear := 50 \cdot kips$	*user input*
Axial Force:	$Axial := 50 \cdot kips$	*user input*

Anchor Bolt Data:

Use ASTM A615 Grade 75

Number of Anchor Bolts = N	$N := 24$	*user input*
Bolt Ultimate Strength:	$F_u := 100 \cdot ksi$	*user input*
Bolt Allowable Strength:	$Fy := 75 \cdot ksi$	*user input*
Diameter Of Anchor Bolts	$D := 2.25in$	*user input*
Threaded length per inch	$n := 4.5$	*user input*
Bolt "Column" Distance:	$l := 3in$	*user input*
Bolt Modulus:	$E := 29000 \cdot ksi$	*user input*

Base Plate Data:

Use ASTM A572 Grade 55

Plate Yield Strength:	$Fy_{bp} := 55 \cdot ksi$	*user input*
Base Plate Thickness:	$PlateThicknessProvide := 3.25 \cdot in$	*user input*

ANCHOR BOLT AND
BASE PLATE ANALYSIS

Section No.	Elevation ft	Size	Actual V K	Actual f_v ksi	Allow. F_v ksi	Ratio $\frac{f_v}{F_v}$	Actual T kip-ft	Actual f_{vt} ksi	Allow. F_{vt} ksi	Ratio $\frac{f_{vt}}{F_{vt}}$
L1	146.67 - 125.67 (1)	TP32.508x25.41x0.25	16.82	0.657	26.000	0.051	14.15	0.407	26.000	0.016
L2	125.67 - 82.92 (2)	TP44.632x32.508x0.375	35.59	0.701	26.000	0.054	29.80	0.327	26.000	0.013
L3	82.92 - 43.67 (3)	TP55.014x42.2513x0.4375	42.46	0.581	26.000	0.045	31.73	0.196	26.000	0.008
L4	43.67 - 1.67 (4)	TP66.05x52.1537x0.5	49.98	0.480	26.000	0.037	31.71	0.110	26.000	0.004

Pole Interaction Design Data

Section No.	Elevation ft	Ratio $\frac{P}{P_a}$	Ratio $\frac{f_{bx}}{F_{bx}}$	Ratio $\frac{f_{by}}{F_{by}}$	Ratio $\frac{f_v}{F_v}$	Ratio $\frac{f_{vt}}{F_{vt}}$	Comb. Stress Ratio	Allow. Stress Ratio	Criteria
L1	146.67 - 125.67 (1)	0.006	0.350	0.000	0.051	0.016	0.358 ✔	1.333	H1-3+VT ✔
L2	125.67 - 82.92 (2)	0.009	0.747	0.000	0.054	0.013	0.758 ✔	1.333	H1-3+VT ✔
L3	82.92 - 43.67 (3)	0.011	0.907	0.000	0.045	0.008	0.919 ✔	1.333	H1-3+VT ✔
L4	43.67 - 1.67 (4)	0.012	0.924	0.000	0.037	0.004	0.937 ✔	1.333	H1-3+VT ✔

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	$SF*P_{allow}$ K	% Capacity	Pass Fail
L1	146.67 - 125.67	Pole	TP32.508x25.41x0.25	1	-6.13	1330.70	26.9	Pass
L2	125.67 - 82.92	Pole	TP44.632x32.508x0.375	2	-18.37	2637.61	56.9	Pass
L3	82.92 - 43.67	Pole	TP55.014x42.2513x0.4375	3	-30.33	3796.58	68.9	Pass
L4	43.67 - 1.67	Pole	TP66.05x52.1537x0.5	4	-49.97	5408.10	70.3	Pass
							Summary	
						Pole (L4)	70.3	Pass
						RATING =	**70.3**	**Pass**

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
153.96	Barkhamsted Branch 1	14	57.720	3.4126	0.2135	13278
142.67	(2) DB980F90E-M	14	54.872	3.3817	0.2005	13278
138.86	Barkhamsted Branch 2	14	52.170	3.3504	0.1882	8500
135.00	GPS	14	49.453	3.3151	0.1760	5688
133.00	LPA-80063/4CF	14	48.057	3.2947	0.1699	4856
128.17	Generic T-Arm Mount	14	44.730	3.2379	0.1555	3602
124.67	(4) DB844H90E-XY	14	42.367	3.1885	0.1457	3168
122.09	Barkhamsted Branch 3	14	40.654	3.1471	0.1388	3027
113.17	(3) DU04-8670	14	34.944	2.9739	0.1172	2733
110.55	Barkhamsted Branch 4	14	33.332	2.9151	0.1115	2657
92.30	Barkhamsted Branch 5	14	23.014	2.4330	0.0773	2226
83.50	Barkhamsted Branch 6	14	18.663	2.1710	0.0636	2070

Compression Checks

Pole Design Data

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	F_a ksi	A in^2	Actual P K	Allow. P_a K	Ratio $\frac{P}{P_a}$
L1	146.67 - 125.67 (1)	TP32.508x25.41x0.25	21.00	0.00	0.0	39.000	25.5967	-6.13	998.27	0.006
L2	125.67 - 82.92 (2)	TP44.632x32.508x0.375	42.75	0.00	0.0	39.000	50.7359	-18.37	1978.70	0.009
L3	82.92 - 43.67 (3)	TP55.014x42.2513x0.4375	45.00	0.00	0.0	39.000	73.0294	-30.33	2848.15	0.011
L4	43.67 - 1.67 (4)	TP66.05x52.1537x0.5	49.00	0.00	0.0	39.000	104.0280	-49.97	4057.09	0.012

Pole Bending Design Data

Section No.	Elevation ft	Size	Actual M_x kip-ft	Actual f_{bx} ksi	Allow. F_{bx} ksi	Ratio $\frac{f_{bx}}{F_{bx}}$	Actual M_y kip-ft	Actual f_{by} ksi	Allow. F_{by} ksi	Ratio $\frac{f_{by}}{F_{by}}$
L1	146.67 - 125.67 (1)	TP32.508x25.41x0.25	231.86	13.654	39.000	0.350	0.00	0.000	39.000	0.000
L2	125.67 - 82.92 (2)	TP44.632x32.508x0.375	1294.36	29.132	39.000	0.747	0.00	0.000	39.000	0.000
L3	82.92 - 43.67 (3)	TP55.014x42.2513x0.4375	2792.57	35.375	39.000	0.907	0.00	0.000	39.000	0.000
L4	43.67 - 1.67 (4)	TP66.05x52.1537x0.5	5056.61	36.053	39.000	0.924	0.00	0.000	39.000	0.000

Pole Shear Design Data

40	Yes	4	0.00000001	0.00020784
41	Yes	4	0.00000001	0.00039518
42	Yes	4	0.00000001	0.00053469
43	Yes	5	0.00000001	0.00002135
44	Yes	5	0.00000001	0.00002729
45	Yes	5	0.00000001	0.00002466
46	Yes	4	0.00000001	0.00097610
47	Yes	4	0.00000001	0.00063038
48	Yes	4	0.00000001	0.00024967
49	Yes	4	0.00000001	0.00043811
50	Yes	4	0.00000001	0.00078208

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	146.67 - 125.67	22.983	47	1.3729	0.0835
L2	125.67 - 82.92	17.095	47	1.2802	0.0581
L3	88.67 - 43.67	8.379	47	0.9237	0.0280
L4	50.67 - 1.67	2.625	47	0.4902	0.0105

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
153.96	Barkhamsted Branch 1	47	22.983	1.3729	0.0835	31156
142.67	(2) DB980F90E-M	47	21.840	1.3584	0.0784	31156
138.86	Barkhamsted Branch 2	47	20.756	1.3439	0.0736	19946
135.00	GPS	47	19.666	1.3280	0.0689	13348
133.00	LPA-80063/4CF	47	19.106	1.3190	0.0665	11395
128.17	Generic T-Arm Mount	47	17.773	1.2946	0.0609	8457
124.67	(4) DB844H90E-XY	47	16.827	1.2741	0.0570	7458
122.09	Barkhamsted Branch 3	47	16.142	1.2571	0.0544	7155
113.17	(3) DU04-8670	47	13.862	1.1876	0.0459	6562
110.55	Barkhamsted Branch 4	47	13.219	1.1642	0.0437	6407
92.30	Barkhamsted Branch 5	47	9.112	0.9685	0.0303	5502
83.50	Barkhamsted Branch 6	47	7.385	0.8576	0.0248	5152

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
L1	146.67 - 125.67	57.720	14	3.4126	0.2133
L2	125.67 - 82.92	43.037	14	3.2034	0.1482
L3	88.67 - 43.67	21.167	14	2.3263	0.0714
L4	50.67 - 1.67	6.649	14	1.2403	0.0267

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
39	19.51	-50.00	0.00	-19.51	50.00	0.00	0.000%
40	16.90	-50.00	9.64	-16.90	50.00	-9.64	0.000%
41	13.80	-50.00	13.63	-13.80	50.00	-13.63	0.000%
42	9.76	-50.00	16.69	-9.76	50.00	-16.69	0.000%
43	0.00	-50.00	19.27	0.00	50.00	-19.27	0.000%
44	-9.76	-50.00	16.69	9.76	50.00	-16.69	0.000%
45	-13.80	-50.00	13.63	13.80	50.00	-13.63	0.000%
46	-16.90	-50.00	9.64	16.90	50.00	-9.64	0.000%
47	-19.51	-50.00	0.00	19.51	50.00	0.00	0.000%
48	-16.90	-50.00	-9.64	16.90	50.00	9.64	0.000%
49	-13.80	-50.00	-13.63	13.80	50.00	13.63	0.000%
50	-9.76	-50.00	-16.69	9.76	50.00	16.69	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	5	0.00000001	0.00008398
3	Yes	5	0.00000001	0.00009063
4	Yes	5	0.00000001	0.00011085
5	Yes	5	0.00000001	0.00011372
6	Yes	5	0.00000001	0.00004751
7	Yes	5	0.00000001	0.00003932
8	Yes	5	0.00000001	0.00005194
9	Yes	5	0.00000001	0.00004715
10	Yes	5	0.00000001	0.00008362
11	Yes	5	0.00000001	0.00012675
12	Yes	5	0.00000001	0.00010979
13	Yes	5	0.00000001	0.00007636
14	Yes	5	0.00000001	0.00004784
15	Yes	5	0.00000001	0.00004126
16	Yes	5	0.00000001	0.00005351
17	Yes	5	0.00000001	0.00008118
18	Yes	4	0.00000001	0.00005270
19	Yes	5	0.00000001	0.00015678
20	Yes	5	0.00000001	0.00016826
21	Yes	5	0.00000001	0.00019992
22	Yes	5	0.00000001	0.00020231
23	Yes	5	0.00000001	0.00009229
24	Yes	5	0.00000001	0.00009237
25	Yes	5	0.00000001	0.00011341
26	Yes	5	0.00000001	0.00010397
27	Yes	5	0.00000001	0.00015363
28	Yes	5	0.00000001	0.00022587
29	Yes	5	0.00000001	0.00020094
30	Yes	5	0.00000001	0.00014865
31	Yes	5	0.00000001	0.00009545
32	Yes	5	0.00000001	0.00010313
33	Yes	5	0.00000001	0.00012521
34	Yes	5	0.00000001	0.00015837
35	Yes	5	0.00000001	0.00002201
36	Yes	5	0.00000001	0.00002303
37	Yes	5	0.00000001	0.00002442
38	Yes	5	0.00000001	0.00002372
39	Yes	4	0.00000001	0.00059701

Load Combination	Vertical K	Shear$_x$ K	Shear$_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead+Wind 45 deg - Service	50.00	13.80	-13.63	-1382.93	-1362.24	-24.22
Dead+Wind 60 deg - Service	50.00	16.90	-9.64	-982.53	-1674.57	-21.68
Dead+Wind 90 deg - Service	50.00	19.51	-0.00	-15.88	-1937.87	-12.43
Dead+Wind 120 deg - Service	50.00	16.90	9.64	950.77	-1674.57	0.15
Dead+Wind 135 deg - Service	50.00	13.80	13.63	1351.17	-1362.24	6.64
Dead+Wind 150 deg - Service	50.00	9.76	16.69	1658.40	-955.20	12.69
Dead+Wind 180 deg - Service	50.00	0.00	19.27	1917.42	27.47	21.82
Dead+Wind 210 deg - Service	50.00	-9.76	16.69	1658.41	1010.15	25.11
Dead+Wind 225 deg - Service	50.00	-13.80	13.63	1351.17	1417.19	24.22
Dead+Wind 240 deg - Service	50.00	-16.90	9.64	950.77	1729.53	21.67
Dead+Wind 270 deg - Service	50.00	-19.51	-0.00	-15.88	1992.84	12.43
Dead+Wind 300 deg - Service	50.00	-16.90	-9.64	-982.53	1729.53	-0.15
Dead+Wind 315 deg - Service	50.00	-13.80	-13.63	-1382.94	1417.20	-6.64
Dead+Wind 330 deg - Service	50.00	-9.76	-16.69	-1690.18	1010.16	-12.68

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-50.00	0.00	0.00	50.00	0.00	0.000%
2	0.00	-50.00	-49.34	0.00	50.00	49.34	0.000%
3	24.98	-50.00	-42.73	-24.98	50.00	42.73	0.000%
4	35.32	-50.00	-34.89	-35.32	50.00	34.89	0.000%
5	43.26	-50.00	-24.67	-43.26	50.00	24.67	0.000%
6	49.96	-50.00	0.00	-49.96	50.00	0.00	0.000%
7	43.26	-50.00	24.67	-43.26	50.00	-24.67	0.000%
8	35.32	-50.00	34.89	-35.32	50.00	-34.89	0.000%
9	24.98	-50.00	42.73	-24.98	50.00	-42.73	0.000%
10	0.00	-50.00	49.34	0.00	50.00	-49.34	0.000%
11	-24.98	-50.00	42.73	24.98	50.00	-42.73	0.000%
12	-35.32	-50.00	34.89	35.32	50.00	-34.89	0.000%
13	-43.26	-50.00	24.67	43.26	50.00	-24.67	0.000%
14	-49.96	-50.00	0.00	49.96	50.00	0.00	0.000%
15	-43.26	-50.00	-24.67	43.26	50.00	24.67	0.000%
16	-35.32	-50.00	-34.89	35.32	50.00	34.89	0.000%
17	-24.98	-50.00	-42.73	24.98	50.00	42.73	0.000%
18	0.00	-61.39	0.00	0.00	61.39	0.00	0.000%
19	0.00	-61.39	-39.41	-0.00	61.39	39.41	0.000%
20	19.94	-61.39	-34.13	-19.94	61.39	34.13	0.000%
21	28.20	-61.39	-27.87	-28.20	61.39	27.87	0.000%
22	34.54	-61.39	-19.71	-34.54	61.39	19.71	0.000%
23	39.88	-61.39	0.00	-39.88	61.39	-0.00	0.000%
24	34.54	-61.39	19.71	-34.54	61.39	-19.71	0.000%
25	28.20	-61.39	27.87	-28.20	61.39	-27.87	0.000%
26	19.94	-61.39	34.13	-19.94	61.39	-34.13	0.000%
27	0.00	-61.39	39.41	-0.00	61.39	-39.41	0.000%
28	-19.94	-61.39	34.13	19.94	61.39	-34.13	0.000%
29	-28.20	-61.39	27.87	28.20	61.39	-27.87	0.000%
30	-34.54	-61.39	19.71	34.54	61.39	-19.71	0.000%
31	-39.88	-61.39	0.00	39.88	61.39	-0.00	0.000%
32	-34.54	-61.39	-19.71	34.54	61.39	19.71	0.000%
33	-28.20	-61.39	-27.87	28.20	61.39	27.87	0.000%
34	-19.94	-61.39	-34.13	19.94	61.39	34.13	0.000%
35	0.00	-50.00	-19.27	0.00	50.00	19.27	0.000%
36	9.76	-50.00	-16.69	-9.76	50.00	16.69	0.000%
37	13.80	-50.00	-13.63	-13.80	50.00	13.63	0.000%
38	16.90	-50.00	-9.64	-16.90	50.00	9.64	0.000%

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Pole	Max. Vert	31	61.39	39.88	-0.00
	Max. H_x	14	50.00	49.96	0.00
	Max. H_z	2	50.00	0.00	49.34
	Max. M_x	2	4963.09	0.00	49.34
	Max. M_z	6	5001.78	-49.96	0.00
	Max. Torsion	3	64.10	-24.98	42.73
	Min. Vert	1	50.00	0.00	0.00
	Min. H_x	6	50.00	-49.96	0.00
	Min. H_z	10	50.00	0.00	-49.34
	Min. M_x	10	-4931.42	0.00	-49.34
	Min. M_z	14	-5056.58	49.96	0.00
	Min. Torsion	11	-64.08	24.98	-42.73

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	50.00	-0.00	0.00	-15.86	27.45	0.00
Dead+Wind 0 deg - No Ice	50.00	0.00	-49.34	-4963.09	27.35	-55.69
Dead+Wind 30 deg - No Ice	50.00	24.98	-42.73	-4300.23	-2487.28	-64.10
Dead+Wind 45 deg - No Ice	50.00	35.32	-34.89	-3514.00	-3528.85	-61.82
Dead+Wind 60 deg - No Ice	50.00	43.26	-24.67	-2489.38	-4328.05	-55.32
Dead+Wind 90 deg - No Ice	50.00	49.96	0.00	-15.81	-5001.78	-31.72
Dead+Wind 120 deg - No Ice	50.00	43.26	24.67	2457.75	-4328.02	0.39
Dead+Wind 135 deg - No Ice	50.00	35.32	34.89	3482.35	-3528.81	16.96
Dead+Wind 150 deg - No Ice	50.00	24.98	42.73	4268.57	-2487.25	32.38
Dead+Wind 180 deg - No Ice	50.00	0.00	49.34	4931.42	27.35	55.70
Dead+Wind 210 deg - No Ice	50.00	-24.98	42.73	4268.62	2541.98	64.08
Dead+Wind 225 deg - No Ice	50.00	-35.32	34.89	3482.41	3583.56	61.79
Dead+Wind 240 deg - No Ice	50.00	-43.26	24.67	2457.80	4382.80	55.30
Dead+Wind 270 deg - No Ice	50.00	-49.96	0.00	-15.80	5056.58	31.71
Dead+Wind 300 deg - No Ice	50.00	-43.26	-24.67	-2489.43	4382.82	-0.37
Dead+Wind 315 deg - No Ice	50.00	-35.32	-34.89	-3514.05	3583.59	-16.94
Dead+Wind 330 deg - No Ice	50.00	-24.98	-42.73	-4300.28	2542.00	-32.36
Dead+Ice+Temp	61.39	-0.00	-0.00	-27.58	47.19	0.00
Dead+Wind 0 deg+Ice+Temp	61.39	0.00	-39.41	-4054.29	47.08	-41.78
Dead+Wind 30 deg+Ice+Temp	61.39	19.94	-34.13	-3514.78	-1998.07	-48.01
Dead+Wind 45 deg+Ice+Temp	61.39	28.20	-27.87	-2874.84	-2845.19	-46.27
Dead+Wind 60 deg+Ice+Temp	61.39	34.54	-19.71	-2040.87	-3495.20	-41.38
Dead+Wind 90 deg+Ice+Temp	61.39	39.88	0.00	-27.52	-4043.16	-23.65
Dead+Wind 120 deg+Ice+Temp	61.39	34.54	19.71	1985.81	-3495.18	0.42
Dead+Wind 135 deg+Ice+Temp	61.39	28.20	27.87	2819.78	-2845.17	12.83
Dead+Wind 150 deg+Ice+Temp	61.39	19.94	34.13	3459.71	-1998.05	24.37
Dead+Wind 180 deg+Ice+Temp	61.39	0.00	39.41	3999.21	47.09	41.79
Dead+Wind 210 deg+Ice+Temp	61.39	-19.94	34.13	3459.74	2092.25	48.00
Dead+Wind 225 deg+Ice+Temp	61.39	-28.20	27.87	2819.81	2939.37	46.26
Dead+Wind 240 deg+Ice+Temp	61.39	-34.54	19.71	1985.85	3589.40	41.36
Dead+Wind 270 deg+Ice+Temp	61.39	-39.88	0.00	-27.52	4137.39	23.64
Dead+Wind 300 deg+Ice+Temp	61.39	-34.54	-19.71	-2040.89	3589.41	-0.41
Dead+Wind 315 deg+Ice+Temp	61.39	-28.20	-27.87	-2874.87	2939.39	-12.82
Dead+Wind 330 deg+Ice+Temp	61.39	-19.94	-34.13	-3514.81	2092.25	-24.35
Dead+Wind 0 deg - Service	50.00	0.00	-19.27	-1949.19	27.47	-21.82
Dead+Wind 30 deg - Service	50.00	9.76	-16.69	-1690.17	-955.21	-25.11

Comb. No.	Description
32	Dead+Wind 300 deg+Ice+Temp
33	Dead+Wind 315 deg+Ice+Temp
34	Dead+Wind 330 deg+Ice+Temp
35	Dead+Wind 0 deg - Service
36	Dead+Wind 30 deg - Service
37	Dead+Wind 45 deg - Service
38	Dead+Wind 60 deg - Service
39	Dead+Wind 90 deg - Service
40	Dead+Wind 120 deg - Service
41	Dead+Wind 135 deg - Service
42	Dead+Wind 150 deg - Service
43	Dead+Wind 180 deg - Service
44	Dead+Wind 210 deg - Service
45	Dead+Wind 225 deg - Service
46	Dead+Wind 240 deg - Service
47	Dead+Wind 270 deg - Service
48	Dead+Wind 300 deg - Service
49	Dead+Wind 315 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Force K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
L1	146.67 - 125.67	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-10.58	16.59	9.90
			Max. Mx	14	-6.13	231.80	4.97
			Max. My	2	-6.19	8.57	223.26
			Max. Vy	14	-16.82	231.80	4.97
			Max. Vx	2	-16.19	8.57	223.26
			Max. Torque	3			29.19
L2	125.67 - 82.92	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-27.73	40.82	23.90
			Max. Mx	14	-18.37	1294.29	13.34
			Max. My	2	-18.43	23.07	1256.57
			Max. Vy	14	-35.59	1294.29	13.34
			Max. Vx	2	-34.96	23.07	1256.57
			Max. Torque	3			60.27
L3	82.92 - 43.67	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-40.85	46.93	27.43
			Max. Mx	14	-30.33	2792.52	15.69
			Max. My	2	-30.36	27.15	2729.51
			Max. Vy	14	-42.46	2792.52	15.69
			Max. Vx	2	-41.83	27.15	2729.51
			Max. Torque	3			64.19
L4	43.67 - 1.67	Pole	Max Tension	1	0.00	0.00	0.00
			Max. Compression	18	-61.39	47.19	27.58
			Max. Mx	14	-49.97	5056.58	15.81
			Max. My	2	-49.97	27.36	4963.09
			Max. Vy	14	-49.98	5056.58	15.81
			Max. Vx	2	-49.37	27.36	4963.09
			Max. Torque	3			64.12

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 300 deg - Ice		-34.54	-19.71	-1996.13	3510.57	-0.43
Wind 315 deg - Ice		-28.20	-27.87	-2811.97	2874.70	-12.90
Wind 330 deg - Ice		-19.94	-34.13	-3437.98	2046.01	-24.50
Total Weight	50.00			-15.44	26.72	
Wind 0 deg - Service		0.00	-19.27	-1917.83	26.72	-21.88
Wind 30 deg - Service		9.76	-16.69	-1662.96	-940.21	-25.18
Wind 45 deg - Service		13.80	-13.63	-1360.64	-1340.73	-24.28
Wind 60 deg - Service		16.90	-9.64	-966.64	-1648.06	-21.73
Wind 90 deg - Service		19.51	0.00	-15.44	-1907.15	-12.46
Wind 120 deg - Service		16.90	9.64	935.75	-1648.06	0.15
Wind 135 deg - Service		13.80	13.63	1329.75	-1340.73	6.66
Wind 150 deg - Service		9.76	16.69	1632.07	-940.21	12.72
Wind 180 deg - Service		0.00	19.27	1886.94	26.72	21.88
Wind 210 deg - Service		-9.76	16.69	1632.07	993.66	25.18
Wind 225 deg - Service		-13.80	13.63	1329.75	1394.18	24.28
Wind 240 deg - Service		-16.90	9.64	935.75	1701.50	21.73
Wind 270 deg - Service		-19.51	0.00	-15.44	1960.59	12.46
Wind 300 deg - Service		-16.90	-9.64	-966.64	1701.50	-0.15
Wind 315 deg - Service		-13.80	-13.63	-1360.64	1394.18	-6.66
Wind 330 deg - Service		-9.76	-16.69	-1662.96	993.66	-12.72

Load Combinations

Comb. No.	Description
1	Dead Only
2	Dead+Wind 0 deg - No Ice
3	Dead+Wind 30 deg - No Ice
4	Dead+Wind 45 deg - No Ice
5	Dead+Wind 60 deg - No Ice
6	Dead+Wind 90 deg - No Ice
7	Dead+Wind 120 deg - No Ice
8	Dead+Wind 135 deg - No Ice
9	Dead+Wind 150 deg - No Ice
10	Dead+Wind 180 deg - No Ice
11	Dead+Wind 210 deg - No Ice
12	Dead+Wind 225 deg - No Ice
13	Dead+Wind 240 deg - No Ice
14	Dead+Wind 270 deg - No Ice
15	Dead+Wind 300 deg - No Ice
16	Dead+Wind 315 deg - No Ice
17	Dead+Wind 330 deg - No Ice
18	Dead+Ice+Temp
19	Dead+Wind 0 deg+Ice+Temp
20	Dead+Wind 30 deg+Ice+Temp
21	Dead+Wind 45 deg+Ice+Temp
22	Dead+Wind 60 deg+Ice+Temp
23	Dead+Wind 90 deg+Ice+Temp
24	Dead+Wind 120 deg+Ice+Temp
25	Dead+Wind 135 deg+Ice+Temp
26	Dead+Wind 150 deg+Ice+Temp
27	Dead+Wind 180 deg+Ice+Temp
28	Dead+Wind 210 deg+Ice+Temp
29	Dead+Wind 225 deg+Ice+Temp
30	Dead+Wind 240 deg+Ice+Temp
31	Dead+Wind 270 deg+Ice+Temp

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	1.63	A	1	1.2	1	1	1	50.678	0.99	46.92	C
			B	1	1.2	1	1	1	50.678			
			C	1	1.2	1	1	1	50.678			
L2 125.67-82.92	1.27	6.61	A	1	1.2	1	1	1	137.406	2.47	57.72	C
			B	1	1.2	1	1	1	137.406			
			C	1	1.2	1	1	1	137.406			
L3 82.92-43.67	1.24	10.25	A	1	1.2	1	1	1	161.736	2.51	64.05	C
			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4 43.67-1.67	1.24	15.51	A	1	1.2	1	1	1	210.331	2.73	65.00	C
			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	3.94	34.00						OTM	592.91 kip-ft	8.70		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	34.00					
Bracing Weight	0.00					
Total Member Self-Weight	34.00			-15.44	26.72	
Total Weight	50.00			-15.44	26.72	
Wind 0 deg - No Ice		0.00	-49.34	-4885.56	26.72	-56.01
Wind 30 deg - No Ice		24.98	-42.73	-4233.09	-2448.63	-64.46
Wind 45 deg - No Ice		35.32	-34.89	-3459.13	-3473.96	-62.16
Wind 60 deg - No Ice		43.26	-24.67	-2450.50	-4260.72	-55.63
Wind 90 deg - No Ice		49.96	0.00	-15.44	-4923.99	-31.90
Wind 120 deg - No Ice		43.26	24.67	2419.61	-4260.72	0.38
Wind 135 deg - No Ice		35.32	34.89	3428.25	-3473.96	17.05
Wind 150 deg - No Ice		24.98	42.73	4202.20	-2448.63	32.56
Wind 180 deg - No Ice		0.00	49.34	4854.67	26.72	56.01
Wind 210 deg - No Ice		-24.98	42.73	4202.20	2502.08	64.46
Wind 225 deg - No Ice		-35.32	34.89	3428.25	3527.40	62.16
Wind 240 deg - No Ice		-43.26	24.67	2419.61	4314.16	55.63
Wind 270 deg - No Ice		-49.96	0.00	-15.44	4977.43	31.90
Wind 300 deg - No Ice		-43.26	-24.67	-2450.50	4314.16	-0.38
Wind 315 deg - No Ice		-35.32	-34.89	-3459.13	3527.40	-17.05
Wind 330 deg - No Ice		-24.98	-42.73	-4233.09	2502.08	-32.56
Member Ice	4.19					
Total Weight Ice	61.39			-26.52	45.38	
Wind 0 deg - Ice		0.00	-39.41	-3965.74	45.38	-42.01
Wind 30 deg - Ice		19.94	-34.13	-3437.98	-1955.25	-48.26
Wind 45 deg - Ice		28.20	-27.87	-2811.97	-2783.93	-46.51
Wind 60 deg - Ice		34.54	-19.71	-1996.13	-3419.81	-41.58
Wind 90 deg - Ice		39.88	0.00	-26.52	-3955.87	-23.76
Wind 120 deg - Ice		34.54	19.71	1943.08	-3419.81	0.43
Wind 135 deg - Ice		28.20	27.87	2758.92	-2783.93	12.90
Wind 150 deg - Ice		19.94	34.13	3384.94	-1955.25	24.50
Wind 180 deg - Ice		0.00	39.41	3912.69	45.38	42.01
Wind 210 deg - Ice		-19.94	34.13	3384.94	2046.01	48.26
Wind 225 deg - Ice		-28.20	27.87	2758.92	2874.70	46.51
Wind 240 deg - Ice		-34.54	19.71	1943.08	3510.57	41.58
Wind 270 deg - Ice		-39.88	0.00	-26.52	4046.64	23.76

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
Sum Weight:	3.94	34.00						OTM	592.91 kip-ft	8.70		

Tower Forces - Service - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	1.63	A	1	1.2	1	1	1	50.678	0.99	46.92	C
			B	1	1.2	1	1	1	50.678			
			C	1	1.2	1	1	1	50.678			
L2 125.67-82.92	1.27	6.61	A	1	1.2	1	1	1	137.406	2.47	57.72	C
			B	1	1.2	1	1	1	137.406			
			C	1	1.2	1	1	1	137.406			
L3 82.92-43.67	1.24	10.25	A	1	1.2	1	1	1	161.736	2.51	64.05	C
			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4 43.67-1.67	1.24	15.51	A	1	1.2	1	1	1	210.331	2.73	65.00	C
			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	3.94	34.00						OTM	592.91 kip-ft	8.70		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	1.63	A	1	1.2	1	1	1	50.678	0.99	46.92	C
			B	1	1.2	1	1	1	50.678			
			C	1	1.2	1	1	1	50.678			
L2 125.67-82.92	1.27	6.61	A	1	1.2	1	1	1	137.406	2.47	57.72	C
			B	1	1.2	1	1	1	137.406			
			C	1	1.2	1	1	1	137.406			
L3 82.92-43.67	1.24	10.25	A	1	1.2	1	1	1	161.736	2.51	64.05	C
			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4 43.67-1.67	1.24	15.51	A	1	1.2	1	1	1	210.331	2.73	65.00	C
			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	3.94	34.00						OTM	592.91 kip-ft	8.70		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L2 125.67-82.92	1.27	7.64	A	1	1.2	1	1	1	140.968	4.86	113.69	C
			B	1	1.2	1	1	1	140.968			
			C	1	1.2	1	1	1	140.968			
L3 82.92-43.67	1.24	11.46	A	1	1.2	1	1	1	165.007	4.92	125.46	C
			B	1	1.2	1	1	1	165.007			
			C	1	1.2	1	1	1	165.007			
L4 43.67-1.67	1.24	17.08	A	1	1.2	1	1	1	213.831	5.33	126.87	C
			B	1	1.2	1	1	1	213.831			
			C	1	1.2	1	1	1	213.831			
Sum Weight:	3.94	38.19						OTM	1167.41 kip-ft	17.07		

Tower Forces - With Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	2.01	A	1	1.2	1	1	1	52.428	1.96	93.19	C
			B	1	1.2	1	1	1	52.428			
			C	1	1.2	1	1	1	52.428			
L2 125.67-82.92	1.27	7.64	A	1	1.2	1	1	1	140.968	4.86	113.69	C
			B	1	1.2	1	1	1	140.968			
			C	1	1.2	1	1	1	140.968			
L3 82.92-43.67	1.24	11.46	A	1	1.2	1	1	1	165.007	4.92	125.46	C
			B	1	1.2	1	1	1	165.007			
			C	1	1.2	1	1	1	165.007			
L4 43.67-1.67	1.24	17.08	A	1	1.2	1	1	1	213.831	5.33	126.87	C
			B	1	1.2	1	1	1	213.831			
			C	1	1.2	1	1	1	213.831			
Sum Weight:	3.94	38.19						OTM	1167.41 kip-ft	17.07		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft^2	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	1.63	A	1	1.2	1	1	1	50.678	0.99	46.92	C
			B	1	1.2	1	1	1	50.678			
			C	1	1.2	1	1	1	50.678			
L2 125.67-82.92	1.27	6.61	A	1	1.2	1	1	1	137.406	2.47	57.72	C
			B	1	1.2	1	1	1	137.406			
			C	1	1.2	1	1	1	137.406			
L3 82.92-43.67	1.24	10.25	A	1	1.2	1	1	1	161.736	2.51	64.05	C
			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4 43.67-1.67	1.24	15.51	A	1	1.2	1	1	1	210.331	2.73	65.00	C
			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			

Tower Forces - With Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	2.01	A	1	1.2	1	1	1	52.428	1.96	93.19	C
			B	1	1.2	1	1	1	52.428			
			C	1	1.2	1	1	1	52.428			
L2 125.67-82.92	1.27	7.64	A	1	1.2	1	1	1	140.968	4.86	113.69	C
			B	1	1.2	1	1	1	140.968			
			C	1	1.2	1	1	1	140.968			
L3 82.92-43.67	1.24	11.46	A	1	1.2	1	1	1	165.007	4.92	125.46	C
			B	1	1.2	1	1	1	165.007			
			C	1	1.2	1	1	1	165.007			
L4 43.67-1.67	1.24	17.08	A	1	1.2	1	1	1	213.831	5.33	126.87	C
			B	1	1.2	1	1	1	213.831			
			C	1	1.2	1	1	1	213.831			
Sum Weight:	3.94	38.19						OTM	1167.41 kip-ft	17.07		

Tower Forces - With Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	2.01	A	1	1.2	1	1	1	52.428	1.96	93.19	C
			B	1	1.2	1	1	1	52.428			
			C	1	1.2	1	1	1	52.428			
L2 125.67-82.92	1.27	7.64	A	1	1.2	1	1	1	140.968	4.86	113.69	C
			B	1	1.2	1	1	1	140.968			
			C	1	1.2	1	1	1	140.968			
L3 82.92-43.67	1.24	11.46	A	1	1.2	1	1	1	165.007	4.92	125.46	C
			B	1	1.2	1	1	1	165.007			
			C	1	1.2	1	1	1	165.007			
L4 43.67-1.67	1.24	17.08	A	1	1.2	1	1	1	213.831	5.33	126.87	C
			B	1	1.2	1	1	1	213.831			
			C	1	1.2	1	1	1	213.831			
Sum Weight:	3.94	38.19						OTM	1167.41 kip-ft	17.07		

Tower Forces - With Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	2.01	A	1	1.2	1	1	1	52.428	1.96	93.19	C
			B	1	1.2	1	1	1	52.428			
			C	1	1.2	1	1	1	52.428			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
			C	1	1.2	1	1	1	137.406			
L3 82.92-43.67	1.24	10.25	A	1	1.2	1	1	1	161.736	6.44	163.96	C
			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4 43.67-1.67	1.24	15.51	A	1	1.2	1	1	1	210.331	6.99	166.40	C
			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	3.94	34.00						OTM	1517.86 kip-ft	22.26		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	1.63	A	1	1.2	1	1	1	50.678	2.52	120.11	C
			B	1	1.2	1	1	1	50.678			
			C	1	1.2	1	1	1	50.678			
L2 125.67-82.92	1.27	6.61	A	1	1.2	1	1	1	137.406	6.32	147.75	C
			B	1	1.2	1	1	1	137.406			
			C	1	1.2	1	1	1	137.406			
L3 82.92-43.67	1.24	10.25	A	1	1.2	1	1	1	161.736	6.44	163.96	C
			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4 43.67-1.67	1.24	15.51	A	1	1.2	1	1	1	210.331	6.99	166.40	C
			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	3.94	34.00						OTM	1517.86 kip-ft	22.26		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	1.63	A	1	1.2	1	1	1	50.678	2.52	120.11	C
			B	1	1.2	1	1	1	50.678			
			C	1	1.2	1	1	1	50.678			
L2 125.67-82.92	1.27	6.61	A	1	1.2	1	1	1	137.406	6.32	147.75	C
			B	1	1.2	1	1	1	137.406			
			C	1	1.2	1	1	1	137.406			
L3 82.92-43.67	1.24	10.25	A	1	1.2	1	1	1	161.736	6.44	163.96	C
			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4 43.67-1.67	1.24	15.51	A	1	1.2	1	1	1	210.331	6.99	166.40	C
			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	3.94	34.00						OTM	1517.86 kip-ft	22.26		

Tower Pressure - Service

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft²	Face	A_F ft²	A_R ft²	A_{leg} ft²	Leg %	C_AA_A In Face ft²	C_AA_A Out Face ft²
L1 146.67-125.67	135.74	1.498	10	50.678	A	0.000	50.678	50.678	100.00	0.000	0.000
					B	0.000	50.678		100.00		
					C	0.000	50.678		100.00		
L2 125.67-82.92	103.49	1.386	9	137.406	A	0.000	137.406	137.406	100.00	0.000	0.000
					B	0.000	137.406		100.00		
					C	0.000	137.406		100.00		
L3 82.92-43.67	63.00	1.203	8	161.736	A	0.000	161.736	161.736	100.00	0.000	0.000
					B	0.000	161.736		100.00		
					C	0.000	161.736		100.00		
L4 43.67-1.67	21.98	1	6	210.331	A	0.000	210.331	210.331	100.00	0.000	0.000
					B	0.000	210.331		100.00		
					C	0.000	210.331		100.00		

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	1.63	A	1	1.2	1	1	1	50.678	2.52	120.11	C
			B	1	1.2	1	1	1	50.678			
			C	1	1.2	1	1	1	50.678			
L2 125.67-82.92	1.27	6.61	A	1	1.2	1	1	1	137.406	6.32	147.75	C
			B	1	1.2	1	1	1	137.406			
			C	1	1.2	1	1	1	137.406			
L3 82.92-43.67	1.24	10.25	A	1	1.2	1	1	1	161.736	6.44	163.96	C
			B	1	1.2	1	1	1	161.736			
			C	1	1.2	1	1	1	161.736			
L4 43.67-1.67	1.24	15.51	A	1	1.2	1	1	1	210.331	6.99	166.40	C
			B	1	1.2	1	1	1	210.331			
			C	1	1.2	1	1	1	210.331			
Sum Weight:	3.94	34.00						OTM	1517.86 kip-ft	22.26		

Tower Forces - No Ice - Wind 45 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	R_R	D_F	D_R	A_E ft²	F K	w plf	Ctrl. Face
L1 146.67-125.67	0.20	1.63	A	1	1.2	1	1	1	50.678	2.52	120.11	C
			B	1	1.2	1	1	1	50.678			
			C	1	1.2	1	1	1	50.678			
L2 125.67-82.92	1.27	6.61	A	1	1.2	1	1	1	137.406	6.32	147.75	C
			B	1	1.2	1	1	1	137.406			

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Valmont T-Arm (1) (AT&T/Cingular)	C	From Face	0.00 2.00 0.00 0.00	0.0000	113.17	No Ice 1/2" Ice	10.54 14.45	10.54 14.45	0.34 0.41

Tower Pressures - No Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 146.67-125.67	135.74	1.498	25	50.678	A	0.000	50.678	50.678	100.00	0.000	0.000
					B	0.000	50.678		100.00		
					C	0.000	50.678		100.00		
L2 125.67-82.92	103.49	1.386	23	137.406	A	0.000	137.406	137.406	100.00	0.000	0.000
					B	0.000	137.406		100.00		
					C	0.000	137.406		100.00		
L3 82.92-43.67	63.00	1.203	20	161.736	A	0.000	161.736	161.736	100.00	0.000	0.000
					B	0.000	161.736		100.00		
					C	0.000	161.736		100.00		
L4 43.67-1.67	21.98	1	16	210.331	A	0.000	210.331	210.331	100.00	0.000	0.000
					B	0.000	210.331		100.00		
					C	0.000	210.331		100.00		

Tower Pressure - With Ice

$G_H = 1.690$

Section Elevation ft	z ft	K_Z	q_z psf	t_Z in	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
L1 146.67-125.67	135.74	1.498	18	0.5000	52.428	A	0.000	52.428	52.428	100.00	0.000	0.000
						B	0.000	52.428		100.00		
						C	0.000	52.428		100.00		
L2 125.67-82.92	103.49	1.386	17	0.5000	140.968	A	0.000	140.968	140.968	100.00	0.000	0.000
						B	0.000	140.968		100.00		
						C	0.000	140.968		100.00		
L3 82.92-43.67	63.00	1.203	15	0.5000	165.007	A	0.000	165.007	165.007	100.00	0.000	0.000
						B	0.000	165.007		100.00		
						C	0.000	165.007		100.00		
L4 43.67-1.67	21.98	1	12	0.5000	213.831	A	0.000	213.831	213.831	100.00	0.000	0.000
						B	0.000	213.831		100.00		
						C	0.000	213.831		100.00		

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00						
Valmont T-Arm (1)	B	From Face	2.00	0.0000	133.00	No Ice	10.54	10.54	0.34
(Verizon - proposed)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
Valmont T-Arm (1)	C	From Face	2.00	0.0000	133.00	No Ice	10.54	10.54	0.34
(Verizon - proposed)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
Generic T-Arm Mount	A	From Face	2.00	0.0000	128.17	No Ice	5.50	5.50	0.13
			0.00			1/2" Ice	6.90	6.90	0.17
			0.00						
Generic T-Arm Mount	B	From Face	2.00	0.0000	128.17	No Ice	5.50	5.50	0.13
			0.00			1/2" Ice	6.90	6.90	0.17
			0.00						
Generic T-Arm Mount	C	From Face	2.00	0.0000	128.17	No Ice	5.50	5.50	0.13
			0.00			1/2" Ice	6.90	6.90	0.17
			0.00						
(4) DB844H90E-XY	A	From Face	4.00	0.0000	124.67	No Ice	2.87	3.73	0.01
(Sprint/Nextel)			0.00			1/2" Ice	3.18	4.10	0.04
			0.00						
(4) DB844H90E-XY	B	From Face	4.00	0.0000	124.67	No Ice	2.87	3.73	0.01
(Sprint/Nextel)			0.00			1/2" Ice	3.18	4.10	0.04
			0.00						
(4) DB844H90E-XY	C	From Face	4.00	0.0000	124.67	No Ice	2.87	3.73	0.01
(Sprint/Nextel)			0.00			1/2" Ice	3.18	4.10	0.04
			0.00						
Valmont T-Arm (1)	A	From Face	2.00	0.0000	124.67	No Ice	10.54	10.54	0.34
(Sprint/Nextel)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
Valmont T-Arm (1)	B	From Face	2.00	0.0000	124.67	No Ice	10.54	10.54	0.34
(Sprint/Nextel)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
Valmont T-Arm (1)	C	From Face	2.00	0.0000	124.67	No Ice	10.54	10.54	0.34
(Sprint/Nextel)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
(3) DU04-8670	A	From Face	4.00	0.0000	113.17	No Ice	6.53	4.20	0.03
(AT&T/Cingular)			0.00			1/2" Ice	6.94	4.57	0.07
			0.00						
(3) DU04-8670	B	From Face	4.00	0.0000	113.17	No Ice	6.53	4.20	0.03
(AT&T/Cingular)			0.00			1/2" Ice	6.94	4.57	0.07
			0.00						
(3) DU04-8670	C	From Face	4.00	0.0000	113.17	No Ice	6.53	4.20	0.03
(AT&T/Cingular)			0.00			1/2" Ice	6.94	4.57	0.07
			0.00						
TMA	A	From Face	4.00	0.0000	113.17	No Ice	0.47	0.47	0.03
(AT&T/Cingular)			0.00			1/2" Ice	0.56	0.56	0.03
			0.00						
TMA	B	From Face	4.00	0.0000	113.17	No Ice	0.47	0.47	0.03
(AT&T/Cingular)			0.00			1/2" Ice	0.56	0.56	0.03
			0.00						
TMA	C	From Face	4.00	0.0000	113.17	No Ice	0.47	0.47	0.03
(AT&T/Cingular)			0.00			1/2" Ice	0.56	0.56	0.03
			0.00						
Valmont T-Arm (1)	A	From Face	2.00	0.0000	113.17	No Ice	10.54	10.54	0.34
(AT&T/Cingular)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
Valmont T-Arm (1)	B	From Face	2.00	0.0000	113.17	No Ice	10.54	10.54	0.34
(AT&T/Cingular)			0.00			1/2" Ice	14.45	14.45	0.41

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
			0.00						
(2) DB980F90E-M	C	From Face	4.00	0.0000	142.67	No Ice	3.90	2.29	0.01
(Sprint/Nextel)			0.00			1/2" Ice	4.28	2.65	0.03
			0.00						
Valmont T-Arm (1)	A	From Face	2.00	0.0000	142.67	No Ice	10.54	10.54	0.34
(Sprint/Nextel)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
Valmont T-Arm (1)	B	From Face	2.00	0.0000	142.67	No Ice	10.54	10.54	0.34
(Sprint/Nextel)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
Valmont T-Arm (1)	C	From Face	2.00	0.0000	142.67	No Ice	10.54	10.54	0.34
(Sprint/Nextel)			0.00			1/2" Ice	14.45	14.45	0.41
			0.00						
LPA-80063/4CF	A	From Face	4.00	0.0000	133.00	No Ice	7.01	6.08	0.02
(Verizon - proposed)			6.00			1/2" Ice	7.42	6.48	0.07
			0.00						
LPA-80063/4CF	A	From Face	4.00	0.0000	133.00	No Ice	7.01	6.08	0.02
(Verizon - proposed)			-6.00			1/2" Ice	7.42	6.48	0.07
			0.00						
LPA-80063/4CF	B	From Face	4.00	0.0000	133.00	No Ice	7.01	6.08	0.02
(Verizon - proposed)			6.00			1/2" Ice	7.42	6.48	0.07
			0.00						
LPA-80063/4CF	B	From Face	4.00	0.0000	133.00	No Ice	7.01	6.08	0.02
(Verizon - proposed)			-6.00			1/2" Ice	7.42	6.48	0.07
			0.00						
LPA-80080/4CF	C	From Face	4.00	0.0000	133.00	No Ice	2.62	6.06	0.01
(Verizon - proposed)			6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
LPA-80080/4CF	C	From Face	4.00	0.0000	133.00	No Ice	2.62	6.06	0.01
(Verizon - proposed)			-6.00			1/2" Ice	2.92	6.45	0.05
			0.00						
DB948F65E-M	A	From Face	4.00	0.0000	133.00	No Ice	4.95	3.26	0.01
(Verizon - proposed)			2.00			1/2" Ice	5.34	3.62	0.05
			0.00						
DB948F65E-M	A	From Face	4.00	0.0000	133.00	No Ice	4.95	3.26	0.01
(Verizon - proposed)			-2.00			1/2" Ice	5.34	3.62	0.05
			0.00						
DB948F65E-M	B	From Face	4.00	0.0000	133.00	No Ice	4.95	3.26	0.01
(Verizon - proposed)			2.00			1/2" Ice	5.34	3.62	0.05
			0.00						
DB948F65E-M	B	From Face	4.00	0.0000	133.00	No Ice	4.95	3.26	0.01
(Verizon - proposed)			-2.00			1/2" Ice	5.34	3.62	0.05
			0.00						
DB948G85E-M	C	From Face	4.00	0.0000	133.00	No Ice	1.92	3.30	0.01
(Verizon - proposed)			2.00			1/2" Ice	2.22	3.66	0.03
			0.00						
DB948G85E-M	C	From Face	4.00	0.0000	133.00	No Ice	1.92	3.30	0.01
(Verizon - proposed)			-2.00			1/2" Ice	2.22	3.66	0.03
			0.00						
GPS	C	From Face	4.00	0.0000	135.00	No Ice	1.00	1.00	0.01
(Verizon - proposed)			3.00			1/2" Ice	1.50	1.50	0.01
			0.00						
GPS	C	From Face	4.00	0.0000	135.00	No Ice	1.00	1.00	0.01
(Verizon - proposed)			-3.00			1/2" Ice	1.50	1.50	0.01
			0.00						
Valmont T-Arm (1)	A	From Face	2.00	0.0000	133.00	No Ice	10.54	10.54	0.34
(Verizon - proposed)			0.00			1/2" Ice	14.45	14.45	0.41

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L4	43.67-1.67	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.24

Feed Line/Linear Appurtenances Section Areas - With Ice

Tower Section	Tower Elevation ft	Face or Leg	Ice Thickness in	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	146.67-125.67	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	0.20
L2	125.67-82.92	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.27
L3	82.92-43.67	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.24
L4	43.67-1.67	A	0.500	0.000	0.000	0.000	0.000	0.00
		B		0.000	0.000	0.000	0.000	0.00
		C		0.000	0.000	0.000	0.000	1.24

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
Barkhamsted Branch 1	A	From Face	3.00	0.0000	153.96	No Ice	48.51	48.51	0.32
			0.00			1/2" Ice	48.51	48.51	0.73
			0.00						
Barkhamsted Branch 2	A	From Face	3.00	0.0000	138.86	No Ice	120.49	120.49	2.29
			0.00			1/2" Ice	120.49	120.49	3.83
			0.00						
Barkhamsted Branch 3	A	From Face	3.00	0.0000	122.09	No Ice	13.86	13.86	0.09
			0.00			1/2" Ice	13.86	13.86	0.21
			0.00						
Barkhamsted Branch 4	A	From Face	3.00	0.0000	110.55	No Ice	134.66	134.66	2.56
			0.00			1/2" Ice	134.66	134.66	4.28
			0.00						
Barkhamsted Branch 5	A	From Face	3.00	0.0000	92.30	No Ice	28.62	28.62	0.90
			0.00			1/2" Ice	28.62	28.62	1.44
			0.00						
Barkhamsted Branch 6	A	From Face	3.00	0.0000	83.50	No Ice	22.07	22.07	0.77
			0.00			1/2" Ice	22.07	22.07	1.30
			0.00						
(2) DB980F90E-M (Sprint/Nextel)	A	From Face	4.00	0.0000	142.67	No Ice	3.90	2.29	0.01
			0.00			1/2" Ice	4.28	2.65	0.03
			0.00						
(2) DB980F90E-M (Sprint/Nextel)	B	From Face	4.00	0.0000	142.67	No Ice	3.90	2.29	0.01
			0.00			1/2" Ice	4.28	2.65	0.03

Tapered Pole Properties

Section	Tip Dia. in	Area in^2	I in^4	r in	C in	I/C in^3	J in^4	It/Q in^2	w in	w/t
L1	25.8020	19.9645	1596.6741	8.9318	12.9083	123.6938	3195.4492	9.9841	4.0322	16.129
	33.0095	25.5967	3365.0901	11.4516	16.5141	203.7712	6734.6080	12.8008	5.2814	21.126
L2	33.0095	38.2463	4989.1833	11.4072	16.5141	302.1172	9984.9316	19.1268	5.0614	13.497
	45.3205	52.6769	13035.3157	15.7112	22.6731	574.9254	26087.7837	26.3435	7.1952	19.187
L3	44.5590	58.0637	12825.6959	14.8439	21.4637	597.5542	25668.2681	29.0374	6.6662	15.237
	55.8627	75.7863	28519.3401	19.3747	27.9471	1020.4754	57076.2067	37.9003	8.9125	20.371
L4	54.9741	81.9744	27632.3873	18.3371	26.4941	1042.9648	55301.1340	40.9950	8.2990	16.598
	67.0689	104.0279	56471.9085	23.2703	33.5534	1683.0458	113018.124 1	52.0238	10.7448	21.49

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in
L1 146.67-125.67				1	1	1		
L2 125.67-82.92				1	1	1		
L3 82.92-43.67				1	1	1		
L4 43.67-1.67				1	1	1		

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight plf
1 5/8 (Sprint/Nextel)	C	No	Inside Pole	142.67 - 4.67	6	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
1 5/8 (Verizon - proposed)	C	No	Inside Pole	133.00 - 4.67	12	No Ice	0.00	1.04
						1/2" Ice	0.00	1.04
7/8 (Sprint/Nextel)	C	No	Inside Pole	124.67 - 4.67	12	No Ice	0.00	0.54
						1/2" Ice	0.00	0.54
7/8 (Cingular)	C	No	Inside Pole	113.17 - 4.67	12	No Ice	0.00	0.54
						1/2" Ice	0.00	0.54

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
L1	146.67-125.67	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	0.20
L2	125.67-82.92	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.27
L3	82.92-43.67	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.000	0.000	1.24

Tower Input Data

There is a pole section.
This tower is designed using the TIA/EIA-222-F standard.
The following design criteria apply:

Basic wind speed of 80 mph.
Nominal ice thickness of 0.5000 in.
Ice density of 56 pcf.
A wind speed of 69 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 50 mph.
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in pole design is 1.333.
Local bending stresses due to climbing loads, feedline supports, and appurtenance mounts are not considered.

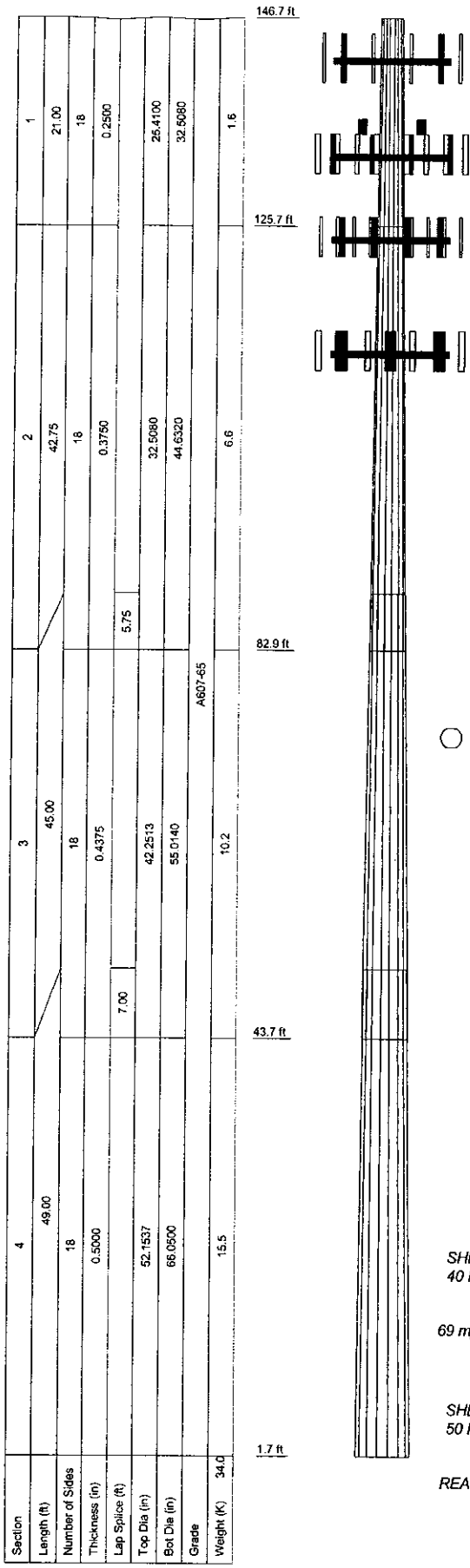
Options

Consider Moments - Legs	Distribute Leg Loads As Uniform	Treat Feedline Bundles As Cylinder
Consider Moments - Horizontals	Assume Legs Pinned	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Diagonals	√ Assume Rigid Index Plate	Calculate Redundant Bracing Forces
Use Moment Magnification	Use Clear Spans For Wind Area	Ignore Redundant Members in FEA
√ Use Code Stress Ratios	Use Clear Spans For KL/r	SR Leg Bolts Resist Compression
Use Code Safety Factors - Guys	Retension Guys To Initial Tension	All Leg Panels Have Same Allowable
Escalate Ice	√ Bypass Mast Stability Checks	Offset Girt At Foundation
Always Use Max Kz	Use Azimuth Dish Coefficients	Consider Feedline Torque
Use Special Wind Profile	√ Project Wind Area of Appurt.	Include Angle Block Shear Check
Include Bolts In Member Capacity	Autocalc Torque Arm Areas	Poles
Leg Bolts Are At Top Of Section	SR Members Have Cut Ends	√ Include Shear-Torsion Interaction
Secondary Horizontal Braces Leg	√ Sort Capacity Reports By Component	√ Always Use Sub-Critical Flow
Use Diamond Inner Bracing (4 Sided)	Triangulate Diamond Inner Bracing	Use Top Mounted Sockets
Add IBC .6D+W Combination		

Tapered Pole Section Geometry

Section	Elevation ft	Section Length ft	Splice Length ft	Number of Sides	Top Diameter in	Bottom Diameter in	Wall Thickness in	Bend Radius in	Pole Grade
L1	146.67-125.67	21.00	0.00	18	25.4100	32.5080	0.2500	1.0000	A607-65 (65 ksi)
L2	125.67-82.92	42.75	5.75	18	32.5080	44.6320	0.3750	1.5000	A607-65 (65 ksi)
L3	82.92-43.67	45.00	7.00	18	42.2513	55.0140	0.4375	1.7500	A607-65 (65 ksi)
L4	43.67-1.67	49.00		18	52.1537	66.0500	0.5000	2.0000	A607-65 (65 ksi)

RISA TOWER DETAILED OUTPUT



Section	1	2	3	4
Length (ft)	21.00	42.75	45.00	49.00
Number of Sides	18	18	18	18
Thickness (in)	0.2500	0.3750	0.4375	0.5000
Lap Splice (ft)		5.75	7.00	
Top Dia (in)	25.4100	32.5080	42.2513	52.1537
Bot Dia (in)	32.5080	44.6320	55.0140	66.0500
Grade	A607-65			
Weight (K)	1.6	6.6	10.2	15.5

34.0

DESIGNED APPURTENANCE LOADING

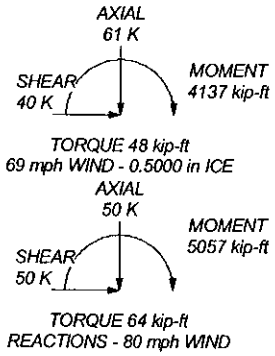
TYPE	ELEVATION	TYPE	ELEVATION
Barkhamsted Branch 1	153.96	DB948G85E-M (Verizon - proposed)	133
(2) DB980F90E-M (Sprint/Nextel)	142.67	Valmont T-Arm (1) (Verizon - proposed)	133
(2) DB980F90E-M (Sprint/Nextel)	142.67	Valmont T-Arm (1) (Verizon - proposed)	133
(2) DB980F90E-M (Sprint/Nextel)	142.67	Valmont T-Arm (1) (Verizon - proposed)	133
Valmont T-Arm (1) (Sprint/Nextel)	142.67	Generic T-Arm Mount	128.17
Valmont T-Arm (1) (Sprint/Nextel)	142.67	Generic T-Arm Mount	128.17
Valmont T-Arm (1) (Sprint/Nextel)	142.67	Generic T-Arm Mount	128.17
Barkhamsted Branch 2	138.86	(4) DB844H90E-XY (Sprint/Nextel)	124.67
GPS (Verizon - proposed)	135	(4) DB844H90E-XY (Sprint/Nextel)	124.67
GPS (Verizon - proposed)	135	(4) DB844H90E-XY (Sprint/Nextel)	124.67
LPA-80063/4CF (Verizon - proposed)	133	Valmont T-Arm (1) (Sprint/Nextel)	124.67
LPA-80063/4CF (Verizon - proposed)	133	Valmont T-Arm (1) (Sprint/Nextel)	124.67
LPA-80063/4CF (Verizon - proposed)	133	Valmont T-Arm (1) (Sprint/Nextel)	124.67
LPA-80063/4CF (Verizon - proposed)	133	Barkhamsted Branch 3	122.09
LPA-80080/4CF (Verizon - proposed)	133	(3) DU04-8670 (ATI/Cingular)	113.17
LPA-80080/4CF (Verizon - proposed)	133	(3) DU04-8670 (ATI/Cingular)	113.17
DB948F65E-M (Verizon - proposed)	133	(3) DU04-8670 (ATI/Cingular)	113.17
DB948F65E-M (Verizon - proposed)	133	TMA (ATI/Cingular)	113.17
DB948F65E-M (Verizon - proposed)	133	TMA (ATI/Cingular)	113.17
DB948F65E-M (Verizon - proposed)	133	TMA (ATI/Cingular)	113.17
DB948F65E-M (Verizon - proposed)	133	Valmont T-Arm (1) (ATI/Cingular)	113.17
DB948G85E-M (Verizon - proposed)	133	Valmont T-Arm (1) (ATI/Cingular)	113.17
		Valmont T-Arm (1) (ATI/Cingular)	113.17
		Barkhamsted Branch 4	110.55
		Barkhamsted Branch 5	92.3
		Barkhamsted Branch 6	83.5

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A607-65	65 ksi	80 ksi			

TOWER DESIGN NOTES

1. Tower designed for a 80 mph basic wind in accordance with the TIA/EIA-222-F Standard.
2. Tower is also designed for a 69 mph basic wind with 0.50 in ice.
3. Deflections are based upon a 50 mph wind.
4. TOWER RATING: 70.3%



URS Corporation
500 Enterprise Drive, Suite 3B
Rocky Hill, CT 06067
Phone: (860) 529-8882
FAX: (860) 529-3991

Job: *145' Monopole w/ Branches*		
Project: *50 Rust Road, Barkhamsted, CT*		
Client: Verizon Wireless	Drawn by: Staff	App'd:
Code: TIA/EIA-222-F	Date: 01/06/08	Scale: NTS
Path: P:\08\ERI Files\145_Summit Tree_Pole_Barkhamsted_CT.er		Dwg No. E-1

RISA TOWER INPUT/OUTPUT SUMMARY

6. DRAWINGS AND DATA

5. CONCLUSIONS AND RECOMMENDATIONS

The results of the analysis indicate that the tower structure does not have the capacity to support the proposed loading conditions. **The tower and its foundation are considered structurally adequate with the wind load classification specified above and the proposed antenna loading.**

Limitations/Assumptions:

This report is based on the following:

1. Tower inventory as listed in this report.
2. Tower is properly installed and maintained.
3. All members are as specified in the original design documents and are in good condition.
4. All required members are in place.
5. All bolts are in place and are properly tightened.
6. Tower is in plumb condition.
7. All member protective coatings are in good condition.
8. All tower members were properly designed, detailed, fabricated, and installed and have been properly maintained since erection.
9. Foundations were properly constructed to support original design loads as specified in the original design documents.
10. All coaxial cable is installed within the monopole unless specified otherwise.

URS is not responsible for any modifications completed prior to or hereafter in which URS is not or was not directly involved. Modifications include but are not limited to:

A. Adding antennas
B. Removing/replacing antennas
C. Adding coaxial cables

URS hereby states that this document represents the entire report and that it assumes no liability for any factual changes that may occur after the date of this report. All representations, recommendations, and conclusions are based upon information contained and set forth herein. If you are aware of any information which conflicts with that which is contained herein, or you are aware of any defects arising from original design, material, fabrication, or erection deficiencies, you should disregard this report and immediately contact URS. URS disclaims all liability for any representation, recommendation, or conclusion not expressly stated herein.

Ongoing and Periodic Inspection and Maintenance:

After the Contractor has successfully completed the installation and the work has been accepted, the owner will be responsible for the ongoing and periodic inspection and maintenance of the tower.

The owner shall refer to TIA/EIA-222-F for recommendations for maintenance and inspection. The frequency of the inspection and maintenance intervals is to be determined by the owner based upon actual site and environmental conditions. It is recommended that a complete and thorough inspection of the entire tower structural system be performed at least yearly and more frequently as conditions warrant. According to TIA/EIA-222-F section 14.1, Note 1: It is recommended that the structure be inspected after severe wind and/or ice storms or other extreme loading conditions.

3. ANALYSIS METHODOLOGY AND LOADING CONDITIONS

The structural analysis was conducted in accordance with the 2005 Connecticut State Building Code, TIA/EIA-222-F - Structural Standard for Steel Antenna Towers and Antenna Supporting Structures, and the American Institute of Steel Construction (AISC) Manual of Steel Construction - Allowable Stress Design (ASD).

The analysis was conducted using RISA Tower 5.0.2. Two load conditions were evaluated as shown below which were compared to allowable stresses according to AISC and TIA/EIA.

Load Condition 1 = 80 mph (fastest mile) Wind Load (without ice) + Tower Dead Load
Load Condition 2 = 69 mph (fastest mile) Wind Load (with ice) + Ice Load + Tower Dead Load

Please note that wind pressure is a function of velocity squared. Under Load Condition 2, a 25 percent reduction in wind pressure is allowed by code to account for the unlikelihood of the full wind pressure and ice load occurring at the same time. The same results may be achieved by utilizing a lower wind pressure without taking the 25 percent reduction, as shown above.

The TIA/EIA standard permits a one-third increase in allowable stresses for towers and monopoles less than 700 feet tall. For the purposes of this analysis, in computing the load capacity the allowable stresses of the tower members were increased by one-third.

4. FINDINGS AND EVALUATION

Combined axial and bending stresses on the monopole structure were evaluated to compare with allowable stresses in accordance with AISC. The calculated stresses under the proposed loading were below the allowable stresses (see table below). Detailed analysis and calculations for the proposed load condition are provided in section 6 of this report. Additionally, the anchor bolts, base plate, pipe flange connection plate, bolts and foundation were all found to be within the allowable limits.

Tower Component Stress vs. Capacity Summary

Component (Section No.)	Controlling Component / Elevation	Stress Ratio (% capacity)	Pass/Fail	Notes:
Pole Shaft (L4)	1.67'-43.67'	70.3%	Pass	
Anchor Bolts	Compression	71%	Pass	
Base Plate	Bending	61%	Pass	
Pipe Flange Bolts	Tension	58.3%	Pass	
Pipe Flange Plate	Bending	42.4%	Pass	

Foundation	Component	Stress (% capacity/FOS)	Pass/Fail	Comments:
Reinf. Concrete Pad and Pier	OTM	64%/3.13	Pass	Min. F.O.S of 2.0 req'd per IBC 2003 Section 3108.4.2

2. INTRODUCTION

The subject tower is located at 50 Rust Road, Barkhamsted, CT. The structure is an existing 145' tapered steel monopole (tree-pole), designed by Paul J. Ford and Company and manufactured by Summit Manufacturing, LLC.

The inventory is summarized in the table below:

Antenna Type	*Carrier*	*Mount*	*Antenna Centerline Elevation*	*Cable*
(6) Decibel DB980F90E-M antennas	Sprint/Nextel (existing)	(3) 12' T-Arms	142'-8"	(6) 1 5/8" coax cables (within monopole)
(4) Antel LPA 80063/4CF, (2) Antel LPA 80080/4CF, (4) Decibel DB948F65E-M and (2) Decibel DB948G85E-M antennas	**Verizon (proposed)**	(3) 12' T-Arms (existing to remain)	**133'**	**(12) 1-5/8" coax cables (within monopole)**
(2) GPS antennas	**Verizon (proposed)**	(3) 12' T-Arms (same as above)	**135'**	**(2) 1/2" coax cables (within monopole)**
-	Unknown (existing)	(3) 4' Stand-offs	128'-2"	-
(12) Decibel DB844H90E-XY antennas (est)	Sprint/Nextel (existing)	(3) 12' T-Arms	124'-8"	(12) 7/8" coax cables
(9) CSS DUO1417-8686-4-0 antennas and (6) TMA's	AT&T (existing)	(3) 12' T-Arms	113'-2"	(12) 7/8" coax cables (within monopole)

This structural analysis of the communications tower was performed by URS Corporation (URS) for Verizon Wireless. The purpose of this analysis was to investigate the structural integrity of the existing tower with its existing and proposed antenna loads. This analysis was conducted to evaluate stress on the tower and the effect of forces to the foundation of the tower resulting from existing and proposed antenna arrangements.

1. EXECUTIVE SUMMARY - *continued*

This analysis is based on:

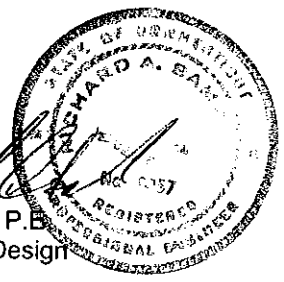
1) The tower structure's theoretical capacity, not including any assessment of the condition of the tower.
2) Tower geometry and structural member sizes utilized in the preparation of this report obtained from manufacturers original design documents prepared by Paul J. Ford and Company, job no. 29200-1316 signed and sealed September 7, 2000.
3) Monopole (tree-pole) extension manufactured by Summit Manufacturing, LLC., drawing number 10916-D6 dated April 12, 2001.
4) Site documentation and visual verification of existing appurtenances conducted from the existing grade by URS during December 2007.
5) Antenna and mount configuration as specified within Section 2 and 6 of this report.
6) Geotechnical report prepared by Dr. Clarence Welti, P.E., P.C. dated March 27, 2000.
7) This analysis excludes structural adequacy evaluation of the tree branches.

This report is only valid as per the assumptions and data utilized in this report for antenna inventory, mounts and associated cables. The user of this report shall field verify the assumption of the antenna and mount configuration as well as the physical condition of the tower. Notify the engineer in writing immediately if any of the information in this report is found to be other than specified.

If you should have any questions, please call.

Sincerely,

URS Corporation



Richard A. Sambor, P.E.
Manager Facilities Design

RAS/jrm
cc: AA, DR, ICA – URS, CF/Book

1. EXECUTIVE SUMMARY

This report summarizes the structural analysis of the existing 145' steel tapered monopole (tree-pole) structure located at 50 Rust Road, Barkhamsted, CT. The analysis was conducted in accordance with the 2005 Connecticut State Building Code and the TIA/EIA-222-F standard for a wind velocity of 80 mph (fastest mile) and 69 mph (fastest mile) concurrent with ½" ice. The antenna loading considered in the analysis consists of all existing and proposed antennas, transmission lines, and ancillary items as outlined in the Introduction Section of this report. The proposed Verizon Wireless installation is as follows:

Proposed Antenna and Mount	Carrier	Antenna Center Elevation
<u>On the existing Alltel antenna T-Frames :</u> **<u>Remove:</u>** **(9) existing panel antennas and (6) TMA's** **(12) 1 5/8" coaxial cables** **(12) existing panel antennas** **(12) 1 5/8" coaxial cables** **<u>Install:</u>** **<u>Alpha Sector</u>** **(2) Antel LPA 80063/4CF antennas** **(2) Decibel DB948F65E-M antennas** **<u>Beta Sector</u>** **(2) Antel LPA 80063/4CF antennas** **(2) Decibel DB948F65E-M antennas** **<u>Gamma Sector</u>** **(2) Antel LPA 80080/4CF antennas** **(2) Decibel DB948G85E-M antennas** **<u>Miscellaneous</u>** **(2) GPS antennas** **(12) 1 5/8" coaxial cables** **(2) 1/2" dia coaxial cables (GPS)** **(all Verizon coax feed lines shall be located within existing monopole)**	**Alltel (existing to be removed)** **Verizon (existing to be removed)** **Verizon (Proposed)**	**@ 133'** **@104'** **@ 133'** **@ 135'**

The results of the analysis indicate that the tower structure does have the capacity to support the proposed loading conditions. **The tower and its foundation are considered structurally adequate with the wind load classification specified above and the proposed antenna loading.**

TABLE OF CONTENTS

DETAILED STRUCTURAL ANALYSIS AND EVALUATION OF AN EXISTING 145' MONOPOLE (TREEPOLE) FOR PROPOSED ANTENNA ARRANGEMENT

Site I.D: Barkhamsted South
Address: 50 Rust Road
Barkhamsted, CT 06063

prepared for

verizonwireless

Verizon Wireless
99 East River Drive
East Hartford, Connecticut 06108

prepared by

URS

URS CORPORATION
500 ENTERPRISE DRIVE, SUITE 3B
ROCKY HILL, CT 06067
TEL. 860-529-8882

36931112.00000
VZ4-037

January 06 2008

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
Internet: ct.gov/csc

Daniel F. Caruso
Chairman

June 16, 2008

The Honorable Donald S. Stein
First Selectman
Town of Barkhamsted
Town Hall
67 Ripley Hill Road
P. O. Box 558
Pleasant Valley, CT 06063

RE: **EM-VER-005-080612** – Cellco Partnership d/b/a Verizon Wireless notice of intent to modify an existing telecommunications facility located at 127 New Hartford Turnpike, Barkhamsted, Connecticut.

Dear Mr. Stein:

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 June 30, 2008.

Thank you for your cooperation and consideration.

Very truly yours,

S. Derek Phelps
Executive Director

SDP/jb

Enclosure: Notice of Intent

c: Karl Nilsen, Zoning Enforcement Officer, Town of Barkhamsted