STATEMENT OF KEVIN PLUMB

IN OPPOSITION OF A CONNECTICUT SITING COUNCIL APPLICATION BY T-MOBILE, DOCKET 421

TRUMBULL, CONNECTICUT

I am a resident of Trumbull, Connecticut. I reside at 10 Marina Avenue. I am a Professional Broadcast Engineer (CPBE) specializing in RF and transmission systems, with over 25 years of continuous service. In addition to my normal duties I am the engineer for several tower sites across the United States, responsible for the construction, maintenance, safety, FCC compliance, and day to day operations. I hold numerous industry certifications including the CPBE (certified professional broadcast engineer (#50916 which expires 7/1/2014) issued by the Society of Broadcast Engineers issued July 1st 2009. I have been asked by CATT to submit comments regarding the Connecticut Siting Council Docket 421, applicant T-Mobile.

BACKGROUND

T-Mobile seeks to install a cell tower facility alongside the Trumbull Police Headquarters building on Edison Road located, within a high density residential neighborhood. The proposed supporting structure for this communications system will be a standard monopole. In order to accommodate existing public safety land / mobile 2-way radio systems, the proposed monopole supporting structure will also include a platform at the top of the structure.

SAFETY RELATED CONCERNS

Measurements (NCRP) in NCRP Report No. 86 (1986), and by the American National Standards Institute and the Institute of Electrical and Electronic Engineers, Inc. (IEEE) in ANSI/IEEE C95.1-1992 (IEEE C95.1-1991). The FCC guidelines provide a maximum permissible exposure (MPE) level for occupational or "controlled" situations, as well as "uncontrolled" situations that apply in cases that affect the general public. The FCC's Office of Engineering and Technology (OET) Commission issued a technical bulletin (OET Bulletin No. 65) entitled, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields" (Edition 97-01, August 1997), to aid in the determination of whether FCC-regulated transmitting facilities, operations or devices comply with limits for human exposure to radiofrequency electromagnetic fields as adopted by the Commission in 1996. The Bulletin contains updated and additional technical information for evaluating compliance with the current FCC policies and guidelines. The perimeter of the Trumbull Police Headquarters on which this T-Mobile installation will be located is not fenced and truly open to the public without any access restrictions. Pursuant to OET Bulletin 65, the property boundary is at a sufficient distance from the T-Mobile site to comply with the FCC's uncontrolled MPE level.

The T-Mobile application clearly meets the 1996 FCC standards with respect to Human Exposure to Radiofrequency Electromagnetic Fields. However, there is a serious hazard issue falling ice from the monopole and top platform. Falling ice from communications structures are a real issue, especially for those areas that qualify for the FCC classification of "uncontrolled" access situations as defined in OET 65. It should be noted that T-Mobile, in their application, is well aware of the injury potential to falling ice based on their specification requirement for "ICE BRIDGE/ SHIELDS" (see Exhibit C in T-Mobile's application). The ice bridge is heavy gauge reinforced steel designed to cover and protect T-Mobile's base stations and cables at the same time break up any falling ice. It is a known fact [1] that falling ice from towers often falls in sheets and even in mild wind conditions the ice may drift away from the base of the monopole and has the potential to fall outside the property of the Trumbull Police Headquarters or possibly hit persons or property in the uncontrolled area.

T-Mobile clearly indicates on its application submittals that it will comply with EIA/TIA 222-"F" tower structural standard which was accepted by the town of Trumbull. However, it should be noted that the "F" standard is outdated and over 15 years old. The comprehensive Revision "G" of Standard 222 that became effective in 2006 governing telecommunication tower activities in the US is to guide the creation of tower structures that successfully perform their intended function using the most up to date state of the art information. The standard addresses both the tower superstructure and the foundation, as both are necessary for the successful performance of a tower in service. The term "tower" encompasses both the superstructure above the ground and the foundation below the ground functioning together to support loads under all design conditions. The standard has been prepared by individuals and companies who work and practice in this area, i.e., fabricators, erectors, consultants, contractors, and architect, engineers. The EIA/TIA-222-G code aligns with the national building codes,

[1] See Fact Sheet-Ice_Fall

most notably the 2002 version of the International Building Code (IBC) which also refers the designer to several references of other codes, such as NEC and NFPA. The underlying reference to which the IBC deals with telecommunications towers is called ASCE-7. ASCE is an acronym for the American Society of Civil Engineers and ASCE-7 deals with all things structural, including towers. The latest version of ACSE-7 (2002) will ultimately refer the designer to what is the EIA/TIA-222-G standard. Revision G requires more site-specific parameters be given consideration prior to both specification and construction of tower and foundation, as compared to Revision F. Some of these parameters which now require attention include Exposure Category, Structure Classification and Topographic Category. The minimum design windspeed has gone from 70-mph fastest-mile under Revision F, to 90-mph 3-second gust under Revision G. With new wind force equations in Revision G, the change in wind speeds alone does not produce a significant change to the wind forces on towers. The introduction of the parameters listed above is proving to have a more substantial impact. In addition, the Soil Type now carries a more finite definition as compared to the 'Normal Soil' specification which was phased out with Revision F.

The recent 2006 inclusion of ice loading provisions represents a significant change that brings the standard into compliance with the current standards, codes, and guides .

Examples of differences between Revision "F" and "G"

ICE LOADS- Revision F

Though it recognizes a consideration of radial solid ice uniform thickness with a density of 56 lb/ft3, the standard does not specifically state an ice requirement. The standard does recognize that ice may be a significant load for structures to be located in areas of significant ice accumulation and provides information for consideration in an annex.

ICE LOADS- Revision G

The design ice thickness specified in the new standard is a uniform radial thickness of glaze ice at 33 feet above the ground in exposure Category C for a 50-year mean recurrence interval. Escalation of ice thickness and wind on ice over the height of the structure is required. Ice is assumed to be glaze ice with a density of 56 lb/ft3. Accumulation of ice is considered on the structure and appurtenances. All elements are assumed to be covered with a uniform thickness of ice that results in a wind drag. Design ice thickness is also escalated with height and is based on regional climatic data. For engineering design, all members are traditionally assumed to be covered with a uniform thickness of ice, which together with the ice density may be used to calculate the ice weight as well as the wind drag.

Structure Classification[2] (increased factors for tower safety survivability)

Class-Revision "F"

No specialized classification

Class-Revision "G"

Three types of structure classification have been created each with increasing survivability factors. Class I= Least expensive construction methods acceptable for a delay of service return to public. Class II=Default standard. Class III=Most costly construction method to be used for structures that support critical life safety communications such as Fire/Police.

The current version ANSI/EIA/TIA-222 G took effect Jan. 1, 2006, and was essentially a top-to-bottom rewrite. It is also the most comprehensive standard to date and takes into account certain classifications of a structure based on its location and anticipated wind, ice and seismic factors. It considers topography that may affect a structure's exposure to wind, i.e. behind a valley, atop a hill, etc. In previous standards the design of a structure was based on "allowable stress" 222G bases designs on "Limit State Loading." In this case Limit State Loading is based on two conditions: Strength Limits, which essentially define the maximum loading a structure can tolerate and still be safe for the subject location and classification; and the "Serviceability Limits State" describes how the tower will perform under more normal conditions. There are now requirements for towers located in seismically active zones. 222G also expands on the safety requirements that were addressed in the previous version. It categorizes the experience

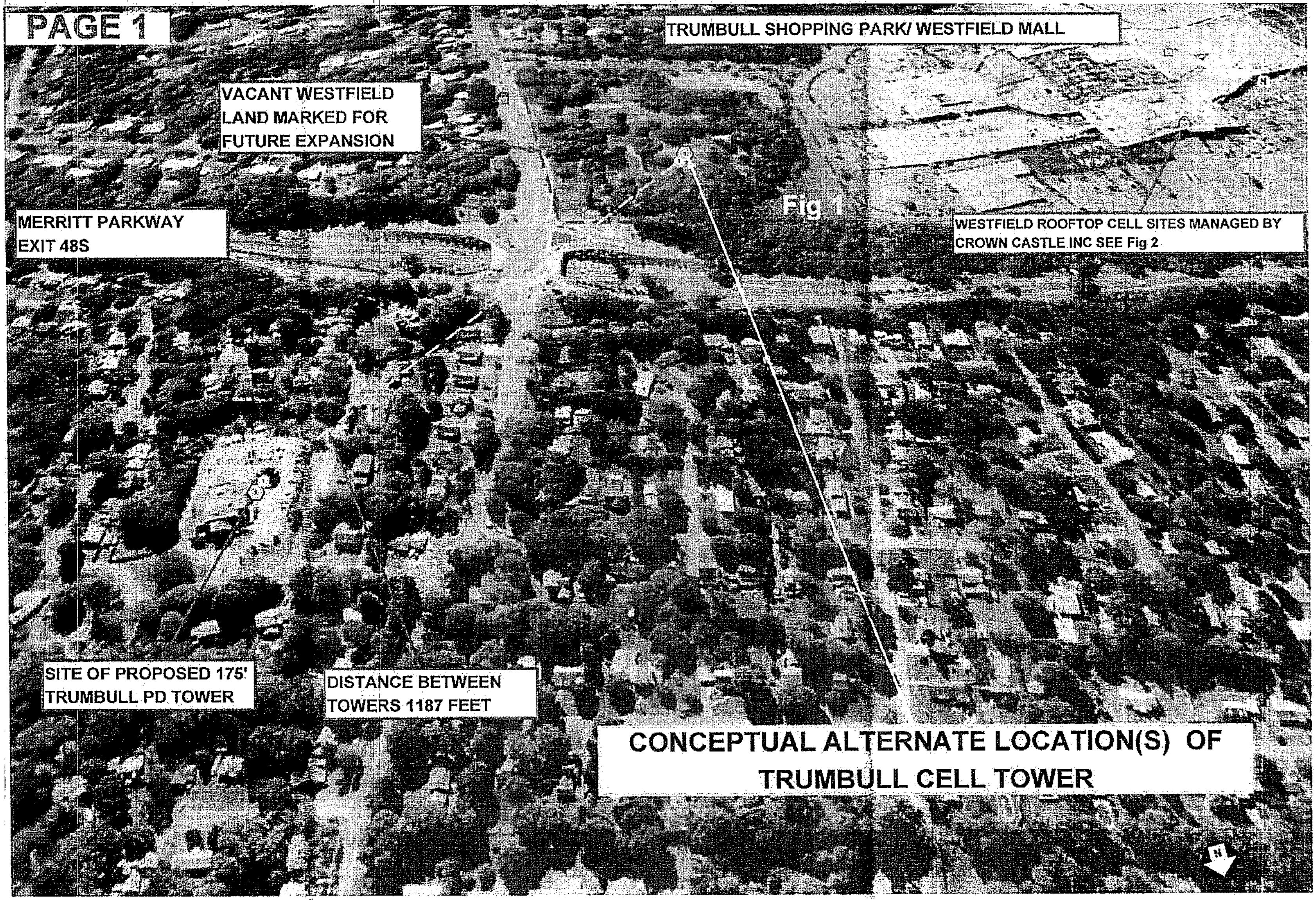
[2] See page 39 of ANSI/TIA 222 G standard and table 2-1

of individuals that might climb a structure and specifies specific safety items to be included with the design of a tower, i.e. safety cables, ladders, rest platforms, etc.

CONCLUSION

In an effort to reduce the injury potential of falling ice to police staff, visitors, prisoners, or neighbors within the applicants specified "uncontrolled" public area. I support CATT efforts to encourage the Siting Council to specify structural methods to mitigate the know hazard of falling ice. Such as:

Low-profile small diameter monopole or flagpole design with applicant's cables and antennas enclosed inside the structure. Furthermore, eliminate any horizontal surfaces such as antenna platforms, T arms, outriggers etc. Instead, require T-Mobile to enclose the 3 (33mhz, 155mhz, and 800mhz) antennas inside a radome located at the top of the monopole attached to one center line mount. Lastly, to ensure that monopole is built to the most modern tower structural standard, require T-Mobile to make this tower and its foundation compatible with EIA/TIA 222 G. Please refer to the attachment which indicates a monopole built to the concept requested. The attached monopole system is available from Valmont Industries.


PAGE 1
TRUMBULL SHOPPING PARK/ WESTFIELD MALL
VACANT WESTFIELD
LAND MARKED FOR
FUTURE EXPANSION
MERRITT PARKWAY
EXIT 48S
Fig 1
WESTFIELD ROOFTOP CELL SITES MANAGED BY
CROWN CASTLE INC SEE Fig 2
SITE OF PROPOSED 175'
TRUMBULL PD TOWER
DISTANCE BETWEEN
TOWERS 1187 FEET
CONCEPTUAL ALTERNATE LOCATION(S) OF
TRUMBULL CELL TOWER
N

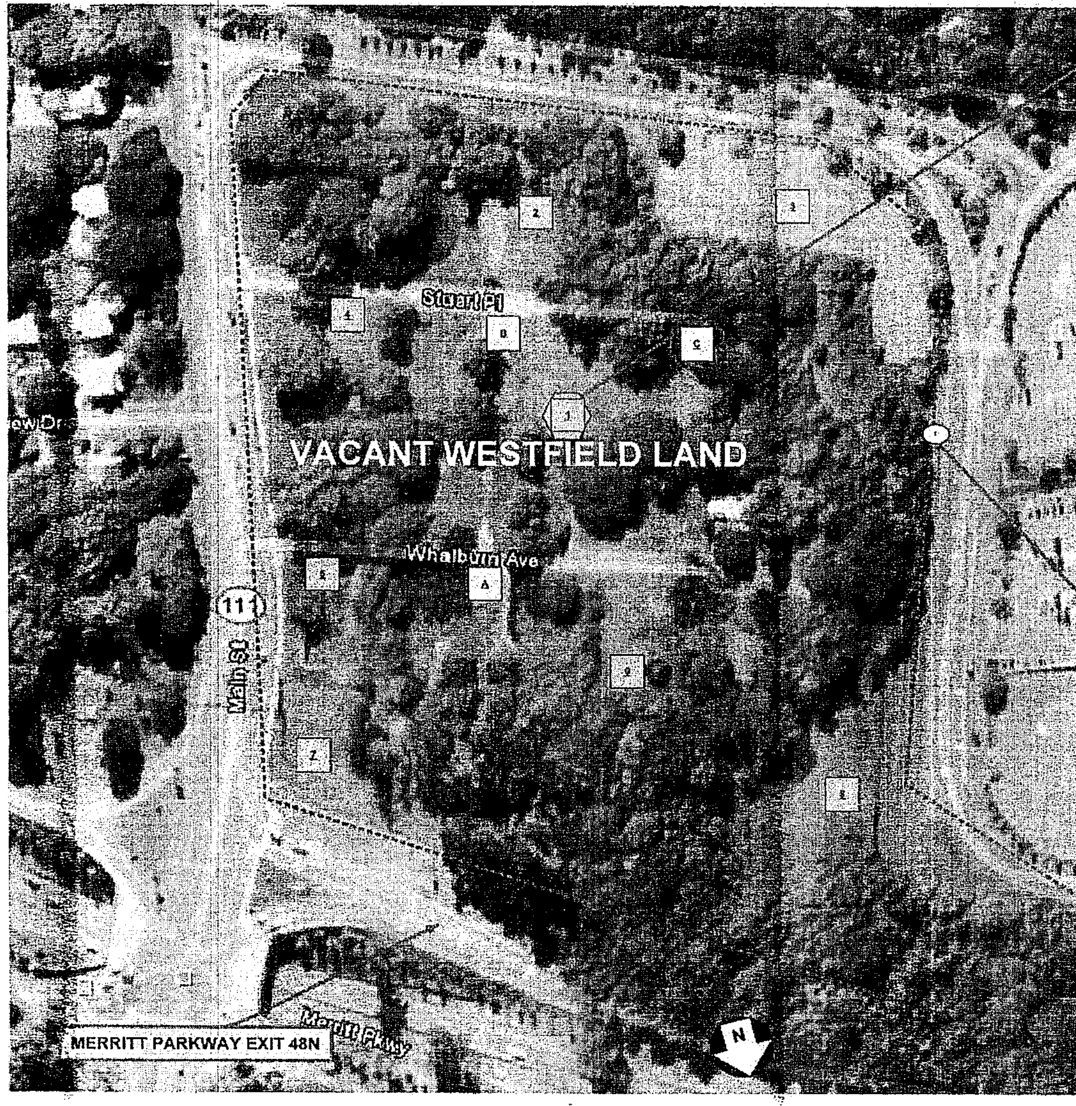
PAGE 2

GPS BASED ACTUAL LONG/LAT & GROUND ELEVATIONS (NAD 83)

- 1 — N41-13'50.4" W 073-13'18.0" HASL=299
- 2 — N 41-13'49.0" W 73-13'15.08" HASL=261
- 3 — N 41-13'47.1" W 073-13'18.4" HASL=272'
- 4 — N 41-13'49.5" W 073-13'14.3" HASL=228'
- 5 — N 41-13'51.9" W 073-13'14.5" HASL=283'
- 6 — N 41-13'52.3" W 073-13'18.8" HASL=263'
- 7 — N 41-13'53.9" W 073-13'14.1" HASL=310
- 8 — N 41-13'53.0" W 073-13'22.8" HASL=223'

OVERHEAD UTILITY OBSERVATIONS

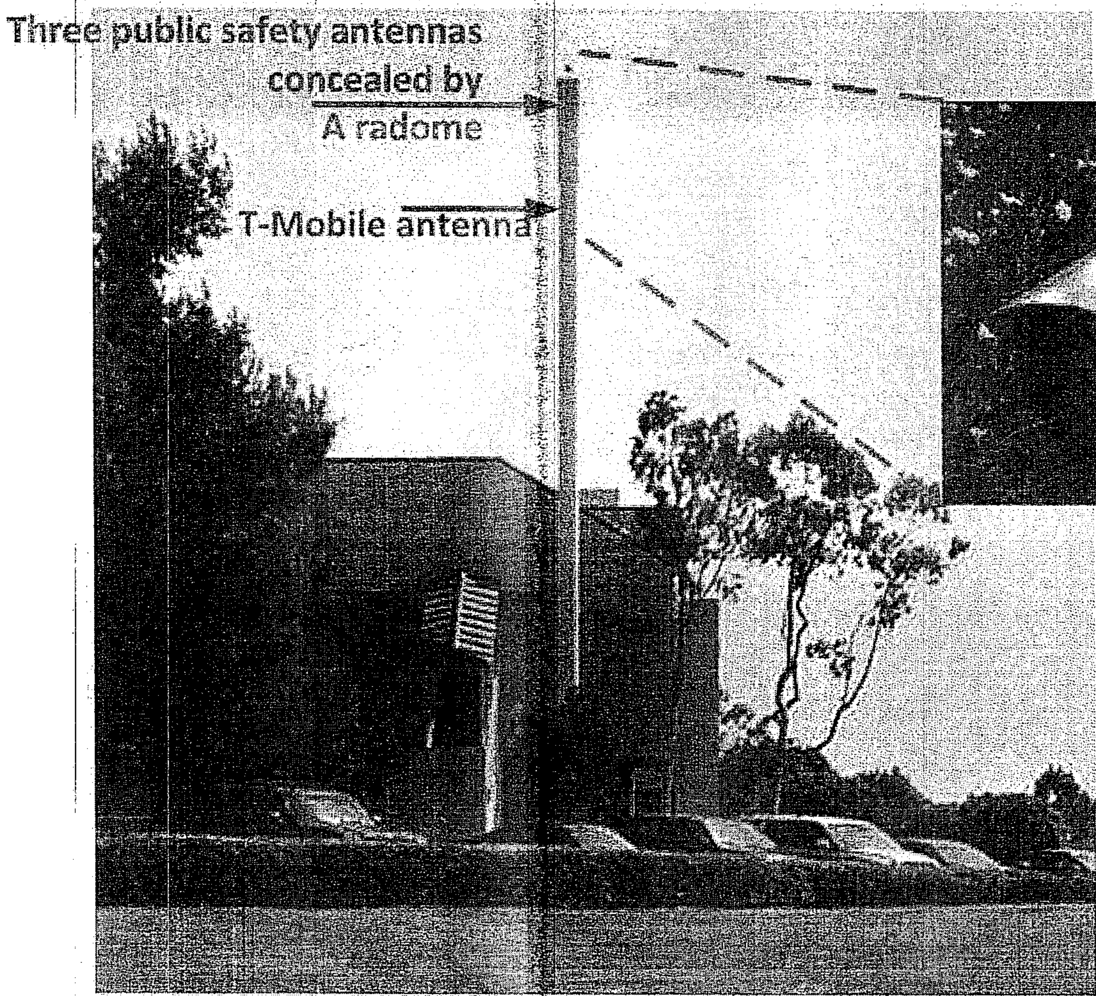
- A — Whalburn Ave= 480v 1 phase/ standard low voltage step downs/ service off United Illuminating Primary Trumbull Branch Pole 278-CATV standard residential telco
- B — Stuart Pl= 480v 3 phase standard low voltage step downs/service off United Illuminating Primary Trumbull Branch Pole 810-ATT multi Fiber POP/ plus 2 full copper slicks/
- B — Stuart Pl= 480v 3 phase standard low voltage step downs/<u>Primary AC service to mall</u>/ service off United Illuminating Primary Trumbull Branch Pole 810-ATT multi Fiber POP/ plus 2 full copper slicks/ <u>primary hand off point for all data & telcom into shopping park</u>

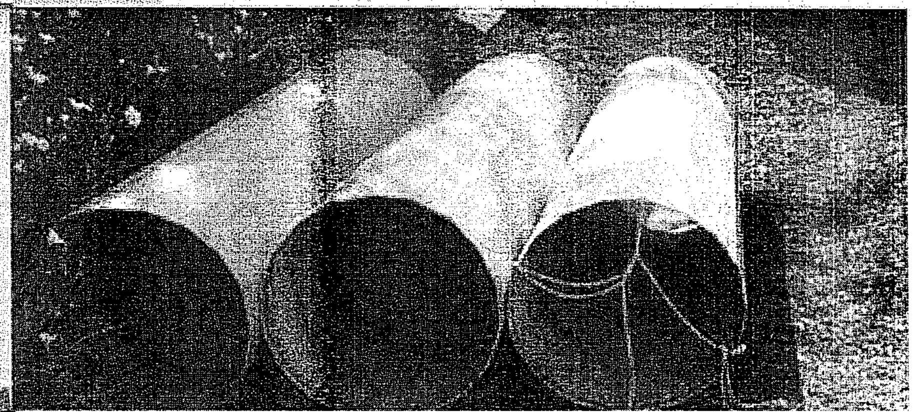


CONCEPTUAL ALTERNATE LOCATION(S) OF TRUMBULL CELL TOWER. *NOTE LOCATION BASED ON DEVELOPMENT PLAN*

BOUNDARY BETWEEN DEVELOPED PROPERTY AND VACANT PROPERTY BOTH UNDER WESTFIELD CONTROL

Figure 1





RADOME REMOVED

ALTERNATE MONOPOLE DESIGN FOR TRUMBULL PD TO REDUCE ICELOAD

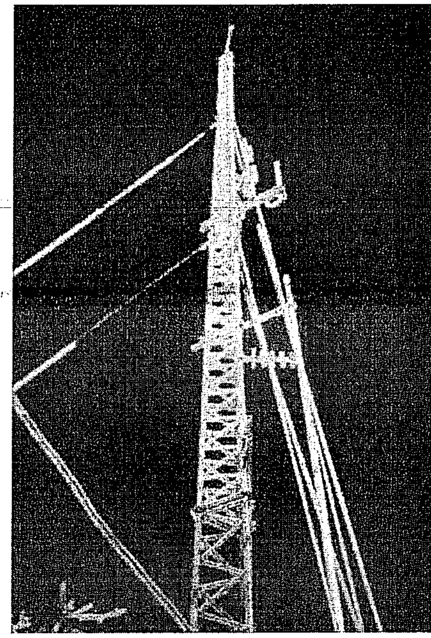
OPPOSITION STATEMENT BY
KEVIN PLUMB 11/22/11

Fact Sheet

DETERMINING DISTANCE OF ICE FALL FROM TOWERS

You can determine the approximate distance from a tower at which a chunk of ice of any size might land. Because that distance is dependent on what you assume about the ice, and because, to our knowledge, no one has measured the frequency of ice chunks of different sizes and shapes falling from towers, it is appropriate to use simplifying assumptions to get an approximate analytical solution to the problem, rather than to develop a numerical solution with all the detailed aerodynamics.

Basically, as the ice starts falling from the tower, it falls faster and faster, accelerated by gravity until it reaches its terminal velocity, which depends on how much drag there is on it from the air through which it moves. You can determine the terminal velocity by equating the force of gravity with the drag force:



$$mg = \frac{1}{2} C_D \rho_a A V_T^2,$$

where
- m is the mass of the chunk of ice;
- g is the acceleration of gravity;
- ρ_a is the density of air;
- C_D is the drag coefficient of the chunk of ice;
- A is the cross-sectional area of the chunk of ice;
- V_T is the terminal velocity of this chunk of ice.

Solve for V_T, to get

$$V_T = \sqrt{\frac{2mg}{C_D \rho_a A}}.$$

You then want to know how far the ice is blown horizontally by the wind while it is falling. First calculate how much time (Δt) it takes to reach the ground, if the ice travels at terminal velocity all the way down.

$$V_T \Delta t = H,$$

where H is the height of the tower (assuming the ice falls from the top).

Assuming that the ice moves horizontally as fast as the wind blows, the ice will travel downwind a distance D before it hits the ground, where

$$D = W\Delta t,$$

where W is the wind speed. Putting it all together,

$$D = HW\sqrt{\frac{\rho_a C_D A}{2mg}}.$$

This says that the ice that falls from the top of the tower travels a greater distance before it hits if the tower is taller or if the wind speed is greater, as we all would have guessed without going through the equations. The distance also increases as the area assumed for the chunk of ice increases and the assumed mass decreases. If you think of a parachute compared to a rock, that makes sense, too.

This is a crude approximation, useful for crude assumptions about the ice. In reality, the ice spends more time than Δt falling from the tower, since it takes some time to accelerate to the terminal velocity, so D is an under-estimate of the real distance. On the other hand, the ice takes some time to accelerate horizontally to the wind speed,

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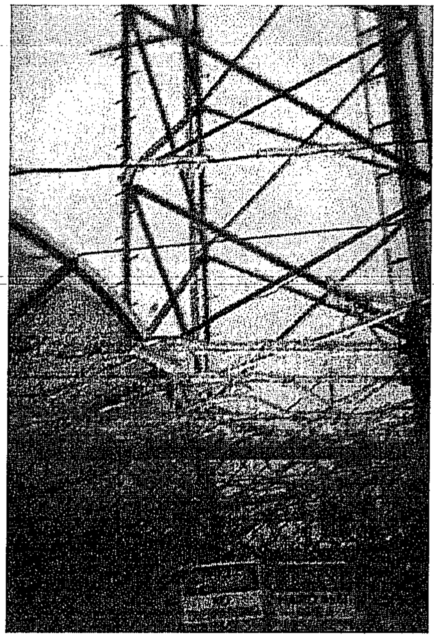
depending on its shape, roughness, and orientation as it falls, so D is an overestimate of the real distance. If we're lucky, the errors from those simplifications cancel each other. The drag coefficient C_D depends on the shape and surface roughness of the ice chunk and its orientation as it falls. Often, for bluff bodies, $C_D = 1$ is not an unreasonable assumption. A positive or negative lift force may also act on the ice chunk during its flight, which could either increase or decrease D.



This formula for D can be used in metric units with

H in m,
W and V_T in m/s,
m in kg,
$g = 9.8$ m/s^2,
$\rho_a = 1.3$ kg/m^3,
A in m^2,

to give D in m (m = meters, s = seconds, kg = kilograms). In English units, with

H in ft,
W and V_T in mph,
m in lb,
$g = 32.2$ ft/s^2,
$\rho_a = 0.081$ lb/ft^3,
A in ft^2,

D is in feet if you put in the conversion factors for the various units in the equation, which gives

$$D = \frac{5280}{3600} HW \sqrt{\frac{\rho_a C_D A}{2mg}}.$$

So, for example, take H = 500 ft and W = 50 mph and see how different assumptions about the ice chunk affect D:

$$D = 1300\sqrt{\frac{C_D A}{m}}.$$

Assuming $C_D = 1$, and assuming the ice density is 57 lb/ft^3, gives

A *(ft²)*	m *(lb)*	D *(ft)*
0.25 (3 in. by 12 in.)	1 (3/4 in. thick)	650
0.25	0.6 (1/2 in. thick)	839
0.5 (4 in. by 18 in.)	2.4 (1 in. thick)	593
0.27 (3.25 in. by 12 in.)	2 (1.5 in. thick)	478

It might also be reasonable to assume an ice density less than 57 lb/ft^3 to account for the possibility of rime ice, rather than glaze ice, forming on the tower. This would result in a smaller ice mass for a given-size ice chunk and thus a larger D.

So, we have four not-unreasonable assumptions for the shape and size of a chunk of ice that might fall from the tower, and the calculated distance away from the tower at which it hits the ground varies from 478 ft to 839 ft. This illustrates the difficulties in determining the ice fall radius for a tower.

POINT OF CONTACT

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This statement was prepared by me or under my direct supervision and is believed

to be true and correct.

DATED: November 26, 2011

The above signed, [signature], being known to me or after satisfactory proof of identification, personally appeared before me and verified the above prefiled testimony for the Connecticut Siting Council dated 11/26/11 is true and accurate and that they adopted it as their free act and deed on the 26th day of November, 2011.

CT Notary My Commission Expires/ Connecticut Commissioner of the Superior Court

[signature] / 11/26/2011
(signature/date)

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exp. 6/30/2014