PLANNING AND DEVELOPMENT DEPARTMENT

Planning Board Transmittal for the Town Council Meeting

Case: ZT 2010-003			
Reference Name	**Telecommunications – Additions of UDO Sections 7160.020(H)(6-7), and UDO Section 7160.040**		
Meeting Date	March 16, 2010		
Members Present	Chair Russell Whitehurst	Vice Chair Cowan	Vincent Howard
	Gary Vaughn	Kathy Broom	Robert Rollins
	Larry Miller-alt	John Simulcik-Alt	
Members Absent	Robert Wilbur		
Case Found Complete	Yes		
Motion	Recommended to Council for approval with modifications		
Member making the motion	Board Vice-Chair Cowan		
Second the motion	Board Member Howard		
Vote	Unanimous		

Summary

1.) This text amendment was a Town-initiated request to add the following sections to the Unified Development Ordinance (UDO), dealing with telecommunications:
   a.) **UDO Sections 7160.020(H)(6-7)**: These sections are added to ensure the Town's protection in handling wireless communications towers and/or facilities, specifically in regards to compliance with federal (FCC) and industry-wide guidelines for construction and design.
   b.) **UDO Section 7160.040**: This section deals with antenna usage, specifically with regards to amateur radio antennas and ensuring that any Town regulations related to them conform to recently passed NC Session Law (S.L.) 2007-147.

Planning Board Meeting (March 16, 2010)

The Planning Board heard this item at its March 16, 2010 meeting. A brief discussion by the Board focused mainly on the UDO Section 7160.020(H)(6-7) requirements for federal and industry-wide guidelines for construction and design of wireless communications facilities, especially how the Town would be protected in ensuring compliance with permit approvals.

Staff also informed the Planning Board that proposed UDO Section 7160.040 (dealing with antenna uses) would be removed from this text amendment, and brought back to the Board in April after further research and discussion by staff regarding the issue of antennas.

The Board made the following consistency findings, after staff had read them into the record:

1. The following findings were made consistent with the Comprehensive Plan:

   1.3.1 of the Comprehensive Plan – Quality of Life; the proposed UDO ordinance amendments will help to make the UDO consistent with state, federal and other regulatory standards for telecommunications facilities, and allow for the promotion of a greater quality of life for the citizens of the Town Indian Trail by preserving the general process for review of such facilities.

   1.3.2 of the Comprehensive Plan – Land Use; the proposed UDO ordinance amendments will help to promote a quality mix of different land uses while avoiding land use conflicts with neighboring properties and surrounding municipalities through a streamlined process of review, and;

2. This UDO ordinance amendment is in the best interest of the public because it promotes a more efficient development system and review process, while providing a greater quality of life for all residents of the Town of Indian Trail.

Making these required findings, the Planning Board voted unanimously to recommend approval of the amendment with one modification, which is as follows:

1.) Per staff's recommendation, the Planning Board agreed to recommend unanimous approval of ZT2010-003, but also concurred with staff's recommendation that UDO Section 7160.040 be removed from consideration at this time. Staff needs more time to conduct research into the issue of antenna uses, and will bring this issue back at a later date.

2.) For purposes of the Council's consideration, the only item under consideration for this text amendment relates to the addition of UDO Sections 7160.020(H)(6-7), not the addition of UDO Section 7160.040 (please disregard all references to proposed UDO Section 7160.040 in this transmittal).

Town Council Action
Receive the Planning Board's Transmittal, public testimony, and motion to:

1. Confirm the findings as read into the record and approve ZT 2010-003 as transmitted by the Planning Board; or
2. Confirm the findings as read into the record and approve ZT 2010-003 as transmitted by the Planning Board and make any modifications as the Council sees fit to make;
3. Table ZT2010-003 and remand the amendment back to the Planning Board for further consideration; or
4. Disagree with the findings and disapprove ZT 2010-003 as transmitted by the Planning Board.

Attachments:
Attachment 1 – Draft Ordinance for UDO
Attachment 2 – Town Council Report for April 13, 2010

TC ATTACHMENT 1

STATE OF NORTH CAROLINA)
) ORDINANCE #
TOWN OF INDIAN TRAIL)

AN ORDINANCE AMENDING CHAPTER 7160 – TELECOMMUNICATIONS OF THE INDIAN TRAIL UNIFIED DEVELOPMENT ORDINANCE (UDO), INDIAN TRAIL, NORTH CAROLINA

WHEREAS, the Town is the applicant for ZT 2010-003 requesting to amend Chapter 7160 – Telecommunications, specifically Sections 7160.020(H)(6-7), to ensure that the Town follows and recognizes federal and industry-wide guidelines regarding wireless communications tower and/of facilities, in addition to what is already required for such uses; and

WHEREAS, this Zoning Amendment (ZT 2010-003) was duly noticed in compliance with North Carolina General Statutes; and

WHEREAS, the amendment was heard by Planning Board on March 16, 2010 in a public meeting; and

WHEREAS, the Planning Board after hearing the amendment and deliberations made the following findings and recommended approval to the Town Council:

1. The following findings were made consistent with the Comprehensive Plan:

    1.3.1 of the Comprehensive Plan – Quality of Life; the proposed UDO ordinance amendments will help to make the UDO consistent with state, federal and other regulatory standards for telecommunications facilities, and allow for the promotion of a greater quality of life for the citizens of the Town Indian Trail by preserving the general process for review of such facilities.

    1.3.2 of the Comprehensive Plan – Land Use; the proposed UDO ordinance amendments will help to promote a quality mix of different land uses while avoiding land use conflicts with neighboring properties and surrounding municipalities through a streamlined process of review, and;

2. This UDO ordinance amendment is in the best interest of the public because it promotes a more efficient development system and review process, while providing a greater quality of life for all residents of the Town of Indian Trail.

WHEREAS, the Town Council received the Planning Board transmittal for a recommendation of approval in the required public hearing held on April 13, 2010 and after receiving the Board's transmittal, along with public comment and Council deliberations, concur with the required findings and amendment recommendation as transmitted by the Planning Board.

NOW THEREFORE, BE IT ORDAINED ON MARCH 16, 2010 BY THE TOWN COUNCIL OF THE TOWN OF INDIAN TRAIL, NORTH CAROLINA HEREBY TAKES THE FOLLOWING ACTION:

Section 1 – UDO Chapter 7160 is hereby added to as follows:

7160.020 – Freestanding Facilities.

H. Construction and Design

6. In terms of load requirements for freestanding wireless communication towers and/or facilities, such towers and/or facilities must also conform to the Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) standards for construction and design, which deal with loading and wind velocity requirements.

7. In addition, wireless communications towers and/or facilities must also conform to the guidelines of the International Building Code (IBC), particularly with respect to additional construction requirements for such structures (IBC Chapter 16, Section 1609 (1.1)). Furthermore, any wireless communications towers and/or facilities must conform to the regulations and requirements of the Federal Communications Commission (FCC).

Section 2 – This ordinance shall be effective immediately upon adoption.

SO ORDAINED THIS 13TH DAY OF APRIL, 2010.

THE TOWN COUNCIL OF INDIAN TRAIL

By _____
Honorable John J. Quinn, Mayor

Attest:

_____
Peggy S. Piontek, Town Clerk

TC ATTACHMENT 2

Town of Indian Trail
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PLANNING DEPARTMENT

Zoning Staff Report

Case: ZT 2010-003 Amendment of Chapter 7160 Telecommunications		
Reference Name(s)	Additions of UDO Section 7160.020(H)(6-7); UDO Section 7160.040 (Telecommunications)	
Applicant	Town of Indian Trail	
Submittal Date	March 16, 2010	
Location	Town-Wide	
Tax Map Number	N/A	
Recommendations & Comments	**Planning Staff**	Recommend approval of the proposed UDO amendments as transmitted by the Planning Board

Introduction/Executive Summary

Staff is introducing this text amendment (ZT2010-003) for two distinct revisions to the existing Unified Development Ordinance (UDO) Chapter 7160 concerning telecommunications. The proposed revisions are as follows:

- Addition of UDO Section 7160.020(H)(6), which will reference the EIA (Electronic Industries Alliance) and TIA (Telecommunications Industry Association) construction and design standards for wireless communications facilities and towers (especially for wind and loading impacts), along with the International Building Code (IBC) and Federal Communications Commission (FCC) standards for such uses.
- ~~Addition of UDO Section 7160.040, which reflects a recent change in NC state law regarding the treatment and standards for amateur radio antennas and uses, incorporating the new state requirements for such uses under NC Session Law 2007-147~~ ***(NOTE – this was pulled from consideration by staff's recommendation at the Planning Board for further investigation and research; please disregard)***.

Analysis

The first part of this amendment deals with referencing the various EIA, TIA, IBC, and FCC regulations and guidelines for all wireless communications facilities in the Town. For loading

requirements, especially during inclement weather events (i.e., strong winds, storms, etc.), there are industry-specific standards, along with state and/or federal regulations, that must be adhered to. This proposed UDO addition simply recognizes the need for referencing these standards and regulations for all wireless communications facilities and/or towers (Attachment One). The additions are as follows:

UDO Section 7160.020(H) (6) – Construction and Design

"In terms of load requirements for freestanding wireless communication towers and/or facilities, such towers and/or facilities must also conform to the Electronic Industries Alliance (EIA) and the Telecommunications Industry Association (TIA) standards for construction and design, which deal with loading and wind velocity requirements.

UDO Section 7160.020(H) (7) – Construction and Design Con't

"In addition, wireless communication towers and/or facilities must also conform to the guidelines of the International Building Code (IBC), particularly with respect to additional construction requirements for such structures (IBC Chapter 16, Section 1609 (1.1)). Furthermore, any wireless communications towers and/or facilities must conform to the regulations and requirements of the Federal Communications Commission (FCC).

NOTE – Please disregard this second section; issue will be brought to the Planning Board in April after further staff research into the issue.

~~The second part of this amendment deals with a recent State of North Carolina Session Law regarding amateur radio antennas as a use. Put simply, there is a recognition that amateur radio antennas are often used for emergency situations (i.e., first responders such as police, fire, EMT's, etc.), and the NC General Assembly passed Session Law 2007-147 dealing with the handling of amateur radio antennas at the local level. This Session Law, which became effective in October of 2007, places an explicit limit on how a municipality or county how restrict the height of antenna used for amateur radio purposes. Such uses would still need to meet the requirements of local permitting authorities (i.e., Town requirements). However, unless a clearly defined health, safety or aesthetic objective is outlined by the municipality or county for justifying a lowering of height below 90 feet tall, then the antenna must be permitted to take place (Attachment Two). The proposed amendment, in view of the recent state law, is as follows:~~

~~"UDO Section 7160.040 – Amateur Radio Antennas and Wireless Towers.~~

- ***~~A.~~ All of the requirements of this Chapter shall apply with respect to the construction, design, placement, and/or permitting of new wireless communication towers and/or facilities that utilize amateur radio antennas in some capacity, except where:***
  - ***~~1.)~~ Amateur radio antennas, as required under NC Session Law 2007-147, cannot be made to be 90 feet or lower in height unless the Town makes a reasonable determination during the approval process that such a height restriction is needed to achieve a clearly defined health, safety, and/or aesthetic objective of Town.***
- ***~~B.~~ All existing and new towers and/or facilities built to have amateur radio antennas and/or uses as part of their construction and design shall still be subject to the Special Use Permit (SUP) requirements of this Chapter, and of UDO Chapter 360.***

C. ~~***Such towers and/or facilities shall also conform to all of the requirements of this UDO, along with applicable Union County, State of North Carolina, federal (primarily FCC), and/or the latest generally accepted industry construction and design regulations, standards, and specifications for such amateur radio uses."***~~

Required Consistency Findings
The Town Council is required to make two consistency findings, one for consistency with Town adopted plans and another regarding the benefit of the public. Staff is of the opinion the following findings can be made:

1. The proposed UDO amendment is consistent with the following goals:

    1.3.1 of the Comprehensive Plan – Quality of Life; the proposed UDO ordinance amendments will help to make the UDO consistent with state, federal and other regulatory standards for telecommunications facilities, and allow for the promotion of a greater quality of life for the citizens of the Town Indian Trail by preserving the general process for review of such facilities.

    1.3.2 of the Comprehensive Plan – Land Use; the proposed UDO ordinance amendments will help to promote a quality mix of different land uses while avoiding land use conflicts with neighboring properties and surrounding municipalities through a streamlined process of review.

2. This UDO ordinance amendment is in the best interest of the public because it promotes a more efficient development system and review process, while providing a greater quality of life for all residents of the Town of Indian Trail.

Staff Recommendation
Staff recommends that the Town Council make the required consistency findings and recommend adoption of the UDO ordinance amendments as stated and modified in this report.

Staff Contact
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Attachments:
Attachment One – EIA/TIA Wireless Communication Tower and/or Facility Standards (Chapter 222, Revision G)
Attachment Two – NC Session Law 2007-147 Regarding Amateur Radio Antennas
(Informational Purposes Only; UDO addition on this to be considered at April Planning Board meeting).

ATTACHMENT ONE

New Standards for Broadcast Structures ANSI/EIA/TIA-222-G

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ABSTRACT

The next revision of the ANSI/TIA/EIA standard "Structural Standards for Steel Antenna Towers and Antenna Supporting Structures" will represent the most drastic change to the standard since its first publication in 1949. This revision will change the loads and design criteria for communication towers including broadcast structures. It will also have an impact on the load carrying capacity of existing structures.

The revised standard (Rev G) is scheduled for release in 2003. The proposed changes will require an aggressive training schedule for all users of the standard. The authors of this paper who are members of he technical review committee for the TIA/EIA-222 standard will present in this paper the major changes proposed and also explain how theses changes may affect broadcast structures.

INTRODUCTION

This paper outlines the latest development regarding the next revision of the ANSI/TIA/EIA-222. It is based on the most recent proposals at the time of this writing. Subsequent revisions and additions may occur during the consensus verification process.

DESIGN PHILOSOPHY

This proposed revision of the standard is based on limit states design. The structures are checked for two major limit states (i) strength limit states and (ii) serviceability limit states. The strength limit states ensures that structures are safe under extreme loading conditions while the serviceability limit states checks that the structures is capable of providing the service under normal conditions.

ENVIROMENTAL LOADS

Structures Classification

Structures are classified according to reliability requirements. Three categories are provided. Category I structures have the lowest reliability requirements and are intended to represent structures for which there is a low hazard to human life and damage to property in the event of failure. This classification is intended for structures that are used for services that are optional and /or where a delay in returning the services would be acceptable. Ice loading does not apply to this category of structures. The nominal 50-year return wind load is reduced using an importance factor to a nominal 25-year return loading. Category II structures represent a substantial hazard to human life and damage to property in the event of failure and are intended for services that may be provided by other means. Category II structures use nominal 50-year return wind and ice loads. Category III structures are essential facilities and use nominal 100-year return loads determined using appropriate importance factors applied to the nominal 50-year return loads.

Wind Loads

A load factor of 1.6 is applied to nominal wind loads for strength limit states design. A directionality factor is applied to the factored wind loads to account for the probability of the wind occurring from the worst-case direction. Structures that are highly wind direction dependant have a lower directionality factor. Triangular or square latticed towers are assigned a directionality factor of 0.85, whereas pole structures are assigned a directionality factor of 0.95. The directionality factor for a structure is to be used for determining wind loads on the structure as well as all attached appurtenances. When determining strength requirements for an appurtenance itself, however, a directionality factor of 0.95 applies.

Wind speeds are escalated with height according to the terrain characteristics surrounding a given site. The exposure categories are identical to those contained in ASCE 7 for Exposure B (urban or hilly areas), Exposure C (flat open areas) and Exposure D (non-hurricane shorelines). Simplified equations are also provided for determining wind speed-up effects due to significant topographic features such as hills, ridges and escarpments.

Gust effect factors vary based on the type of structure. For self-supporting latticed towers, the gust effect factor varies from 0.85 to 1.00 as the structure height increases. A constant gust effect factor of 1.10 is proposed for pole structures. A 0.85 gust effect factor is specified for guyed masts, however, wind load

responses are modified after analysis to account for the dynamic characteristics of wind load on guyed structures. A 1.25 amplification factor to account for dynamic interaction effects is proposed to be applied to the gust effect factor for structures supported on buildings or other structures. A gust effect factor of 1.00 is used for determining the strength requirements of appurtenances.

A patch loading is introduced for tapered self-supporting latticed towers that have extended straight portions or portions with significantly reduced leg slopes. The patch loading is intended to simulate the dynamic wind loading effects on such structures.

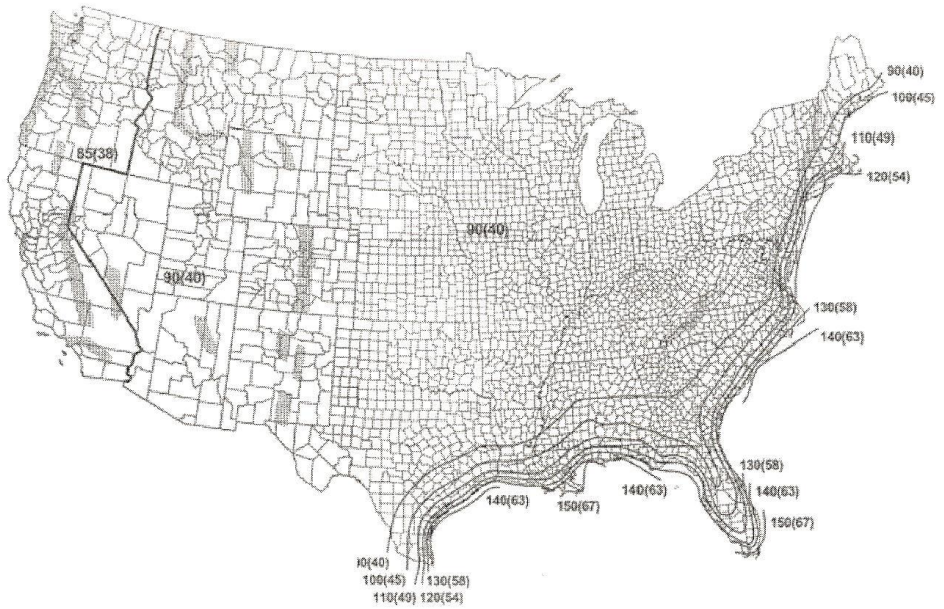

Figure 1: Wind Map

Ice Loads

A load factor of 2.0 is applied to the nominal radial thickness of ice as opposed to the weight of ice or to the projected area of ice. For guyed masts, a 50 degree F temperature drop is to be considered for the ice condition. The weight of ice on a member is calculated by considering the factored radial thickness of ice around a cylinder that circumscribes the member. The projected area of ice is calculated by considering twice the factored radial thickness of ice. The additional projected area due to ice is considered round for the purposes of calculating drag factors.

Nominal 3-second gust wind speeds that are to be considered to occur simultaneously with ice are provided. A load factor of 1.0 is applied to wind loading for the ice condition since wind pressure is applied to a factored ice thickness. Ice loads are escalated with height since ice accumulation is known to increase with wind speed. Ice Map is shown in Figure 2.

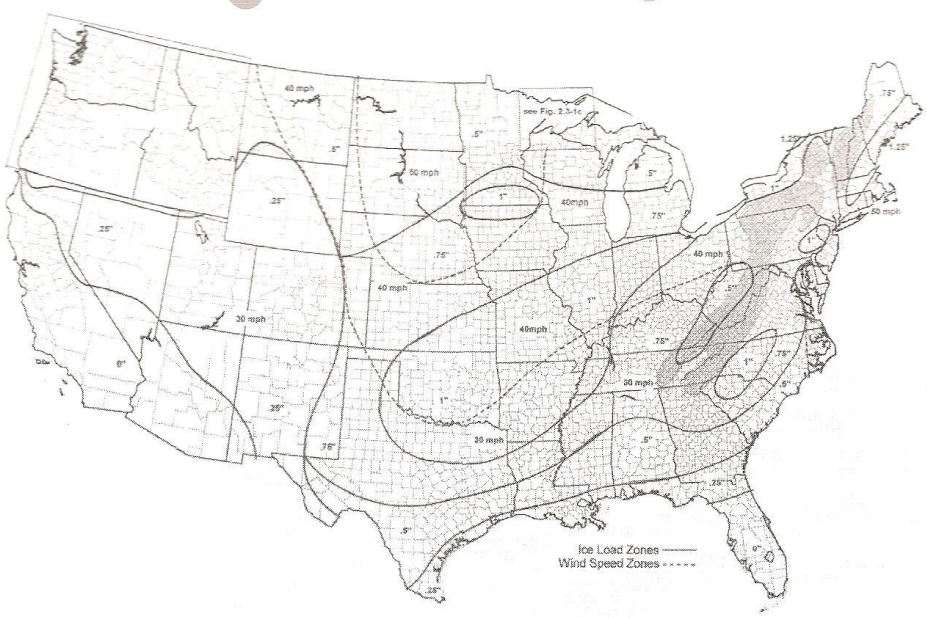

Figure 2: Ice Map

Earthquake Loads

Earthquake loads rarely govern the design of broadcast antennas and their supporting structures; however, these structures require special considerations of their response characteristics in regions of high seismicity. The standard provides design criteria to insure sufficient strength and stability to resist the effects of seismic ground motions for self-supporting and guyed antenna supporting structures. Unless otherwise required, earthquake effects are only specified to be considered in very limited areas of high seismicity.

Serviceability Limit States

Limit state deformations under service load conditions are provided in the standard. The service load condition is defined as a 60 mph wind speed without ice using an importance factor of 1.00, a gust effect factor equal to 1.0 and a directionality factor of 0.85 for all structures. Structures are limited to 4 degrees twist or sway rotation and a horizontal displacement equal to 5% of the height of the structure. In addition, more stringent rotation requirements are provided for structures supporting microwave antennas.

ANALYSIS METHODS

This new section of the standard includes the minimum acceptable models of analysis with requirements to consider the effects of displacements on member forces (P-Δ effects).

For self-supporting lattice towers, the analysis model should be either: (a) an elastic three-dimensional truss model made up of straight members pin connected at joints producing only axial forces in the members, or (b) an elastic three-dimensional frame-truss model where continuous members (legs) are modeled as 3-D beam elements while other members are modeled as 3-D truss elements.

For self-supporting pole structures, the analysis model should be an elastic three-dimensional beam-column model producing moments, shears and axial forces in the structure with a minimum of five beam elements per pole section.

For guyed masts, the analysis model should be either: (a) an elastic three-dimensional beam-column on non-linear elastic supports where the mast is modeled as equivalent three-dimensional beam-column members supported by cable members with a minimum of five beam elements in each span; (b) or an elastic three-

dimensional truss model made up of straight members or cables pin connected at joints producing only axial forces in the members; or (c) an elastic three-dimensional frame-truss model were the continuous members (legs) are modeled as 3-D beam elements while other members are modeled as 3-D truss elements.

Modified Guyed Mast Response

In addition, section 3.0 of the standard provides a prescribed method of modifying guyed mast responses to account for the dynamic effects of wind loading on taller guyed masts. The procedure redistributes the loads to account for the effects of the dynamic load response. Unlike other approximate methods such as patch-loading techniques, the new procedure generates an estimate of the peak dynamic response envelopes based on the analysis results from the static analysis. The non-wind load responses are separated from the wind load responses and the resulting wind load components are then modified. By employing scaling factors, which are determined based on structure properties and geometry, the wind-induced dynamic component of the mast axial, shear, torsion, bending moment and guy forces are obtained. Calibration studies indicate that the prescribed method provides a reliable prediction of the dynamic effects of wind loads.

FOUNDATIONS

The design of communication structure foundations is dominated by unusual and unique design and installation techniques. When combined with the marked change in the design criteria that will be legislated by revision G to create loads, reaction sets and subsequent foundation designs, it is important to understand the changes that will affect foundation designs. The foundation chapter has been updated to improve and replace many older design practices and to provide more concise design information. The changes implemented are intended to provide the designer the information required to design a foundation that is economical and consistent with limit states design methodology. Changes contained within the new foundation chapter include the elimination of "normal soil", the inclusion of assumed soil design parameters for sites lacking geotechnical information and a more concise presentation of the design parameters required to maintain foundation stability.

IMPACT ON THE DESIGN OF NEW BROADCAST STRUCTURES

Revision G will introduce new variables to consider for the design of broadcast structures. The proposed design methodology will allow the design criteria for a structure to be fine tuned based on site-specific data as opposed to generic criteria used in previous additions of the standard.

Procurement and user guidelines are provided in an annex to identify site-specific and/or suggested supplementary requirements for the design of a structure. Default parameters are provided when site-specific conditions are not available. The default values are intended to result in design criteria similar to the generic criteria used in the existing version of the standard. Following is a description of some of the major site-specific and supplementary requirements issues to consider for a structure. Some of these issues are also appropriate to consider when using the existing standard.

The standard provides county listings of wind, ice and earthquake loading criteria, however, when more stringent loadings are know to exist or are required to satisfy a local requirement, the more stringent requirements should be specified. For example, some counties are listed as being in a special wind or ice loading area. Local authorities in these areas may have more stringent loading requirements. Some areas may be subject to in-cloud icing which may be a more stringent ice loading condition. These conditions must be considered as supplementary conditions and be included in the specification for a structure.

Criteria for determining loading criteria are provided within the standard. This is required for locations outside the United States and may be also be used to determine loading criteria for counties located in special loading regions. Minimum design values applicable to any location are provided. A means for handling specifications that involve "survival" or "withstand" conditions is also clarified in the standard.

It is not uncommon to have wind speeds reported over different averaging periods (for example, a 1 minute average wind speed or an average hourly wind speed). A conversion table (Table 1) is provided to convert wind speeds to 3-second gust wind speeds which are to be used with the standard.

3-sec gust (mph)	Fastest-mile (mph)	10-min avg. (mph)	Hourly mean (mph)
60	50	42	40
70	58	49	46
80	66	56	53
85	70	59	56
90	75	62	60
95	78	66	63
100	80	69	66
105	85	73	70
110	90	76	73
115	95	80	76
120	100	83	79
125	105	87	83
130	110	90	86
135	115	94	89
140	120	97	93
145	125	101	96
150	130	104	99
155	135	108	103
160	140	111	106
165	145	115	109
170	150	118	113

Table 1: Wind Speed Conversions

The category of a structure must be established based on the reliability requirements for the structure. The design loadings for a structure are modified according to the structure's category. The standard provides for progressively more stringent loading as the reliability requirements or importance of a structure increases (category 1 to category 3). Importance relates to the consequences of failure to human life or property as well as to the type of communication services that are supported by a structure. The use of different classifications results in cost savings for structures that have lower reliability requirements. The default category is specified as being category 2.

The terrain surrounding a site significantly affects wind loading for a structure. The proposed standard allows the flexibility to consider various types of terrain (exposure B for rough surfaces, exposure C for flat surfaces, and exposure D for smooth surfaces). Exposure D results in the most stringent loading. Previous versions of the standard were based on exposure C conditions. Allowing the use of other exposures results in site-specific design criteria for a structure based on its surrounding terrain. Exposure C is specified as the default exposure.

It is known that topographic features can produce significantly higher wind speeds as the wind passes over them. The standard provides definitions of various types of topographic features which must be considered in design. Simplified methods are provided to determine the magnitudes of the increased wind speeds. The standard also allows the use of more sophisticated methods when accurate topographic data is available. The appropriate type of topographic feature for a structure must be included in the specifications. The default condition assumes that a structure is not located on a significant topographic feature with that no wind speed-up considerations are required for design.

It is important to note that for a guyed mast, the relative differences between the base of the mast and the guy anchor locations must be considered in design. These relative elevation differences must be included in the specification of the structure if detailed topographic data is not available. This information is required in order to perform a proper analysis of a guyed mast even though the structure may not be located on a significant topographic feature. This information is also required in order to provide the correct length of guys. The default condition is assumed to be level grade between the guy anchor locations and the base of the structure.

For any type of structure, it is important to specify the elevation of the base of the structure. Since wind loads are escalated with height, the wind load for a 100 ft. structure supported at ground level would be less than the wind load for the same structure supported on top of a building or other structure.

Specific criteria are provided in the standard regarding loading from transmission lines. As a default, transmission lines may be considered to be bundled together in blocks or clusters and distributed on multiple faces. The arrangement of lines has a significant effect on the wind and ice loading of a structure. If specific arrangements of lines are desired, the requirements should be clearly defined in the specification for the structure.

The ground elevation for a specific site may influence the loading for a structure due to the change in air density with elevation. Wind loading is a direct function of the density of air. The air temperature, weather and the season also affects air density. The standard provides a value to use for design, however, other values may be provided in the specification for a structure based on the air density representative of the site.

Revision G of the standard is the first version of the standard that addresses earthquake loading. The soil structure at a site has a significant effect on the loads resulting from an earthquake. Design parameters are provided for various soil conditions. When soil

conditions at a site are known, they should be included in the specification for the structure. A stiff soil condition is assumed as a default condition for the purposes of determining earthquake design parameters.

Serviceability requirements are to be investigated under a 60 mph basic wind speed loading condition without ice. This is equivalent to the 50 mph fastest-mile wind speed specified in the current standard for investigating serviceability requirements. Twist, sway and deflection limitations are provided. When more stringent requirements are required for an application, the requirements should be included in the specification for the structure.

The minimum corrosion protection required by the proposed standard is hot dip galvanizing as in previous versions. The proposed standard, however9, requires additional corrosion protection for steel guy anchors in direct contact with corrosive soil (resistivity less than 5000 Ohm-cm and/or Ph values below 3 or greater than 9). It is also recommended that additional corrosion control methods be used for AM antenna structures and other structures in close proximity to buried pipelines or electrical substations.

Cathodic control and concrete encasement are specified as acceptable additional corrosion protection. When taping or coatings are utilized, cathodic protection is also required due to the increased risk of corrosion at cracks or discontinuities. The default soil condition is considered non-corrosive. It is recommended that soil resistivity and Ph values be included in the scope of a geotechnical investigation and be included in the specification for a structure.

The proposed standard eliminates the use of the term "normal soil". Instead, presumptive soil parameters are included in an appendix for use when a geotechnical report is not available. Presumptive soil parameters for both sand and clay type soils are provided. The default soil type is clay with a frost depth equal to 3.5 ft. It is the intent of the standard that the presumptive parameters will be verified at the time of installation. The use of presumptive soil parameters for design is not allowed for essential facilities (category 3 structures).

Revision G contains significantly more climbing and working facilities requirements. For example, rest platforms are required at 150 ft. minimum spacing for structures greater than 500 ft. in height. It is a requirement that warning signs be placed on structures that do not meet the requirements of the standard regarding climbing and working facilities. A stamped or engraved metal identification tag is also to be affixed at the base of cable safety climb systems indicting the size and type of cable (to insure compatibility with a climber's safety sleeve). The standard specifies a 3/8 inch diameter cable as a standard in order to minimize the safety sleeve sizes required to be maintained by a climber.

IMPACT ON EXISTING BROADCAST STRUCTURES

Several new provisions of the standard will have a major impact on the existing broadcast towers and their support capacities.

The new standard accounts for the site-specific conditions more accurately. Classification of the importance category of the structure based on its location and its usage, wind exposure categories to reflect surface irregularities, topographic effects, and ice thickness specified by county location; these factors are combined to reflect the particularity of the structure based on its use and location. This categorization will allow the owner of a broadcast tower to have the environmental loading (by adjusting the return period) more closely match the importance of the structure and the associated risk taken by the owner.

This new revision of the standard is based on the limit state loading which will amplify the applied loads and expose any overall stability issues within a tower structure. Some of the slender broadcast towers with long guy spans will have difficulties having their analysis model converge to a solution under the ultimate loading conditions as determined from the new G revision. Some of these overall stability issues may not have always been detected using the older loading provisions.

The new standard provides a county listing of mandatory ice thickness that escalates with height and its corresponding simultaneous wind speed. This is intended to reflect the limit state condition of heavy icing and the related lower simultaneous wind speed when these parameters are combined. Older broadcast towers that were designed with no ice loading consideration will be negatively impacted while some other towers that were designed for higher wind speed combined with an ice thickness may result in an increase in their support capacity.

The appurtenances loading provisions of the new standard allow for reduction of the drag factors when it falls into a supercritical flow condition and allow for a reduction in the effective projected areas based on the location of the appurtenances. For a broadcast tower with large diameter waveguide lines, this will result in a significant reduction of the loading impact from these appurtenances.

Guyed masts are to be analyzed to resist a modified load response under the G revision to account for the dynamic loading that these structures are susceptible to. By redistributing the loading response from a static

analysis, this simplified method provides a loading pattern that more closely matches a dynamic analysis results. This provision will impact existing broadcast towers in that some additional capacity may be available in the lower portion of the tower and in the guy wires and anchors, and some reduction in capacity will result in the upper portions of the tower. Also, the minimum shear response requirements will negatively affect towers that were originally designed to closely meet the loading requirement curve.

The new standard also introduces seismic requirements for towers that are in high seismic zones. In general, this provision should not affect broadcast towers unless they have structural irregularities and are located in high seismic zones. Then, either a modal analysis (self-support) or a time history analysis (guyed) would be required to properly account for the seismic loading.

There are other miscellaneous provisions that will affect broadcast towers, such as high-frequency dampers requirements and end articulation of guy assemblies. These requirements need to be met when modifying an existing tower.

CONCLUSIONS

In conclusion, the new provisions of the TIA/EIA 222-G standard will allow the designer to use the state of the art knowledge in the design of structures and will allow owners of broadcast towers to fine-tune the design requirements and utilize site-specific data that more closely represent the current understanding of the environmental loading these structures are subjected to.

ACKNOWLEDGEMENT

The authors wish to acknowledge the hard work of all their colleagues on the TR14.7 technical committee for the development of this standard.

REFERENCES

ASCE-98 "Minimum Design Loads for Building and other Structures" American Society of Civil Engineers, Jan 2000.

ATTACHMENT TWO (informational only)

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2007

SESSION LAW 2007-147
HOUSE BILL 1340

AN ACT TO RECOGNIZE THE VALUE OF AMATEUR RADIO COMMUNICATIONS BY REQUIRING CITY AND COUNTY ORDINANCES REGULATING ANTENNAS TO REASONABLY ACCOMMODATE AMATEUR RADIO COMMUNICATIONS.

The General Assembly of North Carolina enacts:

SECTION 1. Article 19 of Chapter 160A of the General Statutes is amended by adding a new section to read:

"**§ 160A-383.3. Reasonable accommodation of amateur radio antennas.**

A city ordinance based on health, safety, or aesthetic considerations that regulates the placement, screening, or height of the antennas or support structures of amateur radio operators must reasonably accommodate amateur radio communications and must represent the minimum practicable regulation necessary to accomplish the purpose of the city. A city may not restrict antennas or antenna support structures of amateur radio operators to heights of 90 feet or lower unless the restriction is necessary to achieve a clearly defined health, safety, or aesthetic objective of the city."

SECTION 2. Article 18 of Chapter 153A of the General Statutes is amended by adding a new section to read:

"**§ 153A-341.2. Reasonable accommodation of amateur radio antennas.**

A county ordinance based on health, safety, or aesthetic considerations that regulates the placement, screening, or height of the antennas or support structures of amateur radio operators must reasonably accommodate amateur radio communications and must represent the minimum practicable regulation necessary to accomplish the purpose of the county. A county may not restrict antennas or antenna support structures of amateur radio operators to heights of 90 feet or lower unless the restriction is necessary to achieve a clearly defined health, safety, or aesthetic objective of the county."

SECTION 3. This act becomes effective October 1, 2007.

In the General Assembly read three times and ratified this the 26th day of June, 2007.

s/ Beverly E. Perdue
President of the Senate

s/ Joe Hackney
Speaker of the House of Representatives

s/ Michael F. Easley
Governor

Approved 2:16 p.m. this 29th day of June, 2007