

MEMORANDUM

TO: City of Charlotte: Code Update Project Team
FROM: Clarion Associates (Matt Goebel, Kristin Cisowski)
DATE: April 3, 2014
RE: Wireless Telecommunications Standards – Background Review of Other Codes

This memorandum provides background information to inform the review and update of Charlotte’s wireless communications transmission facilities (WCTF)¹ requirements, which are located in Section 12.108 (Height Limitations) of the Zoning Ordinance. This memo is not intended to recommend specific amendments to the city’s standards; rather, changes will be discussed and evaluated as part of upcoming meetings.

To help place Charlotte’s regulations in perspective, the memo includes relevant provisions from the model wireless telecommunications facility siting ordinance prepared by PCIA, the Wireless Infrastructure Association, which served as the basis for North Carolina’s recent model wireless telecommunications ordinance.² The memo also discusses similar regulations in effect elsewhere in North Carolina and across the country. Eight code examples were selected for review, not because they necessarily represent best practices in the field, but in an attempt to illustrate the range of regulations currently in place in communities of similar size and population. The eight codes reviewed include:

- **Boston, MA:** Article 86 Wireless Communications Equipment
- **Cary, NC:** 5.2.4(D) Telecommunications Facilities
- **Cleveland, OH:** Chapter 354 Wireless Telecommunication Facilities
- **Denver, CO:** Section 11.5.2 Telecommunications Towers; Telecommunications Tower – Alternative Structure; Telecommunication Facilities – All Others
- **Los Angeles, CA:** Section 12.21.A.20 Wireless Telecommunication Facilities Standards
- **Philadelphia, PA:** Chapter 14-600 (16) Wireless Service Facilities (Freestanding Towers) and (17) (Building or Tower-Mounted Antenna)
- **Portland, OR:** Chapter 33.274 Radio Frequency Transmission Facilities
- **Raleigh, NC:** 6.3.3(C) Telecommunication Tower (less than 250 ft.) and (D) (greater than 250 ft.)

The following issues are addressed (with page numbers):

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¹ Throughout this memo, “WCTF” is used to generally refer to telecommunications towers and the accessory equipment and structures used in conjunction with the towers.

² PCIA is the principle trade association representing the companies that make up the wireless telecommunications infrastructure industry. Its members include carriers, infrastructure providers, and professional services firms that own and manage more than 125,000 telecommunications facilities throughout the world.

CODES REVIEWED

The eight sample codes reviewed were selected for the following reasons:

Boston, MA

Boston's code is reviewed because it is an east coast city with a population similar to Charlotte's and because it addresses most of the key issues identified by Charlotte. However, the ordinance is dated (1997).

Cary, NC

Cary's code is reviewed because it is the seventh-largest municipality in North Carolina and has been recently updated to reflect new federal and state rules. The city amended its telecommunications regulations in November of 2013 (clarifying residential setback requirements for new lots created in the vicinity of an existing tower), and in January of 2014 (to bring the code into compliance with revised federal rules and state law requiring local governments to approve any "eligible facilities request" to collocate on existing structures in a timely manner). Additionally, Cary's code has some unique features that work well for telecommunications regulations (e.g., a hierarchy of tower type preferences, appropriate incentives to encourage those preferences, and the use of tables to present dimensional standards). Cary's code was also consulted in drafting North Carolina's model ordinance.

Cleveland, OH

Cleveland's code is reviewed because it is a mid-size city that requires strict residential setback requirements (3x the tower height). Cleveland's code is also well-organized, which makes it easy to read.

Denver, CO

Denver's code is reviewed because it is an example of a western city with a population similar to Charlotte's. The Denver code is also well-organized and easy-to-read, due in part to the use of dimensional tables. Additionally, Denver's code requires heightened landscaping standards for towers located near residential zoning districts.

Los Angeles, CA

Los Angeles's code is reviewed because it is a larger city with relatively relaxed telecommunications regulations.

Philadelphia, PA

Philadelphia's code is reviewed because it is a larger city with straightforward yet strict requirements, which address a tower's fall zone. Additionally, Philadelphia revised its planning and zoning code in 2012 and the telecommunications regulations providing for building-mounted or tower-mounted antenna were amended again in 2013.

Portland, OR

Portland's code is reviewed because it is a west coast city that is often seen as a model of progressive land use regulations. The code provides an example of some strict and specific regulations. However, we found the organization to be somewhat challenging and not easy to read. Additionally, unlike the other codes reviewed, some of Portland's standards are based on radio frequency emissions, which complicates the code and reflects its age.

Raleigh, NC

Raleigh's code is reviewed because it is the second-largest municipality in North Carolina. The city adopted a new Unified Development Ordinance in September 2013; however, the new ordinance carried forward the city's prior wireless telecommunications regulations. Raleigh's outdated regulations are a good example of regulations that could be better organized and less complex, making them more user-friendly. However, the code is also a good example of how to incentivize a preference for a certain tower type. (Raleigh is not alone in going through a full code update with the exception of its telecommunications regulations. Morrisville, NC, took a similar approach.)

TOWER TYPES



Monopole



Lattice Tower



Guyed Tower



Stealth Tower

Most jurisdictions and the PCIA recognize four main tower types, or antenna support structures (depicted above). Ordinances often express a preference for one tower type over another, usually monopole or stealth, since they typically have less visual impact. Many codes also provide incentives to encourage certain tower types (e.g., offer a reduced setback requirement for a monopole), and some codes prohibit a certain type of tower (usually lattice) outright.

Charlotte's existing code favors monopole and stealth towers. It requires a replacement tower to be monopole and a tower within 400 ft. of a residential zone district to be concealed (i.e., stealth). Stealth towers are advantageous because they blend with the environment as flagpoles, trees, boulders, bell towers, etc. However, the PCIA cautions that stealth towers reduce coverage capacity and the ability to collocate providers on one tower, resulting in an increased need for additional free-standing structures.

Code Examples

For all topics in this memo, we list the PCIA model ordinance first and the other code examples alphabetically.

Model Ordinance

- In residential districts, the model ordinance promotes stealth towers by suggesting that stealth towers less than 60 feet tall should be permitted in any residential district with administrative approval, while other tower types should not be permitted in residential districts.
- In other areas, the model ordinance does not generally favor one type of tower over another.

Boston, MA

- One of the older ordinances reviewed (1997), Boston's code only identifies monopoles and lattice towers in its definition of "equipment mounting structure." Although this definition is "not limited to" monopoles and lattice towers, stealth or concealed towers are not directly addressed in the code.
- The code does not include preferences or incentives for certain tower types.

Cary, NC

- Cary's code uniquely includes a hierarchy of the Town's preferences (i.e., guidance, not requirements) for WCTF types and locations, in the following descending order:
 - Antenna collocation on an existing tower
 - Stealth antenna on an existing building/structure
 - Building-mounted antenna and/or tower
 - New concealed (stealth) tower
 - New freestanding non-stealth tower (monopole)
 - New freestanding non-stealth tower (lattice-type)

- Additionally, the Town incentivizes the use of stealth towers by allowing them as a permitted use in nearly all zoning districts, in accordance with the following table. Conversely, a freestanding, non-stealth tower is only permitted by right if more than 200 ft. from a residential property line.

Cary, NC: Location of Proposed Stealth Tower

Max. Height of Stealth Tower	Residentially-Zoned Land Used for Residential Purposes or Vacant	Non-Residential Zoning District	Residentially-Zoned Land Used for Non-residential Purposes
up to 150 feet	A	A	A
greater than 150 feet, up to 175 feet	B	A	A
greater than 175 feet, up to max. height allowed	C	C	A

A — Planning Director * — Permitted Use with Site Plan Review;

B — Zoning Board of Adjustment — Special Use and Site Plan Review

C — Town Council — Special Use and Site Plan Review

Cleveland, OH

- While most jurisdictions include all tower types in their general definition of telecommunications towers, Cleveland's code specifically defines "lattice tower" and "monopole tower" separately.
- Cleveland prefers a monopole rather than a lattice tower design by requiring a monopole, wherever feasible.
- Although the code considers aesthetic design in tower approvals (see discussion below), and requires an unobtrusive design, the code does not explicitly address stealth or concealed towers.

Denver, CO

- Denver's code subtly favors monopole construction by requiring the smallest minimum separation distances between monopole towers.
- Aside from the monopole separation incentive, the code does not promote one type of tower over another.

Los Angeles, CA

- Generally, the Los Angeles code only refers to monopoles. In one location it states "monopole or tower," and refers to "stealth techniques" in the context of landscaping.

Philadelphia, PA

- The Philadelphia code does not indicate a preference for or incentivize the use of one tower type over another.

Portland, OR

- Portland's code discourages lattice towers. They are prohibited in OS, R, and C zones, as well as EX, EG, and I zones that are within 50 ft. of a residential zone.

Raleigh, NC

- Raleigh's code favors monopole towers by offering a reduced tower setback (for towers less than 250 ft.) if a monopole design is used. The required setback is reduced from 200% of the tower height to 100%, but the setback can never be less than 50 ft. from an abutting residential district.
- The code also encourages collocation by reducing the setback requirements when an existing tower is replaced by a tower that supports more than one service provider.

TOWER HEIGHT

Local governments restrict tower heights, especially when a tower is near to a residential district, to minimize adverse visual impact. On the other hand, service providers argue that, because taller towers equate to better service (quality and coverage) and the need for fewer short towers, allowing taller towers can actually result in less overall aesthetic impact. Logically, it makes sense that taller towers will have a farther-reaching signal that translates into better service. Additionally, because taller towers can support more providers, coverage is also likely to be better. However, tower height is only one factor in determining service coverage and quality. Other factors include the size of the service area and topography, both of which can interfere with the reach of the

signal. Thus, a community must consider more than just tower height when increased coverage (likely for public safety and convenience reasons) is a priority.

Currently, Charlotte permits towers up to a height of 40 feet in any district, and above 40 feet in any zoning district as a secondary or primary use, with restrictions. For instance, stricter setback requirements are required for increased height when the tower is on or adjacent to a residential lot (see setback section below).

Of the codes we reviewed, five allow greater tower heights based on the number of users the tower will accommodate (model code, Cary, Denver, Los Angeles, Raleigh), four base their height requirements on underlying zoning districts (Cleveland, Denver, Philadelphia, Portland), and three identify different height requirements with respect to residential zoning districts (model, Cary, Raleigh).

Code Examples

Model Ordinance

- The model ordinance suggests the following height requirements:
 - Non-residential districts: the minimum height necessary to meet applicant’s service objectives.
 - Residential districts: maximum 199 ft. (which is quite tall, considering some jurisdictions do not allow any towers in residential districts).
- Additionally, the model ordinance suggests that maximum tower heights be based on the number of providers (collocations) a tower will support:
 - 2 providers – 60 to 100 ft.
 - 3 providers – 100 to 150 ft.
 - 4 or more providers – greater than 150 ft.

Boston, MA

- Boston’s code provides different maximum tower height standards for different districts:
 - Industrial and Airport Districts – 200 ft.
 - Other Non-Residential Districts – 150 ft.
 - Residential Districts – Towers are generally not allowed
- Boston’s code also provides maximum heights for roof-mounted antenna, based on the height of the building or structure to which the antenna is attached:
 - If the building is taller than 45 ft. – antenna can be 20 ft. tall or 20 % of the building height, whichever is greater.
 - If the building is 15 to 45 ft. – antenna can be 10 ft.
 - If building is less than 15 ft. – antenna can be 6 ft.
 - Façade-mounted antenna may be 5 ft. above the cornice line.

Cary, NC

- Cary’s code, which encourages stealth towers in residential districts, aligns with the model ordinance and sets the maximum permitted height for stealth towers at 199 ft. Stealth towers over 150 ft. require either BOA or Town Council approval.
- The maximum permitted height for non-stealth towers (not permitted in residential districts, except R40 or R80 by special use permit) is 350 ft.
- The Cary code encourages collocation and requires certain tower heights to accommodate a certain number of providers:
 - 120 ft. – 4 antenna arrays
 - 121-150 ft. – at least 5 antenna arrays
 - Greater than 151 ft. – at least 6 antenna arrays
- Like Boston, the code also provides building-mounted tower and antenna height standards (maximum heights on non-residential buildings only) in tabular form as follows:

CARY: MAXIMUM TOWER AND ANTENNAE HEIGHT, NON-RESIDENTIAL BUILDINGS

Building Height	Maximum Tower Height (including antennae; measured from building height)
Over 150 feet	15 percent of building height
75 to 149 feet	25 percent of building height
Less than 75 feet	40 percent of building height

Cleveland, OH

- Cleveland's height restrictions are simple, consistent, and based on the height limit of the underlying zoning district. A structure or antenna cannot exceed the height limit of the established zoning district by more than 20 ft.

Denver, CO

- Generally, tower height is governed by the underlying zoning district height standards, or the following collocation incentive heights, whichever is greater.
 - If one tower user – 75 ft. (max) height
 - If two or more users – 90 ft. (max) height
- Alternative tower structures, not more than 50 ft. in height are permitted in all zone districts, subject to certain requirements.

Los Angeles, CA

- Like the industry model ordinance, Los Angeles has a lenient height requirement. The code simply requires that monopoles are designed at the minimum functional height.
- The height standard for roof-mounted antenna is stricter than that for freestanding towers. Roof-mounted antenna may not extend more than 10 ft. above the roof's highest point.

Philadelphia, PA

- Philadelphia's approach to tower and antenna height is simpler than the other codes reviewed because only one height standard is provided. Different variables (e.g., building height, proximity to residential, and collocation) do not change the height limit.
- Tower height is governed by the underlying zoning district in which the tower is located, or a maximum height of 60 ft., whichever is greater.
- The maximum allowable building-mounted or tower-mounted antenna height is 15 ft.

Portland, OR

Portland's height regulations are unlike those found in other codes, and more difficult to interpret, because they are based on effective radiated power (ERP). However, like many codes, collocation is required for greater tower heights.

- In C, E, or I zones, facilities operating at 1,000 watts ERP or less, supported by a new tower must meet the height requirement for buildings in the base zone.
- For towers accommodating a facility of 100,000 watts or more, the tower must be designed to accommodate at least three two-way antennas for every 40 ft. of height over 200 ft.
- Any other tower (99,000 watts or less), the design must accommodate at least three two-way antennas for every 40 feet of tower, or at least one two-way antenna for every 20 feet of tower and one microwave facility.

Raleigh, NC

- 510 ft. is the max tower height.
- Like the model ordinance and Cary, Raleigh encourages collocation, with towers supporting more users being awarded greater maximum heights, according to the following:
 - 100 to 150 ft. tower - 2 providers (min)
 - 150 to 180 ft. – 3 providers (min)
 - 180 to 200 ft. – 4 providers (min)
 - Greater than 200 ft. – 5 providers (min)
- Residential districts: In residential districts, a tower may be either:
 - 75 ft. tall maximum, or
 - Located no closer than 1500 ft. to a tower greater than 75 ft.
- Raleigh's code also includes an unusual overlay district height restriction that places additional height restrictions that trump those over the underlying district.

SETBACK AND YARD REQUIREMENTS

Determining appropriate setback and yard standards for WCTFs is a balancing act, especially when these facilities are located near residential areas. Local governments commonly increase residential setback requirements to preserve neighborhood character, minimize aesthetic impacts and adverse health effects,³ and to maintain property values. Required setbacks from residential districts and uses are generally much greater than setbacks from non-residential districts and uses.

On the other hand, large setbacks reduce possible siting options for new towers. In many communities, because suitable cell tower sites in non-residential areas are becoming scarce, and given extensive residential setback standards, providers have reportedly found it difficult to locate new towers. For example, service providers claim that Charlotte's 200 ft. residential setback requirement has posed siting challenges, based on notes from a July 2013 meeting with city officials.

Of the codes reviewed, only two (Philadelphia and Los Angeles) factor the tower's fall zone into its setback requirements. The following reviews local WCTF setback and yard regulations from around the country, paying particular attention to setbacks and separation from residential areas and uses.

Code Examples

Model Ordinance

- The model ordinance recommends that towers be set back from all property lines and all off-site residential dwellings a distance equal to the height of the structure.
- For accessory equipment (e.g., power supplies, generators, batteries, cables, equipment buildings, cabinets, storage sheds, etc.), the model ordinance suggests a setback consistent with the underlying zoning district.

Boston, MA

- In Airport and Industrial districts, minimum tower setbacks are:
 - 20 ft. from the street
 - 150 ft. from residential, open space, and school uses
- In other non-residential districts (e.g., general business, neighborhood shopping, community commercial), minimum tower setbacks are:
 - 50 ft. from the street
 - 150 ft. from residential, open space, and school uses
 - 20 ft. from lot lines
- Residential districts: Towers are prohibited.
- Roof and facade-mounted antennas are allowed as conditional uses in residential districts:
 - A roof-mounted antenna must be set back from a roof edge by 10 ft. or 10% of roof depth, whichever is greater.
 - A facade-mounted antenna must be setback from residential buildings and school uses by 50 ft.

Cary, NC

- Stealth Towers:
 - Must generally comply with the minimum building setback for the zoning district in which the tower is located.
 - Stealth towers must be set back the height of the tower from existing dwellings in a non-residential zoning district and from the property line of all residential zoning districts.
 - The setback requirement from non-residential zoning districts and residentially zoned property used for non-residential purposes is reduced to a distance equal to ½ of the tower height (but not less than the minimum required buffer for the underlying zone district).
- Non-stealth towers:
 - Must also generally comply with the minimum building setback for the zoning district in which the tower is located.

³ The federal telecommunications act (TCA) prevents a local jurisdiction from denying a tower application based on environmental and health effects if FCC guidelines are met, and the PCIA reports that there is no credible evidence that radio frequency emissions adversely impact a person's health.

- Cary’s residential setback requirement for non-stealth towers is greater than Charlotte’s existing requirement. A 200 ft. minimum setback or 2x the height of the tower, whichever is greater, is required from all residentially zoned property lines and from all residential dwellings in a non-residential zoning district.
- Cary’s non-residential setback requirement — a distance equal to the tower height from the property line of non-residentially zoned property as well as residentially-zoned property used for non-residential purposes — is what AT&T suggests for Charlotte’s residential setback.
- Both stealth and non-stealth towers must be setback from ROW boundaries by the height of the proposed tower.
- Cary does not have a fall zone provision.

Cleveland, OH

- Compared to the other codes we reviewed, Cleveland’s non-residential setback requirements are more lenient and its residential setback requirements are more restrictive.
- The code requires the following tower setbacks:
 - 10 ft. from the lot line of a Non-Residential or Non-Landmark district
 - 3x the tower height from a Residential, Landmark, or Public Park zoning district lot line
 - 2 miles from the Public Airport (measured from center of tower to any border of airport)
 - 25 ft. from the ROW
 - 3x the new tower height from other existing towers
- The code also requires the following setbacks for tower accessory buildings:
 - 50 ft. from a residential zoning district lot line
 - 25 ft. from the ROW

Denver, CO

- Denver’s code distinguishes setback requirements from separation distances.
- Similar to other codes, the minimum underlying zoning district setback requirements apply to all towers.
- Denver’s tower separation distance requirements from off-site residential uses, which are presented in an easy to read tabular format (Table 1 below), are much stricter than the other codes we reviewed.
- The Denver code also provides minimum separation distances between towers in tabular form (Table 2 below).
- Tower separation distances are measured from the base of the tower to the lot line of the off-site use or designated area.
- The City will consider requests for smaller separation distances than those in the below tables, provided the proposed tower is at least 100 ft. from the uses and zones in Table 1 and at least 500 ft. from another existing tower.

TABLE 1. TOWER SEPARATION FROM CERTAIN USES AND ZONES.	
Off-Site Use/Designated Area	Separation Distance
Single-unit or two-unit dwellings	500 feet or 3 times the height whichever is greater
Vacant platted or unplatted residentially zoned land	500 feet or 3 times the height whichever is greater
Existing multi-unit residential units	500 feet or the height of tower whichever is greater
City park and open space uses	1,000 feet
Nonresidentially zoned lands with nonresidential uses	None; only setbacks apply

TABLE 2. MINIMUM SEPARATION BETWEEN TOWERS (IN FEET)				
Existing Towers–Types	Lattice	Guyed	Monopole 75 feet in height or greater	Monopole not more than 75 feet in height
Lattice	2,500	2,500	1,500	1,000
Guyed	2,500	2,500	1,500	1,000
Monopole 75 feet in height or greater	1,500	1,500	1,500	1,000
Monopole not more than 75 feet in height	1,000	1,000	1,000	1,000

Los Angeles, CA

- Consistent with most other codes reviewed, Los Angeles requires monopoles to meet the building setback requirements of the underlying zoning district.
- Los Angeles considers the monopole fall zone in its setback requirements.
- Compared to the other codes reviewed, the City’s setback requirements for monopoles adjacent to residential uses are minimal.
- Monopoles must be setback from streets, residential uses, and all areas or zones accessible to the public a distance equal to 20 % of the monopole height, unless a qualified structural engineer specifies in writing that any collapse of the pole (the fall zone) will occur within a lesser distance.

Philadelphia, PA

- Generally, buildings and structures associated with a newly erected tower (excluding antennas and antenna towers or support structures) must comply with the setback requirements of the underlying zoning district.
- Like Denver, Philadelphia has strict setback requirements from residential areas.
- Minimum setbacks are based on distances from residential dwellings as follows:
 - In residential and CMX -1 (a commercial district) districts: towers must be at least 500 ft. from the lot line of any residential dwelling, or the fall zone distance, whichever is greater.
 - In all commercial (other than CMX-1) and industrial districts: towers must be at least 250 ft. from the lot line of any residential dwelling, or the fall zone distance, whichever is greater.
- The radius of a fall zone (around the entire tower) is equal to the height of the tower at its highest point.
- Additionally, buildings and structures associated with new towers must comply with the setback requirements of the underlying zoning district.

Portland, OR

- Unlike the other codes reviewed, Portland’s code identifies different setback requirements for towers and guy anchors.
- Portland’s required setback from residential zoning districts is less restrictive than the other codes reviewed. From residential and open space zoning districts, and public streets, towers must be set back a distance equal to 20% of the tower height or 15 ft., which is greater.
- The required tower setback from non-residential zoning districts is not clear. Base zoning district requirements likely govern.
- Tower guy anchors must meet the main building setback requirements of the base zoning district.
- Accessory equipment or structures must meet the base zone setback standards.
- Additionally, unlike the other codes reviewed, Portland’s code regulates the distance between antenna and habitable area of a structure based on effective radiated power (ERP). Most codes simply require that the ERP not exceed FCC requirements.

Raleigh, NC

- For new towers LESS than 250 ft., the minimum setback standards are:
 - 20 ft. from a non-residential district property line
 - 200% of the tower height from a residential district property line, but not less than 50 ft. The required setback may be reduced to 100% of the tower height, but the setback can never be less

- than 50 ft. from an abutting residential district. (Unlike Cary, Raleigh does not apply residential setback requirements to residential dwellings in non-residential zoning districts.)
 - 100% of the tower height from the property line of an abutting mixed use or special district.
 - Unlike other codes, Raleigh's code also identifies setback requirements for towers located on the property of a civic use in a residential district. In these instances, the setbacks above apply, except that a tower can never be located closer than 200% of the tower height to the property line of a lot with a dwelling or congregate care facility, or a vacant lot.
 - 20 ft. from any public street (this requirement is not identified for towers over 250 ft.).
 - Raleigh incentivizes collocation (for replacement towers) by offering to reduce setbacks (in excess of 100 ft.) by 15% for each additional user over that of the original tower.
- For new towers GREATER than 250 ft., the setback standards are:
 - 20 ft. from a non-residential district property line (same as for towers < 250 ft)
 - 100 % of the tower height from a residential district property line, but not less than 50 ft. (again, this does not apply to a residential dwelling that is not a permitted use in the underlying zoning district)
 - 50% of the tower height from the property line of an abutting mixed use or special district (more lenient than for towers < 250 ft).
 - Same collocation incentive for replacement towers greater than 250 feet as noted above for those less than 250 ft., but setback cannot be reduced to less than 50% of the tower height.
- Raleigh's code clarifies that the minimum setback is measured from the outside dimensions of the tower, not from guy anchors.

LANDSCAPING AND SCREENING OF TOWERS AND EQUIPMENT BUILDINGS

Local governments incorporate landscaping, buffering, and screening provisions into their WCTF regulations to minimize the aesthetic impact that tall metal towers and their associated equipment buildings have on the visual character of their communities. Nearly all of the codes that we reviewed indicated an intent (either in a purpose statement or in landscape and screening provisions) to protect the unique aesthetic character of the community while also meeting citizen needs for wireless communications services.

Charlotte's existing regulations do not indicate a purpose for the WCTF standards or address landscaping and screening requirements in any detail. Landscaping and buffering requirements for new towers simply state that a permit applicant must consider any comments from adjoining property owners concerning landscaping and screening and other design issues of the facility. For replacement towers, the existing regulations require that replacement towers conform to landscaping and buffering requirements in force at the time of the replacement tower permit applications.

Code Examples

Model Ordinance

- Landscaping: Generally, the model ordinance suggests that, rather than incorporating general landscaping standards into local regulations, the regulations should give the Zoning Administrator the authority to impose (or not) reasonable landscaping requirements on accessory equipment.
- Fencing: The model ordinance suggests that ground-mounted accessory equipment and support structures should be enclosed with a six ft. (min) fence, and that the Zoning Administrator should have the authority to waive this requirement when appropriate.

Boston, MA

- When design review for a WCTF is not required, Boston's code defers to the screening and buffering requirements of the underlying zoning district.
- When design review is required, the design guidelines (suggestions) are vague, stating that:
 - All WCTF should be sited, designed, and screened to minimize the visibility of the equipment from surrounding public streets and neighborhoods; and that
 - Ground-mounted equipment should be screened from view by suitable vegetation.

Cary, NC

- Landscaping: Cary requires that all fences and walls be screened in accordance with landscaping standards found elsewhere in the code.
- Fencing: Cary requires that the tower base and each guy anchor be surrounded by an 8 ft. (min) opaque fence or wall (stricter than model ordinance).

Cleveland, OH

- Landscaping must:
 - Surround the outside perimeter of the security fence, and
 - Be 10 ft. wide (min), 6 ft. tall (min), and consist of evergreen trees or shrubs, spaced at 8 ft. intervals (max).
 - These requirements can be waived or modified by Planning Commission if the facility is not otherwise visible from adjacent parcels or by the general public.
- A security fence must surround a ground-mounted telecommunications tower and be:
 - 6 ft. (min) – 8 ft. (max) in height
 - Setback 10 ft. (min) from property lines
 - Wrought iron, black vinyl chain link, or a decorative masonry wall if within 25 ft. of ROW (barbed wire ok, if permitted by other regulations)

Denver, CO

- Unlike other codes that identify general landscaping and screening standards for towers in all districts, Denver requires heightened standards for towers near to residential or mixed use commercial zoning districts, as follows:
 - If a tower is within 200 ft. of a R or MU commercial zone, screening shall be accomplished in one of two ways:
 - Using 6 ft. tall landscaping (solid and view-obscuring), or with
 - A finished masonry wall of similar material and/or finish as the primary structures on the site or adjacent to the site.
 - In all other districts, the area around the tower must be landscaped with a buffer of plant materials that effectively screen the view of the tower base from residential property. This buffer must be:
 - 5 ft. wide and 5 ft. tall (at maturity); and consist of
 - 50% coniferous or broadleaf evergreens
- If the visual impact of the tower is minimal, landscaping requirement may be reduced or waived.
- Denver's code also requires that telecommunications support facilities (at grade) meet the same screening and landscape requirements as towers.

Los Angeles, CA

- The Los Angeles code requires landscaping at the perimeter of the property on which a tower is located if it abuts a street, a residential use, or any zone or area open to the public as follows:
 - Landscaped buffer must begin at property line,
 - Include at least one row of shrubs, spaced 3 ft. apart (max), which will form a continuous hedge of at least 5 ft. in height in two years,
 - Include another row of shrubs or trees, at least 4 ft. in height at the time of planting, and spaced 15 ft. apart (max), and be
 - Appropriately irrigated and maintained.

Philadelphia, PA

- Philadelphia's code includes very specific landscape screening requirements, and its fencing requirement aligns with the model ordinance's suggested height.
- Landscaping:
 - New towers must be surrounded by a continuous evergreen screen that is at least 6 ft. wide and 6 ft. tall when planted, and which will reach a 15 ft. height (min) at maturity.
 - Vegetative species used for screening must be from a Commission-approved list.
 - Additionally, based on existing structures, vegetation, topography, or other natural features, the Commission can waive or modify screening requirements.

- Fencing:
 - Consistent with the model ordinance, towers (unless located on an existing building) must be enclosed by a 6 ft. fence.
 - Furthermore, the required fence must be behind the required landscape screen and setback standards.
- The code also requires that the building or tower-mounted antenna be painted or screened to match the color or simulate the materials of the building or tower on which mounted.

Portland, OR

- Like Denver, but even more zone-specific, Portland provides distinct WCTF landscaping and screening requirements based on zone district.
- If a tower is located in a C, E, or I zone and more than 50 ft. from a residential zone, the tower base and accessory equipment must be screened by a landscaped area 5 ft. deep. Alternatively, if a tower base and accessory equipment is screened by an existing building or fence, then the landscaping requirement may be modified.
- If a tower is located in an OS or R zone and less than 50 ft. from another residential zone, heightened screening standards must be met:
 - The landscape area around the tower base must be 15 ft. deep (min), and
 - The landscape area around the accessory equipment/structures must be 10 ft. deep (min).

Raleigh, NC

- Landscaping:
 - Generally, Raleigh requires a protective yard (equal to the width of the tower height that is planted) around a tower, unless the tower is separated from the ROW by a distance equal to 200% of the tower height.
 - Installation of any fence, wall, planting or berm does not reduce this protective yard requirement.
 - All fences and walls must be screened with plant material so that no more than 2/3 of the fence surface is visible from a public street or from any adjoining residential zoned lot, or congregate care facility (landscaping must meet maturity in 3 yrs).
- Fencing:
 - Like Cary (and stricter than the model ordinance), the tower base and each guy anchor must be surrounded by an 8 ft. (min) fence or wall, unless the base and anchors are mounted on a building greater than 8 ft. tall.

ARCHITECTURAL DESIGN AND CONCEALMENT

As with screening and buffering requirements, local governments regulate the architectural design of WCTFs to minimize the aesthetic impacts of unsightly metal towers and associated equipment. These types of provisions are found in all the codes that we reviewed. Stealth technology, which can be used to disguise a tower as a bell tower, tree, or some other landscape element, is one common way of softening the visual impact of WCTFs and can be either encouraged or required. Codes also generally require that accessory structures associated with cell towers be designed to resemble the architectural style, scale, color, and texture of buildings in the immediate neighborhood. Additionally, when a tower or antenna is attached to a building, design/concealment provisions typically require that the wireless equipment be integrated into the design of the building (e.g., behind a dormer) to the greatest extent possible.

Charlotte's existing regulations contain some concealment provisions. For instance, new WCTFs within 400 ft. of a residential zoning district must be designed, constructed, or integrated into an existing structure in order to make them indiscernible. However, a flagpole can only be used as a concealment measure on a site used for institutional or non-residential uses.

The following reviews architectural design and concealment provisions found in various local codes across the country. Other aesthetic provisions, including lighting and signage on WCTFs, are also noted.

Code Examples

Model Ordinance

According to the model ordinance, aesthetics of WCTFs encompasses lighting and marking, signage, and landscaping, but not architectural design. Accordingly, the model ordinance does not address design features like architectural style, scale, color, and texture of WCTFs.

- Lighting and Marking: The model ordinance recommends that WCTFs shall not be lighted or marked unless required by the Federal Communications Commission (FCC) or the Federal Aviation Administration (FAA). Most of the codes we reviewed included this provision.
- Signage: The model ordinance recommends that signs located on a WCTF shall be limited to ownership and contact information, FCC antenna registration number (if required) and any other information required by government regulations. Commercial advertising is strictly prohibited. Most of the codes we reviewed included this provision.

Boston, MA

Boston's code includes the following general design guidelines:

- Wireless equipment should be sited, designed, and screened to minimize visibility from surrounding public streets and neighborhoods.
- If attached to an existing building, equipment should be integrated into the building or structure in a manner that blends with its architectural characteristics.
- If not attached to an existing building or structure, the equipment should reflect and complement the architectural character of the surrounding neighborhood.
- If visible from surrounding streets and neighborhoods, the color of such equipment should be selected to minimize the equipment's visibility. If visible against the sky, the use of black is discouraged, and the use of white, gray, or other light shades is encouraged.

Cary, NC

- Cary's purpose statement identifies the need to minimize the aesthetic impact of WCTF infrastructure.
- The city requires that the following (subjective) factors are considered when designing a Concealed Stealth Antenna and Tower:
 - Complementing the physical landscape (e.g., faux pine trees, unipoles/slick sticks, bell towers, etc.);
 - Configuring and locating the tower in a manner that minimizes adverse effects including visual impacts on the landscape and adjacent properties; and
 - Designing for compatibility with adjacent structures and landscapes with specific design considerations such as architectural designs, scale, color, and texture.
- Similarly, the code requires that the exterior appearance of a support structure be compatible with buildings in the surrounding area.

Cleveland, OH

- Like the other codes reviewed, Cleveland requires unobtrusive and neighborhood-friendly design of WCTFs, including towers, antennas, and accessory structures, to the maximum extent possible.
- Like the Boston code, this code specifies that painted towers must be light gray or off-white to blend with the sky and clouds, unless the FAA requires or Planning Commission approves something else.
- Cleveland's code also identifies materials (e.g., brick, stone, wood, metal, etc.) that can be used on accessory buildings to ensure neighborhood design compatibility.

Denver, CO

- Denver's code requires design review of all antennas, towers, and alternative structures. Design must use materials, colors, textures, screening, and landscaping that are compatible with the natural setting and manmade structures surrounding a WCTF.
- Like Philadelphia and Boston, Denver requires neutral paint colors to reduce visual obtrusiveness, subject to FAA requirements.
- Unique to Denver is a provision limiting the mass of antennas on a tower (450 cubic ft./user, and no one dimension can exceed 14 ft./user).

Los Angeles, CA

- The Los Angeles code simply requires that WCTFs be designed to have the least possible visual impact on the environment, taking into consideration technical, engineering, economic, and other pertinent factors.

Philadelphia, PA

- Philadelphia includes architectural design provisions in its decision-making criteria for freestanding towers requiring special exception approval. Generally, to obtain this approval, an applicant must demonstrate that the proposed facility will preserve the existing character of the surrounding buildings and land use to the greatest extent practical.
- The City requires that building or tower-mounted antenna be painted or screened to match the colors or simulate the materials of the building on which it is attached.

Portland, OR

- Portland's code focuses its architectural design provisions on those WCTFs located in OS, R, and C zones and those in EX, EG, and I zones within 50 ft. of a residential zone. In these areas, few visual impacts and clean and uncluttered facilities are required.

Raleigh, NC

- Raleigh's code gives a service provider the option of designing a WCTF building in a residential district to look like a residence, or enclosing it with an 8 ft. fence that is architecturally compatible with the material and color of surrounding homes.