Background Report for

Update of the City's Wireless Telecommunications Facilities Policy
Date Prepared: March 31, 2015
Date Revised: April 22, 2015
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This report contains background information in preparation of the City of Roanoke's Wireless Telecommunications Facilities Policy in the coming months. This report is meant to provide the parameters in which the City must work to craft a thorough and equitable policy. Information on consumer demand, technology, federal regulation, and public input are all included.

Demands on Wireless Providers:

Consumers are increasingly relying upon cell phones, smart phones, and the wide range of wireless devices available instead of landline phones and wireline internet connections. Dependable access without signal loss is viewed by many as essential to their daily lives. The increasing number of wireless users, wireless devices, and data traffic, including the continued evolution of broadband networks (1G/analog, 2G/cell phone, 3G/smart phone, 4G/universal personal communicator device, and soon 5G), will mean more wireless telecommunications facilities to meet capacity demands. For example in 2013, 4G connections generated 14.5 times more data traffic than non-4G connections, accounting for thirty (30) percent of all mobile data traffic even though 4G connections represented only 2.9 percent of all mobile connections worldwide4G. Below is a snapshot of recent national studies regarding the prevalent use of wireless technology to illustrate increasing demand. A local survey conducted by the Department of Planning, Building, and Development yielded similar results.

1. Cisco (design, manufactures, and sells networking equipment) reported global mobile data traffic increased seventy (70) percent from 2011to 2012 and eighty-one (81) percent from 2012 to 2013.

2. A Pew Research Center (nonpartisan fact tank) study shows that the number of American adults owning a smart phone is continually increasing, from thirty-five (35) percent in 2011, to forty-eight (48) percent in 2012, to fifty-six (56) percent in May of 2013.

3. Pyramid Network Services (communication systems contractor) predicts that 70 percent of all mobile subscriptions in the United States will be 4G LTE (Long-Term Evolution) by 2017.

4. In 2013, Neilson (global information and measurement company) reported that 5 million people in the United States no longer watch traditional television and instead obtain video programming from their smart phones, tablets, set-top devices, or computers even if they had a cable or satellite subscription available for use.

5. According to a Cellular Telephone Industry Association's Annual Operator Report, 3.2 trillion MB of data was used in 2013 – a one hundred twenty (120) percent increase from 2012.

6. The Federal Communications Commission estimates that wireless phones are the source of over 70% of calls to the 9-1-1 emergency communications center.

7. A Federal surveys show that two out of every five Americans have dropped their landline phones completely (41%).

Available & Emerging Technology:

Wireless service requires both coverage of particular areas and capacity within those areas to be fully functional. The technology surrounding wireless infrastructure is continually evolving to meet the demands of consumers. Macrocell systems of the past with huge antennas bolted to large towers are no longer the only

technologies available. DAS (distributed antenna systems) and other small cell systems are viable alternatives to address both coverage and capacity within systems.

On the horizon is the use of television frequency which allows longer ranges and more penetration into buildings and urban canyons. This would make the deployment of higher speed services like 4G LTE more cost effective. The Federal Communications Commission (FCC) planned to auction off parts of the TV spectrum, voluntarily provided by broadcasters for compensation, in mid-2015 to wireless carriers. The National Association of Broadcasters challenged the auction through a lawsuit filed in November 2014 citing potential loss of viewership effectively stalling the auction until a final ruling.

Macrocell Systems

Macrocell systems enable service providers to deliver voice, text, and broadband communications through high powered radiofrequency (RF) signals to large geographic areas. These systems are typically characterized by multiple provider antennas affixed to tall, freestanding towers or the top of tall buildings. Macrocells have the highest coverage and capacity capabilities of all system types; however, increasing demand for wireless technology is quickly exceeding the network capacity of these sites. In other words, regardless of how far a wireless signal is able to penetrate a defined geographic area, each facility can still only accommodate a certain number of consumers at a time. Therefore, more facilities at lower heights or the deployment of supplemental systems described below are most effective in high density areas.

Below are descriptions of antenna support structure and antenna types.

1. Freestanding Support Structures:

    a. Monopole: A freestanding, antenna-supporting structure that is composed of a single shaft of steel attached to a foundation. Typically between 100 and 200 feet tall with antennas mounted on the exterior of the tower. Wooden monopoles are called masts and are shorter and slimmer than steel monopoles. They are typically used in wooded settings, extending no more than 10 feet above the tallest tree within twenty-five (25) feet.
    b. Lattice: A self-supporting, stand-alone antenna-supporting structure which consists of three to four sides of vertical and horizontal supports with multiple legs and cross bracing of structural steel. Typically between 200 and 400 feet tall with antennas mounted on the exterior of the tower.
    c. Guyed Wire: A freestanding, antenna-supporting structure supported by a series of guy wires that are connected to anchors placed in the ground. Typically 300 feet tall or more with antennas mounted on the exterior of the tower.
    d. Stealth (Disguise): A freestanding, antenna-supporting structure designed to appear to be something other than a wireless telecommunications facility (e.g. utility poles, flagpoles displaying flags, trees).

2. Host Support Structures

    a. Building-Mounted – Wireless telecommunications facility roof-mounted (attached to roof, parapet, or penthouse and extending above the roofline) or surface-mounted (attached to the surface or façade) to a building.

b. Stealth (Concealment): Wireless telecommunications facility enclosed within an existing structure or appurtenance of a structure resulting in the facility being either invisible or made part of the feature enclosing it (e.g. church steeples, bell towers, church spires, clock towers, cupolas, light standards, chimneys).

c. Stealth (Camouflage): A way of painting and mounting a wireless telecommunications facility that requires minimal changes to the host structure in order to accommodate the facility.

d. Utility Infrastructure: Wireless telecommunications facility mounted on existing utility infrastructure (e.g. water tower, power lines).

3. Antennas

   a. Omni-Directional Antenna (Whip): A cylindrical antenna designed to transmit or receive signals in a three hundred sixty (360) degree pattern.

   b. Sector Antenna (Panel): A directional antenna designed to transmit or receive signals in a directional pattern that is less than three hundred sixty (360) degrees. Sectorized antennas are grouped and mounted on either a host structure or on a freestanding support structure with one of two types of antenna arrays depending on polarization needs.

      i. Distributed Antenna Array: Antenna array with protruding sidearms or other extension devices to provide spatial diversity of antennas. These antenna arrays are commonly called reindeer hats or top hats.

      ii. Flush-Mounted Antenna Array: Antenna array attached flush to an antenna-supporting structure. Antennas are dual-polarized or cross-polarized eliminating the need to protrude from the support structure. Protrusions from the face of a pole are no greater than one-half (1/2) the diameter of the pole itself and in no case greater than twelve (12) inches.

   c. Dish Antenna: A parabolic, spherical, or elliptical antenna intended to receive wireless communications.

Distributed Antenna Systems

Distributed Antenna Systems (DAS) increase capacity of existing macrocell systems by distributing radiofrequency signals from and aggregate return signals to a central hub. They typically cover targeted areas both indoors and outdoors with medium to high capacity requirements. One DAS unit can support multiple carriers (each accommodating up to 200 simultaneous users); support WiFi which can be used to off-load data traffic from capacity constrained macrocell systems; and can be deployed individually covering a few blocks or as part of a larger system serving an entire city. DAS systems are typically placed on buildings or existing poles in the public right-of-way such as utility, street lights, traffic signals, and so forth at a relatively low and uniform heights and then hardwired back to a central hub. The systems are very scalable and efficient, but have high initial costs due to design and construction complexity of the network.

Small Cell Systems

Small cell system is an umbrella term for microcell and picocell/metrocell systems. These systems provide small footprint coverage to high traffic areas in need of supplemental capacity to support existing macrocell

coverage much like DAS. However while small cell systems are cheaper to install than DAS, they are typically installed piecemeal in isolated areas rather than as part of a larger system; are limited to one carrier per unit (accommodating as few as 80 users); and can only deliver a single wireless communication technology. They are typically placed at low elevations on buildings or poles in the public right-of-way.

Federal Communications Commission Regulations:

The Federal Communications Commission (FCC) is committed to facilitating wireless coverage for consumers everywhere. Section 704 of the Telecommunications Act of 1996 (47 USC_332) set forth a process to balance the demands of wireless providers and local and state governments. The Act preserves local zoning authority, but imposes four limitations.

1. Shall not "unreasonably discriminate" among providers of functionally equivalent services and shall not prohibit or have the effect of prohibiting service
2. Must act on a request within "reasonable period of time"
3. Decision to deny must be "in writing" and supported by "substantial evidence"
4. No regulation on the ground that radiofrequency (RF) emissions are harmful to the environment or to human health

Since the 1996 Act, the FCC has sought to further expedite the deployment of wireless telecommunications facilities. The FCC Declaratory Ruling in 2009 imposed a timeline, or "shot clock", in which local jurisdictions must act upon a wireless siting application – ninety (90) days for collocations and one hundred fifty (150) days for new towers. In Section 6409 of the Middle Class Tax Relief and Job Creation Act of 2012 (47 USC_1455) Congress directed the FCC to remove obstacles to the modification process of wireless facilities.

Section 6409 requires a State or local government to not deny, and approve, any eligible facilities that were legally established request for a modification that does not substantially change the physical dimensions of the tower or base station. Eligible modifications to a tower or base station include the collocation of new transmission equipment, removal of transmission equipment, or the replacement of transmission equipment. This ruling does not relieve the FCC from the requirements of the National Historic Preservation Act or the National Environmental Policy Act of 1969.

The FCC further clarified the parameters of a substantial change. It is defined as the addition of an antenna (1) on a tower that would increase the height by more than 10% or 20 vertical feet, (2) that required installation of more than standard number of equipment cabinets (over 4) or more than 1 new equipment shelter, (3) that would increase girth (width) of the tower by more than 20 feet; or (4) would involve excavation around the tower site beyond the existing boundaries of the property associated with the facility. A substantial change would also include defeating the concealment elements of a stealth wireless facility. In accordance with the FCC Report and Order, this ruling goes into effect April 9, 2015.

SurveyMonkey Results:

Below are general statements regarding the majority of the 111 survey responses received as of March 31, 2015. The complete data is enclosed with this report as Attachment A.

1. Reside in the SW quadrant of the City (62.26%).

2. 53 to 65 years old age range (31.19%).
3. Own a smart phone (86.24%).
4. Receive calls and texts several times a day (85.32%).
5. Access email or the internet several times a day (84.40%).
6. See their wireless device as a necessity (81.65%).
7. Rate their quality of coverage at their residence as average (40.37%).
8. Use wired internet service at home (79.63%).
9. Use wired internet service at work (46.79%).
10. Primary purpose is personal use (98.17%).
11. Have cancelled their land line phone (57.80%).
12. Collocations on existing structure were ranked as follows starting with most visually preferred:
    a. Concealment of wireless facilities (e.g. within church steeple)
    b. DAS on utility pole
    c. Mounted on public utility (e.g. water tower)
    d. Mounted on building roof.
13. Freestanding wireless facilities were ranked as follows starting with most visually preferred:
    a. Wooden mast 10' above tree line
    b. 100' steel monopole
    c. Guyed wire
    d. Lattice Tower
14. Flush mounted antenna arrays were visually preferred (94.12%) over reindeer hat antenna arrays.
15. More freestanding towers 10' above the tree line were preferred over fewer taller freestanding towers.
16. Land use for siting freestanding towers were ranked as follows starting with the most appropriate:
    a. Industrial
    b. Large-scale Commercial
    c. Downtown
    d. Institutional
    e. Neighborhood Commercial
    f. Multifamily Residential
    g. Single-family Residential
    h. Agricultural or Recreation and Open Space

Public Input Meeting:

A public input meeting was held on Tuesday, April 14 at 4:00 p.m. and 7:00 p.m. in the Auditorium of the Main Library. The meeting was publicized twice through MyRoanoke, email blasts from Neighborhood Services, social media, and a WSLS10 interview which aired several times. In total, six persons attended including citizens and industry representatives.

Below are synthesized comments from the public input meeting. A direct transcription of comments may be found in a separate document. Most comments centered on the visual impacts and viability of available and emerging technology, crafting regulations, and realities of the wireless industry.

1. Technology
    a. Coverage

    i. Remaining areas in need to additional coverage are residential which are the most difficult to add facilities. It would be difficult to consistently apply stealth standards to all neighborhoods.

  b. Capacity
    i. Need to decide if you want to increase capacity by fewer large towers or several smaller towers.
    ii. Increase of about 15% macro sites to serve the Roanoke market.

  c. Design
    i. Facilities have actually gotten larger rather than smaller as it was assumed. More technology needs to be added to facilities to accommodate increase bandwidth (e.g. flush-mounted antennas limits or prevents upgrades in service as there is not enough room to attach more antennas).
    ii. Facilities along 419 (freestanding, building mounted etc.) are what we don't want.
    iii. Encourage colocation on utility poles.
    iv. Must balance the need for service with visual impact.
    v. Control visibility of base station with landscaping plans and fencing standards (no barbed wire).
    vi. DAS is often seen as a way to "have your cake and eat it too", however, really only practical in downtown setting. The technology also just isn't there yet (e.g. handling volume) to effectively provide an alternative to more traditional facilities.

2. Regulation
  a. Regulations need to be clear, concise, and evenly applied. More than anything, applicants want to know what is going to be expected of them up front (regulatory, costs, ect) so they can plan and budget accordingly without any surprises along the way.
  b. Be careful with permitting based on zoning classification – many industrial sites are very visible to residential property (especially considering topography).
  c. Roanoke needs a master tower plan mapping all macro sites and carriers to identify where the gaps in service are located. This should be valley wide. Carriers know where their gaps are located and we need to identify how to get coverage in those areas.
  d. Example: Good process with Rocky Mount for stealth facility in middle of town.
  e. Roanoke City Ordinance is very strict in terms of getting more macro sites. Setbacks and public opposition are what kills tower projects and improving coverage. It is also a mistake to try and only encourage stealth towers.

3. Industry Demand
  a. Citizen concern about a new company entering the valley that needs to establish sites. Response from industry representative that realistically the only change to current carriers is an acquisition or merger because it is very difficult and expensive to acquire spectrum from the FCC and then establish facilities.
  b. Expansion is necessary because of increased demand by virtue of the number of people using this technology and the increased data requirements.
  c. Carriers are no longer building towers as they cost about $350,000 for one facility. Partnership with real estate companies that build towers and lease space to multiple tenants (colocation).