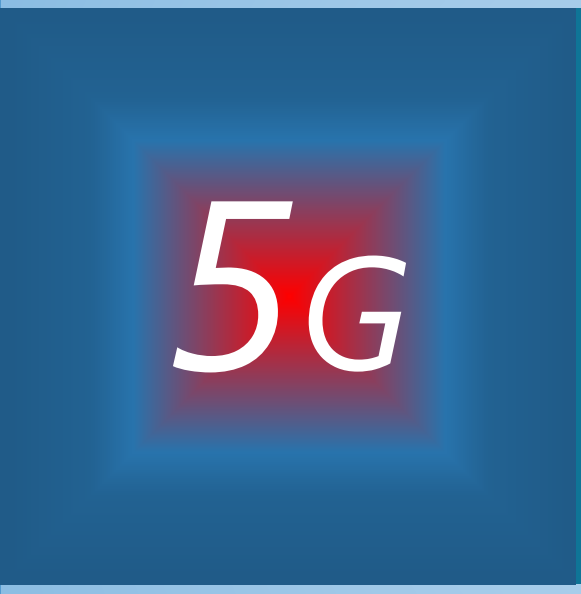
Small Cell Case Study

Charlotte, the city that got it right



The promise of 5G for our cities means fantastic IOT, Smart City, Smart Grid applications enabled by the ultra-fast wireless communications

The price of 5G is that in order for it to work, it requires more "cell towers" or "small cells" ..... many more

A study using lessons learned from two recent small cell deployments to lessen the costs to other municipalities

By: Dan L. Himes

The coronavirus pandemic has prompted dramatic changes in the way we work, communicate, educate our children, purchase essentials and even care for the sick. Social distancing and self-isolation have made it mandatory that we utilize all those promising Internet-based applications the telecom and tech world have been touting since the early days of 4G networks. Work-from-home, telehealth, distance learning; suddenly everyone needs them - all at the same time. So far, our Internet has stood up to the challenge and performed well. However, although most of us take a high-speed connection for granted, the wired and wireless telecommunications infrastructure needed to make all this work for everyone is not yet in place and won't be for some time.

A decade ago, 4G whet our appetite for these applications when we started to receive directions via GPS, talked to friends via Facetime, and did mobile browsing on our phones. 5G will make the promises we heard ten years ago a reality and bring us applications we can't even imagine now. In order to make it work as advertised, the network must get closer to the user, much closer. Today, we get our 4G from a tower a mile or more away. Before we can realize the wonders of 5G, the tower must come to us.

The price of progress

The "towers" are coming in the form of small cells, mini cell sites the height of utility poles. How many will we need? A lot of them. Some industry experts have predicted that 20 – 25 small cells per square mile will be needed to get the desired coverage. Take the area of your town and do the math, then multiply that by the number of carriers deploying 5G, the numbers are staggering! Now imagine your town enduring that many construction projects and the resulting visual clutter along your rights of ways.

Single-carrier small cell pole

Colocation of small cells

Unless a small cell gets attached to an existing utility pole, each one will require a new pole be set in the ground. Some poles are direct-buried but some soil conditions require a concrete foundation to provide the needed support. Additionally, every small cell requires separate connections to a fiber optic cable service and a power source.

The pole installation and connections require separate construction projects often causing road closures and sometimes night-time work. These aggravations and disruptions result in complaints from the residents and businesses and are replicated for each carrier. However, colocation of the small cell radios at one site reduces the amount of pole installations and power connections, and possibly fiber optic connections, thereby reducing the annoyance of multiple, on-going neighborhood construction projects.

Tower owners = Neutral hosts

Since most wireless carriers are not in the business of providing space for their competitors, a third-party usually pays for the pole/cabinet and all construction, installation and operational costs of a co-located site, then leases the space to the carriers. These third-parties are referred to as neutral hosts. These can be electric utilities, municipalities, or are often companies that own multiple cell towers and/or large fiber optic cable networks.

FCC accelerates the 5G processes

The carriers want to build 5G small cells as fast as possible and the FCC has assisted them by enacting rules that make it harder for municipalities to stem the tide.

The FCC rules stipulate how much the cities can charge the carriers for the permits, the maximum annual charge for the use of the right of way and even the time the city has to process the request. Some cities have sued the FCC saying these rules don't allow them to be properly compensated but the 5G rollout will continue. Municipal leaders must find a way to embrace the technology, they cannot afford to resist it. No one wants their town to be a low-tech island.

Miami - the Super Bowl deadline

Some cities have had good small cell experiences, some not so good. When Miami was faced with the deadline of getting 5G operational in advance of Super Bowl LIV in certain high-traffic zones of the city, the rushed installations by the carriers created unnecessary aggravation and unsightly visual clutter for the businesses and residents of those areas. Click here for White Paper on Miami small cell project.

Other cities such as Charlotte, NC, also worked on hard deadlines but had more preparation time and worked in a cooperative environment with the carriers, the local power company and neutral host providers to make it a positive experience for all involved.

Charlotte, the city that got it right

Charlotte, NC, is the most populous city in the Carolinas and the second largest in area in the southeastern US. Charlotteans, as its residents are known, don't always follow the accepted rules, as evidenced by what the rest of the country refers to as "downtown", they call their "Uptown". Perhaps this unconventional thinking led the people in charge of Charlotte's rights of way to forego the adversarial approach many cities seem to have taken with the carriers (and their 5G plans) and instead foster an attitude of cooperation to maintain a balance of functionality and aesthetics while preserving as much of the City's right of way space as possible.

Charlotte deadlines

Charlotte too had to deal with event deadlines which originally started on February 1, 2011 when it was announced the city would host the 2012 Democratic National Convention. The City wanted to provide the optimum experience for the thirty-five thousand plus delegates and visitors who would be making Uptown home during the convention week.

The Charlotte Department of Transportation is responsible for construction in the city's rights of way and for years has enjoyed an amicable relationship with the telecom companies and the local power company. In Charlotte, the

power company owns the streetlight poles and the City pays it for the power used by the light.

Soon after the DNC announcement, the City was approached by a national tower owner representing a wireless carrier advising that they would need to add to the capacity of the existing 3G and 4G networks by adding small cells to nineteen existing streetlight poles within the uptown area. With the deadline in mind, the City and power company agreed to the request.

After the convention, the City and the electric utility met to reevaluate the installations and determined that due to maintenance requirements of the streetlight and the safety of the maintenance staff, continued retrofitting of the existing poles to accommodate small cells was not feasible.

Charlotte's DOT team met with the utility with the goal of designing a "dual-use" pole that would meet the utility's needs for the streetlight and provide the power and space the carriers needed to house their radios and equipment. The City insisted that the final pole design must blend with the City's existing aesthetics.

The team also strongly encouraged the approach that any new small cell poles could only replace existing poles. Where small cell locations were needed, the wireless carriers and neutral hosts were required to purchase dual-use replacement poles that would closely match the existing street lights, then cover the cost of installation.

Another requirement by the City was that the small cell equipment would be mounted at a sufficient height on the pole so the view of the motorists and pedestrians would not be impeded. The goal was to make the equipment as unseen as possible so the public would not even notice it as well as to prohibit blocking any portion of the right of way and sidewalk. A cabinet was designed to mount on the pole above eye level to house multiple radios and related equipment.

"Dual Use" utility-owned pole with 4G small cell in Charlotte

4G Takes Over

In 2014-2015, it became apparent that 4G was quickly replacing the 3G network and, therefore, more equipment was needed per small cell location. By 2016, one of the neutral hosts introduced a company that was in the process of developing poles and other outdoor hardware that would host and conceal small cells. Qube-MRS® met with the stakeholders and began to design a new pole/cabinet combination.

After much collaboration with all involved, Qube-MRS® developed an equipment shroud that could be attached to an existing pole and host not just one, but multiple 4G radios. The shroud had a patented equipment mounting system that would accommodate any popular radio. In late 2017, the first "smart pole" from

Qube was installed in Uptown Charlotte less than a block from the site of the convention center.

The first Qube® 4G small cell shroud in Uptown Charlotte

4G to 5G

A 5G network is an adjunct to the existing 4G network and provides higher bandwidth and better throughput with much lower latency. A 5G smart pole should be able to support 4G radios and also provide space for the 5G equipment which utilizes a fully integrated radio and directional panel antenna. The Qube® antenna mount system was designed with a stackable, expandable equipment platform near the top which can accommodate the 5G radio/antenna equipment for all US carriers.

In addition to being a functioning streetlight pole, the pole and cabinet was capable of supporting many "smart city" components. Gunshot detectors, vehicular and pedestrian traffic analytics, weather sensors, EV charging stations, are just some of the applications that can be supported by the new smart pole.

On July 18, 2018, the RNC Site Selection Committee voted to hold their 2020 convention in the same arena the Democrats had used in Uptown Charlotte. Although it has since been moved to Jacksonville, FL, the Charlotte small cell work continues on pace.

Relying on the lessons learned during the 2011-2012 3G/4G small cell deployment, Charlotte once again embarked on an area-wide program to install new small cells and retrofit some of the old 4G-only sites to accommodate 5G radios.

Tryon Street Uptown

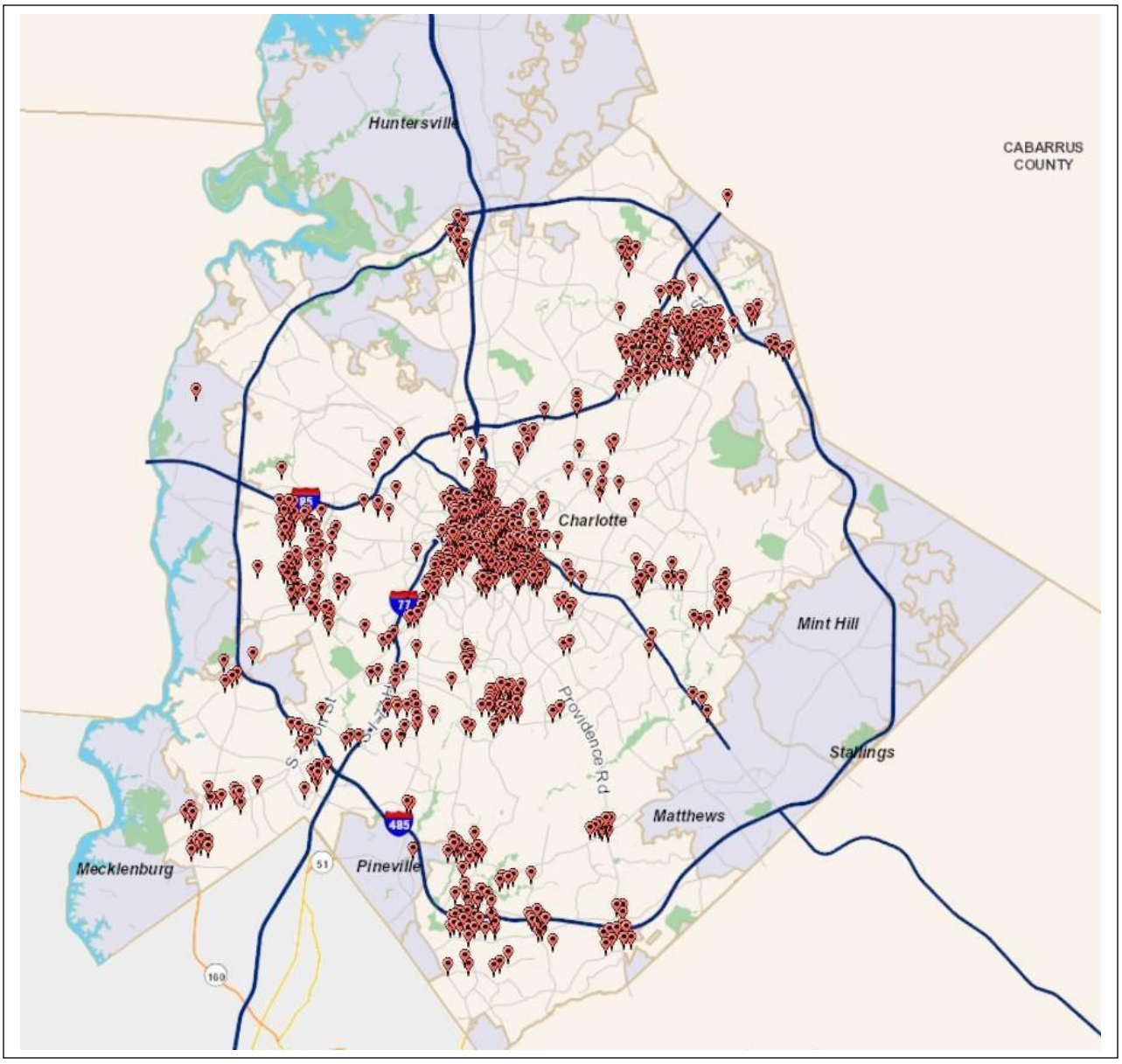
Tryon Street traverses Uptown Charlotte and is home to many major US corporations including Bank of America and Duke Energy. The City was being pressured by multiple wireless carriers to erect small cells along the historic thoroughfare.

The City DOT team, power company and carriers worked with Qube-MRS® to develop a multi-carrier smart pole for the 4G/5G buildout along Tryon Street. Currently, Charlotte has nine installed providing wireless infrastructure for multiple carriers throughout the Uptown area. Currently, there are over three hundred Qube® small cell shrouds installed within the city limits of Charlotte.

Qube® multi-carrier 4G and 5G smart pole on Tryon Street in Uptown Charlotte

Charlotte small cells

As of March, 2020, Charlotte has 1,280 small cells installed delivering 4G and 5G services for three wireless carriers and three neutral host providers.



The City of Charlotte is 308 square miles. If the 100 small cells per square mile projection is correct, the City would need 30,800 small cells installed in order to reach full 5G coverage.

Key Takeaways

Municipalities need to be educated on the promise and the price of 5G

Understanding the process of planning, construction and installation of small cells can lessen the headaches and shorten the timeline of bringing 5G to a community. Researching the different types of small cells and the various mounting options is critical to success.

Municipalities should investigate their rights in dealing with carriers and develop a thorough understanding of the FCC's Small Cell Order of September, 2018. The entire FCC order can be found at:

https://www.fcc.gov/document/fcc-facilitates-wireless-infrastructure-deployment-5g

Other links of interest:

Verizon Sues City of Rochester, NY:

https://www.fiercetelecom.com/telecom/verizon-squares-off-city-rochester-new-york-over-5g-fees

Dozens of Cities Sue FCC over Small Cell Rule

https://www.fiercewireless.com/5g/mayors-who-are-suing-fcc-call-its-small-cell-rules-a-land-grab

Coordination among carriers

Some upfront coordination with the carriers and possibly a neutral-host provider/tower owner can drastically reduce the aggravation of multiple construction projects and eliminate the visual clutter of a lot of redundant poles from being installed in the public right-of-way.

Colocation of small cells

Another important takeaway is that there are companies manufacturing small cell pole and cabinet combinations that are aesthetically pleasing and can accommodate up to four carriers. This colocation of carrier equipment can mean 75% less site acquisition, permitting, engineering, construction and equipment installation. Qube-MRS® is the company that manufactured the multi-carrier small cell solution deployed on the Charlotte Uptown Tryon Street project.

A successful 5G deployment should include:

- Cooperation *among all parties involved in 5G deployment*
- Communication *between all stakeholders*
- Coordination *between wireless carriers*
- Consolidation *of 5G construction projects*
- Colocation *of small cell 4G radios and 5G integrated radios/antennas into one mounting asset, and where needed with a shared 4G antenna*

About the author:

Dan Himes has spent the last 30 years as an owner and/or partner in a number of companies involved supplying equipment as well as engineering and construction services to the telecom industry. Mr. Himes is a partner in the firm that performed the construction, installation and integration of the Qube-MRS® small cell solution on the Miami Biscayne Boulevard 5G deployment and was integrally involved in the delivery of the project.

Dan joined the Qube-MRS® team in January of 2020 to assist in their business development efforts.

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