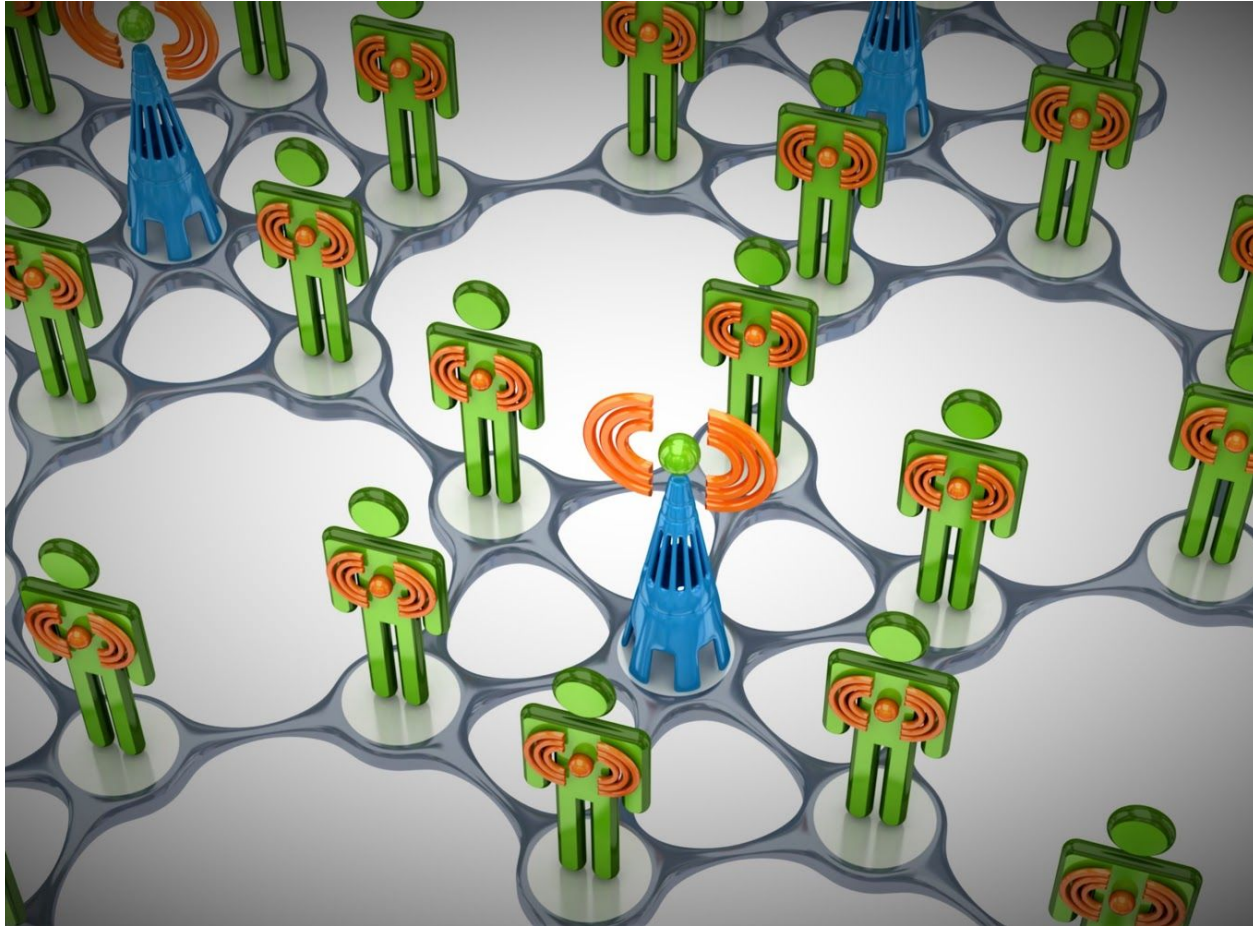


Worcester Small Cell Technology Report



WORCESTER REGIONAL
CHAMBER OF COMMERCE
RECRUIT | RETAIN | INCUBATE



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1.0 Executive Summary

The Worcester Small Cell Technology Report was prepared at the request of the Worcester Regional Chamber of Commerce. This report covers topics and background necessary to understanding the benefits of Small Cell Technology and its important role in advancing technology in cities today. The team at AJ Mayfair LLC has taken efforts to ensure that data included in this report is factual but there is a possibility of updates in data or material as well as an omission of facts.

In summary, establishing a Small Cell Network is a necessary step in working towards a Smart City.

- **Smart Cities across America are implementing Small Cell Networks and planning for the future of technology.**
- **A Small Cell network would ultimately increase broadband access to underserved areas of Worcester and ensure the capacity and speeds needed to recruit and retain business and residential consumers.**
- **The upcoming 5G network requires cities to adopt the small cell technology to increase speeds and coverage.**
- **Worcester is taking the necessary steps to increase the network while maintaining the vision and history of the city.**

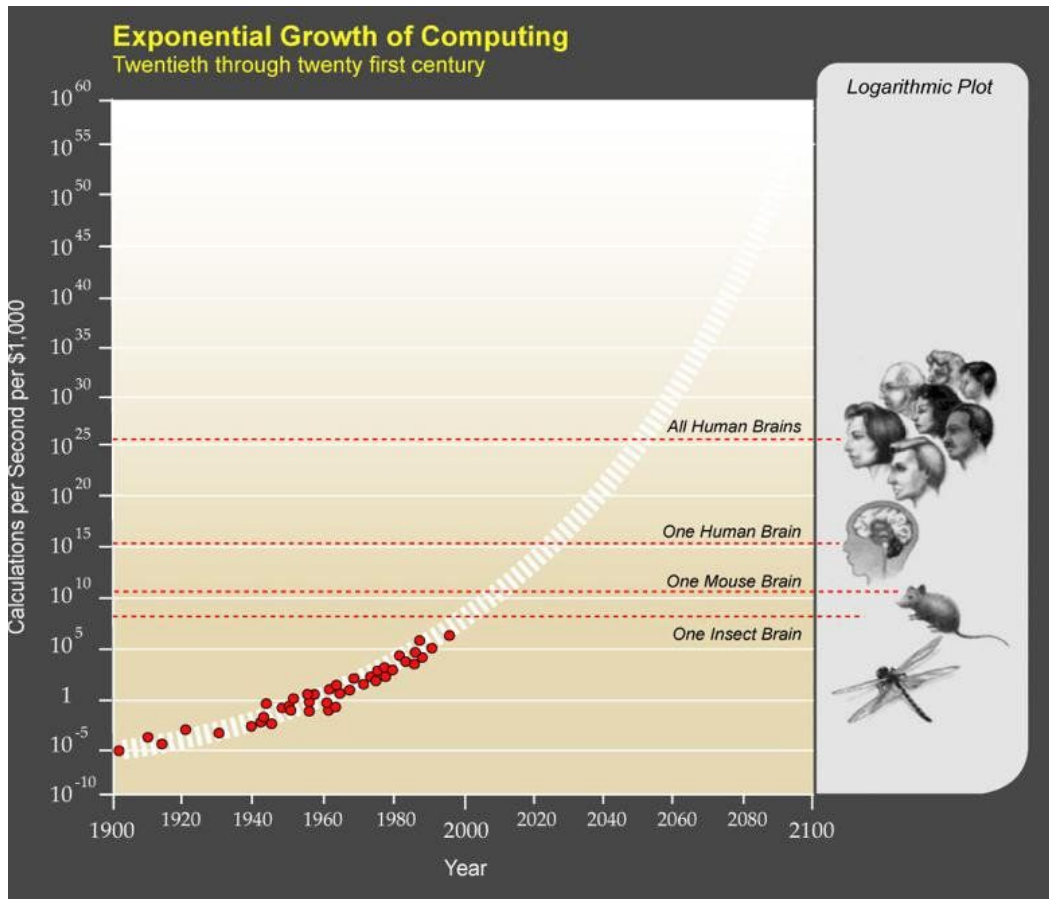
2.0 Report Background and Study Area

AJ Mayfair LLC is a vendor neutral consulting firm specializing in the telecommunications field. The information in this report is pulled from a number of sources including but not limited to subject matter experts, small cell providers, members of Worcester's Small Cell Committee and members of the Worcester Regional Chamber of Commerce community.

3.0 The Need for Network Expansion

Gordon Moore, the co-founder of Intel in 1965, developed a theory relative to the power of computers. Entitled Moore's Law, Moore predicted that the power of computers will continue to double every two years as illustrated below.

This law can be applied to the mobile device environment, where the latest mobile



phones are more than ten times faster than their predecessors. For example, the chip in the Apple 6 Iphone is more than 50 times faster than the original Iphone.¹ Pew Research Centers conducted their first survey of smartphone ownership in 2011 and compared results to those of the same survey performed in 2018. The results illustrated that 95 % of Americans own a cellphone, a 35 % increase in that seven year period. These demands are causing carriers and communities across the world

¹ <https://www.wired.com/2015/02/smartphone-only-computer/>

to look at ways to increase capacity and speeds while building upon existing infrastructure.

3.1 Smart Cities

The National League of Cities defines a Smart City as “a city that has developed technological infrastructure that enables it to collect, aggregate, and analyze real-time data to improve the lives of its residents.” This means that Smart Cities are equipped with mobile devices and applications that help to manage crime, taxes, transportation and the overall functionality and distribution of city services. Therefore, developing a reliance on connectivity or what is referred to as IoT (the Internet of Things) is crucial for any city to retain a wide variety of businesses and workers.

3.2 Network Demands on Smart Cities

In response to the needs of Smart Cities and the demand for increased capacity and speed, cities are tasked with upgrading the existing infrastructure in both an economical and efficient fashion. Eden Strategy Institute and OXD (ONG&ONG Experience Design) released a study ranking Smart Cities for 2018/2019. Boston, Massachusetts ranks number seven on the list that includes both cities in the United States as well as International cities. Boston, among others on this list, has found ways to integrate technology into the everyday functioning of the city. This has been accomplished by engaging residents daily through parking apps, and other applications that allow residents and businesses to interact with city departments and resources.

Cities today face the challenge of providing equality of access to broadband connectivity and smart devices. If much of the population is unable to access the applications, the framework needed for a Smart City cannot be effective. A city must find a way to increase network coverage, capacity and speed while making it cost effective for both the users and the municipality.

To address the network needs, Boston formed a partnership with Verizon in 2016 to increase the affordability and accessibility to networks in areas that were struggling with connectivity. This partnership is not only increasing the fiber footprint but also allowing the development of the Small Cell network, ultimately improving the wireless services in the city by increasing the speed and filling network gaps.²

3.3 5G demands on MNOs

Mobile Network Operators or MNOs have an increased need for network expansion. The rapidly changing technology has MNOs working to ensure there is enough capacity for the current demand of mobile devices as planned for the future.

The MNOs are preparing to release the the next generation of mobile networks, the 5G network. 5G will use higher frequencies for radio communications than its predecessors. Higher frequencies weaken the signal and will require smaller cell structures in closer proximity to one another to create network densification.³ In order to implement the 5G network; MNOs, cities and towns need to work together to increase the networks while maintaining the individuality of each city.

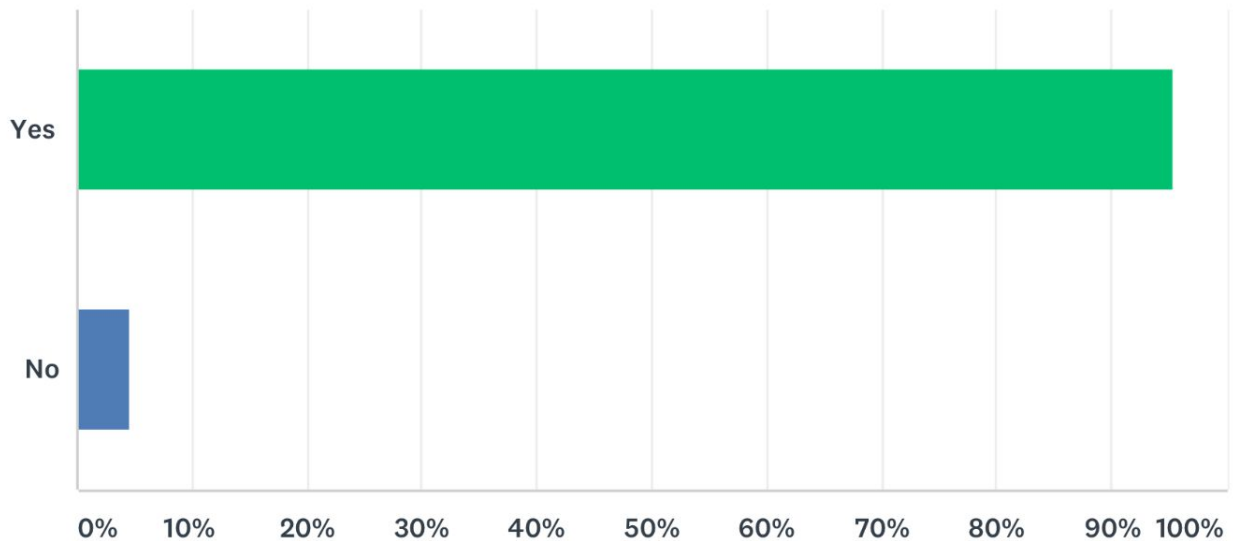
² <https://www.cityofboston.gov/news/default.aspx?id=205>

³ <https://techcentral.co.za/why-5g-is-so-very-different-to-previous-technologies/83460/>

4.0 The Worcester Business Community

A 2018 Worcester Regional Chamber of Commerce survey of Worcester professionals showed that 95.45% of Worcester businesses use a mobile device for professional use. Of these members, 65.7% of these businesses rely on mobile applications to gather data or service customers, patients or clients. Of the professionals surveyed, 62.69% have experienced a lack of mobile network in certain areas of the city, further supporting the need for advancement.

Do you use a mobile device for professional use?
(smartphone, tablet,iPad)



As Worcester continues to develop, its growth sectors require more access to technology with demands on the existing network architecture. According to The Worcester Regional Economic Competitiveness Outlook, a report commissioned by the Chamber in 2013, Health and Education are Worcester’s fastest growing sectors. A recent study performed by Zebra Technologies entitled, [The Future of Healthcare: 2022 Hospital Vision Study](#) found that “By 2020, usage of mobile devices is expected to grow by 40 percent for all hospital workers.”

The recent addition of Polar Park and the Worcester Red Sox further increases the urgency to grow the Small Cell infrastructure. “Smart Stadiums” are becoming a necessity for fans today. Many fan experiences expect access to applications that purchase tickets, find seats and help locate the shortest concession lines. The infrastructure is also expected to support security cameras, point of sale systems and other components. Ultimately, the fan experience will have an impact on the profitability and economy of the city.

Indoor facilities like the DCU Center are also eager for Worcester to implement regulations and procedures for small cell networks. The DCU Center is looking forward to better connectivity to give fans the same experience as other venues across the country. Although indoor facilities are more apt to use Distributed Antenna Systems (DAS) on the interior of the facility, improvements in the exterior public spaces will also provide some benefit. Ultimately, if exterior equipment is deployed, the DCU Center will need to follow city regulations as to the appearance of any equipment on the outside of the building. The most important goal would be to significantly enhance indoor cell reception.

5.0 The Small Cell Solution

Ultimately, Worcester and other cities are looking at Small Cell networks as a way to economically and efficiently expand their infrastructures. In general terms, a Small Cell refers to a wireless signal that is both small in coverage area as well as structural size compared to the usual cell tower or macrocell. Often the terms femtocells, picocells, microcells, WiFi cells and DAS are included in the term. Small cells can be constructed in public rights of way (ROW) including street lights, utility poles and other street furniture as well as private property. Each small cell requires power, backhaul through fiber or microwave transmission and a location to install the structure which is about the size of a pizza box.⁴

Small cells are typically deployed to alleviate capacity constraints where crowds gather or to cover targeted areas including public squares and spaces, downtown pedestrian areas, parks, office buildings, campuses, or stadiums and arenas.⁵ On a larger scale, small cells help to fill network gaps in areas that affect residential communities as well. The type of small cell needed in a particular area is dependent upon the coverage area as well as the number of users that would be connecting.

Small Cell Type	Cell Radius	Power Level (Watts)	Approximate Number of Users
Outdoor DAS	1 mile	20	3,000 per sector
Indoor DAS	Up to 200 feet per antenna	2	2,500-3,000 per sector
Microcell	1 mile	10	1,800 per baseband unit
Metrocell	500-1,000 feet	5	200
Picocell	750 feet	1	32
Wi-Fi	50-60 feet	0.1	Up to 200 per access point
Femtocell	50-60 feet	0.1	4-6

⁴ <https://www.ctia.org/news/what-is-a-small-cell>

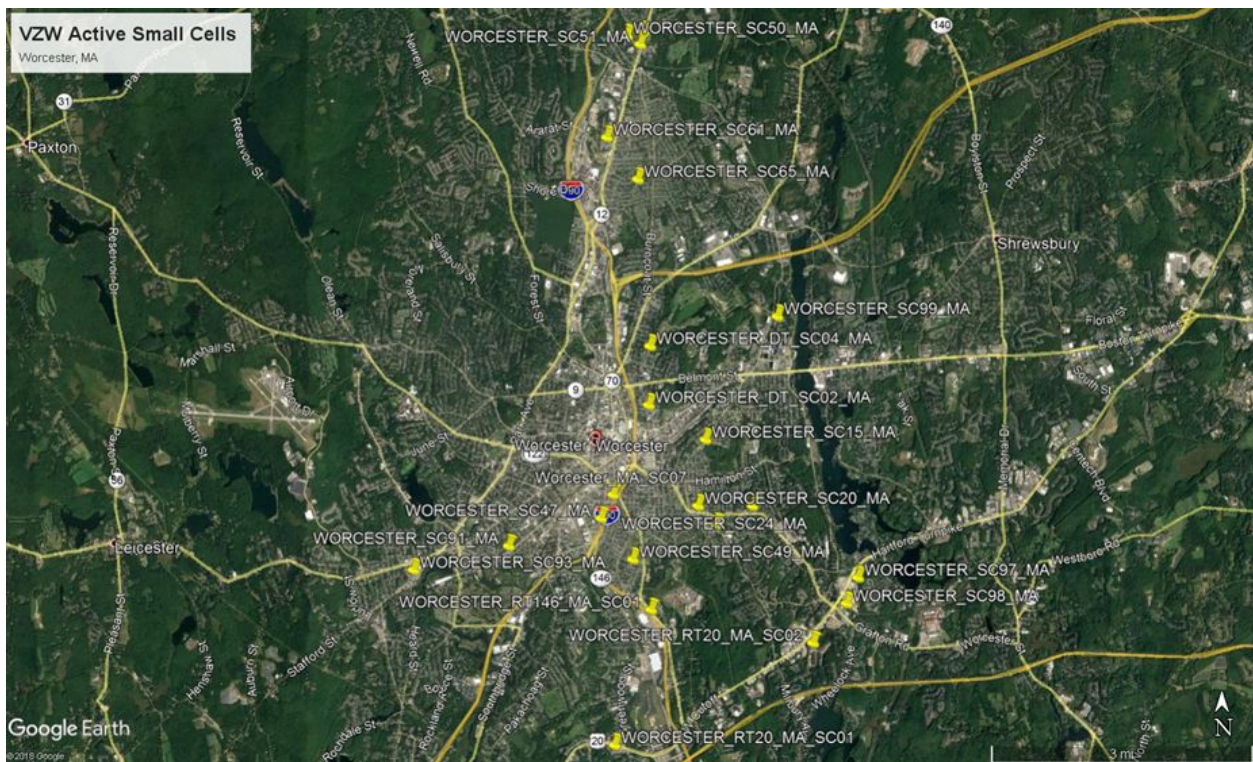
⁵ https://www.nlc.org/sites/default/files/2018-08/CS_SmallCell_MAG_FINAL.pdf

6.0 Small Cell Models

There are varied approaches to how cities handle agreements with small cell providers. For example, a neutral host allows commercial property owners, venues, MNOs and DAS providers to work in a shared infrastructure. This means that multiple carriers are established on the same structure, reducing cost and maximizing efficiency. In a neutral host environment, a third party company, assumes all responsibility, including deployment, maintenance, financial and regulatory approvals. This model allows multiple carriers to work from one main “neutral host.” Other models include allowing multiple carriers to work off independent infrastructure but this tactic can cause issues with planning and aesthetics. Lastly, a city or municipality may choose to work with only one carrier, limiting options for consumers but making it easier to manage.

7.0 Worcester's Current Small Cell Network

Carriers are eager to work with Worcester to develop the small cell network. AT&T and Crown Castle are among the vendors who who have a strong interest in partnering with Worcester. Verizon, also interested, currently has approximately 20 small cells that are deployed in the city today. Although the structures are on private property, Verizon stated that “ Worcester provided a favorable permitting environment that allowed Verizon to quickly and efficiently meet the growing capacity and public safety needs for this community. ”



8.0 Small Cell Technology Committee

Providing a carrier-friendly process that streamlines the upfront work is important to timing but it is also necessary for cities like Worcester to look at other factors that would impact not only how quickly the network is deployed but possible cost and environmental impacts.

In response to these concerns, City Manager Edward Augustus, developed a Small Cell Technology Committee to evaluate Worcester's needs, expand the mobile network while preserving the history and vision of the city. Committee members include, Eileen Cazaropoul (CIO City of Worcester), John Odell (Energy and Asset Management), John Kelly (Inspectional Services Commissioner), Steve Rolle (Assistant Chief Development Officer), and Karen Meyer (Assistant City Solicitor).

Members of Worcester's Small Cell Committee are considering a number of factors while evaluating what is necessary to grow the small cell network while maintaining the history and vision of the city. Adverse effects are important, specifically any health and aesthetic concerns, as well as any any economical benefits that may be available.

- **Aesthetics** Worcester is rich in historical architecture, the committee seeks to maintain both the history and vision. The committee has identified the need for regulations regarding the visual appeal of the smaller cell structures.
- **Permitting** An understanding of local, state and federal laws that may apply to land use and public right of way concerning small cells is imperative.
- **Radio Interference and Safety** Radio interference would be detrimental to emergency response, therefore placement and planning is important.
- **FCC Regulations** The FCC has recently made a declaratory ruling that is meant to accelerate the process of small cell deployment for MNO's but has in turn limited the decisions that would be made at the local level.

8.1 FCC Small Cell Ruling

On September 25th, 2018 the order titled Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment became part of a strategy that the Federal Government is using to eliminate regulatory delays and implement networks efficiently.⁶

In summary, the new order states that;

- *Cities are prohibited from charging carriers fees that are greater than the cost of the application or approximate costs of deployment.*
- *Cities are mandated to adhere to two new procedural "shot clocks." Specifically, cities must respond to applications for new builds within 90 days and colocation within 60 days.*

In opposition of the ruling, which is estimated to take effect in early November, over 100 local governments filed comments during the rulings comment period.⁷ To cities, the ruling means the need for additional resources or the reallocation of resources. In the past, the average time for application approval was 120 days. With the new regulations cities would be mandated to approve in half that time. Some cities were already funding resources through the fees they were able to collect from the MNOs. The limitation put on cities to restrict the fees will cause an additional burden.

8.2 Small Cell Consultant

On August 31 st, 2018, the committee released the RFP for a small cell consultant. The contract was recently awarded to City Scapes Consultants, Inc., a firm specializing in wireless communication master planning and development. The firm is tasked with 3 specific deliverables per the RFP.

⁶ <https://www.fcc.gov/document/fcc-facilitates-wireless-infrastructure-deployment-5g>

⁷ <https://www.naco.org/resources/counties-cities-voice-concern-over-fcc-small-cell-ruling>

Deliverable 1

A report summarizing the wireless facilities in the area today as well as the regulations and practices specific to the small cell network. The report will also review any adverse impacts on radio interference and public right of way access as well as identify a framework specific to public property installations and any possible monetary benefits.

Deliverable 2

Draft a city ordinance, regulations, administrative procedures, and basic guidelines for installations.

Deliverable 3 *Draft a final RFP for a host to provide technical support through the review of the RFP responses for the best model to implement in the city*

9.0 Recommendations Based on Findings

The City of Worcester including residential, institutional, non-profit and business leaders will benefit from expansion of the Small Cell Network. Specific recommendations would be:

1. Educate stakeholders on the importance of the Small Cell Network to the Worcester Community.
 - Publish this report and any progress made on the advancement of the small cell network while continuing to educate stakeholders on the benefits to the Worcester community.
 - Continue to monitor the attitudes of the business community through annual surveys to understand Chamber needs and measure success.
2. Include representation from the Worcester business community on the Small Cell Technology Committee once regulations, permitting and model has been identified.
 - Community input regarding land use and aesthetics will be a valuable tool to Committee members. Creating a survey related to the visual aspects of the Small Cells would be beneficial.
 - The Small Cell Network is already comprised of cells on privately held property in the Worcester area. Commercial land owners are a valuable asset to building out the network.
3. Work with higher education to create partnerships and establish a complete understanding of network needs.
 - Utilizing the Chamber's Higher Education Partnership, conduct a visioning exercise with higher education leaders to understand the

future and current broadband demands of the education sector to communicate with the Small Cell Technology Committee.

4. Collaborate with other municipal leaders on best practices.

- Many municipalities have been successful in implementing Small Cells. Worcester is in a position to learn from the mistakes and successfully implement a robust network.

10. Conclusion

The Worcester Regional Chamber of Commerce, business leaders and city officials have demonstrated a commitment to advancing Worcester's infrastructure. By hiring a consultant to review procedure and recommend best practices, Worcester will be able to implement network enhancements with minimal resources and in an efficient and minimally disruptive manner to the city.

There is an urgency to establish a model and regulations surrounding the implementation of the network, based on 5G rollout as well as network consumption. Worcester is taking a carefully strategic approach but must move forward expeditiously to support the rapid development and technology. If Worcester capitalizes on the momentum of recent commercial development, the city will soon be viewed among other Smart Cities, like Boston and San Jose.