



WORCESTER REGIONAL

Chamber of Commerce

Worcester Fiber Connectivity Report

Worcester Regional Chamber of Commerce

November 2015

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Table of Contents

1.0 Executive Summary	3
3.0 National and State Landscape	5
4.0 Overview of Available Technologies to Commercial Consumers	7
5.0 Benefits of Available Technologies to Commercial Property Owners and Tenants.....	9
5.1 Why Do Commercial Tenants want Dark Fiber?	9
5.2 Why Do Landlords want Dark Fiber?	9
6.0 Community Fiber Models.....	11
6.1 Worcester's Network Model	11
6.2 Worcester's Initial Fiber Loops	12
7.0 Key Terms Related to Fiber, the Value of Worcester's Geographic Location	14
7.1 Data Centers	14
7.1.1 Long-haul Fiber vs. Metro Fiber - Worcester's Long-haul Network	16
7.1.2 Metro Fiber	17
7.1.3. Dark Fiber vs. Lit Fiber - Dark Fiber.....	18
7.2 What is "Lit" Fiber?	19
8.0 The Impact of Fiber Networks on Economic Development	24
8.1 Broadband and the effect on Worcester's Growth Sectors	25
9.0 Worcester's Top Commercial Development Opportunities	27
10.0 Expansion Plans	28
11.0 Improving Service for Small Business	29
12.0 Recommendations Based on Findings.....	30
13.0 Conclusion and Steps Toward Enhancements	33

1.0 Executive Summary

The Worcester Regional Fiber Optic Analysis and Review was prepared at the request of the Worcester Regional Chamber of Commerce. This report covers topics and background necessary to understand the benefits of the Worcester fiber optic network, as well as the history and current state of infrastructure.

This report will discuss why the network is important to commercial consumers, specifically Worcester's growth sectors. Although there are many providers and options available to commercial businesses for connectivity, this document will focus on the robust dark and lit fiber optic network that Worcester has in place today and its importance to economic growth in the city.

In summary, Worcester has the key elements necessary to support high-tech businesses because it has:

- **Redundant and diverse long-haul fiber optic network connectivity (a.k.a. the Internet).**
- **Six different long-haul providers.**
- **Excellent metropolitan fiber network density.**
- **A carrier hotel in the center of the city (a co-location center or secure site where data communications are interconnected).**
- **Direct fiber connections to Boston, Hartford and New York City (where all internet, national and international traffic flows).**
- **Eight data centers within 20 miles.**
- **Eleven different service providers with fiber in the City.**
- **Over 20 providers with service delivery ability.**

With a clear fiber implementation strategy and adjustments to local policies, the region will gain a competitive economic advantage. A set plan would support the growth of fiber capacity and maximize the economic output available through the existing and future network. This study outlines specific recommendations to implement a more robust fiber strategy aimed toward improving access and growing future fiber capabilities.

2.0 Report Background and Study Area

AJ Mayfair LLC is a vendor-neutral consulting firm specializing in the telecommunication field. The information in this report is pulled from a number of sources including but not limited to interviews held with subject matter experts, service providers, and members of the Worcester Regional Chamber of Commerce business community.

The most accurate information pertaining to the network pathway comes from the fiber provider itself. Although for the purposes of providing information for this report, most of the providers would allow access through a non-disclosure agreement (NDA), some would not provide routes at all.

For the purpose of publishing the maps related to this report, AJ Mayfair LLC worked specifically with New England Fiber, a fiber research consultant, to provide the most accurate, publically available information. Verizon however, does not provide data through a NDA or to New England Fiber and their sources.

It is important to keep in mind that the telecommunications world is changing rapidly. Layers of the network are changing daily and additional lit buildings, those that already have Telecom Carrier and/or Internet Service Providers (ISPs) fiber facilities installed somewhere within the building with a tie back into the network, are being added frequently due to new service requests or change of service requests.

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. It is the intent of this report to provide facts and data that can be used for site selection when evaluating development opportunities. It is also a source for the existing business community.

3.0 National and State Landscape

On March 17, 2010 the Federal Communications Commission (FCC) released the *National Broadband Plan*. The intent was to set “out a roadmap for initiatives to stimulate economic growth, spur job creation and boost America's capabilities in education, health care, homeland security and more”¹. In the years following, the United States has significantly expanded its broadband network and increased access. Investments from the federal government have helped deploy or upgrade more than 78,000 miles of network infrastructure, and more than 45 million Americans have adopted broadband over the last seven years. Today, more than 90 percent of Americans can access the Internet on a wired line and 98 percent by either wired or wireless connection.

"Access to high-speed broadband is no longer a luxury; it is a necessity for American families, businesses, and consumers. Affordable, reliable access to high-speed broadband is critical to U.S. economic growth and competitiveness. High-speed broadband enables Americans to use the Internet in new ways, expands access to health services and education, increases the productivity of businesses, and drives innovation throughout the digital ecosystem."

President Barack Obama

As consumers and businesses are quickly becoming more reliant on the internet and its applications, the demands on requirements for speed and redundancy become more important. For example, beginning in 2000 the Federal government defined "broadband" as any service with a download speed of 200 kilobits per second (kbps) or faster.² In 2010, the FCC redefined "basic" broadband service as a connection with speeds of at least 4 megabits per second (Mbps) downstream – 20 times faster than the 2000 definition.

¹ <https://www.fcc.gov/national-broadband-plan>

² <http://www.ntia.doc.gov/report/2013/us-broadband-availability-june-2010-june-2012>

Although the above statistic shows progression, the need for dramatic advancement exists in many cities.

In March of 2015, President Obama signed a Presidential Memorandum, *Expanding Broadband Deployment and Adoption by Addressing Regulatory Barriers and Encouraging Investment and Training*. The result of the Memorandum was the creation of the Broadband Opportunity Council. The report announced a policy that allows executive departments and agencies that have “statutory authorities” pertaining to the deployment of broadband to:

- Identify and address regulatory barriers that may unduly impede either wired broadband deployment or the infrastructure to augment wireless broadband deployment.
- Encourage further public and private investment in broadband networks and services.
- Promote the adoption and meaningful use of broadband technology; and otherwise.
- Encourage or support broadband deployment, competition, and adoption in ways that promote the public interest.³

The Commonwealth of Massachusetts is ranked as the sixth most connected state. Since 2011, state access to a wired connection of at least 10mbps has improved from 97.0 percent to 98.6 percent.⁴

³https://www.whitehouse.gov/sites/default/files/broadband_opportunity_council_report_final.pdf

⁴ <https://www.fcc.gov/national-broadband-plan>

4.0 Overview of Available Technologies to Commercial Consumers

Although many of the options available to residential consumers today are also available to commercial clients, pricing and availability vary significantly. Based on a survey of Chamber members, Worcester businesses have access to a variety of technologies today including the following:

Digital Subscriber Line (DSL)

DSL uses your existing phone line and is often used by the small business customer. DSL allows you to utilize your phone and the computer at the same time and does not tie up your phone line. There are distance limitations for DSL that are dependent upon the distance to a Local Exchange Carrier's Central Office. It is not available in all areas and the speed and type can vary.

Cable

All local Cable TV providers offer high speed access utilizing a modem that attaches to the same cable connection your TV utilizes

Wireless

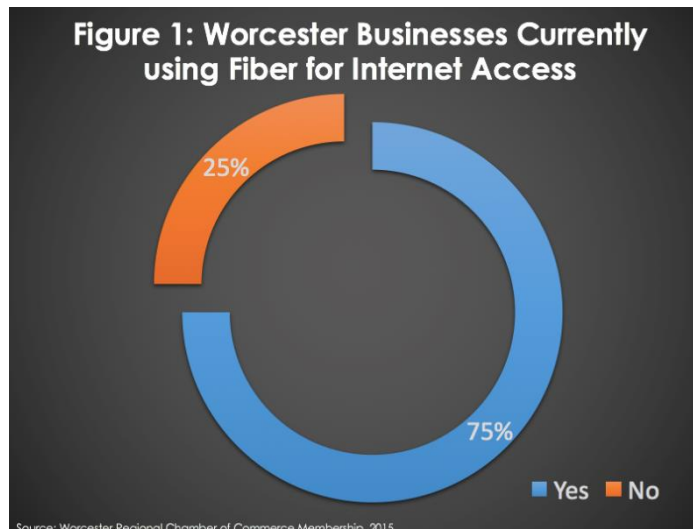
Wireless Services use an externally mounted antenna which must be in line of sight to the carrier's nearest antenna. These services offer speeds comparable to DSL and Cable depending on the provider.

Satellite

Like Satellite TV service, Satellite Internet service is available anywhere you have an unobstructed view of the sky. Several providers now offer satellite internet service. Satellite connections introduce a slight delay which may be unacceptable for some applications. This service is often more expensive and is typically the last resort for areas where other high speed options are unavailable.

Fiber

As defined by the FCC, "Fiber optic technology converts electrical signals carrying data to light and sends the light through transparent glass fibers about the diameter of a human hair. Fiber transmits data at speeds far



exceeding current DSL or cable modem speeds, typically by tens or even hundreds of Mbps. The types of fiber are described in section 7.1.1, 7.1.2 and 7.1.3.

5.0 Benefits of Available Technologies to Commercial Property Owners and Tenants

There are a variety of benefits to commercial property owners and tenants related to available technologies. Depending on the type of industry sector and/or consumer, a set of criteria can be applied. An overview of benefits for commercial tenants and landlords is provided below.

5.1 Why Do Commercial Tenants want Dark Fiber?

When it comes to doing business, competitiveness is key. To a large extent competitiveness is dependent on access to resources – human capital and technological capability. Over the last number of years, with the global markets emerging, efficient and effective connectivity can impact the success of business across the country. For these reasons, commercial tenants seek Dark Fiber:

Unlimited Bandwidth

Access to virtually unlimited bandwidth capacity. To a tenant this means heavy data applications are not an issue.

Flexibility and Scalability

Commercial consumers often want to manage their own network and change out equipment as their technology needs grow. According to Moore's Law, technology offers changes in performance and pricing every 18 months.

Security

Dedicated fiber means security. Dark fiber also allows redundancy in the form of access to data centers and colocation facilities.

5.2 Why Do Landlords want Dark Fiber?

Kelleher and Sadowsky, one of Central Massachusetts's leading commercial real estate brokers, has direct experience with today's Worcester market. James Umphrey, a principal at Kelleher and Sadowsky confirmed that discussions about access are a part of negotiations with every client.

Site Selection Magazine agrees with Umphrey, locations with inadequate connectivity are quickly passed over for projects requiring broadband. *Site Selection Magazine* goes on to say that communities lacking broadband infrastructure make the process of elimination easier for investment decision-makers and influencers.

Landlords seek Dark Fiber for the following reasons:

Competition

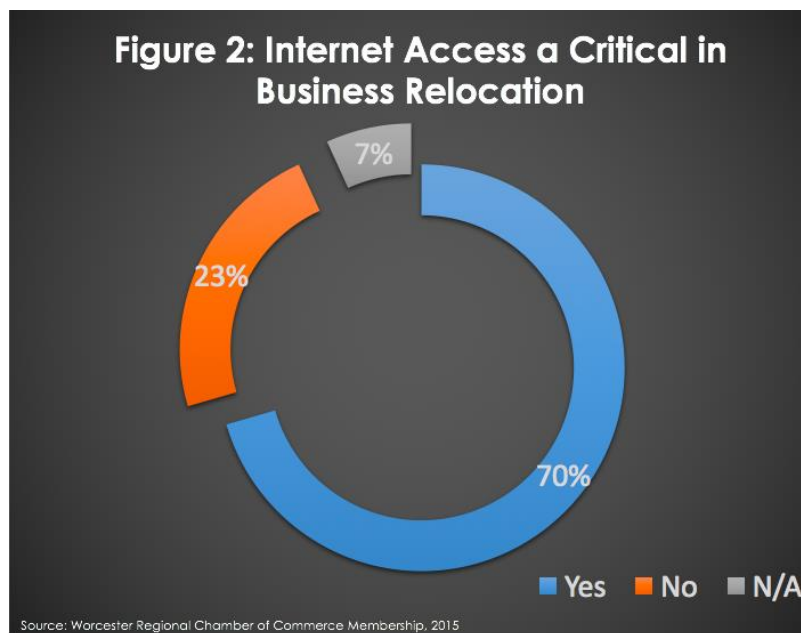
Commercial property that has dark fiber to the building is seen as “move in ready”. Tenants will not have to be concerned about changing technologies and what speeds will be available at the site.

Vendor Choice

Dark Fiber allows more internet providers access to the building allowing competition and driving down cost for tenants.

Increase Property Value

The connection of dark fiber allows landlords to collect higher rents and retain long term tenants.



6.0 Community Fiber Models

Communities across the country have successfully implemented fiber network models. To date, three models dominate the marketplace. They include:

Private Sector-Led

A private or non-profit commercial operator owns and operates the network. Community Anchor Institutions (CAIs) and community leaders in economic developments show support by contributions such as planning and financial and regulatory support. This particular model is how Worcester's infrastructure operates today.

Government-Led and Private Supported

A public entity owns the network and private partners build, maintain and operate. This is done in exchange for an exchange of contributational support from the private sector.

Joint-Ownership Model

A private operator and the public entity jointly building and maintaining the network.⁵

6.1 Worcester's Network Model

Worcester's fiber network model falls into the private sector-led category. The The National Telecommunications and Information Administration (NTIA) released a report entitled, *BroadbandUSA: An Introduction to Effective Public-private Partnerships for Broadband Investments*. The report highlights key factors to maintain and build out fiber networks that relate to the fiber network models noted above. They are:

Leadership and Involvement of Government

Local and state government are advised to work together to identify the community's needs, create solutions and attract private funding through simplification of right of way access and permitting processes.

Private Sector Contributions and Funding

Service providers, hardware vendors, commercial developers and technology companies bring expertise and new thought processes in network architecture and deployment that support the work of local leaders.

Support from the Community

⁵ http://www2.ntia.doc.gov/files/ntia_ppp_010515.pdf

Anchor institutions, non-profit groups, research, education and government networks can drive initial demand and help to build out the network throughout the municipality.

6.2 Worcester's Initial Fiber Loops

One of the largest limitations hindering widespread fiber optic adoption is the cost requirements to implement new fiber optic lines when old infrastructure, such as DSL and cable, are still in use. Although these older services are available and still service some consumers in Worcester, the city has an advantage. According to the *Community Based Broadband Report*, released by the White House in 2015, there are only 495 cities or towns in the US with Broadband networks in place and only ten in Massachusetts. Worcester being one of the ten and the broadband in this case is fiber.⁶

Worcester's fiber backbone was built prior to the dot com bubble bursting, at a time when vendors were laying fiber with the prediction of a booming economy. According to Lighttower, the owner of the original fiber loops, most of this Worcester Network was built out in 1998 and 1999 by NEESCom. NEESCom was one of many predecessors of Lighttower focused on leasing "dark fiber," to enterprise customers, educational institutions, and medical facilities utilizing electric company assets. NEESCom was owned by the power company at the time, and the thought was to utilize existing power company right of way assets to compete with Bell Atlantic for the lucrative enterprise telecom business.

According to Lighttower, three loops were built out back to 474 Main Street, NEESCom's Colocation Facility (across from city hall);

Downtown loop

North on Main St. to route 9 and back on Chestnut St.

WPI Loop

West from Downtown loop to Institute Road. NEESCom was interested in connecting WPI due to an "Internet II" project they were developing.

Biotech Loop

East from the downtown loop to UMass Medical area

Subsequent connections were built east to Marlborough and west to Springfield to connect Worcester to NEESCom's other networks being built at the same

⁶ https://www.whitehouse.gov/sites/default/files/docs/community-based_broadband_report_by_executive_office_of_the_president.pdf

time. Over time, the power company decided to spin off the fiber company and NEESCom eventually evolved into Lightower through mergers and acquisitions.

7.0 Key Terms Related to Fiber, the Value of Worcester's Geographic Location

7.1 Data Centers

Most major cities have at least one key hub or carrier hotel location where all of the elements of the networks meet, such as the long-haul fiber routes that span the continent, the metro fiber infrastructure that often originates at the hub and the dozens of companies that provide the many varieties of telecommunication services we consume.

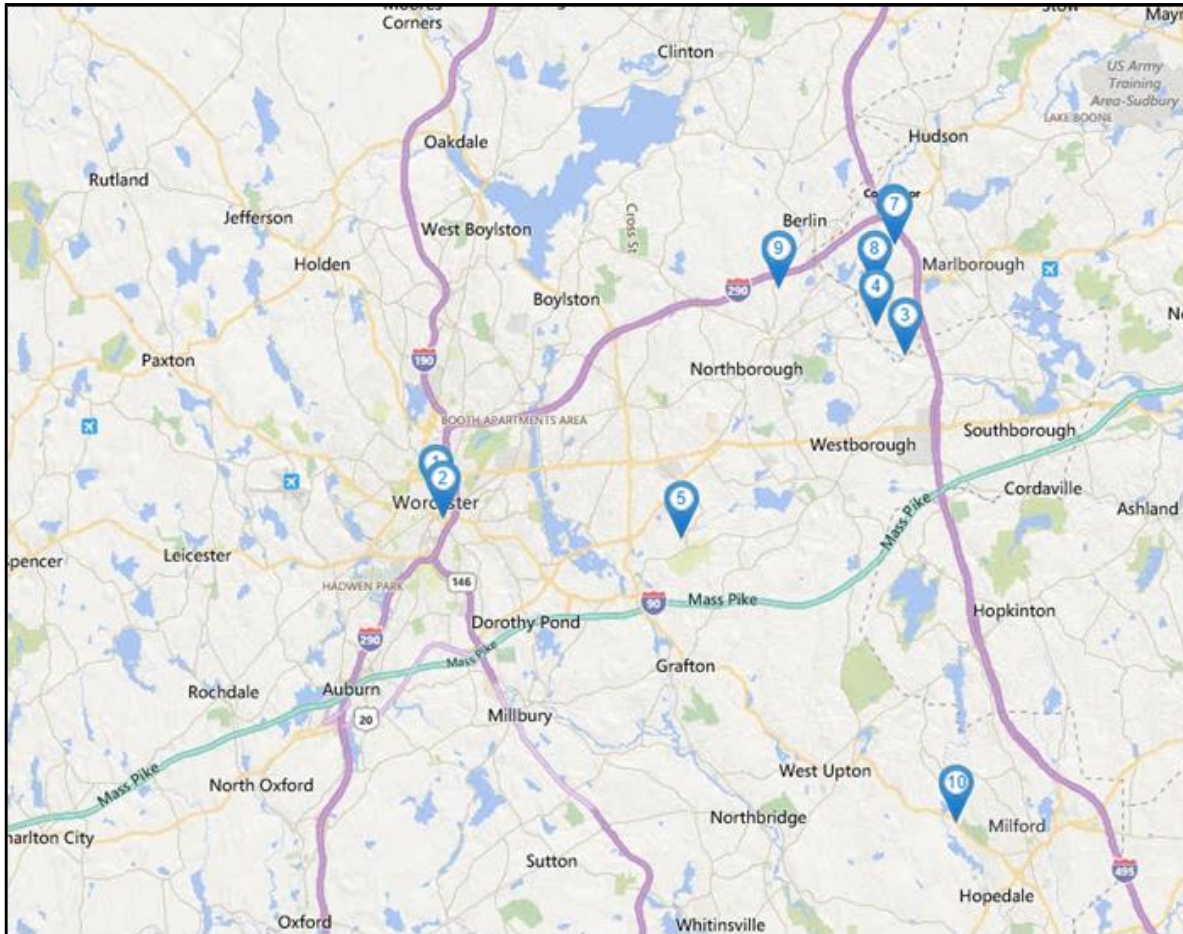
Across the country, buildings like 474 Main Street in Worcester were selected as hub locations because of their prime geographic position.

Figure 3: Carrier Hotel & Internet Hub



Unlike many cities across the United States, Worcester is in a powerful position with ten data centers within a 20-mile radius, as shown in Figure 4. Accessibility such as this allows Worcester the opportunity to connect and leverage with a variety of centers.

Figure 4: Data Centers within a 20-mile Radius of Worcester



Data Centers, within a 20-mile radius of Worcester

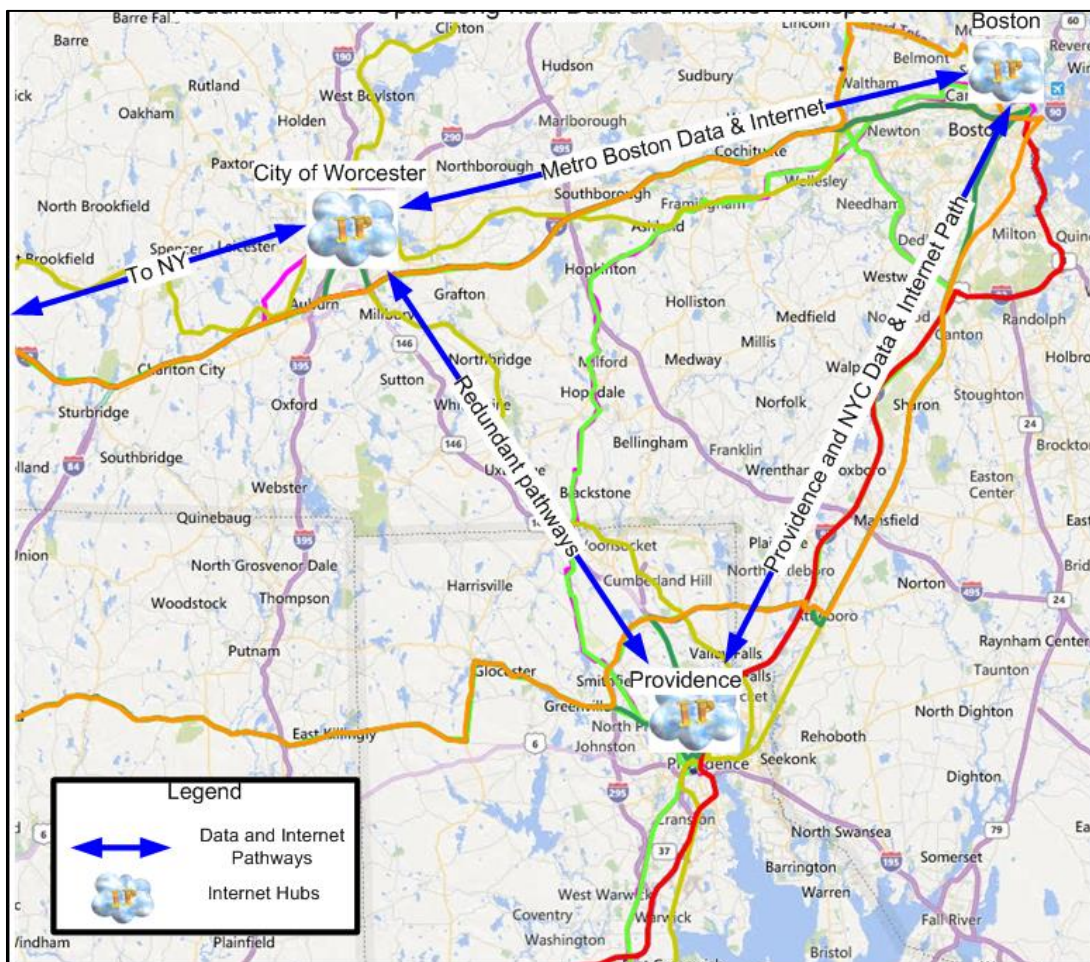
1. 90 Washington Street, Worcester
2. 34 – 474 Main Street, Worcester (Carrier Hotel)
3. St. Martin Drive, Marlborough
4. 45 Bartlett Street, Marlborough
5. 8 Centennial Drive, Marlborough
6. 250 Locke Drive, Marlborough
7. 260 Locke Drive, Marlborough
8. 313 Boston Post Road West, Marlborough
9. 175 Bearfoot Road, Northborough
10. 285 West Street, Milford

7.1.1 Long-haul Fiber vs. Metro Fiber - Worcester's Long-haul Network

Often times the analogy of a highway and a side street is used to understand the differences between Long-haul Fiber and Metro Fiber.

Long-haul Fiber networks act as a major highway to connect metropolitan areas to one another to carry data and connect networks. These networks provide a key backbone for transporting data and voice through a standardized method of transporting traffic from state-to-state and city-to-city. The following maps illustrate the importance of Worcester's Long-haul networks.

Figure 5: Redundant Fiber Optic Long-Haul Data & Internet Transport



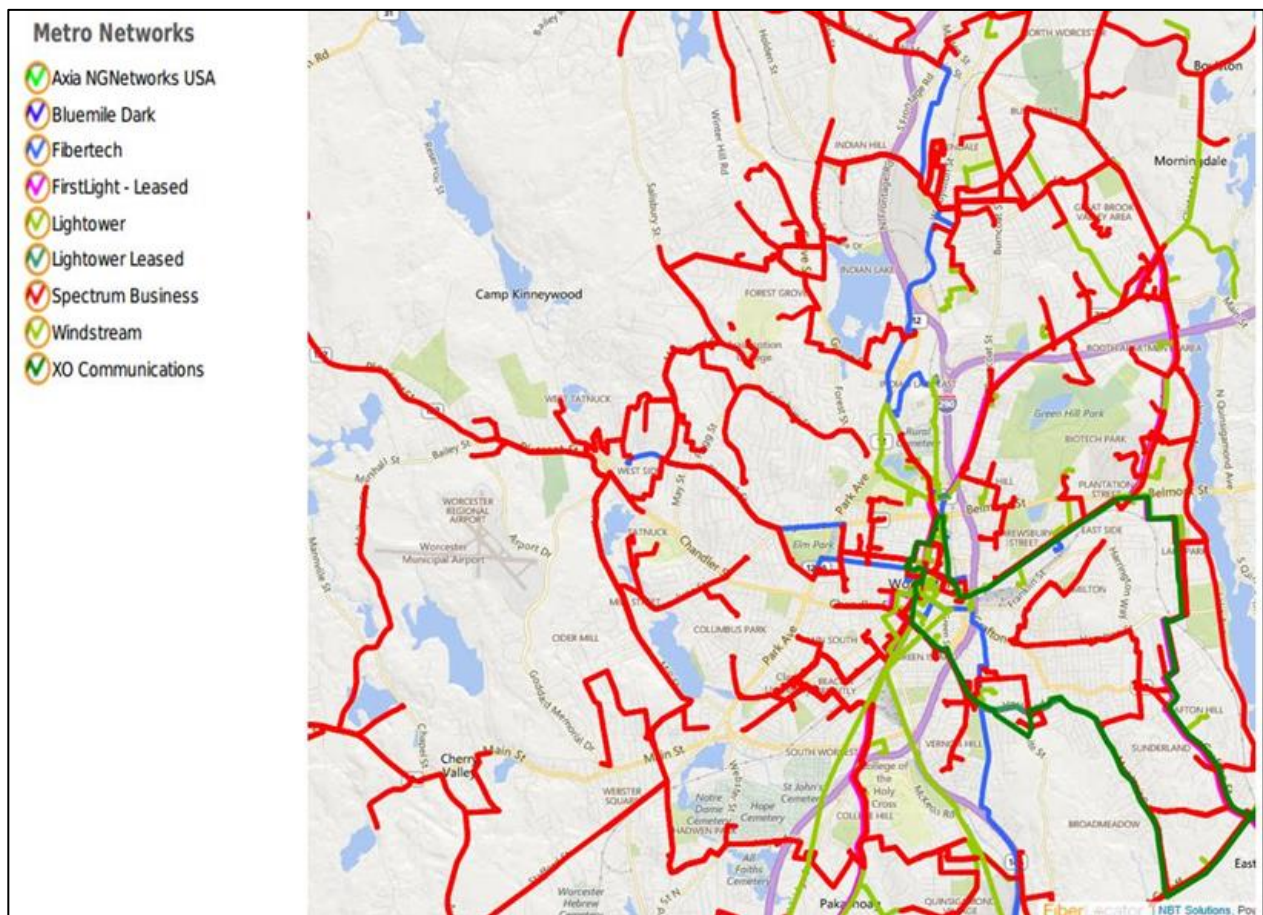
7.1.2 Metro Fiber

Metro networks can be compared to side streets and roads that support transportation within the town or city. Similar to the road infrastructure, metro networks typically have some type of “on-ramp” to the long-haul network (Carrier Hotel or Hub).

Most metro networks are built on customer demand. Many are built in a protected ring fashion, while others are built in a linear fashion to provide services to a single building.

Regardless of their design, metro networks are critical in providing the link to long-haul networks, existing data centers in a given area and to the buildings that house the businesses. Metro Fiber enables buildings to become “lit”.

Figure 6: Worcester’s Metro Network



*Figure 6 is an approximation based on collected information and public information that is gathered by New England Fiber/Fiber Locator. Any network pertaining to the LEC (Verizon) is not available

7.1.3. Dark Fiber vs. Lit Fiber - Dark Fiber

Although both dark and lit fiber offer large amounts of bandwidth, the two technologies meet different needs in the marketplace. Dark fiber is a fiber that is not being used for any type of “lit” service, meaning the network is not transmitting data. For additional information on “lit,” please see below. In some cases, Dark Fiber is sold as a product to enable the buyer to connect two points using their own equipment. As previously mentioned, a single pair of fibers can support an extraordinary amount of data, voice and video requirements. Some businesses prefer to control their own network elements completely, and dark fiber helps them achieve that goal.

There are a few dark fiber networks in the Worcester market, including Lighttower and Wow (Wide Open West) Business. According to *Bizjournals.com*, Wow, a Denver based company purchased Bluemile’s network in September 2013. At the time of this report, Wow’s website offers services only in Alabama, Florida, Kansas, Georgia and Illinois. The figures below identify the approximation of the fiber network provided by each business.

Figure 7: Dark Fiber Option, Lighttower

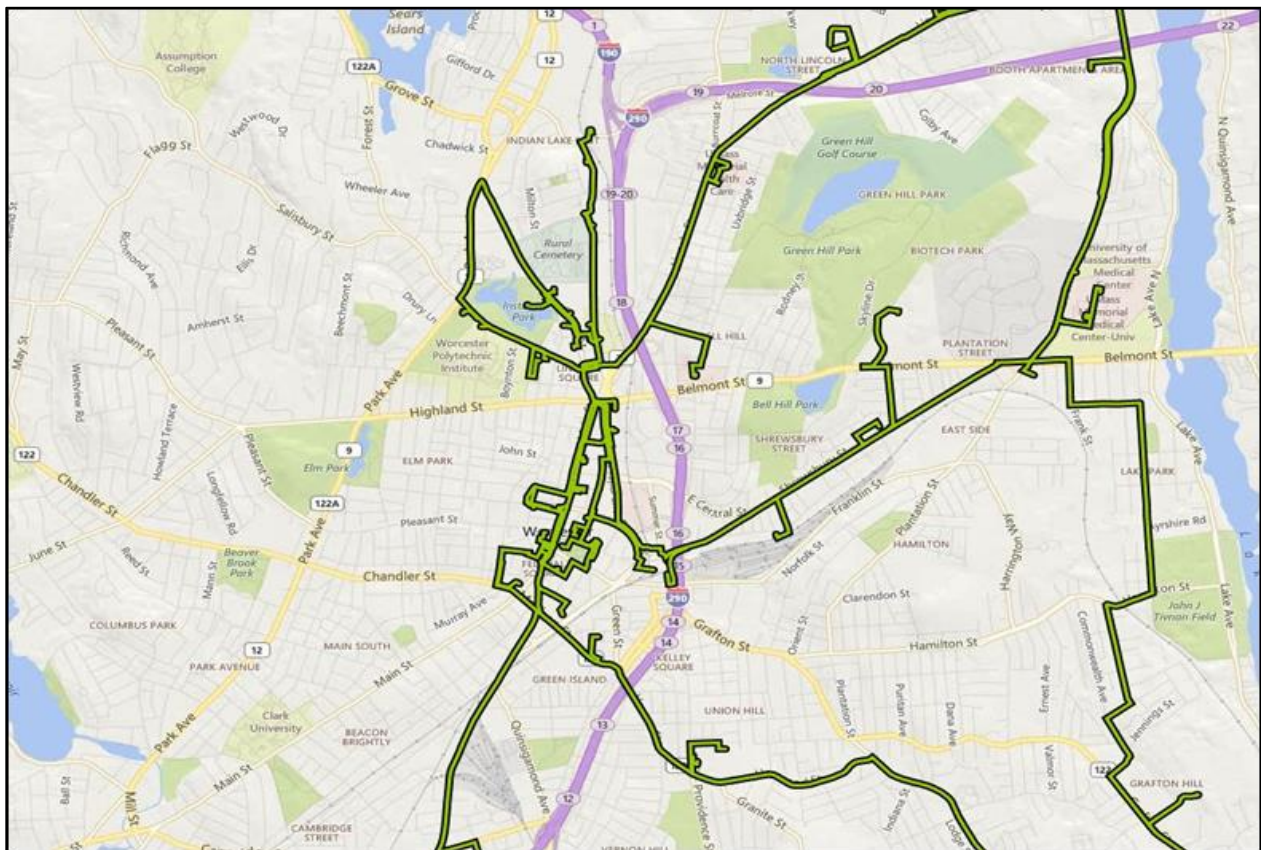
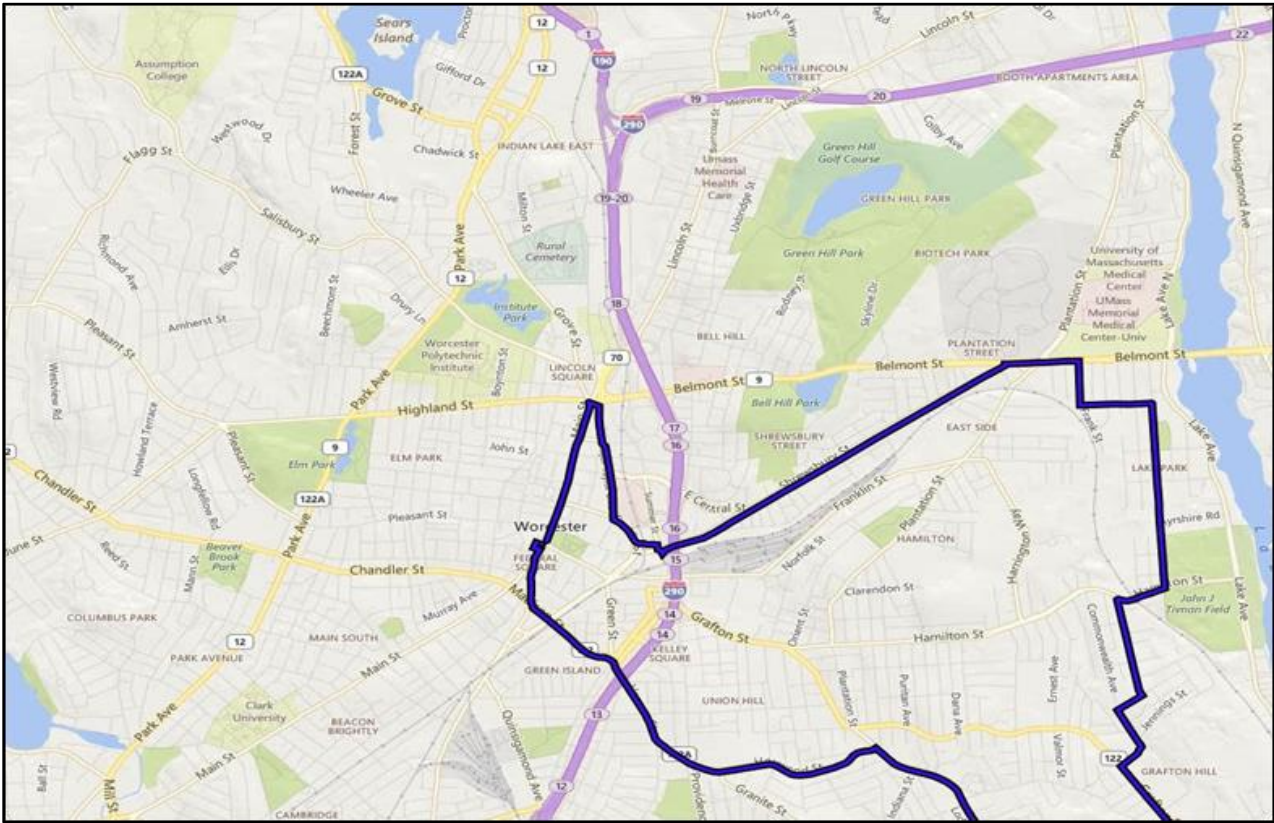


Figure 8: Wow Business (Acquired from Bluemile in 2013)



7.2 What is “Lit” Fiber?

Lit Fiber can be defined as fiber optic cable that is being used to transmit data. Worcester has over 150 “lit” buildings in and around the City. All of the key commercial and business districts are serviceable by high-capacity, fiber-based infrastructure. The following figures illustrate the “lit” building landscape in Worcester.

Figure 9: Worcester's Lit Fiber Network

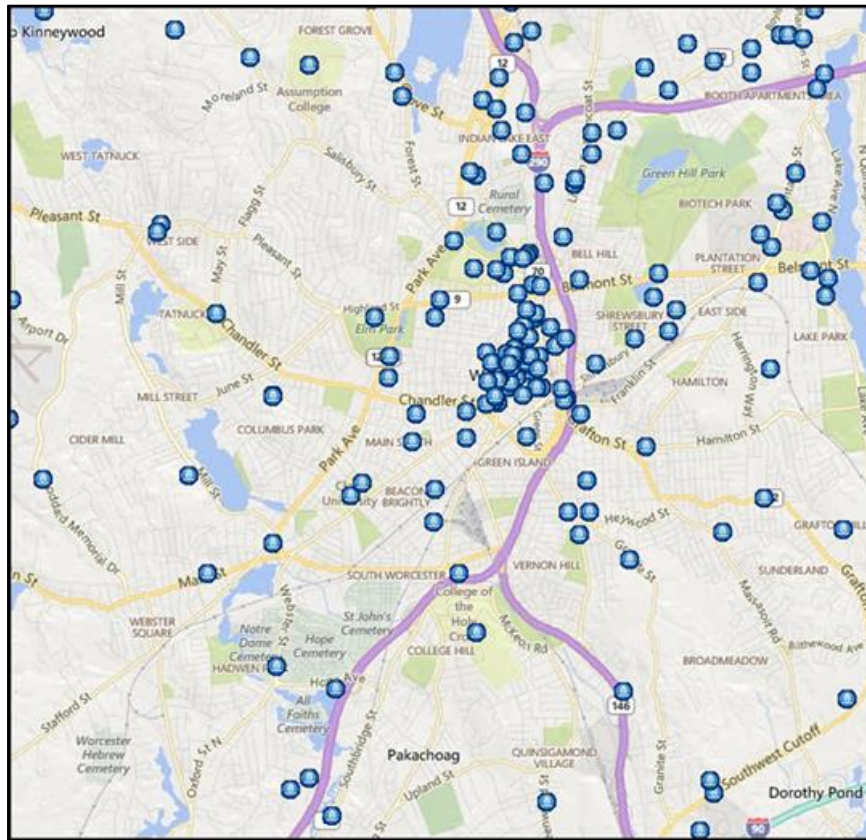


Figure 10: Lit Buildings, South of Belmont Street

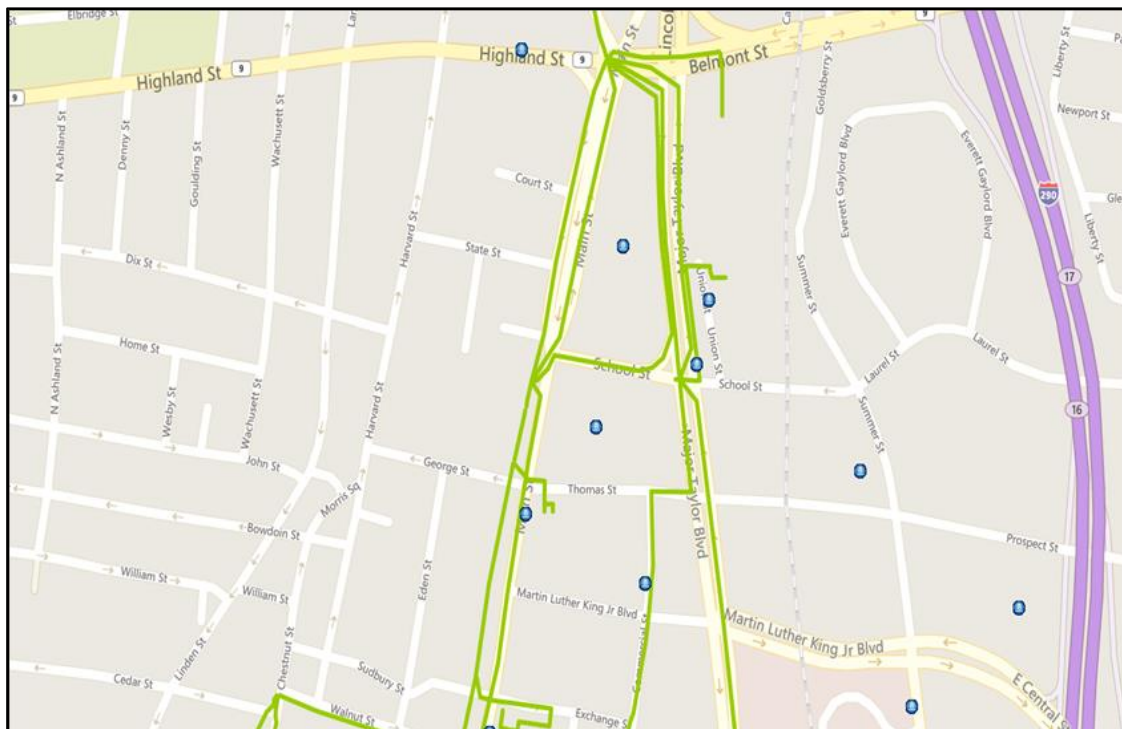


Figure 11: Lit Buildings, North of Belmont Street

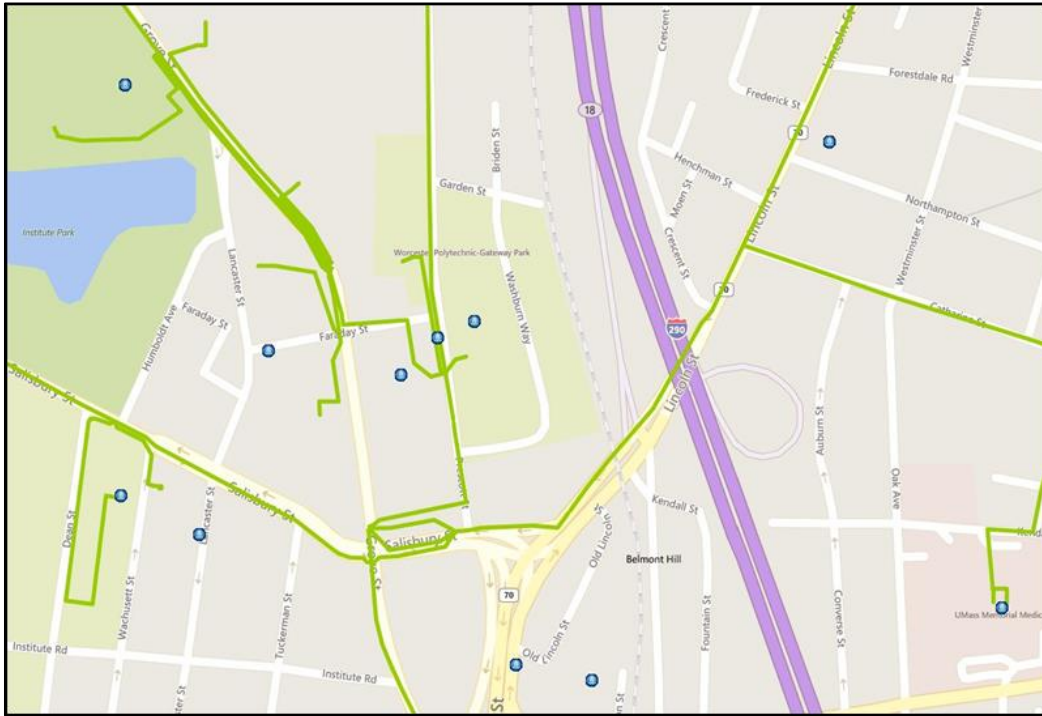


Figure 12: Lit Buildings, North of 290

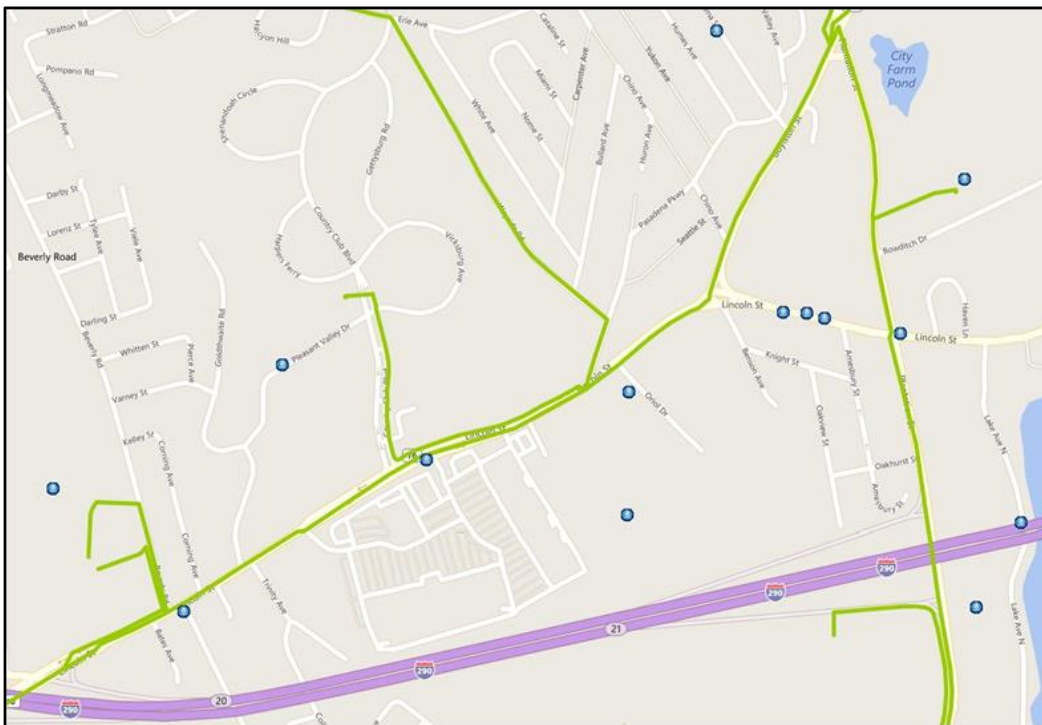


Figure 13: Lit Buildings, North Worcester

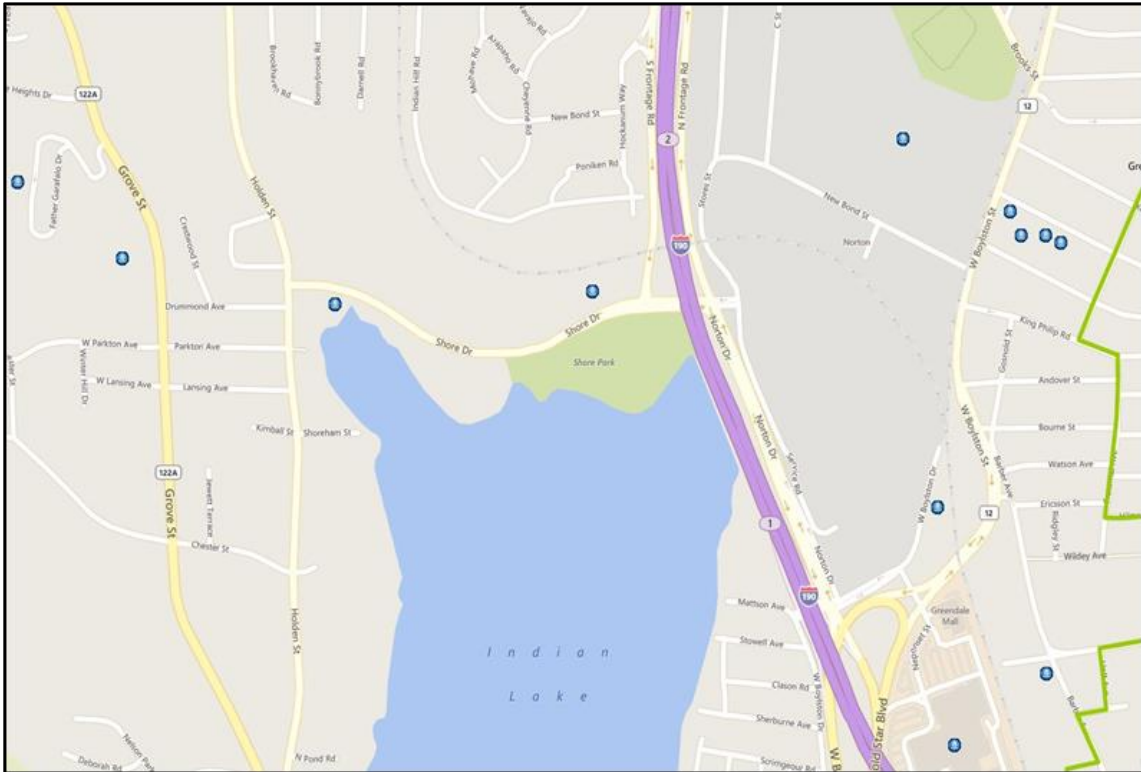



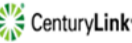
















Figure 14: High Capacity Infrastructure in the Central Business District



Figure 15: High Capacity Infrastructure in the Central Business District

Service Provider	Services	Fiber Footprint	Products
	International Service Provider	High density of fiber in the downtown business area district. Interconnects at 474 Main for long haul connectivity.	All telecom products
	Regional Service Provider.	Small fiber footprint. Has one (1) fiber path that runs parallel to the Mass pike through the south end section of Worcester.	IP Transit, Metro Ethernet
	Limited regional services	Moderate footprint. There are two (2) paths that run east from 474 Main street that traverses east through Marlborough and Framingham.	Transport, IP Transit, Metro Ethernet and other services. Dark Fiber possible
	Regional Service Provider	Small footprint, has single path that's runs East to West through Worcester interconnecting into 474 Main Street.	All telecom products
	International Service Provider	Has Point of Presence in 474 Main Street for connectivity with multiple Carriers of choice.	Transport, IP Transit, Metro Ethernet and other services
	Cable and Business Services Provider	Moderate footprint. Has Point of Presence on Washington Street for metro connectivity.	IP Transit, Metro Ethernet and Voice services
	Regional Service Provider	Small fiber path that connects Boston to Worcester and through to Hartford and New York	Transport, IP Transit, Metro Ethernet and other services. Dark Fiber possible
	Regional Service Provider	Small footprint. Has Point of Presence on Chestnut St for connectivity.	All telecom products
	Regional Service Provider	Small fiber footprint. Has one (1) fiber path that through the Worcester Carrier Hotel into the Boston and surrounding area.	Transport, IP Transit, Metro Ethernet and other services. Dark Fiber possible
	International Service Provider	Has multiple Point of Presence through the city for many connection possibilities.	Transport, IP Transit, Metro Ethernet and other services

Service Provider	Services	Fiber Footprint	Products
	International Service Provider	Moderate Long Haul fiber runs east to west through Worcester interconnecting into 474 Main Street.	All telecom products
	Regional Service Provider	High density of fiber through the city of Worcester. The heaviest area of concentration is the downtown area near the 474 Main St Data Center.	Transport, Dark Fiber and some Managed IP services
	Cable and Business Services Provider	Spectrum Business is a division of Charter Cable who is the incumbent Cable Company. They would have a significantly high density of fiber in the City.	IP Transit, Metro Ethernet and Voice services
	Regional Service Provider	Moderate Long Haul fiber that runs through Worcester on multiple paths and interconnects at 474 Main St. Connects Worcester to major cities in all directions.	Transport, IP Transit, and other services
	National Service Provider	Highest density of fiber in the City as they are the incumbent Local Exchange Carrier.	All telecom products
	National Service Provider	Small fiber footprint as one path traverses through the city and interconnects at 474 Main St.	All telecom products
	International Service Provider	Moderate footprint. There is two (2) paths that travel east from Worcester through to Boston and north.	All telecom products
	National Service Provider	Small presence in the city. Mostly used for long haul connectivity.	Transport, IP Transit, Metro Ethernet and other services including dark Fiber

8.0 The Impact of Fiber Networks on Economic Development

Many studies have recently pointed to a link between connectivity speeds and residential real estate prices. In early 2015, the Fiber to the Home (FTTH) Council Americas released a white paper to investigate the relationship between fiber-delivered Internet services and housing prices. Using the National Broadband Map and a nationwide sample of real estate prices from 2011 to 2013, the study's authors found that access to fiber may increase a home's value by up to 3.1 percent.⁷

Although studies regarding fiber and its effect on the business community are in the early stages, one study performed by the economic, financial and strategy firm Analysis Group, entitled *Early Evidence Suggests Gigabit Broadband Drives EDP (gross domestic product)*, looked at 14 communities in nine states and determined that the availability of gigabit speeds contributed to the economy in communities in a variety of ways. Specifically, impacts were seen "through the direct effect of infrastructure investment and increased expenditures, as well as shifts in economic activity (e.g. job creation and occupational changes) and productivity gains."⁸

“Medical conglomerate Spectrum Health in Grand Rapids, MI employs over a thousand doctors seeing on average 25 patients a day. If each patient uses on average just 100 MB of data a day that equals a staggering 2,500,000 MB of data a day.”

<https://ussignal.com/blog/why-does-fiber-make-sense-for-healthcare>
McKinsey & Company: Internet matters: The Net's sweeping impact on growth, jobs, and prosperity.

Speedmatters.org released a study that for each \$5 billion in new broadband investment, 250,000 jobs are created. Moreover, with every percentage point increase in new broadband penetration, employment expands 300,000.⁹

The Executive Office of the White House released the *Community Based Broadband Report*, in January 2015. The report discussed the importance of fiber as an asset and investment to any community. The report points to the theory that fiber optic technology is "future proof" and can offer an unlimited potential for speed and bandwidth. Studies show that even if typical broadband speeds

⁷ <http://www.ftthcouncil.org/blog/study-shows-home-values-up-3.1-with-access-to-fibe>

⁸ <http://www.ftthcouncil.org/p/bl/et/blogid=3&blogaid=305>

⁹ <http://siteselection.com/issues/2011/sep/sas-optical-infrastructure.cfm>

become 1000 times faster in 20 years, a single existing fiber-optic connection can still support it.¹⁰

At the local level, data released in 2015 correlates the investment in fiber and the reshaping the economic landscape in Chattanooga Tennessee. “The gigabit broadband service has helped the City attract a new community of computer engineers, tech entrepreneurs and investors.” Since then, the municipality, which is a government led model, has “gone from close to zero venture capital to at least five organized funds with investable capital of over \$50 million.”¹¹ Six years after the implementation of the Chattanooga network, an independent study confirmed that the “infrastructure has generated \$865.3 million to \$1.3 billion in economic and social benefits while creating between 2,800 and 5,200 new jobs”.¹²

8.1 Broadband and the effect on Worcester’s Growth Sectors

Because Worcester has the ability to offer dark fiber as well as options for lit fiber, it becomes an attractive city for industries in need of high bandwidth.

According to the *Community Based Broadband Report*, the growing need for rapid bandwidth is driven by new applications of the internet. Many are becoming reliant on these applications in everyday life. Many Americans, use video streaming, for education as well as entertainment and working from home. Cloud Storage allows users to store their files on the Internet, share them, and access them from any device; and online games that allow users to interact with one another in a virtual environment.¹³

All of these uses pertain to the three growth sectors identified in a 2013 report released by the Worcester Chamber, entitled *Worcester Regional Economic Competitiveness Outlook*. The report detailed that the three highest growth sectors were:

- Professional, Scientific and Technical
- Education and Health
- Manufacturing

¹⁰ <http://broadbandnow.com/Fiber>

¹¹ <https://www.whitehouse.gov/the-press-office/2015/01/13/fact-sheet-broadband-works-promoting-competition-local-choice-next-gener>

¹² https://www.epb.net/media-relations/news/news_archive/economic-study-affirms-value-of-epb-fiber-optics-network/

¹³ https://www.whitehouse.gov/sites/default/files/docs/community-based_broadband_report_by_executive_office_of_the_president.pdf

The report also states that during the years between 2000 and 2010, Worcester County's Scientific Research and Development subsector grew employment by 31.7 percent. Computer System Design and Related Services subsector, which includes digital gaming grew employment by 46.3 percent. The importance of recruiting, retaining and incubating businesses in these sectors relies heavily on the type of data infrastructure that Worcester is able to offer. Without the speed that fiber can offer, access to these applications becomes difficult.

The application in one specific sector, Education and Health, can provide important examples. Worcester is home to nine colleges and universities that employ many of the city's current population and are educating the employees of the future. In an article entitled, *How Higher Ed Is Using Cloud Computing*, the following statistics were determined:

- 68 percent of institutions will use the cloud for conferencing and collaboration.
- 65 percent of institutions will use the cloud for storage.
- 65 percent of institutions will use the cloud for office and productivity suites.
- 62 percent of institutions will use the cloud for messaging.

Technological advancements have changed the way in which healthcare facilities and operators function. As identified by service providers, such as FPL Fiber, fiber-optic connections support an array of functionality related to research and development, as well as first-response approaches, while reducing operating costs and meeting regulatory compliance requirements. Tele-medicine and doctor-to-doctor communication, on a global scale, is reliant on high speed data traffic.

For example, as reported in [Broadband: Transforming Tennessee's Healthcare Sector](#), over 76 percent of businesses in Tennessee's healthcare sector use broadband for business functions. This represents an increase of 29 percent in just four years, showing that the healthcare sector has a higher than average adoption rate.

“Over 76 percent of businesses in Tennessee’s healthcare sector use broadband for business functions. This represents an increase of 29 percent in just

9.0 Worcester's Top Commercial Development Opportunities

The top 25 development opportunities in Worcester are within one-mile of a fiber network, as shown in Figure 16, which does not include any current or future build outs. Vendors were asked to qualify the opportunities for fiber access.

Figure 16: Fiber Network in Worcester and Top 25 Development Opportunities



Top 25 Development Opportunities

1. 195 Mill Street
2. 244 Main Street
3. 401-403 Main Street
4. 484 Main Street
5. 520 Park Avenue
6. 531-545 Main Street
7. 551 Main Street
8. 55-57 Union Street
9. 627 Main Street
10. 75 Quinsigamond Avenue
11. 35 Hamilton Street
12. 60 Prescott Street
13. Midtown Mall
14. One Mercantile/City Square
15. 25 Sagamore Road
16. Armory Street
17. 365 Plantation Street
18. Union Station
19. 34 Grove Street
20. 3 Salem Street
21. Wyman Gordon/Kelley Square
22. 274 Franklin Street
23. 344 Park Avenue
- 24 & 25. Not Shown: 1-564 Southwest Cutoff and Lincoln Street

10.0 Expansion Plans

The amount of fiber in Worcester is increasing. With this increase, through connecting additional school buildings, access to the fiber is becoming likely for many business consumers that may have had difficulty with access previously.

To date, Lighttower sells and leases both dark and “lit” fiber directly to commercial businesses in Worcester. Lighttower is currently expanding its reach in the city. According to Lighttower, the company currently owns and maintains approximately, 187 route miles of fiber in Worcester.

Lighttower predicts an approximate increase of 35 additional miles at the time of this report based on a recent award to connect some educational facilities in the city through Addition Networks. Addition Networks is a division of Merrimack Education Center, a non-profit ISP and technology provider to schools, cities, towns and other organizations in Massachusetts.

Although the detailed paths of expansion have not been made public, based on the mileage and the buildings that are being “lit”, the following assumption that can be made. Fiber may be brought closer to many buildings and businesses that were previously difficult or cost prohibitive to connect to fiber, therefore making access to these businesses more affordable.

Because Lighttower leases fiber to other carriers, competition could increase.

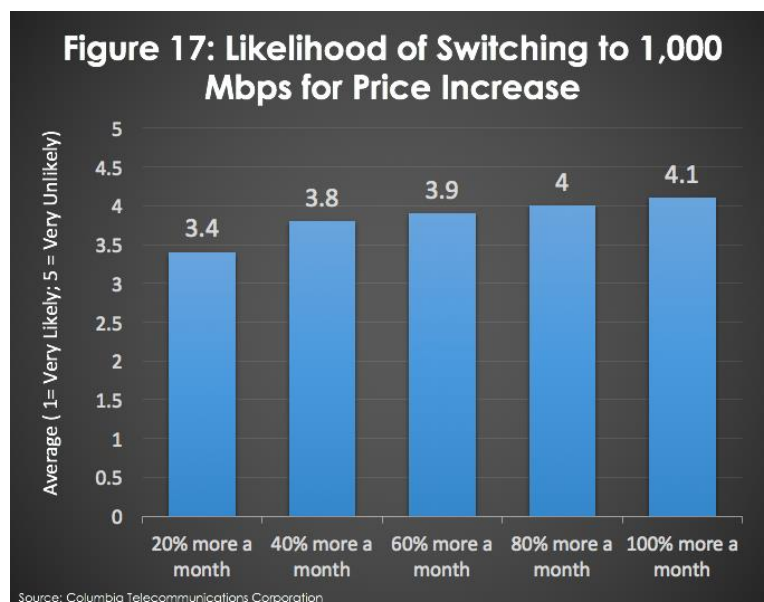
11.0 Improving Service for Small Business

Worcester has a strong network; however, advancements can and should still be made to ensure that the network continues to remain strong in the future. Of those Chamber members who responded to a 2015 survey, over half said they were satisfied with their current service.¹⁴ Twenty-five percent of respondents were currently using the fiber network. On the converse, 48 percent were not satisfied under the existing conditions. Over 80 percent of respondents noted a budget of less than \$24,000, which would likely constrain their ability to connect.

As indicated by Chamber member responses, there is a sense of frustration among some chamber members due to the high cost of commercial high-speed internet for the smaller consumer. According to *The Impact of Broadband Speed and Price on Small Business*, Worcester is not the only city with this issue. As reported by the Small Business Association in 2010, businesses are somewhat hesitant to pay more for an extremely fast Internet connection of 1,000 Mbps, as shown in Figure 17.¹⁵

Consumers have options. Increasing the vendor competition and working in collaboration to find solutions would be a step forward. As the network is

further built out, vendors and the community should work together to understand improved access. Specifically, accessibility will be increased over time, at a more cost effective rate, which will help a wide range of businesses and consumers to become more competitive in the marketplace. As a result, other competitors may join the community or promotions may be offered to entice new points of access.



¹⁴ Chamber of Commerce Member Survey, 2015. Number of respondents: 45.

¹⁵ <https://www.portlandoregon.gov/revenue/article/396099>

12.0 Recommendations Based on Findings

The City of Worcester would benefit from expanding the reach and further accessibility of fiber to businesses and consumers, of all types. Specific recommendations to achieve this include:

- 1. Educate stakeholders on the importance of fiber to economic development.**
 - a. Publish this report and accompanying summary materials to educate municipal, non-profit, institutional, and business leaders about Worcester's current fiber network and the importance of improved accessibility and connectivity to future economic development efforts.
 - b. Continue to monitor the attitudes of local businesses toward fiber through annual surveys to better understand Chamber member needs and measure progress.
 - c. Educate the Massachusetts Broadband Institute on the opportunities and challenges for fiber in Worcester, and seek assistance to increase the availability and adoption of broadband in the region.

- 2. Establish city leadership on fiber development and accessibility.**
 - a. Establish a "Fiber/Broadband Ombudsman" that works with various departments and incoming business to increase opportunity, including development on the 25 parcels.
 - b. Establish an interdisciplinary internal city team to:
 - i. Identify accessibility issues; explore solutions and liaise with multiple stakeholders.
 - ii. Understand the existing permitting process for fiber related development.
 - iii. Identify ways to streamline the permitting process for fiber related projects to alleviate time and cost to business and consumers.
 - iv. Establish a workflow, across government departments to identify how existing infrastructure (utility lines, existing conduit) can be repurposed for fiber upgrades.

3. Create a Fiber Accessibility Task Force

Establish a task force encompassing company leaders from both the small and large business community, city departments, the higher education community as well as the vendor community. Collaboration between these entities should work towards expanding access and utilization of broadband in Worcester.

A municipal example of this effort in Massachusetts is the City of Cambridge's *Broadband Task Force*.

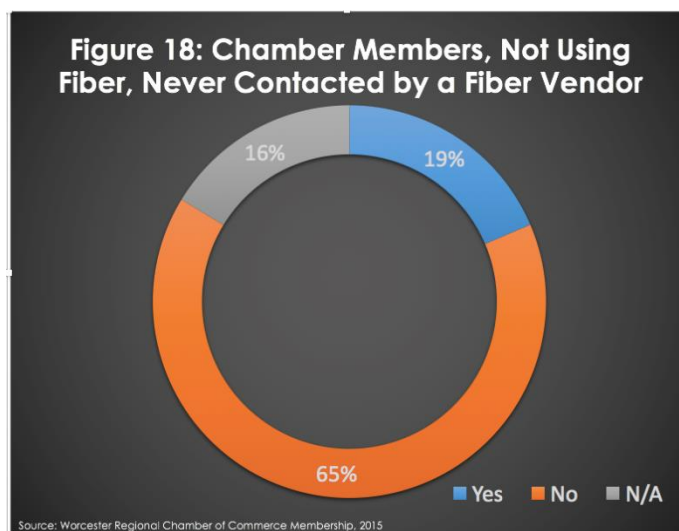
4. Partner with Higher Education to Support Enhanced Network for the Future.

- a. Utilizing the Chamber's Higher Education Partnership, conduct a visioning exercise with higher education leaders to define the future fiber demands of the Education sector, and communicate those needs with vendors and the Massachusetts Broadband Institute.
- b. Work with college-based consultants such as WPI's Interactive Qualifying Project Program to assess future fiber needs of specific growth sectors.
- c. Partner with the Massachusetts Digital Gaming Institute to demonstrate various technologies and games being developed in Worcester, and the importance of high speed internet access to incubate, retain and grow gaming companies in the region.

5. Increase Communication between Vendors and the Business Community

Identify ways in which the community can collaborate with vendors to increase transparency and communication.

For example, many of the vendors in Worcester were unaware of the development that is occurring across the city and therefore many do not target the area for new sales.



As shown in Figure 18, only one-third of surveyed Chamber members, not using fiber, have been contacted by a vendor. By supporting the connection between vendors and consumers, benefits will be had by both sides.

6. Municipal Leaders should draft and advocate for policies that integrate fiber into infrastructure improvement projects through a collaborative effort.

Establish a “Dig Once Policy.” This policy would identify a “Lead Vendor” (a vendor that approaches the municipality for a build-out request). The vendor would coordinate with other vendors on cost and engineering associated with build out.

These types of policies result in minimal disruption and more competition. They also expedite the competitive process and streamline the permitting process for many vendors at one time.

Examples of cities with “Dig Once” policies include San Francisco and Saint Paul. In addition, President Obama signed an Executive Order in June 2012 to facilitate the “Dig Once” policy at the Federal level.

7. Collaborate with other municipalities on best practices. Specifically, those communities with a Privately-Led network in place.

Many cities are in the midst of similar research today and it makes sense to collaborate. Worcester already has a network in place so the goal would be to learn how to extend the network and there is significant value in learning from the experience of other communities.

8. Market Worcester’s outstanding fiber network as a competitive advantage for economic development.

The Chamber and City should market the available fiber network, as well as the efforts being undertaken to expand upon that network, to prospective developers, businesses and other stakeholders. While the region is already poised as a leader in innovation, the link between fiber access and job creation is undeniable. The Chamber and the City should consider this a competitive advantage for economic development purposes.

13.0 Conclusion and Steps Toward Enhancements

The Chamber, business leaders and city officials recognize the importance of the network infrastructure to both the business community, institutions and the public and are committed to enhance what is currently in place.

In fact, the City of Worcester is already making progress related to the suggestions included in this report. For example, Phoenix Communications, a local fiber installer has been among the proponents pushing to ensure that vendors have better access to provide their services and business consumers have more options at a better price. One of the options that is currently being addressed within the city is the approval of “micro-trenching”. Micro-trenching is a method of fiber installation in which conduit is inserted into a trench less than $\frac{3}{4}$ wide and between 9-12 inches in depth. The benefit to the city would be little to no disruption to the street or infrastructure and once it is filled. Often times it is difficult to see that there was an opening. The result is a cost savings due to the need for little resources and the speed involved in deployment.¹⁶

Worcester has the ingredients for a larger and more robust fiber network that will offer cost effective solutions for all business consumers. Implementing the recommendations above will help to take Worcester's telecommunication infrastructure to the next level. At the conclusion of this study, AJ Mayfair is optimistic that the Chamber, City and other relevant stakeholders will make significant progress in improving access and expanding the network.

¹⁶ http://www.bbcmag.com/2009issues/may-june09/BBP_MayJune09_MicroTrenching.pdf