Broadband Master Plan and Smart City Report

for

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From

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Executive Summary

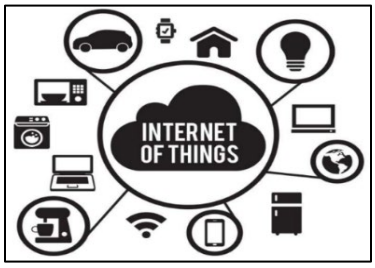
Broadband is a 21st century challenge, ranked as one of the most important technology investments to make worldwide. It is key for economic development purposes, competitiveness, job creation and a new foundation for more prosperous communities. In Newark's case, there is a desire to improve reliability and speeds in the community, including wireless and 5G technologies. Broadband increases the opportunities to achieve these goals.

Access to the internet is a critical part of everyday life for most of the world. The internet, known as a network of networks, allows individuals to connect to each other, no matter where you live or do business in the world. Broadband is the way we connect to the internet, using diverse types of technology such as copper wireline, fiber optics, cellular, wireless, coax or even satellite.

Although there are different technologies, the terms broadband and internet can be interchangeable terms that refer to ability to access the "Net" or internet. "High-speed" broadband is the term for devices to connect to the internet via wireless, fiber optics, hybrid fiber coax or DSL technologies. The Federal Communications Commission has defined broadband as internet speeds of at least 25 megabits per second (Mbps) download and 3 Mbps upload. California has set a higher standard of 100Mbps down and 20 Mbps up.

The internet of things (IoT) refers to a collective network of devices that can communicate with each other, the cloud and other networks. IoT integrates everyday "things" such as refrigerators, TVs, cars, phones and a myriad of devices and implants to continuously monitor and report their status with minimal or no human interaction needed. The IoT relies on broadband, in all its many forms, to connect to the internet.

Figure 1 - Internet of Things



Technology advancements are creating an online reality that cannot be ignored, and any city that does not embrace this new reality will be left behind. Distance learning, telehealth and remote work are requirements for residents to be able to function in this new online environment. Until recently, broadband was viewed as a luxury provided by the private sector, with cities held captive by the whims of these companies.

The City of Newark is no different. Partnering with Government Technology Group LLC (GTG), a Broadband Master Plan and Smart City Study was performed to assess broadband and Smart City opportunities in the city.

The City recognized their community's desire for high-speed, affordable broadband services. Government Technology Group (GTG) performed the assessment of the broadband and Smart City needs of the city, exploring opportunities for improving and expanding high speed broadband communications for all community members in their jurisdiction, while taking advantage of broadband communications to support innovative Smart City solutions.

The assessment included a survey of the community, workshops with residents, stakeholders and businesses and discussions with City staff to obtain a holistic view of their needs.

The outreach performed by GTG shows that the city is well served by broadband internet, but there is a need to expand fiber to other areas of the city to support municipal services and build infrastructure that could be used to improve competition between broadband providers in the city, if determined as a need in the future. Broadband expansion could also be beneficial in improving wireless connectivity in the city for public safety, public works and for the public with expanded 5G services.

For Newark to be successful in moving forward with the recommendations of the Broadband Master Plan the following top six recommendations should occur:

1) Defining roles and responsibilities, assigning a point person to lead broadband efforts, and continual oversight on program initiatives and progress.
2) Establish a staff committee for oversight and accountability for program initiatives and progress.
3) Newark should consider a public private partnership for a partner that can engineer and construct the High-Level Design as well as attract an ISP to provide Internet services to the community. The provider should also have the ability to add public/private WiFi to areas identified by the City.
4) Create policies and procedures relative to broadband development including a dig once policy and development agreement standards.
5) Finally, developing funding mechanisms or financing strategies that help pay for broadband programs (i.e. Technology Fund, PEG fees, Enterprise Funding, Utility User Tax) will be critical for the initial and ongoing success of broadband development.

6) Incrementally build city-owned broadband infrastructure with a P3 if this model is selected.

This report provides recommendations for the organization as a strategic roadmap that focuses on using time and resources efficiently.

Introduction

Methodology

The methodology GTG used for this plan consists of proven steps, encompassing the vital information needed to establish a Broadband/Smart City plan and the steps to accomplish said plan.

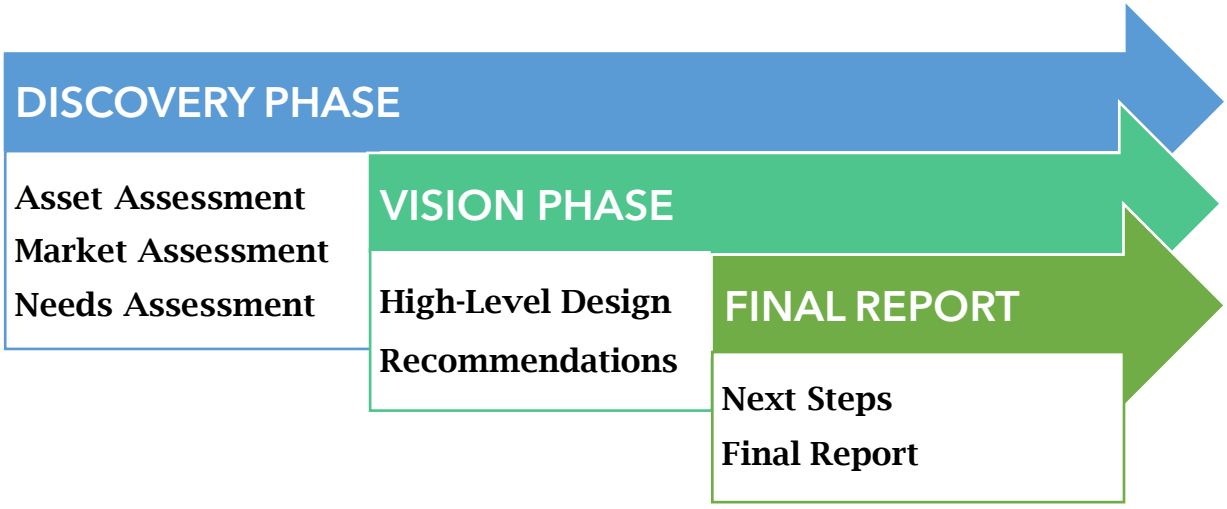


Figure 2- Methodology

Asset Assessment is investigating and analyzing what assets—street and traffic lights, towers, existing conduit or fiber, for example —exist in the city that can be leveraged for the expansion of broadband. GTG looks at city-owned assets as well as privately owned assets.

Market Assessment includes researching the area and discovering what services are available, in what areas they are available and at what price.

Needs Assessment is required to understand what the city needs to support economic development, as well as community needs related to broadband and Smart City innovation.

High-Level Design provides a road map for the expansion of broadband through construction. Although it is not always recommended that municipalities build a network to serve the community, a high-level design is necessary to understand what it would take to build a network, providing the city an opportunity to incrementally build and take advantage of Dig Once policies, developer agreements and capital projects.

Recommendations comprise the totality of the report, with an outline of the direction the city should follow to support the needs of the community.

Next Steps apply actions to the recommendations to accomplish the tasks required for implementation of the broadband and Smart City plan.

Final Report and Presentation including all the elements outlined above in a final document and presentation to staff, city council and the public, if desired.

Key Findings

- Expanding broadband to city facilities will reduce telecommunication costs for the city, while providing a foundation for improved services, such as attracting a private sector partner to expand low-cost, high-speed internet within the city.
- Most community members have access to high-speed broadband, but the existing infrastructure is not future proof i.e. fiber. Some providers are using a hybrid fiber coax solution while others continue to use dated copper lines.
- Internet Service Provider broadband infrastructure is dated impacting reliability.
- Cellular coverage within city facilities is lacking or spotty. This could be due to saturation of coverage or something blocking the signal i.e., trees and buildings.
- There is a desire for Wi-Fi for business, inclusivity, old town area, restaurant row, the Senior Center, community center and parks.
- Newark is interested in developing broadband in a way that offers a competitive advantage for its community.
- The City lacks a Dig Once policy and Developer Agreement standards for expanding broadband infrastructure at a reduced cost to the city.
- Broadband access and affordability are issues for lower-income residents. All businesses—particularly large, technology-focused businesses—need reliable, modern broadband infrastructure.

- Newark works closely with property owners and developers to streamline the development and building permit review and inspection processes. The City should continue enhancing these processes as needed.
- The City issued an RFP to reduce telephone and Internet costs to select facilities. The City's broadband plan should be considered during the evaluation process to assist in reducing costs while improving speeds and reliability.
- The City has a security framework in place, a foundational piece to support Smart City/Connected Community programs.
- The City has multiple opportunities to implement Smart City solutions, taking advantage of broadband infrastructure planned for implementation.
- The City is in the process of updating its streetlights. The new streetlights are Smart City/Connected Community ready i.e., they can be used to expand Wi-Fi when funding becomes available.
- The City has Smart City/Connected Community projects and services in place, i.e., eNotifications, TextMyGov.
- There is a desire to improve cellular coverage at the Mall and Costco. The City can help provide Wi-Fi outside the buildings, but private businesses need to work with cellular providers to improve service inside the buildings.

Asset Assessment

Assets are everything owned by a city that has inherent value. This includes physical items, as well as the non-physical, such as space and intellectual property. Asset inventory is one of the first steps in the planning process and is required to find a starting point for infrastructure expansion. For this study, GTG focused on assets that are or can be utilized for broadband. Some assets evaluated include:

- Network equipment
- Fiber optic cables
- In ground conduits
- Wireless towers and antennas
- Agreements with assets attached
- Office space, rack space

Planned Assets

Planned assets and capital improvement projects are necessary to track and are included in the network designing process because they can add a great deal of infrastructure at a reduced cost. These projects can also speed up deployment by taking advantage of opportunities that can be used later when needed. Some of the opportunities can be agreements with other agencies, counites, rail lines, internet service providers (ISPs) and more.

Newark has a few planned projects that fall into these categories:

- **Bayside Transit Oriented Development** – Future major Bay Area regional rail and bus transit center, which includes a large transit oriented residential development, located in the southwest portion of the city near the intersection of Enterprise Dr. and Willow Street.
- **Traffic Signal Interconnect** – Three separate projects running along Cherry St, Thronton Ave, and Newark Blvd provide transportation flow and control improvements.
- **Old Town Project Development Area Streetscape Improvements** – Major project to enhance the downtown core of Newark.

Each of these projects offer Newark improved opportunities to add fiber, conduit, and access points as they are developed. Additionally, these projects could help Newark expand its reach of fiber throughout the community, providing opportunities for residents, businesses, schools, and other government facilities to gain access to high-speed broadband infrastructure.

City-Owned Broadband Infrastructure

The City owns limited broadband infrastructure. To provide improved services for the community and the potential for enhanced internet services for community, the city should take advantage of Dig Once policies and regional efforts to build out the high-level design provided in this report.

Technology Trends

Overall, activities, processes and resources are being digitized. On one level, this is simply a function of the increasing capacity and speed of digital technologies. On another level, these trends are driven by a larger mega-trend

towards demand-driven, pull-based systems, including agile development and lean production.

Pull-based systems produce just-in-time results, like getting a coffee at a cafe; it is not made until you order it. Tying this to agile and lean production, you ensure information is visible and accessible as needed, improving decision making and collaboration, resulting in improved, cost-effective services. Much of the rationale for digitization has centered on cost avoidance or reduction, whereas the larger trend is primarily focused on increasing customer value and revenue in an efficient manner. These trends are interacting with larger socioeconomic factors, particularly the aging population, a shrinking workforce, and climate change. While beyond the scope of this study, this report provides a solid foundation for effectively addressing the trends noted below.

A specific trend directly impacting local governments is the emergence of a *Connected Community (Smart City),* which can be defined as "a place where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and business."[1] While Connected Community activities have often been very technology-centric rather than citizen-centric, the general purpose is to improve and integrate public processes. Generally, Connected Communities focus on energy, environment, and public-facing activities, but major internal changes, typically referred to as digital transformation, are necessary for external improvements.

"*Digital transformation* is the integration of digital technology into all areas of a business, fundamentally changing how businesses, including local governments, operate and deliver value to customers."[2] This has important implications for municipalities, not the least of which relate to residents and other external stakeholders. For Newark, digital transformation means residents are likely working remotely or running businesses from their homes. Of course, this also implies major changes for the city itself. Specifically, citizen/customer-facing systems might be deployed and/or upgraded so the City's operations can be done completely online. This also means the City should be providing some form of connectivity, such as electronic kiosks and

[1] https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en

[2] https://enterprisersproject.com/what-is-digital-transformation

public Wi-Fi, for convenience and for those who do not have access to affordable or reliable internet at home or at their business.

Three related trends are the rise of cloud services, integration of information technologies (IT) with operational technologies (OT), and, most significant for current purposes, emergence of broadband as a utility.

Cloud services include a wide range of applications, data collection, processing and storage and network functions provided via numerous, distributed computing resources. The two major implications for municipalities are (a) reduced need to operate servers but (b) increased costs for and reliance on online services along with (c) new applications—mostly web-based—that were impractical or unavailable in the past.

A general class of cloud-based applications and related technologies focuses on adding intelligence to assets and machines of various sorts, allowing them to be integrated with information technologies (or vice-versa).

Operational technologies (OT) are "programmable systems or devices that interact with the physical environment [to] detect or cause a direct change through the monitoring and/or control of devices, processes and events."[3] For municipalities, OT includes everything from garbage trucks to traffic signals. Increasingly, OT is being added to "dumb" assets such as manholes, SCADA systems, traffic, parking meters and streetlights. Integration with IT enables cost reduction and performance improvement.

Broadband is technically any channelized communications media, but it has come to mean always-on, high-speed internet access. Broadband is important for people, as it allows them to access media content, connect with friends and pursue their interests. As businesses and government undergo digital transformation, broadband is increasingly important in everyday life. Access to education, jobs and healthcare effectively require broadband. On the other side of this trend, businesses and municipalities that do not have and use broadband are at a huge competitive disadvantage. While it may seem a bit pedantic to include broadband as a trend in a report for a broadband study, it is important to understand that broadband isn't an end, but rather a means to improved outcomes that enables other trends.

[3] https://csrc.nist.gov/glossary/term/operational_technology

Beneath all these trends runs a more fundamental observation: The critical and growing need for robust *cybersecurity*. Internet access can provide a way for malicious hackers to steal data from or take over municipal systems. As the amount of OT increases, so do the digital vulnerabilities that allow hackers to control them, operate software bots and attack other systems. Cybersecurity is as much about practices and procedures as well as technologies. For example, "deep fake" technology and spoofing—imitating or taking over accounts—are being used to get critical information or direct payments. People need to be educated about how to recognize possible scams and "social hacks" and avoid them.

Fiber optics has become the gold standard for broadband deployment. There is no broadband deployment medium that can compare to the speeds, symmetrical bandwidth or low latency that fiber optics provide. Wireless, cellular or hybrid fiber-coaxial (HFC) cannot compare to the speeds or reliability of fiber optics. Japan's National Institute of Information and Communications Technology (NICT) set a new speed record over a single strand of fiber at 1.02 petabits per second.[4]

File Downloaded	Apx. File Size	Apx. Download Times							
		Broadband Speed				Fiber Speed			
		1 Mbps	5 Mbps	10 Mbps	20 Mbps	100 Mbps	200 Mbps	300 Mbps	1 Gbps
One song (4 min)	4 MB	30 sec	5 sec	3 sec	1.5 min	0.3 sec	0.15 sec	0.1 sec	Instant
Video clip (5 min)	30 MB	3 min	40 sec	26 sec	13 sec	2.5 sec	1.25 sec	0.8 sec	0.2 sec
Audiobook (9 hours)	110 MB	10 min	2 min	1.5 min	45 sec	9.2 sec	4.6 sec	3 sec	1 sec
TV Show (45 min)	200 MB	20 min	5 min	3 min	1.5 min	16 sec	8 sec	5.3 sec	1.5 sec
HD TV Show (45 min)	600 MB	1 hour	15 min	8 min	4 min	50 sec	25 sec	17 sec	5 sec
Movie (2 hours)	1500 MB	2 hours	25 min	15 min	7 min	1.5 min	45 sec	30 sec	8 sec
HD Movie (2 hours)	4500 MB	6 hours	72 min	1 hour	30 min	4.5 min	2.25 min	1.5 min	25 sec
All speeds and times are estimates, and can vary based on line quality and modem. Source: Fastmetrics.com and Apple.com.									

Figure 3 - Download Times Comparison

Library of Congress - Estimated 240 Terabytes (240,000,000 Megabytes)						
		Seconds	Minutes	Hours	Days	Months
25 Mbps	DSL	9,600,000	160,000	2,667	111	3.7
50 Mbps	Cable	4,800,000	80,000	1,333	56	1.9
100 Mbps	Cable/Fiber	2,400,000	40,000	667	28	

[4] https://www.tvtechnology.com/news/japans-nict-sets-new-data-transmission-speed-record#:~:text=Japanese%20researchers%20have%20set%20a,(32%20miles).

500 Mbps	Cable/Fiber	480,000	8,000	134	6	
1 Gbps	Cable/Fiber	240,000	4,000	67	3	
10 Gbps	Fiber	24,000	400	7		
1.02 Petabits	Fiber	0.227				

Figure 4 - Library of Congress Download Comparison

Fiber optic networks are essential for backhaul of all networks to connect to the internet, including cellular networks. Fiber optic cables are flexible strands of glass that trap the light inside a core only 8-10 microns wide inside of a strand that is 125 microns wide. Trapping and controlling the light allows fiber to avoid the many issues that arise from wireless and copper networks, such as obstacles in a wireless environment and the slow speeds of analogue or digital signals over copper.

Wireless technologies are advancing in ways never imagined. There are two basic trains of thought on broadband: fixed wireline and wireless. The two rarely come together, and proponents of each technology overplay their own importance, thinking that either wireless or wireline is the only way to go. In more urban areas, the reality is wireless last-mile deployment is the future.

Last mile refers to the connection from the street to the resident. This is commonly referred to as fiber-to-the-neighborhood. Fiber optics networks are essential for back-haul, connecting each neighborhood to the internet. However, the cost savings realized by a wireless last mile cannot be overlooked, especially with the current wireless technologies available. Terragraph is a wireless company that uses different technologies and deployment strategies to overcome the inherent issues with the typical wireless deployments. Tarana Wireless is one such company that is reshaping the future of wireless deployments, making it faster, easier, and more cost-effective to deploy high-speed broadband. Companies such as Mimosa, Ubiquity, and others are all creating better, stronger, more resilient equipment with higher bandwidth. Wireless technology is a way that municipalities and private companies quickly deploy more cost-effective networks.

Satellite is another budding technology that is currently experiencing growing pains. Satellite uses light to relay information from the end user to a satellite orbiting the earth at either low level, 250-350 miles above the earth, or as far out as 26,000 miles. Although the signal is travelling at the speed of light, going that far into space, being bounced off a satellite and returning to earth creates exceedingly high latency, the time it takes for data to reach the other end.

Satellite signals are shared, which requires a lot of satellites to be in orbit with many base stations on earth, connected to fiber optic networks providing the end users a connection to the internet.

Starlink wants approval for 30,000 low orbit satellites to be deployed for the satellite network to improve functionality. The Federal Communications Commission (FCC) in December 2022 granted approval for 7,500 satellites to be deployed. However, Starlink was recently denied Rural Digital Opportunity Fund (RDOF) subsidies of nearly $885 million because the satellite provider failed to provide the speeds promised at a high cost per dish required at residents' homes. Satellite technology holds possibilities as a broadband provider to the more rural areas of the USA that have no other options.

"Starlink's technology has real promise," Federal Communications Commission (FCC) chair Jessica Rosenworcel explains. "But the question before us was whether to publicly subsidize it's still developing technology for consumer broadband — which requires that users purchase a $600 dish — with nearly $900 million in universal service funds until 2032."

Artificial Intelligence is a trend that is talked about across every aspect of business and industry. However, Newark should be extremely cautious, as this is an emerging technology that has significant risk associated with putting it in practice.

Newark should consider the following cautionary points as it relates to artificial intelligence, depending on where and how it is planned to be used:

- **Bias.** AI systems are trained on data, and if that data is biased, the AI system will be biased as well. This can lead to discrimination against certain groups of people. Newark should take steps to ensure that the AI systems used are trained on unbiased data.
- **Privacy and security.** AI systems collect and store a lot of data, and this data could be misused or hacked. Newark, as well as all cities, should take steps to protect the privacy and security of the data that is collected and stored by AI systems.
- **Transparency and accountability.** It can be difficult to understand how AI systems make decisions. This can make it difficult to hold AI systems accountable for their decisions.

To help mitigate some of these risks Newark should consider the following:

- **Develop ethics guidelines for the use of AI.** These guidelines should address issues such as bias, privacy, security, transparency, and accountability.

- **Invest in AI research and development.** This research should focus on using AI systems that are more fair, transparent, and accountable.
- **Partner with the private sector and academia to develop and implement AI solutions**. This will help to ensure that Newark is able to access the latest AI technologies and best practices.

While AI could be a powerful tool, it's important to be aware of the maturity and risk associated with it.

Market Analysis

The Market Assessment section of the study serves the purpose of evaluating broadband availability to determine whether it aligns with the requirements of the local market. To gain a more comprehensive understanding of the local broadband landscape in Newark, we conducted an analysis of current services and associated pricing within the city. For effective broadband planning, it is imperative to understand the offerings and costs of technology providers.

Various factors contribute to disparities in broadband access and adoption in different areas. The primary cause of such discrepancies is geographical access to broadband, where certain locations lack providers offering broadband services in proximity. Additionally, the affordability of services plays a pivotal role, as the cost may be prohibitive for some potential subscribers.

Broadband access and adoption are shaped by many factors, encompassing availability, pricing, service quality and the extent to which it caters to a community's needs. In the realm of broadband and telecommunications, service quality primarily revolves around the speed and reliability of the services provided. Broadband is increasingly viewed by many municipalities as a modern utility, given its integral role in our daily lives. Consequently, the focus is predominantly on high-speed, dependable broadband, with customer service becoming a significant consideration only in competitive market environments.

GTG focused on the following questions when conducting the market assessment:

1. What is the current coverage of the local providers?
2. What technologies are offered: fiber-to-the-home, HFC (hybrid fiber-coaxial), DSL, 5G or Satellite?

3. What are the pricing tiers for each provider?

4. What is the competitive nature of broadband in Newark?

GTG conducted a comprehensive analysis of the broadband landscape within the City of Newark, with the aim of assessing the available broadband options for residents, businesses, the city itself and other entities. This analysis delves into several key aspects, including the internet speeds offered, the associated pricing, the providers of these services, the level of competition within the local market and an evaluation of the existing and planned broadband infrastructure.

Key Findings

- The City of Newark is served by local providers. According to network maps shared by the local providers, the community has access to high-speed broadband.
- The largest provider in the area is Comcast/Xfinity and is the only provider that covers around 98% of the city. Providers are outlined next in this section.
- According to the FCC Broadband map, approximately 32% of the residents have access to a FTTH provider, offering up to 1000 Mbps symmetrical download and upload speeds.

FCC Broadband Maps

The FCC Broadband Maps, officially known as the Federal Communications Commission Broadband Data Collection, are a crucial initiative in the United States, designed to improve the accuracy and transparency of broadband coverage data. These maps are instrumental in ensuring that every American has access to reliable, high-speed internet services, playing a pivotal role in shaping broadband policy, investment, and infrastructure development across the country.

Data Collection: The FCC Broadband Maps involves the collection of data from internet service providers (ISPs) to create an up-to-date and detailed representation of broadband coverage nationwide. ISPs are required to report information on the availability of their services, including maximum advertised speeds, technology used (e.g., DSL, cable, fiber) and geographic coverage.

Mapping Accuracy: One of the primary objectives of these maps is to provide an accurate depiction of where broadband services are available and where they

are not. This information is vital for identifying underserved and unserved areas that may lack adequate internet access.

Transparency: The FCC Broadband Maps aim to enhance transparency and accountability in the broadband industry. By making coverage data publicly available, consumers can make more informed choices about their internet service providers and advocate for better connectivity.

Policy Development: The FCC Broadband Maps play a crucial role in informing broadband policy development at federal, state, and local levels. Policymakers use this data to allocate resources, design subsidy programs and prioritize areas in need of improved broadband infrastructure.

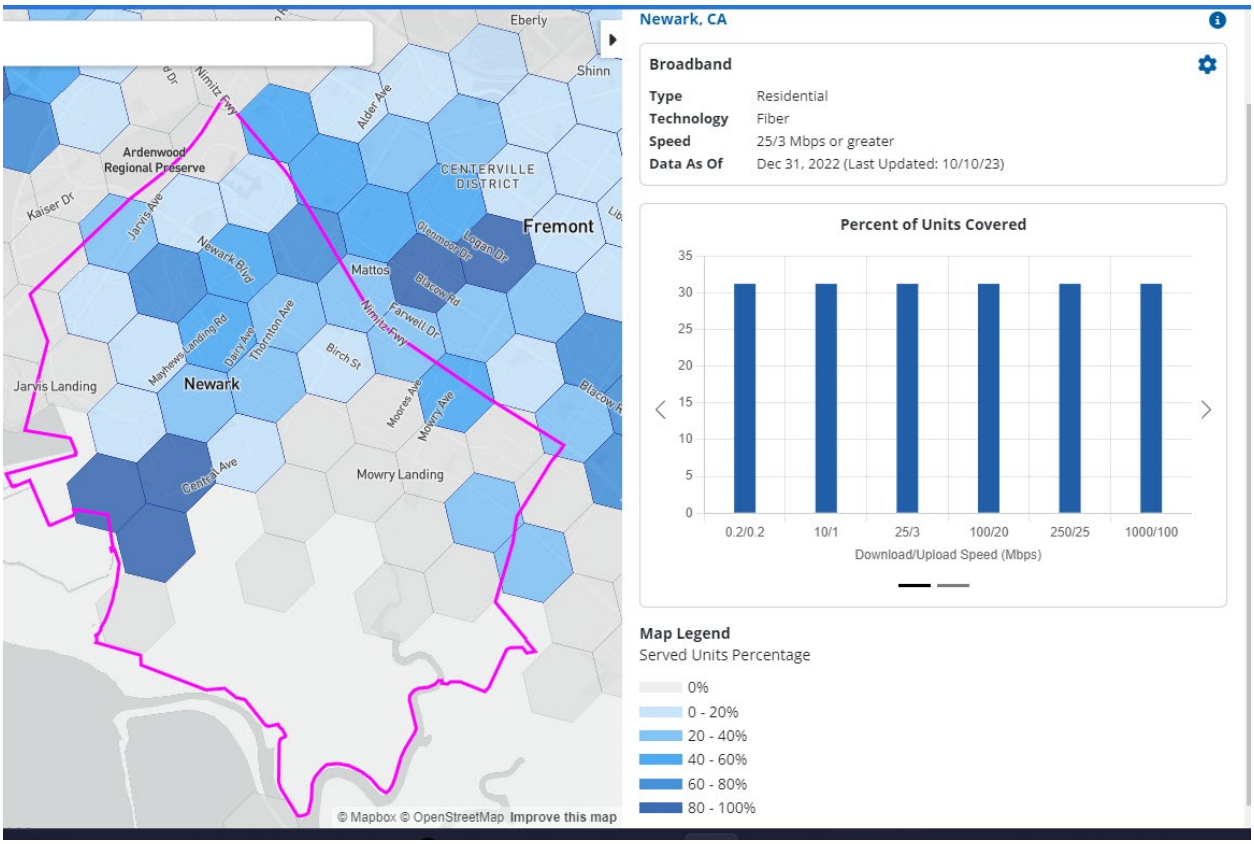
Challenges and Controversies: The accuracy of these maps has been a subject of debate. Critics argue that they may overstate the availability of broadband in certain areas, leading to inadequate funding allocation. There are also concerns about the reliability of ISP-reported data and the need for more independent verification.

Ongoing Improvements: The FCC has been actively working to enhance the quality and reliability of its broadband maps. These improvements include better data collection techniques and increased granularity in mapping, enabling a more precise understanding of coverage in smaller geographic areas.

Impact on Rural and Underserved Communities: Accurate broadband mapping is particularly crucial for rural and underserved communities. It helps direct resources to areas that are most in need, bridging the digital divide and ensuring that all Americans have access to essential online services and opportunities.

In summary, the FCC Broadband Maps are a fundamental tool for shaping the future of internet connectivity in the United States. They enable better-informed decision-making, transparency, and the equitable distribution of broadband resources to ensure that everyone can participate in the digital age. Continued efforts to refine and enhance these maps are essential to address the evolving needs of our increasingly connected society.

FCC Maps can be found at: https://broadbandmap.fcc.gov/location-summary.


Newark, CA
Broadband
Type Residential
Technology Fiber
Speed 25/3 Mbps or greater
Data As Of Dec 31, 2022 (Last Updated: 10/10/23)
Percent of Units Covered
0.2/0.2
10/1
25/3
100/20
250/25
1000/100
Download/Upload Speed (Mbps)
Map Legend
Served Units Percentage
0%
0 - 20%
20 - 40%
40 - 60%
60 - 80%
80 - 100%
Newark
Fremont
Mowry Landing
Jarvis Landing
Ardenwood Regional Preserve
CENTERVILLE DISTRICT
© Mapbox © OpenStreetMap Improve this map

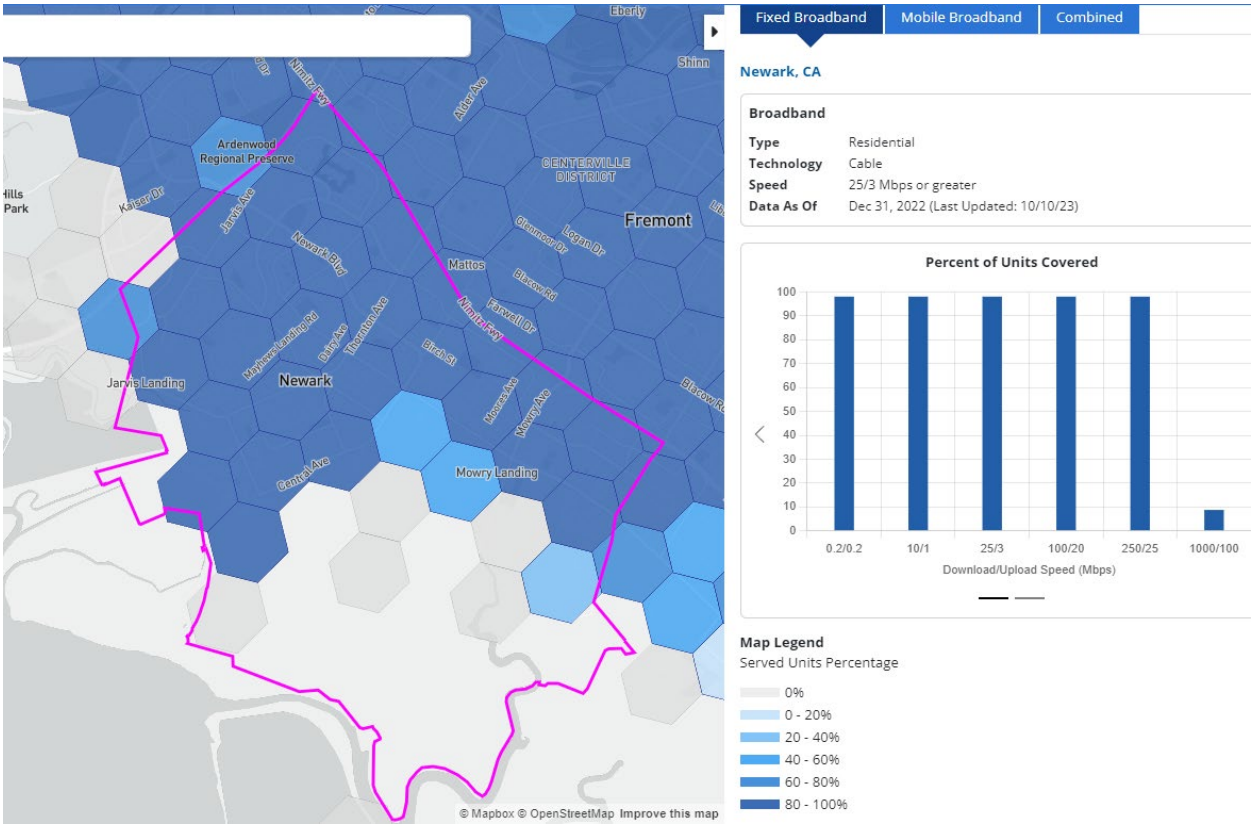

Fixed Broadband
Mobile Broadband
Combined
Newark, CA
Broadband
Type Residential
Technology Cable
Speed 25/3 Mbps or greater
Data As Of Dec 31, 2022 (Last Updated: 10/10/23)
Percent of Units Covered
0.2/0.2
10/1
25/3
100/20
250/25
1000/100
Download/Upload Speed (Mbps)
Map Legend
Served Units Percentage
0%
0 - 20%
20 - 40%
40 - 60%
60 - 80%
80 - 100%
Newark
Fremont
Mowry Landing
Jarvis Landing
Ardenwood Regional Preserve
CENTERVILLE DISTRICT
© Mapbox © OpenStreetMap Improve this map

Figure 5: FCC Broadband Maps, Newark, CA

Providers in Newark

According to the FCC broadband map[5], there are six available providers in Newark: Comcast Corporation, AT&T, Hughes Network Systems LLC, Space Exploration Holdings LLC, T-Mobile USA Inc and ViaSat Ince.

Comcast Corporation is a global media and technology company with two primary businesses: Comcast Cable and NBCUniversal. Comcast Cable is one of the United States' largest video, high-speed Internet and phone providers to residential customers under the XFINITY brand and provides these services to businesses. Comcast is the predominant provider in Newark, serving 63.7% of the city's residents, according to this survey. Current offerings in Newark can be found in the chart below[6].

Provider	Technology	Speed/ Mbps	$/Month	Data limit
Comcast/Xfinity	HFC	75	$51.00	No
Comcast/Xfinity	HFC	200	$35.00	No
Comcast/Xfinity	HFC	400	$50.00	No
Comcast/Xfinity	HFC	800	$60.00	No
Comcast/Xfinity	HFC	1000	$60.00	No
Comcast/Xfinity	HFC	1200	$80.00	No

AT&T, recognized as the world's largest telecommunications company, holds the second-largest position in the mobile phone services industry. Notably, in recent years, this multinational conglomerate ventured significantly into the media and entertainment sectors, particularly through its acquisition of Warner Media in 2018. However, a shift in strategy emerged in February 2021, when AT&T announced its intention to spin off DirecTV, six years after acquiring this satellite TV business. Subsequently, in May of the same year, plans were unveiled to spin off Warner Media and merge it with Discovery.

[5] https://broadbandmap.fcc.gov/location-summary/

[6] https://www.xfinity.com/digital/offers/plan-builder

Under the leadership of CEO John Stankey, AT&T seeks to refocus its efforts on expanding its 5G wireless connectivity capabilities. In pursuit of this objective, the company is currently engaged in a highly competitive, multibillion-dollar battle against rivals such as T-Mobile and Verizon. This battle revolves around achieving the fastest speeds and the most extensive 5G network coverage.

Provider	Technology	Speed/ Mbps	$/Month	Data limit
ATT	Fiber	300	$55.00	No
ATT	Fiber	1000	$65.00	No
ATT	Fiber	1000	$80.00	No

T-Mobile offers 5G home internet for just $50 a month with AutoPay, up to 50% savings against the industry benchmark, or $30 per month for families with Magenta MAX, T-Mobile's most popular phone plan. It's a flat rate, with no added taxes or fees, equipment costs, annual contracts, or price hikes. Availability for this service requires upgrading or constructing 5G antennas. This does not happen on a city-wide basis, but rather an incremental build over time. Coverage in Newark is limited and there is minimal subscribership.

Provider	Technology	Speed/ Mbps	$/Month	Data limit
T-Mobile - Home Internet	5G	max 235	$ 55.00	No

Satellite providers available in the city include ViaSat, HughesNet and Starlink. Satellite companies utilize wireless signals transmitted from a base station/ground unit, bouncing these signals off an array of satellites orbiting the Earth at an average distance of 26,000 miles. Even at the speed of light, a 52,000-mile round trip introduces a significant amount of latency. Latency refers to the time it takes for data to travel from one point on a network to another.

Starlink has begun deploying satellites in a low earth orbit, approximately 350 miles above Earth's surface. Users of these lower orbit satellites experience significantly lower latency, better speeds and overall performance. However, Starlink's proposal to add an additional 9,000 low orbit satellites has been denied for several reasons. Foremost among these is a lack of understanding

about how objects in low Earth orbit behave over time and what might happen when they eventually re-enter the Earth's atmosphere.

Another reason for the denial is the concern about space pollution. Allowing too many objects into orbit could limit our ability to observe space from the Earth's surface and pose potential risks to existing satellites and space missions.

Provider	Technology	Speed/ Mbps	$/Month	Data limit
ViaSat	Satellite	12	$ 69.99	40 GB
	Satellite	25	$ 99.99	60 GB
	Satellite	30	$ 149.99	100 GB
	Satellite	30	$ 199.99	150 GB
	Satellite	30	$ 299.99	300 GB
Hughes Net	Satellite	25	$ 74.99	50 GB
Starlink	Satellite	25	$ 110.00	1 TB

4G Coverage and 5G Coverage

According to the FCC Broadband Map[7] shown below, 3G has been upgraded and is no longer being used or deployed by any courier, with 100% of Newark having access to 4G, 5G and 5G NR. Newark area providers include Verizon, T-Mobile (Metro PCS and Sprint), US Cellular and AT&T. In every city, there are small pockets that are not covered by cellular signals, which are not reported or shown on maps. It is nearly impossible to ascertain this information without metering these signals through mobile mapping efforts. Mobile mapping uses software and antennas, which test and record the signal strength throughout the city and is used to identify pockets that need to be bolstered with more cellular towers. Newark residents report suffering from many pockets of bad

[7] https://broadbandmap.fcc.gov/area-summary/mobile?version=jun2023&geoid=0650916&type=place&zoom=11.95&vlon=-122.109695&vlat=37.521020&tech=tech4g&env=0

cellular coverage that have not been identified by mobile mapping, something that should be accomplished by the cellular providers.

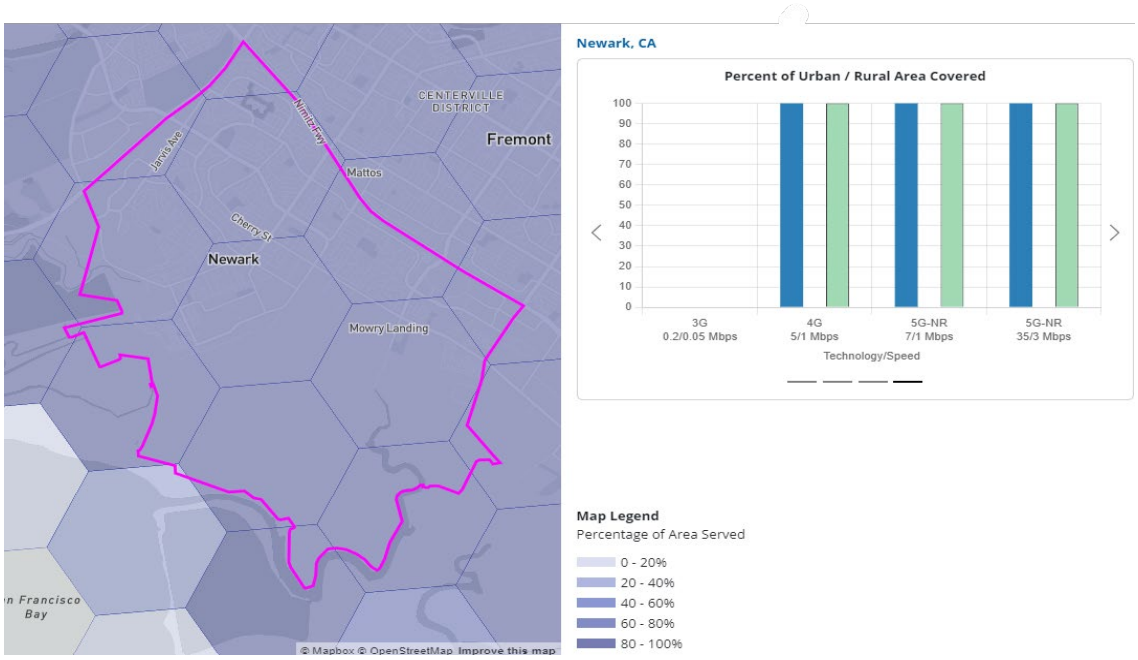


Figure 5 - FCC Broadband 3G, 4G, 5G, and 5G NR (New Radio)

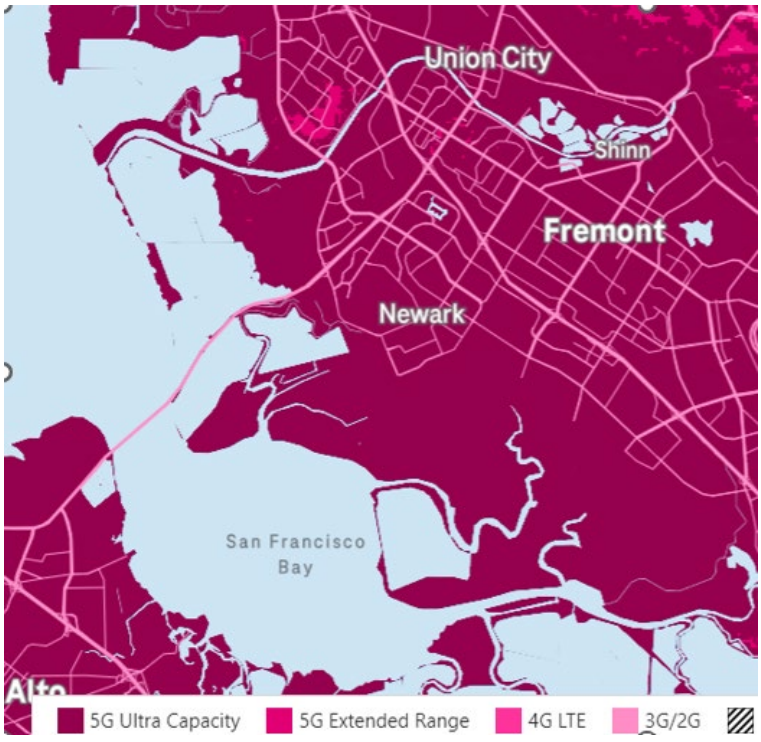


Figure 7 – Verizon Coverage Map

Figure 8 - Verizon coverage map showing availability of 5G Home Internet and 4G LTE

Figure 9 - ATT Coverage Map showing availability of 5G+, 5G and 4G LTE according to AT&T's website

Privately Owned Fiber Optic Cables

In Newark, there are several providers with both metro and long-haul fiber assets, as illustrated in the maps below. The first image (Figure 10), which displays the local metro networks, prominently features assets owned by Crown Castle and CenturyLink (formerly Level 3 fiber). These networks are instrumental in providing high-speed, reliable connectivity within the city.

The second image (Figure 11) showcases the long-haul fiber routes that traverse Newark, and it includes infrastructure owned by Level 3, CenturyLink and Electric Lightwave. These routes follow many of the city's major corridors, serving as the backbone for data transmission over longer distances.

These extensive fiber networks, both metro and long-haul, are essential for supporting the growing demand for data and communication services in Newark. They not only enable businesses, residents and other entities to access high-speed internet, but also play a pivotal role in connecting the city to the broader region and the global digital infrastructure. As Newark continues to develop and expand its technological capabilities, these fiber assets will be crucial in facilitating economic growth, innovation, and improved connectivity for all.

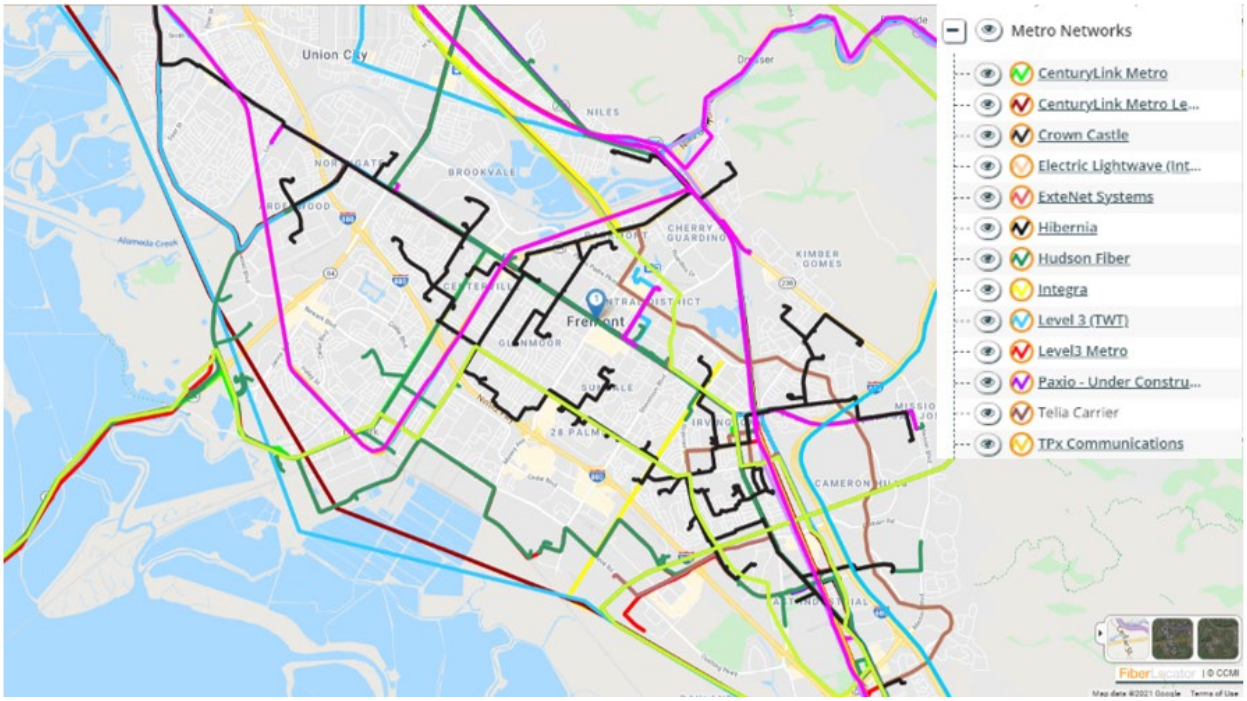


Figure 10 – Assets owned by Crown Castle and CenturyLink

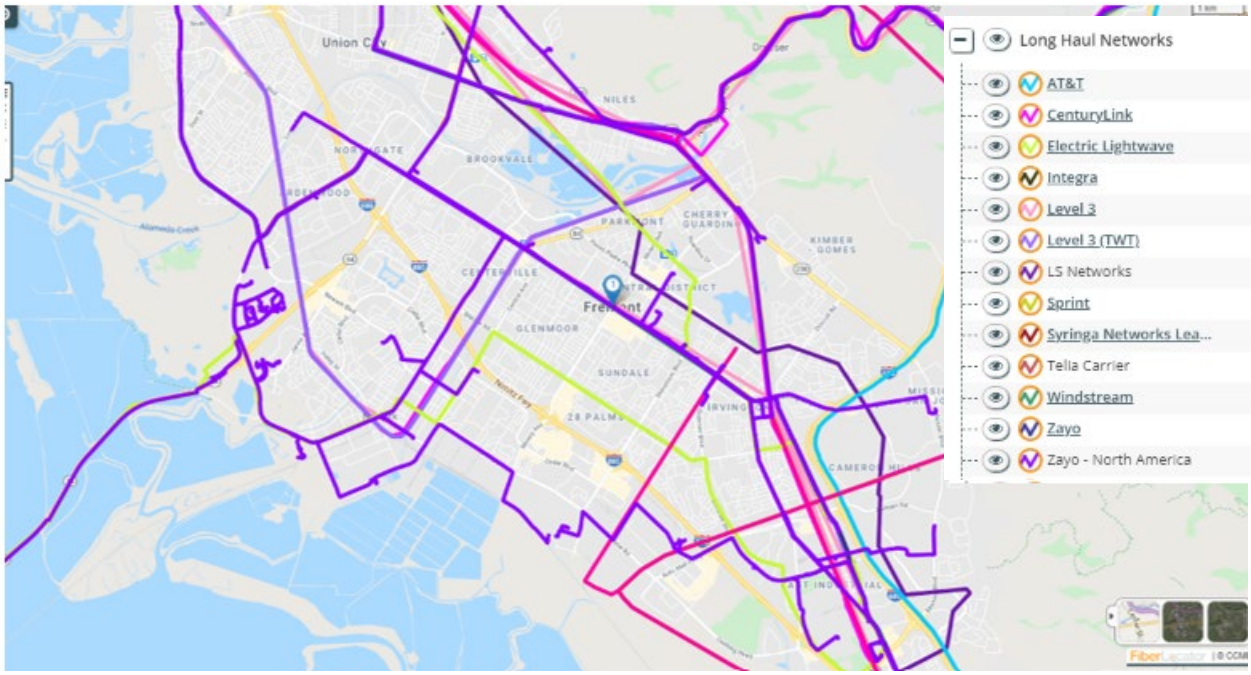


Figure 11 - Newark long-haul fiber routes and infrastructure owned by Level 3, CenturyLink and Electric Lightwave.

Data Centers

Connectivity in any urban area, community or region is predominantly defined by its access to the internet, with the critical factors being internet speeds and available bandwidth. One often underestimated component of a fiber optic network is its links to data centers. These data centers serve as hubs where numerous internet service providers, private enterprise networks (such as Facebook and Amazon), point-to-point connections and various avenues to connect with the global network converge. In the City of Newark, there is one data center situated within its boundaries that was purchased by T5 Data Centers in October 2020:

T5 Data Centers (formerly Apple Newark Data Center)

39800 Eureka Drive

Newark, CA 94560

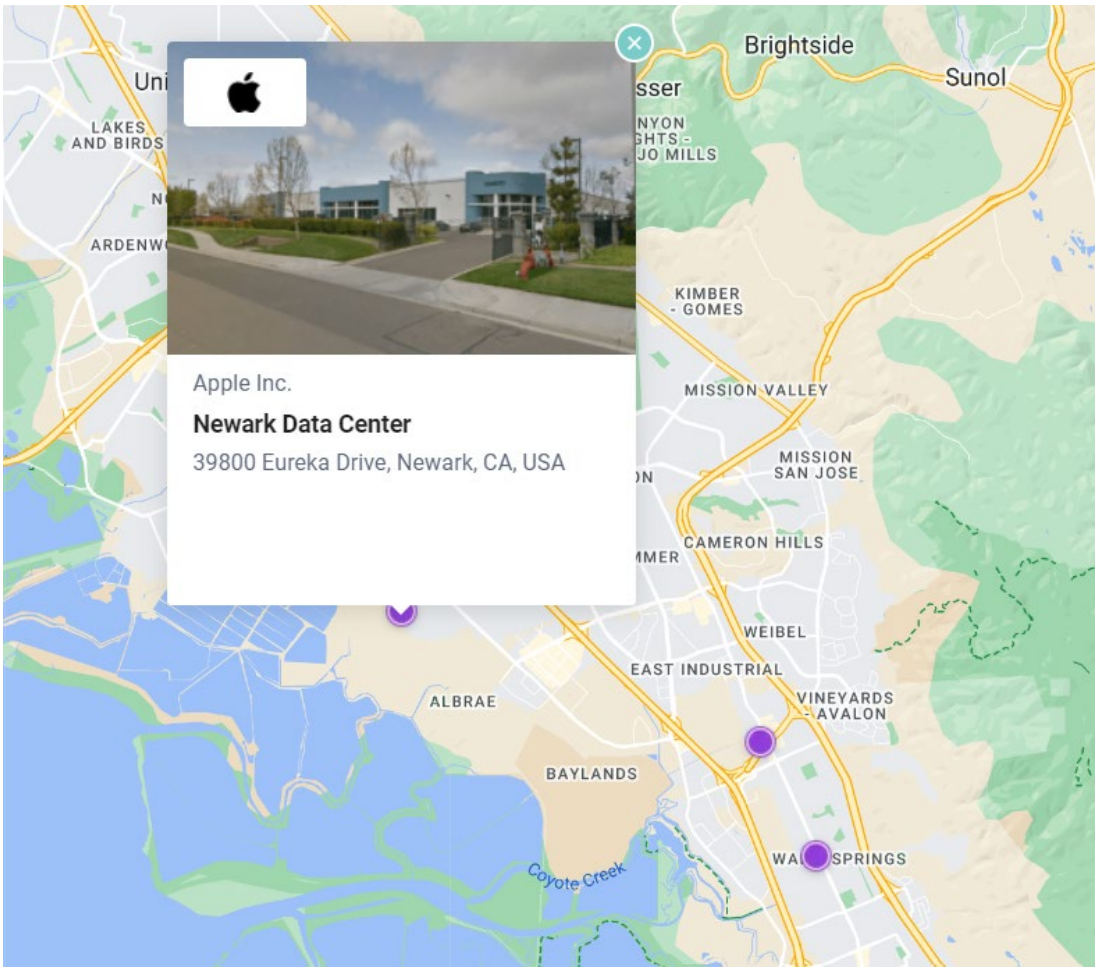


Figure 12 – Data Center in Newark Map

There are 88 data centers within a 25-mile radius of Newark, with the majority in San Jose and San Francisco. With this high concentration of data centers, Newark has options when it comes to connectivity and access to the internet, anchor institutions, other municipalities.

Significant benefits of connecting to a regional hub include business continuity and disaster recovery benefits. These locations allow for offsite storage and redundancy in critical systems that the city could take advantage of.

In addition to private data centers, the California Department of Technology (CDT) is working on the California Middle-Mile project, which refers to the development and implementation of a middle-mile network in the state of California. It is part of the broader effort to expand broadband infrastructure and improve internet connectivity across the state. The project aims to establish a network of fiber optic cables that connect various communities and regions within California, providing a reliable and high-speed backbone for

broadband services. The middle-mile network is planned to run along 680 and I-880. The CDT will also be building Data Hubs approximately every 50 miles on the middle-mile network and splice boxes/vault every 2400 feet. GTG recommends the City coordinate with CDT to determine a location for the connection to the middle-mile network that will provide access to other local governments for sharing communications and having access to high-speed low-cost Internet services in addition to providing areas for disaster recovery equipment.

Other opportunities include working with BART or the City of Fremont to connect the City's fiber network to the regional Oakland hub or the Hurricane hub in Fremont for access to high-speed low cost Internet services.

Conclusion

Newark is served by the local incumbent provider with sufficient broadband to handle the needs of the community in the area outside of complaints related to customer service, reliability, costs and accessibility. It would benefit the area to have a more competitive landscape, however, the area is not being neglected and the City should continue to work with and support the local providers. Studying the 4G and 5G provider coverage maps you can see the entire area has access to 5G cellular coverage and 5G home coverage.

Although Newark is well covered by the local providers and access to broadband seems to be an option for most of the community, in addition to complaints regarding customer service, reliability, costs and accessibility, the issue of adoption comes into view. The lack of adoption can be caused by a few reasons including affordability, access to devices, and digital illiteracy, among others. Newark should become an active participant in helping alleviate the digital divide by adopting programs and raising awareness of the Affordable Connectivity Program, ACP.

Two major complaints from city departments and residents were reliability and speed of 5G coverage with areas that impact public safety, public works, and the community. The City should evaluate the need for additional towers within the city to increase speeds due to saturation and reliability for public safety purposes or determine if this is limited to pockets where buildings, trees, etc. may be causing coverage issues and an additional tower would be unnecessary.

Service Availability

Once the providers are identified, it is important to understand the areas the providers operate within.

Address Assessment

For a better understanding of the availability of providers and the broadband options they offer to specific locations, GTG pulled 40 random addresses and researched the options available at each address. Those results can be found in the chart below. We are not including the actual address researched for privacy concerns.

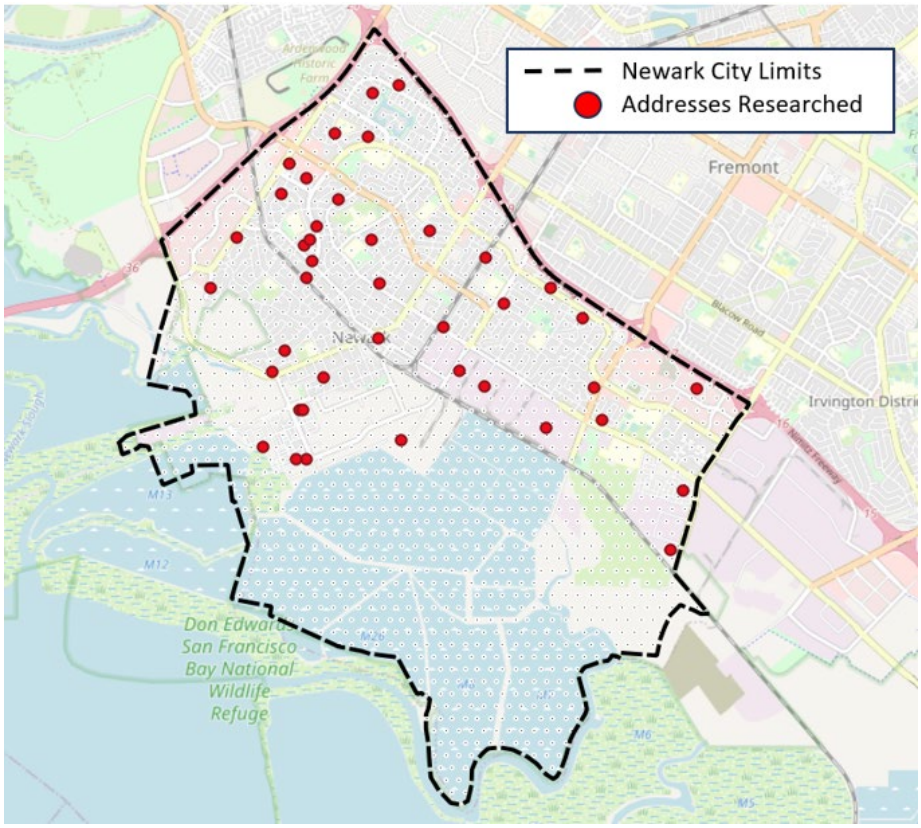


Figure 13 – Address Assessment in City of Newark

Street	Comcast HFC	ATT Fiber	ATT DSL	Satellite	T-Mobile	Fixed wireless
RAMSGATE DR	X		X	X	X	X
BRETON DR	X			X	X	X
REYMOUTH DR	X		X	X	X	
ORLEANS DR	X	X		X	X	X
CRYSTAL SPRINGS DR	X		X	X	X	X
HALEY ST	X	X		X	X	X
COLBERT PL	X	X		X	X	X
PAPAYA ST	X			X		X
CHERRY ST	X			X	X	X
BIRCH ST	X		X	X	X	X
BAY BREEZE ST	X			X	X	X
LUMA TER	X	X		X	X	X
CHERRY ST						
BLUEGRASS CT	X		X	X	X	X
EBBETTS ST	X			X	X	X
CROYDON PL	X		X	X	X	X
ASHBOURNE CT	X		X	X	X	X
MANOR CT	X		X	X	X	
CHAPMAN DR	X		X	X	X	X
DICHONDRA PL	X		X	X	X	X
RAVENWOOD AVE	X		X	X	X	X
JARVIS AVE	X			X	X	X
BENNINGTON DR	X		X	X	X	X
LIDO CT	X		X	X	X	X
GEORGE AVE	X		X	X	X	X
NORMANDY DR	X	X		X	X	X
CEDAR BLVD	X	X		X	X	X
REDEKER PL				X	X	X
CENTRAL AVE				X		X

MARTEL PL	X	X		X	X	X
CARTER AVE	X		X	X	X	X
MORTON AVE				X		X
SHADY HOLLOW DR	X		X	X	X	X
RAILROAD AVE	X		X	X	X	X
MANDARIN AVE				X		X
PEACHTREE AVE	X		X	X	X	X
SANDY COVE WAY	X	X		X	X	X
BLUE ANCHOR WAY	X	X		X	X	X
CENTRAL AVE	X	X		X	X	X
ROCKVIEW WAY	X	X		X	X	X

The table below shows, of the 40 total addresses researched, the providers that were available and the percentage of the coverage offered.

	Comcast HFC	ATT Fiber	ATT DSL	Satellite	Fixed wireless	T-Mobile
Total	**35**	**11**	**18**	**35**	**33**	**34**
Percentage of Households	**88%**	**28%**	**45%**	**88%**	**83%**	**85%**

State of California Maps

The State of California maintains a broadband availability map that, like the FCC, shows addresses that are identified as in need of broadband access. These maps are crucial to understand the areas of the city that need bolstering. These maps represent information that is supplied by the internet service providers and can be used to identify the areas and neighborhoods that each provider supports with broadband service. It is worthwhile to compare the maps identifying locations where the information overlaps and greatly increases the validity of the provided information. To help see the disparities in broadband

speed, the State has the below online "Broadband Interactive Map"[8] that shows, according to state complied and federal data, addresses that have a need for better broadband.

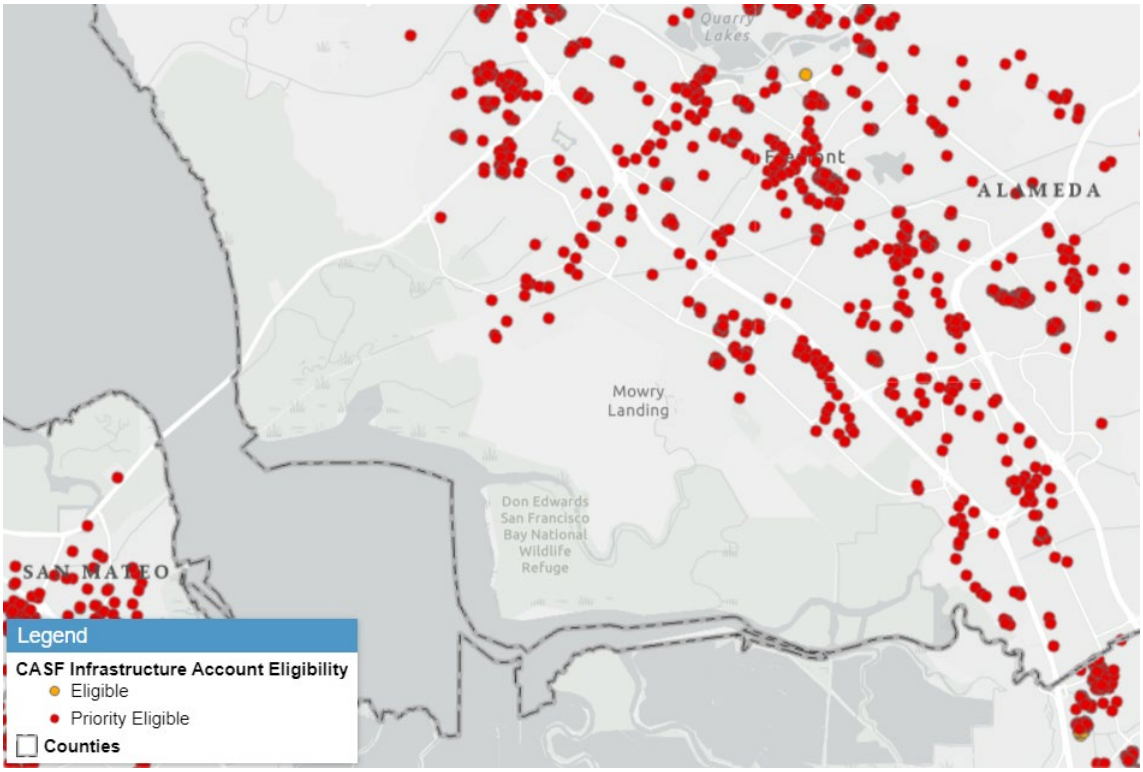


Figure 14 - California Interactive Broadband Map

FCC Broadband Maps

The FCC has a substantial amount of information that is collected through FCC Form 477, a report that providers fill out and self-report the technology they offer and where they offer it. The form has received criticism, claiming that the information is not accurate due to providers wanting to show they offer better services in a wider area than they actually do.

The self-reporting portal, according to the Institute for Local Self-reliance, has inherent flaws such as:[9]

1. ISPs may fill out forms improperly.

[8] https://www.broadbandmap.ca.gov/

[9] https://ilsr.org/when-you-cant-trust-the-data-flaws-in-the-federal-communications-commissions-broadband-forms/

2. The data is out of date.
3. The data only includes maximum advertised download and upload speeds.
4. The submitted data itself overstates availability.

Understanding the results could be flawed, information given by providers clearly shows that Newark is well-served by the local incumbents, stating 100% coverage with 250 Mbps download and 25 Mbps upload. One positive change in the Broadband Data Collection (BDC) is the establishment of mechanisms to dispute the claims of providers, hopefully to further refine the data and provide a realistically accurate portrayal of the current state of broadband.

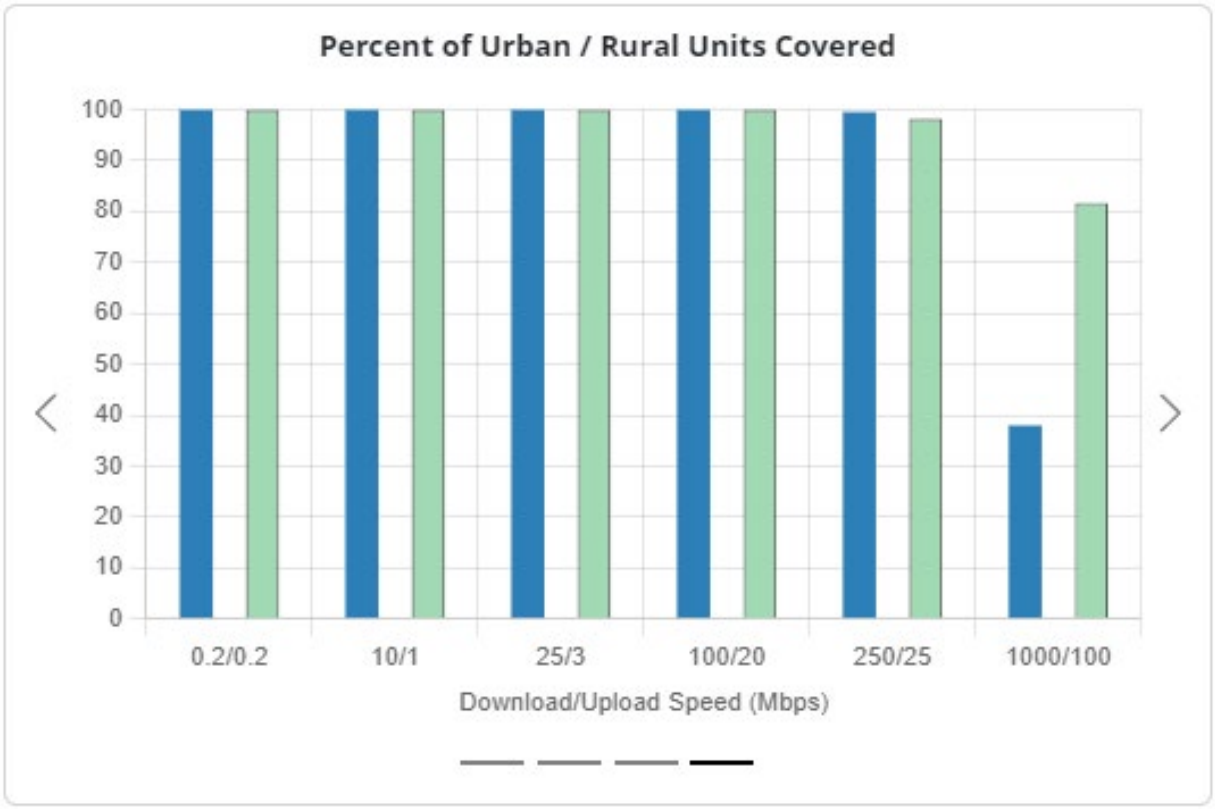


Figure 15 – FCC Form 477 for City of Newark

Goals and Needs

Broadband Survey

To gain insight into the needs of the community, it is important to initiate community engagement to gather input from as many community members as possible. One step that GTG takes to gain as much insight as possible is to conduct an online broadband survey where the respondents can answer questions and provide information from their point of view. The survey was linked from the city's website, and the city promoted it to the public through many different communication channels including social media, mass email marketing, print and digital marketing, word of mouth and in community outreach meetings. At the end of the survey, GTG collected 276 responses.

Survey responses

The completion rate of the survey was 81.5%, with a total of 276 responses. Most respondents, 81%, identified themselves as residents, while 19% identified themselves as local businesses. Although not all responses were complete, the partial surveys include all surveys with at least 75% of the questions filled out. Partial surveys provide valuable information, which is why some of the numbers in the graphs do not always equal 276.

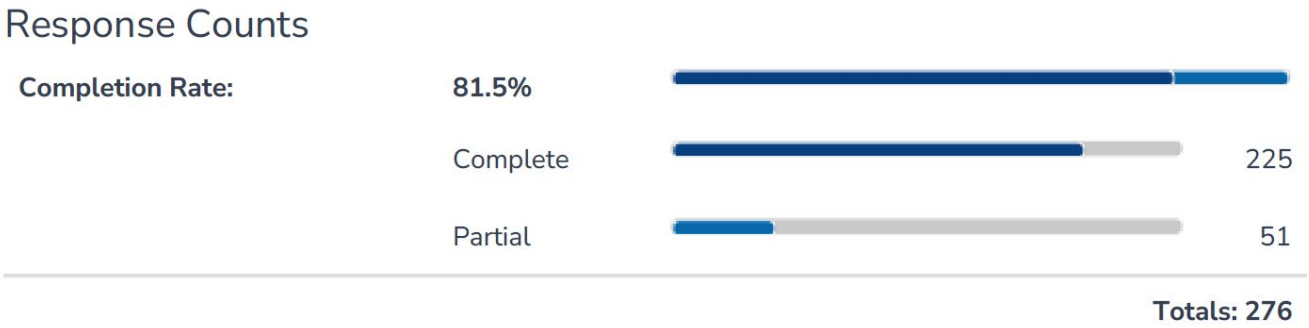


Figure 16 - Response count

The current broadband standard set by the FCC for download speed is 25 Mbps (megabits per second) and 3 Mbps for upload speed. However, it was proposed in July of 2022 to increase the broadband standard to 100 Mbps download and 20 Mbps upload. It has not been adopted on the federal level; however,

California and many other states have set 100 Mbps as the minimum download speed for broadband.

It's important to note the asymmetrical nature of HFC broadband speeds, where the need for downloading data is greater than the need for uploading. This results in standards that are not symmetrical, meaning the download and upload speeds are not the same. All fiber networks can have symmetrical services, and much faster than those of hybrid networks. This survey shows comparison values of both networks.

The data on the adequacy of the internet connection at respondents' locations presents a significant insight into the overall satisfaction with internet services. Despite 55% of respondents affirming the adequacy of their internet connection, the fact that 45% expressed dissatisfaction suggests that there might be underlying issues affecting user experience and expectations.

This discrepancy highlights the importance of not only delivering high-speed broadband, but also ensuring consistent reliability and performance. It indicates that factors such as intermittent service disruptions, latency issues or insufficient customer support might be contributing to the dissatisfaction among a considerable portion of users.

To improve overall satisfaction, it would be beneficial for internet service providers to focus not only on delivering high-speed connections, but also on addressing issues related to service reliability, consistency, and customer support. By paying attention to these factors, providers can ensure that users not only have access to high-speed internet but also enjoy a seamless and reliable online experience, ultimately leading to higher customer satisfaction and loyalty.

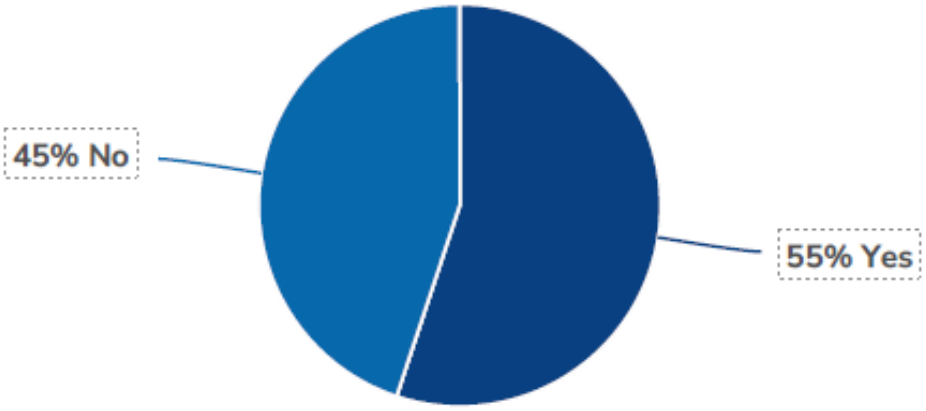


Figure 17 - Internet adequacy survey in City of Newark

The data for internet satisfaction highlights a significant divide in customer sentiment. With 47.3% expressing satisfaction and 52.7% reporting dissatisfaction with their current internet provider, it's evident that there is room for improvement in the service quality and customer experience provided by these companies.

Furthermore, the presence of healthy competition within the market can be advantageous for consumers. When multiple internet providers operate in the same area, it fosters an environment where each company is compelled to enhance its services to attract and retain customers. This competitive pressure often leads to improved offerings, better pricing, and a focus on customer satisfaction.

However, despite the positive influence of competition, it's crucial for providers to address the underlying issues contributing to customer dissatisfaction, such as service reliability and customer support. By prioritizing these aspects, internet providers can work towards enhancing the overall customer experience and fostering greater satisfaction among their customer base.

Value	Percent
Yes	47.3%
No	52.7%

Reliability in broadband refers to the consistent and uninterrupted availability of internet connectivity. It encompasses factors such as network stability, minimal downtime, and consistent speeds. Reliable broadband is crucial for various activities, including remote work, online education, telemedicine, and general internet usage.

To ensure reliable broadband, it is essential for service providers to invest in robust infrastructure, regular maintenance, and efficient customer support. Additionally, the document emphasizes the need for redundancy and backup systems to minimize service disruptions.

While the survey analysis document may not provide specific reliability data for Newark, such as actual down time and outages, it does acknowledge the significance of reliable broadband service for the community. 71% of respondents share that they feel their internet is reliable enough or very reliable. This is positive news for the community, showing that the ISPs are providing good broadband on reliable networks.

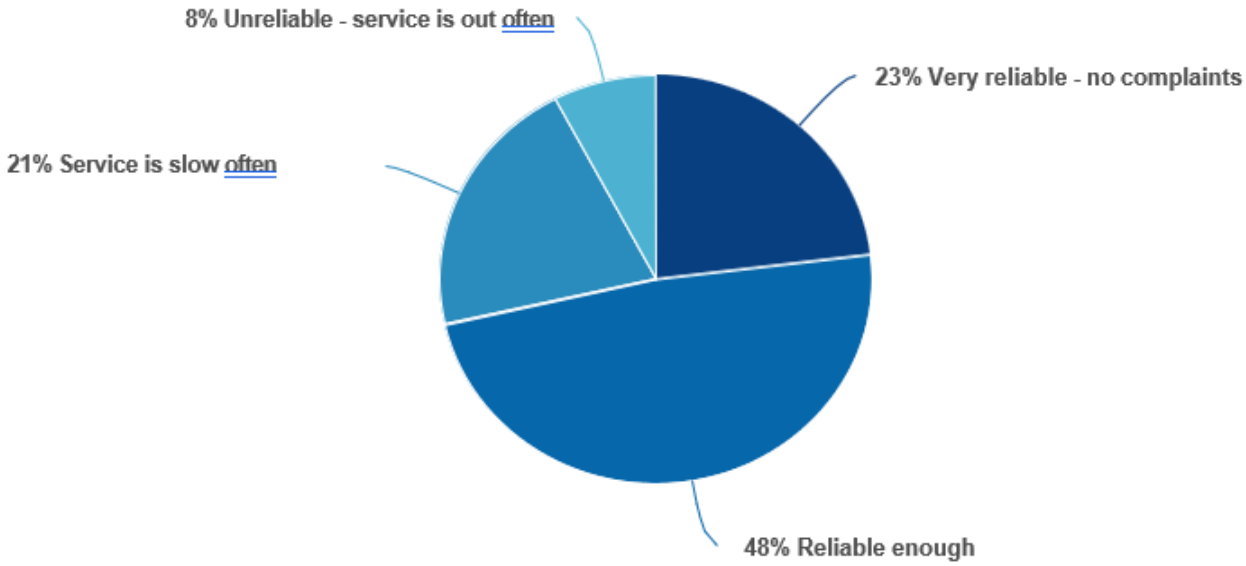


Figure 18 – Reliability survey in City of Newark

Based on the data, the breakdown of internet service providers among the respondents is as follows:

Value	Percent
AT&T	32.4%
Comcast/Xfinity	60.5%
T-Mobile	3.8%
Verizon	0.5%
Other - Write In	2.7%

These percentages represent the distribution of the different internet service providers among the responses. Comcast/Xfinity appears to have the largest share, followed by AT&T, T-Mobile, and Verizon, while a small percentage of respondents are using smaller ISPs.

Speed Test Results

The map depicted in Figure 19 illustrates the respondent locations, categorized by speed test results, ranging from up to 25 Mbps (Federal Minimum), up to 100 Mbps (California minimum), up to 500 Mbps and up to 1000 Mbps (1 Gigabit). The data reveals that areas with high-speed connectivity are spread across the city, whereas locations with slower connections are concentrated primarily in the region south of 880, positioned between Central Blvd and Mowery Ave. The underlying reasons for this area's notably high concentration of DSL subscribers remain ambiguous.

Upon examining why respondents chose their respective service providers, it was commonly reported that these providers were either the sole option available or were perceived as the best available choice. This implies the possibility that some users might be paying for high-speed services that aren't being fully delivered. In the case of respondents utilizing Comcast/Xfinity's HFC network, it may be necessary to consider network upgrades. Meanwhile, for those relying on AT&T's DSL services, the expectation of higher speeds is unrealistic, as DSL is an outdated technology with very limited speeds, commonly meeting the Federal standards but fail to meet the broadband standards set by the State of California.

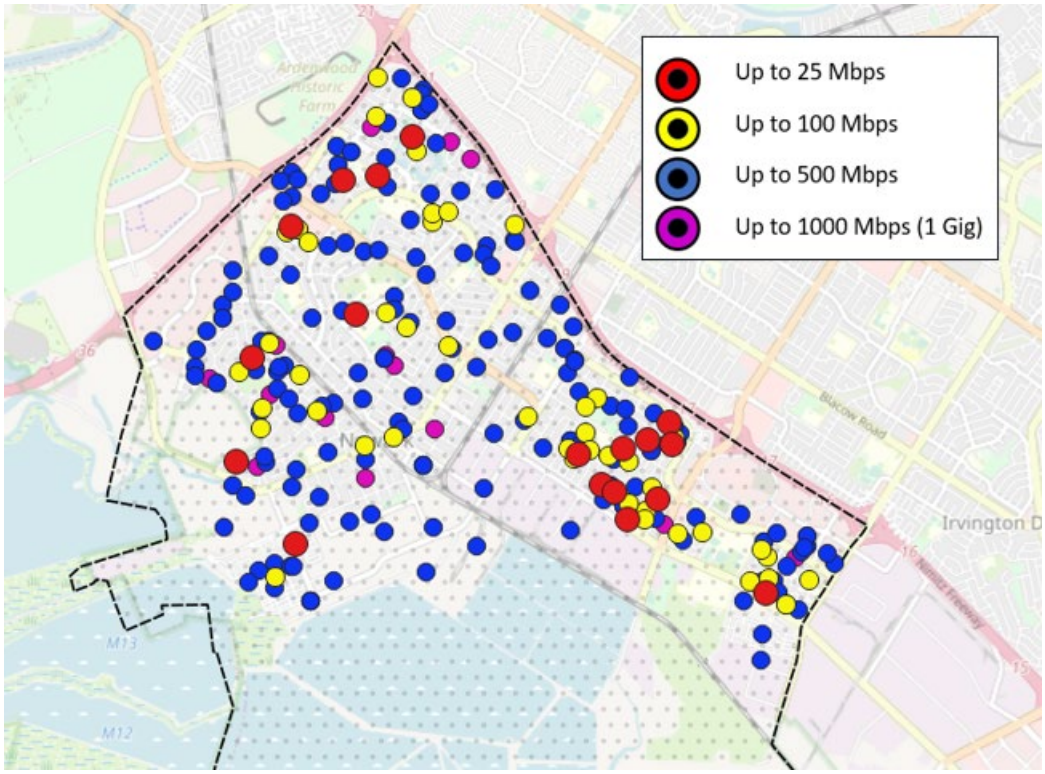


Figure 19 – Respondent locations with corresponding speed test results

Comments from Business Respondents

In the survey conducted by GTG, respondents were invited to share their comments regarding their Internet service. Specifically, businesses were asked "Please explain how better Internet access would impact your organization. Will it help with economic development, services, or sales? Do you have other thoughts on the impact of better Internet access?" It is essential to clarify that GTG did not alter the wording or grammar of any comment, whether they were from businesses, residents or other key stakeholders. The only adjustments made were for the sake of brevity.

Response ID	Comments
262	*At this time we are told we can not improve our service because the area is not wired to accommodate high speed (even though we are paying for it) the service we have now goes out frequently in the early evenings and weekends for minutes at a time. If one or more companies would rewire our area of Newark, we can have choices of carriers, and choose a internet package that would suit our needs*
236	*Better Internet access would significantly enhance the operations and reach of our company. Here's how: Economic Development: A faster and more reliable Internet connection would enable us to tap into global markets, collaborate in real-time with partners and stakeholders regardless of their geographical location, and efficiently utilize cloud-based resources. This would drive productivity and foster innovation, placing us in a competitive position in the marketplace...*
256	*it would help with downloading large format files to create the decal panels for application to our customers vehicles. it would help with downloading parts information and manuals and diagrams along with the need to open files received from customers with their art work and or their damaged units. So yes, it would help with services, sales and the development of our business, to make it better.*
235	*Our building only offers access to T1 lines or higher, which we cannot afford (and maybe now fiber optics) or microwave access using a dish on the roof of the building. There is no other access option. It is very limiting for a small business like ours. There's no cable access or other ways to reasonably purchase internet access. I'm hoping this survey results in better options for the business community.*
223	*We notice frequent glitches and unscheduled outages with Comcast. And, it's very expensive!*

240	*We relied extensively on Zoom sessions, especially during the pandemic. The upload speed available to us was terrible, and the download speed was frequently inadequate. Churches are increasingly reaching out to members at a distance. The available DSL services were inadequate for live streaming -- which is what most churches use now. The limitations have contributed to the ending of our services. Infrastructure along Cedar Blvd is inadequate for ALL utilities.*

Comments from Residents

In the survey conducted by GTG, respondents were invited to share their comments regarding their Internet service. Specifically, residents were asked "What would better broadband mean to you and your family or the area?".

Response ID	Comments
189	*1. I'd love to have 500mbps / 1gbps broadband access for less than $50 per month and not have to haggle with AT&T at the end of every annual contract that I will be switching to Comcast and then they magically bring the price down for another 12 months. 2. There seems to be a relatively local player, SAIL internet which uses AT&T backbone, is there a chance to get them to become a approved provider by the city?*
238	*ATT said for years that fiber options were coming, but after 10 years of waiting, nada. So cable was the best option. Connectivity means everything to compete in the world today and stay informed. The speed of that connection will determine the rate of information and response in certain situations. Extremely important to stay relevant.*
187	*Better choice of providers who all provide the same level of service and speed. Right now, comcast/xfinity are the only ones who provide a decent service with speed needed.*

181	*Better upload speed and removal a caps would allow me to work from home*
25	*Better work and education experience. I am full time remote worker.*
195	*Broadband access is becoming as necessary as water. electricity, etc. It is important for business as many times the decision to locate at a specific city is based on availability of broadband access.*
173	*Broadband should be free*
102	*Cell service is really bad on my cell phone-get a lot of dropped calls (phone uses my Wi-Fi) Internet disconnects fairly often. I need a stable one because I work from home*
48	*Cheaper, more competition.*
65	*Comcast is very expensive & constantly raising its rates. I am a retired senior, but I haven't qualified for ACP for some reason.*
213	*Comment: When we move to the Birch Grove neighborhood in 2020 we were originally with AT&T, we switch ISPs because the DSL in the neighborhood were so bad that cause one of our DSL lines to go offline repeatedly. My hope is with this broadband masterplan it will prioritize the Birch Grove neighborhood to get fiber optic.*
141	*connectivity speeds of 1gbps which power all the connected devices for todays needs and future needs at an affordable cost.*
119	*Consistent download speeds. Even though we have high speed internet, sometimes the response is slow.*
174	*Consistent speed, no drop services and affordable .*
148	*Cost. Broadband is not available at my address.*
50	Download speed ã€‹ 500 mbps , upload ã€‹200 mbps . No sudden drops

129	*Easier to stay connected throughout the city especially in newer housing developments where service can be minimal.*
175	*Everyone having Internet accessibility is very important to our family. I think it's important for everybody to have equity and opportunity in resources.*
36	*We have service through AT&T and Xfinity. This is in case one goes down, as I work from home. It would be nice if the services didn't 'hiccup' as much as they do.*
205	*We need choices with our broadband provider and better cellular service,*
108	*We take meetings from home. Our children like the stream shows. The internet has always been horrible in this area. They told us that the wires run underground are disconnected (per ATT) we would love to be able to do the things we need to do without such slow speeds and the constant loss of connection.*
44	*We use Comcast Business to get better broadband than residential already, so we are satisfied, except it is expensive.*
155	*We would fiber optic internet*
92	*We would prefer to have fiber internet over cable.*
117	*When we moved here in 2020, we had AT&T as our ISP but we ran into problems by the fact of the lines kept on going down and slowing down our speed after a year of working with AT&T it was determined that the lines in the house was fine but the outside line were the issue. My comment is that I am sure that I am not the only person in the birch grove area that is having this issue. Since we are on T-mobile home internet we have zero issues with our interent.*
176	*Would like to automate as much of the home as possible*

Affordable Connectivity Program (ACP)

The FCC introduced the Affordable Connectivity Program (ACP) to improve broadband accessibility and affordability for low-income households. Qualified households can receive a $30 monthly subsidy from participating broadband providers, lowering the cost of securing a 100 Mbps download speed broadband connection. By making internet access more affordable, the ACP aims to reduce the digital divide. Cities can effectively promote the advantages of the ACP to residents and program managers serving disadvantaged communities.

According to data from educationsuperhighway.com, a key ACP adoption tracker and information provider, the table below displays a 26% adoption rate among eligible families within city limits. The data also highlights that 738 eligible households currently lack regular internet access and often rely on cellular hotspots for connectivity. Notably, cellular providers, being private entities, operate on profit-oriented business models, limiting the public sector's control and influence over the coverage they provide.

City	Adoption Rate	Eligible Households	Enrolled Households	Eligible Unconnected Households
Newark	26%	4488	1146	738

Among the survey respondents, the table below indicates the levels of awareness and adoption. It is concerning that only 26% of the eligible households in Newark are utilizing the program, especially considering the national average adoption rate of 80%. Given this significant gap, the City of Newark should prioritize promoting and increasing awareness of the program in underserved areas, aiming to bridge the digital divide.

KNOW ABOUT THE ACP		
Yes	39.9%	67
No	60.1%	101

TAKING ADVANTAGE OF ACP		
Yes	1.2%	2
No	98.8%	166

It should be noted that 34 respondents would like to receive additional information regarding the ACP.

Community Outreach Meetings

To gather information regarding the needs of the community in Newark, GTG, working with City staff, held a stakeholder outreach/listening session allowing the public to voice their opinions in a structured manner. Although the meeting had relatively low attendance, the participants provided some quality information. The low attendance was more than likely due to the broadband availability in Newark. The meetings were publicized by City staff with emails, publications and signs being used to inform the public of the meetings. The public tends to only attend these types of meetings if there is a serious problem they are experiencing, or the state of broadband is overall unsatisfactory. Newark is well served by the local incumbents presumably leading to the low meeting attendance.

Policies

The City of Newark does not have policies in place regarding broadband and related assets. Basic broadband policies include a Dig Once policy or joint build, master license agreement, construction standards, developer agreements or similar mechanisms.

A Dig Once policy would include procedures to facilitate broadband development and minimize restoration issues. Developer agreements are another way to have developers of larger parcels or land development provide broadband infrastructure. These could be put in place to reduce costs for expanding broadband in Newark and to support City services.

Permitting and restoration requirements follow city standard processes and timelines. The city should evaluate an expedited process to support broadband expansion.

On a positive note, the city's general plan does reference technology in multiple areas. This is a best practice that Newark has in place including:

1. LU-1.5 Technology Focus. Promote the city as a good location for technology businesses and clean industry, capitalizing on Newark's location within Silicon Valley.
2. Action T-2.D. Utilize Technology to Improve Safety. Evaluate and implement alternative safety measures for bicyclists and pedestrians using the latest technologies available.
3. Policy E D-1.2 Newark's Competitive Edge. Maintain and enhance Newark's competitive edge relative to other cities in the East Bay, Silicon Valley, and Peninsula Areas, particularly in the **technology** sector. This will require competitive fees and fast processing times.
4. Policy E D-1.7 Flexibility. Ensure that city policies, zoning, and economic development programs are flexible enough to respond to rapid changes in **technology**, real estate market dynamics, and the workplace. Economic development efforts should be modified and adapted as necessary as local, regional, national, and global economic conditions evolve.
5. Emergency Preparedness references to updating response to new requirements, technology, and communication protocol.
6. Action EH-1.B Code Updates. Periodically revise construction codes and regulations to incorporate the latest **information** and **technology** related to natural hazards such as earthquakes and flooding.

This plan supports expanding broadband and Smart City initiatives to enhance public safety, economic development, transportation, and mobility, as well as other improvements that increase efficiency and expand services to Newark's community.

Gaps

The gaps in fiber optic infrastructure appear to be in a lack of consistent coverage by the incumbents. Deciding where and how to build in any city or urban area is a highly secretive process and usually does not make clear sense to anyone reviewing coverage maps. Newark is not different, as shown in the

map below, with select neighborhoods built with FTTP (fiber-to-the-premise) as reported by a national incumbent, while the neighboring areas are not built. This creates gaps for the City of Newark to try to solve and encourage providers to build satisfactory networks.

As you can also see in Figure 20 below, there is virtually no fiber network or access in the business areas around the city, with the incumbent providers not offering fiber services to commercial market. The incumbent providers will on occasion support businesses with fiber connectivity, however at very high upfront construction costs. Consequently, reliability and speed seem to be major issues for businesses. It is important that the city supports economic development, especially in the retail sector, as the city relies on sales tax as a major revenue source.

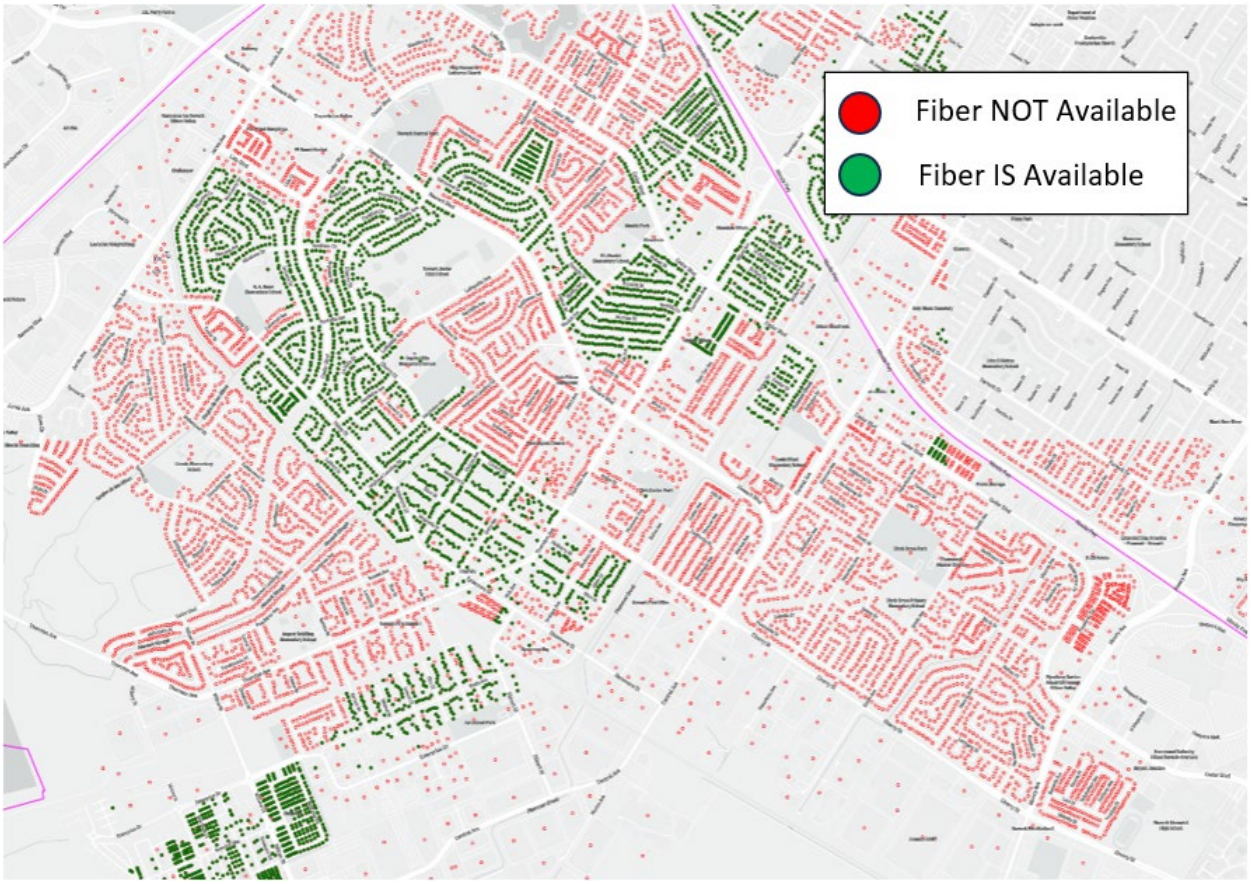


Figure 20 – Fiber service availability

Newark has major gaps in its policies related to fiber and other network infrastructure. These gaps include:

- Dig Once policies and joint-build policies and programs.
- Developer Agreements that include fiber and conduit expansion.

- Siting cell sites and antennas on public assets/property, including a master license agreement
- Assets to leverage an expansion of the fiber network
- Fiber services to a significant portion of the commercial and industrial sectors of the city, as outlined in phase areas 1 – 3, which is detailed further in the report.

Conceptual Design

High-Level Designs (HLDs) represent a conceptual framework featuring routes, potential construction methods and overall project estimated footage, offering a budgetary overview and potential timeframes for project completion.

The City of Newark presents a distinctive scenario, necessitating a tailored approach to HLD development that caters to the diverse needs of its community. With varying levels of internet accessibility among residents, ranging from robust connectivity to the absence of broadband, the HLD must address the connectivity of city facilities, support residents lacking broadband access and contribute to the economic development of Newark.

The HLD is strategically put together, prioritizing the use of the most cost-effective construction methods. Initial considerations involve leveraging existing infrastructure, such as fiber optic cables, conduits, and other pre-existing assets, before implementing new construction. Underground construction, such as boring and plowing, are generally recognized as the most expensive and time-consuming approaches to network development. While the expenses associated with new construction methods can vary significantly, they generally surpass the costs of utilizing existing infrastructure. The chart below illustrates the available construction methods along with estimated costs for each.

Construction Methods	Estimated Cost/Foot	Brief Description
Existing Infrastructure		
Existing city owned fiber optic cable	$4 – $10	Re-splicing, adding splice cases, testing, and documenting existing fiber
Existing city owned empty conduit	$10 – $15	Placing new cable in existing conduit, splicing, splice cases, testing and documenting fiber

Remove and replace city owned Fiber	$25 – $35	Removing working circuits, splicing, adding splice cases, testing, and documenting existing fiber
Upgrade traffic interconnect conduit	$30 – $40	Removing interconnect cables, upgrade handholes and sweeps, pull new cable, splice, test, and document
Aerial Construction		
Over lash aerial cable	$7 – $15	Pole Loading, place new cable on existing strand (over lash), splice, test, and document
New attachment aerial cable	$15 – $25	Pole load, build new attachments, place strand, lash cable, splice, test, and document
New aerial with new poles	$90 – $120	Same as above but must permit and place new telephone poles first.
Underground Construction		
Plowing	$30 – $40	Using a vibratory plow with 4' stinger to place conduit prior to new cable placement
Micro trenching	$20 – $30	Micro trenching uses a thin 1" – 2" by 12" deep to cut a trench into the ground, pavement, or other and place conduit in the trench and seal it with special material to prevent cable from coming out of the trench.
Rock Wheel	$110 – $125	Uses a 6" – 8" blade to cut a trench up to 36" deep through any material including rock, gravel, asphalt, dirt etc.
Boring/Directional Drilling	$95 – $120	Uses rods and a machine to drill a hole under the surface of the earth at any depth needed with minimal disturbance
Open trench	$80 - $100	Using machines like mini excavators, backhoes, shovels to open a trench to place conduit and back fill over conduit

Assumptions used for the City of Newark HLD include:

- The HLD consists of connecting city facilities. By prioritizing the facilities according to usage and cost to construct, the HLD is broken into 3 phases.

- The HLD was updated per Council feedback to add fiber and WiFi connections to four City Parks, improving access to underserved areas within the City.
- All new underground construction will be directional drilling/boring.
- Construction costs are for infrastructure, including cable, splicing, and prevailing wage.
- Construction methods are chosen in order of cost effectiveness, providing a fiscally responsible build.
- Due to all construction and engineering costs increasing by over 30% after COVID-19, the HLD cost assumptions include a 20% contingency.
- City assets will be used to house all major equipment and power needed to build, run, and maintain the network.
- All cabinets, hubs, distribution multiport service terminals (MSTs) and other assets built must be placed in the public right-of-way.
- Routes are based on road access. There may be easements to lessen the footage and will be discovered during the low-level engineering.

Tradeoffs

Construction methods cost very differently, and the inclination would be to use the least expensive methods to save on the up-front capital investment needed. However, all construction methods have positive and negative elements, and the tradeoffs are something that needs to be considered in advance of construction of a network. Below are some examples of tradeoffs when considering different construction methods.

Example 1: New underground construction can be done in a variety of ways, with boring being one of the most expensive. Microtrenching is one of the least expensive methods but has drawbacks that need to be evaluated and mitigated prior to use. Microtrenching is a shallow underground technique that is a viable in neighborhoods where there is little traffic and little exposure to major emergencies, such as water main breaks, that require major excavation in a hurried manner, possibly exposing the shallower fiber to damage and outages. However, in major intersections, heavily travelled roads, water mains, storm drains, side sidewalks and gutters microtrenching present a much higher risk to damage than using directional drilling/boring, which is much deeper at 36” - 48” deep on average.

Example 2: Aerial construction is one of the fastest construction methods to deploy. The positive reasons for building aerial infrastructure include speed to deploy, relatively inexpensive labor costs versus other methods and easily inspectable infrastructure. With the cost of aerial about 1/5th to 1/4th that of new underground (boring), it makes aerial the obvious choice. However, there are negatives involved with aerial construction that must be understood and accepted prior to being used. This includes a vulnerable infrastructure more easily damaged and susceptible to vandalism, as well as yearly pole lease fees, making aerial not as attractive over time. The yearly pole leasing fees add up and can negate any cost savings over a matter of 20 years. It is important to understand the tradeoffs when it comes to construction methods and how those factors can affect the network overtime. Especially the upfront capex costs versus the operational costs.

Example 3: Underground construction has very high initial costs and a myriad of additional operational costs. Anyone doing underground digging must call 811 to avoid hitting utilities that have been buried. All owners of underground infrastructure must respond to these calls and mark where the underground infrastructure is located. These services have costs associated with them, which are usually outsourced to companies specializing in locating underground utilities. In the event of damage to underground infrastructure, this maintenance can be very expensive, with costs estimated to be 5% - 10% of the total network cost annually.

One can see that when viewed as a process and not simply a construction method, but rather using operating costs, vulnerabilities and other concerns, choosing a infrastructure can be a far more complicated process than initial cost alone.

Phasing

Most city-wide networks are broken into smaller phased areas that are meant to speed up deployment, bring in revenue prior to the entire network being built and to provide milestones to gauge budget, timing, and overall success of the project.

An additional benefit to the city in replacing current broadband services is reducing the reliance on very high-cost internet services and connections.

Phase	Construction Type	Est Footage	Miles	Percentage
Phase 1	Aerial	8,239	1.56	46%
	New Underground	9,599	1.82	54%
Phase 1 Total		**17,839**	**3.38**	
Phase 2	Aerial	3,203	0.61	64%
	New Underground	1,788	0..34	36%
Phase 2 Total		**4,991**	**0.95**	
Phase 3	Aerial	4,986	0.94	74%
	New Underground	1,717	0.33	26%
Phase 3 Total		**6,703**	**1.270**	
Grand Total		**29,532**	**5.59**	
20% Contingency		**35,438**	**6.71**	

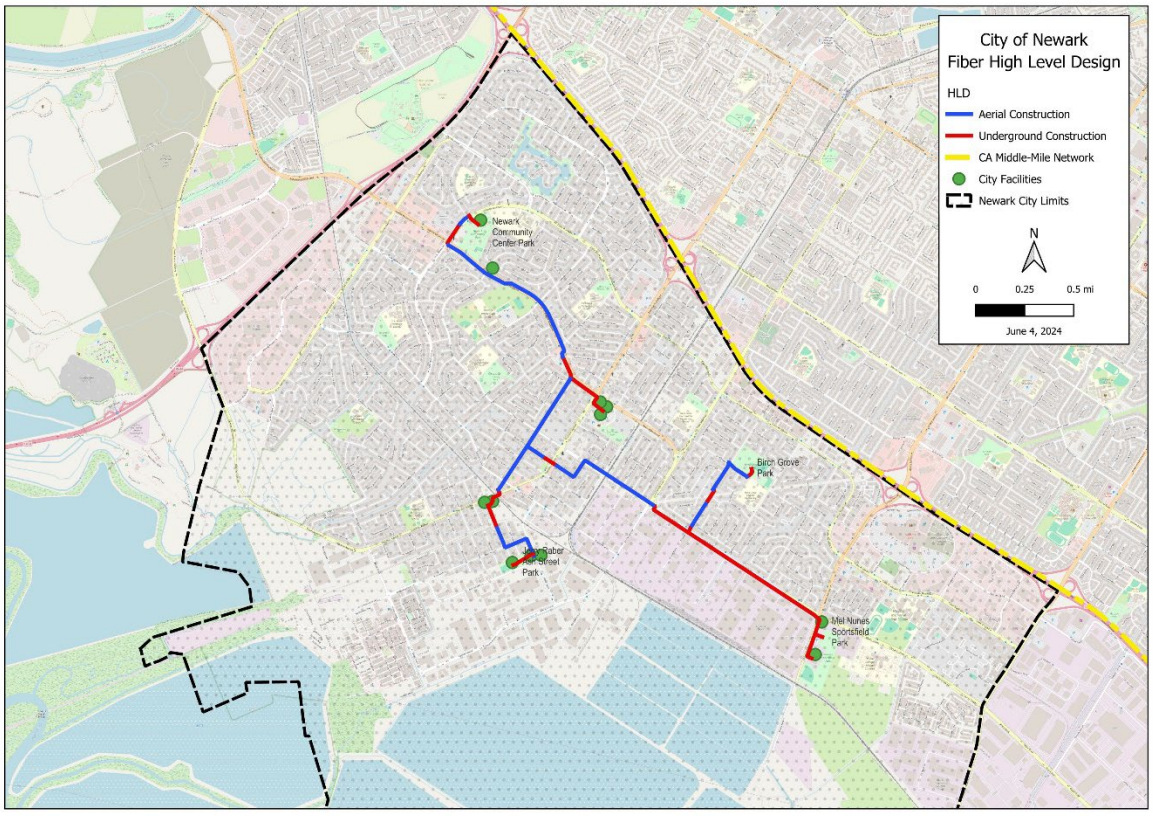


Figure 21 – HLD by Construction Type

Phase 1

During the needs assessment, it was made clear that the Sillman Center is a major recreational hub for the residents, students and visitors and the facility offers many amenities that benefit those in the area. This phase contains much of the new underground construction, due to the lack of poles and other aerial infrastructure along Cherry Street. This phase connects the Silliman Center and Fire Station 27. As shown in the table below, the construction cost for phase 1 is estimated at $1.406 million, making it the most expensive phase. It is the recommendation to connect Mel Nunes Sportsfield and Birch Grove parks during this phase.

Phase 2

Phase 2 builds off phase 1, requiring at least some of that phase to be complete before it can be initiated. The footage in this phase is far less, but is just as important, as it connects areas of great importance for the City of Newark. In this phase, the following will be connected: Fire Station 28, Center for the Elderly and Public Works Corps Yard. This phase has an approximate value of $303,545 according to the sample table below. It is recommended to connect Jerry Raber Ash Street Park during this phase.

Phase 3

Phase 3 connects the remaining two city facilities, Fire Station 29 and Community/Childcare Center by adding infrastructure to phases 1 and 2. The cost of this phase is estimated at $339,233. It is recommended to connect Newark Community Center Park during this phase.

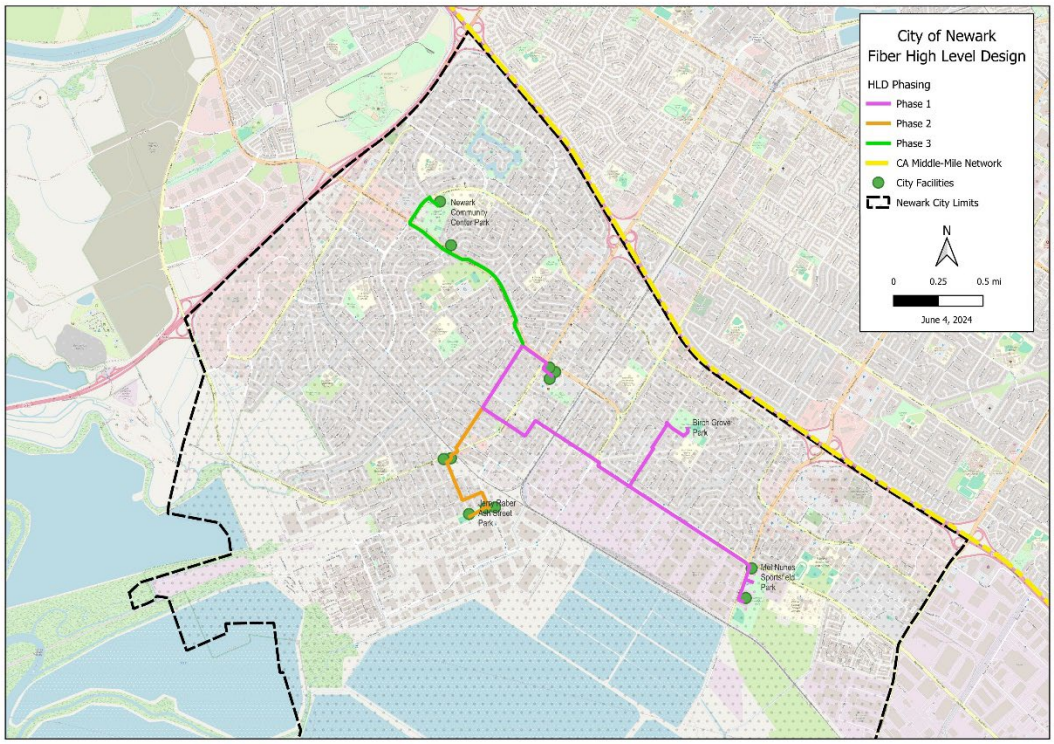


Figure 22: HLD Map by Phase

HLD Footages, WiFi and Budget

During the April 25th 2024 council meeting, where the Broadband/Smart City draft was presented, Council expressed a desire to provide wireless connectivity for its community. Based on analysis of surveys including identifying areas that are highly populated community gathering areas, this report was updated to include fiber and WiFi to Mel Nunes, Birch Grove, Jerry Raber and Newark Community parks.

The following table outlines the projected construction types, along with their estimated footage and costs. The cost per foot includes prevailing wage, engineering, cable, and splicing. It does not include any new equipment. As previously noted in the report, the costs significantly surged in the last year, attributed to post-COVID inflationary trends. These pricing figures were gathered through discussions with utility contractors in the local area, who acknowledge the ongoing upward trajectory of construction-related inflation. However, they anticipate this phenomenon to stabilize soon. It is crucial to

emphasize that given the volatile nature of construction costs, the estimates provided below will remain valid for a limited duration.

Phase	Construction Type	Est $/FT	Segment Total
Phase 1	Aerial	$25.00	$205,977.50
	New Underground	$125.00	$1,199,925.00
	WiFi		$57,929.38
Phase 1 Total			**$1,463,831.88**
Phase 2	Aerial	$25.00	$80,070.00
	New Underground	$125.00	$223,475.00
	WiFi		$36,558.53
Phase 2 Total			**$340,103.53**
Phase 3	Aerial	$25.00	$124,657.50
	New Underground	$125.00	$214,575.00
	WiFi		$36,558.53
Phase 3 Total			**$375,791.03**
Grand Total			**$2,179,726.44**
13.6% Contigency			**$2,476,169.24**

Cost of Services by Phase

The table above shows the cost of construction for the 3 phases, while the table below shows the current cost of service the city pays for, listed by location. As the phases are built the operational cost for each location that will be served by the new network should be noted as savings and treated as a return on investment of the new construction and overtime, will further justify completing the network.

Build Phase	Facility	Service Address	Monthly Totals	Grand Total with Taxes and Surcharges	Annual
Phase 1	SILLIMAN CENTER	6800 MOWRY AVE	$1,102.66	$1,364.46	$16,373.52
Phase 1	FIRE STATION #27	39039 CHERRY	$494.39	$623.46	$7,481.52
Phase 1	LIBRARY	37055 NEWARK BLVD	$114.12	$142.01	$1,704.12
Phase 1	POLICE GROUND FLOOR	37077 NEWARK BLVD	$2,341.00	$2,926.00	$35,112.00
Phase 1	COUNCIL CHAM	37101 NEWARK BLVD	$59.52	$74.40	$892.80
			Total Cost	**$5,130.33**	**$61,563.96**
Phase 2	SENIOR CENTER	7401 ENTERPRISE DR	$171.79	$217.50	$2,610.00
Phase 2	SERVICE CENTER/CORP YARD	37440 FILBERT	$752.24	$923.11	$11,077.32
Phase 2	ALT EOCFIRE STATION 28	7550 THORNTON AV	$853.24	$1,025.07	$12,300.84

Phase 2	OLD FIRE STATION 1	7700 THORNTON AVE	$38.04	$45.90	$550.80
Phase 2	WATKINS HALL	37103 ASH	$38.04	$45.90	$550.80
			Total Cost	**$2,257.48**	**$27,089.76**
Phase 3	COMMUNITY CTR/CHILD CARE	35501 CEDAR BL	$769.03	$1,003.03	$12,036.36
Phase 3	FIRE STATION 29	35775 RUSCHIN DR	$624.32	$744.39	$8,932.68
Phase 3	37365 ASH	37365 ASH	$38.04	$45.90	$550.80
			Total Cost	**$1,793.32**	**$21,519.84**

Business Model and Funding

There are a range of business models for local governments to impact broadband development, from passive, policy-only models to fully active, full-service models. To follow best practices, it makes sense to develop policies to encourage local, non-profit broadband service providers. This would involve establishing expedited, non-discriminatory access to local Public Right of Way (PROW) and standards for constructing and developing network assets that use the PROW. Beyond that, the city could establish procurement preferences for services from such providers and a special class for them within a wireless facilities master license agreement.

To determine the proper business model for a municipal network, local governments need to understand the various factors and how they interplay with each other.

The different business models shown in the table below compare the various levels of investment and amount of municipal control. The City of Newark has different options from doing nothing, letting the incumbent providers handle broadband all the way to becoming a municipal ISP and provide services to the community. Rarely is extremely a viable option with the key factors leading to a business model somewhere in the middle.

Business Models

Internal expansion

Any business model beyond leasing a limited amount of dark fiber will require dedicated staff. Dark Fiber is unused fiber that can be leased and is maintained by the lessee, reducing impact to staff and city resources. The program or division would need a broadband manager with a strong understanding of facilities leasing and maintenance. The broadband manager would be responsible for the overall organizational performance, focused on finances and governance.

If the city is actively promoting use of the network, it will also need a sales and marketing specialist to identify and manage leases. The sales and marketing manager may also work with wholesale customers to promote internet services to the community. An infrastructure specialist will also be needed to follow through with the policies put in place, dig once, also to track placement, ownership, and maintenance of the infrastructure. Finally, the program or division will need a fiber management system (FMS) and should have a maintenance fund to cover repair costs. Major maintenance or repair tasks—anything requiring excavation—would need to be contracted out. Additional positions may also be needed, depending on the scope and scale of the project.

If the city were to move forward with any of the above, it would require substantial overhead and operating costs, as well as a much larger capital investment in infrastructure and equipment. Payroll can account for 90% or more of ongoing costs. Equipment licenses, maintenance, refresh, and upgrades create high periodic costs and ongoing reoccurring costs. Limiting operations to a backbone network will greatly reduce both up-front and on-going costs and set the stage for private investment.

Public Private Partnership (P3)

P3 agreements are a common business model in the modern municipal network for the construction, operation, and maintenance of city-owned infrastructure. These agreements are so popular because they can entail any of the following business models by working with private ISPs and creating an agreement that the city can support. All cities have varying amounts of assets, capital, and staff to support municipal networks. Some cities have a sufficient staff to run and monitor a network, some cities contract the majority of the operations to private companies or individuals and have little staff that can help with the

running of a network, while other cities have substantial infrastructure that can be leveraged in a P3 to ultimately generate revenue through these agreements. It is important to understand the level of commitment from both parties when considering the following:

- Who will pay for the network construction?
- What funds will both parties be required to put into the agreement?
- What are the roles and responsibilities of either party?
- Who will determine the ownership and control of any future network expansion?
- What is the revenue model that will allow both parties to benefit from an agreement?

Public policy only

Public policies are a vital part of the modern city broadband network, whether it be city or privately owned. Policies that may have a substantial impact on the broadband networks include Dig Once policies and developer agreements. Dig once policies put in place a mechanism for the city to add infrastructure while other companies and agencies are doing work in the right-of-way allowing the city to add infrastructure as part of these other projects. Developer agreements are important because they allow the city to require infrastructure to be added to the development of large plots. Other policies that should be created and implemented are those streamlining the permitting process to encourage local ISP investment in broadband throughout the city. A major deterrent for private company broadband construction in municipalities is if the permitting process and restoration requirements impact the return on investment (ROI) that drives all private company investments. This is not a real “business” model but does have an impact on the local broadband market and regardless of the business model used, policies must be evaluated and updated or implemented.

Infrastructure provider

In this business model, the municipality builds infrastructure and leases that infrastructure out to other agencies with the goal of generating enough revenue to, at a minimum, pay for the cost and maintenance of the infrastructure. Private companies work off profits and ROI models that require lower cost construction and enough subscribers to offset these costs. There are areas in every city that have a low ROI and private companies simply will not build in these areas and skip to higher profit areas. Cities can build infrastructure that the private sector can use, lowering the costs of construction and increasing the ROI. The infrastructure can be conduit only, fiber or wireless towers.

Public services provider

Cities connecting publicly owned assets, public organizations, county, nonprofit organizations, schools, libraries and/or other non-private locations are considered public services providers. These organizations are usually limited to anchor institutions, critical organizations, public safety organizations, utilities, and healthcare. A government owned network can provide a better quality of service at lower costs.

Open access provider

Open access networks are those networks that do not offer exclusive access to any one entity. This philosophy is geared towards increasing competition and potentially increasing revenue by not limiting access to only one lessee.

Lit services are when the provider supplies the equipment, fiber and anything needed to support a certain level of service. Simply put, if the customer wants 100 Mbps service, that is what the city would need to provide. The customer pays for the level of service they want and the cost increases with the increase in speed.

Conversely, if the customer wants to provide their own equipment, the city will only provide the fiber from end to end and the customer is responsible for the equipment and speeds they are wanting. The city only maintains the fiber and does not have any involvement with the equipment. These circuits are known as "dark" circuits and the bandwidth used is not controlled by the city. Although the equipment is not provided by the city, the circuits are remarkably close in cost.

Municipal services provider (ISP)

Municipalities that provide end user services to residential and business customers are considered retail service providers. Most commonly, local governments offer triple-play services consisting of phone, television, and Internet services, essentially becoming an equal competitor to incumbent cable and broadband providers. As a retail provider, the organization is responsible for a significant number of operational functions, including management of retail services, network operations, billing, provisioning, network construction, and general management.

For a municipal services approach, the following would need to be taken into consideration:

Capital Expenses

- Develop the cost model for the network, including one-time and ongoing capital expenditures to build the network. This will include an assessment of current facility locations, city-owned land and the city right-of-way for construction and the need to purchase any land or equipment.
- Provide a phased deployment approach, including prioritization and costs for each phase.

Operating Expenses

- Develop the cost model for operations, including operations and maintenance, network operations, field services, staffing, billing, and customer service.

Revenue Potential

- From the market analysis and outreach, determine the customer segmentation and growth on the network, across each type of customer (business, school, hospital, etc.).
- Determine customer growth rates for the network, based on benchmarking analysis from other utility and municipal providers.
- Determine a proposed competitive rate schedule for potential services, using pricing information from the market analysis and benchmarking information.

Financial Viability

- Develop financial statements including:
  - Operating income and cash flow
  - Net present value analysis
  - Projected revenues and benefits
  - Uses and sources of funds
  - Operational expenses
  - Depreciation schedule
  - Debt service analysis
  - Key assumptions
- Conduct comprehensive financial analysis on the project to determine overall financial sustainability using key metrics such as free cash flow, debt service coverage, operating margin, and net income.

Grants and Other Funding Sources

The City of Newark is an affluent community and therefore is not competitive for most federal and state grants that support expanding broadband to unserved and underserved communities. The city should monitor and apply for

transportation and Smart City related grants which can be coupled with expanding fiber optic installation to expand broadband in the community.

The city has been prudent in the development of a CIP for conduit infrastructure tied to street projects. This supports expansion of broadband in the community and supports regional efforts related to broadband. In addition to the CIP, the city should evaluate the addition of technology fees, which can facilitate building out broadband quicker, supporting the community and economic development.

The City has existing American Rescue Plan Act (ARPA) and Public, Education and Government (PEG) funds that can be used to begin the installation of broadband infrastructure within the constraints of the funding sources and if not already allocated to other city projects. Due to the city's lack of competitiveness for current broadband grants, the city is left with limited options outside the above sources. Other options include bonds, debt, or direct revenue (fees & taxes).

Recommendations

The city needs to create a platform to attract investment and innovation. The following recommendations support the city in this effort.

Form or designate a broadband advisory committee.

Without accountability and designated resources, master plans can fall by the wayside. It is important that there is a level of accountability. The city should evaluate a committee of city staff that have the level of authority and interest to ensure broadband progresses in the community. A point person with interest in the project should be appointed as the lead to this team.

Investigate a Public Private Partnership (P3).

Private companies have the experience and expertise to engineer, build out and maintain a city network. Through partnerships, allowing the partner to use the infrastructure constructed for the city network, costs can be greatly reduced and help alleviate the operational expenses of owning a network. The city staff should maintain the equipment, routers and services, and the partner should maintain the physical layer of cables and splicing. A partnership should be leveraged to add competition and reduce the need for the city to build a fiber-to-the-premises, FTTP, network. A P3 partnership would meet one of the city's goals to offer internet to the public at reduced costs with improved reliability.

Create policies and workflows.

Create workflows and city policies that aid in the further development of broadband infrastructure through Dig Once policies, updated construction standards, developer agreements and requirements, including infrastructure with capital improvement projects and other policies. These policies should be applied to both the public and private sectors doing work in the public right-of-way (ROW).

Permitting and restoration requirements prove to be difficult for developers and private ISPs looking to build in the ROW. Permits can take too long to approve, but through policies and updated requirements, the city can alleviate some of this by ensuring the permitting process is streamlined.

SB 378 passed into law in 2022 and requires municipalities to allow microtrenching for the purpose of placing fiber optic cables, in certain circumstances. The city should consider creating a standard to address when microtrenching is going to be used, including policies in place for dealing with microtrenching during emergency digging in the ROW.

The city should also consider creating a digital inclusion policy that will further digital inclusion and help bring digital equity to Newark in support of digital inclusion efforts recommended below.

Create a Technology Enterprise Fund.

Dedicating all revenues generated from telecommunication carriers or ISPs through leases of city poles, ROW access, cell towers and/or land for placement of towers and other public assets to a Technology Enterprise Fund will ensure the city has a financing source for the purchase, installation and/or construction of new broadband assets and Smart City applications, particularly to take advantage of opportunities outside of the annual budget process, such as coordinated joint trenching. These funds would also be used for digital inclusion efforts.

Newark should consider investments that provide modern, reliable broadband infrastructure and programs that would offer free or low-cost services to qualified residents, the school district, and the library.

The city should also use the fund to support innovative Smart City/Connected Community programs that improve efficiencies while enhancing services for the community. This includes infrastructure investments that deliver real-time environmental, public safety and transportation information to stakeholders,

such as streetlight sensors for noise, air quality, on-street parking availability, traffic congestion and evacuation routes. “Push” notifications can be employed to relay important messages; retail location intelligence can improve economic development by offering analytic information on foot traffic in the surrounding business areas.

Incrementally build city-owned broadband infrastructure.

The city should adopt the HLD and implement policies that include broadband in all projects. If there is an opportunity to add this infrastructure as part of other projects, the city can incrementally build infrastructure as needed over time to reduce costs. Keeping the future in mind, the broadband committee should be included in the planning process with broadband being considered a utility like power, water and sewer.

Evaluate the use of Public, Education and Government (PEG) funds where applicable to enhance services with broadband.

The City has a need in the Emergency Operations Center (EOC) for multiple video and audio feeds for its Joint Information Center (JIC) to broadcast and monitor live reports of events.

The City also has the need for remote location broadcasting of events i.e. festivals and city events, which broadband would support.

The use of PEG funds is a potential source of funding to assist with these needs.

Support digital inclusion.

Digital divide is the problem and digital inclusion are the steps and activities to help fix the problem, with digital equity as the goal.

Digital divide is the gap between those who have adequate broadband and ability to use it and those who do not. It is easy to define the problem, however, less so to define the underlying causes such as affordability, physical access, owning devices that can access the internet, and even knowing how to use the internet effectively.

No two cities have the same issues that need to be solved, but there are some causes of the digital divide that exist, to some extent, in every town, city, county and state. One of those causes is the affordability of internet access. In addition to the local ISP affordability information provided on their websites, the city should promote the Federal Affordable Connectivity Program (ACP),

which is an FCC-funded subsidy that helps ensure households can afford the broadband they need for work, school, healthcare and more. Details can be found at https://www.fcc.gov/acp. The survey resulted in showing the city has a low take rate for the ACP program. Education regarding this important tool to assist those in need is prudent.

The library in Newark has many resources to be leveraged in digital inclusion efforts including computers, iPads, and other devices the community can benefit from. The city should promote the library and its resources to the community. The library has study rooms that can be used to hold educational classes on how to use the internet. The aged population tends to learn technology more slowly and can use help with how to access telehealth, doctor appointments, online bill pay, and many other activities required to exist in the increasingly online lifestyle of the world.

Another aspect of digital inclusion is to ensure the affordability of the devices that allow users to connect to the internet. Cities have surplus equipment, desks, computers, and laptops, among other things, which could be donated to senior centers, schools, economic development centers or any other group that helps lessen the digital divide. Senior centers are in particular need, with most residents being on fixed incomes with no way to purchase devices.

Next Steps

Outlined below is a summary of the next steps the city should take to improve and expand broadband.

1. Create a staff committee to advise, keep abreast of and hold accountability for broadband.
    a. Define roles and responsibilities.
    b. Keep the committee small and nimble, including representatives from key departments such as Public Works, Information Technology, Police Department, Community Development and a representative from the City Manager's Office.
2. In addition to the committee, assign or hire a person or consultant to be the City's point person leading the broadband efforts lined out in the study.

3. Pursue a public private partnership, create an RFP to find partnerships with a local ISP.
    a. Find a partner that can engineer and construct HLD phases 1 – 3 as appropriate and as budget allows including the addition of WiFi in the four city parks identified (Newark Community, Jerry Raber, Birch Grove and Mel Nunes).
    b. Create a partnership that will accomplish the goals of the broadband plan in providing underserved businesses with reliable service.
4. Review city policies to update as needed.
    a. Dig Once policy.
    b. Developer agreements.
    c. Create workflows and policy to ensure broadband is a consideration on all city capital improvement projects, permitted work in the ROW, and planning efforts.
    d. Review needs for wireless telecommunication facilities ordinance.
5. Create a broadband enterprise fund to support broadband efforts, construction, and partnerships.
    a. Assign a portion of PEG fees to a broadband fund where applicable.
    b. Assign a portion franchise fees to a broadband fund.
    c. Create a financing strategy that separately tracks revenues and expenditures for this fund.
    d. Create a funding policy that established a reserve as well as strives to ensure that revenues match expenditures without being a burden to the city's General Fund.
6. Incrementally build city-owned broadband infrastructure with a P3 if this model is selected.
7. Evaluate the community's needs for Wi-Fi for locations such as the Silliman Center, the Senior Cener, low-income neighborhoods, Restaurant Row, the Old Town area and City parks.
8. Monitor grants such as BEAD and CASF including funding for education and accessibility. Traffic grants are also a great source of funding for expanding a fiber network
9. Think regionally – the City should consider working with other local governments in the region to reduce costs and take advantage of economies of scale while improving services. This includes the county, schools, Ohlone College and other neighboring cities like Fremont and Union City that are pursuing expanding broadband as well.
10. Create a digital inclusion policy and program including the following:

   a. Promote the Affordable Connectivity Program or other programs that provide similar services.
   b. Use library resources to educate individuals.
   c. Standards for donating surplus equipment.

11. Promote digital inclusion efforts for the residents of the city.
   a. Promote the Affordable Connectivity Program. Newark has residents that have a challenging time affording internet access.

12. Instead of auctioning off extra and surplus equipment, donate to local groups and individuals that would benefit.
   a. Senior Centers
   b. Youth Centers
   c. Economic Development Groups
   d. Small Business Associations
   e. Under privileged households
   f. Schools
   g. Etc.

Connected Communities

Connected Communities AKA “Smart City” have different meanings city to city, and the definition has evolved over time. Initially, the focus was on infrastructure projects and centrally controlled systems with reporting and analytics. These investments provided very little value for the communities they served. Now, Connected Community initiatives focus on the use of technology and data to increase collaboration, drive decisions, and improve the community’s livability, workability and sustainability.

A Connected Community Program improves internal alignment to become an efficient, collaborative, and transparent city that is continuously improving cross-departmental coordination and data-sharing, refining operational approaches and priorities through a participatory governance process and active resident engagement.

Connected Communities help keep community members feeling inclusive, safe, and informed through continuous innovation with modern technologies improving response time and situational awareness.

Newark’s Connected Community/Smart City leveraged broadband as a foundation to build equity through creative ways of providing the necessary connectivity to support unserved and underserved neighborhoods.

Newark’s Connected Community/ Smart City plan should be coupled with the City’s broadband master plan to establish a collaborative ecosystem to bring together residents, businesses, industry, government, non-profits and other stakeholders to ideate and implement solutions that maximize “Livability” for residents, “Workability” in the City and “Sustainability” for all as overarching value propositions.

With the implementation of a Connected Community strategy and plan, operational efficiency will be improved and likewise become the backbone for delivering “Newark Community Connect," enabling the city to rethink and innovate how the city functions and delivers its services.

Government Technology Group (GTG) would use the following as a framework for helping Newark achieve its goals of digital transformation. This process aids transparency, programs, and budget alignment, coordinating across organizations to realize functional requirements

Vision

The vision establishes the foundation, by which the actual transformation is executed against. This vision should directly align with city initiatives and the

foundational principles of operational efficiency and improved service delivery.

Transformation

Transformation is the execution of the vision by way of specific projects aimed at delivering the desired outcomes. This is not so much technology centric, rather people and process oriented, leaning on technology to realize the objectives.

Outcomes

The outcomes reflect the improvements to the overall process of city operations and service delivery. They represent a new way for the city to measure performance, engage residents and build on a foundation of continuous improvement.

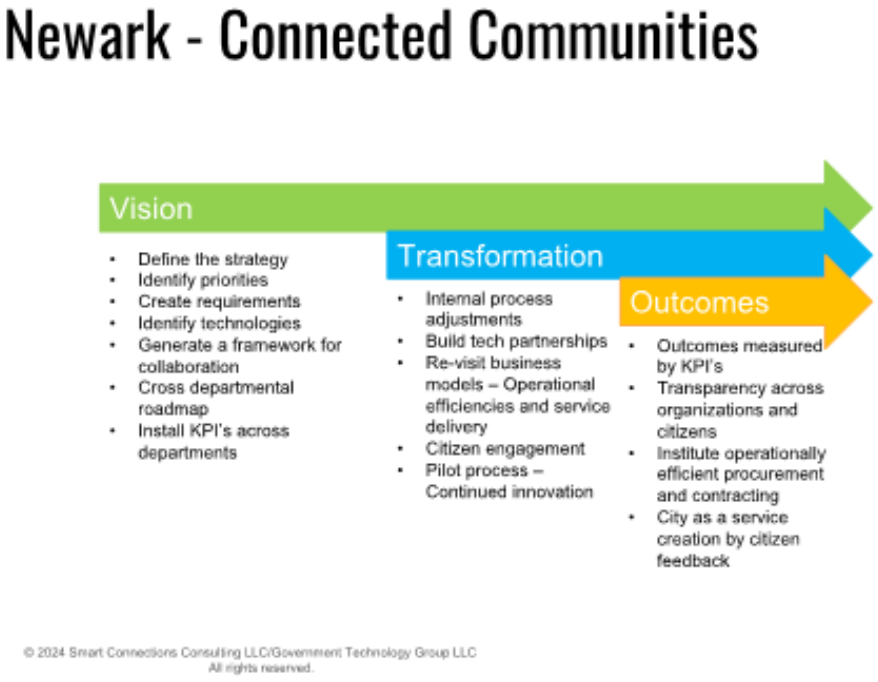


Figure 23 – Connected Communities in Newark

Case Study Examples

The cases below demonstrate Connected Community/Smart City use cases that we have participated in with the respective cities.

East Palo Alto – Digital Equity

During the pandemic the County of San Mateo took action to make sure that its infrastructure assets were utilized to deliver connectivity services to its underserved communities, East Palo Alto was the ideal community.

We leveraged the county's fiber as the backbone and solved the middle mile with CBRS (Citizens Broadband Radio Service) and deployed several WAPs (Wireless AP's) for the public Wi-Fi in various parks and city buildings. The Wi-Fi was used to connect the homes so that there was support for distance learning and remote work. The program was an absolute success and improved the county's DDI (Digital Divide Index) number.

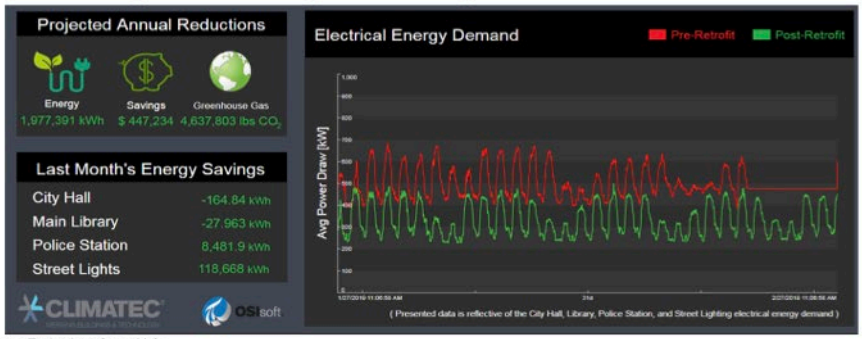
San Leandro – Connected Lighting

The City of San Leandro initiated an LED relamping program and decided to connect the streetlights via a Low Power Wide Area Network (LPWAN) for the purpose of energy conservation.

Energy Conservation Initiative

- Network = 6LowPan
- Controls with mobile alerts
- Energy savings through LED conversion

San Leandro Smart Streetlights and Energy Monitoring



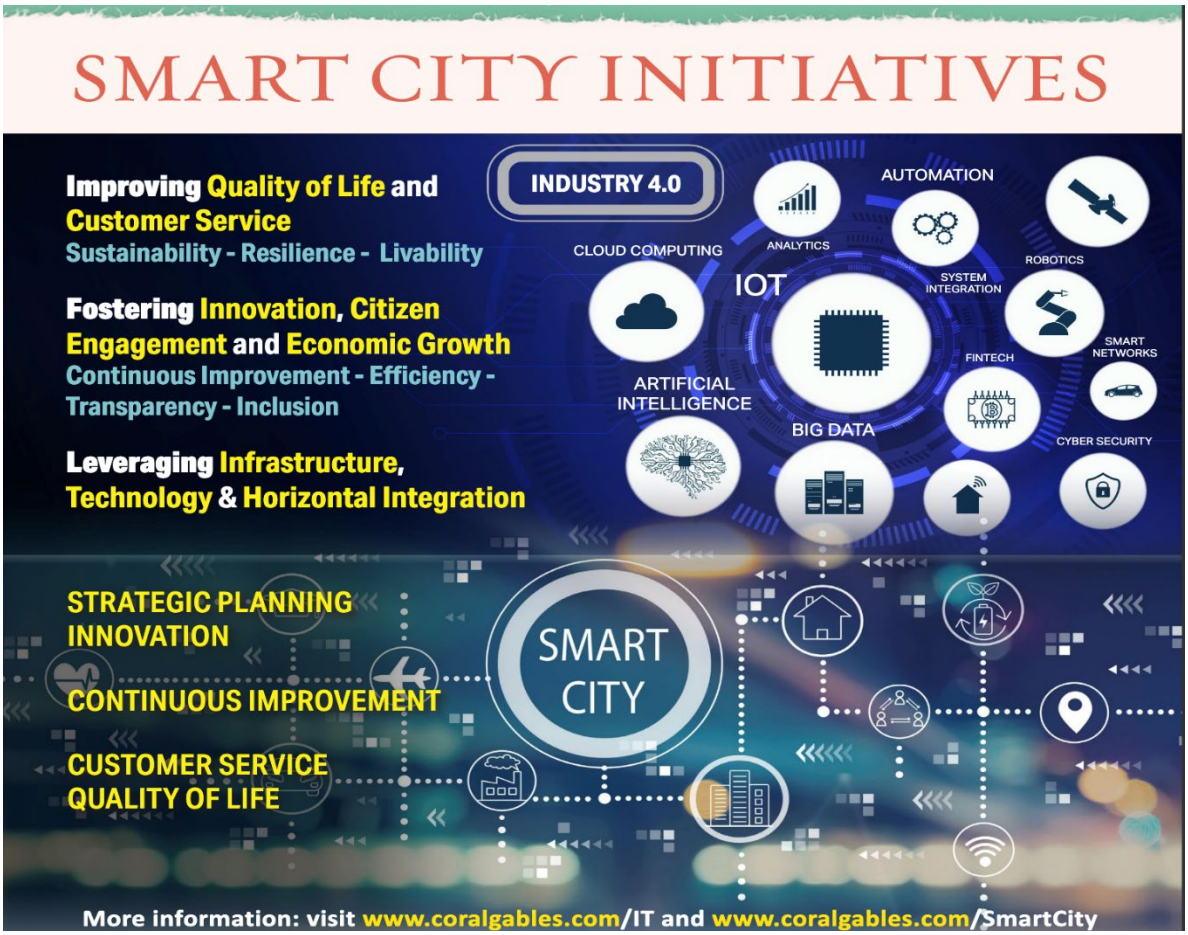
Lessons learned:

While the energy savings was successful, there were plans to leverage the lighting network for additional applications e.g. environmental monitoring, people counting, etc. The challenge was that the protocol for the wireless network was not broadly adopted, making it very difficult to integrate additional sensors for new applications. As a lesson learned, it is important to:

1. Ensure that the technical choice supports the strategic plan.
2. Understand the standards and protocols that are supported.
3. Leverage your infrastructure for more than a single use whenever possible.

Coral Gables – Connected Communities/Smart City Platform

The City of Coral Gables Florida set out over 10+ years ago to create a Connected Community that embraced services and transparency while improving city operations. This was under the leadership of Raimundo Rodulfo – CIO.



Coral Gables demonstrates the focus and effort it takes to deliver on the vision of "Connected Community/Smart City" by:

1. Establishing and revisiting their strategic plan.
2. Establishing the foundation of systems interoperability for improved service delivery.
3. Focus on innovation and open standards.
4. Clear KPI's that are communicated to the community.

Palo Alto – Digital Twin for Traffic Monitoring Case Study

Working directly with the Palo Alto CIO and the chief traffic engineer, the program was executed over the course of 18 months and has garnered significant visibility from an innovation perspective. The objective was to set the foundation for traffic modernization using existing data to build a real time digital twin as insight to aid in improving traffic flow and give priority to cyclists and pedestrians at crosswalks.

Palo Alto - Traffic Baseline Deliverable

Leveraging the Trafficware Management System data provided in partnership by the city, we were able to deliver a baseline of the current traffic conditions to inform decisions on where to introduce “Adaptive Traffic Signaling,” as well as preparing for vision zero initiatives. The user interface allows for real time insight into traffic flow, congestion, and pedestrians at crosswalks.

The second part of the project was to deliver the ability to visualize the traffic data for the purpose of preemptive signaling, which was successfully demonstrated.

The outcome was successful and there were several additional use cases documented to leverage the traffic data combined with other city data - e.g. environmental monitors coupled with traffic flow data show the CO2 emissions based on traffic flow.

Newark Strategic Horizon Chart

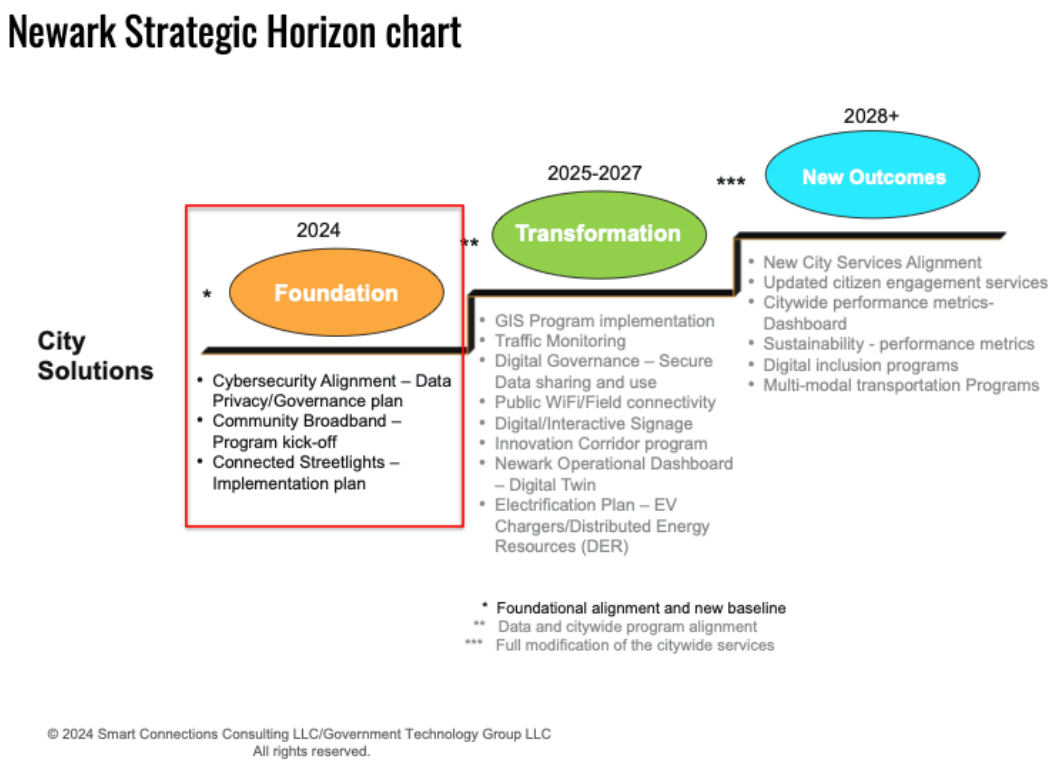


Figure 24 – Newark Strategic Horizon chart

The strategic horizon chart is a living reference tool that aligns programs and projects to the city vision for Connected Communities/Smart City. It is meant to be updated as priorities and initiatives change over time.

Top Areas of Opportunity

The following list highlights areas of opportunity for Newark to establish project initiatives that deliver value to the city and residents alike.

1. Connected street lighting
    a. Improves energy efficiency.
    b. Improves community safety.
    c. Reduces carbon footprint.

   d. Extends additional Connected Community applications e.g. Public Wi-Fi, Air quality sensors etc.
2. Community broadband
   a. Promotes Digital Equity and ensures reliable and affordable internet access for all community members irrespective of income or location.
   b. Enhances education and lifelong learning.
   c. Boosts economic development and innovation.
   d. Improves public service and citizen engagement.
3. Traffic monitoring
   a. Reduces traffic congestion and improves commutes.
   b. Enhances public safety and emergency response.
   c. Benefits environment and sustainability.
   d. Prepares for autonomous vehicles.
4. Cybersecurity, privacy, and data governance
   a. Improves the city's security posture.
   b. Improves transparency for the community.
   c. Prepares the city for use of the extended datasets generated by the solutions.

With a robust broadband strategy, the above listed solutions deliver a solid foundation for continued innovation for Newark's Connected Community.

Other Smart City/Connected Communities Recommendations

Newark has several areas that align to the strategy initiatives of Livability, Workability, and Sustainability. These domains are very common amongst the majority of cities.

Livability

- **Environmental Monitoring** – The benefits here are aligned to the city delivering information to the residents about the conditions in the surrounding areas. Is it advised to hike, ride bikes? Is the temperature combined with CO2 emissions safe? What is the particulate count?
- **Digital Signage/Kiosk** – The benefits here serve the residents and visitors as they will be able to walk and engage the signage for information. Likewise, it can be used to engage residents and allow them to initiate permits and other city forms without going inside city hall.

- **Security Monitoring** – The benefits here are aligned with residents feeling safe. It is likewise aligned with workability when the police department is looking for forensic information related to criminal activity.
- **Multi-Modal Transportation** – This benefits the city residents in a variety of ways.
  - Getting to public transportation hubs will improve the experience for all.
  - Establishing e-mobility programs for the elderly.
  - Could get residents out of their car and into public transportation which would have an impact on sustainability.

Workability

- **Wireless connectivity** – The benefits of the city considering ancillary wireless connectivity in conjunction with its fiber deployment covers workability as well as livability.
  - First responders will have reliable connections within a variety of areas in the city. This leans toward considering PLTE (Private LTE) for some areas of the city.
  - Benefits the residents when looking at large numbers of digital signs or additionally tap to pay EV Chargers, etc.
  - Field workers will have the ability to relay GIS information whenever there are changes needed.
  - Recreation centers will experience a much higher level of reliability as well as improved services.
- **GIS program** – This will benefit the city across the board. Operational efficiency when field visits are made in terms of understanding and clearly knowing where the assets, wireless AP's, etc. are located.
- **Digital Twin** – Digital Twins are very useful when the data is available. The benefits tie themselves to providing insight into a variety of areas and visualizing them in a single dashboard that is updating in real time.
  - Improvement in traffic monitoring – Leads to adaptive traffic monitoring.
  - Improvement in emergency response – Leads to managing routes to specific locations. Also, unifies the various data streams into a single view shared amongst the teams.
  - Can become the "Single Pane of Glass" used by most city workers.
- **Security foundation** – When extending Connected Community services to operational technology, the city should evaluate its security strategy and

processes to reduce risk to the city from potential cyber security incidents.

- **Automated redundant internet** – As innovation occurs and the city relies more heavily on the Internet to support its Connected Community program, it should evaluate automated redundant internet access if the new enhancements are deemed critical to the business needs of the city.

Sustainability

- **Buildings** – With Newark's sustainability targets, buildings (both old and new) should be under consideration. Note that Newark is already in a good place with the city hall and police departments already equipped with building automation to support HVAC and building services.
  - Energy efficient windows for all construction.
  - Solar and other distributed energy resources to reduce emissions.
  - Connectivity within building that monitors and manages lighting, HVAC, and energy.
- **EV charging** - This provides even greater value when attached to other sustainable initiatives, renewables, and other energy efficient programs.

GTG is well prepared to help Newark execute a plan for solution delivery.

With a robust broadband strategy, the above listed solutions deliver a solid foundation for continued innovation for Newark's Connected Community.

Acknowledgements

We would like to acknowledge with much appreciation the crucial role of city staff and regional stakeholders from Newark. City staff provided valuable feedback on a regular basis during the project in addition to assisting with getting the word out to the community regarding this important project.