Broadband Master Plan

for

City of Shafter
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From

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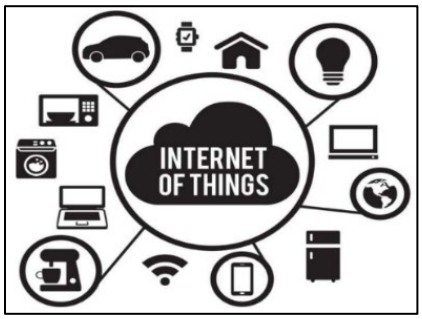
Executive Summary

Access to the internet has become a critical part of everyday life for most of the world. The internet is known as a network of networks allowing the world to connect to each other no matter where you live or do business. 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.

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 the new foundation for more prosperous communities. In Shafter's case, there is a desire to provide broadband to unserved and underserved areas while building fiber infrastructure to improve economic development for its community. Broadband increases the opportunities to achieve this goal.

Although 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 download and 20 Mbps upload.

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 its many forms, to connect to the internet.



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 Shafter is no different. Partnering with Government Technology Group LLC (GTG), Shafter initially started with a Broadband Assessment of its assets, followed by an application for grant funding (Local Agency Technical Assistance (LATA) used for planning and engineering services) and created a Business plan to support an application for the Last Mile Federal Funding Account (FFA) grant which is pending approval.

The planning effort includes this Broadband Master Plan that was performed to assess broadband in the city. The city has built significant broadband infrastructure to connect City facilities and recognizes the need to expand high-speed affordable broadband services for its community. Government Technology Group (GTG) performed an assessment of the broadband needs of the city by exploring opportunities for improving and expanding high speed broadband communications for all residents and the business sector in their jurisdiction. The assessment included a survey of the community, workshops with residents and businesses and discussions with the City's broadband team on a bi-weekly basis.

The outreach performed by GTG showed the city has unserved and underserved areas. The city also has fiber assets in place that could be used to support and expand broadband to unserved and underserved areas of the city at a reduced cost while supporting municipal services and building infrastructure that could be used to improve competition between broadband providers in the City with the assistance of a public private partner.

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 that encompass the vital information needed to provide a master plan and steps to accomplish said plan.

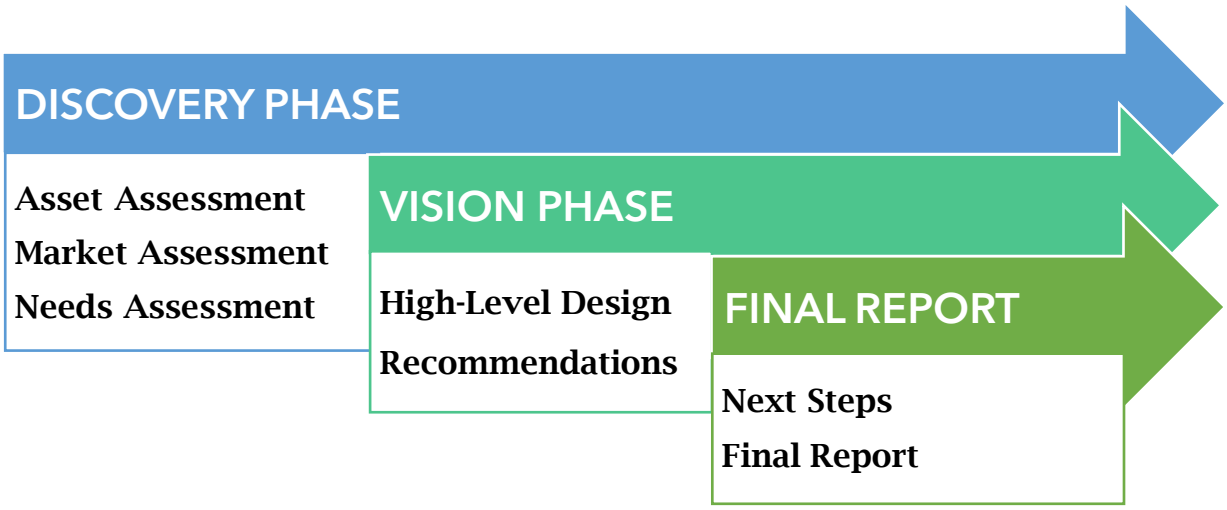


Figure 1 - Methodology

Asset Assessment is investigating and analyzing what assets (street and traffic lights, towers, existing conduit or fiber as examples) 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 residential and business needs.

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 the 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 that 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 City-wide Strategic Fiber Optic Feasibility Study.

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

- The City of Shafter only has privately built residential fiber optic access in the Gossamer Grove neighborhood.
- The City has significant city owned fiber infrastructure to its facilities and core area of the City that can be used for providing residential service by a private sector partner if desired.
- The existing Hybrid Fiber Coaxial (HFC)/cable system is poorly maintained with residents reporting maximum speeds far less than reported by providers.
- The City's existing fiber network is perfect for engaging with a private partner to deploy a full fiber-to-the-home (FTTH) to all residents.
- The states middle mile network has been designed to go through Shafter, providing opportunities to connect to broadband hubs that provide low-cost wholesale internet services in addition to technology services such as disaster recovery.
- Cellular coverage within city facilities is lacking, with providers reporting full coverage throughout the city, but there are gaps within critical areas of the municipality where coverage is not adequate for personal or business use.
- The City lacks a Dig Once policy for expanding broadband infrastructure at a reduced cost to the City.
- Thirty percent of residents in the community lack awareness of the Affordable Care Program (ACP) to assist low-income residents.

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 identified
- 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.

As of early 2024, there are not any planned capital projects in Shafter that specifically focus on expanding broadband. Fortunately, the city has been prudent in building fiber infrastructure that can be used as a foundation.

The city owns substantial (approximately 40 miles) broadband infrastructure. In order to provide improved services for the community and the potential for enhanced internet services for residents and business, the city should take advantage of this infrastructure and expand it more rapidly with the use of dig once polices.

Technology Trends

Overall, activities, processes, and resources are being digitized and virtualized. 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 toward 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 coffee shop. 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.

With Shafter's existing broadband infrastructure in place and the planned expansion with grants, dig once and development agreements, Shafter will have the communications system in place to take advantage of these trends.

A specific trend directly impacting local governments is the emergence of a *Connected (Smart) Community*, 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 Communities 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,

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

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 Shafter, 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 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 "[p]rogrammable 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, 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

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

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

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 in and of itself. Rather, it is a means to improved outcomes that enables other trends.

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 can 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]

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

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 2 - 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	
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 3 - 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 and being able to control where it is going allows fiber to avoid the many issues that arise from wireless networks 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 and the 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 segment of the study is conducted to evaluate broadband availability for households and businesses in the area and ensure its alignment with the demands of the local market. To gain a comprehensive understanding of the local broadband landscape in Shafter, GTG analyzed the current services offered and their corresponding prices within the city.

The focus was to understand the internet speeds provided, 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. This step is crucial for effective broadband planning, as it enables us to understand the offerings of technology providers and their associated costs.

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

By the Numbers

Broadband access and adoption are influenced by a range of factors, including availability, pricing, service quality, and alignment with the community's needs. In the realm of broadband and telecommunications, service quality primarily revolves around the speed and reliability of the services provided. Many municipalities increasingly view broadband as a modern utility due to its integral role in our daily lives. Therefore, the focus primarily centers on high-speed, reliable broadband, with customer service becoming a significant consideration, particularly in competitive market environments.

During the market assessment, GTG concentrated on key questions, including:

- What is the current coverage of the local service providers?
- What technologies are being offered, such as fiber-to-the-home, HFC (hybrid fiber-coaxial), DSL, 5G, or Satellite?
- What are the pricing tiers offered by each provider?
- What is the competitive landscape of broadband in Shafter?

Key Findings

- The City of Shafter is well served by HFC with local providers supporting 85% -90% of Shafter residents with access to high-speed broadband. However, the network is an older network that does not support the reported speeds in all areas of the city and is an asymmetrical network.
- The largest provider in the area is Charter/Spectrum.
- The only residents that have access to fiber optic broadband is the Gossamer Grove neighborhood.

- ATT currently has DSL subscribers and supports existing DSL services according to their website, will not be installing or providing new DSL services. This effectively limits the current broadband landscape to one provider.
- Shafter has 2,836 households eligible for the Affordable Connectivity Program, ACP, with 1,992 enrolled in the program. An adoption rate of 70% leaves room for improvement and should be promoted by the city.

FCC Broadband Maps

The FCC Broadband Maps, officially known as the Federal Communications Commission Broadband Data Collection, are a vital initiative in the United States, aimed at improving the precision and transparency of broadband coverage data. These maps play a significant role in ensuring that all Americans have access to dependable, high-speed internet services, ultimately influencing broadband policy, investment, and infrastructure development across the nation.

Data Collection: The FCC Broadband Maps involves gathering data from internet service providers (ISPs) to create an updated and detailed representation of nationwide broadband coverage. ISPs are required to report information on the availability of their services, including maximum advertised speeds, technology utilized (such as DSL, cable, fiber), and geographical coverage.

Mapping Accuracy: Ensuring accurate depictions of where broadband services are and aren't available is one of the primary objectives of these maps. This data is crucial for identifying underserved and unserved areas that might lack adequate internet access.

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

Policy Development: These maps are crucial for informing broadband policy development at federal, state, and local levels. Policymakers rely on this data to allocate resources, design subsidy programs, and prioritize areas in need of enhanced broadband infrastructure.

Challenges and Controversies: The accuracy of these maps has been a subject of debate. Critics argue that they might 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 efforts include improved data collection techniques and increased precision in mapping, allowing for a more detailed understanding of coverage in smaller geographic areas.

Impact on Rural and Underserved Communities: Accurate broadband mapping is particularly critical for rural and underserved communities, directing resources to areas with the greatest need, bridging the digital divide, and ensuring that all Americans can access essential online services and opportunities.

In summary, the FCC Broadband Maps serves as a crucial tool in shaping the future of internet connectivity in the United States. They facilitate better-informed decision-making, promote transparency, and contribute to the equitable distribution of broadband resources, ensuring universal access to the digital age. Ongoing efforts to improve and update these maps are vital in addressing the evolving needs of our progressively interconnected society.

Findings from review of the maps show the City has multiple areas that are unserved or underserved in the community. These areas lack 100% fiber infrastructure and are eligible for grant funding.

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

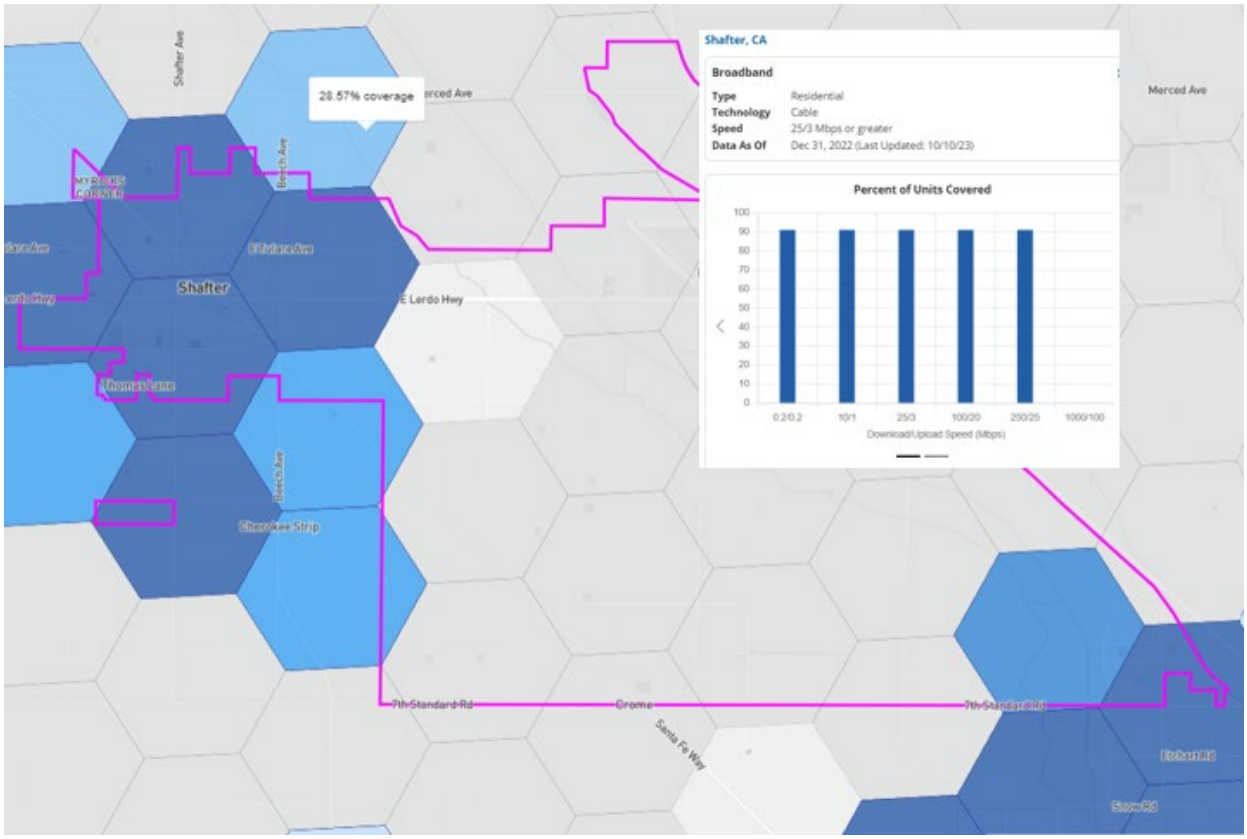


Figure 5 - Shafter Cable HFC (Hybrid Fiber-Coaxial) Coverage Map

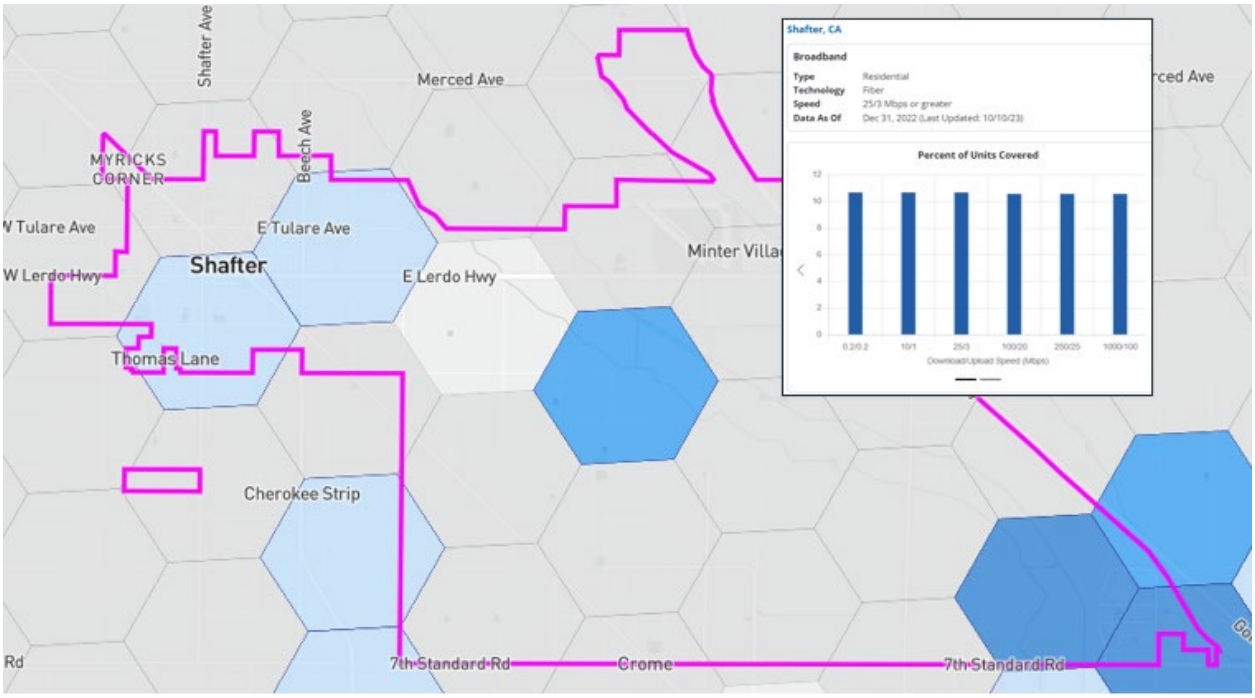


Figure 6 - Shafter Fiber Optic Network Coverage Map

Providers in Shafter

According to the FCC broadband map[5] the two wireline internet service providers available in Shafter are Charter/Spectrum (Cable/HFC) and AT&T (DSL). Unlicensed fixed wireless providers are Applied Technology Group and Unwired Broadband Holdings. There are three satellite providers: Hughes Network Systems LLC, Space Exploration Holdings LLC, and ViaSat Inc. Licensed fixed wireless (5G or Ultra-wideband) providers are T-Mobile USA, Inc. and Verizon Communications. Vast networks has a Master Services Agreement (MSA) with the City to install equipment and use facilities in the Gossamer Grove area. Vast business model focuses on commercial accounts historically. The fiber located in the Gossamer Grove area does not show up on any of the FCC maps or publicly available documentation.

Charter/Spectrum

At Charter, they advertise that they connect their customers to superior communications and entertainment products with the highest quality service. From Spectrum Internet Gig and their path to 10G, to Advanced Wi-Fi and Spectrum Mobile, their fast and secure broadband network powers the future.

In addition to their ongoing network expansion, Charter's multi-year, multi-billion-dollar rural construction initiative will add over 100,000 miles of fiber-optic network infrastructure to deliver gigabit-speed internet access to more than 1 million currently unserved, mostly rural homes and small businesses across the country. Spectrum offers hybrid fiber coaxial (HFC) throughout the city which is not symmetrical but for residential use it will perform nicely. Businesses, especially those that require high data transfer rates and large file sizes or need off-site network backup on a regular basis, can struggle with the slower upload speeds.

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

Provider	Technology	Download Speed	MRC	Data Cap
Spectrum HFC	**Internet Ultra**	500 Mbps*	$39.99	No
	Internet GIG	1,000 Mbps*	$59.99	No

Table 1 - Spectrum Offerings[6]

* Non-symmetrical up to 30 Mbps upload

AT&T

AT&T is a prominent global telecommunications giant, which holds a significant position in the mobile phone services industry, is ranked as the second-largest company in the field. Notably, the corporation made substantial forays into the media and entertainment sectors, highlighted by its acquisition of Warner Media in 2018. However, a strategic shift occurred in February 2021, when AT&T announced plans to drive DirecTV, six years after acquiring the satellite TV business. Subsequently, in May of the same year, the company unveiled intentions to spin off Warner Media and merge it with Discovery.

Under the leadership of CEO John Stankey, AT&T is redirecting its focus towards expanding its 5G wireless connectivity capabilities. In pursuit of this objective, the company is engaged in a fierce, multibillion-dollar competition against rivals such as T-Mobile and Verizon. This battle revolves around achieving the fastest speeds and the most extensive 5G network coverage.

In the City of Shafter, AT&T exclusively offers DSL service, except in the Gossamer Grove Area, where select availability exists.

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

Table 2 - AT&T Offerings

T-Mobile

T-Mobile's[7] 5G Home Internet is 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. No added taxes or fees, no equipment costs, no annual contracts, and no price hikes. Availability for this service requires the upgrading or new construction of 5G antennas which does not happen on a city-wide basis, rather an incremental build over time. Coverage in Shafter is limited and there is minimal subscribership.

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

Table 3 - T-Mobile Home Internet Offering

Satellite Providers

Satellite providers available in the city are ViaSat, Hughes Net, and Starlink. Satellite companies use wireless signals transmitted from a base station/ground unit bouncing that signal off an array of satellites orbiting the earth at an average of 26,000 miles. Even at the speed of light a 52,000-mile round trip adds a great deal of latency. Latency is the time takes for data to pass from one point on a network to another.

Starlink has begun adding satellites at a 350-mile orbit and those using these lower orbit satellites have a much better, lower latency, with a better speeds and performance, however, Starlink's application to add an additional 9000 low orbit satellites has been denied due to a myriad of reasons the foremost being not understanding how low orbit objects behave over time, what happens if/when they return earth. Another reason is the need to keep "space pollution" in check by not allowing there to be too many things in orbit limiting the ability to observe space from the earth's surface.

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

Table 4 - Satellite Offerings

Market Analysis Conclusion

Shafter residents benefit from adequate broadband service provided by the local incumbent, effectively meeting the demands of the households in the region. However, issues surrounding satisfaction, reliability, costs and the absence of healthy competition persist within the community. Introducing a more competitive environment could significantly enhance the local landscape, although this should not overshadow the continued collaboration and support extended to the existing local providers.

The business sector in Shafter appears to be particularly affected by insufficient broadband connectivity. While the incumbent provider offers community support through a HFC (hybrid fiber-coaxial) network, which effectively caters to most residential requirements, businesses often face challenges due to the higher demands for upload speeds, a capability that HFC networks do not adequately support. These demands primarily involve off-site data storage, website functionalities, large-scale file transfers and various other data-intensive operations.

Despite the robust service provision, the challenge of adoption emerges, potentially influenced by factors such as affordability, limited access to devices, digital illiteracy, and other related barriers. Shafter must proactively engage in initiatives that address the digital divide, taking an active role in implementing programs and raising awareness about the Affordable Connectivity Program (ACP).

Service Availability

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.

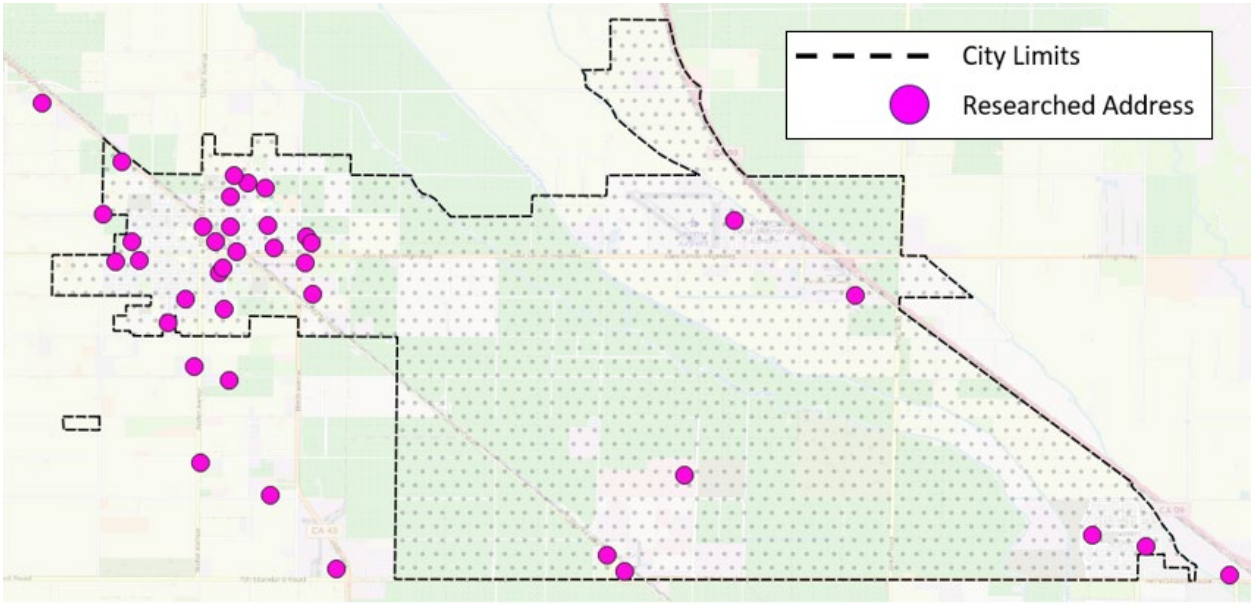


Figure 7 - Addresses Researched

Address	Zip	HFC	COPPER	SATELLITE	5G HOME	FIXED WIRELESS
PACIFIC AVE	93263		X	X	X	X
ELM ST	93263	X	X	X	X	X
STATE AVE	93263	X	X	X		X
E LOS ANGELES AVE	93263		X	X		X
OAK LAKE LN	93263	X		X		X
COBBLE CREEK DR	93263	X		X		X

GOLDEN STATE HWY	93263			X		X
LORRAINE ST	93263			X	X	X
SANTA FE WAY	93263			X	X	X
CREEK RD	93263			X	X	X
IMPERIAL ST	93263			X	X	X
SHAFTER AVE	93263		X	X	X	X
SMITH LN	93263	X	X	X	X	X
ORANGE ST	93263	X		X	X	X
THOMAS LN	93263	X	X	X	X	X
HARTLEY ST	93263	X	X	X	X	X
JESSIE AVE	93263	X	X	X	X	X
PHEASANT RUN DR	93263	X	X	X	X	X
WIEDMANN AVE	93263	X	X	X	X	X
BECKER AVE	93263	X	X	X	X	X
N SHAFTER AVE	93263			X	X	X
OLEANDER AVE	93263	X	X	X	X	X
SONORA DR	93263	X	X	X	X	X
TAMARA CT	93263	X	X	X	X	X
WALNUT ST	93263	X	X	X	X	X
ROSE AVE	93263	X	X	X	X	X
BEECH AVE	93263			X	X	X
CALIFORNIA AVE	93263	X	X	X	X	X
MAYER LN	93263	X	X	X	X	X
HIGHWAY 43	93263			X	X	X
E ORANGE AVE	93263	X	X	X	X	X
W TULARE AVE	93263	X		X	X	X
REDWOOD DR	93263	X	X	X	X	X
AVIATION ST	93263			X	X	X
ZERKER RD	93263			X	X	X
ZACHARY AVE	93263			X	X	X

WAHOO CT	93263	X		X	X	X
CENTRAL AVE	93263		X	X	X	X
CENTRAL VALLEY HWY	93263		X	X	X	X
E EUCLID AVE	93263	X	X	X	X	X

Table 6 below shows, of the 40 total addresses researched, the providers that were available and the percentage of the coverage by those providers.

	HFC	COPPER-DSL	SATELLITE	FIXED WIRELESS	5G HOME
Count	24	24	40	40	35
Percentage	60%	60%	100%	100%	88%

Table 6 - Technology Coverage by Percentage

4G Coverage and 5G Coverage

According to FCC F477 LTE reporting shows that the entire Shafter area is covered by all 4 of the national cellular providers. Those providers are Verizon, T-Mobile (Metro PCS and Sprint), US Cellular, and AT&T. That said, there are always small pockets of every city that are not covered by cellular signals and are not reported on maps used for reporting purposes, therefore it is nearly impossible to ascertain this information without metering these signals in the field. The map below shows the results from the FCC F477 mapping[8].

[8] https://www.fcc.gov/reports-research/maps/lte-coverage-number-providers-ye-2018/

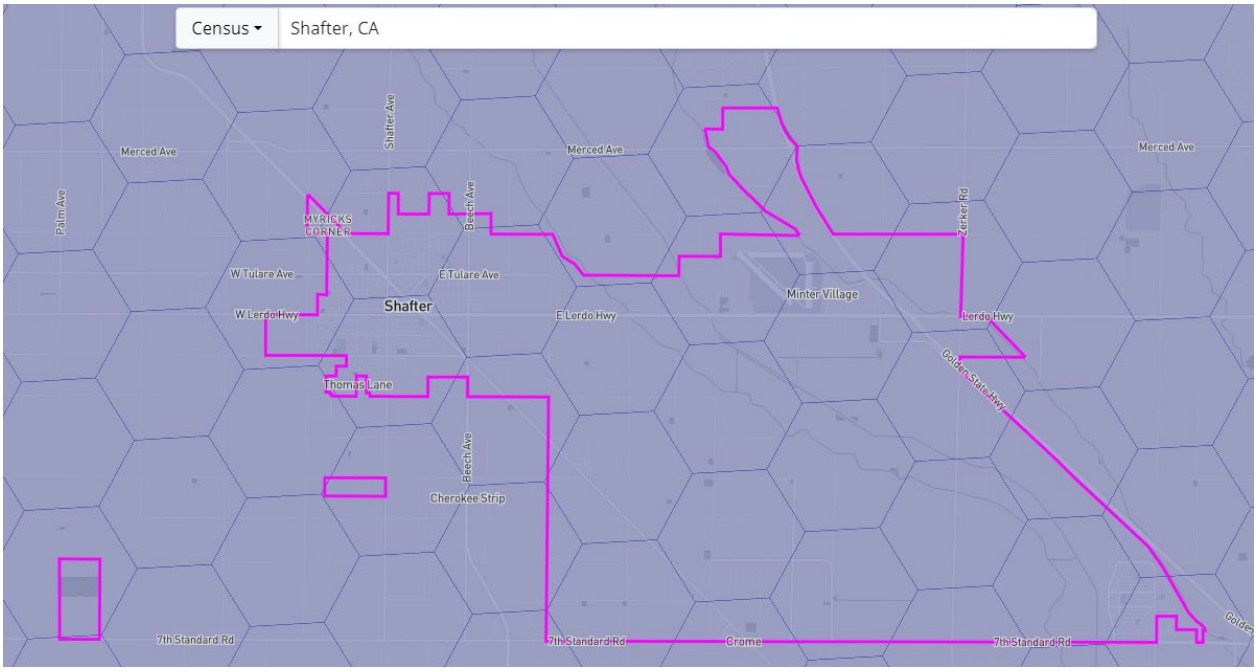


Figure 8 - Cellular Coverage Map

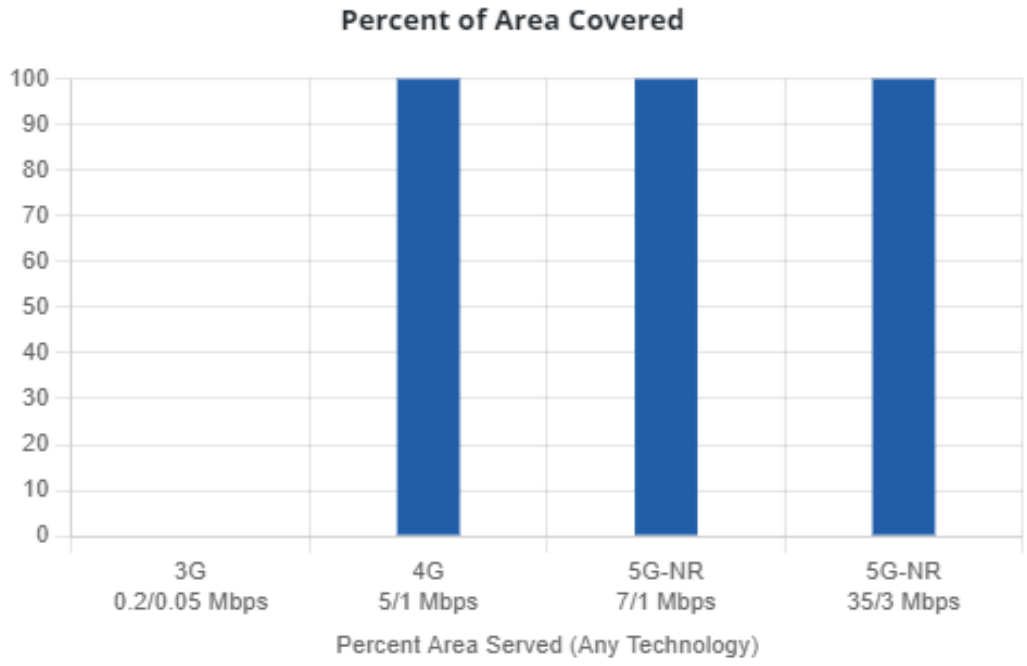


Table 7 - Percentage of Coverage

California Middle-Mile Broadband Initiative

The California Middle-Mile Project 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 designed to facilitate the transportation of data between local communities and major internet hubs or data centers. It helps bridge the gap between the long-haul networks that connect different regions or states and the last-mile connections that reach individual homes and businesses.

The California Middle-Mile Project is overseen by the Office of Broadband and Digital Literacy in the California Department of Technology. The project involves collaboration with several stakeholders, including the California Public Utilities Commission (CPUC) and the third-party administrator, CENIC California Middle Mile Broadband Initiative LLC. The network is being constructed along state highways and rights-of-way, and its goal is to provide increased access to affordable, high-capacity broadband services for unserved and underserved communities throughout California.

Shafter has a significant opportunity to use and support the middle-mile project because it is planned to be built through the core of Shafter along the Central Valley Hwy. GTG advises the City of Shafter to establish and maintain communication with the coordinators of the middle-mile endeavor, allowing them to capitalize on the potential benefits by assisting in the engineering and construction phases, and subsequently utilizing the network to establish connections with neighboring municipalities, law enforcement agencies, regional stakeholders, and other prospective ventures. This middle-mile network is anticipated to link with several pre-existing data centers, including CoreSite's LA1 data center in Los Angeles, also known as One Wilshire, thereby enabling connections to be established globally.

Figure 9 - California Middle-Mile Initiative Map

Data Centers

The accessibility of the internet largely shapes the connectivity within any urban area, community, or region, with crucial determinants being internet speeds and the availability of bandwidth. An often-overlooked element of a fiber optic network is its integration with data centers. These data centers act as central points where multiple internet service providers, private enterprise networks (such as Facebook and Amazon), point-to-point connections and diverse pathways converge to access the global network.

Regional data centers are becoming a crucial piece to broadband infrastructure. The closest data center to Shafter is in Bakersfield (16.5 miles away), there are more in San Luis Obispo (85.3 miles away) as well as Fresno in the Central Valley (100 miles away). The other major urban data centers that the middle-mile network would allow access to are found in Santa Barbara and Los Angeles.

The California Department of Technology (CDT) will 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 to share communications and have access to high speed low cost Internet services in addition to providing areas for disaster recovery equipment.

Figure 10 - Data Center Location Map

Goals and Needs

Broadband Survey

To gain insight into the needs of the community, it is important to initiate community engagement in order to gather input from as many residents and businesses 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.

Conducting an online survey and promoting it through various channels like social media, email lists and word-of-mouth is an effective way to gather data and engage with the community. By publicizing the survey, GTG aimed to reach a wider audience and encourage participation from residents and businesses in Shafter. This approach aligns with the importance of surveys in understanding

the needs of stakeholders, making informed decisions, and driving positive change.

Promoting the survey through social media platforms allows for broad visibility and easy sharing, reaching a larger number of potential respondents. Email lists enable targeted outreach to specific groups or individuals who may have a vested interest in the topic, ensuring a diverse range of perspectives are captured. Additionally, word-of-mouth promotion can generate buzz and encourage participation among community members who may not be actively engaged with digital platforms.

By leveraging these promotion methods, GTG aimed to maximize the reach and participation in the survey, enabling them to gather valuable insights and opinions from the community. This data can then inform research, policy development, and decision-making processes, ultimately working towards meeting the needs of various stakeholders and driving positive change in Shafter.

Survey Responses

According to the survey analysis, the completion rate of the survey was 73.2%, with a total of 127 responses (Figure 11). Most respondents, 99.2%, identified themselves as residents, while 0.8% identified themselves as local businesses. Although not all responses were completed, 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 127.

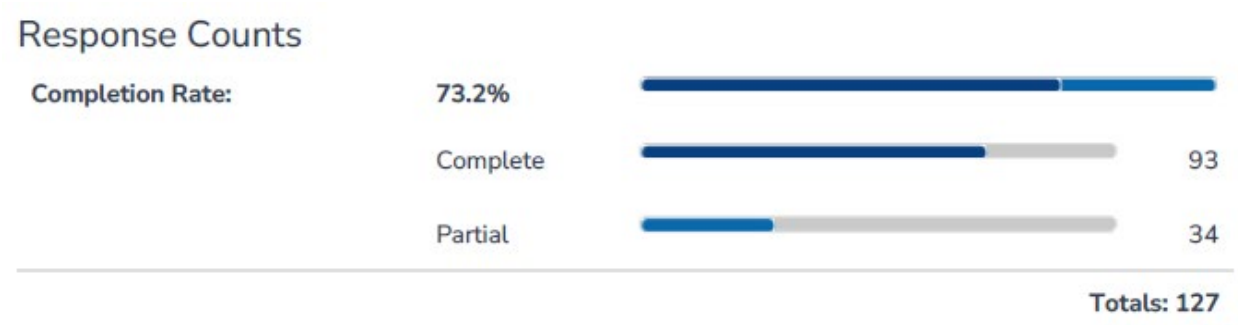


Figure 41 - Response Counts

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 is crucial to acknowledge the asymmetrical nature of HFC broadband speeds, where downloading data is prioritized over uploading. Consequently, this leads to non-symmetrical standards, resulting in varying download and upload speeds. In contrast, all-fiber networks offer symmetrical services that are notably faster than those of hybrid networks. This survey provides comparative data on both network types.

The data concerning the adequacy of internet connections at respondents' locations provides valuable insights into overall satisfaction with internet services. While 36% of respondents reported satisfaction with their internet connections, the dissatisfaction expressed by 64% suggests potential underlying issues impacting user experiences and expectations (Figure 12). This discrepancy emphasizes the significance of not just providing high-speed broadband but also ensuring consistent reliability and performance. It suggests that intermittent service disruptions, latency issues or inadequate customer support could be contributing to the dissatisfaction among a significant portion of users.

To enhance overall satisfaction, internet service providers should prioritize not only delivering high-speed connections, but also addressing concerns related to service reliability, consistency, and customer support. By addressing these factors, providers can ensure that users not only have access to high-speed internet but also experience a seamless and dependable online experience. This approach can ultimately lead to increased customer satisfaction and loyalty.

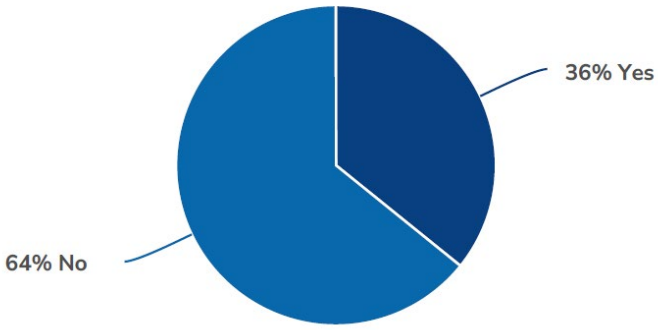


Figure 15 - Internet Adequacy

The data on internet satisfaction underscores a significant disparity in customer sentiment, with 32.6% expressing being satisfied and 67.4% indicating dissatisfaction with their current internet service providers (Figure 13). This stark contrast highlights the need for enhancing service quality and improving the overall customer experience offered by these companies. Furthermore, the existence of healthy competition within the market can prove advantageous for consumers. When multiple internet providers operate in the same area, it fosters an environment where each company is compelled to elevate its services to both attract and retain customers. This competitive pressure often results in improved service offerings, better pricing and a heightened focus on customer satisfaction.

However, despite the positive impact of competition, it remains crucial for providers to address underlying issues contributing to customer discontent, such as service reliability and customer support. By prioritizing these critical aspects, internet providers can strive to enhance the overall customer experience, thereby fostering increased satisfaction within their customer base.

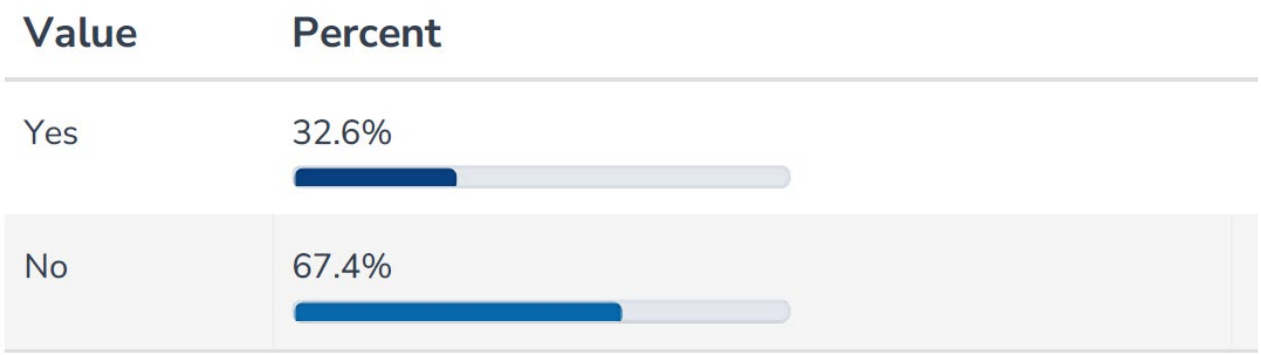


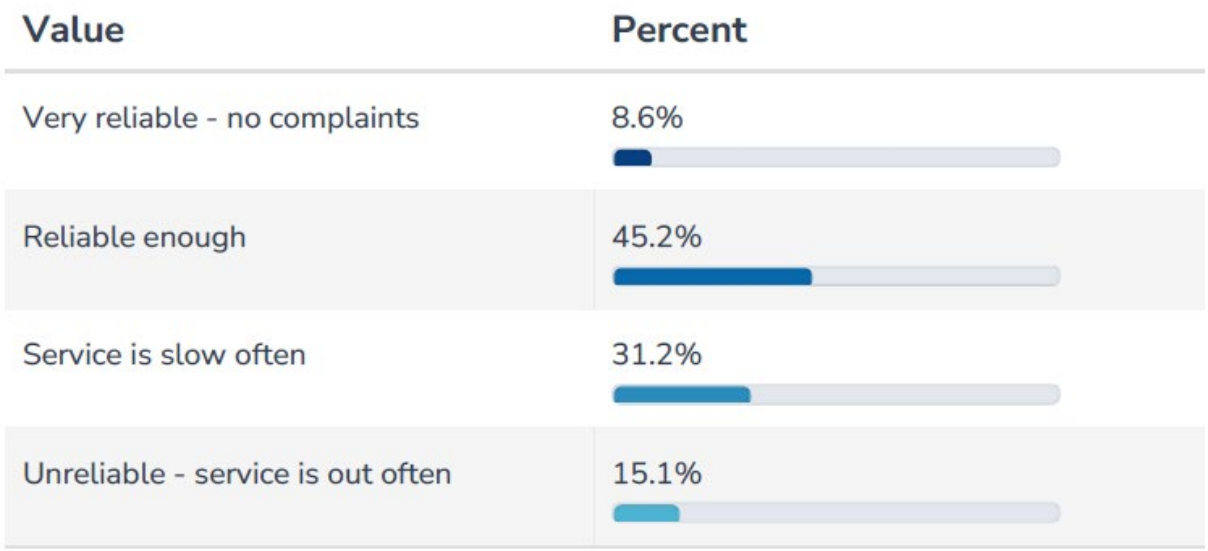
Figure 16 – Satisfaction

Broadband reliability refers to the consistent and uninterrupted availability of internet connectivity, encompassing aspects such as network stability, minimal downtime, and consistent speeds. A dependable broadband connection is vital for a wide array of activities, including remote work, online education, telemedicine, and general internet usage.

To ensure reliable broadband, service providers must prioritize investments in robust infrastructure, regular maintenance, and efficient customer support. Additionally, the establishment of redundancy and backup systems is essential to minimize service disruptions.

While the survey analysis document may not offer specific reliability data for Shafter, such as actual downtime and outages, it acknowledges the critical importance of reliable broadband service for the community (Figure 14).

Notably, 53.8% of respondents expressed confidence in the reliability of their internet service, a mere 8.6% sharing their experience as very reliable and 45.2% sharing a reliable enough rating. "Reliable enough" indicates there is room for improvement, and this provides opportunity for additional entrants to offer fiber to the home services and can expect a reasonable high take rate of 25%-35% (percentage of possible subscriber's vs how many take the new service offering). This indicates that ISPs are delivering strong broadband over dependable networks, which is promising news for both providers and users.



Value	Percent
Very reliable - no complaints	8.6%
Reliable enough	45.2%
Service is slow often	31.2%
Unreliable - service is out often	15.1%

Figure 14 – Internet Service Reliability

Based on the survey data, there are two primary companies providing internet services to the residents and businesses of Shafter. Figure 15 below shows the breakdown of internet service providers from the survey respondents.

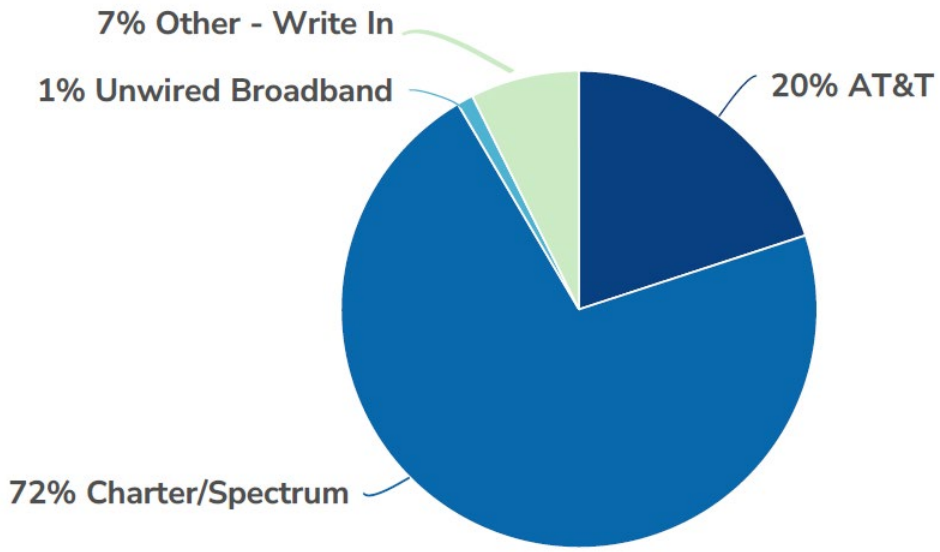


Figure 15 – Internet Service Providers

These percentages represent the distribution of the different internet service providers among the responses. Charter/Spectrum has the majority of subscribers with 72%, followed by AT&T with 20%, and other companies with a total of 8%. When a single ISP has this high of a take rate this shows that there is a lack of competition.

Speed Test Results

The map below depicts respondent locations along with speed test results categorized into different groups: up to 25 Mbps (Federal Minimum), up to 100 Mbps (California minimum), up to 500 Mbps and up to 1000 Mbps (1 Gigabit). The results indicate that most of the city is covered by high-speed broadband, aligning with the information provided by the FCC Maps regarding HFC network access. Notably, the downtown area and the "core" of Shafter demonstrate the highest concentration of low-speed connections.

The reasons for this phenomenon are complex, with affordability and limited device access emerging as probable contributing factors. To discern the precise causes, further data collection would be necessary.

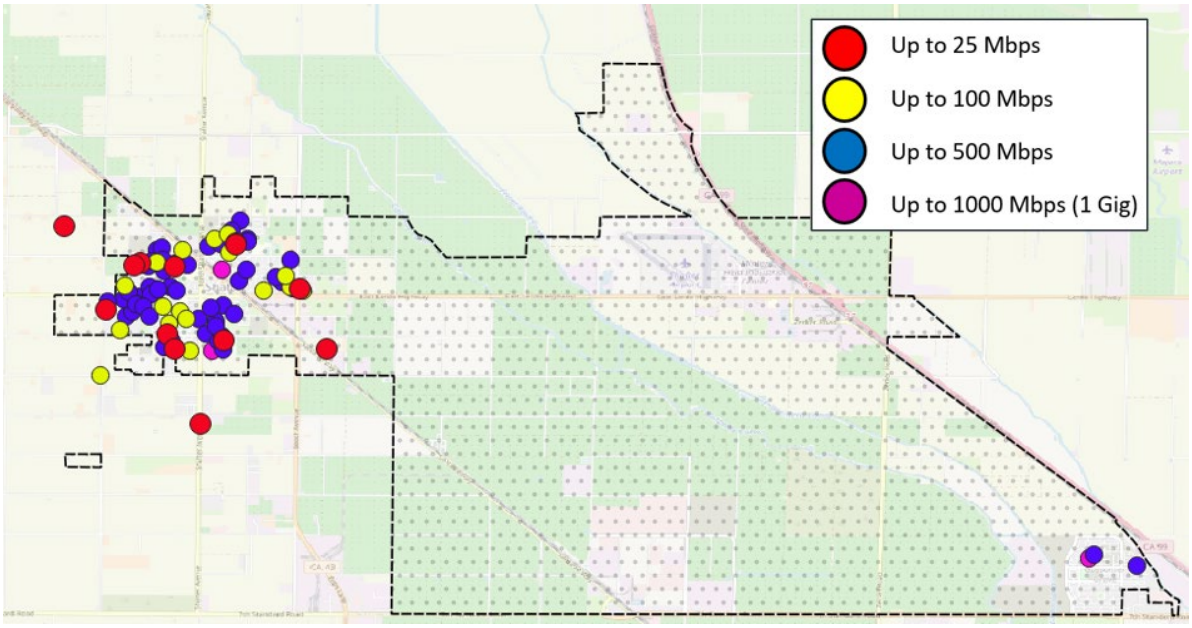


Figure 16 – Respondent Locations and Speed Test Results

ACP

The Affordable Connectivity Program (ACP) was launched by the Federal Communications Commission (FCC) to enhance the accessibility and affordability of broadband for low-income households. This initiative enables qualifying households to obtain a $30 monthly subsidy from participating broadband providers, thus cutting the cost of securing a minimum 100 Mbps download speed broadband connection. By rendering internet access more economical, the ACP effectively works towards closing the digital gap. Cities can effectively communicate and promote the benefits of the ACP to their residents and program managers serving underprivileged communities.

The data presented in tables 8 and 9 illustrate the utilization and level of awareness of the Affordable Connectivity Program among respondents. As per information from *educationsuperhighway.com*, a primary tracker of ACP adoption and information provider for the program, the figures demonstrate a 70% adoption rate within city limits among eligible families. Additionally, the data indicates that 1,493 eligible households currently lack regular internet access, with many relying on cellular hotspots for connectivity. Notably, cellular providers, being private enterprises, operate based on profit-driven business

models, which limits public sector control and influence over the coverage they offer.

City	Adoption Rate	Eligible Households	Enrolled Households	Eligible Unconnected Households
Shafter	70%	2836	1992	1493

Table 8 – ACP Adoption Rate

KNOW ABOUT THE ACP		
Yes	25.0%	21
No	75.0%	63

USING THE ACP		
Yes	11.9%	10
No	88.1%	74

Table 9 – ACP Awareness

Noting that 75% of the respondents do not know about the ACP shows that the city should be promoting it, especially to the underserved areas in the city and to the unincorporated parts of Kern County that the city supports through various programs.

It should be noted that 35 respondents would like to know more about the ACP.

Response Comments

In the survey conducted by GTG, respondents were invited to share their comments regarding their Internet service. Specifically, they were asked "What would better broadband mean to you and your family or the area?". It's essential to clarify that GTG did not alter the wording or grammar of any comment,

whether they were from businesses or residents. The only adjustments made were for the sake of brevity.

Response ID	Comments
106	Being able to use all devices I spend my money on. Not having to fight with the internet company on a daily basis.
86	Better able to do our job.
54	Better broadband will help with day to day activities. For instance if the internet was a little faster I can finish my work and further move on with my daily activities. When you spend a few minutes just for a page to download it can be pretty frustrating. These last few months the internet connection has been so bad that we have to use cellular data just to get our work done.
123	Better broadband would make connections more reliable when doing work and for emergencies. It will allow more companies to compete by offering lower prices for the area.
118	Better entertainment options
127	Better service better price
40	Better service, better productivity
92	Broadband internet is very important to our household. My wife works remotely in the field of clinical research for the UC system, doing data analysis. And my wife and I both engage in remote learning to keep up with our continuing education. We of course use internet for entertainment and shopping as well, and our current level of service is adequate for those purposes. But we don't have enough bandwidth to host video conferences for work, which is a limitation for both of us. I grew up in Shafter and am very glad to be able to live here with my wife, and we are happy to have our current level of service which does mostly meet our needs. But improved and more affordable service would be helpful to us. I know others with family connections to Shafter who would consider (strong emphasis on consider) returning or moving here, if they were able to do remote work while living here. A major question I am asked is how our internet performs, and my honest answer is that it is mostly ok, but not truly sufficient for intensive data-centric work.

107	Broadband is currently too expensive for what I am getting. It should be no more than $50/month. Because there is no other provider in town with deceit speeds, I am stuck
128	Broadband is the future. Everything is on the internet now and every device requires the internet. When its slow it severely hinders human development. I have had AT&T for a while now and they greatly throttle my internet outside of my home and continue to do so at my house. Downloads for a game I had for my PS5 took over a week to download.
129	Could keep in touch with friends and relatives. Also easier shopping.
26	Devices not getting dropped. Wireless overload. Almost everything uses WiFi now.
91	El mejoramiento de servicios para el consumidor mejora la vida del mismo que las utiliza, como el internet utilizado en negocios y lugares pÃºblicos y tambiÃ©n en el hogar ayuda a estar mejor conectados resolviendo las necesidades del dÃa sin perder tiempo
72	Faster better service and more affordable
14	Faster internet means that we get work done faster.
20	faster streaming
24	FIBER
52	For our family. It's too expensive for the quality of service. We have to reboot the modem almost weekly.
28	Having fiber connection would help me and my family to stay better connected. Also it would bring better security to us since there are less outages and uptime is more reliable. Besides speed and reliability, fiber is less expensive than the top tier Spectrum high speed internet which is not 1000mbps upload and still suffers from so many outages. Also for business, fiber would help bring cost down to security systems by adopting more affordable and cloud security systems. There are just so many advantages to get Fiber in Shafter

Community Outreach Meetings

To gather information regarding the needs of the residents and businesses in Shafter, GTG, working with city staff holds Stakeholder outreach/listening

sessions allowing the public to voice their opinions in a structured manner. GTG, along with City staff, held one meeting with the community. Unfortunately, the meeting had only a few attendees. This could be attributed to the perception that Shafter is well served by local incumbents in terms of high-speed internet, primarily Charter, which may have led to a lower level of interest or urgency among residents to participate in the sessions. We would like to acknowledge with much appreciation the crucial role of City staff and regional stakeholders from Shafter. City staff provided valuable feedback on a bi-weekly basis during the project in addition to assisting with getting the word out to the community regarding this important project.

State and Federal Data

The FCC maps shown earlier are ones that show what providers are available and the technologies they offer. The maps in this section are from the National Telecommunications and Information Administration and the California Interactive Broadband map that show the needs that exist based on information provided by the last Census Bureau tabulation.

The National Telecommunications and Information Administration (NTIA) map is no longer available and has been replaced by the new FCC Broadband Data Collection map. Although both maps represent data that has been reported by providers and is highly scrutinized, the new FCC map shows speed available by location (address) where the older map showed where providers are providing service on the census block level: if one address was served within a census block the entire block was shown as being served which greatly skewed results in the providers favor and did not accurately represent the true availability of broadband. The map below (Figure 17) shows the availability of high-speed broadband within the city limits of Shafter, while the graph below (Figure 18) shows broadband availability by speed.

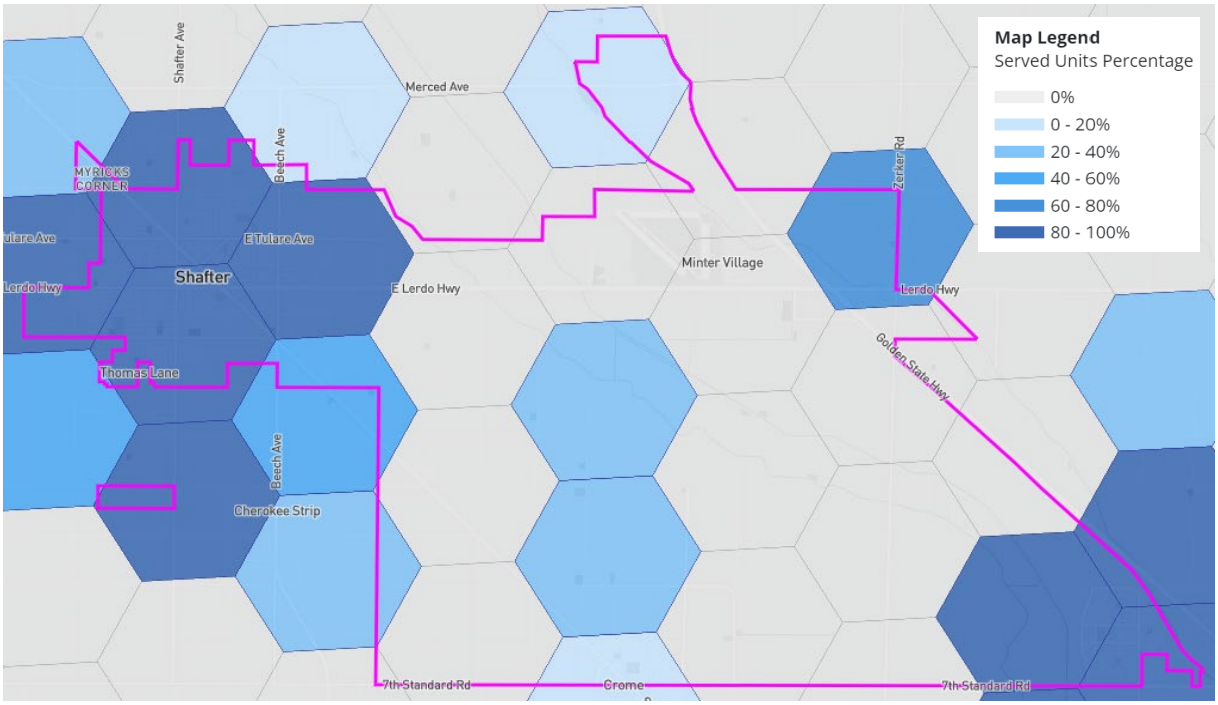


Figure 17 – Locations with minimum speeds of 100 Mbps upload and 20 Mbps download

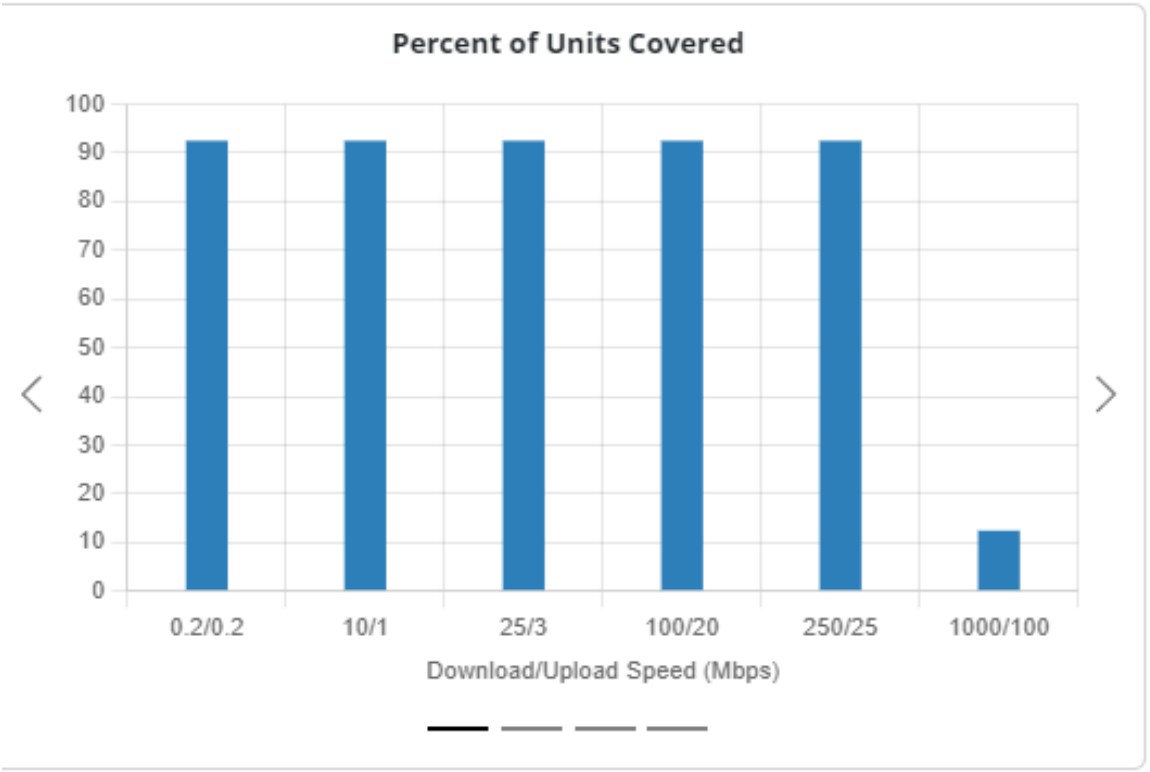


Figure 18 – Provider Reported Speeds

The California Interactive Broadband map provides many different data sets that are especially useful for analyzing the needs for cities in California. The figure below shows priority areas as defined by the California Public Utilities Commission (CPUC) used for the California Advanced Services Fund (CASF) last mile funding.

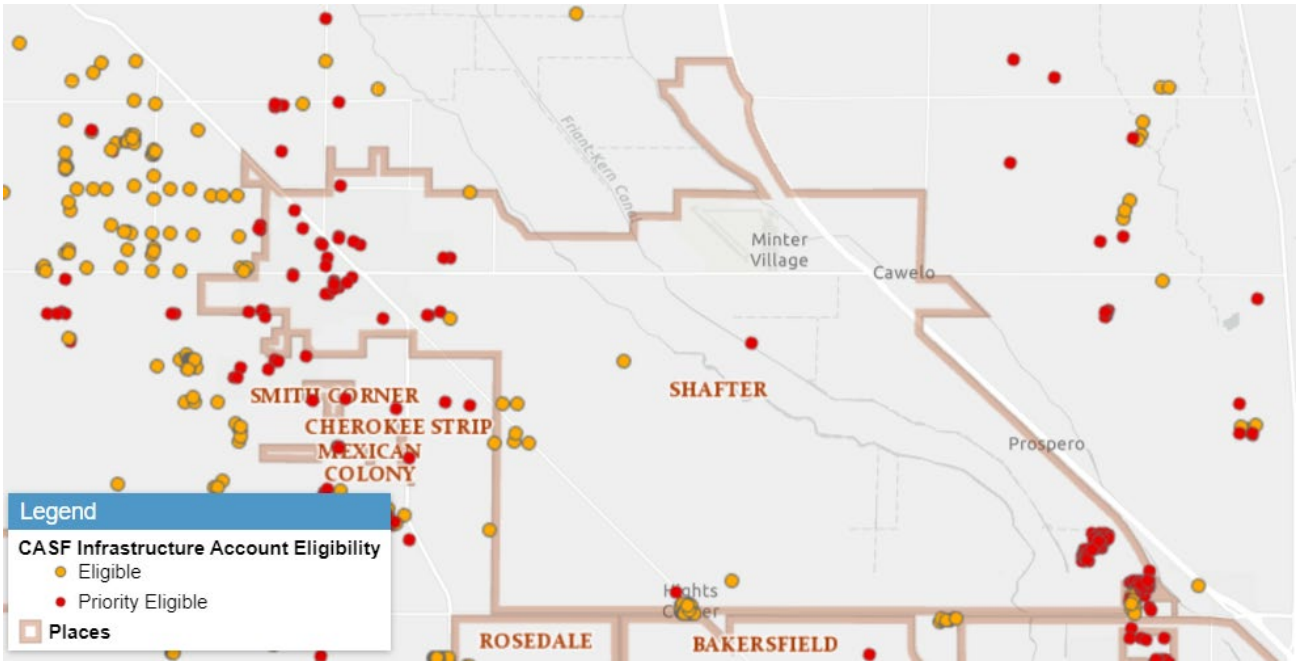


Figure 19 – Priority location map

According to the California broadband map, Figure 19 shows locations that are eligible for and priority eligible for CASF grants to help support these locations. Shafter has priority locations, meaning they can qualify for CASF grants over the orange eligible locations, scattered throughout, however primarily in the downtown area.

In addition to the priority locations map, there is also a map (Figure 20) showing the areas that are served with the FCC standard of 25/3 download and upload speeds (green), less than 25/3 but above 10/1 (yellow), and priority unserved areas with subscribers receiving less than 10/1 speeds. The download/upload speeds are important because as the world moves forward with more and more activities moving to online and app-based formats, these areas cannot partake in these activities, many of which such as telehealth are vitally important.

Figure 20 – FCC served-status map

Policies

The City of Shafter does not have policies in place regarding broadband and related assets. Basis 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.

Gaps

Shafter does not have a fiber-to-the-home provider, other than itself through its current partner Vast Networks. The city has a robust fiber network already constructed and in use, however, to support all the residents and businesses of Shafter, the city's network will need to be expanded through a Public Private Partnership (P3).

During the project reach out process, residents reported incumbent providers are not offering fiber services or even well-maintained hybrid fiber coaxial (HFC) services to the residents in Shafter, consequently, reliability, speed, and customer services are all major concerns and issues reported by the community. It is important that the city supports economic development through meeting demands of current and future broadband needs for all the city as well as, the commercial areas that have great potential for new businesses, retaining current ones, and allowing current businesses to expand.

The discovery process resulted in findings that Shafter has major gaps in its policies related to fiber and other network infrastructure. These include:

- "Dig Once" and joint-build policies and programs.
- Placing cell communication equipment on public assets/property, including a master license agreement.
- Limited city assets to leverage for the expansion of a fiber network.
- The city lacks fiber service provider to utilize the city network for providing services to a significant portion of the commercial and industrial sectors of the city, which is detailed further in this report.

Conceptual Design

High-Level Designs, HLDs, are a conceptual design that includes routes, possible construction methods, and overall footage to gain a budgetary overview as well as possible timeframes needed to complete the project.

The HLD is put together utilizing the most cost-effective construction methods first: existing fiber optic cables, conduits, and other existing infrastructure before considering new construction. New construction methods such as boring,

plowing, micro trenching or aerial, are by far the most expensive and slowest ways to build a network. Although the cost of new construction methods can vary greatly, they are typically more expensive than using existing infrastructure. The chart below shows the construction methods available and estimated cost 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, 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	$15 – $25	Using a vibratory plow with 4' stinger to place conduit prior to new cable placement
Micro trenching	$15 – $25	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	$100 – $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	$75 – $100	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 Shafter HLD include:

- With most of the network build to occur in the downtown core area, the HLD is not broken into phases. This will most likely change with the implementation of a P3 agreement and the needs of the partner.
- New underground construction will be directional drilling/boring or microtrenching. The City supports CA SB 378 allowing microtrenching in the City's right of way.
- Construction costs are for infrastructure, including cable and splicing.
- Construction methods are chosen in order of cost effectiveness, providing a fiscally responsible build.
- The Gossamer Grove area will be built in cooperation with the developer and is not included in the HLD.
- Per foot costing is based on average pricing from local vendors it includes prevailing wage.
- All construction and engineering costs have risen over 30% after COVID-19 and are expected to rise, but at a much slower rate.
- City assets will be used to house all major equipment and power needed to build, run, and maintain a FTTH network.

- All cabinets, hubs, distribution 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.

Tradeoff

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.

While underground construction may seem a higher cost up front, there are limited ongoing operational cost i.e. maintenance only. Aerial installations require ongoing operational costs that will exceed initial underground installation cost over the long term i.e. 15-20 years and continue in perpetuity.

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.

Shafter is spread out over 38.7 square miles, however as illustrated in the map below (Figure 16), most of the new construction is in the northwest area of the city. With minimal segments of new construction in other parts of the city, it is not necessary to break the HLD into phases. This idea may change when a public private partnership is developed, and the partner may have ideas on how to prioritize the HLD into phases that will benefit the partnership and provide return on investment (ROI).

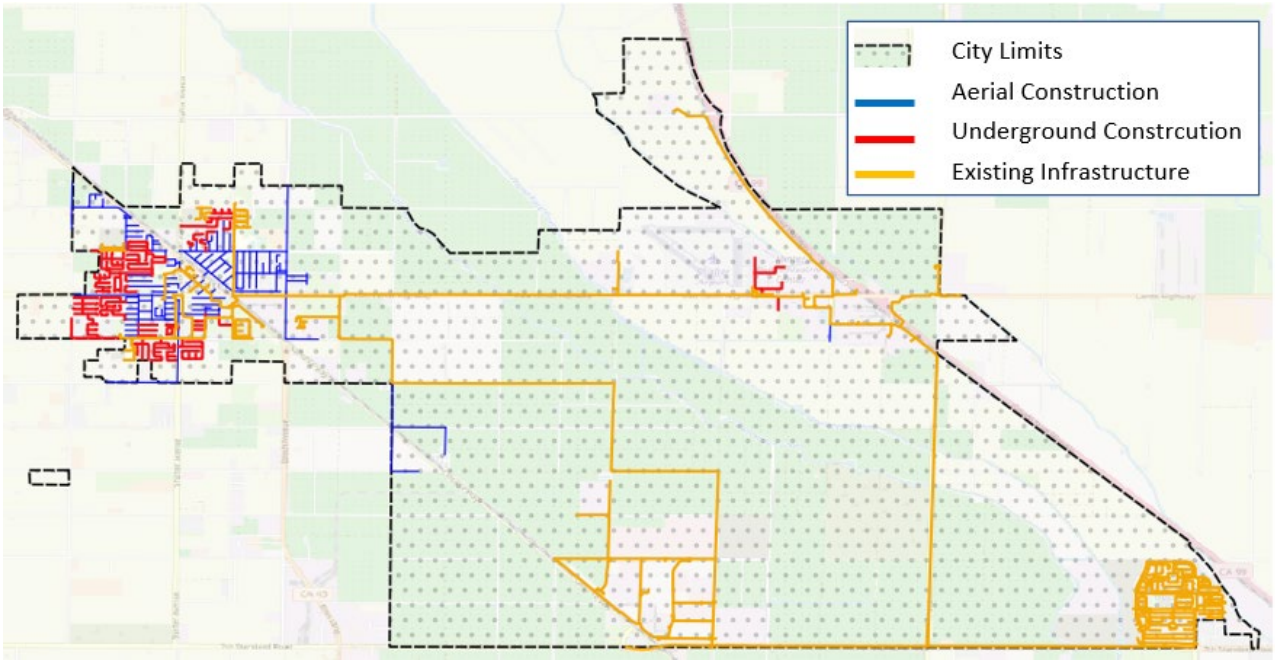


Figure 21 - HLD Map

HLD Footages and Budget

The table below shows the estimated types of construction with associated footage and costs. The foot price includes prevailing wage, engineering (estimates $2/FT), cable and splicing. As mentioned previously in the report, the costs have skyrocketed in the past year due to the Covid inflation that occurred. The pricing was obtained by speaking with local area utility contractors, who mention that the inflationary state of construction is continuing to rise. It is important to note that with the unstable nature of construction costs, the below estimates will only be valid for a limited time.

Construction Type	Est. Miles	Est. Footage	Est. $/FT	Est. Total Cost
Aerial	27.88	147,191.0	$25.00	$3,679,775.00
NU	18.67	98,573.2	$100.00	$9,857,320.00
Existing Fiber				
Downtown Corridor	1.90	11,035.2	$5.00	$55,176.00
North Mannel Ave Schools	1.10	6,388.8	$5.00	$31,944.00
Statewide Long-haul Interconnect	1.80	10,454.4	$5.00	$52,272.00
Backbone Ring	20.30	117,902.4	$5.00	$589,512.00
Industrial Park Ring	4.30	24,974.4	$10.00	$249,744.00
Southeast Residential Development	2.50	14,520.0	$1.00	$14,520.00
Grand Total	**81.64**	**431,039.40**		**$14,530,263.00**

10% Contingency	89.80	474,143.34		$15,983,289.30

Table 10 – HLD Footages/Costs

The estimated split between construction types can be found in table 11 below.

Aerial %	Underground %	Existing %
34%	23%	43%

Table 11 – Construction Type

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 discussed below compare the various levels of investment and amount of municipal control. The City of Shafter has different options from doing nothing i.e. let the incumbent providers handle broadband, all the way to becoming a municipal ISP and provide services to the businesses and residents in Shafter. Rarely is extreme 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 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 sufficient staff to run and monitor a network, some cities contract most 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. The City of Shafter has installed over 40 miles of fiber infrastructure including 4 network facilities/hubs that is a significant investment that can be used by P3 to quickly expand Internet

services in the community. In addition to this, Shafter has staff that are versed in fiber optic infrastructure that will assist in communications with a P3 partner. 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. The City currently has a development agreement process in place that will assist in expansion of fiber in new buildouts in the community. The City can further expand on this with the adoption of a Dig Once policy.

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. Expanding the City network to these important locations can reduce costs and improve services. The cons to this is that it will reduce revenue to a P3 partner that could be used to support this business model if chosen including expansion to other areas of the community.

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 would 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 O&M, 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 Shafter has low-income areas of the community that are competitive with most federal and state grants that support expanding broadband to unserved and underserved communities. In addition to these, 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 proactive over the last decade in developing and deploying a city-wide city-owned network. This foundation can be used to support expansion of broadband in the community and regional efforts related to broadband and the California Middle Mile Project. To enhance this foundation and the City's digital including efforts, the city should evaluate the addition of a technology fee which can facilitate building out broadband quicker supporting the community and economic development.

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. We recommend the committee be kept small and nimble with key stakeholders interested in broadband.

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 this within the City for when microtrenching is going to be used. This should include 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 Shafter 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.

Submit an RFP for 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 its equipment on the City network, 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.

Incrementally build City-owned Broadband Infrastructure

The city should adopt the HLD with the general concept understood by the broadband committee. With policies in place to include broadband in all projects that will further broadband. If there is an opportunity to add infrastructure as part of other projects, this will help the city to incrementally build infrastructure as needed over time and although slower, it will 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 currently does not collect PEG fees. This is a potential revenue source for broadcasting/distributing content for the City's PEG Channels for its community.

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, digital inclusion is the steps and activities to help fix the problem, and Digital Equity is 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, it is not easy to define the underlying causes such as affordability, physical access, having devices that can access the internet, and even knowledge of how to use the internet effectively.

Shafter currently has areas of low income in the community that suffer from digital divide issues. 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 the City's website, 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.

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 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 to be the city's point person leading the broadband efforts lined out in the study.
3. Create workflows to ensure broadband is a consideration on all city capital improvement projects, permitted work in the ROW, and planning efforts.
    a. Planning projects to be reviewed by broadband committee for relevance to add broadband components when needed.
    b. Permits submitted by private companies performing work in the ROW, reviewed by broadband committee, adding dig once policies to applicable permits.
4. Create a digital inclusion policy including the following:
    a. Promote the Affordable Connectivity Program.
    b. Use library resources to educate individuals.
    c. Standards for donating surplus equipment.
    d. Define public educational opportunities.
5. Review City policies update as needed.
    a. Dig Once policy.
    b. Developer agreements.

    c. Review wireless telecommunication facilities ordinance.
6. Create a broadband enterprise fund to support broadband efforts, construction, and partnerships.
    a. Assign a portion franchise fees to a broadband fund.
    b. Adopt a Public Education and Government (PEG) fee and assign a portion to a broadband fund to support expansion of PEG services in the community.
7. Create a financing strategy that separately tracks revenues and expenditures for this fund.
    a. 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.
8. Pursue a public private partnership, create an RFP to find partnerships with a local ISP.
    a. Submit an engineering RFP for a low-level design.
    b. Find a Public Private Partner and create a partnership that will accomplish the goals of the broadband plan in providing underserved businesses with reliable service.
9. Promote digital inclusion efforts for the residents of the city.
    a. Shafter businesses suffer from the lack of access to reliable high-speed broadband.
    b. Promote the Affordable Connectivity Program. Shafter is affluent but there are still those residents that have a challenging time affording internet access.
10. 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

Appendix A: Shafter Business Model Comparison

City of Shafter

Potential Fiber Optic Expansion – Business Model Comparison

The City of Shafter has been a leader in local government building over 40 miles of broadband infrastructure and applying for grants to expand on the investment made in its community. To date, the network has been used for City purposes and for revenue through lease agreements. This is one model for providing infrastructure and improved broadband services in the community.

The federal government has recently made huge investments in broadband throughout the nation due to the lack of equality and access to unserved and underserved areas of communities because these areas did not make business sense to expand to by the private sector. The private sector also charged an exorbitant amount of costs for providing connections with communities due to monopolies. This includes residents, businesses and public agencies.

In addition to this, most of the private sector infrastructure was built on old technologies that do not provide high speed reliable internet services. Cities had the ability to audit the private sector to update and repair this dated technology, but this ability was moved in the early 2000's to the state essentially removing the ability of local governments to enforce the private sector to repair issues that impacted its residents, businesses and own connectivity that supported phones, internet and connections between its facilities.

Local governments do not need to choose between waiting for the private sector to address the issue of serving unserved, unserved, low speed and unreliable services — which it would have done if it were profitable—or taking on the task solely as a public endeavor. Instead, public-private partnerships can break this dichotomy and offer communities new options. In fact, over the past few years, a variety of collaborative public-private models, featuring different levels of risk-sharing, have emerged and proven to be effective examples worth replicating.

GTG LLC developed a Broadband Master Plan for the City and recommends the City pursue a Public Private Partnership model (P3) to reduce impact of City staff currently supporting the network, enhance broadband services in the community, provide a source of revenue beyond the current leases and to share what the City does best, build infrastructure, with a partner that provides maintenance, operations and internet services which it is better suited for.

The following includes the current model the City is using and additional models with varying risk, rewards, pros and cons.

Current Model - Infrastructure Provider

The current P3 model the City uses maintains its expertise as an infrastructure builder but also retains the risk of maintaining infrastructure. This requires the City to continue to require extensive in house broadband expertise. The City does receive some revenue from leasing the network similar to an "Open Network" which allows for multiple Internet Service Providers to operate over the same fiber infrastructure.

- The City owns the assets and partners with one or more retail services providers.
- The City builds infrastructure and leases it out to other agencies/ISPs with the goal of generating revenues to maintain that infrastructure over time.
- The City has done a version of this over the past 10+ years.
- Would require a significant investment from the Econ Development team at the City.
- Private ISPs can pass revenues to the City (via an ROI model), RISKY if the company cannot generate enough subscribers.
- Pros
    - City owns and controls all facets of the network
    - City has some level of control over where and when development occurs
    - Allows for potential revenue
    - Provides some economic development improvement
    - City stays out of ISP business
- Cons
    - Capital outlay
    - City does not own network equipment for lit fiber
    - Longer build times likely due to capital requirements
    - Impacts City staff resources
    - Requires contract expertise for ISP's
    - City has limited control over services provided and cost to community

Recommended Model - Public-Private Partnership (P3)

This model leverages the best capabilities of the public and private sectors. In this model, the City builds infrastructure via grants, revenue from the P3, policy (dig once) and other means. This model ensure the entire community benefits from broadband with the City maintaining local control while the private sector manages and maintains the network.

This model is scalable and reduces the impact on locale staff and the City having to maintain this expertise in house.

This is a shared risk model reducing risks to the City while leveraging what it does best and sharing risk with a P3 that has a track record of profitable, customer service oriented broadband services.

- Public-private partnerships (P3s) are a model that can help local governments and businesses work together to provide broadband services to the community.
- A P3 can be a way to close the digital divide and provide universal service at an affordable price.
- A P3 is meant to serve the community, focusing on service connections (FTTH).
- Many different versions of this model are possible, based on our network and needs.
- Gives the maintenance and future expansion responsibilities to an ISP (outside of grants, dig once and development agreement projects), but lessens the City's revenues if expansion is required right away.
- ISP would have the opportunity to generate customers using our network as a backbone.
- Revenue sharing agreement would help lower the City's current historic level of investment.
- Significant contract work is necessary to ensure the City is not liable for any failures of the ISP or their network equipment/resources.
- City typically retains ownership of existing network and municipal expansions. City to determine who owns the current and future infrastructure.
- Need to determine revenue model and P3 fit i.e. single or multiple for all or partial services.
- Tips for effective P3s include:
    - Before construction begins, partners should determine reporting standards and performance metrics and codify them in contracts and service level agreements (SLAs).
    - Strong contract oversight can improve capital efficiency.
    - As the network matures, a community may want more control or flexibility and should consider these needs when designing contracts.
- Pros
    - City retains ownership of fiber lines and *possibly* some network equipment
        - Can negotiate with other ISP if existing ISP non-favorable
        - Improves economic development at a faster rate with the City expanding the network via grants and policy and the private sector providing the last mile connection for businesses.
        - City not responsible for ongoing maintenance
            - Reduces staffing requirements
            - Reduces financial burden

    - Leverage ISP's network for city's use/benefit
    - ISP vendor maintains network
        - Sufficient staffing
        - 365x24x7 operation
        - Expertise
        - Handles network, operations security
        - Active, continuous network monitoring
        - ISP can leverage ISP Peering
        - Best interest for ISP to build and advance networks to the current state-of-the-art fiber network
    - Builds a FFTP network which
        - Offers competitive Internet rates
        - Begins to close the digital equity divide
        - Encourages economic growth
        - Can extend network to hard-to-reach unincorporated areas near/around the city. These may be areas that by default the City provides some level of service
- Cons
    - Potential that ISP defaults leaving city responsible for maintaining and operating network and potentially services to residents and businesses

Other Broadband Models

Public Policy Only

The Public Policy only model is one of the lowest risk broadband infrastructure models. The only model with less risks is to do nothing. This model still requires in-house expertise due to the significant investment the City has in fiber infrastructure.

- City's function reduced to creating policies that are in-line with State and Federal statutes only.
- Policies would include:
    - Dig Once
    - Microtrenching
    - Permitting/ROW
- Maintain current system integrity and PAUSE all expansion.
- Limit all budgetary action on the network until policies are in place –may require the removal of our Enterprise Fund.
- This option would force the City into a standstill situation.
- Pros
    - City owns and controls all facets of the network
    - Reduces financial burden of expensive leased lines and circuits

    - Reduces impact on City staff for building out system and coordinating with an ISP
    - City stays out of ISP business
- Cons
    - City maintains existing network
        - Impacts City staff resources (requires time/expertise of city staff)
        - City will be impacted when outages occur
        - Limits revenue opportunities for City
        - Limits improvements for economic growth
        - Long term continued maintenance costs

Internal Expansion

This model retains the most risks for the City. There are no shared costs although there would be some revenue via leases. The City would have to maintain the network and retain advanced inhouse broadband expertise or outsource for it. This model would be a slower buildout model, and revenue could disappear if the lessees do not see the market as profitable.

- City remains responsible for expanding network resources (historic precedent).
- City expands its leases of Dark Fiber to ISPs for future use.
- Substantial operating costs and overhead in first 10 years to support building out dark fiber resources to certain areas of town.
- Broadband Manager, Sales/Leasing Marketing Specialist will be required
- Pros
    - City owns and controls all facets of the network
    - City has some level of control over where and when development occurs
    - Allows for potential revenue
    - City stays out of ISP business
- Cons
    - Capital outlay
    - City does not own network equipment for lit fiber
    - Longer build times likely due to capital requirements
    - Impacts City staff resources
    - Requires contract expertise for ISP's
    - City has limited control over services provided and cost to community

Public Services Provider

This is a common public sector broadband model. It reduces risk by sharing the costs with other public organizations. While this model keeps local government agencies out of the ISP business, it also reduces the City's ability to improve economic development and make broadband deployment more equitable by reaching unserved and underserved areas of the region. This model also requires the City to maintain broadband expertise but some of this can be shared with other public agencies that are benefiting from this model.

- City focuses on connecting and subscribing public entities only.
- Those entities can include: City assets; public organizations; county facilities; non-profit orgs; schools and libraries.
- This can be done in conjunction with a P3 but reduces revenues.
- Grants available for connecting and maintaining public agencies are abundant.
- Pros
    - City owns and controls all facets of the network
    - City reduces impact (speed and costs) on broadband services for public agencies
    - Potential shared investment with partnerships of other public agencies
    - City has some level of control over where and when development occurs
    - City stays out of ISP business
- Cons
    - Capital outlay
    - Longer build times likely due to capital requirements
    - City maintains network
        - Impacts City staff resources
        - Requires broadband expertise for city staff
        - City and other public agencies will be impacted when outages occur
        - Limits revenue opportunities for City
        - Limits improvements for economic growth
        - Long term continued maintenance costs

Open Access Network

There are two versions of this type of network. The first is similar to a leased model with the exception that a third party would operate a "box" that would be installed at a residence or business that allows the community member to pick and choose the provider of their choice from a multitude of providers that subscribe to the network. The resident/business using the "box" could choose their ISP based off speed, reliability, customer satisfaction or other incentives provided by ISP's. The second model is where

the City builds out the major corridors of this City and a P3 builds the last mile i.e. to the residence or business.

- City opens our existing network to any ISP or provider that wishes to connect.
- Strand-level data maintenance may be critical in this model, as the available strands of fiber may get consumed quickly.
- A standardized ROI model will lead to a standard MSA for each connected agency.
- City or its third-party contractor is responsible for the "lit services" portion of the network, which means that if the ISP is requesting a bump in speed, then the City is responsible for providing this, and revenues would be manipulated by operating costs.
- This model can increase customer choice and improve service.
- Pros
    - City owns and controls all facets of the network
    - City has control over where and when development occurs
    - Allows for potential revenue
    - City stays out of ISP business
    - This model would provide for competition
- Cons
    - Capital outlay
    - Longer build times likely due to capital requirements
    - Impacts City staff resources
    - Requires contract expertise for ISP's
    - City has limited control over services provided and cost to community

Municipal Services Provider

This model contains the most risks and generally is only considered when a City owns an electric utility. This is due to the City already having the resources to bill and provided customer service to members of the community while having a department that extends conduit to residents and businesses that could have a shared trench to reduce costs. Skill sets are similar as well from electric to broadband services for installation and maintenance.

The City would act as an ISP and need expertise in this area which is not a best practice for local government. The City would also retain the risks of building out the network and maintaining it in areas of the City not usually considered profitable by the private sector.

- The City, as a municipality, effectively acts as an ISP by providing services to all entities within our jurisdiction and in accordance with our own policies adopted by Council.

- As a retail provider, there are considerable costs associated with this model, including operations, managing services for commercial use, billing, provisioning, new network construction, and an online UI.
- The City would need to have a firm plan in place for capital and operating expenses, revenue potential, as well as reporting on financial viability.
- This option requires an entire Department to be created with multiple staff members at differing functions.
- Pros
    - City owns and controls all facets of the network
    - Revenue stream
    - Promotes economic development
    - Controls destiny
- Cons
    - Capital upfront development costs
    - Long term continued maintenance costs
    - Capital improvements required to continue expanding network as required, for planned system upgrades, and ongoing maintenance
    - Impacts City staff resources greatly increasing staffing requirements
    - Maintain network
    - City becomes an ISP Business providing Internet services
    - Customer billing system required
    - Customer help desk/call center required
    - 24x7 network monitoring required

Appendix B: Shafter Partnership Request for Proposals

This item is available separately from this document.

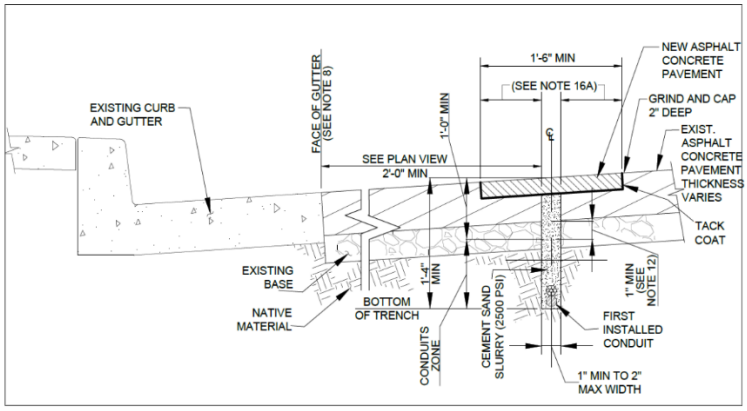
Appendix C: Microtrenching Standards

City of Shafter

Microtrenching Installation and Construction Standards

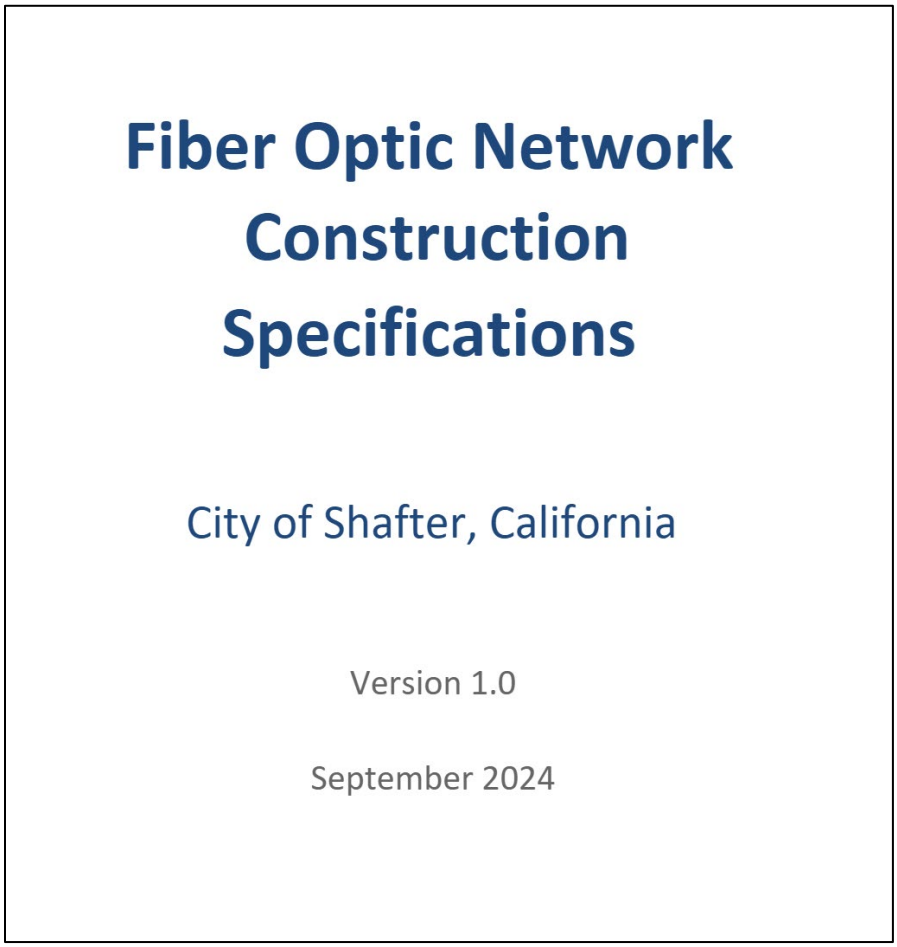
Microtrenching is a low-impact slot-cut trenching method that enables quick installation of underground fiber in trenches that are narrower and shallower than typical open trenches currently used in the industry. All work shall be constructed in accordance with the latest standard specifications approved and implemented by the City Engineer. If requested, the Contractor may use the alternative crack filling methods upon City approval. The Permit Applicant, Contractor, and/or Utility Owner must indemnify and hold harmless the City of Shafter, its elected and appointed officials, employees, agents, and successors from all liabilities, losses, claims, settlement payments, costs and expenses, damages, penalties, fines, attorney's fees, and other amounts resulting from construction, operation, and maintenance activities of all infrastructure installed in a micro trench inside the rights-of-way owned by the City of Shafter.

The City's Microtrenching standards have been established and adopted in accordance with California State Senate Bill 378 (Microtrenching) signed by the governor on October 8, 2021. All work shall be constructed according to the latest standard specifications for engineering and constructing this type of product and will meet at State of CA construction code requirements.



This item is available separately from this document.

Appendix D: Shafter Network Construction Specifications



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Appendix E: Citywide Broadband Business Plan

Shafter Broadband Business Plan

September 2023

City of Shafter
336 Pacific Avenue
Shafter, CA 93263

This item is available separately from this document.