

Town of Firestone, CO

Broadband Feasibility Report

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Introduction

Vantage Point Solutions (VPS) was awarded a contract to conduct a Broadband Assessment and Feasibility Study for the Town of Firestone, Colorado. The main purpose of this Study was to determine what the broadband problems and challenges are in Firestone and provide recommendations for next steps on how to address the problems identified.

To conduct the feasibility assessment, VPS gathered data and information by:

- Engaging with local officials
- Conducting provider research
- Conducting stakeholder outreach
- Issuing a Request for Information for enhanced broadband services
- Conducting a residential survey
- Researching information obtained through publicly available sources

This comprehensive report details the information that was collected and analyzed and discusses the following aspects of the Study:

1. Survey and Stakeholder Outreach
2. Network Types and Operating Models
3. Potential Network Designs
4. Funding and Financing Options
5. Recommendations

When discussing broadband, it is important to understand the definition. The Federal Communications Commission (FCC) currently defines broadband as speeds that reach a minimum of 25 Mbps downstream and 3 Mbps upstream (25/3). However, most of the federal grant programs define unserved areas as those where service levels fall below a lower threshold of 10 Mbps downstream and 1 Mbps upstream (10/1). Although even the current FCC definition of broadband is far behind what most customers perceive to be adequate for residential use, for purposes of this report – high-speed broadband is internet speeds that meet or exceed the federal definition of broadband.

Key Findings

The biggest question a municipal feasibility study needs to answer is “what is the problem we need to solve?” As such, the most critical task of a feasibility study is to conduct outreach in the community in order to talk to as many stakeholders as possible. Stakeholders represent key groups of potential end-users of a municipal network such as citizens, businesses and government agencies. The purpose is to obtain feedback regarding current levels of service, future needs and concerns. The information gathered from these tasks directly assists in the development of the models and the final recommendations.

- Based on the data, 98% of respondents purchase internet services in some form. These results are very much in line with other Front Range communities and indicate that everyone who wants to subscribe to a broadband service is able to do so. **Thus, there is no problem in Firestone accessing high-speed broadband service.**

- One-third of respondents are paying over \$80 a month for high speed services. **This suggests that respondents are both purchasing the highest speed services offered and these packages are expensive.**
- Speed and reliability are the most important attributes for internet service with price of service coming in third. However, respondents are strongly dissatisfied with price, customer service and technical support of their current service with respondents rating satisfaction under 36% at each of those. **Essentially, respondents are not satisfied with the value they are getting for the cost of their current internet service.**
- When asked about the quality of their cellular service, over 61% of respondents reported having a strong signal while the rest experience issues with their cellular service. **While 43% subscribe to Verizon, respondents subscribe to a wide variety of cell providers. Solving intermittent cell problems will require the participation of all the major cell providers.**
- **Respondents indicate high support for government involvement in funding and solving broadband issues in Firestone.** This indicates constituent trust in local government action, as well as the desire for action to improve broadband in Firestone.

In summary, the biggest issue facing Firestone is lack of competition amongst broadband providers including high cost and low customer service and inconsistent cell service. The Town of Firestone does not have an access problem. In other words, everyone who wants to purchase broadband services is able to do so. Therefore, the following recommendations are made to the Town of Firestone:

1. **The Town should NOT move forward with a last-mile Fiber-To-The-Premises (FTTP) municipal broadband network.**
2. **The Town should move forward with either issuing an RFP to the RFI bidders or directly entering into negotiations to establish a Public-Private Partnership (PPP) for a FTTP network.**
3. **If the Town does not establish a PPP that results in the Town's middle-mile network needs being met, then the Town should consider expanding its own middle-mile network as needed.**
4. **Finally, in addition and independent of the network solutions, the Town should consider implementing one or more of the broadband policy solutions noted in this Report.**

This Report fully details the data and information collected and analyzed through this project as well as provides rationale for the recommendations noted above.

1. Glossary

Below are key terms found in this Report. An expanded discussion the various technology types is found in **Appendix A**.

Broadband: The Federal Communications Commission (FCC) currently defines broadband as speeds that reach a minimum of 25 Mbps downstream and 3 Mbps upstream (25/3).

Backbone: A high-fiber count fiber optic mainline that provides connectivity to the internet. Connections to buildings from the backbone are called lateral connections.

Backhaul: In a telecommunications network, the backhaul portion of the network comprises the intermediate links between the core network, or backbone network, and the small subnetworks at the edge of the network.

Conduit: A means by which something is transmitted. The conduit houses the fiber.

Dark Fiber: Refers to fiber optic cable that has been installed and is available to use but is not connected to any electronic devices and not transmitting any data. *Also referred to as excess capacity.*

Fiber-to-the-Premise (FTTP) or Fiber-to-the-Home (FTTH): A last-mile network that connects all buildings (residential, business and government) in a community.

Indefeasible Right of Use (IRU): Commonly used in the industry to provide long-term access to assets. Conduit and fiber deployed is leased through an agreement called an IRU.

Last-Mile Network: Network that provides services directly to homes and businesses in the community.

Latency: Term used to indicate the delay that happens in data communication over a network.

Middle-Mile Network: Typically defined as a network that serves community anchor institutions (i.e. schools, libraries, government buildings, public safety agencies, hospitals, etc.) but does not directly serve homes and businesses.

Open-Access Network: A network where the infrastructure assets (conduit and fiber) are made available through leases to multiple non-network owners that meet the terms and conditions set.

Outside Plant (OSP): Commonly used to refer to the engineering and construction of fiber infrastructure assets.

Over the Top (OTT): Television provided over a data stream but utilizing the existing wiring to the household

Public-Private Partnerships (PPPs): A legal partnership created by two or more public and private partners that balances and apportions risk, benefit and control of a last-mile network.

2. Survey and Stakeholder Outreach Results

The most critical task of a feasibility study is to conduct outreach in the community in order to talk to as many stakeholders as possible. The purpose is to obtain feedback regarding current levels of service, future needs and concerns. In order for the stakeholder outreach to be as comprehensive as possible, VPS utilized a variety of methods to collect the data and information including meetings with citizens, one-on-one meetings with key groups, and conducting a residential survey.

2.1 Stakeholder Meetings

VPS and the Town conducted Stakeholder surveys and follow up calls with a variety of groups. A chart detailing comments provided during these meetings is detailed below. Please note that all of the opinions stated in this Section are the opinions of the groups that the statement is attributed to.

Organization	Comments
Chamber	Comcast has been slow in pandemic; cost is high; need options
Library	Currently upgrading to a gig; they lease out laptops and hotspots; play a critical role
Fire District	Working remotely has created some issues with Comcast (upload to access VPN). Century Link biggest problem. Issues with cell service
Sanitation District	Need better connection between facilities; lost service recently with Century Link outage
Real Estate	Cellular issues more of a concern for homebuyers than broadband issues
Town	Economic development (get ahead of growth); smart city applications (parks, traffic signals, water); leveraging vertical assets; integration with development planning; cell service & cost

In addition, the Stakeholder survey results provided additional detail including:

- Only 18% were dissatisfied with their organization's internet service. For those that were dissatisfied it was due to the cost, speed or reliability of the service
- Internet bandwidth consumption ranged from 25mbps to over a gigabit, however, several groups did not know what bandwidth they were receiving.
- In the Covid-19 environment most were able to work from home without issue however a few noted problems with spotty service, slow upload and download speeds.

2.2 Residential Survey Results

A survey can be administered as an informal exercise or treated more formally as a statistically valid market demand research project.

An informal survey is one that lacks a randomized targeted mail program. This means that the survey would be hosted online, and the link shared by publishing on websites, and shared through social media, emails, press releases and other methods. In an informal survey, respondents would choose to participate (self-selection bias) and the geographic distribution would solely depend on where the respondents live. Those with the strongest opinion will be most likely to volunteer to participate. There is little control over the respondent sample.

A statistically valid survey would also be hosted online but would include randomized targeting across a large sample of residents that represent the geographic areas of the community. The targeting would be done through a robust mail campaign that sends at least 2-3 postcards/letters to the selected households. Depending on response rate, a financial incentive may or may not be needed to push the response rate to the targeted amount. A mail program required for this option would be an additional \$7500 - \$10,000 depending on the sample size.

Due to the technical nature of the subject, a telephone survey is not recommended. It is much easier for respondents to understand the question if they are able to see it and read it multiple times. While the questions themselves will be easy to understand, sometimes there are multiple choices that make phone surveys more cumbersome.

For this project, VPS proposed to conduct an online informal survey. VPS has utilized this approach with great success in other Front Range communities. In addition, VPS has market information regarding other Front Range communities that can assist with comparison to the Town of Firestone. Additionally, if the Town were to seriously consider building and implementing a municipal broadband network, a statistically valid survey would be recommended. However, for this project, the information survey will provide valuable directional information at a fraction of the cost.

The survey itself contained a total of 30 questions (4 of which were demographic related) and was hosted on the online platform Survey Monkey. The survey was promoted by the Town, and others through social media and email. Respondents self-selected to complete the survey. Overall, VPS received 218 survey responses. The survey data and analysis is presented below broken down by topic. Actual results are rounded to the closest whole percent for presentation purposes.

This section discusses the key data obtained from the survey. The raw survey results can be found in **Appendix B**.

2.2.1 Demographics

The survey first asked respondents to identify themselves by neighborhood within Firestone. Below are the percentages.

Neighborhood	Percentage
St. Vrain Ranch	17%
Oak Meadows	11%
Stoneridge	11%
Ridge Crest	11%
Old Town	8%
Booth Farms	5%
Mountain Shadows	5%
Neighbors Point	5%
Barefoot Lakes	4%
Monarch Estates	4%
Eagle Crest	3%
Sagebrush	3%
Other (please specify)	3%
Overlook	2%
Owl Lakes Estates	2%
Saddleback Heights	2%
The Shores	2%
Globe	1%
Cimarron Pointe	.5%
Del Rey Subdivision	.5%
Zadel Ranch Westwind Village	.5%
Arbor Apartments	0%
Firestone Meadows Apartments	0%
Oak Meadows Townhomes	0%
Russell Subdivision	0%
Timberland	0%

2.2.2 Household Services Purchased and Ranking by Importance

Respondents purchase a variety of communications services for their household, but they are not purchased equally. For example:

- 98% purchase internet (This is based on the average of 2 questions regarding purchasing of internet services)
- 95% purchase cellular/mobile service
- 57% purchase cable or satellite television
- 30% purchase land-line telephone service

When asked to rank the services from most to least important, internet and cellular/mobile telephone service were overwhelmingly the most important. On a ranking scale with 4 being most important, the following scores illustrate what respondents find most important:

- 3.6 for High-speed internet connection
- 2.9 for Cellular/mobile telephone

- 2.2 for Television
- 1.2 for Fixed (land-line) telephone

Based on the data, 98% of respondents purchase internet services in some form. For comparison, it is not uncommon in some rural communities to see that percentage drop well below 90%. These results are very much in line with other Front Range communities and indicate that everyone who wants to subscribe to a broadband service is able to do so.

For the less than 2% that do not purchase internet services it was because it was either not available at their location or too expensive.

2.2.3 Current Internet Service Providers and Pricing

Currently there are 5 primary providers in Firestone. Almost two-thirds of respondents subscribe to Comcast while just under 27% subscribe to Century Link. Less than 2% subscribe to Rise Broadband and none subscribe to either of the two satellite services.

For those that do purchase internet services, the survey asked about cost. Almost 20% of respondents answered that they purchase internet through a bundled package with phone and/or television so it’s difficult to determine how much they are paying just for internet. However, of the remainder that do purchase internet as a stand-alone service:

Price Ranges	Responses
\$21 to \$40	5%
\$41 to \$60	27%
\$61 to \$80	19%
\$81 to \$100	16%
\$100 to \$125	7%
Over \$125	7%

Another key point is that one-third of respondents are paying for high-speed services at over \$80 a month.

It should be noted that the survey did not ask respondents to test their speed due to the fact that speed tests are dependent on the time of day they are tested, and it can create confusion for the respondents in the middle of a survey because individuals need to open a new web browser to conduct the test. Also, the respondent may not be completing the survey from home. Due to this fact, it should be noted that no steps were taken to verify speeds and experience claimed by respondents.

2.2.4 Current Internet Subscribers Experience

The next set of questions explores how respondents feel about their current internet service. In this question, respondents were asked to select the statement that best describes their experience. **Over one-third stated that they have a connection that meets all their needs while almost 38% experience intermittent issues.**

Statements	Percentage
My internet is fast and meets all of my needs, including video streaming	35%
My internet connection is fast until there are multiple internet users streaming/doing tasks online at the same time	22%
I can stream video with some delays and buffering	19%
My connection is fine during certain times of the day, slow during peak periods	19%
My internet connection is so slow it is difficult to do anything other than view web pages	4%
My internet connection is adequate, but I cannot stream video	1%

Delving a bit deeper into the various aspects of internet service, respondents indicated which attributes were most important to them. Respondents had a choice of 5 options for each answer. Below is a percentage of respondents that selected **Very Important or Important** (the top 2 choices) for each attribute.

- Reliability 99%
- Speed 99%
- Price 93%
- Overall customer service 81%
- Technical support 73%
- Ability to bundle internet with phone or television 24%

Taking this one step further, the survey then asked how satisfied respondents are with these same attributes from their current providers. Again, respondents had a choice of 5 options for each answer. Below is a percentage of respondents that selected **Very Satisfied or Satisfied** (the top 2 choices) for each attribute.

- Reliability 69%
- Speed 74%
- Price 34%
- Overall customer service 32%
- Technical support 36%

Finally, the survey looked at respondent's satisfaction with the overall service and value from their internet provider. Approximately 54% have a combined satisfaction rate of the top two categories while only 19% are dissatisfied. The remaining respondents had no opinion. This is fairly high satisfaction percentage that is in line with other Front Range communities.

Overall, **55% of Comcast customers** are satisfied compared with **50% of Century Link customers**. The following chart breaks this down by neighborhood where there were more than 4% of respondents. Please note that these are low response percentages for this data to be anything other than anecdotal.

Location	Percent Responded	Satisfaction Level	Provider
St. Vrain Ranch	17.43%	41	81% Comcast; 16% CL
Oak Meadows	11.01%	52	70% Comcast; 30% CL
Stoneridge	11.01%	61	74% Comcast; 27% CL
Ridge Crest	10.55%	48	65% Comcast; 31% CL
Old Town	7.80%	53	50% Comcast; 38% CL; 12% Other
Booth Farms	5.05%	55	64% Comcast; 36% CL
Mountain Shadows	5.05%	45	82% Comcast; 18% CL
Neighbors Point	4.59%	40	90% Comcast; 10% CL
Barefoot Lakes	4.13%	78	89% Comcast; 11% Other

2.2.5 Willingness to Switch from Current Providers

Keeping in mind what respondents are currently paying for internet service, the survey asked respondents what is the most they would pay if a new provider offered gigabit service. The respondents answered the following:

Price Ranges	What Respondents Want to Pay	What Respondents Currently Pay
\$21 to \$40	11%	5%
\$41 to \$60	36%	27%
\$61 to \$80	29%	19%
\$81 to \$100	16%	16%
\$100 to \$125	5%	7%
Over \$125	3%	7%

Over 91% of respondents indicated that they would switch providers at the price selected above. As noted previously, respondents are paying higher rates for their current service and are looking for a lower cost service that is high value.

2.2.6 Willingness to Pay One-time Hookup Fees

The survey also asked respondents what is the most you would pay for a one-time hookup/connection fee if it were required by a new provider that offered a reliable, robust, high-speed internet connection (up to 1 gig). The purpose of this question is to explore partial funding mechanisms for deploying a network. Any hook-up fees can help offset some or a significant portion of the deployment fees depending on the amount.

Below is the data on how much respondents would be willing to pay:

- 41% would pay \$50 dollars or less
- 33% would be willing to pay up to \$100 dollars for a hook-up fee
- 6% would be willing to pay up to \$250 dollars
- Just over 1% of respondents would pay or consider a fee over \$500 dollars
- 16% were averse to the idea of a hookup fee and indicated that they would not pay an upfront hook-up fee regardless of cost.

Respondents do not mind paying hook-up fees if they are reasonably priced, but in Firestone, fees would need to be under \$100. This is most likely due to the fact that 98% of the respondents are already connected to the internet. Unfortunately, at this price point, the fee would do little to offset any deployment costs.

2.2.7 Television

Television is an important staple in many households across America. As technology changes, there have become more options for watching popular shows, movies, and live events. Many individuals have begun to move away from traditional sources of television (cable or satellite) and started purchasing programming options over the internet.

Therefore, the question asked respondents to select the ways in which they watch television. Respondents could select more than one choice. With respect to television programming respondents reported that:

Television Medium	Percentage
Internet (such as Netflix, Hulu, Vudu)	77%
Satellite (such as DirecTV)	22%
Antenna (over the air - free)	27%
Cable television	34%
I only stream shows using the internet and I do not subscribe to another television service	14%
I do not subscribe to any television service	2%

The data tells us that 77% of respondents' internet service is strong enough to stream programming through Netflix, Hulu, Amazon, etc. Respondents were able to select more than one option, so someone could indicate they purchase cable service and buy programming through the internet.

In addition, slightly over 14% of respondents stream video services and do not also pay for some other type of programming via satellite or cable. This group of respondents is referred to as "cord cutters"

Cord cutting is the term given to households that stop purchasing traditional television services and instead solely utilize their internet connection to stream television content. The national average ranges from 13-15% of viewers are cord cutters. As you can see by the percentages above, **cord cutting is in line with the national average.**

2.2.8 Cellular Telephone

Since the feasibility study also looked at cellular broadband, the survey asked a few questions about resident's cell phone experiences. Overall 93% purchase cellular telephone service. Percentages of identified carriers are as follows:

- 43% Verizon
- 21% AT&T
- 15% T-Mobile
- 8% X-Finity Mobile (supported by Verizon network)
- 6% Sprint
- 7% Other

When asked about the quality of their cellular service, over 61% of respondents reported having a strong signal while the rest experience issues with their cellular service. In addition, 11% noted that they have a carrier provided cell booster to help improve the signal at their house.

Answer Choices	Responses
Occasionally, I have a problem with my cell signal, but most of the time it is strong enough for me to make/receive calls without an issue.	38%
I have a strong cellular signal at my house and can always make/receive phone calls without an issue.	23%
I need to move around the house in order to find the best place to make/receive a call.	21%
The cell signal is weak at my house and it's very difficult to use my cell phone at home.	18%
I have no cellular service at my house.	0%

The following chart breaks this down by neighborhood where there were more than 4% of respondents. Please note that these are low response percentages for this data to be anything other than anecdotal.

Location	Percent Responded	Strong Service	Good most of Time
St. Vrain Ranch	17.43%	14%	33%
Oak Meadows	11.01%	9%	13%
Stoneridge	11.01%	22%	39%
Ridge Crest	10.55%	9%	26%
Old Town	7.80%	47%	47%
Booth Farms	5.05%	18%	64%
Mountain Shadows	5.05%	27%	37%
Neighbors Point	4.59%	50%	30%
Barefoot Lakes	4.13%	78%	22%

Overall, based on the data, the cellular coverage is relatively good and reliable in some areas, but indicates gaps in other areas. Many respondents also specifically pointed out the need for better cell service in certain areas in the “additional comments” section of the survey. See **Appendix C** for all respondent comments to the survey.

2.2.9 Local Government Action

The final 2 substantive questions in the survey asked about the role of local government in improving broadband including providing funding measures to support broadband improvements. The responses strongly indicate **high support for government involvement. This indicates constituent trust in local government action, as well as the desire for action to improve broadband in Firestone.**

Role of the Town in improving broadband

Which Statement Do you most Agree with? Please select one statement.	Percentage
The Town should consider building its own municipal network and become a provider	35%
The Town should try to create a public-private partnership by engaging with new company providers to increase competition and improve services.	25%
The Town should find new ways to work with existing providers (Comcast, Century Link, Rise Broadband, etc..) to improve broadband services and accessibility.	16%
Current internet connectivity is not acceptable. The Town should do something to improve broadband, but I don't know what should be done.	14%
Current internet connectivity in Firestone is sufficient. Nothing more needs to be done.	10%

Public Financing

Select the statements you agree with. Check all that apply	Percentage
The Town should consider re-directing funds collected by other means for broadband	41%
The Town should create a special tax to raise additional money if needed	34%
The Town should consider utilizing in-kind options only such as waiving of permit fees	30%
I do not think the Town should spend any public funds for a broadband project even if broadband needs to be improved.	22%
The Town should issue a bond and go into debt if needed	22%

2.2.10 Pandemic

In order to gain insight into behavior and internet usage, the survey asked a few questions regarding home-based businesses and working from home pre and mid-pandemic. Here are the key points:

- Approximately 52% work from home in a non-pandemic environment
- 74% stated that the internet was sufficient to meet all family needs during the pandemic while 4% had to upgrade their bandwidth package to improve internet
- Just over 55% of student internet needs have been met during the pandemic

2.3 Key Findings

The Key findings from the survey are as follows:

- Based on the data, 98% of respondents purchase internet services in some form. These results are very much in line with other Front Range communities and indicate that everyone who wants to subscribe to a broadband service is able to do so. **Thus, there is no problem in Firestone accessing high-speed broadband service.**
- One-third of respondents are paying over \$80 a month for high speed services. **This suggests that respondents are both purchasing the highest speed services offered and these packages are expensive.**
- Speed and reliability are the most important attributes for internet service with price of service coming in third. However, respondents are strongly dissatisfied with price, customer service and technical support of their current service with respondents rating satisfaction under 36% at each of those. **Essentially, respondents are not satisfied with the value they are getting for the cost of their current internet service.**
- Overall, 54% are satisfied with their internet service with only 19% stating they are dissatisfied. This is fairly high satisfaction percentage that is in line with other Front Range communities.
- In addition, slightly over 14% of respondents solely stream video services for television and do not also pay for some other type of programming via satellite or cable. **The percentage of “cord cutters: in Firestone is in line with the national average and suggests that a new provider may not need to offer television as a service.**
- When asked about the quality of their cellular service, over 61% of respondents reported having a strong signal while the rest experience issues with their cellular service. **While 43% subscribe to Verizon, respondents subscribe to a wide variety of cell providers. Solving intermittent cell problems will require the participation of all the major cell providers.**
- **Respondents indicate high support for government involvement in funding and solving broadband issues in Firestone.** This indicates constituent trust in local government action, as well as the desire for action to improve broadband in Firestone.

3. Market Assessment and Mapping

3.1 Current Competitive Landscape

The last data collection piece involved conducting a competitive analysis/market assessment to capture what existing internet providers are offering in Firestone in terms services and pricing. The below charts detail the what the internet providers in Firestone are offering for advertised services and speeds. This does not capture special promotions that may be locally available. Please note that this information is what is reported by the carriers to the FCC and third-party websites.

There are three major internet providers offering residential and business services. Pricing and speed vary greatly between the providers. The last two charts show the bundled service offerings available from XFINITY from Comcast and Century Link.

It should be noted that while there are 3 providers in Firestone, only one of them offers gigabit service.

Provider	Type	Coverage %	Fastest Advertised Speed	User Rec. Rating
Residential				
Rise Broadband	Fixed Wireless	100%	15 Mbps	-
CenturyLink	DSL	99.6%+	100 Mbps	35%
XFINITY from Comcast	Cable	99.3%+	1000 Mbps	41%
Business				
Rise Broadband	Fixed Wireless	100%	15 Mbps	-
Comcast Business	Cable	98.4%+	300 Mbps	41%
CenturyLink Business	DSL	100%	40 Mbps	35%

Residential Pricing

Provider	Speed	Price
Rise Broadband	Up to 5 Mbps	\$42.95
	Up to 10 Mbps	\$52.95
	Up to 15 Mbps	\$62.95
CenturyLink	Up to 10 Mbps w/ 1 TB Data	\$45.00
	Up to 20 Mbps w/ 1 TB Data	\$50.00
	Up to 100 Mbps	Not Publicly Available
XFINITY from Comcast	Up to 25 Mbps w/ 1 TB Data	\$50.00
	Up to 100 Mbps w/ 1 TB Data	\$70.00
	Up to 300 Mbps w/ 1 TB Data	\$90.00
	Up to 600 Mbps w/ 1 TB Data	\$100.00
	Up to 1000 Mbps w/ 1 TB Data	\$110.00

Business Pricing

Provider	Speed	Price
Rise Broadband	Up to 15 Mbps	\$62.95
Comcast Business	Up to 35 Mbps	\$69.95
	Up to 75 Mbps	\$99.95
	Up to 150 Mbps	\$39.95
	Up to 300 Mbps	\$199.95
CenturyLink Business	Up to 40 Mbps	\$65.00

Xfinity Bundled Services

X1 Saver Pro+ Triple Play			
Broadband Speed	Channel Offering	Price	Add-Ons
Up to 300 Mbps	140+	\$104.99	Unlimited Local Calling
X1 Starter Pro+ Triple Play			
Broadband Speed	Channel Offering	Price	Add-Ons
Up to 600 Mbps	140+	\$114.99	Unlimited Local Calling
X1 Preferred Pro+ Triple Play			
Broadband Speed	Channel Offering	Price	Add-Ons
Up to 1000 Mbps	220+	\$139.99	Unlimited Local Calling

CenturyLink Bundled Services

High-Speed internet & Home Phone Unlimited			
Broadband Speed	Channel Offering	Price	Add-Ons
Up to 40-80 Mbps	-	\$85.00	Unlimited Local Calling

3.2 Mapping

The scope of work for this project anticipated the development of a map that includes an inventory of existing broadband services. However, a map was not generated for the following reasons:

- All 3 providers in Firestone report coverage at 99+%. Thus, there are no gaps in Firestone and so a map depicting coverage would show total coverage in Firestone and would not enhance the understanding.
- Providers will not share location information as it is deemed proprietary and confidential.
- The competitive analysis provided in this Section details the existing broadband services in Firestone.

4. Municipal Network Model Overview

Now that the existing infrastructure, provider offerings and stakeholder outreach results have been presented and analyzed, the next step in the process is to understand what the various network models are and to explore the pros and cons of each.

There are two main types of municipal networks that serve end-users (other than networks built exclusively for internal government use) and they are most commonly referred to as last-mile and middle-mile. For purposes of this discussion, the term network is inclusive of all technologies including fiber and/or wireless.

4.1 Last-Mile Network Models

A last-mile network (also known as Fiber-to-the-Premise or FTTP) is one that is designed to provide service directly to homes and businesses in the community. Last-mile networks can also serve government buildings and other community anchor institutions.

Last-mile networks are the most expensive to deploy but can provide the biggest benefit to the community. However, municipal FTTP networks are also more-rare due to the cost it takes to deploy the infrastructure and the need to have an operator/provider who can run and manage the network. For this reason, most of the municipal last-mile networks in existence are in communities that also have a municipal electric utility. This is because the local government (through its municipal utility) already owns utility pole infrastructure that can be leveraged to offset deployment costs. Municipal electric utilities also have operating and billing systems already in place to serve customers. Therefore, they have experience in serving customers and can more easily shift gears to offer a broadband service as a new offering rather than having to create an operational system greenfield.

The other key factor is that last-mile networks usually require a take-rate that is between 40-60%. This means that the network operator needs to obtain 40-60% of the residential subscriptions available in the community in order to recoup the capital investment, make a profit and be sustainable.

Examples of FTTP networks – both those that have a municipal electric utility and those that do not - are provided below. The municipal electric networks are all very similar and so only one example is provided.

Muni Electric FTTP Network Examples	
Longmont, CO	<p>Longmont’s “NextLight” is a gigabit fiber network owned and operated by the City and its power utility, Longmont Power & Communications (LPC). In 2013 Longmont supported the network build at a 70% level, approving a \$40.3 million bond issuance to cover the startup costs of the Internet service. Even the \$40 million price tag would have been significantly higher if not for the existing asset of an 18-mile fiber loop within the City’s limits.</p> <p>Longmont has 38,000 premises and 92,000 residents within its approximately 30 square miles. NextLight offers symmetrical gigabit service at \$50/month for those who signed up early. This \$50 rate is for both the lifetime of the home as well as the owner should he/she move within City limits.</p> <p>Late in 2016 the City voted to increase LPC’s budget by \$7 million, sourced from the Electric and Broadband Utility Fund balance to hire staff needed to support take rates significantly higher as initially predicted. Current take rates average 53%.</p>

Non-Muni Electric FTTP Network Examples	
Rio Blanco County, CO	Rio Blanco County utilized county funds and Colorado grant funds to construct an FTTP network serving its rural community. The technologies deployed are a mix of fiber and wireless. Rio Blanco is building a fiber to the premises network in its main two population centers (Meeker and Rangley) and a shared fixed wireless solution designed to reach all other addresses. Additionally, Rio Blanco is building middle-mile fiber available for carriers to lease in the county.
Ammon, ID	<p>The City of Ammon Idaho has a very unique model. Ammon has built an open access network that lets multiple private ISPs offer service to customers over City-owned fiber. The City self-funded a portion of the network. However, Ammon is using a model similar to Google Fiber's "Fiberhoods," in which construction happens first in neighborhoods where a majority of residents commit to buying service. Those who opt-in have the option to pay either an upfront fee of \$3000 or pay the amount gradually over a 20-year period, excluding an additional utility fee of \$16.50 a month. Should a home-owner sell their house prior to the \$3000 fee being paid off – it would be the responsibility of the new home-owner to continue those payments. Conversely, should a homeowner move after paying the upfront fee – the new homeowner would have the benefit of the network connection without needing to pay the connection fee.</p> <p>This model has been touted as the “model of the future” but it is far from being complete. Success is yet to be determined the fee structure may not be appropriate for many communities.</p>
Fairlawn, OH	The City of Fairlawn established FairlawnGig as a forward-thinking, economic development strategy founded on the belief that business growth, innovation, and community transformation will follow with every connection. The build cost approximately \$10 million dollars (paid for by bond) for the City to connect every home and business. The City is not looking to the network to become a profit-making revenue stream. The City felt that FairlawnGig was a necessity for the community at large. The network has a take rate of just over 50% and is looking at expanding to neighboring towns.
Hudson Oaks, TX	The City of Hudson Oaks established a PPP with a local wireless ISP that was interested in becoming a fiber-based service provider. The City invested in the infrastructure and the ISP came on board to run and manage the network.

4.2 Middle-Mile Networks

A municipal middle-mile network is typically defined as a network that serves community anchor institutions (i.e. schools, libraries, government buildings, public safety agencies, hospitals, etc.) but does not directly serve homes and businesses. A middle-mile network could either be operated directly by the municipality or outsourced to a network operator.

The purpose of middle-mile networks is generally to build a high fiber count (fiber cables with strand counts of 144 and above) backbone¹ that provides direct lateral connections to key institutions and enables infrastructure assets to be leveraged and leased by others including businesses and private providers. Although, there are middle-mile networks that are built to support internal government needs only (closed network).

Middle-mile networks are much more commonly constructed by municipalities than last-mile networks due to the significantly lower cost of deployment and operations and reduced risk. Middle-mile networks can be a tremendous asset to a community in that it can generate revenue, and provide critical infrastructure needed to support government operations.

Examples of middle-mile networks are provided below.

¹ A backbone is literally the spine of the network. Backbone's are usually built along main corridors and provide transport to and from the hub site where the electronics are located to the connected entity.

Middle-Mile Municipal Network Examples	
Kent County, MD	Kent County, Maryland is a rural county on the Eastern shore of the state. Kent County determined a few years ago that they wanted to invest in middle-mile infrastructure that they could own as an asset. The County decided not to finance the network build through a bond, but rather paid for it entirely out of general funds. The County now has a 110- mile network completed and have made the assets available to be leased and leveraged by others.
City of Centennial, CO	The City of Centennial (107,000 residents) is in the process of building a fiber backbone. The City is self-funding the middle-mile portion of the network build and will own the assets. Centennial has selected Ting to be the FTTP service provider, who is now offering \$89/month range for symmetrical gigabit speeds. While the network is the property of the City and eventually an “open network,” Ting partnerships typically feature an “exclusive right to operate network” term of multiple years. While the build is the responsibility of the respective cities, Ting will lease and light the fiber and provide all equipment and Internet access. Funding the build is a \$5.7 million allocation from the general fund. The City Council led by the fiber subcommittee looked at this funding as an infrastructure investment removing the expectation that this funding would be directly paid back.
Northwest Colorado Broadband (NWCB); Steamboat Springs, CO	The City of Steamboat Springs teamed with Routt County, Yampa Valley Electric Association, Yampa Valley Hospital, Chamber of Commerce and the Steamboat Springs School System to legally form a nonprofit. The partners supplied some of the capital along with State grant funds to build a middle-mile network through Steamboat Springs. NWCB selected Mammoth Networks as its network operator who will manage, operate the network and lease fiber to interested and qualified applicants. NWCB is also talking with the City of Craig and Moffat County about being the Network Operator for a regional network.

4.3 Open Access Middle-Mile Networks

An open access network is one where the infrastructure assets (conduit and/or fiber) are made available under certain policies and procedures to multiple non-network owners. Most middle-mile networks are usually open networks and most last-mile networks are usually closed particularly those built by providers.² Publicly funded grant programs offered by the federal and state government sometimes require networks to be open access.

Middle-mile networks that lease dark fiber and conduit are designed to be open access. With middle-mile networks – the more users, the bigger the benefit to the network and the more revenue it generates. A private provider that is considering building in a community may have an interest in leasing middle-mile assets because it helps with reducing their costs of deployment. A provider, then, would only need to invest in the lateral connections to homes and businesses and would not have to build the backbone. Larger businesses and those with multiple office locations may also be interested in leasing fiber assets to help connect an internal network or obtain better broadband.

In most cases, excess³ conduit and fiber deployed can be leased through an agreement called an Indefeasible Right of Use (IRU). IRUs are commonly used in the industry to provide long-term access to assets. The term of an IRU typically runs between 10-20 years.

² Open access is a hotly debated topic particularly as it relates to last-mile networks because the greater the number of providers, the harder it is for a new-entrant provider to meet its take-rate goals and make a profit. This will be of particular concern for providers that are also making a financial investment. Will a provider be able to meet take rates of 40-60% while other providers are invited to compete for the same customers? Ultimately, the open access question will be determined by all the investors and stakeholders.

³ Conduit and fiber strands that will not be used by the municipality.

4.4 Conduit Leasing

Conduit is something that is generally (except in extreme circumstances) part of every underground network fiber build. The most expensive part of a deploying a broadband network is the construction. The cost of the actual assets (fiber and conduit) are a tiny portion of the overall budget. Therefore, if engaging in a network build, it is cost-effective to install larger or extra conduit banks and install high-count fiber during the initial construction phase to cover all current and future needs. It is not cost-effective to have to dig more than once.

There are a variety of conduit sizes that can accommodate one or more fiber cables. Often, the network owner will install a larger size conduit than what is needed in order to lease excess space to other providers that want to install fiber. Sometimes a network owner will install multiple conduits side-by-side instead of having one larger conduit bank because some providers prefer to have exclusive rights to a single conduit for security reasons.

Conduit pricing is usually based on a per-foot basis. Pricing varies based on demand in the region and amount of conduit available. Below is a chart that provides examples of three different pricing structures for conduit:

Location	Price	IRU Term	Total Cost
Boulder, Co	\$5.50 per foot	20 years	\$722,271 in a one-time payment
Lincoln, NE	\$65,000 per year	20 years	\$1.3 million paid monthly over 20 years with an escalation clause not exceed CPI.
Baltimore, MD	\$3.00 per foot w/increases likely	Negotiable	Depends on how much is leased. The City requires any new conduit built by provider to be owned by the City.

Investing in conduit without building a fiber network is actually a strategy that several localities have successfully implemented.

In 2012, the City of Lincoln invested \$700,000 into building an extensive conduit system. Restrictions on municipal broadband prevented them from building a fiber network, so they limited the infrastructure to conduit. The conduit was leased for several years to multiple providers including Level 3 and NebraskaLink. In 2014 the City launched a free Wi-Fi initiative with backhaul provided by NebraskaLink. In 2015, the City announced that the conduit project had attracted Allo Communications, who planned to lease the conduit and undertake a massive FTTP buildout with the goal to serve every home and business in Lincoln. As of September 2018, the project is nearly complete. Allo plans to have the project completed no later than early 2019. Allo charges competitive pricing with 1 gigabit service costing approximately \$90 per month, and 300 Mbps costing approximately \$65 per month.

Atlanta BeltLine is a nonprofit organization that was established to help ignite economic development in an urban area of central Atlanta. The BeltLine owns an old railroad Right-of-Way (ROW) that is a natural loop around the City. The Beltline has been building a conduit system to run under the land around the entire ROW. The BeltLine is moving forward with plans to lease the conduit to interested broadband providers and they have recently hired a company to assist them with the marketing and management of the system.

4.5 Dark Fiber Leasing

Dark fiber refers to fiber optic cable that has been installed and is available to use but is not connected to any electronic devices and not transmitting any data. Dark fiber is also referred to as excess capacity. Fiber optic cable comes in strand counts ranging from 12 strands to 1400+ strands. Any strands not in use by the owner (or other entity) are considered dark fiber strands that can be leased.

Similar to conduit, dark fiber pricing is subjective and includes but is not limited to the following criteria:

- Availability of dark fiber in the area
- Market rate of other dark fiber in the area (sometimes very difficult to ascertain)
- Number of strands to be leased (minimum of two)
- Amount of footage to be leased (per mile)
- Term of years requested
- Payment up-front versus over time
- Number of strands remaining that may not be marketable (i.e. if an entity only leases a portion of a route, the corresponding strands on the remainder of the route may not be usable. Often providers require the entire route to be leased for this reason.)

Unlike conduit, dark fiber is not based on price per foot but rather based on a per-strand, per mile, per month basis. Prices can range from \$5-\$750 per pair of strands with a typical IRU term of 10-20 years. Similar to conduit, payments can be made on monthly, annually or on a one-time payment. One-time payments require less administrative work and book keeping. It also provides a large infusion of cash. However, smaller entities may not be able to provide one-time payment and it is difficult to estimate market value over the course of twenty years. Ultimately, all of these considerations are discussed in the negotiating process.

Maintenance can be included in the cost of the IRU or added as an additional fee. Maintenance fees range from about \$200-700 per mile, per year. The below chart shows what a rate schedule would look like for a price per pair of strands ranging from \$10 - \$100 exclusive of any up-front or maintenance fees.

Rate Schedule Based on Flat Fee Per Pair of Strands										
Per Pair	Per Mile	Per month	Per Year	10 Yrs	20 Yrs	Per Mile	Per month	Per Year	10 Yrs	20 Yrs
\$10	1	\$10	\$120	\$1,200	\$2,400	10	\$100	\$1,200	\$12,000	\$24,000
\$20	1	\$20	\$240	\$2,400	\$4,800	10	\$200	\$2,400	\$24,000	\$48,000
\$30	1	\$30	\$360	\$3,600	\$7,200	10	\$300	\$3,600	\$36,000	\$72,000
\$40	1	\$40	\$480	\$4,800	\$9,600	10	\$400	\$4,800	\$48,000	\$96,000
\$50	1	\$50	\$600	\$6,000	\$12,000	10	\$500	\$6,000	\$60,000	\$120,000
\$60	1	\$60	\$720	\$7,200	\$14,400	10	\$600	\$7,200	\$72,000	\$144,000
\$70	1	\$70	\$840	\$8,400	\$16,800	10	\$700	\$8,400	\$84,000	\$168,000
\$80	1	\$80	\$960	\$9,600	\$19,200	10	\$800	\$9,600	\$96,000	\$192,000
\$90	1	\$90	\$1,080	\$10,800	\$21,600	10	\$900	\$10,800	\$108,000	\$216,000
\$100	1	\$100	\$1,200	\$12,000	\$24,000	10	\$1,000	\$12,000	\$120,000	\$240,000

4.6 Other Conduit and Dark Fiber Leasing Considerations

When leasing conduit and dark fiber, the owner of the infrastructure must take into account the following considerations:

- A map (GIS ideally) and inventory of all assets leased and available to be leased must be kept current and active. There are several companies that offer cloud-based cutting-edge fiber management software solutions.
- Maintenance of the conduit and the fiber generally falls to the network owner and so the owner must have policies and procedures in place to meet any service level agreements (SLAs) that the lessees have in place. In other words – the network owner must be able to repair fiber cut within an emergency window to prevent downtime outages to the network customers.
- The network owner must have a plan in place for third-party network access.
- The network owner must have a process in place for interested third-party applications as well as templates for legal agreements and other documents.

5. Overview of Operating Costs

When considering network options, understanding the operating costs and developing the right ownership and operating model are critical for success. This Section provides a high-level overview of operating costs.

5.1 Operating Costs

If and when a network model is selected, the next phase would be to develop a full business and financial plan that would include operating costs. Since a model has not been selected yet, we wanted to provide a rough overview of what operating costs would look like for the various options.

5.1.1 Last-Mile Operating Costs

For any of the last-mile FTTP network options, operating costs to build into a business plan would include but would not be limited to the following items:

- Personnel
- Customer service for residential customers (call center, technicians, etc...)
- Back office billing and administrative systems
- Operational vehicles
- Electronics and equipment warranty and support
- Insurance
- Electricity/utilities
- Transport/bandwidth cost
- Marketing
- Professional services - legal/consulting/accounting
- Depreciation
- Maintenance and repair

The full business plan will also determine the pricing for offerings such as video, phone, and broadband services. Pricing of services should not be developed without a business plan.

Based on VPS experience in developing business plans for providers across the country, operating costs can range between \$90 and \$160 dollars per location/per month.

5.1.2 Middle-Mile Operating Costs

The operating costs for a middle-mile network would be significantly less than what is discussed above. When comparing the operating costs of an FTTP with a middle-mile network, it is clear that for a middle-mile network:

- Personnel will be significantly less and could be as few as one or two individuals
- Customer service (call center, technicians, etc..) would not be needed
- Back office billing and administrative systems could be rolled into existing Town systems
- Operational vehicles would probably not need to be purchased
- Electronics and equipment warranty and support will be significantly less
- Network insurance will be significantly less and might be covered by current Town Insurance policy

- Electricity/utilities will be significantly less
- Transport/bandwidth cost will be significantly less
- Marketing will only be needed if the Town wants to lease its conduit or dark fiber
- Professional services - legal/consulting/accounting would be significantly less
- Maintenance and repair including locates will be significantly less (less fiber miles to manage)

If Firestone decided to build a backbone network that did not connect to any anchor institutions, the capital costs and the costs to operate the network would be less.

If Firestone were to build an open-access middle-mile network there could be a few additional costs for the set-up to manage the conduit and dark fiber leasing program. However, there have been models where the locality outsources these tasks to a vendor who then pays commission on fees generated from leased assets. This kind of model can help to offset some of the operating costs of a dark fiber leasing program.

6. Network Ownership Models

There are multiple kinds of ownership and operating models for municipal networks.

6.1 Publicly Owned and Operated Network

This is a municipal network that is almost 100% self-provisioned. In other words, the municipality solely owns, and internally manages and operates the network and may only need to hire a few contractors for things like locates, and installations. Networks that are self-provisioned are most likely to be municipal electric utility broadband networks such as Longmont NextLight because they already have the back-office systems, trucks, and experience to add on a broadband service. However, FairlawnGig as previously discussed is a rare example of a greenfield municipal network that is 100% self-provisioned without having an electric utility.

6.2 Publicly Owned and Privately Operated Network

In this model, the municipality owns the assets, and provides oversight, but outsources the management and operations to a third-party entity who also provides the services. This is a more common model for municipal networks and is appealing for localities that do not wish to directly become a service provider. An example of this type of operating structure is Hudson Oaks, Texas previously discussed. Hudson Oaks owns the infrastructure and is leasing access to a local ISP who is serving as the service provider.

6.3 Hybrid

Another option is to create a hybrid model that combines one or more of the above options. This includes:

- Public-Private Partnership (PPP)
- Creation of a non-profit or regional entity

6.3.1 Public Private Partnerships (PPPs)

Public-private partnerships (PPPs) are a relatively young phenomenon in broadband. A PPP is a legal partnership wherein the partners balance and apportion risk, benefit and control. Recently, more and more municipalities are exploring establishing a PPP for deploying and operating last-mile networks. There are many different types of PPPs and these are more fully explored in Section 7.

6.3.2 Joint Authority or Non-Profit Entity

For networks that may involve more than one municipality or financial contributions that are coming from more than one entity, a good option to consider is to create some kind of joint-authority entity or nonprofit. For example, Northwest Colorado Broadband that was more fully discussed in Section 3 created a nonprofit entity with six founding members that included the City, County, school system, electric association, Chamber of Commerce, and hospital. Several of the partners contributed funding and/or own assets that were part of the project to build a middle-mile network through Steamboat Springs. The founding members serve on the Board of the nonprofit and the nonprofit is responsible for overseeing the network build, and operations. Since the nonprofit does not have any staff, the nonprofit hired a network operator to manage the network and manage the dark fiber leasing and marketing.

The entity may also pursue grants and expand services in the region. By establishing a separate entity such as this, can increase the ability to share resources, share costs and create economies of scale for smaller networks that may better entice network partners. A regional entity could also more easily deploy and manage options for programs including Wi-Fi deployment, smart city applications and dark fiber leasing.

6.4 Privately Owned and Operated Network

A more traditional model would be to pursue an entirely privately owned and operated network. This could include encouraging existing providers to either enter the market as a new provider or working with local providers to expand into areas not previously served. In most cases, tax incentives and other non-cash benefits have not served as a big enough incentive for providers to build into new areas. In most cases, the private provider would most likely as for cash contributions.

7. Funding and Financing

A key component in developing the business plan for the selected model is to identify all potential funding sources. This last section briefly discusses possible funding options for municipalities separate from any private-sector partner contributions that could be possible. Depending on the amount of funding needed to support the selected model, one more of the below options could be utilized.

One thing to keep in mind is that a local government usually has a different need for building a network than a private sector provider. For example, a private provider is largely profit driven and must generate revenue for the network to be sustainable. Municipal networks – particularly those that are middle-mile usually serve a different purpose. The municipality is building the network for internal connectivity to anchor institutions, to generate cost savings, or to use for economic development purposes. Therefore, in many cases, municipal networks cannot rely on network-generated revenue as a mechanism to support a bond payment or loan.

7.1 Public Self-Funding

The first funding option to consider is through general fund set-aside. Depending on the amount of funding needed, the municipality may be able to entirely fund a network build by either shifting funds or budgeting for them. Kent County, Maryland funded their entire 100-mile network build by paying for it directly out of their general funds. A municipality may also set-aside general funds to pay back a revenue bond if partially or fully funding a network out of general funds is not feasible.

7.2 Bond Funding

Aside from allocating capital project funds as part of the budget process, bond funding is something municipalities can utilize to assist with funding network construction, and to support startup and maintenance costs. This is traditionally what many municipalities have used to finance their broadband network. Bonds can be repaid either by revenue generated from the network or through other funds. Bonding agencies have supported this movement because a fiber network is a valuable asset to a community. However, bonding agencies will tell you that if a municipality does not have a municipal electric system to leverage as a backstop, the municipality would need to rely on the general fund or come up with additional revenue sources for paying back the bond.

If revenue from the network is expected to be relied upon as funds to pay back the bond, the business plan must support that expectation. In addition, the municipality should have a contingency in place in the event the identified funds for paying back the bond do not materialize. For example, the State of Kentucky ended up with an \$11 million-dollar shortfall for bond repayment because a source of funding to pay back the bond fell through.

7.3 Taxation

Taxation is another source of funding that local governments can consider. Some municipalities have either obtained approval to utilize other taxation revenues already in place or have opted to place a referendum on the ballot for residential approval to establish a special taxation district. These strategies are typically utilized in high-dollar builds when millions of dollars of funding is needed.

7.4 Connection Fees/Liens

Another mechanism for partially funding a last-mile network is to charge a large connection fee to every home that wishes to connect to the network. The City of Ammon, Idaho has funded a significant part of their network by charging a \$3000

connection fee payable either in lump sum or over a twenty-year period to every home that wishes to purchase service. The connection fee operates like a lien. If a resident moves, the payment stays with the house and applies to the next home-owner. If money is still owed, the new resident will be expected to pay the remaining funds due. Based on the survey results, this does not appear to be an option for residents.

7.5 Recurring Fees

In addition to one or more of the above mechanisms, a network operator can also charge a recurring monthly fee per subscription as a means for generating recurring revenue. For example, at a rate of \$5.00 per month, this could generate an additional \$72 per year per subscriber. With 5000 subscribers on the network that could generate as much as \$360,000 per year in addition to the revenue earned from the subscribers generally.

7.6 Federal Grant, Loan, and Funding Programs

Most of the federal grant programs now are focused on rural areas that are underserved with advertised speeds of less than 10/1. Based on the survey and market assessment, it does not appear that Firestone would qualify for any of the current federal grant programs.

7.7 Third-Party Funding – Public Private Partnerships

Municipalities looking to build a FTTP network often seek to establish a PPP in order to off-set the costs and share the financial risk with a private sector partner. There are also many different types of PPPs. For example, PPPs include but are not limited to the following:

- An investment entity that steps forward to provide funding for the network in exchange for a long-term payback on their investment. This is a traditional PPP. The investment entity usually requires an ownership stake in the assets and sets other conditions such as requiring the municipality to provide a credit backstop to guarantee investments. The municipality generally may or may not need to provide cash contributions. An investment entity is only likely to be drawn to projects that cost a minimum of \$15 million dollars. An investment entity also generally works with another partner that is the service provider.
- A partnership wherein both the municipality and provider contribute funding and resources to the project. Both may share in ownership of the assets. One example is that the municipality can invest in and own the middle-mile infrastructure, while the provider invests in and owns the drops from the middle-mile network to the customer premise. However, there are many iterations of this model.

The type of PPP depends on a number of factors, including:

- Whether the provider can make a profit with take rates that justify an investment;
- The sum total amount of financial resources the municipality can provide;
- Whether the municipality is willing to be flexible on asset ownership;
- Whether there is a private-entity that is interested and viable;
- Whether the municipality and private partner can come to agreement on terms and requirements.

Some ISPs would prefer to own their own infrastructure - including the middle-mile backbone in order to control the infrastructure. On the other hand, other ISPs need the municipality to build the middle-mile to offset deployment costs.

The Town issued an RFI to investigate the viability of establishing a PPP in Firestone. This will be discussed in Section 8.

8. Analysis and Recommendations

Based on all the information detailed in this Report, this Section analyzes the network models and provides recommendations.

8.1 Gap Analysis

As a reminder, the biggest question a municipal feasibility study needs to answer is “what is the problem we need to solve?”

In summary, the biggest issue facing Firestone is lack of competition amongst broadband providers including high cost and low customer service and inconsistent cell service. The Town of Firestone does not have an access problem. In other words, everyone who wants to purchase broadband services is able to do so.

The cellular issue is much more difficult to solve because it requires the cellular providers to actively engage with the Town to determine where additional equipment might be needed to boost their cell signal. Unfortunately, each cellular provider has its own network and needs to conduct its own analysis. There is no one solution that would resolve the issues with all the carriers at the same time.

The COVID-19 pandemic has brought into focus that robust broadband is an essential service. In this pandemic environment, residents must be able to function in the following areas:

- Work from home including frequent use of video conferencing
- Enable students to connect to classrooms and complete schoolwork from home
- Obtain necessary supplies including medicines by shopping online
- Engage in critical telehealth consults with medical personnel
- Connect with family, friends and community in a time of isolation
- Enjoy video entertainment and gaming

A solid broadband connection is required to do any of the above tasks, but families need to perform many of these tasks simultaneously. Lower speed internet services are easily overloaded when students are in a virtual classroom along with a parent on a video meeting. The ability to send data upstream from the home at higher speeds has recently become a focus. Over time, this problem will exponentially grow as more devices and services require a robust broadband connection.

This pandemic is a global disrupter that will fundamentally alter the way we live and work. Some businesses are already planning on staying 100% virtual. What this means is that it is an urgent imperative for communities to have the **affordable robust broadband** they need to function in a post-pandemic society.

Most Front Range communities like Firestone do have adequate broadband services through local providers. However, the pandemic has created an urgent need for reliable, robust and affordable access to enable the following:

- **Student Learning.** The "Homework Gap" is a term used to describe a situation where students have access to internet at school but not at home due to lack of access or cost. Not only does this impact how teachers utilize technology in the classroom, but it limits things like distance learning to access programs and learning tools that are not available locally.

- **Economic development.** Simply put, broadband enables a community to attract and retain jobs, increase property value (8% in some communities), recruit workers and increase the overall tax base. Companies that do not have access to high-speed networks are forced to move or pay outrageous sums of money to build their own infrastructure.
- **Telehealth.** Telehealth access has proven to prolong life and enhance quality of life including critical access to specialists. Telehealth enables patients to access specialists and services that do not exist in their community. COVID-19 has made telehealth a critical need but it requires access to broadband.
- **Aging in Place.** More and more older adults are aging in place. The role of technology plays a significant role in the quality of life of older adults enabling them to safely live independently and access everything from telehealth to keeping in contact with family to utilizing Etsy. Many older adults lack internet access due to the cost of the service as well as the lack of knowledge of how to use the technology.

In addition, Firestone should consider network needs for growth and inclusion of future technologies to enable Firestone to become a “Smart Community”. Smart community applications include such things as:

- Smart Parking solutions
- Remote surveillance
- Remote smart lighting and solar solutions for parking lots, parks and trails
- Smart Kiosk - indoor kiosk that can provide analytics as well as menu customization for:
 - Events calendar
 - Maps
 - Security monitoring
 - Campus news

Network connectivity is still seen as the most important barrier to the Internet of Things (IoT) and the implementation of Smart Community solutions. While wireless solutions are important, fiber is the critical ingredient to allow for connectivity integration throughout the various digital platforms.

The good news is that there are multiple ways to approach solving all of these broadband gap issues.

8.2 Solving for Broadband Gap Issues

Establishing Partnerships with Providers

The first solution would be to establish partnerships with providers. As a part of this feasibility process, the Town issued a Request for Information (RFI) for Enhanced Broadband Services. The RFI asked specific questions for all respondents to answer in order to facilitate comparisons between proposals. The RFI process was not intended to result in a contract. Rather, the RFI process was issued to serve as a first filter for establishing partnerships and to gauge viability of a potential PPP. Only respondents to the RFI will be eligible to participate in a future RFP that would result in a contract if the Town desires to go in that direction.

The benefit of taking the next step to issue an RFP or enter into negotiations with one or more provider is that the town could negotiate certain elements to be part of the PPP including for the provider to:

- Provide an Indefeasible Rights of Use (IRU) to the Town for long-term lease of 12+ strands for Firestone use including smart community applications.
- Become the middle-mile network operator for the Town if the Town desired to expand its own middle-mile network.
- Provide free drops to nonprofits
- Establish a local office for drop-in service such as bill paying and equipment return
- Build to all the commercial and industrial centers including the planned growth areas
- Offer low-cost service to qualifying families and older adults

The benefits to establishing a partnership are extensive and also include solving the competition problem. Currently Comcast is the only provider offering gigabit internet service. By bringing in a new provider that offers gigabit service, Firestone will see:

- Lower prices
- More options for residents
- Potentially better customer service

Expanding Middle-Mile Network

Another solution would be for the Town to expand on its middle-mile network. Middle-mile networks cost less to deploy because they are only designed to create a ring through the community and connect to a selected number of anchor institutions. Middle-mile networks can also be phased in more easily over time as budget allows. While last-mile networks can also be phased in, network financing would most likely be dependent on revenue and the longer it takes to build the network – the longer it will take to hook up customers and generate revenue.

The benefits of a middle-mile network are substantial and would enable the Firestone to:

- Deploy critical infrastructure including IoT that will serve regional needs for the next 30+ years
- Own a network with an investment cost that is much smaller with a risk much less significant than a last-mile network
- Potentially phase-in a last-mile solution
- Potentially build fiber to towers to better encourage wireless technology deployment
- Reduce costs for last-mile providers in reaching the underserved areas
- Lease excess fiber and conduit to generate revenue and encourage private provider investments
- Attracting last-mile providers that can invest in last-mile connections to homes and businesses

Some of these benefits only come from the Town building and owning its own middle-mile infrastructure. However, Firestone could also establish partnerships that could provide the Town with critical infrastructure and services as well.

Implementing Broadband-friendly Policies

By itself, broadband friendly policies will do little to improve the broadband environment in a community. However, implemented in concert as a part of a comprehensive solution, it can be an effective way to close the broadband gaps in a community. Policies include:

- **Dig Once Policies** that require the placement of conduit/fiber when road construction is occurring. The key to a Dig Once policy is ensuring that it is connected to the Town’s network plan. Otherwise, the Town could end up

with pieces of conduit all over the place that are not connected to each other. This also requires close coordination between Town departments to effectively execute. See attached guidebook for creating Dig Once Policies provided as **Appendix D**.

- **New Development policies** that require the developer to include a plan for telecommunications infrastructure as a part of the community before it is built. This includes the placement of conduit and/or fiber during construction of the development. This can be done at fraction of the cost for the Town and would be valuable infrastructure for the Town to own. In addition, developers do not always notify broadband providers and cellular carriers of a new development prior to it being built. For obvious reasons, it is much easier for infrastructure to be put in while a community is being built than trying to retrofit it afterwards. This can also be done as part of the Dig Once policy. See City of Greeley ordinance provided as **Appendix E**.
- **Streamlining Permitting**. This includes publishing clear permitting requirements, fees and applications on the Town website and establishing a single point of contact for the carriers.
- **5G and wireless facilities**. Currently, the push to deploy 5G is centered on large cities and dense urban areas because the technology outputs greater speeds at shorter distances. Thornton could very well see 5G applications in the near future. To be prepared, the Town should work to update the ROW code, design standards and policies to comport with federal and state law.
- **Establishing a Pilot Grant Program** that would provide subsidies to connect qualifying businesses to a broadband connection. The Town could set aside a specific amount of funds (e.g. \$25,000) to improve economic development by helping businesses that are too far away from a network and cannot connect to a network due to the cost.

These policies could be developed one by one or the Town could consider establishing a Policy Working Group to develop them all at once as a package.

8.3 Final Recommendations

Based on all the information gathered and analyzed as a part of this process, VPS recommends the following:

1. **The Town should NOT move forward with a last-mile FTTP municipal broadband network.** Based on the data collected and the fact that three existing providers offer a variety of broadband services of up to a gigabit to 99+% of Firestone, the Town does not have a broadband access problem. Without a municipal electric utility to offset the costs of deployment by leveraging utility poles, an FTTP network could cost Firestone up to \$5000 per location or \$25-\$35,000 per mile to construct. With the existing competition in Firestone, the take rates could be as low as 30% and this does not justify a financial investment by the Town. In addition, the Town has an opportunity to establish a partnership with a new provider that could bring in the desired competition at a fraction of the cost to the Town.
2. **The Town should move forward with either issuing an RFP to the RFI bidders or directly entering into negotiations with Allo Communications to establish a PPP for a FTTH network.** Allo Communications provided the strongest submission based on a review of the three proposals submitted in response to the RFI. It should be noted that it is uncommon for a new provider to express an interest in building a new network in a community. It is even more uncommon for that provider to propose a 100% fiber solution that can deliver gigabit speeds.

While Allo is relatively new to Colorado, they are a highly-rated service provider in the State of Nebraska. This year's PCMag ranked Allo in the top ten fastest ISPs in the country. More recently, Allo has developed PPPs with the Town of Breckenridge and the City of Fort Morgan. Interestingly, both of those PPPs have different elements showing that Allo is willing to work with the community to establish a partnership that makes sense for the local community.

The other two submissions provided interesting information but those fell short of offering what Allo is proposing.

3. **If the Town does not establish a PPP that results in the Town's middle-mile network needs being met, then the Town should consider expanding its own middle-mile network as needed.** This is something that can be completed over time and phased-in. If the Town determines this to be the best course of action, the Town should consider finding a network operator to manage the network. The proposals submitted by the other two respondents to the RFI indicate that they could be considered for this role.
4. Finally, in addition and independent of the network solutions, **the Town should consider implementing one or more of the broadband policy solutions noted above.**

Appendix A – Technology Background

For background and as a Broadband 101 primer, it's important to understand the definition of broadband as well as the different types of technologies referenced in this Report. Broadband technologies can be broken down into two main categories – wireline and wireless. This Appendix provides an overview of each and helps define some the terms that will be utilized in this report.

Wireline Technologies

Wireline technologies rely on a physical cable for transmission of the communication signal. These cables usually transport an electrical signal on a copper cable or an optical signal on a fiber optic cable. There are three common wireline technologies used by wireline companies today. These are:

- Digital Subscriber Line (DSL) – This wireline technology overlays a broadband signal on existing twisted pair copper cables. Broadband speeds on DSL networks are dependent on the customer's distance from electronics in remote terminals or central offices. Modern DSL technologies can typically provide 1 Mbps to 2 Mbps download speeds, depending upon the quality and size of the copper cable. However, for customers served by copper cable that exceeds 18,000 feet in length, the distortion caused by the capacitance of the cable renders the cable unsuitable for quality voice. Telephone companies have historically provided voice service over twisted pairs of copper cable. Consequently, millions of miles of twisted pair copper cables have been deployed throughout the country. However, most service providers have concluded that DSL is near the end of its useful life and will not be a long-term solution for broadband delivery. Therefore, they have been looking to fiber technology to meet the increasing customer demand.
- Coaxial Cable (DOCSIS) – Coaxial cable can also be used to provide wireline broadband services with typical speeds of 160 Mbps downstream and 120 Mbps upstream that can be shared by a large number of subscribers. Most Cable Television (CATV) providers like Comcast rely on COAX cables. The CATV industry has implemented standards called Data Over Cable Service Interface Specifications (DOCSIS), which defines how the COAX network can be used to deliver broadband services to their customers. It is important to note that the CATV coax networks are shared – meaning a single cable leaving the CATV headend is split many times to serve many customers. Often, a single cable will provide broadband and/or video to hundreds of customers. This architecture worked well for broadcast video services, since it was a “one-to-many” service, but has limitations when delivering services such as broadband, where each customer requires their own unique connection.
- Fiber to the Premises (FTTP) – This wireline technology serves all customers by a fiber optic cable. Most FTTP equipment allows between 70 Mbps and 1 Gbps of broadband to each customer and is capable of serving customers that are more than twelve miles from the central office or electronic field terminal locations.

Wireless Technologies

Wireless technologies transmit the communication signal “over the air” on a radio frequency (RF) carrier. There are four common wireless technologies used by providers today. These are:

- Fifth Generation (5G) – The Third Generation Partnership Program (3GPP) organization is in process of defining the 5G standards, expected circa 2019. Per the GSM Association, 5G will be targeting user throughputs of 10 Gbps peak, a hundred times that of 4G networks. Although inherently a mobile technology, the first wave of 5G will be utilized for the fixed delivery of wireless broadband services. 5G is anticipated to incorporate higher-

order spatial diversity (MIMO schemes, beam forming, cell splitting, etc.), self-organizing networks to minimize self-interference and new user interfaces to support the Internet of Things (IoT).

- Fourth Generation (4G) – Utilizes Long Term Evolution (LTE) licensed spectra to provide wireless broadband services, as defined by the 3GPP organization, with duplexing methodology of both time (TD-LTE) and frequency Divisions. Although inherently a mobile technology, today, nearly all terrestrial wireless providers have standardized on Long Term Evolution (LTE) with fixed Customer Premises Equipment (CPE), as the Wireless Metropolitan Area Network (WMAN) broadband technology of choice. All major cellular providers in the U.S. have deployed LTE and continue to expand their LTE footprints.
- Unlicensed Operations – Unlicensed operations on unlicensed spectra can also be used to provide wireless broadband services. Systems operating on unlicensed spectra typically utilize vendor proprietary air interfaces, Institute of Electrical and Electronics Engineers (IEEE) 802.11, or another variant of the IEEE standards. Operations in the unlicensed spectra inherently are utilized for the fixed delivery of wireless broadband services, as the utilization of fixed devices allow for additional deployment efforts to overcome interference inherent within the unlicensed bands.
- Satellite - Satellite-based broadband is not considered a viable broadband alternative due to the high latency which makes it unsuitable for many applications and unable to provide reliable, high-quality voice connectivity.

Some believe that wireless can be a substitute for terrestrial wireline connections that may be too costly to construct. While wireless can be part of the solution and should be considered for deployment in very rural areas – there are considerations that should be taken into consideration.

- Wireless technologies must be replaced every 5-7 years and they can be very costly to maintain.
- Wireless is not suited for growth. For example – since bandwidth is shared among subscribers, available bandwidth per subscriber decreases as density of subscribers or devices increases.
- Available bandwidth decreases as distance of subscriber from access point increases.
- Broadband speeds are more limited. 4G technologies might allow customers to burst up to 10 or 20 Mbps for short periods of time.
- Not well suited for large bandwidth needs and often discouraged by carriers by only allowing a limited amount of data per month.
- Geography and atmospheric conditions can and will impact service delivery for technologies that need to be in sight of each other in order to transmit a signal. Mountains, hills, valleys, buildings, and trees interfere with the propagation of the wireless signal. Some technologies such as LTE can provide non-line-of-site service (NLOS) to some extent, but at significantly reduced throughput compared to direct LOS. These terrain issues and obstacles can mean that some customers cannot receive the broadband signal or that additional towers (and investment) are required.

Wireline vs. Wireless Technology

Both wireless and wireline broadband service providers have benefited from technology advances, but *wireline* technologies have historically been capable of speeds many times faster than the best *wireless* technologies. Fiber optic cable has been used by service providers for more than forty years to build high-speed broadband networks, primarily for long haul transport routes. Over the last ten to fifteen years, fiber has also been used to increase broadband speeds to the customer because no other technology can deliver as much broadband speed. With FTTP,⁴ the broadband speed provided is not dependent upon cable length, but electronics, and each new generation of FTTP electronics allows service providers the ability to offer significantly higher broadband speeds over greater distances without having to make

⁴ Fiber-to-the-Premises is sometimes referred to as Fiber-to-the-Home (FTTH).

significant changes to their outside plant architecture. There is no foreseeable end to the amount of bandwidth that can be provided over fiber cables.

There are many reasons why fiber is the best technology to construct modern network or upgrade existing networks. Fiber is immune to electromagnetic interference, provides the most reliable services, and minimizes operational expenses. Therefore, it delivers the best voice and broadband services available for today and the foreseeable future. Over the last several years, increases in copper prices, advances in technology, and growth in broadband demand have all worked together to make FTTP a more economical wireline technology for providing broadband. Not only is a fiber network less expensive to deploy, maintain, and upgrade than other wireline technologies, but it has superior broadband capabilities, such as being able to offer telecommuting, telemedicine services, and telepresence. All of these factors make it clear that copper is a dying technology in the telecommunications industry. It would be unwise for companies to utilize copper in their network deployments going forward, except in certain very limited situations.

Once fiber infrastructure is in place, service providers are able to increase the broadband by simply upgrading the electronics on the fiber cable, which represents a relatively small portion of the overall fiber network investment. Fiber technology will allow higher speeds to be delivered to customers over time with minimal incremental investment, making it the best technology for meeting future broadband service needs.

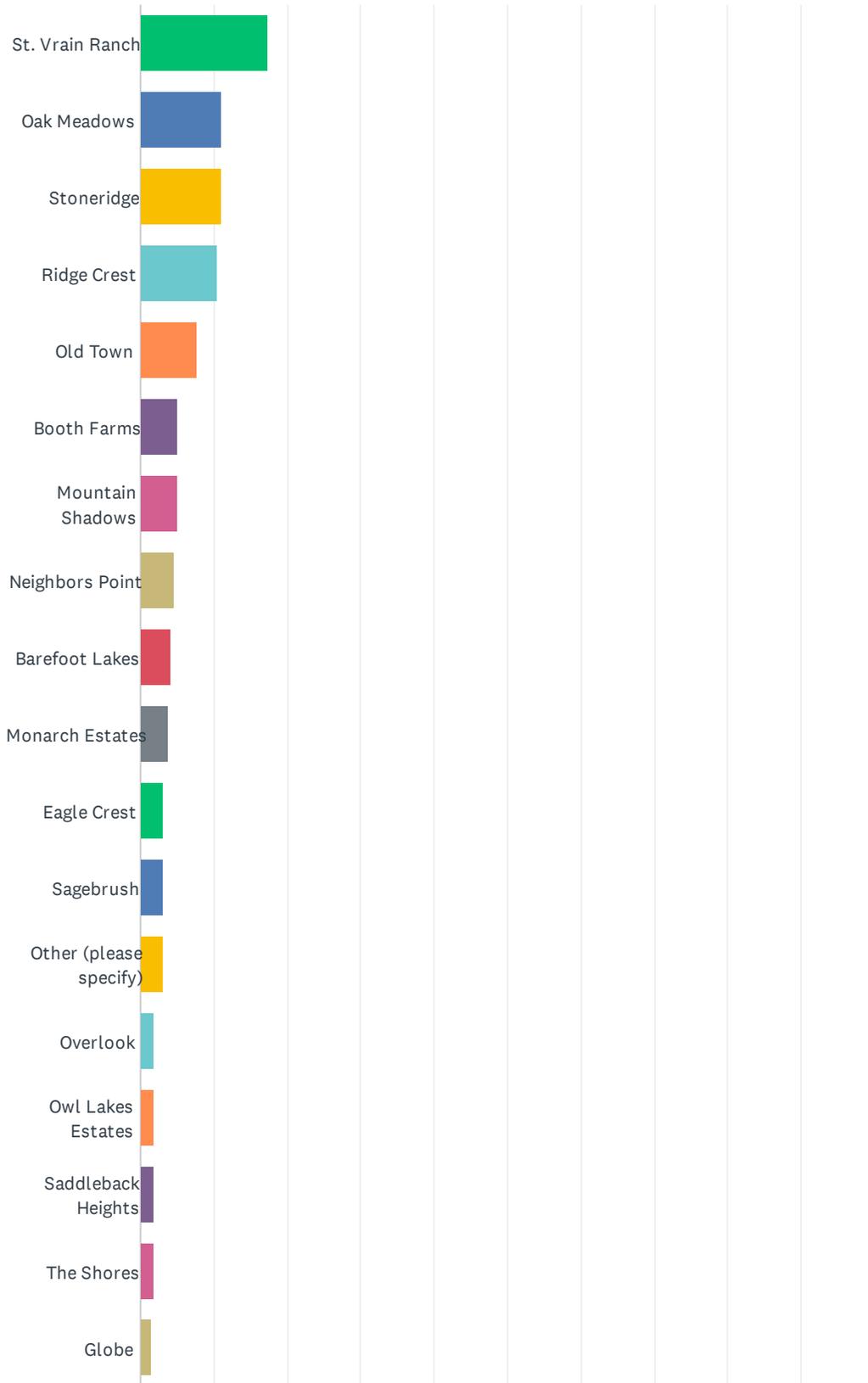
The amount of bandwidth per customer is significantly greater for a FTTP network when compared to a wireless network. Using the technologies available today, the bandwidth delivered to a customer can be more than 100 times greater than what is possible over a wireless network under similar conditions. The bandwidth advantage for FTTP will increase significantly in the coming years due to technology advances with the electronics.

Fiber optic cable is the most-costly to construct. However, it is also an enabling technology that allows for growth. A lion's share of the FTTP investment is the placement of the cable facilities, which typically has a 30-year life, compared to the wireless infrastructure, which has a greater portion of the investment associated with faster-depreciating infrastructure. When placement costs are included over a 30-year life, the cost savings for a wireless network are significantly reduced or eliminated.

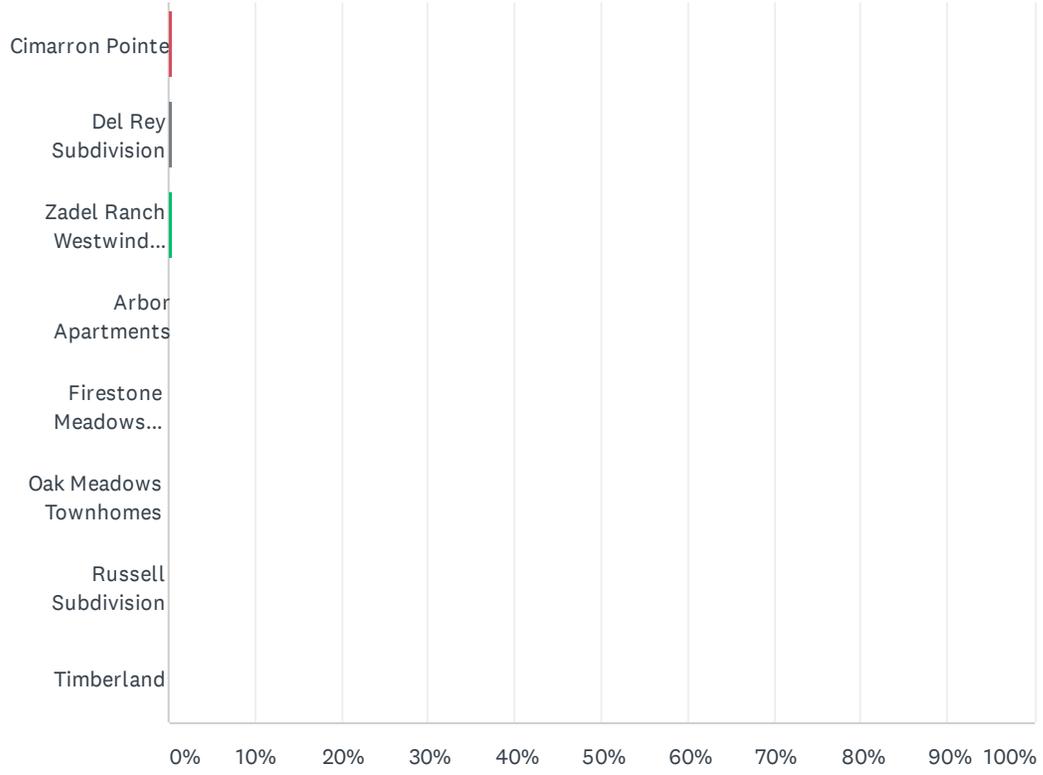
Appendix B – Raw Survey Results

Q1 Where in Firestone do you reside? Please select your development from the dropdown menu.

Answered: 218 Skipped: 0



Town of Firestone Broadband Survey

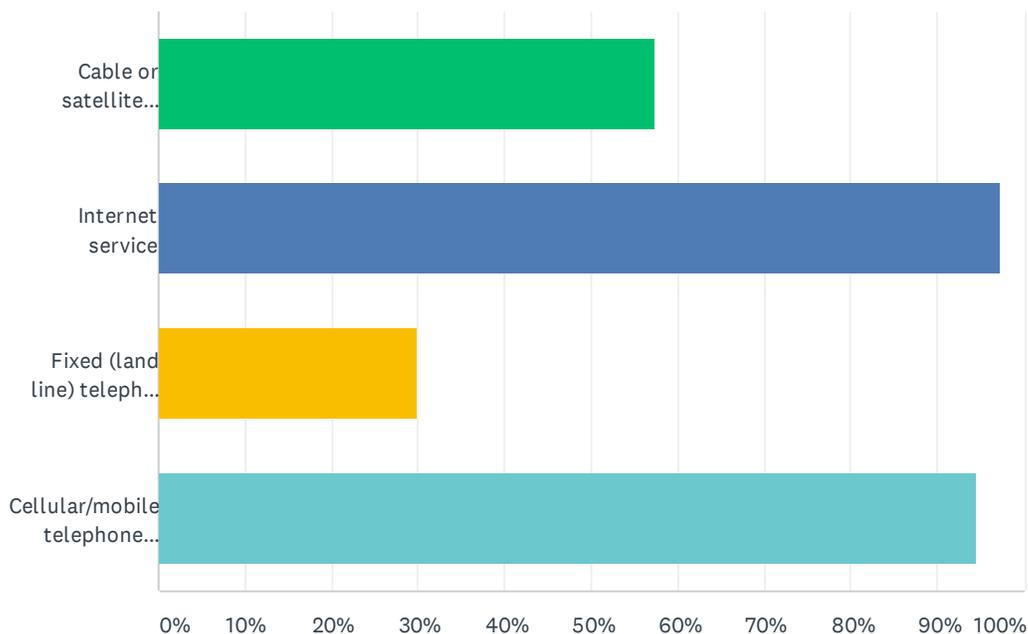


Town of Firestone Broadband Survey

ANSWER CHOICES	RESPONSES	
St. Vrain Ranch	17.43%	38
Oak Meadows	11.01%	24
Stoneridge	11.01%	24
Ridge Crest	10.55%	23
Old Town	7.80%	17
Booth Farms	5.05%	11
Mountain Shadows	5.05%	11
Neighbors Point	4.59%	10
Barefoot Lakes	4.13%	9
Monarch Estates	3.67%	8
Eagle Crest	3.21%	7
Sagebrush	3.21%	7
Other (please specify)	3.21%	7
Overlook	1.83%	4
Owl Lakes Estates	1.83%	4
Saddleback Heights	1.83%	4
The Shores	1.83%	4
Globe	1.38%	3
Cimarron Pointe	0.46%	1
Del Rey Subdivision	0.46%	1
Zadel Ranch Westwind Village	0.46%	1
Arbor Apartments	0.00%	0
Firestone Meadows Apartments	0.00%	0
Oak Meadows Townhomes	0.00%	0
Russell Subdivision	0.00%	0
Timberland	0.00%	0
TOTAL		218

Q2 Which of the following services does your household purchase? (check all that apply)

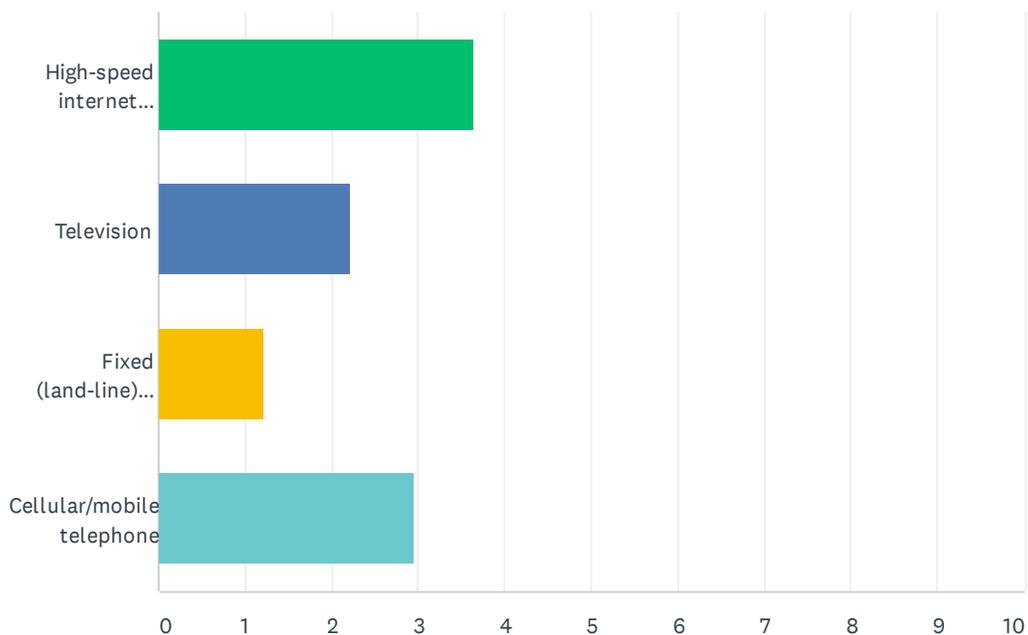
Answered: 218 Skipped: 0



ANSWER CHOICES	RESPONSES	
Cable or satellite television	57.34%	125
Internet service	97.25%	212
Fixed (land line) telephone service	29.82%	65
Cellular/mobile telephone service	94.50%	206
Total Respondents: 218		

Q3 Please rank the following services by order of importance to your household, with 1 being the most important and 4 being the least important.

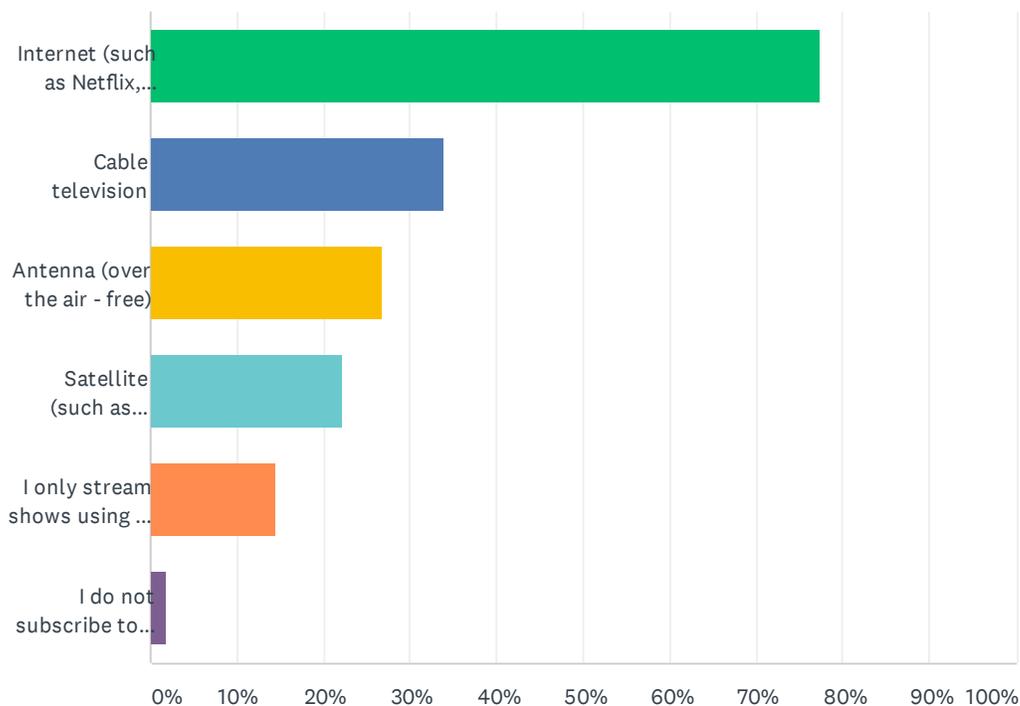
Answered: 217 Skipped: 1



	1	2	3	4	TOTAL	SCORE
High-speed internet connection	71.03% 152	23.36% 50	4.21% 9	1.40% 3	214	3.64
Television	5.19% 11	19.81% 42	66.04% 140	8.96% 19	212	2.21
Fixed (land-line) telephone	2.42% 5	1.93% 4	10.63% 22	85.02% 176	207	1.22
Cellular/mobile telephone	22.22% 48	55.09% 119	18.52% 40	4.17% 9	216	2.95

Q4 What kind of television service does your household subscribe to? (check all that apply)

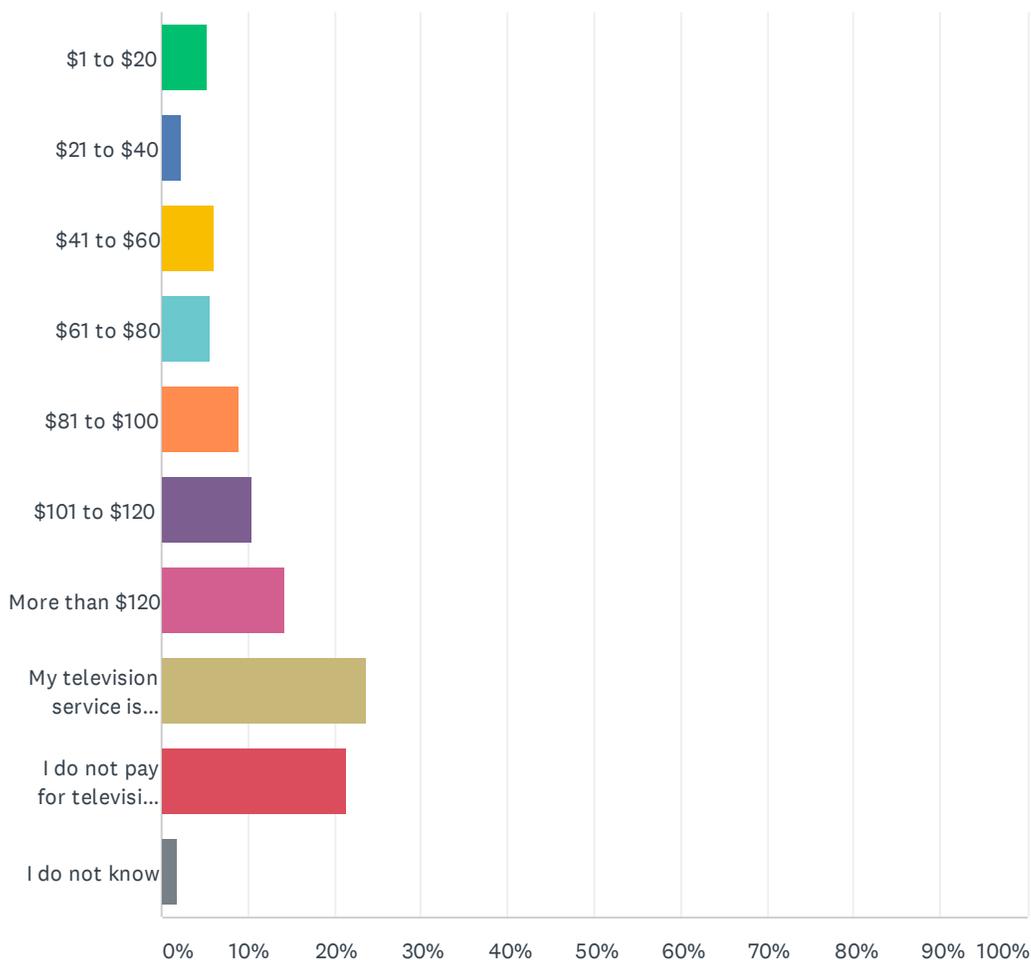
Answered: 216 Skipped: 2



ANSWER CHOICES	RESPONSES	
Internet (such as Netflix, Hulu, Vudu)	77.31%	167
Cable television	33.80%	73
Antenna (over the air - free)	26.85%	58
Satellite (such as DirecTV)	22.22%	48
I only stream shows using the internet and I do not subscribe to another television service	14.35%	31
I do not subscribe to any television service	1.85%	4
Total Respondents: 216		

Q5 Approximately how much does your household currently pay per month for cable or satellite television service (not including internet or phone)?

Answered: 211 Skipped: 7

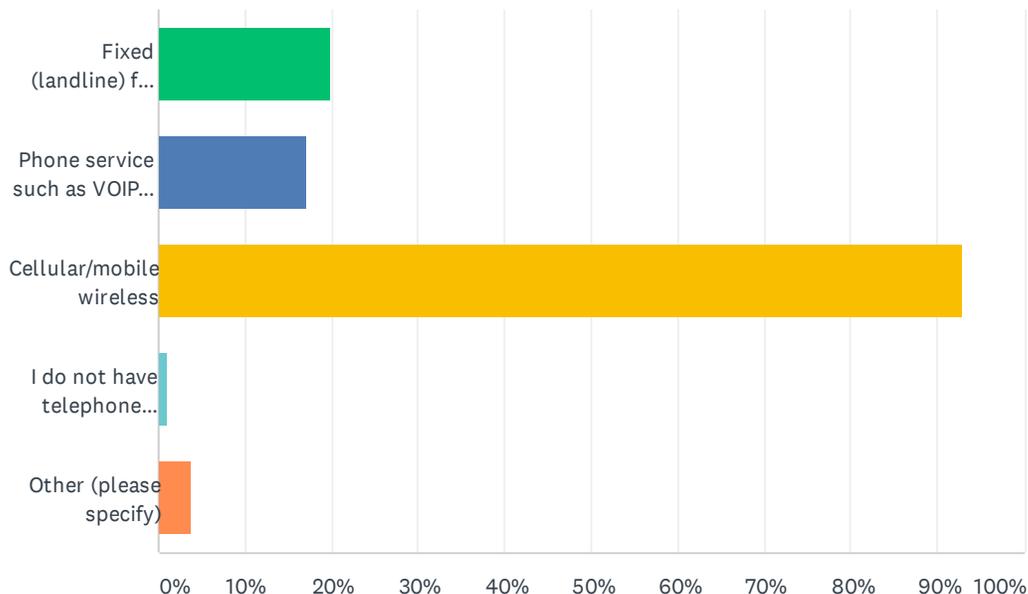


Town of Firestone Broadband Survey

ANSWER CHOICES	RESPONSES	
\$1 to \$20	5.21%	11
\$21 to \$40	2.37%	5
\$41 to \$60	6.16%	13
\$61 to \$80	5.69%	12
\$81 to \$100	9.00%	19
\$101 to \$120	10.43%	22
More than \$120	14.22%	30
My television service is bundled with internet or phone	23.70%	50
I do not pay for television - I get it over an antenna	21.33%	45
I do not know	1.90%	4
TOTAL		211

Q6 Please indicate which type(s) of telephone services your household purchases: (check all that apply)

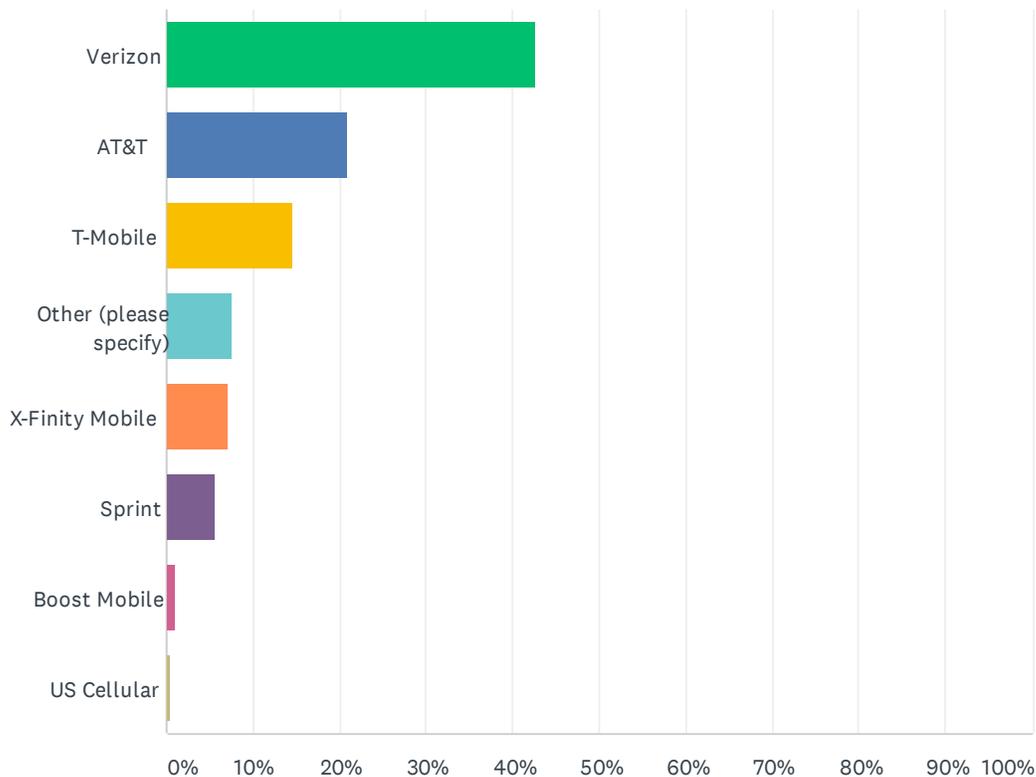
Answered: 211 Skipped: 7



ANSWER CHOICES	RESPONSES	
Fixed (landline) from my telephone provider	19.91%	42
Phone service such as VOIP directly from my cable provider	17.06%	36
Cellular/mobile wireless	92.89%	196
I do not have telephone service	0.95%	2
Other (please specify)	3.79%	8
Total Respondents: 211		

Q7 If you subscribe to a cellular/mobile wireless service - who is your carrier?

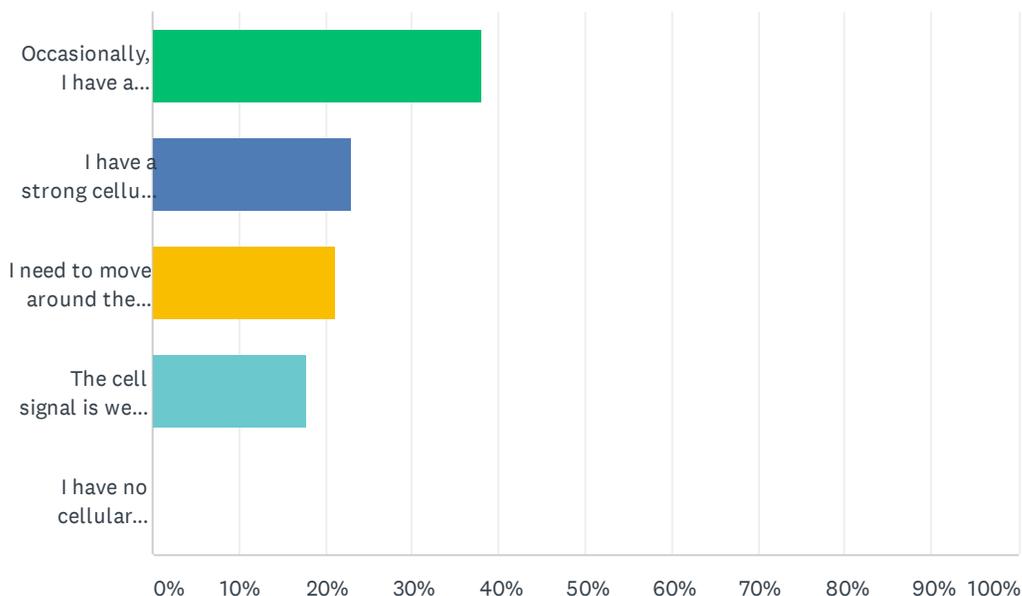
Answered: 211 Skipped: 7



ANSWER CHOICES	RESPONSES	
Verizon	42.65%	90
AT&T	20.85%	44
T-Mobile	14.69%	31
Other (please specify)	7.58%	16
X-Finity Mobile	7.11%	15
Sprint	5.69%	12
Boost Mobile	0.95%	2
US Cellular	0.47%	1
TOTAL		211

Q8 If you subscribe to a cellular/mobile wireless service - how would you describe the cellular signal at your house?

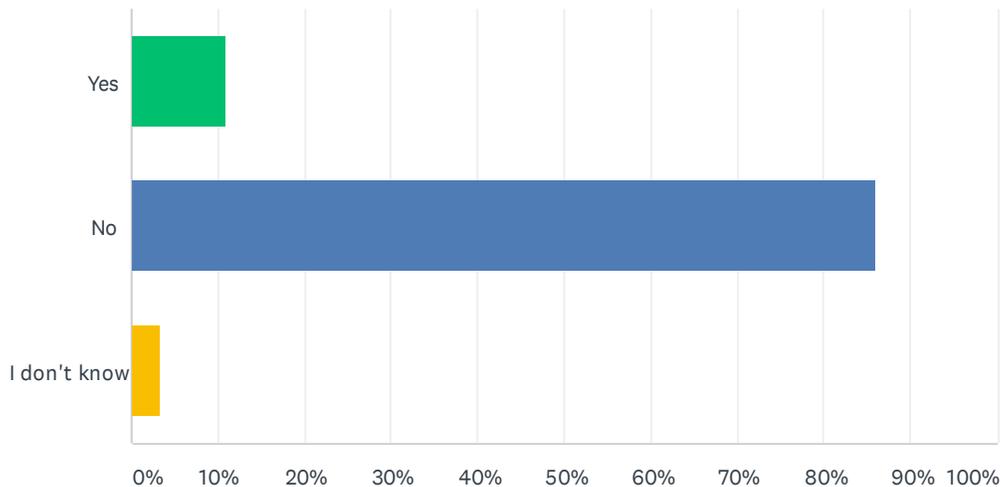
Answered: 213 Skipped: 5



ANSWER CHOICES	RESPONSES	
Occasionally, I have a problem with my cell signal, but most of the time it is strong enough for me to make/receive calls without an issue.	38.03%	81
I have a strong cellular signal at my house and can always make/receive phone calls without an issue.	23.00%	49
I need to move around the house in order to find the best place to make/receive a call.	21.13%	45
The cell signal is weak at my house and it's very difficult to use my cell phone at home.	17.84%	38
I have no cellular service at my house.	0.00%	0
TOTAL		213

Q9 Do you have a carrier provided cell booster device at your house?

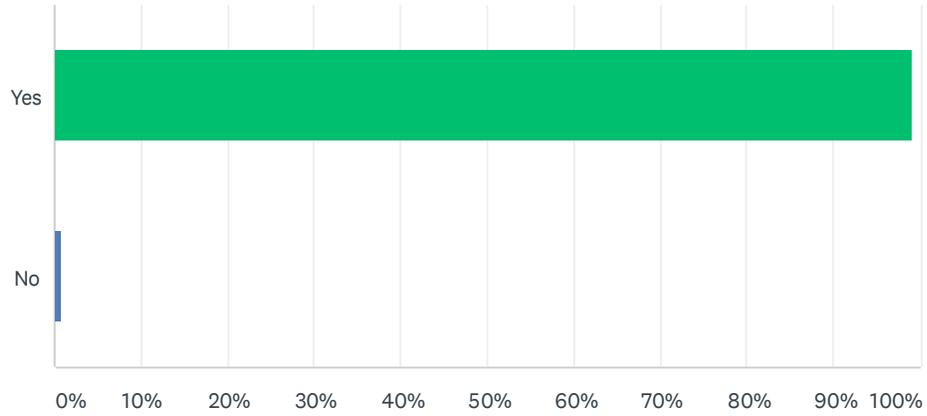
Answered: 213 Skipped: 5



ANSWER CHOICES	RESPONSES	
Yes	10.80%	23
No	85.92%	183
I don't know	3.29%	7
TOTAL		213

Q10 Do you purchase home internet service?

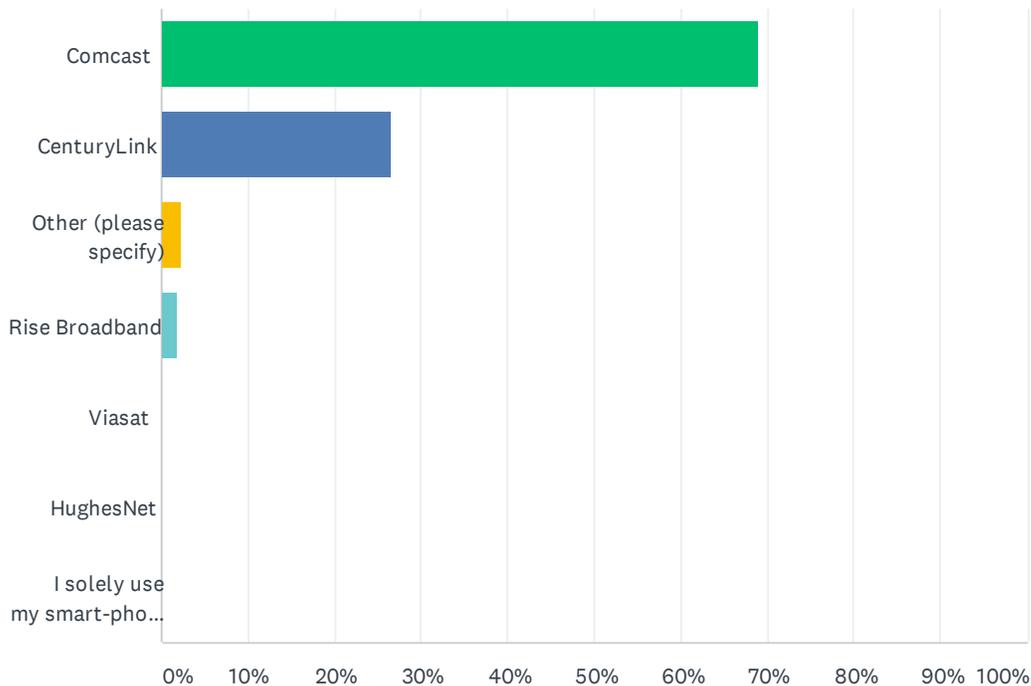
Answered: 213 Skipped: 5



ANSWER CHOICES	RESPONSES	
Yes	99.06%	211
No	0.94%	2
TOTAL		213

Q11 Who is your current primary home internet service provider?

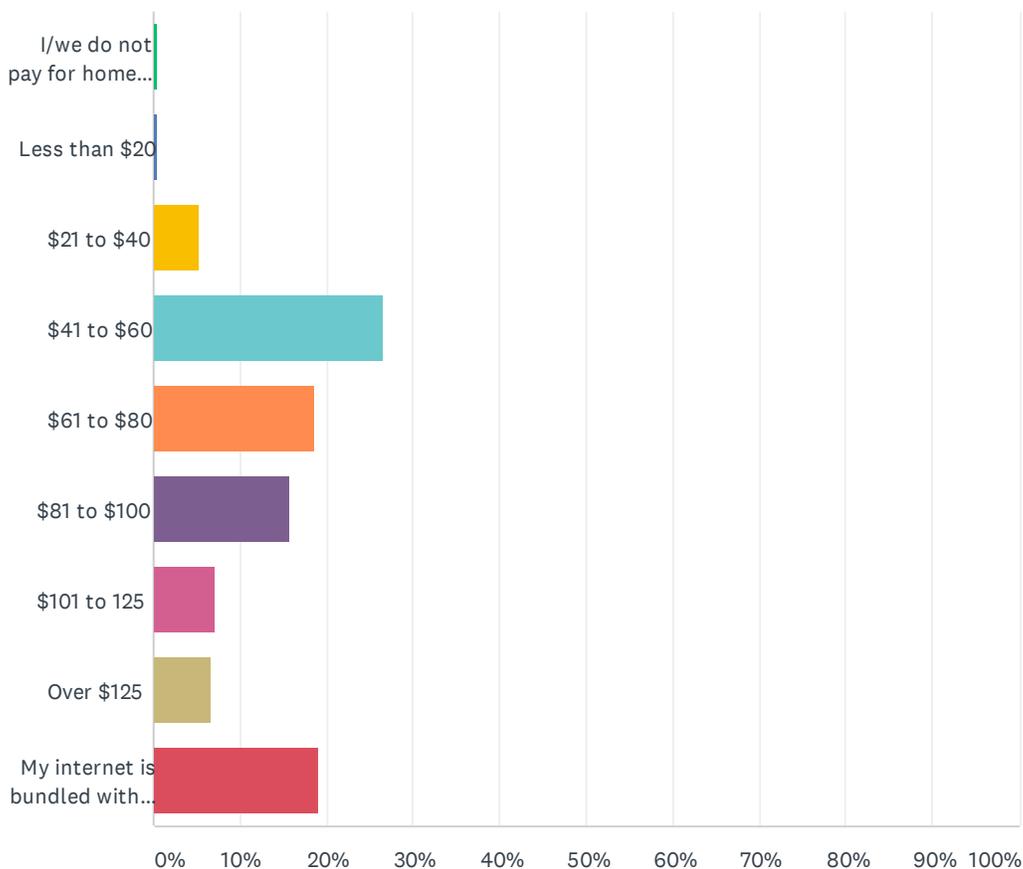
Answered: 210 Skipped: 8



ANSWER CHOICES	RESPONSES	
Comcast	69.05%	145
CenturyLink	26.67%	56
Other (please specify)	2.38%	5
Rise Broadband	1.90%	4
Viasat	0.00%	0
HughesNet	0.00%	0
I solely use my smart-phone as a hot-spot for my internet connectivity	0.00%	0
TOTAL		210

Q12 Approximately how much does your household currently pay per month for internet service only (not including television or phone)?

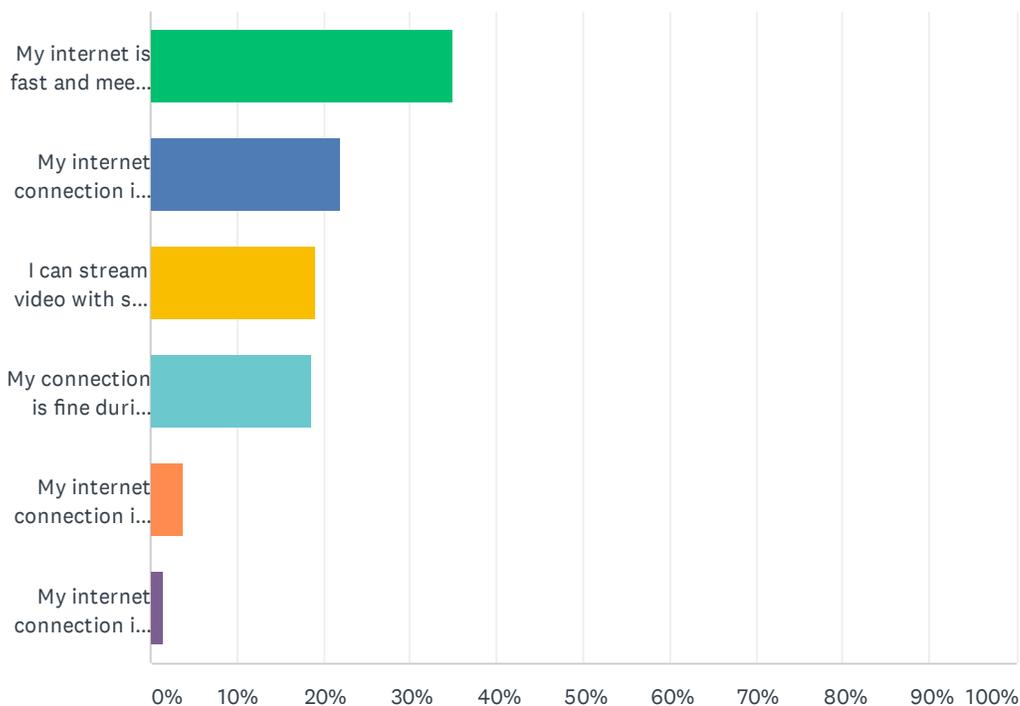
Answered: 210 Skipped: 8



ANSWER CHOICES	RESPONSES	
I/we do not pay for home internet service.	0.48%	1
Less than \$20	0.48%	1
\$21 to \$40	5.24%	11
\$41 to \$60	26.67%	56
\$61 to \$80	18.57%	39
\$81 to \$100	15.71%	33
\$101 to 125	7.14%	15
Over \$125	6.67%	14
My internet is bundled with other services and I do not know	19.05%	40
TOTAL		210

Q13 The following are statements regarding your current home internet service. Please select the statement that best describes your experience.

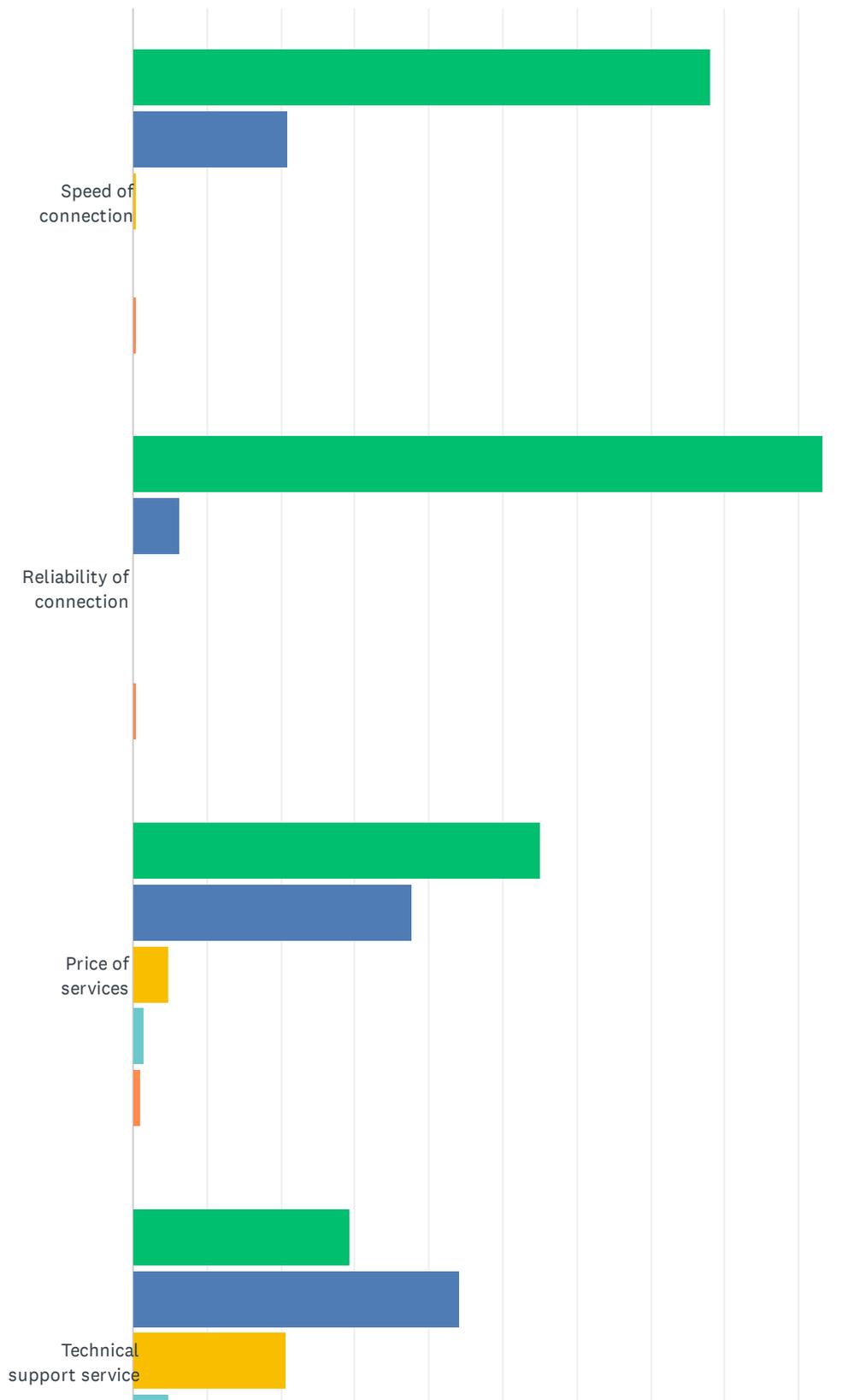
Answered: 209 Skipped: 9



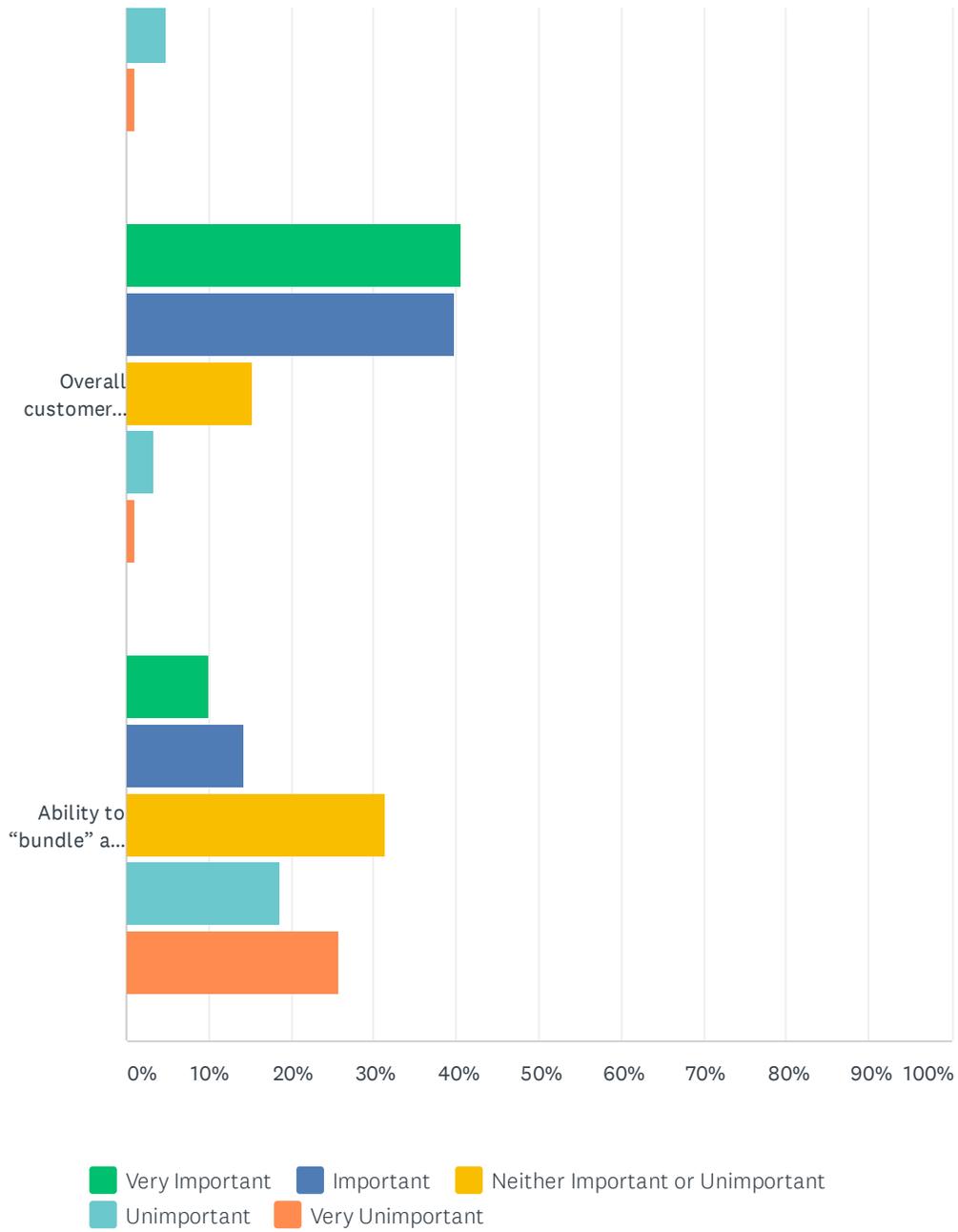
ANSWER CHOICES	RESPONSES	
My internet is fast and meets all of my needs, including video streaming	34.93%	73
My internet connection is fast until there are multiple internet users streaming/doing tasks online at the same time	22.01%	46
I can stream video with some delays and buffering	19.14%	40
My connection is fine during certain times of the day, slow during peak periods	18.66%	39
My internet connection is so slow it is difficult to do anything other than view web pages	3.83%	8
My internet connection is adequate, but I cannot stream video	1.44%	3
TOTAL		209

Q14 How important are the following aspects of home internet service to you?

Answered: 210 Skipped: 8



Town of Firestone Broadband Survey

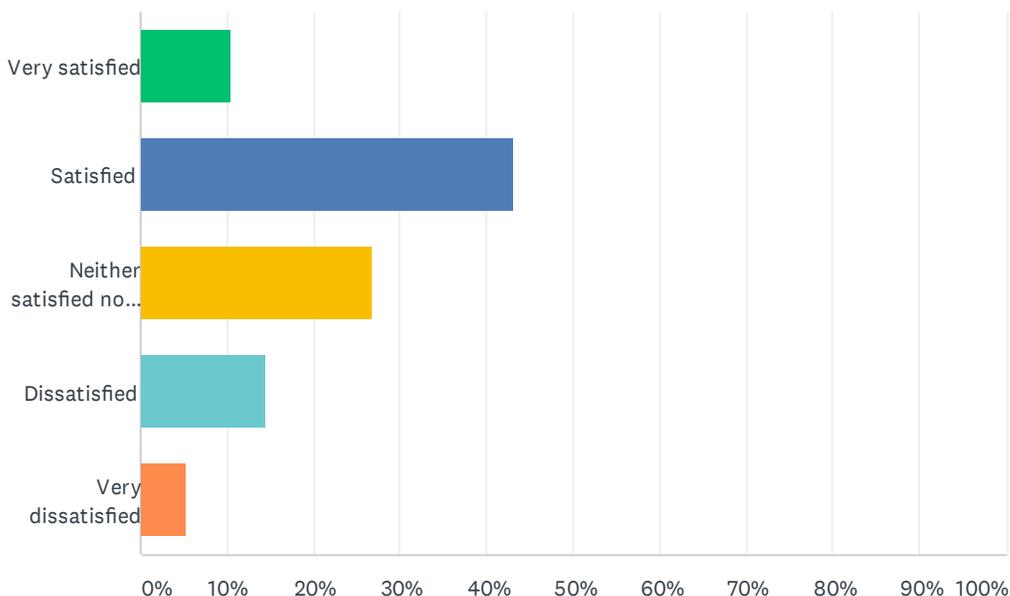


Town of Firestone Broadband Survey

	VERY IMPORTANT	IMPORTANT	NEITHER IMPORTANT OR UNIMPORTANT	UNIMPORTANT	VERY UNIMPORTANT	TOTAL	WEIGHTED AVERAGE
Speed of connection	78.10% 164	20.95% 44	0.48% 1	0.00% 0	0.48% 1	210	1.23
Reliability of connection	93.27% 194	6.25% 13	0.00% 0	0.00% 0	0.48% 1	208	1.08
Price of services	55.07% 114	37.68% 78	4.83% 10	1.45% 3	0.97% 2	207	1.53
Technical support service	29.33% 61	44.23% 92	20.67% 43	4.81% 10	0.96% 2	208	1.98
Overall customer service	40.67% 85	39.71% 83	15.31% 32	3.35% 7	0.96% 2	209	1.80
Ability to "bundle" a package with television and phone service	10.00% 21	14.29% 30	31.43% 66	18.57% 39	25.71% 54	210	2.91

Q15 How satisfied are you with the overall service and value you receive from your current internet provider?

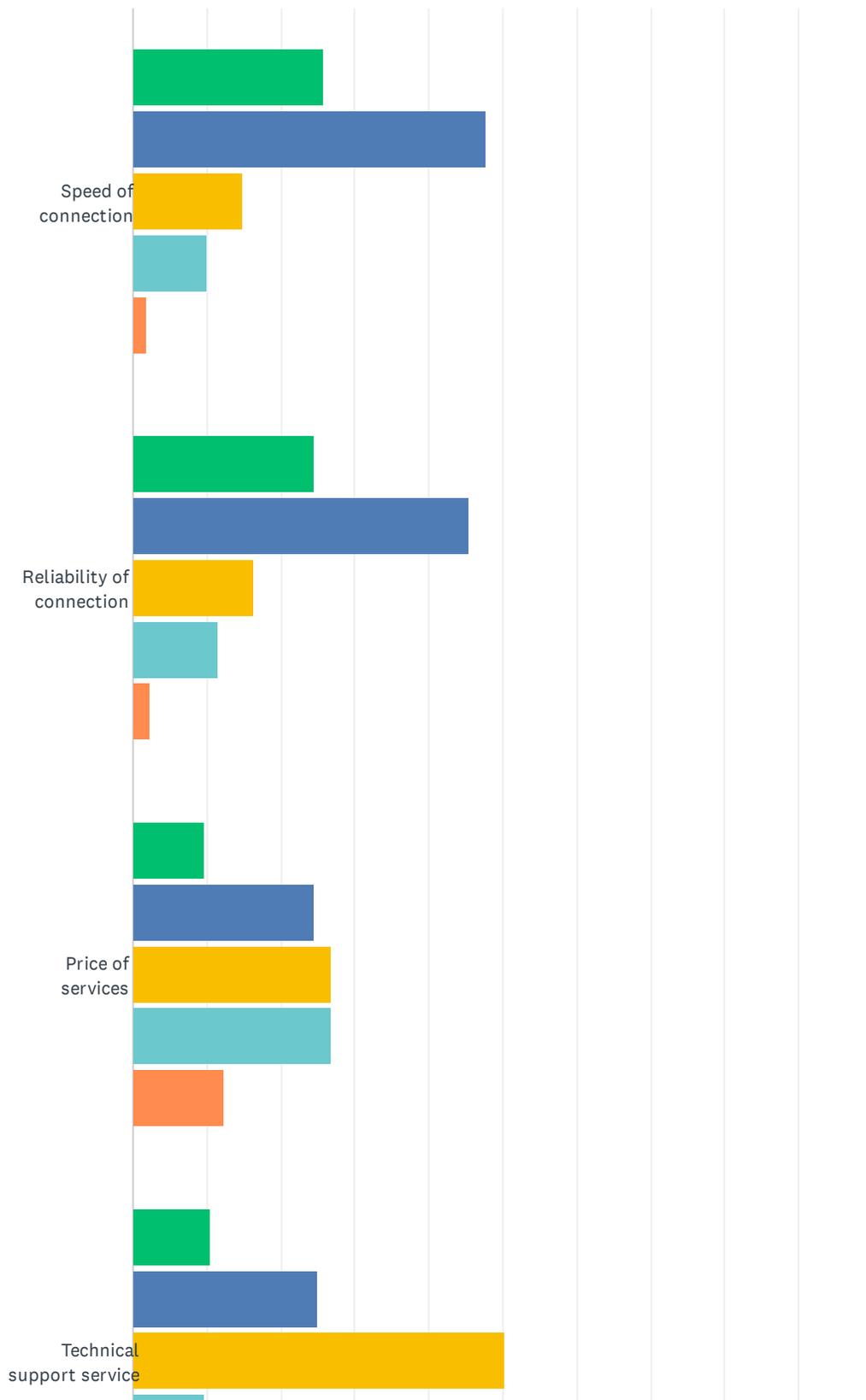
Answered: 209 Skipped: 9



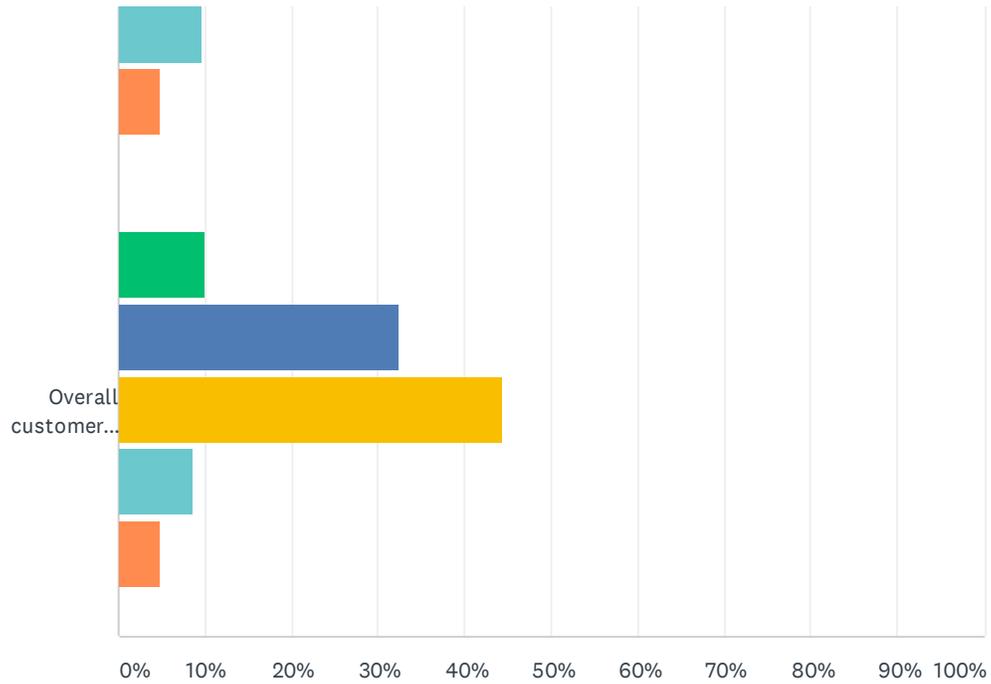
ANSWER CHOICES	RESPONSES	
Very satisfied	10.53%	22
Satisfied	43.06%	90
Neither satisfied nor dissatisfied	26.79%	56
Dissatisfied	14.35%	30
Very dissatisfied	5.26%	11
TOTAL		209

Q16 How satisfied are you with the following features of your current home internet access?

Answered: 210 Skipped: 8



Town of Firestone Broadband Survey

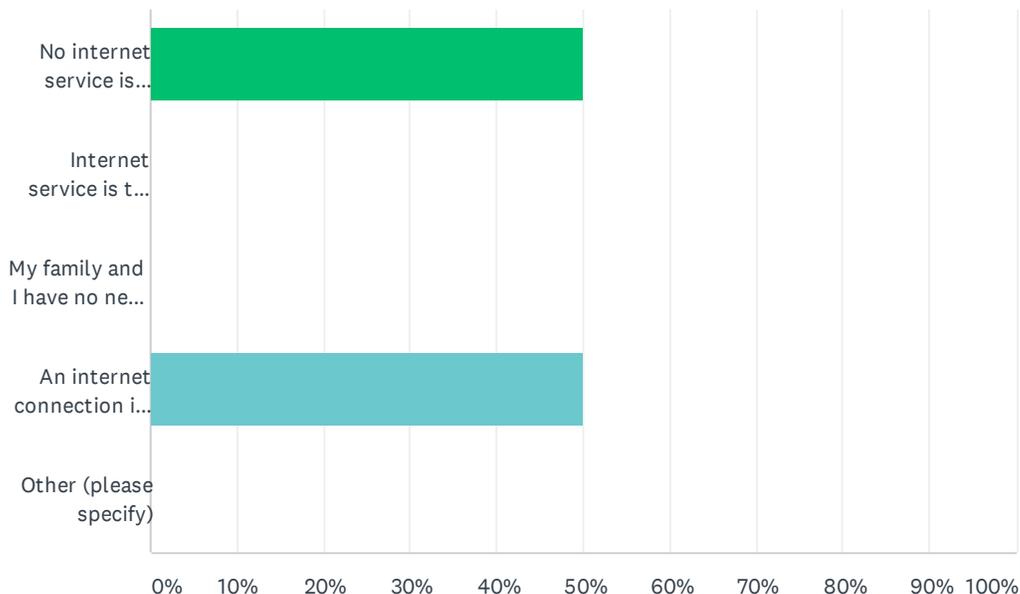


■ Very Satisfied
 ■ Satisfied
 ■ Neither satisfied or unsatisfied
 ■ Unsatisfied
■ Very unsatisfied

	VERY SATISFIED	SATISFIED	NEITHER SATISFIED OR UNSATISFIED	UNSATISFIED	VERY UNSATISFIED	TOTAL	WEIGHTED AVERAGE
Speed of connection	25.71% 54	47.62% 100	14.76% 31	10.00% 21	1.90% 4	210	2.03
Reliability of connection	24.40% 51	45.45% 95	16.27% 34	11.48% 24	2.39% 5	209	2.08
Price of services	9.57% 20	24.40% 51	26.79% 56	26.79% 56	12.44% 26	209	2.69
Technical support service	10.53% 22	24.88% 52	50.24% 105	9.57% 20	4.78% 10	209	2.59
Overall customer service	10.00% 21	32.38% 68	44.29% 93	8.57% 18	4.76% 10	210	2.52

Q17 You indicated that your household does not currently purchase internet services. Please tell us why:

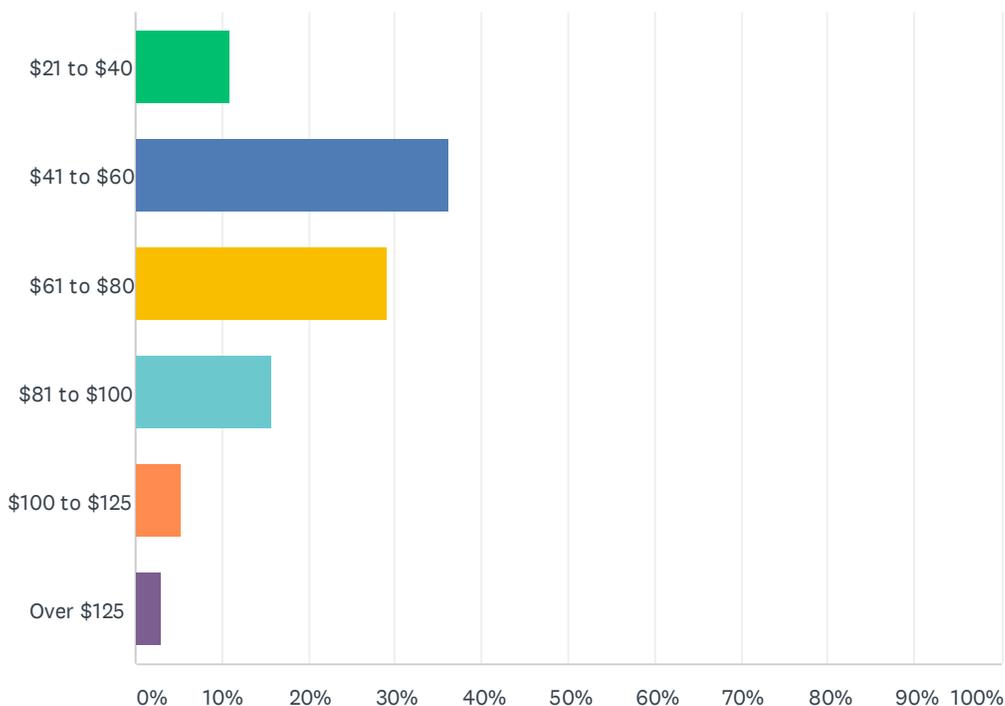
Answered: 2 Skipped: 216



ANSWER CHOICES	RESPONSES	
No internet service is available at our location	50.00%	1
Internet service is too slow to purchase	0.00%	0
My family and I have no need for the internet	0.00%	0
An internet connection is too expensive	50.00%	1
Other (please specify)	0.00%	0
TOTAL		2

Q18 If a new internet provider offered a reliable, robust, high-speed gigabit internet connection, what is the most you would pay monthly for that service?

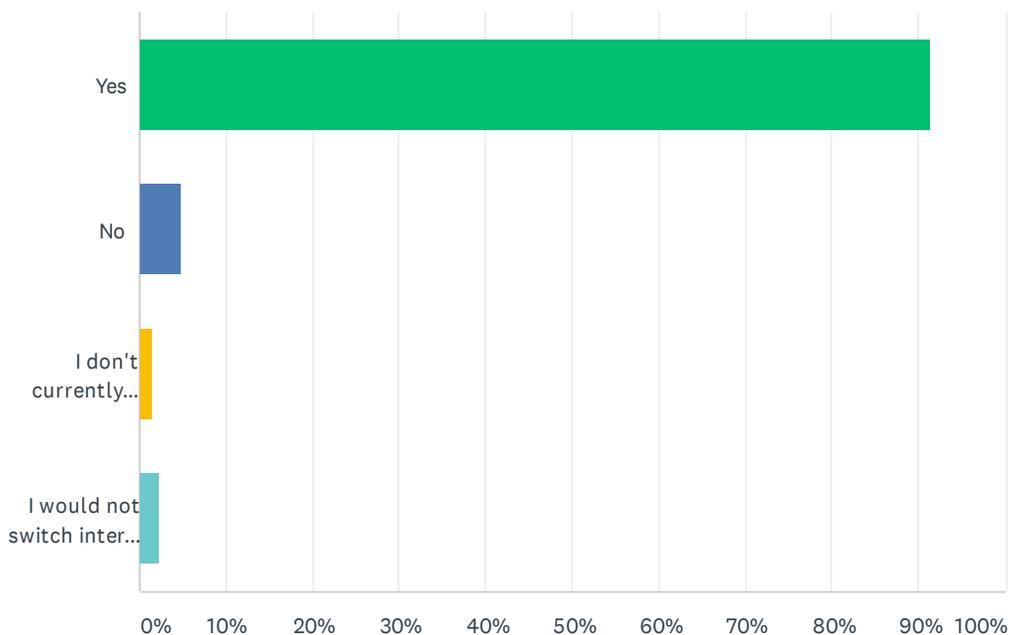
Answered: 210 Skipped: 8



ANSWER CHOICES	RESPONSES	
\$21 to \$40	10.95%	23
\$41 to \$60	36.19%	76
\$61 to \$80	29.05%	61
\$81 to \$100	15.71%	33
\$100 to \$125	5.24%	11
Over \$125	2.86%	6
TOTAL		210

Q19 If a new internet provider offered a gigabit high-speed internet connection, at the price you selected in the previous question, would you switch providers?

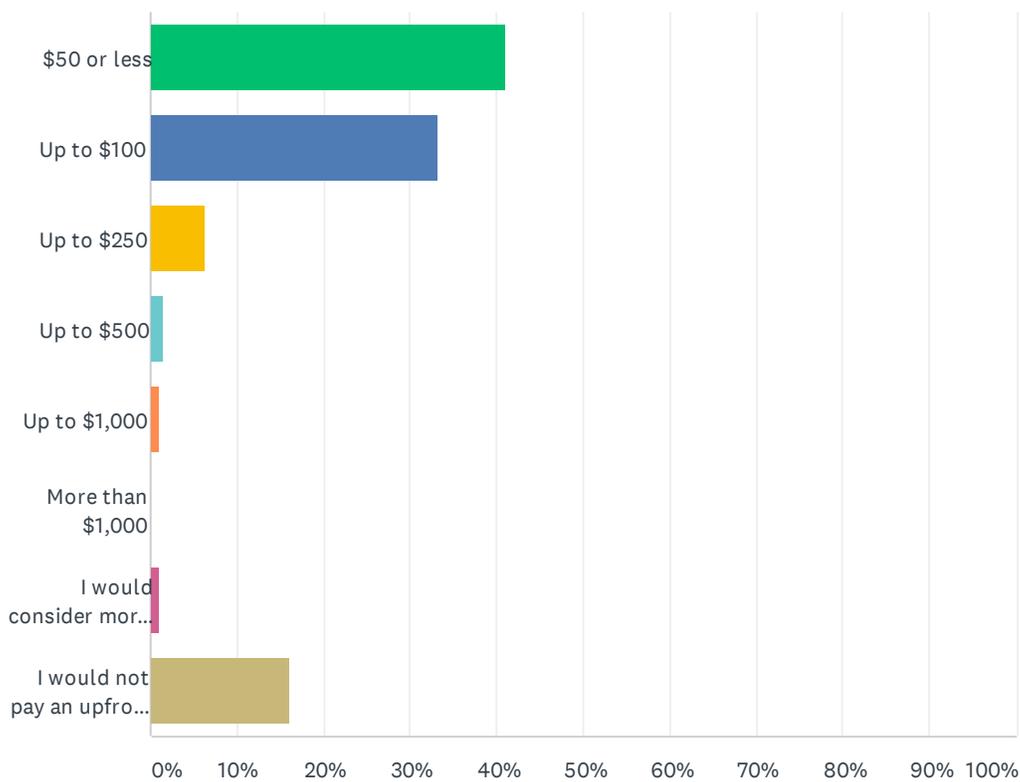
Answered: 208 Skipped: 10



ANSWER CHOICES	RESPONSES	
Yes	91.35%	190
No	4.81%	10
I don't currently purchase internet, but I would subscribe to a new provider	1.44%	3
I would not switch internet providers no matter what the price	2.40%	5
TOTAL		208

Q20 If a one-time hookup/connection fee was required by a new high-speed internet provider in order to get service to your home - how much would you be willing to pay for that connection?

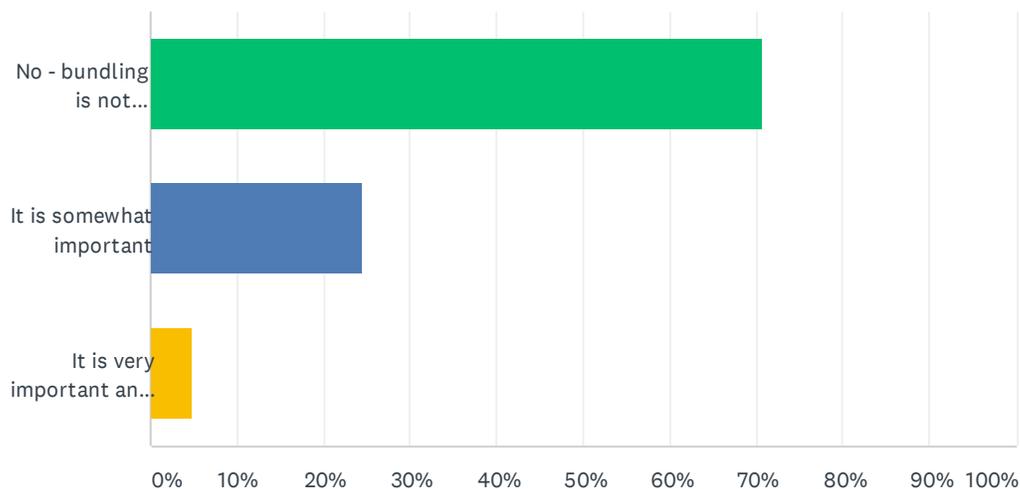
Answered: 210 Skipped: 8



ANSWER CHOICES	RESPONSES	
\$50 or less	40.95%	86
Up to \$100	33.33%	70
Up to \$250	6.19%	13
Up to \$500	1.43%	3
Up to \$1,000	0.95%	2
More than \$1,000	0.00%	0
I would consider more than \$1000 if it could be paid off over time.	0.95%	2
I would not pay an upfront hook-up fee	16.19%	34
TOTAL		210

Q21 Is it important for you to receive television and internet services from the same provider?

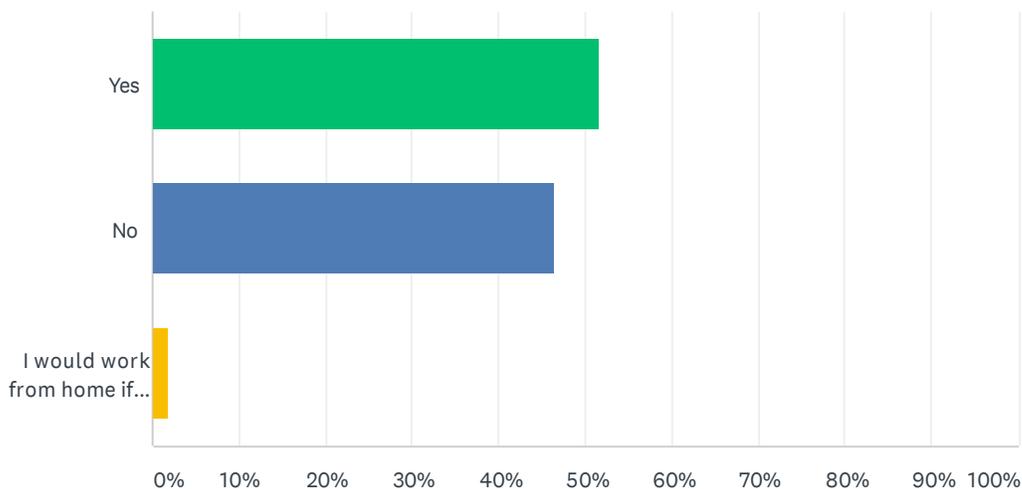
Answered: 209 Skipped: 9



ANSWER CHOICES	RESPONSES	
No - bundling is not important to me	70.81%	148
It is somewhat important	24.40%	51
It is very important and I want both services from the same provider	4.78%	10
TOTAL		209

Q22 In a non-pandemic environment, do you work from home? (At least 1 day a week)

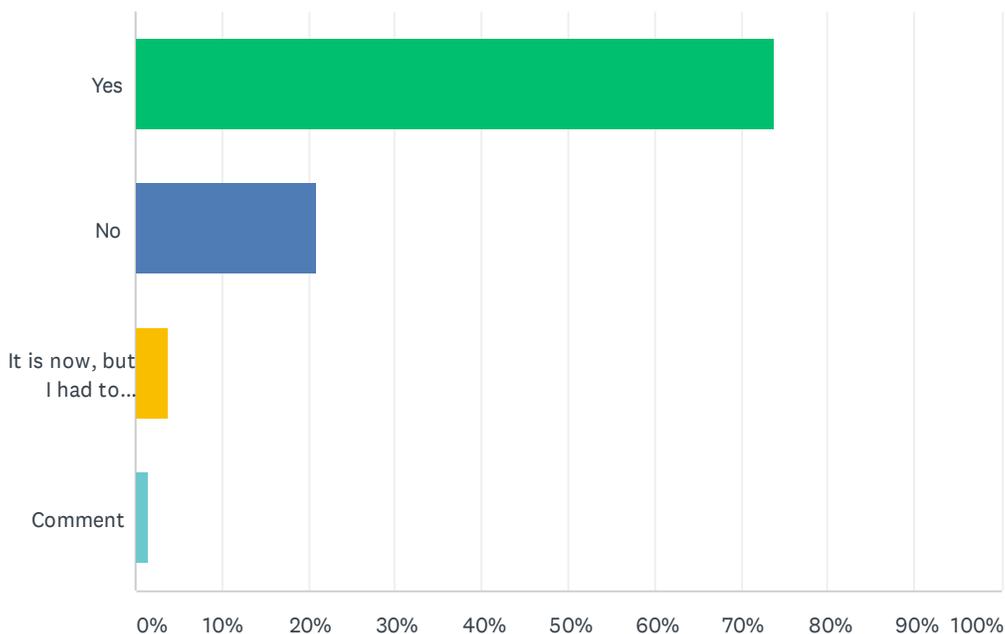
Answered: 209 Skipped: 9



ANSWER CHOICES	RESPONSES	
Yes	51.67%	108
No	46.41%	97
I would work from home if I had a better internet connection	1.91%	4
TOTAL		209

Q23 During this pandemic crisis, is your internet sufficient to meet all your family's needs.

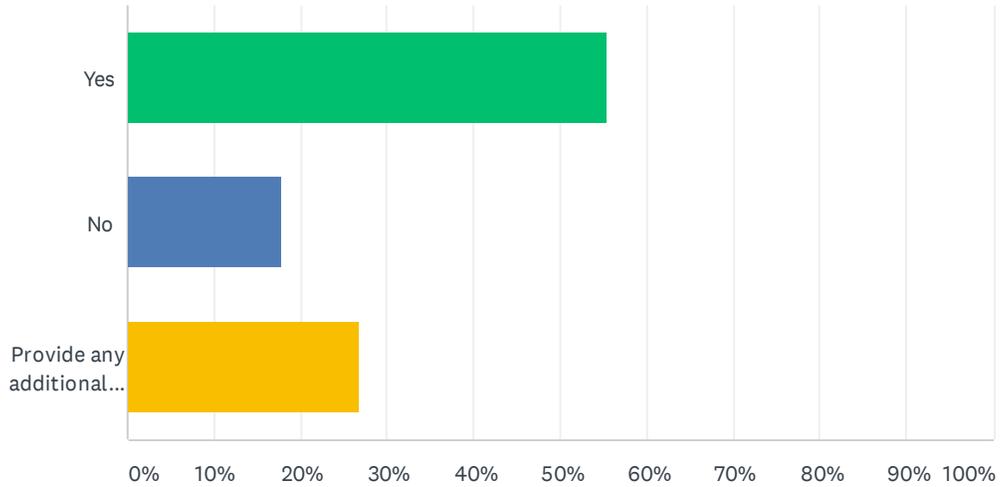
Answered: 210 Skipped: 8



ANSWER CHOICES	RESPONSES	
Yes	73.81%	155
No	20.95%	44
It is now, but I had to upgrade my internet package to buy more bandwidth	3.81%	8
Comment	1.43%	3
TOTAL		210

Q24 If you have students in your household (K-12 and/or college) who are currently taking classes at home due to the pandemic, are your students able to have all their on-line needs met?

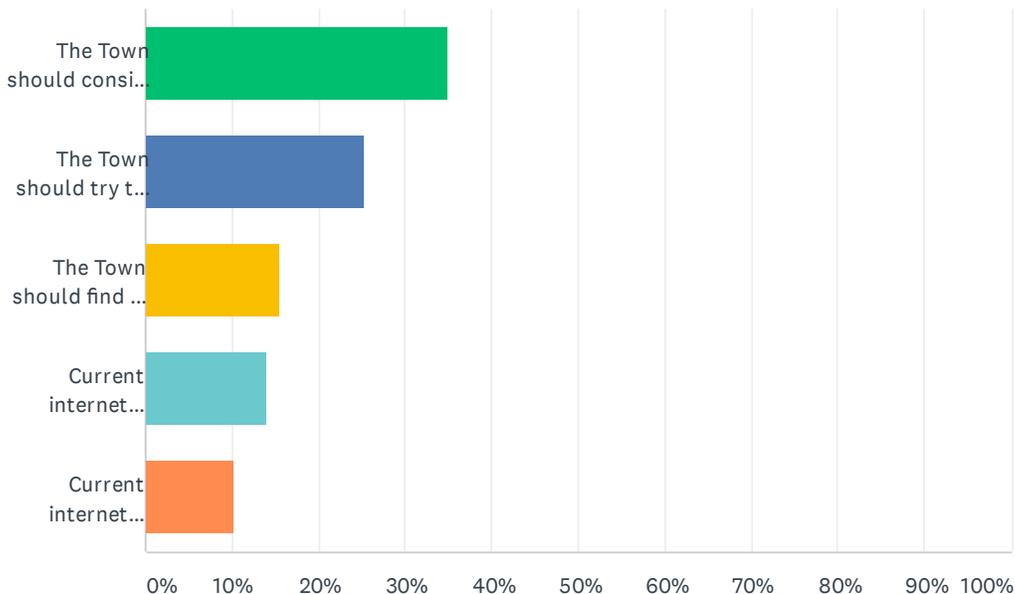
Answered: 202 Skipped: 16



ANSWER CHOICES	RESPONSES	
Yes	55.45%	112
No	17.82%	36
Provide any additional explanations	26.73%	54
TOTAL		202

Q25 Which below statement do you most agree with?

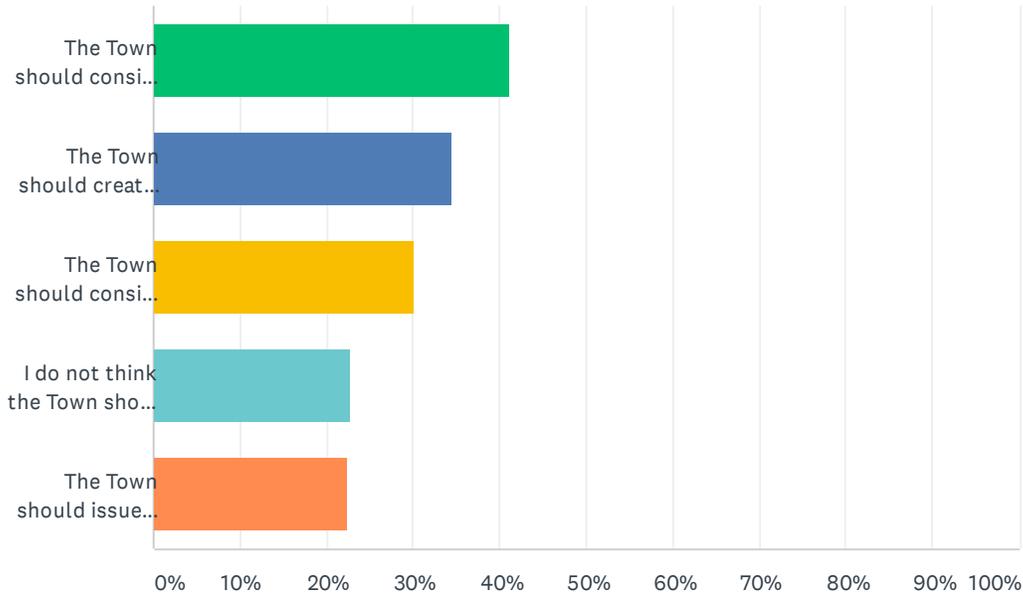
Answered: 206 Skipped: 12



ANSWER CHOICES	RESPONSES	
The Town should consider building its own municipal network and become a provider	34.95%	72
The Town should try to create a public-private partnership by engaging with new company providers to increase competition and improve services.	25.24%	52
The Town should find new ways to work with existing providers (Comcast, Century Link, Rise Broadband, etc..) to improve broadband services and accessibility.	15.53%	32
Current internet connectivity is not acceptable. The Town should do something to improve broadband, but I don't know what should be done.	14.08%	29
Current internet connectivity in Firestone is sufficient. Nothing more needs to be done.	10.19%	21
TOTAL		206

Q26 If you think the Town should do something to improve broadband in Firestone, what funding mechanisms should the Town consider? Assume potential funding needs from nominal to substantial. Please check all that apply.

Answered: 206 Skipped: 12



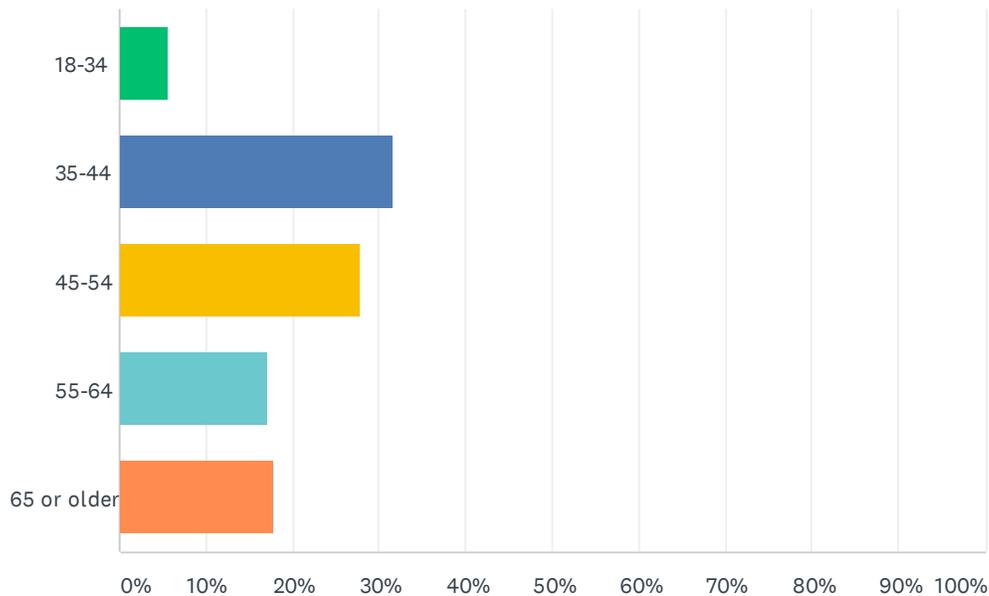
ANSWER CHOICES	RESPONSES	
The Town should consider re-directing funds collected by other means for broadband	41.26%	85
The Town should create a special tax to raise additional money if needed	34.47%	71
The Town should consider utilizing in-kind options only such as waiving of permit fees	30.10%	62
I do not think the Town should spend any public funds for a broadband project even if broadband needs to be improved.	22.82%	47
The Town should issue a bond and go into debt if needed	22.33%	46
Total Respondents: 206		

**Q27 Please provide any additional comments you may have about
broadband in Firestone**

Answered: 71 Skipped: 147

Q28 Age Group

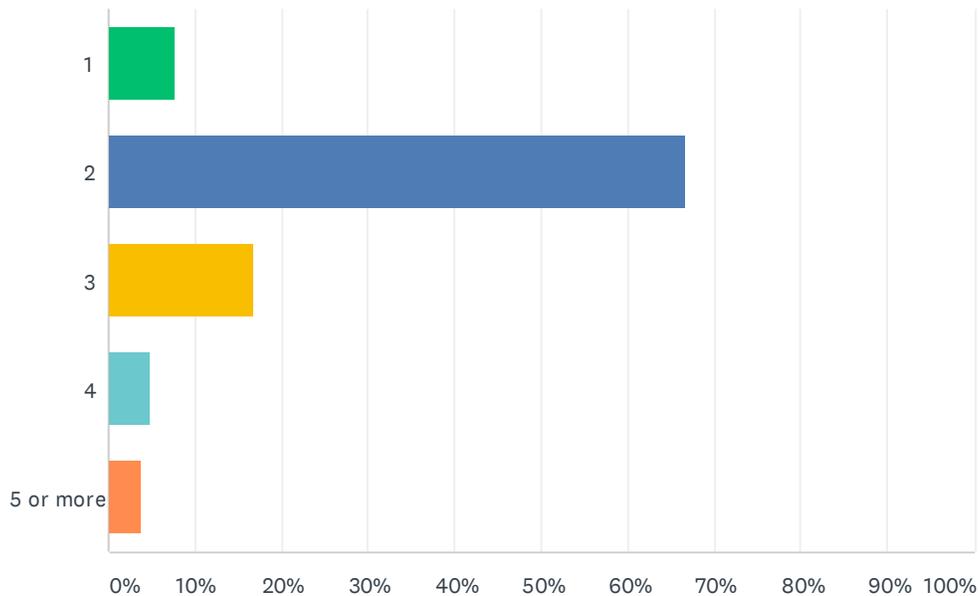
Answered: 209 Skipped: 9



ANSWER CHOICES	RESPONSES	
18-34	5.74%	12
35-44	31.58%	66
45-54	27.75%	58
55-64	17.22%	36
65 or older	17.70%	37
TOTAL		209

Q29 How many adults 18 years or older reside in your household?

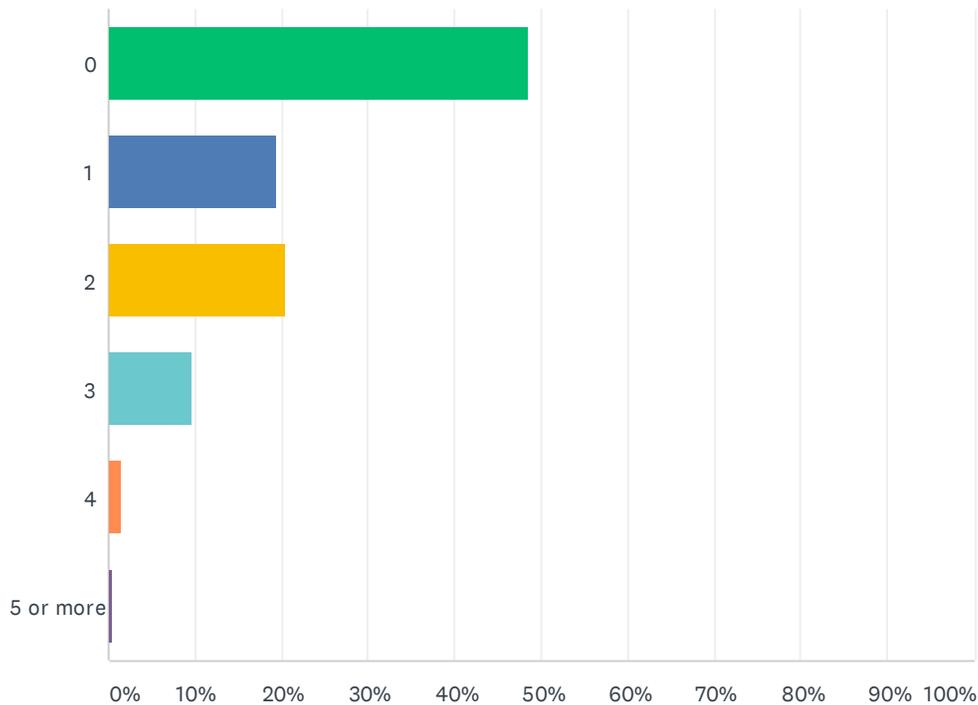
Answered: 208 Skipped: 10



ANSWER CHOICES	RESPONSES	
1	7.69%	16
2	66.83%	139
3	16.83%	35
4	4.81%	10
5 or more	3.85%	8
TOTAL		208

Q30 How many children under the age of 18 reside in your household?

Answered: 210 Skipped: 8



ANSWER CHOICES	RESPONSES	
0	48.57%	102
1	19.52%	41
2	20.48%	43
3	9.52%	20
4	1.43%	3
5 or more	0.48%	1
TOTAL		210

Appendix C – Survey Respondent Comments

**Q27 Please provide any additional comments you may have about
broadband in Firestone**

Answered: 71 Skipped: 147

Town of Firestone Broadband Survey

#	RESPONSES	DATE
1	I would like to see more options in town for price competition	5/7/2020 11:00 AM
2	my internet is pretty good but I know others is terrible. I think we need options and a city based option is good. I'm curious as to if there are grants available for things like this.	5/2/2020 7:11 AM
3	It would have to be affordable—max \$40 a month!	4/29/2020 10:39 PM
4	All of this would depend on cost and what is offered	4/29/2020 6:41 PM
5	Do it now. Do not wait. You are already behind. Enough contemplation already, get started.	4/29/2020 11:00 AM
6	Let's do it	4/28/2020 6:03 PM
7	I believe in competition not taxes	4/27/2020 8:44 PM
8	We need more high speed competition. Comcast has a monopoly right now.	4/27/2020 1:18 PM
9	Seems like some kind of monopoly by Comcast prevents me from having great services	4/27/2020 12:57 PM
10	We miss NEXTLIGHT after moving to Firestone from Longmont!! And Firestone should consider working with them to extend this service to Firestone making Firestone the most desirable community!!	4/27/2020 12:39 PM
11	BRING US NEXTLIGHT! We miss NextLight after moving to Firestone, from Longmont ☹	4/27/2020 12:38 PM
12	Municipal broadband is a great bet neutral way to guarantee equal traffic and offer more options against the current monopoly of service provider. It would also add to the sense of town pride	4/27/2020 12:38 PM
13	Thank you for looking into this!	4/27/2020 11:55 AM
14	I had a hard time answering the last question because I have never lived where the city provided broadband service and so I have not idea how other cities or town have funded it. I think it's something worth exploring, which obviously with this survey, you are exploring it. I suppose if it costs less or the same and works better than what is offered out there right now, then it would be worth it to have the town provide the service. And I am wondering if the town provided broadband, would Comcast and other companies still provide it as well? So would it create more competition? I'm all for some competition because Comcast's customer service is really terrible, but they don't really seem to care because it's always been that way because there's such little competition in certain markets so they have no reason to improve.	4/27/2020 11:53 AM
15	Next light in Longmont seems to have been amazing in our office. No idea how its funded or contracted with th ed city	4/27/2020 11:31 AM
16	Firestone should do all they can to learn from Longmont and their implementation. They should also be aware of cost competitiveness. Current pricing models from Comcast and others do not include a competitive environment. Comcast pricing is based on no competition. As shown in Longmont, Comcast is able to cut their pricing models by 50% or more in order to remain competitive. Anything considered by Firestone should be at a monthly fee with a similar structure or less to Longmont. Keeping in mind that Comcast and others will drop their prices in order to compete. Firestone should only consider hard line service to homes. Wireless and other solutions do not provide the service and reliability of wireless or radio solution.	4/27/2020 11:29 AM
17	Fiber optic internet service option for residential homes would be great; like they have in Longmont.	4/27/2020 11:24 AM
18	Thanks for considering this need in our community.	4/17/2020 7:45 AM
19	The benefits of having a good internet system is so important taking into consideration that you don't break the bank!	4/16/2020 10:00 AM
20	They have gig speeds across the street. In oak Meadows we top out at 100 mbs forthe same price with Century link. Cable gets crowded and slow. Look to the Longmont model	4/15/2020 3:38 PM
21	I'm a captive of the Comcast monopoly. Can't get just internet, have to buy bundle. Longmont NextLight seems to be well received. Give Comcast competition and lower cost to Firestone houses and firms.	4/14/2020 12:49 PM
22	Be like Longmont. NextLight is amazing!	4/14/2020 7:05 AM

Town of Firestone Broadband Survey

23	I would ditch Comcast in a heartbeat if I had another choice for fast reliable internet. It would be amazing for the town to provide service and I would be the first to jump over.	4/13/2020 4:51 PM
24	My primary wish is to have something other than Comcast to choose from. Comcast is extraordinarily expensive, and they raise rates without reason and without warning.	4/12/2020 10:32 PM
25	Good broadband can make working remotely more pleasant. Given the drive times to Denver and Boulder, this makes Firestone a more attractive place to live. Improving my property values, and increasing the tax base. This will attract remote workers who need to be in this area.	4/11/2020 8:44 PM
26	We have good internet but pay way too much. I'm so tired of fighting for companies to offer higher speeds at affordable prices. Please take a look at what Longmont has offered their residents- faster and Cheaper.	4/11/2020 5:44 PM
27	I think the town should consult with customers in Longmont to see if they are getting good service with the city before diving in to this. The mobile/internet bundle we have with Xfinity is VERY competitive and I doubt that the Town could compete.	4/11/2020 8:29 AM
28	my internet service is running on top of the ground and has to be fix several times a year very sad way of doing business I would like to be using broadband	4/11/2020 8:03 AM
29	Please do this. Longmont is light years ahead of us.	4/10/2020 10:37 PM
30	Are other towns actually profiting when setting up town broadband? If the town isn't an expert in broadband, why go into that service when there are other companies that specialize in that service?	4/10/2020 9:37 PM
31	They just passed the .6% tax good for the next 25 years. Use this money to get it done!	4/10/2020 8:41 PM
32	Call Longmont, they figured it out. Piggy-back on them. :)	4/10/2020 7:40 PM
33	I loathe Comcast. I will support anything that has the end result of fucking them over.	4/10/2020 7:33 PM
34	Please offer something like Longmont does.	4/10/2020 6:39 PM
35	Firestone needs to leverage more property tax. A broadband initiative should be paid for by a tax, but not a sales tax. It's a service to the homeowners here, so it should be charged to us homeowners. Our sales tax is already high, on par with bigger cities like Longmont, and we have very little business in this town.	4/10/2020 6:12 PM
36	Longmont has provided a good model for how to provide local internet service at an affordable cost that I would support. I don't know the background of the service implementation nor infrastructure required or how it was accomplished but it was very reliable and very affordable	4/10/2020 6:04 PM
37	Very interested as long as the hook up fee isn't too much	4/10/2020 4:51 PM
38	Broadband options in Firestone are extremely limited and in many cases expensive for what you get. This is a drawback to living in Firestone when compared to other places like Longmont. The city should be working to find ways to make the landscape more competitive in terms of speed, price and providers. Bundled options with fixed contract renewals are very bad and should be discouraged from providers servicing Firestone.	4/10/2020 3:17 PM
39	Century-Link too slow and cumbersome, Xfinity too expensive. Alternative would be nice.	4/10/2020 3:14 PM
40	There is no competition. Centurylink does not provide good connection speeds and latency for work at home. Comcast knows this and does not compete. Firestone should look into ways to garner competition and/or other means of providing high speed internet. But, it should be financially feasible for the town as a whole.	4/10/2020 2:24 PM
41	WE NEED IT.	4/10/2020 1:58 PM
42	Promote competition; don't fund.	4/10/2020 12:27 PM
43	Longmont has a pretty good setup, I think we could benefit from their hard work	4/10/2020 12:25 PM
44	None	4/10/2020 12:24 PM
45	Thank you for beginning to look into this. As the pandemic rages on, it will change society's approach to work, learning, business and interactions, well into the future. Broadband will play	4/10/2020 12:24 PM

Town of Firestone Broadband Survey

a major role in this social transformation. A multi-provider model will help to keep cost in competitive line and it will help push technical advances.

46	Forget about it, let each households do their own thing. Various levels of government already has their collective noses into too much of our personal lives and money.	4/10/2020 12:22 PM
47	Firestone should have the same internet capability as Longmont	4/10/2020 12:14 PM
48	Cellular coverage needs to be improved, not internet access.	4/10/2020 12:14 PM
49	I get cut off so much its frustrating. I don't think the internet is very reliable in Old Town Firestone.	4/10/2020 12:07 PM
50	It's not government's job to provide internet infrastructure. If people are dissatisfied with internet speed and cell phone coverage, complain to the provider that is taking their payments but not improving their service. I'd much rather see town money be spent on road improvements, parks, snow removal, etc.	4/10/2020 11:44 AM
51	At this time, none	4/10/2020 11:17 AM
52	In this day and age, this should be a priority as the traditional providers are clearly billing too much	4/10/2020 11:01 AM
53	It is a competitive environment. Firestone should consider installation of a fiber optic network similar to Longmont's (or partner WITH Longmont). In a era of reducing technology prices, Firestone should be able to offer FASTER service at a LOWER price.	4/10/2020 10:50 AM
54	I don't see a downside. Get 'er done.	4/10/2020 10:34 AM
55	Broadband options are currently limited and introducing competition and choices would go a long way to improving the situation	4/10/2020 10:29 AM
56	N/A	4/10/2020 10:21 AM
57	Would love to utilize something like nextlight	4/10/2020 10:09 AM
58	I am very much in favor of Firestone providing broadband as an alternative to our current options. It would keep our money local and provide some new jobs.	4/10/2020 10:06 AM
59	It would be nice to have a reliable internet service, and be able to have for than a 5 for speed..all we can currently get from Century Link..poor company..can't keep things repaired.	4/10/2020 10:03 AM
60	In the del Rey subdivision our only option for internet is century link. If the town could assist in getting other providers into our neighborhood that would be amazing. We have contact Comcast/xfinity and to run the lines it's \$10,000. We have had almost all of our neighbors say they would switch to xfinity, because century link sucks. Also our line from the box to our home is broken. But century link says we are required to pay to have that line fixed. We have been fighting with them for 4 years. I am at home with 2 teachers, and 2 students trying to do remote learning and it's nearly impossible. Please help with something better than century link	4/10/2020 9:59 AM
61	People move to Longmont just for their 1GB connectivity.	4/10/2020 9:39 AM
62	Cell service is more of an issue than broadband	4/10/2020 9:36 AM
63	Please do not do anything that will not significantly improve the broadband service. Seriously consider the best option, fiber optic.	4/10/2020 9:31 AM
64	Let's get this done. DSL is outdated, and we need to be a city of the future	4/10/2020 9:26 AM
65	I have been surprisely impressed with CenturyLink's service over the past few weeks.	4/10/2020 9:25 AM
66	Very envious of Nextlight service in Longmont, hoping Firestone does something similar	4/10/2020 9:24 AM
67	I am actually paying for 2 internet services, Century Link and Xfinity so our internet needs are met during this pandemic. I'm teaching from home and I have a high school & college student who rely on decent internet. It's still spotty, at best.	4/10/2020 9:16 AM
68	I would LOVE to have something like Longmont's NextLight	4/10/2020 9:15 AM
69	get er done!	4/10/2020 9:14 AM
70	High speed fiber optic internet is being offered in our area by Century Link and we have found	4/10/2020 9:13 AM

Town of Firestone Broadband Survey

this service sufficient to meet all our needs. I think competition between Comcast and Century Link is sufficient to keep tech in our area moving forward. I do not see how spending town funds would be prudent or beneficial in this area. There are other projects of greater need at this time.

71	I work for NextLight in Longmont, and it is a great product and doing very well for the city. Take rates are high, service is phenomenal and reliable at a great price. It can be done, but has to be done right.
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4/10/2020 9:09 AM

Appendix D – Dig Once Policy Guidebook



DIG SMART: Best Practices for Cities and States Adopting Dig Once Policies

EXECUTIVE SUMMARY

Advanced fiber networks and high speed broadband are increasingly important to a community's quality of life and a healthy local economy. An essential step to deploying broadband is installing conduit and fiber, often in underground trenches where other similar infrastructure is also located. This installation process requires excavators to dig in the public rights-of-way, frequently in areas that are already paved or developed. Excavation is both disruptive to the community and expensive for the service provider.

Cities and states can reduce excavation costs, minimize disruption in public rights of way, and encourage broadband deployment through "Dig Once." Dig Once encompasses several approaches to installing conduit in conjunction with other compatible construction projects.

This paper focuses on the most impactful form of this policy: governments installing conduit whenever there is underground construction in the public right of way -- whether that construction is for installing new utility equipment, repairs, or road work. The government then has the opportunity to lease that conduit to broadband providers that are interested in deploying fiber networks to the community. This approach benefits the community by facilitating broadband entry and by giving the government an ongoing revenue source. In fact, as we will show, these revenues can more than make up for the initial capital expense. While some governments may be hesitant to pay for conduit themselves because of its short-term budget impact, they can recoup that investment over time while also creating significant benefits from the community.

To distinguish it from other types of "Dig Once" policies, we call this approach "Dig Smart." This paper lays out the benefits of Dig Smart, how to implement Dig Smart, and the practical implications of Dig Smart.

I. DIG SMART POLICIES BENEFIT LOCAL COMMUNITIES.

Dig Smart benefits local governments and residents by promoting the deployment of advanced fiber networks and broadband competition. Dig Smart policies mandate the installation of conduit throughout public rights-of-way, lowering costs for providing broadband service and making a community more attractive for broadband providers hoping to break into a new market or expand their existing operations. The resulting competition leads to more choices

and lower prices for consumers. In addition, Dig Smart policies decrease the frequency of inconvenient and possibly dangerous construction along roadways, protect the reliability of broadband networks, and incentivize providers to lay fiber underground, hiding unsightly equipment and beautifying the community.

A. Dig Smart Promotes Competition in Broadband, Which Benefits Consumers.

Lack of competition is a serious problem in the broadband market. The Federal Communications Commission found that nearly 75% of homes have *at most* one choice in a provider of fixed Internet access at download speeds of 25 Mbps (the current definition for “broadband” and the minimum the FCC says is necessary to access the most advanced online applications).¹

Without competition, consumers often are charged higher broadband Internet access prices. The Center for Public Integrity conducted an international comparative study on broadband competition, looking at the differences between comparable U.S. and French cities.² The French cities, on average, had seven choices in broadband service providers, whereas the U.S. cities averaged out to two choices.³ In the U.S. cities, prices for broadband were up to *three and a half times higher* than in the French cities.⁴

One of the primary reasons competition is lacking in the broadband marketplace is that the barriers to entry are so high. The upfront costs of deploying broadband service are enormous – particularly for the most advanced fixed residential broadband service, fiber-to-the-premises. The most expensive part of deploying advanced fiber networks is the physical installation of conduit to hold the fiber, due to the costs of excavation.⁵ Indeed, the Federal Highway

¹ Federal Communications Commission, Fact Sheet: FCC Chairman: More Competition Needed in a High-Speed Broadband Market 1 (2014), https://apps.fcc.gov/edocs_public/attachmatch/DOC-329160A1.pdf.

² Allan Holmes and Chris Zubak-Skees, *U.S. Internet Users Pay More and Have Fewer Choices than Europeans*, Center for Public Integrity (Apr. 1, 2015), <http://www.publicintegrity.org/2015/04/01/16998/us-internet-users-pay-more-and-have-fewer-choices-europeans>.

³ *Id.*

⁴ *Id.*

⁵ Jon Brodtkin, *One Big Reason We Lack Internet Competition: Starting an ISP is Really Hard*, ARS Technica (Apr. 6, 2014), <http://arstechnica.com/business/2014/04/one-big-reason-we-lack-internet-competition-starting-an-isp-is-really-hard/>. The FCC found that installation costs were the largest cost element to deploying broadband via fiber. U.S. Dept. of Transp., Fed. Highway Admin., Office of Policy and Governmental Affairs, Executive Order: Accelerating Broadband Infrastructure Development 16 (2012), <http://www.fhwa.dot.gov/policy/otps/workplan.pdf>. The percentage cost of conduit as compared to the excavation project itself is only 0.1% to 4.3%. Gigabit Communities:

Administration estimates that it is ten times more expensive to install fiber where the provider has to excavate and repair an existing road than it would be to install fiber in conjunction with other roadwork.⁶

Dig Smart policies specifically address the costs of excavation in installing new conduit. San Francisco estimates that implementation of its Dig Smart law will lead to cost savings in excavation ranging from 25%-33%.⁷ By minimizing the costs associated with conduit installation with a Dig Smart policy, more broadband providers will be able to compete in the marketplace and deploy broadband services. This will promote greater competition, which will foster lower prices, prompt incumbents to engage in more consumer-friendly behavior and lead to more choices for a community's residents.

B. Dig Smart Reduces Disruptive Repeated Excavation.

Installing equipment underground is disruptive, especially in areas that are already paved or developed or have underground infrastructure present. Excavators must first work through the jurisdiction's "locates" system to notify existing underground infrastructure owners and then those owners must mark the location of their facilities. Then the excavator must dig trenches where the conduit can be installed, which typically involves jackhammering through pavement. The excavators must surround the trenches with barricades, warning devices, and covers because the trenches are usually where people will encounter them. With each additional excavation, communities face risks to public safety, traffic disruption, risk of property damage service outages, and wasted government resources.

Traffic Disruption and Road Deterioration. Putting conduit underground alleviates crowding in urban public space, but the issues associated with excavation are exacerbated in these urban areas. Excavation along roadways will often halt or impede traffic, sometimes for

Technical Strategies for Facilitating Public or Private Broadband Construction in Your Community, <http://www.ctcnet.us/wp-content/uploads/2014/01/GigabitCommunities.pdf>

⁶ *Eshoo, Walden Introduce "Dig Once" Broadband Deployment Bill*, Eshoo.House.Gov (Oct. 22, 2015), <https://eshoo.house.gov/issues/economy/eshoo-walden-introduce-Dig-Once-broadband-deployment-bill/>.

⁷ See U.S. Gov't Accountability Off., GAO-12-168R, Broadband Conduit Deployment 5 (2012), <http://www.gao.gov/assets/600/591928.pdf>; San Francisco, Cal., Ordinance 220-14 (Oct. 6, 2014) (codified in various provisions of the S.F. Public Works Code), <http://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/ordinances14/o0220-14.pdf>. In addition, the Utah Department of Transportation estimated cost savings of 15.5% per mile when conduit and fiber are installed at the time a road is being constructed versus installing the conduit and fiber at a later time. U.S. Gov't Accountability Off., GAO-12-168R, Broadband Conduit Deployment 5 (2012), <http://www.gao.gov/assets/600/591928.pdf>. It is worth noting that the cost savings here are largely due to no longer having to re-excavate; laying conduit is enough to reap the benefits of the cost savings, as stringing the fiber generally does not require re-excavation. *Id.*

lengthy periods of time, and create traffic congestion that increases vehicular accidents and wastes commuters' time.⁸ In addition, without Dig Smart, construction initiated by a broadband provider is often re-excavation, meaning that many roads have been excavated previously to install underground infrastructure. Like an article of clothing that is patched and patched again, repeated excavation damages the integrity of the road and shortens its lifespan.⁹

Public Safety and Service Outages. Excavating where utilities already exist comes with other risks. Although state authorities require various locates processes before excavators may begin digging,¹⁰ there is always the chance that the excavator may inadvertently damage existing equipment underground, sometimes because the underground equipment operator failed to accurately mark its facilities.¹¹ Fiber is often installed alongside established utility infrastructure (e.g., gas or electric). Any damage to those pipes or cables could cause a serious disruption of services and harm to surrounding property. The math is simple: the more often excavations occur around existing utilities, particularly for distribution of natural gas, the more likely that gas lines or other utilities are struck resulting in significant risks to life and property.

Wasted Governmental Resources. Underground conduit installation requires time and resources from both the excavator and the government. Because excavations involve public safety and environmental concerns, there are a number of legal and regulatory hurdles to approving a dig.¹² Excavation usually requires permits from the state or local permitting authority.¹³ Indeed, if the excavation extends through a wide area, the excavator may need to seek permits in multiple jurisdictions. Further, governments will sometimes undertake (or require the excavator to undertake) environmental reviews for excavations, depending on how

⁸ *Id.*

⁹ U.S. Gov't Accountability Off., GAO-12-168R, Broadband Conduit Deployment 5 (2012), <http://www.gao.gov/assets/600/591928.pdf>.

¹⁰ *See, e.g.*, Cal. Gov't Code § 4216.2(a)(1); Ga. Code Ann. § 25-9-6(a); 220 Ill. Comp. Stat. 50/4; Kan. Stat. Ann. § 66-1804(a); Mo. Rev. Stat. § 319.026; Or. Admin. R. § 952-001-0050; Tex. Util. Code Ann. § 251.151(a).

¹¹ CommScope, Broadband Applications and Construction Manual 8.2 (2014) http://www.commscope.com/Docs/Fiber_Optics_Const_Manual_CO-107147.pdf (“high consideration” is given to locates marks when determining excavation damages).

¹² U.S. Gov't Accountability Off., GAO-12-168R, Broadband Conduit Deployment (2012), <http://www.gao.gov/assets/600/591928.pdf>.

¹³ *See, e.g.*, Mass. Gen. Laws ch. 81, § 21 (“No state highway shall be dug up ... without written permit of the department ...”); 605 Ill. Comp. Stat. 5/9-113 (“No ... equipment of any public utility company, municipal corporation or other public or private corporation, association, or person shall be located ... under or along any highway, or upon any township or district road, without first obtaining written consent of the appropriate highway authority...”).

extensive the excavations may be.¹⁴ Governments must spend time and resources that could be conserved by only having to do the permitting and reviewing once.¹⁵

C. Dig Smart Incentivizes Installing Fiber Underground.

With Dig Smart in place, broadband providers can more easily and cost-effectively install fiber underground. Thus, the policy encourages broadband providers to choose to place their fiber underground rather than along utility poles. Undergrounding fiber has some significant advantages, including better service reliability and more attractive neighborhoods.

Service Reliability. Underground fiber improves the reliability of broadband services.¹⁶ Unlike fiber attached to exposed poles, underground fiber is protected from ice, falling trees, high winds, natural disasters, lightning, sabotage, and other types of destruction, as well as decaying pole infrastructure.¹⁷ This leads to fewer outages. Fiber on poles also requires more maintenance, such as trimming trees to prevent them from interfering with the lines, as well as other repairs from normal wear and tear of open-air exposure.¹⁸ Placing lines underground therefore reduces the costs of providing service and facilitates competition.

Aesthetics. Communities generally prefer to have fiber underground for aesthetic reasons as well because it eliminates unsightly utility poles and hanging lines that obscure the landscape.¹⁹

II. HOW TO IMPLEMENT DIG SMART.

Dig Smart mandates government installation of conduit whenever excavation occurs in the public right-of-way and where government-owned conduit does not already exist, whether a private entity is excavating or the government is digging for a public works project. Dig Smart

¹⁴ California Environmental Quality Act, Cal. Pub. Res. Code § 21000 *et seq.* This statute, and others like it, requires an in-depth environmental impact report for all activities for which private entities receive a government-issued permit.

¹⁵ U.S. Gov't Accountability Off., GAO-12-168R, Broadband Conduit Deployment 6 (2012), <http://www.gao.gov/assets/600/591928.pdf>.

¹⁶ *Id.* at 5.

¹⁷ *Cf.* Edison Electric Institute, Out of Sight, Out of Mind 2012: An Updated Study on the Undergrounding of Overhead Power Lines (2012), <http://www.eei.org/issuesandpolicy/electricreliability/undergrounding/documents/undergroundreport.pdf>.

¹⁸ *Id.* at 25.

¹⁹ Edison Electric Institute, Out of Sight, Out of Mind 2012: An Updated Study on the Undergrounding of Overhead Power Lines 5 (2012), <http://www.eei.org/issuesandpolicy/electricreliability/undergrounding/documents/undergroundreport.pdf>.

includes requirements that developers of new subdivisions install conduit or other appropriate or necessary communications infrastructure to each residence in the subdivision and in public or homeowner's association rights-of-way in the subdivision. With mandatory conduit installation, the Dig Smart approach is for the government to pay for the extra incremental costs of laying down the conduit, with the government retaining ownership of the installed conduit.

Dig Smart also minimizes legal controversies; unlike with respect to a private service provider installing underground infrastructure on private property, the applicable government entity already possesses authority to control construction in the public rights-of-way. Governments also possess broad latitude to condition the grant of construction permits in the public rights-of-way.²⁰ Even in states where municipal broadband is restricted,²¹ Dig Smart is an appropriate and lawful approach; municipalities would not be running afoul of such restrictions on providing service, as the conduit itself is not a service but only a facility.

With Dig Smart, conduit is installed as excavation occurs, gradually increasing coverage of the conduit network around the community with each new construction project. Dig Smart makes the community ready for deployment of advanced broadband services and eliminates additional excavation necessary to make those services a reality. In addition, service providers do not have to shoulder the added burden of seeking trenching partners or paying for the costs of conduit installation, and thus the opportunity to lease government conduit will encourage them to build a fiber network in the community. By maintaining ownership of the conduit, the government generates revenue by leasing those valuable assets out to broadband providers interested in providing fiber service to the community. Dig Smart works for the community and works for the government.

For governments desiring to reap the community benefits of adopting Dig Smart, model legislation is included in Appendix A.

²⁰ See Jason Koebler, *The 21 Laws States Use to Crush Broadband Competition*, Motherboard (Jan. 14, 2015), <http://motherboard.vice.com/read/the-21-laws-states-use-to-crush-broadband-competition>.

²¹ Dig Once ideas—including Dig Smart—tend to be politically popular, supported by Democrats and Republicans. The federal Dig Once House bill, sponsored by Rep. Eshoo (D-Calif.) and Rep. Walden (R-Or.), received praise from both sides of the aisle, along with endorsements from FCC Commissioners Rosenworcel (a Democrat) and Pai (a Republican). See Moriah, Mensah, “*Dig Once*” *Could Lead to Smarter Broadband*, R Street (Jan. 14, 2016), <http://www.rstreet.org/2016/01/14/dig-once-could-lead-to-smarter-broadband/>. See also Amir Nasr, *Widely Supported ‘Dig Once’ Bill Faces Procedural Hurdles*, Morning Consult (Nov. 18, 2015), <http://morningconsult.com/2015/11/widely-supported-dig-once-bill-faces-procedural-hurdles/>; Alisha Green, *Bipartisan “Dig Once” Legislation Provides Hope for Broadband Expansion*, Government Technology (Nov. 2, 2015), <http://www.govtech.com/network/Bipartisan-Dig-Once-Legislation-Provides-Hope-for-Broadband-Expansion.html> (“At least one issue on Capitol Hill brings together Republicans, Democrats, the tech industry, and the White House: legislation to expand high-speed Internet access nationwide, especially for rural, tribal, and other remote areas.”).

A. How Dig Smart Works for Governments in Practice

Governments can use Dig Smart as a source of potential revenue, once the municipality or other governmental authority has installed enough conduit to interest broadband providers in leasing. With a private excavation project, the government typically would pay the costs for materials (the conduit itself), installing the conduit in the excavated trench, and any design variations in a private excavation project required to facilitate conduit installation. For public works projects, the government can install conduit in conjunction with existing construction much less expensively than would be possible in a separate excavation and installation project. The costs of conduit, including materials and installation, are slight relative to the expenses for digging up and repairing the ground.²² Sample road and underground construction costs from various cities generally run from \$200,000 per mile for something like a sewer replacement to \$10 million per mile for larger road system construction.

Figure 1²³



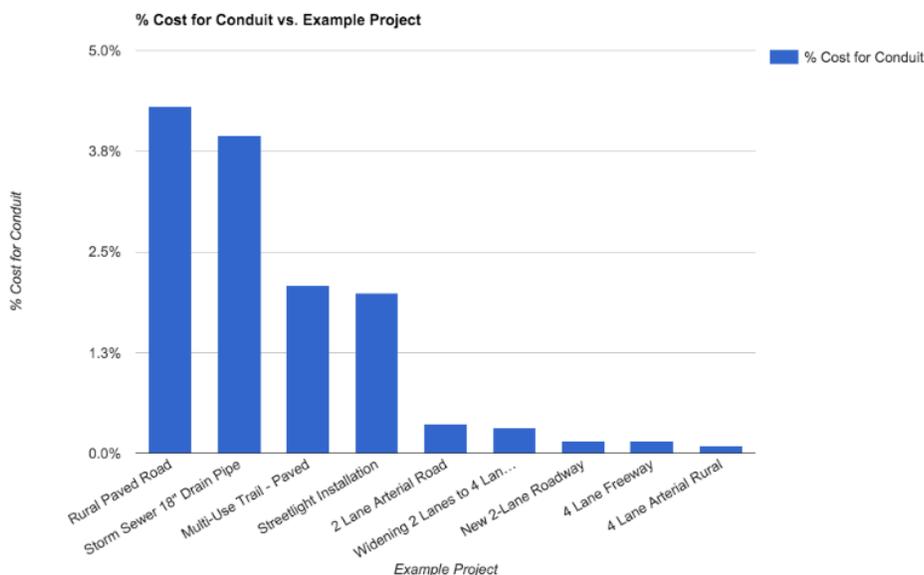
In contrast, the average cost of the conduit itself is around \$10,000 per mile (or around \$1.90 per foot), making it 0.1% to 4.3% of the total cost of any given excavation project.²⁴

²² U.S. Dept. of Transp., Fed. Highway Admin., Office of Policy and Governmental Affairs, Executive Order: Accelerating Broadband Infrastructure Development 16 (2012), <http://www.fhwa.dot.gov/policy/otps/workplan.pdf> (“[T]he largest cost element for deploying broadband via fiber optic cable is the cost of placement, such as burying the fiber in the ground, rather than the cost of the fiber itself.”).

²³ Data from discussions with BHC Rhodes, civil engineering firm: <http://ibhc.com/>

²⁴ *Gigabit Community: Technical Strategies for Facilitating Public or Private Broadband Construction in Your Community*, <http://www.ctcnet.us/blog/gigabit-communities-how-local-governments-can-facilitate-private-investment-in-new-gigabit-networks/>.

Figure 2²⁵



Dig Smart does require the government to pay certain upfront construction costs on top of the actual cost of the conduit itself. Installation will often require additional fees for design changes in trenching—the trenching required for sewer lines, for example, may not be the kind typically used for conduit and accommodating those changes will incur design costs. Other additional costs may include extra labor fees for installation. However, the cost of installation should be considered an investment. Governments can usually install conduit at a discounted rate per linear mile as compared with private utilities.²⁶ Moreover, after installation, the government will own the conduit and, because it is in the public right-of-way, the government will not owe any licensing fees to any landowner on which the conduit is located. The government would then lease the conduit to a broadband provider and recover the modest costs of installation.

The following example shows how quickly the government would be able to recover its investment. Assume the cost of the conduit itself and extra conduit installation fees (independent of the main excavation costs) is \$25,000 per mile (or \$4.73 per foot).²⁷ Private service providers typically lease installed conduit for between \$0.65 and \$0.80 per linear foot of conduit per year. With a lease rate of \$0.65 per linear foot of conduit annually, a local agency would more than recover its upfront installation costs after 8 years of leasing (8 x \$0.65 = \$5.20).

²⁵ Data from discussions with BHC Rhodes, civil engineering firm: <http://ibhc.com/>

²⁶ Data from discussions with BHC Rhodes, civil engineering firm: <http://ibhc.com/>

²⁷ This is not meant to be an exact number on how much installation of conduit would cost, but rather, an approximation, with an illustration on how such a policy could be profitable over time.

The 8-year period here is a minimal estimate, too, especially if the government manages to secure multiple lessees. Where the government installs conduit with multiple duct banks to accommodate multiple providers, it can recover costs more quickly with adequate demand. The additional revenue could be used for a number of purposes, including covering internal costs for managing the public rights-of-way. Below is an example on calculating a return on investment (“ROI”), assuming a lease to just one broadband service provider.

Fiber Installation Cost (per mile)	\$25,000
Fiber Lease Rate (per mile per year)	\$3,432 (or \$0.65 per foot)
10-Year Income	\$34,320
Return-On-Investment (ROI) Example	37%

To protect its investment in the conduit and discourage re-excavation, a government can also require that new broadband providers use existing conduit to the maximum extent feasible. Of course, the government is unlikely to obtain lessees immediately upon implementing Dig Smart legislation. Broadband providers would want to lease conduit after the community has a critical mass of conduit network already in place, and the actual recovery time of installation costs will depend on when broadband providers lease the government’s assets. Accordingly, governments interested in Dig Smart should enact legislation as soon as possible, because the benefits of Dig Smart begin to accrue as more excavation projects are undertaken. Once Dig Smart is in place, a government can begin building up enough conduit to begin leasing it to generate revenue in excess of costs.

B. Other Ways to Encourage Dig Smart

States too should be interested in bringing more broadband options to their citizens. States, of course, can implement Dig Smart policies and install conduit when excavating rights-of-way under state jurisdiction. Although states do not control access to local rights-of-way, states can encourage Dig Smart policies at the municipal level in at least two ways.

First, states may adopt resolutions or other legislative policies that encourage municipal enactment of Dig Smart laws.²⁸ This allows states to signal support for Dig Smart at no cost to the state.

Second, states may consider creating a monetary incentive for municipalities to adopt Dig Smart laws. States could condition grant of certain funds for local governments based on the local government implementing a Dig Smart policy. For instance, state road construction funding could be conditioned on the locality installing conduit that will increase the opportunities in the local community for better advanced communications services.

²⁸ See Minn. Stat. § 237.90; Fla. Stat. § 364.0135.

III. OTHER “FLAVORS” OF DIG ONCE

Dig Smart is the gold standard of Dig Once. There are other types of Dig Once that are unlikely to be as effective as Dig Smart but nonetheless encourage broadband deployment while reducing the burdens of additional excavations. These other types of Dig Once are described here and compared to the advantages of Dig Smart. The primary other “flavors” of Dig Once policies and laws are: (1) coordination, (2) voluntary joint trenching, and (3) mandatory joint trenching.

(1) Coordination.²⁹ Coordination requirements help inform interested excavators, such as broadband providers, when underground or road construction is going to happen so that they can be prepared to install equipment in conjunction with scheduled excavations. Coordination is facilitated by governments establishing a “coordination database” and requiring underground facilities owners to update the coordination database with information on upcoming scheduled excavation. Interested excavators may then use this database for coordinating underground facilities installation with existing planned construction.

A coordination policy requires governments to expend resources on organizing and posting information from different entities. While a coordination policy would help some enterprising service providers in identifying excavation areas where they could potentially coordinate installation of their equipment, the marginal benefits of this are low, and it in no way guarantees that conduit will actually be installed. Coordination databases rely on the existence of other interested entities to effectuate infrastructure deployment. Where no service provider is already building in the market and therefore monitoring the database, opportunities to install conduit when there is planned excavation in the public rights-of-way may be missed. Moreover, this policy by itself does not allow the government to control for quality or for competition-maximizing conduit that has room to accommodate more than one fiber cable. Finally, with coordination, any installed conduit will be the property of the private entity, rather than the government. The government, therefore, has little direct opportunity to earn a return from implementing a coordination policy.

(2) Voluntary Joint Trenching. Voluntary joint trenching requires entities that have received approval to excavate in public rights-of-way to formulate construction plans, and schedule construction, with other service providers that are interested in installing or maintaining equipment in public rights-of-way.³⁰

Voluntary joint trenching (in contrast with mandatory joint trenching, discussed below) is termed “voluntary” because the policy relies on other excavators volunteering to jointly trench for the Dig Once benefits to be realized. (The initial excavator is required, however, to formulate construction plans with and schedule construction with other service providers that want to jointly trench.) The disadvantage of this approach to Dig Once is that if no broadband provider comes forward within the allotted time after the lead excavator notifies of an

²⁹ See, e.g., Santa Monica, Cal., Mun. Code, § 7.06.300(b); Minn. Stat. § 161.462.

³⁰ See, e.g., 30-092 Vt. Code R. § 8091; Ocala, Florida, Mun. Code, § 58.136.

excavation, then no conduit would be installed. Interested service providers could miss the window for joint trenching and end up having to re-excavate. Indeed, a provider that does not yet exist by definition cannot take advantage of this opportunity. Voluntary joint trenching has many of the same drawbacks as a coordination policy. Ultimately, this policy would *encourage* more efficient excavations (and additional deployment of broadband network infrastructure) but not *guarantee* it. Although governments should not depend on voluntary joint trenching as a reliable means of achieving Dig Once objectives, if companies wish to jointly trench, governments should not prevent them from negotiating a private solution to excavation and conduit installation. Industry-driven initiatives in joint trenching can work in tandem with Dig Smart laws to minimize excavation and maximize installation of conduit.

(3) Mandatory Joint Trenching. Mandatory joint trenching requires all potential excavators to install their infrastructure in the same trench at the same time. All parties then split the costs of the excavation.³¹ A mandatory joint trenching law would require that all excavators determine a “lead.” That lead excavator would then approach the city to receive a “joint trench” permit on behalf of all the service providers installing underground infrastructure in the excavation.

Mandatory joint trenching makes installation of conduit more certain than with voluntary joint trenching, as broadband providers must install conduit where it does not already exist as part of the joint trenching. Some municipalities with this type of joint trenching also have an enforcement clause that prevents re-excavation within a certain amount of time.³² But these restrictions on re-excavation (often called moratoria) can delay broadband deployment and discourage competition if an interested broadband service provider misses the window. If broadband providers miss the period for joint excavation, they could be barred from re-excavating for years. This delay would work against the goals of Dig Once, which include deploying more broadband for consumers. In addition, other types of non-broadband excavators could be shut out from installing important equipment for their services. Ultimately, these unintended consequences could hurt various service providers and local residents.

³¹ See, e.g., Los Angeles Department of Public Works, Joint Trench Utility Permit Guidelines (2015), <http://dpw.lacounty.gov/general/forms/download/2175.pdf>.

³² See Houston, Texas, Mun. Code, § 40-145.

CONCLUSION

High-speed broadband Internet access brings greater prosperity and convenience to communities. Local and state government policy therefore should facilitate more competition in the broadband market. Dig Smart is a win-win policy for states and municipalities, as residents benefit from broadband competition (bringing faster service at lower prices) and less excavation disruptions. Unlike some other government initiatives, Dig Smart has the potential for government to recoup funds spent on public works through leasing of conduit. Dig Smart is the best way for communities to accelerate deployment of the fastest, most advanced broadband and should be seriously considered by any city or state that wants to bring better services to its residents.

APPENDIX A: MODEL LEGISLATION

This appendix includes model legislation for (1) municipalities or states to implement Dig Smart policies and (2) states to facilitate Dig Smart policies at the municipal level. The model legislation here also includes definitions and sensible exceptions for Dig Smart requirements (*e.g.*, in cases of emergency repair).

These provisions may be adapted for municipal or state use. In place of “city” or “state” the model legislation uses Government Entity. These provisions are models to serve as a starting point for cities and states interested in obtaining the benefits of Dig Smart; the provisions may be altered as appropriate or necessary to conform to specific community preferences and existing laws.

Definitions

Section XX.XX

As used in this chapter creating “Dig Smart” requirements, the following definitions apply:

- (1) “Communications Infrastructure” means conduit installed in public rights of way that can accommodate at least two separate fiber optic cables.
- (2) “Developer” means any person or private entity that proposes to subdivide, divides or causes to be divided real property into a subdivision.
- (3) “Emergency” means an Unexpected Occurrence requiring prompt action to prevent or mitigate loss of, or damage to, life, health, property, or essential public services.
- (4) “Excavate” or “Excavation” means any work or action in which earth, rock, pavement, or other material in the ground or underwater in a public right-of-way is moved, removed, or otherwise displaced by means of tools, equipment, or explosives in any of the following ways: grading, trenching, digging, ditching, drilling, tunneling, scraping, cable or pipe plowing and driving, or any other means.
- (5) “Excavator” means any person, private entity, or Government Entity that engages in Excavation or has applied for a permit from Government Entity to Excavate.
- (6) “Operator” means any person, private entity, or Government Entity that owns, operates, or maintains Underground Facilities.
- (7) “Public Works Project” means any Excavation project undertaken by Government Entity.
- (8) “Underground Facilities” means underground or submerged conductor, pipe, structure, conduit, or equipment used or installed for use in providing electric or communications service or in carrying, providing, or gathering gas, oil or oil products, sewage,

wastewater, storm drainage, or water or other liquids. All Underground Facilities shall be considered to extend up to the connection to the customer's facilities.

- (9) "Unexpected Occurrence" is an unexpected event, including without limitation fires, floods, earthquakes, or other soil or geologic movements, riots, accidents, and damage to Underground Facilities requiring repair.

Exceptions to Dig Smart Requirements

Section XX.XX

- (a) Emergency. Operators, Excavators, and Developers are not required to comply with "Dig Smart" requirements in cases of Excavation because of an Emergency.
- (b) *De Minimis* Excavation. Notwithstanding anything else set forth in this chapter, "Dig Smart" requirements involving Excavation only apply when the contiguous length of the proposed Excavation will be at least 900 linear feet in the public right-of way.

Mandatory Installation of Conduit

Section XX.XX

- (a) Installation of Conduit in Public Rights-of-Way in Public Works Projects. Whenever an agency or department of the Government Entity undertakes a Public Works Project involving the planning, construction, reconstruction, or repaving of a public right-of-way, such project shall include, to the maximum extent practicable and feasible, installation of underground Communications Infrastructure by the Government Entity.
- (b) Installation of Conduit in Public Rights-of-Way in Other Excavations.
- (1) To the maximum extent practicable and feasible, the Government Entity shall condition all Excavation permits on the installation of underground Communications Infrastructure on behalf of the Government Entity.
- (2) The Government Entity shall provide at the Government Entity's cost the necessary materials (but not any equipment used for installation) for the permittee to install underground Communications Infrastructure in the public right-of-way.
- (3) The Government Entity shall bear all reasonable and documented design and construction costs associated solely with inclusion of the Government Entity's Communications Infrastructure in the Excavation.
- (4) Title to the installed Communications Infrastructure provided by the Government Entity shall vest in the Government Entity upon installation without any further action of the Excavator or the Government Entity.

State Facilitation of Local Dig Smart

Section XX.X

To the extent practicable, the Department of XX shall encourage and assist local units of government to adopt and implement “Dig Smart” policies for construction or other improvements to county state-aid highways, municipal state-aid roads, and any other rights-of-way under the local unit of government’s jurisdiction. “Dig Smart” refers to policies that require the government entity to install conduit in conjunction with excavation along public rights-of-way.

APPENDIX B: ADDITIONAL RESOURCES

- [Federal Highway Administration Policy Brief on Dig Once](#)
- [Executive Order on Dig Once](#)
- [U.S. Government Accountability Office Study on Dig Once](#)
- [Study on the Effects of Undergrounding Power Lines](#)
- [Article on Eshoo-Walden House Bill](#)

Appendix E – City of Greeley Dig Once Ordinance

**CITY OF GREELEY, COLORADO
ORDINANCE NO. _____, 2019**

**AN ORDINANCE ADDING CHAPTER 14.80 OF THE GREELEY MUNICIPAL
CODE REGARDING EXCAVATION IN THE PUBLIC RIGHT OF WAY**

WHEREAS, the City of Greeley (“City”) is a Colorado home rule municipality, with all powers and authority vested under Colorado law; and

WHEREAS, the City owns and maintains a system of streets and Rights of Way for the promotion of public health, safety, welfare and convenience; and

WHEREAS, the City is aware that the demand for technological infrastructure in the future will likely require the installation of additional facilities in, under and upon City-owned streets and Rights of Way; and

WHEREAS, contractors excavating or otherwise working within the City Rights of Way pursuant to a lawfully issued permit are required to perform construction or maintenance operations within the parameters of the Greeley’s Municipal Code; and

WHEREAS, demand for access to broadband services is growing, and in order to fill such demand, more broadband network infrastructure is needed; and

WHEREAS, the City Council has considered the above, finds adoption of this Ordinance is necessary to protect the health, safety and welfare of the City.

NOW THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL FOR THE CITY OF GREELEY, COLORADO, AS FOLLOWS:

Section 1. Chapter 14.80 of the Greeley Municipal Code shall be adopted as set forth on Exhibit A attached hereto and incorporated herein by this reference.

Section 2. This Ordinance shall become effective five days following its final publication, as provided by the Greeley Municipal Charter.

PASSED AND ADOPTED, SIGNED AND APPROVED THIS _____ DAY OF _____, 2019.

ATTEST:

CITY OF GREELEY, COLORADO

City Clerk

Mayor

CHAPTER 14.80
EXCAVATION IN THE PUBLIC RIGHT OF WAY

14.80.010 LEGISLATIVE DECLARATION.

A. Purpose: to provide principles and procedures for the coordination of construction excavation within any public Rights of Way, and to protect the integrity of the Rights of Way and road system.

B. Objectives. Public and private uses of Rights of Way for location of Facilities employed in the provision of public services should, in the interests of the general welfare, be accommodated; however, the City must ensure that the primary purpose of the Rights of Way, namely the safe and efficient passage of pedestrian and vehicular traffic, is maintained to the greatest extent possible. In addition, the value of other public and private installations, Facilities and properties should be protected, competing uses must be reconciled, and the public safety preserved. The use of the Rights of Way corridors for location of Facilities is secondary to these public objectives. This ordinance is intended to assist in striking a balance between the public need for efficient, safe transportation routes and the use of Rights of Way for location of facilities by public and private entities. It thus has several objectives:

1. To insure that the public health, safety and welfare is maintained and that public inconvenience is minimized.
2. To facilitate work within the Rights of Way through the standardization of regulations and permitting.
3. To conserve and fairly apportion the limited physical capacity of the public Rights of Way held in public trust by the City.
4. To promote cooperation among the Applicants and Permittees (as defined herein) and the City in the occupation of the public Rights of Way, and work therein, in order to (i) eliminate duplication that is wasteful, unnecessary or unsightly, (ii) lower the Permittee's and the City's costs of providing services to the public, and (iii) minimize Rights of Way excavations.

14.80.020. DEFINITIONS

For the purpose of this Chapter, the following words shall have the following meanings:

- A. "*Applicant*" means an owner or duly authorized agent of such owner, who has submitted an application for a Permit to Excavate in the Rights of Way.
- B. "*City*" means the City of Greeley, Colorado.
- C. "*Conduit*" means a single enclosed raceway for cables, fiber optics or other wires, or a pipe or canal used to convey fluids or gases.

D. “*Department*” means the Department of Public Works.

E. “*Developer*” means the person, partnership, corporation, or other legal entity who is improving property within the City and who is legally responsible to the City for the construction of improvements within a subdivision or as a condition of a building permit or other land use or development authorization.

F. “*Director*” means the Director of Public Works of the City or his/her authorized representative.

G. “*Facility*” or “*Facilities*” means, including, without limitation, any pipes, conduits, wires, cables, amplifiers, transformers, fiber optic lines, antennae, poles, ducts, fixtures and appurtenances and other like equipment used in connection with transmitting, receiving, distributing, offering, and providing broadband, utility and other services.

H. “*Landscaping*” means materials, including without limitation, grass, ground cover, shrubs, vines, hedges, or trees and non-living natural materials commonly used in landscape development, as well as attendant irrigation systems.

I. “*Major Work*” means any reasonably foreseeable Excavation that will affect the Rights of Way for more than five (5) consecutive calendar days.

J. “*Owner*” means any Person, including the City, who owns any Facilities that are or are proposed to be installed or maintained in the Rights of Way.

K. “*Permit*” means any authorization for use of the Rights of Way granted in accordance with the terms of this ordinance, and other applicable laws and policies of the City.

L. “*Permittee*” means the holder of a valid Permit issued pursuant to this Chapter and other applicable provisions of applicable law for Excavation in the Rights of Way, including but not limited to the City of Greeley for its own capital projects.

M. “*Person*” means any person, firm, partnership, special, metropolitan, or general district, association, corporation, company, or organization of any kind.

N. “*Rights of Way*” means any public street, road, way, place, alley, sidewalk or easement, that is owned, held or otherwise dedicated to the City for public use.

14.80.030. POLICE POWERS

A Permittee's rights hereunder are subject to the police powers of the City, which include the power to adopt and enforce ordinances, including amendments to this ordinance, and regulations necessary to the safety, health, and welfare of the public. A Permittee shall comply with all applicable ordinances and regulations enacted, or hereafter enacted, by the City or any other legally constituted governmental unit having lawful jurisdiction over the subject matter

hereof. The City reserves the right to exercise its police powers, notwithstanding anything in this ordinance or any Permit to the contrary. Any conflict between the provisions of the ordinance or a Permit and any other present or future lawful exercise of the City's police powers shall be resolved in favor of the latter.

14.80.040. COLOCATION OF THE CITY'S FIBER CONDUIT

A. Intent. To permit the City to collocate conduit for fiber whenever an entity is proposing construction activities that involve directional boring or open trenching within public Rights of Way.

B. Requirements. To collocate and install City owned fiber conduit simultaneously with a Permit holder's construction activity at the City's request:

1. Right of Way Permits. All permittees proposing construction activities that involve directional boring or open trenching within public Rights of Way that extend more than five-hundred (500) feet in length are required to co-locate and install City owned conduit simultaneously with the Permit holder's construction activity at the City's request, unless such co-location requirement is not allowed by any other state or federal law, rule, or regulation. The City may, upon initial review of the permit application, determine that the permittee's proposed construction activity does not demonstrate a need for collocation of City infrastructure.

2. Collocation of Conduit. For any construction activity that requires a collocation of City conduit, the City shall, as a condition of the issuance of the permit or the continued validity of a permit, direct the permittee to install City owned conduit with tracer wire and associated infrastructure, as identified by the City, concurrent with the installation of the permittee's infrastructure following the City's review and approval of all estimated costs associated with the collocation of the City conduit. The permittee shall install the City conduit with tracer wire adjacent to the permittee's infrastructure and within the same bore or trench alignment. The City will bear all construction installation cost associated with the collocation, including the City conduit, pull boxes, and all other materials and infrastructure to be installed, including the incremental labor and equipment cost incurred by the permittee (or its contractor or subcontractor) that are reasonably and directly attributable to the required collocation of City conduit, material and infrastructure. The City shall not pay for design or potholing cost.

3. Documentation. When a collocation of City conduit is required, the permittee may be required to submit signed as-built documentation of the City's conduit to the City if physical verification of the City conduit is not possible.

4. Fees. The City designated representative may incrementally waive Rights of Way permit fees set forth for any construction activities associated with the collocation project.

14.80.060. CONSTRUCTION OF NEW STREETS

A. Intent. This is intended to require those constructing public streets, public improvements, and alleys, including the City and Developers, to provide and install such conduit and appurtenances to accommodate future broadband needs within the Rights of Way without further excavation.

B. Requirements. Whenever any new public street or alley is constructed, whether by the City as a public works project or by a Developer or other private party in conjunction with development, the following shall be required:

1. In all new local streets and alleys serving or abutting residential development, a minimum of two 2" conduit with pull box every 600 (six hundred) feet or less (and at every 90 degree turn) shall be installed by the party constructing the street or alley.

2. In all new collector or arterial streets serving or abutting residential development, and in all new streets and alleys serving or abutting nonresidential development, a minimum of four 2" conduit with pull box every 600 (six hundred) feet or less (and at every 90 degree turn) shall be installed by the party constructing the street or alley; provided however that at the discretion of the Director, the number and size of the conduit and spacing of pull box may be modified to address the reasonably known plans and/or demand for broadband capacity in these locations.

3. In addition to installing conduit, the party constructing the street or alley will be required to install such vaults and other appurtenances as may be necessary to accommodate installation and connection of broadband Facilities within the conduit.

4. All construction and installation shall be accomplished according to construction standards adopted by the City. The construction standards shall be adopted with due consideration given to existing and anticipated technologies and consistent with industry standards.

5. All Facilities installed by Developers or other private parties pursuant to this section shall be conveyed and dedicated to the City with the dedication and conveyance of the public street and/or Rights of Way.

6. All installation costs shall be the responsibility of the party constructing the public street.

C. Use by Broadband Service Providers and Network Owners. Whenever conduit installed or to be installed under this section is available or will become available within a newly constructed public streets or Rights of Way upon dedication, all broadband service providers or network owners thereafter locating Facilities within such street, alley or Rights of Way shall be required to locate their communications lines within such conduit unless it can be demonstrated to the reasonable satisfaction of the City that such location is not technologically feasible or reasonably practicable. Conduit capacity shall be allocated to broadband service providers or

network owners on a first-come, first-served basis; provided, that the City may reserve capacity within such conduits for its own use; and provided further, that the Director may adopt additional rules for conduit allocation in order to ensure that all broadband service providers and network owners have reasonable access to the Rights of Way and that no barriers to entry or competition result from the allocation of conduit space.

D. Fees. The City reserves the right to charge reasonable fees for the use of conduit installed pursuant to this section, to the extent consistent with and as limited by federal and state laws. Any such fees shall be established by resolution or ordinance.