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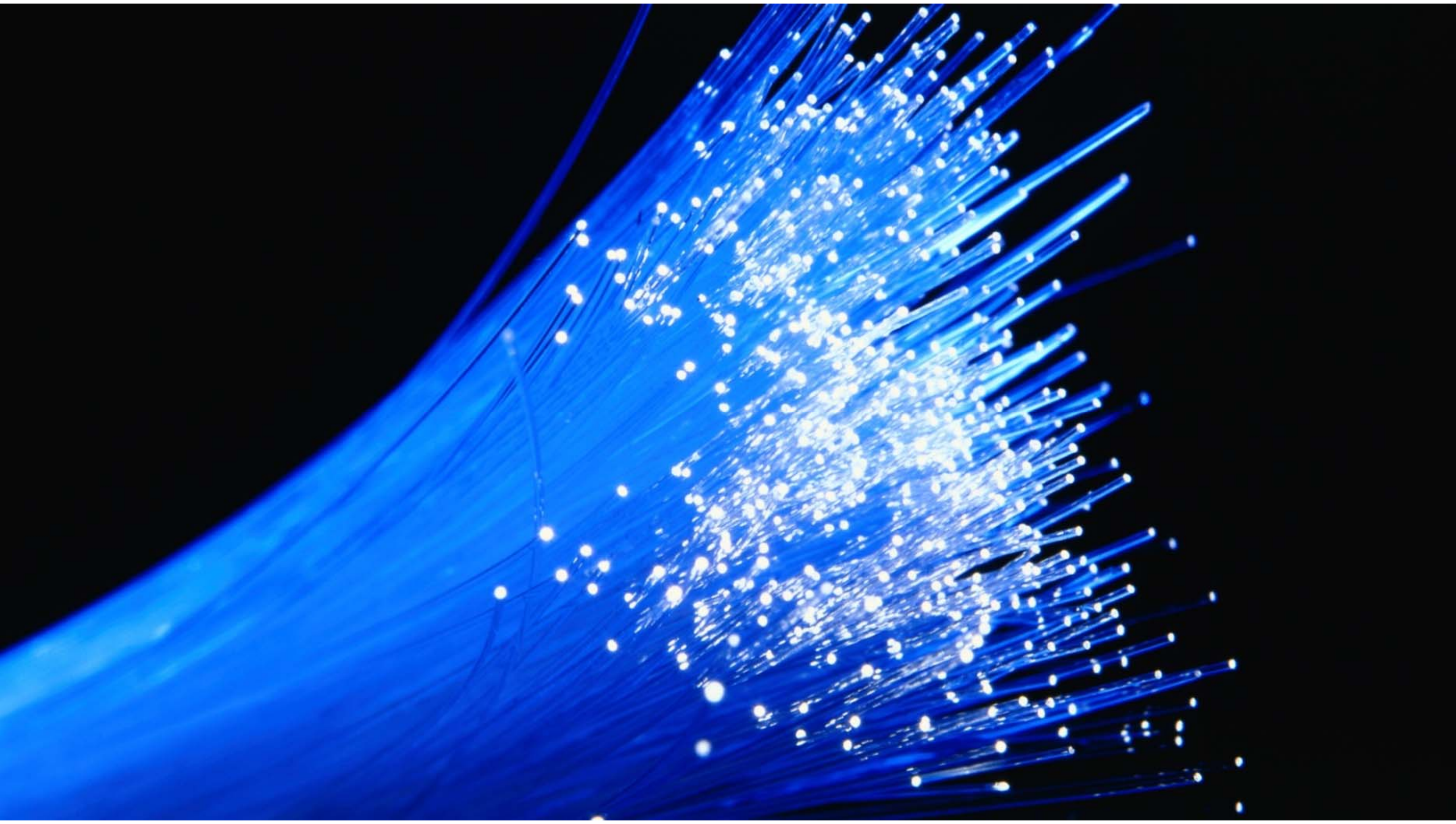

Strategic Fiber Plan

Prepared for the City of Baton Rouge/ Parish of East Baton Rouge
September 2017

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1 Executive Summary

Like many localities throughout the U.S., the City of Baton Rouge and the Parish of East Baton Rouge (City-Parish) aim to find creative ways to foster broadband accessibility for its residents and businesses.

The City-Parish commissioned this report to understand its current broadband landscape and to determine what steps it can take to promote greater communitywide deployment of next-generation fiber optic infrastructure for its internal needs and to its residents and businesses.

1.1 Project Background and Objectives

The City-Parish is committed to working collaboratively with private sector providers to achieve mutual goals, and to taking tangible steps to bolster broadband connectivity throughout the City-Parish. While City-Parish leaders have no desire to enter the market as a retail service provider competing with the private sector, the City-Parish will consider whether some public-sector infrastructure deployment makes sense to support the private sector's efforts.

Specifically, the City-Parish is interested in three key areas of broadband development and deployment:

- Implementation of a "Dig Once" policy—an emerging best practice among local governments that seeks to ensure that localities maximize the deployment of broadband infrastructure during construction projects that disrupt the public right-of-way (PROW)
- Evaluation of the feasibility of constructing fiber to connect City-Parish government facilities and libraries that currently pay for commercial broadband services
- Exploration and potential implementation of a public–private partnership to construct a fiber-to-the-premises (FTTP) network that would deliver broadband to all residents and businesses, while balancing the risks and rewards inherent in large-scale infrastructure initiatives

Although a Dig Once policy will not fully solve the City-Parish's broadband challenges, Dig Once is a proven method for ensuring that the private and public sectors can cost-effectively build communications infrastructure whenever construction occurs in the PROW. It is an efficient means of not only deploying fiber and conduit, but also reducing the traffic disruptions and wear-and-tear on roads and other infrastructure that comes from digging on multiple occasions.

In addition to taking these forward-thinking steps around infrastructure construction in the community, the City-Parish aims to consider constructing fiber to meet its internal needs—and to consider partnerships with the private sector to expand broadband availability in the community. City-Parish leaders do not wish to compete directly with incumbent broadband providers. Rather, a public–private partnership could allow both the private and public sectors to focus on their respective areas of strength and share the benefits of broadband deployment while mitigating their potential risks. As such, and as a component of this study, the City-Parish issued a request for information (RFI), drawing on the analysis in this report, to identify potential private partners for FTTP deployment.

1.2 Methodology

The City-Parish engaged CTC Technology & Energy (CTC) to develop a multifaceted strategic fiber plan. This report was researched and prepared in early 2017 by CTC with ongoing input from City-Parish staff. In addition to drawing on our extensive industry experience, our analysis was guided by our conversations with City-Parish leadership about the City-Parish's objectives and desired outcomes.

Over the course of the engagement, CTC performed the following general tasks:

- Evaluated the City-Parish's current supply of broadband assets by reviewing maps, studies, documents, and data that the City-Parish shared with us, as well as state and national broadband map data
- Developed "Dig Once" policy recommendations
- Interviewed local incumbent and competitive internet service providers (ISPs) and researched available services and dark fiber
- Conducted residential market research
- Designed a candidate fiber network to connect public libraries (Phase 1) and City-Parish facilities (Phase 2) identified by the City-Parish
- Developed a candidate FTTP network design and cost estimate for connecting every home and business in the City-Parish
- Evaluated potential public–private partnership models the City-Parish may wish to consider to enable deployment of an FTTP network
- Prepared a long-term financial analysis based on our sample FTTP network design, cost estimate, and potential partnership models

1.3 Current State of the City-Parish Broadband Market

With a combined population of more than 447,000,[1] the City-Parish is a metropolitan area with a diverse range of consumers and an equally complex assortment of broadband needs. To support our planning and strategic recommendations, we researched the supply of broadband services and dark fiber in the City-Parish and conducted statistically valid market research to understand residents' current broadband use and potential future needs.

1.3.1 Broadband Providers Offer a Range of Services and Have Dark Fiber in the City-Parish

Through our discussions with local incumbent and competitive providers, and through our analysis of the local market, we determined that a range of broadband services is available today in the City-Parish—but that some residents do not have access to broadband. More specifically, even if service is available in some areas, it may be priced beyond the reach of consumers there. (See Section 2 for a full assessment of the broadband landscape.)

Not surprisingly, the available services tend to be concentrated in the City-Parish's high-population-density areas where ISPs can reach the most customers. Low-density areas tend to have fewer competing providers; in some areas, residents may be able to purchase service from only one service provider—thus effectively eliminating consumer choice.

Additionally, the services available in the City-Parish tend to be geared toward either residential customers or large, enterprise customers; there exists a large gap in the type of mid-range services favored by medium-sized businesses and institutions. These customers' needs cannot be met through traditional cable modem service or the telephone company's digital subscriber line (DSL) service, but they also cannot generally afford expensive high-end service. The same issue can also affect small businesses that have significant broadband needs but minimal telecommunications budgets, and even residential users who may require enhanced connectivity.

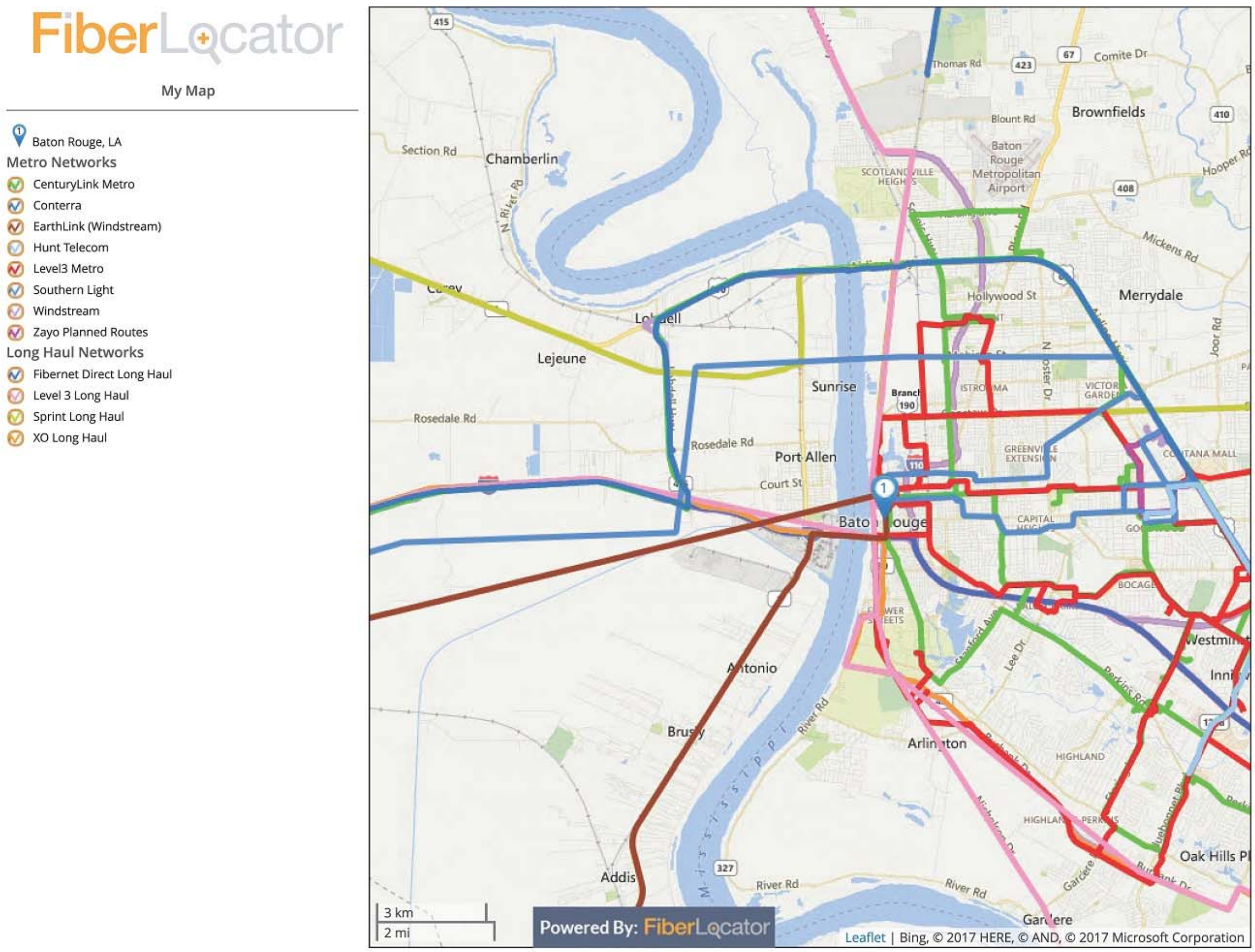
We also found that some providers have "dark fiber" infrastructure in the City-Parish (see the map in Figure 1, below[2]). Dark fiber refers to fiber strands that are installed (e.g., in conduit or on aerial poles) but are not "lit" by network electronics. Local governments and network operators often install excess fiber to meet future needs, or install dark fiber specifically to lease to enterprise customers that have the technical capabilities to operate the fiber on their own.

[1] https://factfinder.census.gov/bkmk/table/1.0/en/PEP/2016/PEPANNRES/0500000US22033, accessed September 2017.

[2] Please note FiberLocator presents details on fiber routes as reported by providers. No provider is obligated to submit information regarding routes and availability. There is likely more fiber installed than what is indicated by FiberLocator; it is also likely that some fiber that is listed may not be available for lease or use by a third party.

Dark fiber is infrastructure that could potentially be used as a backbone for a future public–private network.

Figure 1: Dark Fiber Infrastructure in the City-Parish



1.3.2 Market Research Indicates That Most Residents Have Broadband, but Service Is Not Ubiquitous

The City-Parish conducted a mail survey of randomly-selected residents in January 2017. The survey captured information about residents' current communications services, satisfaction with those services, desire for improved services, willingness to pay for faster internet speeds, and opinions regarding the role of the City-Parish regarding internet access and service.[3]

[3] Unless otherwise indicated, the percentages reported are based on the "valid" responses from those who provided a definite answer and do not reflect individuals who said "don't know" or otherwise did not supply an answer because the question did not apply to them.

Key findings of this statistically valid survey include the following:

- Parish residents are highly connected, with 94 percent of respondents having some form of internet connection; specifically, 85 percent of residents have home internet service and 83 percent have a cell/mobile telephone with internet service.

- Broadband service is not available everywhere in the City-Parish, and older, low-income, and less-educated respondents are less likely than their counterparts to have some form of internet access at their home

- About 45 percent of respondents said that the City-Parish should install a state-of-the-art communications network and either offer services or allow private companies to offer services to the public

The full survey results and analysis are included in Section 4.

1.3.3 Local Incumbent Providers Have Reiterated a Commitment to Expanding Services in the City-Parish

Although there are gaps in the service that is currently available throughout Baton Rouge and East Baton Rouge, some local providers have indicated to the City-Parish a commitment to infrastructure upgrades and other steps that will support service expansion. While the City-Parish may consider an FTTP deployment, such incumbent upgrades and other private sector deployment and expansion could supplement this effort and help fill gaps in the more immediate future.

1.4 A "Middle Mile" Fiber Network to Connect Key City-Parish Facilities That Currently Lease Broadband Connections Would Cost About $15 Million

Construction of a "middle mile" fiber network to connect City-Parish facilities and libraries would be an alternative to leasing commercial broadband services for those sites; the network would likely offer substantial long-term cost savings over leased circuits and would provide robust technical advantages and efficiencies.

CTC's engineering team developed a system-level design for a fiber network that comprises approximately 148 route miles of fiber and connects 87 City-Parish facilities and libraries that currently pay for leased broadband services. We estimate the network would cost approximately $15 million to construct and activate.[4]

We separated the fiber routing into two phases. Phase 1 comprises 96 miles of fiber construction that would connect 15 libraries, while Phase 2 is composed of 52 miles of fiber that would

[4] See Appendix B for lists of sites.

connect 72 City-Parish sites (see Figure 2, below). Design priorities targeted by this conceptual design include:

- Connect from the existing City-Parish fiber network using strands in CenturyLink and Level(3) cables
- Extend the existing network backbone to connect 15 library facilities for which leased service fees can be avoided (see "Library" in Figure 2)
- Provide fiber connectivity to 72 City-Parish facilities for which leased service fees can be avoided (see "City-Parish Site" in Figure 2)
- Minimize costly railroad, levee, and interstate crossings

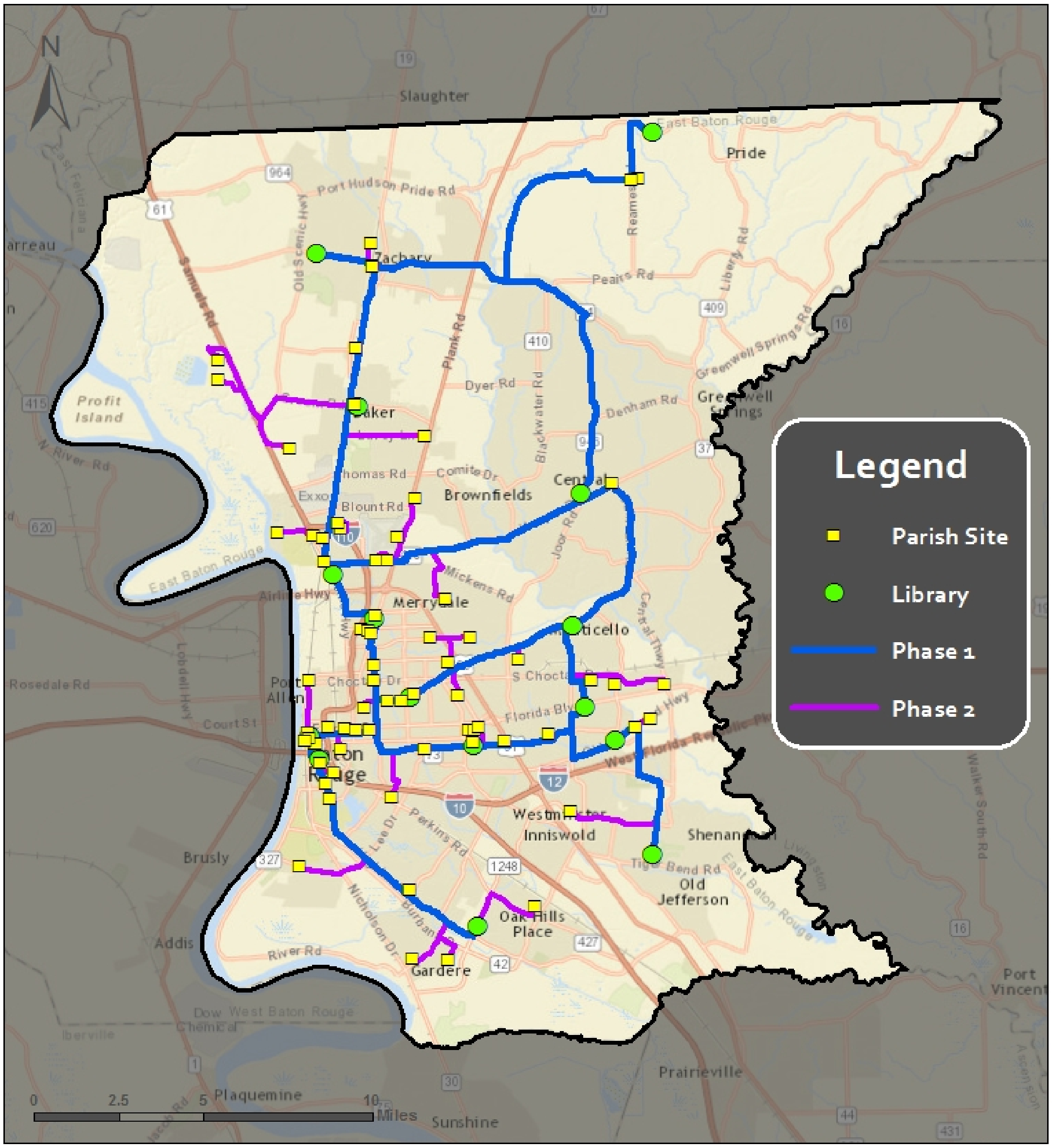
While not fully vetted in the manner necessary for permitting and construction, this fiber optic design is likely to closely approximate a final design that meets the stated design objectives.

To provide 1 Gigabit per second (Gbps, or Gigabit) services to all 15 library sites in Phase 1 and all 72 City-Parish sites in Phase 2, the City-Parish would need to construct an estimated $13.55 million of outside plant (OSP) fiber and install network electronics totaling approximately $1.65 million. These costs total approximately $15.2 million. Note that developing fiber infrastructure to serve these sites would do more than simply serve these locations; the fiber necessary to support these locations could be used to expand service further into the community over the long term.

To maintain positive cash flow over the course of 10 years, the City-Parish would need to receive $1,875 per month per site—or a total of $163,125 per month for the 87 sites—in this base case scenario.

The network proposed in this report offers the City-Parish many benefits, including a higher level of control over the network and the ability to scale the network as data demands increase. Further, the costs in this model are comprehensive, including labor, replacement electronics, and fiber maintenance costs for the lifetime of the model. (See Section 6.3 for additional details.)

Figure 2: Middle Mile Fiber Network to Connect City-Parish and Library Sites



The economics of this approach are very strong. Our conservative projections demonstrate that the public ownership approach would pay for itself in no more than 10 years and possibly considerably sooner—and would realize considerable savings beyond that time.

Our analysis assumes that the public network will involve construction of 148 fiber miles that will connect 87 public facilities, including libraries, at 10 Gbps (and higher speeds in later years, as needs grow). Based on a capital cost of $15.2 million, the monthly cost per site is $1,875, including all costs and debt service.

By comparison, the following is the monthly cost of leasing comparable circuits from providers in the Baton Rouge market:

Based on a 60-month contract, Uniti offers 1 Gbps at $1,240 per month per site and 10 Gbps at $4,880 per month per site. The pricing for the 10 Gbps product is based only on availability in downtown locations and actual availability is unclear. Indeed, service to most sites is likely to require the City/Parish to pay for construction to those sites, either upfront or through increased service pricing that includes the amortized price of construction.

Cox offers 1 Gbps at $2,900 per month per site. Cox declined to provide us with a price for 10 Gbps service, but did indicate that it is available at some locations. Pricing for all products is based on downtown locations, with actual availability unclear and a likely additional cost for construction to sites that currently don't have infrastructure sufficient to support such services.

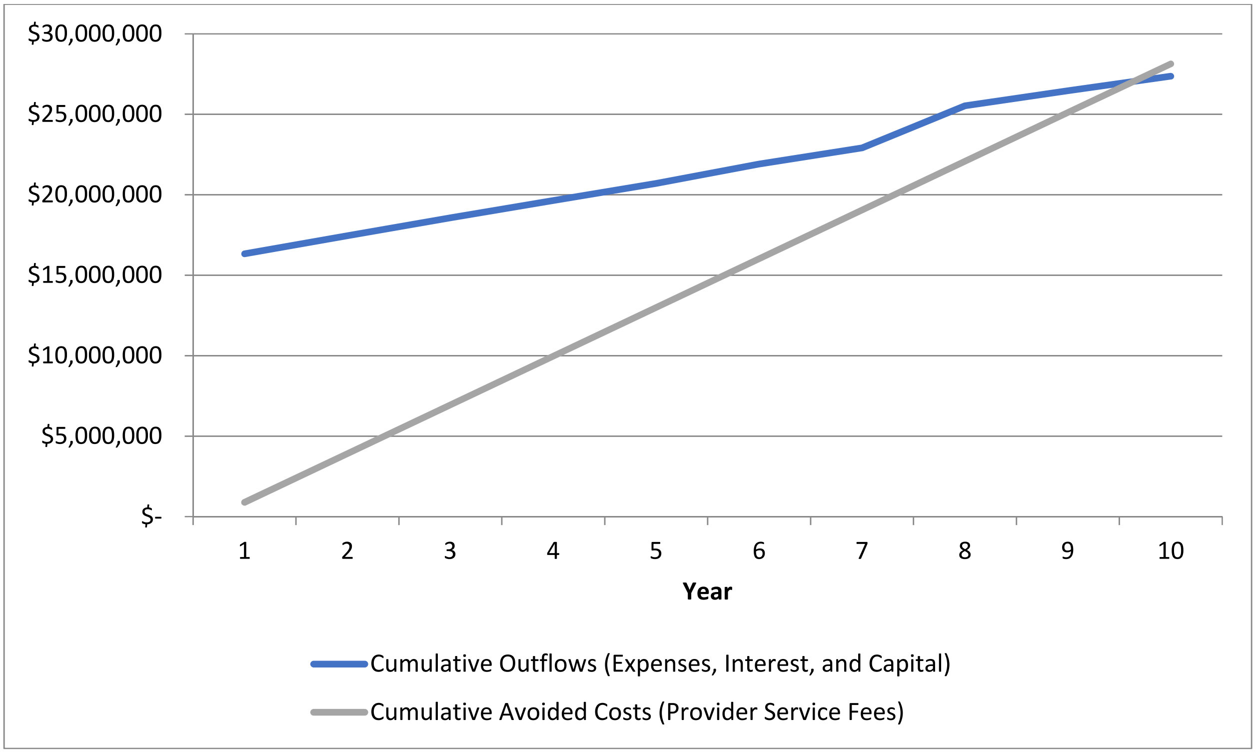
The following table illustrates the comparison:

Table 1: Comparison of Monthly Costs Under City/Parish Ownership Model Compared to Renting from Uniti or Cox

	Owned by City/Parish	Leased from Uniti	Leased from Cox
1 Gbps	$1,875	$1,240	$2,900
10 Gbps	$1,875	$4,880	Not provided
Additional fees?	No	Likely (construction)	Likely (construction)

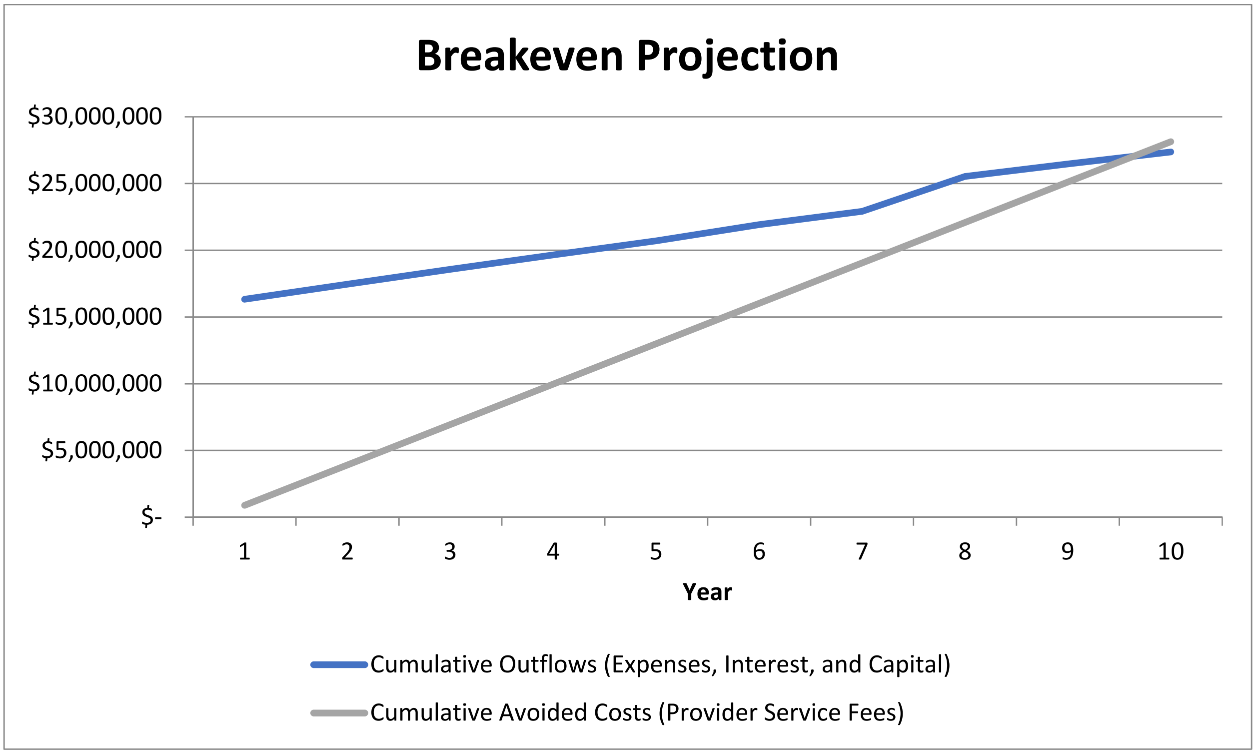
As the following graphic illustrates, City/Parish ownership of such a network would pay for itself in nine years relative to leasing from Uniti—and would realize substantial savings after that. This projection is based on the conservative assumption that the City/Parish would procure circuits for half its sites at 1 Gbps and the other half at 10 Gbps; the savings would be considerably higher if the City/Parish requires 10 Gbps (or higher bandwidth) at all sites, which it almost certainly will.

Figure 3: Comparison of Cumulative Cost of City/Parish Fiber Ownership Relative to Renting from Uniti



Similarly, the following graphic shows that City/Parish ownership would pay for itself in ten years relative to leasing from Cox—and would realize substantial savings after that. This projection is based on the conservative assumption that the City/Parish would procure all public sites at 1 Gbps; the savings would be considerably higher if the City/Parish requires higher bandwidth, which it almost certainly will.

Figure 4: Comparison of Cumulative Cost of City/Parish Fiber Ownership Relative to Renting from Cox



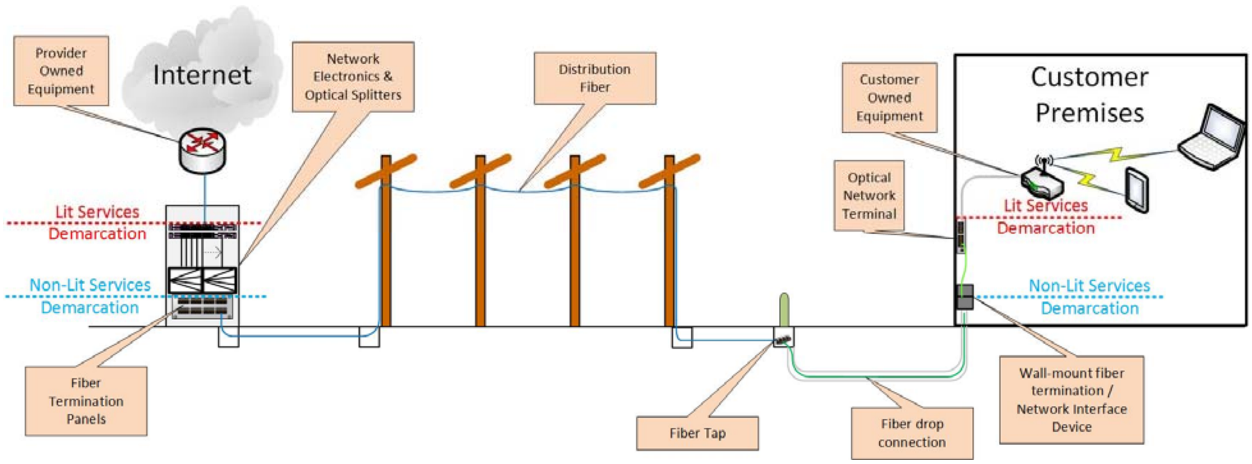
1.5 Building a Ubiquitous FTTP Network Would Cost the City-Parish $441 Million to $515 Million

We developed a sample network design for a ubiquitous FTTP network throughout the City-Parish. Our conceptual, high-level FTTP design reflects the City-Parish's goals regarding improved access to and affordability of high-speed broadband access to all residents, and is open to a variety of architecture options. Our analysis considered two approaches to deploying an FTTP network:

- A "lit" model, in which the City-Parish deploys all FTTP infrastructure, including all customer drop cables, network electronics, and customer premises equipment (CPE), and serves end users

- A "non-lit" model in which the City-Parish deploys a dark FTTP network and customer drop cables, and leases the infrastructure to a private partner that purchases network electronics and CPEs and serves end users

Figure 5: Demarcation Between City-Parish and Partner Network Elements in the Lit and Non-Lit Models



As we discuss in greater detail in Section 7 and Section 9, we project that it will cost more than $515 million to deploy a ubiquitous FTTP network under a lit model in which the City-Parish directly serves the end user with a Gigabit data service. (That cost estimate reflects only the cost of construction, not the ongoing costs of operations.). However, the City-Parish has been firm in that it does not wish to provide end users with services and thus this lit model is not currently under consideration.

If the City-Parish pursues a non-lit model in which it deploys FTTP OSP (including drop cables) but a private partner is responsible for network electronics and CPEs, and for serving end users, the total deployment cost for the City would be approximately $441 million. It is this non-lit model that forms the basis for our FTTP financial analysis in Section 9.

We also present an alternative non-lit model that shifts the drop costs to the private partner. This model reduces costs to the City-Parish but then gives the private partner "control" over network access. This model and its related costs are presented in Section 9.2.

Figure 6: Cost for Constructing Lit and Non-Lit Ubiquitous FTTP Networks[5]

	Lit Model	Non-Lit Model
Total Estimated Cost	$515 million	$441 million

[5] These estimated total costs assume a percentage of residents and businesses that subscribe to the service, otherwise known as the penetration rate or the "take rate," of 35 percent. Based on data we have seen in other markets, 35 percent is within the range of penetration rate that may exist in a market where both the cable and telephone companies also provide broadband service.

Each of these approaches has merit, and the City-Parish will incur capital risk regardless of which model it selects. Delivering broadband service will be expensive, even if the City-Parish is deploying only the fiber infrastructure and partnering with one or more private partners to offer service over the network (i.e., the non-lit model).

Although the City-Parish does not wish to directly compete with the private sector by entering the marketplace as a retail service provider, evaluating the costs associated with the lit model is important in the context of developing a public–private partnership because it gives a sense of the costs the City-Parish might expect to incur versus the costs for which one or more partners may be responsible.

Based on our analysis, if the City-Parish were to enter a public–private partnership in which it deployed a non-lit network and relied on a partner to deploy network electronics and CPEs, the private partner would have an upfront cost of approximately $74 million (based on a 35 percent "take rate").

While $74 million is significantly less than the City's projected capital cost of approximately $441 million for the non-lit model, the partner would be responsible for the cost associated with replenishing network electronics and CPEs, which may occur every five, seven, or 10 years. Additionally, in this model, the partner would also be responsible for the costs associated with operating the network and the retail business—costs that are inherently variable, difficult to predict, and likely to be significant. In the non-lit model, in other words, the City-Parish is able to avoid operational risk.

1.5.1 Lit FTTP Cost Estimate

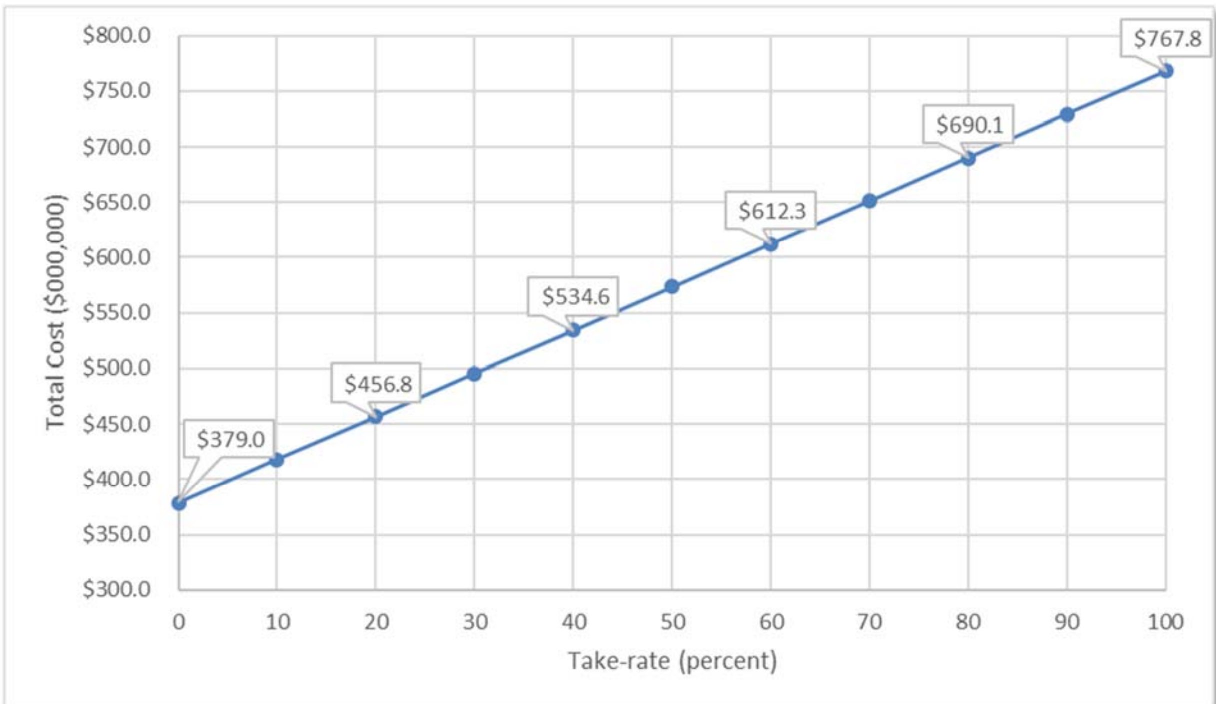
The full FTTP network deployment with a 35 percent take rate will cost more than $515 million, including OSP construction labor, materials, engineering, permitting, pole attachment licensing, network electronics, drop installation, CPEs, and testing. The average cost per passing is $2,745.

Table 2: Estimated Lit FTTP Cost

Cost Component	Total Estimated Cost
OSP	$357.9 million
Central Network Electronics	32.6 million
FTTP Service Drop and Lateral Installations[6]	83.0 million
CPE	41.6 million
Total Estimated Cost:	$515.1 million

Figure 7 shows the change in total estimated cost that occurs by varying the expected total number of customers that subscribe to the service. Table 2 assumes a take rate of 35 percent.

Figure 7: Total Estimated Cost versus Take Rate



The cost is roughly linear by take rate because the cost of adding additional subscribers is a fixed cost (i.e., the cost of fiber drops and electronics).

Actual costs may vary, and cannot be definitively determined until a detailed design is completed, or until construction commences. The factors that will have an impact on the total deployment cost include: 1) costs of private easements, 2) utility pole replacement and make ready costs, 3)

[6] "Drops" connect individual customer premises to the network (i.e., the fiber cable extending from a home to the utility pole in the right-of-way). "Laterals" are cables that are considered part of the distribution fiber network, and include relatively short extensions from the backbone fiber routes and the connections to residential and commercial multi-dwelling units.

variations in labor and material costs, 4) the amount of subsurface hard rock along the fiber routes, and 5) the City-Parish's operational and business model. We have incorporated suitable assumptions to address these items based on our experiences in similar markets.

The total cost of operations will also vary with the business model chosen and the level of existing resources that can be leveraged by the City-Parish and any potential business partners.

1.5.2 Non-Lit FTTP Cost Estimate

This non-lit FTTP network deployment with a 35 percent take rate will cost about $441 million, including OSP construction labor, materials, engineering, permitting, pole attachment licensing, and drop installation. As we noted, this estimate does not include any electronics or subscriber equipment—these costs would be incurred by the City-Parish's private partner.

Table 3: Estimated Non-Lit FTTP Cost

Cost Component	Total Estimated Cost
OSP	$357.9 million
FTTP Service Drop and Lateral Installations	83.0 million
Total Estimated Cost:	$440.9 million

This estimate assumes that the City-Parish constructs and owns the FTTP infrastructure up to a demarcation point (a network interface device) at each residence and business, and leases the dark fiber backbone, distribution fiber, and drop fiber to a private partner. The private partner would be responsible for all network electronics and CPEs—as well as network sales, marketing, and operations.

1.5.3 The City-Parish's Low-Density Areas Create Higher OSP Construction Costs

In our network design, we identified high- and low-density areas within the City-Parish. In our modeling, high-density areas have an average of 97 passings per square mile, and low-density areas have an average 66 passings per square mile.

There are 38,795 high-density passings and 148,851 low-density passings in the City-Parish, for a total of 187,610 passings. (The passing count treats single-unit buildings and each unit in small multi-business buildings as single passings. It treats larger multi-tenant businesses and large multi-dwelling unit (MDU) apartment buildings as single passings.) The disparity between the number of low- and high-density passings creates one of the key financial challenges in deploying FTTP.

Because low-density areas require more construction of fiber to reach a smaller number of homes, lower-density neighborhoods tend to cost more to construct per premises passed—making low-density areas more costly and harder to serve. Table 4 illustrates the cost of OSP

FTTP construction (excluding $83.0 million in fiber service drop and lateral installation costs) for low- and high-density areas of the City-Parish.

Table 4: Costs for OSP FTTP Construction (Low and High Density)

Cost Component	Total Estimated Cost	High Density Cost	Low Density Cost
OSP Engineering	$44,591,000	$5,319,000	$39,272,000
Quality Control/Quality Assurance	23,430,000	2,795,000	20,635,000
General OSP Construction Cost	249,981,000	34,467,000	215,514,000
Special Crossings	14,271,000	1,755,000	12,516,000
Backbone and Distribution Plant Splicing	7,736,000	1,210,000	6,526,000
Backbone Hub, Termination, and Testing	17,871,000	3,553,000	14,318,000
Total Estimated Cost:	$357,880,000	$49,099,000	$308,781,000

1.6 The Huntsville and Westminster Models Are Two Likely Public–Private Partnership Approaches for Deploying FTTP in the City-Parish

To frame our analysis around potential infrastructure development and collaboration between the City-Parish and the private sector, we applied two similar but unique public–private partnership models. One is currently underway in the city of Westminster, Maryland, with its partner Ting Internet. The other is being implemented by Google Fiber and Huntsville Utilities, in Huntsville, Alabama.

1.6.1 Overview of the Models

Each of these models is a "non-lit" or "dark FTTP" approach, in which the public-sector entity constructs and owns the fiber network, and the private partner "lights" the fiber with electronics and directly serves the end user. Each of these models entails a full FTTP network buildout, in which the locality will construct and maintain ubiquitous infrastructure that passes every residence and business, and lease the fiber backbone and distribution fiber to the private partner. The private partner will be responsible for all network electronics and customer premises equipment (CPEs), as well as network sales, marketing, and operations.

Where these models differ is in their treatment of drop cables, or the fiber cable that runs from the distribution fiber in the PROW to the customer's home or business. In the Huntsville model, the City-Parish would be responsible for constructing backbone and distribution fiber up to the PROW, while the private partner would construct the drop cable into the home or business. (Note that this is different from the non-lit FTTP model we used to estimate costs, and that we describe in our financial analysis; in that model, the City-Parish would construct the drop cable.) Because the drop connection would be funded by the private partner in the Huntsville model, the number of subscribers (and thus the number of drop cables) would not directly affect the City-Parish's financial outcomes.[7] Fiber lease payments from the private partner to the City-Parish in this model would be based on the number of customer "passings" in the network (i.e., the number of households and businesses that the fiber optic network passes in the PROW).

In the Westminster model, the City-Parish would be responsible for constructing and maintaining both the distribution fiber and the drop cables. Each home and business that wishes to subscribe to the services provided by the private partner would need a City-Parish-funded drop cable installed. In this model, the fiber lease fees paid by the partner to the City-Parish would have a two-tiered structure—one fee for the number of passings in the network and an additional fee for each subscriber. This subscriber fee would help offset the cost of the fiber drops, and would only apply to premises where drops are constructed. The financial viability of this model relies, in part, on the take rate.

The City of Westminster, Maryland, negotiated a per-passing fee of $6 per customer and a per-subscriber fee of $17 per customer with its partner, Ting Internet.

Huntsville Utilities in Huntsville, Alabama, was able to negotiate a per-passing fee of $7.50 paid from Google Fiber to the utility. There is no per-subscriber fee in Huntsville because the public entity is not paying for the drop cables.

1.6.2 Per-Passing and Per-Subscriber Fees

We anticipate that in either a Huntsville or a Westminster model, the City-Parish would be able to charge its partner a per-passing fee, which is a fixed fee paid per passing per month from the private partner to the public entity. Because this fee is based on a known, fixed quantity, the incoming revenue from a per-passing fee would be predictable.

A per-subscriber fee, which we anticipate the City-Parish would assess in a partnership model like the one in Westminster, would be paid to the City-Parish by its partner based on the number of subscribers that purchase service from the private partner. This number would be variable and unpredictable, and would largely depend first on the partner's marketing and advertising efforts, and later on its ability to retain subscribers. One major advantage of this model is that the City-Parish would own and control the fiber to each premises.

[7] We note that there are alternative partnership models in which, even if the City-Parish were responsible for the drop cable, the number of subscribers may impact the City-Parish's financial obligations. The partnership structure, including the structure of payments between the parties, will determine exactly what impact, if any, the number of subscribers will have on the City-Parish.

In the city of Westminster's contract with Ting Internet, the locality negotiated a per-passing fee ($6) plus a per-subscriber fee ($17) per month for dark fiber usage. That is, Ting pays the city for every premises the network passes, plus an additional fee for every subscriber receiving service over the network, totaling $6 per non-subscribed passing and $23 per subscribed passing. As such, the take rate is vitally important to the feasibility of the project. Note that our projections for the City-Parish assume a 35 percent take rate.

In the Huntsville model, there is no per-subscriber fee, because the private partner is responsible for paying for the drop cable to connect to the customer premises (i.e., the last mile). In its contract with Google Fiber, Huntsville Utilities negotiated a monthly per-passing fee of $7.50. We note that this number is low, and the City-Parish would likely need to obtain significantly higher fees to become and remain cash flow positive (see Section 9).

1.7 Financial Analysis of a Candidate FTTP Network

We investigated the financial feasibility of two potential FTTP network models. In both, the City-Parish would construct and maintain ubiquitous fiber infrastructure to every residence and business, and lease the fiber backbone and distribution fiber to a private partner. The private partner would be responsible for all network electronics and CPEs—as well as network sales, marketing, and operations.

While the engineering cost estimate described above and in Section 7 includes costs associated with operating as a retail service provider, this financial analysis does not include operations costs for such a model. Although it is important to understand the upfront capital costs associated with such a model in order to paint a clear picture of overall capital costs, our financial analysis evaluates costs based on the assumption that the City-Parish does not wish to compete directly with the private sector.

In our first model, which is similar to the Huntsville model, the City-Parish would be responsible for constructing backbone and distribution fiber up to the PROW, while the private partner would construct the drop cable into the home or business. Since the last-mile connection would be funded by the private partner, the number of subscribers (and thus the number of drop cables) will not directly affect the City-Parish's financial outcomes. As such, fiber lease payments to the City-Parish for this model will be based solely on the number of passings in the network. (See Section 9.2 for more details.)

Our second model, which is similar to the Westminster model, proposes a scenario in which the City-Parish would be responsible for constructing and maintaining both distribution fiber and drop cable infrastructure. Since this model presents significant additional costs to the City-Parish, the fiber lease fees would have a two-tiered structure—one fee for the number of passings in the network and an additional fee for each subscriber. This subscriber fee helps offset the cost of fiber drops, and only applies to premises where drops have been constructed. Each home and business that wishes to subscribe to the services provided by the partner would need a City-Parish-funded drop cable installed. Thus, the financial viability of the model is heavily dependent upon the total customer take rate. (See Section 9.3 for more details.)

We have included multiple scenarios for each model to demonstrate potential options the City-Parish can consider, and to illustrate funding and financing concerns. All our models represent the minimum requirements for the City-Parish to maintain positive cash flow over the course of 20 years.

In all scenarios we analyzed, the City-Parish's partner would need to pay higher lease fees than the private partners pay in either Huntsville or Westminster. However, if the City-Parish is able to procure sufficient startup funding to lower the private partner's lease fees, it may be able to develop a financially feasible partnership in some scenarios.

1.8 Private Sector Input on City-Parish's Plans

Understanding the services and infrastructure that providers in the region currently offer to residents and businesses is an important step to understanding the local competitive landscape. While we were able to glean meaningful information from our independent analysis, we also engaged the provider community by holding teleconference meetings. These discussions sought to engage providers directly to determine, from their perspective, how they are currently approaching the City-Parish marketplace. These discussions were also meant to encourage providers to offer feedback on the City-Parish's initiative and suggest steps the City-Parish might take to lower barriers to market entry for the private sector.

Throughout the course of our engagement, we assured local providers that the City-Parish does not intend to compete directly with the private sector by becoming a retail service provider, and that the City-Parish's interest is in bolstering the private sector, and potentially entering into a public–private partnership. Over the course of approximately two weeks in January 2017, we spoke with six private providers via teleconference:

- AT&T
- CenturyLink
- Cox Communications
- Eatel
- Hunt Telecom
- Level(3)

While each of these providers has a unique perspective, certain themes arose throughout each of the discussions. The providers generally indicated that they are currently serving the residents and businesses of the City-Parish and intend to continue rolling out network upgrades and even deploying additional infrastructure as it makes sense. As we noted, there is a range of services available throughout the City-Parish today, including enterprise services for large business users all the way down to residential services available at a significant discount for low-income families.

One key theme that emerged in our conversations was that, in order for them to be able to justify building infrastructure to a certain area, providers must be able to obtain a reasonable return on investment (ROI). It is because of this reality that a public–private partnership may make sense, or it may be important for the City-Parish to look at steps it can take to bolster the private sector. Because the City-Parish is not beholden to a bottom line in the same way as a private company, there may be long-term steps the public entity can take that would be unrealistic for the private sector.

Since the City-Parish can seek bond funding, which has a much longer life than private capital—particularly financing that is beholden to Wall Street—public infrastructure development may make sense. For example, a locality may opt to build to areas in the community where ROI is traditionally low, such as low-income neighborhoods, in exchange for the private partner offering discounted services there.

In general, the providers we spoke with seemed amenable to partnering in some capacity with the City-Parish. None of the providers dismissed the notion out of hand, though some were more skeptical than others of the City-Parish's ability to take any tangible steps toward broadband deployment. There was general agreement that the City-Parish should not become a direct competitor with the private sector. The degree to which a partnership will fit with the City-Parish's goals, and the nature of partnership, will depend on a number of details that remain to be evaluated and ironed out. But, overall, the private provider community seems comfortable with the idea of the City-Parish taking steps to support private industry, as long as it does not put the City-Parish in competition with the existing providers.

1.9 Recommendations

The analysis presented in this report illustrates the potential costs and feasibility of building a City-Parish middle mile network and an FTTP network, with the following recommended next steps.

1.9.1 Adopt A Robust Dig Once Policy

The City-Parish can benefit by encouraging coordination and incentivizing efforts between the City-Parish and the private sector when excavating the PROW and placing conduit. Coordination can enable the City-Parish to better protect the PROW, minimize disruptions, and reduce costs of installation of utilities and conduit.

Such joint trenching efforts around the country—usually referred to as "Dig-Once"—have taken many different forms. Such a policy would represent a long-term strategy for the City-Parish. Dig once policies reduce the long-term cost of building communications facilities by capitalizing on significant economies of scale through:

1. Coordination of fiber and conduit construction with utility construction and other disruptive activities in the PROW

2. Construction of spare conduit capacity where multiple service providers or entities may require infrastructure

We understand based on our discussions with the City-Parish that both issues are important. The public rights-of-way are crowded, particularly in older areas of development where the PROW is narrower. Making use of Dig Once opportunities may also reduce the cost of a fiber optic build to support connectivity to government and institutions, or last-mile construction to homes and businesses.

The incentivizing measures range from implementing business processes for improved sharing of information, to facilitating coordination, to adopting legislative measures that enforce standards and specifications for additional conduits that can be used by the City-Parish or leased to other companies.

It is also important to note that City-Parish transportation and utility projects can provide many opportunities for Dig Once coordination and that taking advantage of those opportunities can start immediately, while the City-Parish potentially works in parallel to implement coordination with non-City utilities.

CTC engineers reviewed relevant specifications and PROW construction processes of the City-Parish, and developed Dig Once policy recommendations based on our experience developing Dig Once ordinances, specifications, and guidelines for other local governments. See Section 5 for details.

In conjunction with its Dig Once planning, we recommend that the City-Parish evaluate its permitting processes. Based on our discussions with local providers, the City-Parish's permitting process is not currently perceived as either onerous or prohibitive. However, there are often ways for localities to make their permitting and other processes more straightforward, less costly, and more encouraging for private providers. This is not to say that the City-Parish should develop a permitting process that is too lenient or that does not allow for public input into the process.

On the contrary, we believe it is critically important for the City-Parish to have strong visibility into the plans of any company that wishes to place infrastructure in the PROW.

If a locality aims to be inviting to private providers deploying infrastructure in the PROW, particularly those that seek to upgrade or replace aging communications infrastructure, there are important steps the public entity can take—such as formalizing and publicizing permitting and other pertinent process. Developing and publicizing clear processes can alert the private sector that a locality is willing to work with the industry to enable greater private deployment. Localities and providers can cooperatively plan before construction so as to understand respective schedules and needs, and so that the provider can stage its work around known and predictable local processes.

1.9.2 Determine Parameters of a Potential Public–Private Partnership

One of the most important steps the City-Parish can take is to quantify and solidify its own goals, so it can then also understand its expectations for a public–private partnership. Because there are a variety of business models that a partnership can take on, it is important for the City-Parish to be clear on its expectations before beginning the process of negotiations with a private provider. This is especially true if the City-Parish is going to make a significant capital investment to deploy network infrastructure; the City-Parish should have a strong understanding of what it intends to ask of a private partner, and what contributions it will make to a partnership.

As we note in Section 8, if the City-Parish constructs the FTTP laterals, these construction costs translate to an average of $1,920 per passing ($1,303 and $2,081 for high- and low-density areas, respectively). If the City-Parish is not responsible for lateral construction, these costs would be reduced to an average $1,908 per passing ($1,267 and $2,074 for high- and low-density areas, respectively). Still, one of the partners will be responsible for construction, and if the City-Parish passes these costs to a partner, it is important to quantify and understand the capital and other risks a partner will be taking in a public–private partnership.

The City-Parish will want to consider its precise expectations of a partner, which requires knowing what steps the public entity will take toward infrastructure deployment. Once that line of demarcation is determined, the City-Parish can then begin to evaluate each entity’s capital costs and operational risks. While the City-Parish cannot unilaterally decide the role a partner might play, it can determine what its ideal partnership structure would look like, and what kind of investment and other risks it might expect of the private partner.

1.9.3 Issue a Request for Proposal (RFP) to Identify Potential Private Partners for FTTP Deployment

In the summer of 2017, the City-Parish conducted a public procurement process through a request for information (RFI); the RFI was distributed to a range of private providers that may be interested in entering a public–private partnership. One goal of the RFI was to develop a framework and documentation to help the City-Parish to more precisely articulate its goals, and signal to the private sector the City-Parish's desire to more broadly deploy fiber infrastructure.

This procurement process yielded six (6) total responses from a range of companies. Four (4) additional providers indicated through the RFI's non-binding letter of intent (LOI) that they would submit a response to the RFI, but did not ultimately provide a response.

Although some potential partners opted not to respond to a broad RFI process, and none of the responses were a perfect match for the City-Parish's stated goals and preferred business model, it was a promising effort that could be supplemented with a more in-depth and robust Request for Proposal (RFP) process. Based on feedback from providers, some companies may be unwilling or unable to commit the resources necessary to respond to an RFI, but would be willing and able to provide a response to an RFP.

The City-Parish has identified public–private partnership as a desirable path forward, and the analysis presented in this study (including the market research, FTTP cost estimate, and FTTP financial analysis) will enable the City-Parish to prepare a detailed RFP to determine whether a partnership will be a viable option. The City-Parish may be able to engage the private sector to facilitate an FTTP build-out. Building on the knowledge gathered through the RFI process, the RFP process should cast a wide net and seek to closely engage local private providers, including the large incumbent providers, as well as potential new entrants to the City-Parish market.

Many public–private partnership models entail shared risk and reward between public and private entities, but it is important to note that not all private entities will be amenable to partnering, and some may be particularly unhappy to see the public sector enter the private market in any capacity. Still, there are a handful of private companies in the industry today that are willing to work with localities to deploy a business model where the City-Parish assumes some level of infrastructure risk, and we encourage the City-Parish to open discussions with one or more of these vendors, depending on what it is legally able to do.

2 Inventory of Existing Public and Private Broadband Infrastructure and Services

It is important to understand the broadband services currently available in City-Parish to frame the region's future needs. Through a combination of analysis and discussions with providers in the area, we developed an inventory of existing public and private broadband infrastructure and services, which we outline here.

2.1 ISP-Reported Data on Available Services Indicate That Some City-Parish Residents Do Not Have Access to Broadband

Twice annually, internet service providers (ISPs) submit data to the Federal Communications Commission (FCC) via Form 477, reporting census blocks in which they can or do offer wireline broadband services with speeds of at least 25 Mbps (download)/3 Mbps (upload). This information is then aggregated by the FCC and released to the public. The data illustrate the areas where wireline infrastructure is deployed and service is *possible* within a given census tract.[8]

The most recently released map (as of December, 2015) is shown in Figure 8.

It is important to remember that the reported data merely indicate where infrastructure is available to connect new customers within a "reasonable time frame," and service must only be available to one household within the census block for it to be considered "available." Additionally, "access" does not necessarily equate to "affordable access." That said, the December 2015 data still suggest that within the City-Parish, 2.68 percent of the urban population and 7.19 percent of the rural population (totaling 13,339 citizens) do not have access to wireline broadband service.[9] Though these unavailability rates were lower than the national averages (3.91 and 39.25 percent, respectively),[10] they still indicate a need to increase broadband availability to all residents and businesses within the City-Parish.

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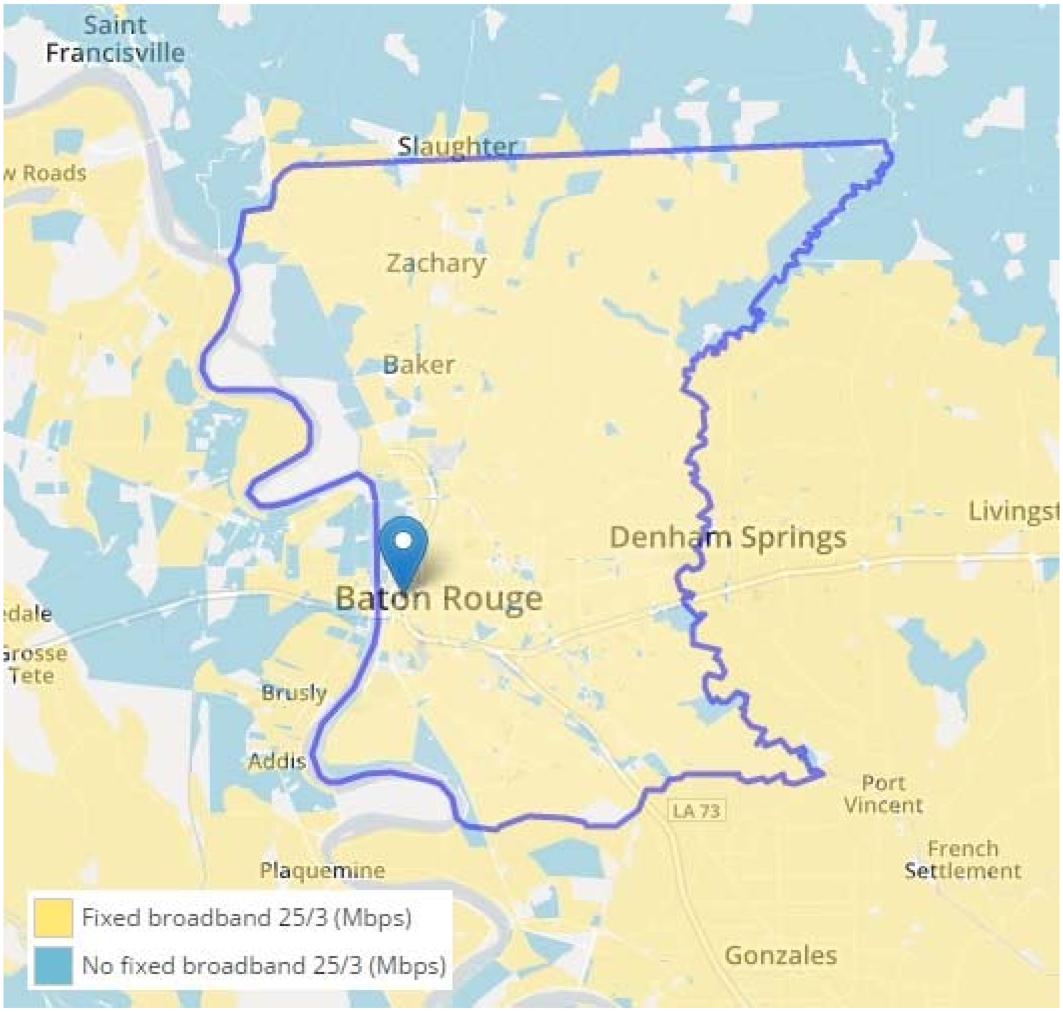
[8] https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477, accessed April 2017

[9] https://opendata.fcc.gov/Wireline-Competition-Bureau/Fixed-Broadband-Deployment-Data/9tdg-7vpy/data, accessed April 2017

[10] https://www.fcc.gov/reports-research/maps/fixed-broadband-deployment-data/, accessed April 2017

Figure 8: Availability of Wireline Broadband Service in Baton Rouge (2015)[11]



2.2 ISPs' Current Service Offerings in the City-Parish

In the sections below, we describe the services currently available to large businesses (enterprises), small businesses, and residential customers in the City-Parish. This competitive assessment lists all of the services we were able to identify in online and telephone research.

2.2.1 Enterprise Services

This section provides an overview of competitive providers of dark fiber and lit services with respect to enterprise customers in the City-Parish of Baton Rouge. These services would typically serve medium to large business customers.

Throughout our research, we identified 13 service providers in the Baton Rouge region that offer a range of services, from dark fiber connectivity to data transport services, with speeds that range

[11] https://www.fcc.gov/maps/fixed-broadband-deployment-data/, accessed April 2017

from 1 Megabits per second (Mbps) to 100 Gigabits per second (Gbps). We expect to see continued consolidation of competitors through mergers and acquisitions, so the number of providers might decline over time.

While many providers do not own infrastructure in the City-Parish, they can offer lit services through agreements with other local providers. Individual providers tailor these services to customers' requirements (speed, class of service, etc.). Greater proximity of the service location to the provider's existing network infrastructure results in lower service pricing. Providers prefer to offer transport services between locations on their networks (on-net) and provision Multiprotocol Label Switching (MPLS) based services for connecting locations that are off-net (i.e., obtaining last-mile connectivity from a third party, such as AT&T).

Comprehensive pricing comparisons are difficult, if not impossible, to compile for two reasons. First, service providers rarely make pricing publicly available, and will typically provide quotes only for a bona fide potential customer. Second, enterprise service providers do not have standard rates. Unlike the residential services that AT&T and Cox deliver for a set monthly fee, enterprise services are customized to individual customers' specific needs, and are priced accordingly.

2.2.1.1 Dark Fiber Services

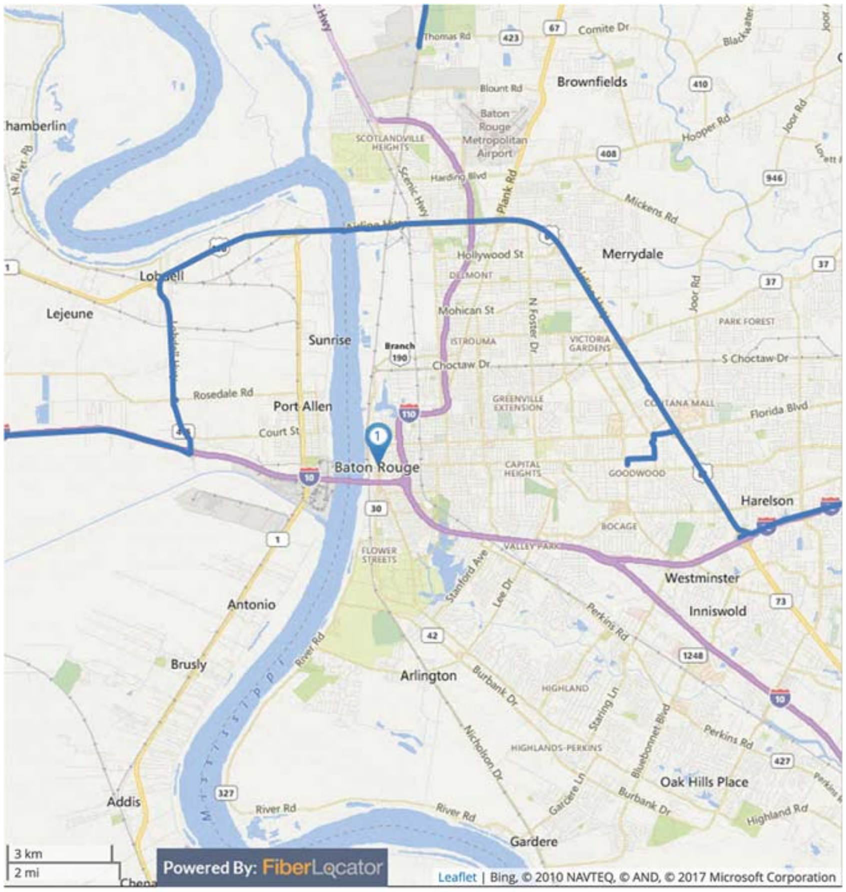
Dark fiber refers to fiber strands that are installed (e.g., in conduit or on aerial poles) but are not "lit" by network electronics. Local governments and network operators often install excess fiber to meet future needs, or install dark fiber specifically to lease to enterprise customers that have the technical capabilities to operate the fiber on their own.

Three service providers in the Baton Rouge region offer dark fiber services: Conterra, Level (3), and Southern Light.

Conterra offers dark fiber services within the City-Parish and provides connectivity to rural and metro areas in 22 states.[12] Conterra's dark fiber routes in the City-Parish are shown in Figure 9.[13]

[12] http://www.conterra.com/about/network-map/, accessed January 2017
[13] Obtained from FiberLocator, https://www.fiberlocator.com/

Figure 9: Conterra Dark Fiber Routes



Level (3) has dark fiber services, with routes depicted in Figure 10.[14] Services are offered only to select customers based on the provider's application requirements.[15] Pricing varies individually, based on distance from the provider's fiber ring. A difference in a few tenths of a mile can cause significant differences in the price of dark fiber connectivity due to additional construction costs.

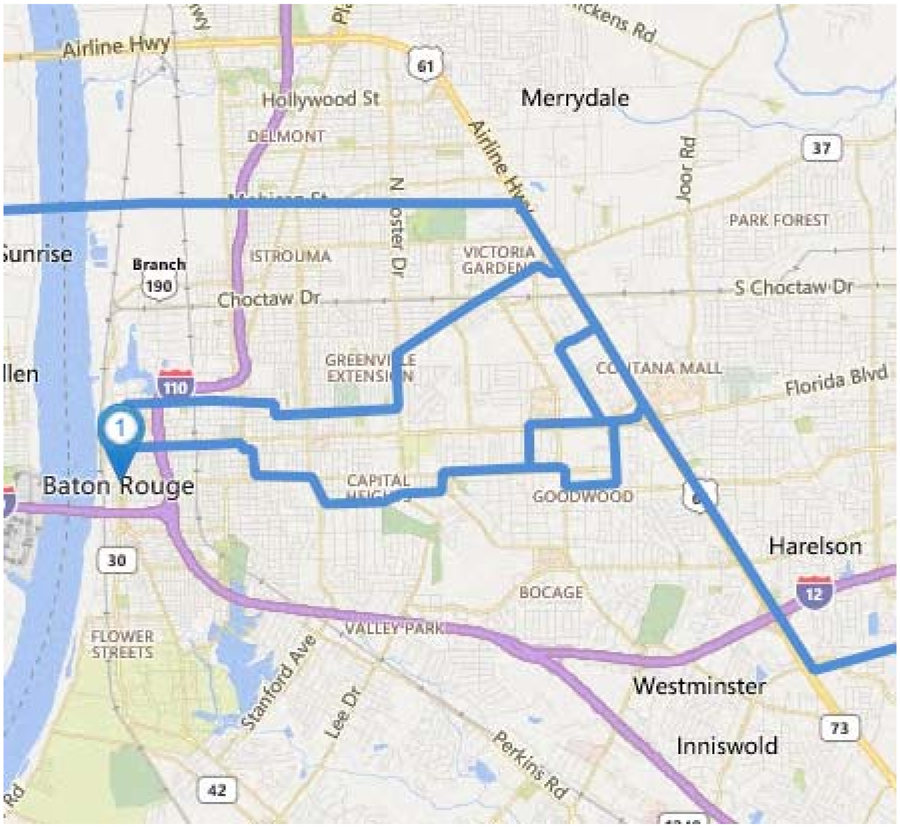
[14] Obtained from FiberLocator, https://www.fiberlocator.com/
[15] http://maps.level3.com/default/, accessed January 2017

Figure 10: Level (3) Dark Fiber Routes

Southern Light also offers dark fiber access within the City-Parish. Southern Light's fiber routes in the Baton Rouge area are depicted in Figure 11.[16]

[16] http://southernlightfiber.com/, accessed January 2017

Figure 11: Southern Light Dark Fiber Routes



2.2.1.2 Lit Fiber Services

Almost all existing service providers offer Ethernet and Dedicated Internet Access (DIA) services. Typically, bandwidths for these services range from 1 Mbps to 100 Gbps.

Ethernet service can be classified into three types: Ethernet Private Line (EPL or E-Line), Ethernet Virtual Private Line (EVPL) and ELAN, all of which may be known by different names among providers. EPL service is a dedicated, point-to-point high-bandwidth Layer 2 private line between two customer locations. EVPL service is like EPL, but is not dedicated between two locations. Instead, it provides the ability to multiplex multiple services from different customer locations onto one point on the provider's network (multiple virtual connections), and connect that one point to another point on the network. ELAN service is a multipoint to multipoint service, that enables customers to connect physically distributed locations across a Metropolitan Area Network (MAN) as if they are on the same Local Area Network (LAN).

Internet services over Ethernet are typically classified under two categories: Dedicated Internet Access (DIA) and MPLS IP Virtual Private Networks (IP-VPN). Providers prefer to offer MPLS-based IP-VPN services when the service locations are off-net, thus avoiding construction and installation costs. MPLS based networks provide high performance for real-time applications such as voice and video and are typically priced higher.

The customer can choose a type of Ethernet service based on their bandwidth demands and the number of locations they need to connect. Typically, Ethernet services are used by large business that have IT staff to manage their network.

Ethernet services in the Baton Rouge region are offered by AT&T, Level (3), CenturyLink, Conterra, Comcast, Cox, Eatel, EarthLink, Hunt Telecom, Southern Light, Verizon, Windstream Communications, and XO Communications. Prices depend on bandwidth, location, network configuration, whether the service is protected or unprotected, and whether the service has a switched or mesh structure. Additional non-recurring charges (e.g. installation fees) may be charged.

AT&T has four different types of Ethernet products: GigaMAN, DecaMAN, Opt-E-MAN, and Metro Ethernet. GigaMAN provides a native-rate interconnection of 1 Gbps between customer end points. It is a dedicated point-to-point fiber optic service between customer locations which includes GigE Network Terminating Equipment (NTE) at the customer premises. DecaMAN connects the end points at 10 Gbps and is transmitted in native Ethernet format similar to GigaMAN, only 10 times faster. Opt-E-MAN service provides a switched Ethernet service within a metropolitan area. It supports bandwidths ranging from 1 Mbps to 1,000 Mbps, and configurations such as point-to-point, point-to-multipoint, and multipoint-to-multipoint. Metro Ethernet service provides various transport capabilities ranging from 2 Mbps through 1 Gbps while meeting IEEE 802.3 standards.[17]

CenturyLink provides point-to-point inter-city and intra-city configurations for full-duplex data transmission. The company offers speeds of 100 Mbps to 10 Gbps.[18]

Comcast provides DIA and Ethernet services, including Ethernet Private Line. Their EPL service enables customers to connect their CPE using an Ethernet interface, as well as using any Virtual Local Area Networks (VLAN) or Ethernet control protocol across the service without coordination with Comcast. EPL service is offered with 10Mbps, 100Mbps, 1 Gbps or 10 Gbps Ethernet User-to-Network Interfaces (UNI) and is available in speed increments from 1Mbps to 10 Gbps.[19]

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[17] http://www.business.att.com/service_overview.jsp?repoid=Product&repoitem=w_ethernet&serv=w_ethernet&serv_port=w_data&serv_fam=w_local_data&state=California&segment=whole, accessed January 2017

[18] http://www.centurylink.com/business/products/products-and-services/data-networking/private.html, accessed January 2017

[19] http://business.comcast.com/ethernet/products/ethernet-private-line-technical-specifications, accessed January 2017

Conterra offers Ethernet services, including EPL, ELAN and EVPL with speeds up to 100 Gbps. DIA services are available up to 10 Gbps speeds.[20]

Cox offers Ethernet LAN Service, EPL, and Ethernet Access Services to locations within Baton Rouge.[21] Cox also offers scalable, symmetric DIA service with speeds up to 1 Gbps in certain locations in the City-Parish.[22] Cox quoted Pricing for a 1 Gbps DIA service in the City-Parish at $3,600 per month for a 36-month term, while 10 Gbps DIA service is upwards of $10,000 per month.

Eatel offers Ethernet and DIA services from 10 Mbps up to 10 Gbps.[23]

EarthLink offers a variety of Ethernet services in the City-Parish, including DIA, MPLS IP-VPN, and IPsec VPN, which uses the Ipsec protocol instead of IP over MPLS. It also offers Hybrid WAN service, which allows connectivity between multiple locations with different types of service. Symmetrical Ethernet service is available over both copper and fiber connections.[24]

Hunt Telecom offers Metro Ethernet and DIA services from 10 Mbps to 10 Gbps within the City-Parish.[25]

Level (3)'s Metro Ethernet dedicated service is available in bandwidth options of 3 Mbps to 1 Gbps and offers Ethernet Virtual Private Line (VPL) in speeds ranging from 3 Mbps to 1 Gbps. It is an end-to-end Layer 2 switched Ethernet service delivered via a Multiprotocol Label Switched (MPLS) backbone.[26]

Verizon offers Ethernet services under three different product categories—Ethernet Local Area Network (LAN), EPL, and EVPL. The Ethernet LAN is a multipoint-to-multipoint bridging service at native LAN speeds. It is configured by connecting customer User-to- Network Interfaces (UNIs) to one multipoint-to-multipoint Ethernet Virtual Connection or Virtual LAN (VLAN), and provides two Class of Service options—standard and real time. Ethernet Private Line is a managed, point-to-point transport service for Ethernet frames. It is provisioned as Ethernet over SONET (EoS) and speeds of 10 Mbps to 1 Gbps are available. EVPL is an all-fiber optic network service that connects subscriber locations at native LAN speeds; EVPL uses point-to-point Ethernet virtual connections

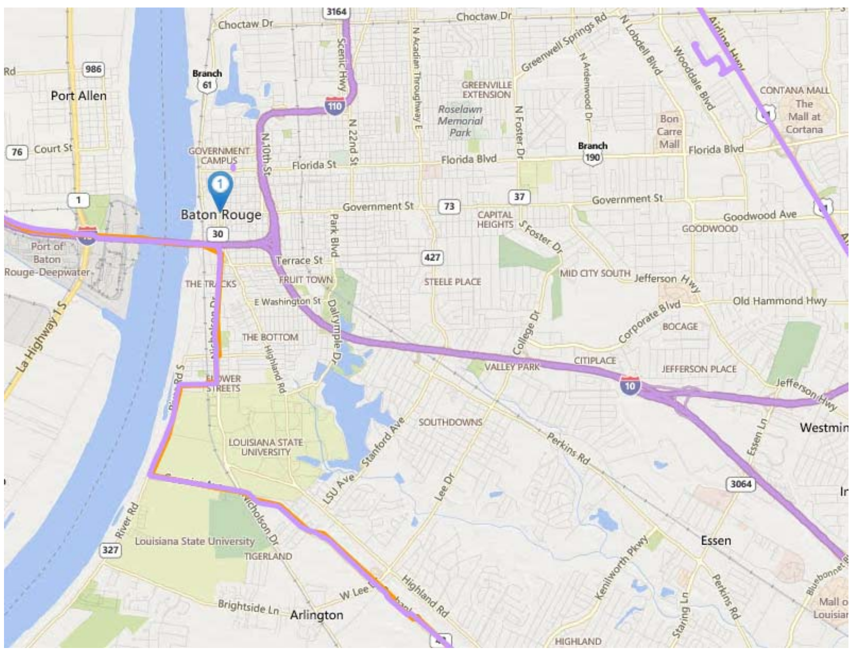
[20] http://www.conterra.com/solutions/internet-solutions/, accessed January 2017
[21] https://www.cox.com/business/networking/metro-ethernet.html, accessed January 2017
[22] https://www.cox.com/content/dam/cox/business/documents/internet/Cox_Business_Optical_Internet_Overview.pdf, accessed December 2016
[23] http://www.eatel.com/business/data/metro-ethernet , accessed January 2017
[24] https://www.earthlink.com/why-earthlink/our-network, accessed January 2017
[25] http://www.hunttelecom.com/metro-internet/, accessed January 2017
[26] http://www.level3.com/en/products-and-services/data-and-internet/vpn-virtual-private-network/evpl/, accessed January 2017

(EVCs) to define site-to-site connections. It can be configured to support multiple EVCs to enable a hub and spoke configuration and supports bandwidths from 1 Mbps to 1 Gbps.[27]

Southern Light offers Ethernet and DIA services in Baton Rouge, and provides speeds up to 10 Gbps.[28] Pricing for a 100 Mbps Ethernet service is approximately $400 per month and 1 Gbps Ethernet service approximately $1,000 per month for a 60-month term, at a location next to their existing network. DIA service in the City-Parish is priced comparable to Ethernet services, as Southern Light aims to buildout their fiber network.

Windstream Communications has a nationwide presence serving major metropolitan areas, including Baton Rouge, with speeds up to 1 Gbps.[29] Figure 12 shows the Windstream network in the region.[30]

Figure 12: Windstream Network Map



XO Communications can offer Ethernet services at multiple bandwidth options from 3 Mbps to 100 Gbps over their Tier 1 and partnership networks.[31]

[27] http://www.verizonbusiness.com/products/data/ethernet/, accessed January 2017
[28] http://southernlightfiber.com/, accessed January 2017
[29] http://www.windstreambusiness.com/, accessed January 2017
[30] Obtained from FiberLocator, https://www.fiberlocator.com/
[31] http://www.xo.com/carrier/transport/ethernet/, accessed January 2017

2.2.2 Residential and Small Business Services

Residential and small business customers in the Baton Rouge area have access to a range of services, though individual service options are largely dependent on location. Table 5 lists the service providers and minimum price for each type of service that is available in the City-Parish.

Table 5: Overview of Residential and Small Business Data Services in Baton Rouge

SERVICE TYPE	PROVIDER	MINIMUM PRICE (PER MONTH)
Cable	Cox	$39.99
DSL	AT&T	$40
	EarthLink	$80
FTTP	AT&T	$90
Satellite	HughesNet	$49.99
	Exede	$59.99
3G/4G/ Wireless ISP	Sprint	$15
	AT&T	$14.99
	Verizon	$60
	T-Mobile	$20
	Mobius	-

2.2.2.1 Cable

Cox Communications offers internet services via cable modem in standalone and bundled service packages in Baton Rouge as provided in Table 6. Cox offers a promotional rate for 12 months for some services for new customers.[32]

Table 6: Cox Communications Residential Internet – Internet Only

PACKAGE	INTERNET SPEED (DOWNLOAD)	PRICE PER MONTH	PROMOTIONAL PRICE PER MONTH
Essential	Up to 15 Mbps	$62.99	$39.99
Preferred	Up to 50 Mbps	$77.99	$59.99
Premier	Up to 150 Mbps	$87.99	$64.99
Ultimate	Up to 300 Mbps	$99.99	$84.99

Cox also offers internet services for small businesses in three tiers for a three-year contract. A 10 Mbps download and 2 Mbps upload service is available at $99 per month. A 25 Mbps download and 5 Mbps upload is offered at $145 per month. A 50 Mbps download and 10 Mbps upload is offered at $350 per month. Discounted prices are available if bundled with additional services (e.g., voice or TV).

[32] https://www.cox.com/residential/pricing.html#internet, accessed January 20117

2.2.2.2 Digital Subscriber Line (DSL)

AT&T offers DSL service for residential customers in the City-Parish, with promotional rates of $40 per month for unbundled or standalone DSL service with a 12-month commitment. Speed options up to 45 Mbps are available as indicated in Table 7.

Table 7: AT&T Residential Internet — Internet Only

INTERNET SPEED (DOWNLOAD)	PRICE PER MONTH	PROMOTIONAL PRICE PER MONTH
Up to 18 Mbps	$50	$40
Up to 24 Mbps	$60	$40
Up to 45 Mbps	$70	$40

AT&T offers DSL-based small business services starting at $80 per month for 18 Mbps download and 1.5 Mbps upload speeds.

EarthLink provides DSL-based business services in the region starting at $80 per month and offering speeds up to 6 Mbps with 99.9 percent network availability.[33]

2.2.2.3 Fiber-to-the-Premises (FTTP)

AT&T offers fiber-based internet services for residential customers in the Baton Rouge area at 1 Gbps speed with prices starting at $90 per month.[34]

2.2.2.4 Satellite

HughesNet has four residential packages available and four geared toward businesses. In addition to slight increases in download and upload speeds, plans are differentiated by their monthly data allowances.

Residential offerings include an “anytime” allowance, plus a larger 50 GB “bonus bytes” allowance which can be used from 1 a.m. to 10 a.m. Business offerings include a “business period” allowance to be used between 8 a.m. and 6 p.m. plus a smaller 10 GB “anytime” allowance. All packages require a two-year agreement. Details and pricing are listed in the tables below. Some promotional discounts are available for the first three months.

[33] http://www.earthlinkbusiness.com/DSL/, accessed December 2016.
[34] https://engage.att.com/louisiana/blog/?PostId=3455, accessed December 2016.

Table 4: HughesNet Satellite Residential Plans[35]

Package	Internet Speed (Down/Up)	Monthly Data Allowance (Anytime + Bonus Bytes)	Monthly Price
Choice	5 Mbps / 1 Mbps	5 GB + 50 GB	$49.99
Prime Plus	10 Mbps / 1 Mbps	10 GB + 50 GB	$59.99
Pro Plus	10 Mbps / 2 Mbps	15 GB + 50 GB	$79.99
Max	15 Mbps /2 Mbps	20 GB + 50 GB	$129.99

Table 5: HughesNet Satellite Business Plans[36]

Business Package	Internet Speed (Down/Up)	Monthly Data Allowance (Business Period + Anytime)	Monthly Price
Select 100	10 Mbps / 1 Mbps	20 GB + 10 GB	$79.99
Select 200	10 Mbps / 2 Mbps	30 GB + 10 GB	$99.99
Select 300	10 Mbps / 2 Mbps	40 GB + 10 GB	$129.99
Select 400	15 Mbps / 2 Mbps	50 GB + 10 GB	$159.99

Exede Internet also offers residential and business satellite services in the City-Parish. Residential plans provide 12 Mbps download and 3 Mbps upload, starting at $59.99 per month for 10 GB of data and increasing to 18 GB for $99.99 or 30 GB for $149.99. After reaching the monthly data cap, download speeds are reduced to 1 Mbps to 5 Mbps.

Exede's Business Class product provides 15 Mbps download speeds and 4 Mbps upload. There are two separate 30 GB data caps that run from 8 a.m. to 3 a.m. and 3 a.m. to 8 a.m. providing 60 GB total per month.[37]

2.2.2.5 Wireless

Verizon offers two 4G LTE data packages with multiple choices for data allowances and pricing, depending on the desired mobility and equipment chosen. The HomeFusion Broadband Package (LTE-Installed) is a data-only 4G LTE service with Wi-Fi connectivity and wired Ethernet for up to four devices. Available download speeds are 5 Mbps to 12 Mbps and upload speeds are 2 Mbps to 5 Mbps. Monthly prices range from $60 for a 10 GB data allowance to $120 for a 30 GB data cap. Overages are charged at $10 per additional GB. A two-year contract is required, with a $350

[35] http://www.hughesnet.com/plans-and-pricing/internet-service, accessed January 2017.
[36] http://business.hughesnet.com/plans-and-pricing/internet-service, accessed January 2017.
[37] https://www.inmyarea.com/internet/94557, accessed January 2017.

early termination fee. Verizon offers a $10 monthly deduction for every month completed in the contract.

Verizon also offers the Ellipsis JetPack (a wireless hotspot device) as a mobile solution, with download speeds of 5 Mbps to 12 Mbps and upload speeds of 2 Mbps to 5 Mbps. Prices for 12 options of data allowances range from $30 per month for a 4 GB data allowance to $335 per month for 50 GB of data, in addition to a monthly line access charge of $20. The device is $0.99 with a two-year contract, and requires an additional $35 activation fee.[38]

Sprint offers 4G LTE wireless data, with three data packages ranging from 100 MB per month data allowance for $15 per month, to 6 GB per month data allowance for $50 per month, to 30 GB per month data allowance for $110 per month. Data overages are billed at $.05 per megabyte. A two-year contract is required, as well as an activation fee of $36 and equipment charges for three different types of devices. There is an early termination fee of $200.

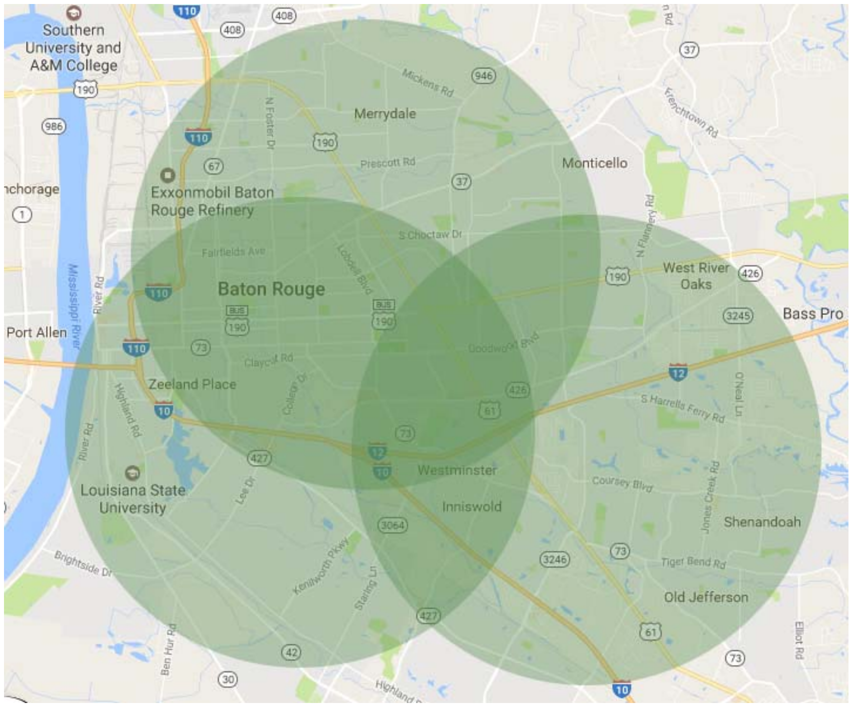
AT&T also offers 4G LTE wireless data service under three service packages: a 250 MB per month download allowance for $14.99 per month, a 3 GB per month download allowance for $30 per month and a 5 GB per month download allowance for $50 per month. There is an overage fee of $10 per 1 GB over the limit. There are also variable equipment charges, with or without a contract, and an activation fee up to $45.[39]

T-Mobile offers a wireless data option for $20 per month with a limit of 2 GB per month. T-Mobile offers additional capabilities and increasing data limits at incremental costs for a total of five packages, up to $80 per month for up to 18 GB of data. Depending upon current promotions, the $35 activation fee is sometimes waived. [40]

Mobius is a wireless ISP that offers residential internet services in Baton Rouge. Mobius also offers business internet service with scalable speeds in the City.[41] Mobius' network map is depicted in Figure 13.

[38] http://www.verizonwireless.com/support/wireless-internet-data-only/, accessed January 2017
[39] https://www.att.com/shop/wireless/plans/planconfigurator.html, accessed January 2017
[40] http://www.t-mobile.com/cell-phone-plans/mobile-internet.html, accessed January 2017
[41] http://www.mobiusisit.com/internet.html, accessed January 2017

Figure 13: Mobius Coverage Map



2.3 Inventory of City-Parish Assets that Could Support Future Broadband Deployment

From discussions with City-Parish stakeholders, we identified assets that may be of value in broadband deployment, either for a middle-mile network serving government, institutions, and businesses, or for a last-mile network that also extends to residences and small businesses.

These assets fall into three main categories:

1) Fiber optic strands negotiated through franchise agreements that are available for government use

2) Fiber and conduit infrastructure constructed by the City-Parish for traffic communications

3) Streetlights that may be used for installation of wireless communications

2.3.1 Franchise Agreement Fiber

The City-Parish has negotiated with Level(3) and CenturyLink the use of four strands of single-mode fiber where the companies construct fiber cables. In addition, the City-Parish can request for the companies to extend the fiber into buildings and pay the cost of the incremental construction.

Through these arrangements, the City-Parish has connected approximately 40 locations over fiber and connected them with its own equipment at speeds up to 10 Gbps. The City-Parish recently upgraded the equipment, so it is relatively up-to-date and early in its life. The fiber is approximately 10 years old.

The fiber is configured in two rings, one in the downtown area and one extending from downtown to the airport. The fiber routes serve most of the City-Parish buildings in the downtown and airport areas, with government and educational locations outside the area served by AT&T, CenturyLink, or Cox. The exact routing of the fiber is not known to the City-Parish.

The City-Parish has described the arrangement as robust and directed CTC to use this franchise agreement fiber as a starting point for designing a candidate network to serve government and educational facilities, rather than overbuilding or replacing it. It is our understanding from discussions with the City-Parish that the fiber is limited to government and educational use and cannot be used for private sector purposes.

2.3.2 Traffic Communications Fiber

The City-Parish operates a fiber and copper network to connect traffic signals and cameras. This infrastructure connects 550 City-Parish and State traffic signals; 60 percent of the signals are connected with fiber.

The fiber to the traffic signals is multimode fiber, which is more limited in capacity than the singlemode fiber commonly used for broadband communications. Relative to singlemode fiber, multimode fiber is limited to lower bandwidth and shorter distances. The fiber to traffic cameras is mostly singlemode.

The fiber is all underground, in 2-inch conduit. The City-Parish does not have comprehensive maps of the fiber or conduit infrastructure.

If the City-Parish proceeds with its own fiber construction, we recommend that the fiber and conduit routes be documented using latitude/longitude mapping and integration with the City-Parish's GIS capabilities, as well as the conduit examined to determine if it has capacity for additional cables. We also recommend the City-Parish review how the infrastructure was funded, to determine if there are limitations on its use for non-traffic or non-government purposes.

Including the fiber and conduit in a future network design may reduce the time and cost of fiber expansion along the routes where it exists. The conduit alone may provide significant value, enabling the City-Parish to pull an additional cable through it, or, if it is full, replace the copper, multimode fiber, and smaller singlemode fiber cables with higher-count singlemode fiber cables that can serve the traffic signals and cameras as well as expanded broadband services.

2.3.3 Streetlights

The City-Parish reports that, in part resulting from the high maintenance and power costs it pays Entergy, it is in the process of setting up City-Parish owned streetlights in some corridors. There are approximately 35,000 streetlights in the City-Parish, and the City-Parish is in the process of converting 3,000 to municipally owned LED lights. Phillips will be the supplier. The City-Parish is working with Phillips to install a mesh-based wireless network as part of the LED lighting system, and to connect the mesh network to the wired traffic communications network.

Depending on the network design, the mesh-based network may have wider applicability, including support for additional Smart City efforts, public Wi-Fi, and partnerships with private entities. There may also be opportunities to coordinate the streetlight replacement and upgrade with deployment of “small cell” antennas by commercial wireless providers, which frequently look to municipal streetlights as desirable locations.

3 Discussions with City-Parish Stakeholders

An important step that informs our analysis is our discussions with key stakeholder groups about the perceived broadband needs from the perspective of consumers of all kinds in the City-Parish. As is often the case, and as we discussed briefly above, low-income neighborhoods seem to have the highest need. Private providers often claim that these areas are difficult to serve because there may be little ROI, and it can take significant capital costs to bring infrastructure to these areas.

Often, there may be only one provider in low-income areas, which means people whose homes or businesses are located there are forced by buy the only available services at whatever price the single provider elects to charge. Although there is a range of providers offering services throughout the City-Parish, not all services are available in all areas. In particular, it seems that, anecdotally, North Baton Rouge is especially vulnerable. Private providers are simply not building fiber infrastructure to low-income neighborhoods because of the uncertain ROI and the high cost to build fiber, and consumers in these areas suffer for it.

In addition to speaking with stakeholders that represent the residential market, we held discussions with business stakeholders of various sizes. One of the key concerns for business stakeholders is that, in some areas, the only available service is offered over antiquated DSL lines. In these cases, the service is often slow, and upload speeds are especially troubling. This can be hugely problematic for businesses that require connectivity to maintain smooth operations. Additionally, outages can be catastrophic for businesses.

The general consensus of the stakeholders we interviewed was agreement that the City-Parish should not become a retail service provider, competing directly with the private sector. Instead, the City-Parish should focus on infrastructure development, and potentially even “lighting” any fiber infrastructure it deploys to make it accessible to providers that do not have the funds to place network electronics on the fiber. If the City-Parish controls the infrastructure and lights the fiber, it can have some control over speeds by maintaining the electronics, which dictate the network’s speed.

4 Residential Market Research

As part of its efforts to evaluate and improve internet access and quality for its residents, the City-Parish conducted a survey of residents in early 2017.

4.1 Summary

Key findings include:

- Parish residents are highly connected, with 94 percent of respondents having some form of internet connection. Specifically, 85 percent of residents have home internet service and 83 percent have a cell/mobile telephone with internet service.
- Older, low-income, and less-educated respondents are less likely than their counterparts to have some form of internet access at their home.
- More than one-half of households use a cable modem internet connection, while much smaller shares have fiber, DSL, satellite, and other connections. The most frequent uses of home internet are online shopping and streaming movies, videos, or music. About 58 percent occasionally use the internet to access City-Parish information or services.
- Reliability of the internet connection ranks as the most important aspect, followed by connection speed and price paid. Residents are generally satisfied with the speed and reliability of their internet service.
- Respondents indicated a willingness to switch to a very high-speed internet connection, especially at monthly prices below $50 or for one-time hookup fees below $100.
- Four in 10 of respondents' employers allow telework, and more than one-fourth of responding households have a member who already teleworks.
- More than one-half of respondents have cable television, while one-fourth receive television service through the internet and 19 percent have satellite/Dish. Those under age 35 are less likely than older respondents to have cable television but are more likely to use the internet. The most important television programming features are local programming and news programming.
- About 45 percent of respondents said that the City-Parish should install a state-of-the-art communications network and either offer services or allow private companies to offer services to the public.

This section documents the survey process, discusses methodologies, presents results, and provides key findings that will help the City-Parish assess the current state and ongoing needs of its residents regarding high-speed communications services.

4.2 Survey Process

The City-Parish conducted a mail survey of randomly-selected residences in January 2017. The survey captured information about residents' current communications services, satisfaction with those services, desire for improved services, willingness to pay for faster internet speeds, and opinions regarding the role of the City-Parish regarding internet access and service. A copy of the survey instrument is included in Appendix D.

CTC and its partner market research firm, Clearspring Research, coordinated and managed the survey project, including development of the draft questionnaire, sample selection, mailing and data entry coordination, survey data analysis, and reporting of results.

4.2.1 Survey Mailing and Response

A mail survey was conducted with a random selection of households in East Baton Rouge Parish, LA. The sampling frame was obtained from InfoUSA, a nationally recognized provider of consumer databases with high coverage rates. The sample was selected randomly utilizing a computer algorithm.

A total of 3,750 survey packets were mailed first-class in January 2017 with a goal of receiving 600 valid responses.[42] Recipients were provided with a postage-paid business reply mail envelope in which to return the completed questionnaire. A total of 477 useable surveys were received by the date of analysis,[43] providing a gross[44] response rate of 12.7 percent. The margin of error for aggregate results at the 95 percent confidence level for 477 responses is ±4.5 percent, slightly outside the initial sample design criteria. That is, for questions with valid responses from all survey respondents, one would be 95 percent confident (19 times in 20) that the survey responses lie within ±4.5 percent of the population as a whole (roughly 156,000 households).

4.2.2 Data Analysis

The survey responses were entered into SPSS[45] software and the entries were coded and labeled. SPSS databases were formatted, cleaned, and verified prior to the data analysis. Address information was merged with the survey results using the unique survey identifiers printed on each survey. The survey data was evaluated using techniques in SPSS including frequency tables, cross-tabulations, and means functions. Statistically significant differences between subgroups

[42] CTC purchased a database of households that were selected at random.

[43] At least five responses were received after analysis had begun, and are not included in these results.

[44] 245 surveys were undeliverable, mostly vacant residences. The "net" response rate is 477/(3,750-245) = 13.6%.

[45] Statistical Package for the Social Sciences (http://www-01.ibm.com/software/analytics/spss/)

of response categories are highlighted and discussed where relevant.

The survey responses were weighted based on the age of the respondent. Since older persons are more likely to respond to surveys than younger persons, the age-weighting corrects for the potential bias based on the age of the respondent. In this manner, the results more closely reflect the opinions of the adult population as a whole in East Baton Rouge Parish.

Table 8 and Figure 14 summarize the weighting used for survey analysis.

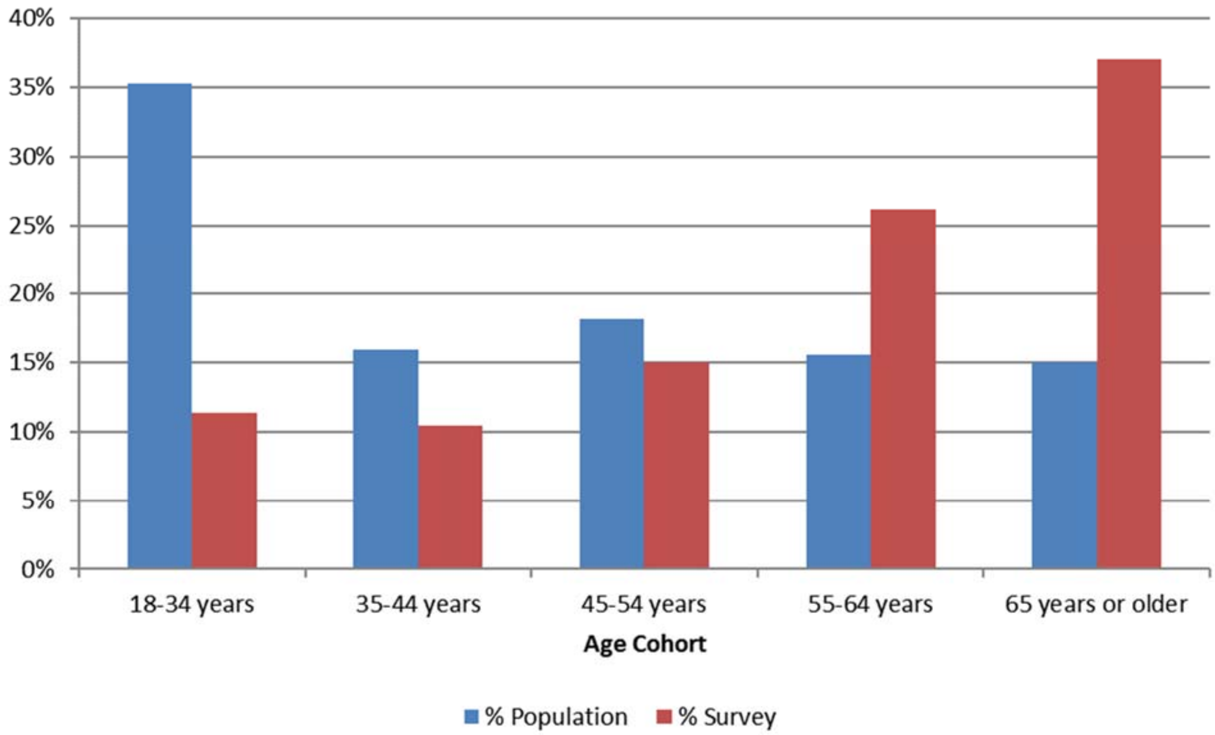
Table 8: Age Weighting

Age Cohort	Census Population[46]	**Survey Responses	Weight
18-34*	112,781	53	3.107
35-44	50,932	49	1.518
45-54	58,226	70	1.215
55-64	49,831	122	0.596
65+	48,030	173	0.405
Total	319,800	467	

*For Census data, the 20-34 age cohort was used since many younger adults will not live in separate households.
**Not all respondents provided their age.

[46] Source: U.S. Census Bureau, 2010 Census, Adult Population in East Baton Rouge Parish, LA.

Figure 14: Age of Respondents and East Baton Rouge Adult Population



The following sections summarize the survey findings.

4.3 Survey Results

The results presented in this report are based on analysis of information provided by 477 sample respondents from an estimated 172,000 households in East Baton Rouge Parish.[47] Results are representative of the set of City-Parish households with a confidence interval of ±4.5 percent at the aggregate level.

Unless otherwise indicated, the percentages reported are based on the "valid" responses from those who provided a definite answer and do not reflect individuals who said "don't know" or otherwise did not supply an answer because the question did not apply to them. Key statistically-significant results ($p \leq 0.05$) are noted where appropriate.

4.3.1 Home Internet Connection and Use

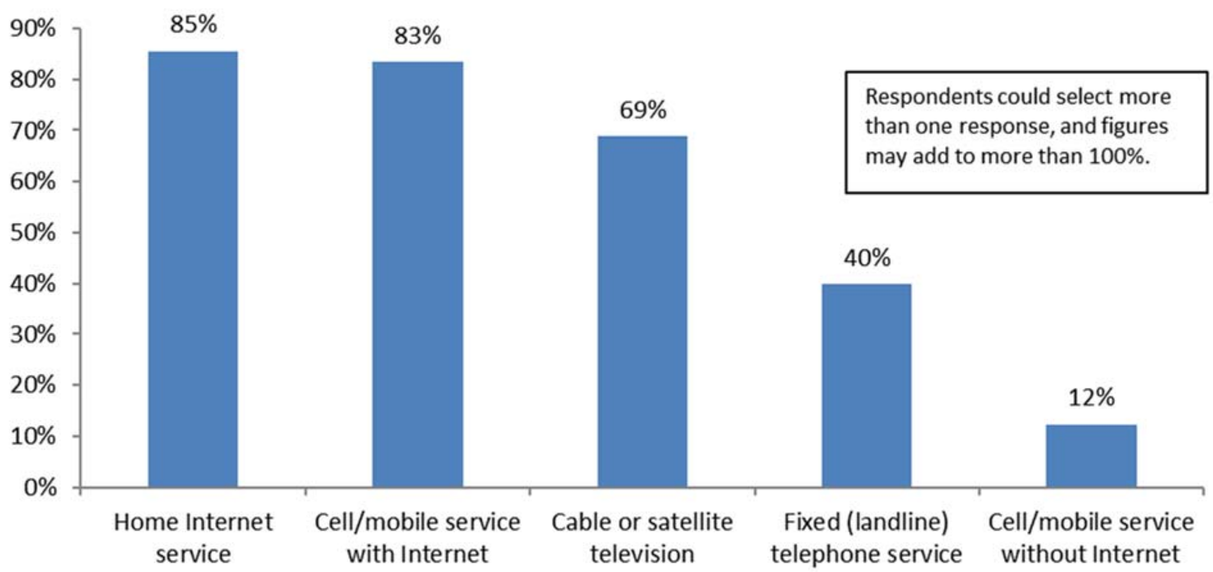
Respondents were asked about their home internet connection types and providers, use of the internet for various activities, and satisfaction and importance of features related to internet service. This information provides valuable insight into residents' need for various internet and related communications services.

[47] Source: U.S. Census Bureau, 2010 Census, Number of Households in East Baton Rouge Parish, LA.

4.3.1.1 Communications Services

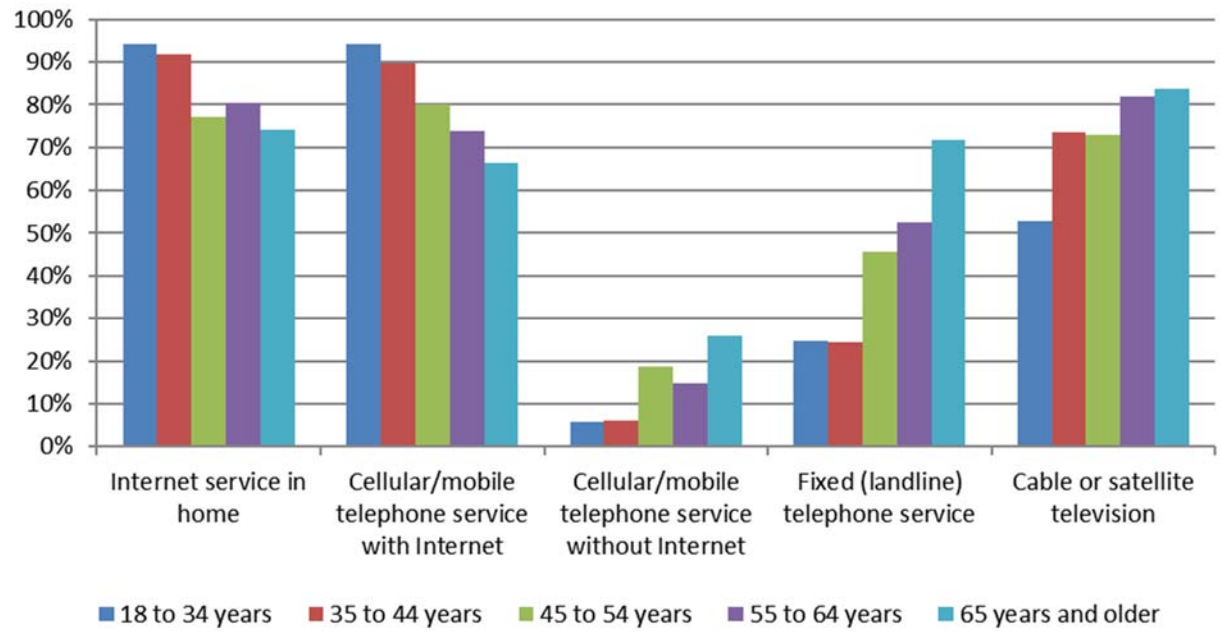
Respondents provided information about the communication services currently purchased for their household. As illustrated in Figure 15, 85 percent of respondents purchase home internet service, and 83 percent purchase cellular/mobile telephone service with internet. (94 percent have some internet access—either a home connection or via smartphone.) Nearly seven in 10 respondents purchase cable or satellite television service. Additionally, four in 10 have fixed (landline) telephone service, and 12 percent have cellular/mobile service without internet.

Figure 15: Communications Services Purchased



Use of communication services is correlated with the age of the respondent. In particular, those ages 18 to 44 are more likely to have internet service in the home or to have cellular/mobile telephone service with internet. They are less likely than older respondents to have a fixed (landline) telephone service or cellular/mobile telephone service without internet. Purchase of cable or satellite television service is lower among those less than age 35, as shown in Figure 16.

Figure 16: Services Purchased by Age of Respondent



The use of some communication services is also associated with education level and household income (even when controlling for age of respondent). In particular, respondents who earn under $50,000 per year and those with a high school education or less are less likely to purchase internet service in the home or to purchase cellular/mobile telephone service with internet (see Figure 17 and Figure 18).

Figure 17: Services Purchased by Household Income

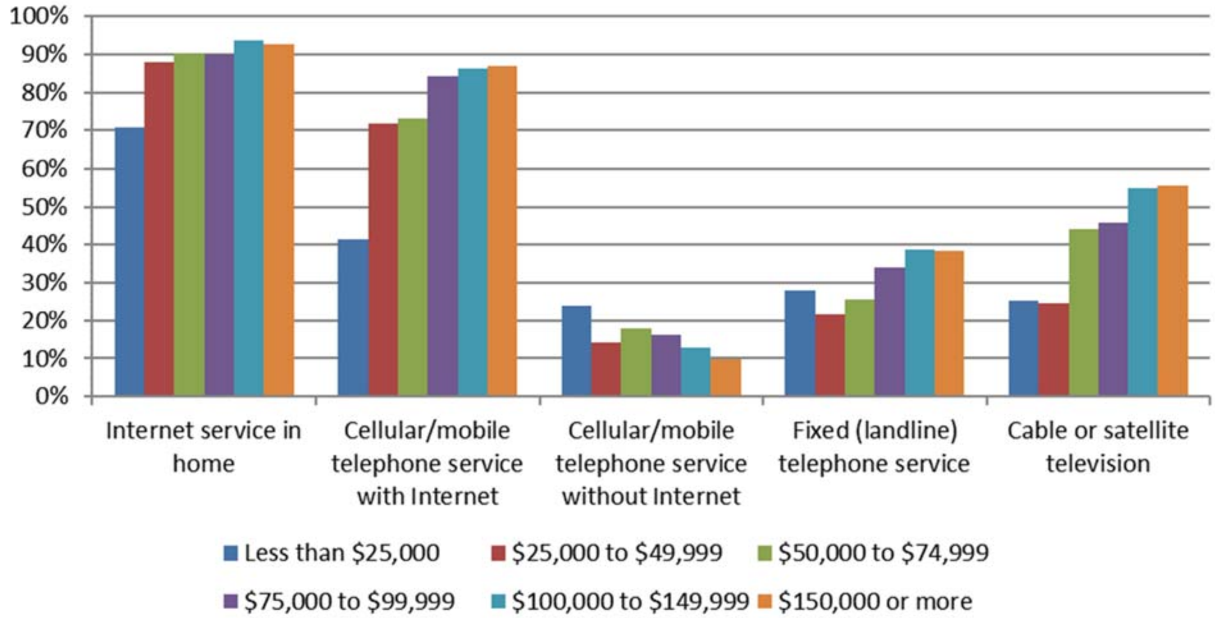
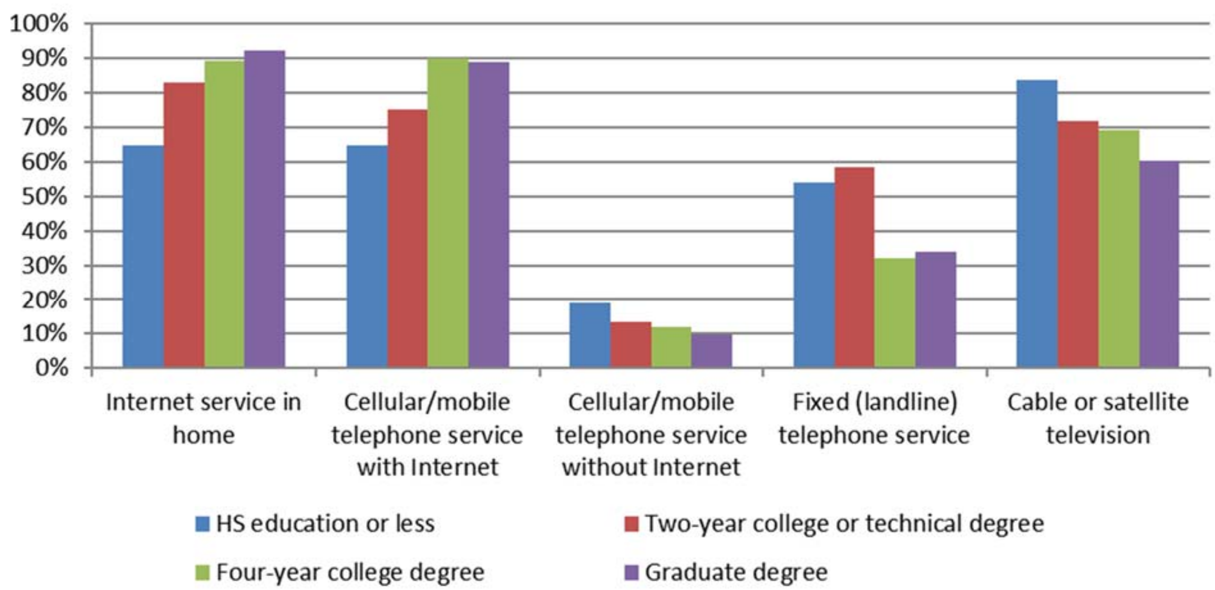


Figure 18: Services Purchased by Education



As discussed previously, a majority of respondents have some internet access, including 75 percent who have both home internet service and a cellular/mobile telephone service with internet (smartphone). Approximately 11 percent of respondents have a home connection only (no smartphone), and 9 percent have a smartphone only (no home internet). As indicated in

Figure 19, 94 percent of respondents reported having some internet access. Total internet access by demographics is illustrated in Table 9.

Figure 19: Purchase Internet Services

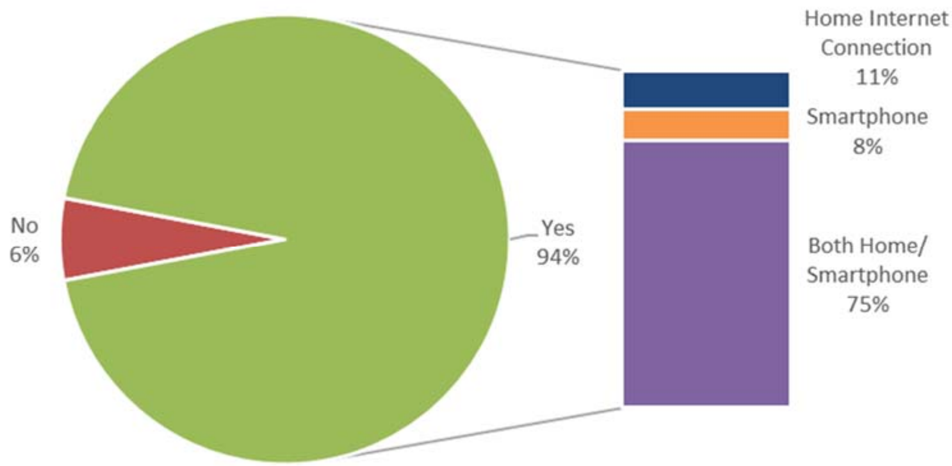


Table 9: Internet Access by Key Demographics

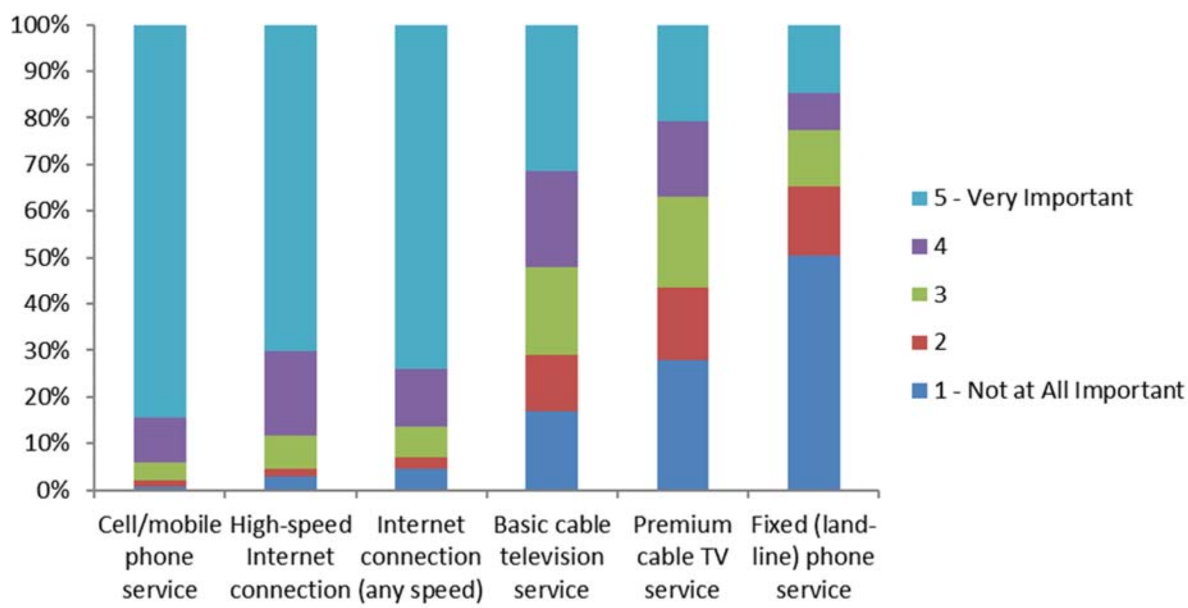
		Home Internet Connection Only	Smartphone Only	Both Home/ Smartphone	Total Internet Access	No Internet Access	*Count*
Gender	Female	11%	10%	71%	92%	8%	242
	Male	11%	7%	79%	97%	3%	224
Age Group	18 to 34 years	4%	4%	91%	98%	2%	165
	35 to 44 years	10%	8%	82%	100%	0%	74
	45 to 54 years	10%	13%	67%	90%	10%	85
	55 to 64 years	19%	12%	61%	93%	7%	73
	65 years and older	20%	13%	54%	87%	13%	70
Race/ Ethnicity	Other race/ethnicity	15%	16%	57%	88%	12%	120
	White/Caucasian only	9%	6%	81%	97%	3%	339
Education Level	HS education or less	12%	12%	52%	77%	23%	71
	Two-year college or technical degree	20%	12%	63%	95%	5%	68
	Four-year college degree	8%	9%	81%	98%	2%	174
	Graduate degree	9%	6%	83%	98%	2%	153
Household Income	Less than $50,000	17%	11%	53%	81%	19%	100
	$50,000 to $99,999	12%	5%	80%	97%	3%	170
	$100,000 to $149,999	5%	7%	88%	100%	0%	85
	$150,000 or more	4%	9%	86%	99%	1%	85
Number of Children in Household	No Children in HH	11%	8%	75%	94%	6%	322
	Children in HH	8%	10%	78%	96%	4%	141
Total Household Size (Adults + Children)	1	12%	4%	71%	87%	13%	76
	2	10%	10%	77%	96%	4%	201
	3	21%	6%	71%	98%	2%	63
	4 or more	5%	9%	80%	94%	6%	122
Own or Rent Residence	Own	11%	9%	75%	95%	5%	397
	Rent	6%	7%	80%	93%	7%	65
Year at Current Address	Less than 1 year	5%	6%	89%	99%	1%	63
	1 to 2 years	9%	6%	84%	99%	1%	67
	3 to 4 years	7%	5%	84%	97%	3%	58
	Five or more years	13%	11%	68%	92%	8%	277

4.3.1.2 Importance of Communication Services

Respondents were asked about the importance of various communications services to their household. internet and cell/mobile phone services were by far the most important, with at least seven in 10 saying cell/mobile phone service, High-speed internet service, or internet connection of any speed are "very important," as illustrated in Figure 20.

Just a small segment of respondents placed moderate or high importance on basic cable television service, premium cable television service, or fixed (landline) telephone service. Although 32 percent of respondents indicated that basic cable television service is of some importance, 17 percent said it is "not at all important." Furthermore, 28 percent said premium cable television service is "not at all important," and 51 percent said fixed (landline) telephone service is "not at all important." As noted previously, only 40 percent of City-Parish homes have landline telephone service.

Figure 20: Importance of Communications Service Aspects



For households without home internet service, the importance placed on cell/mobile telephone service, high-speed internet service, or internet connection of any speed is much lower than for those with some form of internet access. Just a small segment of respondents with no internet access said these features are "very important." This implies that there is <u>not</u> a sizeable gap between desire for internet services and access to these services, but again this is based on a very small segment of respondents (see Figure 21).

Figure 21: Importance of Communication Services by Home Internet Service

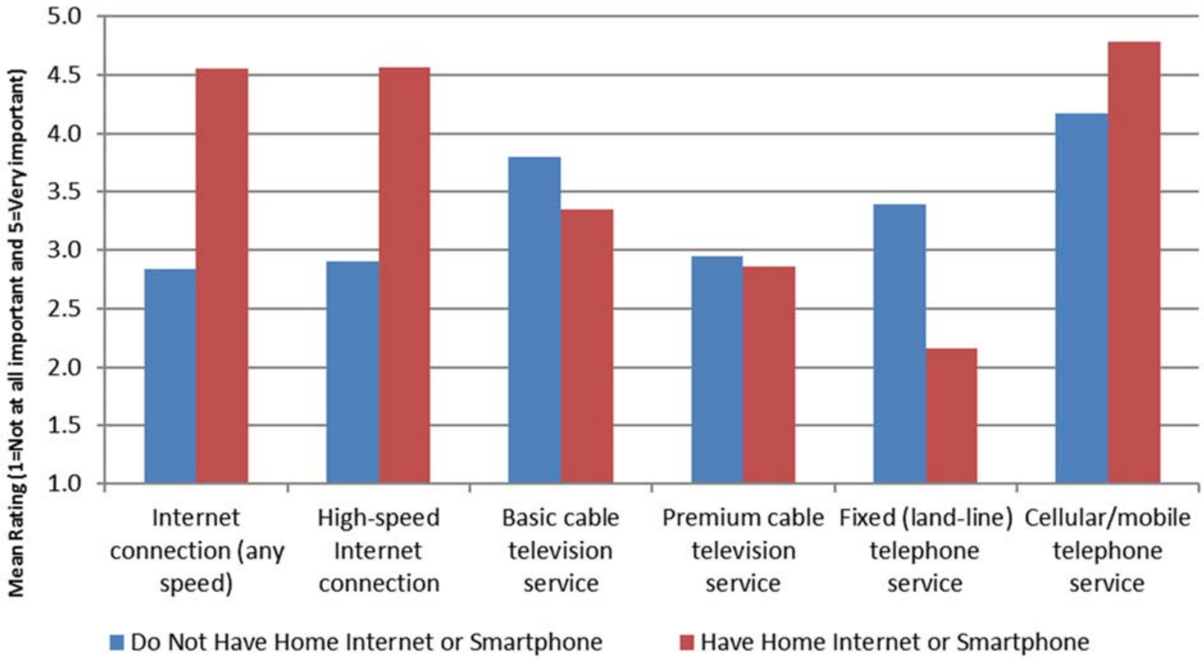
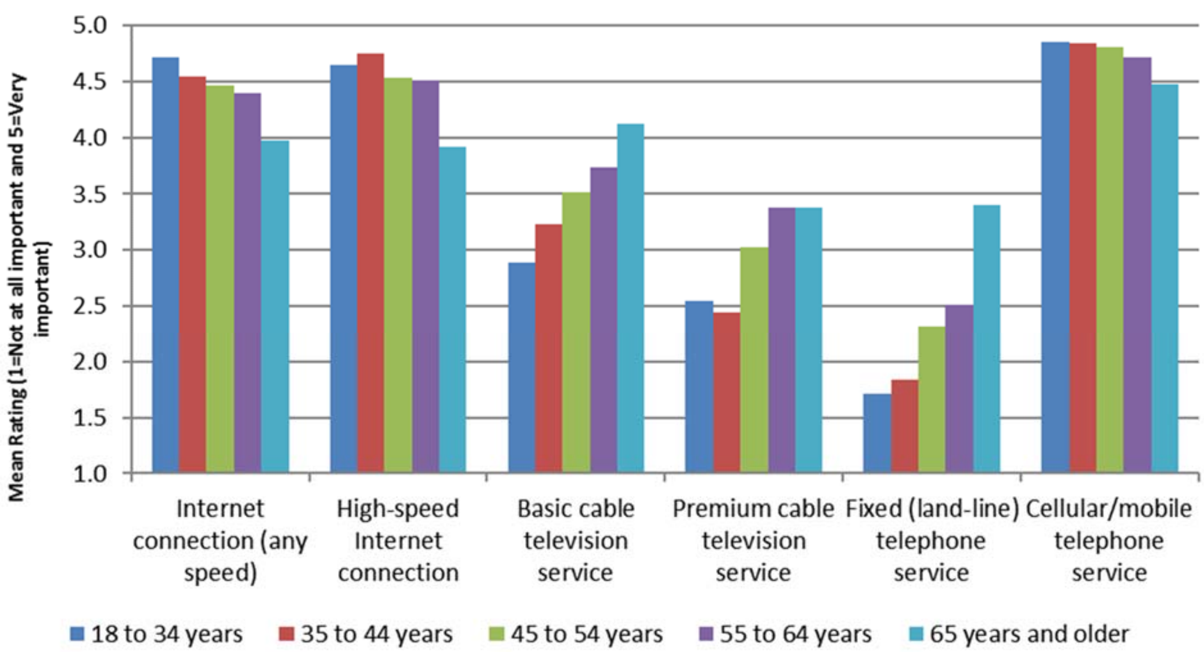


Figure 22 illustrates the importance of communications services by the age of the respondent. The importance of an internet connection and cellular telephone service is lower for those ages 65 and older. Conversely, the importance of cable television and landline telephone services tends to increase with the age of the respondent.

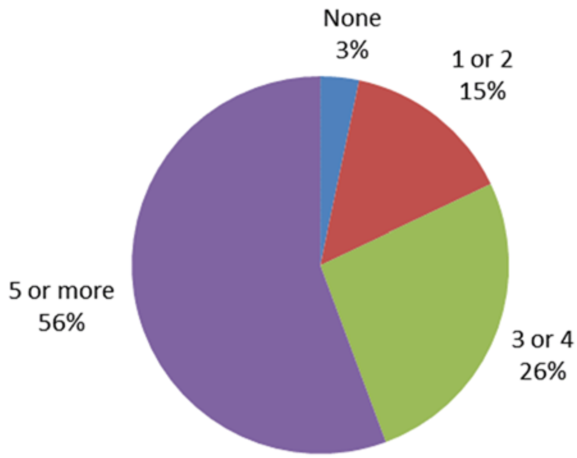
Figure 22: Importance of Communication Services by Age of Respondent



4.3.1.3 Personal Computing Devices

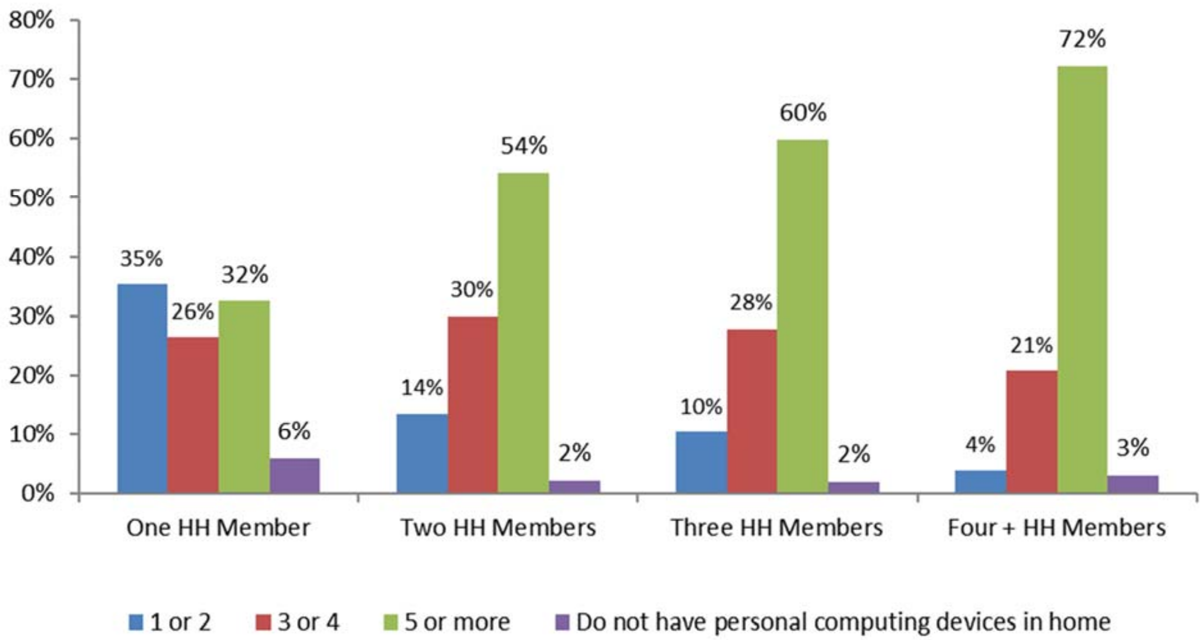
Respondents were asked to indicate the number of personal computing devices they have in the home. As might be expected, all respondents with internet access (either home connection or smartphone) have at least one personal computing device. Additionally, 44 percent of respondents without internet access also have a personal computing device. More than one-half of respondents have five or more personal computing devices. Another 26 percent have three or four devices, and 15 percent have one or two devices (see Figure 23).

Figure 23: Number of Personal Computing Devices



The number of personal computing devices in the home correlates with the number of people residing in the home. Nearly three-fourths of households with four or more residents have at least five personal computing devices (see Figure 24).

Figure 24: Number of Personal Computing Devices in Home by Household Size



Those with household earnings under $50,000 per year and those with a high school education or less are less likely than their counterparts to have home internet or personal computing devices, although saturations are still relatively high (see Figure 25 and Figure 26).

Figure 25: Have Computing Device(s) and Internet in Home by Level of Education

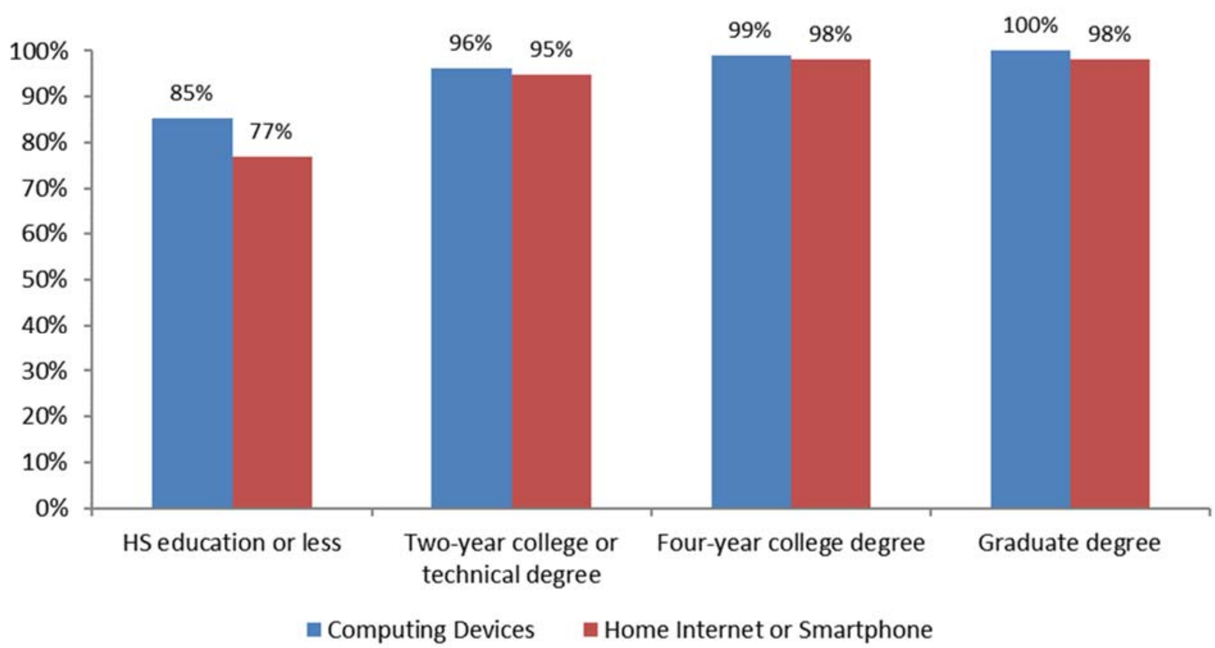
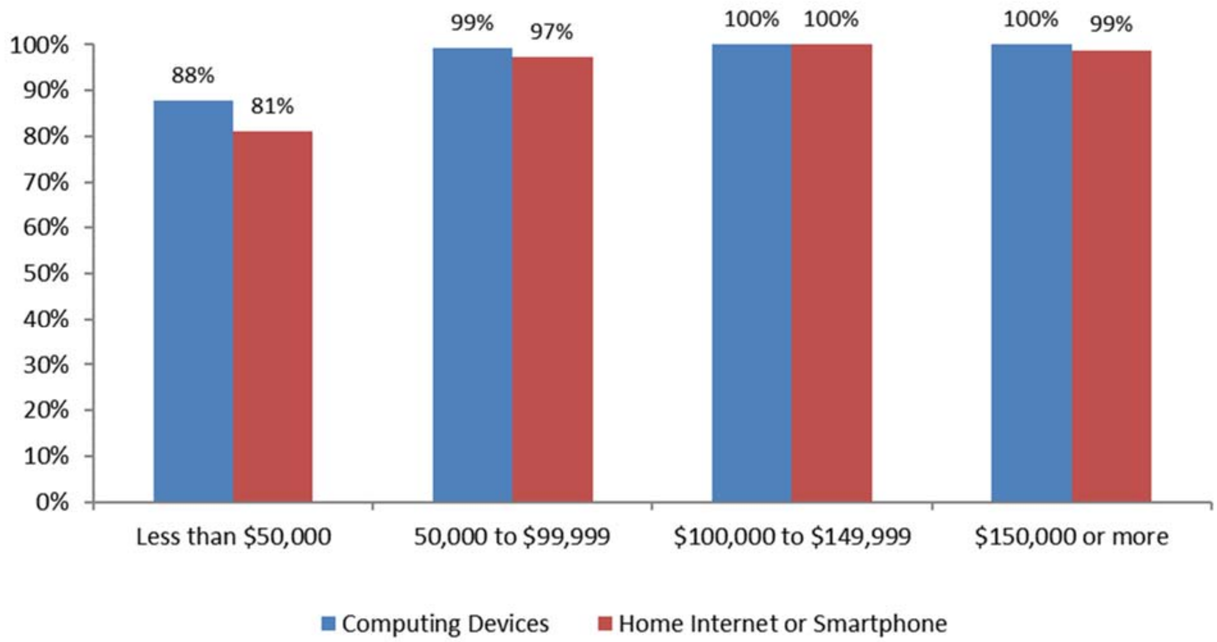


Figure 26: Have Computing Device(s) and Internet in Home by Household Income

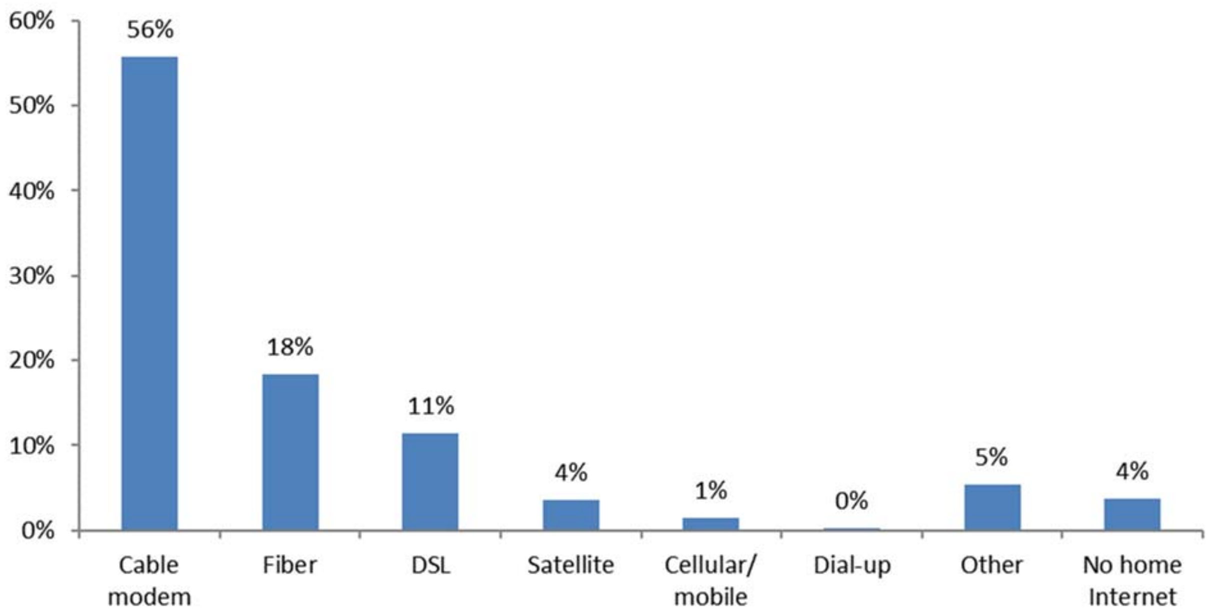


4.3.1.4 Internet Services Purchased

Respondents were asked about their purchase of internet services for their home, as well as the cost and speed of services purchased.

As shown in Figure 27, a majority of homes (96 percent) reported having home internet service, consistent with 94 percent reporting internet access via a home connection or via a Smartphone in Question 1. More than one-half of respondents have a cable modem connection as their primary home internet connection, 18 percent have fiber-optic, and 11 percent have DSL. Only 1 percent indicated that they use a cellular/mobile device as their primary internet connection at home.

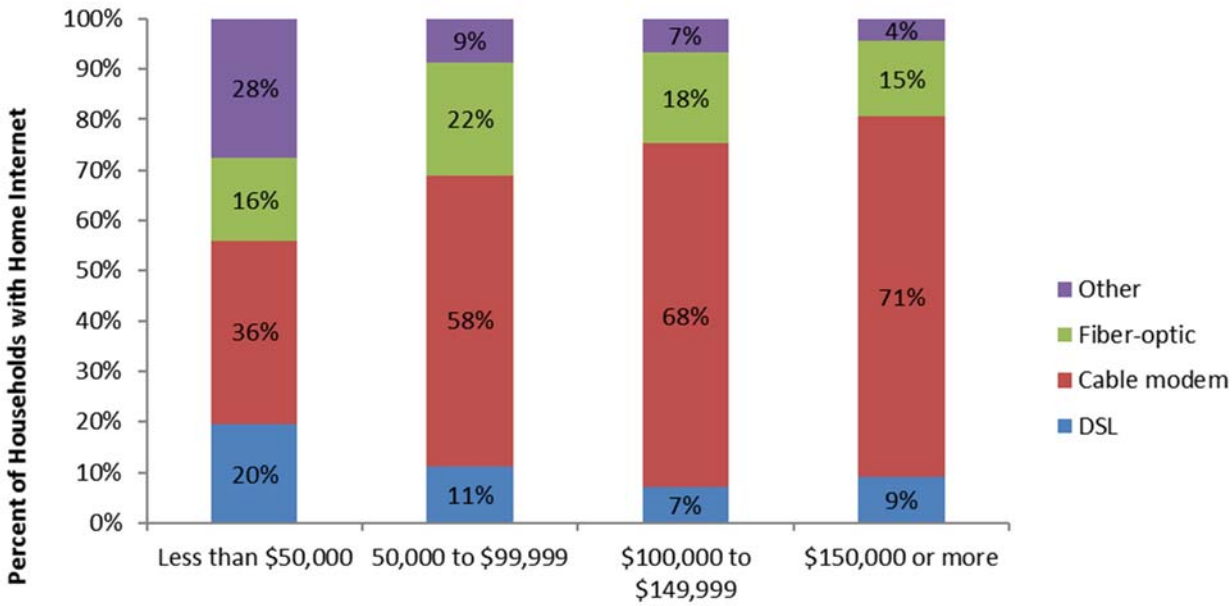
Figure 27: Primary Home Internet Service



Ten of 18 responding households without internet access (and who provided a response) said that the expensive cost is the main reason for not purchasing home internet service.

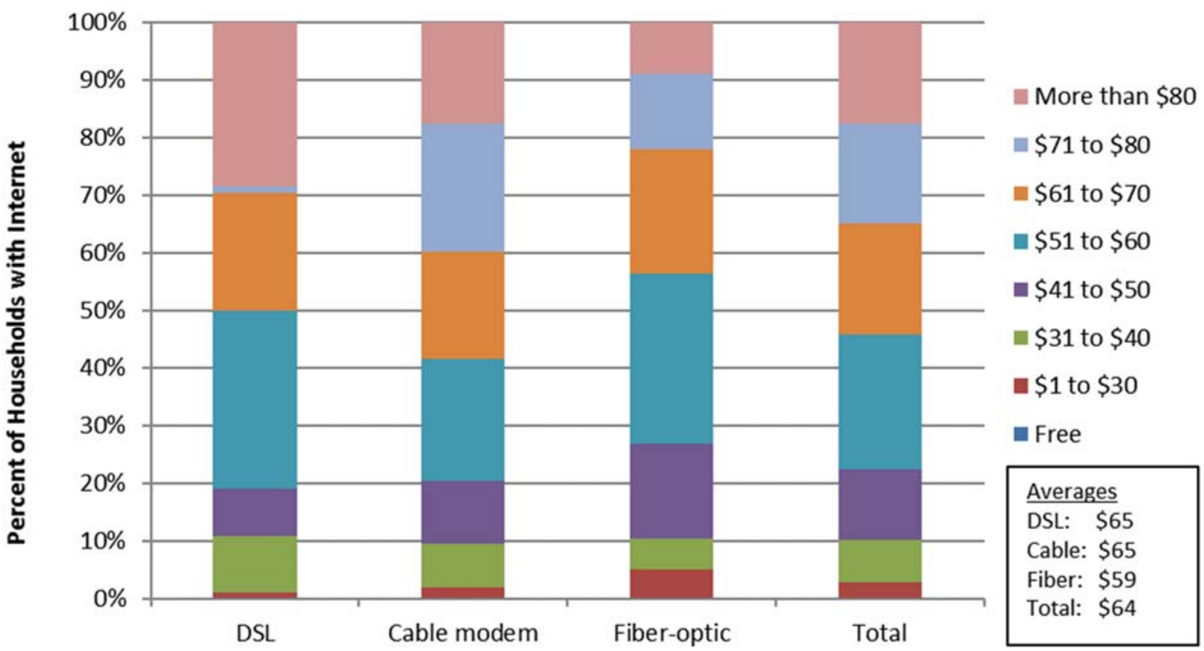
Purchase of home internet connection or a Smartphone was discussed in detail in the previous section. However, among those with home internet the specific connection type also varies significantly by household income. Specifically, those with household incomes below $50,000 per year are less likely than those with a higher household income to have a cable modem connection, and they are more likely to have DSL or another type of internet connection, as shown in Figure 28.

Figure 28: Primary Home Internet Service by Household Income



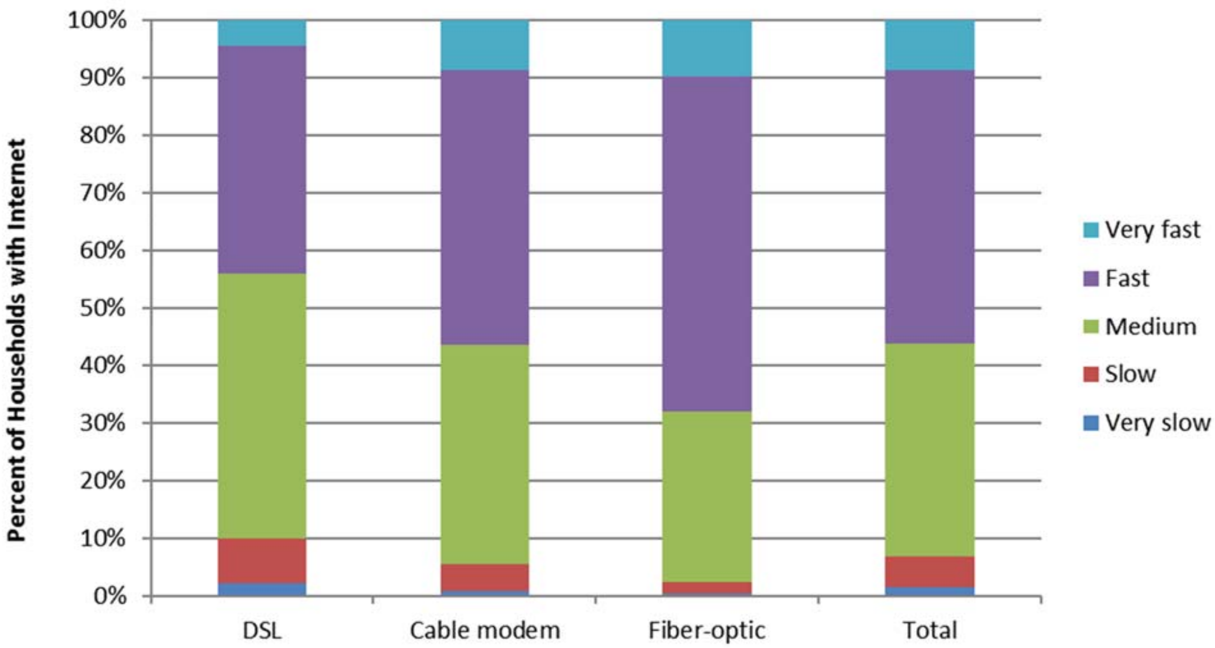
Respondent households pay approximately $64 per month for internet service, on average. More than one-half of respondents with home internet pay over $60 per month, while nearly one-half pay $60 or less per month. The average monthly price is the same for cable and DSL, as illustrated in Figure 29.

Figure 29: Estimated Average Monthly Price for Internet Service



Most internet subscribers described their internet speed as “medium” (37 percent) or “fast” (47 percent), while only six percent said it was “slow” or “very slow.” Fiber-optic internet subscribers rated their connection speed as somewhat faster, with two-thirds saying it is “fast” or “very fast,” as illustrated in Figure 30.

Figure 30: Internet Speed (Respondent Opinion)



4.3.1.5 Internet Service Aspects

Respondents were asked to rate their levels of importance and satisfaction with various internet service aspects. Respondents rated connection reliability as the most important aspect, followed by the connection speed and price, as shown in Table 10.

Table 10: Importance of Internet Service Aspects

Service Aspect	Mean	Top-Two Box Percentages: Somewhat Important	Top-Two Box Percentages: Very Important
Speed of Connection	4.5	27%	67%
Reliability of Connection	4.8	13%	86%
Price of Services	4.4	22%	73%
Overall Customer Service	4.2	27%	53%
Ability to Bundle with TV service	2.4	13%	22%

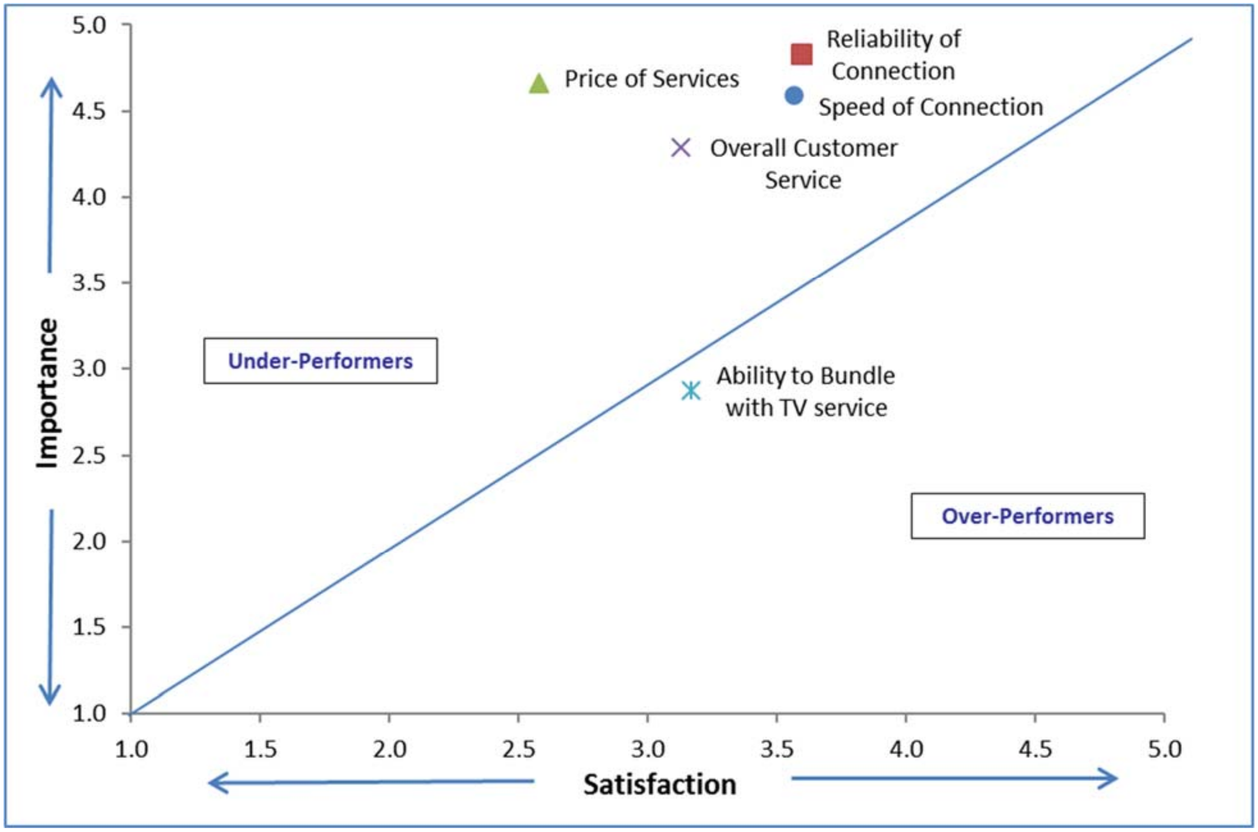
Respondents also rated the speed and reliability of their connection as the aspects with which they are most satisfied, as shown in Table 11. The lowest satisfaction aspect was for the price of service, which is typical in satisfaction surveys.

Table 11: Satisfaction with Service Aspects

Service Aspect	Mean	Top-Two Box Percentages
Speed of Connection	3.7	40% 17%
Reliability of Connection	3.7	40% 21%
Price of Services	2.6	11% 6%
Overall Customer Service	2.9	27% 11%
Ability to Bundle with TV service	3.0	21% 15%
Somewhat Satisfied Very Satisfied		0% 20% 40% 60% 80% 100%

A comparison of the importance placed upon internet service aspects and satisfaction levels provides insight into aspects that are meeting consumers' needs and aspects where satisfaction falls short of importance levels. The importance scores and performance scores were plotted to help visually determine areas in which internet service providers are doing well and areas that might need improvement. The "upper quadrant" of this "quadrant analysis" indicates that the price is the largest "underperforming" aspect (that is, they are farthest from the equilibrium line), followed by reliability, customer service, and connection speed, as illustrated in Figure 31.

Figure 31: Internet Service Aspect "Quadrant" Analysis



The difference between importance and satisfaction of home internet aspects is also presented in the "gap" analysis table (see Table 12). The largest gaps between importance and performance are for price, reliability, and overall customer service. Note that reliability has one of the highest satisfaction rankings, but the importance of reliability is extremely high.

Table 12: Internet Service Aspect "Gap" Analysis

	Mean Satisfaction	Mean Importance	GAP < = >	Customer Expectations
Price of Services	2.6	4.7	-2.1	Not Met
Reliability of Connection	3.6	4.8	-1.2	Not Met
Overall Customer Service	3.1	4.3	-1.2	Not Met
Speed of Connection	3.6	4.6	-1.0	Not Met
Ability to Bundle with TV service	3.2	2.9	0.3	Exceeded

4.3.1.6 Willingness to Pay for Faster Internet

Respondents were asked if they would be willing to switch to very fast internet service (1 Gbps) for various price levels. The mean willingness to switch across this array of questions is illustrated in Figure 32, while detailed responses are illustrated in Figure 33.

Figure 32: Mean Willingness to Switch to 1 Gbps Internet at Price Levels

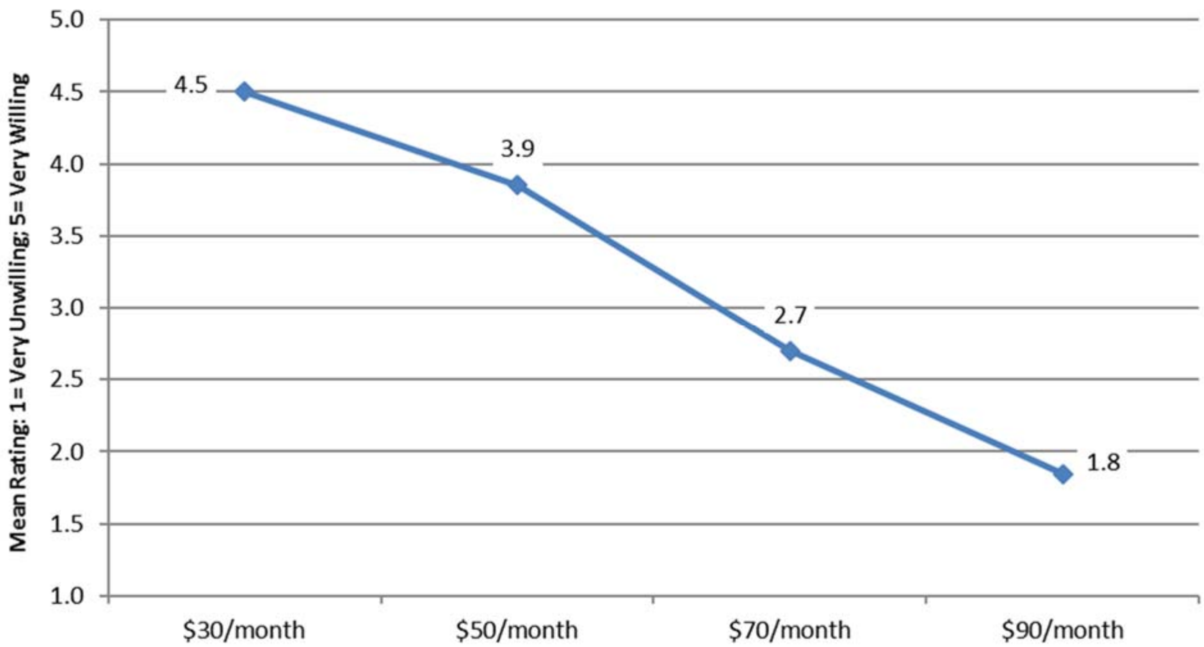
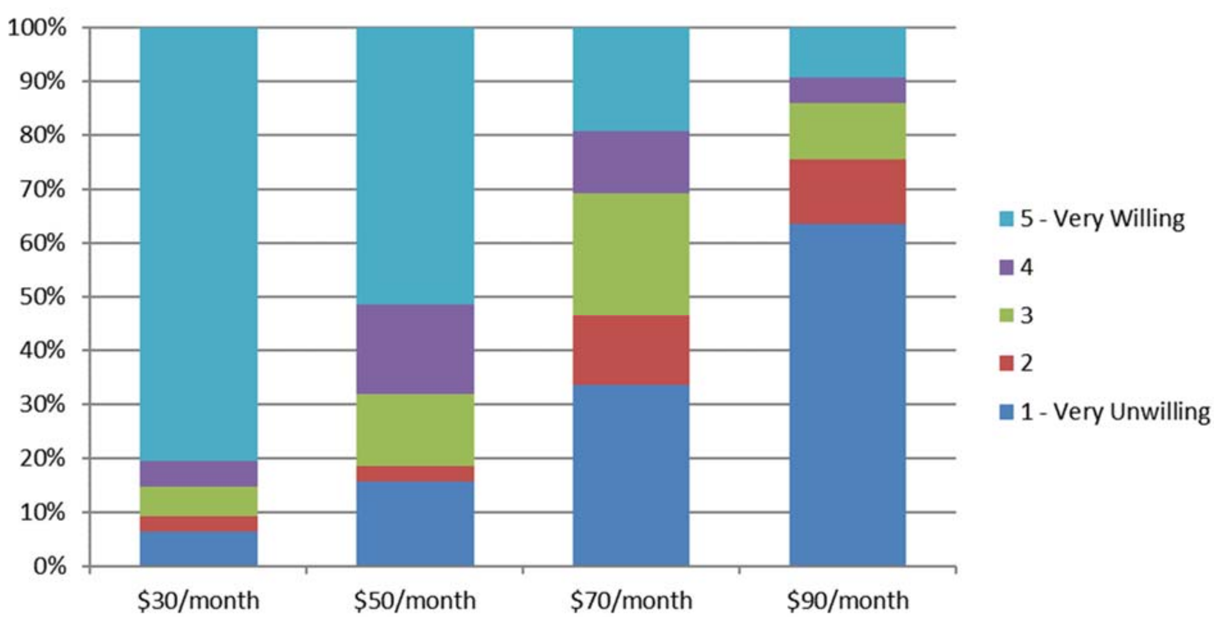


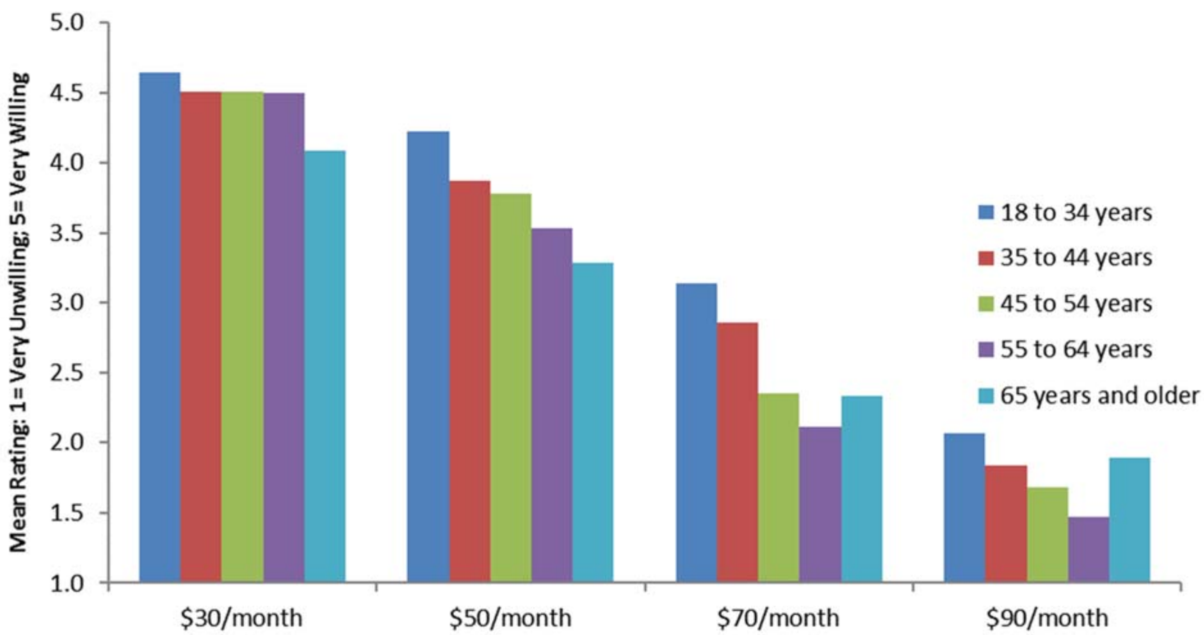
Figure 33: Willingness to Switch to 1 Gbps Internet at Various Price Levels



As depicted in Figure 34 and Figure 35, respondents' willingness to switch to very fast internet service (defined at 1 Gbps service in the survey) is very high at $30 per month, but drops considerably as the price increases. At a price of approximately $70 per month, the mean rating falls below 3.0 (neither willing nor unwilling). From another perspective, 85 percent are somewhat or very willing to switch to 1 Gbps internet for $30 per month, dropping to 68 percent at $50 per month, 31 percent at $70 per month, and 14 percent at $90 per month.

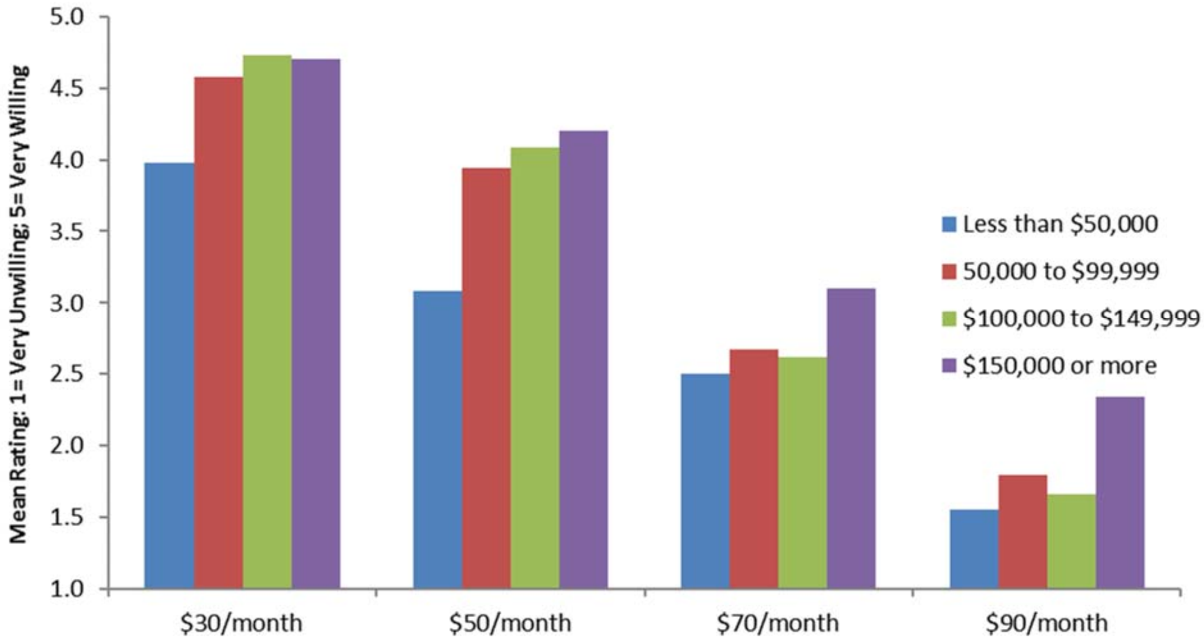
The willingness to switch to very fast internet service is higher among younger respondents, particularly those ages 18 to 34 (see Figure 34).

Figure 34: Willingness to Switch to 1 Gbps Internet by Age of Respondent



Additionally, willingness to switch is correlated with household income. Those earning less than $50,000 per year would be less willing to switch at the $30 and $50-per-month price points, compared with those earning a higher household income. At the $70 and $90-per-month price points, the greatest willingness to switch is among the highest earners (those earning $150,000 or more annually; see Figure 35), which is intuitive.

Figure 35: Willingness to Switch to 1 Gbps Internet by Price and Household Income



4.3.1.7 Internet Uses and Importance

Respondents were asked about their use of the internet for various activities, as illustrated in Figure 36. Among those items listed, the internet is most frequently used for shopping (69 percent) and watching movies, videos, or TV (68 percent). Approximately one-half frequently use the internet for listening to music. Although nearly six in 10 occasionally use the internet to access government information or services; just 17 percent use the internet frequently for this purpose. Use of the internet for playing online games, making video calls, and running a home business is less frequent than the other activities included in this question.

The use of the internet for some activities varies by age, as illustrated in Figure 37. Younger respondents are much more likely to use the internet for many applications, especially listening to music and watching videos or movies. With the exception of accessing government information and services, internet subscribers ages 65+ are less likely to ever use the internet for the various activities evaluated.

Figure 36: Frequency of Home Internet Activities

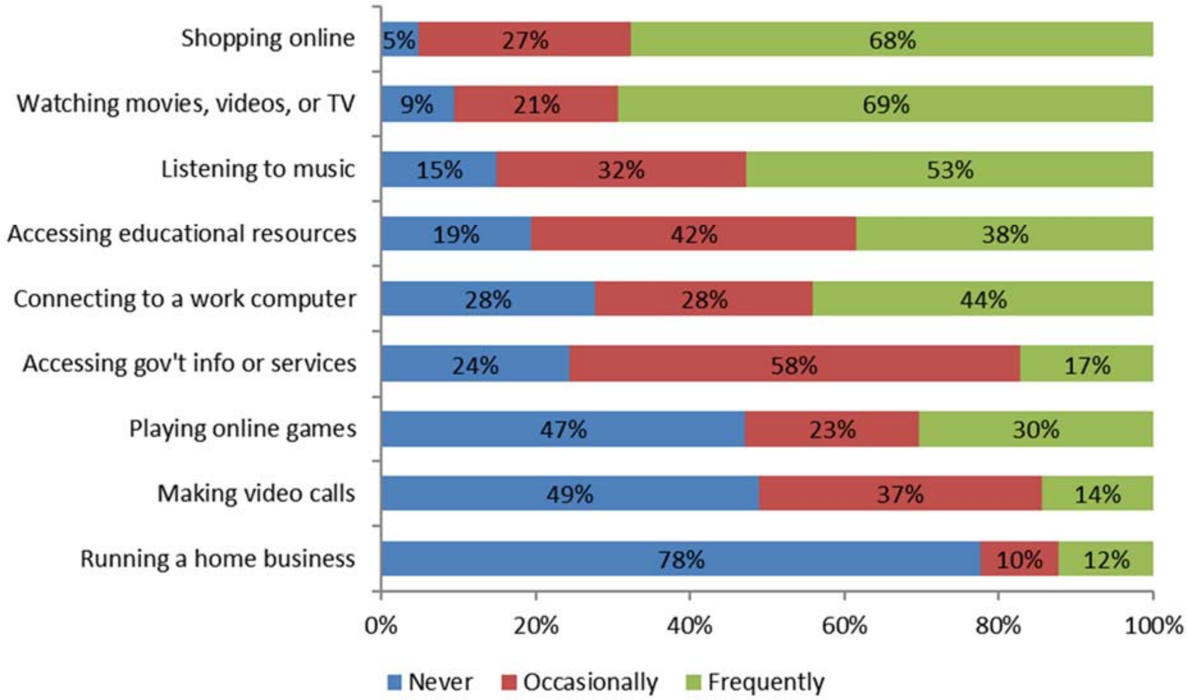
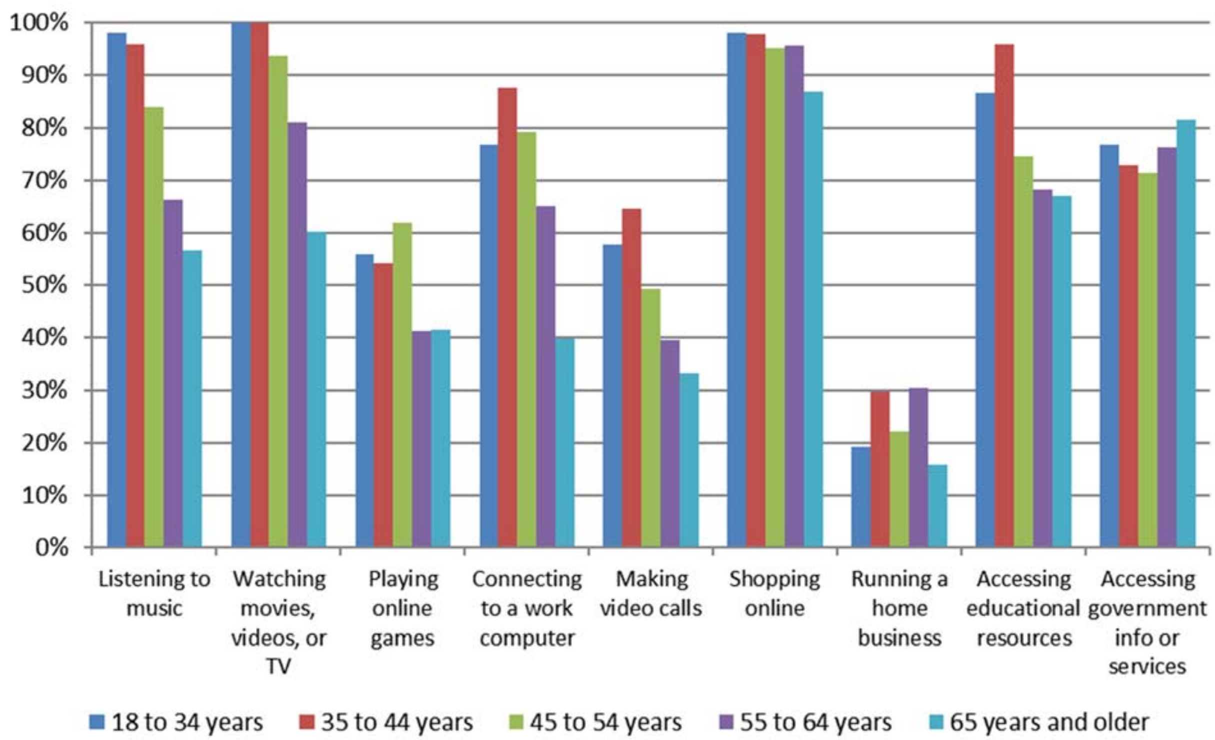
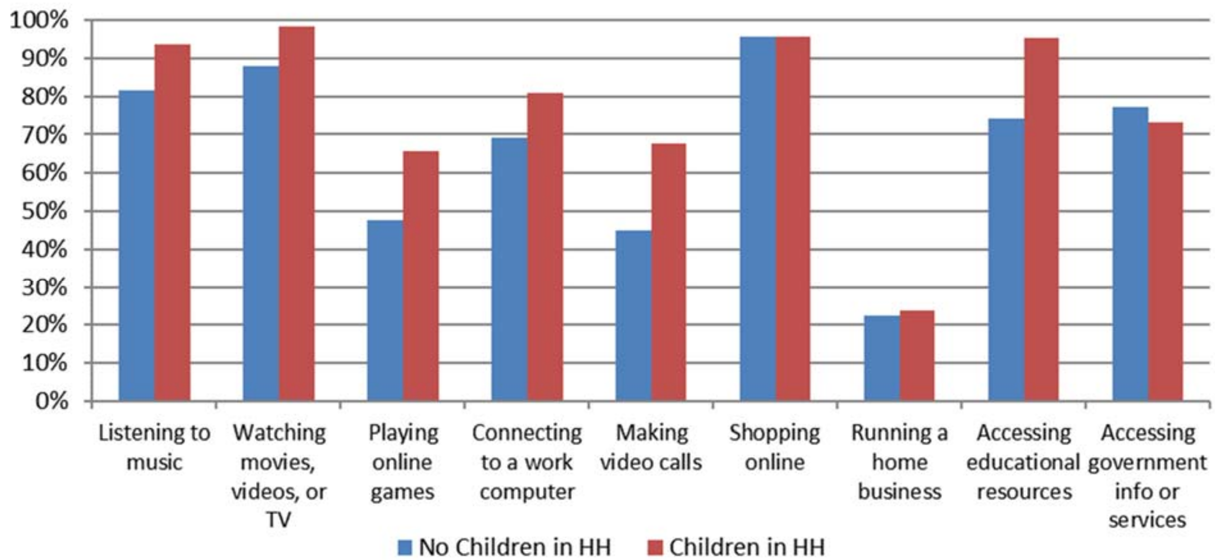


Figure 37: Home Internet Activity by Age of Respondent (Percent Ever Using)



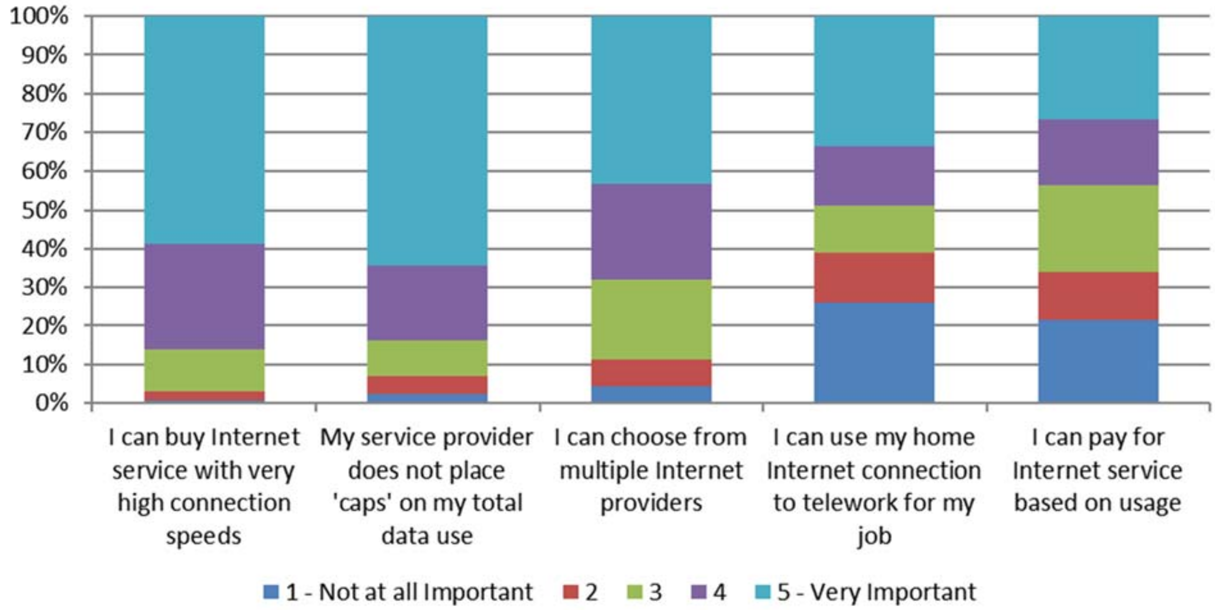
Similarly, respondents with children under age 18 in the household are more likely to use the internet for various activities, particularly for accessing educational resources (see Figure 38).

Figure 38: Home Internet Activity by Children in Household (Percent Ever Using)



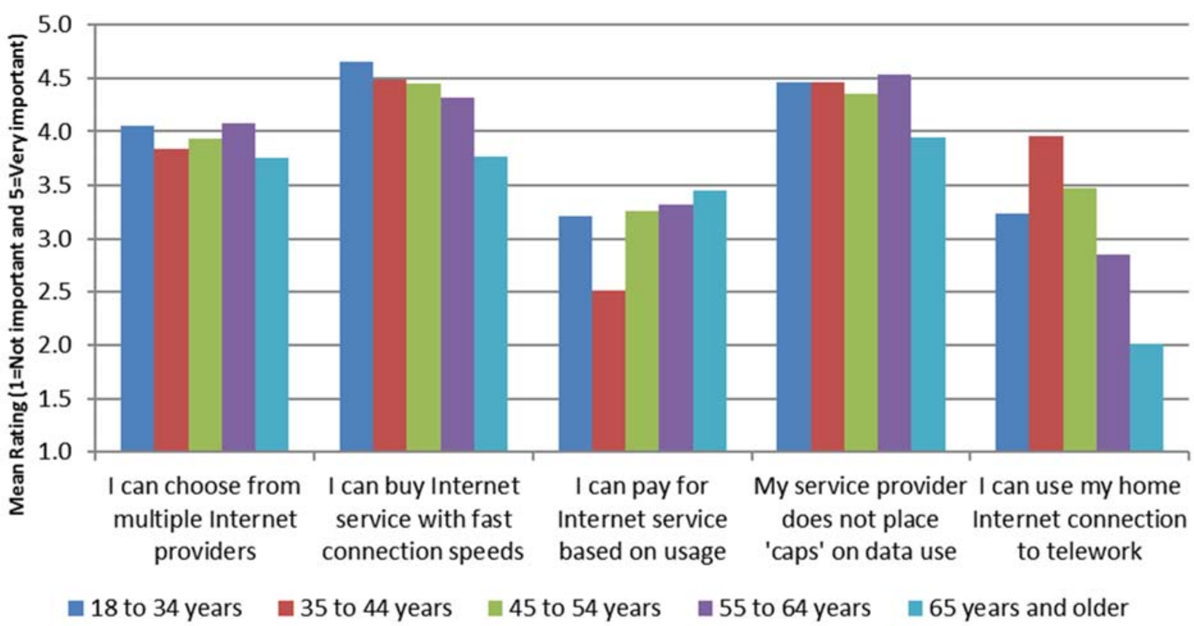
Respondents were asked to rate the importance of aspects when selecting a home internet provider. The most important aspects are the ability to have very high connection speeds and the service provider not placing "caps" on data use, with approximately six in 10 saying these aspects are "very important." The least important aspects of home internet service are using a home internet connection to telework and paying for service based on usage (see Figure 39).

Figure 39: Importance of Aspects When Selecting a Home Internet Provider



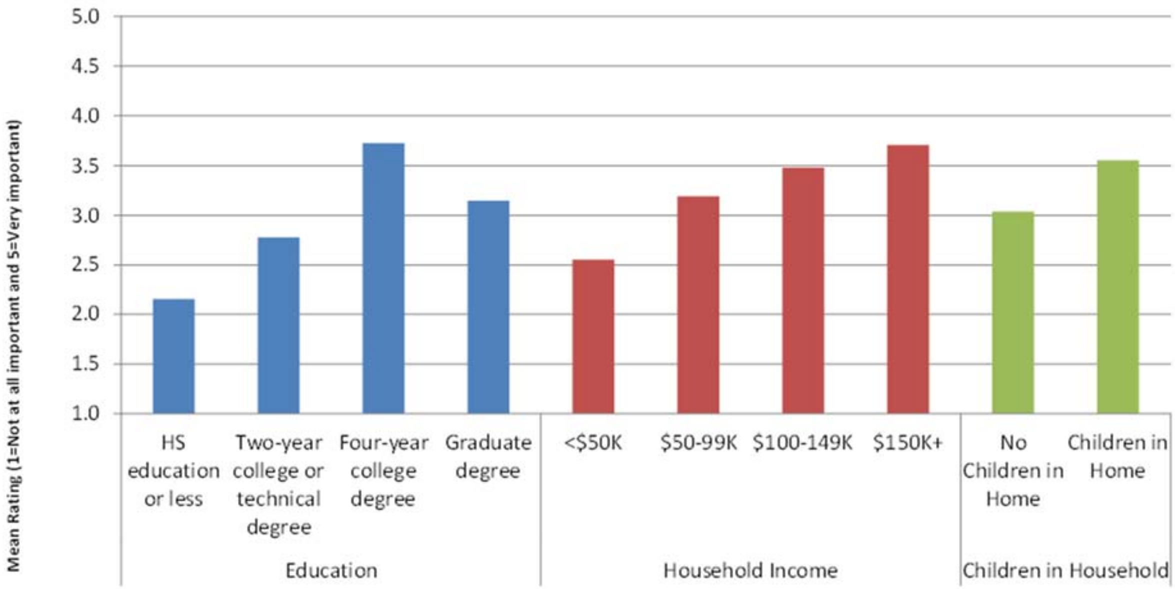
Respondents ages 65 or older placed less importance on high connection speeds, unlimited data use, and ability to use home internet connection to telework (see Figure 40).

Figure 40: Importance of Home Internet Service Aspects by Age



Additionally, the average importance rating increases as household income increases, and those with a four-year college degree placed more importance on this aspect than did those with more or less education, as illustrated in Figure 41.

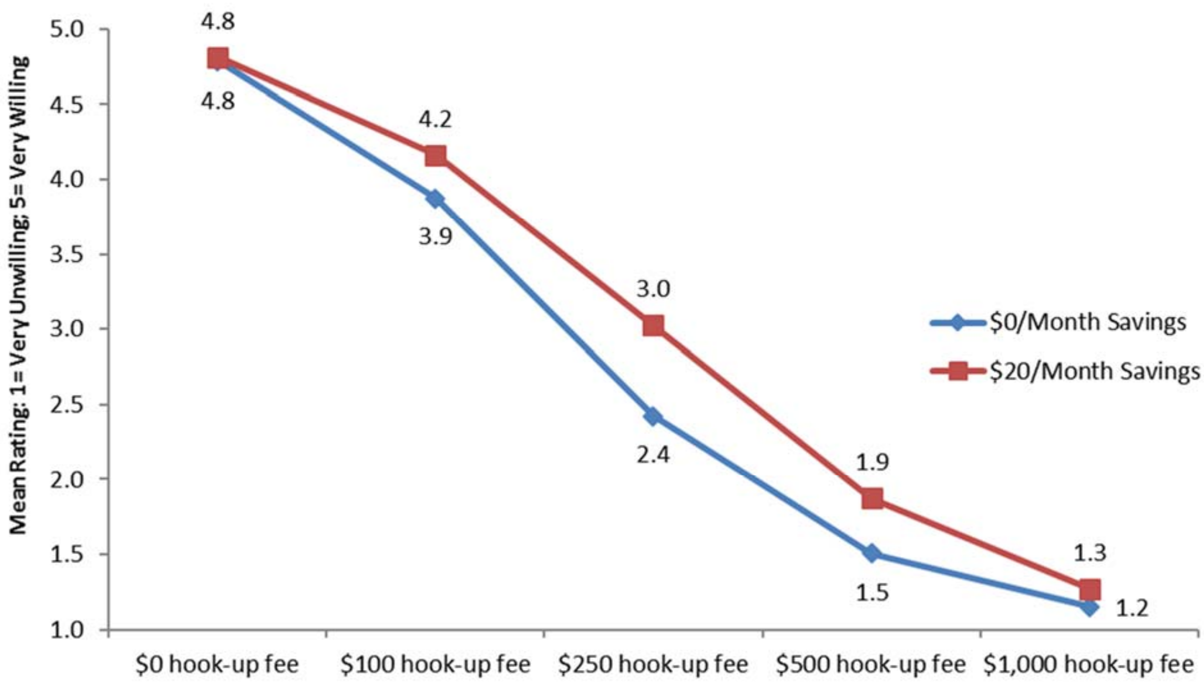
Figure 41: Importance of Home Internet Service to Telework by Demographics



4.3.1.8 Willingness to Pay Hook-Up Fee for Fiber-Optic Network

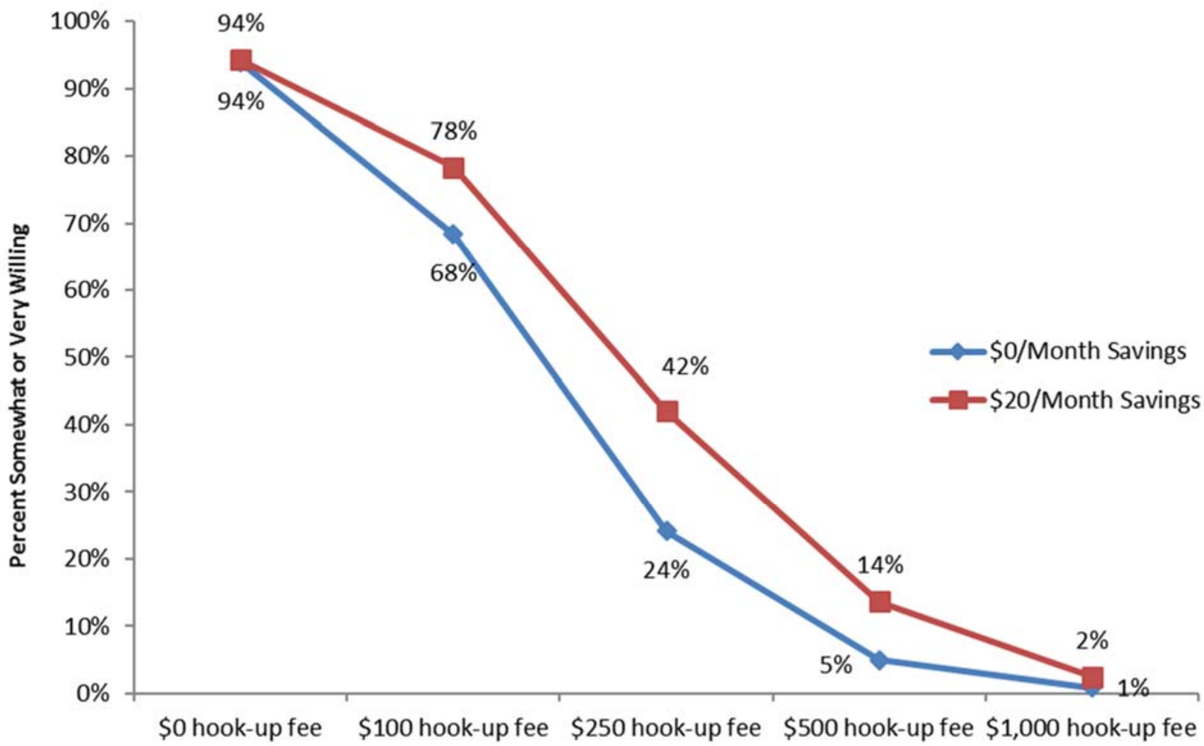
Respondents were asked if they would be willing to pay an upfront hook-up fee to connect to a fiber-optic communications network with very fast internet (1 Gbps) for either no savings per month or for $20 savings per month. Almost all respondents would be very willing to switch to the network for no hook-up fee (for $0 savings and for $20 savings), as would be expected. Additionally, they would be more willing to pay the fee for some savings on their monthly communications bill. Respondents are somewhat willing to pay a $100 hook-up fee, particularly for $20 per month savings, but willingness to pay a hook-up fee falls sharply at higher price points, as shown in Figure 42.

Figure 42: Average Willingness to Pay Upfront Hook-Up Fee for Fiber Optic Network



The majority of respondents would pay a $100 hook-up fee for no savings (68 percent) or a $20 savings per month (78 percent). Although nearly one-half would be at least somewhat willing to pay a $250 hook-up fee for a $20 per month savings, this falls to 24 percent if there were no monthly savings on their bill, as illustrated in Figure 43.

Figure 43: Willingness to Pay Upfront Hook-Up Fee for Fiber Optic Network



The willingness to pay an upfront hook-up fee tends to increase as household income increases, for either no monthly savings or for a $20 per month savings (see Figure 44 and Figure 45).

Figure 44: Willingness to Pay Upfront Hook-Up Fee by Household Income

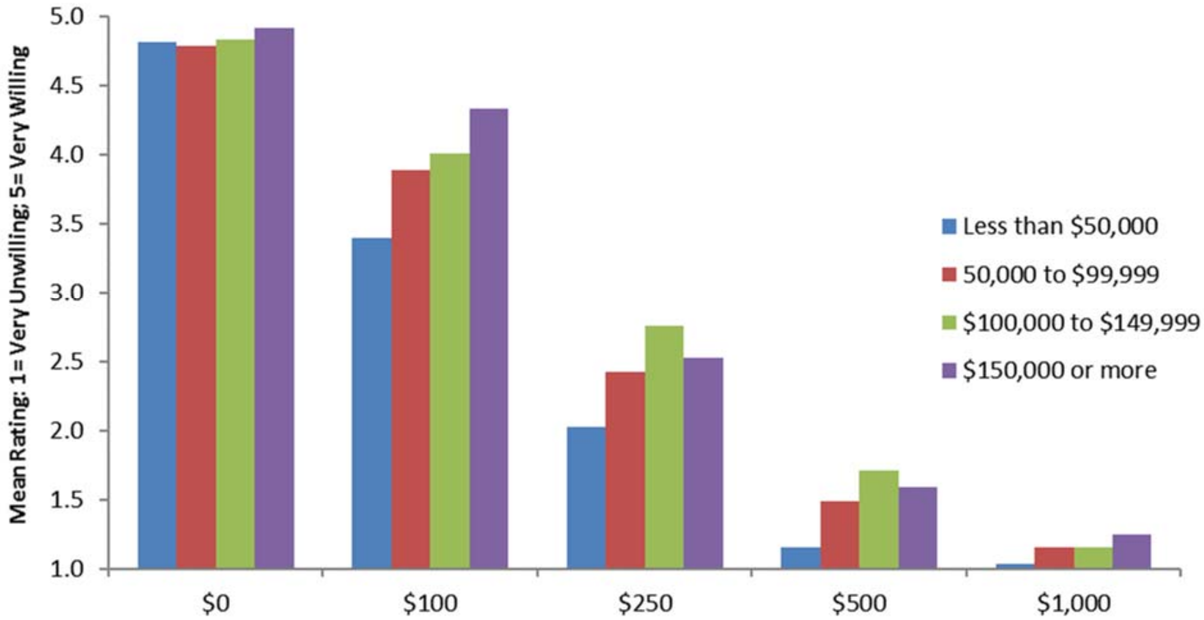
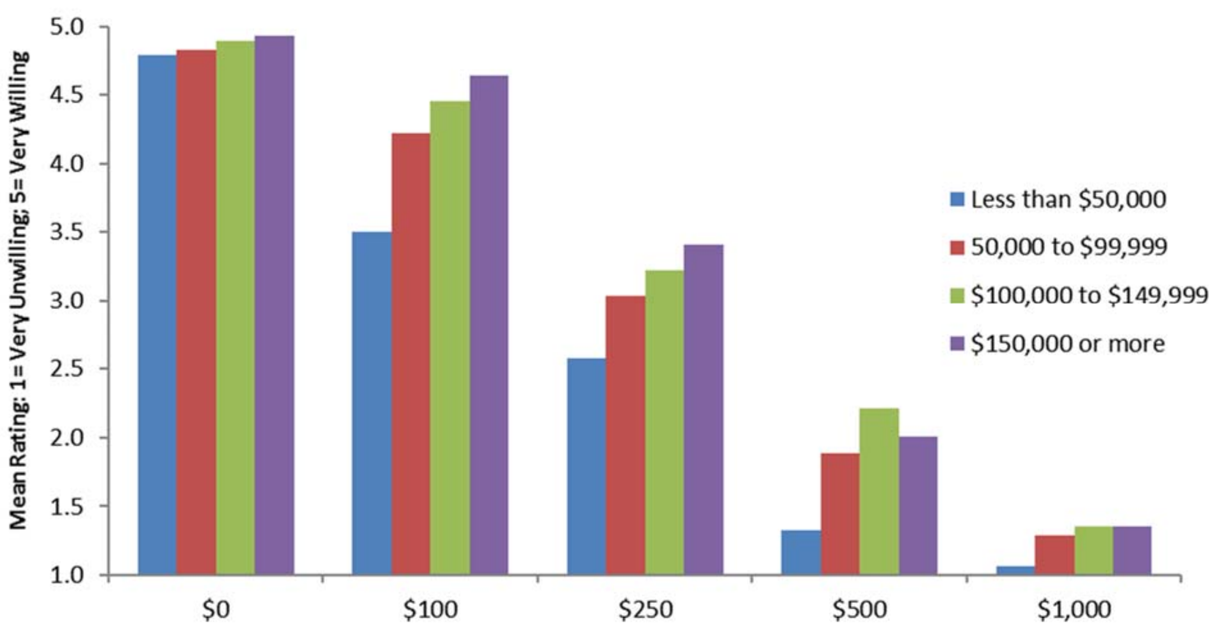
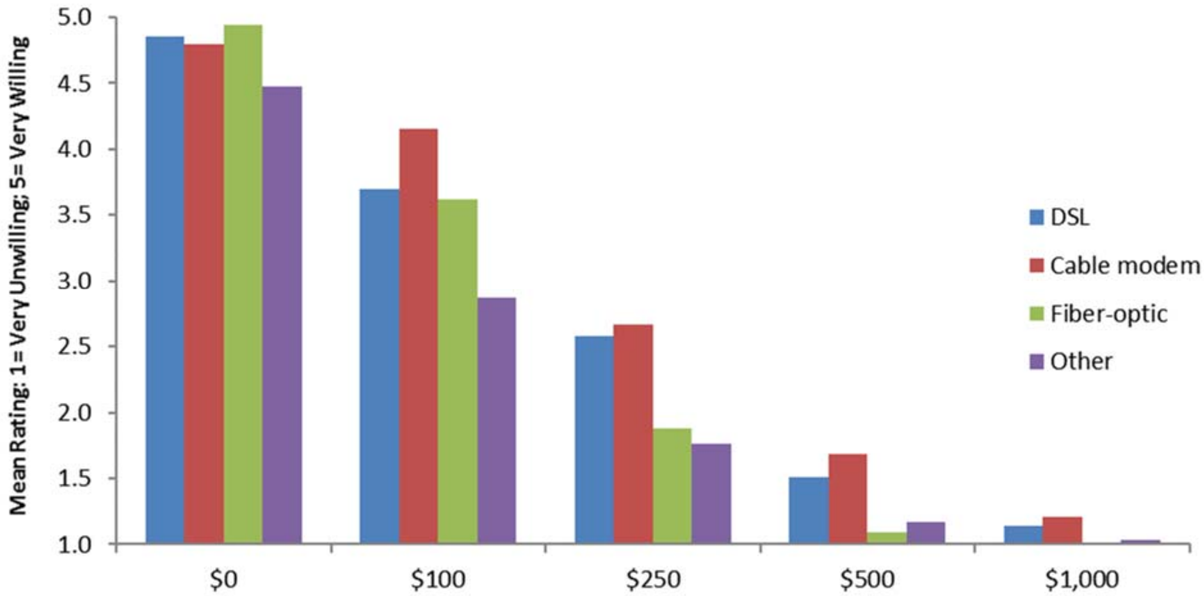


Figure 45: Willingness to Pay Upfront Hook-Up Fee for $20/Month Savings by Income



Additionally, those with "other" internet connection types would be less willing to pay an upfront hook-up fee to connect to a fiber network, compared with those with cable or DSL (see Figure 46). These individuals also placed less importance on having a high-speed internet connection.

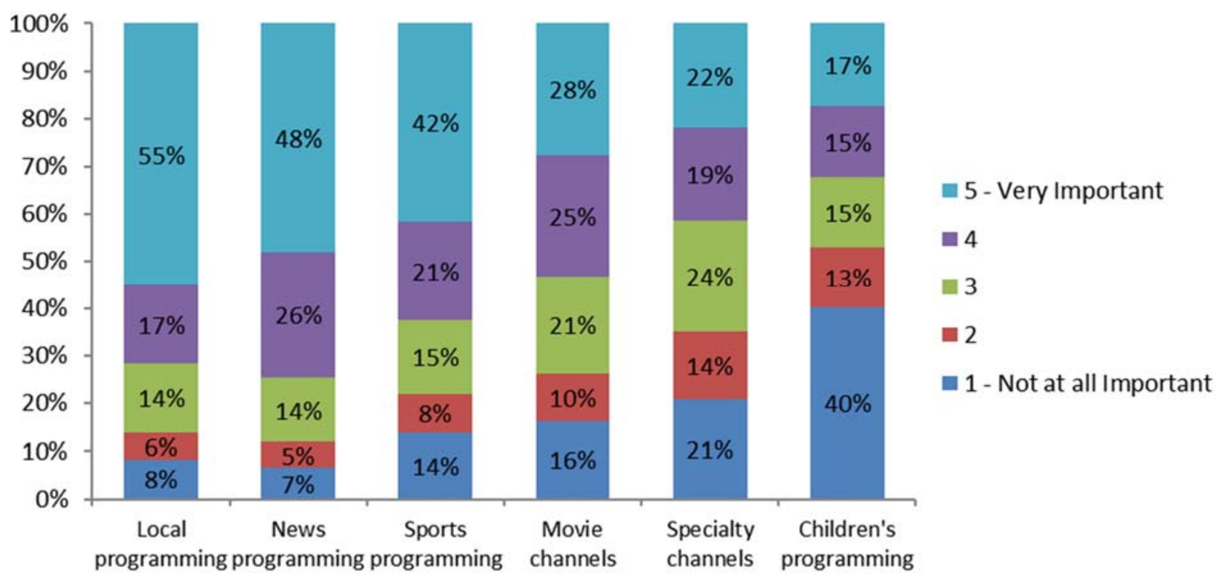
Figure 46: Willingness to Pay Upfront Hook-Up Fee by Connection Type



4.3.2 Television and Telephone Service

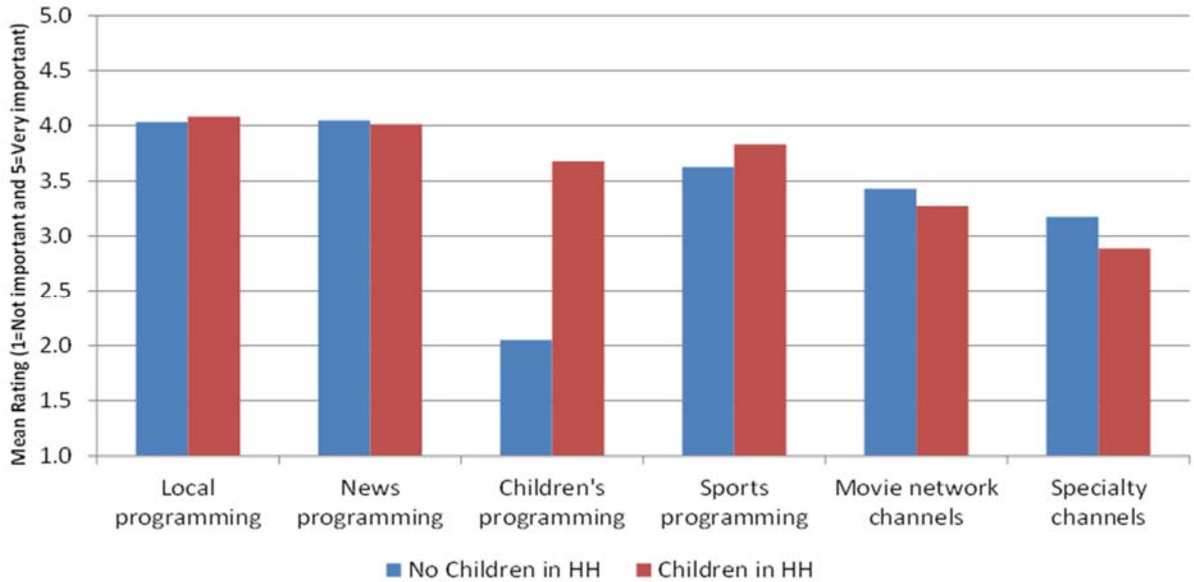
Respondents were asked to evaluate the importance of television programming features. The most important television programming aspects are local programming and news programming, while the least important is children's programming, as illustrated in Figure 47.

Figure 47: Importance of Television Programming Features



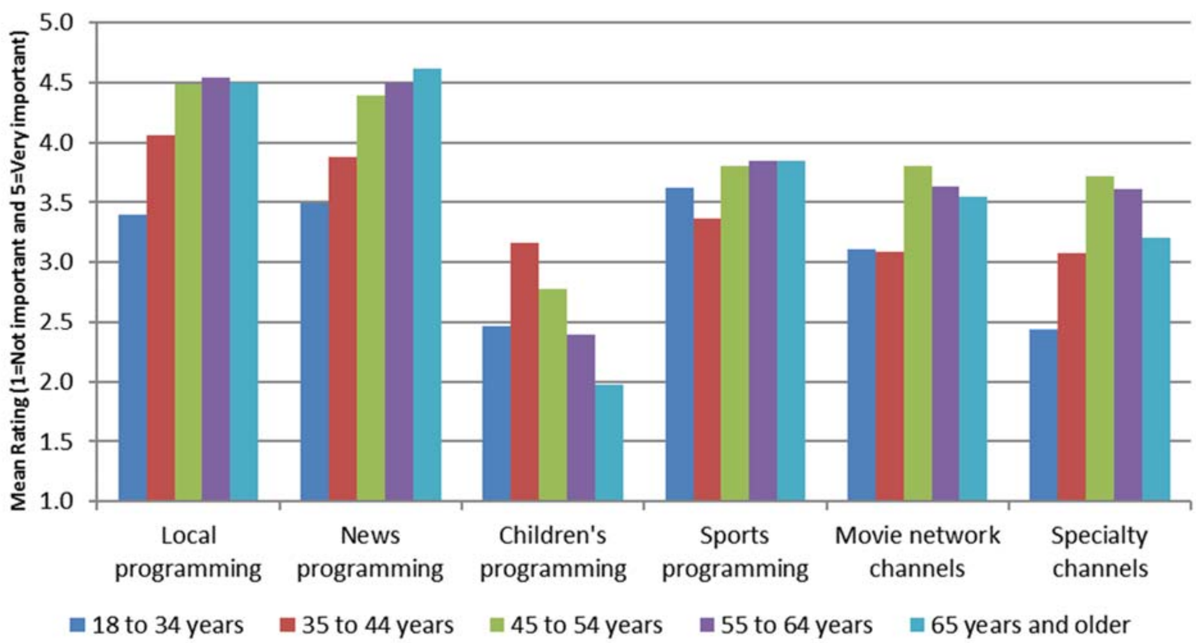
However, those with children in the household placed significantly more importance on children's programming, as shown in Figure 48.

Figure 48: Importance of Television Programming Aspects by Children in Household



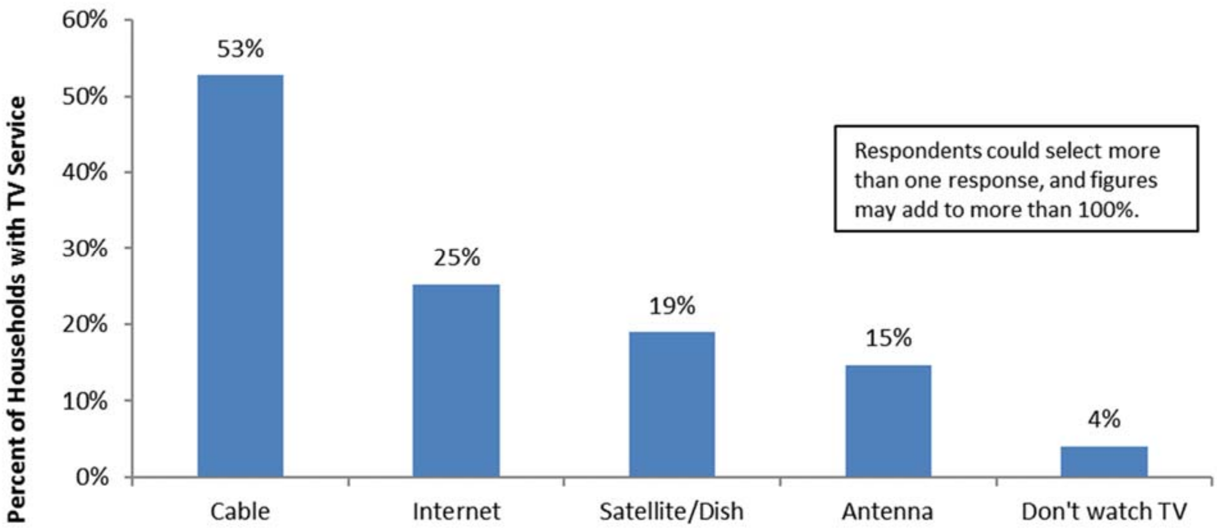
Additionally, the importance placed on most types of programming is lower for those ages 18 to 34, compared with older respondents (see Figure 49).

Figure 49: Importance of Television Programming Aspects by Age of Respondent



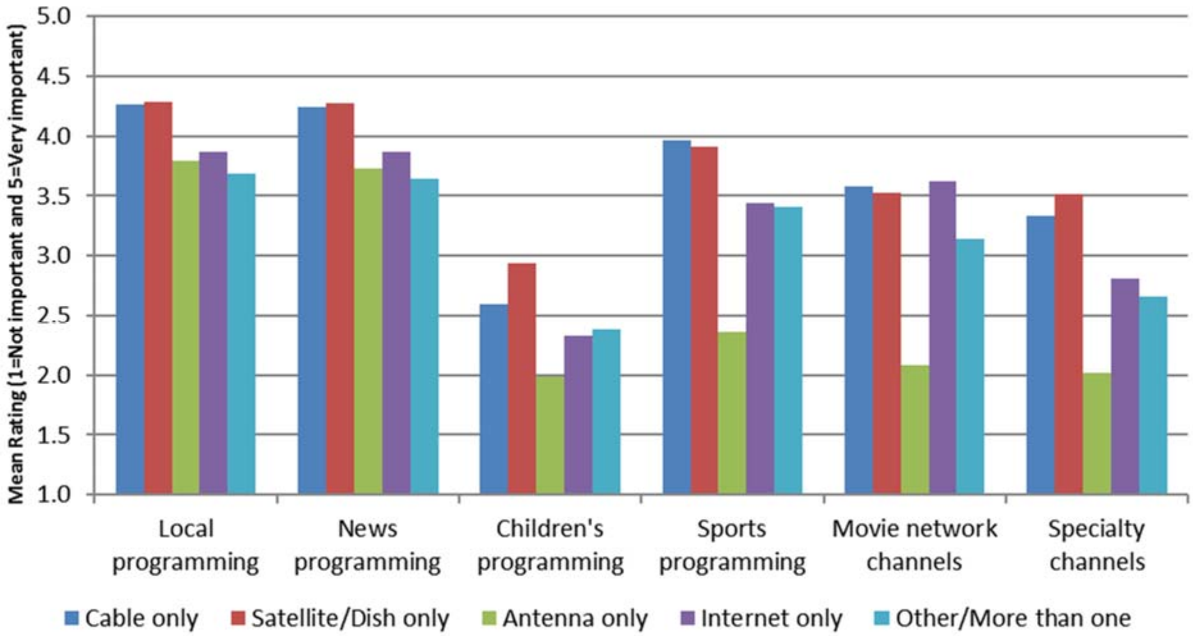
More than one-half of respondents purchase cable television service, while one-fourth receive television service through the internet and 19 percent have satellite/Dish service. Just 15 percent of respondents have antenna (over-the-air) television service, and four percent do not watch television (see Figure 50).

Figure 50: Types of Television Service in Home



About 42 percent of respondents have cable television service only, and 17 percent have satellite/Dish only. Although 25 percent use the internet to receive television service, just 10 percent of all respondents use it as their only television service. Just five percent of respondents have antenna only; these individuals tended to place less importance on types of programming, although this is based on a relatively small number of individuals (see Figure 51).

Figure 51: Importance of Television Programming Features by Types of Television Service



Subscription to television services varies significantly by key demographics. Specifically, those under age 35 are less likely than older respondents to have cable television but are more likely to use internet television. Similarly, renters (of whom 62 percent are ages 18 to 34) are less likely than homeowners to have satellite/Dish television service, and they are more likely to use the internet or not watch TV (see Figure 52 and Figure 53).

Figure 52: Types of Television Service in Home by Age of Respondent

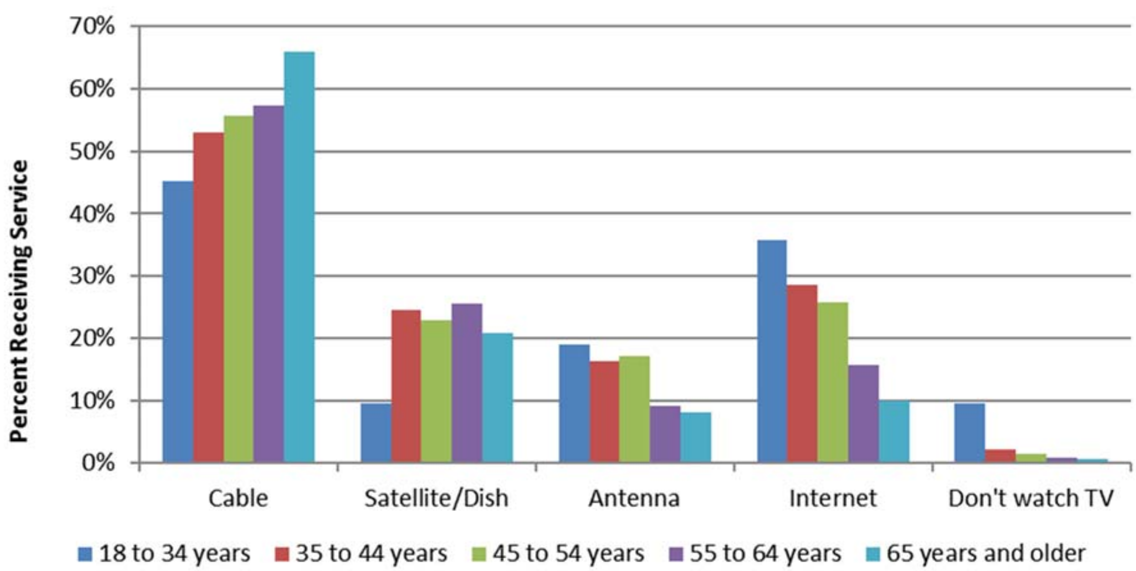
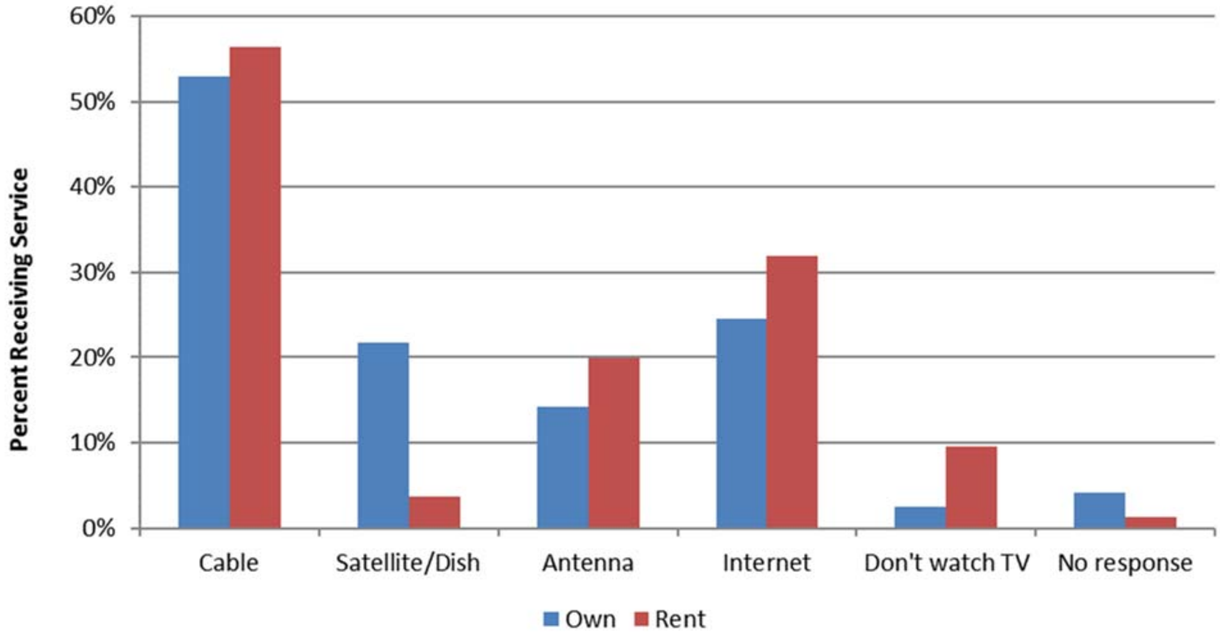
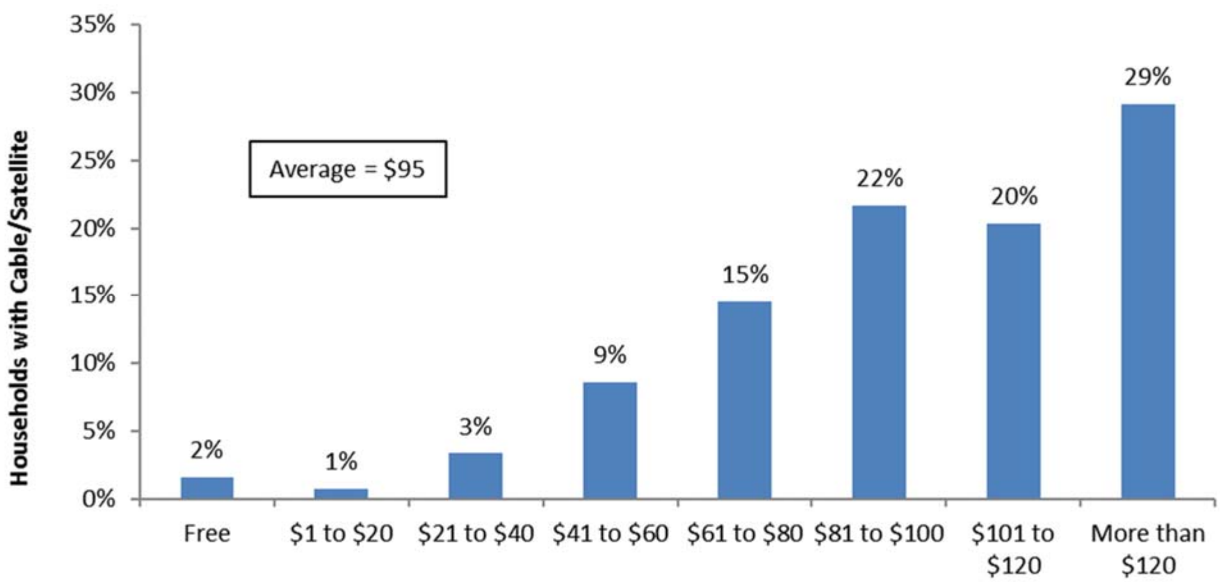


Figure 53: Types of Television Service in Home by Home Ownership



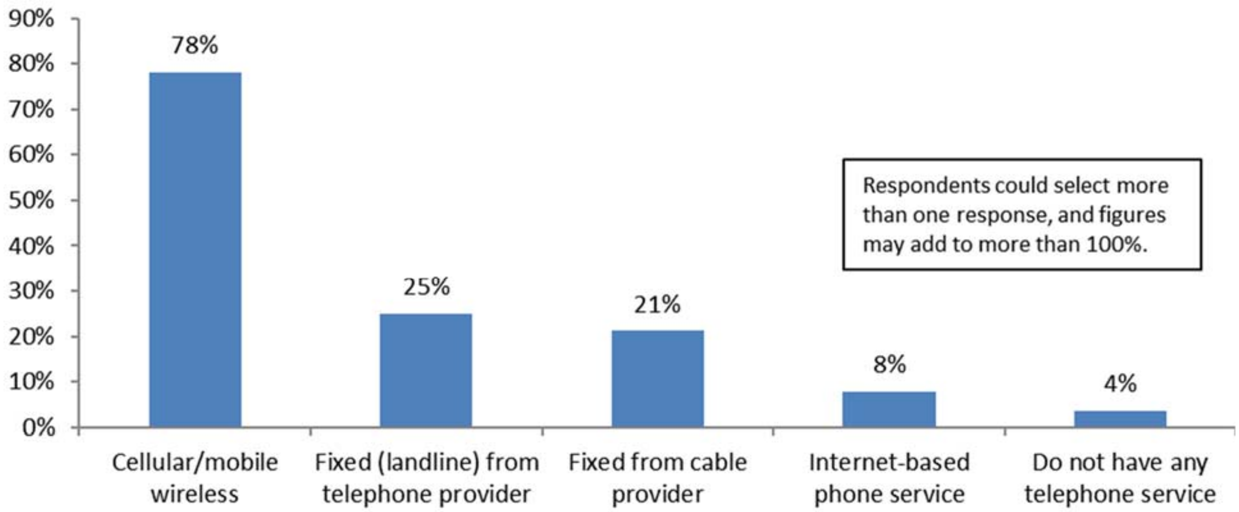
The estimated average monthly price for cable or satellite television service is $95, with nearly one-half of those paying over $100 per month, as illustrated in Figure 54. Cost per month is very similar for both cable and satellite/Dish subscribers.

Figure 54: Monthly Price of Cable or Satellite TV Service



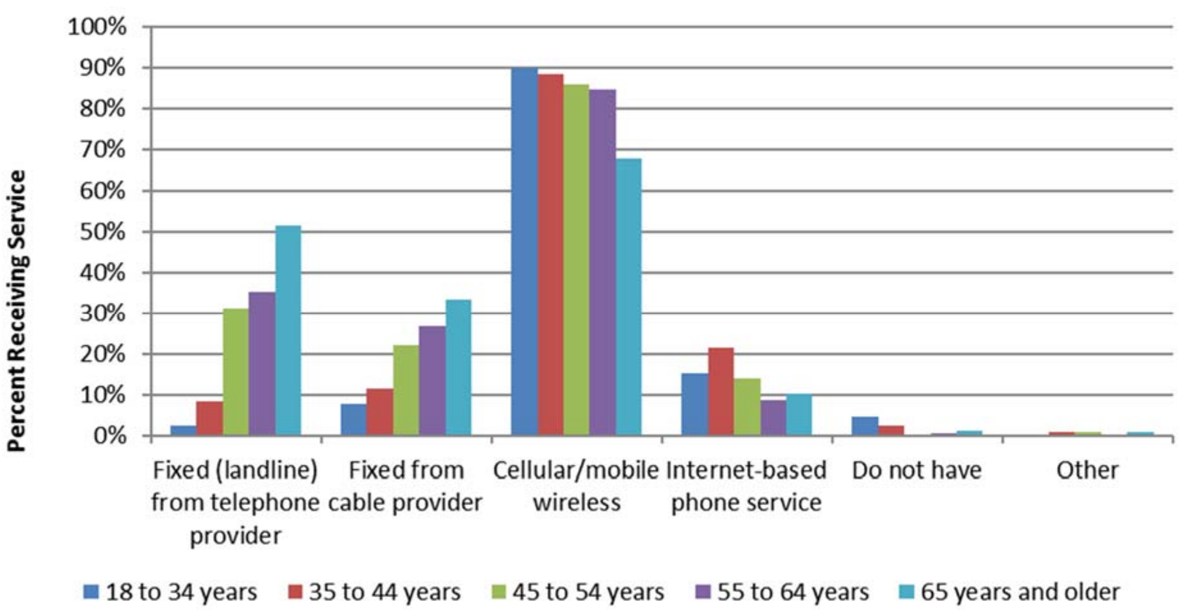
Respondents were asked about their home and mobile telephone services. As illustrated in Figure 55, 78 percent of respondents have a wireless telephone. Nearly one-half have a landline, including 25 percent from a traditional provider and 21 percent from their cable provider.

Figure 55: Home Telephone Service(s)



As illustrated in Figure 56, respondents aged 65 and older are more likely than younger respondents to have landline telephone service, either from a traditional provider or their cable provider, and they are less likely to have cellular/mobile wireless telephone service.

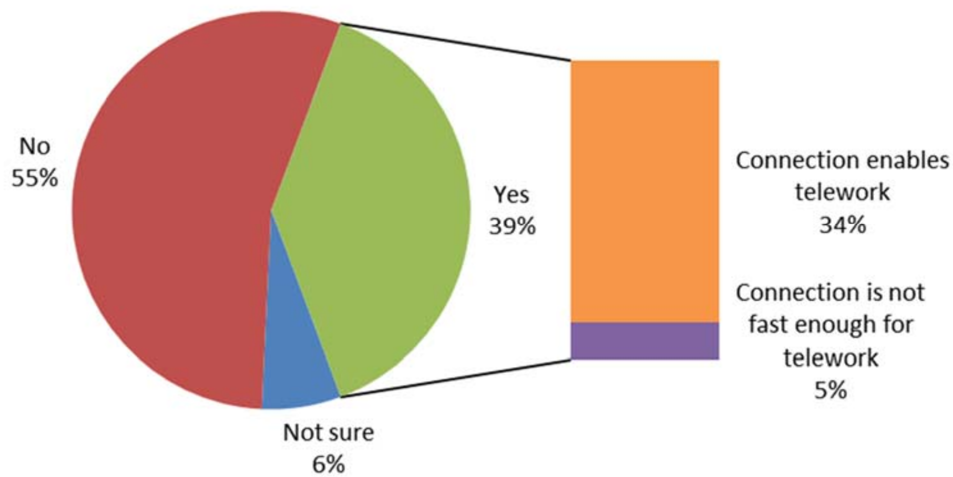
Figure 56: Home Telephone Service(s) by Age of Respondent



4.3.3 Telework and Home Business

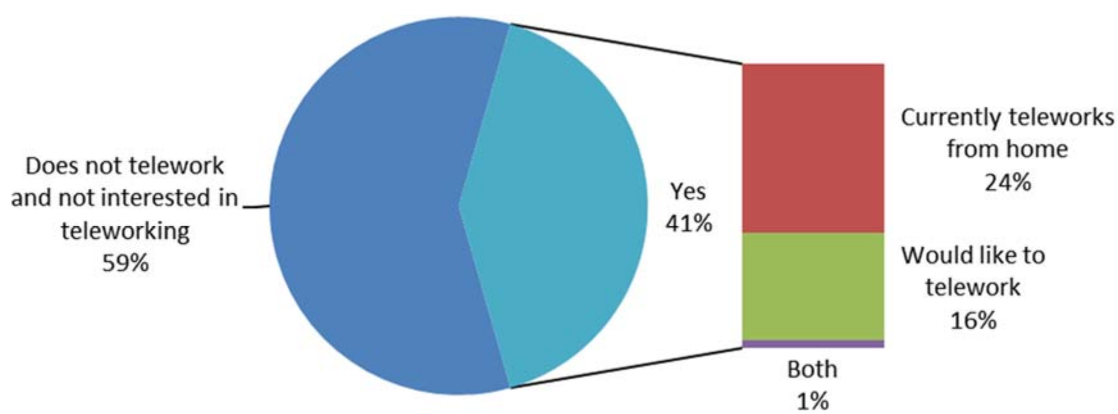
About four in 10 respondents indicated that a member of their family is allowed by their employer to telework, most of whom said their internet connection enables telework. Just five percent said their internet connection was not fast enough to allow telework (see Figure 57).

Figure 57: Employer Allows Telework



As shown in Figure 58, approximately 24 percent of respondents indicated that someone in their family already teleworks from home and another 16 percent would like to telework. (One percent stated both.)

Figure 58: Household Member Teleworking



A majority (68 percent) of household members who are allowed to telework and who have a fast-enough home internet connection do indeed telework from home. This indicates that a substantial additional share may telecommute if feasible, allowed by their employer, and if their connection were fast enough to enable telework.

Those with a higher education and those with a higher estimated household income are more likely to have a household member who telecommutes, as shown in Figure 59 and Figure 60, respectively.

Figure 59: Current Telecommuting and Interest by Level of Education

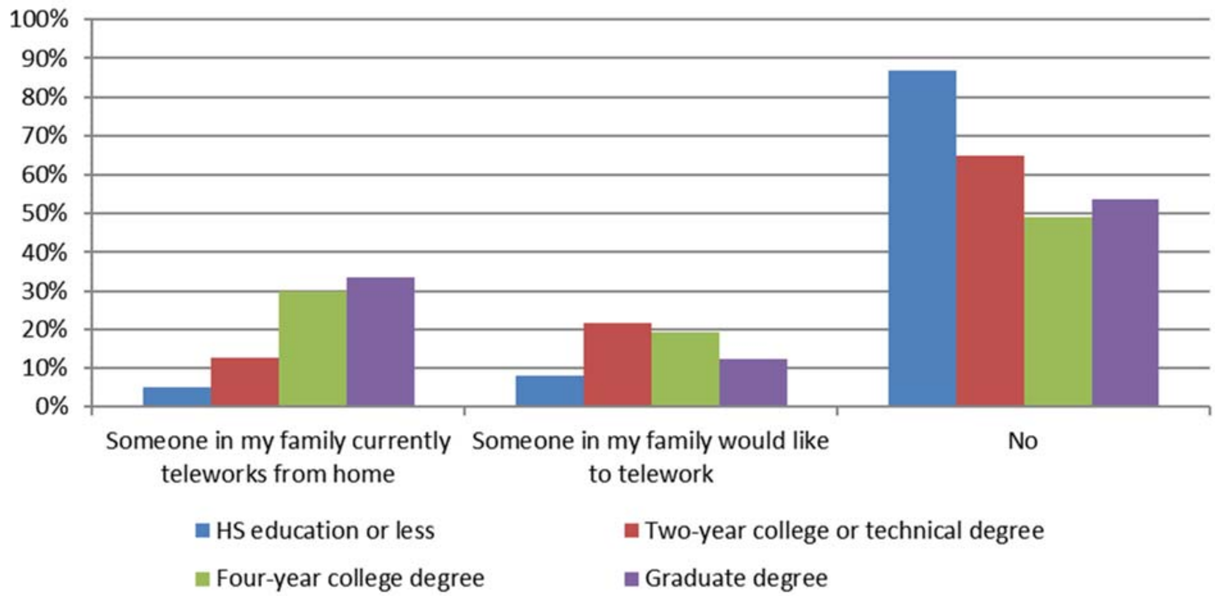
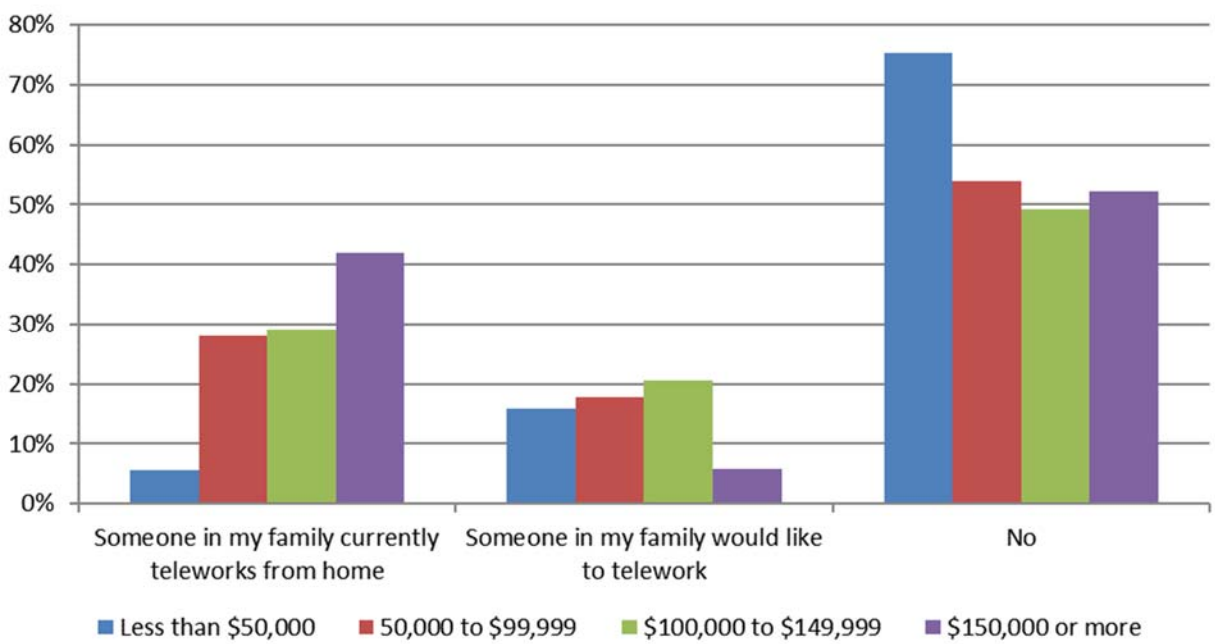
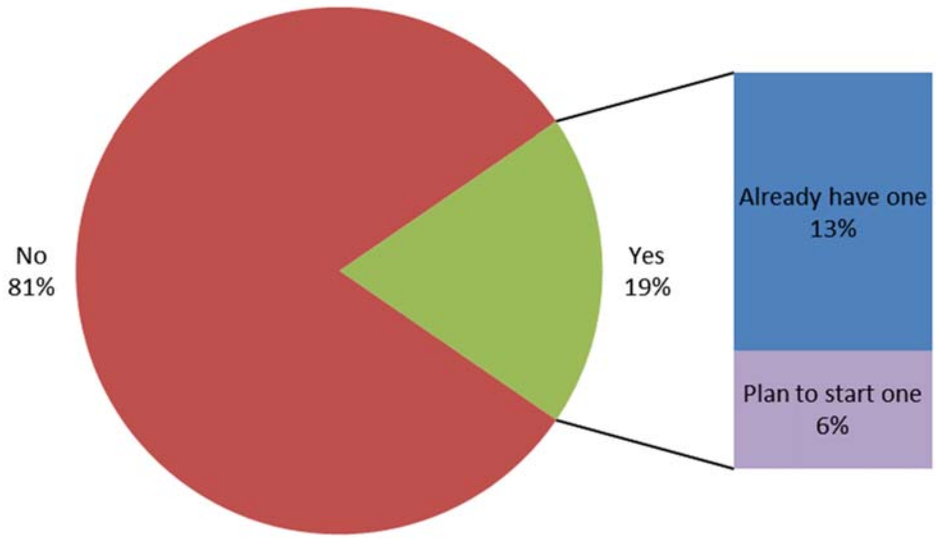


Figure 60: Current Telecommuting and Interest by Household Income



About one-fifth (19 percent) of respondents either have a home-based business or are planning to start one within the next three years, as illustrated in Figure 61. Of those who operate or are planning to start a home-based business, 80 percent indicated that a high-speed internet connection is (or would be) very important to this business.

Figure 61: Own or Plan to Start a Home-Based Business



4.3.4 Respondent Opinions

Respondents were asked their opinions about the City-Parish's role in providing or promoting broadband communications services within the City-Parish. The most favorable opinions were for the City-Parish to help ensure that all residents, students, and teachers have access to competitively-priced broadband services. Figure 62 illustrates the mean ratings, while Figure 63 provides detailed responses to each portion of the question.

Figure 62: Opinions About the Role(s) for the City-Parish (Mean Ratings)

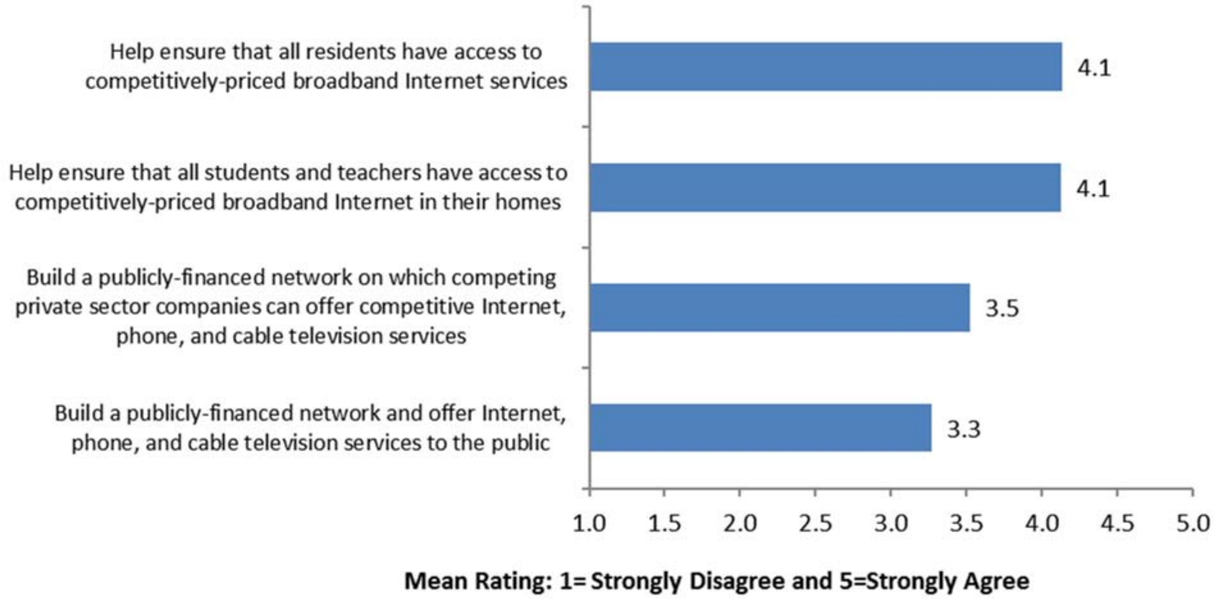
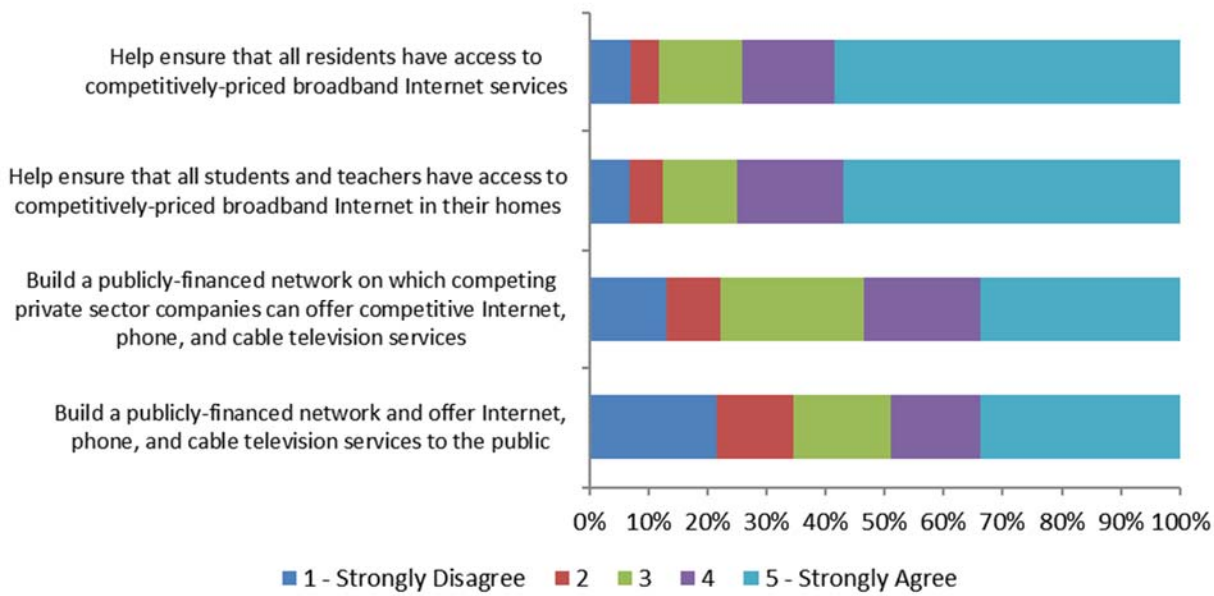
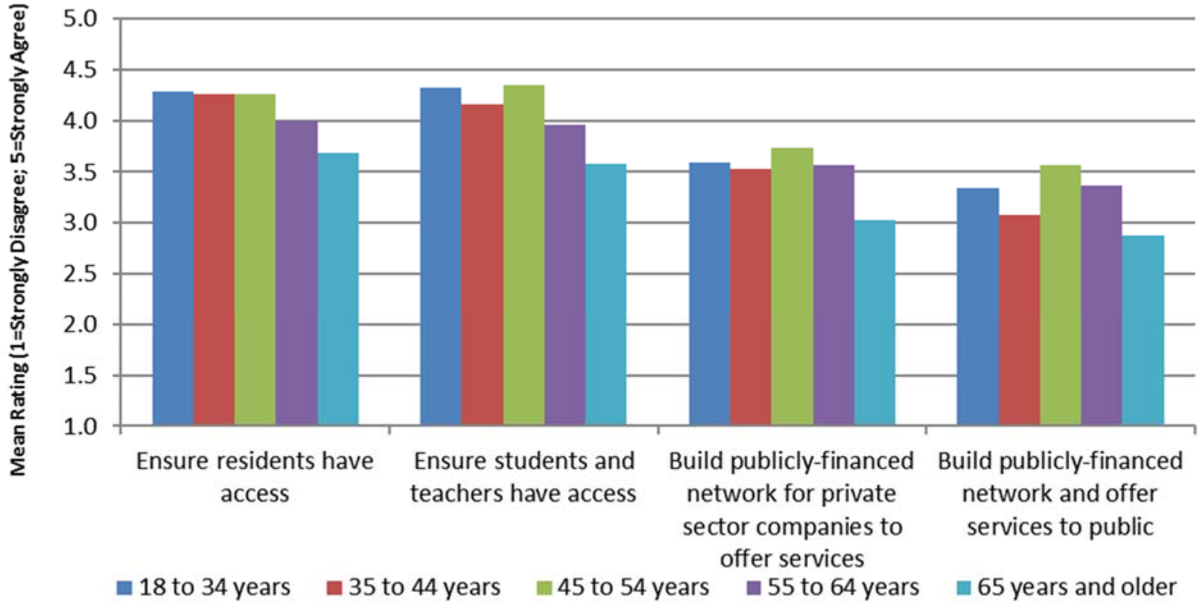


Figure 63: Opinions About the Role(s) for the City-Parish



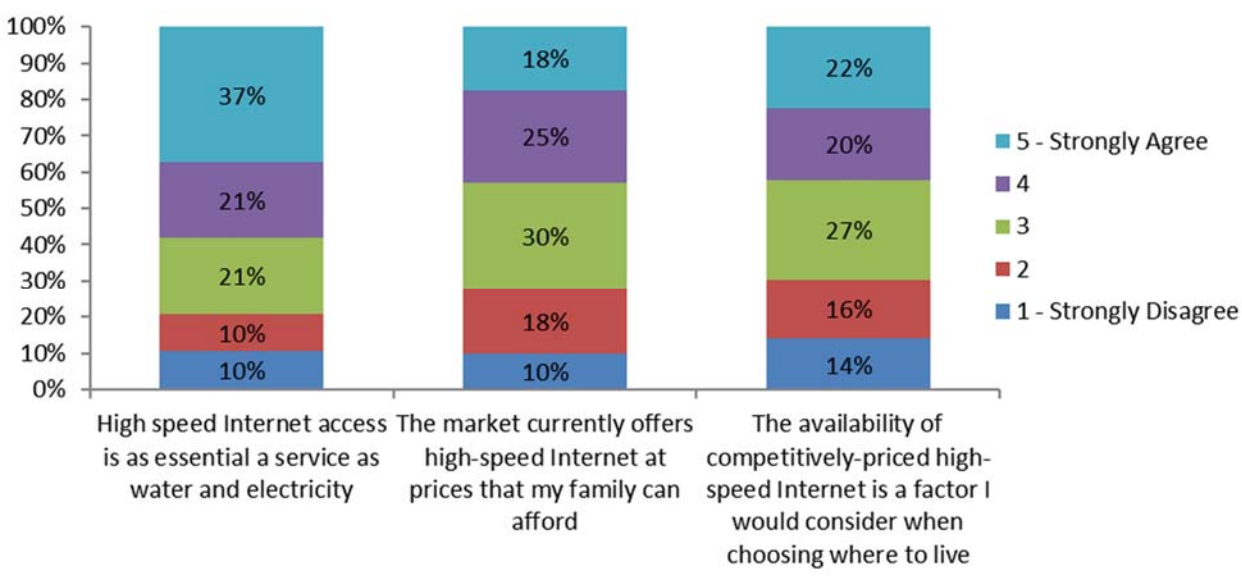
There is not strong agreement that the City-Parish should build a publicly-financed network (to either offer services to the public OR for private sector companies to offer network services); however, respondents were more likely to agree than disagree with these statements. Support of the City-Parish's role is lower among respondents aged 65 or older, as illustrated in Figure 64.

Figure 64: Opinions About the Role(s) for the City-Parish by Age



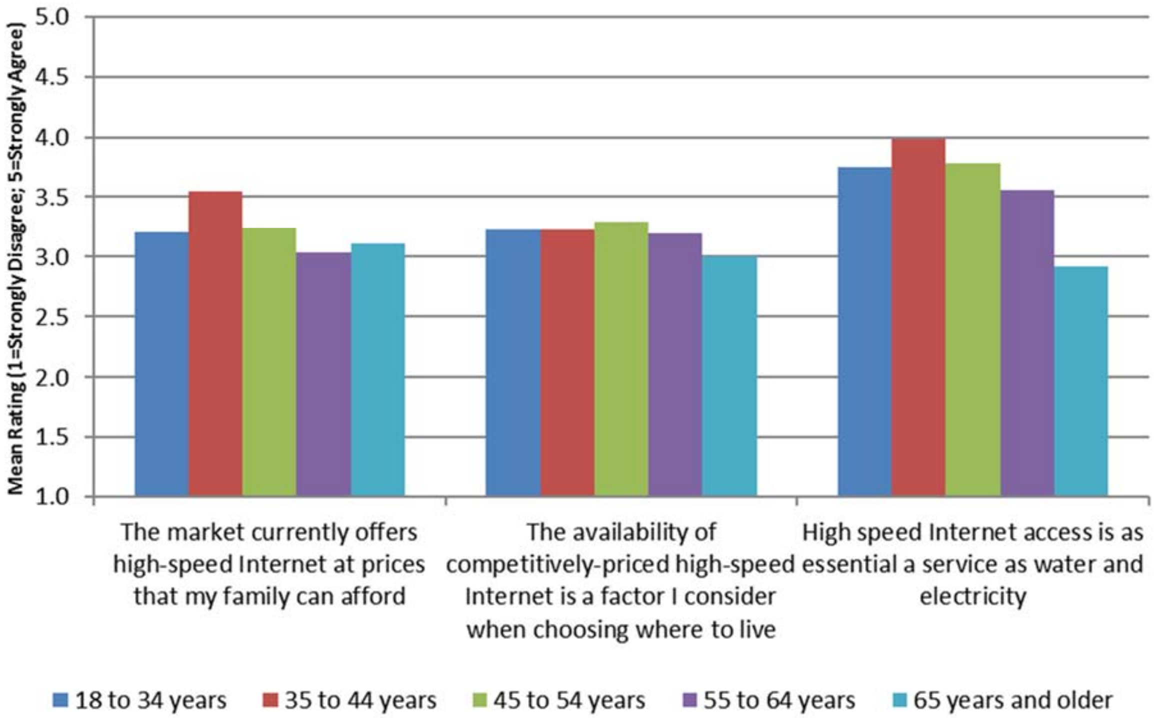
Respondents were also asked their opinion of the current broadband market. Nearly four in 10 strongly agreed that high-speed internet is an essential service. Much smaller shares thought that the market currently provides high-speed internet at prices they can afford or that the availability of high-speed internet is a factor they consider when choosing where to live (see Figure 65).

Figure 65: Opinions About the Broadband Internet Market



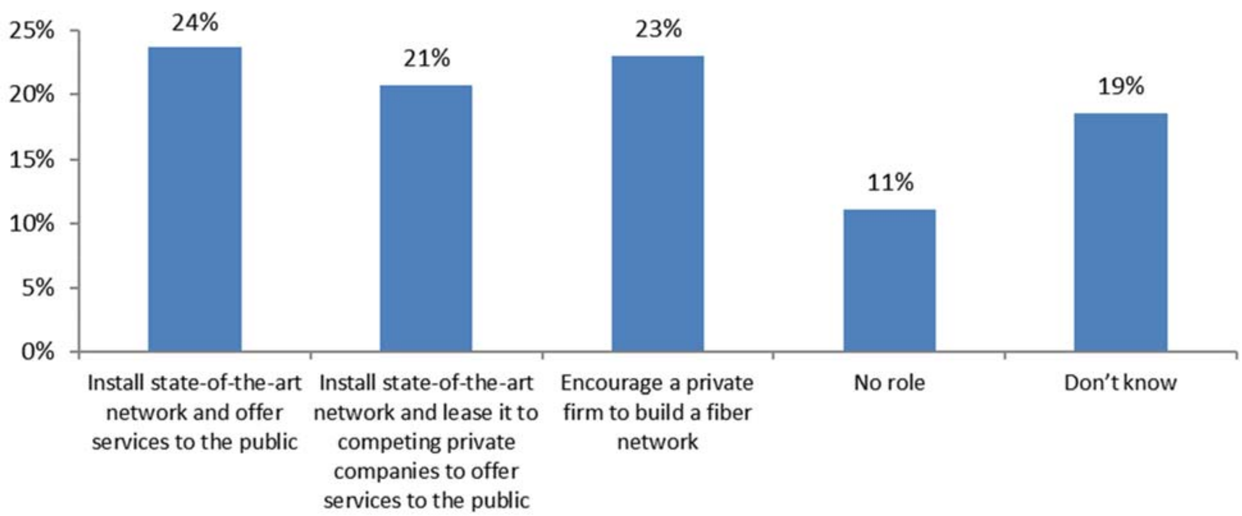
Respondents aged 65 or older were less likely than younger respondents to agree that internet is an essential service or a factor when choosing where to live (see Figure 66).

Figure 66: Opinions About Broadband Internet by Age of Respondent



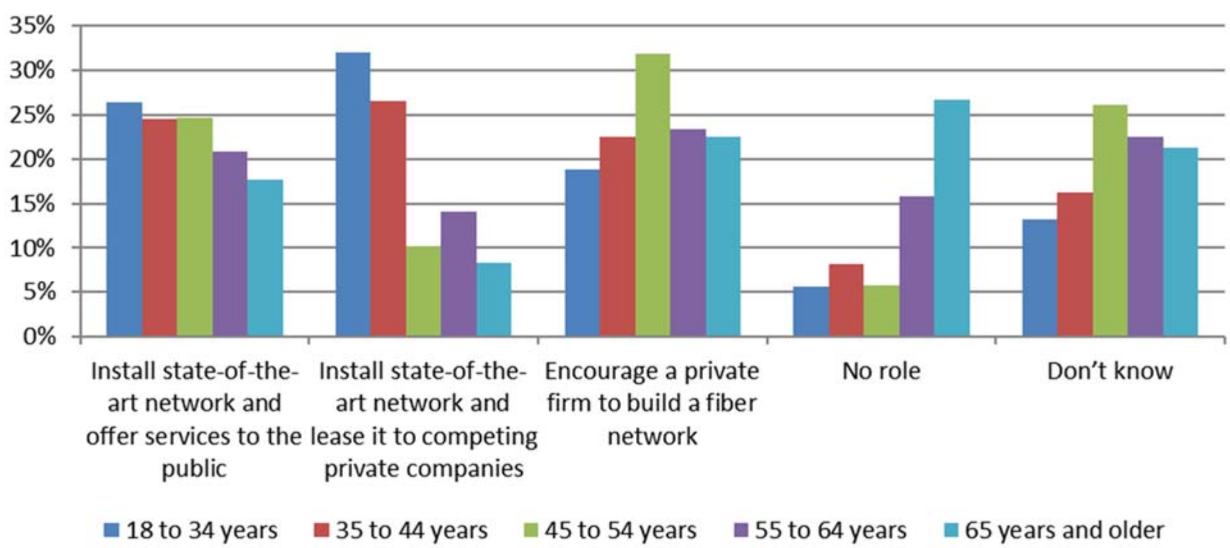
Respondents were asked what should be the ***main*** role of the City-Parish with regards to internet infrastructure and services. Nearly one-half indicated that the City-Parish should install a state-of-the-art network, but they were split on whether the City-Parish should offer services directly or if the City-Parish should lease to private companies to offer services to the public. Another 23 percent said the City-Parish could encourage a private firm to build a high-speed network. Only 11 percent thought the City-Parish should play no role, and 19 percent were unsure, as illustrated in Figure 67.

Figure 67: MAIN Role of the City-Parish with Respect to Broadband Access



Support for installation of a state-of-the-art network tends to decline somewhat as age increases, while respondents age 65 or older were more likely than younger respondents to say the City-Parish should have no role in a communications network (see Figure 68).

Figure 68: MAIN Role of the City-Parish with Respect to Broadband Access by Age of Respondent



Additionally, respondents with a higher level of education or a higher level of household income were less likely to indicate that the City-Parish should install and provide services, but they were more likely to suggest the City-Parish should install and lease to private companies OR encourage a private firm to build a network. Despite some differences, a majority of all education and income groups believes there should be some role for the City-Parish in providing broadband internet access (see Figure 69 and Figure 70).

Figure 69: MAIN Role of the City-Parish with Respect to Broadband Access by Education

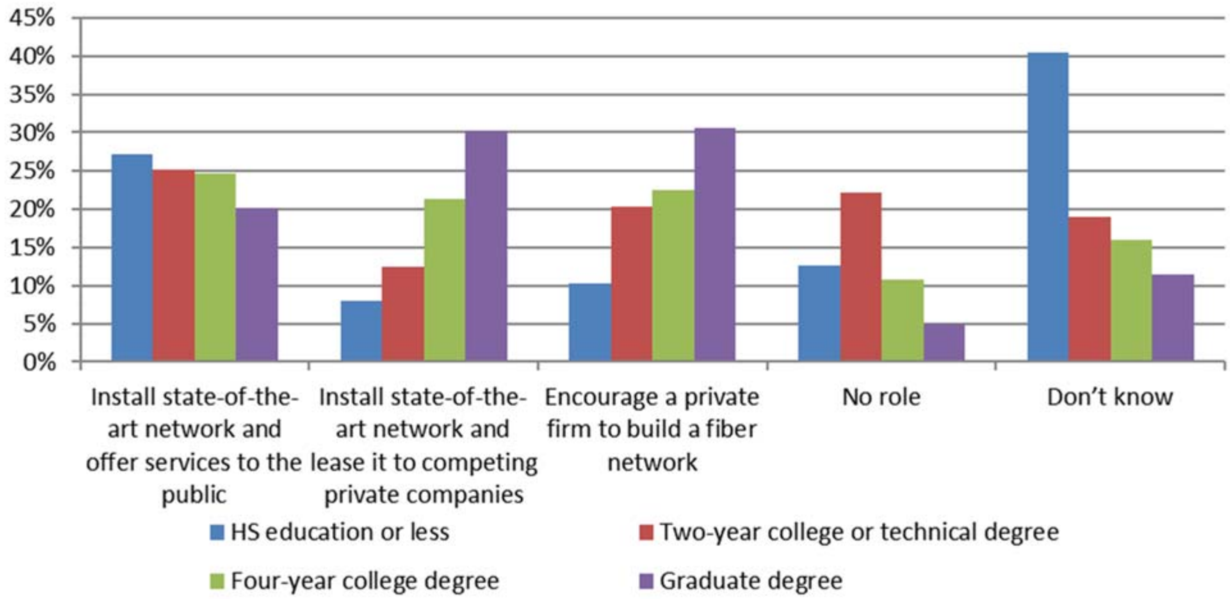
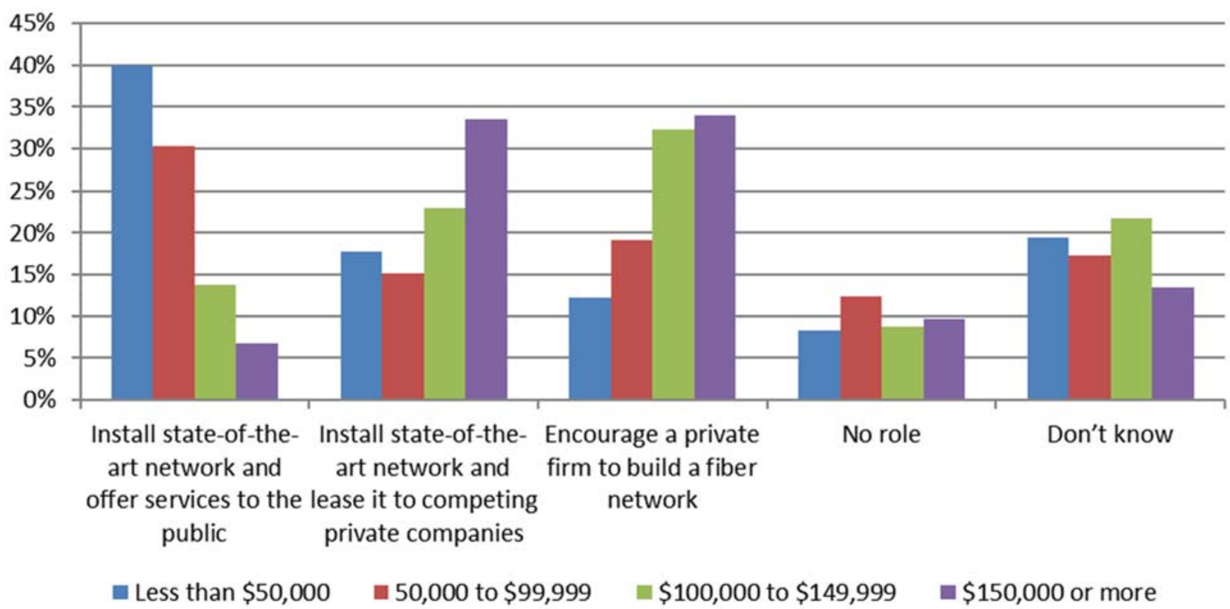


Figure 70: MAIN Role of the City-Parish with Respect to Broadband Access by Household Income



These responses indicate a relatively clear signal about residents' desire to have a state-of-the-art communications network and for the City-Parish to play some role in its installation. It should be noted that this question did not specifically ask about how that network should be financed or funded. Questions regarding consumers' willingness to pay monthly fees or hook-up costs for access to that network were presented previously.

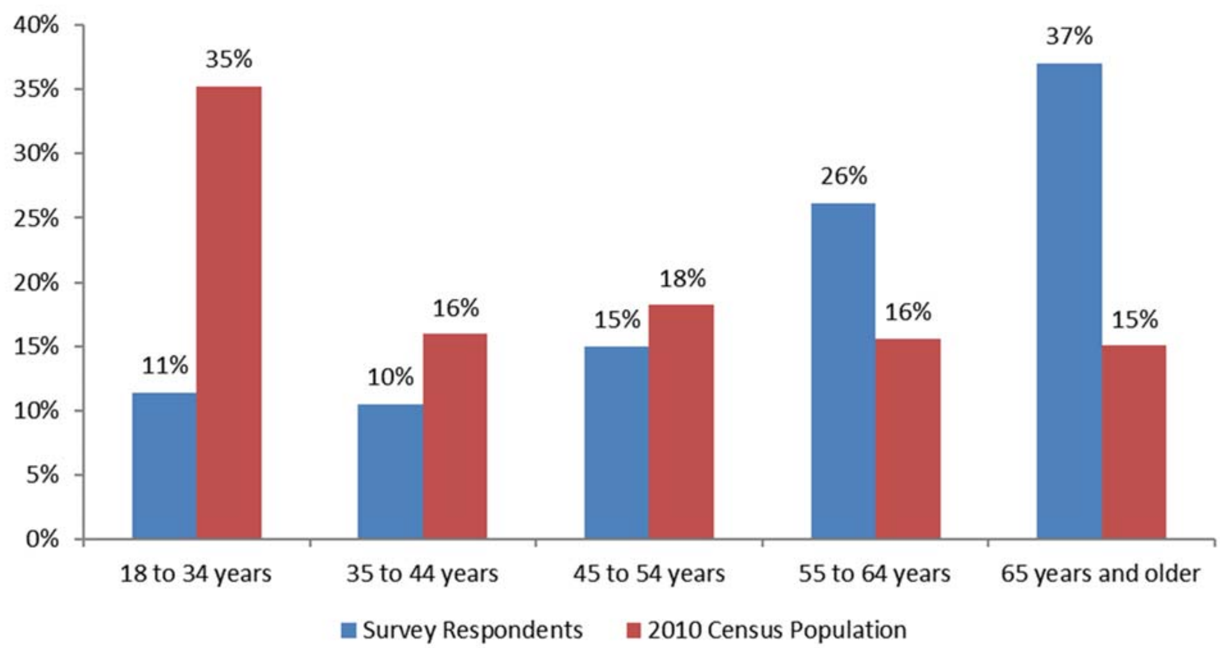
4.3.5 Respondent Information

Basic demographic information was gathered from survey respondents and is summarized in this section. Several comparisons of respondent demographic information and other survey questions were provided previously in this report.

Fifty-two percent of survey respondents were women and 48 percent were men, indicating relatively balanced gender response.

As indicated previously regarding age-weighting, disproportionate shares of survey respondents were in the older age cohorts relative to the City-Parish's adult population as a whole. Approximately 37 percent of survey respondents are ages 65 an older, compared with only 15 percent of the population. Conversely, only 11 percent of survey respondents are under age 35, compared with 35 percent of the population (see Figure 71). The survey results have been adjusted to account for these differences, as discussed earlier in this report.

Figure 71: Age of Respondents and East Baton Rouge Adult Population



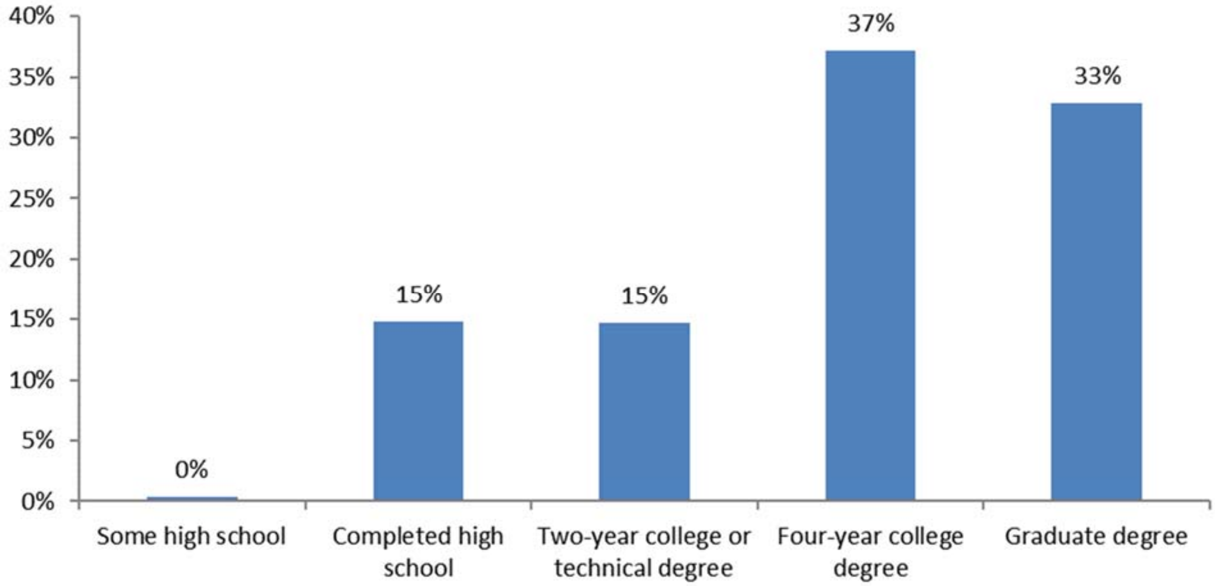
Respondents ages 35 to 44 are more likely than older and younger respondents to have children in the household. They are more likely to be college-educated, compared with older and younger respondents. Those ages 45 or older are more likely than younger respondents to have a high school education or less. Those ages 18 to 34 are more likely than older respondents to be renters, and they have lived in their home for fewer years on average (see Table 13).

Table 13: Demographic Profile by Age of Respondent

		18-34	35-44	45-54	55-64	65+	Total
Gender	Female	56.6%	45.8%	54.3%	50.0%	46.2%	51.9%
	Male	43.4%	54.2%	45.7%	50.0%	53.8%	48.1%
	Weighted Count	*165*	*73*	*85*	*73*	*70*	*465*
Race/Ethnicity	Other race/ethnicity	26.9%	27.1%	32.9%	25.2%	16.6%	26.2%
	White/Caucasian only	73.1%	72.9%	67.1%	74.8%	83.4%	73.8%
	Weighted Count	*162*	*73*	*85*	*71*	*69*	*459*
Highest level of education	High school education or less	13.2%	4.1%	21.4%	19.7%	19.8%	15.2%
	Two-year college or technical degree	11.3%	10.2%	14.3%	21.3%	20.9%	14.7%
	Four-year college degree	37.7%	57.1%	32.9%	27.9%	29.7%	37.2%
	Graduate degree	37.7%	28.6%	31.4%	31.1%	29.7%	32.9%
	Weighted Count	*165*	*74*	*85*	*73*	*70*	*467*
Approximate 2016 household income	Less than $50,000	25.0%	13.3%	22.7%	18.9%	32.0%	22.8%
	$50,000 to $99,999	48.1%	22.2%	34.8%	35.1%	40.1%	38.6%
	$100,000 to $149,999	13.5%	28.9%	22.7%	24.3%	13.6%	19.3%
	$150,000 or more	13.5%	35.6%	19.7%	21.6%	14.3%	19.2%
	Weighted Count	*162*	*68*	*80*	*66*	*60*	*440*
Total Household Size (Adults + Children)	1	13.2%	13.0%	17.1%	16.8%	24.6%	16.4%
	2	47.2%	19.6%	30.0%	52.1%	67.7%	43.4%
	3	13.2%	19.6%	14.3%	16.0%	6.6%	13.7%
	4 or more	26.4%	47.8%	38.6%	15.1%	1.2%	26.4%
	Weighted Count	*165*	*70*	*85*	*71*	*68*	*462*
Number of children in household	No Children in HH	71.7%	34.8%	58.6%	84.0%	98.8%	69.6%
	Children in HH	28.3%	65.2%	41.4%	16.0%	1.2%	30.4%
	Weighted Count	*165*	*70*	*85*	*71*	*68*	*462*
Own/rent residence	Own	75.0%	89.4%	87.1%	96.6%	94.6%	85.9%
	Rent	25.0%	10.6%	12.9%	3.4%	5.4%	14.1%
	Weighted Count	*162*	*71*	*85*	*71*	*68*	*462*
Number of years lived at current address	Less than 1 year	26.4%	14.9%	5.7%	.8%	4.2%	13.6%
	1 to 2 years	26.4%	12.8%	10.0%	5.0%	2.4%	14.5%
	3 to 4 years	15.1%	19.1%	11.4%	6.7%	7.1%	12.4%
	Five or more years	32.1%	53.2%	72.9%	87.5%	86.3%	59.5%
	Weighted Count	*165*	*71*	*85*	*72*	*68*	*466*

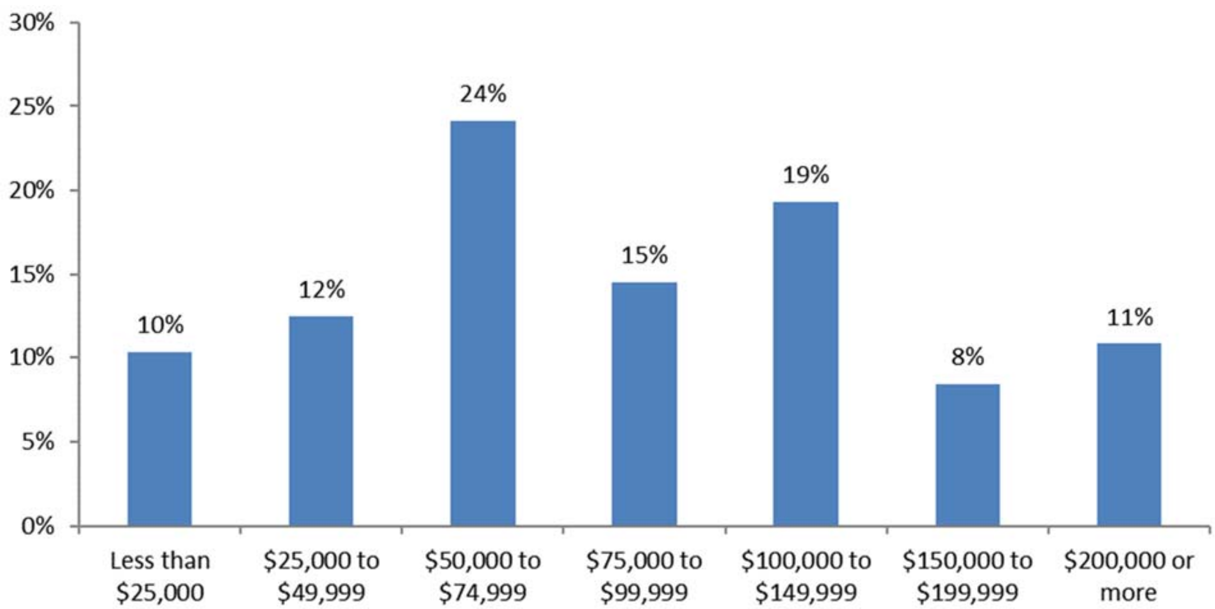
The respondents' highest level of education attained is summarized in Figure 72. Seven in 10 respondents have a four-year college degree or a graduate degree.

Figure 72: Education of Respondent



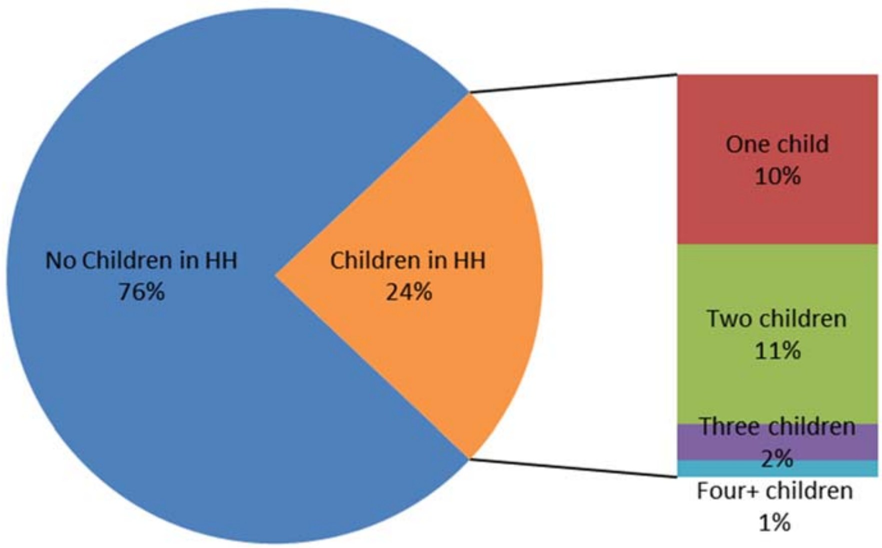
About one-fifth of respondents had a household income of less than $50,000 in 2016. About 38 percent of respondents had household incomes of $100,000 or more, as illustrated in Figure 73.

Figure 73: 2016 Household Income



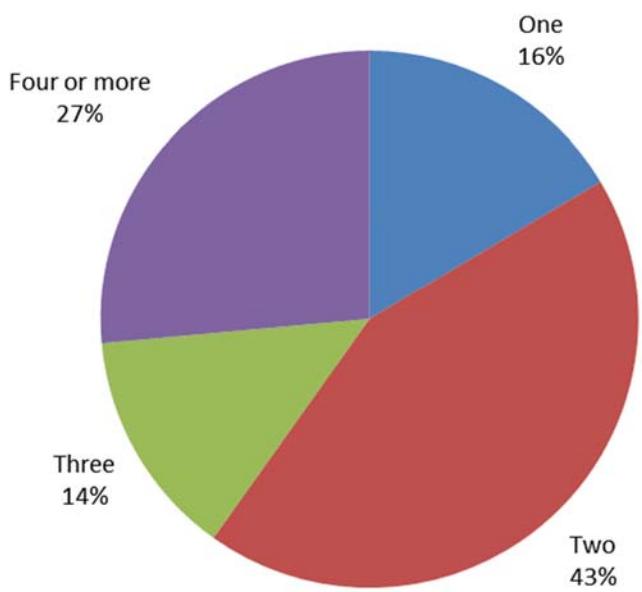
Respondents were asked to indicate the number of adults and children in their household. About one-fourth of respondents have at least one child under age 18 living at home (Figure 74).

Figure 74: Number of Children in the Household



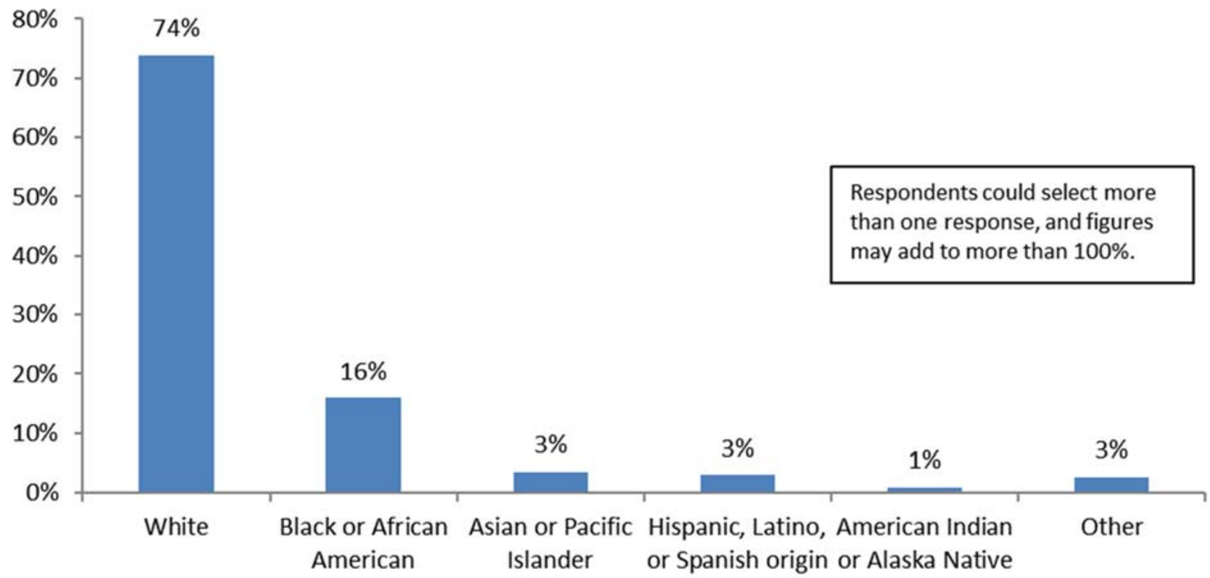
About 16 percent of respondents have just one person living in the household, and 43 percent have two household members (including both adults and children). Four in 10 respondents have three or more household members (see Figure 75).

Figure 75: Total Household Size



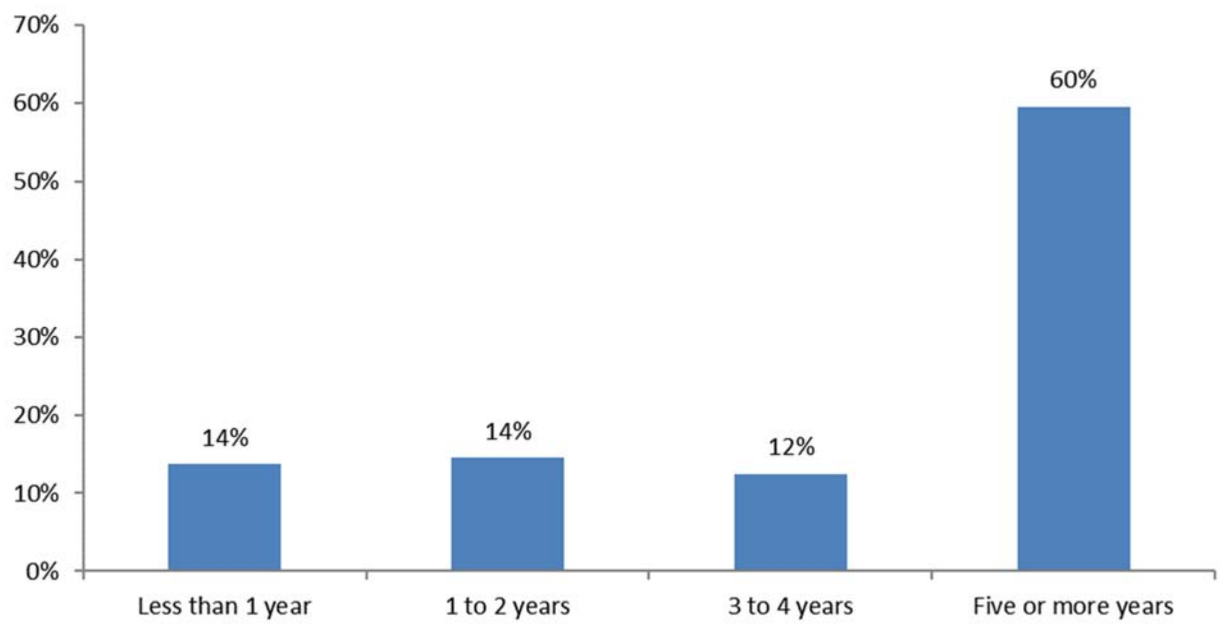
Three-fourths are White only, and one-fourth represents other races/ethnicities, as shown in Figure 76.

Figure 76: Race/Ethnicity of Respondent



A majority of respondents (84 percent) are homeowners. Six in 10 respondents have lived at their residence for five or more years, as shown in Figure 77.

Figure 77: Length of Residence at Current Address



5 Dig Once Policy Development

Regardless of what specific future broadband construction plans it might pursue, the City-Parish can benefit by encouraging coordination and incentivizing efforts between the City-Parish and the private sector when excavating the PROW and placing conduit. Coordination can enable the City-Parish to better protect the PROW, minimize disruptions, and reduce costs of installation of utilities and conduit.

Such joint-trenching efforts around the country—usually referred to as "Dig-Once"—have taken many different forms. Dig once policies reduce the long-term cost of building communications facilities by capitalizing on significant economies of scale through:

1. Coordination of fiber and conduit construction with utility construction and other disruptive activities in the PROW
2. Construction of spare conduit capacity where multiple service providers or entities may require infrastructure

We understand based on our discussions with the City-Parish that both issues are important. The PROW is crowded, particularly in older areas of development where the PROW is narrower. Making use of Dig Once opportunities may also reduce the cost of a fiber optic build to support connectivity to government and institutions, or last-mile construction to homes and businesses.

The incentivizing measures range from implementing business processes for improved sharing of information, to facilitating coordination, to adopting legislative measures that enforce standards and specifications for additional conduits that can be used by the City-Parish or leased to other companies.

It is also important to note that City-Parish transportation and utility projects can provide many opportunities for Dig Once coordination and that taking advantage of those opportunities can start immediately, while the City-Parish potentially works in parallel to implement coordination with non-City utilities.

CTC engineers reviewed relevant specifications and PROW construction processes of the City-Parish, and developed Dig Once recommendations based on our experience developing Dig Once ordinances, specifications, and guidelines for other local governments. In the sections below, we describe our recommendations for the specifications and the process.

5.1 Implementing New Policies to Support Infrastructure Development in City-Parish Rights-of-Way

The City-Parish needs to develop a process to track planned, ongoing, and completed excavation in a timely way and for identifying and prioritizing potential projects for City-Parish participation.

The City-Parish also needs a way to quickly notify potentially interested parties and to coordinate participation with excavators. The impact on the excavator can be minimized by using a well-thought-out process that minimizes delays.

5.1.1 Develop a Procedure to Track and Manage Infrastructure

We recommend, at a high level, the following type of procedure. First, the City-Parish needs to be aware of its needs for fiber optics and the needs of other potential users. These can be mapped as potential sites, neighborhoods or corridors of interest based on reporting from City-Parish departments and discussions with service providers.

These areas of interest should feed into a prioritization plan, such as the one described in Section 5.1.2. This will enable the City-Parish to quickly identify whether a proposed excavation should be part of Dig Once.

The City-Parish should take efforts to be aware of excavation as soon as possible. For excavation initiated by the City-Parish, opportunities should be reviewed when the departments initiate them. For those outside the City-Parish, there should be regular consultations with utilities to discuss and identify projects long before they are designed and permitted (Section 5.1.4).

If the City-Parish identifies an area as a likely Dig Once opportunity, it should require that the excavator submit plans and cost estimates to the City-Parish prior to permitting; the plans would need to include conduit per the Dig Once specifications. The City-Parish should review the plans and cost estimates for consistency with the Dig Once requirements. If the plans are compliant and the cost estimates reasonable per local costs and industry standards, the project could proceed; otherwise, the applicant would need to resubmit compliant plans. If the City-Parish and the applicant were to reach an agreement, the City-Parish could issue an approval; if not, the City-Parish could still decline to participate in the project.

After the excavator installs the conduit, the City-Parish should inspect the conduit for quality and compliance with the Dig Once requirements. If the conduit were compliant, the excavator would submit as-built information. If the conduit were not compliant, the excavator and the City-Parish would negotiate a remedy, and the excavator would perform the negotiated remedy. The City-Parish would then re-inspect the conduit; if the conduit were compliant, the excavator would submit the as-built information and request reimbursement.

The excavator's as-built information should include scale plans of the completed project, including:

1. Vertical and horizontal position of conduit and vaults
2. GPS coordinates for manholes

3. Edge-of-curb offset measurement every 50 feet

4. Colors, diameters, and materials of conduit

In addition, the excavators responsible for any permitted infrastructure, even if not Dig Once, should be required to submit final KML files so that the City-Parish can maintain an inventory of broadband infrastructure options, whether for City-Parish use or for access by the public.

In order to have a systematic way to broaden this information it can be made accessible through the City's GIS platform along with capital improvement projects. The City-Parish would need to address potential concerns of sharing proprietary information with competitors both with non-disclosure agreements (NDA), and with controlled access via credentials to information shared with the City-Parish that other registered parties would not be able to see. It is important to have a mechanism to identify which projects are planned, which have entered construction, what the target dates are, and which projects are completed.

5.1.2 Criteria to Prioritize Projects for Building

Because of the cost of conduit engineering and installation, even in a Dig Once opportunity, it is necessary to prioritize construction to ensure that 1) priorities are identified when Dig Once opportunities emerge, 2) resources are not wasted in designing conduit that is unlikely to be wanted, and 3) resources are not wasted building conduit that is unlikely to be used.

We observe that the following factors typically result in less useful conduit, based on our experience in a range of Dig Once settings:

- Ability to use utility poles along the same path with a reasonable cost of attachment
- Excavation projects that extend only a short distance, such as for a few blocks
- Excavation projects isolated from other projects and existing fiber and conduit infrastructure
- Excavation projects in low- and medium-density residential areas, not in proximity to City facilities, community anchor institutions, or large developments
- Excavation projects that only affect the top layer of the street

We also note that the cost of conduit construction is approximately 50 percent higher in Dig Once opportunities where the excavator is not digging a trench, or where the trench cannot be shared or needs to be widened for placement of the Dig Once conduit.

To ensure that Dig Once projects are both financially feasible and consistent with the City-Parish's long-term goals, we recommend prioritization based on the following factors:

1. Ability to place conduit over long, continuous corridors
2. Proximity of the project to government and community anchor facilities requiring service
3. Lack of existing locality communications infrastructure in the vicinity
4. Potential interest in conduit from partners or customers (e.g., government departments, service providers, or developers)
5. Lack of cost-effective alternatives due to physical constraints in the vicinity (e.g., targets of opportunity such as bridges or freeway underpasses)
6. Lack of capacity on utility poles along the route
7. Low risk to Dig Once communications infrastructure (e.g., electrical and communications conduit in Dig Once construction is in closer proximity to the Dig Once conduit than other types of utilities, making the Dig Once conduit more visible to the excavator and therefore easier to avoid in the event the excavator's conduit needs to be repaired)
8. Limited delays to critical infrastructure (i.e., the incremental days for Dig Once coordination must not create a public safety risk)
9. Beneficial project cost (i.e., prioritizing projects with lower-than-average costs)
10. Synergies with opportunistic major projects, such as highway, mass transit, or bridge replacement
11. Plans for major PROW crossings, such as railroad, water, highway, or interstate, which often are difficult for private carriers to facilitate or justify
12. Conduit placement for building fiber into key sites, data centers, or facilities deemed potential targets for redevelopment

As opportunities emerge, or as existing opportunities are reviewed, we recommend they be evaluated, scored, and ranked based on the above criteria.

5.1.3 Estimation of Incremental Costs

The City-Parish needs to understand the incremental costs associated with design and construction of the additional infrastructure to determine whether the project is a good opportunity for Dig Once. We recommend providing exceptions or forego the excess conduit construction if the cost-benefit analysis is not reasonable.

For cost estimation purposes, the incremental cost is the cost of additional materials (conduit, vaults, location tape, building materials) and labor (incremental engineering, incremental design, placement and assembly of incremental conduit, placement of incremental vaults, interconnection, testing, and documentation).

The cost does not have to include roadway or sidewalk restoration or paving (which we assume to be part of the original project) beyond that which is specifically required for the placement of vaults for the City-Parish's conduit within paved or concrete surfaces outside of the original project boundaries.

In a trenching project, where trenches are joint, the cost does not include trenching or backfilling. Where the Dig Once trench is separate from the original trench, the incremental cost includes trenching and backfill, but does not include repaving or restoring the road surface (again, assumed to be part of the original project).

Average costs may be derived based on multiple contractor pricing schedules. As the City-Parish gains experience by participating in projects, it will develop a more accurate sense of cost.

5.1.4 Coordination with Excavators

Coordinating with excavators—potentially through quarterly outreach or filing requirements—is an important best practice, even if only City-Parish excavators are engaged. The earlier opportunities are known, the earlier they can be considered for Dig Once. That enables (but does not guarantee) more coordination among excavators, earlier engineering, and lower costs.

We recommend the City-Parish consider notifying excavators as soon as possible of excavation projects where they may be able to take advantage of joint trenching. A formal timeline, such as a 60-day window for excavators to decide whether and how to participate, will allow a reasonable amount of time for decision making.

Regular co-ordination meetings are also an excellent opportunity to form informal relationships and share information.

5.1.5 Bidding Consideration

If the City-Parish selects an excavation project as a Dig Once opportunity, we recommend the excavator include the Dig Once infrastructure in the base bid. It is also important to coordinate Dig Once into early part of engineering; adding the conduit as a change order also makes the conduit unreasonably expensive.

We have seen, in other cities, instances in which the winner of the base bid has put unreasonable prices on an optional communications conduit—either to gain an unreasonable margin on the optional task or to change the City's decision on Dig Once, so as to avoid doing the optional task.

We also recommend that the City-Parish suggest ways in which it might incentivize excavators to construct larger conduits or add conduit for excess capacity. These might include offering favorable terms in master agreements, such as use of government buildings or properties for hub facilities, or reduced costs for placement of infrastructure on City-Parish light poles.

5.2 Updating the City-Parish's Engineering Standards and Specifications to Support Dig Once

The City-Parish's Unified Development Code addresses aspects of protecting the PROW but also needs a mechanism for service providers to participate in a joint trench process and place excess conduit capacity for future use. If the City-Parish seeks to implement a Dig Once policy that requires construction of additional conduit for fiber optic capacity, we recommend it develop standards and specifications to expedite planning and decision making, to take advantage of opportunities as they emerge.

The challenge in developing a standard specification for a Dig Once project is to incorporate the requirements of known and unknown users, and to provide sufficient capacity and capability without excessive costs. The following factors may be considered in developing a conduit specification:

1. Capacity—sufficient conduit needs to be installed, and that conduit needs to have sufficient internal diameter, to accommodate future users' cables and to be segmented to enable conduit to be shared or cables added at a future date

2. Segmentation—users need to have the appropriate level of separation from each other for commercial, security, or operational reasons

3. Access—vaults and handholes need to be placed to provide access to conduit and the ability to pull fiber. Vaults need to be spaced to minimize the cost of extending conduit to buildings and other facilities that may be served by fiber

4. Costs—materials beyond those that are likely to be needed will add cost, as will the incremental labor to construct them. Beyond a certain point, trenches need to be widened or deepened to accommodate conduit

5. Robustness—the materials, construction standards, and placement need to reasonably protect the users' fiber, and not unduly complicate maintenance and repairs

6. Architecture—sweeps, bend radius, and vault sizes need to be appropriate for all potential sizes of fiber

We recommend further discussions with private carriers to better develop a specification. It may also be appropriate to have a different specification for different projects. Based on our knowledge of a range of Dig Once efforts, we believe the following sample approach is suitable for major corridors and can be modified as discussion proceed with excavators in the PROW:

- Two 2-inch spare conduit, minimum SDR 11 HDPE, each of a separate color or unique striping to simplify identification of conduits within vaults and between vaults, in the event conduit must be accessed or repaired at intermediate points; of the two 2-inch conduit, one conduit would be reserved for use by the traffic department and the other for the general use of the City-Parish

- Composite vaults sized for the likely number of cables, placed in the sidewalk or available green space within the PROW, as close to the curb or gutter as possible

- Vaults spaced at intervals of 600 feet or less, typically at intersections (in urban and suburban areas)

- Sweeping conduit bends with a minimum radius of 36 inches to allow cable to be pulled without exceeding pull-tension thresholds when placing high-count fiber cables (e.g., 864-count)

- Conduit placed in the same trench directly above the excavator's infrastructure or, where this is not possible, placed with minimum horizontal offset to minimize cost

Typical drawings contain the recommended standards for depth, bend, location, location tape, and vaults/handholes. Figure 78 (below) is a typical diagram showing Dig Once coordination with a communications excavator. Figure 79 is a typical diagram showing Dig Once coordination with a water, power or sewer excavator, and provides two options—one with Dig Once conduit directly above the utility, and one with Dig Once conduit offset laterally.

Ideally, the Dig Once conduit is placed over the excavator utilities. This reduces or eliminates the need for additional trenching and would incur the lowest incremental cost. With the permission of the utility owner, it may be possible to place the Dig Once conduit directly over the utility conduit (see "Model A" in Figure 79 below). Reducing the clearance between the utility and the Dig Once conduit will reduce or eliminate any incremental excavation to accommodate the Dig Once conduit.

In some scenarios, the conduit may need to be offset horizontally from the utility Infrastructure. This may be the case where the infrastructure is a water pipe that should be offset for ease of maintenance. Offsetting the Dig Once conduit may also reduce the risk of the conduit being damaged by a broken water pipe or by repair to that pipe. “Model B” in Figure 79 depicts a Dig Once scenario in an offset trench.

These scenarios assume that the City-Parish has identified a given corridor as suitable for conduit installation, and that it has justified the incremental cost and effort for installation, potentially based on a standard set of criteria.

It is important to note that the above approach is designed to create consistency and predictability in costs and deployment and, of necessity, is a compromise among the potential users. Some users might prefer larger conduit for consistency with earlier builds. Others might seek a larger count of smaller conduit, to provide more flexibility. If an excavation project has a longer time horizon and sufficient budget, it is possible to customize the Dig Once build, potentially adding conduit or adding vaults at certain locations.

The City-Parish can express a willingness to work with the excavator on an approach suited to its project.

We also recommend the City-Parish be open to a wider range of specifications, such as having additional microduct installed at the time of microtrenching. In this case, the City-Parish can require the provider to install a City-Parish microduct and terminate the City-Parish microduct in designated handholes. There is precedent for this approach: The city of Boston negotiated an arrangement with Crown Castle under which the company installed city-owned shadow microduct in all areas where Crown Castle installed microduct.

We suggest that the City-Parish require that all handholes have custom covers for easy identification. Labeling the covers with the owner’s name will help reduce problems with locates, repair, and abandonment.

Figure 78: Typical Diagram – Dig Once Coordination with a Communications Excavator

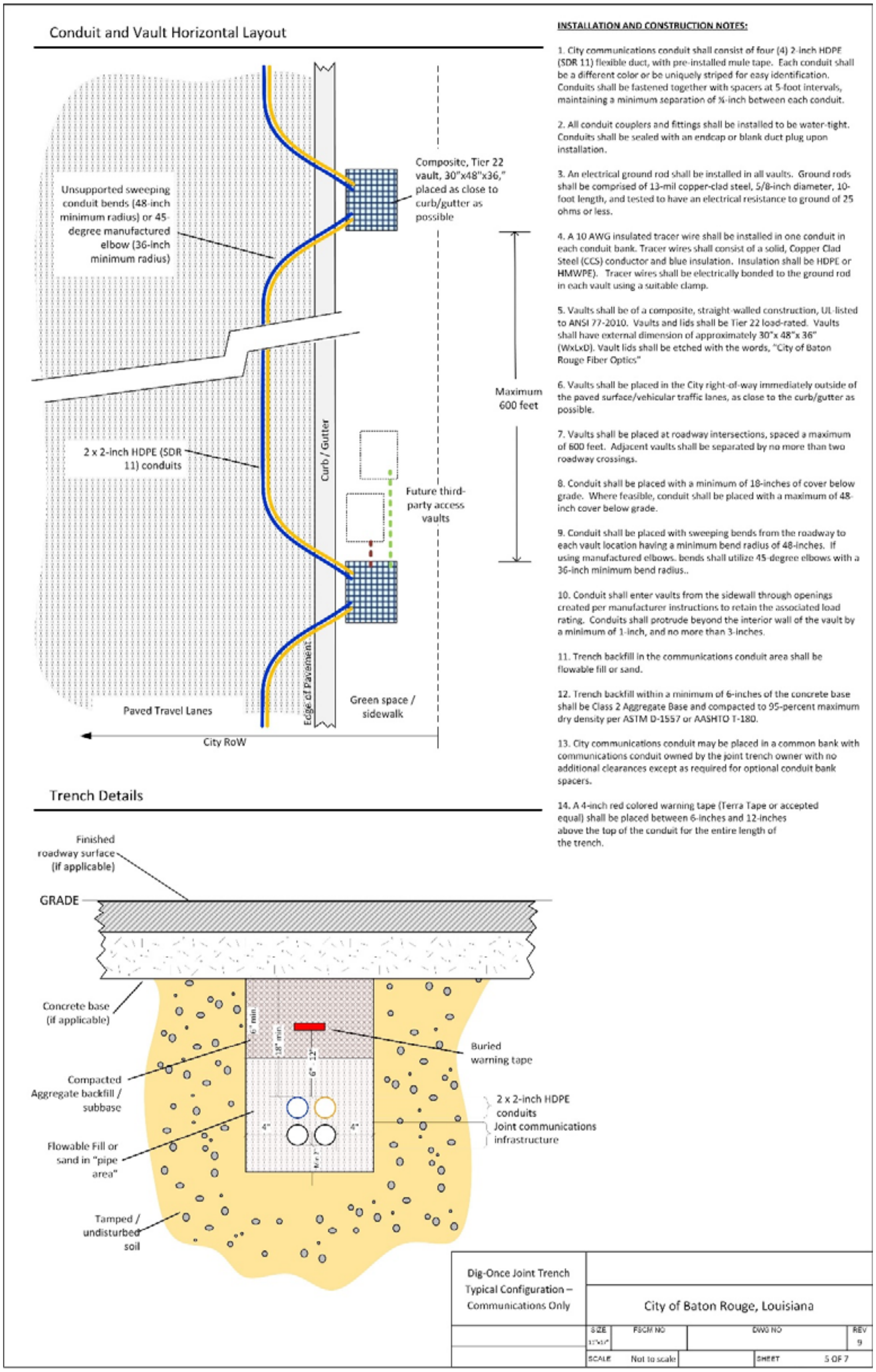
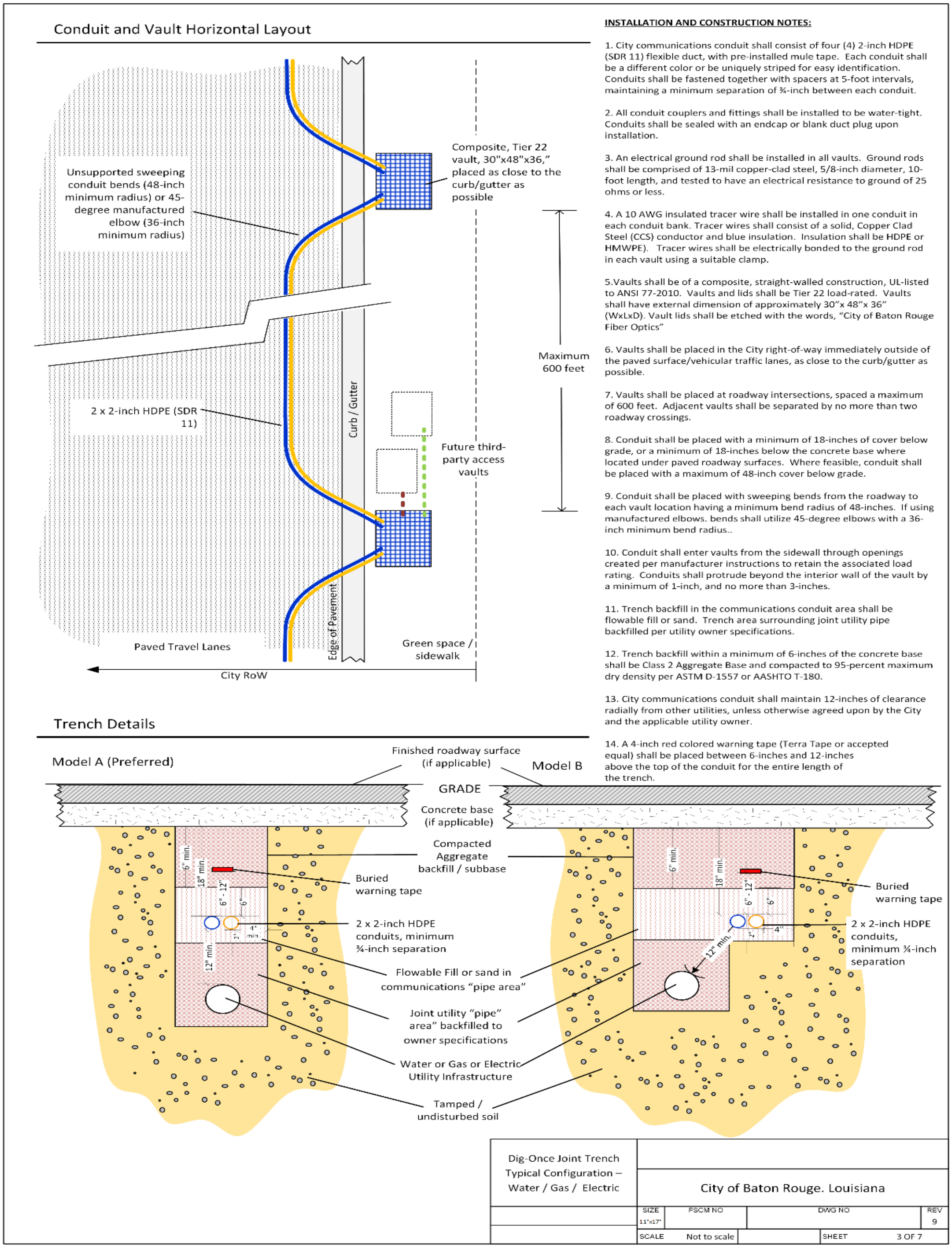


Figure 79: Typical Diagram – Dig Once Coordination with a Water, Power, or Sewer Excavator



6 Design, Cost Estimate, and Financial Analysis for Middle Mile Fiber Network to Connect City-Parish Facilities

Construction of a fiber optic network designed specifically to connect City-Parish facilities is an alternative to commercial services that may offer long-term cost savings and provide technical advantages. We developed a candidate network design that builds on the City-Parish's existing fiber and network resources, and extends the network further out into the City-Parish. In this section, we provide an overview of a technical approach and cost estimate developed to examine the feasibility of constructing the network.

6.1 Technical Approach

CTC developed a system-level design for a fiber optic network to serve as the basis for estimating costs. Design priorities targeted by this conceptual design include:

- Connecting from the existing City-Parish fiber optic network using strands in CenturyLink and Level(3) cables
- Extending the existing network backbone to connect 15 library facilities for which leased service fees can be avoided (see "Library" in Figure 80)
- Providing fiber connectivity to 72 additional City-Parish facilities for which leased service fees can be avoided (see "City-Parish Site" in Figure 80)
- Minimizing costly railroad, levee, and interstate crossings to meet basic connectivity objectives

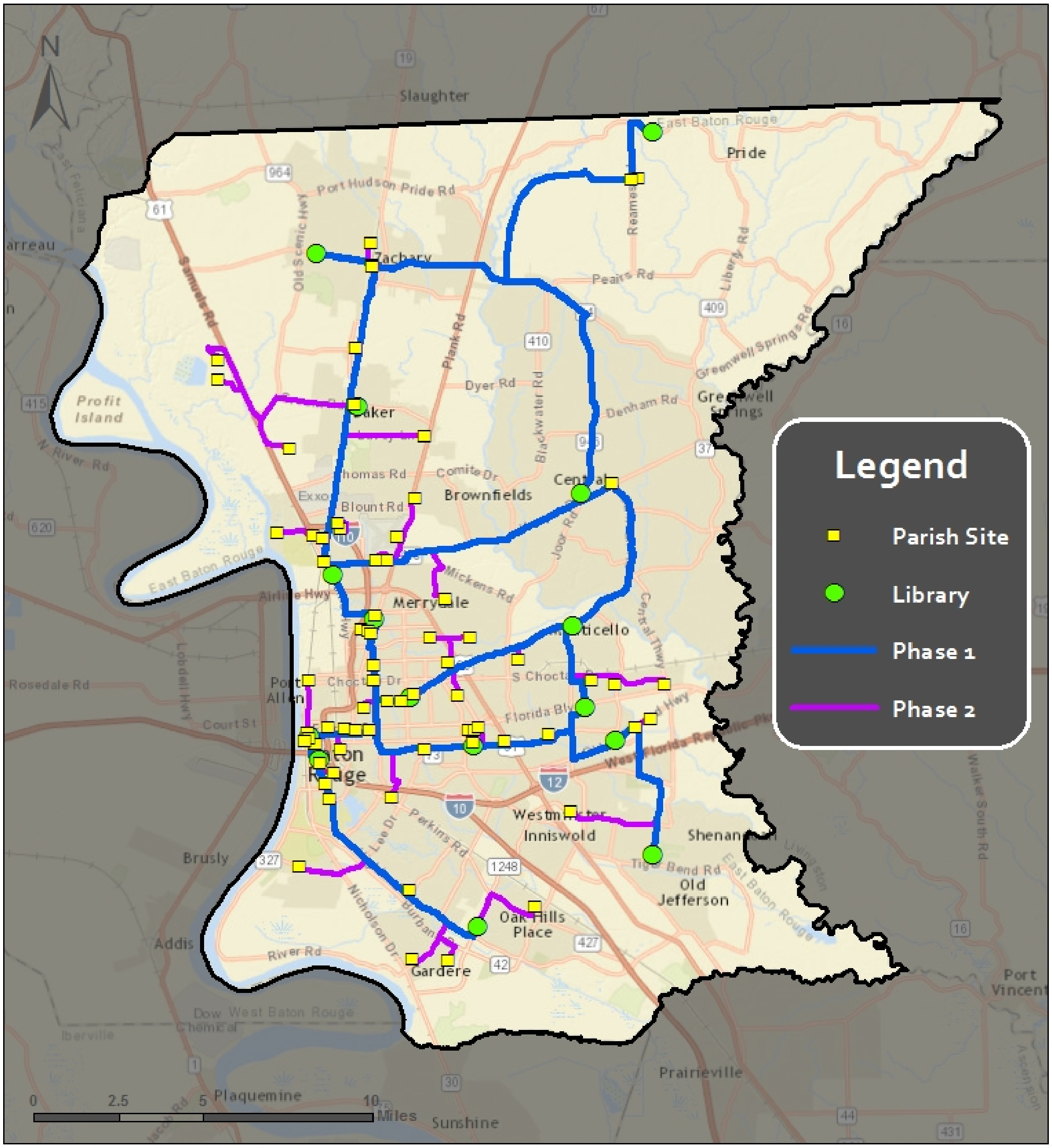
The resulting network architecture, illustrated in Figure 11, comprises approximately 148 route miles of fiber connecting all 87 City-Parish sites and libraries.[48]

We have separated the fiber routing into two phases. Phase 1 is 96 miles of fiber construction that connects all 15 library sites, which were selected as core locations for the broader network.[49] Phase 2 is 52 miles of fiber that connects 72 City-Parish sites.

While not fully vetted in the manner necessary for permitting and construction, this fiber optic design is likely to closely approximate a final design meeting the stated design objectives.

[48] See Appendix B for lists of sites.
[49] One advantage of using the library sites as core network locations is their potential eligibility for subsidy through the federal E-rate program.

Figure 80: System-Level Fiber Network Architecture



A wide range options is feasible given the physical architecture of the proposed network. Depending on how the fiber strands are spliced, single or ringed connections can be established over the backbone routes, and it is possible to provide “express” connections from one end of the network to another without the need for “patching” between intermediate sites.

The cost estimates are based on a backbone consisting of a 288-strand cable occupying one 2-inch conduit where underground, and aerial strand where there are utility poles.

Beyond the physical fiber optic cable routing, there are several technical design and construction attributes impacting costs, including the following:

- **Fiber strand count:** The number of individual fiber strands provided in a single cable correlates to the capacity of the cable. Due to the vast effective bandwidth of fiber, it is feasible to scale the rate of data transmission carried by even a single fiber strand to meet all of the City-Parish's needs indefinitely; however, the cost of network electronics increases exponentially with this capacity. On the other hand, the material cost of fiber strands represents a very minor component of the overall cost of fiber construction (about $0.01 per strand per foot, compared to $15 to $25 per foot for the total cost of typical construction). It is thus prudent to install a cable of sufficient size to meet any conceivable requirements to ensure these needs can be met with a configuration of electronics that are as low-cost as possible. In fact, with sufficient fiber strands, the City-Parish can increase network capacity many orders of magnitude above current levels with little or no change to its network electronics. While we anticipate no portion of the network will require more than a few dozen strands, cost estimates are based on the installation of a 288-count cable along most segments of the network. This will ensure sufficient capacity for nearly any conceivable expansion of internal needs, fiber leasing, or even future support of business or residential services.
- **Underground versus aerial construction:** The cost estimates anticipate primarily aerial construction of the fiber, with fiber cables placed in a 2-inch conduit where the utility pole make ready is too high or where existing utilities are underground. Since the City-Parish does not own its own utility poles, aerial construction will require negotiating pole attachment agreements. These agreements generally require recurring fees per pole, and generally require the attacher to pay the cost of any upgrades or modifications to the utility poles necessary to support the new attachment. Our site survey for the FTTP report indicates that the poles along major roadways where middle mile fiber would go are in good shape.
- **Make ready:** Make ready is the preparation of a utility pole to accommodate a new cable. This can be accomplished through moving the existing cables or, if there is not enough space, replacing the pole with a larger pole. Make ready is one of the largest variables that affect the cost of a fiber optic construction build. The amount of aerial construction, the size and quality of poles, the number of poles per mile, and the number of existing attachments all play into the make ready costs. CTC's OSP engineer noted that the quality of the poles and pole attachments varied, as they do in many municipalities—but that overall, many poles could support an additional communications attachment with minimal make ready. if access to the utility poles is not granted or make-ready and pole

replacement costs are too high, the network would have to be constructed underground—which could significantly increase the cost of construction. We used the following assumptions for make ready:

Table 14: Make-Ready Assumptions

Make Ready Component	Assumption
Percentage of viable aerial routes:	85%
Make ready cost per move:	$450
Average moves per pole:	2
Average poles per mile:	40
% poles requiring make ready:	5%
% poles requiring replacement:	2%
Average pole replacement cost:	$10,000

- **Conduit size and quantity:** Using industry best practices, cost estimates are based on the installation of fiber in a flexible plastic conduit that provides a path into which fiber cable can be installed, allowing for cable slack to be pulled to accommodate repairs, or for new cable to be installed to expand capacity. We assume underground construction will consist primarily of horizontal, directional drilling to minimize PROW impact and to provide greater flexibility to navigate around other utilities. While cost estimates are based on the placement of a single 2-inch conduit, High-Density Polyethylene (HDPE) flexible conduit it should be noted that placing additional conduits simultaneously results in relatively minor increases in cost, within limits. Depending on material prices, 2-inch conduit is preferable along backbone routes, as it can accommodate one or more additional large-strand-count fiber cables in each, with sufficient space for placing additional smaller cables to for purposes of placing "lateral" connections to future locations.

- **Handhole placement and size:** Handholes are enclosures installed underground in which conduit terminates for the purpose of providing access to conduit for installing cable, as well as to house cable splice enclosures and cable slack loops required for future repairs. Handholes generally must be placed at intersections of multiple conduit paths, or where the conduit path makes a sharp change in direction. Handholes provide important access points to underground conduit, enabling expansion of the conduit infrastructure (i.e., installation of a lateral connection to a new network location) without disrupting conduit or installed cables. While cable can be pulled upwards of several thousand feet at a time, cost estimates for the City-Parish network assume installation of handholes every 500 feet on average, ensuring that the infrastructure supports cost-effective expansion to new sites, including access to businesses that might be targets of commercial network operators seeking to lease City-Parish fiber (or conduit space).

- **PROW restoration and fees**: The network cost estimates assume that the City-Parish may have to pay encroachment fees for construction along or under State roads and for railroad crossing application and licensing fees, which can total upwards of $15,000 per crossing, not including special construction costs, which generally entail steel encasement of conduit. The cost estimates assume that the City-Parish will incur typical costs for permanent asphalt and concrete restoration required for utility "test pitting" necessary to verify the location of other utilities in the path of the fiber to prevent damage; generally, this consists of excavation within small areas of less than 2 feet in diameter.

6.2 Cost Estimates

CTC estimates the cost to construct and activate the fiber network described in the previous sections to be approximately $15 million. The cost estimate is itemized between construction scenarios and includes network site electronics and lateral and fiber termination costs at City-Parish facilities.

Phase 1 connects 15 library facilities and expands the footprint of the network and Phase 2 connects 72 additional City-Parish sites. Table 7 provides the cost estimate for fiber construction and network electronics.

Table 15: Summary of Network Construction Costs

Cost Component	Phase 1 Backbone Core to Libraries	Phase 2 Additional Sites	Estimated Cost
Engineering	$1,744,000	$932,000	$2,676,000
Project Management / Quality Assurance	667,000	357,000	1,024,000
General OSP Construction	5,039,000	2,317,000	7,356,000
Railroad, Bridge, and Interstate Crossings	923,000	631,000	1,554,000
OSP Fiber Splicing	293,000	84,000	377,000
Fiber Termination / Building "Entrance"	372,000	190,000	562,000
Network Electronics	1,219,000	-	1,219,000
Total Network Costs:	$10,257,000	$4,511,000	$14,768,000

6.2.1 Outside Plant (OSP)

OSP (layer 1, also referred to as the physical layer) is both the most expensive part of the network and the longest lasting. Cost estimates are inclusive of all engineering, project management, quality assurance, and construction labor anticipated to be necessary to implement the network on a turnkey basis, and are based on relatively conservative pricing assumptions. The following summarizes the scope anticipated by each of the cost components itemized in the table above:

- **Engineering:** Includes system level architecture planning, preliminary designs and engineering field walk-outs to determine candidate fiber routing; development of detailed engineering prints and preparation of permit applications; and post-construction "as-built" revisions to engineering design materials

- **Project Management / Quality Assurance**: Includes expert quality assurance field review of final construction for acceptance, review of invoices, tracking progress, and coordination of field changes

- **OSP Construction**: Consists of all labor and materials related to "typical" underground OSP construction, including conduit placement, utility pole make-ready construction, fiber installation, and surface restoration; includes all work area protection and traffic control measures inherent to all roadway construction activities

- **Railroad, Bridge, and Interstate Crossings**: Consists of specialized engineering, permitting, and incremental construction (material and labor) costs associated with crossings of railroads, bridges, and interstate/controlled access highways

- **OSP Fiber Splicing**: Includes all labor related to fiber splicing of outdoor fiber optic cables

- **Fiber Termination/Building Entrance**: Consists of all costs related to fiber lateral installation into network sites, including OSP construction on private property, building penetration, inside plant construction to a typical backbone network service "demarcation" point, fiber termination, and fiber testing

Actual costs may vary due to unknown factors, including: 1) costs of private easements, 2) congestion in the PROW, 3) variations in labor and material costs, and 4) subsurface hard rock.

Costs for underground placement were estimated using available unit cost data for materials and estimates on the labor costs for placing, pulling, and boring fiber based on construction in comparable markets. The material costs were generally known apart from unknown economies of scale and inflation rates, and barring any sort of phenomenon restricting material availability and costs.

6.2.2 Network Access Electronics

The City-Parish operates a fiber network that interconnects the City-Parish's existing fiber and City-Parish sites that are served by leased circuit. The existing City-Parish network electronics can be leveraged to connect the City-Parish sites to the fiber optic network. We assumed that the core electronics would be upgraded to handle the additional bandwidth and distribution electronics would be placed at each library site and act as hubs for the new additional sites in Phase 2.

For every site, a pair of 1 Gbps fiber optic transceivers would be purchased to connect the sites back to the library hubs. The library distribution electronics would then connect via 10 Gbps links to the core sites. Multiple 10 Gbps links can be added as capacity is needed on the network and sites may be upgraded to 10 Gbps links as needed.

We estimate a total electronics cost of $1.22 million, including installation and integration, for all 87 sites.

6.3 Financial Analysis for Fiber Network to Connect City-Parish Facilities

This section presents a high-level analysis of the financial implications of the City-Parish constructing the network at the costs presented in the above section. This model assumes the City-Parish connects all 87 sites (15 library sites in Phase 1 and 72 sites in Phase 2) proposed in this report.

The analysis presented in this section assumes the City-Parish can maximize the use of its existing network assets, keeping construction costs as low as possible. We have provided the entirety of the tables presented in this analysis to the City-Parish in Excel format.

6.3.1 Middle Mile Base Case

Our base case assumes the City-Parish can construct the network at our cost estimates by maximizing the use of its current fiber assets. In this base case, we propose the fees and financing which would be necessary for the City-Parish to maintain positive cash flow, and look at the implications of changing critical assumptions, such as the per month fee and operating and maintenance expenses. We have provided a complete financial model in Excel format that can be used to show the impact of changing assumptions.

To provide 1 Gbps services to all 15 library sites in Phase 1 and all 72 City-Parish sites in Phase 2, the City-Parish would need to construct $13.55 million of OSP, as well as install network electronics totaling $1.65 million. These costs total $15.2 million.

In this base case, for the enterprise to maintain a positive cash flow over the course of 10 years, the cost for the City-Parish would be $1,875 per month per site. For all 87 sites, these site fees (or total cost for the City-Parish) would total $163,125 per month.

While this cost may be slightly higher than commercially available rates in the City-Parish, it is important to remember that these prices are not an "apples-to-apples" comparison. The network proposed in this report offers the City-Parish many benefits, including a higher level of control over the network and the ability to scale the network as data demands increase. Further, the costs in this model are comprehensive, including labor, replacement electronics, and fiber maintenance costs for the lifetime of the model.

This model assumes fees from 50 percent of libraries and 25 percent of City-Parish sites will be collected in year one, and all sites will be connected for the entirety of year two on.

Please note that we used a "flat model" in the analysis, which means that inflation and operating cost increases (including for salaries) are not applied because it is assumed that operating cost increases will be offset by increases in operator lease payments over time (and likely passed on to subscribers in the form of increased prices). We anticipate that the City-Parish will apply an inflation factor, typically based on a Consumer Price Index (CPI), to the portion of the per-site fee that covers projected operating expenses.

We have included a financial summary for this model in Table 16.

Table 16: Middle Mile Base Case Financial Summary

Income Statement	Year 1	Year 3	Year 5	Year 10
Site Fees	$574,000	$1,957,500	$1,957,500	$1,957,500
Total Cash Expenses	(219,000)	(412,500)	(412,500)	(412,500)
Depreciation	(950,900)	(950,900)	(950,900)	(950,900)
Interest Expense	(720,000)	(695,230)	(642,290)	(487,630)
Net Income	$(1,315,900)	$(101,130)	$(48,190)	$106,470

Cash Flow Statement	Year 1	Year 3	Year 5	Year 10
Unrestricted Cash Balance	$100,000	$118,960	$135,920	$178,320
Depreciation Operating Reserve	-	532,000	1,064,000	554,000
Debt Service Reserve	-	-	-	-
Total Cash Balance	$100,000	$650,960	$1,199,920	$732,320

This model would result in the enterprise operating with a negative net income through year six, finishing year seven with $9,360 in net income, and ending year 10 with over $106,000 in net income. The City-Parish would operate with a positive cash balance throughout the model, finishing year one with $100,000 and ending year 10 with more than $732,000.

6.3.2 Middle Mile Base Case Financing

This financial analysis assumes that the City-Parish will cover all its capital requirements with general obligation (GO) bonds. We assumed that the City-Parish's bond rate would be 4.5 percent.

We expect that the City-Parish will take a 20-year bond for a total of $16 million in financing. (The difference between the financed amount and the total capital costs represents the amount needed to maintain positive cash flow in the early years of network deployment.) The resulting principal and interest (P&I) payments will be the major factor in determining the City-Parish's long-term financial requirements.

We project that the bond issuance costs will be equal to 0.91 percent of the principal borrowed. For the bond, we assume neither a debt service nor an interest reserve account are required. Principal repayment on the bonds will start in year two.

We have included a detailed income statement in Table 17.

Table 17: Middle Mile Base Case Income Statement

Income Statement		Year 1	Year 3	Year 5	Year 10
a. Revenues					
Anchor Connectivity Services		$574,000	$1,957,500	$1,957,500	$1,957,500
CAI Capital Contributions		-	-	-	-
	Total	$574,000	$1,957,500	$1,957,500	$1,957,500
b. Operating Expenses - Cash (not including taxes)					
Operating & Maintenance Expenses		$86,000	$186,000	$186,000	$186,000
Operating Expenses - Training, Attachments, Utilities		78,000	79,500	79,500	79,500
Salaries		55,000	147,000	147,000	147,000
	Total	$219,000	$412,500	$412,500	$412,500
c. Revenues less Cash Operating Expenses		$355,000	$1,545,000	$1,545,000	$1,545,000
d. Operating Expenses - Non-Cash					
Depreciation		$950,900	$950,900	$950,900	$950,900
e. Operating Income		$(595,900)	$594,100	$594,100	$594,100
f. Non-Operating Income					
Interest Expense (Long-Term))		$(720,000)	$(695,230)	$(642,290)	$(487,630)
Interest Expense (Internal)		-	-	-	-
	Total	$(720,000)	$(695,230)	$(642,290)	$(487,630)
g. Net Income		$(1,315,900)	$(101,130)	$(48,190)	$106,470
h. Taxes		$ -	$ -	$ -	$ -
i. Net Income After Fees & In Lieu Taxes		$(1,315,900)	$(101,130)	$(48,190)	$106,470

This model would operate with a negative net income through year six, generating a net income of $9,360 by the end of year seven, and growing to just over $106,000 by the end of year 10.

We have included a detailed cash flow statement in Table 18.

Table 18: Middle Mile Base Case Cash Flow Statement

Cash Flow Statement	Year 1	Year 3	Year 5	Year 10
a. Net Income (From Income Statement)	$(1,315,900)	$(101,130)	$(48,190)	$106,470
b. Cash Outflows				
Depreciation Operating Reserve	$ -	$(266,000)	$(266,000)	$(266,000)
Financing	(146,000)	-	-	-
Capital Expenditures	$(15,389,000)	$ -	$ -	$ -
Total	$(15,535,000)	$(266,000)	$(266,000)	$(266,000)
c. Cash Inflows				
Long Term Financing (Bond)	$16,000,000	$ -	$ -	$ -
Total	$16,000,000	$ -	$ -	$ -
d. Total Cash Outflows and Inflows	$465,000	$(266,000)	$(266,000)	$(266,000)
e. Non-Cash Expenses - Depreciation	$950,900	$950,900	$950,900	$950,900
f. Adjustments (Proceeds from)				
Long Term Financing (Bond)	$(16,000,000)	$ -	$ -	$ -
Total	$(16,000,000)	$ -	$ -	$ -
g. Adjusted Available Net Revenue	$(15,900,000)	$583,770	$636,710	$791,370
h. Principal Payments on Debt				
Long Term Bond Principal	$ -	$575,290	$628,230	$782,890
Total	$ -	$575,290	$628,230	$782,890
i. Net Cash	$100,000	$8,480	$8,480	$8,480
Adjusted Net Cash	$100,000	$8,480	$8,480	$8,480
Cash Balance (Enterprise)				
Unrestricted Cash Balance	$100,000	$118,960	$135,920	$178,320
Depreciation Operating Reserve	-	532,000	1,064,000	554,000
Debt Service Reserve	-	-	-	-
Total Cash Balance	$100,000	$650,960	$1,199,920	$732,320

This model will operate cash positive for the life of the projection, accumulating $100,000 by the end of year one, almost $1.2 million by the end of year five, and just over $732,000 by the end of year 10.

6.3.3 Middle Mile Capital Additions

Significant network expenses—known as "capital additions"—are incurred in the first few years during the construction phase of the network. These represent the equipment and labor expenses associated with building a fiber network. As assets age, capital additions are necessary to replace equipment and software.

This analysis projects that the capital additions in year one will total $15.39 million. Future capital additions, which will be funded by the depreciation account, include:

- Replacement of support equipment such as vehicles, OTDR, and fiber management software in year six ($185,000)
- Replacement of headend and hub equipment software in year eight ($1.66 million)

A summary table of these capital additions is included in Table 19.

Table 19: Middle Mile Capital Additions

Capital Additions	Year 1	Year 6	Year 8
a. Fiber Implementation Costs			
Fiber (20-year depreciation)	$13,549,000	$ -	$ -
Headend and Hub Equipment Software (7-year depreciation)	1,655,000	-	1,655,000
Total	$15,204,000	$ -	$1,655,000
b. Support Equipment (5-year depreciation)			
Vehicles	$35,000	$35,000	$ -
Emergency Restoration Kit	50,000	50,000	-
Fiber OTDR and Other Tools	50,000	50,000	-
Fiber Management Software	50,000	50,000	-
Total	$185,000	$185,000	$ -
Total Capital	$15,389,000	$185,000	$1,655,000
Total Accrued Capital	$15,389,000	$15,574,000	$17,229,000
Total Funded by Depreciation Account	$ -	$185,000	$1,655,000

Accounting for these additions, the City-Parish will have accrued $15.57 million in fiber assets by the end of the construction period, and total accrued capital will be almost $17.23 million by the end of year eight.

6.3.4 Middle Mile Operating and Maintenance Expenses

The cost to deploy a fiber network goes far beyond fiber implementation. Network deployment requires maintenance and technical operations, support personnel, and other functions. In this model, the City-Parish's financial requirements are limited to expenses related to OSP infrastructure and network administration.

The model assumes a straight-line depreciation of assets, and that the OSP and materials will have a 20-year life span.

While networks require additional personnel for maintenance, this model assumes the City-Parish will acquire one full-time-equivalent (FTE) position by year two for fiber plant operating and maintenance technicians, otherwise, it could use its existing staff to cover most labor expenses. These staffing requirements represent what would be necessary to operate the enterprise. While these positions could easily be contracted to an outside firm, it is in the City-Parish's best interest to keep GIS and recordkeeping (such as fiber strand mapping, etc.) in-house.

That said, we assume the City-Parish will need to acquire a 0.15 FTE position for GIS, and 0.10 position for administrative support. Salaries and benefits are based on estimated market wages, and benefits are estimated at 35 percent of base salary, resulting in labor costs of $147,000 annually from year two on.

Table 20 illustrates these labor additions.

Table 20: Middle Mile Labor Expenses

New Employees	Year 1	Year 2	Year 3+	Labor Cost (for one FTE)
Fiber Plant O&M Technicians	0.25	1.00	1.00	$90,000
Administration Support (Allocation)	0.10	0.10	0.10	$65,000
GIS	0.15	0.15	0.15	$80,000
Total New Staff	0.50	1.25	1.25	

Additional key operating and maintenance assumptions include the following:

- Locates and ticket processing are estimated to be $9,900 in year one and $19,800 from year two on
- Dedicated Internet Access (DIA) of 1 Gbps per site, with an oversubscription rate of 40 to 1,[50] totaling $26,100 in year one, and $52,200 from year two on
- Insurance is estimated to be $2,000 annually
- Office expenses are estimated to be $6,000 annually

[50] Internet service providers (ISP) recognize that users in a given area do not all access the internet at the same time; therefore, ISPs only subscribe to a portion of their networks' total potential demand. For example, an ISP that has 1,000 subscribers with 10 Mbps service might contract for a 100 Mbps connection rather than the maximum 10,000 Mbps internet connection its users might require. The ratio of a network's maximum potential demand to its contracted rates is its oversubscription ratio. In this example, the oversubscription ratio is 100:1.

- Fiber maintenance is estimated to be $3,400 in year one and $6,800 from year two on
- Contingency expenses are estimated at $10,000 in year one and $20,000 from year two on
- Attachment fees are estimated at $75,600 annually
- Training is estimated at $1,500 annually beginning in year two
- Utilities fees are estimated at $2,400 annually

These expenses are summarized in Table 21.

Table 21: Middle Mile Operating and Maintenance Expenses

Operating and Maintenance Expenses	Year 1	Year 3	Year 5	Year 10
Operating and Maintenance Expenses				
Locates & Ticket Processing	$9,900	$19,800	$19,800	$19,800
DIA	26,100	52,200	52,200	52,200
Insurance	-	20,000	20,000	20,000
Office Expense	6,000	6,000	6,000	6,000
Fiber Maintenance	34,000	68,000	68,000	68,000
Contingency	10,000	20,000	20,000	20,000
Total	$86,000	$186,000	$186,000	$186,000
Operating Expenses - Training, Attachments, Utilities				
Attachment Fees	$75,600	$75,600	$75,600	$75,600
Education and Training	-	1,500	1,500	1,500
Utilities	2,400	2,400	2,400	2,400
Total	$78,000	$79,500	$79,500	$79,500
Salaries				
Fiber Plant O&M Technicians	$30,000	$122,000	$122,000	$122,000
Administration Support (Allocation)	9,000	9,000	9,000	9,000
GIS (Allocation)	16,000	16,000	16,000	16,000
Total Staff	$55,000	$147,000	$147,000	$147,000
Total Operating and Maintenance Expenses	$219,000	$412,500	$412,500	$412,500

Total operating and maintenance expenses would equal $219,000 in year one, and grow to $412,500 in year two on.

6.3.5 Middle Mile Scenario 2: Increased Expenses and Salaries

This scenario projects the effects of increasing estimated expenses by 25 percent. All other assumptions from our base case remain the same. If this increase were to occur, the City-Parish would not be able to maintain a positive cash flow by the end of year 10.

We have included a financial summary of this scenario in Table 22.

Table 22: Middle Mile Scenario 2 Financial Summary

Income Statement	Year 1	Year 3	Year 5	Year 10
Site Fees	$574,000	$1,957,500	$1,957,500	$1,957,500
Total Cash Expenses	(232,800)	(449,300)	(449,300)	(449,300)
Depreciation	(950,900)	(950,900)	(950,900)	(950,900)
Interest Expense	(720,000)	(695,230)	(642,290)	(487,630)
Net Income	$(1,329,700)	$(137,930)	$(84,990)	$69,670

Cash Flow Statement	Year 1	Year 3	Year 5	Year 10
Unrestricted Cash Balance	$45,200	$(141,840)	$(331,280)	$(804,880)
Depreciation Operating Reserve	-	532,000	1,064,000	554,000
Debt Service Reserve	-	-	-	-
Total Cash Balance	$45,200	$390,160	$732,720	$(250,880)

If expenses were to increase by 25 percent, the City-Parish would operate with a negative net income through year seven, which would become positive in year eight (totaling $3,700) and grow to just under $70,000 by year 10. The increased expenses would exceed the monthly revenue, and would result in a cumulative cash deficit of almost $251,000 by the end of year 10.

6.3.6 Middle Mile Scenario 3: Increased Expenses and Connection Fee

To offset the potential increase in expenses, we projected the results of an increased connection fee. If the City-Parish's expenses were to be 25 percent higher than our base case scenario, a fee increase of $100 per month (totaling $1,975) would generate a positive cash flow for the City-Parish.

We have included a financial summary of this scenario in Table 23.

Table 23: Middle Mile Scenario 3 Financial Summary

Income Statement	Year 1	Year 3	Year 5	Year 10
Site Fees	$605,000	$2,061,900	$2,061,900	$2,061,900
Total Cash Expenses	(232,800)	(449,300)	(449,300)	(449,300)
Depreciation	(950,900)	(950,900)	(950,900)	(950,900)
Interest Expense	(720,000)	(695,230)	(642,290)	(487,630)
Net Income	$(1,298,700)	$(33,530)	$19,410	$174,070

Cash Flow Statement	Year 1	Year 3	Year 5	Year 10
Unrestricted Cash Balance	$76,200	$97,560	$116,920	$165,320
Depreciation Operating Reserve	-	532,000	1,064,000	554,000
Debt Service Reserve	-	-	-	-
Total Cash Balance	$76,200	$629,560	$1,180,920	$719,320

The increased connection fee offsets increased expenses, resulting in a positive net income of over $19,000 in year five, which grows to just over $174,000 in year 10. The City-Parish maintains a positive cumulative cash balance, totaling $1.18 million by the end of year five, and over $719,000 by the end of year 10.

6.3.7 Middle Mile Scenario 4: Decreased Expenses

If the City-Parish's expenses were to total 25 percent less than our projections, the model would be financially viable, with both increased net income and cash balance from the base case. All other assumptions remain the same are our base case.

A financial summary of this model is provided in Table 24.

Table 24: Middle Mile Scenario 4 Financial Summary

Income Statement	Year 1	Year 3	Year 5	Year 10
Site Fees	$574,000	$1,957,500	$1,957,500	$1,957,500
Total Cash Expenses	(205,300)	(375,800)	(375,800)	(375,800)
Depreciation	(950,900)	(950,900)	(950,900)	(950,900)
Interest Expense	(720,000)	(695,230)	(642,290)	(487,630)
Net Income	$(1,302,200)	$(64,430)	$(11,490)	$143,170

Cash Flow Statement	Year 1	Year 3	Year 5	Year 10
Unrestricted Cash Balance	$154,700	$379,460	$602,620	$1,160,520
Depreciation Operating Reserve	-	532,000	1,064,000	554,000
Debt Service Reserve	-	-	-	-
Total Cash Balance	$154,700	$911,460	$1,666,620	$1,714,520

If the City-Parish could decrease overall expenses by 25 percent,[51] the City-Parish would operate with an increased net income and cash balance than our base case. Net income would be negative in years one through five, and become positive one year earlier than our base case, equaling almost $17,000 in year six. By year 10, net income would equal just over $143,100. The cumulative cash balance would also remain higher than our base case, resulting in just under $1 million at the end of year three, and growing to just over $1.7 million by the end of year 10.

6.3.8 Middle Mile Scenario 5: Decreased Expenses and Connection Fee

Should the City-Parish's expenses decline (as in Scenario 4), and the City-Parish chooses to pass this savings on to subscribers, the model could still operate cash-positive. In this scenario, we project both 25 percent decreased expenses, and a decreased connection fee ($100 less than our base case, totaling $1,775).

A financial summary of this model is provided in Table 25.

Table 25: Middle Mile Scenario 5 Financial Summary

Income Statement	Year 1	Year 3	Year 5	Year 10
Site Fees	$543,000	$1,853,100	$1,853,100	$1,853,100
Total Cash Expenses	(205,300)	(375,800)	(375,800)	(375,800)
Depreciation	(950,900)	(950,900)	(950,900)	(950,900)
Interest Expense	(720,000)	(695,230)	(642,290)	(487,630)
Net Income	$(1,333,200)	$(168,830)	$(115,890)	$38,770

Cash Flow Statement	Year 1	Year 3	Year 5	Year 10
Unrestricted Cash Balance	$123,700	$140,060	$154,420	$190,320
Depreciation Operating Reserve	-	532,000	1,064,000	554,000
Debt Service Reserve	-	-	-	-
Total Cash Balance	$123,700	$672,060	$1,218,420	$744,320

This model would result in a negative net income in years one through eight, growing in year nine to just over $5,000. In year 10, the City-Parish's net income would equal just under $39,000. The City-Parish's cumulative cash balance would remain positive throughout the projection, ending year one with just under $124,000, year five with roughly $1.2 million, and ending year 10 with $744,000.

[51] This scenario is purely for illustration of the effect of expenses on necessary site fees. It is not a guarantee that the City-Parish would be able to feasibly reduce its operating and maintenance expenses.

7 Design and Cost Estimate for FTTP Construction

At the City-Parish's request, CTC prepared a high-level network design and cost estimate for investing in the infrastructure capable of deploying a gigabit-capable FTTP network to all homes and businesses in the City-Parish via public-private partnership. The CTC cost estimate provides data relevant to assessing the financial viability of network deployment, and to developing a business model for a potential City-Parish construction effort (including the full range of models for public–private partnerships). This estimate also enables financial modeling to determine the approximate revenue levels necessary for the City-Parish to service any debt incurred in building the network.

The CTC design and cost estimate are underpinned by data and insight gathered by CTC engineers through several related steps of discussions with City-Parish stakeholders and an extensive field and desk survey of candidate fiber routes.

The descriptions in this document are highly technical and make use of several acronyms. We have included a glossary as Appendix A.

7.1 FTTP Cost Estimate

Based on these inputs and other guidance from the City-Parish, we developed a conceptual, high-level FTTP design that reflects the City-Parish's goals and is open to a variety of architecture options. The cost estimate presented uses a combination of aerial and underground construction.

From this design, we present two cost examples. The first is the cost to deploy an FTTP infrastructure, all electronics, consumer drops, and CPEs, which we refer to as a "lit" model. This estimate shows the *total capital costs* (by the City-Parish or the City-Parish and partners) to build an FTTP network to support a ubiquitous Gigabit data service.

The second estimate is the cost to deploy just the FTTP OSP, which we refer to a as a "non-lit" model. This is the total capital cost for the City-Parish to build a dark FTTP network for lease to a private partner. It is this non-lit model that forms the basis for our FTTP financial analysis in Section 9. The non-lit model is presented with two alternatives—one in which the drop costs are the responsibility of the partner (referred to as the Huntsville Model) and one in which the drop costs are the responsibility of the City-Parish (Westminster Model).

The difference between these two cost estimates reflects the general range of costs that a private partner would need to incur to deploy FTTP with the City-Parish. Please note that the partner's costs (electronics) are subject to a seven- to 10-year replacement cycle, as compared to the 20- to 30-year lifespan of the City-Parish's fiber investment.

7.1.1 Lit FTTP Cost Estimate

The full FTTP network deployment will cost more than $515 million, inclusive of OSP construction labor, materials, engineering, permitting, pole attachment licensing, network electronics, drop installation, CPEs, and testing.[52] The cost per passing is $2,745 on average.

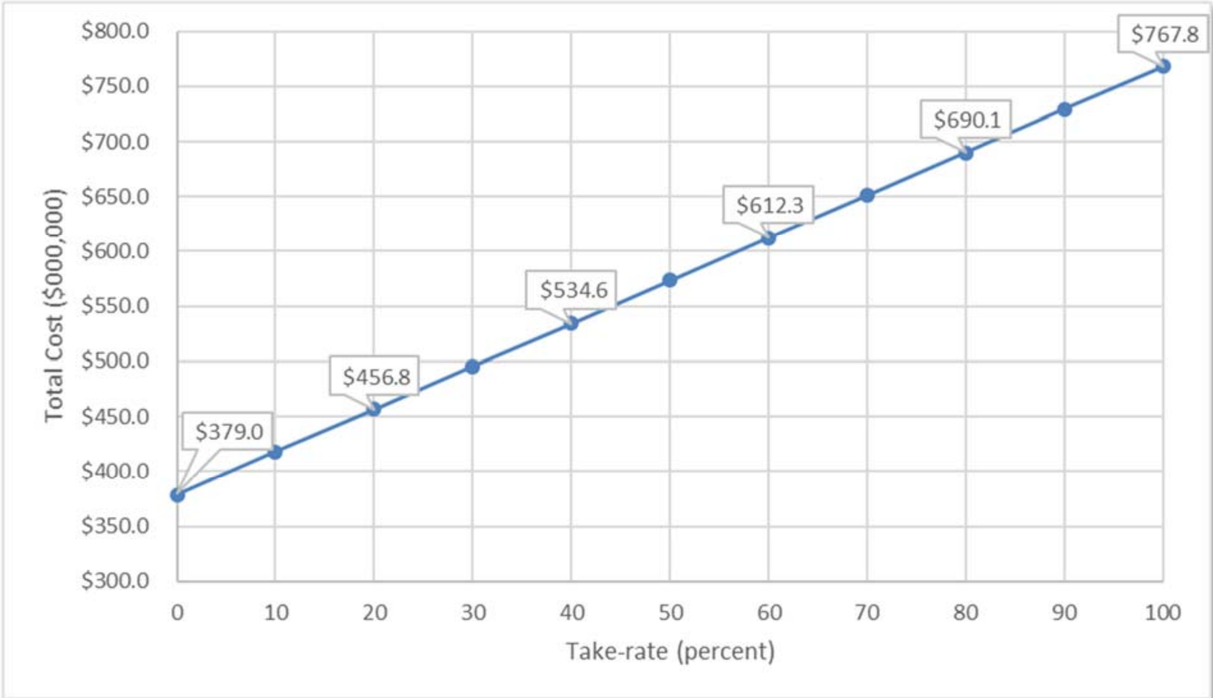
Table 26: Estimated Lit FTTP Cost

Cost Component	Total Estimated Cost
OSP	$357.9 million
Central Network Electronics	32.6 million
FTTP Service Drop and Lateral Installations	83.0 million
CPE	41.6 million
Total Estimated Cost:	$515.1 million

Figure 12 shows the total estimated cost by varying the expected penetration rate. Table 10 assumes a penetration rate of 35 percent.

[52] The estimated total cost breakdown assumes a percentage of residents and businesses that subscribe to the service, otherwise known as the penetration rate or the “take rate,” of 35 percent. This is within the range of penetration rate that may exist in a market where both the cable and telephone companies also provide broadband service.

Figure 81: Total Estimated Cost versus Take Rate



The cost is roughly linear by take rate as the cost of adding additional subscribers is a fixed cost.

Actual costs may vary due to factors that cannot be precisely known until the detailed design is completed, or until construction commences. These factors include: 1) costs of private easements, 2) utility pole replacement and make ready costs, 3) variations in labor and material costs, 4) subsurface hard rock, and 5) the City-Parish's operational and business model. We have incorporated suitable assumptions to address these items based on our experiences in similar markets.

The total cost of operations will also vary with the business model chosen and the level of existing resources that can be leveraged by the City-Parish and any potential business partners.

7.1.2 Non-Lit FTTP Cost Estimate

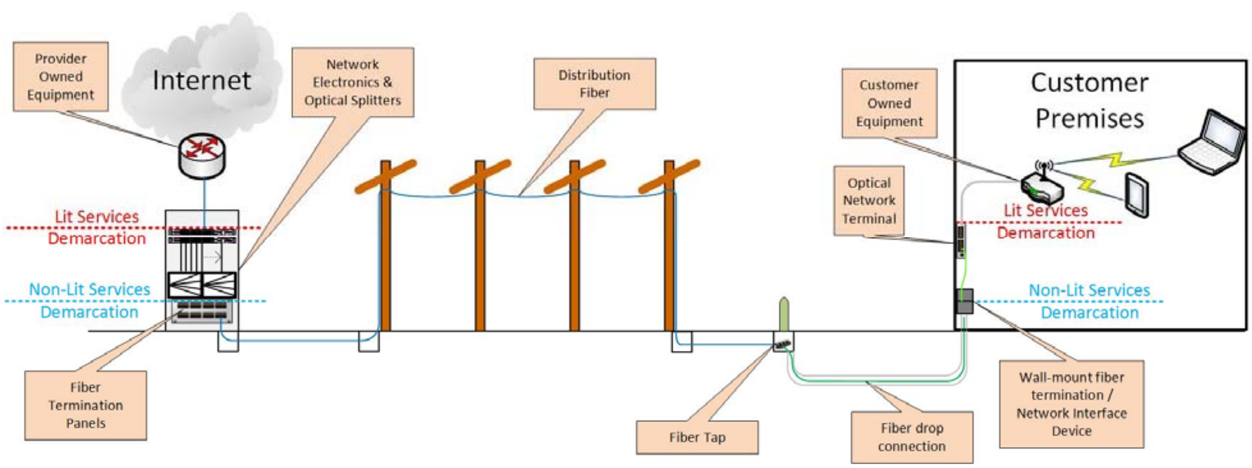
This non-lit FTTP network deployment will cost about $441 million, inclusive of OSP construction labor, materials, engineering, permitting, pole attachment licensing, and lateral drop and materials. This estimate does not include any electronics or subscriber equipment.

Table 27: Estimated Non-Lit FTTP Cost

Cost Component	Total Estimated Cost
OSP	$357.9 million
FTTP Service Drop and Lateral Installations	83.0 million
Total Estimated Cost:	$440.9 million

This estimate assumes that the City-Parish constructs and owns the FTTP infrastructure up to a demarcation point (a network interface device) at each residence and business, and leases the dark fiber backbone, distribution, and drop fiber to a private partner. The private partner would be responsible for all network electronics and CPEs—as well as network sales, marketing, and operations.

Figure 82: Demarcation Between City-Parish and Partner Network Elements in the Lit and Non-Lit Models



7.2 Cost Estimate Breakdown

The cost components for OSP construction include the following tasks:

- ***Engineering*** – includes system level architecture planning, preliminary designs and field walk-outs to determine candidate fiber routing; development of detailed engineering prints and preparation of permit applications; and post-construction "as-built" revisions to engineering design materials. The OSP engineering is estimated at $44.6 million.
- ***Quality Control / Quality Assurance*** – includes expert quality assurance field review of final construction for acceptance. The quality control/quality assurance is estimated at $23.4 million.

- ***General OSP Construction*** – consists of all labor and materials related to "typical" underground or aerial OSP construction, including conduit placement, utility pole make-ready construction, aerial strand installation, fiber installation, and surface restoration; includes all work area protection and traffic control measures inherent to all roadway construction activities. General OSP construction is estimated at $250 million.

- ***Special Crossings*** – consists of specialized engineering, permitting, and incremental construction (material and labor) costs associated with crossings of railroads, bridges, and interstate / controlled access highways. This also includes the necessary costs for levee crossing and encroachments. Special crossings are estimated at $14.3 million.

- ***Backbone and Distribution Plant Splicing*** – includes all labor related to fiber splicing of outdoor fiber optic cables. Backbone and distribution plant splicing is estimated at $7.7 million.

- ***Backbone Hub, Termination, and Testing*** – consists of the material and labor costs of placing hub shelters and enclosures, terminating backbone fiber cables within the hubs, and testing backbone cables. The backbone hub, termination, and testing is estimated at $17.9 million.

- ***FTTP Service Drop and Lateral Installations –*** consists of all costs related to fiber service drop installation, including OSP construction on private property, building penetration, and inside plant construction to a typical backbone network service "demarcation" point; also includes all materials and labor related to the termination of fiber cables at the demarcation point. A take-rate of 35 percent was assumed for standard fiber service drops. The lateral costs are estimated at $2.4 million. At a 35 percent take rate, drop costs add $80.6 million.

7.3 Field Survey

A CTC OSP engineer performed a preliminary survey of Baton Rouge onsite and via Google Earth Street View to develop estimates of per mile cost for aerial in the power space and communications space, and per mile costs for underground (where poles are not available). The engineer reviewed available green space, necessary make-ready on poles, pole replacement—all of which have been factored in to the design and cost estimate.

Table 10 summarizes the conditions determined through our field and desk survey. The table refers to the two types of population densities we used in the cost estimation model—high and low. (See below for more details.)

Table 28: Field Survey Findings

	High Density	Low Density
Aerial Construction	30%	60%
Poles per Mile	45	40
Moves per Pole	3	2
Poles Requiring Make Ready	15%	15%
Poles Requiring Replacement	5%	5%
Intermediate Rock	2%	2%
Hard Rock	1%	1%

CTC's OSP engineer noted that the quality of the poles and pole attachments in Baton Rouge varied, as they do in many cities—but that overall, many poles could support an additional communications attachment with moderate make ready.

The following example photos document the existing utility conditions observed by CTC's OSP engineer. Figure 83 shows a typical utility pole line along a major roadway. The poles are relatively clear and make ready will be minimal.

Figure 83: Typical Clean Utility Pole Line Along Major Roadways

Figure 84 shows a typical utility pole requiring make ready and tree trimming to add a new attachment in the communications space.

Figure 84: Utility Pole Requiring Make Ready

Figure 85 shows a utility pole that is likely too short to support an additional attachment and will need replacement.

Figure 85: Pole Replacement Required on a Utility Pole

7.4 FTTP Network Design

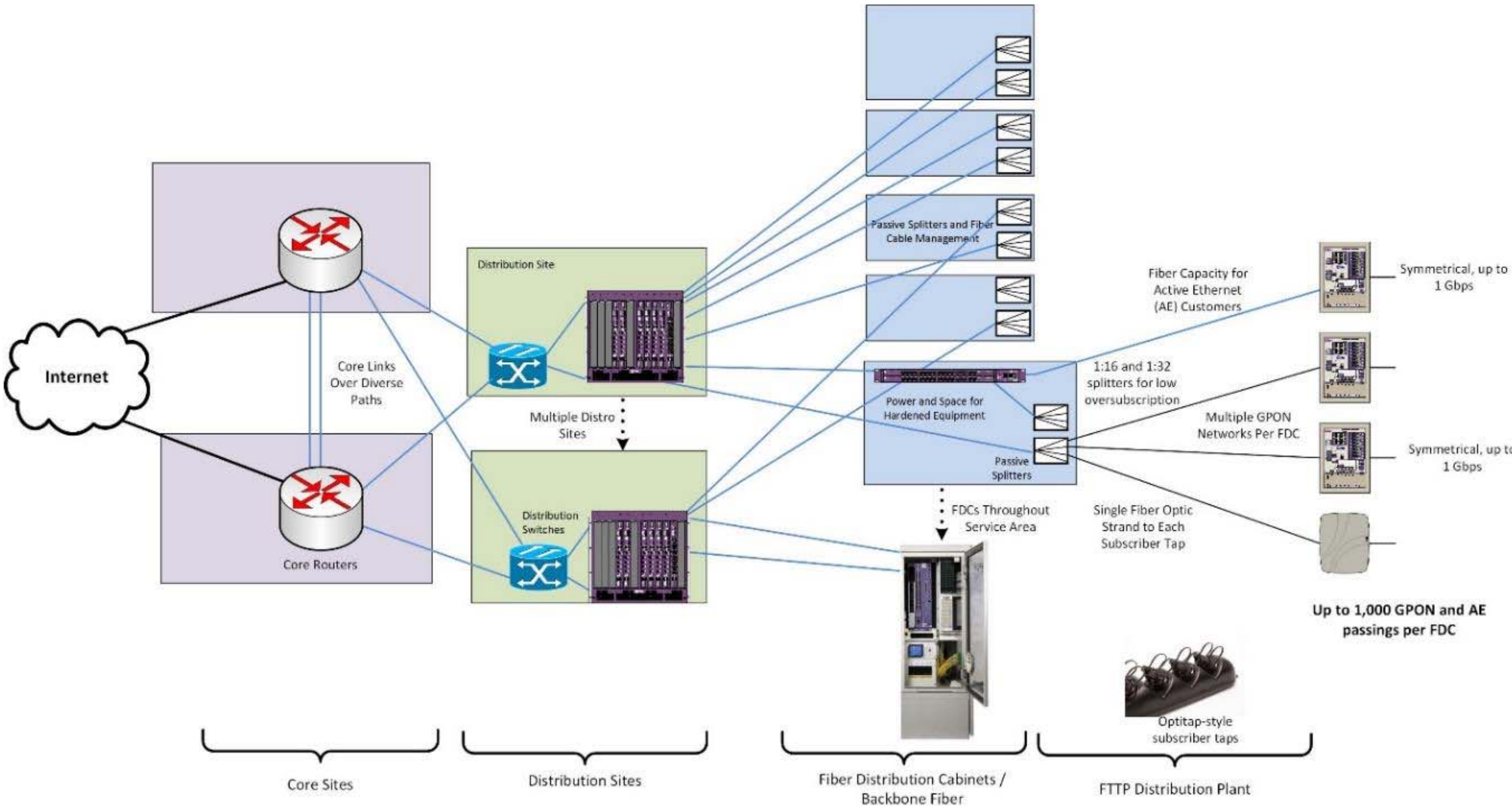
The network's OSP is both the most expensive and the longest lasting portion. The architecture of the physical plant determines the network's scalability for future uses and how the plant will need to be operated and maintained; the architecture is also the main determinant of the total cost of the deployment.

Figure 17 (below) shows a logical representation of the high-level FTTP network architecture we recommend in Baton Rouge. This design is open to a variety of architecture options. The drawing illustrates the primary functional components in the FTTP network, their relative position to one another, and the flexibility of the architecture to support multiple subscriber models and classes of service.

The recommended architecture is a hierarchical data network that provides critical scalability and flexibility, both in terms of initial network deployment and its ability to accommodate the increased demands of future applications and technologies. The characteristics of this hierarchical FTTP data network are:

- Capacity – ability to provide efficient transport for subscriber data, even at peak levels
- Availability – high levels of redundancy, reliability, and resiliency; ability to quickly detect faults and re-route traffic
- Failsafe operation – physical path diversity to minimize operational impact resulting from fiber or equipment failure
- Efficiency – no traffic bottlenecks; efficient use of resources
- Scalability – ability to grow in terms of physical service area and increased data capacity, and to integrate newer technologies
- Manageability – simplified provisioning and management of subscribers and services
- Flexibility – ability to provide different levels and classes of service to different customer environments; can support an open access network or a single-provider network; can provide separation between service providers on the physical layer (separate fibers) or logical layer (separate VLAN or VPN providing networks within the network)
- Security – controlled physical access to all equipment and facilities, plus network access control to devices

Figure 86: High-Level FTTP Architecture



This architecture offers scalability to meet long-term needs. It is consistent with best practices for an open access network model that might potentially be required to support multiple network operators, or at least multiple retail service providers requiring dedicated connections to certain customers. This design would support a combination of Gigabit Passive Optical Network (GPON) and direct Active Ethernet services (with the addition of electronics at the fiber distribution cabinets), which would enable the network to scale by migrating to direct connections to each customer, or reducing splitter ratios, on an as-needed basis.

The design assumes placement of manufacturer-terminated fiber tap enclosures within the PROW or easements, providing watertight fiber connectors for customer service drop cables and eliminating the need for service installers to perform splices in the field. This is an industry-standard approach to reducing both customer activation times and the potential for damage to distribution cables and splices. The model also assumes the termination of standard lateral fiber connections within larger multi-tenant business locations and multi-dwelling units (MDU).

7.4.1 Network Design

The network design and cost estimates assume the City-Parish will:

- Identify and procure space at two core facilities to house network electronics and provide backhaul to the internet
- Use existing City-Parish land to locate eight distribution hub facilities with adequate environmental and backup power systems to house network electronics
- Use the existing City-Parish fiber optics to connect core sites to distribution hubs
- Construct additional fiber or use existing City-Parish fiber where available to connect the distribution hubs to fiber distribution cabinets (FDC)
- Construct fiber optics from the FDCs to each residence and business (i.e., from termination panels in the FDC to tap locations in the PROW or on City-Parish easements)
- Construct fiber laterals into large, multi-tenant business facilities and MDUs

Leveraging the City-Parish's traffic conduit and fiber resources could decrease the costs associated with both constructing a backbone and identifying locations to house electronics that are near the City-Parish's existing resources. However, it is not expected that this will make a large impact on the costs.

We assume that the City-Parish's franchise agreement does not permit use of the CenturyLink and Level(3) fiber for this purpose. Again, the impact on total costs would be minimal.

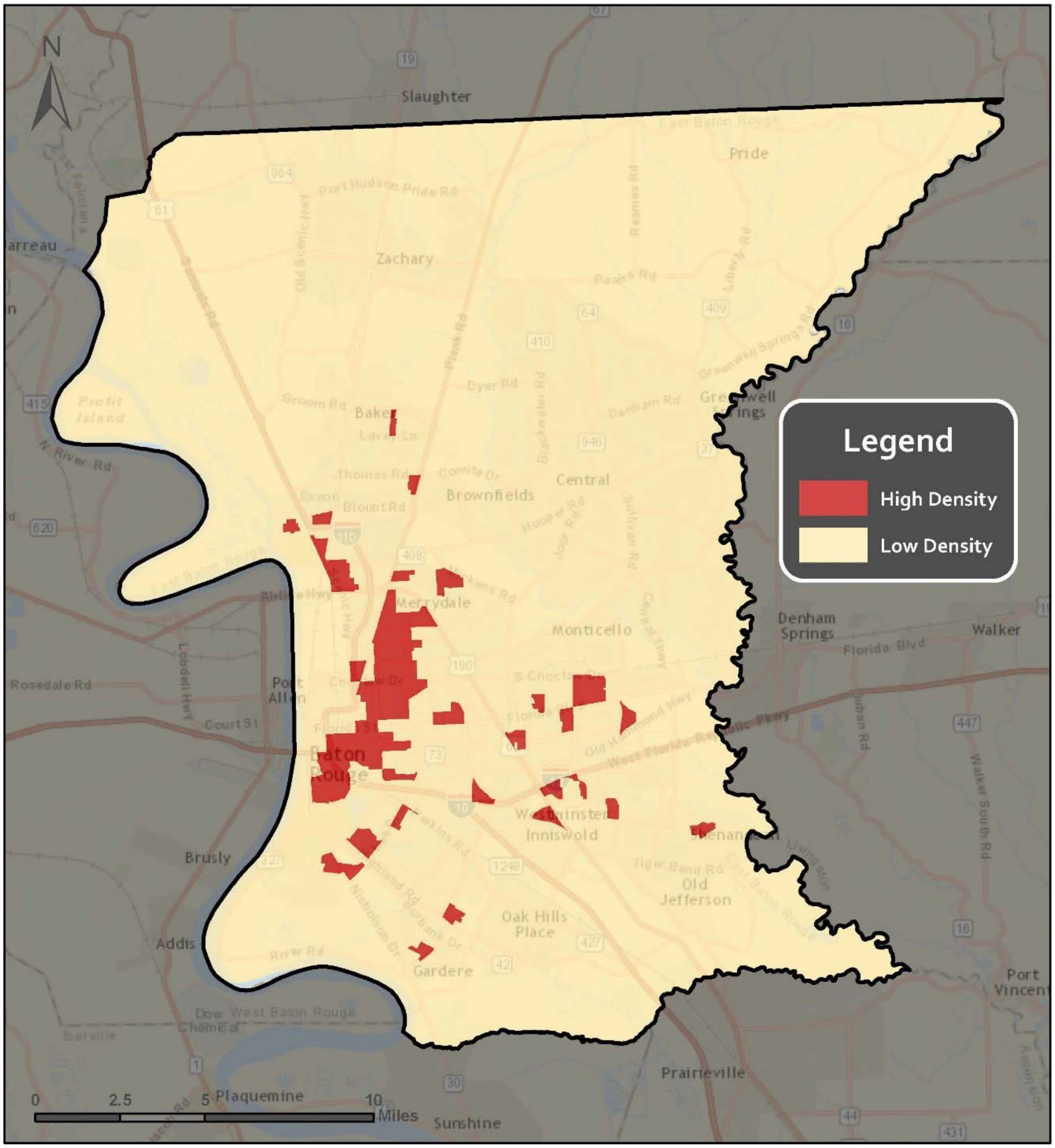
The FTTP network and service areas were defined based on the following criteria:

- Targeting 512 passings per FDC
- Service areas defined by passing density and existing utilities and are broken into the categories of high, medium, and low densities;
- Multiple FDCs serve each service area
- FDCs suitable to support hardened network electronics, providing backup power and an active heat exchange[53]
- Avoiding the need for distribution plant to cross major roadways, levees, and railways

Coupled with an appropriate network electronics configuration, this design serves to greatly increase the reliability of fiber services provided to the customers compared to that of more traditional cable and telephone networks. The backbone design minimizes the average length of non-diverse distribution plant between the network electronics and each customer, thereby reducing the probability of service outages caused by a fiber break.

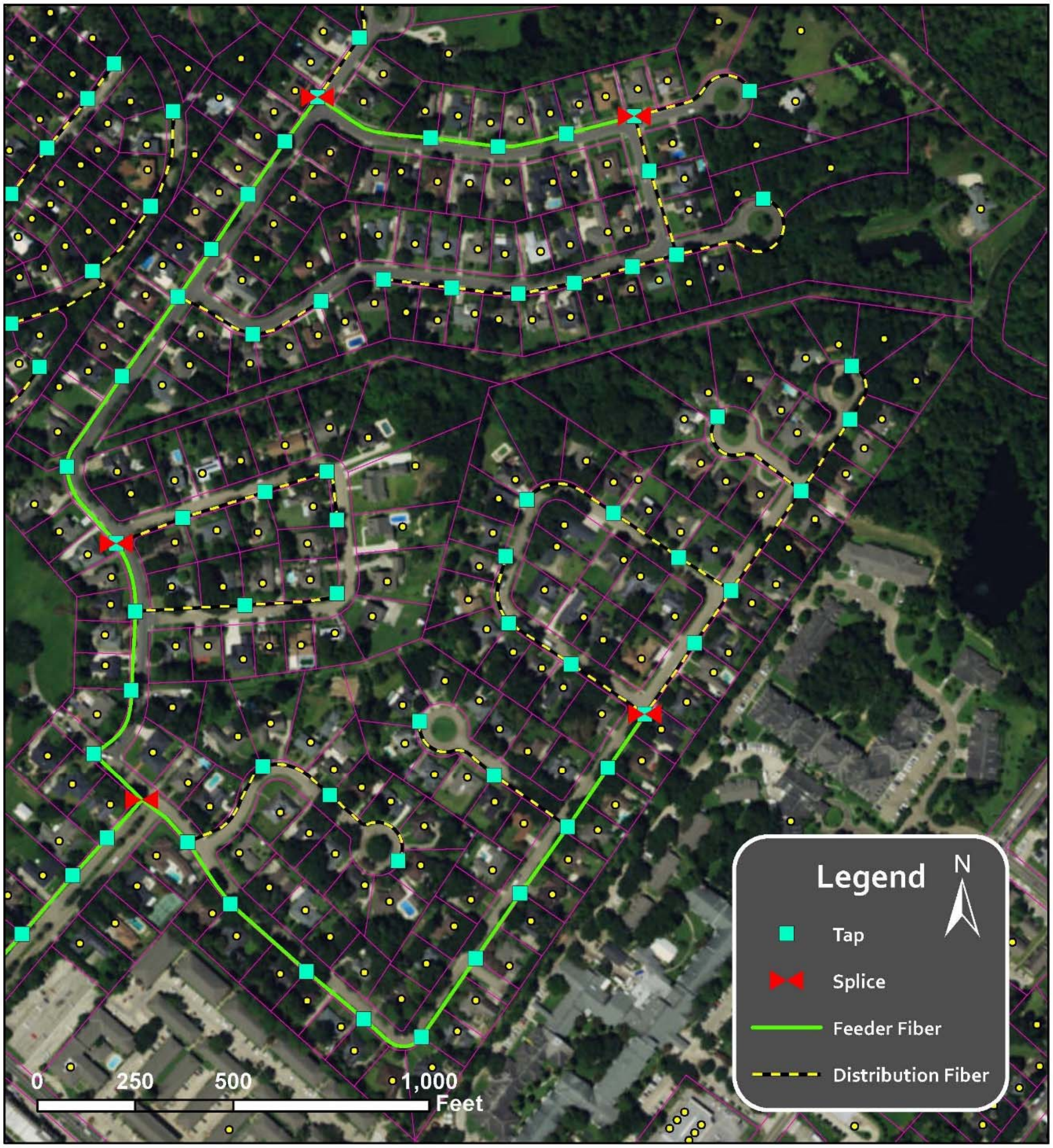
[53] These hardened FDCs reflect an assumption that the City-Parish's operational and business model will require the installation of provider electronics in the FDCs that are capable of supporting open access among multiple providers. We note that the overall FTTP cost estimate would decrease if the hardened FDCs were replaced with passive fiber distribution cabinets (which would house only optical splitters) and the providers' electronics were housed only at hub locations.

Figure 87: FTTP Service Areas



The access layer of the network, encompassing the fiber plant from the FDCs to the customers, dedicates a single fiber strand from the FDC to each passing (potential customer address). This traditional FTTP design allows either network electronics or optical splitters in the FDCs. See Figure 19 below for a sample design.

Figure 88: Sample FTTP Access Layer Design



This architecture offers scalability to meet long-term needs, and is consistent with best practices for an open access network model that might potentially be required to support multiple network operators, or at least multiple retail service providers requiring dedicated connections to certain customers.

7.4.2 Network Core and Hub Sites

The core sites are the bridges that link the FTTP network to the public internet and deliver all services to end users. The proposed network design includes two core locations, based on the network's projected capacity requirements and the need for geographical redundancy (i.e., if one core site were to fail, the second core site would continue to operate the network).

The location of core network facilities also provides physical path diversity for subscribers and all upstream service and content providers. For the design and cost estimates, we assume that the Baton Rouge core sites will be housed in secure locations with diverse connectivity to the internet and the City-Parish's existing fiber optic network.

The core locations in this plan will house providers' Operational Support Systems (OSS) such as provisioning platforms, fault and performance management systems, remote access, and other operational support systems for FTTP operations. The core locations are also where any business partner or content / service providers will gain access to the subscriber network with their own point-of-presence. This may be via remote connection, but collocation is recommended.

The core locations are typically run in a High Availability (HA) configuration, with fully meshed and redundant uplinks to the public internet and/or all other content and service providers. It is imperative that core network locations are physically secure and allow unencumbered access 24x7x365 to authorized engineering and operational staff.

The operational environment of the network core and hub locations is similar to that of a data center. This includes clean power sources, UPS batteries, and diesel power generation for survival through sustained commercial outages. The facility must provide strong physical security, limited/controlled access, and environmental controls for humidity and temperature. Fire suppression is highly recommended.

Equipment is to be mounted securely in racks and cabinets, in compliance with national, state, and local codes. Equipment power requirements and specification may include -48 volt DC and/or 120/240 volts AC. All equipment is to be connected to conditioned / protected clean power with uninterrupted cutover to battery and generator.

For the cost estimate, we assumed that the core facilities would be in leased data centers and distribution hubs will be located at existing City-Parish facilities with land for a telecommunications shelter.

7.4.3 Distribution and Access Network Design

The distribution network is the layer between the hubs and the fiber distribution cabinets (FDCs, which provide the access links to the taps). The distribution network aggregates traffic from the FDCs to the core. Fiber cuts and equipment failures have progressively greater operational impact as they happen closer to the network core, so it is critical to build in redundancies and physical path diversities in the distribution network, and to seamlessly re-route traffic when necessary.

The distribution and access network design proposed in this report is flexible and scalable enough to support two different architectures:

1. Housing both the distribution and access network electronics at the hubs, and using only passive devices (optical splitters and patches) at the FDCs
2. Housing the distribution network electronics at the hubs and pushing the access network electronics further into the network by housing them at the FDCs

By housing all electronics at the hubs, the network will not require power at the FDCs. Choosing a network design that only supports this architecture may reduce costs by allowing smaller, passive FDCs in the field. However, this architecture will limit the redundancy capability from the FDCs to the hubs.

By pushing the network electronics further into the field, the network gains added redundancy by allowing the access electronics to connect to both hub sites. In the event one hub has an outage the subscribers connected to the FDC would still have network access. Choosing a network design that only supports this architecture may reduce costs by reducing the size of the hubs.

Selecting a design that supports both of these models would allow the City-Parish to accommodate many different service operators and their network designs. This design would also allow service providers to start with a small deployment (i.e., placing electronics only at the hub sites) and grow by pushing electronics closer to their subscribers.

7.4.3.1 Access Network Technologies

FDCs can sit on a curb, be mounted on a pole, or reside in a building. The model recommends installing sufficient FDCs to support higher than anticipated levels of subscriber penetration. This approach will accommodate future subscriber growth with minimal re-engineering. Passive optical splitters are modular and can be added to an existing FDC as required to support subscriber growth, or to accommodate unanticipated changes to the fiber distribution network with potential future technologies.

Figure 89: Fiber Distribution Cabinet

The FTTP design also includes the placement of indoor FDCs and splitters to support MDUs. This would require obtaining the right to access the equipment for repairs and installation in whatever timeframe is required by the service agreements with the customers. Lack of access would potentially limit the ability to perform repairs after normal business hours, which could be problematic for both commercial and residential services.

In this model, we assume the use of GPON electronics for the majority of subscribers and Active Ethernet for a small percentage of subscribers (typically business customers) that request a premium service or require greater bandwidth. GPON is the most commonly provisioned FTTP service—used, for example, by Verizon (in its FiOS systems), Google Fiber, and Chattanooga EPB.

Furthermore, providers of gigabit services typically provide these services on GPON platforms. Even though the GPON platform is limited to 1.2 Gbps upstream and 2.4 Gbps downstream for the subscribers connected to a single PON, operators have found that the variations in actual subscriber usage generally means that all subscribers can obtain 1 Gbps on demand (without provisioned rate-limiting), even if the capacity is aggregated at the PON. Furthermore, many GPON manufacturers have a development roadmap to 10 Gbps and faster speeds as user demand increases.

GPON supports high-speed broadband data, and is easily leveraged by triple-play carriers for voice, video, and data services. The GPON OLT uses single-fiber (bi-directional) SFP modules to support multiple (most commonly less than 32) subscribers.

GPON uses passive optical splitting, which is performed inside fiber distribution cabinets (FDC), to connect fiber from the OLTs to the customer premises. The FDCs house multiple optical splitters, each of which splits the fiber link to the OLT between 16 to 32 customers (in the case of GPON service).

Active Ethernet (AE) provides a symmetrical (up/down) service that is commonly referred to as Symmetrical Gigabit Ethernet. AE can be provisioned to run at sub-gigabit speeds, and like GPON easily supports legacy voice, voice over IP, and video. AE is typically deployed for customers who require specific service level agreements that are easier to manage and maintain on a dedicated service.

For subscribers receiving Active Ethernet service, a single dedicated fiber goes directly to the subscriber premises with no splitting. Because AE requires dedicated fiber (home run) from the OLT to the CPE, and because each subscriber uses a dedicated SFP on the OLT, there is significant cost differential in provisioning an AE subscriber versus a GPON subscriber.

The fiber plant is designed to provide Active Ethernet service or PON service to all passings. The network operator selects electronics based on the mix of services it plans to offer and can modify or upgrade electronics to change the mix of services.

7.4.3.2 Expanding the Access Network Bandwidth

GPON is currently the most commonly provisioned FTTP technology, due to inherent economies when compared with technologies delivered over home-run fiber[54] such as Active Ethernet. The cost differential between constructing an entire network using GPON and Active Ethernet is 40 percent to 50 percent.[55] GPON is used to provide services up to 1 Gbps per subscriber and is part of an evolution path to higher-speed technologies that use higher-speed optics and wave-division multiplexing.

This model provides many options for scaling capacity, which can be done separately or in parallel:

1. Reducing the number of premises in a PON segment by modifying the splitter assignment and adding optics—for example, by reducing the split from 16:1 to 4:1, the per-user capacity in the access portion of the network is quadrupled

2. Adding higher speed PON protocols can be accomplished by adding electronics at the FDC or hub locations; since these use different frequencies than the GPON electronics, none of the other CPE would need to be replaced.

3. Adding WDM-PON electronics as they become widely available, which will enable each user to have the same capacity as an entire PON; again, these use different frequencies than GPON and are not expected to require replacement of legacy CPE equipment

4. Option 1 could be taken to the maximum, and PON replaced by a 1:1 connection to electronics—an Active Ethernet configuration

[54] Home run fiber is a fiber optic architecture where individual fiber strands are extended from the distribution sites to the premises. Home run fiber does not use any intermediary aggregation points in the field.
[55] "Enhanced Communications in San Francisco: Phase II Feasibility Study," CTC report, October 2009, at p. 205.

These upgrades would all require complementary upgrades in the backbone and distribution Ethernet electronics, as well as in the upstream internet connections and peering—but they would not require increased fiber construction.

7.4.3.3 Customer Premises Equipment (CPE) and Subscriber Services

In the final segment of the FTTP network, fiber runs from the FDC to customers' homes, apartments, and office buildings, where it terminates at the subscriber tap—a fiber optic housing located in the PROW closest to the premises. The service installer uses a pre-connectorized drop cable to connect the tap to the subscriber premises without the need for fiber optic splicing.

The drop cable extends from the subscriber tap (either on the pole or underground) to the building, enters the building, and connects to CPE.

7.5 Cost Estimates for FTTP Construction

This section provides a summary of cost estimates for construction of an FTTP network to all City-Parish residents and businesses. This deployment would cost more than $515 million, inclusive of OSP construction labor, materials, engineering, permitting, pole attachment licensing, network electronics, drop installation, CPE, and testing.

The costs are described in detail below.

Table 29: Breakdown of Estimated Cost (Lit Model With 35 Percent Take Rate)

Cost Component	Total Estimated Cost
OSP	$357.9 million
Central Network Electronics	32.6 million
FTTP Service Drop and Lateral Installations	83.0 million
CPE	41.6 million
Total Estimated Cost:	$515.1 million

7.5.1 OSP Cost Estimation Methodology

As with any utility, the design and associated costs for construction vary with the unique physical layout of the service area—no two streets are likely to have the exact same configuration of fiber optic cables, communications conduit, underground vaults, and utility pole attachments. Costs are further varied by soil conditions, such as the prevalence of subsurface hard rock; the condition of utility poles and feasibility of "aerial" construction involving the attachment of fiber infrastructure to utility poles; and crossings of bridges, railways, and highways.

To estimate costs, we extrapolated the costs for strategically selected sample designs on the basis of street mileage and passings. Specifically, we developed sample FTTP designs to generate costs per passing for two types of population densities high and low.

Our observations determined that for the medium underground and low-density areas, utilities are primarily underground, but the low-density areas require more construction of fiber to reach a smaller number of homes in an area.

Downtown business districts in high-density urban areas tend to have underground utilities; utilities are predominantly aerial in urban residential areas (although the poles there tend to require more make ready). Low-density areas tend to have the greatest variation in the percentages of aerial versus underground construction. Generally, the newest subdivisions and developments tend to be entirely underground, whereas older neighborhoods have a mixture of aerial and underground construction. Many areas also tend to have rear easements for utilities, which can increase the cost of construction due to restricted access to the utility poles.

The assumptions, sample designs, and cost estimates were used to extrapolate a cost per passing for the OSP. This number was then multiplied by the number of passings in each area based on the City-Parish's GIS data. The actual cost to construct FTTP to every premises in the City-Parish could differ from the estimate due to changes in the assumptions underlying the model. For example, if access to the utility poles is not granted or make-ready and pole replacement costs are too high, the network would have to be constructed underground—which could significantly increase the cost of construction. Alternatively, if the City-Parish were able to partner with a local telecommunications provider and overlash to existing pole attachments, the cost of the build could be significantly lower. Further and more extensive analysis would be required to develop a more accurate cost estimate across the entire City-Parish.

7.5.2 OSP

In terms of OSP, the estimated cost to construct the proposed FTTP network is $358 million, or $1,910 per passing.[56] As discussed above, the model assumes a mixture of aerial and underground fiber construction, depending on the construction of existing utilities in the area as well as the state of any utility poles and existing infrastructure Table 12 provides a breakdown of the estimated OSP costs by type of area. (Note that the costs have been rounded.)

[56] The passing count includes individual single-unit buildings and units in small multi-dwelling and multi-business buildings as single passings. It treats larger buildings as single passings.

Table 30: Estimated OSP Costs

Area	Distribution Plant Mileage	Total Cost	Passings	Cost per Passing	Cost Per Plant Mile
Entire City-Parish	2,966	$358 million	187,600	$1,910	$120,000
High Density	354	$49 million	38,800	$1,270	$140,000
Low Density	2,612	$309 million	148,800	$2,070	$120,000

Costs for aerial and underground placement were estimated using available unit cost data for materials and estimates on the labor costs for placing, pulling, and boring fiber based on construction in comparable markets.

The material costs were generally known with the exception of unknown economies of scale and inflation rates, and barring any sort of phenomenon restricting material availability and costs. The labor costs associated with the placement of fiber were estimated based on similar construction projects.

Aerial construction entails the attachment of fiber infrastructure to existing utility poles, which could offer significant savings compared to all-underground construction, but increases uncertainty around cost and timeline. The utility pole owners can impose costs related to pole remediation and "make-ready" construction that can make aerial construction cost-prohibitive in comparison to underground construction.

While generally allowing for greater control over timelines and more predictable costs, underground construction is subject to uncertainty related to congestion of utilities in the public rights-of-way and the prevalence of subsurface hard rock—neither of which can be fully mitigated without physical excavation and/or testing. While anomalies and unique challenges will arise regardless of the design or construction methodology, the relatively large scale of this project is likely to provide ample opportunity for variations in construction difficulty to yield relatively predictable results on average.

We assume underground construction will consist primarily of horizontal, directional drilling to minimize PROW impact and to provide greater flexibility to navigate around other utilities. The design model assumes a single two-inch, High-Density Polyethylene (HDPE) flexible conduit over underground distribution paths, and dual two-inch conduits over underground backbone paths to provide scalability for future network growth.

7.5.3 Central Network Electronics Costs

Central network electronics will cost an estimated $33 million, or $175 per passing, based on an assumed take-rate of 35 percent.[57] (These costs may increase or decrease depending on take rate and the costs may be phased in as subscribers are added to the network.) The central network electronics consists of the electronics to connect subscribers to the FTTP network at the core, hubs, and cabinets. Table 13 below lists the estimated costs for each segment.

Table 31: Estimated Central Network Electronics Costs

Network Segment	Subtotal	Passings	Cost per Passing
Core and Distribution Electronics (Sections 7.5.3.1 and 7.5.3.2)	$19 million	187,600	$100
FTTP Access Electronics (Section 7.5.3.3)	$14 million	187,600	$75
Central Network Electronics Total	$33 million	187,600	$175

7.5.3.1 Core Electronics

The core electronics connect the hub sites and connect the network to the internet. The core electronics consist of high performance routers, which handle all of the routing on both the FTTP network and to the internet. The core routers should have modular chassis to provide high availability in terms of redundant components and the ability to "hot swap"[58] line cards and modular in the event of an outage. Modular routers also provide the ability to expand the routers as demand for additional bandwidth increases.

The cost estimate design envisions redundant rings between the core sites running networking protocols such as hot standby routing protocol (HSRP) to ensure redundancy in the event of a core failure. Additional rings can be added as network bandwidth on the network increases. The core sites would also tie to both hubs using 10 Gbps links. The links to the hubs can also be increased with additional 10 Gbps and 40 Gbps line cards and optics as demand grows on the network. The core networks will also have 40 Gbps to internet service providers that connect the FTTP network to the internet.

The cost of the core routing equipment for the two core sites is $8 million. These costs do not include the service provider's Operational Support Systems (OSS) such as provisioning platforms, fault and performance management systems, remote access, and other operational support systems for FTTP

[57] The take rate affects the electronics and drop costs, but also may affect other parts of the network, as the City-Parish may make different design choices based on the expected take rate. A 35 percent take rate is typical of environments where a new provider joins the telephone and cable provider in a City-Parish. In CTC's financial analysis, we will examine how the feasibility of the project depends on a range of take rates.

[58] A "hot swappable" line card can be removed and reinserted without the entire device being powered down or rebooted. The control cards in the router should maintain all configurations and push them to a replaced line card without the need for reconfirmation.

operations. The services providers and/or their content providers may already have these systems in place.

7.5.3.2 Distribution Electronics

The distribution network electronics at the two hub sites aggregate the traffic from the FDCs and send it to the core sites to access the internet. The core sites consist of high performance aggregation switches, which consolidate the traffic from the many access electronics and send it to the core for route processing. The distribution switches typically are large modular switch chassis that can accommodate many line cards for aggregation. The switches should also be modular to provide redundancy in the same manner as the core switches.

The cost estimate assumes that the aggregation switches connect to the access network electronics with 10 Gbps links to each distribution switch. The aggregation switches would then connect to the core switches over single or multiple 10 Gbps links as needed to meet the demand of the FTTP users in each service area.

The cost of the distribution switching equipment for distribution hubs is $11 million. These costs do not include any of the service provider's OSS or other management equipment.

7.5.3.3 Access Electronics

The access network electronics at the FDCs connect the subscribers' CPEs to the FTTP network. We recommend deploying access network electronics that can support both GPON and Active Ethernet subscribers to provide flexibility within the FDC service area. We also recommend deploying modular access network electronics for reliability and the ability to add line cards as more subscribers join in the service area. Modularity also helps reduce initial capital costs while the network is under construction or during the roll out of the network.

The cost of the access network electronics for the network is $14 million. These costs are based on a take rate of 35 percent and include optical splitters at the FDCs for that take-rate.

7.5.4 Customer Premises Equipment and Service Drop Installation (Per Subscriber Costs)

CPEs are the subscriber's interface to the FTTP network. For this cost estimate, we selected CPEs that provide only Ethernet data services (however, there are a wide variety of CPEs offering other data, voice, and video services). Using the estimated take rate of 35 percent, we estimated the CPE for customers will be $83 million.

Each activated subscriber would also require a fiber drop cable installation and related electronics, which would cost roughly $1,900 per subscriber, or $125 million total (assuming a 35 percent take rate).

The drop installation cost is the biggest variable in the total cost of adding a subscriber. A short aerial drop can cost as little as $250 to install, whereas a long underground drop installation can cost upward of $3,000. (We estimate an average of $1,280 per drop installation.)

The other per-subscriber expenses include the cost of the optical network terminal (ONT) at the premises, a portion of the optical line termination (OLT) costs at the hub, the labor to install and configure the electronics, and the incidental materials needed to perform the installation. The numbers provided in the table below are averages and will vary depending on the type of premises and the internal wiring available at each premises.

Table 32: Per Subscriber Cost Estimates

Construction and Electronics Required to Activate a Subscriber	Estimated Average Cost
Drop Installation and Materials	$1,280
Subscriber Electronics (ONT and OLT)	320
Electronics Installation	200
Installation Materials	100
Total	**$1,900**

7.6 Operating Cost Considerations

This section outlines some of the key technical operating expenditures that an FTTP network would incur. Costs for technical operations of the FTTP network include staffing (technicians, program manager), OSP maintenance, electronics maintenance, and customer support.

The costs discussed in this section are not meant to be inclusive of all operating costs such as marketing, legal, and financial costs. Further the magnitude of total cost of operations will vary with the business model chosen, balance of added new staff versus using contractors, the level of existing resources that can be leveraged by the City-Parish, and any potential business partners.

In the Financial Analysis, we outline the estimated costs for the dark FTTP lease model. This model does not require electronic costs, vendor maintenance fees, or other costs associated beyond maintaining a dark fiber network.

7.6.1 Technical Operational Expenditures

Again, we note that the City-Parish does not wish to offer a retail data service, but this analysis considers as a reference point some of the costs, nuances, and technical requirements of directly serving customers. If the City-Parish were to offer a retail data service, we estimate that the City-Parish would likely initially purchase 20 Gbps of internet capacity. This is an estimated number for the beginning of the network deployment and can be expected to grow as, video streaming and other cloud applications grow in importance. Depending upon the contract terms internet bandwidth we would estimate costs in the $0.50 per Mbps per month to $1.00 per Mbps per month range in Baton

Rouge. We recommend that the internet access be purchased from multiple internet providers and be load balanced to ensure continuity during an outage.

The operating costs also include maintenance contracts on the core network electronics. These contracts ensure that the City-Parish has access to software support and replacement of critical network electronics that would be cost-prohibitive to store as spares. Where cost effective such as the distribution aggregation switches and the FTTP electronics, we recommend storing spares to reduce the total costs of maintenance contracts. We estimate hardware maintenance contracts and sparing at 15 percent of the total electronics cost.

In addition, we recommend planning for an annual payment into a depreciation operating reserve account based on the equipment replacement cost to help limit risk. This reserve fund should never go negative; the balance that accrues in this account will fund the capital needs for ongoing capital replenishments.

7.6.2 Fiber Maintenance Costs

The City-Parish would need to augment its current fiber staff or contractors with the necessary expertise and equipment available to maintain the fiber optic cable in a City-Parish-wide FTTP network. Typical maintenance costs can exceed 1 percent of the total fiber OSP construction cost per year and includes a mix of City-Parish staff and contracted services. These staffing considerations are discussed further in Section 9.

Fiber optic cable is resilient compared to copper telephone lines and cable TV coaxial cable. The fiber itself does not corrode, and fiber cable installed over 20 years ago is still in good condition. However, fiber can be vulnerable to accidental cuts by other construction, traffic accidents, and severe weather. In other networks of this size, we have seen approximately 80 outages per 1,000 miles of plant per year.

The fiber optic redundancy from the hubs to the FDCs in the backbone network will facilitate restoring network outages while repair of the fiber optic plant is taking place.

Depending on the operational and business models established between the City-Parish and service providers, the City-Parish may be responsible for adds, moves, and changes associated with the network as well as standard plant maintenance. These items may include:

- Adding and/or changing patching and optical splitter configurations at FDCs and hubs
- Extending optical taps and laterals to new buildings or developments
- Extending access to the FTTP network to other service providers
- Relocating fiber paths due to changes such as the widening of roadways

- Participating in the moving of utilities due to pole replacement projects
- Tree trimming along the aerial fiber optic path

The City-Parish would need to obtain contracts with fiber optic contractors that have the necessary expertise and equipment available to maintain an FTTP network. These contracts should specify the service level agreements the City-Parish needs from the fiber optic contractors to ensure that the City-Parish can meet the service level agreements it has with the network service providers. The City-Parish should also ensure that it has access to multiple fiber optic contractors if one contractor is unable to meet the City-Parish's needs. The fiber optic contractors should be available 24x7 and have a process in place for activating emergency service requests.

7.6.2.1 Fiber Locating

The City-Parish will be responsible for locating and marking all underground conduit for excavation projects per Louisiana's One-Call System statutes. Locating involves receiving and reviewing excavation tickets to determine whether the area of excavation may impact the City-Parish's underground FTTP infrastructure. If the system is impacted, the City-Parish must mark its utilities in the manner and within the allotted timeframe provided by the statute.

Locating is either done in-house or by contractors who specialize in utility locating. The City-Parish may be able to leverage its existing utility locating personnel, processes, or contractors to reduce the cost of utility locating for the FTTP network.

7.6.2.2 Pole Attachment Fees

The City-Parish will need to pay utility pole owners an annual fee per pole to attach its fiber optic cables to the poles. Pole attachment fees can be thought of a rent for using the pole. Pole attachment fees are set by the pole owner and would be outlined in the City-Parish's pole attachment agreement with the owner(s) which will be negotiated as part of the agreement. For the estimate, we assumed $20 per pole.

7.6.3 Technical Staffing Requirements

Additional staffing will be required to perform the maintenance and operation responsibilities of the FTTP network. The staffing levels and the responsibility for that staffing will vary greatly with the various potential business models. The following sections outline the technical groups that will be required to maintain and operate the network.

7.6.3.1 Outside Plant (OSP)

The OSP group will be responsible for the maintenance, operations, and expansion of the City-Parish's telecommunications infrastructure including conduit, fiber, pole attachments, and splice enclosures. During construction, the OSP group will be responsible for tracking and overseeing the construction of new infrastructure. Once the network is constructed, the OSP group will oversee any future adds, moves, or changes to the network.

The OSP group may use contractors to perform activities such as construction, repair, and locating. Management of contractors will be a responsibility of an OSP manager with OSP technicians assisting with project oversight and quality assurance and quality control. The OSP manager will also assist with engineering and design of any adds, moves, and changes that occur on the network.

The OSP group will have responsibility for general field operations. This group will include OSP technicians to perform locates, and contracted support to provide repair services. Tasks will include management of the One Call process, fiber locates, response and troubleshooting of Layer 1 troubleshooting, and fleet management. Additionally, it is critical that while many of OSP jobs may be outsourced, that the OSP group be equipped with the proper locate and testing equipment.

Our estimate includes one OSP manager and up to seven OSP technicians to operate the network, depending on what roles are contracted and what locate capabilities exist within the City-Parish.

7.6.3.2 Network Engineering

The network engineering group develops and maintains the network architecture, responds to high-level troubleshooting requests, manages network electronics and makes sure the network delivers to the end user a reliable service.

The network engineering group is responsible for making architecture decisions that determine how the network can deliver services. The network engineering group will also be responsible for change management and architectural review to ensure that network continuity is ensured after changes.

The network engineering group will also be responsible for vendor selections when new hardware, technologies, or contractor support is needed to support the network. The network engineering team will perform regular maintenance of the network as well as provision, deploy, test, and accept any electronics to support new sites or services.

Network technicians will be responsible for troubleshooting issues with network electronics and responding to customer complaints.

To operate network electronics (if required by the business model) we estimate a staffing requirement of two network managers, six network engineers, and seven network technicians that could be a combination of personnel as well as contracted support.

7.6.3.3 Network Operations Center and Customer Service

The network will require individuals to perform monitoring and oversight of the network electronics. The group will be responsible for handling technical calls from users, actively monitoring the health of the network, and escalating issues to the proper operations groups. The group is also required to develop and monitor network performance parameters to ensure that the network is meeting its obligations to its users, as defined in the network service level agreements (SLAs).

Often network operations require a 24x7 customer service helpdesk and tools for network monitoring, alerting, and provisioning.

8 Potential Public–Private Partnership Models for FTTP Deployment

Our analysis of potential FTTP network deployment was developed with the assumption that the City-Parish would pursue a public–private partnership. This section describes a variety of partnership models that we considered; these approaches encompass a range of agreements unique to the needs of the public and private entities. Like the telecommunications industry itself, the public–private partnership landscape is fast changing to meet evolving public and private needs.

8.1 Types of Partnership Models

In recent years, three general types of partnerships have emerged within the broadband industry, though not every model has been tested:

- **Model 1: Private Investment, Public Facilitation**, in which the public entity takes modest measures to encourage private investment in the area; the most prominent example of this model is Google Fiber's deployment in cities like Kansas City and Austin
- **Model 2: Private Execution, Public Funding,** which entails significant risk for the public entity and relies on the private sector for execution; this model is new in the broadband industry in the U.S., though it has been used in road construction and public transit projects
- **Model 3: Shared Investment and Risk,** which takes advantage of the strengths of both the public and private sector partners; this model aims to offset risk by assigning to each entity tasks with which it is familiar and that it is likely to be able to carry out successfully[59]

There are variations within each partnership model, and even models that have been underway for a number of years are still fairly new with relatively few data points to provide meaningful insight into what does and does not work with respect to public–private partnerships. What is clear is that most localities are looking for a way to deploy state-of-the-art broadband infrastructure while managing risk, reward, and control. And most private entities are seeking ways to broaden their customer base while being mindful of their own need for significant enough ROI to make investment worth the deployment.

In some cases, control is the driving factor for a locality, and maintaining control means directly deploying infrastructure that the public sector will own. There is significant capital risk involved in developing fiber infrastructure and then seeking a partner. Localities that go this route must realize that, even if they directly deploy fiber infrastructure, they are not guaranteed a partner. Moreover, even if they find a private partner, these localities are not guaranteed a partner who is able and willing to put their own skin in the game and completely offset the locality's risk. While this approach gives the locality the greatest degree of control, there is also substantial risk in the form of upfront capital

[59] The examples we mention in Section 1.6 are variations of this model, which often takes the form of public sector infrastructure deployment and private sector operations.

costs and ongoing debt service. Localities that opt to go this route are likely to be well-served by strong procurement processes that inform the private sector of the locality's plans.[60]

The balance of risk and rewards depends greatly on the locality itself, and what constitutes "risk." For example, a locality whose economic vitality relies on access to broadband infrastructure—such as through the ability to attract large businesses—may have reason to invest in a publicly-owned network, knowing that it will likely not recover its costs. In this case, the locality may believe that the benefits conferred on the community through increased economic development will be significant enough to offset its capital risk. The key is for localities to understand their vulnerabilities, to take calculated risks, and to ensure that any partnership balances the risk and reward between the public and private entity.

8.2 Public and Private Sector Shared Investment and Risk Through Lit or Non-Lit Partnership

As we noted, there are two variations on the shared investment and risk model: a lit and a non-lit model. In a non-lit model, the City-Parish invests in network infrastructure and relies on a private partner to deploy network electronics and install CPEs. Additionally, in a non-lit model, the City-Parish or the private provider may be responsible for deploying the drop cables to directly serve the end user. The City-Parish may have a preference, which it can state in its procurement process, or this can be negotiated throughout the process of coming to a final agreement with a private partner.

In a lit model, the City-Parish develops all the same infrastructure as the non-lit model, and goes a step further to deploy network electronics. In this model, either the City-Parish or the private partner could be the retail service provider, delivering service to the end user. This significantly reduces the cost the private partner would incur, but also gives the City-Parish a greater level of control because it can both determine where infrastructure should be deployed and control the network at the "virtual" layer through electronics deployment. However, again, the City-Parish has made it clear it does not wish to become the retail service provider and deliver any services to external end users.

8.3 Case Studies of Partnership Models

While there are not significant available data points, it is possible to evaluate public–private partnerships anecdotally through case studies of partnerships that are currently underway. Here we look at some of the existing partnerships throughout the U.S., which represent a range of partnership models.

8.3.1 Model 1 Case Study: Holly Springs, NC

Over the course of many years, the Town of Holly Springs designed, engineered, and constructed a backbone fiber network to connect municipal buildings. To their great credit, Holly Springs' visionary

[60] The City-Parish will undergo a request for information process that uses the results of this analysis, including the robust market research, to inform the procurement.

elected officials chose to build a fiber network with dramatically higher capabilities than the need apparent at the time—knowing that a robust fiber backbone might attract interest from private ISPs that recognize the potential to leverage that backbone to more efficiently build their own FTTP infrastructure.

But a robust backbone network was not enough. The town's government also developed policies and strategies to attract private broadband investment. As a result, Ting Internet announced in mid-2015 that it will bring "crazy fast fiber internet" to the homes and businesses of Holly Springs. Ting plans to expand on Holly Spring's existing fiber pathways and offer symmetrical gigabit Internet access to homes and businesses.

A key factor in Ting's decision to invest in Holly Springs was the fact that the town not only was willing to lease excess fiber in its backbone, but that it also brought best practices to bear in its willingness to work with Ting and facilitate Ting's efforts. Among other things, the town offered efficient government processes, access to information and facilities, and facilitation and support—all of which boosted Ting's confidence about this community as an investment opportunity.

8.3.2 Model 2 Case Study: Commonwealth of Kentucky

As mentioned above, this model is new in the broadband industry in the U.S. The Commonwealth of Kentucky has executed an agreement for a statewide middle-mile network under this model, known as KentuckyWired.

Once complete, the network will connect 1,100 government entities over a 3,400-mile fiber optic backbone and excess capacity will be made available to private sector companies for lease, development, and innovation. Incumbent ISPs and, possibly, newer, less traditional ISPs are expected to take the opportunity to build out the network's "last mile," connecting residences and small businesses.

Kentucky will retain ownership of the network; the partner (known as a concessionaire) will build, maintain and operate the network for 30 years. The project is currently estimated to be complete in mid-2019.

8.3.3 Model 3 Case Study: Westminster, MD

The city of Westminster, Maryland, is a bedroom community of both Baltimore and Washington, D.C. where 60 percent of the working population leaves in the morning to work elsewhere.[61] The area has no major highways and thus, from an economic development perspective, has limited options for creating new jobs. Incumbents have also traditionally underserved the area with broadband.

[61] Case study is based in part on a presentation by Dr. Robert Wack, President, Westminster (Maryland) City Council, during a webinar hosted by the Fiber to the Home Council and facilitated by CTC Technology & Energy. *See*: http://goo.gl/x82Ro7 (password required). See also: Robert Wack, "The Westminster P3 Model," *Broadband Communities Magazine* (Nov./Dec. 2015), http://goo.gl/op1XpH.

The city began an initiative 12 years ago to bring better fiber connectivity to community anchor institutions through a middle-mile fiber network. In 2010, the State of Maryland received a large award from the federal government to deploy a regional fiber network called the Inter-County Broadband Network (ICBN) that included infrastructure in Westminster.[62]

Westminster saw an opportunity to expand the last mile of the network to serve residents. At the time, though, it did not have any clear paths to accomplish this goal. City leaders looked around at other communities and quickly realized that they were going to have to do something unique. Unlike FTTP success stories such as Chattanooga, Tennessee, they did not have a municipal electric utility to tackle the challenge. They also did not have the resources, expertise, or political will to develop from scratch a municipal fiber service provider to compete with the incumbents. As a result, they needed to find a hybrid model.

As the community evaluated its options, it became clear that the fiber infrastructure itself was the city's most significant asset. All local governments spend money on durable assets with long lifespans, such as roads, water and sewer lines, and other infrastructure that is used for the public good. The leaders asked, "Why not think of fiber in the same way?" The challenge then was to determine what part of the network implementation and operations the private sector partner would handle and what part could be the city's responsibility.

The hybrid model that made the most sense required the city to build, own, and maintain dark fiber, and to look to partners that would light the fiber, deliver service, and handle the customer relationships with residents and businesses. The model would keep the city out of network operations, where a considerable amount of the risk lies in terms of managing technological and customer service aspects of the network.

The city solicited responses from potential private partners through a request for proposals (RFP). Its goal was to determine which potential partners were both interested in the project and shared the city's vision.

The city eventually selected Ting Internet, an upstart ISP with a strong track record of customer service as a mobile operator. Ting shared Westminster's vision of a true public–private partnership and of maintaining an open access network. Ting has committed that within two years it will open its operations up to competitors and make available wholesale services that other ISPs can then resell to consumers.

Under the terms of the partnership, the city is building and financing all of the fiber (including drops to customers' premises) through a bond offering. Ting is leasing fiber with a two-tiered lease payment.

[62] "The Project," Inter-County Broadband Network, http://icbn-md.com/

One monthly fee is based on the number of premises the fiber passes; the second fee is based on the number of subscribers Ting enrolls.

Based on very preliminary information, given that this is a market in development as we write, we believe this is a highly replicable model.

What is so innovative about the Westminster model is how the risk profile is shared between the city and Ting. The city will bond and take on the risk around the OSP infrastructure, but the payment mechanism negotiated is such that Ting is truly invested in the network's success.

Because Ting will pay Westminster a small monthly fee for every home and business passed, Ting is financially obligated to the city from day one, even if it has no customers. This structure gives the city confidence that Ting will not be a passive partner, because Ting is highly incented to sell services to cover its costs.

Ting will also pay the city based on how many customers it serves. Initially, this payment will be a flat fee—but in later years, when Ting's revenue hits certain thresholds, Ting will pay the city a small fraction of its revenue per user. That mechanism is designed to allow the city to share in some of the upside of the network's success. In other words, the city will receive a bit of entrepreneurial reward based on the entrepreneurial risk the city is taking.

Perhaps most significantly, there is also a mechanism built into the contract that ensures that the two parties are truly sharing risk around the financing of the OSP infrastructure. In any quarter in which Ting's financial obligations to the city are insufficient to meet the city's debt service, Ting will pay the city 50 percent of the shortfall. In subsequent quarters, if Ting's fees to the city exceed the debt service requirements, Ting will be reimbursed an equivalent amount. This element of the financial relationship made the deal much more attractive to the city because it is a clear demonstration of the fact that its private partner is invested with it.

8.4 Additional Strategic Considerations for Public–Private Partnerships

As public-sector entities of all sizes and capabilities evaluate potential models for public–private partnerships, it is important to approach each proposal with a healthy dose of common sense. Next-generation fiber deployment, particularly on a large scale to reach all residences and businesses in a community, is a valuable and future-proof investment. But it will not be cheap or easy. If anyone tells you otherwise, or claims that they will deliver enormous benefits at little or no cost or risk, ask for examples of projects where they have accomplished what they are promising. If it were easy, we would already have seen enormous private investment in FTTP across the country. Communities should be skeptical of rosy projections.

It is also critical to look for private sector partners that are interested in developing meaningful partnerships to deploy next-generation infrastructure. A significant risk around economic development incentives and other measures to facilitate investment is that private companies will request that localities take on additional costs as a condition of the private investment. For example, a private partner might ask the local government to hire dedicated inspectors and provide free access to real estate—and provide in return only tacit commitments for new services or technological upgrades. The goal of these partnerships is not simply to shift private sector costs to the public sector. If a company is a true partner, it will be willing to make firm commitments to invest in the community in return for the actions the locality takes to lower the cost of deploying infrastructure.

In addition, partners and partnerships will differ in different parts of the country, and with the size of a community. A primary challenge for localities seeking buildout to every residence and business is that the larger the community, the more difficult it may be for a private partner to deploy its service universally. By taking on the risk of fiber construction and finding a partner to light the network and provide service, a locality can increase the potential for a universal fiber buildout to every location. However, this will come with a very high price tag—regardless of which entity makes the investment, it is not inexpensive to deploy a ubiquitous fiber network throughout a community.

Finally, do not underestimate the importance of the political element in tackling these challenges. Political concerns will play a huge role in finding solutions. Community and political leaders must jointly decide to pursue a project of this scope, to solve the problems that may arise along the way, and to bring fiber and its benefits to the community.

9 FTTP Financial Analysis

In this section, we investigate the financial feasibility of two potential non-lit, dark FTTP network models. In both, the City-Parish would construct and maintain ubiquitous fiber infrastructure to every residence and business, and lease the fiber backbone and distribution fiber to a private partner. The private partner would be responsible for all network electronics and CPEs—as well as network sales, marketing, and operations.

While the engineering cost estimate described in Section 7 includes costs associated with operating as a retail service provider, this financial analysis does not include operations costs for such a model. Although it is important to understand the upfront capital costs associated with such a model in order to paint a clear picture of overall capital costs, our financial analysis evaluates costs based on the assumption that the City-Parish does not wish to compete directly with the private sector.

The fundamental difference between the two models we present in this financial analysis concerns drop cables, or the fiber cable that runs from the distribution fiber in the public right-of-way (PROW) into the customer’s home or business.

In our first model, presented in Section 9.2, the City-Parish would be responsible for constructing backbone and distribution fiber up to the PROW, while the private partner would construct the drop cable into the home or business. (Note that this is different from the non-lit design we used for our cost estimate, which included the cost of fiber drops.) Since the last-mile connection would be funded by the private partner, the number of subscribers (and thus the number of drop cables) will not directly affect the City-Parish’s financial outcomes. As such, fiber lease payments to the City-Parish for this model will be based solely on the number of passings in the network.

This model is similar to the agreement between the city of Huntsville, Alabama’s Huntsville Utilities and Google Fiber. We have included reference and comparison to Huntsville’s agreement with Google Fiber to demonstrate the terms and fees that make up that arrangement.

Our second model, presented in Section 9.3, proposes a scenario where the City-Parish would be responsible for constructing and maintaining both distribution fiber and drop cable infrastructure. Since this model presents additional costs to the City-Parish, the fiber lease fees would have a two-tiered structure—one fee for the number of passings in the network and an additional fee for each subscriber. This subscriber fee helps offset the cost of fiber drops, and only applies to premises where drops have been constructed. Each home and business that wishes to subscribe to the services provided by the partner would need a City-Parish-funded drop cable installed. This the financial viability of the model is heavily dependent upon the total customer take rate.

The city of Westminster, Maryland, and Ting Internet agreed to a similar structure, and we have included discussion of their terms and pricing as an example of the implications of this model.

We have included multiple scenarios for each model to demonstrate potential options the City-Parish can consider, and to illustrate funding and financing concerns. All our models represent the minimum requirements for the City-Parish to maintain positive cash flow over the course of 20 years.

In all scenarios, the City-Parish's partner would need to pay substantially higher lease fees than the private partners pay in either Huntsville or Westminster. However, if the City-Parish can procure sufficient startup funding—such as grants,[63] revenues from the general fund, or other local resources to lower the necessary private partner's lease fees, it may be able to attract a partner in some scenarios.

9.1 FTTP Model Cost Considerations

In our network design, we identified high- and low-density areas within the City-Parish. In our modeling, high-density areas have an average of 97 passings per square mile, and low-density areas have an average 66 passings per square mile. There are 38,795 high-density passings and 148,851 low-density passings, totaling 187,610 passings, in the City-Parish.

For reference, Table 33 summarizes our non-lit FTTP cost estimates for both high- and low-density areas.

Table 33: Non-Lit FTTP OSP Cost Estimates

Cost Component	Total Estimated Cost	High Density Cost	Low Density Cost
OSP Engineering	$44,591,000	$5,319,000	$39,272,000
Quality Control/Quality Assurance	23,430,000	2,795,000	20,635,000
General OSP Construction Cost	249,981,000	34,467,000	215,514,000
Special Crossings	14,271,000	1,755,000	12,516,000
Backbone and Distribution Plant Splicing	7,736,000	1,210,000	6,526,000
Backbone Hub, Termination, and Testing	17,871,000	3,553,000	14,318,000
FTTP Lateral Installations	2,355,000	1,387,000	968,000
Total Estimated Cost:	$360,235,000	$50,486,000	$309,749,000

Please note the above estimate does not include the drop costs to individual residences and small businesses. These drop costs are only the City-Parish's responsibility in the second model, and are discussed in Section 9.3.

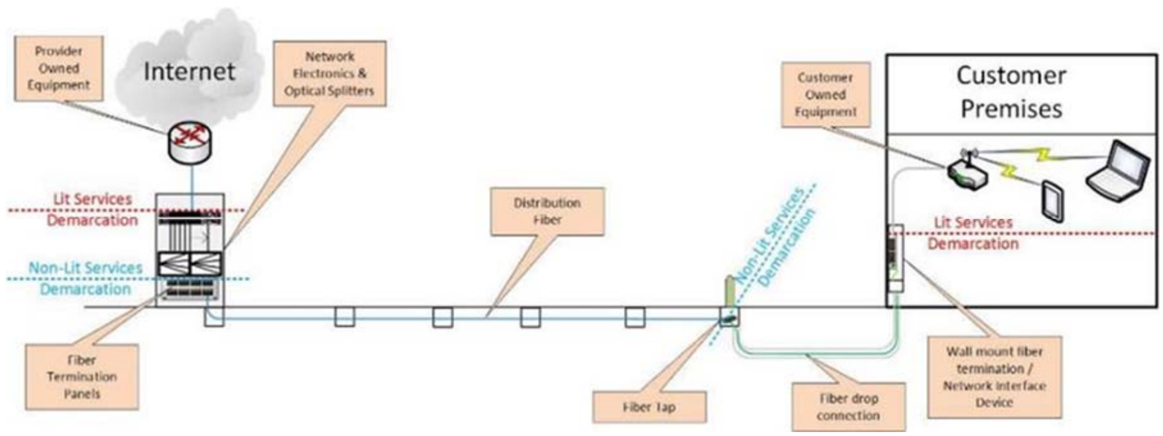
The City-Parish construction costs (OSP and laterals) translate to an average of $1,920 per passing ($1,303 and $2,081 for high- and low-density areas, respectively).

[63] This startup funding would need to come from grants, cash on hand, local resources, or any source which would not need to be paid back. At present, there is very limited federal funding available for such ventures.

9.2 FTTP Model Not Including Drop Cable Costs (Huntsville Model)

Our first model assumes that the City-Parish constructs and owns network infrastructure throughout the City-Parish area up to a demarcation point in the PROW, and leases the dark fiber backbone and distribution fiber to a private partner. This demarcation is illustrated in Figure 90.

Figure 90: Demarcation Between City-Parish and Partner Network Elements (Huntsville Model)



In this model, the private partner would be responsible for constructing drop cables into each subscriber's home or business; network electronics and CPEs; and network sales, marketing, and operations. It should be noted that network electronics and CPEs are significant additional expenses for the private partner to consider, and as such, the City-Parish should bear them in mind when negotiating pricing with potential partners.

The financial analysis presented here represents a minimum requirement for the City-Parish to obtain a break-even cash flow each year. We have provided a complete financial model in Excel format that can be leveraged to show the impact of changing assumptions. The spreadsheet can be an important tool for the City-Parish to use if it negotiates with a private partner.

Please note that we used a "flat model" in the analysis, which means that inflation and operating cost increases (including salaries) are not used because it is assumed that operating cost increases will be offset by increases in operator lease payments over time (and likely passed on to subscribers in the form of increased prices). We anticipate that the City-Parish will apply an inflation factor, typically based on a Consumer Price Index (CPI), to the portion of the per-subscriber fee that covers projected operating expenses during negotiations with a private partner.

These financial projections do not include any economic development or other indirect benefits, which are often not easily quantifiable.

In our modeling, we compared a similar FTTP deployment in the city of Huntsville, Alabama, between Huntsville Utilities and Google Fiber. In the contract with Huntsville Utilities and Google Fiber, the city negotiated a monthly per-passing fee of $7.50.

We include this reference to demonstrate the minimum pricing attractive enough to incent partnership with the private sector, the financial implications of that pricing, and what Huntsville Utilities pricing would look like in relation to network deployment costs for the City-Parish. In all models, the required per-passing fees are higher than in the Huntsville partnership; charging lease fees similar to those paid by Google Fiber in Huntsville will result in cumulative cash deficits greater than $393 million over 20 years.

We have included a base case scenario for this model as well as three alternate scenarios, demonstrating the effects of increased startup funding on necessary partner lease fees, as well as the implication of the City-Parish using the same fees that Google pays Huntsville Utilities.

9.2.1 FTTP Base Case Financial Analysis

In our base case scenario, we present what would be necessary to maintain positive cash flow given the estimated OSP construction and operating costs.

To cover construction costs and maintain a positive cash flow, the City-Parish would need to charge a private partner $17.33 per month per passing for all 187,610 commercial and residential passings. At 2.31 times the fee upon which Huntsville Utilities and Google Fiber agreed, this fee may not be attractive enough to incent partnership.

We have provided a summarized income and cash flow statement in Table 34.

Table 34: FTTP Base Case Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$1,755,190	$39,004,120	$39,004,120	$39,004,120	$39,004,120
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(5,465,330)	(18,144,850)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(5,166,000)	(16,202,280)	(12,581,110)	(8,068,460)	(2,444,850)
Taxes	-	-	-	-	-
Net Income	$(10,724,830)	$(3,068,870)	$552,700	$5,065,350	$10,688,960

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$111,300	$3,488,770	$4,683,310	$5,877,500	$7,071,330
Depreciation Reserve	-	381,030	352,580	324,130	295,680
Total Cash Balance	$111,300	$3,869,800	$5,035,890	$6,201,630	$7,367,010

If the City-Parish could obtain $17.33 per passing per month, it would have net income of more than $10.6 million by the end of year 20. This would also result in a cumulative unrestricted cash balance of almost $7.4 million by the end of year 20.

9.2.1.1 FTTP Financing

This financial analysis assumes that the City-Parish will cover all its capital requirements with general obligation (GO) bonds. We assumed that the City-Parish's bond rate would be 4.5 percent.

We expect that the City-Parish will take will take three 20-year bonds—one each in years one, two, and three—for a total of $375.9 million in financing. (The difference between the financed amount and the total capital costs represents the amount needed to maintain positive cash flow in the early years of network deployment.) The resulting principal and interest (P&I) payments will be the major factor in determining the City-Parish's long-term financial requirements; P&I accounts for 80 percent of the City-Parish's annual costs in our base case model after the construction period.

We project that the bond issuance costs will be equal to 0.91 percent of the principal borrowed.[64] We assume neither debt service nor interest reserves need to be maintained for the lifetime of the bond. Principal repayment on the bonds will start in year three.

We have included a detailed income statement in Table 35.

Table 35: FTTP Base Case Income Statement

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
a. Revenues					
Per Passing	$1,755,190	$39,004,120	$39,004,120	$39,004,120	$39,004,120
Total	$1,755,190	$39,004,120	$39,004,120	$39,004,120	$39,004,120
c. Operating Costs					
Operation Costs	$1,035,305	$4,519,610	$4,519,610	$4,519,610	$4,519,610
Labor Costs	813,380	3,206,250	3,206,250	3,206,250	3,206,250
Total	$1,848,685	$7,725,860	$7,725,860	$7,725,860	$7,725,860
d. EBITDA	$(93,495)	$31,278,260	$31,278,260	$31,278,260	$31,278,260
e. Depreciation	5,465,330	18,144,850	18,144,450	18,144,450	18,144,450
f. Operating Income (EBITDA less Depreciation)	$(5,558,825)	$13,133,410	$13,133,810	$13,133,810	$13,133,810
g. Non-Operating Income					
Interest Income	$-	$950	$880	$810	$740
Interest Expense (20 Year Bond)	(5,166,000)	(16,203,230)	(12,581,990)	(8,069,270)	(2,445,590)
Total	$(5,166,000)	$(12,581,110)	$(12,581,110)	$(8,068,460)	$(2,444,850)
h. Net Income (before taxes)	$(10,724,830)	$(3,068,870)	$552,700	$5,065,350	$10,688,960
i. Facility Taxes	$ -	$ -	$ -	$ -	$ -
j. Net Income	$(10,724,830)	$(3,068,870)	$552,700	$5,065,350	$10,688,960

[64] This bond issuance rate is based on City-Parish estimates.

This base case results in a net income of roughly negative $10.7 million by the end of year one, and negative $3 million in year five. By the end of year 10, net income is just over $550,000, growing to almost $10.7 million by the end of year 20.

We have included a cash flow statement in Table 36.

Table 36: FTTP Base Case Cash Flow Statement

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
a. Net Income	$(10,724,830)	$(3,068,870)	$552,700	$5,065,350	$10,688,960
b. Cash Outflows					
Depreciation Reserve	-	(127,010)	(127,010)	(127,010)	(127,010)
Financing	(1,049,700)	-	-	-	-
Capital Expenditures	(108,379,500)	-	-	-	-
Total	$(109,429,200)	$(127,010)	$(127,010)	$(127,010)	$(127,010)
c. Cash Inflows					
20-Year Bond Proceeds	$114,800,000	$ -	$ -	$ -	$ -
Total	$114,800,000	$ -	$ -	$ -	$ -
d. Total Cash Outflows and Inflows	$5,370,800	$(127,010)	$(127,010)	$(127,010)	$(127,010)
e. Non-Cash Expenses - Depreciation	$5,465,330	$18,144,850	$18,144,450	$18,144,450	$18,144,450
f. Adjustments					
Proceeds from Additional Cash Flows (20 Year Bond)	$114,800,000	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue	$(114,688,700)	$14,948,970	$18,570,140	$23,082,790	$28,706,400
h. Principal Payments on Debt					
20 Year Bond Principal	$ -	$14,709,620	$18,330,860	$22,843,580	$28,467,260
Total	$ -	$14,709,620	$18,330,860	$22,843,580	$28,467,260
i. Net Cash	$111,300	$239,350	$239,280	$239,210	$239,140
j. Cash Balance					
Unrestricted Cash Balance	$111,300	$3,488,770	$4,683,310	$7,071,330	$111,300
Depreciation Reserve	-	381,030	352,580	324,130	295,680
Total Cash Balance	$111,300	$3,869,800	$5,035,890	$7,367,010	$111,300

This scenario keeps the City-Parish operating with a positive cumulative unrestricted cash balance totaling just under $3.9 million by the end of year five, and almost $7.4 million by the end of year 20.

9.2.1.2 FTTP Base Case Capital Additions

Significant network expenses—known as "capital additions"—are incurred in the first few years during the construction phase of the network. These represent the equipment and labor expenses associated with building a fiber network. (Again, because the City-Parish's responsibility will be limited to OSP, we have not included any costs for fiber drops, or core network equipment.) This analysis projects that the capital additions (including vehicles and test equipment) in year one will total approximately $108.4 million. These costs will total approximately $180.3 million in year two, $72.2 million in year three, and $2,000 in year four. This totals over $360.9 million in capital additions for years one through four.

These costs are illustrated in Table 37.

Table 37: FTTP Capital Additions

Capital Additions	Year 1	Year 2	Year 3	Year 4
OSP and Facilities				
Total Backbone and FTTP	$108,070,500	$180,117,500	$72,047,000	$ -
Additional Annual Capital	-	-	-	-
Total	$108,070,500	$180,117,500	$72,047,000	$ -
Miscellaneous Implementation Costs				
Splicing	$ -	$ -	$ -	$-
Vehicles	70,000	140,000	122,500	-
Emergency Restoration Kit	100,000	-	-	-
Work Station, Computers, and Software	14,000	20,000	22,000	2,000
Fiber OTDR and Other Tools	50,000	25,000	25,000	-
Generators & UPS	-	-	-	-
Fiber Management Software	75,000	-	-	-
Additional Annual Capital	-	-	-	-
Total	$309,000	$185,000	$169,500	$2,000
Total Annual Capital Additions	$108,379,500	$180,302,500	$72,216,500	$2,000
Total Capital Additions	$360,900,500			

9.2.1.3 FTTP Operating, Maintenance, and Financing Expenses

The cost to deploy a dark FTTP network goes far beyond fiber implementation. Network deployment requires sales and marketing, network maintenance and technical operations, and other functions. In this model, we assume that the City-Parish's partner will be responsible for lighting the fiber and selling service. As such, the City-Parish's financial requirements are limited to expenses related to OSP infrastructure and network administration.

The model assumes a straight-line depreciation of assets, and that the OSP and materials will have a 20-year life span while network test equipment will need to be replaced after five years.

These expanded responsibilities will require the addition of new staff. We assume the City-Parish will add a total of 29 full-time-equivalent (FTE) positions within the first four years, and will then maintain that level of staffing. Our assumptions include one FTE for OSP management, one FTE for administration support, one FTE for GIS and record keeping, seven FTEs for customer service, and 19 FTEs for fiber plant maintenance and operations.

These staffing requirements represent what would be necessary to operate the enterprise. While these positions could easily be contracted to an outside firm, it is in the City-Parish's best interest to keep GIS and recordkeeping (such as fiber strand mapping, etc.) in-house.

Salaries and benefits are based on estimated market wages, and benefits are estimated at 35 percent of base salary. Salaries (including benefits) are summarized in Table 38.

Table 38: FTTP Labor Expenses

New Employees	Year 1	Year 2	Year 3	Year 4+	Labor Cost
OSP Manager	0.50	1.00	1.00	1.00	130,000
Administration Support (Allocation)	0.50	1.00	1.00	1.00	65,000
GIS	1.00	1.00	1.00	1.00	80,000
Customer Service Representative	1.00	2.00	6.00	7.00	65,000
Fiber Plant O&M Technicians	4.00	12.00	19.00	19.00	90,000
Total New Staff	7	17	28	29	

Additional key operating and maintenance assumptions include the following:

- Insurance is estimated to be $10,000 from year two on
- Office expenses are estimated to be $2,400 in year one and $4,800 annually in year two on
- Locates and ticket processing are estimated at $121,400 in year one, $607,200 in year two, and $1,214,400 in year three on
- Contingency expenses are estimated at $50,000 annually
- Fiber and network maintenance is estimated at 1 percent of the total construction cost per year (roughly $540,000 in year one, $1.44 million in year two, and $1.8 million in year three on); this is in addition to staffing costs to maintain the fiber
- Legal fees are estimated to be $50,000 in year one, $25,000 in year two, and $10,000 in year three on
- Consulting fees are estimated at $50,000 in year one $25,000 in year two, and $10,000 in year three on

- Education and training are estimated at just over $16,200 in year one, $40,100 in year two, and $64,100 in year three on
- Pole attachments are estimated at just over $183,200 in year one, $672,000 in year two, $1.1 million in year three, and $1.22 million in year four on

These expenses, as well as principal and interest payments, are shown in Table 39.

Table 39: FTTP Operating, Maintenance, and Financing Expenses

Operating Expenses & P&I	Year 1	Year 5	Year 10	Year 15	Year 20
Insurance	$ -	$100,000	$100,000	$100,000	$100,000
Office Expenses	24,000	48,000	48,000	48,000	48,000
Locates & Ticket Processing	121,400	1,214,400	1,214,400	1,214,400	1,214,400
Contingency	50,000	50,000	50,000	50,000	50,000
Fiber & Network Maintenance	540,350	1,801,180	1,801,180	1,801,180	1,801,180
Legal	50,000	10,000	10,000	10,000	10,000
Consulting	50,000	10,000	10,000	10,000	10,000
Education and Training	16,270	64,130	64,130	64,130	64,130
Pole Attachment Expense	183,285	1,221,900	1,221,900	1,221,900	1,221,900
Sub-Total	$1,035,305	$4,519,610	$4,519,610	$4,519,610	$4,519,610
Labor Expenses	$813,380	$3,206,250	$3,206,250	$3,206,250	$3,206,250
Sub-Total	$813,380	$3,206,250	$3,206,250	$3,206,250	$3,206,250
Total Expenses	$1,848,685	$7,725,860	$7,725,860	$7,725,860	$7,725,860
Principal and Interest	$5,166,000	$27,290,730	$30,911,970	$30,912,040	$30,912,110
Facility Taxes	-	-	-	-	-
Sub-Total	$5,166,000	$27,290,730	$30,911,970	$30,912,040	$30,912,110
Total Expenses, P&I, and Taxes	$7,014,685	$35,016,590	$38,637,830	$38,637,900	$38,637,970

The City-Parish's total operating, maintenance, and financing expenses will equal just over $7 million in year one, growing to $38.6 million in years 10 and beyond.

9.2.2 FTTP Scenario 2: Added Startup Funding

Our second scenario proposes use of $50 million in startup funding to lower the required partner lease fees. These funds would be from cash reserves, grants, or other sources that would not need to be repaid.[65] The total amount financed would be reduced accordingly, to $320.9 million. All other assumptions remained the same as our base case.

In this scenario, the City-Parish would be able to charge the partner $15.38 per passing per month, or 2.05 times the fees paid by Google in Huntsville. This fee may not be attractive enough to incent

[65] This scenario is for illustration only; there is no guarantee that such funding would be available to the City-Parish.

partnership, and as such, the City-Parish would need to increase the amount of startup funding to attract a partner in this scenario.

Table 40 presents a summarized income and cash flow statement for this scenario.

Table 40: FTTP Scenario 2 Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$1,557,630	$34,614,050	$34,614,050	$34,614,050	$34,614,050
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(5,465,330)	(18,144,850)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(2,826,000)	(13,907,150)	(10,834,450)	(7,005,280)	(2,233,420)
Taxes	-	-	-	-	-
Net Income	$(8,582,390)	$(5,163,810)	$(2,090,710)	$1,738,460	$6,510,320

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$729,240	$3,424,600	$5,283,940	$7,142,930	$9,001,560
Depreciation Reserve	-	381,030	352,580	324,130	295,680
Total Cash Balance	$729,240	$3,805,630	$5,636,520	$7,467,060	$9,297,240

This model results in a net income of roughly negative $8.5 million in year one, but would end year 20 with a net income of just over $6.5 million. This pricing remains cash-positive, ending year one with just under $730,000, growing to over $5.6 million by the end of year 10, and almost $9.3 million by the end of year 20.

9.2.3 FTTP Scenario 3: Increased Startup Funding

Our third scenario is much like the second, though we increase the amount of startup funding available to $100 million. It bears repeating that this money would need to come from a source that would not need to be paid back (e.g., grants, revenues from the general fund, or local resources). This increase in funding reduces the amount necessary to be financed, decreasing the total bond amount to $266.9 million.

As expected, this funding increase results in even lower partner lease fees. If the City-Parish could obtain $100 million in startup funds, the required lease fees to remain operable would be reduced to $13.28 per passing per month. This fee is 1.77 times the fee paid by Google in Huntsville. As this necessary fee lowers, the scenario will become more and more attractive to a private partner.

Table 41 summarizes the income and cash flow statements for this model.

Table 41: FTTP Scenario 3 Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$1,344,880	$29,886,270	$29,886,270	$29,886,270	$29,886,270
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(5,465,330)	(18,144,850)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(441,000)	(11,660,440)	(9,127,880)	(5,971,840)	(2,038,800)
Taxes	-	-	-	-	-
Net Income	$(6,410,140)	$(7,644,880)	$(5,111,920)	$(1,955,880)	$1,977,160

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$386,090	$3,291,410	$3,715,800	$4,139,840	$4,563,520
Depreciation Reserve	-	381,030	352,580	324,130	295,680
Total Cash Balance	$386,090	$3,672,440	$4,068,380	$4,463,970	$4,859,200

This model results in a negative net income in years one through 15, growing to just under $2 million in year 20. Cumulative cash balance remains positive throughout the projection, finishing year one with almost $386,000 and year 20 with just under $4.86 million.

9.2.4 FTTP Scenario 4: Huntsville Pricing

As an example of the implications of Google's lease payments to Huntsville Utilities, we have included a projection of the City-Parish charging the same fee ($7.50 per passing per month) to its private partner. Construction and operating costs remain the same as the base model, and no startup funding is obtained.

A financial summary for this scenario is included in Table 42.

Table 42: FTTP Scenario 4 Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$759,820	$16,884,900	$16,884,900	$16,884,900	$16,884,900
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(5,465,330)	(18,144,850)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(5,166,000)	(16,202,280)	(12,581,110)	(8,068,460)	(2,444,850)
Taxes	-	-	-	-	-
Net Income	$(11,720,200)	$(25,188,090)	$(21,566,520)	$(17,053,870)	$(11,430,260)

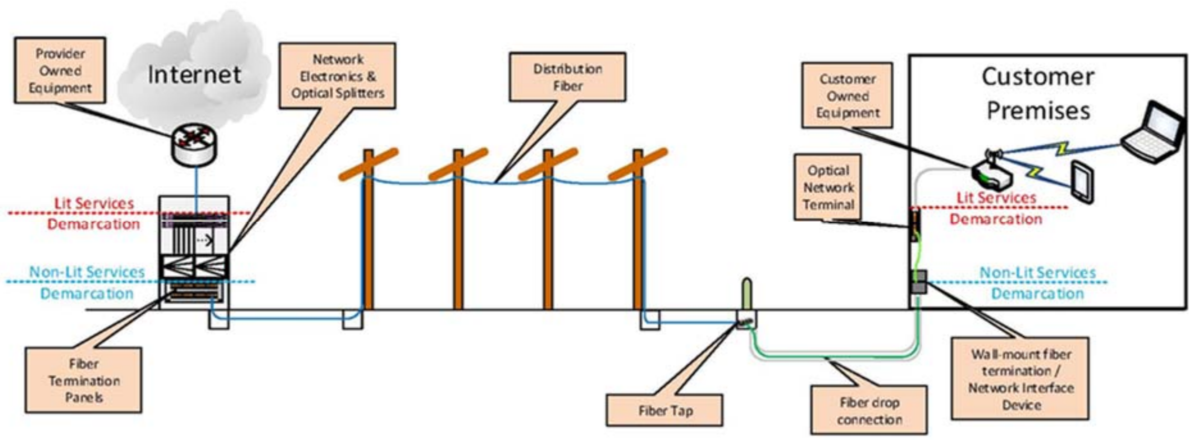
Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$(884,070)	$(65,412,610)	$(174,814,170)	$(284,216,080)	$(393,618,350)
Depreciation Reserve	-	381,030	352,580	324,130	295,680
Total Cash Balance	$(884,070)	$(65,031,580)	$(174,461,590)	$(283,891,950)	$(393,322,670)

If the City-Parish were to charge the same lease fees as Huntsville Utilities, it would be unable to generate a positive cash flow for the life as the model. Further, the City-Parish's cumulative cash balance would remain negative throughout, with a deficit totaling $393.3 million at year 20.

9.3 FTTP Model Including Fiber Drops (Westminster Model)

Our second model assumes that the City-Parish constructs and owns network infrastructure throughout the entirety of the City-Parish up to a demarcation point in the customer's home or business, and leases the dark fiber backbone, distribution fiber, and fiber drops to a private partner. The private partner would be responsible for all network electronics and CPEs, as well as network sales, marketing, and operations. This demarcation is illustrated in Figure 91.

Figure 91: Demarcation between City-Parish and Partner Network Elements (Westminster Model)



Network electronics and CPE are significant additional expenses for the private partner to consider, and as such, the City-Parish should bear them in mind when negotiating pricing with potential partners.

The financial analysis presented here represents a minimum requirement for the City-Parish to obtain a break-even cash flow each year, excluding any potential revenue from other dark fiber lease opportunities that may be available to the City-Parish. We have provided a complete financial model in Excel format that can be leveraged to show the impact of changing assumptions. The spreadsheet can be an important tool for the City-Parish to use if it negotiates with a private partner.

Please note that we used a "flat model" in the analysis, which means that inflation and operating cost increases (including for salaries) are not used because it is assumed that operating cost increases will be offset by increases in operator lease payments over time (and likely passed on to subscribers in the form of increased prices). We anticipate that the City-Parish will apply an inflation factor, typically based on a Consumer Price Index (CPI), to the portion of the per-subscriber fee that covers projected operating expenses during negotiations with a private partner.

These financial projections do not include any economic development or other indirect benefits, which are often not easily quantifiable.

In our modeling, we compared a similar dark FTTP deployment in the city of Westminster, Maryland. In its contract with Ting Internet, the city negotiated a per-passing fee ($6) plus per-subscriber fee ($17) per month for dark fiber usage. That is, Ting pays the city for every premises the network passes, plus an additional fee for every subscriber receiving service over the network, totaling $6 per non-subscribed passing and $23 per subscribed passing. As such, the take rate is vitally important to the feasibility of the project.

We include this reference to demonstrate what pricing is attractive enough to incent partnership, the financial implications of that pricing, and what Westminster pricing would look like in relation to network deployment costs for the City-Parish. In all models, the required per-passing and per-subscriber fees are higher than Westminster's partnership; charging lease fees similar to those paid by Ting in Westminster, Maryland will result in a cumulative cash deficit of almost $326 million after 20 years.

We have included seven potential scenario projections for this model. These include a base case that projects what fees are necessary to maintain a positive cash flow each year, followed by four scenarios that demonstrate the implications of changing said fees and other variables. The final two scenarios show the implications of only building to high- or low-density areas.

9.3.1 FTTP Model Including Fiber Drops Base Case

For our base case scenario, we present what would be necessary to maintain positive cash flow given the estimated OSP construction and operating costs. In this base case model, we assume a private partner can obtain and maintain a 35 percent take rate.[66]

Please note the construction cost estimate in Section 9.1 does not include the total of drop costs to individual residences and small businesses. For this model, we estimate each drop to cost an average of $1,228.75. If 35 percent of the City-Parish's 187,610 passings were to subscribe (65,664 subscribers), drop cost construction would total roughly $80.7 million.

Though the City-Parish will be responsible for funding and constructing the drops, these costs are offset by the per-subscriber lease fees that are the responsibility of the private partner.

To maintain positive cash flow with this model, assuming the private partner can obtain and maintain a 35 percent take rate, the City-Parish would need to charge the partner $11.70 per passing and an additional $33.15 per subscriber. This fee is 1.68 times the fee that Westminster obtained in its agreement with Ting Internet.

We have included a summarized income and cash flow statement for this model in Table 43.

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[66] Many overbuilders have obtained around 35 percent take rate (in three to four years) when entering an overbuild market.

Table 43: FTTP Including Fiber Drops Base Case Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$1,985,960	$45,197,680	$45,197,680	$45,197,680	$45,197,680
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(6,157,110)	(34,281,750)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(5,328,000)	(19,526,710)	(15,209,620)	(9,830,180)	(3,126,320)
Taxes	-	-	-	-	-
Net Income	$(11,347,840)	$(16,336,640)	$4,117,750	$9,497,190	$16,201,050

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$288,270	$820,740	$2,196,850	$3,739,810	$5,280,720
Depreciation Reserve	-	547,900	552,000	387,450	222,900
Total Cash Balance	$288,270	$1,368,640	$2,748,850	$4,127,260	$5,503,620

If the City-Parish could obtain the lease fees discussed above, it would operate with a negative net income through year eight, then increase to more than $4 million by the end of year 10 and just over $16.2 million by the end of year 20. This model would operate with a cumulative unrestricted cash balance of roughly $288,000 by the end of year one, increasing to roughly $2.7 million by the end of year 10, and growing to just over $5.5 million by the end of year 20.

9.3.1.1 FTTP Including Fiber Drops Base Case Financing

This financial analysis assumes that the City-Parish will cover all its capital requirements with general obligation (GO) bonds. We assumed that the City-Parish's bond rate would be 4.5 percent.

We expect that the City-Parish will take three 20-year bonds – one each in years one, two, and three—for a total of $450.7 million in financing. (The difference between the financed amount and the total capital costs represents the amount needed to maintain positive cash flow in the early years of network deployment.) The resulting principal and interest (P&I) payments will be the major factor in determining the City-Parish's long-term financial requirements; P&I accounts for roughly 80 percent of the City-Parish's annual costs in our base case model after the construction period.

We project that the bond issuance costs will be equal to 0.91 percent of the principal borrowed. We assume neither debt service nor interest reserves need to be maintained for the lifetime of the bond. Principal repayment on the bonds will start in year three.

We have included a detailed income statement in Table 44.

Table 44: FTTP Including Fiber Drops Base Case Income Statement

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
a. Revenues					
Per Passing	$1,021,200	$22,693,310	$22,693,310	$22,693,310	$22,693,310
Per Subscriber	964,760	22,504,370	22,504,370	22,504,370	22,504,370
Total	$1,985,960	$45,197,680	$45,197,680	$45,197,680	$45,197,680
c. Operating Costs					
Operation Costs	$1,035,305	$4,519,610	$4,519,610	$4,519,610	$4,519,610
Labor Costs	813,380	3,206,250	3,206,250	3,206,250	3,206,250
Total	$1,848,685	$7,725,860	$7,725,860	$7,725,860	$7,725,860
d. EBITDA	$137,275	$37,471,820	$37,471,820	$37,471,820	$37,471,820
e. Depreciation	6,157,110	34,281,750	18,144,450	18,144,450	18,144,450
f. Operating Income (EBITDA less Depreciation)	$(6,019,835)	$3,190,070	$19,327,370	$19,327,370	$19,327,370
g. Non-Operating Income					
Interest Income	$ -	$1,370	$1,380	$970	$560
Interest Expense (20 Year Bond)	(5,328,000)	(19,528,080)	(15,211,000)	(9,831,150)	(3,126,880)
Total	$(5,328,000)	$(15,209,620)	$(15,209,620)	$(9,830,180)	$(3,126,320)
h. Net Income (before taxes)	$(11,347,840)	$(16,336,640)	$4,117,750	$9,497,190	$16,201,050
i. Facility Taxes	$ -	$ -	$ -	$ -	$ -
j. Net Income	$(11,347,840)	$(16,336,640)	$4,117,750	$9,497,190	$16,201,050

Our base case would result in a negative net income through year eight, increasing to roughly $3.18 million in year nine, and growing to $16.2 million by year 20.

We have included a detailed cash flow statement in Table 45.

Table 45: FTTP Including Fiber Drops Base Case Cash Flow Statement

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
a. Net Income	$(11,347,840)	$(16,336,640)	$4,117,750	$9,497,190	$16,201,050
b. Cash Outflows					
Depreciation Reserve	$ -	$(188,550)	$(99,790)	$(99,790)	$(99,790)
Financing	(1,082,600)	-	-	-	-
Capital Expenditures	(111,838,400)	-	-	-	-
Total	$(112,921,000)	$ (188,550)	$ (99,790)	$ (99,790)	$ (99,790)
c. Cash Inflows					
20-Year Bond Proceeds	$118,400,000	$ -	$ -	$ -	$ -
Total	$118,400,000	$ -	$ -	$ -	$ -
d. Total Cash Outflows and Inflows	$5,479,000	$(188,550)	$(99,790)	$(99,790)	$(99,790)
e. Non-Cash Expenses - Depreciation	$6,157,110	$34,281,750	$18,144,450	$18,144,450	$18,144,450
f. Adjustments					
Proceeds from Additional Cash Flows (20 Year Bond)	$(118,400,000)	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue	$(118,111,730)	$17,756,560	$22,162,410	$27,541,850	$34,245,710
h. Principal Payments on Debt					
20 Year Bond Principal	$ -	$17,536,090	$21,853,170	$27,233,020	$33,937,290
Total	$ -	$17,536,090	$21,853,170	$27,233,020	$33,937,290
i. Net Cash	$288,250	$220,470	$309,240	$308,830	$308,420
j. Cash Balance					
Unrestricted Cash Balance	$288,270	$820,740	$2,196,850	$3,739,810	$5,280,720
Depreciation Reserve	-	547,900	552,000	387,450	222,900
Total Cash Balance	$288,270	$1,368,640	$2,748,850	$4,127,260	$5,503,620

This base case would operate cash-positive throughout the life of this projection. The City-Parish would finish year one with a cumulative balance of just over $288,000, growing to over $2.7 million by the end of year 10 and just over $5.5 million by the end of year 20.

9.3.1.2 FTTP Including Fiber Drops Base Case Capital Additions

Significant network expenses—known as “capital additions”—are incurred in the first few years during the construction phase of the network. These represent the equipment and labor expenses associated with building a fiber network. (Again, because the City's responsibility will be limited to OSP and drops, we have not included any core network equipment or CPEs.)

This analysis projects that the capital additions in year one will total just over $111.8 million. These costs will total $197.6 million in year two, just over $116 million in year three, and $16.1 million in year four, totaling over $441.5 million in capital additions for years one through three.

These additions are shown in greater detail in Table 46.

Table 46: FTTP Including Fiber Drops Base Case Capital Additions

Capital Additions	Year 1	Year 2	Year 3	Year 4
OSP and Facilities				
Total Backbone and FTTP	$108,070,500	$180,117,500	$72,047,000	$ -
Additional Annual Capital	-	-	-	-
Total	$108,070,500	$180,117,500	$72,047,000	$ -
Last Mile and Customer Premises Equipment				
Average Drop Cost	3,458,900	17,289,700	43,800,000	16,135,900
Additional Annual Replacement Capital	-	-	-	-
Total	$3,458,900	$17,289,700	$43,800,000	$16,135,900
Miscellaneous Implementation Costs				
Splicing	$ -	$ -	$ -	$ -
Vehicles	70,000	140,000	122,500	-
Emergency Restoration Kit	100,000	-	-	-
Work Station, Computers, and Software	14,000	20,000	22,000	2,000
Fiber OTDR and Other Tools	50,000	25,000	25,000	-
Generators & UPS	-	-	-	-
Fiber Management Software	75,000	-	-	-
Additional Annual Capital	-	-	-	-
Total	$309,000	$185,000	$169,500	$2,000
Total Annual Capital Additions	$111,838,400	$197,592,200	$116,016,500	$16,137,900
Total Capital Additions	$441,585,000			

9.3.1.3 FTTP Including Fiber Drops Operating, Maintenance, and Finance Expenses

The cost to deploy a dark FTTP network goes far beyond fiber implementation. Network deployment requires sales and marketing, network maintenance and technical operations, and other functions. In this model, we assume that the City-Parish's partner will be responsible for lighting the fiber and selling service. As such, the City-Parish's financial requirements are limited to expenses related to OSP infrastructure and network administration.

The model assumes a straight-line depreciation of assets, and that the OSP and materials will have a 20-year life span while network test equipment will need to be replaced after five years.

These expanded responsibilities will require the addition of new staff. We assume the City-Parish will add a total of 29 full-time-equivalent (FTE) positions within the first four years, and will then maintain that level of staffing. Our assumptions include one FTE for OSP management, one FTE for administration support, one FTE for GIS and record keeping, seven FTEs for customer service, and 19 FTEs for fiber plant maintenance and operations.

These staffing requirements represent what would be necessary to operate the enterprise. While these positions could easily be contracted to an outside firm, it is in the City-Parish's best interest to keep GIS and recordkeeping (such as fiber strand mapping, etc.) in-house.

Salaries and benefits are based on estimated market wages, and benefits are estimated at 35 percent of base salary. Salaries (including benefits) are summarized in Table 47.

Table 47: FTTP Including Fiber Drops Labor Expenses

New Employees	Year 1	Year 2	Year 3	Year 4+	Labor Cost
OSP Manager	0.50	1.00	1.00	1.00	130,000
Administration Support (Allocation)	0.50	1.00	1.00	1.00	65,000
GIS	1.00	1.00	1.00	1.00	80,000
Customer Service Representative	1.00	2.00	6.00	7.00	65,000
Fiber Plant O&M Technicians	4.00	12.00	19.00	19.00	90,000
Total New Staff	7	17	28	29	

Additional key operating and maintenance assumptions include the following:

- Insurance is estimated to be $10,000 from year two on
- Office expenses are estimated to be $2,400 in year one and $4,800 annually in year two on
- Locates and ticket processing are estimated at $121,400 in year one, $607,200 in year two, and $1,214,400 in year three on
- Contingency expenses are estimated at $50,000 annually
- Fiber and network maintenance is estimated at 1 percent of the total construction cost per year (roughly $540,000 in year one, $1.44 million in year two, and $1.8 million in year three on); this is in addition to staffing costs to maintain the fiber
- Legal fees are estimated to be $50,000 in year one, $25,000 in year two, and $10,000 in year three on
- Consulting fees are estimated at $50,000 in year one, $25,000 in year two, and $10,000 in year three on

- Education and training are estimated at just over $16,200 in year one, $40,100 in year two, and $64,100 in year three on
- Pole attachments are estimated at just over $183,200 in year one, $672,000 in year two, $1.1 million in year three, and $1.22 million in year four on

These expenses, as well as principal and interest payments, are shown in Table 48.

Table 48: FTTP Including Fiber Drops Operating, Maintenance, and Financing Expenses

Operating Expenses & P&I	Year 1	Year 5	Year 10	Year 15	Year 20
Insurance	$ -	$100,000	$100,000	$100,000	$100,000
Office Expenses	24,000	48,000	48,000	48,000	48,000
Locates & Ticket Processing	121,400	1,214,400	1,214,400	1,214,400	1,214,400
Contingency	50,000	50,000	50,000	50,000	50,000
Fiber & Network Maintenance	540,350	1,801,180	1,801,180	1,801,180	1,801,180
Legal	50,000	10,000	10,000	10,000	10,000
Consulting	50,000	10,000	10,000	10,000	10,000
Education and Training	16,270	64,130	64,130	64,130	64,130
Pole Attachment Expense	183,285	1,221,900	1,221,900	1,221,900	1,221,900
Sub-Total	$1,035,305	$4,519,610	$4,519,610	$4,519,610	$4,519,610
Labor Expenses	$813,380	$3,206,250	$3,206,250	$3,206,250	$3,206,250
Sub-Total	$813,380	$3,206,250	$3,206,250	$3,206,250	$3,206,250
Total Expenses	$1,848,685	$7,725,860	$7,725,860	$7,725,860	$7,725,860
Principal and Interest	$5,328,000	$32,745,710	$37,062,790	$37,063,200	$37,063,610
Facility Taxes	-	-	-	-	-
Sub-Total	$5,328,000	$32,745,710	$37,062,790	$37,063,200	$37,063,610
Total Expenses, P&I, and Taxes	$7,176,685	$40,471,570	$44,788,650	$44,789,060	$44,789,470

The City-Parish's operating expenses will total almost $7.2 million in year one, growing to $40.5 million in year five, and $44.7 in year 10 and beyond.

9.3.2 FTTP Including Fiber Drops Scenario 2: Take Rate Increased to 50 Percent

Our second scenario looks at the impact of a higher take rate on necessary partner lease fees. In this scenario, we increased the take rate from our base case of 35 percent to 50 percent. With this increase in subscribers, the City-Parish is responsible for the funding and construction of additional fiber drops. To offset these costs, the City-Parish would need to increase its total of the bonds to $488.2 million.

As a result, the fees necessary from the partner would decrease slightly: $9 per passing per month and $25.50 per subscriber per month. These fees are 1.5 times the amount per subscribed customer in Westminster.

A financial summary for this scenario is included in Table 49.

Table 49: FTTP Including Fiber Drops Scenario 2 Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$1,773,170	$48,966,210	$48,966,210	$48,966,210	$48,966,210
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(6,157,110)	(41,198,610)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(5,328,000)	(21,144,840)	(16,566,970)	(10,793,000)	(3,597,450)
Taxes	-	-	-	-	-
Net Income	$(11,560,630)	$(21,103,100)	$6,528,930	$12,302,900	$19,498,450

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$75,480	$2,527,550	$7,214,880	$12,183,460	$17,149,980
Depreciation Reserve	-	623,980	742,210	577,660	413,110
Total Cash Balance	$75,480	$3,151,530	$7,957,090	$12,761,120	$17,563,090

This model would result in a negative net income for the first years of the project, becoming $6.5 million by year 10 and almost $19.5 million by the end of year 20. The City-Parish's cumulative unrestricted cash balance ends year one at just over $75,000, increasing to almost $17.6 million by the end of year 20.

9.3.3 FTTP Including Drop Costs Scenario 3: Decreased Financed Amount

Our third scenario suggests the implications of lowering the amount financed, and increasing startup funding. In this scenario, we propose the City-Parish begin the project with $50 million in funding from cash on hand, grants, or other sources, which do not need to be repaid.[67] This model assumes the partner can obtain and maintain a 35 percent take rate.

The lowered financed amount ($396.7 million), and sequentially the lowered interest payments, result in decreased necessary partner lease fees: $9.06 per passing per month and $25.67 per subscriber per month, or 1.51 times the fees paid by Ting to Westminster. As the necessary lease fees decrease, the model becomes more attractive to potential partners.

A summary of this scenario's income statement and cash flow statement are included in Table 50.

[67] This scenario is for illustration of the effect of startup funding only; there is no guarantee that such funding would be available to the City-Parish.

Table 50: FTTP Including Fiber Drops Scenario 3 Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$1,784,990	$40,624,100	$40,624,100	$40,624,100	$40,624,100
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(6,157,110)	(34,281,750)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(2,988,000)	(17,274,900)	(13,496,710)	(8,788,810)	(2,921,820)
Taxes	-	-	-	-	-
Net Income	$(9,208,810)	$(18,658,410)	$1,257,080	$5,964,980	$11,831,970

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$902,755	$955,214	$1,667,374	$2,546,384	$3,423,344
Depreciation Reserve	-	547,900	552,000	387,450	222,900
Total Cash Balance	$902,755	$1,503,114	$2,219,374	$2,933,834	$3,646,244

This model would operate with a positive net income of almost $1.3 million by year 10, growing to over $11.8 million by year 20. The City-Parish's cumulative unrestricted cash balance would end year one just under $1 million, growing to $2.2 million by the end of year 10, and $3.6 million by the end of year 20.

9.3.4 FTTP Including Fiber Drops Scenario 4: Increased Startup Funding

Our fourth scenario increases startup funding to $100 million. Again, this funding would need to be from a source that would not need to be paid back, such as grants, revenues from the general fund, or local resources.[68] We assume the partner can obtain and maintain a 35 percent take rate.

The resulting decreased financed amount ($343.7 million) lowers necessary lease fees even further to $8.10 per passing per month and $22.95 per subscriber per month—1.35 times those agreed upon by Ting in Westminster.

A summary of this scenario's income statement and cash flow statement are included in Table 51.

[68] This scenario is for illustration of the effect of increased startup funding only; there is no guarantee that such funding would be available to the City-Parish.

Table 51: FTTP Including Fiber Drops Scenario 4 Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$1,595,860	$36,319,560	$36,319,560	$36,319,560	$36,319,560
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(6,157,110)	(34,281,750)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(603,000)	(15,071,510)	(11,823,890)	(7,777,170)	(2,734,130)
Taxes	-	-	-	-	-
Net Income	$(7,012,940)	$(20,759,560)	$(1,374,640)	$2,672,080	$7,715,120

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$583,270	$2,090,380	$3,483,840	$5,044,150	$6,602,410
Depreciation Reserve	-	547,900	552,000	387,450	222,900
Total Cash Balance	$583,270	$2,638,280	$4,035,840	$5,431,600	$6,825,310

Were the City-Parish able to obtain this level of startup funding, it would operate with a negative net income in years one through 10, eventually growing to almost $2.7 million by year 15 and $7.7 million by year 20. The City-Parish's cumulative unrestricted cash balance by the end of year one would be just over $583,000, growing to over $5 million by the end of year 10, and $6.8 million by the end of year 20.

9.3.5 FTTP Including Fiber Drops Scenario 5: City of Westminster Pricing

We have included the implications of using the lease fees agreed upon in Westminster to illustrate the viability of such low fees in the City-Parish. This model assumes a 35 percent take rate, with a $6 per passing per month and $17 per subscriber per month fee.

A summary of this scenario's income statement and cash flow statement are included in Table 52.

Table 52: FTTP Including Fiber Drops Scenario 5 Financial Summary

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$1,182,120	$26,903,380	$26,903,380	$26,903,380	$26,903,380
Total Cash Expenses	(1,848,690)	(7,725,860)	(7,725,860)	(7,725,860)	(7,725,860)
Depreciation	(6,157,110)	(34,281,750)	(18,144,450)	(18,144,450)	(18,144,450)
Interest Expense	(5,328,000)	(19,526,710)	(15,209,620)	(9,830,180)	(3,126,320)
Taxes	-	-	-	-	-
Net Income	$(12,151,680)	$(34,630,940)	$(14,176,550)	$(8,797,110)	$(2,093,250)

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$(515,570)	$(56,029,720)	$(146,125,110)	$(236,053,650)	$(325,984,240)
Depreciation Reserve	-	547,900	552,000	387,450	222,900
Total Cash Balance	$(515,570)	$(55,481,820)	$(145,573,110)	$(235,666,200)	$(325,761,340)

If the City-Parish were to charge the same fees as Westminster, it would result in a negative net income for 20 years, and a cumulative unrestricted cash balance of over $325.76 million by the end of year 20.

9.3.6 FTTP Including Fiber Drops Scenario 6: Buildout to Only High-Density Areas

Our sixth scenario looks at the implications of the City-Parish only building an FTTP network to the high-density areas discussed in Section 9.1. As a reminder, these areas have an average of 97 passings per square mile, and total roughly 20 percent of the City-Parish's passings (38,795 of 187,610 total passings). The increased density lowers overall construction costs, as shown in Table 53.

Table 53: Non-Lit FTTP Cost Comparison (Entire City-Parish v. High-Density Areas)

Cost Component	Total Estimated Cost	High Density Cost
OSP Engineering	$44,591,000	$5,319,000
Quality Control/Quality Assurance	23,430,000	2,795,000
General OSP Construction Cost	249,981,000	34,467,000
Special Crossings	14,271,000	1,755,000
Backbone and Distribution Plant Splicing	7,736,000	1,210,000
Backbone Hub, Termination, and Testing	17,871,000	3,553,000
FTTP Lateral Installations	2,355,000	1,387,000
Total Estimated Cost:	$360,235,000	$50,486,000

Only building to high-density areas would reduce construction costs by $310 million, totaling nearly $5.5 million to potentially reach 20 percent of the City-Parish's passings.

Please note these construction costs do not include fiber drop costs. If 35 percent of the City-Parish's 38,759 high-density passings subscribe, at an average $1,228.75 per drop, it would add an additional $16.7 million the construction costs. Keep in mind, these fees would be offset by the subscriber fees paid to the City-Parish by the private partner.

In this model, most of our assumptions from the base case remain the same, though the amount financed would reduce to $69.4 million. Due to the smaller size of the network, operating and maintenance costs would also be reduced. Because of this reduction in expenses, necessary partner fees would also be reduced. For this model to remain cash positive, the City-Parish would need to charge $8.10 per passing and $22.95 per subscriber—or 1.35 times the fees charged in Westminster.

An income statement for this scenario is shown in Table 54.

Table 54: FTTP Including Fiber Drops Scenario 6 Income Statement

Income Statement		Year 1	Year 5	Year 10	Year 15	Year 20
a. Revenues						
Per Passing		$169,540	$3,767,370	$3,767,370	$3,767,370	$3,767,370
Per Subscriber		160,560	3,736,080	3,736,080	3,736,080	3,736,080
	Total	$330,100	$7,503,450	$7,503,450	$7,503,450	$7,503,450
c. Operating Costs						
Operation Costs		$292,644	$776,790	$776,790	$776,790	$776,790
Labor Costs		327,380	789,750	789,750	789,750	789,750
	Total	$620,024	$1,566,540	$1,566,540	$1,566,540	$1,566,540
d. EBITDA		$(289,924)	$5,936,910	$5,936,910	$5,936,910	$5,936,910
e. Depreciation		946,770	5,922,940	2,589,100	2,589,100	2,589,100
f. Operating Income (EBITDA less Depreciation)		$(1,236,694)	$13,970	$3,347,810	$3,347,810	$3,347,810
g. Non-Operating Income						
Interest Income		$ -	$860	$1,010	$850	$680
Interest Expense (20 Year Bond)		(805,500)	(3,010,890)	(2,347,100)	(1,519,890)	(489,040)
	Total	$(805,500)	$(2,346,090)	$(2,346,090)	$(1,519,040)	$(488,360)
h. Net Income (before taxes)		$(2,042,190)	$(2,996,060)	$1,001,720	$1,828,770	$2,859,450
i. Facility Taxes		$ -	$ -	$ -	$ -	$ -
j. Net Income		$(2,042,190)	$(2,996,060)	$1,001,720	$1,828,770	$2,859,450

If the City-Parish elects to only build to high-density areas, it would result in a negative net income until year eight, becoming just over $1 million by year 10, and growing to $2.8 million by year 20.

We have included a cash flow statement in Table 55.

Table 55: FTTP Including Fiber Drops Scenario 6 Cash Flow Statement

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
a. Net Income	$(2,042,190)	$(2,996,060)	$1,001,720	$1,828,770	$2,859,450
b. Cash Outflows					
Depreciation Reserve	$ -	(118,460)	(51,780)	(51,780)	(51,780)
Financing	(163,700)	-	-	-	-
Capital Expenditures	(16,093,200)	-	-	-	-
Total	$(16,256,900)	$(118,460)	$(51,780)	$(51,780)	$(51,780)
c. Cash Inflows					
20-Year Bond Proceeds	$17,900,000	$ -	$ -	$ -	$ -
Total	$17,900,000	$ -	$ -	$ -	$ -
d. Total Cash Outflows and Inflows	$1,643,127	$(118,460)	$(51,780)	$(51,780)	$(51,780)
e. Non-Cash Expenses - Depreciation	$946,770	$5,922,940	$2,589,100	$2,589,100	$2,589,100
f. Adjustments					
Proceeds from Additional Cash Flows (20 Year Bond)	$(17,900,000)	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue	$(17,352,320)	$2,808,420	$3,539,040	$4,366,090	$5,396,770
h. Principal Payments on Debt					
20 Year Bond Principal	$ -	2,696,350	3,360,140	4,187,350	5,218,200
Total	$ -	$2,696,350	$3,360,140	$4,187,350	$5,218,200
i. Net Cash	$547,707	$112,070	$178,900	$178,740	$178,570
j. Cash Balance					
Unrestricted Cash Balance	$547,680	$375,180	$1,141,870	$2,034,610	$2,926,520
Depreciation Reserve	-	342,050	403,620	338,520	273,420
Total Cash Balance	$547,680	$717,230	$1,545,490	$2,373,130	$3,199,940

This model would operate with a positive cumulative cash flow throughout, ending year one with almost $548,000, year 10 with $1.5 million, and year 20 with just under $3.2 million.

9.3.7 FTTP Including Fiber Drops Scenario 7: Buildout to Only Low-Density Areas

Like Scenario 6, this scenario looks at the viability of building only to the low-density areas discussed in Section 9.1. As a reminder, these areas have an average 66 passings per square mile, making up roughly 80 percent of the City-Parish's passings (148,851 of 187,610 total).

Since low-density areas require a greater amount fiber to be constructed to each passing, and 80 percent of the City-Parish are low-density areas, this scenario is significantly more expensive than scenario 6. For reference, our low-density construction costs from Section 9.1 are included in Table 56.

Table 56: Non-Lit FTTP Cost Comparison (Entire City-Parish v. Low-Density Areas)

Cost Component	Total Estimated Cost	Low Density Cost
OSP Engineering	$44,591,000	$39,272,000
Quality Control/Quality Assurance	23,430,000	20,635,000
General OSP Construction Cost	249,981,000	215,514,000
Special Crossings	14,271,000	12,516,000
Backbone and Distribution Plant Splicing	7,736,000	6,526,000
Backbone Hub, Termination, and Testing	17,871,000	14,318,000
FTTP Lateral Installations	2,355,000	968,000
Total Estimated Cost:	$360,235,000	$309,749,000

Only building to low-density areas would decrease the City-Parish's construction costs by roughly $51 million, totaling $309.7 million to potentially reach 80 percent of the passings in the City-Parish.

Please note these construction costs do not include fiber drop costs. If 35 percent of the City-Parish's 148,851 high-density passings subscribe, at an average $1,228.75 per drop, it would add an additional $64 million the construction costs. Keep in mind, these fees would be offset by the subscriber fees paid to the City-Parish by the private partner.

In this model, most of our assumptions from the base case remain the same, though the amount financed would reduce to $382.2 million. Due to the smaller size of the network, operating and maintenance costs would also be reduced. Because of this reduction in expenses, necessary partner fees would also be reduced. For this model to remain cash positive, the City-Parish would need to charge $10.98 per passing and $31.11 per subscriber—or 1.83 times the fees charged in Westminster.

An income statement for this scenario is shown in Table 57.

Table 57: FTTP Including Fiber Drops Scenario 7 Income Statement

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
a. Revenues					
Per Passing	$882,560	$19,612,610	$19,612,610	$19,612,610	$19,612,610
Fiber leases (net)	834,000	19,449,600	19,449,600	19,449,600	19,449,600
Total	$1,716,560	$39,062,210	$39,062,210	$39,062,210	$39,062,210
c. Operating Costs					
Operation Costs	$920,884	$3,969,920	$3,969,920	$3,969,920	$3,969,920
Labor Costs	691,880	2,875,500	2,875,500	2,875,500	2,875,500
Total	$1,612,764	$6,845,420	$6,845,420	$6,845,420	$6,845,420
d. EBITDA	$103,796	$32,216,790	$32,216,790	$32,216,790	$32,216,790
e. Depreciation	5,253,140	28,415,650	15,611,950	15,611,950	15,611,950
f. Operating Income (EBITDA less Depreciation)	$(5,149,344)	$3,801,140	$16,604,840	$16,604,840	$16,604,840
g. Non-Operating Income					
Interest Income	$ -	$4,130	$7,700	$10,040	$12,390
Interest Expense (20 Year Bond)	(4,581,000)	(16,553,230)	(12,890,610)	(8,326,310)	(2,638,370)
Total	$(4,581,000)	$(12,882,910)	$(12,882,910)	$(8,316,270)	$(2,625,980)
h. Net Income (before taxes)	$(9,730,340)	$(12,747,960)	$3,721,930	$8,288,570	$13,978,860
i. Facility Taxes	$ -	$ -	$ -	$ -	$ -
j. Net Income	$(9,730,340)	$(12,747,960)	$3,721,930	$8,288,570	$13,978,860

If the City-Parish builds to only low-density areas, it would result in a negative net income years one through eight, resulting in a net income of just over $3.7 million in year 10, and almost $14 million by year 20.

A cash flow statement is shown in Table 58.

Table 58: FTTP Including Fiber Drops Scenario 7 Cash Flow Statement

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
a. Net Income	$(9,730,340)	$(12,747,960)	$3,721,930	$8,288,570	$13,978,860
b. Cash Outflows					
Depreciation Reserve	$ -	$(568,310)	$(312,240)	$(312,240)	$(312,240)
Financing	(930,800)	-	-	-	-
Capital Expenditures	(95,959,200)	-	-	-	-
Total	$(96,890,000)	$(568,310)	$(312,240)	$(312,240)	$(312,240)
c. Cash Inflows					
20-Year Bond Proceeds	$101,800,000	$ -	$ -	$ -	$ -
Total	$101,800,000	$ -	$ -	$ -	$ -
d. Total Cash Outflows and Inflows	$4,909,966	$(568,310)	$(312,240)	$(312,240)	$(312,240)
e. Non-Cash Expenses - Depreciation	$5,253,140	$28,415,650	$15,611,950	$15,611,950	$15,611,950
f. Adjustments					
Proceeds from Additional Cash Flows (20 Year Bond)	$(101,800,000)	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue	$(101,367,200)	$15,099,380	$19,021,640	$23,588,280	$29,278,570
h. Principal Payments on Debt					
20 Year Bond Principal	$ -	$14,877,720	$18,540,340	$23,104,640	$28,792,580
Total	$ -	$14,877,720	$18,540,340	$23,104,640	$28,792,580
i. Net Cash	$432,800	$221,660	$481,300	$483,640	$485,990
j. Cash Balance					
Unrestricted Cash Balance	$432,800	$336,780	$2,249,400	$4,661,000	$7,084,350
Depreciation Reserve	-	1,653,720	3,078,960	4,017,660	4,956,360
Total Cash Balance	$432,800	$1,990,500	$5,328,360	$8,678,660	$12,040,710

This scenario would result in a cumulative cash balance of almost $433,000 by the end of year one, growing to just over $5.3 million by the end of year 10, and $12 million by the end of year 20.

Appendix A: Glossary of Terms

Access Fiber – The fiber in an FTTP network that goes from the FDCs to the optical taps that are located outside of homes and businesses in the PROW.

AE – Active Ethernet; a technology that provides a symmetrical (upload/download) Ethernet service and does not share optical wavelengths with other users. For subscribers that receive AE service—typically business customers that request a premium service or require greater bandwidth—a single dedicated fiber goes directly to the subscriber premises with no optical splitting.

CPE – Customer premises equipment; the electronic equipment installed at a subscriber's home or business.

Distribution Fiber – The fiber in an FTTP network that connects the hub sites to the fiber distribution cabinets.

Drop – The fiber connection from an optical tap in the PROW to the customer premises.

FDC – Fiber distribution cabinet; houses the fiber connections between the distribution fiber and the access fiber. FDCs, which can also house network electronics and optical splitters, can sit on a curb, be mounted on a pole, or reside in a building.

FTTP – Fiber-to-the-premises; a network architecture in which fiber optics are used to provide broadband services all the way to each subscriber's premises.

GPON – Gigabit passive optical network; the most commonly provisioned FTTP service—used, for example, by Verizon (in its FiOS systems), Google Fiber, and Chattanooga Electric Power Board (EPB). GPON uses passive optical splitting, which is performed inside FDCs, to connect fiber from the Optical Line Terminals (OLTs) to multiple customer premises over a single GPON port.

IP – Internet Protocol; the method by which computers share data on the Internet.

LEC – Local Exchange Carrier; a public telephone company that provides service to a local or regional area.

MDU – Multi-dwelling unit; a large building with multiple units, such as an apartment or office building.

OLT – Optical line terminal; the upstream connection point (to the provider core network) for subscribers. The choice of an optical interface installed in the OLT determines whether the network provisions shared access (one fiber split among multiple subscribers in a GPON architecture) or dedicated AE access (one port for one subscriber).

OSP – Outside plant; the physical portion of a network (also called "layer 1") that is constructed on utility poles (aerial) or in conduit (underground).

OSS – Operational Support Systems (OSS); includes a provider's provisioning platforms, fault and performance management systems, remote access, and other OSS for FTTP operations. The network's core locations house the OSS.

OTT – Over-the-top; content, such as voice or video service, that is delivered over a data connection.

Passing – A potential customer address (e.g., an individual home or business).

POTS – "Plain old telephone service;" delivered over the PSTN.

PROW – Right-of-way; land reserved for the public good such as utility construction. PROW typically abuts public roadways.

PSTN – Public switched telephone network; the copper-wire telephone networks that connect landline phones.

QoS – Quality of service; a network's performance as measured on a number of attributes.

VoIP – Voice over Internet Protocol; telephone service that is delivered over a data connection.

Appendix B: Middle Mile Site List

NAME	ADDRESS	CITY	STATE	ZIP	PHASE
BAKER BRANCH	3501 GROOM RD	BAKER	LOUISIANA	70714	1
BLUEBONNET REGIONAL BRANCH	9200 BLUEBONNET BLVD	BATON ROUGE	LOUISIANA	70810	1
CARVER BRANCH	720 TERRACE ST	BATON ROUGE	LOUISIANA	70802	1
CENTRAL BRANCH	11260 JOOR RD	CENTRAL	LOUISIANA	70818	1
DELMONT GARDENS BRANCH	3351 LORRAINE ST	BATON ROUGE	LOUISIANA	70805	1
EDEN PARK BRANCH	5131 GREENWELL SPRINGS RD	BATON ROUGE	LOUISIANA	70806	1
FAIRWOOD BRANCH	12910 OLD HAMMOND HWY	BATON ROUGE	LOUISIANA	70816	1
GREENWELL SPRINGS REGIONAL BRANCH	11300 GREENWELL SPRINGS RD	BATON ROUGE	LOUISIANA	70814	1
JONES CREEK REGIONAL BRANCH	6222 JONES CREEK RD	BATON ROUGE	LOUISIANA	70817	1
PRIDE-CHANEYVILLE BRANCH	13600 PORT HUDSON-PRIDE RD	PRIDE	LOUISIANA	70770	1
RECYCLED REEDS	234 LITTLE JOHN DR	BATON ROUGE	LOUISIANA	70815	1
RIVER CENTER BRANCH	120 SAINT LOUIS ST	BATON ROUGE	LOUISIANA	70802	1
CENTRAL BRANCH	7373 SCENIC HWY	BATON ROUGE	LOUISIANA	70807	1
ZACHARY BRANCH	1900 CHURCH ST	ZACHARY	LOUISIANA	70791	1
MAIN LIBRARY	7711 GOODWOOD BLVD	BATON ROUGE	LOUISIANA	70806	1
TRAFFIC ENGINEERING	329 CHIPPEWA ST	BATON ROUGE	LOUISIANA	70805	2
BRFD STATION 2	3333 CHOCTAW DR	BATON ROUGE	LOUISIANA	70805	2
EMS STATION 14/BRFD STATION 7	5758 CLAYCUT RD	BATON ROUGE	LOUISIANA	70806	2
EMS STATION 4/BRFD STATION 19	11010 COURSEY BLVD	BATON ROUGE	LOUISIANA	70816	2
LABELLE AIRE HEAD START	1919 N CRISTY DR	BATON ROUGE	LOUISIANA	70815	2
BRFD STATION 6	5321 GREENWELL SPRINGS RD	BATON ROUGE	LOUISIANA	70806	2
BRPD MISDEMEANOR INVESTIGATIONS	4778 GUS YOUNG AVE	BATON ROUGE	LOUISIANA	70802	2
DR. MARTIN LUTHER KING, JR. COMMUNITY CENTER	4142 GUS YOUNG AVE	BATON ROUGE	LOUISIANA	70802	2
ATM/EOC	3773 HARDING BLVD	BATON ROUGE	LOUISIANA	70807	2
BRFD STATION 14	4121 HARDING BLVD	BATON ROUGE	LOUISIANA	70811	2
BRPD DISTRICT 2 STATION	2265 HIGHLAND RD	BATON ROUGE	LOUISIANA	70802	2
BRFD STATION 11	3186 HIGHLAND RD	BATON ROUGE	LOUISIANA	70802	2
LSP TOWER	7667 INDEPENDENCE BLVD	BATON ROUGE	LOUISIANA	70806	2
BRPD VCU	7919 INDEPENDENCE BLVD	BATON ROUGE	LOUISIANA	70806	2
BRPD PISTOL RANGE	999 W IRENE RD	ZACHARY	LOUISIANA	70791	2
CHANEYVILLE COMMUNITY CENTER	13211 JACKSON RD	ZACHARY	LOUISIANA	70791	2
BRPD EVIDENCE/CRIME SCENE	2905 EVANGELINE ST	BATON ROUGE	LOUISIANA	70805	2
EMS STATION 15/BRFD STATION 3	3142 EVANGELINE ST	BATON ROUGE	LOUISIANA	70805	2
CHILD DEVELOPMENT AND LEARNING CENTER	7315 EXCHANGE PL	BATON ROUGE	LOUISIANA	70806	2
BRFD STATION 18	1993 N FLANNERY RD	BATON ROUGE	LOUISIANA	70815	2
HUMAN RESOURCES AND CODE ENFORCEMENT	1755 FLORIDA ST	BATON ROUGE	LOUISIANA	70802	2

NAME	ADDRESS	CITY	STATE	ZIP	PHASE
CATS TOWER	2250 FLORIDA ST	BATON ROUGE	LOUISIANA	70802	2
EMS STATION 6/BRFD STATION 1	3024 FLORIDA ST	BATON ROUGE	LOUISIANA	70806	2
SOUTH WASTEWATER TREATMENT FACILITY	2850 GARDERE LN	BATON ROUGE	LOUISIANA	70820	2
EBRP MAIN LIBRARY	7711 GOODWOOD BLVD	BATON ROUGE	LOUISIANA	70806	2
CITY-PARISH EMPLOYEES FEDERAL CREDIT UNION	433 GOVERNMENT ST	BATON ROUGE	LOUISIANA	70802	2
BRFD STATION 12	555 GOVERNMENT ST	BATON ROUGE	LOUISIANA	70802	2
NEW HORIZON HEAD START	1111 N 28TH ST	BATON ROUGE	LOUISIANA	70802	2
BRPD DOWNTOWN BIKE PATROL	201 3RD ST	BATON ROUGE	LOUISIANA	70801	2
CAPITAL AREA HEAD START	3250 N ACADIAN THWY	BATON ROUGE	LOUISIANA	70805	2
BRPD TRAINING	9050 AIRLINE HWY	BATON ROUGE	LOUISIANA	70815	2
BAKER POLICE HEADQUARTERS	1320 ALABAMA AVE	BAKER	LOUISIANA	70714	2
BRPD AIR SUPPORT	4475 BLANCHE NOYES AVE	BATON ROUGE	LOUISIANA	70807	2
BRFD STATION 15	3150 BRIGHTSIDE DR	BATON ROUGE	LOUISIANA	70820	2
EAST MAINTENANCE LOT	1505 CENTRAL THWY	BATON ROUGE	LOUISIANA	70819	2
JEWEL J. NEWMAN COMMUNITY CENTER	2013 CENTRAL RD	BATON ROUGE	LOUISIANA	70807	2
CHILDREN'S WORLD EARLY HEAD START	7200 MAPLEWOOD DR	BATON ROUGE	LOUISIANA	70812	2
BRFD STATION 10	7380 MENLO DR	BATON ROUGE	LOUISIANA	70808	2
BRFD STATION 5	3215 MONTERREY DR	BATON ROUGE	LOUISIANA	70814	2
FREEMAN-MATTHEWS HEAD START	1383 NAPOLEON ST	BATON ROUGE	LOUISIANA	70802	2
CHARLIE THOMAS MEMORIAL HEAD START	8686 PECAN TREE DR	BATON ROUGE	LOUISIANA	70810	2
BROWNSFIELD VFD STATION 71	11420 PLANK RD	BATON ROUGE	LOUISIANA	70811	2
BRPD DISTRICT 1 STATION	4445 PLANK RD	BATON ROUGE	LOUISIANA	70805	2
BRFD STATION 4	6241 PRESCOTT RD	BATON ROUGE	LOUISIANA	70805	2
EMS STATION 10/DISTRICT 6 STATION 51	7878 PRESCOTT RD	BATON ROUGE	LOUISIANA	70812	2
PROGRESS ROAD HEAD START	1881 PROGRESS RD	BATON ROUGE	LOUISIANA	70807	2
CHANEYVILLE VFD STATION 40	22790 REAMES RD	ZACHARY	LOUISIANA	70791	2
BRFD STATION 17	14450 OLD HAMMOND HWY	BATON ROUGE	LOUISIANA	70816	2
EMS STATION 12	15094 OLD HAMMOND HWY	BATON ROUGE	LOUISIANA	70816	2
ALSEN/ST IRMA LEE VFD STATION 25	674 OLD RAFE MAYER RD	BATON ROUGE	LOUISIANA	70807	2
WONDERLAND HEAD START	1500 OLEANDER ST	BATON ROUGE	LOUISIANA	70802	2
PUBLIC WORKS AND PLANNING CENTER	1100 LAUREL ST	BATON ROUGE	LOUISIANA	70802	2
EMS STATION 13	6252 LAVEY LN	BAKER	LOUISIANA	70714	2
NORTH MAINTENANCE LOT	3207 MAIN ST	BAKER	LOUISIANA	70714	2
EMS STATION 8	4525 MAIN ST	ZACHARY	LOUISIANA	70791	2
ZACHARY POLICE HEADQUARTERS	4510 MAIN ST	ZACHARY	LOUISIANA	70791	2
BRPD DISTRICT 4 STATION	8227 SCENIC HWY	BATON ROUGE	LOUISIANA	70807	2

NAME	ADDRESS	CITY	STATE	ZIP	PHASE
DISCOVERY HEAD START	9700 SCENIC HWY	BATON ROUGE	LOUISIANA	70807	2
BRFD STATION 13	835 SHARP RD	BATON ROUGE	LOUISIANA	70815	2
EMS STATION 3	11644 SULLIVAN RD	CENTRAL	LOUISIANA	70818	2
SOUTH MAINTENANCE LOT	3055 VALLEY ST	BATON ROUGE	LOUISIANA	70808	2
CREATIVE HEAD START	3165 VICTORIA DR	BATON ROUGE	LOUISIANA	70805	2
DR. LEO S. BUTLER COMMUNITY CENTER	950 E WASHINGTON ST	BATON ROUGE	LOUISIANA	70802	2
EMS STATION 11	8140 YMCA PLAZA DR	BATON ROUGE	LOUISIANA	70810	2
BRFD STATION 8	150 S WOODDALE DR	BATON ROUGE	LOUISIANA	70806	2
NORTH WASTEWATER TREATMENT FACILITY	50 WOODPECKER ST	BATON ROUGE	LOUISIANA	70807	2
CITY HALL	222 SAINT LOUIS ST	BATON ROUGE	LOUISIANA	70802	2
CHARLES R. KELLY COMMUNITY CENTER	3535 RILEY ST	BATON ROUGE	LOUISIANA	70805	2
RIVER CENTER	275 S RIVER RD	BATON ROUGE	LOUISIANA	70802	2
ZACHARY RURAL PROGRAM	5746 ROLLINS RD	ZACHARY	LOUISIANA	70791	2
BRFD STATION 16	1200 ROSENWALD RD	BATON ROUGE	LOUISIANA	70807	2
NORTH LANDFILL	16001 SAMUELS RD	ZACHARY	LOUISIANA	70791	2

Appendix C: "Residential Internet, Cable TV, and Telephone Services Survey" Questionnaire

City of Baton Rouge, Parish of East Baton Rouge

Residential Internet, Cable TV, and Telephone Services Survey

January 2017

> ***Even if you do not have home Internet access, please complete the relevant portions of this survey form and return to us. Your opinions, experiences, and information are important to us.***

The City of Baton Rouge/Parish of East Baton Rouge (City-Parish) is sending you this survey as part of our research into how our residents use Internet services. *The information gathered will not be used to sell you anything.* It will not be used for any purpose other than its stated intention—to inform the City-Parish's understanding of its residents' use of Internet services, and to explore strategies to improve Internet accessibility and affordability in Baton Rouge.

Even if you do not have Internet access at your home, please complete the relevant portions of this survey. We value your input.

Completing this survey should take approximately ten minutes. It should be completed by the person who makes purchase decisions for your household's use of Internet services.

Please return your completed form in the enclosed postage-paid envelope by January 31, 2017.

If you have questions regarding this survey, please contact the Department of Information Services at (225) 389-3070 or send an e-mail to fiberstudy@brgov.com.

Thank you!

HOME INTERNET CONNECTION AND USE

1. Which of the following services do you currently purchase for your household? *(✓ all that apply)*

- [1] Internet service in my home (excluding cellular/mobile)
- [2] Cellular/mobile telephone service with Internet (smartphone)
- [3] Cellular/mobile telephone service without Internet (basic phone)
- [4] Fixed (land line) telephone service
- [5] Cable or satellite television
- [6] Don't know
- [7] None of the above

2. How IMPORTANT or UNIMPORTANT are the following services to your household? *(please circle your response)*

Aspect	*Not at All Important*				*Very Important*
(a) Internet connection (any speed)	1	2	3	4	5
(b) High-speed Internet connection	1	2	3	4	5
(c) Basic cable television service	1	2	3	4	5
(d) Premium cable television services	1	2	3	4	5
(e) Fixed (land-line) telephone service	1	2	3	4	5
(f) Cellular/mobile telephone service	1	2	3	4	5

3. How many personal computing devices (desktop/laptop computers, tablets, Smart TVs, other Internet-enabled devices) do you have in your home?

- [1] 1 or 2
- [2] 3 or 4
- [3] 5 or more
- [4] I do not have any personal computing devices in my home

1

4. What is your primary home Internet service connection? *(✓ only one)*

- [1] No home Internet service **(Please continue to Question 5)**
- [2] Telephone line—dial-up
- [3] Digital Subscriber Line (DSL) (from AT&T or other)
- [4] Cable modem (from Cox or other)
- [5] Satellite (from DirecTV, Dish Network, or HughesNet, etc.)
- [6] Cellular/mobile Internet
- [7] Fiber-optic connection (Cox or AT&T)
- [8] Condo or apartment association Internet
- [9] Other (Please specify: ______________________)

Please skip to Question 6

5. If you do not have Internet service at your home, what is your main reason for not purchasing home Internet service? *(✓ only one – then skip to* ***Question 15*** *on page 6)*

- [1] No Internet service is available at our location
- [2] We have no Internet-enabled devices in our home
- [3] We have no need for the Internet
- [4] We can get Internet access at another location
- [5] Costs are too expensive

6. Approximately how much does your family pay PER MONTH for your *home* Internet service (not including television or phone service if you bundle services)?

- [1] Free
- [2] $1 to $30
- [3] $31 to $40
- [4] $41 to $50
- [5] $51 to $60
- [6] $61 to $70
- [7] $71 to $80
- [8] More than $80

7. How would you describe the speed of your *home* Internet connection?

- [1] Very Slow
- [2] Slow
- [3] Medium
- [4] Fast
- [5] Very Fast

2

8. How IMPORTANT or UNIMPORTANT are the following aspects of *home* Internet service to you? *(please circle your response)*

Aspect	*Not at All Important*				*Very Important*
(a) Speed of connection	1	2	3	4	5
(b) Reliability of connection	1	2	3	4	5
(c) Price of services	1	2	3	4	5
(d) Overall customer service	1	2	3	4	5
(e) Ability to "bundle" with TV service	1	2	3	4	5

9. How SATISFIED or DISSATISFIED are you with the following aspects of current *home* Internet access? *(please circle your response)*

Aspect	*Very Dissatisfied*				*Very Satisfied*
(a) Speed of connection	1	2	3	4	5
(b) Reliability of connection	1	2	3	4	5
(c) Price of services	1	2	3	4	5
(d) Overall customer service	1	2	3	4	5
(e) Ability to "bundle" with TV service	1	2	3	4	5

10. Consider what price level would make you interested in switching to another Internet service. How WILLING or UNWILLING would you be to switch to 1 Gbps service (10 to 20 times faster than a cable modem) for the following monthly price? *(please circle your response)*

Monthly Price	*Very Unwilling*				*Very Willing*
(a) $30 per month	1	2	3	4	5
(b) $50 per month	1	2	3	4	5
(c) $70 per month	1	2	3	4	5
(d) $90 per month	1	2	3	4	5

3

11. How often does your family use your *home* Internet connection (excluding cellular/mobile) for: *(please circle your response)*

Home Internet Activity	*Never*	*Occasionally*	*Frequently*
(a) Listening to music (streaming)	1	2	3
(b) Watching movies, videos, or TV	1	2	3
(c) Playing online games	1	2	3
(d) Connecting to a work computer	1	2	3
(e) Making video calls (Skype, etc.)	1	2	3
(f) Shopping online	1	2	3
(g) Running a home business	1	2	3
(h) Accessing educational resources	1	2	3
(i) Accessing government information or services	1	2	3

12. How IMPORTANT or UNIMPORTANT are these features when selecting a *home* Internet service? *(please circle your response)*

Feature	*Not at All Important*				*Very Important*
(a) I can choose from multiple Internet providers	1	2	3	4	5
(b) I can buy Internet service with very high connection speeds	1	2	3	4	5
(c) I can pay for Internet service based on usage (amount of data)	1	2	3	4	5
(d) My service provider does not place "caps" on my total data use	1	2	3	4	5
(e) I can use my home Internet connection to telework for my job	1	2	3	4	5

4

13. One potential way to provide higher speed Internet services to residents is through a "fiber-optic communications network" (1 Gbps; 10 to 20 times faster than cable modem). One way to help offset the infrastructure investment required to build such a network is to charge residences an initial hook-up fee to connect to the network (allowing competing Internet, phone, and cable television companies to offer consumer services). How WILLING or UNWILLING would you be to pay a one-time hook-up fee in exchange for having access to this type of high-speed network?: *(Please circle your response)*

Price of Hook-up (one-time)	*Very Unwilling*				*Very Willing*
(a) $0 (zero)	1	2	3	4	5
(b) $100	1	2	3	4	5
(c) $250	1	2	3	4	5
(d) $500	1	2	3	4	5
(e) $1,000	1	2	3	4	5

14. If you were able to save $20 per month on your communications bill, how WILLING or UNWILLING would you be to pay an upfront hook-up fee for fiber-optic Internet service (1 Gbps; 10 to 20 times faster than cable modem) if the one-time fee were?: *(Please circle your response)*

Price of Hook-up (one-time)	*Very Unwilling*				*Very Willing*
(a) $0 (zero)	1	2	3	4	5
(b) $100	1	2	3	4	5
(c) $250	1	2	3	4	5
(d) $500	1	2	3	4	5
(e) $1,000	1	2	3	4	5

TELEVISION AND TELEPHONE SERVICE

15. How IMPORTANT or UNIMPORTANT are the following television programming features to you? *(circle your response)*

Programming Content	*Not at All Important*				*Very Important*
(a) Local programming	1	2	3	4	5
(b) News programming	1	2	3	4	5
(c) Children's programming	1	2	3	4	5
(d) Sports programming	1	2	3	4	5
(e) Movie network channels	1	2	3	4	5
(f) Specialty channels	1	2	3	4	5

16. How do you receive television service at your home? *(✓all that apply)*

- 1 Cable (Cox)
- 2 Satellite/Dish
- 3 Antenna (over-the-air)
- 4 Internet
- 5 Don't watch television

Please answer Question 17

17. Approximately how much do you pay PER MONTH for cable or satellite television service (not including Internet or phone)?

- 1 Free
- 2 $1 to $20
- 3 $21 to $40
- 4 $41 to $60
- 5 $61 to $80
- 6 $81 to $100
- 7 $101 to $120
- 8 More than $120

18. Please indicate which type(s) of telephone service you have: *(✓all that apply)*

- 1 Fixed (landline) from my telephone provider (AT&T or other)
- 2 Fixed from my cable provider (Cox)
- 3 Cellular/mobile wireless (AT&T, Verizon, Sprint, etc.)
- 4 Internet-based phone service (Skype, Ooma, etc.)
- 5 Do not have any telephone service
- 6 Other phone service (please specify: ____________________)

INTERNET USE FOR JOBS/CAREERS

19. Is any member of your household allowed by his/her employer to telework from home? *(✓ only one)*

- [1] Yes, and our home Internet connection enables telework
- [2] Yes, but our home Internet connection is too slow to telework
- [3] No
- [4] Not sure

20. Are you or is any member of your household currently teleworking, or interested in telework opportunities?

- [1] Someone in my household currently does telework from home
- [2] Someone in my household would like to telework
- [3] No

21. Does someone in your household have a home-based business or plan to start a home-based business in the next three years?

- [1] Yes, I/we already have a home-based business
- [2] Yes, I/we plan to start one in next three years
- [3] No **(Please skip to Question 23)**

22. How IMPORTANT or UNIMPORTANT is a high-speed Internet connection for your existing or potential home-based business?

- [1] Not at all important
- [2] Somewhat unimportant
- [3] Somewhat important
- [4] Very important

7

ROLE OF THE CITY-PARISH AND YOUR OPINION

23. Using a scale of 1 to 5, where 1 is Strongly Disagree and 5 is Strongly Agree, please indicate to what degree you believe that the City-Parish should do the following: *(please circle your response)*

Aspect	*Strongly Disagree*				*Strongly Agree*
(a) Help ensure that all residents have access to competitively-priced broadband Internet services	1	2	3	4	5
(b) Help ensure that all students and teachers have access to competitively-priced broadband Internet in their homes	1	2	3	4	5
(c) Build a publicly-financed network on which competing private sector companies can offer competitive Internet, phone, and cable television services	1	2	3	4	5
(d) Build a publicly-financed network and offer Internet, phone, and cable television services to the public	1	2	3	4	5

24. Using a scale of 1 to 5, where 1 is Strongly Disagree and 5 is Strongly Agree, please indicate to what degree you agree with the following statements: *(please circle your response)*

Aspect	*Strongly Disagree*				*Strongly Agree*
(a) The market currently offers high-speed Internet at prices that my family can afford	1	2	3	4	5
(b) The availability of competitively-priced high-speed Internet is a factor I would consider when choosing where to live	1	2	3	4	5
(c) High-speed Internet access is as essential a service as water and electricity	1	2	3	4	5

25. What do you think the MAIN role for the City-Parish should be with respect to broadband access? *(✓ MAIN role)*

- [1] Install state-of-the-art network and offer services to the public
- [2] Install state-of-the-art network and lease it to competing private companies to offer services to the public
- [3] Encourage a private firm to build a high-speed network
- [4] No role
- [5] Don't know

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INFORMATION ABOUT YOUR HOUSEHOLD

The following questions will help describe the total group of survey respondents. Your individual information will not be reported separately—it will be reported only as a part of a larger group to help ensure that the respondents are a representative sample of the citizens of Baton Rouge.

26. The person completing this questionnaire is:

- 1 Female
- 2 Male

27. Which of the following best describes your age?

- 1 18 to 34 years
- 2 35 to 44 years
- 3 45 to 54 years
- 4 55 to 64 years
- 5 65 years and older

28. What is your race? *(✓ all that apply)*

- 1 White
- 2 Black or African American
- 3 Hispanic, Latino, or Spanish origin
- 4 Asian or Pacific Islander
- 5 American Indian or Alaska Native
- 6 Other: ____________________

29. What is the highest level of education you have completed?

- 1 Some high school
- 2 Completed high school
- 3 Two-year college or technical degree
- 4 Four-year college degree
- 5 Graduate degree

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30. What was your approximate 2016 household income?

- 1 Less than $25,000
- 2 $25,000 to $49,999
- 3 $50,000 to $74,999
- 4 $75,000 to $99,999
- 5 $100,000 to $149,999
- 6 $150,000 to $199,999
- 7 $200,000 or more

31. How many people reside in your home (adults and children)?

Adults (including yourself)	Children age 18 and younger
1 1	0 None
2 2	1 1
3 3	2 2
4 4 or more	3 3
	4 4 or more

32. Do you own or rent your residence?

- 1 Own
- 2 Rent

33. How long have you lived at your current address?

- 1 Less than 1 year
- 2 1 to 2 years
- 3 3 to 4 years
- 4 Five or more years

Thank you for completing this survey!

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