MIKE LOYA CENTER
FOR INNOVATION AND COMMERCE

Broadband Cost Comparative Analysis

Benchmark Financial Analysis Across Counties

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Introduction

Mike Loya Center for Innovation and Commerce (MLCIC)

The MLCIC seeks to develop the region's economy by promoting a culture of innovation and entrepreneurship at the confluence of business administration and engineering through research, education, and collaboration.

The MLCIC's core values focus on supporting and facilitating multidisciplinary collaborative research to discover unique solutions to business and technology challenges present in today's global markets. Students working with the center are infused with a high sense of commitment to their community, a culture of teamwork and collaboration, and the shared goal of striving for excellence.

Emerging challenges due to ripple effects of the COVID-19 public health crisis continue to impact the global economy. In El Paso County, local, state, and federal agencies have implemented strategic efforts to reduce community transmission of COVID-19. The sanitary measures taken to reduce transmission of COVID-19 have triggered an increase in internet usage for work, health, and education. The rise of internet demand exposed a technological challenge for El Paso; the lack among certain vulnerable constituencies, of reliable and fast broadband service. Universal availability of broadband service is more critical than ever to accessing work, health, and education resources and to sustaining economic competitiveness and growth throughout our region.

Taking as a baseline the market research findings and needs from the Hunt Institute, the MLCIC will analyze how demographically similar communities have expanded broadband services, focusing on their approaches, challenges, and expansion costs. Based upon a comparative analysis of these successful benchmarks, an estimate is constructed to model how this may apply to El Paso County.

City of El Paso, TX Current Coverage

Demographics

Land Area: 260 square miles
Population: 839,238
Households: 268,310
Population density: 790.6
Median Household Income: $46,871
Per Capita Income: $21,683
https://www.census.gov/quickfacts/elpasocountytexas

Internet Service Providers In El Paso, TX

Currently, El Paso is served by multiple internet providers. Some price variation exists between zip codes within the County. General plan and price structures for leading regional competitors follow:

Table 1.1 **SPECTRUM**

Connection	Speed Mbps	Setup Fee	Price per Month
Cable	100/10	$9.99	$49.99
Cable	400/20	$9.99	$69.99
Cable	940/35	$199.99	$109.99

Table1.2 **AT&T**

Connection	Speed Mbps	Setup Fee	Modem per Month	Price per Month
Fiber	100/100	$99.00	$10.00	$35.00
IPBB	100/20	$99.00	$10.00	$35.00
Fiber	300/300	$99.00	$10.00	$45.00
Fixed Wireless	NA/25	$99.00	$0.00	$45.00
Fiber	1000/1000	$99.00	$10.00	$60.00

Table 1.3 **VIASAT**

Connection	Speed Mbps	Modem per Month	Price per Month
Satellite	NA/12	$12.99	$89.99
Satellite	NA/25	$12.99	$99.99
Satellite	NA/30	$12.99	$149.99

Table 1.4 **HughesNet**

Connection	Speed Mbps	Data Cap	Price per Month
Satellite	25/3	10GB/mo.	$49.99
Satellite	25/3	20GB/mo.	$59.99
Satellite	25/3	30GB/mo.	$89.99
Satellite	25/3	50GB/mo.	$139.99

Table 1.5 **Basic Service Packages**

ISP	Speed	Price
Spectrum	940mbps	$49.99 per month
AT&T	1,000mbps	$35.00 per month
VIASAT	100mbps	$50.00 per month
HughesNet	25mbps	$49.99 per month
Windstream	50mbps	$60.00 per month
	Average Price	**$49.00**

As illustrated in table 1.5, the leading providers' basic service plan allows us to calculate an average price of $49.00 for essential internet services for speeds that surpass the FCC's minimum requirements for broadband of 25Mbps download speed and 3Mbps upload speed.

This average may be utilized as a benchmark to predict the gap between the current price and that which underserved communities may be able and willing to pay for broadband services. The measure may also be utilized to estimate break-even levels and profitability based on the estimated cost for broadband expansion in El Paso, Texas.

Significant Legal Documents and Implemented Policies

Mont Belvieu, TX

Texas law prohibits municipalities from obtaining the necessary certificates to "provide local exchange telephone service, basic telecommunications service, or switched access service." However, it excludes "non-voice data transmission service" as not being a component of "basic local telecommunication service."

The municipality argued that connectivity via fiber was a non-switched telecommunications service. Mont Belvieu successfully argued that the access they planned to offer would connect subscribers to the Internet rather than to long-distance providers or other subscribers. Because the Internet is not a "telecommunications provider" as defined by the Texas Utilities Code, Mont Belvieu's plan to connect subscribers to the Internet, rather than a telecommunication provider, is not prohibited.

Phone and video services cannot be offered directly or through a third-party by the City; however, Mont Belvieu did extensive education for their community focused on fast-growing over-the-top offerings such as Hulu, Netflix, Amazon Prime, Disney+, YouTube, etc. and how broadband speed is essential to stream these services.

More detailed information on the City's petition and final decision may be found at:

The City's petition: https://muninetworks.org/sites/www.muninetworks.org/files/2017-02-Mont-Belvieu-Original-Petition.pdf

The Final Judgement: https://muninetworks.org/sites/www.muninetworks.org/files/2017-04-Mont-Belvieu-FINAL-JUDGMENT.pdf

Chattanooga, TN

In April 2008, Comcast sued the Chattanooga Electric Power Board (EPB) to prevent the City from building a fiber network to provide service to underserved residents getting slow speeds from the incumbent cable provider.

Comcast claimed EPB illegally subsidized the buildout with ratepayer funds, Comcast quickly lost in court, and EPB built the fiber network. Details of the legal decision are at:

https://www.leagle.com/decision/intnco20090513587

DIG ONCE POLICY

Dig Once requirement - The term means a provision designed to reduce the cost and accelerate the deployment of broadband by minimizing the number and scale of repeated excavations for the installation and maintenance of broadband conduit or broadband infrastructure in rights-of-way

Local and state governments can ease the process of installing fiber networks by adopting a "Dig Once" policy; this would require public and private excavators to coordinate with local government on the installation of extra fiber or conduit whenever the ground would be broken in the public right-of-way (PROW). Detailed policy examples include the following:

https://www.ctcnet.us/wp-content/uploads/2014/01/GigabitCommunities.pdf

https://www.congress.gov/bill/116th-congress/house-bill/7205/text?q=%7B%22search%22%3A%5B%22%5B2020-10-06+TO+2020-10-06%5D%22%5D%7D&r=46&s=1

Dig once policies have several added benefits such as:

- Reduction in deployment costs
- Encouraging competition among internet service providers
- Collaborating to close the digital divide
- Ensuring fast and efficient deployment of telecommunication networks.
- Reducing costs by coordinating among departments and decreasing disruptions to the community and roads.
- Improving aesthetic beauty of neighborhoods by employing underground lines

A general model for designing operational Dig Once ordinances and legislation may be found at:

https://www.duraline.com/about-us/news/dig-once-model-legislation/

Managing rights-of-way to maximize use and facilitate broadband expansion, examples:

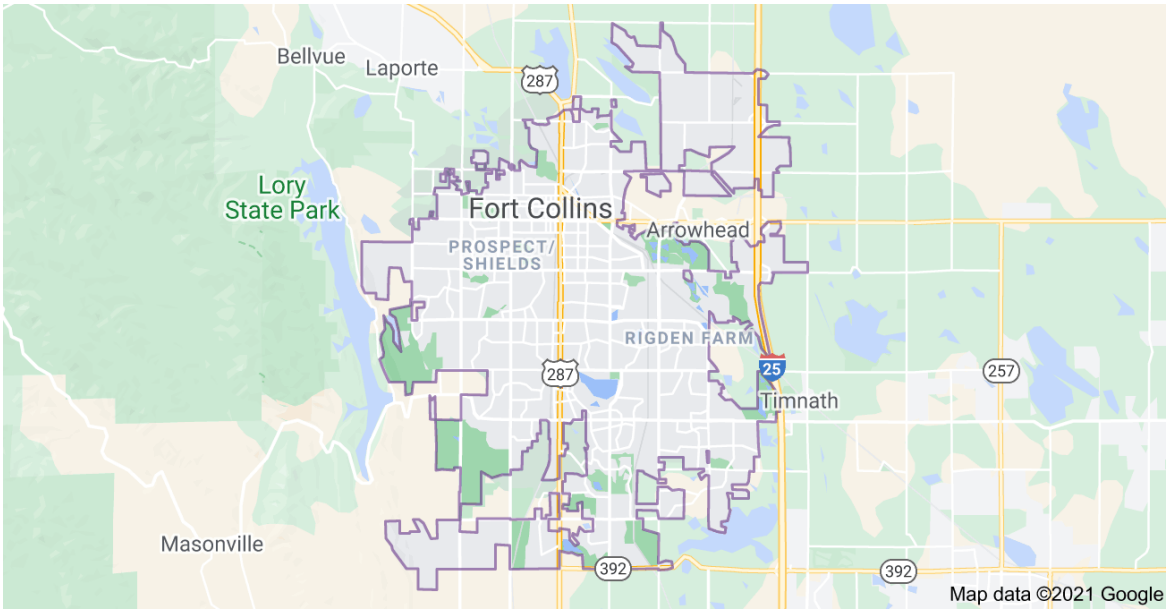
Boston, MA – In 1994, Boston was one of the first cities to put forth a mandate to require all telecommunications carriers to install underground conduits in the same trench at the same time on a shared-cost basis. This approach has worked well in Boston, minimizing street excavation and expediting the broadband expansion process.

San Francisco, CA – Established a "communication Infrastructure in Excavation Projects" to ensure that fiber and conduit were included in construction projects and multiple excavations were minimized when feasible.

Sandy, OR – Enforced an ordinance requiring all new development to install underground fiber along with other utilities. The code adaption expanded the existing policy, adding broadband (fiber) to the list of public facilities. This increased the ease of developing a public-private fiber-to-the-premises project.

San Benito, CA – "Dig Once" policy is now part of its "Complete Streets" policy by including a provision for a full range of infrastructure mainline and distribution, above and below ground, as appropriate.

Fort Collins, Colorado



Land Area: 57.06 square miles
Population: 174,871
Households: 70,429
Population density:
Median Household Income: $62,132
Per Capita Income: $34,482
https://www.fcgov.com/visitor/fcfacts

https://www.census.gov/quickfacts/fact/table/fortcollinscitycolorado

The community-owned fiber network began looking into the benefits and needs of municipal high-speed fiber network in 2010. The City voted to overturn Senate Bill 05-152, which prohibited the City from providing public broadband.

In 2016 the City conducted a community survey to determine citizen's preferences for broadband expansion. The community overwhelmingly supported a retail model from among the following four options:

1. Do Nothing – Rely on incumbents to upgrade their systems and provide improved speeds and reliability.
2. 3rd party partnership – Develop a partnership with an existing internet service provider that leverages their expertise and experience combined with the City's brand and reputation.
3. Wholesale model – The City builds out a fiber network and attracts other service providers to market and operate the system.
4. Retail model – the City enters the business of building out, operating and providing Internet and other services across a city-owned fiber network.

The capital requirements would be in the range of $130M-$150M with the largest cost component of the capital requirement being the network construction, estimated at more than $80M. The estimates have been calculated on the "passing cost" or "cost-per-passing," a key variable in modeling the network's construction cost which conveys the cost of installing fiber to pass each premises. It is worth adding that “passing” premises does not connect those locations to the network or enable internet access; it only means the fiber is in close proximity to the premises.

Table 2.1

Capital Requirements	Amount
Network Construction	$80M
Bond Issues Fees, Capitalized interest, Financing Misc.	$13M
Contract Installation	$7M
Facility & Vehicles	$6M
Fiber Drop, Powering, Optical Network Terminal (ONT)	$6M
Fixed Equipment	$5M
Engineering, Design, Inspection	$4M
Back-office System and Capital	$1M
Subtotal	**$122M**
Working Capital	$10M
Contingency	$18M
Total	**$150M**

Fort Collins will require more than 800 miles of fiber infrastructure to reach 62,000 premises, a sample of neighborhoods was analyzed to calculate a cost per passing resulting in the following:

Table 2.2

Outside Plant Costs	Weighted Average Cost per Passing
Materials	$116
Labor	$739
Total	$855
Contingency @ 15%	$128
Total	**$984**

Included in the total capital requirement is the "drop cost." The fiber connection requires the drop phase before a premises is connected to the Internet; this expense includes two components: pre-install and premises installation. Pre-installation includes trenching and installing the fiber underground on the property. Premises installation is the equipment (ONT, power cable, connectors, etc.) Below is an average of the cost of a drop to a premises in Fort Collins, the highest cost variable being the contract labor component.

Table 2.3

Drop Components	Average Cost
Contract Labor	$296
ONT Expenditures	$172
Fiber Cable, UPS, Power	$123
Total	**$591**

The City used the retail model below, focusing on the three lowest material revenue streams. Note the current benchmark speed for broadband is 25Mbps download speed/3Mbps upload speed as of 2015.

Table 2.4

City Commercial Retail Model	Price
25Mbps/5Mbps	$59.95/month
50Mbps/10Mbps	$69.95/month
100Mbps/20Mbps	$89.95/month

Customer Service

A customer service team is required to respond to incoming customer calls, handle customer contact in retail locations, up-sell customers, and make outbound calls to the customers for follow-up. Uptown consulting estimated that Fort Collins Utilities will need to add four Customer Service Representatives (CSRs) in year two of the network development and an additional two full-time equivalents (FTE) by year five. An FTE is defined as an employee's scheduled hours divided by the employer's hours for a full-time workweek. Employees scheduled to work 40 hours weeks are considered 1.0 FTE. Employees scheduled to work 20 hours per week are 0.5 FTE.

Table 2.5 **Personnel Requirements**

Position Title	Base Salary	Year 1	Year 2	Year 3	Year 4	Year 5
General Manager (GM)	$135,000	1	1	1	1	1
Data Technician	$105,000	1	2	2	2	2
Commercial Account Representative	$80,000	1	2	2	2	2
Sales Engineer	$80,000	1	1	1	1	1
Field Operations Supervisor	$80,000			1	1	1
Marketing Coordinator	$75,000	0.5	1	1	1	1
MDU Account Manager	$75,000	1	2	2	2	2
Contingency	$70,000	5	5	5	5	5
Maintenance Technicians	$65,000		1	1	2	2
Technical Service Representatives (TSR)	$60,000		4	4	5	6
Service Technicians	$60,000		1	3	4	4
Installation Technicians	$55,000		3	7	6	5
Customer Service Representatives (CSR)	$50,000		4	4	2	6
Total		10.5	27	34	37	38

Table 2.6 **Expense Summary**

Capital Expenditures	Year 1	Year 2	Year 3	Year 4	Year 5
Network Construction	$0	$19,857,262	$20,254,819	$20,661,335	$19,211,856
Contract Installation	$0	$438,171	$438,171	$1,137,085	$3,085,613
Facility & Vehicles	$5,600,000	$335,400	$335,400	$95,509	$0
Fiber Drop, Powering, ONTs	$0	$601,550	$601,550	$1,872,583	$2,307,130
Fixed Equipment	$967,500	$878,663	$878,663	$914,225	$932,612
Engineering, Design, Inspection	$2,713,442	$250,217	$250,217	$252,273	$278,337
Back office Systems and Capital	$790,000	$240,000	$24,000	$24,000	$24,000
Total	**$10,070,942**	**$22,601,623**	**$24,419,448**	**$25,791,379**	**$25,839,547**
				Cumulative Total	**$108,722,580**

Table 2.7 **Revenue Summary**

	Year 1	Year 2	Year 3	Year 4	Year 5
Active Residential Premises	0	1,982	6,655	12,069	18,014
Total revenue	**$0**	**$916,653**	**$4,879,311**	**$10,888,757**	**$18,211,765**

In this projection, year two is the first year of subscriber revenue. Network installation is projected to continue at 25% per year through year 5, and the estimated number of subscribers is projected to increase approximately 5,000 per year through year four and another 6,000 in year five.

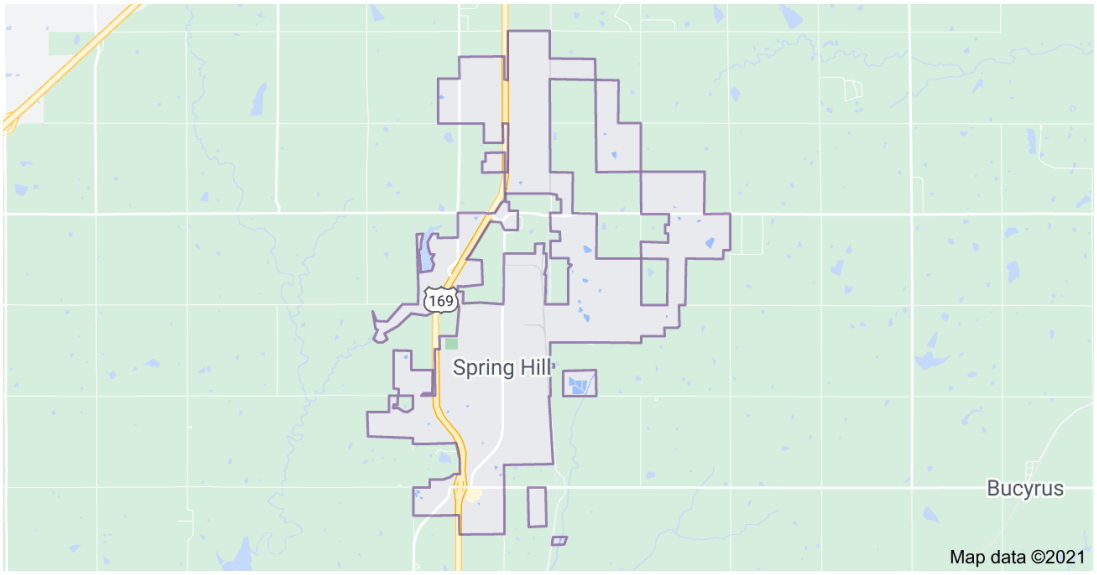
Cost per Mile

Using the City's actual February 2021 construction budget of $109,217,775 along with the total fiber to be pulled through 4,952,640 ft. of installed conduit, we can derive an actual cost per mile as follows: https://fcconnexion.com/wp-content/uploads/2021/11/march-2021-connexion-monthly-report.pdf

Table 2.8

Cost per mile estimate		
Number of Miles	938	1
Cost	$109,217,775	$116,437

Spring Hill, Kansas



Land Area: 8.42 square miles
Population: 7,326
Households: 2,158
Population density: 2,121
Median Household Income: $80,357
Per Capita Income: $29,507
https://www.census.gov/quickfacts/springhillcitykansas

The estimated cost to construct the Outside Plant (OSP) referring to all physical cabling and supporting infrastructure such as conduit, cabinets, tower, or poles of the proposed Fiber-To-The-Premises (FTTP) is approximately $4.8 million, or $1,700 per passing. This model assumes a mixture of aerial and underground fiber construction.

Table 3.1

Distribution Plant Mileage	Total Cost	Passings	Cost Per Passing	Cost Per Plant Mile
39	$4,770,000	2,800	$1,700	$120,000

The $1,700 per passing cost for the City of Spring Hill is similar to other communities with a high underground infrastructure percentage. If the City cannot negotiate pole attachment agreements or is prohibited from doing so, the FTTP network will have to be built entirely underground. All underground construction increases the price per passing by an average of $230 to $1,930.

Table 3.2

Distribution Plant Mileage	Total Cost	Passings	Cost Per Passing	Cost Per Plant Mile
39	$5,410,000	2,800	$1,930	$140,000

The complete Broadband Feasibility Study completed by Columbia Telecommunications Corporation for Spring Hill, can be viewed here:

https://www.ctcnet.us/wp-content/uploads/2019/11/Spring-Hill-Broadband-Feasibility-Study-Final-20180201.pdf

Over the past two years, the City's Broadband Task Force and city staff worked diligently to develop a recommendation for broadband expansion. The Task Force determined that it was not in the City's best interest to own and operate an internet utility. Instead, they recommended the City put effort into a Public-Private Partnership (P3), as detailed in the following:

https://springhillks.gov/Faq.aspx?QID=146

CTC advisors gave two models of recommendation to Spring Hill:

The Huntsville Model and Westminster Model

Both of these are a Dark FTTP models; the public partner constructs, owns and maintains a fiber network that passes every home and business, and a private partner places electronics to "light" the network. Both models entail a full FTTP network buildout, the City constructs and leases the fiber backbone and distribution fiber to private partners.

The difference between these models is their treatment of fiber drop cable, which connects the customer's premises to the network. In the Huntsville Utilities agreement with Google Fiber, the private entity is responsible for installing, owning, and maintaining fiber drop cables. In Westminster's agreement with Ting, the public entity is accountable for fiber drop cables.

The Huntsville Model for Spring Hill, Kansas

The City constructs and owns network infrastructure and leases the dark fiber backbone and distribution fiber to a private partner. The private partner would be responsible for building drop cables into each home or business; network electronics and CPE; sales, marketing, and operations. The financial analysis presented below represents a minimum requirement for the City to obtain a break-even cash flow each year. The suggested implementation used a "flat model," with inflation and operation cost increases not incorporated because it is assumed that operating cost increase will be offset by the increase in operator lease payments over time.

This model is a similar FTTP deployment to Huntsville, Ala. In its contract with Google Fiber, Huntsville Utilities negotiated a monthly per-passing fee of $7.50. This reference is to demonstrate pricing may be attractive to incentivize partnerships. This base case model is presented to demonstrate what would be necessary to maintain a positive cash flow given estimated OSP construction and operating costs. The model assumes a straight-line depreciation of assets, materials having a 20-year life span, and network equipment being replaced after five years.

To cover network deployment, operating costs, the City would need to charge a private partner $27.75 per month per passing for a total of 2,804 commercial and residential passings. As shown below, the model will not generate a positive net income until year five but will operate cash-positive, finishing year

one with a cumulative surplus of under $4,000 in year one, over $224,000 in year ten, and almost $357,000 by the end of year 20.

Table 3.3 **Model Base Case Financial Summary**

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$74,730	$933,730	$933,730	$933,730	$933,730
Total Cash Expenses	($381,540)	($470,190)	($470,190)	($470,190)	($470,190)
Depreciation	($89,840)	($264,550)	($259,530)	($259,530)	($259,530)
Interest Expense	($57,450)	($160,330)	($118,020)	($68,970)	($12,110)
Taxes	-	-	-	-	-
Net Income	($454,100)	$38,660	$85,990	$135,040	$191,900

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$3,810	$158,920	$224,460	$290,460	$356,660
Depreciation Reserve	-	50,260	73,290	96,190	119,090
Total Cash Balance	$3,840	$209,180	$297,750	$386,610	$475,750

Model Base Case Capital Additions

Significant network expenses, or "capital additions," are incurred in the first years during the network's construction phase. In this model, the City is responsible for only OSP. This model excludes any fiber drops or core network equipment. The analysis, given projects with capital additions in year one, will total approximately $1.5 million in year one, $2.4 million in year two, and roughly $957,800 in year three.

Table 3.4

Capital Additions -	Year 1	Year 2	Year 3
Outside Plant & Facilities	$1,436,700	$2,394,500	$957,800
Miscellaneous Implementation Costs			
Vehicles	$35,000	$35,000	
Work Station, Computers, and Software	$5,000	$500	
Fiber OTDR and Tools	$50,000		
Total	$90,000	$35,500	
Total Annual Capital Additions	$1,526,700	$2,430,000	$9,578,000

Operating and Maintenance Expenses Model

Assuming the City's partner will be responsible for lighting the fiber and selling the service, Spring Hill's financial requirements are limited to expenses related to OSP infrastructure and network administration. The expanded responsibilities will require addition of new staff on top of the current City staff, with an additional 2.75 full-time-equivalent (FTE) positions within the first two years.

Table 3.5

New Employees	Year 1	Year 2	Year 3+	Labor Cost
Business Manager & HR	0.25	0.25	0.25	130,000
GIS & Record Keeping	0.25	0.5	0.5	85,000
Service Tech/Installers & IT Support	1	1	1	75,000
Fiber Plan O&M Techs	1	1	1	80,000
Total New Staff	2.5	2.75	2.75	

Base model #2 Westminster model for Spring Hills, Kansas

We assume the private partner can obtain and maintain a 35 percent take rate for this base model. They have estimated each drop to cost an average of $1,592. If 35 percent of the City's 2,804 passings were to subscribe (about 980 subscribers), drop cost construction would total just under $1.6 million. The City 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 cashflow with this model, assuming a 35 percent take rate, the City would need to charge the partner $15.60 per passing and an additional $44.20 per subscriber. The table below provides the summarized income and cash flow for this model.

Table 3.6 **Model Base Case Financial Summary**

Income Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Total Revenues	$68,530	$1,045,760	$1,045,760	$1,045,760	$1,045,760
Total Cash Expenses	($381,740)	($474,100)	($474,100)	($474,100)	($474,100)
Depreciation	($93,820)	($342,720)	($337,700)	($337,700)	($337,700)
Interest Expense	($60,300)	($201,350)	($148,220)	($86,630)	($15,250)
Taxes	-	-	-	-	-
Net Income	($467,330)	$27,590	$85,740	$147,330	$218,710

Cash Flow Statement	Year 1	Year 5	Year 10	Year 15	Year 20
Unrestricted Cash Balance	$8,990	$12,430	$71,080	$130,170	$189,590
Depreciation Reserve	-	51,400	77,750	104,000	130,250
Total Cash Balance	$8,990	$63,830	$148,830	$234,170	$319,840

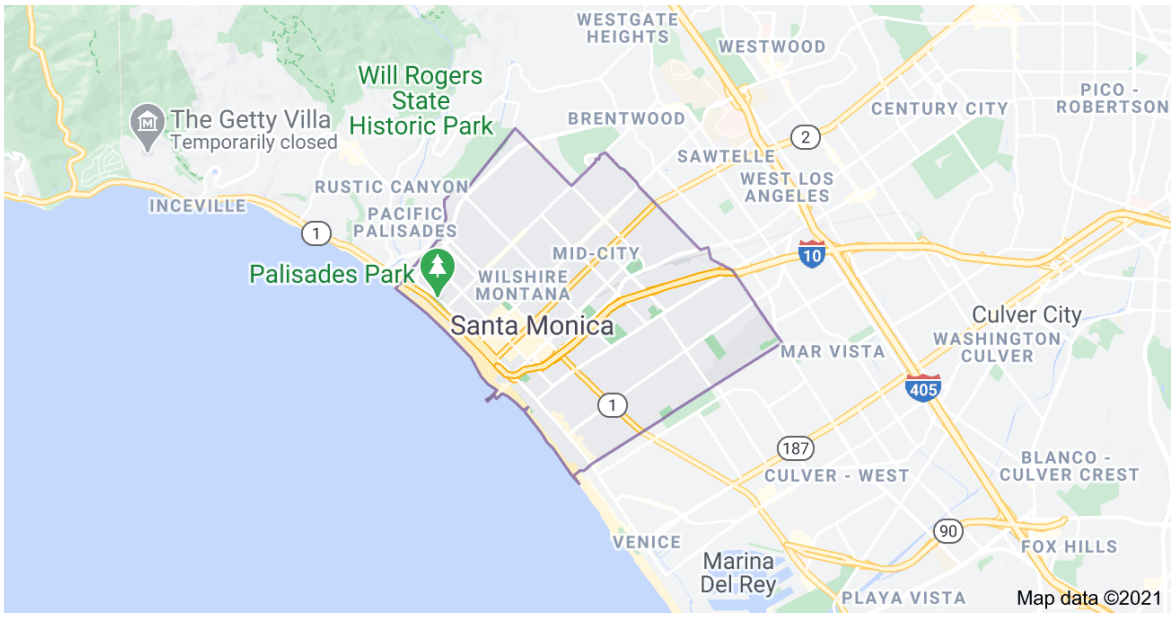
Model Base Case Capital Additions

Under this model, the analysis projects that capital additions in year one will total approximately $1.6 million. These costs will total approximately $2.8 million in year two, $1.7 million in year three, and roughly $390,000 in year four. This totals just under $6.5 million in capital additions for years one through four.

Table 3.7

Capital Additions	-	Year 1	Year 2	Year 3	Year 4
Outside Plant & Facilities					
Total Backbone and FTTP		$1,436,700	$2,394,500	$957,800	
Last Mile and CPE					
Average Drop Cost		$79,600	$390,000	$703,700	$390,000
Miscellaneous Implementation Costs					
Vehicles		$35,000	$35,000		
Work Station, Computers, and Software		$5,000	$500		
Fiber OTDR and Tools		$50,000			
	Total	$90,000	$35,500		
Total Annual Capital Additions		$1,606,300	$2,820,000	$1,661,500	$390,000

Santa Monica, CA



Land Area: 8.42 square miles
Population: 92,987
Households: 50,912
Population density: 10,575
Median Household Income: $96,570
Per Capita Income: $75,481
https://www.smgov.net/Departments/HED/eddContent.aspx?id=23577

In 1998 Santa Monica unveiled a visionary Telecommunications Master Plan that led to an incremental approach to fiber-optic network construction. The result has been one of the most successful "Dig Once" policies in the United States. This approach has reduced the cost of laying fiber by up to 90% by coordinating fiber and conduit installation with other entities.

The City of Santa Monica examine three options:

1. Do nothing – "continued reliance on existing providers."
2. Municipal Fiber Network (MFN) – Ring connecting City sites and conduit for lease to others where possible.
3. Full-Service Network – Hybrid fiber-coaxial network connecting residents and businesses – offering video, Internet, telephone, or some combination.

The City was discouraged by the Full-Service Network Option because the models predicted it would cost $35 million and wasn't expected to break even for over ten years. This approach assumed a residential take rate of 21% for cable television service, 20% for Internet access, and 15% for telephone services.

Santa Monica ultimately chose the Municipal Fiber Network (MFN). Fiber network connecting anchor facilities were expected to cost approximately $2 million to build and expected to achieve payback in 10 years. However, the network was built in stages that differed from those first anticipated, changing the costs. The Santa Monica Plan recommended building the MFN over three fiscal years, coupling the network expansion with already planned capital projects to reduce the cost of placing fiber on public rights-of-way

In 2000 Pacific Bell applied for an excavation permit to place conduits underneath several area streets. The City requested Pacific Bell place two 4-inch conduits along 17,000 feet of the road and pull boxes that would allow it to be later populated with fiber; in 2002, the City agreed to pay no more than $220,000 for that work as their portion of joint trenching.

Table 4.1

One-time fee	Feet	Cost per Foot
$220,000	17,000	$12.94

In 2002 an opportunity to move forward arose when Adelphia's cable franchise was up for renewal. Santa Monica negotiated for Adelphia to connect 43 buildings with six strands of fiber and provide physical maintenance for those routes. The 43 locations included 13 school districts, six college buildings, and 24 City locations. Santa Monica would cut its telecom expenditures by ceasing to lease circuits from other providers. The City paid a $530,000 one-time fee for this network. The ongoing cost of $37,200 for maintenance was split among the City, Schools, and Colleges based on facilities connected.

Table 4.2

One-time fee	Passings	Cost Per Passing
$530,000	43	$12,326

Table 4.3

Annual Fee	Minimum Split	Cost per Split
$37,200	43	$865

The initial investment was $530,000 to connect a total of 43 municipal facilities, school districts, and Santa Monica college with City-owned fiber offering much superior capacity connections. The City's network saved around $400,000 in the first year and ultimately $700,000 per year in ongoing savings. The City continued to reinvest those savings to expand the network infrastructure.

Leasing fiber to other service providers and providing local business services has resulted in over $5 million in revenues. Businesses have lowered their cost by over 2/3 for high-capacity connections. The savings have funded public amenities, including free Wi-Fi in 32 hot zones, 80% of traffic signals are synchronized, 550 video cameras assist public safety, and drivers have multiple ways of getting real-time parking information.
https://cdn.ilsr.org/wp-content/uploads/2014/03/santa-monica-city-net-fiber-2014-2.pdf

Current Santa Monica Internet Prices

Table 4.4 **Santa Monica City Net**

Service	Speed Mbps	Installation	Price per Month
Standard Rate	1000/1000	$69.00	$69.00
Affordable Housing Discounted Rate	1000/1000	$48.00	$48.00
Standard Rate	10,000/10,000	$360.00	$360.00
Affordable Housing Discounted Rate	10,000/10,000	$252.00	$252.00

Chattanooga, TN

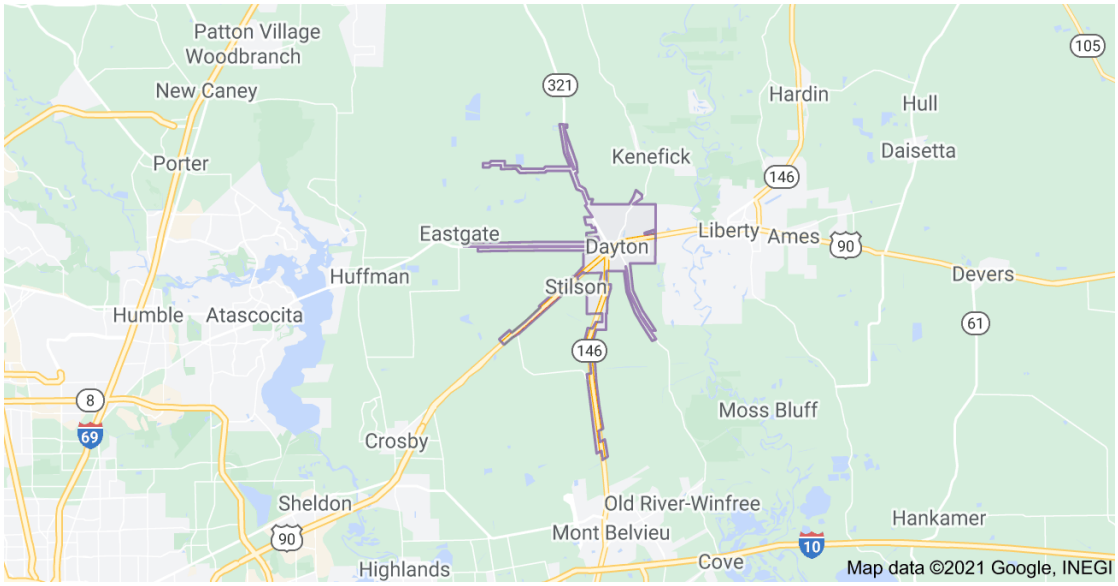
Land Area: 143.2 square miles
Population: 182,799
Households: 75,940
Population Density: 1,352
Median Household income: $45,527
Per Capita Income: $30,592
https://www.census.gov/quickfacts/chattanoogacitytennessee

Smart grid and broadband initiatives in Chattanooga cost approximately $390 million. EPB (formerly Electric Power Board of Chattanooga) has laid over 6,000 miles of fiber optic cable. The network covers approximately 35,000 subscribers in urban, suburban, and rural areas.

Table 5.1

Total Cost	Total Miles	Cost Per Mile
$390,000,000	6,000	$65,000

Dayton, TX



Land area: 30.7 square miles
Population: 8,389
Population Density: 361
Median Household income: $52,179
Per Capita Income: $29,123
Households: 3,024
https://www.census.gov/quickfacts/daytoncitytexas

Located 15 miles from Houston, Dayton has more than 8,000 residents.
The City council of Dayton, Texas, approved a $13.7 million bond to operate its fiber-optic system. The goal was to construct a 70-mile fiber network.

https://muninetworks.org/content/another-fiber-optic-project-texas-aims-connect-residents-and-businesses

Table 6.1

Total Cost	Total Miles	Cost Per Mile
$13,700,000	70	$195,714

Mont Belvieu, Texas

Land Area: 16.46 square miles
Population: 6,574
Households: 2,199
Population Density: 255.6
Median Household Income: $94,560
Per Capita Income: $46,518
https://www.census.gov/quickfacts/montbelvieucitytexas

In 2016, a feasibility study in Mont Belvieu revealed that 60 percent of residents and at least 79 percent of businesses felt local Internet access was not adequate for their needs. Mont Belvieu experienced a combination of poor Internet access and a growing community. ISPs did not want to deploy infrastructure to new areas, leaving residents to depend on mobile hotspots. The City decided the best course of action was to invest in a publicly owned Internet network infrastructure through a community Fiber-to-the-Home (FTTH) network, which led to the creation of MB Link - Texas' first municipally-owned fully fiber broadband network.

In December 2016, the city council adopted a resolution to authorize a notice that it would be issuing Certificates of Obligation (COs) not to exceed $14 million to cover the cost of broadband infrastructure. An ordinance issuing the COs was approved the following January.

The Director of Mont Belvieu's broadband and information technology services stated that it cost about $9 million to build the MB Link Infrastructure and estimates maintenance and staffing costs of approximately $1 million annually. The city projects it will break even and start making money from MB Link in 2025. After its first year of operations, MBLink has over 1,500 residential customers and 30

business partners. MBLink achieved a 60% penetration rate in the first 12 months of operations. Mont Belvieu Constructed over 75 miles of fiber and came in under budget at $13 million.

https://www.tml.org/DocumentCenter/View/1879/062020TTC

Details of Mont Belvieu's journey to success are detailed here:
https://ilsr.org/court-confirms-texas-city-has-authority-to-build-finance-community-owned-network/

Table 7.1

Total Cost	Total Miles	Cost Per Mile
$13,000,000	75	$173,333

MB LINK

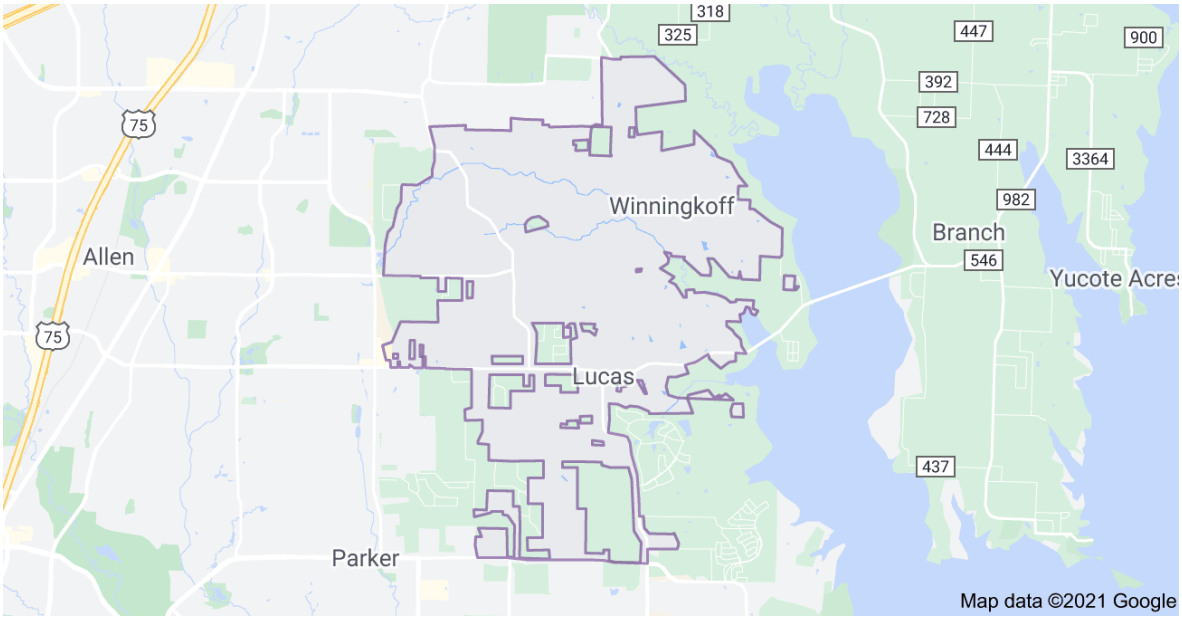
The result of Mont Belvieu's broadband expansion was MB Link, Texas' first municipally-owned fully fiber-optic broadband network. Below are the 2019 rates and packages offered by MB Link.

Table 7.2 **MB LINK Prices**

Service	Speed Mbps	Deposit	Installation	Price per Month
Platinum Pro	1000/1000	$75.00	$75.00	$75.00
SMB 100	100/100	$100.00	$100.00	$100.00
SMB 300	300/300	$150.00	$100.00	$150.00
SMB 500	500/500	$250.00	$100.00	$250.00
SMB 1000	1000/1000	$450.00	$100.00	$450.00

https://www.montbelvieu.net/DocumentCenter/View/1739/MB-Link-Rates-and-Packages-Card

Lucas, Texas



Land Area: 15.91 square miles
Population: 8,553
Households: 2,228
Population Density: 409.9
Median Household Income: $160,278
Per capita income: $67,708
https://www.census.gov/quickfacts/lucascitytexas

The total 20-year estimated capital costs for fiber broadband infrastructure in Lucas are $20,650,000. The City is intending to only fund Initial buildout costs of $17,380,000. The remaining cost will be covered through revenue. Additional funding of $1,800,000 in working capital and $4,73,000 in loans are planned for initial operating expenses and early end-of-year shortfalls.

Lucas needs to build approximately 107.85 miles of backbone and distribution fiber for its 2,458 residential premises or "passings," or on average, 232 feet per passing. The 107.85 miles of backbone are planned to be completed within three years from the network design.

The full Lucas City Broadband design and Financial Model may be viewed here: https://storage.googleapis.com/proudcity/lucastx/uploads/2020/07/Final-Broadband-Study-City-of-Lucas-Broadband-Design-and-Financial-Model.pdf

Table 8.1

Total Cost	Total Miles	Cost Per Mile
$20,650,000	108	$191,470

Capital Expenditures

Magellan estimated a high-level conceptual design for Lucas's fiber network over 20 years. Estimated costs for fiber buildout labor and materials, needed equipment, buildings, operations support system and business support system (OSS/BSS), and project/construction management estimations have been established. Breakdown of the 20-year capital cost encompassing initial rollout cost and periodic renewals and replacements based on expected life of the associated assets are shown in the following table.

Table 8.2

Area	Description	Estimated 20-Year expense
Network Design	Formal low-level design backbone and distribution networks	$711,839
Construction	Buildout with 10% Contingency	$10,609,285
Network Equipment	Includes expected upgrades and refits over 20-years	$2,045,273
General Equipment	Vehicles, trencher, tools, testers, etc.	$657,300
Building Improvements	Datacenter, warehouse, NOC, offices	$550,000
Premises Drops	Based on 55% Residential; 55% Business uptakes	$4,572,970
Construction and Turnkey Project Management	Management of the network buildout; inspections, and overall project management	$1,500,000
	TOTAL	**$20,646,666**

Product & Pricing

For Lucas City, the best fit scenario was assuming a 55% uptake ratio from both residential and business; as a retail provider, Lucas would provide a standard set of fast Internet offerings as illustrated in the table.

Table 8.3 **Residential Offerings**

Mbps	Percent of Subscribers Taking Service	Monthly Rate
1,000/1,000	90%	$115
10,000/10,000	10%	$195

Table 8.4 **Business Offerings**

Mbps	Percent of Subscribers Taking Service	Monthly Rate
250/250	56%	$225
1,000/1,000 SMB	36%	$350
1,000/1,000 SMB	5%	$450
1,000/1,000 Dedicated	3%	$1,195

*SMB –Server Message Block is a network protocol used by Windows-based computers that allow systems within the same network to share files. It allows computers connected to the same network or domain to access files from other local computers as easily as if they were on the computer's local hard drive.

*Dedicated – Service where a provider dedicates a specific amount of bandwidth for that connection. This bandwidth is not shared with anyone other than the physical circuit user.

Considering and expecting two years from construction to the first customer, Lucas's projected revenue is captured in table 8.5, showing the 20-year projected proceeds in millions of dollars.

Table 8.5 **Projected Revenue**

Year	Residential	Business	Anchors	Total
3	0.25	0.02	0.04	0.31
4	1.23	0.08	0.08	1.39
5	2.15	0.11	0.08	2.34
6	2.53	0.12	0.23	2.88
7	2.68	0.12	0.37	3.17
8	2.78	0.12	0.37	3.27
9	2.84	0.13	0.37	3.34
10	2.91	0.13	0.37	3.41
11	2.94	0.13	0.37	3.44
12	2.95	0.13	0.37	3.45
13	2.95	0.13	0.37	3.45
14	2.96	0.13	0.37	3.46
15	2.97	0.14	0.37	3.48
16	2.98	0.14	0.37	3.49
17	2.99	0.14	0.37	3.5
18	3	0.14	0.37	3.51
19	3	0.14	0.37	3.51
20	3.01	0.15	0.37	3.53

Comparative Benchmarks

An overview of studied cities' critical demographics is shown in Table 9.1. Information includes, from left to right, the location, land area in squared miles, population, number of households, population density, median household, and per capita income. Table 9.2 illustrates the average cost per mile in the respective cities.

Table 9.1 **Summary of Demographics**

Location	Land Area in Square Miles	Population	Households	Population Density	Median Household	Per Capita Income
El Paso, TX	260	839,238	268,310	3,228	$46,871	$21,683
Fort Collins, CO	57.06	174,871	70,429	3,036	$62,132	$34,482
Spring Hill, KS	8.42	7,326	2,158	870	$80,357	$29,507
Santa Monica, CA	8.42	92,987	50,912	11,043	$96,570	$75,481
Chattanooga, TN	143.2	182,799	75,940	1,277	$45,527	$30,592
Dayton, TX	30.7	8,389	3,024	273	$52,179	$29,123
Mont Belvieu, TX	16.46	6,574	2,199	399	$94,560	$46,518
Lucas, TX	15.91	8,553	2,228	409.9	$160,278	$67,708

Table 9.2 **Average Cost per Mile**

Location	Total Cost	Total Miles	Cost per Mile
Fort Collins, CO	$109,217,775	938	$116,437
Spring Hills, KS	$4,770,000	39.75	$120,000
Dayton, TX	$13,700,000	70	$195,714
Mont Belvieu, TX	$13,000,000	75	$173,333
Chattanooga, TN	$390,000,000	6,000	$65,000
Lucas, TX	$20,650,000	108	$191,470

Cost of Living Adjustment

A cost of living adjustment provides for level comparison of costs in geographically ad demographically disparate areas of the United States. Relative cost of living indices are represented below in relation to the national average of 100. Table 9.3 shows cost of living indices of studied cities, compared to the El Paso Index of 81.4, at the time of completion of this document.

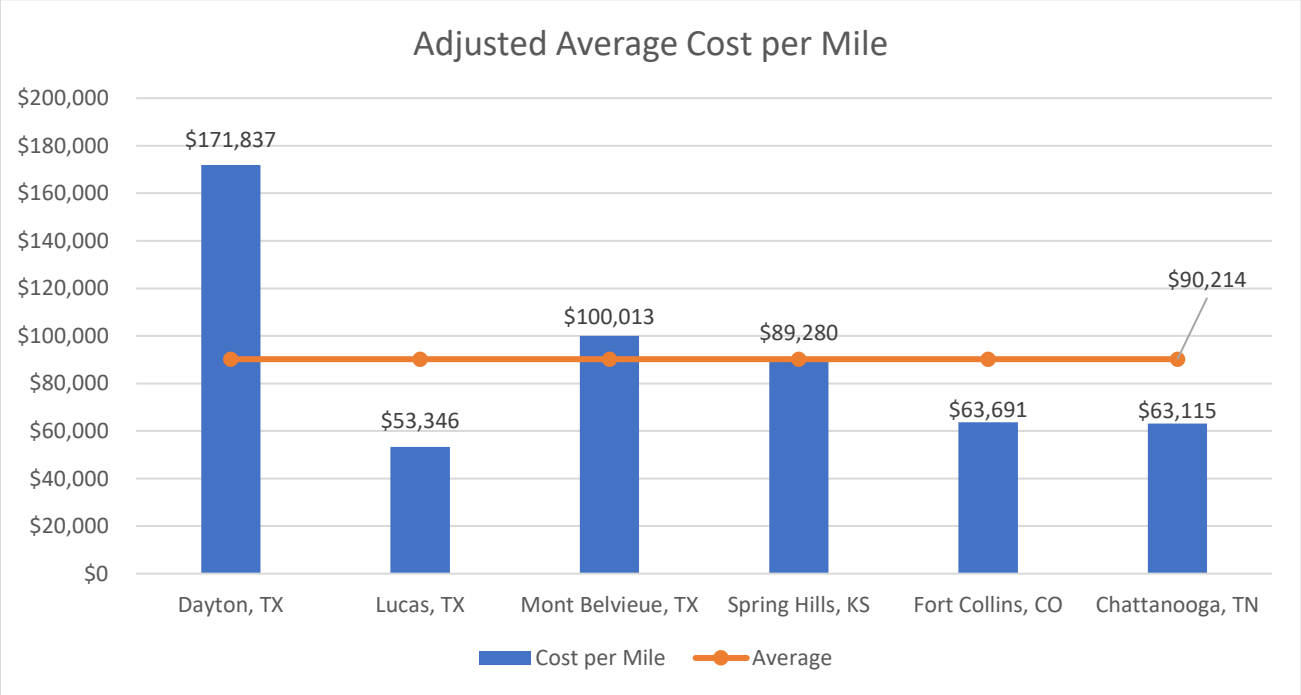
Table 9.3 **Cost of Living Indices**

Location	COLI	Percent Difference
El Paso, TX	81.4	Base Index
Dayton, TX	91.3	12.2% more expensive
Lucas, TX	140.1	72.1% more expensive
Mont Belvieu, TX	115.8	42.3% more expensive
Spring Hills, KS	102.2	25.6% more expensive
Fort Collins, CO	118.3	45.3% more expensive
Chattanooga, TN	83.8	2.9% more expensive

https://www.bestplaces.net/cost-of-living

Table 9.3 **Adjusted Dollars to El Paso, TX Cost of Living Index**

Location	Total Cost	Total miles	Cost per Mile
Dayton, TX	$12,028,600	70	$171,837
Lucas, TX	$5,761,350	108	$53,346
Mont Belvieu, TX	$7,501,000	75	$100,013
Spring Hills, KS	$3,548,880	39.75	$89,280
Fort Collins, CO	$59,742,123	938	$63,691
Chattanooga, TN	$378,690,000	6,000	$63,115
		AVERAGE	**$90,214**



Population Density bearing on Cost per Mile

Population Density, the number of people living per square mile of land area assuming the population is evenly distributed, may have significant impact on broadband expansion costs. Texas, for example, is known for its large land area, which may increase the cost per mile of projects such as broadband expansion. As illustrated in the graphic below, cities with higher population density tend to have lower costs per mile for broadband. The lower price can be explained by the inherent increase in the number of passings per mile constructed through more densely populated areas. More passings mean more connections per mile. In the same manner, cities with less population density may need to build more miles of infrastructure to achieve the same broadband expansion success.