Regional Broadband Feasibility Study

Funded through a grant from the US Economic Development Administration (EDA), Award Number ED20CHI3070066.

OMEGA
OHIO MID-EASTERN GOVERNMENTS ASSOCIATION

July 2022

REID CONSULTING GROUP

This report was prepared by Reid Consulting Group, LLC for Ohio Mid-Eastern Governments Association // June 30, 2022

Contents

GLOSSARY

terms are listed in order of appearance

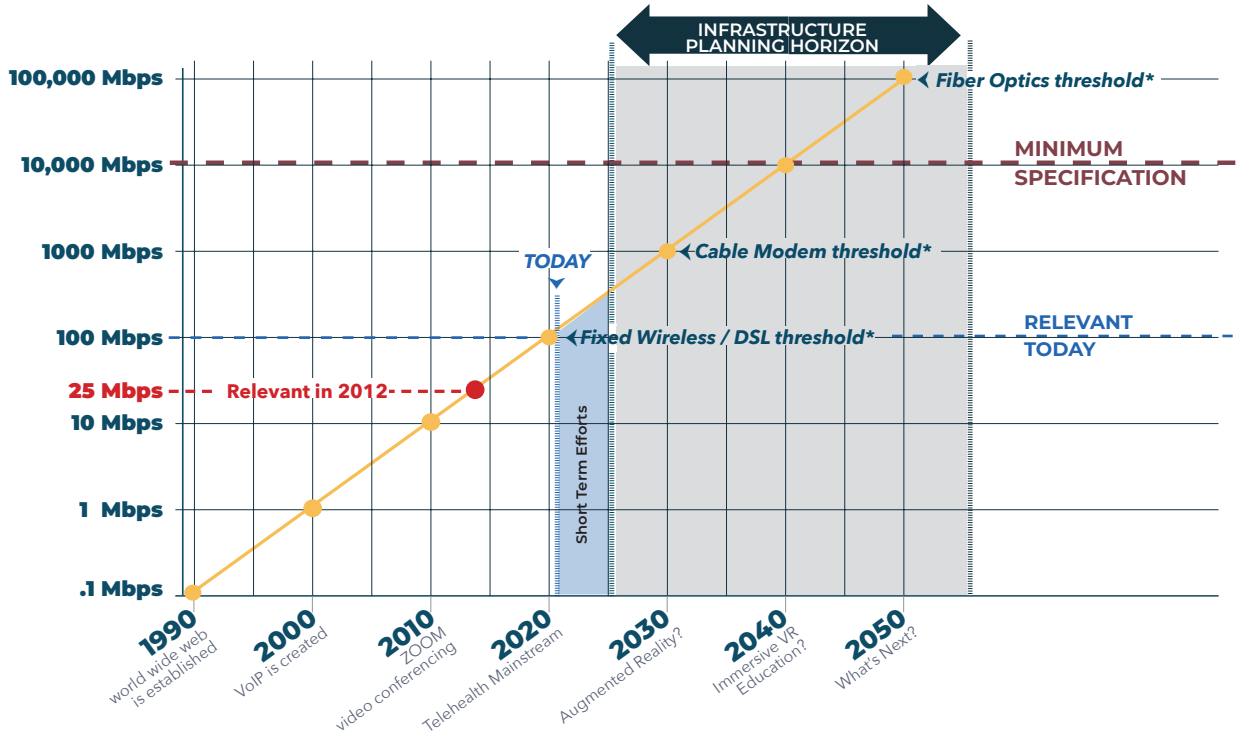
OMEGA Region	A ten county development district in Appalachian Ohio that includes: Belmont, Carroll, Columbiana, Coshocton, Guernsey, Harrison, Holmes, Jefferson, Muskingum, Tuscarawas.
Mbps down / download speed	The rate that digital data is transferred from the internet to your computer or device, measured in megabits per second. Download speed affects streaming services, web page load times, and file downloads like images, videos, and device updates.
Mbps up / upload speed	The rate that data is transferred from your computer to the internet, measured in megabits per second. Upload speed is important for video calls, telehealth sessions, remote work and online learning, live gaming and sending email attachments
unserved	Any home or business that has an internet speed of less than 25 Mbps down and 3Mbps up, often written as 25/3 Mbps.
underserved	Any home or business that has an internet speed of less than 100 Mbps down and 20 Mbps up, often written as 100/20 Mbps.
last mile	The technology that bridges the distance between the Internet service provider's network and the end user (customer).
middle mile	The communication network segment between the network backbone to a local network.
subsidy	A sum of money from a government or granting agency to offset the cost of installation or deployment of internet infrastructure by a public or private entity.
ISP	An acronym for Internet Service Provider.
make ready	The process and cost of preparing an existing utility corridor for a new communication cable attachment.
cost-to-pass	The cost of installing communication cable along a utility corridor, passing close enough by homes and businesses to allow installation of drop cables to serve those locations.
cost-to-serve	The cost of installing drop cable and necessary equipment from the utility corridor to the end user.

Executive Summary

In spite of past federal attempts to bring broadband to rural America, the digital divide remains a pressing reality for Appalachian Ohio. According to new coverage maps developed by Reid Consulting Group, over one third of all households in the OMEGA region are unable to obtain FCC minimum broadband speeds of 25 Mbps down and 3 Mbps up. This translates to over 80% of the populated land in the ten OMEGA member counties.

38%
of households

81%
of populated land
is unserved



With internet demand increasing tenfold every decade, the OMEGA region needs a high-capacity network that not only meets today's needs but also has enough capacity and longevity to remain useful in 2055 and beyond.

SCOPE

This report focuses primarily on expanding the availability of "last mile" broadband infrastructure that reaches individual homes and businesses. While some regions of the OMEGA district would benefit from having additional "middle mile" fiber to bridge the gap between unserved territories and internet providers' home offices, the last mile remains the most significant challenge.

In the past, internet providers have been unwilling to invest in rural broadband infrastructure due to the OMEGA region's rugged terrain and low population density. Using only private funding, a provider simply cannot make a sustainable business case for serving rural areas. Fortunately, federal and state agencies are beginning to recognize just how important broadband access is to the economic, cultural, and physical well-being of rural households. With over $1 billion in new state and federal broadband funding on the way in Ohio, the OMEGA region has a once-in-a-lifetime opportunity to significantly reduce the digital divide.

The pandemic exacerbated the need for affordable reliable high-speed broadband. To address this issue, OMEGA retained Reid Consulting Group to conduct a Regional Broadband Feasibility Study. This study identifies the true extent of broadband need across the OMEGA region and provides in depth, county-by-county broadband profiles that can be used to prioritize broadband service to unserved and underserved areas, develop costs estimates, and build compelling grant applications. This study was funded by a grant from the U.S. Economic Development Administration and provides a roadmap to OMEGA's members for quantifying the need for reliable high-speed broadband and a process for providing service to the unserved and underserved areas.

Residential and business broadband surveys conducted by Reid Consulting Group on behalf of OMEGA corroborate these findings. 80% of respondents who know their home connection's download speed report less than 25 Mbps while 71% of respondents were dissatisfied or extremely dissatisfied with both their connection speed and reliability. 66% of households report having at least three different devices online at the same time, with 23% having more than five.

Respondents report 3-5 devices connected to the internet at one-time

21%
of respondents DO NOT HAVE home internet

How to use this report

This report is meant to be a practical planning tool to help local officials and economic development professionals create broadband project proposals for regional, state, and federal grant programs as well as internet service providers. Proposal development involves three phases: identifying need, prioritizing project areas, and applying for funding. In most cases, there will be multiple viable approaches. Given the current funding environment, developing multiple options will increase the likelihood of a successful application.

[1] IDENTIFY THE NEED

On paper or on a computer, use the provided county profile maps (Appendix 1) to draw outlines of potential project areas. At this point, do not worry about deciding which areas are more likely to receive funding. Just look at the county's color-coded broadband profile map and start drawing. An interactive, web-based version of the OMEGA region's maps also is available to OMEGA members. This map can help you plan because it allows you to turn layers on and off, and zoom in/out. Login credentials are required to use the interactive map. These credentials will be provided to OMEGA members on request. Scan or click on the QR code at the bottom of this page to login.

Reid Consulting Group recommends creating multiple project area outlines. Some of those areas could be large, even county-wide, while others should focus on specific communities or unincorporated areas. Both types of projects will be useful. The larger regions could be the focus of large grant programs, while smaller areas could be proposed to regional agencies or directly to internet service providers. Overlap between different project areas is acceptable and in fact encouraged. The goal is to develop a wide range of options from which to choose. It can be helpful at this point to use your knowledge of your constituents' needs and your county's existing civil infrastructure to help define specific areas. OMEGA staff also can offer a regional perspective and can facilitate inter-agency collaboration for project areas that cover more than one county.

An example of this process can be found in Appendix 3.

scan

with your smartphone to login to the interactive map

A FAQ on how to use the interactive map can be found in Appendix 2

[2] PRIORITIZE

Once you have drawn a set of potential project areas, it is time to rank those projects. The following criteria will be useful as you decide which projects you want to focus on.

Coverage

Look for contiguous areas with little or no service. Depending on the context, keep in mind that some areas may logically extend across county borders.

Proximity to Open Middle Mile

Unserved areas that are close to existing middle mile (the dark blue lines on the color-coded speed map and the unserved roads map) can be more appealing to providers than areas with no middle mile. On the other hand, if a grant program includes a middle mile component, then areas without existing middle mile would be good candidates.

Proximity to Well Served Areas

Having existing service nearby (green on the color-coded map) can make a project location more attractive to an incumbent provider or funding agency because, in theory, it would cost less to expand existing infrastructure versus building from scratch. Just keep in mind that proximity to existing service is not enough in itself to encourage expansion.

Business Opportunity Areas

Look for unserved areas with a high concentration of businesses (blue dots of any size) and/or with one or more high demand businesses (the large blue dots.) Elected officials, economic development officers, and OMEGA staff could help identify specific business needs.

Residential Opportunity Areas

For some projects, it can be useful to draw boundaries based on population density. The more unserved households per square mile, the more attractive the project will look. Identifying areas that have a lower population density also can be helpful, since those areas will have a greater per-household subsidy requirement.

Existing or Pending Subsidies

Some grant programs will not award funds to areas already covered by other grants. When drawing project boundaries, you may wish to exclude areas that have received RDOF authorization (see below), or you may wish to create an adjoining project area that is designed specifically to encourage an RDOF recipient to extend coverage beyond their RDOF winnings. As address lists become available for the Ohio Residential Broadband Expansion Grant (ORBEG) program, these locations also can be used to refine project area boundaries.[1]

[1] As of this report's publication, BroadbandOhio has not released the final lists of funded addresses.

Partnerships & Funding Opportunities

Having multiple options for project areas with a clear understanding of priorities makes it easier to match those areas up with specific funding programs or internet providers. For example, some grant programs focus exclusively on residential service, while others include economic development as a core component.

GRANT PROGRAMS

Appalachian Regional Commission (ARC) POWER

The ARC POWER program accepts grant applications for projects that focus on economic development and business expansion. While not a broadband-specific program, up to one-third of available POWER funds in 2022 were earmarked for broadband.

Who can apply: Local development districts, states/counties/cities or other political subdivisions and their agencies, institutions of higher education, and public or private nonprofits. Public/private partnerships are encouraged, with the private partner selected via RFP.

Locations: Unserved Appalachian communities and regions affected by job losses in coal mining, coal power plant operations, and coal-related supply chain industries due to the changing economics of America's energy production. Must have a business component: sole fiber-to-the-home projects will not be considered. Areas that received funding through other programs are not eligible.

Project size: $400K - $2.5M for deployment. Up to $50K available to fund planning efforts. Applicant must provide at least some match (cash or in-kind).

Technology: Any

https://www.arc.gov/arcs-power-initiative/

American Rescue Plan Act (ARPA)

ARPA provides funds to local government agencies to address infrastructure needs, including broadband. While ARPA funds alone are not sufficient to fund broadband projects on a large scale, they can be used to incentivize provider investment or included in grant applications as matching funds. For example, a county could contribute some of its ARPA funding as match for an ARC POWER application or to help incentivize an internet provider or rural electric cooperative to apply for an ORBEG grant.

United States Department of Agriculture (USDA) ReConnect

The USDA's ReConnect program provides capital subsidy via grants, loans, and grant/loan hybrids to deploy broadband to rural areas with speeds slower than 100 Mbps up and 20 Mbps down.

Who can apply: Corporations, LLCs, Co-ops, and states or local governments including any agency, subdivision, instrumentality, or political subdivision thereof

Locations: Rural areas where at least 90% of households have speeds below 100/20 Mbps. Rural areas include cities/towns with population below 20,000 and urbanized areas contiguous and adjacent to a city/town with population below 50,000. Areas that received funding under other programs are not eligible.

Project size: Grants: up to $25M; Grant/loan hybrids: up to $50M ($25M grant and $25M loan); Loans: up to $50M

Technology: Any

https://www.usda.gov/reconnect

Click or Scan with your smartphone to view maps of USDA defined rural locations

Ohio Residential Broadband Expansion Grant (ORBEG) program

BroadbandOhio's ORBEG focuses on expanding residential broadband availability in the State of Ohio. During the first round, $250 million was awarded across the state with a large percentage of that money going to Appalachian Ohio. Reid Consulting Group expects ORBEG to receive approximately $1 billion in new federal broadband funding through the Infrastructure Investment & Jobs Act (IIJA)/ Broadband Equity, Access, and Deployment (BEAD) program and an additional $270 million from the Treasury Capital Projects Fund.

Who can apply: Internet service providers.

Locations: Unserved (below 10/1 Mbps) and underserved communities (below 25/3 Mbps).

Project size: Any

Technology: Any

https://broadband.ohio.gov/

Rural Digital Opportunity Fund (RDOF)

The FCC's Rural Digital Opportunity Fund provides capital subsidy to deploy broadband to areas with speeds slower than 25 Mbps up and 3 Mbps down. Funds from the first phase of this program were awarded in December 2020 via reverse auction, but authorization and disbursement of those funds is still in progress as of summer 2022. The FCC will be conducting at least one more round of RDOF funding using new maps that have yet to be published.

➡ ***If a provider abandons territories won during the first round, then those territories should be eligible during round 2.***

Who can apply: Anyone who bids in RDOF must have an Eligible Telecommunications Carrier (ETC) designation before the due diligence phase of the award process. This requirement somewhat favors established internet providers and telecommunications carriers; however, it does not rule out other organizations. For example, a rural electric cooperative or municipality could bid on RDOF territories as long as they file ETC paperwork with enough lead time to be certified during due diligence phase of the award.

Locations: Census blocks with speeds < 25/3 Mbps as defined by the FCC's internal maps

Project size: Any

Technology: Any

ⓘ https://www.usac.org/high-cost/funds/rural-digital-opportunity-fund/

Click or Scan with your smartphone to view RDOF phase 1 auction results

Status of RDOF Phase 1 Awards *Census Blocks Authorized or Ready to Authorize*

Many RDOF Phase 1 awards in the OMEGA region remain tied up in financial, technical, and managerial due diligence. As of, June 30, 2022, only two providers in the OMEGA region have received funding authorization. Charter has been authorized for 3473 census blocks, while Windstream has been authorized for just 6.

County	Charter AUTHORIZED	Windstream AUTHORIZED	Mercury READY TO AUTHORIZE
Belmont	--	6	--
Carroll	353	--	286
Columbiana	502	--	--
Coshocton	675	--	119
Guernsey	540	--	--
Harrison	--	--	10
Holmes	367	--	425
Jefferson	--	--	62
Muskingum	486	--	25
Tuscarawas	550	--	38

Mercury Wireless has 965 blocks listed as "ready to authorize," meaning that funding is close to being released; however, Mercury Wireless also has defaulted on 1114 blocks. LTD Broadband has defaulted on 19 of their blocks, Charter Communications on 48, and the Rural Electric Cooperative Consortium on 27. When a provider defaults on a census block, they turn down the offered subsidy and withdraw that census block from the list of blocks to be served.

No decision has been made yet on Connect Everyone's 1638 census blocks or on LTD Broadband's remaining 261.

PARTNERSHIPS

Along with grant programs, planners also should consider sharing their project areas with internet service providers and local utilities. As interest in rural broadband ramps up nationally, incumbent providers are increasingly willing to expand coverage to villages and towns that adjoin their existing territories. In locations with older cable modem service, competing providers may be willing to overbuild an incumbent provider with fiber in an effort to capture market share. In that scenario, it may be possible to convince that provider to expand their coverage to neighboring unserved locations.

Many grant programs, including ARC POWER, prioritize or require public/private partnerships. In rural settings, we recommend seeking out these sorts of partnerships wherever possible. The private partner brings the technical and business experience while the public partner helps ensure transparency and compliance.

If a project area is served by a rural electric cooperative, then consideration should be given to collaborate or partner with the rural electric cooperative. With a pole network that already reaches every household in their service footprint, a co-op is well positioned to install fiber-to-the-home. Also, co-ops tend to be customer focused and willing to deploy services at lower margins than a private, for-profit business would.

When creating broadband project areas and seeking funding, OMEGA is an excellent regional resource. OMEGA staff can assist with economic development planning and can help identify opportunities to coordinate or collaborate across county lines.

For Questions contact:

Jeannette Wierzbicki, P.E.
Executive Director

jeannettew@omegadistrict.org
740.439.4471 ext. 204

Background

EXISTING INFRASTRUCTURE CHALLENGES

TERRAIN

Broadband deployments in Appalachian Ohio face two significant challenges: rugged terrain and outdated infrastructure. The region's steep hills and narrow valleys present significant barriers to both wireless and wired providers. Wireless coverage uses line-of-sight transmission from tower to end users. If a wireless provider's transceiver does not have an unobstructed view of a home or business, then that location will not be able to receive service. This "terrain shadow" effect applies equally to fixed wireless internet and cellular service.

Wired coverage, whether cable or fiber, also can be challenging to deploy in rugged terrain. With bedrock often close to the surface in many locations, providers typically must depend on aerial cable installations. In most cases, this means working with utility companies to attach new cable to existing poles. Although fiber optic cable is lightweight compared to power lines, the additional cable span still represents a major increase in wind and ice loads. Depending on how old a pole is, it may need to be replaced to avoid breaking under the added strain. Also, new cables sometimes cannot be added without violating minimum ground clearance requirements. In this case, the pole ends up needing to be replaced with a taller pole. These "make-ready" costs add up quickly, leaving providers less willing to invest in new cable runs.

have unobstructed view (line of sight) of tower likely to receive service

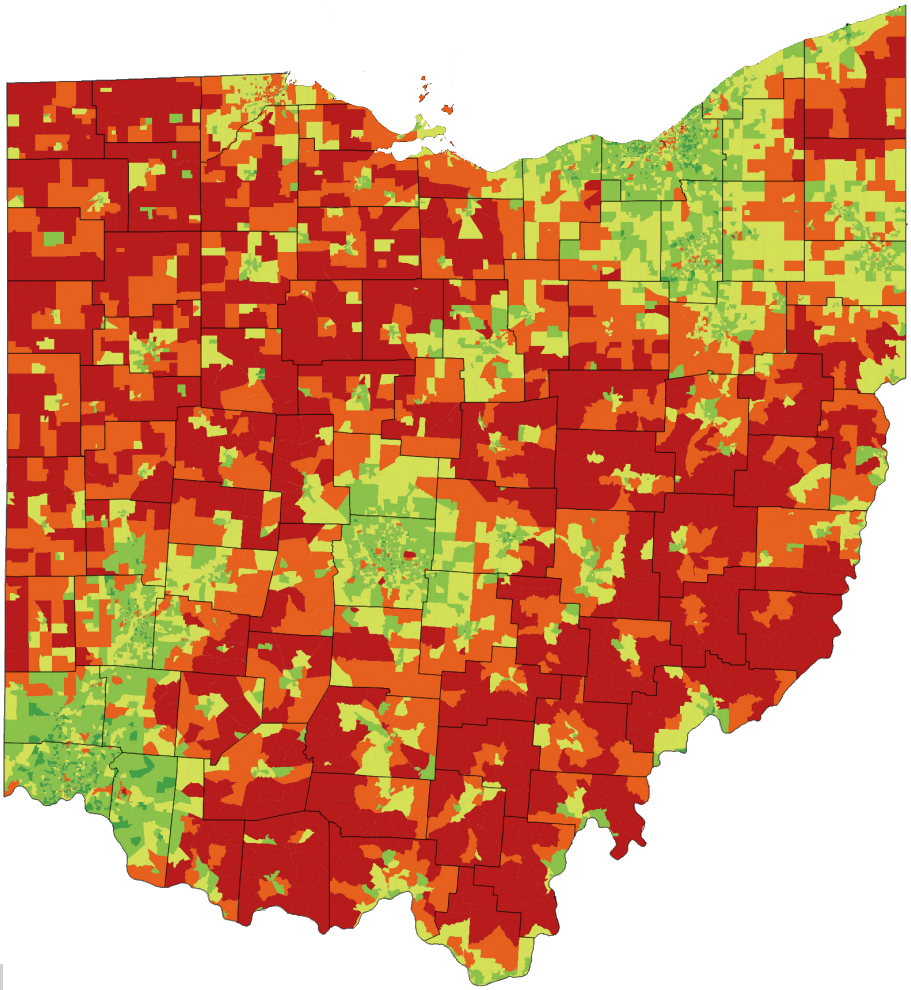
have an obstructed view due to terrain NOT likely to receive service

OUTDATED INFRASTRUCTURE

With the exception of some larger cities and towns, the only available infrastructure to carry wired broadband in rural areas is copper telephone cable.

When properly maintained, copper cable can support DSL internet service at speeds that meet the current federal minimum of 25 Mbps down and 3 Mbps up; however, most of the cables in our region were installed over 50 years ago and have seen little maintenance since then. At this point, rural copper cable is in such poor condition that it is unable to support reliable landline telephone service, let alone high-speed broadband.

Why does rural broadband require subsidy?



While rugged terrain and a lack of modern infrastructure play a part in perpetuating the digital divide, population density is the main factor that has prevented internet providers from investing in rural locations.

Broadband infrastructure is expensive. High quality, high strand-count fiber optic cable can cost between $60,000 and $100,000 per mile to install on existing utility poles. Burying fiber in conduit can increase this cost in some locations to as much as $150,000 per mile. Given these capital expenses, internet providers typically only deliver service in locations with enough potential customers to recoup those expenses. This fiscal caution can be seen in statewide broadband speed maps.

Locations with the highest speed ratings (above 50 Mbps download and 10 Mbps upload) correspond closely to the metro footprints of Ohio's major cities while unserved areas (below 25/3) align with the rural expanse. This same pattern is visible at the county level, as illustrated by the table to the right.

In cities and towns, population density is high enough that at least one provider has invested in the infrastructure necessary to deliver broadband services in those areas. In rural locations where density can be less than 1% of urban locations, service is non-existent. This is a direct result of the cost/benefit equation. Without significant capital subsidy, it is unlikely that any internet provider will ever serve low population density rural areas.[2]

URBAN

location	households per square mile	median household income
Zanesville	2,166	$33,158
Steubenville	1,770	$37,457
Coshocton	1,388	$46,034

RURAL

location	households per square mile	median household income
Entirety of Harrison County	39	$49,454
Wayne Twp. Jefferson County	28	---
Spencer Twp. Guernsey Co.	20	---

[2] Population density is the primary driver of rural broadband availability, but it should be noted that poverty can be an additional factor in the state's major cities where population density is uniformly high. For example, many census blocks in East Cleveland are rated below 10/1 Mbps in spite of carriers reporting that they have fiber-to-the-curb in these locations. While poverty may be a secondary factor in OMEGA cities, its effects are outweighed by the overall population density.

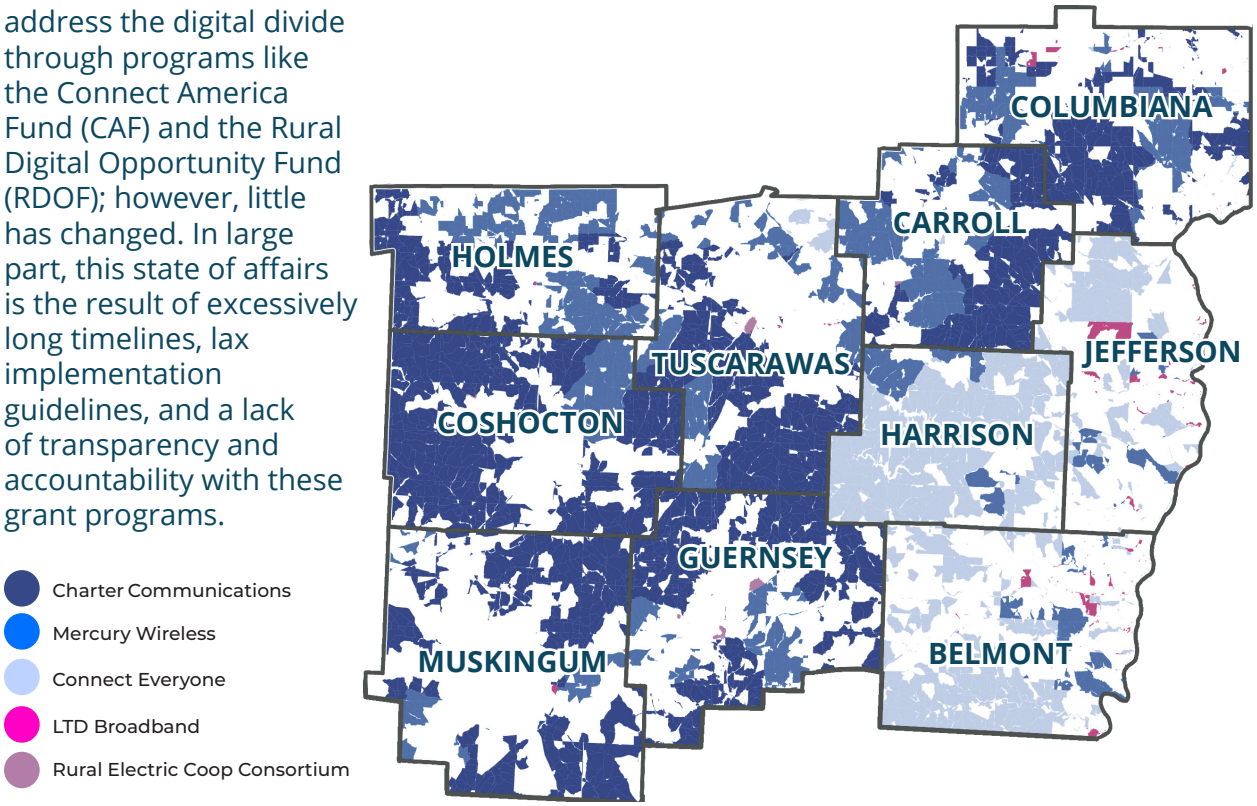
> ***All people in the United States shall have access to rapid, efficient, nationwide communications service with adequate facilities at reasonable charges."***
> ***– Communications Act of 1934***

PROBLEMS WITH PAST SUBSIDY PROGRAMS

For nearly a century, the federal government has recognized the need to subsidize communications infrastructure in rural America. The Communications Act of 1934 established a nationwide Universal Service Fund to encourage the delivery of ubiquitous telephone service. This program still exists, and its founding purpose remains just as relevant today is it was in 1934.

Since 1990, the FCC has given close to $100 billion in Universal Service funding to telecommunications carriers to address the digital divide through programs like the Connect America Fund (CAF) and the Rural Digital Opportunity Fund (RDOF); however, little has changed. In large part, this state of affairs is the result of excessively long timelines, lax implementation guidelines, and a lack of transparency and accountability with these grant programs.

The majority of RDOF funds that were awarded in December 2020 have yet to be authorized as of June 2022. Once authorized, recipients have six years to deploy with minimal reporting requirements. If a deadline is missed, the provider can request an additional year with no financial penalty. Fees for non-deployment do not start until years 8-10, and those fees are low enough that recipients have a financial incentive to abandon the most remote locations.[3]



[3] RDOF Phase 1 Concerns and Suggestions, Feb. 18, 2021, Buckeye Hills Regional Council, public comments filed with the FCC

Broadband Coverage Mapping

To address broadband availability issues in the region, it is essential to identify the true extent of the problem.

The maps in this report use a rating system developed by Reid Consulting Group that combines Ookla Speedtest Intelligence® data licensed by InnovateOhio for the months of February 2020 through August 2021 with FCC carrier filings of available speeds (Form 477), carrier reports of actual broadband deployments to USAC (HUBB), RDOF Phase 1 eligibility, and population density. This rating system makes it possible to identify broadband availability at the census block and census block group levels. For additional details on this methodology, see Appendix 4.

STATE OF OHIO

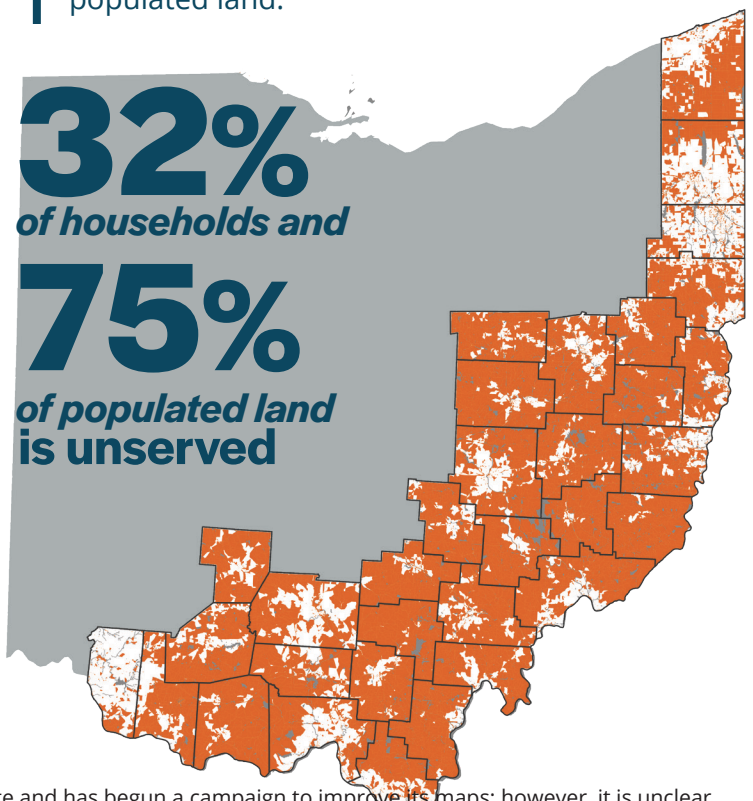
At the state level, there are 791,300 unserved households, representing 15% of total households and 66% of populated land. By way of comparison, the FCC believes there are only 190,000 unserved households,[4] while Microsoft estimates over 2,000,000 households are unable to receive broadband.[5]

16%
of households

66%
of populated land

APPALACHIAN OHIO

In Appalachian Ohio, the percentages are significantly higher. 310,377 households are unable to obtain FCC minimum broadband speeds. These households represent 32% of all households in the region and 75% of populated land.



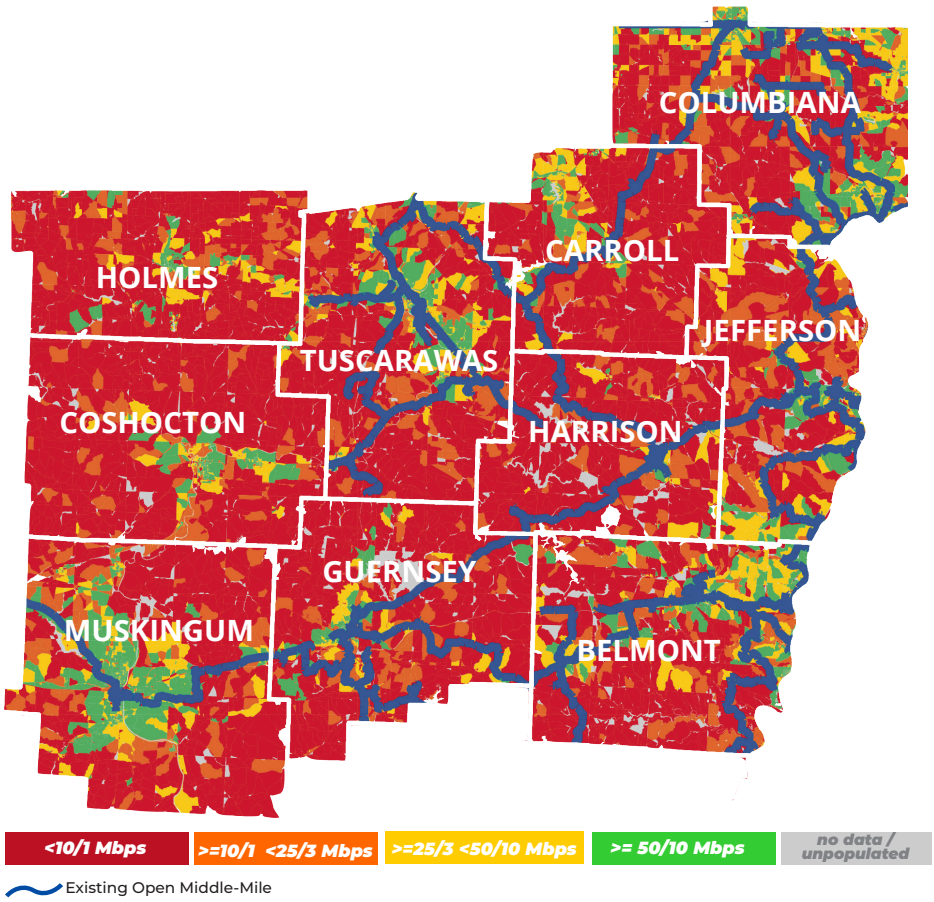
[4] The FCC has acknowledged that their coverage estimates are not accurate and has begun a campaign to improve its maps; however, it is unclear when their update maps will be published or whether the new mapping methodology will correctly capture the true extent of the problem.

[5] Microsoft arrived at this number by analyzing the download and upload speeds for security and feature updates distributed to individual users by its Windows Update service.

OMEGA DISTRICT

There are 106,434 unserved households in the ten county OMEGA district. This means that 38% of households are unable to obtain FCC minimum speeds of 25 Mbps down and 3 Mbps up. To give a sense of the geographic expanse involved, 81% of the populated land in the OMEGA district is unserved.

38%
of households unserved



county [6]	populated square mile	unserved square mile	percent unserved	households	unserved households	percent unserved
Belmont	513	376	73%	32,728	11,187	34%
Carroll*	388	337	87%	13,995	7,827	56%
Columbiana	524	348	67%	48,611	13,739	28%
Coshocton	550	501	91%	17,547	9,206	52%
Guernsey	502	443	88%	21,043	10,894	52%
Harrison*	379	356	94%	8,776	5,772	66%
Holmes	416	365	88%	16,581	12,177	73%
Jefferson	393	293	75%	33,289	12,503	38%
Muskingum	644	477	74%	42,134	10,139	24%
Tuscarawas*	556	439	79%	43,104	12,990	30%

Detailed, county-by-county broadband profiles can be found in Appendix 1

[6] Due to issues with LBRS/911 data, census household counts were used in Carroll, Harrison, and Tuscarawas counties

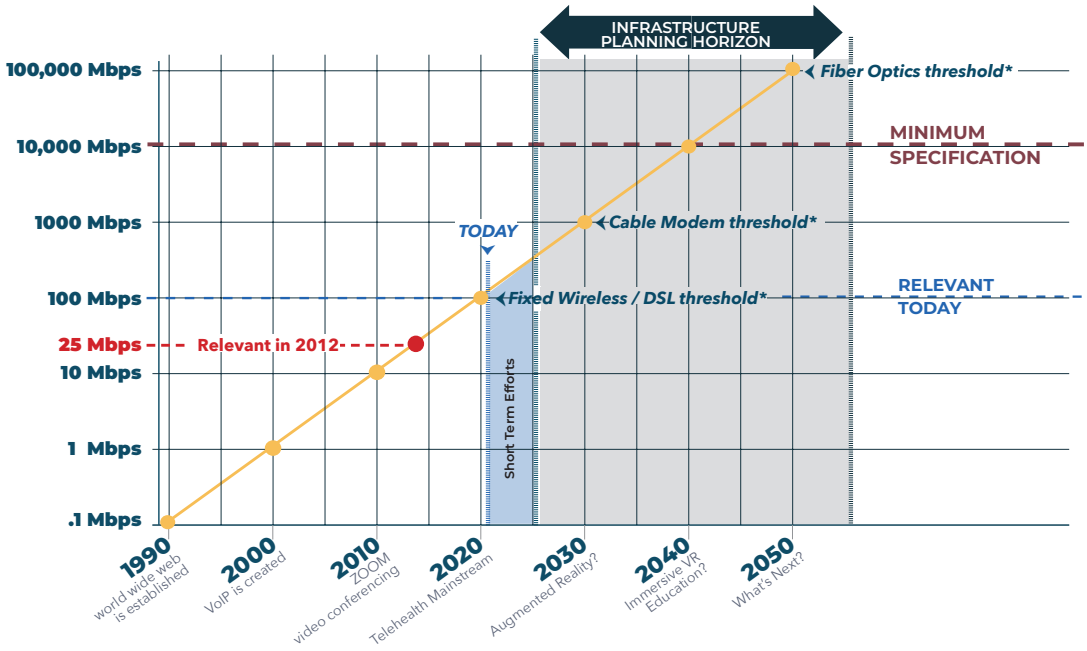
Recommended Solutions

BUILDING FOR THE FUTURE

For planning purposes, broadband deployments must be treated like infrastructure projects. Much like water, sewer, and roads, broadband networks should be designed to last decades rather than years. Networks installed today should utilize technologies, materials, and design specifications that will deliver 30-to-40-year longevity. Networks also should have sufficient capacity to meet not only current needs but also those of 2055.

Given the capital costs and construction requirements for broadband, we recommend a planning window that starts in 2025 and continues through 2055. This timeline assumes a supply chain lead time of approximately one year to obtain materials and electronics and a construction/deployment window of two years. Lead times may vary based on project size, market dynamics, and labor availability.

Since the web was invented in 1990, broadband demand has increased ten-fold every decade.



When home internet first became common, most households connected using landline modems that operated at 56 Kbps (0.056 Mbps). By 2000, speeds had increased to 1 Mbps. A decade later, a well-served household could expect 10 Mbps. The FCC's current 25/3 Mbps threshold was last relevant in 2012, when the average download speed reached 25 Mbps. Currently, someone living in a well-served area can expect at least 100 Mbps down/20 Mbps up.

With remote work and learning, telehealth, and virtual reality quickly becoming mainstream, it is not difficult to imagine the average speed reaching 1,000 Mbps (1 Gbps) ten years from now. In fact, many internet providers already offer 1 Gbps and 2 Gbps plans with business connections routinely operating at 10 Gbps. Some urban networks already provide 100 or even 400 Gbps connectivity.

CHOOSING THE RIGHT TECHNOLOGY

Currently, a variety of technologies are available to deliver broadband service. Each of these technologies has specific advantages and disadvantages; however, given a 30-year planning window, the most important criteria are speed and longevity. Barring future improvements, fiber optic is the only technology available today that can deliver speeds in excess of 100 Gbps. Most other technologies have a maximum speed of between 100 Mbps and 1,000 Mbps (1 Gbps).

Fixed Wireless

Fixed wireless offers relatively quick deployment times and lower initial costs compared to fiber; however, the technology uses line-of-sight transmission to reach homes and businesses. Given our region's rugged terrain, this can make the service inaccessible for customers who live in steep valleys with one or more ridges between their home or business and the provider's tower. As with the other services in this category, most fixed wireless services top out at 100 Mbps. Some manufacturers have begun deploying fixed wireless transceivers and advanced antenna arrays that can reach gigabit speeds, but these technologies remain limited to line-of-sight between the tower and end user. Despite the limitations, fixed wireless deployments do potentially provide a competitive overlay for the eventual fiber-to-the-home networks.

DSL

DSL theoretically tops out at around 100 Mbps, but those speeds are only achievable if landline telephone cabling is in good condition. Given that most of the copper cabling in our region is 2-3 decades beyond its expected lifespan, DSL providers will be hard pressed to meet even a 25 Mbps threshold.

Fiber to the Home

Fiber optic cabling is the only technology available today that is capable of meeting the 100 Gbps speed threshold predicted for 2055. In fact, 100 Gbps fiber networks already exist in some cities with 400 Gbps speeds on the way. Fiber does have significant up-front capital costs, but those costs are balanced by low ongoing maintenance and excellent longevity. Researchers have yet to discover an upper speed limit for fiber, meaning that a high-quality fiber installed today can support ever-increasing speeds simply by replacing the electronics on each end of that cable.

Cable Modem

Cable TV-based internet services have good download capacity, with many providers offering 1 Gbps and 2 Gbps packages; however, upload capacity can be a problem. Even the fastest cable download packages can struggle to exceed 10 Mbps upload. Thus, areas with existing cable infrastructure may meet current download demand, but the technology will increasingly show its limitations as video conferencing and virtual reality sessions become more common. For most Cable TV systems, a relatively inexpensive upgrade can address the current upload constraints.[7]

Satellite

Satellite services are capable of providing 100 Mbps, but they have limited expansion capacity. Also, the amount of time it takes for a data signal to reach a high orbit satellite and return to earth can cause poor performance for video conferencing and other services that depend on low latency. Emerging constellations of low earth orbit satellites such as Starlink solve the latency issues, but remain limited in overall capacity. Rugged terrain can also block access in many Appalachian Ohio locations.

[7] When deploying in new territories, many cable providers are moving to fiber optic instead of expanding their existing COAX/DOCSIS systems. It also is possible to perform a "high split" upgrade on older cable technology to improve upload capacity.

Facilitating Public/Private Partnerships

LEVERAGING ARPA FUNDS

Fiber-to-the-home currently represents the best long-term solution for our region; however, large scale fiber deployments can be multi-year projects with significant supply chain and workforce development lead times. For constituents who live and work in unserved communities, deploying fixed wireless by fiber-to-the-home providers can have a significant impact, not only by expanding coverage but also by creating a competitive overlay for future service offerings.

The American Rescue Plan Act (ARPA) specifically identifies broadband as an eligible infrastructure expense. Although local ARPA funding typically is not enough to complete a large fiber deployment, such funds can be used as an incentive to expand wireless coverage or as matching funds when applying for smaller fiber projects. At the state level, an additional $2 billion in ARPA funding is pending; however, it is unclear how much of this funding may be used for broadband.

LONG TERM CONSIDERATIONS

Using ARPA funds to facilitate fiber projects or to expand fixed wireless can be a good way to jump start broadband expansion. When developing such a proposal, it is important to consider the larger context. For example, areas served by an ARPA-funded program could be rendered ineligible for future subsidy from other agencies, either because an agency is unwilling to "overbuild" an existing solution or because the availability of at least some service in the project area could mark the entire area as served. Also, if a deployed technology does not age well, this could have long term ramifications.

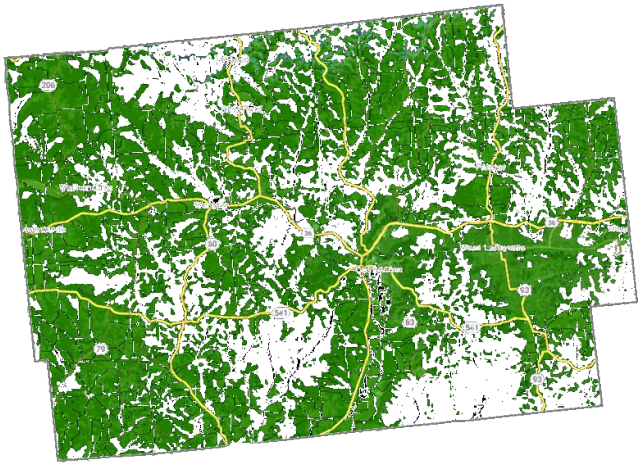
Ultimately, each project will have its own unique benefits and risks. A project appropriate for one county may not be viable in another.

PROJECT EXAMPLES

COSHOCTON COUNTY
Ohio TT Fixed Wireless Partnership

Coshocton County decided to commit $5 million of its ARPA funds to making fixed wireless available across much of the county. After issuing an RFP, Coshocton chose Ohio TT as its internet partner. Ohio TT has committed to building 11 new towers and adding transceivers to 10 existing towers.

Ultimately, Ohio TT expects to offer some level of internet service to up to 15,000 county residents. Along with quick relief to residents who currently have no broadband, this program also will place competitive pressure on fiber and cable providers in Coshocton County. With a viable wireless alternative available, wired providers will need to ensure their services perform well and are competitively priced if they wish to retain market share.



● proposed coverage area

CARROLL COUNTY
ARC POWER Grant Application

Carroll County chose to earmark some of its ARPA funds as match for an Appalachian Regional Commission POWER grant proposal that would bring fiber to four locations that would otherwise remain unserved. If approved, the $4 million project would install 86 miles of fiber to 384 homes and 53 businesses with Charter Communications as the internet service partner. ARC is expected to make their funding decision in Fall 2022.

funding source	amount
ARC POWER Grant	$1,999,999
Carroll County ARPA funds	$1,125,006
Charter Communications	$874,000
TOTAL	$3,999,005

EASTGATE Lake to River Regional Broadband Expansion

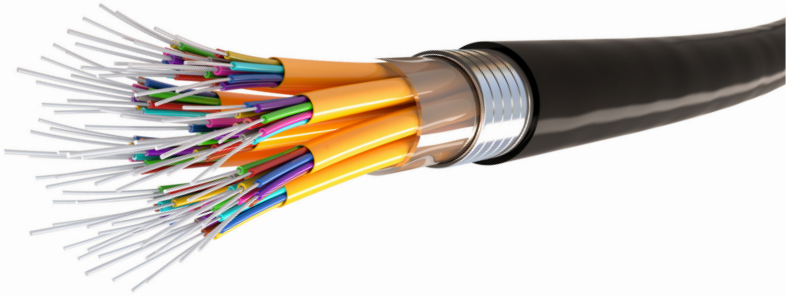
This project, proposed by the Eastgate Regional Commission, would install 100 miles of fiber middle mile along State Route 11, running from Lake Erie to the Ohio River. A portion of this project would run through Columbiana County.

Counties Covered	Project Cost
Ashtabula, Trumbull, Mahoning	$12,000,000
Ashtabula, Trumbull, Mahoning, Columbiana	$15,000,000

Fiber to the Home

DESIGN RECOMMENDATIONS

Fiber optic cable currently is one of the longest lasting solutions for broadband delivery. The cable itself can be expected to last upwards of 40 years, and its speed is limited only by the electronics attached at each end. As electronics improve, an existing fiber network can be repeatedly upgraded simply by replacing those electronics. This is significantly less expensive than replacing or upgrading other forms of cable infrastructure.



HIGH QUALITY : HIGH STRAND COUNT CABLE

All of the budget recommendations in this report's county broadband profiles assume a fiber network with enough capacity to remain useful in 2055. To build such a network, Reid Consulting Group recommends the use of armored, high strand count cables with:

- **A minimum of one dedicated fiber strand per household**
- **A minimum of 50% additional fiber strands to support population growth and future requirements**
- **Sufficient extra strands to support cellular tower expansion, 5G, and SmartGrid deployments**

These cables should be installed to USDA Rural Utility Services specifications.

AERIAL INSTALLATION [vs] UNDERGROUND

Burying fiber can avoid utility pole attachment fees and associated make-ready costs required for aerial installations. Such savings in pole-related costs must be weighed against the total cost of going underground. Costs can vary widely based on burial depth, the presence or absence of other underground infrastructure, the need to bore beneath roads, how much rock is encountered, and whether conduit is used versus direct burial. Some parts of the OMEGA region may lend themselves well to underground installations while others may be cost prohibitive. For areas with a moderate incidence of surface rock, it is estimated that burying fiber in conduit (the preferred approach for long term durability) would cost between $90,000 to $140,000 per mile in total. In areas with high incidence of surface rock, buried installations become cost prohibitive for last-mile projects.

MIDDLE MILE [vs] LAST MILE

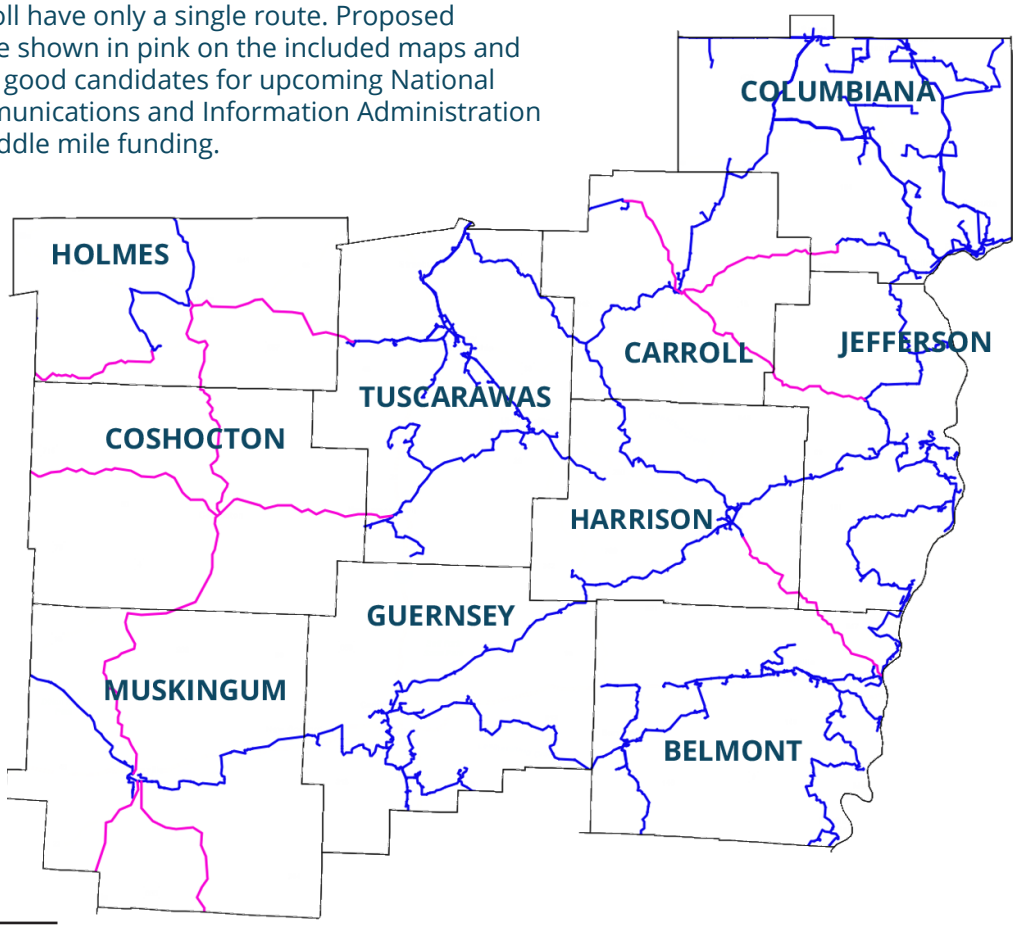
A fiber optic network can be simplified into two basic categories: middle mile and last mile. Middle mile fiber bridges the gap between an internet provider's existing network and the communities that provider wishes to serve. Last mile fiber branches off from middle mile to reach individual homes, businesses, and communities. While both last mile and middle mile are necessary to deliver broadband services, it has become clear that middle mile alone does not reduce costs sufficiently to enable last mile connectivity. The middle mile supports connections to large customers such as K-12 schools, health care facilities and cell towers. Yet additional subsidy is required to make the business case work for last mile projects, particularly in rural areas.

county	length (miles)	estimated cost[9]
Belmont	9.14	$913,592
Carroll	36.84	$3,683,876
Columbiana	3.11	$311,197
Coshocton	58.32	$5,831,799
Guernsey	0.00	$0
Harrison	8.41	$841,424
Holmes	37.49	$3,749,292
Jefferson	12.51	$1,251,212
Muskingum	48.66	$4,866,100
Tuscarawas	4.00	$399,598

In the individual county profiles, we identify existing "open" last mile and middle mile fiber[8] upon which any provider can lease capacity. The profiles also identify potential middle mile expansion routes. For example, Coshocton and Holmes counties currently do not have any open middle mile, while Muskingum and Carroll have only a single route. Proposed routes are shown in pink on the included maps and would be good candidates for upcoming National Telecommunications and Information Administration (NTIA) middle mile funding.

PROPOSED MIDDLE MILE FIBER

Proposed Middle-Mile
Existing Open Middle-Mile



[8] Individual providers sometimes build "closed" middle mile that is used exclusively for their own purposes. Such routes typically are considered trade secrets and are not made available to the public.

[9] Fiber costs for middle mile have been estimated at $100,000 to accommodate the fact that middle mile fiber generally requires significantly more fiber strands than last mile.

Fiber to the Home

BUDGET CONSIDERATIONS

Cost per Mile

Building a fiber network involves three basic expenses: preparing utility corridors to support fiber optic cables (make-ready), installing fiber along those corridors, whether aerial or underground (cost-to-pass), and connecting individual homes and businesses to the new fiber (cost-to-serve).

MAKE READY

As part of any broadband deployment, electric utilities must modify or replace at least some of their poles to accommodate increased cable weight, wind and ice loads, and limited clearance between power lines and aerial communications cabling. These costs vary based on electric provider and the kind of cable being installed. A heavier cable may require more make-ready than a lighter one.

Make ready costs can vary significantly from one utility provider to another. In this report, we assume a make ready of $41,000 per mile to accommodate high strand count cables that require strand-and-lash support. This figure is approximately what it would cost to build an independent communications pole network as a last resort, should ISPs and local utilities be unable to reach an acceptable agreement.

	LOW	EXPECTED	HIGH
Make Ready	$32,000 [10]	$41,000	$60,000
Cost to Pass	$32,000	$40,000 [11]	$40,000
TOTAL	$64,000	$81,000	$100,000

COST TO PASS

Fiber optic comes in a wide range of styles, from lightweight household drop lines to high-capacity, armored cable sheaths that bundle hundreds of fiber strands together to carry massive amounts of data. Household drop fiber is inexpensive and puts less strain on utility poles, but it has limited capacity. Broadband speeds have increased 10-fold every decade since 1990. To ensure that a fiber network built today remains useful 40 years from now, this report assumes the use of high strand-count cables.

While a provider could deliver rural broadband that meets current state and federal speed requirements using only low strand-count household drop cable, such a network would offer little flexibility to expand services or increase speeds as demand rises. Material and labor costs for high strand-count fiber are estimated at $40,000 per mile.

COST TO SERVE

Internet providers typically absorb the cost of running a drop cable from an individual home or business to the nearest utility pole. As such, the cost-to-serve is not included in budget estimates.

[10] Some industry groups estimate make-ready as low as $5,000-10,000 per mile. Such estimates generally either assume the pole owners will make up the difference or that low strand count drop cables are being deployed.

[11] Given current inflation rates, some providers are including material cost increases of up to 15% per year in their budget projections.

COUNTY-WIDE COST AND ESTIMATED SUBSIDY

Estimating Distance

Last mile broadband infrastructure typically follows existing roads. Total project cost can be estimated by multiplying make-ready and cost-to-pass by the number of state, county, municipal, township, and unincorporated road miles in unserved census blocks.

Estimating Cost and Subsidy

For each county, Reid Consulting Group calculated a total cost to reach all unserved households by multiplying total fiber cost ($81,000/mile) by the total number of unserved state, county, municipal, and township road miles and adding a per-household electronics cost. Reid Consulting Group then estimated how much of that cost an internet provider may be willing to cover. Based on population density, this amount falls between $1,000 and $2,500 per household.

The estimated subsidy, also known as the funding gap, is the total projected cost per county minus the expected internet provider investment.

The budget numbers in this report are intentionally conservative. Fiber costs include not only construction but also engineering, permitting, easements, materials, and testing. The county-wide figures also include areas that may be served via RDOF and ORBEG. If providers fulfill all of their commitments through RDOF and ORBEG, then total county costs will be significantly lower.

MAKE READY

Below is a table that summarizes the costs and required subsidy to deploy last mile fiber[12] for each county in the OMEGA region. As noted above, these costs include all unserved areas, including those that may be served via RDOF, ORBEG, or other subsidy programs.

county	fiber miles needed	total cost	estimated ISP investment	required subsidy
Belmont	876	$79,049,695	$19,241,640	$59,808,055
Carroll	695	$61,934,843	$13,462,440	$48,472,403
Columbiana	759	$71,360,761	$23,631,080	$47,729,681
Coshocton	899	$79,463,869	$15,834,320	$63,629,549
Guernsey	975	$86,785,065	$18,737,680	$68,047,385
Harrison	695	$60,444,358	$9,927,840	$50,516,518
Holmes	784	$74,445,479	$23,136,300	$51,309,179
Jefferson	673	$63,508,448	$21,505,160	$42,003,288
Muskingum	910	$81,041,586	$17,439,080	$63,602,406
Tuscarawas	932	$84,848,446	$22,342,800	$62,505,646
OMEGA district	8,198	$742,882,449	$185,258,340	$557,624,109

[12] In areas with very low population density, fixed wireless or a satellite service like Starlink may be the only financially viable option to serve those locations

Appendixes