Broadband Infrastructure Needs and Recommendations

Metropolitan Kansas City

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FEDERAL RESERVE BANK *of* KANSAS CITY

KC RISING

MARC
MID-AMERICA REGIONAL COUNCIL

BROADBAND INFRASTRUCTURE NEEDS AND RECOMMENDATIONS METROPOLITAN KANSAS CITY

BACKGROUND

Over the next several years, the states of Missouri and Kansas will receive billions of dollars from the federal government to expand broadband access and address digital equity. Over the past 18 months, the Mid-America Regional Council (MARC), the Federal Reserve Bank of Kansas City and KC Rising (an initiative of the Civic Council of Greater Kansas City) launched a process to identify broadband infrastructure investments that could support increased access and adoption for residents throughout the nine-county Kansas City metropolitan region (Cass, Clay, Jackson, Platte and Ray counties in Missouri; and Johnson, Leavenworth, Miami and Wyandotte counties in Kansas).

This report focuses on broadband infrastructure in the metro area and recommendations to the two states to address specific needs. Earlier in 2023, MARC, the Federal Reserve Bank of Kansas City and KC Rising produced a report on digital equity needs https://www.marc.org/economy/broadband-and-digital-equity. The work to prepare both reports was supported by KC Rising, the Regional KC COVID-19 Response and Recovery Fund and the Mid-America Regional Council.

MARC engaged Black & Veatch to support the broadband infrastructure analysis with resources provided by the COVID-19 KC Regional Response and Recovery Fund and the Civic Council of Greater Kansas City. The purpose of the analysis was to review available data and identify priority areas where federal BEAD and other resources could improve broadband infrastructure that enables households, anchor institutions and businesses to engage in meaningful use – with adequate speeds, reliability, costs. The scope of the Black & Veatch work included steps to:

- ✓ Identify unserved and underserved portions of the Kansas City region without adequate fiber and wireless networks.
- ✓ Identify current internet service providers by county, approximate service areas, speed test data, and advertised costs.
- ✓ Recommend project area investments, specifically related to future grant opportunities.
- ✓ Provide MARC aggregated data and maps for future action.

A group of community advisors were invited to assist MARC in review of information with Black & Veatch personnel to outline the approach for mapping and analysis of the map data and the identification of priority areas for funding support. They included:

Bob Bennett, Parkville MO
Julie Brewer, UCS of Johnson Co
Dustin Burns, McCown Gordon
William Crumpler, KC Digital Divide
Aaron Deacon, KC Digital Drive
Tom Esselman, PC's for People
Bryan Gash, Mid-Continent Public Library
Sheri Gonzales, University of Kansas
Donnell Hammond, Kaufman Foundation

Jeremy Hegle, Federal Reserve Bank of KC
Dustin Loup, Marconi Society
Janet McRae, Miami County
Lai Yi Ohlsen, M-Labs
Randy Riggs, KC Rising
William Wells, aSTEAM Village
George White, GLMV Architecture Inc.
Pedro Zamora, Hispanic EDC

The work continued into the summer of 2023 as the federal agencies and states made additional information available to support broadband infrastructure planning work.

ADEQUATE RELIABLE INTERNET SERVICE

The analysis conducted by Black & Veatch, by MARC Research Services and Community Development staff and consultant Doug Johnson used the National Telecommunications and Information Administration (NTIA) definition of served, underserved and unserved areas for reliable internet service. The consultants and MARC analyzed services (not including satellite or unregulated service) at the census block group level. The definitions include:

- ➢ Served - Areas that have access to reliable internet speeds greater than 100 Mbps download and 20 Mbps upload (100/20)
- ➢ Underserved - Areas lacking reliable access to internet speeds of at least 100 Mbps downstream and 20 Mbps upstream, (100/20) and greater than 25 Mbps downstream/3 Mbps upstream (25/3)
- ➢ Unserved - Areas lacking reliable internet speeds of at least 25 Mbps downstream and 3 Mbps upstream, (25/3)

The FCC definition uses 25 Mbps download and 3 Mbps upload as its minimum requirement for broadband.

Mapping Internet Speeds - The federal government is supporting all states to improve broadband infrastructure across the nation, including the states of Missouri and Kansas. Funds have been authorized by Congress to support infrastructure and to address digital equity.

The Federal Communications Commission (FCC) and National Telecommunications and Information Administration (NTIA) have produced map resources to enable public and private stakeholders to identify those areas that lack adequate infrastructure as measured by reliability and speed. Adequate speed is defined as service of at least 100 Mbps download and 20 Mbps upload. Unserved areas are those with 25/3 Mbps or less.

> The gap between those who have access to broadband and those who do not is referred to as the **digital divide**. The term originated at the National Telecommunications and Information Administration (NTIA) in the mid-1990s "to express the gap between 'haves' and 'have-nots' in terms of access to computers." The term has evolved to include other aspects of technology access, especially broadband availability. Despite billions of federal dollars directed toward broadband

deployment, discrepancies in access to broadband remain. The continuing lack of broadband access in some areas can be attributed to several factors, including terrain, population density, demography, and market characteristics. Rural and tribal areas are most affected, but urban areas can also be. (Congressional Research Service, *The Persistent Digital Divide: Selected Broadband Deployment Issues and Policy Considerations,* April 18, 2023)

An important reason there is a digital divide is that not every household has equal access to a fast and reliable internet connection. There are many factors in addition to the presence of broadband infrastructure – economic resources, appropriate devices, and computer training – but without a broadband connection to the internet the digital divide will never be closed. This issue has taken on greater importance recently because of the federal dollars that have been earmarked for the improvement of internet infrastructure in areas where it is currently nonexistent or substandard.

One of the primary goals of this report is to provide jurisdictions and internet providers with the documentation necessary to support applications for infrastructure improvement funds. Unfortunately, this task is more difficult than it might initially seem primarily because nearly all internet service providers (ISPs) are privately owned and are reluctant for business reasons to be very transparent about the location and capabilities of their network infrastructure. As a result, determining exactly where additional resources are needed with respect to internet infrastructure is an imprecise and challenging undertaking.

Data Limitations - None of the data that is publicly available is definitive enough to clearly distinguish between areas where broadband internet service is reasonably available and adequate and where it is not. The data provides important clues to that answer, but ultimately a fair amount of interpretation is required and thus there is considerable debate among those seeking greater services and those providing existing services.

FCC 477 Forms - All broadband internet providers are required to file forms with the Federal Communications Commission (FCC) reporting the census blocks in which they offer service, along with a variety of descriptive characteristics of that service. This is a very rich data set. The problem is that this is self-reported data that tends to be biased in ways that exaggerate both the amount of geographic coverage and the speed of the service that is being provided.

According to the FCC, the 477 Form for each provider lists the Census blocks "in which they can or do offer service to at least **one** location." This means that a Census block could be listed as covered by a broadband service if the Internet Service Provider (ISP) "can" provide such service (regardless of whether they actually provide service) and the entire Census block can be listed if only one household is served regardless of whether the provider is willing or able to serve other households in the same block.

In addition, the key attribute with respect to the quality of service is the maximum advertised speed of both upload and download data transmission. While useful to a degree, this number is more theoretical than actual. It is roughly equivalent to upload and download speeds under ideal circumstances that rarely exist in real life. The reality is that every ISP is providing a connection to the internet that is shared by other users. The internet traffic caused by multiple users trying to send or receive data at the same time causes network contention which slows down transmission speeds

for everyone. This is analogous to a highway with a speed limit of 65 miles per hour (maximum advertised speed) but due to traffic congestion the actual speed is only 40 miles per hour (internet speed test result).

The distinction revolves around network bandwidth which is the total carrying capacity at a particular speed. Unfortunately, this information is not readily available and probably varies at different locations on the network. The ISP's maximum advertised speed is an indicator of both speed and bandwidth but not guaranteed. An individual user will never experience speeds greater than the maximum advertised speed and will likely experience speeds that are significantly lower.

Despite its limitations, the 477 data is still useful in some respects. In particular, the data shows the number and geographic scope of ISPs that are using technology that is at least capable of providing broadband speeds versus those that are using technology that is inherently limited.

Ookla Speed Test Results - Ookla is a company that hosts a website where any user can test the speed of their internet service, both upload and download. The test can be repeated as often as the user wants, which means it is useful for testing various network settings and hardware options. The conclusions in this report are based on tens of thousands of Ookla tests over a one-year period for the Kansas City metro area.

On the surface, this data is the most "on point" indicator of where there is good broadband service. However, there are several weaknesses in this type of test score data, and consequently, the FCC has indicated that it will ignore, or at least downplay, speed test data as a basis for decision-making in federal funding awards.

Ookla tests, for example, do not indicate the type of subscriber plan used by the household conducting the test. It is possible that the user could have gotten much better service (and thus a better Ookla result) if they had been willing to pay more for a higher speed plan. In fact, this is a likely outcome in areas where limited income is an issue. In addition, if the test is done with a wireless device rather than a device with a wired network connection, then the speed limitations of Wi-Fi technology, the quality of the hardware being used, and the location of the device relative to the Wi-Fi access point can all influence the result. An Ookla test done with poor Wi-Fi equipment from a remote corner of a residence can yield a result that is far worse than the actual level of service being provided by the ISP.

The bottom line is that a bad Ookla result doesn't necessarily mean that good service isn't available. In fact, Ookla speed tests are likely to somewhat understate the actual level of internet service available. Still, there is value in this data because the average speeds from a reasonably large number of tests are a pretty good indicator of what typical internet service is like in "real world" conditions. In addition, the presence or absence of high Ookla test results is a useful clue to the quality and extent of broadband coverage. Even in low-income neighborhoods, some households are likely to have opted for the best service available even if the average household has a lower-cost subscriber plan. Thus, good scores scattered throughout an area is an indicator that good service is available even if many households opt for slower plans, and a complete absence of good Ookla scores is an indicator that good options do not exist regardless of what ISPs say they offer.

Black & Veatch Broadband Coverage Analysis - MARC engaged the consulting firm of Black & Veatch to highlight the areas in the region that have the poorest broadband service and the greatest potential gain from broadband infrastructure investments. The purpose of their analysis was to review available data and identify priority areas where federal BEAD and other resources could improve broadband service levels, including adequate speed, reliability, and cost.

Although Black & Veatch examined a variety of data sources, their analysis leaned heavily on Ookla speed test results. They aggregated results by Census block group and categorized the percentage of households that were served, underserved and unserved into low, medium, and high categories. This was done for both upload and download speeds and the results were symbolized with a bi-variate approach using both color and intensity to indicate the results. For example, in a map showing households that met the FCC's served definition on page 8, darker purple hues indicated higher proportions of acceptable upload speeds and darker blues indicated higher proportions of acceptable download speeds. Dark purples indicated areas with acceptable speeds for both.

The advantage of this approach is that the resulting maps give an easy-to-understand summary of where broadband speeds are good and where they need improvement. The bi-variate approach includes both upload and download speeds in a single map view. The use of Ookla speed test data means that the results indicate speeds being realized in real-world conditions.

There are, however, several caveats that go along with this data source. To begin with, the reliance on Ookla test scores means that the results share the weaknesses of that source including the likelihood that the scores underestimate the actual service speeds that ISP are providing. Secondly, the process of categorizing a block group into low, medium, and high categories means that a considerable amount of detail is lost. The study does not specify, for example, the percentages that correspond to low, medium, and high. That means that an area that scores poorly might have good service available, but it is not widely used, or it might mean that good service is not available and infrastructure improvements are badly needed.

FCC Funding and Service Status Maps - This is the latest product from the FCC and the State of Missouri showing broadband service coverage and some associated data. It has been made available in "view only" mode on a county-by-county basis for the State of Missouri. The areas on the map which are shaded a dark green are considered by the FCC to be fully served to the 100/20 broadband standard. In the remaining areas, each household is identified with a colored dot that indicates whether it is served, underserved, or unserved, and whether funding has been allocated for infrastructure improvements.

These are useful maps, but their use as an objective data source is subject to some of the same concerns as the 477 maps. Namely, it is self-reported data from the ISPs and thus the degree of coverage may be somewhat exaggerated. In addition, the data that is publicly available does not include information on which areas are served by which providers, what technology is used to provide coverage, or what speeds of internet service are being provided. Finally, the limited access which has been granted to the underlying data and the fact that the State of Kansas has not released similar maps restricts the ultimate usefulness of this data source for the purposes of this study.
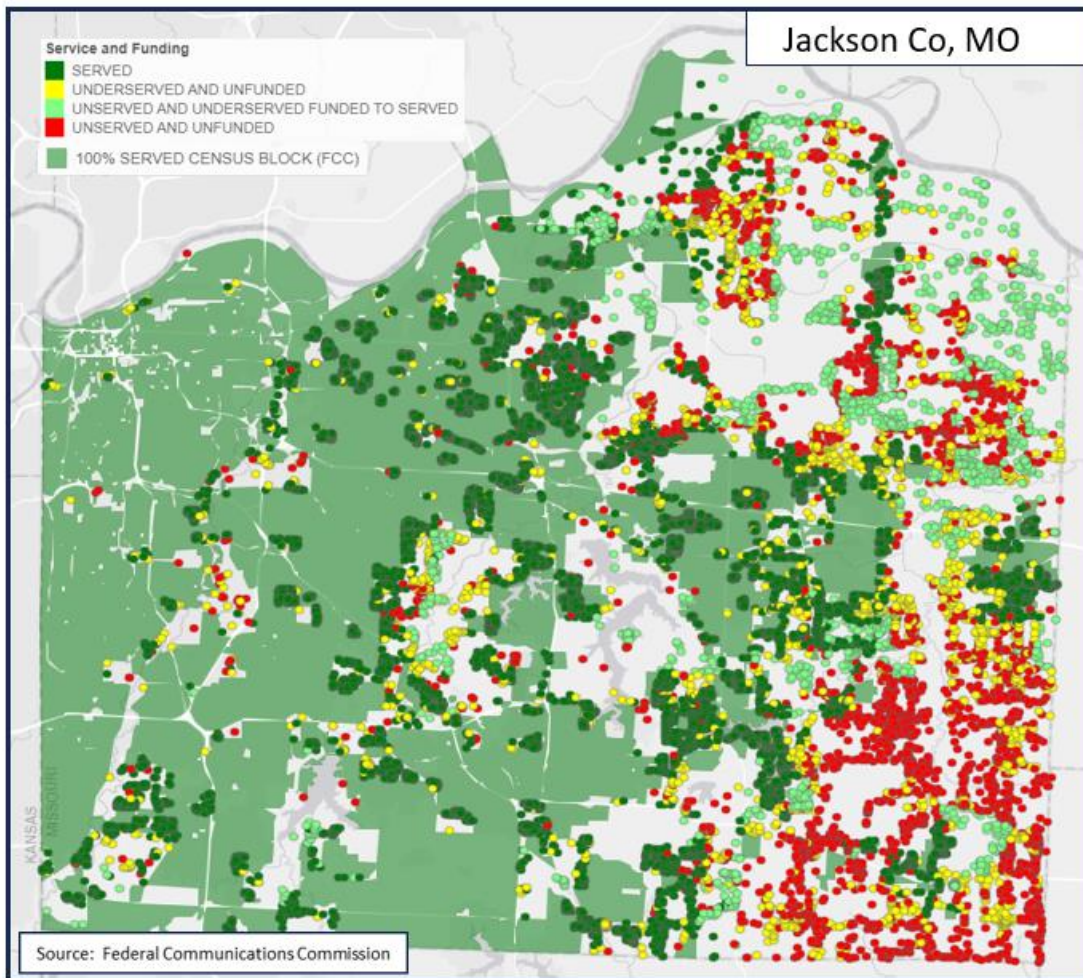
Map above is an example of FCC and Missouri Broadband Office maps.

Regional Patterns

Although a full understanding of the quality of internet service requires a very localized look at the data, some interesting conclusions can be drawn from maps drawn at a regional scale. For example, the two maps on page 8 are from the Black & Veatch analysis. They show the probability of areas being either "unserved" or "underserved" according to the NTIA definitions. The darker the color, the more likely an area is to be unserved or underserved. Although not perfect, these maps are a reasonable indicator of general internet quality. What is readily apparent is that the most urban neighborhoods in the Kansas City metropolitan area have better service than rural areas in the metro area or in the two states.

Unserved Upload and Download Speeds in MARC Region
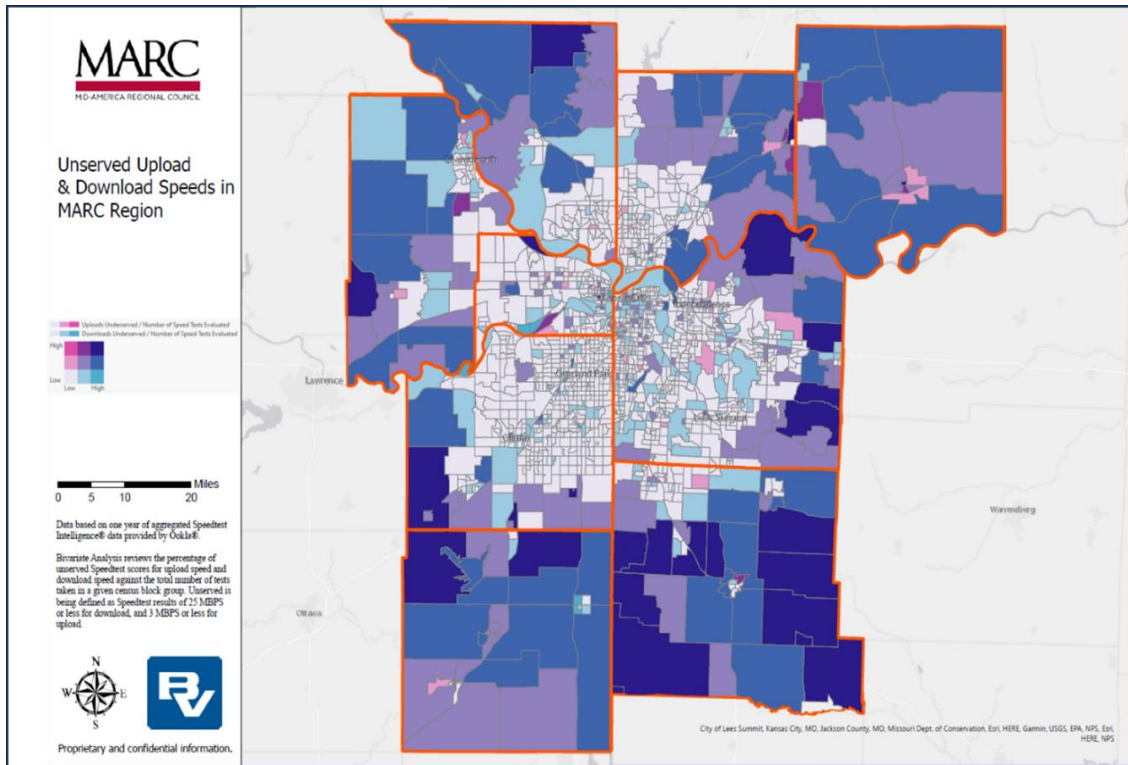
Underserved Upload and Download Speeds in MARC Region
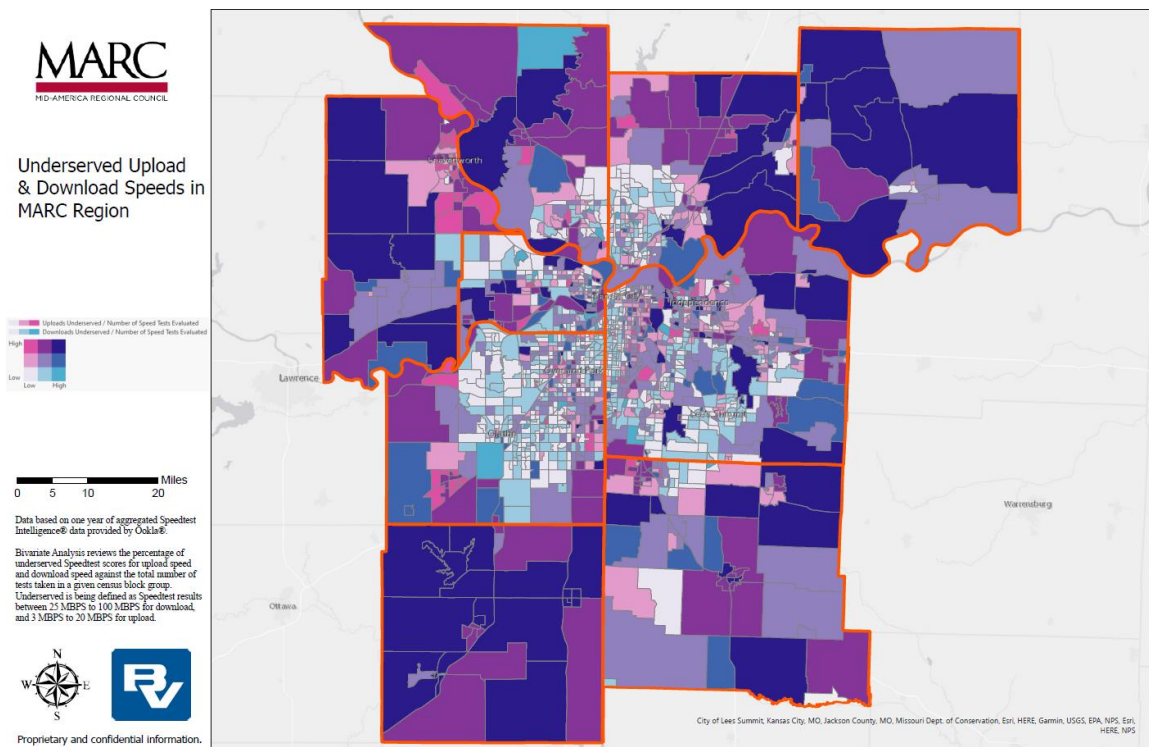
This is not a particularly surprising result given that internet service is a product provided by privately owned companies operating with the goal of being as profitable as possible. The areas that are densely developed offer the potential for much more revenue per unit of infrastructure and thus have always been a higher priority for most ISPs.

The map below shows maximum advertised consumer download speed from the FCC's 477 data (aggregated by Census block groups) overlaid with dots that represent the average Ookla download results for those block groups with speeds below 60 megabits per second (Mbps). The striking aspect of this map is that the vast majority of the region is shaded in dark green which indicates that at least one ISP is claiming network speeds over 400 Mbps while at the same time there are numerous dots indicating that average test speeds are far below those levels. This is the disconnect between what ISPs claim to provide and what actual consumers are experiencing.

Maximum Advertised Speed vs. Average Ookla Download Speeds
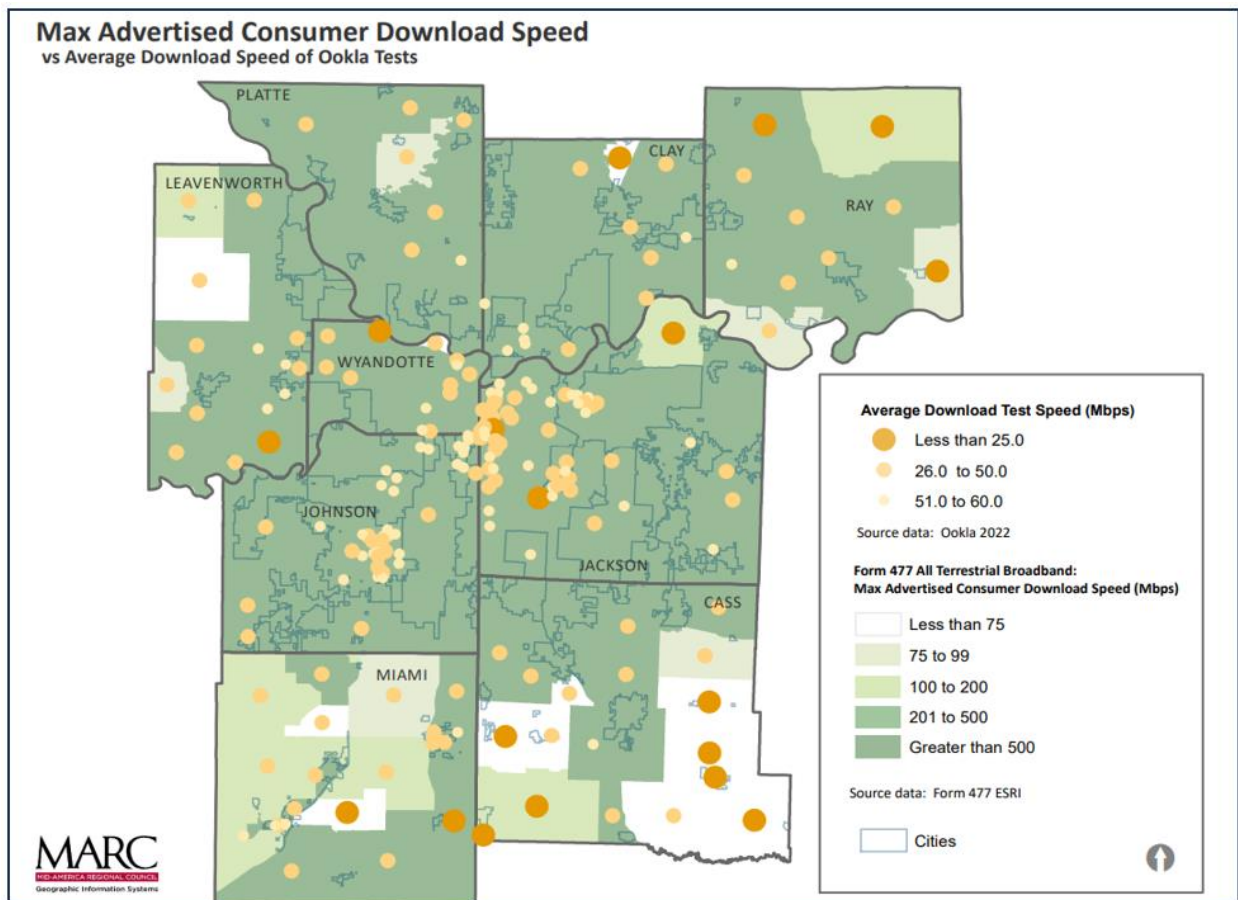
The above map also illustrates the urban/rural split described above. The peripheral areas of Ray, Cass, Miami and Leavenworth counties are shown in shades that indicate that even the optimistic 477 data doesn't claim that these areas are well served.

The map below shows the average minimum broadband price per Census block group (excluding satellite providers). The most obvious conclusion supported by this map is that rural areas pay more for internet service than urbanized areas despite the fact that the quality of their service is notably worse.

Average Minimum Broadband Price
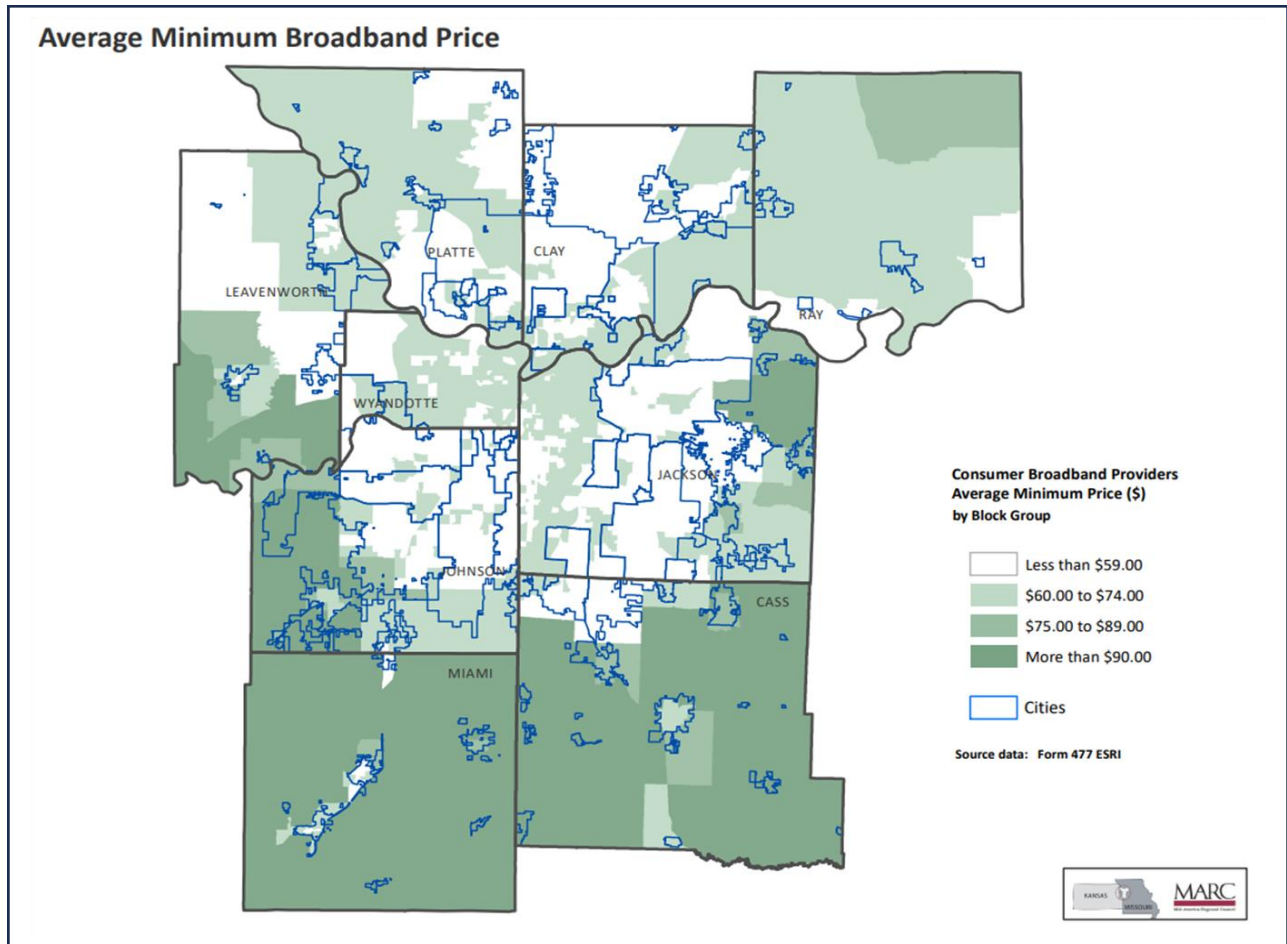
A second conclusion is that a substantial number of urban core neighborhoods pay somewhat more than suburban neighborhoods. In particular, the northeast and east side neighborhoods in Kansas City, Missouri, and the older neighborhoods in the eastern and central portions of Kansas City, Kansas, seem to fall into this pattern. The density of households and the layout of the neighborhoods are comparable to newer suburban areas such as those in northeast Johnson County so household income (i.e., market potential for ISP providers) appears to be the distinguishing factor.

County by County Patterns

These same themes can be understood in greater detail by focusing on each county and digging a little deeper into the nuances of the data. For each county, three sample locations are examined that illustrate the characteristics of internet service at a very local level.

Cass County - The availability of internet services in Cass County is a perfect example of the dichotomy that exists between moderately dense and moderately affluent suburban communities on the one hand and much less dense rural areas on the other. The suburban areas are dense enough with middle to upper income households to attract service from at least one or two major internet service providers (ISPs). The rural areas, in contrast, make do with an assortment of much smaller ISPs that use technology with much more limited range and speed.
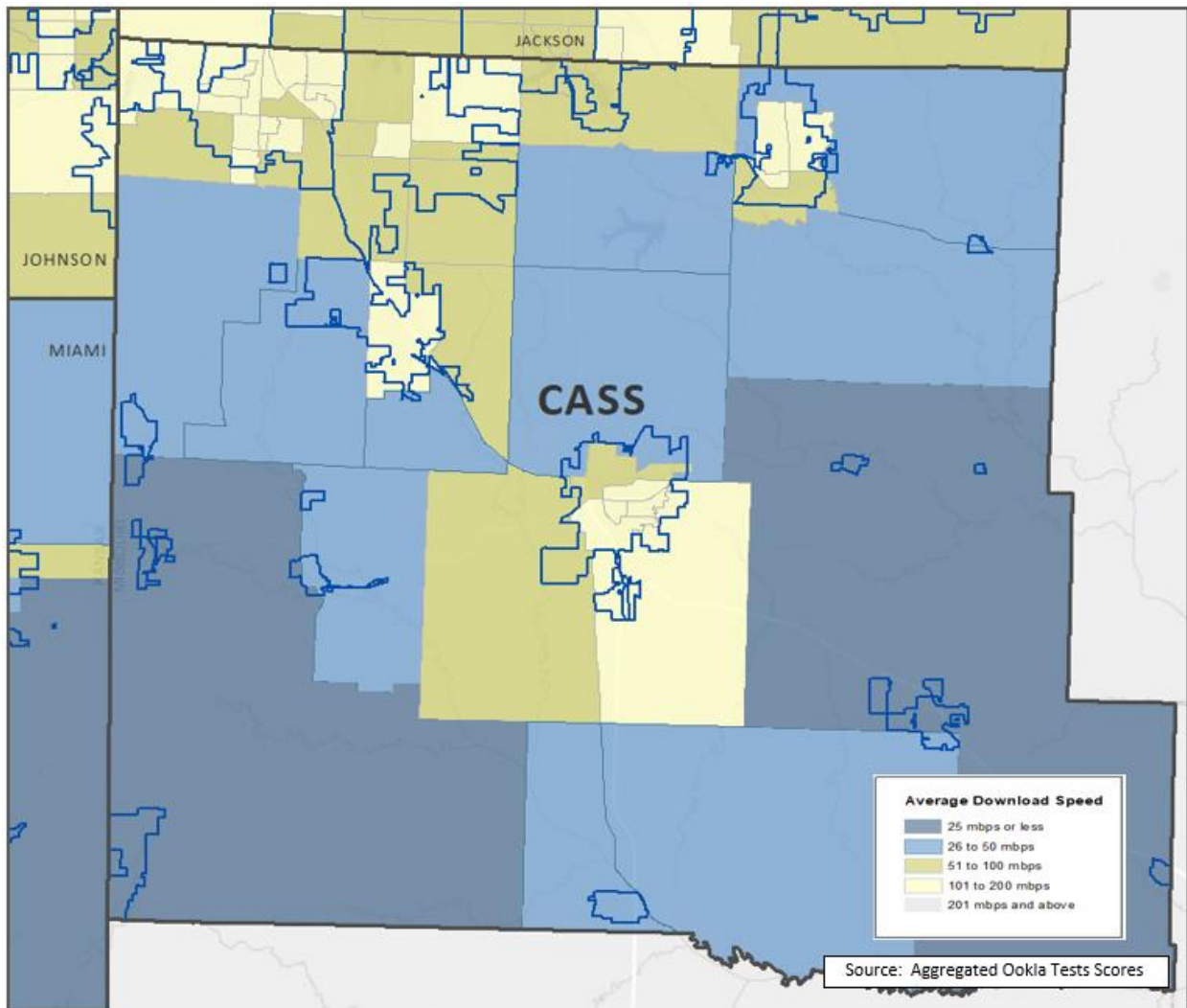
Take, for example, the residential neighborhood in Belton south of North Avenue and west of Cedar Street (represented by Census block group #29037061300). Five different companies are listed by the FCC as providing internet service to this area, including one that claims to provide

fiber-based service to the home. The maximum advertised download speed is over 900 Mbps (megabits per second) and the maximum advertised upload speed is 35 Mbps.

Not all of the ISPs operating in this neighborhood, however, are of equal quality. The median advertised download speed, for example, is just 18 Mbps and the median upload speed is just 10 Mbps. Actual internet performance as indicated by Ookla test scores suggest that many households are using higher quality ISPs. The maximum download result was over 900 Mbps and the mean download speed was over 110 Mbps. The actual distribution of Ookla test results show a fairly random distribution of good, average and poor scores. This suggests that relatively high-quality internet service is available throughout the Census block group for those households that are willing to pay for higher speed, more expensive subscriber services.

This same pattern holds for virtually all the surrounding block groups in Belton, Raymore and Loch Lloyd. There are several providers, which may have the result of lower broadband prices for this area (an average of $58 per month) and the distribution of Ookla scores indicates that reasonably fast internet service can be obtained if desired.
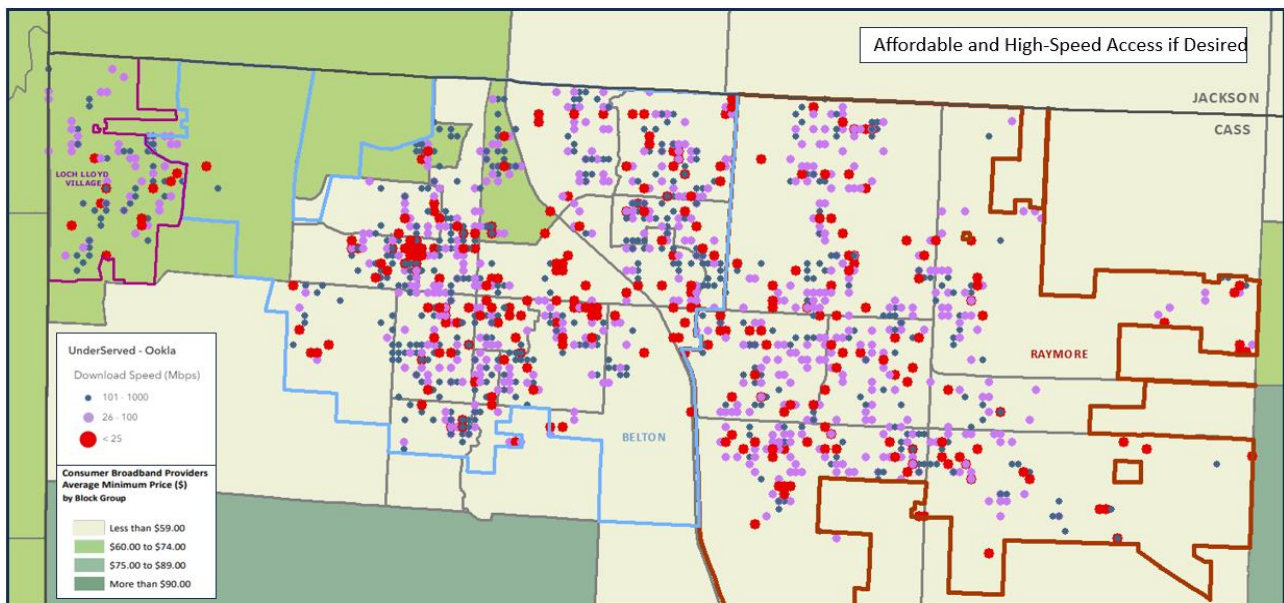
In contrast, the southwestern corner of the county (near the unincorporated communities of Main City and Everett) has internet service that is of much lower speeds and quality. This area (represented by Census block group #29037061100) is much larger geographically but contains a similar number of households and a similar population. There are actually more ISPs in this area (9),

but none can provide fiber to the home and service speeds are much slower. The maximum advertised download speed is 100 Mbps and the median advertised speed is 25 Mbps.

According to the FCC Funding and Service Status map, the vast majority of households in this area are "unserved and unfunded" or "underserved and unfunded". This means that not only is the area poorly served, but there are also no funds currently allocated to projects that would improve internet infrastructure in this area. The best option for most households is listed as satellite service from ViaSat.
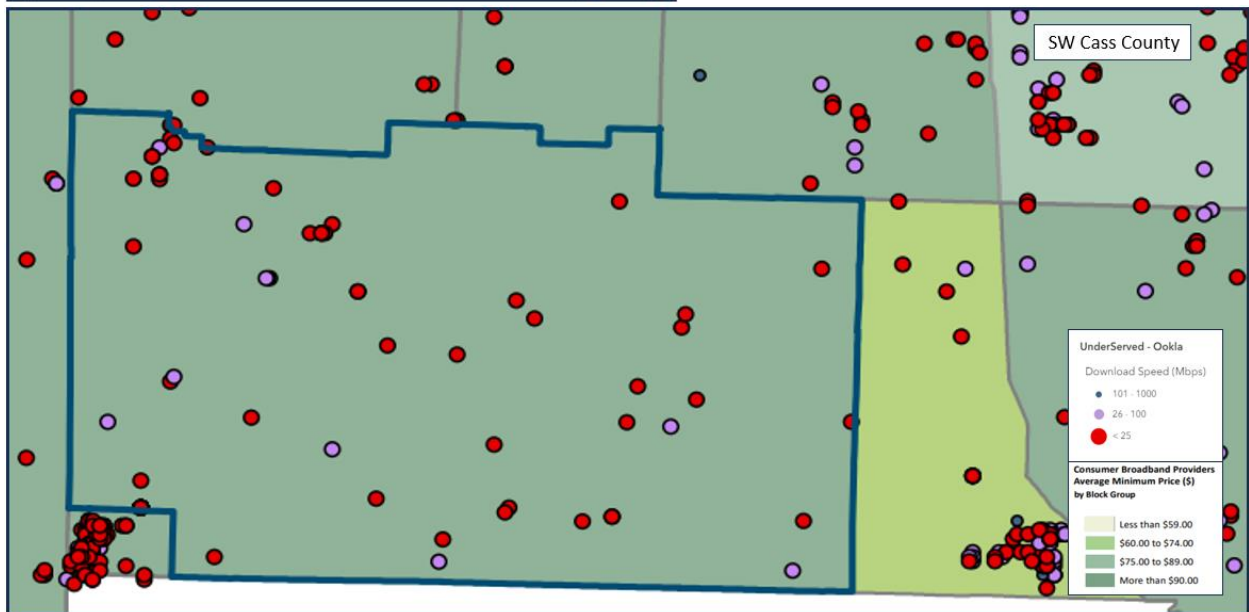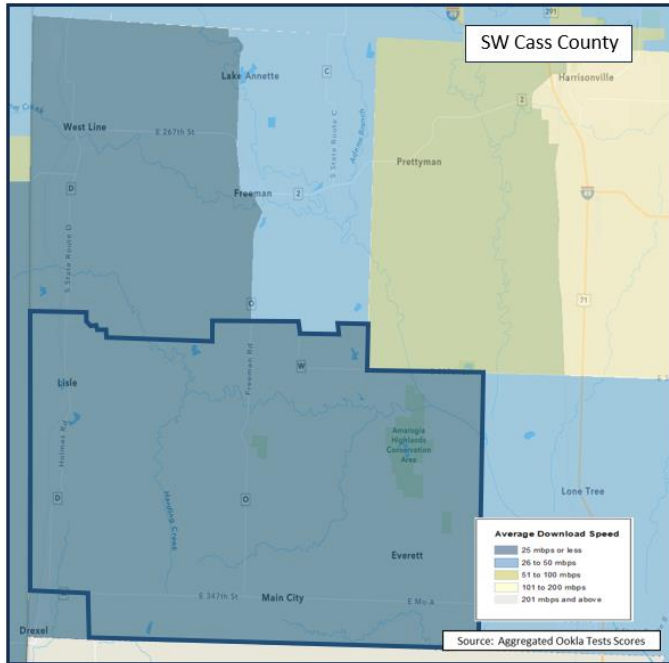
The difficulty in providing internet service to this area is illustrated by the Ookla test data. The maximum download speed was 102 Mbps and the mean download speed was just 22 Mbps. Since this area is less densely populated, there are fewer Ookla test scores to examine, but the roughly 20 tests in our sample data set are nearly evenly divided between what the FCC and the NTIA would classify as "unserved" – less than 25 Mbps download – and what the NTIA would classify as "underserved" – between 25 and 100 Mbps. The difference is also underscored by the average price

that households pay ($104 per month) for service that is considerably more than what is available in the suburban communities.

This same pattern is repeated along both the southern and eastern borders of Cass County. Providers with less sophisticated infrastructure do provide internet services but at slow speeds. Ookla test scores throughout this area are skewed toward the unserved and underserved speed ranges and costs are relatively high.
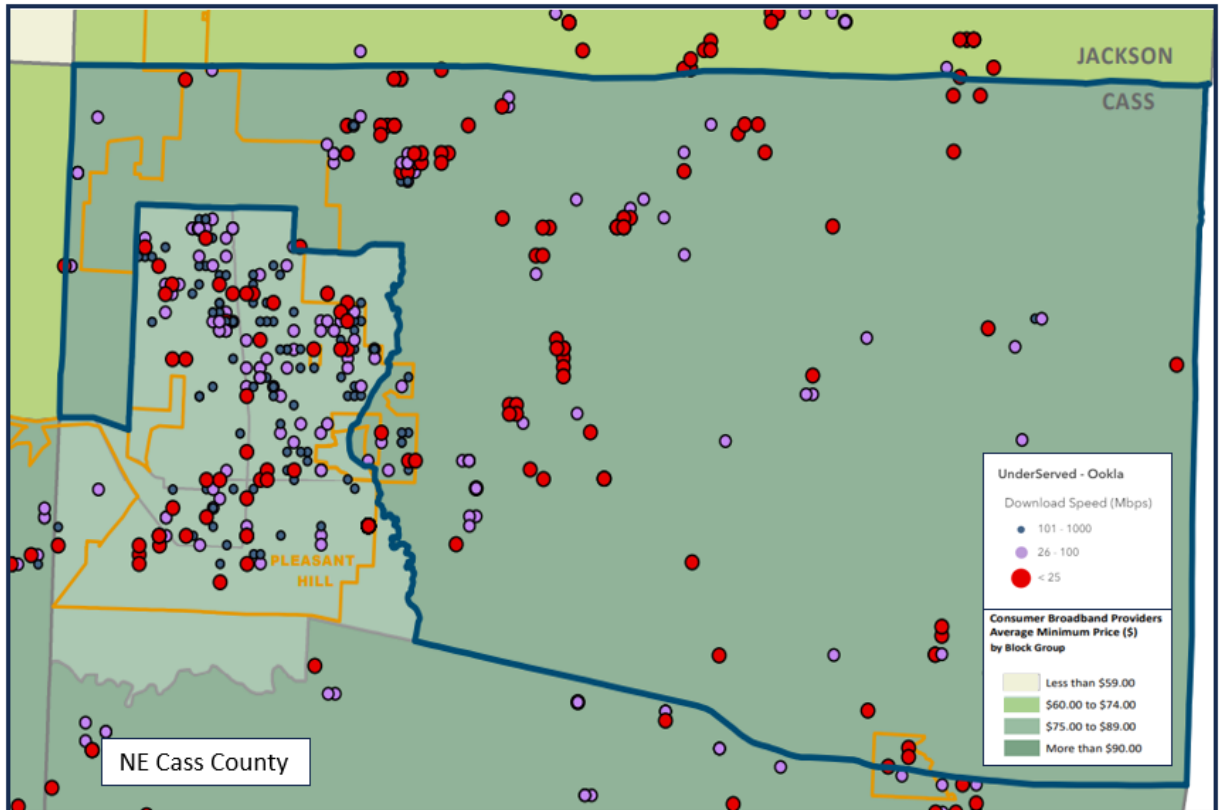

The exurban area around Pleasant Hill is a blend of the two previous examples. The city itself has reasonably good internet service from several providers, and Ookla test scores indicate that fast download speeds can be obtained throughout the community. For the northeastern quarter of the community (Census block group #29037060600) the average download speed was a respectable 160 Mbps and the maximum download speed was 625 Mbps. The average monthly cost, however, is slightly higher than other urbanized areas at approximately $80 per month.

A notable feature of the Pleasant Hill area is that internet service levels drop fairly quickly just outside of the city limits. While the occasional consumer tests show decent download speeds, the average drops to roughly 40 Mbps and the cost jumps to more than $100 per month.

In summary, suburban cities (Belton, Raymore, Peculiar, Pleasant Hill and Harrisonville) get much better internet service than the rural portions of the county. The rural areas are served by much smaller ISPs that use technology that is frequently not capable of meeting the federal standards for broadband service.

Miami County - The distribution of internet services in Miami County is typical in many ways of the challenges facing largely rural counties on the fringe of a metropolitan area. It also underscores the differences between what the Internet Service Providers (ISPs) claim they are able to provide and what they actually are able to deliver to many county residents.
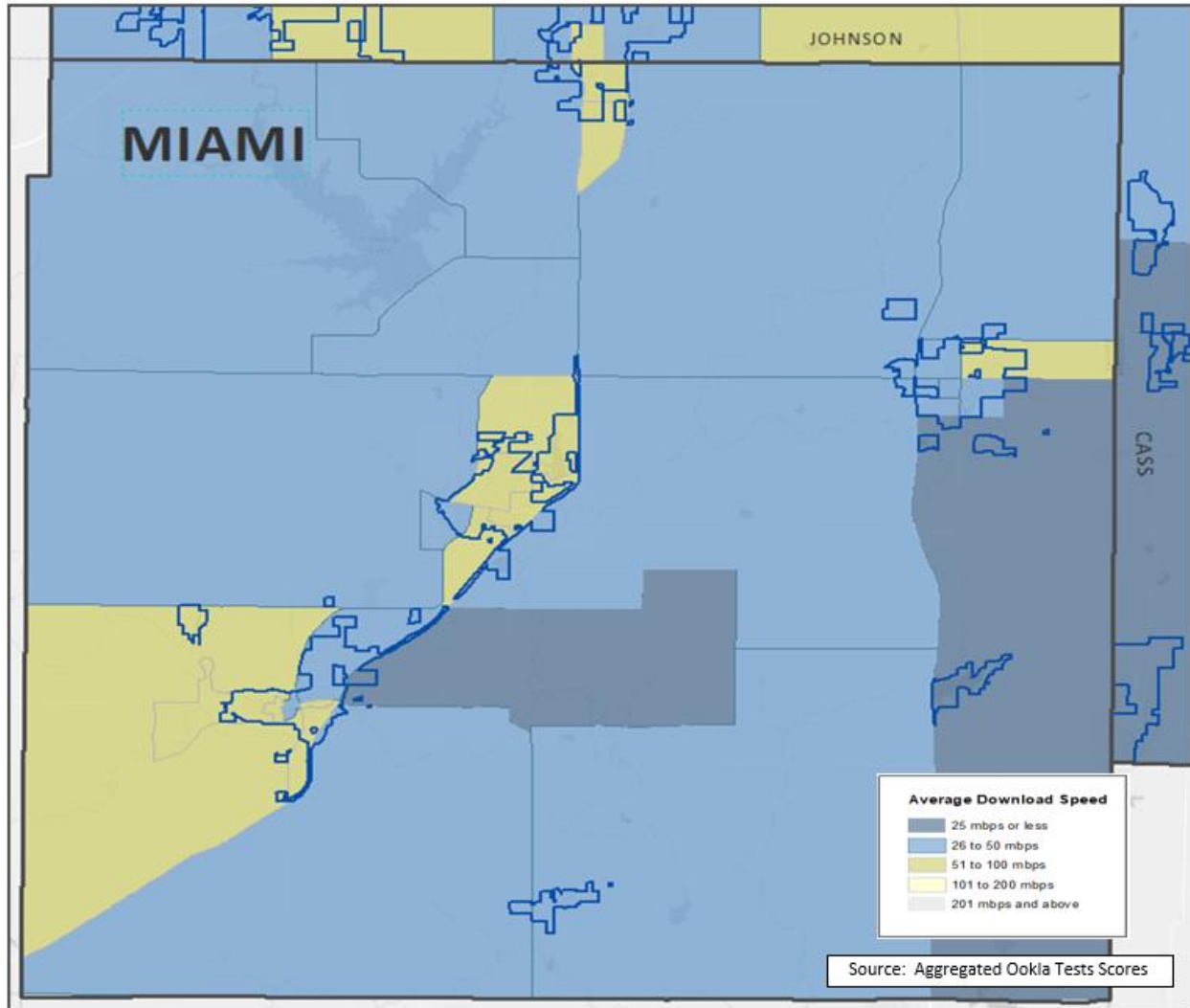
The FCC's 477 data indicates that most of the county is serviced by at least one ISP capable of delivering internet speeds that meet the NTIA's broadband standard of 100 megabits per second (Mbps) download speed and 25 Mbps upload speed. The reality, however, is that the majority of the ISPs in Miami County don't claim to be able to meet the NTIA's broadband standard and the speeds they deliver are well short of the minimum acceptable speed. They stay in business because they serve portions of the county that the faster ISPs don't serve. Consequently, only isolated areas receive true broadband service while the bulk of the county gets by with far less.

As an example, the area immediately west of Paola (Census block group #20121100602) is a patchwork of ISP coverages, mostly from fixed wireless and satellite providers that don't meet the current broadband speed definition. One cable provider that serves a portion of this area claims download speeds up to 150 Mbps but upload speeds are a maximum of 10 Mbps. Residents who

are closer to Paola where service is relatively good tend to have better results, but further west the quality of the internet options decline.
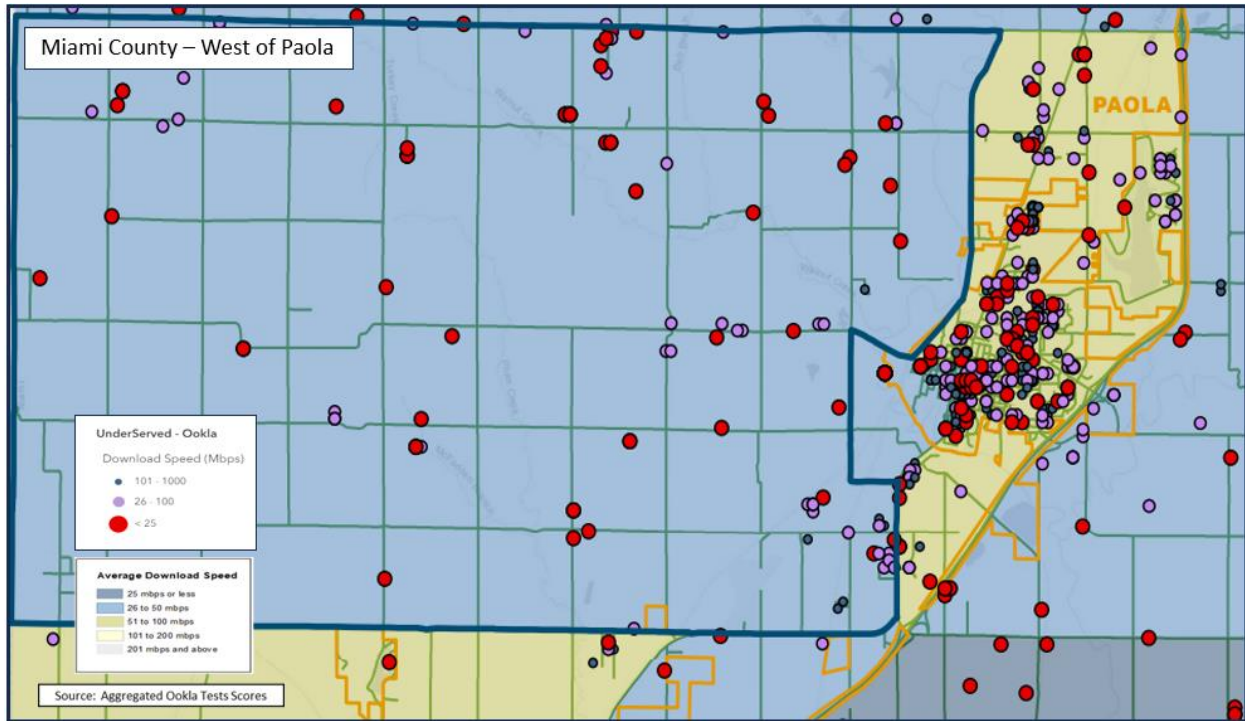

Data from the Ookla speed tests indicate that a few households reached maximum download speeds of 218 Mbps but the average (or mean) household had download speeds of only 41 Mbps. In general, the further away from Paola, the worse the Ookla test results tended to be.

A positive result of the county's efforts to identify broadband limitations and encourage ISP investment is a recent grant by the Kansas Office of Broadband Development to Comcast to expand high speed broadband service to Paola and the Hillsdale area. Broadband investments are still needed on the eastern edge of the county and within the city of Fontana.

In the cities of Paola, Spring Hill, Louisburg and Osawatomie, there are internet options with relatively high-speed service including occasional areas with fiber to the home that promise download speeds of up to 1,000 Mbps. However, the promised availability of high-speed options does not always result in the typical consumer receiving that result. For example, the southwestern portion of Louisburg (Census block group #20121100400) has several households that received relatively high Ookla speed test results, but the mean Ookla download speed was just under 40 Mbps and Ookla tests with download speeds under 25 Mbps outnumber those with speeds over 100 Mbps. According to the 477 data from the FCC, seven of the ten ISPs in this area have maximum download speeds of less than 50 Mbps.
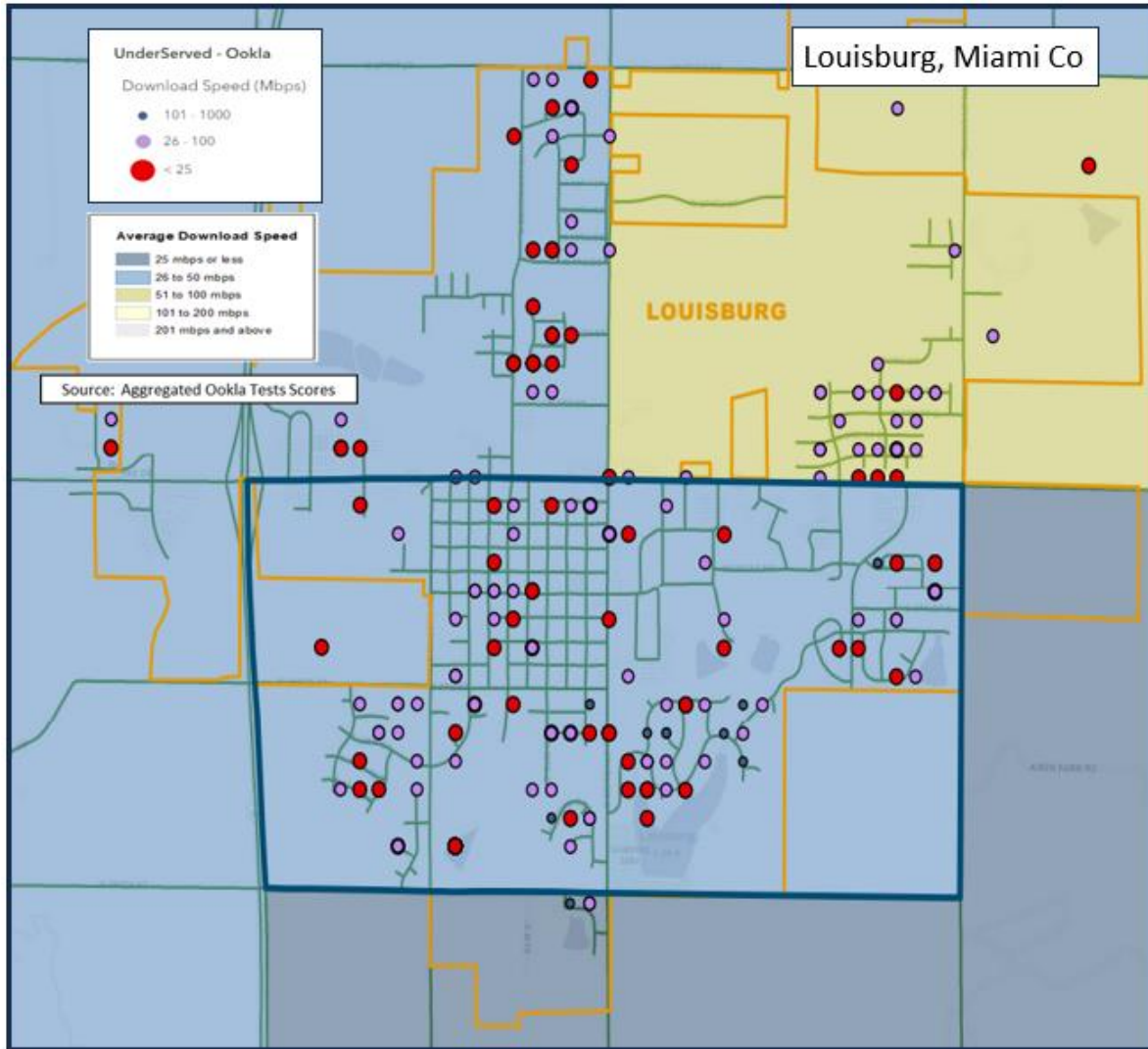
Unfortunately, there are portions of Miami County where there are virtually no internet options that meet the NTIA definition of "broadband" service. Census block group #20121100500, for example, is located directly east of Osawatomie and south of Paola. The fastest service available in this area is a satellite service from Space Exploration Holdings (SpaceX) that promises service speeds up to 100 Mbps download and 10 Mbps upload. Aside from that relatively expensive option, the other eight ISPs all offer download speeds of less than 40 Mbps and upload speeds less than 8 Mbps. The Ookla test results reported a maximum download speed of 77 Mbps and an average download speed of less than 20 Mbps.
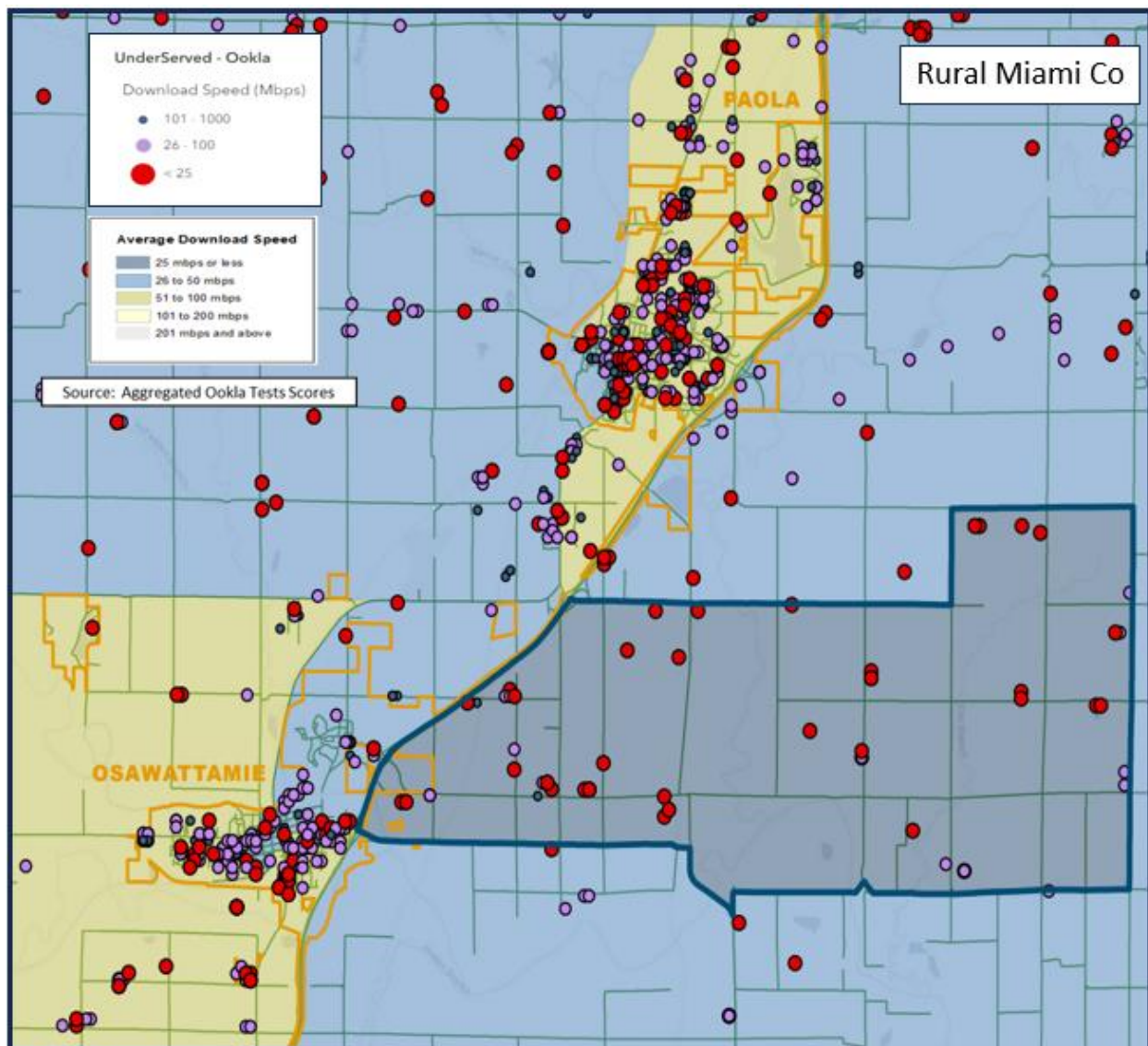
As is true with much of the metro area, the cost of internet service seems to be inversely proportional to the quality of service. In the urbanized areas where the best service options exist, the average cost per month is generally below $60 per month. In the more rural areas, the average cost frequently exceeds $100 per month for service that is distinctly slower.

In summary, only the urbanized areas of Spring Hill, Louisburg, Paola and Osawatomie have reasonably fast, terrestrial-based internet options for residents. Satellite service from SpaceX appears to be available throughout much of the county but is one of the more expensive options. Many of the remaining ISPs utilize technology that is limited in its capabilities and often constrained by topography and vegetation. The fact that so many relatively slow ISPs exist in Miami County suggests that the actual geographic reach of the fastest internet providers is less than the FCC's 477 data portrays or that the cost of the higher quality options is more than many households can afford.

Wyandotte County - Broadband internet service in Wyandotte County benefits from two important characteristics. First, the county is relatively densely populated which makes installing broadband infrastructure more economically efficient. Consequently, there are providers with relatively high-speed service available throughout most of the county. A limitation for some neighborhoods may be due to topography or other physical constraints for broadband infrastructure installation. Second, Kansas City, Kansas, was one of the initial cities selected when Google Fiber rolled out its services roughly 10 years ago. Google serves much of the area with speeds up to 2,000 Mbps and includes many civic and educational facilities.
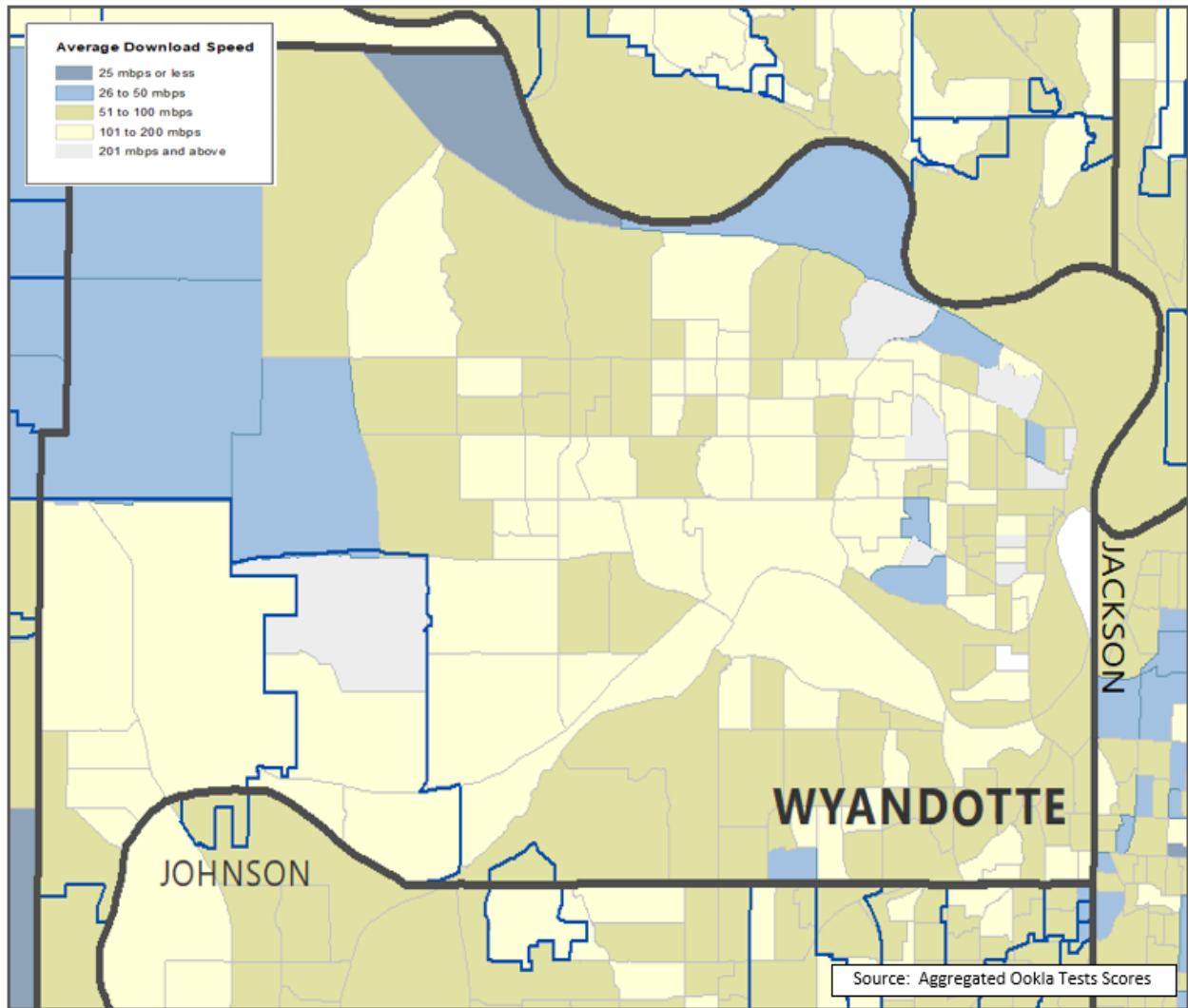
This does not mean, however, that every resident enjoys internet service at or above the NTIA's definition of broadband (100 Mbps download and 25 Mbps upload speeds). There are some isolated locations where wired systems are impractical, which leaves satellite or fixed wireless providers as the best option despite their slower speeds. There may also be areas that have historically been served by older technologies such as traditional cable or copper DSL services that some residents may have stayed with because of lower costs or familiarity (or reluctance on the part of the provider to upgrade their equipment).

The residential area that is a half-mile west of the downtown and south of Minnesota Avenue (Census block group #20209041700) is served by four terrestrial systems and three satellite systems. The terrestrial systems include Google Fiber (Alphabet Inc.) and a cable-based system by Charter Communications, both of which advertise ultra-fast download speeds of up to gigabit levels.
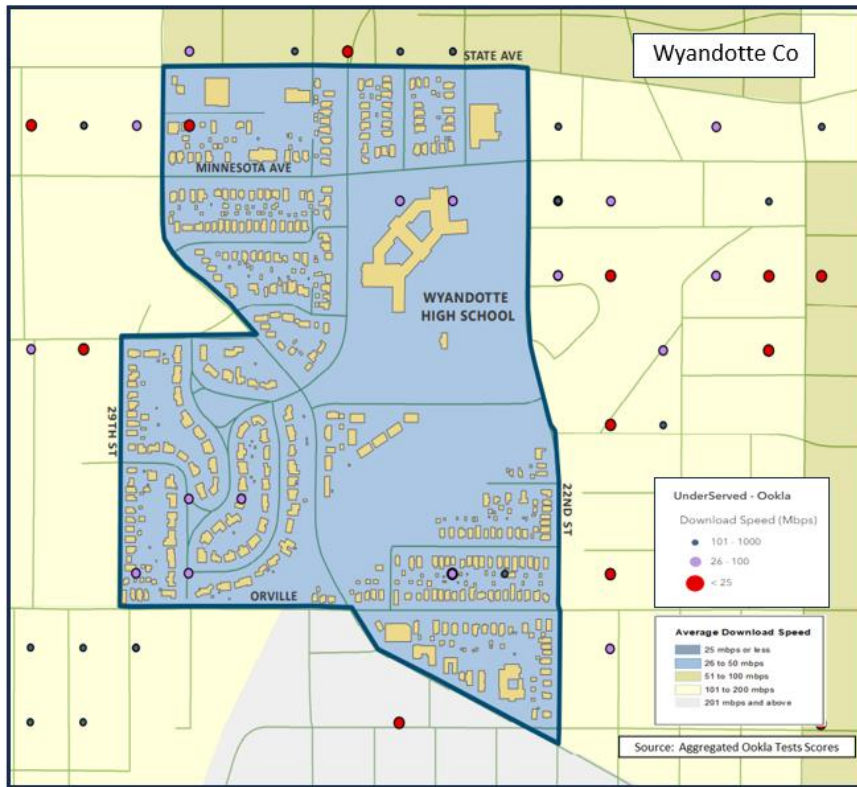
Actual speeds, of course, often fall short of what is advertised and not every household will opt for the highest performance options. The Ookla speed tests from this block group indicate maximum download speeds of 441 Mbps and average download speeds (mean) of 93 Mbps. This data indicates that the area is relatively well served with internet options, and the primary issue is likely one of affordability rather than availability.

The second sample area is essentially the eastern half of the city of Edwardsville (Census block group #20209044702). This is a mixed-use neighborhood consisting of single-family
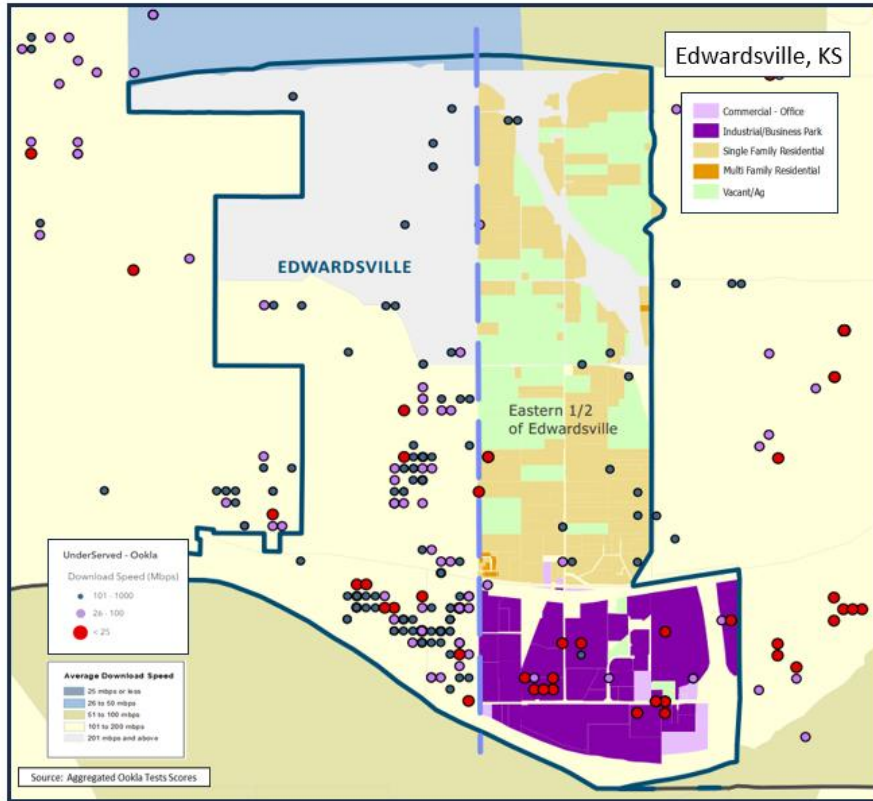
homes, apartments, nursing homes, and a large industrial area. Here there are no fiber-to-the-home ISPs, but Charter Communications does provide their cable-based services at speeds up to 1,000 Mbps. In addition to Charter, there are three satellite providers, a fixed wireless provider and an older DSL service provided by AT&T.

The Ookla test results reveal a broad range of service speeds from very fast to very slow. The faster speeds are fairly evenly distributed, suggesting again that good internet service is available but that some choose to subscribe to other plans. The maximum download speed was over 470 Mbps, and the average download speed was 135 Mbps which is relatively good.
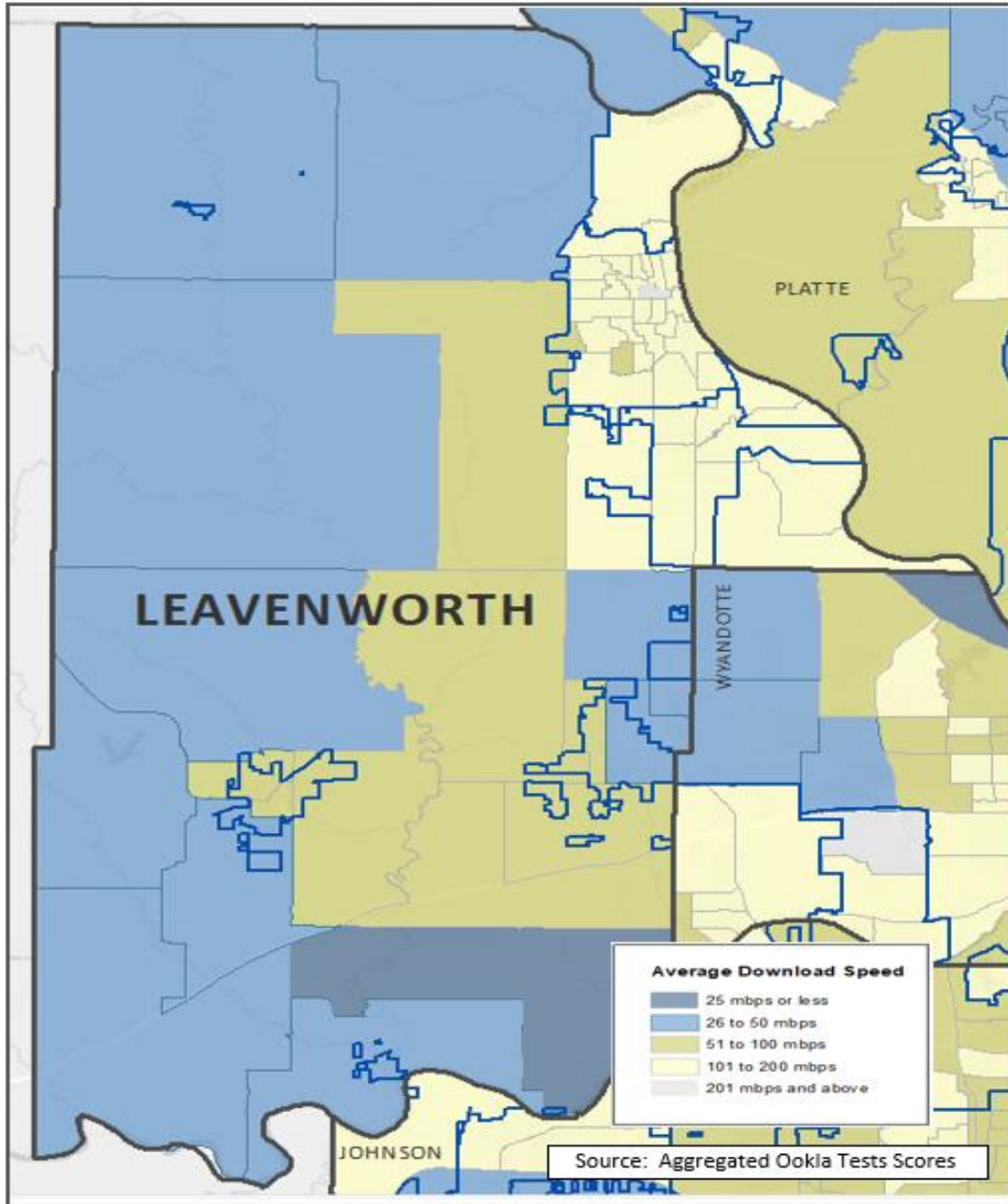
The third sample area is in the exurban development in the northwest corner of the county surrounding the unincorporated community of Piper. Oddly, this area has the broadest array of internet service providers in the county including, for at least a portion of the area, two different fiber-to-the-home ISPs (Google and AT&T) and two high-speed cable-based systems (Charter and Comcast). In addition, there are several satellite, fixed wireless and DSL providers who provide much slower service options. Combined, some portions of this area have more than 10 ISP options.
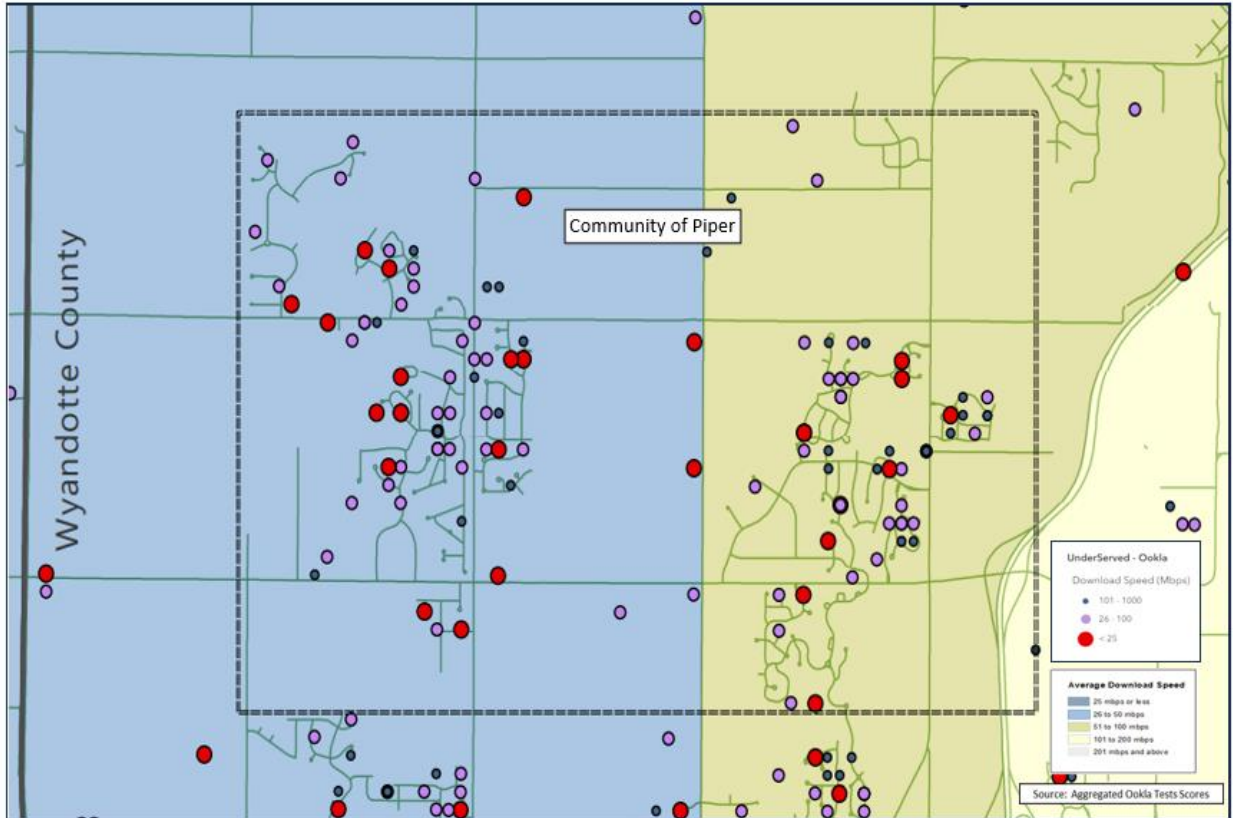
This surplus of internet providers stands in contrast to the rather lackluster results of the Ookla speed tests. The average download speed is slightly under 50 Mbps although the maximum test result was over 400 Mbps. The relatively high proportion of test results in the "unserved" and "underserved" categories suggest that while good service is available in some areas it may not be available everywhere. In addition, some residents may have initially signed up for service with the older DSL, fixed wireless or satellite systems that have limited capabilities and never upgraded to newer options when they became available.

In summary, the vast majority of Wyandotte County appears to be reasonably well served by a variety of internet service providers, although there are some neighborhoods and isolated areas where service options are more limited. There are neighborhoods with a considerable number of Ookla speed tests in the "unserved" and "underserved" categories, but this may be less an issue of availability of high-quality service and more an issue of affordability by the household or reluctance by the provider to upgrade their infrastructure from older systems.

Leavenworth County - Internet service in Leavenworth County contains the extremes of service that are typically for peripheral counties with both dense urban areas, smaller suburban communities, and low-density rural areas. The more heavily populated areas tend to have reasonably good internet options while the less dense areas have more limited choices and slower internet speeds.

Average Download Speed

	25 mbps or less
	26 to 50 mbps
	51 to 100 mbps
	101 to 200 mbps
	201 mbps and above

Source: Aggregated Ookla Tests Scores

As an example, the southeast corner of the county (southwest of Bonner Springs in the Mahon/Lenape area) is a mixture of farms and residential acreages. This area (Census block group
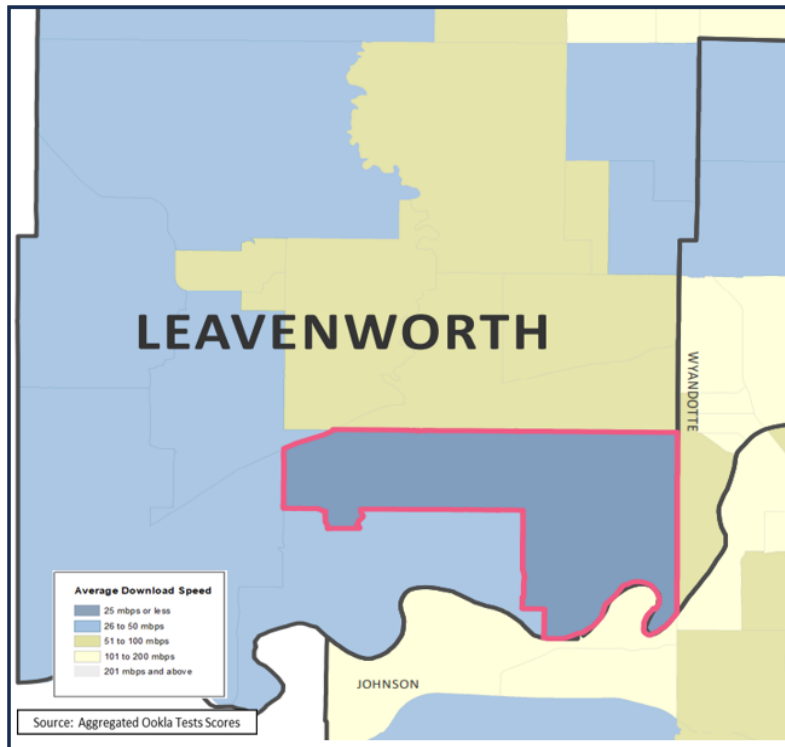
#20103071400) contains no urbanized communities and is the most poorly served area in the county. Many parts of the block group have no cable-to-the-home or fiber-to-the-home providers, leaving only relatively low-speed fixed wireless and satellite ISPs. The maximum advertised speed in the majority of the area is 100 Mbps and actual speeds appear to be well below that level.

Ookla speed tests in this area are predominantly in the "unserved" range with download speeds below 25 Mbps. Based on more than 100 tests, the maximum download speed observed using the Ookla data was just 106 Mbps and the average (mean) download speed was a mere 24 Mbps.

In contrast, the more urban community of Lansing has both more and faster ISP options. The area east of Main Street and south of Mary Street (Census block group #20103071102) recorded maximum download speeds of over 350 Mbps and average download speeds of over 150 Mbps. Ookla test results over 100 Mbps are distributed across this block group indicating that good service is probably available to the entire area.
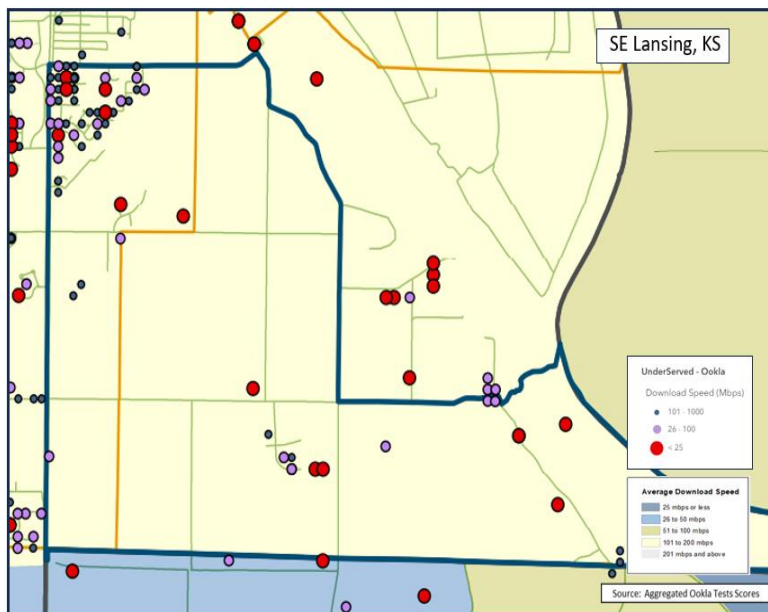

Parts of this neighborhood have access to 10 different ISPs, including one provider (Charter Communications) that offers cable to the home and maximum advertised speeds of up to 1 Gbps download and 35 Mbps upload. The remaining ISPs are a mixture of fixed wireless, DSL and satellite services that provide slower options, most of which do not meet the NTIA's 100/20 broadband definition.

In the northwestern corner of the county, near the small communities of Easton and Millwood, the results are similar to the first sample area although average download speeds are

marginally better. This area (Census block group #20103070900) recorded a maximum download speed of 136 Mbps but an average download speed of just 34 Mbps. The majority of the test results are in the "underserved" category with download speeds between 40 and 50 Mbps.
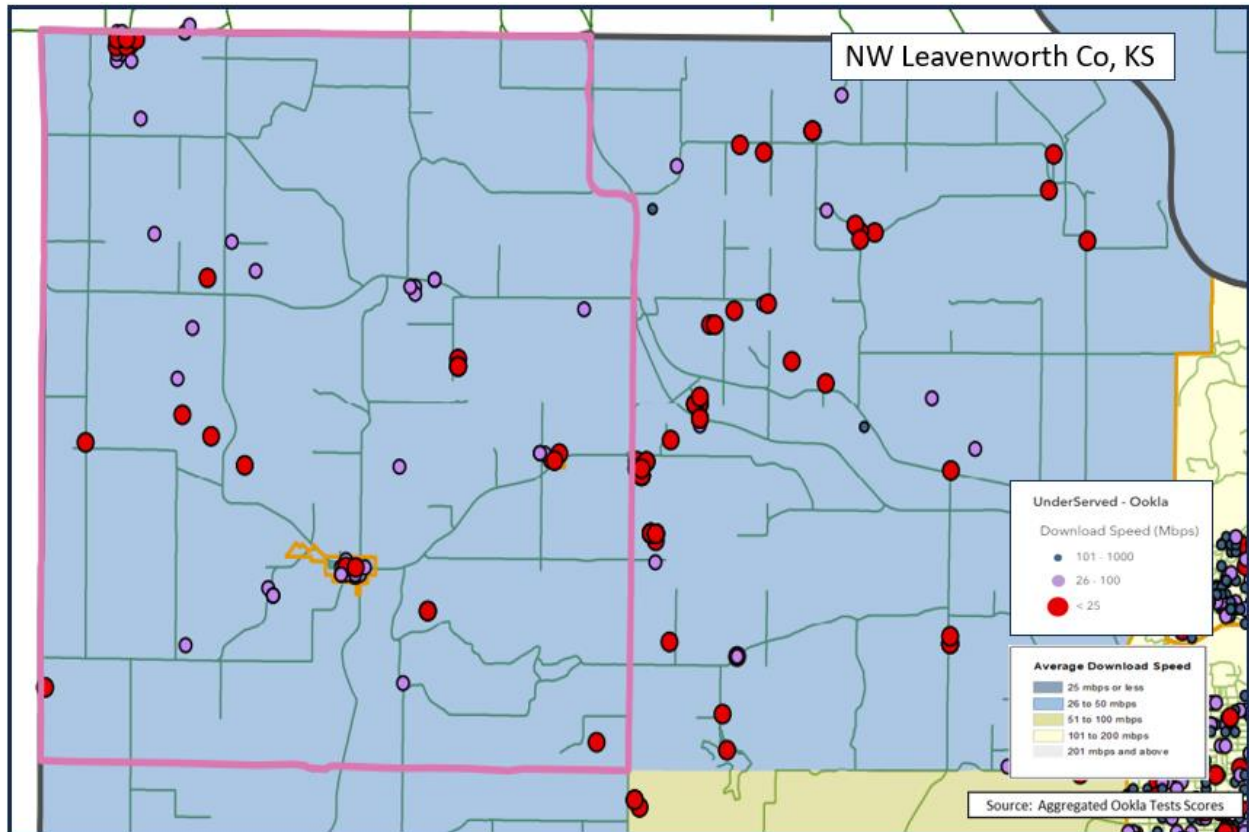

The ISPs in this area do not include any cable-to-the-home or fiber-to-the-home options. The fastest service (Mercury Broadband) has a fixed wireless option with a maximum advertised download speed of 100 Mbps and a maximum advertised upload speed of 20 Mbps. The remaining ISPs use fixed wireless, DSL, and satellite technologies and offer speeds less than 50 Mbps.

In summary, Leavenworth County is like many of the other counties that include large, low-density areas along with several urbanized cities. Internet service varies significantly between the two extremes, with speeds, number of options and prices all favoring the more densely populated portions of the county.

Platte County - Platte County is a study in contrasts from the rural, lightly populated areas across the north and along the Missouri River to the much more urbanized areas from Platte City to Park City. This diversity plays out in terms of internet service in a variety of ways, from areas that are well covered by service options to other areas where choices are distinctly limited.
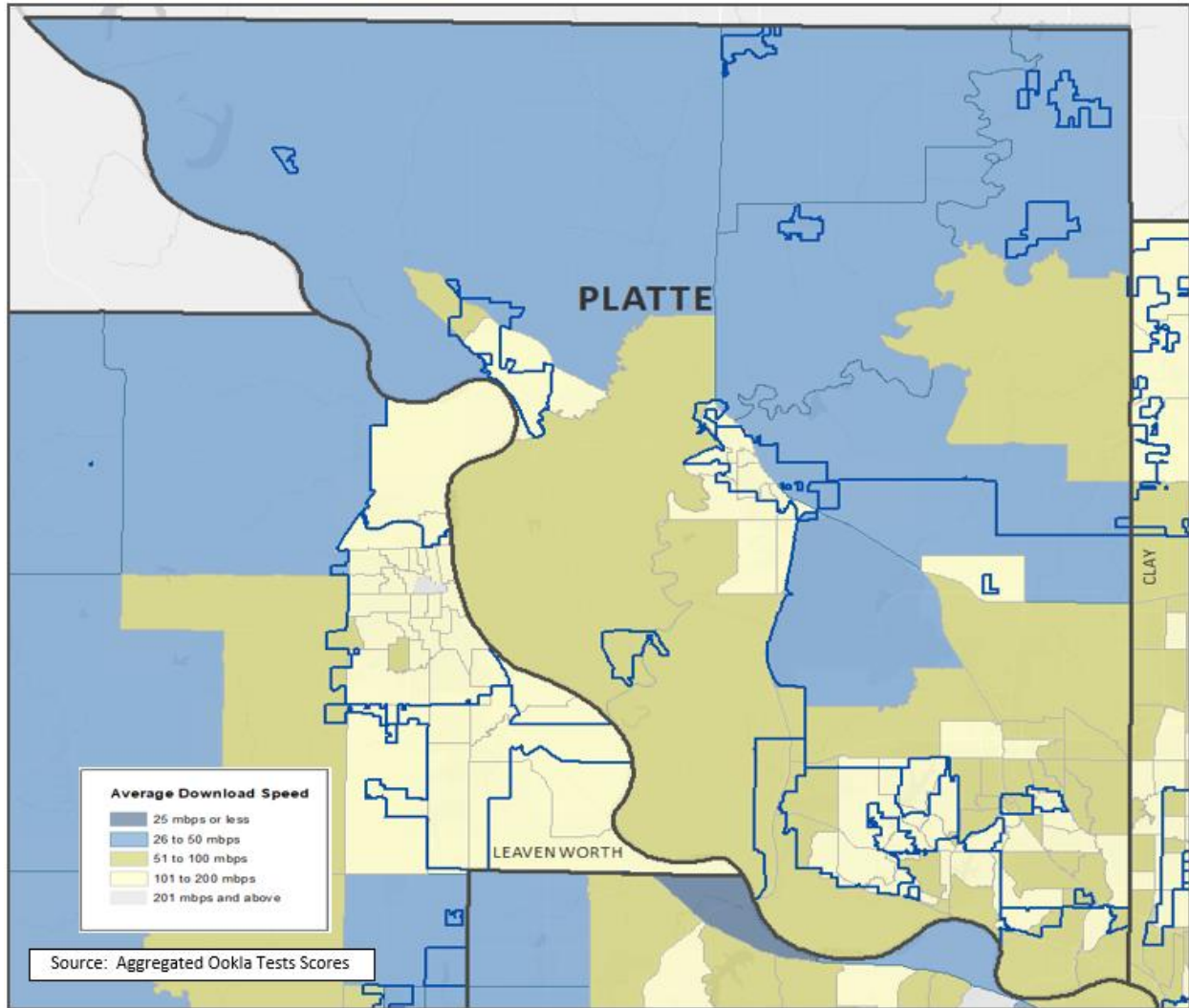
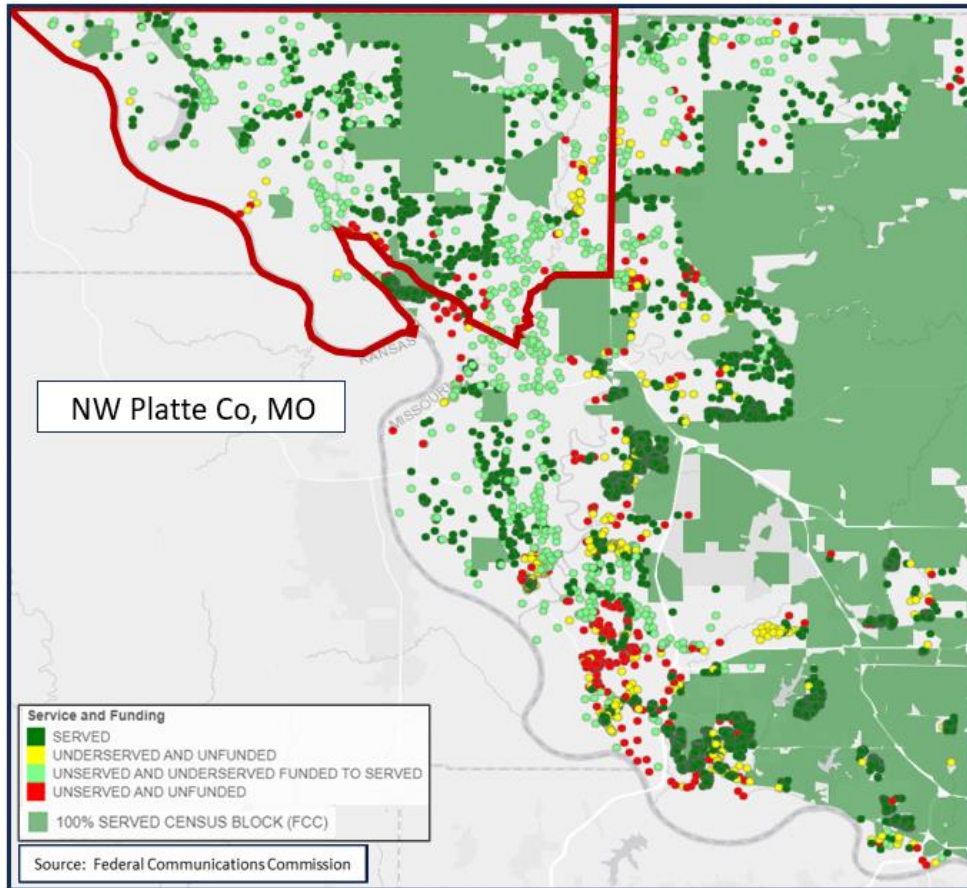A prime example is the lightly populated area in the northwest corner of the county, stretching from the Missouri River on the west to I-29 on the east (Census block group #29165030700). This area is largely agricultural with few clusters of residential development, making it a difficult area to serve with internet infrastructure. The result is that much of the area has limited options and slow speeds.
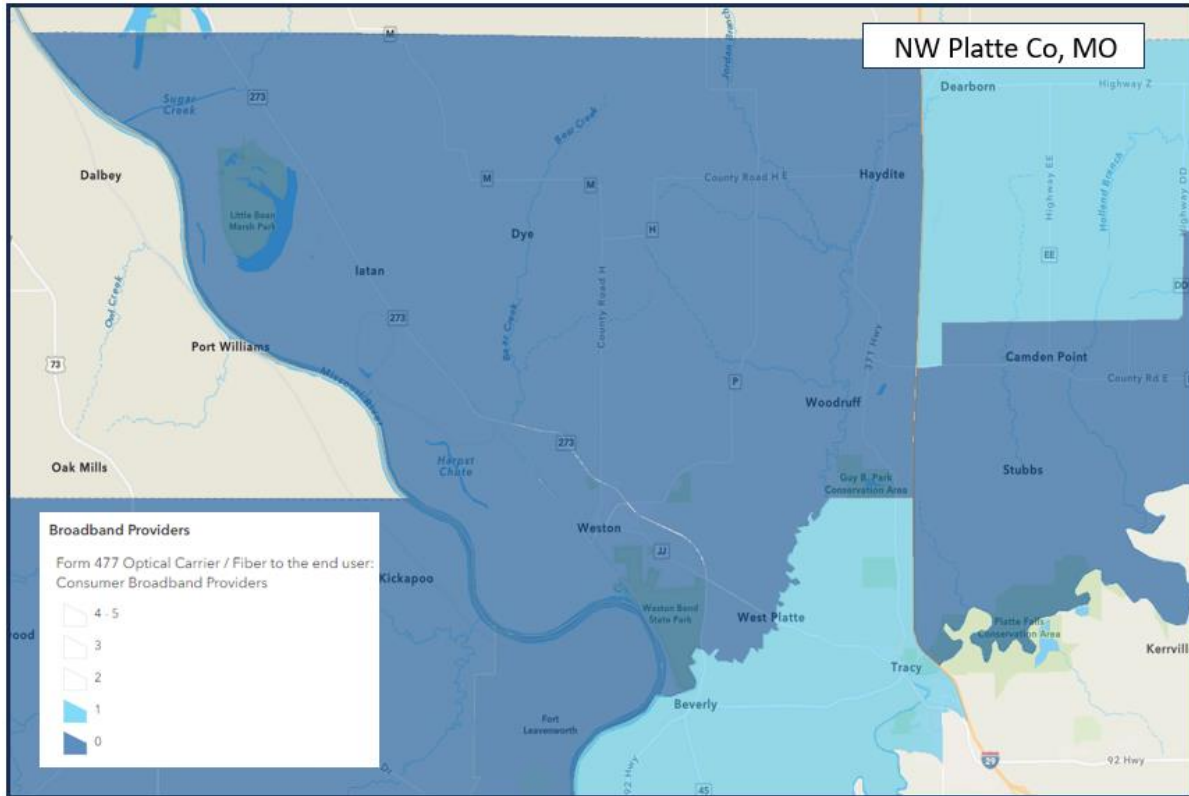
The area around the small community of Iatan, for example, has only a handful of ISP options split between satellite and fixed wireless technologies. Most advertise maximum download speeds of 35 Mbps or slower and just one (Mercury Broadband) advertises download speeds that meet the NTIA's 100 Mbps standard for broadband service. On the other side of this area, closer to New Market and Dearborn, there are areas with 8 to 10 ISP options including one (United Electric Cooperative) that offers fiber service with advertised speeds up to 1 Gbps.

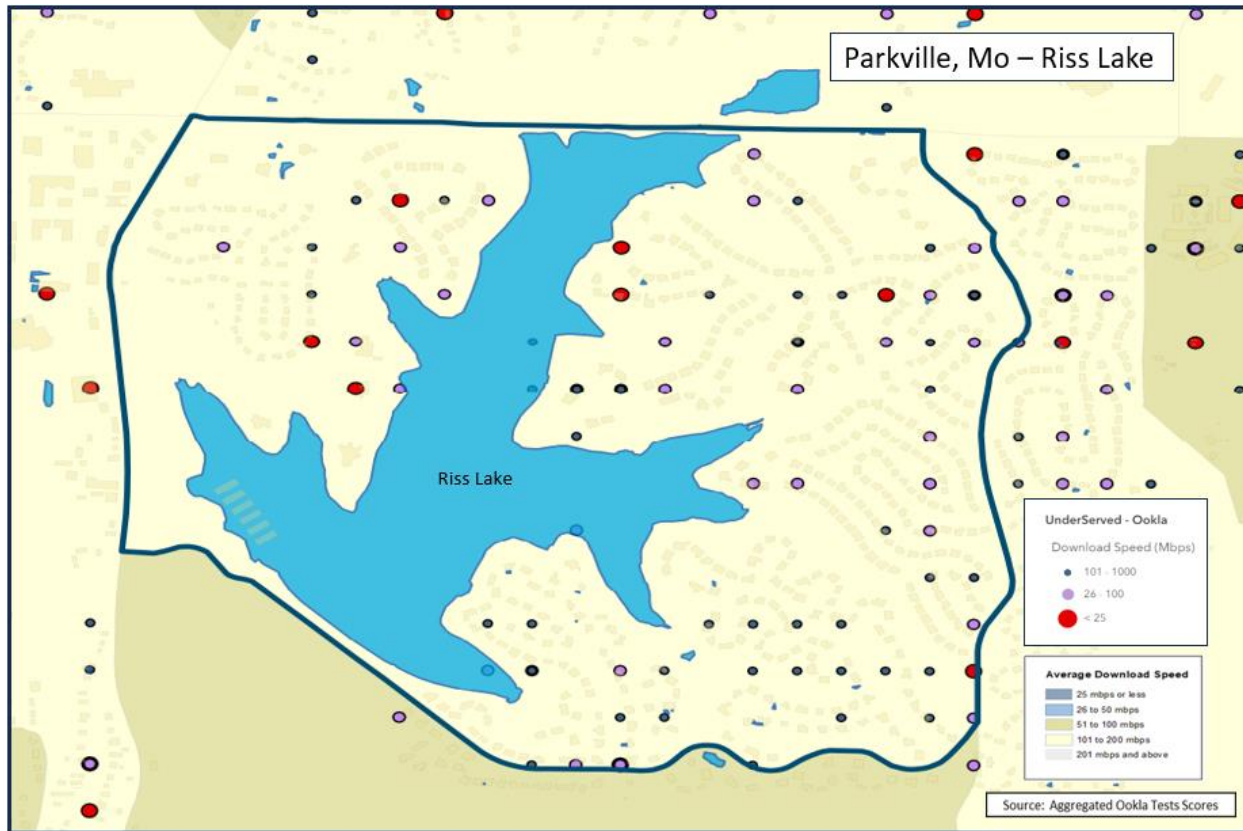The FCC's Funding and Service Status map shows that many addresses in this area will be included in infrastructure improvements that have already been funded. Charter and Conexon Connect are the ISPs that have been awarded funds and they are promising download speeds up to 1 Gbps.

NW Platte Co, MO

Service and Funding
- SERVED
- UNDERSERVED AND UNFUNDED
- UNSERVED AND UNDERSERVED FUNDED TO SERVED
- UNSERVED AND UNFUNDED
- 100% SERVED CENSUS BLOCK (FCC)

Source: Federal Communications Commission

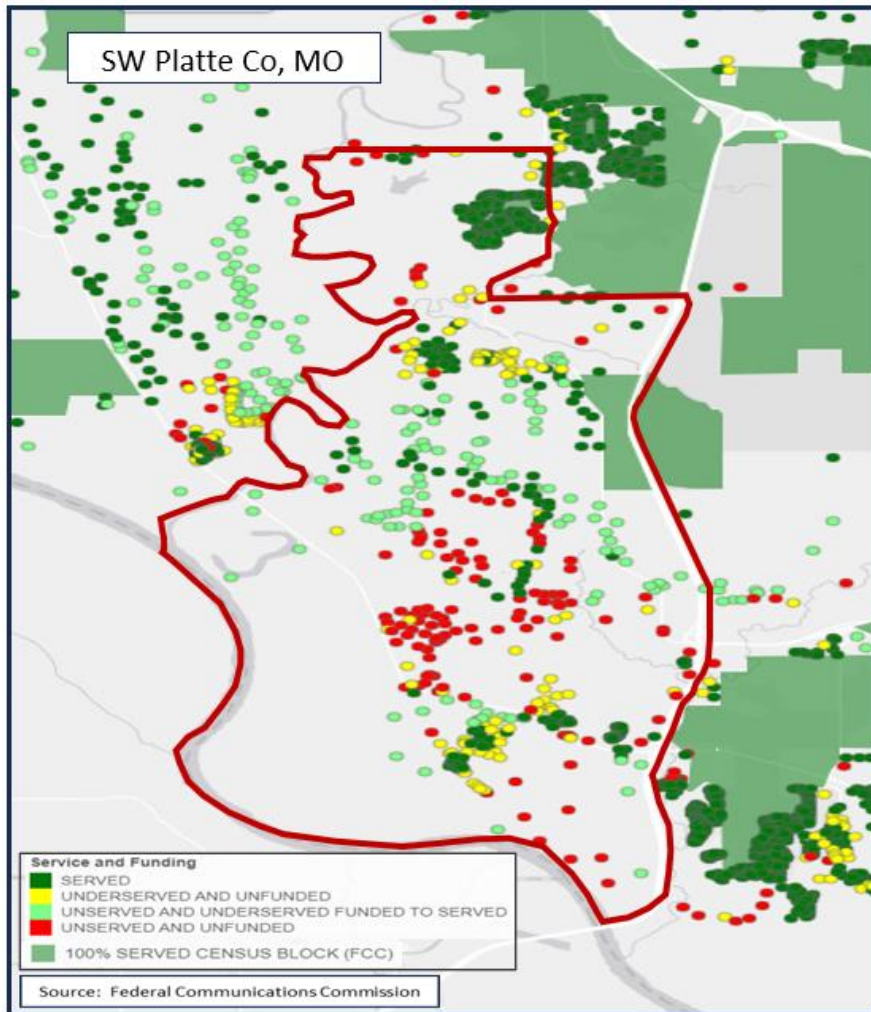This diversity in service options is reflected in the Ookla speed test results which average just 42 Mbps download speed, but which include a maximum download speed of over 470 Mbps. Unfortunately, there are far more test results in the "unserved" and "underserved" categories than in the "served" category.

At the other extreme is the area around Riss Lake (Census block group #29165030103) in Parkville, which has generally good internet speeds. Average test results are over 135 Mbps download speeds with a maximum speed of nearly 490 Mbps. The distribution of good test results is fairly uniform across the area indicating that high speed service should be available to nearly every household.

This area is served by 7 to 10 different internet providers including Charter Communications which advertises download speeds up to 1 Gbps via a cable-to-the-home technology. Part of the area is also served by Google Fiber which advertises speeds up to 2 Gbps.

Parkville, Mo – Riss Lake

Riss Lake

UnderServed - Ookla

Download Speed (Mbps)
- 101 - 1000
- 26 - 100
- < 25

Average Download Speed
- 25 mbps or less
- 26 to 50 mbps
- 51 to 100 mbps
- 101 to 200 mbps
- 201 mbps and above

Source: Aggregated Ookla Tests Scores

In between these two extremes is an area in the southwest corner of the county near the small community of Waldron (Census block group #29165030401). Much of the area is agricultural land in the Missouri River valley, but there are a few clusters of development along I-435. Two high-

SW Platte Co, MO

Service and Funding
- ■ SERVED
- ■ UNDERSERVED AND UNFUNDED
- ■ UNSERVED AND UNDERSERVED FUNDED TO SERVED
- ■ UNSERVED AND UNFUNDED
- ■ 100% SERVED CENSUS BLOCK (FCC)

Source: Federal Communications Commission

speed ISPs serve the area near the I-435 interchange with Highway 45 (Charter Communications and AT&T Fiber), both of which advertise download speeds up to 1 Gbps. The remainder of the area, however, has fewer and slower options to choose from. In fact, the fastest option for much of the area is a satellite-based ISP (ViaSat) that advertises maximum download speeds of 100 Mbps and maximum upload speeds of 3 Mbps.

On the FCC's Funding and Service Status map there are numerous households that are categorized as either unserved or underserved. Most of these locations have not been funded for infrastructure improvements, although Wisper (a fixed wireless provider) has been granted funds to cover a portion of this area.

The Ookla test results reflect this dichotomy in service. The maximum download speeds recorded were over 450 Mbps but the average (mean) download speed was a more pedestrian 80 Mbps. The clear majority of the test results fell into either the "underserved" category (25 Mbps to 100 Mbps download) or "unserved" category (less than 25 Mbps download).

In summary, Platte County is like many of the other counties in the region in that the rural portions have few, if any, high-speed internet options while the urbanized areas have a much better selection.

Jackson County. As the most urbanized county in the metro area, Jackson County benefits from a relatively high density of development which makes the installation of internet infrastructure more cost effective than in many other areas. Consequently, most of the residential neighborhoods have at least one high-speed provider. There are, however, some potential problem areas where only limited options exist or where affordability is a major obstacle to widespread adoption. In addition, there are some isolated areas in the Blue and Little Blue River valleys and the more rural portions of eastern Jackson County where no high-speed ISPs exist.

Source: Aggregated Ookla Tests Scores
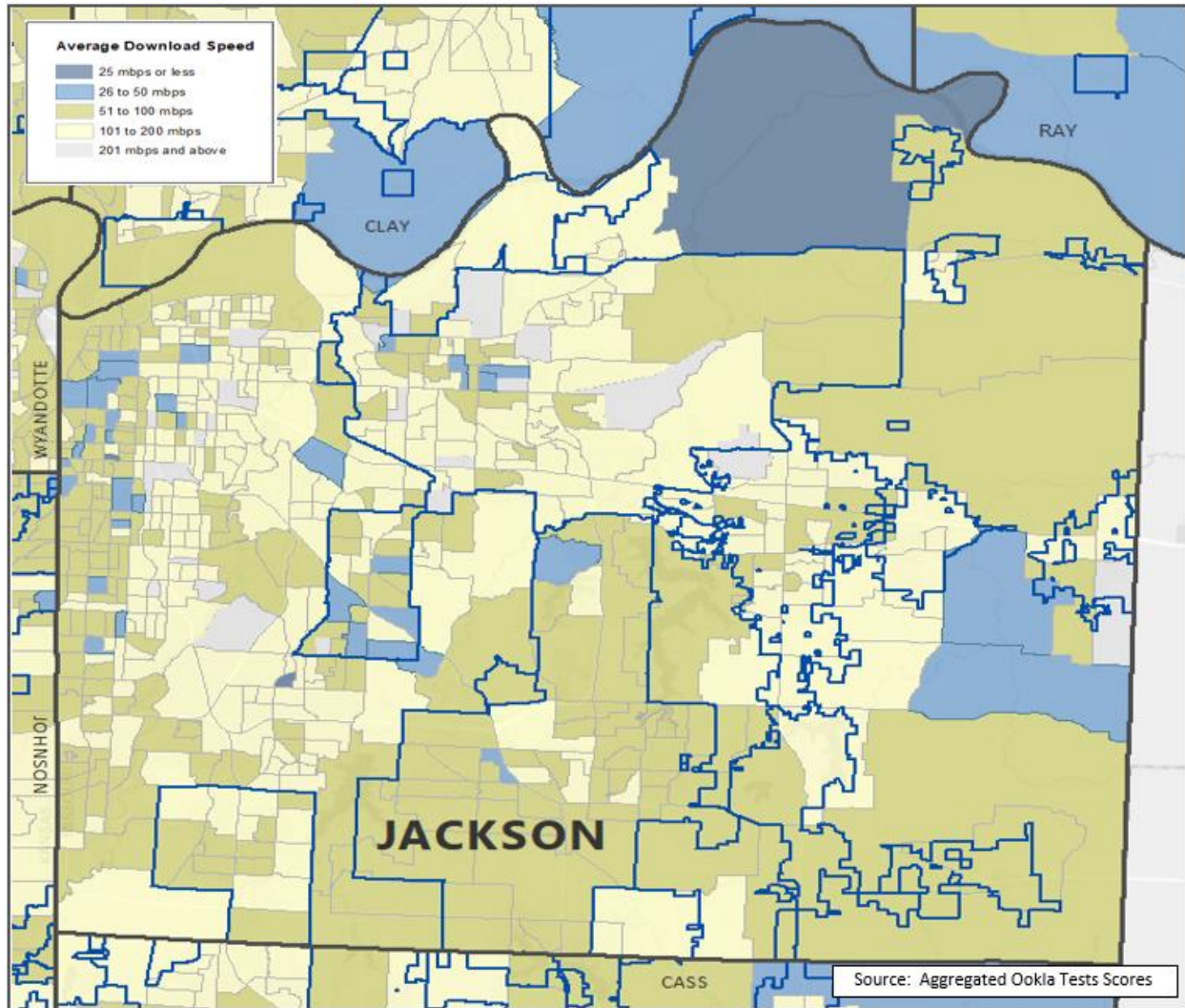
In the Sugar Creek neighborhood north of Highway 24 and east of Sterling Avenue (Census block group #29095011100), Comcast offers 1.2 Gbps download speeds with their cable service and there are limited blocks where AT&T offers a fiber-to-the-home service with 1 Gbps speeds. But for much of this area, Comcast is listed as the only provider that can meet the NTIA's 100/20

broadband standard. The other ISPs are a mixture of satellite, fixed wireless and DSL services that generally offer download speeds of 50 Mbps or lower and upload speeds of 10 Mbps or lower.
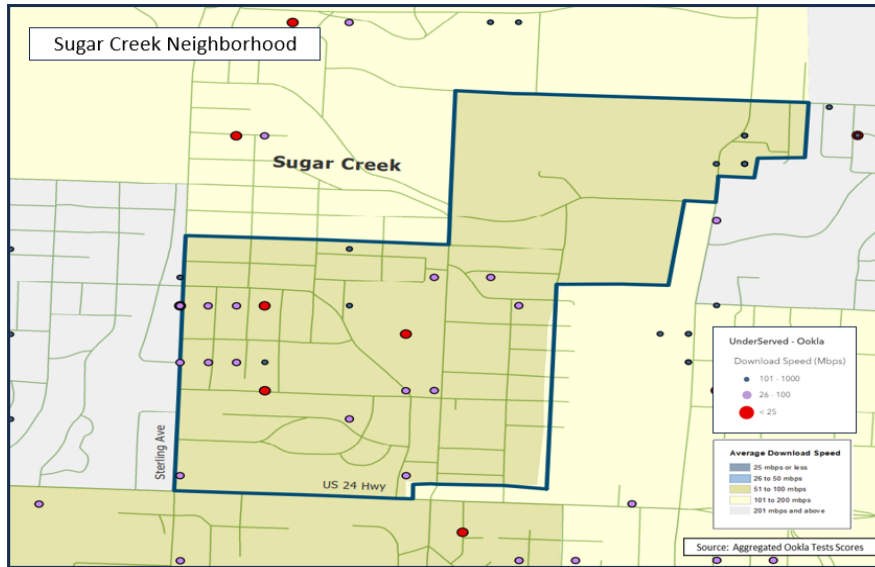
Overall, the average download speed is a decent 82 Mbps and the maximum download speed is over 530 Mbps. So while fast internet service is available, residents may be opting for either lower cost service plans or service from providers that cannot offer broadband speeds.

The area south of Grain Valley near the Tarsney Lake neighborhood (Census block group #29095014002) is predominantly rural but contains pockets of suburban style residential development. The low density of development means that no terrestrial to-the-home services are available which leaves only limited internet options for the vast majority of households. Consequently, the average Ookla download speeds are below 30 Mbps.
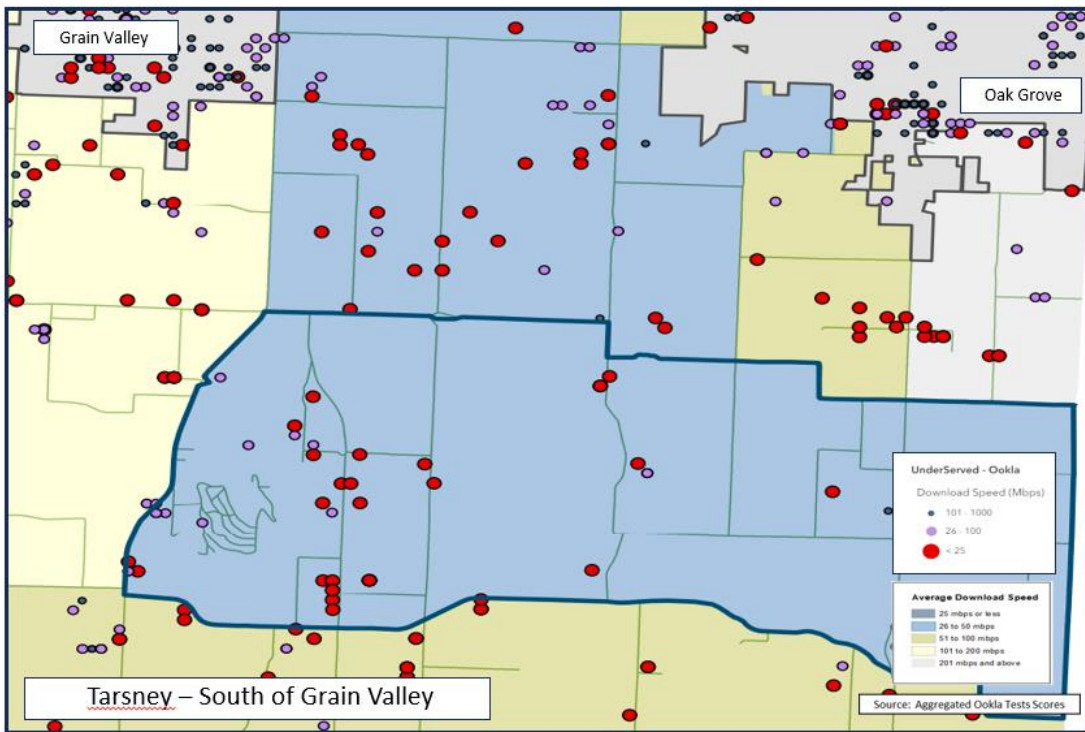
For much of the area, the fastest available options are satellite providers that advertise maximum download speeds of 100 Mbps and maximum upload speeds of 10 Mbps or less. The non-satellite

options are fixed wireless or DSL services that advertise maximum download speeds of 25 Mbps or less.
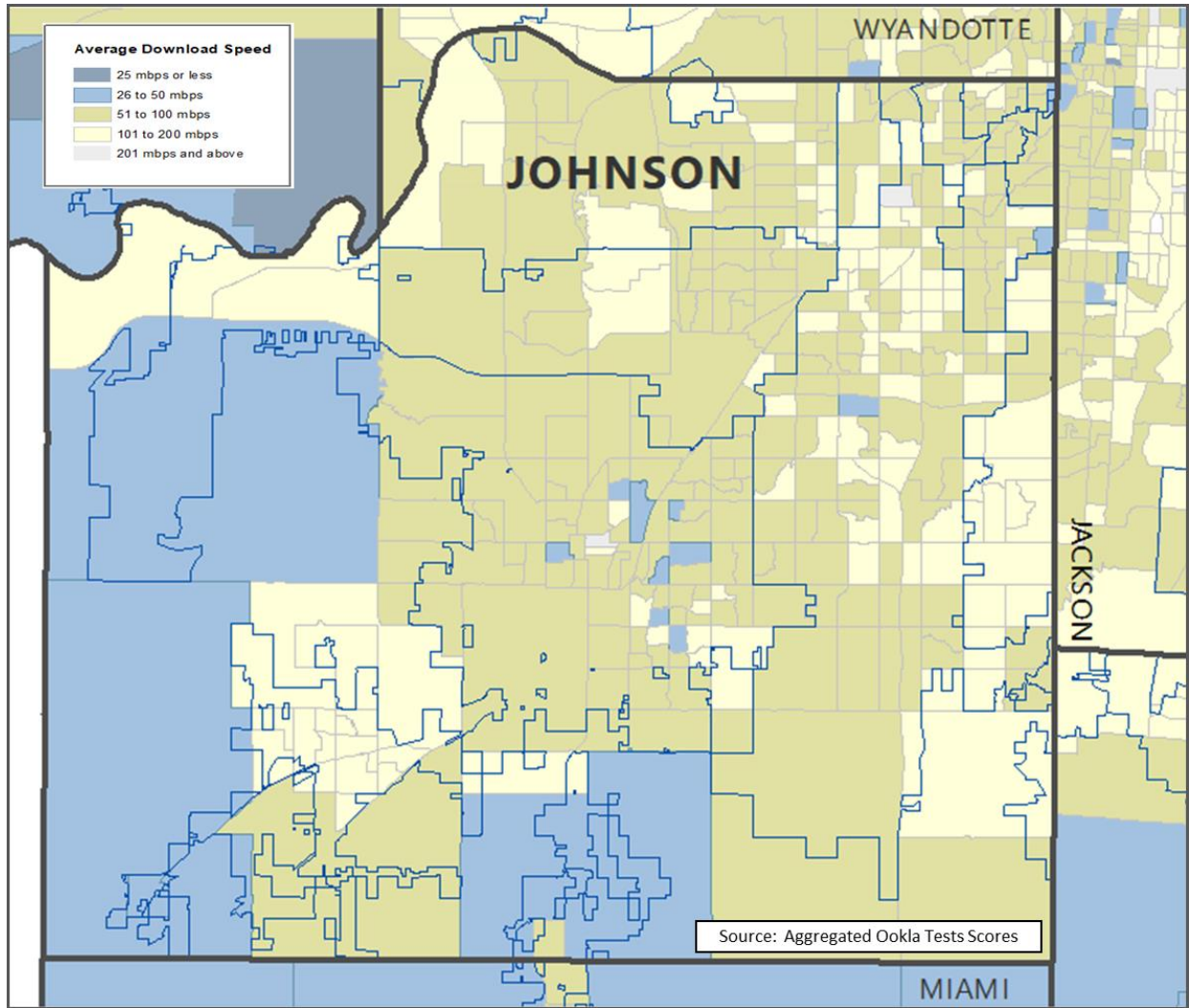
In contrast, the neighborhood between Prospect and 71 Highway, and 27th Street to 31st Street (Census block group #29095016600) has two high-speed ISPs in Alphabet (Google Fiber) and Charter Communications (Spectrum). Both advertise maximum download speeds of 1 Gbps or better, and upload speeds in the case of Google Fiber of up to 1 Gbps. Five additional ISPs are listed as providing internet service to this area, but they advertise much slower speeds and use a mixture of satellite, DSL and fixed wireless technologies.
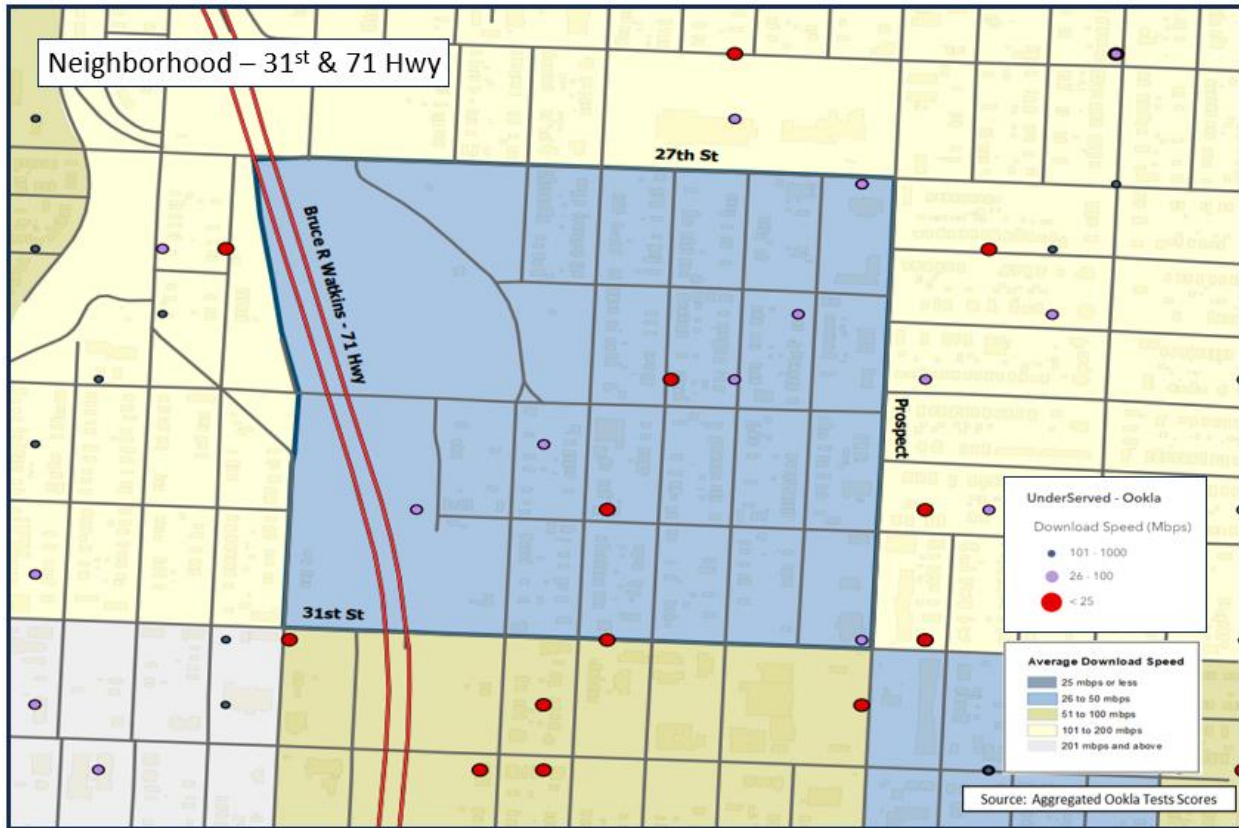
Despite the fast service that is theoretically available, the Ookla test results are relatively poor. The average download speed is just 43 Mbps and there are no test results over 100 Mbps. Similar results can be found in the surrounding block groups although there are occasional Ookla tests with results in the 500 Mbps range. This indicates that while fast internet service is likely available to residents, other issues (such as affordability) are preventing them from taking advantage of that opportunity.

In summary, Jackson County is an area with contrasts -- generally good internet service available over much of the area, but with a variety of issues that prevent households from experiencing universally good results. In some areas, particularly along the eastern edge of the county, there are no high-speed providers and in other areas there may only be one high-speed option. In still other areas there may be good options available but other issues may limit the households that actually experience high speed service.

Johnson County - Due to its combination of both density and relative affluence, Johnson County has perhaps the best internet service in the metro area. That does not mean that there are no problems, just that the problem areas tend to be more limited in size and the scale of the problem tends to be somewhat less serious.

Average Download Speed
- 25 mbps or less
- 26 to 50 mbps
- 51 to 100 mbps
- 101 to 200 mbps
- 201 mbps and above

Source: Aggregated Ookla Tests Scores

The Millhaven neighborhood in the city of Mission (Census block group #20091050600) is typical of much of the urbanized part of the county. Fiber-to-the-home service is provided by two different ISPs (Alphabet's Google and AT&T) along with a cable service by Charter Communications (Spectrum). All three providers advertise maximum download speeds of 1 Gbps or greater. In addition, there are seven other ISPs that provide service to the area using fixed wireless, satellite or DSL technologies.

The result is that households in this area experience good internet service. Average download speeds are 114 Mbps and maximum speeds approach 450 Mbps. Ookla tests with high-speed results are common and distributed throughout the neighborhood, indicating that high quality service is available to anyone who is interested. In addition, the wide variety of providers has resulted in prices for internet service that are among the lowest in the region.
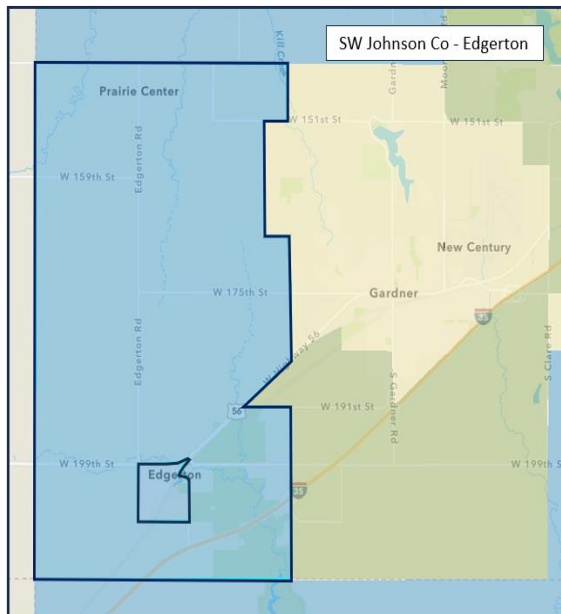
In contrast, the extreme southwestern corner of the county near Edgerton (Census block group #20091053701) receives internet service that is distinctly lower in quality and higher in price. A portion of the area is served by a cable service (Mediacom Communications) that advertises maximum download speeds of up to 1 Gbps, but a majority of the area does not have any fiber-to-the-home or cable-to-the-home service. In those areas, the fastest available internet provider is a relatively expensive satellite service (SpaceX). The other available options are a mixture of satellite, fixed wireless and DSL technologies and have maximum download speeds of 40 Mbps or lower.

The result is that while there are a small handful of good Ookla test results (maximum download speeds of 520 Mbps), the vast majority of tests are below the NTIA's 100/20 broadband standard. Average download speeds are less than 40 Mbps. In addition, the cost for service is roughly double what it is in the Millhaven example.
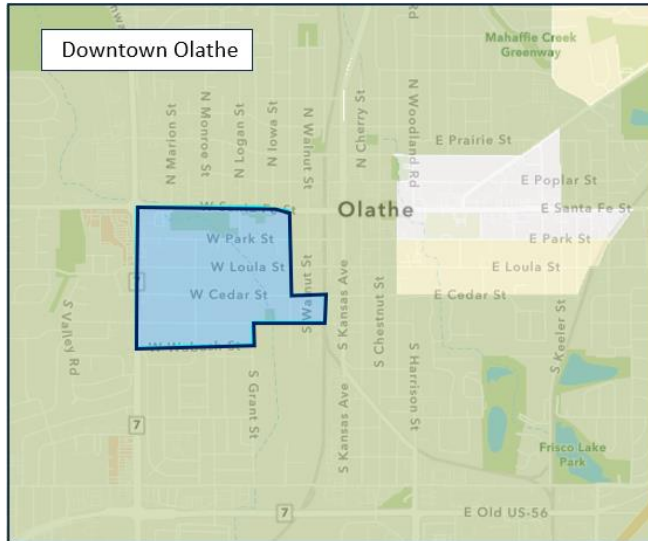
A third example is in the City of Olathe in the area between Santa Fe and Wabash, and K-7 Highway and Pine St (Census block group #20091053601). This is a neighborhood of older homes near the center of the city. Reasonably good internet service is available here, but it seems that relatively few households take advantage of that availability. The average download speed based on Ookla tests was just 43 Mbps and the maximum download test result was just 95 Mbps.

Both Google Fiber (Alphabet) and Comcast Cable serve this area and advertise download speeds of over 1 Gbps. It may be, however, that the residents tend to opt for lower priced plans or lower priced ISPs.

In summary, Johnson County is a part of the region that has been relatively well served by the large, private sector ISPs. Much of the county has fiber-to-the-home service or cable service that can deliver high internet speeds. There are pockets in the county, particularly along the western boundary, where high speed options are either very limited or not available at all. In addition, there are areas where affordability seems to limit the quality of the internet service that people actually receive.

Clay County - The dichotomy between urban and rural surfaces again in Clay County. The urban areas and the more densely populated suburban areas, principally along the western county line, are generally well served while the rural areas have slower and spottier coverage.
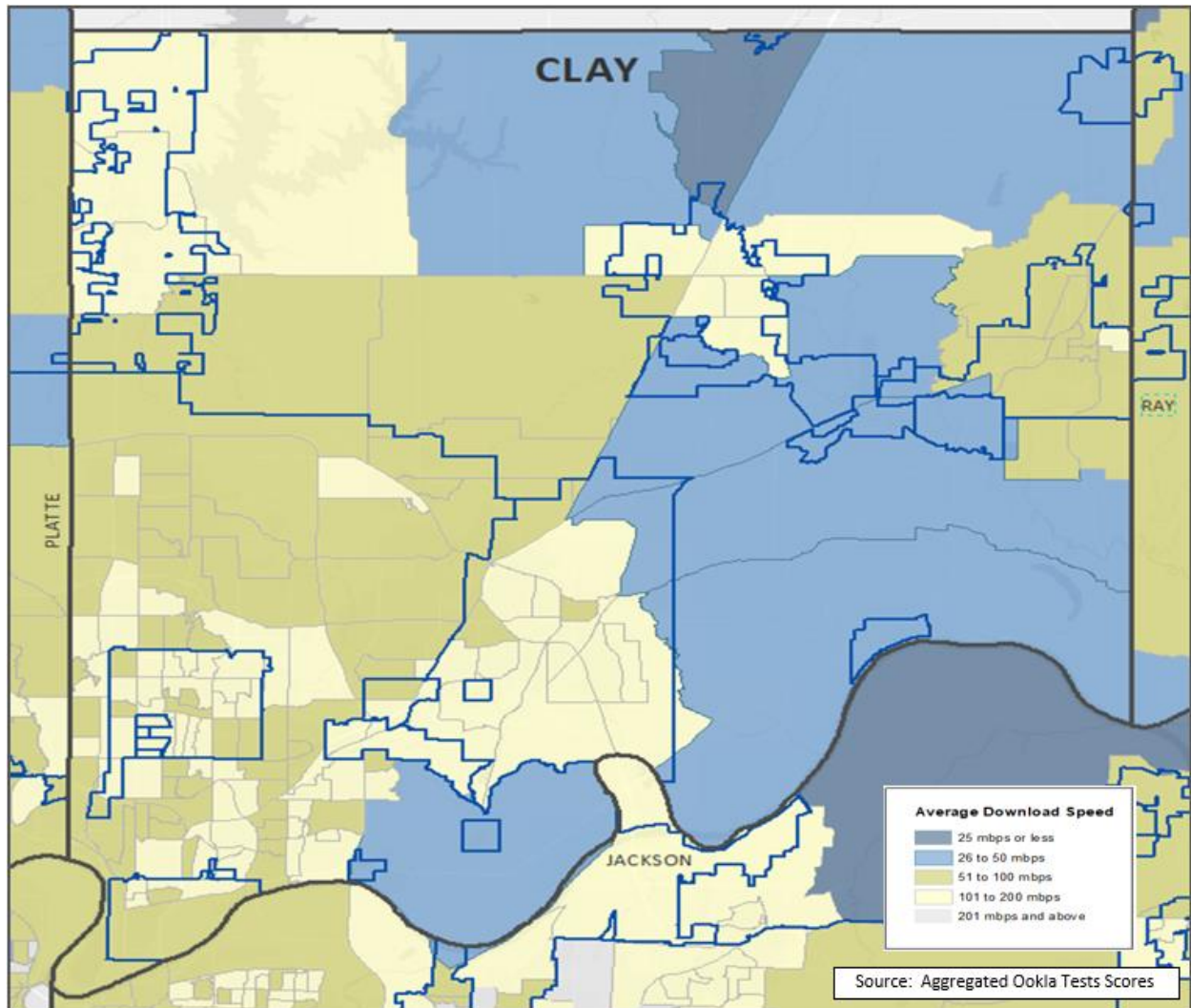

As an example, the area in the southeast corner of the county, including Missouri City and the rural area to the north, has generally poor internet service. This area (Census block group #29047021600) has a few households with decent Ookla test results (maximum download speeds over 350 Mbps) but the vast majority have only middling results (average download speeds of 41 Mbps). The best scores are clustered near the western edge of this block group near Liberty but are entirely absent from the remainder of the area.

The Ookla test results are consistent with the FCC's 477 data which shows that almost the entire area is unserved by any terrestrial ISP with advertised download speeds over 60 Mbps, and most are under 30 Mbps. The one exception is a satellite-based ISP (ViaSat) that advertises download speeds up to 100 Mbps and upload speeds up to 3 Mbps.

Source: Federal Communications Commission
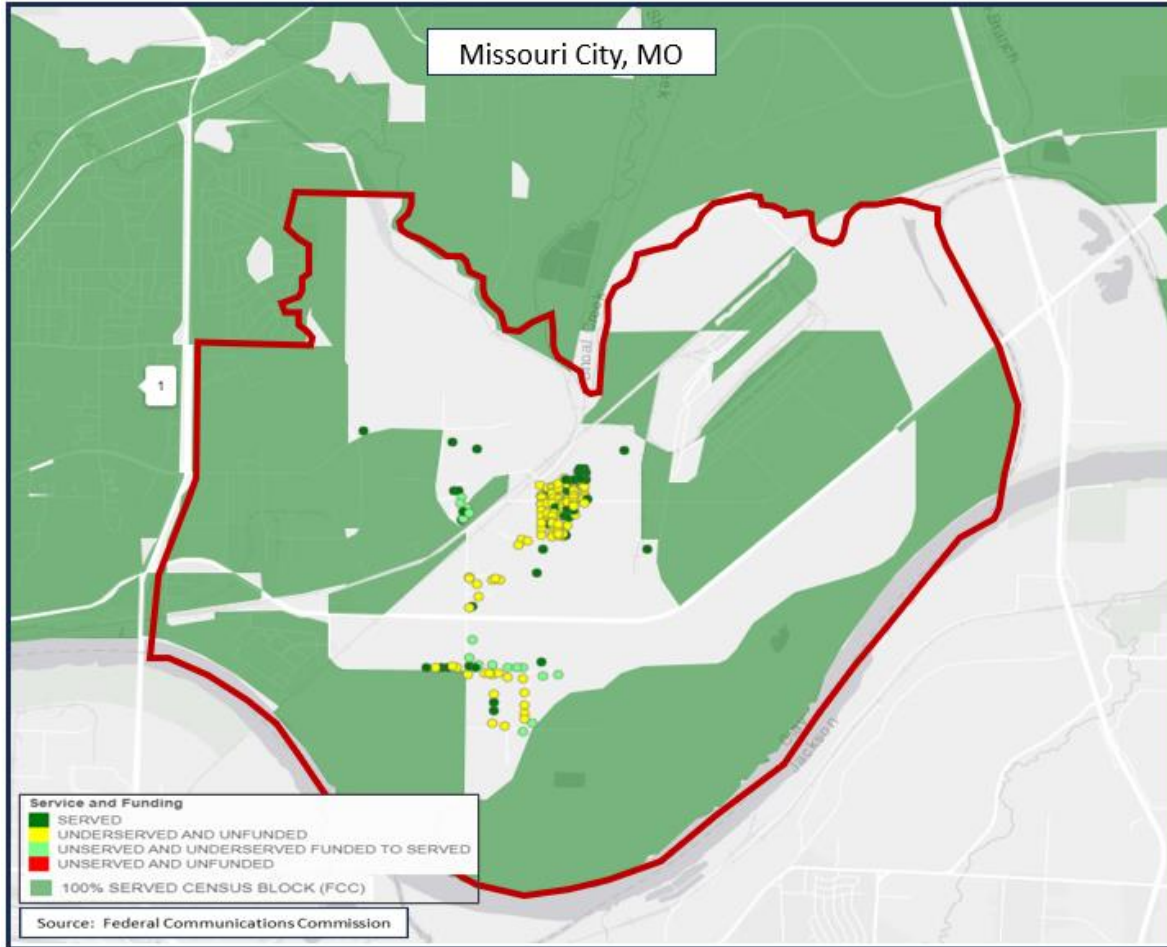
These conclusions are reinforced by the FCC's Funding and Service Status map for Clay County which shows numerous household locations that do not meet the threshold for broadband internet service. Most are in the "underserved and unfunded" category, but there are several in the "unserved and unfunded" category.

The second sample area is in the Kearney area, west of I-35 and south of Highway 92 (Census tract #29047021804). This is a relatively large area that contains a mixture of agricultural land and large-lot residential subdivisions. It is also an area that illustrates that Ookla test score averages can conceal areas that have very different internet options and performance levels. Portions of this tract are served by fiber-to-the-home services from Alphabet (Google), AT&T, and United Electric Cooperative, and cable-to-the-home service from Charter Communications. All of these options advertise maximum download speeds of 1 Gbps or better. Other parts of the same Census tract, however, have no high-speed, "to-the-home" service of any kind and must make do with a combination of satellite, fixed wireless and DSL providers.
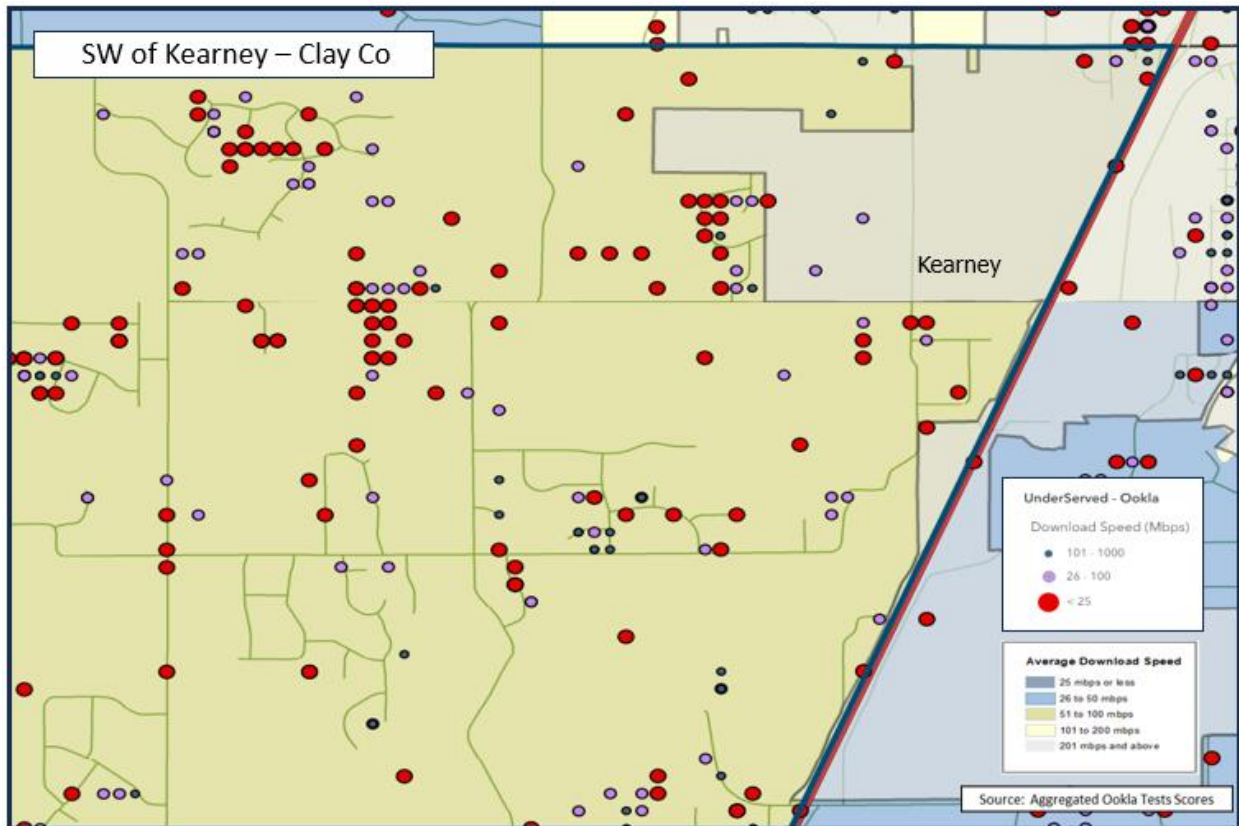
Consequently, the Ookla test scores go as high as 520 Mbps and the average download speed is a respectable 71 Mbps. This masks, however, areas where the Ookla test results are typically below 50 Mbps and there are no households with results that meet the 100/20 broadband threshold. This is consistent with the FCC's Funding and Service Status map which shows numerous households that are "unserved" or "underserved" and not currently funded for infrastructure improvements.

By contrast, an area in the heart of Gladstone east of Troost and north of 72nd Street (Census tract #29047021103) has consistently good service by multiple providers. The entire tract (and the surrounding tracts as well) are served by both Alphabet (Google) and Charter Communications with advertised download speeds of up to 1 Gbps or better.

Ookla test score top out at nearly 500 Mbps and average just over 190 Mbps. On the FCC's Funding and Service Status map the entire area is shown as "served."

In summary, Clay County is like other counties in the region in that the best ISPs tend to focus on the areas of greatest residential densities. The lower density areas have options that are more limited in the speeds they can offer. Faster options are beginning to show up in these lower density areas, but there is no consistency in the availability of quality services.

Ray County - As the most rural county in the region, Ray County experiences the most extreme form of the urban/rural divide relative to internet service. There are portions of the county, however, that have reasonably good internet options including areas in the northeast corner that are served by Green Hills Telephone which is one of the rare companies to offer fiber services with up to 1 Gbps speeds in rural areas.
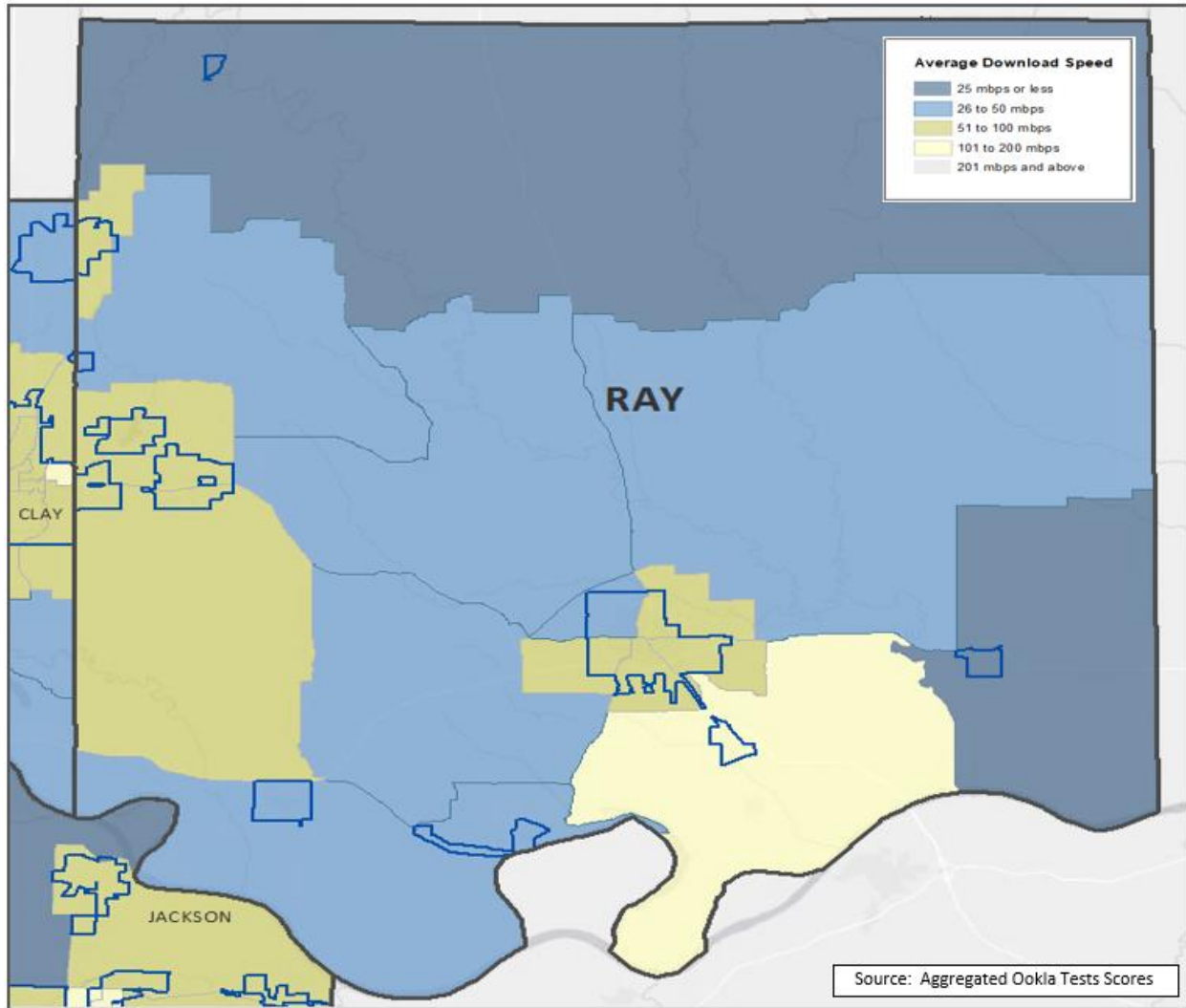
The northwest corner of the county east of Highway 13 (Census tract #29177080000), is an example of one of the areas where internet service is the worst. Not only are there very few providers, in some areas there are no providers that can offer speeds over 60 Mbps. Most of the options are

satellite systems, along with a limited number of ISPs using either DSL or fixed wireless technologies.
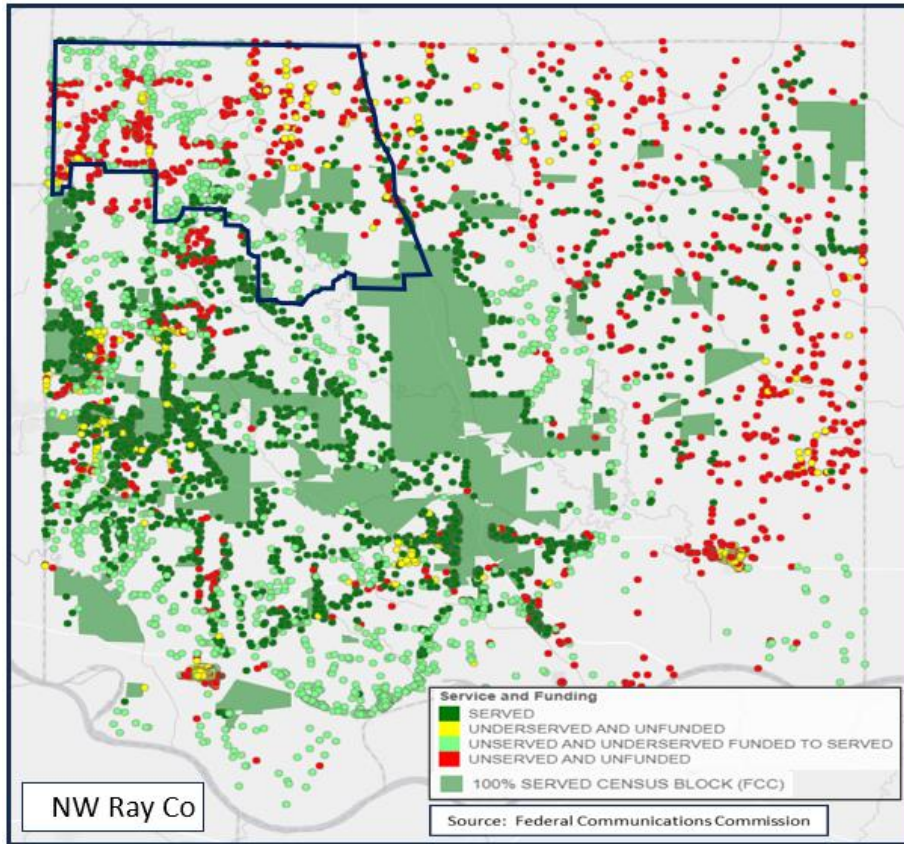
Ookla test scores for this block group average just 22 Mbps, among the lowest in the metro area. The FCC's Funding and Service Status map shows the vast majority of households as being either unserved or underserved, although several dozen locations are categorized as having funding to improve infrastructure to a "served" level.

Service and Funding
SERVED
UNDERSERVED AND UNFUNDED
UNSERVED AND UNDERSERVED FUNDED TO SERVED
UNSERVED AND UNFUNDED
100% SERVED CENSUS BLOCK (FCC)

Source: Federal Communications Commission

SE Ray Co
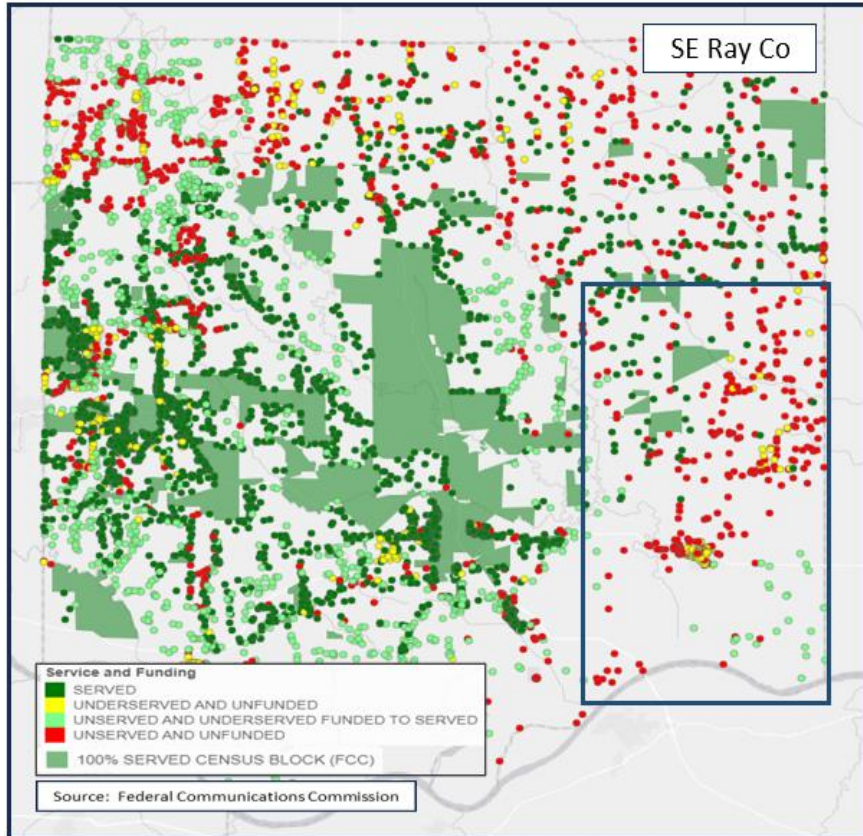
The southeast corner of the county, around the small community of Hardin (Census tract #29177080100), had even worse Ookla test scores. The average download speed in this area was just 14 Mbps with a maximum download result of 43 Mbps. On the FCC's Funding and Service Status map, virtually the entire area is shown as either underserved or unserved.

This block group has no cable- or fiber-to-the-home options and even the fixed wireless and DSL options offer speeds of less than 25 Mbps. The best options appear to be satellite-based ISPs such as ViaSat or SpaceX that advertise speeds up to 100 Mbps but are relatively expensive.

The third sample area is in the heart of Richmond (Census block group #29177080200). This area does not have a surplus of options but at least there are a few that can provide reasonably fast internet service. This block group is served by a cable-to-the-home service from Mediacom Communications with maximum download speeds of up to 1 Gbps and a fixed wireless service from Wisper that offers maximum download speeds of up to 100 Mbps.
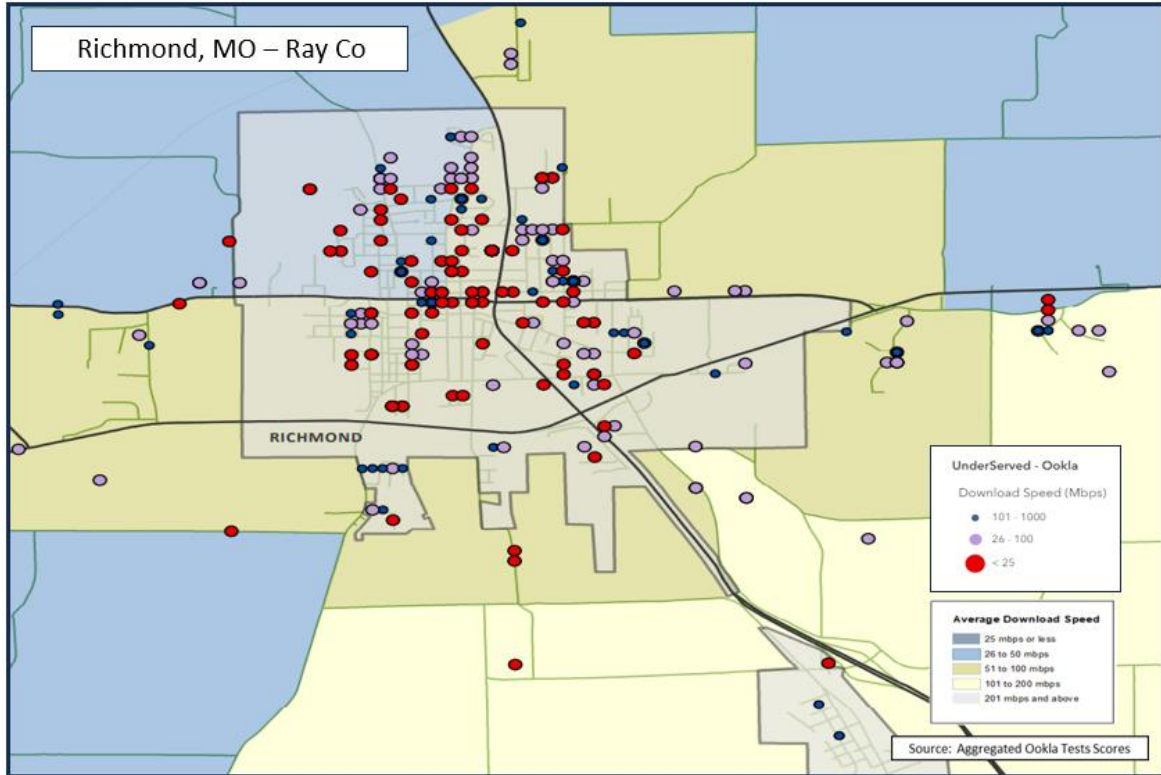
Ookla scores in this area average 78 Mbps download speeds, with a maximum recorded download speed of 536 Mbps. This block group (and virtually all of Richmond) is shown as fully served on the FCC's Funding and Service Status map.

In summary, Ray County gets by with no significant participation by any of the major ISPs in the metro area. There are some local fiber providers, however, along with one cable provider that can provide high-speed internet service to selected portions of the county. The remaining areas are served primarily by fixed wireless, DSL and satellite systems and performance is inconsistent. Some of the most remote areas have so few options that they are "unserved" according to the NTIA's broadband definitions.

Conclusions

It is difficult to draw firm conclusions about the status of internet infrastructure in the region because definitive information is not publicly available. Most internet service providers (ISPs) are privately owned and do not release the details of their network or their technological limitations. What data is available from the Federal Communications Commission (FCC) and testing services such as Ookla are indicators of service quality and geographic extent, but they are not precise or detailed enough to give a complete picture of infrastructure needs.

Despite these limitations, it is possible to conclude that the metropolitan area is definitely in need of additional internet infrastructure investment. In particular, the rural periphery of the region has slower service at much higher prices, and in some cases virtually no broadband service at all. In

addition, areas along the river valleys tend to have relatively poor service. This is likely a result of low densities due to floodplain development restrictions and the physical difficulty of extending network infrastructure into areas that are bisected by major waterways.

The use of sample data sources and information aggregated by Census blocks or block groups also hides small residential pockets that have been overlooked or shortchanged by ISPs, including heavily urbanized areas in the core of the metro area. In particular, multi-family residential projects may have obsolete wiring or owners with contractual arrangements that prevent residents from signing up for the type of internet service that they would prefer even if that service is generally available in their neighborhood. Community-based nonprofit organizations have had some success working with public housing agencies to upgrade the technology available to their residents and to provide personalized assistance to the residents themselves so that they understand and apply the advantages of faster internet access. Kansas and Missouri should set aside funds for this type of program even if it differs from traditional internet infrastructure expansion.

It is also important to point out the impact of affordability on actual internet usage. In some areas, high-speed internet service may be available but might be priced beyond the means of many households, even with the federal Affordable Connectivity Program (ACP) subsidy. Additional infrastructure resources may be needed to promote competition between ISPs or to shift to internet technologies that can be delivered at a lower cost.

In particular, fixed wireless service holds considerable promise due to the cost savings of not having to run fiber or cable to each residential structure. This includes traditional 5G cellular providers as well as nonprofit community organizations that utilize the latest small-cell, CBRS (Citizens Broadband Radio Service) technology. Download and upload speeds may fall somewhat short of the NTIA standard but would represent a significant service upgrade at a price that is much more affordable than what is provided by fiber-to-the-home ISPs.

There should also be a push to make sure that anchor institutions throughout the region have high-speed internet connections. This is already the case in most locations but there are a few exceptions, particularly in small communities and rural counties. Infrastructure improvements to service government buildings, libraries, schools and community centers should be prioritized because of the outsized impact that these facilities provide to the community.

Finally, it is crucial to understand that bridging the digital divide is not merely a matter of physical infrastructure. Digital education, appropriate devices and on-going support services are just as essential and just as deserving of governmental funding.

Recommendations

1. Invest broadband infrastructure funds to address unserved and underserved portions of the Kansas City metropolitan region, particularly those rural and very low-density areas.

   The areas where broadband infrastructure investment are needed and which meet federal BEAD grant requirements include: outlying portions of the metro area – Ray County, eastern Jackson County, much of Cass County outside larger city limits, and Clay and Platte counties north of Kansas City and outside larger city boundaries in Missouri; and in Kansas, much of Miami County outside the larger cities, southwest and western Johnson County, portions of western Wyandotte County and urban areas unserved due to low density or difficult topography, and Leavenworth County outside major cities.

   In addition, there are areas where due to topography or low-income neighborhoods that limited ISP investment due to market demand forecasts, broadband infrastructure is not available for suburban or urban properties.

   There may be small neighborhood areas in suburban and urban locations where service isn't available, and small-scale grants may offer the opportunity to address these gaps.

   The federal program requires that the states fund broadband investments for those areas that are not served as a priority before areas that are underserved. The manner in which the federal government requires demonstration of unserved and underserved using the national FCC fabric maps makes it difficult if not impossible to challenge information provided by the ISP providers.

2. Invest broadband infrastructure funds in areas where only one provider offers adequate service (100/20) but the costs are extremely high relative to what is charged in other parts of the metro area. In areas where the costs to install broadband are greater due to topography, density of customer base or distance among housing units, greater support for providers and subsidies for households may be necessary to allow for cost-effective services to be installed and delivered.

   There are urban, suburban and rural portions of the metro region that are served by only one provider (other than satellite or unregulated service). Households in these areas face high cost and unreliable or low speed services. Additional federal investment is appropriate for these areas.

3. Invest broadband infrastructure funds in low-income neighborhoods where current services use old DSL technology and low speeds at relatively high costs or invest in funds in innovative approaches such as a secure wireless mesh network enabling households to enroll in a subscription at a very low cost.

Historic redlining of residential neighborhoods in urban areas has impacted the investment by private companies in newer fiber technologies to provide broadband services. Many of these older urban neighborhoods have unreliable or lower speed services due to older ISP equipment. In some cases, the high cost of subscriber services limits household choices for lower speed, inadequate services. Although many providers are enrolled in the federal Affordable Connectivity Program, the cost for services is still above the reach of some households and there is uncertainty about the future of the subsidy program. States could support projects that offer alternative technologies such as wireless networks to help lower income households with affordable, reliable services.

For fixed wireless service, the provider should be required to ensure that the advertised speed is available to all customers, regardless of how far away they are from the tower. While this may not be an appropriate solution in all areas, there could be low-income neighborhoods or rental housing developments where this type of solution would offer an appropriate, low-cost option. An example in the Kansas City area is a nonprofit organization, PCs for People, offering a wireless solution in some multi-dwelling units.

4. Invest in broadband and/or wireless solutions for multi-dwelling units (MDU), particularly where residents have limited incomes and current technology is old and inadequate or doesn't exist. This could be a place to influence the operationalizing of the federal law and an important focus where funding for replacing old wiring in MDUs could create opportunities for workforce development, either in training individuals to install such infrastructure or to utilize the technology to work from home.

5. Invest broadband infrastructure funds to connect anchor institutions in urban, suburban and rural areas to support services to disadvantaged populations and increase workforce and educational opportunities.

   The states should allow for a portion of the federal funds to support enhancements to anchor institution systems and networks to improve public services. Anchor institutions include schools, libraries, health care organizations, local government, public housing and other public service entities.

6. Include criteria in the selection of broadband projects for funding that achieve these outcomes:

   a. Equity for households to be served by supporting investments in areas across the state – rural, suburban, urban – where service does not exist or is inadequate due to cost, reliability, or speed. The states of Missouri and Kansas could consider steps to limit the ability for grantees to immediately sell their companies upon receipt of federal funds or require minimum service quality that could be beneficial to the community, such as digital literacy classes or funding devices or ensuring there won't be any digital discrimination in the new service. As an example, community benefits agreements could be used and written consistent with the FCC's digital discrimination policy.

b. Equity for companies/organizations receiving grant funds to enable smaller companies/organizations to compete by lessening barriers to entry and ability to make sizable investments recognizing cash flow limitations to wait for reimbursement. For Missouri, it is recommended that the letter of credit requirement be waived in some circumstances to ensure smaller companies also have a chance to get some of the funding.

7. Address these challenges in the selection of projects for broadband funding:

a. Require grant recipients to commit to serving the geographic areas proposed in their applications for a minimum time period following close out of the grant before selling their service area to another provider. This attempts to minimize the risk of companies seeking federal funds solely to make a return on their (and the government's) investment rather than improving service to portions of the state. (see comment in 5a above).

b. Require grant recipients to offer service that meets the NTIA definition of "served" for all customers receiving service through the federally funded project and at a subscriber fee that is at or below comparable service within the geographic area where improved service is proposed.

c. Require grant recipients to extend infrastructure to allow for services to all households in a service area proposed in the application, not just one or a few.

d. Require grant recipients to report to the state (public record) the number of housing units/properties that have access to broadband service for the first time as a result of the federally funded investment.

e. There are concerns about the timing of already awarded RDOF and ARPA grants and the grants to be awarded through the BEAD funding. The timing of implementation could be impacted by rising construction costs and supply chain challenges. These concerns may mean that some RDOF or ARPA awardees or early BEAD grant awardees won't be able to deliver what was originally proposed. The states may limit other applicants from proposing to serve areas that our expected to be served by RDOF or ARPA funds. The states should monitor implementation to ensure that BEAD money can go where it's needed if RDOF or ARPA projects fall through or must cut back on promised service areas. Solutions should be outlined (perhaps in grant rounds beyond the initial one) to make sure that areas don't end up being left out when their RDOF or ARPA projects don't end up being completed.