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Comparing Broadband Availability & Speed Tests in Indiana

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Roberto Gallardo is the Director of the Purdue Center for Regional Development and a Purdue Extension Community & Regional Economics Specialist. He is also an associate professor in the Agricultural Economics department. He holds an electronics engineering undergraduate degree, a master's in economic development, and a Ph.D. in Public Policy and Administration. Gallardo has worked with rural communities over the past decade conducting local & regional community economic development, including use of technology for development.

He has authored more than 100 articles including peer-reviewed and news-related regarding rural trends, socioeconomic analysis, industrial clusters, the digital divide, and leveraging broadband applications for community economic development. He is also the author of the book “Responsive Countryside: The Digital Age & Rural Communities”, which highlights a 21st century community development model that helps rural communities transition to, plan for, and prosper in the digital age. Dr. Gallardo is a TEDx speaker and his work has been featured in a WIRED magazine article, a MIC.com documentary, and a RFDTV documentary. He lives in West Lafayette with his wife and two daughters.

Comparing Broadband Availability & Speed Tests: How Bad Is It?

Abstract

One of the well-known limitations of the Federal Communications Commission (FCC) Form 477 broadband data is that it overstates availability, especially in rural areas. Our study undertakes a comparison of the FCC data with recently released speed test data for the state of Indiana from Ookla at the Census block level. Speed thresholds analyzed include the current broadband definition of 25 Megabits per second download (Mbps) and 3 Mbps upload or 25/3 as well as a faster 100 Mbps download and 20 Mbps upload speeds or 100/20. Results indicate that 25/3 FCC availability data matches closely with Ookla speed test results in urban areas of the state but is 36% higher in rural areas. Results also show that 100/20 FCC availability data was 88% higher in urban areas and 296% higher in rural areas of the state. To better understand this 100/20 difference, an analysis was conducted controlling by poverty levels since perhaps 100/20 is available but homes do not subscribe due to higher cost resulting in lower speed tests. Upcoming eligibility for the Infrastructure and Investment Jobs Act (IIJA) should not be based solely on the FCC data but should also include community-led broadband surveys, more detailed provider footprints and capacity (assuming they share this information with the proper safeguards), as well as speed tests.

Introduction

It is well known that the Federal Communications Commission (FCC) Form 477 data – the only publicly available national broadband availability dataset – has its challenges, mainly that it overstates broadband availability. As a case in point, the FCC December 2020 dataset estimated that roughly 148,000 people in Indiana did not have access to 25 Megabits per second (Mbps) download and 3 Mbps upload, or 25/3 for short (the current definition of broadband). However, October 2020 estimates conducted by Microsoft – based on server logs and other proprietary information – reveals there were roughly 3.3 million Indiana residents who did not use the internet at a minimum of 25 Mbps download¹. While the two sets of data are not necessarily comparing apples to apples given that one metric is focusing on availability for both download and upload while the other is tracking actual download speeds only—this discrepancy is significant and worthy of further exploration.

There are three key reasons why the FCC dataset often overstates availability. First, the information is not validated by consumers. Data is self-provided by internet service providers twice per year and

includes what could be served. Second, the lack of granularity also affects availability given that it focuses on Census blocks – the smallest geography for which the U.S. Census compiles socioeconomic data – versus address-level data. In other words, if one single housing unit in an entire Census block (which can easily exceed 2 square miles in rural areas) has access to broadband, the entire Census block and all housing units or population within it is considered served. Lastly, FCC dataset refers to maximum advertised speeds available in a particular location but does not factor in actual speeds experienced by the consumer.

For this reason, speed test results would be a good metric to compare to FCC broadband availability since it could serve as a valuable mechanism for assessing the extent to which the FCC dataset overestimates availability. Fortunately, one of the most used speed test platforms (Ookla) released speed test results at the Census block level for the entire nation, allowing us to conduct an analysis for the state of Indiana. The next section discusses our data and methodology, followed by results. This report then wraps-up with a concluding section.

¹[Broadband Access & Connectivity | Microsoft CSR](#)

Data & Methods

Two datasets were utilized in this analysis using the 2010 Decennial Census as a base. The first is the December 2020 FCC's Form 477 broadband availability dataset. This dataset includes provider name, technology transmission type, and maximum advertised speeds among other variables². In addition to this data, the FCC also publishes an annual estimated number of housing units and population per Census block.

To allow for urban/rural differences, 2010 Census block data was added that identifies a block as urban or rural. Since Census blocks change over time, some Census blocks from the FCC dataset that did not exist in 2010 were not categorized as urban or rural. Dummy variables were calculated to indicate if 25/3 or 100/20 Mbps broadband were advertised in a Census block regardless of provider or technology.

The second dataset utilized was obtained from Ookla. Ookla is an online platform that runs speed tests. The raw speed test data was grouped into tiles or quads (roughly 600 meters x 600 meters) including average

download and upload speeds, latency, and number of speed tests³. Millions of speed tests completed in 2020 in Indiana were analyzed. These tiles were then geolocated to obtain average data per Census blocks weighted by number of speed tests. Furthermore, since data is available by quarter, these were averaged (number speed tests were added) to estimate 2020 data and make it comparable to the FCC data. Dummy variables were also created to identify Census blocks that had speed tests of 25/3 or higher as well as 100/20 or higher. Worth noting is that not all Census blocks reported speed tests and those with less than five speed tests were removed⁴.

Once 2020 FCC and Ookla data were available at the Census block level for Indiana and linked to 2010 urban/rural categories and housing/population FCC estimates, the percent of population with access to advertised (FCC) and actual (Ookla) 25/3 and 100/20 Mbps were then aggregated to the county level, distinguishing their urban and rural portions.

Results

According to the FCC's dataset and as shown in **Figure 1**, about 94% of Indiana residents had access to 25/3 Mbps as of December 2020. Of these, 99.7% had access to 25/3 in urban Indiana compared to 96.8% in rural Indiana. However, when examining the Ookla speed test data, the share of Indiana residents using the internet at a minimum of 25/3 Mbps was 89% but 99.5% in urban areas and 71.1% in rural areas.

In other words, the 25/3 Mbps FCC share is roughly the same as the Ookla reported speeds in urban areas but is about 6% higher in the state overall and 36% higher in rural Indiana.

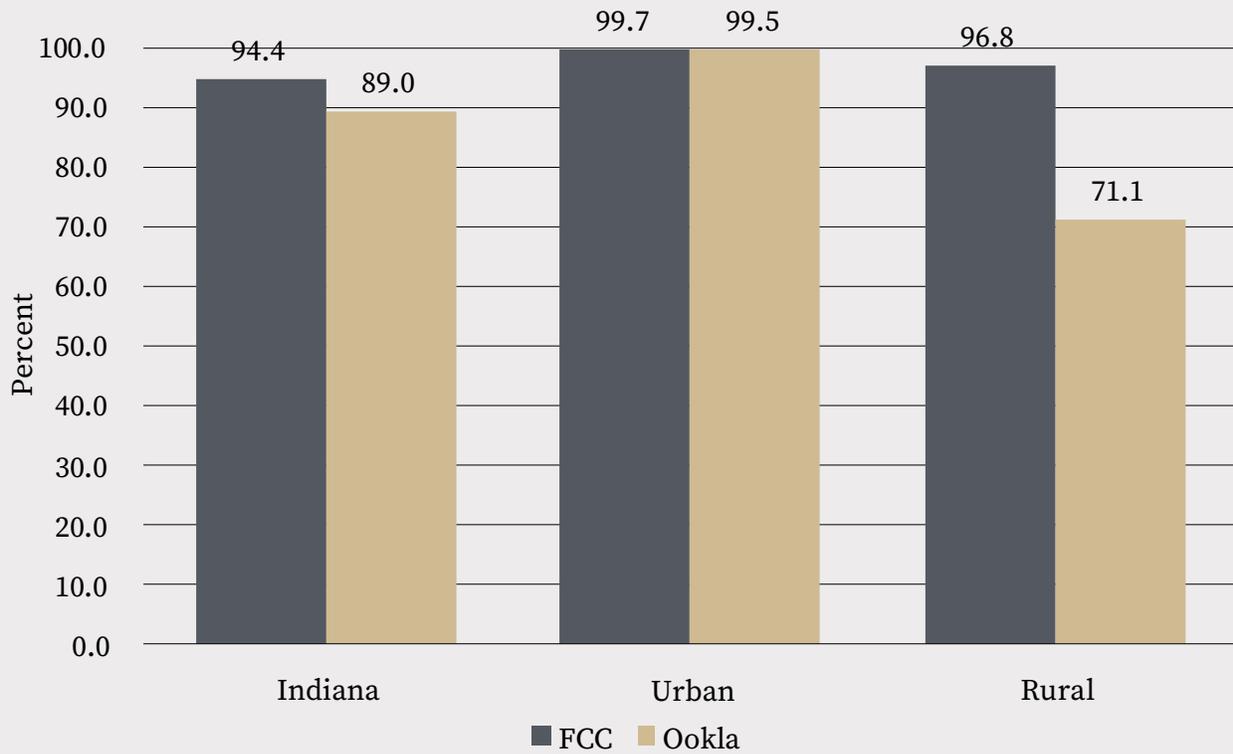
When looking at the faster threshold of 100/20 Mbps, **Figure 2** shows that the differences between the FCC numbers and Ookla speed tests are much larger. FCC data shows that close to 90% of Indiana residents had access to advertised 100/20 Mbps while Ookla speed test results show that only 43% used the internet at that speed. Regarding urban areas, close to 98% had access to this speed according to the FCC while Ookla data shows that only 52% used the internet at these speeds. Lastly, close to 78% of rural population in Indiana had access to 100/20 according to the FCC while Ookla speed test data shows that less than one-fifth (19.9%) used the internet at this speed.

²[Fixed Broadband Deployment Data from FCC Form 477 | Federal Communications Commission](#)

³[GitHub - teamookla/ookla-open-data: Speedtest by Ookla Global Fixed and Mobile Network Performance Map Tiles](#)

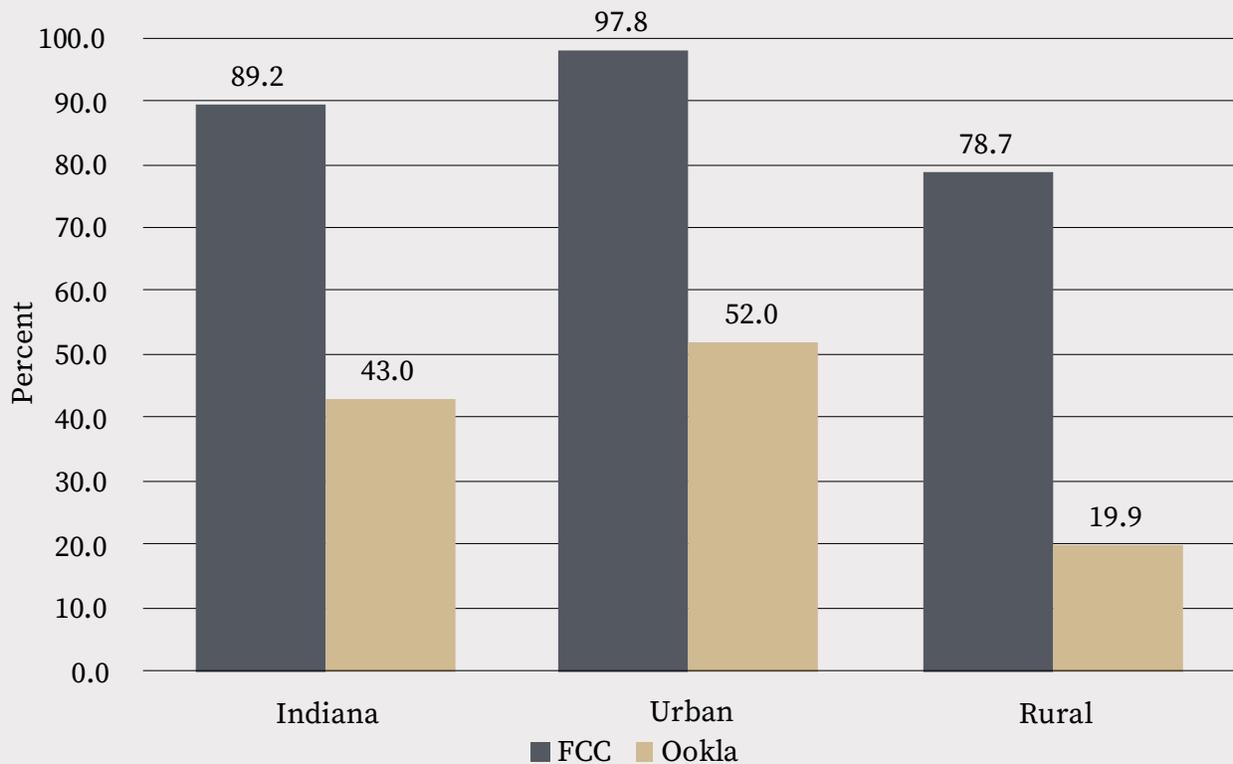
⁴This resulted in roughly 23,761 Census blocks being removed. Population analyzed was of 6.3 million versus the total population of 6.7 million.

Figure 1. Percent of Population with access to 25/3 Mbps per FCC & Ookla Data



Source: FCC Form 477; Ookla Speed Tests

Figure 2. Percent of Population with access to 100/20 Mbps per FCC & Ookla Data



Source: FCC Form 477; Ookla Speed Tests

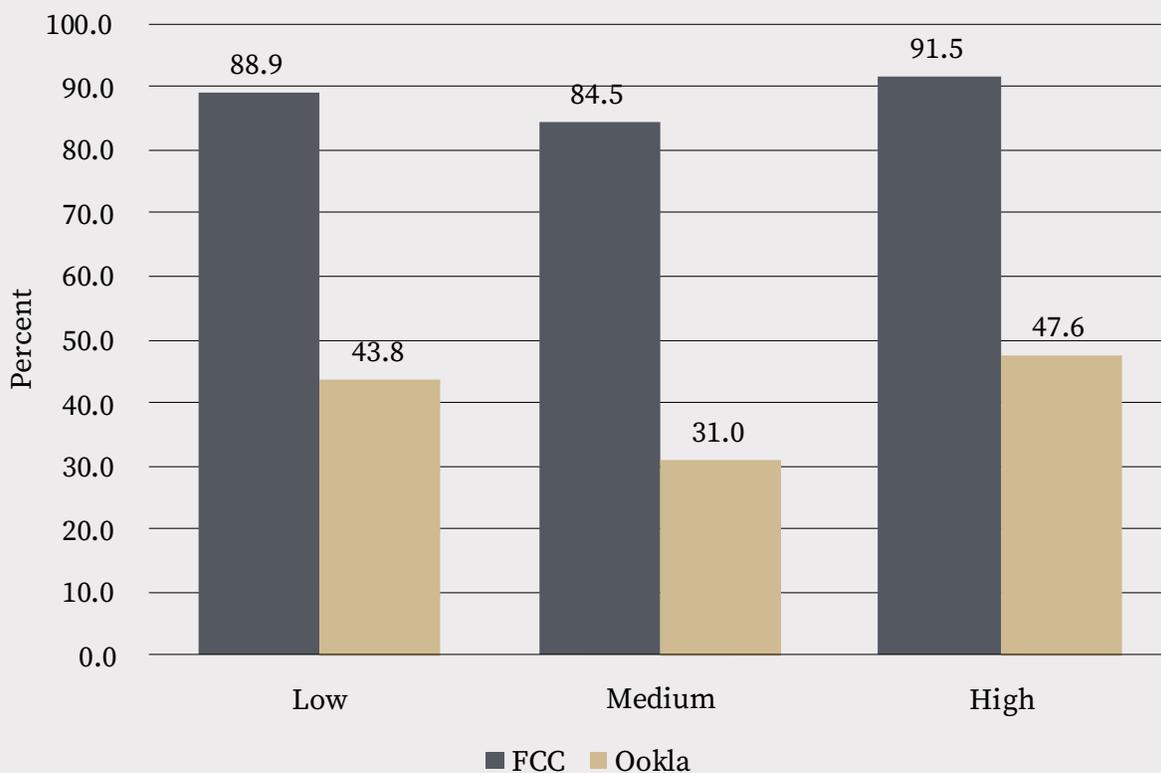
What this translates to is the following: the 100/20 Mbps FCC was 108% higher in the state overall compared to the Ookla data, 88% higher in urban areas, and a shocking 296% higher in rural areas.

While it is true that 100/20 Mbps may be available in these different geographic areas, households may not subscribe due to a higher cost. As such, the speed tests will not match the FCC availability dataset, in part explaining the large differences shown in Figure 2. To parse this out a bit more, all counties in Indiana were divided into three groups of 30 or 31 counties based on their poverty rate: low (poverty rate of less than 10%), medium (poverty rate between 10% and less than 13.4%), and high (poverty rate ranging from 13.4% to 22.8%). Why? If cost were a key obstacle to the adoption of 100/20 Mbps service,

then it is expected that high poverty counties should show an even larger difference between 100/20 FCC (advertised) and Ookla (actual) while low poverty counties should reveal a smaller difference.

Figure 3 shows that there is no increase or reduction in the difference based on poverty levels. In fact, the share of population using internet at 100/20 Mbps in the high poverty counties was greater compared to the low poverty counties (47.6% versus 43.8%). Another potential explanation is that homes, regardless of poverty level, are not subscribing to higher speed tiers even if they are available to them. However, given the recent pandemic and the increase in remote work, telehealth, and e-learning, it is hard to believe they would not subscribe to a faster speed service if they can afford it.

Figure 3. Share of Population with access to 100/20 Mbps per FCC & Ookla by Poverty Groups

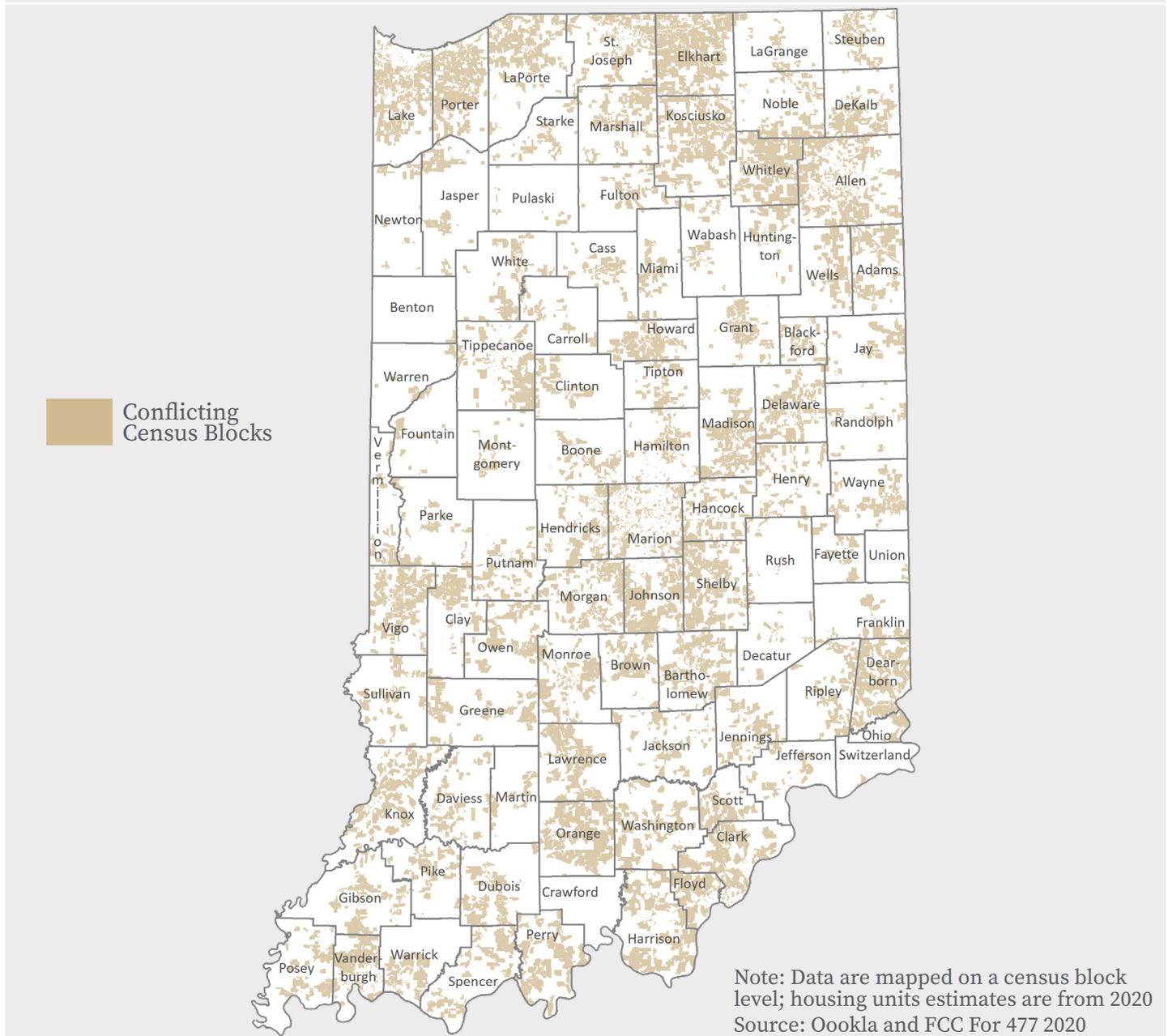


Source: FCC Form 477; Ookla Speed Tests; ACS 2016-2020

To visually show where the discrepancies take place between FCC and Ookla data, **Figure 4** shows Census blocks in the state (tan color) where the FCC data indicates 100/20 Mbps service is available while multiple Ookla speed test results show speeds below 100/20. These conflicting census blocks appear throughout the state. Keep in mind that the white areas do not necessarily mean that there were no discrepancies there. Rather, it may mean that speed test was not available or sufficient or that FCC and Ookla data did align.

For those who are interested in examining county-specific information that compares 100/20 Mbps FCC and Ookla data, please go to this [online interactive table](#). The table lists the total for a given county as well as its urban and rural portions. Note that the table can be sorted in ascending or descending order. To restore to the original layout, sort by “Record”. For example, Perry County showed the highest discrepancy with the FCC data overstating 100/20 Mbps availability by 989%.

Figure 4. Conflicting Census Blocks



Conclusions

Before reviewing the implications of this study, it is worth discussing its limitations. First, speed tests are not the perfect metric. Speed test results can be affected by many factors including time of day, device used, operating system, distance to Wi-Fi modem, Wi-Fi configuration, and other issues. Second, while there were millions of speed tests completed throughout the state in 2020, these were not evenly distributed. In other words, speed tests are not indicative of all residents in the state. Remember that more than 20,000 Census blocks were not included in the analysis due to the absence of speed test results or having less than five per Census blocks. Lastly, this analysis is based on the same assumption for which the FCC dataset has been criticized, namely, that our sample of speed tests is used to categorize an entire Census block as being served or unserved.

It has been known for some time that the FCC dataset overstates 25/3 Mbps availability, especially in rural areas. In fact, a study commissioned by the FCC in 2019 found that FCC data overstated availability in rural Missouri and Virginia by roughly 38%, a figure that is in alignment with the findings from this study⁵.

More worrisome, however, is that the FCC overestimates 100/20 availability even more. The recently passed Infrastructure Investment and Jobs Act (IIJA) states that areas eligible for funding will be

determined by FCC maps where 100/20 is not available. Based on the results of this analysis, FCC numbers show that 78.7% of Indiana rural residents had access to 100/20 Mbps while the Ookla numbers show that 19.1% of Indiana residents in rural areas used the internet at 100/20 Mbps. This is a difference of more than 763,000 residents. Employing solely the FCC data to guide IIJA activities could result in a large swath of Indiana residents being left behind when it comes to expanding investments in broadband services.

The FCC has announced that Form 477 data will improve by using a different reporting technique. Rather than using Census blocks it will use shapefiles – used in Geographic Information Systems that should provide more granularity and accuracy.

While this new effort by the FCC is to be applauded, the odds of the data improving significantly in its first iteration are slim. For this reason, IIJA eligibility should not only be based on the FCC data but also on community-led broadband surveys, more detailed provider footprints and capacity, and speed tests. This eligibility can be coupled with the strong community engagement component also in the IIJA. The bottom line is that communities should have a more active role to play to ensure that the country takes advantage of this once in a lifetime opportunity to reduce the infrastructure digital divide.

⁵[UST BSLF PoC Findings - August 2019.pdf \(fcc.gov\)](#)

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