BROADBAND AVAILABILITY BEYOND THE RURAL/URBAN DIVIDE

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Abstract

While it is commonly understood that broadband is less available in rural communities and more available in urban communities, a simple two-way, rural-urban comparison masks the fact that there is considerable variation in availability within these two types of communities. By assigning communities to one of five categories, it becomes clear that there is not a simple rural/urban divide. Rather, one group of rural Americans has even less broadband access than previously understood and two groups of urban Americans have more broadband than is typically identified.

Additionally, this more granular analysis of broadband availability in rural and urban communities demonstrates that greater broadband availability within rural communities or within urban communities is closely associated with population density. However, comparing broadband availability across the combination of all rural and urban communities establishes that a community's proximity to a Metropolitan Statistical Area (MSA) is often more closely associated with higher broadband speeds than is population density alone.

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About the *Broadband Briefs* Series

This report on the availability of broadband, authored by the National Telecommunications and Information Administration (NTIA) and the Economics and Statistics Administration (ESA), is the second report in the Broadband Briefs series and uses publicly available data collected by the Department of Commerce to examine broadband availability in greater detail. The U.S. Department of Commerce publishes key economic and demographic data that support effective decision-making by policymakers, businesses, and the American public. Information and Communications Technology is critical to economic growth and the Department plays a leading role in this area by overseeing programs that expand broadband access and adoption and also measure current availability and adoption across the country. The Department makes data available from its broadband-related programs—including the Broadband Technology Opportunities Program (BTOP), the State Broadband Initiative (SBI), and the Current Population Survey (CPS) Computer and Internet Use Supplement—for use by researchers and the public to conduct economic, financial, demographic, and other studies. In addition, the Department conducts its own research and analysis to further examine the availability of broadband and the factors associated with increased broadband deployment.

This report uses data from the June 30, 2011 State Broadband Initiative (SBI) dataset and the 2010 Decennial Census, to compare broadband availability across rural and urban communities. NTIA, in collaboration with the FCC, and in partnership with the 50 states, five territories and the District of Columbia, updates the SBI data and publishes the National Broadband Map (NBM) twice a year. Each state, or its designee, collects broadband data by census block or road segment. More information about data collection, verification, and publication is available in the About section of the NBM. All data are publicly available in the Analyze, Developer or Data Download sections of the NBM and all previous datasets are also available on NTIA's website. The description of how NTIA and the FCC process these data is available on the Technical Overview section of the National Broadband Map.

Data Definitions Used in this Report

NTIA's broadband availability dataset contains, among other information, advertised speeds at the census block level. In census blocks larger than two square miles, the data is collected by road segment. For the purposes of NTIA's data collection, broadband is "available" if it can be deployed to a business or consumer within 7-10 business days and without an extraordinary commitment of resources. This definition is in contrast to "adoption," which means that a consumer or business subscribes to or uses broadband at a particular location. The definition of broadband does not specifically include price, latency, bandwidth limitations, or other factors that may impact a user's ability to purchase or use the service.

This report examines broadband availability, from the most basic speed levels, which allow a user to access several basic web tools, to the fastest speeds, for which developers are now beginning to design applications. NTIA begins its analysis at the combined advertised connection of 3 Mbps downstream and 768 kbps upstream, which is the closest combination of speeds for which NTIA collects data that would allow a consumer to "access a basic set of applications that include sending and receiving e-mail, downloading Web pages, photos and video, and using simple video conferencing."[1] Downstream speed measures the rate at which a user can download data from the Internet, including viewing Web pages, receiving emails, or downloading music. Upstream speed measures the rate at which a user can upload data to the Internet, including sending email messages and files. The report also assesses broadband availability at seven download speed tiers, as follows:

- ≥ 3 Mbps and < 6 Mbps;
- ≥ 6 Mbps and < 10 Mbps
- ≥ 10 Mbps and < 25 Mbps
- ≥ 25 Mbps and < 50 Mbps
- ≥ 50 Mbps and < 100 Mbps
- ≥ 100 Mbps and < 1 Gbps
- ≥ 1 Gbps

While the basic speed combination of 3 Mbps/768 kbps allows a consumer to access a basic set of applications, many institutions, such as schools and libraries, and applications, such as distance learning, telemedicine, and high quality video conferencing, require much faster speeds. For example, a November 2010 report published for the U.S. Small Business Administration found that distance learning and telecommuting activities require download speeds of at least 25 Mbps in order for a single user to

[1] Federal Communications Commission. "National Broadband Plan." March 2010. Accessed April 2013. http://www.broadband.gov/plan/8-availability/. The National Broadband Plan calls for actual speeds of 4 Mbps downstream and 1 Mbps upstream. The advertised speed of 3 Mbps downstream and 768 kbps upstream is slower than this benchmark and readers should also consider the availability of at least 6 Mbps as a proxy for a service that is slightly higher than this minimum.

have an "OK" experience, and 50 Mbps for a "Good" experience.[2] In addition, if more than one person shares a connection (for example, two parents and two children in one household), the group will need greater bandwidth to maintain the same experience level that a single user has over the same connection. As households use one device to watch a video and another to comment or take notes through a virtual desktop, they require faster speeds. The speed tiers for which NTIA collects data reflect service levels available to users today.[3] Already, in limited areas, broadband providers are starting to offer super-fast speeds from hundreds of megabits per second to a gigabit per second. For example, in Kansas City, Missouri, Google is deploying gigabit services and recently announced plans for a similar rollout in Austin, Texas.[4] In June 2012, Verizon announced that it would offer a 300 Mbps service over its network.[5] EPB, the local electric company in Chattanooga, Tennessee, also offers broadband service up to 1 Gbps.[6] These speeds may be faster than many users need today, but just as the country advanced from using dial-up speeds to broadband, data trends suggest that the need and demand for faster broadband speeds is growing. For example, in August 2000, only 4.4 percent of households had a home connection to broadband – then considered 200 kbps – but 41.5 percent of households had adopted dial-up connections, at either 28.8 kbps or 56 kbps. In just 10 years, dial-up subscribers declined to 2.8 percent of households in 2010. By contrast, 68.2 percent of households were subscribed to broadband service in that same year.[7]

[2] U.S. Small Business Administration, Office of Advocacy, The Impact of Broadband Speed and Price on Small Business, Columbia Telecommunications Corporation, November 2010. Accessed April 2012. http://archive.sba.gov/advo/research/rs373tot.pdf.

[3] NTIA expects that, in the future, it will be important to disaggregate faster speed tiers in order to reflect the changing availability of broadband services.

[4] Finley, Klint. "Google's Super-Speed Internet Will Hit Austin in 2014." Wired.com. April 9, 2013. Accessed April 10, 2013. http://www.wired.com/wiredenterprise/2013/04/google-fiber-austin-official/.

[5] Stacey Higginbotham. "Why you will need a 300 Mbps broadband connection." Gigaom. June 22, 2012. Accessed April 10, 2013. http://gigaom.com/2012/06/22/why-you-will-need-a-300-mbps-broadband-connection/.

[6] See https://epbfi.com/internet/.

[7] National Telecommunications and Information Administration. "Digital Nation, Expanding Internet Access, NTIA Research Preview." February 2011. Accessed April 11, 2013. http://www.ntia.doc.gov/files/ntia/publications/ntia_internet_use_report_february_2011.pdf.

Broadband Availability, Urbanization, and Metropolitan Labor Markets

Rural and Urban

The 2010 Decennial Census designates urban and rural[8] areas for each of the more than 11 million Census blocks[9] in the United States. About four-fifths (80.7 percent) of the population lives in blocks designated as urban. These urban blocks have 2,343 Residents per Square Mile (RPSM). The remaining one-fifth (19.3 percent) of the population lives in rural blocks where the density is 17 per square mile. Analyzing the June 30, 2011 broadband availability data, NTIA and ESA confirm that broadband is less available in rural areas than in urban areas. This finding is not unexpected, as it has been the case for all SBI datasets, and follows historical patterns of broadband deployment.[10] For example, 71 percent of the rural population in June 2011 had access to basic wireline broadband service, defined in this report as combined advertised speeds of at least 3 Mbps downstream and 768 kbps upstream, while nearly the entire urban population (98 percent) had basic wireline broadband service available (see Figure 1). The gap widens at faster speeds. For example, only 23 percent of rural residents had wireline download speeds of 50 Mbps or greater available to them, but 63 percent of urban residents, nearly three times as many, had wireline download speeds of 50 Mbps or greater available to them. In contrast to wireline service, the gaps were much smaller between the shares of urban and rural residents who had basic wireless broadband service available (86 percent of rural residents compared to 98 percent of urban residents). However, the differences were larger at higher speeds: only 15 percent of rural residents had wireless download speeds of 10 Mbps or greater available, compared to 70 percent of urban residents.[11] There were also large gaps between rural and urban populations that had access to higher-

[8] The methods used by the Census Bureau to classify areas as urban or rural are extremely detailed and complex. A highly simplified description of the Census Bureau's method for identifying urban areas starts by identifying a densely settled urban core (i.e., with at least 1,000 persons per square mile). The Census Bureau then considers areas surrounding urban cores and classifies them as urban lower-density enclaves (less-densely populated residential areas, central business districts, parks, rivers, lakes, etc.) surrounded by more densely populated areas using criteria depending on distance between cores, overall population densities, and overall population levels. Every Census block not identified as urban is identified as rural. The criteria defining the 2010 Census urban areas are available at http://www.census.gov/geo/www/ua/fedregv76n164.pdf; see also http://www.census.gov/geo/www/ua/uafaq.html).

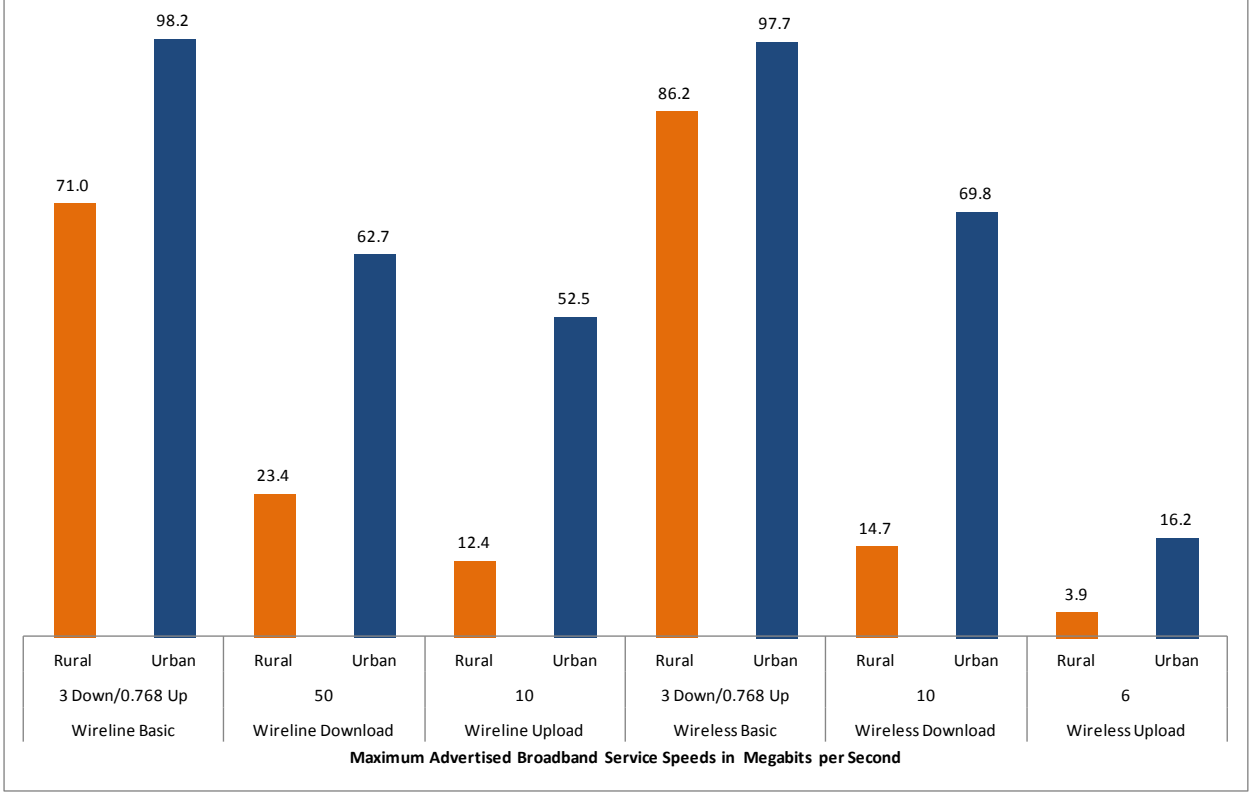
[9] The SBI dataset provides broadband availability data by Census block or road segment. Census blocks are the smallest areas for which the Census Bureau tabulates statistics in the Decennial Census. They are typically bounded by physical features or administrative borders. Census blocks are typically small in area, such as a single city block, but can be much larger in less densely populated areas. In this report, the United States consists of the 50 states and the District of Columbia.

[10] For a discussion of the historical barriers to construction and maintenance of rural telecommunications infrastructure, see Sten, Peter. "Broadband Internet's Value for Rural America." Page 16. Economic Research Service/USDA. August 2009, Accessed April 11, 2013. http://www.ers.usda.gov/media/155154/err78_1_.pdf

[11] Though this paper uses broadband availability in June 2011 as the basis for the analysis, preliminary analysis of June 2012 data demonstrates that while broadband speeds have increased in rural and urban communities, the patterns identified in this brief still hold.

speed upload service.[12] For example, only 12 percent of the rural population had wireline upload speeds of 10 Mbps or greater compared to 53 percent of urban residents.

Figure 1 **Rural Urban Availability at Selected Speeds (June 2011): Disparities increase as speeds increase**



Five-way rural/urban/MSA classification

To provide a more detailed evaluation of the rural-urban divide, this report splits rural and urban areas into subgroups, creating five geographic categories that are ranked from highest population density to lowest: Central Cities (2,754 Residents per Square Mile (RPSM)), Suburbs (1,970 RPSM),[13] Small Towns (1,447 RPSM), Exurbs (37 RPSM), and Very Rural (11 RPSM) (See Figure 2).[14] Central Cities, Suburbs, and Small Towns comprise the Census blocks designated as urban by the Census Bureau. Not surprisingly, the bulk of the U.S. population is in Central Cities (about one-third of the total population) and in the Suburbs (more than 40 percent of the total population). Small Towns account for just seven percent of

[12] While most analyses focus on download speeds, upload speeds are critical to user experience in two or multi-party communications such as video. In addition, as more consumers move to cloud-based services that are accessible through any device, they will need to continue uploading documents, photos, and video for storage and backup.

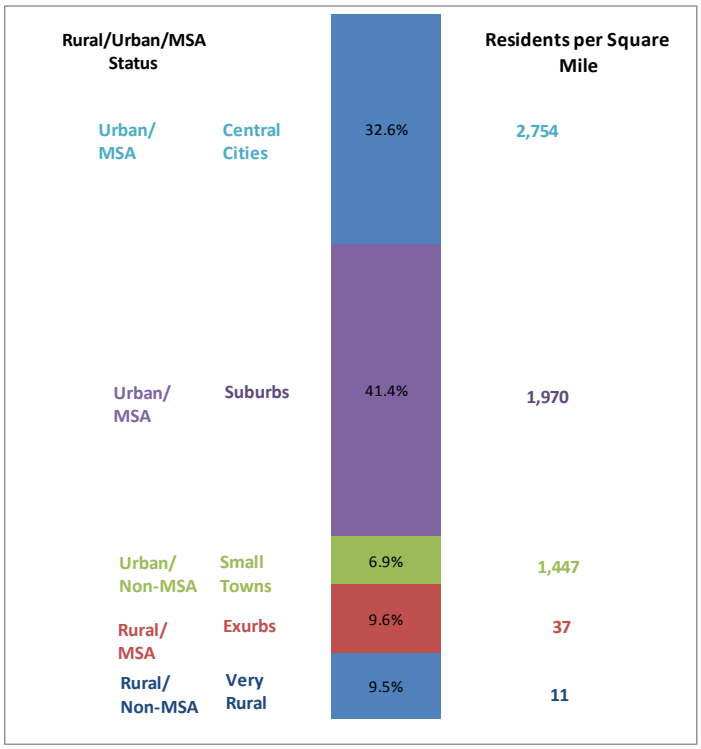
[13] There is no standard definition of what constitutes suburban areas. Other researchers have defined suburbs as the entire portion of a MSA that lies outside of the Central City (see, for example, Frey 2012).

[14] Note that 0.2 percent of the population of the United States resides in rural areas within Central Cities.

the population. Census blocks designated as rural are divided into two sub-groups: Exurbs[15] and Very Rural.

In terms of location, Central Cities are the principal core cities of Metropolitan Statistical Areas (MSAs).[16] Suburbs are inside MSAs, but not in the principal cities; and Small Towns are located outside of MSAs. Small Towns are different from the two other urban areas because of their location outside MSAs, but they are also distinguished from rural areas because of their significantly higher population density. Though they have very low population density, Exurbs are located in MSAs. In contrast, Very Rural areas are located outside of MSAs and have the lowest levels of population density. Location inside or outside of an MSA is also a representation for proximity to the Central City. That is, Suburbs are generally closer to Central Cities and ringed by Exurbs, both of which are inside MSAs and positioned closer to Central Cities than are Very Rural communities and Small Cities, both located outside MSAs.

Figure 2: Five-Way Classification of Census Blocks



This five-way geographic categorization provides a much richer picture of broadband availability than does the standard rural/urban categorization. Figure 2 shows that the shares of population in the United States residing in Exurbs and Very Rural areas are roughly equal – slightly less than 10 percent each. Exurbs are likely to have vastly different economies than Very Rural areas, which are part of much smaller labor markets and are generally farther away from Central Cities. By decoupling these two categories, it is possible to assess the diversity of broadband availability within rural communities.

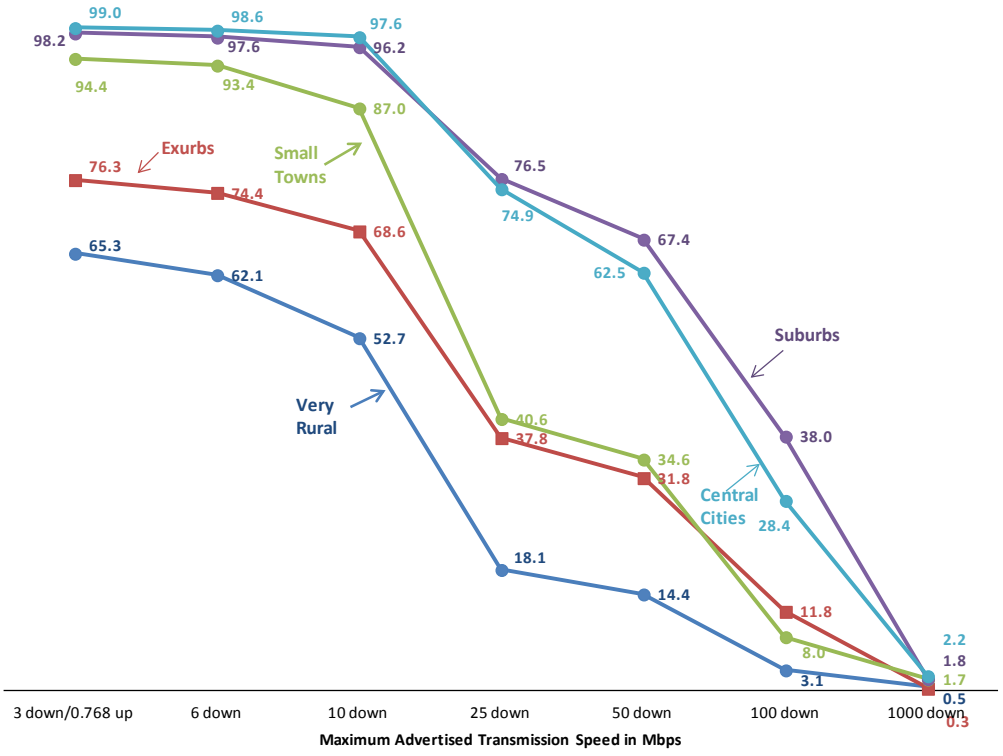
[15] There is no standard definition of what constitutes exurban areas. Some researchers have used other methods to define exurbs, based on Census tract-level data on housing unit densities, age of housing stock, and commuting patterns (see, for example, the commentaries by Gardner and Marlay). Others define exurban counties of MSAs as those with less than 25 percent of their population in urbanized areas (see, for example, Frey 2012).

[16] An MSA is a collection of counties centered on one or more core counties with Urbanized Areas each featuring a population of at least 50,000. Non-core counties in an MSA share close social and economic ties with the core counties as evidenced by commuting patterns. The U.S. Office of Management and Budget is the federal agency that defines (and updates) MSAs (see http://www.whitehouse.gov/omb/bulletins_b03-04/).

First, in rural areas, 71 and 86 percent of residents in June 2011 had basic wireline and wireless broadband service available, respectively (see Figure 1). However, the shares of population that live in areas with basic broadband services available are somewhat greater in Exurbs than in Very Rural areas: 76 percent of Exurban residents had basic wireline available compared to 65 percent for Very Rural residents (see Figure 3). There are gaps of about the same magnitude in the availability of basic wireless download broadband service (86 percent in overall rural, 90 percent in Exurbs, and 82 percent in Very Rural areas; see Figure 5).[17]

Figure 3

Percent of Population with Wireline Download Broadband Service Available at or Above Maximum Advertised Speeds



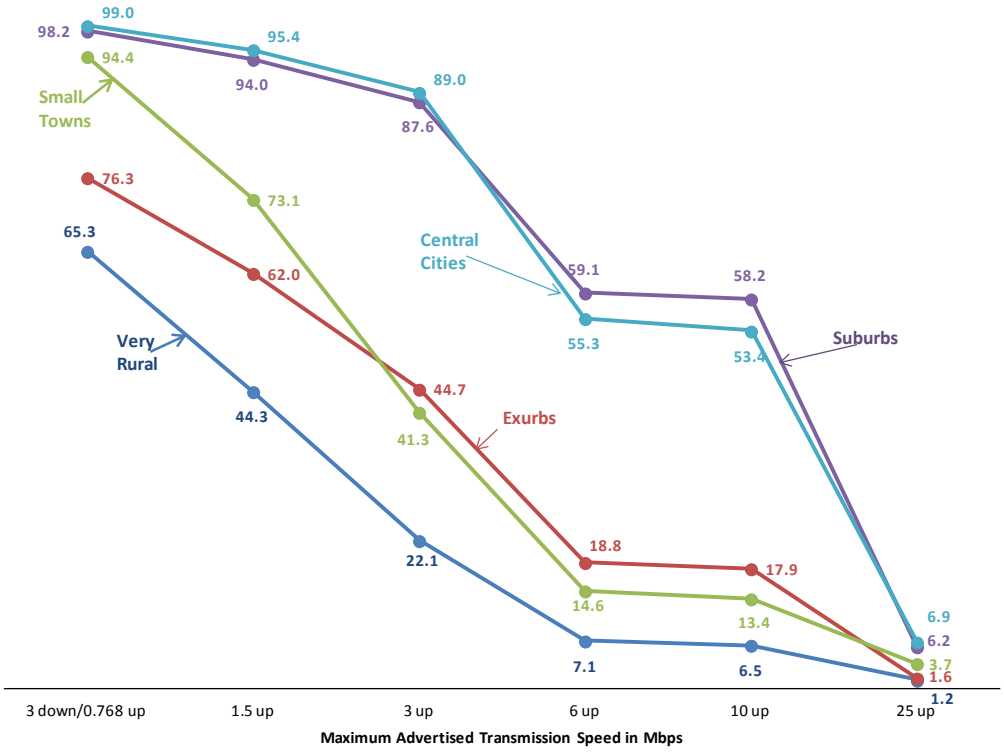
There are much larger proportional differences between Very Rural areas and Exurbs in the availability of higher-speed services. In June 2011, wireline download speeds of at least 50 Mbps were available to only 14 percent of the Very Rural population, which is less than half of the Exurban population share (32 percent; see Figure 3). The gap was even larger for wireless download speeds; four percent of Very Rural residents had wireless download speeds of 10 Mbps available – only one-sixth the share of Exurban residents (see Figure 5). Similarly, only seven percent of Very Rural residents had wireline upload speeds of 6 Mbps or greater available to them, compared to 19 percent of Exurbanites (see Figure 4). However,

[17] Since Exurbs and Very Rural areas share about the same percentage of the population, the overall percentage of rural residents with access at a given speed is always halfway between the lower Very Rural availability rate and the higher Exurban availability rate.

the gap in higher-speed wireless upload service was relatively small, in part due to the lower upload speeds available overall (see Figure 6). Two percent of those in Very Rural areas had access to upload speeds of 6 Mbps compared to about six percent of Exurbanites.

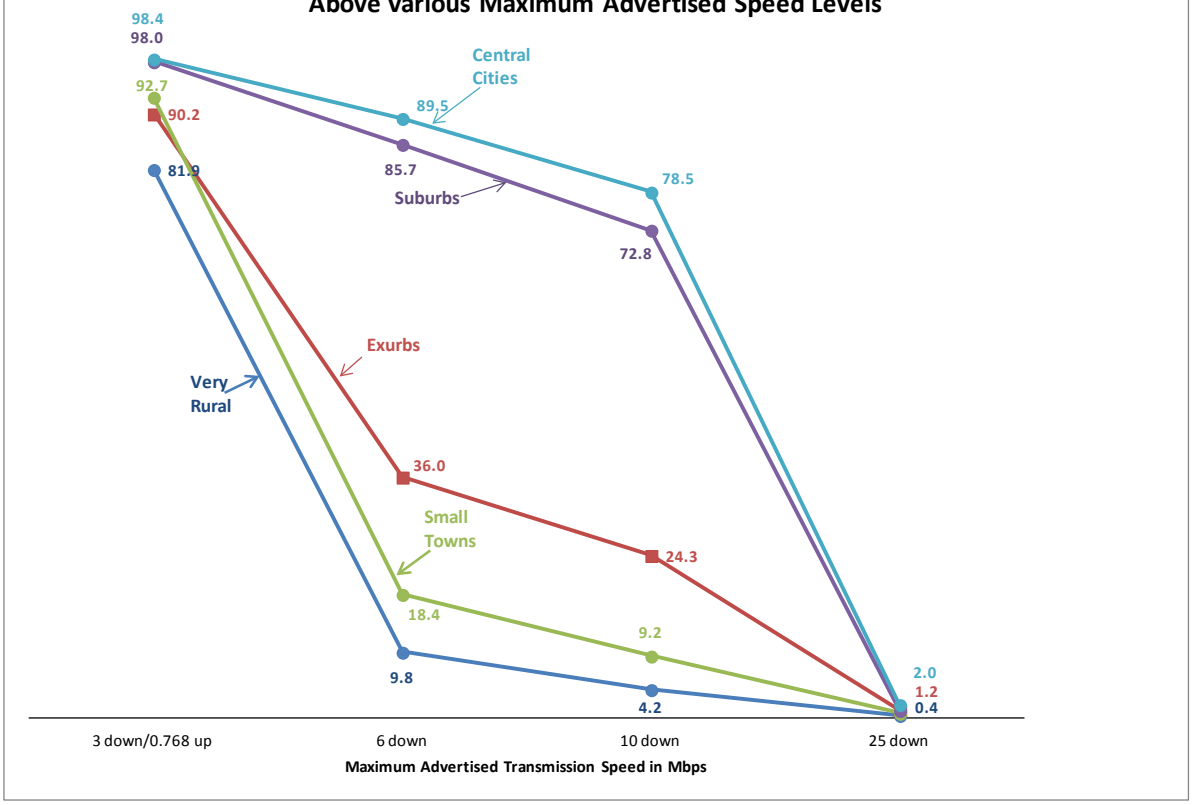
Figure 4

Percent of Population with Wireline Upload Broadband Service Available at or Above Various Maximum Advertised Speed Levels



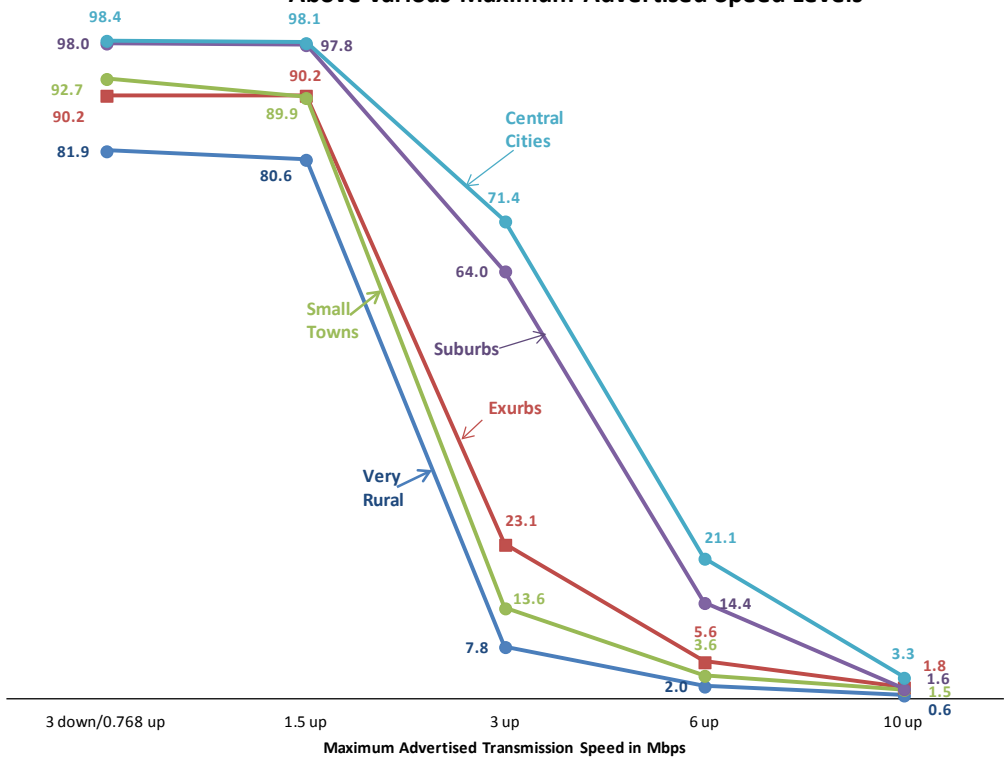
This five-way analysis presents a more robust story when considering urban areas as well. In contrast to the two rural areas discussed above, most residents of the three urban areas have basic broadband service available to them. However, there are differences across the three areas in the level of availability of higher-speed service. Small Towns have much lower availability rates for higher-speed service than urban areas within MSAs (i.e., Suburbs and Central Cities). For example, Small Towns had an availability rate of 41 percent for wireline download speeds of at least 25 Mbps; the corresponding rates were 75 and 77 percent for Central Cities and Suburbs, respectively. And we find that only 8 percent of the Small Town population had wireline download speeds of at least 100 Mbps available to them. Urban residents in MSAs (*i.e.*, Suburbs and Central Cities) had much higher availability rates at speeds of 100 Mbps or greater: 28 percent for Central Cities and 38 percent for suburbs (see Figure 3). Similar gaps in availability also exist for wireline upload speeds of at least 1.5 Mbps or greater (availability rate of only 73 percent for Small Towns versus 94 and 95 percent for Suburbs and Central Cities – see Figure 4); wireless download speeds of 6 Mbps or more (18 percent for Small Towns versus 86 percent for Suburbs and 90 percent for Central Cities – see Figure 5); and wireless upload speeds of 3 Mbps or greater (14 percent compared to 64 percent for Suburbs and 71 percent for Central Cities– see Figure 6).

Figure 5 Percent of Population with Wireless Download Broadband Service Available at or Above Various Maximum Advertised Speed Levels



Proximity to Central Cities, which as noted is also approximated by location inside or outside of an MSA, may be more strongly associated with the availability of the highest speed levels of broadband service than population density. While Exurbs were less likely to have basic wireline broadband service than Small Towns, Exurbs did have somewhat higher availability rates for higher-speed wireline broadband service than Small Towns (for example, 12 percent compared to eight percent for wireline download speeds of 100 Mbps or greater and 18 percent compared to 13 percent for wireline upload speeds of 10 Mbps or greater), and Exurbs are far more likely to have wireless download speeds of 10 Mbps or greater than Small Towns (24 versus 9 percent). That is, Exurbs, which are rural, had more broadband availability at higher speed levels than did Small Towns, which are urban. Though the population in Exurbs is much sparser than that in Small Towns, 37 people per square mile compared to 1,447, Exurbs are located within MSAs and are closer to Central Cities than Small Towns, which are located outside of MSAs. This suggests that proximity to a Central City may be more strongly associated with the availability of the highest speed levels of broadband service than population density. More research needs to be conducted to determine whether location within an MSA and proximity to a Central City are simply associated with increased broadband availability or whether they are factors that contribute to increased broadband availability.

Figure 6 **Percent of Population with Wireless Upload Broadband Service Available at or Above Various Maximum Advertised Speed Levels**



Interestingly, Suburbs have somewhat greater broadband availability rates for higher-speed wireline service than Central Cities. For example, Suburbs had 10 percentage points greater availability of wireline download service at speeds of 100 Mbps or greater than Central Cities. In other words, despite having fewer residents per square mile, those in the Suburbs were more likely to have access to higher speeds than those in the more densely populated Central Cities. This finding suggests that, in some cases, factors other than location within an MSA and population density may be more strongly associated with availability of higher-speed broadband service.

Conclusion

While each SBI dataset has demonstrated that broadband is less available in rural areas than in urban areas, this analysis demonstrates that there is considerable variation within these categories. Though a rural/urban split continues to be useful in providing generalized information about availability, a five-way classification uncovers a more refined picture of the divide in broadband availability across the nation. For example, at wireline download speeds of 50 Mbps, broadband availability varies from 14 percent (Very Rural), 32 percent (Exurban), 35 percent (Small Town), 62 percent (Central City), to 67 percent (Suburban), even though the overall broadband availability was 63 percent in urban areas compared to 23 percent in rural areas. In addition, wireline and wireless broadband availability, particularly at faster speeds, tends to be higher within Central Cities and the Suburbs compared to

everywhere else. Moreover, not only are far fewer rural residents than urban residents able to access 4G wireless services (*i.e.*, at least 6 Mbps downstream), but a further divide also exists within rural communities. For wireless download services greater than 6 Mbps, Very Rural communities have approximately half the availability rate of Small Towns, and Small Towns have about half the availability rate of Exurbs (10, 18, and 36 percent, respectively). For wireline download service, Very Rural communities also have the least availability of all five areas.

The differences in the availability of the broadband speeds both within rural areas and within urban areas are generally associated with population density. For example, the data show significantly less broadband availability in Very Rural areas compared to Exurbs, and in Small Towns compared to Suburbs and Central Cities. However, at the faster wireline download speeds, access in the Suburbs and Central Cities does not fit this pattern. Higher percentages of Suburban residents have higher-speed wireline download service available than Central City residents, despite lower population densities in the Suburbs.

When comparing availability across all five categories, location within an MSA is in some cases more closely associated with access to some broadband speeds and types than is population density. In particular, despite their rural categorization, which is primarily related to their lower average population densities, Exurbs are actually generally located closer to Central Cities, since they are located within MSAs, than are Small Towns. Exurbs, the data show, also have greater broadband availability than Small Towns, which are located outside of MSAs, to wireline download speeds higher than 50 Mbps and wireline upload speeds faster than 3 Mbps, as well as all wireless download and upload speeds. Within each urban and rural category, the subgroups located outside an MSA (Very Rural and Small Cities), and therefore farther from a Central City, always have less broadband availability than those areas inside an MSA (Exurbs in rural, and Suburbs and Central Cities in urban). This finding, in combination with the finding that Exurbs often have greater availability than Small Towns, suggests that proximity to a Central City in some cases is more closely associated with higher broadband speeds than is population density.

Rural residents are about evenly split between those living inside Very Rural areas (outside of MSAs) and Exurbs (rural areas inside MSAs). Exurbanites are much more likely to have higher-speed broadband service available than residents of Very Rural areas. Similarly, persons living in Small Towns (*i.e.*, urban areas outside of MSAs), about 7 percent of the population, are much less likely to have higher-speed broadband service available than the nearly three-quarters of the population that live in Suburbs (urban areas in MSAs but outside of the principal city in the MSA) or Central Cities. In fact, Small Town residents tend to have less broadband availability than Exurbanites, despite the fact that the former live in much more densely populated areas than the latter. Suburban residents (41 percent of the population) are somewhat more likely to have higher-speed wireline broadband service than Central City residents (about one-third of the population), but the opposite is true for higher-speed wireless broadband service.

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Note: Due to a correction in fixed wireless broadband availability in Hawaii between June and December 2011, this report uses December 2011 fixed wireless data for Trex Broadband.

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