Broadband Availability in the Workplace

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Abstract

Building on previous work examining broadband availability across different geographies by population, this report examines broadband availability by job location. As in *Broadband Availability, Beyond the Rural/Urban Divide,* this report divides the United States into five categories based on degree of urbanization. Rather than examining broadband and general population levels, however, this report assesses the impact of broadband availability in the workplace. Virtually all jobs have access to very basic broadband speeds. However, jobs located in more rural communities have less access to high-speed broadband than more urban communities, for both upload and download speeds, and the gaps in availability generally are greater at higher speeds.

This brief also examines two industries – manufacturing and information. Manufacturing jobs, which are relatively concentrated in more rural communities, have less access to higher speed broadband than information jobs, which are concentrated in more urbanized communities.

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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 third report in the Broadband Brief series and uses publicly available data collected by the U.S. Department of Commerce (Department) to examine broadband availability in greater detail. The Department publishes key economic and demographic data that support effective decision-making by policymakers, businesses, and the American public. Information and Communications Technology (ICT) 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 broadband 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 and June 30, 2012 SBI datasets, the Census Bureau's 2010 Decennial Census Summary Files, and the 2010 Longitudinal Employer-Household Origin-Destination Employment Statistics (LODES) dataset to analyze broadband availability by job location. NTIA, in collaboration with the Federal Communications Commission (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 website.

Introduction

Businesses increasingly need access to faster download and upload speeds to compete in today's digital economy, and fast broadband speeds also open the opportunity for companies to hire workers independent of location. Business establishments located in areas with significant high-speed broadband availability have opportunities to leverage the benefits of broadband in ways that businesses located in unserved or underserved areas do not.[1] Additionally, all else being equal, businesses located in areas with less high-speed broadband availability may be disadvantaged compared to their better-served competitors. These factors may also influence where a company expands its operations, or where it moves to initially.[2]

Following the methodology of *Broadband Brief No. 2, Broadband Availability, Beyond the Rural/Urban Divide*, this brief divides the United States into five categories based on their degree of urbanization and proximity to large cities. However, rather than examining the impact on residents, this report assesses the extent to which broadband access is present where jobs are located. To perform this analysis, NTIA's June 30, 2011 and 2012 broadband availability data are matched by Census block with the Longitudinal Employer-Household Origin-Destination Employment Statistics (LODES) Data Set. LODES data cover virtually all wage and salary civilian employment in the United States for each Census Block in 2010.[3]

Using this five-way rural-urban analysis, this brief demonstrates the variability in higher-speed broadband availability for jobs within different geographic areas. It also compares broadband availability in the information sector, where jobs are typically located in areas with some of the fastest broadband speeds, with jobs in manufacturing, where more jobs are located in areas without access to high-speed broadband. The data show the same persistent gaps in the availability of high-speed broadband in the workplace based on geographic area that were evident when measuring broadband availability by population, *i.e.*, generally the more urban the area, the greater the availability of high-speed broadband. Determining how best to bridge the rural-urban broadband gap in the workplace is an area for further research and policy focus.

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[1] An establishment is a single physical location where business is conducted or where services or industrial operations are performed. For purposes of this report "businesses" refers to "establishments."
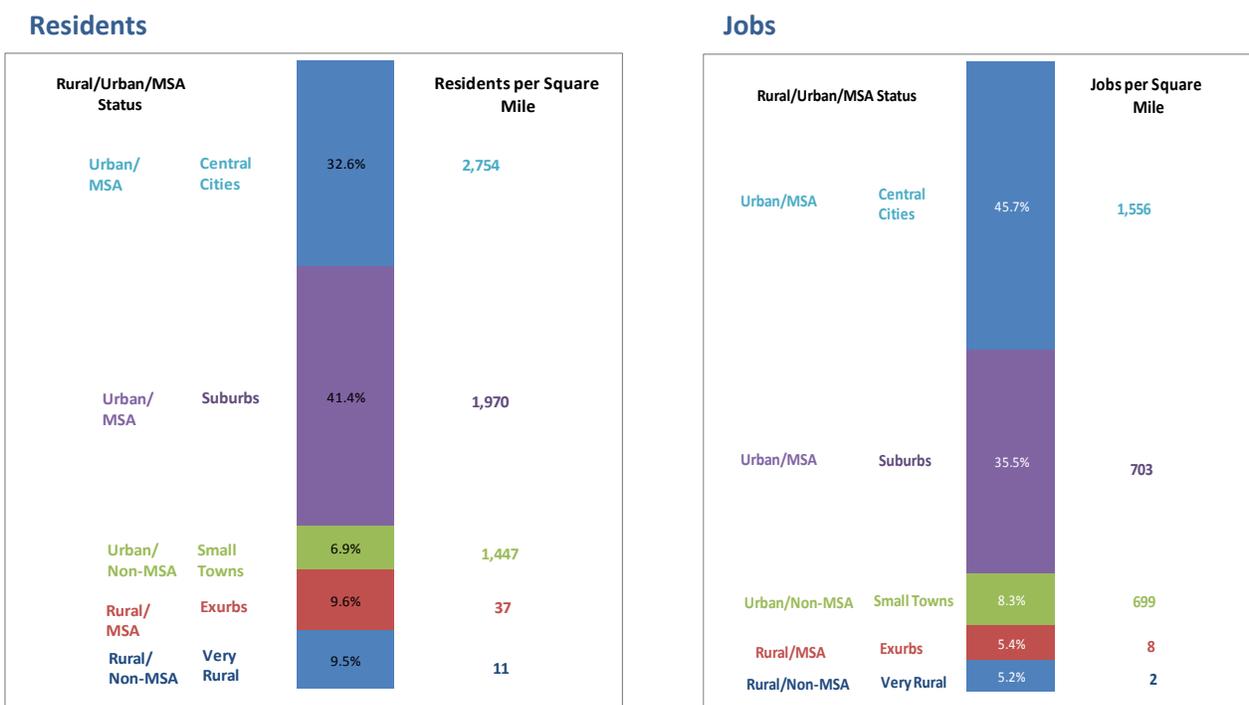
[2] For example, the results of a small nonrandom survey in fall 2012 of readers of *Area Development Magazine* indicate that advanced ICT services are ranked as the fourth most "important" or "very important" factor (out of 26) in relocation or expansion, cited by 85.1 percent of respondents. See: "27th Annual Survey of Corporate Executives: Changing Site Selection Priorities." Q1/Winter 2013. Accessed 08/12/13. http://www.areadevelopment.com/Corporate-Consultants-Survey-Results/Q1-2013/27th-Corporate-Executive-RE-survey-results-37376241.shtml?Page=1.

[3] Note that there are no LODES data for Massachusetts. See Appendix II for information about data collection and technical terms.

Broadband Availability and Job Location

Building on previous work that NTIA and ESA undertook to examine broadband availability across different geographic areas by population, this report examines broadband availability by job location. The United States is again divided into five categories based on the degree of urbanization and proximity to large cities.[4] However, rather than examining residential broadband availability, this report assesses the level of broadband availability in the workplace. Figure 1 (below) shows the distribution of residents and jobs across five geographic categories: Central Cities, Suburbs, Small Towns, Exurbs and Very Rural.

Figure 1: Percent of Residents and Jobs by Location

Residents

Rural/Urban/MSA Status			Residents per Square Mile
Urban/MSA	Central Cities	32.6%	2,754
Urban/MSA	Suburbs	41.4%	1,970
Urban/Non-MSA	Small Towns	6.9%	1,447
Rural/MSA	Exurbs	9.6%	37
Rural/Non-MSA	Very Rural	9.5%	11

Jobs

Rural/Urban/MSA Status			Jobs per Square Mile
Urban/MSA	Central Cities	45.7%	1,556
Urban/MSA	Suburbs	35.5%	703
Urban/Non-MSA	Small Towns	8.3%	699
Rural/MSA	Exurbs	5.4%	8
Rural/Non-MSA	Very Rural	5.2%	2

Virtually all jobs in the United States are now located in areas with at least basic wired or wireless broadband service availability, defined here as combined advertised wireline or wireless download speeds of 3 megabits per second (Mbps) and upload speeds of 768 kilobits per second (kbps). These speeds are relatively slow, but serviceable for a number of purposes, such as basic email and Internet browsing, assuming the connection is reliable and the advertised speed comports with the typical experiences of users. However, similar to the availability of broadband to residents, a smaller percentage of job locations have access to broadband at faster speeds compared to slower speeds. For example, 79 percent of job locations had broadband access at 25 Mbps downstream (at which more data-intensive tasks can be performed efficiently, such as downloading pictures or large data files) in

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[4] See Broadband Brief No. 2, *Broadband Availability: Beyond the Rural/Urban Divide* for more details about how the five areas are defined. Accessed 7/1/13.http://www.ntia.doc.gov/report/2013/broadband-availability-beyond-ruralurban-divide.

June 2012. Half of all jobs were located in areas with download speeds of 100 Mbps and 11 percent of jobs were located in areas with download speeds of 1 gigabit per second (Gbps). The same pattern of fewer jobs with access to faster speeds, compared to the percent with access to basic broadband, is true for upload speeds as well, especially for speeds faster than 3 Mbps. For example, less than two-thirds of jobs were located in areas with access to 6 Mbps upload speeds, 28 percent were located in areas with 25 Mbps service and 18 percent were located in areas with 100 Mbps service. (See Figures 2 and 3.)

At slower speeds, broadband availability is similar both where people live and work. However, the difference in availability does increase at very high speeds, *e.g.*, at 1 Gbps, only 3 percent of the

> **A FOCUS ON FAST SPEEDS:** While many factors affect broadband speeds in the workplace, any analysis should consider that just as the speeds individuals experience are slower when a single connection is shared with others in a household, the same effect is true in a business where one connection typically supports the needs of many employees. This paper generally highlights the availability of faster broadband speeds. In particular, it often compares advertised download speeds of 50 Mbps or greater and upload speeds of 6 Mbps or greater. These comparisons are useful when considering the possible needs of businesses. At these speeds, data-intensive content, such as large data files and videos, are accessible to workers more quickly from the Internet or are more easily shared with others (for example, customers and suppliers). In addition, these speeds were chosen because they were the median speeds available for jobs in 2011 - the baseline year used for comparison in this paper. In other words, in 2011, roughly half of U.S. jobs were located where broadband service at these or higher speed tiers was available.[5]

population had access in June 2012, as reported in *Broadband Brief No. 1, U.S. Broadband Availability: June 2010-June 2012*, but nearly 11 percent of jobs did. This result is a reflection of the more urban-centered distribution of jobs compared to the population as a whole. For example, while 9.5 percent of the population lives in Very Rural areas, only 5.2 percent of jobs are located there. Conversely, only 32.6 percent of the population lives in Central Cities, but 45.7 percent of the jobs are located there. (See Figure 1.)

Even with recent growth in national broadband availability, in 2012, jobs in Very Rural areas, which account for about 5 percent of jobs, were still much less likely than jobs located in other areas to have higher-speed broadband service, including jobs in Exurbs, which are also considered rural areas. For example, only 33 percent of jobs in Very Rural areas had download speeds of 50 Mbps or greater available, and only 20 percent had upload speeds of 6 Mbps or greater in as shown in Figures 5 and 6. In comparison, in 2012, 53 percent of jobs in Exurban areas had access to 50 Mbps download service, and 39 percent had access to broadband upload speeds of 6 Mbps.

The disproportionate lack of high-speed broadband in less densely populated areas likely puts these communities at a disadvantage in attracting jobs compared to otherwise similar areas with access to high-speed broadband service. For example, in Utah, a medical record and health information

technology firm located in a rural area, but it began considering moving to a more urban location because poor broadband connectivity resulted in work interruptions and lost productivity. In this case, the Utah Broadband Project, which is the NTIA-funded State Broadband Initiative in Utah, was able to help the firm identify a solution to provide it the redundancy needed to allow it to remain in the rural area and continue to serve as source of employment for the residents of the community.[6]

Small Towns (which are considered urban due to their relatively high population density and account for 8 percent of jobs) and Exurbs have roughly similar download speed availability. Jobs in Exurbs were slightly less likely than jobs in Small Towns to have higher-speed download broadband service available (53 compared to 56 percent), but they did have markedly higher availability of upload speeds at 6 Mbps (39 compared to 30 percent). This is especially noteworthy given that Small Towns actually have much greater job density (699 jobs per square mile) compared to Exurbs (8 jobs per square mile). This gap in access to upload speeds diminishes at 25 Mbps and above, with neither group having access to greater than 13 percent availability. (See Figures 7 and 8.)

Just as with broadband availability by population, both Central Cities and Suburbs have substantially more access than Small Towns, Exurbs or Very Rural communities. At download speeds of 10 Mbps, Suburbs (about 36 percent of jobs) and Central Cities (about 46 percent of jobs) have the same level of access – practically 100 percent. At the 25, 50 and 100 Mbps levels, Central Cities lag slightly behind Suburbs in access to these download speeds. For example, at 50 Mbps, 80 percent of jobs in Central Cities have access compared to 84 percent in Suburbs. (See Figure 9.) However, at the fastest speed measured, 1 Gbps or greater, Central Cities had more access than Suburbs in June 2012, 15 percent compared to 9 percent. Upload speeds display the same pattern, but the cross-over point between Suburbs and Central Cities is at a lower speed. At 3 Mbps, all jobs locations have access to broadband service. At 6 and 10 Mbps, suburbs have just two percentage points more access than Central Cities. At 25 Mbps and faster, jobs in Central Cities begin to have faster upload speeds than those in Suburbs. The greatest gap in access for upload speeds is also at 25 Mbps, 38 percent of jobs in Central Cities had access compared to 26 percent of jobs in Suburbs. At 50 Mbps, 100 Mbps and 1 Gbps, the gaps in access are smaller.

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[5] In June 2012, the median advertised download speed tier increased to 100 Mbps or greater but less than 1 Gbps. See the Appendix for a list of all speed tiers.

[6] National Telecommunications and Information Administration. "Broadband Technology Opportunities Program 14th Quarterly Program Status Report." September 2012. Accessed 9/1/13.http://www.ntia.doc.gov/files/ntia/publications/btop_14th_quarterly_report.pdf.

Changes in Workplace Broadband Availability between 2011 and 2012

The increases in broadband availability for the U.S. population between June 2011 and June 2012 were similar to the increase in broadband availability for jobs.[7] That is, holding job location constant, more jobs across all geographies had access to faster broadband speeds in June 2012 than they had in June 2011. This change is a result of the increasing availability of higher broadband speeds across geographic locations.[8]

As noted earlier, the distribution of jobs across various geographies is different than the distribution of population (for example, 9.5 percent of the population lives in Very Rural areas, but only 5.2 percent of jobs are located in these communities), resulting in a somewhat different pattern of broadband availability. The data show substantial growth in the share of Very Rural jobs with higher download speeds available between 2011 and 2012. For example, the share of Very Rural jobs with 50 Mbps service available nearly doubled from 18 percent to 33 percent. Increases in availability of upload speeds were substantial but more modest; for example, the share of Very Rural jobs with 6 Mbps or greater service increased from 13 percent to 20 percent. (See Figures 5 and 6.) Whereas Exurbs had slightly greater access to 50 Mbps in 2011 compared to Small Towns (36 compared to 35 percent), in June 2012, the position flipped and jobs in Small Towns had slightly more access to 50 Mbps download speeds than those in Exurbs (53 percent compared to 56 percent). Though 6 Mbps upstream availability increased 58 percent in Small Towns between 2011 and 2012 (19 to 30 percent), Exurbs still had substantially higher (nine percentage points) 6 Mbps upload speed availability than Small Towns. (See Figures 7 and 8.)

Central Cities (46 percent of jobs) and their Suburbs (36 percent of jobs) each experienced increases of 20 percentage points in 50 Mbps download availability, but the pattern of Central Cities lagging slightly behind Suburbs in access to 50 Mbps and 100 Mbps speeds, and slightly in front of Suburbs at 1 Gbps, remained the same in both years (Figure 9). Availability increases were smaller, but significant, for upload speeds. Central City upload access at 6 Mbps increased from 60 percent to 70 percent and Suburban access at that speed tier increased from 64 percent to 72 percent (Figure 10).

Though the gaps across geographies remained at higher speeds, the substantial increases in broadband deployment and advertised speeds between 2011 and 2012 were reflected in the increase in jobs that gained access to higher broadband speeds. In fact, even holding all job locations and densities constant, the growth in access to faster broadband speeds was widespread and substantial for the workplace. Moreover, the growth in access to broadband speeds took place across all industry sectors and regardless of the degree of urbanization in areas where jobs are located.

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[7] See Broadband Brief No. 2, *Broadband Availability: Beyond the Rural/Urban Divide* for a review of the broadband availability changes by population between 2011 and 2012. Accessed 7/1/13.http://www.ntia.doc.gov/report/2013/broadband-availability-beyond-ruralurban-divide.

[8] It is also possible that the movement of jobs could result in a change of this type. However, this analysis was not able to evaluate the movement of jobs and this report can thus reach no conclusion on that matter.

Industry Focus: Broadband Availability in Manufacturing and Information Jobs

The manufacturing and information sectors are critical to the U.S. economy in terms of innovation, productivity growth and exports.[9] Manufacturing jobs (which represent 9.2 percent of all jobs) tend to have lower-speed broadband service available and are more concentrated in rural areas (Very Rural and

Exurban communities) than most other industries. In fact, of the 20 industries into which all jobs in the U.S. can be classified, only two sectors are more concentrated in rural areas and have lower-speed service availability: agriculture, forestry, fishing and hunting; and mining, quarrying and oil and gas extraction. Moreover, the share of manufacturing jobs located in Very Rural and Exurban communities (19 percent) is 80 percent higher than the corresponding share for all jobs (10.6 percent). In contrast, the information sector has the highest share of jobs located in areas with broadband service of 50 Mbps or greater and is among the most urbanized of industry sectors. Jobs in this sector, which represent 2.3 percent of all jobs, include innovative and data-intensive activities, such as the production and distribution of information and entertainment products and software; the provision of the means for transmitting such products as well as data or communications; and the

Table 1: Distribution of Manufacturing and Information Jobs by Geographic Category			
	All Jobs	**Manufacturing**	**Information**
All Geographies	**100%**	**9.2%**	**2.3%**
Rural			
Very Rural	5.2%	10.1%	2.0%
Exurbs	5.4%	8.9%	2.7%
Urban			
Small Towns	8.3%	10.6%	5.4%
Suburbs	35.5%	36.5%	32.8%
Central Cities*	45.7%	34.0%	57.1%

*A very small share (0.7 percent) of Census blocks are in rural areas within Central Cities

processing of data.[10] Clearly, many jobs in the information sector need access to high-speed broadband, but so do many jobs in the manufacturing sector. (See Table 1 for the distribution of manufacturing and information jobs by geographic category.)

The gaps between broadband availability for manufacturing jobs compared to all jobs are most pronounced at the 25, 50 and 100 Mbps service levels. For example, in 2012, only 69 percent of manufacturing jobs were in areas with 50 Mbps or greater download service, compared to three-fourths

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[9] See, for example, U.S. Department of Commerce (2012) *The Competitiveness and Innovative Capacity of the United States*, in particular chapters 5 and 6. Accessed 8/1/13. http://esa.gov/sites/default/files/reports/documents/thecompetitivenessandinnovativecapacityoftheunitedstates.pdf.

[10] Office of Management and Budget (1998) *North American Industry Classification System: United States, 1997.*

of all jobs. The differences were slightly more for upload service at 6 Mbps – 53 percent for manufacturing compared to 63 percent for all jobs (See Figures 11 and 12). One reason for the more limited high-speed broadband availability is the geographic location of manufacturing jobs; one in five manufacturing jobs was in Very Rural or Exurban areas, which comprise rural areas, compared to only 11 percent of all jobs. (See Table 1.)

Between 2011 and 2012, areas in which manufacturing jobs are located became much more likely to have higher-speed download service available, as shown in Figures 11 and 12. This expansion of broadband service resulted in a 40 percent increase in the share of manufacturing jobs that had access to 50 Mbps or greater download speeds (from 49 percent to 69 percent). The share of manufacturing jobs with 6 Mbps or greater upload speeds increased somewhat more modestly but still significantly, from 45 percent to 53 percent. However, even with the increase in broadband availability, manufacturing jobs were less likely than the overall job force to have access to high-speed broadband service in both 2011 and 2012.

Bringing Broadband to Pennsylvania's Manufacturers[11]

In Pennsylvania, 15,000 manufacturing establishments employ 574,000 people, equal to 10 percent of the entire state workforce. These are typically well-paying jobs with average compensation of almost $65,000 annually. In 2011 alone, manufacturing created more than 12,000 new jobs.[12] Given the importance of manufacturing to its economy, Pennsylvania has used a portion of its NTIA-funded State Broadband Initiative (SBI) award to develop a statewide broadband technical assistance program targeting manufacturers. The purpose of the program is to identify and address gaps in availability and utilization, and ensure firms are utilizing the full potential of broadband and IT to expand into new markets, increase productivity, innovate and streamline processes though the use of technology.

The program has found that, not unlike in the residential sector, access, utilization and price are all barriers to manufacturing firms leveraging high-speed broadband to improve their competitiveness. To drive the utilization of broadband, team members have been educating and advising Pennsylvania manufacturers, and have completed 235 broadband assessments and 138 technology strategic plans over the course of the last two years. These customized assessments and plans help smaller manufacturers learn about broadband options and IT solutions that can save money and increase productivity. For example, as a result of one assessment, a company implemented a cloud-based accounting system and expanded broadband availability throughout its facility. This project cost $750 and the company expects to realize a cost savings of $18,000. In another case, a rural manufacturer that had been sharing computing assets with a neighboring company is moving forward with a broadband project to leverage cloud computing to modernize their ERP system, while incorporating search engine

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[11] Suleski, Sue, Director, Broadband Initiatives in the Pennsylvania Governor's Office of Administration. Emails and phone interviews. July 16 – Nov 7, 2013.

[12] Team Pennsylvania Foundation. "Governor's Manufacturing Advisory Council: Recommendations to encourage growth in Pennsylvania's manufacturing sector." Page 3. 2012. Accessed 11/6/13. http://teampa.com/wp-content/uploads/2012/09/GMAC_FinalReportRecommendations_Revised.pdf.

optimization, mobile device accessibility, and video streaming into their website. They expect the $17,000 investment to save $108,000 over the next three years, generate $200,000 in revenues, and create two jobs, while improving supply chain management, facilitating remote sales, reducing network downtime, increasing IT processing speeds, and improving network security.

However, access continues to be an issue for some manufacturers, whether they are located in rural areas with poor availability overall, or urban "donut holes" where the quoted price to extend adequate service is cost-prohibitive. In some cases, access is a function of price. For example, in more urban Bucks County one manufacturer had fiber service for $80/month, but in more rural Erie County, another manufacturer was limited to a 3G wireless service that typically achieved speeds of 1.5 – 3 Mbps for the same price. Pennsylvania's Broadband Technical Assistance program model brings together broadband providers, BTOP recipients, nearby businesses, economic and community developers, and other partners with the common goal of expanding the availability and use of relevant, reliable and affordable solutions to help these businesses thrive.

Jobs in the information sector were more likely to have broadband service at every speed level and were also more concentrated in urban areas (about 95 percent) than the overall job force (about 90 percent). (See Table 1.) For example, 83 percent of information jobs were located in areas with download speeds of 50 Mbps or greater available in 2012 (up from 66 percent in 2011), compared to 75 percent of all jobs and only 69 percent of manufacturing jobs. A slightly larger gap existed between the share of jobs with higher upload service available in the information sector compared to jobs overall: in 2012, 63 percent of all jobs had access to 6 Mbps upload speeds, and 75 percent of information jobs did. For comparison, only 53 percent of manufacturing jobs had access to these upload speeds. (See Figures 12, 13 and 14.)

Jobs in the information sector have more access than other industries to the higher levels of broadband speeds that may facilitate innovation across geography – by supporting cloud and distributed computing, teleworking and other activities. The greater access to higher broadband speeds for information jobs may be partly because this industry demands these abilities more than others do, but it also may be partly because they are more concentrated in more urbanized communities that tend to have greater access to higher-speed broadband. Manufacturing, like many other industries, also benefits from higher-speed broadband access. For example, developers are devising innovative applications for manufacturing that require 1 Gbps or greater speeds. One such application allows designers to send Computer Aided Design (CAD) drawings to other facilities and managers and remotely control 3D printing so that a product can be tested before going into full production.[13] However, sizeable shares of today's manufacturing jobs are more likely to be located in rural areas with less access to such speeds. Rural communities where manufacturing jobs are located may need access to faster broadband service to help retain such jobs.

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[13] US Ignite. "Our Current Internet is a Single Lane Highway. But We Can Fix It." August 12, 2013. Accessed 8/28/13. http://us-ignite.org/2013/08/our-current-internet-is-a-single-lane-highway-but-we-can-fix-it/.

Broadband Availability in Manufacturing and Information Jobs

Appendix I:

Summary of Findings: Shares of Jobs with 50 Mbps Download Speeds or 6 Mbps or Greater Upload Speeds Available				
	Download Speed: 50 Mbps or Greater		**Upload Speed: 6 Mbps or Greater**	
Speed Example: Duration for transferring a 2 hour high-definition video (4 GB)[14]	6 minutes or less		53 minutes or less	
Shares of jobs located in areas with these speeds available	2011	2012	2011	2012
All	56%	75%	54%	63%
Industry				
Manufacturing	49%	69%	45%	53%
Information	66%	83%	66%	75%
Geographic Category				
Rural				
Very Rural	18%	33%	13%	20%
Exurbs	36%	53%	29%	39%
Small Towns	35%	56%	19%	30%
Urban				
Suburbs	64%	84%	64%	72%
Central Cities	60%	80%	60%	70%

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[14] Apple Corporation. "Frequently Asked Questions (FAQ) for purchased movies." ("How large is the average movie?") Accessed 3/27/13. http://support.apple.com/kb/ht1906.

Appendix II: Technical Notes

Data Used in the Analysis

State Broadband Initiative (SBI) Dataset. NTIA's broadband availability dataset contains, among other information, advertised speeds by Census Block. 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."[15] 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:

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

While the basic speed combination of 3 Mbps/768 kbps allows an individual consumer to access a basic set of applications, many consumers and institutions, such as schools and libraries, and applications, such as distance learning, telemedicine and high quality video conferencing, require much faster speeds.

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[15] Federal Communications Commission. "National Broadband Plan." March 2010. Accessed 4/1/13.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.

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 for a single user to have an "OK" experience, and 50 Mbps for a "Good" experience.[16] 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.[17] 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.[18] In June 2012, Verizon announced that it would offer a 300 Mbps service over its network.[19] EPB, the local electric company in Chattanooga, Tennessee, also offers broadband service up to 1 Gbps.[20] 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 a decade, by 2010, dial-up subscribers declined to 2.8 percent of households. By contrast, in that same year, 68.2 percent of households were subscribed to broadband service.[21]

Longitudinal Employer-Household Origin-Destination Employment Statistics (LODES) Data Set. This data set is largely compiled from administrative data collected in partnership with state unemployment insurance programs as well as data from the Office of Personnel Management (OPM) on employees and jobs for most Federal employees. The resulting data set covers virtually all wage and salary civilian employment in the United States for each Census Block in 2010 except for Massachusetts.

2010 Decennial Census Summary File 1 Data Set. This data set contains data compiled from questions asked of all people and about every housing unit in the United States and totaled for each Census Block. It is the source in this report for identifying geographic areas, such as rural and urban areas,

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[16] U.S. Small Business Administration, Office of Advocacy, The Impact of Broadband Speed and Price on Small Business, Columbia Telecommunications Corporation, November 2010. Accessed 4/1/12. http://archive.sba.gov/advo/research/rs373tot.pdf.

[17] 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.

[18] Finley, Klint. "Google's Super-Speed Internet Will Hit Austin in 2014." Wired.com. April 9, 2013. Accessed 4/10/13. http://www.wired.com/wiredenterprise/2013/04/google-fiber-austin-official/.

[19] Stacey Higginbotham. "Why you will need a 300 Mbps broadband connection." Gigaom. June 22, 2012. Accessed 4/10/13. http://gigaom.com/2012/06/22/why-you-will-need-a-300-mbps-broadband-connection/.

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

[21] National Telecommunications and Information Administration. "Digital Nation, Expanding Internet Access, NTIA Research Preview." February 2011. Accessed 4/11/13. http://www.ntia.doc.gov/files/ntia/publications/ntia_internet_use_report_february_2011.pdf.

Metropolitan Statistical Areas (MSAs), and the Central City portions of MSAs in which each Census Block is located.

North American Industry Classification System. The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. (http://www.census.gov/eos/www/naics/).

Geographic Terms

Coverage. This report covers jobs in each state except Massachusetts. In this report, a "job" is a wage and salary-paying job covered by unemployment insurance.

Census Block. Census Blocks are the smallest statistical area for which the Census Bureau collects data. Census Blocks are bounded by physical features (such as roads or bodies of water) or non-visible boundaries (such as city or county limits or selected property lines) or both. There were about 11.1 million Census Blocks in the 2010 Decennial Census.

Urban. The methods used by the Census Bureau to classify areas as urban 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; also see http://www.census.gov/geo/www/ua/uafaq.html).
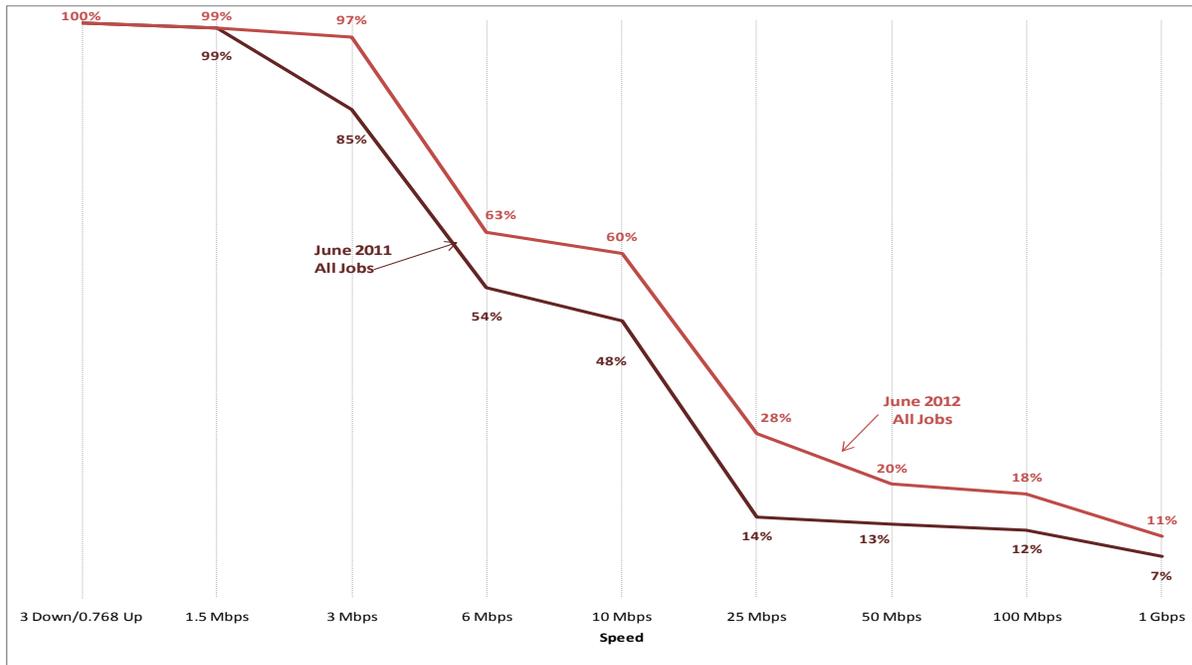
Rural. All Census Blocks not designated Urban are designated Rural by the Census Bureau.

Metropolitan Statistical Area (MSA). A MSA is a collection of counties including and surrounding an urbanized core that share a high degree of economic and social integration (such as 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/ for more information).

Figure 2: Availability of Download Speeds for all Jobs

100%   99%   98%
        97%
        95%
        79%
June 2011   75%
All Jobs   June 2012
        65%   All Jobs
                56%
                        50%
                29%
                        11%
                7%

3 Down/0.768 Up   6 Mbps   10 Mbps   25 Mbps   50 Mbps   100 Mbps   1 Gbps
Speed
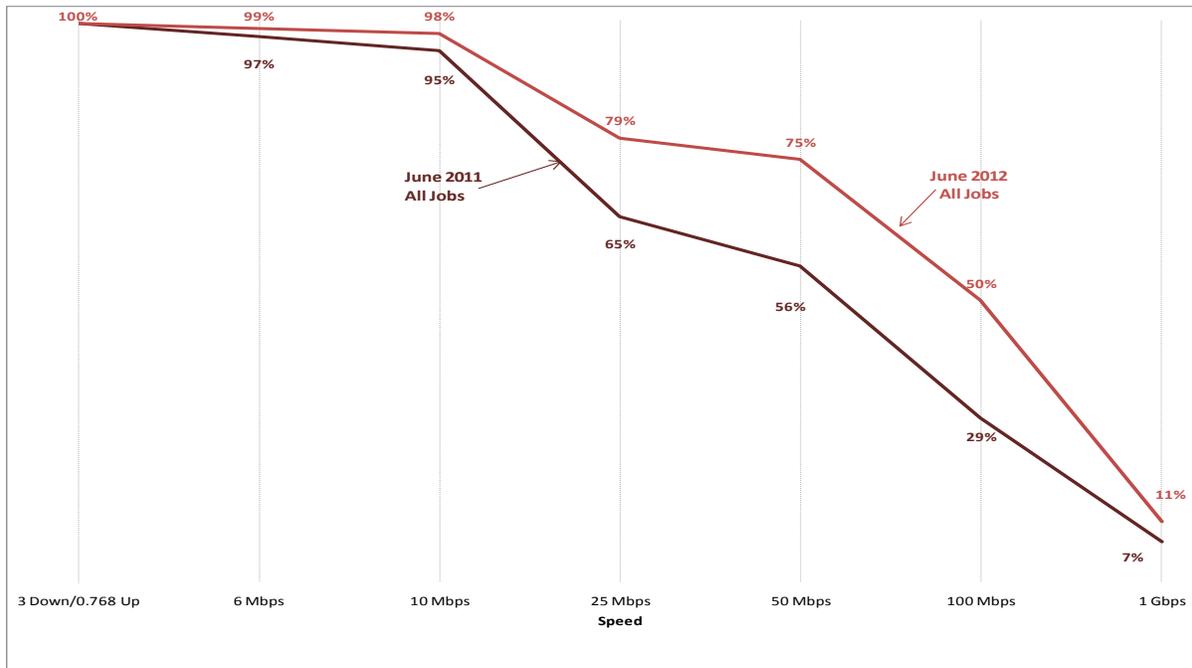
Figure 3: Availability of Upload Speeds for all Jobs

100%   99%   97%
        99%
        85%
                63%
June 2011   60%
All Jobs
        54%
        48%
                28%   June 2012
                        All Jobs
                14%   20%   18%
                        13%   12%   11%
                                7%

3 Down/0.768 Up   1.5 Mbps   3 Mbps   6 Mbps   10 Mbps   25 Mbps   50 Mbps   100 Mbps   1 Gbps
Speed

Figure 5: Availability of Download Speeds for Rural Jobs (Very Rural and Exurban Areas)
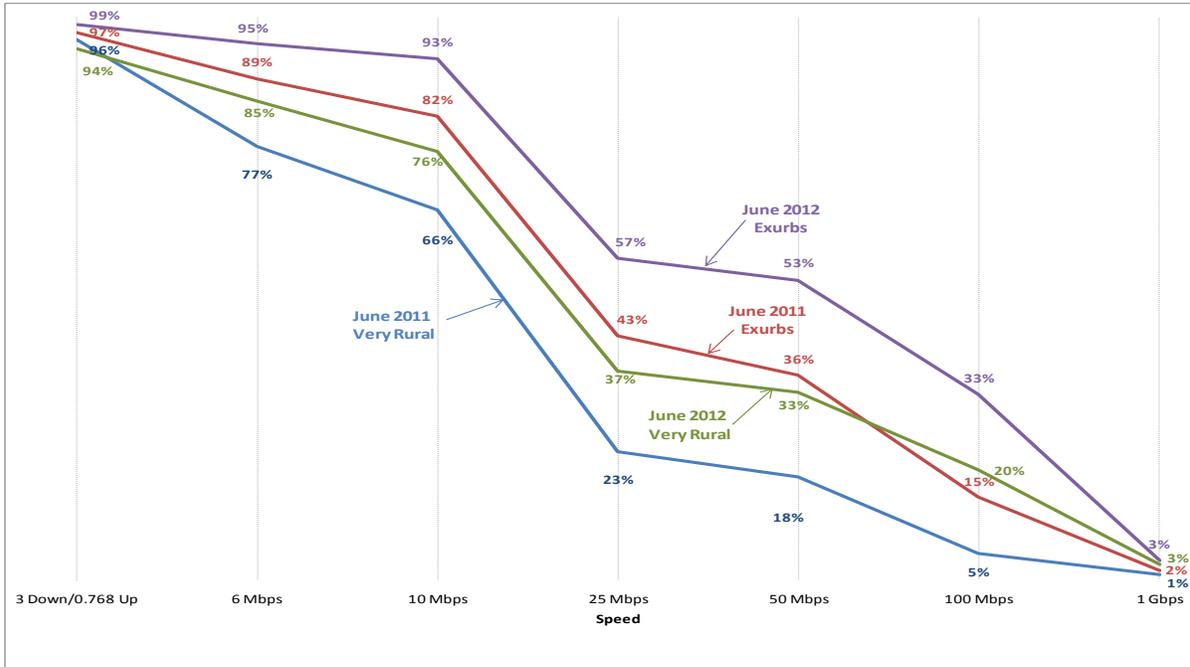
Figure 6: Availability of Upload Speeds for Rural Jobs (Very Rural and Exurban Areas)
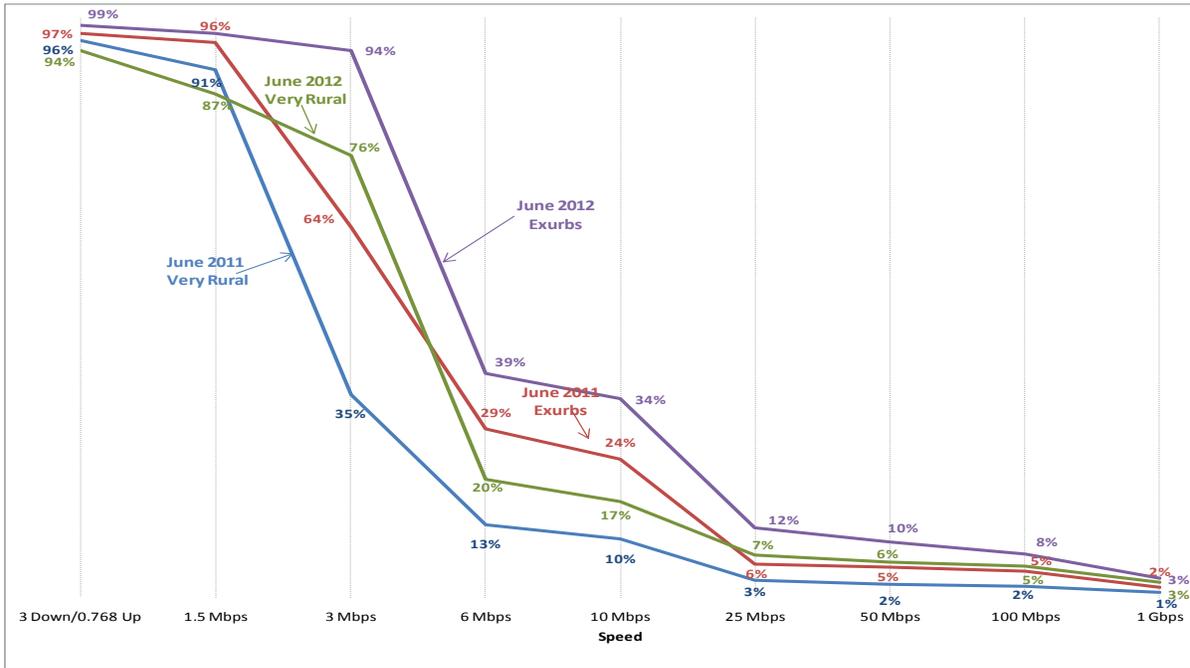
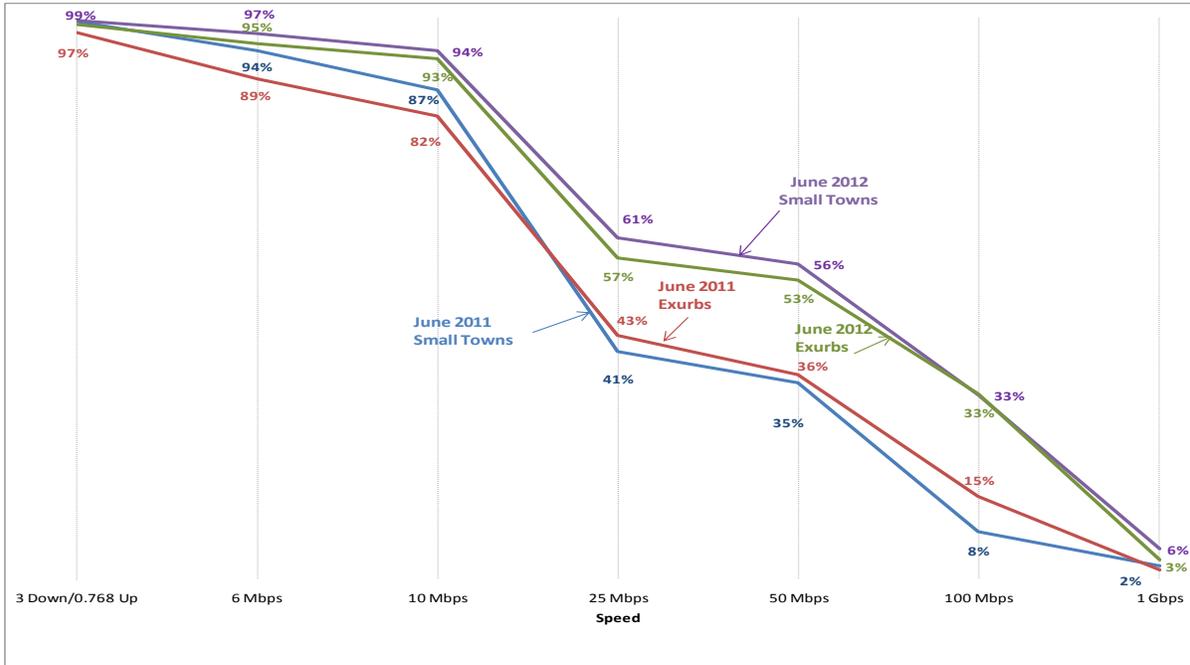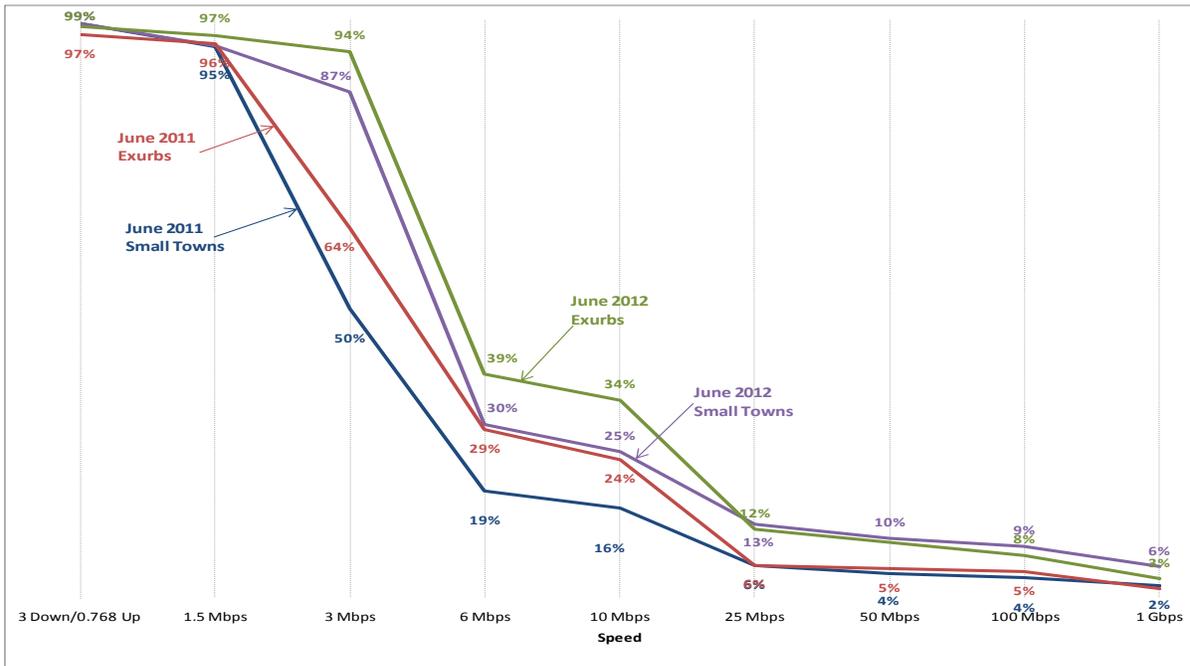**Figure 7: Availability of Download Speeds for Small Town and Exurban Jobs**
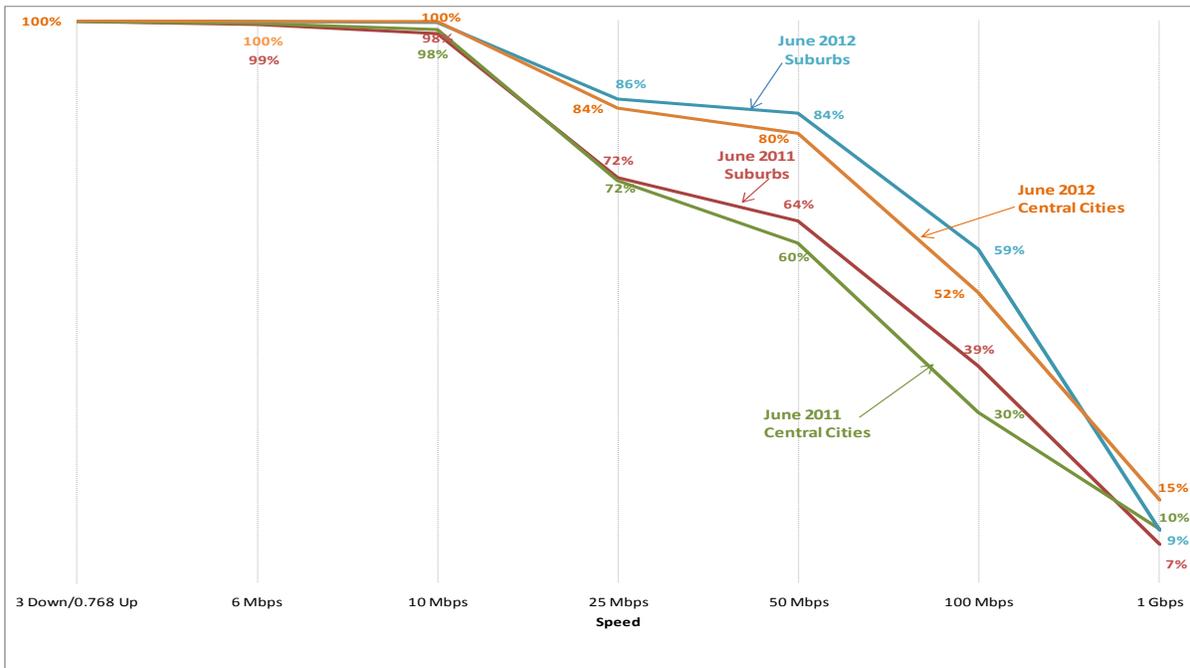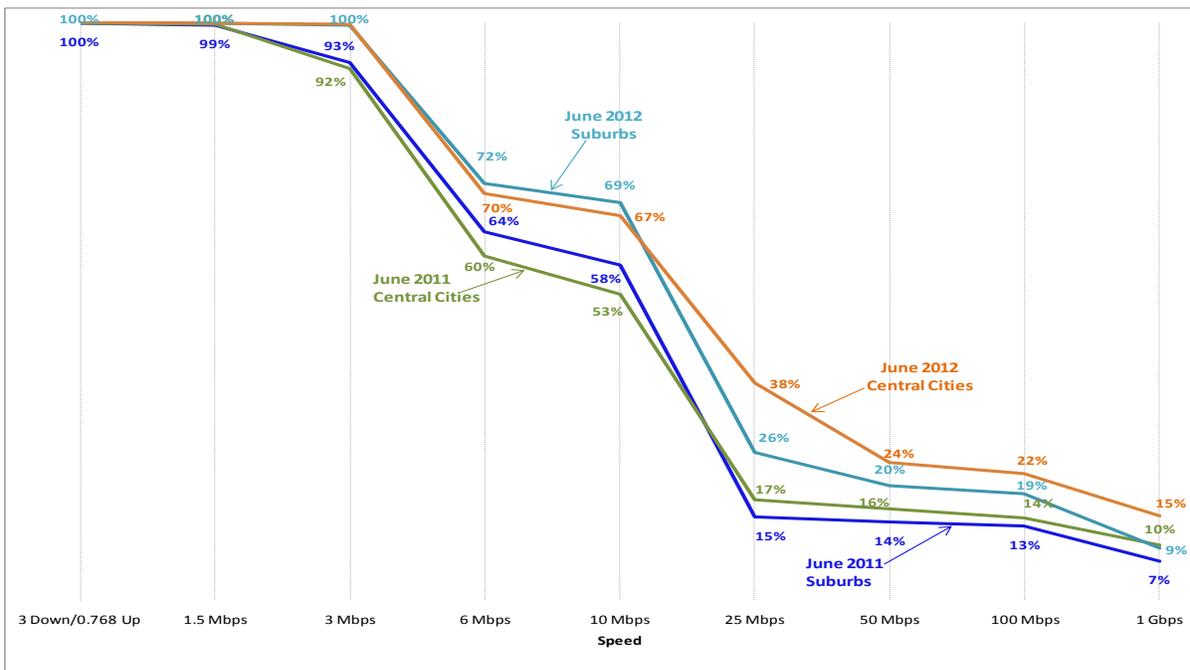

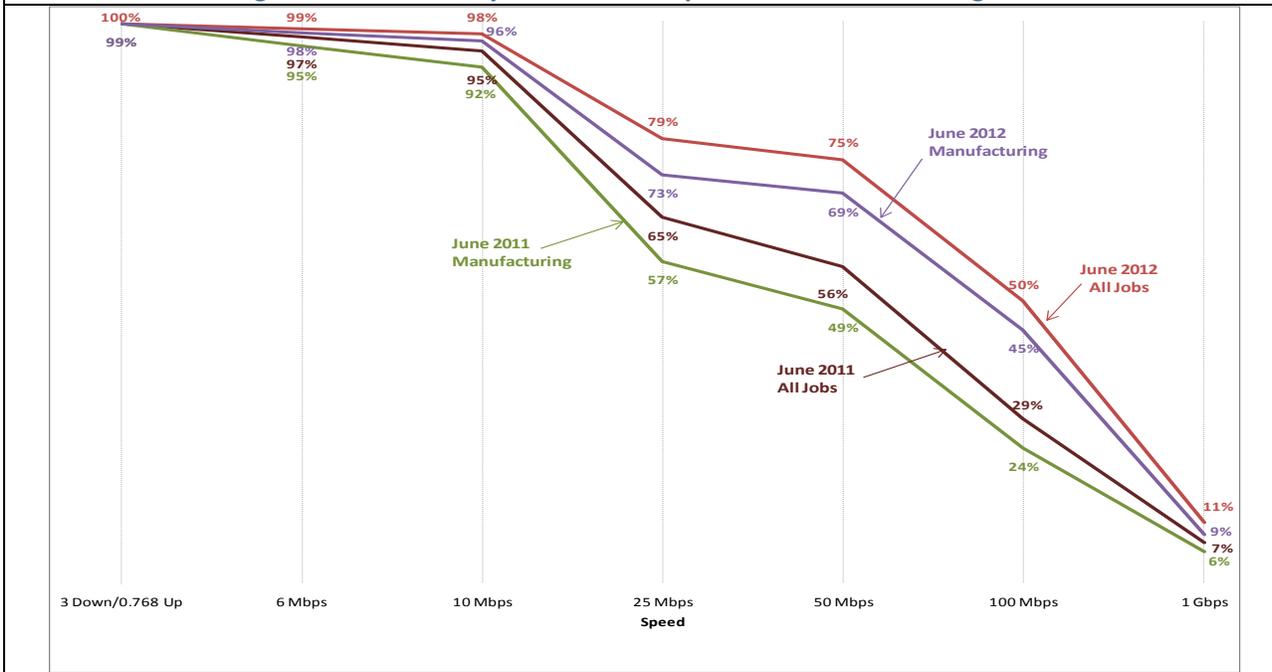**Figure 8: Availability of Upload Speeds for Small Town and Exurban Jobs**

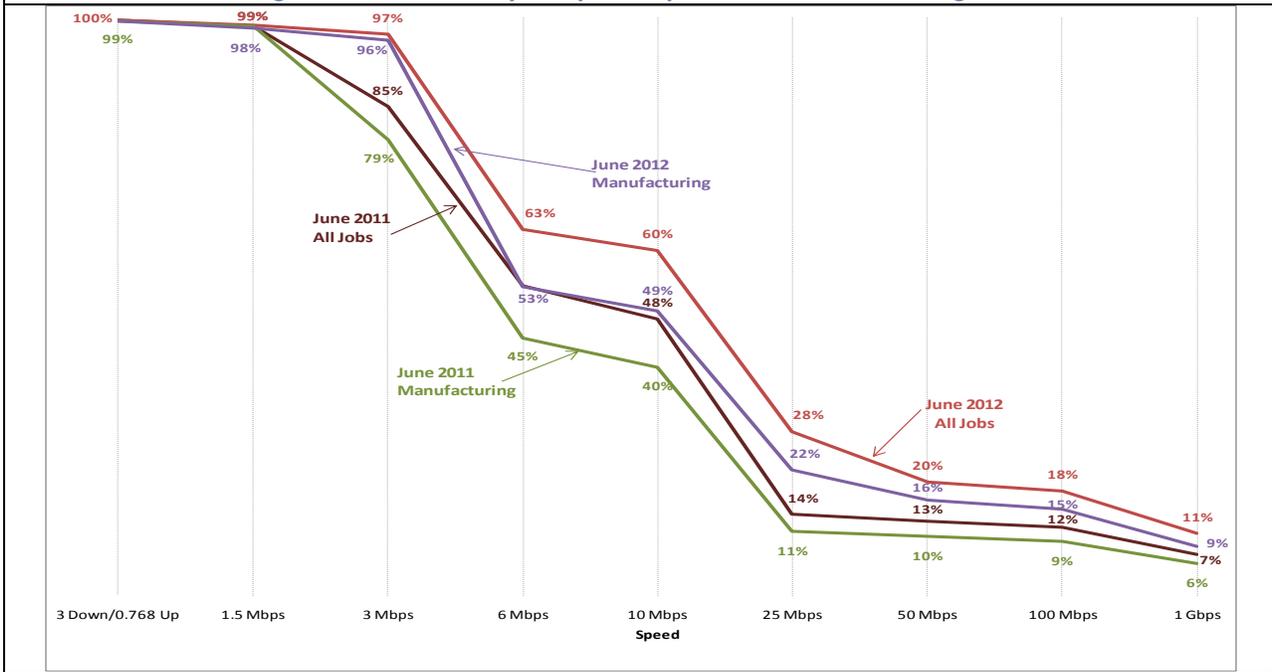**Figure 9: Availability of Download Speeds for Urban MSA (Central Cities and Suburbs) Jobs**

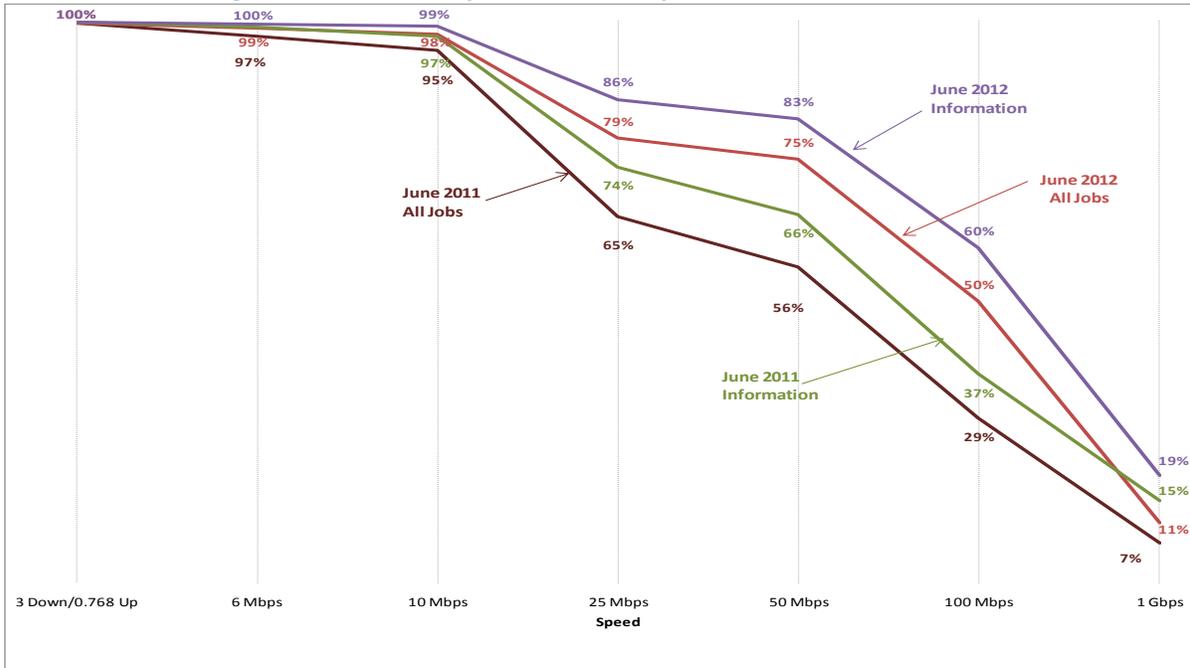**Figure 10: Availability of Upload Speeds for Urban MSA (Central Cities and Suburbs) Jobs**

Figure 11: Availability of Download Speeds for Manufacturing Jobs

Figure 11: Availability of Download Speeds for Manufacturing Jobs

Figure 12: Availability of Upload Speeds for Manufacturing Jobs

Figure 12: Availability of Upload Speeds for Manufacturing Jobs

Figure 13: Availability of Download Speeds for Information Jobs

Figure 14: Availability of Upload Speeds for Information Jobs