Scoping Broadband Access in Illinois

Table of Contents

b. **Geographic & Socio-economic Variables** (*Table 3.1- Top & Bottom 10)*
   i. **Geographic Discussion**
      1. *(Figure 3.3- Top & Bottom 10 Geographically)*
   ii. **Socioeconomic Discussion**
      1. *(Figure 3.4 - Unemployment & Poverty)*
      2. *(Figure 3.5 - Population per square mile)*
      3. *(Figure 3.6 - Median Household Income)*
      4. *(Figure 3.7 - Workforce Count)*

Conclusion

Scoping Broadband Access in Illinois: A Statewide Baseline Inventory for Supply

Introduction

The Partnership for a Connected Illinois Statewide Baseline Inventory for Supply of Broadband will highlight, introduce, and quantify the issues relating to broadband data submitted by providers within Illinois. The purpose of this paper is to reveal some of our current findings at PCI, to drive forward toward the next stages in the work on collecting and publishing broadband data, and to help encourage the construction, promotion and use of higher-capacity broadband networks. Under the U.S. Department of Commerce's State Broadband Initiative, and in collaboration with the Illinois Department of Commerce and Economic Opportunity, PCI is the non-profit entity charged with serving private and public stakeholders throughout Illinois in ensuring that Better Broadband leads to Better Lives.

This inventory will summarize the following research outcomes for the PCI Statewide Baseline Inventory for Supply of Broadband:

- Inventorying and quantifying the state of broadband access, and the advertised speeds of access, in Illinois, according to the best available information;
- Defining and developing metrics against which to evaluate changes in broadband access across the State;
- Introducing the concepts of ranking in assisting the State with assessing how different geographic units (i.e., counties, school districts, etc.) compare against each other relative to broadband supply, which particular reference to advertised speeds and availability.

Assessing the lower-speed and less-served areas of the State is the first step in evaluating broadband supply. In Part I of this study, our research will quantify the percentage of households and geographic that are served (to the best of our knowledge), at particular speeds. Three important points bear emphasis:

1. PCI updates broadband information from providers on a semi-annual basis. Because of the large numbers of carriers providing information, and because of continual updates from providers, there may be errors in this information. As PCI and providers mutually improve our data-collection and validation processes, percentages of the State covered at particular speeds may change.
2. Even if PCI has effectively captured the areas in which providers say they offer service at a particular advertised speed, PCI believes it is essential to verify the claims of services. We need to compare how actual broadband speeds compare to advertised speeds. Indeed, this report highlights some discrepancies between those two measurements.
3. Even if the providers and PCI have accurately represented areas and households that receive broadband service at a particular speed, and verified the actual speeds of such services, the public's understanding and expectation of broadband capabilities continues to evolve. For many years, service greater

than 200 kilobits per second (Kbps) was considered to be "broadband" by the Federal Communications Commission. Now, the FCC and the National Telecommunication and Information Administration define "broadband" as service of 768 Kbps or greater. But it is possible that many in the public do not accept service as that speed as actually representing "broadband" for the purposes of current-generation services – led along the high-performance applications of the future. This is why it is vital consider service 1 Gigabit per second (Gbps), 100 Megabits per second (Mbps), 10 Mbps, and 6 Mbps.

Results of PCI's research into the supply of broadband and particular speeds will assist the State, and other stakeholders, in understanding the lay of the land relative to supply. Outcomes of this research are to assist broadband stakeholders like eTeams, carriers, and other community action organizations in developing data-driven solutions in promoting adoption/access strategies for increasing broadband deployments.

Part Two of this Baseline Inventory for Supply relates to evaluation and assessment. PCI aims to develop a data-driven culture to assess the impact of broadband on citizens, businesses, and community anchor institutions (CAIs). This research will serve a role to both capture State-wide and local county snapshots of current broadband supply side trends. Using this approach, PCI will be able to assess, score, and benchmark how prepared the State of Illinois is to compete in the digital economy. Simply put, these early scores will serve as a baseline in assessing how broadband deployments change over time. PCI aims to target how geographic broadband coverage changes over time and how these changes impact households, CAIs, and businesses across the State of Illinois. Capturing these changes over time will be critical in evaluating the social and economic benefits of broadband investments in Illinois.

Part Three of the Baseline Inventory for Supply relates to the idea of scoring or ranking targeted geographic units on broadband access. A ranking is a quick and easy way to compare areas against each other relative to set criteria. PCI's goal for this research outcome is to introduce a ranking system for counties relative to each other and the state as a whole on carrier speeds available and geographic coverage. This research introduces broadband stakeholders across the State of Illinois, an early ranking system to evaluate supply side data. In addition, PCI hopes to engage other stakeholders on developing new methodologies or geographic units of measurement (i.e., educational districts, workforce zones, or other regional economic development authorities) that need to be ranked in evaluating the social or economic impacts of broadband.

Part 1: Inventorying and Quantifying Broadband

Speaking at John A. Logan College in Carterville, Illinois Governor Pat Quinn announced the federal government and state investment in the Illinois Broadband Opportunity Partnership – Southern Region, or a $45 million investment in fiber optic broadband infrastructure through an open network built by Clearwave. See http://broadbandillinois.org/Projects/Clearwave.html. Said Quinn: "We have a rare chance…to ensure every rural, underserved, unserved community in our state is connected to world-class information and communication infrastructure." This baseline report will begin by defining the current supply-side status of broadband in Illinois.

With so many variables to consider, there has to be a measurement system established that is able to place a part of the state into one of these categories. In this section we will attempt to define these areas, explain why we removed mobile broadband data for the purpose of this initial study, and explore the three methods of verification that were used in this analysis. This verification process is crucial to ensuring the provider data is represented as accurately as possible.

Defining Broadband Availability at Particular Speeds of Service

For the purpose of this paper, PCI modeled all speed tiers around the groupings defined by the National Telecommunications and Information Administration. The speed tiers are:

- 1 gigabit per second and higher
- 100 megabits per second to 1 gigabit per second
- 50 megabits per second to 100 megabits per second
- 25 megabits per second to 100 megabits per second
- 10 megabits per second to 25 megabits per second
- 6 megabits per second to 10 megabits per second
- 3 megabits per second to 6 megabits per second
- 1.5 megabits per second to 3 megabits per second
- 768 kilobits per second to 1.5 megabits per second
- No broadband service (i.e., internet service is at less than 768 kilobits per second)

Removing Mobile Broadband

Unless specifically noted, the mobile broadband (Technology of Transmission Code 80) data has been removed from the data sets under study for this report. There were a variety of reasons for doing so. In looking at speed test results from all the cellular technologies, it was discovered that the typical real world speeds over a 12-month period were in many instances different than the maximum advertised speeds. It is also known that providers in the cellular technologies do not have different speed tier data plans, which might otherwise skew a reading of speed test results. In other words, all users have equal access to the maximum available cellular speeds offered – unlike, for example, digital subscriber line (DSL) or cable modem service. Another major factor against inclusion of mobile broadband in the same field of analysis are the data caps in place by carriers. These caps generally limit the ability for users to download more than 5 Gigabytes (GB) of data per month, without paying overage charges. This kind of cap can limit the ability of users to access the range of services traditionally associated with broadband.

We made a conscious decision to put mobile broadband in a different category when assessing the broadband supply conditions for the State. It is not well suited for a primary internet connection in the home or business. It does however, play a vital role in the mobility aspect of broadband throughout the State. The net impact of this methodological change can be seen in Figure 1.1. These impact was, however, very diverse geographically. Simply put, some areas of Illinois were significantly affected by the removal of mobile broadband; whereas, other areas of the State were not impacted. The maps and tables below highlight these geographic patterns for summarizing supply side patterns. Table 1.1 shows the results of the Mobile Speed Test. Figure 1.2 shows where these speed tests were taken in the state and Figure 1.3 shows the mobile speed test results by technology type and operating system. Finally, Figure 1.4 shows some of the results from this mobile speed test.

Figure 1.1: Comparison of Broadband Coverage with and without Cellular Data

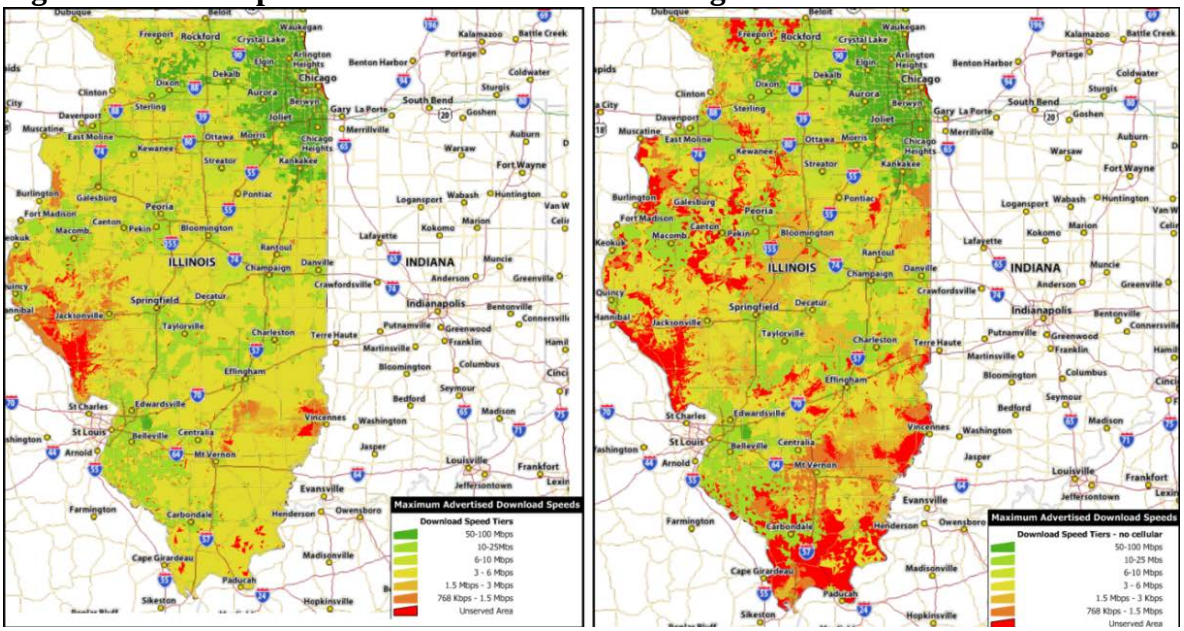


Table 1.1: Mobile Speed Test App Results.

Mobile App Speed Test Data Summaries	Download Average Mbps	**Download Median Mbps**	Download Min Mbps	Download Max Mbps	Upload Average Mbps	**Upload Median Mbps**	Upload Min Mbps	Upload Max Mbps	**Latency Median (in ms)**	Latency minimum (in ms)
Wi-Fi	7.248	**5.445**	1	58.398	2.316	**1.679**	1	37.255	**82**	331
Cellular	1.734	**1.275**	1	42.403	1.435	**0.456**	1	67.5	**189**	-61219
UMTS	1.504	**0.912**	1	15.472	0.595	**0.423**	1	15.472	**161**	18
Edge	0.121	**0.09**	1	4.36	0.497	**0.075**	1	33.75	**390**	46
GPRS	0.068	**0.025**	1	1.498	0.166	**0.026**	2	1.985	**534**	82

Dates Gathered: 3-1-2010 through 3-31-2011
37479 Tests over Wi-Fi = 44.14%
42456 Tests over cellular = 50%
4319 Tests over UMTS = 5.08%
634 Tests over Edge = .75%
34 Test over GPRS = .0004%

84909 records total
39421 test using Android operating system = 46.43%
45501 test using Apple IPhone operating system = 53.59%

Figure 1.2: Map showing the locations of the mobile speed test results.

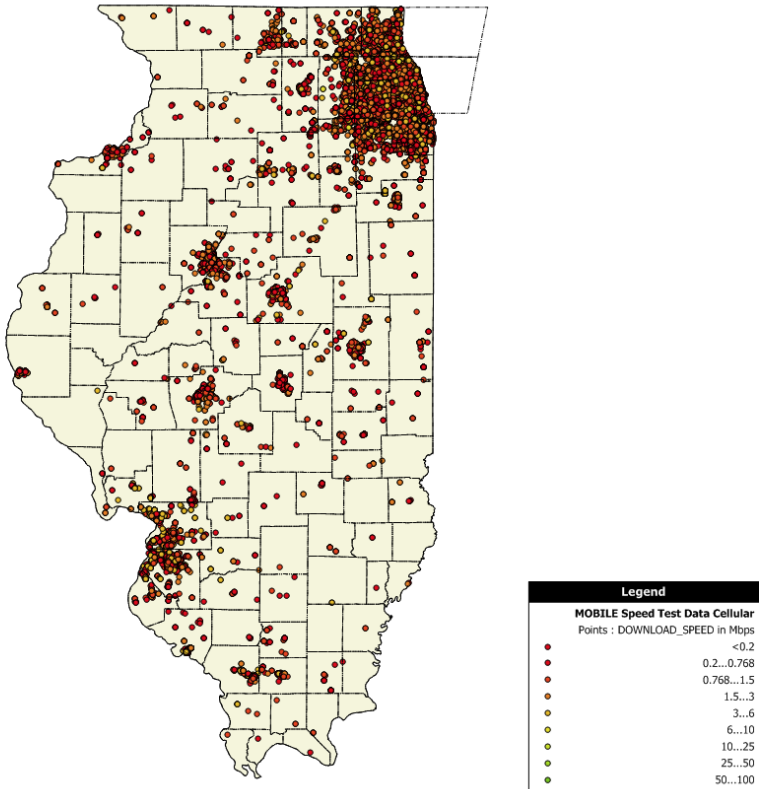


Figure 1.3: Mobile App speed tests by technology type and operating system

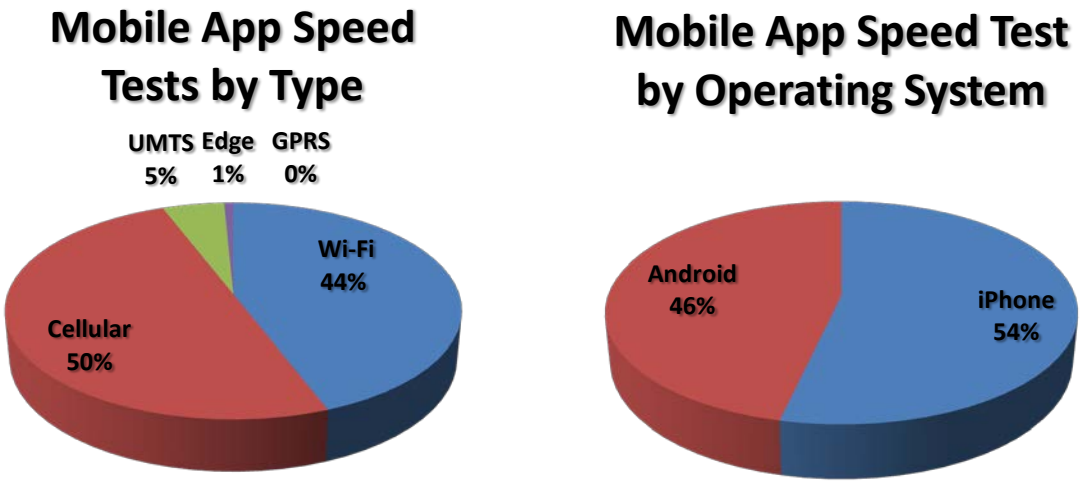
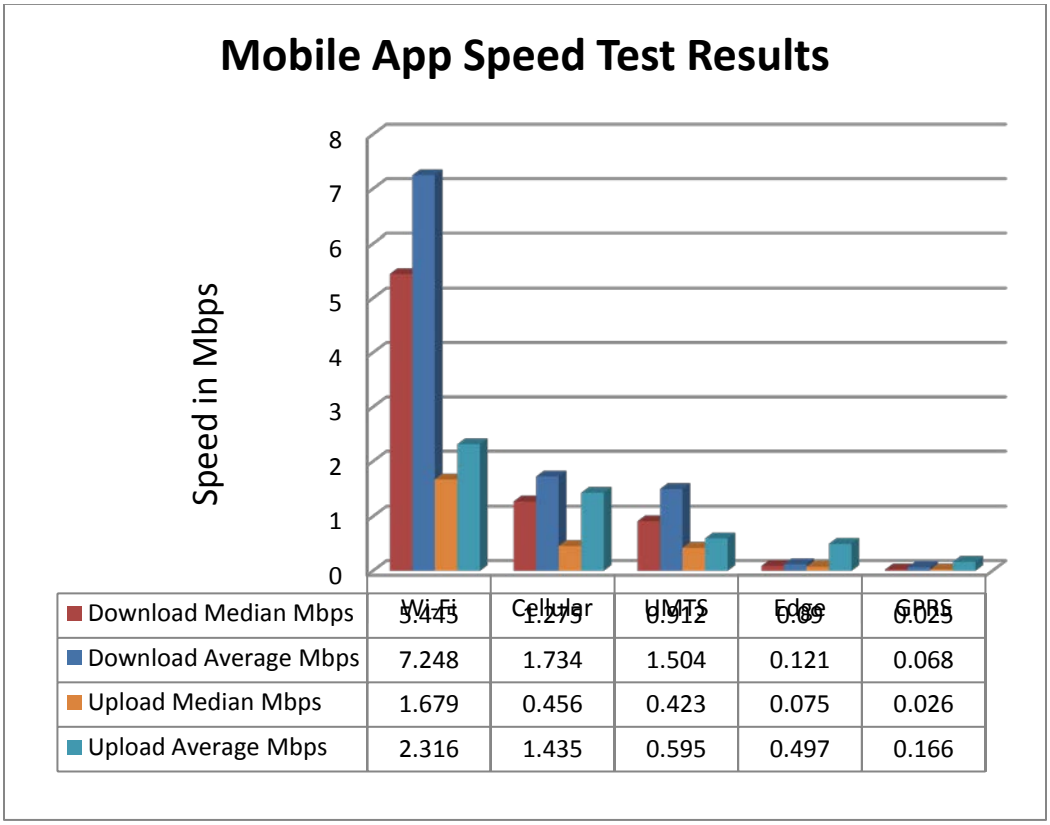


Figure 1.4: Mobile App speed test comparisons.



	Wi-Fi	Cellular	UMTS	Edge	GPRS
Download Median Mbps	5.445	1.279	0.912	0.69	0.025
Download Average Mbps	7.248	1.734	1.504	0.121	0.068
Upload Median Mbps	1.679	0.456	0.423	0.075	0.026
Upload Average Mbps	2.316	1.435	0.595	0.497	0.166

Verification

Using separate data sets outside of the carrier submitted data, PCI has done some basic verification to begin to investigate the accuracy of the carrier maps. Verification is the process of finding other data sources outside of the carrier coverage submissions to indicate that there is some type of verified broadband activity or subscribers. From a national perspective, the broadband availability maps have been met with a certain amount of skepticism. Part of the problem lies in the fact that it has been difficult to check the carrier data against other sources. In this report we have started this process by examining two sets of information. At PCI, we have also worked closely with the providers to ensure their data is represented as accurately as possible.

Speed Test Verification

The first method of verification is user speed test data through the NTIA and FCC's National Broadband Map, which is available at the http://broadbandmap.gov website. Through this website, and through the FCC's http://broadband.gov web site, the federal government solicited street address information with each speed test. They provided PCI with speed test data gathered over a 12-month period. This has been mapped and some limited studies have been conducted. These speed tests were accompanied by mini-surveys which allowed for some analysis. The users were asked to input their street address and the type of internet connection they were using.

In some cases, the outside sources of data can only show broadband activity and nothing more. Other sources show activity and speed, and then some also show an internet protocol address, or IP address, with the other data points. With an IP address, one can generally search to find out which ISP has control of the particular address thus giving you a reasonable assumption that a speed test is for a particular carrier. Some speed tests do not give physical street address data that matches with the IP address information. When that happens, it is impossible to show the data point at the proper location on a map for further study and compare it to carrier maps. The following tables and figures provide a summary of the findings from this speed test verification. Table 1.2 shows a summary of the locations from which this survey was employed as well as the speed test method that was used. Figure 1.5 gives a visual representation of the location in which these speeds tests were taken. Figure 1.6 shows the locations from which the speed test was taken throughout the state. Table 1.3 and Figure 1.7 each show the results of this speed test.

Table 1.2: User Speed Test Summary

Total Tests	**27,807**	
OOKLA Tests	18,559	66.74%
MLAB Tests	9,248	33.26%
Testing From:		
Community Center, library, or school	1,318	4.74%
Home	23,630	84.98%
Large Business	308	1.11%
Medium Business	639	2.30%
Mobile Connection *not the same data as in the mobile app speed test summaries.	293	1.05%
Other	213	0.77%
Small Business	1,406	5.06%

Source: Broadband Speed Test Data 5/12/2010 - 5/01/2011

Figure 1.5: User Speed Test by Location

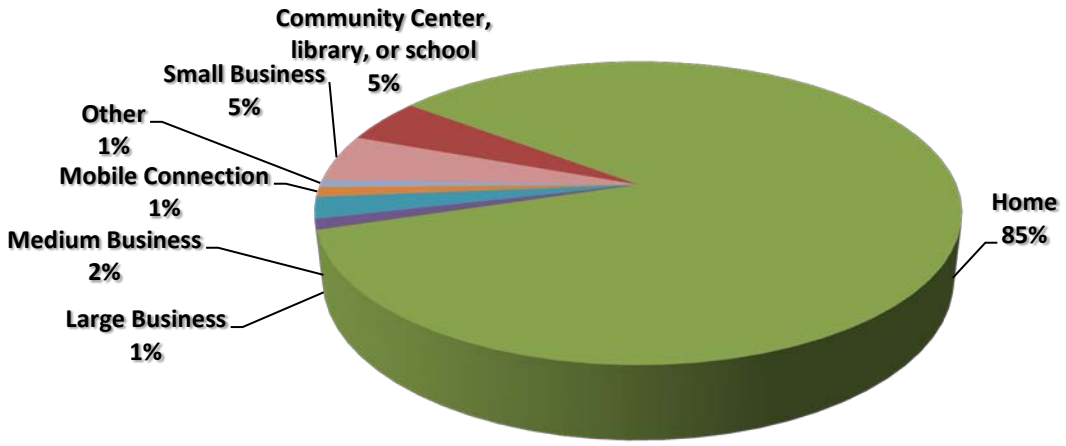


Figure 1.6: Location of Speed Tests

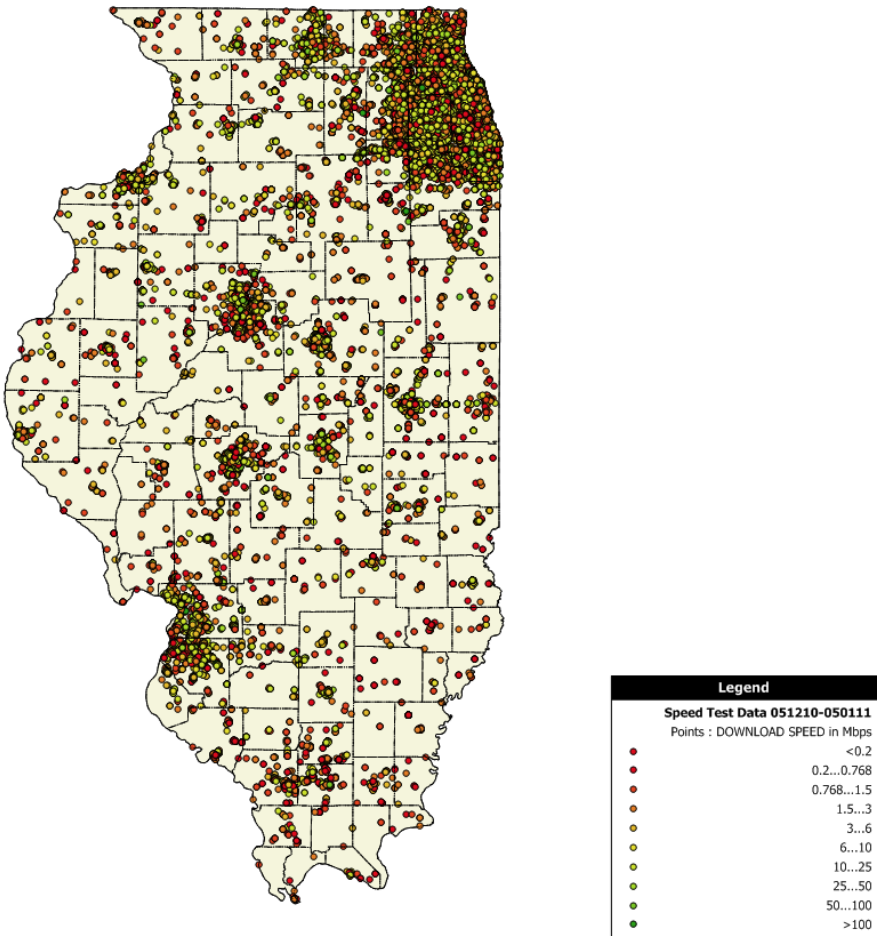
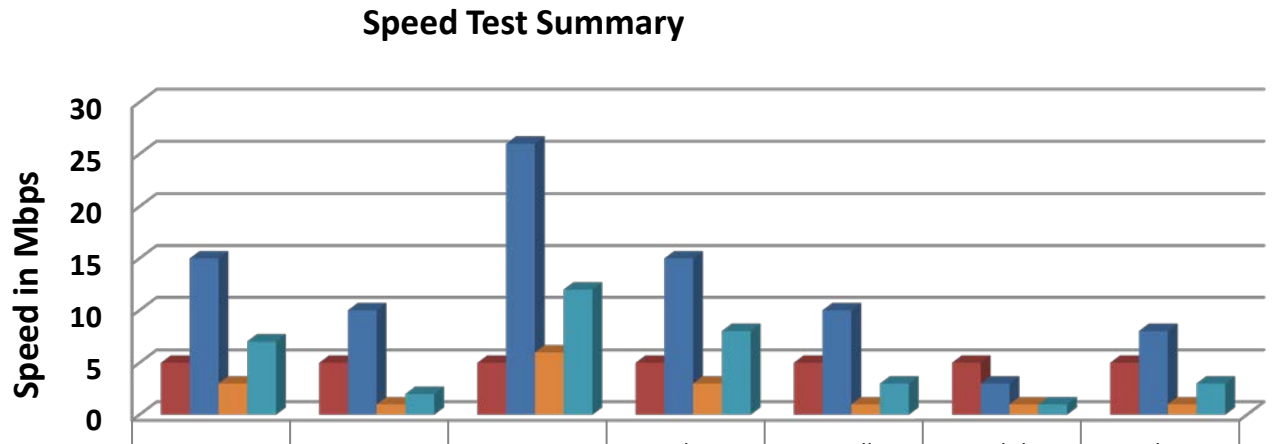


Table 1.3: Speed Test Statistics

Speed Statistics								
Accessing From:	Download Average in Mbps	**Download Median in Mbps**	Download Minimum in Mbps	Download Maximum in Mbps	Upload Average in Mbps	**Upload Median in Mbps**	Upload Minimum in Mbps	Upload Maximum in Mbps
Statewide:	10	**5**	0	702	3	**1**	0	142
Community Center, library, or school	15	**5**	0	195	7	**3**	0	142
Home	10	**5**	0	485	2	**1**	0	97
Large Business	26	**5**	0	174	12	**6**	0	97
Medium Business	15	**5**	0	155	8	**3**	0	96
Small Business	10	**5**	0	702	3	**1**	0	96
Mobile Connection	3	**5**	0	158	1	**1**	0	74
Other	8	**5**	0	95	3	**1**	0	68

Figure 1.7: Speed Test Summary



	Community Center, Library, or School	Home	Large Business	Medium Business	Small Business	Mobile	Other
Download Median in Mbps	5	5	5	5	5	5	5
Download Average in Mbps	15	10	26	15	10	3	8
Upload Median in Mbps	3	1	6	3	1	1	1
Upload Average in Mbps	7	2	12	8	3	1	3

Gadberry Verification

The second set of data was gathered by the Gadberry Company. This information is user-sourced through a variety of methods. The data indicates if there is broadband activity at the street address level and they then incorporate that information at the census block level. We have compared blocks showing coverage as stated by the carriers against the user reported information. There are some areas of the state where there are low or no user reported information.

This company has a product that can show broadband activity at the census block level. The information is sourced from consumers through various means such as online surveys, consumer product registration systems, phone surveys and warranty registrations. They have a master database of more than 118 million occupied households nation-wide, of which over 20 million of the responses had data related specifically to broadband internet use. We have used this data as a source of first pass validation to at least show if there is broadband present in the census blocks the carriers say there is service. This data set cannot address any issues of who the carrier is or what price or speed can be offered. One nice feature of their data set is the flag that indicates 4 different categories if they did not show broadband service in the block. The first and most obvious is that there are no occupied households in the block, the next is that there were enough sample records in the block to have a high confidence that there is no broadband service available, the next category is that there were some responses in the census block but too low a sample rate to be sure there is broadband, and the last category is that there were no address

sample points in the block. Following are maps and summaries of this user-sourced validation process.

To get a summary of validation data, a list of unique census blocks that are known to have one or more broadband provider serving the block (minus cellular coverage) was generated. These are the blocks that the carriers state have broadband service. The unique blocks are then compared to the Gadberry data set with these results. Table 1.4 and Figure 1.8 below show the results of this categorization process based on the Gadberry data set. As you can see, in 93.51 percent of census blocks in the State, providers report that they offer broadband, or internet connectivity at speeds of at least 768 Kbps. Approximately 44.19 percent of those census blocks have been verified through the Gadberry data as having broadband, while 24.90 percent of those blocks show there are no households within those blocks. The Gadberry data set did not have user sourced address sampling in 9.03 percent of these blocks. Also, 21.55 percent of these blocks contained too little sampling to make an absolute determination. Figure 1.9 below shows where these 21.55 percent or 73,796 census blocks are throughout the state. Please note that these census blocks with sampling too low for a good determination are interleaved throughout the State's 366,137 census blocks, yielding an image that looks a lot like Swiss cheese.

Table 1.4: Categorization of census blocks based upon Gadberry data set

Total statewide census blocks	366,137	
Total unique blocks covered with some form of broadband as provided by carriers	342,363	93.51%
Total of the unique blocks Gadberry shows has broadband (crowd sourced)	151,280	44.19%
Number of unique blocks with no occupied households	85,238	24.90%
Number of blocks with no user sourced address sampling	30,910	9.03%
high enough sampling for accurate determination (likely does not have Broadband in Use)	1,139	0.33%
some precise address sampling but too low to expect a good determination	73,796	21.55%

Figure 1.8: Gadberry Data Set Verification Results by Census Block

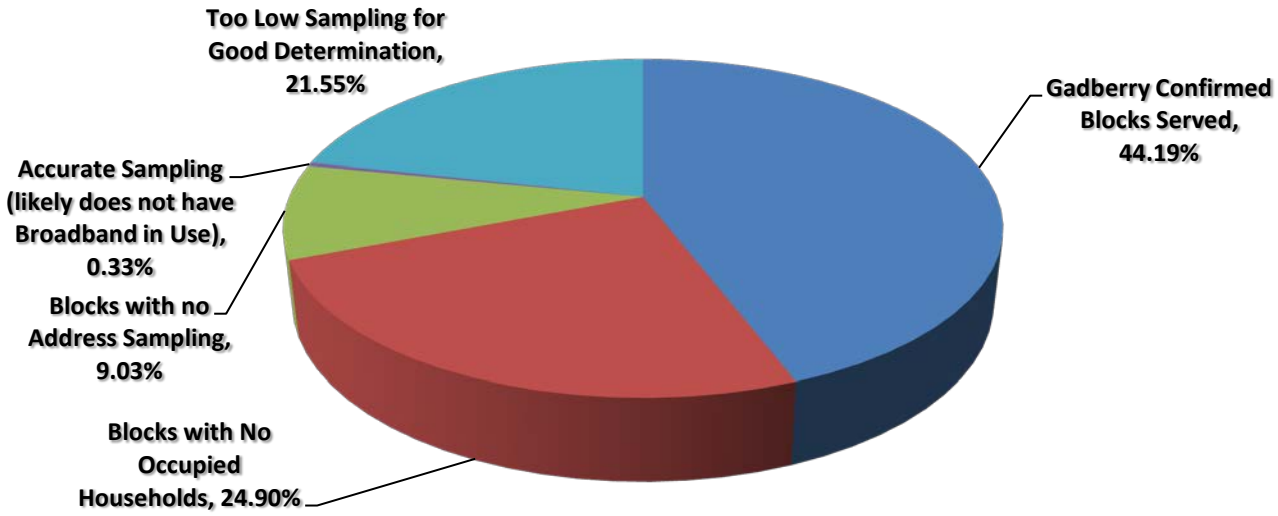
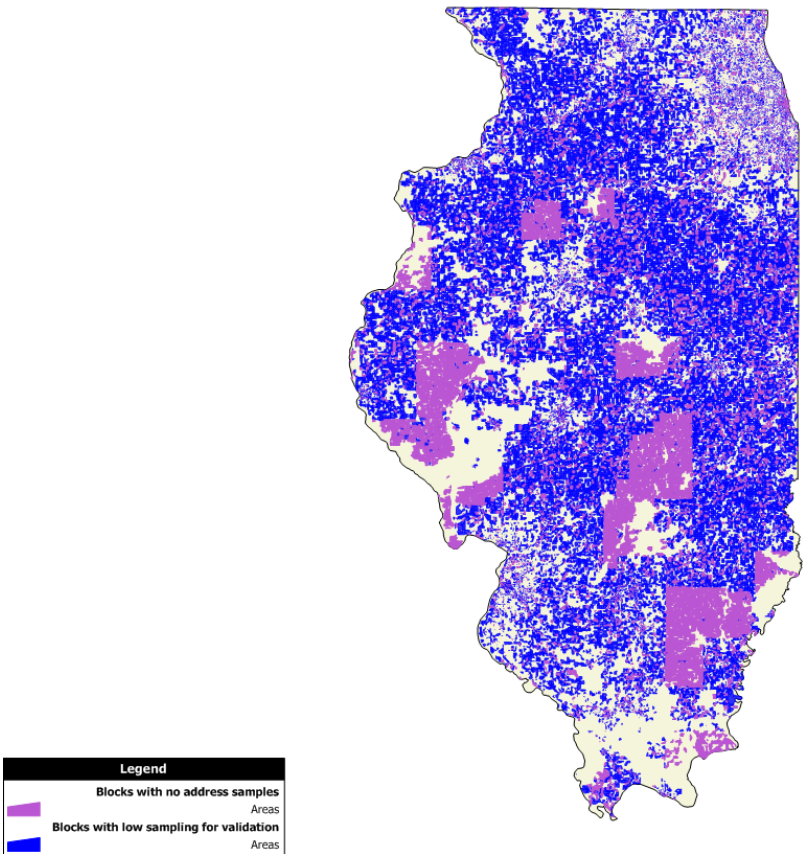


Figure 1.9: Map showing the Gadberry census blocks with either a low or no sample rate.



Provider Verification

Another method of verification is with the broadband providers themselves. PCI has been and continues to be in the process of providing carriers with maps showing the data that PCI currently has on record for each of their particular service areas. These are fully editable maps, and the carriers are encouraged to submit comments, corrections and improvements in the next couple of months. We believe that this verification process will prove to be quite valuable. There may be instances in which providers offering both fiber to the home and DSL service may have inadvertently misrepresented coverage by stating that the same maximum speed is available to its entire DSL area as it is in their fiber footprint. Similar misunderstandings may have occurred with respect to the deployment of the modernized cable infrastructure technology known as DOCSIS 3.0. Hence, it is quite possible that subsequent data updates may change these supply numbers significantly, possibly even lowering the percentages of those higher speed tier availability numbers. PCI is working very closely with the provider community to ensure their data is represented as accurately as possible. Questions about the data process can be addressed to intake@broadbandillinois.org, or to 217-886-4044.

Part 2: Defining and Developing a Supply Baseline

In creating a Statewide Baseline Inventory for Supply of Broadband, it is important to take into consideration the unique landscape of the State of Illinois. There are significant disparities in the percentage of land-area that has access to particular forms of broadband at particular speeds of service.

Mapping Broadband

To develop a statewide master speed tier map, PCI did the following: separate maps were created for each specific *maximum advertised download speed* tier categories for both the wireless (minus mobile broadband) and the wireline technologies. These maps yielded wireless and wireline coverage areas. They were merged to create a master Statewide service area for each individual speed tier. These maps were then laid one over the other, and each of the highest speed tiers were used to trim the lower speed tier coverage areas beneath them. This process produced speed tier maps showing areas uniquely covered by the highest possible advertised speed as stated by all carriers.

Using this unique state map, the area of each speed-tier was calculated and that result divided by the total land area of the state to produce the percentage of land area covered. To calculate the total households passed by each speed tier, the unique polygons were used to select the census block centroid points located within those bounded areas. The number of occupied households for each tier was then tallied. It is important to note that occupied household counts are current as of the end of 2008. This section will show the results of this Statewide analysis based upon total land-area and total household within the certain speed tiers.

Analysis by Land Area & Households Covered

Analysis reveals that Illinois has distinct geographic patterns associated with underserved and un-served areas of Illinois. Using Figure 2.1, the PCI Data Team was able to inventory household counts and speed tier coverage by geographic area as shown in Table 2.1.

Using this information, PCI calculates[1] that zero percent of the State is served by Gigabit or 100 Mbps broadband; that 65 percent of households in the State are served by broadband with advertised speeds of 50 Mbps and higher (for 8 percent of the land area); that 29 percent of households are served by broadband with advertised speeds of 10 Mbps to 50 Mbps (or 26 percent of the land area); that 2 percent of households are served by broadband with advertised speeds of 6 Mbps to 10 Mbps (for 10 percent of the land area); that 3 percent of households are served by broadband with advertised speeds of 3 Mbps to 6 Mbps (for 28 percent of land area); that half a percentage point are served by broadband with advertised speeds of 1.5 Mbps to 3 Mbps (for 6 percent of the land area); and that one-third a percentage point are served by broadband with advertised speeds of 768 Kbps to 1.5 Mbps (for 3 percent of the land area). An additional 1 percent of households are served by internet at non-broadband speeds, e.g. dial-up

[1] Each of these calculations are subject to the three important points highlighted in the introduction: (1) ensuring that data from providers is correct and updated; (2) verifying advertised speeds against actual speeds measured by end-users; and (3) understanding public expectations about the need for, and use of, ever-increasing broadband speeds.

service (for 19 percent of land area). As Figure 2.1 shows, counties in southern, western, and southeastern Illinois are more at risk for access or meeting national goals for speed.

Figure 2.1: Statewide broadband coverage by maximum advertised download speed.

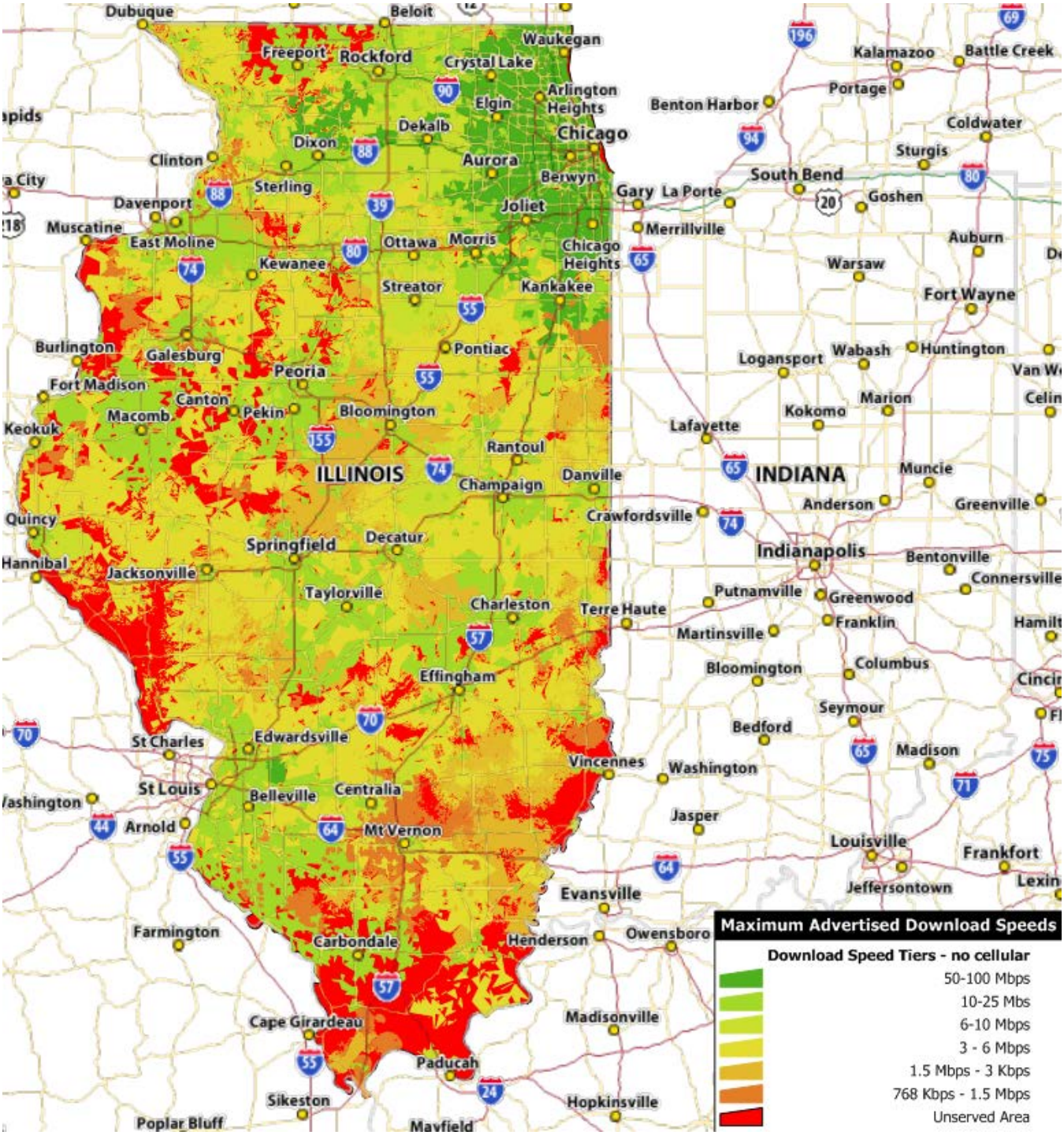


Table 2.1: Speed Tiers by Household Counts and Geographic Coverage

Maximum Advertised Download Speed Tier	Number of Occupied Households with access	Percentage of State Occupied Households Total	Percentage of Land Area Covered by Speed Tier
50-100 mbps	3,161,172	65.15%	7.80%
25-50 mbps	-	0.00%	0.00%
10-25mbs	1,399,699	28.85%	25.78%
6-10 mbps	79,537	1.64%	10.14%
3 - 6 mbps	124,910	2.57%	28.47%
1.5 mbps - 3 mbps	23,703	0.49%	6.41%
768 kbps - 1.5 mbps	14,330	0.30%	2.57%
Total occupied households without access (contained in 18,478 census blocks)	48,471	1.00%	18.83%
Statewide Total Occupied Households	4,851,822		land area statewide 55,593 sq. mi.

Examining speed tiers geographically helps in assessing potential long-term broadband goals for access. What is the implication of having only 7.80 percent of the State of Illinois with access up to 50 to 100 Mbps, as shown in Figure 2.2? Figure 2.3 shows the percentage of households who could access these speeds, this does not show the speed tiers *actually subscribed to*, nor does it show the percentage of households who have broadband internet services.

Figure 2.2: Speed Tiers by Geographic Coverage in Illinois

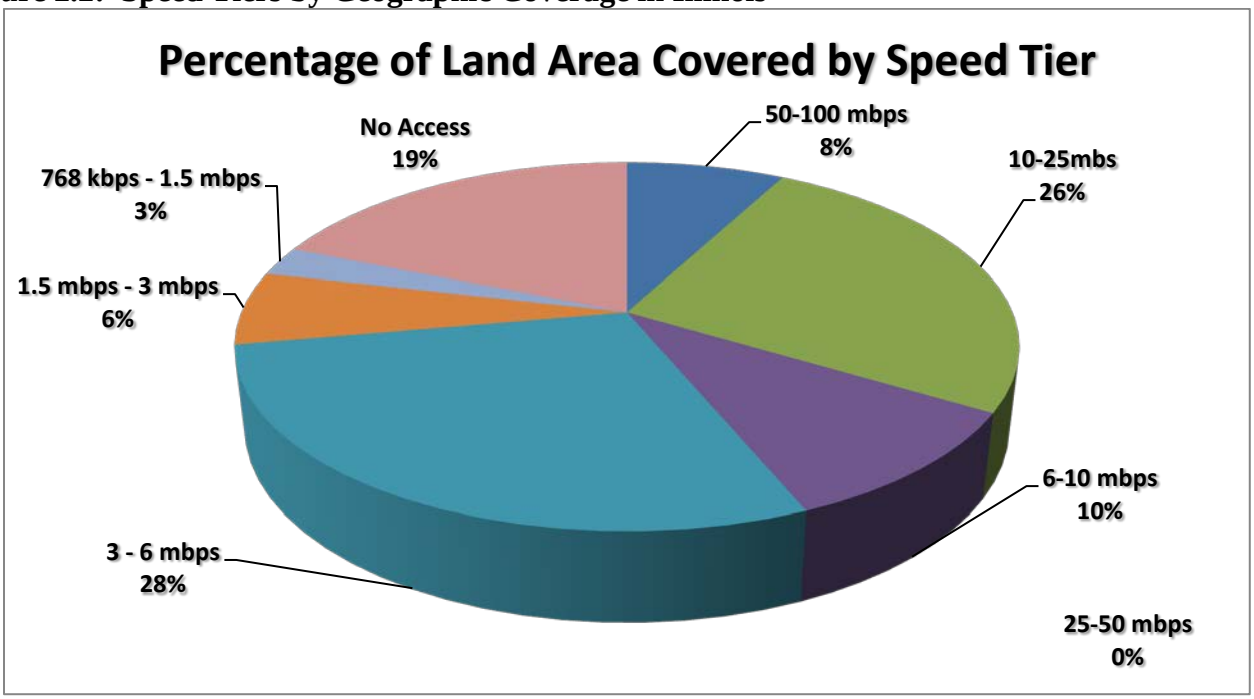
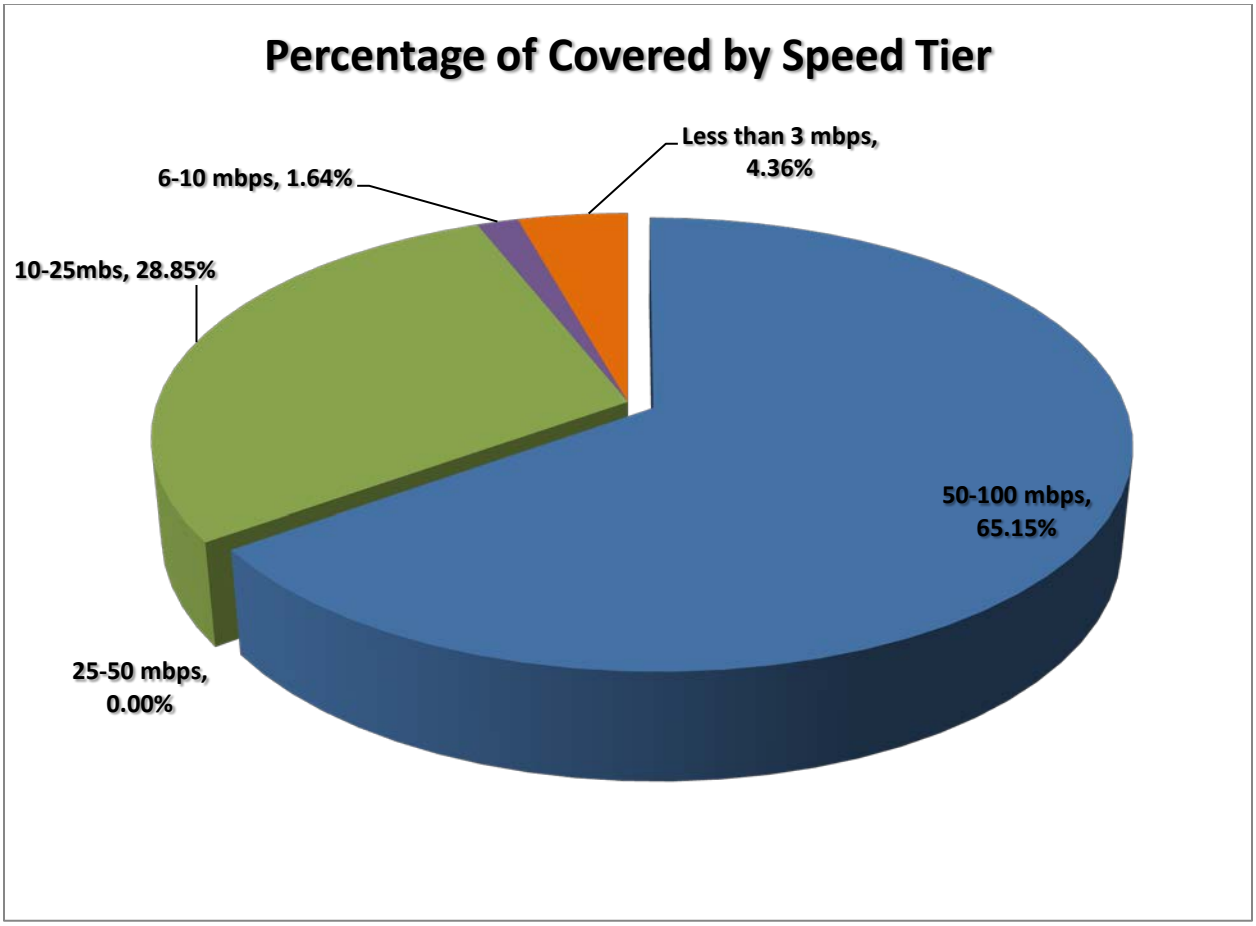


Figure 2.3: Percentage of occupied households with access to particular speed tiers.



This baseline demonstrates that the most significant investment in broadband occurs in areas where population is most dense. Thus, the challenge for Illinois is to ensure that the investment in broadband becomes a priority throughout the entire State so that all citizens receive the benefits of broadband. For example, how can all citizens benefit from advancements in telemedicine or distance learning that requires 25 Mbps or higher connection speeds? Simply put, location matters just as much as the percentages, and this determines what type (and speed) of broadband access any given household, community anchor institutions, or business will have access to. What are the economic development and quality of life issues that are being impacted by the capacity of the current broadband networks within the State? PCI's goal is to assist stakeholders in identifying these disparities in broadband access, and to engage discussions on the economic/cultural impacts on such diverse access to supply in Illinois as well as the realities of improving the infrastructure over time.

Part 3: County Level Rankings

One of the objectives of this report is to develop a ranking system to compare geographic units for broadband access. In a state where the average household income is $82,835 at the high end in Kendall County and $28,370 at the low end in Alexander County, this ranking system based upon broadband connectivity is absolutely essential. In this section, we will take a closer look at the methodology that was used to rank Illinois's 102 counties based upon the level of broadband access within them. We will conclude this discussion with a look at some of the socioeconomic variables that we have found to coincide with high and low levels of broadband connectivity.

Ranking Methodology by Geographic Coverage and Household Count

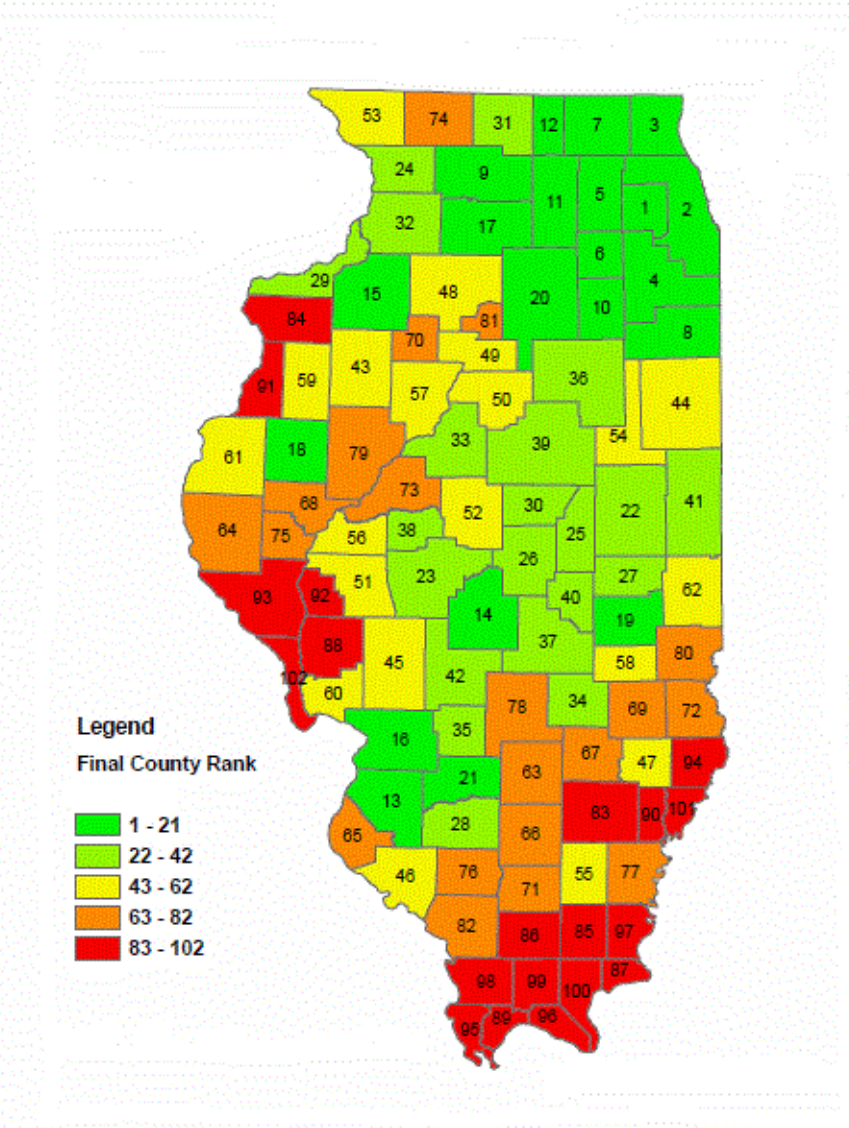
PCI's data team targeted counties as an initial focus to demonstrate and produce maps using a ranking system ranging from (1-102). Results indicated dynamic regional patterns across Illinois' 102 counties (Figure 3.1). For this baseline inventory, ranking will be based on speed availability and the ratio of geographic coverage of each speed tier relative to the master geographic unit of study. Using weighted averages between the two variables produces a score, assisting PCI in evaluating counties against each other for broadband availability. In addition, it will assist in developing an index or score to assess an individual county over time for improvements on access.

The geographic unit for the ranking and comparison is the county boundaries. This geographic unit is widely understood and relates to many levels of local government, economic development, and PCI eTeam efforts. Geographic coverage was defined as the maximum advertised download speed, based on NTIA speed tier codes, for all carriers at that speed within a county. These speed tiers were summarized for the percentage of the county's geographic area represented by each speed tier. A weighted average for each speed tier's coverage of the county as a percentage was multiplied by the speed tier value itself. In summarizing a county's overall score, each county's speed tiers weighted averages were summarized resulting in the broadband score. The maximum value for the score would equal a value of nine for a given county. A value of nine would represent a county with 100 percent coverage at the fastest NTIA speed tier. Using these scores, a ranking from 1 to 102 was developed representing all Illinois counties and how they compared against each other relative to the percentage of households covered by NTIA speed tiers.

The map in Figure 3.1 indicates geographic trends associated with broadband access and supply. Using this ranking system PCI has established a baseline to evaluate broadband access over time. Using the rank model any given county can assess their broadband access over time using simply metrics linking speed with geographic coverage, and also comparing that to other counties and regarding statewide results. Geographic patterns suggest real strengths in the Chicago metro area as most of the counties rank the highest there. Areas in southern and western Illinois are behind relative to access and speed. Goals and outcomes of this research are to assist broadband stakeholders to visually see these disparities at both state and local levels. At the minimum, each county now has a baseline to evaluate their position (Appendix A) in Illinois

relative to broadband access, and can assess over time how they are improving or declining in relation to other counties.

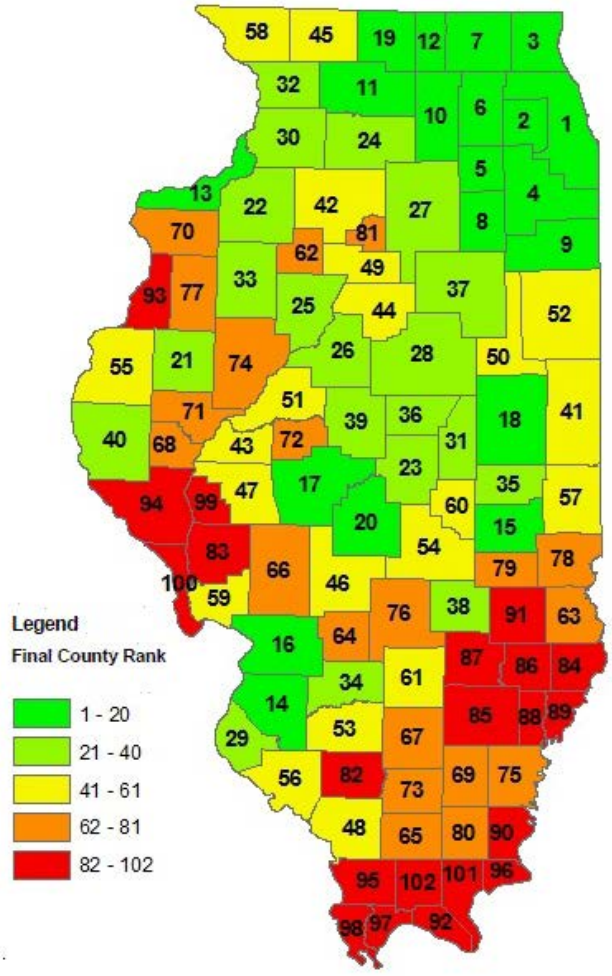
Figure 3.1: County Broadband Access Rank Map Weighted by Percent of Geographic Area Covered by NTIA Speed Tiers



A similar system was used to rank Illinois's 102 counties by household count. As with Figure 3.1, a weighted average for each speed tier's coverage of the county's occupied households as a percentage was multiplied by the speed tier value itself. In summarizing a county's overall score, each county's speed tiers weighted averages are summarized, resulting in the occupied household broadband score. The maximum value for the score would equal a value of nine for a given county. A value of nine would represent a county with 100 percent coverage by household accessibility at the fastest NTIA speed tier. Using these scores, a ranking from 1 to 102 was developed representing all Illinois counties and how they compared against each other relative to

the percentage of households covered by NTIA speed tiers. While there are some changes from the previous figure, the overall geographic picture remains the same.

Figure 3.2: County Broadband Rank Map Weighted by Percentage of Households Covered by NTIA Speed Tiers



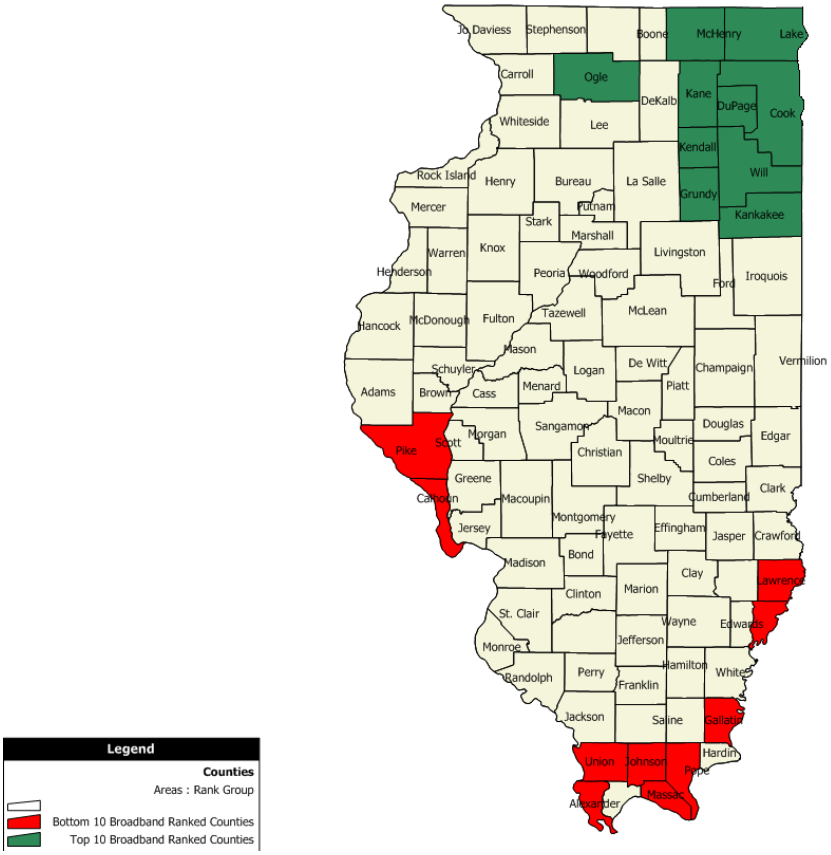
Geographic patterns, socioeconomic factors & broadband deployment

Another goal for this research was to begin exploring local socioeconomic factors shaping broadband deployments. Examining the counties listed in Tables 3.1 (as well as the full list of counties listed in Appendix A), what factors or variables can be empirically connected to counties with higher or lower broadband ranks? Understanding this information will assist PCI and the broader research community in defining at risk populations both geographically and demographically. This information will provide guidance in developing policies targeted in the correct areas and populations for improvements in broadband infrastructure, adoption and access.

Table 3.1: Top 10 & Bottom 10 Broadband Ranked Counties

County	Ranking	2010 Workforce	2010 Unemployed	% RATE	Resident total population 2010	Median household income 2009	People of all ages in poverty - percent 2009	Total number of firms 2007	Land in farms 2007 (acres adjusted)	Land area in square miles 2000	Population per square mile 2010
DUPAGE	1	524,521	43,516	8.3	916,924	$ 73,554	6.7	101,556	7,948	334	2748.5
COOK	2	2,604,300	272,436	10.5	5,194,675	$ 52,516	16	511,023	8,198	946	5493.1
LAKE	3	365,683	38,395	10.5	703,462	$ 76,336	7.6	68,447	34,525	448	1571.8
WILL	4	367,626	38,339	10.4	677,560	$ 72,478	7	53,101	220,851	837	809.6
KANE	5	271,334	27,947	10.3	515,269	$ 66,604	9.4	38,590	192,372	520	990.1
KENDALL	6	60,201	5,914	9.8	114,736	$ 82,835	4.2	8,311	166,872	321	357.9
MCHENRY	7	180,783	17,286	9.6	308,760	$ 74,669	6.6	28,523	215,584	604	511.6
KANKAKEE	8	57,222	7,511	13.1	113,449	$ 49,375	15.1	8,399	385,808	677	167.6
OGLE	9	27,915	3,778	13.5	53,497	$ 52,197	10.9	4,622	366,470	759	70.5
GRUNDY	10	26,784	3,325	12.4	50,063	$ 63,349	6.8	3,673	215,474	420	119.2
PIKE	93	8,780	776	8.8	16,430	$ 38,191	17.1	1,444	389,808	830	19.8
LAWRENCE	94	8,222	785	9.5	16,833	$ 36,587	18.1	1,242	194,035	372	45.3
ALEXANDER	95	2,982	351	11.8	8,238	$ 28,370	29.4	383	47,626	236	34.9
MASSAC	96	7,190	700	9.7	15,429	$ 38,302	16.4	1,395	89,693	239	64.5
GALLATIN	97	2,688	271	10.1	5,589	$ 34,319	19.3	548	185,753	324	17.3
UNION	98	8,351	1,011	12.1	17,808	$ 38,080	20	1,451	122,362	416	42.8
JOHNSON	99	5,229	573	11	12,582	$ 40,497	16.9	713	100,499	345	36.5
POPE	100	1,917	208	10.9	4,470	$ 37,177	18	-	60,809	371	12.1
WABASH	101	6,112	609	10	11,947	$ 42,564	12.7	1,104	114,361	223	53.5
CALHOUN	102	2,524	274	10.9	5,089	$ 44,930	11.3	-	87,938	254	20

Figure 3.3: Top & Bottom 10 Ranked Counties



When looking at the extreme ranges for broadband access, spatial patterns between northern and southern Illinois are revealed in Figure 3.3. However, the more interesting question begins with addressing what are the differences between these counties from a marketing and/or demographic perspective? Looking at local socioeconomic factors relating to economic development, employment, and population density begins to unravel the factors driving broadband markets in Illinois (Tables 3.1 and Figures 3.4 through 3.7).

This information indicates patterns or commonalties for counties with better broadband service. Counties associated with larger populations, high incomes, and greater numbers of businesses attract and get more broadband services. Likewise, smaller rural counties, with lower household incomes, and less businesses do not attract as many broadband services. Knowing these and other variables impacting broadband deployments need to be more fully defined, measured, and empirically validated. This information will assist the broadband research community in assessing what viable markets look like, and also how to reposition underserved or un-served areas to attract new services. It is important to ask the question, *does better broadband access drive these socio-economic factors or is the better broadband access an effect of the socio economic factors?*

Figure 3.4

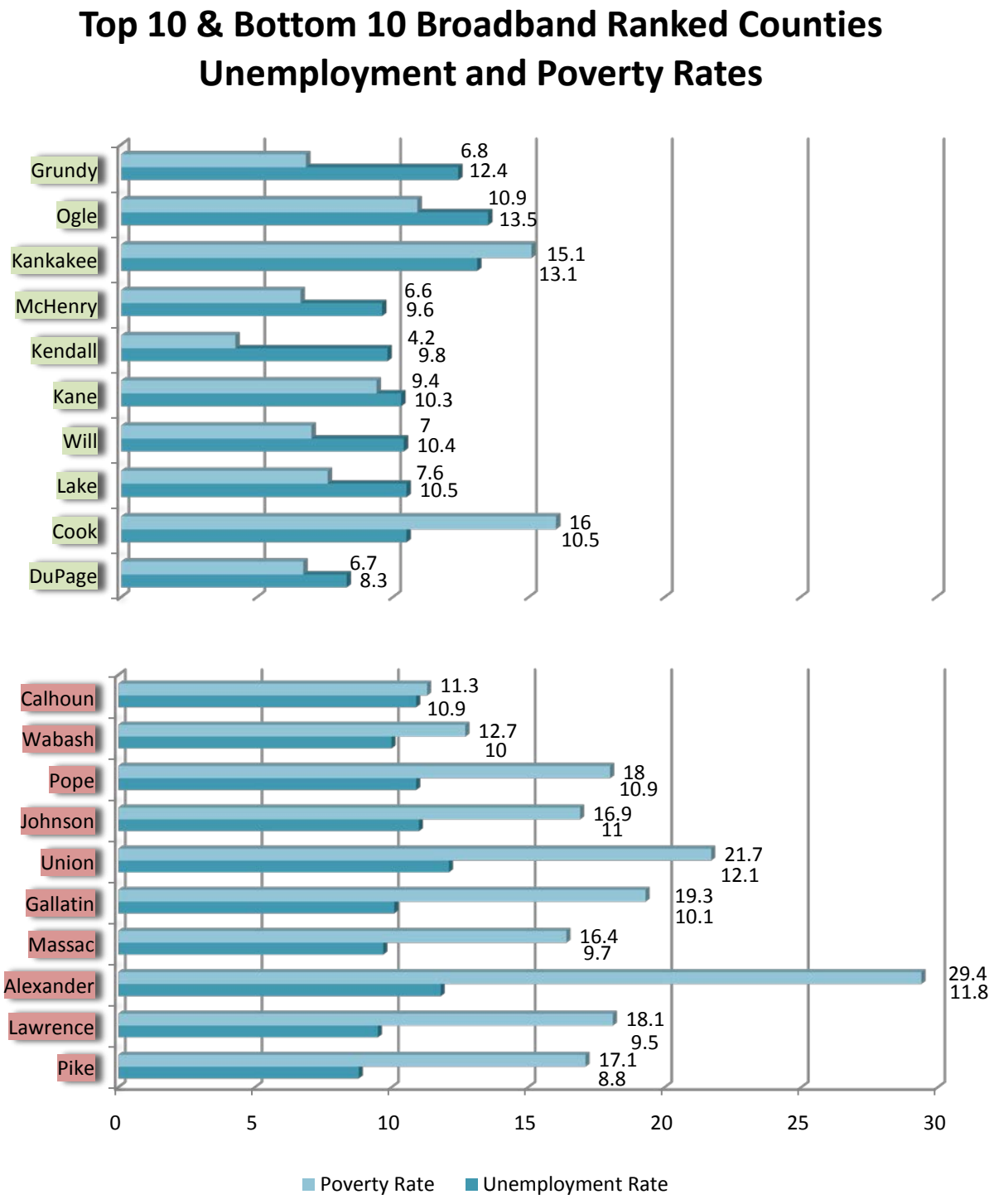

Top 10 & Bottom 10 Broadband Ranked Counties
Unemployment and Poverty Rates
Grundy 6.8 12.4
Ogle 10.9 13.5
Kankakee 15.1 13.1
McHenry 6.6 9.6
Kendall 4.2 9.8
Kane 9.4 10.3
Will 7 10.4
Lake 7.6 10.5
Cook 16 10.5
DuPage 6.7 8.3
Calhoun 11.3 10.9
Wabash 12.7 10
Pope 18 10.9
Johnson 16.9 11
Union 21.7 12.1
Gallatin 19.3 10.1
Massac 16.4 9.7
Alexander 29.4 11.8
Lawrence 18.1 9.5
Pike 17.1 8.8
0 5 10 15 20 25 30
Poverty Rate
Unemployment Rate

Figure 3.5

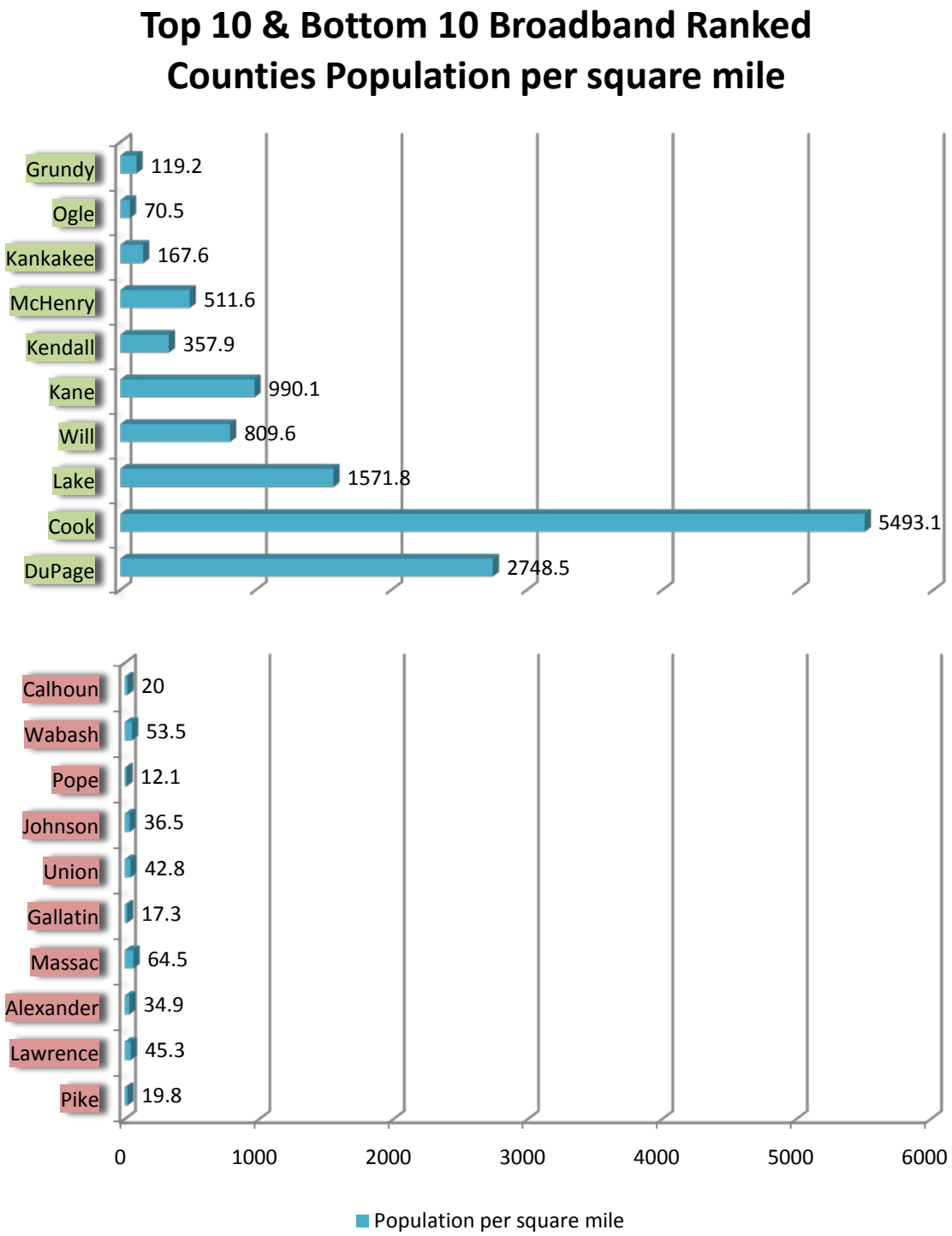

Top 10 & Bottom 10 Broadband Ranked Counties Population per square mile
Grundy
119.2
Ogle
70.5
Kankakee
167.6
McHenry
511.6
Kendall
357.9
Kane
990.1
Will
809.6
Lake
1571.8
Cook
5493.1
DuPage
2748.5
Calhoun
20
Wabash
53.5
Pope
12.1
Johnson
36.5
Union
42.8
Gallatin
17.3
Massac
64.5
Alexander
34.9
Lawrence
45.3
Pike
19.8
0
1000
2000
3000
4000
5000
6000
Population per square mile

Figure 3.6

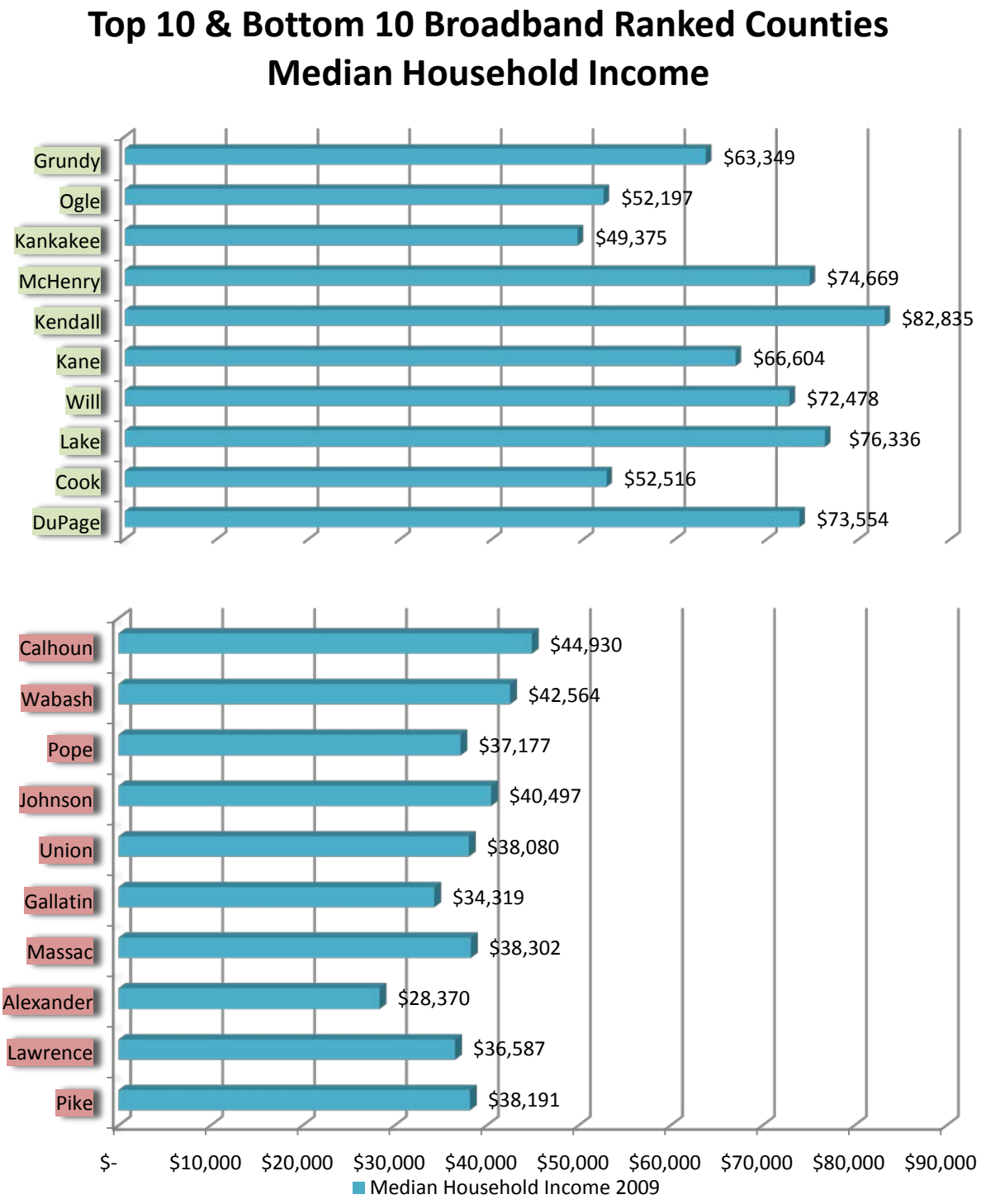
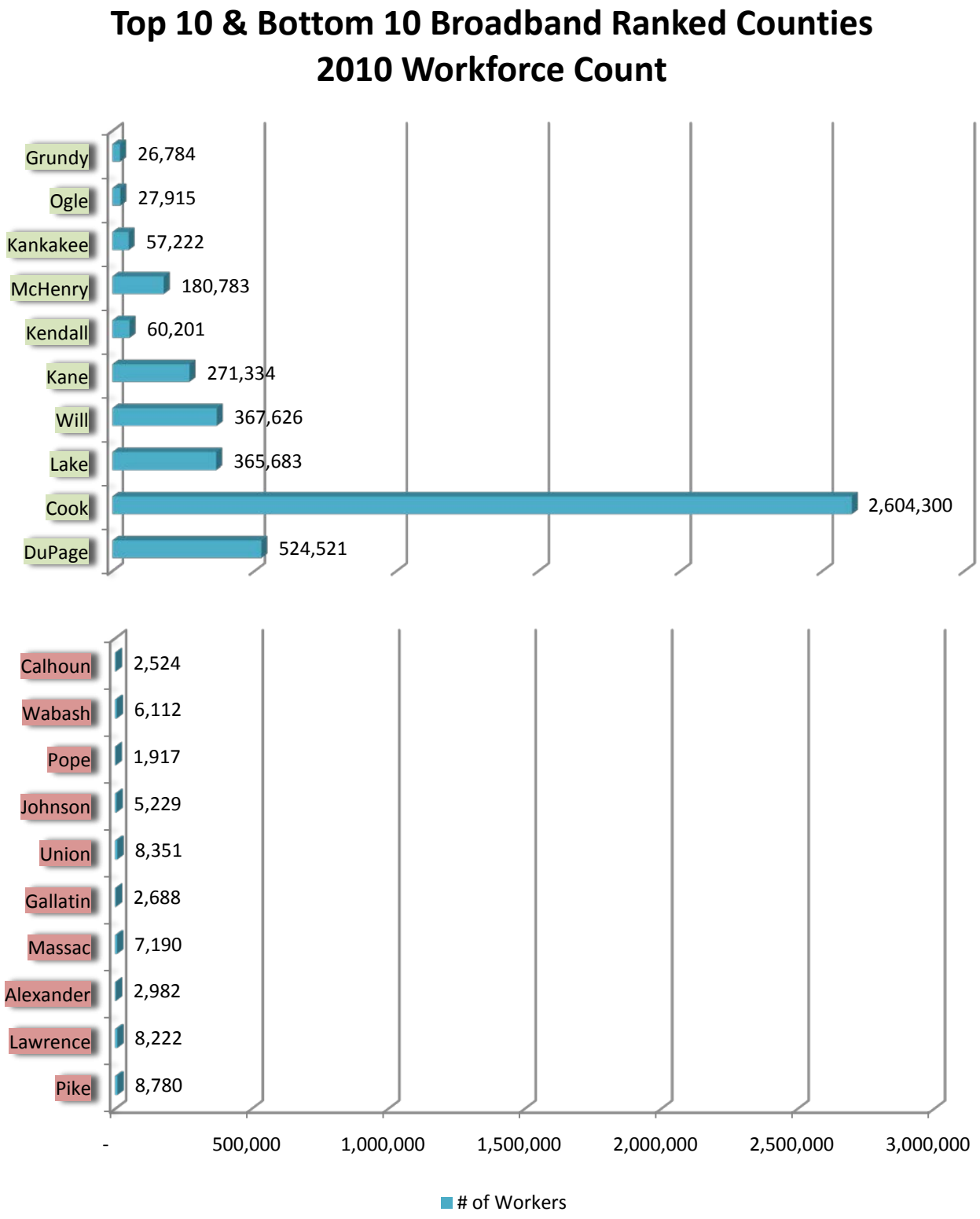

Top 10 & Bottom 10 Broadband Ranked Counties
Median Household Income
Grundy
Ogle
Kankakee
McHenry
Kendall
Kane
Will
Lake
Cook
DuPage
$63,349
$52,197
$49,375
$74,669
$82,835
$66,604
$72,478
$76,336
$52,516
$73,554
Calhoun
Wabash
Pope
Johnson
Union
Gallatin
Massac
Alexander
Lawrence
Pike
$44,930
$42,564
$37,177
$40,497
$38,080
$34,319
$38,302
$28,370
$36,587
$38,191
$- $10,000 $20,000 $30,000 $40,000 $50,000 $60,000 $70,000 $80,000 $90,000
Median Household Income 2009

Figure 3.7


Top 10 & Bottom 10 Broadband Ranked Counties
2010 Workforce Count
Grundy
26,784
Ogle
27,915
Kankakee
57,222
McHenry
180,783
Kendall
60,201
Kane
271,334
Will
367,626
Lake
365,683
Cook
2,604,300
DuPage
524,521
Calhoun
2,524
Wabash
6,112
Pope
1,917
Johnson
5,229
Union
8,351
Gallatin
2,688
Massac
7,190
Alexander
2,982
Lawrence
8,222
Pike
8,780
-
500,000
1,000,000
1,500,000
2,000,000
2,500,000
3,000,000
# of Workers

Conclusion

This report serves to start a discussion among the Illinois broadband stakeholder community. Simply put, this report poses and introduces some early results on scoping the current broadband access landscape across the State of Illinois. In summary, this study concludes large geographic disparities for speeds across the state. In particular, specific regions in southern and western Illinois have both access and speed deficiencies in relation to State averages. Fiber developments offering speeds of 1 Gigabit per second connectivity have been extremely limited – although that is likely to change with a variety of broadband projects funded by the American Recovery and Reinvestment Act, and by State capital fund dollars. Providers serving Chicago and the Collar counties report broadband at speeds in the 50-100 Mbps range, as do providers serving the Kankakee area, and a few other limited areas. Connectivity in the 10-25 Mbps range appears to be available in most of the cities around the State, including the Quad Cities, Macomb, Peoria, Champaign, Danville, Springfield, Taylorsville, Charleston, Effingham, Metro East and Carbondale. Even these observations need to be qualified by the points stated in the introduction: the constant refinement of broadband information in partnership with the providers, and the need to verify actual speeds against advertised speeds; and in consumers' evolving expectations of adequate speeds of broadband connectivity, particularly for engaging in typical home and business broadband use (and not, for example, applications and uses common mobile broadband users).

How does the State of Illinois leverage and harness the full potential of broadband in economic development, business, and community service with this type of system? This data suggest, at the most basic level, that broadband companies are attracted to the most viable markets for private sector investment and network sustainability. Our data suggest these early markets are defined by issues relating to population patterns, incomes, and business activity. Again, this list is by no means exhaustive; however, it does represent an early attempt to define factors shaping broadband markets.

In summary, this reports looks for feedback on what steps are needed to move broadband research forward in Illinois. PCI's broader mission relates to using data to support and increased access and infrastructure, and enhancing the adoption, use and maximum impact of broadband by private and public sector entities across the State. In this process, PCI aims to capture and measure the social and economic impacts of broadband. PCI's data team is currently exploring external data sets to address these concerns relating to business activity, take rates and pricing information. One of primary goals is to assess in measurable ways how broadband impacts jobs and economic development. These types of stories and measurable impacts will be critical in elevating demand, which in theory; will drive more carriers to produce supply. We look forward to feedback and engagement from other broadband stakeholders in addressing these research questions.

Partnership for a Connected Illinois
August 15, 2011

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Appendix A – County Broadband Access Ranking Chart

County	Rank	2010 Workforce	2010 Unemployed	% Rate	Resident total population 2010	Median household income 2009	People of all ages in poverty 2009	Total number of firms 2007	Land in farms 2007 (acres adjusted)	Land area in Sq. mi. 2000	Pop per square mile 2010
ADAMS	64	38,371	2,846	7.4	67,103	$ 41,582	15.7	5,561	374,133	857	78.3
ALEXANDER	95	2,982	351	11.8	8,238	$ 28,370	29.4	383	47,626	236	34.9
BOND	35	8,636	870	10.1	17,768	$ 45,520	13.7	1,350	224,760	380	46.7
BOONE	12	26,452	4,194	15.9	54,165	$ 60,425	8.9	3,425	137,162	281	192.6
BROWN	75	3,572	181	5.1	6,937	$ 42,134	15.9	373	151,058	306	22.7
BUREAU	48	19,555	2,222	11.4	34,978	$ 47,015	12.8	2,918	478,389	869	40.3
CALHOUN	102	2,524	274	10.9	5,089	$ 44,930	11.3	-	87,938	254	20
CARROLL	24	8,424	954	11.3	15,387	$ 41,578	13.2	1,669	265,153	444	34.6
CASS	56	7,793	607	7.8	13,642	$ 41,828	12.5	1,166	173,543	376	36.3
CHAMPAIGN	22	106,393	9,567	9	201,081	$ 42,101	19.9	13,525	550,481	997	201.7
CHRISTIAN	14	18,266	1,819	10	34,800	$ 43,182	14.7	2,949	449,512	709	49.1
CLARK	80	8,260	1,041	12.6	16,335	$ 43,003	13.4	1,452	238,706	502	32.6
CLAY	67	6,631	805	12.1	13,815	$ 37,055	14.7	732	209,834	469	29.4
CLINTON	21	18,730	1,552	8.3	37,762	$ 53,873	8.4	2,876	268,441	474	79.6
COLES	19	27,941	2,676	9.6	53,873	$ 37,790	19.1	3,872	254,869	508	106
COOK	2	2,604,300	272,436	10.5	5,194,675	$ 52,516	16	511,023	8,198	946	5493.1
CRAWFORD	72	9,789	934	9.5	19,817	$ 40,572	15.2	1,597	205,356	444	44.7
CUMBERLAND	58	5,628	586	10.4	11,048	$ 41,962	11.4	626	144,981	346	31.9
DEKALB	11	60,076	5,831	9.7	105,160	$ 51,087	17	7,815	370,772	634	165.8
DEWITT	30	9,035	796	8.8	16,561	$ 47,820	11.1	1,165	198,680	398	41.7
DOUGLAS	27	10,281	955	9.3	19,980	$ 49,916	8.7	1,871	261,513	417	47.9
DUPAGE	1	524,521	43,516	8.3	916,924	$ 73,554	6.7	101,556	7,948	334	2748.5
EDGAR	62	10,360	1,122	10.8	18,576	$ 40,560	16	1,251	352,535	624	29.8
EDWARDS	90	3,186	292	9.2	6,721	$ 40,030	11.3	500	116,690	222	30.2
EFFINGHAM	34	18,471	1,548	8.4	34,242	$ 47,485	10.2	3,422	242,009	479	71.5
FAYETTE	78	10,562	1,216	11.5	22,140	$ 39,611	20.2	2,194	303,258	716	30.9
FORD	54	7,130	718	10.1	14,081	$ 45,821	9.9	1,500	270,720	486	29
FRANKLIN	71	18,214	2,339	12.8	39,561	$ 32,417	18.8	3,165	207,877	412	96
FULTON	79	18,774	2,188	11.7	37,069	$ 40,694	13.9	2,540	385,302	866	42.8
GALLATIN	97	2,688	271	10.1	5,589	$ 34,319	19.3	548	185,753	324	17.3
GREENE	88	6,976	671	9.6	13,886	$ 39,226	14.3	1,080	273,088	543	25.6
GRUNDY	10	26,784	3,325	12.4	50,063	$ 63,349	6.8	3,673	215,474	420	119.2
HAMILTON	55	4,115	400	9.7	8,457	$ 39,337	14.2	1,013	219,873	435	19.4
HANCOCK	61	9,584	1,104	11.5	19,104	$ 43,774	11.6	2,125	392,898	795	24
HARDIN	87	1,813	210	11.6	4,320	$ 33,367	21.4	446	34,733	178	24.2
HENDERSON	91	3,820	389	10.2	7,331	$ 43,041	12.2	604	170,443	379	19.4
HENRY	15	26,991	2,479	9.2	50,486	$ 50,193	9.8	3,237	489,903	823	61.3
IROQUOIS	44	17,138	1,720	10	29,718	$ 46,419	12.2	2,722	677,803	1,116	26.6
JACKSON	82	32,827	2,579	7.9	60,218	$ 30,899	28.5	4,212	224,414	588	102.4
JASPER	69	5,050	486	9.6	9,698	$ 47,087	11.3	1,127	243,451	494	19.6
JEFFERSON	66	20,760	1,994	9.6	38,827	$ 38,326	18.9	2,846	232,531	571	68
JERSEY	60	11,619	1,093	9.4	22,985	$ 48,573	10	2,278	189,462	369	62.3
JO DAVIESS	53	13,230	1,159	8.8	22,678	$ 47,103	10.5	2,655	281,457	601	37.7
JOHNSON	99	5,229	573	11	12,582	$ 40,497	16.9	713	100,499	345	36.5
KANE	5	271,334	27,947	10.3	515,269	$ 66,604	9.4	38,590	192,372	520	990.1
KANKAKEE	8	57,222	7,511	13.1	113,449	$ 49,375	15.1	8,399	385,808	677	167.6
KENDALL	6	60,201	5,914	9.8	114,736	$ 82,835	4.2	8,311	166,872	321	357.9

County	Rank	2010 Workforce	2010 Unemployed	% Rate	Resident total population 2010	Median household income 2009	People of all ages in poverty 2009	Total number of firms 2007	Land in farms 2007 (acres adjusted)	Land area in Sq. mi. 2000	Pop per square mile 2010
KNOX	43	26,206	2,498	9.5	52,919	$ 40,056	13.2	3,333	362,951	716	73.9
LAKE	3	365,683	38,395	10.5	703,462	$ 76,336	7.6	68,447	34,525	448	1571.8
LASALLE	20	60,381	7,880	13.1	113,924	$ 52,208	12.5	8,452	643,291	1,135	100.4
LAWRENCE	94	8,222	785	9.5	16,833	$ 36,587	18.1	1,242	194,035	372	45.3
LEE	17	18,496	2,034	11	36,031	$ 46,901	10.5	2,448	395,624	725	49.7
LIVINGSTON	36	19,206	1,996	10.4	38,950	$ 50,173	11.2	2,551	628,502	1,044	37.3
LOGAN	52	13,687	1,311	9.6	30,305	$ 45,722	13.8	1,823	320,356	618	49
MACON	26	55,274	6,502	11.8	110,768	$ 44,407	15.1	7,843	290,603	581	190.8
MACOUPIN	45	24,165	2,567	10.6	47,765	$ 44,673	12.1	3,653	394,228	864	55.3
MADISON	16	138,701	13,582	9.8	269,282	$ 50,628	13.1	18,652	312,936	725	371.4
MARION	63	18,341	2,222	12.1	39,437	$ 37,277	19.4	3,236	260,679	572	68.9
MARSHALL	49	7,137	688	9.6	12,640	$ 46,526	10.4	1,057	204,584	386	32.7
MASON	73	7,719	967	12.5	14,666	$ 43,947	12.5	651	273,362	539	27.2
MASSAC	96	7,190	700	9.7	15,429	$ 38,302	16.4	1,395	89,693	239	64.5
MCDONOUGH	18	17,094	1,490	8.7	32,612	$ 36,381	22.6	2,554	307,725	589	55.3
MCHENRY	7	180,783	17,286	9.6	308,760	$ 74,669	6.6	28,523	215,584	604	511.6
MCLEAN	39	93,167	7,201	7.7	169,572	$ 56,471	14.4	12,693	675,984	1,184	143.3
MENARD	38	7,095	557	7.9	12,705	$ 55,260	9.3	1,128	168,594	314	40.4
MERCER	84	8,770	951	10.8	16,434	$ 54,533	9.4	1,344	306,306	561	29.3
MONROE	65	18,528	1,442	7.8	32,957	$ 71,342	5	3,242	178,134	388	84.9
MONTGOMERY	42	13,779	1,800	13.1	30,104	$ 37,458	14.9	2,543	347,765	704	42.8
MORGAN	51	17,750	1,660	9.4	35,547	$ 42,672	14.1	2,795	320,512	569	62.5
MOULTRIE	40	8,046	693	8.6	14,846	$ 45,758	10.8	1,186	167,791	336	44.2
OGLE	9	27,915	3,778	13.5	53,497	$ 52,197	10.9	4,622	366,470	759	70.5
PEORIA	57	98,594	10,610	10.8	186,494	$ 47,330	16.8	13,461	259,204	620	301
PERRY	76	9,514	1,135	11.9	22,350	$ 40,276	17.8	1,445	200,354	441	50.7
PIATT	25	8,952	753	8.4	16,729	$ 58,519	6.7	1,407	267,265	440	38
PIKE	93	8,780	776	8.8	16,430	$ 38,191	17.1	1,444	389,808	830	19.8
POPE	100	1,917	208	10.9	4,470	$ 37,177	18	-	60,809	371	12.1
PULASKI	89	2,870	322	11.2	6,161	$ 32,671	25.1	264	101,189	201	30.7
PUTNAM	81	3,267	393	12	6,006	$ 56,372	8.5	493	62,705	160	37.6
RANDOLPH	46	15,424	1,409	9.1	33,476	$ 43,160	13.3	2,250	252,926	578	57.9
RICHLAND	47	7,388	742	10	16,233	$ 40,037	15.1	1,481	202,860	360	45.1
ROCK ISLAND	29	78,729	7,488	9.5	147,546	$ 48,668	11.2	9,363	178,623	427	345.7
SALINE	85	12,961	1,310	10.1	24,913	$ 35,723	16.6	1,937	117,233	383	65
SANGAMON	23	110,862	8,876	8	197,465	$ 52,581	13.1	17,195	518,153	868	227.4
SCHUYLER	68	4,271	318	7.4	7,544	$ 44,814	13.3	508	207,457	437	17.3
SCOTT	92	2,756	266	9.7	5,355	$ 49,450	10.4	449	135,731	251	21.3
SHELBY	37	11,266	1,146	10.2	22,363	$ 44,956	10.9	1,699	387,288	759	29.5
ST CLAIR	13	124,858	13,666	10.9	270,056	$ 46,368	17.1	17,084	306,533	664	406.8
STARK	70	2,887	313	10.8	5,994	$ 46,211	11.5	-	169,775	288	20.8
STEPHENSON	74	24,641	2,886	11.7	47,711	$ 44,307	13	3,662	337,932	564	84.6
TAZEWELL	33	73,637	7,458	10.1	135,394	$ 53,904	8.3	9,910	329,268	649	208.7
UNION	98	8,351	1,011	12.1	17,808	$ 38,080	20	1,451	122,362	416	42.8
VERMILION	41	37,494	4,547	12.1	81,625	$ 37,167	21.7	5,848	457,375	899	90.8
WABASH	101	6,112	609	10	11,947	$ 42,564	12.7	1,104	114,361	223	53.5
WARREN	59	9,421	794	8.4	17,707	$ 43,296	13.6	1,350	294,907	543	32.6
WASHINGTON	28	8,341	656	7.9	14,716	$ 50,299	9.6	-	353,903	563	26.2
County	**Rank**	**2010**	**2010**	**%**	**Resident**	**Median**	**People**	**Total**	**Land in**	**Land**	**Pop**

		Workforce	Unemployed	Rate	total population 2010	household income 2009	of all ages in poverty 2009	number of firms 2007	farms 2007 (acres adjusted)	area in Sq. mi. 2000	per square mile 2010
WAYNE	83	8,192	791	9.7	16,760	$ 40,497	14.6	1,653	333,255	714	23.5
WHITE	77	7,826	682	8.7	14,665	$ 38,905	15.5	1,250	296,989	495	29.6
WHITESIDE	32	30,246	3,280	10.8	58,498	$ 45,359	11.8	4,063	405,333	685	85.4
WILL	4	367,626	38,339	10.4	677,560	$ 72,478	7	53,101	220,851	837	809.6
WILLIAMSON	86	35,622	3,348	9.4	66,357	$ 39,386	18.3	5,889	94,124	423	156.7
WINNEBAGO	31	146,319	22,185	15.2	295,266	$ 44,390	17.7	23,684	183,615	514	574.7
WOODFORD	50	21,478	1,743	8.1	38,664	$ 64,748	6.8	2,365	288,400	528	73.2

About the Authors

About Dr. Mike Rudibaugh

Mike Rudibaugh is the Mapping and Analysis Director for PCI

Dr. Rudibaugh's career started as a faculty member instructing Earth Science and Geographic Information Systems courses at Lake Land College in 1996. He has worked on numerous federal grants relating to STEM education and workforce development issues challenging the American economy. Dr. Rudibaugh holds a B.A. from Eastern Illinois University (Psychology) and a M.A. (1996) and Ph.D. (2006) from Indiana State University in Economic Geography. His dissertation research focused on assessing the impact of location (urban vs. rural) and resulting influence on strategic planning issues impacting community colleges. He currently serves as Director of Mapping and Analysis for the Partnership for a Connected Illinois.

About Brian Webster

Brian Webster is the Telecom Data Coordinator for PCI

Brian Webster Consulting and Wirelessmapping.com were created to fill a need for affordable wireless engineering services for those unable to justify the cost of hiring and maintaining fulltime RF Engineering and mapping staff. Projects are approached with a creative eye, cost-conscious methodology and over 21 years of telecommunications industry experience. The integration of Geographic Information Systems (GIS) helps present complex engineering and demographic information in clear, color diagrams that help the end user make actionable fact based decisions. These capabilities allow demographic data and market analysis information to be included as overlays to engineering diagrams, along with raw data for input to financial and/or analytical models. Brian has been conducting studies and mapping competitive broadband technologies at the census block level for over eight years. This data was used to assist broadband network operators as they work to cover un-served markets. He currently serves as the Telecom Data Coordinator for the Partnership for a Connected Illinois.