

## 2015 Urban Rate Survey – Fixed Broadband Service Analysis

### Introduction

The form and content of the Urban Rate Survey for fixed broadband services was adopted in an Order released in April 2013.<sup>1</sup> That Order concluded that the urban rate survey would be conducted from a statistically valid sample of fixed terrestrial broadband providers drawn from 2010 Census urban areas and urban clusters within Metropolitan Statistical Areas. Last year, the Bureau determined that a weighted linear regression was the best method to determine the broadband reasonable comparability benchmark because of the different characteristics of broadband offerings. This methodology was used to estimate the mean rate for a specific set of service characteristics. Two standard deviations were added to this mean to determine the benchmark for services meeting those defined service characteristics.<sup>2</sup> The Bureau used the same methodology this year, with small adjustments to improve the sample collected.

The 2015 Urban Rate Survey (URS) received 370 applicable responses with monthly rates from 100 different carriers offering fixed broadband service in 252 different Census tracts. Although the reasonable comparability benchmark can be calculated for any combination of download speed, upload speed, and usage allowance that meets the Commission's requirements, the benchmarks for a sample of common offerings are as follows:

Download Speed (Mbps)	Upload Speed (Mbps)	Usage Allowance (GB)	Benchmark
10	1	100	\$71.41
10	1	250	\$76.00
10	1	Unlimited	\$77.81
25	5	250	\$95.09
25	5	Unlimited	\$96.90

### Sample Selection

Similar to the process used for the first URS, this year's URS asked for broadband service rates from a sample of service providers. To determine which broadband providers to sample, the Wireline Competition Bureau (Bureau) relied on data collected via FCC Form 477. The Bureau used the U.S. Census Bureau's definition of urban to determine what areas were eligible for the survey and then defined as the sample pool all fixed terrestrial broadband service providers that operated in these areas.

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<sup>1</sup> *Connect America Fund*, WC Docket No. 10-90, Order, 28 FCC Rcd 4242 (Wireline Comp. Bur. and Wireless Telecom. Bur. 2013).

<sup>2</sup> *Connect America Fund*, WC Docket No. 10-90, Report and Order, 29 FCC Rcd 13485 (Wireline Comp. Bur. 2014).

The sample was derived from 58,332 urban Census tracts encompassing the 50 states, the District of Columbia, and Puerto Rico. The first phase in the sample selection process was to randomly select 375 Census tracts without replacement from this list of urban Census tracts. Each Census tract had an equal chance of being selected in the sample. The selection was performed using the “RandomSample” function in Mathematica.

Using Form 477 December 2013 filings, the Bureau identified 1,030 (service provider, Census tract)<sup>3</sup> pairs for 137 different service providers in 374 different Census tracts.<sup>4</sup> This list is referred to as the “full sample.”

If a service provider was in 25 or fewer (service provider, Census tract) pairs in the sample, then responses were requested for all such pairs in the sample. If a service provider was in 26 or more (service provider, Census tract) pairs in the sample, then survey responses were requested for 25 such pairs randomly selected without replacement or weighting from the sample.<sup>5</sup> The selection was performed using the “RandomSample” function in Mathematica. The selection process produced a list of 488 (service provider, Census tract) pairs encompassing 136 different service providers in 286 different Census tracts. Results of the response selection are referred to as the “survey sample.”

### Data Preparation

A total of 2,352 rates were provided at a variety of service levels. Several rates were excluded from the analysis for various reasons as described in the Appendix attached hereto, resulting in a total of 2,306 rates available for the analysis. The table below presents the number of responses, the number of different service providers, the number of different Census tracts, and the number of rates for each technology among responses received with rates available for the analysis.

Technology	Responses	Service Providers	Census Tracts	Rates
Cable	195	39	177	1147
DSL	120	26	107	647
FTTH	44	22	43	247
Fixed Wireless	35	29	27	120
Other	25	1	25	145
All	370	100	252	2306

<sup>3</sup> Two responses were requested from Windstream for the same Census tract (37057060203) since it was listed twice in the 477 data. Both responses indicated Windstream did not offer broadband service in the Census tract.

<sup>4</sup> No providers were listed for Census tract 04013061017.

<sup>5</sup> Thus, for instance, while the full sample contained requests for rates from Verizon Pennsylvania in 17 Census tracts, the Bureau randomly selected only 6 of those requests to survey. The uniform distribution of Verizon Pennsylvania rates reported in the survey was assigned as the Verizon Pennsylvania rate in the other 11 Census tracts which were not requested in the survey. This process was used for each of the service providers (including Verizon, AT&T, and Time Warner) that had their responses limited to 25. For the purposes of applying this threshold, all eight Verizon companies in the sample were treated as a single company; likewise, both Time Warner companies in the sample were treated as a single company.

All speed values were expected to be entered in Mbps, but some appeared to be entered as Kbps or used thousands in the binary sense. For consistency, speed values entered in the survey were converted as shown in the table below:

Speed Entered	Speed Used
0.128	0.125
0.256 or 256	0.25
0.37, 0.38, or 0.384	0.375
0.512 or 512	0.5
0.768	0.75
1024	1000

### Monthly Rate for a Service Type Response

Monthly rates were treated as unique for a combination of Census tract, FRN, service name, technology, download speed, upload speed, and capacity allowance.<sup>6</sup> The following average monthly rate was used if the service provider offered multiple rates in the Census tract for each unique combination

- Minimum Rate = Minimum Monthly Charge + Minimum Other Mandatory Charge + Minimum Surcharge
- Maximum Rate = Maximum Monthly Charge + Maximum Other Mandatory Charge + Maximum Surcharge
- Average Rate = (Minimum Rate + Maximum Rate)/2
- Rate Spread = Maximum Rate - Minimum Rate

The following average monthly rate was used if the service provider did not offer multiple rates in the Census tract for a unique combination:

- Average Rate = Minimum Monthly Charge + Minimum Other Mandatory Charge + Minimum Surcharge
- Rate Spread = 0

### Weights for Rates

Each (Census tract, service provider) pair in the full sample was assigned the following weights:

*Household Weight (HW)*. Each pair in the full sample was assigned a Household Weight equal to the number of households in the Census tract.

*Provider Weight (PW)*. Each pair in the full sample was labelled as a having a major or minor presence depending on the fraction of households the service provider had as customers in the Census tract. If

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<sup>6</sup> One service provider (Orlando Telephone Company) provided one rate for 10 Mbps service and the additional costs for upgrades to 15 and 25 Mbps service. The upgrade rates were added to the 10 Mbps rate to obtain the appropriate monthly rates for 15 and 25 Mbps service.

the service provider had more than 7% of the households as residential customers, it was considered as having a major presence in the Census tract; otherwise, it was considered as having a minor presence in that Census tract.

For each Census tract in the full sample, the number of service providers with a minor presence in the Census tract was found. Service providers were included in this count:

- if the provider had a minor presence in the Census tract and gave a response with a rate for this Census tract not excluded from this analysis or
- if the provider had a minor presence in the Census tract and a response was not requested from the provider for this Census tract, but had provided responses with rates for other Census tracts.

The Provider Weight was set equal to 1 if the service provider had a major presence in the Census tract. Otherwise, it was set to  $1/(1+P)$  where P is the number of service providers with a minor presence in the Census tract.<sup>7</sup>

The following weights were also used:

*Service Weight (SW)*. Respondents often provided multiple rates for the same download speed, sometimes offered via different technologies and/or service names. Each rate was assigned a Service Weight equal to  $1/L$  where L is the number of rate responses provided by a service provider for the same download speed in a Census tract.

*Request Weight (RW)*. Each unit in the full sample not requested in the survey sample was assigned a weight equal to the number of requests for the unit's service provider in the survey.<sup>8</sup>

Given a rate  $r$  uniquely identified by Census tract (CTr), service provider (FRNr), service name, technology, download speed, upload speed, and data cap, the weight for the rate is

$$\text{Rate Weight} = SW_r \times [PW_{CTr,FRNr} \times HW_{CTr} + \sum (PW_{CTi,FRNr} \times HW_{CTi} / RW_{CTi,FRNr})]$$

where the sum is over all units in the full sample for service provider FRNr that were not requested in the survey sample.<sup>9</sup>

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<sup>7</sup> This assignment of Provider Weights is consistent with the weights used in the 2014 URS. The only exception is that the weight assignment is more accurate here since it uses information from the survey on the presence of service providers in the Census tract in place of relying only on Form 477 responses.

<sup>8</sup> The one exception was Verizon Maryland. Verizon Maryland had 5 Census tract requests in the full sample, but as a result of the random selection of 25 Verizon Census tracts to receive the survey, none from Verizon Maryland was in the survey sample. Therefore, there were no Verizon Maryland rates for use to populate the 5 Verizon Maryland responses for the full sample. Instead, the Bureau used the rates from all 25 Verizon responses for this purpose with a Request Weight of 25.

<sup>9</sup> If the service provider FRNr is a Verizon service provider then the sum also includes all units in the full sample for Verizon Maryland Inc.

## Regression Analysis

We applied a multidimensional weighted linear regression technique to all services with download bandwidths between 2 and 40 Mbps inclusive. This sub-sample of the data contained 1,446 rates<sup>10</sup> from 345 responses encompassing 93 different providers in 243 different Census tracts. The rates in this sub-sample ranged from \$6.99 to \$147.95 with a weighted standard deviation of \$17.1113. We undertook a weighted linear regression fit based on the following model:

$$\text{Average Monthly Rate (\$)} = K_0 + K_D D + K_U U + K_{UI} UI + K_A A$$

for download speed in Mbps (D), upload speed in Mbps (U), unlimited usage allowance indicator (UI),<sup>11</sup> and the log of usage allowance in GB (A).<sup>12</sup> We estimated the parameters as:

$$\text{Average Monthly Rate (\$)} = 13.8465 + 1.22028 D + 0.197281 U + 29.4602 UI + 11.5315 A.$$

The weighted R Squared was 0.59 and each estimated coefficient was highly significant (< 0.0001 significance) except for  $K_U$  which had significance 0.012.

The reasonable comparability benchmark is the estimated average monthly rate plus twice the standard deviation of rates for service plans with download speeds of 10 Mbps or greater, upload speeds of 1 Mbps or greater, and usage allowance of 100 GB or greater. The root weighted mean squared error (RWMSE)<sup>13</sup> about the regression fit was \$11.047 for all rates with service levels meeting these criteria for download speeds between 10 and 25 Mbps inclusive. The RWMSE is an estimate of the standard deviation of rates for service plans meeting the reasonable comparability benchmark criteria. Based on this estimate of the standard deviation, the equations for the reasonable comparability benchmark are:

Reasonable Comparability Benchmark (\$) = 65.4007 + 1.22028 D + 0.197281 U for unlimited usage allowance and

Reasonable Comparability Benchmark (\$) = 35.9405 + 1.22028 D + 0.197281 U + Min[29.4602, 11.5315 LOGA] otherwise where LOGA is  $\text{Log}_{10}[\text{usage allowance in GB}]$ .

If a reasonable comparability benchmark is needed for lower download speeds, the following equation may be used based on an RWMSE of \$9.74832 for download speeds greater than or equal to 4 Mbps but less than 10 Mbps:

Reasonable Comparability Benchmark (\$) = 62.80334 + 1.22028 D + 0.197281 U for unlimited usage allowance and

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<sup>10</sup> The survey responses provided 1,450 rates within this download range. However, four of these rates exceeded \$155 and were considered outliers. This is consistent with the 2014 URS Broadband analysis in which the maximum rate included in the regression analysis was \$151.45.

<sup>11</sup> UI = 1 if usage allowance greater than or equal to 500 GB and 0 otherwise.

<sup>12</sup> A = 0 if usage allowance is greater than or equal to 500 GB and  $\text{Log}_{10}[\text{usage allowance in GB}]$  otherwise.

<sup>13</sup> RWMSE is the square root of the weighted average of the square of observed rates minus average rate as defined by the average monthly rate equation.

Reasonable Comparability Benchmark (\$) = 33.34314 + 1.22028 D + 0.197281 U + Min[29.4602, 11.5315 LOGA] otherwise .

The table below provides examples of reasonable comparability benchmarks based on the above equations (rounded up to the nearest cent) for several service plan levels as well as equivalent benchmarks derived using the 2014 URS Broadband analysis.

Download Speed (Mbps)	Upload Speed (Mbps)	Usage Allowance (GB)	2014	2015 <sup>14</sup>
4	1	100	\$57.20	\$61.49
4	1	Unlimited	\$74.31	\$67.89
10	1	100	\$68.35	\$71.41
10	1	250	\$78.61	\$76.00
10	1	Unlimited	\$85.45	\$77.81
25	5	250	\$96.97	\$95.09
25	5	Unlimited	\$103.81	\$96.90

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<sup>14</sup> The difference in benchmarks between 2014 and 2015 for the 10 Mbps and 25 Mbps downstream service offerings is not statistically significant.

## Appendix: Rates Excluded from the Analysis

Google Fiber Kansas LLC and Google Fiber Missouri LLC responded with free product offerings (\$0 rate) for 5/1/Unlimited service in three Census tracts. According to Google's website, these "free product offerings" require a \$300 construction fee which is waived for Google Fiber's other service plans.<sup>15</sup> Such offerings were considered outside the scope of the analysis because of their uncommon fee structure. Moreover, inclusion of the Google offerings within the sample produced only minor variations in the benchmarks. The Bureau will consider collecting non-recurring charges in future Surveys to account for these types of offerings.

In its one response, Ranch Wireless provided 16 rates which match their Business Internet Plans<sup>16</sup> as well as 5 rates which matched their Residential Internet Plans.<sup>17</sup> The responses which match Ranch Wireless's Business Internet Plans were considered outside the scope of the analysis because the analysis encompasses residential service only.

WEHCO Video Inc. provided 3 rates for services named Business Standard, Business Enhanced, and Business Turbo. Similarly, these responses were considered outside the scope of the survey and were excluded from the analysis.

Armstrong Utilities Inc. provided 5 rates for services named Zoom Business I, Zoom Business II, Zoom Enterprise I, Zoom Enterprise II, and Zoom Enterprise III which matched service plans listed on their business web page.<sup>18</sup> For the reason noted above, these responses were considered outside the scope of the survey and were excluded from the analysis.

Tacoma Power dba Click! Network provided 18 responses to the survey. Most of the rates provided in the responses came with the comment: "Wholesale rate to ISP." Discussions with Tacoma Power revealed that Tacoma Power only provides transport services to ISPs, not to residential customers. Therefore, these rates were not included in the analysis.

Verizon California Inc. responded with two identical rates for 300/300/Unlimited service provided via FTTH technology in Census tract 6037574500. One of the rates was excluded from the analysis.

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<sup>15</sup> See <https://fiber.google.com/cities/kansascity/plans/#plan=free>.

<sup>16</sup> See <http://ranchwireless.com/business-internet-plans/>

<sup>17</sup> See <http://ranchwireless.com/residential-internet-plans/>

<sup>18</sup> See <http://armstrongonewire.com/business/zoom.aspx>