**2016 Urban Rate Survey – Fixed Broadband Service Analysis**

**Sample Selection Introduction**

Every year, the Wireline Competition Bureau conducts a survey of the prices for residential standalone Internet service “to help ensure that universal service support recipients offering fixed voice and broadband services do so at reasonably comparable rates to those in urban areas.” [[1]](#footnote-1) This document shows how the fixed broadband reasonable comparability benchmark was calculated for 2016.

The sampling unit for the 2016 fixed broadband survey was a (service provider, census tract) pair. The frame[[2]](#footnote-2) for the survey was the set of sampling units of providers offering fixed broadband service to residential customers in urban census tracts. The frame consisted of 145,217 sampling units, encompassing 1,158 service providers and 58,044 census tracts.

For each sampling unit, the number of offers was calculated as:

Offers = Provider Presence Ratio x (Number of households in the sampling unit’s census tract)

Provider Presence Ratio was calculated as the fraction of housing units in the census tract for which the provider offered fixed broadband service.

The 2016 Urban Rate Survey for fixed broadband services differed from the 2015 survey in two significant ways. First, the survey sample was stratified in 2016 to reduce the sample sizes requested from large national service providers, which had demonstrated little variation in rates across census tracts in past surveys. This reduced the burden on respondents and allowed for a broader representation of service providers in the sample while maintaining the precision of the survey. Second, the 2016 survey uses a different weighting mechanism that uses weights equal to estimates of the number of households offered service by a service provider in a census tract based on number of subscribers.

**Stratification**

The frame was divided into 24 strata to reduce the burden on survey respondents. Past Urban Rate Surveys demonstrated that for many of the service providers (particularly the large national service providers), the rates offered for services did not vary across census tracts. Stratification allows us to reduce the number of survey responses requested in such cases while still capturing the offered rates in accordance with their estimated effect on the reasonable comparability benchmark. The following 22 strata contained sampling units from the service providers indicated in parentheses:

* AT&T (AT&T Services, Inc.)
* COMCAST (COMCAST CABLE COMMUNICATIONS, INC.)
* Verizon New York Inc. (Verizon New York Inc.)
* Verizon Pennsylvania LLC (Verizon Pennsylvania LLC)
* Verizon New Jersey Inc. (Verizon New Jersey Inc.)
* Verizon California Inc. (Verizon California Inc.)
* Verizon New England Inc. (Verizon New England Inc.)
* Verizon Virginia LLC (Verizon Virginia LLC)
* Verizon Maryland LLC (Verizon Maryland LLC)
* Verizon Florida LLC (Verizon Florida LLC)
* Verizon Delaware LLC (Verizon Delaware LLC)
* GTE Southwest Incorporated dba Verizon Southwest (GTE Southwest Incorporated dba Verizon Southwest)
* Verizon Washington, DC Inc. (Verizon Washington, DC Inc.)
* Time Warner (Time Warner Cable Inc.)
* CenturyLink (CenturyLink, Inc., CenturyLink Communications, LLC)
* Cox (Cox Communications)
* Charter (Charter Communications, Inc.)
* Frontier (Frontier Communications Corporation)
* CSC Holdings (CSC Holdings LLC)
* Bright House (Bright House Networks, LLC)
* Windstream (service providers identifying Windstream as their holding company)
* WideOpenWest (Knology and WideOpenWest)

The remaining sampling units were divided into two strata based on the number of offers in the sampling unit:

Major – Remaining sampling units with at least 500 offers

Minor – Remaining sampling units with fewer than 500 offers

The table below presents the sampling plan including the sample size for each stratum. Sampling units were selected randomly from each stratum, unweighted and without replacement. The sample sizes for each stratum are a reflection of the estimated number of offers in the stratum and the estimated variability of offered rates from the previous Urban Rate Survey.



**Data Preparation**

The table below presents the number of responses, the number of different service providers, and the number of different census tracts requested, received, and received with rates in the 2016 Urban Rate Survey for fixed broadband service. The only non-response sampling units were in the Major and Minor strata.

|  |  |  |  |
| --- | --- | --- | --- |
| Survey Status | Responses | Service Providers | Census Tracts |
| Requested | 500 | 177 | 498 |
| Received | 467 | 157 | 465 |
| Rates Provided | 446 | 147 | 444 |

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.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Technology | Responses | Service Providers | Census Tracts | Rates |
| Cable | 235 | 47 | 234 | 1606 |
| DSL | 96 | 37 | 96 | 537 |
| FTTH | 54 | 37 | 54 | 267 |
| Fixed Wireless | 94 | 50 | 94 | 340 |
| Other | 20 | 5 | 20 | 107 |

A total of 2,857 rates were provided at a variety of service levels. Several rates were excluded from the analysis for the reasons described in the Appendix, resulting in a total of 2,655 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 | 234 | 46 | 233 | 1439 |
| DSL | 95 | 36 | 95 | 535 |
| FTTH | 52 | 35 | 52 | 264 |
| Fixed Wireless | 91 | 47 | 91 | 313 |
| Other | 18 | 3 | 18 | 104 |
| All | 442 | 143 | 440 | 2655 |

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

|  |  |
| --- | --- |
| Speed Entered | Speed Used in Mbps |
| 0.128 or 128 | 0.125 |
| 0.256 or .258 | 0.25 |
| 0.37, 0.38, or 0.384 | 0.375 |
| 0.512 or 512 | 0.5 |
| 0.768 or 768 | 0.75 |
| .896 | .875 |
| 1024 | 1 |
| 3000 | 3 |

**Monthly Rates and Rate Spreads for the Survey Sample**

Monthly rates were treated as unique for a combination of census tract, FCC Registration Number (FRN), service name, technology, download speed, upload speed, and capacity allowance. 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:

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

**Weights for Rates**

Weights are needed to capture the estimated number of offers each response represents; without such weights, the offered rates from a minor service provider with little coverage would have the same influence on the benchmark as a response from a large national service provider. The weights are also needed to compensate for the variability in sampling across the strata. Each (census tract, service provider) pair in the full sample was assigned the following weights:

*Stratum Weight.* Each stratum S is assigned a weight as follows:

StratumWeightS = FrameOffersS / SampleOffersS where

FrameOffersS = Total number of offers in the frame for stratum S and

SampleOffersS = Total number of offers for stratum S in the sample.

*Same Rate Weight (SRW)*. Several respondents provided i) multiple service levels or ii) equal service levels via different technologies for the same rate in the same census tract.[[3]](#footnote-3) In such cases, the rate was assigned a Service Weight equal to 1/R, where R is the number of rate responses provided by a service provider at the same rate in the census tract.

*Service Level Weight (SLW)*. Several respondents provided multiple rates for the same service level 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 responses with different rates provided by a service provider for the same download speed in the census tract.

Given a rate r in stratum S uniquely identified by census tract (CT), service provider (FRN), service name, technology, download speed, upload speed, and data cap, the weight for the rate is

Rate Weight = StratumWeightS x OffersCT,FRN x SRWr x SLWr

Where OffersCT,FRN = Number of offers from service provider FRN in census tract CT.

**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 encompassed 1,735 rates from 403 responses encompassing 135 different providers in 401 different census tracts. The rates in this sub-sample ranged from $6.99 to $200.00 with a weighted standard deviation of $17.3639. We undertook a weighted linear regression fit based on the following model:

Average Monthly Rate ($) = K0 + KD D + KU U + KUI UI + KA A

for download speed in Mbps (D), upload speed in Mbps (U), unlimited usage allowance indicator (UI),[[4]](#footnote-4) and the log of usage allowance in GB (A).[[5]](#footnote-5) We estimated the parameters as:

Average Monthly Rate ($) = 12.7886 + 1.1793 D + 0.11665 U + 29.0361 UI + 11.4907 A.

The weighted R Squared was 0.52, and each estimated coefficient was highly significant (< 0.0001 significance), except for KU which was not statistically significant.

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 residual (RWMSR) [[6]](#footnote-6) is an estimate of the standard deviation of rates for service plans meeting the reasonable comparability benchmark criteria.

If the distribution of residuals was consistent across the range of download speeds, a single RWMSR could be calculated, doubled, and then added to the Average Monthly Rate equation to obtain an equation for the reasonable comparability benchmark. However, in the 2016 Urban Rate Survey, residuals (and consequently, RWMSR and standard deviation) tend to be greater for lower download speeds than they are at higher download speeds. The figure below is a bubble chart[[7]](#footnote-7) plotting the RWMSR by download speed for rates with download speeds from 2 to 40 Mbps, upload speeds of 1 Mbps or greater, and usage allowance of 100 GB or greater. The figure indicates that the RWMSR tends to be lower at download speeds greater than 10 Mbps.



The reasonable comparability benchmark is the Average Monthly Rate plus twice the standard deviation of rates:

12.7886 + 1.1793 D + 0.11665 U + 29.0361 UI + 11.4907 A + 2 RWMSR

where RWMSR is an estimate of the standard deviation of the rates.

As indicated above, RWMSR is not constant across download speeds. Treating RWMSR as a function of download speed, the comparability benchmark equation is:

12.7886 + 1.1793 D + 0.11665 U + 29.0361 UI + 11.4907 A + 2 RWMSR(D).

This equation can be rewritten as:

12.7886 + C(D) + 0.11665 U + 29.0361 UI + 11.4907 A

where C(D) = 1.1793 D + 2 RWMSR(D).

The figure below plots C(D) versus download speed squared. The linear nature of the trend indicates that a quadratic fit of C(D) to download speed is reasonable. The weighted quadratic fit is:

C(D) = 30.6646 + 0.0258656 D2.



Substituting this formula for C(D) in the equation for the comparability benchmark produces the following equation:

12.7886 + (30.6646 + 0.0258656 D2) + 0.11665 U + 29.0361 UI + 11.4907 A.

Based on this fit, the equations for the reasonable comparability benchmark are:

72.4893 + 0.0258656 D2 + 0.11665 U for unlimited usage allowance and

43.4532 + 0.0258656 D2 + 0.11665 U + Min[29.0361, 11.4907 LOGA] otherwise

where LOGA is Log10[usage allowance in GB].

The equations may also be used if a reasonable comparability benchmark is needed for lower download speeds greater than or equal to 4 Mbps.

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 2015 URS Broadband analysis.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Download Speed (Mbps) | Upload Speed (Mbps) | Usage Allowance (GB) | 2015 | 2016[[8]](#footnote-8) |
| 4 | 1 | 100 | $61.49 | $66.97 |
| 4 | 1 | Unlimited | $67.89 | $73.02 |
| 10 | 1 | 100 | $71.41 | $69.14 |
| 10 | 1 | 150 | $73.44 | $71.17 |
| 10 | 1 | 250 | $76.00 | $73.72 |
| 10 | 1 | Unlimited | $77.81 | $75.20 |
| 25 | 5 | 250 | $95.09 | $87.76 |
| 25 | 5 | Unlimited | $96.90 | $89.24 |

**Appendix: Rates Modified or Excluded for the Analysis**

Barry County Telephone Company provided one response. The response included rates for MEI.NET Business 1MB/256KB. This service was considered out of scope and was excluded from the analysis. The response also included MEI.NET 3 Meg Home BASIC and MEI.NET 6 Meg Home PLUS services; the provider’s contact subsequently indicated that these services do not exist, and so they were excluded from the analysis.

BelWave Communications, Inc. provided one response to the survey. The response provided rates only for Business Class Service. This response was considered outside the scope of the survey and was excluded from the analysis.

Blue Ridge Cable Technologies, Inc. provided one response to the survey. Comments in the response indicated that when multiple rates were provided, the low rate was for service in a bundle while the high rate was without a bundle. Consequently, only the unbundled rates were used in the analysis.

BounceLinx provided one response with five service levels. The provider’s website only listed four of these service levels as residential.[[9]](#footnote-9) The fifth service level (33/33/Unlimited with a $462 monthly charge) was not residential and was excluded from the analysis.

Comporium, Inc. provided one response to the survey. Comments in the response indicated that when multiple rates were provided, the low rate was for residential customers while the high rate was for business customers. Consequently, only the residential rates were used in the analysis.

Cyber Mesa Computer Systems Incorporated provide two responses. One response provides rates for Enterprise Internet service. This service appears to be a business service[[10]](#footnote-10) and was excluded from the analysis.

DigitalPath, Inc. provided one response. The response included rates for several services for business customers[[11]](#footnote-11) which were excluded from the analysis.

Fox Valley Internet provided two responses to the survey. In one response, multiple rates were provided for two service levels. The provider’s contact indicated that the high rate was for business customers. Consequently, only the low rates were used in the analysis.

Frontier Communications Corporation provided multiple responses with multiple rates. The low rate was for customers paying for service via automatic payment. Since such payments may not be available to all customers, only the high rate was used in the analysis. Also, in one census tract, Frontier provided two rate responses that were identical except for maximum activation cost; only the rate response which captured the minimum and maximum activation cost was retained for the analysis.

Hotwire Communications provided three responses to the survey. Hotwire provides service predominantly to multi-family buildings (apartments, condos, student housing, etc.) and does not provide service to individual residential customers. The Hotwire response was excluded from the analysis.

ImOn Communications, LLC provided one response to the survey. Two services, Internet Standard and Senior Internet Standard, have the same service levels but different rates. Because the Senior Internet Standard service appears to be for a limited set of customers, it was excluded from the analysis.

Intelliwave provided one response. The response consisted of one service level with multiple rates. The provider’s website[[12]](#footnote-12) indicates that the provider has multiple service levels each with a single monthly rate. As the provider did not revise the response, this questionable data was not included in the analysis.

Jackson Energy Authority provided one response with four service levels. All of the levels had a usage allowance of 0. In conversation, the provider’s contact indicated that these values should be “Unlimited”, not zero. Consequently, unlimited usage allowance was used for these service levels in the analysis. One rate for 75/25 service was part of a bundle; this rate was excluded from the analysis.

Service Electric Cable TV, Inc. provided two responses. The responses included rates for Commercial service for business customers.[[13]](#footnote-13) These rates were excluded from the analysis.

Smartcom Telephone, LLC provided one response with four service levels. In discussion with the provider’s contact, it was determined that the FTTH offering was marketed only to business customers; this service level was excluded from the analysis. The DS1 offering does have residential customers but is not actively marketed; it was excluded from the analysis. The DSL offering had multiple rates but the low rate ($29.95) is offered to residential customers. Therefore, the low rate was included in the analysis. Smartcom provided multiple rates for fixed wireless service. The fixed wireless offering has a maximum service level of 2/2/Unlimited at the maximum rate of $69.95; fixed wireless offerings below this service level were not included in the analysis.

Time Warner Cable provided multiple responses for EarthLink service, but these services are not actively marketed to new customers. Consequently, they were excluded from the analysis.

The Utah Telecommunication Open Infrastructure Agency provided one response to the survey. The response indicated that it is “a Governmental agency that provides wholesale transport to retail service providers. Prohibited by Utah state law from providing retail services.” No monthly rates were provided. The response was considered outside the scope of the analysis.

Verizon New England provided one response. The response indicated that the “FTTH 500/500” service used DSL technology; this was corrected to FTTH.

Virginia Broadband, LLC provided one response. The provider’s website[[14]](#footnote-14) indicates that it serves “rural areas and towns of Central and Eastern Virginia.” The Office of Rural Health Policy identifies the tract in the response as rural. Consequently, the response was identified as out of scope and excluded from the analysis.

WEHCO Video Inc. provided two responses, each with 3 rates for services named Cablelynx Business Standard, Cablelynx Business Enhanced, and Cablelynx Business Turbo. These services were considered outside the scope of the survey and their rates were excluded from the analysis.

1. *Connect America Fund*, Order, 28 FCC Rcd 4242 (2013). [↑](#footnote-ref-1)
2. The frame is the set of all sampling units from which we selected our sample. [↑](#footnote-ref-2)
3. Such a situation could arise when a provider uses different technologies to provide similar services to customers in different parts of a census tract. [↑](#footnote-ref-3)
4. UI = 1 if usage allowance greater than or equal to 350 GB and 0 otherwise. [↑](#footnote-ref-4)
5. A = 0 if usage allowance is greater than or equal to 350 GB and Log10 (usage allowance in GB) otherwise. [↑](#footnote-ref-5)
6. RWMSR is the square root of the weighted average of the square of residuals (observed rate minus average rate as defined by the Average Monthly Rate equation) plus the square of the spreads divided by 12. [↑](#footnote-ref-6)
7. In a bubble chart, the size of the bubble is related to the weight of the observation. In this case, the weight is the sum of the weights for the rates with that download speed. [↑](#footnote-ref-7)
8. The 2016 comparability benchmarks in bold and italics are significantly different from the 2015 benchmarks at the 0.05 level of significance. [↑](#footnote-ref-8)
9. <http://www.bouncelinx.com/#!plans/cwld> [↑](#footnote-ref-9)
10. *See* <https://www.cybermesa.com/Business.htm>. [↑](#footnote-ref-10)
11. *See* <http://digitalpath.net/business/business_internet.html>. [↑](#footnote-ref-11)
12. <http://www.intelliwave.com/?page_id=97>. [↑](#footnote-ref-12)
13. <http://www.sectv.com/Web/aspInternetBusiness.aspx?strSystem=LV>. [↑](#footnote-ref-13)
14. [www.vabb.com](http://www.vabb.com) [↑](#footnote-ref-14)