

North Carolina Data Submission Fall 2013

Data Collection Methodology

NC Broadband, a Division of the North Carolina Department of Commerce

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Table of Contents

Executive Summary.....	4
North Carolina's SBDD Grant	4
North Carolina Department of Commerce	4
The Center for Geographic Information Science at UNC-Greensboro	4
Fall 2013 Broadband Data Collection and Mapping Process	5
Data Collection.....	5
Integration of Provider Data into NTIA Statewide Geodatabase.....	6
BB Service by Census Block	6
BB Service Road Segment	6
BB Service Address.....	6
BB Service Wireless.....	6
BB Service Overview	7
BB Service - Critical Anchor Institutions.....	7
Census Block data (tabular)	7
Street Data	7
Creating last mile and middle mile features	10
Provider-specific notes, functions and corrections performed by NC Broadband as needed	10
Post-processing Functions for Final Integration	23
Census Block	23
Road Segment Data	24
Address Data	24
Wireless.....	24
Overview	24
Last Mile.....	24
Middle Mile	25
Community Anchor Institutions (CAI)	25
Verification Implemented Prior to Fall Data Submission.....	25
Standardizing	25
Lat/long coordinates	25

Multiple FRNs..... 25

Correct technology type codes 26

Subscriber-weighted nominal speeds..... 26

Wireless model fieldwork 26

Check Geometry 26

Comparisons with Citizen-Sourced Data..... 26

Executive Summary

North Carolina's SBDD Grant

The North Carolina Department of Commerce is the designated Eligible Entity in North Carolina to receive funding under the State Broadband Data and Development (SBDD) grant program of the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce. North Carolina was awarded \$6,610,996 in federal funding under this program through Award #37-50-M09002. This grant runs from October 1, 2009 – October 1, 2014.

North Carolina Department of Commerce

NC Broadband, a division of the North Carolina Department of Commerce, is responsible for implementation of the work under the SBDD grant. In this capacity, NC Broadband serves as the State Broadband Initiative for North Carolina. Work under the SBDD grant is being conducted by staff members of NC Broadband as well as the relevant contractors under the grant.

NC Broadband is responsible for implementation of the following programs as part of this grant:

- State Capacity Building
- Data Collection and Mapping of broadband availability
- Technical Assistance to communities
- Implementation of the LITE-UP Pilot Program
- Update of the NC Master Address File

The Department of Commerce is the state's leading economic-development agency, working with local, regional, national and international companies. The Department's mission is to improve the economic well-being and quality of life for all North Carolinians. The mission is carried out by serving existing business and industry, including providing international trade assistance; recruiting new jobs and domestic and foreign investment; encouraging entrepreneurship and innovation; marketing North Carolina and its brand; supporting workforce development; strengthening communities; and promoting tourism, film and sports development. The Department also provides data, statistics, information and reports for state government and agencies, which regulate commerce in the state. As such, the Department of Commerce is a natural fit to house the State Broadband Initiative for North Carolina, with broadband infrastructure being key to reaching North Carolina's business and workforce goals, and with broadband infrastructure being a critical component to allow all NC businesses and communities to participate in the global economy.

The Center for Geographic Information Science at UNC-Greensboro

The Center for Geographic Information Science (CGISc) at the University of North Carolina Greensboro (UNCG) is an educational research entity that relies on theories, concepts, and applications to solve, analyze, and model the geographic aspects of human and natural phenomena. CGISc collaborates and partners with government agencies, non-profit organizations and private corporations. Research

activities are supported by faculty, staff, students, and partners from various specialized fields such as geographic information systems, remote sensing and image processing, cartography, engineering, and mathematics.

As a contractor under this grant, CGISc assists the data administrator and GIS specialist of DOC's NC Broadband division in the processing of incoming datasets, cartography using the collected and mapped information, and analysis of spatial data for strategic planning. The center also conducts predictive modeling for fixed wireless providers of broadband service based on equipment configurations and field-calibrated ground conditions such as terrain, tree canopy, and the built environment.

Fall 2013 Broadband Data Collection and Mapping Process

Data Collection

The official data request letter from the NC Department of Commerce was sent hardcopy in the mail to all identified providers of broadband service on July 11. An email version was distributed as well, on July 19. Providers were given a link to the relevant Webpage which houses: Data Instructions, the Excel Data Template, the NC Department of Commerce Designation Letter, the Guidance Letter from NTIA from June 2011, and a file to download the 2010 Census Block GIS layer from NC OneMap. Providers were also reminded that they may choose to submit availability data by census block and street segment, considered public data under the grant program, or address-level data, and were asked to contact DOC with questions about confidentiality of data. Providers were asked to reply to the data request on or before Friday, August 2, 2013.

As mentioned above, Excel and geodatabase templates were shared with providers, along with PDF format instructions summarizing all NTIA requirements and information relevant to each type of provider (fixed wireless, mobile wireless, and wireline). Technical assistance was provided to any organization who requested it, and some outreach to providers was conducted for increased participation and data improvement purposes.

A secure server hosted by MCNC is configured with an open source, browser-based direct file upload system called eGroupware. Providers were sent a log-in name and password for this upload system once they contacted either Angie Bailey or Stephanie Jane Edwards to communicate that their data was ready for submission. A confirmation e-mail went to Stephanie Jane once data had been uploaded.

Individual reminder e-mails were sent, or phone calls made, to targeted providers. NC Broadband did use some previously-submitted datasets for providers that were unresponsive, or who asked that previous data be used for this round. The number of known broadband service providers operating in North Carolina is currently at 111, with several name changes, several providers being removed, and others being identified and added.

Out of these 111 known providers, 80 now have broadband data in this statewide geodatabase. Several additional providers are in communications with NC Broadband, in an effort to produce usable data for upcoming data collections. Since the last data collection, the following providers have been added to the list of identified broadband providers operating in North Carolina: Cashiers Valley Computers, Chatham Wireless, RidgeComms, Sky-Tek Communications, U.S. Cellular, and VistaNet. Providers that have data included in North Carolina's statewide data package for the first time this round are Blue Ridge

Mountain Electric Membership Co-op, Cashiers Valley Computers, Chatham Wireless, RidgeComms, Vistanet Telecommunications, and Zito Media.

Integration of Provider Data into NTIA Statewide Geodatabase

For ease of data integration, a front-end Excel format template was offered to all providers, containing notes defining required fields, explanations of which data is required in which formats by which types of providers, and hyperlinks connecting fields to additional tables listing the corresponding NTIA-specified values and codes (for speed tiers, technology types, connection point facility types and capacities, county codes, end user types). A brief description of how census block FIPS codes work was also taken from an internet source and distributed as needed to providers who had questions about how to report this information.

BB Service by Census Block

As requested by the NTIA mapping and planning team, all census block data is included with 2010 census block geometry. Technical assistance was often needed by providers to correctly report served areas by either the 15-digit FIPS codes or in some way by which NC Broadband staff could derive the appropriate FIPS codes.

BB Service Road Segment

The reporting and mapping of data by street segment presented significant challenges to accurate interpretation of where broadband availability is and is not. This is mainly attributed to the difficulty of standardization among the many data structures by which providers report street segments. Quality of data has improved since some providers have switched to submitting data in shapefile format, and others have been able to start including a Tigerline ID (TLID) field for reference in mapping tabular information. Use of this unique identifier has reduced ambiguity in some tabular datasets and improved data quality upon mapping.

BB Service Address

A few address-level datasets were submitted to NC Broadband with the latitude/longitude coordinates already determined in a spatial format, but most needed to be geocoded. This was done using the NC Master Address file as the primary reference file, significantly increasing the accuracy of matching records. Secondary sources for address records that did not find a match this way included street segment interpolation, ESRI data utilizing the 4-digit ZIP extension, and manual placement/digitizing based on a combination of reference data and online browser maps. Upon completion of geocoding for each provider submitting address data, the address point features were overlain with a 2010 census block layer to add the census block FIPS code attribute, then all address feature points were loaded into the geodatabase feature class. The geocoded shapefiles for each provider are kept with geocode match score and match reference type for every matched address, so the thoroughness of this data type could be tracked and/or improved with more time.

BB Service Wireless

Approximately ten small, fixed wireless providers have been able to share technical information about their transmitting towers, antennae, and frequencies, so that NC Broadband can produce for them a service coverage shapefile using the contracted services of the University of NC at Greensboro Center for Geographical Information Science (<http://cgis.uncg.edu>). An Excel template was developed with all the relevant information that can be filled in by providers with technical assistance in some cases, and the propagation model is field-calibrated to reflect actual ground conditions. NC Broadband has very

recently begun to work with TowerCoverage.com, in order to obtain wireless footprints from some fixed wireless providers in the state that subscribe to the towercoverage.com service and who do not participate in the broadband mapping efforts by any other means. Any additional wireless footprints collected through this collaboration will be included in the Spring 2014 data package.

BB Service Overview

Records for overview containing subscriber-weighted nominal speeds of a given provider were generally joined to a template layer of county features, using the option to keep matching records only. Then these matching features and their new attributes were exported as a new shapefile before being loaded into the collective overview feature class. For providers with multiple technology types serving a given county in at least one instance, this information was single-field geocoded using the 5-digit county FIPS code, and then geocoded point features were spatially joined to the county polygon using “within” criteria.

Some detail formatting performed as needed:

- Add state FIPS code and any needed leading zeros onto county code for the new State+County FIPS code. Most providers list just the county code because this was the original NOFA request.
- Change state abbreviation values from “37” to “NC”.
- Change weighted speeds to appropriate units (kbps) and remove unit text.
- Translate to county from weighted speeds reported by RSA/MSA.

BB Service - Critical Anchor Institutions

Only anchor Institutions that could be geolocated were included. Only 17 CAIs were identified that could not be geocoded to a point feature. CAIs were collected by contacting administrative offices of some CAI category types and receiving databases of information, as well as collecting from individual CAI locations for other types using survey emails and follow up phone calls as necessary. There are 6,844 CAI’s identified, located, and included in the geodatabase to date. In this current data collection round, most CAI’s are included as previously reported, with only a few additions in the library category as an update.

Census Block data (tabular)

- Fields standardized and transferred into Excel template
- Geocoded to centroids of census blocks using 2010 Census Block layer in WGS1984 projection as reference file for “Address Locator”.
- Spatial join of geocoded census block data points to polygon features

Street Data

Some datasets were submitted to NC Broadband by providers already in shapefile format, and others were reported in various tabular formats (text, Excel, CSV, etc.). Of the tabular datasets, some included a Tigerline ID (“TLID”) field along with some or all other fields such as city, state, zip, and census block FIPS.

- For datasets submitted tabular with TLID:

- Max and Min address ranges were calculated from the FromRight, ToRight, FromLeft, ToLeft format used by most standard street segment reference files and incoming datasets
- All data formatted into back-end Excel format, including converted speeds if reported at some other granularity.
- Table geocoded to Tigerline 2010 street segment file using single-field and “TLID” values, with zero offset.
- Geocoded point features converted to street segment geometry via spatial join using “contains” criteria, keeping matched records only.
- For datasets submitted tabular without TLID:
 - Max and Min address ranges were calculated from the FromRight, ToRight, FromLeft, ToLeft format used by most standard street segment reference files and incoming datasets
 - All data formatted into back-end Excel format, including converted speeds if reported at some other granularity.
 - Table geocoded to Tigerline 2010 street segment file using hypothetical addresses created at intervals by a Python script and either ZIP5 or census block FIPS (whichever available) as address locator zone.
 - Geocoded point features converted to street segment geometry via spatial join using “contains” criteria, keeping matched records only.
- For datasets submitted as shapefiles: Checked for duplicates using frequency tool, duplicates removed in one of various ways as deemed appropriate, and geometry checked and repaired if needed. VB If/Then statements used to calculate “Max” and “Min” address range attributes required by the NTIA/FCC, converted from the FromRight, ToRight, FromLeft, ToLeft format used by most standard street segment reference files and incoming datasets:
 - **To calculate “Min”:**

```

Dim fromRight
Dim toRight
Dim fromLeft
Dim toLeft

fromRight = [FROMRIGHT]
toRight = [TORIGHT]
fromLeft = [FROMLEFT]
toLeft = [TOLEFT]

Dim minright
If fromRight = 0 And toRight = 0 Then
  minright = 0
ElseIf fromRight = 0 Then
  minright = toRight
ElseIf toRight = 0 Then
  minright = fromRight
Else

```



```

If fromRight < toRight Then
    minright = fromRight
Else
    minright = toRight
End If
End If

```

```

Dim minleft
If fromLeft = 0 And toLeft = 0 Then
    minleft = 0
ElseIf fromLeft = 0 Then
    minleft = toLeft
ElseIf toLeft = 0 Then
    minleft = fromLeft
Else
    If fromLeft < toLeft Then
        minleft = fromLeft
    Else
        minleft = toLeft
    End If
End If

```

○ **To calculate “Max”:**

```

Dim fromRight
Dim toRight
Dim fromLeft
Dim toLeft

```

```

fromRight = [FROMRIGHT]
toRight = [TORIGHT]
fromLeft = [FROMLEFT]
toLeft = [TOLEFT]

```

```

Dim maxright
If fromRight > toRight Then
    maxright = fromRight
Else
    maxright = toRight
End If

```

```

Dim maxleft
If fromLeft > toLeft Then
    maxleft = fromLeft
Else
    maxleft = toLeft
End If

```

```

Dim max
If maxleft > maxright Then
    max = CStr(maxleft)
Else
    max = CStr(maxright)
End If

```

Creating last mile and middle mile features

- Formatted numeric fields in Excel as text since the short integer format in the data model for these fields will not accept values from the Excel import's default general format.
- ArcToolbox > Data Management Tools > Layers and Table Views > Create XY Event Layer
- Zoom to Layer, verifying that all points are located inside NC boundaries

Provider-specific notes, functions and corrections performed by NC Broadband as needed

Access/On Multimedia Inc. F13

- This is a middle mile only provider
- Provider confirmed no changes since last round so previous data was used

Cape Lookout Internet Services F13

- Duplicated Centurylink footprint (CB and street), to represent their reseller status.

AT&T F13

- Converted subscriber weighted nom speed data from CBSA to county. Selected counties from mapped subscriber weighted nominal speed data that actually contain broadband availability data by census block or street segment. Exported selection as Overview file.
- There were some instances where some CBs reported as served in a county were in a non-reported CBSA. In each instance, the CBs lay just outside the edge of a reported CBSA, so the reported CBSA numbers were attributed.
- Calculated conversion of Left and Right To/From addresses for street segment data to NTIA's required Max/Min values (using "min" and "max" formulas in Excel)
- Checked data by CB for duplicates, none found.
- Mapped street segment data to 2010 census tigerline street centerlines using 2010 TLID field.
- Removed 29 duplicates from street data
- Verified FRN's 0004979233 for AT&T Mobility, 0004496774 for AT&T Corp middle mile, and 0001857952 for BellSouth Telecommunications DBA AT&T North Carolina.

ATMC F13

- Merged shapefiles of address level data from two counties served, renaming and consolidating attribute fields.
- Added Address field populated with a concatenation formula of component address information. Note: concatenated differently based on source data, since attributes structured differently for each. Postal field used for City in Brunswick County.
- Checked for duplicates in address data (address and transtech fields), 9 duplicates removed.
- Added EndUserCat field and populated with code 5

- Overlay of address points w/CB layer to get FIPS code field
- Manually nudged 7 address points (in Calabash, NC) on the SC border into the tigerline state boundary.
- Applied spectrum value from previous submission to wireless footprint
- Created new fields and used Calculate Geometry function in ArcMap to generate Lat and Long attributes
- Confirmed FRN's 0004383485 for wireless and 0004061586 for wireline in FCC FRN Search System.

ATMC Wireless F13

- Clipped shapefile to Tiger 2010 state boundary
- Eliminated polygon parts less than 0.125 square miles
- Ran simplify polygon to remove extraneous points, set to 20 feet max offset.
- Added spectrum attribute

BalsamWest F13

- Added FRN from FCC search tool online

BRMEMC (Blue Ridge Mountain Electric Membership Corporation) F13

- Worked with provider who sent FTTL service area polygon, clipped out 2012 Tigerline street segments inside this polygon and applied broadband characteristics described by the provider.
- Added FRN from search engine results and verification using the FCC FRN system.

CenturyLink F13

- Reprojected CB and street shapefiles and changed format of some fields for loading (created new fields of compatible type for TransTech, EndUserCat, and Provider_Type fields)
- Used If/Then scripts to calculate min and max address fields from left and right max/min ranges in ArcMap field calculator
- Removed 9,307 duplicate street segments (using delete duplicates function on records with the same shape and speed values, then confirming with frequency tool), and 1,170 duplicate census blocks
- Made correction removing census blocks 370370206001031 and 370370206001018 (and reported street segments inside), from service area, per 9/16/2013 email from Gerry Flurer at CenturyLink.
- Verified FRN 0017179383 in FCC's online search system.

Charter F13

- Added Provider Type of 1 and EndUserCat field with value 5 for "Other/Unknown"
- Streets submitted and mapped in 2010 Tigerline, with no address range information. No unique identifier in common with reference Tigerline file, so no resulting address range info.
- Checked for duplicates in CB shapefile using Delete Identical, none found. Removed 86 duplicates from street shapefile.
- exclusion of a small area of street segments and census blocks along the southern border of Cleveland County which was determined by the provider contact to be bleedover from availability data in SC.
- Ran repair geometry on census blocks and street segments. No errors found.

Chatham Wireless F13

- Recreated tower locations by zooming in on PDF map in Chatham County proposal/report showing Chatham wireless existing service area with street network for reference.
- Based on report information, buffered tower location point features by 4 miles and merged all boundaries.
- Duplicated footprint to create a separate record for each spectrum range used according to the proposed report.
- Populated attributes based on information in proposal/report and provider website.
- Ran repair geometry tool to ensure no errors in footprint shape.

Clearwire F13

- Copied shapefile, and then merged all gridded shapes into one footprint.
- Removed polygon islands and donuts smaller than 0.125 square mile
- Simplified polygon to remove extra vertices, with a max allowable offset of 150 feet.
- Clipped footprint to Tigerline 2010 North Carolina state boundary
- Joined broadband attributes from previous round, then added EndUserCat field with a value of 5
- Confirmed FRN 0017775628 in FCC Search System

Comcast F13

Used data submitted in the spring, with the exception of manually removing two census blocks from the service area, per Comcast:

- Mapped CB's submitted this round
- Calculated min/max address ranges for street segment data in Excel
- Manually cleaned up street data text.
- Geocoded hypothetical midpoint of tabular street segments by address range, using composite street geolocator with zero offset.
- Spatially joined the above geocoding results to TIGER 2010 street segment features (using Intersect criteria with search range of 5 feet). Ran Delete Identical tool on the resulting street segments based on unique shape, TLID, and TransTech.
- Mapped Overview data as submitted in Fall 2010
- Clipped all mapped data to Caswell county, as directed by Comcast point of contact
- Created ArcGIS Explorer map for provider to review and feedback on data quality issues

Cricket F13

- put the shp in the appropriate format and dissolved correctly.
- add the padded zero's to the FRN so that there are 10 digits.
- Confirmed FRN 0002963528 in FCC FRN Search System
- Missing typical speeds, copied from advertised.
- reduced the number of vertices to a reasonable number (was under limit, but still excessive at 100k +)
- removed polygon islands and donuts smaller than 0.125 square mile
- Added EndUserCat field and populated with a value of 5

Country Cablevision and Carolina Mountain Cablevision F13

Mapped Spring 2013 data, which was processed in the following way:

- Formatted fields of new address data
- Removed 178 duplicates from Carolina Mountain Cable, 299 from Country Cable, existing due to exclusion of unit/apt numbers
- Geocoded addresses and designated those in Haywood County as those served by Carolina Mountain Cablevision
- Created overview table based on information sent from provider in a follow up email.

DNet

- Wireless propagation modeling, with new parameters based on followup with the provider, to more closely reflect the signal conditions and operating practices in the field. Included 14 dbi receiver gain at 20' above grade level for this, per provider input.
- Changed TRANSTECH for 3 GHz to 71, and SPECTRUM to 8 (By definition, 3GHz is licensed)
- Verified FRN 0006287379 in the FCC's online search system.

Electronics Service Co of Hamlet

- Customized propagation model for unique antenna setup high up in trees
- Clipped output to state boundary
- Populated last mile Ownership field with '0' for owned, but still need confirmation from provider

Electronic Solutions

- No changes since spring to wireless footprint. Data carried over with the addition of code 5 for end user category
- Clipped wireless footprint to Census Bureau's Tigerline state boundary
- Last mile end user totals updated. Coordinates of one last mile connection point corrected.
- FRN 0018446666 confirmed in FCC registration system

Ellerbe Telephone Company F13

- Mapped Spring 2013 data after confirmation of no changes: 3 FIPS codes were unrecognized, 371239605003094, 371239605003068, 37153970200314
- 2 duplicates were removed
- 25 of the CBs should have been reported at the street level
- Overview – Montgomery County missing; does not cover all the census blocks that were provided (also had this problem in last submission)

Frontier F13

- Mapped (created XY event layer then export to shapefile) additions to DSLAMS since fall as last mile connection points. Loaded into geodatabase in addition to previously reported last mile points.
- Applied a 15,000 foot service circle to last mile points for availability (no dissolve), then a 8700 foot and 6000 radius to a subset of points as per the provider
- Applied speed codes reported by provider to be the max available within each radius.
- Created subset of 2010 road segments that intersect each set of radius buffers, via spatial join using intersect criteria. Merge rule set to max for all four speed fields in order to capture the appropriate radius that applies to any given street segment.

- Added fields for EndUserCat and ProviderType, populated all records with 5 and 1, respectively.
- Verified FRN 0018802660 using the FCC's online search system
- Populated ownership field for Last mile as zero for owned

Greenlight

- Reprojected shapefiles as submitted. Carried broadband characteristic attributes from previous round over to new address feature class, per the provider. Also, some addresses had disappeared from availability since last submission. Provider confirmed that this was correct, due to changes to some hub boundaries for feeder cable.
- Removed extra spaces and concatenated full contents for Address field.
- Recalculated lat/long attributes to capture 6 decimal places, revealing the variation in geometry of point features
- Applied new overview value from submitted spreadsheet.
- Confirmed FRN 0015950934 in FCC registration system.

HughesNet

- Joined list of ZIP codes for North Carolina to 2010 ZIP code boundaries.
- Merged ZIP code boundaries into single feature
- Repaired geometry on merged polygon
- Joined attributes from Spring 2013 HughesNet data, and checked each field to ensure all values represent the broadband characteristics reported by the provider this fall
- Found FRN [0017434911](#) using the FCC's online system search. Applied FRN to HughesNet data.

Interstar F13

Mapped Spring 2013 data, which was processed in the following way:

- Saw that previous service area polygons still represent the best approximation of coverage over this new set of addresses plus previously submitted addresses, so transferred previous polygon created in the following way:
 - identified clusters of these address points, then used subsets of the point locations to derive Minimum Bounding Polygons (Convex Hulls) representing available wireless coverage.
- One-to-one spatial join associating provider attributes and speeds with minimum bounding polygons.
- Added spectrum field and populated with code 6.

Inteliport F13

Mapped Spring 2012 data which was mapped in the following way:

- Provider is working on but has not yet been able to compile equipment specs that would allow us to run a propagation model, so in the meantime, polygons were created from census block locations.
- Follow up from provider in March 2012 clarified the max advertised speed values, based on service tiers and throttling used to keep streaming media from overloading the bandwidth when many users are subscribing to a given microcell. These were reduced from the maximum bandwidth capacity values included previously.
- Census block shapes used in the wireless feature class were merged into a single, multipart polygon based on their identical attributes.

Level 3 Communications

- Used script to sort newly submitted addresses from those previously submitted, using newly submitted attributes in both cases
- Applied value of 0 for Owned in ownership field of middle mile data, since this is a middle mile provider and it is very likely that they own all the middle mile facilities
- Verified FRN 0003723822 in the FCC's online search system.

MAIN F13

- Submitted no changes since last round, so previous data was used except for:
- Added EndUserCat field with code 5
- Verified FRN 0008338493 in FCC FRN search system.
- Made correction to ownership field in last mile from previous round, as all but one of these structures are leased.

MCNC F13

- Used new output data sets from MCNC for Address and MidMile data
- Added the negative sign in the longitude field for 2 records in the address feature class
- One address record had numbers in the lat/long fields that were out of range for NC. Looked up the rooftop coordinates of the address using Google Geocoding API and populated with those coordinates.
- Verified FRN 0001844554 in the FCC's online search system.
-

MediacomF13

Spring 2013 mapped, to which the following notes apply:

- Freshly geocoded entire address data set, transferred new transtech codes and speeds.
- Coded for EndUserCat based on a text field in data from provider

Megapath F13

- Populated with EndUserCat code 2 for Non-Residential, per the NTIA program office.
- Checked CB spreadsheet for duplicates, none found
- Duplicated provider name in DBA Name field for all data pieces
- Mapped street segments using a python script that plots a point at regular intervals between the min and max address ranges submitted and then joins to the 2010 tigerline street segment associated with those ranges and attributes.
- Verified FRN 0003753787 in FCC FRN online search system.

MI-Connection F13

- Ran address sorting script to transfer over previously geocoded addresses with updated attributes and generate table with additional addresses to be geocoded this round. (32,281 out of 38,524 found a match).
- Those not matched were geocoded, merged with those that did, and duplicates were removed.
- Typical speeds were adjusted based on phone call with contact at MI Connection in spring 2013
- Removed 7 duplicate records from address data

Morris F13

- Script used to check for new address records, only about 10 additions found. These were geocoded and added to those carefully cleaned up in the previous round.
- Address data checked for duplicates, none found.
- Verified FRN 0018570887 in FCC FRN search system online.
- Last mile elevation values reported as height above sea level rather than above grade level, replaced with -9999
- Edited typical speeds to match max advertised speed codes, per follow up with the provider.

Changed 226 records with max download speed code 7 from transtech code 40 to 41, based on follow up with the provider.

NC Wireless F13

- Wireless - replicated their 900 MHz coverage kml file, used the maximum speed attributes of the 900 MHz transmitters in the area; calculated LOS coverage for the higher frequencies, using a more specific speed breakdown for these higher unlicensed Verified FRN 0014898977 in online FCC FRN search system.

North State F13

- Corrections for missing FIPS digit and inserted leading zeros for tracts.
- Speeds were reported as Typical Up/Down only. Substituted these values into Max Ad Up/Down as well.
- Ran script to update existing and geocode new address records reporting broadband coverage.
- Middle Mile, Last Mile: Added negative sign to longitude values
- Identified some areas in address data where some new developments are serviceable but the individual locations to not have assigned addresses yet. Instead of deleting these as duplicates, a hyphenated temporary building number was manually assigned to these addresses to represent and distinguish these accurate locations (done in cases where 10 or more records were involved)
- Changed EndUserCat values of 3 and 4 to 2.
- 398 duplicates were removed
- Verified FRN in the FCC's online search system

Northland Cable F13

- Added EndUserCat field populated with code 5
- Confirmed with provider that 236 addresses dropped from coverage area since last round should in fact be excluded as they are not served at this time.
- Found and removed 166 duplicates in address records
- Verified FRN 0001568971 for Northland Cable Properties and 0001579747 for Northland Cable Television in FCC FRN search system.
- Corrected FRN in address records to match corresponding parent company name
- Last mile: replaced raw elevation values with -9999 placeholder value

Randolph TMC F13

- Formatted text information and consolidated into one Excel file
- Streets method:

- Used a python script to create addresses at intervals of 95 between the min and max along streets reported by Randolph, and linked via spatial join to Census 2012 tigerline street polylines.
- Removed duplicate points where the transtech and TLID were identical (speed was not an issue, as each transtech had the same speed codes respectively)
- Verified FRN 0001951284 in online FCC FRN system search tool.

RidgeComms

- Obtained KML and PNG files from towercoverage.com
- Could not successfully import KML using the data conversion tool in ArcToolbox, so manually rubbersheeted the PNG footprint using towercoverage webmap interface as reference.
- Vectorized the resulting coverage representation. Deleted background shapes by value field. Merged feature parts into a single footprint.
- Duplicated the footprint to create a separate layer for each spectrum range reported by the provider.
- Populated broadband attributes according to information provided in CSV files via towercoverage.com
- Ran repair geometry tool to ensure no spatial errors in coverage footprint shapes.

RST Global Communications

- Geocoded address-level data for service area
- Edited typical speeds to match max advertised speeds, after follow up with the provider to determine that this reflects actual capacity at peak hours versus current subscription trends.
- Carried forward addresses reported previously that were not in the new submission, based on follow up with provider (these records were appended to the fall 2013 address shapefile). Updated provider info for these records.
- Modified provider name in middle mile feature data to match syntax in accompanying feature classes. Excluded one middle mile point that is located in South Carolina.
- FRN confirmed in FCC registration system
- Changed EndUserCat values of 3 or 4 to values of 2 for non-residential in the current data transfer model.

Sprint F13

- Confirmed that middle mile connection point information matches previously submitted, and moved that data over to new transfer geodatabase.
- Confirmed with provider the changes in data since last round
- Simplified polygons with point removal at a max offset of 150 feet.
- Eliminated polygon parts less than 0.125 square miles
- Ran repair geometry to ensure no topological errors, none found.
- Confirmed FRN 0003774593 in FCC FRN Search System.

Star Telephone Membership Corporation F13

- Identified a formatting issue with zeroes in the tract number section and corrected this. Identified a remaining 78 census block records that did not find a match, and were found to be vintage 2000 census block FIPS codes. Converted these records to year 2010 geometry, and combined with blocks reported as 2010 geometry, then removed some resulting duplicates.

- Used field calculator to make the contents of Provider Name and DBAName fields consistent and spelled out in every feature class rather than sometimes abbreviating Corporation to Corp.
- Corrected FRN to have sufficient number of digits/leading zeroes.
- Added lat/long coordinates to middle mile point reported, based on communication that Star TMC, Starvision, and Interstar all share this connection point.

Starvision F13

- This provider sends census block data in addition to address-level data, but the census block records are just duplicates of the address data and only the address records are used for better granularity.
- Parsed street information in address data
- Address records came with lat/long coordinates. Six needed manual adjustments or were missing coordinates (identified in output file).
- This provider only has records for active customer locations, so previously reported addresses from spring 2013 that were not already included in the newer data were carried forward.
- Verified FRN 0018515676 in the FCC's online search system.

Skybest and Skyline F13

- Created missing .prj file for shapefile exports from provider, based on follow up determining an NAD 83 North Carolina FIPS 3200 ft projection.
- Converted polylines to polygon for each DSL and fiber-to-the-home technology layers.
- Created fields and attributed manually from contents of provider-supplied .mdb files.
- Spatial join with Tigerline 2010 streets WGS84 by location inside newly created polygons (using streets was found to be more accurate, with less overstatement, than an overlay with census blocks).
- Manual touch up, deletion of streets that only touch the boundary of served polygons.
- Used VB script in Field Calculator to derive max/min address range information
- Excluded 1 midmile point and 2 last mile points from skyline that located outside the state boundary.
- Verified FRN 0001952555 for Skyline and 0004274890 for Skybest

SkyeNet Wireless Communications F13

- Provider does not participate in data collection. Information was gleaned from the provider's website in previous data collections, by selecting and merging the relevant census blocks corresponding to served areas indicated on the provider's online map. This footprint was checked for currency using the company website on 8/1/2013.
- Unlicensed spectrum is assumed and no match could be found on the FCC FRN system.
- Maximum speeds were obtained from the FAQ page of the same website. Typical speeds were inferred by information also on the FAQ page, with speed codes most closely matching the ranges described. Speeds were updated after checking the website again on 8/1/2013.

Skyrunner F13

Fall 2012 data was used, which was processed in this way:

- Corrected footprint using most current wireless equipment specs and -80 dbm (previous signal threshold change had been done on older data by mistake).
- Added Sky Catcher data to the footprint to reflect the recent acquisition of their network.

- Last Mile: assumed Ownership by Skyrunner in the Ownership field, wireless type for backhaul, and capacity codes equivalent to max advertised speed of the surrounding wireless footprint.

Star TMC F13

- Corrected zero misplacement in tract numbers and 15-digit CB FIPS codes (double zeros should be at the end, rather than beginning of tract numbers)
- SomeCB's found to be reported in year 2000 vintage. Converted those to year 2010 using methods similar to those described in Fall 2011:
 - Select all records in Spring 2011 provider dataset
 - Relate FIPS 2000 field in provider data to FIPS 2000 field in statewide crosswalk table
 - Relate FIPS 2010 field in statewide crosswalk table to GEOID field in 2010 census block layer.
 - Export related/selected 2010 CB records as new layer, and related/selected crosswalk records as a provider-specific dBase table.
 - Join Field on exported Crosswalk subset with Spring 2011 provider data layer based on year 2000 CB number.
 - Join Field on new 2010 CB layer with the joined crosswalk DBF (which should now have the relevant provider data) based on 2010 FIPS field.

Suddenlink F13

- Removed records without speed codes, as per the provider these indicate blocks and street segments without Suddenlink broadband service.
- Checked census block data for duplicates, none found
- 432 duplicates removed from address data.
- Added provider type code 1 to all records. Added EndUserCat code 5 to census block data
- HOUSE_NBR was the unique ID in the past. Used it for table joins to the S13 data.
- Started with the S13 dataset as a foundation. For all addresses that joined to S13, used the S13 location, but updated the BB attributes (if there were changes) - 4,481 addresses matched. For all F13 addresses that did NOT join to S13, geocoded and added to the S13 dataset - 1,102 new addresses. Addresses that existed in S13 data, but not in F13, were not deleted - 27 in S13 but not in F13.
- 99.6% of addresses have coordinates
- Confirmed with provider that all of the network is DOCSIS 3.0 capacity, but that they have not yet increased their advertised speeds, they have determined that their market does not currently support it
- Verified FRN 0014848808 in FCC FRN search system online.

Surry TMC and Piedmont Communications F13

- Added zeroes to FRN for 10-digit format.
- Checked CB data for duplicates, none found
- Used script to create hypothetical incrementally within the address ranges supplied in Excel format).
- Spatially joined the geocoded points to polyline street segments, then dissolve to remove duplicates). Used max of speeds as statistics fields.
- Used Tigerline address ranges for the min and max address ranges in street attribution. Used parsed street name attribution from Surry/Piedmont data.

- Removed seven CBs where streets were given (they were double reported)

TDS Telecom F13

- Data submitted as geodatabase feature classes, availability at address level. Addresses and mid-mile points spatially joined with 2010 census blocks to derive complete/correct FIPS codes.
- Removed 14 duplicates in address data (based on address and provider name fields).
- Duplicated max advertised speed codes in typical speed fields
-
- Confirmed FRN's 0003767662 for Saluda Mountain, 0003767712 for Service, and 0003766714 for Barnardsville in the FCC FRN Search System.

Time Warner Cable F13

- Changed DBA Name to proper case to match ProvName field and other datasets
- CB and Streets:
 - Reprojected into WGS 1984
 - Added Provider Type field and coded as a "1"
 - Added EndUserCat field and coded as "5" Input Max Advertised speeds as Typical Speeds as well, since they were not included.
- Streets: no min or max address ranges of any kind were included in the data, so a spatial join with Tiger 2012 street centerlines was done to attach address ranges based on "center contained in" criteria. Used script to calculate absolute min and max address values.
- 3161 duplicates removed from street centerlines (based on identical shape and address range attributes)
- Checked census block layer for duplicates, none found.
- Ran geometry repair on census blocks and street segments (no errors found)
- Mapped middle mile data, which contained nationwide connection facilities TWC chose to include as middle mile, and none of these fall within North Carolina's boundaries, so none was added to the transfer geodatabase.
- Confirmed FRN 0007556251 in FCC Search System.

T-Mobile F13

- Reprojected shapefiles into WGS 1984.
- Added Notes field to categorize by technology type/T-mobile service tier (LTE, U1900, HSPA21, HSPA42, UTM5).
- Attributed manually from information sent in a text file from T-Mobile.
- Eliminate Polygon part tool to remove features <0.125 square mile.
- Added spectrum info based on follow up with provider, duplicated footprints that utilize more than one category of spectrum.
- Verified FRN 0006945950 in FCC FRN search system
- Ran repair geometry to check for any errors in topology, none found
- Edited LTE speed, reducing max advertised download speed from code 8 to code 7, per email on 9/17/2013 from National Broadband Map program office.

Tri-County F13

- *Separated addresses reported by technology type*
- Addresses for availability were geocoded where coordinates were missing
- Addresses for availability that had coordinates were corrected (Lat and Long field was reported backwards), then digitized
- Outlying addresses were checked for correctness. Outliers were in locations a significant distance away from the geographic pattern, and/or located in a river. If the location did not match to TIGER street name, then the address was discarded. 4 DSL addresses were discarded. 4 Fixed Wireless addresses were discarded.
- *Addresses for wireless subscribers mapped using existing lat/longs and minimum bounding polygons created (using Convex Hull option)*
- Spectrum code of 5 inserted.
- Addresses within CBs <2 square miles were separated from address within CBs > 2 square miles
- For addresses inside CBs < 2 square miles, *addresses with lat/longs submitted and geocoded addresses merged together, then aggregated to corresponding census blocks, using spatial joins with max merge rule for speed fields.*
- For addresses inside CBs > 2 square miles, selected streets that lay within 500 ft of DSL address. *Joined using max merge rule for speed fields and a 500-foot search radius.*
- Deleted street segments that were outside of the large CBs, but fell within the 500 ft search area.
- *Used script to calculate absolute min and max addresses for the final selection of street segments.*
- LastMile - missing ownership, inserted 0. Also, the last mile points were being reported some distance away from their availability locations. The coordinates reported by provider were found to be incorrect. The provider then supplied addresses for central offices, which were used to correct most locations by geocoding, and four locations for wireless towers were corrected using coordinates supplied separately from the provider, then one record was located using range-interpolation in the Google geocoding API. Two locations could not be corrected with confidence, so these were excluded.

Verizon Wireless F13

- Created new, single-feature layers for “evdo” and “lte” shapefiles, using a dissolve by state abbreviation field.
- Added spectrum code field and populated accordingly, duplicating dissolved EVDO feature for each spectrum attribute used.
- Merged dissolved “evdo” and “lte” files into one and joined fields from last round after confirming (with accompanying document from provider) that attribute codes remain the same for each respective spectrum code.
- Simplify wireless polygon to remove extraneous vertices, max offset 150 ft.
- Eliminate polygon parts less than 0.125 square miles
- Confirmed FRN 0003290673 in FCC FRN Search System.

Vistanet Telecommunications, Inc.

- Obtained KML and PNG files from towercoverage.com
- Could not successfully import KML using the data conversion tool in ArcToolbox, so manually rubbersheeted the PNG footprints using towercoverage webmap interface as reference.

- Vectorized the resulting coverage representations. Deleted background shapes by value field. Merged feature parts into a single footprint for each service area.
- Merged two service area footprints into a single file with two wireless footprint features.
- Populated broadband attributes according to information provided in CSV files via towercoverage.com
- Ran repair geometry tool to ensure no spatial errors in coverage footprint shapes.

Wilkes F13

- Worked with the provider to improve data granularity from census block to street segment across the entire service area. First, provider sent remote boundaries with broadband characteristics for each one.
- Remote boundaries were imported from CAD, projected, and converted to polygons. Broadband characteristics were added to these using table join with a spreadsheet compiled by the provider, with remote name as the linking field. After checking with the provider, typical speeds were edited to match the max speeds, better reflecting typical user experience at the max tier during peak hours, rather than factoring in subscribers of lower speed tiers.
- Clip of 2012 Tigerline street centerlines using remote boundary perimeters.
- One-to-one spatial join linking the remote boundary attributes to the street segment that contains their centroid. Checked back with provider and then excluded streets segments served by remotes that still have max speeds below the mapping program threshold.
- Manually removed 12 street segment duplicates following the county line associated with the neighboring county
- Updated weighted speeds, and middle mile connection points to reflect recent changes from copper to fiber network. Converted middle mile coordinates from degrees, minutes, and seconds using the formula: $\text{Degrees} + \text{Minutes}/60 + \text{Seconds}/3600 = \text{Decimal Degrees}$

Windstream F13

Spring 2013 data was used, which was processed with the following notes:

- Windstream submitted census blocks for which speeds only were to be updated.
- Same census blocks and street segments as originally submitted in previous data collection were used, but speeds from new data were used based on spatial join between geocoded census block centroids with updated speed codes and actual census block polygons from previous data collections.
- Only 7 census blocks with new speeds fell within Lexcom coverage area, and no updated speed records specified that company name, so Lexcom speeds were left the same. Provider did not respond to three inquiries seeking confirmation on this matter.

Yadtel F13

- Structures file represents where service is available, rest of submission represents actual subscribers
- Consolidated into one dataset of copper and fiber using the address. Where structures had both copper and fiber indicated, there are two entries with the respective transtechs. (NOTE: there were no discrepancies this time between city, zip, and county fields in the structures file. It appeared clean this time.)
- If the address was in the subscriber data, the Yadkin-provided coords were used.

- If the address was in the structures data only, then it was geocoded by CGIS.
- EndUserCat based on structures file. If Occupant is not null, then 2, otherwise 5. If address did not appear in structures (as was the case for much of the copper), then EndUserCat = 5
- Copied typical speeds from advertised speeds
- Based on follow up with the provider, updated all speeds for fiber records to code 8 down, 4 up
- Edited ProvName field so that all records in all feature classes say “Yadkin Valley Telephone Membership Corporation” for ilec records, and “Yadkind Valley Telecom, Inc.” for clec records.
- Last Mile: Replaced height above sea level elevation values with -9999
- Middle Mile: BHCcapacity code was reported in last mile scale, changed this to closest corresponding value in middle mile scale (from 8 to 3). Replaced height above sea level elevation values with -9999
- Verified FRN 0004341285 for Yadtel as ilec, and 0003747847 as clec, in the FCC’s online search system.

Providers for which typical speed information was not supplied to NC Broadband:

- AT&T (FRN: 0001857952)
- Barnardsville Telephone Company (FRN: 0003766714)
- Clearwire (FRN: 0017775628)
- Comcast (FRN: 0013431911)
- Frontier Communications of the Carolinas, Inc. (FRN: 0018802660)
- Greenlight/City of Wilson (FRN: 0015950934)
- Lexcom (FRN unknown)
- Saluda Mountain Telephone Company (FRN: 0003767662)
- Service Telephone Company (FRN: 0003767712)
- Time Warner Cable (FRN: 0013430244)
- Verizon (FRN: 0001962588)
- ViaSat Communications (FRN: 0007843766)
- Windstream Concord Telephone (FRN: 0003762010)
- Winstream North Carolina (FRN: 0004967634)
- Yadtel (FRN: 0004341285 and 0003747847)

For these providers listed, the coded values for maximum advertised speeds were duplicated in the typical speed fields, since the placeholder code “ZZ” to indicate missing information is no longer accepted in the data model. When typical speed information is not supplied by the provider, a comprehensive and accurate substitute is not available, particularly since speed test data does not necessarily reflect the throughputs of the highest speed tier available.

Post-processing Functions for Final Integration

Census Block

After Census Block data was loaded into the transfer geodatabase feature class, FIPS code fields were calculated using commands in the Field Calculator and contents of the FullFIPSID field. The following calculation formulas were used:

STATE FIPS = Left ([FULLFIPSID],2)
COUNTYFIPS = Mid([FULLFIPSID],3,3)
TRACT = Mid([FULLFIPSID],6,6)
BLOCKID = Right ([FULLFIPSID],4)

- Duplicate records were identified using the ArcToolbox Frequency tool and various field combinations. Duplicates were resolved by editing Pineville Telephone Company's FRN field to avoid confusion (this provider uses the same FRN for two DBA's).
- Warnings on speed values were identified and either edited or explained after follow up with the provider and/or further investigation.
- Ran repair geometry tool 2x and confirmed that no features were deleted.

Road Segment Data

- Warnings on speed values were identified and either edited or explained after follow up with the provider and/or further investigation.
- Ran repair geometry tool and confirmed that no features were deleted.

Address Data

- Warnings on speed values were identified and either edited or explained after follow up with the provider and/or further investigation.
- Ran Repair Geometry tool and 14,098 features that could not be accurately geocoded were removed for null geometry.
- Manually corrected some missing values in several component address fields, and was able to populate from contents of the full address field.

Wireless

- Duplication of multipart coverage polygons to reflect multiple speed combinations or spectrum ranges used, per NTIA/FCC instruction.
- Warnings on speed values were identified and either edited or explained after follow up with the provider and/or further investigation.
- Ran Repair Geometry tool 2x and confirmed that no features were deleted.

Overview

- Field Calculated "Geographic Unit Type" field to CO, and "StateAbbr" field to NC.
- Deleted records of information for wireless technology types.
- Verified that all FRN's were either 9999 or 10 digits with leading zeroes.
- Ran Repair Geometry tool 2x and confirmed that no features were deleted.

Last Mile

- Field Calculated "Ownership" field to -9999 for records null in this field. Calculated "StateAbbr" field to NC.

- Ran Repair Geometry tool and confirmed that no features were deleted.

Middle Mile

- Spatial join with census block layer to derive the 15-digit FIPS code, then reload features into middle mile feature class including the new values for populating the “FullFIPSID” field.
- Replaced Null Elevation values with -9999 “default” value using Field Calculator.
- Populated State Abbreviation column with “NC”.

Community Anchor Institutions (CAI)

- Corrected CAIID field values for a number of Library CAI records, and added 6 new library sites from the IMLS public library research data (http://www.imls.gov/research/pls_data_files.aspx)
- Deleted 1 duplicate record
- Otherwise, loaded existing CAI’s as present in Spring 2013 data submission.

Verification Implemented Prior to Fall Data Submission

Data verification methods implemented by NC Broadband in time for submission at the federal level followed generally along the lines of quality control. Methods most often used are outlined below. Time constraints on existing staff did not allow for the execution of some more complex verification approaches that are in the planning/setup stages, but verification involving multiple data sources is in use and will continue to develop as part of NC Broadband’s ongoing work.

Standardizing

The files from datasets received from each provider, except for those few submitted in shapefile format, were manually transferred to a back end Excel-format template with field headers, to create a single-file, standardized field structure for each provider’s data that could be used for quick reference and map feature creation. This step also helped staff to ensure that all required components were either present or requested in follow up to the provider, and that the components were reported in the correct format.

Lat/long coordinates

Some information was submitted to NC Broadband with lat/long coordinates included for the location of point features. This location information was checked during the mapping process, and values were corrected if the provider had made mistakes such as reversing the latitude with the longitude, or forgetting to include the negative sign for the longitude value. In addition, NC Broadband followed up with providers on point features that showed up in the map outside the state and/or outside the provider’s reasonably expected service area. Point features that mapped outside the state after follow up with providers, including those that mapped to zero degrees latitude and longitude due to an unknown location, were deleted from the geodatabase for submission at the federal level. For fixed wireless data generated by propagation model from antenna specs, the latitude/longitude coordinates of the antenna locations reported by the provider to NC Broadband were verified by NC Broadband’s university GIS research contractor (UNCG Center for GIScience) using high-resolution orthoimagery.

Multiple FRNs

In several instances, providers reported multiple FRN’s that increased in numerical increments of one for each record of data, and this was found to be a simple error when the providers were trying to paste

their organization information down the rows applying to a list of broadband data records. This was checked for and corrected after confirming that the lowest/first reported FRN was the correct one.

Correct technology type codes

Knowledge from our technical staff and online research was sometimes used to supplement data that NC Broadband had relevant to a provider that was unresponsive or otherwise did not supply this specific piece of the information. For example, a provider may have gaps in their transmission technology field and these were filled in when technical staff could confirm that the provider operates with only a single technology type. Or the staff may know which technology type is used by a provider who left this field blank on all records.

Subscriber-weighted nominal speeds

Weighted nominal speed values were checked, and staff followed up with the provider if all values were the same for multiple counties, as this could result from either a single speed tier for a given transmission technology across counties, or in some cases providers were not following the formula provided and had manually entered the same value regardless of differences in subscriber numbers. When these cases were discovered, technical assistance was offered and a new subscriber-weighted nominal speed dataset created to reflect variation between counties.

Wireless model fieldwork

For fixed wireless provider data that was generated as coverage area output from models based on technology and environmental factors, the data was verified by “ground-truthing” with measurements of signal strengths at sample locations within a provider’s service area, observation of the influential ground conditions in each location, and comparison to the expected signal strengths at the same locations in the model. Some calibration of the model was then performed so that the resulting polygons could more accurately reflect what would be found in real life.

Check Geometry

After compiling all datasets into the geodatabase feature classes, the check geometry process in Arc Toolbox’s Data Management section was used on each feature class to identify and repair any geometry errors in the features.

Comparisons with Citizen-Sourced Data

NC Broadband maintains a mapped database of input from citizens who report having no access to broadband at their location from any broadband provider (or possibly just mobile or satellite options that don’t meet the user’s needs or budget from their perspective). Input is collected throughout the year directly from local citizen advocates, from NC Broadband’s website feedback form, and from locally conducted surveys. Comparison of provider-sourced data with this information allows for targeted follow up with providers in order to promote access to broadband for these citizens, as well as to pursue refinement of our statewide broadband data. FCC deadzone and speed test data is also being retrieved and processed for inclusion in data comparison.

North Carolina continues to work with the North Carolina Department of Public Instruction and State Board of Education to look at how to best partner on ways to obtain more granular citizen-sourced data of unserved areas. With the move to online textbooks in NC by 2017, we are examining how we can better work with the school systems to identify these unserved pockets, for verification of our data collection efforts and for demand aggregation pockets for our last-mile work under our Technical

Assistance program. Mapped survey results would be used for data comparisons and verification, shared with providers that serve the areas, and discussed in locally-based broadband planning teams with technical assistance staff provided by NC Broadband. Further data collection from citizen input and comparative analysis approaches will be described as more conclusive information develops.