North Carolina Data Submission
April 2012

Data Collection Methodology

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

3/31/12

Table of Contents

Executive Summary 4

North Carolina's SBDD Grant 4

North Carolina Department of Commerce 4

Spring 2012 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 16

Census Block 16

Road Segment Data 17

Address Data 17

Wireless 17

Overview 17

Last Mile 18

Middle Mile 18

CAI 18

Verification Implemented Prior to Spring Data Submission 18

Standardizing 18

Lat/long coordinates 18

Multiple FRNs 19

Correct technology type codes 19
Subscriber-weighted nominal speeds 19
Wireless model fieldwork 19
Check Geometry 19
Comparisons with Citizen-Sourced Data 19

Executive Summary

North Carolina's SBDD Grant

In 2009 the e-NC Authority, the state broadband authority for North Carolina at the time, was designated as the 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. In 2009-2010, the e-NC Authority was awarded $6,610,996 in federal funding under Award #37-50-M09002, to implement the following programs for North Carolina: broadband data collection and mapping, technical assistance, state capacity building, computer ownership and address file improvements, with the grant running from October 1, 2009 – October 1, 2014.

During the 2011 legislative session in North Carolina, the sunset date of the e-NC Authority was not extended by the legislature, so North Carolina's state broadband authority ceased to exist after December 31, 2011. The Appropriations Act (Session Law 2011-145) directed the e-NC Authority to work with the NTIA to transfer the federal NTIA grant to the North Carolina Department of Commerce (DOC). The e-NC Authority worked closely with NCDOC and the NTIA on the due diligence process for this grant transfer and in December 2011 the Governor designated the NC Department of Commerce as the new Eligible Entity under this grant. North Carolina's SBDD grant was transferred to the North Carolina Department of Commerce this quarter, effective January 1, 2012. The remainder of North Carolina's SBDD project is now being implemented by the newly-created Broadband Division (NC Broadband) of the NC Department of Commerce. The overall goals, activities and deliverables for North Carolina's SBDD program are the same, with just this substitution of grant entities.

Under this federal award of $4,045,959 (remaining funding transferred to NCDOC), NC Broadband is responsible for implementation of the following programs:

- 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

North Carolina Department of Commerce

NC Broadband, a division of the North Carolina Department of Commerce, was created specifically and primarily to carry out the remaining work of the State Broadband Data and Development Grant awarded to North Carolina by the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce. 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.

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.

Spring 2012 Broadband Data Collection and Mapping Process

Data Collection

The official data request letter from the NC Department of Commerce was sent to all identified providers of broadband service on January 30, via e-mail, with a hardcopy mailed letter distributed as well. The grant transfer to DOC was explained in the letter. Providers were given a link to the relevant Webpage which housed: 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 February 17, 2012.

During this data collection, as providers inquired about data confidentiality, they were provided with a letter from the NC Department of Commerce explaining the protections provided under North Carolina's Public Records Act. Working through the NC Telecommunications Industry Association at their request, DOC provided letters to sixteen telco providers explaining these protections. Working through the North Carolina Cable Telecommunications Association at their request, DOC provided three additional letters. Letters were provided directly to four additional providers (three of these being mobile providers). Non-Disclosure Agreements were secured with four of DOC's contractors with potential access to the data. The DOC did not enter into NDAs with any providers. There were no unresolved confidentiality issues brought forward by providers.

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.

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 Samantha Jackson 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 Fall datasets for providers that were unresponsive, or who asked that previous data be used for this round. NC Broadband plans to make a more concerted effort at full participation in the Fall 2012

data round. Participation in this round was more challenging due to the transfer of the SBDD grant (effective as of January 1, 2012, and executed on March 19, 2012), and the additional negotiations required on data confidentiality. The number of known broadband service providers operating in North Carolina is now at 105.

Out of these 105 known providers, 75 now have broadband data in this statewide geodatabase.

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 seven 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.

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 5,857 CAI's identified, located, and included in the geodatabase to date. There were no changes to the CAI feature class since the previous data collection round in fall 2011.

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 false midpoint address 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: 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.

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

AT&T S12

- Converted subscriber weighted nom speed data from CBSA to county
- Converted max advertised speed data from CBSA to county
- Translated max advertised speeds from KBPS to NTIA codes
- Applied converted speeds to appropriate availability records by county based on FIPS codes, by pasting the CBlock FIPS codes into speed columns and using Find/Replace functions in Excel (ex Find fields with 37001* and Replace with 7). For data by street and CB.
- Copied max advertised speeds into typical speed columns (for which data was not supplied by AT&T)
- 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.
- Geocoded street-level data using 2010 TLID field.
- 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.
- Linked geocoded points representing street segment data to polyline street segments via one-to-many spatial join, using intersect criteria with a 2 foot search radius. Eliminated extraneous joins by selecting out records in the results where target and joined TLID fields did not match.

AT&T Mobility S12

- Merged shapefile features into a single multipart polygon to remove arbitrary grid boundaries.
- Validation: Ran "Eliminate Polygon Part" tool to remove any parts or donut holes less than 0.125 square miles in area.
- Removed extraneous vertices using a max offset of 150 feet.
- Added attributes supplied in Excel spreadsheet.

ATMC S12

- 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.

- Added EndUserCat field and populated with code 5
- Overlay of address points w/CB layer to get FIPS code field
- Created new fields and used Calculate Geometry function in ArcMap to generate Lat and Long attributes
- Deleted 9,836 duplicates (using FRN, TransTech, and Address fields for check). 96,071 records remaining.

ATMC Wireless S12

- Clipped shapefile to state boundary
- Eliminated polygon parts less than 0.125 square miles
- Ran simplify polygon to remove extraneous points, set to 150 feet max offset.
- Added spectrum attribute

CenturyLink S12

- Copied 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

Charter

- Re-projected and formatted attribute fields. Added 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.

Comporium S12

- For DBA Springboard: Tidied up text submission of address data and removed duplicates of equal or lesser max speeds. Ran address sorter script, all addresses found a match with previous data and were transferred new GDB (with the newer tech and speed attributes).

Comcast S12

- 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 150 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 S12

- Eliminated polygon parts smaller than 0.125 square mile, and removed extraneous points using a max 20-foot offset.

- Merged and duplicated polygons based on spectrum used
- Formatted attribute fields

Electronics Service Co of Hamlet
- Customized propagation model for unique antenna setup high up in trees
- Clipped output to state boundary

Electronic Solutions S12
- Compared to Fall 2011 data, found the newly submitted data to be the same except for the number of end users (in wireless and last mile tabs).
- Copied and renamed the formatted/mapped layers from Fall 2011, updated numbers of end users.

Ellerbe Telephone Company S12
- Converted 2010 census blocks as well as middle mile, last mile, and overview information from Fall 2011 data collection transferred into current geodatabase.

Epproach
- Copied Census blocks from Fall 2010 geodatabase
- Merged census block polygons
- Loaded into geodatabase and populated Unlicensed for spectrum field.

Frontier
- Began new with data submitted in this round, as per the provider this dataset includes/supercedes data previously combined from updates and formerly-Verizon's network.
- Applied speed codes based on email follow-up with provider
- Added fields for EndUserCat and ProviderType, populated all records with 5 and 1, respectively.
- Created XY Event layer for new last mile/DSLAM points submitted.
- Applied a 15,000 foot service circle to new last mile points for availability (no dissolve).
- Created subset of 2010 road segments that intersect the 15,000 ft radius buffers, via spatial join using intersect criteria.
- Applied appropriate speed codes as explained by the provider contact.

Greenlight (City of Wilson) S12
- Re-projected shapefiles into WGS84.
- Added FRN2 field with leading zeroes, Lat, Long, EndUserCat (populated with code 5), and Provider type field (populated with code 1) to address attributes, and re-concatenated "Address" field.
- Spatial join of address points to obtain census block FIPS codes
- Removed duplicate addresses using Delete Identical tool in ArcToolbox, checking in Address, TransTech, MaxAdDown and MaxAdUp fields.
- Populated missing Typical speed fields with Maximum Advertised fields.
- Added/populated FRN w/leading zeroes, lat and long fields for middle and last mile
- Attribute join to county template feature class for Overview

Interstar

- Mapped subscriber addresses supplied by the provider, then used the point locations to derive a Minimum Bounding Polygon (Convex Hull) representing available wireless coverage.
- One-to-one spatial join associating provider attributes and speeds (max for served area) with minimum bounding polygon.
- Added spectrum field and populated with code 6.

Inteliport

- 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.

Mediacast S12

- Max Advertised speed values duplicated to populate typical speed fields.
- Wireless propagation of previous data, this time using a higher minimum signal strength threshold of -80 dBm.

Mediacom S12

- Confirmed with provider that address data includes both current and potential customers, and that the list of serviceable addresses had not changed since the fall. Provider did submit new file with typical speeds. These values were the same as populated in fall by duplicating the max advertised speeds.
- Transferred formatted and mapped data from Fall 2011 database. (112,075 points as these do not include duplicates or those we could not geocode).

MI-Connection S12

- Deleted 5,989 duplicate records (using address, transtech, and EndUserCat fields)
- Ran script to sort out new address records from previously submitted addresses.
- Populated unmatched/ungeocoded addresses with placeholder values (-9999)
- Concatenated Address field for cleaner, consistent contents

Morris S12

- Use of same address list as Fall 2011, confirmed that these include both current and potential broadband customer locations.
- Learned that speeds for fiber records had been reported by Mbps and converted these to NTIA codes to match other records.
- Spatial join with 2010 census blocks for FIPS field.

NC Wireless

- Wireless propagation of data, this time using a higher minimum signal strength threshold of -80 dBm.
- Follow up helped correct the max advertised and typical speeds of one tower footprint within more practical values based on channel availability.

North State

- Emailed about missing FIPS digit and inserted (leading zero for tracts) upon their response.
- Speeds were reported as Typical Up/Down only. Substituted these values into Max Ad Up/Down as well.
- Duplicate CB records were given to us for each service tier. Merged into CB shapefile after geocoding by:
    - Splitting into separate shapefiles by tech type (10, 30, and 50)
    - One-to-one spatial join field merge rule taking the maximum value from duplicates' speed fields.
- Middle Mile, Last Mile: Added negative sign to longitude values
- Last Mile point with longitude -70.97528 fell out of state boundaries and was changed to -79.97528 based on locations of all the other last mile locations.

Randolph TMC and Randolph Telephone Company S12

- Formatted text information and consolidated into one Excel file
- Generated hypothetical street addresses based on the min, max, and integer midpoint of each address range provided. Geocoded these addresses to Tigerline 2010 reference file, with zero offset (3 potential points for every address range record sent by Randolph). Each original record assigned a unique ID which was duplicated with each set. Set field created as well to distinguish.
- Geocoded addresses spatially joined to corresponding street segments
- Merged any duplicates based on TLID, FRN, and temporary ID.

Sprint Nextel

- Validation: Ran "Eliminate Polygon Part" tool to remove any parts or donut holes less than 0.125 square miles in area.

Star Telephone Membership Corporation S12

- Followed up with provider on census block FIPS codes that would not match existing blocks. Identified a formatting issue with zeroes in the tract number section and corrected this. Followed up a second time about a remaining 71 (3%) census block records that did not find a match.
- Corrected one last mile connection point with a formatting issue on lat/long that was creating an inconsistent extent when mapped.
- 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.

Skybest and Skyline S12

- 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

Sky Catcher

- Wireless Propagation study.
- Created XY Event Layer to map Middle Mile information, deleted duplicate records. Remaining records loaded into geodatabase.

SkyeNet Wireless Communications S12

- 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. Maximum speeds were obtained from the FAQ page of the same website.
- Speeds were updated after checking the website again on 3/28/2012.

Surry TMC and Piedmont Communications S12

- Created 3 hypothetical addresses from within the address ranges supplied in Excel format: one street number being the integer midpoint, one being the min value plus 2, and one being the max value minus 2. (only 3 address ranges supplied went completely unmatched).
- Spatially joined the geocoded points to polyline street segments using intersect criteria and a search radius of 2 feet.
- Manually copy/pasted additional street segments that fell between the segments captured by min, max, midpoint point locations.
- Extended attribution to the new copy/pasted street segments based on attributes of surrounding availability data.
- Corrected technology codes for Piedmont Communications from 40 to 41 based on follow up with provider.
- Changed max and typical speeds for one record for Piedmont Communications tech type 41 from zeroes to the codes matching all other type 41 records of the same provider.

TDS Telecom S12

- 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.
- ZIP code information added to approximately 1700 address records
- Address field reparsed to include commas and new ZIP code info
- 256 duplicate address records removed
- 74 addresses with null geometry sent to UNCG Center for GIS for geocoding (excluded from original load)
- Duplicated max advertised speed codes in typical speed fields

Tele-media S12

- Provider type of 1 assumed and populated.
- Checked for duplicates CB's in Excel, none found
- No changes reported since last two rounds. Converted 2010 census blocks from Fall 2011 data collection transferred into current geodatabase.

Time Warner Cable S12

- 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 this was left null in the transfer geodatabase.
- 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.

T-Mobile S12

- Reprojected shapefiles into WGS 1984.
- Added field to categorize by technology type/T-mobile service tier (3G, 4G).
- Attributed manually from information sent in a text file from T-Mobile.
- Executed spatial Union between coverage of higher speed and the broader 3G coverage, then extracted (Data Export selected features) resulting 3G only features to distinguish max speeds here versus where higher speeds are also available. Merged into single shapefile
- Eliminate Polygon part tool to remove features <0.125 square mile.

Tri-County S12

- Concatenated address information into single Address field in BackEnd template spreadsheet.
- Fall data used for wireless.
- Addresses geocoded for DSL availability, then aggregated to corresponding census blocks and street segments
- For Tech Type 10: Selected and exported resulting aggregated CB data for CB's <2 mi. These were loaded into the geodatabase with associated broadband data.

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.

- 1177 duplicate records (with same value for Provider Name, DBA Name, FRN, TransTech, FullFIPSID, EndUserCat, and all four speed fields) were removed using the ArcToolbox Delete Identical tool.
- 1087 duplicate records (with same value for Provider Name, DBA Name, FRN, TransTech, and FullFIPS ID) were removed using the ArcToolbox Dissolve tool on the original provider dataset for CenturyLink and those records were reloaded into the transfer geodatabase.
- 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

- Populated FIPS code field for 3 address points that did not have a value after their dataset's spatial join (because of location on the state border).
- Verified that all FRN's were either 9999 or 10 digits with leading zeroes.
- 970 duplicates (with same value for shape, Provider Name, DBA Name, FRN, Address, TransTech, FullFIPSID, EndUserCat, and all four speed fields) removed using the ArcToolbox Delete Identical tool.
- 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.

Wireless

- Duplication of multipart coverage polygons to reflect multiple 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.
- Field Calculated missing Maximum Advertised Up and Down speed fields to "ZZ" "default" values.
- 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".

CAI

- Parsed address information for address fields
- Excluded 526 records for which survey respondents report that they do subscribe to broadband but did not give speed information accepted by the NTIA's script.

Verification Implemented Prior to Spring 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 more substantial verification involving multiple data sources continue to develop.

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 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 has recently begun mapping layers 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 users needs or budget from their perspective). A compiled layer is collected from local citizen advocates, citizen input on NC Broadband's website feedback form, and locally conducted surveys. Comparison of provider-sourced data with this source of information has allowed for targeted follow up with providers in order to promote access to broadband for these citizens, as well as to begin refinement of our statewide broadband data. FCC deadzone and speed test data has also been retrieved and is being processed for inclusion and comparison. Further data collection from citizen input and comparative analysis approaches will be described in fall 2012.