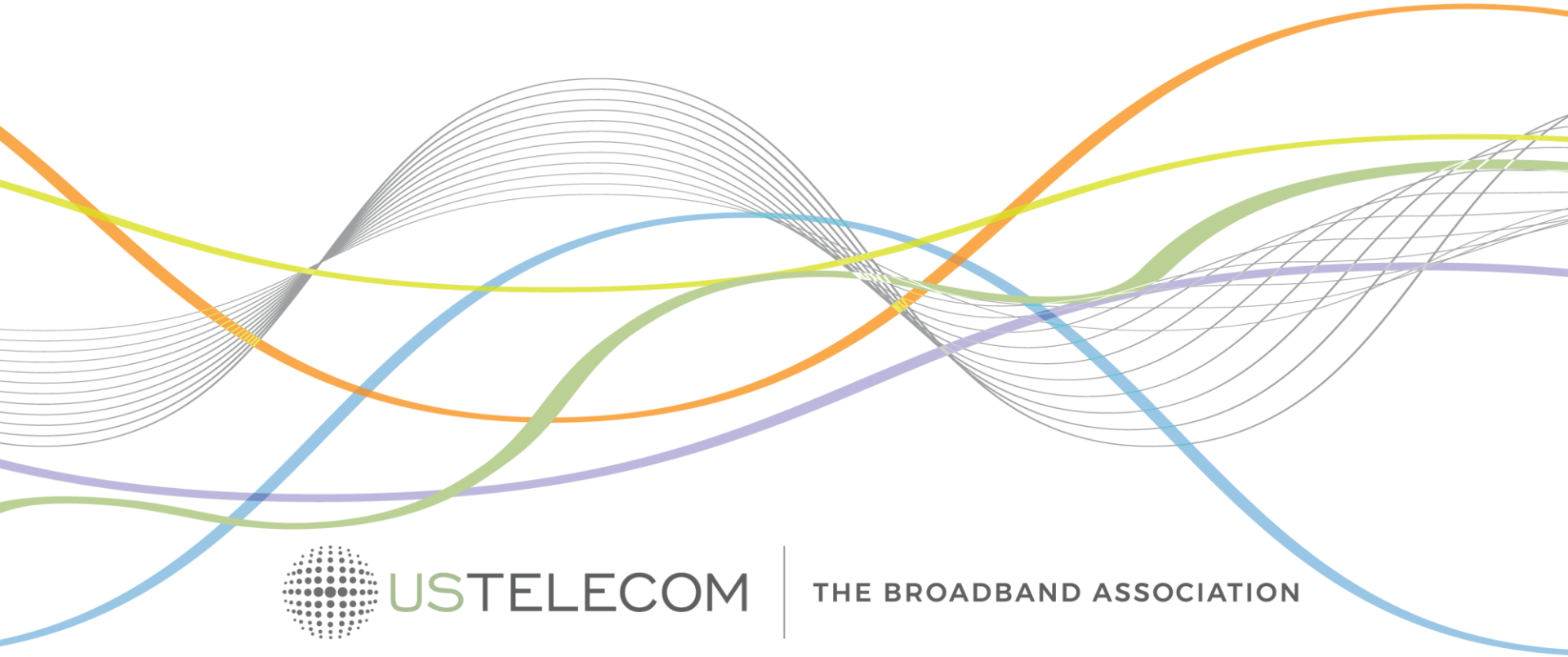
Broadband Mapping Initiative Pilot Results Overview

Tuesday, August 20, 2019



USTELECOM | THE BROADBAND ASSOCIATION

Presenters

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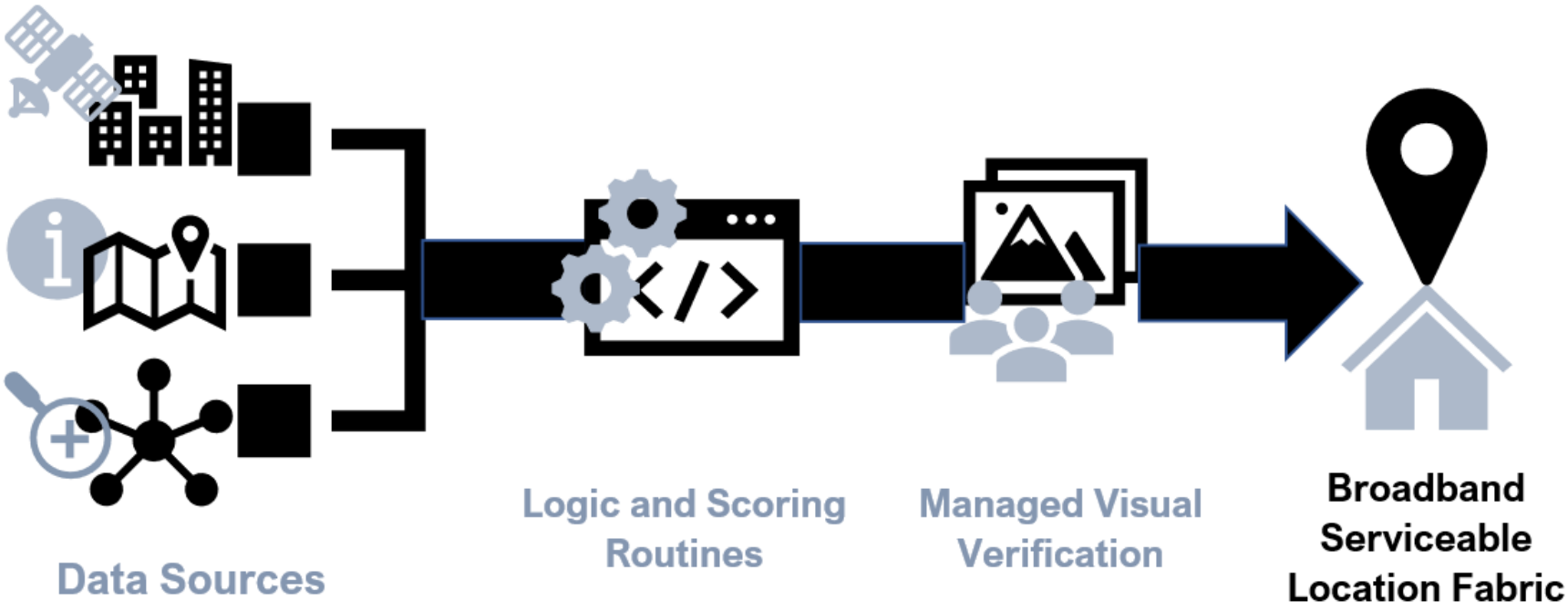
Broadband Mapping Initiative Partners

USTelecom	ITTA	WISPA
AT&T	CenturyLink	Chariton Valley
Consolidated	Frontier	Riverstreet
TDS	Verizon	Windstream

Pilot Origins

- Challenges with Broadband Availability Data
- The Need for the Broadband Serviceable Location Fabric
- Pilot Kick-off: March 21, 2019
- Two State Test: Missouri and Virginia

How It Works – Overview



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Key Pilot Findings:
Rural Missouri & Virginia

Key Findings

RURAL LOCATION COUNTS

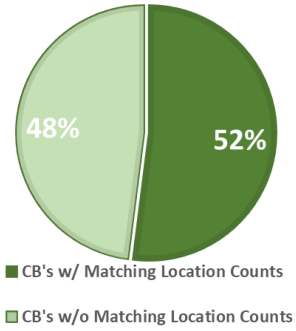
38% of total Rural Locations in Census Blocks reported to be served are UNSERVED[1]

The FABRIC identifies unseen locations

445,000+

48% of Rural Census Block Fabric Location Counts Don't Match Currently used Estimates of Location Counts

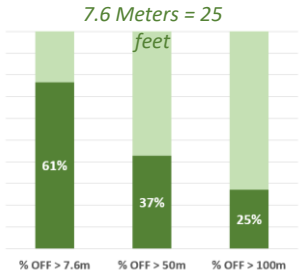
The FABRIC corrects these counts



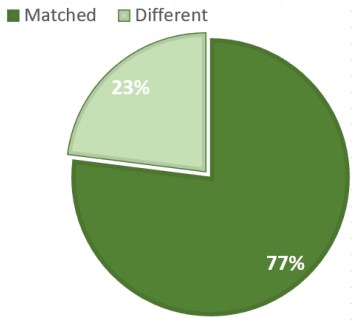
RURAL DISTANCE DIFFERENCES

61% of Rural Pilot provided geocoded[1] Locations NOT at the correct structure location

The FABRIC corrects theses coordinates



25% of Rural Pilot Locations are off by over 100m



23% of Rural Pilot Locations NOT geocoded[1] to Correct Census Blocks

The FABRIC trues-up these locations

[1]Geocoded = Use of Geocoding Tool

[1] *Not every broadband provider chose to participate in this Pilot, so the actual number of unserved may be lower.*

Bottom Line

The FABRIC greatly improves the accuracy of Census Block location counts

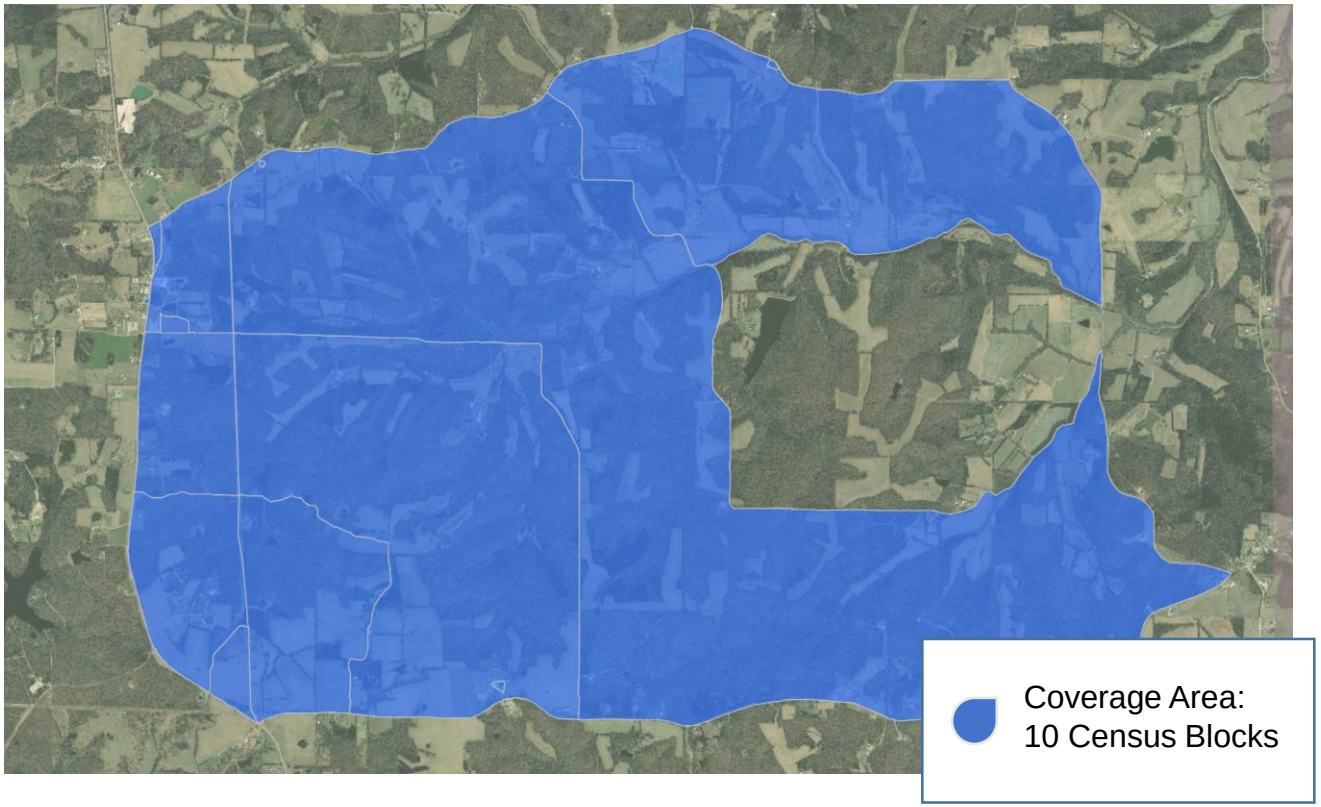
The FABRIC provides much improved accuracy for location coordinates

Key Pilot Findings:
Unserved Locations Now Viewable

10 Census Blocks in MO that would be identified as SERVED in today's 477

"One-served, All-Served"

Blue area represents the coverage of the 10 Census Blocks



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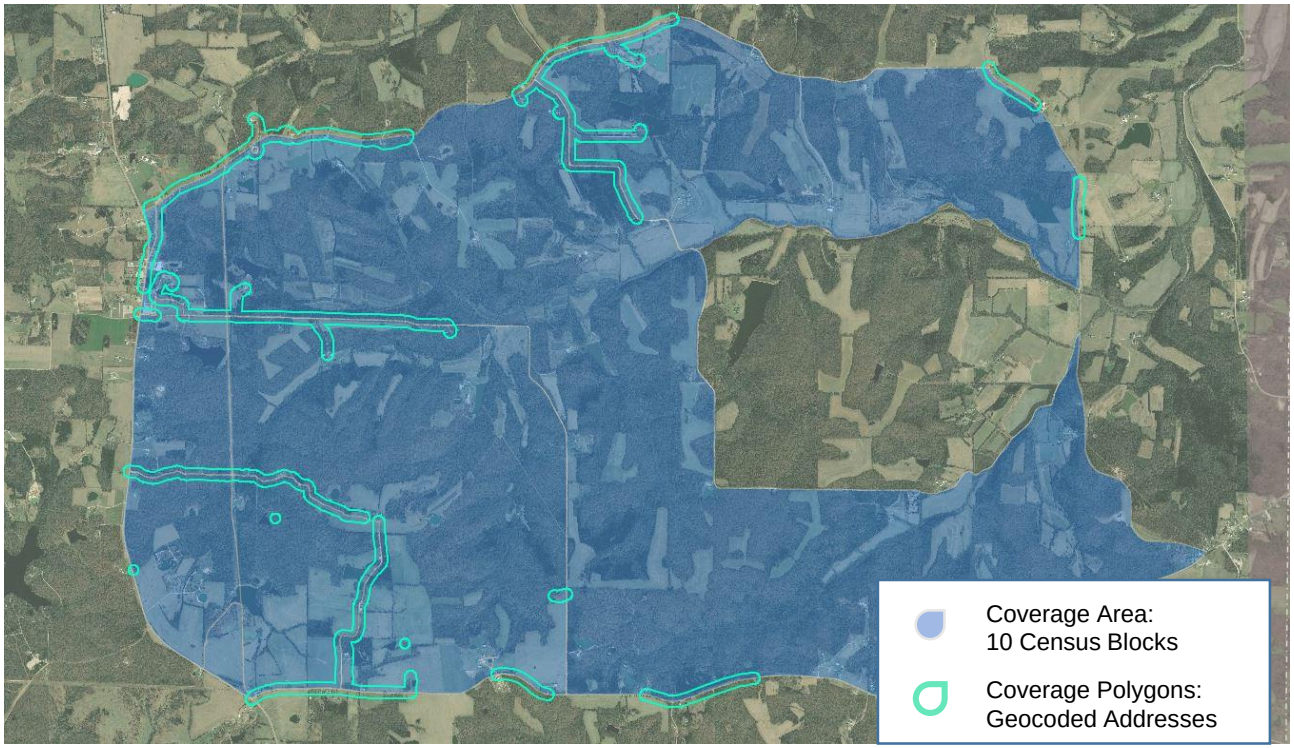
Key Pilot Findings:
Unserved Locations Now Viewable

Polygon approach for 477 coverage in these 10 census blocks

Polygons Based on:

- Geocoded addresses served
- 150ft buffers on roads

We now have knowledge of Served



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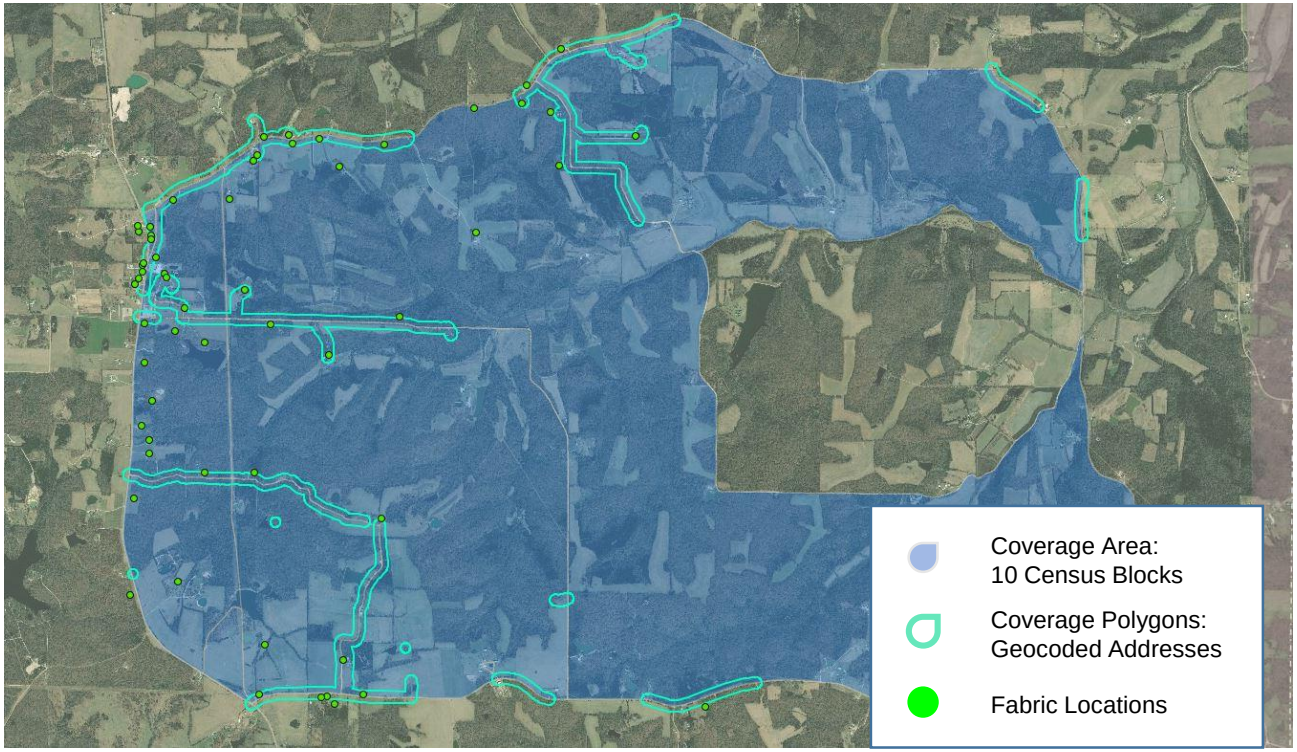
Key Pilot Findings:
Unserved Locations Now Viewable

Polygons are created using commercial geocoding of addresses in these 10 census blocks

Green dots represent Fabric locations associated with addresses used to create polygons

It is clear the polygons based on poor geocoded information will miss locations



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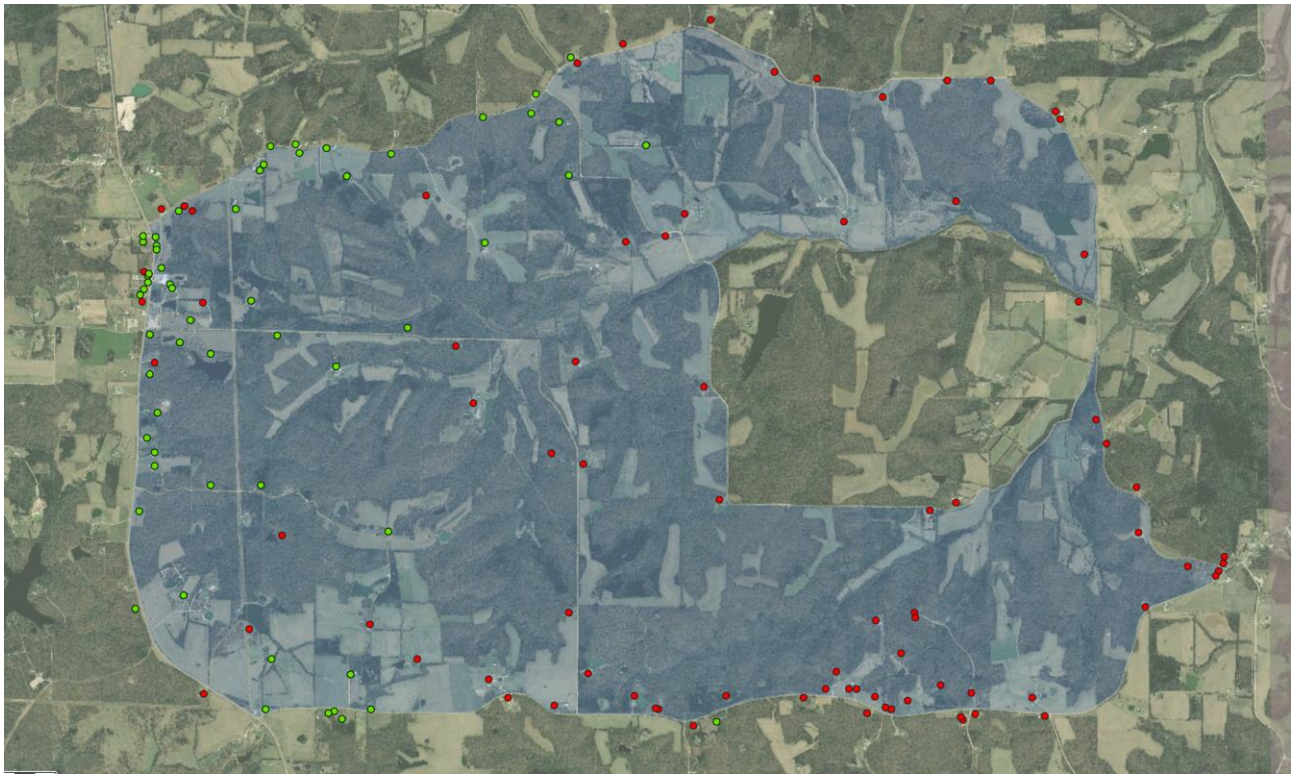
Key Pilot Findings: Unserved Locations Now Viewable

The BIG COVERAGE REVEAL

The Fabric process allows us to now see extent of the Served (green dots) and Unserved (red dots) locations in this 10 Census Block area



- Coverage Area: 10 Census Blocks
- Unserved Fabric Locations
- Fabric Locations

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National Fabric Considerations

Things to consider

Address Data Normalization:

- Consider creating address format standards for carrier filings
- Efforts need to be focused on identifying multi-dwelling units and the determination of count of units

Serviceable Structure:

- FCC should define what a serviceable structures represents
- Requirements for the assignment of structures into residential and business categories needs to identified

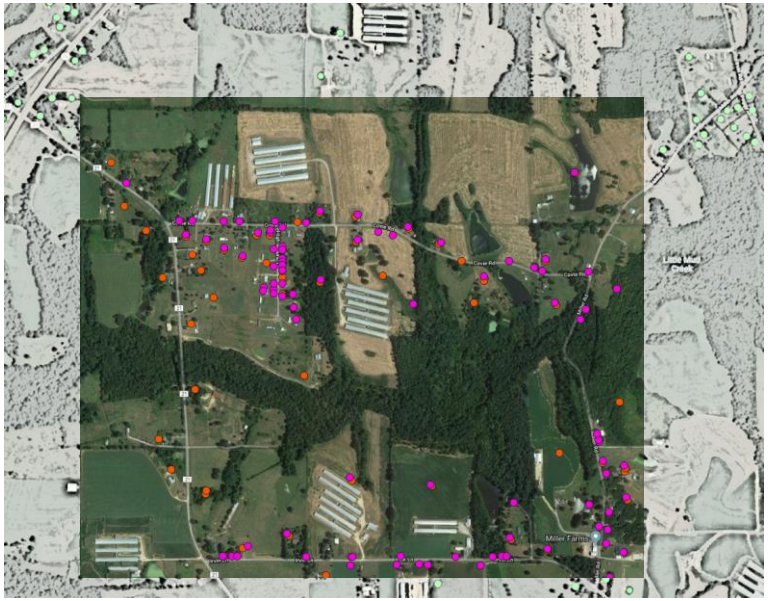
Parcel Attribute Normalization:

- Assessor LandUse identification along with a few other key fields are key drivers of fabric identification and customer type (e.g., residential) determination. A national effort to produce guidelines for assessor's use would lead to an improved fabric product
- Some areas of the country lack public parcel information. These parcel boundaries constrain processing of all the various layers of data. A national effort to create a complete national parcel layer would lead to an improved fabric product

National Fabric	Open Source[1]	Proprietary[2]	Key Issues
Budget	**Upfront: $22M - $24.5M** **Annual Updates: $7M - $8M** • Beneficial to use some proprietary data • Would rely heavily on Visual Verification • Fabric could be made publicly-available (but still may require some restrictions on use)	**Upfront: $8.5M - $11M** **Annual Updates: $3M - $4M** • Superior initial product • Would rely on third-party data • Fabric would be restricted in use but could still be used publicly	• Visual Verification is a large cost-driver but is a key driver of quality • Without third party, proprietary data, obtaining and normalizing public parcel attributes is labor-intensive and costly • Continuing from the proof of concept will save 8-12 months of time
Timeline	**Continue From Proof of Concept*: 12 – 15 months** **** This pilot has advanced the process by 8-12 months*** ***Does not account for time related to procurement/contracting***		

[1]Open Source = Creation of National Fabric assuming use of only Open Source data
[2]Proprietary = Creation of National Fabric assuming use of both Open Source and Proprietary data

Where the Fabric Makes a Difference: Targeting Locations Locations



Dots shown represent the results of entering the same service addresses into two geocoders. It is unclear how many locations exist in this area where service would be installed.

The Fabric uses multiple data sources to better identify the locations (green triangles) of homes and businesses that would need service.

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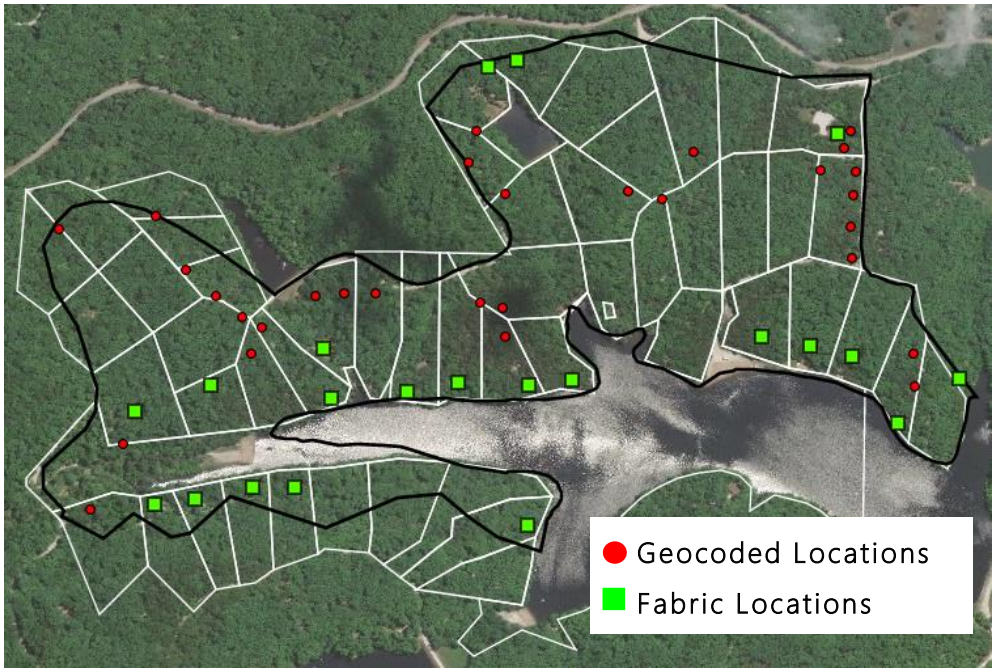
Where the Fabric Makes a Difference: Counting Locations



Visual inspection suggests Fabric count is more realistic

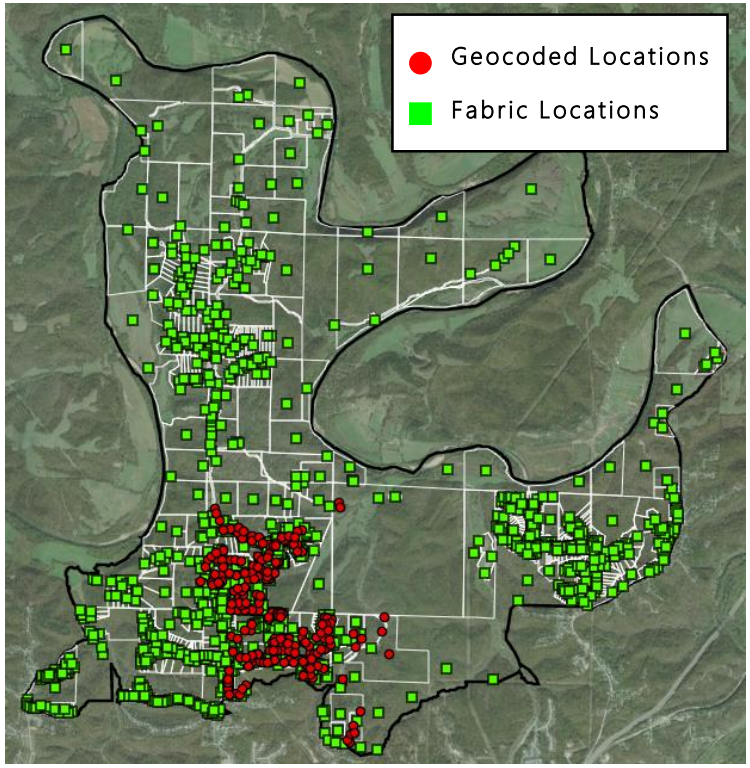
The number of locations identified for the same census block can vary substantially depending on the data source.

In this example, there is a 55% differential in location counts:

- 2011 Census Housing Units = 47
- Geocoded Locations filed in the HUBB = 30
- Fabric Locations = 21

Are all the locations served?

Where the Fabric Makes a Difference: Counting Locations



The number of locations identified for the same census block can vary substantially depending on the data source and data vintage.

In this example, there is a 32% differential in location counts:

- 2011 Census Housing Units = 260
- Geocoded Locations filed in the HUBB = 196
- Fabric Locations = 380

The Fabric identified 120 additional locations beyond build out requirements

Where the Fabric Makes a Difference: Accurate Geocoding

Geocoded vs. Fabric Locations

Geocoding in rural areas often identifies a latitude/longitude at or near the roadside. The Fabric generates a latitude/longitude specific to the rooftop of each structure.

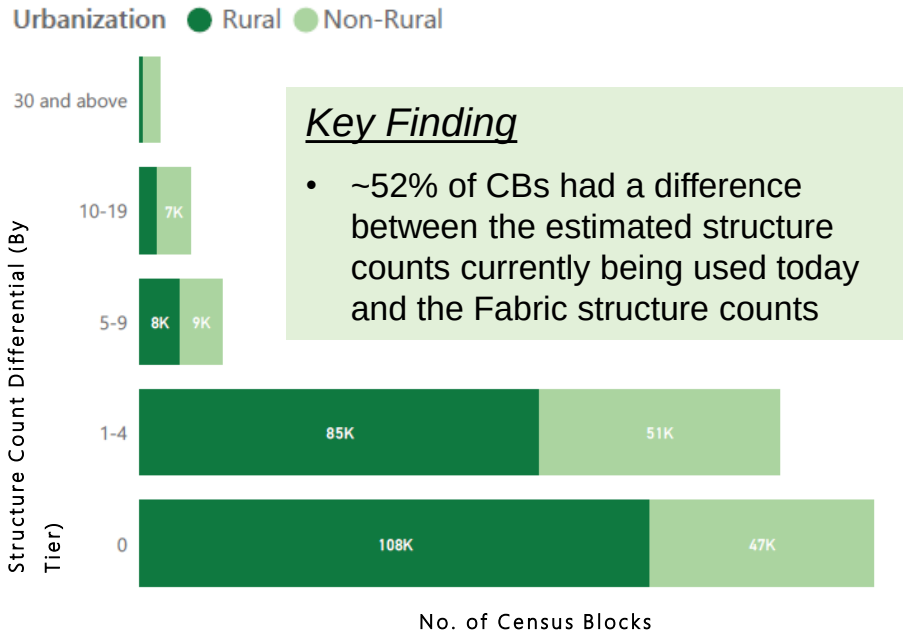
In this example, the difference for just eight locations submitted to the HUBB was over 521 meters.

Structure-accurate coordinates can support location reporting and network planning

Missouri Structure Counts[1]: Fabric vs. Census & Business Estimates

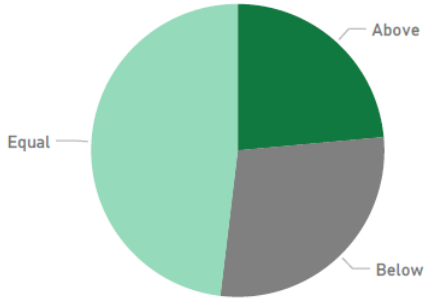
*[1]Data represents a comparison between serviceable structures identified in Broadband Location Fabric and Census 2011 **and** Business 2012 structure estimates*

Structure Count Differential (Absolute Value)



Key Finding

- ~52% of CBs had a difference between the estimated structure counts currently being used today and the Fabric structure counts



Absolute Differential: Fabric vs Census	% Census Block Counts	Census Block Counts	Area mi²	MO Fabric-Census	HU2010
Variation	51.90%	168,043	52,973	-349,399	2,270,427
Equal	48.10%	155,731	15,769	0	442,302
Total	**100.00%**	**323,774**	**68,742**	**-349,399**	**2,712,729**

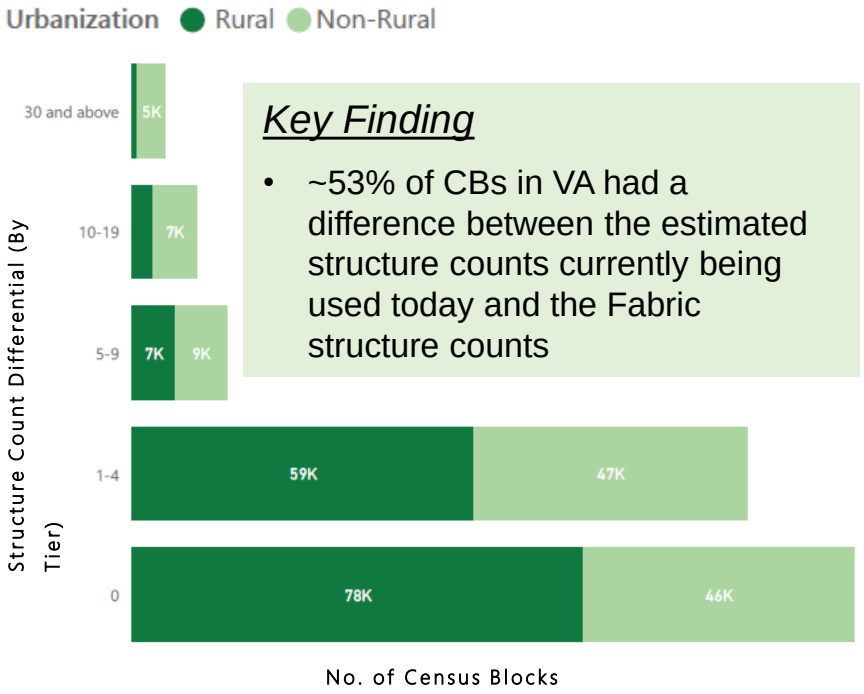
***Area mi²** = Total square miles of census blocks counted*

****Fabric-Census** = Differential in structure count between Fabric and corresponding Census data*

Virginia Structure Counts[1]: Fabric vs. Census & Business Estimates

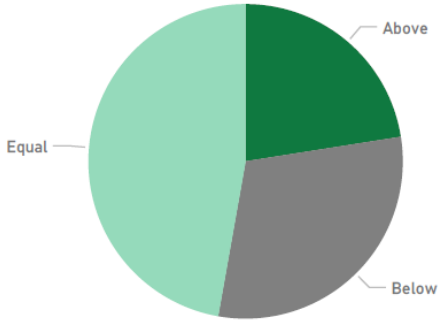
*[1]Data represents a comparison between serviceable structures identified in Broadband Location Fabric and Census 2011 **and** Business 2012 structure estimates*

Structure Count Differential (Absolute Value)



Key Finding

- ~53% of CBs in VA had a difference between the estimated structure counts currently being used today and the Fabric structure counts



Absolute Differential: Fabric vs Census	% Census Block Counts	Census Block Counts	Area mi²	VA Fabric-Census	HU2010
Variation	52.79%	138,720	32,355.23	-391,649	2,971,091
Equal	47.21%	124,036	7,134.86	0	393,848
Total	**100.00%**	**262,756**	**39,490.08**	**-391,649**	**3,364,939**

***Area mi²** = Total square miles of census blocks counted*

****Fabric-Census** = Differential in structure count between Fabric and corresponding Census data*

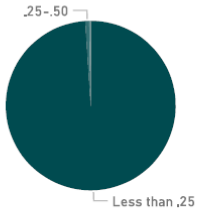
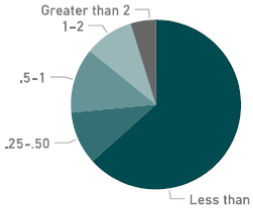
Missouri Form 477
Carrier Pilot Coverage Analysis

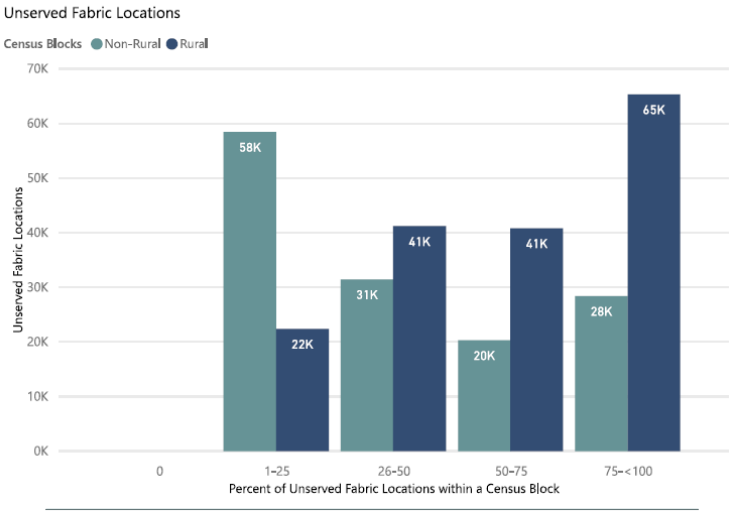
Key Findings

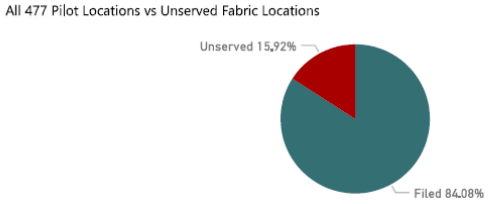
- **9% of Non-Rural locations UNSERVED**
- **36% of Rural locations UNSERVED**
- 300,000+ Missouri Fabric locations are unserved by Pilot Carriers

Location Fabric Data and Carrier Pilot 477 Data: MO Fabric

All counts represent unique structure locations

Non-Rural	Rural
Census Blocks by Size (sq mi)	Census Blocks by Size (sq mi)
	
1,467,436	468,827
Fabric Locations in Census Blocks with Carrier Pilot Data	Fabric Locations in Census Blocks with Carrier Pilot Data
1,328,876	299,164
Fabric Locations in Pilot Carrier Form 477	Fabric Locations in Pilot Carrier Form 477
138,560	169,663
Unserved Fabric Locations	Unserved Fabric Locations
9%	**36%**
Unserved Non-Rural Fabric Locations	**Unserved Rural Fabric Locations**





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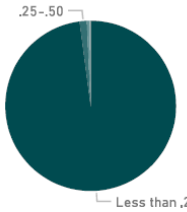
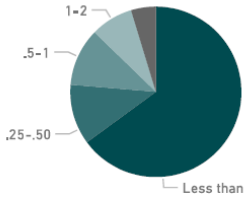
Virginia Form 477
Carrier Pilot Coverage Analysis

Key Findings

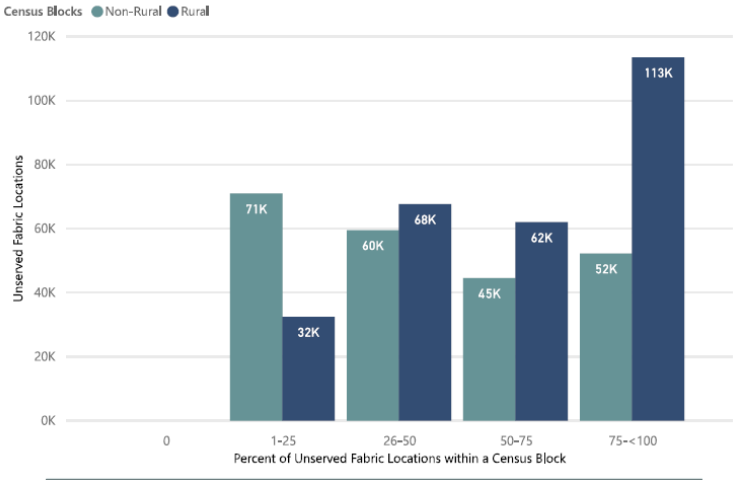
- **12% of Non-Rural locations UNSERVED**
- **39% of Rural locations UNSERVED**
- 500,000+ Virginia Fabric locations are unserved by Pilot Carriers

Location Fabric Data and Carrier Pilot 477 Data: VA Fabric

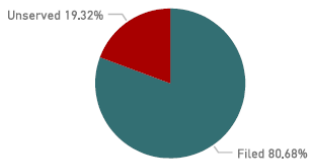
All counts represent unique structure locations

Non-Rural	Rural
Census Blocks by Size (sq mi)	Census Blocks by Size (sq mi)
	
1,903,257	698,177
Fabric Locations in Census Blocks with Carrier Pilot Data	Fabric Locations in Census Blocks with Carrier Pilot Data
1,676,068	422,693
Fabric Locations in Pilot Carrier Form 477	Fabric Locations in Pilot Carrier Form 477
227,189	275,484
Unserved Fabric Locations	Unserved Fabric Locations
12% **Unserved Non-Rural Fabric Locations**	39% **Unserved Rural Fabric Locations**

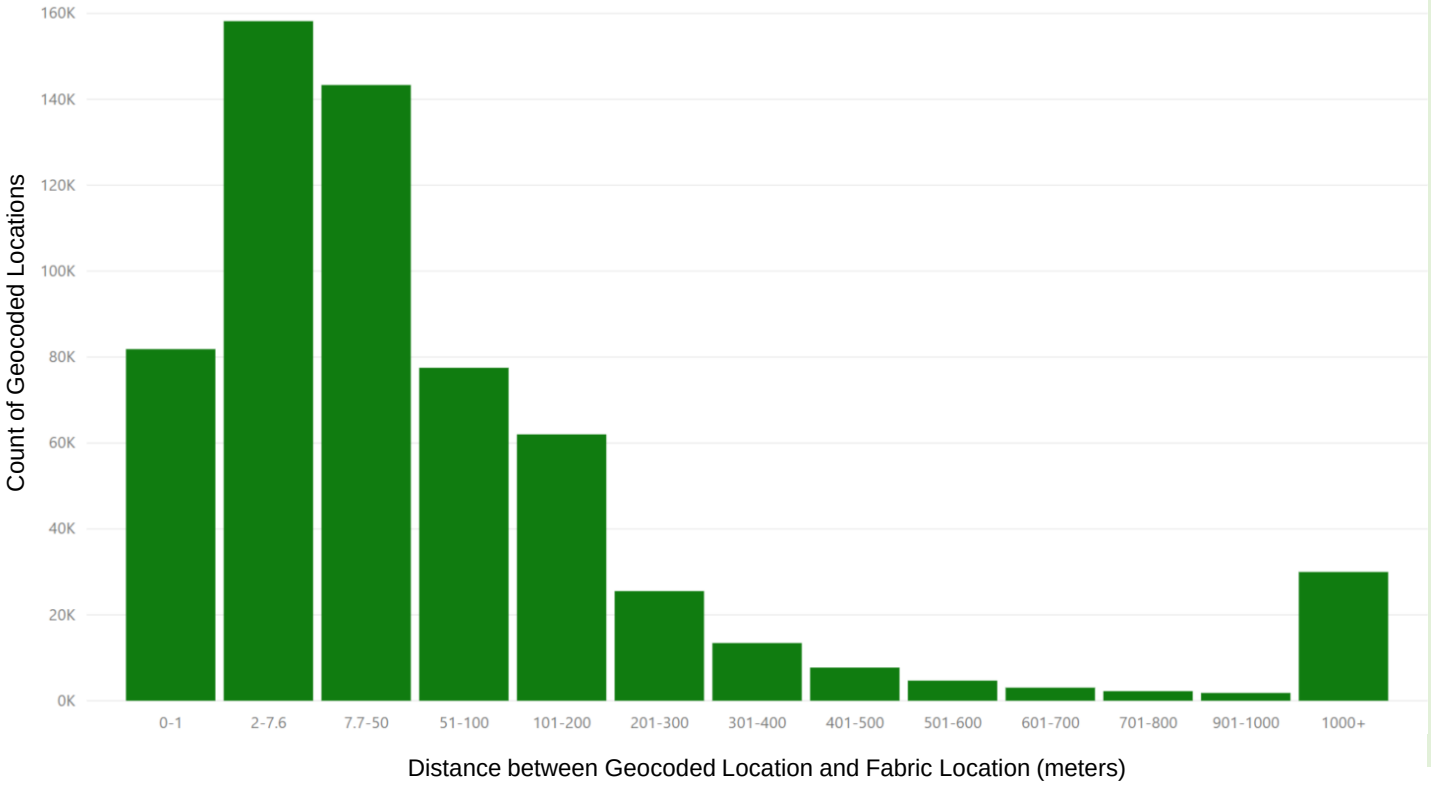
Unserved Fabric Locations



All 477 Pilot Locations vs Unserved Fabric Locations



Aggregated Location Distance Differential: Geocoded[1] vs. Fabric

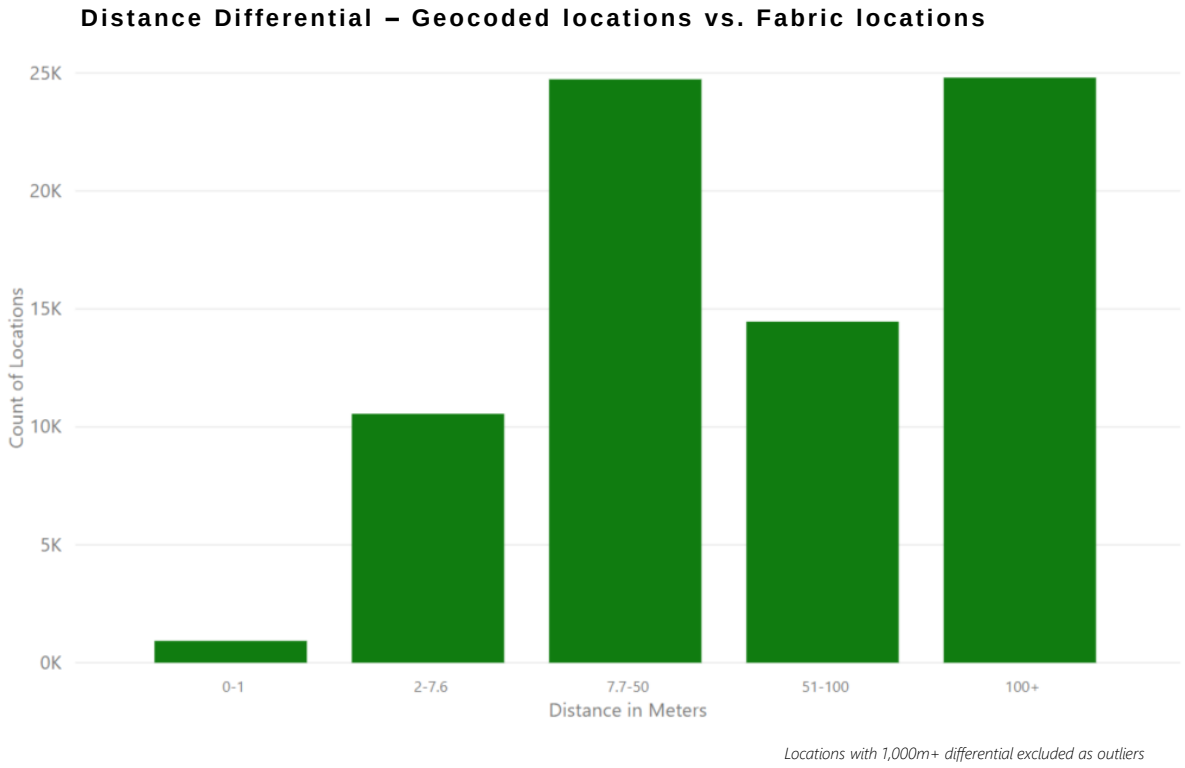


Key Findings

- Only 1% of pilot provider's geocoded locations matched geographically the corresponding Fabric locations
- Most coordinates off by 25m+

[1] Comparison uses the georeferenced locational data provided by the carriers in the Pilot study.

Missouri Location Distance Differential: Geocoded[1] vs. Fabric



Locations with 1,000m+ differential excluded as outliers

Key Findings

- **84% of geocoded locations > 7.6m from Fabric locations**
- **55% of geocoded locations > 50m from Fabric locations**

Average distance between geocoded & Fabric is ~130m

Context

7.6 meters is the HUBB accepted margin of error to determine if a filed location is in an eligible area. A difference of more than 50 meters could represent a different location, a different eligible census block, or skew build costs and network designs.

[1] *These locations, many of which were geocoded by a geocoding tool, were sourced from HUBB data as a point of comparison for this study.*

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Public Policy Implications of the Broadband Mapping Initiative

- Significantly Improved Broadband Reporting
- Targeted Broadband Funding for Multiple Programs
- Efficient Network Design