Market Assessment

Technical Memorandum - Appendix

August 2023

CONTENTS

Overview

This document provides an overview of the detailed methodologies that went into creating the Market Assessment for the Bus Network Redesign. It includes data sources, and summarization of key results that were used to guide the service planning process.

Existing and Future Population and Employment

Population and employment figures for 2020 and 2035 are obtained at the Transportation Analysis Zone (TAZ) level.

Data Sources

- Metropolitan Washington Council of Governments Cooperative Forecast series (Round 9.1a).

Results

Figure 1 and **Figure 2** illustrate population density for 2020 and 2035. **Figure 3** and **Figure 4** illustrate employment density for 2020 and 2035. All of the maps are overlaid with the Metrobus Frequent Service Network.

Figure 1: Regional Population Density, 2020

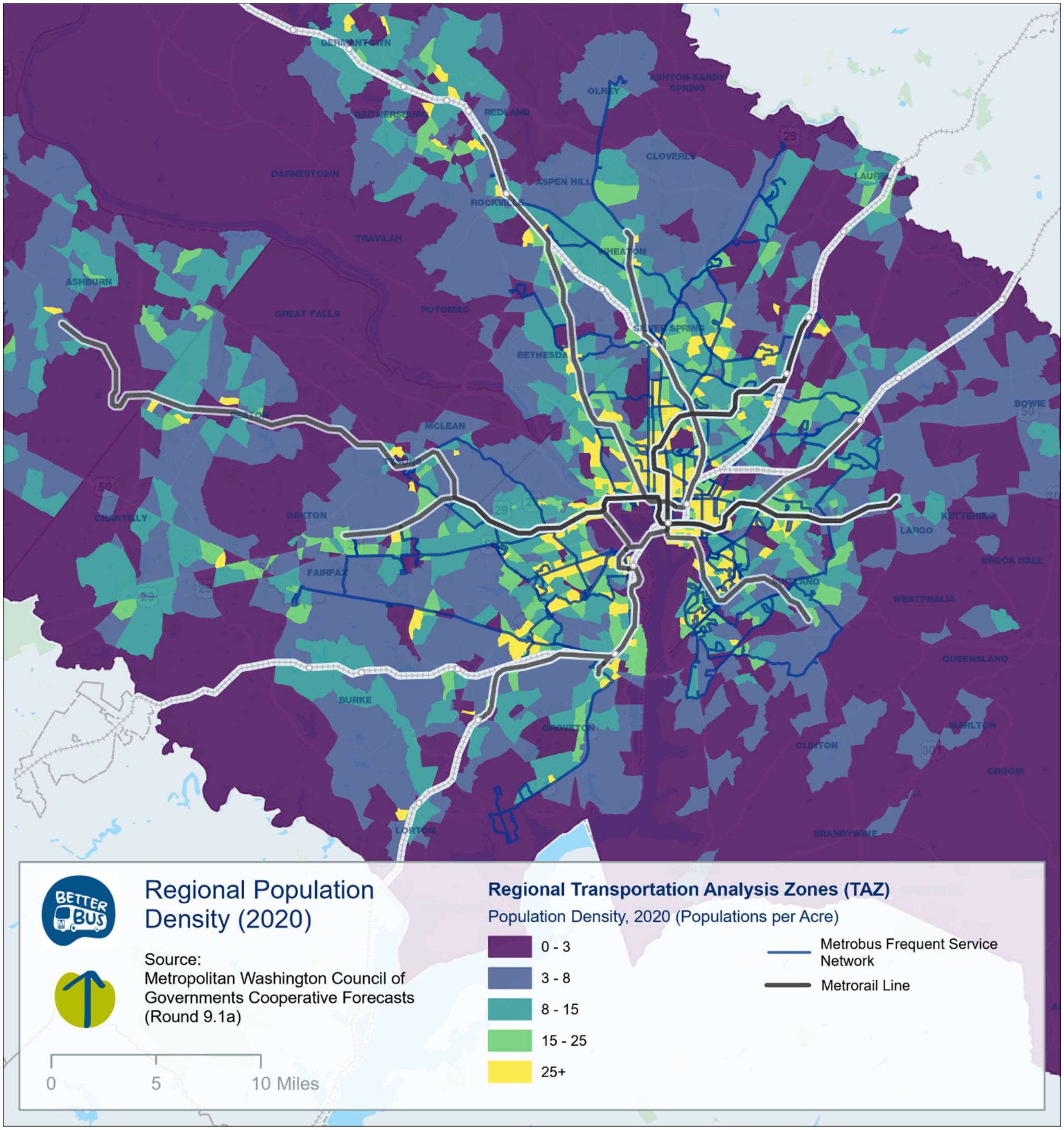


Figure 2: Forecast Regional Population Density, 2035

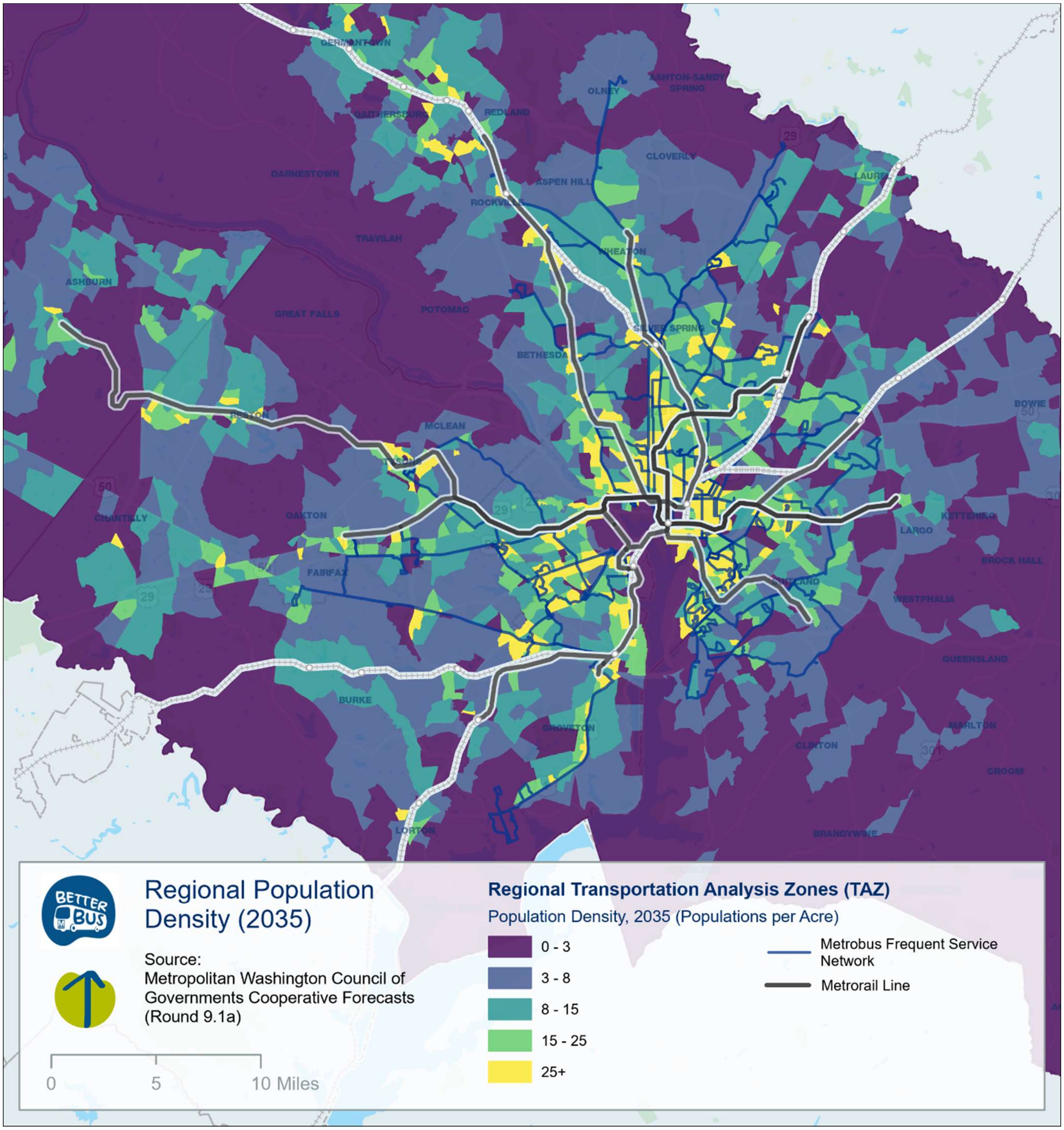


Figure 3: Regional Employment Density, 2020

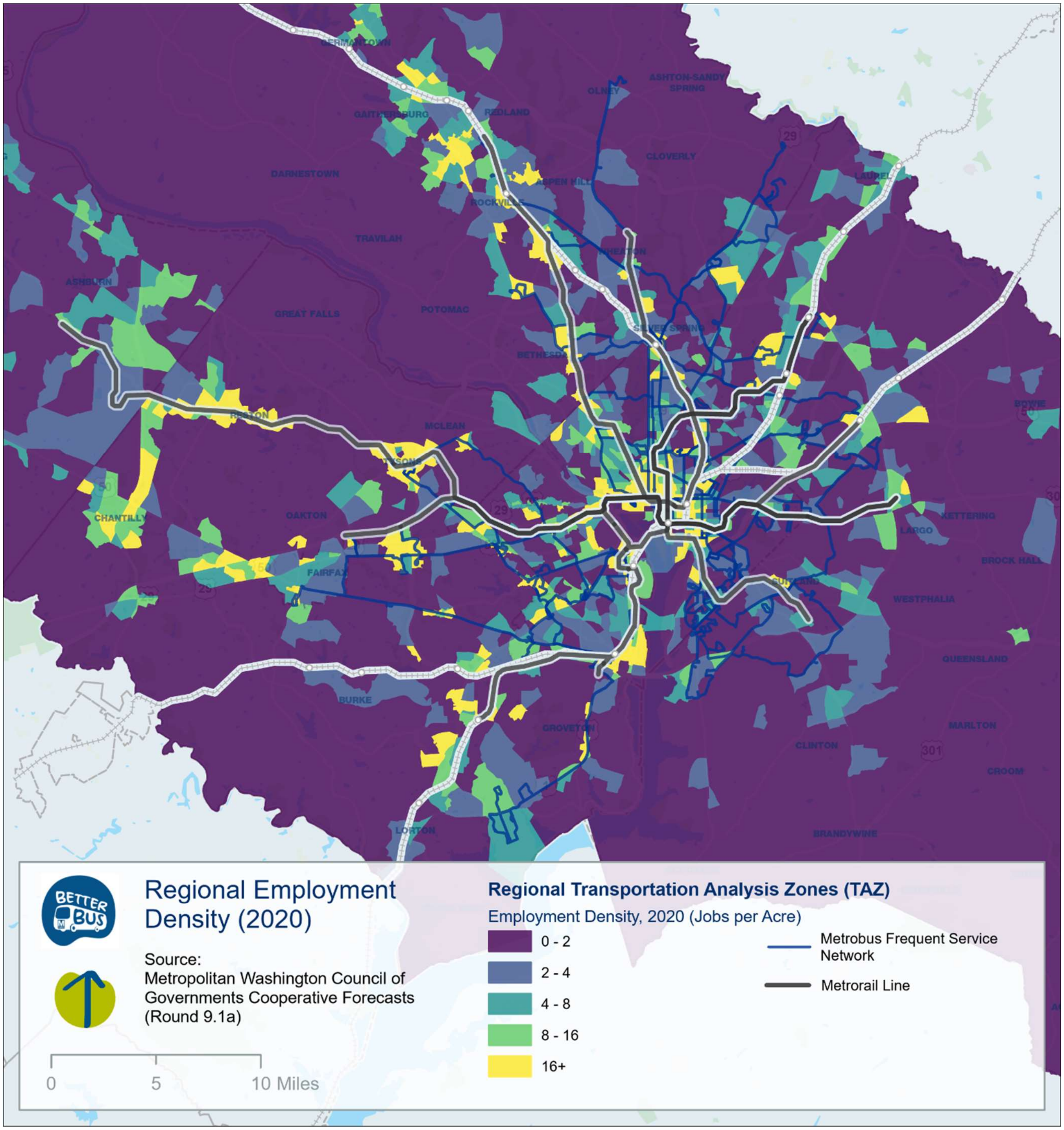
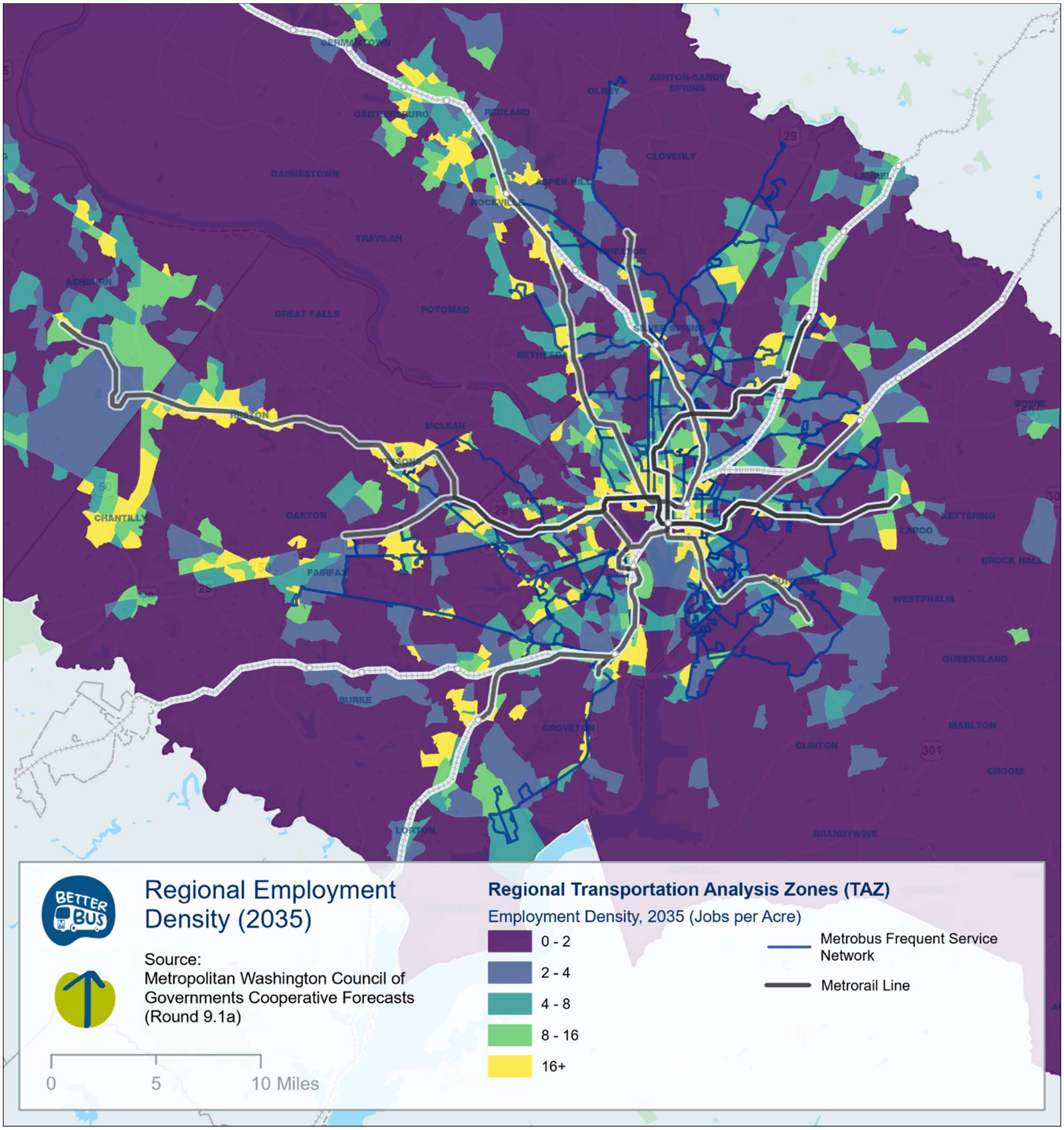


Figure 4: Forecast Regional Employment Density, 2035



Transit Potential

Transit potential is a density-based metric designed to capture an area's overall capacity to support fixed-route transit. It is calculated through summing the population and jobs per acre for each regional geography. Below we use the forecast population and jobs density figures in 2035 to calculate a future transit potential.

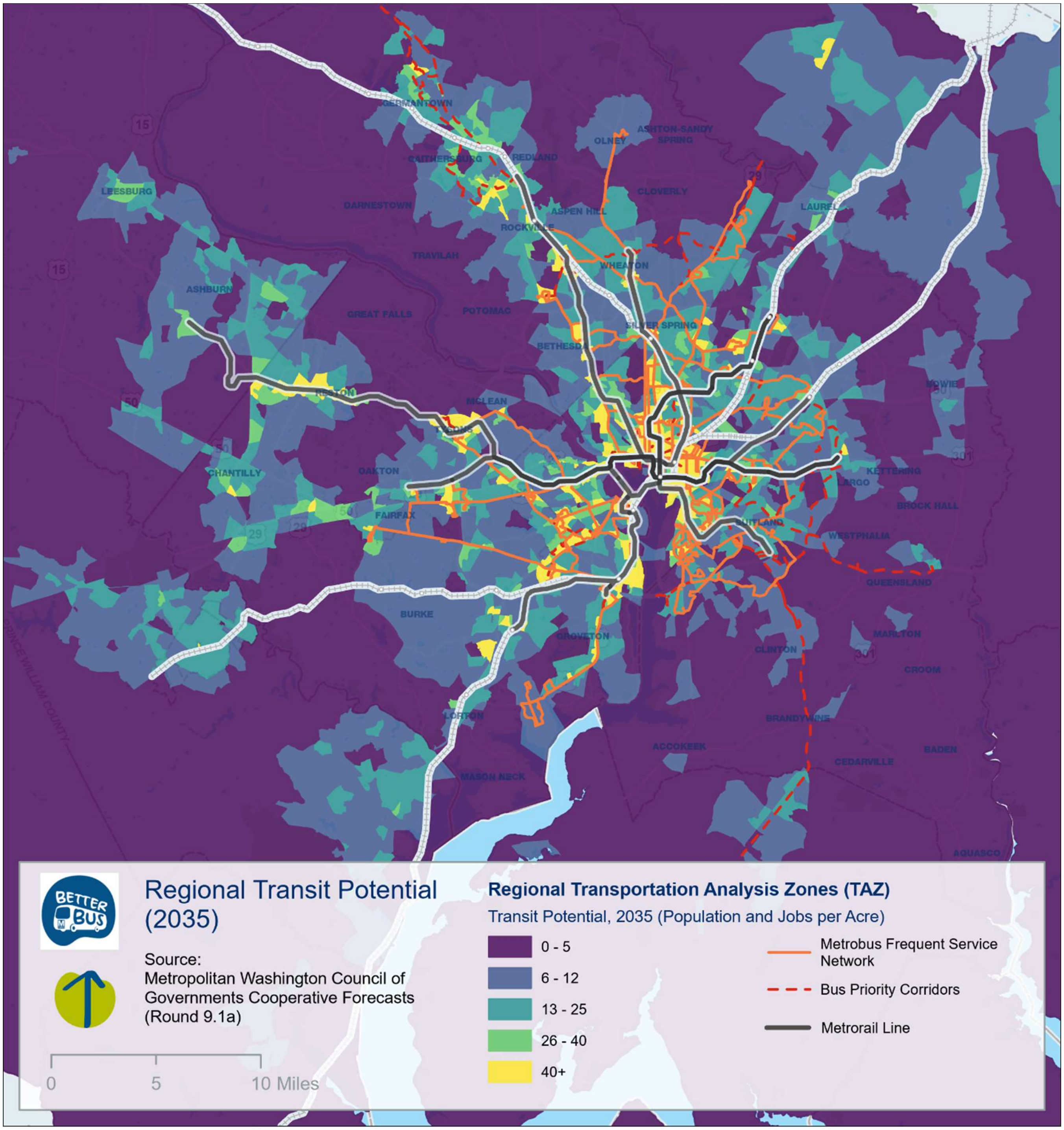
Data Sources

- Metropolitan Washington Council of Governments Cooperative Forecast series (Round 9.1a).

Results

Figure 5 details the regional transit potential for 2035 and is overlaid with the Metrobus Frequent Service Network and Bus Priority Corridors.

Figure 5: Forecast Transit Potential, 2035



Transit Propensity

Foursquare ITP's transit propensity application is a web-based tool to help planners classify geographies in a study area according to their transit propensity, defined as the likelihood of public transportation services being used in that geography if a reasonable transit option is available. The application relies on population, employment, and activity correlates of transit propensity found in the public transit literature.

The model ranks geographies within the study area according to the chosen measures and outputs four main transit propensity indices:

1. Transit-Oriented Population Origins
2. Commuter Origins
3. Employment Destinations
4. Activity Destinations

This model makes use of machine learning approaches to estimate variable weights, leading to improved transit propensity results. It relates stop-level ridership data to the relevant demographic, employment, and activity center variables of surrounding geographies, with additional steps to exclude observations that are not related to the chosen index.

For the Better Bus Initiative, the model has been calibrated using stop-level ridership data for all transit providers in the region, including Metrobus.

Data Sources

The model scores geographies in the WMATA Bus Compact Area according to each of the four transit propensity indices by assigning automatic weights to the contributing variables listed below in **Table 1**.

Table 1: Propensity Variables and Data Sources

Propensity Index	Contributing Variables Variable Description	Source
Transit Oriented Population (TOP) Origin Propensity	Population	ACS
	Population 65 and older	ACS
	Population under 18	ACS
	Population in Households with Income Less than 200 Percent of Poverty Line	ACS
	People of Color (non-white or Hispanic) population	ACS
	Zero-Car Households	ACS
	One-Car Households	ACS
	Civilian population age 18 and older with a disability	ACS
	Individuals 5 and older who speak English less than very well (Limited English Proficiency)	ACS
Commuter Origin Propensity	Population in the labor force age 16 and older	ACS
	Workers 16 and older who do not work at home	ACS
Employment Destination Propensity	Total Jobs	LEHD

Propensity Index	Contributing Variables Variable Description	Source
Activity Destination Propensity	Retail jobs	LEHD
	Restaurant jobs	LEHD
	Education Jobs	LEHD
	Entertainment/Recreation Jobs	LEHD
	Healthcare/Social Assistance Jobs	LEHD
	Public Administration jobs	LEHD

Results

Figure 6 thru **Figure 9** illustrate the various propensity analyses at a regional level.

Figure 6: Transit-Oriented Population Origins Propensity Index.

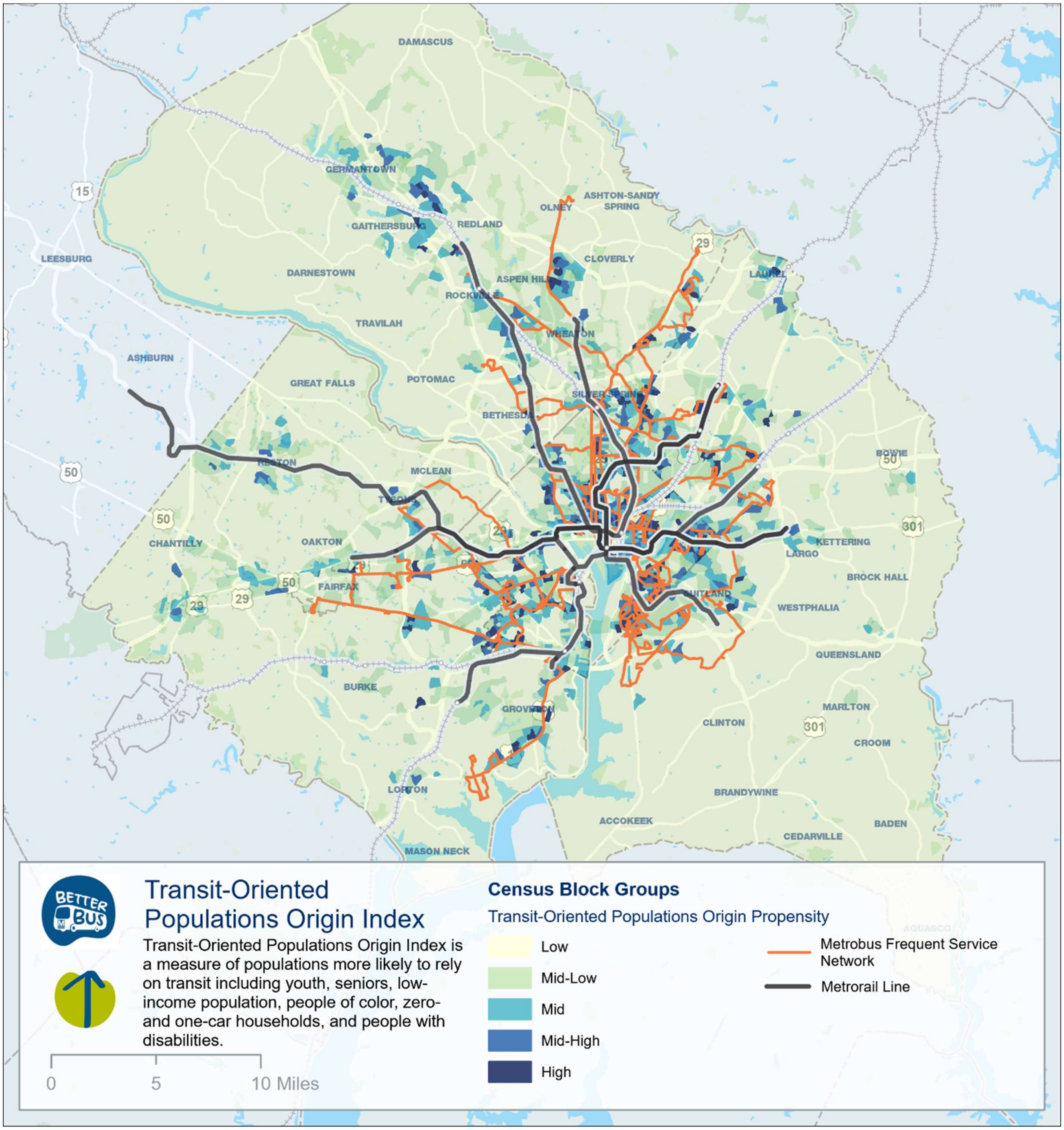


Figure 7: Commuter Origins Transit Propensity Index.

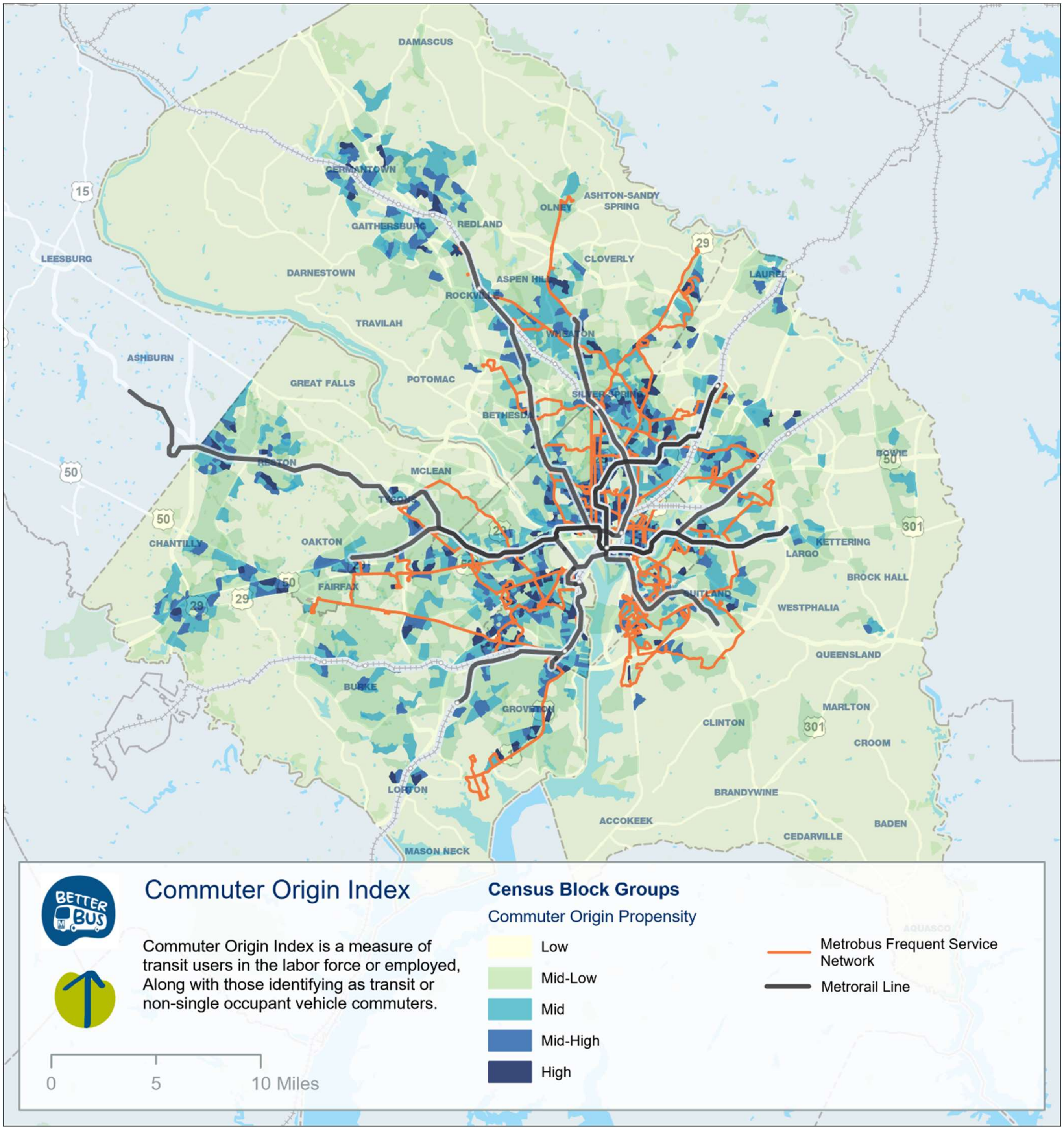


Figure 8: Activity Destinations Transit Propensity Index.

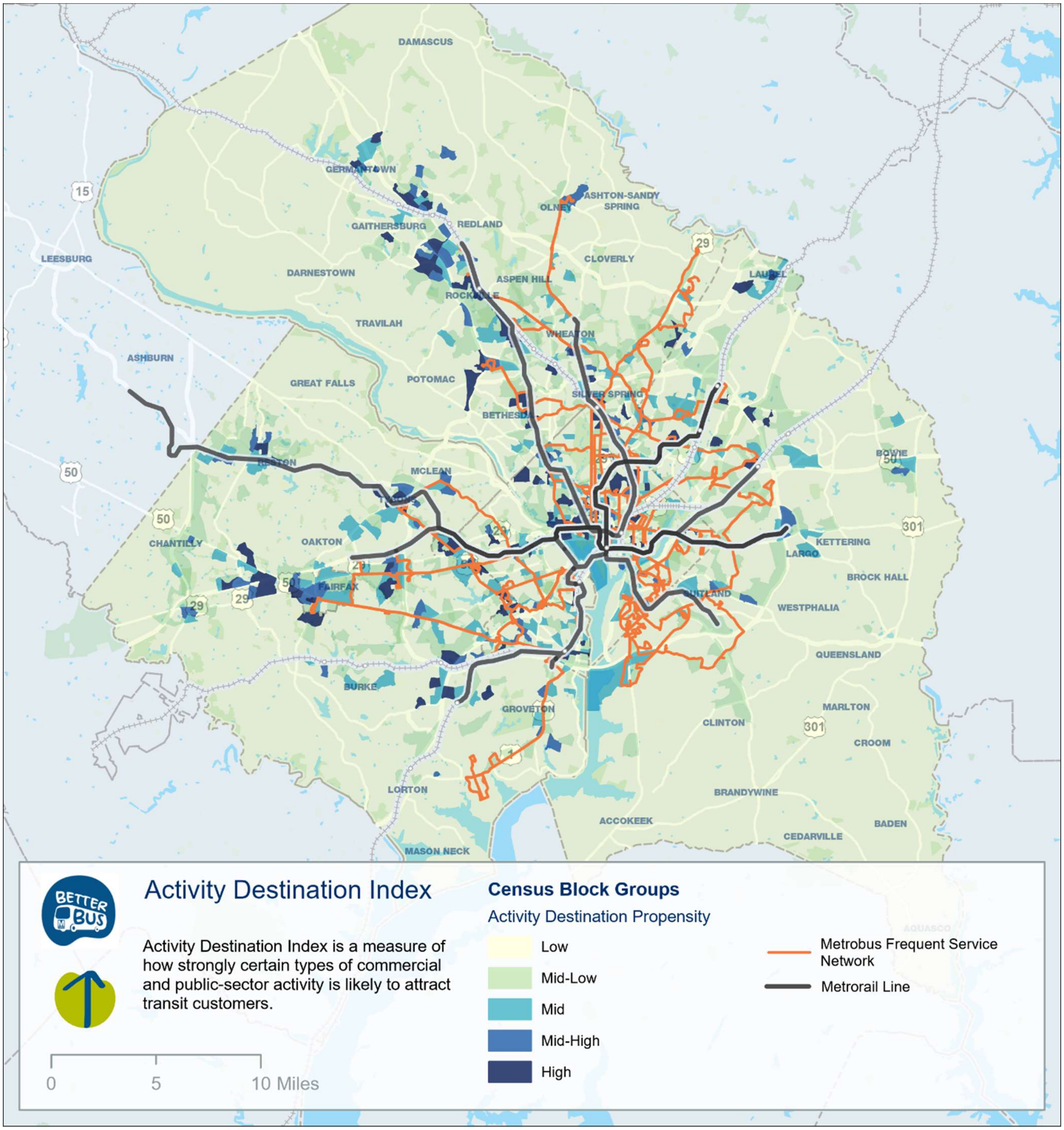
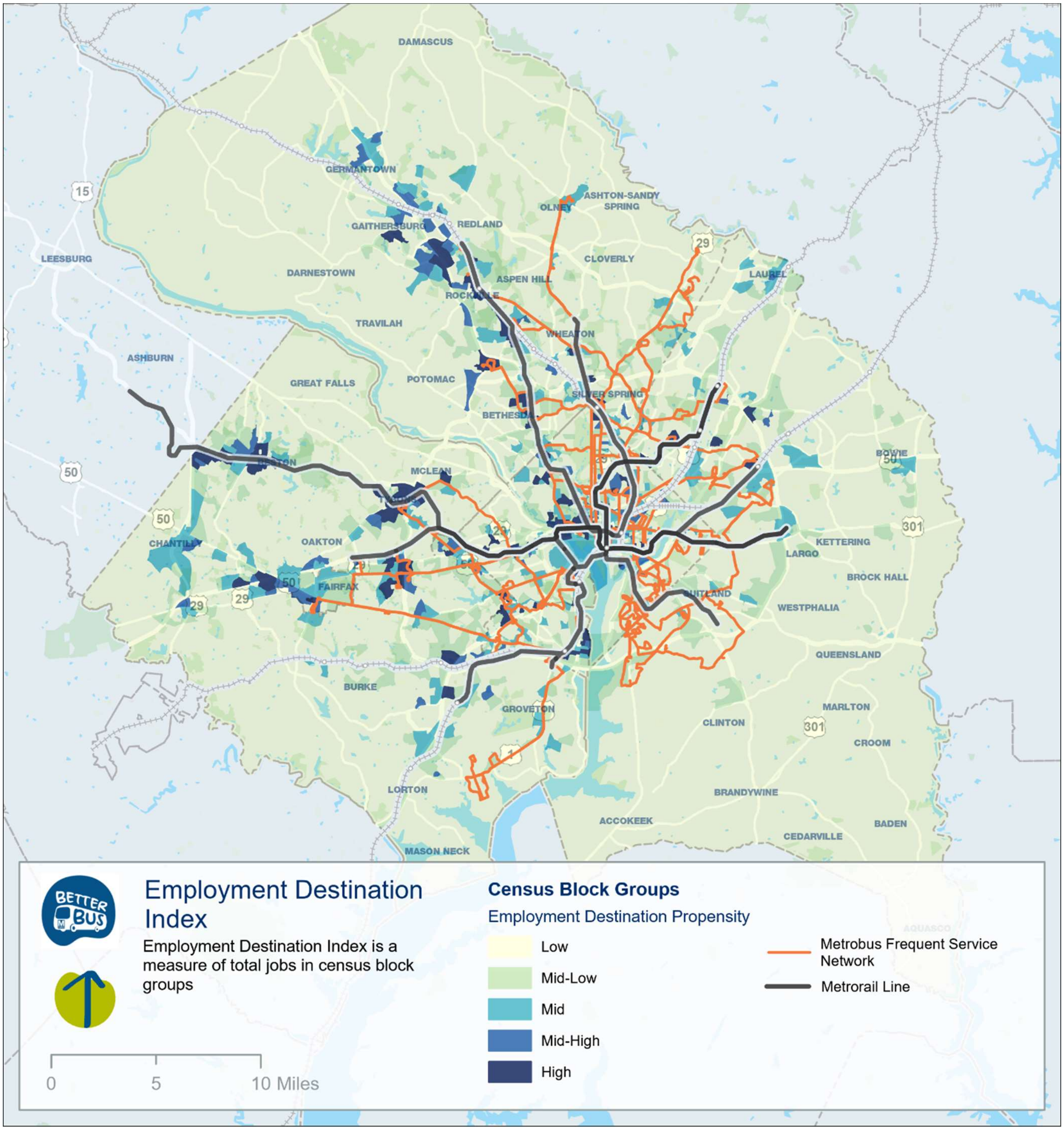


Figure 9: Employment Destinations Transit Propensity Index.



Demographic Analysis

American Community Survey (ACS) estimates were used to report the distribution of populations of interest in the Metrobus service region. The definitions of the demographic variables are as reported above in the transit propensity model inputs table.

Data Sources

- ACS Data

Results

Three population groups were mapped out: Low-Income (**Figure 10**), People of Color (**Figure 11**) and Person with a Disability (**Figure 12**).

Figure 10: Low-Income Population

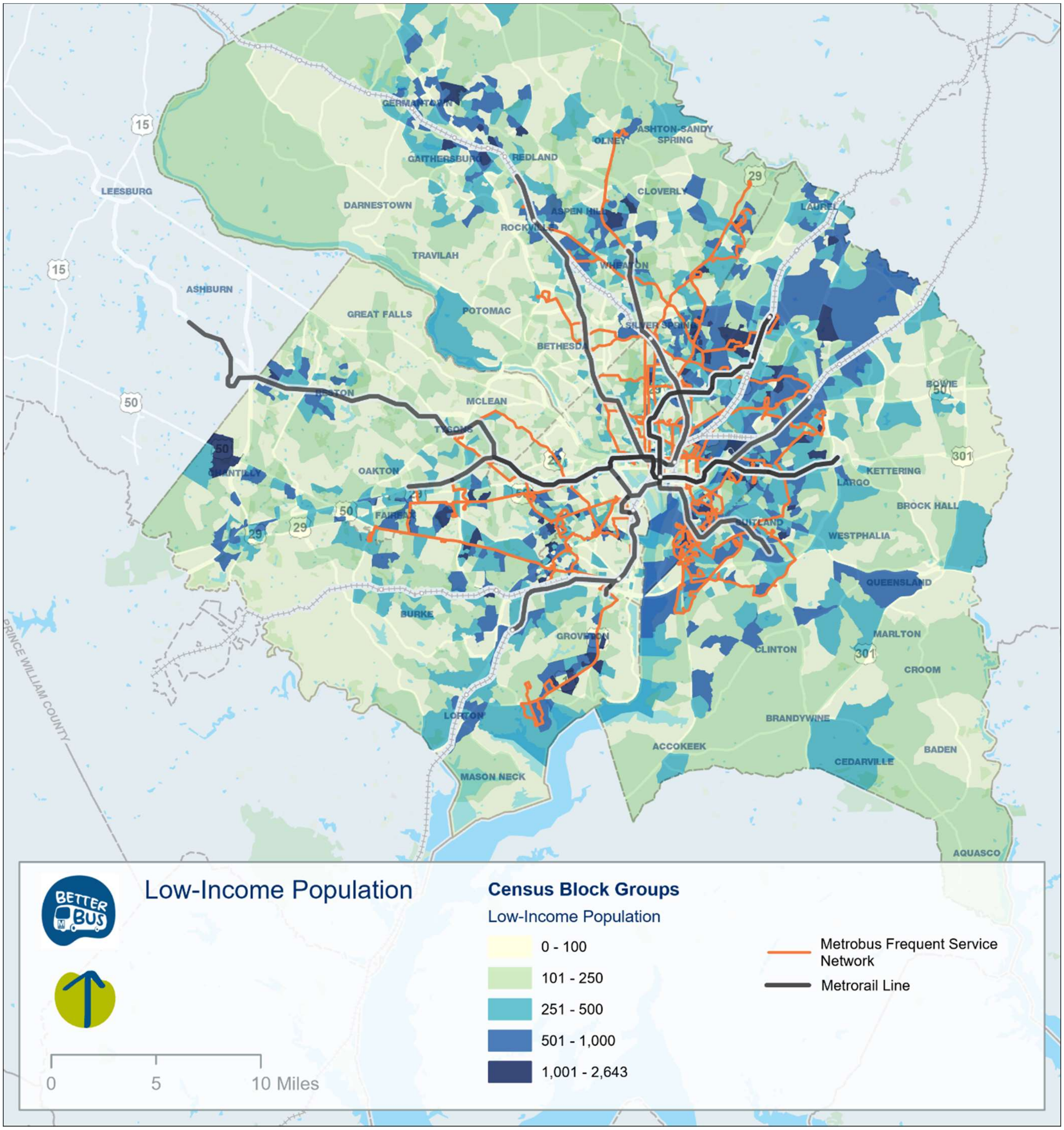


Figure 11: People of Color

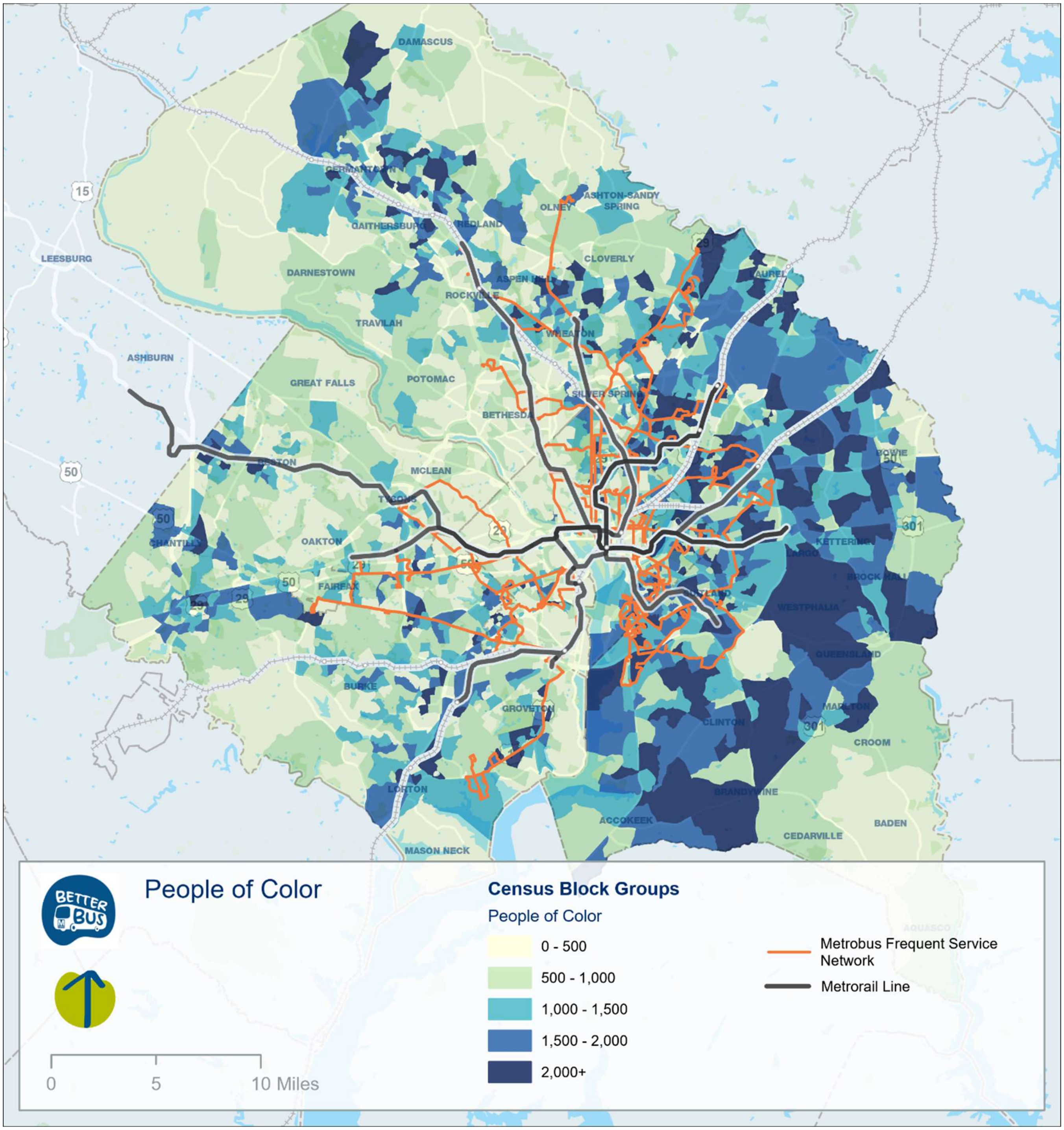
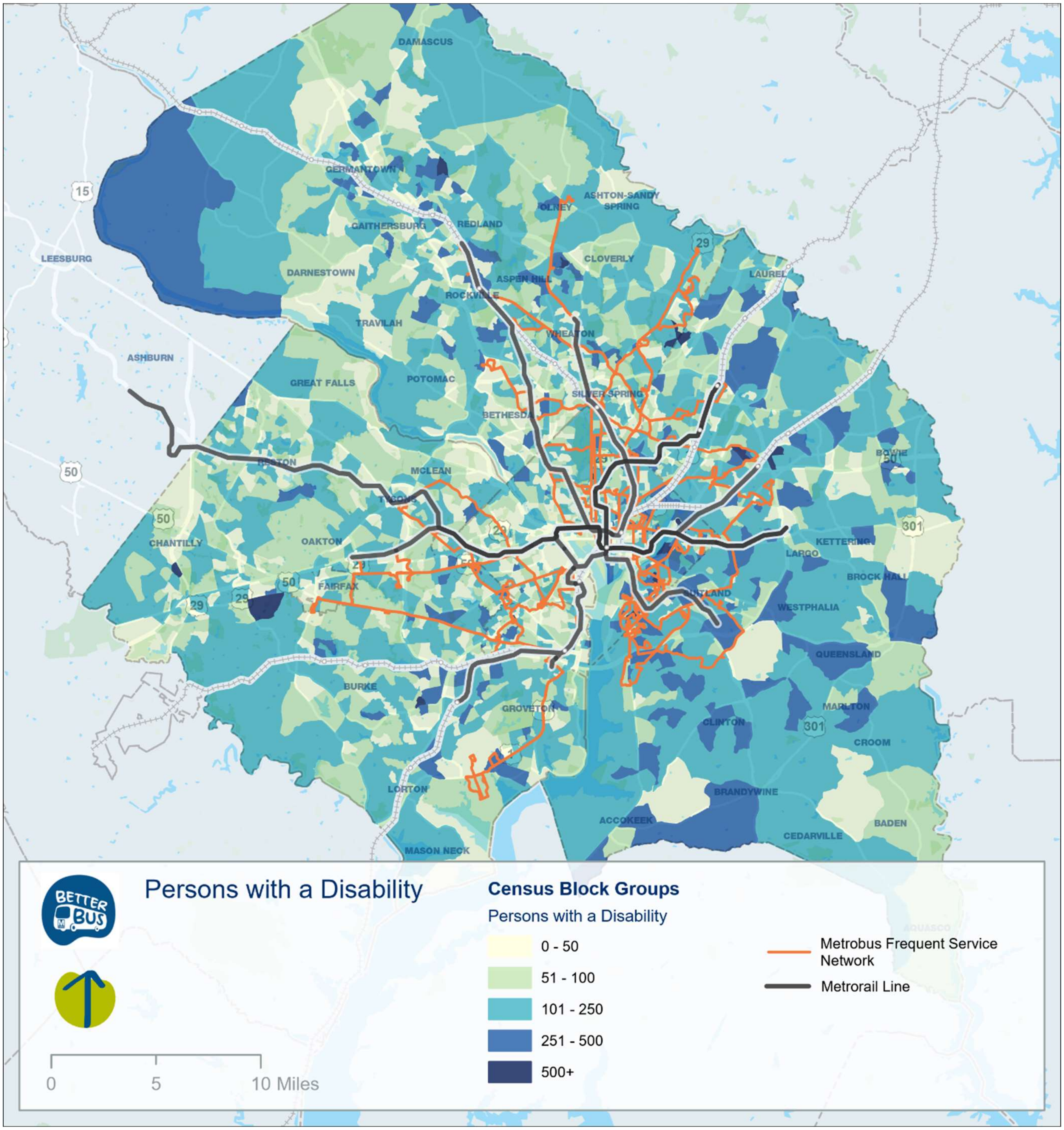


Figure 12: Persons with a Disability



Travel Demand

A roadmap to processing raw cellphone data records (CDR) data is provided by National Cooperative Highway Research Program (NCHRP) Report 868. LOCUS data is collected through a multitude of apps on smartphones providing location-based services (LBS), which are anonymized to protect privacy of the users. These data have high-fidelity spatial and temporal attributes which allow for detailed travel pattern analysis. The processing of LOCUS data begins by extracting activity stays from the raw data and then inferring trip ends. Home and work locations are then inferred and finally the data are filtered to remove records with incomplete or insufficient information.

Trip Purpose

Trip purpose is based on the inferred location types of the trip ends. Location types are inferred from the LBS data such that "Home" refers to the location that the device is at most often during nighttime hours, "Work" is the most common (or regular) location of the device during traditional business or school hours, and "Other" is any other location. While all valid devices are assigned a home location, not all have a work location (representing non-workers, non-students). Also, these definitions may flip the tags for home and regular locations for people who work non-standard hours (home is tagged as work, and vice-versa) – but the trip is successfully captured and accurately labeled as a "home-work" trip. Other trip purposes include "home-other", "work-other", and "other-other".

Transit Modes

Transit refers to all bus and rail operators in the region (Metrorail, Metrobus, and Regional Operators), while "bus" refers to all bus providers in the region (Metrobus and Regional Operators).

Equity Focus Communities and Low-Income Communities

Equity Focus Communities (EFC) are Census Block Groups identified by Metro to have the highest concentrations of low-income households, people of color, and disabled persons (**Figure 13**). These include approximately 30 percent of the region's population. Low Income Communities (LIC) are Census Block Groups having 31 percent or more households classified as low-income households (annual household income less than 200 percent of the federal poverty line), as shown in **Figure 14**. EFC and LIC tags are applied to the data based on the inferred home location of the devices and are propagated to all trips made by those devices – so any trip made by devices residing in these communities are labeled as EFC/LIC trips, even if one or both ends of the trip are not in an EFC or LIC. *Note that LIC travel is not reflective of all low-income travel, but only a snapshot of travel by residents of these select LICs.*

Figure 13: Equity Focus Communities

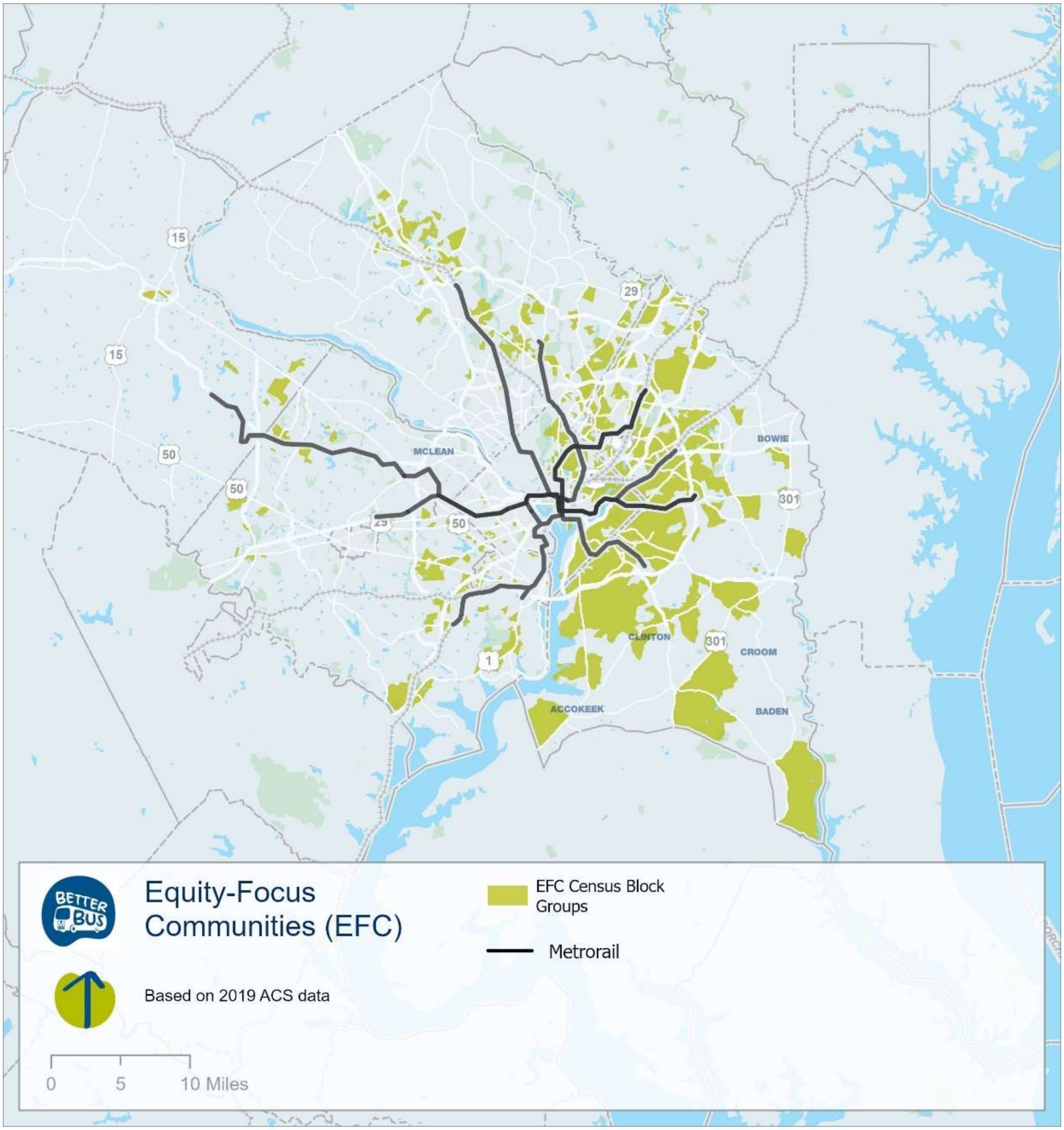
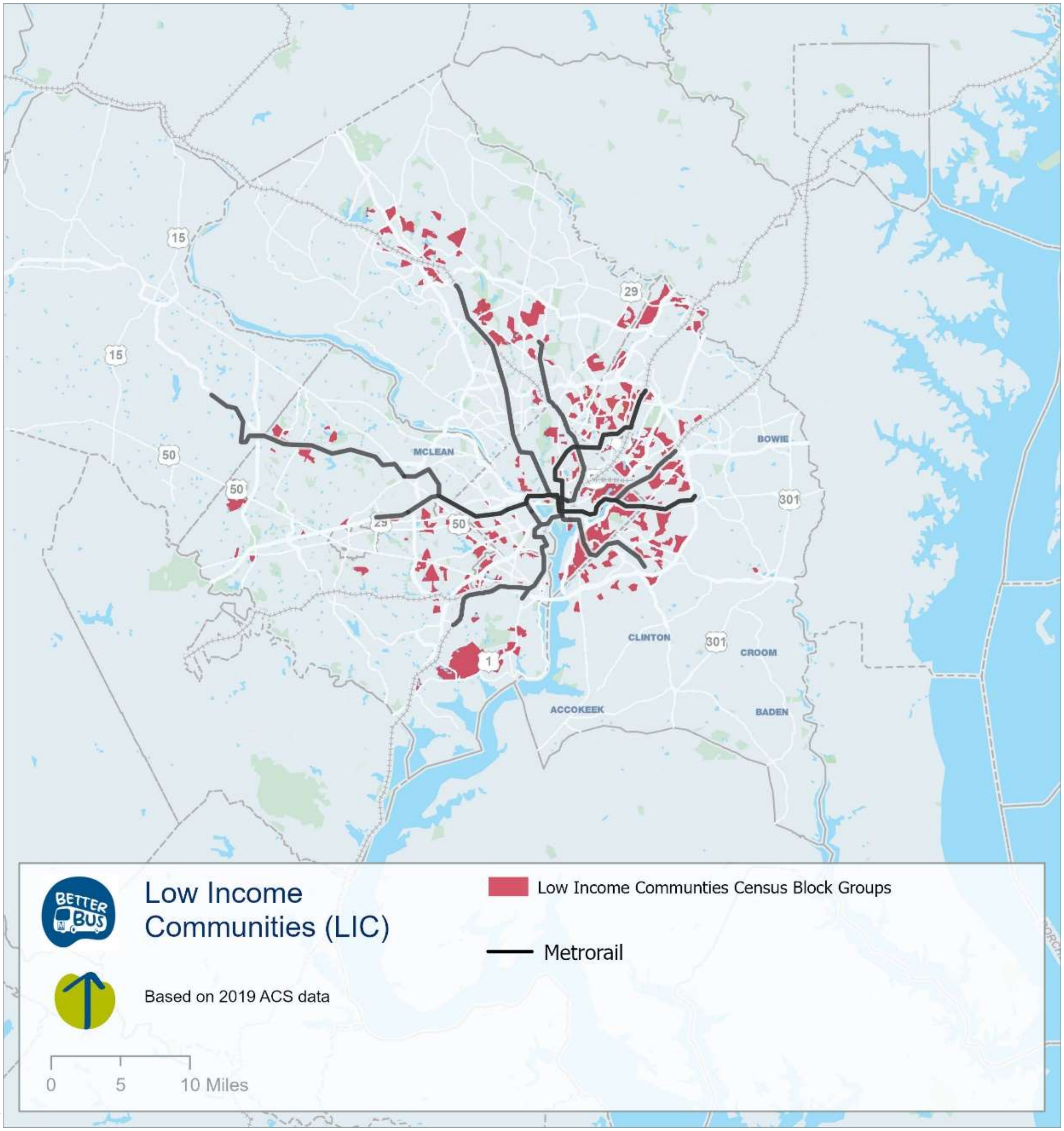


Figure 14: Low-Income Communities



`

Data Sources

- 2019 LOCUS Data (for overall travel patterns - covers motorized and non-motorized modes)
- 2019 WMATA ODX (Trace) Data (for transit travel patterns – covers modes Metrorail and Metrobus)
- 2019 NTD data for Regional Operators scaled to Trace data
- Census data (for expansion and equity tagging)

Data Privacy and Protecting Personal Identifiable Information

Data privacy is a top priority for LOCUS data products. All data are stripped of any Personal Identifiable Information (PII) even before it flows down to LOCUS servers from the data vendors, and hence the data cannot be linked to a cell phone number or an individual. Data are only collected from apps where people have explicitly opted in for location tracking. Further, all data shared via the LOCUS license are aggregated across spatial and temporal dimensions to add an additional layer of privacy protection. Whenever there is a choice to be made between privacy and accuracy, privacy is chosen.

Results

Table 2 to **Table 5** show the total and transit travel demand by purpose, travel by various communities, as well as the trip length distribution.

Table 2: Total Trips and Transit Trips by Trip Purpose

Trip Purpose	Total Trips	Transit Trips	Transit Share
Home-Work	2,332,487	452,795	19%
Home-Other	5,944,382	165,065	3%
Work-Other	1,441,654	65,307	5%
Other-Other	3,200,789	148,644	5%
Total	**12,919,313**	**831,812**	**6%**

Table 3: Total Trips and Transit Trips by Low-Income Community

Community	Total Trips	Transit Trips	Transit Share	Transit Share of Low-Income Community compared to all Transit Trips
Low-Income Community	2,489,630	191,731	8%	23%
Not Low-Income Community	10,429,683	640,081	6%	
Total	**12,919,313**	**831,812**	**6%**	

Table 4: Total Trips and Transit Trips by Equity Focus Communities

Community	Total Trips	Transit Trips	Transit Share	Transit Share of Equity Focus Community compared to all Transit Trips
Equity Focus Community	3,645,756	264,809	7%	32%
Not Equity Focus Community	9,273,557	567,002	6%	
Total	**12,919,313**	**831,812**	**6%**	

Table 5: Trip Length Distribution

Trip Distance	Total Trips	Transit Trips	Total Share	Transit Share
Less than 1 mile	2,779,952	75,764	22%	9%
1 to 2.5 miles	2,653,438	150,817	21%	18%
2.5 to 5 miles	2,553,046	182,975	20%	22%
5 to 7.5 miles	1,504,092	110,840	12%	13%
7.5 to 10 miles	1,000,588	77,660	8%	9%
10 to 15 miles	1,180,191	98,566	9%	12%
15 to 25 miles	943,767	105,565	7%	13%
25 to 50 miles	301,459	29,621	2%	4%
More than 50 miles	2,780	3	0%	0%
Total	**12,919,313**	**831,812**	**100%**	**100%**

Figure 15 through **Figure 21** provide a spatially granular look at travel demand in the region and also travel by time of day. Unless specified, the figures represent travel on an average day (Monday thru Sunday). Weekday statistics represent the daily travel on a typical weekday (Monday thru Thursday), while weekend statistics represent daily travel on a typical weekend day (Saturday thru Sunday).

Figure 15: Weekday Total Trip Density by Origin

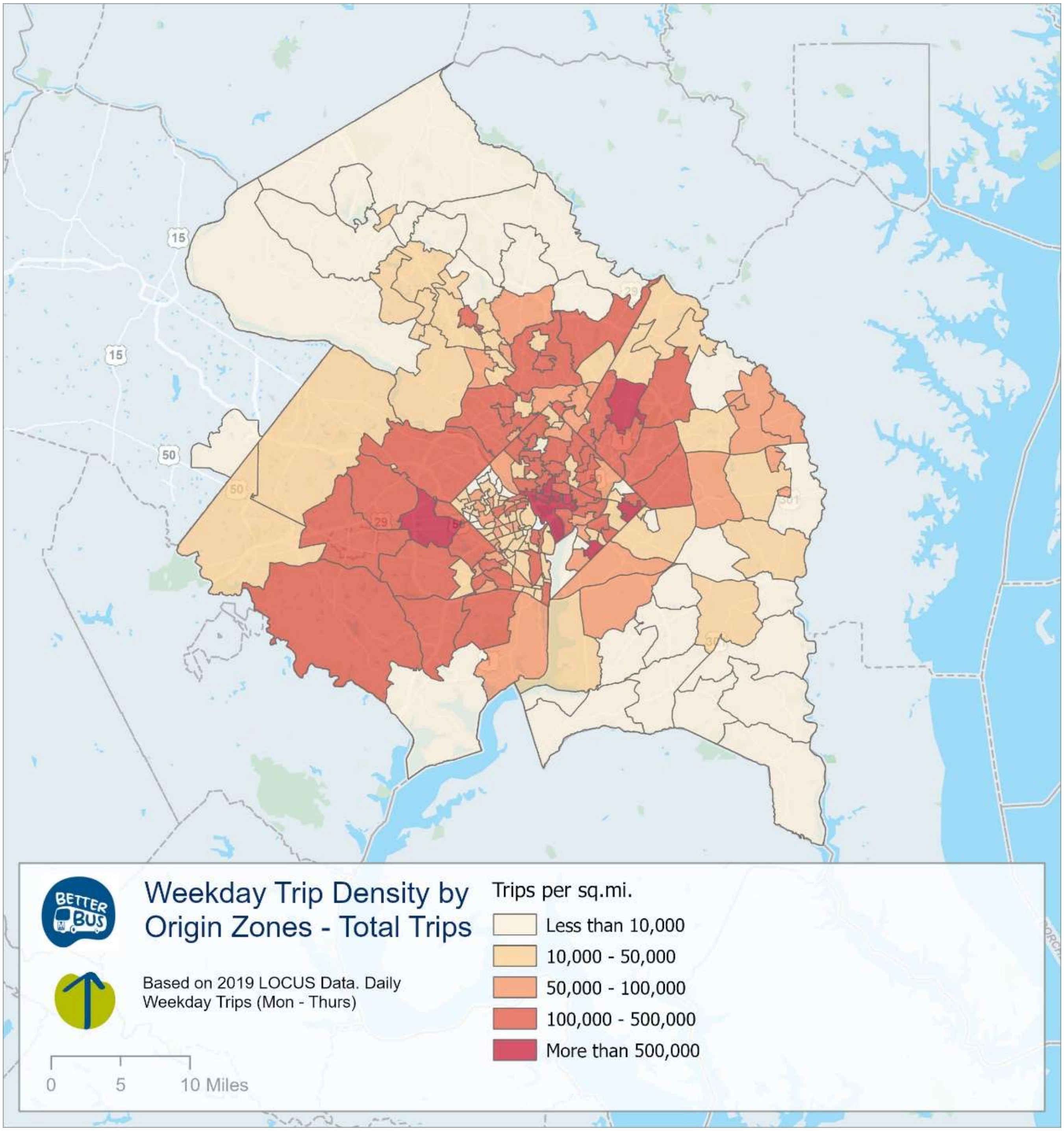


Figure 16: Weekend Total Trip Density by Origin Zones

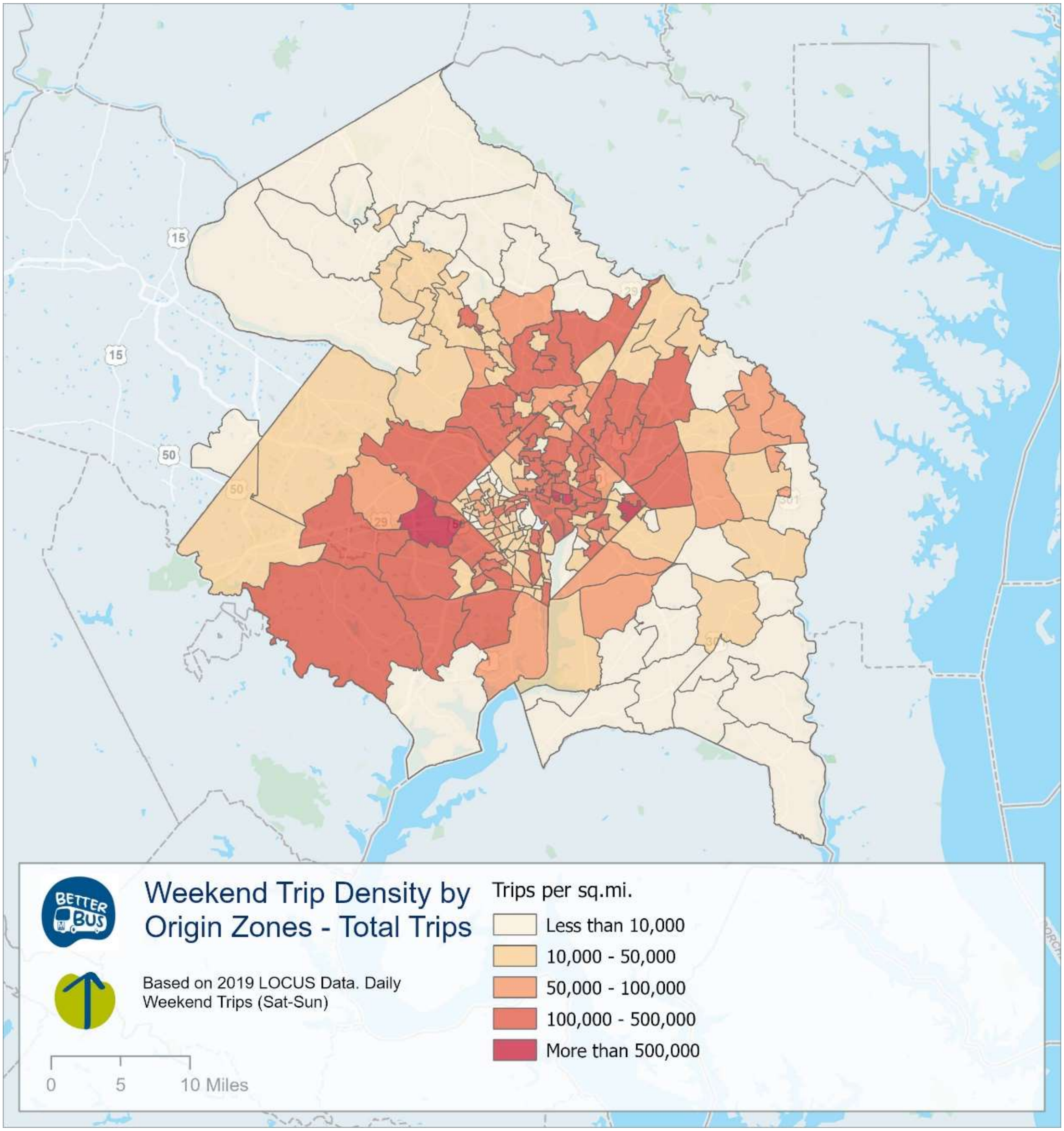


Figure 17: Transit Trip Density by Origin Zones

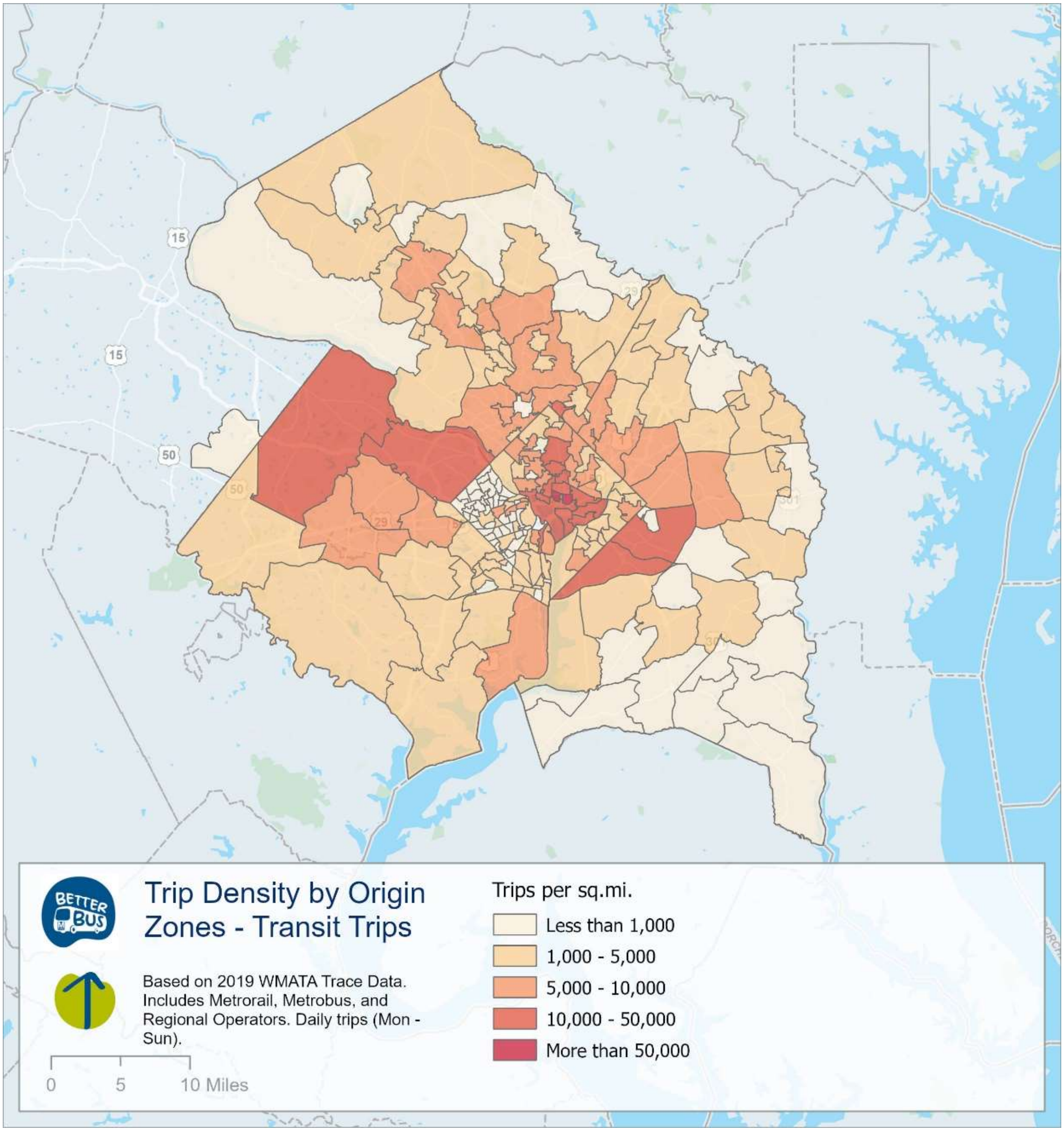


Figure 18: Weekday Trips by Time of Day

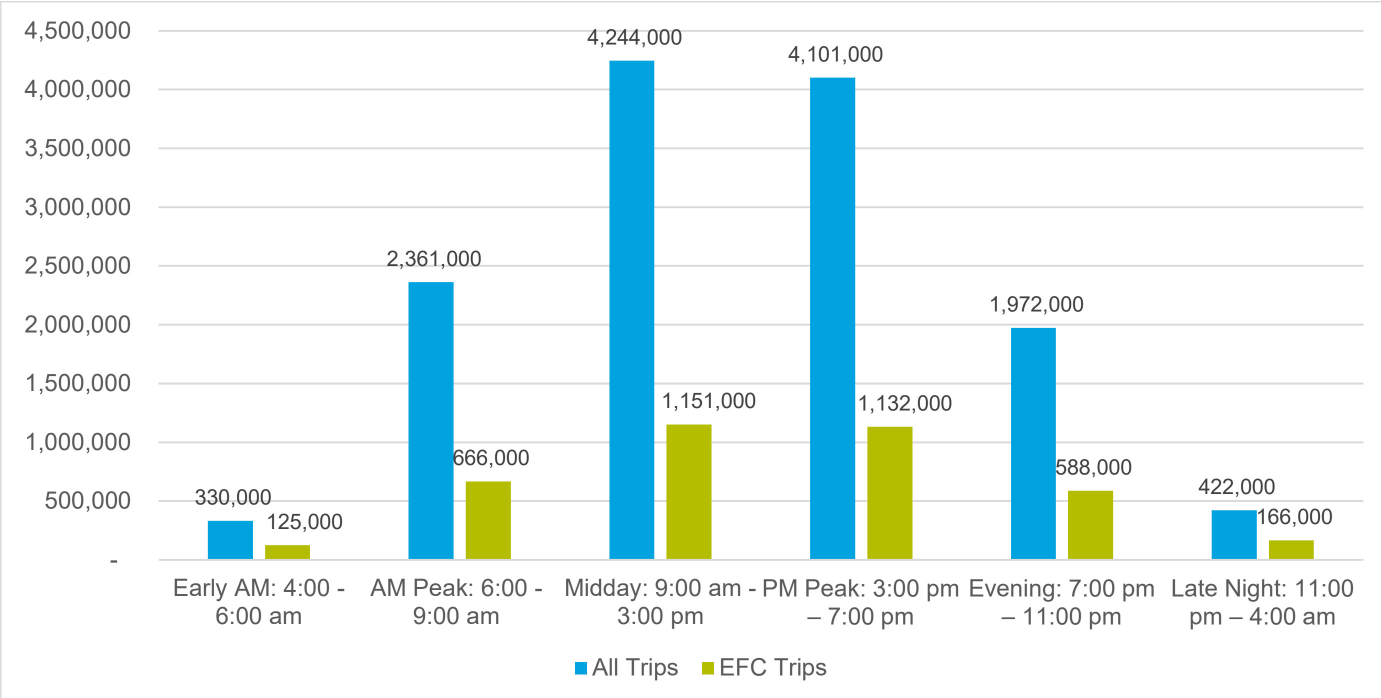


Figure 19: Weekend Trips by Time of Day

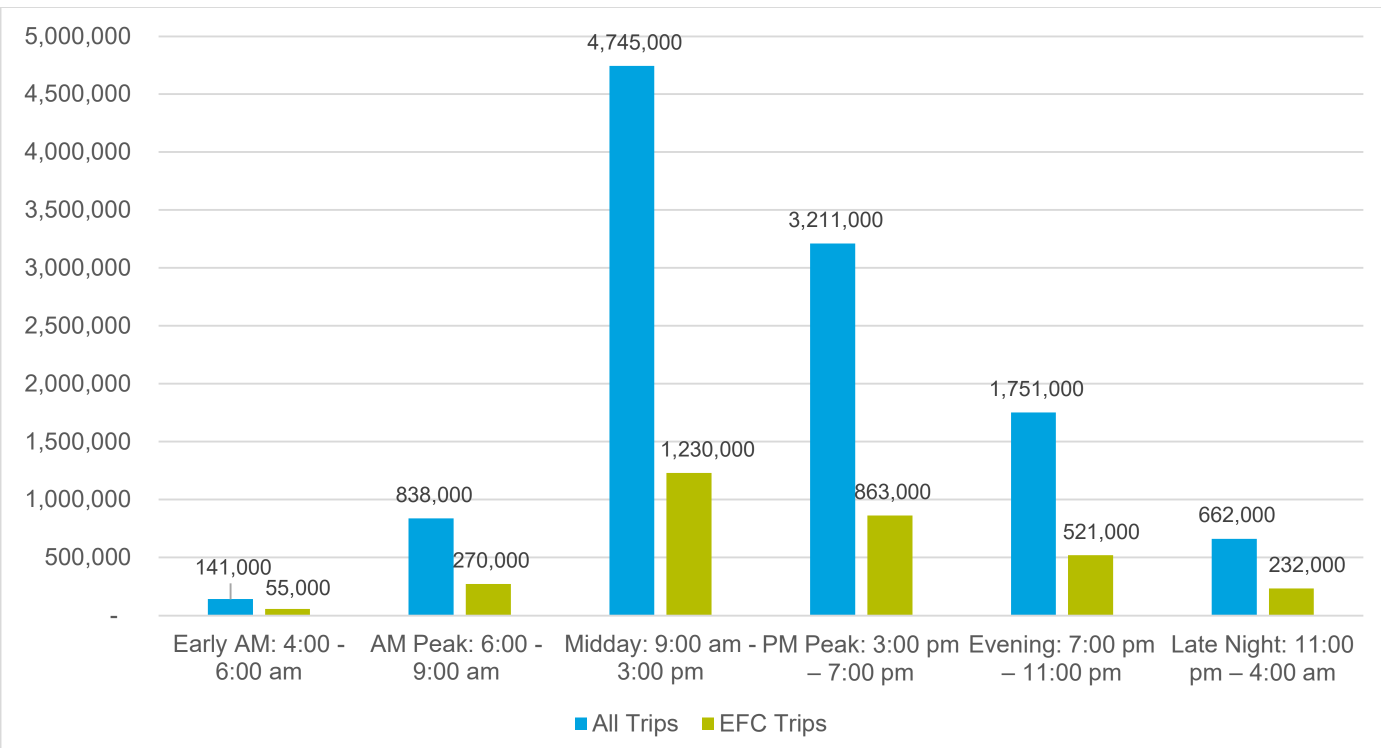


Figure 20: Weekday Total Trip Density by Origin Zones - Travel by Residents of Equity Focus Communities (EFC)

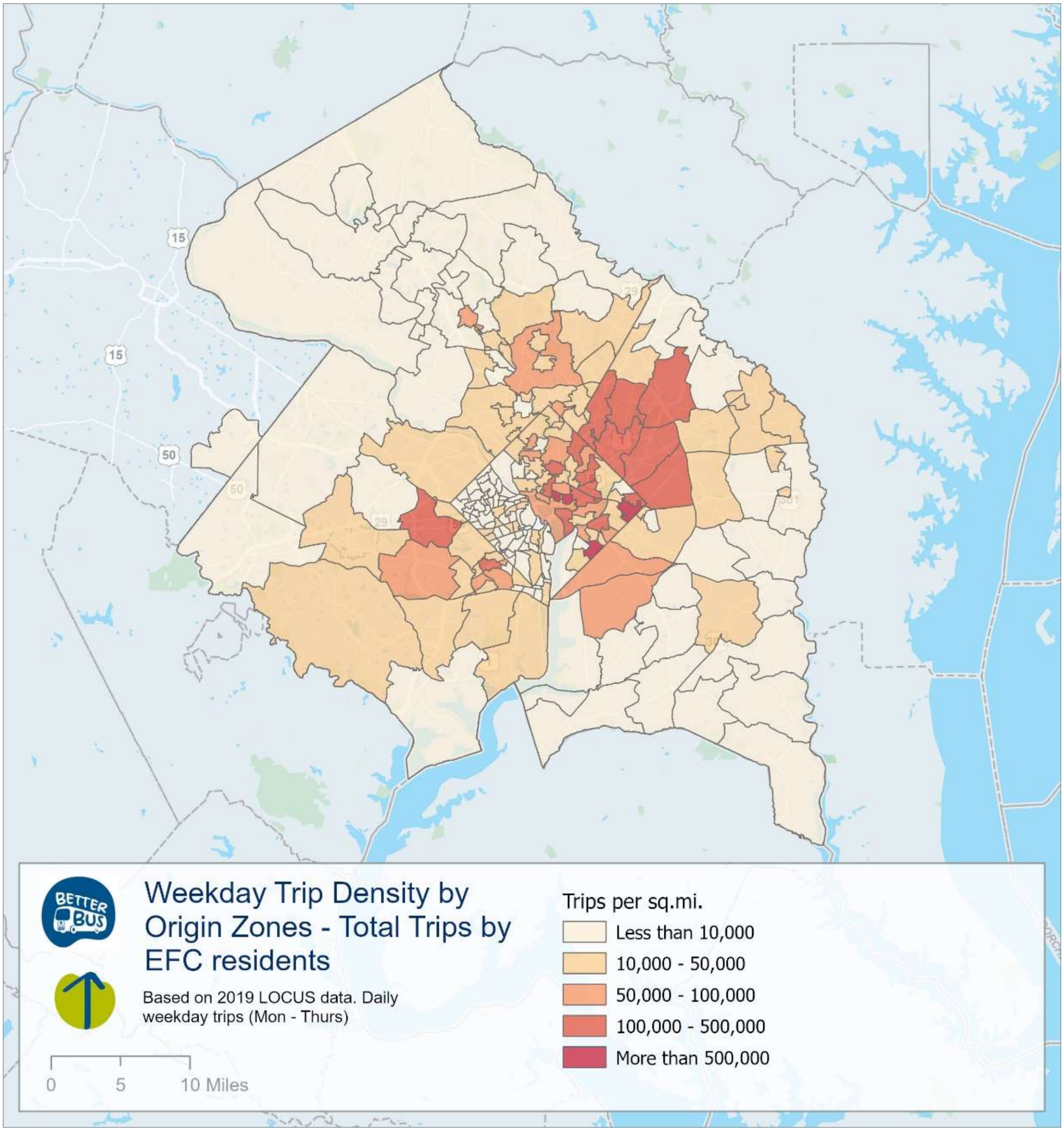


Figure 21: Weekend Total Trip Density by Origin Zones - Travel by Residents of Equity Focus Communities (EFC)

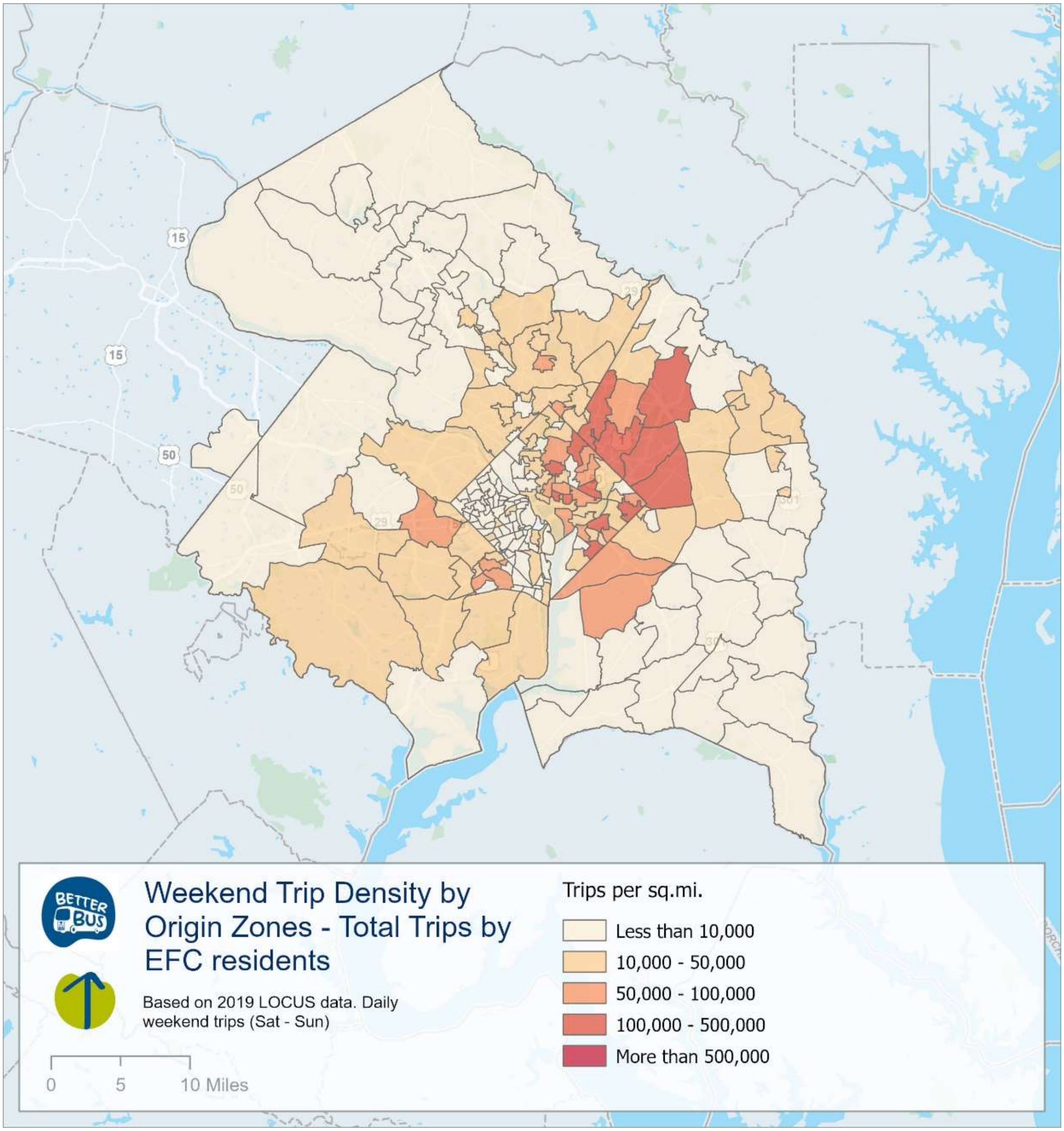


Figure 22 to **Figure 24** focus on trip length distributions, trip purpose, and transfers for all trips, transit trips, and bus trips. The total number of trips was 12,919,313, the total number of transit trips was 831,812, and the total number of bus trips was 367,903.

Figure 22: Trip Length Distribution

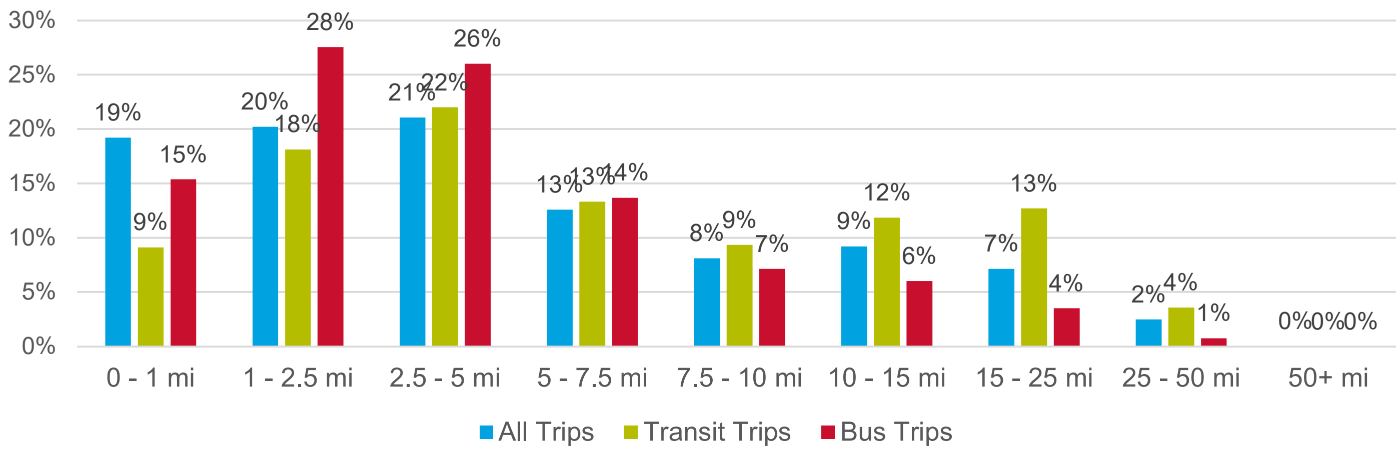


Figure 23. Trip Distribution by Purpose

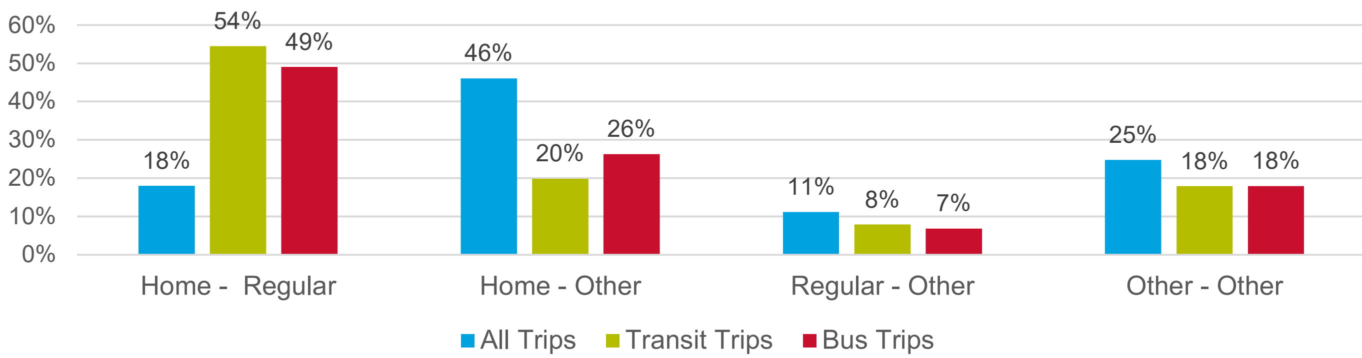
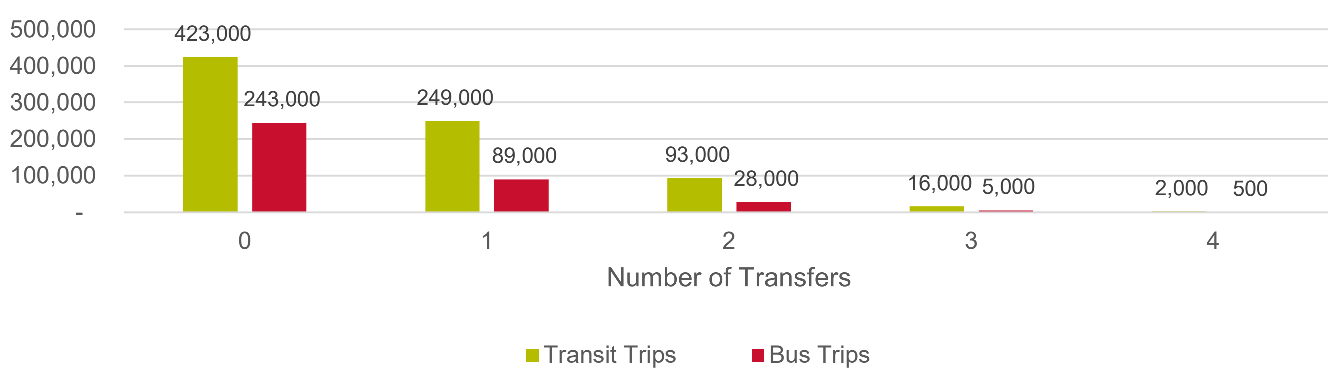


Figure 24. Number of Transfers



Travel Time Convenience

To understand how people are choosing to move throughout the Washington DC region, an in-depth analysis was conducted on transit mode share. This was paired with an analysis comparing transit travel time to auto travel time, to create a travel time ratio (TTR) that was used to assess the various types of travel markets. Travel time ratios (transit travel time/drive time) are used as an indicator of relative convenience of transit – the longer it takes to accomplish a given trip on transit compared to driving, is perceived as less convenient by the traveler.

To accommodate the large-scale nature of the LOCUS and Trace datasets, and to make it easier to understand travel demand and provide market assessments, the region was grouped into geomarkets (49) using a clustering algorithm based on a multi-dimensional similarity score that takes in socio-economic compositions (percent of population that is low income, percent of population that are people of color) and travel intensities (total trips originating or ending), and fine-tuned based on professional judgements and local knowledge. Details of this methodology are documented in a separate Geomarkets Methodology memo.

Once the geomarkets were identified, the next step was to summarize for each travel market (based on Origin Geomarket, Destination Geomarket, Time of Day, Day of Week etc.) total trips and transit trips, transit mode share, the average travel time ratio, and the percent of peak and commute trips for each geomarket pair. Using the travel time ratio and transit mode share (and total travel as a filter), travel markets are classified into four categories:

- Successful Markets: Encompasses areas with good mode share and convenient transit options (TTR is low).
- Untapped Markets: Encompasses areas with low mode share and inconvenient transit options (TTR is high).
- Underserved Markets: Encompasses areas with good mode share and inconvenient transit options (TTR is high).
- Markets that Need Improvement: Encompasses areas with low mode share and convenient transit options (TTR is low).

Furthermore, for each travel market, a drill-down to the itinerary level is provided to diagnose the reasons for lack of convenient transit options by decomposing the top route itineraries into individual travel time components (access, egress, transfers, in-vehicle, wait times) and key contributors to lack of competitiveness are identified. Additional details can be found in a separate Transit Competitiveness Methodology memo.

Estimating Travel Times and Best Path

In order to understand the relative convenience of transit trips compared to driving, disaggregate trip level data (using start and end latitude/longitudes and actual start/stop times) were routed through specialized routing engines that generated:

1. Best transit itineraries for walk or for drive access by different modes (all transit, bus only, or rail only). Itineraries include detailed decompositions of the transit journey such as times of each component of the trip– access, wait, in-vehicle, transfer (walk and wait), and egress – and number of transfers.
2. Congestion adjusted drive times and drive distances.

The results are summarized at the geomarket level to identify areas with gaps in transit service.

Data Sources

- 2019 LOCUS Data (for overall travel patterns - covers motorized and non-motorized modes)

- 2019 WMATA Trace Data (for transit travel patterns – covers modes Metrorail, Metrobus, and Regional Operators)
- 2019 GTFS schedules
- Census data (for expansion and equity tagging)

Results

Figure 25 to **Figure 27** show the transit mode share for different days of the week by origin geomarket.

Figure 25: Weekday Transit Mode Share by Origin Geomarket

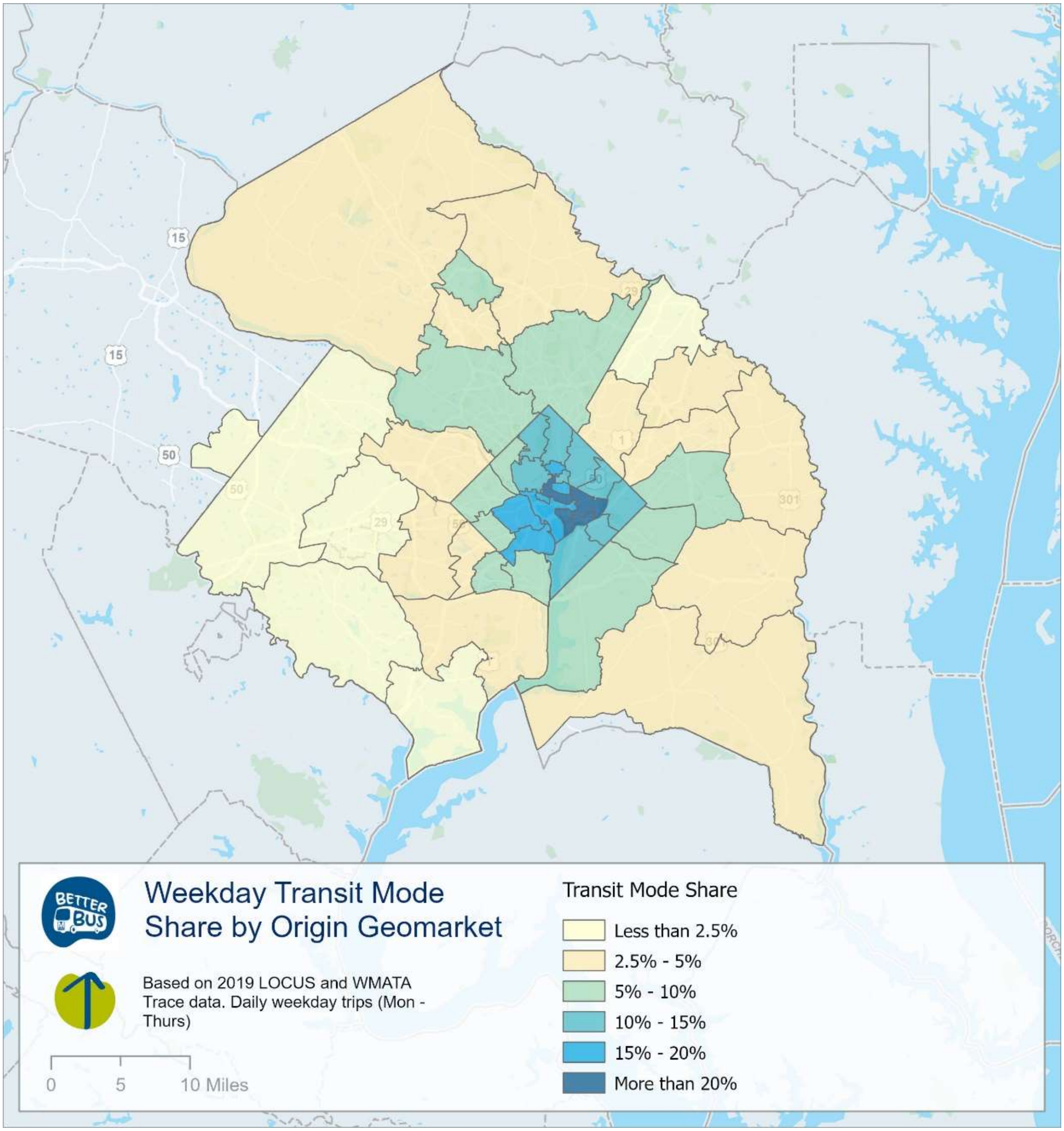


Figure 26: Saturday Transit Mode Share by Origin Geomarket

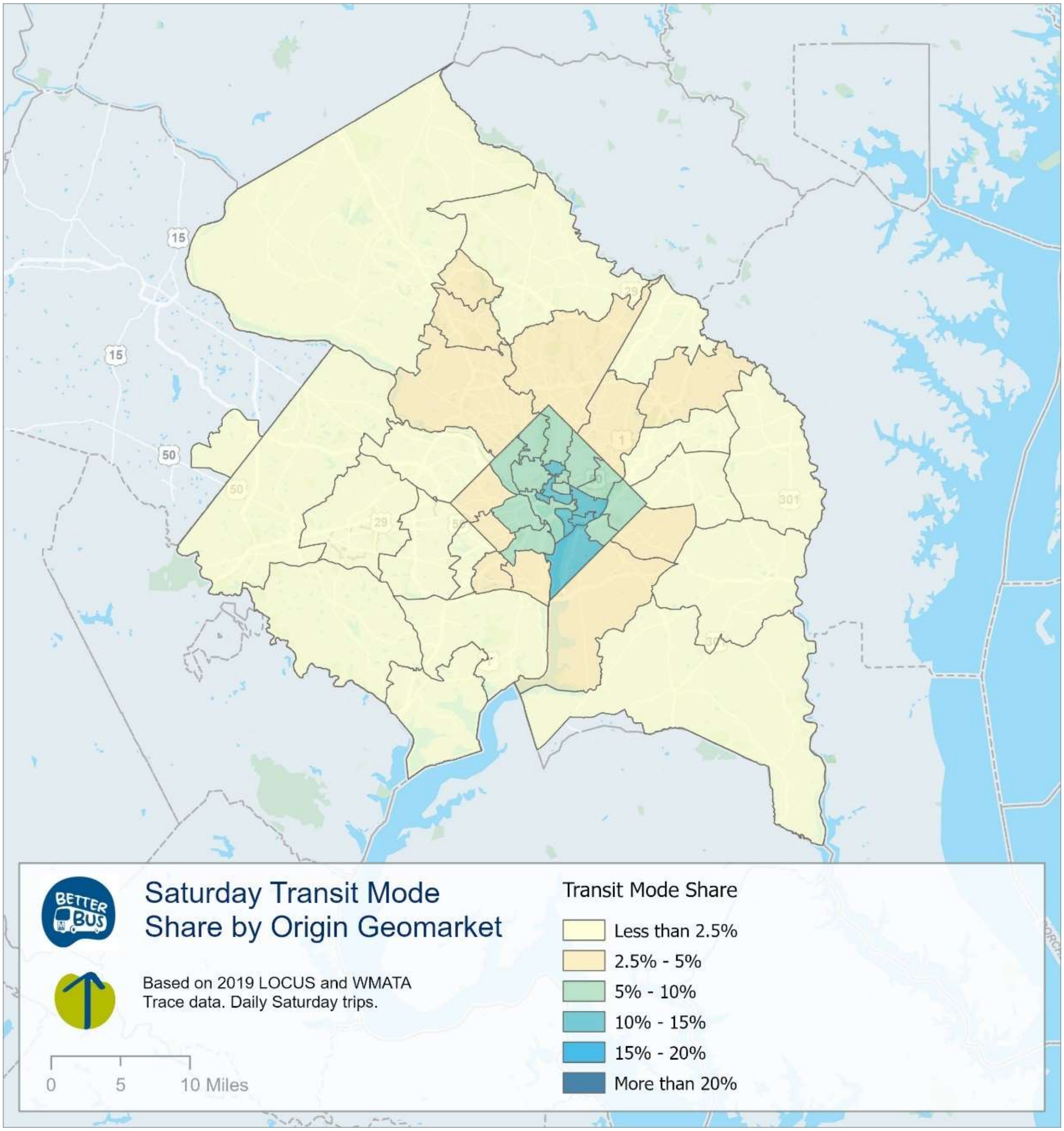


Figure 27: Sunday Transit Mode Share by Origin Geomarket

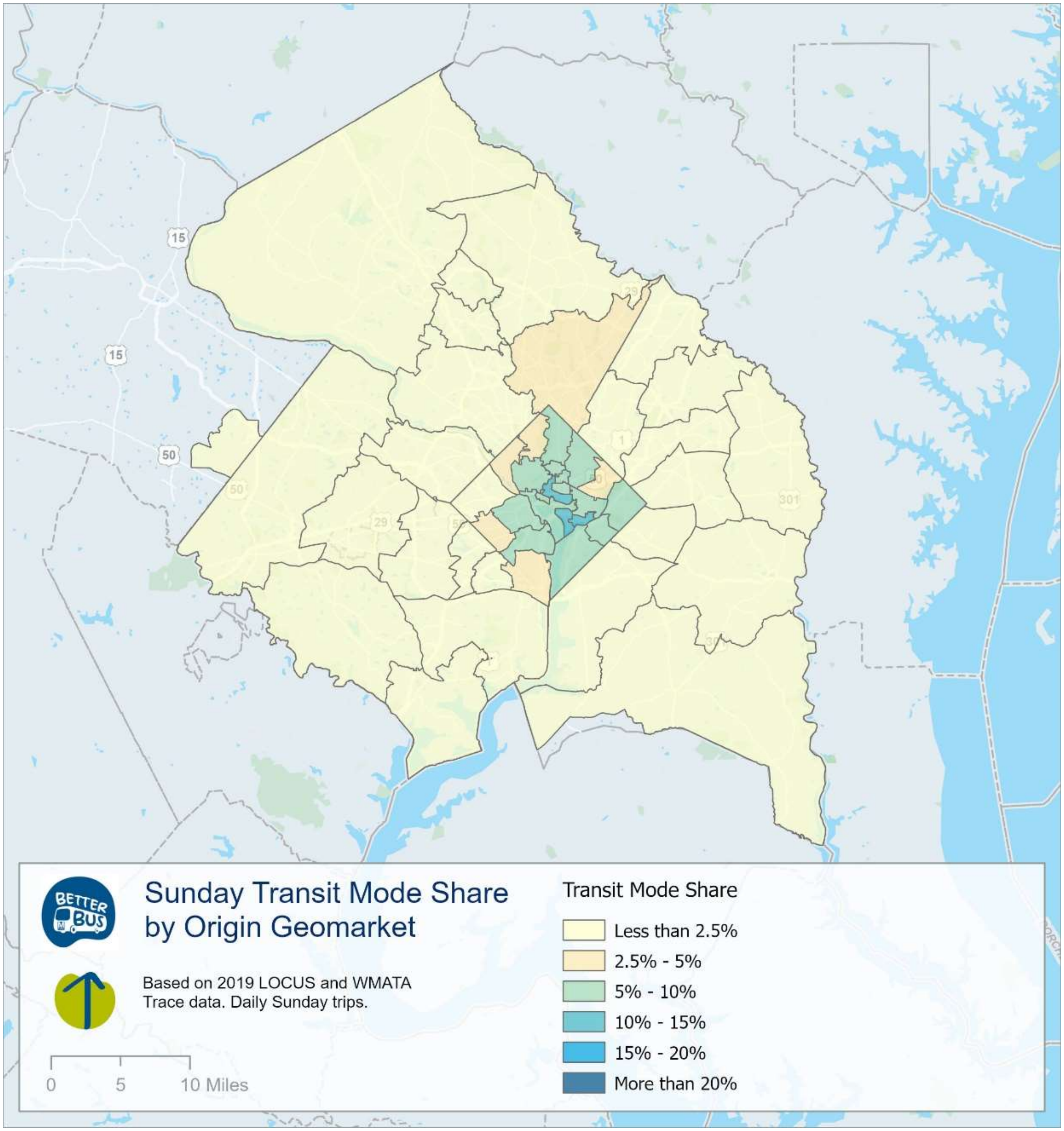


Table 6 highlights how transit mode share changes across the day[1] and across the week. As shown, the highest mode share is observed during the peak periods on weekdays.

Table 6: Transit Mode Share by Day of Week and Time of Day

Day of Week	Time of Day					
	Early AM	AM Peak	Midday	PM Peak	Evening	Late Night
Weekdays (Monday thru Thursday)	7%	11%	6%	9%	5%	2%
Saturday	1%	4%	4%	4%	3%	2%
Sunday	1%	3%	3%	3%	3%	1%

Table 7 highlights the percentage of total trips that fall into different buckets of mode share and travel time convenience for the weekday peak periods. Note that neither the rows or columns sum to 100%; the numbers in each cell represent the percentage of the total number of trips that fall into a specific bucket and the percentages in the whole table represent the full universe of trips. For example, 59.3 percent of total trips have a mode share of less than 2.5 percent. 31.2% of total trips have a mode share of less than 2.5 percent and a travel time ratio of greater than 5. This works out to be 52.6 percent of trips with a mode share of less than 2.5 percent have a travel time ratio greater than 5. Similar results for different time periods can be found in **Table 8** through **Table 11**.

Table 7: Transit Mode Share Vs Travel Time Ratio - Weekday AM and PM Peak Periods

Mode Share	Travel Time Ratio						Percentage of Total Trips
	Less than 1	1 to 2	2 to 3	3 to 4	4 to 5	More than 5	
Less than 2.5%	0.0%	1.2%	5.9%	10.2%	10.8%	31.2%	**59.3%**
2.5% to 4.9%	0.0%	0.4%	2.1%	3.4%	3.0%	5.4%	**14.3%**
5% to 7.49%	0.0%	0.3%	1.1%	1.3%	1.0%	1.4%	**5.1%**
7.5% to 9.9%	0.0%	0.2%	0.6%	0.7%	0.5%	0.7%	**2.6%**
10.0% to 19.9%	0.0%	0.4%	1.2%	1.3%	0.8%	0.9%	**4.4%**
20.0% to 29.9%	0.0%	0.2%	0.5%	0.5%	0.3%	0.3%	**1.8%**
30.0% to 39.9%	0.0%	0.1%	0.3%	0.3%	0.2%	0.2%	**1.1%**
40.0% to 49.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	**0.7%**
50.0% to 59.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	**0.6%**
60.0% to 69.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	**0.6%**
70.0% to 79.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	**0.7%**
80.0% to 89.9%	0.0%	0.2%	0.5%	0.5%	0.3%	0.3%	**1.8%**
90.0% to 100.0%	0.0%	1.6%	2.7%	1.6%	0.6%	0.4%	**7.0%**
Total	**0.1%**	**4.8%**	**15.7%**	**20.5%**	**17.8%**	**41.2%**	**100.0%**

[1] Early AM: 4:00 AM – 6:00 AM; AM Peak: 6:00 AM – 9:00 AM; Midday: 9:00 AM – 3:00 PM; PM Peak: 3:00 PM – 7:00 PM; Evening: 7:00 PM – 11:00 PM; Late-night: 11:00 PM – 4:00 AM.

Table 8: Transit Mode Share Vs Travel Time Ratio - Weekday Midday Period

Mode Share	Travel Time Ratio						Percentage of Total Trips
	Less than 1	1 to 2	2 to 3	3 to 4	4 to 5	More than 5	
Less than 2.5%	0.0%	0.5%	3.8%	8.4%	10.5%	38.4%	**61.7%**
2.5% to 4.9%	0.0%	0.2%	1.8%	3.6%	3.3%	6.2%	**15.1%**
5% to 7.49%	0.0%	0.2%	1.0%	1.3%	1.0%	1.7%	**5.1%**
7.5% to 9.9%	0.0%	0.1%	0.5%	0.7%	0.6%	0.9%	**2.8%**
10.0% to 19.9%	0.0%	0.3%	1.2%	1.4%	1.0%	1.4%	**5.3%**
20.0% to 29.9%	0.0%	0.2%	0.6%	0.6%	0.4%	0.5%	**2.2%**
30.0% to 39.9%	0.0%	0.1%	0.3%	0.3%	0.2%	0.3%	**1.2%**
40.0% to 49.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.2%	**0.8%**
50.0% to 59.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	**0.7%**
60.0% to 69.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	**0.6%**
70.0% to 79.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	**0.6%**
80.0% to 89.9%	0.0%	0.1%	0.3%	0.3%	0.2%	0.2%	**1.1%**
90.0% to 100.0%	0.0%	0.7%	1.0%	0.6%	0.3%	0.2%	**2.8%**
Total	**0.0%**	**2.6%**	**11.3%**	**18.0%**	**17.8%**	**50.3%**	**100.0%**

Table 9: Transit Mode Share Vs Travel Time Ratio - Weekday Evening Period

Mode Share	Travel Time Ratio						Percentage of Total Trips
	Less than 1	1 to 2	2 to 3	3 to 4	4 to 5	More than 5	
Less than 2.5%	0.0%	0.3%	2.9%	7.8%	10.5%	43.6%	**65.1%**
2.5% to 4.9%	0.0%	0.1%	1.2%	3.0%	3.0%	6.3%	**13.7%**
5% to 7.49%	0.0%	0.1%	0.8%	1.2%	1.0%	1.7%	**4.7%**
7.5% to 9.9%	0.0%	0.1%	0.4%	0.7%	0.5%	0.9%	**2.6%**
10.0% to 19.9%	0.0%	0.2%	0.9%	1.4%	1.0%	1.7%	**5.1%**
20.0% to 29.9%	0.0%	0.1%	0.5%	0.6%	0.4%	0.6%	**2.2%**
30.0% to 39.9%	0.0%	0.1%	0.3%	0.3%	0.2%	0.3%	**1.2%**
40.0% to 49.9%	0.0%	0.0%	0.2%	0.2%	0.1%	0.2%	**0.7%**
50.0% to 59.9%	0.0%	0.0%	0.2%	0.2%	0.1%	0.1%	**0.6%**
60.0% to 69.9%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	**0.5%**
70.0% to 79.9%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	**0.5%**
80.0% to 89.9%	0.0%	0.1%	0.2%	0.2%	0.2%	0.2%	**0.9%**
90.0% to 100.0%	0.0%	0.3%	0.7%	0.5%	0.3%	0.3%	**2.1%**
Total	**0.0%**	**1.4%**	**8.5%**	**16.3%**	**17.5%**	**56.2%**	**100.0%**

Table 10: Transit Mode Share Vs Travel Time Ratio - Weekend

Mode Share	Travel Time Ratio: Less than 1	1 to 2	2 to 3	3 to 4	4 to 5	More than 5	Percentage of Total Trips
Less than 2.5%	0.0%	0.4%	3.4%	9.1%	12.2%	48.4%	**73.4%**
2.5% to 4.9%	0.0%	0.2%	1.3%	2.5%	2.2%	4.2%	**10.4%**
5% to 7.49%	0.0%	0.1%	0.7%	0.9%	0.8%	1.4%	**3.8%**
7.5% to 9.9%	0.0%	0.1%	0.4%	0.6%	0.5%	0.8%	**2.3%**
10.0% to 19.9%	0.0%	0.2%	0.9%	1.2%	0.9%	1.4%	**4.5%**
20.0% to 29.9%	0.0%	0.1%	0.4%	0.4%	0.3%	0.5%	**1.7%**
30.0% to 39.9%	0.0%	0.1%	0.2%	0.2%	0.2%	0.2%	**0.9%**
40.0% to 49.9%	0.0%	0.0%	0.2%	0.1%	0.1%	0.1%	**0.6%**
50.0% to 59.9%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	**0.4%**
60.0% to 69.9%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	**0.3%**
70.0% to 79.9%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	**0.3%**
80.0% to 89.9%	0.0%	0.1%	0.2%	0.2%	0.1%	0.1%	**0.8%**
90.0% to 100.0%	0.0%	0.1%	0.2%	0.1%	0.1%	0.0%	**0.5%**
Total	**0.0%**	**1.4%**	**8.2%**	**15.6%**	**17.3%**	**57.5%**	**100.0%**

Table 11: Transit Mode Share Vs Travel Time Ratio - Weekday Late Night/Early AM

Mode Share	Travel Time Ratio: Less than 1	1 to 2	2 to 3	3 to 4	4 to 5	More than 5	Percentage of Total Trips
Less than 2.5%	0.0%	0.2%	2.9%	8.5%	10.5%	41.2%	63.3%
2.5% to 4.9%	0.0%	0.1%	1.2%	2.7%	2.6%	5.6%	12.2%
5% to 7.49%	0.0%	0.1%	0.8%	1.4%	1.1%	2.1%	5.5%
7.5% to 9.9%	0.0%	0.1%	0.5%	0.9%	0.7%	1.2%	3.3%
10.0% to 19.9%	0.0%	0.1%	1.1%	1.7%	1.3%	2.0%	6.2%
20.0% to 29.9%	0.0%	0.1%	0.5%	0.8%	0.5%	0.8%	2.6%
30.0% to 39.9%	0.0%	0.0%	0.3%	0.4%	0.3%	0.4%	1.5%
40.0% to 49.9%	0.0%	0.0%	0.2%	0.3%	0.2%	0.3%	1.0%
50.0% to 59.9%	0.0%	0.0%	0.2%	0.2%	0.1%	0.2%	0.7%
60.0% to 69.9%	0.0%	0.0%	0.1%	0.2%	0.1%	0.2%	0.6%
70.0% to 79.9%	0.0%	0.0%	0.1%	0.2%	0.1%	0.2%	0.6%
80.0% to 89.9%	0.0%	0.0%	0.2%	0.3%	0.2%	0.3%	1.1%
90.0% to 100.0%	0.0%	0.1%	0.4%	0.4%	0.2%	0.3%	1.4%
Total	**0.0%**	**0.8%**	**8.6%**	**18.0%**	**17.9%**	**54.7%**	**100.0%**

Figure 28 to **Figure 31** show the average travel time ratios (transit travel time by drive time) by origin geomarkets for different days of the week and times of day. The travel time ratio is indicative of how convenient (or inconvenient) a trip would be if accomplished on transit (as compared to driving) – higher values mean more inconvenient transit itineraries.

Figure 32 compares the travel time ratios for trips made by re Equity-Focus Communities (EFCs) residents vs other non-EFC residents – higher the ratio of the average travel time ratios (EFC by non-EFC), more onerous or less convenient are the transit options available for trips made by the residents of EFCs, as compared to trips by the non-EFC residents.

Figure 28: Weekday AM and PM Peaks - Average Travel Time Ratio by Origin Geomarket

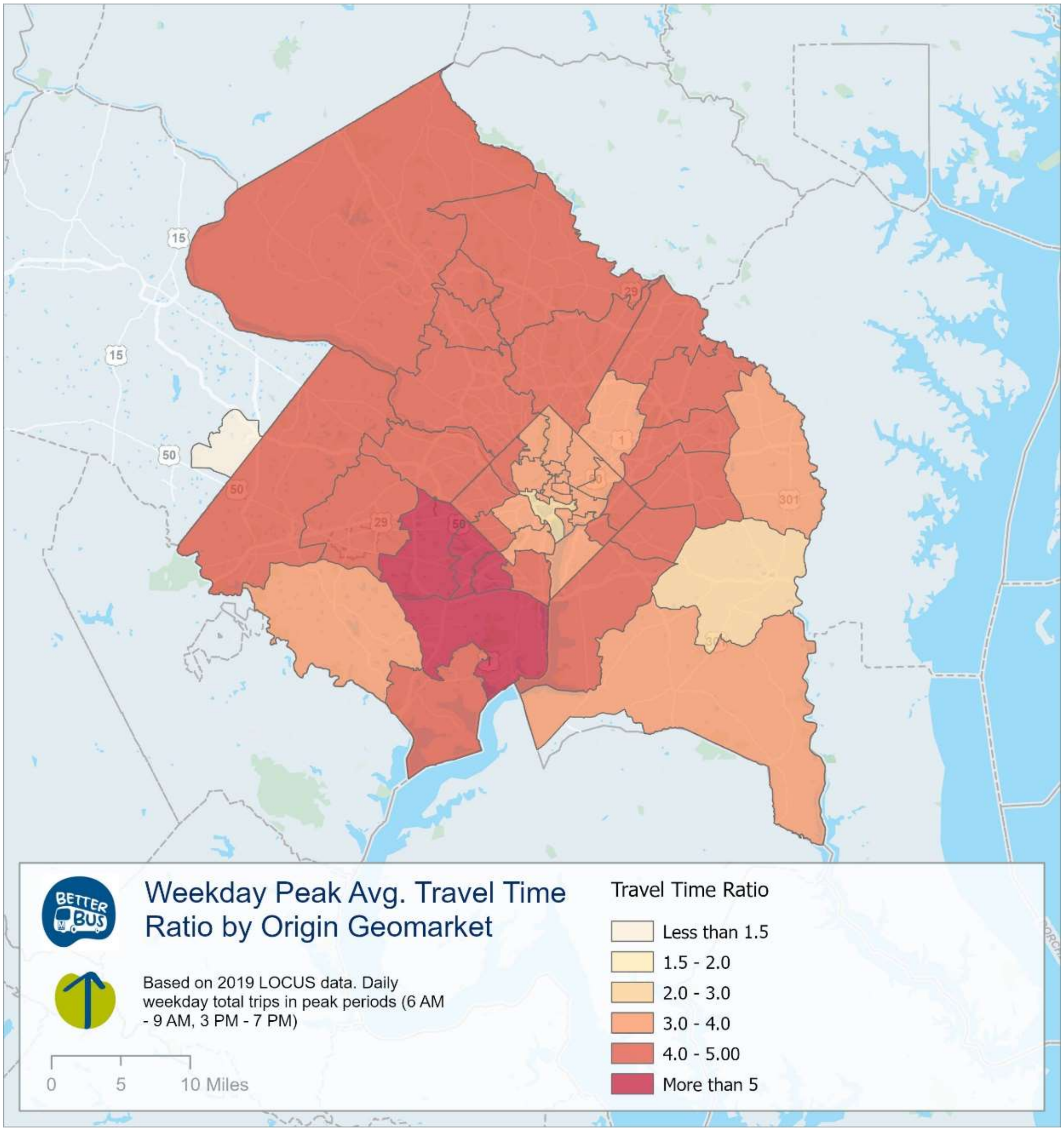

Weekday Peak Avg. Travel Time Ratio by Origin Geomarket
Based on 2019 LOCUS data. Daily weekday total trips in peak periods (6 AM - 9 AM, 3 PM - 7 PM)
0
5
10 Miles
Travel Time Ratio
Less than 1.5
1.5 - 2.0
2.0 - 3.0
3.0 - 4.0
4.0 - 5.00
More than 5

Figure 29: Weekday Midday – Average Travel Time Ratio by Origin Geomarket

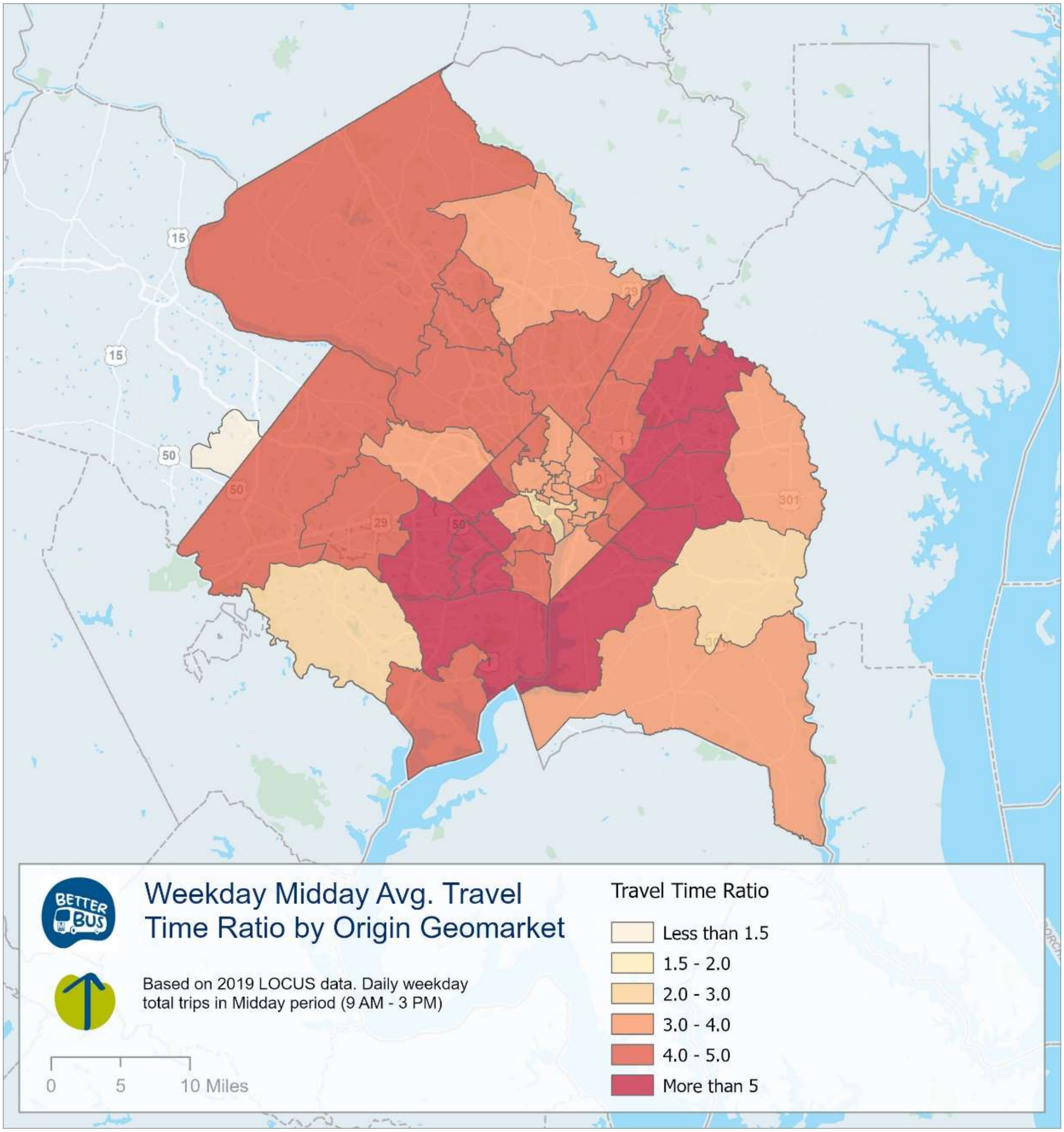


Figure 30: Weekday Evening – Average Travel Time Ratio by Origin Geomarket

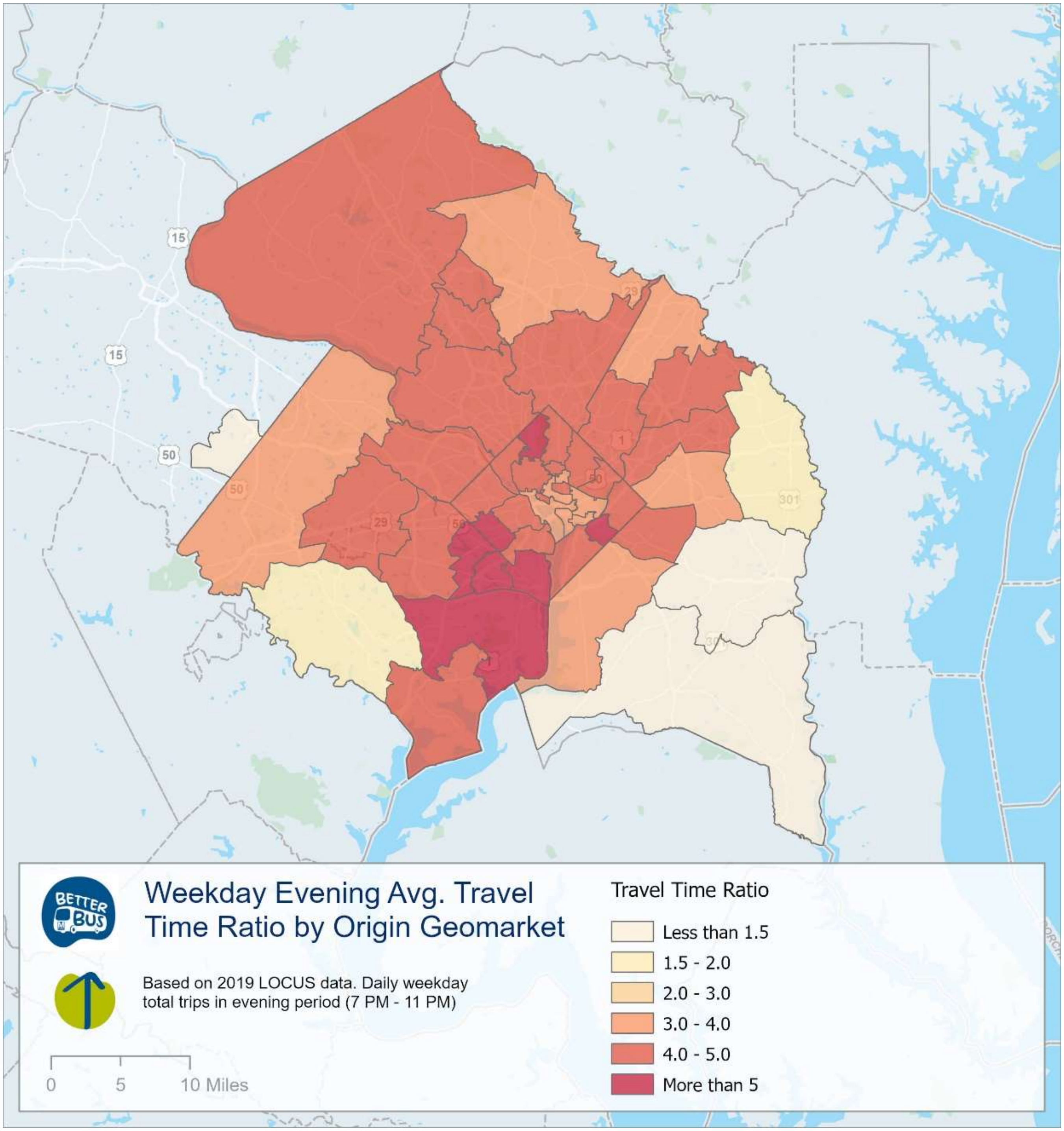


Figure 31: Average Saturday Travel Time Ratio by Origin Geomarket

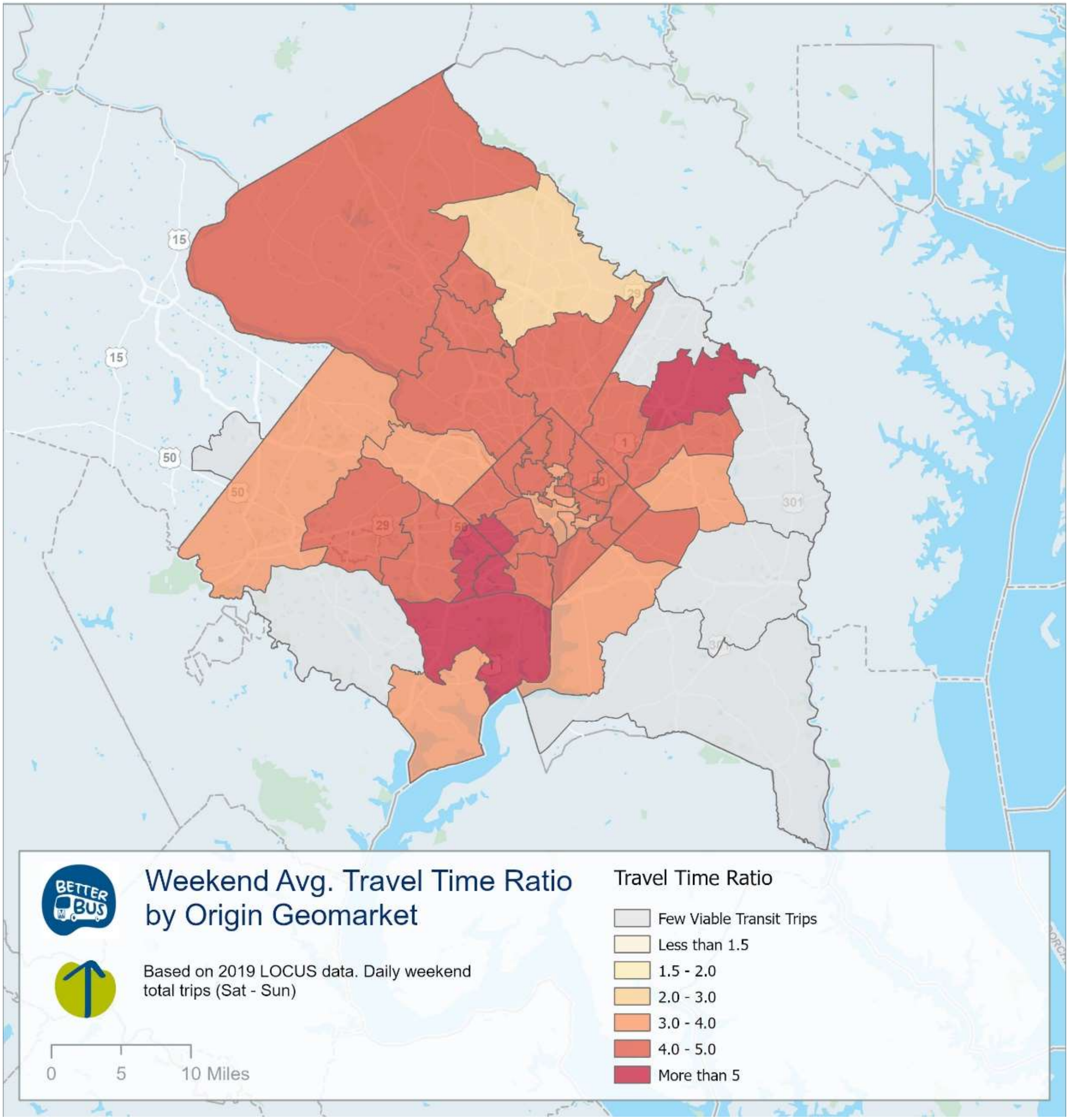
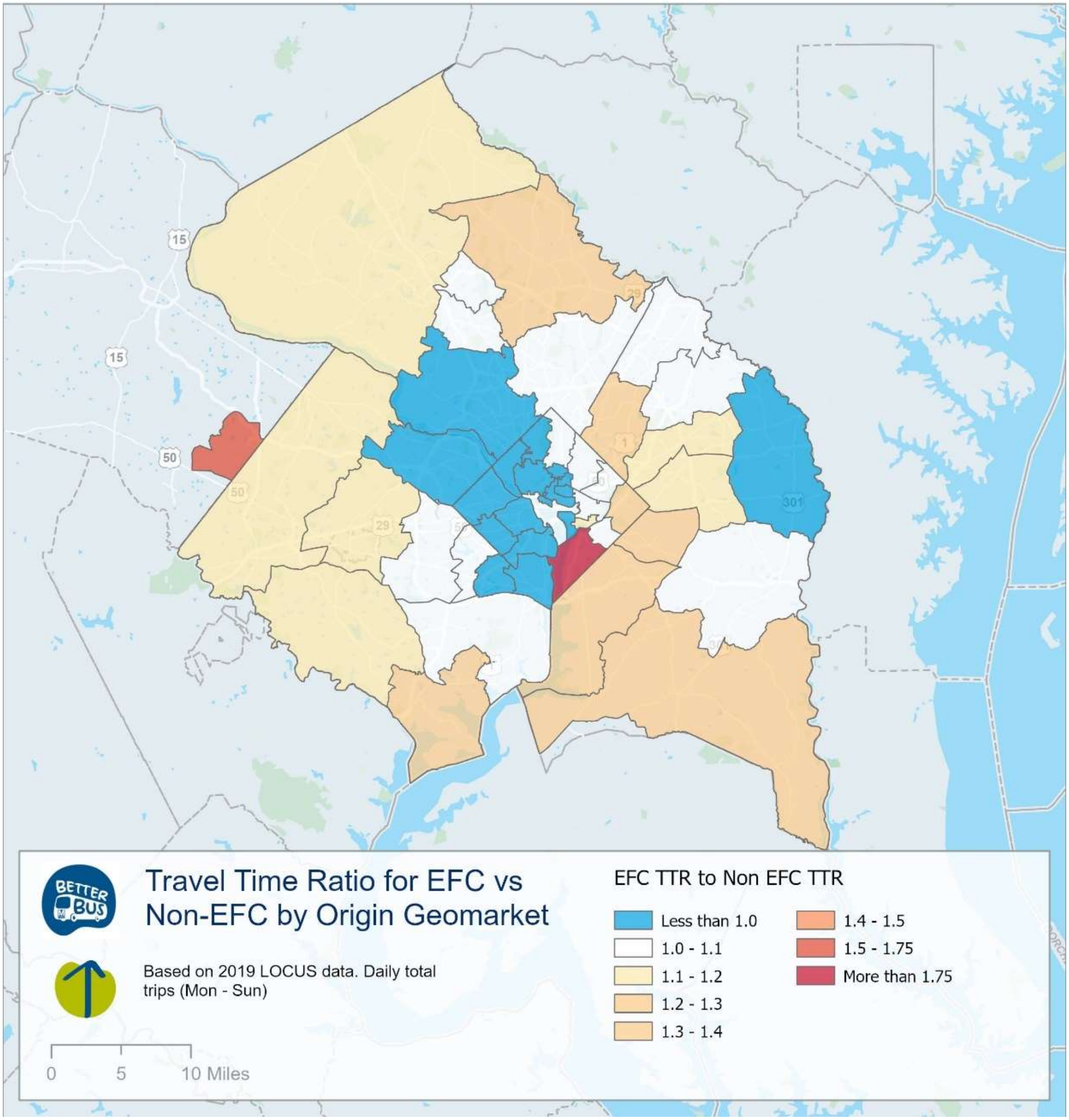


Figure 32: Ratio of Equity-Focus Communities (EFC) Travel Time Ratio to Non-EFC Travel Time Ratio by Origin Geomarket



Accessibility

The accessibility analysis begins by spatially intersecting points of each destination type (grocery stores, educational facilities, medical facilities, and jobs) to the Census Block Group (CBG) that contains it. Educational facilities used for this analysis include high schools, colleges, and universities; Medical facilities include hospitals and urgent care facilities; and jobs are total jobs by CBGs as reported by Census. Next, for each CBG ("origin CBG") in the region, the average travel times on transit to CBGs containing destinations of interest ("destinations CBG") are computed using the trips observed in the total flow dataset (so based on actual travel patterns, instead of latent demand). Based on the selected transit travel time band (15 mins, 30 mins, or 60 mins), "destinations CBGs" accessible within the transit travel time from the given origin CBG are extracted and the destinations contained in the "destinations CBG "are summed. This yields the number of destinations of given type accessible within the selected transit travel time band per CBG. This number is then aggregated to the Geomarket level for summarization purposes – average values for CBGs contained in that geomarket.

Data Sources

- 2019 LOCUS Data
- Census data
- Hospitals and Urgent Care Facilities: https://hifld-geoplatform.opendata.arcgis.com/
- Total Jobs: https://lehd.ces.census.gov/data/
- Grocery Store and Educational Facilities: Google

Results

Figure 33 to **Figure 36** provide the locations of different destination types.

Figure 33: Locations of Grocery Stores

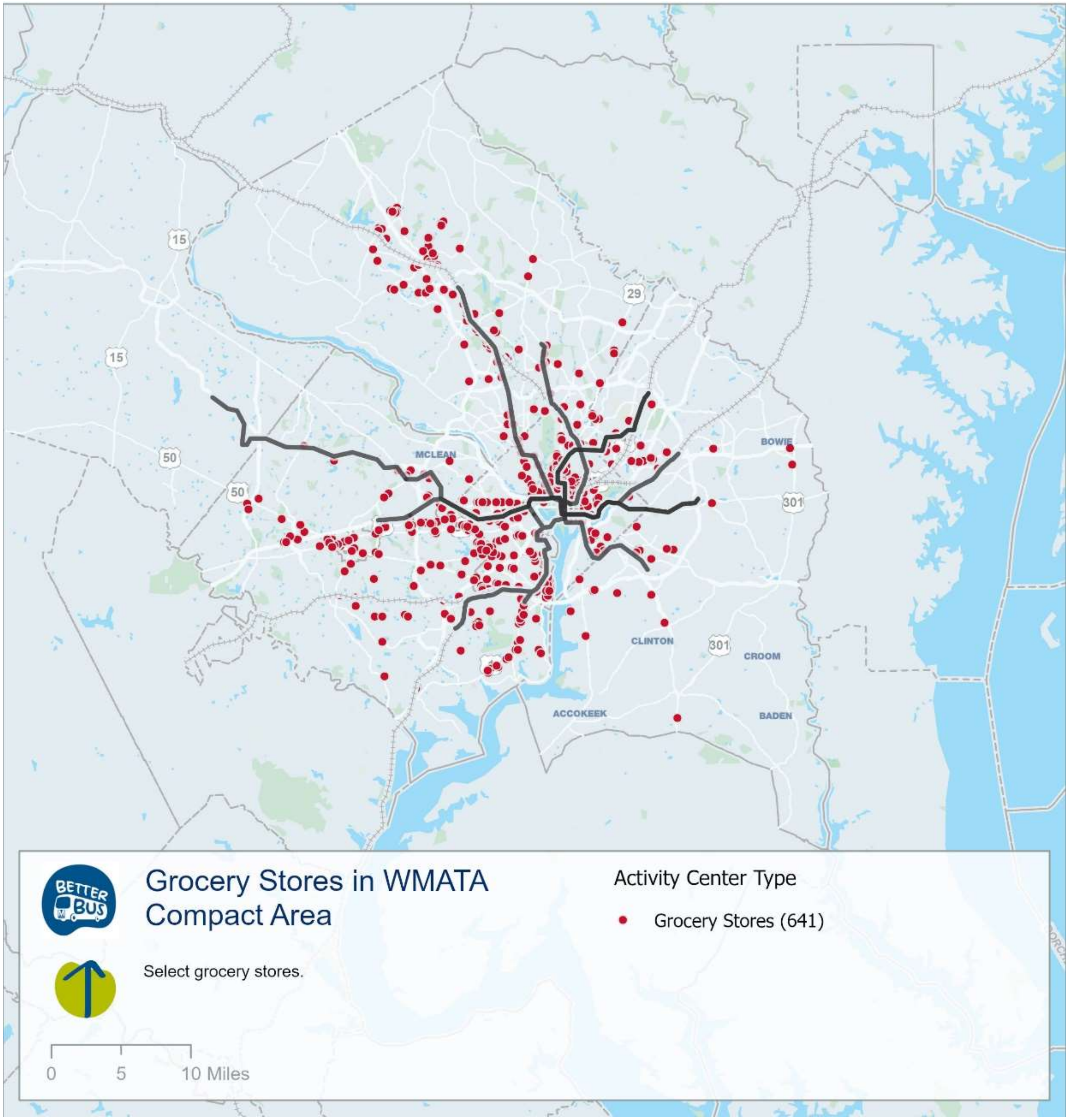


Figure 34: Locations of Educational Facilities

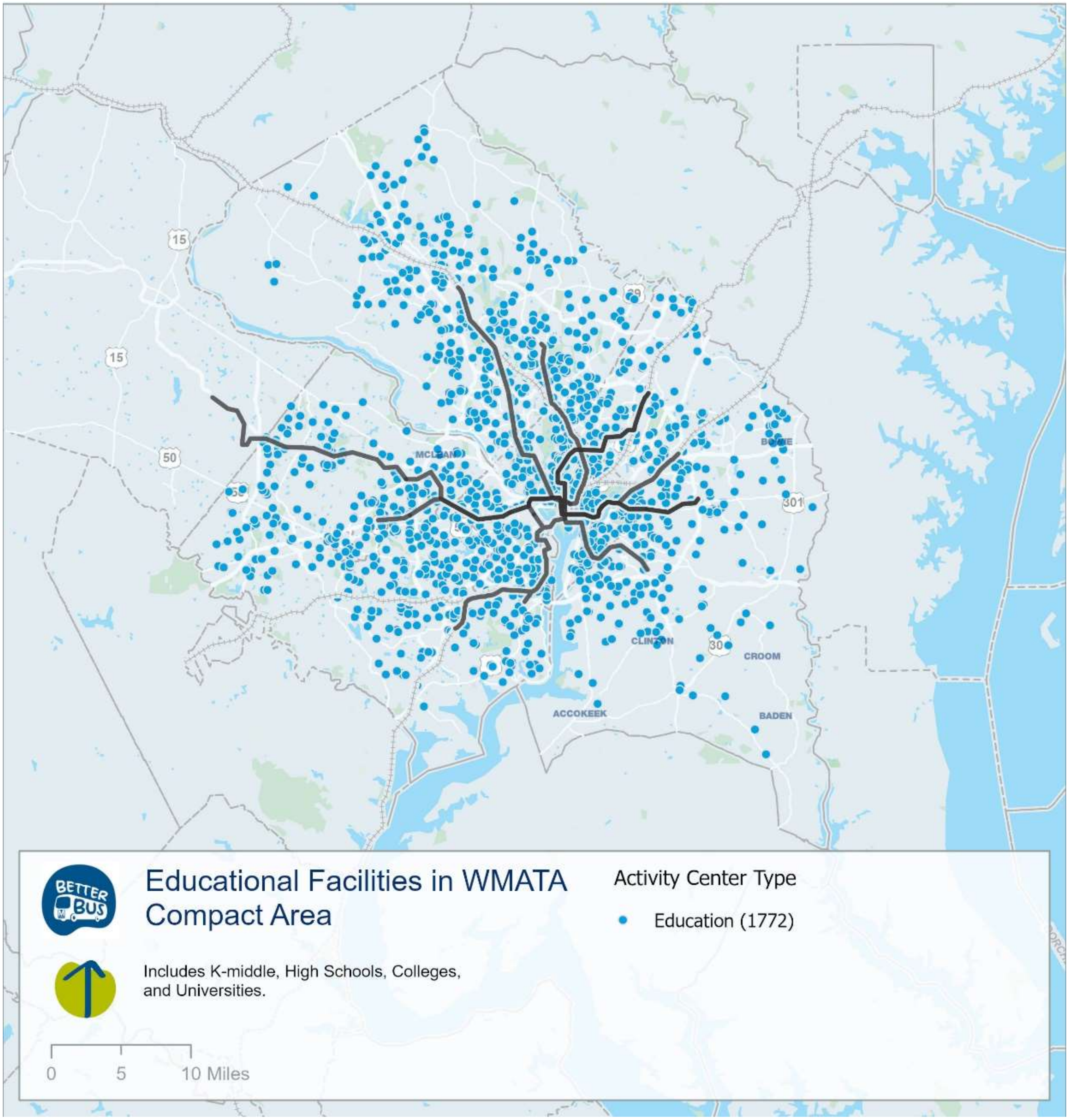


Figure 35: Locations of Medical Facilities

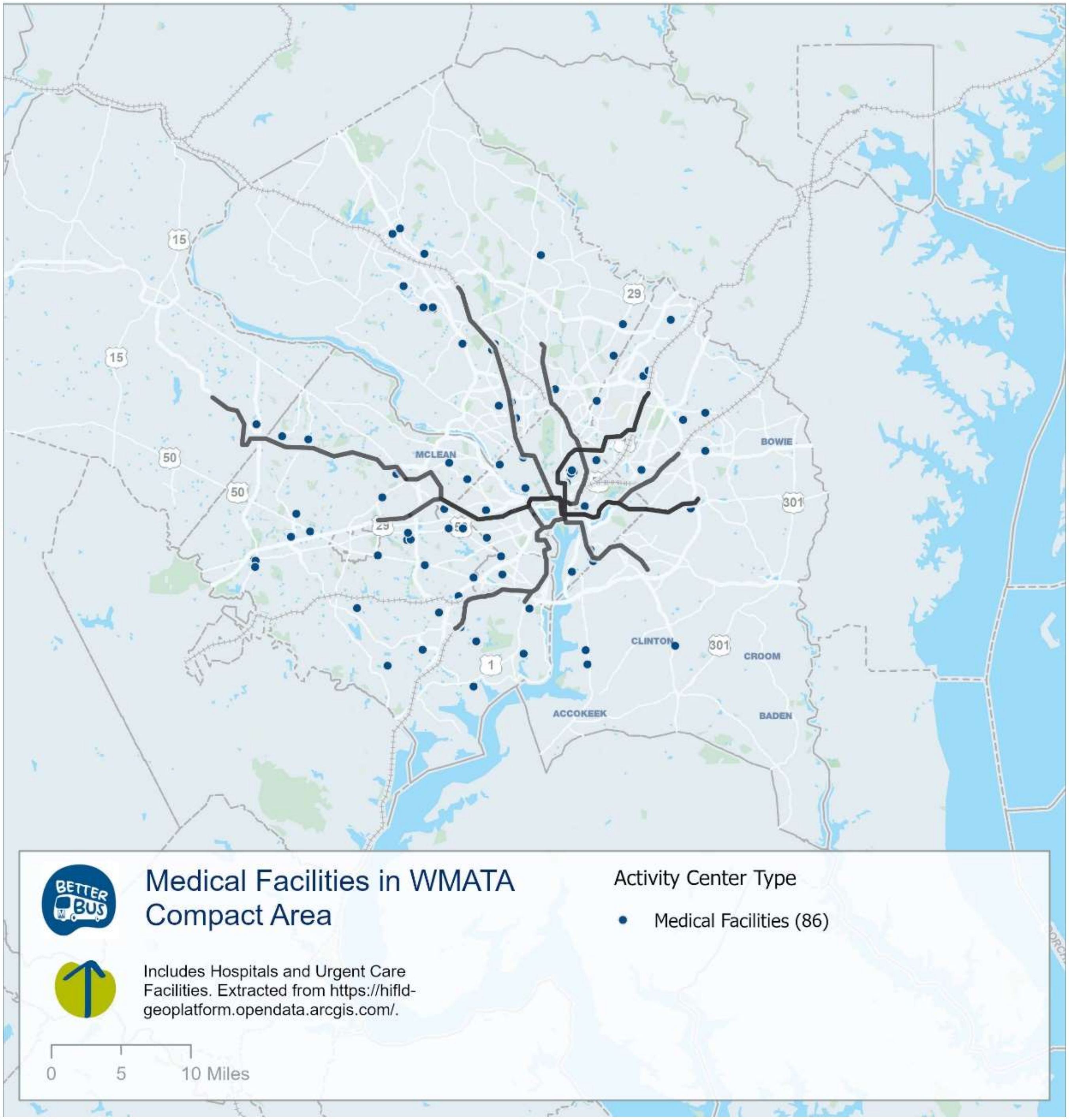


Figure 36: Total Jobs by Census Block Group

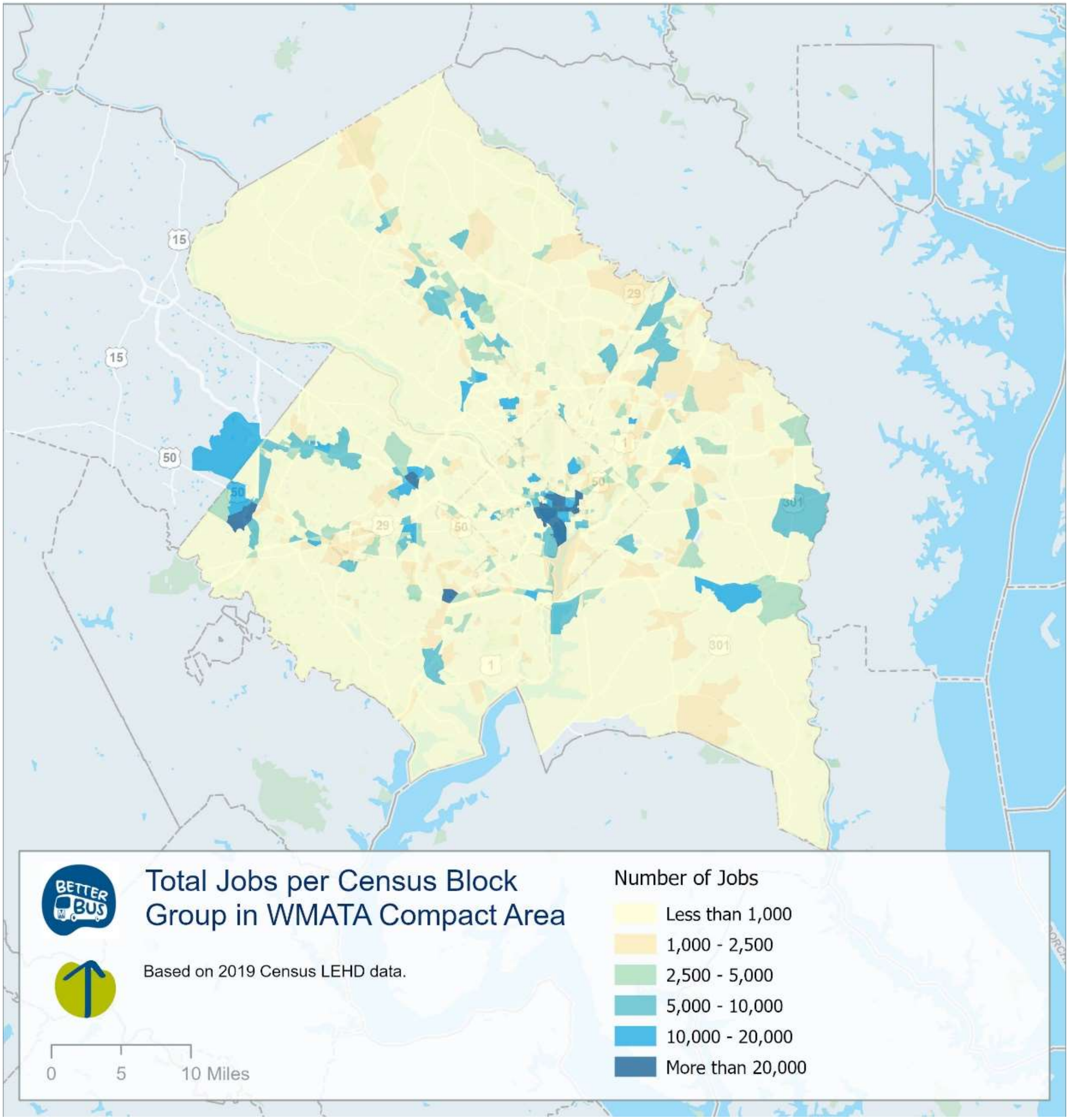


Figure 37 to **Figure 54** show, for different destination types, the number of destinations accessible within 15, 30, or 60 minutes using transit per Census Block Group. The results have been summarized at the Geomarket level (average values for Census Block Groups contained in that Geomarket).

Figure 37: Average Number of Hospitals Accessible within 15 mins by Transit by Geomarket

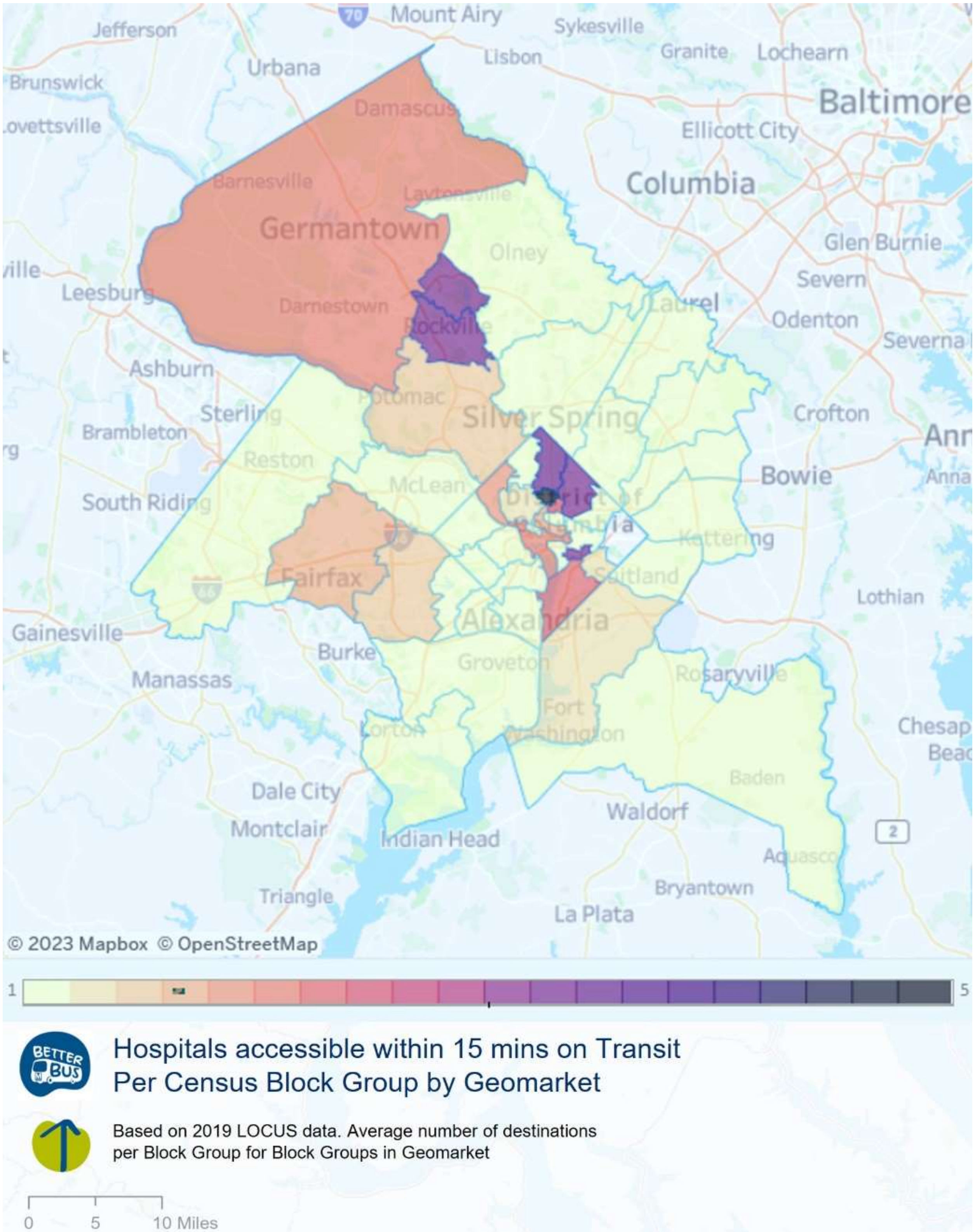


Figure 38: Average Number of Hospitals Accessible within 30 mins by Transit by Geomarket

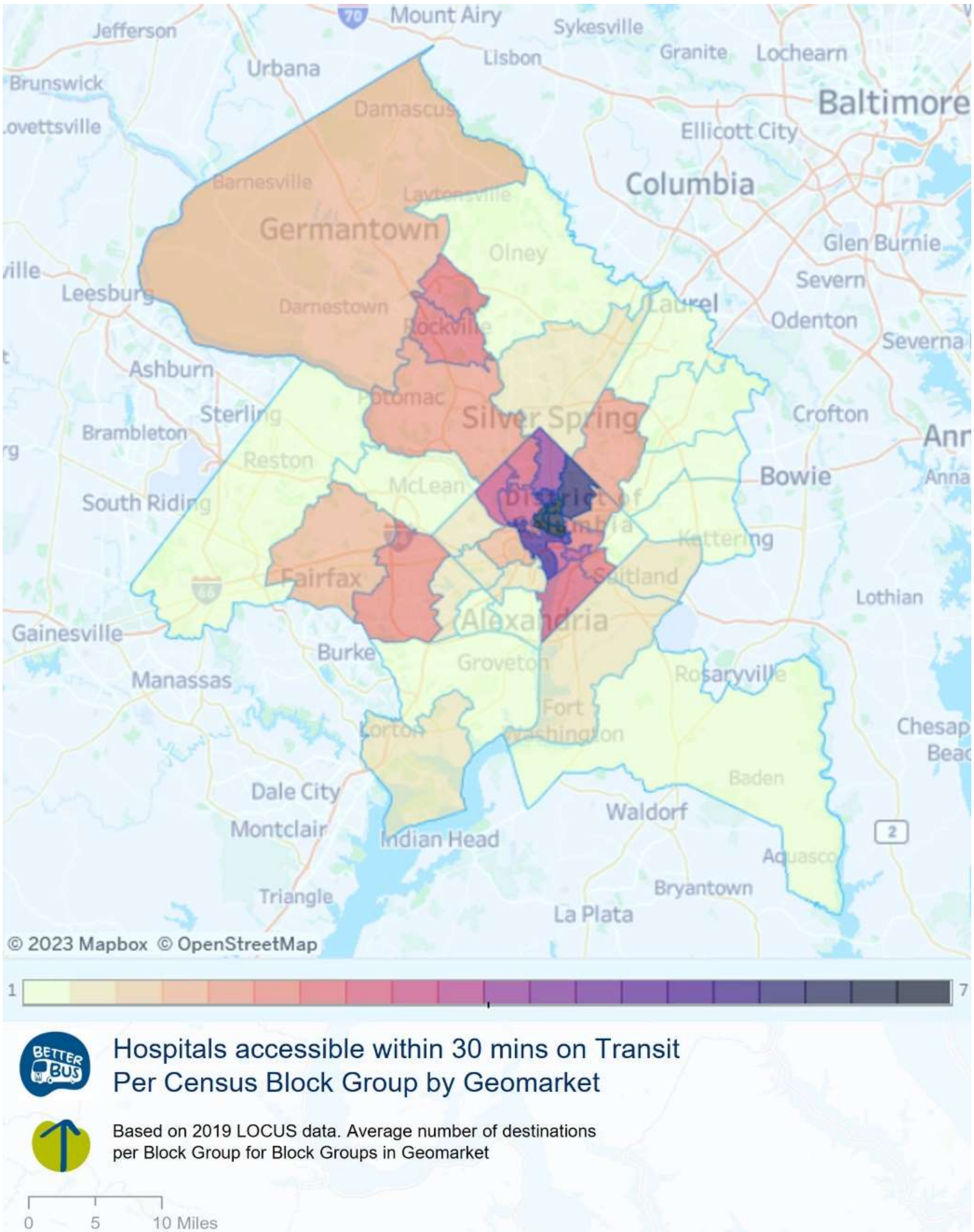


Figure 39: Average Number of Hospitals Accessible within 60 mins by Transit by Geomarket

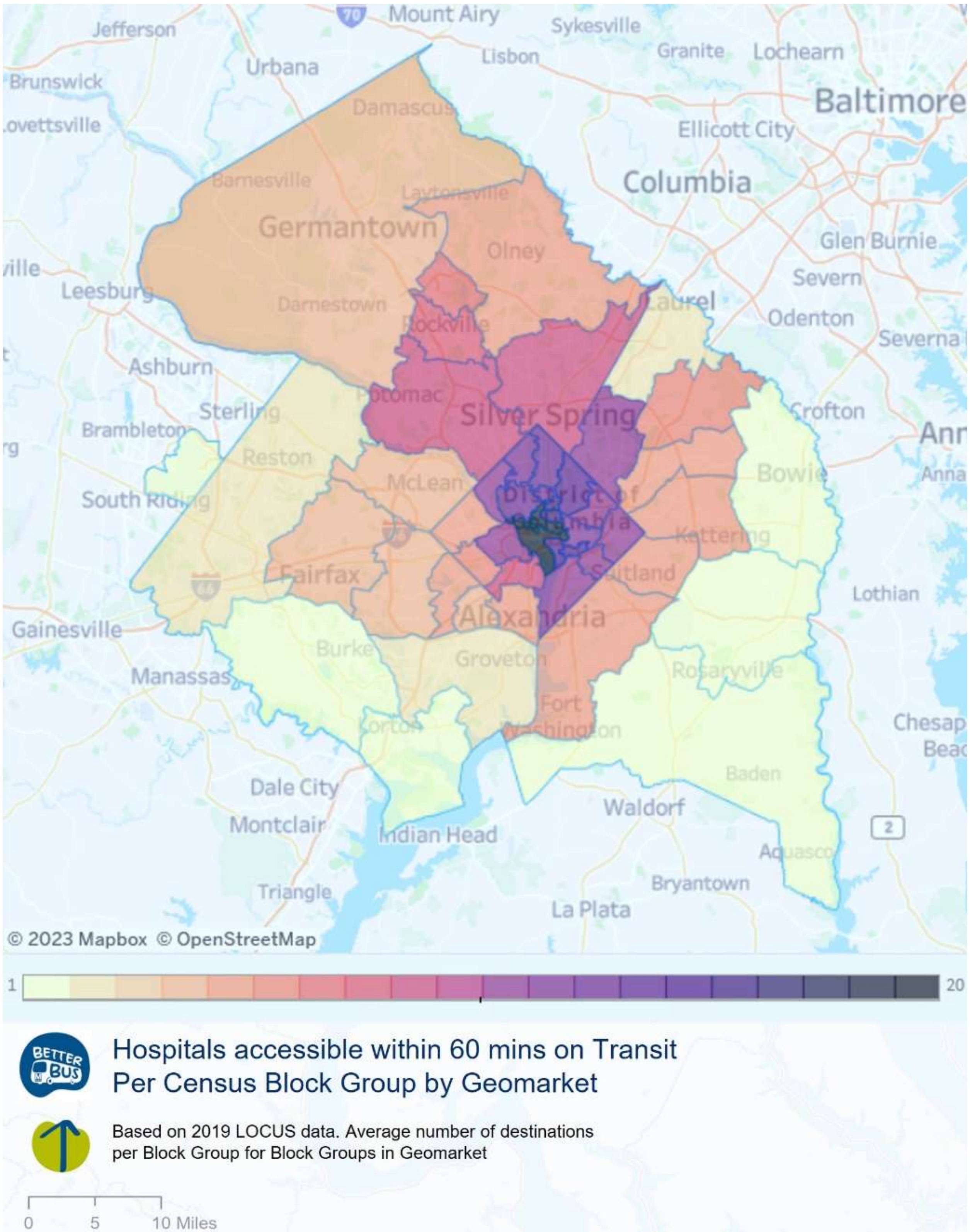


Figure 40: Average Number of Urgent Care Facilities Accessible within 15 mins by Transit by Geomarket

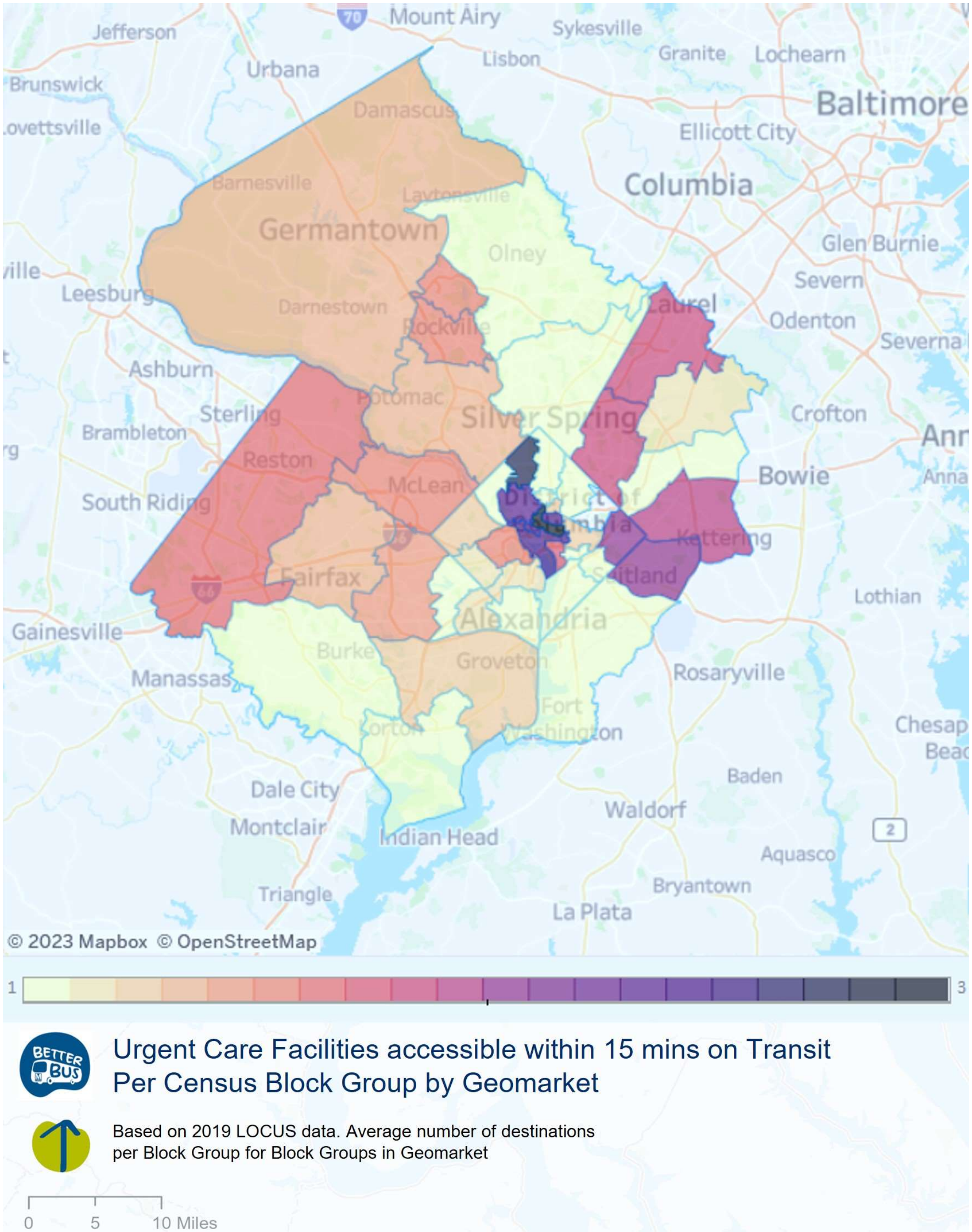


Figure 41: Average Number of Urgent Care Facilities Accessible within 30 mins by Transit by Geomarket

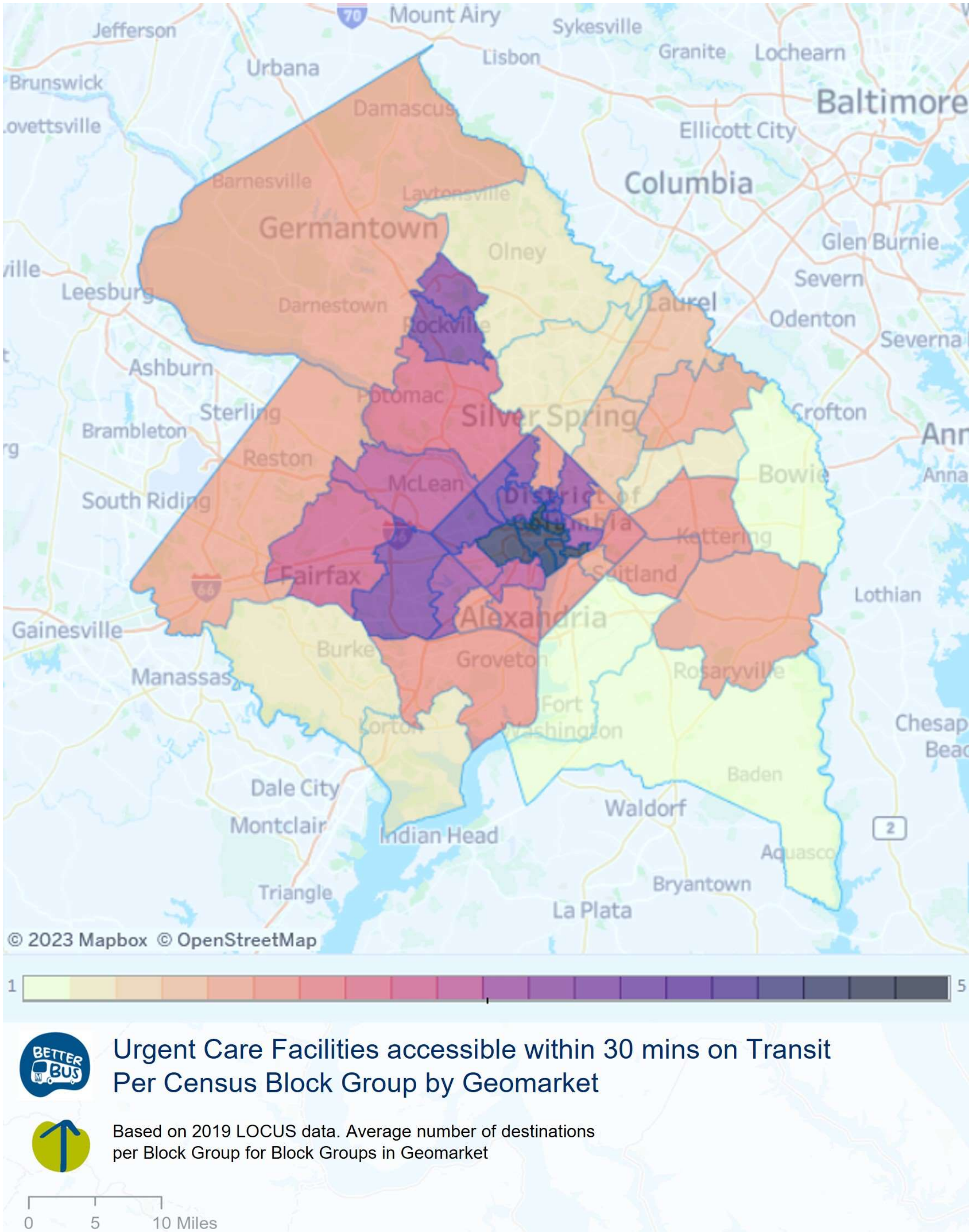


Figure 42: Average Number of Urgent Care Facilities Accessible within 60 mins by Transit by Geomarket

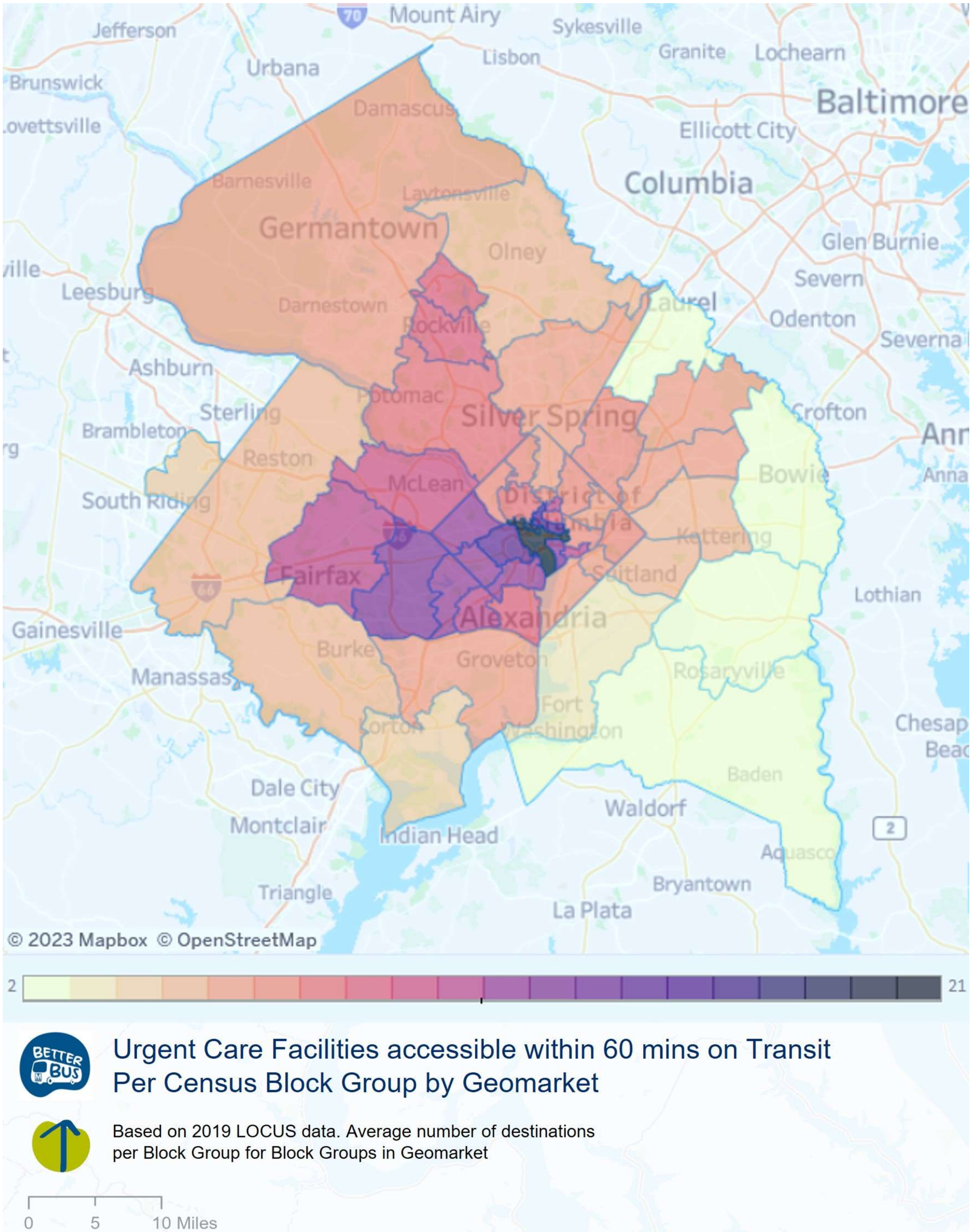


Figure 43: Average Number of Schools Accessible within 15 mins by Transit by Geomarket

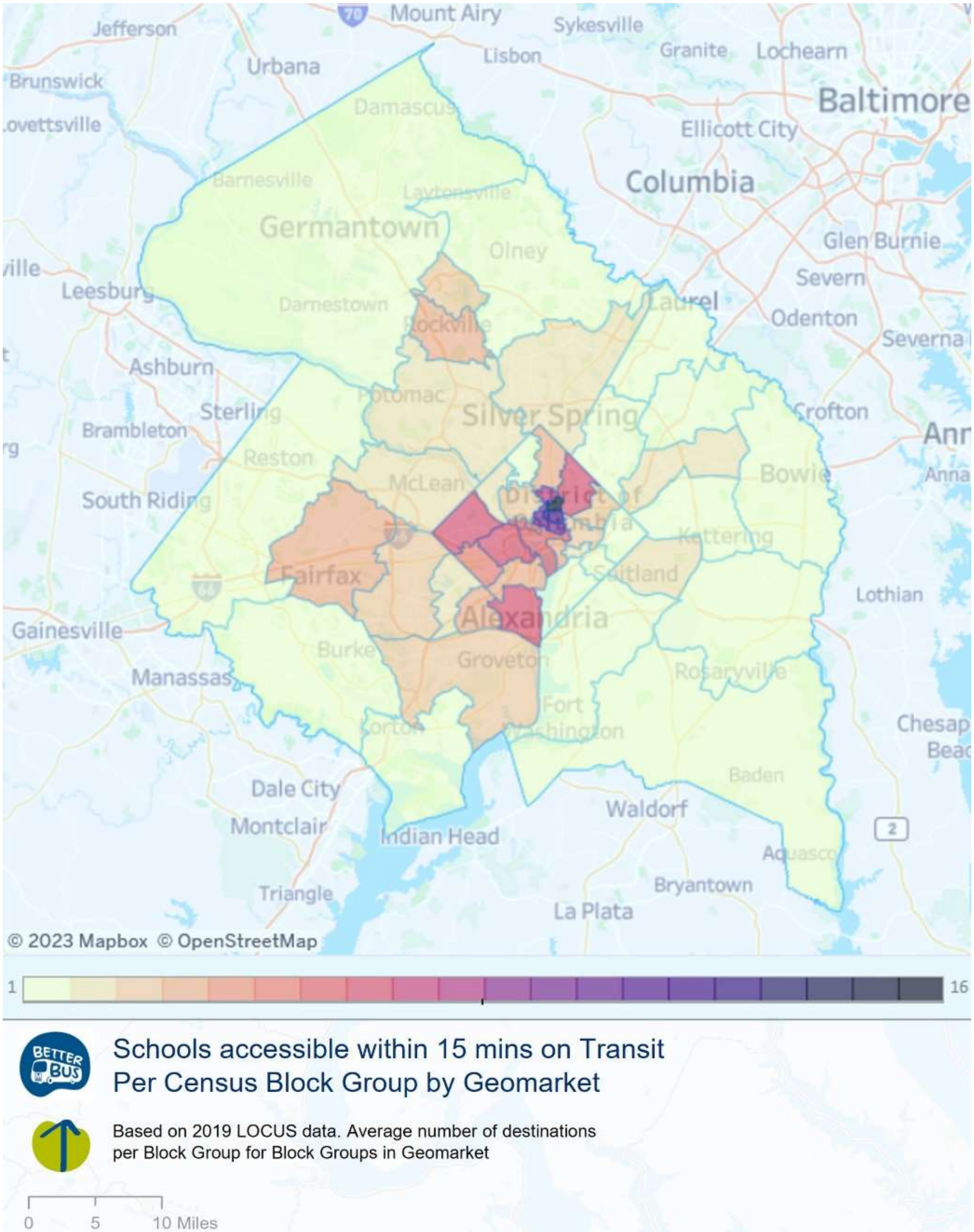


Figure 44: Average Number of Schools Accessible within 30 mins by Transit by Geomarket

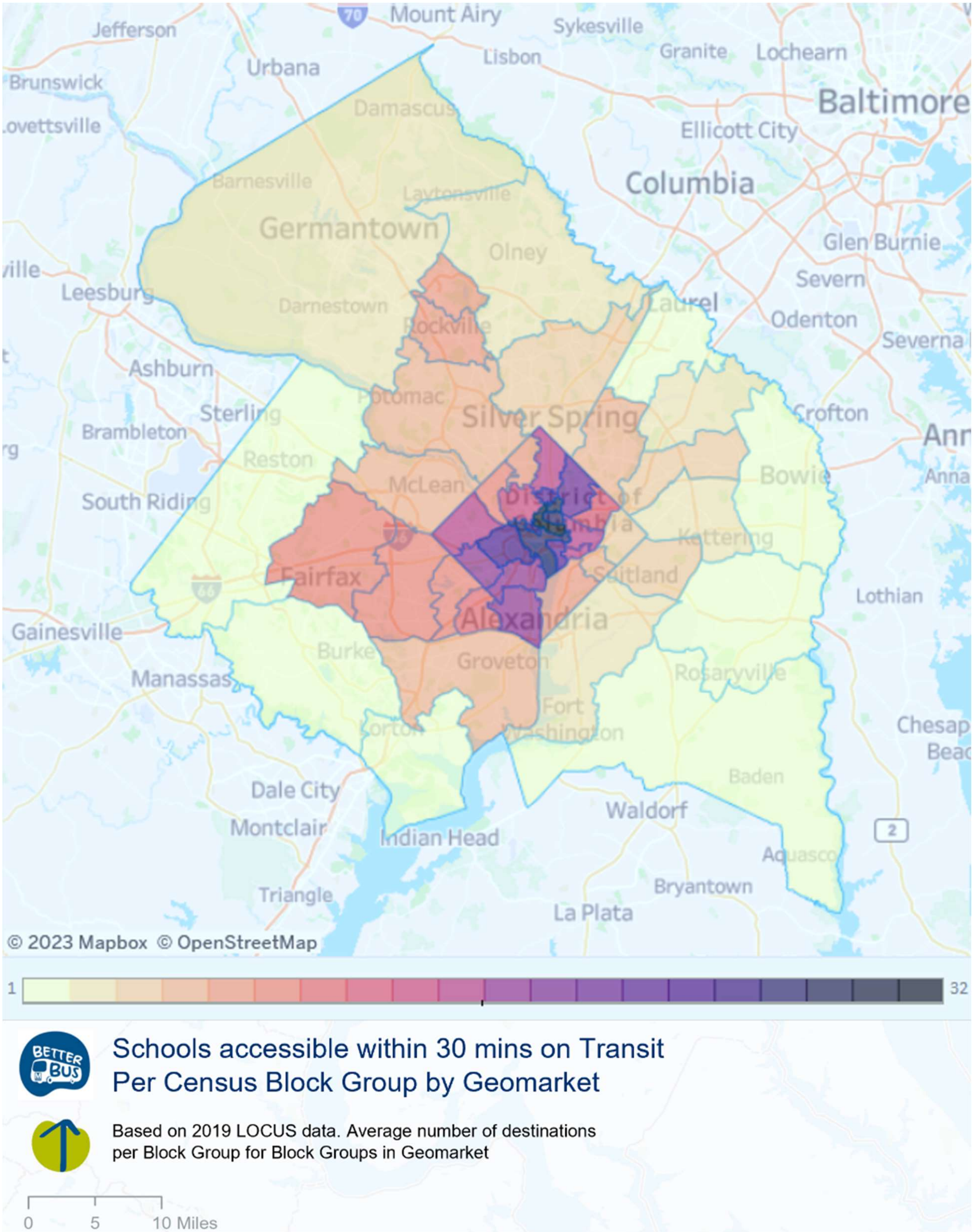


Figure 45: Average Number of Schools Accessible within 60 mins by Transit by Geomarket

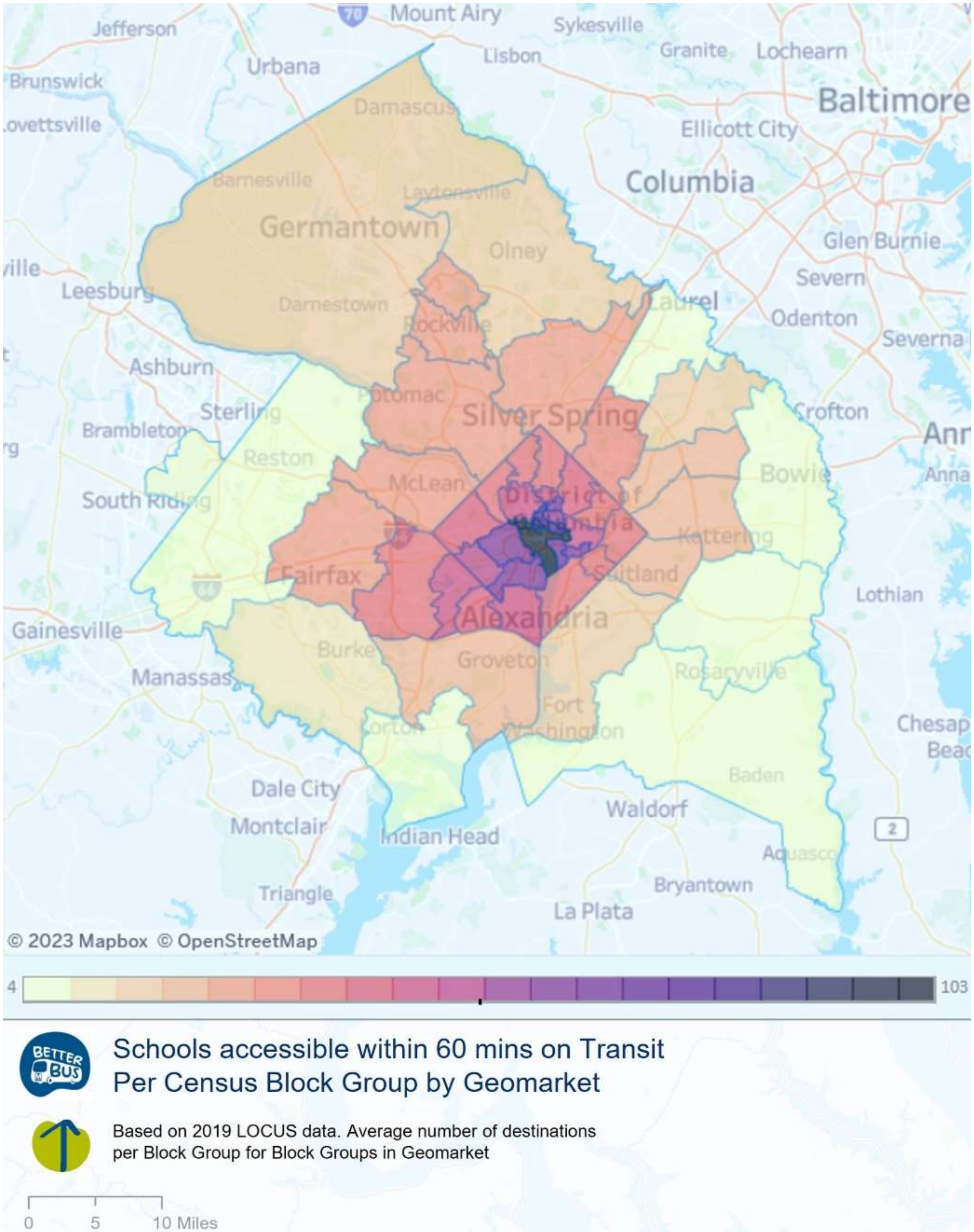


Figure 46: Average Number of Colleges Accessible within 15 mins by Transit by Geomarket

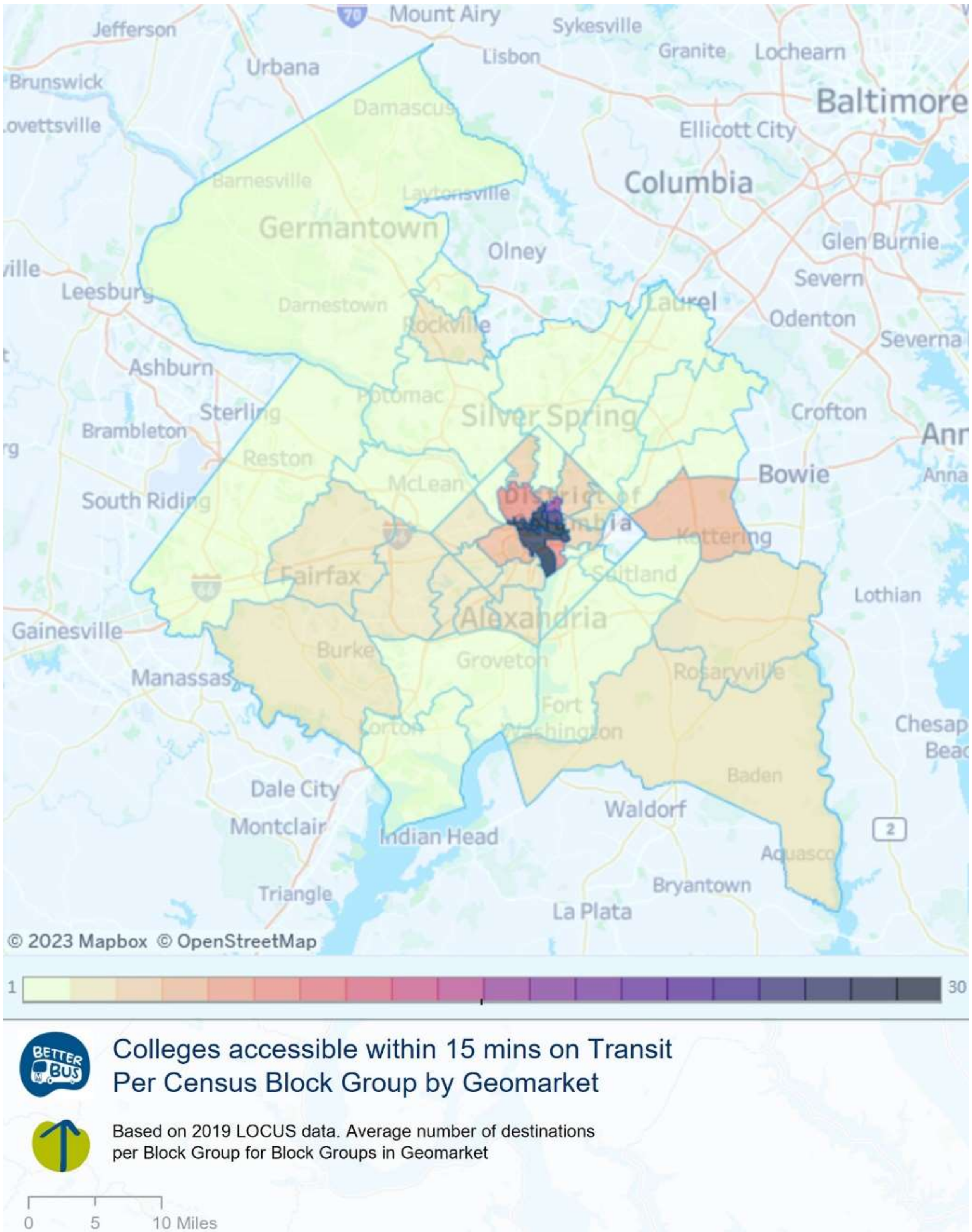


Figure 47: Average Number of Colleges Accessible within 30 mins by Transit by Geomarket

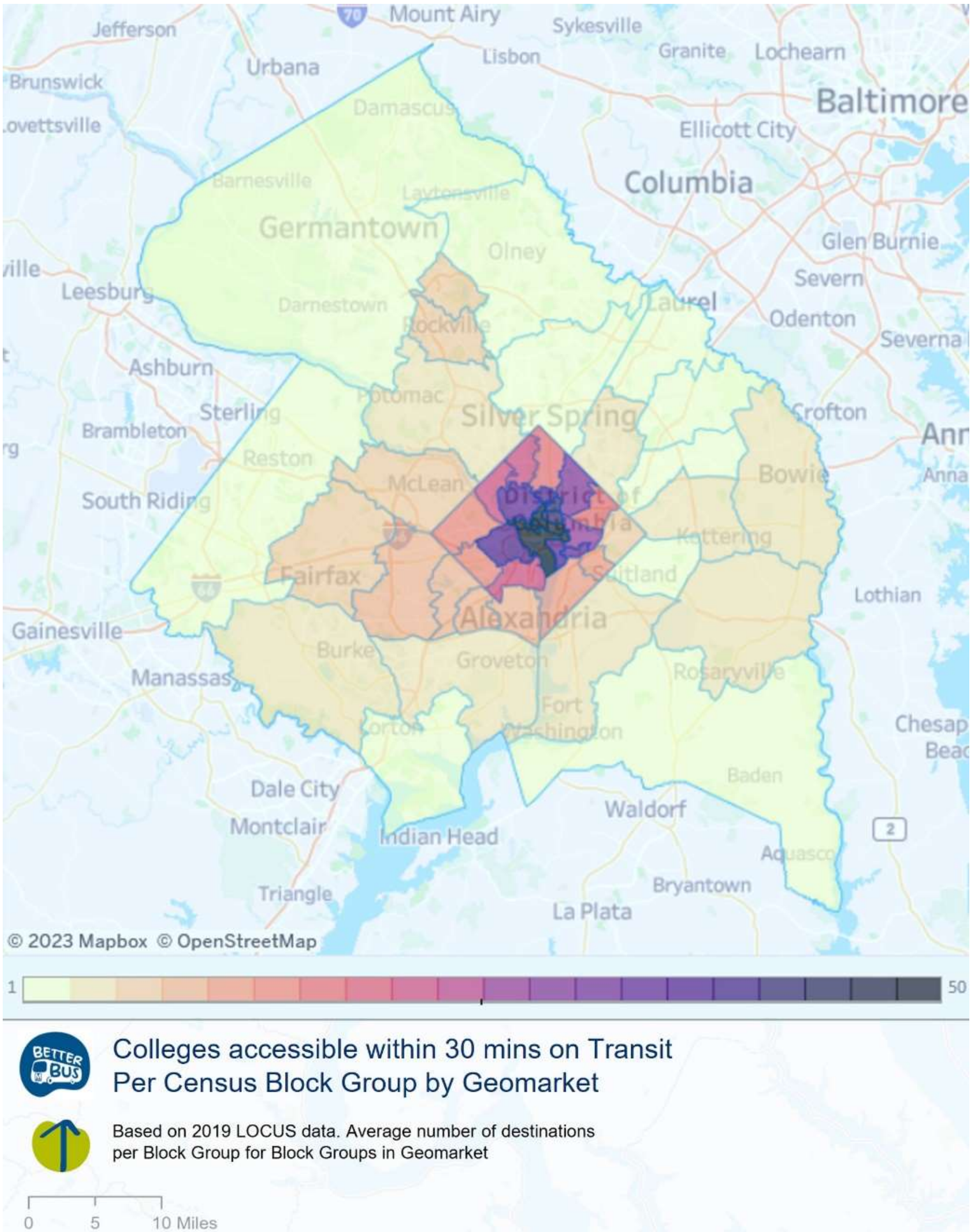


Figure 48: Average Number of Colleges Accessible within 60 mins by Transit by Geomarket

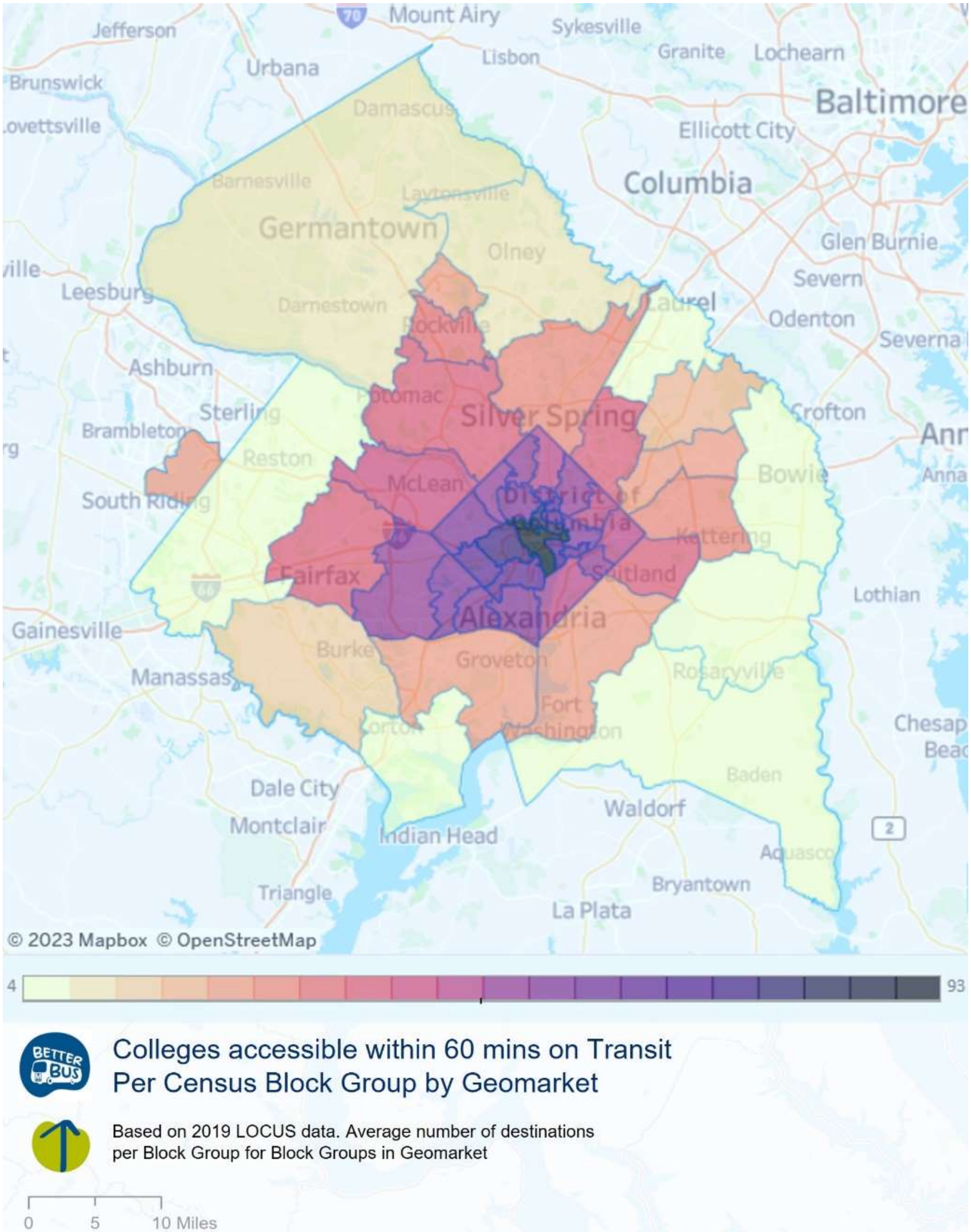


Figure 49: Average Number of Universities Accessible within 15 mins by Transit by Geomarket

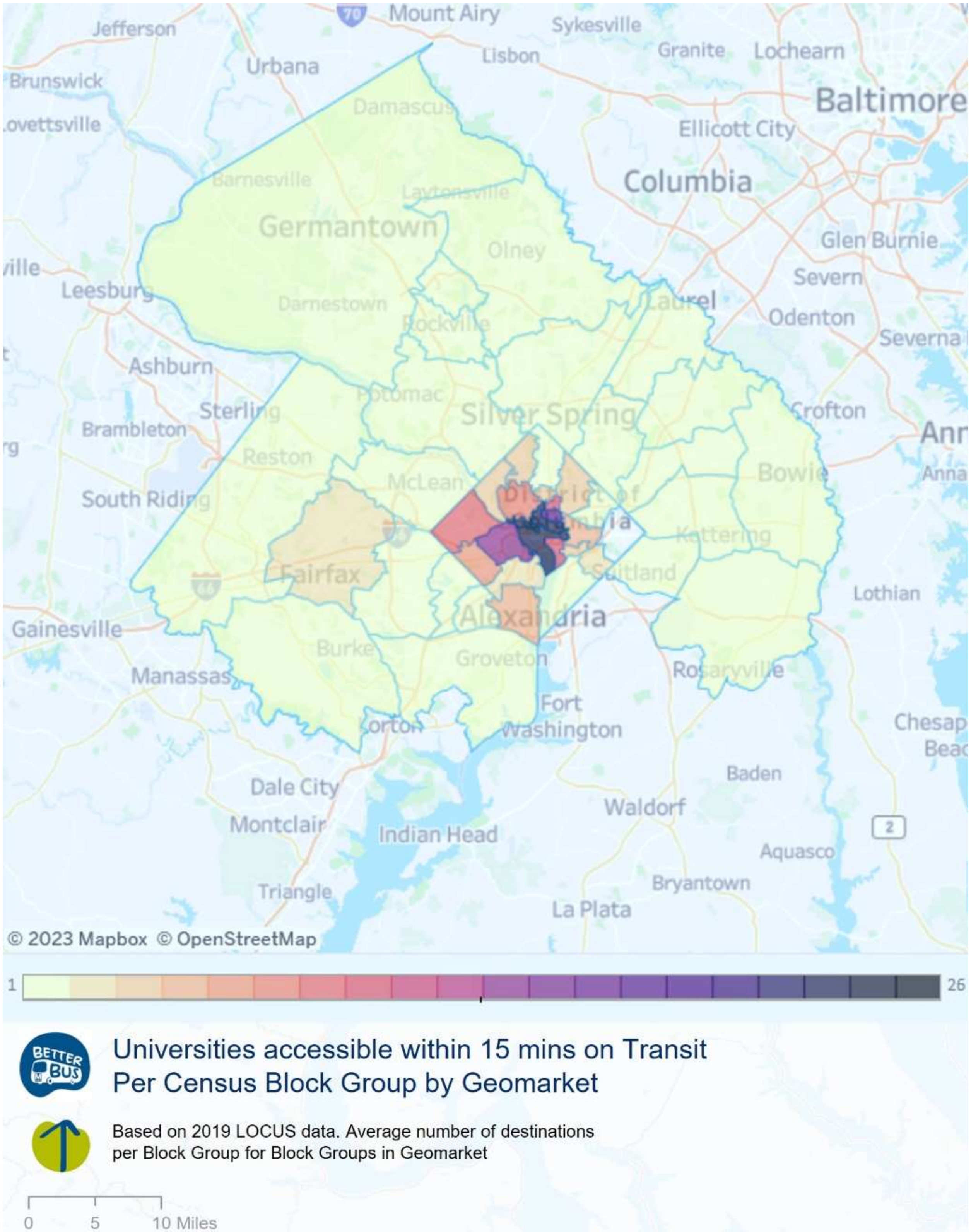


Figure 50: Average Number of Universities Accessible within 30 mins by Transit by Geomarket

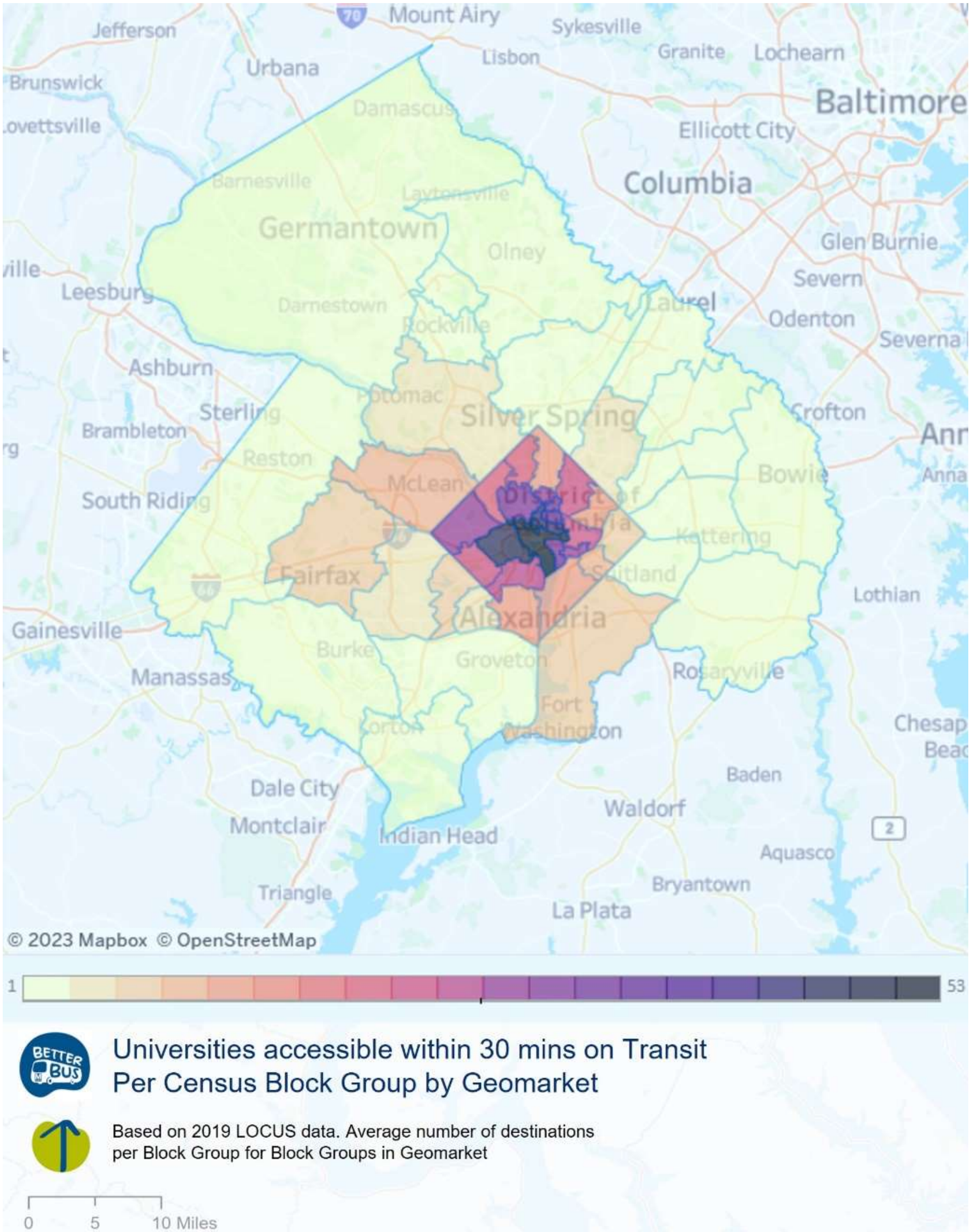


Figure 51: Average Number of Universities Accessible within 60 mins by Transit by Geomarket

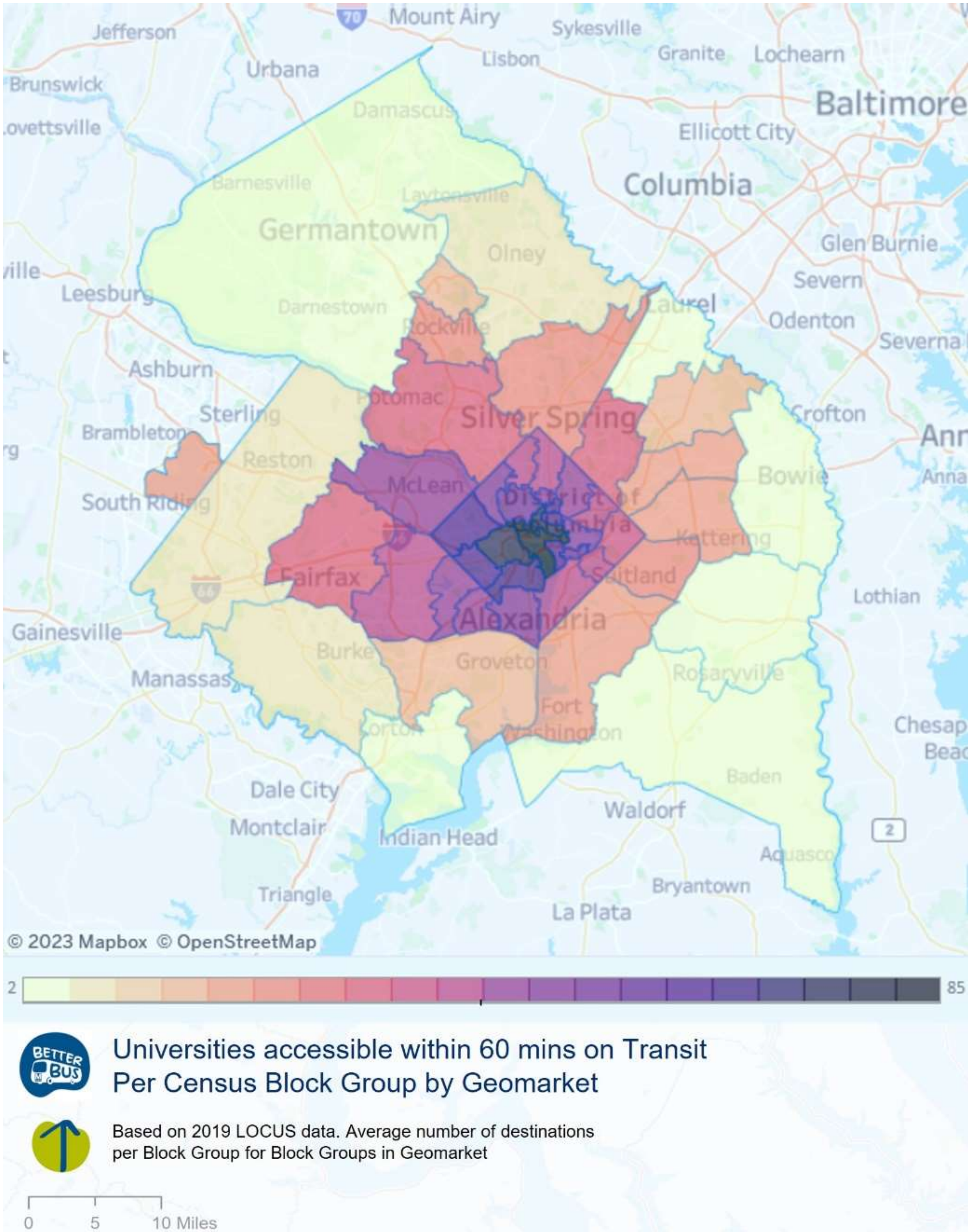


Figure 52: Average Number of Jobs Accessible within 15 mins by Transit by Geomarket

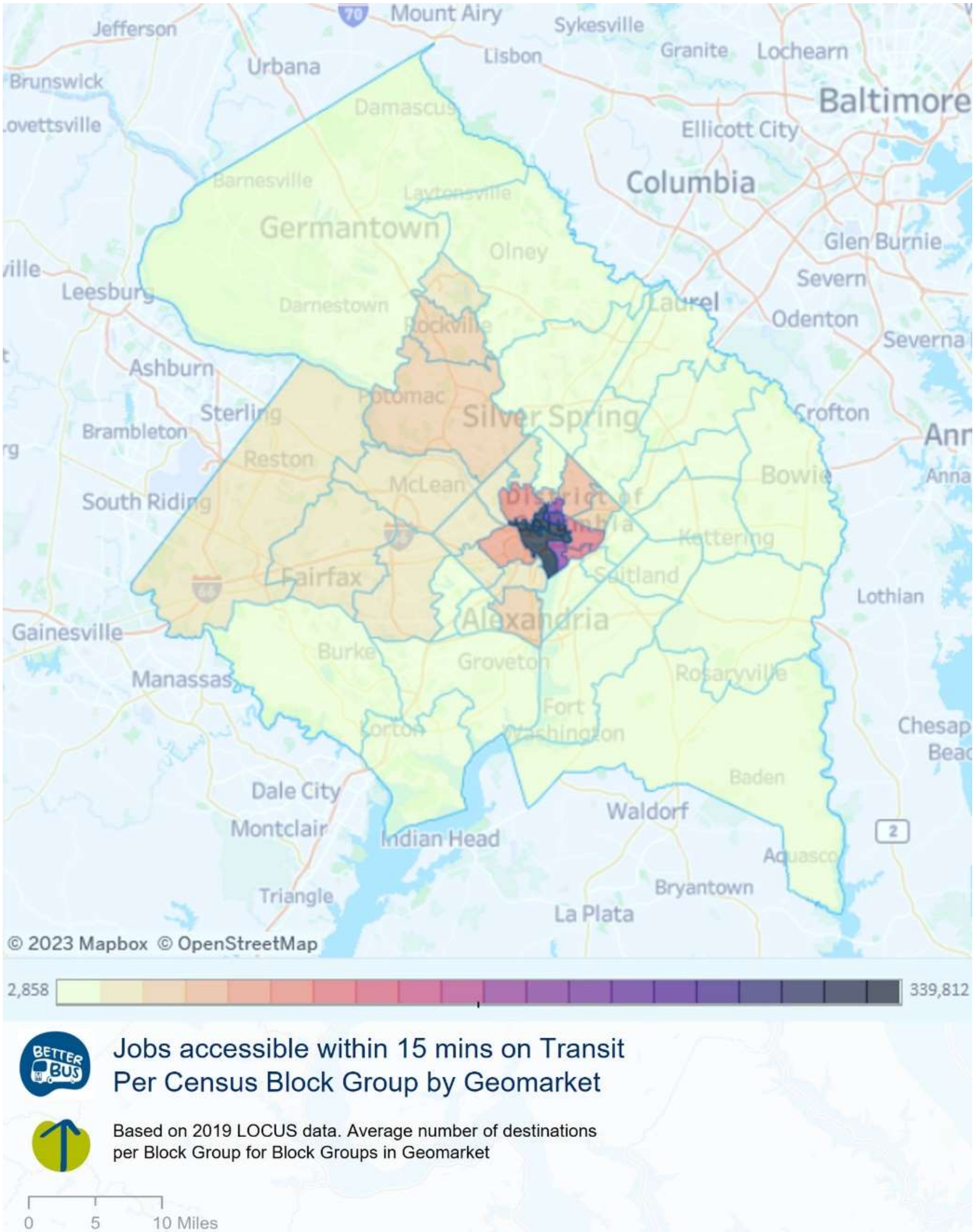


Figure 53: Average Number of Jobs Accessible within 30 mins by Transit by Geomarket

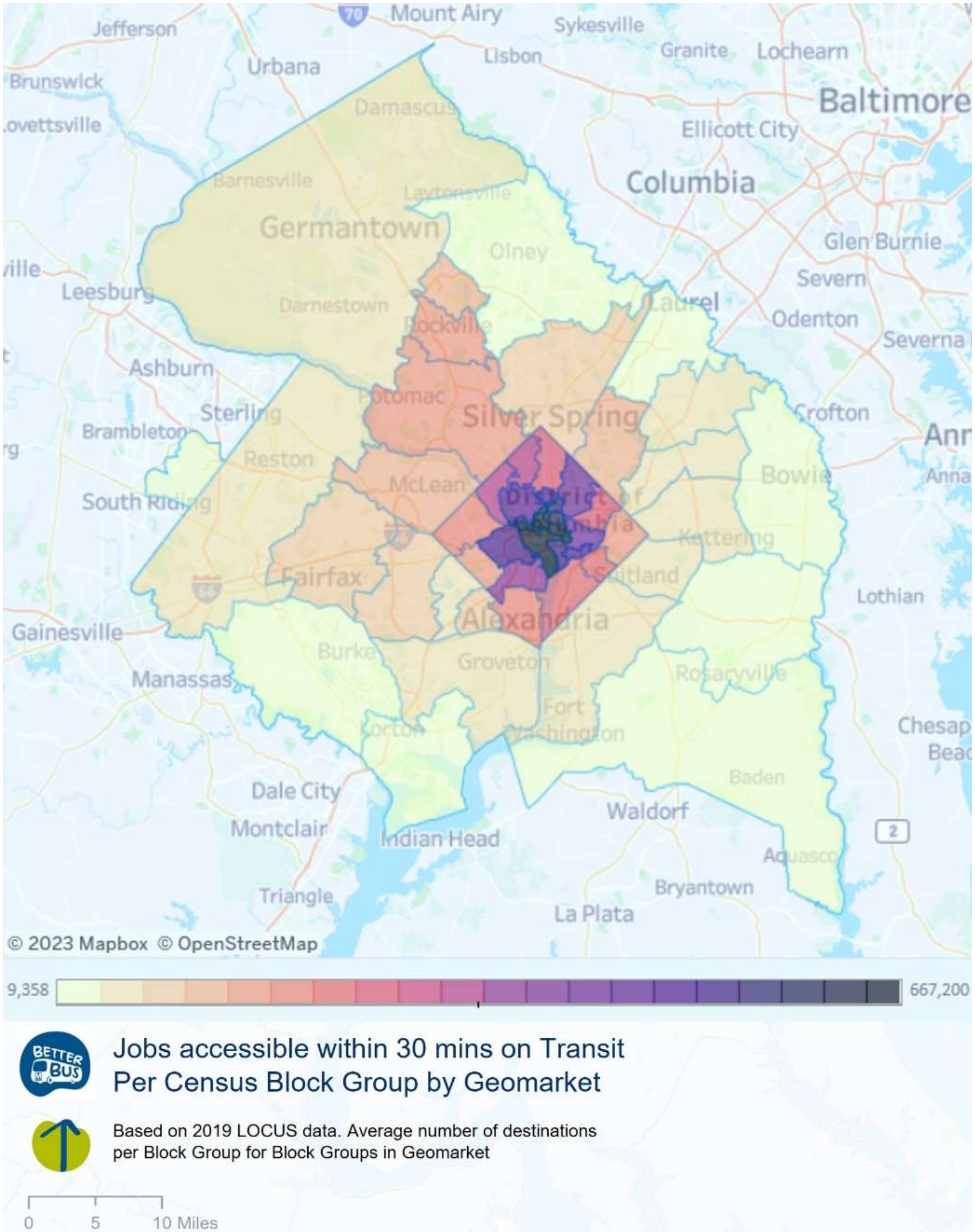
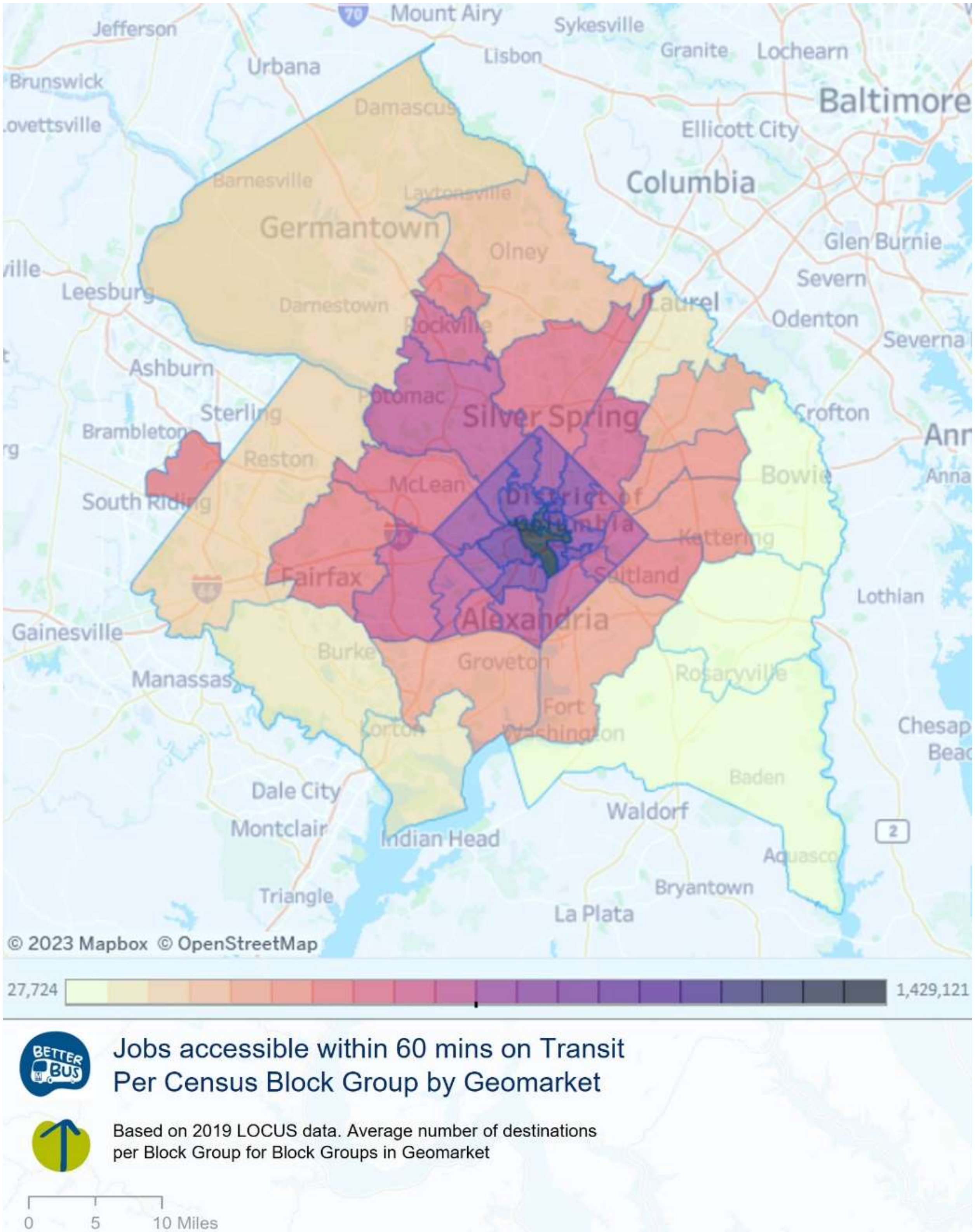


Figure 54: Average Number of Jobs Accessible within 60 mins by Transit by Geomarket



Geomarket Profiles

High-level summaries of the travel demand and travel time convenience analyses for each geomarket can be found in a separate compilation of Geomarket Profiles.