BUS TRANSFORMATION PROJECT

Bus System Today
January 2019

WASHINGTON AREA BUS TRANSFORMATION PROJECT

Overview of the Regional System

The current regional system includes nine bus service providers:

- WMATA
- Loudoun County Transit
- The Bus
- Fairfax County Connector
- RideOn
- ART
- DASH
- CUE
- DC Circulator

There are over 164 million annual bus trips across the region. However, ridership fell by 12 percent across the region since 2012.

Together, the jurisdictional services (all except WMATA) have decreased in passengers per hour by 32 percent, from 25 to 17 passengers per hour, since 2012.

Metrobus ridership decline did not begin until 2015 and has had a slower decline in passengers per hour with only a 14 percent decrease, from 35 to 30 passengers per hour, since 2012.

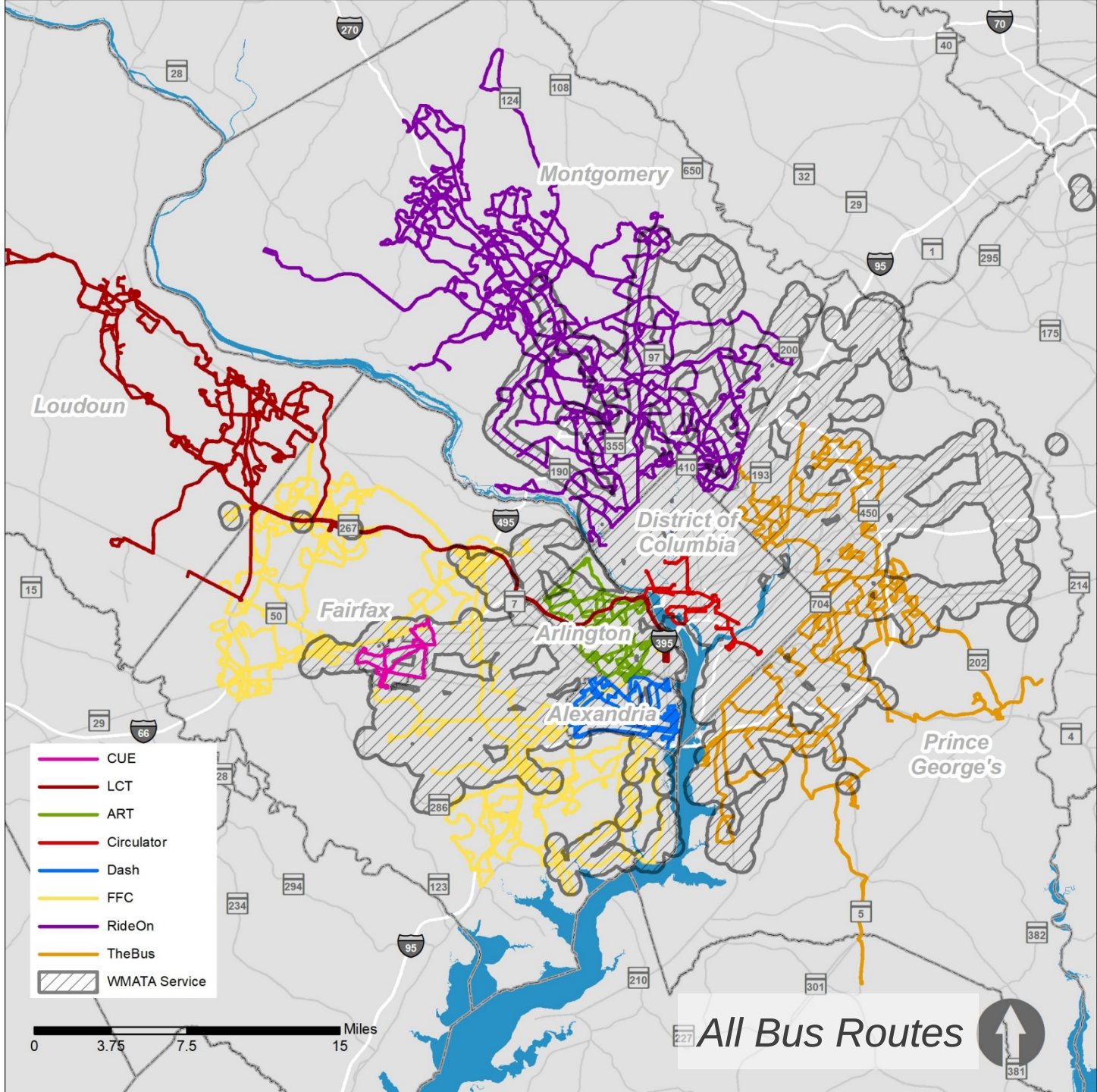
In an effort to address the state of the regional bus service, this analysis will examine four key questions that also set the structure for this document:

1. How current **customer expectations and demands** are being met.
2. How **regional coordination** can improve and how the current **funding formula** can be reassessed.
3. How **technology** can influence bus service.
4. How agencies are doing with respect to **financial sustainability**.

Region's Bus Service Providers

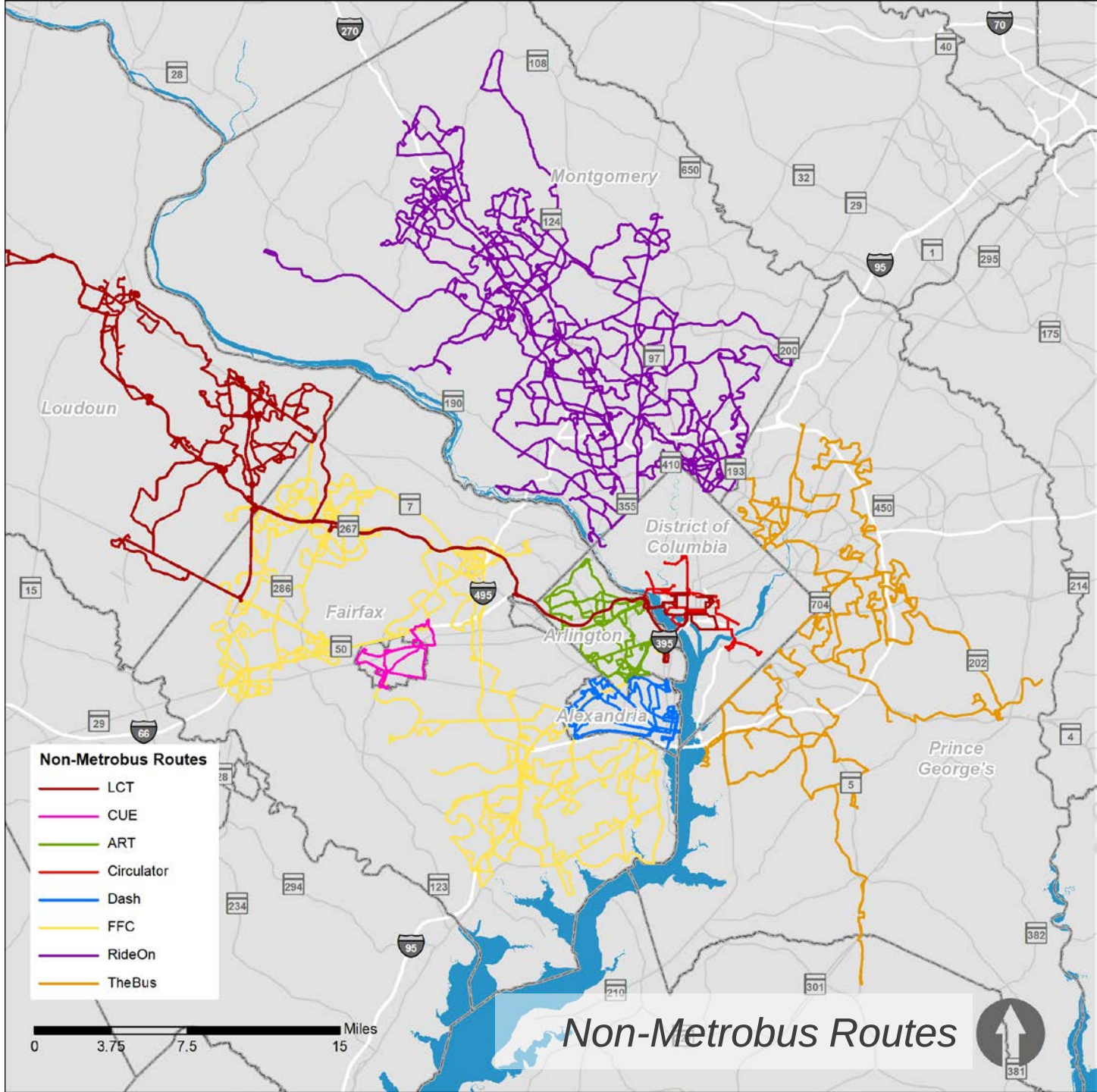
There are currently nine providers across the WMATA Compact area:

- Metrobus
- Loudoun County Transit
- The Bus
- Fairfax County Connector
- Ride On
- ART
- DASH
- CUE
- DC Circulator

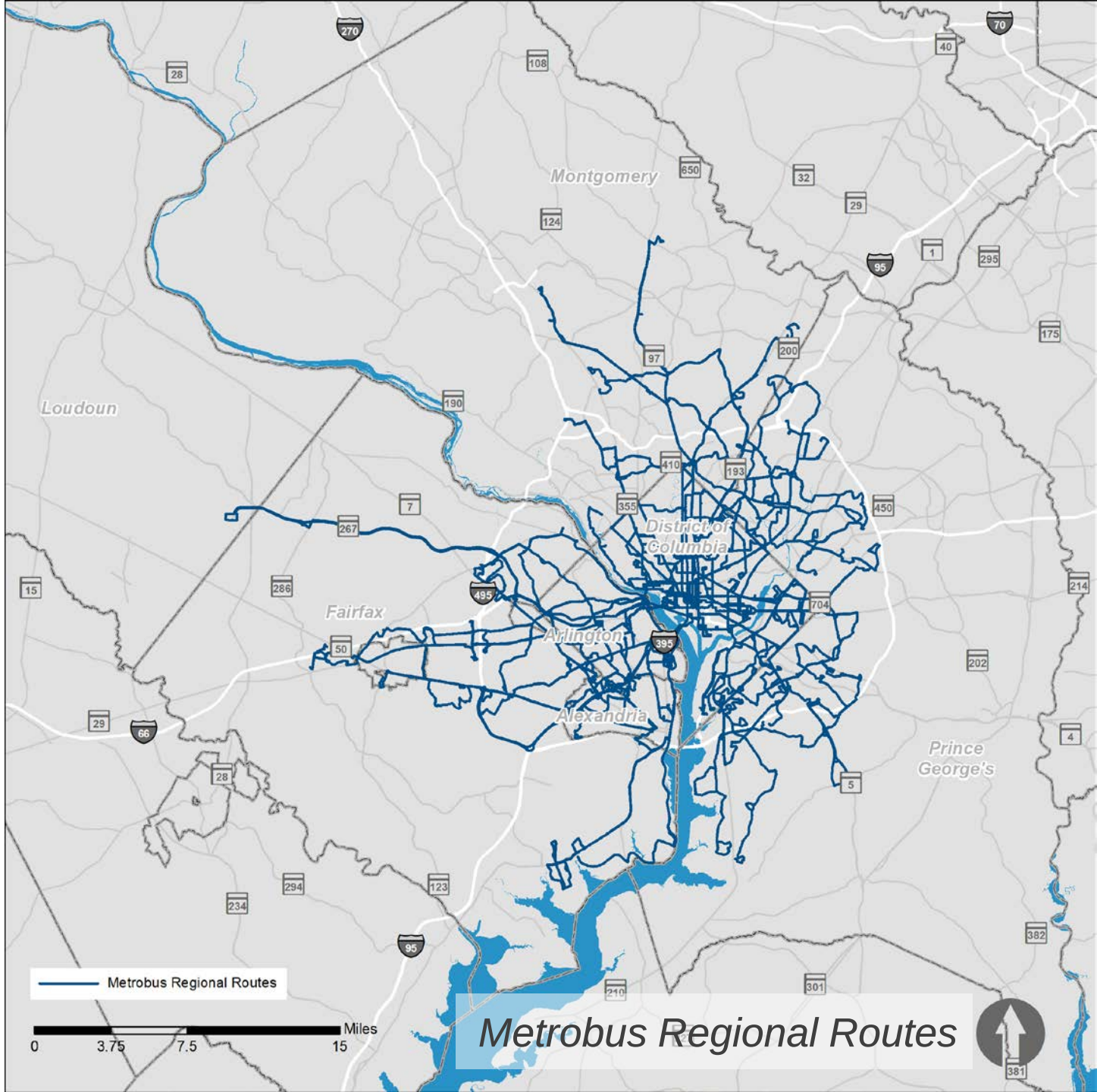


Non-Metrobus Routes

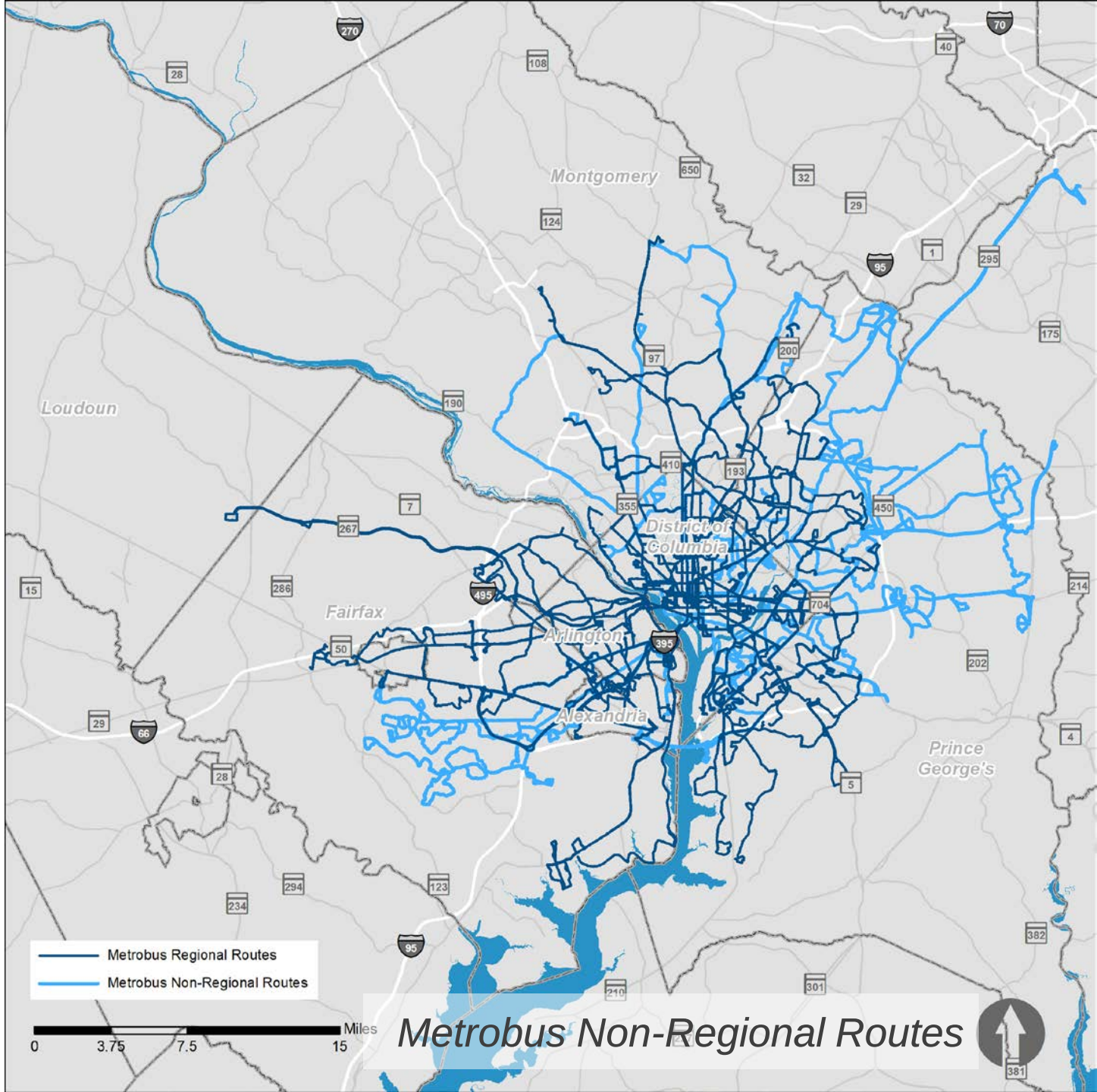
- Loudoun County Transit
- CUE
- ART
- DC Circulator
- DASH
- Fairfax County Connector
- Ride On
- The Bus



Metrobus Regional Routes



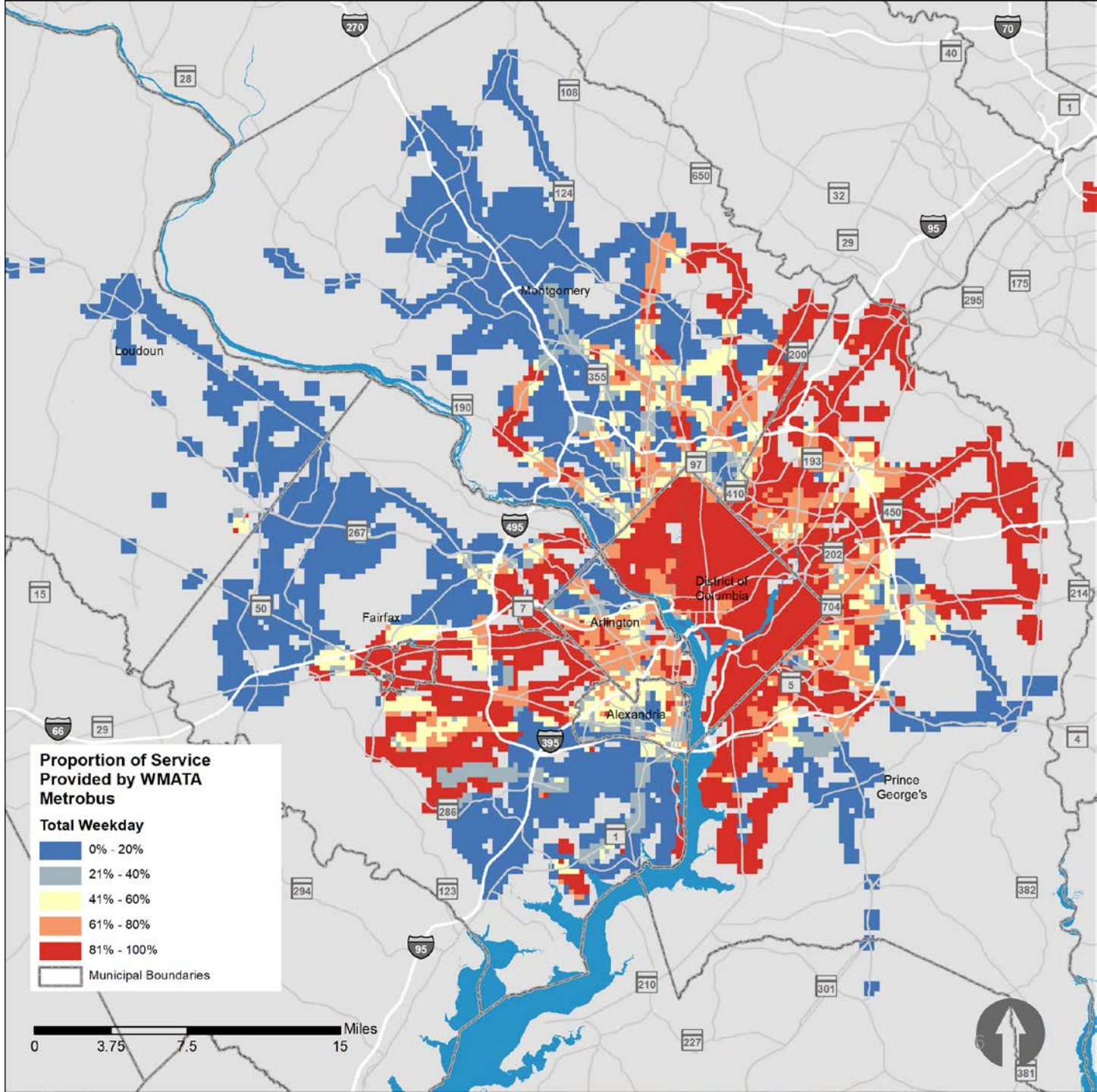
Metrobus Regional and Non-Regional Routes



Proportion of bus service provided by WMATA

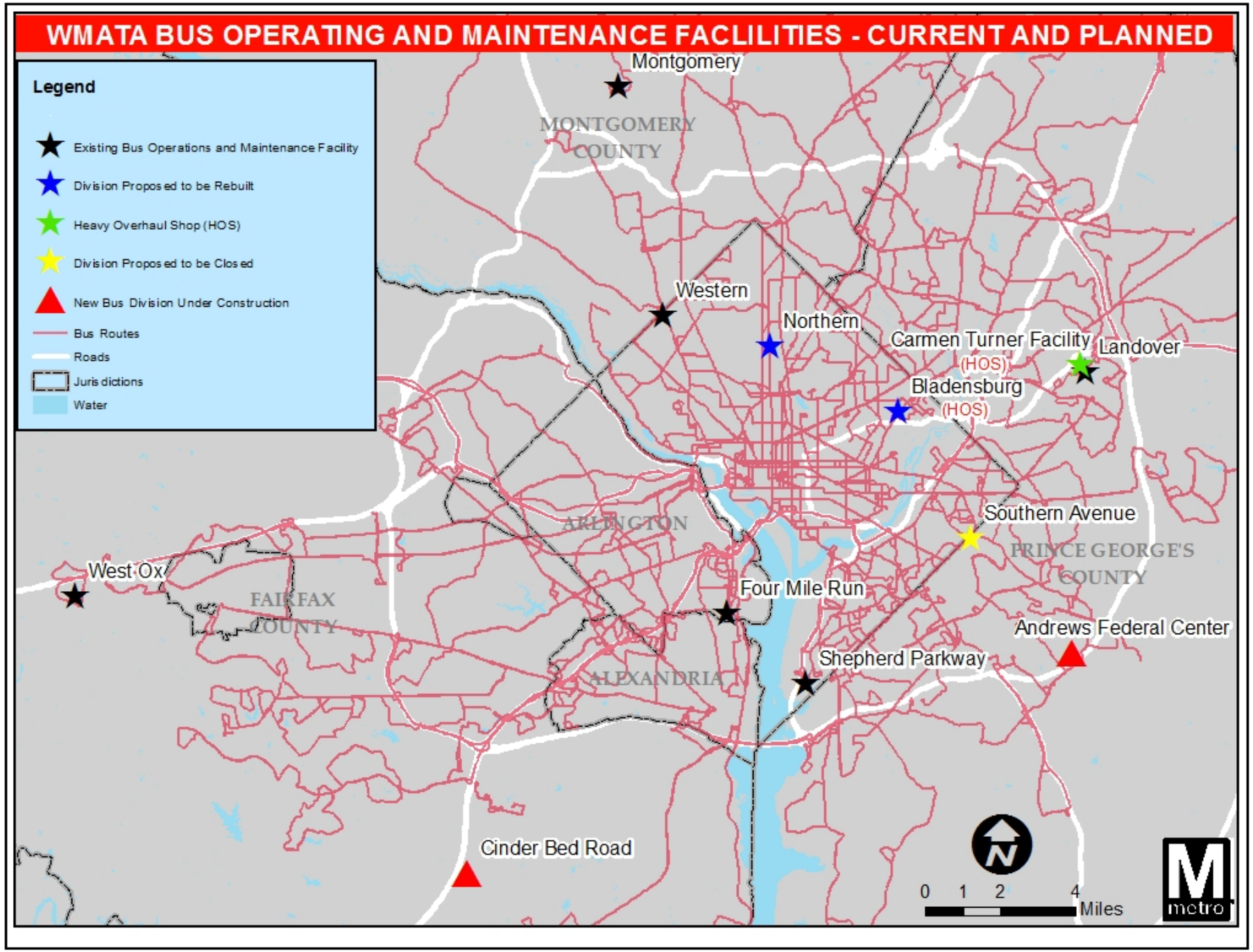
This analysis shows what percentage of the region's bus service is provided by WMATA:

- The areas in red have a majority of the bus service provided by WMATA
- Outside of Washington D.C., Metrobus provides the majority of service in parts of Prince George's and Fairfax Counties
- Metrobus has an even distribution of service in Alexandria, Arlington and Southeastern Montgomery County



Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules

Metrobus facilities across the service area



Bus is a major part of the region's transportation system

Agency	Average Daily Ridership	Number of Routes	Fleet Size	Annual Operating Cost * (millions)	Average Age of Fleet
Metrobus	443,000	254	1,503	$590.1	8
Loudoun County Transit	2,000	30**	112	$7.6	6
The Bus	15,000	28	93	$27.1	6
Fairfax County Connector	33,000	87	303	$81.4	6
CUE	3,000	2	12	$3.3	4
Ride On	85,000	80	338	$109.0	6
ART	10,000	23	65	$12.1	5
DASH	14,000	13	85	$16.1	7
DC Circulator	16,000	6	67	$19.0	8
Total	621,000	523	2,578	$865.7	--

Source: National Transit Database (2016 and 2017)

* As noted in the 2018 Regional Bus Service Provision Study by the Transportation Planning Board, there is a significant variation in how agencies attribute costs for operations, maintenance, and capital expenses of bus service. https://www.mwcog.org/documents/2018/12/27/regional-bus-service-provision-study/

**Does not include commuter bus routes

Metrobus' Unique Obligations

Metrobus has obligations that a typical bus operator does not have, including the following:

- ❑ Provision of bus bridges and emergency services for Metrorail
- ❑ Operation and maintenance of over 40 bus stations and terminals
  - The costs are not directly charged to local operators, but are allocated among jurisdictions based on subsidy allocation formula
- ❑ Provision of police services
  - Metrobus bears crime-incurred costs, including lost trips, equipment damage, workers' compensation, and insurance losses
  - Operating in center city is a different cost profile than in suburbs; current subsidy allocation formula does not reflect the difference among jurisdictions

1. Customer Expectations and Demands

Executive Summary: Customer Expectations & Demands

Throughout the region, 81 percent of people are within a quarter-mile of a bus stop and can access transit (irrespective of the level of service at the stop).

- Access to an appropriate level of service of bus transit is lacking in many areas.

A majority of transit dependent and transit supportive populations live within D.C. Arlington, and Alexandria, areas which receive high levels of bus service.

- There are concentrations of jobs and people in Fairfax County, Montgomery County, and Prince George's County that are also transit supportive, but lack adequate bus service.

There are 18,000 daily transfers between other local bus providers and Metrobus. There are an additional 49,200 daily transfers among Metrobus routes.

- Trips with a bus-to-bus transfers throughout the region require an average wait of approximately 12 minutes.
- According to national trends, having a bus stop with a shelter to protect you from the weather instead of having to wait out in the open is important to encourage ridership.

Bus riders surveyed throughout the region in 2016 were substantially less satisfied than those surveyed in 2013.

Across the WMATA compact area, the different transit agencies measure bus service characteristics in a variety of ways. This complicates analysis and performance monitoring at a regional scale.

CUSTOMER EXPECTATIONS & DEMANDS – SUBTOPICS:

RIDER PROFILE

EQUITY

REGIONAL CONNECTIVTY

RIDER EXPERIENCE

SERVICE ANALYSIS

Key Terms

Transit-Dependent Populations: Composed of low-income households (<$30,000 annual household income) and zero-car households.

Transit-Supportive Populations: Composed of Youth population (<18 years old), senior population (+65 years old), and one-car households.

Transit Potential Area: A measure based on the density of jobs and people per acre.

Access: Defined as locations within a quarter-mile of any bus stop.

Level of Service (LOS): Defined by frequency and span of service.

Weekday Service Periods: Early Morning -Before 6:00 AM; Morning Peak: 6:00 AM to 9:00 AM; Midday – 9:00 AM to 3:00 PM; Afternoon Peak – 3:00 PM to 6:00 PM; Evening – 6:00 PM t0 11:00 PM; Late Night – After 11:00 PM.

Weekend Service Periods: Core: 9:00 AM to 3:00 PM.

CUSTOMER EXPECTATIONS & DEMANDS

RIDER PROFILE

EQUITY

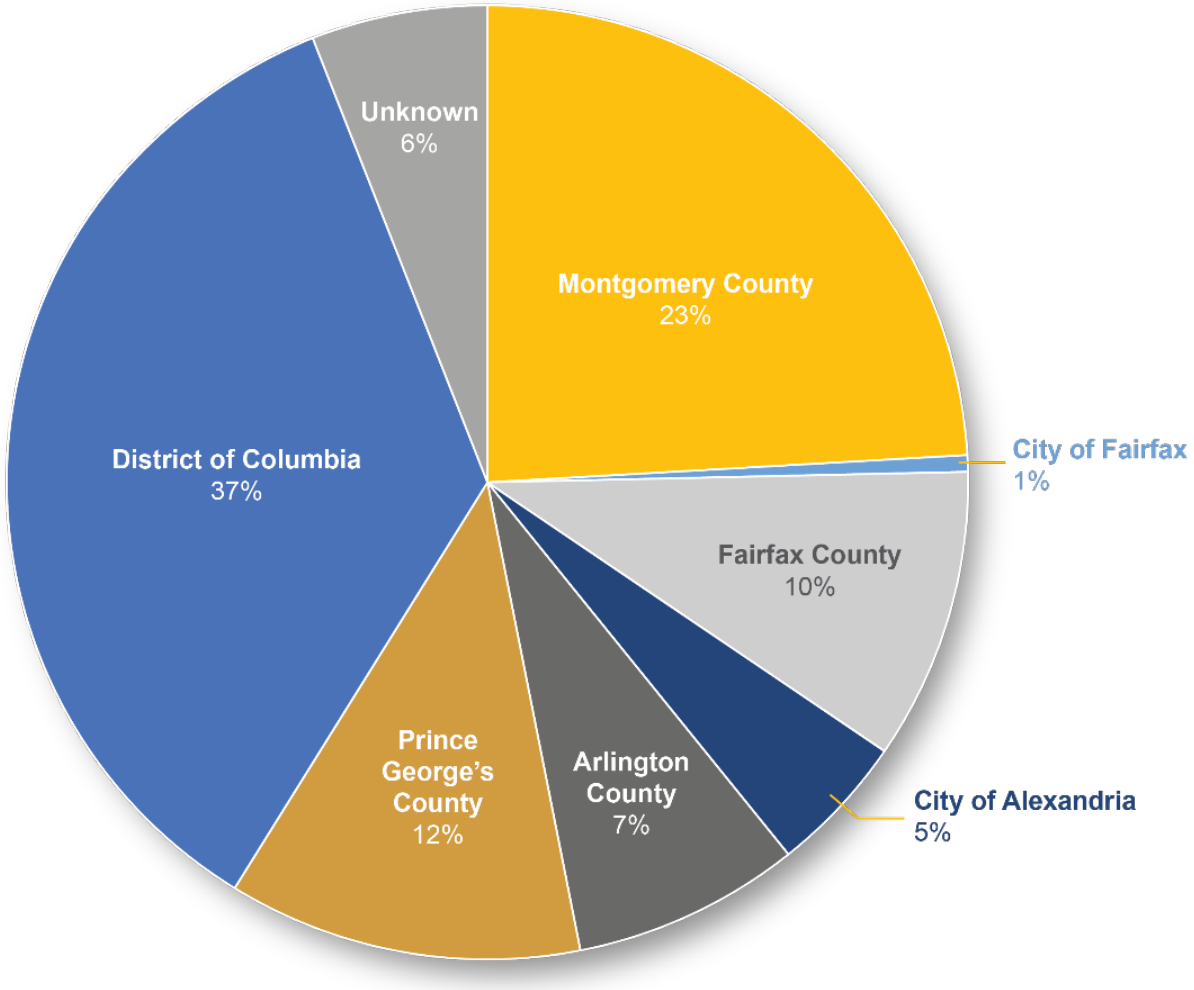
REGIONAL CONNECTIVTY

RIDER EXPERIENCE

SERVICE ANALYSIS

Where Bus Customers Live in the Region

- Most bus customers in the region reside in DC, whose residents account for over one third of the region's bus trips.
- Montgomery County has the second highest amount of bus trips, with its residents accounting for nearly one quarter of all bus trips.



Bus Customers:

Low Income*

Zero-Car

5% of the WMATA compact service area households are low-income

- **52%** of Metrobus customers.
- **31%** of ART customers.
- **21%** of DASH customers.
- **38%** of Fairfax Connector customers.

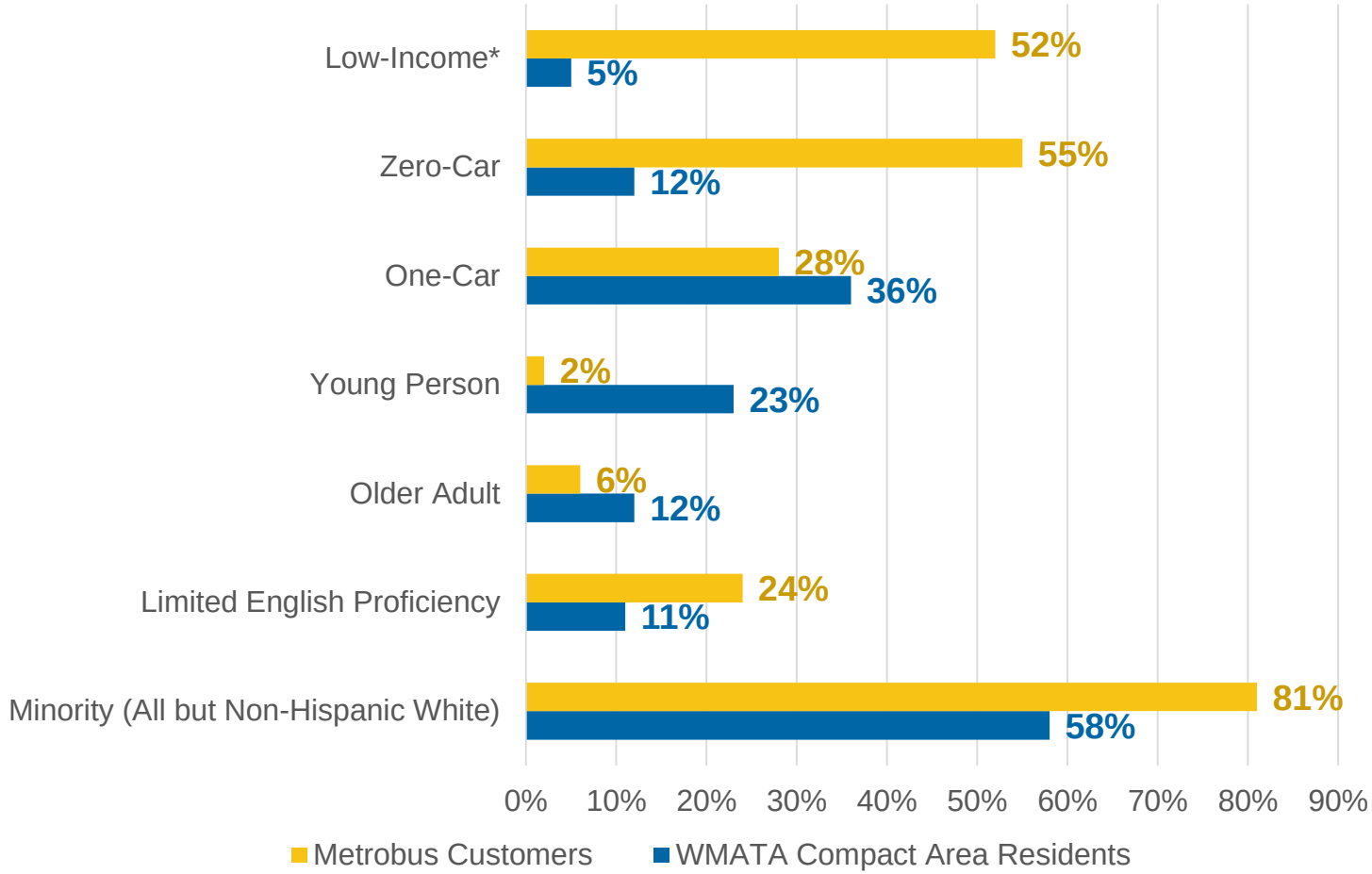
12% of the WMATA compact service area household have zero-cars

- **55%** of Metrobus customers.
- **72%** of Prince George's County TheBus customers.
- **77%** of CUE customers.

Source: WMATA 2014 Passenger Survey; WMATA 2017-2020 Public Participation Plan; US Census 2011-2016 5-Year Estimates
*Low income defined as living in a household with income less than $30,000 a year
**Higher-income zero-car households are likely not as dependent on transit as lower-income zero-car households.

Compared to non-riders, Metrobus customers are more transit dependent

- Metrobus riders are far more likely to come from low-income and zero-car households, which are the two strongest indicators of transit dependency
  - The proportion of low-income Metrobus riders is 10x the proportion of low-income residents of the region
  - The proportion of zero-car household Metrobus riders is more than 4x the proportion of zero-car households in the region
- Metrobus riders are more likely to be of a racial minority group and to have limited English proficiency



Source: WMATA 2014 Passenger Survey; WMATA 2017-2020 Public Participation Plan; US Census 2011-2016 5-Year Estimates
*Low income defined as living in a household with income less than $30,000 a year

Buses service a diverse population across the region. Rider characteristics across bus systems

The following data is derived from individual survey's conducted by each system:

ART: Arlington County

Race: 68% non-white

Income: 31% annual household income under $25,000

Primary language spoken at home: 28% non-English

DASH: City of Alexandria

Race: 61% non-white

Income: 21% annual household income under $30,000

Rider Age: Average age is 38

Fairfax Connector: Fairfax County

Race: 58% non-white

Income: 38% annual household income under $30,000

LEP: 20% speak English below level of "very well"

TheBus: Prince George's County

Car Ownership: 72% of riders do not own a car

Mode of access to bus: 65% walk to access TheBus

Frequency of bus use: 47% ride TheBus five days per week

CUE: City of Fairfax

Car Ownership: 77% of riders do not have access to a car

Mode of access to bus: Majority surveyed walk to access the bus

Driver's License: Majority surveyed reported not having a valid driver's license

Source: Arlington Transit Ridership Study (2013), DASH 2012 Onboard Survey, Fairfax Connector Ridership Survey (2015), Prince George's County, Transit Vision Plan, 2018 – 2022, Onboard Survey - CUE and Mason Shuttles (2014)

CUSTOMER EXPECTATIONS & DEMANDS

RIDER PROFILE

EQUITY

REGIONAL CONNECTIVTY

RIDER EXPERIENCE

SERVICE ANALYSIS

Transit Need Indicators

For this analysis, the study area is broken into ¼ mile grids that data is summarized into. The ¼ mile grids represent and area that is accessible by walking. We will look at the following census-based demographics which we group together to simplify results and interpretation.

Transit Dependent

Zero-Car Households
Low-Income Households
(<$30,000 annual income)

Transit Supportive

One-Car Households
Youth Population
(<18 years old)
Senior Population
(>65 years old)

Transit Potential

Jobs per acre
People per acre

Transit Dependent populations tend to need all day service as they are most likely to ride outside of peak periods
Transit Supportive populations identify areas that are suitable for transit and would most likely use it if it is available.
Transit Potential areas identify areas that can support transit, for example: the more potential in an area the more transit that can be supported.

Using American Community Survey 5-year Estimate data from 2016, the following analysis looks at where transit is needed in the region and then compares these areas of need to the level of service offered in these areas to identify gaps.

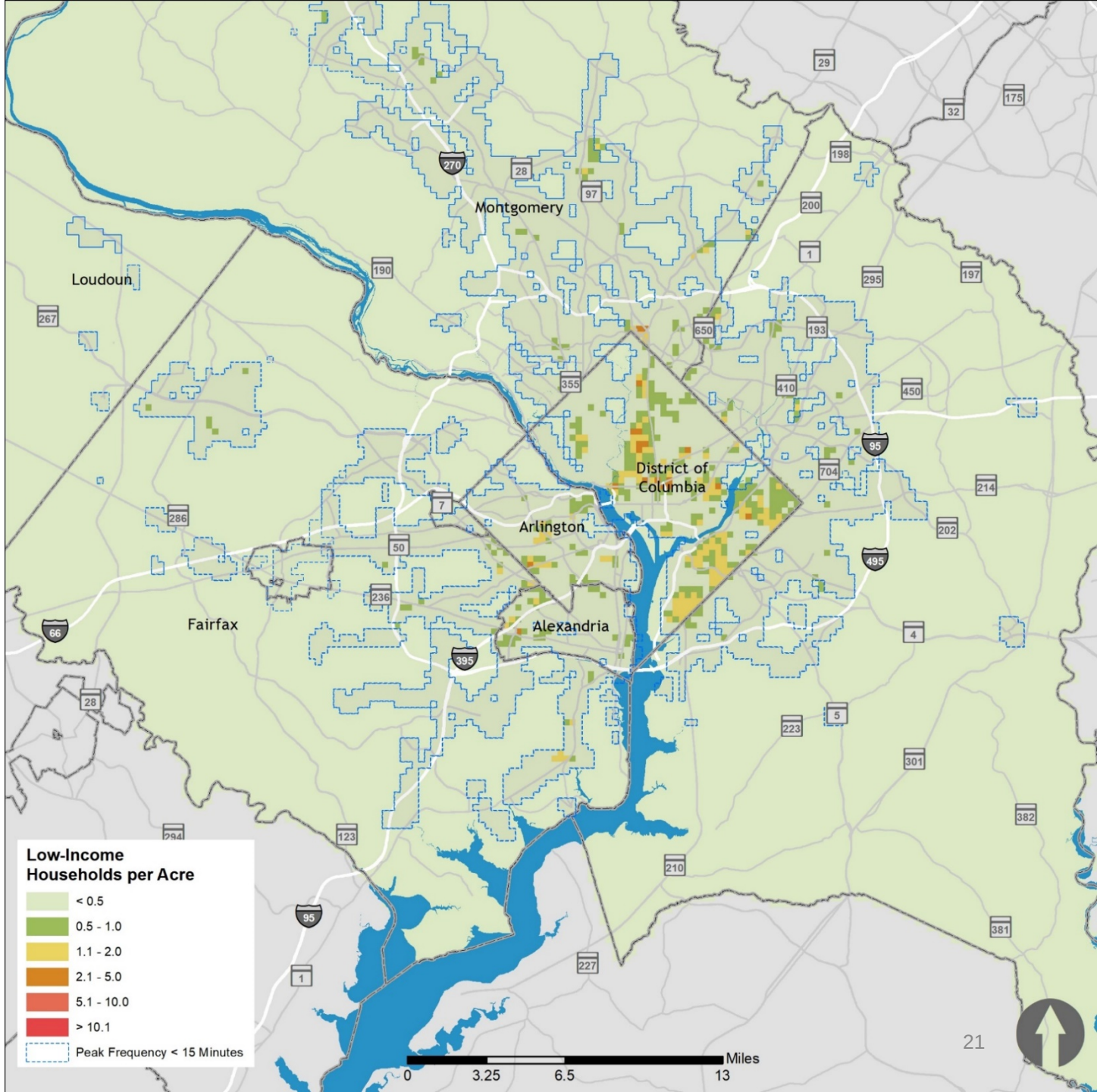
Transit Dependent: Low-Income Households

The highest concentrations of Low-Income Households (LIHH) are found in D.C., where approximately 25 percent of households (approximately 70,000 total) are low-income. Ninety-seven percent of D.C. LIHH have access to peak high frequency bus, defined as service every 15 minutes or better.

Prince George's County has the second highest concentration of LIHH, where 15 percent of households (approximately 45,000 total) are low-income. Of these households, 61 percent have access to peak high frequency bus service.

Seventy-five percent of the total LIHH in the region have access to high frequency bus service during peak periods.

Jurisdiction	Low-Income Households (% of Total Households)	% Low-Income HH with Access to High Freq. Peak Service
City of Alexandria	13%	100%
Arlington County	12%	99%
Fairfax City	11%	59%
Fairfax County	9%	56%
City of Falls Church	11%	75%
Loudoun County	7%	6%
Montgomery County	12%	73%
Prince George's County	15%	61%
Washington D.C.	25%	97%



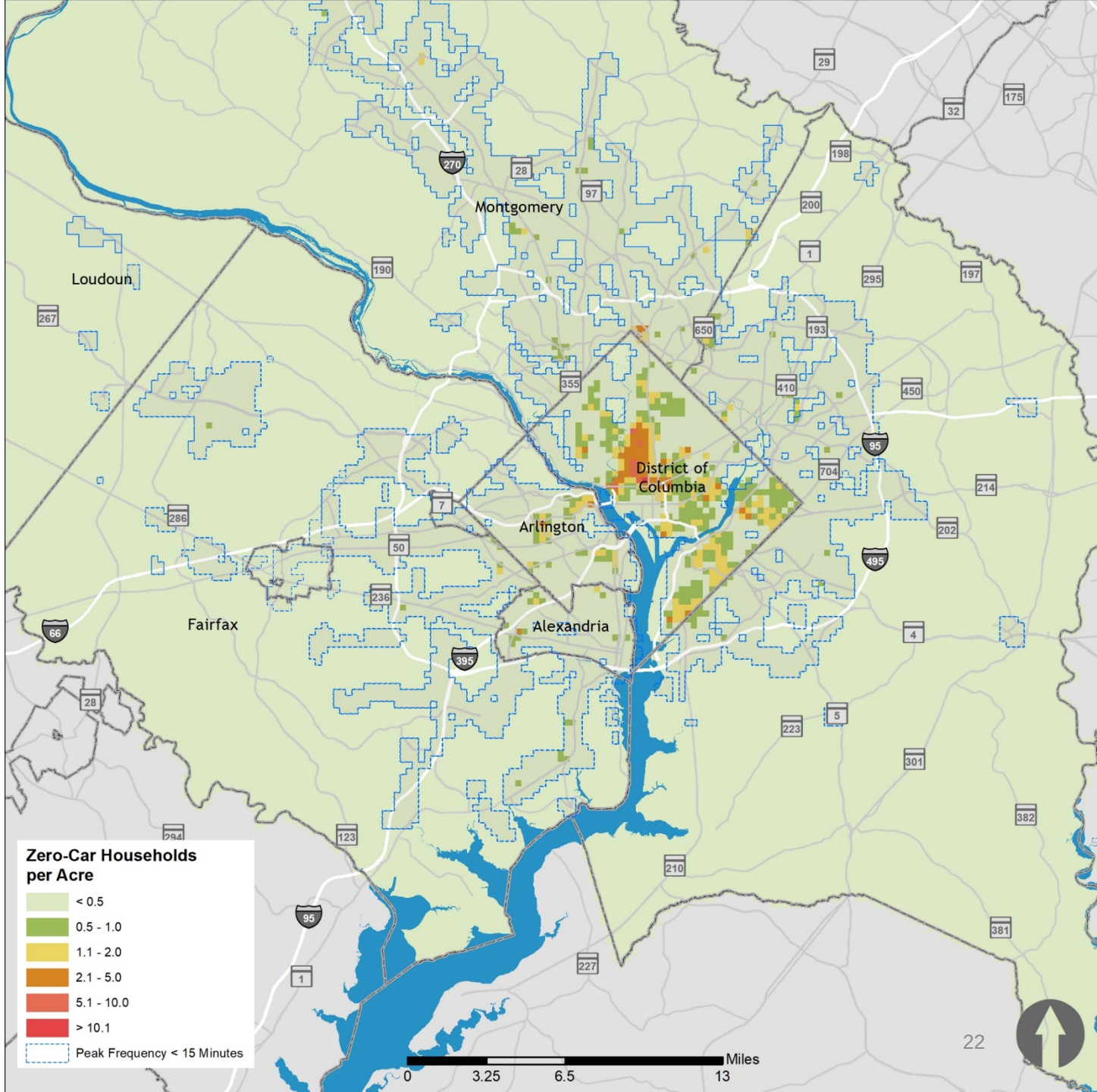
Transit Dependent: Zero-Car Households

The highest concentration of zero-car households are found in D.C., where approximately 36 percent of households (100,000 households in total) have no car. Ninety-eight percent of these zero-car D.C. households have access to peak high frequency bus, defined as service every 15 minutes or better.

Arlington and Alexandria have the next highest concentrations of zero-car households, at 12 and 10 percent of households respectively. Of those zero-car households, 98 percent of Alexandria and 100 percent of Arlington zero-car households have access to peak high frequency bus.

Eighty-eight percent of the region's zero-car households have access to high frequency bus service during the peak periods.

Jurisdiction	Zero-Car Households (% of Total Households)	% Zero-Car Households with Access to High Freq. Peak Service
City of Alexandria	10%	98%
Arlington County	12%	100%
Fairfax City	5%	63%
Fairfax County	4%	62%
City of Falls Church	6%	78%
Loudoun County	2%	7%
Montgomery County	8%	82%
Prince George's County	9%	73%
Washington D.C.	36%	98%



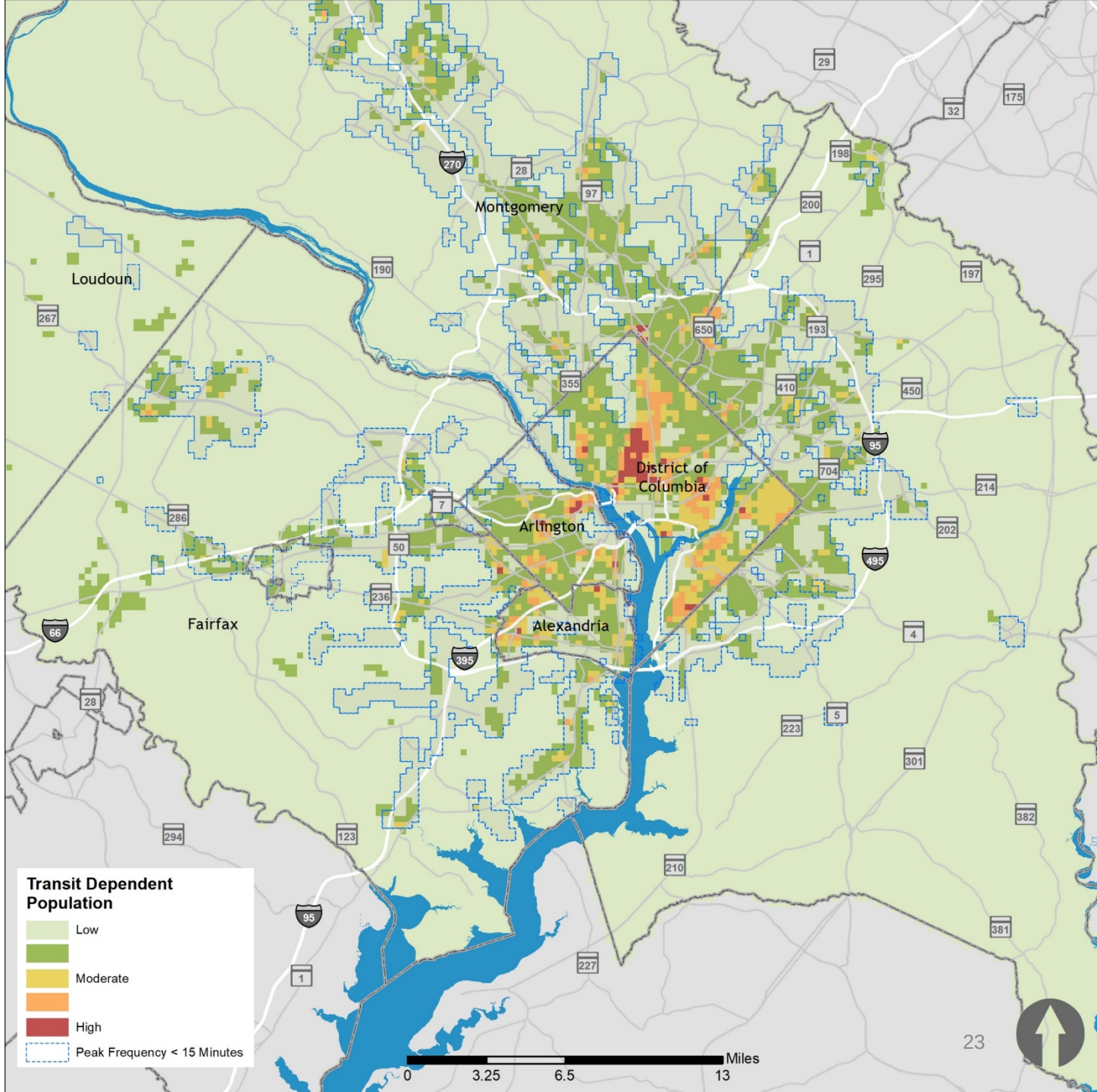
Transit Dependent Population Concentrations

By combining the two demographics, zero-car households and low-income households, with equal weight and ranking areas from Low to High, we can locate where transit dependent populations are throughout the region.

By this metric, the highest concentrations of Transit Dependent Populations are found in D.C., Arlington, and Alexandria.

The areas with the least amount of bus service, such as Loudoun County, also have smaller proportions of zero-car and low-income households compared to the jurisdiction's total number of households.

Jurisdiction	Zero-Car Households (% of Total Households)	Low-Income Households (% of Total Households)
City of Alexandria	10%	13%
Arlington County	12%	12%
Fairfax City	5%	11%
Fairfax County	4%	9%
City of Falls Church	6%	11%
Loudoun County	2%	7%
Montgomery County	8%	12%
Prince George's County	9%	15%
Washington D.C.	36%	25%

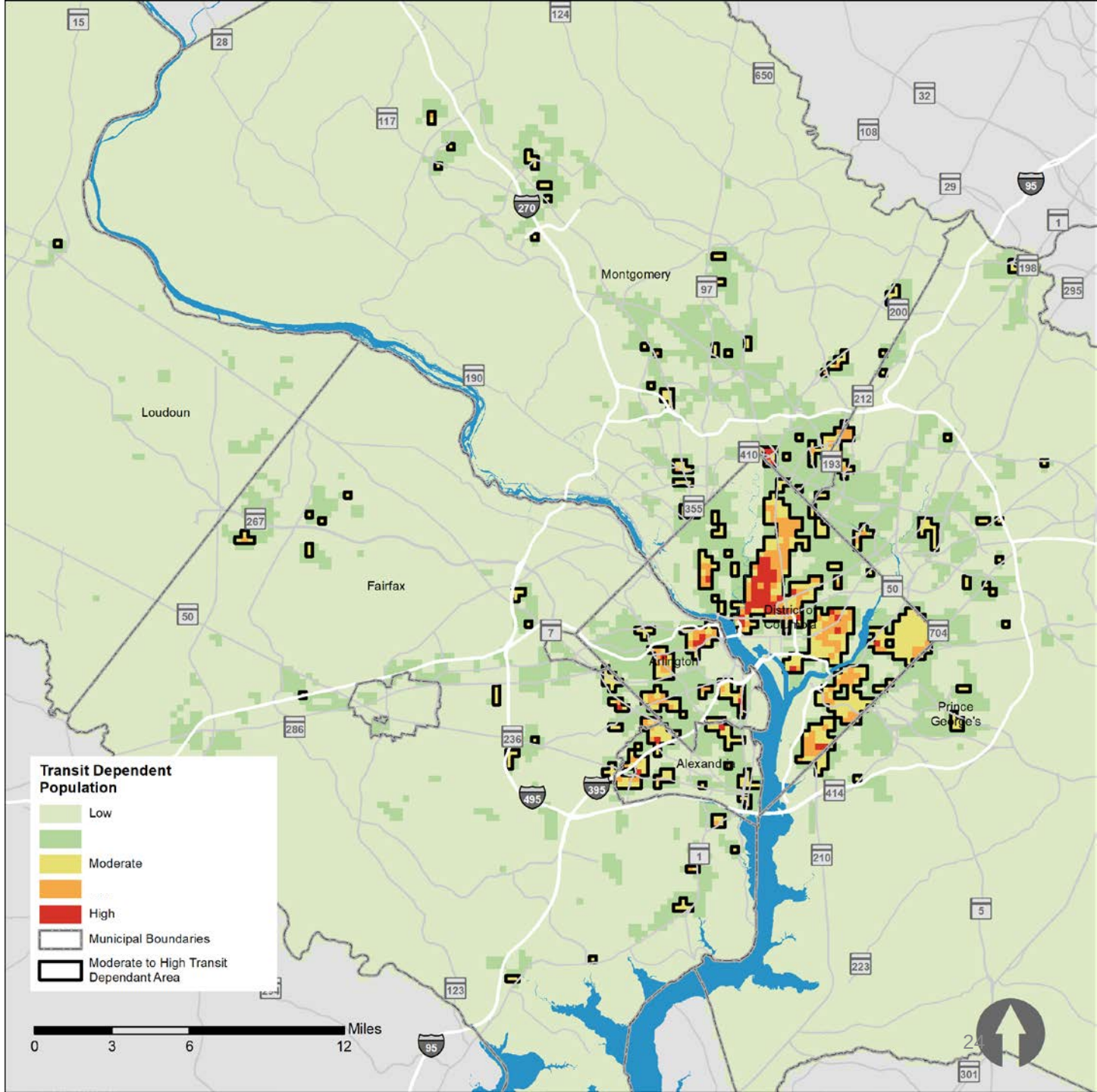


Transit Dependent Population Concentrations

The areas with higher concentrations of transit dependent populations ranked Moderate to High are outlined in the map. Most of these higher concentrations are located in D.C., Arlington, and Alexandria.

Transit dependent populations are more likely to need late night and weekend service to get to work.

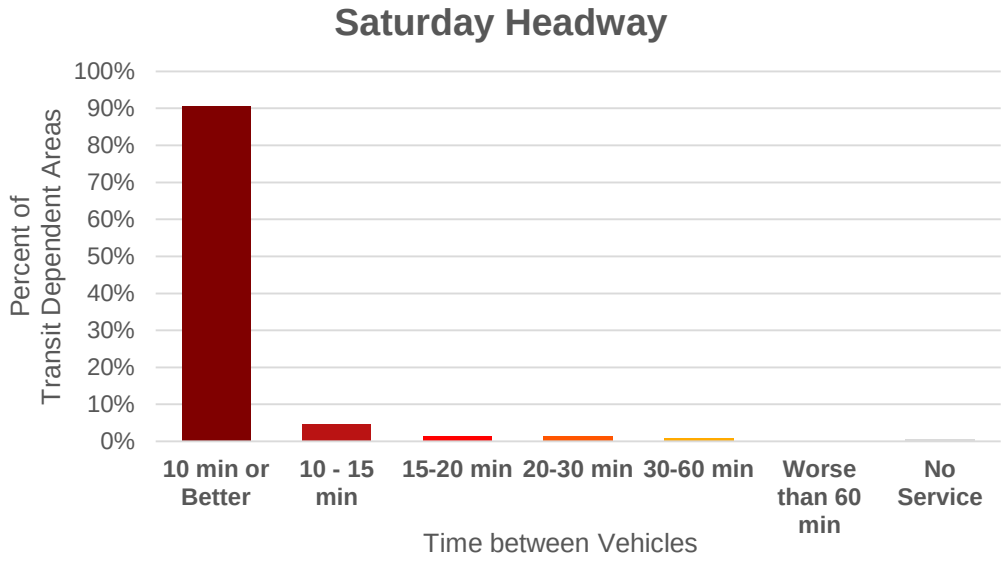
The areas defined here will be compared to Saturday, Sunday, and Late Night bus level of service throughout the region in the following slides.



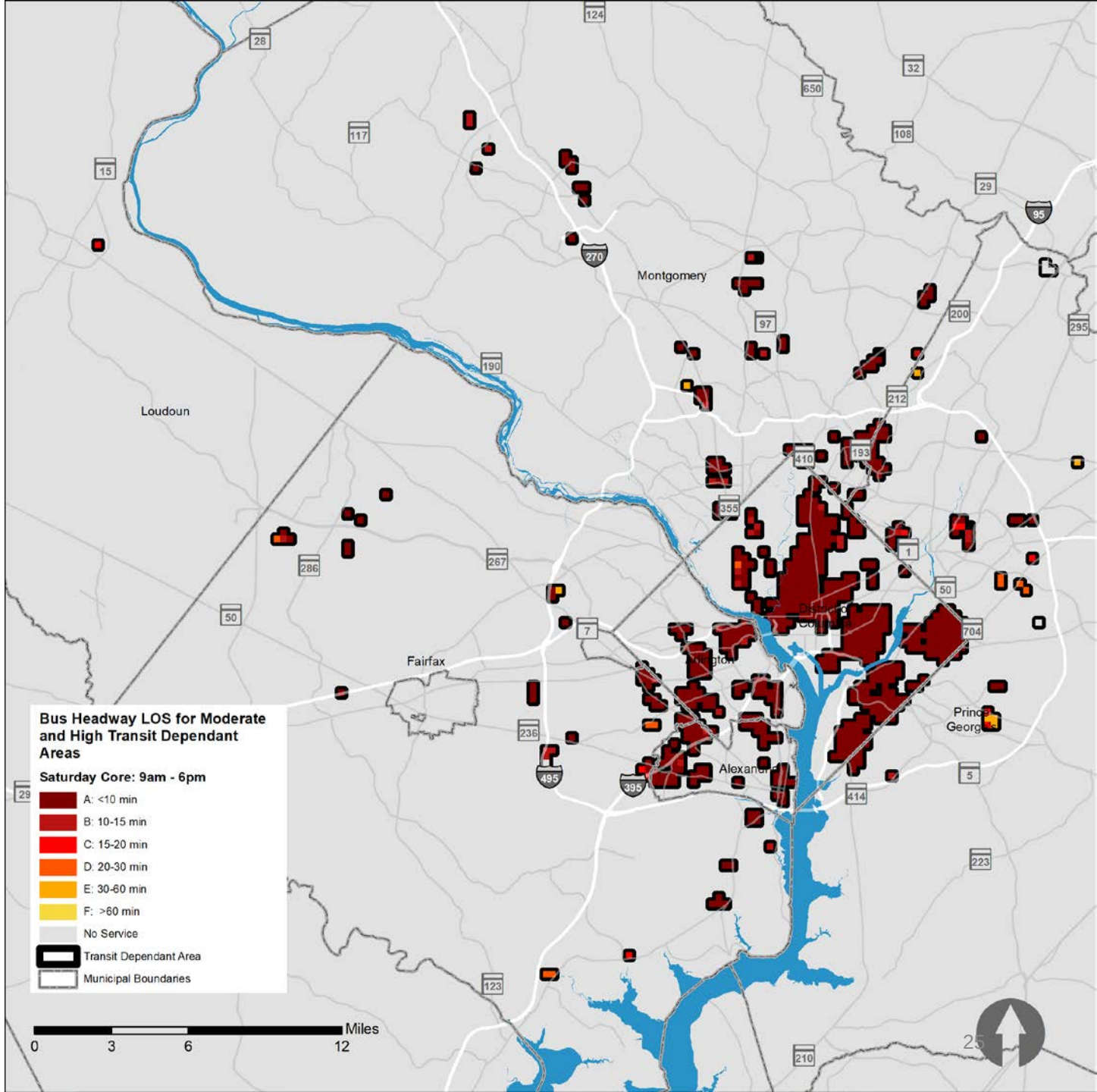
Saturday: Are we providing service when transit dependent people need it?

Ninety-one percent of moderate to high concentrations of transit dependent populations have access to a bus every 10 minutes or better across all services within a ¼ mile on Saturdays during the core hours of 9:00 AM – 6:00 PM.

Most of the areas that receive lower levels of service (greater than 15 minute headways between vehicles) are in Fairfax and Prince George's Counties.



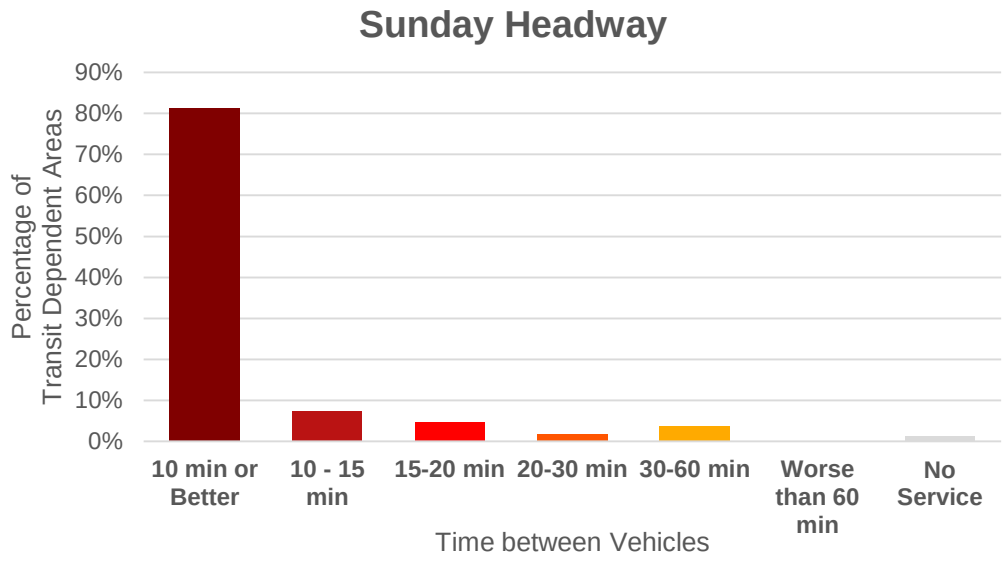
Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules



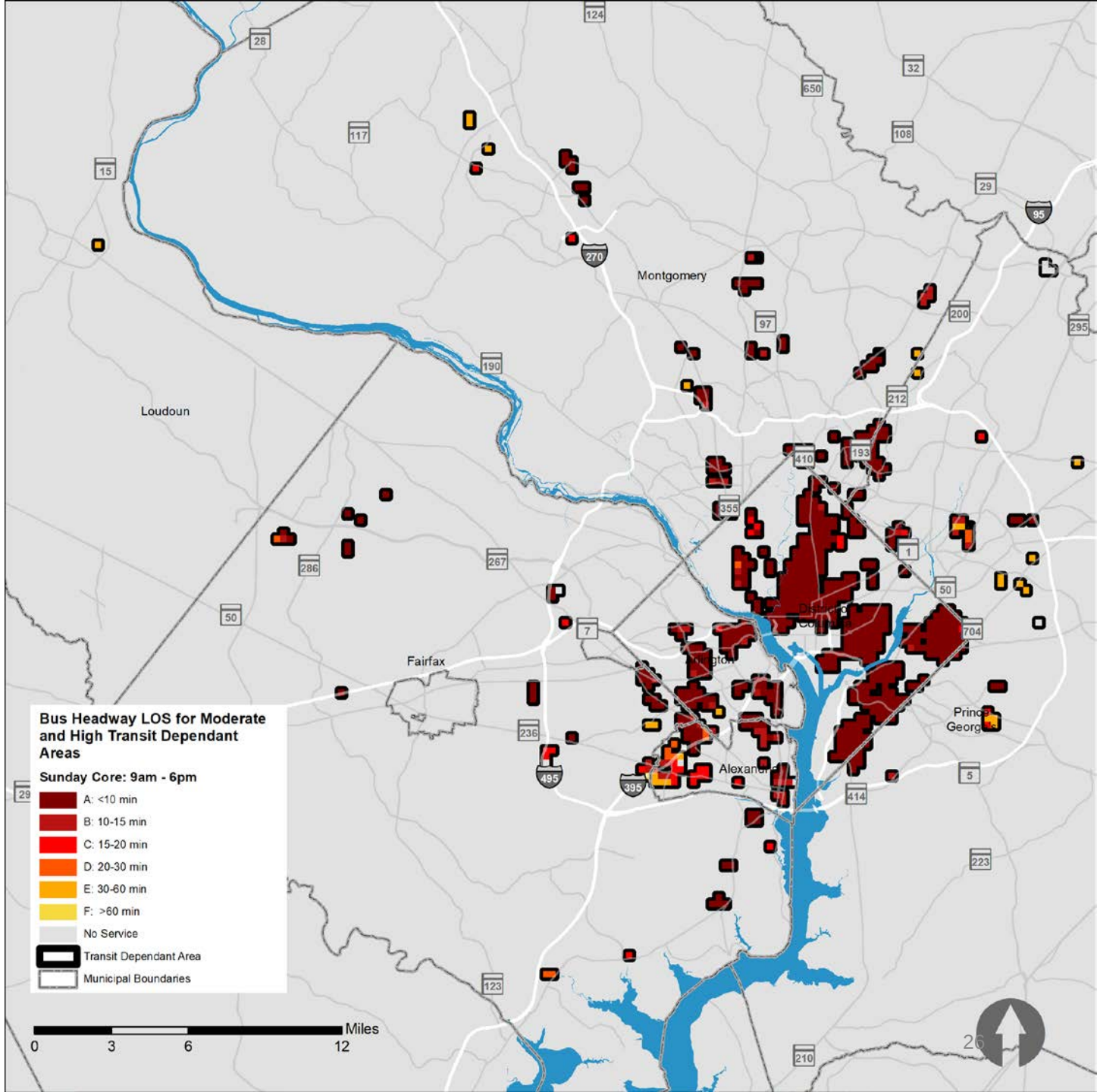
Sunday: Are we providing service when transit dependent people need it?

A majority of moderate to high transit dependent areas have access to a bus every 10 minutes or better across all services within a ¼ mile on Sundays.

However, there are areas that do not have adequate service, such as Lincolnia in Fairfax County and New Carrollton in Prince George's County



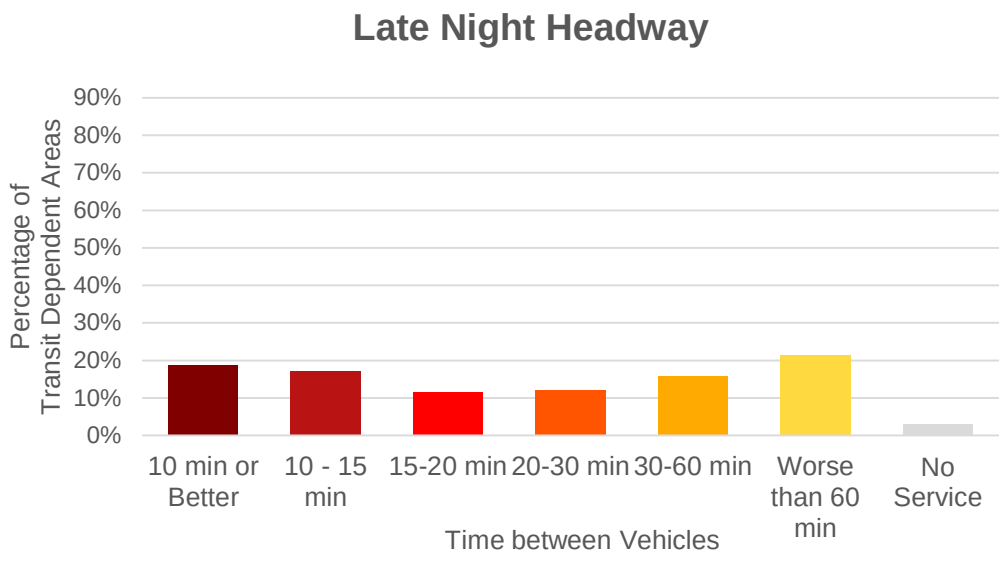
Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules



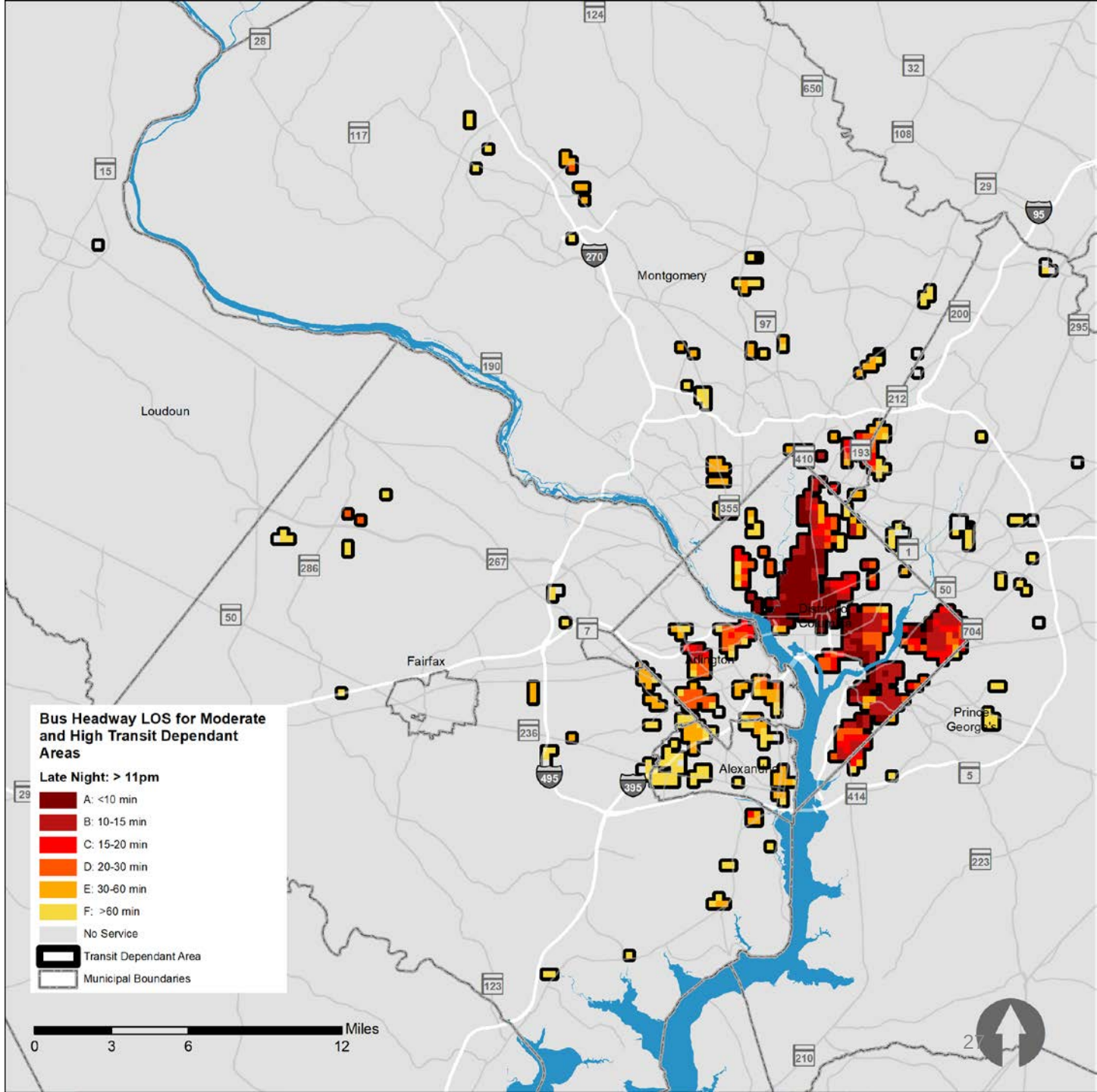
Late Night: Are we providing service when transit dependent people need it?

Transit dependent areas in D.C. are more likely to have frequent late night service.

Over one-third of transit dependent areas have only receive bus service every 30 minutes or worse across all services within a ¼ mile. Three percent of transit dependent areas have no late night service.



Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules



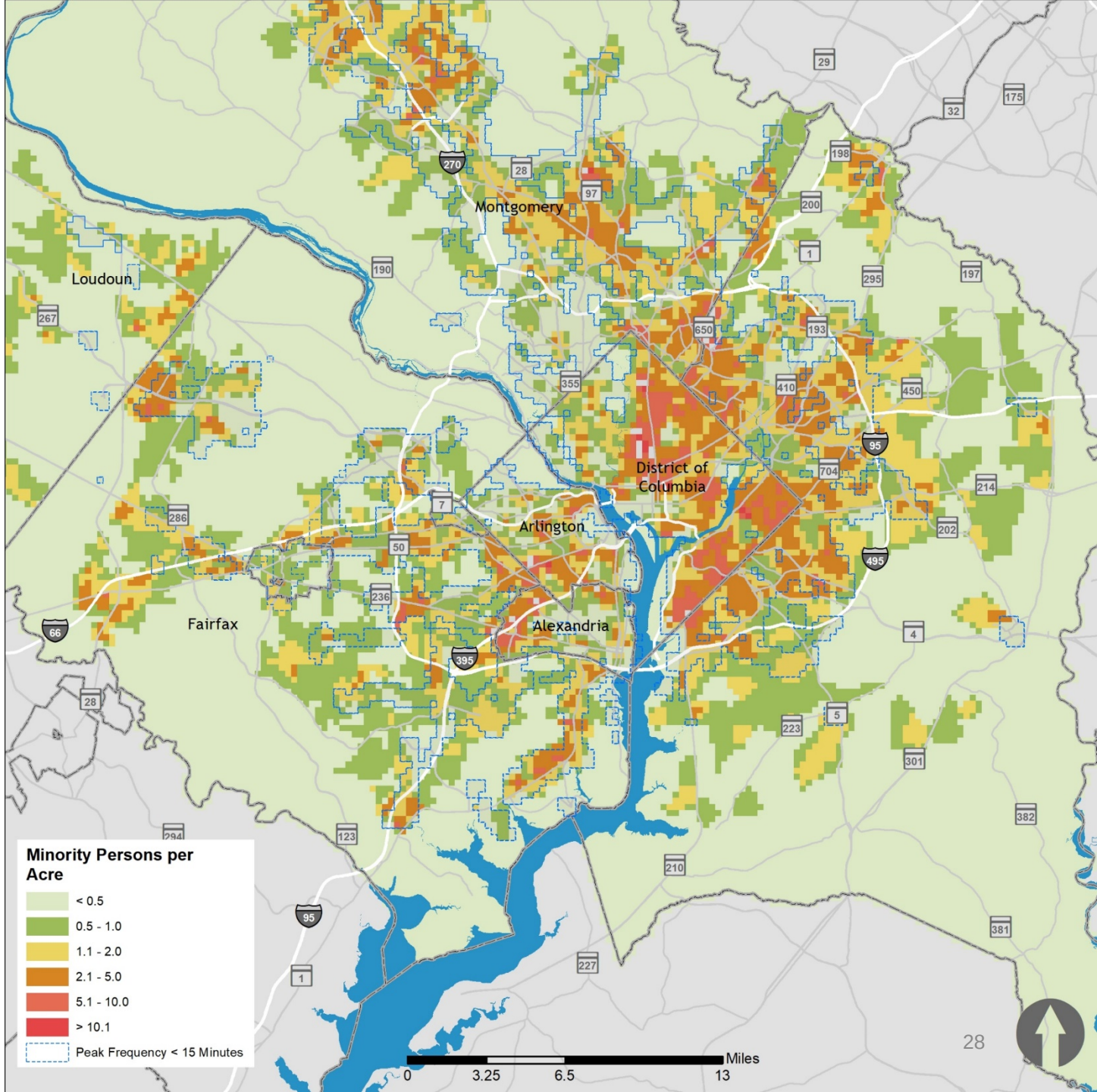
Minority populations

Minority (Hispanic or non-white) populations are often more likely to take transit than non-hispanic white populations. However, it is not necessarily indicative of transit need.

It is important to note where these populations are and how proportionately they are being served. However, they are not included in the transit-dependent measure for this analysis.

Sixty percent of the minority population within the region have access to peak high frequency bus service of 15 minutes or better.

Jurisdiction	Minority Population	Minority Population (% of the total Population)	% of Minority Population with Access to High Frequency Peak Service
City of Alexandria	72,652	48%	100%
Arlington County	83,915	37%	98%
Fairfax City	9,667	41%	54%
Fairfax County	540,152	48%	46%
City of Falls Church	3,795	28%	79%
Loudoun County	150,194	41%	4%
Montgomery County	554,895	54%	64%
Prince George's County	775,188	87%	48%
Washington D.C.	423,287	65%	97%



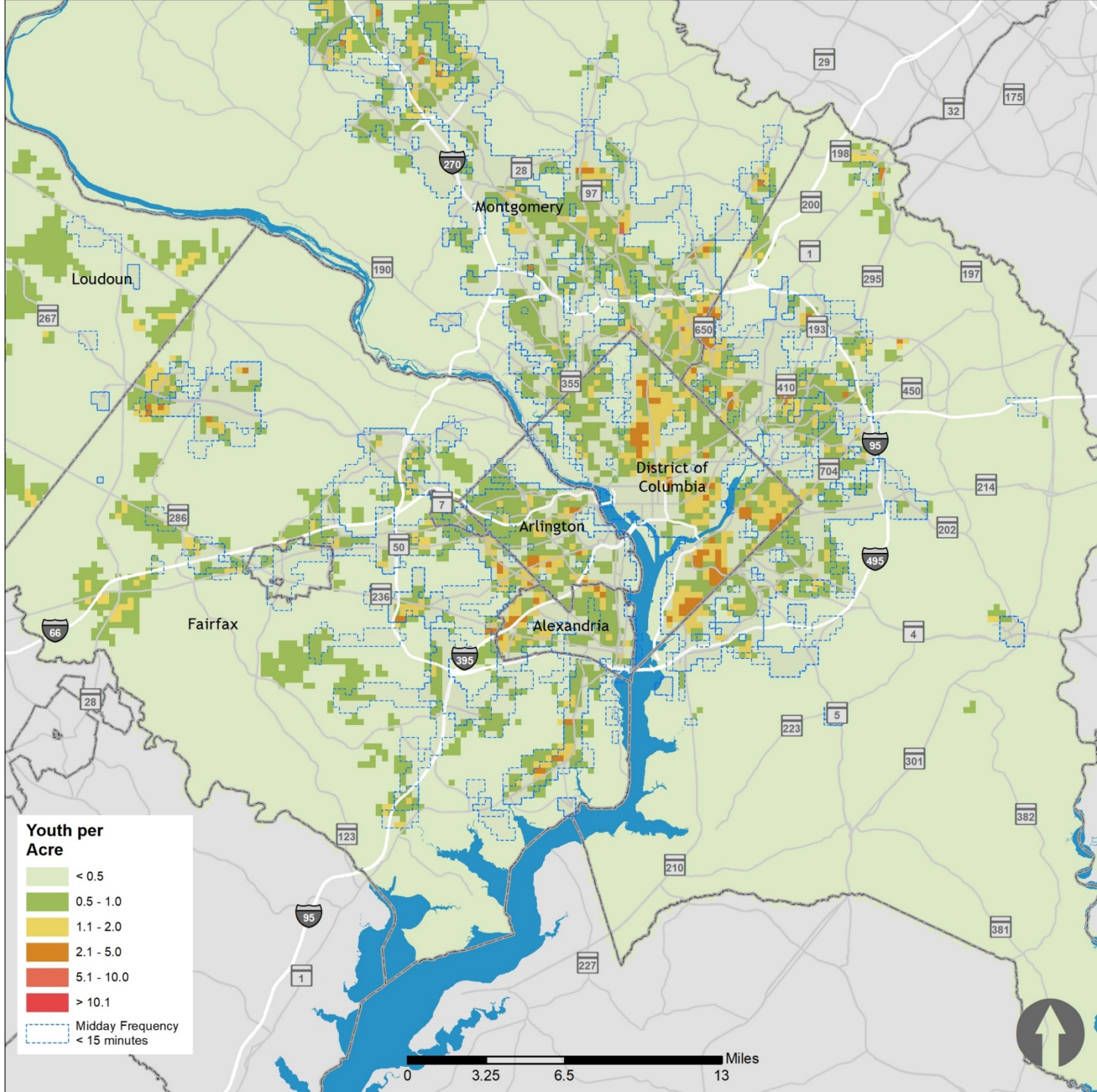
Transit Supportive: Youth Populations

Most of the region's youth (age 17 and younger) are located in the suburban jurisdictions. Loudoun County has the highest number of young people with around 107,000, which encompasses 29 percent of the county's population). But only three percent of the youth population has access to midday high frequency bus.

The suburban jurisdictions with the highest proportion of youth populations with access to high frequency bus are Montgomery and Prince George's Counties. While D.C., Alexandria, and Arlington have lower proportions of youth, and their access to midday high frequency is high.

Forty-three percent of the region's youth population has access to midday high frequency bus service of 15 minutes or better.

Jurisdiction	Youth Population (% of Total Population)	% Youth Population with Access to High Frequency Midday Service
City of Alexandria	18%	93%
Arlington County	17%	81%
Fairfax City	21%	51%
Fairfax County	24%	23%
City of Falls Church	25%	60%
Loudoun County	29%	3%
Montgomery County	24%	52%
Prince George's County	23%	38%
Washington D.C.	18%	91%

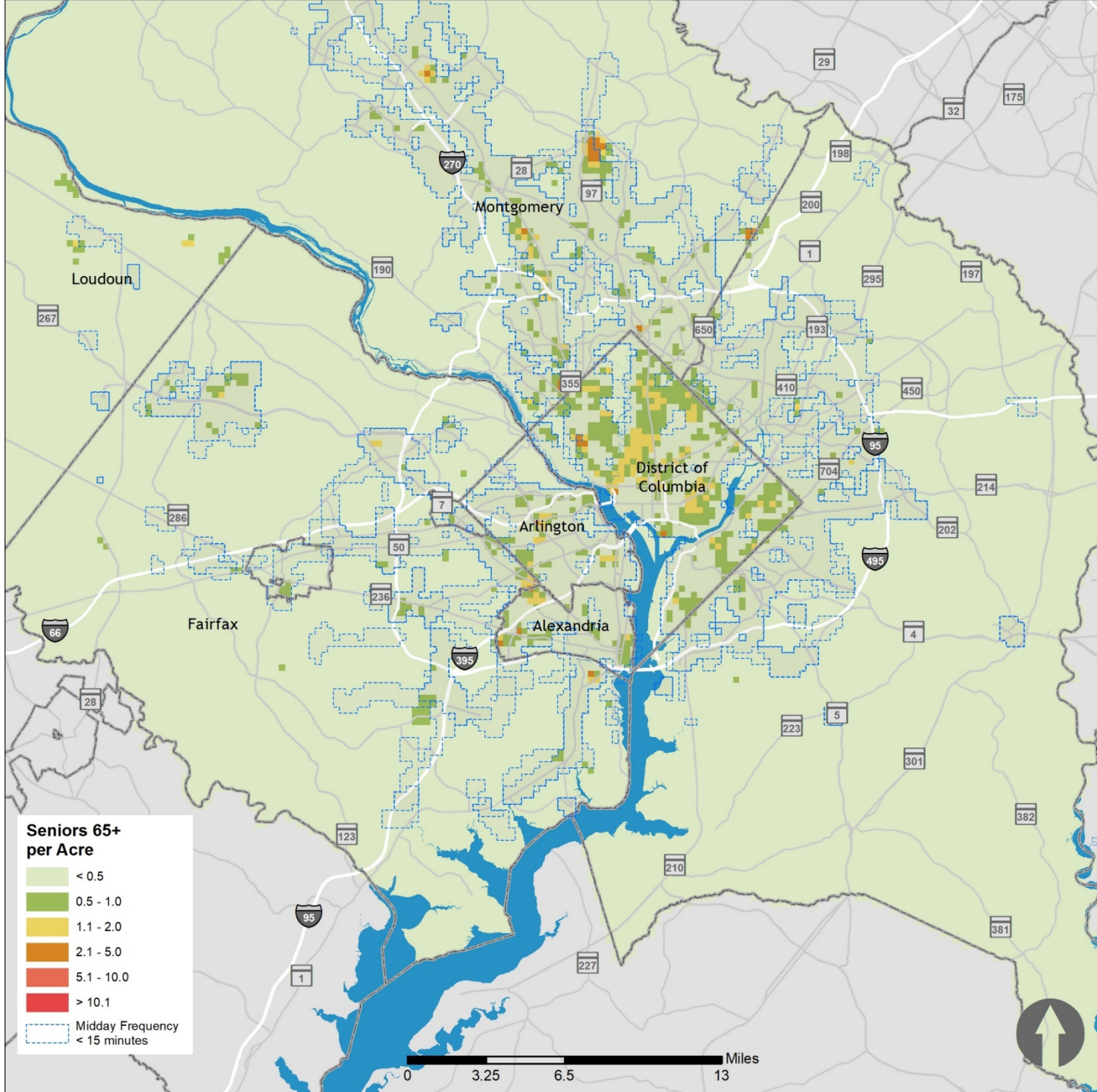


Transit Supportive: Senior Populations

The senior (age 65 and older) population of each jurisdiction ranges from 8 to 15 percent. The jurisdictions with the largest senior populations are Montgomery County (140,000) and Fairfax County (130,000). Fifty-two percent of the seniors in Montgomery County and 21 percent of the seniors in Fairfax County have access to midday high frequency bus.

Fifty-five percent of the senior population in the region has access to midday high frequency bus service of 15 minutes or better.

Jurisdiction	Senior Population (% of Total Population)	% Senior Population with Access to High Frequency Midday Service
City of Alexandria	10%	89%
Arlington County	9%	81%
Fairfax City	15%	53%
Fairfax County	12%	21%
City of Falls Church	12%	62%
Loudoun County	8%	3%
Montgomery County	14%	52%
Prince George's County	11%	31%
Washington D.C.	11%	90%



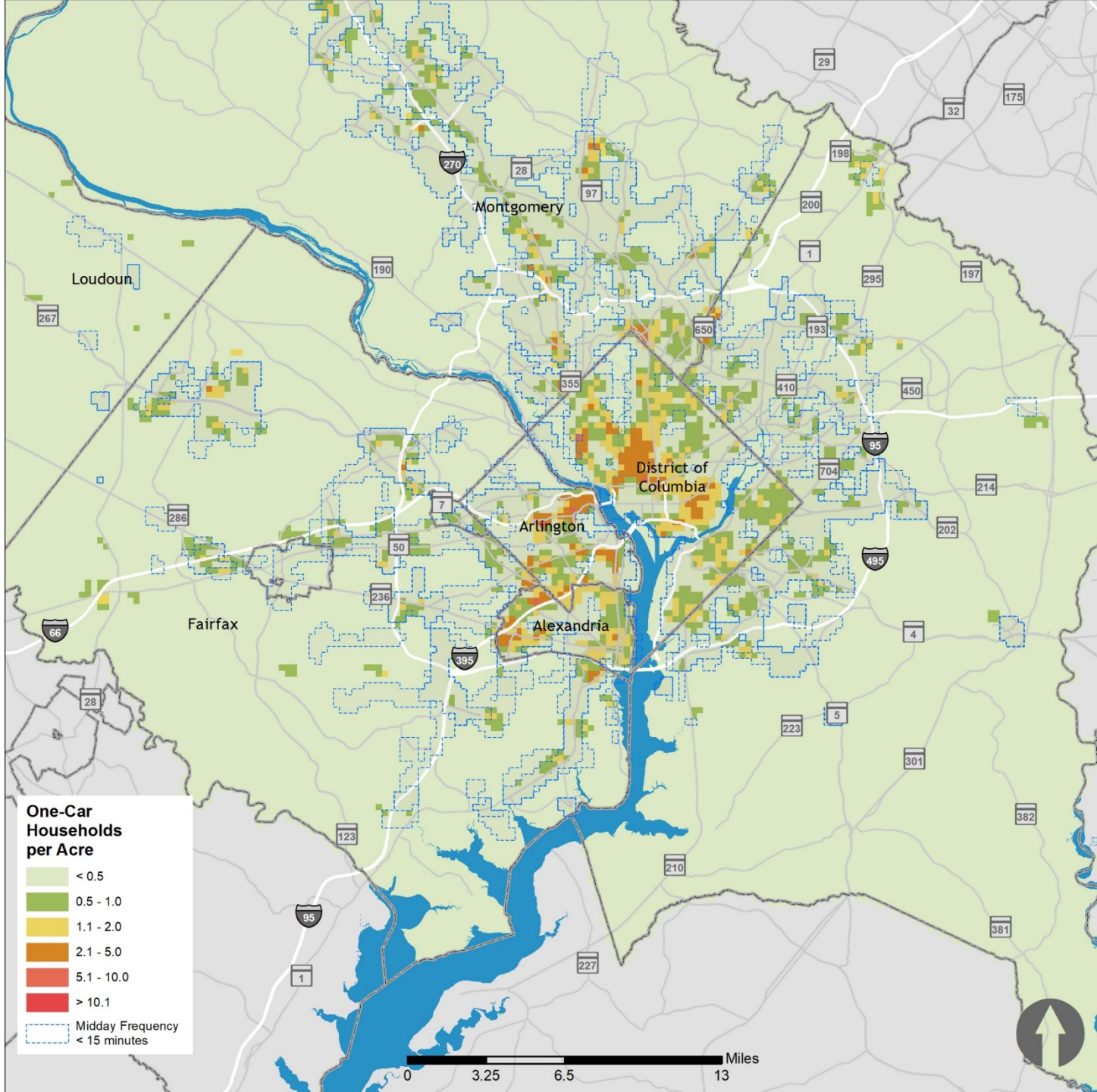
Transit Supportive: One-Car Households

The highest concentration of one-car households is in Alexandria, with approximately 35,000 households, which is 52 percent of Alexandria's households. Ninety-two percent of these one-car Alexandria households have access to midday high frequency bus.

D.C. is the jurisdiction with the largest amount of one-car households with access to high frequency bus – 113,000 of the 121,000 one-car households in D.C. have access to high frequency bus.

Sixty-three percent of the total one-car households in the region have access to midday high frequency bus service of 15 minutes or better.

Jurisdiction	One-Car Households (% of Total Households)	% One-Car Households with Access to High Frequency Midday Service
City of Alexandria	52%	92%
Arlington County	48%	95%
Fairfax City	28%	52%
Fairfax County	29%	38%
City of Falls Church	41%	69%
Loudoun County	22%	5%
Montgomery County	34%	68%
Prince George's County	37%	43%
Washington D.C.	44%	94%



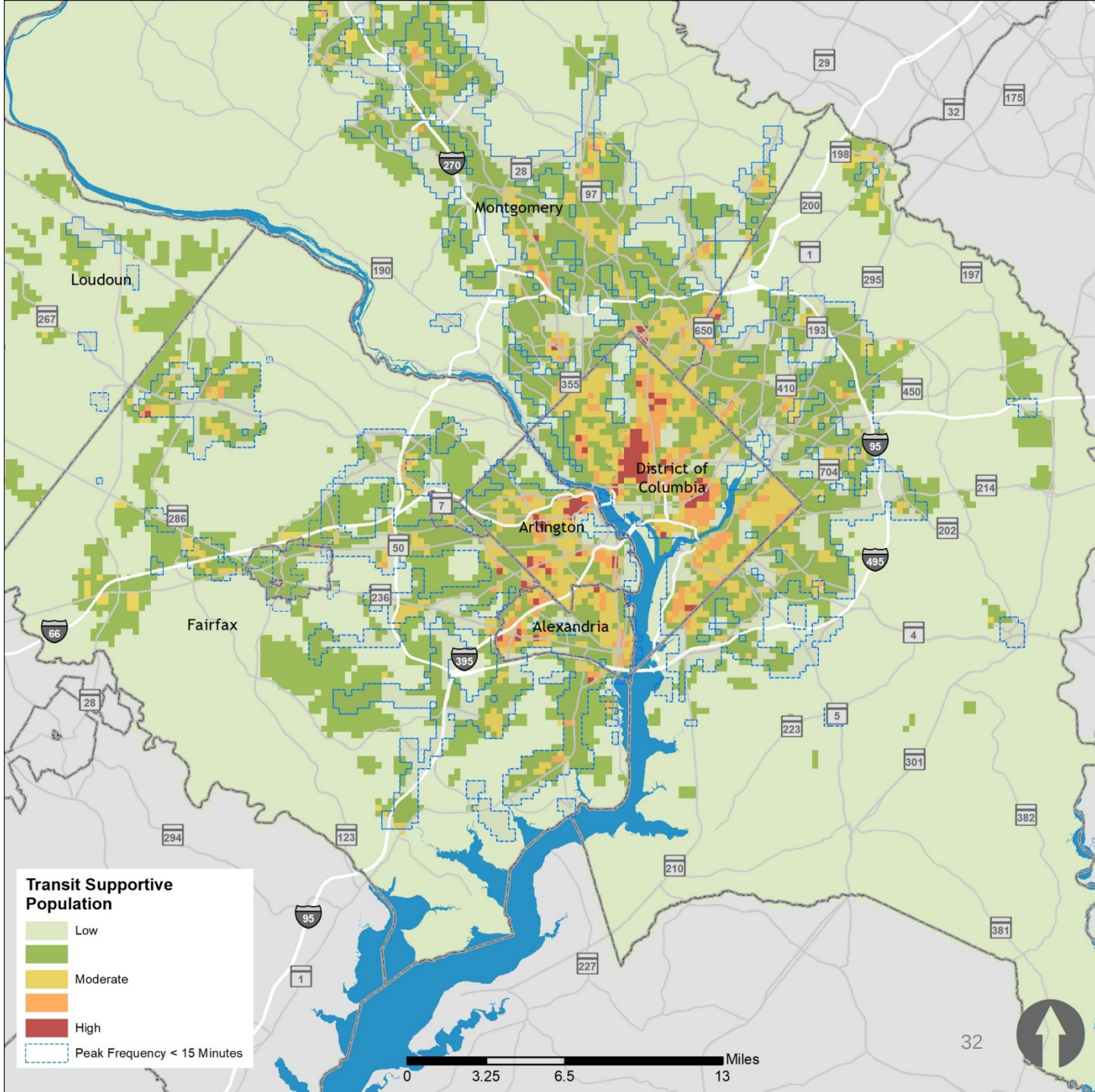
Transit Supportive Population Concentration

By combining the three demographics of one-car households, youth populations, and senior populations, with equal weight, we can locate where transit supportive populations are within the region.

The highest concentrations of transit supportive populations are in D.C., Alexandria, and Arlington. However, transit supportive populations are much farther reaching into outer ring suburbs than transit dependent populations.

Any area classified as Moderate to High will be used for further analysis.

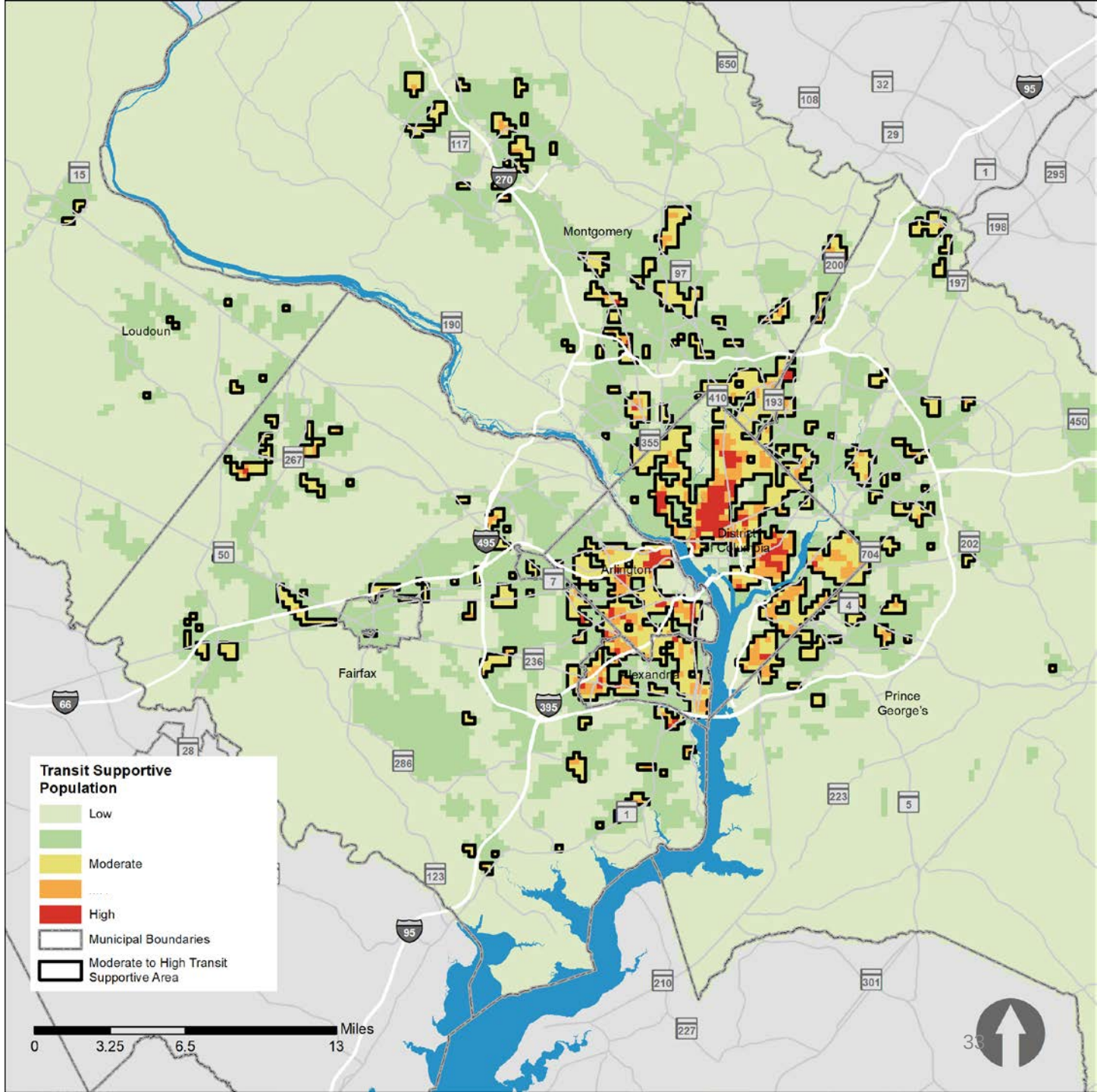
Jurisdiction	Youth Population	Senior Population	One-Car Households
City of Alexandria	18%	10%	52%
Arlington County	17%	9%	48%
Fairfax City	21%	15%	28%
Fairfax County	24%	12%	29%
City of Falls Church	25%	12%	41%
Loudoun County	29%	8%	22%
Montgomery County	24%	14%	34%
Prince George's County	23%	11%	37%
Washington D.C.	18%	11%	44%



Transit Supportive Population Concentration

The areas with higher concentrations of transit supportive populations ranked Moderate to High are outlined in the map.

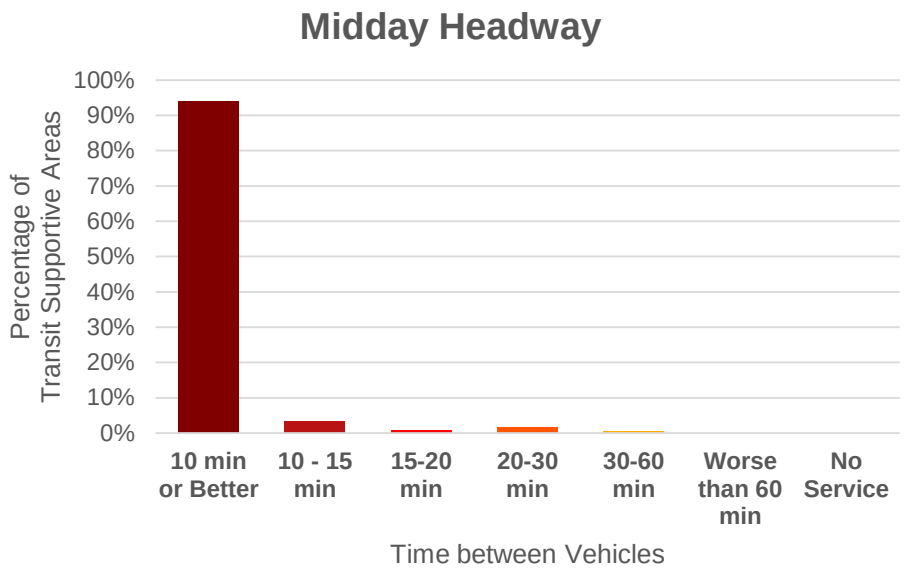
Transit supportive areas are more likely to use transit for a wider variety of uses, and therefore could benefit more from midday and off-peak services.



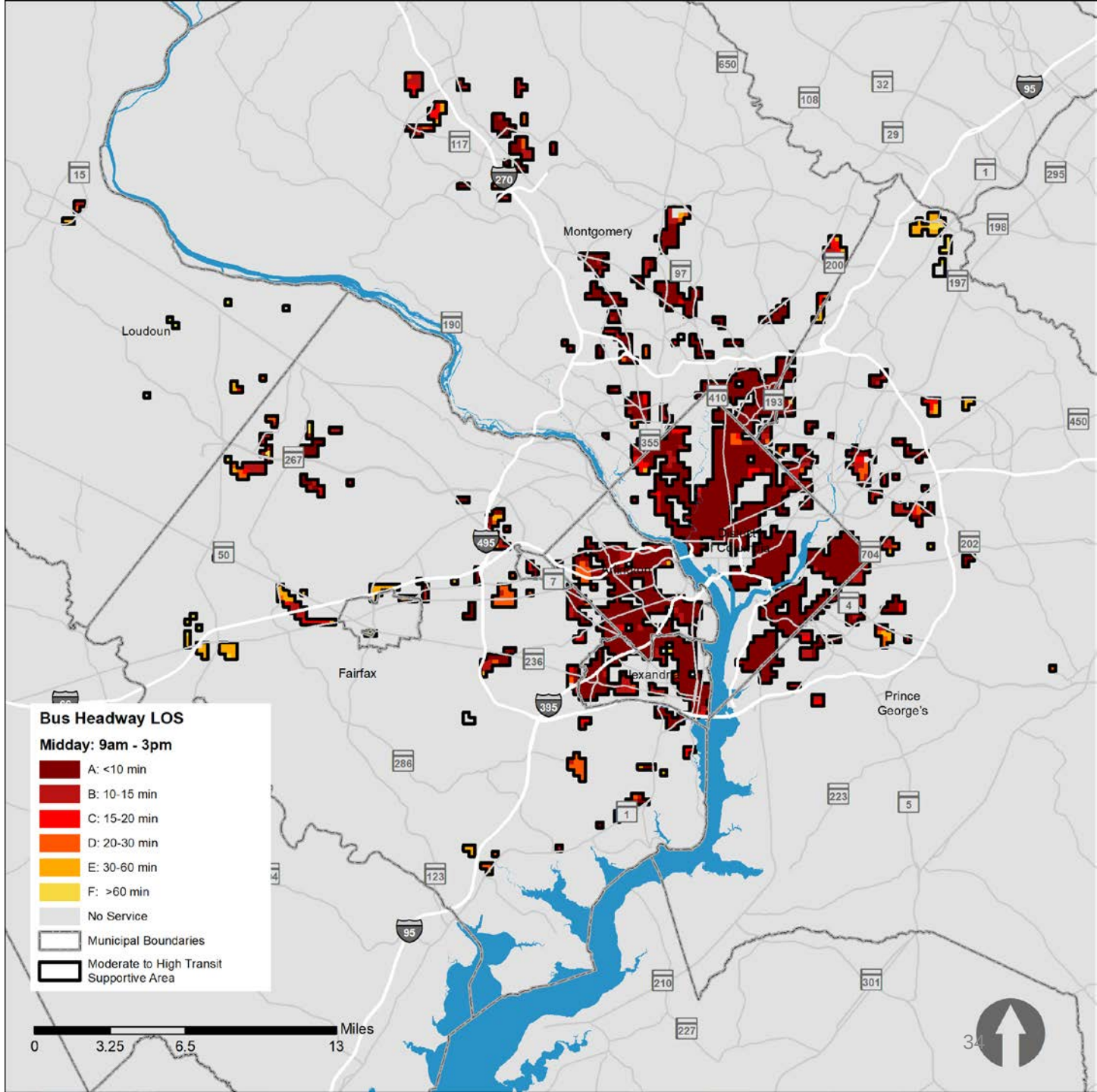
Are we providing service when transit supportive people need it?

The map shows where midday bus services (9:00 AM – 3:00 PM) overlap with the areas of moderate to high transit supportive populations.

Most of these areas have access to midday service with a route every 15 minutes or better.



Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules



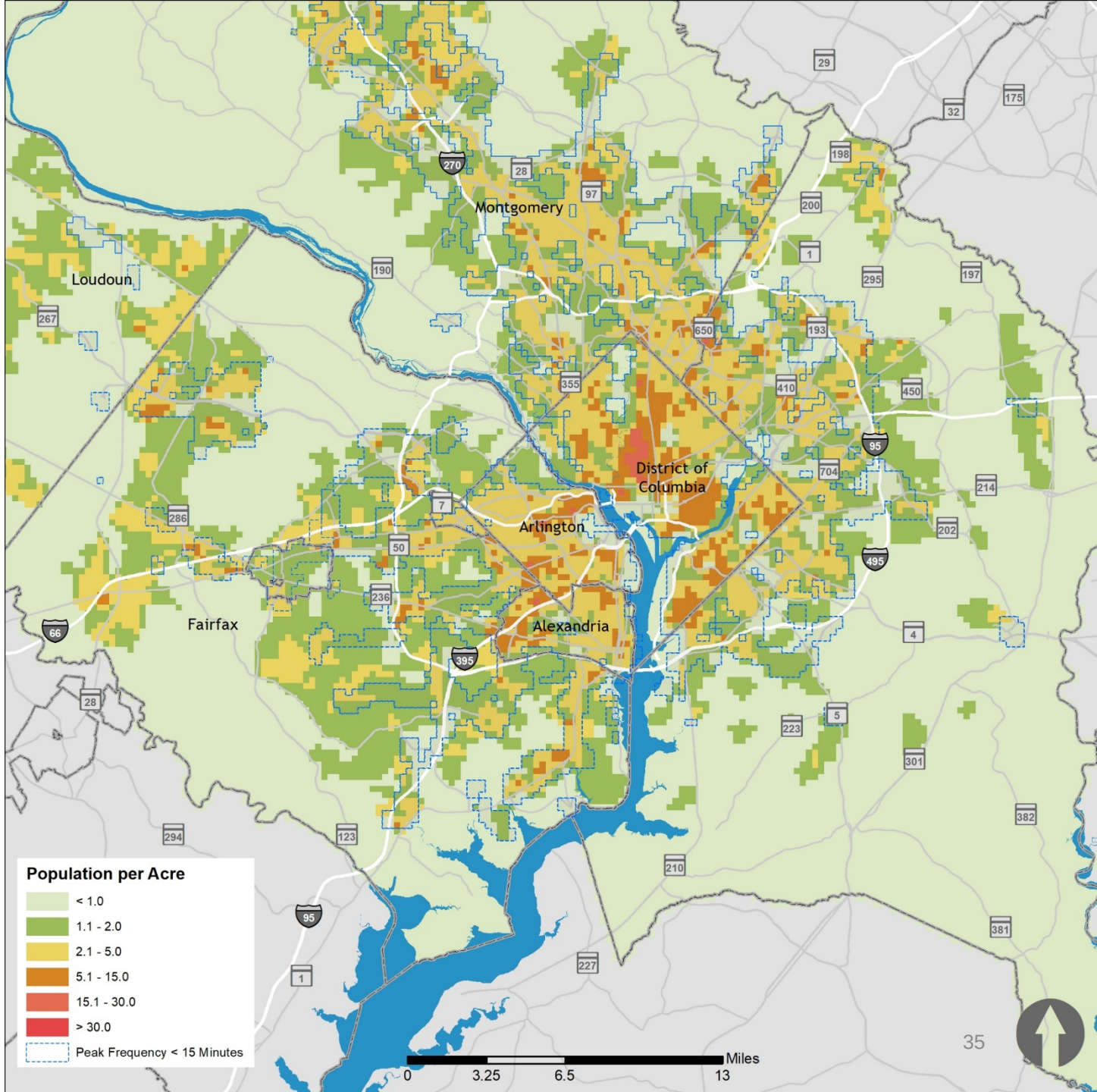
Transit Potential: Population Density

D.C., Alexandria, and Arlington have the most dense population and also the highest amounts of population with access to peak high frequency bus.

Fairfax County and Montgomery County have the largest populations, each with over one million people. Access to peak high frequency bus in these jurisdictions is available to 38 and 60 percent of their populations, respectively.

Fifty-six percent of the total regional population has access to high frequency peak bus.

Jurisdiction	Total Population	% Population with Access to High Frequency Peak Service
City of Alexandria	151,473	98%
Arlington County	226,092	95%
Fairfax City	23,620	54%
Fairfax County	1,130,848	38%
City of Falls Church	13,597	72%
Loudoun County	362,435	3%
Montgomery County	1,026,371	60%
Prince George's County	886,850	46%
Washington D.C.	655,342	97%



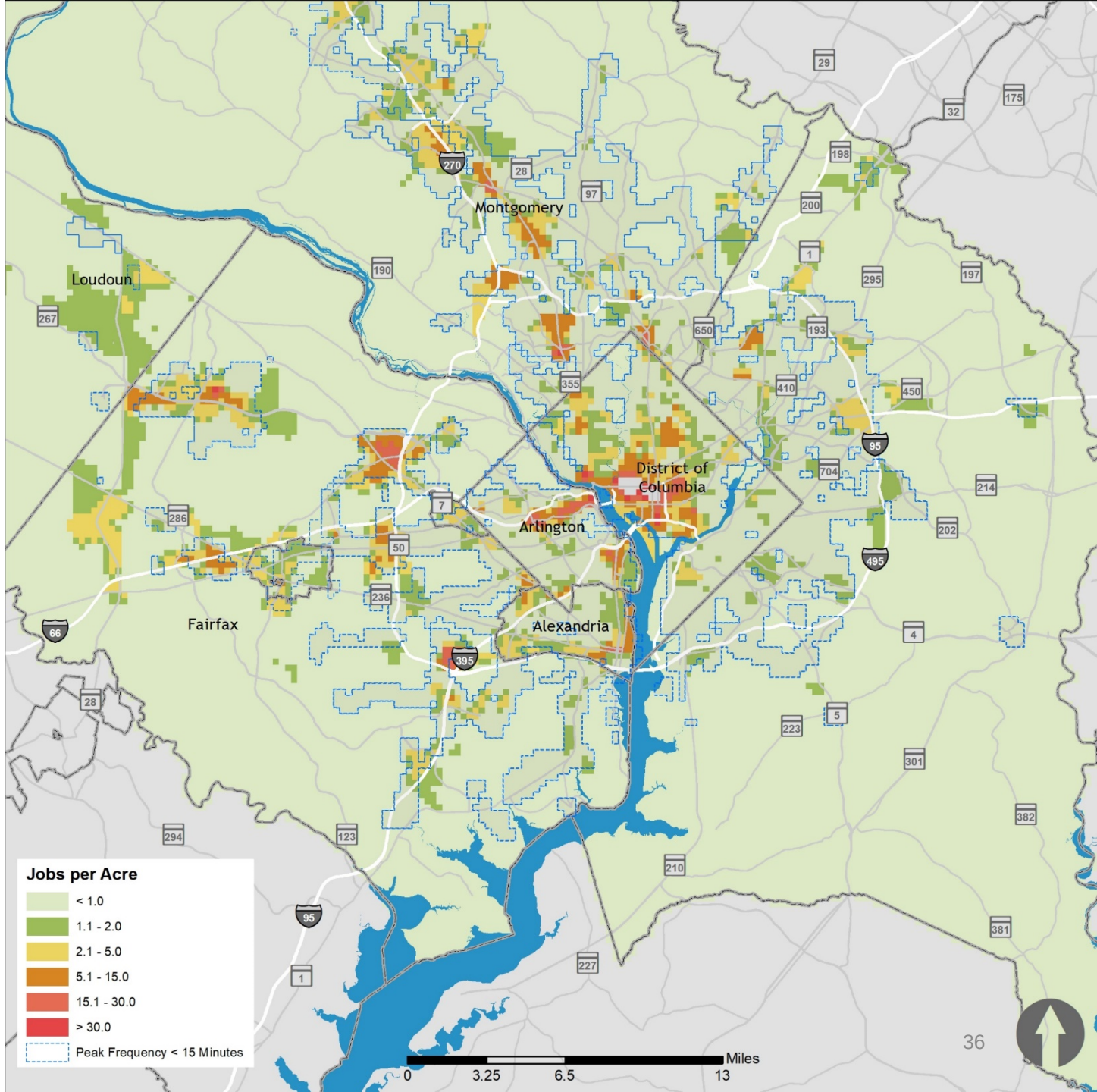
Transit Potential: Employment Density

Compared to where the region's population lives, jobs are more concentrated near high-frequency transit. **In all but two of the jurisdictions, more than 50 percent of the jobs are near high-frequency bus.**

D.C. has the most jobs (635,000) and the second highest percentage of jobs with access to high frequency bus (94 percent). Arlington County's 140,000 jobs nearly all have access to high frequency bus (99 percent).

Loudoun County and Prince George's County both have significant quantities of jobs but many of those jobs are without access to high frequency bus. Seventy percent of the total jobs in the region have access to high frequency peak bus service of 15 minutes or better.

Jurisdiction	Total Jobs	% Jobs with Access to High Frequency Peak Service
City of Alexandria	84,541	88%
Arlington County	139,976	99%
Fairfax City	21,515	52%
Fairfax County	561,437	57%
City of Falls Church	9,015	67%
Loudoun County	140,479	7%
Montgomery County	440,136	77%
Prince George's County	281,260	46%
Washington D.C.	635,234	94%



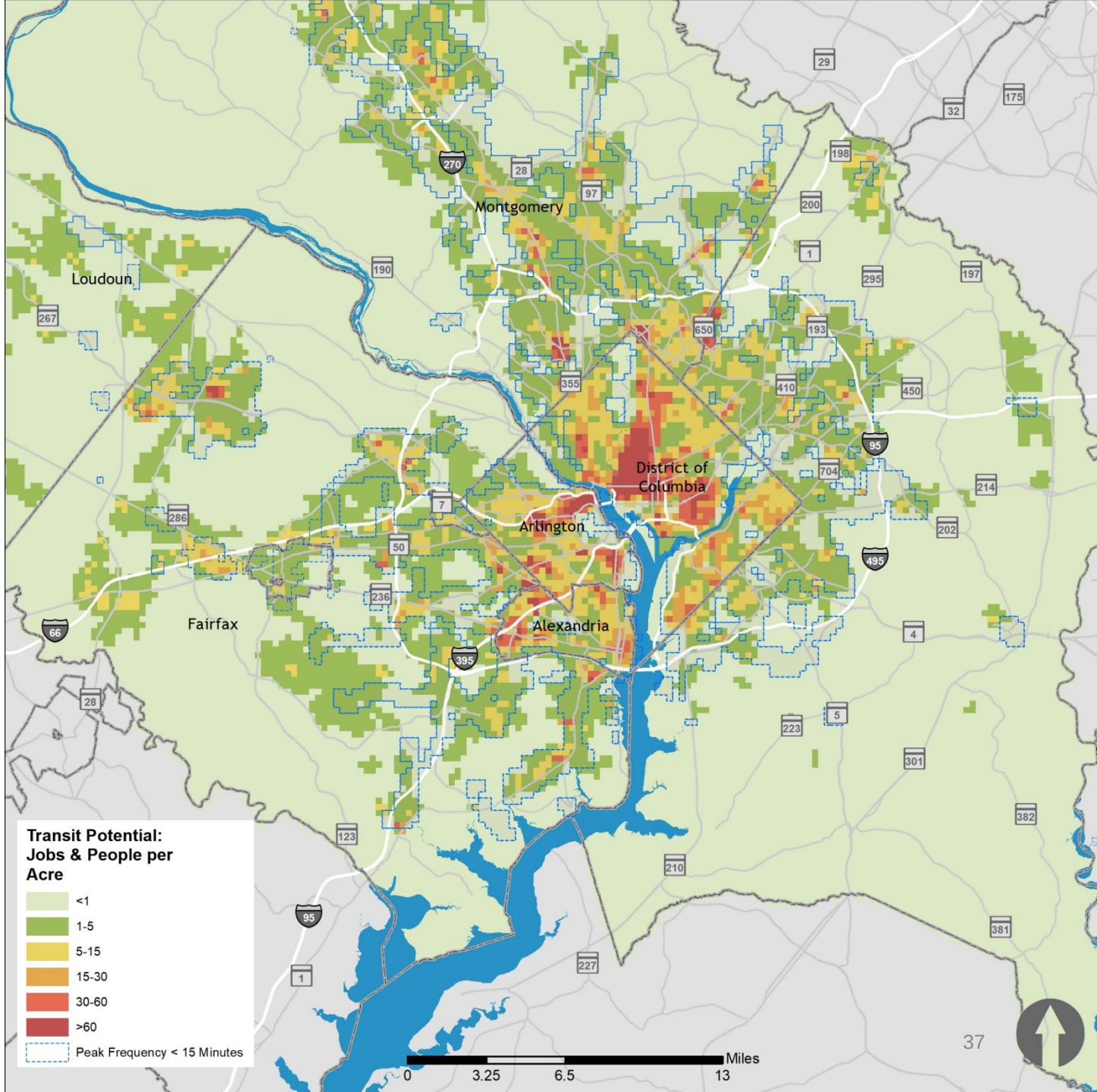
Transit Potential Concentration

Research suggests that a household density of 4.5 units per acre and employment density of approximately 4 jobs per gross acre is a typical minimum residential density for hourly daytime transit service to be feasible

Thirty percent of the region has more than five jobs and people per acre.

In areas with fewer than five jobs + people per acre, alternative forms of service, such as on-demand or flexible routes, should be considered.

Source: Transit Cooperative Research Program (TCRP) Report 165: Transit Capacity and Quality of Service Manual, Third Edition, Chapter 5, 5-17

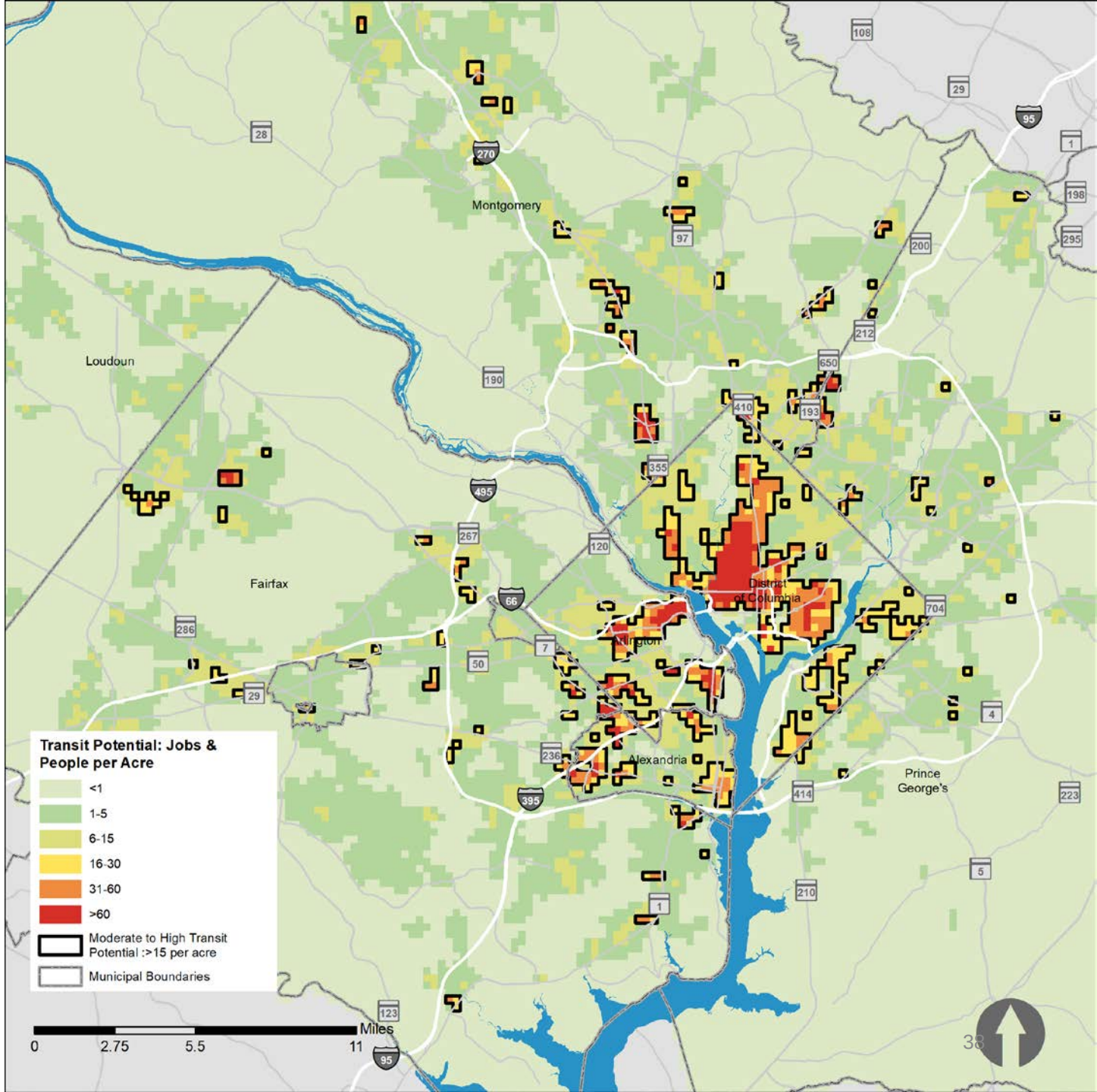


Are we providing transit when people want it?

Areas with high transit potential (jobs + people per acre) can support higher levels of service.

The areas with the highest concentration of jobs and people are in D.C., Arlington and Alexandria.

There are also areas in the other jurisdictions with high concentrations of jobs and people, mostly following the pattern of Metrorail lines and stations.

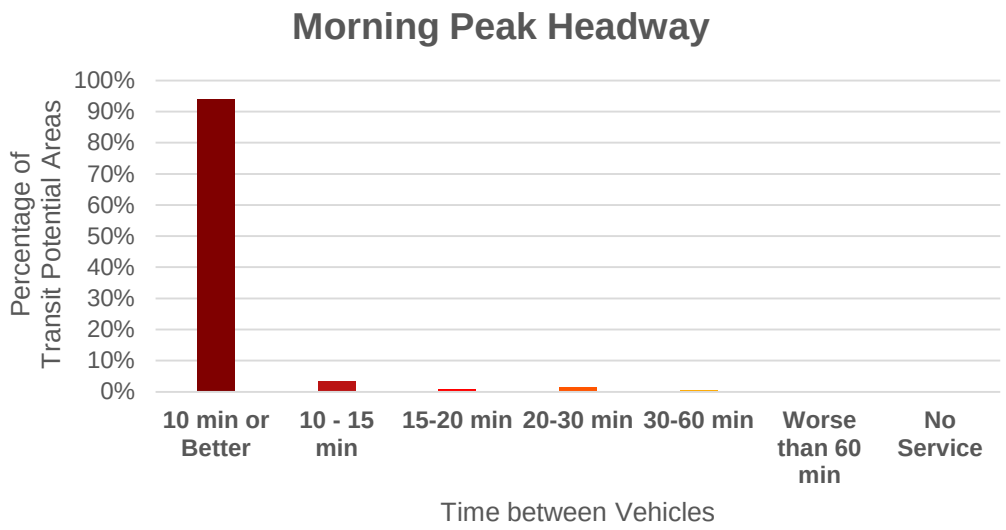


Morning Peak: Are we providing transit when people want it?

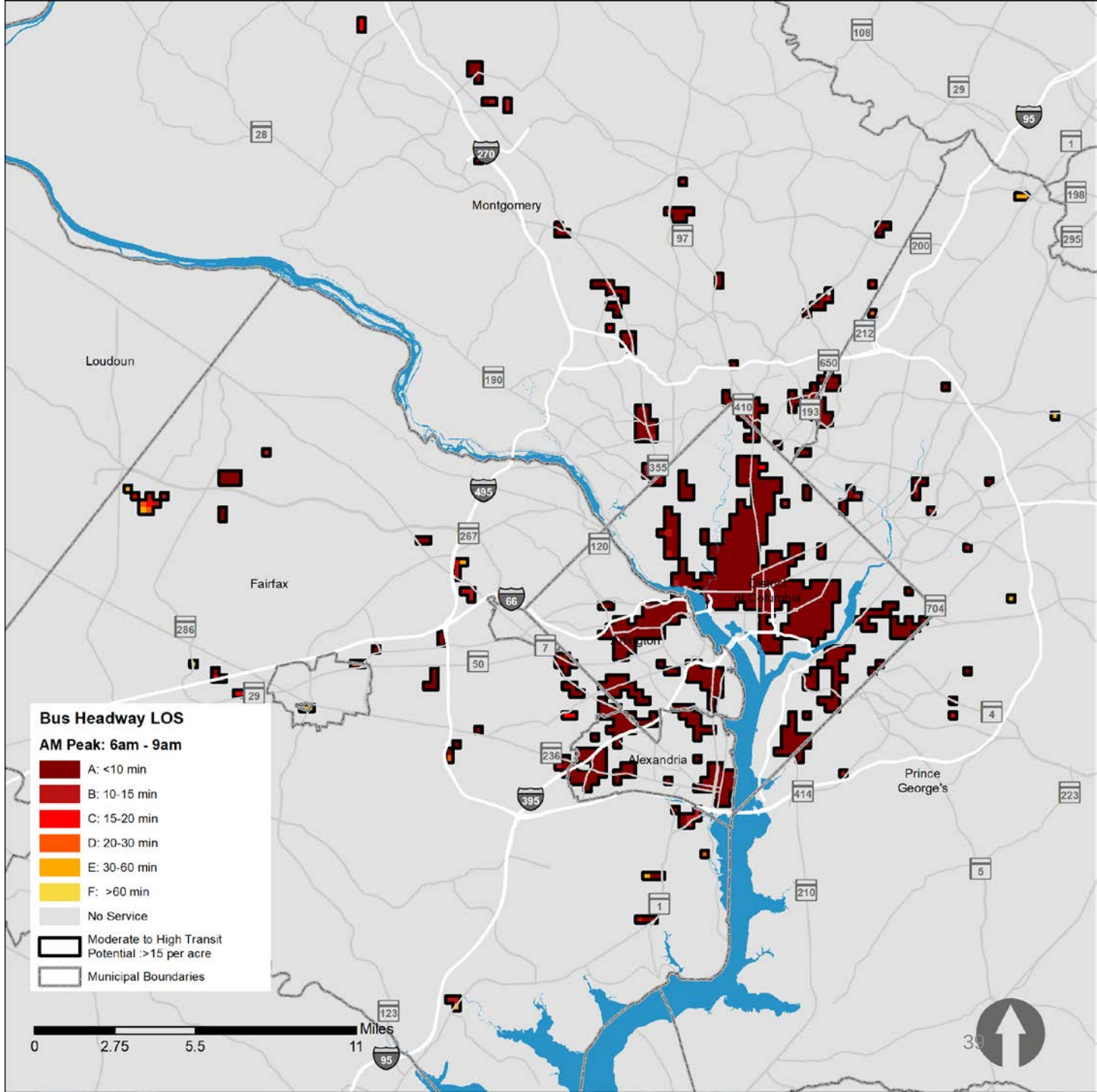
Areas with a higher density of jobs and people need more frequent peak bus service. Morning peak is considered between 6:00 AM – 9:00 AM.

Almost all areas of high transit potential receive morning peak service that is better than 10 minute frequency.

Areas furthest away from Downtown, such as the Reston and Dulles areas, receive less frequent service.



Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudoun County Transit Shapefiles and Schedules

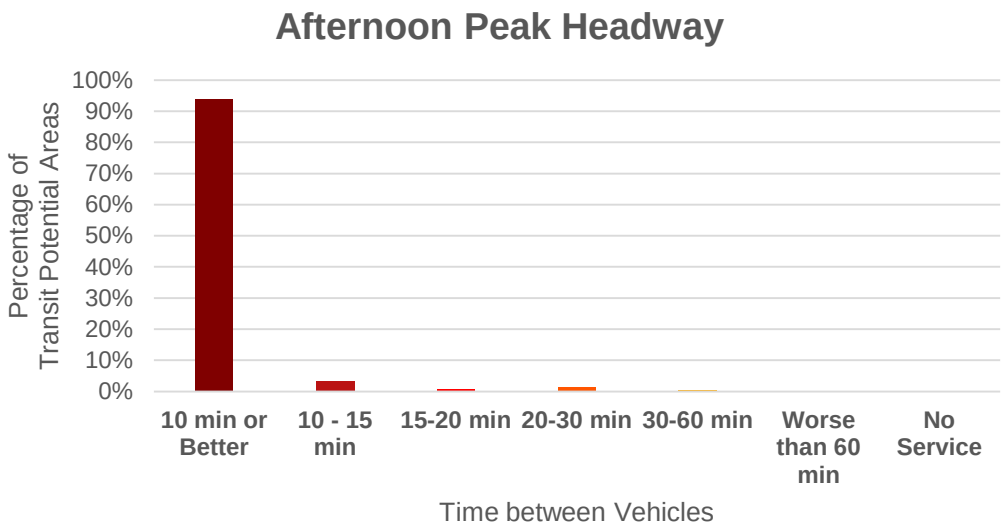


Afternoon Peak: Are we providing service when people want it?

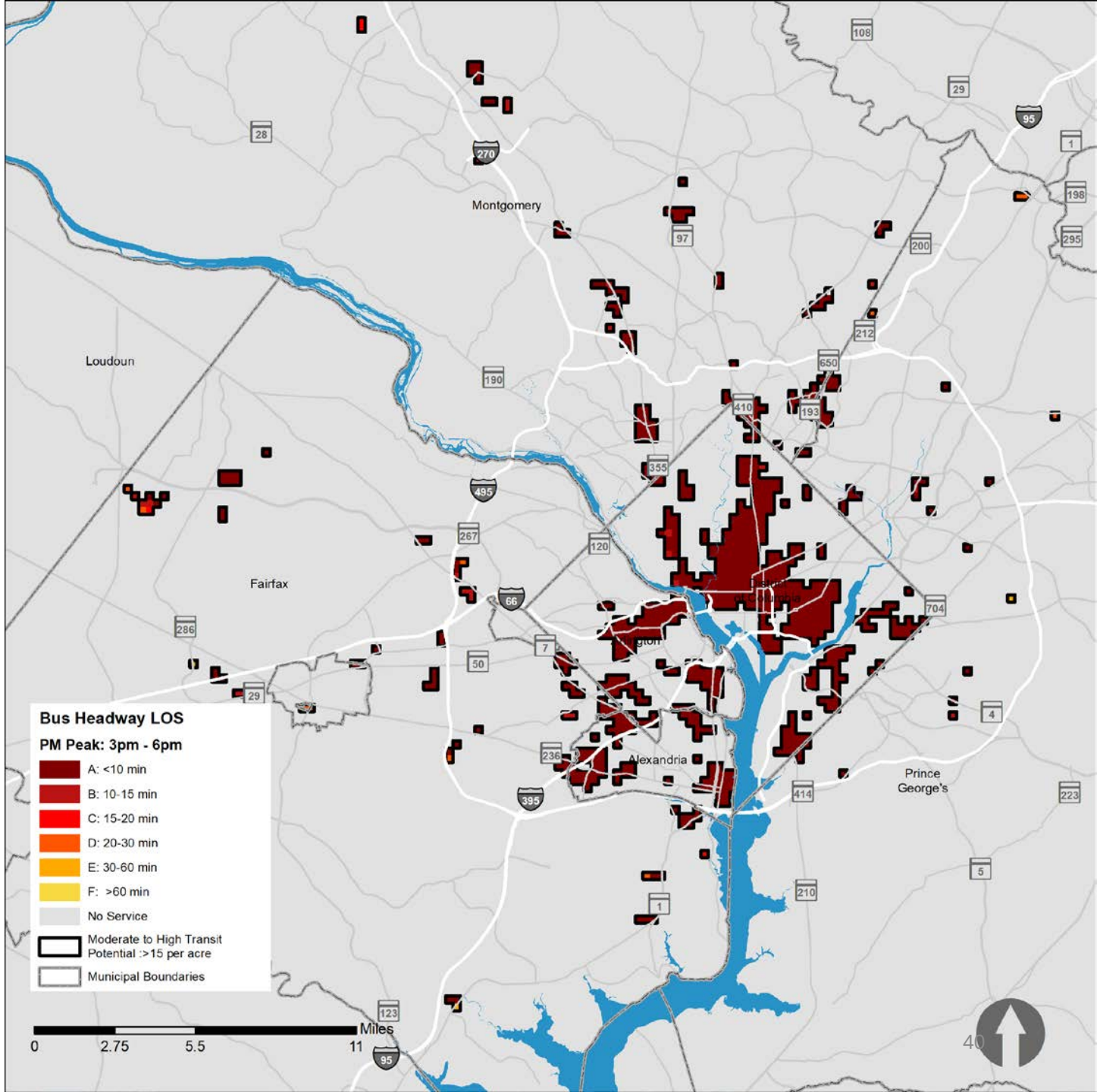
Areas with a higher density of jobs and people need frequent peak service. The afternoon peak period is considered between 3:00 PM – 6:00 PM.

Almost all areas of high transit potential receive afternoon peak service that is faster than 10 minute frequency.

Areas furthest away from the Downtown, such as the Reston and Dulles areas, receive less frequent service.



Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudoun County Transit Shapefiles and Schedules



Differences in span and frequency of service between jurisdictions

In terms of weekday peak frequency better than every 15 minutes, the City of Alexandria, D.C., and Arlington County have substantial coverage throughout their jurisdictions. Areas further away from the urban core receive less frequent service during the midday.

Late night and early morning service are not offered across the region and the level of service declines in most areas after the afternoon peak period.

In suburban areas, a higher percentage of weekday services are focused on peak only commuting service than in more urban areas.

For example, on weekdays, only 50 percent of the areas served by bus in Loudoun County have service for at least 14 hours a day, compared to 81 percent for both Montgomery and Prince George's County. Alexandria, Washington D.C, and Fairfax City have 100 percent of areas served being served over 14 hours a day on weekdays.

Overall service declines across the region on weekends in a similar pattern. The suburban areas see less areas served by any transit than the urban areas.

For example, over 99 percent of the areas served by bus service on the weekdays in Alexandria are served on Saturdays, and 81 percent on Sundays. Only 60 percent of the areas served on weekdays in Prince George's County are served on Saturdays, and 53 percent on Sundays.

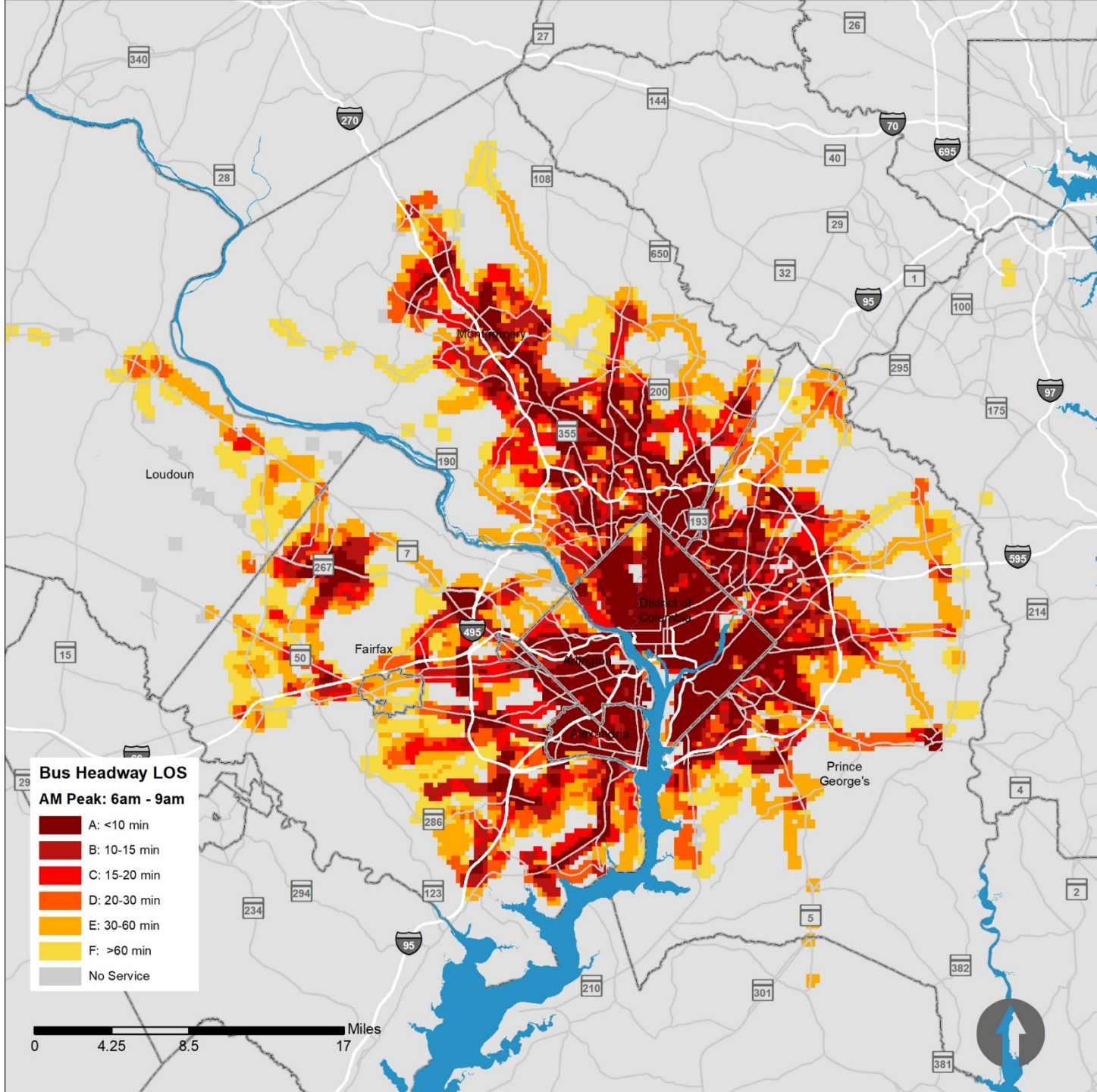
Weekday Peak Frequency

Across the region level of service declines in most areas after the afternoon peak period. Late night and early morning service is not offered across the region.

For weekday peak frequency better than 15 minutes, the City of Alexandria has the most coverage in terms of the percentage of the City covered, approximately 92 percent.

Jurisdiction	% of Jurisdiction with Morning High Frequency (<15 minutes) Peak Service
City of Alexandria	92%
Arlington County	80%
Fairfax City	47%
Fairfax County	28%
City of Falls Church	56%
Loudoun County	0%
Montgomery County	40%
Prince George's County	35%
Washington D.C.	88%

Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules

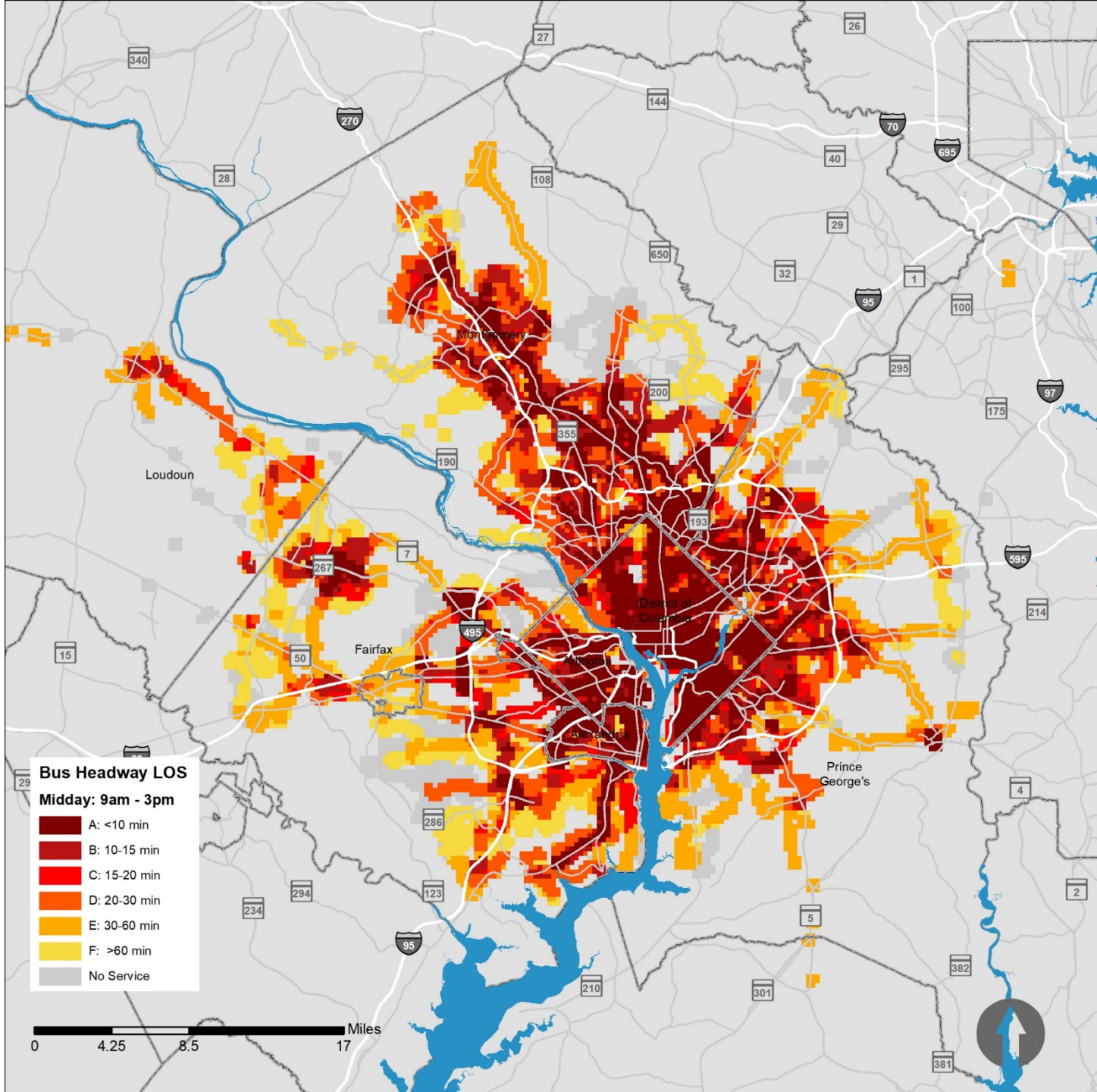


Weekday Midday Frequency

For midday frequency better than 15 minutes, the City of Alexandria and D.C. have the most coverage in terms of during the midday, approximately 85 and 83 percent, respectively.

Jurisdiction	% of Jurisdiction with Midday High Frequency (<15 minutes) Service
City of Alexandria	85%
Arlington County	76%
Fairfax City	52%
Fairfax County	24%
City of Falls Church	61%
Loudoun County	8%
Montgomery County	47%
Prince George's County	34%
Washington D.C.	83%

Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules

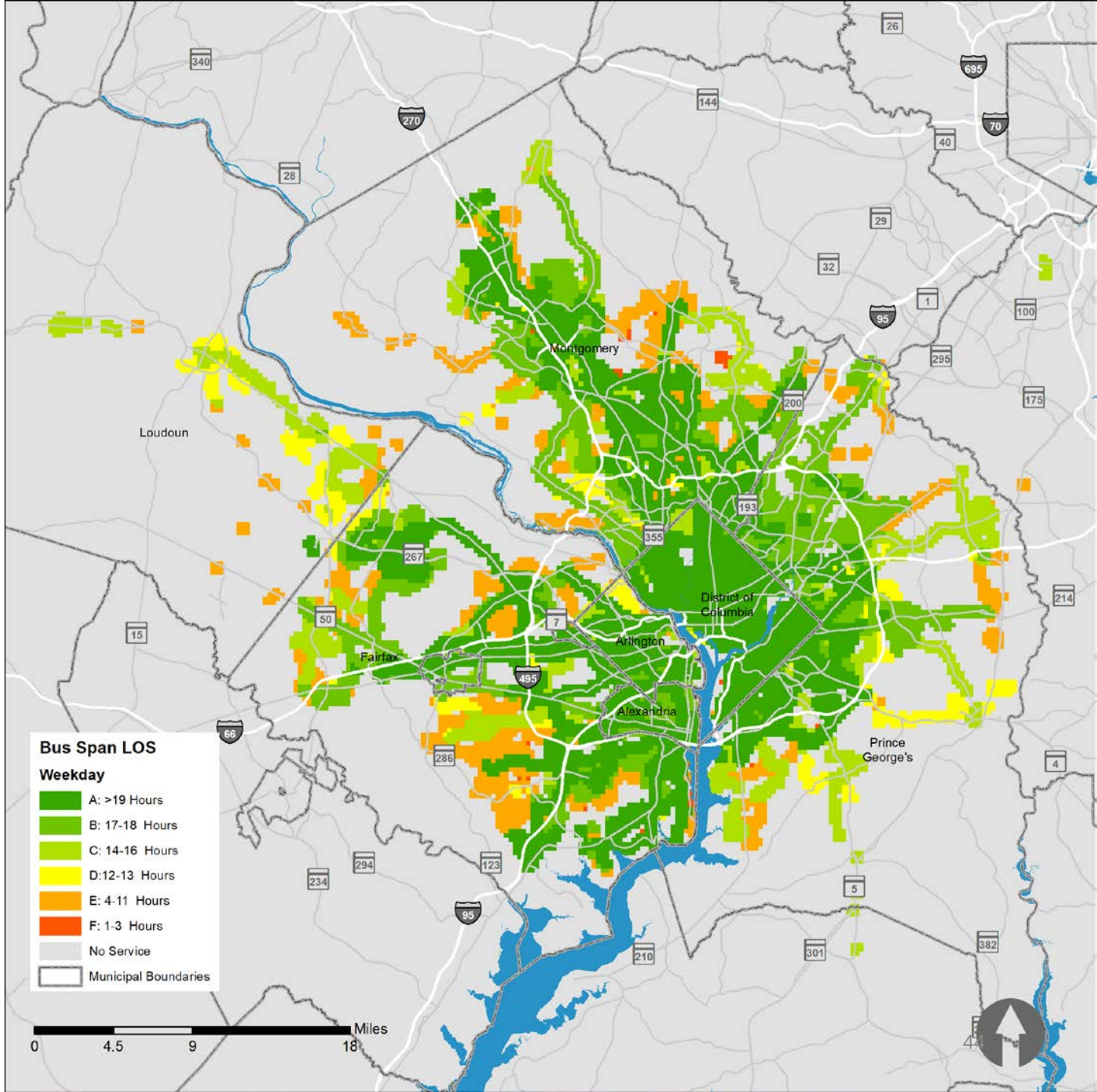


Weekday Span of Service

All-day service, or service that spans longer than 14 hours, is considered better transit service.

D.C., Arlington, and Alexandria are almost entirely covered by weekday service spans greater than 14 hours daily. D.C. is almost entirely covered by weekday service operating at more than 19 hours per day.

Throughout the rest of the region, areas around Metrorail stations also have service spans greater than 14 hours per day. Further away from Metrorail and activity centers weekday spans begin to worsen.



Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules

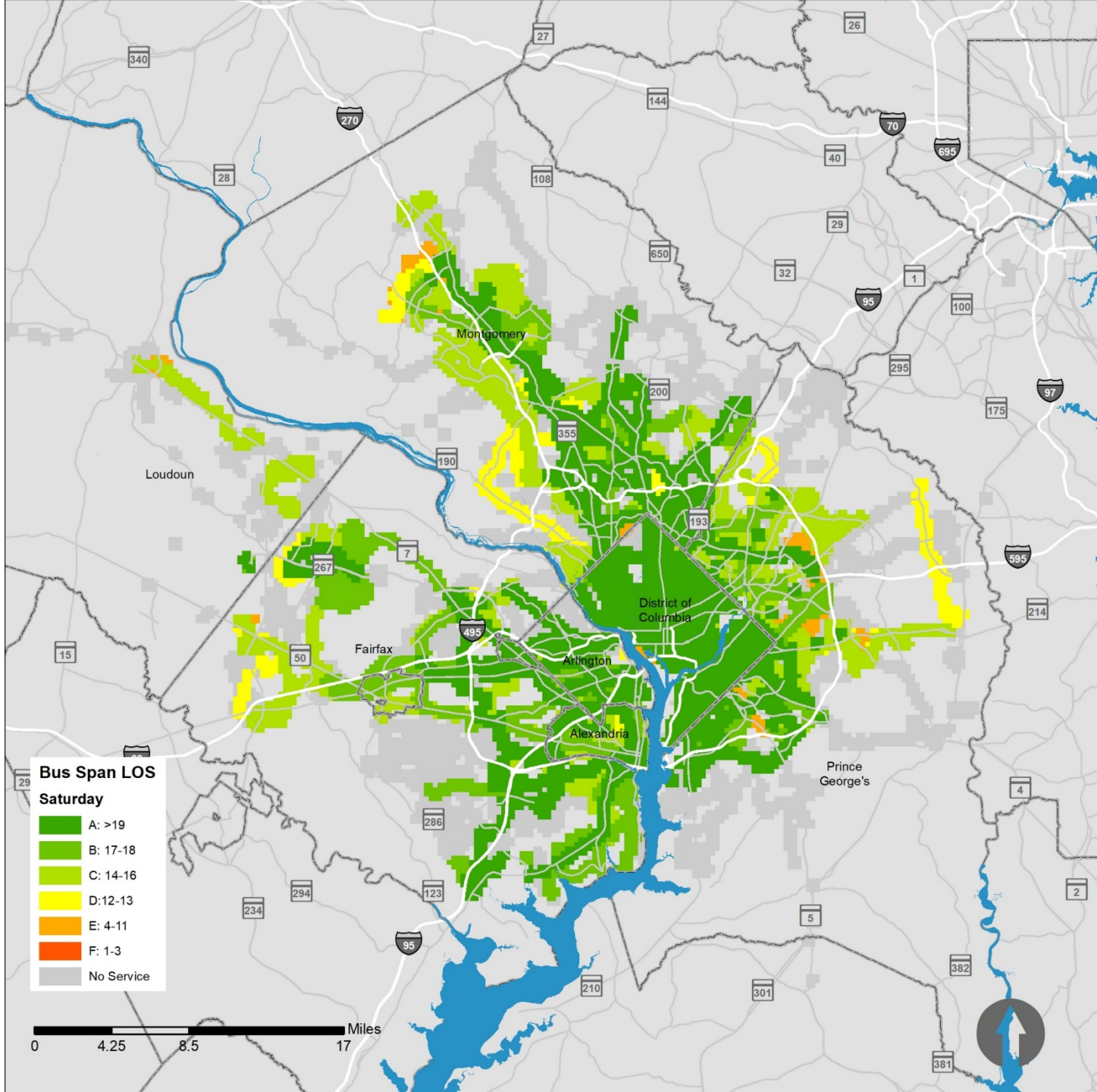
Saturday Span of Service

All-day service, or service that spans longer than 14 hours, is considered better transit service.

Fewer routes run on Saturdays compared to weekdays, and as such, the map of span on Saturdays covers less geographic area than the weekday map does.

Most of the areas with bus service on Saturdays in D.C., Arlington, and Alexandria have service spanning 14 hours or longer.

Throughout the rest of the region, of the routes that run on Saturday, many have spans greater than 14 hours per day. The areas that have spans 12 hours or less on Saturdays are in general further from activity centers, except for a few areas of Prince George's County inside the beltway.



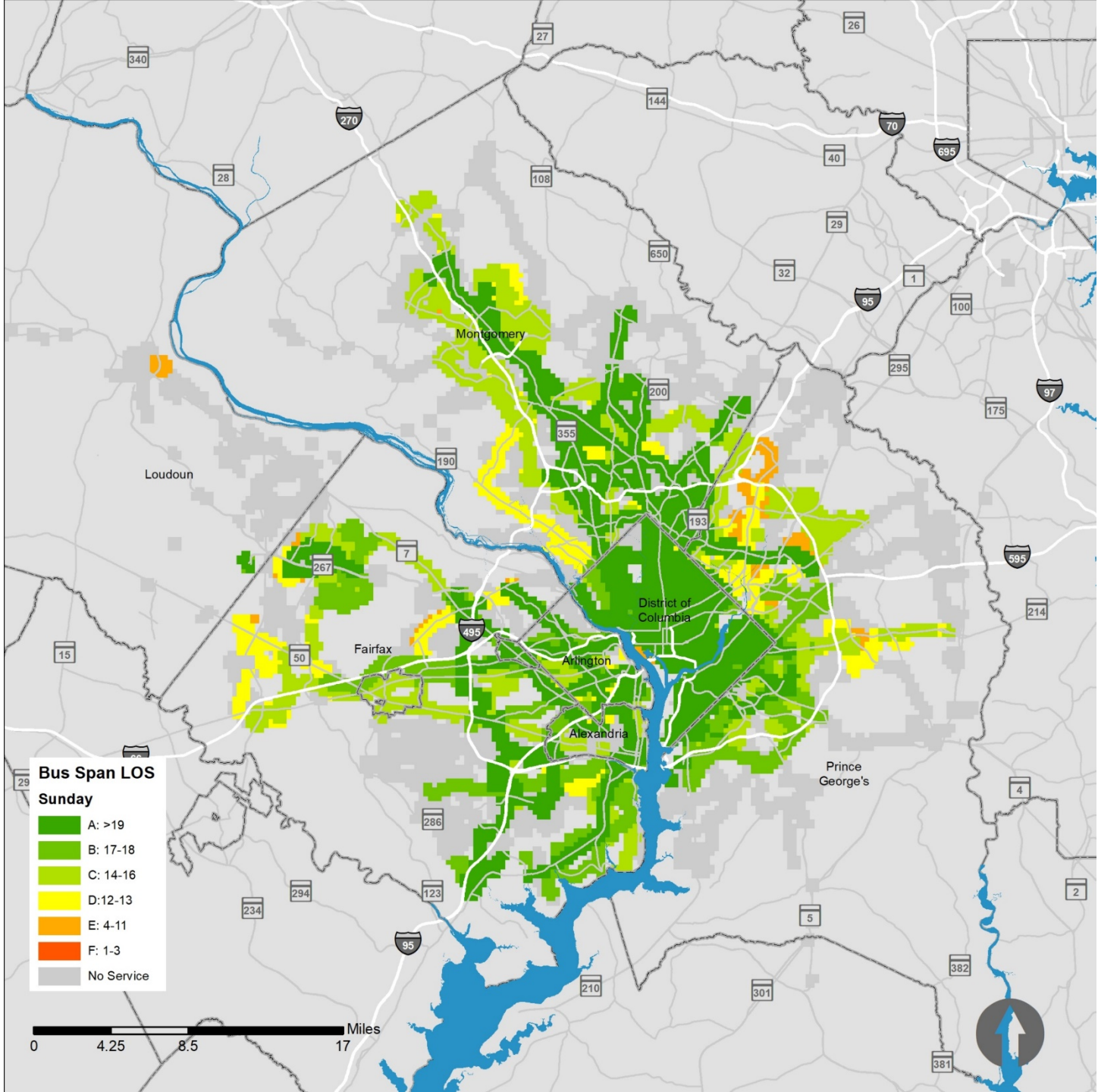
Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules

Sunday Span of Service

All-day service, or service that spans longer than 14 hours, is considered better transit service.

Fewer routes run on Sundays compared to Saturdays and weekdays. Many areas that had spans greater than 14 hours per day on Saturdays drop to 13 hours or lower on Sundays, meaning the buses operate fewer hours of the day.

The best spans of service on Sundays are in D.C., which is still mostly covered with spans greater than 17 hours per day.

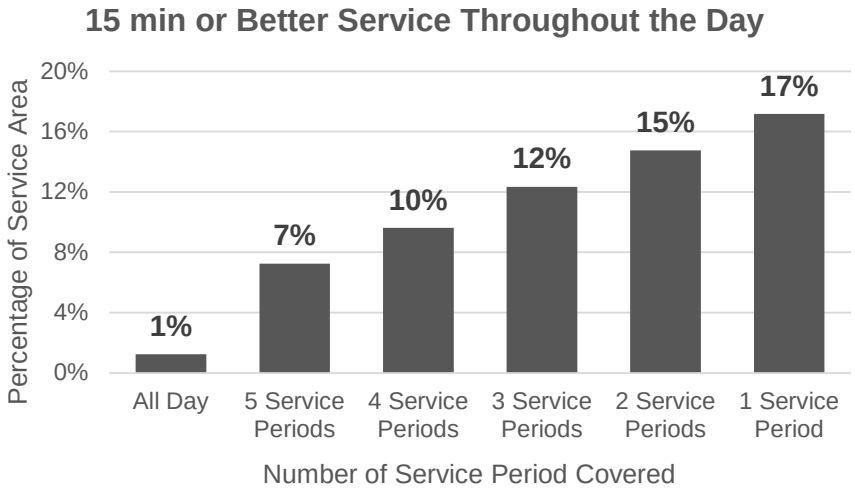


Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudon County Transit Shapefiles and Schedules

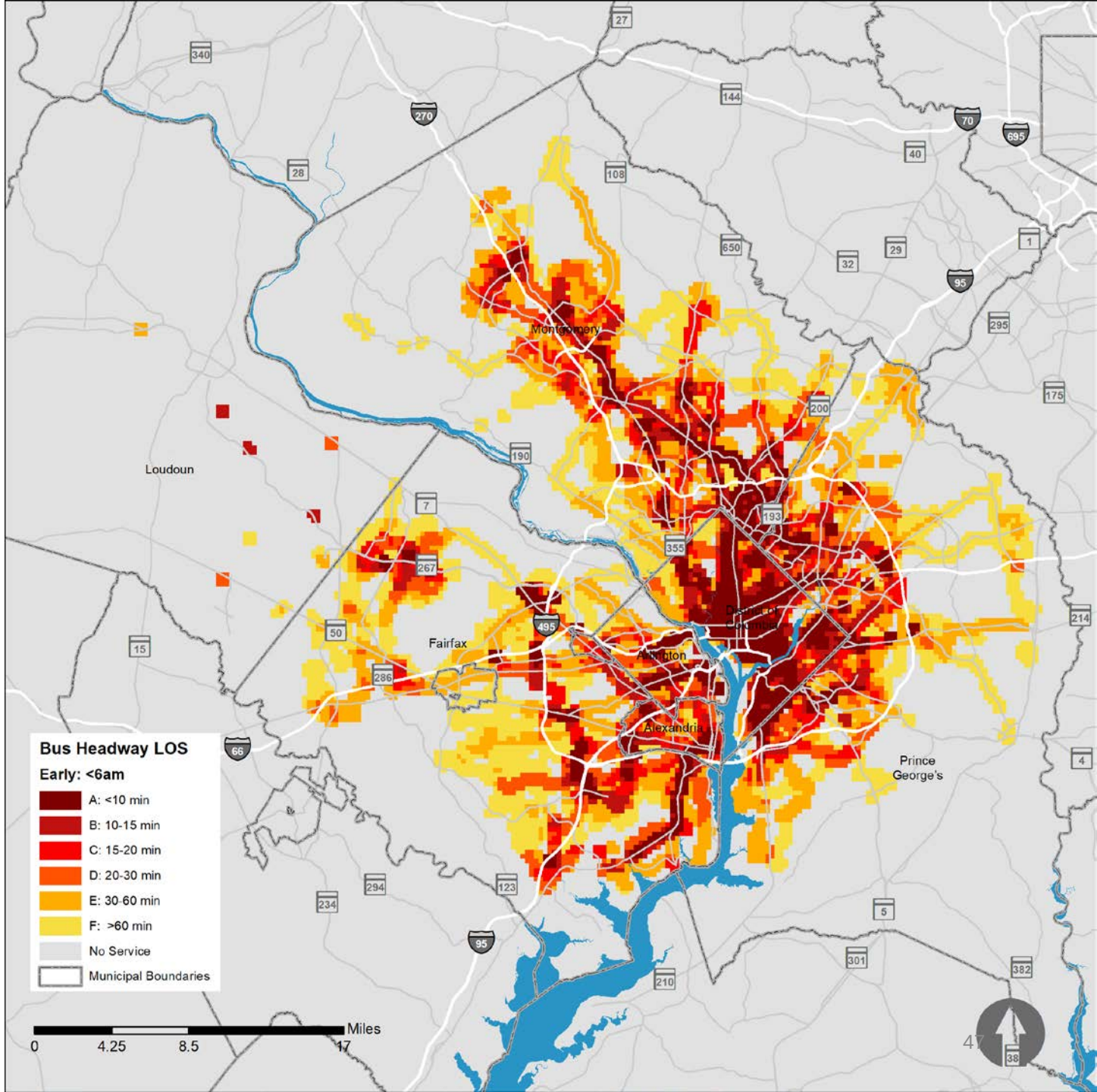
Early Morning & Late Night Weekday Service

The map shows early morning (before 6:00 AM) weekday headways. Frequent early morning service is available in D.C. and on major commuting corridors elsewhere in the region.

Frequent service (15 minute headways or better) is typically only available during a few service periods throughout the day. Thirty-two percent of the service area only has frequent service during 1-2 service periods each day. Only one percent of the service area has better than 15-minute service all day, which includes early morning and late night periods.



Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudoun County Transit Shapefiles and Schedules

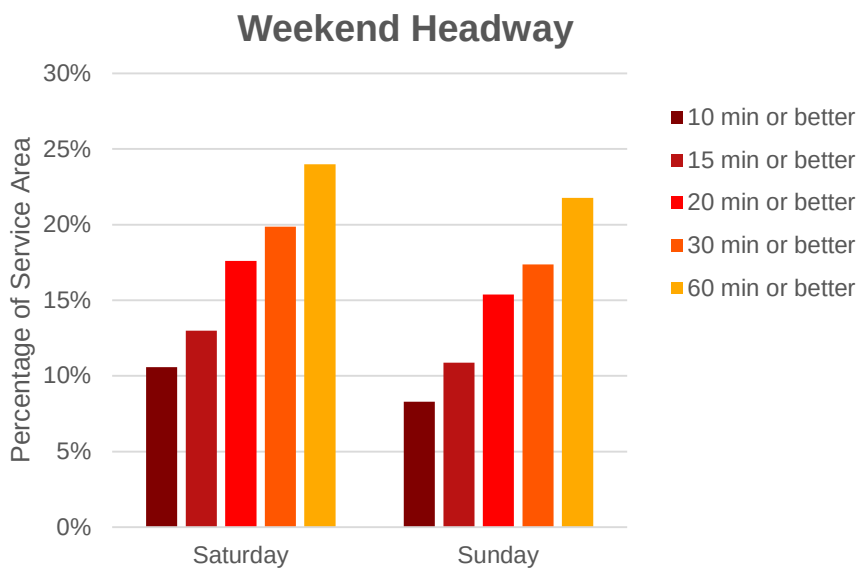


Weekend Midday Headway

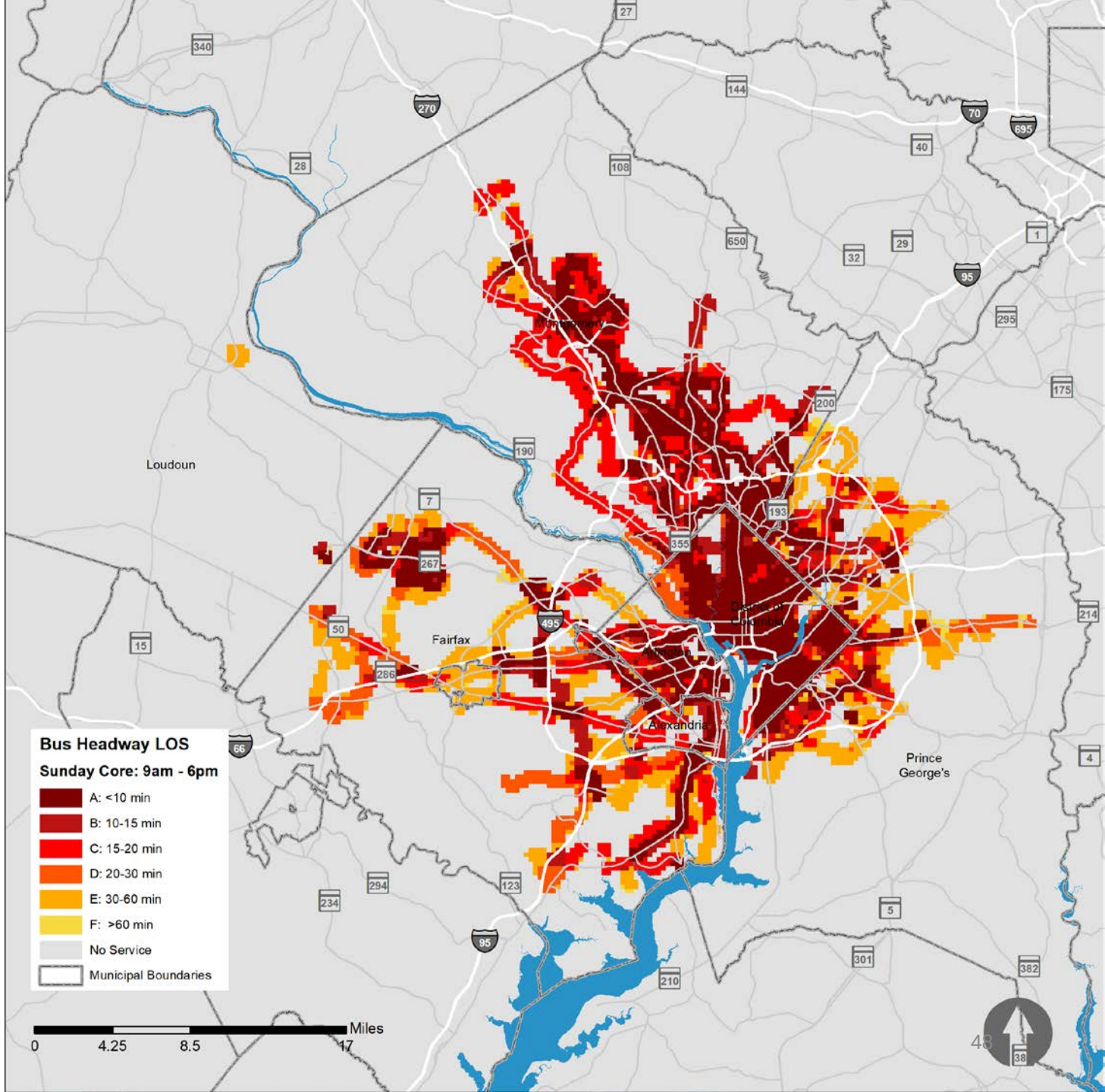
As compared to weekday service, weekend service provides comparable access to high frequency service.

However, there is less coverage throughout the region on the weekends.

For the core service from 9:00 AM – 6:00 PM, coverage is significantly less than weekday coverage.



Source: WMATA, Ride On, TheBus, ART, Dash, CUE, Fairfax Connector, and DC Circulator GTFS Feeds. Loudoun County Transit Shapefiles and Schedules



CUSTOMER EXPECTATIONS & DEMANDS

RIDER PROFILE

EQUITY

REGIONAL CONNECTIVTY

RIDER EXPERIENCE

SERVICE ANALYSIS

Most regional bus transfers are to and from Metrobus

There are 18,000 daily transfers between other local bus providers and Metrobus. There are an additional 49,200 daily transfers between Metrobuses.

Of the other agencies, Ride On provides the most daily transfers to and from Metrobus (7,900) as well as the most transfers within their own system (5,500).

	ART	DC Circulator	DASH	CUE	Fairfax Connector	Loudoun Transit	The Bus	Ride On	WMATA Metrobus
ART	500								
DC Circulator	100	300							
DASH			500						
CUE				100					
Fairfax Connector			200	100	2,600				
Loudoun Transit									
The Bus							300		
Ride On								5,500	
WMATA Metrobus	1,900	2,500	1,300	100	2,200	<100	2,100	7,900	49,200

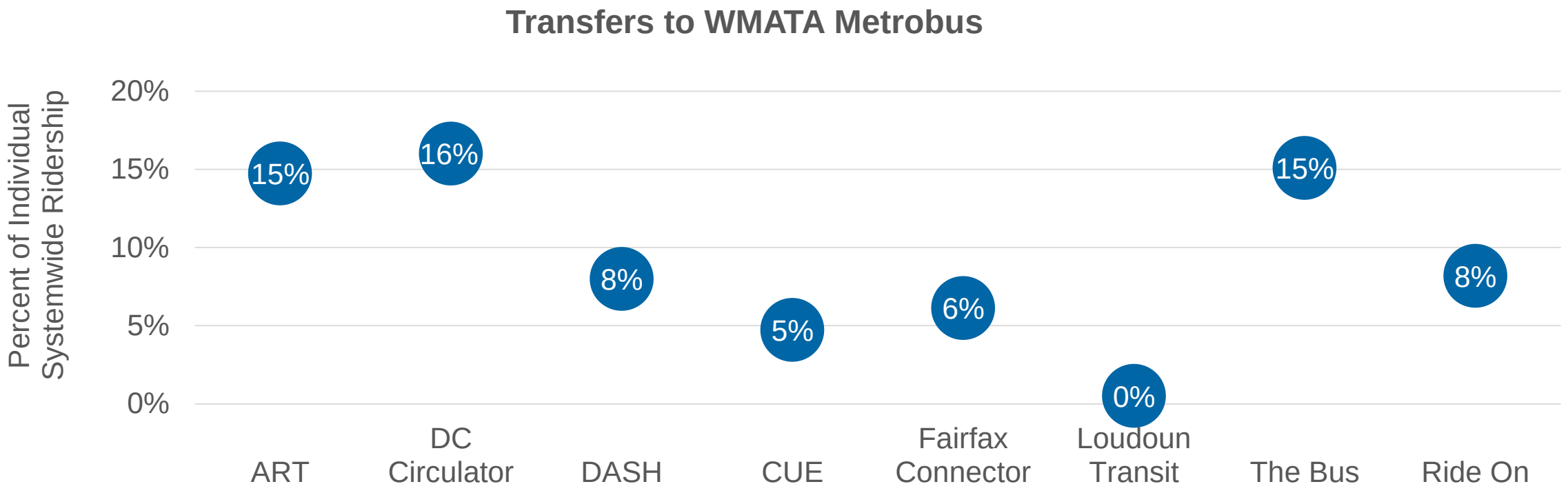
HIGH LOW

Source: October 2017 Weekday SmarTrip Transfers

Metrobus Transfers are a Notable Share of Ridership

Approximately 16 percent of all ART, DC Circulator, and The Bus trips involve a transfer to or from a Metrobus.

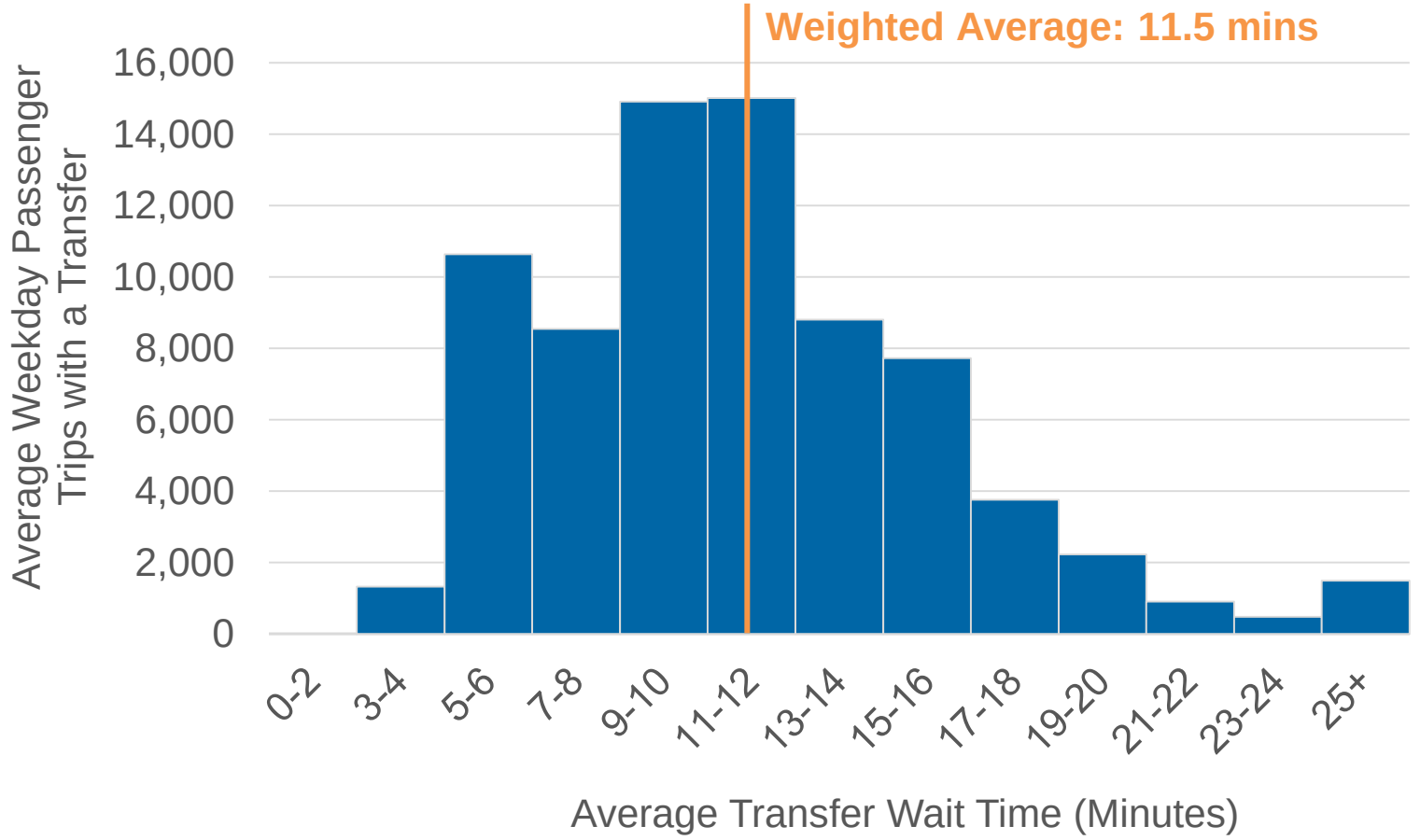
These three systems also have high overlap between their coverage areas and Metrobus coverage areas.



Source: October 2017 Weekday, Saturday and Sunday SmarTrip Transfers (WMATA), October 2017 Unlinked Trips (NTD)

Direct Service: Transfer Analysis

Trips with a bus-to-bus transfer require an average wait of almost 12 minutes. Transfers to Metrobus in particular require a similar average wait time.



Note: Research suggests that forced transfers negatively impact ridership: transfers of less than 5 minutes reduce demand by 15 to 20 percent, and transfers with 5 to 10 minutes of wait time reduce demand by 25 to 30 percent

Source: October 2017 Weekday SmarTrip Transfers (WMATA), GTFS feeds effective October 1, 2017. Analysis excludes transfers to and from Loudoun County bus runs and transfers not associated with a particular bus route, affecting less than 5% of total transfers and total transfer pairs.

Direct Service: Job Access within 45 minutes

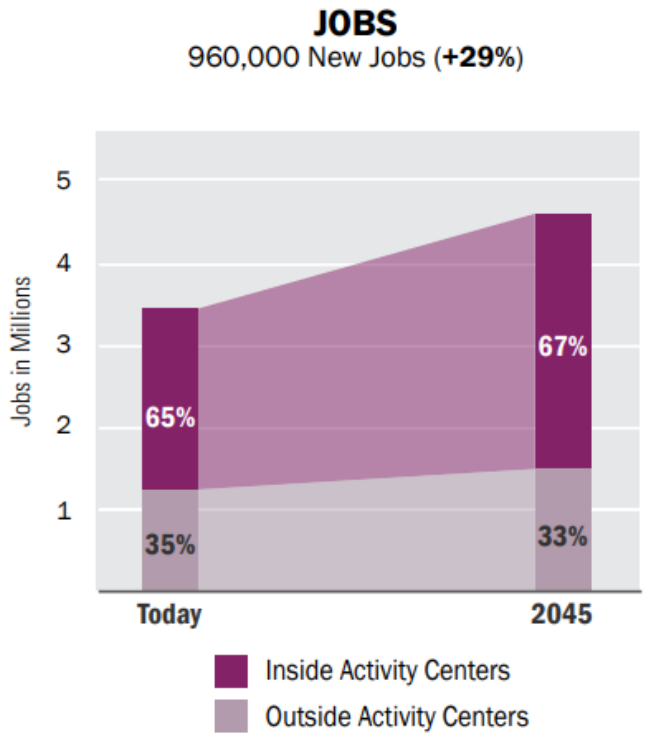
Regional access to jobs via transit

Today, a resident of the region can reach, on average, 369,000 jobs via transit within a 45-minute commute.

Looking to the future, in 2045, accounting for growth in population and jobs, a resident of the region could reach, on average:

- 444,000 jobs via transit within a 45-minute commute (an increase of 20 percent from today) assuming that no new transportation improvements are constructed.
- 518,000 jobs (an increase of 40 percent from today) if the planned investments in transportation infrastructure are implemented.

Projected job growth in and outside of activity centers by 2045



Source: "Performance Analysis of Financially Constrained Element," *Visualize 2045*, National Capital Region Transportation Planning Board, visualize2045.org.

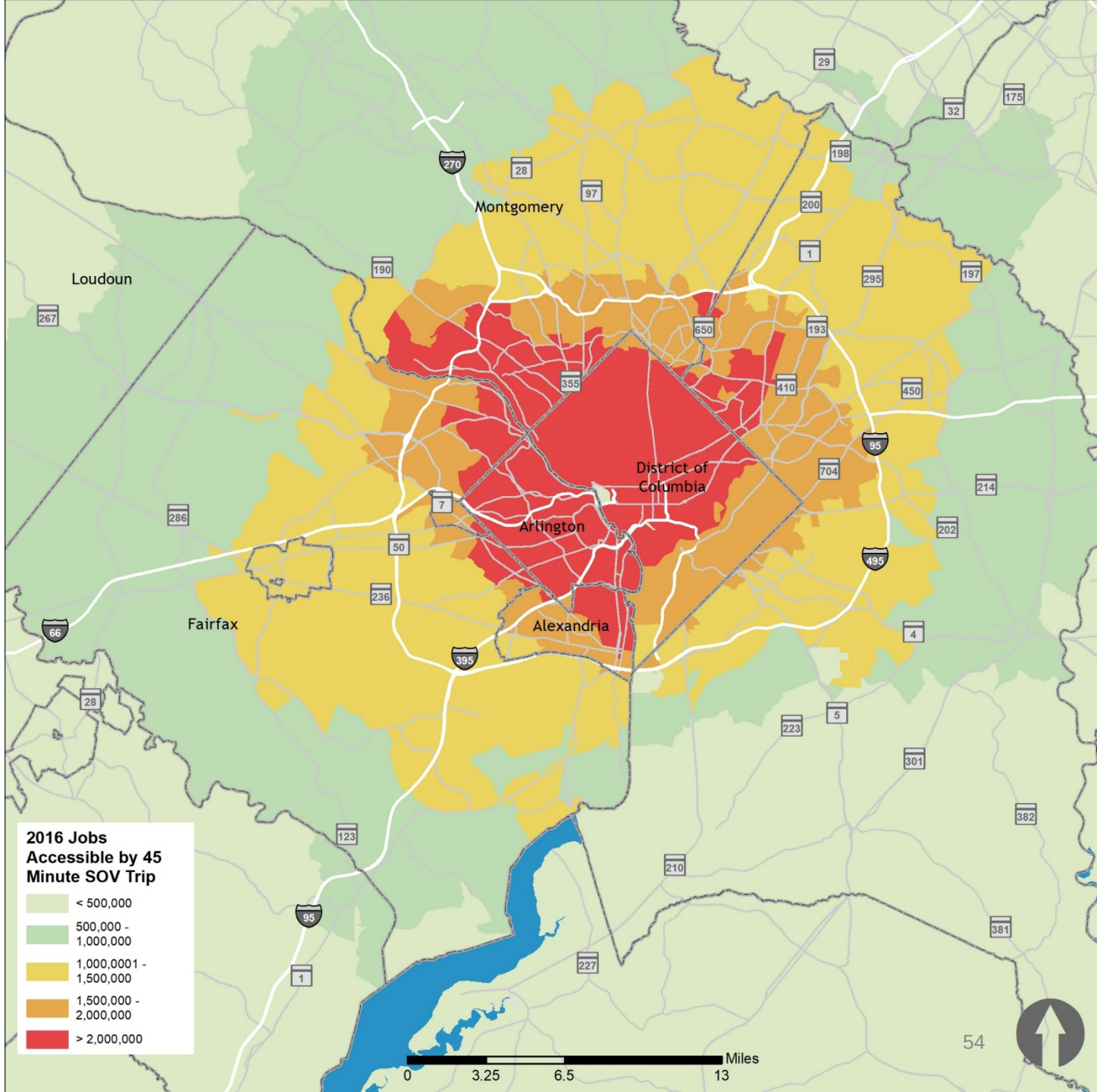
Access to Jobs

Accessibility is a key metric in economic opportunity and understanding how well people are able to get around the region. The following analysis quantifies how many jobs the average household can access within a 45-minute commute on different modes.

The average household in the region can access over 1.4 million jobs within 45 minutes by car, or approximately 50 percent of the jobs in the region.

Accessibility to jobs varies significantly across the region, as jobs are not equally spread across the jurisdictions. Households in Arlington, the District of Columbia, and Alexandria all have access to more jobs than average.

Jurisdiction	Average Number of Jobs Accessible	Percent of Regional Jobs Accessible
City of Alexandria	1,858,000	65%
Arlington County	2,377,000	83%
Fairfax County/Falls Church	1,160,000	41%
Loudoun County	426,000	15%
Montgomery County	1,178,000	41%
Prince George's County	1,213,000	42%
Washington D.C.	2,307,000	81%

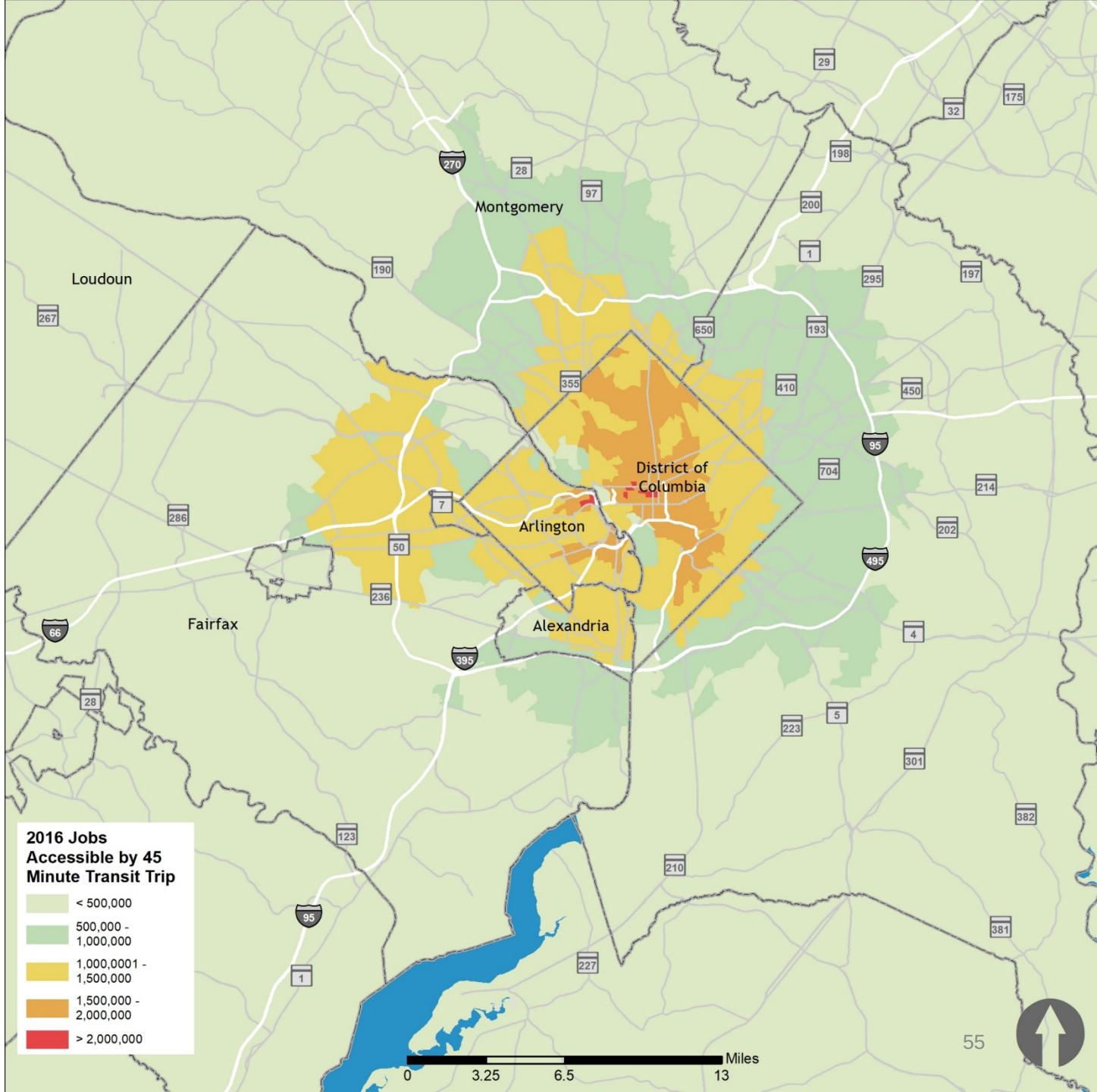


Access to Jobs by Transit

The average household in the region can access 580,000 jobs within 45 minutes by transit, or only 20 percent of the jobs in the region. This means that the average household can access 2.5 times more jobs by car than by transit.

Accessibility to jobs varies significantly, as jobs and transit service are not equally spread across the region. Households in Arlington, the District of Columbia, and Alexandria all have access to more jobs by transit than average.

Jurisdiction	Average Number of Jobs Accessible	Percent of Regional Jobs Accessible
City of Alexandria	739,000	26%
Arlington County	1,132,000	40%
Fairfax County/Falls Church	396,000	14%
Loudoun County	29,000	1%
Montgomery County	480,000	17%
Prince George's County	486,000	17%
Washington D.C.	1,061,000	37%



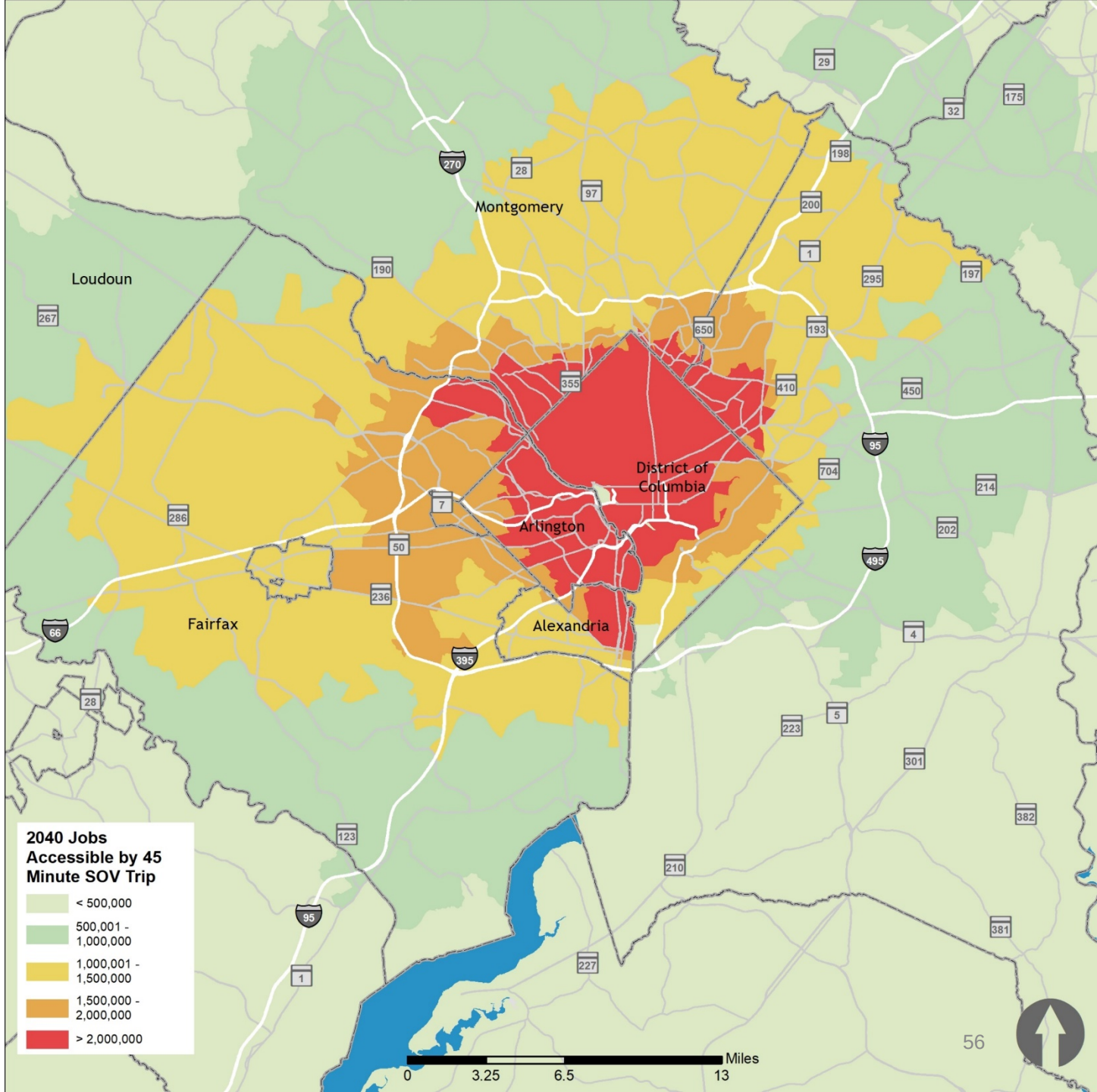
Access to Jobs in the Future

By 2040, new development and increases in congestion levels will impact accessibility throughout the region.

By 2040, the average household in the region will be able to access 1.4 million jobs within 45 minutes by car, only 38 percent of the jobs in the region.

Accessibility to jobs varies significantly across the region, as jobs are not equally spread across the jurisdictions. Households in Arlington, the District of Columbia, and Alexandria all have access to more jobs than average. Some jurisdictions will actually see a decrease in the number of accessible jobs.

Jurisdiction	Average Number of Jobs Accessible	Percent of Regional Jobs Accessible
City of Alexandria	1,693,000	46%
Arlington County	2,406,000	66%
Fairfax County/Falls Church	1,294,000	35%
Loudoun County	546,000	15%
Montgomery County	1,102,000	30%
Prince George's County	892,000	24%
Washington D.C.	2,344,000	64%



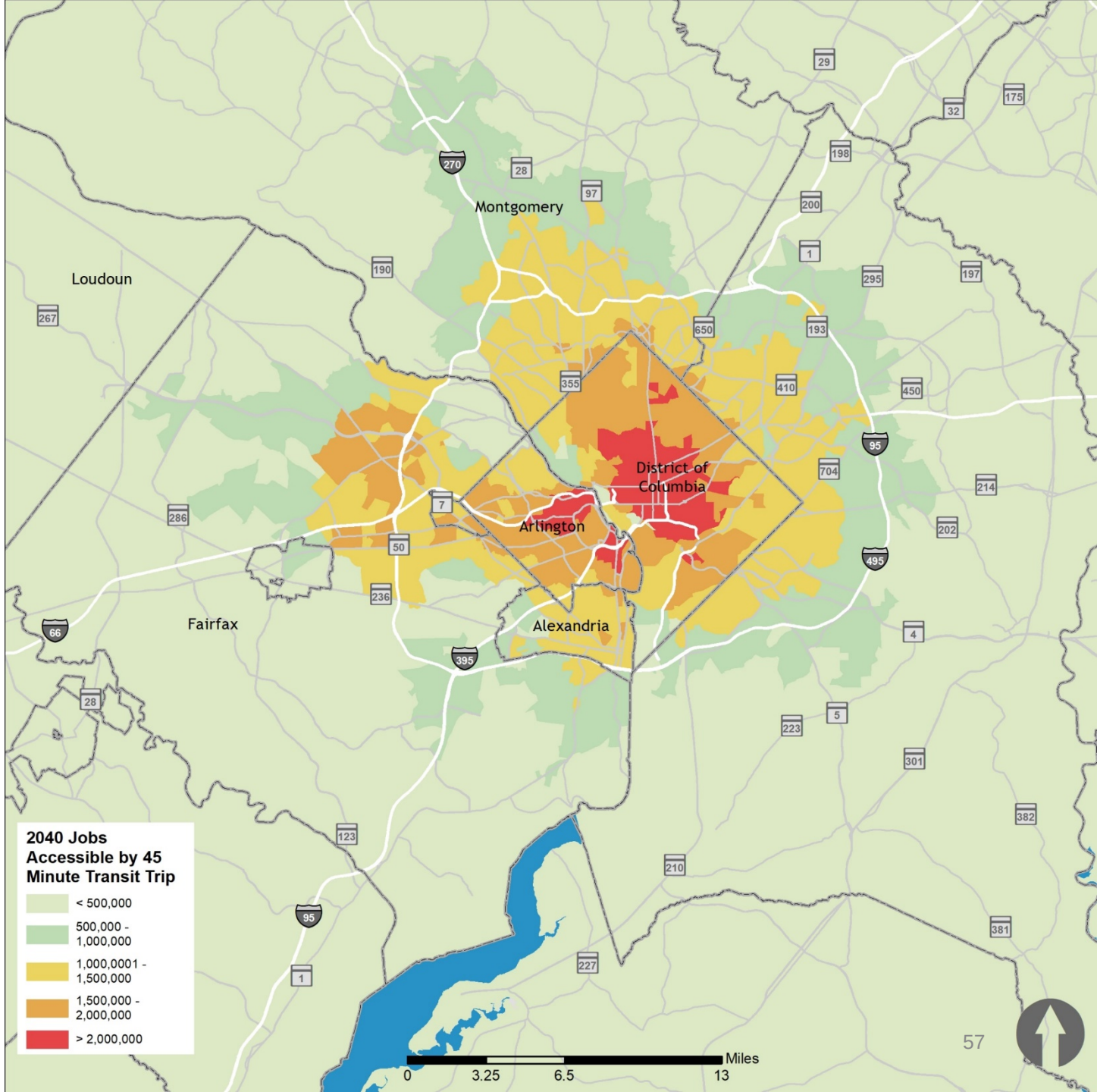
Access to Jobs by Transit in the Future

By 2040, the average household in the region will be able to access 751,000 jobs within 45 minutes by transit, or 21 percent of the jobs in the region. This is an increase over existing conditions.

Transit will have improved relative to driving - the the average household will be able to access 1.9 times more jobs by car than by transit.

Accessibility to jobs varies significantly, as jobs and transit service are not equally spread across the region. Households in Arlington, the District of Columbia, and Alexandria all have access to more jobs by transit than average.

Jurisdiction	Average Number of Jobs Accessible	Percent of Regional Jobs Accessible
City of Alexandria	957,000	26%
Arlington County	1,466,000	40%
Fairfax County/Falls Church	573,000	16%
Loudoun County	94,000	3%
Montgomery County	609,000	17%
Prince George's County	560,000	15%
Washington D.C.	1,321,000	36%



Regional Travel Plays an Important Role in Daily Trips

- Over 27 percent of Metrobus transfers are from connecting jurisdictional systems
- Most daily bus travel between jurisdictions has destinations in D.C.
- Approximately 10 percent of the trips occurring between Alexandria and Arlington occur on the bus.

The following slides illustrate the daily travel between jurisdictions on all modes, on just bus, and the percentage of trips taken on bus.

Source: October 2017 Weekday, Saturday and Sunday SmarTrip Transfers (WMATA), October 2017 Unlinked Trips (NTD, MWCOG/NCRTPB Travel Forecasting Model, Round 9.0.)

Total Daily Travel Between Jurisdictions Across All Modes

Origins \ Destinations →	District of Columbia	Montgomery County	Prince George's County	Arlington County	City of Alexandria	Fairfax Co./Fairfax City/Falls Church	Loudoun County
District of Columbia	-	124,500	114,200	49,100	18,000	63,300	4,500
Montgomery County	329,100	-	123,700	29,400	6,700	51,400	4,700
Prince George's County	385,700	174,400	-	42,800	21,500	666,300	3,300
Arlington County	76,500	10,900	6,800	-	46,200	114,800	3,500
City of Alexandria	44,300	5,400	6,300	66,600	-	95,400	2,000
Fairfax Co./Fairfax City/Falls Church	208,300	47,900	27,600	185,800	121,100	-	99,500
Loudoun County	29,400	12,000	3,800	15,500	4,700	153,300	-

HIGH LOW

Source: MWCOG/NCRTPB Travel Forecasting Model, Round 9.0.

Total Daily Travel Between Jurisdictions on Bus

Origins \ Destinations	District of Columbia	Montgomery County	Prince George's County	Arlington County	City of Alexandria	Fairfax Co./Fairfax City/Falls Church	Loudoun County
District of Columbia	-	8,900	5,300	2,500	700	600	0
Montgomery County	10,500	-	2,400	400	<100	<100	0
Prince George's County	19,200	7,500	-	600	<100	<100	0
Arlington County	5,200	<100	<100	-	2,000	2,500	0
City of Alexandria	3,300	<100	<100	6,700	-	2,400	0
Fairfax Co./Fairfax City/Falls Church	2,200	<100	<100	6,600	2,300	-	100
Loudoun County	700	<100	-	700	<100	600	-

HIGH LOW

Source: MWCOG/NCRTPB Travel Forecasting Model, Round 9.0.

Proportion of Daily Travel Taken on Bus

Origins \ Destinations	District of Columbia	Montgomery County	Prince George's County	Arlington County	City of Alexandria	Fairfax Co./Fairfax City/Falls Church	Loudoun County
District of Columbia	-	7%	5%	5%	4%	1%	0%
Montgomery County	3%	-	2%	1%	0%	0%	0%
Prince George's County	5%	4%	-	1%	0%	0%	0%
Arlington County	7%	0%	0%	-	4%	2%	0%
City of Alexandria	7%	1%	0%	10%	-	3%	0%
Fairfax Co./Fairfax City/Falls Church	1%	0%	0%	4%	2%	-	0%
Loudoun County	2%	0%	0%	4%	0%	0%	-

HIGH LOW

Source: MWCOG/NCRTPB Travel Forecasting Model, Round 9.0.

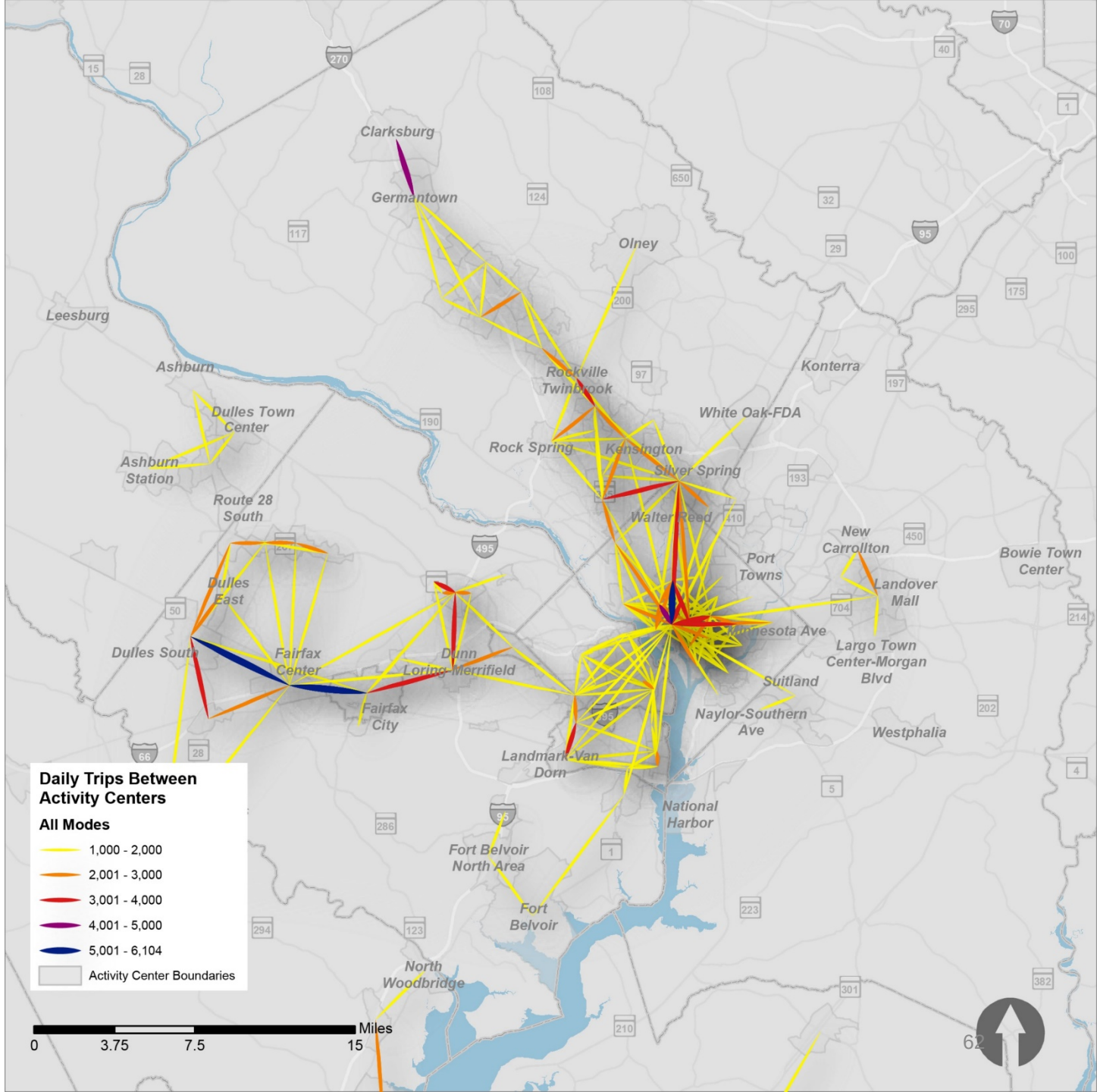
Daily trips between activity centers using all modes

The straight lines connecting activity centers represent the daily travel flows (trips) between the two, in either direction. Any two activity centers that have less than 1,000 daily trips between them are not represented by straight lines on the map.

The majority of regional trips are between adjacent areas where local bus service could be used.

We can classify many of these trips between adjacent areas as short distance trips of less than 10 miles.

The variety of trips means that not every connection can be made directly.



Source: MWCOG/NCRTPB Travel Forecasting Model, Round 9.0.

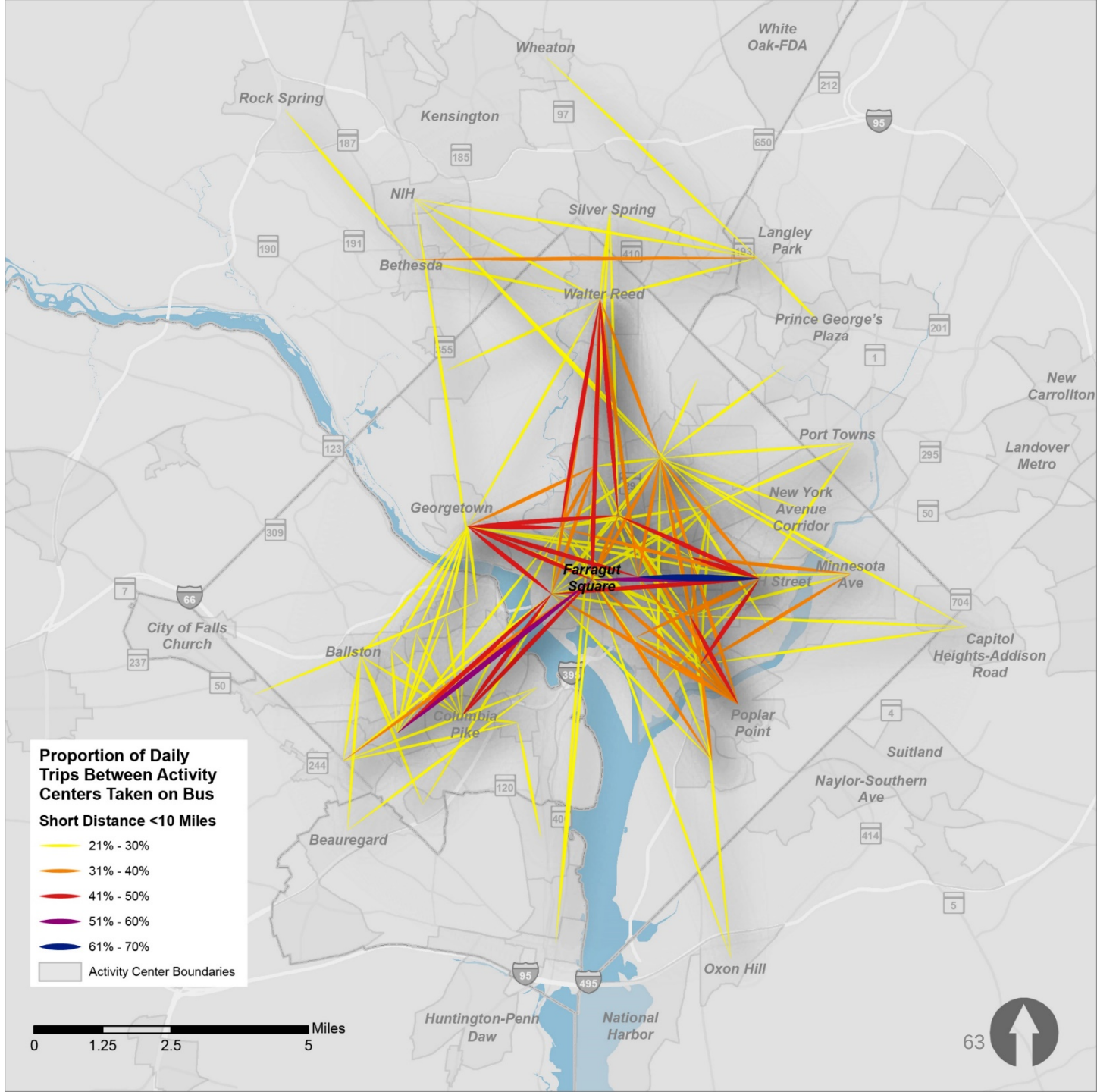
Proportion of short distance daily trips between activity centers taken by bus

Bus occupies a large portion of the travel in downtown D.C. It is especially prominent in areas without Metrorail service or when a more direct connection is needed.

Most short distance bus trips are made within and around D.C. Between 61 and 70 percent of trips made between H Street and Farragut Square are made by bus trips.

Most trips that start in D.C. and end in another jurisdiction, end in Arlington.

As seen from the previous Daily Trips by All Modes map, there are many short distance trips around the region. However, most outside of the areas shown here are generally made by other modes (<20 percent by bus).

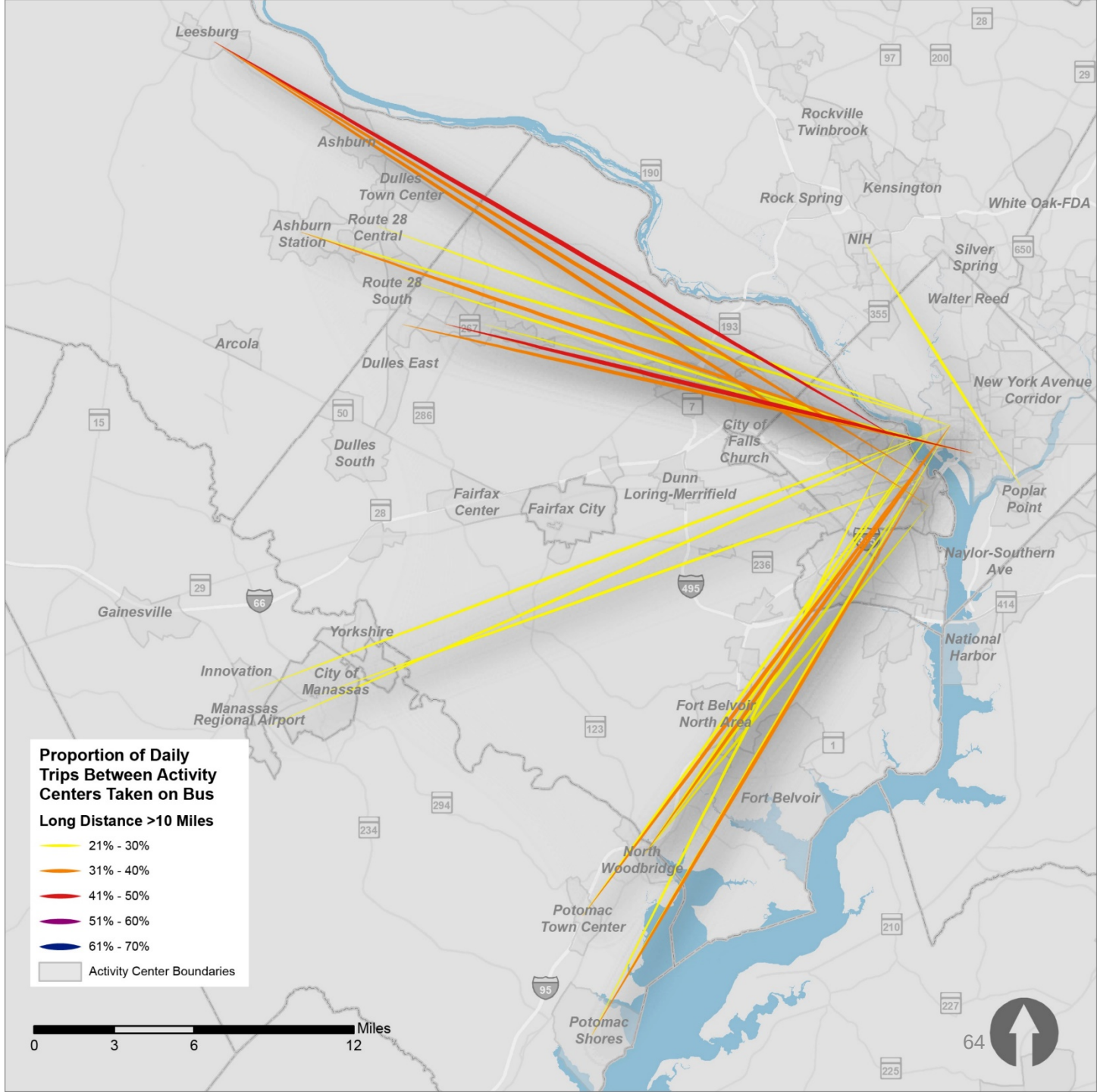


Source: MWCOG/NCRTPB Travel Forecasting Model, Round 9.0.

Proportion of long distance daily trips between activity centers taken on bus

Bus services provide a large portion of the long distance (over 10 miles) travel to D.C. and the Pentagon from outlying areas in Northern Virginia.

The connection between NIH and Poplar Point is the only connection represented that traverses Downtown D.C.



Source: MWCOG/NCRTPB Travel Forecasting Model, Round 9.0.

Trace Model: Key Takeaways

The Trace Model synthesizes a variety of WMATA data sources to construct a detailed record of how passengers and vehicles move throughout the WMATA Metrobus and Metrorail systems. Trace Model data allows for a previously unachievable level of clarity on how customers use bus service, including where customers get off the bus and how customers connect between routes on their journey.

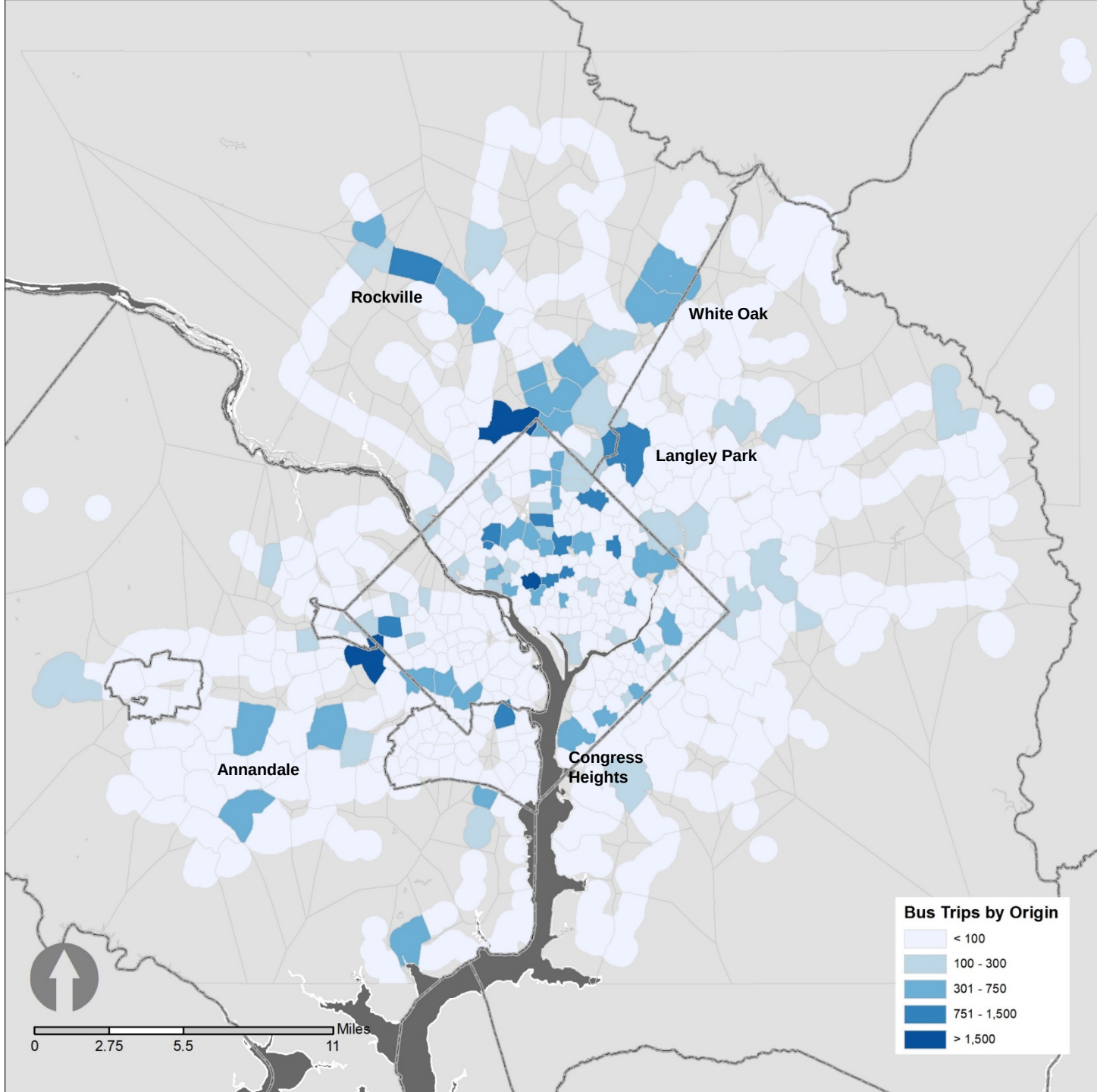
Highlights of an analysis of trip origins and destinations, transfers, and system usage include:

- Customers typically use Metrobus or Metrorail twice a day; only ten percent of customers will make three or more journeys using these services.
- Some of the highest concentrations of bus trip origins and destinations are found in the D.C., Rockville, and Langley Park

Daily Bus Trip Origins

According to the Trace Model, **the highest concentrations of bus trip origins are in D.C., 68 percent of all Metrobus bus trips.** As well as in Silver Spring, Montgomery County, and Seven Corners, Fairfax County.

Several areas just outside of D.C. in both Fairfax County and Montgomery County have high concentrations of bus trip origins.

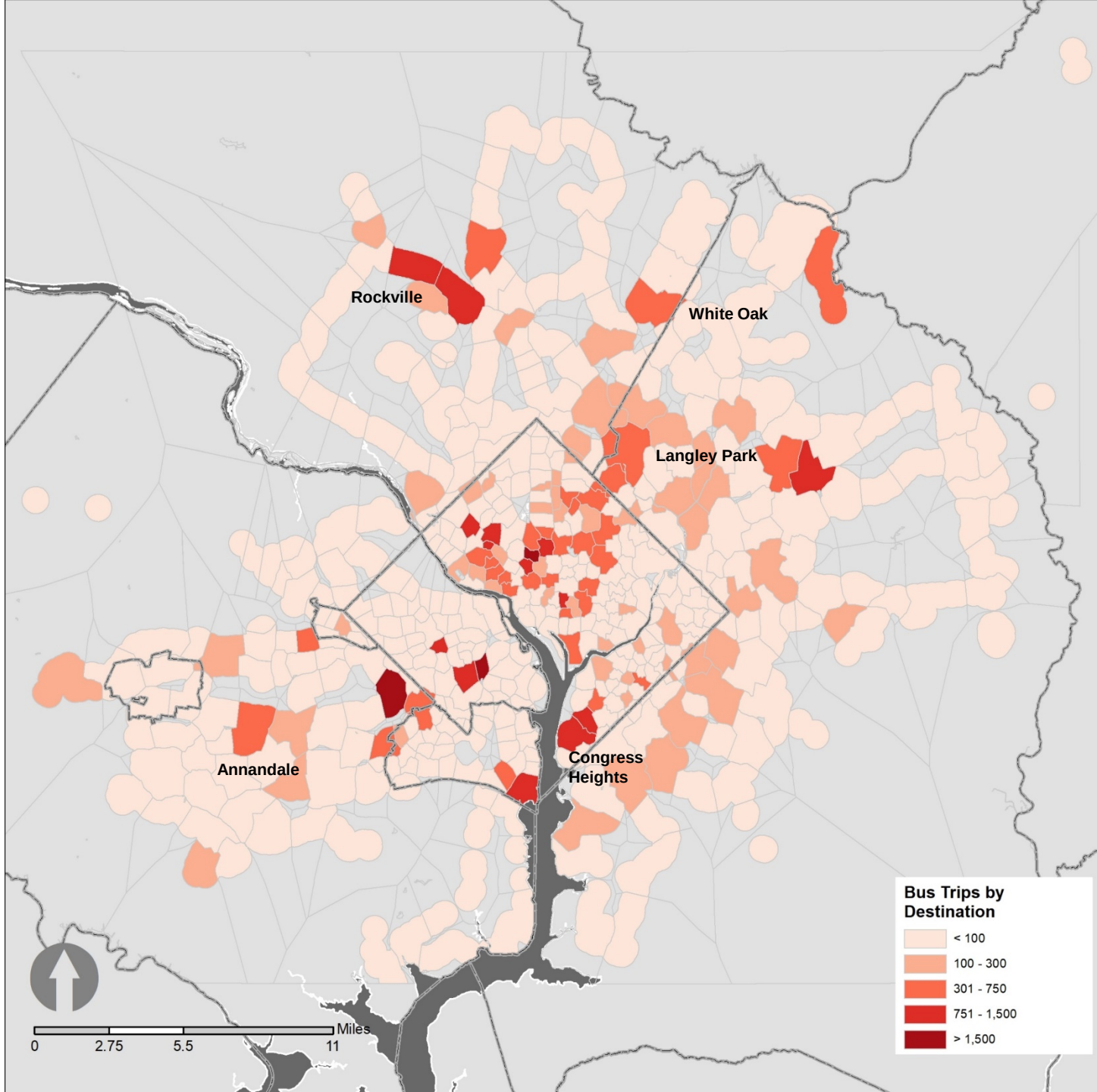


Daily Bus Trip Destinations

The highest concentrations of bus trip destinations are in D.C., 69 percent of all bus trips.

Approximately 10 percent (181,000) of all bus trips end in Prince George's County, 7 percent in Montgomery County, and 5 percent in Arlington County.

There is also a high concentration of bus trips ending in the Bailey's Crossroads area in Fairfax County.

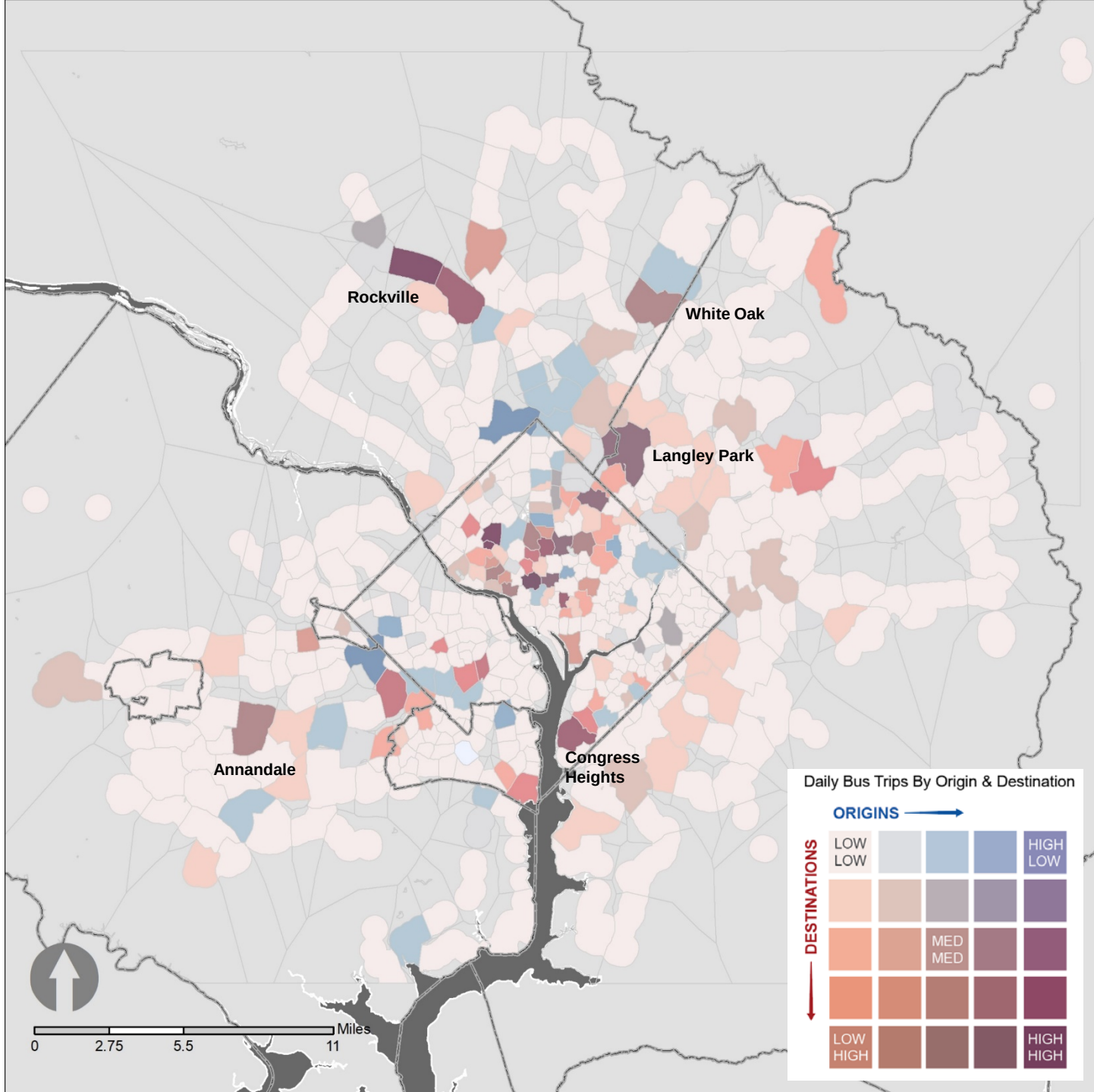


Daily Bus Trip Origins & Destinations

This map shows the overlap of the bus trip origins and destinations. Areas that appear purple are areas where high bus trip origins and destinations overlap or match.

Areas that appear more blue, are where more trips originate, and areas that appear more orange/red are where more trips end (destinations).

In D.C., the Rockville area, the Langley Park area, Annandale, and the White Oak area there is an overlap of trip origins and destinations.

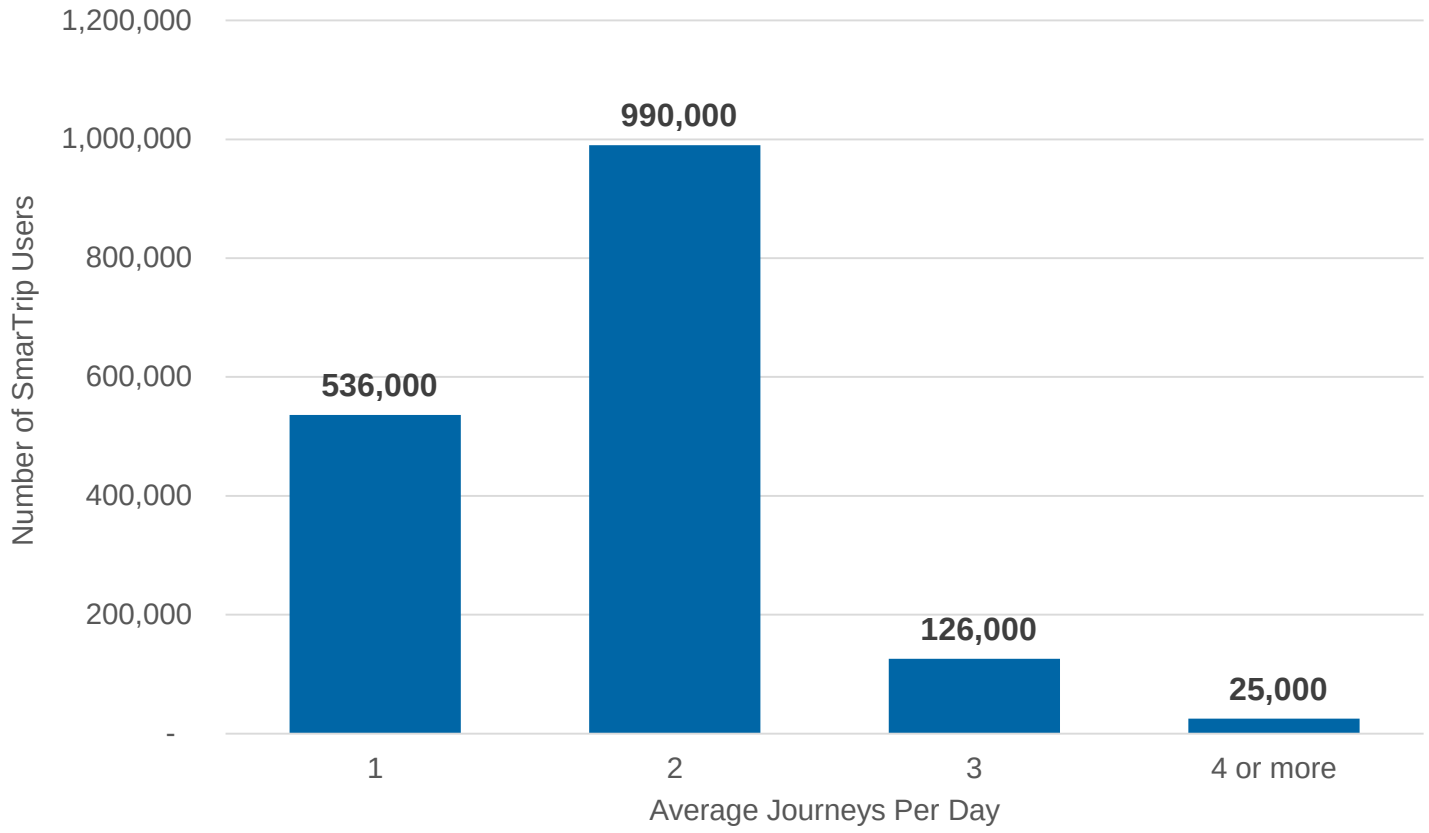


The Average Customer Uses Metrobus or Metrorail Twice in a Day

Customers make an average of 1.9 journeys a day on Metrorail and Metrobus.

As a significant number of travelers make only one journey, suggesting that other modes are used to complement WMATA services.

Only 9 percent of customers take three or more journeys in a day using Metrobus or Metrorail.



Source: WMATA Trace Model, September 2018. Values reflect SmarTrip card users traveling on Metrobus and Metrorail on days when trips were made. Assumes individual uses same SmarTrip card throughout the month of September 2018. Overall average and standard deviation is weighted by the number of trips each SmarTrip user made in September 2018.

CUSTOMER EXPECTATIONS & DEMANDS

RIDER PROFILE

EQUITY

REGIONAL CONNECTIVTY

RIDER EXPERIENCE

SERVICE ANALYSIS

Customer Satisfaction: National Trends

“What makes an unhappy transit rider? Transit service that is infrequent, slow, and unreliable, and transit stops that lack shelter and information. Addressing these deficiencies should be at the top of agencies’ to-do lists.”

When transit riders across the country were asked to rate potential bus service improvements to a theoretical bus route, the three highest rated responses were:

- Once on the bus, the trip takes 15 minutes instead of 30 minutes
- The bus comes every ten minutes instead of every twenty minutes
- The fare is reduced to $1.75 instead of $2.50

The next two highest rated responses were about amenities:

- The bus stop has a shelter to protect you from the weather instead of having to wait out in the open
- There is a countdown clock at the stop and a smartphone app telling you when the next bus is coming

Source: A survey of transit riders across the U.S. *Who’s On Board 2016*. TransitCenter. http://transitcenter.org/wp-content/uploads/2016/07/TransitCenter-WOB-2016.pdf

Customer Satisfaction: 2016 State of the Commute for the Metropolitan Washington Region

Bus riders surveyed in 2016 were substantially less satisfied than those surveyed in 2013: 41 percent were satisfied with the transportation network in 2016, compared to 58 percent in 2013.

The survey asked commuters to rate their satisfaction with the transportation network in the Washington metro region.

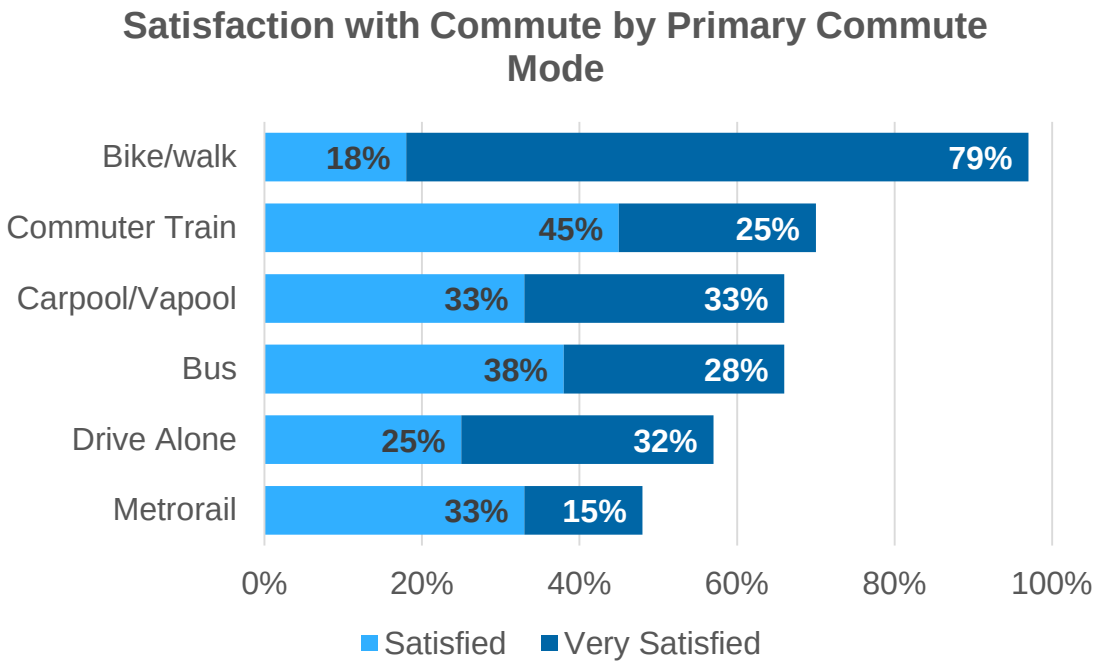
- 36 percent of respondents reported being satisfied.
- 41 percent of bus riders reported being satisfied, slightly higher than the average respondent, but lower than the 58 percent satisfaction rate among bus riders in 2013.

Respondents' distance to nearest bus correlates to their transportation satisfaction.

- 42 percent of respondents who live less than one mile from a bus stop were satisfied with transportation.
- Rates of transportation satisfaction declined as the distance grew between respondents' homes and bus stops.

The survey asked commuters to rate their satisfaction with their commute. (Graphic at right)

- In 2016, 58 percent said they were satisfied with their commute, which was slightly lower than what respondents reported in the 2013 survey (64 percent).
- 66 percent of bus riders said they were satisfied with their commute.



Source: *2016 State of the Commute Survey Report for the Metropolitan Washington Region*. National Capital Region Transportation Planning Board. https://www.mwcog.org/documents/2016/06/21/state-of-the-commute-survey-report--carsharing-state-of-the-commute-travel-surveys/

CUSTOMER EXPECTATIONS & DEMANDS

RIDER PROFILE

EQUITY

REGIONAL CONNECTIVTY

RIDER EXPERIENCE

SERVICE ANALYSIS

Service Types

The following service types and subservice types were identified based on the existing services available throughout the region:

Local Service: General bus service used to move people in urban and suburban areas.

- **Coverage/On-demand** - Low frequency (>45 minutes) bus service that provides access to other transit.
- **Local Frequent** - Medium frequency (20-40 minutes) service that supports the demand for transit.
- **Peak hour only -** Circulates throughout neighborhoods and connects to a Metrorail or Activity Center.

Corridor Service: Service designed to move many people quickly along high use corridors.

- **Bus Rapid Transit (BRT)** - High-capacity bus service with its own right of way, multiple-car vehicles at short headways, and/or longer stop spacing than traditional buses.
- **High Frequency Corridor/BRT-Lite** - High-frequency (<15 minutes) bus service on a designated corridor.
- **Limited Stop** - Service with larger stop spacing to improve reliability and travel time on key corridors.

Commuter Service: Bus service intended to get residents to and from work; operating only in the weekday peak period and connecting to an Activity Center or Metrorail Station.

- **Bus-to-Rail Commuter** - Closed door bus service that complements Metrorail by collecting passengers far outside the rail service area and bringing them to the end of the Metrorail line.
- **Express** - Travels on higher speed facilities and is extended limited stop bus service that brings passengers directly to an activity center

Special Service: Services designed to meet specific span service that fills gaps in other coverage during non-peak times.

- **Airport Shuttle** - Long distance bus service connecting to Regional Airports
- **Late Night Gap** – Bus service that operates only during the night to fulfill a special need or cover the closure of Metrorail
- **Weekend Gap** - Bus service that operates only during the weekend to fulfill a special need or cover the closure of Metrorail

Service Characteristics

The routes are classified based on operating characteristics that can be derived from an agencies General Transit Feed Specification (GTFS) feed and applied to all agencies within the region that followed the specification. The following route features were calculated:

- **Frequency** – The average number of vehicles per hour that pass a certain point on a route.
- **Span** – Hours of service provided by a route on a given service day by day type and service period.
- **Number of Trips** – Total number of trips taken within a period by day type and service period.
- **Length** – The length in miles averaged across all patterns of the route.
- **Stops per Mile** – The number of scheduled stops per mile averaged across all patterns of the route.
- **Directness** – Ratio of the routes length to the straight-line distance between the first and last stop.
- **Route Endpoints** – The presence of an Activity Center or Metrorail station within ¼ mile of the end of a route.
- **Largest Stop Spacing** – the longest distance that the bus operates closed door service.

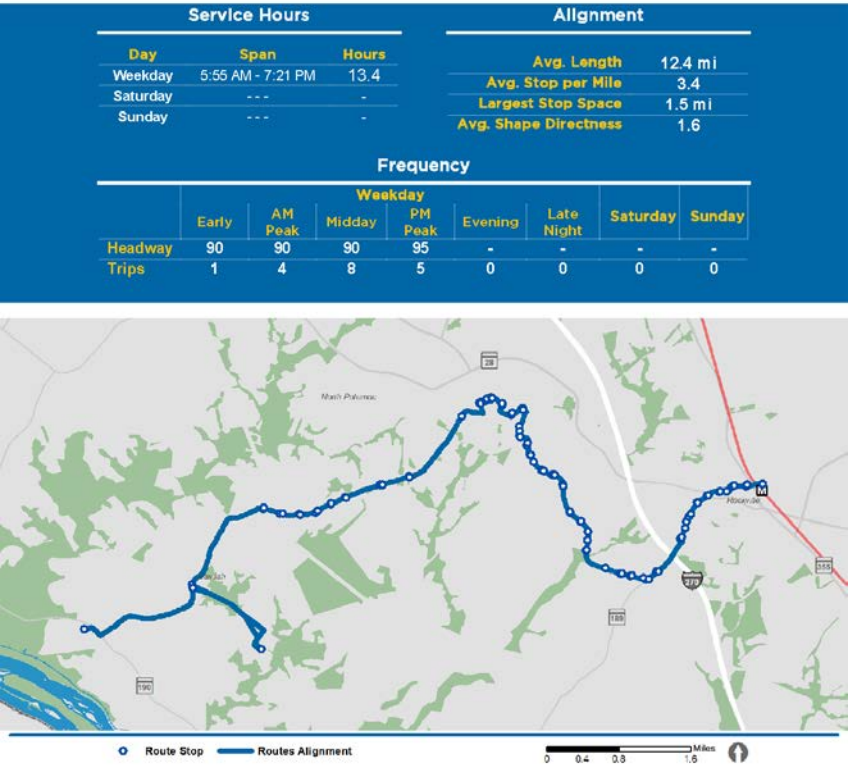
Note: Loudoun County did not have a GTFS feed for use in this classification.

Local Service Example

Ride On 301 - Coverage/On-demand
Low frequency (>45 minutes) bus service that provides access to transit.

Dash AT1 - Local Frequent
Medium frequency (20-40 minutes) service that supports the demand for transit.

ART 62 - Peak Hour Only
Circulates throughout neighborhoods and connects to a Metrorail or Activity Center.



Service Hours

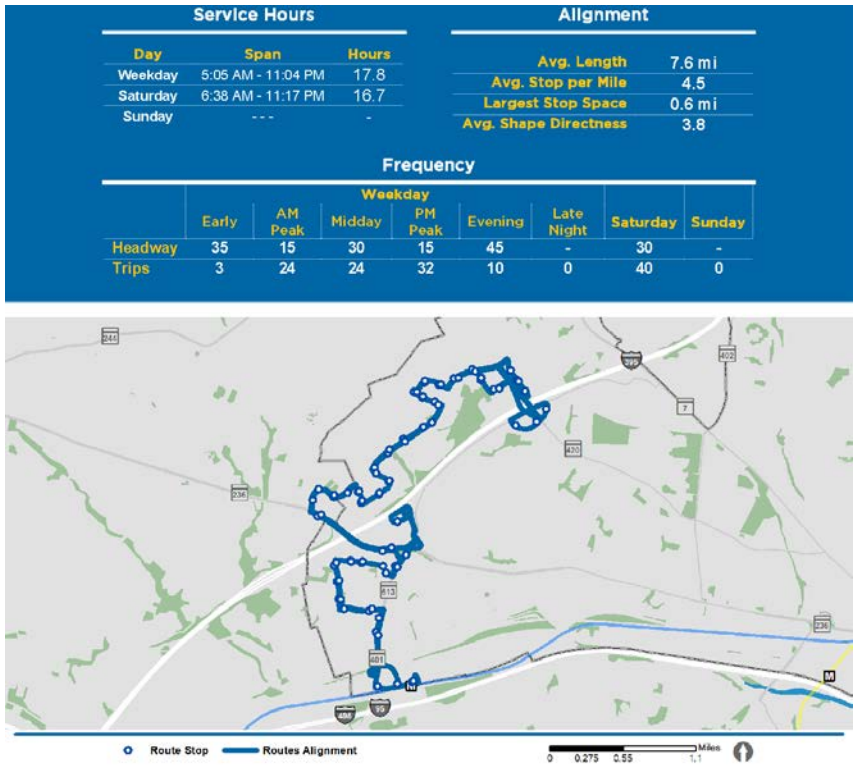
Day	Span	Hours
Weekday	5:55 AM - 7:21 PM	13.4
Saturday	---	-
Sunday	---	-

Alignment

Avg. Length	12.4 mi
Avg. Stop per Mile	3.4
Largest Stop Space	1.5 mi
Avg. Shape Directness	1.6

Frequency

	Weekday						Saturday	Sunday
	Early	AM Peak	Midday	PM Peak	Evening	Late Night		
Headway	90	90	90	95	-	-	-	-
Trips	1	4	8	5	0	0	0	0



Service Hours

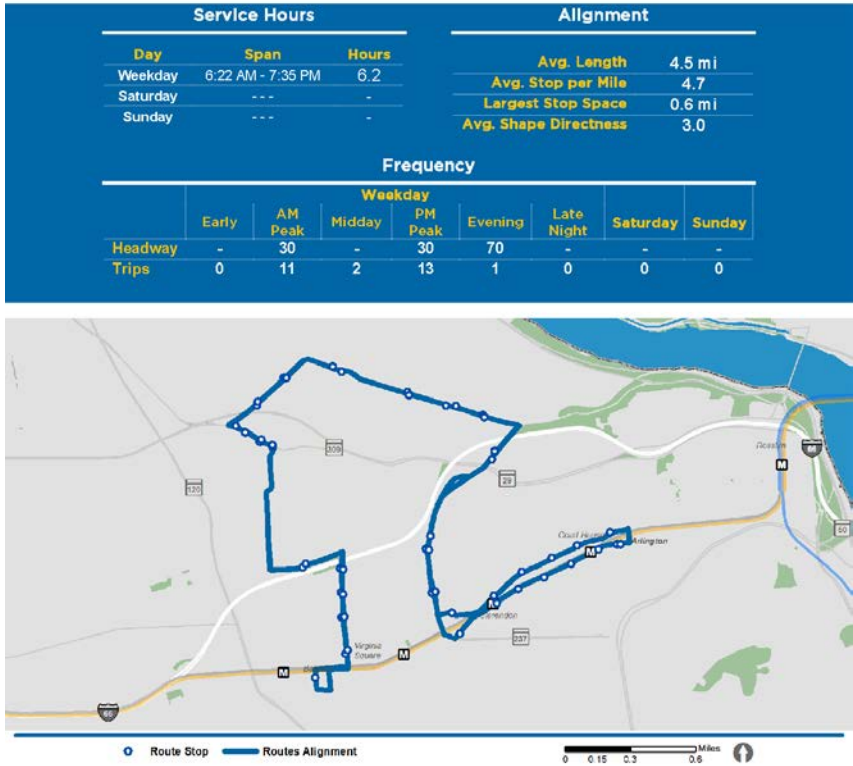
Day	Span	Hours
Weekday	5:05 AM - 11:04 PM	17.8
Saturday	6:38 AM - 11:17 PM	16.7
Sunday	---	-

Alignment

Avg. Length	7.6 mi
Avg. Stop per Mile	4.5
Largest Stop Space	0.6 mi
Avg. Shape Directness	3.8

Frequency

	Weekday						Saturday	Sunday
	Early	AM Peak	Midday	PM Peak	Evening	Late Night		
Headway	35	15	30	15	45	-	30	-
Trips	3	24	24	32	10	0	40	0



Service Hours

Day	Span	Hours
Weekday	6:22 AM - 7:35 PM	6.2
Saturday	---	-
Sunday	---	-

Alignment

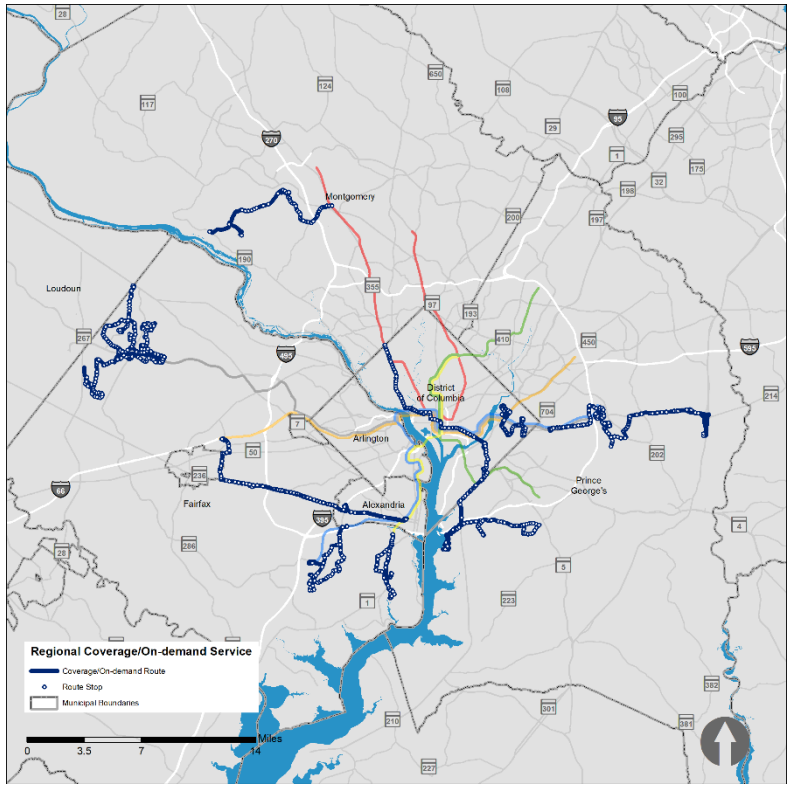
Avg. Length	4.5 mi
Avg. Stop per Mile	4.7
Largest Stop Space	0.6 mi
Avg. Shape Directness	3.0

Frequency

	Weekday						Saturday	Sunday
	Early	AM Peak	Midday	PM Peak	Evening	Late Night		
Headway	-	30	-	30	70	-	-	-
Trips	0	11	2	13	1	0	0	0

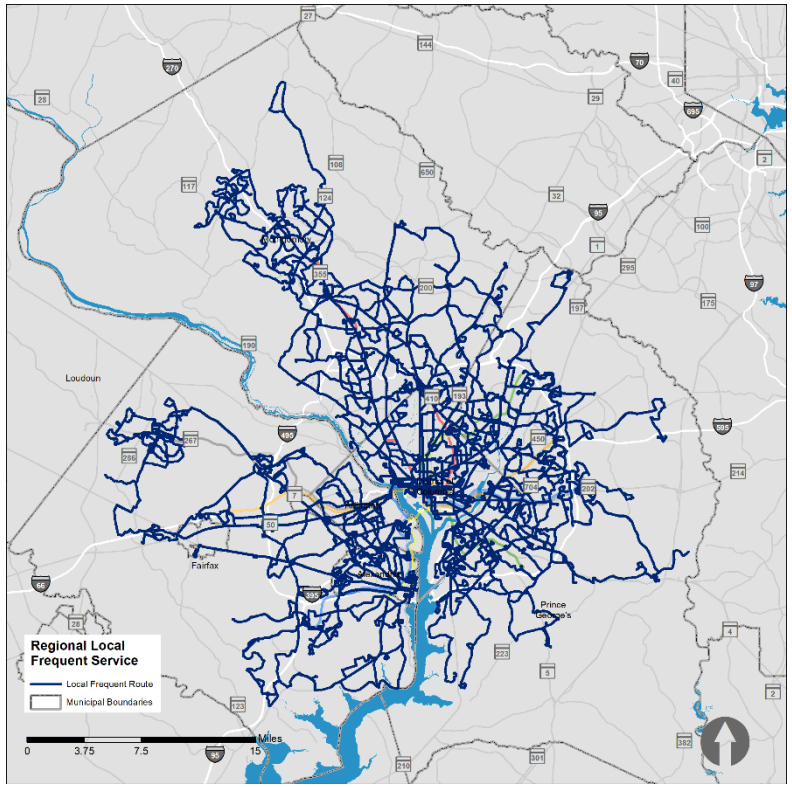
Local Service Area

Coverage/On-demand



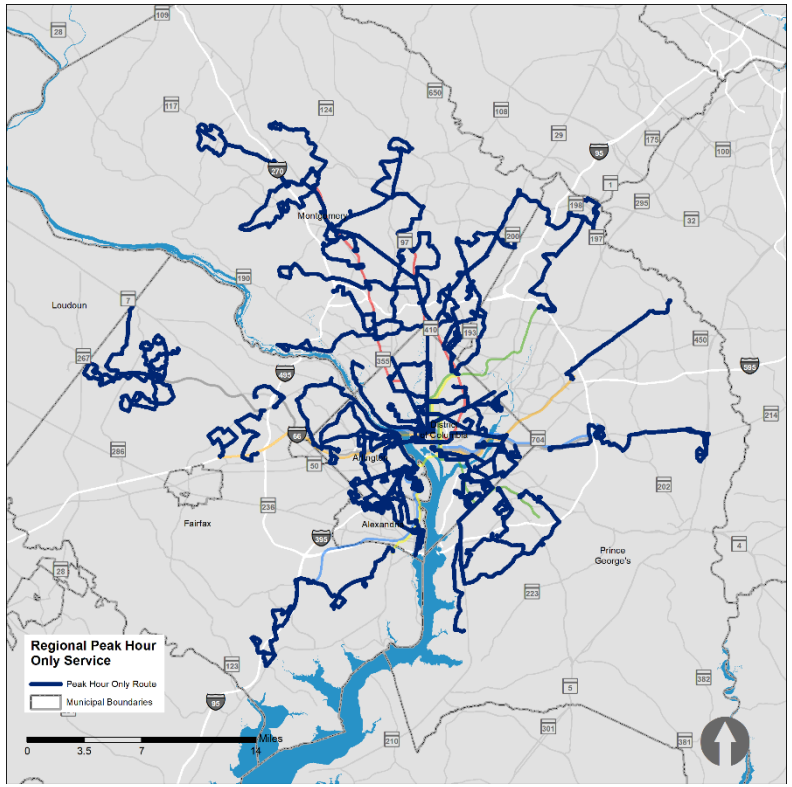
- **18 Coverage Routes**
- Operated by agencies with larger service areas: WMATA, Ride On, Fairfax Connector, and TheBus

Local Frequent



- **267 Local Frequent Route**
- Operated by all agencies

Peak Hour Only



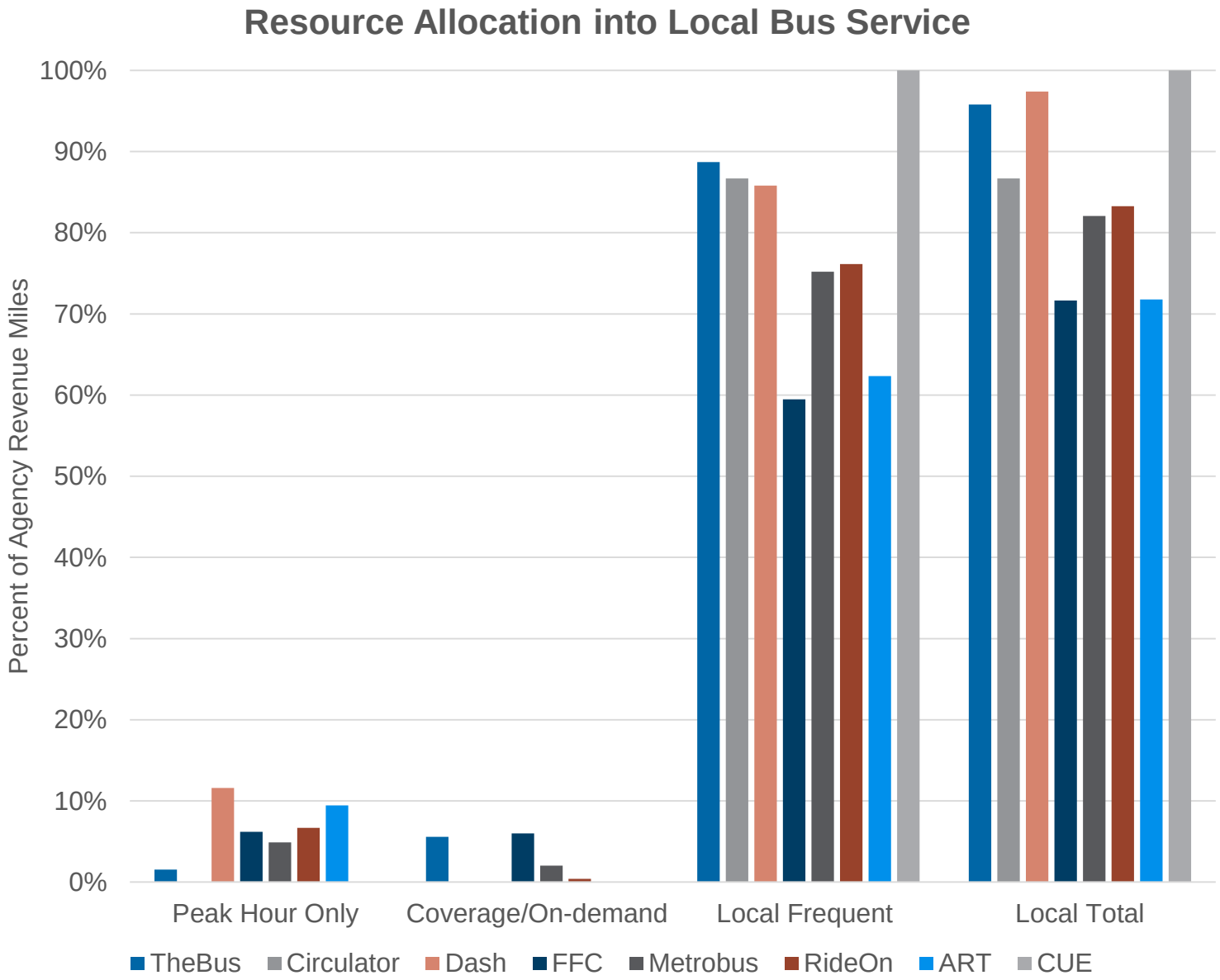
- **99 Peak Hour Route**
- Most commonly operated around Metrorail stations or within D.C.

Local Service Summary

For all agencies the majority of revenue miles are operated on local routes, most of which are local frequent routes. **For smaller agencies like CUE, TheBus, Dash, and the Circulator more than 80 percent of their revenue miles are on this type of service.**

Coverage services are operated by agencies with a larger service area but make up a smaller portion of all agencies services.

Peak hour only services generally are available from agencies with dense service areas.



Corridor Service Example

Metroway- Bus Rapid Transit (BRT)
High-capacity bus service with its own right of way, multiple-car vehicles at short headways, and/or longer stop spacing than traditional buses.

Service Hours

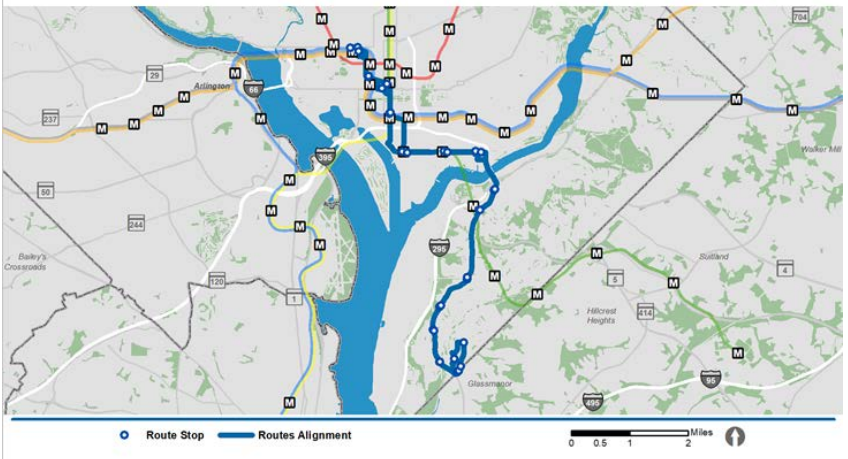
Day	Span	Hours
Weekday	5:30 AM - 10:24 PM	16.9
Saturday	6:30 AM - 12:26 AM	17.9
Sunday	7:30 AM - 10:25 PM	14.9

Alignment

Avg. Length	4.1 mi
Avg. Stop per Mile	3.0
Largest Stop Space	0.6 mi
Avg. Shape Directness	1.4

Frequency

	Weekday						Saturday	Sunday
	Early	AM Peak	Midday	PM Peak	Evening	Late Night		
Headway	5	5	10	5	15	-	20	20
Trips	8	59	61	77	25	0	60	60



Metrobus X2 - High Frequency Corridor/BRT-Lite
High-frequency (<15 minutes) bus service on a designated corridor.

Service Hours

Day	Span	Hours
Weekday	4:00 AM - 3:56 AM	24.9
Saturday	4:08 AM - 4:20 AM	24.1
Sunday	4:10 AM - 3:59 AM	23.8

Alignment

Avg. Length	4.4 mi
Avg. Stop per Mile	4.7
Largest Stop Space	0.5 mi
Avg. Shape Directness	1.1

Frequency

	Weekday						Saturday	Sunday
	Early	AM Peak	Midday	PM Peak	Evening	Late Night		
Headway	25	10	10	5	15	20	10	10
Trips	15	45	90	65	36	27	108	113

Metrobus A9- Limited Stop
Service with larger stop spacing to improve reliability and travel time on key corridors.

Service Hours

Day	Span	Hours
Weekday	5:55 AM - 7:41 PM	7.9
Saturday	---	-
Sunday	---	-

Alignment

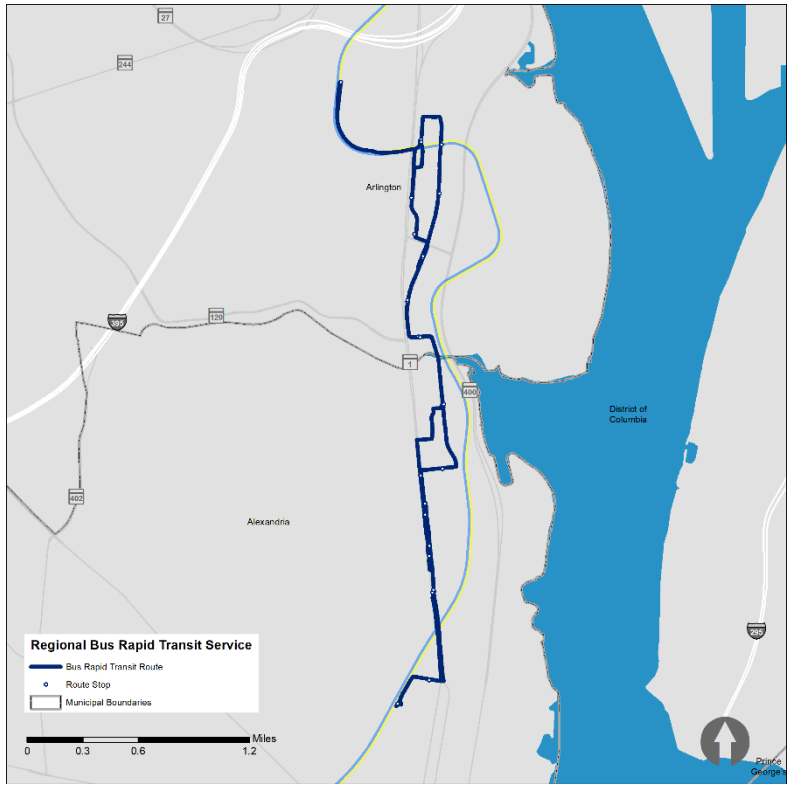
Avg. Length	9.8 mi
Avg. Stop per Mile	1.8
Largest Stop Space	1.2 mi
Avg. Shape Directness	1.7

Frequency

	Weekday						Saturday	Sunday
	Early	AM Peak	Midday	PM Peak	Evening	Late Night		
Headway	10	30	-	30	-	-	-	-
Trips	1	12	0	13	0	0	0	0

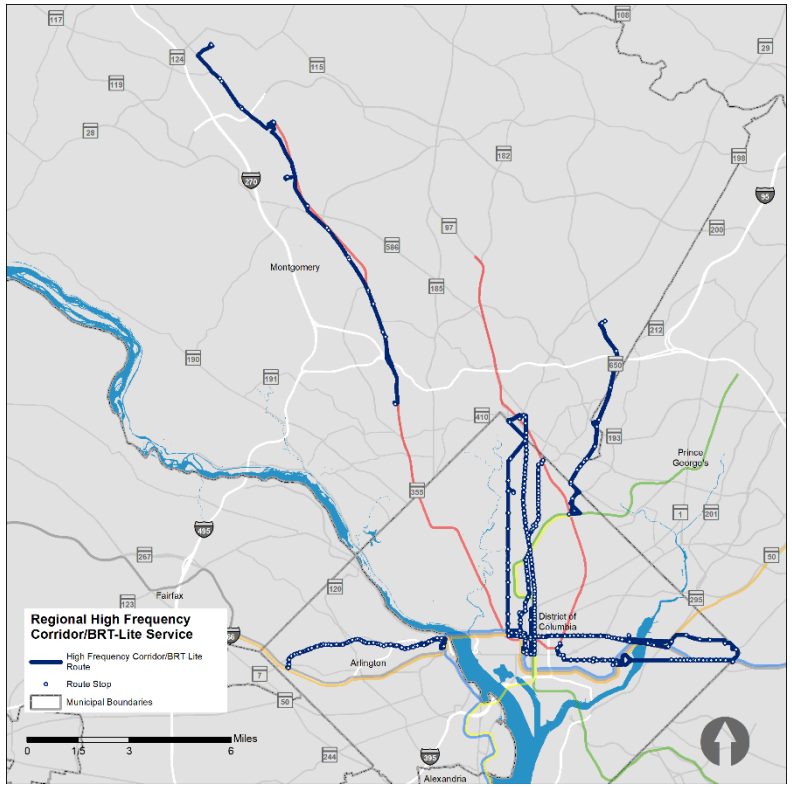
Corridor Service Area

Bus Rapid Transit (BRT)



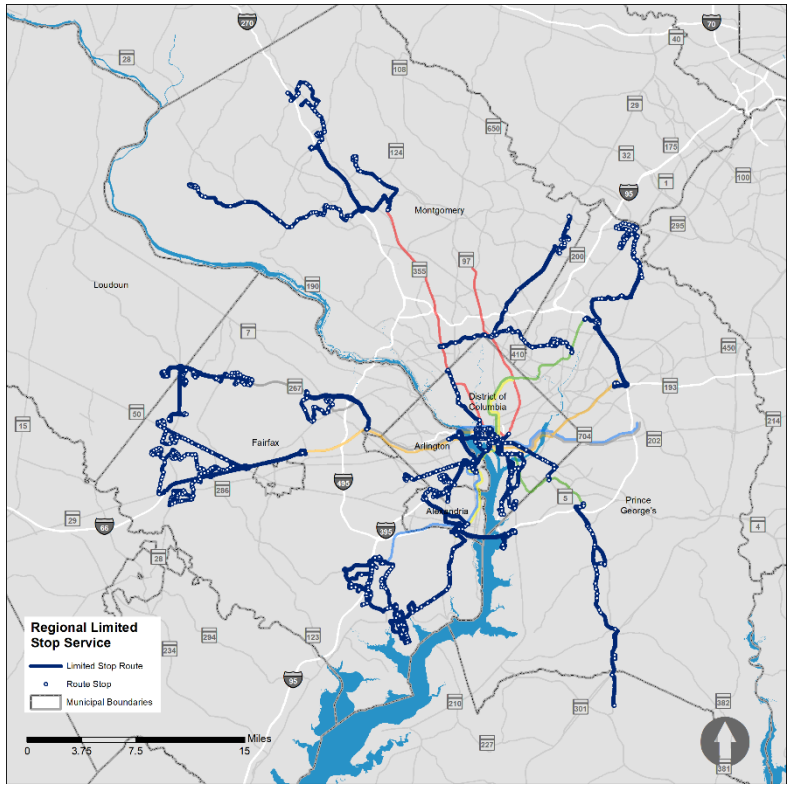
- **1 BRT Route**
- Operated By Metrobus between Arlington and Alexandria

High Frequency Corridor/BRT-Lite



- **10 High Frequency Corridor Route**
- Predominantly operated by Metrobus

Limited Stop

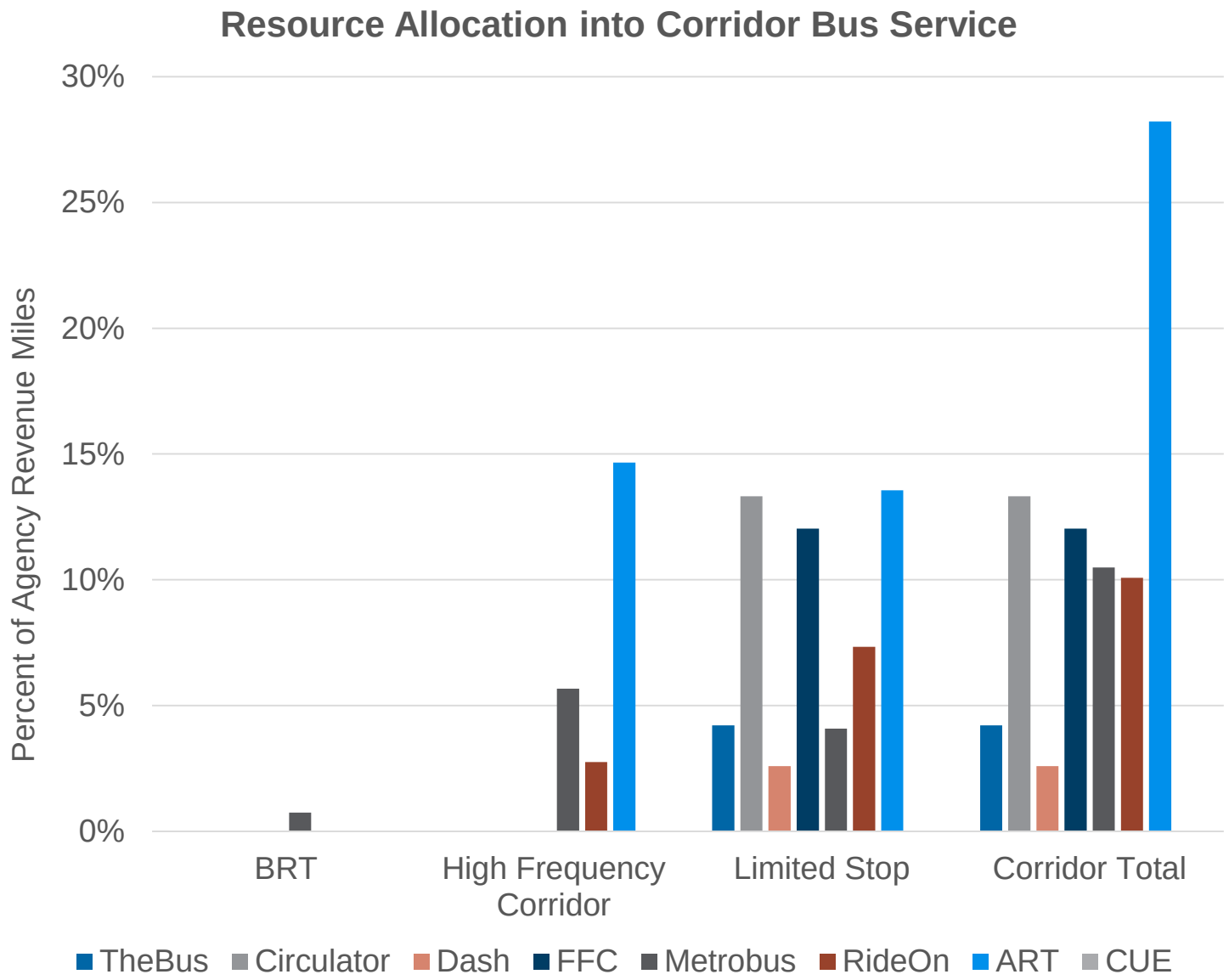


- **51 Limited Stop Routes**
- Operated in in dense areas as limited stop overlays and in suburban areas as a all day connection to Metrorail stations

Corridor Service Summary

Half of the agencies within the region commit 10 to 15 percent of their revenue miles to corridor services. Dash and TheBus offer fewer corridor services, but Metrobus provides corridor routes in those service areas.

ART is unique in how many revenue miles are assigned to corridor routes.



Commuter Service Example

Fairfax Connector 632 - Bus-to-Rail Commuter
Closed door bus service that complements Metrorail by collecting passengers far outside the rail service area and bringing them to the end of the Metrorail line.

Service Hours

Day	Span	Hours
Weekday	5:16 AM - 8:03 PM	8.7
Saturday	---	-
Sunday	---	-

Alignment

Avg. Length	13.1 mi
Avg. Stop per Mile	1.0
Largest Stop Space	7.9 mi
Avg. Shape Directness	1.5

Frequency

	Weekday							
	Early	AM Peak	Midday	PM Peak	Evening	Late Night	Saturday	Sunday
Headway	45	35	-	30	125	-	-	-
Trips	2	11	0	14	1	0	0	0

Ride On 70 - Express
Closed door bus service that brings passengers directly to an activity center.

Service Hours

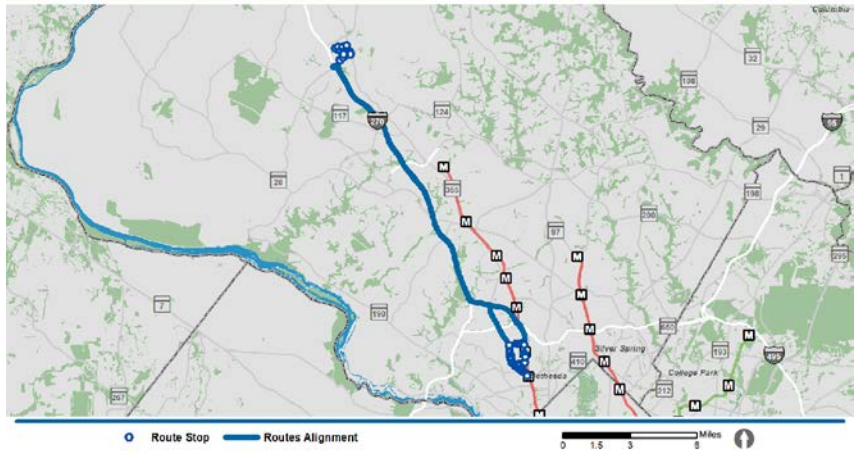
Day	Span	Hours
Weekday	4:45 AM - 8:33 PM	11.5
Saturday	---	-
Sunday	---	-

Alignment

Avg. Length	19.4 mi
Avg. Stop per Mile	1.0
Largest Stop Space	15.3 mi
Avg. Shape Directness	1.1

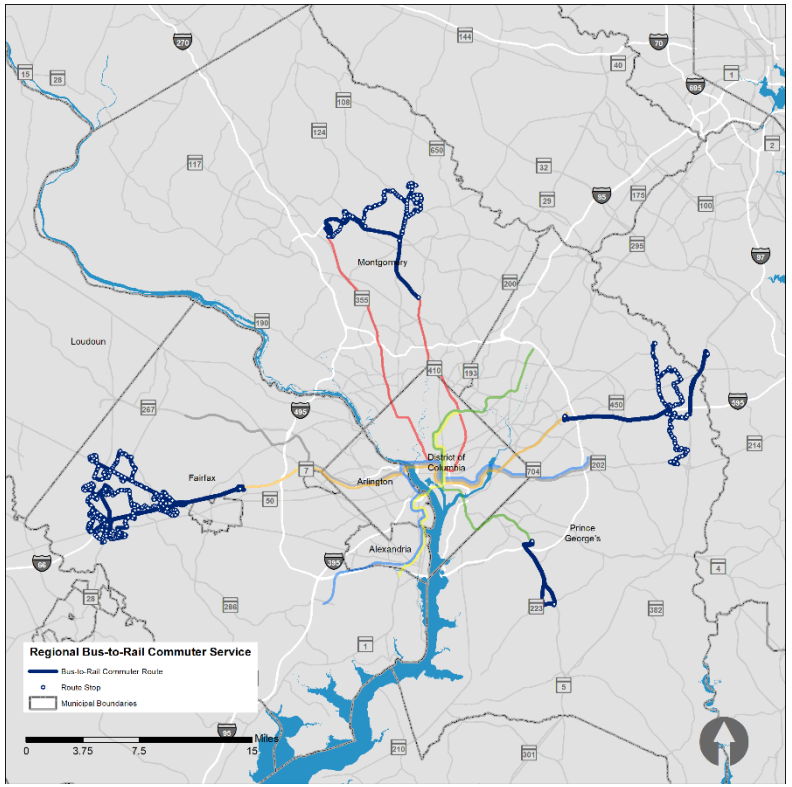
Frequency

	Weekday							
	Early	AM Peak	Midday	PM Peak	Evening	Late Night	Saturday	Sunday
Headway	25	15	50	20	60	-	-	-
Trips	6	22	4	27	3	0	0	0



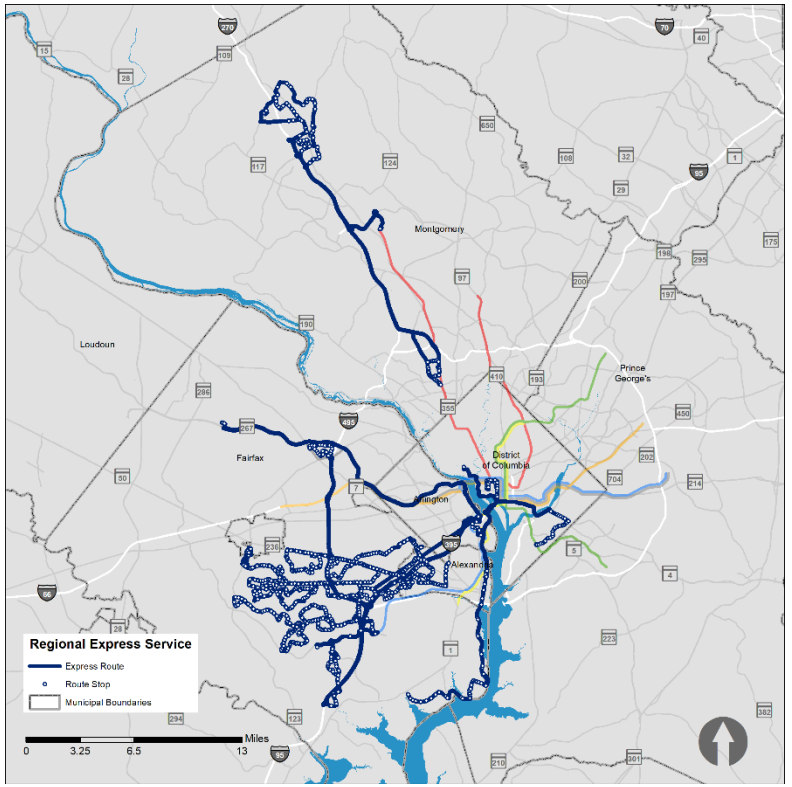
Commuter Service Area

Bus-to-Rail Commuter



- **18 Bus-to-Rail Commuter Routes**
- Operate in the far extent of Montgomery, Prince George's, and Fairfax Counties

Express



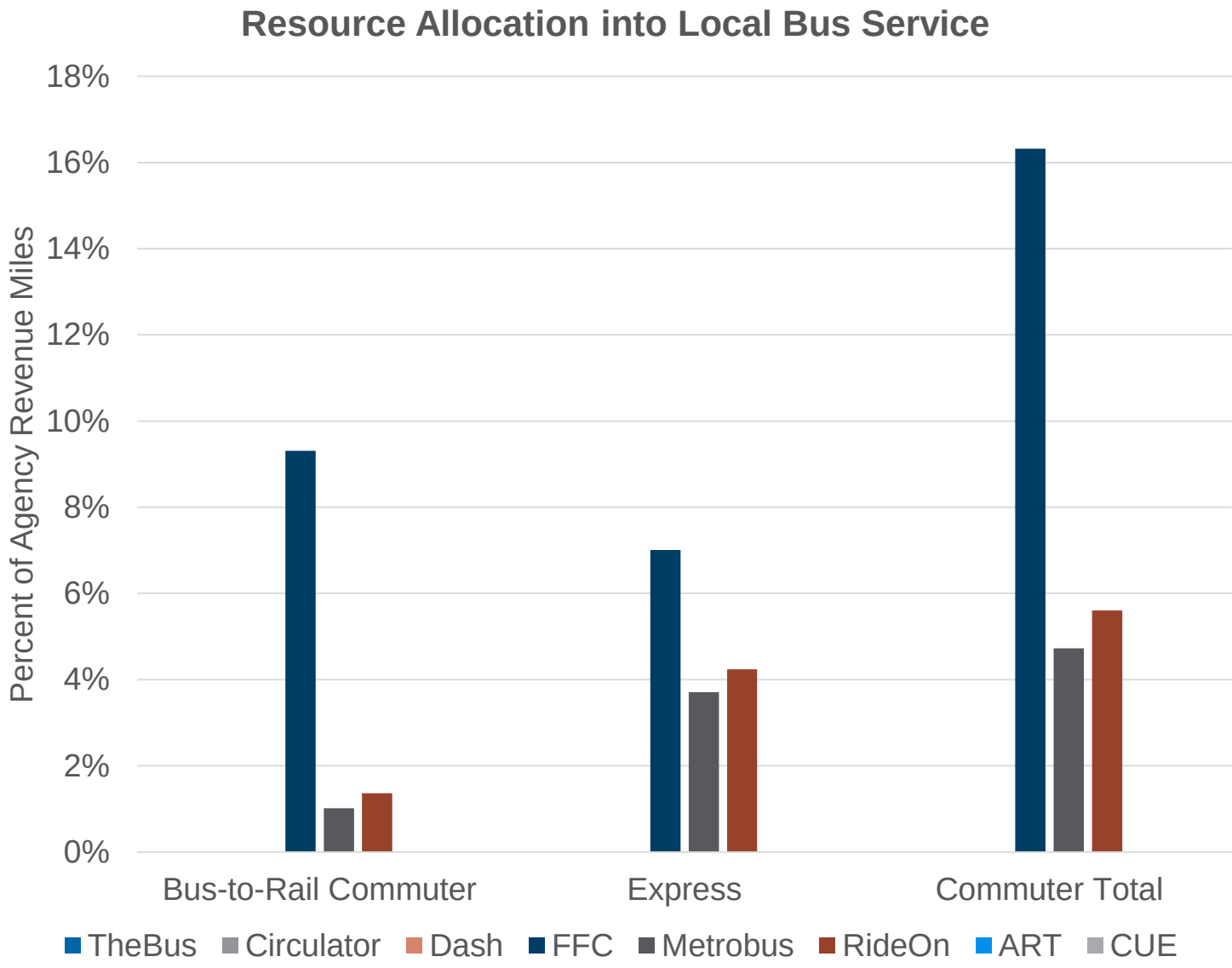
- **33 Express Routes**
- Mainly operate in Northern Virginia

Note: Loudoun County did not have a GTFS feed for use in this classification.

Commuter Service Summary

Only four agencies in the WMATA compact operate commuter services (Loudoun not shown). WMATA and Ride On allocate similar amounts of resources to commuter services. Fairfax Connector, which provides service farther from the D.C. than other agencies, relies more heavily on Commuter services.

Additionally, Fairfax Connector is unique in how many resources it allocates to Bus-to-Rail Commuter services.



Special Service Example

Metrobus 5A - Airport Shuttle
Long distance bus service connecting to regional Airports

Metrobus 23A - Late Night Gap
Bus service that operates only during the night to fulfill a special need or cover the closure of Metrorail

Metrobus C27- Weekend Gap
Bus service that operates only during the weekend to fulfill a special need or cover the closure of Metrorail

Service Hours

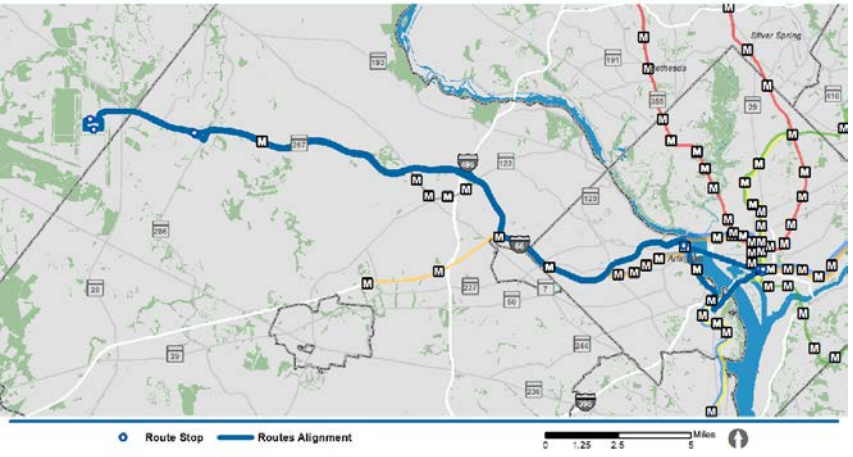
Day	Span	Hours
Weekday	4:50 AM - 12:17 AM	19.7
Saturday	5:30 AM - 12:18 AM	18.8
Sunday	5:30 AM - 12:10 AM	18.7

Alignment

Avg. Length	29.2 mi
Avg. Stop per Mile	0.2
Largest Stop Space	17.2 mi
Avg. Shape Directness	1.2

Frequency

	Weekday							
	Early	AM Peak	Midday	PM Peak	Evening	Late Night	Saturday	Sunday
Headway	45	35	40	30	45	190	60	60
Trips	3	11	19	15	11	1	20	20



Service Hours

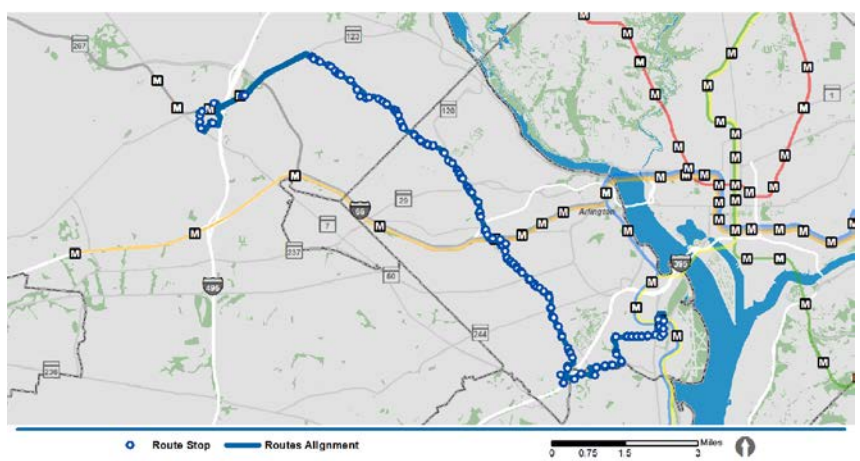
Day	Span	Hours
Weekday	9:06 PM - 1:21 AM	5.2
Saturday	5:45 AM - 1:01 AM	19.3
Sunday	5:45 AM - 12:57 AM	19.2

Alignment

Avg. Length	17.8 mi
Avg. Stop per Mile	4.3
Largest Stop Space	1.6 mi
Avg. Shape Directness	1.8

Frequency

	Weekday							
	Early	AM Peak	Midday	PM Peak	Evening	Late Night	Saturday	Sunday
Headway	-	-	-	-	40	40	-	-
Trips	0	0	0	0	6	2	0	0



Service Hours

Day	Span	Hours
Weekday	---	-
Saturday	8:05 AM - 10:03 PM	10.4
Sunday	8:05 AM - 10:03 PM	10.4

Alignment

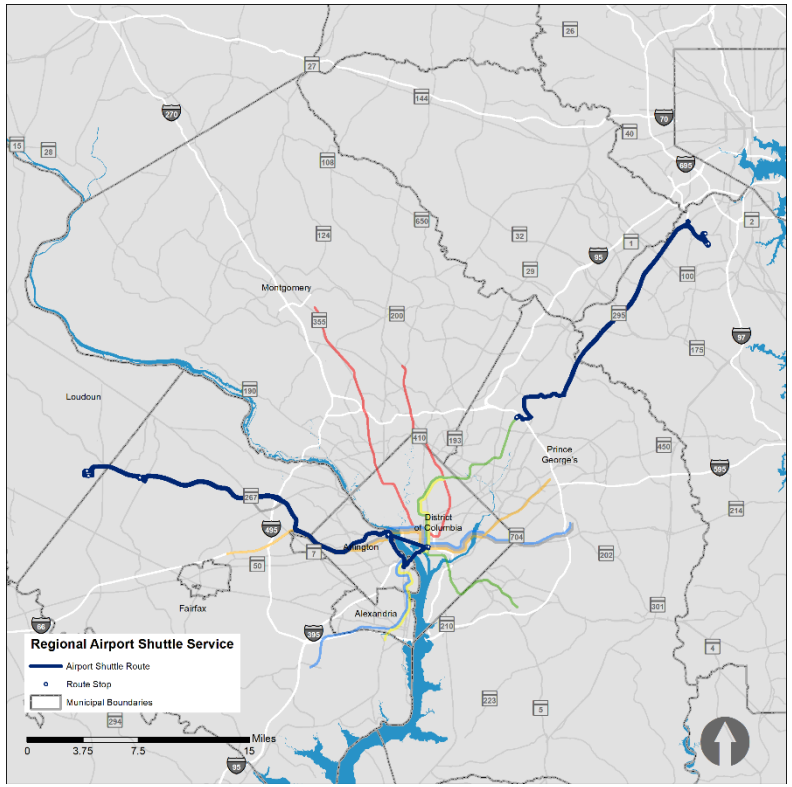
Avg. Length	14.3 mi
Avg. Stop per Mile	2.9
Largest Stop Space	1.2 mi
Avg. Shape Directness	1.6

Frequency

	Weekday							
	Early	AM Peak	Midday	PM Peak	Evening	Late Night	Saturday	Sunday
Headway	-	-	-	-	-	-	110	110
Trips	0	0	0	0	0	0	7	7

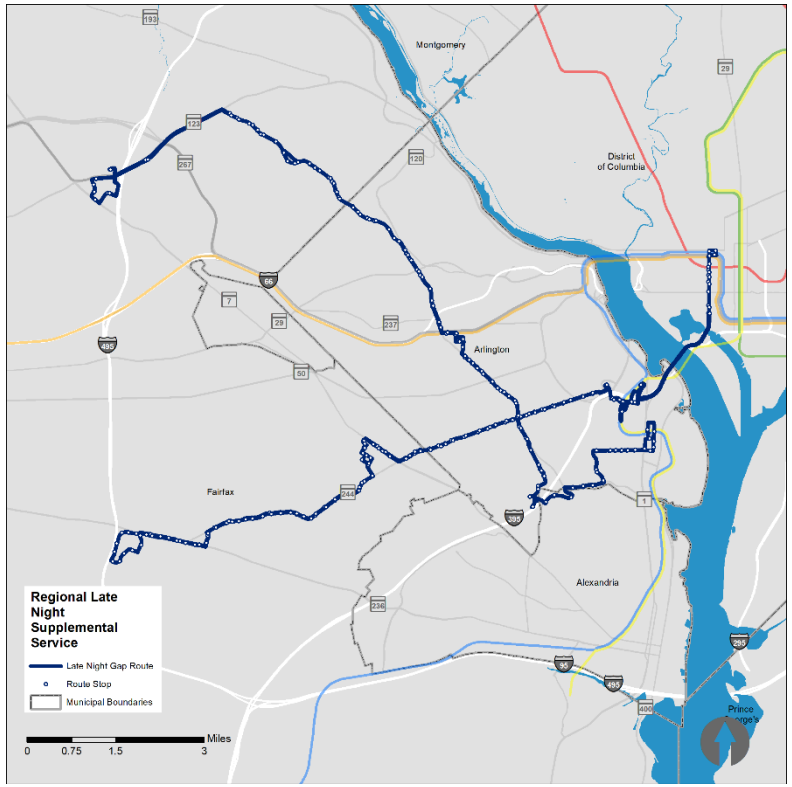
Special Service Area

Airport Shuttle



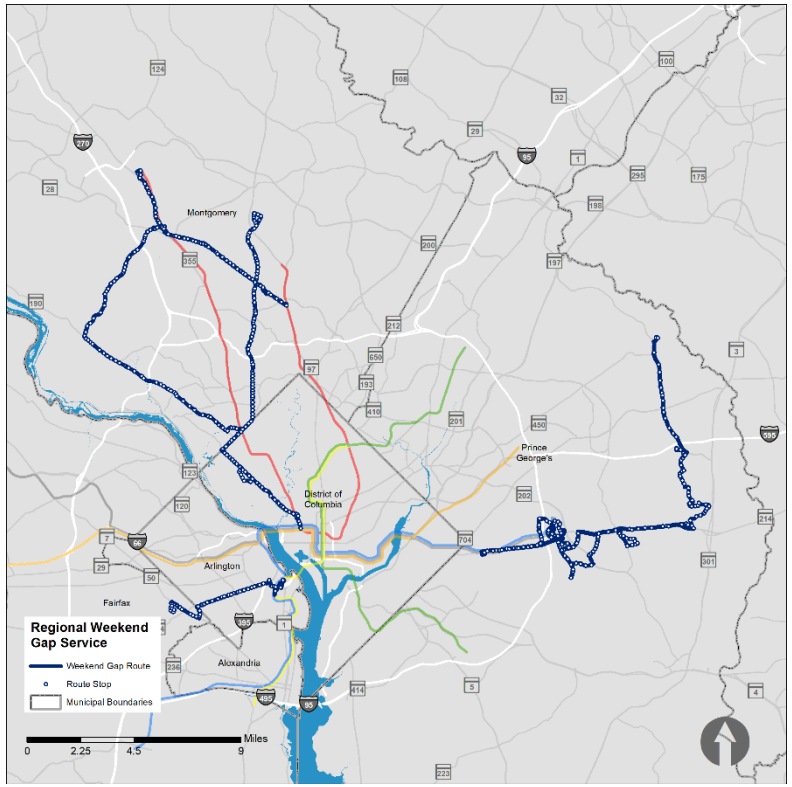
- 2 Airport Routes

Late Night Gap



- 2 Late Night Gap Routes

Weekend Gap

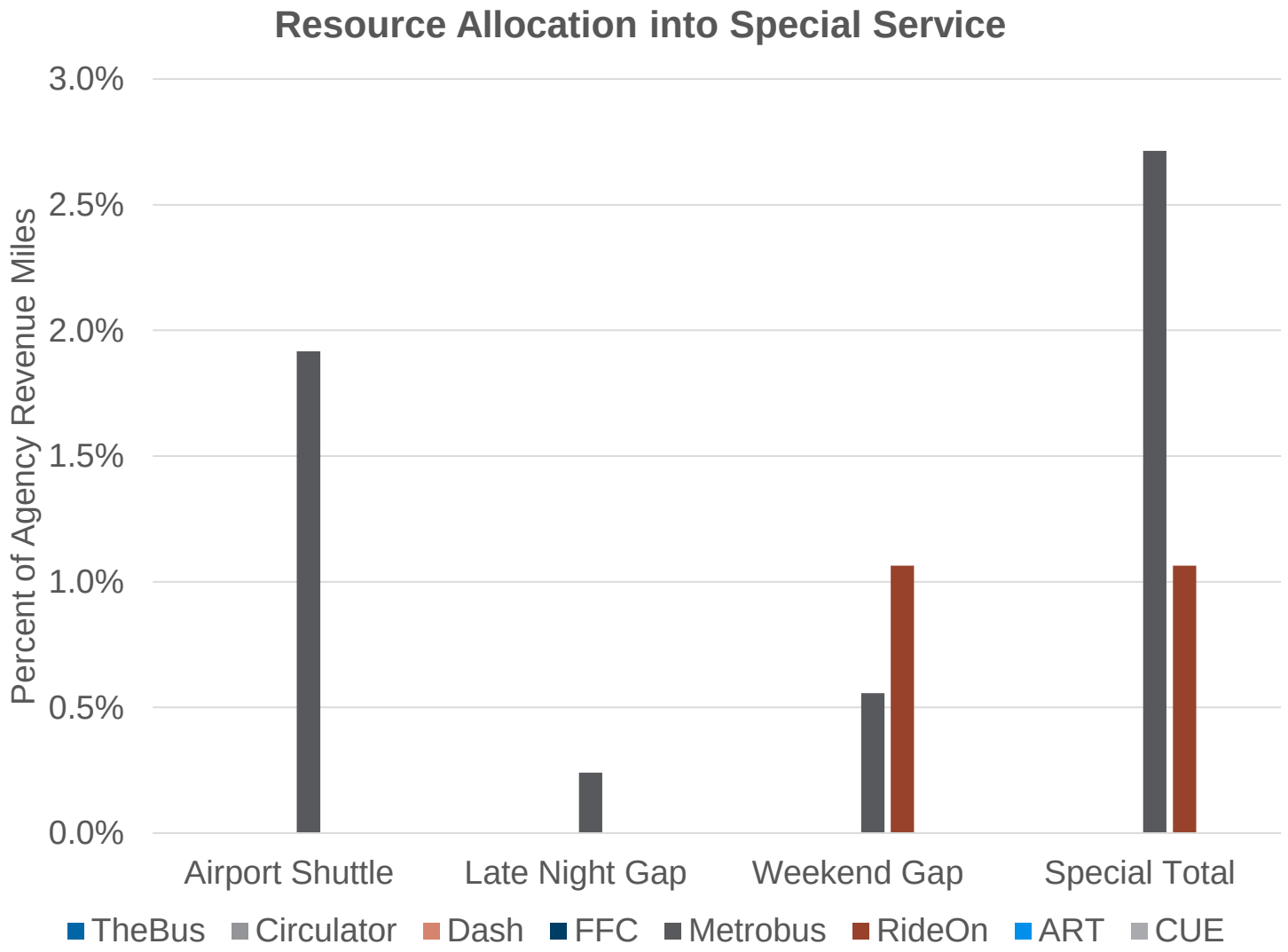


- 8 Weekend Gap Routes

Special Service Summary

Special Services are operated by Metrobus or are related to Metrobus Operations.

Ride On’s weekend gap route is operated by Metrobus on weekdays.



2. Regional Coordination

Executive Summary: Regional Coordination

The region includes two states, the District of Columbia, and multiple counties and cities.

In 1967, the Compact created the Washington Area Metropolitan Transit Authority (WMATA) as an "instrumentality and agency" of each of the signatory parties: District of Columbia, Maryland, Virginia.

All existing bus routes in the region are divided into Regional and Non-regional routes.

- WMATA has overall responsibilities for the regional routes, including: Governance, Planning, Fare policy, Operation
- Each jurisdiction is responsible for its non-regional routes and decide the service delivery method of non-regional routes: in-house operation, WMATA operated, or third-party contractor operated

Subjectivity of regional and non-regional definitions introduces uncertainty in decision-making authority and planning scope between WMATA and the jurisdictions.

Existing funding allocation process is not fully aligned with the goal to promote regional interests.

Lack of clarity in planning scope and responsibilities undermines WMATA's ability to be effective in its Compact-defined role of regional bus planner.

REGIONAL COORDINATION

Responsibilities

Bus Funding

Regional v. Non-Regional Bus Routes

Regional Governance and Coordination

Key Terms

Governance: Authority for decision making related to funding, policy, and general operations

Planning: Decision making related to the location, frequency, span of service, facilities, etc.

Coordination: Planning and decision making conducted in concert with among different agencies and jurisdictions

REGIONAL COORDINATION

Responsibilities

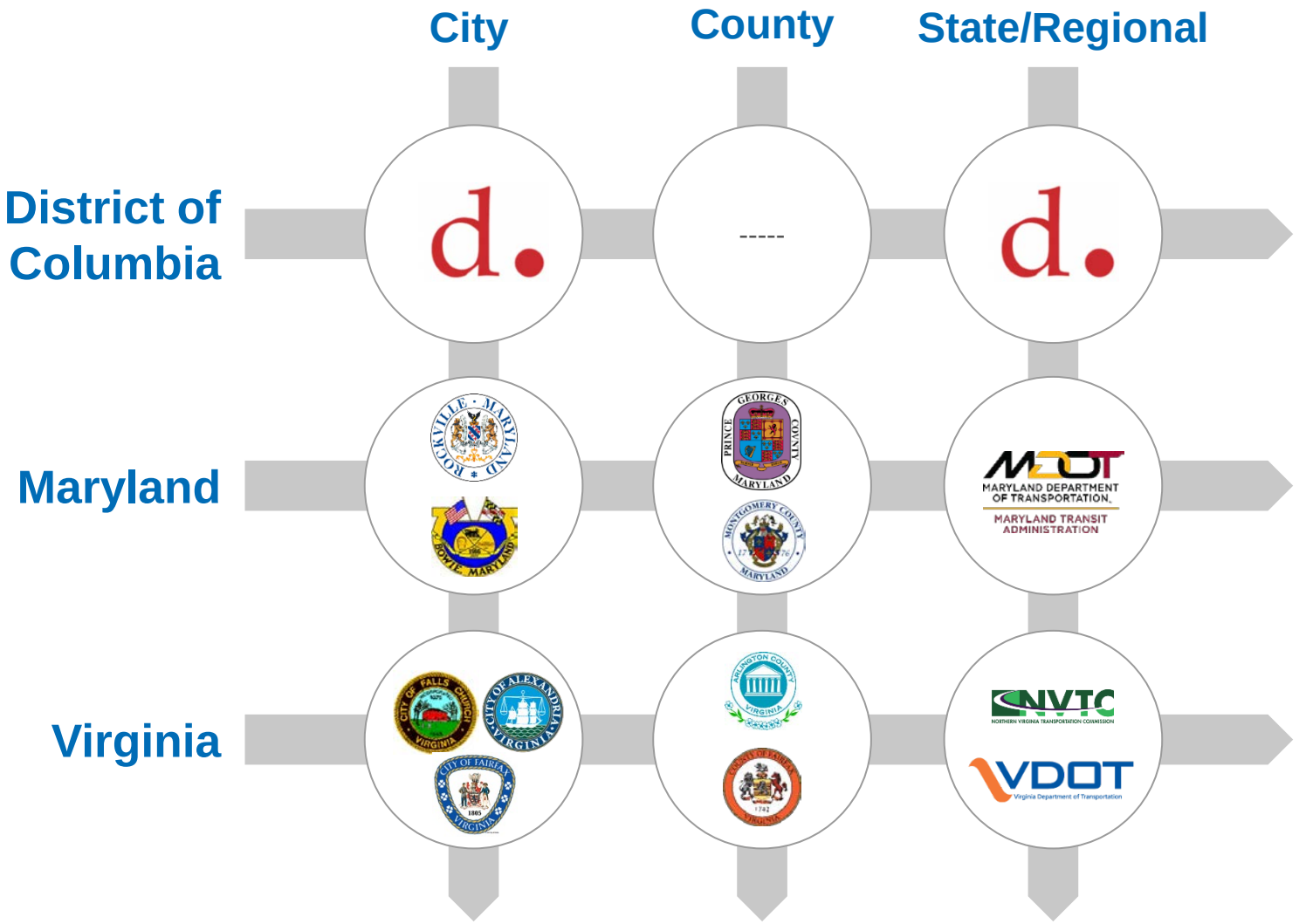
Bus Funding

Regional v. Non-Regional Bus Routes

Regional Governance and Coordination

Complex set of stakeholders driving decisions about mobility and transit

Sample list – not exhaustive



The Region – Washington Metropolitan Area

The region includes two states, the District of Columbia, and multiple counties and cities

- **District of Columbia**
- **State of Maryland**
  - Montgomery County
  - Prince George's County
- **Commonwealth of Virginia**
  - City of Alexandria
  - Arlington County
  - Fairfax County
  - City of Fairfax
  - City of Falls Church
  - Loudoun County

State-level Transportation Organization

At the state level, several agencies are charged with policy making, planning, construction, and operations for surface transportation

- **District of Columbia Department of Transportation (DDOT)**

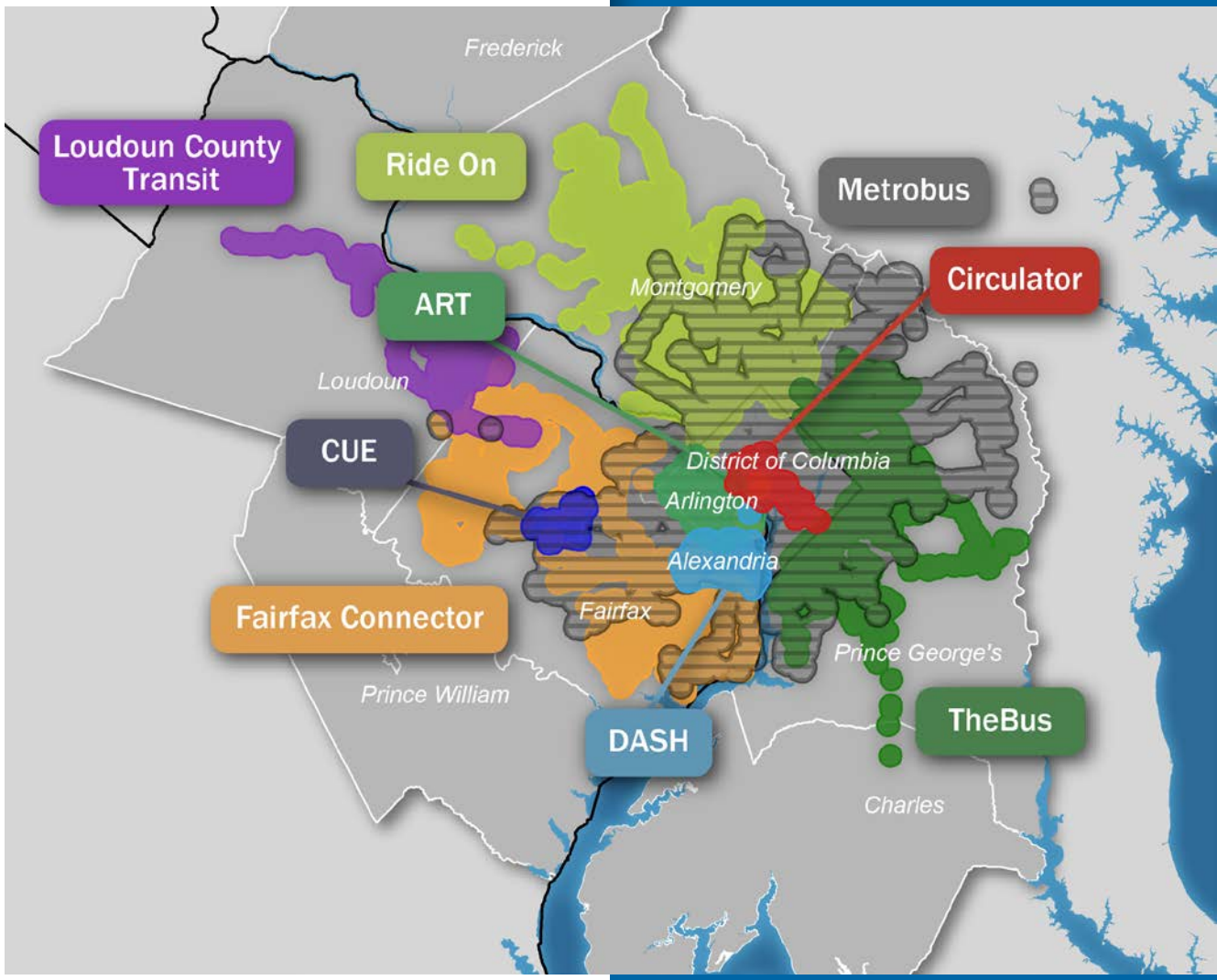
- **Maryland Department of Transportation (MDOT)**
  - State Highway Administration (SHA)
  - Maryland Transit Administration (MTA)
  - Maryland Transportation Authority (MDTA)

- **Commonwealth of Virginia**
  - Office of Intermodal Planning and Investment (OIPI)
  - Virginia Department of Transportation (VDOT)
  - Department of Rail and Public Transportation (DRPT)

Bus Operators in the Region

A number of transit operators provide local bus service in the Region

- **WMATA Metrobus**
- **DC Circulator**
- **Ride On**
- **TheBus**
- **Arlington Transit (ART)**
- **CUE Bus**
- **DASH**
- **Fairfax Connector**
- **Loudoun County Transit**



WMATA Compact

1967 Compact created the Washington Area Metropolitan Transit Authority (WMATA) as an “instrumentality and agency” of each of the signatory parties: District of Columbia, Maryland, Virginia

Defines the organization, responsibilities, and authority of WMATA:

- Broad independent authority to **own and operate public transit facilities and services**
  - Sue and be sued
  - Enter into and perform contracts
  - Construct, acquire, condemn, own, operate, sell real property
- **Develop and adopt a Mass Transit Plan** - substantial changes to bus network and service would fall under developing a Mass Transit Plan
- **Coordinate operation of transit** into a unified system without unnecessary duplicating service

WMATA Coordination Roles

- Services defined as ‘Regional’ are coordinated by WMATA.
- WMATA has completed a number of relevant recent initiatives:
  - Regional Bus Study Action Agenda
  - Priority Corridor Network as implemented by Corridor Development Studies
- Local and inter-jurisdictional coordination of the Service Evaluation Studies all of which are implemented in Annual and SOGO work plans
- The JCC (Jurisdiction Coordinating Committee) is designed to advise the General Manager and respective Board members on issues and decisions including capital programs, transit service and operations, and budget development. It holds monthly and quarterly meetings with local providers and provides for engagement and coordination.
- Other examples of coordination include MATOC for collective responses to weather and other emergencies.

Regional Transportation Planning and Coordination

Agencies and coordination structures within the region

	Regional Entity	Representation	Roles & Responsibilities
Region-wide	National Capital Region Transportation Planning Board (TPB)	DC and multiple jurisdictions in MD & VA	Coordinates future plans, provides data and analysis to decision makers, and coordinates regional programs to advance safety, land-use coordination, and more.
	Joint Coordinating Committee (JCC)	DC, MD, VA, and Federal Government	Forum for sharing views and information on key issues coming before the WMATA Board; improve the quality of information for Board decisions
Virginia	Northern Virginia Transportation Commission (NVTC)	Arlington, Fairfax, Loudoun, Alexandria, Falls Church, City of Fairfax	• Represents the interests of the Commonwealth during the establishment of WMATA. • Charged with the funding and stewardship of WMATA and VRE • Coordinates transit service in Northern Virginia.
	Northern Virginia Transportation Authority (NVTA)	Above + Prince William County, Manassas, and Manassas Park	Responsible for long range transportation project planning, prioritization and funding for regional transportation projects in Northern Virginia
Maryland	Washington Suburban Transportation Commission (WSTC)	Montgomery County Prince George's County	Has powers to plan, develop, and oversee a transportation system, including transit, for Montgomery County and Prince George's County It coordinates transit programs with the two counties, WMATA, and Maryland DOT

WMATA Compact

Purpose

"The purpose of this Title is to create a regional instrumentality, as a common agency of each signatory party, empowered, in the manner hereinafter set forth,

- *to plan, develop, finance and cause to be operated improved transit facilities, in coordination with transportation and general development planning for the Zone, as part of a balanced regional system of transportation, utilizing to their best advantage the various modes of transportation,*
- *to coordinate the operation of the public and privately owned or controlled transit facilities, to the fullest extent practicable, into a unified regional transit system without unnecessary duplicating service, and*
- *to serve such other regional purposes and to perform such other regional functions as the Signatories may authorize by appropriate legislation."*

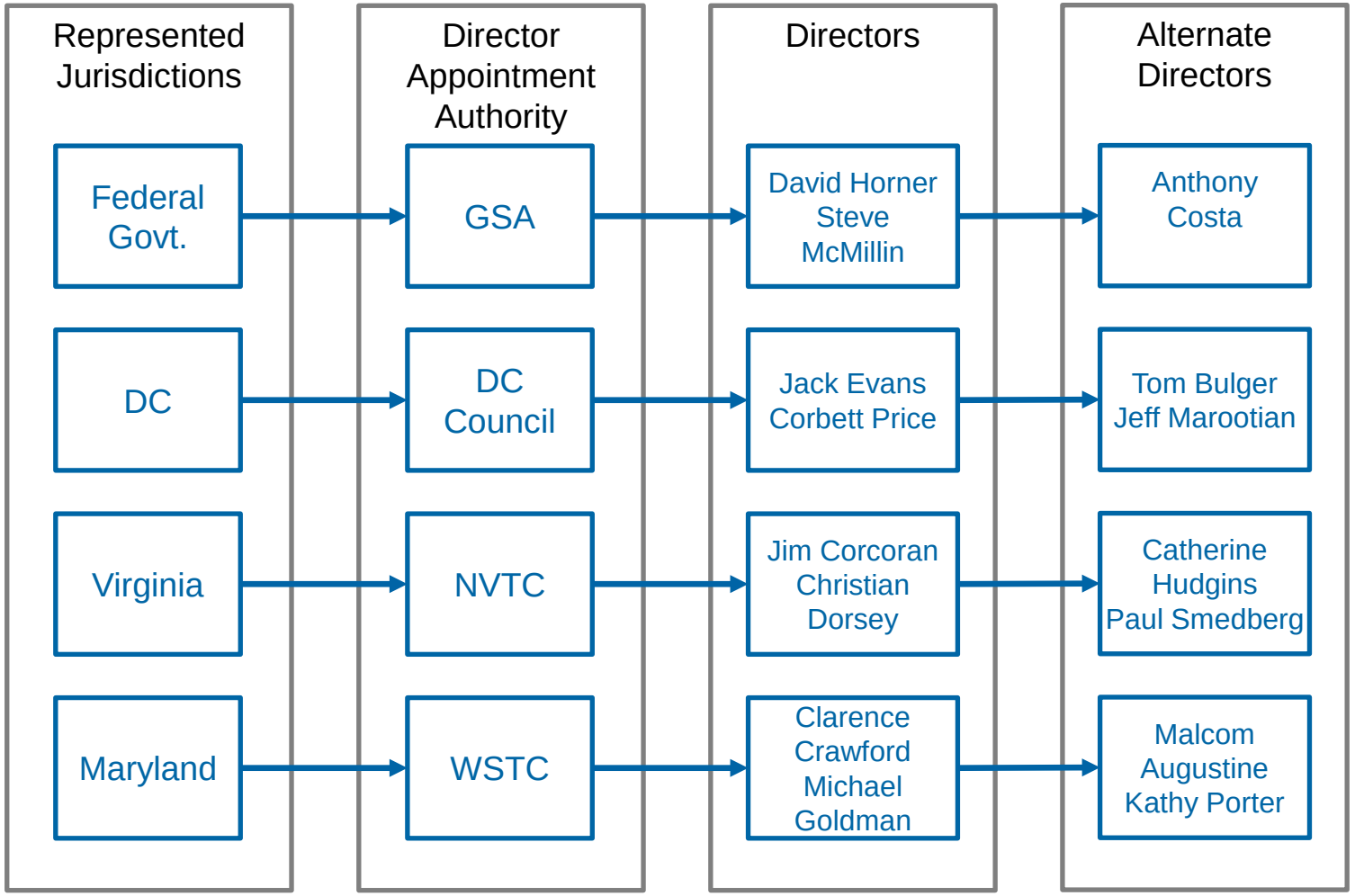
WMATA Board and Organization

The WMATA Board of Directors is comprised of eight people representing four jurisdictions

Board decisions that affect bus:

- Labor agreements
- Budget
- Allocation of overhead costs
- Vehicle procurements
- Fare and service changes
- Facility plans (e.g., siting bus garages)

WMATA Governance



REGIONAL COORDINATION

Responsibilities

Bus Funding

Regional v. Non-Regional Bus Routes

Regional Governance and Coordination

Sources of Funding for Bus

- **Federal funding, mostly used for bus capital projects**
- **State and local funding, used for both capital and operating**
  - District of Columbia, Maryland, and Virginia use different combinations of state and local funding and adopt different funding mechanisms for Metrobus
  - Local jurisdictions directly fund their own bus operations, and states provide funding to the jurisdiction transit operators

Bus Funding, District of Columbia

Overview

District of Columbia WMATA funding comes through the annual budget process, where specific funds are designated for transfer to WMATA.

DDOT directly funds DC Circulator through DC Circulator Fund, a non-lapsing special-purpose fund established to deposit dedicated revenue to Circulator, and with general revenue through annual budget process.

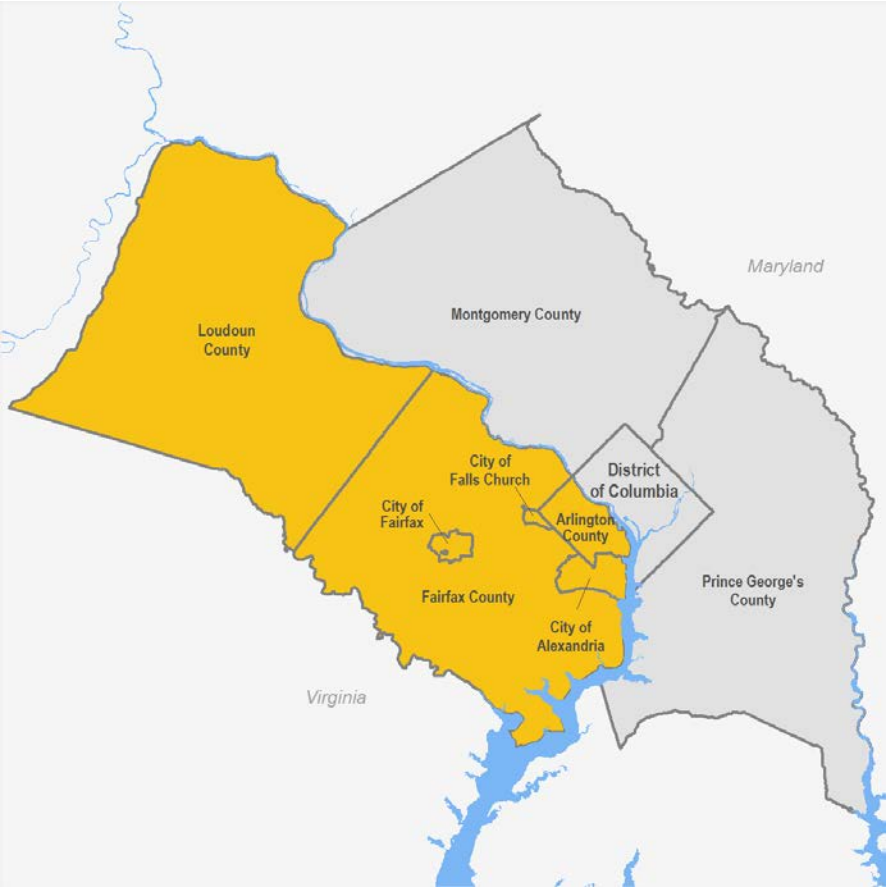
Funding Profile

Dedicated and general funds to DC Circulator and general funds to WMATA for

- Regional Bus*
- Non-Regional Bus* (includes a payment for student bus and rail passes)

*See definitions below under the heading “Regional v. Non-Regional Bus Routes”

Bus Funding, Virginia

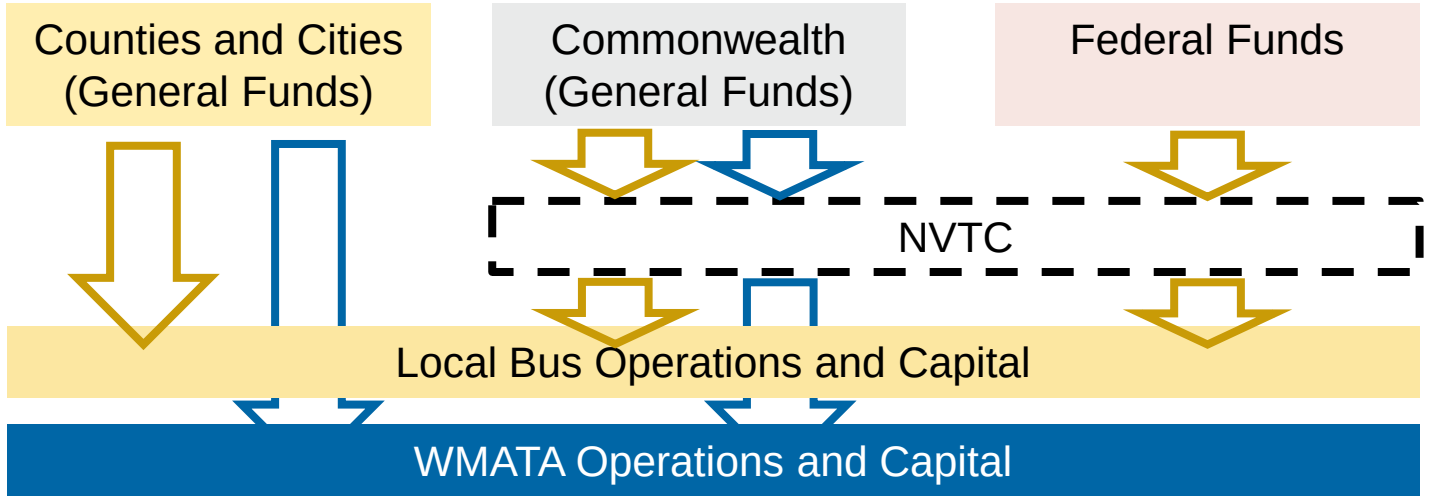


Overview

State funds WMATA through general fund block grants to NVTC, which then assigns funds to WMATA. Local jurisdictions also pay WMATA directly and pay directly for their own local systems.

Funding Profile

- State block grants to NVTC for use on operations or capital
- State dedicated funding
- Jurisdiction direct funding to WMATA via regional formula



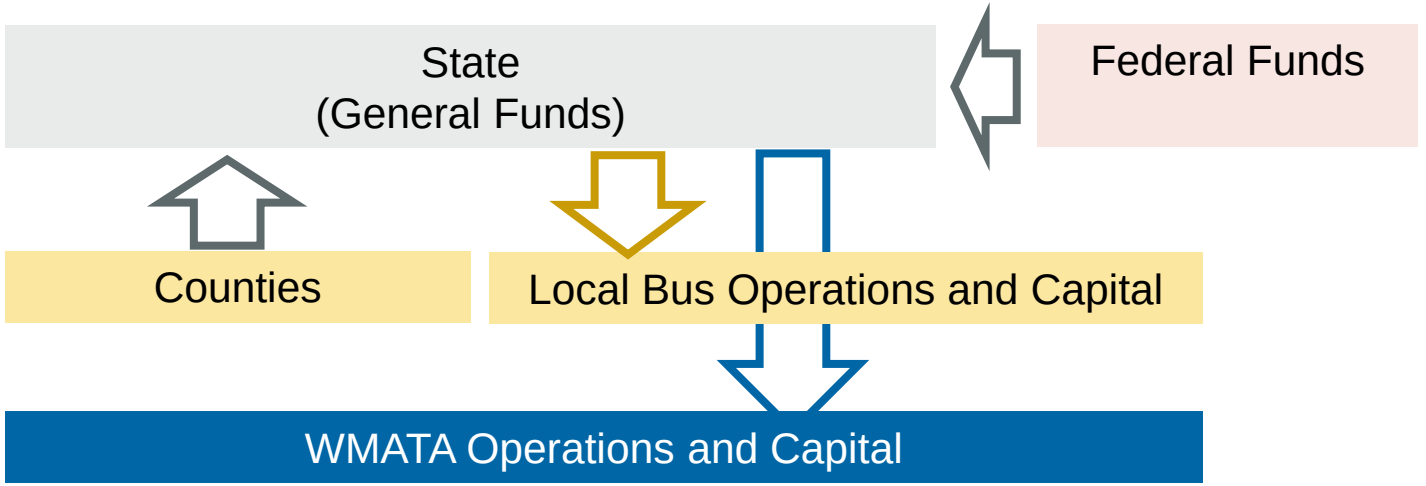
Bus Funding, Maryland

Overview

State plays a more central role in budgeting for bus and directing funds to the transit operators—WMATA, Ride On, and TheBus.

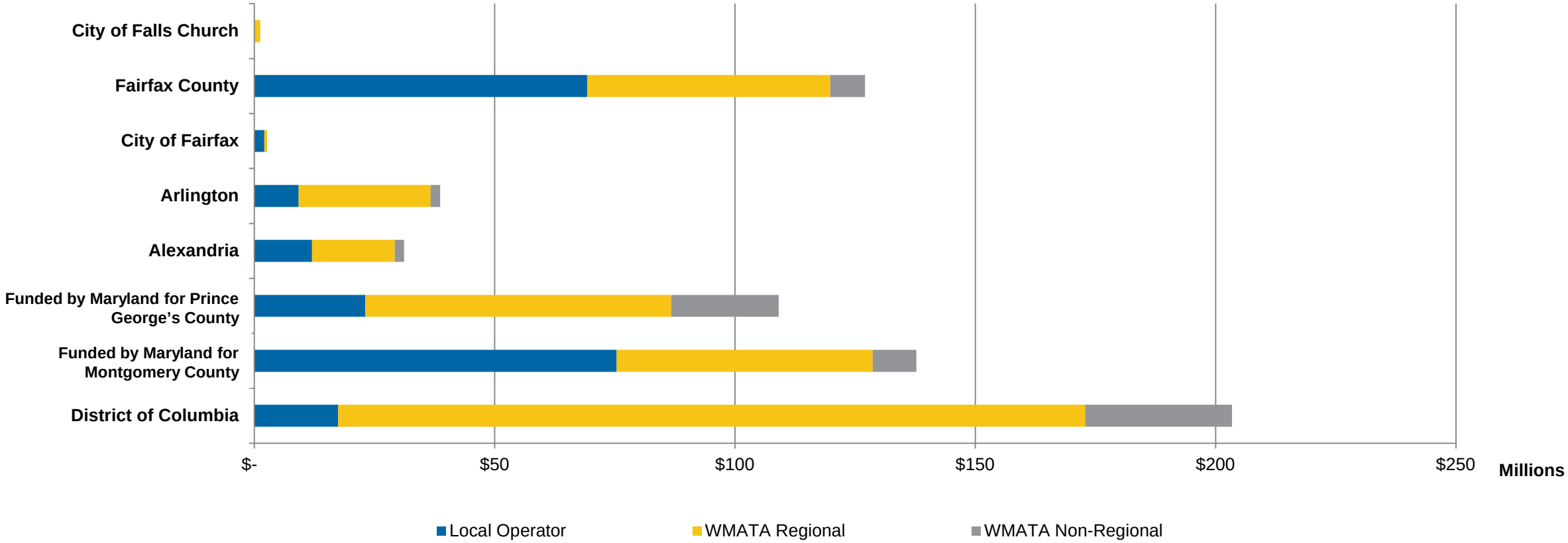
Funding Profile

State works with counties to determine funding levels, then allocates state general funds for transit.



Bus Operating Funding Contribution by Jurisdiction

Bus Operating Subsidy – Contribution by Jurisdiction (FY2016)



*Metrobus funding for Maryland counties is provided by the State

Source: FY2016 National Transit Database

REGIONAL COORDINATION

Responsibilities

Bus Funding

Regional v. Non-Regional Bus Routes

Regional Governance and Coordination

WMATA – Milestones for Defining Bus

WMATA Compact

- Broad delegation to operate public transit facilities and services (2)
- Coordinate operation of transit facilities into a unified system without unnecessary duplicating service (2)
- Serve other regional purposes/functions as Signatories authorize (2)
- Substantial changes to bus network and service would fall under developing a Mass Transit Plan (13)

Blue Ribbon Mobility Panel (1997)

- Stabilized regional bus network
- Developed integrated regional bus network operated by WMATA
- Developed regional/non-regional construct and subsequent Board (1998) policies revised subsidy allocation formula
- Recommendations implemented over five years

Regional Bus Study (2003)

- Addressed short and long-term requirements for Metrobus and locally operated bus service
- Recommended developing a family of bus services including MetroExtra, rationalized bus service and network, improved transfer facilities and expanded service to new corridors and markets
- Identified bus priority for heavy ridership corridors is vital to success of high performance services
- Identified improvements needed to meet Board's goal to double ridership between 2000-2025

Priority Corridor Network (2011)

- Recommended improvements on 24 corridors, which carry 50% of riders
- Recommendations included traffic operations and management, customer information, on-street treatments, service improvements

Regional and Non-Regional Bus Routes

- **All existing bus routes* in the region are divided into**
  - Regional routes
  - Non-regional routes
- **WMATA has overall responsibilities for the regional routes, including**
  - Governance
  - Planning
  - Fare policy
  - Operation
- **Each jurisdiction is responsible for its non-regional routes**
  - Jurisdictions decide the service delivery method of non-regional routes: in-house operation, WMATA operated, or third-party contractor operated
  - Service changes are coordinated through WMATA processes

* WMATA Lines of service were designated as R or NR for planning and allocation purposes. This is not a purpose designation and represented a zero-sum allocation intended to match available funding contributions.

WMATA Adopted Definitions of Regional and Non-Regional Bus Routes

- Blue Ribbon Mobility Panel, 1997

Existing Definitions of Regional & Non-Regional Routes

Regional Routes			Non-Regional Routes
Interjurisdictional Connection (at least ½ mile in each jurisdiction)	**OR**	• Serves at least 1 COG Regional Activity Center • Travels significant distance/regional artery • Achieves cost efficiency	Any routes that do not meet the criteria of a regional route

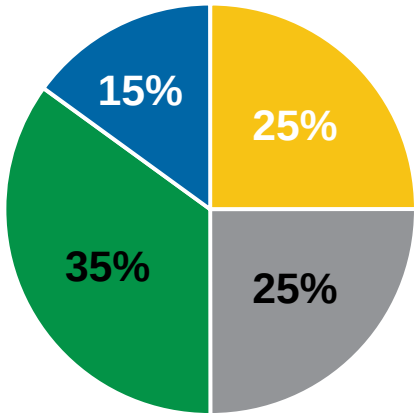
Metrobus jurisdictional subsidy allocation formula depends on regional v. non-regional route definition and designation

Metrobus jurisdictional subsidy allocation

Regional

Direct Regional Operating Costs* AND *All Bus Overhead & Bus Capital Costs less Regional Operating Revenue
divided among jurisdictions**:**

Avg. Weekday Ridership by Jurisdiction



Jurisdiction Population

Regional Service Miles by Jurisdiction

Regional Service Hours by Jurisdiction

Non-Regional

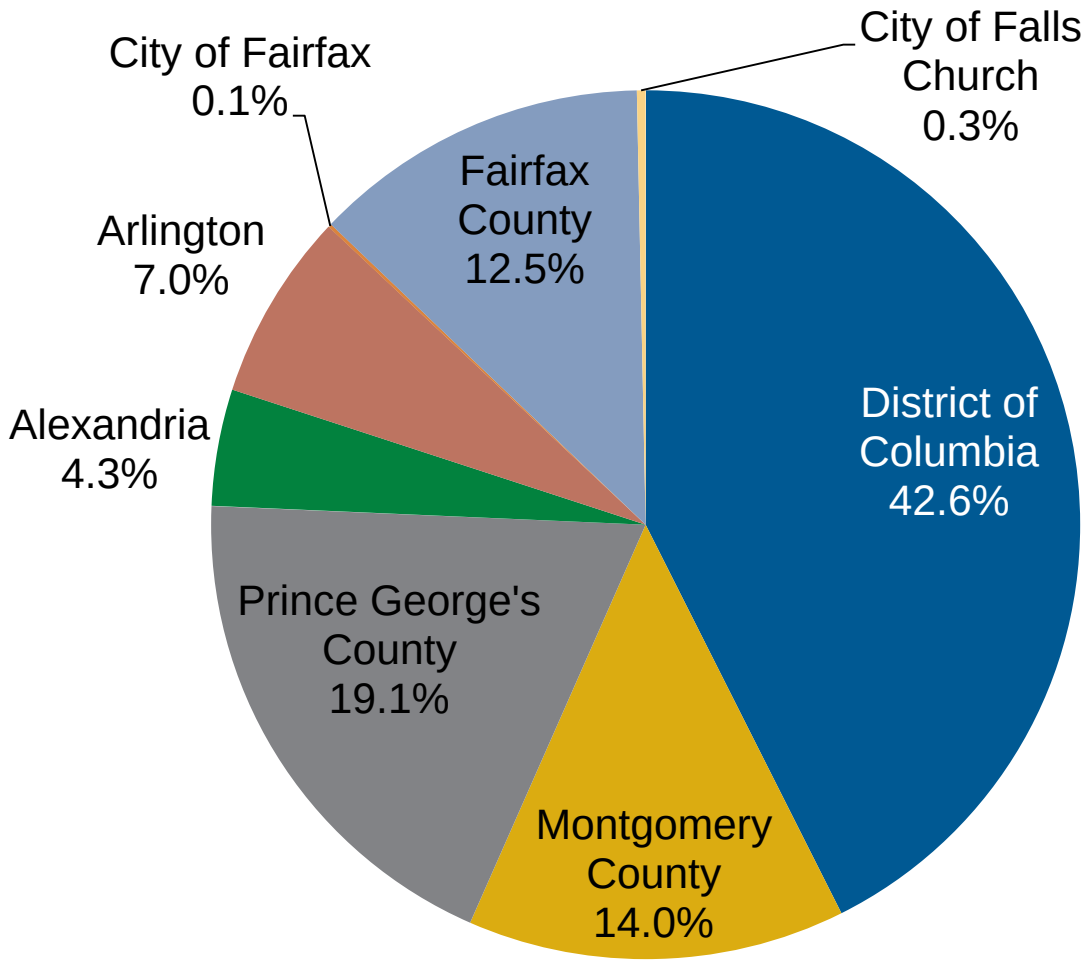
***Direct Non-Regional Operating Costs* in Each Jurisdiction**
(share of *Total Direct Non-Regional Operating Costs* allocated to jurisdictions based on their *Non-Regional Platform Hours*)

Minus

***Non-Regional Operating Revenue* in Each Jurisdiction**

By design, jurisdictions' non-regional subsidy does not include a share of bus overhead & bus capital costs

Metrobus Operating Subsidy by Jurisdiction



Source: WMATA FY2018 Budget

Bus Capital Subsidy Allocation

Capital Project Type	State and Local Subsidy Allocation Method
Bus capital projects and debt issued for bus projects	Apply bus operating allocation formula
General financing expenditures and for project expenditures that cannot be allocated to rail, bus, or paratransit	Apply an average of rail and bus allocation formulas

Source: Capital Funding Agreement FY2011-2016

Analysis of Metrobus capital subsidy allocation is pending data from WMATA

REGIONAL COORDINATION

Responsibilities

Bus Funding

Regional v. Non-Regional Bus Routes

Regional Governance and Coordination

Scope for planning and decision-making

- **Changes in designation of regional v. non-regional routes affect:**
  - Decision-making
  - Planning responsibilities
  - Subsidy allocation

- Over time, **some regional and non-regional routes have been re-designated**, partially to meet jurisdictional financial burden objectives

- Where re-designation deviates from set definitions, **responsibilities and decision-making authority become unclear**

Subjectivity of regional and non-regional definitions introduces uncertainty in decision-making authority and planning scope between WMATA and the jurisdictions*

*Observations based on interviews with transit and transportation officials, 2018

Funding allocation affects decision making

- Under the current Metrobus subsidy allocation formula, overhead and capital costs are allocated based on regional services but not non-regional services. A jurisdiction does not pay a greater share of overhead and capital costs when Metrobus provides more non-regional services for it.

- If non-regional service is short-term or negligible in amount compared to regional service, then it can be argued that capital and overhead costs are not heavily affected by the level of non-regional service and should not be allocated to non-regional service, but entirely to regional service.

- Additional buses are required to provide non-regional service during peak hours in some jurisdictions; non regional service results in no change in share of subsidy for bus capital. The current allocation method may distort jurisdiction decisions about non-regional Metrobus service levels.

- Metrobus subsidy allocation formula for regional routes depends partially on service level in each jurisdiction. Jurisdictions have a tendency to focus on Metrobus service within their boundaries rather than regional benefits of an effective Metrobus network.

Existing funding allocation process is not fully aligned with the goal to promote regional interests*

*Observations based on interviews with transit and transportation officials, 2018

Lack of Effective Regional Bus Planning

- Over time, **inconsistent and unpredictable designation of Regional vs. Non-regional routes** leads to unclear planning scope and responsibilities
- Inconsistent planning and funding decisions have **diminished the predictability and perceived fairness** of the cost allocation process
- **Increased capacity by local jurisdictions** in transportation planning and local bus service provision may lead to **different expectations in regional bus planning**, with local jurisdictions wanting **more focus on shared responsibility**.
- Focus on the funding formula can cause **potential confusion of Service Types vs. Regional/Non-regional designations**
- These factors have led to **diminished authority for WMATA to uniformly implement Service Guidelines** for clearly differentiated Service Types

Lack of clarity in planning scope and responsibilities undermines WMATA's ability to be effective in its Compact-defined role of regional bus planner*

*Observations based on interviews with transit and transportation officials, 2018

3. Technology Trends

Executive Summary: Technology Trends

Five emerging global technology trends are rapidly changing the transit market…

1. **Shared mobility platforms**: Allowing riders to connect with transport options when it is most convenient
2. **Connectivity-enabled traffic management**: Leveraging big data and the Internet of Things to reduce congestion and improve travel time
3. **User-centric design**: Increasing customers' expectations that systems will adapt to their individual needs and habits
4. **Automated mobility**: Allowing vehicles to navigate roadways without human intervention
5. **New propulsion opportunities:** Enabling vehicles to reduce CO2 emissions and ongoing operating cost of vehicles

…and they will play an increasingly important role in shaping the future of mobility:

- **Shared mobility platforms**: TNC ridership in US has grown to 4B+ over past five years, and offerings are increasingly price-competitive with transit
- **Automated mobility**: 100+ automated vehicle pilots underway across the world today; new AV-ready ecosystems emerging in select cities
- **New propulsion opportunities:** Increasing proportion of transit buses in the US powered by electric propulsion, and electric vehicle (EV) usage will continue to rise—plug-in EVs and hybrids forecasted to make up ~50% of new car sales by 2030

These trends are already taking hold in the Washington D.C. region:

- **Connectivity-enabled traffic management**: In the past two years, D.C. has introduced connected Transit Signal Priority systems on high-density corridors, and Virginia has leveraged real-time data to implement dynamic tolling on I-66
- **User-centric design**: Earlier this year, WMATA announced that it is working with a payment vendor to enable customers to pay for their Metro trips using a mobile device rather than a SmarTrip card starting in 2019
- **Automated mobility**: Maryland and D.C. launched worked groups on autonomous vehicles in 2015 and 2018 respectively, while VDOT launched an Automated Vehicle Program Plan and while Virginia Tech began testing AVs in 2017
- **Electric Buses:** DC Circulator has 14 electric buses and is procuring more. Montgomery County got an FTA LONO grant for four electric buses.

Going forward, there are a number of challenges and opportunities along each dimension that region must contend with to be "future ready"

Key Terms

Shared mobility: Transportation services & resources that are shared among users, either concurrently or one after another, e.g., ride-sharing, scooter-sharing; often available on-demand

Connectivity-enabled traffic management: Use of big data and the Internet of Things (e.g., internet / computing devices embedded in everyday objects) to establish systems that reduce congestion and improve trip time

User-centric design: Design of products or services with the user's interests, needs and behaviors top of mind

Automated mobility: Autonomous/connected vehicles or self-driving cars that can guide themselves without human intervention

Electric propulsion: Use of electricity to power vehicles; may be self-contained within a battery, solar panels or an electric generator that converts fuel to electricity

Transportation Network Company (TNC): Organization that pairs passengers via websites and mobile apps with drivers who provide range of door-to-door trip options (e.g., private car service, pooled service, etc.)

Transit Signal Priority: Various techniques used to improve service and reduce delay for bus at intersections controlled by traffic signals; systems make green lights longer or shorten red lights

Dynamic tolling: Variable toll amounts charged based on roadway congestion; leverages GPS and data analytics tools to collect real-time traffic data used to determine charges

1. What is shared mobility?

Transportation services & resources that are shared among users, either concurrently or one after another, e.g.,

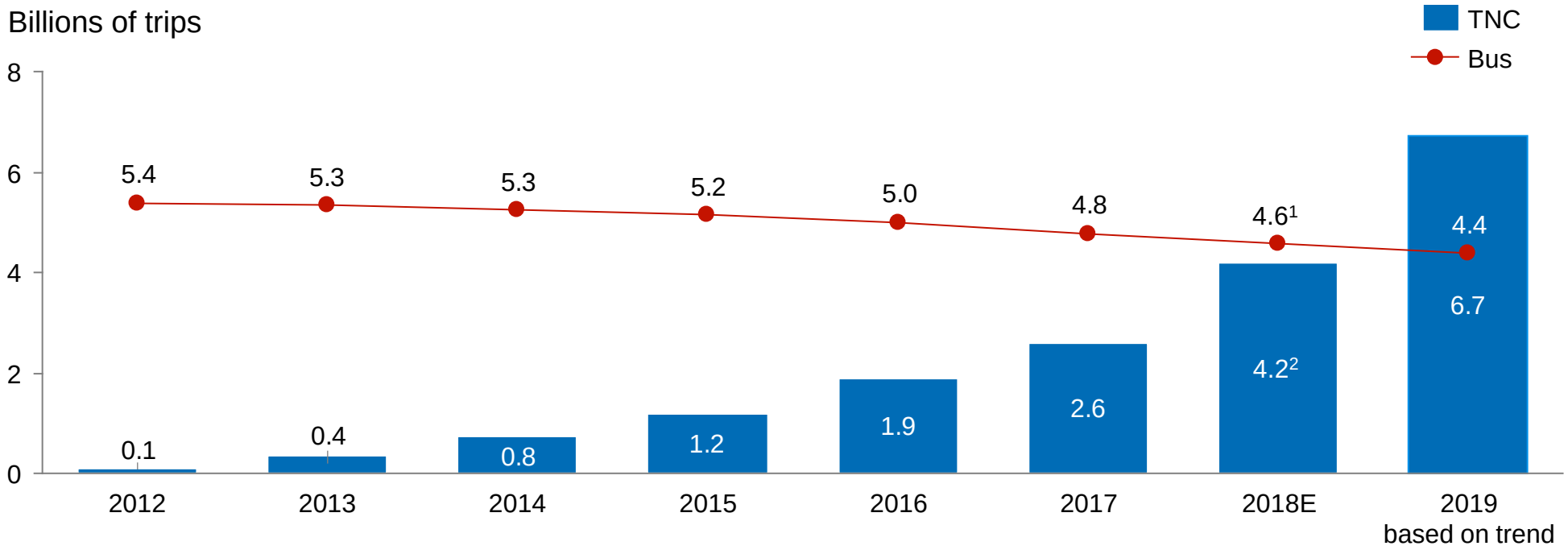
- **Ride-sharing** through Transportation Network Companies (TNCs**)**, which allow riders to source private car trips or carpool with others heading in the same direction

- **Bike and scooter-sharing**, which enable users to reserve and access bikes and scooters for transportation

Shared mobility solutions often are available "on demand" – users can access service when and where they need it

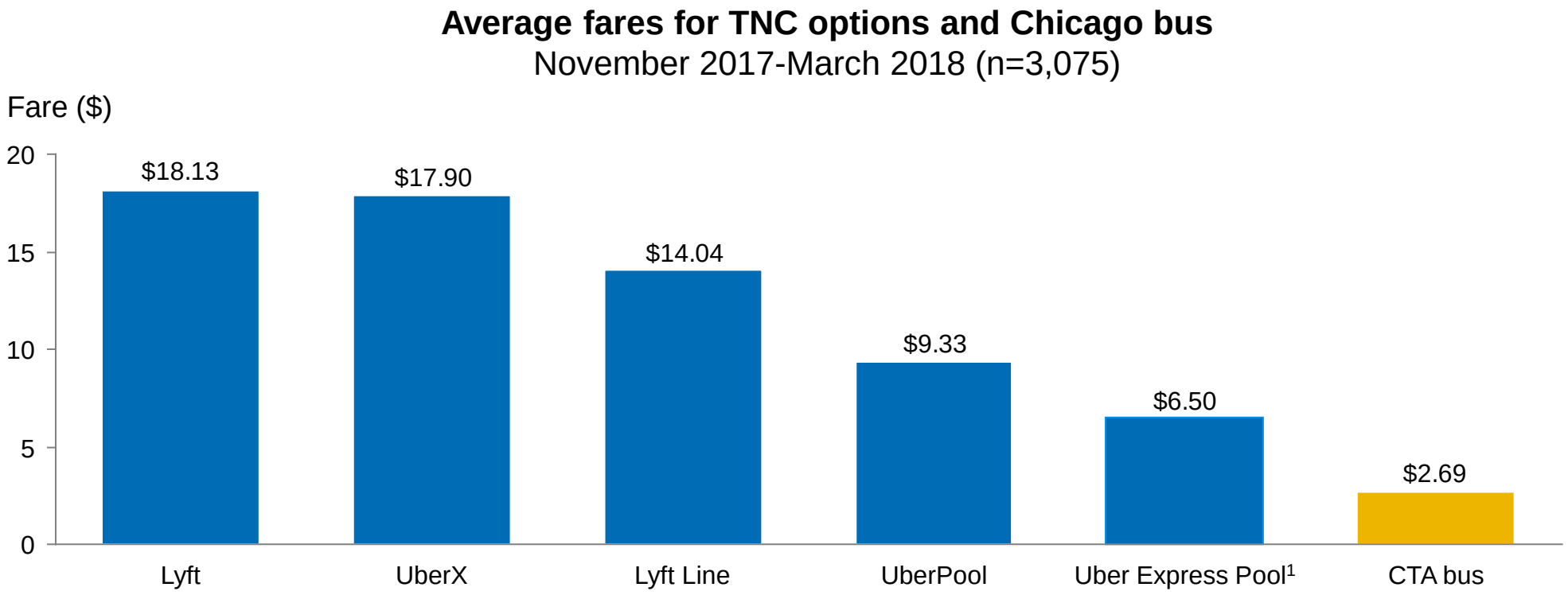
TNC ridership has grown to 4B+ over past five years, while bus ridership has declined

Bus transit and (estimated) TNC ridership in the U.S., 2012-2018



1. BCG estimate. 2. Schaller estimate.
Source: Schaller Consulting *The New Automobility: Lyft, Uber and the Future of American Cities* report (July 2018). APTA bus ridership statistics. BCG Analysis.

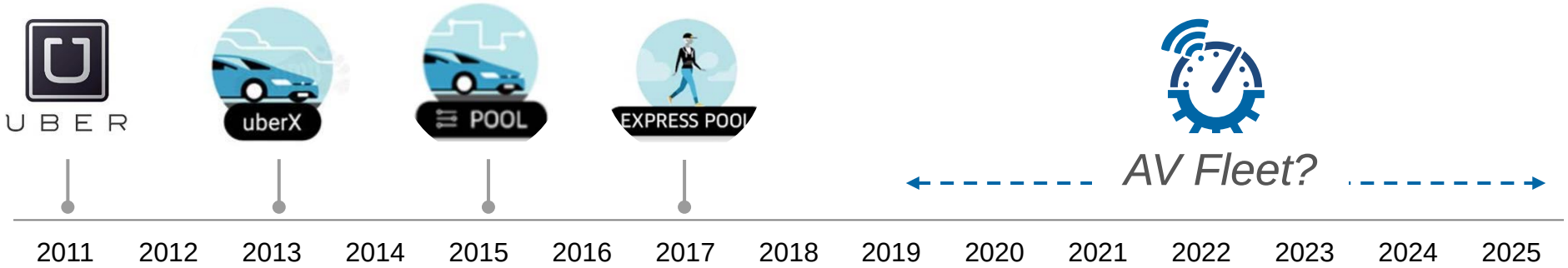
Price point of TNC product offerings continues to decrease and become competitive with transit



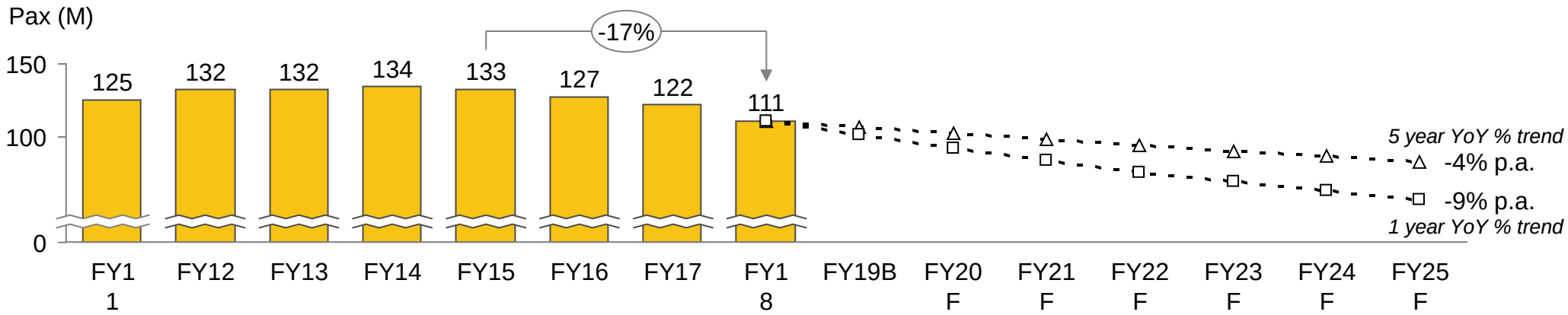
1. Not included in study. Average fare for Uber Express Pool is an estimate by BCG.
Source: Schwieterman, Joseph and Mallory Livingston, "Uber Economics". Chaddick Institute for Metropolitan Development at DePaul University. 2018.

More affordable TNC product launches coincide with bus ridership loss in Washington region

Timeline of Uber service offerings in D.C. region



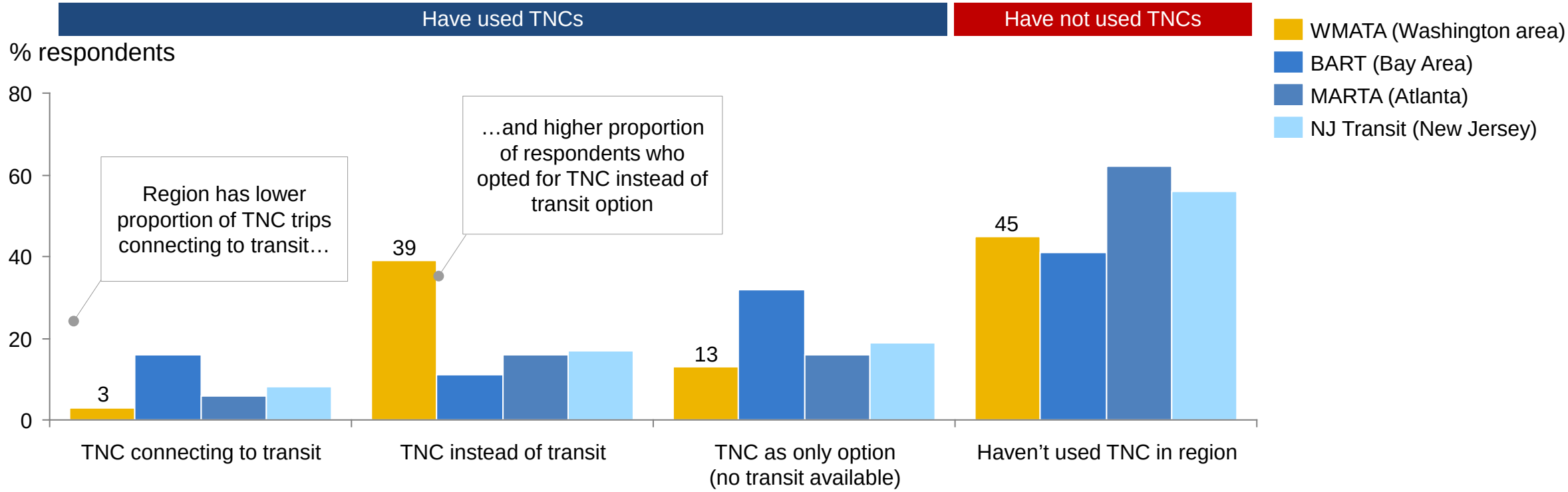
Metrobus Ridership, FY12-18 actual and FY19-25 forecast



Source: WMATA FY12-19 budget books. Uber.com. BCG research.

Today, riders in the Washington region demonstrate significant interest in TNCs as an alternative to transit

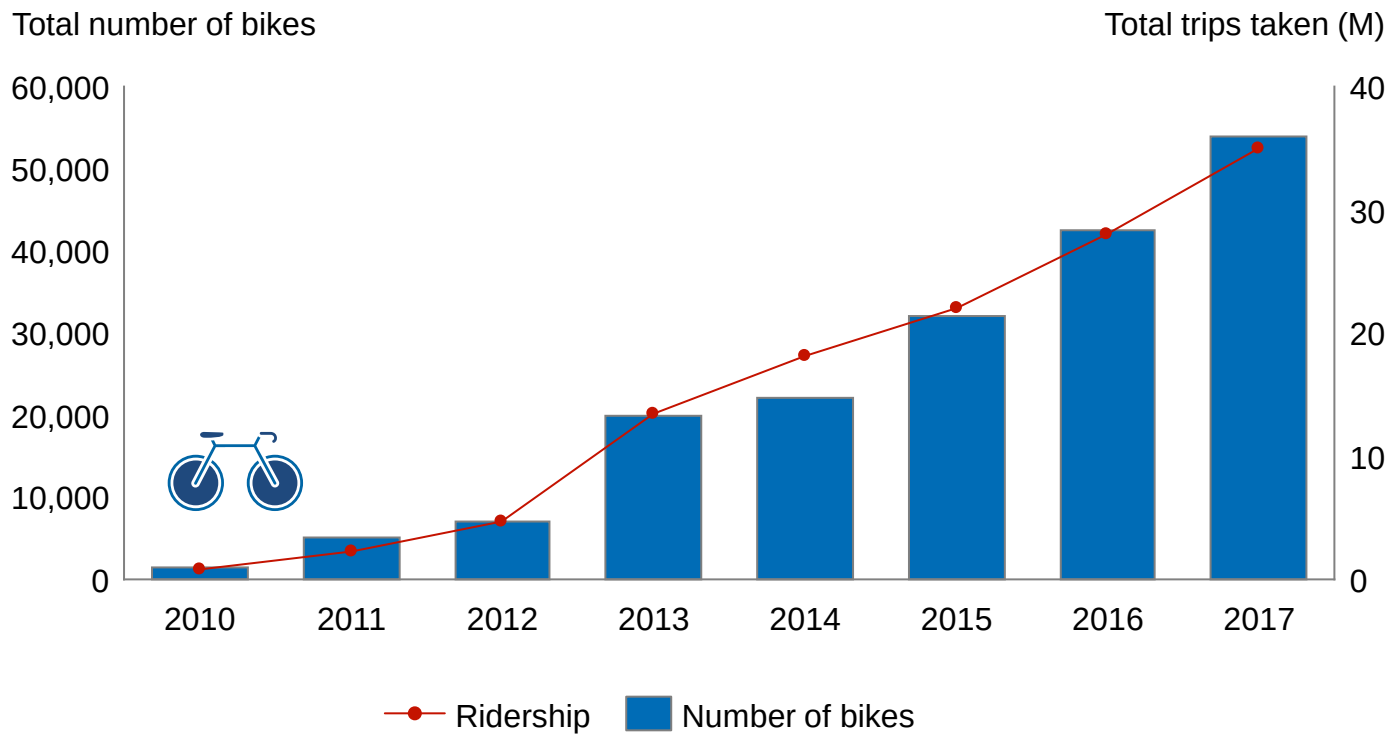
Survey of riders in agency service areas on reason for most recent TNC trip (2018)



Source: TCRP Research Report 195 - Broadening Understanding of the Interplay Among Public Transit, Shared Mobility, and Personal Automobiles. Four Agency Survey. Transportation Research Board. 2018. http://nap.edu/24996.

Bike share growth in the US is also increasing rapidly, but still a small portion of total trips

Bike share growth in the US, 2010-2017

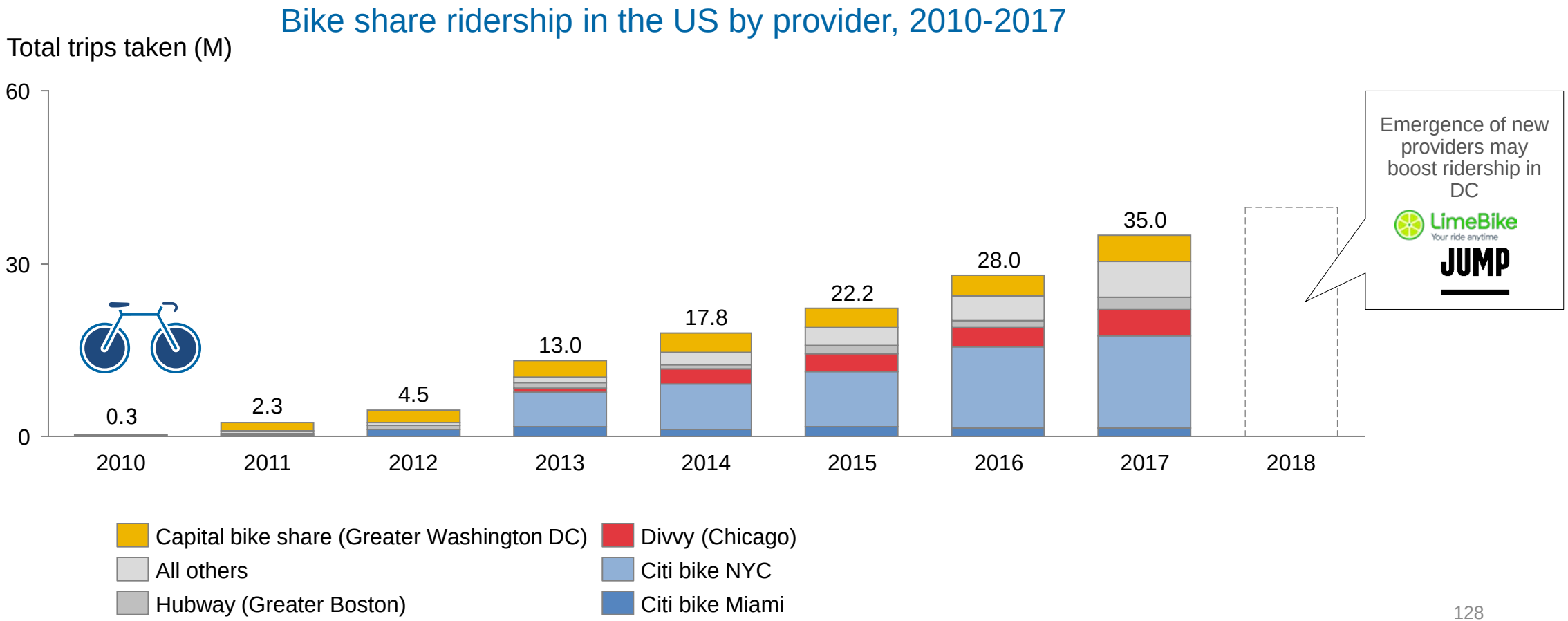


Americans take ~1.1 billion trips a day across all modes — four for every person in the U.S[1]

35M annual trips using bike share – **3% of all trips in the U.S.**

1. Daily travel included in this count are trips from one point to another on a single day.
Source: NACTO (2017) https://nacto.org/bike-share-statistics-2017/. Bureau of Transportation Statistics (2017) https://www.bts.gov/statistical-products/surveys/national-household-travel-survey-daily-travel-quick-facts.

DC region's Capital Bike Share is one of the top five bike share providers in the US, contributing to nearly 14 percent of ridership



Source: NACTO https://nacto.org/bike-share-statistics-2016/, https://nacto.org/bike-share-statistics-2017/

2. What is connectivity-enabled traffic management?

Use of big data and the Internet of Things (IoT) to reduce congestion and improve trip time, e.g.,

- **Dynamic tolling**: Leverages GPS and data analytics tools to collect real-time traffic data used to determine charges that reduce congestion
- **Transit Signal Priority (TSP)**: Uses connected infrastructure to reduce bus wait times at traffic signals by holding green lights longer or shortening red lights

Connectivity-enabled traffic management already present in the region today. For example…

Examples

Transit Signal Priority

In 2016, traffic signals and buses were equipped with Transit Signal Priority technology on high ridership corridors (including at 14th and 16th streets and Wisconsin Avenue), resulting in faster bus speeds

Dynamic tolling

In 2017, Virginia Department of Transportation (VDOT) began using technology to institute dynamic tolling on the 66 Express Lanes (inside the Beltway between Interstate 495 and Rosslyn, VA) in order to decrease congestion and improve traffic flow

Sources: Virginia's $40 toll road better be the future of driving. Wired (2017). https://www.wired.com/story/virginia-i66-toll-road/. Dynamic Tolling Done Right – VDOT shows the way. Planetizen (2018). https://www.planetizen.com/news/2018/01/96527-dynamic-tolling-done-right-vdot-shows-way. https://www.washingtonpost.com/news/dr-gridlock/wp/2016/03/10/metro-gets-green-light-for-pilot-that-gives-buses-priority-at-traffic-lights/?utm_term=.647371db48b8.

...and is used in other regions around the country as well

Examples

Transit Signal Priority

In 2012, San Francisco announced plan to install Transit Signal Priority at 600 intersections throughout the city, with a focus on priority “rapid” route network, which encompasses half of San Francisco’s roughly 1,200 signalized intersections

Incident response

In 2015, Texas Department of Transportation began a 1.5 year transformation project focused on improving the use of data and analytics in roadway incident response, management, and prevention

Source: SFMTA website; Global Traffic Technologies website. BCG case experience

Connectivity-enabled traffic management: San Francisco Transit Signal Priority

Context

In 2012, San Francisco Municipal Transportation Agency announced plan to install Transit Signal Priority at 600 intersections throughout the city, with a focus on priority “rapid” route network, which encompasses half of San Francisco’s roughly 1,200 signalized intersections

Objectives for project:

- Overall traffic optimization for smoother, faster vehicle trips
- Faster and more predictable trips for bus users, improving experience

Approach

To date, signal priority installed on 3 bus lines (2 more pending), with over 250 intersections upgraded, extending green lights or shortening red lights in the direction of travel when a bus approaches

Optimization based on historical data and real-time data on bus speeds

Special traffic optimization rules developed for specific weather pattern, special events, etc.

Impact

4-5 minute (10 percent) reduction in trip time on impacted bus routes

125,000 bus riders experienced shorter commute times

Source: SFMTA website; Global Traffic Technologies website

3. What is user-centric design?

Advancements in technology have led to the emergence of a “user-centric” design philosophy, which is focused on adapting offerings to **customer needs and behaviors**

Today, leading companies design products with the user’s interests in mind, and then develop **solutions tailored to those interests**

Today's customers expect system to adapt to their needs

Customer expectations today

Ubiquity

Interested in on-demand consumption – available anytime, anywhere

Personalization

Looking for customized experience tailored to individual needs

Transparency

Interested in comparing various options for goods & services using unlimited data online

Value focus

Seeking best value for money and excellence in delivery (smart shopping)

Simplicity

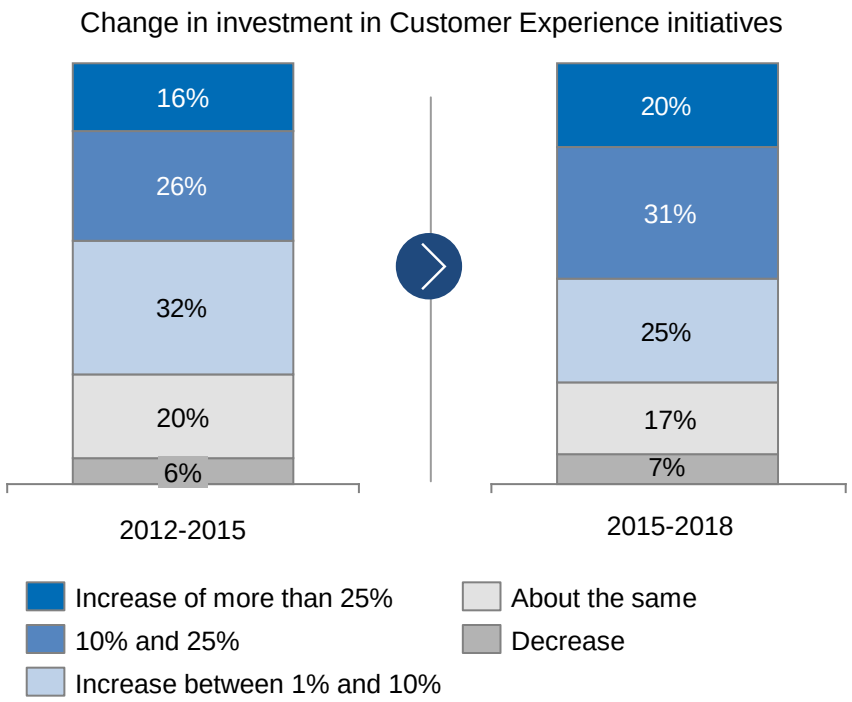
Attracted to straightforward, seamless user interfaces

Proactive support

Expecting proactive support from companies, and anticipation of customer needs

As a result, organizations are adopting a user-centric approach

Companies increasingly investing in customer experience



Major companies have articulated focus on meeting customer needs

"Enhancing the customer experience drives all of us here at Marriott"
Karin Timpone, GMO, Marriot International

"We see our customers as invited guests to a party, and we are the hosts. It's our job every day to make every important aspect of the customer experience a little bit better"
Jeff Bezos, CEO, Amazon

"Customer service shouldn't be a department; it should be the entire company"
Tony Hsieh, CEO, Zappos

Source: Company survey by The Economist Intelligence Unit (~500 respondents, 2015); press clips

Best-in-class examples of user-centricity emerging across industries…

Seamless, intuitive, integrated channel experience – including product purchase, usage, and support

Simplicity & proactive support

NETFLIX

Tailored advice on what to watch by leveraging Big Data; users can access platform using many **different modes**

Data-driven personalization & Ubiquity

facebook

Real time, customized interactions / offers based on user's dynamic profile

Dynamic customization

amazon

…and user focus is increasingly applied in various mobility contexts

Improved data availability on traffic conditions allows users to make informed travel decisions

Integration of gamification in transportation-focused applications to drive user engagement

Demand management levers to manage customer use of transport services (e.g., surge pricing)

Seamless payment options for transportation that enhance convenience for customers

137

Bus providers in the Washington region already focus on some user-centric initiatives

Real-time bus information

In 2014, researchers conducted a study on importance of real-time bus data in Atlanta and Tampa

- Key finding: riders receiving real-time information experienced shorter wait times and greater trip satisfaction; indication that real-time bus data apps might increase ridership
- WMATA was one of the first large scale transit agencies to implement real-time bus information system-wide.

Bus providers across the region provide real-time bus arrival information and trip-planning applications for users today, e.g.,

- WMATA BusETA
- DASH Tracker
- RideOn Real-Time

Mobile fare payment option

In 2017, WMATA conducted research into smartphone ownership and found that most of its customers own smartphones

- 91% of riders with employer-subsidized fare own smartphones
- 76% of frequent riders without employer-subsidized fare own smartphones

Earlier this year, WMATA announced that it is working with its payment vendor to become "mobile ready" by 2019

- Plan to enable customers to pay for their Metro trip using a mobile device rather than a SmarTrip card

Source: WMATA survey from 2017, as cited in *EZ Board, Metrobus Off-Board Fare Payment P3 Pilot Technical Feasibility Study, Technical Memorandum #1*. https://www.wmata.com/about/news/mobile-ready.cfm. https://www.citylab.com/transportation/2014/08/3-big-time-benefits-of-real-time-transit-data/376094/

4. What is automated mobility?

Refers to autonomous/connected vehicles or self-driving cars that can guide themselves without human intervention

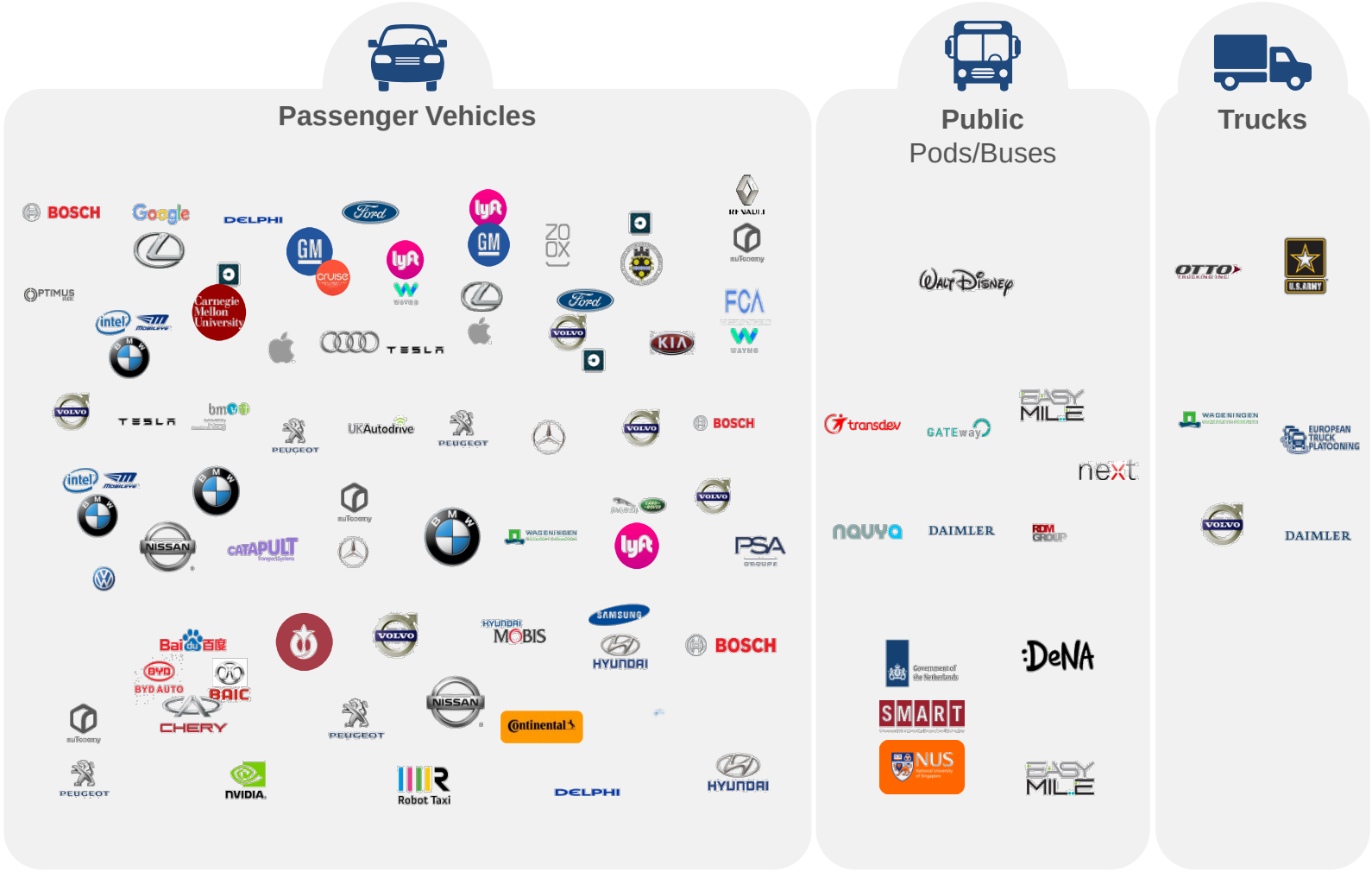
Automated mobility on the horizon across several modes, e.g.,…

- Passenger cars
- Transit vehicles
- Parcel delivery
- Low-speed shuttles
- Freight services

…but questions on future impact remain

- In **what markets** will automated vehicles primarily be used?
- **How quickly** will automated vehicles penetrate those markets?
- In **what capacity** and for what functions will automated vehicles be used?

100+ active autonomous vehicle (AV) pilots underway around the world



Sample list – not exhaustive

Several manufacturers, joint ventures, and start-ups are pushing new AV design concepts

RDM Lutz

UK automotive original equipment manufacturer (OEM) built LUTZ pathfinder AV, with support from local city council

Capacity for two passengers designed for sidewalks

Easy Mile EZ10

Joint venture of vehicle manufacturer Ligier Group and autonomous software firm Robosoft in France

Capacity for 12 passengers on EZ10 car, costs ~€200K; usual speed: 20km/h, max 45km/h

Navya Ama

Lyon-based start-up, Former research project with Nanyang Technological University (NTU), Singapore

Arma electric AV with capacity for 15 passengers and max. speed of 45km/h, costs €160K

Next V2.0

Designed in Italy, first concept created in 2012

6 passenger car, including standing space; vehicles can be combined to increase capacity

Source: Reimagined Car, Boston Consulting Group (2018).

New ecosystems emerging to accelerate AV deployment in urban areas

Singapore-MIT Alliance for Research and Technology (SMART)

Singapore and Boston are examples of cities taking bold steps to create AV friendly environments

City of Boston partnership with World Economic Forum (WEF)

Source: Reimagined Car, Boston Consulting Group (2018)

Singapore-MIT Alliance for Research and Technology (SMART)

- **2013** Tested electric AV at Clean Tech eco-business park[1]
- **2013** Tested autonomous EV at National Technological University[1]
- **2015** Tested autonomous golf cart in Singapore public gardens
- **2015** Land Transport Authority designated one-north district as the first AV test-bed in Singapore
- **2016** Singapore signed an agreement to test self-driving buses in city
- **2017** Ministry of Transport signed an agreement with two automotive companies to develop and test an autonomous truck platooning system

1. In conjunction with Nanyang Tech Univ

Sources: Concept and Business Model for Robot axis/Autonomous Rapid Transit (ART); BCG analysis

City of Boston partnership with World Economic Forum (WEF)

Investigate key questions to assess Boston's mobility landscape and the potential for autonomous vehicles in 2030

- Boston mobility today: What is the current state of mobility in Boston?
- City benefits from AVs: How can Boston and its residents benefit from AVs?
- 2030 transportation in Boston: What could the new eco-system with AVs look like?

Develop a multi-modal mobility plan and pilot AV-enabled mobility in Boston

- Develop a strategy for AV, including service and operating model
- Support launch of AV tests

Boston's collaboration with the World Economic Forum represents our commitment to creating a safe, reliable and equitable mobility plan for Boston's residents. We are focused on the future of our city and how we safely move people around while providing them with reliable mobility choices.

Mayor Walsh

Sources: World Economic Forum; BCG analysis; Boston Transportation Department

Washington region already taking steps to explore automated mobility today

In 2015, Maryland launched **Connected & Automated Vehicles Working Group** to align on plan for Maryland to address rise of AVs

In 2017, Virginia Tech began **testing automated vehicles** in Arlington, Virginia

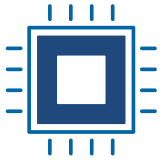
In 2017, VDOT's **Connected & Automated Vehicle Program Plan** released under the office of the Chief of Innovation and Technology

In 2018, Mayor Bowser launched **Interagency Autonomous Vehicle Working Group** to proactively prepare the District for AV technologies

In 2018, **Southwest Business Improvement District** released RFI to solicit input on policies and procedures to support AV pilot on 10th Street SW

Source: DC.gov Press Release (Feb. 2018), https://www.vtti.vt.edu (Aug. 2017). https://www.swbid.org/avrfi

While AV adoption curve is tricky to predict, once the concept is proven, the ramp-up could occur quickly



Technology

- Core technology exists; some hurdle preventing mass deployment (e.g., dynamic mapping, cybersecurity), but major players and start-ups investing heavily to solve the problems

Regulation

- Many cities already testing concept, but broad regulation yet to be passed
- With measurable benefits in lower accidents, deaths, emissions, expect hurdles to be overcome quickly

Consumer willingness

- Barriers will erode over time as people become increasingly comfortable with technology and its benefit
- Entrepreneurs will emerge to meet needs of those consumers with more niche offerings – may have to pay more, or wait longer but if there is a meaningful market need someone will seek to meet it
- Today's children who are growing up in a truly digital world will have far lower resistance to change as older generations which made up our survey ... as demographics shift we will no doubt see a decline in those which have emotional barriers to the technology

Source: Reimagined Car, Boston Consulting Group (2018).

5. What are new propulsion opportunities?

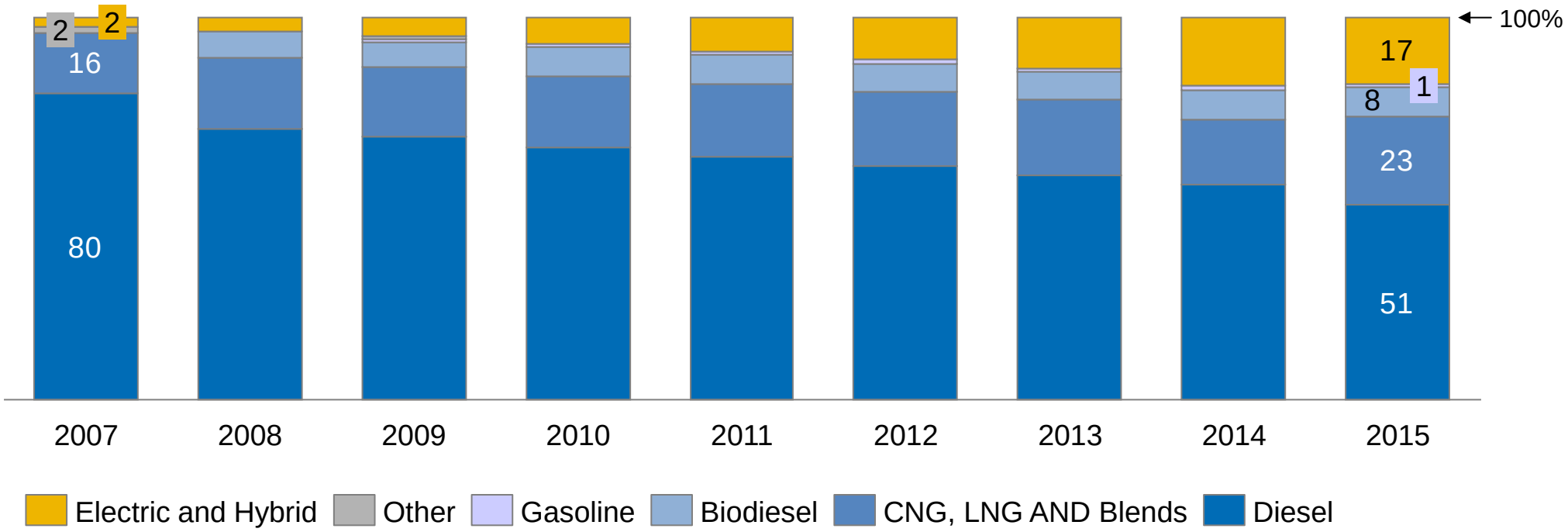
New propulsion opportunities make use of electricity to power vehicles. Propulsion may be self-contained within a battery, solar panels, hydrogen fuel cells or a generator that converts fuel to electricity

In the mobility landscape, propulsion from batteries, fuel cells, and other technologies power Electric Vehicles (EVs), which can come in two forms:

- **Hybrid vehicles**: Combines conventional internal combustion engine with an electric propulsion system
- **Fully electric vehicles**: Operates solely on electric propulsion systems, significantly reducing emissions

Increasing proportion of transit buses in the US powered by electricity

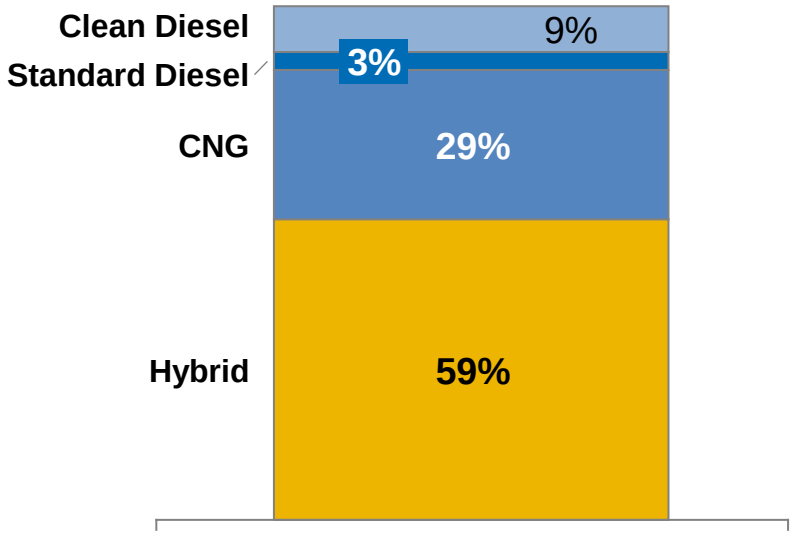
US Transit buses by fuel type, 2007-2015



Source: https://www.afdc.energy.gov/data/10302

Bus providers in Washington region already using electric and hybrid vehicles today

Majority of Metrobus' 1,500+ bus fleet are hybrid vehicles



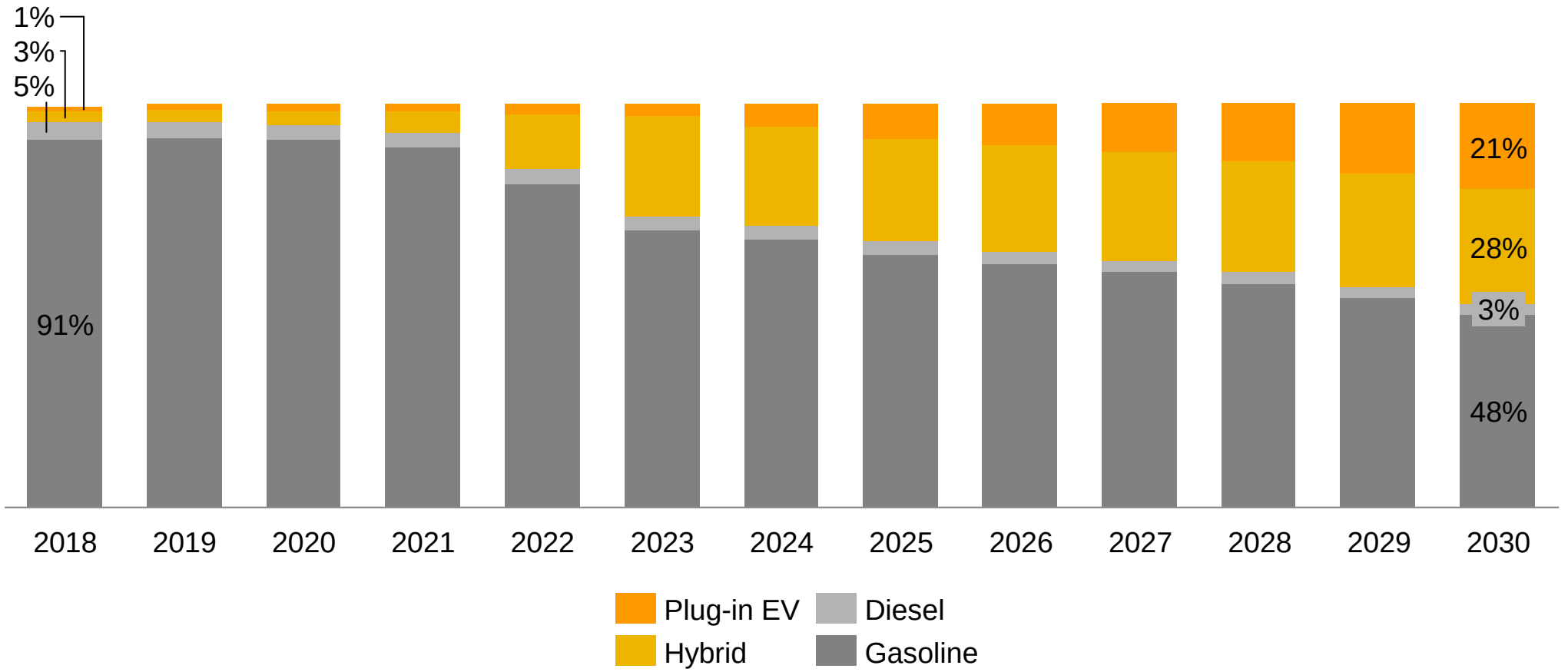
DC Circulator recently incorporated 14 fully electric buses into fleet

In May 2018, 14 new Proterra E2 Catalyst Electric Buses added to DC Circulator fleet

The 100% battery-electric vehicles bring clean, quiet, zero tailpipe emission transportation to more than 4.8 million annual riders across all six distinct Circulator routes

Source: WMATA 2017 Metrobus Fleet Plan, https://www.wmata.com/about/board/meetings/board-pdfs/upload/3A-Metrobus-Fleet-Plan-TO-POST.pdf

EV usage will continue to rise—Plug-in EVs and hybrids forecasted to make up ~50 percent of new car sales by 2030



Source: BCG Analysis

Technology trends offer opportunities and challenges

Trend / Technology	Future challenges for bus	Future opportunities for bus
Shared mobility Allowing riders to connect with transport options when it is most convenient	• Evolution of TNC model suggests it will continue to erode bus market share • TNCs increase congestion which could slow down bus	• Exploration of shared mobility solutions for bus (e.g. microtransit, multi-modal platforms)
Connectivity-enabled traffic management Leveraging big data and IoT to reduce congestion and improve travel time	• Elements needed to set up and maintain traffic management system aren't necessarily within control of transit; while transit owns vehicles, other stakeholders may control traffic lights, roadways, and related infrastructure / data	• Improved bus performance using IoT-enabled infrastructure, e.g, Transit Signal Priority • Dynamic bus scheduling using predictive analytics and real-time data collection
User-centric design Increasing customers' expectations that systems will adapt to their individual needs and habits	• Increased user expectations • Private companies developing user-focused tools at a faster rate than bus • Diverse rider population increases complexity of creating personalized interfaces for each user	• More intuitive and comprehensive transit application interfaces • Introduction of supply and demand management tools • Seamless payment for transit services
Automated mobility Allowing vehicles to navigate roadways without human intervention	• Automated cars could displace mass transit • Switch to automated buses would have employment impacts, significant infrastructure investment	• Reduced operating costs from switching to automated buses • Potential for automated buses to improve passenger safety, trip time • Labor cost savings makes running smaller vehicles more financially viable
New propulsion opportunities Enabling vehicles to reduce CO2 emissions and ongoing operating cost of vehicles	• Reduced environmental competitive advantage • Charging needs must be considered in operations planning, garage locations	• Reduction in carbon emissions by switching to electric or full-cell propulsion vehicles

4. Metrobus Financial Sustainability

Executive Summary: Metrobus' financial sustainability

Since 2013, Metrobus' farebox recovery has declined by 4 percentage points, resulting in an operating loss growth of 3.6% p.a.

The operating loss is the result of both flat revenue growth and rising operating costs

Flat revenue growth has been caused by:

- Despite fare increases, declining bus ridership (2% p.a.) has driven a 1% p.a. decline in fare revenue since 2013
- Declines in fare revenue have only been partially offset by increases in non-fare revenue (e.g. advertising)

Operating costs have increased by 3% p.a. since 2013, without an increase in service levels. The main drivers include:

- Increase in personnel costs, representing 84% of costs in 2017 compared to 79% in 2013
- Relatively high percentage of time and miles spent on deadhead versus national peers
- Decelerating bus speeds of 9% or 1mph over the past 10 years

With current revenue and cost trends, meeting the 3% operating subsidy growth cap will be challenging

- Based on current revenue and cost structure, meeting the operating subsidy cap will require a 4% per year growth in ridership
- Alternative paths to meet the 3% operating subsidy growth cap require a slow down in cost growth, fare increases, and/or a reduction in service

Metrobus' Financial Sustainability

- Financial Situation
- Revenue sources & trends
- Cost drivers & trends
- Impact of subsidy growth cap

Key Terms

Ridership: Defined as unlinked passenger trips - a trip on one transit vehicle regardless of the type of fare paid or transfer presented

Operating loss: Difference between revenue and costs, when costs exceed revenue

CAGR: Compounded Annual Growth Rate – measure of growth over multiple time periods

Service level: The quantity of revenue miles or hours that a bus system provides in a given period of time

Revenue miles/hours: Total miles or hours that a bus is on a given route accepting passengers

Deadhead hours / miles: The hours or miles that a vehicle travels when out of revenue service, including for leaving or returning to the garage or yard facility, changing routes, and when there is no expectation of carrying revenue passengers

Overhead: Indirect labor and expenses typically associated with headquarter functions allocated to a particular business unit

Farebox recovery: The ratio of fare revenue to operating costs which is a measure of determining how much fare revenue covers operating costs

Platform hours/ Vehicle Miles: Total vehicle hours or miles that a bus is on the road for a given route including revenue time, layover time and deadhead time

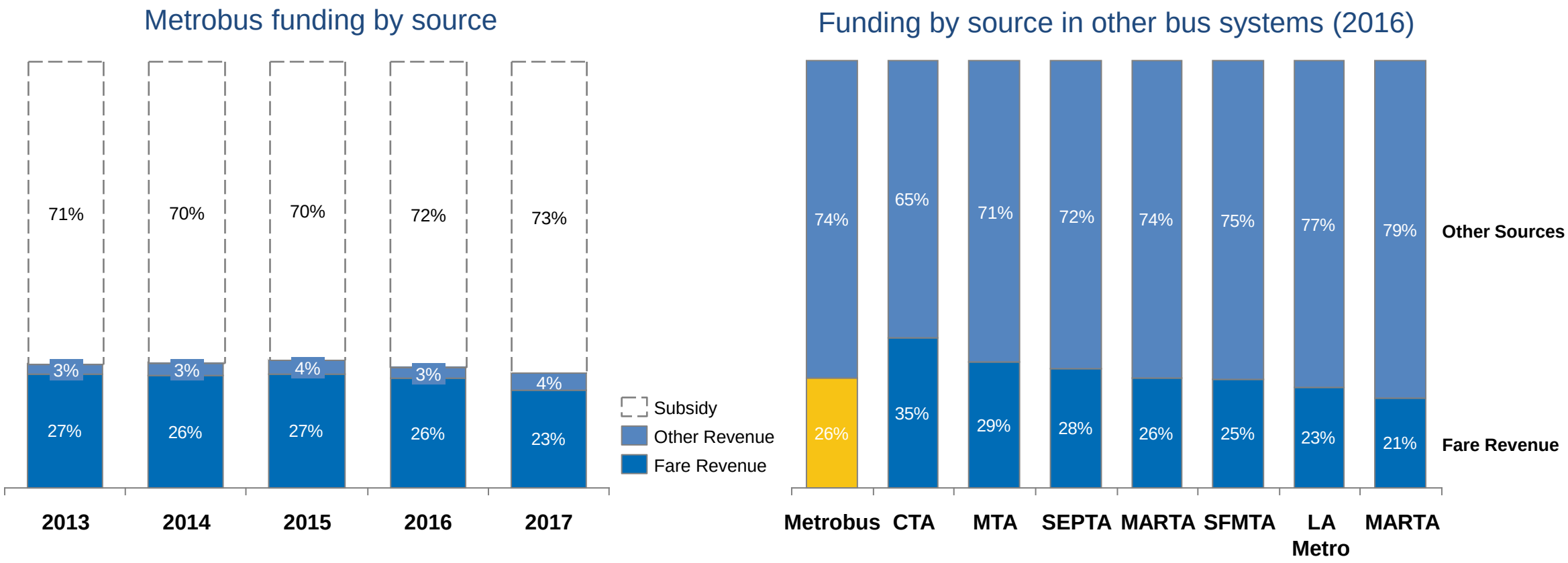
Operating Subsidy: Funding contributions that jurisdictions make towards operating budget

Source: APTA; MWCOG 2018 Regional Bus Service Provision Study; King County Service Planning Terms and Concepts

Metrobus Financial Sustainability

- Financial Situation
- Revenue sources & trends
- Cost drivers & trends
- Impact of subsidy growth cap

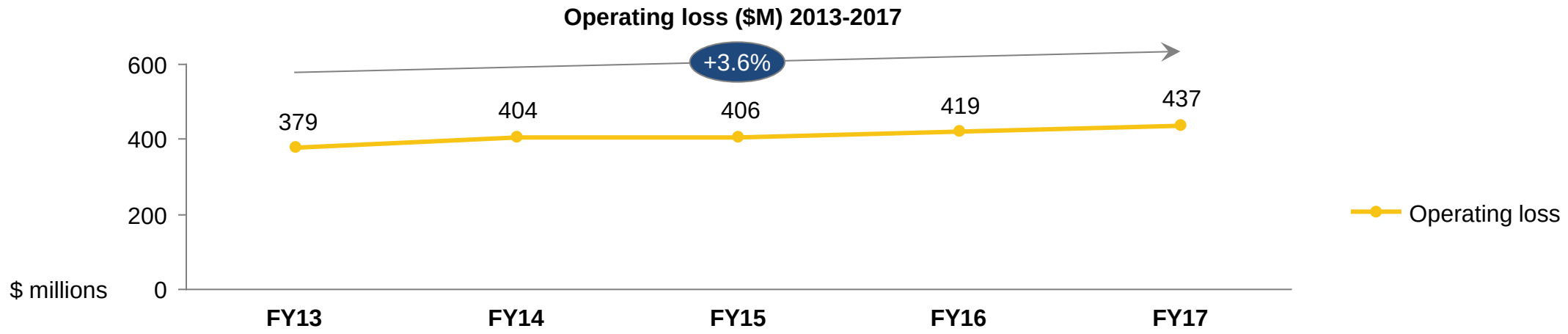
Metrobus farebox recovery has declined by 4 percentage points since 2013, just below average of peer bus systems



Note: Other sources of funding for regional bus systems not specified. Source: WMATA Bus Modal FY12-17 P&L Expense by Category ; National Transit Database, Agency Profiles 2016 Data based on bus fare revenue and operating expenses.

As a result, operating loss grew 3.6% per year since 2013

Growth in cost outpaced modest revenue increase over same time period



						4YR CAGR %
Revenue $M	157	165	176	166	163	**+0.9**
Cost $M	536	569	582	585	600	**+2.9**
Operating Loss $M	**379**	**404**	**406**	**419**	**437**	**+3.6**

Revenue decline in last 2 years has accelerated operating loss growth: -4.3% from FY16 to FY17

Source: WMATA Bus Modal FY12-17 P&L Expense by Category.

Metrobus' Financial Sustainability

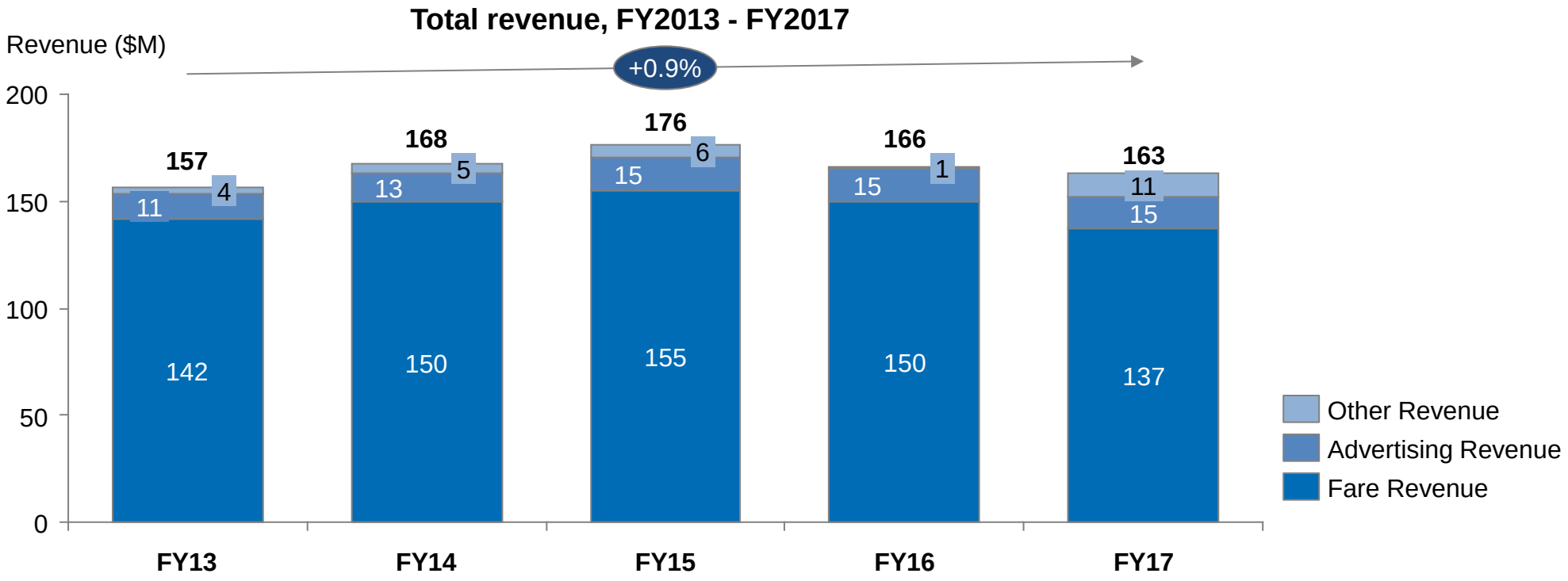
Financial Situation

Revenue sources & trends

Cost drivers & trends

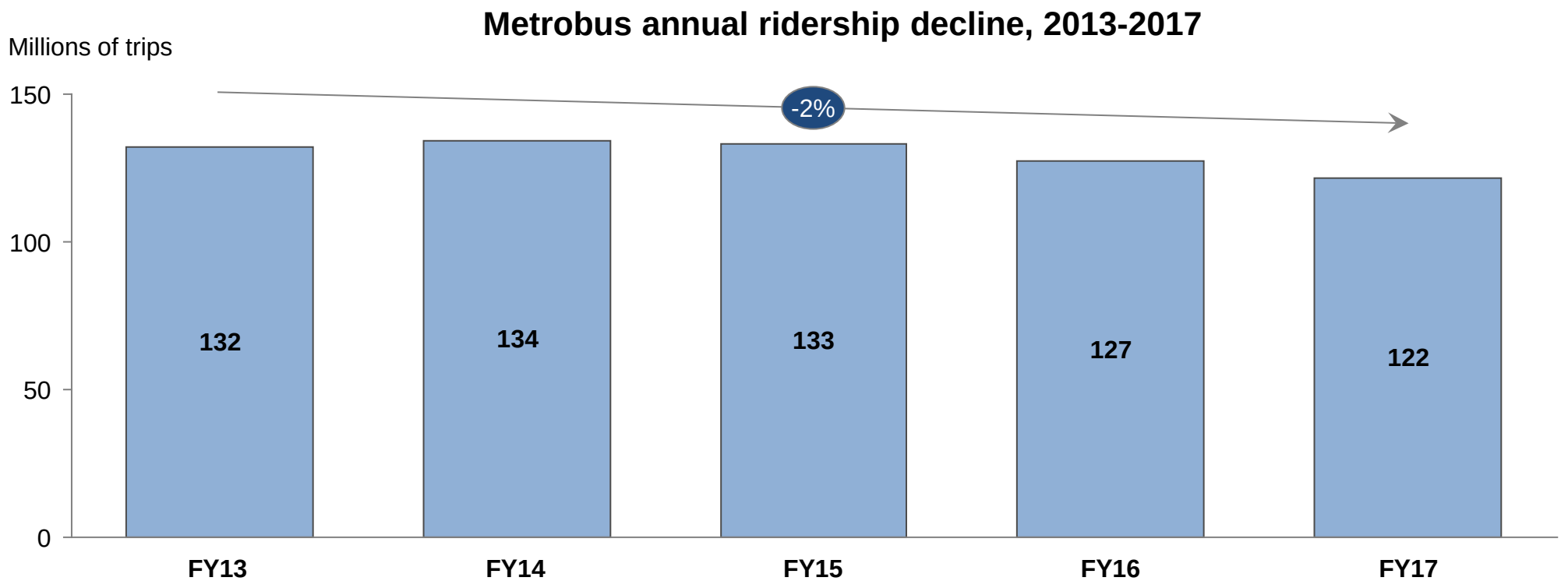
Impact of subsidy growth cap

Revenue growth has remained flat due to declining fare revenue and increase in non-fare revenue



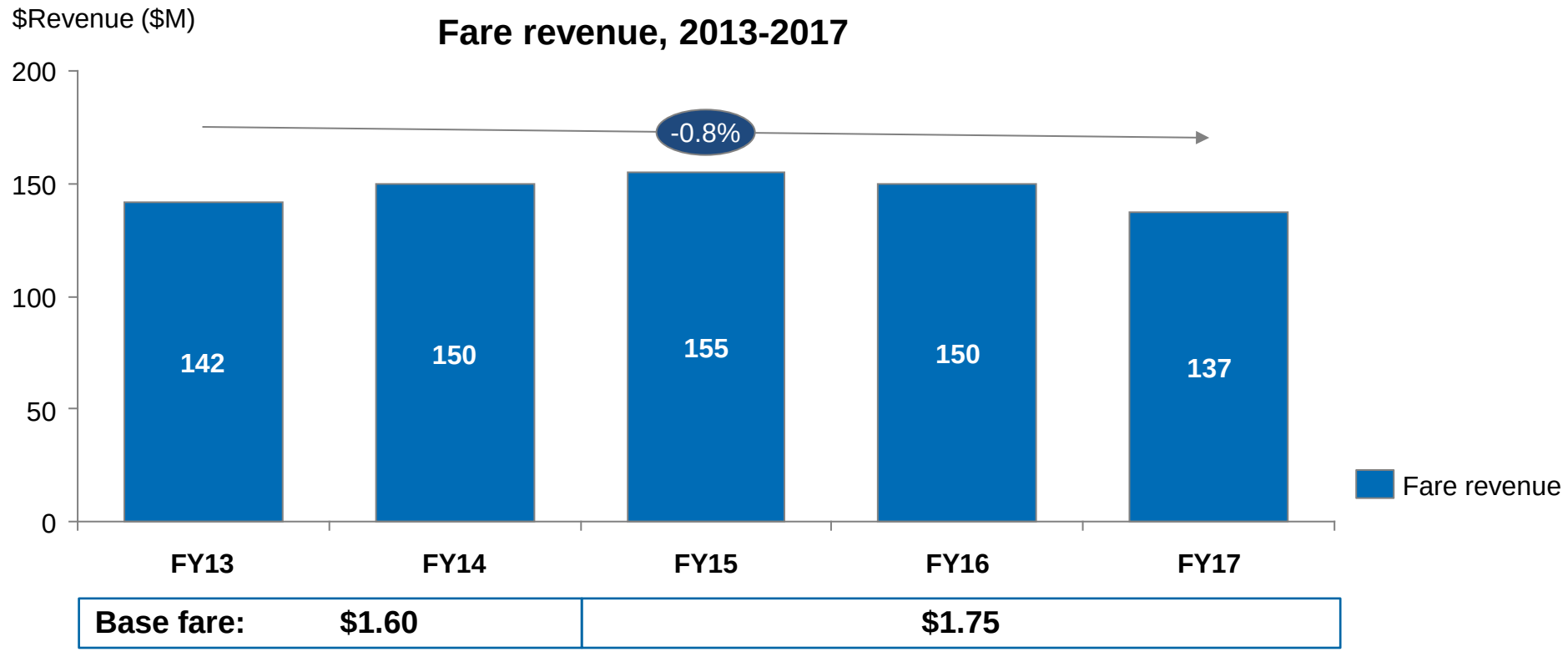
Source: WMATA Bus Modal FY12-17 P&L Expense by Category

On average, bus ridership declining 2% per year since 2013



Source: WMATA FY12-19 Budget Books

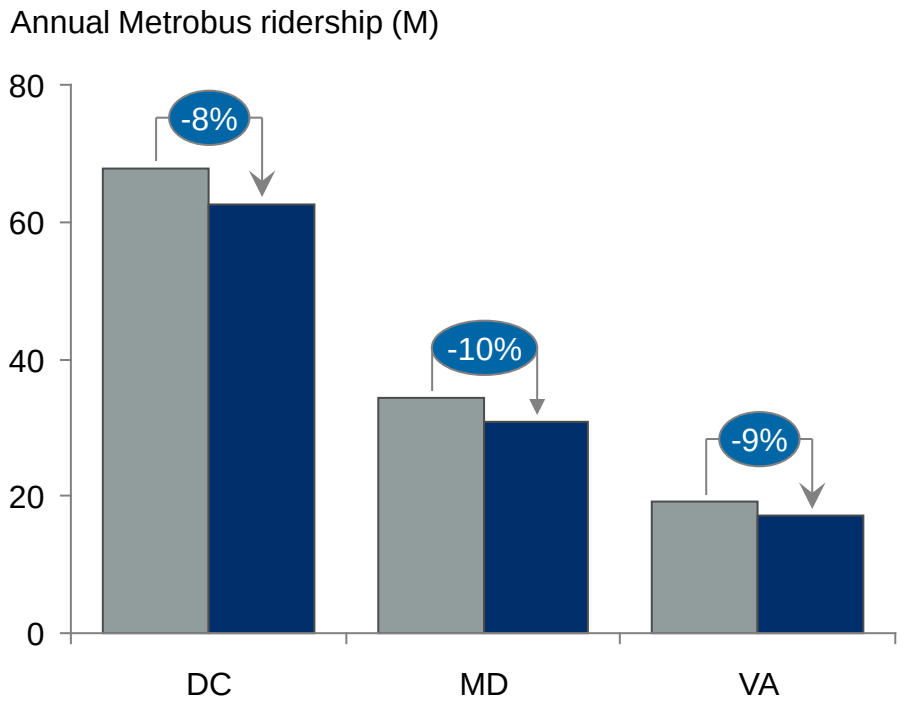
…leading to a ~1% decline per year in fare revenue, even as fares have increased



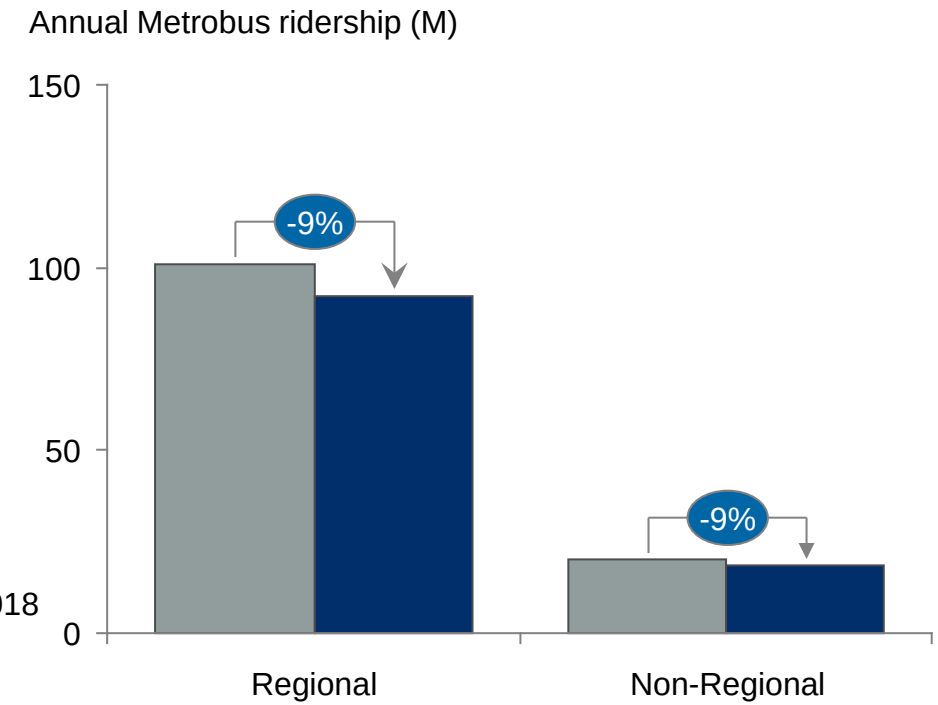
Note: Fare revenue include only passenger revenues, excluding advertising and other revenue sources.
Source: WMATA Bus Modal FY12-17 P&L Expense by Category

Metrobus Ridership: Decline consistent across geographies and lines

Between 8-10% decline in all three jurisdictions



Same rate of decline on regional and non-regional lines

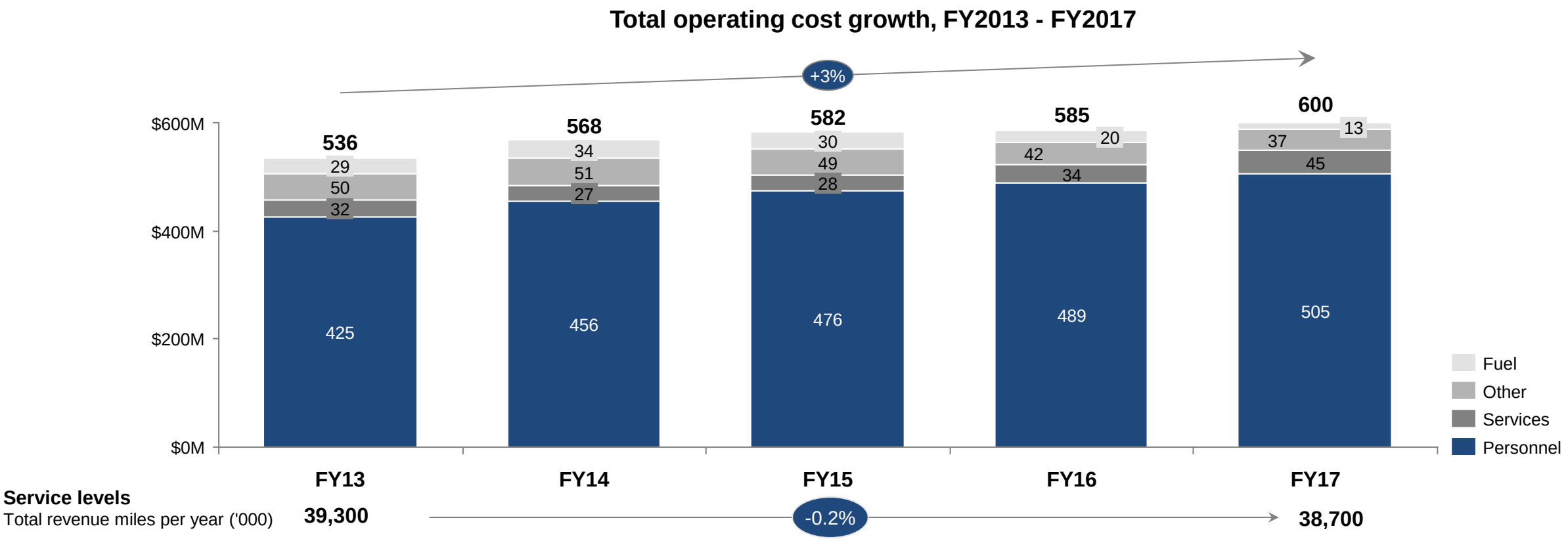


Source: JCC April 2018 Preliminary Ridership Report

Metrobus Financial Sustainability

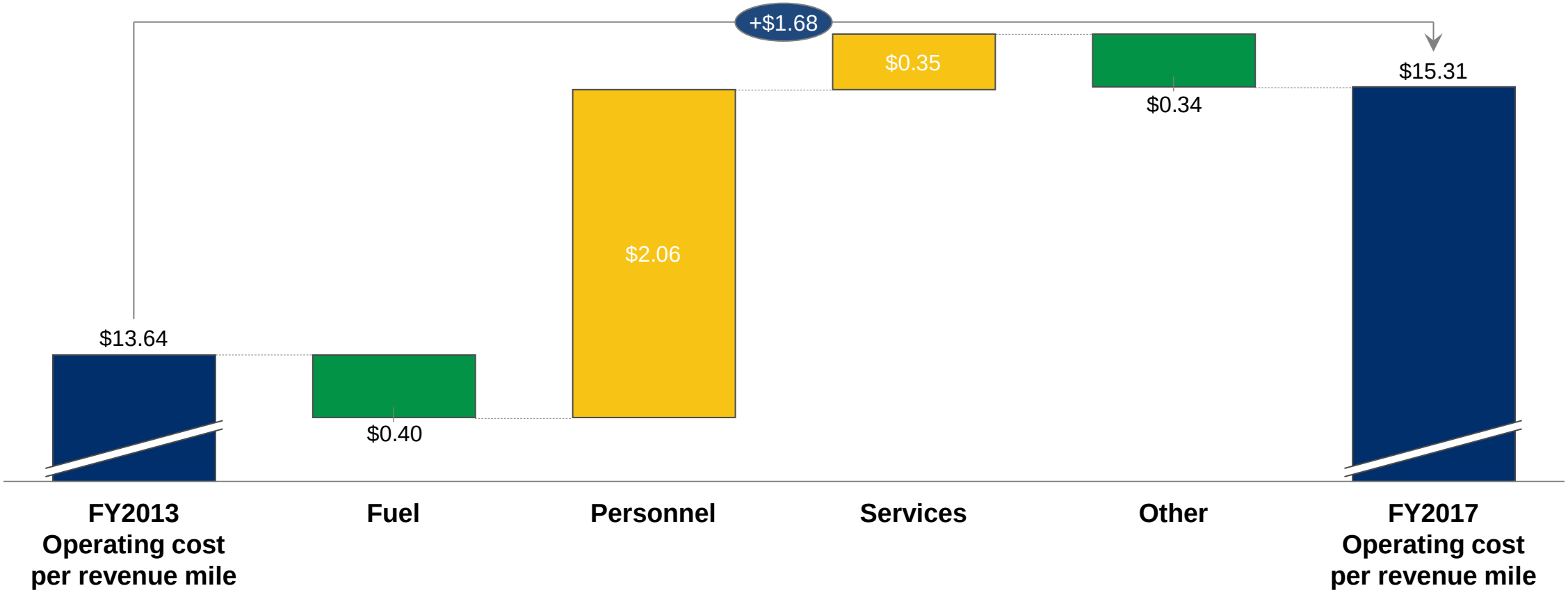
- Financial Situation
- Revenue sources & trends
- **Cost drivers & trends**
- Impact of subsidy growth cap

Metrobus operating costs rose by 3% per year over past 5 years though service levels remained flat…



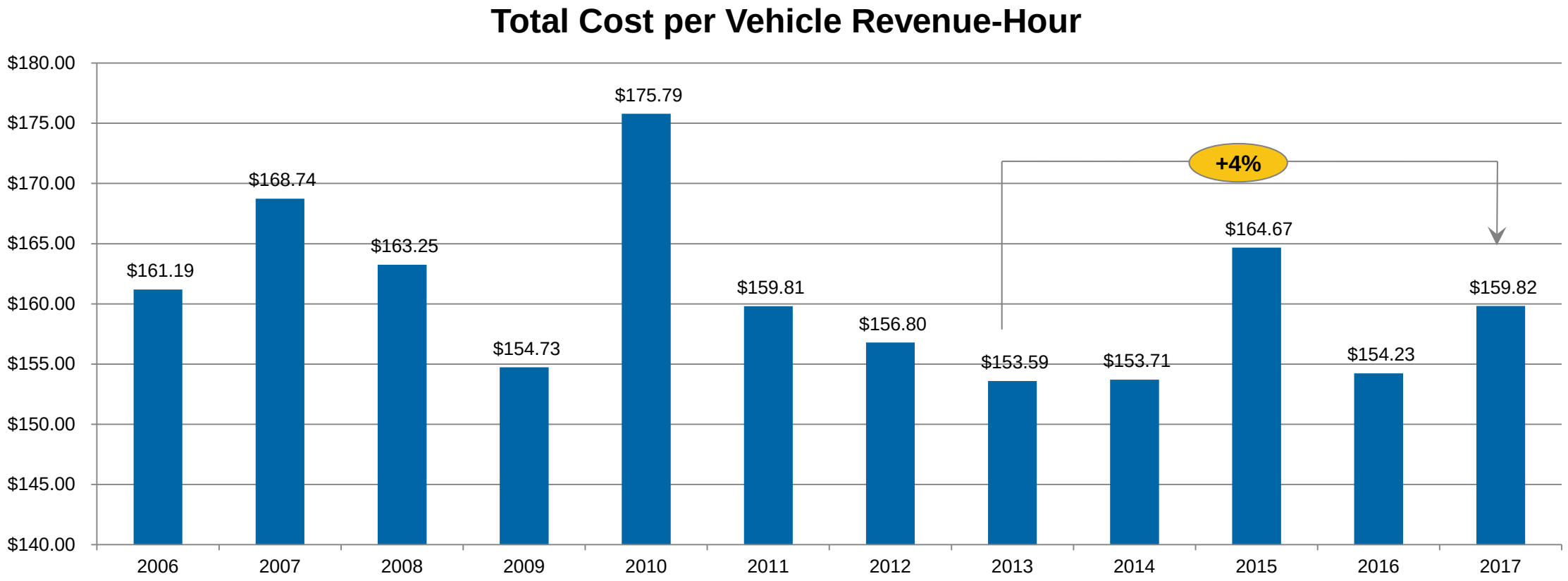
Source: WMATA Bus Modal FY12-17 P&L Expense by Category; Urban Integrated National Transit Database

…making every mile of service $1.68 more expensive

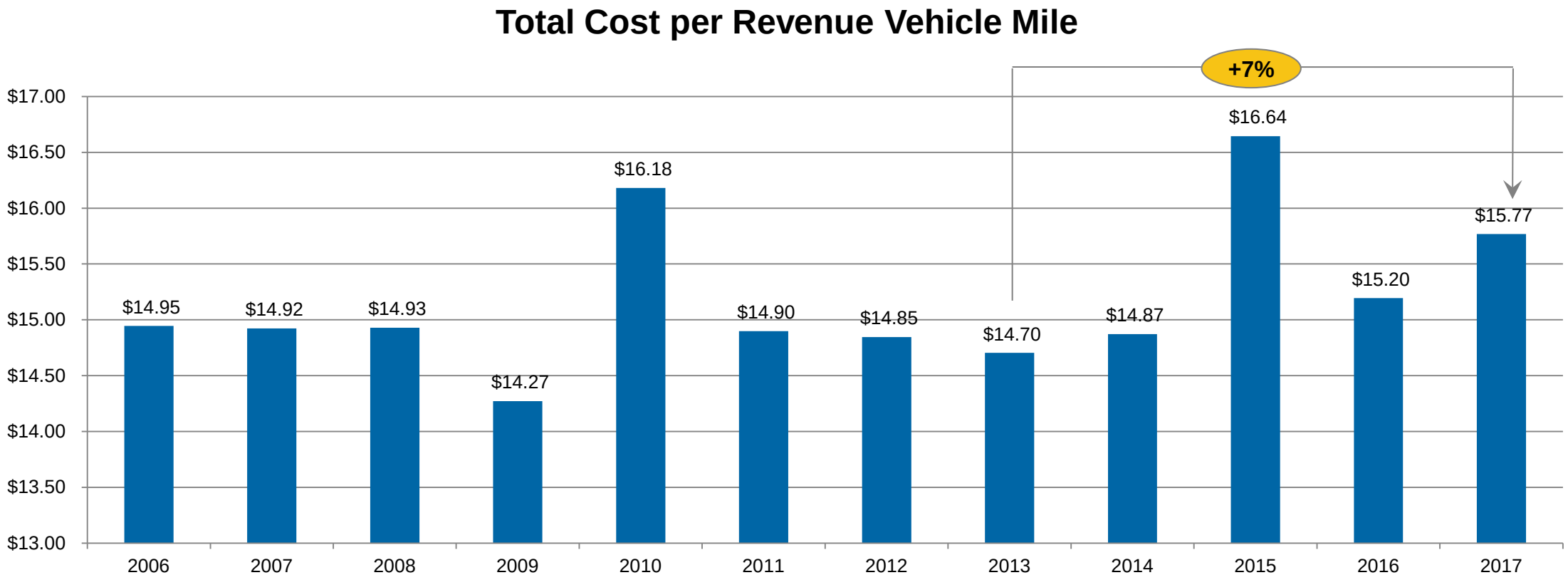


Source: WMATA Bus Modal FY12-17 P&L Expense by Category

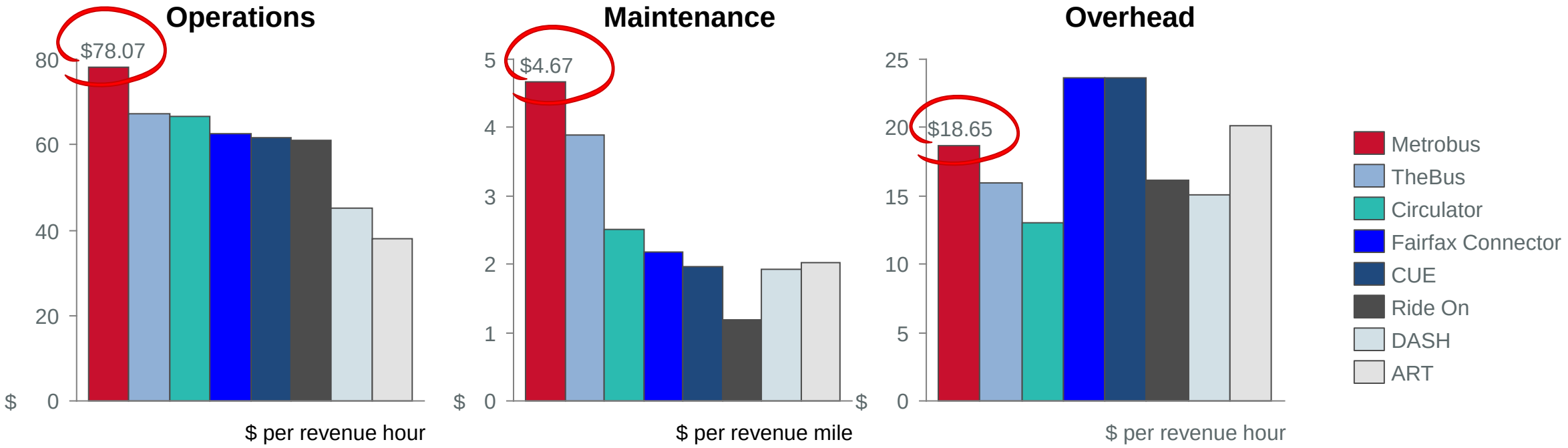
The cost to operate an hour of Metrobus revenue service has decreased by 1% over the last decade, but have increased since 2013.



The cost to operate a mile of Metrobus revenue service has increased by 5% over the last decade, with a more pronounced increase since 2013.



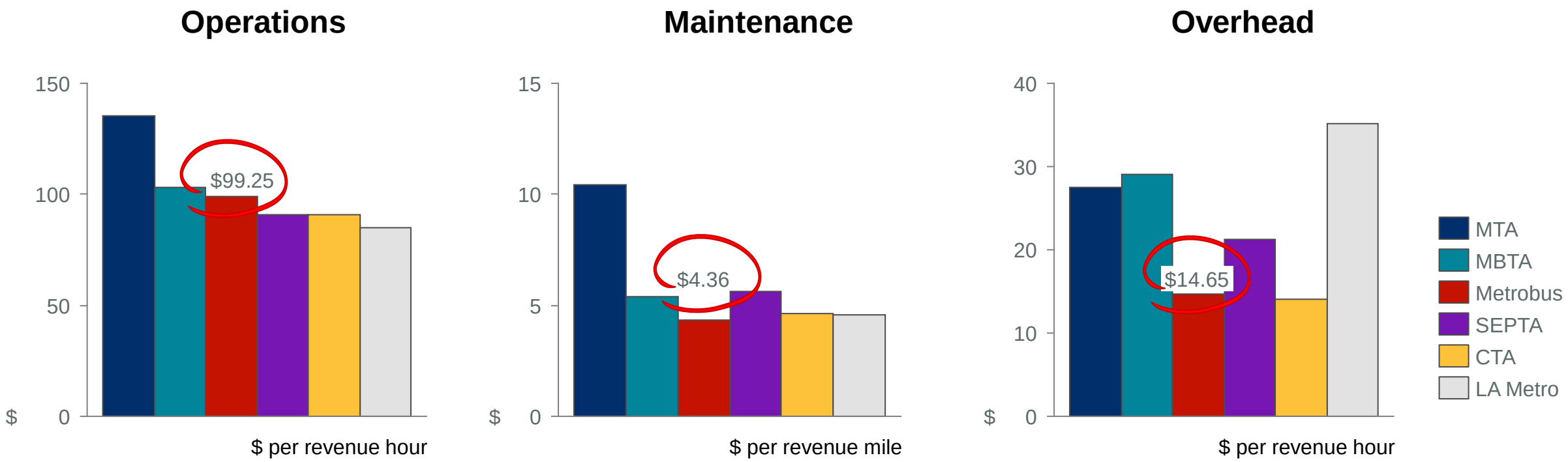
Metrobus current costs are higher than regional peers



Differences in scope, scale, and operating environment affects agency performance across these metrics.

Note: Figures are for Calendar Year 2017. Peer group includes Ride On (Montgomery), Fairfax Connector (Fairfax County), TheBus (Prince George's), DC Circulator, ART (Arlington), DASH (Alexandria), and CUE (City of Fairfax). Source: MWCOG 2018 Regional Bus Service Provision Study

However, Metrobus is on par or below other large agencies nationwide



Note: Figures for 2016 (latest available benchmarks)

Note: All figures are for calendar year 2016.
Source: NTD database.

Three major factors driving Metrobus cost growth – personnel costs, deadhead and slow bus speeds

1

Increased personnel costs

Accounts for 80% or $80M of cost increase from 2013 to 2017, includes salaries & wages, fringe benefits and overtime expenses

Commuter nature of service (peaked) requires a larger labor force

2

High percentage of time and miles spend on deadhead

Metrobus could save, e.g., $16M per year by reducing deadhead hours from 14% to 9% of total platform hours

3

Declining bus speeds

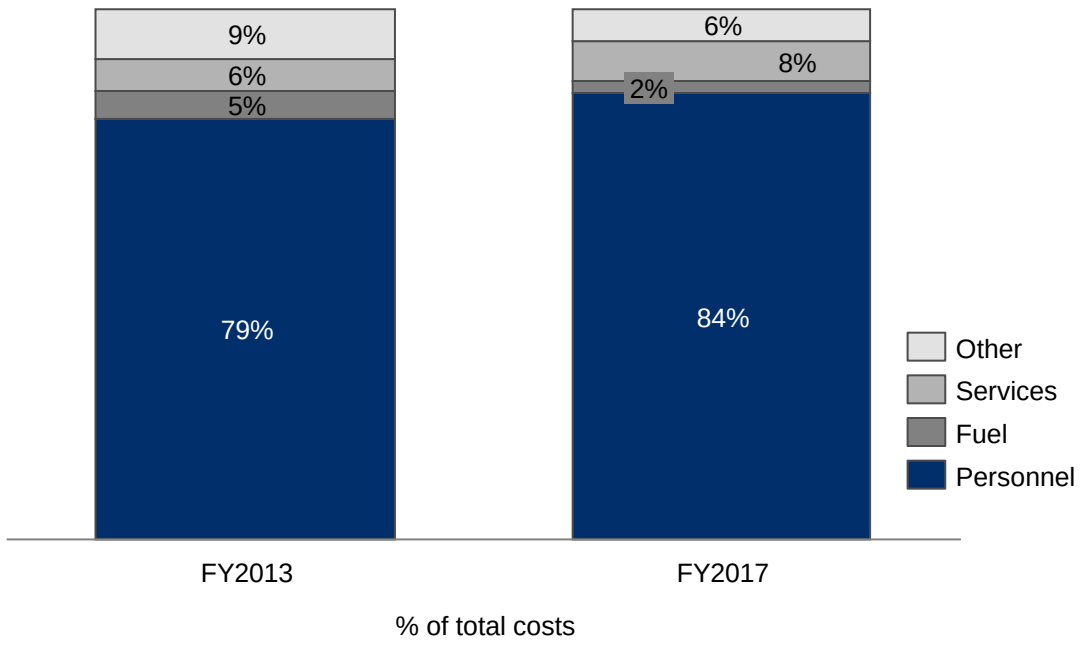
Average Metrobus speeds declined ~1mph since 2007

1mph increase in average bus speeds would unlock savings equal to 4% of operating costs

Other local operators are also experiencing many of these challenges (e.g., road congestion impacting bus speeds)

Metrobus costs largely driven by personnel costs, representing 84% of total costs

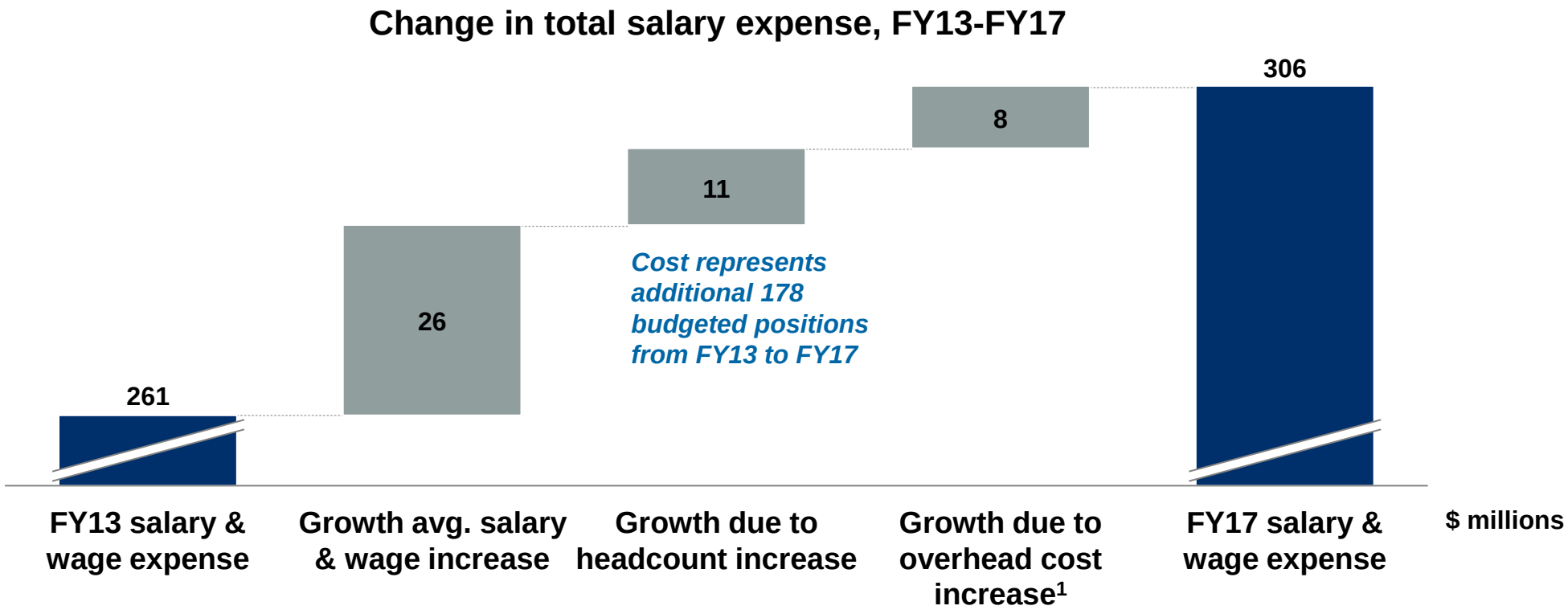
Personnel costs increased from 79% to 84% of total costs



Change in costs driven by $80M increase in personnel costs

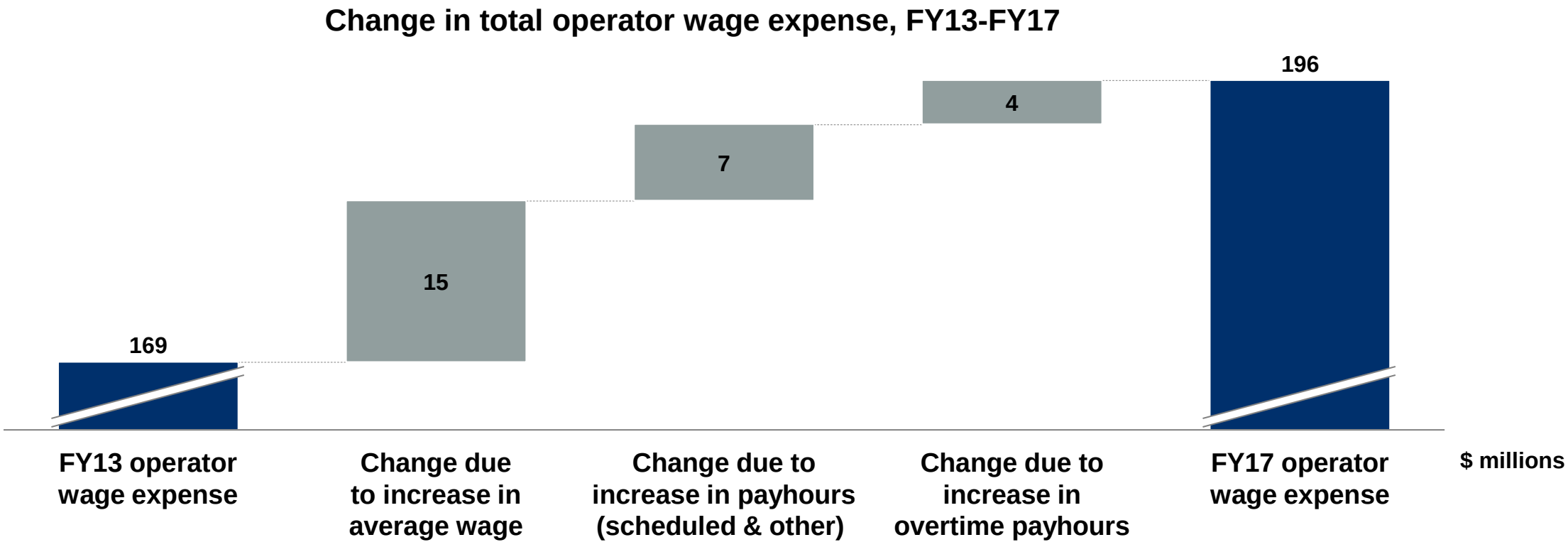
Source: WMATA Bus Modal FY12-17 P&L Expense by Category

Higher salary and wage costs primarily driven by $26M growth in average salaries and wages



Note: This does not include labor arbitration from August 2018 in which WMATA has to pay $82M in wage increases to workers by summer of 2020. 1. Assumes 18.7% of costs attributed to overhead for indirect salary and wage expenses allocated to bus services based on FY19 Platform Rate Calculation. Note: Analysis based on total direct salaried and waged positions budgeted for in FY13 and FY17 for bus services, not including indirect positions. FY13 represents 3,995 budgeted positions and FY17 4,173 budgeted positions. Excludes overtime cost. Source: WMATA Bus Modal FY12-17 P&L Expense by Category; WMATA FY14 and FY18 Approved Annual Budget; Metrobus Mode FY19 Platform Rate Calculation; Washington Post: "Metro must pay $82 million in wage increases to thousands of workers, arbitration panel says"

$15M increase in average operator wage makes up more than half of growth in operator wage expenses

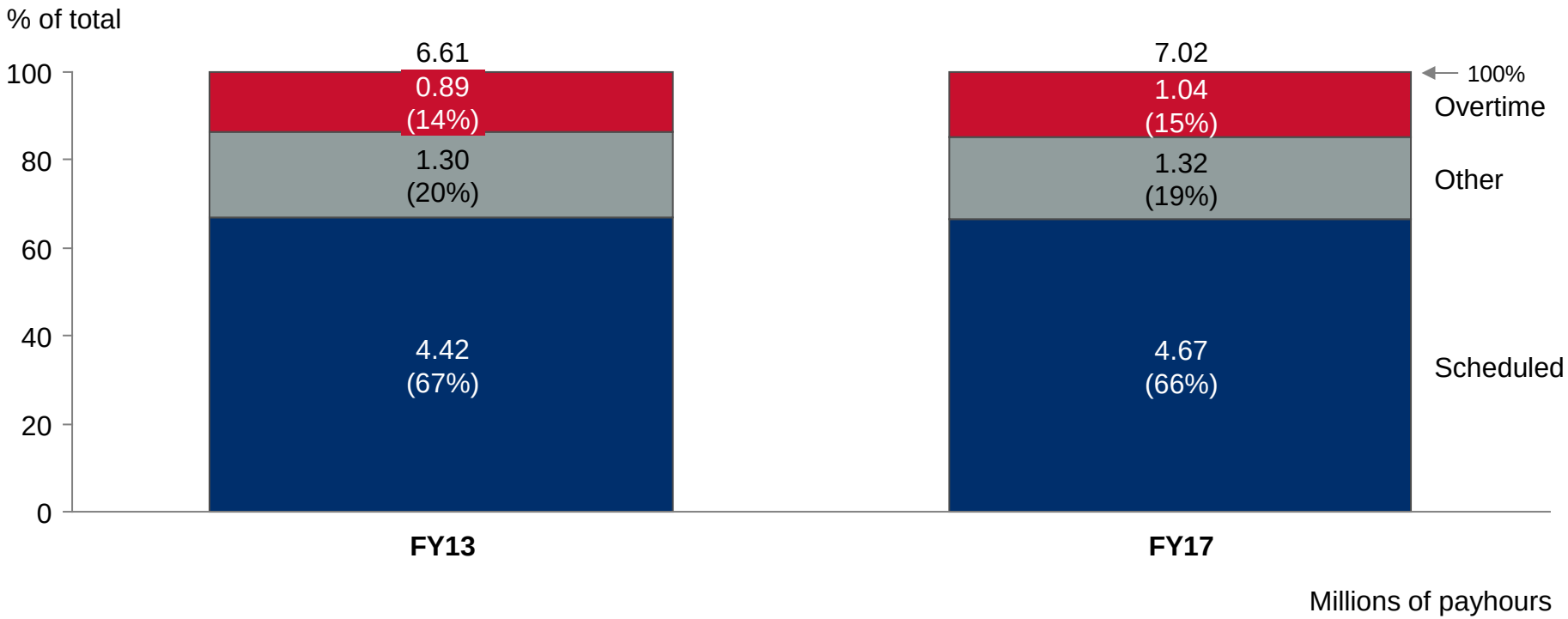


Note: The October 2017 LaHood report noted that WMATA's pay, benefits and employment policies are similar to those at other large transit agencies. https://ggwash.org/files/LaHood-Report.pdf

Sources: WMATA Bus Modal FY12-17 P&L Expense by Category; Metrobus Operator Payhour Data

Of payhours, overtime grew the most adding 150k hours since 2013 – representing $5M in additional cost

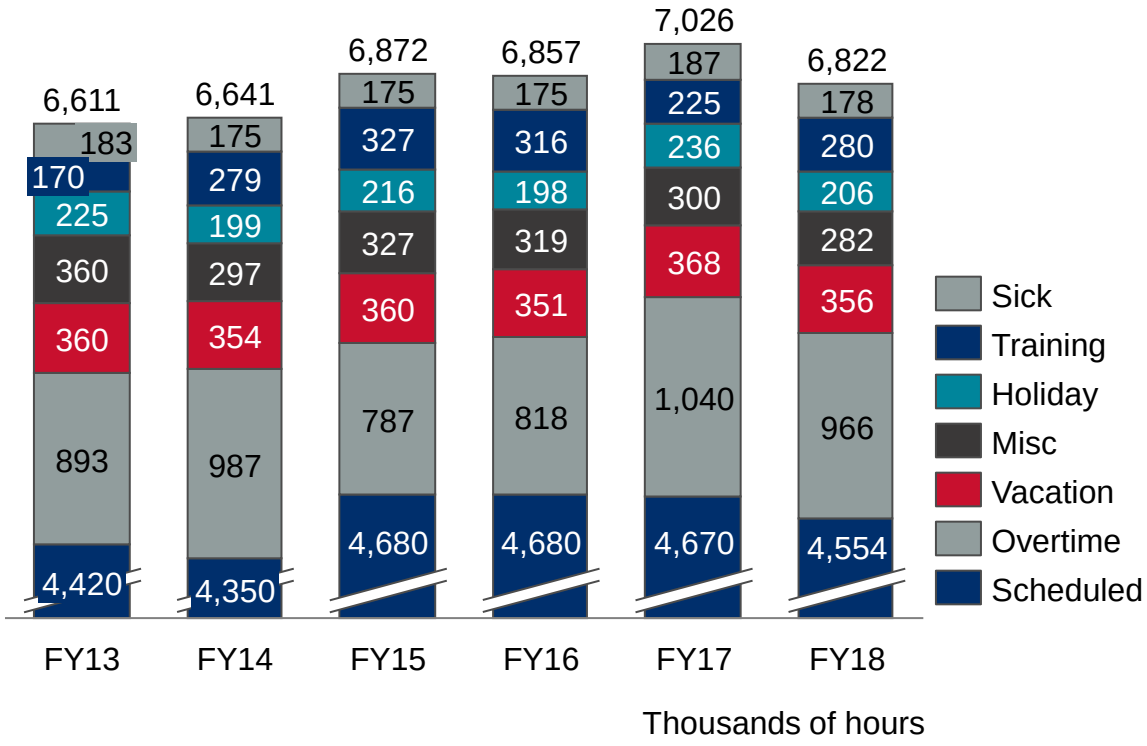
Bus operator payhours, FY2013-FY2017



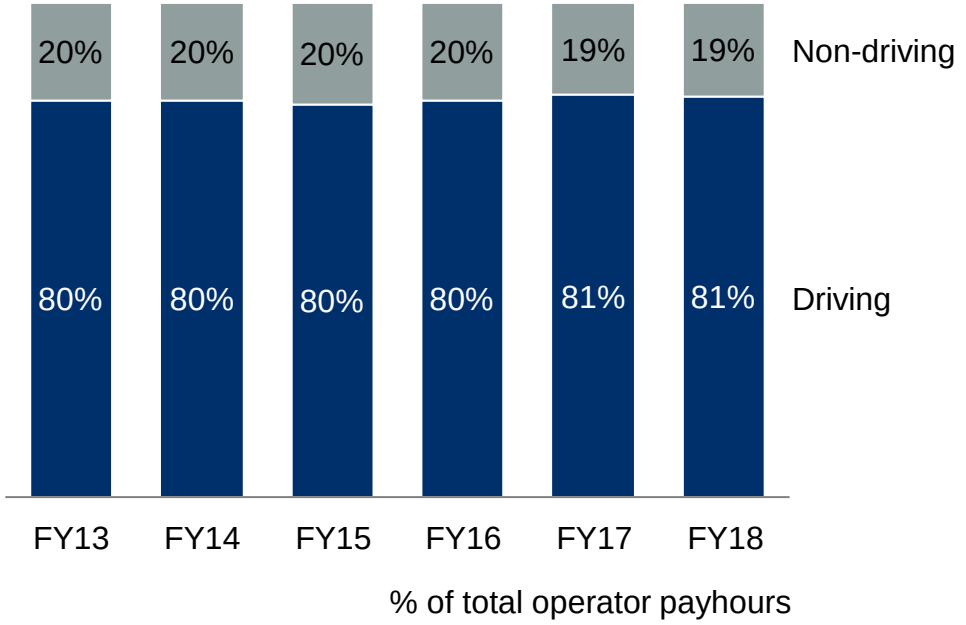
Source: WMATA Bus Modal FY12-17 P&L Expense by Category; Metrobus Operator Payhour Data

Non-driving hours have remained flat over the past 5 years

Metrobus operator payhours by activity, FY2013-FY2018

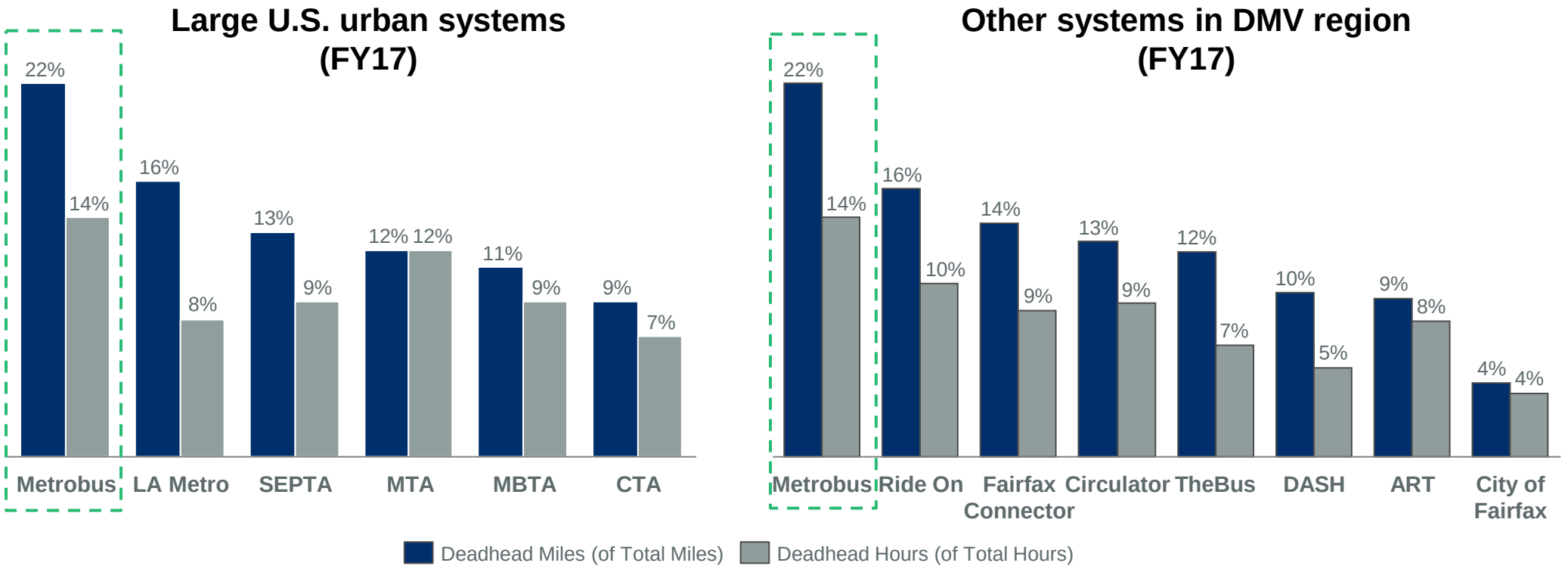


Metrobus operator driving vs. non-driving payhours, FY13-FY18



Source: WMATA FY12-19 budget books, Bus modal P/L, operator payhour data

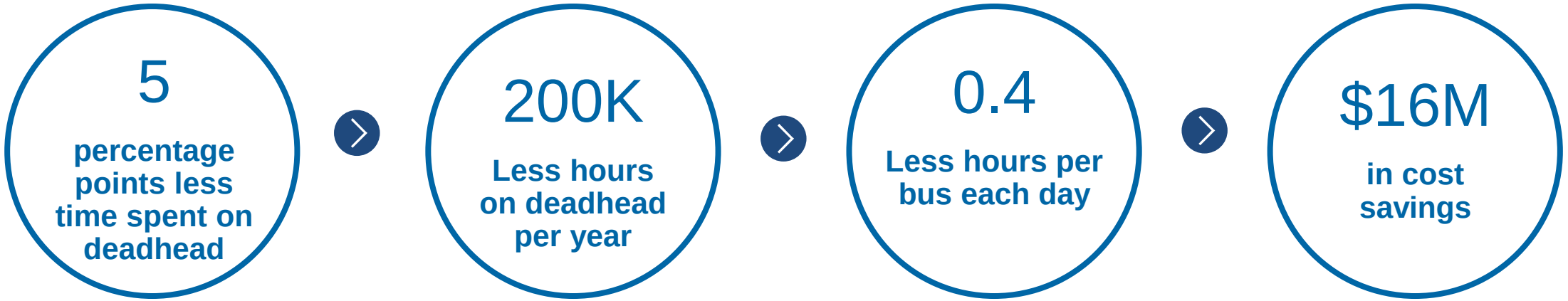
Metrobus spends more hours and miles on deadhead than any other large system or regional peer



Deadhead is largely attributed to the location of bus garages, often driven by jurisdictional decisions, and it was found that WMATA's bus garages are located further from routes than most other transit agencies.

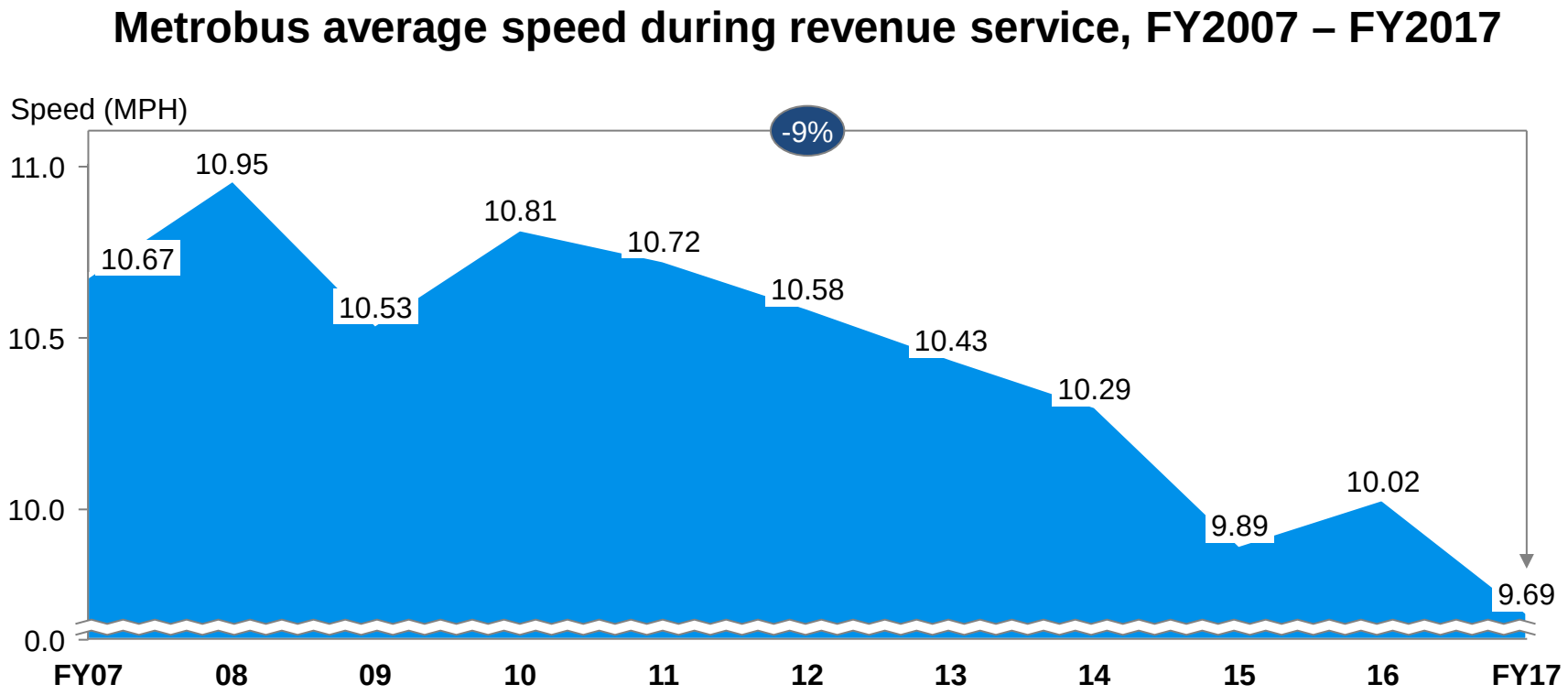
Source: MWCOG 2018 Regional Bus Service Provision Study. National Transit Database.

If Metrobus reduced deadhead to median of peer urban systems (9% of hours) could save $16 million annually



Note: Assume total number of service hours remain constant. Cost savings come from reduction in operator payhours, overtime, associated fringe and fuel or an approximate rate of $81 per hour. Of 4.3M annual platform hours in 2017, 14% to 9% of total platform hours spent on deadhead, represents shift from ~600K hours to ~400K hours on deadhead. Source: WMATA FY12-19 budget books. National Transit Database.

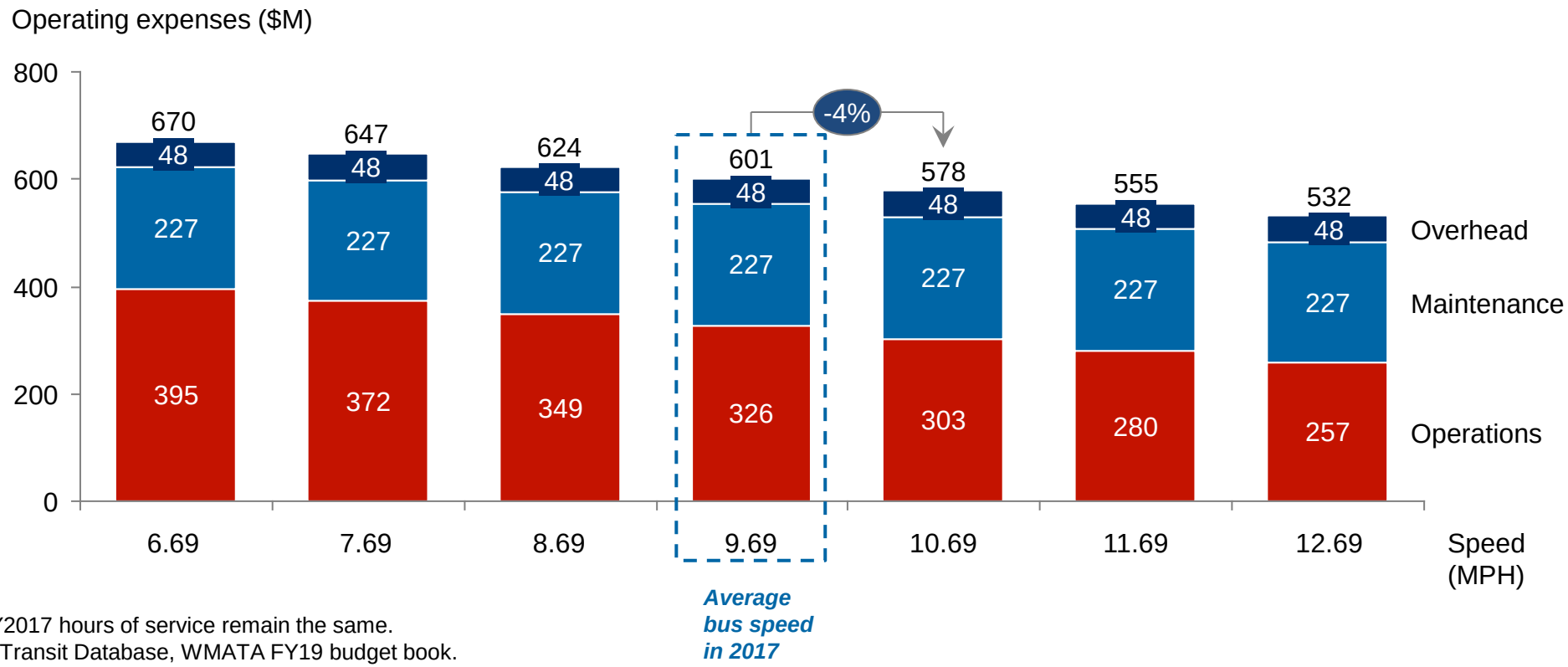
Since 2007, average bus service speed has declined 9% or 1 mile per hour



Source: National Transit Database, WMATA FY19 budget book.

Increasing average bus speed by 1 mile per hour has the potential to decrease operating costs by 4%

Potential operating cost projections at various average bus speeds, FY2017



Note: Assume FY2017 hours of service remain the same.
Source: National Transit Database, WMATA FY19 budget book.

Potential operating cost projections with changes in average speed during revenue service

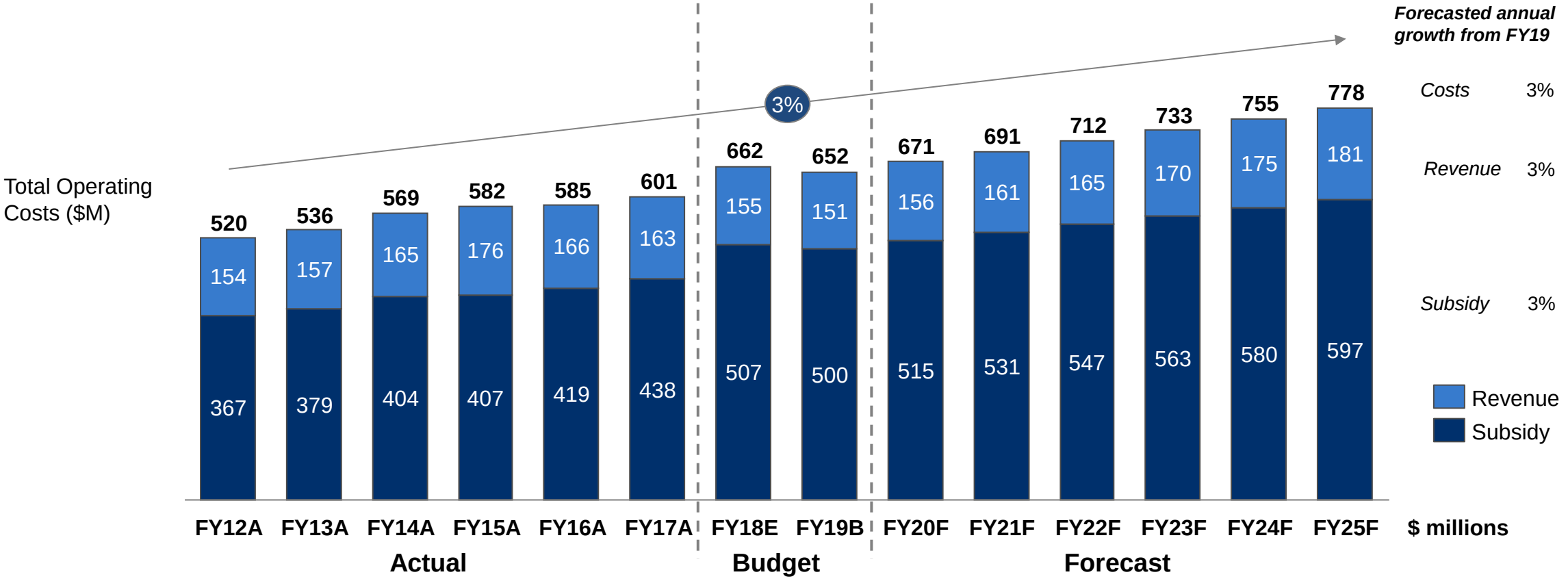
Speed	*9.69 MPH*	*10.69 MPH*	One mile per hour increase in average travel speed
Cost categories	FY2017 Actual ($M)	FY2017 Potential ($M)	Explanation
Revenue miles	*38.4 M*	*38.4 M*	Assume same hours of service and route network
Revenue hours	*3.96 M*	*3.56 M*	10% reduction in hours needed to provide service
Operator cost per revenue hour	*$62*	*$62*	Includes average wage of $28 plus fringe, deadhead loss and non-driving time payhours
Rev. mile operator expense	246	221	10% savings from reduction in revenue hours
Other operations expense	13	12.7	Negligible fuel cost savings (~$0.3M) from reduction in deadhead miles
Other operations expense	87	91	No change
Maintenance	227	227	No change
Overhead	48	48	No change
Total	**601**	**578**	

Note: Assume FY2017 hours of service remain the same.
Source: National Transit Database, WMATA FY19 budget book.

Metrobus Financial Sustainability

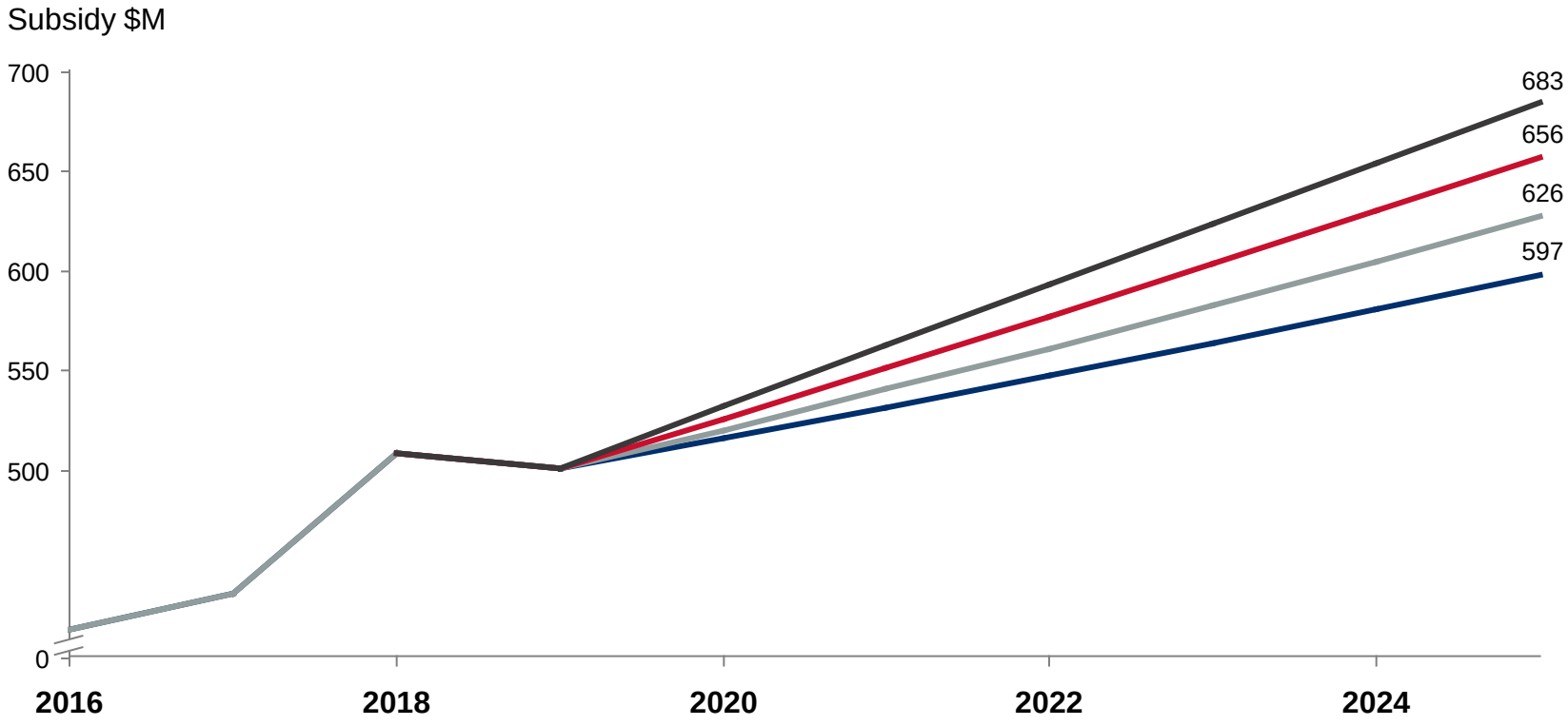
- Financial Situation
- Revenue sources & trends
- Cost drivers & trends
- Impact of subsidy growth cap

If costs continue to grow at 3%, revenue has to grow at same rate to meet 3% operating subsidy growth cap



Note: FY18 budget increase in costs due to reduction in FTA grant funding for bus preventative maintenance, which shifts costs from the capital to operating budget, and inflation in contract maintenance costs. FY19 budget decrease due to reduction in allocated overhead costs. Assume base fare remains $2.00 and average fare per customer remains at $1.24 per FY19 budget.
Source: WMATA FY12-19 budget books. BCG forecast.

Even if ridership is stabilized, with current cost structure and service levels, subsidy growth will exceed 3%



	Ridership growth	Subsidy growth p.a.
683	-9% (1 yr trend)	5.3%
656	-4% (5 yr trend)	4.6%
626	0% (flat)	3.8%
597	4% (meet subsidy cap)	3.0%

If fares remain at $2.00 and fare revenue stays flat, will need >4% p.a. passenger growth to meet cap

Note: Assume base fare remains at $2.00 and average actual fare per passenger is $1.24 per FY19 budget. Maintain non-passenger revenue (i.e. advertising, leases, etc.) at $14M per FY19 budget.
Source: WMATA FY12-19 budget books, BCG forecast.

Any 3% cap scenario requires shift from today's trends

If ridership does not grow, will require fare increase and/or cost cuts

Potential scenarios to achieve 3% cap based on projected trends in ridership	Ridership	Personnel costs	Non-personnel costs	Fares
Ridership growth only	+4% ↑	3% –	3% –	$2.00 –
Raise fares under stable ridership	flat –	3% –	3% –	$2.49 ↑
(5 year trend) Raise fares	-4% ↓	3% –	3% –	$3.06 ↑
(5 year trend) Limit personnel costs growth	-4% ↓	1.3% ↓	3% –	$2.00 –
(5 year trend) Limit non-personnel cost growth	-4% ↓	3% –	-4.8% ↓	$2.00 –
(1 year trend) Raise fares	-9% ↓	3% –	3% –	$4.00 ↑
(1 year trend) Limit personnel costs growth	-9% ↓	0.5% ↓	3% –	$2.00 –

Note 1: Assume base fare remains at $2.00 and average actual fare per passenger is $1.24 per FY19 budget. Maintain non-passenger revenue (i.e. advertising, leases, etc.) at $14M per FY19 budget.
Note 2: Arrows represent improvement or deterioration to ridership, baseline 3% cost growth, or current $2.00 fare. Percentages are per annum from FY19 to FY25.