RIDE ON BUS FLEET MANAGEMENT PLAN

2020 – 2030

June 2021

Version 1.1

Montgomery County Department of Transportation

Division of Transit Services

Rockville, Maryland

MCDOT Montgomery County Department of Transportation

Plan Approval

The Montgomery County Bus Fleet Management Plan (BFMP) 2020 – 2030 provides information about the current Ride On fleet, operational analysis, and planned service modifications that will affect the fleet operation. This Plan was prepared with input from the Montgomery County Department of Transportation (MCDOT) and the Montgomery County Department of General Services (MCDGS). The BFMP may be updated as needed to reflect changes in the County's transit fleet procurements, policies, or services.

I have received, considered, and approve the Montgomery County Bus Fleet Management Plan (BFMP) 2020 – 2030

_____ _____

Christopher Conklin, Director **Date**

Montgomery County Department of Transportation

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS/DEFINITIONS

The following acronyms are used within this document.

APTA	American Public Transportation Association
BEB	Battery Electric Bus
BFMP	Bus Fleet Management Plan
BRT	Bus Rapid Transit
CNG	Compressed Natural Gas
DFMS	Division of Fleet Management Services
EMTOC	Equipment Maintenance and Transit Operating Center
FTA	Federal Transit Administration
MARC	Maryland Area Regional Commuter
MCDGS	Montgomery County Department of General Services
MCDOT	Montgomery County Department of Transportation
MDOT MTA	Maryland Department of Transportation Maryland Transit Administration
MDOT SHA	Maryland Department of Transportation State Highway Administration
NTD	National Transit Database
RFI	Request for Information
TIGER	Transportation Infrastructure Generating Economic Recovery
TNC	Transportation Network Company
TSP	Transit Signal Priority
VOMS	Vehicles Operated in Maximum Service
WMATA	Washington Metropolitan Area Transit Authority
ZEB	Zero Emissions Bus

DOCUMENT RECORD

Version	Issuance Date	Description
1	May 5, 2021	2020 - 2030 BFMP Version 1.0
1.1	June 30, 2021	2020 - 2030 BFMP Version 1.1, revised for updated capital funding

EXECUTIVE SUMMARY

1. INTRODUCTION

The Montgomery County Bus Fleet Management Plan (BFMP) 2020 – 2030 is intended to provide information about the current Ride On fleet, operational analysis, and planned service modifications that will affect the fleet operation. This Plan was prepared with input from the Montgomery County Department of Transportation (MCDOT) and the Montgomery County Department of General Services (MCDGS).

The foundation of this plan is based on current data. It is dynamic and should be updated routinely based on changes in ridership demand, bus operations and fleet conditions. The plan includes:

- Current and projected ridership
- Peak vehicle requirements for average weekday, projected through the study period of the plan. Peak vehicle requirements indicate the number of vehicles needed to meet the greatest passenger demand.
- Average age and composition of the fleet
- Vehicle retirements and procurement plans
- Review of maintenance facilities, including age and capacity
- Maintenance practices, service quality and reliability indicators
- Indicators used to measure service quality and reliability

1.1 Plan Overview and Time Frame

In 2014, Montgomery County developed a Ride On Fleet Management Plan to serve as a guide for the agency in identifying its fleet and facility requirements. The BFMP was updated in 2017. This 2020 BFMP update explores demographic changes behind changing ridership, evaluates zero emission bus plans, identifies near-term requirements, system improvements, and vehicle replacements. The BFMP considers the transit fleet, existing and changing transit operations and related facility needs.

This Ride On Bus Fleet Management Plan covers the period 2020 – 2030. It contains the following:

Section 1: Introduction – Provides the Plan overview along with a listing of related studies.

Section 2: Montgomery County Transit Services Overview – Describes the current transit services in Montgomery County including Ride On, the Washington Metropolitan Area Transit Authority (WMATA) Metrobus and Metrorail services, and the Maryland Department of Transportation Maryland Transit Administration's (MDOT MTA) Commuter Bus and MARC commuter rail services.

Section 3: Ride On Fleet and Vehicle Maintenance – Details the Ride On fleet and maintenance performance.

Section 4: Zero Emission Buses and Fleet Composition – Describes the County's plans for introducing zero emission buses and related infrastructure.

Section 5: Maintenance Facilities – Outlines the three Montgomery County facilities where vehicle maintenance is performed.

Section 6: Fleet Acquisition – Documents the prior fleet acquisition and currently planned procurements.

Section 7: Future Facility Needs – Identifies the needs for facilities improvements and other capital investments.

Section 8: Infrastructure and Maintenance Needs – Describes the County's goals, planned infrastructure and overall maintenance needs.

Section 9: Peer Review – Using the Federal Transit Administration's (FTA) 2018 National Transit Database (NTD) compares Ride On performance to four Washington, D.C. area transit systems and four peer systems.

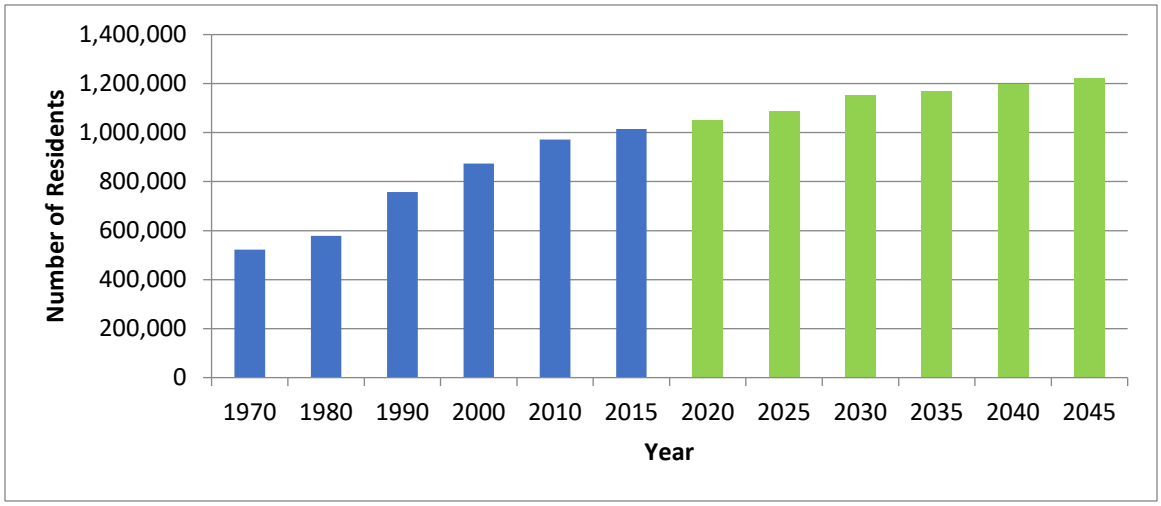
1.2 Montgomery County Overview

Montgomery County is a Maryland suburb of Washington, D.C. located to the northwest of the District. It has been the most populous Maryland county since 1990 with a 2018 population of 1,052,567 – an 8.3 percent increase over the 2010 census figures.[1]

Between 1990 and 2017, Montgomery County experienced rapid growth. The pace at which the population is forecasted to grow has slowed. Figure 1 illustrates the actual and projected population.

The Ride On bus system is an integral part of the County's infrastructure and resources. Ride On is the second largest bus operation in the State, next to Maryland Department of Transportation (MDOT) Maryland Transit Administration (MTA), and the second largest in the Washington Metropolitan Area.

Figure 1: Montgomery County Actual and Forecasted Population



Source: Montgomery Planning; Montgomery County Trends – January 2019; 1940-2010 Census, U.S. Census Bureau; Washington Council of Governments Cooperative Forecast Round 9.1, Research and Special Projects.

[1] U.S. Census Bureau Quick Facts; Population; Montgomery County, Maryland

1.3 Related Studies

Montgomery County Strategic Transit Plan, March 2004 – This strategic transit plan was intended to guide the development of the County's transit services, facilities, and policies. The purpose of the Plan was to advance "Go Montgomery" (2002), a comprehensive package of transit, highway, pedestrian and bicycle initiatives. The Plan defined transit as "one of the keys to addressing the increasing traffic congestion in the region. Montgomery County has long recognized the value of transit and has worked with state and local agencies to build one of the most successful, effective transit networks in the United States."[2] The main goal of the Plan was to assess the Ride On system and guide the County in improving it by focusing on operations and facilities. In defining purpose and need for improved transit in the County, the Plan noted that along with increasing population and employment, trip type and distribution were changing as well.

The Plan was updated in 2008. This effort was undertaken to take a "comprehensive look at transit operations and facilities in the County and long-range actions for the future (2020)."[3] The Plan called for the County to look at future transit within the context of the overall network, incorporating WMATA, MDOT MTA, Ride On, proposed Bus Rapid Transit (BRT) (including the Corridor Cities Transitway – CCT), the Purple Line, and ancillary facilities. It also evaluated bus storage facilities, the transit fleet, and bus service needs.

Among the key challenges cited in the Plan were facilities, availability of buses, impact of congestion on service reliability, and fiscal constraints. At the time the study was completed, with population growth anticipated to exceed one million residents and continued ridership growth projected, the Plan's 2020 vision called for bus facility capacity for 600 buses. The Plan called for construction of a North County garage by 2012, a new/relocated Equipment Maintenance and Transit Operating Center (EMTOC) by 2013 and expansion of the North County garage to full 250 vehicle capacity by 2017. The Plan also addressed the transit fleet, park and ride facilities, customer service, and passenger facilities.

North County Maintenance Depot Study, February 2008 – In 2007 the County's Department of Public Works and Transportation initiated a planning and design study for a 250 bus North County Maintenance Depot. Although the County purchased the property and completed the design, the project was cancelled due to Ten Mile Creek watershed environmental concerns.

Bus Fleet Management Plan 2014 – The Ride On Bus Fleet Management Plan 2013 – 2020 (BFMP) was prepared in 2014 as a cooperative effort of the MDOT MTA, MCDOT and MCDGS. The BFMP 2014 provided information about and analysis of the Ride On fleet. It made recommendations for fleet and facility investments required to support the projected growth and management of the fleet.

Montgomery County Maintenance Strategic Plan 2017 - The Montgomery County Maintenance Strategic Plan 2017 evaluated the Ride On bus needs and developed a series of management briefings. Bus requirements were estimated by bus size and corridor for 2017 to 2030.

Ride On Bus Fleet Management Plan 2017 – 2025 – During FY2017, the County added local and express services in the I-270 corridor from Clarksburg to the Shady Grove Metrorail. In 2017, the limited stop **Ride On ext*R*a** began operating in the MD355 corridor and in early 2018 limited stop service began in the US29 corridor. With USDOT TIGER Grant funding to support it, the Flash on US 29 BRT began service in 2020.

[2] Montgomery County Strategic Transit Plan, March 2004

[3] Montgomery County Strategic Transit Plan, September 2008

With the County's continued transit investment, the bus fleet including a 20 percent spare ratio, was anticipated to grow from 348 to 501 buses by 2025. The Plan recognized that the County's maintenance facility capacity was a constraint to the growth of the Ride On service. It indicated that with the planned fleet expansion and the introduction of articulated buses, the County would need to plan for renovations, expansion, and replacement of existing facilities.

2. MONTGOMERY COUNTY TRANSIT SERVICE OVERVIEW

MCDOT operates the Ride On fixed route bus system, the Commuter Services program that promotes alternative options to driving alone, and the Call-n-Ride program for senior citizens and Medicaid recipients. WMATA operates the Metrorail Red Line as well as Metrobus routes in Montgomery County. The MDOT MTA provides services in the County operating the MARC Brunswick commuter rail services and Commuter Bus services. The Bethesda Urban Partnership operates the Bethesda circulator. Figure 2 illustrates the County's public transit network.

2.1 Montgomery County Department of Transportation Programs

The County's Department of Transportation Division of Transit Services manages three primary programs:

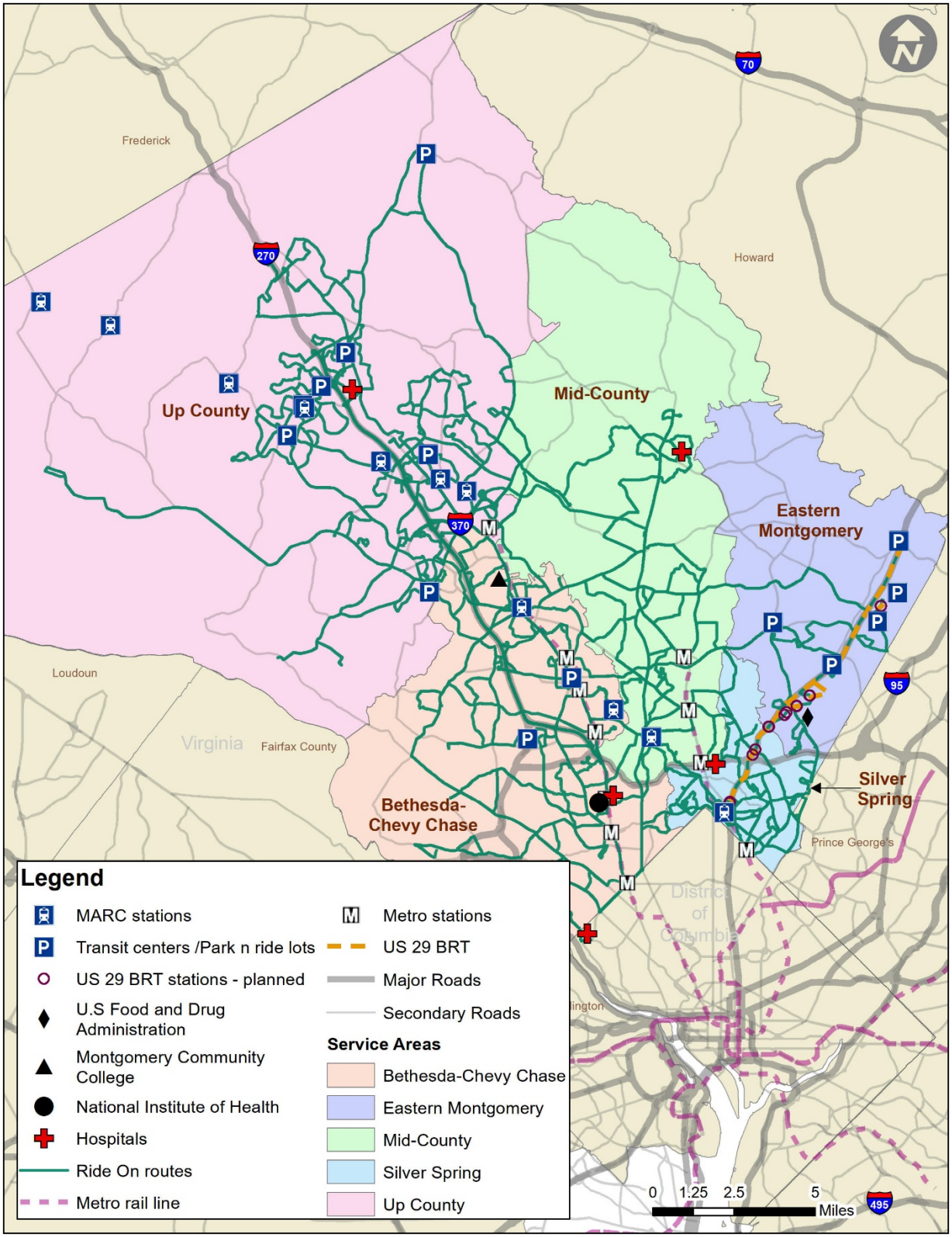
1. Transit Services – The Ride On system is a fixed route system that operates primarily in neighborhoods. It acts as a feeder system to major transfer points and transit centers in the County. This service is intended to support and complement WMATA's Metrorail and Metrobus services. In 2019 Ride On operated 79 routes, 1,176,642 platform hours, and carried 24,806,348 passengers. One route was also operated through a contractual agreement.

2. Commuter Services - This program promotes the use of transit, car/vanpooling, biking, walking, and teleworking. The services are concentrated in five Transportation Management Districts: Silver Spring, Friendship Heights, North Bethesda, Greater Shady Grove, and the Wheaton Transportation Planning and Policy area.

3. Mobility Services – These services provide Medicaid transportation to eligible riders and a user-side subsidy program known as Call-n-Ride that provides transportation for low income, elderly, and people with disabilities.

Additionally, MCDOT Division of Transit Services is responsible for seven support programs including passenger facilities, taxi regulation, customer service, transit planning and implementation, transit parking facility maintenance, fixed costs and administration.

Figure 2: Ride On Transit Services



2.2 Ridership and Service History

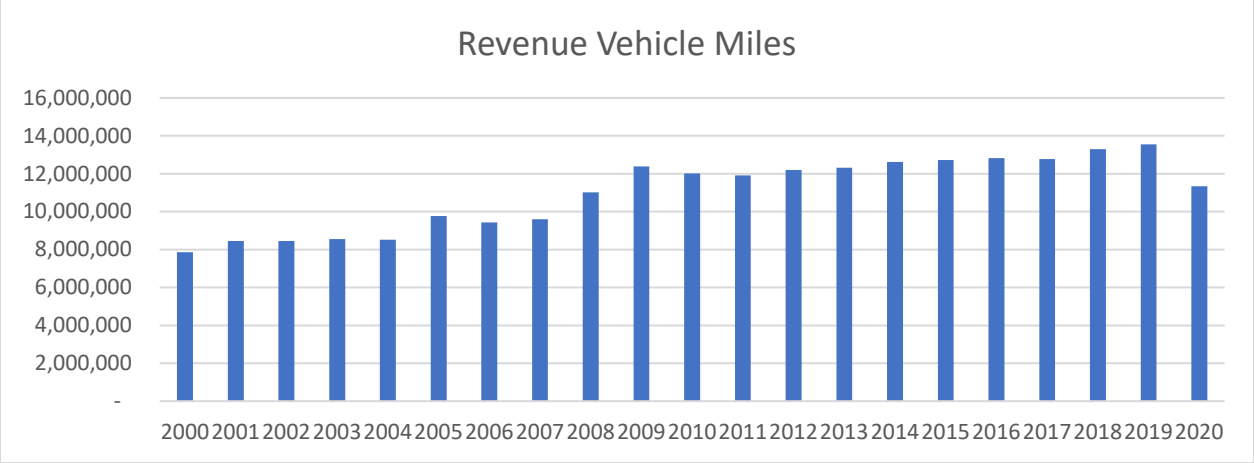
From 2000 to 2008, Ride On experienced ridership growth of 46 percent, an average of 4.8 percent per year. But, beginning in 2009 ridership began to decline. Between the all-time high in 2008 and 2018 ridership fell by 27.45 percent. There are many factors that impacted the ridership demand including, fare increases, reductions in transit services, Metrorail service disruptions, the decreasing cost of gasoline and demographic changes. Figure 3 represents the ridership trend from FY2000 to FY 2020.

Figure 3: Ride On Unlinked Passenger Trips

Source: National Transit Database - FY2018 Time Series and FY2020 Monthly Reports

Figure 4 shows annual revenue vehicle miles as reported to the National Transit Database (NTD). Between 2000 and 2018, Ride On increased the vehicle miles traveled by 31%. However, between 2008 and 2011 Ride On reduced service due to limited operating funding, and vehicle miles decreased by 7.5%. Since 2011, revenue miles have increased by 7.6 %. During FY2020 revenue miles decreased by 16.3% as a result of decreased services during the Covid-19 pandemic.

Figure 4: Ride On Revenue Vehicle Miles



Source: National Transit Database - FY2018 Time Series and FY2020 Monthly Reports

2.3 Service Summary

Table 1, the Ride On Weekday Service Summary, contains information about each route, the average weekday ridership, the number of daily revenue hours operated, and the riders per revenue hour of service. On an average weekday, Ride On typically operates 2,689 revenue hours of service and carries 80,743 passengers.

Table 1: Ride On Weekday Service Summary – FY2020

Route	Route Description	Route Type	Average Weekday Riders	Daily Revenue Hours	Riders Per Revenue Hour
1	Silver Spring-Leland St.-Friendship Heights	Local	1208	34.9	25.1
2	Lyttonsville-Silver Spring	Local	863	15.2	34.8
4	Kensington-Fort Detrick Annex-Silver Spring	Local	213	12.9	11.5
5	Twinbrook-Kensington-Silver Spring	Local	1952	64.6	24.9
6	Parkside-Grosvenor- Montgomery Mall Loop	Loop	291	18.0	11.5
7	Forest Glen-Wheaton	Local	52	2.5	11.8
8	Wheaton-Forest Glen-Silver Spring	Local	723	34.6	16.9
9	Wheaton-Four Corners-Silver Spring	Local	1539	34.1	32.5
10	Twinbrook-Glenmont-White Oak-Hillandale	Local	2916	70.7	35.3
11	Silver Spring-East/West Hwy-Friendship Heights	Ltd	671	14.4	34.6
12	Takoma-Flower Avenue-Wayne Avenue-Silver Spring	Local	1724	40.0	31.4
13	Takoma-Manchester Rd.-Three Oaks Dr.-Silver Spring	Local	295	10.8	21.9
14	Takoma-Piney Branch Road-Franklin Ave.-Silver Spring	Local	733	27.9	20.4
15	Langley Park-Wayne Ave.-Silver Spring	Local	3813	45.4	55.2
16	Takoma-Langley Park-Silver Spring	Local	3558	86.3	34.0
17	Langley Park-Maple Ave.-Silver Spring	Local	1407	31.9	32.1
18	Langley Park-Takoma-Silver Spring	Local	641	32.6	14.7
19	Northwood-Four Corners-Silver Spring	Local	109	6.9	12.2
20	Hillandale-Northwest Park-Silver Spring	Local	2903	71.8	32.8
21	Briggs Chaney-Tamarack-Dumont Oaks-Silver Spring	Local	302	13.0	19.8
22	Hillandale-White Oak-FDA-Silver Spring	Local	495	21.0	18.2
23	Sibley Hospital-Brookmont-Sangamore Road-Friendship Heights	Local	553	25.5	16.3
24	Hillandale-Northwest Park-Takoma	Local	213	7.9	21.1
25	Langley Park-Washington Adventist Hosp-Maple Ave-Takoma	Local	467	14.3	21.5
26	Glenmont-Aspen Hill-Twinbrook-Montgomery Mall	Local	3409	95.5	30.5
28	Silver Spring Downtown (VanGo)	Loop	901	25.1	24.9
29	Bethesda-Glen Echo-Friendship Heights	Local	546	28.0	13.9
30	Medical Center-Pooks Hill-Bethesda	Local	626	30.0	15.1
31	Glenmont-Kemp Mill Rd.-Wheaton	Local	113	8.1	9.4
32	Naval Ship R&D-Cabin John-Bethesda	Local	209	12.1	13.0
33	Glenmont-Kensington-Medical Center	Local	241	20.9	9.7
34	Aspen Hill-Wheaton-Bethesda-Friendship Heights	Local	2609	72.8	29.5
36	Potomac-Bradley Blvd.-Bethesda	Local	310	20.9	14.8
37	Potomac-Tuckerman La.-Grosvenor-Wheaton	Local	231	14.7	15.7
38	Wheaton-White Flint	Local	736	28.3	26.0

Route	Route Description	Route Type	Average Weekday Riders	Daily Revenue Hours	Riders Per Revenue Hour
39	Briggs Chaney-Glenmont	Local	350	14.4	24.3
41	Aspen Hill-Weller Rd.-Glenmont	Local	574	16.5	34.8
42	White Flint-Montgomery Mall	Local	343	33.0	10.4
43	Traville TC-Shady Grove-Hospital-Shady Grove	Local	729	29.9	24.4
44	Twinbrook-Hungerford-Rockville	Local	122	8.3	14.7
45	Fallsgrove-Rockville Senior Center-Rockville-Twinbrook	Local	868	48.1	18.0
46	Montgomery College-Rockville Pike-Medical Center	Local	2644	92.1	28.7
47	Rockville-Montgomery Mall-Bethesda	Local	1587	53.0	29.9
48	Wheaton-Bauer Dr.-Rockville	Local	1695	49.5	34.2
49	Glenmont-Layhill-Rockville	Local	1856	43.5	42.7
51	Norbeck P&R-Hewitt Ave.-Glenmont	Local	236	10.0	23.6
52	MGH-Olney-Rockville	Local	111	13.3	8.3
53	Shady Grove-MGH-Olney-Glenmont	Ltd	253	29.2	8.7
54	Lakeforest-Washington Blvd-Rockville	Local	1680	55.0	30.5
55	GTC-Milestone-MC, G-Lakeforest-Shady Grove-MC,R-Rockville	Local	4932	138.6	35.6
56	Lakeforest-Quince Orchard-Shady Grove Hospital-Rockville	Local	1689	67.9	24.9
57	Lakeforest-Washington Grove-Shady Grove	Local	1577	41.1	38.4
58	Watkins Mill & MD355 - Lakeforest-Montgomery Village-East Village-Shady Grove	Local	1466	46.9	31.3
59	Montgomery Village-Lakeforest-Shady Grove-Rockville	Local	2834	83.0	34.1
60	Montgomery Village-Flower Hill-Shady Grove	Ltd	233	7.6	30.7
61	GTC-Lakeforest-Shady Grove	Local	2570	65.1	39.5
63	Shady Grove-Gaither Road-Piccard Dr.-Rockville	Local	676	26.0	26.0
64	Montgomery Village-Quail Valley-Emory Grove-Shady Grove	Local	1300	40.2	32.3
65	Montgomery Village-Shady Grove	Ltd	119	4.3	27.6
66	Shady Grove-Piccard Drive-Shady Grove Hospital-Traville TC	Local	132	5.2	25.4
67	Traville TC-North Potomac-Shady Grove	Local	125	6.7	18.7
70	Milestone-Medical Center-Bethesda Express	Express	851	40.1	21.2
71	Kingsview-Dawson Farm-Shady Grove	Ltd	209	8.4	24.9
73	Clarksburg-Old Baltimore-Shady Grove	Express	166	18.8	8.8
74	GTC-Great Seneca Hwy.-Shady Grove	Local	1246	42.1	29.6
75	Correctional Facility-Clarksburg-Milestone-GTC	Local	645	39.7	16.3
76	Poolesville-Kentlands-Shady Grove	Local	571	32.3	17.7
78	Kingsview-Richter Farm-Shady Grove	Ltd	208	8.9	23.4
79	Clarksburg-Skylark-Scenery-Shady Grove	Ltd	224	12.3	18.2
81	Rockville-Tower Oaks-White Flint	Local	116	12.0	9.7
83	Germantown MARC-GTC-Waters Landing-Milestone-Germantown	Local	461	42.6	10.8
90	Damascus-Woodfield Rd- Airpark-Shady Grove	Local	797	48.5	16.4
96	Montgomery Mall-Rock Spring-Grosvenor	Loop/	387	18.3	21.1

Route	Route Description	Route Type	Average Weekday Riders	Daily Revenue Hours	Riders Per Revenue Hour
		Local			
97	GTC, Germantown MARC, Waring Station, GTC	Loop	773	19.3	40.1
98	GTC, Kingsview, GCC, Cinnamon Woods	Local	550	29.8	18.5
100	GTC-Shady Grove	Express	2114	42.8	49.4
101	Lakeforest-Montgomery College-Rockville-Medical Cntr	extRa	2146	91.1	23.6
129	Burtonsville-White Oak-Silver Spring	Limited stop	885	48.4	18.3
301	Rockville-Shady Grove Hospital-Tobytown	Contracted	117	11.6	10.1
	Total - 78 routes		80,743	2,689	30.0

Ride On alters bus schedules three times a year in January, May, and September. The vast majority of the modifications are changes to running time to improve schedule adherence. Since the last update of the Montgomery County Fleet Management Plan, Ride On made the following noteworthy changes to their services:

- In September 2017, the following changes were implemented:
  - The Routes 3, 93, and 94 were discontinued due to low ridership
  - Sunday service on the Route 55 was extended to Rockville.
- In May 2018, new service began on the Route 129. This is a limited-stop rush hour service that operates on weekdays from 5:30 to 9 a.m. and from 3 to 7 p.m. along US 29, providing service every 15 minutes between Burtonsville and the Silver Spring Transit Center.
- In September 2018, Ride On made improvements to the following routes:
  - Route 90 – New midday service on weekdays to Milestone and new service to the Clarksburg community via Skylark Road, Newcut Road and Snowden Farm Parkway
  - Route 76 – New service on Saturdays between Shady Grove Station and Quince Orchard High School
  - Route 43 – New service on Sundays between Shady Grove Station and Traville Transit Center and Shady Grove Hospital
  - Route 101 – New stop at Templeton Place and Rockville Pike; service operates every 10 minutes from 5:30 – 9:30 a.m. and 3:30 – 7:30 p.m.
  - Route 30 – Service extended with the addition of 10:10 p.m. and 10:40 p.m. trips
  - Route 58 – Early afternoon service added to and from Multi-Agency Service Park on Turkey Thicket Drive
  - Route 64 – Service runs later all days; service starts earlier on Saturday
- In October 2018 additional trips were added to the Route 301 to and from the Glenstone Museum
- In June 2019, Ride On Flex, on-demand bus service, began providing service in and around Rockville, Glenmont, and Wheaton using new, 11-passenger cutaway buses. Passengers are able to request a bus using a new mobile app
- In September 2019, service on the Nos. 26, 38, and 59 routes was reduced due to decreased ridership as follows:
  - Route 26 – Headways during rush hour changed from 15 to 20 minutes
  - Route 38 – Headways changed from 20 and 25 minutes to 30 minutes
  - Route 59 – Headways changed from 15 to 20 minutes

- In January 2020, the following Clarksburg routes changed:
    - Route 75 – The route operates as a loop serving Snowden Farm Parkway to Little Seneca Parkway, to Newcut Road and back.
    - Route 90 – The new routing continues on Ridge Road to Little Seneca Parkway, Snowden Farm Parkway, Ridge Road, Brink Road, Seneca Crossing Drive, Scottsbury Drive, Shakespeare and Observation Drive.

During the Covid-19 pandemic, MCDOT altered service beginning in mid-March 2020. Fare collection for Ride On bus service was temporarily suspended. Customers were directed to board through rear doors. Ride On buses operated 35 routes according to their Essential Service Plan. Although service is returning to pre-Covid-19 schedules, ridership is not expected to return to prior levels until a vaccine is widely distributed and employment returns.

2.4 Factors Affecting Ride On Ridership

Over the past decade Ride On, like other transit agencies, has experienced ridership decline. In the Washington, D.C. market the obvious reasons are low gasoline prices, decline in federal employment and government shutdowns, increased telecommuting and Metrorail service problems. The aging population and decline in the working age population as a percent of the total population may also play a significant part in declining ridership.

2.4.1 Demographic Change - Aging Population

Demographic changes over the past 10 years, especially growth in the 65+ population, may have played a significant part in the ridership decline and should be considered in future service planning.

Age group estimates published by the Maryland Department of Planning are shown in Table 2. From 2010 to 2020, Montgomery County added 80,250 residents or 8.3%. During that period the working age population ages 25 to 64 increased by 25,818 (4.7%) while the senior population age 65 and older increased by 46,502 (38.8%).

For Ride On the senior population comprises an important and growing ridership group. In the 2014 Ride On on-board survey riders age 65+ were 4.2% of riders while in the 2018 Ride On on-board survey riders age 65+ were 6.7% of riders. The problem is not the growth in senior riders, which is itself a good thing, but is the decline in working age riders from 67.4% to 65.6%. Working age riders use the bus service more frequently than riders 65+ as shown in Table 2 so the gradual aging of the population will result in lower total ridership.

Table 2: Montgomery County Population by Age

Age group	Less than 10 years old	10 to 19 years old	20 to 24 years old	25 to 64 years old	65 years old and older	Total
2010	128,032	124,525	54,031	545,420	119,769	971,777
2020	130,917	130,926	52,675	571,238	166,271	1,052,027
Change 2010 to 2020	2.3%	5.1%	-2.5%	4.7%	38.8%	8.3%
2030	141,224	136,589	57,697	575,271	218,040	1,128,821
Change 2020 to 2030	7.9%	4.3%	9.5%	0.7%	31.1%	7.3%
Source: https://planning.maryland.gov/MSDC/Pages/s3_projection.aspx						

As people age their transit riding habits change with fewer weekly bus rides by seniors and more trips during off-peak hours. The 2018 Ride On-board Survey asked respondents their age group and bus trip frequency. Table 3 shows the result by age group to the question "How often do you use Ride On bus service?" Working-age group riders between 25 and 64 reported 63.1% daily trips compared to 38.6% daily trips by riders 65 years of age and older.

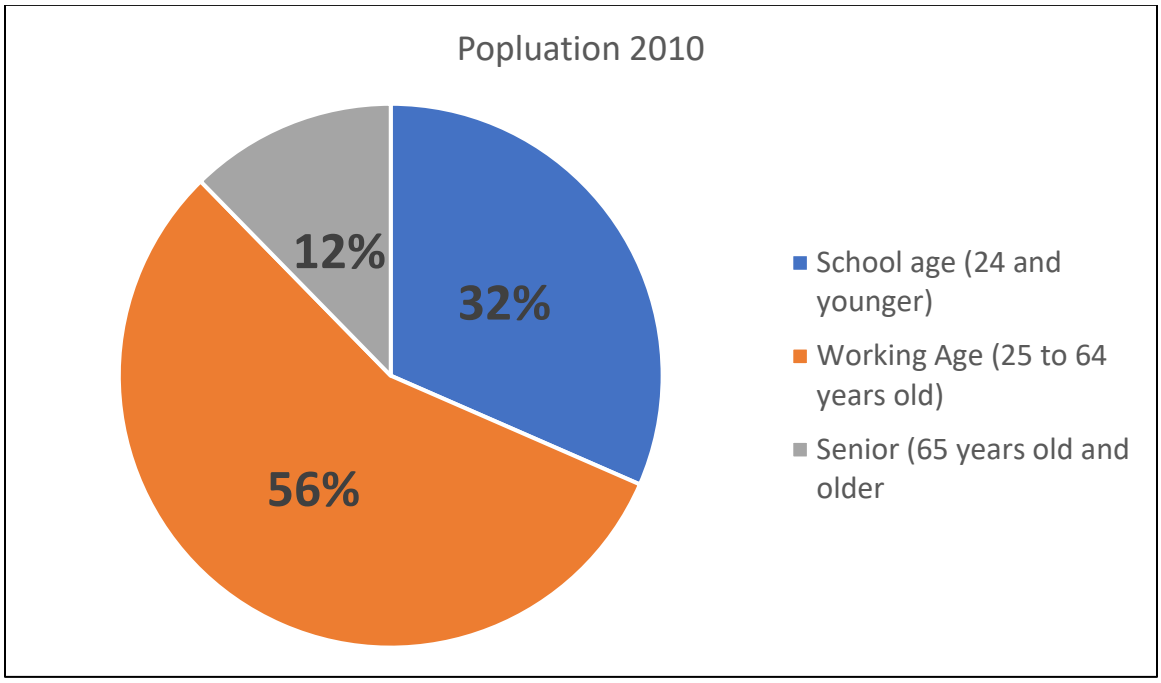
Table 3: Ride On Ridership Frequency by Age Group

2018 Ride On Survey	Age 25 to 64		Age 65+	
Frequency	Responses	%	Responses	%
Daily	3,854	63.1%	291	38.6%
Often	1,464	24.0%	316	41.9%
Occasional	791	12.9%	147	19.5%
Total	6,109	100.0%	754	100.0%
Source: Ride On 2018 On-board Survey				

To illustrate this demographic change Figures 5 and 6 compare Montgomery County's 2010 and 2030 population by age group. In 2010, the Montgomery County population 65 years and older was 12% of the county population while in 2030 the senior demographic is projected to comprise 19% of the population.

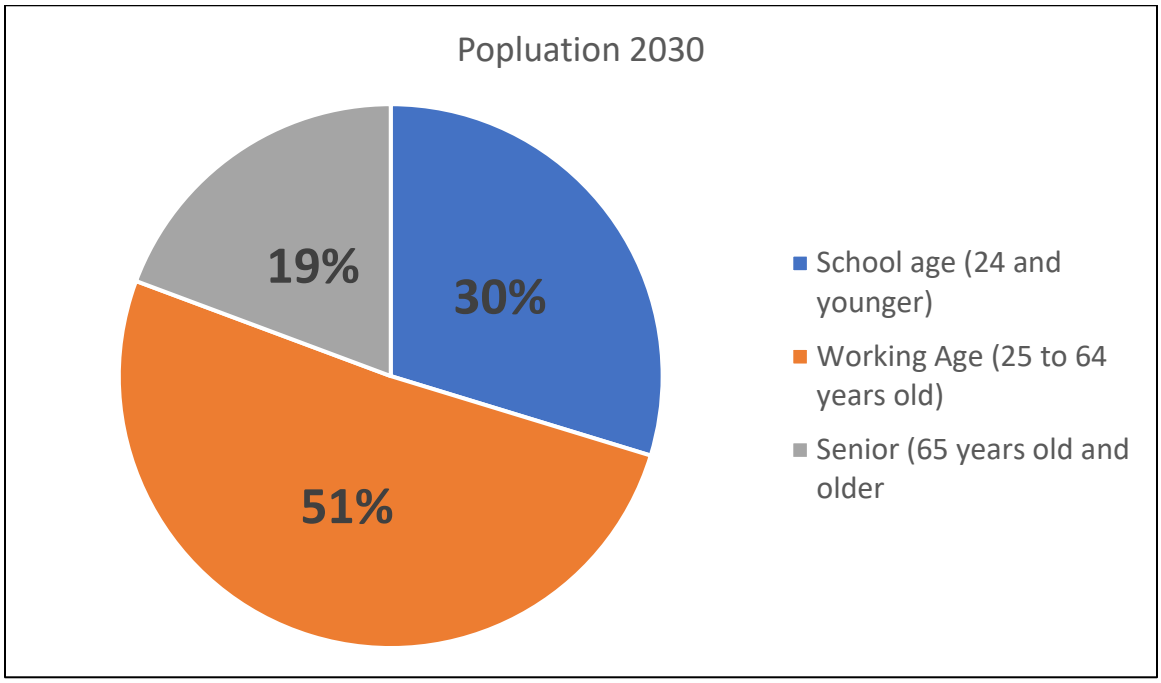
During the 20-year period 2010 to 2030 the county's senior population is projected to grow by 98,000 or 82% and the working age population between 25 and 64 years of age by 30,000 or 5%.

Figure 5: Montgomery County Population by Age Group 2010



Source: https://planning.maryland.gov/MSDC/Pages/s3_projection.aspx

Figure 6: Montgomery County Population by Age Group 2030

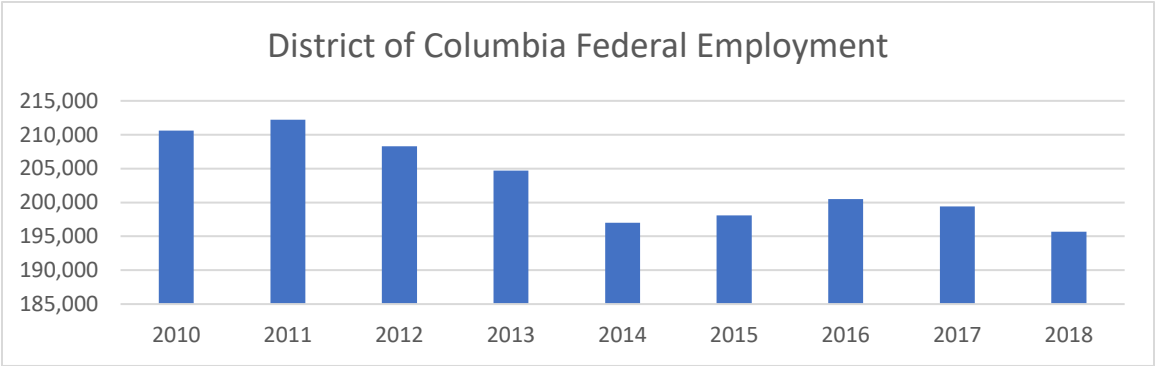


Source: https://planning.maryland.gov/MSDC/Pages/s3_projection.aspx

2.4.2 Federal Employment

The 2018 Ride On Survey reported 13.4% of Ride On riders as federal employees. Consequently, a decline in federal employment in the District of Columbia or a government shutdown is likely to result in lower Ride On ridership. From 2010 to 2018, federal employment in the District of Columbia (Figure 7) as reported by the D.C. Policy Center fell by 7.1%. In addition, during December 2018 and January 2019 there was a 34-day government shutdown or about 10% of the federal employee annual workdays.

Figure 7: District of Columbia Federal Employment



Source:https://www.dcpolicycenter.org/wp-content/uploads/3019/03/Fed-jobs-role-in-DC-economy.png.

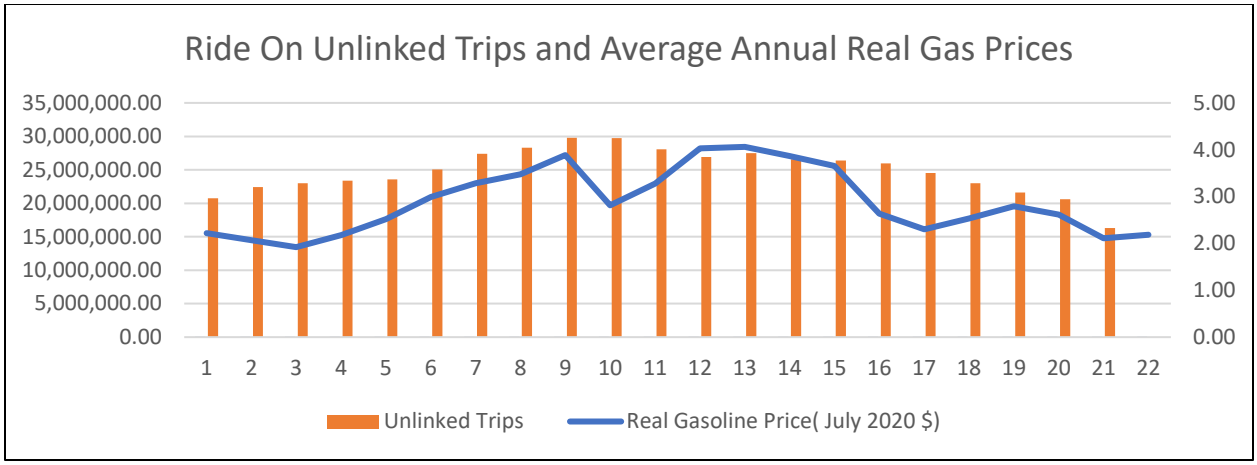
2.4.3 Gasoline Prices

Figure 8 illustrates the direct correlation of gasoline prices and Ride On transit ridership. When the real price (inflation adjusted) of gasoline increased, ridership increased. Conversely, when the gasoline price decreased, ridership declined.

From 2018 to 2020 the average U.S. real price of gasoline has fallen from $2.79 in 2018 to a projected $2.11 in 2020. The U.S. Energy Information Agency is projecting a slight increase in 2021 to $2.19 per gallon.

With low gas prices, Ride On ridership is likely to remain lower than prior periods.

Figure 8: Ride On Annual Unlinked Passenger Trips and Average Annual US Gasoline Prices



Source: US Energy Information Agency Short-Term Energy Outlook Real and Nominal Prices, July 2020

2.4.4 Telecommuting and Mode Share

The U.S. Census American Community Survey one-year estimates for commuting mode are shown for Montgomery County in Table 4. The primary changes from 2010 to 2018 are driving alone increased by 11.5%, walked increased by 25.1% and worked from home increased by 23.3%. The increase in the "drive alone" commuting mode can be attributed to a 15% drop in the real price of gasoline between 2010 and 2018. The increased "walked" share likely demonstrates consumer response to more compact development and the increased "worked at home" share reflects an increased acceptance of remote working in some workplaces. Post Covid-19 the "worked at home" mode share is likely to further increase.

Table 4: Montgomery County Commuting Mode 2010 and 2018

	2010		2018		Change 2010 to 2018
Commuting Mode	**Workers 16+**	**%**	**Workers 16+**	**%**	
Drive alone	332,681	64.8%	371,045	65.8%	+11.5%
Carpool / vanpool	57,064	11.1%	56,598	10.0%	-0.8%
Public transportation	77,525	15.1%	75,431	13.4%	-2.7%
Walked	10,156	2.0%	12,708	2.3%	+25.1%
Other means	5,388	1.0%	10,237	1.8%	+90.0%
Worked at home	30,385	5.9%	37,476	6.7%	+23.3%
Source: American Community Survey - One-year estimates 2010 and 2018					

2.5 Service Planning Approach

So that services may be deployed in a consistent and equitable approach, Ride On has established vehicle load, headways, and service accessibility standards.

Vehicle Load Factor - This standard is measured as the ratio of passengers on board to the seated bus capacity expressed as a percentage. Values of 100% or less indicate all riders are provided a seat while values of more than 100% denote standees. Loading standards indicate the degree of crowding (i.e., standees) which is acceptable, with consideration given to both the type of service and the operating period. Acceptable load factors on Regular Routes is 1.2 and on Express Routes 1.0.

Vehicle Headways - In general, frequencies or "headways" (the time between one bus and the next at the same location in the same direction) are established to provide enough capacity on a route to accommodate the passenger volume and stay within the recommended load factor standards described above. Montgomery County has established a thirty-minute headway as the minimum policy headway for routes operating in any time period.

Service Accessibility – Within Montgomery County, transit service is provided to traffic analysis zones with 3+ households per acre and/or 4+ jobs per acre.

Analysis has been completed for service coverage, low productivity routes and high productivity routes.

- **Service Coverage** – using the regional travel model and data from the 2010 census, the Ride On and Metrobus routes were mapped to identify areas that exceed three households per acre and/or four jobs per acre without transit services. Note that service coverage maps will be updated following the 2020 census.
- **Low Productivity Routes** – low productivity routes per platform hour were analyzed and reviewed with County staff to identify routes where service changes may result in a reduction in the number of peak buses required.
- **High Productivity Routes** – high productivity routes per platform hour were analyzed to identify areas where additional bus frequency and peak buses may be required because of overcrowding.

2.5.1 Service Coverage

Using 2010 Census data, Figures 9 and 10 illustrate the areas of Montgomery County where household and employment density meet the threshold. Currently each of the traffic analysis zones meeting these thresholds has transit service for all or part of the traffic analysis zone.

Figure 9: Traffic Analysis Zones with more than 3 Households per acre

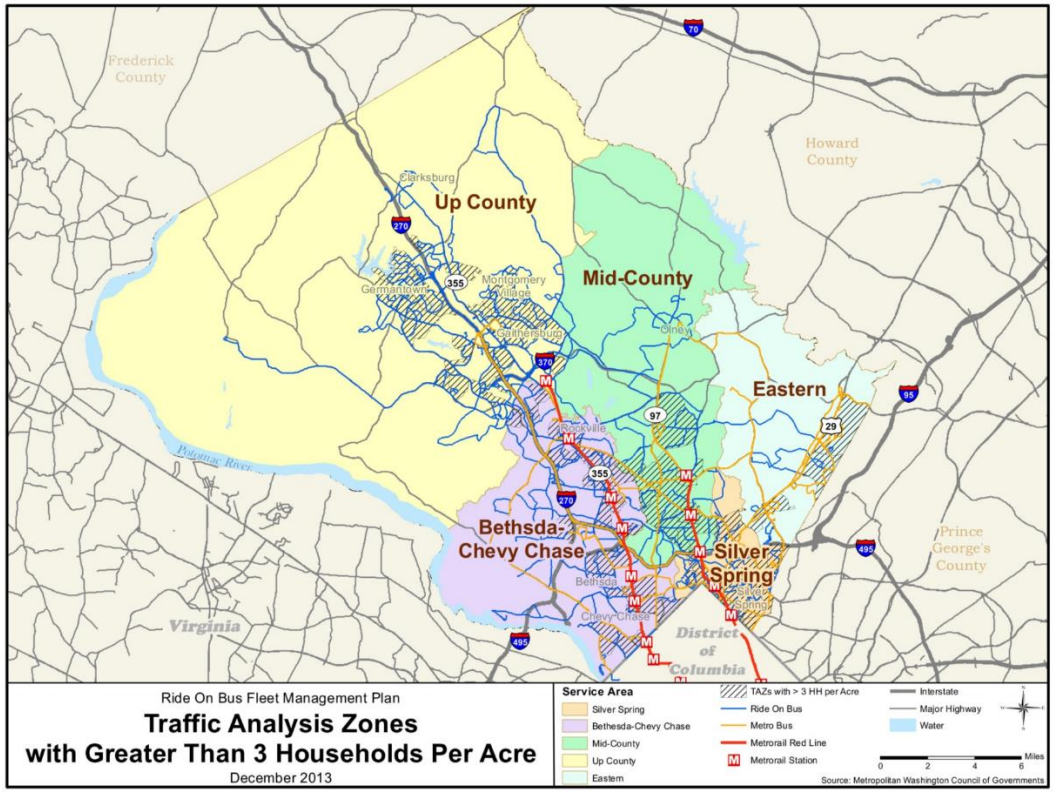


Figure 10: Traffic Analysis Zones with more than 4 Jobs per acre

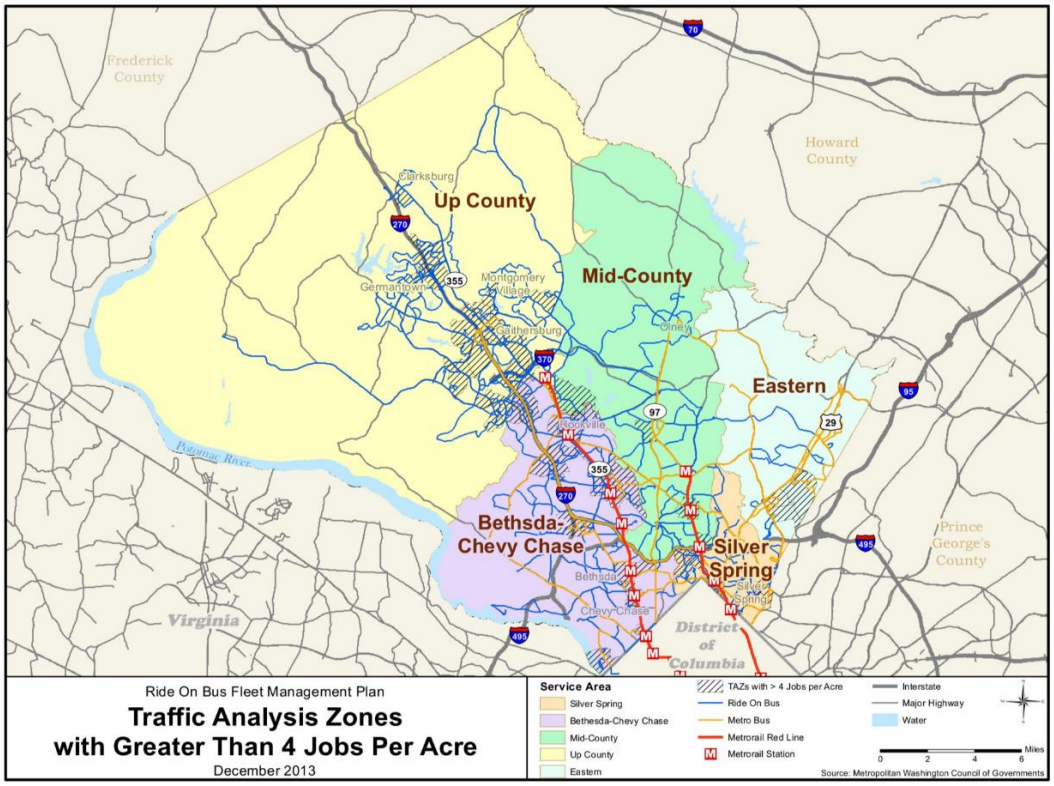
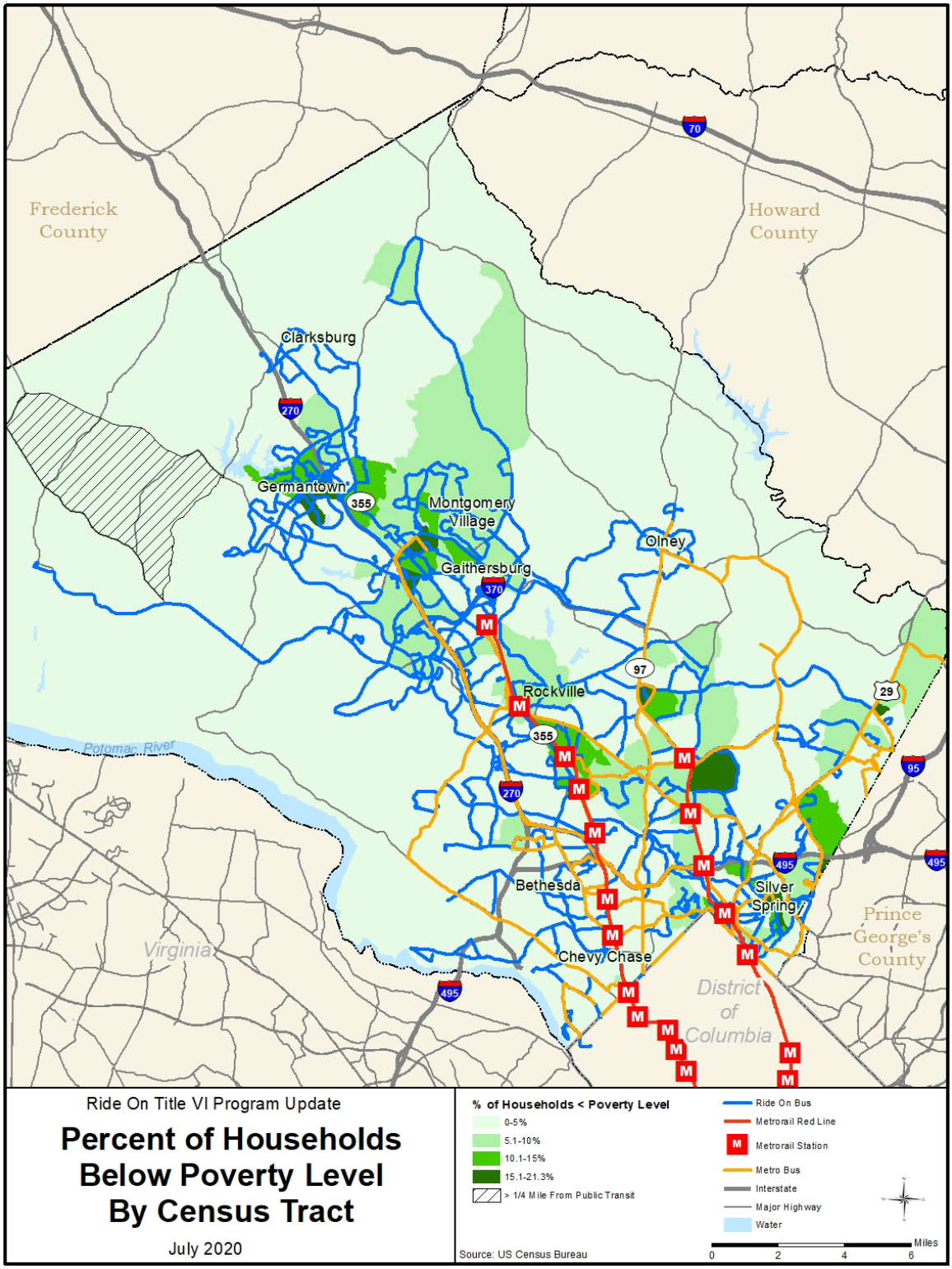


Figure 11 shows census block groups with high concentration of households lower than the federal poverty guidelines.

Figure 11: Percent of Households Below Poverty Level



2.5.2 Low Productivity Routes

The County defines a Low Productivity Route as one in which the average per revenue hour boardings is less than 15. The County reviews these routes to determine if adjustments are warranted. Table 5 illustrates the 18 routes that met the threshold for low productivity.

Table 5: Low Productivity Routes

Route	Route Description	Route Type	Riders Per Revenue Hour	FY 20 Avg. Weekday Boardings	Riders % Change FY17 vs FY20
52	MGH-Olney-Rockville	Local	8.3	111	-29%
53	Shady Grove-MGH-Olney-Glenmont	Limited	8.7	253	-5%
73	Clarksburg-Old Baltimore-Shady Grove	Express	8.8	166	New Service
31	Glenmont-Kemp Mill Rd.-Wheaton	Local	9.4	113	+2%
33	Glenmont-Kensington-Medical Center	Local	9.7	241	-37%
81	Rockville-Tower Oaks-White Flint	Local	9.7	116	-24%
301	Rockville-Shady Grove Hospital-Tobytown	Contracted	10.1	117	New Service
42	White Flint-Montgomery Mall	Local	10.4	343	-8%
83	Germantown MARC-GTC-Waters Landing-Milestone- Germantown	Local	10.8	461	-24%
4	Kensington-Fort Detrick Annex-Silver Spring	Local	11.5	213	-9%
6	Parkside-Grosvenor- Montgomery Mall Loop	Loop	11.5	291	+41%
7	Forest Glen-Wheaton	Local	11.8	52	-28%
19	Northwood-Four Corners-Silver Spring	Local	12.2	109	-31%
32	Naval Ship R&D-Cabin John-Bethesda	Local	13.0	209	-20%
29	Bethesda-Glen Echo-Friendship Heights	Local	13.9	546	-15%
18	Langley Park-Takoma-Silver Spring	Local	14.7	641	+1%
44	Twinbrook-Hungerford-Rockville	Local	14.7	122	-3%
36	Potomac-Bradley Blvd.-Bethesda	Local	14.8	310	-26%

2.5.3 High Productivity Routes

The 2014 BFMP identified overcrowding as a serious problem. Table 6 compares twenty routes with high productivity and overcrowding in FY2013 with operating results in FY2016 and FY2019. During the period FY2013 to FY2019, Ride On introduced the Route 101 ext*R*a-Lakeforest-Medical Center to relieve crowding on Routes 55 and 46. Also during the period there were fare increases in 2014 and 2017 as well as the demographic changes described in Section 2.4. Table 7 illustrates four routes that exceed 40 passenger boardings per revenue hour which indicates overcrowding remains a problem during peak periods.

Table 6: High Productivity Routes FY2013 to FY2019

#	Route Description	Route Type	FY2013			FY2016			FY2019		
			Rev Hours	Wkday Riders	Rides/ RevHr	Rev Hours	Wkday Riders	Rides/ RevHr	Rev Hours	Wkday Riders	Rides/ RevHr
1	Silver Spring-Leland St.-Friendship Heights	Local	31.9	2,367	74.1	34.0	1,910	56.2	34.9	1,208	34.6
15	Langley Park-Wayne Ave.-Silver Spring	Local	48.4	3,410	70.4	47.3	3,294	69.6	45.4	3,813	84.0
65	Montgomery Village-Shady Grove	Ltd	3.1	203	64.7	4.5	189	42.0	4.3	119	27.7
55	GTC-Milestone-MC,G-Lakeforest-Shady Grove-MC,R-Rockville	Local	145.3	8,020	55.2	159.7	7,748	48.5	138.6	4,934	35.6
101	EXTRA-Lakeforest-Medical Center	Ltd							91.1	2,146	23.6
11	Silver Spring-East/West Hwy-Friendship Heights	Ltd	14.9	815	54.6	15.6	823	52.8	14.4	671	46.6
49	Glenmont-Layhill-Rockville	Local	43.1	2,149	49.9	44.2	2,273	51.4	43.5	1,856	42.7
24	Hillandale-Northwest Park-Takoma	Local	6.3	314	49.7	7.4	243	32.8	7.9	213	27.0
60	Montgomery Village-Flower Hill-Shady Grove	Ltd	7.3	360	49.0	7.9	275	34.8	7.6	233	30.7
59	Montgomery Village-Lakeforest-Shady Grove-Rockville	Local	82.6	3,875	46.9	86.2	3,682	42.7	83.0	2,834	34.1
48	Wheaton-Bauer Dr.-Rockville	Local	47.3	2,215	46.8	52.0	2,046	39.3	49.5	1,695	34.2
57	Lakeforest-Washington Grove-Shady Grove	Local	48.7	2,274	46.7	49.1	2,008	40.9	41.1	1,577	38.4
2	Lyttonsville-Silver Spring	Local	19.7	886	45.0	18.8	882	46.9	15.2	863	56.8
61	GTC-Lakeforest-Shady Grove	Local	64.2	2,863	44.6	66.7	2,595	38.9	65.1	2,570	39.5
41	Aspen Hill-Weller Rd.-Glenmont	Local	16.8	740	44.0	16.9	772	45.7	16.5	574	34.8
20	Hillandale-Northwest Park-Silver Spring	Local	73.0	3,152	43.2	67.9	2,846	41.9	71.8	2,903	40.4
78	Kingsview-Richter Farm-Shady Grove	Ltd	9.1	383	41.9	9.4	237	25.2	8.9	208	23.4
12	Takoma-Flower Avenue-Wayne Avenue-Silver Spring	Local	41.8	1,730	41.4	42.5	1,517	35.7	40.0	1,724	43.1
100	GTC-Shady Grove	X	56.2	2,288	40.7	55.5	2,215	39.9	42.8	2,114	49.4
70	Milestone-Medical Center-Bethesda Express	X	183.4	3,741	20.4	39.4	630	16.0	40.1	851	21.2
		Total	943.3	41,785	44.30	825.0	36,185	43.86	861.7	33,106	38.42

Table 7: High Productivity Routes FY2020

Route	Route Description	Route Type	Rides Per Revenue Hour	FY 20 Avg. Weekday Boardings	Riders % Change FY17 vs FY20
15	Langley Park-Wayne Ave.-Silver Spring	Local	84.0	3,813	+25%
100	GTC-Shady Grove	Express	49.4	2149	-5%
49	Glenmont-Layhill-Rockville	Local	42.7	1856	-16%
97	GTC, Germantown MARC, Waring Station, GTC	Loop	40.1	773	+33%

2.6 Peak Vehicle Requirements

Peak Vehicle Requirements (PVR) are based on the number of vehicles operated in maximum service. This is defined as the total number of revenue vehicles operated to meet the annual maximum service requirement. This should be the revenue vehicle count during the peak season of the year; on the week and day that maximum service is provided.

Table 8 lists the existing and anticipated peak vehicle requirements that will be needed by 2030.

Table 8: Proposed Peak Vehicle Requirements

Service	Description	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Ride On	Base PVR	285	285	285	285	285	285	285	285	285	285	285
	129 - Limited	8										
	101 - Extra	14	14	14	14	14	14	14	14	14	14	
	GSE - Extra				11	11	33	33	33	33	33	33
	Projected PVR	307	299	299	310	310	332	332	332	332	332	318
	Total (20% spare)	369	359	359	372	372	399	399	399	399	399	382
BRT	US 29 BRT - 60'		13	13	13	13	13	13	13	13	13	13
	MD 586 BRT - 60'					12	12	12	12	12	12	12
	MD355 BRT - 60'						20	20	20	20	20	42
	BRT Projected PVR	0	13	13	13	25	45	45	45	45	45	67
	BRT Total (20% spare)	0	16	16	16	30	54	54	54	54	54	81
Fixed Route	Training Buses	3	3	3	3	3	3	3	3	3	3	3
	Total	372	378	378	391	405	456	456	456	456	456	466
FLEX	Flex	4	5	9	9	9	12	12	12	15	15	15
	Flex Total (20% spare)	7	7	11	11	11	15	15	15	18	18	18
Grand Total		379	385	389	402	416	471	471	471	474	474	484

2.7 Washington Metropolitan Area Transit Authority (WMATA)

WMATA operates regional Metrorail and Metrobus services within Montgomery County as described below.

2.7.1 Metrorail

WMATA's Metrorail service network (Figure 12) has six lines and 91 stations within a 1,500 square mile service area. The Silver line, WMATA's sixth line, opened its first segment operating between Tysons Corner and Reston, Virginia in 2014. The extension to Dulles Airport is expected to open in 2022. Metrorail provides service throughout the Region to the Maryland surrounding counties and in Virginia to Fairfax, Arlington, and Loudon counties and the City of Alexandria.

WMATA's Metrorail Red Line provides regional rail service to Montgomery County via 12 stations, connecting it to Washington D.C. and the National Capital Region. The Red Line is a "U" shaped alignment. It serves two terminal stations in Montgomery County at Shady Grove in the western part of the County and Glenmont to the east with service to Washington, D.C. Each end operates as a separate route starting at Metro Center. On the Shady Grove route, parking is available at the Rockville, Twinbrook, White Flint, and Grosvenor Heights stations. On the Glenmont service, parking is available at Glenmont, Wheaton, Forest Glen, and Silver Spring. A connection with the MARC Brunswick Line is available at the Silver Spring Station. Connections to MARC and the Amtrak Capital Limited service are available at Rockville.

Figure 12: WMATA System Map

Source: https://www.wmata.com/schedules/maps/upload/Spring_2021_System_Screen_Map_V1d-2.pdf

Table 9 lists average daily boardings at the 12 Red Line Metrorail stations serving Montgomery County.

Table 9: Metrorail Ridership in Montgomery County

Metrorail Station	Average Weekday Boardings
Shady Grove	12,170
Silver Spring	12,160
Bethesda	9,810
Friendship Heights	8,676
Glenmont	5,675
Medical Center	5,606
Grosvenor	5,328
Rockville	4,327
Twinbrook	4,233
Wheaton	3,862
White Flint	3,707
Forest Glen	2,193
SOURCE: WMATA Ridership Data Portal 2010-2019	

2.7.2 Metrobus

WMATA operates 20 bus routes in Montgomery County through agreements with the State of Maryland Department of Transportation and the County. The majority of Metrobus routes are intended to be regional services, crossing into other adjacent counties and Washington, D.C. Table 10 lists the routes, the average weekday boardings, and the growth rate.

Table 10: WMATA Metrobus Boardings

Line	Route(s)	2019 Average Weekday Boardings	Change 2016 - 2019
Greenbelt - Twinbrook	C2, C4	8,113	-22.7%
College Park – White Flint	C8	2,078	-12.4%
McArthur Boulevard	D5	309	-19.7%
Chevy Chase	E6	294	-22.4%
New Carrollton – Silver Spring	F4	4,900	-21.0%
Bethesda – Silver Spring	J1, J2	4,744	3.6%
College Park - Bethesda	J4	741	-21.0%
New Hampshire Avenue	K6, K9	4,900	-12.6%
Connecticut Avenue - Maryland	L8	1,870	-14.8%
Connecticut Avenue	L2	3,252	-14%
Massachusetts Avenue	N2, N4, N6	3,270	-14.4%
Veirs Mill	Q1, Q2, Q3, Q4, Q5, Q6	5,791	-19.0%
16th Street	S2, S4, S9	13,700	-15.4%
River Road	T2	1,047	-28.7%

Line	Route(s)	2019 Average Weekday Boardings	Change 2016 - 2019
Georgia Avenue	Y2, Y7, Y8	6,135	-18.8%
Colesville - Ashton	Z2	694	-21.3%
Calverton – Westfarm	Z6	2,222	-11.9%
Laurel - Burtonsville	Z7	410	-28.0%
Fairland	Z8	2,476	-16.4%
Greencastle – Briggs Chaney	Z11	738	-22.4%
Metrobus Total		67,684	-17.1%
Source: WMATA Bus Ridership Data Portal			

2.8 Commuter Rail and Commuter Bus

The MDOT MTA Commuter Bus and MARC Commuter Rail operating from suburban areas throughout the state provide residents access to the job markets in Baltimore and Washington, D.C. These commuter services generally operate weekdays during peak commuting periods. Over the years, these services have grown in popularity and have been expanded based on funding availability. Ridership on these services is affected by many factors including the price of gasoline, parking availability, and employer subsidy.

2.8.1 MARC Commuter Rail

There are 11 Brunswick Line MARC stations in Montgomery County: Silver Spring, Kensington, Garrett Park, Rockville, Washington Grove, Gaithersburg, Metropolitan Grove, Germantown, Boyds, Barnesville, and Dickerson. Average daily boardings by station are shown in Table 11.

Table 11: MARC Daily Ridership by Montgomery County Stop

Station	FY2019 Average Daily Boardings
Silver Spring	527
Kensington	208
Garrett Park	57
Rockville, Wash	493
Washington Grove	43
Gaithersburg	501
Metropolitan Grove	271
Germantown	865
Boyds	22
Barnesville	87
Dickerson	22
Total Montgomery County Boardings	3096
Source: Maryland.gov Data Portal	

Transfers to other transit services can be made at Silver Spring, Kensington, Garrett Park, Rockville, Washington Grove, Metropolitan Grove, and Germantown.

2.8.2 MTA Commuter Bus

There are eight commuter bus routes that provide service to Montgomery County. The routes, number of trips, and average weekday ridership are shown in Table 12. Intermodal connections are available in Montgomery County at the Shady Grove, Metropolitan Grove, Medical Center, and Silver Spring Metrorail stations from commuter bus routes 201, 203, 305, 315, and 325.

Table 12: MTA Montgomery County Commuter Bus Services

Line	Origin	Destination	Trips				Weekday riders (2/19)
			AM	PM	Mid-Day	Total	
201	Gaithersburg	BWI Airport/MARC	15	19	4	34	362
202[4]	Metropolitan Grove	NSA/Fort Meade	3	3	0	6	42
203	Columbia	Bethesda	5	5	0	10	154
204	Frederick	College Park	5	6	0	11	237
305	Columbia	Silver Spring/Washington, D.C.	11	12	1	23	563
315	Columbia	Silver Spring/Washington, D.C.	10	10	0	20	430
325	Columbia	Silver Spring/Washington, D.C.	7	7	0	14	235
505	Hagerstown	Shady Grove/Rock Springs	8	10	1	18	362
515	Frederick / Monocacy	Shady Grove/Rock Springs	13	15	1	28	705
Total Montgomery County Commuter Service Ridership			77	87	7	164	3090

Source: MTA website (https://www.mta.maryland.gov/schedule?type=commuter-bus) and FY19 February Service Summary

2.9 Ongoing Initiatives

There are four major initiatives underway in Montgomery County to enhance transit. MDOT MTA's Purple Line Light Rail Transit (LRT), Montgomery County Bus Rapid Transit (BRT) service, Ride On extRa, and Ride On Flex.

2.9.1 Purple Line Light Rail Transit

The MDOT MTA Purple Line is a 16-mile light rail line that will operate between Bethesda in Montgomery County and New Carrollton in Prince George's County. Direct connections to the Metrorail Red, Green and Orange lines will be available at Bethesda, Silver Spring, College Park, and New Carrollton. The Purple Line Final Environmental Impact Statement and Draft Section 4(f) Evaluation was published on August 28, 2013. In 2016, the MDOT MTA selected Purple Line Transit Partners, a consortium led by Fluor Enterprises to design, build, operate, and maintain the Purple Line LRT through a contractual agreement for 36 years. Construction began in August 2017.

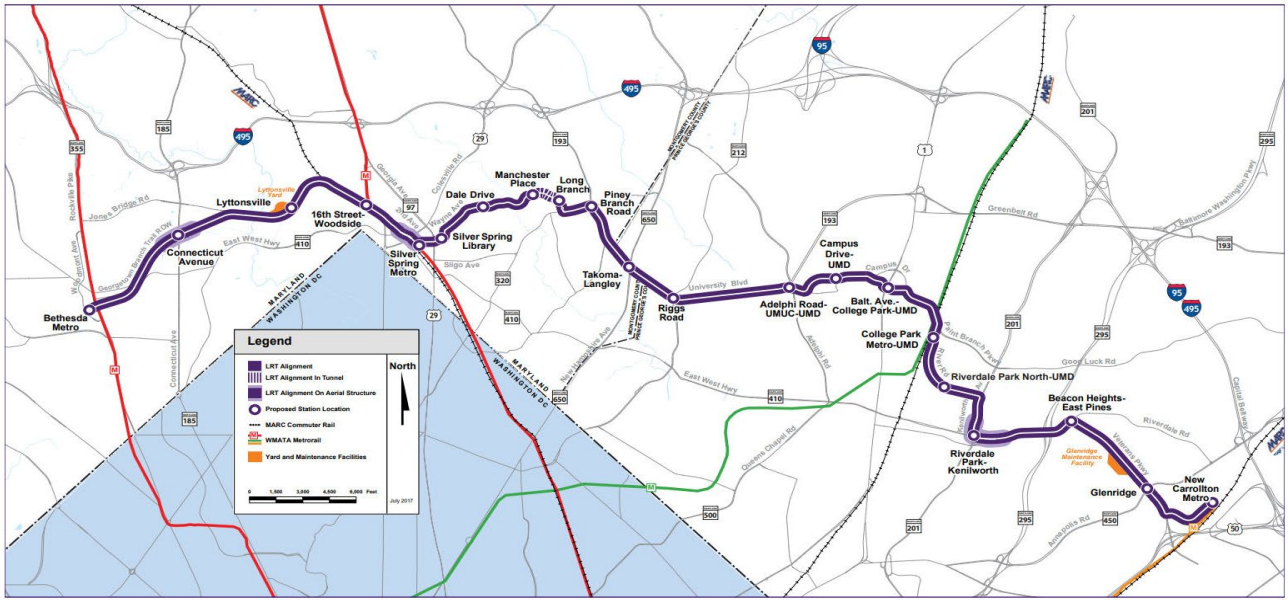
Ongoing construction delays and impacts from significant legal delays have impacted the project. Currently, the anticipated opening date is 2023. However, the MDOT MTA intends to open the line in phases beginning in Prince George's County as work is completed.

[4] The MTA cancelled the Route 202 operating between Metropolitan Grove/MARC and Fort Meade/NSA in March 2019. Additional route changes are being proposed for January 2021 due to a loss of ridership resulting from the COVID 19 pandemic.

The Purple Line alignment is shown in Figure 13. There are 21 barrier-free stations and direct multi-modal connections to MARC, Amtrak, and local bus services. The project also includes the completion of the Capital Crescent Trail between Bethesda and Silver Spring, the completion of the Green Trail along Wayne Avenue to Sligo Creek, and the construction of a bike path through the University of Maryland campus.

In conjunction with the opening of the Purple Line, Ride On will evaluate modifications to routes as needed in the future.

Figure 13: Purple Line Route



Source: MDOT MTA

2.9.2 Montgomery County Bus Rapid Transit

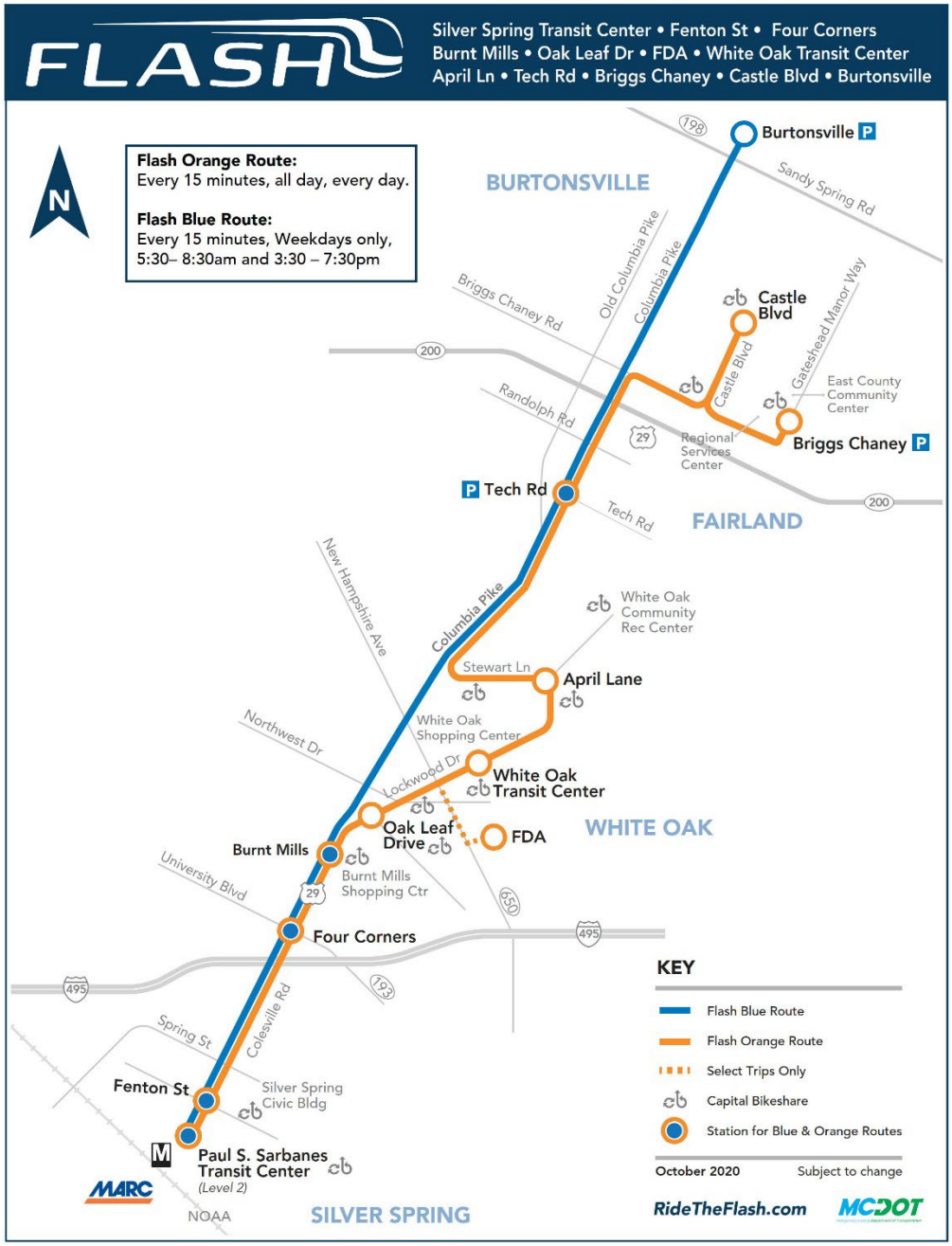
Montgomery County's Countywide Transit Corridors Functional Master Plan (2013) recommends a 102-mile BRT network of 10 corridors to enhance mobility and accessibility throughout the County. Branded as the Flash, MCDOT is working on progressing three of the BRT corridors.

Flash on US 29 BRT – Having begun operation in 2020, known as the Flash, this is the first BRT project to advance in the state. The 14-mile BRT line (Figure 14) will operate between Burtonsville and Silver Spring. The route will utilize existing bus on shoulder lanes along US 29 in the northern portion of the corridor. Along the southern portion of the line, it will operate in mixed traffic along US 29, Lockwood Drive, Stewart Lane, Briggs Chaney Road, and Castle Boulevard. The service features off-board fare collection, level boarding, new state of the art BRT vehicles, new stations, transit signal priority (TSP), and station access improvements. It will operate every 7.5 minutes during the peak periods and every 15 minutes during off peak daily from 5 a.m. to midnight.

The project is funded in part by a grant through the federal Transportation Infrastructure Generating Economic Recovery (TIGER) program.

In early 2020, in preparation for the implementation of the Flash 29 service, the MCDOT proposed service modifications to 10 Ride On routes in conjunction with the new service. They met with significant rider opposition. As a result, MCDOT conducted a series of public workshops to gather input and postponed final restructuring.

Figure 14: Flash 29 Route



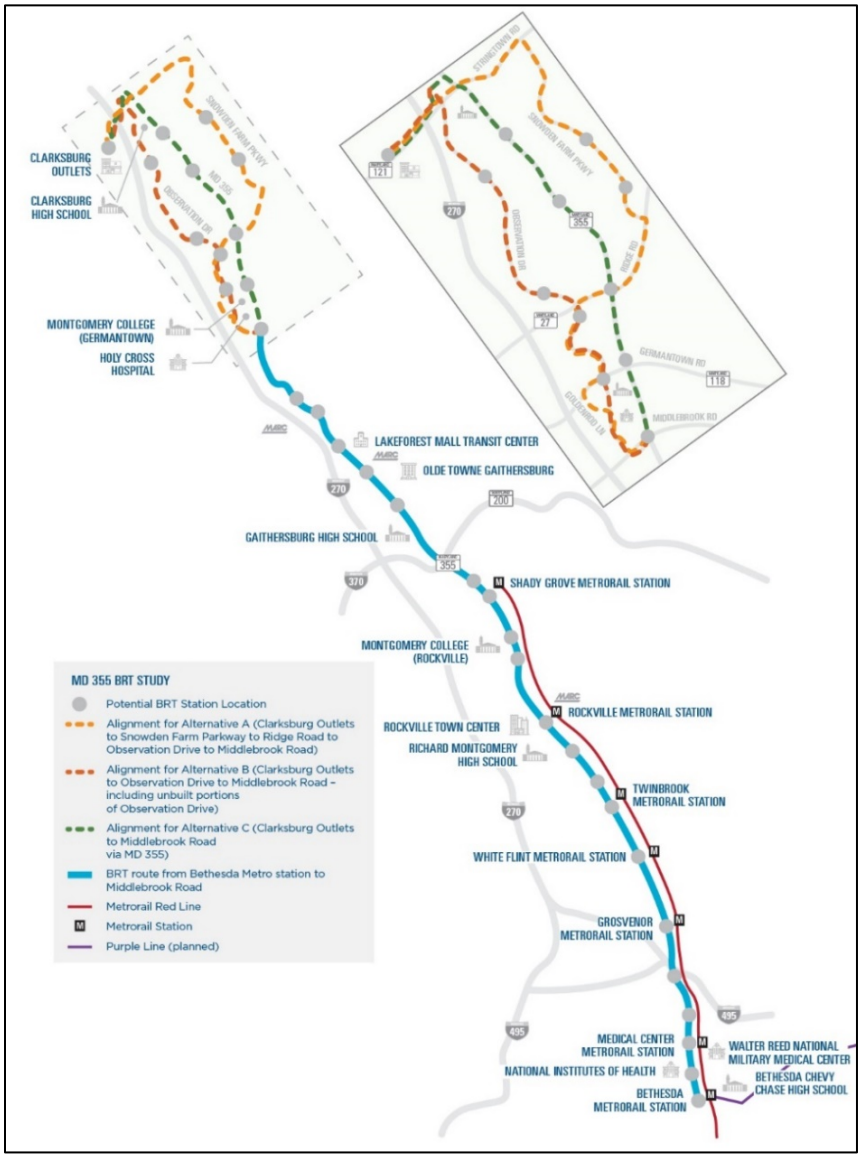
Source: Map from Montgomery County website (https://www.montgomerycountymd.gov/DOT-Transit/Resources/Files/maps/FLASH-map.pdf)

MD 355 BRT – The 355 BRT corridor is approximately 22 miles in length from Clarksburg to Bethesda (Figure 15). The route would serve many activity centers including Clarksburg, Metropolitan Grove, Gaithersburg, Shady Grove/King Farm, Montgomery College, Rockville, Twinbrook, White Flint, Grosvenor, Medical Center, and Bethesda.

MCDOT conducted an alternatives analysis to determine the best way to serve the corridor. In July 2019, the Montgomery County Council decided not to select a preferred design for BRT on MD 355. Instead they directed MCDOT to solicit private sector recommendations for the MD 355 BRT.

In October 2019, the County posted a Request for Information (RFI) regarding the implementation of BRT on MD 355 to seek innovative ideas from engineering consultants, contractors, financiers, concessionaires, and others with experience in innovative project delivery, including private financial participation and novel design, construction, and operating strategies for BRT. The 355 BRT Corridor Summary - June 2019 describes an Alternative B modified which would provide sections of reversable BRT guideway where buses would operate in the BRT guideway in the peak direction and in general purpose lanes at other times.

Figure 15: MD 355 BRT



Source: Montgomery County Flash Website (https://www.montgomerycountymd.gov/dot-dte/projects/MD355BRT/)

The operating plan for Alternative B modified would require four operating patterns:

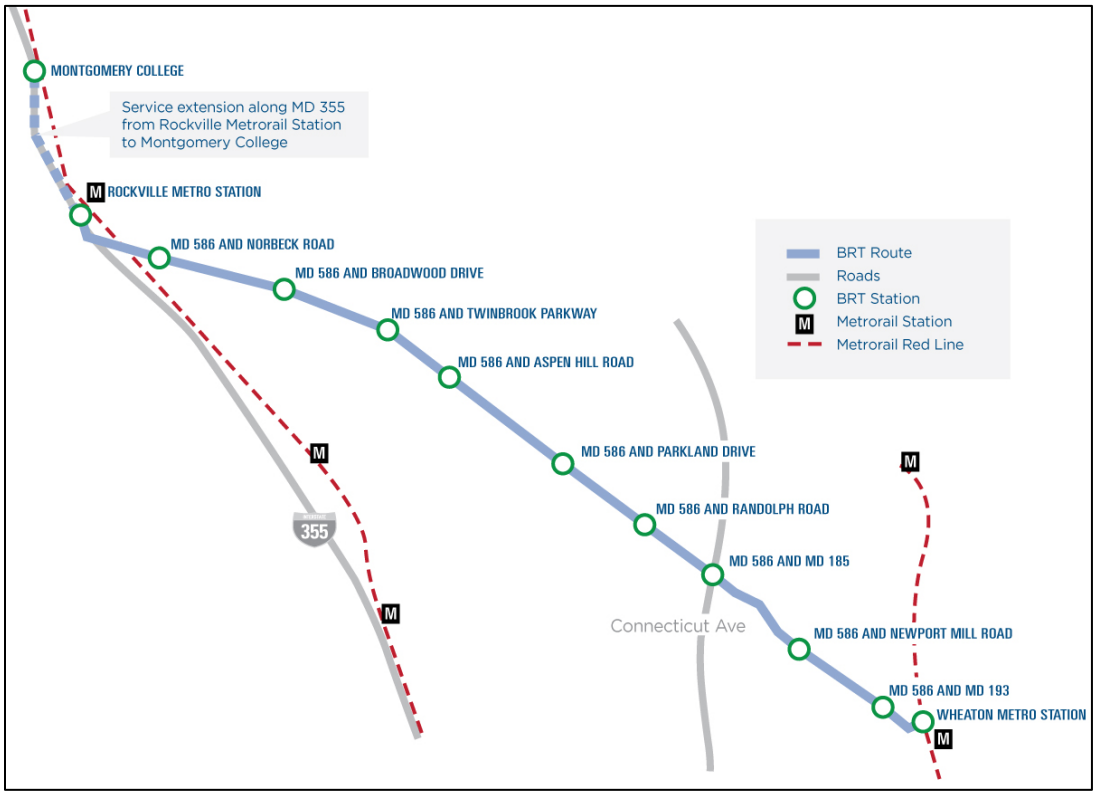
- Flash 1C - Clarksburg to Montgomery College
- Flash 1G - Germantown to Montgomery College
- Flash 2 - Lakeforest to Grosvenor
- Flash 3 - Montgomery College to Bethesda

The Corridor Summary Report indicated a capital cost of $821 million with 42 vehicles costing $880,000 each. Considering that the project will require considerable design and right-of-way acquisition, this report assumes 20 BRT buses would begin operation in FY2028 and 22 more BRT buses would be added in FY2030.

MD 586 BRT – The proposed 6.7-mile BRT line along MD 586 / Veirs Mill Road (Figure 16) would operate between the Rockville and Wheaton Metrorail stations to Montgomery College. In 2017 the MDOT State Highway Administration (SHA) and MDOT MTA, in partnership with MCDOT, completed an evaluation of the alternatives. On June 13, 2017, the Montgomery County Council voted to select Alternative 2.5 as their recommended alternative, with Alternative 3 retained as the master plan option. In 2018, the County approved $3 million for preliminary engineering and $4 million for the final design of the Veirs Mill preferred concept for the 2022 budget.

The MD586 / Veirs Mill Road Bus Rapid Transit Study dated July 2018 describes Alternative 2.5 as having a capital cost of $79.1 million including $16.5 million for vehicles. The service is proposed to operate at 10-minute peak headways and would require 8 peak buses and 10 total buses including spares.

Figure 16: Proposed FLASH 586 Route



Source: Montgomery County FLASH Website (https://www.montgomerycountymd.gov/dot-dte/projects/VeirsMillBRT/)

2.9.3 Ride On ext*R*a

MCDOT is implementing limited stop services in the most congested corridors to provide faster trip times and relieve overcrowding on parallel local routes. The service is branded as the **Ride On ext*R*a** as shown in Figure 17. It features limited stops, 10-minute frequency of service during peak rush hour periods, low-floor branded buses featuring free WiFi access, USB charging ports, information displays, and extra padding on the seats, traffic signal priority, and no loading of fare cards on buses.

The first **Ride On ext*R*a** route began on October 2, 2017 with 14 additional peak vehicles in the MD 355 corridor from Lakeforest Transit Center to Medical Center.

Figure 17: Ride on ext*R*a

The **Great Seneca ext*R*a (GSE)** is a planned premium bus system that would connect Kentlands, Crown Farm, the Great Seneca Science Corridor (GSSC), Shady Grove Metrorail, King Farm, and Rockville Metrorail. The system would provide high-quality transit service through four high-frequency, limited-stop routes to support planned development, community livability, and enhanced mobility. The GSE will serve commuters, local residents, and others by providing service to new and existing commercial centers, residential, and educational development in King Farm, Crown Farm, Life Sciences Center, the Universities at Shady Grove, and Kentlands. The GSE will provide access to transit services into the District of Columbia, MARC Brunswick service at Rockville and the WMATA Red Line at Shady Grove and Rockville.

The initial routes could start operating in FY 2022-23 with 11 peak buses providing service via two routes connecting Shady Grove Metrorail to the Adventist Hospital at West Side and the Universities at Shady Grove via Crown Farm and Shady Grove Road respectively. The full network of routes could start operating in FY 2024-25 and add an additional 22 peak buses for a total of 33 peak buses. The full network would extend a route to Quince Orchard and Kentlands and add two more routes that would expand coverage to Rockville Metrorail, King Farm, Falls Grove, and Kentlands.

2.9.4 Ride On Flex

In an effort to increase transit ridership, improve transportation options for underserved communities, supplement fixed route service, and employ new technology to improve convenience for transit riders, in summer 2019, Ride On introduced a new pilot micro-transit on-demand bus service, the Ride On Flex. Montgomery County has partnered with a transportation network company, Via, for use of its technology platform to provide first-mile and last-mile connections using buses owned and operated by MCDOT. Customers request a ride using a smartphone app. The app directs the rider to a pickup location and gives

an estimated pickup and drop-off time, similar to Uber and Lyft. This new service operates within defined zones in Rockville, Wheaton and Glenmont. The service offers corner to corner pick-ups/drop-offs using new 11 passenger wheelchair accessible buses with on-board WiFi. Payment methods are the same as on standard buses, paid when boarding the bus. In addition, riders can transfer to other transit services after using the Flex and all of Montgomery County's special fare programs for college students, seniors, children, and County employees are acceptable.

The Flex service (see Figure 18) runs in Rockville weekdays from 9 a.m. to 3:30 p.m. In Glenmont/Wheaton, it operates weekdays from 6 to 9 a.m. and from 3:30 to 7 p.m.

Figure 18: Ride On Flex

The County intends to evaluate the performance of Ride On Flex by analyzing data collected through the mobile app and rider feedback. If successful, MCDOT expects to expand service as new vehicles arrive and funding is available.

3. RIDE ON FLEET AND VEHICLE MAINTENANCE

3.1 Ride On Fleet

Because of service and facility requirements, the County uses a combination of different types of vehicles that vary in size and fuel type. Table 13 describes the fleet status by bus size and fuel type as of March 31, 2021. The County was an early adopter of technologies to reduce bus emissions including compressed natural gas (CNG) and clean diesel hybrid. The County is now adding zero emission buses to the fleet mix although the County's transit maintenance facilities play a significant role in the fleet size and fuel type.

Table 13: Ride On Fleet as of March 31, 2021

Bus Size / Type	Bus Model Year	Bus Make	No. Buses	In-service Date	Avg. Mileage	Avg. Annual Miles*	Avg. Age as of 3-31-21	Useful Life (yrs.)	FY Eligible For Retirement (Age)	FY Eligible For Retirement (Miles)
40' Diesel										
	2009	GILLIG	11	6/25/2009	569,585	48,599	11.72	12	2021	2020
	2011	GILLIG	1	10/31/2011	386,319	41,011	9.42	12	2024	2024
	2013	GILLIG	12	9/16/2013	307,689	40,808	7.54	12	2026	2026
	2016	GILLIG	41	5/6/2016	192,791	39,185	4.92	12	2028	2028
	2017	GILLIG	25	10/1/2017	122,803	35,087	3.5	12	2030	2030
	2019	GILLIG	3	4/12/2019	114,093	57,915	1.97	12	2031	2028
	2020	GILLIG	9	9/1/2020	65	113	0.58	12	2033	2033
	2020	GILLIG	18	2/23/2021	0	0	0.08	12	2033	2033
40' Diesel			**120**		**179,019**	**40,030**	**4.39**			
40' Hybrid										
	2009	GILLIG	34	8/20/2009	477,034	41,096	11.61	12	2022	2022
	2011	GILLIG	12	10/22/2011	377,425	41,303	9.43	12	2024	2024
	2012	GILLIG	7	6/25/2012	357,925	42,083	8.77	12	2024	2024
40' Hybrid			**53**		**438,750**	**41,272**	**10.74**			
40' CNG										
	2014	GILLIG	18	4/1/2014	392,427	56,383	6.96	12	2026	2023
	2016	GILLIG	16	5/26/2016	263,376	53,641	4.91	12	2028	2023
	2017	GILLIG	38	10/1/2017	173,022	49,435	3.5	12	2030	2028
	2019	GILLIG	23	4/12/2019	113,278	57,501	1.97	12	2031	2027
40' CNG			**95**		**215,347**	**53,413**	**4.01**			
30' Diesel										
	2013	GILLIG	28	9/23/2013	317,778	42,484	7.48	10	2023	2022
	2014	GILLIG	32	9/2/2014	270,109	41,364	6.53	10	2024	2024
	2020	GILLIG	19	9/1/2020	710.0	1,224	0.58	10	2031	2031
	2020	GILLIG	2	2/23/2021	0	0	0.17	10	2031	2031
30' Diesel			**81**		**216,743**	**31,027**	**5.31**			
35' Electric										
	2019	PROTERRA	4	9/1/20	6,271	8,362	.75	12	2033	2033
60' BRT Diesel										
	2019	NOVA	16	11/1/20	30,629	66,546	.42	12	2033	2027
25' Microtransit										
	2019	Ford	7	6/28/19	8,866	5,042		4	2023	2023

- Average Annual Miles excludes newly delivered 40' and 30' diesel buses that had operated less than 12 months

The Brookville Depot located near Silver Spring is the oldest transit facility and can accommodate 30' and 40' clean diesel buses. Recent upgrades allow the Brookville Depot to charge up to 14 electric buses. The David F. Bone Equipment Maintenance and Transit Operating Center (EMTOC) near Shady Grove is the newest facility opening in 2013. Designed for 30', 40' and 60' CNG and clean diesel buses, EMTOC's fueling systems can accommodate approximately 100 CNG buses. The Nicholson Court Depot is a leased facility which can only accommodate 30' clean diesel buses.

Table 14 summarizes the existing fleet composition by size as of December 2020.

Table 14: 2021 Fleet Composition

Bus Length	Total	Percentage of Fleet
Cutaways	7	2%
30'	81	21%
35'	4	1%
40'	269	71%
60'	16	4%
Total	377	100%
Percentage	100%	

Consistent with the County's sustainability initiatives, the County intends to replace many of the diesel buses with zero emission buses. By 2026, this BFMP also plans to right-size the fleet to better match ridership loads. Zero emission buses and smaller 30' buses will replace 53 40' Hybrid buses. Table 15 shows the planned fleet composition in 2026.

Table 15: 2026 Fleet Composition

Bus Length	Total	Percentage of Fleet
Cutaways	15	3%
30'	117	25%
35'	4	1%
40'	281	60%
60'	54	11%
Total	471	100%
Percentage	100%	

3.2 Vehicle Maintenance

The County's Department of General Services (MCDGS) Division of Fleet Maintenance Services (DFMS) is responsible for vehicle maintenance for the Ride On fleet, as well as all other fleet needs for other County departments. DFMS plans for, acquires, maintains, and disposes of the County's fleet of vehicles, buses, heavy equipment and other vehicular equipment in support of the transportation and service delivery needs. DFMS maintains transit vehicles at two County owned sites; one at Brookville in Silver Spring, and the other at the EMTOC in Gaithersburg; and a leased facility at Nicholson Court in the White Flint area.

Taking into consideration the service requirements and facility constraints, DFMS has developed a maintenance strategy that facilitates timely and cost-effective maintenance for the Ride On fleet. Table 16 shows the type of key maintenance activities performed at each maintenance location.

Table 16: Maintenance Activities Strategy

Maintenance Activity	Facility Location		
	Brookville (Silver Spring)	EMTOC (Gaithersburg)	Nicholson Court (White Flint)
# of Buses (March 2021)	149	153	74
In-House Labor			
Preventive Maintenance	X	X	X
General Repairs	X	X	X
Brake Repairs	X	X	X
A/C Repairs	X	X	X
Body Repairs	X	X	
Body Painting	X	X	
Electronics Repairs	X	X	X
Farebox Repairs	X	X	X
On-Site Contractor			
Fueling & Cleaning	X	X	X
Tires	X	X	X
Off-Site Contractor			
Major Component Rebuild	X	X	X
Minor Component Rebuild	X	X	X
Vehicle Major Overhaul	X	X	X

3.3 Maintenance Staffing

Table 17 illustrates the manpower resources responsible for Ride On maintenance by location.

Table 17: Maintenance Staffing by Location - March 2021

Position	Brookville	EMTOC	Nicholson
Shop Superintendent	1	1	1
Crew Chiefs	6	6	5
Mechanic Technicians	34	39	16
Sr. Supply Technicians	1	1	1
Supply Technicians	7	9	6
Autobody Repairers	3	1	0
Transit Welders	1	0	0
Total Maintenance Employees	53	57	29
Buses Assigned (March 2021)	149	153	74
Buses per Technician	4.4	3.9	4.6

3.4 Maintenance Performance

In the American Public Transportation Association's (APTA) 2019 Public Transportation Fact Book, Ride On ranks the 50th largest transit system based on 2017 unlinked passenger trips. To ensure successful operation of an agency the size and complexity of Ride On, MCDOT and MCDGS have developed a comprehensive management system for tracking maintenance performance. The following information

is a review of the Ride On preventive maintenance (PM) program, PM on-time performance, mechanical failures, road calls, and missed trips.

3.4.1 Preventive Maintenance Cycle

Ride On has four levels of preventive maintenance inspections as shown in Table 18.

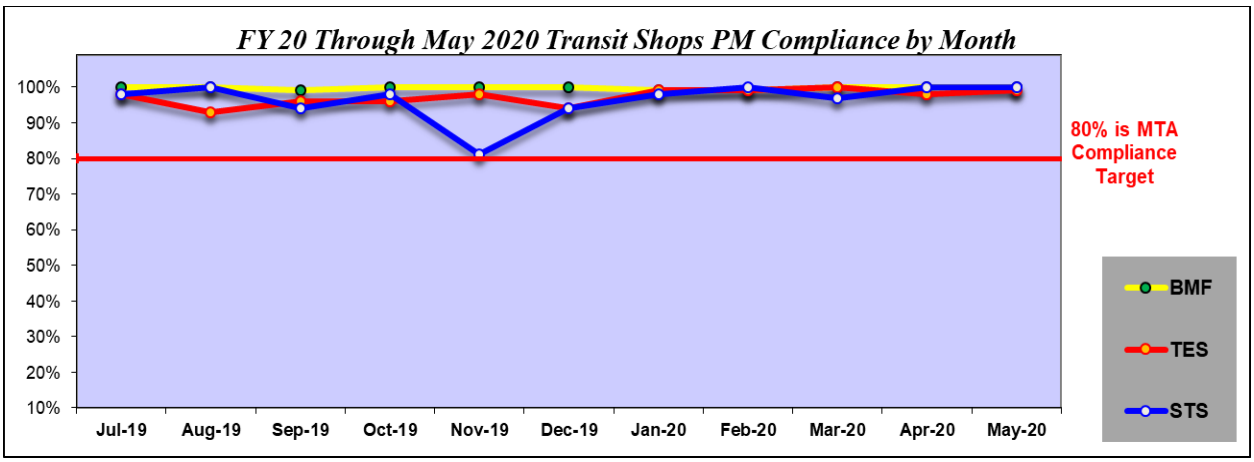
Table 18: Ride On Preventive Maintenance Program

Inspection Type	A	B	C	D
Frequency in Miles	6,000	12,000	24,000	48,000
Estimated Number of Annual Inspections	2,400	1,200	600	300
Exterior	X	X	X	X
Under Chassis	X	X	X	X
Engine Compartment	X	X	X	X
Wheelchair Lift/Ramp	X	X	X	X
Air Conditioning	X	X	X	X
Oil/Lube/Filters	X	X	X	X
Steam Clean Engine	X	X	X	X
Fuel Filters		X	X	X
Crankcase Breather Filter		X	X	X
Transmission Fluid/Filters			X	X
Hydraulic Fluid Change				X
Differential Fluid Change				X

3.4.2 Preventive Maintenance Analysis

The FTA requires that transit properties meet or exceed the manufacturer's suggested preventive maintenance intervals for FTA funded assets. The FTA standard is followed by the MTA and requires that an agency must perform the required maintenance activities within 10% of the predetermined schedule at least 80% of the time in order to be compliant. The preventive maintenance for the Ride On fleet is performed on 6,000-mile intervals as shown in Table 18. For each interval, the inspection is considered "on time" if it is completed 5,400 to 6,600 miles of the prior inspection. DFMS monitors the PM compliance for each shop on a monthly basis. Figure 19 shows the PM compliance by shop for FY20.

Figure 19: Monthly Preventive Maintenance Compliance by Shop – FY2020



3.4.3 Mechanical Failures

DFMS tracks mechanical failures as shown in Table 19.

Table 19: Mechanical Failures by Type and Garage July 2019 to May 2020

Type of Problem	Brookville	EMTOC	Nicholson	Total
Auto Shutdown	185	81	58	324
Ck engine light	119	60	59	238
No Start	74	40	30	144
Fluid Leaks	75	28	21	124
Fire/Smoke	18	11	23	52
Air Bags	37	5	8	50
Transmission	18	21	7	46
Low Air Pressure	17	6	17	40
Other	20	5	9	34
No Heat/AC	24	5	3	32
Tires	12	7	4	23
Electrical	8	10	2	20
Brakes	11	5	2	18
Front Door	5	10	1	16
Lift	7	3	6	16
Rear Door	5	6	5	16
Overheat	9	2	1	12
Broken Belts	6	4	1	11
Mirror	6	2	2	10
Fuel	9	0	0	9
Wipers	6	1	2	9
Steering	6	0	1	7
Op Seat	0	0	3	3
Total	677	312	265	1254
Buses Assigned	149	155	74	378
Average Age	6.29	3.92	6.3	5.28
Failures per Bus	4.54	2.01	3.58	3.32
Vehicle Revenue Miles per Mechanical Failure				13,928

4. ZERO EMISSION BUSES AND FLEET COMPOSITION

Montgomery County has been a national leader in responding to the challenge of climate change. Montgomery County Council Emergency Climate Mobilization Resolution 18-974 adopted in December 2017 has set goals to reduce greenhouse gas (GHG) emissions 80% by 2027 and 100% by 2035[5].

To meet these goals, the County through the Department of General Services, Office of Energy and Sustainability has undertaken multiple initiatives to improve energy efficiency and long-term environmental sustainability. Key initiatives include[6]:

- **Solar** - The County has installed 7.6 megawatts of solar panels on County facilities and over parking lots (Figure 20). The County is pursuing public private partnerships to construct a microgrid at Brookville Bus Depot and a 6-megawatt solar project at Oaks Landfill.
- **Green Fleet** - As of August 2020, the County had 39 electric vehicles including 4 electric buses.
- **Green Buildings** - The County designs new buildings to achieve minimum LEED Silver certification including energy efficient heating and cooling, energy efficient lighting, green roofs and solar panels. The David F. Bone Equipment Maintenance and Transit Operations Center is LEED Gold certified with solar lighting on the parking roof and more than 4 acres of vegetated roof. The Brookville Maintenance Facility Transit Shop also recently received interior lighting upgrades that are more energy efficient and improve repair bay lighting.
- **Advanced Energy Projects** - The County is adding microgrids at key facilities including the Public Safety Headquarters and Montgomery County Correctional Facility which were installed in 2018.

Figure 20: Montgomery County Public Safety Headquarters Solar Panels

In accordance with Montgomery County Council directives, the MCDOT Division of Transit Services and the MCDGS Division of Fleet Maintenance Services are seeking to integrate zero emission vehicles into

[5] https://www.montgomerycountymd.gov/DGS-OES/Resources/Files/2019GreenGovernmentReport.pdf

[6] https://www.montgomerycountymd.gov/dgs-oes/EnergyClimate.html.

the Ride On fleet. For Ride On, Montgomery County was successful in competing for a Federal Transit Administration (FTA) grant to purchase the County's first four electric buses and charging stations. Ride On worked with Proterra, the bus manufacturer, and the Center for Transportation and the Environment, a nonprofit that develops technologies and implements solutions to achieve energy and environmental sustainability. The four Proterra Catalyst 35 ft electric buses entered into service in September 2020. In October 2018, MCDOT received a $4.365 million Bus and Bus Facilities grant from the FTA to replace diesel buses with 10 new electric buses. These buses are currently in procurement and should arrive in 2022.

To assist the County plan for zero emission bus (ZEB) implementation this BFMP identifies transportation related GHG emissions and potential air quality benefits. ZEB implementation challenges are also reviewed, and ZEB electric bus costs and benefits are enumerated.

While this BFMP summarizes the County's plans to purchase ZEBs going forward, because of the challenges with implementing these new technologies, the County may need to acquire some replacement buses that utilize a non-zero emission fuel type.

4.1 Greenhouse Gas Emissions by Mode and Fuel Type

The USEPA estimates that transportation accounted for 28% of 2018 U.S. GHG emissions. Of the transportation sector, light duty vehicles including automobiles and small trucks comprised 59% of the U.S. Transportation Sector emissions.[7]

One of the primary benefits of Ride On is moving people on buses instead of trips using private passenger automobiles. As passengers ride buses they reduce GHG emissions as compared to driving private automobiles. With the current fleet mix, Ride On services save approximately 19,500 metric tons of CO_2 annually as shown in Table 21. In future years the amount and GHG emission savings will be affected by improved automobile fuel efficiency and the Ride On fleet mix.

In calculating the emission reduction estimates, multiple sources have been used including USDOT Altoona Bus Testing results for bus emissions (Table 20) and U.S Bureau of Transportation Statistics (BTS) for automobile fuel economy and vehicle miles traveled.

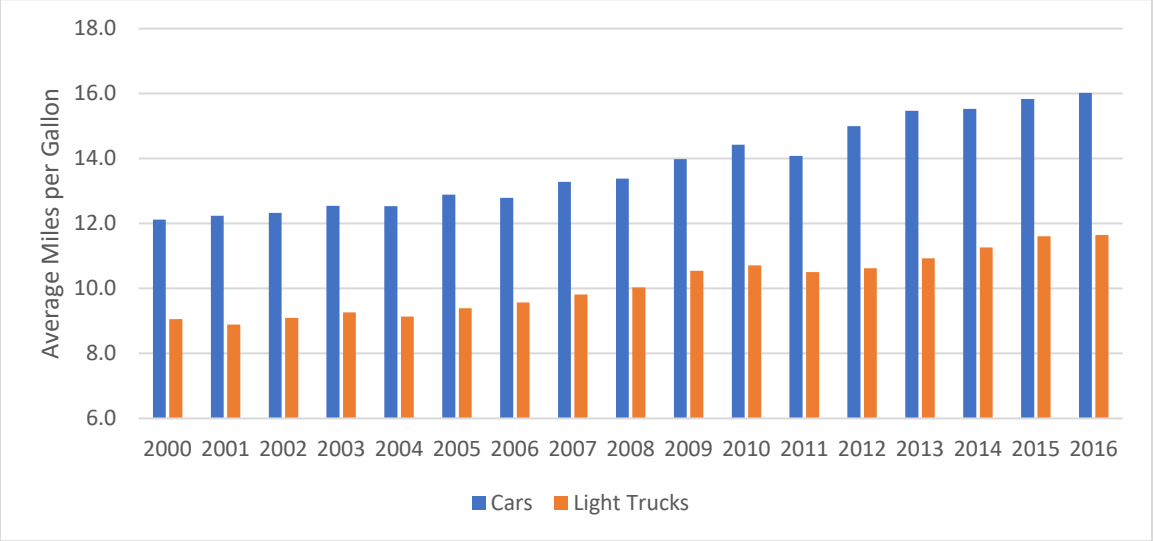
Table 20: Ride On FY2018 GHG Emission Estimates

Bus Type	FY18 Bus Miles	CO_2 Grams per Mile	CO_2Annual Metric Tons	Altoona Test Report
Clean Diesel 40'	4,555,874	2,189	9,980	NABI 40' Test LTI-BT-R1313, 2014
Clean Diesel Hybrid 40'	2,337,597	1,953	4,569	Gillig 40' Test PTI-BT-R1206-P, 2012
CNG 40'	4,994,601	1,725	8,622	Gillig 40' Test PTI-BT-R1306-P, 2013
Clean Diesel 30'	3,869,601	1,634	6,329	NABI 30' Test PTI-BY-R0323, 2004
Total	15,757,673		29,500	

As a result of U.S fuel economy standards, the fuel efficiency of automobiles and light trucks has improved in recent years as shown in Figure 21.

[7] https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions.

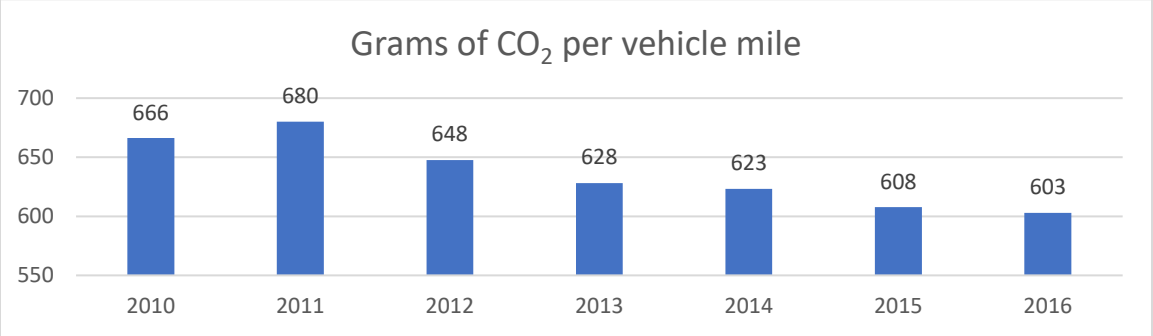
Figure 21: Average Fuel Efficiency of U.S. Light Duty Vehicles



Source: US Bureau of Transportation Statistics: https://www.bts.gov/content/average-fuel-efficiency-us-passenger-cars-and-light-trucks.

GHG emissions are directly related to fuel use. USEPA estimates that each gallon of gasoline contains 8,887 grams of CO_2. Using BTS national mileage estimates and fuel economy for light duty cars and trucks, the grams of CO_2 per vehicle mile have been calculated as shown in Figure 22. Although light duty vehicles also emit other GHGs, CO_2 is the primary pollutant. Fortunately, as automobile fuel economy continues to improve the pollution per vehicle mile will be reduced.

Figure 22: U. S. Cars and Light Trucks Grams of CO_2 per vehicle mile



Source: US Bureau of Transportation Statistics: https://www.bts.gov/content/average-fuel-efficiency-us-passenger-cars-and-light-trucks.

Annual CO_2 emissions for the Ride On bus fleet as shown in Table 20 were calculated for FY2018 using the bus miles operated by fleet from the FY18 National Transit Database and adjusted to the fleet total. The CO_2 grams per mile were reported on the Altoona Bus Testing reports noted, except the 30' Clean Diesel emissions were estimated considering 6 miles per gallon average as compared to the 40' Clean Diesel average of 4.48 gallons per mile.

The County's Ride On bus services contribute to reduced GHG emission by reducing the single occupant automobile trips and associated GHG emissions. During FY 2018 Ride On carried 21.6 million passenger

trips and 81.6 million passenger miles. If these passenger trips had been made using private passenger vehicles, they would have generated 49,034 metric tons of CO_2. The estimated GHG emission savings resulting Ride On are shown in Table 21.

Table 21: Ride On Estimated GHG Emission Savings

	Passenger Trips	Annual Vehicle Miles Traveled Saved	CO_2 Grams per Mile	CO_2Annual Metric Tons
FY2018 Ride On Service Consumed	21,594,040	81,258,497	603	49,034
FY2018 Ride On Service Operations				(29,500)
Net Ride On FY2018 CO_2 Savings				19,534

4.2 Zero Emission Bus Implementation Challenges

Zero emission buses (ZEB) hold the potential of reducing the Ride On operations GHG emissions. Two technologies are currently considered zero emissions including battery electric buses (BEB) and hydrogen fuel cell electric buses (FCEB). These technologies have some challenges which must be considered in introducing ZEBs to Montgomery County.

4.2.1 Daily Service Requirements and Range

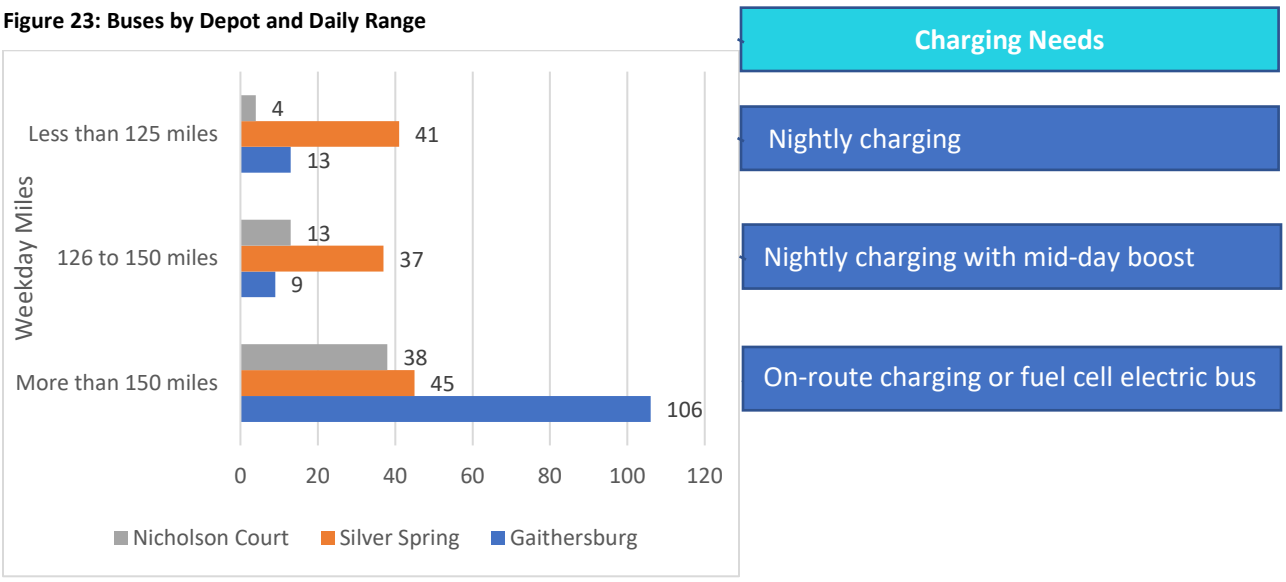
Ride On services span 21 hours per weekday from 4:00 a.m. until 1:00 a.m. the following day. The FY 2020 route profile includes 78 routes operated by the County with 372 peak buses and 52,601 bus miles per weekday. On an average pre-Covid-19 weekday 80,743 passenger trips were taken on Ride On's 4,828 weekday bus trips. Weekday bus miles range from 63 miles to 350 miles per bus. Clean diesel buses typically carry 120 gallons of fuel. Assuming 100 usable gallons, clean diesel buses can range 450 miles between refueling. In comparison, battery electric buses tested at the Altoona Bus Testing Facility had a maximum range of 21.5 miles to 145 miles in the arterial bus profile which is most similar to Ride On routes while hydrogen fuel cell electric buses tested at Altoona should have a 200-mile daily range.

Electric bus range is substantially affected by terrain, passenger loads, and temperature. During cold weather significant amounts of battery capacity is used for heating while on hot days air conditioning uses larger amounts of stored energy. During recent tests of four 25' Proterra buses by Ride On staff, daily range of 100 to 125 miles appeared to be feasible with once daily bus charging. Note that electric bus range will also decline with battery age as usable capacity is reduced with multiple charging cycles.

Ride On currently operates from three bus depots; EMTOC in Gaithersburg, Brookville in Silver Spring and Nicholson Court near White Flint. EMTOC and Brookville are owned by the County and are suitable for ZEB investments while Nicholson Court is a leased facility with a short-term lease expiring in 2022.

Figure 23 shows the daily bus range by depot for the Fall 2020 bus assignments with notes indicating the three levels of charging which may work for ZEBs. There are 58 bus assignments, 4 at Nicholson Court, 41 at Brookville and 13 at EMTOC, which operate less than 125 miles per day and are suitable for nightly depot charging. There are also 59 bus assignments in the 126 to 150-mile range suitable for nightly charging with a mid-day boost and 189 bus assignments in the 150-mile plus range which may require on-route charging or fuel cell electric buses.

Figure 23: Buses by Depot and Daily Range



ZEB implementation should be undertaken in three stages:

- **Stage 1 - Nightly Charging** - Overnight charging should reliably support daily bus mileage of 125 miles or less. This is most similar to Ride On's current operations. There are 54 daily bus assignments in this range.
- **Stage 2 - Nightly Charging with Mid-day Boost** - Adding mid-day charging for select split runs would likely increase the daily electric bus range to as far as 150 miles. There are 46 bus assignments in the 125 to 150-mile range.
- **Stage 3 - On-route Charging or Fuel Cell Electric Buses** - BEB on-route charging and / or fuel cell electric buses should be able to support daily bus operating range greater than 150 miles. BEBs would receive a battery boost at scheduled layovers while the fuel cell electric buses would be fueled by compressed hydrogen gas. If on-route charging is used, it will need to be carefully planned on routes with reliable travel speeds and locations suitable for charging stations and bus layovers.

The first 14 electric buses will be operated at the Brookville Depot utilizing depot chargers and a new electric service installed in 2020 at a cost of $1,097,745. Once the first 14 electric buses are placed in daily service, Ride On staff should reevaluate effective range, location for additional depot chargers, additional utility infrastructure and future year ZEB orders. With 4 ZEBs in operation, this BFMP includes the acquisition of 55 additional ZEBs by 2024 for a fleet total of 59 ZEBs which should work with a combination of nightly and mid-day charging. Additional electrical infrastructure, such as the Brookville Smart Depot project, will be needed to add more than the first 14 electric buses.

4.2.2 Bus Weight and Range

Electric buses have become feasible as lithium-ion batteries become more efficient and cost effective. However, extending electric bus range requires adding more batteries, storage capacity and weight. Using Altoona Bus Testing Center reports, Table 22 shows the battery capacity for tested electric buses, gross vehicle weight with full passenger load and bus test range.

Increased Bus Range > Increased Battery Capacity > Increased Axle Weight

So that electric buses can operate a full day's service on a single charge, bus manufacturers are designing the vehicles with larger capacity batteries. As more battery capacity is added, the vehicles become heavier exceeding the legal axle weight limits. Maryland statute § 24-108(d) states "Any over–the–road bus or any vehicle that is regularly and exclusively used as an intrastate public agency transit passenger bus may not exceed: (1) A single axle weight limit of 24,000 pounds…" Operating vehicles above the legal weight limit directly contributes to roadway and bridge maintenance costs. Changes in state law may be required to operate buses above the 24,000-pound axle weight limit.

Table 22: Electric Bus Test Range and Weight

Manufacturer	Bus Test	Test Date	Length	# axels	Battery Capacity	Axle Gross Vehicle Weight			Test Range Miles
						Front	Middle	Rear	
New Flyer	LTI-BT-R1903-P	4/19	60'	3	600 kWh	14,160	**27,770**	**28,240**	145
Proterra	LTI-BT-R1706-P	9/17	42'	2	not stated	19,140		**24,400**	159
NOVA LSFe+	Not tested		40'	2	594 kWh				
New Flyer	LTI-BT-R1405	6/15	40'	2	196 kWh	14,880		**28,670**	87
NOVA LSFe	LT_-BT-R1703	6/18	40'	2	76 kWh	14,900		**26,790**	21.5
Proterra	LTI-BT-R1811-P	1/19	35'	2	440 kWh	15,560		23,169	n/a
Proterra	LTI-BT-R1805-P	6/18	35'	2	106 kWh	15,350		20,870	32.8
Gillig	LTI-BT-R1715-P	5/18	29'	2	100 kWh	11,200		20,610	43.3
Bold cells are above Maryland's 24,000 lbs. legal single axle weight limit									

4.2.3 Annual Mileage

Ride On's buses are used intensively as shown in Table 13 above. The County's 95 CNG buses have averaged almost 53,000 annual miles per bus while the diesel fleets have averaged approximately 40,000 annual miles per bus. An analysis of the national electric bus fleet annual miles was completed using the National Transit Database FY2018 fleet data as shown in Table 23.

Table 23: Battery Electric Bus FY2018 Average Annual Miles per Bus

Model Year	# Buses	FY2018 Average Miles	Highest Fleet FY2018 Average Annual Miles	Location Highest Average Annual Miles
Rebuilt	13	12,457	18,703	City of Gardena
2012	7	7,176	16,436	City of Tallahassee
2013	28	20,724	25,334	Foothill Transit
2014	19	16,979	18,715	City of Clemson
2015	15	18,181	50,685	City of Clemson
2016	31	17,545	24,170	Foothill Transit
2017	35	15,289	30,048	City of Shreveport
2018	24	3,645	5,761	Rock Island County
Source: National Transit Database - FY 2018 Revenue Vehicle Inventory				

Although battery electric buses are currently being manufactured with higher battery capacity, the NTD data suggests that Ride On should expect average annual miles per electric bus to be 20,000 to 30,000 miles. Table 24 shows a FY2026 fleet mix scenario with 59 electric buses plus the new BRT services in the US29 and MD586 corridors.

The primary implication of the limited electric bus annual miles is that the average miles per bus will increase for the rest of the fleet. If the electric buses operate 26,000 annual miles on average, the annual mileage on the remainder of the fleet would increase by 3.8% from 43,094 to 44,695 annual miles per bus. Also note that the during the first five months of operation, the BRT buses accumulated an annual average 66,546 miles per bus which would result in nearly 800,000 miles per bus over a twelve-year life. Transit buses and their components are designed to operate with a 12-year / 500,000-mile service life and 20% spare ratio. When the BRT fleet is operating at this high of annual mileage, additional component maintenance, mid-life overhaul or additional spare buses may be needed. The BRT fleet may also need to be replaced more frequently than every 12 years.

Table 24: Projected FY2026 Bus Mileage by Fleet

Service	# Buses	Annual Miles	Annual Miles per Bus
Projected Miles Required			
Ride On Services FY2020	372	16,030,968	43,094
Less Route 129	-10	-258,950	25,895
Add Great Seneca ExtRa	37	958,115	25,895
US29 Flash	16	1,000,960	62,560
MD586 Flash	14	875,840	62,560
MD355 Flash	24	1,501,440	62,560
Total Projected FY2026	453	20,108,373	
Projected Miles by Fleet			
BRT	54	3,378,240	62,560
Electric	59	1,534,000	26,000
Clean Diesel and CNG	340	15,196,133	44,695
Total Projected FY2026			

4.2.4 Charging Infrastructure

The electric bus duty cycle and weather will play a considerable role in determining the electric bus charging infrastructure. The Altoona Bus tests completed fuel economy tests for different duty cycles. The arterial duty cycle is closest to a typical Ride On route. Table 25 lists the energy consumption in kWh per mile for the tested buses on the arterial duty cycle with a full passenger load. Actual energy consumption will be affected by elevation change, temperature, passenger loads and stop frequency.

Table 25: Electric Bus kWh per mile

Manufacturer	Bus Test	Test Date	Length	# axels	Test kWh per Mile
New Flyer	LTI-BT-R1903-P	4/19	60'	3	3.89
New Flyer	LTI-BT-R1405	6/15	40'	2	2.29
Proterra	LTI-BT-R1811-P	1/19	35'	2	n/a
Proterra	LTI-BT-R1805-P	6/18	35'	2	2.07
Gillig	LTI-BT-R1715-P	5/18	29'	2	2.15
Proterra	LTI-BT-R1706-P	9/17	42'	2	1.7
NOVA LSFe	LT_-BT-R1703	6/18	40'	2	2.49

For 30’ to 40’ buses the tested energy usage without heating and air conditioning ranges from 1.7 kWh per mile to 2.49 kWh per mile and the 60’ articulated bus required 3.89 kWh per mile. Considering heating and air conditioning loads, charging capacity should allow for 3 kWh per mile for 150 daily miles or 450 daily kWh per bus. At this level of daily energy utilization, a 150-kW charger operating at an average 75% efficiency would require approximately four hours to recharge a bus while a 60-kW charger operating at an average 75% efficiency would require approximately 10 hours to recharge a bus.

Electric bus charging infrastructure requires both utility infrastructure and on-site electrical. For the initial 14 bus chargers at the Brookville Depot, Montgomery County installed a new 3000-amp service at an installed cost of $1,097,745 as shown in Table 26.

Table 26: Brookville Electric Bus Infrastructure Installation Cost

Line Item	Amount
Design and Administration	$97,650
Electric Infrastructure	$948,351
Pepco	$24,773
Permits	$26,972
Total Cost	$1,097,745

A 150-kW charger is also required for each bus at a cost of $160,000 per charger or $2.2 million for the first 14 buses and a total electric charging infrastructure cost of $3.3 million or $238,000 per bus.

On-route 450-kW fast chargers, similar to the pantograph charger shown in Figure 24, will be needed during the third stage of electric bus implementation. They are estimated to cost $600,000 for the charger and $400,000 for the electric infrastructure. The actual costs will depend upon the site work, costs to bring the electrical utilities to the on-route charging location and right-of-way costs.

On-route chargers require land for the charging infrastructure, heavy electrical infrastructure and layover facilities (restrooms) for the bus operators. The chargers must be carefully located and sized considering the routes they will serve and projected energy consumption. An implementation study will be needed to identify potential on-route charger locations, estimate power consumption using route energy simulations, coordinate utility improvements, and develop preliminary designs and budget estimates.

Figure 24: New York City Pantograph Charger

4.2.5 Electric Bus Maintenance

Electric bus maintenance will share many common elements with traditional buses such as tires, suspension and air-conditioning but will have highly specialized components and require technicians skilled in high voltage systems. Clean Diesel, CNG and Electric have subsystems which require different maintenance than the other fuel types. For example:

- Clean Diesel engines as a result of clean air regulations have an extensive exhaust gas recirculation (EGR) system which requires regular maintenance. Clean Diesel engines used in transit buses have a typical 250,000 to 300,000-mile service life. Over a 12 to 15-year service life, Clean Diesel engines require replacement or rebuild at least once at a cost of $30,000 to $50,000 per bus.
- Natural Gas engines operate at higher temperatures than traditional diesel engines. The higher temperatures lead to the need for increased cooling system maintenance. Over a 12 to 15-year service life, Natural Gas engines require replacement or rebuild at least once at a cost of $30,000 to $50,000 per bus.
- Clean Diesel Hybrid buses, like regular Clean Diesel buses require regular EGR system maintenance. However, they also require mid-life battery replacement at nearly $50,000 per bus. Mid-life engine replacement will cost of $30,000 to $50,000 per bus and an occasional traction motors can cost as much as $80,000.
- Electric buses as a new technology will likely have their own maintenance problems. Batteries, control systems, electric motors and charging stations are likely to have their challenges resulting from heavy duty transit use. Depending on the depth of charging cycle, electric buses may require battery pack replacement at least once during a twelve-year service life.

Because electric buses are a new technology with little long-term maintenance experience. Two research studies have been reviewed to understand future bus maintenance costs.

Foothills Transit Battery Electric Bus Demonstration - The performance of twelve 35' Proterra electric buses was compared to eight 40' NABI CNG buses.[8] The electric buses were used on a specific route with an on-route charging station while the CNG buses operated on different routes throughout the system.

Over the study period the electric buses operated a total of 401,244 miles with 90% availability while the CNG buses operated 364,373 miles with 94% reliability. The electric buses had a total maintenance cost of $.16 per mile while the CNG buses had total maintenance cost of $.18 per mile.

The most significant difference in the fleet performance was that the electric buses operated 9,331 between road calls while the CNG buses operated 45,547 miles between road calls. The CNG buses were also able to operate 4,555 monthly miles while the electric buses operated 2,333 monthly miles.

Zero-Emission Bus Evaluation Results: King County Metro - February 2018[9] **-** The operation of three battery electric buses was compared with 10 diesel hybrid buses and three clean diesel buses. The battery electric buses were available 80.6% of the time while the diesel hybrid buses were available 90.5% of the time and the clean diesel buses were available 86.4% of the time. The reliability as measured by miles between road calls was 17,332 miles for the clean diesel, 7,641 miles for the diesel hybrid buses and 6,927 miles for the electric buses. The battery electric buses had an overall energy efficiency of 2.36 kW per mile which equates to a fuel economy of 15.9 miles per diesel gallon equivalent. Bus maintenance costs were mostly attributed to routine bus maintenance with propulsion system maintenance a small component. The electric buses had a maintenance cost of $.26 per mile while the diesel hybrid buses had a cost of $.32 per mile and the clean diesel buses had a cost of $.46 per mile.

Although Montgomery County's experience will be different, the research indicates that electric buses may be less reliable than clean diesel and CNG buses, but the overall maintenance costs may be $.02 per mile to as much as $.20 per mile lower than CNG and clean diesel buses.

The most expensive electric bus maintenance unknowns are battery replacement and traction motors. For hybrid buses, new traction motors cost $80,000 each and battery replacement costs approximately $50,000 per bus for 16 2-kWh batteries or approximately $1,500 per kWh battery capacity. If a BEB has a battery capacity of 600 kWh, at a unit price of $1,500 per kWh, a mid-life battery replacement would cost $900,000 or roughly the cost of a new bus. This seems much too high. Montgomery County should use its current BEB procurement to better quantify the replacement costs and service life for key electric bus components.

4.2.6 Electricity Costs

The April 2020 Pepco bill for the new Brookville electric bus service was analyzed and used to estimate electric costs for 14 battery electric buses operating 364,000 miles annually or 26,000 miles per bus. Assuming 2.5 kWh per mile the buses will require $224,958 in annual electric costs as shown in Table 27. This estimate also assumes that 10 new 150 kW electric chargers are added which directly increase the maximum demand charge and that the electric and transmission rates are not different for peak and off-

[8] https://afdc.energy.gov/files/u/publication/foothill_transit_beb_demo_results.pdf

[9] https://www.transit.dot.gov/research-innovation/summary-zero-emission-bus-evaluation-results-king-county-metro-battery-electric.

peak times as was the case for the April 2020 electric bills. The maximum demand charge should be managed by coordinating charging times so that all of the buses are not charging simultaneously.

The projected electric cost per bus mile is $.618 which is slightly less that the FY2018 Ride On fuel and lubricants cost per mile of $.637.

Table 27: Electric Bus Energy Cost Analysis

	April 2020 Electric Bill Analysis				Annual Estimate 14 Electric Buses	
Type of Charge	**Basis**	**Rate**	**Quantity**	**Cost**	**Quantity**	**Total**
Electric Bus Annual Miles					26,000 per bus	364,000 miles
Electric Bus kWh	kWh per mile	2.5			910,000	
Customer Charge	Monthly	$365.32		$365.32	12	$4,383.84
Energy + Transmission	per kWh	$0.026693	730	$19.49	910,000	$24,290.63
Maximum Demand	kW per month	$4.86370	127.4	$619.64	1,627.4	$94,982.22
Capacity Charge	Monthly			$4,427.13	12	$53,125.56
Energy Fees and Taxes	per kWh	$0.0359811	730	$26.27	910,000	$32,742.80
Gross Receipts Tax	2.048%			$20.57		$2,532.49
Market Hourly Charge	Monthly	$13.99		$13.99	12	$167.88
Sales Tax	6.00%			$329.54		$12,733.53
Total				$5,821.94		$224,958.95
Electric Cost per Mile						$.618

4.2.7 Brookville Smart Depot Project

Consistent with Montgomery County's goal to achieve zero greenhouse gas emissions by 2035, the County intends to create a nation leading transportation system powered by electricity and low carbon fuels. To this end, in August 2019 the County issued a Request for Energy Proposals (RFEP) to generate a short list of prospective public-private partners who might design-build-finance-operate-maintain a smart energy depot at the Brookville Bus Depot. The Brookville Bus Depot is responsible for the maintenance, servicing and parking of over 150 buses. The Smart Depot project will help prepare the site for additional electric buses with a minimum of 54 total electric buses operated from the site. The project will incorporate clean energy, electric vehicle charging and several options for enabling the County to provide sustainable, resilient and reliable energy supply for bus charging and site operations. The County envisions combinations of the following technologies and approaches:

- Solar canopies over parking and conduit placement/infrastructure for future charging of electric buses,
- Enhancements to on-site utility infrastructure to provide reliable and resilient charging of transit buses and other vehicles,
- Energy storage, on-site natural gas generation, potential for combined heat and power,

- Controls and electrical gear for integration into a future microgrid.

The Brookville Smart Depot Project including bus chargers, a photovoltaic micro-grid and finance costs is projected to cost $61.9 million over 25 years.

4.2.8 Electric Bus Cost Benefit Analysis

Electric buses have the promise of reducing GHG emissions and operating and maintenance costs. Assuming 26,000 annual miles per bus, Table 28 shows a benefit-cost analysis for the 14 electric buses.

Table 28: Electric Buses Life Cycle Costs

Electric Bus Capital Costs					
Cost Item			**Units**	**Unit Costs**	**12-year Total**
4 - Proterra 35' Buses and Chargers			4	$793,459	$3,173,836
4 - Proterra 60kW charger			4	$42,500	$170,000
4 - Battery 12-year Extended Warranty			4	$75,000	$300,000
10 - 40' Electric Buses and Chargers			10	$1,081,500	$10,815,000
10 - Battery 12-year Extended Warranty			10	$100,000	$1,000,000
Brookville Depot Electrical Infrastructure			1	$1,097,745	$1,097,745
Diesel Buses not Purchased			-14	$553,266.00	-$7,745,724
				Total Increased Capital Costs for 14 Electric Buses	$8,881,857
Electric Bus Energy and Maintenance Savings					
Cost Item	**Units**	**Data Source**		**Rate**	**12-year Total**
Fuel Cost Savings per Mile	4,368,000 miles	Pepco April 2020 Electric Bill and FY2018 NTD		-$.03 / mile	-$131,040
Maintenance Savings per Mile	4,368,000 miles	Zero-Emission Bus Evaluation Results: King County		-$.20 / mile	-$853,600
Diesel/CNG Engine Replacement	14 engines	Recent repairs		$50,000 each	-$700,000
Traction Motor Replacement for 1/3 of buses	5 buses	BAE Traction Motor		$80,000 each	$400,000
				Total Decreased Operating and Maintenance Costs	-$1,022,560
Electric Bus Emission Tons Avoided and Value					
Emission Savings	**Miles**	**Grams per Mile[10]**	**Tons Avoided**	**Value**	**12-year Total**
Diesel CO_2 Emissions Metric Tons Avoided	4,368,000	2,189	9,568.4	$50 per metric ton	-$478,422
Diesel NOx Emissions Tons Avoided	4,368,000	.92	20.22	$8,600 per ton[11]	-$173,911
Diesel PM Emissions Tons Avoided	4,368,000	.016	.00963	$387,300 per ton	-$3,730
				Total Emission Savings	-$656,063
				Total Net Increased Life Cycle Costs	**$7,173,234**

[10] NABI 40' Test LTI-BT-R1313, 2014

[11] https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf

In this analysis the $8.8 million of increased capital costs for the 14 electric buses is offset by $1.0 million in energy and maintenance savings and $656,000 in emission savings yielding a net increase of $7.1 million for the 14 electric buses.

Note that battery replacement costs are not included in Table 28 as the County is procuring 12-year extended battery warranties which provide 80% battery capacity through the warranty period. Industry projections are battery replacement costs are currently $450 per kWh and projected to decline to $150 per kWh. And, the emissions estimates shown in Table 28 utilized a 2014 Altoona Bus Test to calculate the emissions reduced for CO_2, NOx and PM. The emission values per ton came from 2020 USDOT Benefit-Cost Guidance except $50 per metric ton was used for CO_2.

4.3 Zero Emission Bus Recommendations and Next Steps

The addition of ZEBs to Ride On's fleet is an opportunity to introduce new technology and innovation. However, ZEBs require considerably more capital investment and result in relatively small emissions and operating cost savings. With 4 electric buses in operation, this BFMP includes the acquisition of 55 additional ZEBs by 2024 for a fleet total of 59 ZEBs. A ZEB implementation study should be undertaken to identify needed fuel infrastructure as well as location and cost for on-route chargers. Also, a three-year RFP should be issued to purchase an additional 55 buses to allow for flexibility for adapting to developing technology while addressing the Fleet's retirement's needs.

5. MAINTENANCE FACILITIES

The County maintains transit vehicles at three facilities. The Brookville and EMTOC facilities which are owned by the County, and the Nicholson facility which is leased. Figure 25 shows the various locations, and Table 29 illustrates the type of maintenance spaces available by garage.

The location of maintenance facilities is critical to the effectiveness and efficiency of the operation. They should be located in close proximity to the area in which the routes operate to minimize down time for maintenance activities and deadhead miles traveled.

Figure 25: Ride On Maintenance Facilities

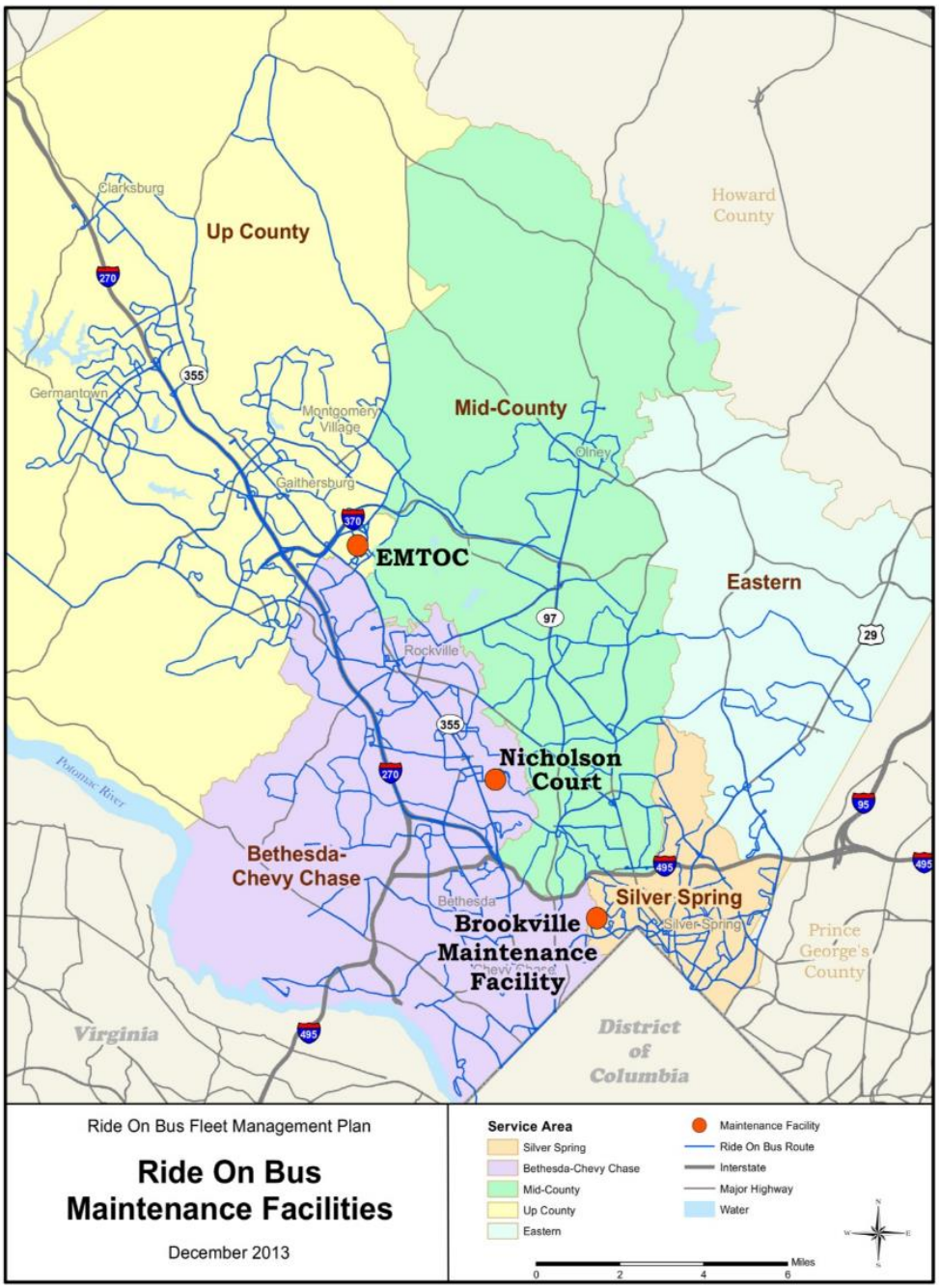


Table 29: Maintenance Spaces Inventory

Ride On Maintenance Spaces Inventory	Garage		
Area Type	**Brookville**	**Nicholson**	**EMTOC**
30’ Bay with Mobile Column Lifts		4	
40’ Bay with Mobile Column Lifts	9		6
40’ Bay with Post Lifts			6
40’ Bay with Service Pit			3
60’ Bay with Post Lifts			1
60’ Bay with Service Pit			1
Chassis Wash	1		1
Service Lane with Fuel without Wash	1		1
Service Lane with Fuel and Bus Wash	1	exterior	2
Fuel Island		1	
Parts Storage (square footage)	4000	1000	8000
Tire Storage	150 tires	40 tires	150 tires
Metal Fabrication Shop	1		1
Electronic / Farebox Shop	1	1	1
Maintenance Offices (square footage)	600	350	450
Maintenance Locker Rooms	400	250	2474
Buses Assigned	149	74	153
Operating Bus Parking	150	65	200
Dead Bus Storage	0	0	48

5.1 Brookville Maintenance Facility

The Brookville Maintenance Facility is in an ideal location in Silver Spring for bus operations in the south-eastern portion of the County. The facility is a converted County owned warehouse at the end of Brookville Road. The nine-repair bay garage (Figure 26) can support a fleet size of 150 buses. Having originally served as a warehouse, the facility was not constructed as a transit operations and maintenance facility (see site plan – Figure 26). It is located on a steep slope with an average grade of more than 5%. Although some portions of the building have been renovated, most of the building needs improvement. The bus maintenance bays (Figure 27) and bus service lane recently had lighting upgrades. The facility has a bus wash, a paint booth, body and metal shop, and steam bay.

Figure 26: Brookville Maintenance Facility Site Plan

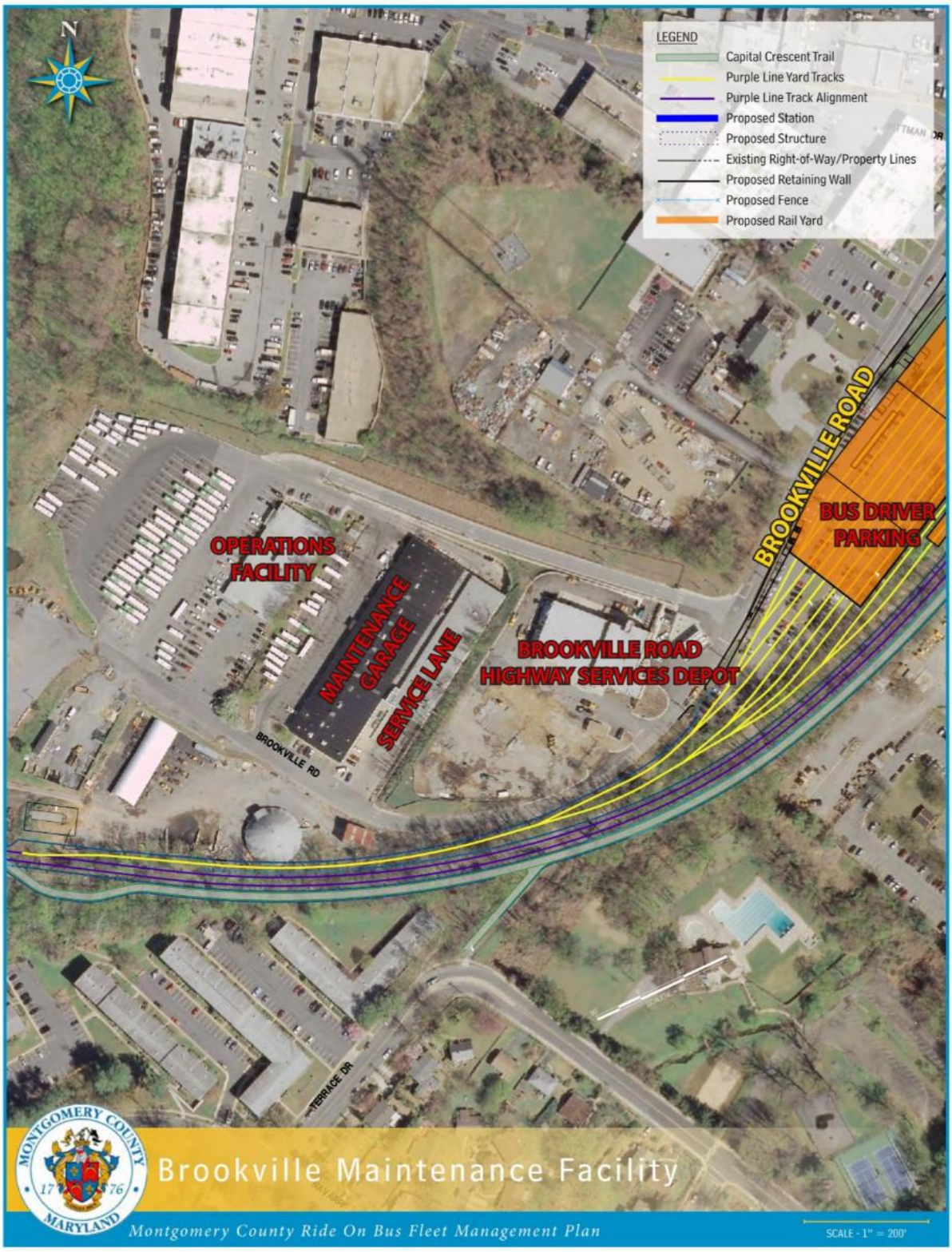


Figure 27: Brookville Maintenance Bays

Figure 28: Brookville Operators' Facility

There are a number of serious issues that plague the facility. In addition to the overall facility condition, the steeply sloped bus parking area drains into Rock Creek, the bus operator parking area is located approximately 1,000 feet from the driver's room, and the existing facility cannot accommodate CNG or articulated vehicles. The grade of this site is steeper than desirable for a transit operations and maintenance facility. While MCDOT and MCDGS have identified a need for Brookville Maintenance Facility improvements, there are no current plans for facility renovation or relocation.

5.2 Nicholson Court

Originally, the Nicholson Court facility was leased by a private contractor that was operating some of the Ride On service. In 2007, the County entered into a lease agreement for a five-year term, with three five-year renewals that could be executed at the County's discretion. In 2017, the County executed the second renewal option, which will expire in May 2022. The County may execute the third and final five-year option which would extend the facility lease until May 2027. Although this is a good depot location, this facility has significant capacity limitations based on its size and the type of equipment that can be accommodated. This is a costly proposition as the lease, property tax and operating costs of the facility are in excess of $900,000 annually. Figure 29 shows the site.

Figure 29: Nicholson Court Site

The Nicholson Court facility has capacity for approximately 65 buses. It features an operations office and four bus maintenance bays as shown in Figure 30. The facility is constrained with limited room for bus parts and storage (Figure 31). Figure 32 shows an above ground fuel storage tank and dispensers in the center of the bus parking area. An outside bus wash area has been constructed on the site to permit bus cleaning by contractors.

The current lease agreement permits the County to only operate 30-foot buses from the site. The facility is well located for small buses needed on routes in Bethesda and Silver Springs. However, Germantown routes requiring small buses have considerable deadhead mileage which contributes to non-revenue operating cost. Given that this is a key operational location, Ride On needs to identify options to replace the current operations and maintenance space with one that allows more flexibility in vehicle accommodations and ample operational space.

Figure 30: Nicholson Bus Maintenance Bays

Figure 31: Nicholson Parts Storage

Figure 32: Nicholson Fueling Island

5.3 Equipment Maintenance and Transit Operating Center (EMTOC)

The David F. Bone Equipment Maintenance and Transit Operating Center (EMTOC) shown in Figures 33 and 34 opened in October 2013. The campus houses 12 buildings serving the MCDOT's divisions of Transit Services, Highway Services, and the MCDGS's Division of Fleet Management. The site includes administrative buildings, parking for 200 buses, bus service lanes, bus wash facility, fare collection area, bus service maintenance bays, parts room, heavy equipment storage shed, soil/gravel storage area, salt barn, Highway Services bays, compressed natural gas fast-fill, gasoline and diesel fueling stations, and employee and visitor parking.

The facility features six repair bays with in-ground rotary lifts shown in Figure 35, three bays with pits for preventive maintenance shown in Figure 36, and six flat repair bays with portable lifts. In addition to the 15 repair bays for regular transit buses, there are two bays that can accommodate articulated buses. The 200-bus parking area is under a parking deck. The facility also offers improved accommodations for drivers and parts storage.

The EMTOC facility replaced a former site near the Shady Grove Metrorail Station. The construction of this facility was prompted by the County's Smart Growth Initiative to relocate old and overcrowded County government facilities and it made way for a sustainable, transit-oriented community in its place.

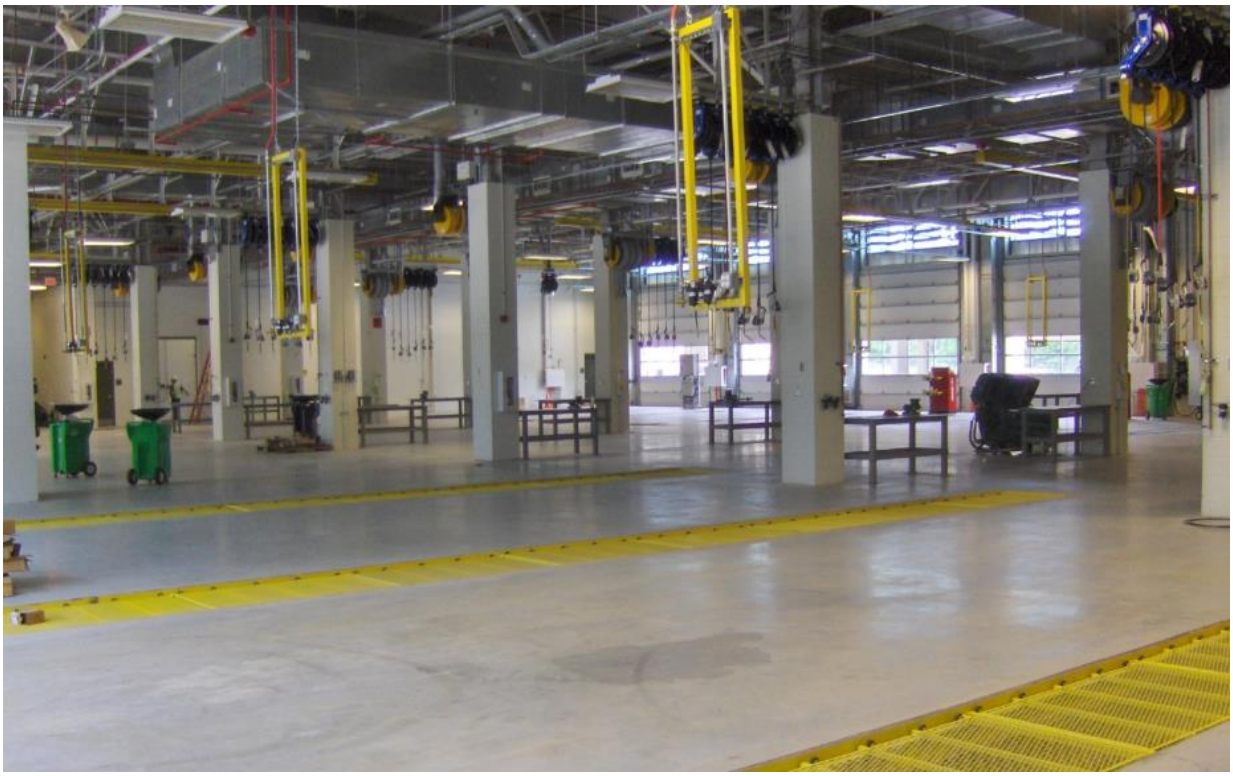
The cost of the new facility, including the transit and other County functions, was budgeted in FY10 at $134 million. These funds were provided from Montgomery County G.O. Bonds and the sale of County properties near the Shady Grove Metrorail Station. No federal or state funds were used in the construction of the EMTOC.

Figure 33: EMTOC Site Plan

Figure 34: EMTOC Facility

Figure 35: EMTOC Repair Bays with In-Ground Rotary Lifts

Figure 36: EMTOC Maintenance Repair Bays with In-Ground Pits



6. FLEET ACQUISITION

Transit buses are generally replaced based on useful life standards. The FTA has established the following guidelines:

- Heavy- duty full size buses (35' - 40') – 12 years
- Smaller medium-duty buses (30') – 7 to 10 years

Buses are typically procured with a combination of federal, state, and local funds. The FTA will participate up to 80% of the cost.

Table 30 lists the existing Ride On fleet and the funding source used to procure each bus.

Table 30: Ride On Existing Fleet Procurement

Bus Model Year	Bus Maker	Size / Type	# Buses	Useful Life	Total Cost	Federal	State	Local
2001	Orion	35' CNG	43	12 years	$11,956,074	$ 8,652,960	$ 270,405	$ 3,032,709
2003	Orion	35' CNG	33	12 years	$ 9,645,833	$ 1,457,921	$ 3,636,020	$ 4,551,892
2005	New Flyer	40' CNG	15	12 years	$ 5,213,325	$ 2,133,881	$ 1,583,961	$ 1,495,486
2005	Orion	35' CNG	24	12 years	$ 7,898,982	$ 2,030,170	$ 5,361,246	$ 507,566
2007	Champion	25' Diesel	50	7 years	$ 8,773,950	$ -	$ 2,807,664	$ 5,966,286
2007	Champion	25' Gas	12	7 years	$ 1,388,772	$ -	$ -	$ 1,388,772
2006	Gillig	40' Hybrid	14	12 years	$ 6,856,989	$ -	$ -	$ 6,856,989
2008	Gillig	40' Diesel	21	12 years	$ 6,671,964	$ 2,433,822	$ 593,889	$ 3,644,253
2008	Gillig	30' Diesel	6	10 years	$ 1,817,148	$ 971,779	$ 602,424	$ 242,945
2009	Gillig	30' Diesel	25	10 years	$ 7,948,275	$ 485,888	$ -	$ 7,462,387
2009	Gillig	40' Hybrid	35	12 years	$18,114,180	$ -	$ -	$18,114,180
2009	Gillig	40' Diesel	11	12 years	$ 3,701,444	$ 2,858,537	$ -	$ 842,907
2011	Gillig	40' Diesel	1	12 years	$ 353,038	$ 353,038	$ -	$ -
2011	Gillig	40' Hybrid	12	12 years	$ 6,255,144	$ 6,196,962	$ -	$ 58,182
2012	Gillig	40' Hybrid	7	12 years	$ 3,660,510	$ 2,858,537	$ -	$ 801,973
2013	Gillig	40' Diesel	12	12 years	$ 5,220,774	$ 3,961,272	$ 413,997	$ 845,477
2014	Gillig	30' Diesel	32	10 years	$13,403,740	$ -	$ 1,025,787	$12,377,953
2014	Gillig	40' CNG	19	12 years	$ 9,141,521	$ 6,763,551	$ 386,003	$1,991,967
2016	Gillig	30' Diesel	1	10 years	$ 429,860	$ -	$ -	$429,860
2016	Gillig	40' Diesel	40	12 years	$18,662,960	$11,200,000	$ 2,800,000	$4,662,960
2016	Gillig	40' CNG	16	12 years	$ 8,127,504	$ -	$ 250,000	$7,877,504
2017	Gillig	40' Diesel	19	12 years	$ 8,724,287	$ -	$ -	$8,724,287
2017	Gillig	40' CNG	14	12 years	$ 7,027,056	$ 1,600,000	$ 400,000	$5,027,056
2017	Gillig	40' Diesel	6	12 years	$2,760,891	$0	$0	$2,760,891
2017	Gillig	40' CNG	20	12 years	$10,038,652	$0	$0	$10,038,652
2017	Gillig	40' Diesel	4	12 years	$2,006,741	$1,600,000	$400,000	$6,741
2019	Gilig	40' CNG	4	12 years	$2,121,899	$1,600,000	$400,000	$121,899
2019	Gilig	40' CNG	19	12 years	$10,079,019	$0	$0	$10,079,019

Bus Model Year	Bus Maker	Size / Type	# Buses	Useful Life	Total Cost	Federal	State	Local
2019	Gillig	40' Diesel	3	12 years	$1,423,212	$0	$0	$1,423,212
2019	Ford	Micro transit	7	4 years	$963,566	$0	$0	$963,566
2019	NOVA	60’ Diesel	16	12 years	$13,349,084	$0	$0	$13,349,084
2020	Proterra	35' Electric	4	12 years	$3,173,836	$1,404,158	$0	$1,769,678
2020	Gillig	30' Diesel	19	10 years	$9,479,022	$0	$0	$9,479,022
2020	Gillig	40' Diesel	5	12 years	$2,607,532	$0	$0	$2,607,532
2020	Gillig	40' Diesel	4	12 years	$2,086,025	$1,600,000	$400,000	$86,025
				Fleet Total	$242,775,331	$60,162,476	$25,305,609	$157,307,250
				Participation Percentage		24.8%	10.4%	64.8%

Table 31 lists the retirement eligibility for the existing Ride On fleet based on 12 years from the in-service date for 40’ and 60’ buses, 10 years from in-service date for 30’ buses and 4 years from in-service date for 25’ buses. With a ZEB fleet introduction of 10 buses per year through FY 2024, the 40’ Hybrid and 40’ Diesel will be replaced with either ZEBs or other type of bus, partially depending on funding availability.

Table 31: Ride On Bus Retirement Eligibility

Budget Year	40’	30’	25’
FY 2021	21		
FY 2022	46		
FY 2023			
FY 2024	20	28	7
FY 2025		32	
FY 2026	31		
FY 2027			
FY 2028	56		7
FY 2029			
FY 2030	63		

Table 10 in section 2.5 described plans for expansion and future peak vehicle requirements. Table 32 summarizes expansion plans by bus type (including spare buses). It is important to note that based upon fuel type and other factors, additional buses may be needed beyond the numbers shown in the chart.

Table 32: Recommended Buses by Type of Expansion

Type of Expansion (Proposed)	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	Total
BRT				14	24			24		27	65
Great Seneca ExtRa			13			26					39
Microtransit		4			4			3			11
Total Expansion Fleet		4	13	14	28	26		27		27	76
Total Ride On Fleet	385	389	402	416	471	471	471	474	474	484	

The type of service to be expanded is not the only consideration for the bus replacement schedule. Bus size and fuel type are also important factors especially because of the capacity constraints and fuel type restrictions of the bus facilities as discussed in section 4. Plans are underway to add capacity for more electric bus chargers at Brookville through the Smart Depot Project. Electric chargers may also be added to EMTOC. Table 33 summarizes the facility limitations. As MCDOT pursues the integration of ZEBs into the fleet, the Department may need to continue to procure conventionally fueled vehicles due to facility, operational needs, or fiscal capacity.

Table 33: Existing Facility Capacity, Bus Size, and Fuel Type

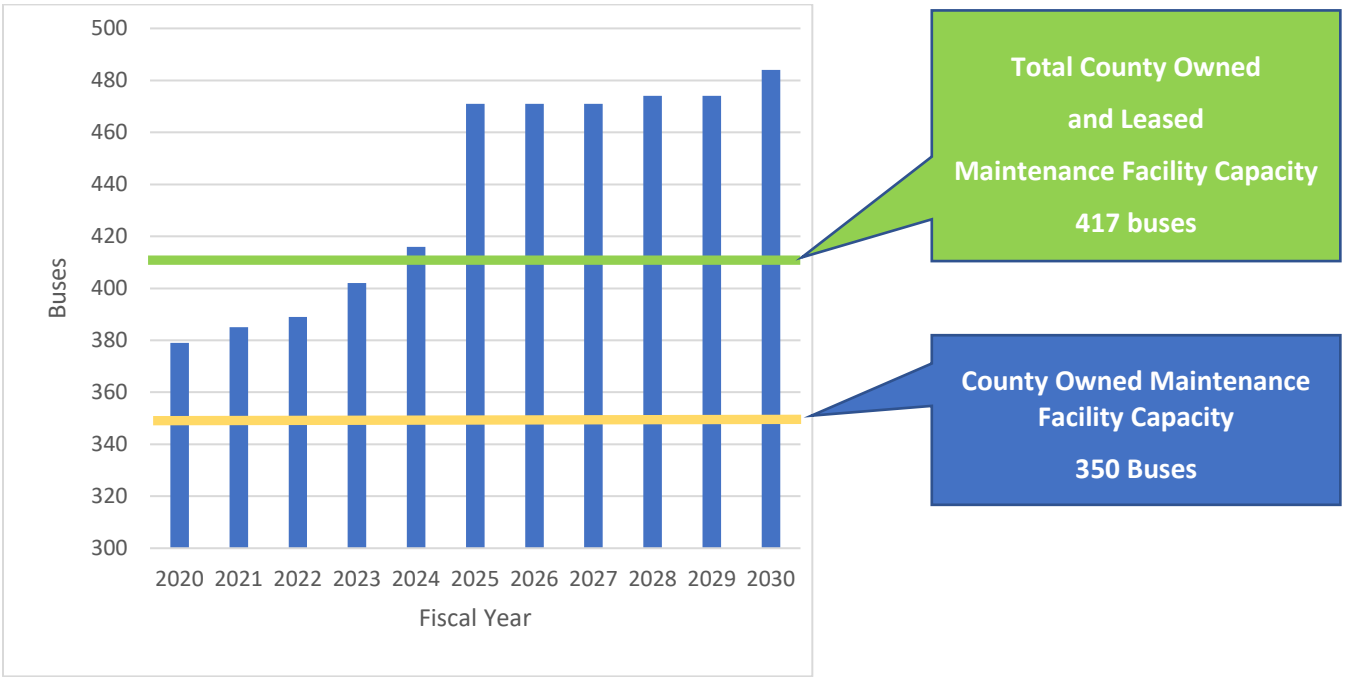
Facility	Fleet Capacity	Bus Size			Bus Fuel		
		30 foot	40 foot	60 foot	Diesel	Electric	CNG
Brookville, Silver Spring	150 buses	X	X		X	70 buses	
Nicholson Court, White Flint	67 buses	X			X		
EMTOC, Gaithersburg	200 buses	X	X	X	X	1 bus	X
Total	417 buses						

Bus depot ZEB infrastructure will be a needed in addition to the current Montgomery County budgeted vehicle procurement project. The Brookville Smart Depot project plans to increase the capacity to 54 electric buses which would provide enough electrical infrastructure for the electric buses included in this BFMP. For future ZEBs, electrical infrastructure and or hydrogen fueling systems may needed.

7. FUTURE FACILITY NEEDS

As shown in Figure 37, maintenance facility capacity is a constraint to the growth of the Ride On service. The two maintenance facilities owned by the County (Brookville and EMTOC) have an existing maintenance capacity of 350 buses. Including the leased Nicholson facility, the County has a total transit maintenance facility capacity of 417 buses.

Figure 37: Ride On Fleet Size and Maintenance Facility Capacity



The need for additional maintenance capacity has been recognized as a problem for Montgomery County for more than a decade. The North County Maintenance Study completed in 2007 proposed a new Depot with an initial capacity of 150 buses with a full build out of 250 buses. That facility along with the new EMTOC would have provided transit maintenance capacity for 605 buses which would allow for continued transit service growth through 2030. However, the development of the North County Maintenance facility has been deferred in order to preserve the Ten Mile Creek watershed.

Facility capacity will be especially strained with the introduction of 60' articulated BRT buses. The EMTOC facility currently has two bus bays suitable for 60' buses and can accommodate a fleet of 14 articulated buses. With 81 Ride On articulated buses planned for the three BRT corridors that will open by 2030, a minimum of six additional articulated bus bays (10 buses per bay) are needed for the Ride On BRT services.

To provide for sufficient transit maintenance capacity in the future, two facility projects are recommended:

- Brookville renovation, including bus bays, parking for articulated buses and electric vehicle charging capabilities.
- Replacement of the leased Nicholson facility with a new maintenance facility with a capacity of 150 to 250 buses including bus bays, parking for articulated buses and electric and CNG vehicle fueling capabilities.

8. INFRASTRUCTURE AND MAINTENANCE NEEDS

Montgomery County plans transit infrastructure investment to support continued growth in the transit service and support the County's long-term goals. The fleet and infrastructure will require expanded maintenance to remain in a state of good repair. This section describes the County's goals, planned infrastructure and overall maintenance needs.

8.1 County Goals and Ride On Infrastructure

Montgomery County has established seven emphasis areas around broad community goals. Through its continued operation and expanded services, Ride On supports these initiatives.

- **Thriving Youth and Families**
  - Through the Kids Ride Free program Montgomery County youth have the opportunity for recreation, work, and education throughout the county. Beginning in 2019, Montgomery County allows kids ages five to 18 to use a Youth Cruiser Smart Trip Card issued through schools to ride free all day. Based on the 2019 On-Board Survey, 5% of Ride On users are under age 18 and 23% are age 18 to 24. With Ride On's extensive local transit network a world of opportunities has been opened for the County's youth.
- **An Affordable, Welcoming County for a Lifetime**
  - Montgomery County is one of the most diverse counties in the nation. Approximately 14.3% of the county's population over 5 years of age speak English less than "very well". Spanish/Spanish Creole, Chinese, African languages, Korean, French (including Patois and Cajun) and Vietnamese, speakers make up the majority (approximately 80%) of the languages spoken at home. The Spanish speaking population has the largest number of persons (68,541) within the county who speak English less than "very well" with Chinese speakers having the second largest segment (16,836 persons) who speak English less than "very well." In the 2019 on-board survey 43% of Ride On's users indicated that they spoke a language other than English at home.
  - Like many communities across the Nation, Montgomery County has a growing elderly population. Between 2010 and 2020 Montgomery County's senior population age 65 and older increased by 46,502 persons or 38.8% while between 2020 and 2030 Montgomery County's senior population age 65 and older is projected to increase by an additional 51,900 persons or 31.1% increase. Ride On's convenient and affordable bus network means that may senior citizens can live independently after they are no longer driving every day.
- **Safe Neighborhoods**
  - The access Ride On provides to educational, employment and social opportunities leads to safer neighborhoods. Ride On has over 5,300 bus stops with 507 shelters and 680 benches resulting in safe and convenient service for most Montgomery County residents.
- **A Greener County**
  - With its existing fleet of clean diesel, hybrid and CNG buses, Ride On produces net zero emissions and contributes to meeting the County's air quality goals by reducing single occupant automobile trips and associated GHG emissions. During FY 2018 Ride On carried 21.6 million passenger trips and 81.3 million passenger miles. If these passenger trips had been made using private passenger vehicles, they would have generated an estimated 49,034 metric tons of CO_2. During FY 2018 Ride On's fleet generated 29,500 metric tons of

CO_2 and resulted in a net savings of 19,354 metric tons of CO_2. As the County increases Ride On services and uses cleaner buses such as ZEBs, Ride On's positive air quality effects will continue to increase.

- **Easier Commutes**
  - Traffic congestion in the Washington Metropolitan Region is among the worst in the nation, and it impacts the lives of many County residents daily. In FY 2020 Ride On provided an estimated 80,743 weekday passenger trips. In addition to direct service to key destinations, Ride On reduces traffic congestion by connecting residents to the Metrorail and Metrobus services. On an average weekday, more than 16,000 Ride On's riders use local bus routes for connections to Metrorail and Metrobus services.
  - Through the County's Flash BRT initiative, continued progress is being made to retain existing riders and attract new commuters. The Flash on US29 began operations in 2020 and the County's Capital Improvements Program includes funding for Veirs Mill and MD355 BRT engineering and planning. Planning is also underway for the New Hampshire Avenue and North Bethesda Transitway BRT corridors.
- **A Growing Economy**
  - Improved access to jobs and education for lower income communities is a key ingredient for expanding economic prosperity for all county residents. The 2019 on-board survey indicated that 47% of Ride On trips were made by residents with household incomes less than $30,000 and 44% of all trips were destined for work and school.
- **Effective, Sustainable Government**
  - When compared to local market peer agencies, Ride On provided the lowest 2018 cost per revenue hour at $113. Comparable agency 2018 costs per revenue hour in 2018 include Metrobus $180, MTA $163, Fairfax Connector $115 and Prince George's County The Bus $118.

8.1.1 Net Zero Greenhouse Gas Emissions

As climate change dramatically impacts our world, Montgomery County has adopted goals to reduce the County's GHG emissions by 80% by 2027 and 100% by 2035.

Ride On directly affects GHG emission by removing single passenger automobiles from local streets and highways. The County's transit service already operates as a net zero GHG emitter. It's most important contribution to the County's long term GHG emission goals is to retain existing transit customers and attract new riders. The County's continued investment in improving the transit customer's experience is the most effective way to reinforce Ride On's positive GHG emissions.

The County's historic investment in new buses (193 new and cleaner buses since 2015), bus stop improvements, transit maintenance facilities (such as Leed Gold certified EMTOC), transit centers (such as Montgomery Mall and Silver Spring) and WMATA bus and rail services continues to attract high transit market share.

Additional GHG emission reductions can be achieved through retaining existing customers and attracting new customers. Multiple strategies can support this initiative including expanded Ride On Ext*R*a and BRT services and fare policies targeting key groups such as Kids Ride Free and free fares for seniors.

ZEBs are also a popular GHG emission strategy. Replacing an existing bus with a ZEB with electricity from 100% clean energy sources is projected to save 683 metric tons of CO_2 over its twelve-year lifetime. However, adding service with one new clean diesel or CNG fueled peak bus at Ride On's FY2020 system average of 23 riders per hour would save 764 metric tons of CO_2 over twelve years.

In supporting the County's GHG emission goals, expanded transit services will be the most effective strategy followed by new LEED certified maintenance facilities and ZEBs.

8.2 Infrastructure Investments

Montgomery County elected officials and staff routinely prioritize investments to meet multiple public goals. A menu of potential infrastructure investments is identified in this section.

8.2.1 Fleet Replacement and Renewal

Ride On fleet replacement and renewal is important to:

1. Reduce long term vehicle maintenance costs. As buses age maintenance costs increase. New buses with multi-year warranties can lower maintenance costs and reduce the need for hard to find mechanics.
2. Increase service reliability. New buses are typically much more reliable than older buses. Reducing breakdowns can improve the customer's experience by minimizing the dreadful event where a bus breaks down with a load of passengers.
3. Improved customer experience. Older buses, even when they are well maintained, are noisier than new buses. Through hundreds of thousands of miles on city streets, old buses rattle. Just as drivers enjoy a new car experience, transit customers know the difference in an old and new bus.
4. Reduce air quality emissions. Although bus engines are certified to the most recent air quality standards, as engines operate thousands of miles, they can be expected to emit more pollutants than new engines.

The FY22 bus replacement budget is shown in Table 34.

Table 34: FY22 Bus Replacement Budget

Budget Year	40'	30'	Microtransit	FY 22 Budget
FY 2021	10	5		$11,795,000
FY 2022	20			$18,300,000
FY 2023	15	30	7	$30,820,000
FY 2024	12	21		$21,333,000
FY 2025	12			$6,444,000
FY 2026	18	1		$10,555,000

8.2.2 Zero Emission Buses

ZEBs hold the potential of reducing Ride On GHG emissions and may provide limited operating cost savings. ZEB technology has some challenges including high capital cost, limited range, limited annual mileage, electric charging infrastructure, and hydrogen generation and storage which must be considered.

The County's revised FY22 - FY26 Ride On Bus Fleet Replacement budget totals $88.1 million for replacement of buses including the acquisition of 55 ZEBs by 2024 for a fleet total of 59 ZEBs. Additional electric infrastructure will also be needed at the Brookville Depot to accommodate these electric buses.

This electrical infrastructure including bus chargers, a photovoltaic micro-grid and finance costs is projected to cost $61.9 million over 25 years.

8.2.3 Operations and Maintenance Facilities

Bus maintenance facility capacity is a constraint to the growth of Ride On. The planned BRT services including Veirs Mill BRT and MD 355 BRT are not possible without expanded bus maintenance capacity. The two maintenance facilities owned by the County (Brookville and EMTOC) have an existing maintenance capacity of 350 buses. Including the leased Nicholson Court facility, the County has a total transit maintenance facility capacity of 417 buses. By 2030 after the expiration of the Nicholson Court lease, the County will need maintenance capacity for 466 buses including 81 60' buses. Consequently, a new facility is needed to accommodate a minimum of 116 buses including 65 60' buses and 51 40' buses.

The Brookville Depot is also in need of renovation. The facility is a converted County owned warehouse at the end of Brookville Road. The nine-repair bay garage is more than 40 years old and energy inefficient. Although some portions of the facility have been renovated, most of the site needs improvement.

While there have been previous maintenance facility planning studies, there are no active maintenance facility projects in the County's Capital Budget.

8.2.4 Bus Rapid Transit

The County's Bus Rapid Transit (BRT) system is planned to supplement the Metrorail Red Line and Purple Line as means to increase transit ridership, support smart growth and development, reduce county-wide GHG emissions and lessen reliance on single occupant auto travel. The County Council approved the Countywide Transit Corridors Functional Master Plan, an amendment to the Master Plan of Highways and Transportation, on November 26, 2013. The amendment authorizes the study of enhanced transit options for 10 transit corridors, including: Georgia Avenue North, Georgia Avenue South, MD 355 North, MD 355 South, New Hampshire Avenue, North Bethesda Transitway, Randolph Road, University Boulevard, US 29, and Veirs Mill Road. The BRT system branded the Flash will provide faster, frequent and more reliable service than local bus services using high capacity buses, substantial stations, traffic signal priority and off-board fare collection. The Flash station concept is shown in Figure 38.

Figure 38: Flash Station Concept

Flash on US 29 Flash – The Flash on US 29 began operation in 2020 as the first BRT project in Maryland. The 14-mile BRT line provides upgraded, frequent, and reliable service between Downtown Silver Spring and Burtonsville along the US 29 (Colesville Road) corridor. The route utilizes existing bus on shoulder lanes along US 29 in the northern portion of the corridor. Along the southern portion of the line, it operates in mixed traffic along US 29, Lockwood Drive, Stewart Lane, Briggs Chaney Road, and Castle

Boulevard. The service features off-board fare collection, level boarding, new state of the art BRT vehicles, new stations, transit signal priority (TSP), and station access improvements. It operates every 7.5 minutes during the peak periods and every 15 minutes during off peak daily from 5 a.m. to midnight.

The $31.5 million project is funded in part by a $10 grant through the federal Transportation Infrastructure Generating Economic Recovery (TIGER) program.

MD 355 Flash – The 355 BRT corridor is approximately 22 miles in length from Clarksburg to Bethesda. The route would serve many activity centers including Clarksburg, Metropolitan Grove, Gaithersburg, Shady Grove/King Farm, Montgomery College, Rockville, Twinbrook, White Flint, Grosvenor, Medical Center, and Bethesda. The MCDOT conducted an alternatives analysis to determine the best way to serve the corridor. The Corridor Summary Report indicated a capital cost of $821 million with 42 vehicles costing $880,000 each. The FY22 Capital Budget includes $5 million for planning design and supervision.

MD 586 Flash – The proposed 6.7-mile BRT line along MD 586/Veirs Mill Road would operate between the Rockville and Wheaton Metrorail stations. Planning conducted by MDOT SHA resulted in a Recommended Alternative in late 2017 including queue jumps for use by BRT and other buses at congested intersections along the corridor, new BRT stations with level boarding and off-board payment, transit signal priority, purchase of new 60-foot articulated vehicles, and other associated pedestrian and bicycle improvements along the corridor. The MD586 / Veirs Mill Road Bus Rapid Transit Study dated July 2018 describes the selected alternative as having a capital cost of $79.1 million including $16.5 million for vehicles.

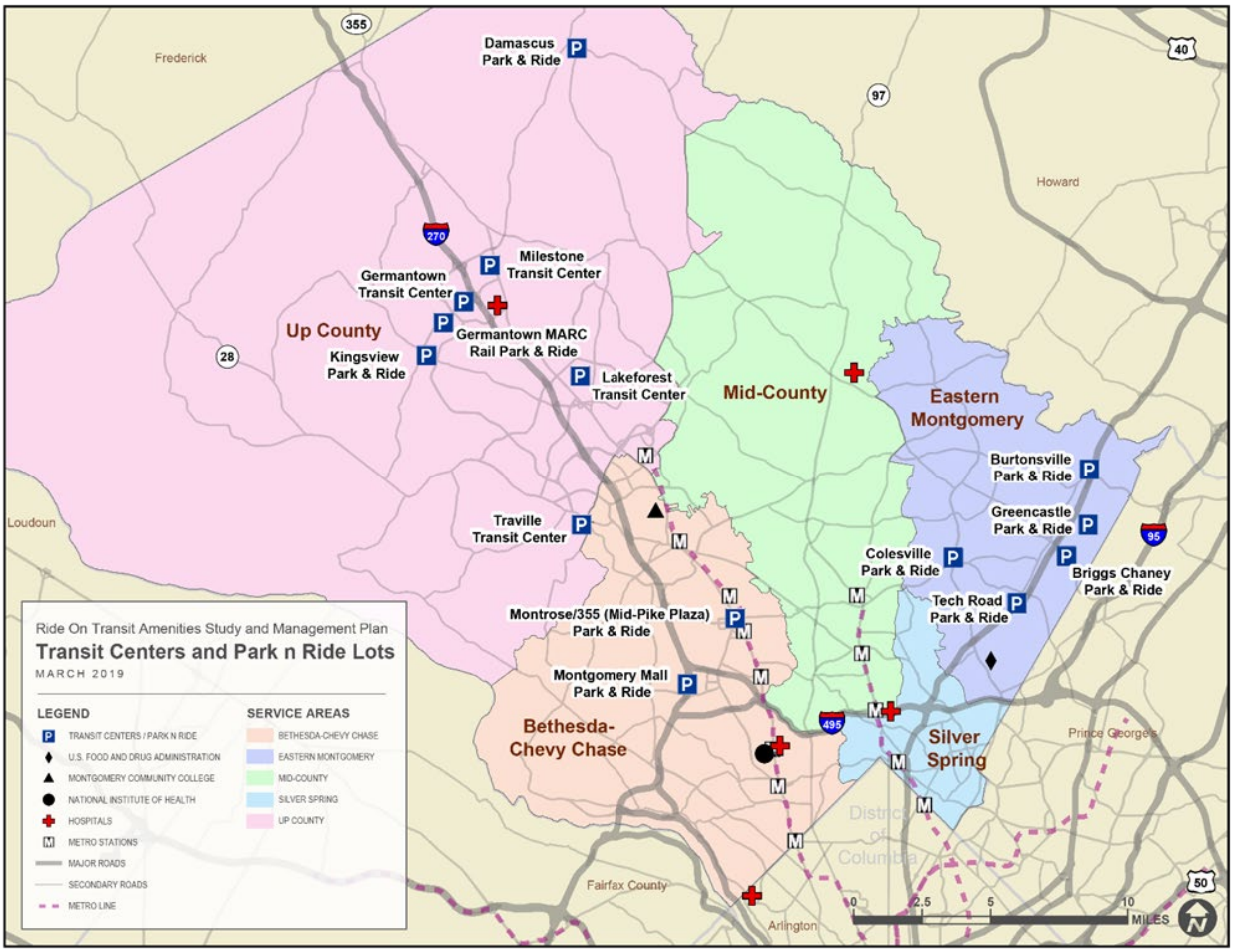
8.2.4 Flex

In an effort to increase transit ridership, improve transportation options for underserved communities, supplement fixed route service, and employ new technology to improve convenience for transit riders, in summer 2019, Ride On introduced a new pilot micro-transit on-demand bus service, the Ride On Flex. Montgomery County has partnered with a transportation network company, Via, for use of its technology platform to provide first-mile and last-mile connections using buses owned and operated by MCDOT. Customers request a ride using a smartphone app. This new service operates within defined zones in Rockville, Wheaton and Glenmont. The service offers corner to corner pick-ups/drop-offs using 7 eleven passenger wheelchair accessible buses with on-board WiFi. The BFMP includes 3 additional Flex buses in 2021, 2024, and 2027.

8.2.5 Transit Centers and Park and Ride Lots

Transit centers improve the transit customer's experience by providing a safe convenient and attractive location for bus boarding. Centers can be large and complex with multiple rail and bus services such as the Silver Spring Transit Center or relatively simple with a limited number of buses. Transit Centers and Park and Ride lots in Montgomery County are owned and maintained by various entities (Figure 39). The largest challenge is the maintenance and upkeep of these facilities. Transit centers under study and project development include Boyds where a new bus loop and parking lot are planned adjacent to the MARC station, Lakeforest Transit Center accommodating the MD 355 Flash, and, White Oak Transit Center serving the Flash on US 29 and planned New Hampshire Avenue BRT.

Figure 39: Transit Centers and Park and Ride Lots



8.2.6 Bus Stop Improvement Program

Installation and improvement of bus stops in Montgomery County make them safer, more accessible and attractive to users, and improve pedestrian safety for County transit passengers. Bus stop enhancements can include sidewalk connections, improved pedestrian access, pedestrian refuge islands and crossing safety measures, area lighting, paved passenger standing areas, and other safety upgrades. Through FY19, approximately 3,340 stops have been modified or installed.

The County Capital Budget includes $400,000 per year to continue the bus stop improvement program.

8.2.7 Communications and Fare Infrastructure

Communications and fare equipment are necessary for Ride On safe operations and revenue generation. Generally, communications and fare equipment have a 15 to 20-year useful life but may need earlier replacement with changes in technology. The County Capital Budget includes a Transit Radio System replacement project with radios, consoles, and networking necessary to incorporate transit services radio operations into the new state-of-the-art public safety radio system. The total cost for this project is estimated to be $3.5 million, with an additional $1.75 million in FY22.

Ride On's transit fare collection systems including interface with WMATA's regional fare system will require updating over the next ten years. The investment should be timed to coincide with new BRT related fare collection systems.

8.3 Infrastructure Maintenance

Infrastructure maintenance includes buses, operations and maintenance facilities, bus stops and shelters, transit centers and park and ride lots. Eighteen BRT stations opening in FY2020 will add to the infrastructure maintenance workload.

8.3.1 Bus Maintenance

The County's Department of General Services (MCDGS) Division of Fleet Maintenance Services (DFMS) is responsible for Ride On fleet maintenance. Table 35 lists the maintenance expenses from FY2015 to FY2018. Figure 46 on page 82 also compares bus maintenance costs per revenue vehicle mile for peer agencies and demonstrates that Ride On has the lowest bus maintenance costs per vehicle mile of the peer agencies.

Table 35: Ride On Bus Maintenance Costs per Mile

Budget Year	FY2015	FY2016	FY2017	FY2018
Bus Maintenance	$18,527,517	$13,425,177	$14,970,238	$15,312,927
Vehicle Miles	15,023,122	15,130,048	15,145,021	15,757,673
Cost per Mile	$1.23	$.89	$.99	$.97

8.3.2 Bus Stop and Shelter Maintenance

The Ride On Transit Amenities Study and Management Plan was completed in May 2019. The Plan identified the maintenance costs for Ride On's 507 shelters, four transit centers and ten park and ride lots. It is based on the condition found during field inspection. Maintenance costs estimates were also developed for the Flash US29 stations.

Prior to 2019, shelter placement and maintenance were provided thorough a Clear Channel outdoor advertising franchise agreement. Since the agreement's expiration, MCDOT has assumed bus shelter maintenance responsibility.

The five-year shelter investment plan as presented in Table 36 is based upon Ride On taking over the bus shelter program. This includes replacement, shelter expansion and maintenance of all bus shelters. The shelter replacement plan considered a shelter useful life as 20 years.

Table 36: Bus Stop and Shelter Maintenance

Fiscal Year	2020	2021	2022	2023	2024
Capital Costs					
Shelter Replacement (25/Yr.)	$275,000	$283,250	$291,748	$300,500	$309,515
Shelter Expansion (25/Yr.)	$606,000	$624,180	$642,899	$662,193	$682,063
LCD Signs (25/Yr.)	$202,500	$208,575	$214,832	$221,277	$227,916
Total Capital Cost	**$1,083,500**	**$1,116,005**	**$1,149,479**	**$1,183,970**	**$1,219,493**
Maintenance Costs					
Bus Shelter (County & Contractor)	$2,007,210	$2,067,426	$2,129,449	$2,193,333	$2,259,133
Total Maintenance Cost	**$2,007,210**	**$2,067,426**	**$2,129,449**	**$2,193,333**	**$2,259,133**

8.3.3 Bus Stop and Shelter Maintenance

The Flash on US 29 is projected to start operations in 2020. To maintain a very high-quality appearance, station maintenance will be more frequent than regular bus shelter cleaning. A responsibly and thoroughly maintained BRT station indicates a customer focused agency that considers riders a priority. The BRT station maintenance is required 18 hours per day, seven days per week. The projected manhour requirements and costs are shown in Table 37.

Table 37: Flash on US 29 Projected Station Maintenance

Labor	# Positions	Hourly Rate	Wages	Benefits	Annual Total
Supervisor	1	$21.25	$44,200	$11,050	$55,250
Crew Chief	2	$18.70	$77,792	$19,448	$97,240
Shelter Technician	8	$17.00	$282,880	$70,720	$353,600
				County Labor Total	**$457,470**

Materials	Items required	Unit Costs	Annual Total
Cleaning supplies	Soap, rags, trash bags, brooms	$150 per station per month	$30,600
Repair parts	Lights and ballasts	$2,000 per station per year	$34,000
Vehicles	8 - pick-up trucks	10,000 annual miles / truck; $.58 per mile	$46,400
Contractor	Pressure wash, and snow removal	Pressure wash $500 per station, snow removal average $150 per station	$457,300
		Materials and Supplies Total	**$568,300**
		Flash on US 29 BRT Station Maintenance Cost Estimate Total	**$1,025,770**

9.0 PEER REVIEW

The purpose of the peer review is to compare Ride On with other transit systems in the surrounding Washington, D.C., Maryland, and Virginia area and peer systems of comparable size and similar operating environments. Those reviewed are shown in Table 38.

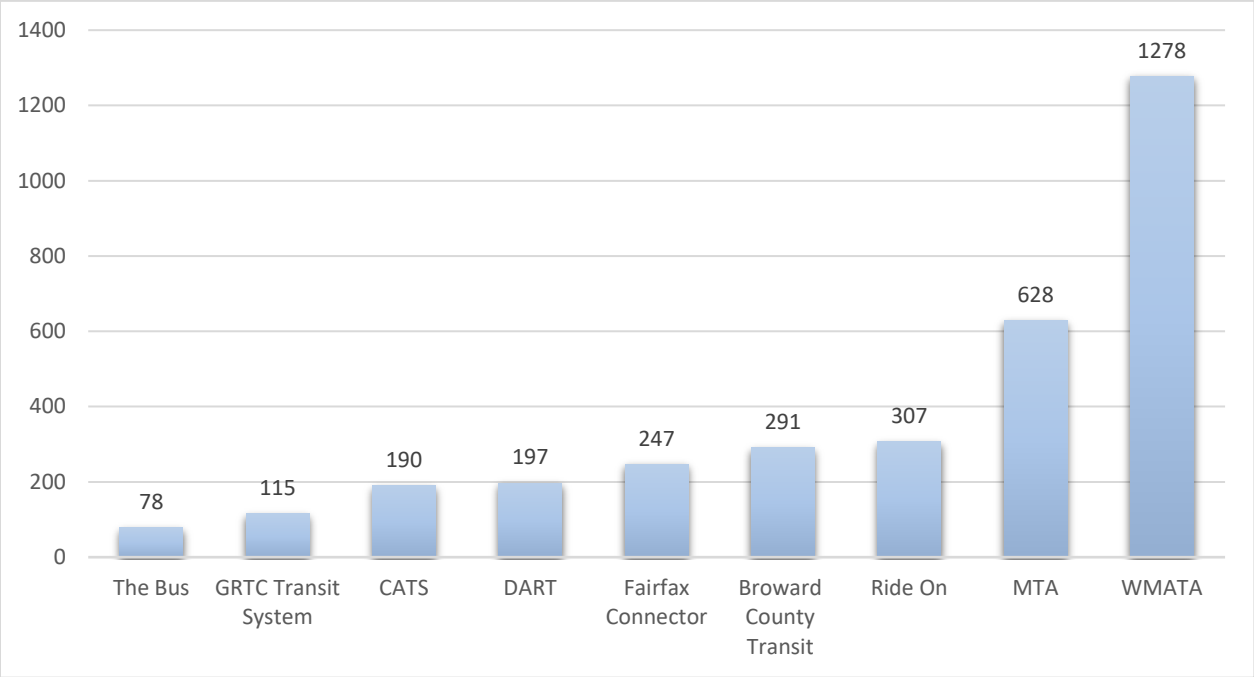
Table 38: Peer Transit Systems

Local Systems	Peer Systems
MDOT Maryland Transit Administration (MTA) – Baltimore, MD	Greater Richmond Transit Company Richmond, VA
Washington Metropolitan Area Transit Authority (WMATA), Washington, D.C.	Delaware Transit Corporation (DART) Wilmington, DE
Fairfax Connector Bus System Fairfax, VA	Broward County Transit Division Fort Lauderdale, FL
Prince George's County Transit (The Bus) Prince George's County, MD	Charlotte Area Transit System Charlotte, NC

9.1 System Size

Revenue vehicle hours and vehicles operated in maximum service (VOMS) shown in Figure 40 were used as a basis to define the size of the system. The following information compares the relative size of Ride On with the other transit systems.

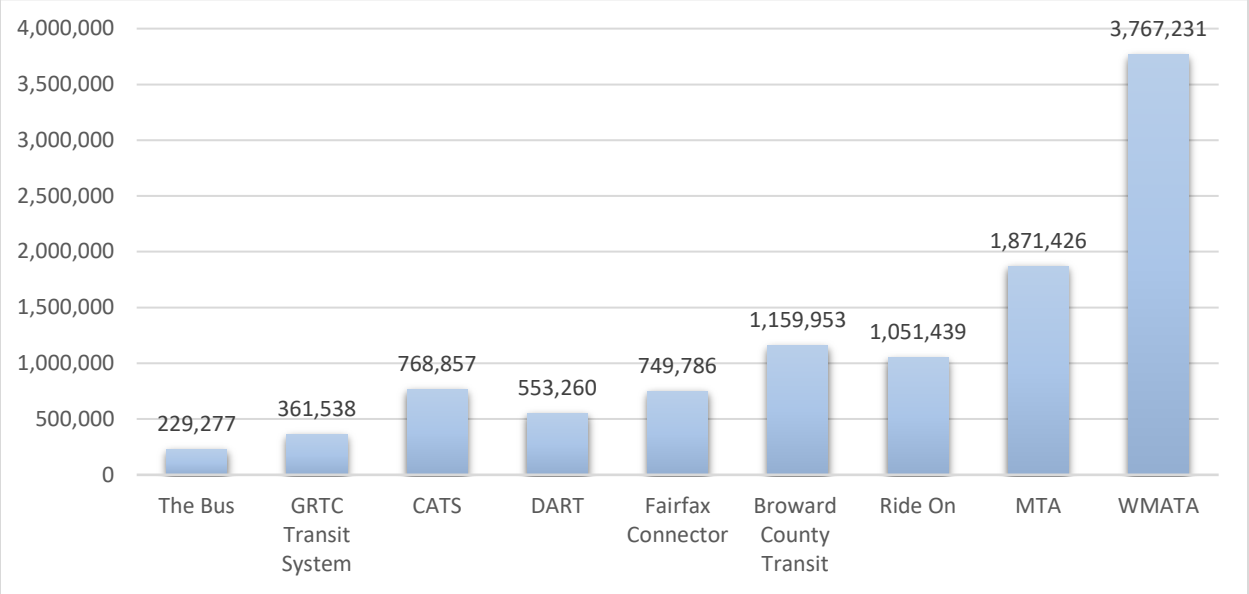
Figure 40: Vehicles Operated in Maximum Service



Source: National Transit Database 2018 Time Series

Figure 41 compares Ride On with the peer agencies according to revenue hours operated. To put this in context, Ride On operates over 29 percent more service than the Fairfax Connector, but far less than WMATA.

Figure 41: Revenue Vehicle Hours FY 2018

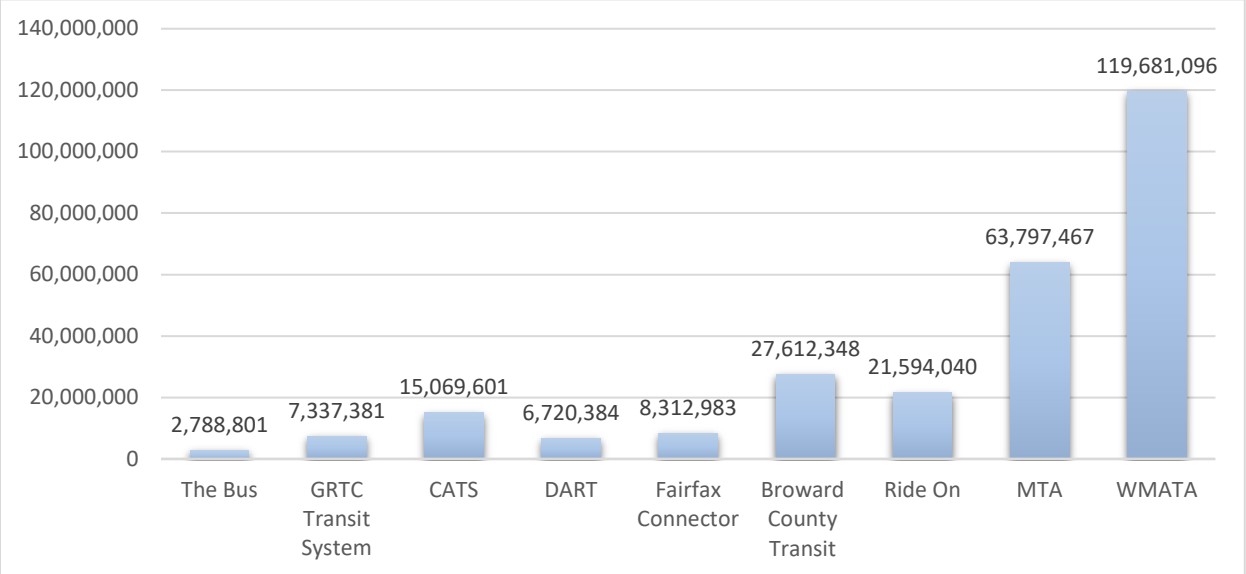


Source: National Transit Database 2018 Time Series

9.2 Service Effectiveness

To compare service effectiveness, data on unlinked passenger trips is used. As shown in Figure 42, Ride On provided almost 21.6 million unlinked passenger trips in FY 2018.

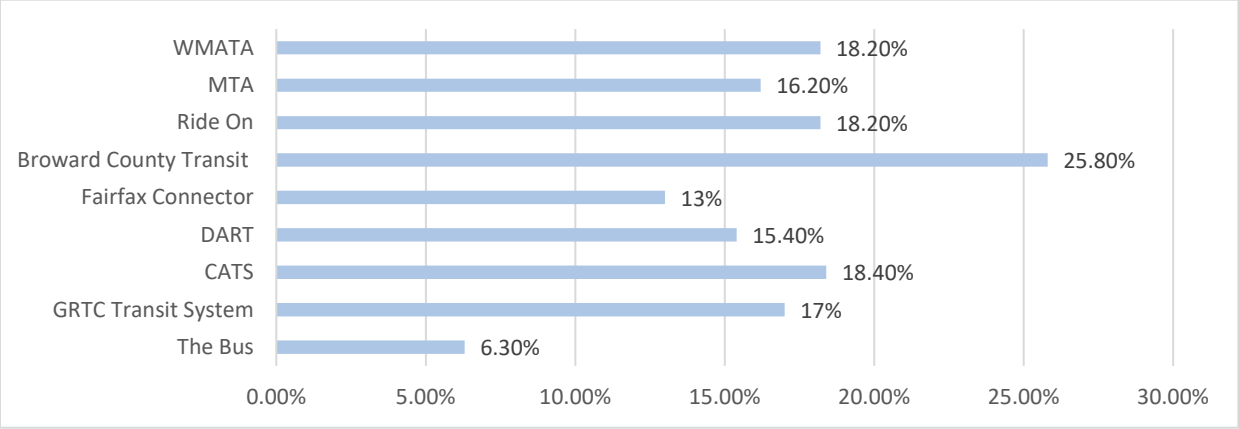
Figure 42: Unlinked Passenger Trips FY 2018



Source: National Transit Database 2018 Time Series

The farebox recovery ratio is the portion of the transit service operating costs that are covered by the passenger fares collected. As shown in Figure 43, in FY 2018, Ride On recovered 18.2% of the expenses through passenger fares.

Figure 43: Farebox Recovery Ratio FY 2018

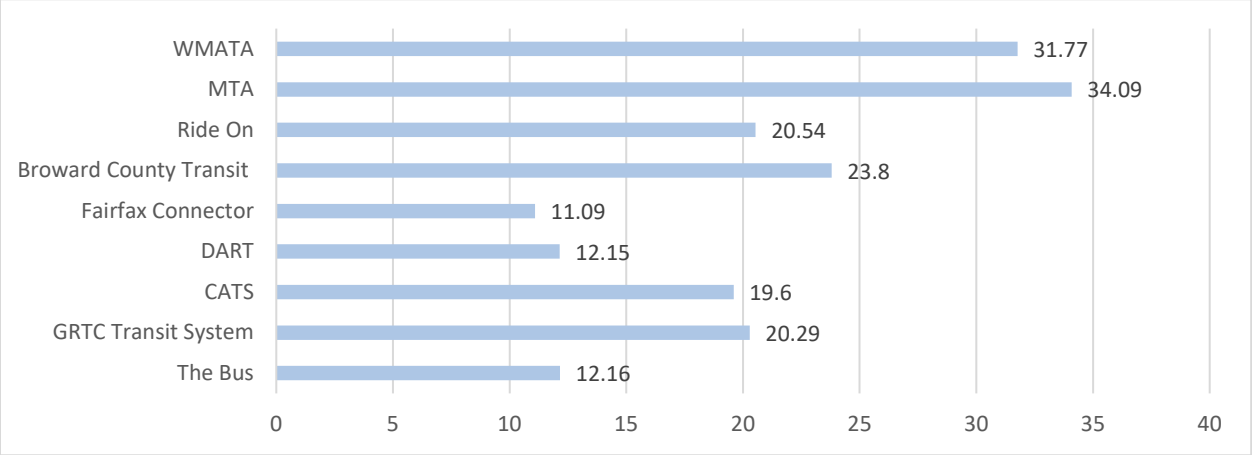


Source: National Transit Database 2018 Time Series

9.3 Productivity

The unlinked passenger trips (riders) per revenue hour as shown in Figure 44 are a key performance indicator of the transit service productivity. But, the type of service provided significantly affects the productivity of the routes and should be considered when comparing peer systems. For instance, WMATA's Metrobus system is designed as a regional bus system operating heavily traveled routes. These types of routes generally have boardings and alightings along the route. The Fairfax Connector, Prince George's County's The Bus and Montgomery County Ride On operate neighborhood routes and feeder routes connecting the neighborhoods to the Metrorail services. These types of services generally have fewer boardings and alightings along the route. Therefore, when you look at the WMATA and MDOT MTA unlinked passenger trips per revenue vehicle hour, you'll note that they are generally higher. But, considering the nature of the Ride On service, it has a relatively high level of productivity as compared to other similar peer systems like Prince George's County's The Bus and the Fairfax Connector.

Figure 44: Unlinked Passenger Trips per Revenue Vehicle Hour FY 2018



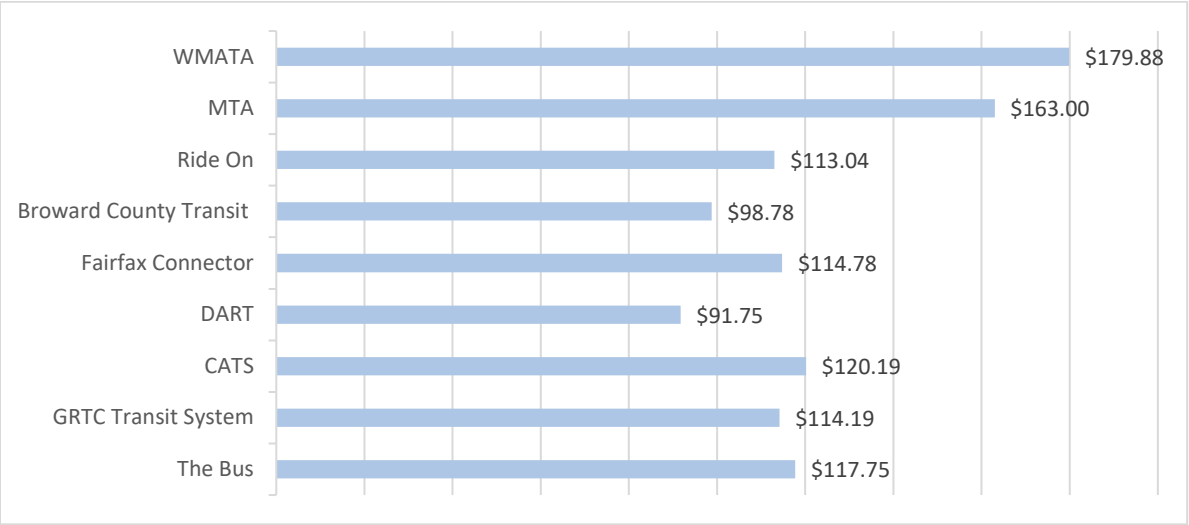
Source: National Transit Database 2018 Time Series

9.4 Cost Effectiveness

There are three key factors used to determine cost effectiveness: operating cost per revenue vehicle hour, maintenance cost per vehicle mile, and net cost per unlinked passenger trip.

The first factor is operating cost per revenue vehicle hour. Figure 45 illustrates how Ride On compares to the peer systems. The Ride On operating cost per revenue hour was significantly lower than WMATA and MDOT MTA. When compared to the other peer systems, Ride On had one of the lowest costs per revenue hour.

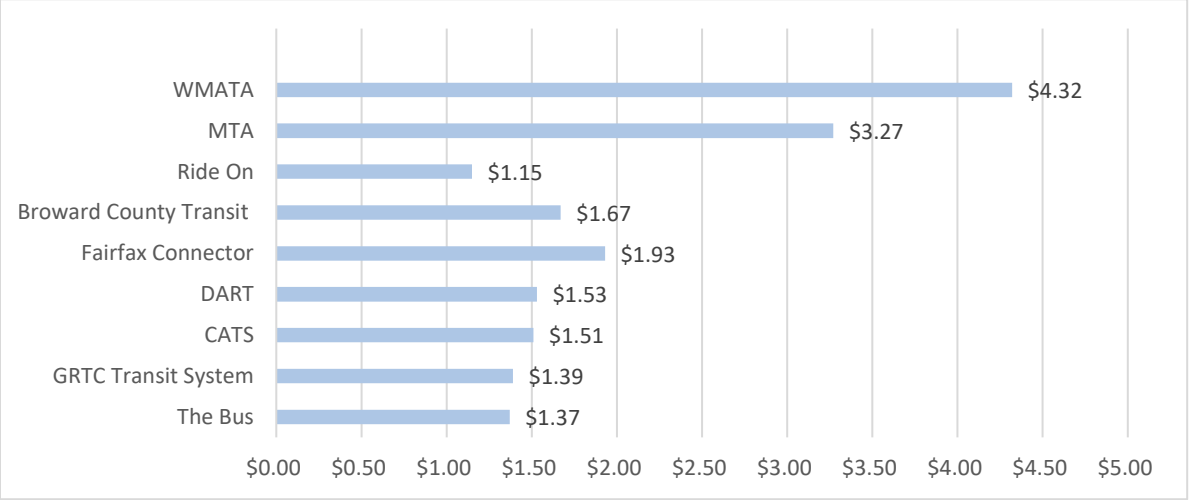
Figure 45: Operating Cost per Revenue Vehicle Hour FY2018



Source: National Transit Database 2018 Time Series

The second factor is maintenance cost per revenue vehicle mile. Figure 46 shows how Ride On compares in this indicator. WMATA's costs were almost four times higher than Ride On. Ride On had the lowest maintenance cost of all the systems compared.

Figure 46: Maintenance Cost per Revenue Vehicle Mile FY 2018



Source: National Transit Database 2018 Time Series

The third factor is net cost per unlinked passenger trip. Figure 47 shows how Montgomery County Ride On compares to the peer group. The Fairfax Connector and Prince George's County's The Bus net cost per unlinked passenger trip are more than double Ride On's cost of $4.50.

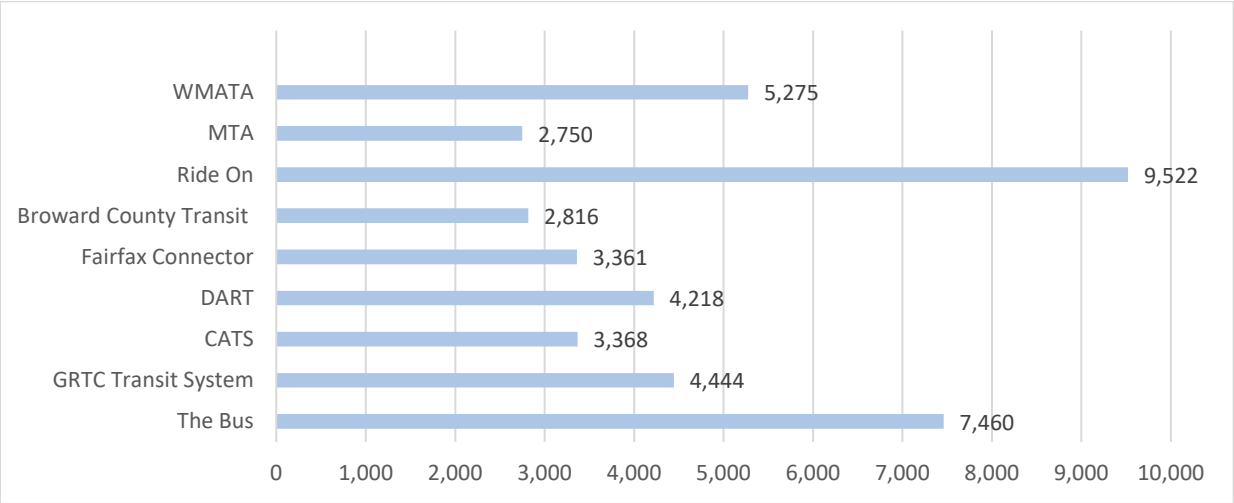
Figure 47: Net Operating Cost per Unlinked Passenger Trip

Source: National Transit Database 2018 Time Series

9.5 Maintenance Reliability

Throughout the transit industry, the average distance between maintenance failures for local transit operations is 4,000 to 15,000 vehicle miles operated. The manner in which these failures are reported varies greatly. There are a number of different factors that affect the distance between failures. But, one notable influencer is the average age of the fleet. Ride On has been working hard to develop a planned replacement stream to ensure reliability. Figure 48 shows how Ride On compares to the peer systems. As illustrated, Ride On far exceeds the others in this area.

Figure 48: Vehicle Miles per Revenue Vehicle System Failure

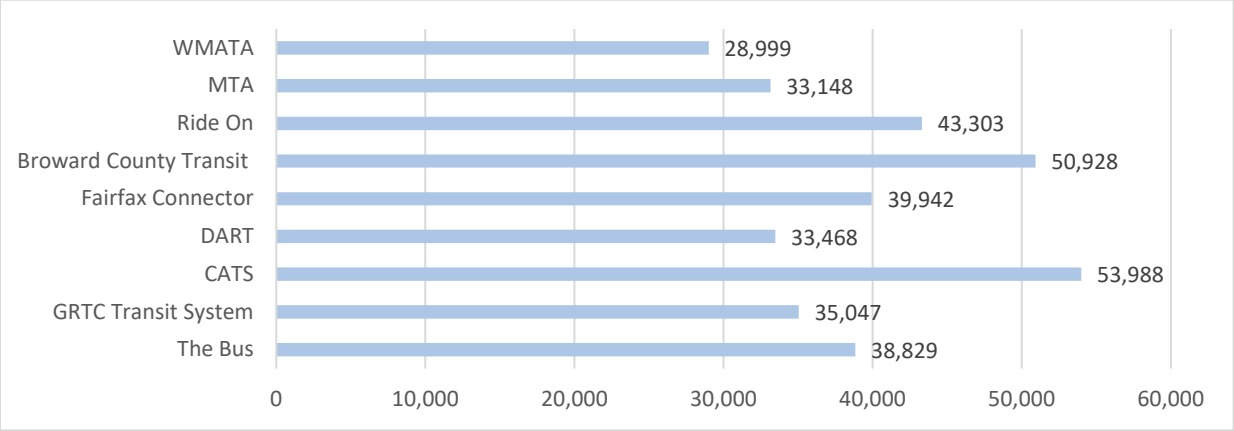


Source: National Transit Database 2018 Time Series

9.6 Vehicle Usage

The annual miles per vehicle operated in maximum service indicates the intensity of the vehicle use. The intensity at which Ride On utilizes their vehicles is one of the highest in the comparison shown in Figure 49. Since preventive maintenance is based on the miles traveled, higher utilization means more frequent maintenance. This has a direct correlation to the number of mechanics and facilities needed to support the operation. Additionally, more intensely used vehicles reach their useful life sooner and therefore, need to be replaced sooner.

Figure 49: Vehicle Miles Traveled per Vehicles Operated in Maximum Service

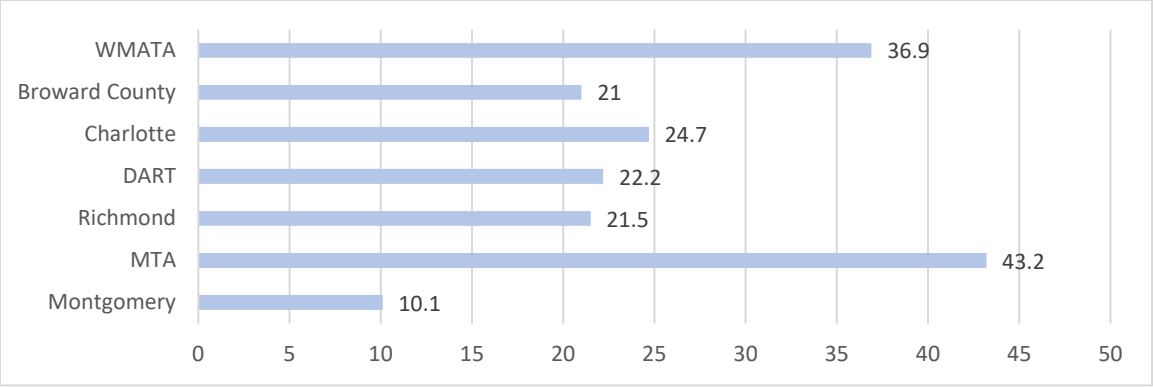


Source: National Transit Database 2018 Time Series

9.7 Maintenance Staffing

The information in Figure 50 illustrates how Montgomery County's maintenance staffing compares to the peer systems. This figure shows the number of maintenance hours per 1,000 vehicle miles. Since the National Transit Database only captures in-house staff maintenance hours, additional estimated hours have been added to the FY 2018 Montgomery County data to include the contractors who fuel and clean the buses. Even with this addition, Montgomery County maintenance labor hours per 1,000 miles are well below the transit industry standard of 25 labor hours per 1,000 miles. This may indicate that there are additional contractors providing part of Ride On's bus maintenance.

Figure 50: Maintenance Hours per 1,000 Vehicle Miles



Source: National Transit Database 2018 Employees