

Metrobus Service Evaluation Study: 17/18 Lines

Kings Park Line: 17A, 17B, 17F, 17M

Kings Park Express Line: 17G, 17H, 17K, 17L

Springfield Line: 18E, 18F

Orange Hunt Line: 18G, 18H, 18J

Burke Centre Line: 18P, 18R, 18S

Technical Memorandum #1

Transit Service Assessment

October 2015



metrobus



(Page Intentionally Left Blank)

Table of Contents

1.	Introduction	1
2.	Lines History	3
2.1.	Historical Context.....	3
2.2.	Demographic and Socioeconomic Context	4
2.3.	Line Descriptions.....	9
2.4.	Fleet Information	19
3.	Level of Service	20
3.1.	Hours of Service	20
3.2.	Service Frequency	22
4.	Ridership	26
4.1.	Daily Ridership	26
4.2.	Ridership by Time Period	26
4.3.	Fare Media Usage	29
4.4.	Five-Year Ridership Trend	30
4.5.	Passenger loads.....	31
4.6.	Boardings/Alightings by Stop	40
4.7.	Boardings/Alightings by Segment	47
5.	Productivity	64
5.1.	Boardings per Trip.....	64
5.2.	Boardings per Revenue Mile	65
5.3.	Cost Recovery Ratio	66
5.4.	Subsidy per Passenger Trip	66
6.	Line Directness and Connectivity	68
6.1.	Line Directness Analysis	68
6.2.	Linkage and Connectivity to Activity Centers	69
7.	Service Reliability	74
7.1.	On-Time Performance.....	74
7.2.	Runtime – Scheduled v Actual	78
7.3.	Interlining/Recovery Time	88

7.4.	Trip Incidents and Trips Lost	89
7.5.	Bus Bunching.....	90
7.6.	Customer Complaints.....	91

List of Tables

Table 1	History: 17/18 Lines.....	3
Table 2	Route Characteristics: Kings Park Line.....	9
Table 3	Route Characteristics: Kings Park Express Line	11
Table 4	Route Characteristics: Springfield Line	13
Table 5	Route Characteristics: Orange Hunt Line	15
Table 6	Route Characteristics: Burke Centre Line	17
Table 7	Garage Assignment: 17/18 Lines	19
Table 8	Service Span: Kings Park Line	20
Table 9	Service Span: Kings Park Express Line	21
Table 10	Service Span: Springfield Line.....	21
Table 11	Service Span: Orange Hunt Line	21
Table 12	Service Span: Burke Centre Line.....	22
Table 13	Service Frequency: Kings Park Line	23
Table 14	Service Frequency: Kings Park Express Line	23
Table 15	Service Frequency: Springfield Line.....	24
Table 16	Service Frequency: Orange Hunt Line	24
Table 17	Service Frequency: Burke Centre Line.....	24
Table 18	Average Daily Ridership: 17/18 Lines	26
Table 19	Fare Media Usage: 17/18 Lines	30
Table 20	FY2010 - FY2014 Trends in Ridership: 17/18 Lines.....	31
Table 21	Ridership Activity by Stop: Route 17A.....	40
Table 22	Ridership Activity by Stop: Route 17B	41
Table 23	Ridership Activity by Stop: Route 17F	41
Table 24	Ridership Activity by Stop: Route 17M.....	42
Table 25	Ridership Activity by Stop: Route 17G.....	42
Table 26	Ridership Activity by Stop: Route 17H.....	43
Table 27	Ridership Activity by Stop: Route 17K	43
Table 28	Ridership Activity by Stop: Route 17L	43
Table 29	Ridership Activity by Stop: Route 18E	44
Table 30	Ridership Activity by Stop: Route 18F	44
Table 31	Ridership Activity by Stop: Route 18G.....	44
Table 32	Ridership Activity by Stop: Route 18H.....	45
Table 33	Ridership Activity by Stop: Route 18J	45

Table 34 Ridership Activity by Stop: Route 18P	46
Table 35 Ridership Activity by Stop: Route 18R	46
Table 36 Ridership Activity by Stop: Route 18S	46
Table 37 Boardings per Trip: 17/18 Lines.....	65
Table 38 Boardings per Revenue Mile: 17/18 Lines.....	65
Table 39 Farebox Cost Recovery Ratio: 17/18 Lines	66
Table 40 Subsidy per Passenger Trip: 17/18 Lines	66
Table 41 Route Directness: 17/18 Lines.....	68
Table 42 Potential Transfers: 17/18 Lines.....	70
Table 43 Bus Transfers: Kings Park Line	70
Table 44 Bus Transfers: Kings Park Express Line	71
Table 45 Bus Transfers: Springfield Line	71
Table 46 Bus Transfers: Orange Hunt Line	71
Table 47 Bus Transfers: Burke Centre Line	72
Table 48 Metrorail Transfers: 17/18 Lines	72
Table 49 Average On-time Performance: 17/18 Lines	75
Table 50 Scheduled v Actual Run Time Difference: 17/18 Lines.....	79
Table 51 Scheduled v Actual Runtime: Route 17A.....	79
Table 52 Scheduled v Actual Runtime: Route 17B.....	80
Table 53 Scheduled v Actual Runtime: Route 17F	80
Table 54 Scheduled v Actual Runtime: Route 17M.....	81
Table 55 Scheduled v Actual Runtime: Route 17G.....	81
Table 56 Scheduled v Actual Runtime: Route 17H.....	82
Table 57 Scheduled v Actual Runtime: Route 17K	82
Table 58 Scheduled v Actual Runtime: Route 17L	83
Table 59 Scheduled v Actual Runtime: Route 18E	83
Table 60 Scheduled v Actual Runtime: Route 18F	84
Table 61 Scheduled v Actual Runtime: Route 18G.....	84
Table 62 Scheduled v Actual Runtime: Route 18H.....	85
Table 63 Scheduled v Actual Runtime: Route 18J.....	85
Table 64 Scheduled v Actual Runtime: Route 18P	86
Table 65 Scheduled v Actual Runtime: Route 18R	86
Table 66 Scheduled v Actual Runtime: Route 18S	87
Table 67 Recovery Time: Kings Park Line	88
Table 68 Recovery Time: Kings Park Express Line	88
Table 69 Recovery Time: Springfield Line	89
Table 70 Recovery Time: Orange Hunt Line	89
Table 71 Recovery Time: Burke Centre Line	89
Table 72 Trip Incidents and Trips Lost: 17/18 Lines.....	90
Table 73 Comparison of Average Headways to Runtimes: 17/18 Lines	90

Table 74 Customer Complaints: 17/18 Lines	92
---	----

List of Figures

Figure 1 Existing Metrobus 17/18 Lines	2
Figure 2 Population Density by Census Block Group: 17/18 Lines.....	6
Figure 3 Minority Population by Census Block Group: 17/18 Lines.....	7
Figure 4 Low Income Household by Census Block Group: 17/18 Lines	8
Figure 5 Kings Park Line: Routes 17A-17B-17F-17M	10
Figure 6 Kings Park Express Line: Routes 17G-17H-17K-17L.....	12
Figure 7 Springfield Line: Routes 18E-18F.....	14
Figure 8 Orange Hunt Line: Routes 18G-18H-18J	16
Figure 9 Burke Centre Line: Routes 18P-18R-18S	18
Figure 10 Average Boardings by Time Period: Kings Park Line	27
Figure 11 Average Boardings by Time Period: Kings Park Express Line	27
Figure 12 Average Boardings by Time Period: Springfield Line	28
Figure 13 Average Boardings by Time Period: Orange Hunt Line	28
Figure 14 Average Boardings by Time Period: Burke Centre Line.....	29
Figure 15 Five Year Ridership Trend: Line 17	30
Figure 16 Five Year Ridership Trend: Line 18	31
Figure 17 Boardings/Maximum Load by Trip: Route 17A	32
Figure 18 Boardings/Maximum Load by Trip: Route 17B	33
Figure 19 Boardings/Maximum Load by Trip: Route 17F.....	33
Figure 20 Boardings/Maximum Load by Trip: Route 17M	34
Figure 21 Boardings/Maximum Load by Trip: Route 17G	34
Figure 22 Boardings/Maximum Load by Trip: Route 17H	35
Figure 23 Boardings/Maximum Load by Trip: Route 17K	35
Figure 24 Boardings/Maximum Load by Trip: Route 17L.....	36
Figure 25 Boardings/Maximum Load by Trip: Route 18E	36
Figure 26 Boardings/Maximum Load by Trip: Route 18F.....	37
Figure 27 Boardings/Maximum Load by Trip: Route 18G	37
Figure 28 Boardings/Maximum Load by Trip: Route 18H	38
Figure 29 Boardings/Maximum Load by Trip: Route 18J	38
Figure 30 Boardings/Maximum Load by Trip: Route 18P	39
Figure 31 Boardings/Maximum Load by Trip: Route 18R	39
Figure 32 Boardings/Maximum Load by Trip: Route 18S.....	40
Figure 33 Boardings/Alightings by Segment: Route 17A	48
Figure 34 Boardings/Alightings by Segment: Route 17B.....	49
Figure 35 Boardings/Alightings by Segment: Route 17F	50
Figure 36 Boardings/Alightings by Segment: Route 17M	51
Figure 37 Boardings/Alightings by Segment: Route 17G	52

Figure 38 Boardings/Alightings by Segment: Route 17H	53
Figure 39 Boardings/Alightings by Segment: Route 17K.....	54
Figure 40 Boardings/Alightings by Segment: Route 17L	55
Figure 41 Boardings/Alightings by Segment: Route 18E.....	56
Figure 42 Boardings/Alightings by Segment: Route 18F	57
Figure 43 Boardings/Alightings by Segment: Route 18G	58
Figure 44 Boardings/Alightings by Segment: Route 18H	59
Figure 45 Boardings/Alightings by Segment: Route 18J	60
Figure 46 Boardings/Alightings by Segment: Route 18P.....	61
Figure 47 Boardings/Alightings by Segment: Route 18R.....	62
Figure 48 Boardings/Alightings by Segment: Route 18S.....	63
Figure 49 On-Time Performance: Kings Park Line	75
Figure 50 On-Time Performance: Kings Park Express Line.....	76
Figure 51 On-Time Performance: Springfield Line	77
Figure 52 On-Time Performance: Orange Hunt Line.....	77
Figure 53 On-Time Performance: Burke Centre Line	78

(Page Intentionally Left Blank)

1. Introduction

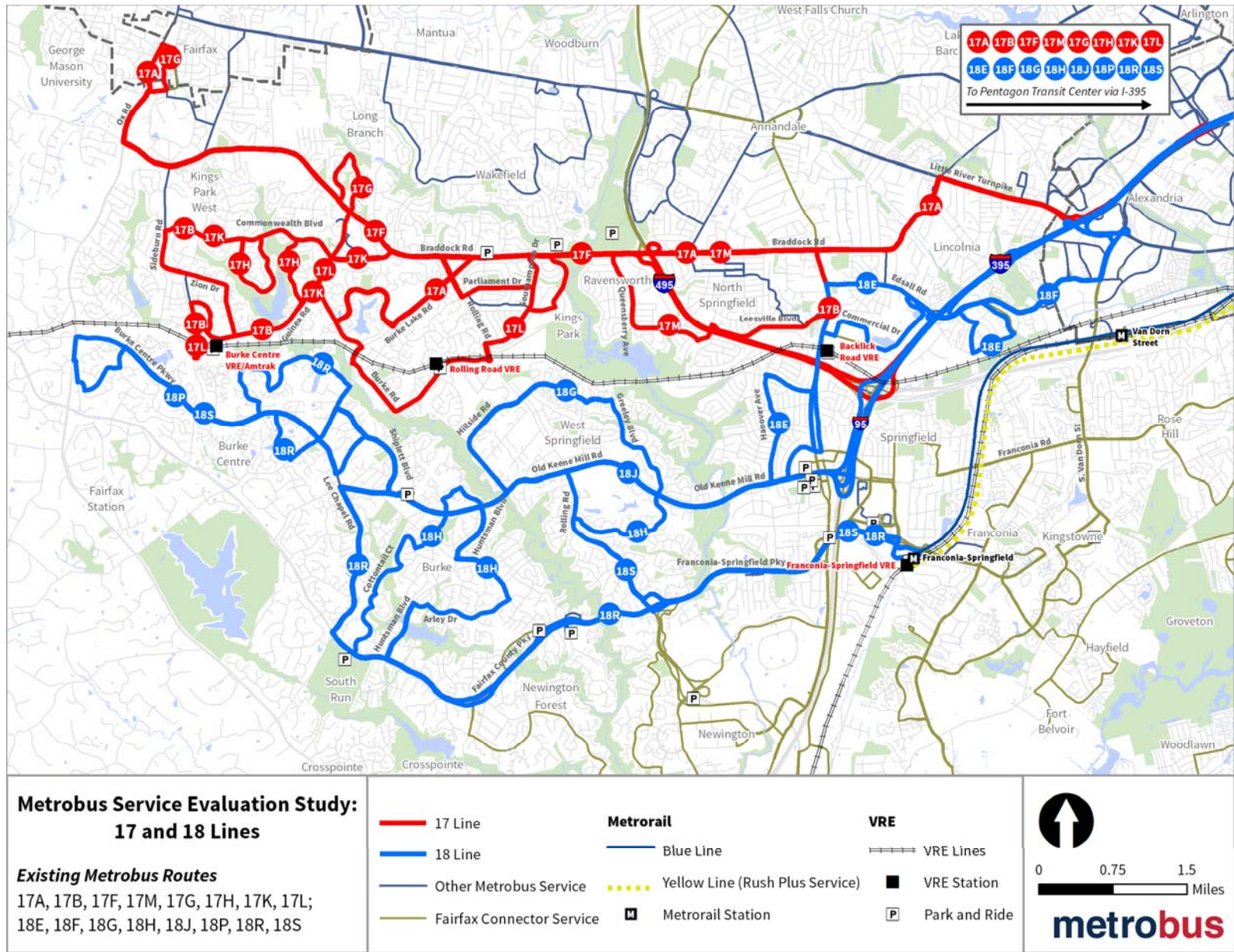
For the purpose of understanding current performance levels, this section offers an assessment of past and current transit service within the 17 and 18 lines' corridor. In essence, the section is a full, data-driven service profile based on information regarding the following topics and subtopics:

- **Line history and individual route descriptions**, including historical alignment adjustments, current alignments, major generators served, and major roads traveled;
- **Level of service**, including service span and service frequencies;
- **Ridership**, including recent and historical total ridership, maximum trip loads, and boards and alights;
- **Line directness and connectivity**, including an analysis of variation directness and service simplicity;
- **Productivity**, including average boardings per revenue mile, average subsidies per passenger, and farebox recovery ratios; and
- **Service reliability**, including on-time performance, average running time, and customer service issues.

The section relies on data provided by WMATA, much of which has also been used for Fairfax County's Transit Development Plan. It concludes with a summary of findings which guide the preparation of preliminary recommendations.

Figure 1 depicts the overall service area of the 17 and 18 lines, respectively, which are comprised of 16 route variations and serve a variety of high demand destinations including the Pentagon and Franconia-Springfield Metrorail stations, George Mason University, Burke Centre, and Springfield. Subsequent figures, tables, and text in this assessment outline current conditions along each of the service lines.

Figure 1 | Existing Metrobus 17/18 Lines



2. Lines History

This section covers the history of transit service within the 17/18 Lines’ corridor and describes the current demographic and socio-economic setting in which these lines operate. A description of each of the variations that comprise both the 17/18 Lines follows, which includes current origins and destinations, major corridors traveled, and main generators along each variation, each of which is addressed through line base maps and tables. The details of the vehicles that form the 17/18 Lines’ fleet are also discussed in this section.

2.1. HISTORICAL CONTEXT

Bus service within the current 17/18 Lines’ corridor has grown gradually over the last several decades.

Table 1 describes a brief history of transit service in this region, indicating key milestones:

Table 1 | History: 17/18 Lines

Year / Period	Milestone
1950s	As downtown Springfield is developed, the A.B.&W. Transit Company commences a bus service between Hanover and Floyd Avenues and Alexandria via Franconia Road and Huntington. This service is later extended to serve Washington, DC. A few years later, the first express service via Shirley Highway (now I-395) begins as Route 18A, offering 3 AM peak northbound and 4 PM peak southbound trips to downtown Washington, the Pentagon and Franconia Road & Pioneer Drive.
1960s	Routes 17P and 17Z provide service between the original Kings Park development and downtown D.C via the Pentagon, Shirley Highway, Little River Turnpike and Braddock Road. By 1969, service is extended to reach Braddock and Pickett/Twinbrook Roads. – ABW lines
1970s	<p>The Northern Virginia Transportation Commission (NVTC) implements the Shirley Highway Express Bus Demonstration Project in 1971, resulting in the following major service changes to and from the Springfield and Kings Park areas:</p> <ul style="list-style-type: none"> • The 18 express service is extended to serve West Springfield; • Midday express service begins serving the Pentagon, North Springfield, Landmark, Bren Mar, Kings Park, and along Franconia Road as far east as Rose Hill; • Service is expanded to Orange Hunt by the mid to late 1970s, and to Burke Centre by 1979; • Express services 17G and 17H begin operating peak-only service between the Olde Forge, Lake Braddock, and Kings Park West neighborhoods and Farragut Square; and • Additional 17 line branches are added to service Burke as well as Commonwealth Boulevard. <p>In 1973, WMATA takes over all Virginia bus operations from A.B.&W. Transit. Some of the overtaken lines include the current 17 and 18 alignments.</p>
1980s	Service is extended to George Mason University and Newington Forest. From 1985-1987, Fairfax Connector assumes operation of all service in the Franconia Road corridor east of Shirley Highway.

Year / Period	Milestone
Early 1990s	<p>In 1992, Fairfax Connector replaces Metrobus operation of Route 18B midday service. The next year, Routes 17B and 17L are extended to serve the Burke Centre VRE Station and Colony Park, rearranging the 17 line alignment to the configuration that has existed ever since.</p> <p>Fairfax Connector replaces Metrobus operation of the Route 18D (Edsall Road-Bren Mar rush hour service) and Route 18N (to Newington Forest). In the Braddock Road corridor, Fairfax Connector begins Route 306, replacing Metrobus' Route 17A midday service.</p>
1997	<p>With the 17 and 18 lines under its control, to accommodate the Metrorail Blue Line extension to Franconia-Springfield, WMATA restructures the 18 lines to their present configuration. The 17 lines remain unaffected by the rail extension.</p>
1999	<p>WMATA executes a system-wide fare simplification plan, establishing regular and express fare tiers for most variations and eliminating suburban fare zones. The 17 and 18 peak flow direction, Routes 17G-H-K-L-M and Routes 18E-G-H-P, as well as off-peak Route 17A-B, charge an express fare of \$2.00. Counter-flow Routes 17F, 18F, and 18J charge the then-regular \$1.10 fare, complying with an ongoing access to jobs initiative to mobilize low income residents from the inner core to suburban jobs. The Routes 18R-S to Franconia-Springfield remains a reduced fare service until Fairfax County eliminates fare subsidies in 2009.</p>
2005	<p>In 2005, the 18R is rerouted to serve the new Gambrill Road Park & Ride, which contains 250 spaces. In 2009, the 18R and S, which had previously been operating on a reduced fare schedule, switches to a regular fare schedule due to the termination of a Fairfax County subsidy. In 2011, the 18R's PM alignment is modified to eliminate an unsafe left turn at Wilmington Drive and Burke Centre Parkway.</p>

2.2. DEMOGRAPHIC AND SOCIOECONOMIC CONTEXT

A review of demographic and socioeconomic information is useful in the development of service recommendations. **Figure 2, Figure 3 and Figure 4** provide demographic and socioeconomic context around the 17/18 Lines' service area. Such an analysis assists in gaining an understanding of the population currently served, as well as the population that would be affected, were any changes to take place. All statistics in the following subsections are taken from the 2009-2013 Five-Year American Community Survey of the U.S. Census. All numerical estimates were calculated using the Census Block Groups within a half mile of the 17/18 Lines.

2.2.1. Population Density

The total population within the 17/18 Line service area is estimated at 380,891. The average population density in the region is 10,166 residents per square mile. Density is highest in around the I-395 corridor and in the areas of Alexandria, West Springfield, Burke Centre, and George Mason University. Density is lowest around Backlick Road and portions of North Springfield. **Figure 2** shows population per square mile around the 17/18 Lines and surrounding area.

2.2.2. Minority Population

Across the 17/18 Line service area, the total minority percentage is estimated to be 47 percent. Annandale, Lincolnia, and regions around Kings Park West and Burke Centre are home to larger minority populations. Areas south of the I-395 corridor are home to larger non-Hispanic white populations.

Figure 3 displays the number of minorities (any racial group other than non-Hispanic white) residing in each Census Block Group.

2.2.3. Low Income Population

Overall, it is estimated that ten percent of households within the 17/18 Line service area earn \$30,000 or less. **Figure 4** shows the percentage of households – by Census Block Group – earning \$30,000 or less per year. While the map does not show large concentrations of poverty across the region, pockets of poverty exist in Alexandria, Kings Park, Burke Centre, and around the Franconia-Springfield Metrorail station. Relatively affluent areas include West Springfield and Ravensworth.

Figure 2 | Population Density by Census Block Group: 17/18 Lines

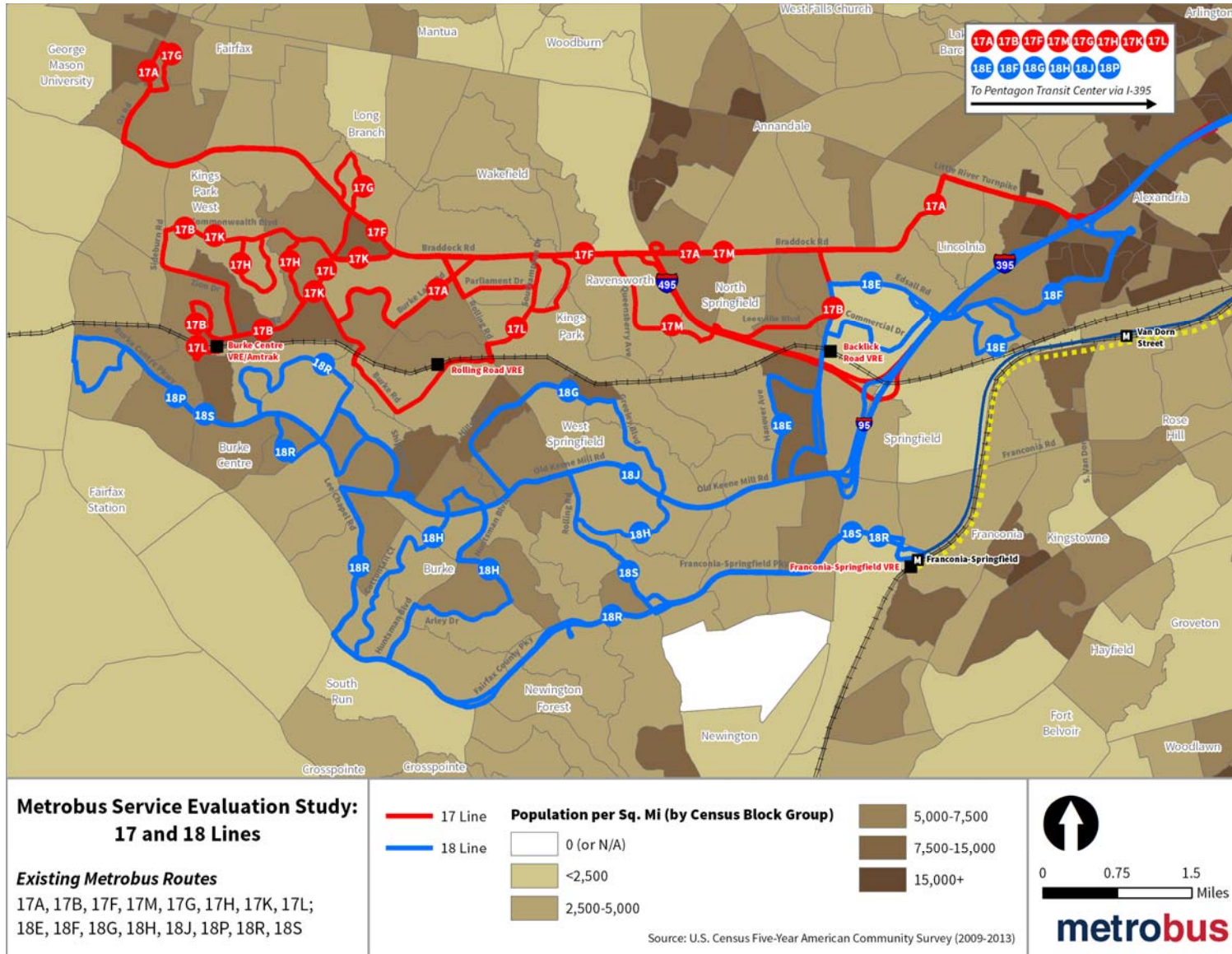


Figure 3 | Minority Population by Census Block Group: 17/18 Lines

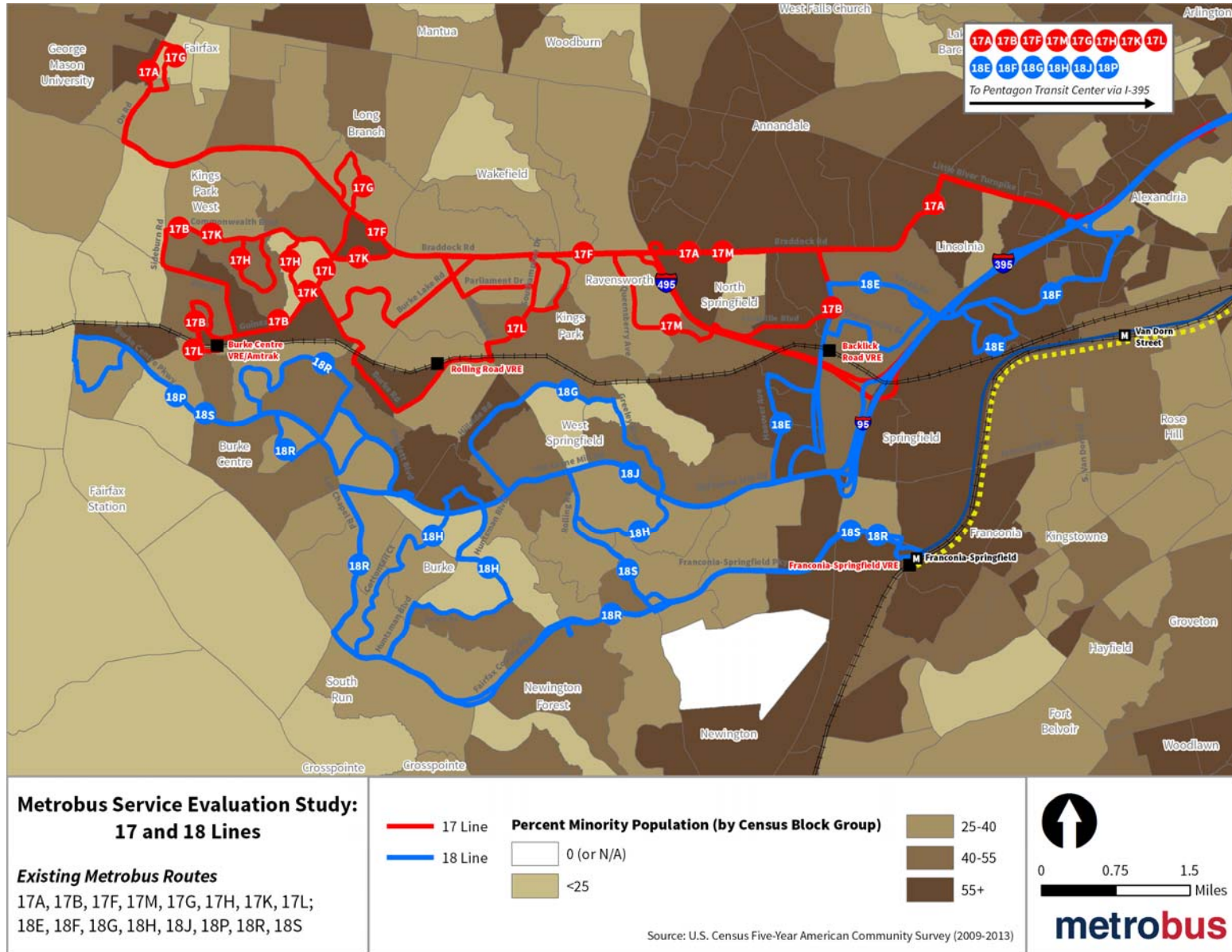
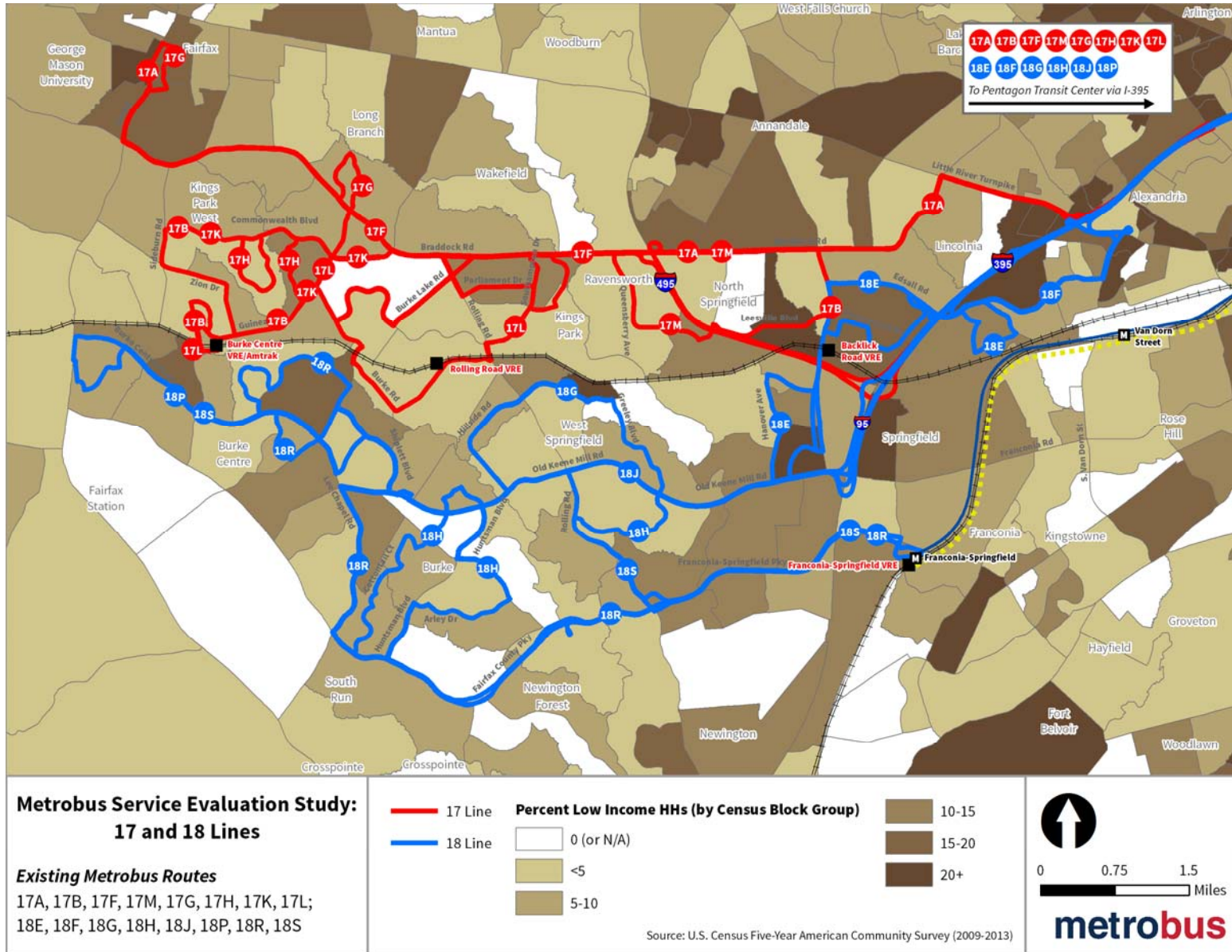


Figure 4 | Low Income Household by Census Block Group: 17/18 Lines



2.3. LINE DESCRIPTIONS

This section offers a description of the 17/18 Lines, covering the following topics:

- Basic alignment
- Termination points
- Total route distance in miles
- Major corridors traveled
- Generators served along the lines

An illustration of each variation for each of the lines has also been produced, which includes the variation alignments, the other connecting and available regional transit services provided by Metrobus, Metrorail and Fairfax Connector, study area Metrorail and Virginia Railway Express (VRE) stations, and local Park & Ride lots, as well as the transit generators within the region.

2.3.1. Kings Park Line: Routes 17A-17B-17F-17M

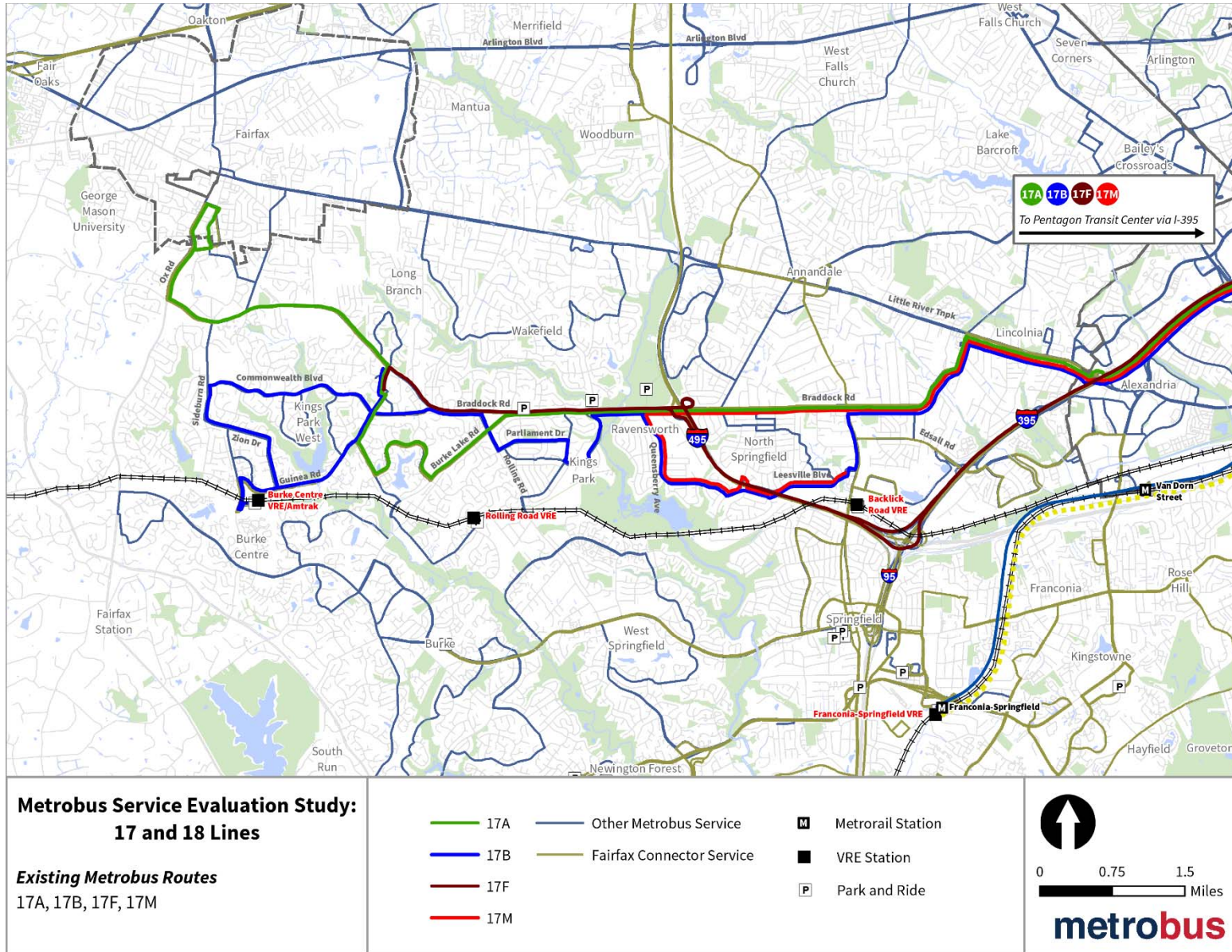
Today, the Kings Park Line runs four routes – the 17A, 17B, 17F, and 17M – from the Pentagon Transit Center to the three destinations listed in **Table 2**. The table also contains each route’s length and the major corridors on which it travels. All four routes travel along I-395 as well as Braddock Road. At 24.8 miles, the Route 17B is the longest route in terms of total distance traveled per direction on the Kings Park Line, while Route 17F (15.6 miles) is the shortest route on the line.

Major generators along the Kings Park Line include Washington Gas (17F and 17M), the Kings Park and George Mason Libraries, as well as George Mason University (17A), and Robinson Secondary School (17B). In addition to the Pentagon Transit Center, transportation-related entities served include Burke Centre VRE Station (17B), Backlick Road VRE Station (17B and 17M), and several Park & Rides along Braddock Road (17A, 17B and 17F). **Figure 5** details the alignments of the Kings Park routes.

Table 2 | Route Characteristics: Kings Park Line

Route	From	To	Total Route Distance (Miles)	Major Corridors Traveled
17A	Pentagon Transit Center	George Mason University	20.6	I-395, Braddock Rd, Lake Braddock Dr
17B	Pentagon Transit Center	Kings Park West	24.8	I-395, Braddock Rd, VA-236, VA-652, Commonwealth Blvd
17F	Pentagon Transit Center	Kings Park West	15.6	I-395, I-495, Braddock Rd
17M	Pentagon Transit Center	North Springfield	14.7	I-395, Braddock Rd, Queensberry Ave, Leesville Blvd

Figure 5 | Kings Park Line: Routes 17A-17B-17F-17M



2.3.2. Kings Park Express Line: Routes 17G-17H-17K-17L

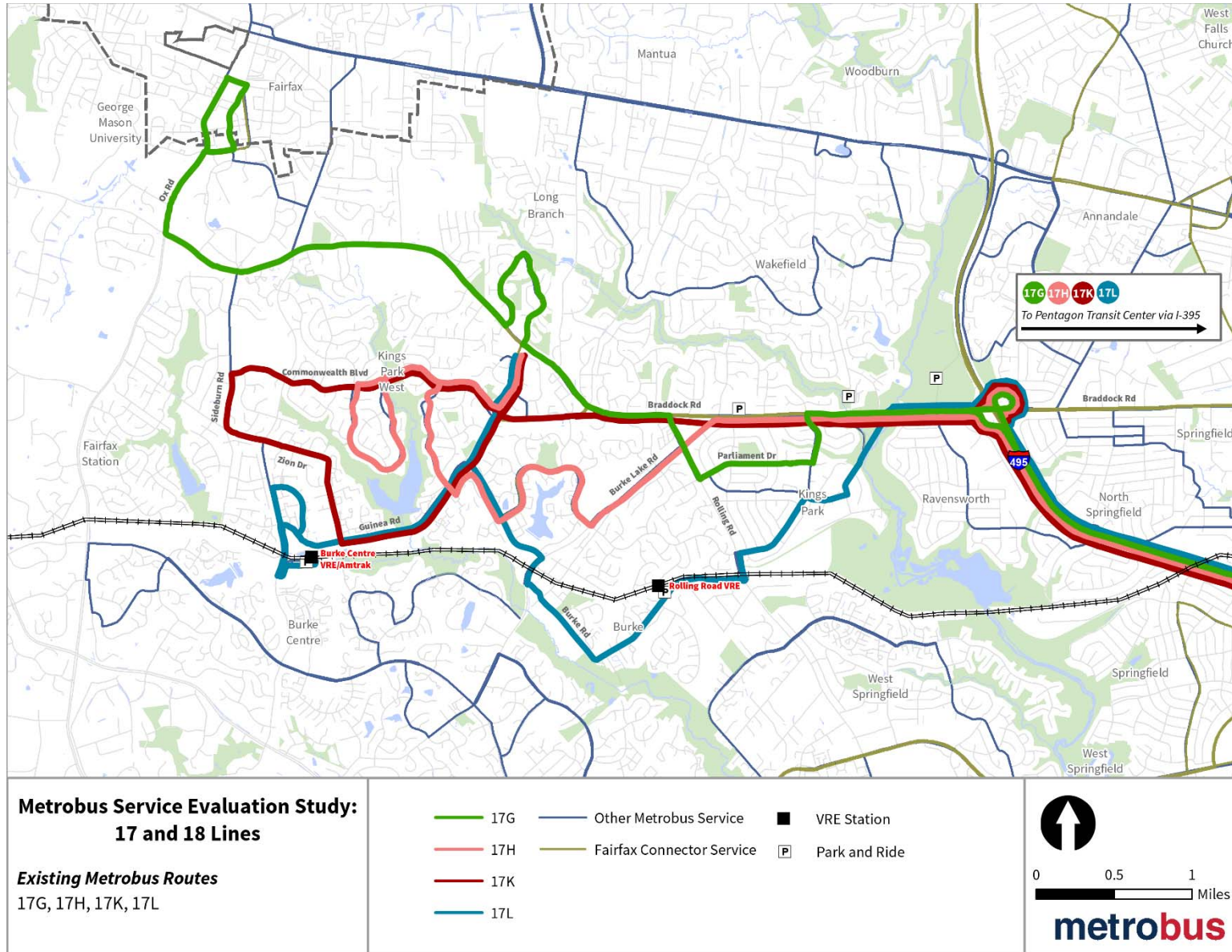
Table 3 describes general information on the Kings Park Express routes: 17G, 17H, 17K, and 17L. Like the Kings Park Line, all routes operate from the Pentagon Transit Center to either George Mason University (17G) or Kings Park West (17H, 17K and 17L). All routes employ I-395, I-495, and Braddock Road, while the Routes 17K and 17L each also operate along VA-652 (Burke Road). The longest and shortest route lengths (per direction) within the Kings Park Express Line, respectively, are the Route 17L (23.2 miles) and the Route 17G (21.0 miles).

Table 3 | Route Characteristics: Kings Park Express Line

Route	From	To	Total Route Distance (Miles)	Major Corridors Traveled
17G	Pentagon Transit Center	George Mason University	21.0	I-395, I-495, Braddock Rd, Lake Braddock Dr
17H	Pentagon Transit Center	Kings Park West	20.7	I-395, I-495, Burke Lake Rd
17K	Pentagon Transit Center	Kings Park West	20.6	I-395, I-495, VA-652, Commonwealth Blvd
17L	Pentagon Transit Center	Kings Park West	23.2	I-395, I-495, VA-652, VA-651

Figure 6 depicts the four routes associated with the Kings Park Express Line, each of which runs along the same corridor until the intersection of I-495 and Braddock Road. In addition to generators served by the Kings Park Line, the Kings Park Express Line also serves the Washington Post (all variations), Lake Braddock Secondary School (17H), and Robinson Secondary School (17K).

Figure 6 | Kings Park Express Line: Routes 17G-17H-17K-17L



2.3.3. Springfield Line: Routes 18E-18F

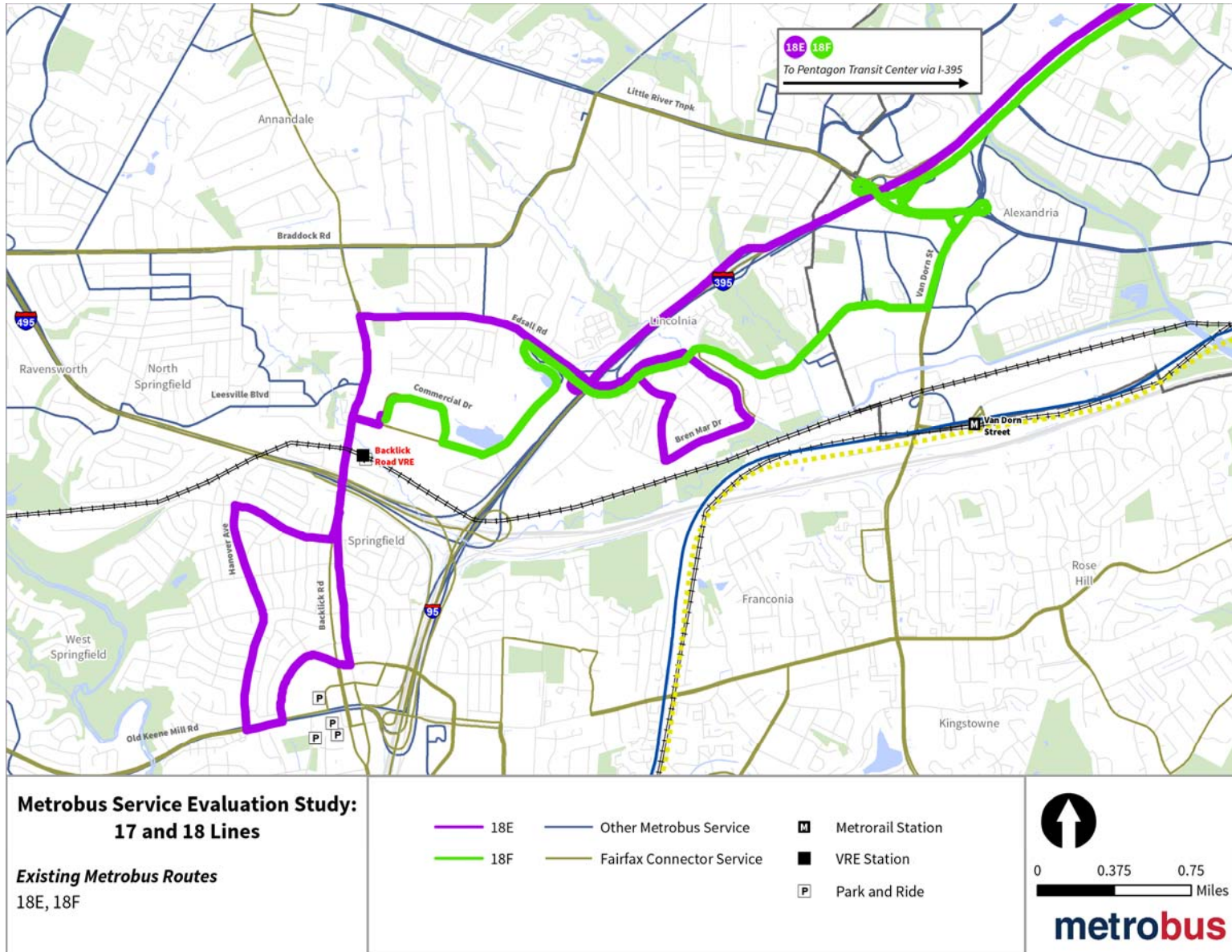
As shown in **Table 4**, the two Springfield routes, 18E and 18F, each originate at the Pentagon Transit Center and serve the Springfield and North Springfield regions, respectively. Both routes travel along I-395. Route 18E’s total distance per direction is just over five miles longer than that of Route 18F.

Table 4 | Route Characteristics: Springfield Line

Route	From	To	Total Route Distance (Miles)	Major Corridors Traveled
18E	Pentagon Transit Center	Springfield	16.6	I-395, VA-648, Backlick Rd
18F	Pentagon Transit Center	North Springfield	11.3	I-395, Van Dorn St

Figure 7 presents an illustration of the two routes of the Springfield Line. Major generators served include the Landmark Mall and Washington Gas (both variations), the Social Security Administration (18F), and the Springfield Plaza and the Richard Byrd Library (18E).

Figure 7 | Springfield Line: Routes 18E-18F



2.3.4. Orange Hunt Line: Routes 18G-18H-18J

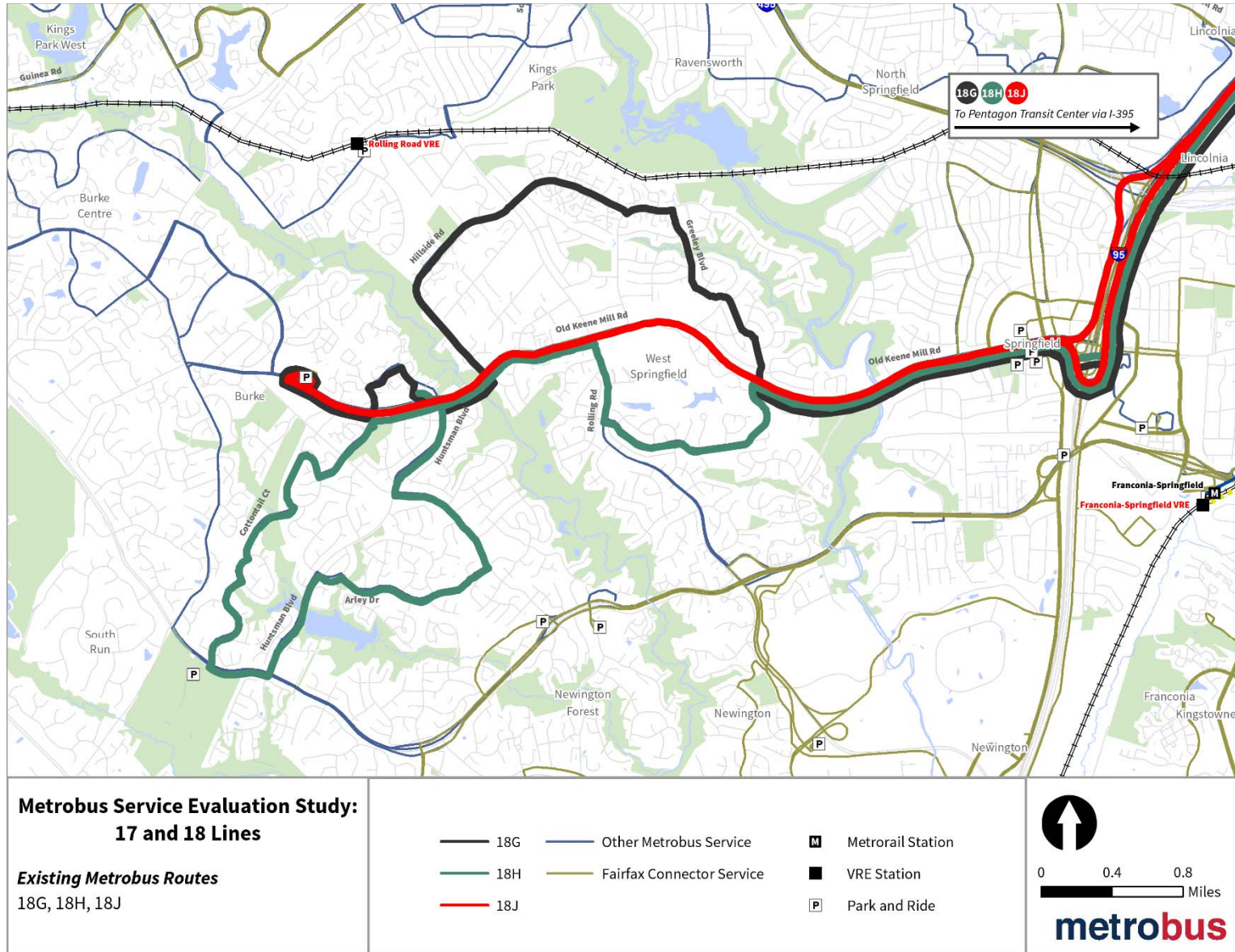
Each of the Orange Hunt Line routes operates to and from the Pentagon Transit Center. All routes travel along I-395 as well as VA-644 (Old Keene Mill Road). At 20.8 miles, the Route 18H is the longest route in terms of total distance traveled per direction on the Orange Hunt Line, while Route 18J (15.2 miles) is the shortest route. **Table 5** describes the routes that comprise the Orange Hunt Line: the 18G, 18H, and 18J.

Table 5 | Route Characteristics: Orange Hunt Line

Route	From	To	Total Route Distance (Miles)	Major Corridors Traveled
18G	Pentagon Transit Center	Burke / West Springfield	17.3	I-395, VA-644, Greeley Blvd, Hillside Rd
18H	Pentagon Transit Center	South Run	20.8	I-395, VA-644, Greeley Blvd, Huntsman Blvd
18J	Pentagon Transit Center	Burke	15.2	I-395, VA-644

Figure 8 depicts the alignments of these three routes. Generators served include the Springfield Plaza, the Richard Byrd Library, and several Park & Rides along VA-644 (all routes), the Springfield Golf & Country Club (18H and 18J), and the Kings Park Library (18G and 18J).

Figure 8 | Orange Hunt Line: Routes 18G-18H-18J



2.3.5. Burke Centre Line: Routes 18P-18R-18S

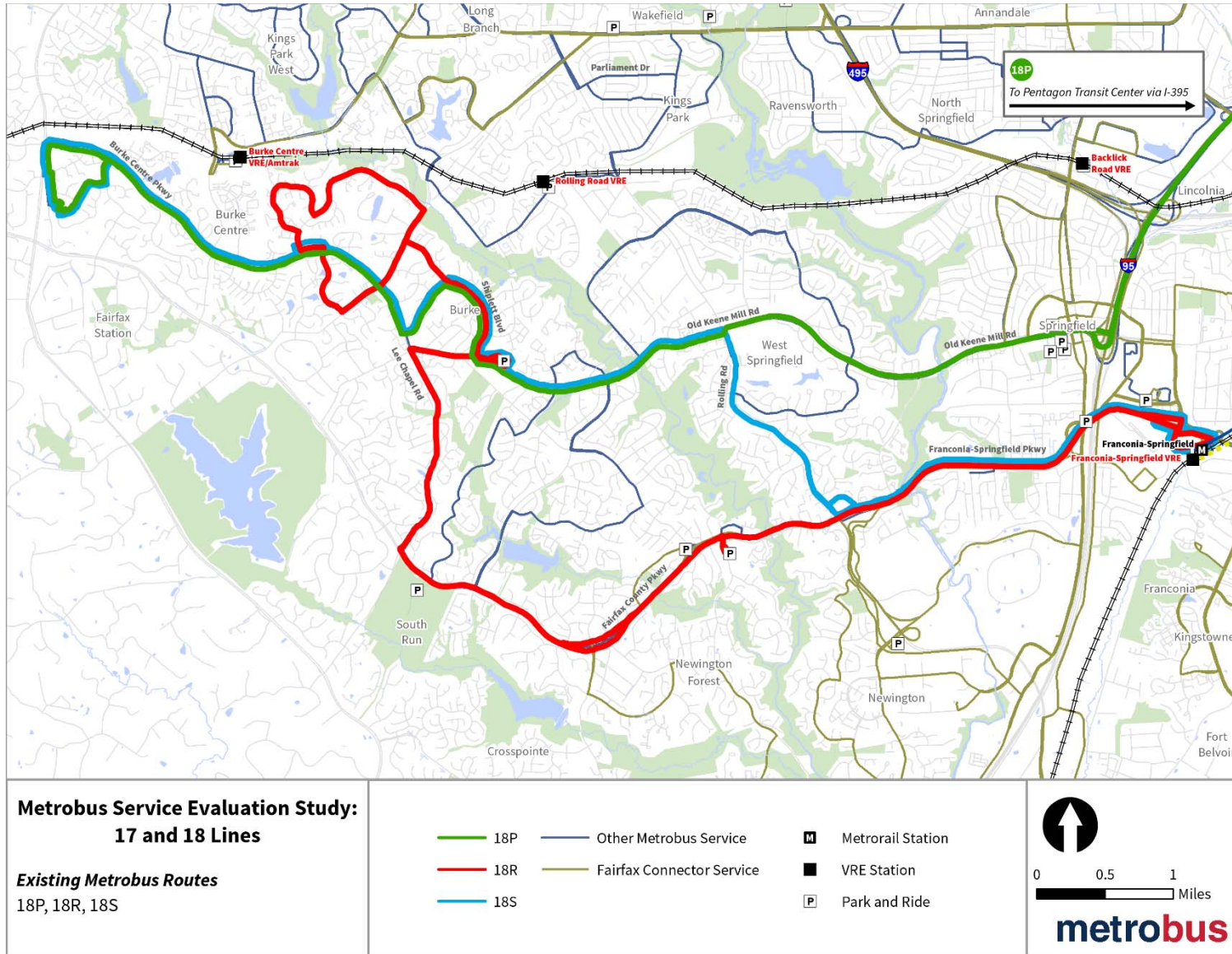
While each of the Burke Centre Line routes originates in the Burke Centre region, the Route 18P operates to the Pentagon Transit Center; Routes 18R and 18S each end at Franconia-Springfield Metrorail Station. All routes operate along VA-644 (Old Keene Mill Road) and VA-643 (Lee Chapel Road). At 21.1 miles, the Route 18P is the longest in terms of total distance traveled per direction. Routes 18R and 18S each travel 14.8 miles in each direction. **Table 6** depicts the Burke Centre routes, the 18P, 18R, and 18S.

Table 6 | Route Characteristics: Burke Centre Line

Route	From	To	Total Route Distance (Miles)	Major Corridors Traveled
18P	Pentagon Transit Center	Burke Centre	21.1 Miles	I-395, VA-644, VA-643
18R	Franconia-Springfield Metro Station	Burke Centre	14.8 Miles	VA-644, VA-643, VA-286
18S	Franconia-Springfield Metro Station	Burke Centre	14.8 Miles	VA-644, VA-643, VA-638

As shown in **Figure 9**, in addition to the generators served along I-395, the Route 18P serves the Springfield Plaza, the Springfield Golf & Country Club, and the Richard Byrd Library. All routes of the Burke Centre Line serve the Pohick Regional Library in Burke. The Route 18R also serves the Gambrill Road Park & Ride lot.

Figure 9 | Burke Centre Line: Routes 18P-18R-18S



2.4. FLEET INFORMATION

All 17/18 Lines' routes use 40-Foot (L) or 40-Foot High Back (HB) buses, each of which seats 40 customers. The 17/18 Lines operate from three WMATA garages: Shepherd Parkway Division, Four Mile Run Division, and West Ox Division. **Table 7** indicates the number of vehicles assigned to garages during morning and afternoon hours.

Table 7 | Garage Assignment: 17/18 Lines

Garage	Route	AM Vehicles	PM Vehicles	Vehicle Type
Shepherd Parkway Division	17A-17B-17F-17M	0	5	L
	17G-17H-17K-17L	0	7	L
	18E-18F	3	3	L
	18P-18R-18S	0	3	L
Four Mile Run Division	17A-17B-17F-17M	0	2	L/HB
	17G-17H-17K-17L	10	4	L/HB
	18G-18H-18J	6	5	L/HB
	18P-18R-18S	0	3	L
West Ox Division	17A-17B-17F-17M	4	1	L
	17G-17H-17K-17L	4	5	L
	18G-18H-18J	0	0	L
	18P-18R-18S	8	5	L
Total Peak Vehicles in Service	Line 17	18	24	L/HB
	Line 18	17	19	L/HB

3. Level of Service

All 17/18 Lines operate on weekdays only. While some of the individual routes offer limited off-peak service, the majority of service is offered during the AM and PM peak periods. Under WMATA’s bus classification system, Routes 18R and 18S are classified as Commuter services; all other 17/18 routes are considered Express services. With each service separated by period and direction, this section presents a detailed description of hours of service and frequencies for the 16 routes operating within the 17/18 lines’ corridor and compares them against WMATA’s guidelines.

3.1. HOURS OF SERVICE

WMATA weekday guidelines for both express and commuter hours of service are identical, and described below:

- The **first trip** in the **morning** should arrive at its final destination terminal no later than **7:00 AM**.
- The **final trip** in the **morning** should arrive at its final destination terminal no earlier than **9:00 AM**.
- The **first trip** in the **evening** should depart from its starting terminal no later than **4:00 PM**.
- The **final trip** in the **evening** should depart from its starting terminal no earlier than **6:30 PM**.

The following subsections assess whether the 17/18 Lines meet WMATA guidelines. If a figure meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

3.1.1. Kings Park Line: Routes 17A-17B-17F-17M

The Kings Park Line meets WMATA standards in terms of the hours of service, though when broken out by route, the Routes 17A, 17B and 17M violate the standard in the morning while the Route 17F violates the standards in the evening (see **Table 8**).

Table 8 | Service Span: Kings Park Line

Route	Morning Peak		Afternoon Peak	
	First Trip Arrival	Last Trip Arrival	First Trip Departure	Last Trip Departure
17A*	7:40 AM	9:50 AM	2:55 PM	10:05 PM
17B	9:25 AM	10:06 AM	2:20 PM	8:25 PM
17F	6:46 AM	9:06 AM	3:36 PM	5:48 PM
17M	6:40 AM	8:41 AM	4:00 PM	6:55 PM
King Park Line	6:40 AM	10:06 AM	2:20 PM	10:05 PM

*Includes both directions

3.1.2. Kings Park Express Line: Routes 17G-17H-17K-17L

The Kings Park Express Line violates the WMATA standards in the morning. As **Table 9** demonstrates, each of the individual routes violates the standards for both the morning and afternoon peak periods in one manner.

Table 9 | Service Span: Kings Park Express Line

Route	Morning Peak		Afternoon Peak	
	First Trip Arrival	Last Trip Arrival	First Trip Departure	Last Trip Departure
17G	6:43 AM	8:33 AM	3:55 PM	6:46 PM
17H	6:09 AM	8:58 AM	4:05 PM	6:30 PM
17K	7:03 AM	8:23 AM	4:26 PM	6:35 PM
17L	6:50 AM	8:28 AM	4:36 PM	6:27 PM
Kings Park Express Line	6:09 AM	8:58 AM	3:55 PM	6:46 PM

3.1.3. Springfield Line: Routes 18E-18F

The Springfield Line fails to meet the WMATA guidelines during both the morning and afternoon periods (see **Table 10**). Both the routes, 18E and 18F, end too early in the morning and start too late in the afternoon, while Route 18F also ends too early in the afternoon.

Table 10 | Service Span: Springfield Line

Route	Morning Peak		Afternoon Peak	
	First Trip Arrival	Last Trip Arrival	First Trip Departure	Last Trip Departure
18E	6:43 AM	8:48 AM	4:33 PM	6:35 PM
18F	6:52 AM	8:26 AM	4:50 PM	6:25 PM
Springfield Line	6:43 AM	8:48 AM	4:33 PM	6:35 PM

3.1.4. Orange Hunt Line: Routes 18G-18H-18J

The Orange Hunt Line fails to meet the WMATA standards during the morning period (see **Table 11**). All three routes, 18G, 18H, and 18J, fail to meet the WMATA standards during the morning period. Route 18H is the only variation that meets WMATA standards during the evening period.

Table 11 | Service Span: Orange Hunt Line

Route	Morning Peak		Afternoon Peak	
	First Trip Arrival	Last Trip Arrival	First Trip Departure	Last Trip Departure
18G	6:20 AM	8:50 AM	4:15 PM	6:30 PM
18H	6:30 AM	8:30 AM	4:00 PM	6:50 PM
18J	7:23 AM	8:23 AM	5:01 PM	6:02 PM
Orange Hunt Line	6:20 AM	8:50 AM	4:00 PM	6:50 PM

3.1.5. Burke Centre Line: Routes 18P-18R-18S

Overall, the Burke Centre Line meets WMATA standards for both the morning and afternoon services (see **Table 12**). The Routes 18R and 18S end service too early in the morning and the Route 18S starts service too late in the afternoons to meet WMATA standards.

Table 12 | Service Span: Burke Centre Line

Route	Morning Peak		Afternoon Peak	
	First Trip Arrival	Last Trip Arrival	First Trip Departure	Last Trip Departure
18P	6:40 AM	9:05 AM	3:35 PM	7:20 PM
18R	6:57 AM	8:57 AM	3:45 PM	7:02 PM
18S	6:15 AM	8:37 AM	4:07 PM	8:20 PM
Burke Centre Line	6:15 AM	9:05 AM	3:35 PM	8:20 PM

3.1.6. Preliminary Findings: Hours of Service

The individual 17/18 Lines vary in their adherence to WMATA guidelines for hours of service. Lines and time periods that merit additional attention include:

- Earlier peak morning service:
 - King Park Line – Routes 17A, 17B
 - Kings Park Express Line – Route 17K
 - Orange Hunt Line – Route 18J
- Later peak morning service
 - Kings Park Line – Route 17M
 - Kings Park Express Line – Routes 17G, 17H, 17K, 17L
 - Springfield Line – Routes 18E, 18F
 - Orange Hunt Line – Routes 18G, 18H, 18J
 - Burke Centre Line – Routes 18R, 18S
- Earlier peak afternoon service:
 - Kings Park Express Line – Routes 17H, 17K, 17L
 - Springfield Line – Routes 18E, 18F
 - Orange Hunt Line – Routes 18G, 18J
 - Burke Centre Line – Routes 18S
- Later peak evening service
 - Kings Park Line – Route 17F
 - Kings Park Express Line – Routes 17L
 - Springfield Line – Route 18F
 - Orange Hunt Line – Route 18J

3.2. SERVICE FREQUENCY

WMATA weekday guidelines for both express and commuter service frequencies are identical, and described below:

- A minimum of **four trips** during morning and afternoon peak periods.

The following subsections assess whether the 17/18 Lines routes meet WMATA guidelines. If a figure meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

3.2.1. Kings Park Line: Routes 17A-17B-17F-17M

Overall, the King Park Line meets WMATA’s service frequency standards for the number of trips per morning and afternoon peak periods (see **Table 13**). However, Route 17B fails to meet the standard in the morning peak period, having only two trips towards the Pentagon. The average frequency for the Kings Park Line varies between morning and afternoon peak periods, at 21 and 32 minutes, respectively, which is reflective of the difference in number of trips during these time periods.

Table 13 | Service Frequency: Kings Park Line

Route	Morning Peak		Afternoon Peak	
	Number of Trips	Average Frequency (min)	Number of Trips	Average Frequency (min)
17A*	5	42	9	60
17B	2	41	4	57
17F	6	28	5	33
17M	6	25	8	25
Kings Park Line	19	36	26	48

*Includes both directions

3.2.2. Kings Park Express Line: Routes 17G-17H-17K-17L

The Kings Park Express Line and all of the individual routes meet WMATA service frequency standards (see **Table 14**). The average frequency for the Kings Park Express Line is fairly similar between the morning and afternoon peak periods, at seven and five minutes, respectively.

Table 14 | Service Frequency: Kings Park Express Line

Route	Morning Peak		Afternoon Peak	
	Number of Trips	Average Frequency (min)	Number of Trips	Average Frequency (min)
17G	6	22	10	19
17H	9	21	8	20
17K	5	20	8	18
17L	5	24	6	22
Kings Park Express Line	25	7	32	5

3.2.3. Springfield Line: Routes 18E-18F

The Springfield Line and all of the individual routes meet WMATA service frequency standards (see **Table 15**). The average frequency for the Springfield Line is fairly similar between the morning and afternoon peak periods, at 31 and 30 minutes, respectively, this is a result of performing the same amount of trips in both time periods, nine minutes each.

Table 15 | Service Frequency: Springfield Line

Route	Morning Peak		Afternoon Peak	
	Number of Trips	Average Frequency (min)	Number of Trips	Average Frequency (min)
18E	5	31	5	30
18F	4	31	4	30
Springfield Line	9	31	9	30

3.2.4. Orange Hunt Line: Routes 18G-18H-18J

Overall, the Orange Hunt Line meets WMATA’s service frequency standards for the number of trips per morning and afternoon peak periods (see **Table 16**). However, the Route 18J fails to meet the standard in both the morning and afternoon peak periods, by performing only three trips in each time period, this could be a result of this route operating as a reverse commute. The average frequency for the Orange Hunt Line is fairly similar between the morning and afternoon peak periods, at 17 and 16 minutes, respectively.

Table 16 | Service Frequency: Orange Hunt Line

Route	Morning Peak		Afternoon Peak	
	Number of Trips	Average Frequency (min)	Number of Trips	Average Frequency (min)
18G	6	30	6	27
18H	5	30	7	28
18J	3	30	3	30
Orange Hunt Line	14	17	16	16

3.2.5. Burke Centre Line: Routes 18P-18R-18S

The Burke Centre Line and all of the individual routes meet WMATA service frequency standards (see **Table 17**). This line serves two different destination points, the Franconia-Springfield Metro Station and the Pentagon Transit Center. At the Franconia-Springfield Metro Station, during the morning and afternoon periods, the line has an average frequency of 16 and 19 minutes, respectively. While at the Pentagon Transit Center, during the morning and afternoon peak periods, this route has an average frequency of 29 and 22 minutes, respectively.

Table 17 | Service Frequency: Burke Centre Line

Route	Morning Peak		Afternoon Peak	
	Number of Trips	Average Frequency (min)	Number of Trips	Average Frequency (min)
18P	6	29	11	22
18R	5	30	7	32
18S*	12	25	19	25
Burke Centre Line	23	28	37	26

Route	Morning Peak		Afternoon Peak	
	Number of Trips	Average Frequency (min)	Number of Trips	Average Frequency (min)

*Includes shortened trips to Springfield

3.2.6. Preliminary Findings: Service Frequency

The individual 17/18 Lines vary in their adherence to WMATA guidelines for frequency of service. Lines and time periods that merit additional attention include:

- Morning peak period:
 - Kings Park Line – Route 17B
 - Orange Hunt Line – Route 18J
- Afternoon peak period
 - Orange Hunt Line – Route 18J

4. Ridership

This section provides and analyzes recent and historic ridership data by line and individual route, using data collected from March to June 2014.

4.1. DAILY RIDERSHIP

WMATA weekday guidelines for both express and commuter ridership are identical, and described below:

- A minimum of **456** average daily riders.

Table 18 assesses whether the 17/18 Lines routes meet WMATA guidelines. If a line meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

Table 18 | Average Daily Ridership: 17/18 Lines

Line	Routes	Line Average Daily Ridership
Kings Park	17A-17B-17F-17M	396
Kings Park Express	17G-17H-17K-17L	1,075
Springfield	18E-18F	186
Orange Hunt	18G-18H-18K-18L	583
Burke Centre	18P-18R-18S	691
17 Line Total		1,471
18 Line Total		1,460

4.1.1. Preliminary Findings: Average Daily Ridership

The individual 17/18 Lines vary in their adherence to WMATA guidelines for average daily ridership. Lines that do not meet the standard include:

- King Park Express Line, misses the standard by 60 boardings a day
- Springfield Line, misses the standard by 270 boardings a day

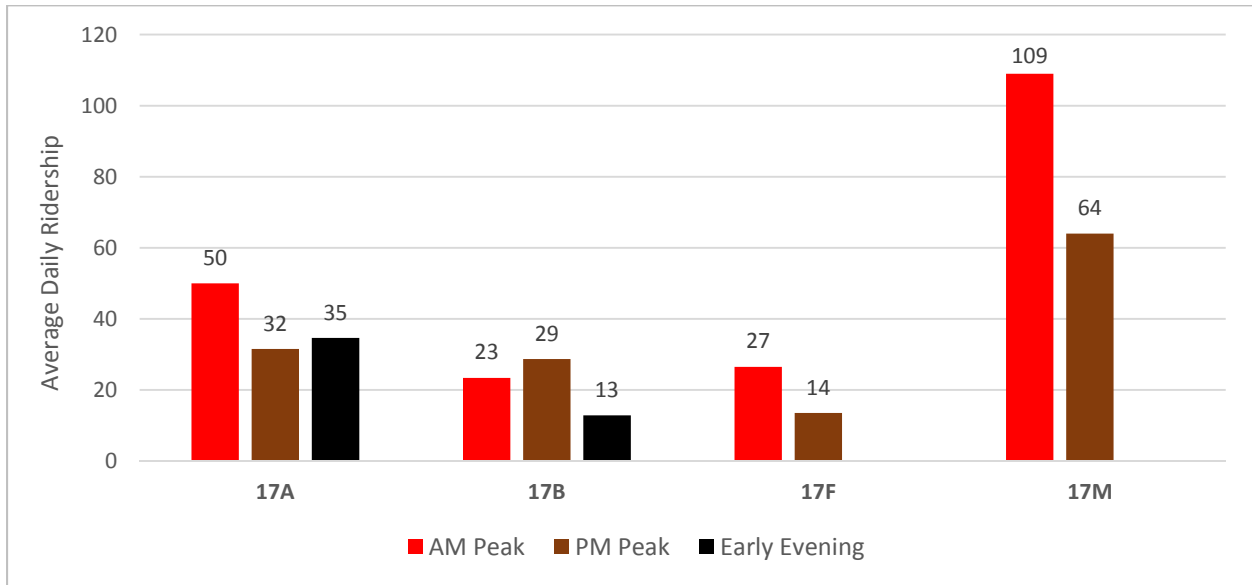
4.2. RIDERSHIP BY TIME PERIOD

The subsection below details average daily boardings by weekday broken out by morning peak, afternoon peak, or early night periods.

4.2.1. Kings Park Line: Routes 17A-17B-17F-17M

The Kings Park Line carries approximately 396 passengers per day. Even though Route 17A operates the most trips daily and is bi-directional, Route 17M carries more passengers per day, with approximately 173 boardings per day compared to 135 (see **Figure 10**). Route 17B, which has the fewest number of trips, carries approximately 65 passengers per day, while Route 17F which performs five more trip than Route 17B, carries 24 fewer passengers on an average day, with only 41 boardings per day.

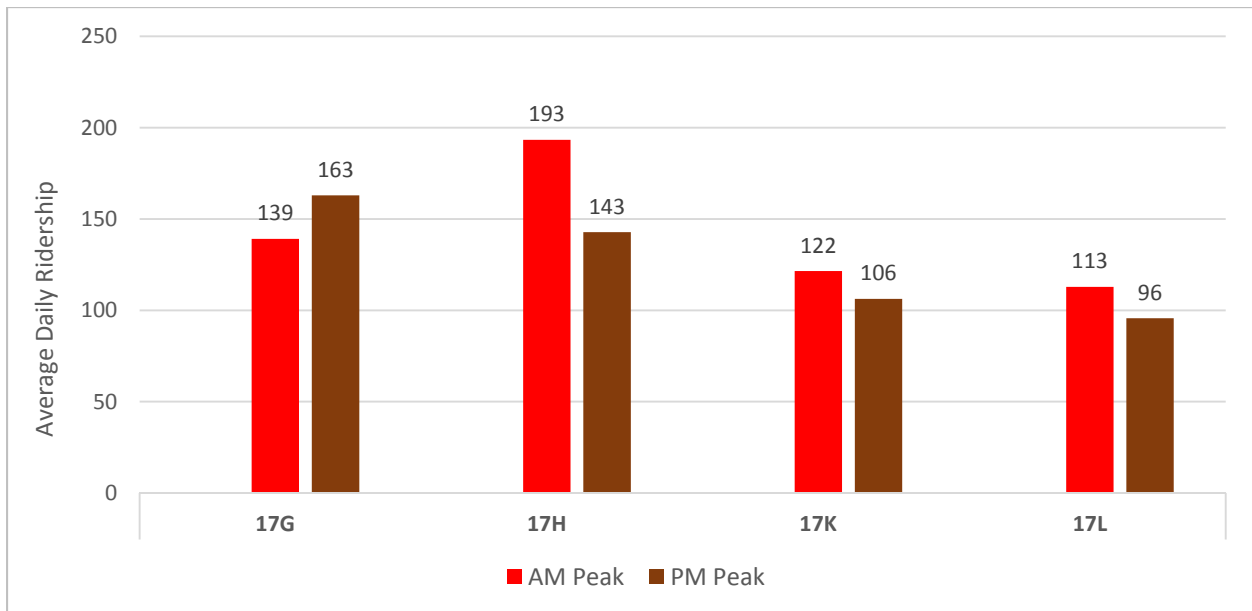
Figure 10 | Average Boardings by Time Period: Kings Park Line



4.2.2. Kings Park Express Line: Routes 17G-17H-17K-17L

The Kings Park Express Line carries approximately 1,075 passengers per day. The individual routes range from 200-300 boardings per day (see **Figure 11**). Route 17H has the most daily boardings at 336, which is reflective of the fact that it has the most trips. Route 17L has the fewest number of trips and carries the fewest amount of passengers daily at 209.

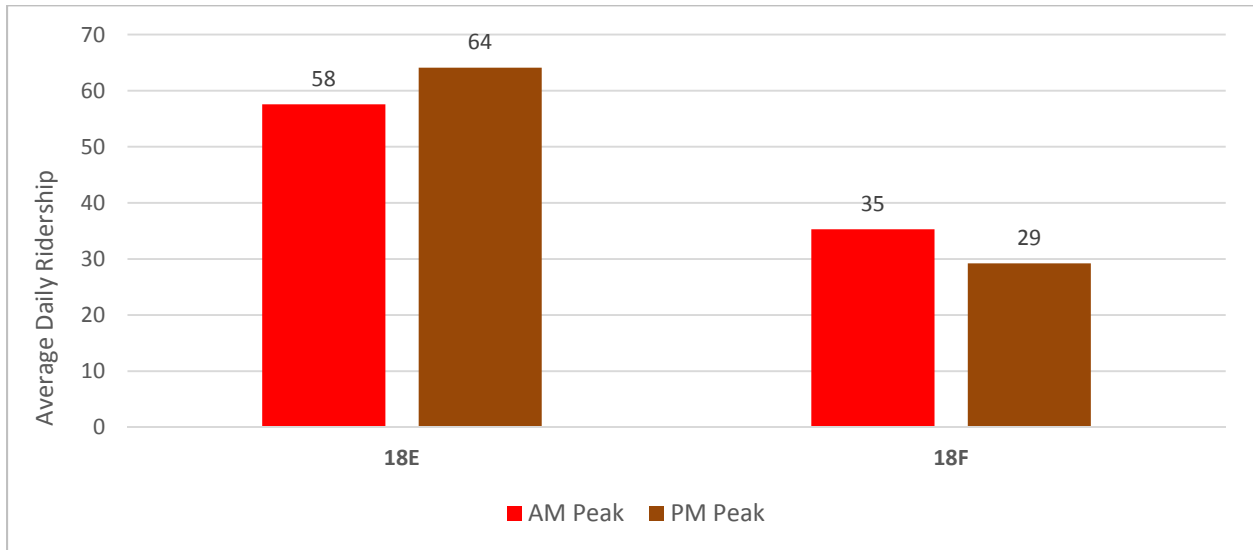
Figure 11 | Average Boardings by Time Period: Kings Park Express Line



4.2.3. Springfield Line: Routes 18E-18F

The Springfield Line carries approximately 186 passengers per day. Route 18F has 64 boardings per day, which is less than the Route 18E which carries approximately 122 (see **Figure 12**). This is a result of the Route 18F performing fewer trips, as well as the fact that it operates as a reverse commute route.

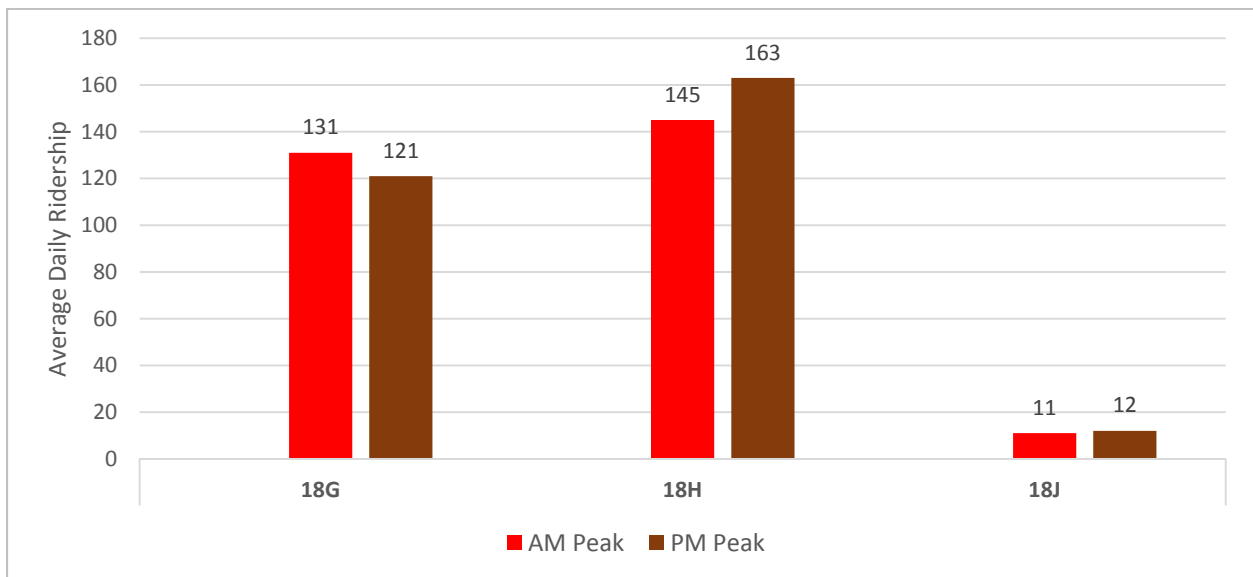
Figure 12 | Average Boardings by Time Period: Springfield Line



4.2.4. Orange Hunt Line: Routes 18G-18H-18J

The Orange Hunt Line carries approximately 583 passengers per day. Routes 18G and 18H both have 12 trips per day and have 252 and 308 passengers board daily, respectively (see **Figure 13**). Route 18J serves significantly less people with 23 boardings per day, this could be a result of the fact it has fewer trip, only six, and is a reverse commute route.

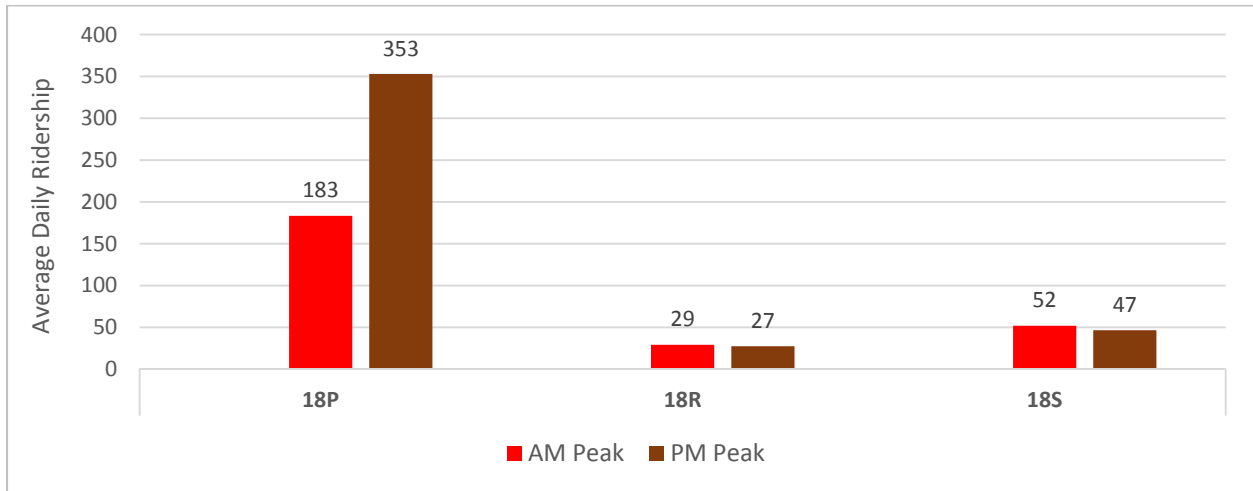
Figure 13 | Average Boardings by Time Period: Orange Hunt Line



4.2.5. Burke Centre Line: 18P-18R-18S

The Burke Center Line carries approximately 691 passengers per day. Route 18P is the best performer on this line with 526 daily boardings, this route is also the only one on the line to connect directly to the Pentagon Transit Center (see **Figure 14**). Routes 18R and 18S both carry significantly less, with 56 and 99 boardings per day, respectively. These routes only service the Franconia-Springfield Metro Station.

Figure 14 | Average Boardings by Time Period: Burke Centre Line



4.2.6. Preliminary Findings: Ridership by Time Period

Ridership by time period varies significantly across 17/18 Lines. Variations with relatively high ridership include:

- Route 17M during the AM Peak Period
- Route 17G during the PM Peak Period
- Route 17H during the AM Peak Period
- Route 18H during the PM Peak Period
- Route 18P during the PM Peak Period

Variations with relatively low ridership include:

- Route 17B during both Peak Periods
- Route 17F during both Peak Periods
- Route 18F during both Peak Periods
- Route 18J during both Peak Periods
- Route 18 R during both Peak Periods
- Route 18S during both Peak Periods

Routes with particularly low ridership may be candidates for consolidation.

4.3. FARE MEDIA USAGE

This section profiles data from the entire month of October 2014, detailing ridership by three different fare categories:

- SmarTrip Cards
- Transfer, including bus-to-bus and rail-to-bus
- Cash ride

The vast majority of passengers on the 17/18 Lines use SmarTrip cards when boarding Metrobus, SmarTrip represents approximately 68 percent of fare media used on these lines (see **Table 19**). This is particularly true on the Kings Park Express and Orange Hunt Lines, where 73 percent of riders pay using cards. While transfers and cash rides have the highest percentage on the Kings Park Line.

Table 19 | Fare Media Usage: 17/18 Lines

Line	Routes	Fare Category		
		SmarTrip	Transfer	Cash Ride
Kings Park	17A-17B-17F-17M	57%	40%	3%
Kings Park Express	17G-17H-17K-17L	73%	26%	1%
Springfield	18E-18F	61%	38%	1%
Orange Hunt	18G-18H-18K-18L	73%	26%	1%
Burke Centre	18P-18R-18S	63%	36%	1%
17 Line Total		69%	30%	1%
18 Line Total		67%	32%	1%

4.4. FIVE-YEAR RIDERSHIP TREND

Ridership numbers have remained relatively steady over the half-decade period, with each line posting a slight overall increase in average daily ridership. This is most likely indicative of the fact that a vast majority of the 17/18 Lines’ passengers are commuters who have been using the services continually over a period of years. **Figure 15** and **Figure 16** display average daily ridership over the previous five fiscal years for the 17/18 Lines.

Figure 15 | Five Year Ridership Trend: Line 17

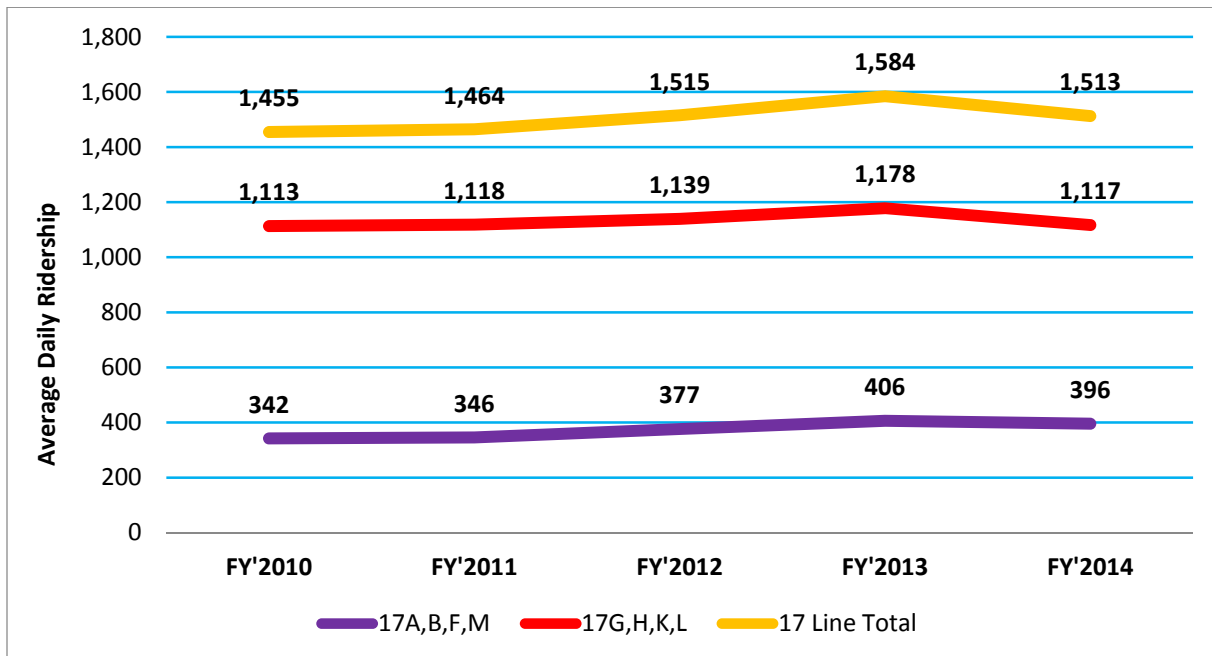
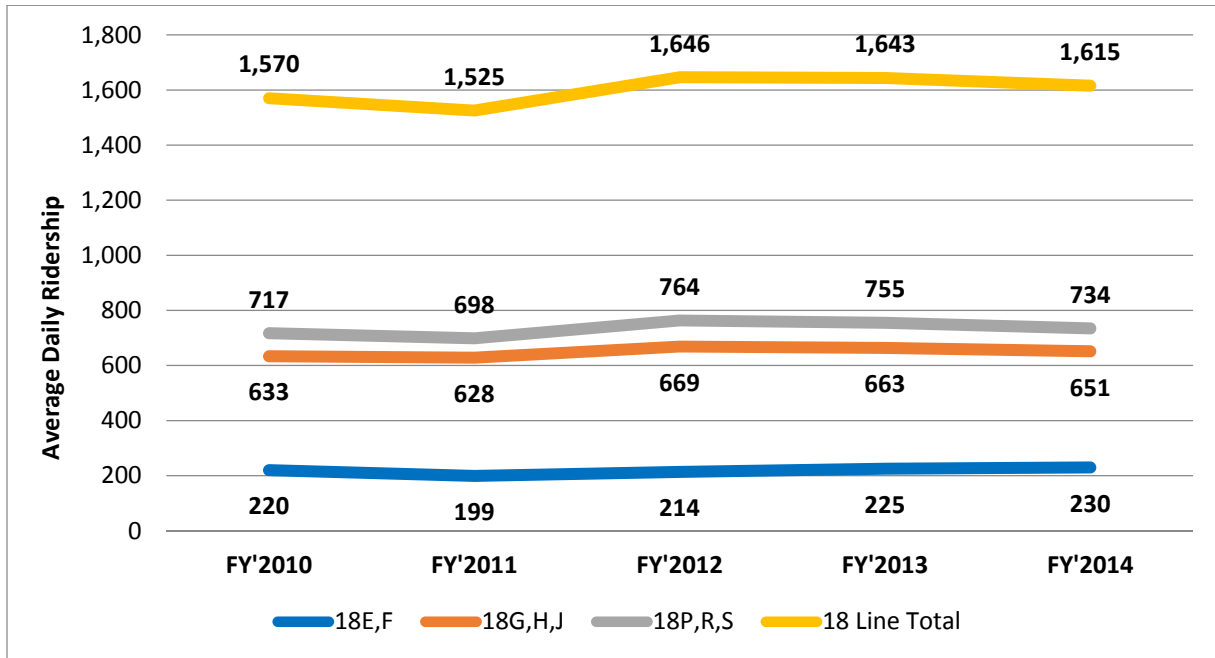


Figure 16 | Five Year Ridership Trend: Line 18



All of the 17/18 Lines have experienced an increase in ridership. At 15.79 percent, the Kings Park Line has witnessed the greatest change in ridership; at 0.36 percent, the Kings Park Express Line has barely increased its overall ridership. On the whole, Line 17 ridership increased by a greater percentage (3.99 percent) than did Line 18 ridership (2.87 percent). **Table 20** shows the percent change in average daily ridership, by line, over the five-year period from FY2010 to FY2014.

Table 20 | FY2010 - FY2014 Trends in Ridership: 17/18 Lines

Line	Routes	Percent Change in Ridership FY2010-FY2014
Kings Park	17A-17B-17F-17M	15.79%
Kings Park Express	17G-17H-17K-17L	0.36%
Springfield	18E-18F	4.55%
Orange Hunt	18G-18H-18K-18L	2.84%
Burke Centre	18P-18R-18S	2.37%
17 Line Total		3.99%
18 Line Total		2.87%

4.5. PASSENGER LOADS

The total number of boardings and the maximum load per trip are used to analyze if there are any potential crowding and determine if an increased or decreased service is warranted based on the WMATA Bus Service Guidelines. All services operate with a 40 seated capacity vehicles, therefore the threshold for increase or decrease service for both express and commuter ridership, and peak and off-peak services are identical, the guidelines are described below:

- The load factor for increasing service is **1.0**, or **40** passengers.
- The load factor for decreasing service is **0.5**, or **20** passengers.

The following subsections assess whether the 17/18 Lines routes meet WMATA guidelines.

4.5.1. Kings Park Line: Routes 17A-17B-17F-17M

For Route 17A, the peak trip for northbound trips is the 4:09 PM trip with 15 boardings and a maximum load of 10 passengers. The peak southbound trip is the 2:55 PM trip with 18 boardings and a maximum load of 14 passengers. On average, northbound trips had an average load factor of 0.18. Southbound trips have an average load factor of 0.23. Both Northbound and southbound load factors fall below the WMATA Bus Service Guidelines, and the guidelines recommend a reduction in service for the Route 17A.

Figure 17 depicts the ridership by trip for Route 17A.

Figure 17 | Boardings/Maximum Load by Trip: Route 17A

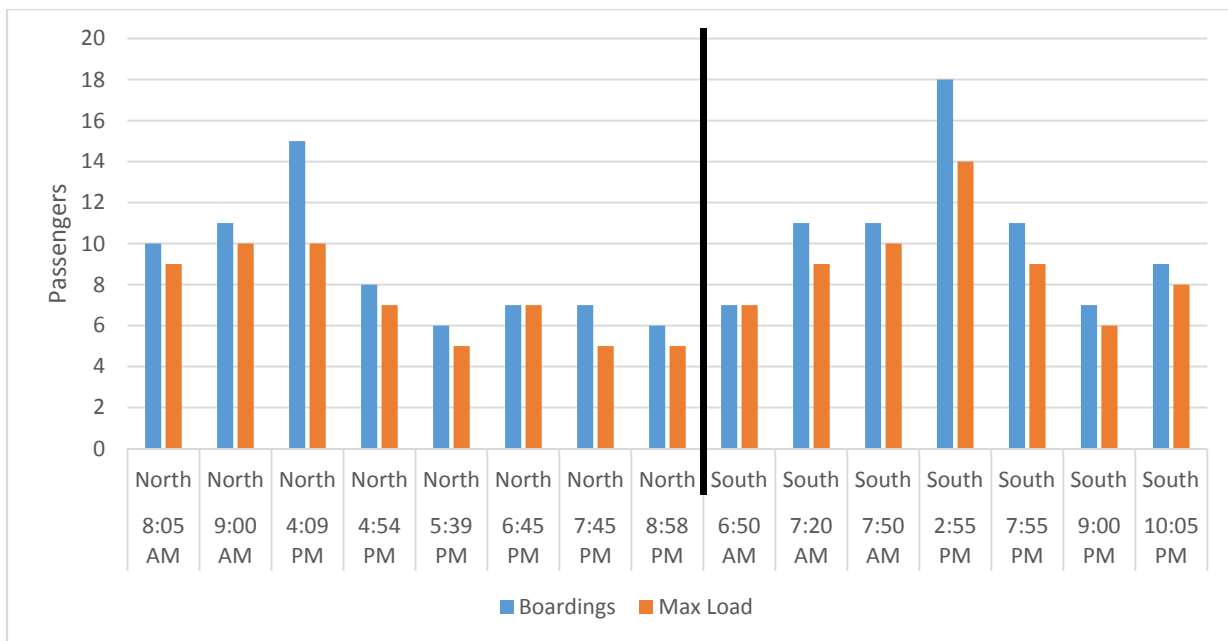
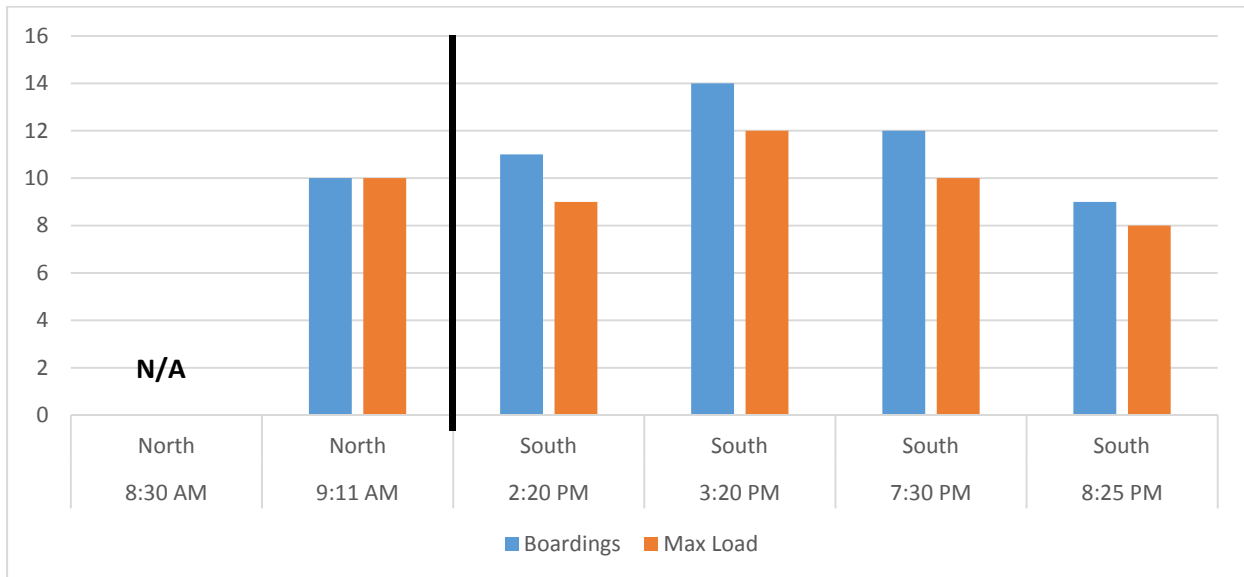


Figure 18 shows the ridership by trip for Route 17B. The peak trip for southbound the Route 17B trips is the 3:20 PM trip with 14 boardings and a maximum load of 12. The load factor for northbound the Route 17B trips is 0.25, while the average load factor for southbound trips is 0.24. These are both below the service guidelines and the guidelines recommend a reduction of service with the existing demand.

Figure 18 | Boardings/Maximum Load by Trip: Route 17B



The peak southbound trip for Route 17F is the 6:20 AM trip with 10 boardings and a reported maximum load of 11 passengers. The peak northbound trip is the 4:36 PM trip with 6 boardings and a maximum load of 6. The average load factor is 0.16 for southbound trips and 0.15 for northbound trips. Both load factors are below the service standard guidelines. **Figure 19** shows the ridership by trip for Route 17F.

Figure 19 | Boardings/Maximum Load by Trip: Route 17F

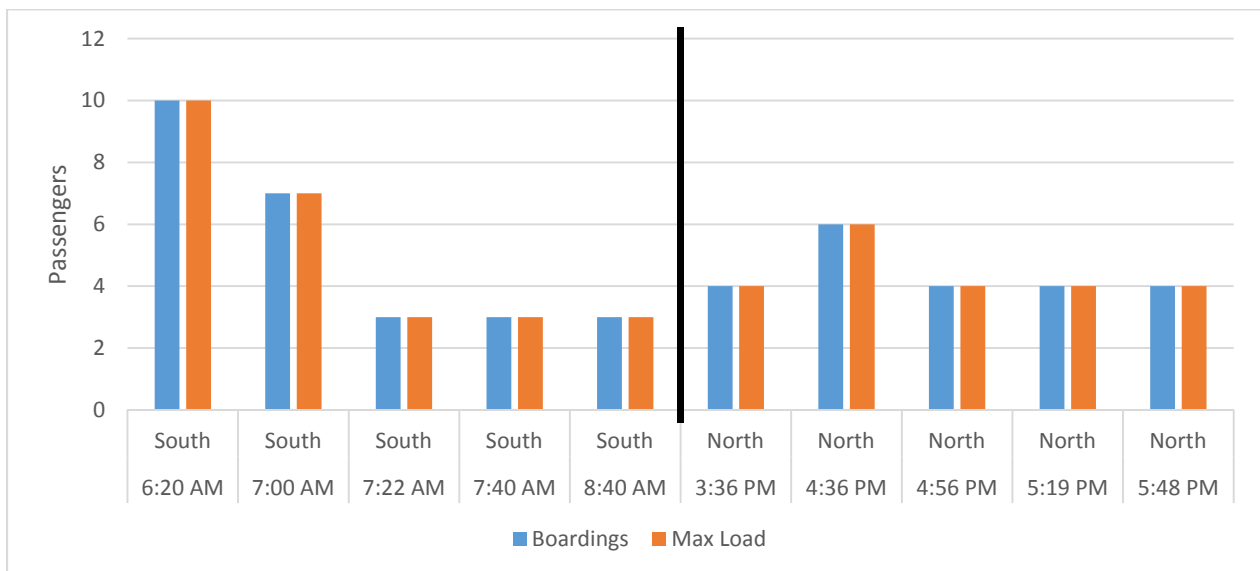
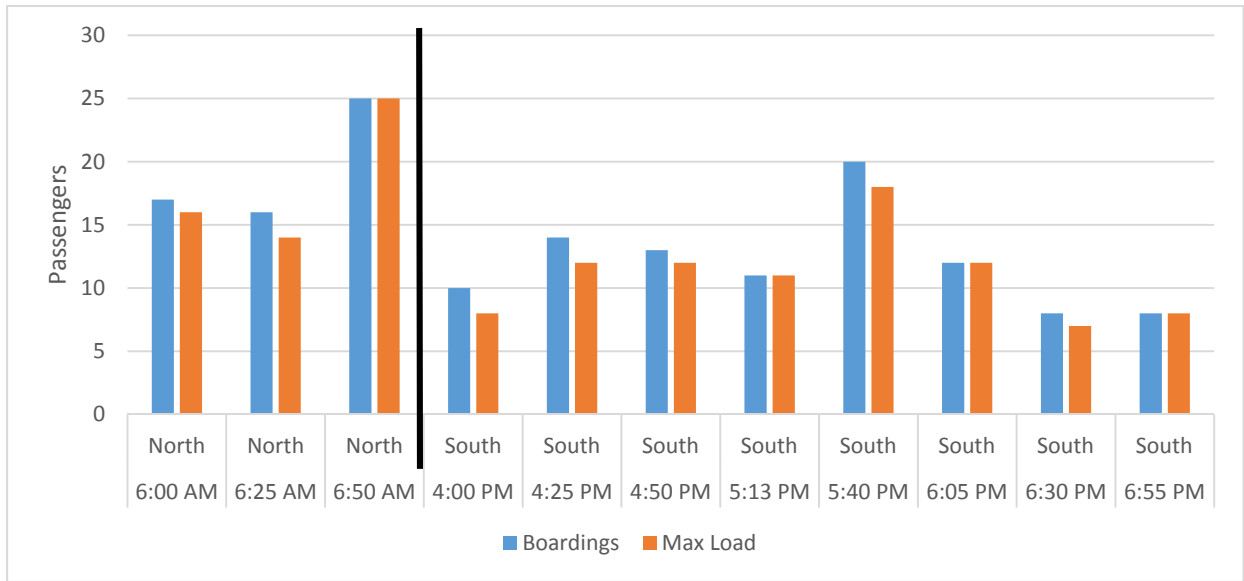


Figure 20 shows the ridership by trip for Route 17M. The peak northbound trip is the 6:50 AM trip with 25 boardings and a maximum load of 25 passengers. The peak southbound trip is the 5:40 PM trip with 20 boardings and a maximum load of 18 passengers. The average load factor is 0.46 for northbound trips

and 0.28 for southbound trips. Both fall below the service guidelines and the guidelines recommend reducing service.

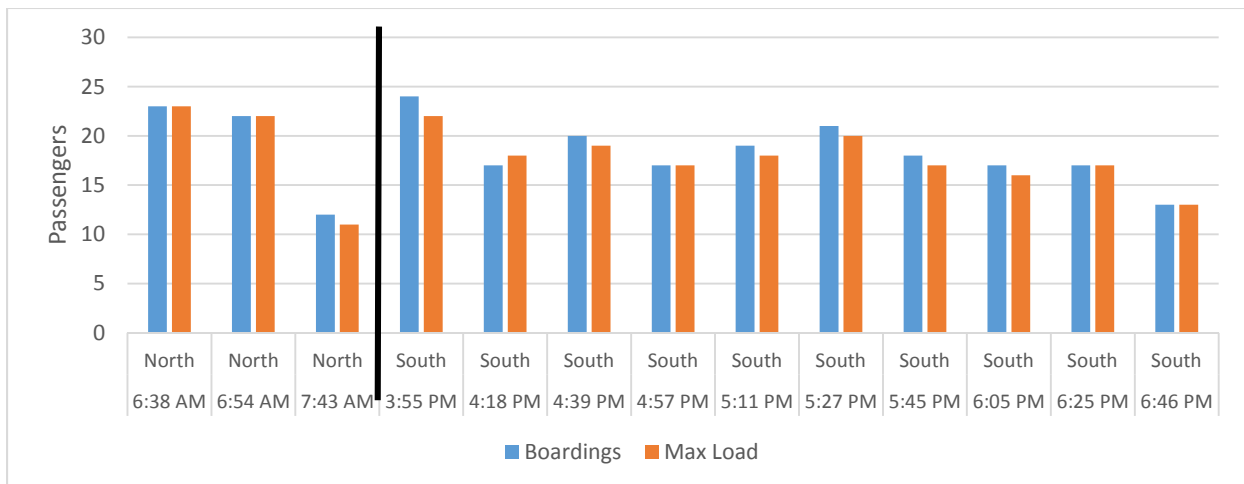
Figure 20 | Boardings/Maximum Load by Trip: Route 17M



4.5.2. Kings Park Express Line: Routes 17G-17H-17K-17L

The peak northbound trip for Route 17G is the 6:38 AM trip with 23 boardings and a maximum load of 23 passengers. The peak southbound trip is the 3:55 PM trip with 24 boardings and a maximum load of 22 passengers. The average load factor is 0.47 for northbound trips and 0.46 for southbound trips. Both average load factors fall below the service guideline and the guidelines recommend a reduction in service. **Figure 21** shows the ridership by trip for Route 17G.

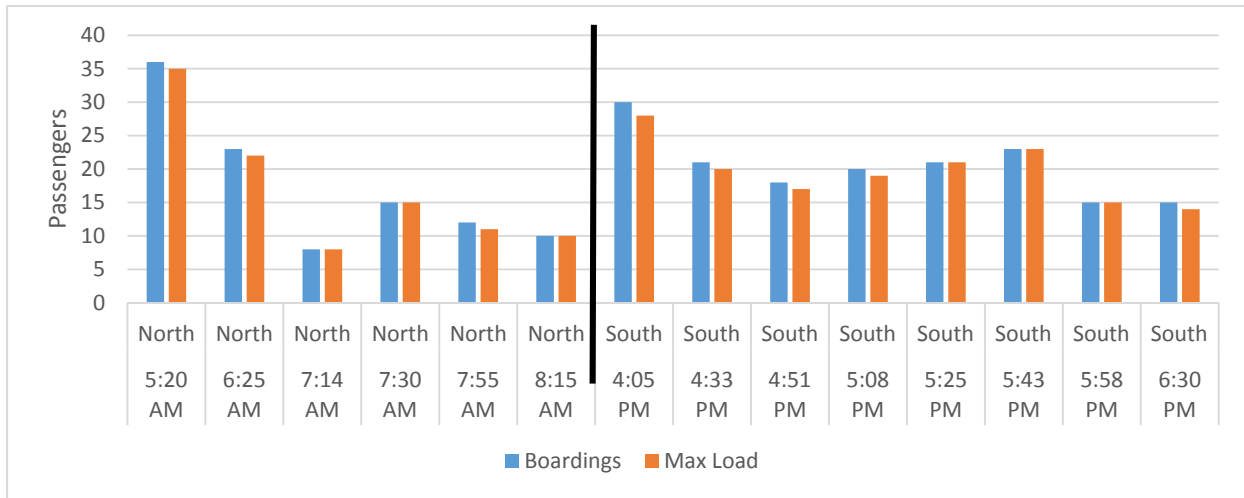
Figure 21 | Boardings/Maximum Load by Trip: Route 17G



For Route 17H, the peak northbound trip is the 5:20 AM trip with 36 average boardings and an average maximum load of 35 passengers. The peak southbound trip is the 4:05 PM trip with 30 boardings and an average maximum load of 28 passengers. The load factor for northbound trips is 0.43 and 0.49 for

southbound trips. Both load factors are less than the service guidelines and the guidelines recommend a reduction in service. **Figure 22** shows the ridership for Route 17H.

Figure 22 | Boardings/Maximum Load by Trip: Route 17H



The peak trip for the northbound the Route 17K is the 6:50 AM trip with 26 boardings and a maximum load of 27 passengers. The peak southbound trips is the 4:26 PM trip with 27 boardings and a maximum load of 25 passengers. The average load factor for northbound trips is 0.54 and 0.47 for southbound trips. The load factor for northbound trips is within the service guidelines, while the load factor for southbound trips is lower than the service guidelines and the guidelines recommend a reduction in service. **Figure 23** shows the ridership by trip for Route 17K.

Figure 23 | Boardings/Maximum Load by Trip: Route 17K

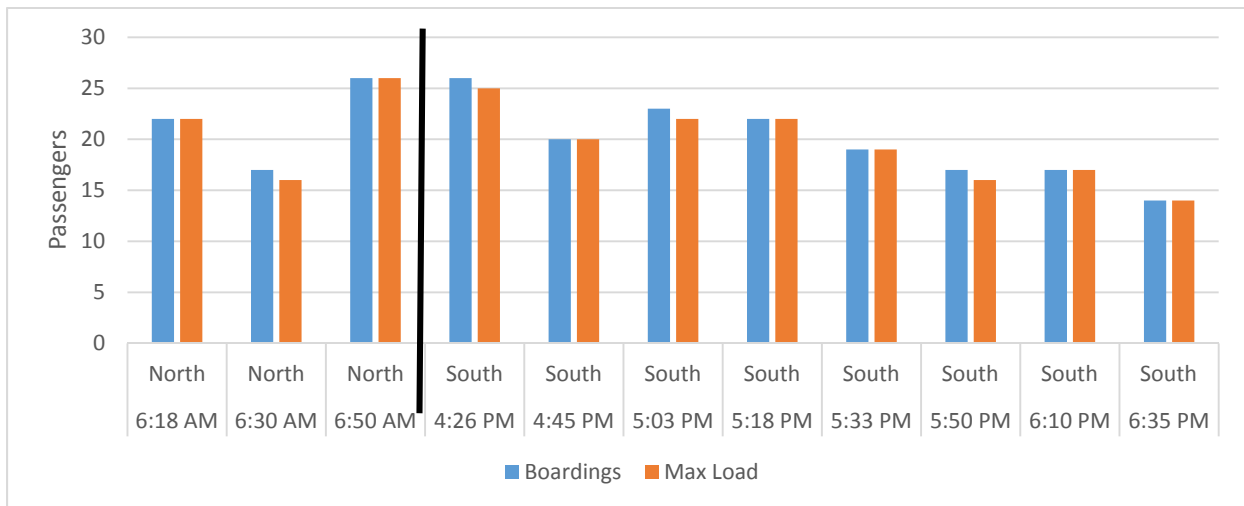
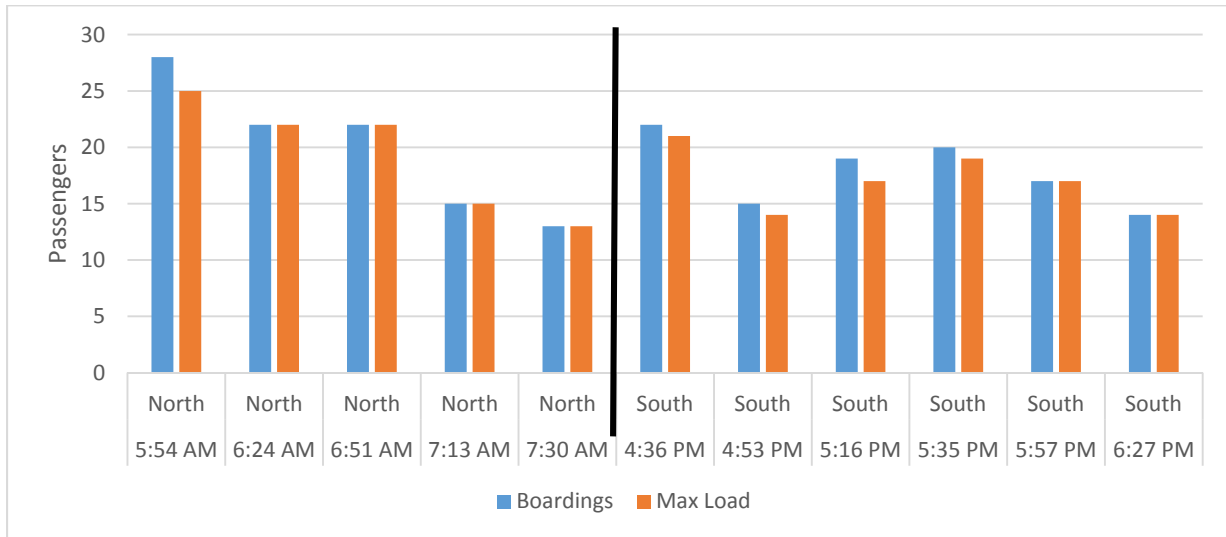


Figure 24 shows the ridership by trip for Route 17L. The first northbound trip at 5:54 AM is the peak trip with 28 boardings and a maximum load of 25 passengers. The peak southbound trip is at 4:36 PM with 22 boardings and a maximum load of 21 passengers. The average load factor is .49 for northbound trips and 0.43 for southbound trips. Both average load factors are under the service guidelines and the guidelines recommend a reduction in service.

Figure 24 | Boardings/Maximum Load by Trip: Route 17L



4.5.3. Springfield Line: Routes 18E-18F

For Route 18E, the 7:00 AM northbound trip is the peak northbound trip with 17 boardings and a maximum load of 17 passengers. The peak southbound trip is the 5:32 PM trip with 18 boardings and reported maximum load of 19 passengers. The load factor is 0.37 for both northbound and southbound trips. These fall below the service guidelines and the guidelines recommend a reduction in service.

Figure 25 shows the ridership by trip for Route 18E.

Figure 25 | Boardings/Maximum Load by Trip: Route 18E

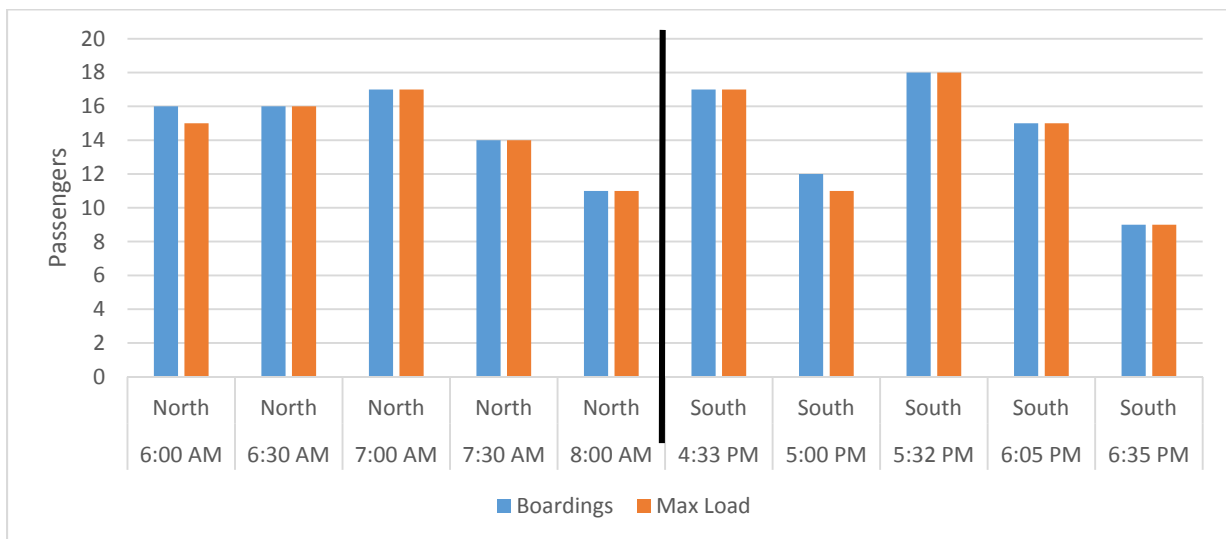
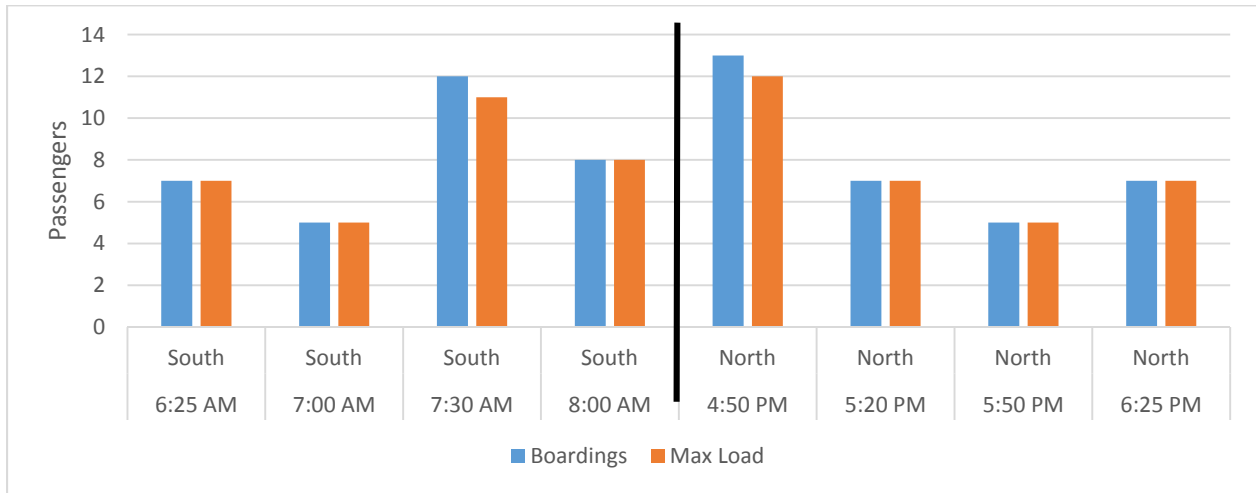


Figure 26 shows the ridership by trip for Route 18F. The peak southbound trip is the 7:30 AM trip with 12 boardings and a maximum load of 11 passengers. The peak southbound trip is the first southbound trip at 4:50 PM with 13 boardings and a maximum load of 12 passengers. The average load factor for southbound trips is 0.20 and 0.22 for northbound trips. Both average load factors are below the service guideline and the guidelines recommend a reduction of service.

Figure 26 | Boardings/Maximum Load by Trip: Route 18F

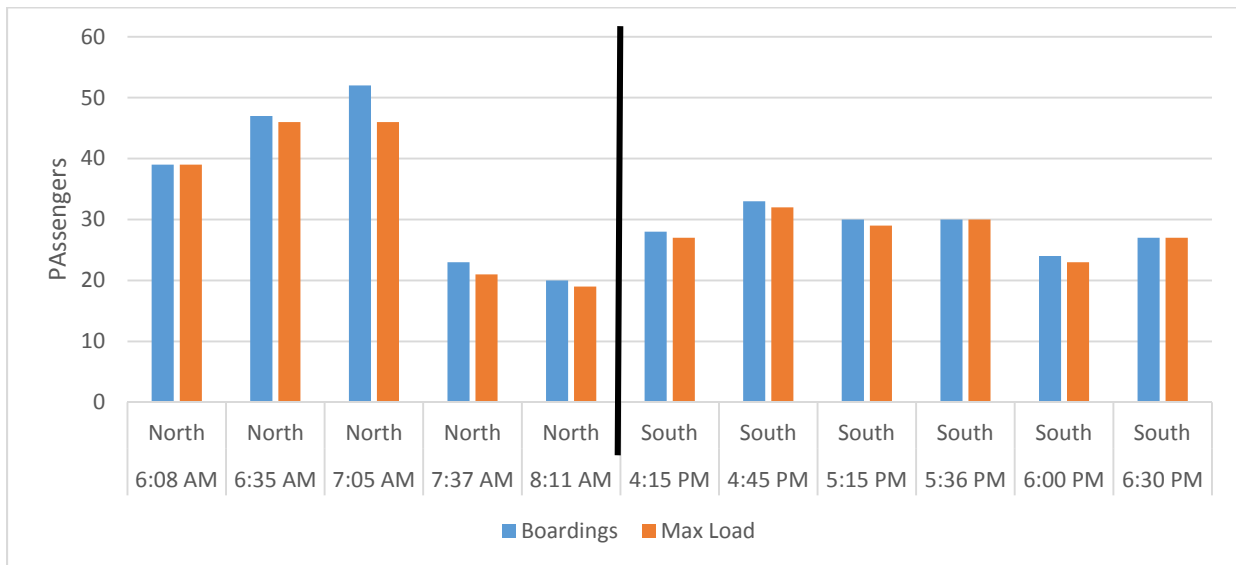


4.5.4. Orange Hunt Line: Routes 18G-18H-18J

The peak northbound trip for the Route 18G is the 7:05 am trip with 52 boardings and a maximum load of 46 passengers, this trip and the 6:35 AM trip exceed the service guidelines. The peak southbound trip is at 4:45 PM with 33 boardings and a maximum load of 32. The average load factor is 0.86 for northbound trips and 0.70 for southbound trips. The average load factor falls within the guidelines.

Figure 27 shows the ridership by trip for Route 18G.

Figure 27 | Boardings/Maximum Load by Trip: Route 18G



For Route 18H, the first northbound trip, at 5:41 AM, is the peak trip with 36 boardings and a maximum load of 26 passengers. The 5:05 PM southbound trip is the peak southbound trip with 36 boardings and a maximum load of 34 passengers. The average load factor for northbound trips is 0.63 and 0.61 for southbound trips. Both average load factors fall within the service guidelines. Figure 28 shows the ridership by trip for Route 18H.

Figure 28 | Boardings/Maximum Load by Trip: Route 18H

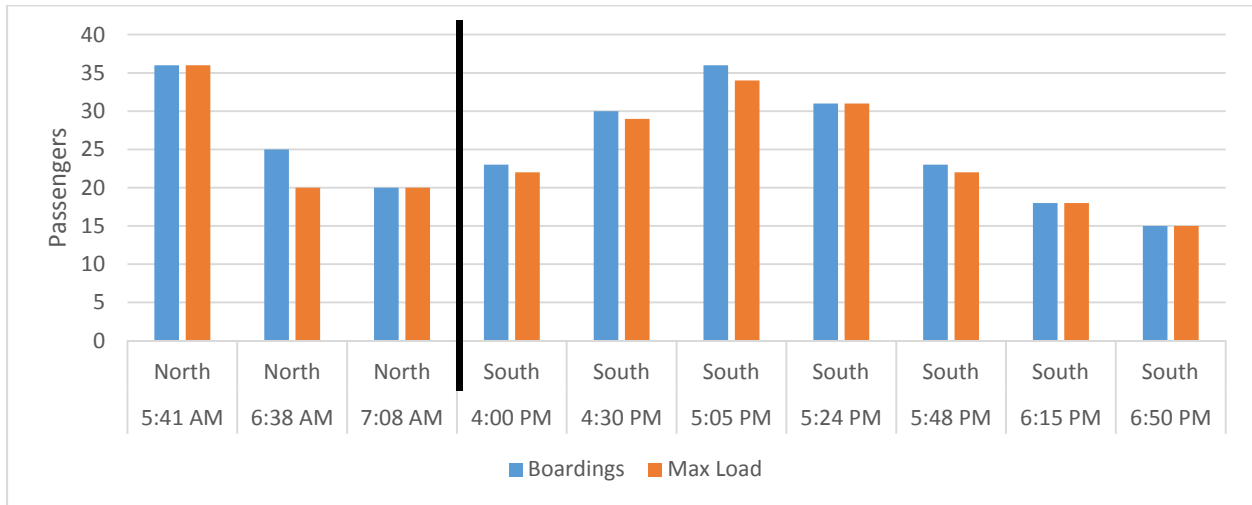
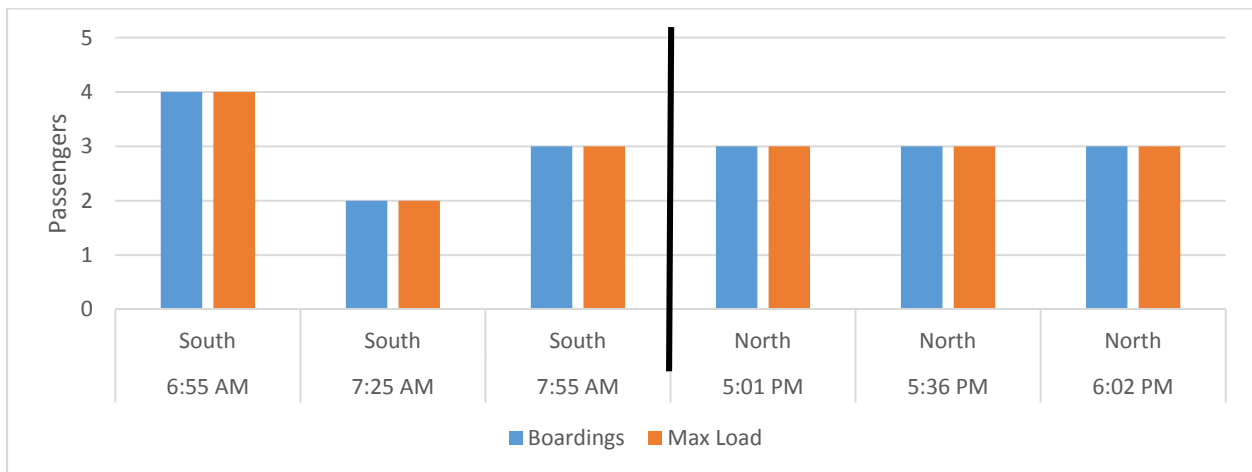


Figure 29 shows the ridership by trip for Route 18J. The 6:55 AM trip is the peak southbound trip with 4 boardings and a maximum load of 6 passengers. All northbound trips had the same number of boardings at 3 passengers. The average load factor is 0.16 for southbound trips and 0.09 for northbound trips. Both load factors are significantly below the service guidelines. The service guidelines recommend a reduction in service.

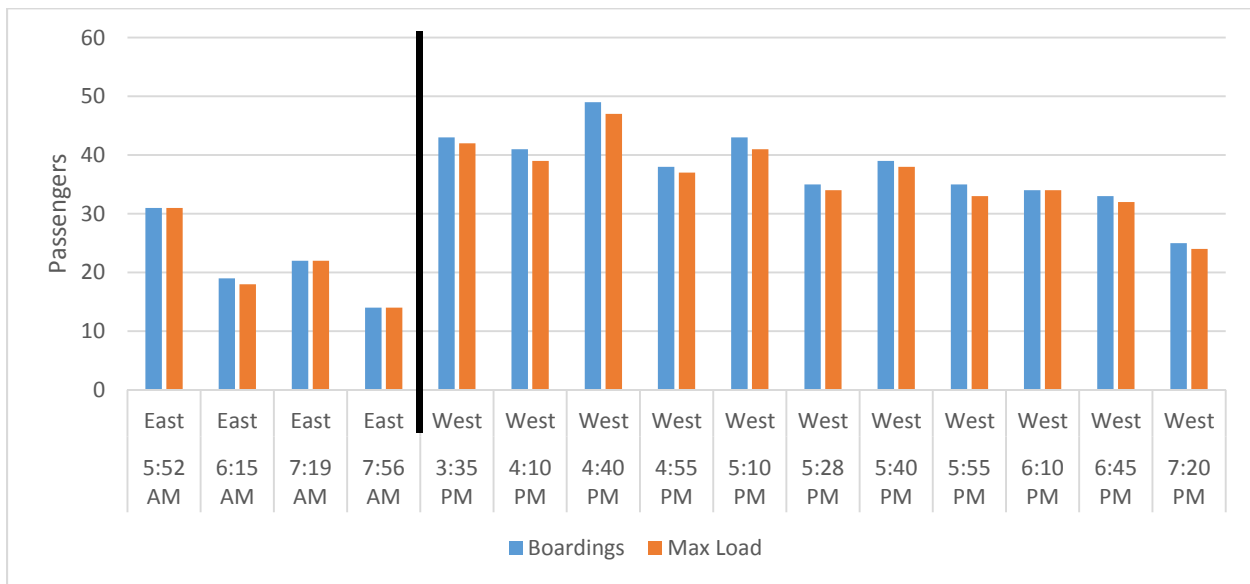
Figure 29 | Boardings/Maximum Load by Trip: Route 18J



4.5.5. Burke Centre Line: Routes 18P-18R-18S

The peak trip for the eastbound Route 18P is the 5:52 AM trip with 31 boardings and a maximum load of 31 passengers. The 4:40 PM trip is the peak westbound trip with 49 boardings and a maximum load of 47 passengers. This trip exceeds the load factor service guidelines. The average load factor for eastbound trips is 0.53 and the average load factor for westbound trips is 0.91. Both are within the service guidelines. **Figure 30** shows Route 18P ridership by trip.

Figure 30 | Boardings/Maximum Load by Trip: Route 18P



The peak trip for the eastbound Route 18R is the 7:11 AM trip with 7 boardings and a maximum load of 7 passengers. The 5:51 PM trip is the peak westbound trip with 9 boardings and a maximum load of 8 passengers. The average load factor for eastbound trips is 0.14 and the average load factor for westbound trips is 0.15. Both load factors are significantly below the service guidelines. The service guidelines recommend a reduction in service. **Figure 31** shows Route 18R ridership by trip.

Figure 31 | Boardings/Maximum Load by Trip: Route 18R

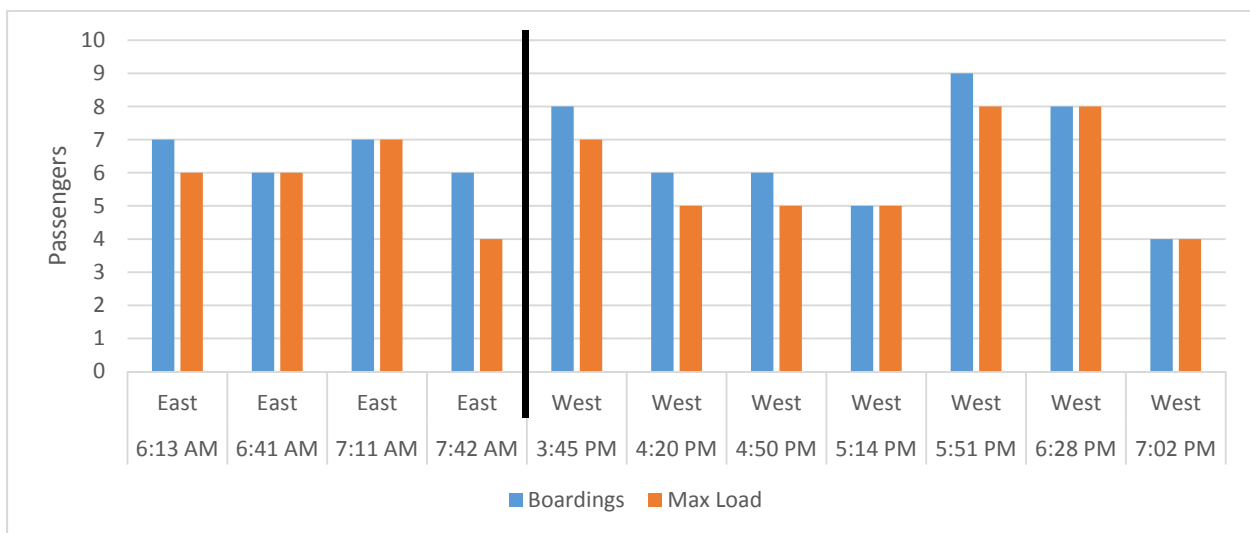
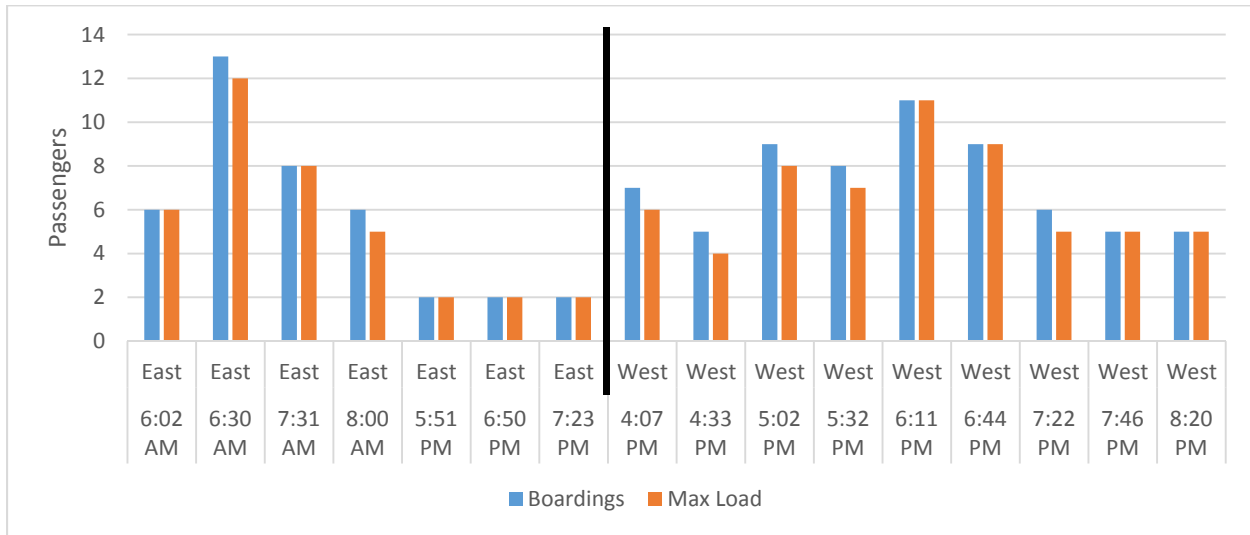


Figure 32 shows the ridership by trip for Route 18S. The peak eastbound trip is at 6:30 AM with 13 boardings and a maximum load of 12 passengers. The peak westbound trip is at 6:11 pm with 13 boardings and a maximum load of 12 passengers. The average load factor is 0.12 for eastbound trips and 0.17 for westbound trips. Both are below the service guidelines and the guidelines recommend a reduction in service.

Figure 32 | Boardings/Maximum Load by Trip: Route 18S



4.5.6. Preliminary Findings: Passenger Loads

While isolated trips may experience crowding according to the WMATA loading guidelines, there is not a crowding issues on the 17/18 lines that needs to be addressed. No time periods analyzed were above the WMATA loading guidelines.

4.6. BOARDINGS/ALIGHTINGS BY STOP

The following section details the boardings and alightings by stop. For each route by direction and time period the top five performing stops are identified in terms of total activity, which includes boarding and alighting.

4.6.1. Kings Park Line: Routes 17A-17B-17F-17M

The Kings Park Line the most concentrated activity is at the Pentagon Transit center for the majority of routes during both peak periods, except for Route 17A in the northbound direction and Route 17B in the morning peak (See **Tables 21 thru 24**). In the northbound direction, Route 17A has the most activity at the bus stop on the Little River Turnpike at Manitoba Drive in the morning and the bus stop on University Drive at George Mason Boulevard in the afternoon. While Route 17B, in the morning peak period, has high alightings at the bus stop on Braddock Road at Backlick Road.

Table 21 | Ridership Activity by Stop: Route 17A

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
LITTLE RIVER TPKE/MANITOBA DR	2	6	8
BRADDOCK RD/QUEENSBERRY AVE	1	3	4
UNIVERSITY DR/GEORGE MASON BLVD	3	0	3
BRADDOCK RD/PORT ROYAL RD	0	1	2
BRADDOCK RD/FORESTDALE DR	1	0	1
PM Peak Northbound			
UNIVERSITY DR/GEORGE MASON BLVD	15	0	15

Stop	Boardings	Alightings	Total Activity
PENTAGON STATION/BUS BAY U11	1	14	15
LITTLE RIVER TPKE/MANITOBA DR	2	4	6
LITTLE RIVER TPKE/OASIS DR	2	4	6
BRADDOCK RD/ROANOKE LA	4	0	5
AM Peak Southbound			
PENTAGON STATION/BUS BAY L4	25	1	26
LITTLE RIVER TPKE/OASIS DR	6	2	8
UNIVERSITY DR/GEORGE MASON BLVD	0	8	8
BRADDOCK RD/BACKLICK RD	3	3	6
LITTLE RIVER TPKE/SOUTHLAND AVE	3	1	4
PM Peak Southbound			
PENTAGON STATION/BUS BAY L4	19	1	20
LITTLE RIVER TPKE/OASIS DR	3	1	4
LITTLE RIVER TPKE/SOUTHLAND AVE	1	1	2
BRADDOCK RD/IRVIN CT	1	1	2
BRADDOCK RD/BACKLICK RD	2	1	3

Table 22 | Ridership Activity by Stop: Route 17B

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
BRADDOCK RD/BACKLICK RD	0	12	12
CLYDESDALE RD/EASTBOURNE DR	4	0	4
TWINBROOK RD/TWINBROOK RUN DR	3	0	3
QUEENSBERRY AVE/ADAIR LA	2	0	2
LITTLE RIVER TPKE/MANITOBA DR	2	0	2
PM Peak Southbound			
PENTAGON STATION/BUS BAY L4	25	0	25
LITTLE RIVER TPKE/OASIS DR	4	2	6
GUINEA RD/HARFORD LA	0	3	3
RT 236 L R TPKE/BEAUREGARD ST (S)	1	0	2
LITTLE RIVER TPKE/SOUTHLAND AVE	0	2	2

Table 23 | Ridership Activity by Stop: Route 17F

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY L4	27	9	37
BRADDOCK RD/PORT ROYAL RD	1	13	14
TWINBROOK RD/TWINBROOK RUN DR	0	7	7
BRADDOCK RD/KINGS PARK DR	0	2	2
BRADDOCK RD/RED FOX DR (E)	0	1	1
PM Peak Southbound			
PENTAGON STATION/BUS BAY U11	1	15	16

Stop	Boardings	Alightings	Total Activity
BRADDOCK RD/PORT ROYAL RD	8	0	9
TWINBROOK RD/HEATHWOOD CT	6	0	6
BRADDOCK RD/RED FOX DR	2	0	3
BRADDOCK RD/QUEENSBERY AVE	2	0	2

Table 24 | Ridership Activity by Stop: Route 17M

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY U11	0	26	27
LITTLE RIVER TPKE/OASIS DR	3	9	12
BRADDOCK RD/SPRING VALLEY DR	5	0	5
BRADDOCK RD/RAVENSWORTH RD	4	0	4
BRADDOCK RD/FERNDAL ST	4	0	4
PM Peak Southbound			
PENTAGON STATION/BUS BAY L5	74	2	76
BRADDOCK RD/BACKLICK RD	4	11	15
LITTLE RIVER TPKE/OASIS DR	11	4	14
LEESVILLE BLVD/APPOMATOX CT	0	11	11
LITTLE RIVER TPKE/SOUTHLAND AVE	4	5	9

4.6.2. Kings Park Express Line: Routes 17G-17H-17K-17L

Along the Kings Park Express Line, ridership activity is concentrated at the Pentagon Transit Center for all routes in both the morning and afternoon periods. (See **Tables 25 thru 28**).

Table 25 | Ridership Activity by Stop: Route 17G

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY U11	1	60	61
UNIVERSITY DR/GEORGE MASON BLVD	8	0	8
PARLIAMENT DR/KINGS PARK DR	6	0	6
BRADDOCK RD/SOUTHAMPTON DR	5	0	5
BRADDOCK RD/DANBURY FOREST DR	4	0	4
PM Peak Southbound			
PENTAGON STATION/BUS BAY L6	167	3	170
BRADDOCK RD/QUEENSBERY AVE	11	11	22
PARLIAMENT DR/ROLLING RD	0	11	11
TWINBROOK RD/BABSON CT	0	9	10
SOUTHAMPTON DR/LANCAESHIRE DR	1	9	9

Table 26 | Ridership Activity by Stop: Route 17H

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY U11	1	65	66
BRADDOCK RD/QUEENSBERY AVE	6	9	15
TWINBROOK RD/TWINBROOK RUN DR	9	0	9
BURKE LAKE RD/SIGNAL HILL DR	9	0	9
BRADDOCK RD/PORT ROYAL RD	0	7	7
PM Peak Southbound			
PENTAGON STATION/BUS BAY L6	144	2	146
BURKE LAKE RD/LAKE BRADDOCK DR	0	15	15
BURKE LAKE RD/SIGNAL HILL DR	0	15	15
BRADDOCK RD/QUEENSBERY AVE	8	7	15
BRADDOCK RD/WAKEFIELD CHAPEL RD	2	9	11

Table 27 | Ridership Activity by Stop: Route 17K

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY U11	1	55	56
COMMONWEALTH BLVD/GAINSBOROUGH DR	7	0	8
TWINBROOK RD/TWINBROOK RUN DR	6	0	6
GUINEA RD/OLLEY LA	6	0	6
BRADDOCK RD/DUNLEIGH DR	6	0	6
PM Peak Southbound			
PENTAGON STATION/BUS BAY L6	143	1	144
BRADDOCK RD/QUEENSBERY AVE	7	9	16
BRADDOCK RD/WAKEFIELD CHAPEL RD	1	11	12
BRADDOCK RD/KING DAVID BLVD	0	12	12
GUINEA RD/BRONITE DR	0	9	9

Table 28 | Ridership Activity by Stop: Route 17L

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY U11	0	94	94
BURKE VRE P&R LOT	19	2	21
BURKE RD/RIDGE FORD DR	8	0	8
BRADDOCK RD/DANBURY FOREST DR	7	0	7
SOUTHAMPTON DR/EASTBOURNE DR	6	0	6
PM Peak Southbound			
PENTAGON STATION/BUS BAY L6	89	1	89
BURKE VRE P&R LOT	2	16	18
BRADDOCK RD/PORT ROYAL RD	14	2	16
BURKE RD/VRE STATION ENTR	0	11	11
BRADDOCK RD/QUEENSBERY AVE	2	6	8

4.6.3. Springfield Line: Routes 18E-18F

Ridership activity is concentrated at the Pentagon Transit Center for all routes on the Springfield Line in both the morning and afternoon periods. (See **Tables 29 and 30**).

Table 29 | Ridership Activity by Stop: Route 18E

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY U11	1	64	65
INDIAN RUN PKWY/EDSALL RD	15	0	15
EDSALL RD/DUBLIN AVE	5	0	5
EDSALL RD/INDUSTRIAL RD	4	1	5
EDSALL RD/BLOOMFIELD DR	4	1	5
PM Peak Southbound			
PENTAGON STATION/BUS BAY U1	62	0	62
EDSALL RD/BLOOMFIELD DR	5	9	14
BERYL RD/SHELDON DR	0	6	7
SHELDON DR/MERLE PL	0	6	6
INDIAN RUN PKWY/EDSALL RD	0	6	6

Table 30 | Ridership Activity by Stop: Route 18F

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY U1	19	0	19
EDSALL RD/EDSALL GARDEN APTS	0	6	6
RT 236 DUKE ST/WALKER ST	3	1	5
INDUSTRIAL RD/INDUSTRIAL DR	0	5	5
INDUSTRIAL DR/ELECTRONIC DR	0	4	4
PM Peak Southbound			
PENTAGON STATION/BUS BAY U11	1	23	24
INDUSTRIAL RED/COMMERCIAL DR	6	0	6
COMMERCIAL DR/#6883	5	0	5
EDSALL RD/BLOOMFIELD DR	5	0	5
DUKE ST/WALKER ST	3	3	5

4.6.4. Orange Hunt Line: Routes 18G-18H-18J

For the Orange Hunt Line, ridership activity is concentrated at the Pentagon Transit Center for the majority routes both the morning and afternoon periods, except for Route 18G which has high alighting activity at Old Keene Mill Road at Commerce Street (See **Tables 31 thru 33**).

Table 31 | Ridership Activity by Stop: Route 18G

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
OLD KEENE MILL RD/COMMERCE ST	1	54	55
OLD KEENE MILL RD/SPRING RD	9	38	47
PENTAGON STATION/BUS BAY U11	0	40	40

Stop	Boardings	Alightings	Total Activity
FORRESTER BLVD/SEABRIGHT RD	18	0	19
FORRESTER BLVD/LAKINHURST LA	11	0	11
PM Peak Southbound			
PENTAGON STATION/BUS BAY U1	163	2	165
OLD KEENE MILL RD/SPRING RD	11	15	26
FORRESTER BLVD/KINGSFORD RD	0	12	12
OLD KEENE MILL RD/BYRON AVE	0	10	10
OLD KEENE MILL RD/TIVERTON RD	0	10	10

Table 32 | Ridership Activity by Stop: Route 18H

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON INBOUND STOP	0	35	35
GREELEY BLVD/BELLAMY AVE	7	20	27
SYDENSTRICKER RD/KERRY LA	6	0	6
HUNTSMAN BLVD/SIDE SADDLE RD	6	0	6
OLD KEENE MILL RD/HUNTER VILLAGE DR	6	0	6
PM Peak Southbound			
PENTAGON STATION/BUS BAY U1	163	2	165
OLD KEENE MILL RD/SPRING RD	11	18	29
OLD KEENE MILL RD/BYRON AVE	0	14	14
OLD KEENE MILL RD/TIVERTON DR	0	9	9
GREELEY BLVD/BELLAMY AVE (E)	0	10	10

Table 33 | Ridership Activity by Stop: Route 18J

Stop	Boardings	Alightings	Total Activity
AM Peak Northbound			
PENTAGON STATION/BUS BAY U1	8	11	19
OLD KEENE MILL RD/KEENE DR	0	4	4
OLD KEENE MILL RD/SPRING RD	0	2	2
OLD KEENE MILL RD/CARRLEIGH PKWY	0	1	2
OLD KEENE MILL RD/ROLLING RD	0	2	2
PM Peak Southbound			
PENTAGON STATION/BUS BAY U11	0	4	5
ROLLING VALLEY MALL/P&R LOT BUS BAY B	3	0	3
OLD KEENE MILL RD/ROLLING RD	3	0	3
OLD KEENE MILL RD/SPRING RD	1	1	2
OLD KEENE MILL RD/WESTMORE CT	0	0	1

4.6.5. Burke Centre Line: Routes 18P-18R-18S

On the Burke Centre Line, the Route 18P is seeing high ridership activity in both the morning and afternoon peak periods at the Pentagon Transit Center. While Routes 18R and 18S are seeing high ridership activity in both the morning and afternoon peak periods at the Franconia-Springfield Metro Station (See **Tables 34 thru 36**).

Table 34 | Ridership Activity by Stop: Route 18P

Stop	Boardings	Alightings	Total Activity
AM Peak Eastbound			
PENTAGON STATION/BUS BAY U11	2	78	80
ROLLING VALLEY MALL/P&R LOT BUS BAY B	21	9	30
BURKE CENTRE PKWY/MARSHALL POND RD	6	0	6
BURKE CENTRE PKWY/POWELLS LANDING RD	5	0	5
BURKE CENTRE PKWY/MARTINS LANDING LA	5	0	5
PM Peak Westbound			
PENTAGON STATION/BUS BAY U1	375	1	375
ROLLING VALLEY MALL/P&R LOT BUS BAY B	1	154	155
OLD KEENE MILL RD/SPRING RD	31	31	62
OLD KEENE MILL RD/BYRON AVE	3	25	28
BURKE CENTRE PKWY/OAK LEATHER DR	0	27	27

Table 35 | Ridership Activity by Stop: Route 18R

Stop	Boardings	Alightings	Total Activity
AM Peak Eastbound			
FRANCONIA-SPRGFLD STA./BUS BAY D	0	17	17
ROLLING VALLEY MALL/P&R LOT BUS BAY C	6	2	8
HOOES RD (S RDWY)/GAMBRILL RD	4	1	5
COFFER WOODS RD/BLINCOE CT	3	0	3
WILMINGTON DR/WOLCOTT DR	2	0	2
PM Peak Westbound			
FRANCONIA-SPRGFLD STA./BUS BAY D	42	0	42
ROLLING VALLEY MALL/P&R LOT BUS BAY C	2	6	8
FRANCONIA-SPRINGFIELD PKWY/BONNIEMILL LA	0	4	5
SHIPLETT BLVD/ASHBRIDGE CT	0	5	5
GAMBRILL RD PARK AND RIDE	0	4	4

Table 36 | Ridership Activity by Stop: Route 18S

Stop	Boardings	Alightings	Total Activity
AM Peak Eastbound			
FRANCONIA-SPRGFLD STA./BUS BAY D	0	30	30
ROLLING RD/BARNACK DR	5	0	5
ROLLING RD/VIOLA ST	5	0	5
ROLLING RD/TANWORTH DR	4	0	5
ROLLING VALLEY MALL/P&R LOT BUS BAY C	3	2	4
PM Peak Westbound			
FRANCONIA-SPRGFLD STA./BUS BAY D	60	0	60
ROLLING VALLEY MALL/P&R LOT BUS BAY C	3	11	14
BURKE CENTRE PKWY/OAK LEATHER DR	0	9	9
ROLLING RD/HUNTER VILLAGE DR	1	6	7
ROLLING RD/VIOLA ST	1	4	4

4.6.6. Preliminary Findings: Boardings/Alightings by Stop

The majority of boardings and alighting activity is concentrated around the Pentagon Transit Center and the Franconia-Springfield Metro Station depending on the time of day.

4.7. BOARDINGS/ALIGHTINGS BY SEGMENT

The following section details the boardings and alightings by segment. Segments were broken up based on the corridors, transit centers, and Metrorail stations that each route serves. For each route by direction and time period the boarding and alighting activity is shown along the summarized segments.

Kings Park Line: Routes 17A-17B-17F-17M

On the Kings Park Line, during the morning peak period Braddock Road has the most ridership activity on average with a combined 108 boardings and alightings, this is followed closely by the Pentagon Transit Center with approximately 100 boardings and alightings. In the afternoon period, the Pentagon has the most ridership activity with approximately 155 boardings and alightings, followed by Braddock Road with approximately 120 boardings and alightings. **Figures 33 thru 36** detail ridership for each route on the Kings Park Line by segment.

Figure 33 | Boardings/Alightings by Segment: Route 17A

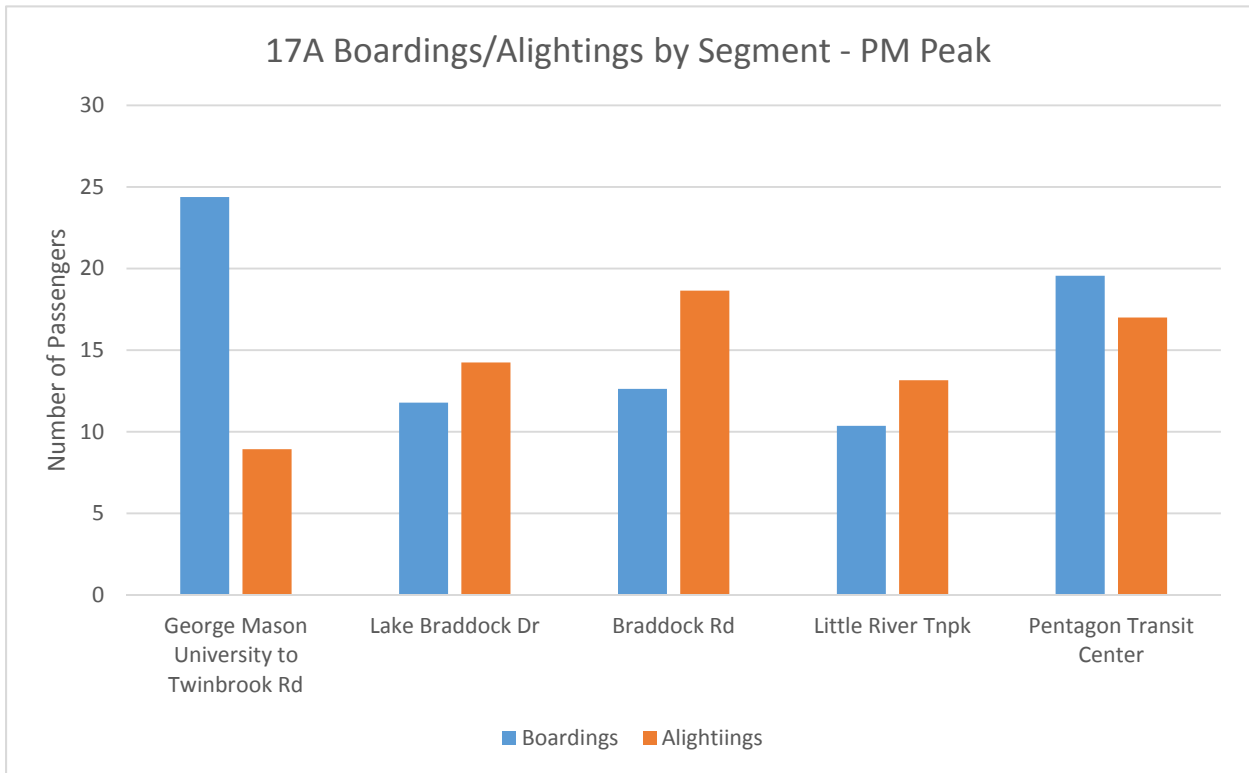
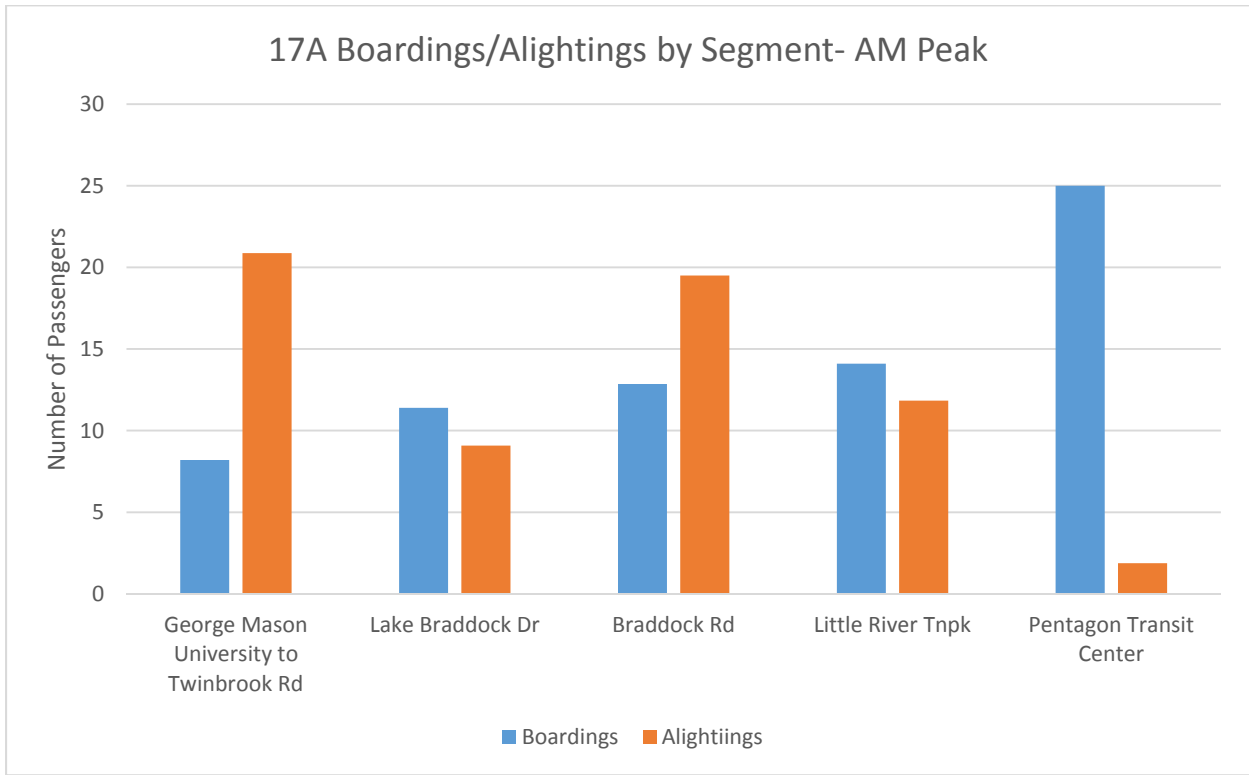


Figure 34 | Boardings/Alightings by Segment: Route 17B

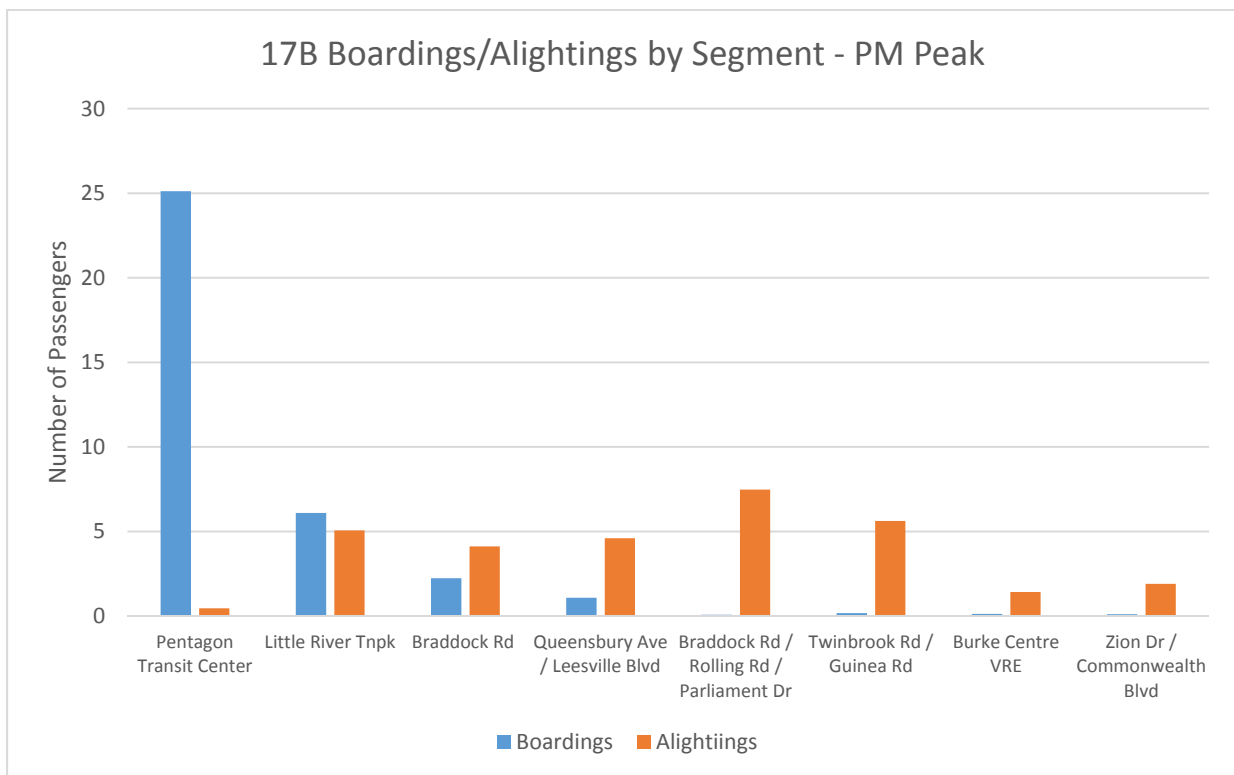
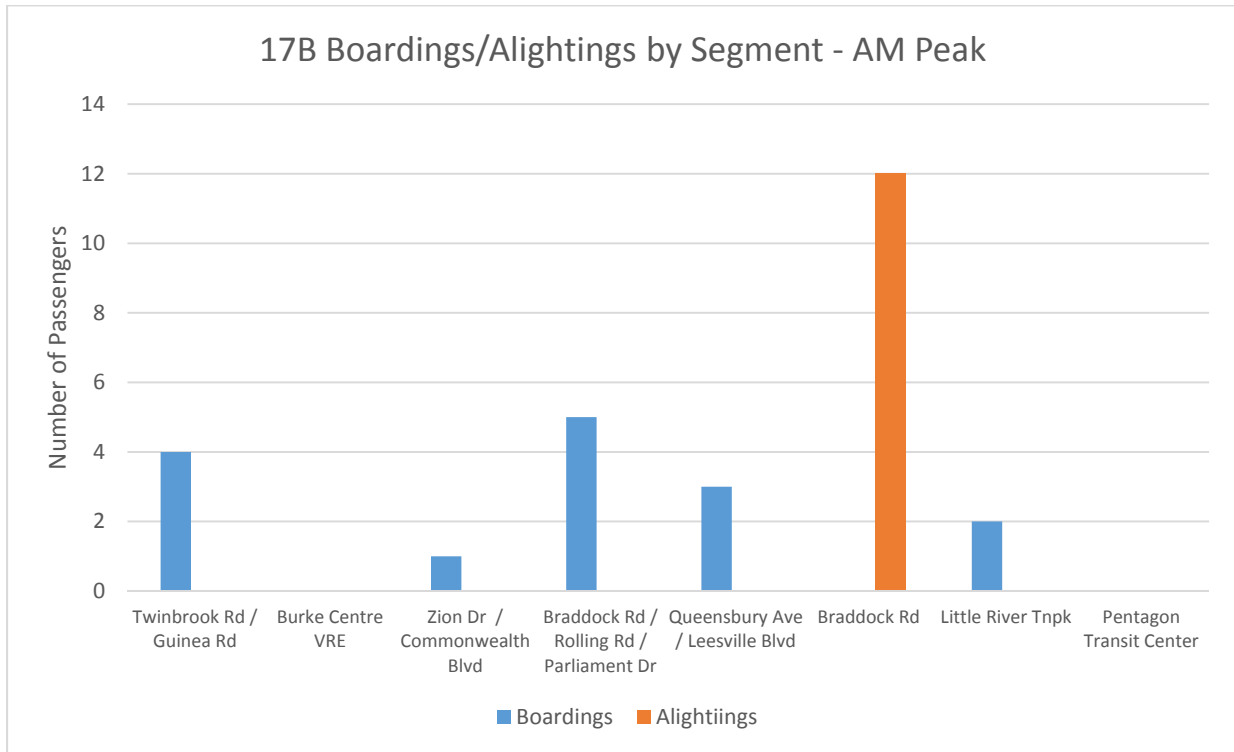


Figure 35 | Boardings/Alightings by Segment: Route 17F

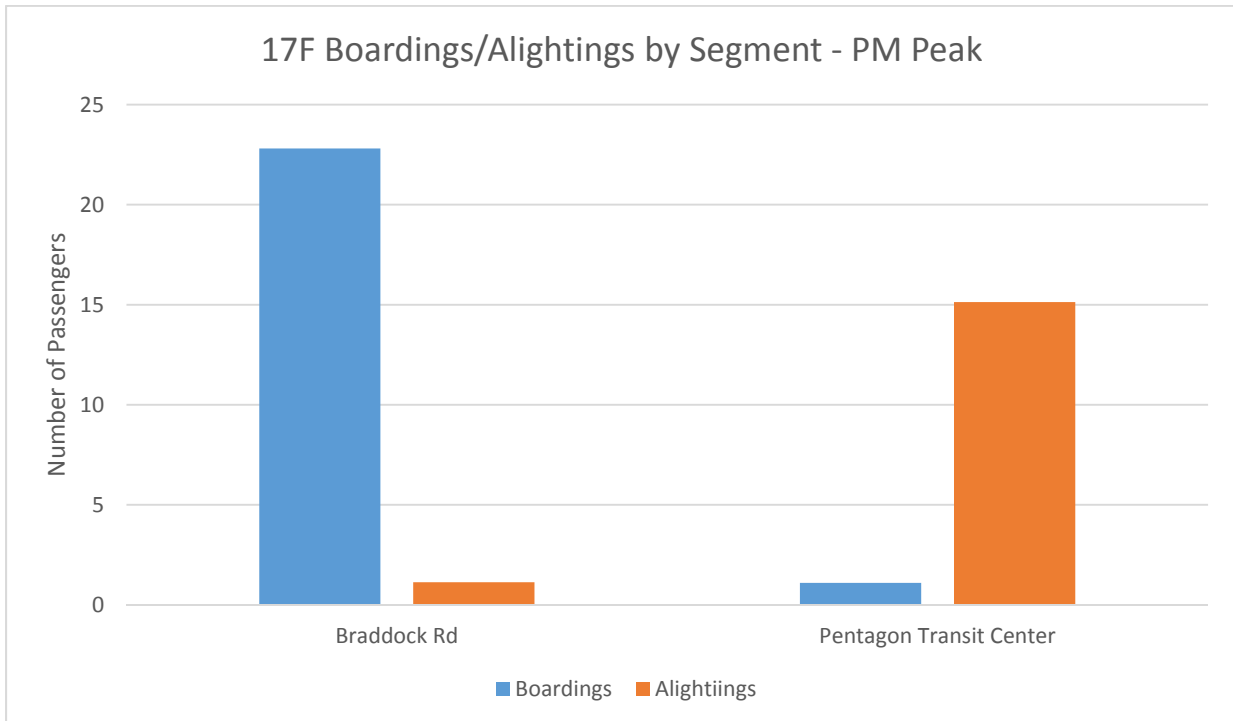
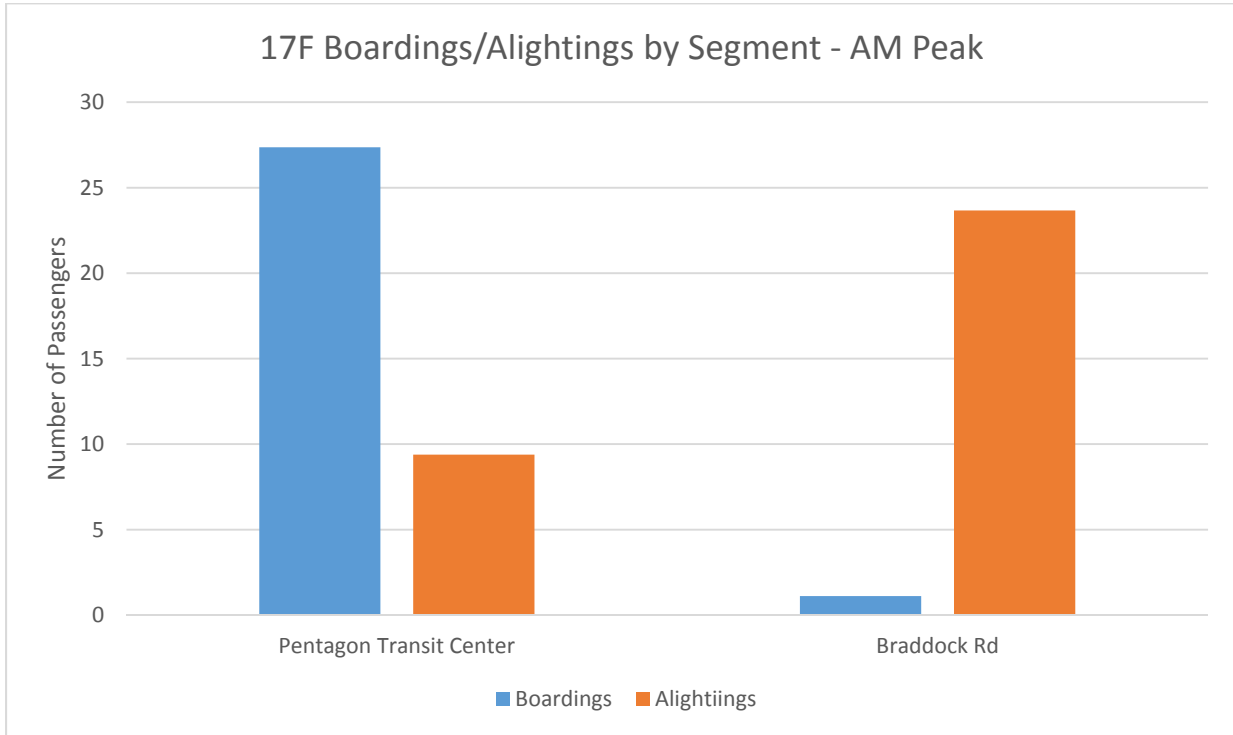
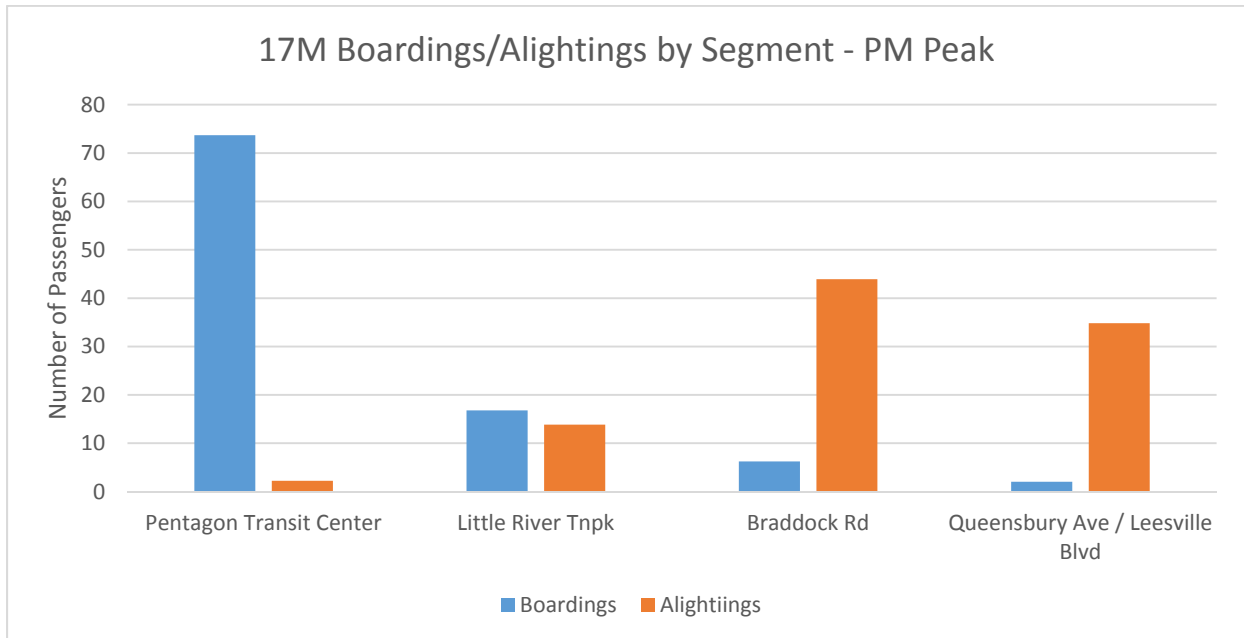
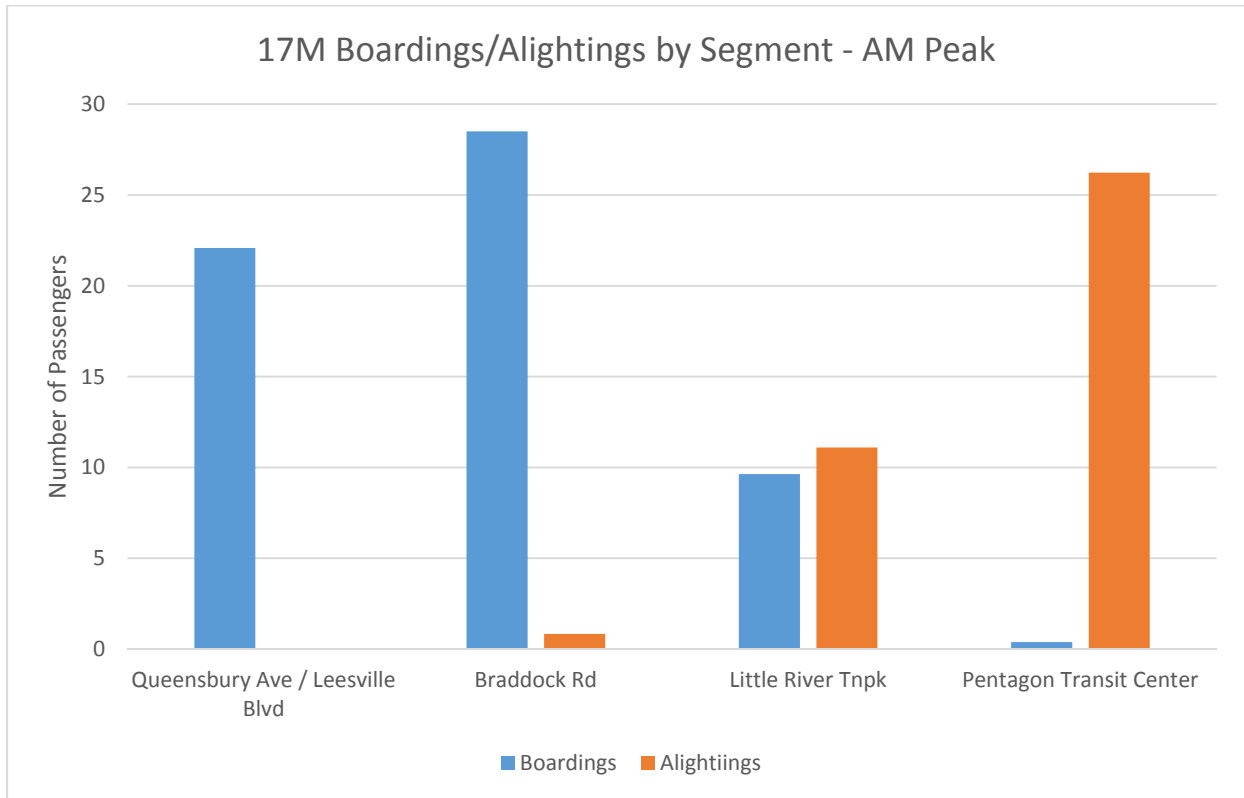


Figure 36 | Boardings/Alightings by Segment: Route 17M



Kings Park Express Line: Routes 17G-17H-17K-17L

The majority of ridership activity is occurring at the Pentagon Transit Center with over 275 alightings in the morning peak period and 542 boardings in the afternoon peak period. **Figures 37 thru 40** detail ridership for each route on the Kings Park Express Line by segment.

Figure 37 | Boardings/Alightings by Segment: Route 17G

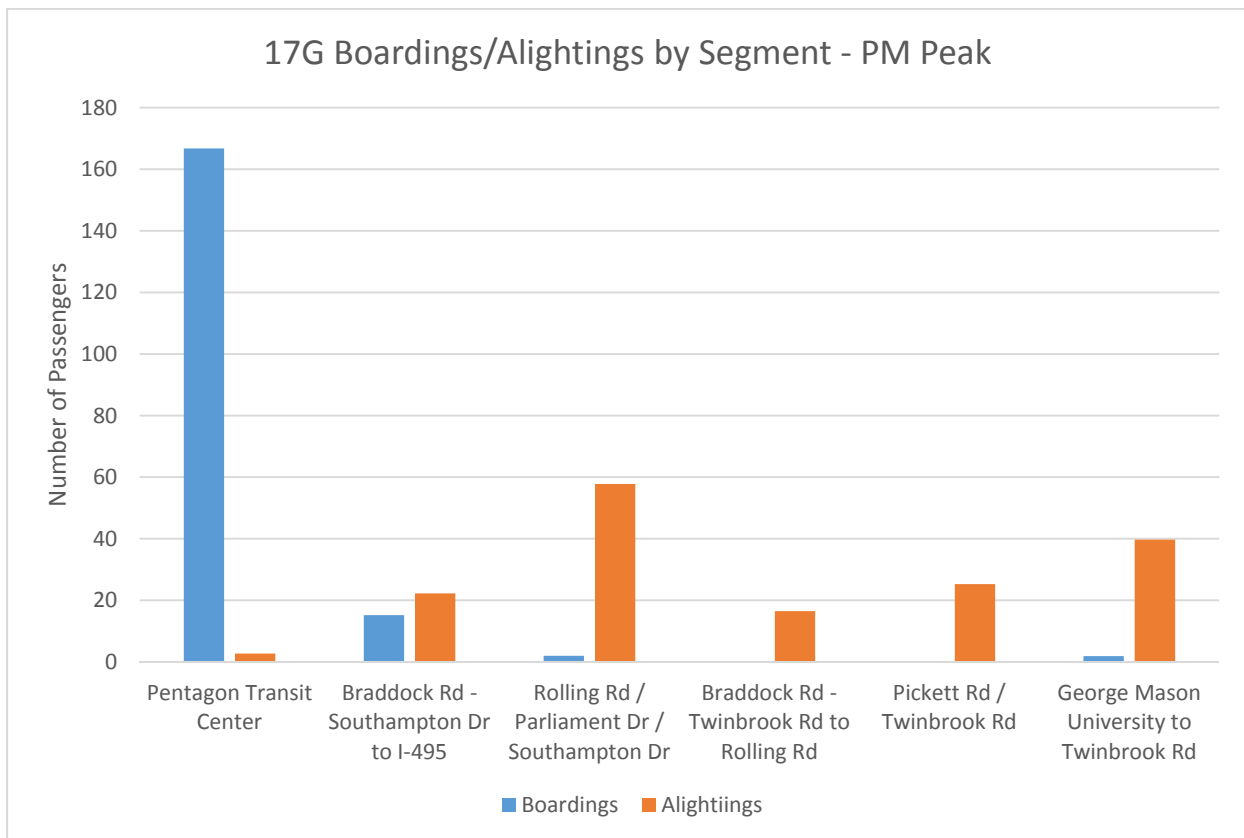
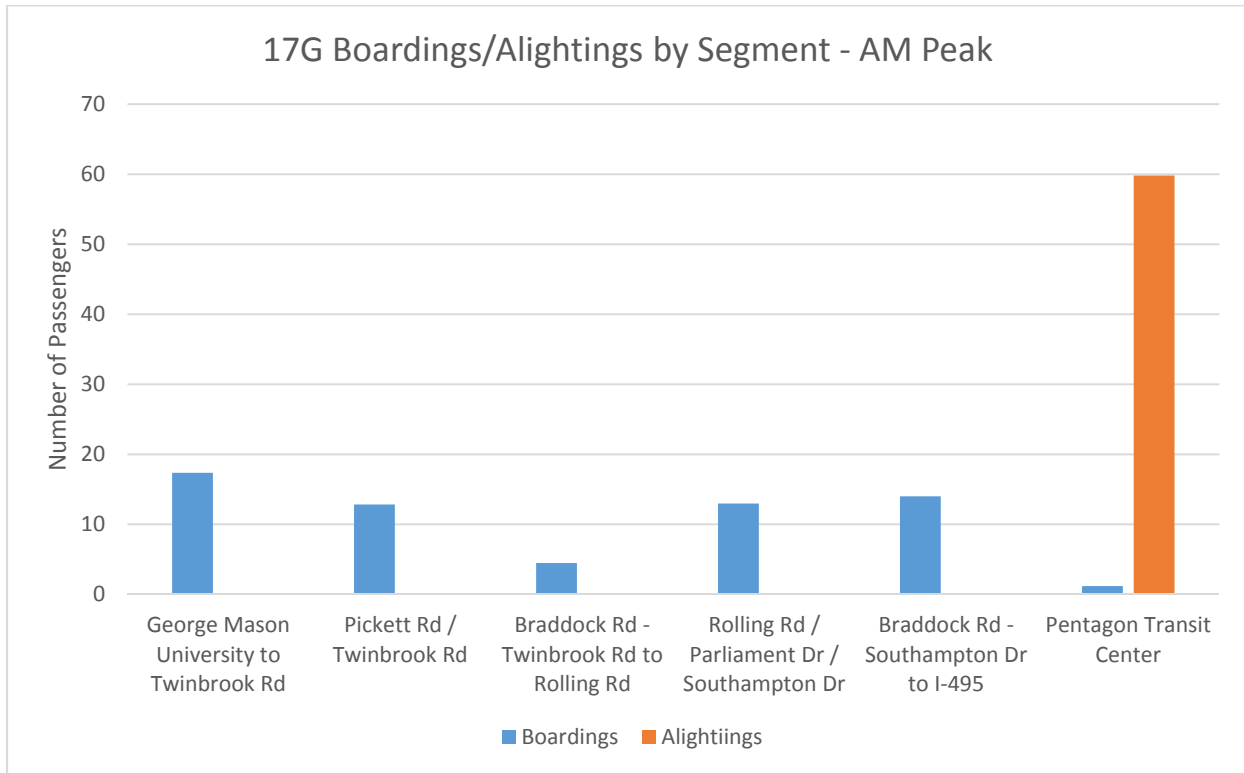


Figure 38 | Boardings/Alightings by Segment: Route 17H

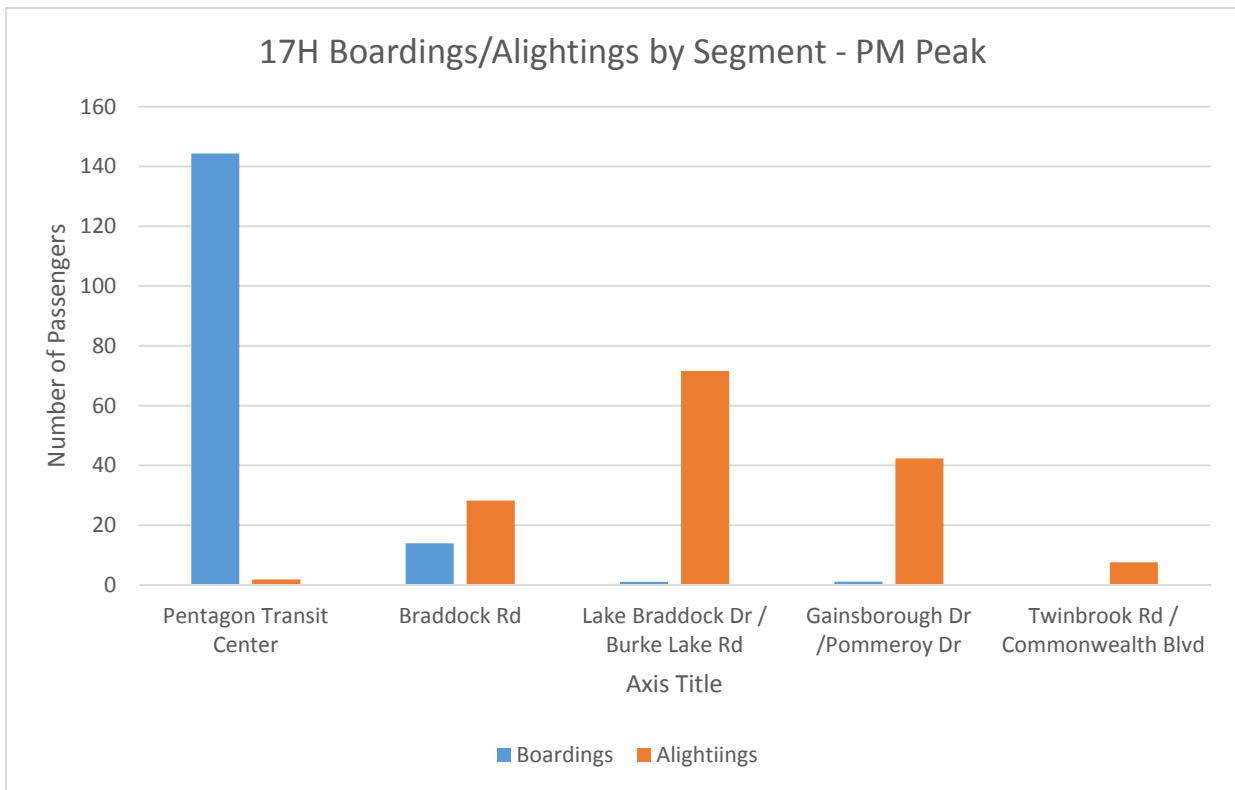
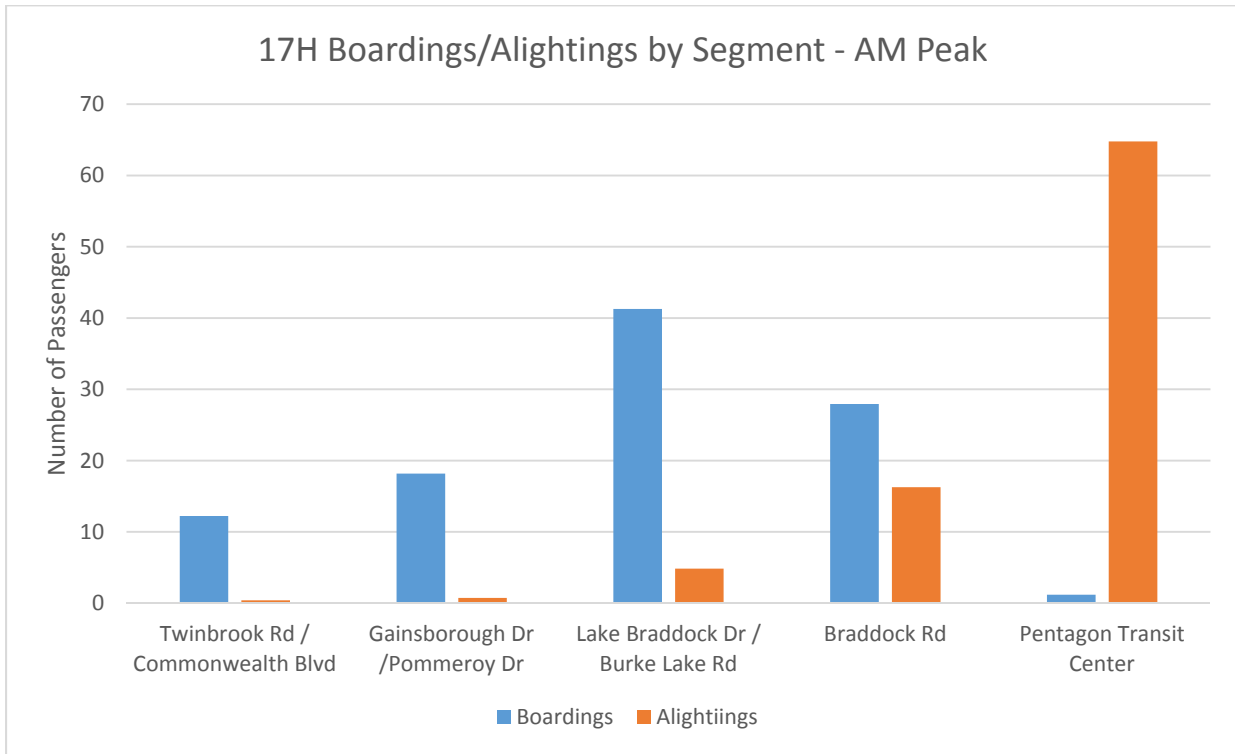


Figure 39 | Boardings/Alightings by Segment: Route 17K

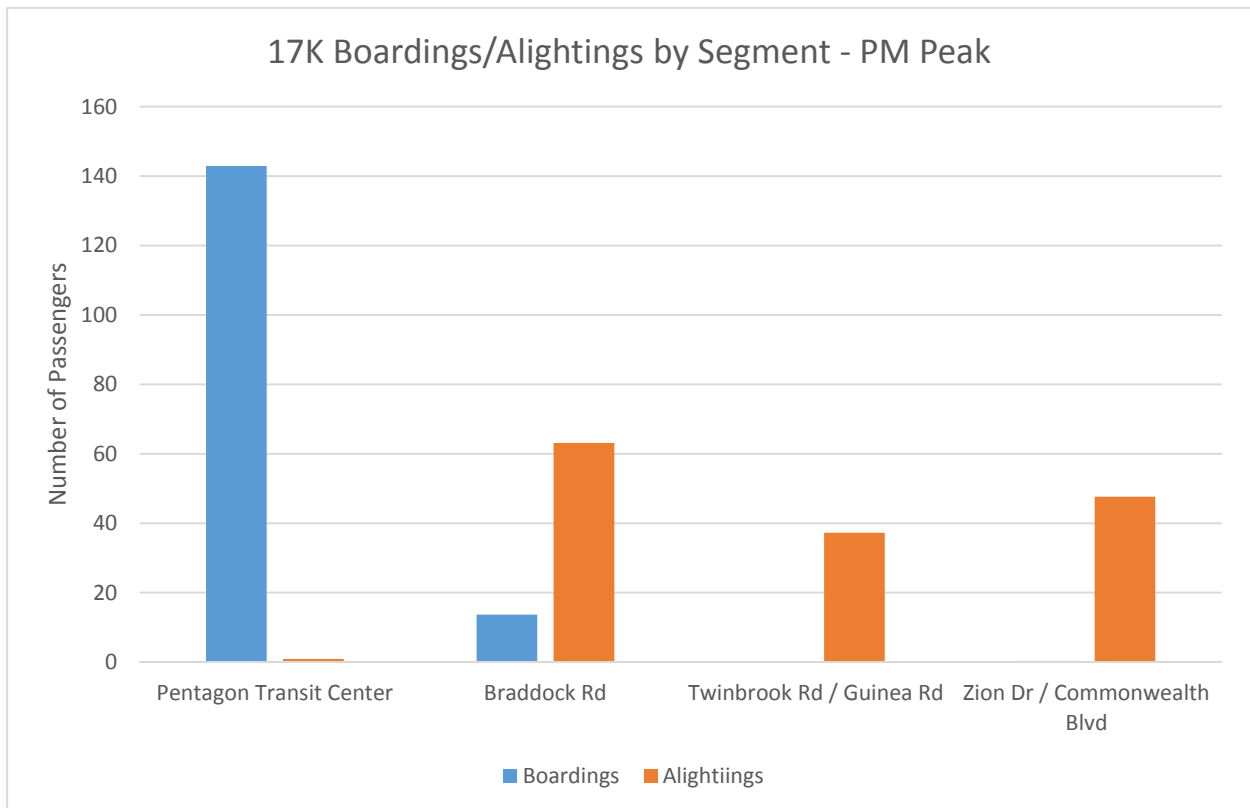
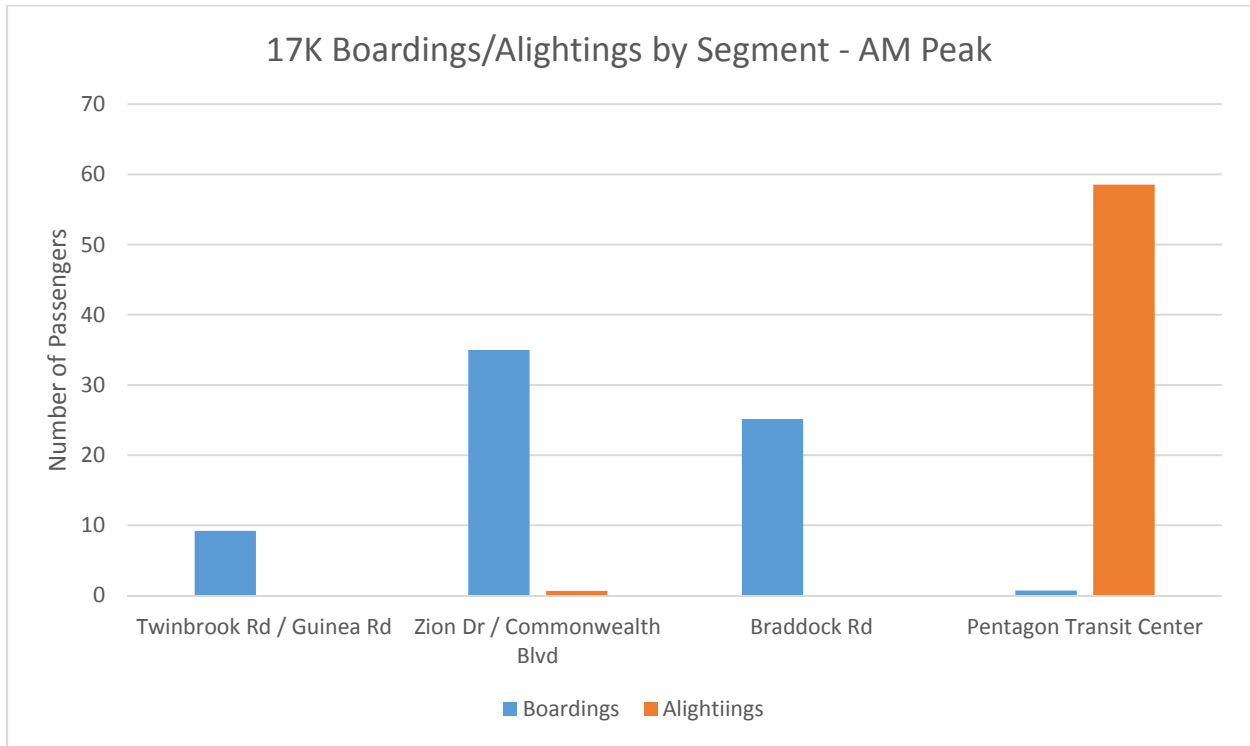
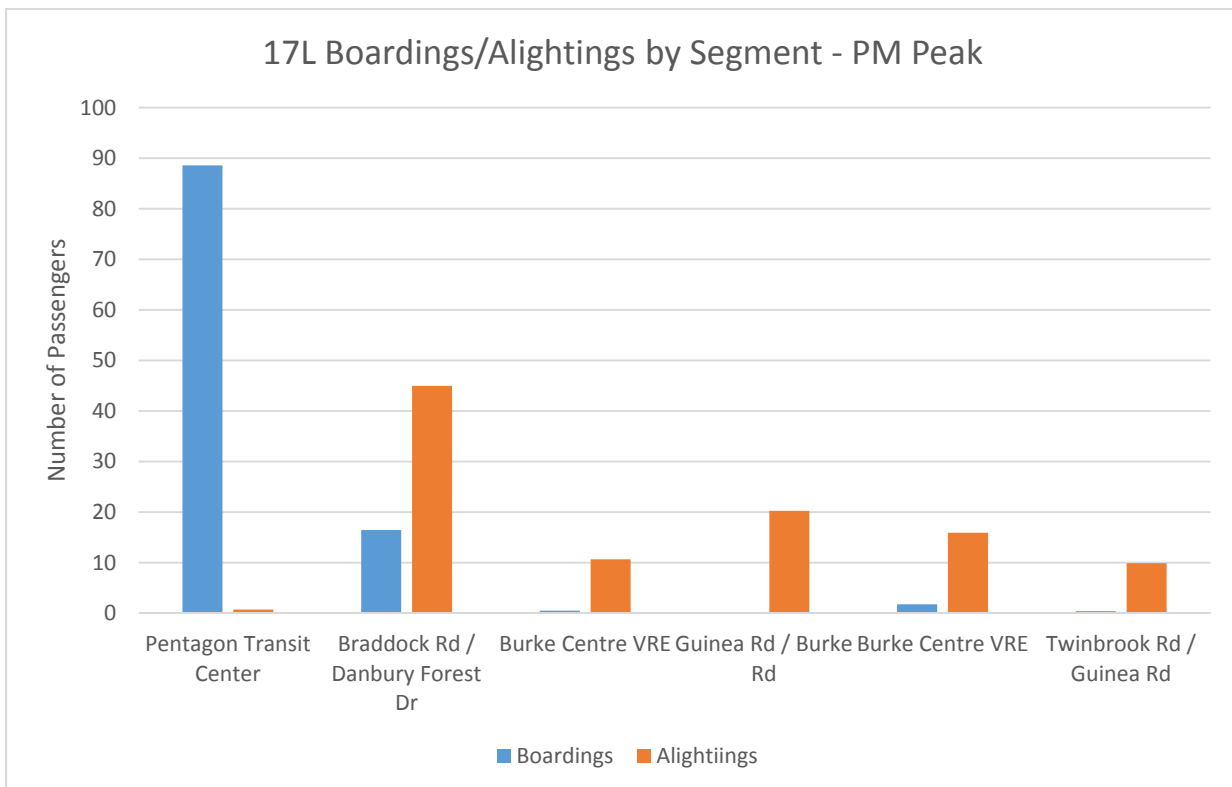
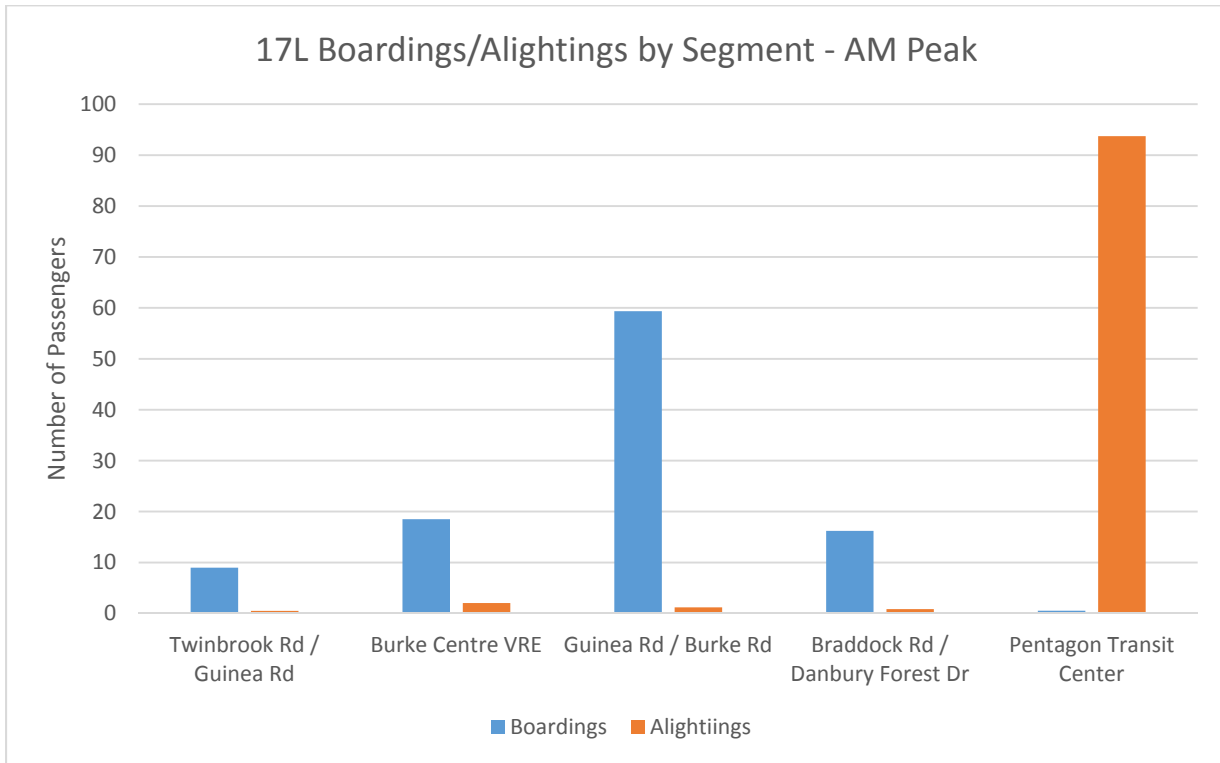


Figure 40 | Boardings/Alightings by Segment: Route 17L



Springfield Line: Routes 18E-18F

On the Springfield Line, during the morning peak period the Pentagon Transit Center has the most ridership activity on average with approximately 88 boardings and alightings, this is followed closely by the Bren Mar Drive Loop with approximately 44 boardings and alightings. In the afternoon period, the Pentagon has the most ridership activity with approximately 90 boardings and alightings, followed by the Bren Mar Drive Loop with approximately 47 boardings and alightings. **Figures 41 and 42** detail ridership for each route on the Springfield Line by segment.

Figure 41 | Boardings/Alightings by Segment: Route 18E

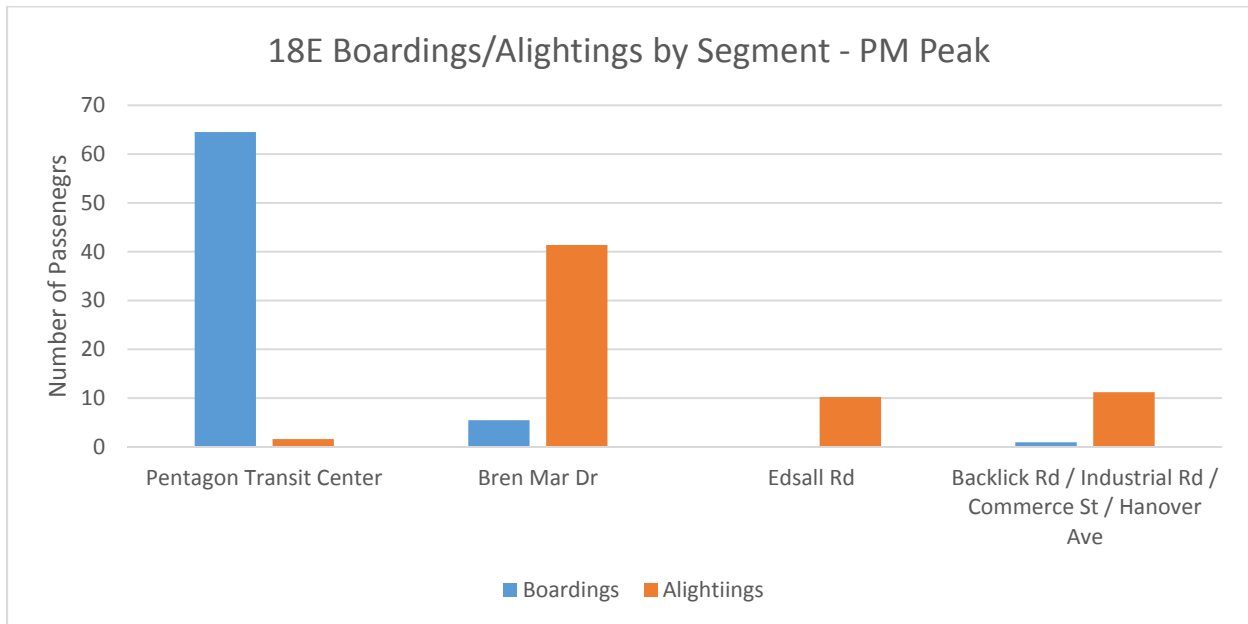
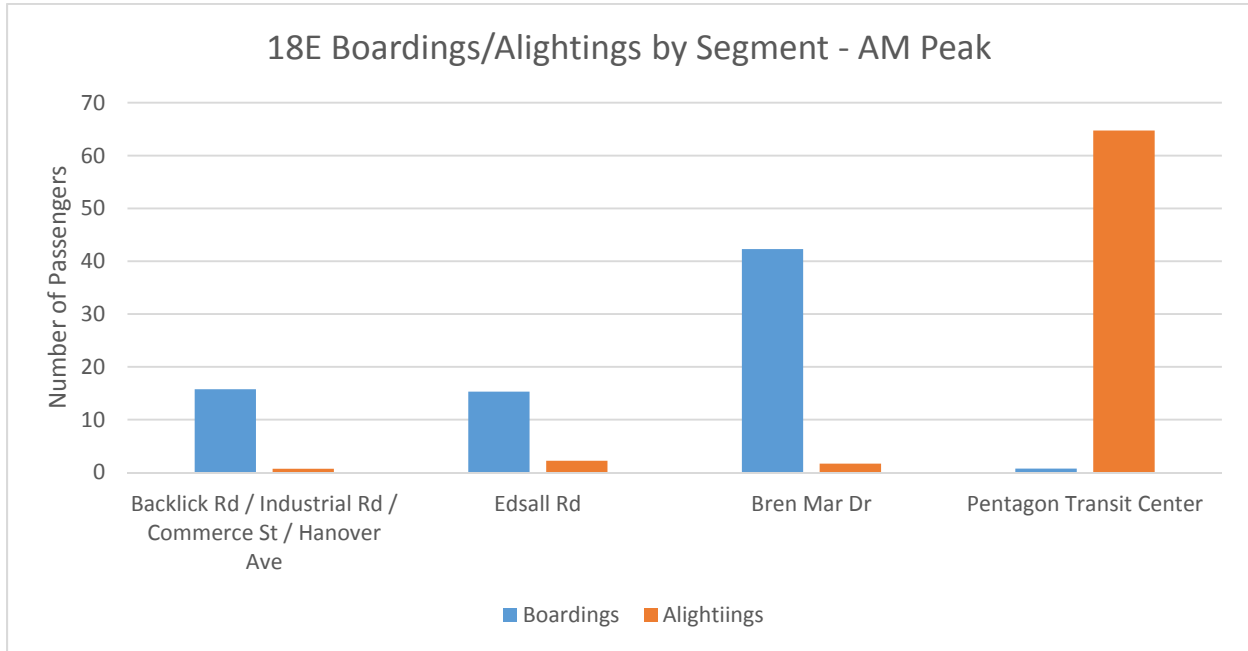
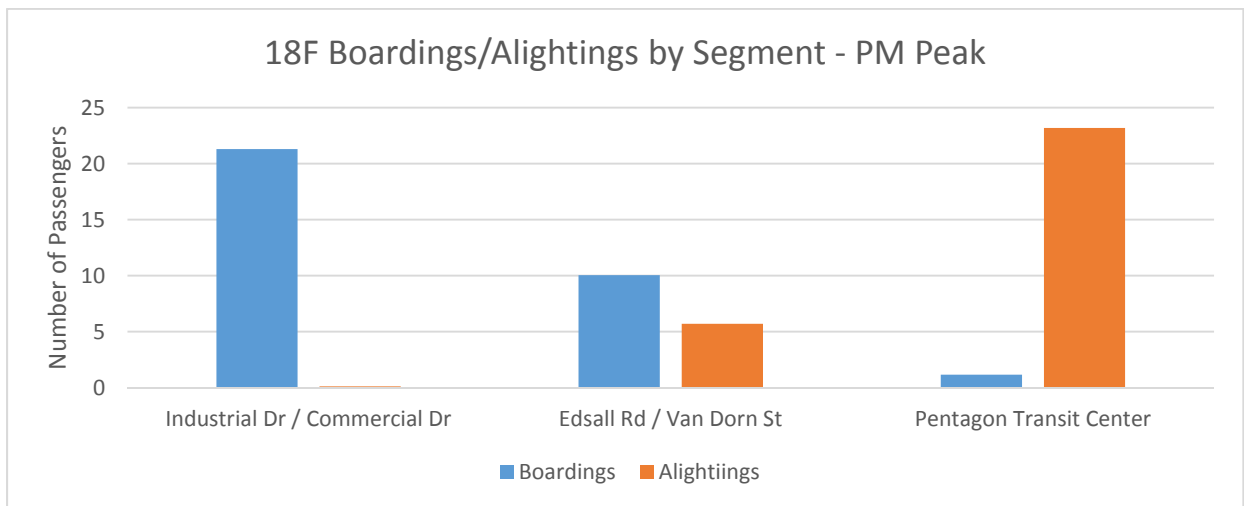
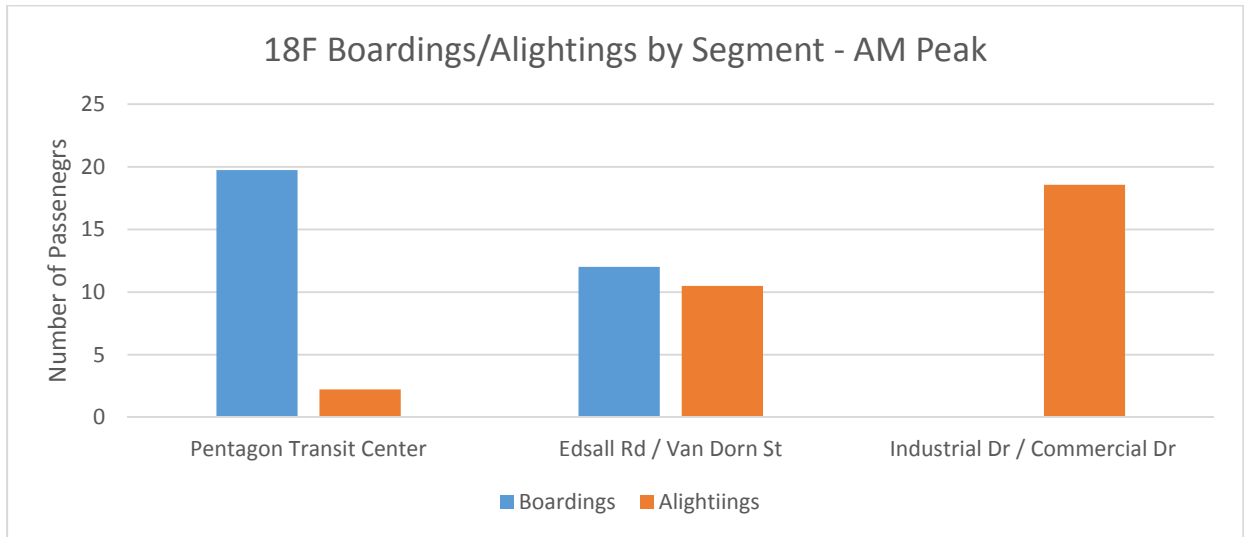


Figure 42 | Boardings/Alightings by Segment: Route 18F



Orange Hunt Line: Routes 18G-18H-18J

The majority of ridership activity is occurring on Old Keene Mill Road with approximately 160 boardings and alightings in the morning peak period, while in the afternoon peak period the majority of ridership activity is at the Pentagon Transit Center, with approximately 335 boardings and alightings. **Figures 43 thru 45** detail ridership for each route on the Orange Hunt Line by segment.

Figure 43 | Boardings/Alightings by Segment: Route 18G

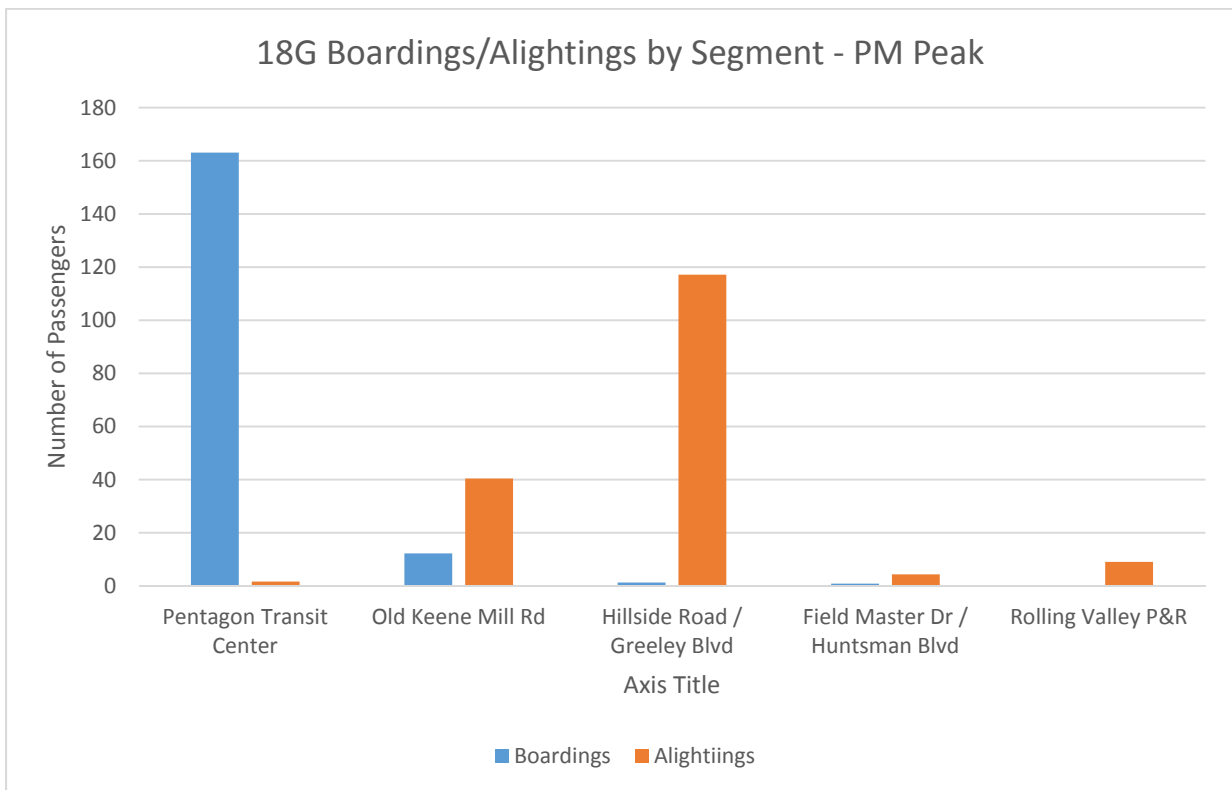
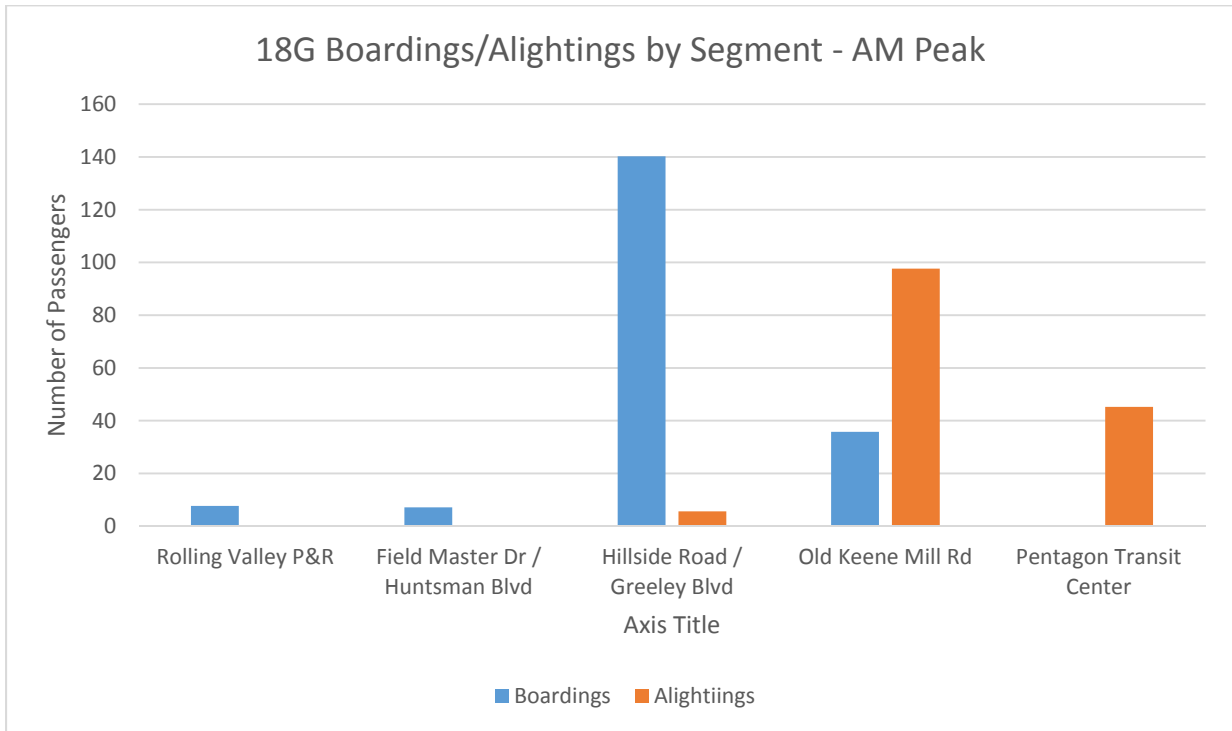


Figure 44 | Boardings/Alightings by Segment: Route 18H

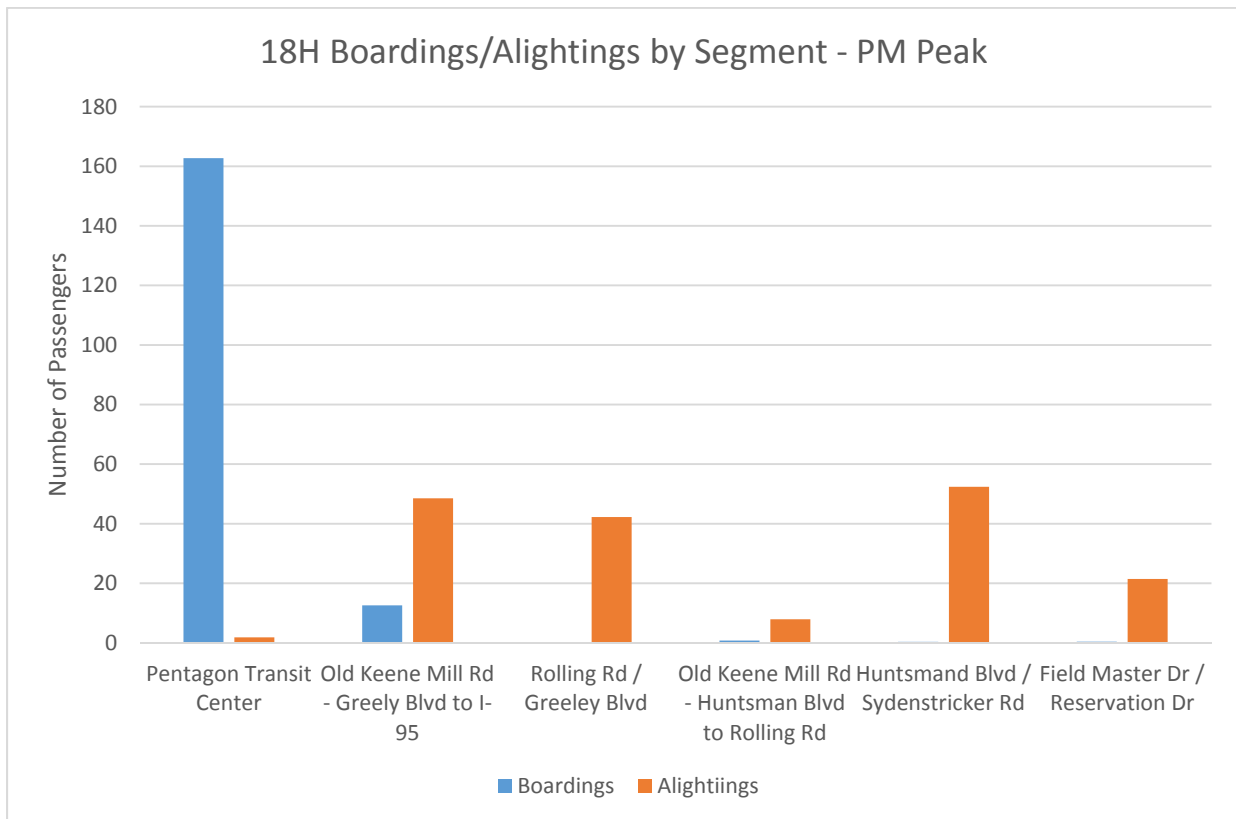
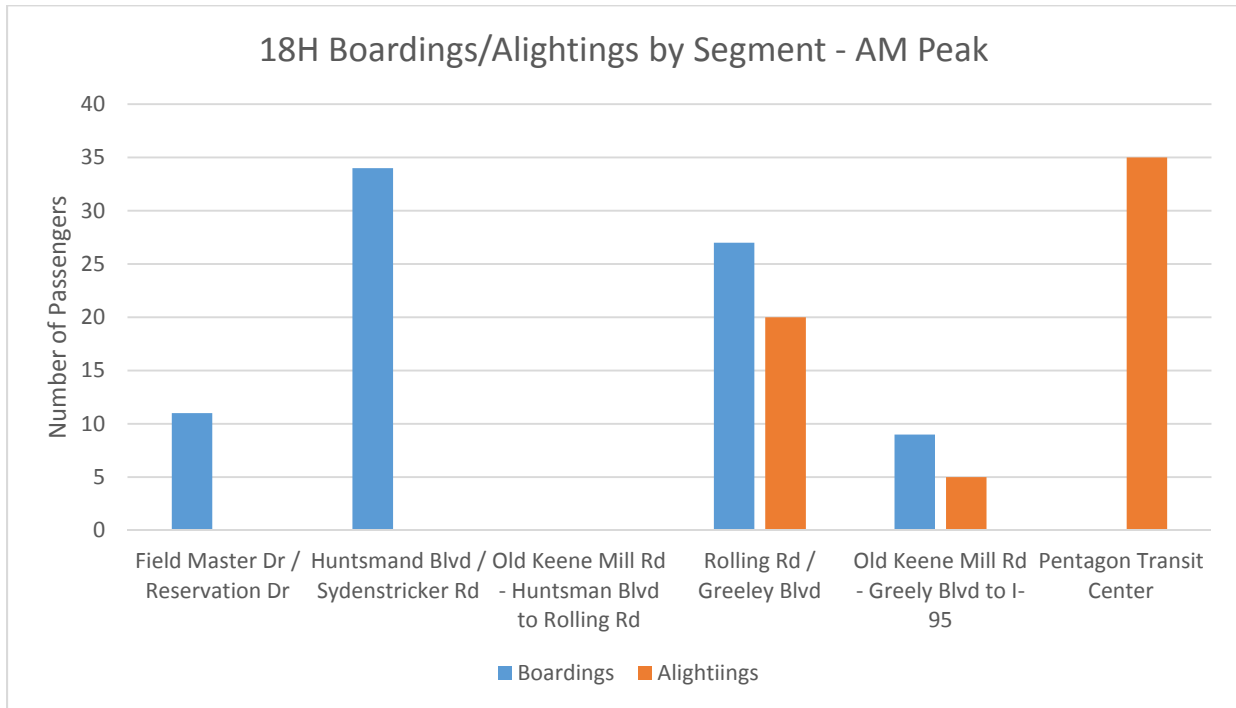
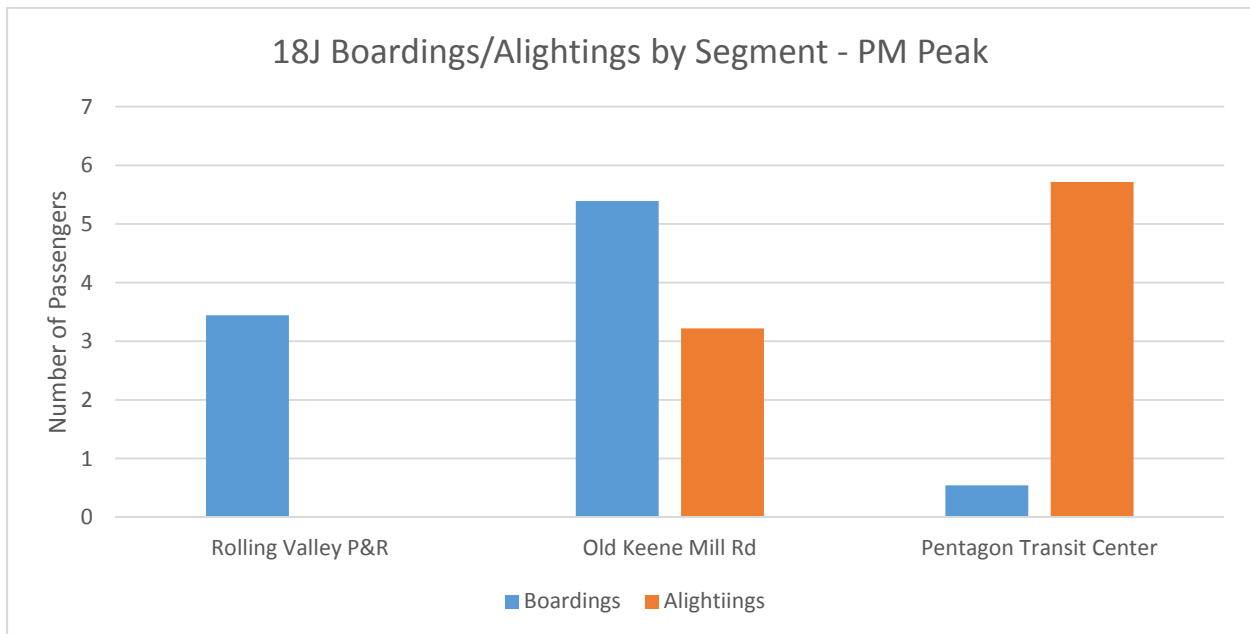
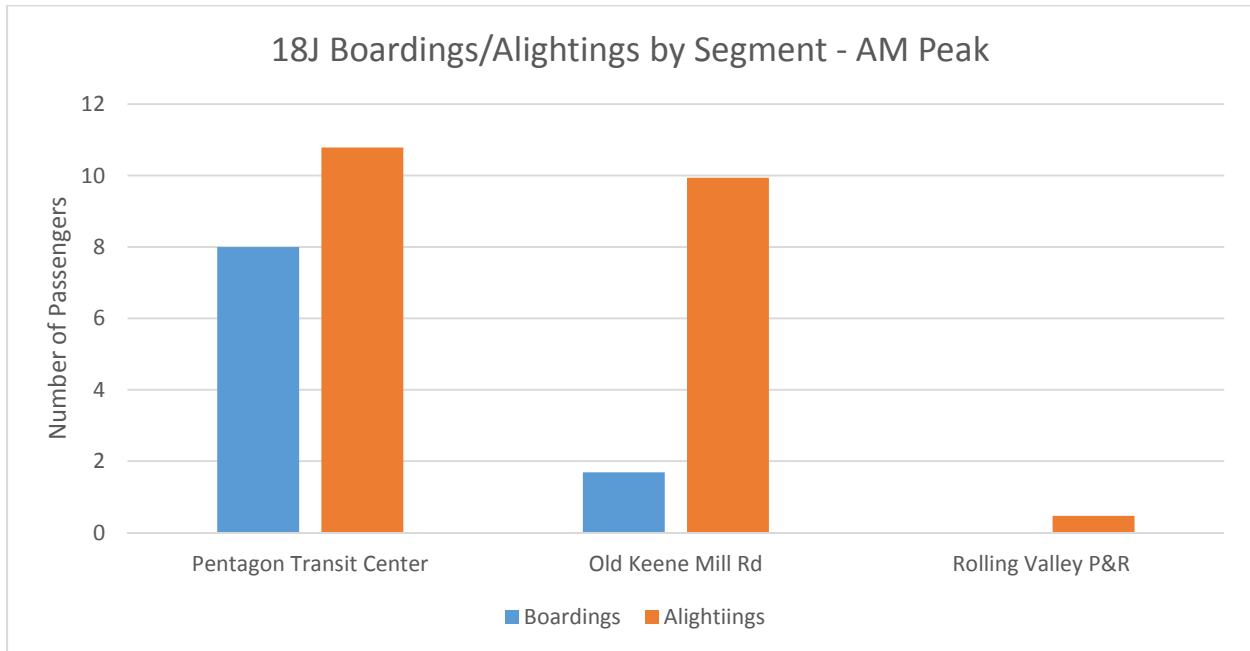


Figure 45 | Boardings/Alightings by Segment: Route 18J



Burke Centre Line: Routes 18P-18R-18S

On the Burke Centre Line, in the morning period both the Pentagon and Old Keene Mill Road east of the Rolling Valley Park and Ride are seeing the most ridership activity. In the afternoon peak period, the Pentagon and Old Keene Mill east of the Rolling Valley Park and Ride have the most ridership activity. **Figures 46 thru 48** detail ridership for each route on the Burke Centre Line by segment.

Figure 46 | Boardings/Alightings by Segment: Route 18P

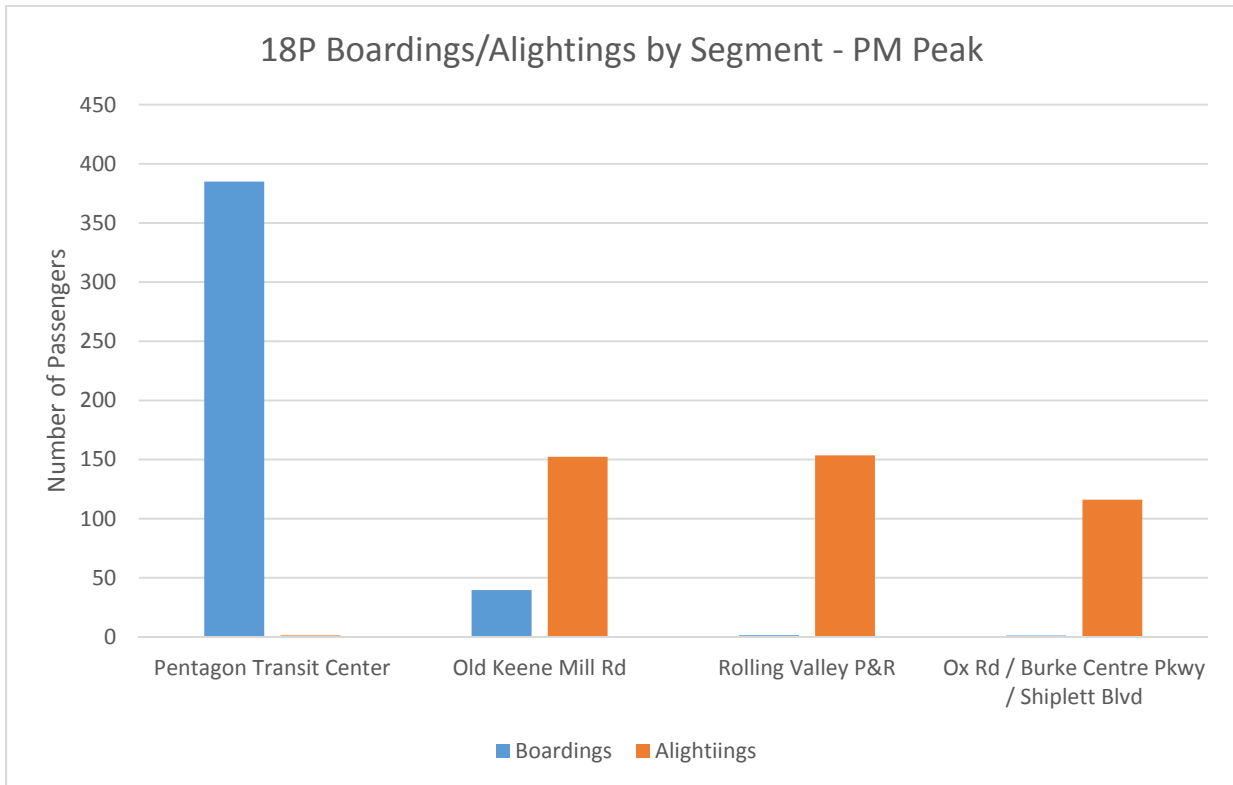
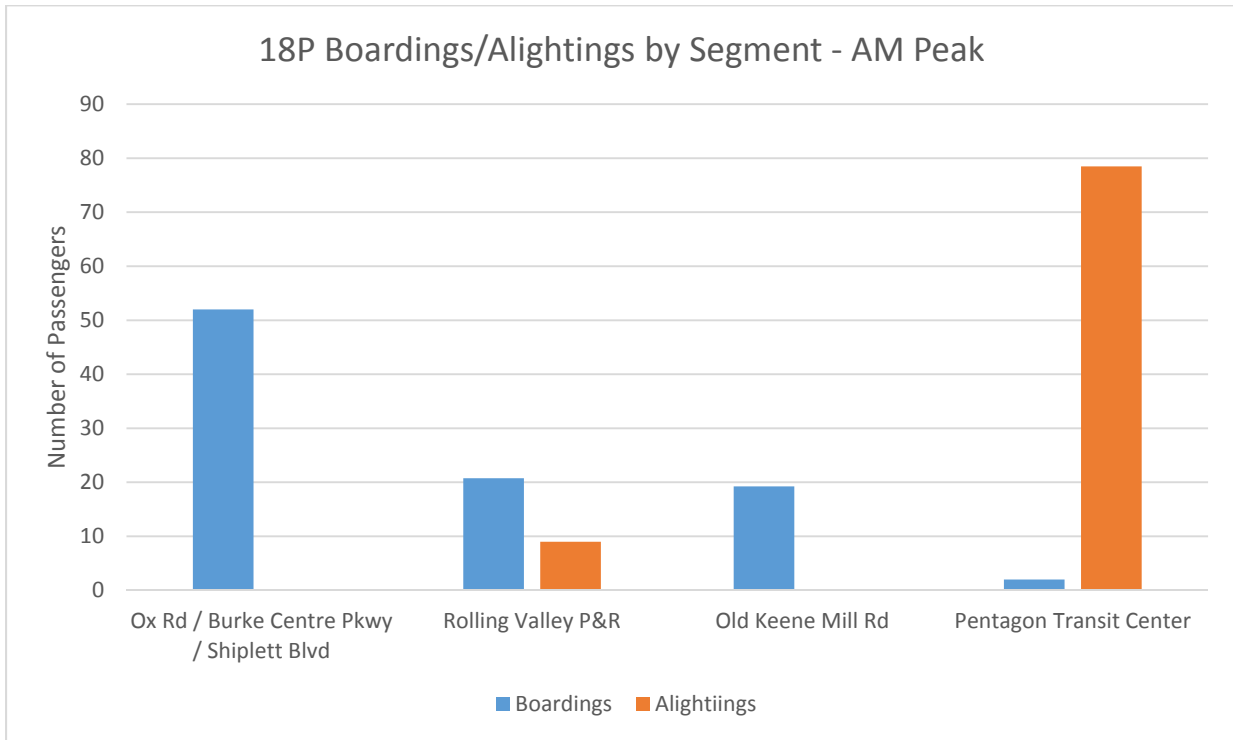


Figure 47 | Boardings/Alightings by Segment: Route 18R

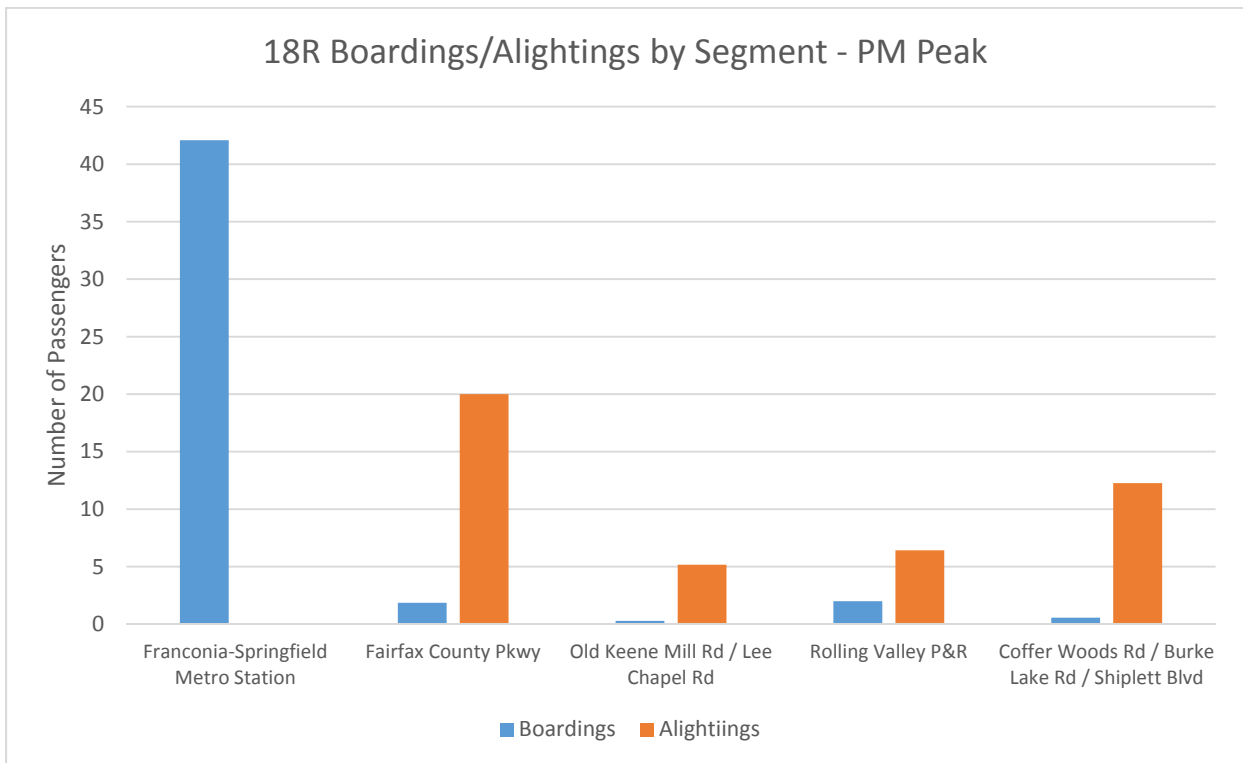
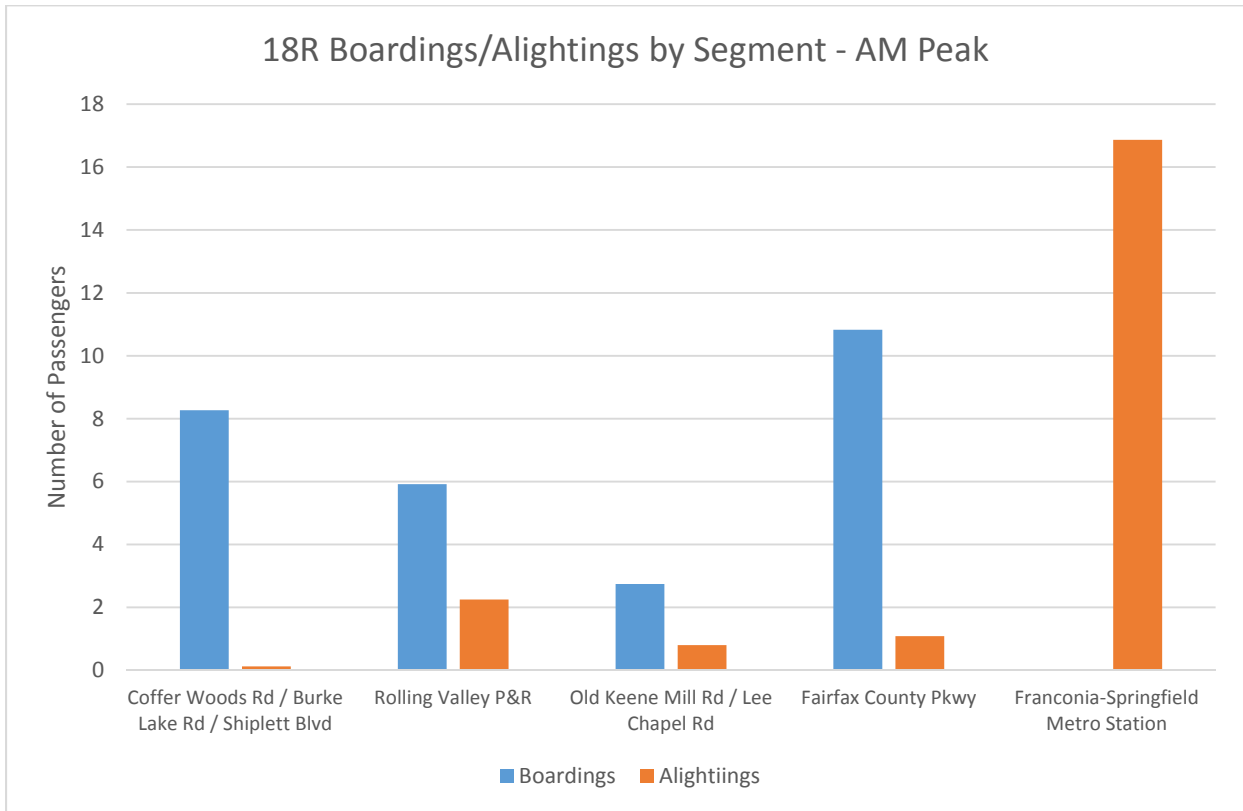
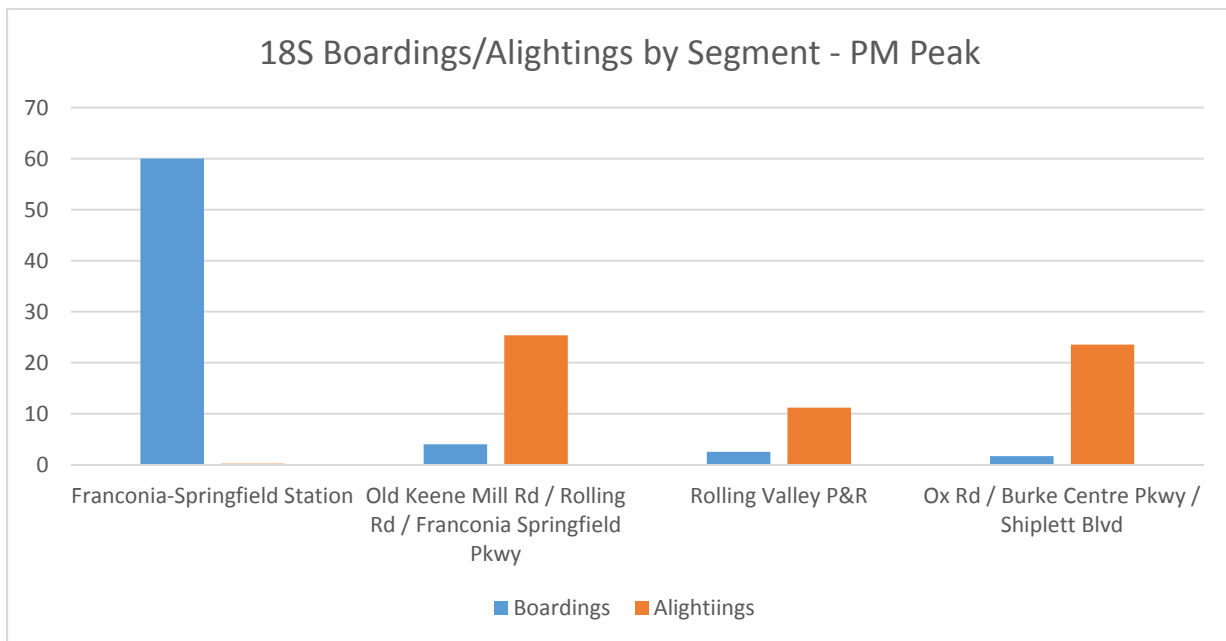
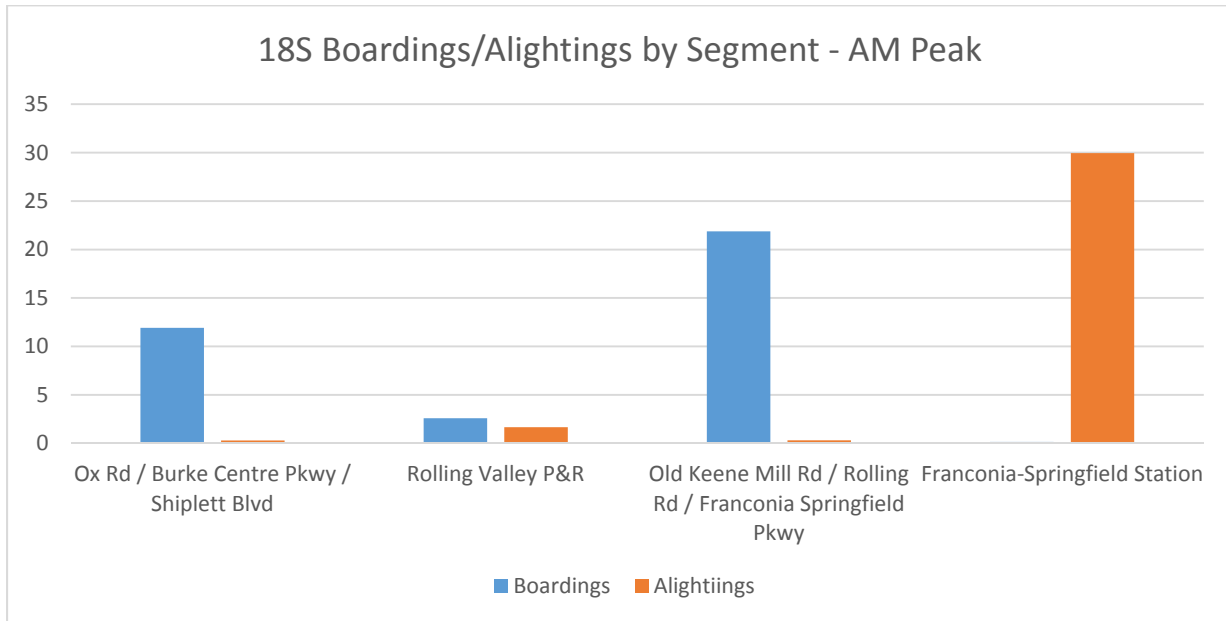


Figure 48 | Boardings/Alightings by Segment: Route 18S



Preliminary Findings: Boardings/Alightings by Segment

The ridership by segments highlight the express nature of the 17/18 Lines service. Morning peak hour trips are primarily bringing passengers to the Metrorail stations at the Pentagon and Franconia-Springfield. Park and Rides also represent major segments along the various 17/18 Lines corridors. Light, but uniform distribution of boardings occur along the remainder of the route segments.

5. Productivity

This section summarizes various productivity measures for the 17/18 Lines. An analysis of productivity reveals the relative efficiency of each individual bus route, and ultimately plays an instrumental role in guiding future recommendations. Based on an assessment, planners may review a service's segments to discern which are the worst- or the best-performing, and prepare recommendations accordingly.

Using daily averages from September 2014, the following metrics are addressed in this section:

- **Boardings per Trip.** This measure offers one mechanism by which to review average utilization of each route, per trip. A higher figure may indicate that a route is either widely utilized or at risk for overcrowding along certain segments; a lower figure indicates lower average utilization, either along certain segments or across the entire line;
- **Boardings per Revenue Mile.** This metric averages the number of passengers that travel on a given bus route for each mile of operation while a vehicle is in revenue service. Like average passengers per revenue trip, higher figures may correspond to wider usage or potential overcrowding. Lower figures generally correspond with lower overall ridership as well as lower average passengers per revenue trip;
- **Cost Recovery Ratio.** Typically expressed as a percentage, the cost recovery ratio of a line is defined as the average daily revenue divided by the operating cost. In general, higher cost recovery ratios will correspond with more productive routes, as operating cost is covered more robustly. Lower figures will likely mean that a line either has relatively low ridership or is more expensive to operate; and
- **Subsidy per Passenger Trip.** To calculate subsidy per passenger, WMATA subtracts daily revenue from daily operating cost. This daily subsidy is then divided by ridership to determine the average dollar amount allocated per passenger on a daily basis. This metric reflects a line's financial efficiency as a function of operating cost and revenue. A higher dollar figure generally corresponds with lower ridership, and lower efficiency; a lower dollar amount usually means higher ridership, and thus less funds devoted per passenger.

The following subsections address general productivity measures by line.

5.1. BOARDINGS PER TRIP

WMATA productivity guidelines for both express and commuter services are identical, and described below:

- A minimum of **11.2** average daily boardings per trip.

The **Table 37** assesses whether the 17/18 Lines meet WMATA guidelines. If a line meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

Table 37 | Boardings per Trip: 17/18 Lines

Line	Route	Boardings per Trip
Kings Park	17A-17B-17F-17M	9.1
Kings Park Express	17G-17H-17K-17L	20.4
Springfield	18E-18F	9.9
Orange Hunt	18G-18H-18J	24.3
Burke Centre	18P-18R-18S	12.8

5.1.1. Preliminary Findings: Boardings per Trip

The following lines do not meet WMATA guidelines for average boardings per trip:

- Kings Park Line
- Springfield Line

5.2. BOARDINGS PER REVENUE MILE

WMATA productivity guidelines for both express and commuter services are identical, and described below:

- A minimum of **1.3** average daily boardings per revenue mile.

The **Table 38** assesses whether the 17/18 Lines meet WMATA guidelines. If a line meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

Table 38 | Boardings per Revenue Mile: 17/18 Lines

Line	Route	Boardings per Revenue Mile
Kings Park	17A-17B-17F-17M	0.5
Kings Park Express	17G-17H-17K-17L	1.0
Springfield	18E-18F	0.7
Orange Hunt	18G-18H-18J	1.3
Burke Centre	18P-18R-18S	1.0

5.2.1. Preliminary Findings: Boardings per Revenue Mile

The following lines do not meet WMATA guidelines for boardings per revenue mile:

- Kings Park Line
- Kings Park Express Line
- Springfield Line
- Burke Centre Line

5.3. COST RECOVERY RATIO

WMATA productivity guidelines for both express and commuter services are identical, and described below:

- A minimum of **15.88%** farebox cost recovery ratio.

The **Table 39** assesses whether the 17/18 Lines meet WMATA guidelines. If a line meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

Table 39 | Farebox Cost Recovery Ratio: 17/18 Lines

Line	Routes	Farebox Cost Recovery Ratio
Kings Park Line	17A-17B-17F-17M	19.76%
Kings Park Express Line	17G-17H-17K-17L	37.86%
Springfield Line	18E-18F	19.51%
Orange Hunt Line	18G-18H-18J	56.29%
Burke Centre Line	18P-18R-18S	28.93

5.3.1. Preliminary Findings: Farebox Cost Recovery Ratio

All lines meet the threshold for farebox cost recovery ratio.

5.4. SUBSIDY PER PASSENGER TRIP

WMATA productivity guidelines for both express and commuter services are identical, and described below:

- A subsidy of \$4.80 or less per passenger trip.

The **Table 40** assesses whether the 17/18 Lines routes meet WMATA guidelines. If a line meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

Table 40 | Subsidy per Passenger Trip: 17/18 Lines

Line	Routes	Subsidy per Passenger Trip
Kings Park Line	17A-17B-17F-17M	\$12.60
Kings Park Express Line	17G-17H-17K-17L	\$5.67
Springfield Line	18E-18F	\$11.36
Orange Hunt Line	18G-18H-18J	\$2.65
Burke Centre Line	18P-18R-18S	\$7.34

5.4.1. Preliminary Findings: Subsidy per Passenger Trip

The following lines do not meet WMATA guidelines for subsidy per passenger trip:

- Kings Park Line

- Kings Park Express Line
- Springfield Line
- Burke Centre Line

6. Line Directness and Connectivity

6.1. LINE DIRECTNESS ANALYSIS

The directness for the 17/18 Line routes was calculated as a ratio of the actual distance to the stop-to-stop straight line distance. While WMATA has no official standard for line directness, a rule of thumb threshold is 125%. Routes that are greater than 125% should be analyzed in greater detail for more efficient routing.

Directness ranges from 107% to 149% on the 17/18 Lines. The Orange Hunt line has the most direct routes, with an average directness of 110%, while the Burke Center Line has the least direct routes, with an average directness of 121%. The Route 18S is the only route that exceeds the 125% threshold, primarily because of the street geometry that the Route 18S alignment follows. **Table 41** presents the results from this analysis. If a route meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

Table 41 | Route Directness: 17/18 Lines

Route	Direction	Destination	Stop-to-Stop Straight Line Distance	Route Distance	Route Directness
Kings Park Line					
17A	N	PENTAGON	18.6	20.0	107%
17A	S	GEORGE MASON UNIVERSITY	19.5	21.1	108%
17B	N	PENTAGON	21.7	24.8	114%
17B	S	KINGS PARK WEST	21.4	24.8	116%
17F	N	PENTAGON	12.9	15.5	120%
17F	S	KINGS PARK WEST	12.8	15.6	122%
17M	N	PENTAGON	13.5	14.6	108%
17M	S	NORTH SPRINGFIELD	13.5	14.7	109%
Kings Park Express Line					
17G	N	PENTAGON	17.5	20.4	117%
17G	S	GEORGE MASON UNIVERSITY	18.4	21.7	118%
17H	N	PENTAGON	17.7	20.7	117%
17H	S	KINGS PARK WEST	17.6	20.8	118%
17K	N	PENTAGON	17.8	20.6	115%
17K	S	KINGS PARK WEST	17.6	20.7	118%
17L	N	PENTAGON	18.8	23.2	123%
17L	S	BURKE	18.8	23.3	124%
Springfield Line					
18E	N	PENTAGON	14.6	16.3	111%

Route	Direction	Destination	Stop-to-Stop Straight Line Distance	Route Distance	Route Directness
18E	S	SPRINGFIELD	14.8	16.9	114%
18F	N	PENTAGON	9.5	11.3	119%
18F	S	SPRINGFIELD	9.4	11.3	120%
Orange Hunt Line					
18G	N	PENTAGON	15.7	17.3	110%
18G	S	ROLLING VALLEY MALL	15.6	17.3	111%
18H	N	PENTAGON	18.7	21.0	112%
18H	S	ORANGE HUNT	19.1	20.6	108%
18J	N	PENTAGON	14.0	15.3	109%
18J	S	ROLLING VALLEY MALL	14.0	15.2	109%
Burke Centre Line					
18P	E	PENTAGON	19.4	21.1	109%
18P	W	BURKE CENTRE	19.4	21.2	110%
18R	E	FRANCONIA - SPRINGFIELD	12.4	14.4	116%
18R	W	BURKE CENTRE	12.9	15.1	118%
18S	E	FRANCONIA - SPRINGFIELD	11.6	14.5	125%
18S	W	BURKE CENTRE	10.2	15.1	149%

6.2. LINKAGE AND CONNECTIVITY TO ACTIVITY CENTERS

The Line 17 provides service to the Pentagon Metrorail Station in Arlington, while the Line 18 provides service to both the Pentagon and the Franconia-Springfield Metrorail Stations. Several major generators are located within the 17/18 Lines' service areas, including George Mason University, the Rolling Valley Mall, Springfield Plaza, Landmark Mall and the Pentagon.

Overall, each of the Line 17 routes serve the different residential neighborhoods of North Springfield, Danbury Forest, Kings Park, Burke and George Mason University. The Kings Park Line (17A, 17B, 17F, and 17M) serve residential areas of North Springfield along Braddock Road, and the commercial area of Lincolnia on Duke Street (VA 236). The Kings Park Express Line (17G, 17H, 17K and 17L) operate express between the I-495/Braddock Road interchange and the Pentagon.

The 18 Line routes generally serve residential areas of Burke Center, Orange Hunt, West Springfield and Springfield, as well as the commercial areas along Old Keene Mill Road (VA 644) near I-95. Of the Springfield Line routes, the Route 18E serves industrial and residential areas just north of the I-395/I-495 interchange, while the Route 18F serves the west side of the City of Alexandria near Landmark Mall. The Orange Hunt Line serves West Springfield around Old Keene Mill Road. The Route 18G serves north of Old Keene Mill Road, Route 18H serves south of Old Keene Mill Road, and Route 18J serves Old Keene Mill Road. The Burke Centre Lines serve the Burke Centre Parkway Corridor and the Fairfax County

Parkway/Franconia-Springfield Parkway corridors and the Franconia Springfield Metrorail Station (18 R/S). The Route 18P serves the Burke Centre Parkway Corridor to Old Keene Mill Road to the Pentagon.

Table 42 lists all possible transfers between 17/18 Line routes and other regional services.

Table 42 | Potential Transfers: 17/18 Lines

Route	Transfers
17A	Pentagon Metrorail; Pentagon Bus Routes; Fairfax City CUE Gold 1, 2, WMATA 15M, 29K; Fairfax Connector 306, 401, 402
17B	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 306, 401, 402, 495
17F	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 306, 321, 322, 495
17M	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 306, 401, 402, 495
17G	Pentagon Metrorail; Pentagon Bus Routes; Fairfax City CUE Gold 1, 2, WMATA 15M, 29K; Fairfax Connector 306
17H	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 306, 495
17K	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 306, 495
17L	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 306, 495
18E	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 310, 321, 322, 401, 402, 494
18F	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 321, 322, 401, 402; DASH AT-1,5,8; WMATA 25B
18G	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 310, 321, 322, 401, 402, 494
18H	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 310, 321, 322, 401, 402, 494
18J	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 310, 321, 322, 401, 402, 494
18P	Pentagon Metrorail; Pentagon Bus Routes; Fairfax Connector 310, 321, 322, 401, 402, 494
18R	Franconia Springfield Metrorail; Fairfax Connector 305, 310, 333, 334, 371, 372, 273, 394, 395, 401, 402, 493, 494
18S	Franconia Springfield Metrorail; Fairfax Connector 305, 310, 333, 334, 371, 372, 273, 394, 395, 401, 402, 493, 494

6.2.1. Kings Park Line: Routes 17A-17B-17F-17M

On the King Park Line, approximately 54 percent of the transfers are from other Metrobus routes, **Table 43** details transfers from individual routes.

Table 43 | Bus Transfers: Kings Park Line

Operator	From Route	To Route	Average Daily Transfers
Fairfax Connector	Tysons Corner	17A; 17B; 17M	4
WMATA	29N	17M	2
Fairfax Connector	Franconia-Springfield	17A; 17M	2
WMATA	29K	17A; 17M	2
DASH	AT 1	17A	1
WMATA	28G	17B	1

Operator	From Route	To Route	Average Daily Transfers
WMATA	16A	17F	1
WMATA	7Y	17M	1
Kings Park Line			10

6.2.2. Kings Park Express Line: Routes 17G-17H-17K-17L

On the King Park Express Line, approximately 55 percent of the transfers are from Metrobus Route 7Y, **Table 44** details transfers from individual routes.

Table 44 | Bus Transfers: Kings Park Express Line

Operator	From Route	To Route	Average Daily Transfers
WMATA	7Y	17G, 17H, 17K, 17L	18
WMATA	16X	17K	5
WMATA	16X	17G, 17H, 17K, 17L	5
City of Fairfax	GOLD 2	17G	2
WMATA	28F	17H	1
WMATA	7M	17K	1
WMATA	10A	17L	1
Kings Park Express Line			33

6.2.3. Springfield Line: Routes 18E-18F

On the Springfield Line, approximately 75 percent of the transfers are from other Metrobus routes, and the other 25 percent are onto the Route 18F from the AT-1 DASH route. **Table 45** details transfers from individual routes.

Table 45 | Bus Transfers: Springfield Line

Operator	From Route	To Route	Average Daily Transfers
WMATA	7Y	18E	2
WMATA	16X	18E	2
DASH	AT 1	18F	2
WMATA	16B	18E, 18F	2
Springfield Line			8

6.2.4. Orange Hunt Line: 18G-18H-18J

Approximately 83 percent of the transfers, on the Orange Hunt Line, are from other Metrobus routes. **Table 46** details transfers from individual routes.

Table 46 | Bus Transfers: Orange Hunt Line

Operator	From Route	To Route	Average Daily Transfers
WMATA	7Y	18G, 18H	5
ART	42	18H	2

Operator	From Route	To Route	Average Daily Transfers
WMATA	16X	18G, 18H	2
WMATA	28G	18G	1
WMATA	16A	18G	1
WMATA	28F	18H	1
Orange Hunt Line			12

6.2.5. Burke Centre Line: Routes 18P-18R-18S

Transfers from bus are split evenly between Metrobus and Fairfax Connector routes. **Table 47** details transfers from individual routes.

Table 47 | Bus Transfers: Burke Centre Line

Operator	From Route	To Route	Average Daily Transfers
WMATA	7Y	18P	6
Fairfax Connector	Rolling Valley-P&R	18R, 18S	4
Fairfax Connector	Franconia-Springfield	18R, 18S	3
WMATA	16X	18P	2
ART	42	18P	1
Fairfax Connector	Huntington-Metro North	18R	1
WMATA	18P	18R	1
Fairfax Connector	Patriot Ridge/Franconia-Springfield Metro	18S	1
Fairfax Connector	Tysons Corner	18S	1
Burke Centre Line			20

6.2.6. Metrorail Transfers

The highest number of transfers on the 17/18 Lines comes from the Kings Park Express Line to the Pentagon. Transfers to Metrorail stations and transfers from Metrorail stations are closely matched for each line. The Route 18P had the most activity at the Pentagon Metro Station, with 245 total boardings/alightings, and the Route 18J had the least amount of activity with 14 total boardings/alightings. **Tables 48** shows the transfers to/from the 17/18 Lines and the two main Metrorail Stations that these lines serve, Pentagon and Franconia-Springfield.

Table 48 | Metrorail Transfers: 17/18 Lines

Route	Transfer to Metrorail	Transfer From Metrorail	Total Activity
Kings Park Line			
17A	26	28	54
17B	11	19	30
17F	10	14	24
17M	58	55	113
Kings Park Express Line			

Route	Transfer to Metrorail	Transfer From Metrorail	Total Activity
17G	62	78	140
17H	115	77	192
17K	64	65	129
17L	52	41	93
Springfield Line			
18E	45	39	84
18F	14	17	31
Orange Hunt Line			
18G	95	82	177
18H	57	73	130
18J	5	9	14
Burke Centre Line			
18P	75	170	245
18R	17	23	40
18S	38	45	83

6.2.7. Preliminary Findings: Linkage and Connectivity to Activity Centers

Most of the transfer activity on the 17/18 Lines is focused around the Metrorail stations. There is not a significant amount of transfers activity from routes along the 17/18 Lines. The majority of transfer activity occurs with routes at the Pentagon Transit Center.

7. Service Reliability

This section addresses various service reliability factors on the 17/18 Lines. An analysis of service reliability essentially grants insight on performance as viewed both technically and by customers. This analysis describes service reliability metrics which are crucial to the development of service recommendations.

Reliability measures reviewed in this section include:

- **On-Time performance.** While specific “on-time” standards differ across transit agencies, on-time performance is potentially related to several items, including route directness, traffic conditions, or ridership peaks and valleys. When considered against these factors and others, on-time performance is quite valuable in the preparation of service recommendations;
- **Actual versus scheduled running time.** Examining actual versus scheduled running time provides valuable information to transportation planners on whether bottlenecks should be investigated, scheduling or blocking plans adjusted, or to increase or decrease service frequency ;
- **Trip incidents and lost trips (with causes).** This analysis provides insight into trends among certain types of incidents, whether some variations proved more prone to certain incident types or lost trips, and whether route schedule adjustment or realignment should be considered, depending on type and severity of issues; and
- **Customer complaints.** Customer voices are undoubtedly important to any transit service’s program; if an agency does not understand what its constituency values, it cannot fully offer better service.

7.1. ON-TIME PERFORMANCE

This section references on-time performance by line for the periods that each individual service is in revenue service. WMATA defines a vehicle as being “on-time” when a trip arrives any time between two minutes prior to the scheduled time and seven minutes after the scheduled time. WMATA weekday guidelines for both express and commuter services are identical, and described below:

- A minimum on-time performance of **79** percent.

The WMATA on-time performance data in this section was accumulated over a period from August 24 to December 13, 2014. General periods of operation are indicated in each subsection. “All day” on-time performance, is marked on each chart using a dotted line.

Table 49 assesses whether the 17/18 Lines meet WMATA guidelines. If a line meets the guidelines, it is marked in **green**; if a figure does not meet the guidelines, it is marked in **red**.

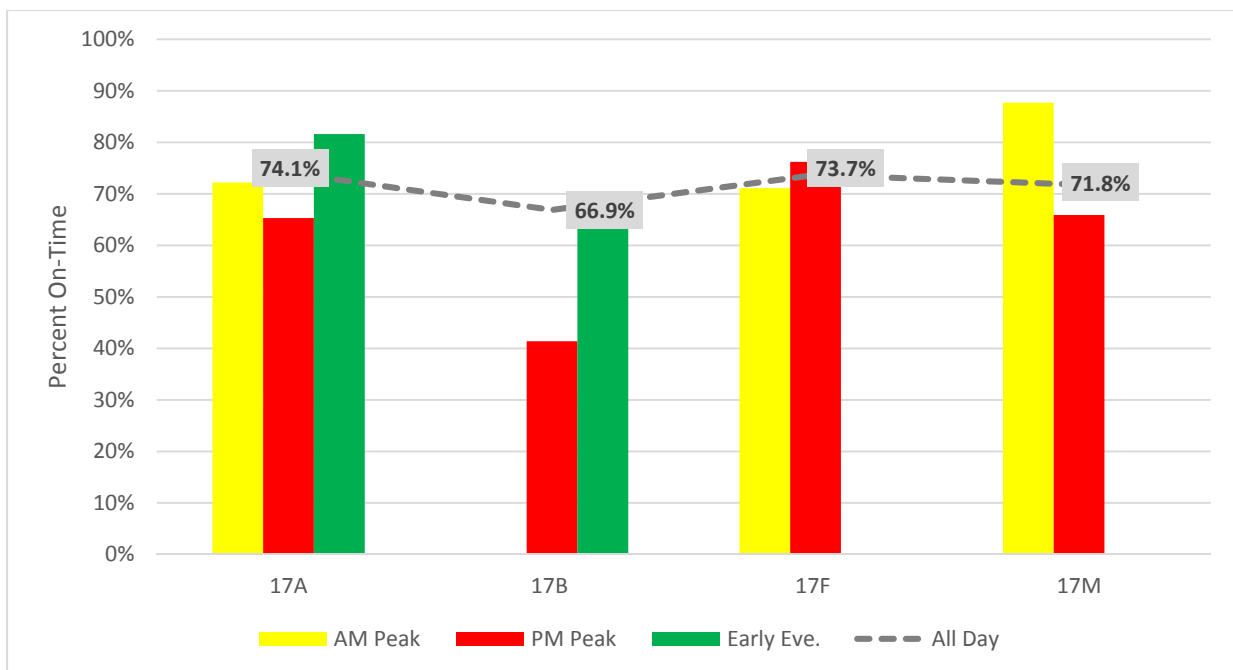
Table 49 | Average On-time Performance: 17/18 Lines

Line	Routes	Average All Day On-time Performance
Kings Park Line	17A-17B-17F-17M	71.6%
Kings Park Express Line	17G-17H-17K-17L	73.7%
Springfield Line	18E-18F	86.6%
Orange Hunt Line	18G-18H-18K-18L	72.0%
Burke Centre Line	18P-18R-18S	77.2%
17 Line Total		72.7%
18 Line Total		78.6%

7.1.1. Kings Park Line: Routes 17A-17B-17F-17M

The morning peak period trips on the Route 17M were, on average, most often on-time as defined by WMATA standards. In contrast, Route 17B’s afternoon peak trips on-time performance was measured at approximately 40 percent. In regards to all day on-time performance the Route 17A was the highest at 74.1 percent. On average, none of the Kings Park Line routes met WMATA standards during the analysis period. **Figure 49** shows the on-time performance of the Kings Park Line during the morning and afternoon peak periods.

Figure 49 | On-Time Performance: Kings Park Line

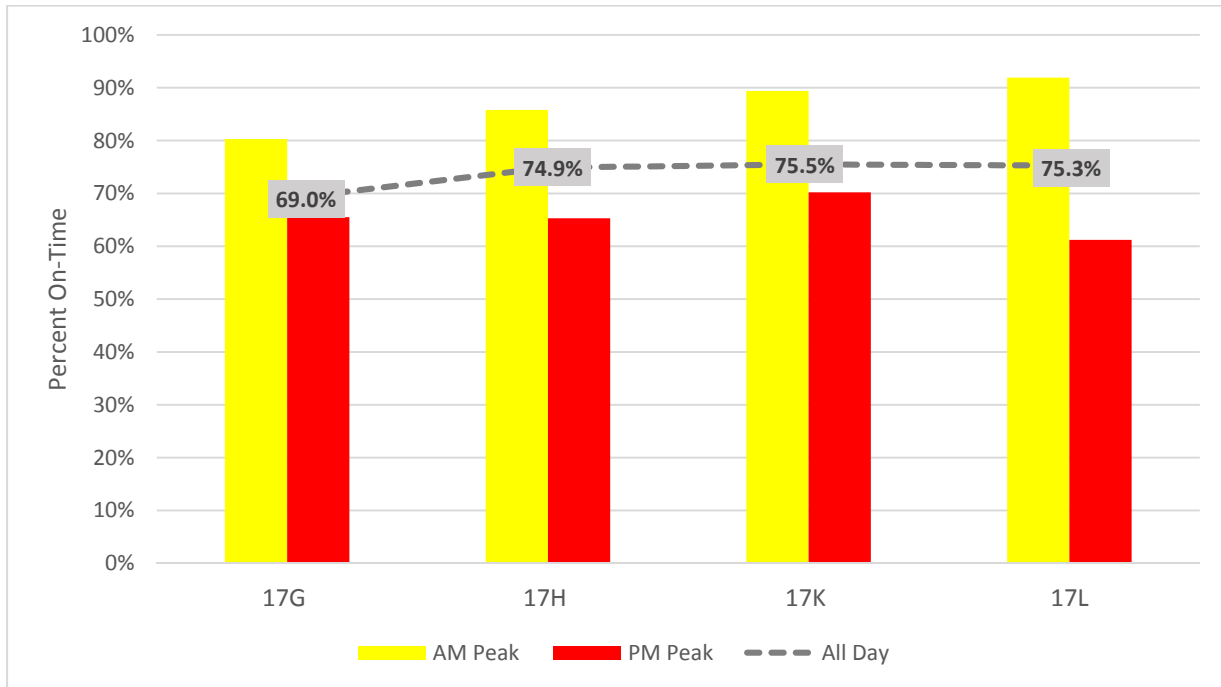


7.1.2. Kings Park Express Line: Routes 17G-17H-17K-17L

Kings Park Express Line on-time performance is shown in **Figure 50**. The early morning trips of the Route 17H were most frequently on-time. Additionally, over the entire line, on average, morning peak period trips arrived on-time more frequently than afternoon peak trips. The Route 17K had the highest all day

on-time average (75.5 percent). Averaging over the course of the entire day, no Kings Park Express Line routes met WMATA’s on-time standard.

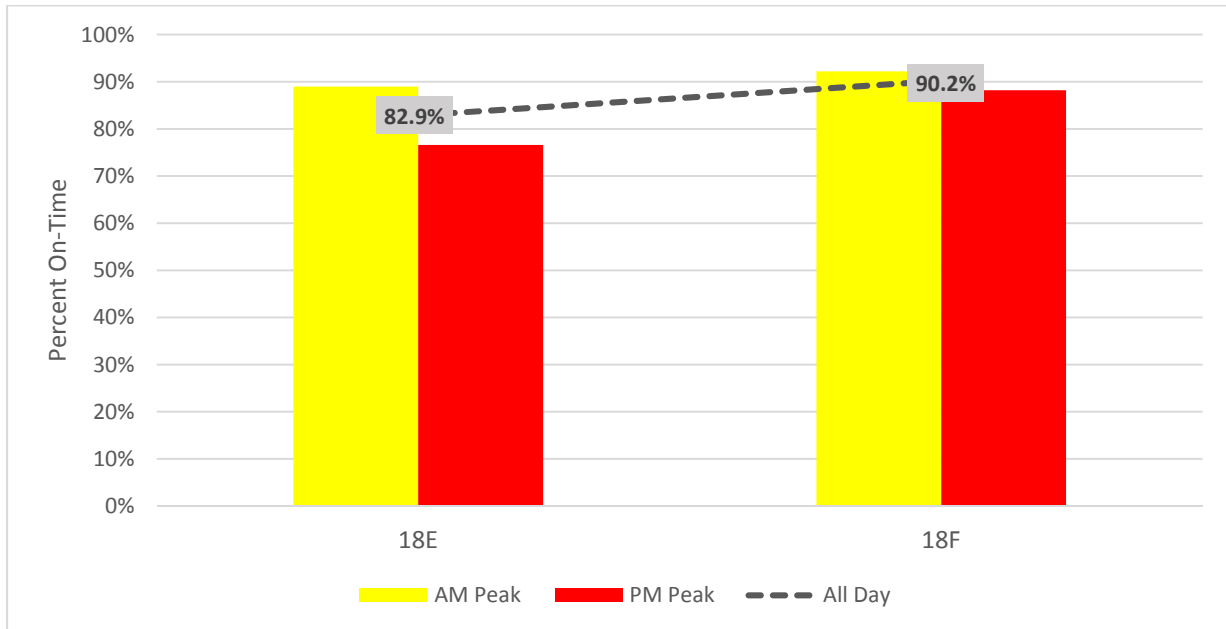
Figure 50 | On-Time Performance: Kings Park Express Line



7.1.3. Springfield Line: Routes 18E-18F

Route 18F, which operates fewer trips than the service offered via the Route 18E, was slightly more often on-time (See **Figure 51**). Moreover, afternoon peak trips were, on average, less frequently on-time than the morning peak period trips. While the Route 18F achieved a higher average all day on-time performance percentage (90.2 percent), both Springfield Line routes met the WMATA on-time standard.

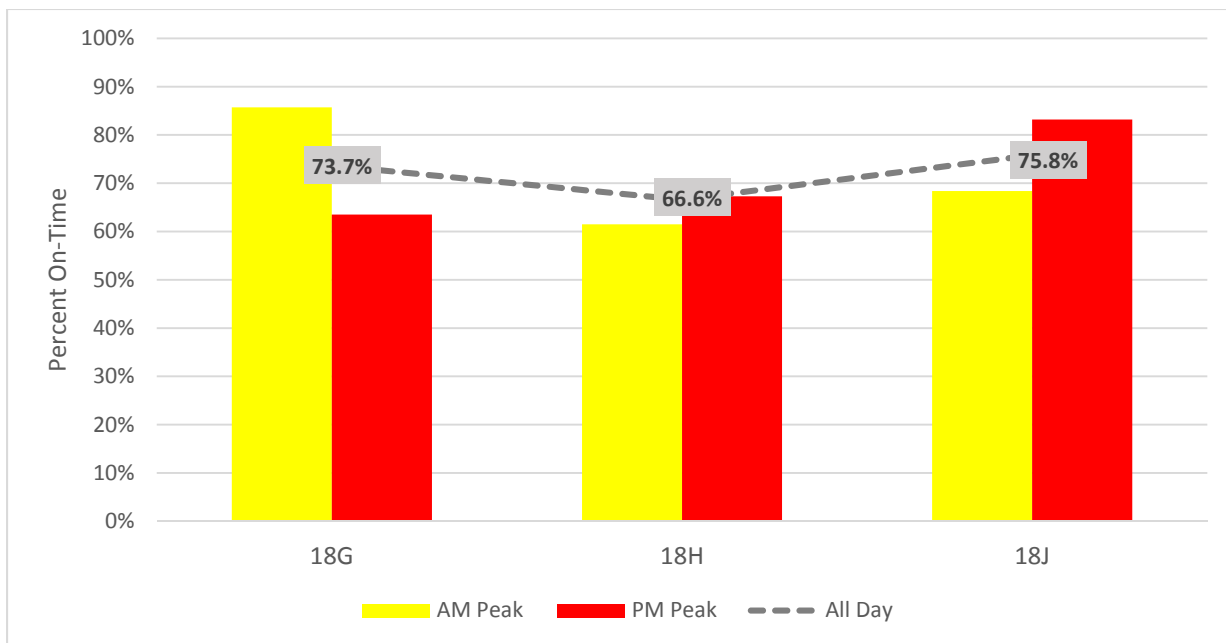
Figure 51 | On-Time Performance: Springfield Line



7.1.4. Orange Hunt Line: Routes 18G-18H-18J

The Orange Hunt routes arriving most often on-time included the morning peak Route 18G trips and the afternoon peak Route 18J trips. On average, across all periods, the Route 18H arrived least often on-time. The Route 18J had the highest all day on-time performance (75.8 percent). Regarding all day averages, no Orange Hunt Line route met the WMATA guideline. **Figure 52** shows on-time performance on the routes that comprise the Orange Hunt Line.

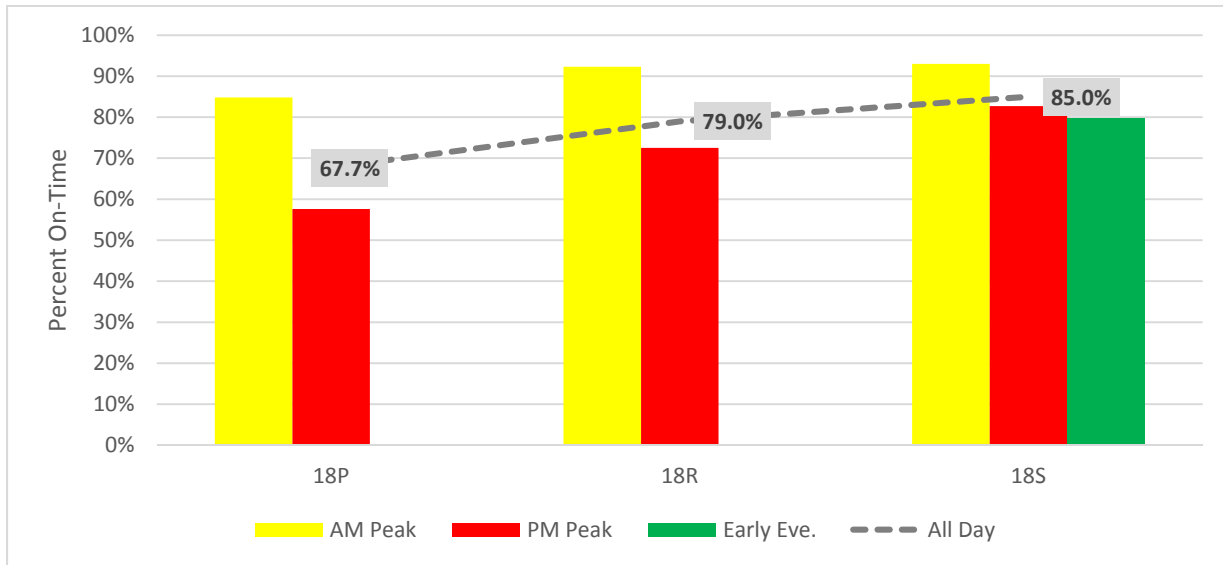
Figure 52 | On-Time Performance: Orange Hunt Line



7.1.5. Burke Centre Line: Routes 18P-18R-18S

The Route 18P achieved high on-time performance during its few early morning trips, which is not surprising given that traffic impacts are few during this period of day. In contrast, the Route 18P afternoon peak service had fewer than 60 percent of its trips arriving on-time. On average, the Route 18S arrived on-time most often over the course of the scheduled service day. Both the Routes 18R and 18S met WMATA’s minimum guideline for on-time performance over the course of the average day. **Figure 53** shows on-time performance on the Burke Centre Line routes.

Figure 53 | On-Time Performance: Burke Centre Line



7.1.6. Preliminary Findings: On-Time Performance

At the Line level, only the Springfield Line meets WMATA’s guideline for all day on-time performance. The following lines do not meet the WMATA guideline:

- Kings Park Line
- Kings Park Express Line
- Orange Hunt Line
- Burke Centre Line

7.2. RUNTIME – SCHEDULED V ACTUAL

Actual running times for the 17/18 Lines were collected during August 2014 and average running times were calculated using this data. The resulting average running time per route, per trip was compared to the scheduled running times, using the most recently published time. The results are presented in **Table 52** through **Table 67**, detailing the actual running time, the scheduled running time, and the minutes ahead or behind schedule for each trip. Additionally, trips that took longer than seven minutes beyond the scheduled runtime have been highlighted in bold.

This analysis identifies running time errors per trip for all of the 17/18 Line routes, and will assist with the creation of new running times for the recommendations that will ultimately be developed through this service evaluation study.

A summary of the average number of minutes greater (positive) or less (negative) than the scheduled run time by line is shown in **Table 50**. If a line is more than two minutes early or later than seven minutes, it is marked in **red**.

Table 50 | Scheduled v Actual Run Time Difference: 17/18 Lines

Line	Route	AM Peak Average Difference in Minutes	PM Peak Average Difference in Minutes
Kings Park Line	17A-17B-17F-17M	5.5	4.4
Kings Park Express Line	17G-17H-17K-17L	-4.6	4.8
Springfield Line	18E-18F	-1.4	0.6
Orange Hunt Line	18G-18H-18J	3.7	1.5
Burke Centre Line	18P-18R-18S	-2.6	4.0

7.2.1. Kings Park Line: Routes 17A-17B-17F-17M

Several Route 17A trips were greater than 7 minutes longer than the scheduled running time, potentially causing on-time performance issues. The 8:05 am northbound trip and the 6:50 am, 7:20 am, 7:50 am, and 2:55 pm southbound trips were all greater than 7 minutes past the scheduled runtime. Several trips, the 6:45 pm, 7:45 pm and 8:58 pm northbound trips, and 7:55 pm and 10:05 pm trips completed the trips in less than the scheduled runtime, with the 8:58 pm trip 9.4 minutes less than the scheduled runtime. **Table 51** shows the average variance from scheduled running time for Route 17A trips.

Table 51 | Scheduled v Actual Runtime: Route 17A

Start Time	Direction	Actual Runtime	Scheduled Runtime	Difference
8:05 AM	North	57.1	50	7.1
9:00 AM	North	50.5	50	0.5
4:09 PM	North	54.2	50	4.2
4:54 PM	North	55.3	50	5.3
5:39 PM	North	52.2	50	2.2
6:45 PM	North	47.5	48	(0.5)
7:45 PM	North	47.6	48	(0.4)
8:58 PM	North	40.6	50	(9.4)
6:50 AM	South	58.9	50	8.9
7:20 AM	South	57.8	50	7.8
7:50 AM	South	59.4	50	9.4
2:55 PM	South	66.7	51	15.7
7:55 PM	South	47.2	48	(0.8)

Start Time	Direction	Actual Runtime	Scheduled Runtime	Difference
9:00 PM	South	47.4	45	2.4
10:05 PM	South	43.9	45	(1.1)

All Route 17B trips for which data are available, took longer than the scheduled runtime, with the afternoon southbound trips being the worst. The maximum over the scheduled runtime was the 3:20 pm southbound trip, at 17.2 minutes greater than the scheduled run time. **Table 52** shows the average variance from scheduled running time for Route 17B trips.

Table 52 | Scheduled v Actual Runtime: Route 17B

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
8:30 AM	North	N/A	54.4	---
9:11 AM	North	58.9	55	3.9
2:20 PM	South	70.9	59	11.9
3:20 PM	South	76.2	59	17.2
7:30 PM	South	69.5	58	11.5
8:25 PM	South	69.7	58	11.7

Table 53 shows the average variance between actual running time and scheduled running time for Route 17F. The southbound 7:40 am trip ran the most over the scheduled run time at 12.9 minutes greater. The remaining trips ran at or near the scheduled running time.

Table 53 | Scheduled v Actual Runtime: Route 17F

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
3:36 PM	North	27	30	(3.0)
4:36 PM	North	30.4	30	0.4
4:56 PM	North	32.1	30	2.1
5:19 PM	North	32.2	30	2.2
5:48 PM	North	30.6	30	0.6
6:20 AM	South	26.2	26	0.2
7:00 AM	South	31.4	26	5.6
7:22 AM	South	29.2	26	3.2
7:40 AM	South	38.9	26	12.9
8:00 AM	South	N/A	26	---
8:40 AM	South	29.5	26	3.5

Table 54 shows the average variance between actual running times and scheduled running times for Route 17M. Four trips, the 6:50 am northbound trip and the 4:00 pm trip ran greater than 7 minutes more than the scheduled run time. Other trips, either no data were available, or ran at or near the scheduled running time.

Table 54 | Scheduled v Actual Runtime: Route 17M

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
6:00 AM	North	41.7	40	1.7
6:25 AM	North	41.3	40	1.3
6:50 AM	North	52.2	41	11.2
7:15 AM	North	N/A	41	---
7:40 AM	North	N/A	41	---
8:05 AM	North	N/A	36	---
4:00 PM	South	43.1	36	7.1
4:25 PM	South	41.7	36	5.7
4:50 PM	South	42.7	40	2.7
5:13 PM	South	46.8	40	6.8
5:40 PM	South	47	40	7
6:05 PM	South	45.9	37	8.9
6:30 PM	South	40.5	37	3.5
6:55 PM	South	37.5	33	4.5

7.2.2. Kings Park Express Line: Routes 17G-17H-17K-17L

Limited Route 17G northbound data are available, but indicated most trips are running faster than the scheduled running time. Several southbound trips, the 3:55 pm, 4:39 pm, 5:11 pm, 6:05 pm, and 6:25 pm trips. The remaining southbound trips ran relatively close to their scheduled runtime. **Table 55** shows the actual versus scheduled running times for Route 17G.

Table 55 | Scheduled v Actual Runtime: Route 17G

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:57 AM	North	N/A	46	---
6:23 AM	North	N/A	45	---
6:38 AM	North	45.1	52	(6.9)
6:54 AM	North	49.1	52	(2.9)
7:16 AM	North	N/A	50	---
7:43 AM	North	40.3	50	(9.7)
3:55 PM	South	62.1	50	12.1
4:18 PM	South	56.4	50	6.4
4:39 PM	South	58.6	50	8.6
4:57 PM	South	58.4	53	5.4
5:11 PM	South	60.3	53	7.3
5:27 PM	South	57.6	53	4.6
5:45 PM	South	52.2	51	1.2
6:05 PM	South	55.1	46	9.1
6:25 PM	South	57.4	46	11.4
6:46 PM	South	50.8	45	5.8

Almost all Route 17H trips ran at or close to the scheduled running time with two exceptions. The 5:20 am northbound trip ran 6.3 minutes faster than the scheduled running time, while the 4:33 pm southbound trip ran 8.4 minutes slower than the scheduled running time. **Table 56** shows the actual running time versus scheduled running times for Route 17H.

Table 56 | Scheduled v Actual Runtime: Route 17H

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:20 AM	North	42.7	49	(6.3)
5:45 AM	North	N/A	49	---
6:07 AM	North	N/A	49	---
6:25 AM	North	45.3	49	(3.7)
6:45 AM	North	N/A	50	---
7:14 AM	North	42.3	47	(4.7)
7:30 AM	North	50.2	47	3.2
7:55 AM	North	41.3	43	(1.7)
8:15 AM	North	42.9	43	(0.1)
4:05 PM	South	51.8	46	5.8
4:33 PM	South	54.4	46	8.4
4:51 PM	South	53.5	52	1.5
5:08 PM	South	53.7	52	1.7
5:25 PM	South	57.2	52	5.2
5:43 PM	South	53.4	51	2.4
5:58 PM	South	54.2	51	3.2
6:30 PM	South	47.7	46	1.7

Most Route 17K trips, both northbound and southbound ran faster than the scheduled run time with one major exception, the 6:10 pm southbound trip. This trip took 8.1 minutes greater than the scheduled run time. **Table 57** shows the actual running time versus scheduled running time for the Route 17K.

Table 57 | Scheduled v Actual Runtime: Route 17K

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
6:18 AM	North	38.3	45	(6.7)
6:30 AM	North	44.9	50	(5.1)
6:50 AM	North	48.1	50	(1.9)
7:08 AM	North	N/A	48	---
7:35 AM	North	N/A	48	---
4:26 PM	South	50.7	48	2.7
4:45 PM	South	48	53	(5)
5:03 PM	South	52.4	53	(0.6)
5:18 PM	South	56.5	53	3.5
5:33 PM	South	51	51	0

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:50 PM	South	50.8	51	(0.2)
6:10 PM	South	53.1	45	8.1
6:35 PM	South	48.1	45	3.1

All Route 17L northbound trips completed their trips faster than the scheduled running time, ranging from 4.2 minutes to 7.5 minutes less than scheduled running time. This contributed to higher on-time performance for the morning peak period. The afternoon southbound trips all ran longer than the scheduled run time, with the 4:36 pm trip running the slowest at 15.1 minutes greater than scheduled runtime. This likely contributed to the poor afternoon peak period on-time performance. **Table 58** shows the actual running time versus the scheduled running time for the Route 17L.

Table 58 | Scheduled v Actual Runtime: Route 17L

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:54 AM	North	51.8	56	(4.2)
6:24 AM	North	53.5	61	(7.5)
6:51 AM	North	54	61	(7)
7:13 AM	North	51.4	58	(6.6)
7:30 AM	North	51.1	58	(6.9)
4:36 PM	South	67.1	52	15.1
4:53 PM	South	64.3	57	7.3
5:16 PM	South	63.8	57	6.8
5:35 PM	South	62.9	60	2.9
5:57 PM	South	64.9	60	4.9
6:27 PM	South	59.9	56	3.9

7.2.3. Springfield Line: Routes 18E-18F

All Route 18E northbound trips ran faster than the scheduled runtime, which contributed to high on-time performance. Actual runtimes for southbound trips were relatively close to the scheduled running times. **Table 59** shows the average running time compared to the scheduled running time for the Route 18E.

Table 59 | Scheduled v Actual Runtime: Route 18E

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
6:00 AM	North	41.3	43	(1.7)
6:30 AM	North	46.9	48	(1.1)
7:00 AM	North	47.1	48	(0.9)
7:30 AM	North	38.8	48	(9.2)
8:00 AM	North	42.1	48	(5.9)
4:33 PM	South	49.4	44	5.4
5:00 PM	South	49.6	46	3.6

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:32 PM	South	50	51	(1.0)
6:05 PM	South	51.8	51	0.8
6:35 PM	South	48.7	42	6.7

In all Route 18F trips, the actual running times are close to the scheduled running times. This contributes to a high on-time performance, close to 90%. **Table 60** shows the average running times compared to the scheduled running times for the Route 18F.

Table 60 | Scheduled v Actual Runtime: Route 18F

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
4:50 PM	North	29.1	32	(2.9)
5:20 PM	North	27.6	29	(1.4)
5:50 PM	North	25.6	29	(3.4)
6:25 PM	North	26.7	29	(2.3)
6:25 AM	South	27.6	27	(0.6)
7:00 AM	South	28.6	27	1.6
7:30 AM	South	29.7	27	2.7
8:00 AM	South	28.8	26	2.8

7.2.4. Orange Hunt Line: Routes 18G-18H-18J

Morning Route 18G northbound trips are all relatively close to actual running times, which contributes to the higher on-time performance for the Route 18G. Only one southbound trip, the 4:15 pm ran significantly over the scheduled runtime at 9.5 minutes. Other trips, ran close or slightly late to the scheduled runtime. **Table 61** shows the actual running times and the scheduled running times for the Route 18G.

Table 61 | Scheduled v Actual Runtime: Route 18G

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:38 AM	North	N/A	43	---
6:08 AM	North	42.6	42	0.6
6:35 AM	North	43.7	45	(1.3)
7:05 AM	North	50.7	45	5.7
7:37 AM	North	43.2	43	0.2
8:11 AM	North	36.7	38	(1.3)
4:15 PM	South	48.5	39	9.5
4:45 PM	South	49.8	43	6.8
5:15 PM	South	44.6	43	1.6
5:36 PM	South	45.3	45	0.3
6:00 PM	South	46.5	45	1.5
6:30 PM	South	45.8	43	2.8

Northbound Route 18H trips varied significantly from the scheduled runtime. The 6:38 am trip average 10.8 minutes longer than the scheduled runtime, while the 7:08 am trip averages 7.5 earlier than the scheduled runtime. The afternoon southbound trips also varied, but were significantly closer to the scheduled runtime. **Table 62** shows the average runtimes and the scheduled runtimes for the Route 18H.

Table 62 | Scheduled v Actual Runtime: Route 18H

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:41 AM	North	52	49	3
6:08 AM	North	N/A	42	---
6:38 AM	North	62.8	52	10.8
7:08 AM	North	44.5	52	(7.5)
7:41 AM	North	N/A	49	---
4:00 PM	South	50.3	48	2.3
4:30 PM	South	53.4	50	3.4
5:05 PM	South	58.4	52	6.4
5:24 PM	South	51	52	(1.0)
5:48 PM	South	54.3	56	(1.7)
6:15 PM	South	58	56	2.0
6:50 PM	South	52.4	56	(3.6)

All northbound Route 18J trips averaged faster than the scheduled running time, ranging from 1.4 to 3.6 minutes faster. Southbound trips averaged much slower than scheduled running time with the 7:25 am trip 21.2 minutes later than the scheduled running time. Delayed running times contributed to poor on-time performance for the morning peak period. **Table 63** shows the average runtime and the scheduled runtime for the Route 18J.

Table 63 | Scheduled v Actual Runtime: Route 18J

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:01 PM	North	29.6	28	(1.6)
5:36 PM	North	28.6	30	(1.4)
6:02 PM	North	25.4	29	(3.6)
6:55 AM	South	37.5	28	9.5
7:25 AM	South	49.2	28	21.2
7:55 AM	South	27.6	28	(0.4)

7.2.5. Burke Centre Line: Routes 18P-18R-18S

Most eastbound Route 18P trips ran at or faster than the scheduled running time, except for the 7:56 am trip, which averaged 3.8 minutes slow. The fast trip was 7.4 minutes faster than scheduled running time. This contributed to the 100% on-time performance of the Route 18P in the morning period. Most westbound trips averaged significantly longer than the scheduled runtime, with the maximum being 13.4

minutes longer than the scheduled runtime. This contributed to the poor on-time performance in the afternoon periods. **Table 64** shows the average running times and the scheduled running times for the Route 18P.

Table 64 | Scheduled v Actual Runtime: Route 18P

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:52 AM	East	43.5	48	(4.5)
6:15 AM	East	45.6	53	(7.4)
6:49 AM	East	N/A	51	---
7:19 AM	East	45	51	(6)
7:56 AM	East	47.8	44	3.8
8:21 AM	East	N/A	44	---
3:35 PM	West	56.4	43	13.4
4:10 PM	West	53.1	46	7.1
4:40 PM	West	59.5	51	8.5
4:55 PM	West	51.6	51	0.6
5:10 PM	West	61.7	49	12.7
5:28 PM	West	58.5	51	7.5
5:40 PM	West	60.5	50	10.5
5:55 PM	West	57.4	50	7.4
6:10 PM	West	59.3	49	10.3
6:45 PM	West	50.1	49	1.1
7:20 PM	West	49.2	45	4.2

Most eastbound Route 18R trips ran at or faster than the scheduled running time, except for the 6:61 am trip, which ran slightly slower. This contributed to high on-time performance for the morning period. Westbound trips averaged similar to the scheduled time except for the 4:50 pm trip, which ran 7.5 minutes slower than the scheduled time. **Table 65** shows the average running times and the scheduled running times for the Route 18R.

Table 65 | Scheduled v Actual Runtime: Route 18R

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
6:13 AM	East	43.1	44	(0.9)
6:41 AM	East	45.9	44	1.9
7:11 AM	East	41.8	51	(9.2)
7:42 AM	East	42.7	49	(6.3)
8:15 AM	East	N/A	42	---
3:45 PM	West	45.5	40	5.5
4:20 PM	West	46.9	46	0.9
4:50 PM	West	53.5	46	7.5
5:14 PM	West	50.4	46	4.4

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:51 PM	West	46.5	45	1.5
6:28 PM	West	44.9	44	0.9
7:02 PM	West	45.3	42	3.3

Table 66 shows the average running times and the scheduled running times for the Route 18S. Almost all trip, both eastbound and westbound ran at or close to the scheduled running time. One trip, the 4:07 pm westbound trip averaged slightly higher than the scheduled running time.

Table 66 | Scheduled v Actual Runtime: Route 18S

Start Time	Direction	Average Runtime	Scheduled Runtime	Difference
5:40 AM	East	N/A	35	---
6:02 AM	East	38.7	41	(2.3)
6:30 AM	East	42.5	41	1.5
7:01 AM	East	N/A	39	---
7:31 AM	East	37.1	39	(1.9)
8:00 AM	East	37	37	0
4:07 PM	West	40.6	34	6.6
4:33 PM	West	39.2	38	1.2
5:02 PM	West	42.7	45	(2.3)
5:32 PM	West	41.5	45	(3.5)
6:11 PM	West	40.3	41	(0.7)
6:44 PM	West	39.2	39	0.2
7:22 PM	West	36.2	33	3.2
7:46 PM	West	35.2	33	2.2
8:20 PM	West	27.9	33	(5.1)

7.2.6. Preliminary Findings: Scheduled Run Time versus Actual Run Time

Based on the available data, runtimes should be adjusted in the morning periods for the following lines:

- Kings Park Express Line
- Burke Centre Lines

7.3. INTERLINING/RECOVERY TIME

Two additional service reliability measures are analyzed for each of the different lines:

- Existing Interlining.** It is noted for each variation which of the trips are currently interlined with WMATA services. Interlining can make directional routes or routes with off-clock cycle times more efficient as recovery time and deadhead time could potentially be minimized. The use of interlining could increase the utilization of WMATAs assets. Interlining with routes that have on-time performance or reliability issues could rollover problems from one route to the next without proper recovery time.
- Recovery Time.** The percentage of recovery time to revenue hours is a good indicator of the efficiency of the route. Recovery time is based on cycle time and headways. Too low of a recovery time and reliability is impacted. Too much recovery time is inefficient use of resources. As a rule of thumb, 10% recovery time is a goal recovery time. Higher recovery time may be needed for routes with more variable run-time.

7.3.1. Kings Park Line: Routes 17A-17B-17F-17M

Several trips on the Kings Park Line are interlined with the Kings Park Express Line, mostly in the morning. The 7:30 pm Route 17B trip is interlined with the Route 18P. **Table 67** summarizes the recovery hours and revenue hours for the Kings Park Line. The percent recovery time for the Kings Park Line is slightly higher than 10% at 16.7%.

Table 67 | Recovery Time: Kings Park Line

Route	Recovery Hours	Revenue Hours	Percent Recovery Time
17A	2.5	14.6	16.7%
17B	1.2	6.9	16.7%
17F	1.0	6.1	16.7%
17M	1.8	10.7	16.7%

7.3.2. Kings Park Express Line: Routes 17G-17H-17K-17L

The Kings Park Express line is interlined with the Kings Park Line and several other services, including Routes 7Y, 23B, 28A, and 29H. **Table 68** summarized the recovery hours and revenue hours for the Kings Park Express Line. The percent recovery time for the Kings Park Express Line is slightly lower than the 10% at 8.5%. This could potentially lead to propagating on-time performance and reliability issues.

Table 68 | Recovery Time: Kings Park Express Line

Route	Recovery Hours	Revenue Hours	Percent Recovery Time
17G	1.2	14.4	8.5%
17H	1.3	15.0	8.5%
17K	1.0	11.7	8.5%
17L	1.0	11.6	8.5%

7.3.3. Springfield Line: Routes 18E-18F

The Springfield Line is not interlined with other WMATA services. Increased efficiency might be possible if there are interlining opportunities. The recovery time is just over 10% at 13.3% indicating a pretty efficient cycle and recovery time, as shown in **Table 69**.

Table 69 | Recovery Time: Springfield Line

Route	Recovery Hours	Revenue Hours	Percent Recovery Time
18E	1.2	9.0	13.3%
18F	0.6	4.3	13.3%

7.3.4. Orange Hunt Line: Routes 18G-18H-18J

Only one trip, the 6:00 pm Route 18G trip is interlined with another WMATA service (Route 25C). Additional efficiency gains may be possible with interlining with additional services; however, recovery time at 12.8% of revenue hours is close to 10% indicating more efficient timing, as shown in **Table 70**.

Table 70 | Recovery Time: Orange Hunt Line

Route	Recovery Hours	Revenue Hours	Percent Recovery Time
18G	1.3	9.8	12.8%
18H	1.5	11.9	12.8%
18J	0.4	3.3	12.8%

7.3.5. Burke Centre Line: Routes 18P-18R-18S

The Burke Centre Line is interlined with several WMATA services: Routes 1A, 17H, 18H, 23A, 25A, and 29H. Performance issues with these variations could potentially impact the performance of the Burke Centre Line. **Table 71** compares the recovery time and revenue hours for the Burke Centre Line. The recovery time is slightly higher for these variations, at 14.3%

Table 71 | Recovery Time: Burke Centre Line

Route	Recovery Hours	Revenue Hours	Percent Recovery Time
18P	2.3	16.1	14.3%
18R	1.5	10.4	14.3%
18S	1.6	11.1	14.3%

7.4. TRIP INCIDENTS AND TRIPS LOST

This section describes total incidents reported from August 2014 through January 2015. The data, organized by line, is categorized by incident type (i.e., accident, maintenance, public, operations or criminal), and by how many trips were lost (rather than delayed) due to these incidents.

As shown in **Table 72**, the Springfield Line had the greatest total number of reported incidents (215 incidents), but also had the fewest number of trips lost, which indicates that the incidents reported on

the Springfield Line didn't impact the operation of the trip. When reviewing trip incidents by incident type, many (285 incidents) of the reported incidents on the 17 and 18 Lines during the analysis period were attributed to "operations issues," a category encompassing such setbacks as unavailable driver manpower as well as drivers arriving late to dispatch locations or getting lost. Criminal activity was reported in just three incidents, which represents the fewest number of reported incident types among 17 and 18 Lines' incidents. Of the 520 total incidents, just 67 of these (12.8 percent) resulted in lost trips.

Table 72 | Trip Incidents and Trips Lost: 17/18 Lines

Line	Incident Type					Total Incidents	Total Trips Lost
	Accident	Maintenance	Public	Operations	Criminal		
17A,B,F,M	3	8	6	18	0	35	13
17G,H,K,L	7	28	8	94	0	137	23
18E,F	10	50	53	99	3	215	2
18G,H,J	3	29	16	52	0	100	16
18,P,R,S	0	8	3	22	0	33	13
Total	23	123	86	285	3	520	67

7.5. BUS BUNCHING

Assuming runtime is the only impact on on-time performance, as long as the maximum minutes late is less than the average headway, bus bunching would not be expected along the corridor. In all cases the average headway is much greater than the maximum number of minutes late, so no bus bunching would be expected along the corridor. **Table 73** compares the average headway for each route to the maximum minutes later observed based on runtime.

Table 73 | Comparison of Average Headways to Runtimes: 17/18 Lines

Route	Direction	Average Headway (Minutes)		Maximum Late (Minutes)	
		AM Peak	PM Peak	AM Peak	PM Peak
17A	North	52 (2 Total Trips)	66	7.1	5.3
	South	30 (3 Total Trips)	65 (4 Total Trips)	9.4	15.7
17B	North	41 (2 Total Trips)	--	3.9	--
	South	--	64 (4 Total Trips)	--	17.2
17F	North	--	40	--	2.2
	South	33	--	12.9	--
17M	North	32	--	11.2	--
	South	--	30	--	8.9
17G	North	31	--	0	--

Route	Direction	Average Headway (Minutes)		Maximum Late (Minutes)	
		AM Peak	PM Peak	AM Peak	PM Peak
	South	--	24	--	12.1
17H	North	27	--	3.2	--
	South	--	27	--	8.4
17K	North	25	--	0	
	South	--	25	--	8
17L	North	39 Minutes	--	0	--
	South	--	33 Minutes		15.1
18E	North	30 Minutes	--	0	
	South	--	31 Minutes		6.7
18F	North	--	32 Minutes (4 Total Trips)		0
	South	32 Minutes (4 Total Trips)	--	2.8	
18G	North	38 Minutes	--	5.7	
	South	--	36 Minutes		9.5
18H	North	42 Minutes	--	10.8	
	South	--	38 Minutes		6.4
18J	North	--	30 Minutes (3 Total Trips)		21.2
	South	30 Minutes (3 Total Trips)	--	0	
18P	East	38 Minutes	--	3.8	
	West	--	25 Minutes		13.4
18R	East	42 Minutes	--	1.9	
	West	--	40 Minutes		7.5
18S	East	35 Minutes	23 Minutes	1.5	6.6
	West	18 Minutes	41 Minutes	N/A	3.2

7.6. CUSTOMER COMPLAINTS

Utilizing data from August 2014 to January 2015, **Table 74** summarizes customer complaints. Of the five 17 and 18 Lines, the most complaints (81) during this period were reported on the Kings Park Express Line. As was the case for this entire dataset, the vast majority of these complaints (83.9 percent) regarded performance; in all, 223 complaints, or 84.4 percent, dealt with performance issues. Overall, 34 total complaints (12.8 percent) regarded either safety and security or behavior.

Table 74 | Customer Complaints: 17/18 Lines

Line	Complaint Type					Total Complaints
	ADA	Behavior	Equipment	Performance	Safety/Security	
17A,B,F,M	0	2	0	13	1	16
17G,H,K,L	0	4	0	68	9	81
18E,F	0	5	1	53	3	62
18G,H,J	0	2	4	51	5	62
18P,R,S	0	2	2	38	1	43
Total	0	15	7	223	19	264