Chapter 3

Service and System Evaluation

1.0 Introduction

The purpose of this chapter is to provide a detailed and comprehensive understanding of the operations and performance of the key transit providers within the City of Alexandria as well as potential unmet transit demand both within the City and for trips between the City and other jurisdictions in the Washington region. The intent of the analysis included in this chapter is to provide a foundation for identifying the need for potential service changes and equipment requirements, including modifications to existing service as well as potential new services to meet transit demand that is not currently being met. The chapter is structured around five key analyses:

- Existing Service Analysis
- Unmet Transit Demand/Trip Flow Analysis
- Development and Redevelopment Areas
- DOT Operations and Service
- Facility and ITS Needs

The evaluations contained in this chapter rely on current DASH and WMATA Metrobus ridership and productivity data, public timetables, U.S. census data, MWCOG population and employment forecasts, and the MWCOG regional model 2015 trip table.

2.0 Existing Service Analysis – Fixed Route Transit

DASH and WMATA Metrobus each provide fixed-route bus transit within the City of Alexandria. This section contains an analysis of these two providers relative to a wide range of evaluation metrics. The first analysis contained here is a trend analysis of DASH service between Calendar Year 2009 and 2013 relative to a number of evaluation metrics (this analysis relies on National Transit Database data in order to be consistent with the peer analysis outlined in the next section. The most recent NTD data is for calendar year 2013). The second analysis involves a comparison of DASH performance to a group of peer agencies that have comparable characteristics to DASH.

2.1 DASH Trend Analysis

Table 3.1 below provides data outlining trends over the last five years for key metrics for the Alexandria Transit DASH system. The data, which is derived from data from the National Transit Database, shows generally very stable trends for each of the metrics presented.

Of note is the fairly significant increase in costs between 2011 and 2012, which also reflects an expansion of service and an increase in peak bus pull out. Annual ridership declined between the first year of the analysis, 2009, and 2011 but then began to increase again in 2012 (this increase at least partially reflects the fact that Alexandria Transit began operating the King Street Trolley in 2012), though there was a decline between 2012 and 2013.

The decrease in boardings and the increase in operating cost resulted in an increase in the cost per boarding metric, which has increased each year of the analysis. Of note is the improvement in cost recovery from fares starting in 2011, which reflects a fare increase implemented in July 2010.

Boardings per revenue hour and boardings per revenue mile, which measure how productively the service provided is utilized, dropped after 2009 as ridership declined but then remained generally stable between 2011 and 2013.

The data in the table generally shows stability in each of the metrics, which indicates a stable balance between the level of service provided and the utilization of that service by riders.

Table 3.1 – DASH Trend Analysis

Measure	Calendar Year				
	2009	2010	2011	2012	2013
Annual Operating Cost	$12,241,274	$12,177,736	$12,889,560	$13,657,919	$13,765,515
Annual Boardings	4,564,995	4,283,850	4,188,320	4,309,179	4,265,417
Peak Bus Pullout	52	52	52	61	57
Cost per Revenue Hour	$77.28	$75.19	$79.28	$79.97	$81.53
Cost Recovery from Fares	21.09%	22.19%	25.67%	26.36%	25.29%
Cost per Boarding	$2.68	$2.84	$3.08	$3.17	$3.23
Boardings per Revenue Hour	28.82	26.45	25.76	25.23	25.26
Boardings per Revenue Mile	3.16	3.04	2.94	2.89	2.89

Source: National Transit Database

2.2 DASH Peer Analysis

This section evaluates Alexandria Transit's operating and financial performance relative to a number of peer transit agencies that have characteristics that are comparable in some way to Alexandria Transit. The use of a peer comparison helps put DASH performance in context and allows for an assessment of its performance along a continuum of agencies, not simply as a discrete stand-alone performance evaluation that provides only limited perspective.

The selection of peers to compare DASH performance against was somewhat difficult because of DASH's relatively unique characteristics, including the City of Alexandria's high population density, the sharing of service within the City with WMATA Metrobus service, and the fact that DASH is a locally operated system within a larger metropolitan area. Within this context, selection of a set of perfectly comparable peers was not feasible. Rather, peers with some comparable characteristics were selected.
Criteria used in selecting the peers incorporated into this evaluation include:

- Service area characteristics, including population density.
- Peer location.
- Annual operating budget.
- Peak bus pull-out.
- Annual boardings.

Outlined below is a description of each of the peer systems selected for the analysis, including the reason for the system's inclusion in the group of peers.

Arlington Virginia (ART) – The locally operated ART system was selected for inclusion in the peer group for three key reasons. The first is its close proximity to Alexandria. The second is its great similarity in terms of service area characteristics, as evidenced by its comparable population density to Alexandria. Finally, Arlington is served both by its ART service as well as Metrobus service, in the same way as Alexandria. ART does have a smaller number of annual boardings and a smaller operating budget than the Alexandria DASH system.

Fairfax Virginia (Fairfax Connector) – The Fairfax Connector was selected based primarily on its location within Northern Virginia and the fact that the County is served by both the Connector and WMATA Metrobus.

Richmond Virginia (GRTC) – The Richmond GRTC system was selected primarily due to its location within Virginia and its size as one of the largest locally operated systems in Virginia (comparable to Alexandria as one of the largest systems in the state).

Harrisburg Pennsylvania (Capital Area Transit) – Capital Area Transit was selected for the peer group primarily because of its annual operating budget, which is comparable to Alexandria, and because of the service area characteristics. There was also a desire to include comparable peer systems that are located outside of Virginia.

Allentown Pennsylvania (LANTA) - LANTA was selected for many of the same reasons Harrisburg was selected; comparable operating budget and relatively comparable service area characteristics.

Culver City California (Culver CityBus) – Culver City was selected based on a number of similarities to Alexandria. These include service area characteristics, as evidenced especially by comparable population densities; annual operating cost; annual boardings; and the fact that the Culver City system is a locally operated system within a larger urbanized area, comparable to Alexandria.

Table 3.2 below provides a wide range of data on the Alexandria DASH system as well as its selected peers. Data is provided in five categories, each summarized below:

- Service Area Characteristics – Service area characteristics are represented by the service area population density.

- Background Data – This data category provides background data on each system in the analysis in order to provide context for the size of each system and includes annual operating cost, annual boardings, and peak bus pullout.

- Cost of Service – This category focuses on how much it costs each system in the analysis to provide service, as measured by the cost per revenue hour.

- Cost Effectiveness – This category focuses on how effectively the financial resources used to provide service are utilized, as measured by cost per passenger boarding and cost recovery from fares.

- Productivity – This category focuses on how productively the service provided to the public is actually utilized by riders, as measured by boarding per revenue hour and boarding per revenue hour.

Alexandria's performance relative to its peers in each of these categories is summarized below.

Population Density – Alexandria has the second highest population density of the peer group, at 8,748 persons per square mile, behind just Culver City California (this high population density in Alexandria was one of the reasons it was difficult to find a fully comparable set of peers). Arlington's population density is slightly lower than Alexandria, at 8,077. The two Pennsylvania systems included in the peer

group both have densities in the range of 3,600 to 3,700 while Fairfax is at approximately 2,648 and Richmond has the lowest density of the peer group at 1,980.

Annual Operating Cost – Alexandria's annual operating cost is $13,765,515. Two of the Virginia systems, Fairfax and Richmond, have the highest annual operating cost of the peer group, and are much larger than Alexandria's cost at $72,033,351 and $38,178,547 respectively. Harrisburg, Allentown, and Culver City also exceed Alexandria's operating cost but are much closer: $20,484,272 (Allentown), $18,731,308 (Culver City), and $14,248,097 (Harrisburg). The smallest annual operating budget in the peer group is Arlington at $8,706,973.

Annual Boardings – Alexandria's annual boardings are 4,265,417. The two largest systems in the peer group, Fairfax County and Richmond, have 10,650,401 and 8,032,266 annual passenger boardings respectively. Two additional systems in the peer group have higher annual boardings than Alexandria, though these boardings are much closer to Alexandria's: Culver City (5,550,045) and Allentown (4,926,294). Harrisburg and Arlington both have smaller annual boardings, at 2,674,422 and 2,644,933 respectively.

Cost of Service – Cost per Revenue Hour - The cost of service metric data in Table 3.2 represents very good news for Alexandria, which has the second lowest cost of service in the peer group ($81.53 per revenue hour), behind only Arlington ($80.21 per revenue hour). This lower cost per revenue hour means more service can be provided to Alexandria residents while maintaining reasonable budgets. The highest cost of service is in Culver City, at $126.39 per revenue hour. Of the remaining systems in the peer group, only one other system, Allentown PA, has a cost per revenue hour below $100.

Cost Effectiveness – Cost Recovery from Fares – Alexandria's low cost of service translates into the second highest cost recovery from fares in the peer group (25.33%) behind only Arlington (31.11%). A number of systems' cost recovery from fares falls just below Alexandria's, generally ranging from 21% to 25%. The lowest cost recovery from fares is in Fairfax, at 17.72%.

Cost Effectiveness – Cost per Boarding – The cost per boarding metric shows very positive news for Alexandria, with the DASH system having the lowest cost per boarding of the entire peer group ($3.23). Alexandria's performance on this metric reflects its low costs but also its relatively high ridership relative to the amount of service it provides. A close second in the peer group is Arlington, with a cost per boarding of $3.29. Culver City also has a low cost per boarding, which in this case reflects higher ridership relative to the service it provides, given its high cost of service.

Productivity – Boarding per Revenue Hour – Alexandria is second among the peer group relative to this metric (25.26 boardings per revenue hour), behind only Culver City (37.45 boardings per revenue hour). Alexandria's performance on this metric relative to the peer group shows productive use of the service it provides on a daily basis. This productive use of provided capacity tracks with its performance on the cost-effectiveness measures. Boardings per revenue hour for the remaining systems in the peer group range from a low of 17.19 (Fairfax County) to 24.37 (Arlington).

Productivity – Boardings per Revenue Mile – As with the boardings per revenue hour metric, Alexandria is second among the peer group relative to this metric (2.89 boardings per revenue mile), again behind only Culver City (3.50 boardings per revenue mile). Arlington is the only other system in the peer group that exceeds 2 boardings per revenue mile, with the remaining systems ranging between 1.12 and 1.84 boardings per revenue mile.

Alexandria has much to be happy about regarding its performance relative to the peer group included in this analysis. The data in Table 3.2 show that the Alexandria DASH system has a very healthy foundation, starting with low operating costs per revenue hour. This low operating cost per unit of service provided, supports, in turn, high cost-effectiveness, meaning a low cost relative to the number of riders who utilize the system. Alexandria's productivity, which measures the level of utilization of the service provided, tracks very closely with the cost-effectiveness measure and shows high productivity relative to the other systems in the peer group. The peer group analysis shows the Alexandria DASH system as a very healthy system, providing cost-effective and productive service to the benefit of its riders and the residents of the City of Alexandria.

Table 3.2 - Peer Analysis Data

	Population	Background Data			Cost of Service	Cost Effectiveness		Productivity	
System	Population Density (per square mile)	Annual Operating Cost	Annual Boardings	Peak Bus Pullout	Cost per Revenue Hour	Fare Recovery	Cost per Boarding	Boarding per Revenue Hour	Boarding per Revenue Mile
Alexandria	**8,748**	**$13,765,515**	**4,265,417**	**57**	**$81.53**	**25.29%**	**$3.23**	**25.26**	**2.89**
Arlington VA	8,077	$8,706,973	2,644,933	37	$80.21	31.11%	$3.29	24.37	2.30
Fairfax VA	2,648	$72,033,351	10,650,401	207	$116.25	17.72%	$6.76	17.19	1.12
Richmond VA	1,980	$38,178,547	8,032,266	128	$101.42	25.24%	$4.75	21.34	1.82
Harrisburg PA	3,675	$14,248,097	2,674,422	63	$113.72	23.48%	$5.33	21.35	1.62
Culver City CA	10,355	$18,731,308	5,550,045	43	$126.39	21.42%	$3.37	37.45	3.50
Allentown PA	3,670	$20,484,272	4,926,294	69	$92.86	21.21%	$4.16	22.33	1.84

Source: National Transit Database

2.3 Service Sufficiency

The next set of analyses involves an analysis of DASH and WMATA service relative to a range of evaluation metrics. The first set of metrics focus on service sufficiency and how well these services meet the needs of Alexandria residents, with a specific focus on the ability of a resident to conveniently use transit at different times of the day, on both weekdays and weekends, and for different trip purposes. Three metrics are considered in the service sufficiency evaluation: hours of service; service frequency; and service coverage. A summary of each of these metrics is outlined below.

2.3.1 Hours of Service

The first element of the hours of service analysis concentrates on the Alexandria Transit DASH system and the King Street Trolley. DASH operates local neighborhood service within Alexandria, connecting to neighborhoods, to Metrorail Stations and employment centers within the City including the Mark Center, Pentagon, Landmark, Old Town, and Potomac Yard. DASH operates 11 fixed routes within the City with ten providing all day weekday service between the general hours of approximately 5:00 - 6:00 AM and 10:00 - 11:00 PM. Exceptions to these general system hours include the AT7 service, which ends after the PM peak period; the AT8 service, which operates past midnight; the combined AT3/4 service which operates only in the off-peak (peak period service in the AT3/4 service area is provided by two stand –alone routes, the AT3 and AT4); and the AT2X express service, which runs in both directions but in the peak periods only.

In addition to these 11 DASH routes, the King Street Trolley begins service at 10:00 AM and operates until 10:15 PM Sunday to Wednesday and to midnight on Thursday, Friday and Saturday. Seven of the 11 DASH routes operate on Saturday and six of the 11 routes operate on Sunday. Table 3.3 summarizes the weekday, Saturday, and Sunday hours of service for all DASH bus routes operating within the City.

Table 3.3 - DASH - Hours of Service

Route	Weekday	Saturday	Sunday
King Street Trolley	10:00 AM to 10:15 PM (Mon - Wed) 10:00 AM to 12:00 AM (Thur - Fri)	10:00 AM to 12:00 AM	10:00 AM to 10:15 PM
AT 1	5:05 am to 10:42 PM	6:44 AM to 10:43 PM	8:20 AM to 7:21 PM
AT2	5:38 am to 11:04 PM	7:12 AM to 11:10 PM	7:59 AM to 7:03 PM
AT2X	6:13 AM to 9:13 AM 3:00 PM – 6:00 PM	n/a	n/a
AT3	5:32 AM to 9:57 AM; 3:30 PM to 7:44 PM	n/a	n/a
AT4	5:50 AM to 9:40 AM; 3:07 PM to 7:25 PM	n/a	n/a
AT3-4	10:26 AM to 2:26 PM; 8:18 PM to 10:07 PM	8:28 AM to 7:38 PM	9:07 AM to 6:16 PM
AT5	5:16 AM to 10:17 PM	6:43 AM to 10:52 PM	7:48 AM to 7:17 PM
AT6	5:35 AM to 10:43 PM	n/a	n/a
AT7	5:09 AM to 7:43 PM	n/a	n/a
AT8	4:54 AM to 12:15 AM	6:25 AM to 11:29 PM	6:52 AM to 11:05 PM
AT9	6:37 AM to 9:10 PM	6:52 AM to 9:52 PM	n/a
AT10	6:33 AM to 10:33 PM	7:00 AM to 10:30 PM	9:10 AM to 6:34 PM

Source: DASH Timetables – effective February 22, 2015

The data in Table 3.3 show very robust weekday hours of service on DASH service, with only two routes ending before 10:00 PM (this does not include the AT3 and AT4 and AT2X, which operate only in the peak period). This long span of service on most DASH routes means riders can use the service not only for traditional work commutes but for other trips purposes. It also means that many riders working non-traditional work shifts can utilize DASH for their work trips. Hours of service on Saturdays, for routes running on Saturday, remain robust, while Sunday span of service falls off significantly relative to weekdays and Saturday.

The King Street Trolley also has quite robust hours, especially on Thursday, Friday, and Saturday. The late start time in the morning means it is not generally available for Old Town residents who might be traditional commuters but other DASH services are available for these commuters in the morning. The hours of service reflect the key market for the Trolley, which is for tourists and visitors to Old Town.

Metrobus operates 35 fixed routes that operate at least partially within the City of Alexandria. On weekdays, 13 of these routes provide all day service while others generally run in the peak period only. Of these peak period services, some provide supplementary service to all-day services while others are peak only services and their service area has no off-peak Metrobus service. Of these all-day weekday services, six run until after midnight, four end service between 10:00 PM and 12:00 AM and three end service before 10:00 PM. All 13 weekday all-day routes begin service prior to 6:00 AM.

11 of the 35 weekday routes run on Saturday and nine run on Sunday. On Saturday and Sunday, all routes in service run all day. Six of the 11 Saturday routes run past midnight, two end service between 10:00 PM and midnight, and three end service before 10:00 PM. Six of the 11 Saturday routes begin service before 6:00 AM and five begin service after 6:00 AM. Of the nine Metrobus

routes that run on Sunday, one ends service after midnight, five end service between 10:00 PM and midnight and three end service before 10:00 PM. Of the nine Sunday services, three start service before 6:00 AM and the remainder start after 6:00 AM. More detail on Metrobus hours of service, by day of week, is provided in Table 3.4 below.

Table 3.4 - WMATA Metrobus - Hours of Service

Route	Weekday	Saturday	Sunday
7A	4:45 AM to 3:30 AM	6:49 AM to 3:30 AM	7:30 AM to 12:12 AM
7F	5:34 AM to 11:50 PM (no peak period, peak direction service - provided by 7Y)	6:17 AM to 10:27 PM	n/a
7Y	5:09 AM to 8:46 AM and 3:01 PM to 7:13 PM (peak period, peak direction service)	n/a	n/a
7B	6:12 AM to 8:31 AM and 4:32 PM to 6:57 PM (peak period, peak direction only)	na	n/a
7C	6:05 AM to 8:47 AM and 4:15 PM to 7:05 PM (peak period, peak direction only)	n/a	n/a
7W	6:25 AM to 8:33 AM and 3:55 PM to 6:50 PM (peak period, peak direction only)	n/a	n/a
7X	6:26 AM to 8:16 AM and 4:15 PM to 6:35 PM (peak period, peak direction only)	n/a	n/a
7H	2 AM, 2 PM trips - reverse peak direction	n/a	n/a
7P	6:14 AM to 8:47 AM and 4:03 PM to 6:03 PM	n/a	n/a
7M	5:40 AM to 6:46 PM	n/a	n/a
8S	6:27 AM to 8:15 AM and 4:15 PM to 6:02 PM (peak period, reverse peak direction service)	n/a	n/a
8W	6:09 AM to 8:54 AM and 3:55 PM to 8:24 PM (peak period, peak direction)	n/a	n/a
8Z	5:35 AM to 8:32 AM and 3:40 PM to 8:00 PM	n/a	n/a
9A	4:30 AM to 1:37 AM	5:24 AM to 1:30 AM	5:00 AM to 12:35 AM
10A	4:37 AM to 12:35 AM (does not run in the peak period peak direction - service is replaced by 10E during that time and direction)	5:17 AM to 12:40 AM	6:15 AM to 10:50 PM
10B	4:52 AM to 1:00 AM	5:37 AM to 1:00 AM	6:45 AM to 11:00 PM
10E	6:02 AM to 8:20 AM and 4:14 PM to 6:31 PM (service is peak period, peak direction service only, replacing the 10A during that time)	n/a	n/a
10R	6:00 AM to 8:00 AM and 4:15 PM to 6:13 PM (service is peak period, peak direction service only - provides bus connections to Rosslyn to mitigate decreased Blue Line headways)	n/a	n/a

Route	Weekday	Saturday	Sunday
10S	6:50 AM to 7:50 AM and 4:48 PM to 5:48 PM (reverse peak service between Rosslyn and Potomac Yard - Blue Line mitigation	n/a	n/a
11Y	6:40 AM to 7:45 AM and 4:10 PM to 6:15 PM (peak period, peak direction)	n/a	n/a
21A	6:00 AM to 8:37 AM and 4:00 PM to 7:20 PM (peak period, peak direction	n/a	n/a
21D	Three AM trips and three PM trips (peak period, peak direction)	n/a	n/a
25A	5:50 AM to 8:48 AM and 3:15 PM to 10:41 PM (AM peak, PM peak, and evening	7:40 AM to 8:42 PM	8:04 AM to 8:40 PM
25B	6:00 AM to 9:30 PM	6:10 AM to 8:10 AM	n/a
25C	5:54 AM to 8:44 AM and 4:58 PM to 8:15 PM (AM peak eastbound and PM peak westbound	n/a	n/a
25D	6:18 AM to 8:05 AM and 4:42 PM to 7:38 PM (AM peak westbound and PM peak eastbound)	n/a	n/a
25E	8:43 AM to 2:45 PM (Midday, both directions)	n/a	n/a
28A	5:09 AM to 12:40 AM	5:50 AM to 12:45 AM	5:50 AM to 11:30 PM
28F	5:47 AM to 8:32 AM and 2:45 PM to 6:32 PM (Southbound in AM Peak and Northbound in PM peak)	n/a	n/a
28G	6:02 AM to 8:50 AM and 3:45 PM to 6:55 PM (Northbound in the AM peak and Southbound in the PM peak)	n/a	n/a
28X	5:14 AM to 6:25 PM	n/a	n/a
29K	5:40 AM to 10:40 PM	n/a	n/a
29N	5:30 AM to 10:10 PM	6:10 AM to 9:20 PM	6:10 PM to 9:20 PM
Rex	5:08 AM to 10:57 PM	4:48 AM to 10:03 PM	4:50 AM to 9:10 PM
Metroway	5:30 AM to 12:00 AM	6:30 AM to 12:00 AM	7:30 AM to 10:00 PM

Source: Metrobus Timetables

The data in Table 3.4 show some very robust service spans on some routes, while other routes have much less extensive spans. Service spans fall fairly significantly on Saturdays and Sundays.

2.3.2 Service Frequency

One of the greatest indicators of the convenience of a transit service is whether a person can arrive at a stop without a timetable and be confident that a bus will arrive within a reasonable amount of time. The more infrequent a service, as measured by the time between buses, the less convenient it becomes. This convenience, in turn, dictates the types of riders who utilize a service, with the greater the convenience, the greater the attractiveness of the service to people who have other transportation options. Table 3.5 summarizes the weekday, Saturday, and Sunday service frequency for all DASH bus routes.

Table 3.5 - DASH Service Frequency

Route	Weekday Peak	Weekday Mid-day	Saturday All Day	Sunday All Day
King Street Trolley	15	15	15	15
AT 1	30	30	30	60
AT2	30	30	60	60
AT2X	15 (avg.)	n/a	n/a	n/a
AT3	20	n/a	n/a	n/a
AT4	20	n/a	n/a	n/a
AT3-4	n/a	60	60	60
AT5	20	30	30	60
AT6	15	30	n/a	n/a
AT7	30	60	n/a	n/a
AT8	10	30	30	30
AT9	30	30	60	n/a
AT10	30	30	30	60

Source: DASH Timetables

The 10-minute weekday peak period frequencies on the AT2 and the AT8 would support random arrival at a stop but the frequencies on the other routes would not support this type of random arrival. 15 minute service on additional routes provides a fairly high level of convenience, especially during the mid-day but the 30 and 60 minute headways on other routes and on weekends provides a basic service that does not provide a high level of convenience. Of note is that DASH is focused on improving service frequencies as part of an initiative to make DASH service levels more in line with the urban nature of Alexandria (more detail is provided in Chapter 4 of the TDP).

Metrobus routes within Alexandria generally run irregular service frequencies that are demand-based and operate between 10 and 60 minutes during the weekday peak periods and 20 to 60 minutes during the off-peak and weekends. The exception is the Metroway Bus Rapid Transit (BRT) service on Route 1 which operates on 12 minutes throughout the day within Alexandria on weekdays and 20 minutes on weekends. Table 3.6 summarizes the average weekday, Saturday, and Sunday service frequency for all Metrobus routes operating within the City.

Table 3.6 -WMATA Metrobus – Service Frequency

Route	Weekday Peak	Weekday Mid-day	Saturday All Day	Sunday All Day
7A	20-30	40	60	40
7F	55-60	40	60	n/a
7Y	10 (7AM to 8 AM)	n/a	n/a	n/a
7B	30	n/a	n/a	n/a
7C	30	n/a	n/a	n/a
7W	15-20	n/a	n/a	n/a
7X	15-20	n/a	n/a	n/a
7H	2 trips in each peak period	n/a	n/a	n/a
7P	20 - 30	n/a	n/a	n/a
7M	10	15	n/a	n/a
8S	30	n/a	n/a	n/a
8W	15 to 30	n/a	n/a	n/a
8Z	15 to 30	n/a	n/a	n/a
9A	30	30	30	40
10A	30	30	30	60
10B	30	30	30	60
10E	15 minutes	n/a	n/a	n/a
10R	30 minutes	n/a	n/a	n/a
10S	30 minutes	n/a	n/a	n/a
11Y	12 to 20	n/a	n/a	n/a
21A	20 to 30	n/a	n/a	n/a
21D	Three AM trips and three PM trips (peak period, peak direction)	n/a	n/a	n/a
25A	30-60	n/a	60-65	60
25B	20-30	60	60	n/a
25C	15-20	n/a	n/a	n/a
25D	20-30	n/a	n/a	n/a
25E	n/a	60	n/a	n/a
28A	30	20	20	30
28F	20 to 30	n/a	n/a	n/a
28G	20-30	n/a	n/a	n/a
28X	15	n/a	n/a	n/a
29K	60-70	60-70	n/a	n/a
29N	60	60	60	60
Rex	10-20	30	30	60
Metroway	12	12	20	20

Source: Metrobus Timetables

The data in Table 3.6 shows generally infrequent service on Metrobus services that run at least partially within Alexandria, especially on weekends. It should be noted that some of these services (such as the 10A and 10B) run together along a trunk portion of the routes to provide a higher combined service frequency but that is not the case in all instances. Where this combined service does occur, the trunk portion of the combined routes may receive high quality service but the outer edges of the route often receive an inadequate level of service.

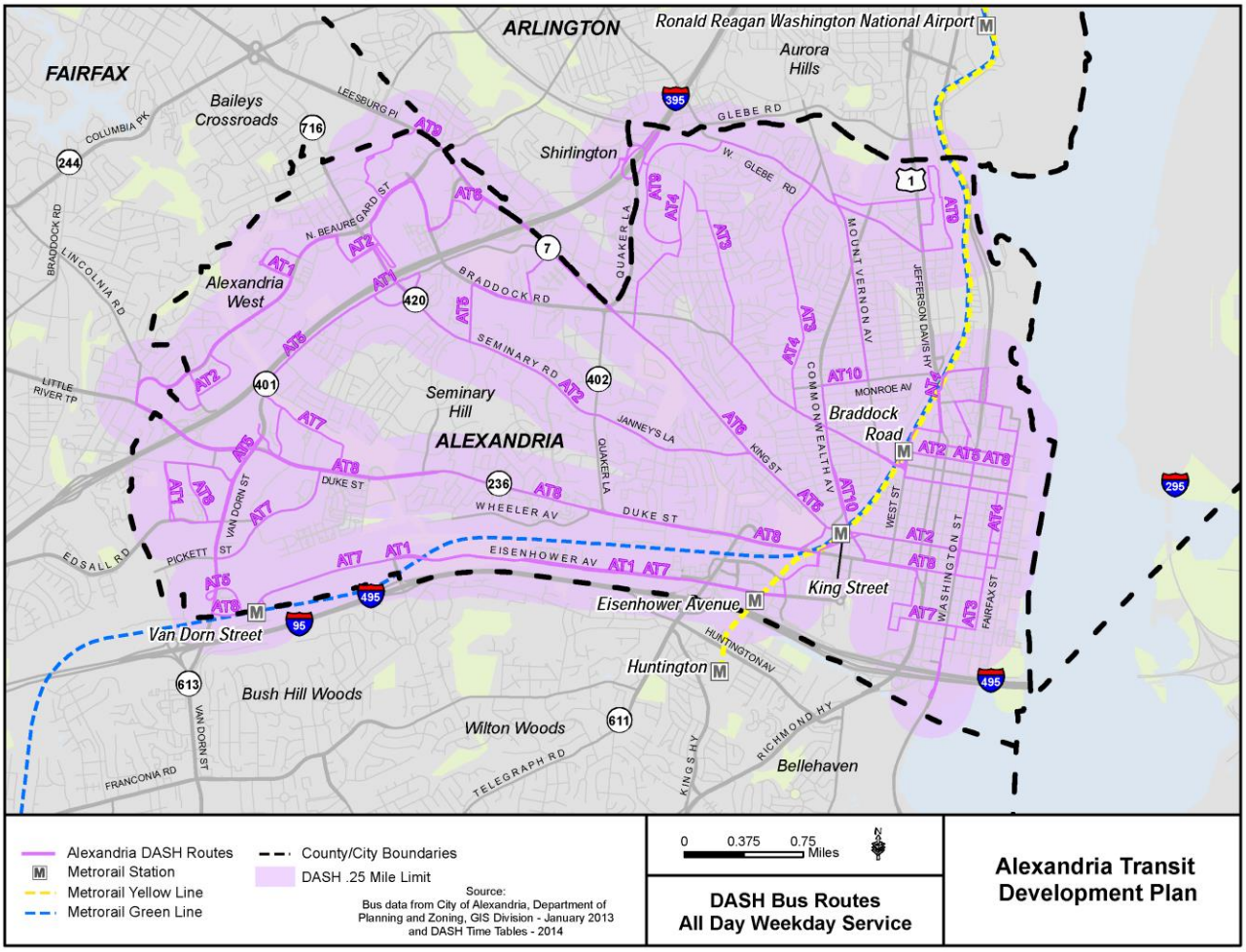
2.3.3 Service Coverage

The fixed-route bus routes service coverage analysis contained in this section identifies the geographic areas within the City of Alexandria that are served by transit as well as areas that are lacking coverage. The analysis takes into account the service coverage by time period (if there is a difference in the number of routes providing service different periods of the day), weekday and weekend, and by transit provider (DASH and Metrobus). The following map series depicts transit service coverage during the weekday peak, weekday mid-day, and the weekend (Saturday and Sunday).

The evaluation of coverage is based on a ¼ mile buffer around each route. This ¼ mile buffer represents the typical distance most riders will walk to access transit.

The first service coverage map is shown in Figure 3.1 and represents DASH weekday service coverage. This map covers the entire day since all DASH routes run throughout the day (unlike WMATA service, where many routes are peak period only).

Figure 3.1 – DASH Service Coverage – All Day Weekday

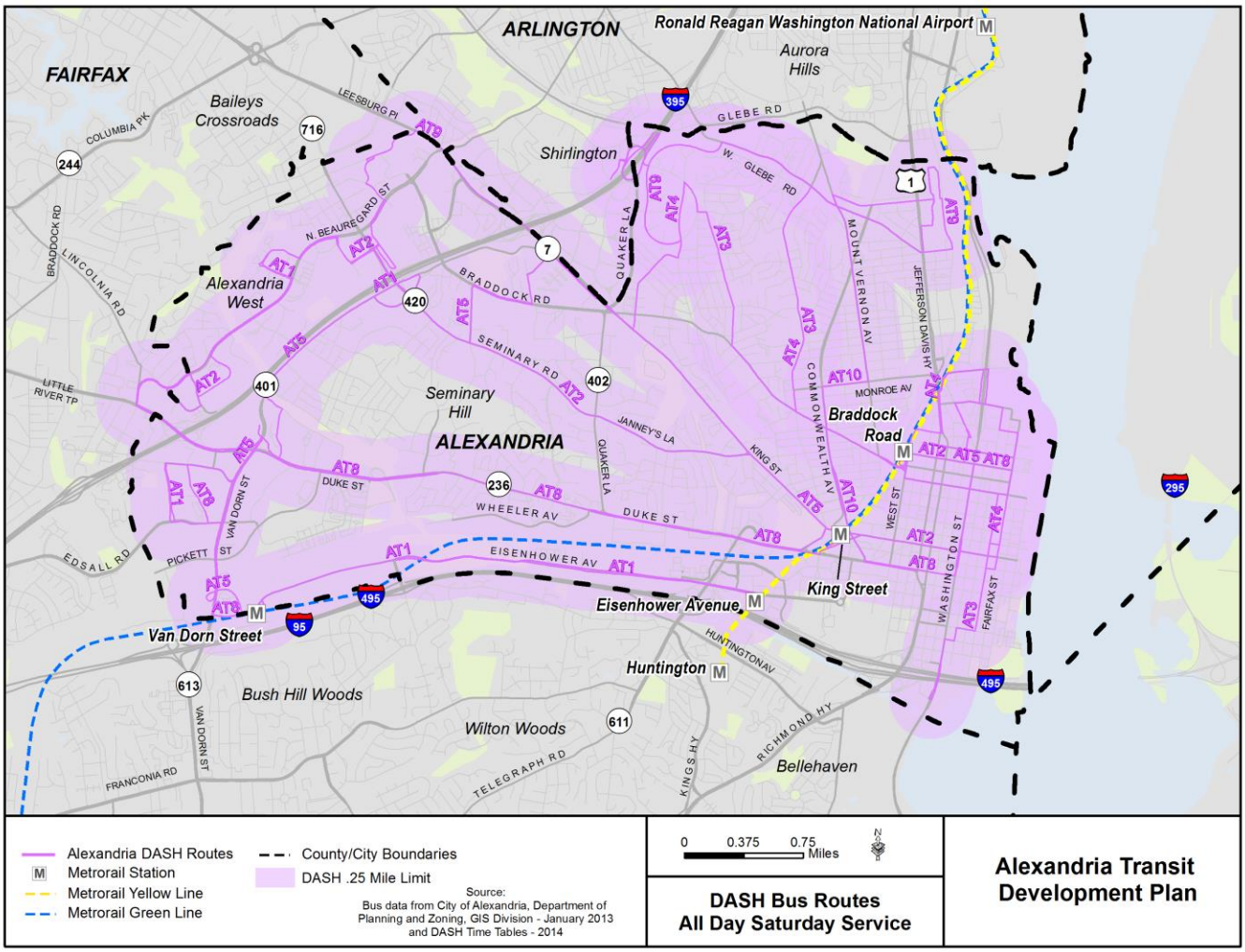


Source: DASH Geographic Information System DATA

This map shows nearly the entire city is covered by some form of DASH service, but with three specific areas not covered. The first area not covered is in the Seminary Hill neighborhood between Seminary Road and Duke Street. This gap reflects the fact that DASH services are generally focused in an east/west direction on Seminary and Duke, running toward Old Town. The second coverage gap is north of Braddock Road and south of Potomac Yard. This reflects the fact that service that runs north from Old Town does not run north of Braddock Road but rather terminates at the Braddock Road Metrorail Station. The final area where there is a small gap in service is in the Eisenhower East area, reflecting the fact that the Eisenhower Avenue services leave the corridor to access the King Street Metrorail station.

Figure 3.2 contains a map showing DASH Saturday coverage.

Figure 3.2 – DASH Service Coverage – Saturday

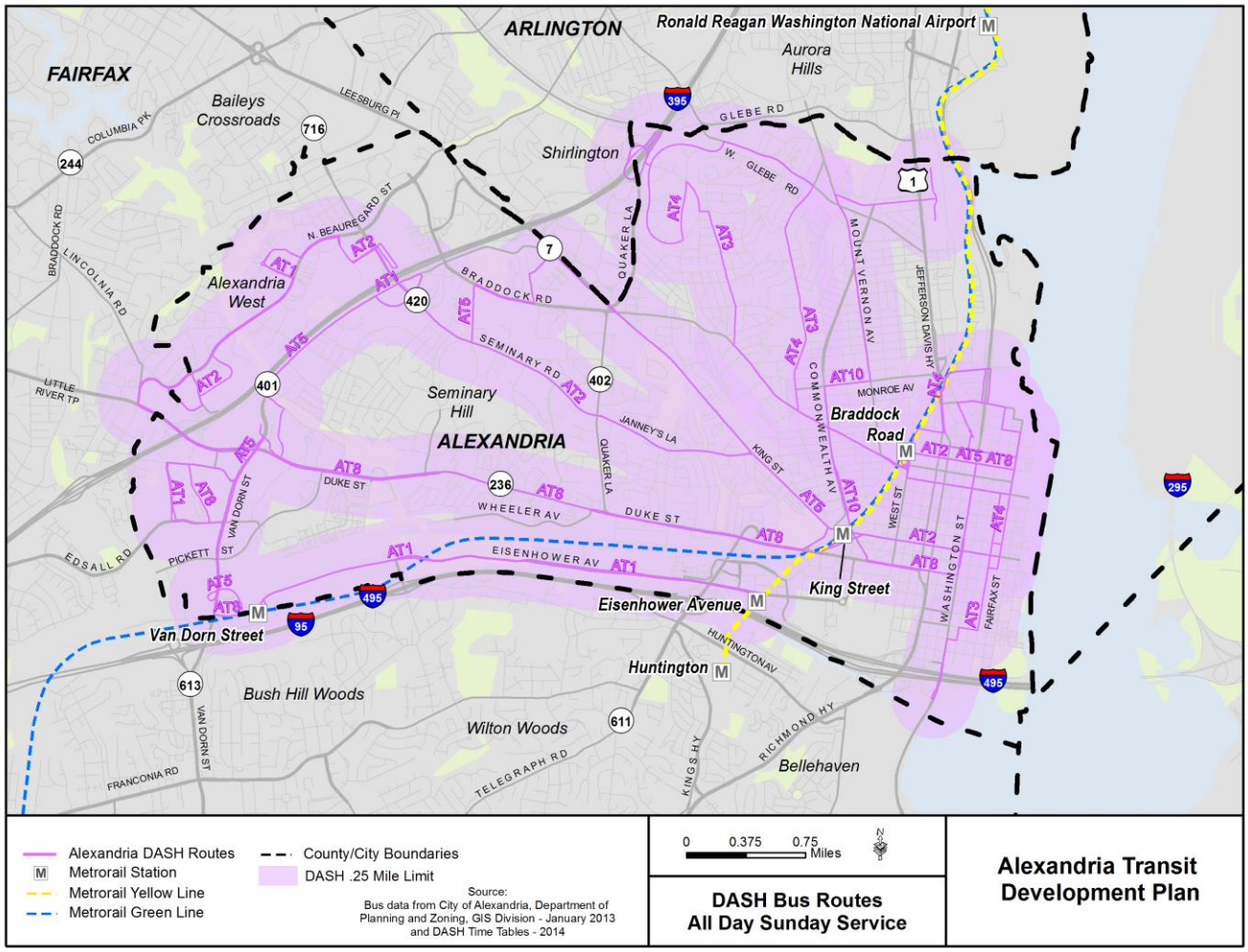


Source: DASH Geographic Information System DATA

The first area of the City with DASH service coverage on weekdays that does not have it on Saturdays is in the southeastern portion of the City, approximately between the Capital Beltway and Eisenhower Avenue. On weekdays, this area is covered by the AT3 and the AT7, neither of which run on Saturdays. The second area that is not covered is in the southwest portion of the City, along S. Pickett Street. This area is covered by the AT7, which, as noted, does not run on Saturday.

Figure 3.3 contains a map showing DASH Sunday coverage.

Figure 3.3 – DASH Service Coverage - Sunday

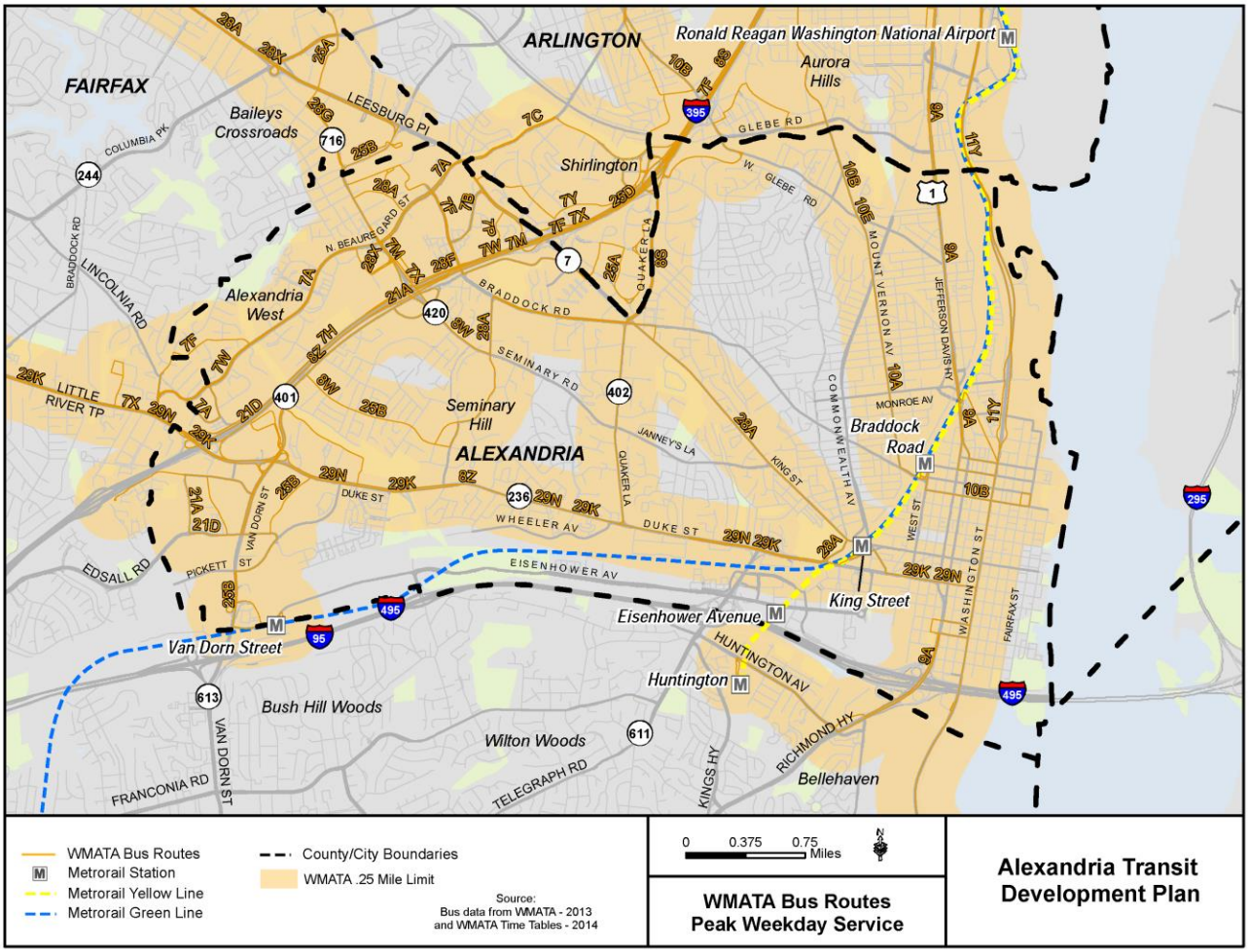


Source: DASH Geographic Information System Data

Two additional areas of the City that are served by DASH on weekdays and Saturdays are not served on Sunday. The first is in the area between Braddock Road and the southern border of Potomac Yards. The portion of this area that is not served on weekdays grows on Sundays due to the fact that the AT9, which runs into Potomac Yard on W. Glebe Road, does not run on Sundays. The other portion of the City that loses DASH service coverage on Sundays is the northwestern most portion of the City, which is also served by the AT9.

Figure 3.4 contains a map showing Metrobus weekday peak period service coverage.

Figure 3.4 – WMATA Metrobus Weekday Peak Period Service Coverage

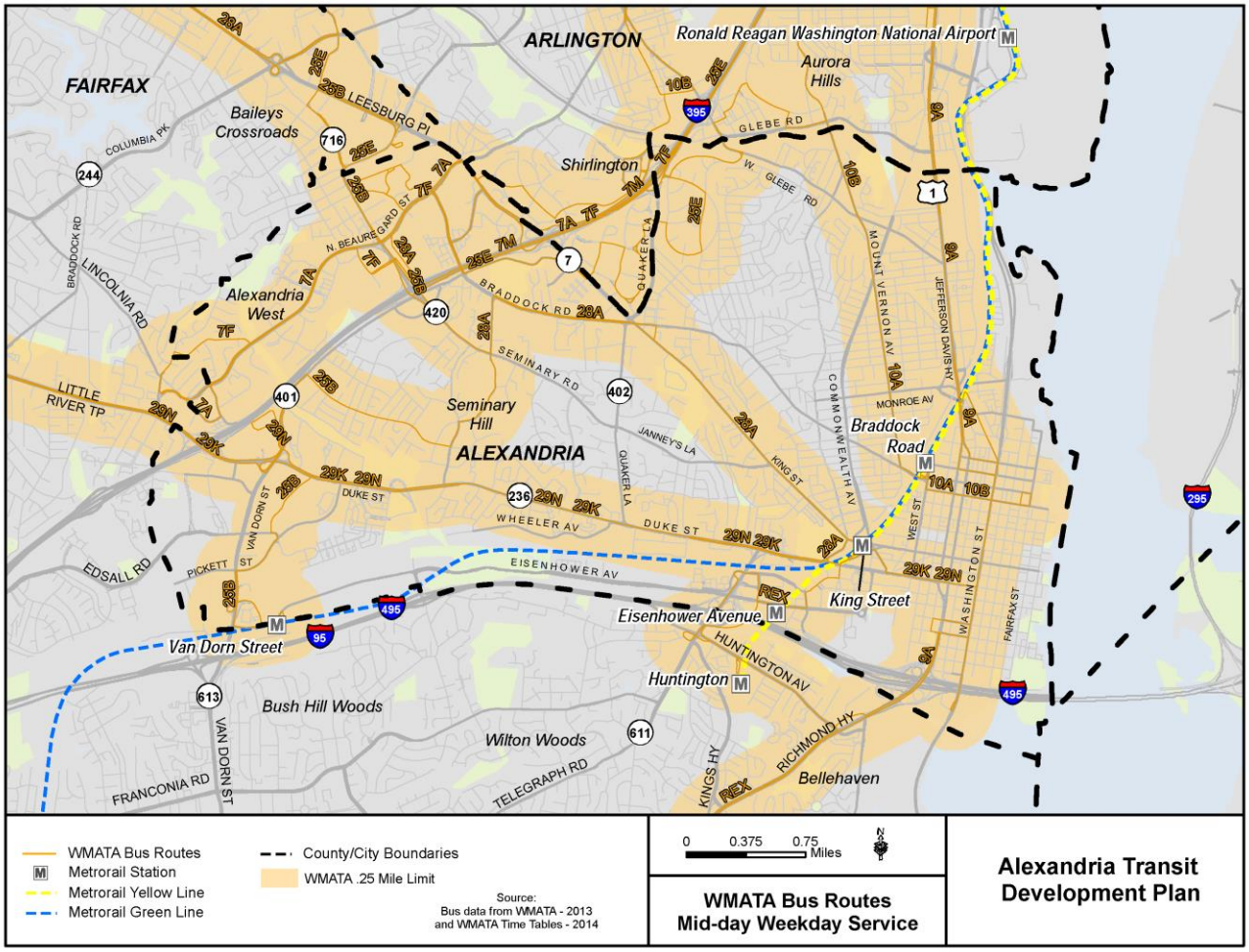


Source: WMATA Geographic Information System DATA

The first section of the City not covered by peak period Metrobus service is along the Eisenhower corridor. There also three areas in the central part of the City between Seminary Road and Duke Street. Finally, there is a large section of the City approximately north of King Street, west of Commonwealth Avenue, and east of Quaker Lane that is not served by Metrobus.

Figure 3.5 contains a map showing Metrobus weekday mid-day service coverage.

Figure 3.5 – WMATA Metrobus Weekday Peak Midday Service Coverage

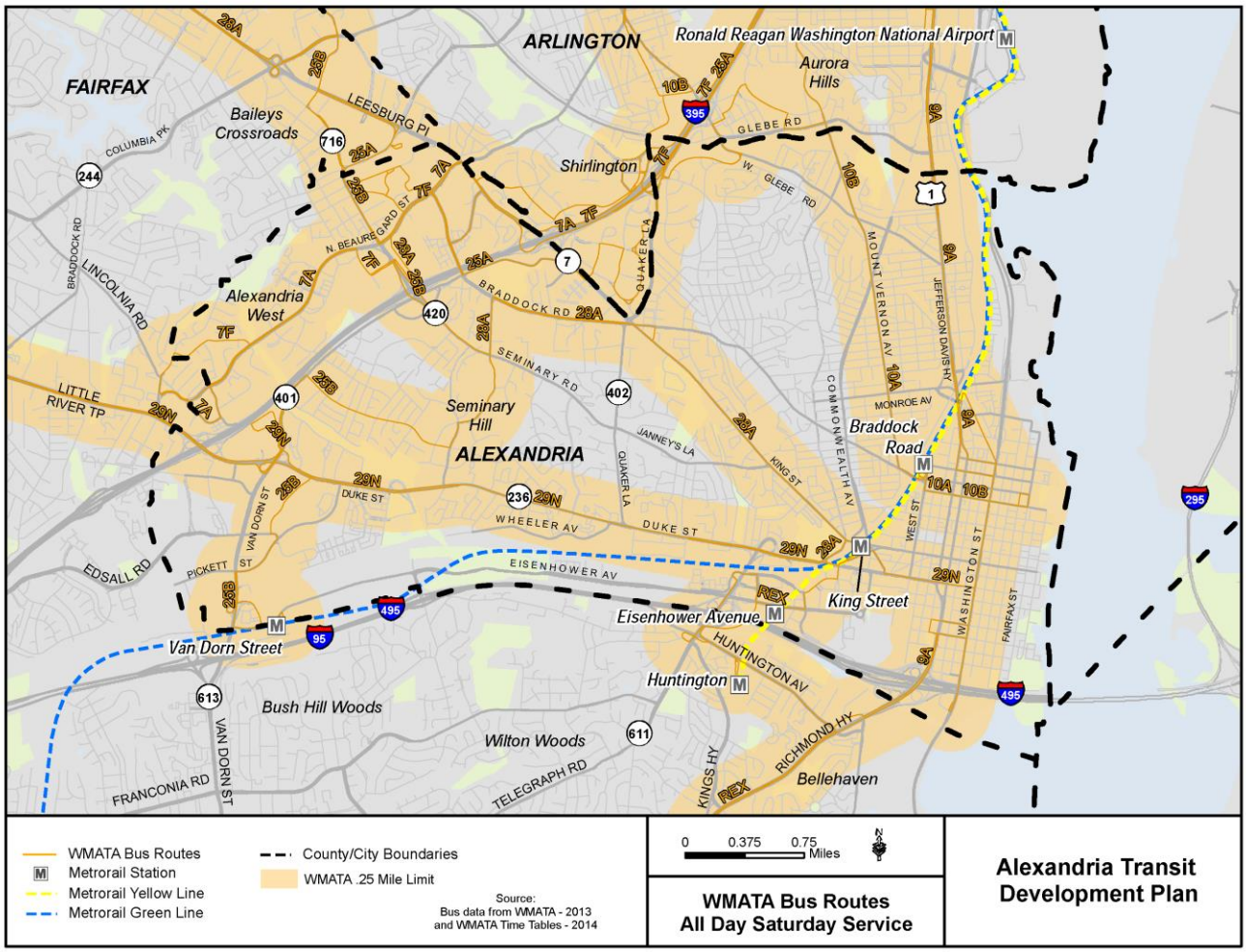


Source: WMATA Geographic Information System DATA

Because many of the Metrobus services within the City are peak period services only, the midday portions of the City not covered by Metrobus grow relative to the peak period. This includes a greater portion of the center of the City between approximately Seminary Road and Duke Street. It also includes a small increase in the size of the area between Commonwealth Avenue and Quaker Lane that is not covered during the peak period.

Figure 3.6 contains a map showing Metrobus Saturday service coverage.

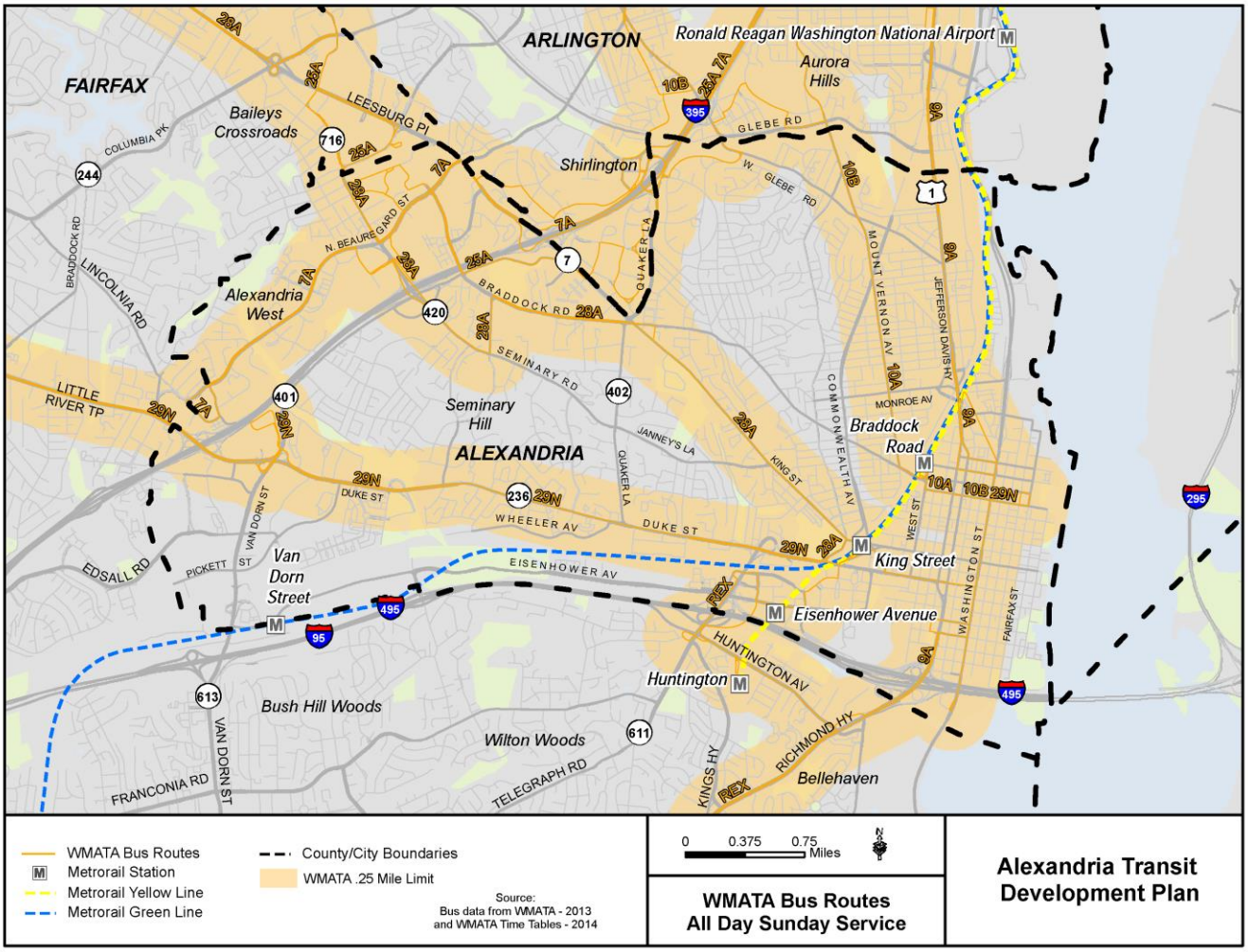
Figure 3.6 – WMATA Metrobus Saturday Service Coverage



Source: WMATA Geographic Information System DATA

The Saturday coverage map generally corresponds to the weekday Midday service coverage. This reflects the fact that core services run all day on weekdays and on Saturdays while supplemental service runs only in the weekday peak period.

Figure 3.7 – WMATA Metrobus Sunday Service Coverage

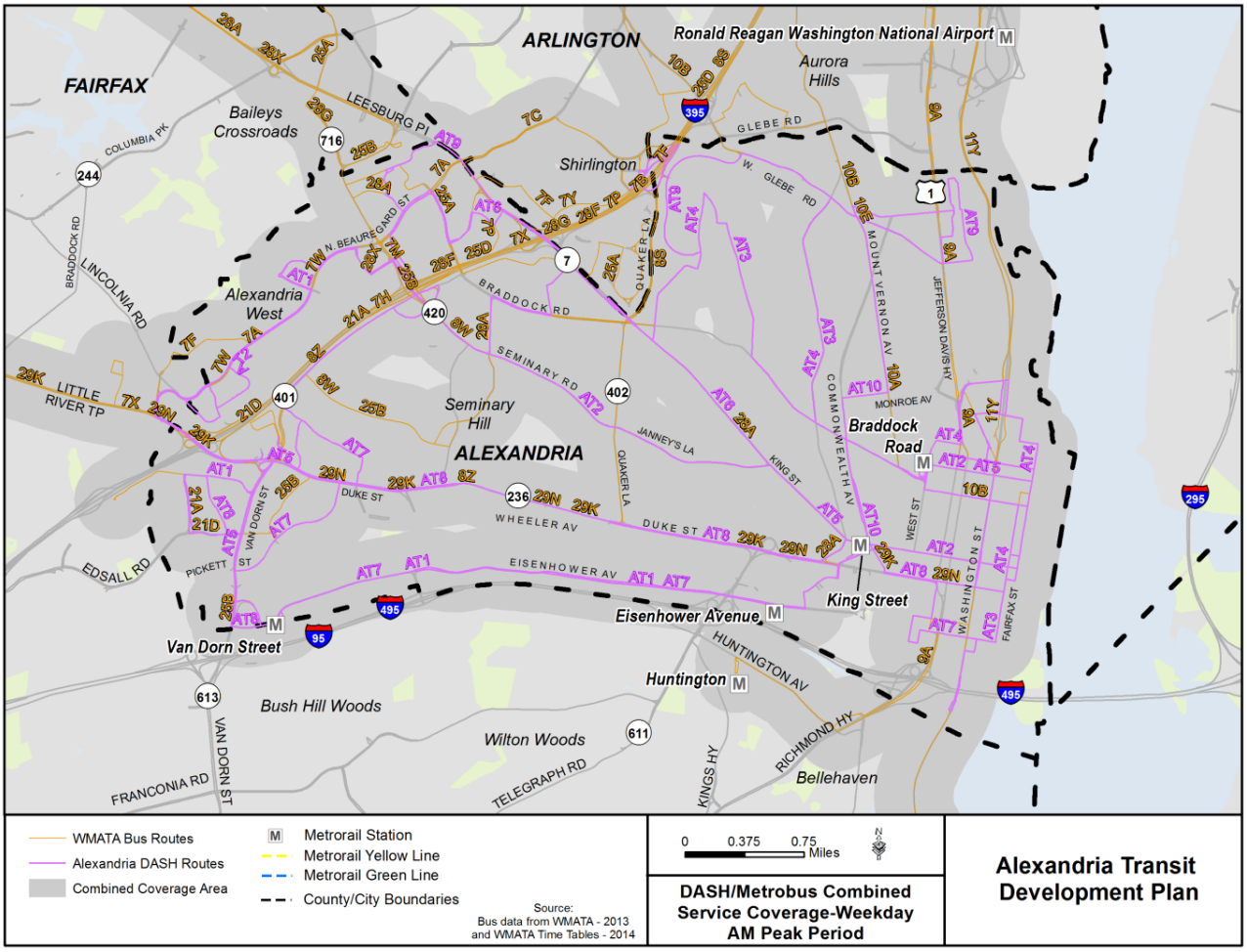


Source: WMATA Geographic Information System DATA

Sunday Metrobus service coverage patterns generally reflect those on Saturday and midday weekdays but the portion of the central portion of the City increases as does the portion along the Eisenhower corridor, especially relative to the far southwestern portion of the City straddling Van Dorn Street.

Figure 3.8 shows weekday peak service coverage for the combined DASH and Metrobus services within the City.

Figure 3.8 – DASH and Metrobus Weekday Peak Service Coverage

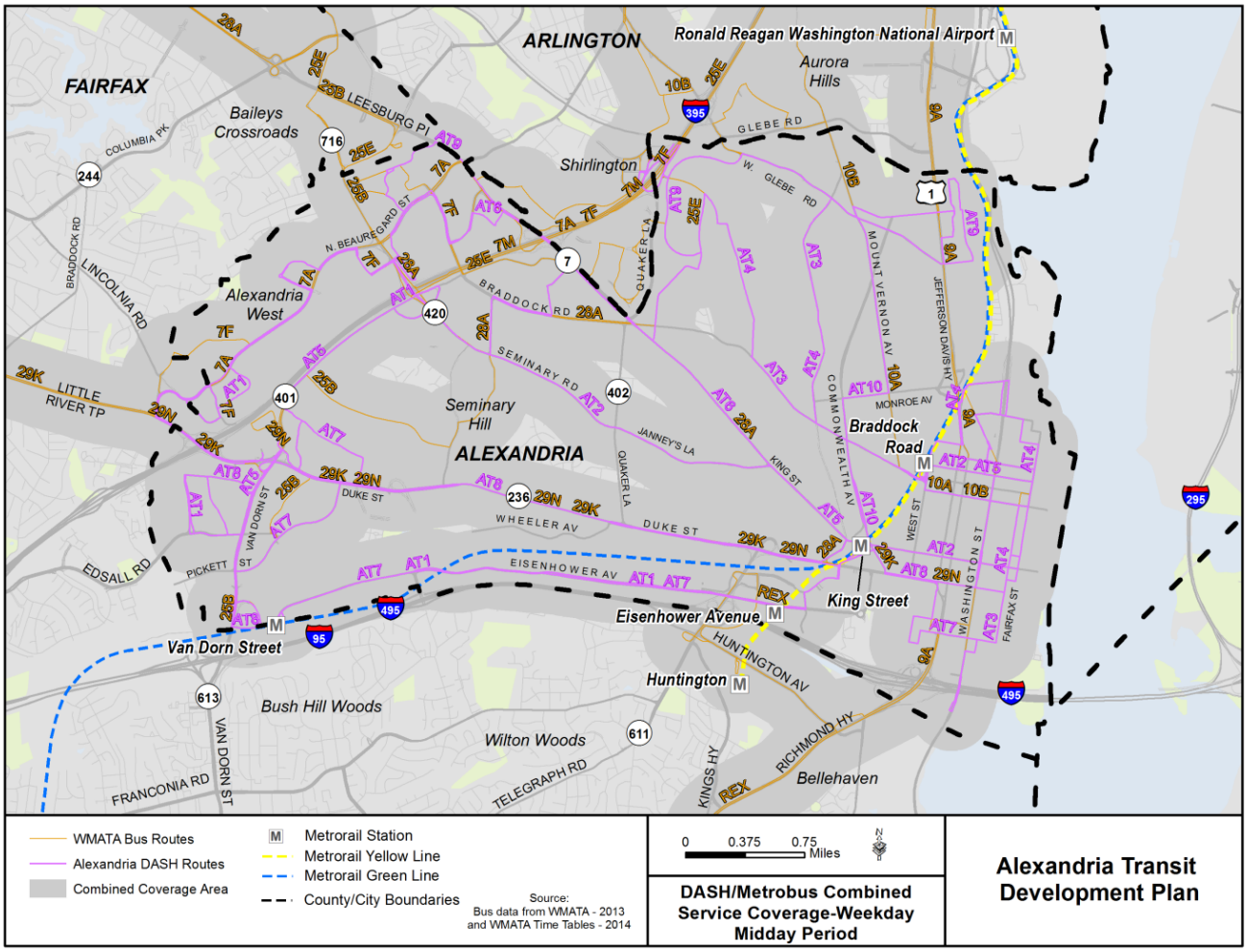


Source: DASH and WMATA Geographic Information System DATA

Combined weekday peak period Metrobus and DASH service coverage show a few minor gaps in service coverage throughout the City. This includes the Eisenhower East area, and in the center of the City between Seminary Road and Duke Street (Seminary Hill). Overall the combined services show that nearly all Alexandria residents are within walking distance of bus service during the peak periods on weekdays.

Figure3.9 shows weekday mid-day service coverage for the combined DASH and Metrobus services within the City.

Figure 3.9 – DASH and Metrobus Weekday Midday Service Coverage

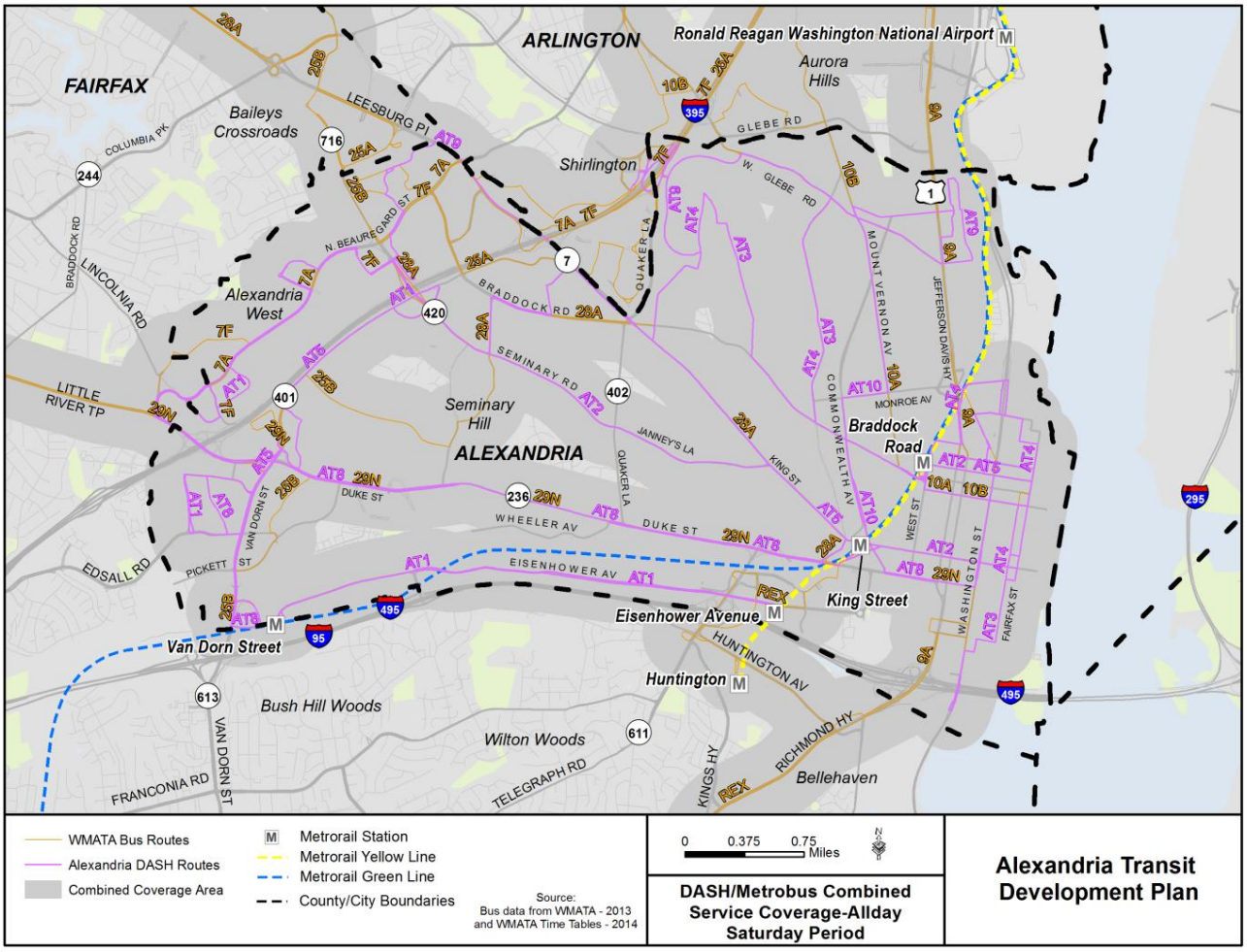


Source: DASH and WMATA Geographic Information System DATA

Combined weekday midday Metrobus and DASH service coverage generally track service coverage in the weekday peak period with the exception of a small expansion of unserved areas between Seminary Road and Duke Street and a small uncovered area north of Seminary Road along Quaker Lane.

Figure 3.10 shows Saturday all day service coverage for the combined DASH and Metrobus services within the City.

Figure 3.10 – DASH and Metrobus Saturday Service Coverage

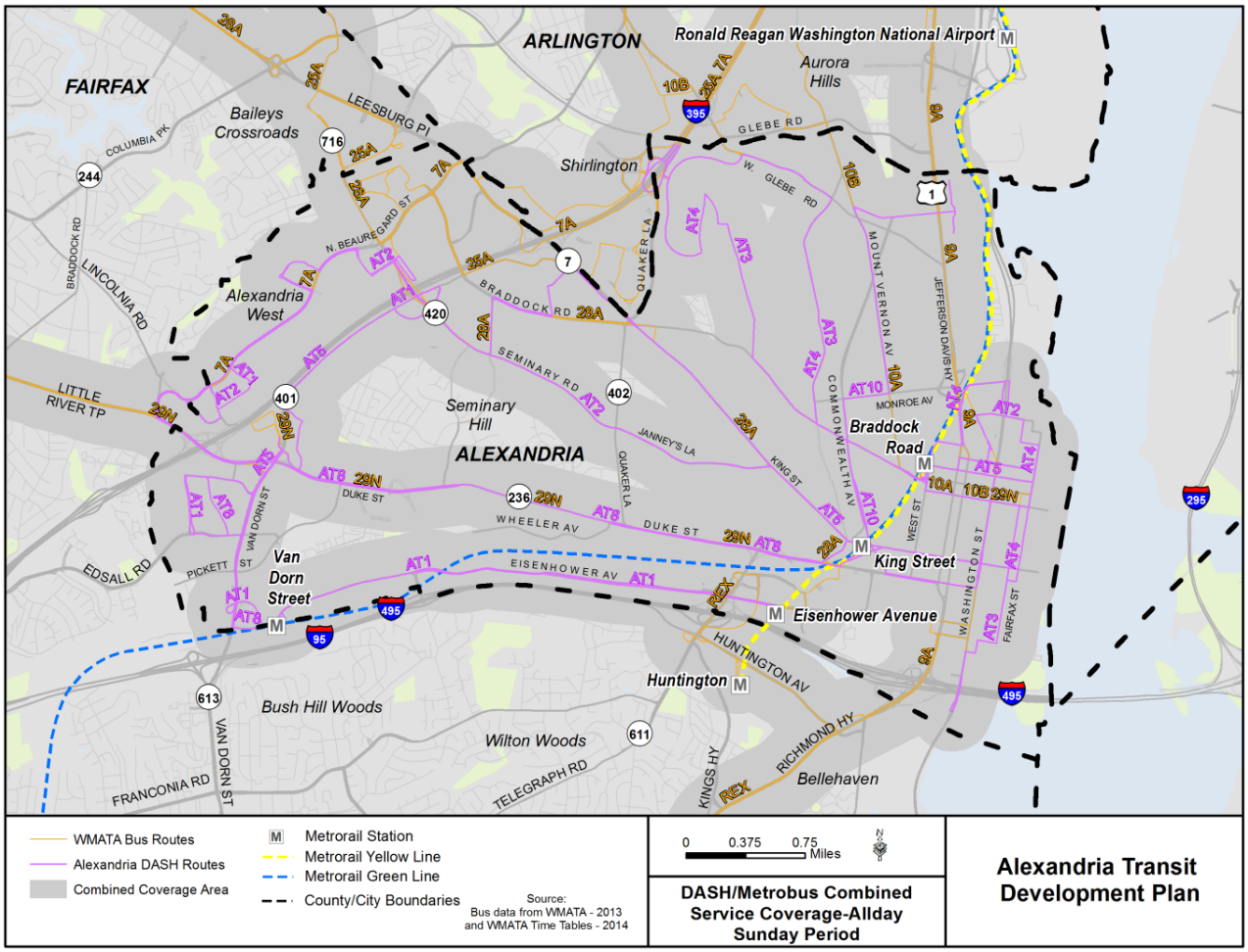


Source: DASH and WMATA Geographic Information System DATA

Portions of the City that are not covered by combined DASH and Metrobus services on Saturday include those areas not covered in the midday on weekdays as well as the area just north of Old Town North. Saturday combined service coverage is still quite extensive.

Figure 3.11 shows Sunday all day service coverage for the combined DASH and Metrobus services within the City.

Figure 3.11 – DASH and Metrobus Sunday Service Coverage



Source: DASH and WMATA Geographic Information System DATA

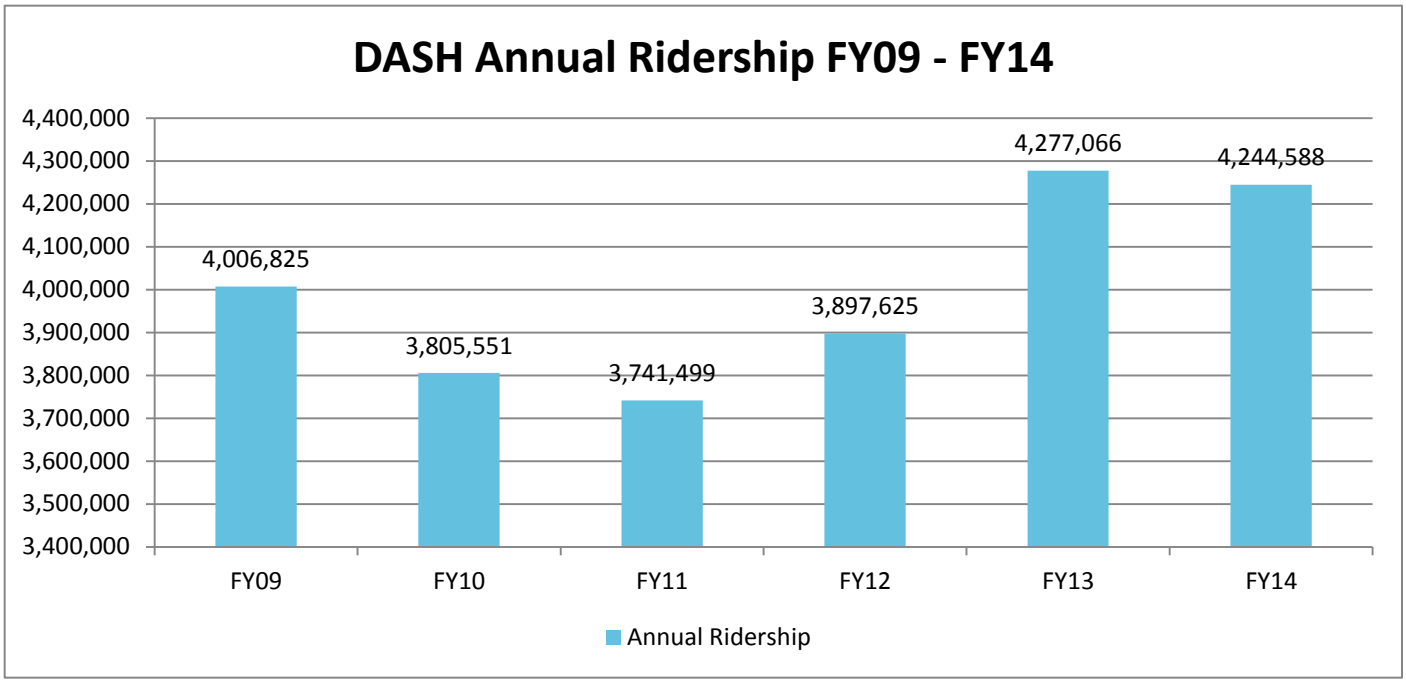
Areas of Alexandria not covered on Sunday by either DASH or WMATA include a larger area between Seminary Road and Duke Street in the Center of the City, north of Old Town, in Eisenhower East, and in the area north of the Van Dorn Metrorail Station,

2.4 Service Evaluation

2.4.1 Ridership

The first metric considered as part of the fixed route service evaluation is ridership. Outlined first is ridership data for DASH service and then following the DASH analysis is ridership data for Metrobus service within the City. Provided first in Figure 3.12 is a graphic showing ridership trends for the DASH system over the last six fiscal years.

Figure 3.12 - DASH Annual Ridership Trends – Last Five Years

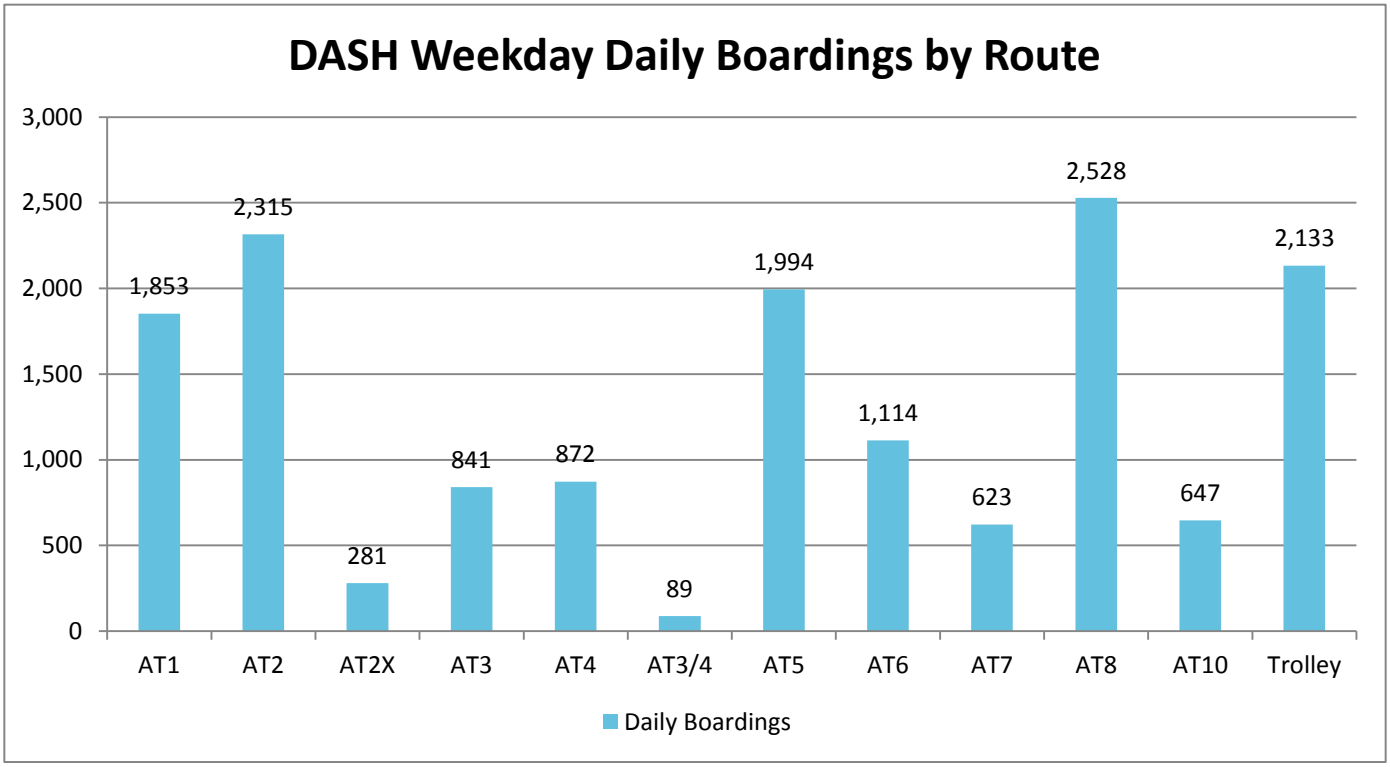


Source: DASH FY 2016 Draft Transit Development Program
Note: Annual Ridership after FY 2012 includes the King Street Trolley, which DASH assumed operation of in FY 2012

The data in Figure 3.12 shows a decline in annual ridership to a low point in FY11 but then an increase reflecting the assumption of King Street Trolley service at the beginning of FY12. There was a slight decline in annual ridership between FY13 and FY14.

Provided below in Figure 3.13 is a graphic showing DASH daily weekday ridership by route based on the On-Board Ridecheck completed in 2014.

Figure 3.13 - DASH Daily Weekday Ridership by Route



Source: DASH Comprehensive Operations Analysis (2014)

Note: The Trolley and AT2X data was not collected as part of the Comprehensive Operations Analysis. The ridership data for these routes is from the FY 2016 Alexandria Transit Development Program and represents ridership data for FY 2013

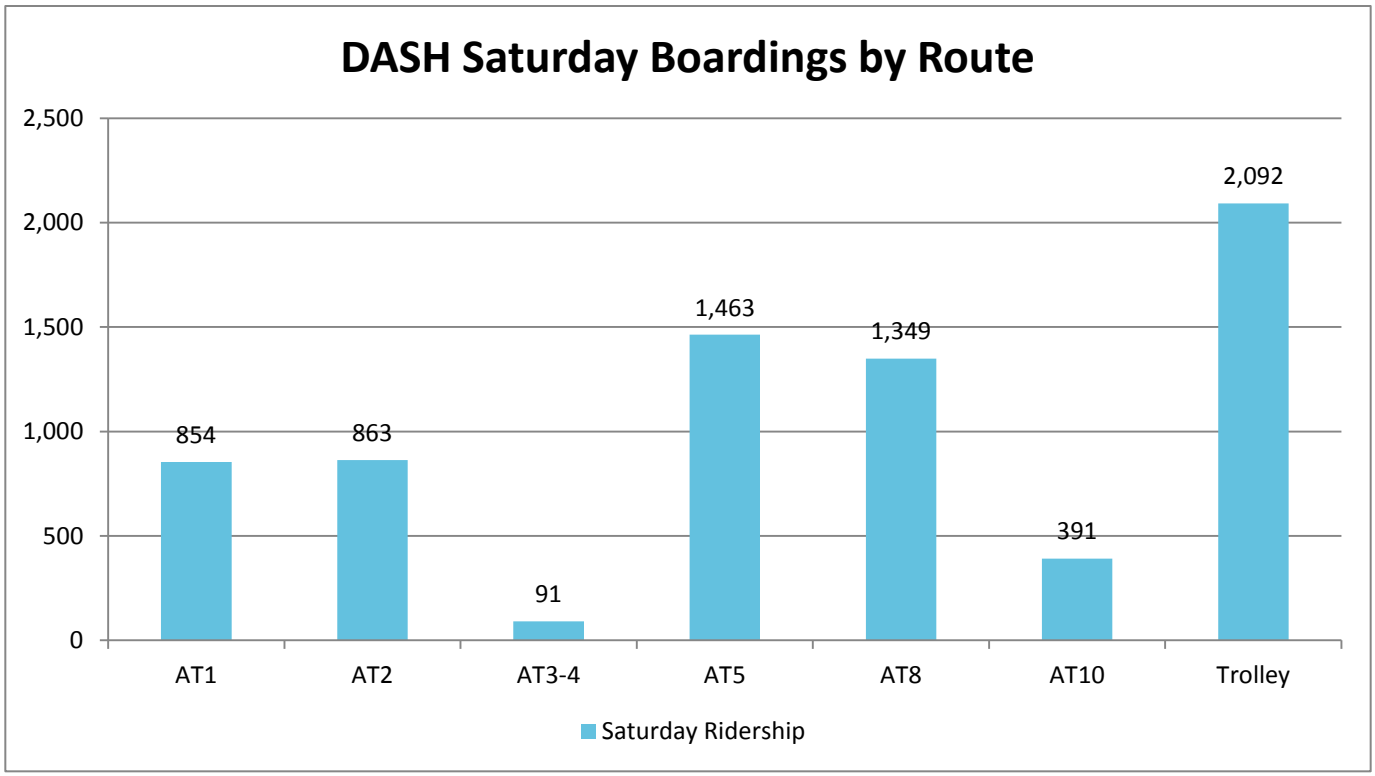
The data in the graphic show that DASH system ridership is dominated by four routes; the AT8, the AT2, the AT5, and the AT1. Together these routes carry 67% of all DASH Riders. The key market for each of these routes is as follows:

- The AT8 route serves the Duke Street corridor.
- The AT2 serves the Seminary Road corridor and also provides service to Mark Center and the Beauregard corridor.
- The AT5 serves the King Street corridor and also provides crosstown connections along the Van Dorn Street corridor
- The AT1 serves the Eisenhower Avenue corridor and also provides crosstown service to Landmark, the Beauregard corridor and Mark Center.

The data also show high ridership on the King Street Trolley, which serves visitors and tourists to the King Street corridor within Old Town Alexandria.

Outlined below in Figure 3.14 is data on daily DASH Saturday ridership by route.

Figure3.14 - DASH Saturday Ridership by Route



Source: DASH Comprehensive Operations Analysis (2014)

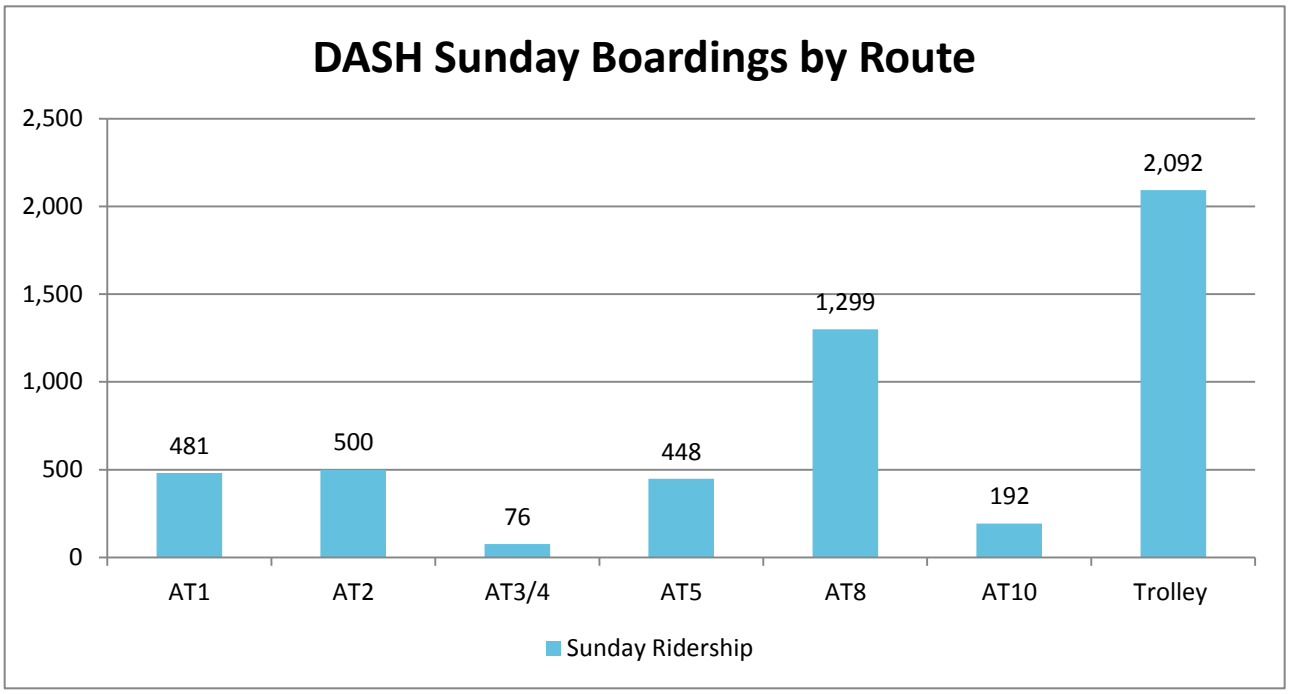
Note: Weekend Trolley ridership is available only as an annual figure. Saturday daily ridership presented here is an estimate based on factoring of annual figure.

The data in Figure 3.14 show that two DASH routes, the AT5 and AT8, dominate Saturday DASH ridership, carrying approximately 56% of Saturday DASH riders. Of note is that the AT5 has the highest ridership on Saturday of all Saturday DASH routes. On weekdays the highest ridership route is the AT8.

The King Street Trolley Saturday ridership is comparable to ridership on weekdays. This high Saturday ridership reflects the target market for the Trolley, which is visitors and tourists to the King Street corridor.

Outlined below in Figure 3.15 is data on daily Sunday DASH ridership by route.

Figure 3.15 - DASH Sunday Ridership by Route



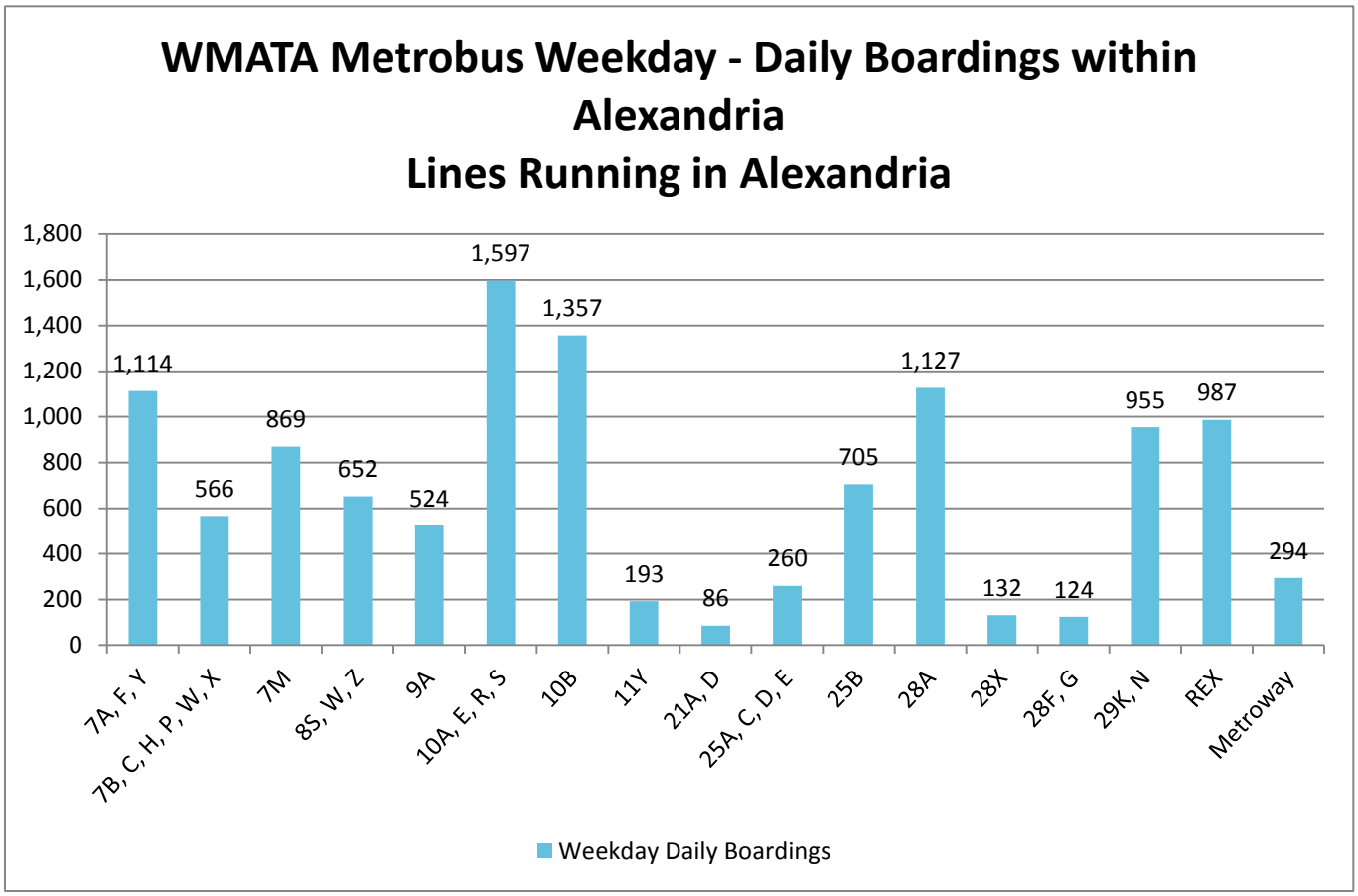
Source: DASH Comprehensive Operations Analysis (2014)

Note: Weekend Trolley ridership is available only as an annual figure. Sunday daily ridership presented here is an estimate based on factoring of annual figure.

The AT8 dominates Sunday DASH ridership, carrying 43% of all DASH Sunday riders. The King Street Trolley ridership estimate shows comparable ridership to Saturday.

Outlined below in Figures 3.16, 3.17 and 3.18 is daily boardings within Alexandria by day of week for each of the WMATA Metrobus services that run in Alexandria. Outlined first in Figure 3.16 is daily weekday boardings within Alexandria.

Figure 3.16 - WMATA Metrobus Alexandria Services - Weekday Daily Boardings within Alexandria

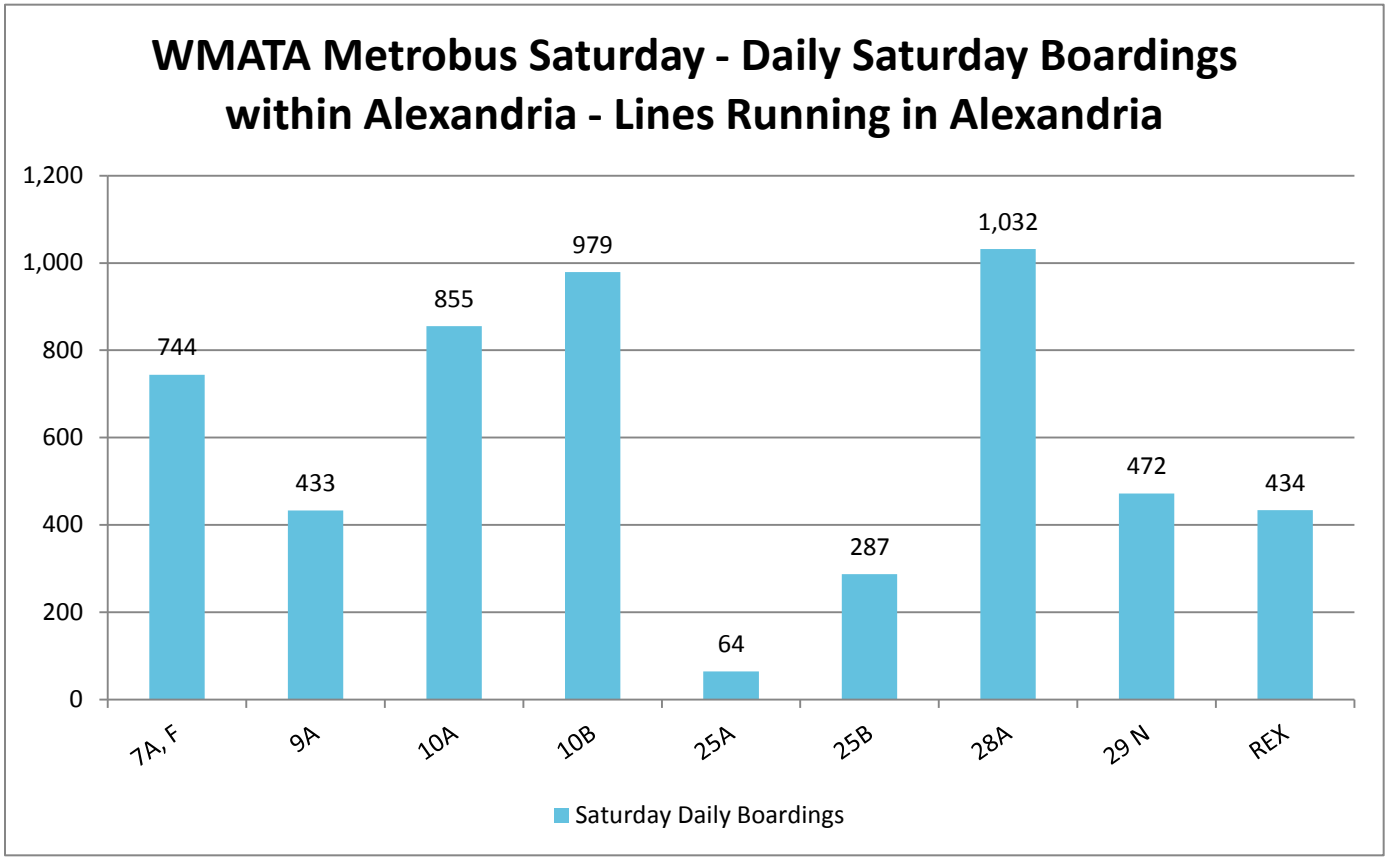


Source: WMATA Boardings and Alightings by Stop Data - 2014

The majority of these Metrobus lines run within Arlington and Alexandria, with a focus for many on the Pentagon Metrorail Station. Two of the heaviest ridership Lines, the 10 A, E, R, S and the 10B have the majority of their stops within Alexandria, though they provide important connections between Arlington and Alexandria. Also of note is the 28A, which though it runs predominantly within Fairfax County on VA Route 7 (Leesburg Pike), has significant boardings within Alexandria as well.

Figure 3.17 shows Saturday ridership on Metrobus Lines running in Alexandria.

Figure 3.17 - WMATA Metrobus Alexandria Services - Saturday Daily Boardings within Alexandria

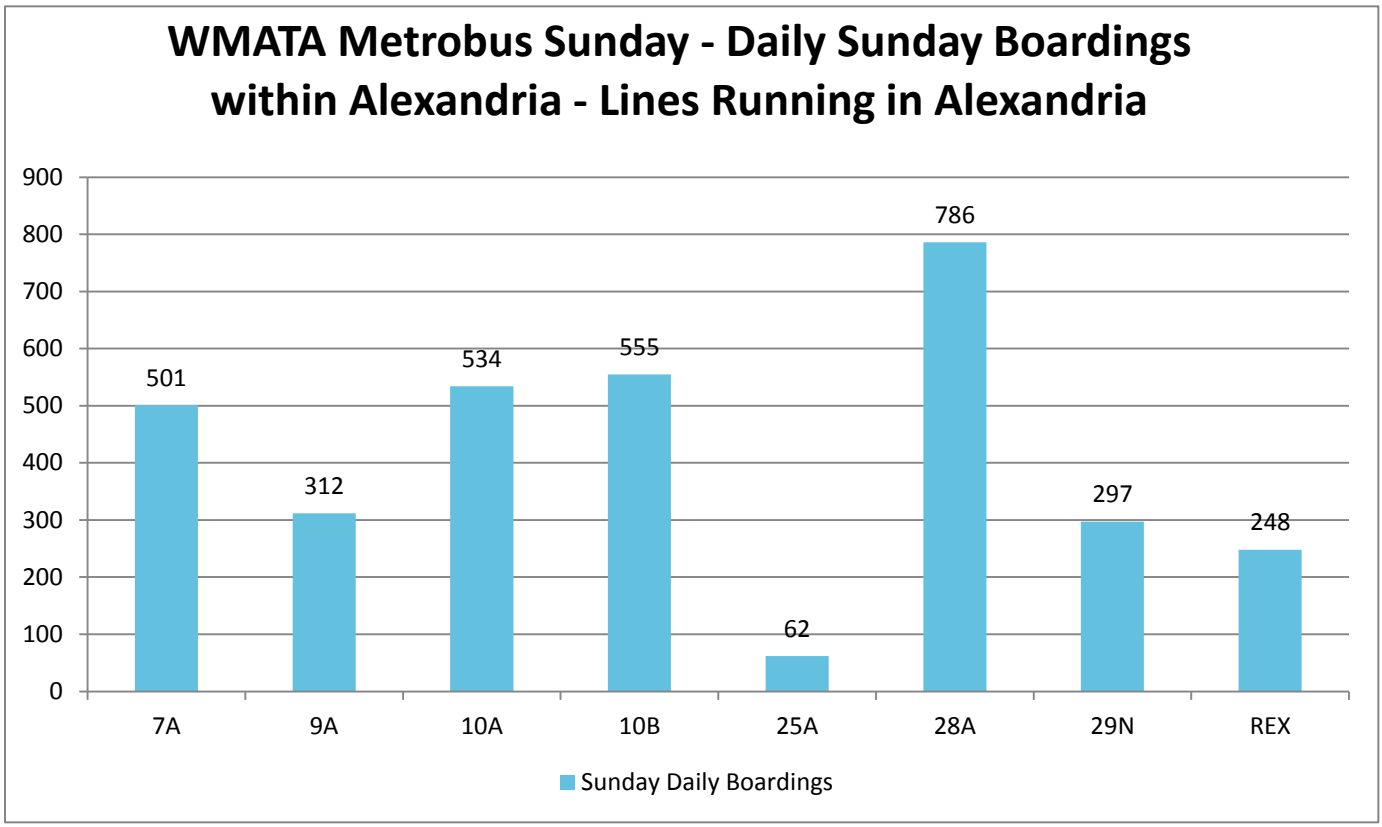


Source: WMATA Boardings and Alightings by Stop Data – 2014

Of significant note regarding Saturday boardinrgs is the high Saturday ridership on the 28A Line, with Saturday boardings within Alexandria nearly equaling 28A weekday boardings.

Figure 3.18 shows Sunday ridership on Metrobus Lines running in Alexandria.

Figure 3.18 - WMATA Metrobus Alexandria Services – Sunday Daily Boardings within Alexandria



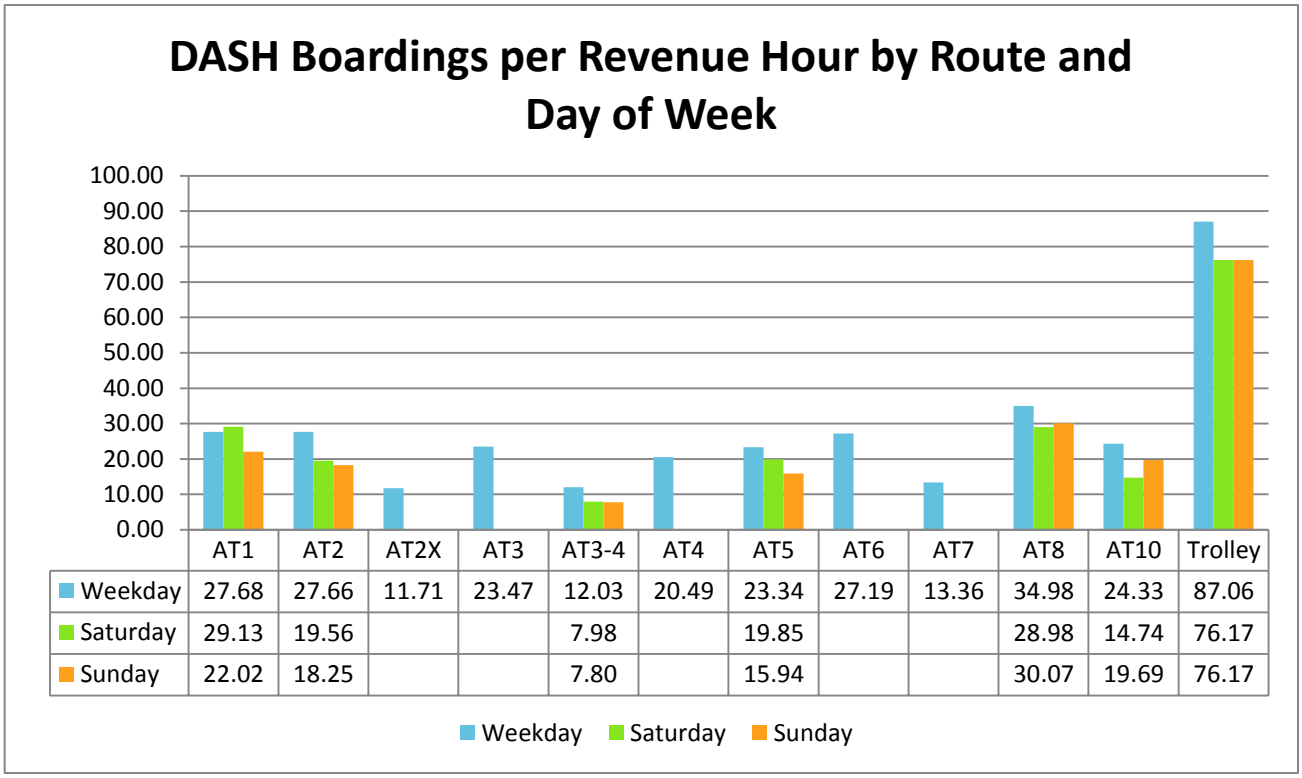
Source: WMATA Boardings and Alightings by Stop Data – 2014

2.4.2 Productivity

Three productivity measures are evaluated for both DASH and WMATA Metrobus service within Alexandria: boardings per revenue hour; boardings per revenue mile; and boardings per trip. The first analysis is of Boardings per Revenue Hour.

Figure 3.19 below shows DASH boardings per revenue hour by route and day of week.

Figure 3.19 - DASH Boardings per Revenue Hour by Route and Day of Week



	AT1	AT2	AT2X	AT3	AT3-4	AT4	AT5	AT6	AT7	AT8	AT10	Trolley
Weekday	27.68	27.66	11.71	23.47	12.03	20.49	23.34	27.19	13.36	34.98	24.33	87.06
Saturday	29.13	19.56			7.98		19.85			28.98	14.74	76.17
Sunday	22.02	18.25			7.80		15.94			30.07	19.69	76.17

Source: DASH Comprehensive Operations Analysis (2014)

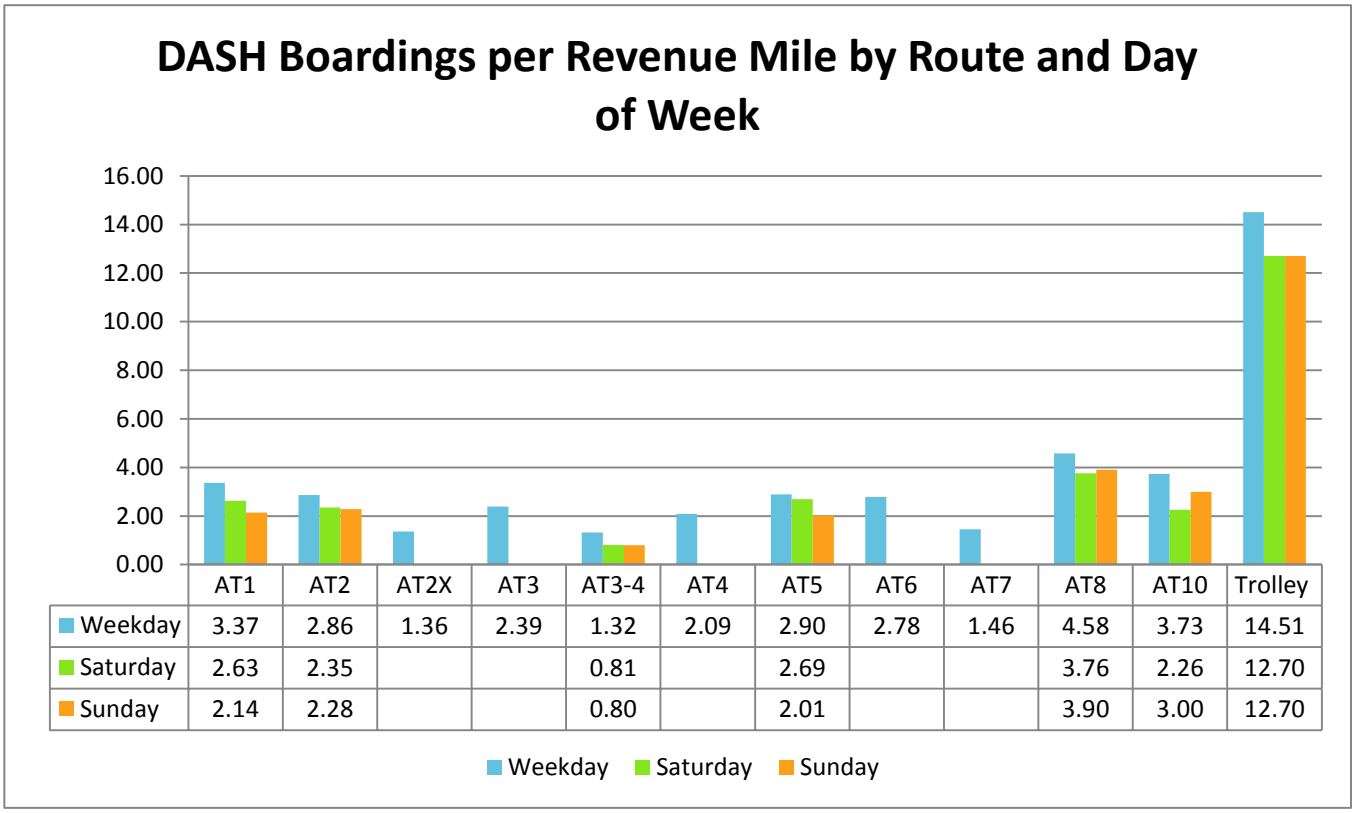
The data in Figure 3.19 show that DASH boardings per revenue hour, not surprisingly, track closely with daily overall boardings. Of interest on two routes, the AT8 and AT10, is that Sunday boardings per revenue hour are higher than Saturday. This likely reflects robust ridership on Sundays in conjunction with less frequent service, thus fewer revenue hours of service provided. Also of note is the higher boardings per revenue hour on Saturday on the AT1 than on weekdays.

The high boardings per revenue hour on the King Street Trolley reflect high ridership and a short route (1.5 miles in length) that requires relatively few revenue hours to meet service.

Relative to the proposed DASH productivity standard outlined in Chapter 3 of 24 boardings per revenue hour, weekday routes not meeting this standard are the AT2X, the AT3-4, the AT4, and the AT7. These routes generally serve less dense portions of the City. DASH and the City accepts this lower productivity in order to ensure all portions of the City receive transit coverage.

Outlined below in Figure 3.20 is data on DASH boardings per revenue mile by route and day of week.

Figure 3.20 - DASH Boardings per Revenue Mile by Route and Day of Week



	AT1	AT2	AT2X	AT3	AT3-4	AT4	AT5	AT6	AT7	AT8	AT10	Trolley
Weekday	3.37	2.86	1.36	2.39	1.32	2.09	2.90	2.78	1.46	4.58	3.73	14.51
Saturday	2.63	2.35			0.81		2.69			3.76	2.26	12.70
Sunday	2.14	2.28			0.80		2.01			3.90	3.00	12.70

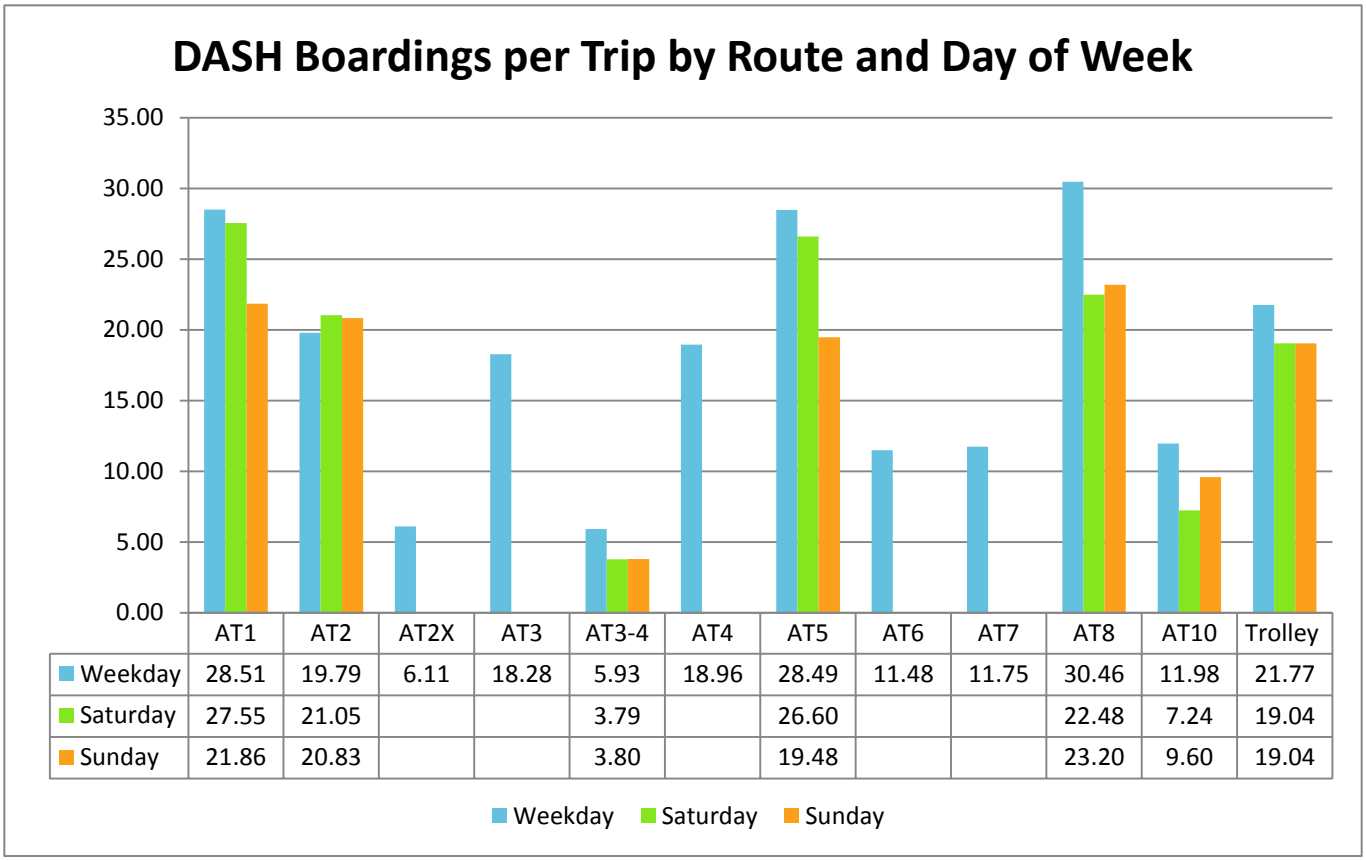
Source: DASH Comprehensive Operations Analysis (2014)

The boardings per revenue mile data in Figure 3.20 generally follow the same patterns as those in Figure 3.19 (boardings per revenue hour), with the highest boardings per revenue mile tracking with route ridership.

The higher figure for the Alexandria Trolley again reflects high ridership and a very short trip distance.

Outlined below in Figure 3.21 is data on DASH boardings per trip.

Figure 3.21 - DASH Boardings per Trip by Route and Day of Week



	AT1	AT2	AT2X	AT3	AT3-4	AT4	AT5	AT6	AT7	AT8	AT10	Trolley
Weekday	28.51	19.79	6.11	18.28	5.93	18.96	28.49	11.48	11.75	30.46	11.98	21.77
Saturday	27.55	21.05			3.79		26.60			22.48	7.24	19.04
Sunday	21.86	20.83			3.80		19.48			23.20	9.60	19.04

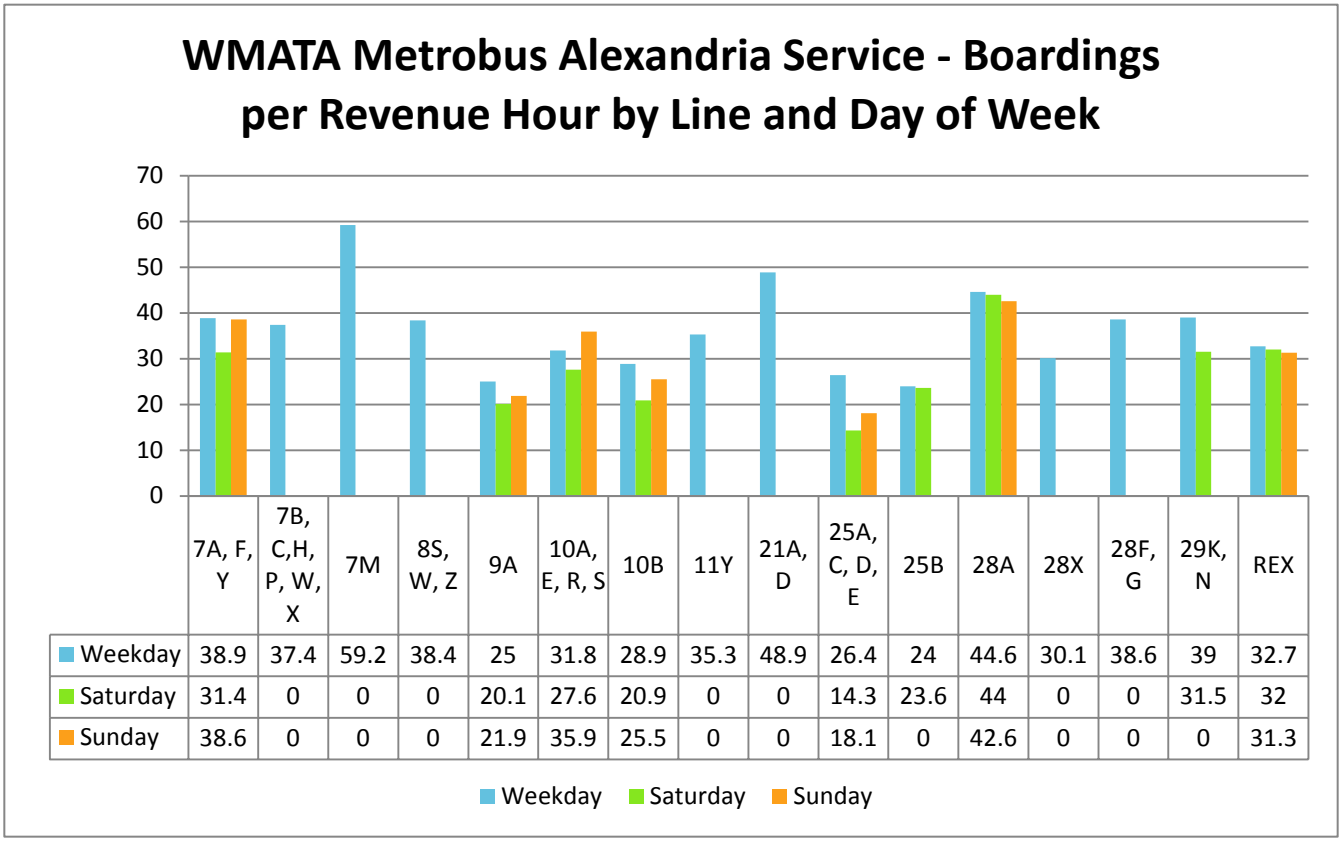
Source: DASH Comprehensive Operations Analysis (2014)

The boardings per trip data in Figure 3.21 generally follow the same patterns as the boardings per revenue hour and boardings per revenue mile data outlined in the previous figures. As with those metrics, the highest performing routes are also those with the highest daily ridership.

The Trolley boardings per trip do not stand out like they do for boardings per revenue hour and boardings per revenue mile because in spite of the high ridership, the Trolley service has a large number of trips on which to carry these riders (the trolley service runs 15 minute headways throughout the day and has long service hours, thus resulting in a large number of trips provided).

Outlined below in Figure 3.22 is data on WMATA Metrobus boardings per revenue hour.

Figure 3.22 - WMATA Metrobus Boardings per Revenue Hour by Route and Day of Week



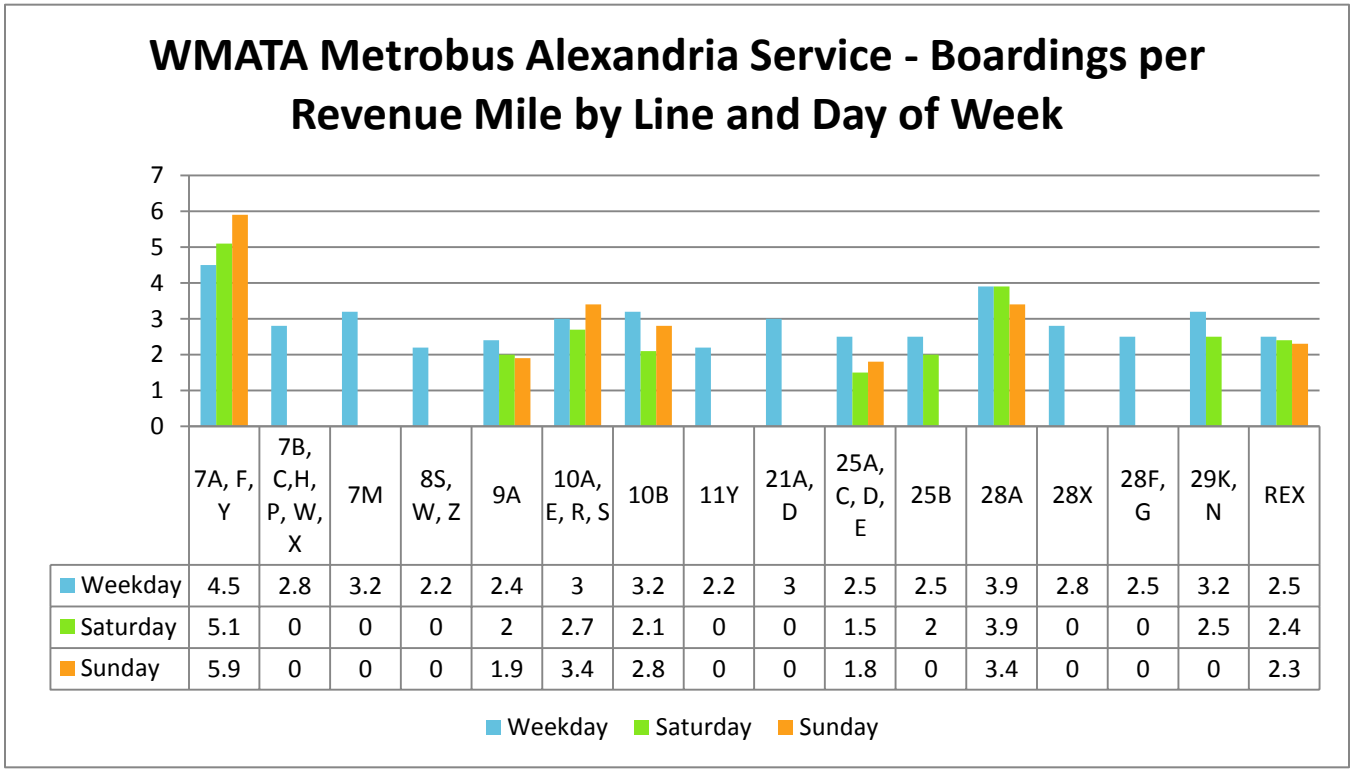
	7A, F, Y	7B, C,H, P, W, X	7M	8S, W, Z	9A	10A, E, R, S	10B	11Y	21A, D	25A, C, D, E	25B	28A	28X	28F, G	29K, N	REX
Weekday	38.9	37.4	59.2	38.4	25	31.8	28.9	35.3	48.9	26.4	24	44.6	30.1	38.6	39	32.7
Saturday	31.4	0	0	0	20.1	27.6	20.9	0	0	14.3	23.6	44	0	0	31.5	32
Sunday	38.6	0	0	0	21.9	35.9	25.5	0	0	18.1	0	42.6	0	0	0	31.3

Source: WMATA Productivity Report (2014)
Note: This data is for the entirety of each line, not just the portion of the line within Alexandria. Service data is not broken out by jurisdiction

Unlike DASH service, WMATA Metrobus boardings per revenue hour do not generally track with daily ridership on the Line. For instance, the 28A Line has significantly higher daily ridership than the other Metrobus Lines evaluated but its boardings per revenue hour are lower than two of the other Lines evaluated and approximately the same as a number of others. This pattern of not tracking directly with ridership is related to differences in line lengths and run times for the services evaluated. The 28A for instance is a long route in terms of length and run time, thus resulting in high revenue hours required to provide the service. Even with its high ridership, the high revenue hours necessary for the service result in a lower boardings per revenue hour.

Figure 3.23 below summarizes data on boardings per revenue mile on the Metrobus routes running in Alexandria.

Figure 3.23 - WMATA Metrobus Boardings per Revenue Mile by Route and Day of Week



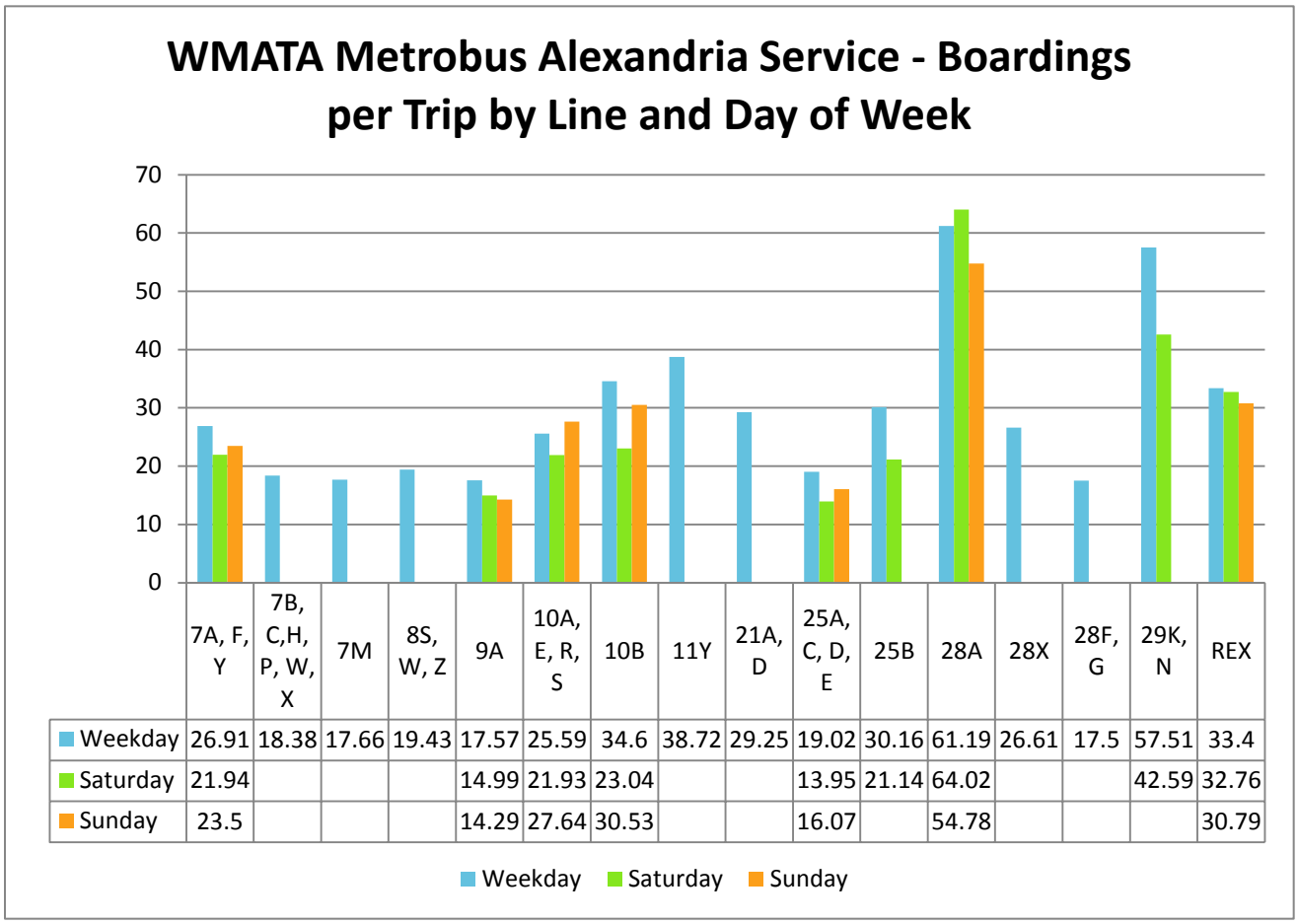
	7A, F, Y	7B, C,H, P, W, X	7M	8S, W, Z	9A	10A, E, R, S	10B	11Y	21A, D	25A, C, D, E	25B	28A	28X	28F, G	29K, N	REX
Weekday	4.5	2.8	3.2	2.2	2.4	3	3.2	2.2	3	2.5	2.5	3.9	2.8	2.5	3.2	2.5
Saturday	5.1	0	0	0	2	2.7	2.1	0	0	1.5	2	3.9	0	0	2.5	2.4
Sunday	5.9	0	0	0	1.9	3.4	2.8	0	0	1.8	0	3.4	0	0	0	2.3

Source: WMATA Productivity Report (2014)
Note: This data is for the entirety of each line, not just the portion of the line within Alexandria. Service data is not broken out by jurisdiction

The data in Figure 3.23 shows the 7A, F, Y Line with the highest boardings per revenue mile of the Metrobus Lines running in Alexandria. Of significant interest is the fact the highest boardings per revenue mile on this line occur on Sunday, reflecting the fact that there is robust ridership on Sunday relative to the level of service provided. Boardings per revenue mile on the other Metrobus Lines generally range between 2.5 and 4 throughout the week.

Figure 3.24 below summarizes Metrobus boardings per trip data.

Figure 3.24 - WMATA Metrobus Boardings per Trip by Route and Day of Week



	7A, F, Y	7B, C,H, P, W, X	7M	8S, W, Z	9A	10A, E, R, S	10B	11Y	21A, D	25A, C, D, E	25B	28A	28X	28F, G	29K, N	REX
Weekday	26.91	18.38	17.66	19.43	17.57	25.59	34.6	38.72	29.25	19.02	30.16	61.19	26.61	17.5	57.51	33.4
Saturday	21.94				14.99	21.93	23.04			13.95	21.14	64.02			42.59	32.76
Sunday	23.5				14.29	27.64	30.53			16.07		54.78				30.79

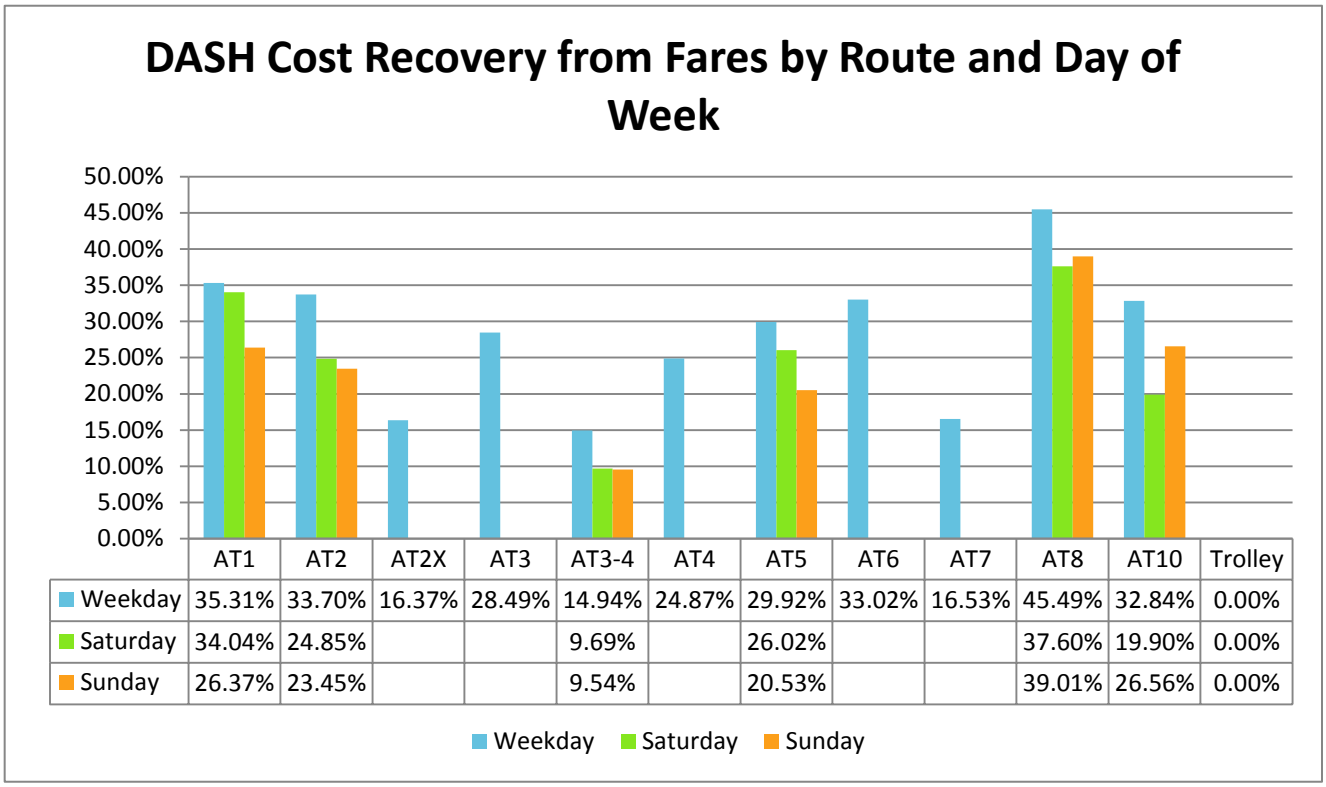
Source: WMATA Productivity Report (2014)
Note: This data is for the entirety of each line, not just the portion of the line within Alexandria. Service data is not broken out by jurisdiction

As with the other productivity metrics, Metrobus boardings per trip are based on a balance between total daily ridership on the Line, level of service, and trip length. An example of a Line with relatively low ridership but robust boardings per trip is the 11Y which is a peak period peak direction service that makes productive utilization of the service provided, especially given that there are relatively few stops served. A second interesting example is the 28A, which has the highest boardings per trip of all the lines evaluated. These boardings per trip exceed the capacity of a bus which means that there is ongoing turnover along the long 28A trip, thus resulting in effective utilization of the capacity provided.

2.4.3 Financial Performance

This section provides information on the financial performance of DASH and Metrobus service running in Alexandria. Two metrics are evaluated, cost recovery from fares and subsidy per passenger. Outlined first below in Figure 3.25 is cost recovery from fares for each DASH route, by day of week.

Figure 3.25 - DASH Cost Recovery from Fares – by Route and Day of Week



	AT1	AT2	AT2X	AT3	AT3-4	AT4	AT5	AT6	AT7	AT8	AT10	Trolley
Weekday	35.31%	33.70%	16.37%	28.49%	14.94%	24.87%	29.92%	33.02%	16.53%	45.49%	32.84%	0.00%
Saturday	34.04%	24.85%			9.69%		26.02%			37.60%	19.90%	0.00%
Sunday	26.37%	23.45%			9.54%		20.53%			39.01%	26.56%	0.00%

Source: DASH Comprehensive Operations Analysis (2014)

Based on the data in Figure 3.25, the DASH system does very well with regard to recouping costs from fares. The majority of the routes have weekday fare recoveries over 30%, with the AT8 on weekdays recovering nearly 46% of costs from the farebox. Fare recovery declines on Saturday and Sunday but a number of routes continue to perform quite well. Two routes do not meet the proposed standard of a 23% fare recovery outlined in Chapter 3, the AT2X and the AT7.

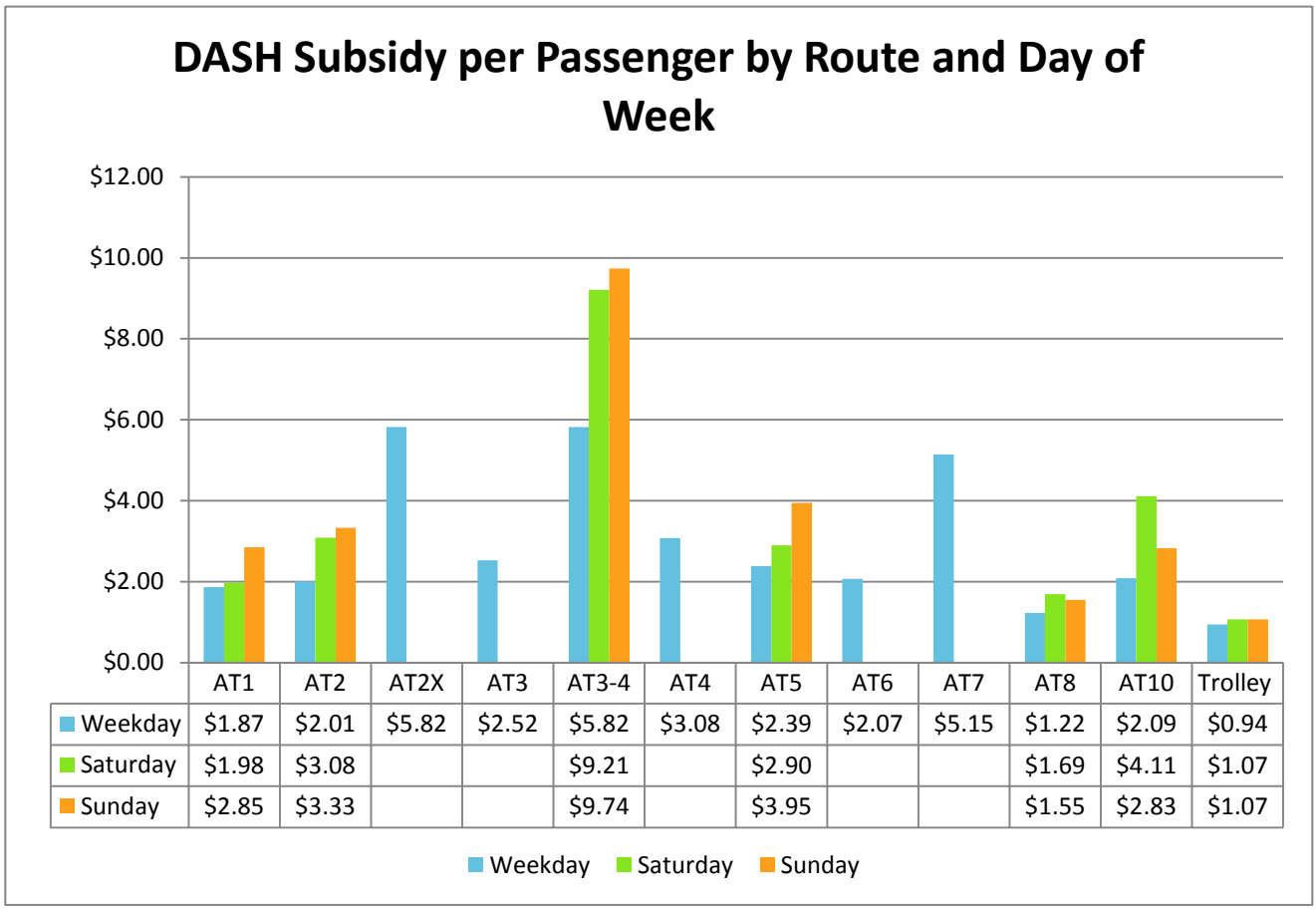
The King Street Trolley is free for riders so there is a 0% fare recovery.

It is also important to note that the funding sources to subsidize the AT2X DASH route and the King Street Trolley do not come from the City of Alexandria general fund that subsidizes DASH. Specifically, the King Street Trolley is paid for through funds from the City's Transportation Improvement Program and the Alexandria Convention and Visitors Association while the AT2X is

funded by the Department of Defense. Final decisions regarding these services will require input from the funding sources.

Outlined in Figure 3.26 is data on a complementary metric, subsidy per passenger.

Figure 3.26 - DASH Subsidy per Passenger – by Route and Day of Week



	AT1	AT2	AT2X	AT3	AT3-4	AT4	AT5	AT6	AT7	AT8	AT10	Trolley
Weekday	$1.87	$2.01	$5.82	$2.52	$5.82	$3.08	$2.39	$2.07	$5.15	$1.22	$2.09	$0.94
Saturday	$1.98	$3.08			$9.21		$2.90			$1.69	$4.11	$1.07
Sunday	$2.85	$3.33			$9.74		$3.95			$1.55	$2.83	$1.07

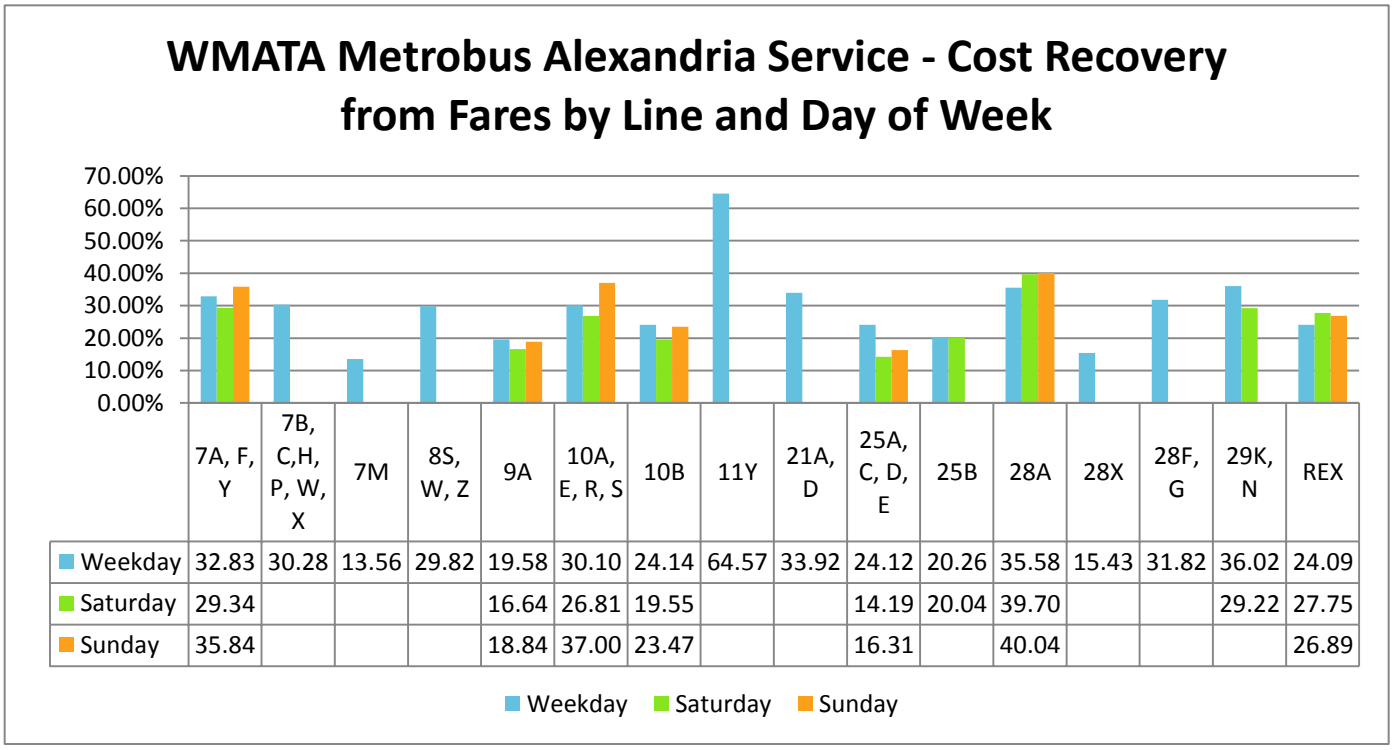
Source: DASH Comprehensive Operations Analysis (2014)

The data in in Figure 3.26 show the reverse pattern to what is shown in Figure 3.25, with the routes with the highest cost recovery having the lowest subsidy per passenger. As with the cost recovery, the data shows that DASH service is highly cost effective, with a low subsidy per passengers, especially on the heaviest ridership routes. Three weekday DASH routes exceed the proposed subsidy per passenger standard of $5.00 or less. These are the AT2X, the AT3-4 and the AT7. Again, DASH and the City accept these lower performing routes in order to provide full transit coverage to the City.

Of note is that even though the Trolley earns no revenue because it is free, its relatively low cost and high ridership means it has the lowest subsidy per passenger in the DASH system.

Outlined below in Figure 3.27 is the cost recovery from fares data for WMATA Metrobus Lines running in Alexandria.

Figure 3.27 - WMATA Metrobus Alexandria Services – Cost Recovery from Fares



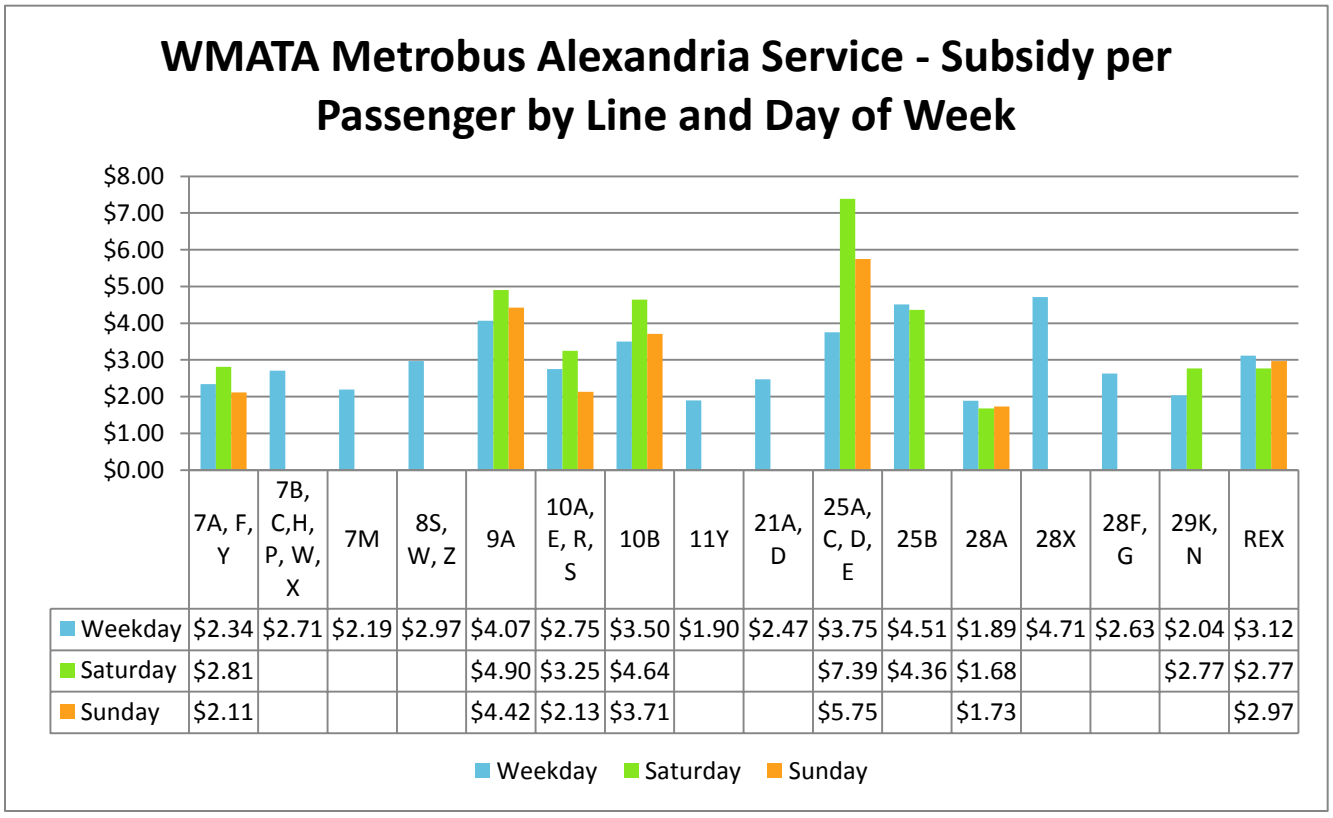
	7A, F, Y	7B, C,H, P, W, X	7M	8S, W, Z	9A	10A, E, R, S	10B	11Y	21A, D	25A, C, D, E	25B	28A	28X	28F, G	29K, N	REX
Weekday	32.83	30.28	13.56	29.82	19.58	30.10	24.14	64.57	33.92	24.12	20.26	35.58	15.43	31.82	36.02	24.09
Saturday	29.34				16.64	26.81	19.55			14.19	20.04	39.70			29.22	27.75
Sunday	35.84				18.84	37.00	23.47			16.31		40.04				26.89

Source: WMATA Productivity Report

The data in Figure 3.27 show generally lower cost recovery form fares on WMATA services than on DASH services. This reflects the higher cost of providing the WMATA service. Of note, however, is the very high cost recovery on the 11Y, which is nearly 65%. Also of note is the higher cost recovery on Sunday relative to weekdays on a number of the Lines including the 7A, F, Y, the 10A, E, and the 28A.

Outlined below in Figure 3.28 is the subsidy per passenger data for the Alexandria Metrobus routes.

Figure 3.28 WMATA Metrobus Alexandria Services – Subsidy per Passenger



	7A, F, Y	7B, C,H, P, W, X	7M	8S, W, Z	9A	10A, E, R, S	10B	11Y	21A, D	25A, C, D, E	25B	28A	28X	28F, G	29K, N	REX
Weekday	$2.34	$2.71	$2.19	$2.97	$4.07	$2.75	$3.50	$1.90	$2.47	$3.75	$4.51	$1.89	$4.71	$2.63	$2.04	$3.12
Saturday	$2.81				$4.90	$3.25	$4.64			$7.39	$4.36	$1.68			$2.77	$2.77
Sunday	$2.11				$4.42	$2.13	$3.71			$5.75		$1.73				$2.97

Source: WMATA Productivity Report

As with the DASH service, the subsidy per passenger metric shows a reverse pattern relative to cost recovery from fares. The lowest subsidy per passenger occurs on the 28A while the 11Y and the 29K, N are the next most cost-effective Lines.

2.4.4 Operations

Two additional operational metrics that take into account passenger comfort and convenience are evaluated in this section. The evaluation of these metrics focuses on DASH services, given that the data to complete this evaluation is more readily available for DASH. The first of these metrics is bus crowding. Based on DASH service standards, a trip is considered crowded if the passenger load on the trip has a load factor of 1.25, meaning the trip's passenger load is 1.25 that of the bus's seated capacity. Based on this load standard, only a few trips in the DASH system, on the AT8, are considered crowded.

The second operational metric evaluated is DASH on-time performance. On-time performance relates to service reliability and passenger convenience, with the lower the on-time performance the less reliable the service. A number of DASH routes experience over 20% of their trips running late, with service on weekends often less reliable than weekday service. DASH is aware of this issue and is making adjustments to schedules to improve on-time performance and reliability.

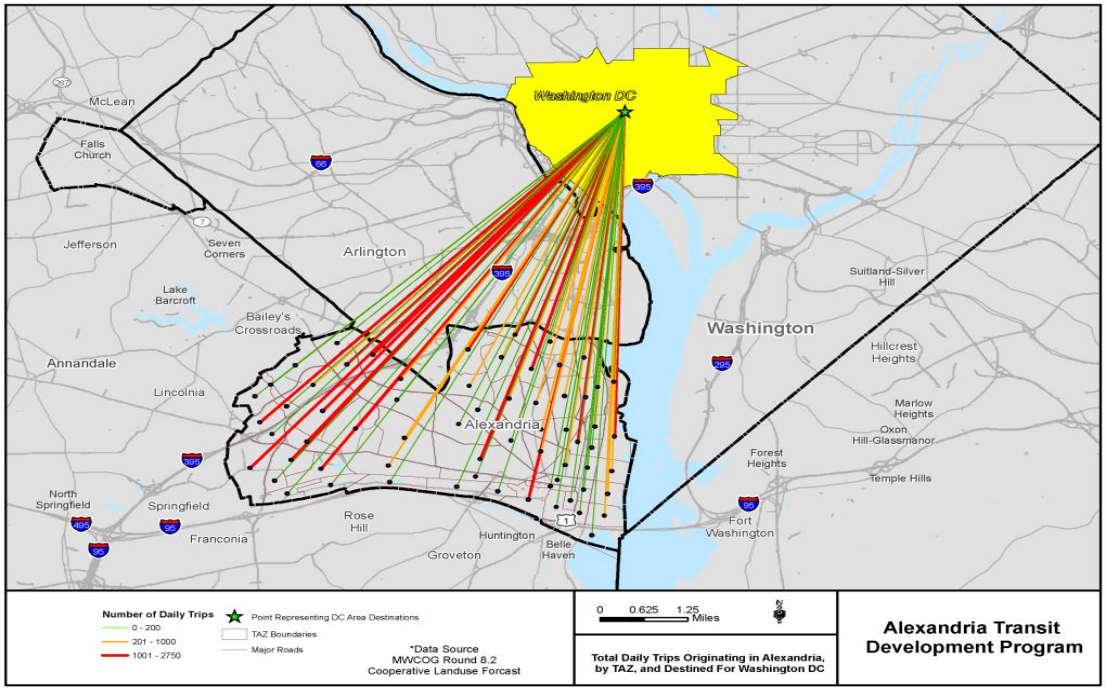
3.0 Unmet Service Demand – Travel Flows

This section of the Service Evaluation chapter considers potential unmet trip demand for trips within Alexandria, trips originating in Alexandria and going to large regional employment destinations outside the City, and for trips coming from outside Alexandria to destinations within the City.

The first set of maps evaluates trips from Alexandria to regional destinations outside the City. The data in these maps is from the Metropolitan Council of Governments regional model trip table for 2015, and includes all trip purposes and trips by all modes. Each map represents trips from Alexandria to a major activity center in the Washington region and contains the total trips originating in each Transportation Analysis Zone (TAZ) within Alexandria (65 TAZs in Alexandria) and going to that activity center. The purpose of showing all trips is to assess total demand potential for trip flows to the subject activity center, especially for trip flows not currently covered by transit.

Figure 3.29 below shows trips from each Alexandria TAZ to downtown Washington DC.

Figure 3.29 - Trip Flows from Alexandria to Washington DC



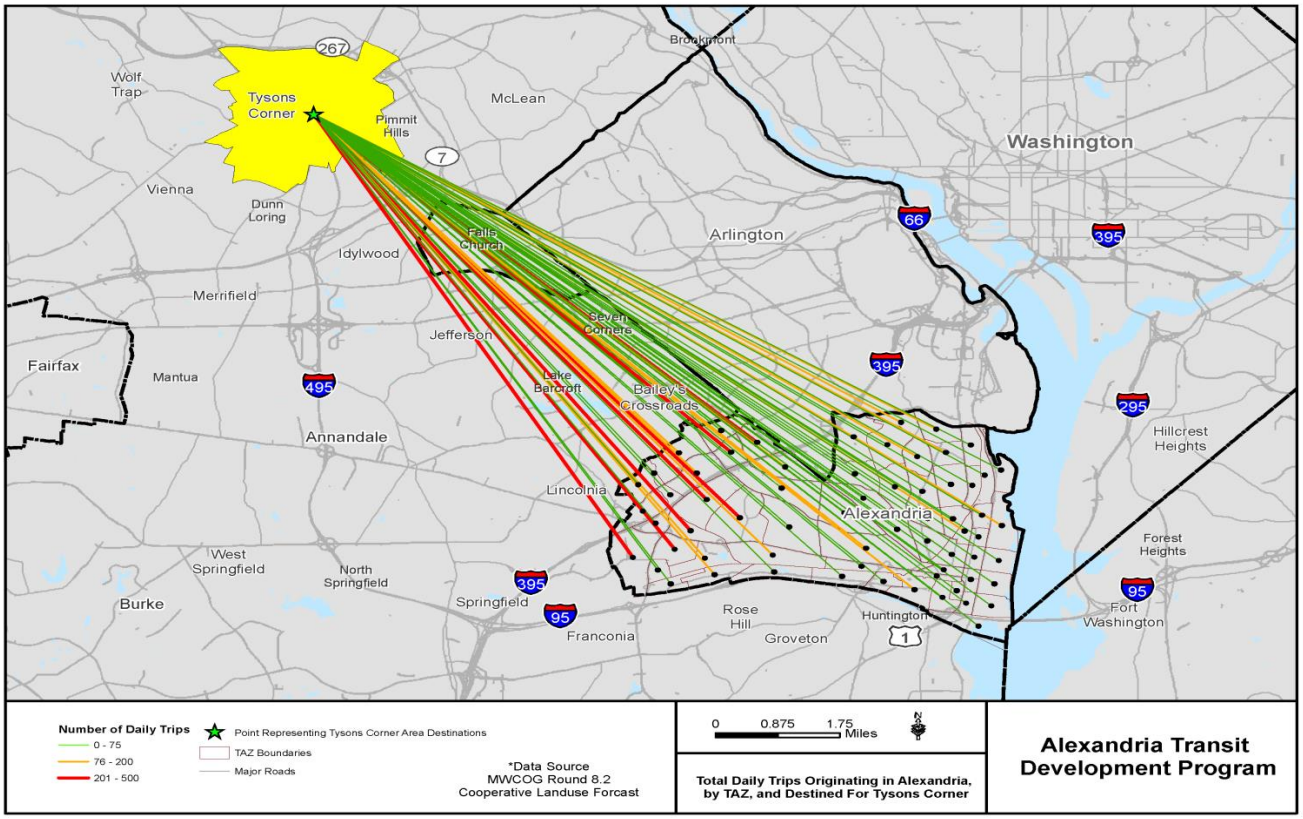
Source: MWCOG Regional Model – 2015 Trip Table

The trip patterns in the map show the origin TAZs within Alexandria that are generating the most trips to DC are generally located in the west end of the City, with secondary generators in the Eisenhower Avenue corridor. Transit access to DC from the western portion of the City can be made from the Van Dorn Metrorail Station on the Blue Line or on the Metrobus 7 Lines via the Pentagon. The proposed West End Transitway service will also provide for improved transit access to downtown DC for trips from this portion of the City.

Transit access to DC from the Eisenhower Avenue corridor is provided via the Eisenhower Yellow Line station. Given that DC is the focus of the regional transit system, the heaviest trips flows from Alexandria to DC are currently generally well served by transit.

Figure 3.30 shows trips from each Alexandria TAZ to Tysons Corner.

Figure 3.30 - Trip Flows from Alexandria to Tysons Corner

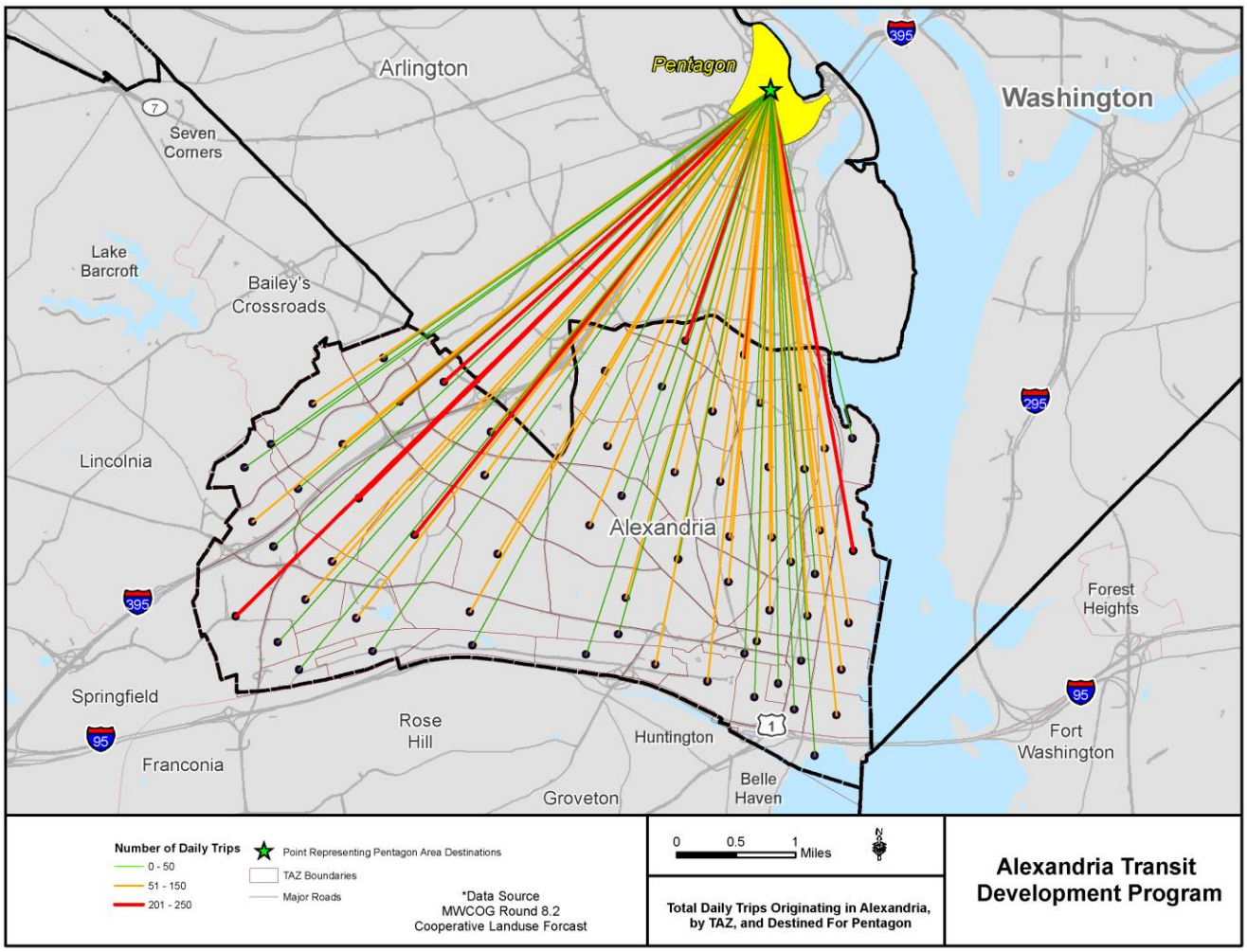


Source: MWCOG Regional Model – 2015 Trip Table

The trip patterns in the map show that the origin TAZs within Alexandria that are generating the most trips to Tysons are generally located in the west end of the City. Current transit access to Tysons from these TAZs is not especially direct, with a transfer on either bus or rail required. In the long run the West End Transitway will provide a more convenient and strong link to service along Leesburg Pike but in the short run links are indirect. Extension of select 28A trips farther south along the Van Dorn and Beauregard corridor may make this link stronger or moving the southern terminal of the 28X farther south may be another alternative.

Figure 3.31 shows trips from each Alexandria TAZ to the Pentagon.

Figure 3.31 - Trip Flows from Alexandria to the Pentagon

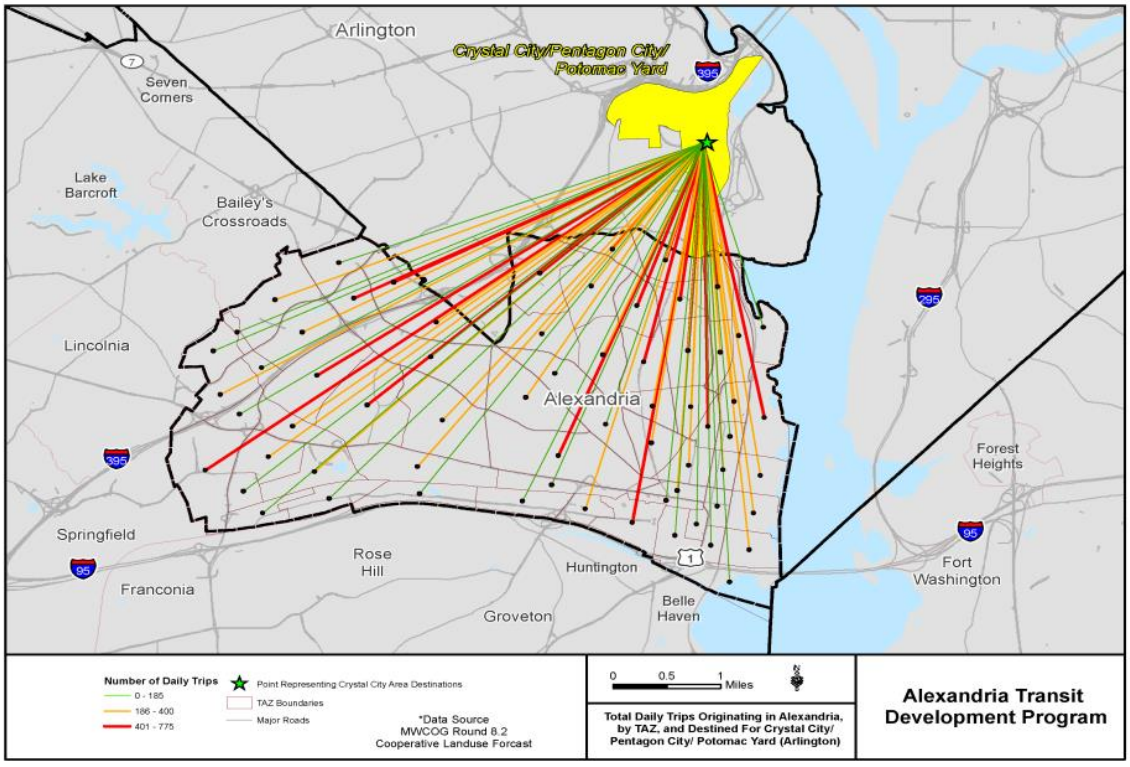


Source: MWCOG Regional Model – 2015 Trip Table

As with the other figures, the heaviest trips flows to the Pentagon generally come from the west side of the City. These TAZs generally have good transit access to the Pentagon. The TAZs in the southwestern most portion of the City have access to the Pentagon via the Blue Line and the Metrobus 8Z and 8W routes. Farther north, in the Beauregard corridor, riders can access the Pentagon via the 7 Lines. Longer term, the West End Transitway will provide excellent transit access to the Pentagon.

Figure 3.32 shows trips from each Alexandria TAZ to Crystal City, Pentagon City, and Arlington Potomac Yard.

Figure 3.32 - Trip Flows from Alexandria to Crystal City, Pentagon City, and Arlington Potomac Yard

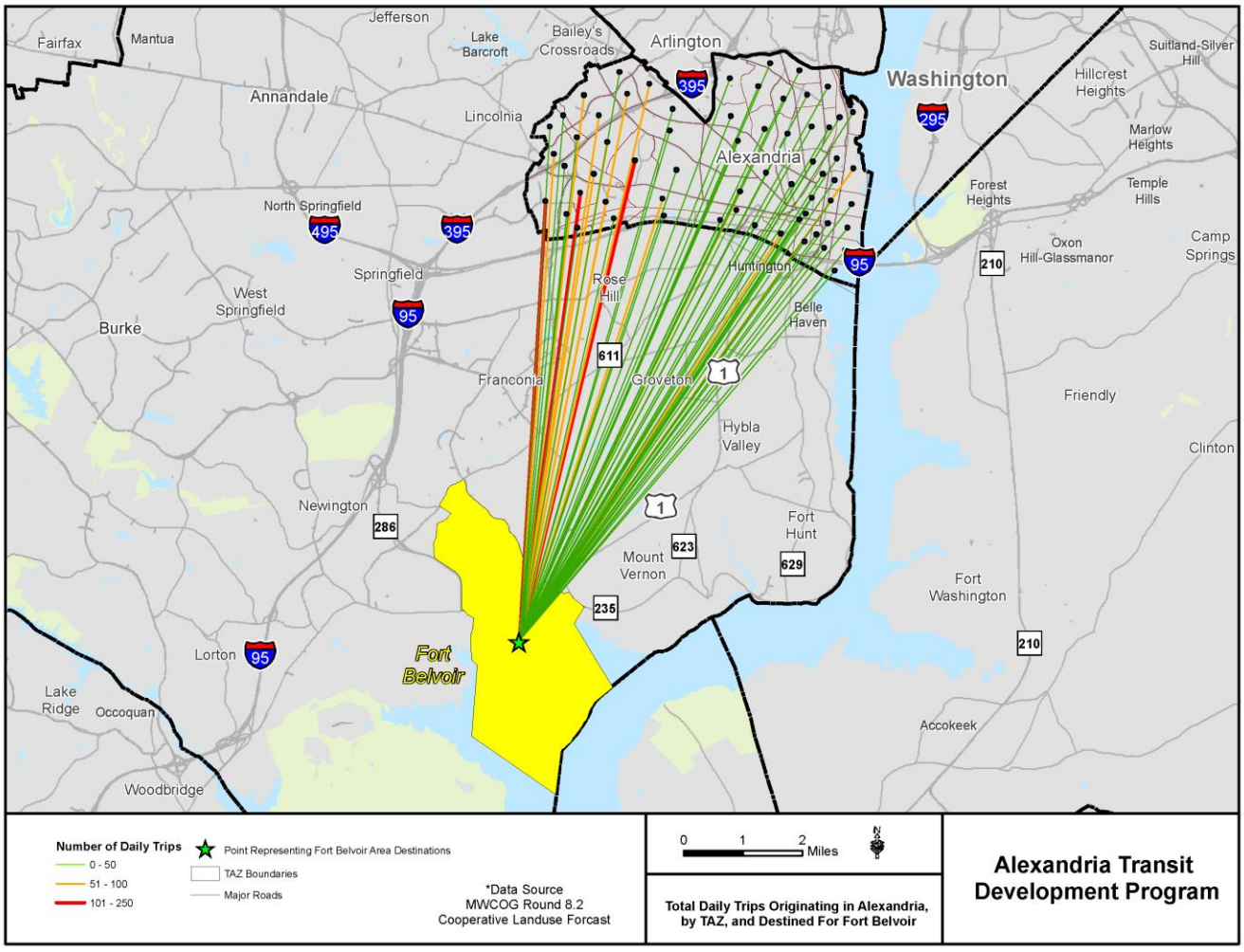


Source: MWCOG Regional Model – 2015 Trip Table

TAZs generating heavy trip flows to Crystal City, Pentagon City and Arlington Potomac Yard are generally more spread out than in the other figures. The first concentration of TAZs generating trips destined for the area is located in the west end of the City. These TAZs generally have access to Crystal City via the Blue Line. Two individual TAZs generating heavy trips, along Eisenhower Avenue and north of King Street in Old Town have access to Crystal City via Metrorail. A significant concentration of TAZs concentrated on Cameron Mills and Russell Roads have relatively direct access via the AT3 and AT4 services to the Pentagon (in the peak period) and then doubling back to Crystal City via the Blue or Yellow lines.

Figure 3.33 shows trips from each Alexandria TAZ to Fort Belvoir.

Figure 3.33 - Trip Flows from Alexandria to Fort Belvoir

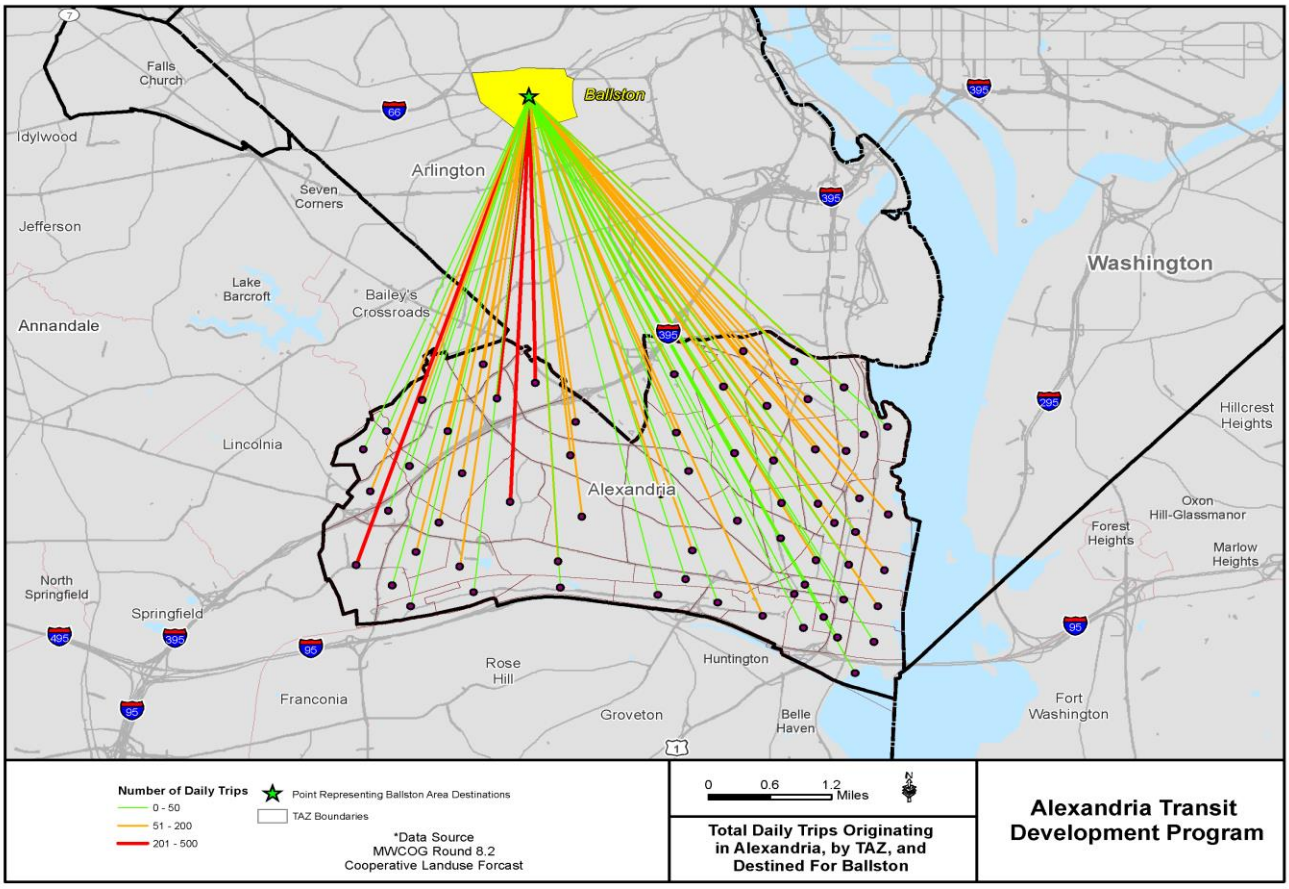


Source: MWCOG Regional Model – 2015 Trip Table

TAZs generating heavy trip flows to Fort Belvoir are generally located in the southwestern section of the City. These TAZs do not have direct transit access to Fort Belvoir. Rather people who wish to make this trip via transit would have to access the Eisenhower or King Street Metrorail station and transfer to the Route 1 REX service.

Figure 3.34 shows trips from each Alexandria TAZ to Ballston.

Figure 3.34 - Trip Flows from Alexandria to Ballston

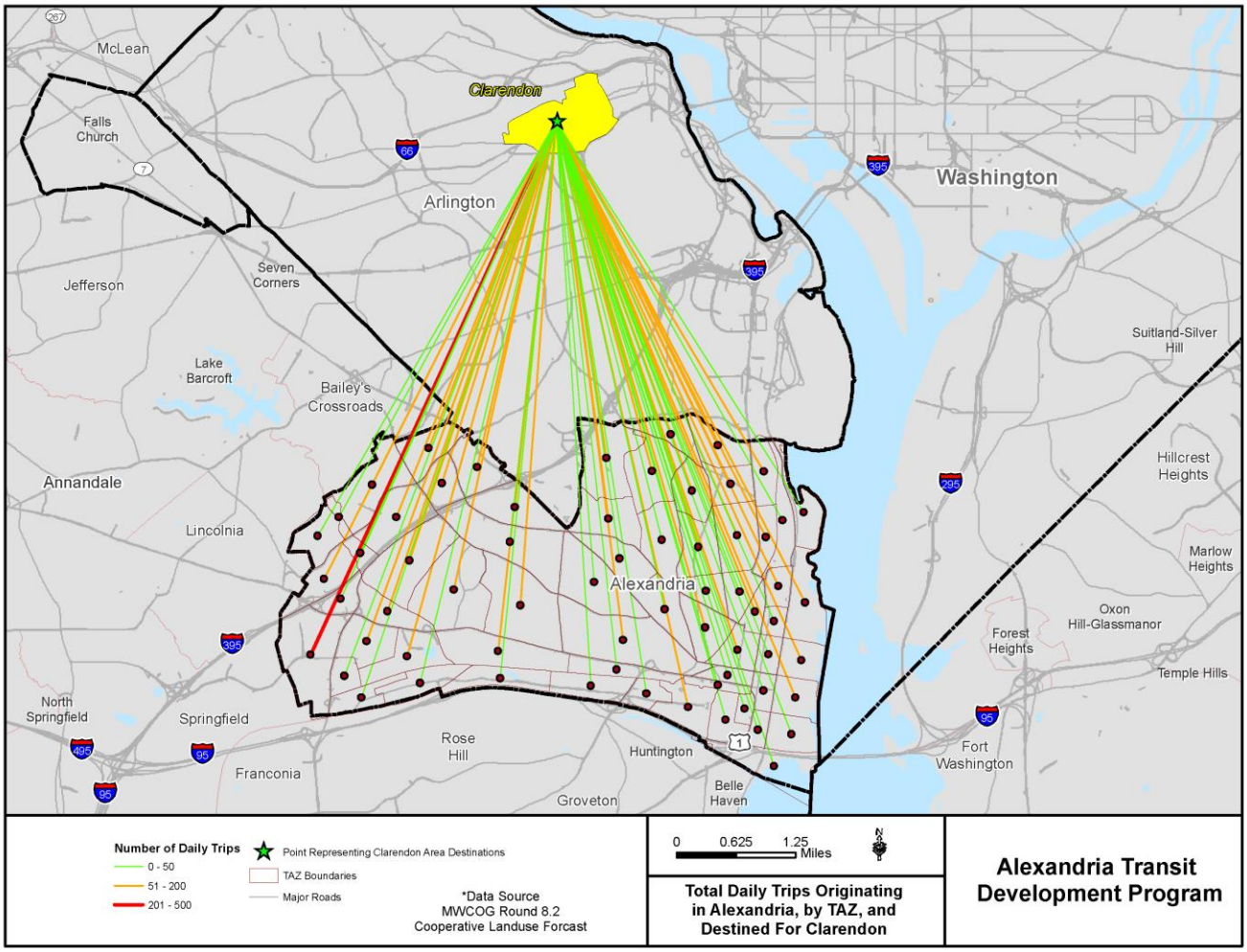


Source: MWCOG Regional Model – 2015 Trip Table

The TAZs generating the heaviest trip flows to Ballston are in the west end of the City, ranged along the Van Dorn and Beauregard Corridors. The most direct transit access for riders from Van Dorn corridor would likely be the Blue Line, with a transfer to the Orange Line in Rosslyn. For riders farther north, the most direct access would be via the Metrobus 25B service that runs between Landmark and Ballston or via the Metrobus 7 Lines service and then a transfer to the 23 Lines or the 10 Lines at the Shirlington Transit Center. Recommendations for enhanced 10 Line service in order to strengthen connections between Arlington and Alexandria are outlined in Chapter 4 of this document. The proposed West End Transitway will also provide more convenient connections for this trip movement.

Figure 3.35 shows trips from each Alexandria TAZ to the Clarendon/Courthouse portion of Arlington.

Figure 3.35 - Trip Flows from Alexandria to Clarendon/Courthouse

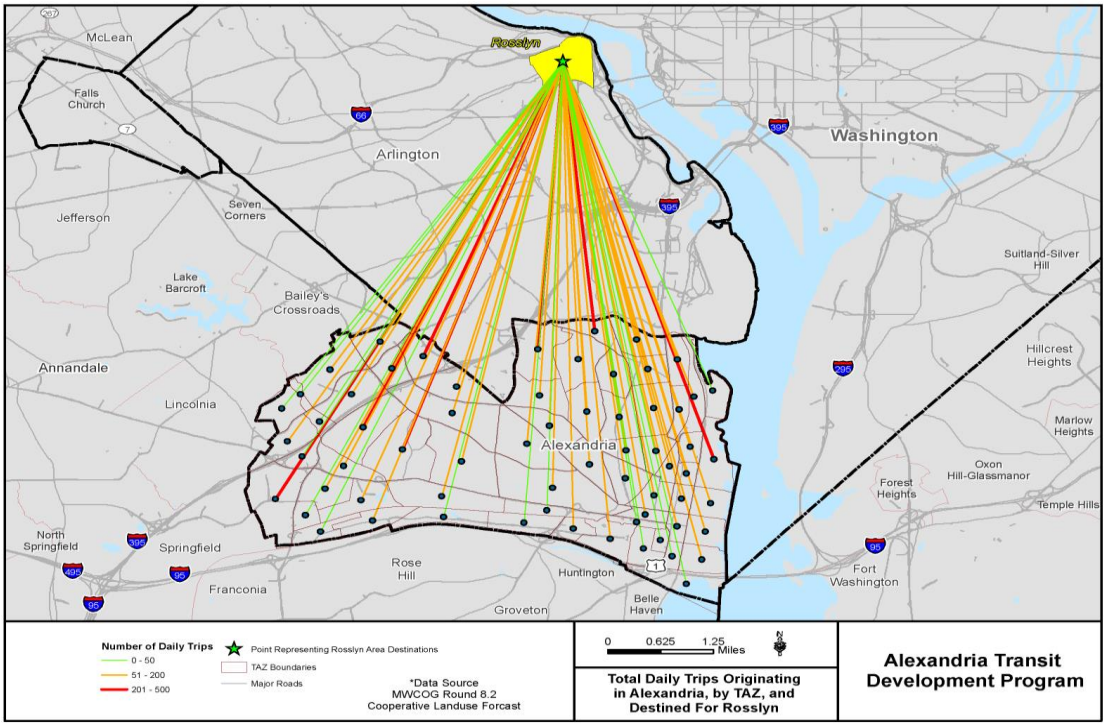


Source: MWCOG Regional Model – 2015 Trip Table

The map shows that the heaviest flows to Clarendon/Courthouse come from the southwestern portion of the City. The most direct transit access to Clarendon from this part of the City is via the Blue and Orange Lines.

Figure 3.36 shows trips from each Alexandria TAZ to Rosslyn.

Figure 3.36 - Trip Flows from Alexandria to Rosslyn

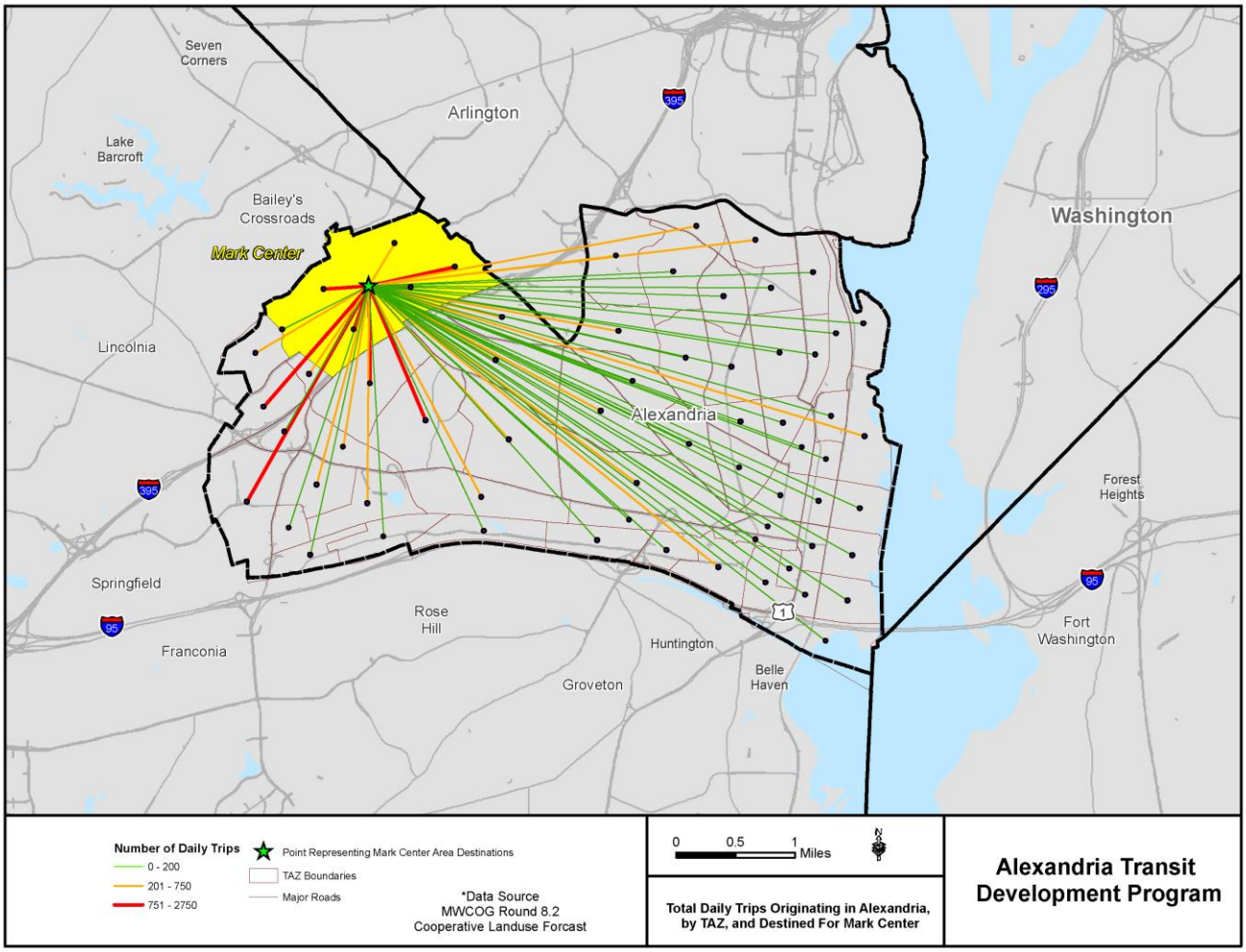


Source: MWCOG Regional Model – 2015 Trip Table

There are three primary areas within the City with heavy trip flows to Rosslyn. The first is the west-end of the City. The most direct transit access for these trips is via the Blue Line. Old Town is a second origin with heavy trip flows to Rosslyn. The most direct transit access for these trips is also via the Blue Line at the King Street Station. These people can also access the recently implemented 10R route which provides a direct bus service from Alexandria to Rosslyn to supplement Blue Line service. The final origin area with heavy trip flows to Rosslyn is from Arlandria. The most direct transit service for this trip flow is likely via the 10B Line to Ballston and then a transfer to the Orange Line.

The next set of maps show trip flows from each Alexandria TAZ to key activity centers within the City. Figure 3.37 shows trip flows to Mark Center from TAZs within Alexandria.

Figure 3.37 - Trip Flows from Within Alexandria to Mark Center

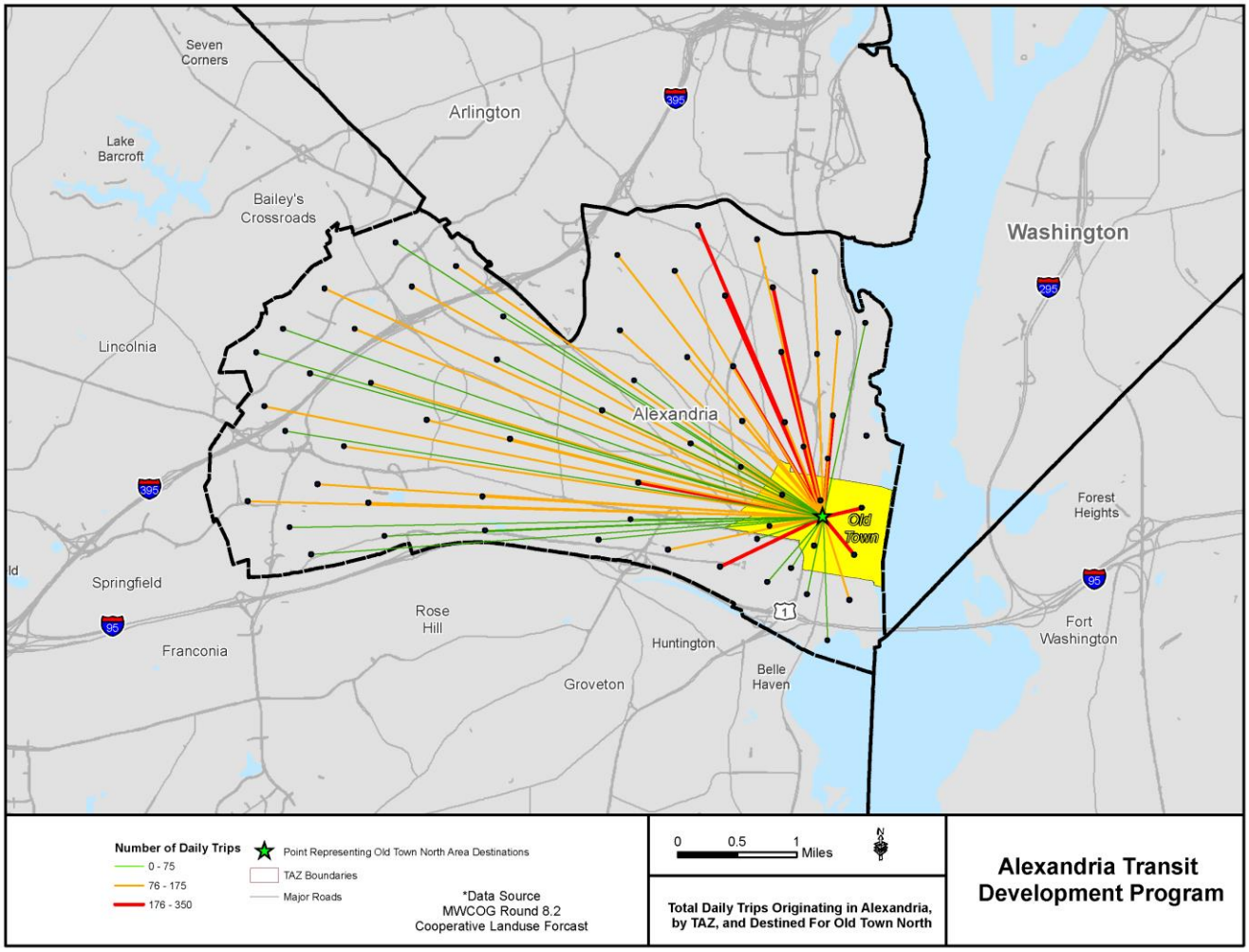


Source: MWCOG Regional Model – 2015 Trip Table

The data here show that the heaviest trips flows come from TAZs close to Mark Center as well as from the west end of the City. Access to the Mark Center from the west end is currently provided by the DASH AT5 Line, and the Metrobus 8 Lines, 7 Lines, and the 25 Line. The West End Transitway, once implemented, will provide excellent access from the west end to Mark Center.

Figure 3.38 shows trip flows to Old Town Alexandria from TAZs within Alexandria.

Figure 3.38 - Trip Flows from Within Alexandria to Old Town

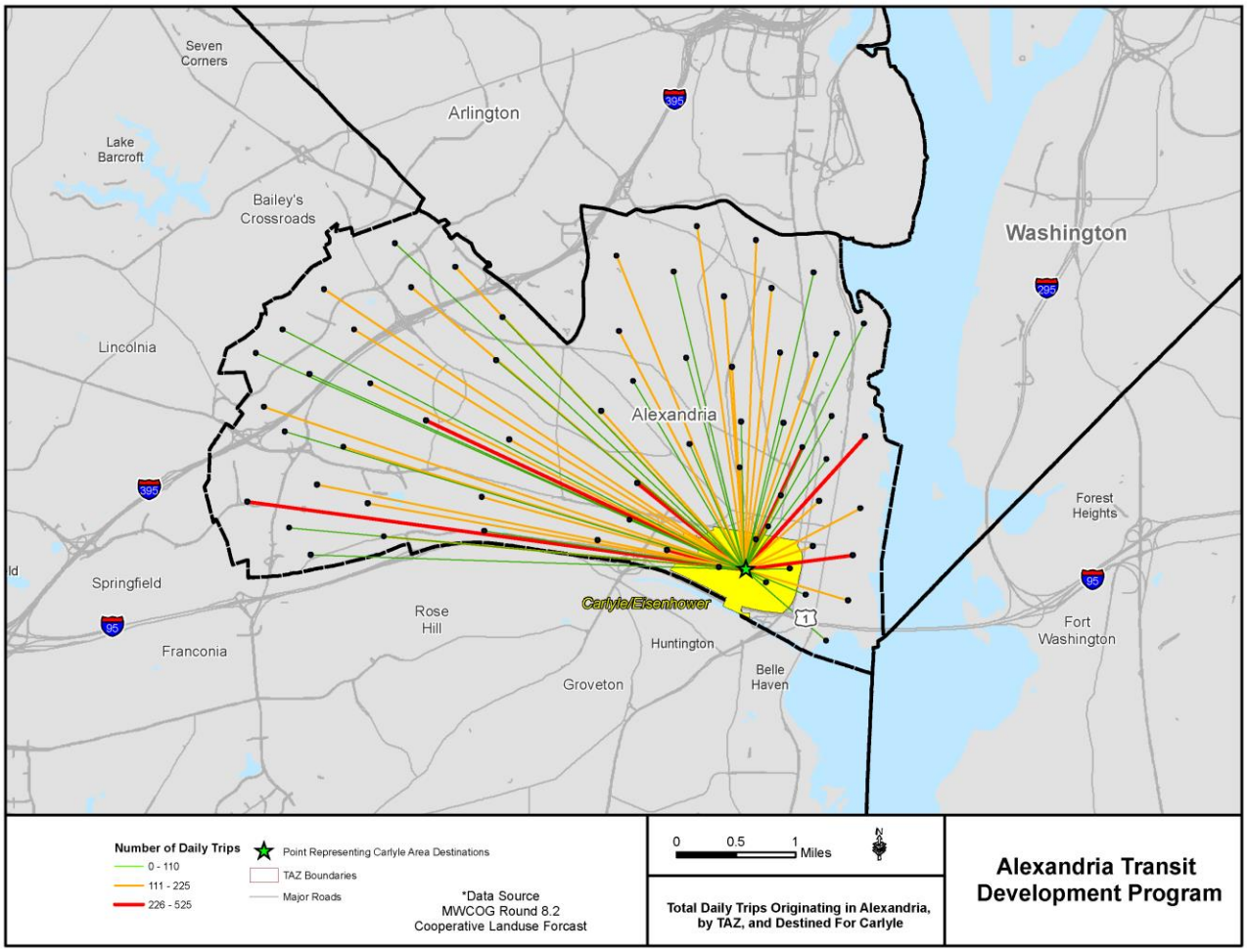


Source: MWCOG Regional Model – 2015 Trip Table

The data show that the heaviest trip flows come from TAZs close to Old Town. Each of these trip flows is served by an existing DASH service. Of note is that the TAZ located along the Eisenhower corridor would be served by a new service recommendation contained in Chapter 4 of this document, the Eisenhower Circulator.

Figure 3.39 shows trip flows to Carlyle/Eisenhower from TAZs within Alexandria.

Figure 3.39 - Trip Flows from Within Alexandria to Carlyle/Eisenhower

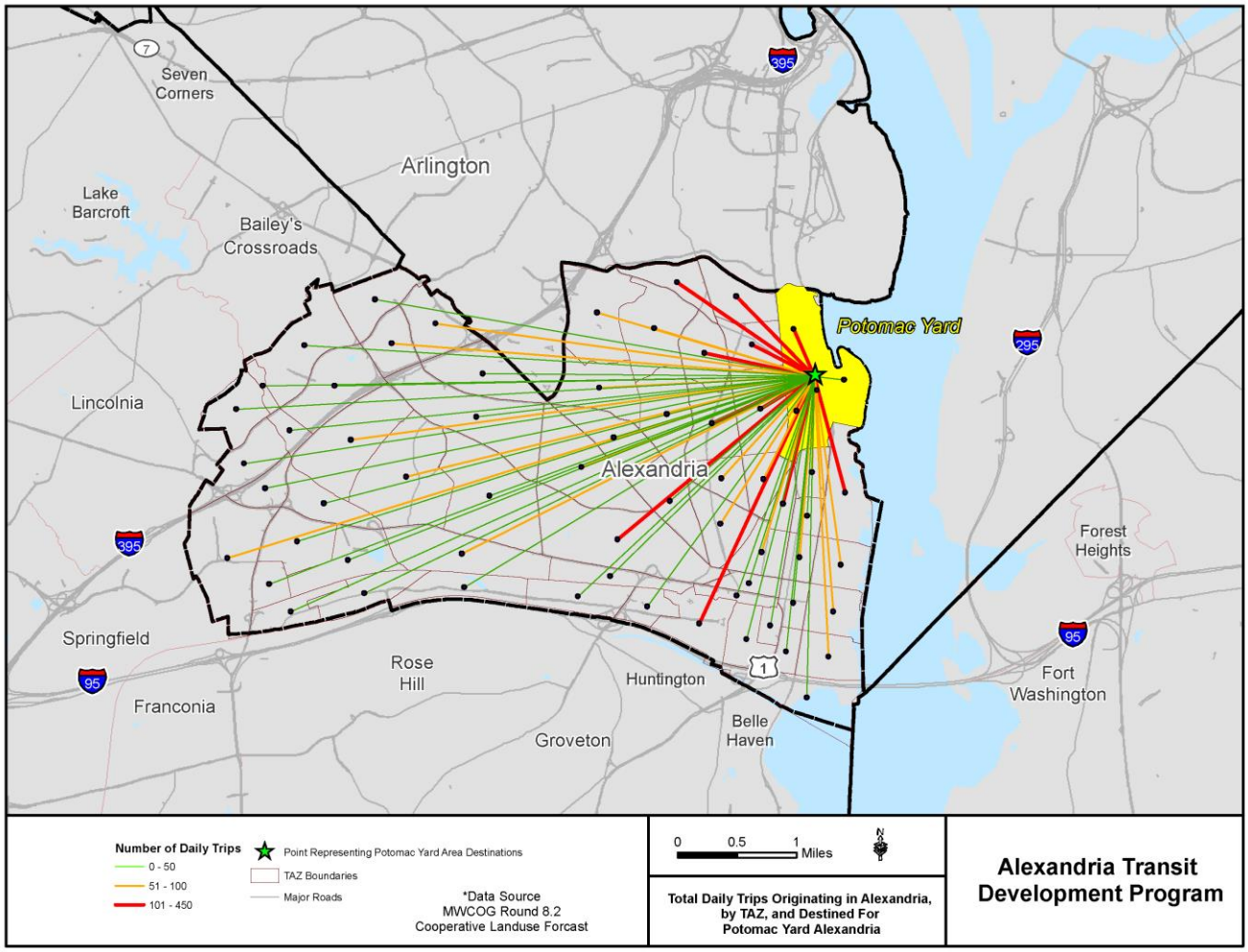


Source: MWCOG Regional Model – 2015 Trip Table

The data show that the heaviest trip flows to the Carlyle area of the City come from the Old Town area, west of Carlyle along the Eisenhower Avenue and Duke Street corridors, and the area of the City south of Old Town. All of these areas are covered by DASH service and generally the Carlyle area can be reached directly by DASH service without a transfer.

Figure 3.40 shows trip flows to the Alexandria portion of Potomac Yard from TAZs within Alexandria.

Figure 3.40 - Trip Flows from Within Alexandria to Alexandria Potomac Yard

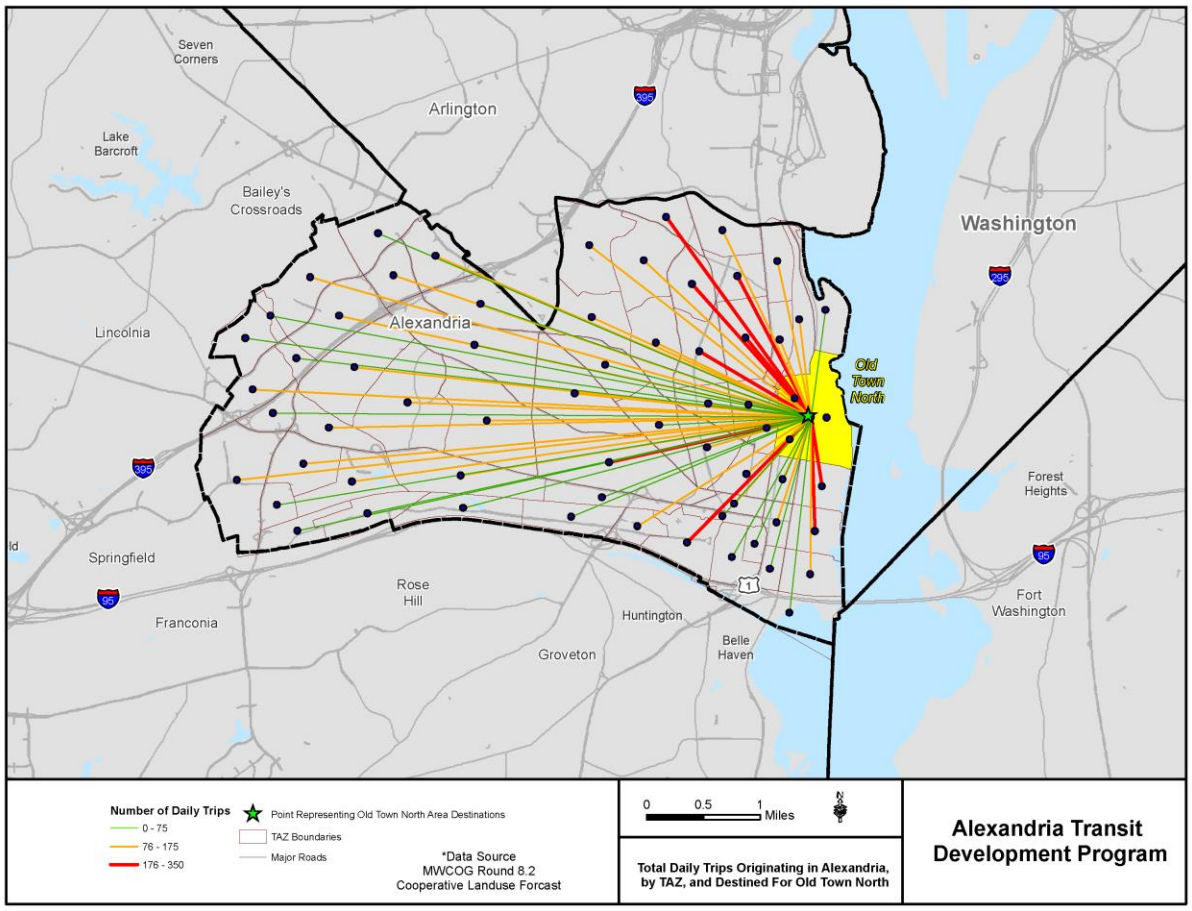


Source: MWCOG Regional Model – 2015 Trip Table

The first concentration of TAZs with heavy trip flows to Potomac Yard is located directly west of Potomac Yard. These TAZs can access the area via the AT9. TAZs to the south of Potomac Yard with heavy trip flows to the area can access the area via Metroway and the DASH AT10 route. Some of the trips from these TAZs can be made directly while others would require a transfer in Old Town.

Figure 3.41 shows trip flows to Old Town North from TAZs within Alexandria.

Figure 3.41 - Trip Flows from Within Alexandria to Old Town North



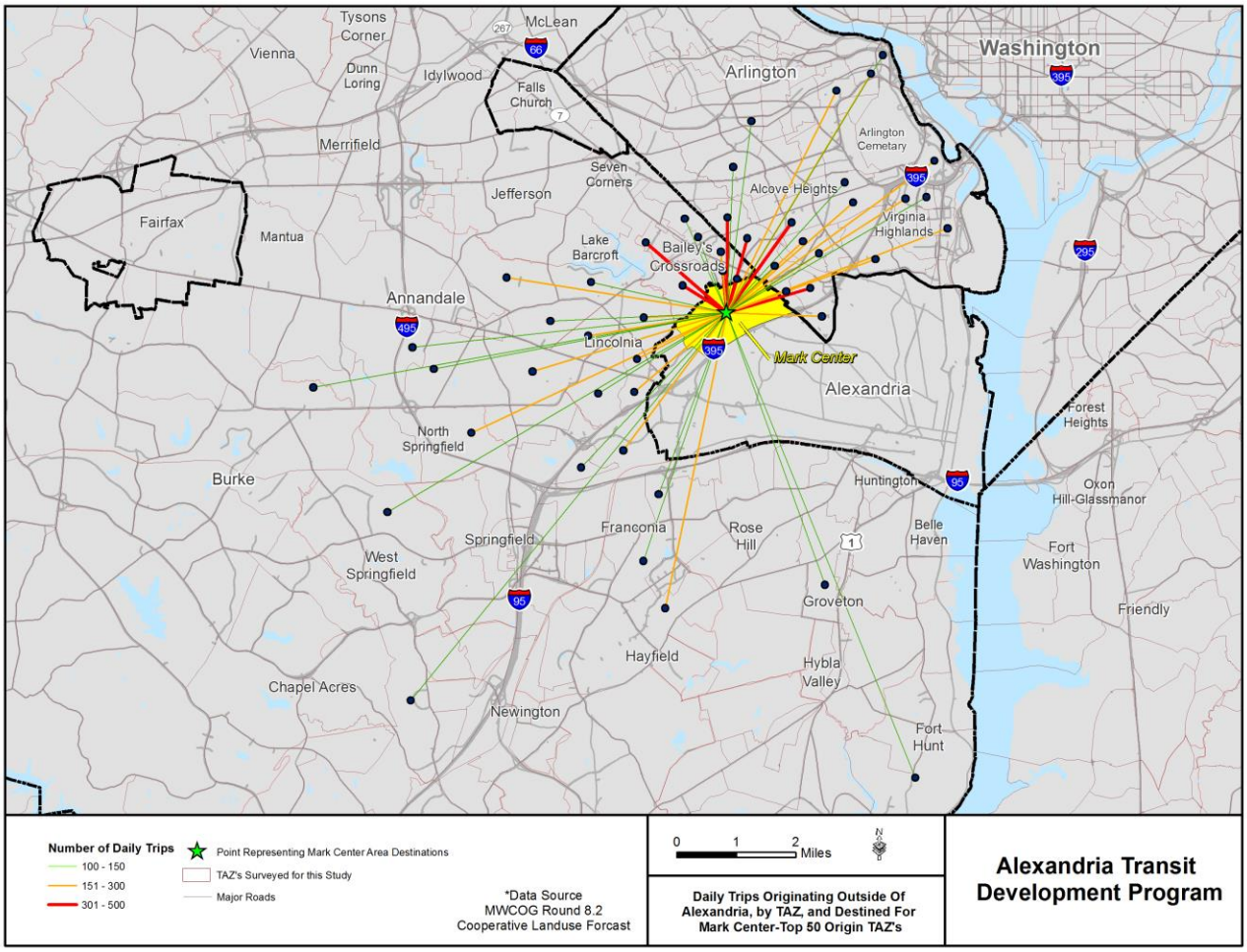
Source: MWCOG Regional Model – 2015 Trip Table

The first concentration of heavy origins to Old Town North is the area located to the northwest of this destination. Access for these trips is provided by the DASH AT3, AT4 and the AT10 routes, as well as the Metrobus 10 Line. Service from the heavy origins south of Old Town is provided by the Metrobus 10 Line as well as the DASH AT2, AT3, AT4, and AT5 routes.

The final set of trip flow maps contain data on trip flows from outside Alexandria to key employment centers within Alexandria. Each map shows the top 50 origin TAZs outside the City to the subject employment center within the City. It is important to note that this analysis covered the entire MWCOG region but each map was scaled to encompass only those origin TAZs that fell within the top 50 origin TAZs to the subject activity center.

Figure 3.42, shows trip flows to Mark Center.

Figure 3.42 - Trip Flows from Outside Alexandria to the Mark Center

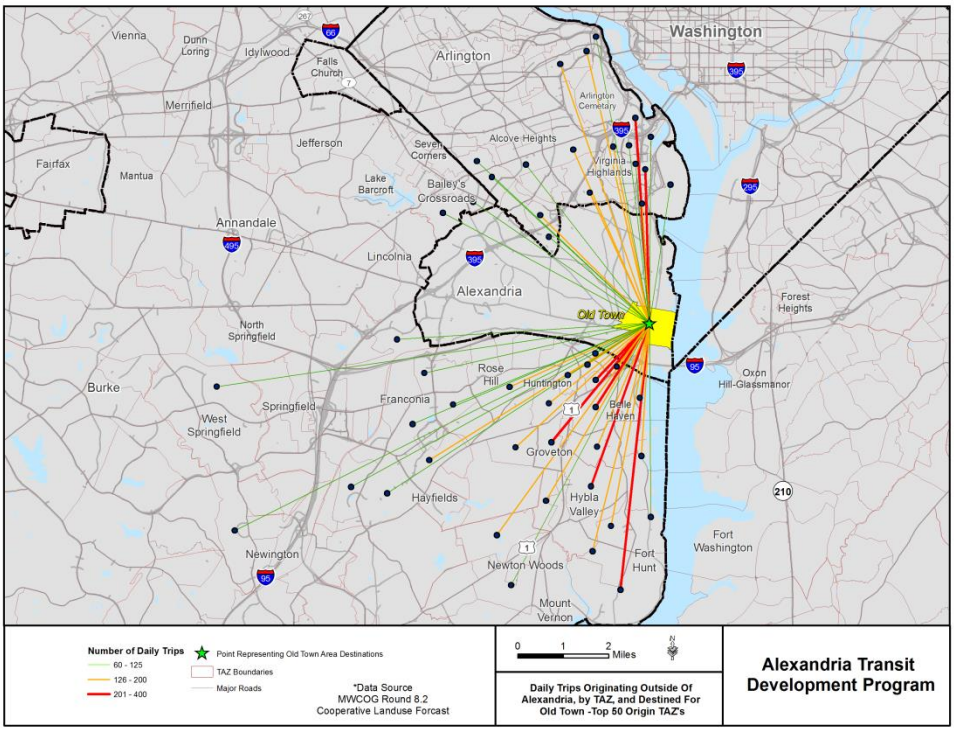


Source: MWCOG Regional Model – 2015 Trip Table

The data in the map shows the heaviest trip flows to Mark Center are concentrated in TAZs close-by in Arlington and Fairfax County. Transit access to the Mark Center from these origin TAZs are provided by the 25, 28, and 7 Metrobus Lines, with some TAZs accessible by direct service, while other TAZs would require a transfer.

Figure 3.43 shows trip flows to Old Town from TAZs located outside the City.

Figure 3.43 - Trip Flows from Outside Alexandria to Old Town

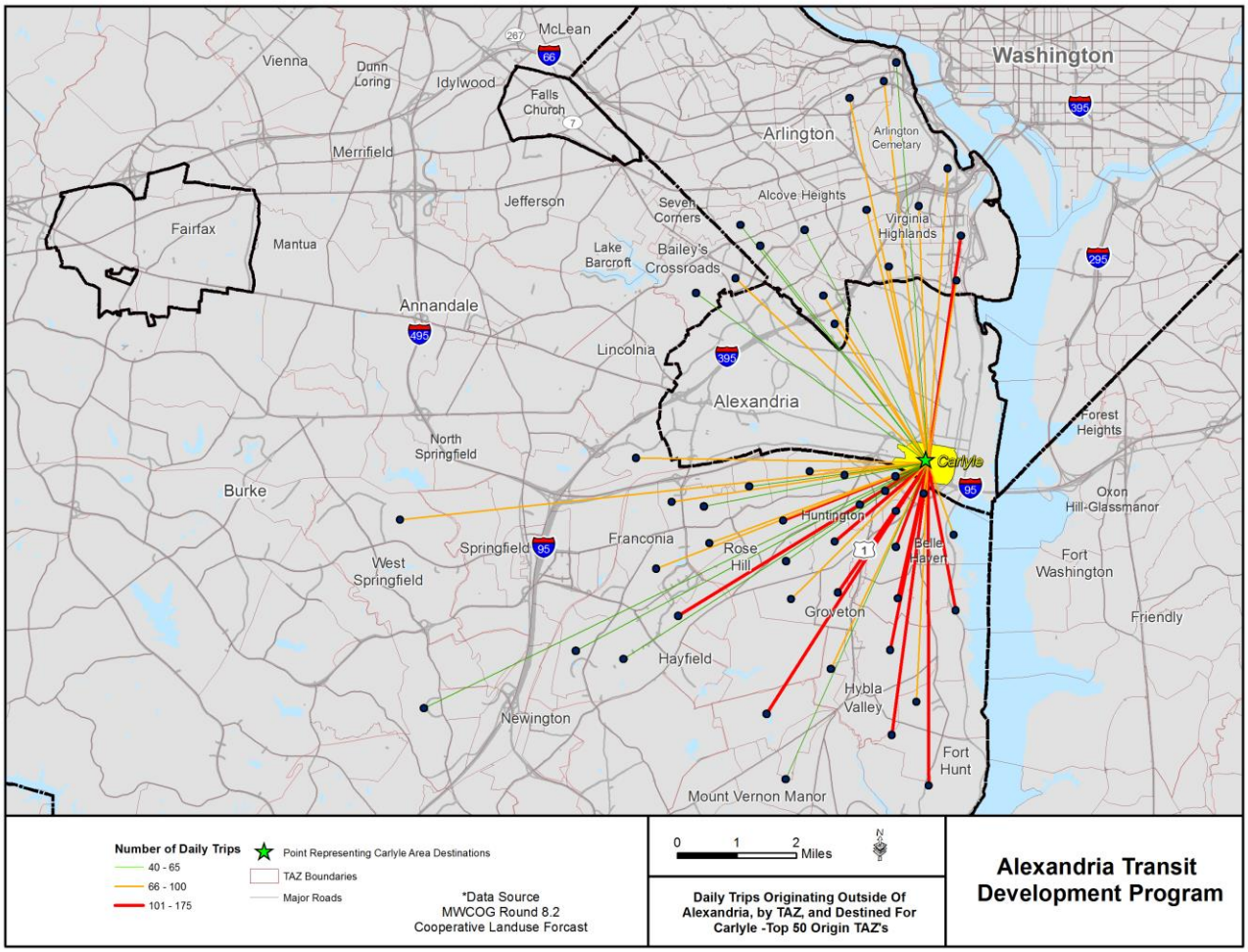


Source: MWCOG Regional Model – 2015 Trip Table

The data in the map shows the heaviest trips flows coming from the Route 1 corridor and just west of Route 1 south of the City in Fairfax County and along the Route 1 corridor in Arlington. The origin TAZs south of the City are served by the REX service, the Yellow Line and Fairfax Connector service while the service north of the City is served by the Blue Line, Metroway, and the Metrobus 9A and 10R routes.

Figure 3.44 shows trip flows to Carlyle from TAZs located outside the City.

Figure3.44 - Trip Flows from Outside Alexandria to Carlyle

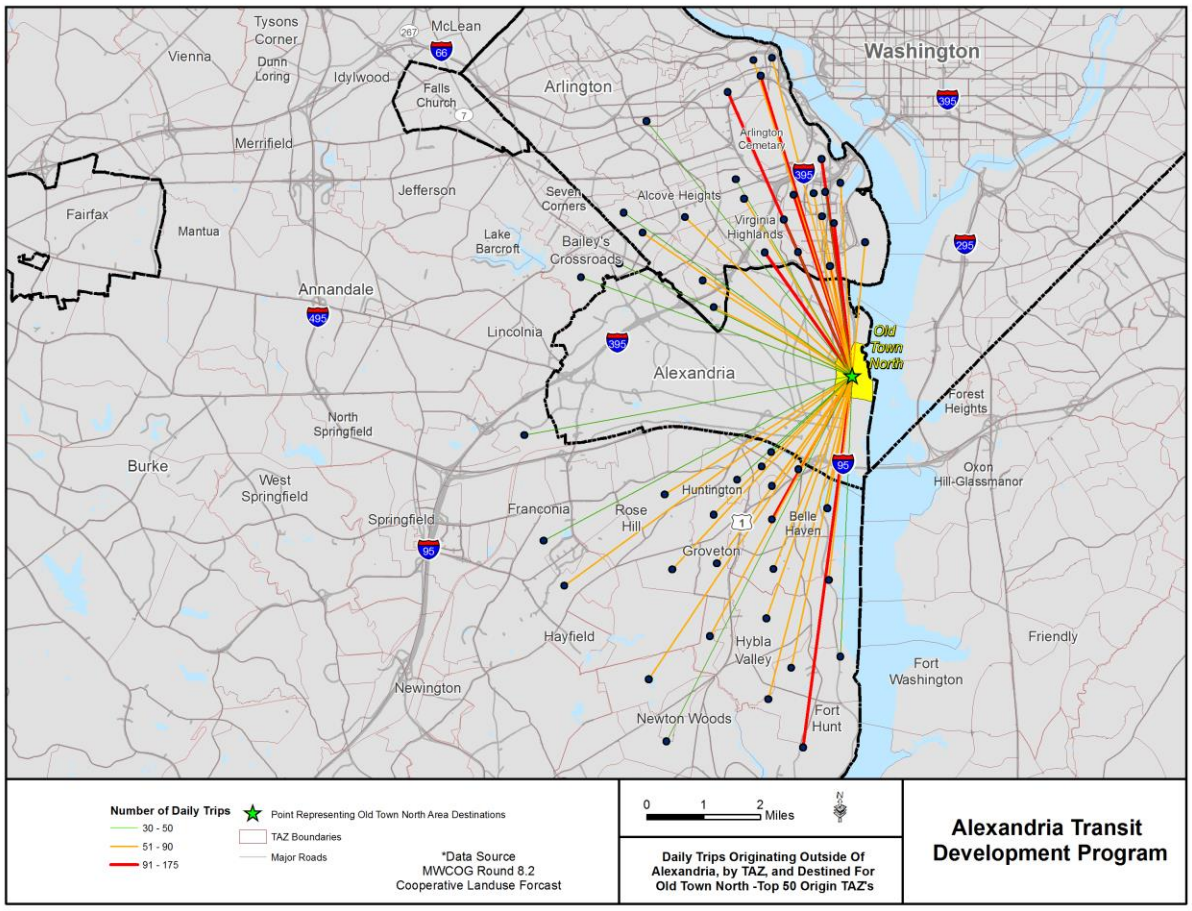


Source: MWCOG Regional Model – 2015 Trip Table

The data in the map show the first concentration of heavy origin zones close by Carlyle to the south in Fairfax County. REX service and the Yellow Line provide transit access for some of these TAZs while others would rely on Fairfax Connector service and a transfer to the Yellow Line or REX. A second heavy trip flow comes from Rosslyn in Arlington. This TAZ would be accessible by the Blue Line or the Metrobus 10R service. The proposed Eisenhower Circulator, outlined in Chapter 4, would play an important role in helping people get from the King Street Metrorail Station, which would be a transfer point for the services noted above, and Carlyle.

Figure 3.45 shows trip flows to Old Town North from TAZs located outside the City.

Figure 3.45 - Trip Flows from Outside Alexandria to Old Town North



Source: MWCOG Regional Model – 2015 Trip Table

The heaviest trip flows to Old Town North come from Arlington, with a secondary concentration south of Alexandria in Fairfax County. The trip flows from Arlington are served by the Metrobus 10 Line and the Blue Line while the flows from the south are best served by the REX service.

4.0 Development and Redevelopment Areas

This section summarizes key development and redevelopment areas within the City, with a specific focus on whether new transit service, or improvements to existing service, will be required to support this planned growth.

4.1 Potomac Yard North

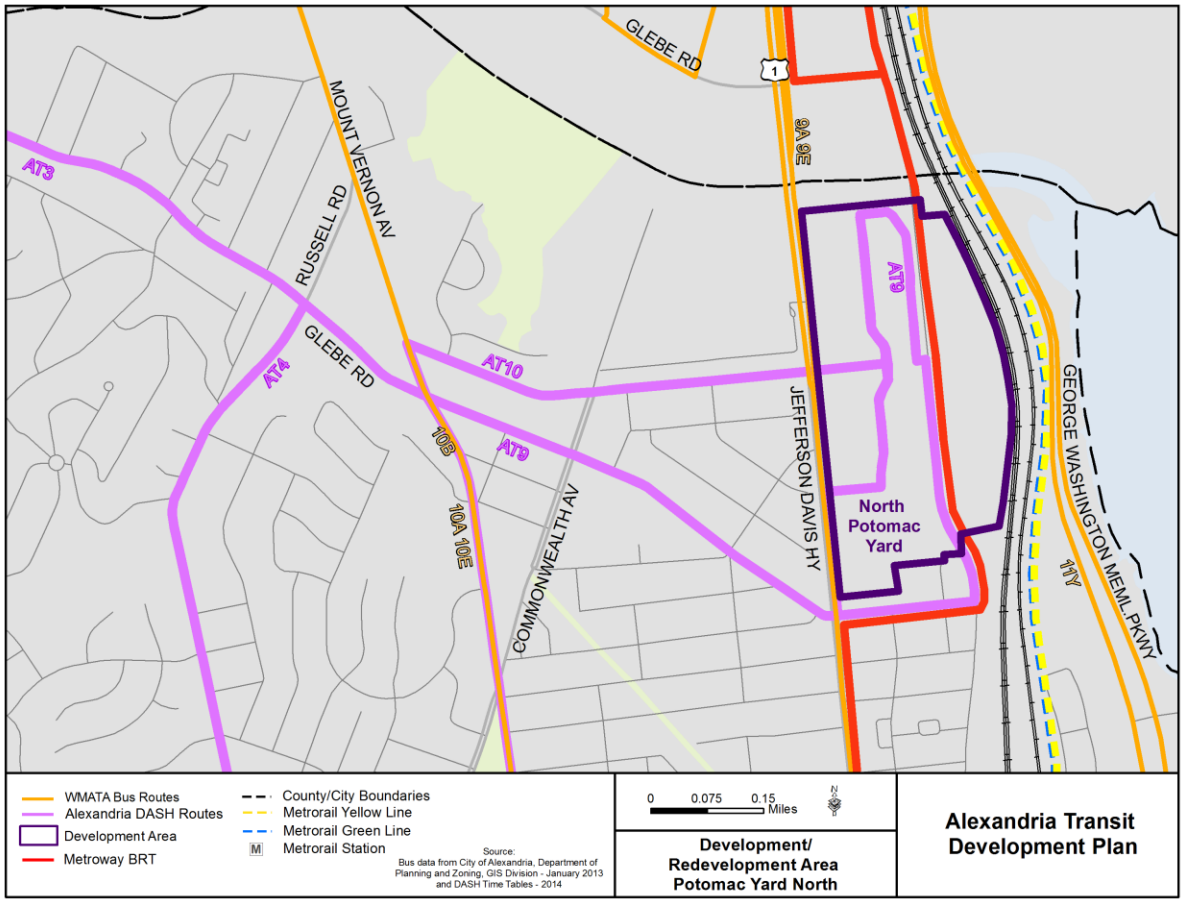
The North Potomac Yard area consists of 295 acres of proposed mixed-use commercial and residential development that will be anchored by the proposed Potomac Yard Metrorail Station. The allocation and mix of land uses planned for North Potomac Yard are based on the proximity and relationship of parcels to transit, planned surrounding uses, open space, and the proposed street network. The ultimate intent of the development is to have a walkable 24-hour community that does not rely on the automobile for mobility. Given these goals, transit is an essential element of the development strategy.

A key focus of the plan is a balance between office, residential, and retail uses, with two to three times more residential than office proposed to achieve this balance.

The Potomac Yard area is currently served by Metrobus 9A service along U.S. Route 1, the Metroway service that runs through the heart of the North Potomac Yard area, and the DASH AT9 and AT10 routes.

A map of the Potomac Yard North development area and the transit services within the development area are shown in Figure 3.46.

Figure 3.46 - North Potomac Yard Development Area



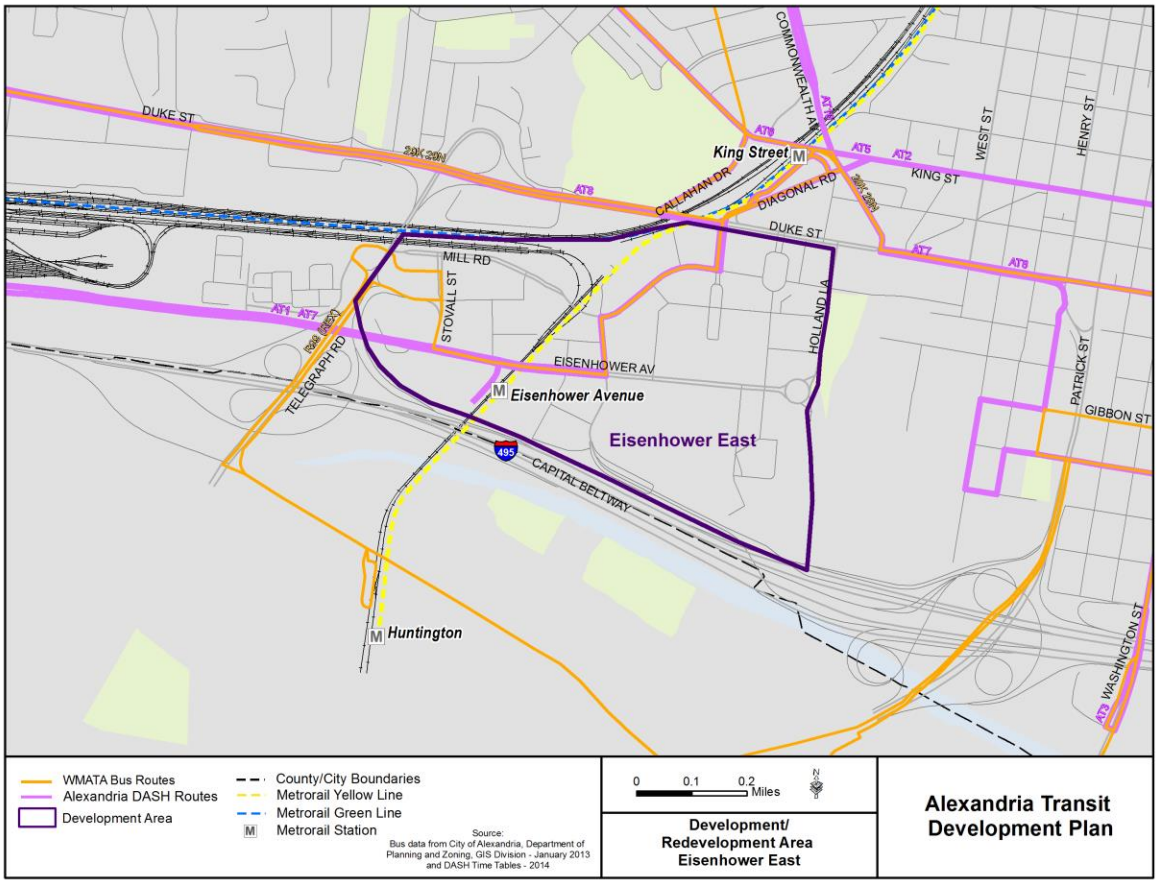
4.2 Carlyle/Eisenhower East

Carlyle/East Eisenhower is a newer mixed-use development that was once predominantly industrial and vacant land. The area is in close proximity to two Metrorail stations (King Street and Eisenhower), Old Town, and Interstate 495.The area consists of about 230 acres bounded on the north by Duke Street and the south by I-495. The eastern boundary is Holland Lane and the western boundary is Telegraph Road (see map in Figure 3.56). The proposed development plan for the area would encompass an urban mixed-use community that is anchored by the Eisenhower Metrorail Station. The redevelopment would rely on transit for mobility and would include a mix of jobs, housing and a retail/entertainment. In economic terms Eisenhower East is a resource of great importance for the City of Alexandria as it provides the foundation for the City's near and long-term commercial and residential growth. The redevelopment represents the opportunity to create additional value outside the Alexandria historic core.

The development area is currently served by the Yellow Line at the Eisenhower Metrorail Station, the DASH AT 8 on Duke Street, the DASH AT1 and AT7 on Eisenhower Avenue, the Metrobus 29K, N on Duke Street, and the Metrobus Route 1 REX service. The area is also a focus of a new proposed service, the DASH Eisenhower Circulator. The area is also close to the King Street Metrorail Station, which is served by the Yellow and Blue Lines as well as a large number of DASH and WMATA bus routes.

The development area and the transit services serving it are shown in Figure 3.47.

Figure 3.47 – Carlyle – Eisenhower East Development Area

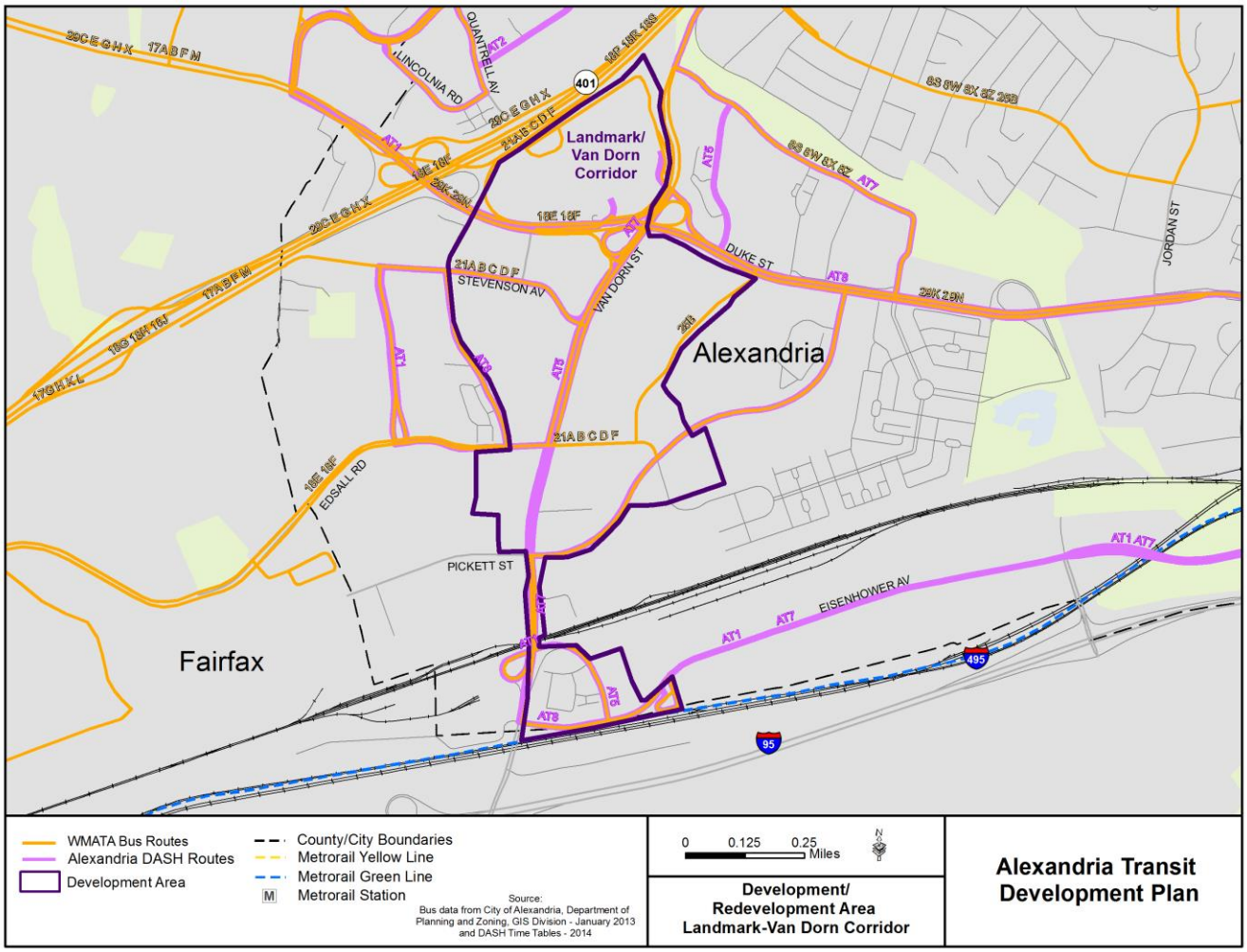


4.3 Landmark/Van Dorn

The Landmark/Van Dorn Corridor Plan begins by noting that the area is characterized by automobile-dominated corridors, disconnected commercial, multi-family, and industrial uses and a lack of a sense of place. The focus of the plan is to transform the current suburban development pattern into a quality mixed use urban community that serves the residents of the development/redevelopment area as well as the City of Alexandria as a whole. The 240 acre development area is focused along Van Dorn Street and extending from the Landmark Mall to the Van Dorn Metrorail Station. Given the existing development within the area, the creation of new urbanized area will require a combination of private development and public sector action. The anchor of the redevelopment will be the transformation of the current Landmark Mall into a mixed-use town center that includes office, residential, and retail uses. The redevelopment area is served by a dense transit network including the Van Dorn Metrorail Station, the DASH AT1, AT5, AT7 and AT8 routes and the Metrobus 25B, and 29K, N Lines. In addition, the proposed West End Transitway will run along Van Dorn Street, thus providing a backbone transit service through the heart of the redevelopment area.

The development area and the transit services serving it are shown in Figure 3.48.

Figure 3.48 – Landmark/Van Dorn Redevelopment Area



4.4 Beauregard

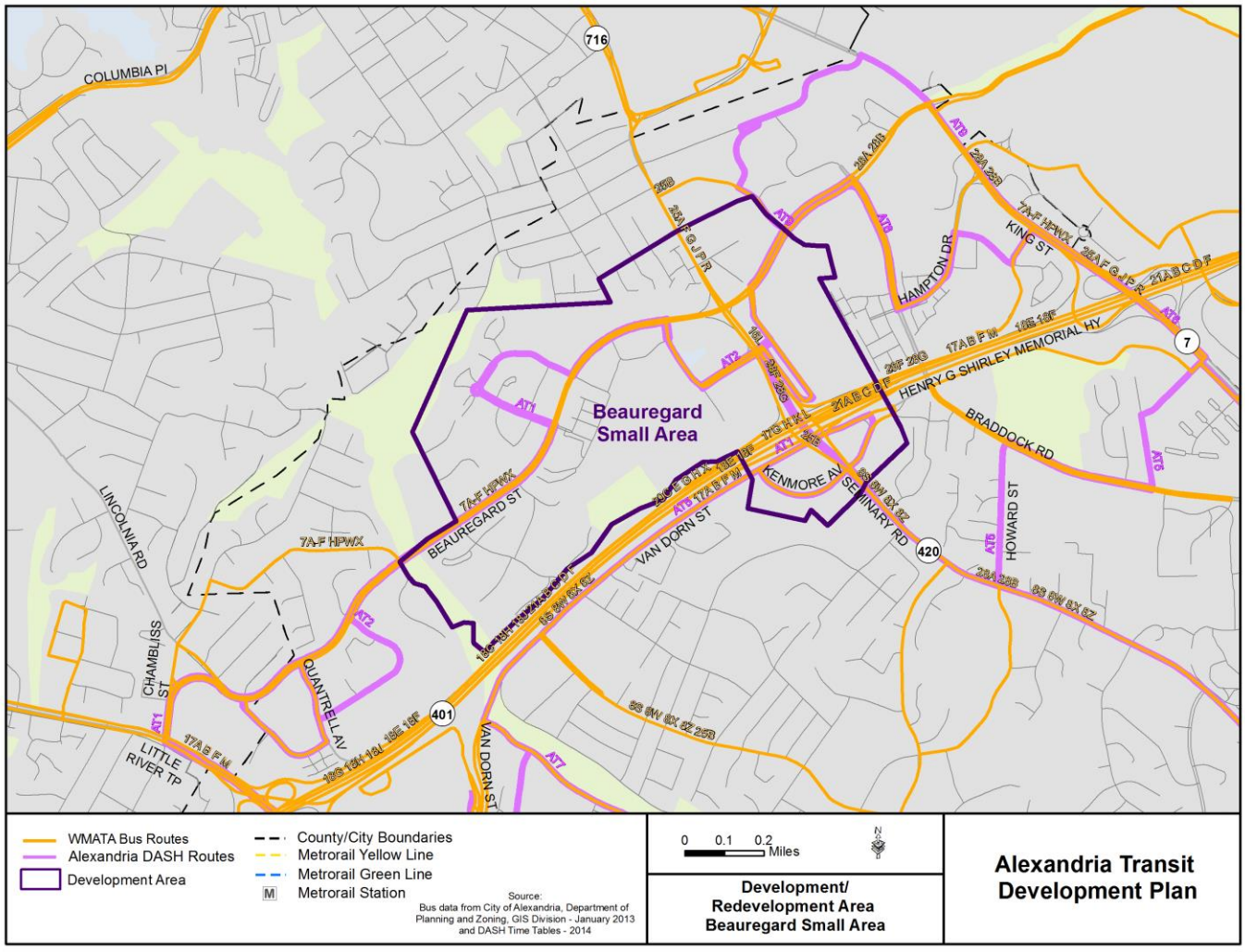
The Beauregard redevelopment area consists of approximately 287 acres that is focused on the North Beauregard corridor in the westernmost portion of Alexandria. The proposed framework for the redevelopment is seven distinct neighborhoods within the overall planning area. The overall land use strategy for the redevelopment is based on the following elements:

- Concentrate redevelopment density at transit stops;
- Appropriate building heights at transit stops;
- A balance of commercial and residential uses;
- Mix of land uses within each of the seven proposed neighborhoods;
- Concentration of retail at transit stops;
- Appropriate transitions to existing neighborhoods;
- Management of parking to support transit;
- Overall focus on open space and parks, especially within specific neighborhoods.

The overall plan recommends increasing density where it can be properly supported by transit. The Beauregard redevelopment area is served by a very dense network of transit service including the Metrobus 7 Lines, the Metrobus 25B Line, the Metrobus 8 Line, the Metrobus 21 Line, and the DASH AT1 and AT2 routes. The proposed West End Transitway would also be located along Beauregard Street and would be a key foundation for the proposed redevelopment described above.

A map of the Beauregard redevelopment area and the transit services within the redevelopment area are shown in Figure 3.49

Figure 3.49 – Beauregard Redevelopment Area



4.5 Waterfront

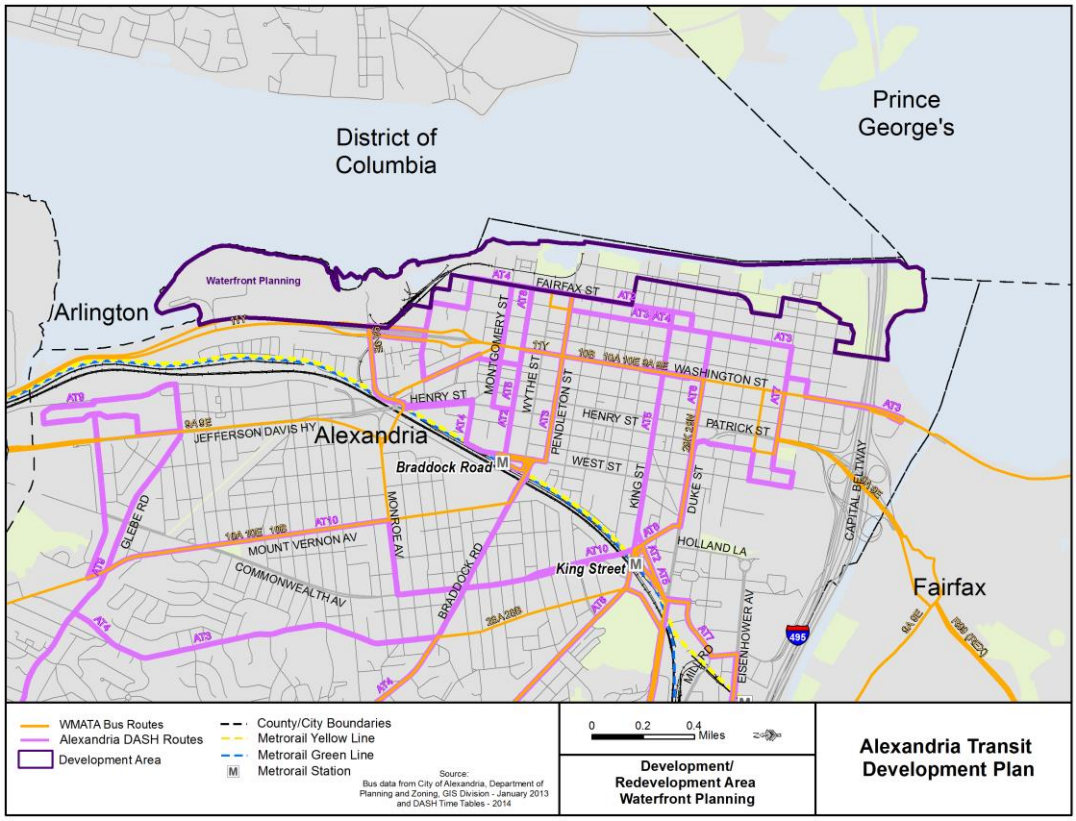
The planning process for the Alexandria waterfront is focused on a comprehensive and consistent redevelopment of key sites along the Alexandria waterfront from I-95 in the south to approximately Slaters Lane in the north. The focus of the plan includes:

- Redevelopment of active and inactive industrial areas along the waterfront, predominantly into mixed used developments. Maintaining the character of the waterfront will be essential in these redevelopments.
- Increase opportunities for access to the waterfront for Alexandria residents, including ensuring that no redevelopment precludes waterfront access.
- Improve parkland and recreational uses along the waterfront.
- Increase marina space along the waterfront.

The area of the Alexandria waterfront identified in the Waterfront Plan is served by the King Street Trolley and a number of adjacent transit services, though no services other than the Trolley actually run within the redevelopment area itself. Adjacent services include the DASH AT2, AT3, AT4, AT5, and AT7, and the Metrobus 10 and 11Y lines.

A map of the Waterfront redevelopment area and the transit services running adjacent to the area are shown in Figure 3.50.

Figure 3.50 – Waterfront Redevelopment Area



4.6 Arlandria/Del Ray

The Arlandria neighborhood is centered on the northern end of Mount Vernon Avenue and is adjacent to Arlington, located across 4 Mile Run. Key goals of the redevelopment framework set out in the Arlandria Neighborhood Plan (2003) include:

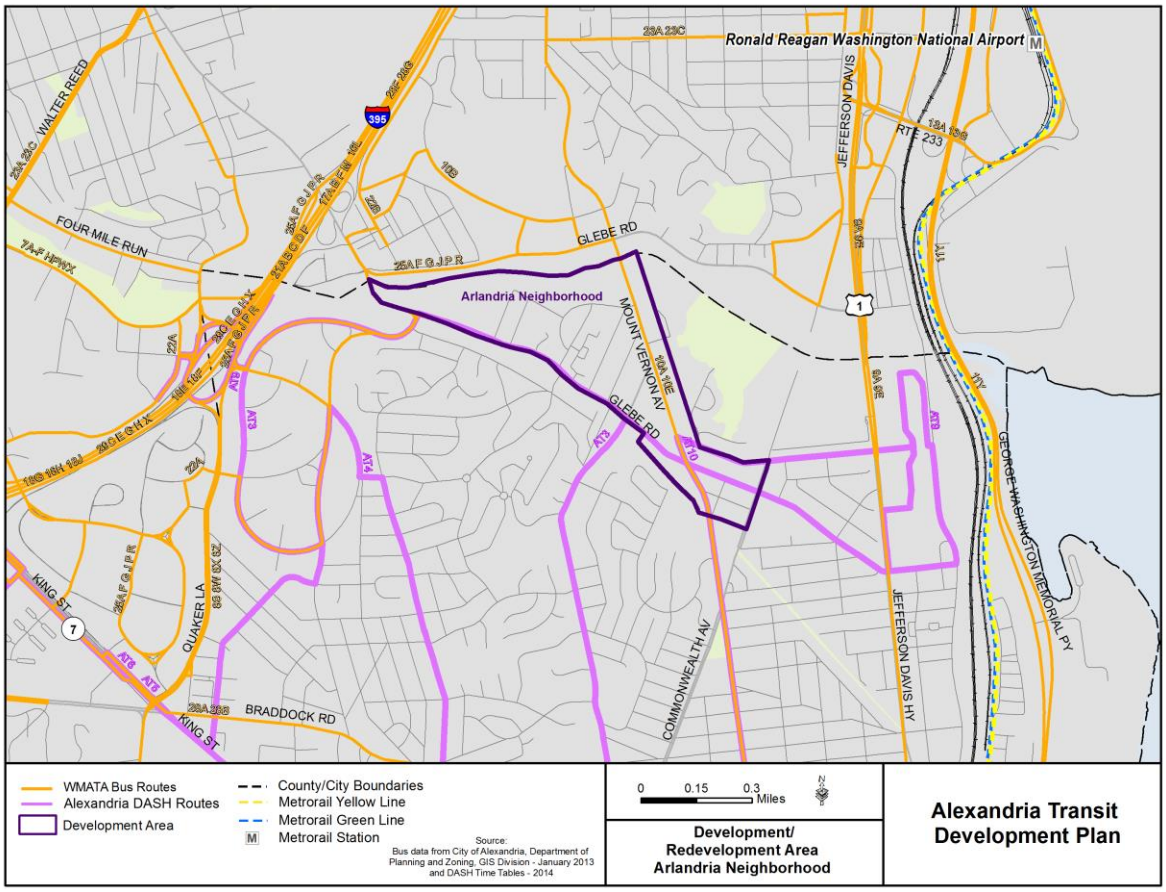
- Active and viable commercial retail that serves both the neighborhood and broader community;
- A transition in uses from automobile oriented to pedestrian oriented;
- Visual and physical connections to Four Mile Run Park; and
- A safer environment for pedestrians.

Current redevelopment projects include the Mount Vernon Village Center and Del Ray Tower along Mount Vernon Avenue. Mount Vernon Village Center will add 685 units and 53,530 square feet of retail to the Arlandria commercial district. Del Ray Tower (aka The Calvert) will add 332 units and 10,900 square feet of retail along Mount Vernon Avenue.

Arlandria is served by the DASH AT3, AT4, AT3/4, AT9 and AT10 routes as well as the WMATA Metrobus 10 Lines.

A map of the Arlandria redevelopment area and the transit services running through or adjacent to the area are shown in Figure 3.51.

Figure 3.51 – Arlandria/Del Ray Redevelopment Area



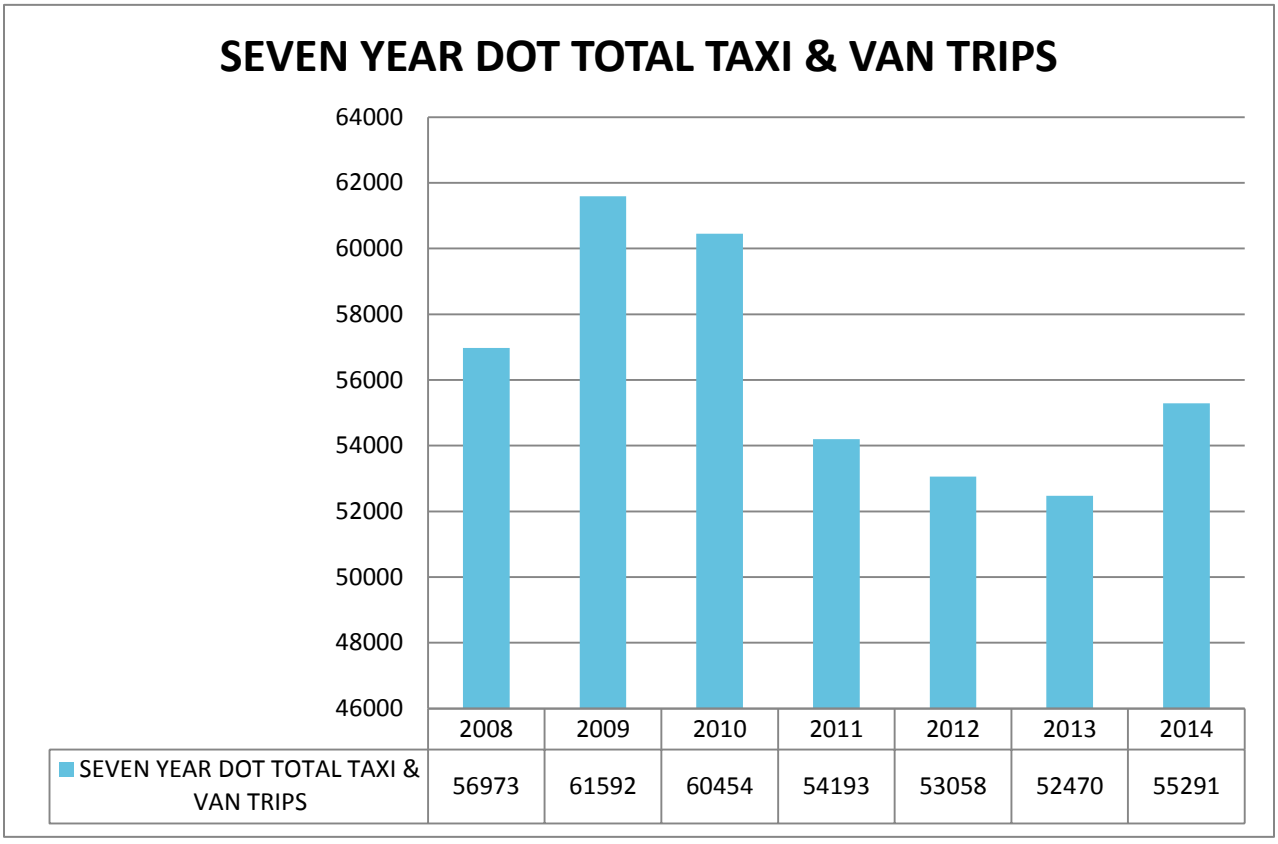
5.0 DOT Paratransit Service

The DOT Demand Response service is operated by the city and is provided for Alexandria City residents with disabilities as an alternative to DASH fixed route service. The service provides disabled Alexandria residents access for all trip purposes to Alexandria, Falls Church, Fairfax County, Fairfax City, and Arlington County. DOT does not go to Washington DC or Maryland (disabled riders wishing to go to those jurisdictions would use the regional MetroAccess demand response service).

Seven year trend data for DOT operational and performance metrics are remarkably stable.

Figure 3.52 shows the number of trips annually since 2008.

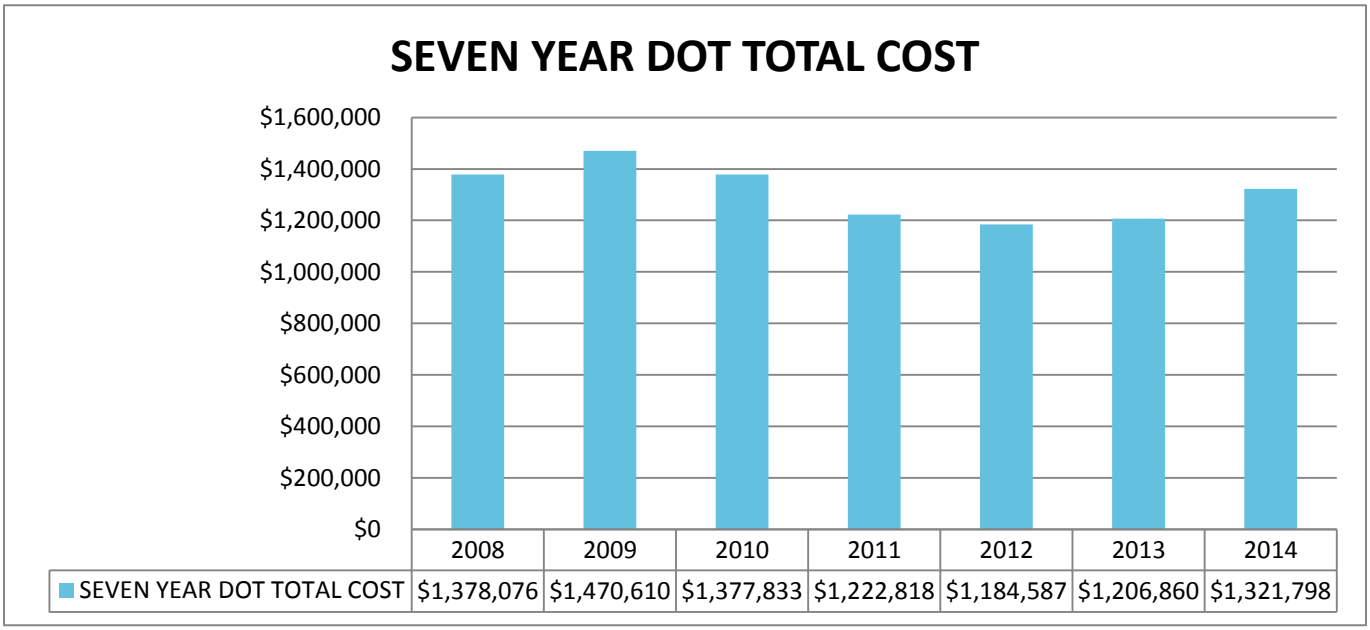
Figure 3.52 – DOT Demand Response Service Annual Trips



The data in Figure 3.52 show a high of 61,592 trips in 2009 to a low of 52,470 trips in 2013, though the average has remained generally around 54,000 to 56,000 annual trips.

Figure 3.53 shows annual operating costs for DOT.

Figure 3.53 – DOT Demand Response Service Annual Cost



The cost data also show significant stability, with a low annual cost of $1,184,587 in 2012 and a high of $1,378,076 in 2008. Other metrics such as cost per trip, cost per mile, and total miles generally show the same stability from year to year.

6.0 Equipment Deficiencies

Alexandria Transit (ATC) plans bus replacement requirements based on a 12-year useful life for vehicles. ATC has noted in its FY 2016 Transit Development Program that due to budgetary constraints, they have had to delay the purchase of replacement buses, thus requiring them to maintain and operate buses beyond their useful life. They have requested capital funding in the FY 2016 Transit Development Program to catch up on all of their replacement requirements (see Chapter 6 for replacement bus funding included in the City's Capital Improvement Program).

Alexandria Transit has also requested funding to begin replacing hybrid bus battery packs, which have a useful life approximately ½ the life of a bus. The battery packs on the first set of hybrid vehicles are nearing the time for replacement.

The final deficiency that Alexandria Transit has requested funding to address is bus storage parking constraints at its existing maintenance and storage facility. They have developed a short-term temporary plan for accommodating the capacity constraint and have also requested funding for a longer-term solution.

In sum, Alexandria Transit is facing some equipment deficiencies but these are not major, and they have plans in place to address these deficiencies.

7.0 ITS Technologies

Alexandria Transit has a detailed technology expansion plan in place. Elements of this plan include:

- Automatic Vehicle Location (AVL) technology on each DASH bus. This AVL capability will support a number of operational and passenger information improvements, including:
    - Real time bus arrival information. Passengers will have the capability to access bus arrival information via their handheld device and there will also be bus arrival signs installed at a number of high ridership stops throughout the DASH system.
    - Computer Aided Dispatch (CAD) capabilities to enhance operations and service reliability.
    - Automated Passenger Counters (APC), which will support collection of boarding and alighting data by stop and trip. This capability will support more sophisticated operations and service planning, and will also support more effective deployment of service to match service levels to demand.
        - To support the most effective use of the APC data, Alexandria Transit will also be procuring a data management system to manage APC data for analysis and reporting requirements.
- The final technology expansion element will be an automated garage mapping system to more effectively manage vehicle maintenance and dispatch.