Dulles Toll Road Comprehensive Traffic and Revenue Study 2014 Update

MWAA
Traffic and Revenue Study Services

Final Report

April 2014

METROPOLITAN WASHINGTON AIRPORTS AUTHORITY

CDM Smith

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Executive Summary

This report summarizes the results of an updated comprehensive traffic and toll revenue (T&R) study for Dulles Toll Road (DTR) in Northern Virginia. The study incorporated work performed by CDM Smith for several recent studies between June 2011 and March 2014 undertaken at the request of the Metropolitan Washington Airports Authority (Airports Authority). The scope of work for the study included development of updated estimates of traffic and toll revenue over a 40-year forecast horizon with a level of detail sufficient to support the project financing effort for improvements in the Dulles Corridor most significantly the Dulles Corridor Metrorail Project.

DTR Overview

The DTR was constructed by the Virginia Department of Transportation (VDOT) and opened to traffic in October 1984. It provides access to well-established and growing activity centers in the Northern Virginia region, such as Tysons Corner, the Reston-Herndon area, Dulles International Airport and eastern Loudoun County.

The DTR is an eight-lane (four in each direction) tolled roadway approximately 13.4 miles in length that extends generally from the Capital Beltway (Interstate 495) to beyond Virginia Route 28 where it links directly to the Dulles Greenway, a privately-operated toll road. Toll collection is by means of cash and electronic toll collection (E-ZPass). The DTR is configured with one Main Line plaza at the eastern end and 19 ramp plazas at major interchanges.

When it opened in 1984, the DTR had two lanes in each direction and eight full interchanges. A ninth interchange and two partial interchanges were subsequently constructed to enhance local access. In response to strong demand, the DTR was widened to six lanes in 1992 and then eight lanes in 1998. Major improvements to the Capital Beltway ramps were made first in 2005 and more recently with interchange improvements and reconfigurations associated with the 495 Express Lanes project which opened in November 2012. MWAA continues to work on improvements in the corridor including the planned conversion of 19 toll plazas to all-electronic in order to satisfy the increasing number of customers that pay by E-ZPass.

Historical Traffic and Revenue

The initial DTR toll rates were 50 cents at the Main Line toll plaza and 25 cents at ramp locations, except for the 35 cents toll at Route 28. During the first 20 years of operation there were no toll rate adjustments. In 2005, the Commonwealth Transportation Board increased toll rates to begin generating funds for transit improvements in the Dulles Corridor. The Main Line toll rate for two-axle vehicles was set at 75 cents in both directions and all ramp tolls were established at a now uniform 50 cents.

Responsibility for operating and maintaining the DTR was transferred to the Airports Authority in 2008. In 2009, the Airports Authority Board of Directors approved a series of toll rate increases for two-axle vehicles consisting of (i) a $0.25 increase at the Main Line toll plaza and at all ramps effective

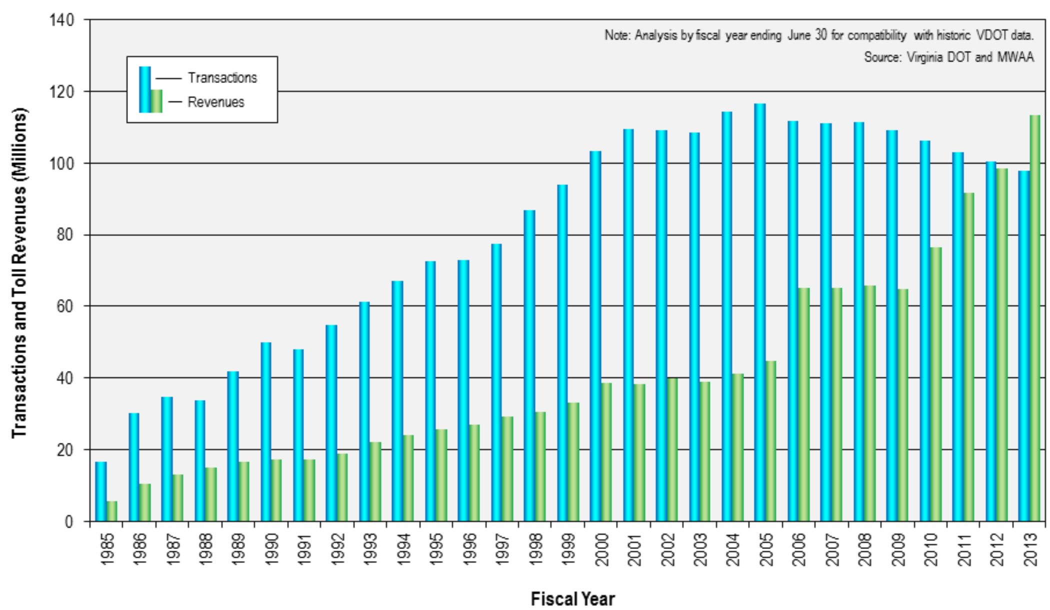
January 1, 2010, (ii) a $0.25 increase at the Main Line plaza only effective January 1, 2011, and (iii) a $0.25 increase at the Main Line plaza only on January 1, 2012. Vehicles with three or more axles were charged an additional 25 cents per axle up to a maximum additional charge of $1.00.

In November 2012, the Airports Authority Board voted to adjust rates on the Dulles Toll Road, beginning in January 2013, from $1.50 to $1.75 at the Main Line toll plaza and from 75 cents to $1.00 on ramps, with an additional increase in January 2014 to $2.50 at the Main Line plaza only. The Board also modified the rate schedule for vehicles with three or more axles to be more consistent with the policies for other toll facilities in the region; as of January 1, 2013, rates for multi-axle vehicles using the DTR were equal to two times the rate for two-axle vehicles plus an additional charge per axle.

The Airports Authority Board considered, but did not approve, a toll rate increase for calendar year 2015. The toll rate scheduled developed by the Airports Authority's financial advisors for purposes of this study assumes that current toll rates will be maintain without any adjustments until 2019.

Historically, toll road demand has been somewhat sensitive to economic growth but has consistently rebounded immediately after economic slowdowns as illustrated in Figure ES-1. The figure also illustrates how the periodic widening of the DTR and toll rate adjustments in 2005, 2010, 2011, 2012 and 2013 resulted in increased toll revenues.

Dulles Toll Road
MWAA Traffic and Revenue Study Services



DTR TRANSACTIONS AND REVENUES FY 1985 - FY 2013

FIGURE ES-1

Study Approach Overview

This updated T&R study is being conducted at a full "investment grade" level and is considered suitable for use in project financing. The study has benefited from the release of the Metropolitan Washington Council of Governments (MWCOG) travel demand model (adopted November 2011) and their socio-economic projections for the region (adopted December 2010). The model also reflects the most recently approved future transportation improvement plans including the impacts of various HOT Lanes projects and the two phases of the Silver Line assumed to open mid-2014 and early 2019.

The regional MWCOG travel demand model was the starting point for the T&R study. It was updated and refined based on the professional experience and judgment of CDM Smith. Key components of the work effort included calibration of the model with existing travel data, confirming how much travelers in the DTR corridor may be willing to pay in order to save time, and conducting an independent evaluation of the socioeconomic forecasts. Another key input was the assumed future toll rate adjustments provided by the Airports Authority's financial advisors.

Calibration of the Travel Demand Model

To refine the model, CDM Smith utilized significant data for the base model year 2011, including detailed traffic data and information related to travel characteristics collected in the DTR corridor. In addition to the detailed corridor reconnaissance, speed and delay surveys and traffic counts in the DTR corridor, CDM Smith utilized base year travel pattern and characteristic surveys conducted at the Main Line and ramp toll locations. CDM Smith also used base year video license plate matching entry/exit pattern surveys to assist in model development and validation.

Value of Time Calculations

Stated preference surveys conducted for MWAA for the Dulles Toll Road Comprehensive Traffic and Revenue Study published in July 2009 (the 2009 study) were used as the basis for estimating toll impacts on the DTR. These surveys provide useful estimates of how travelers in the DTR corridor value time, as well as motorists' preferences regarding toll collection options and other inputs. The surveys found average values of time generally in the range of $0.17 to $0.21 per minute, depending on trip purpose.

The value of time range for the Dulles Toll Road is relatively high compared with the estimates calculated for some other toll facilities, but that reflects the fact that median household incomes in Fairfax and Loudoun Counties are among the highest in the nation. Estimates of the potential impact of the January 2010, 2011, 2012 and 2013 toll adjustments proved to be very accurate, so CDM Smith did not repeat the stated preference surveys for this study and instead focused on verifying that the model was performing well in relation to observed customers' sensitivity to actual toll adjustments.

Review of Socioeconomic Projections

All socioeconomic data has been updated to reflect the 2010 Census results. In addition, an updated independent review of MWCOG's socioeconomic projections for the region was performed by Renaissance Planning Group (RPG). Modifications to the MWCOG data based on the RPG review are discussed in Chapter 4 and in their report which is included as an appendix to the traffic and revenue study. The long term economic and demographic outlook for the DTR corridor remains very favorable.

Future Toll Rate Adjustments

The assumed toll rates for the years 2015 through 2054 are similar to the "Projected Toll Rate Schedule" included in the 2009 study with some conforming adjustments to the assumed rates for multi-axle vehicles:

- In 2019, a $0.75 increase occurs at the Main Line plaza and $0.50 at all ramp plazas.
- Beginning in 2023, and occurring every five years thereafter, there is an increase of $0.75 at the Main Line plaza and $0.50 at all ramp plazas, with the exception of a $0.75 increase at all plazas in 2033.

The detailed toll rate schedule is provided as Table ES-1. The financial advisors to the Airports Authority developed the Projected Toll Rate Schedule and recommended that it be used for this study.

Dulles Greenway tolls were also adjusted in the travel demand model based on already-approved increases through 2020 and expectations of additional future escalations.

Estimated Traffic and Toll Revenue

Base case traffic and toll revenue estimates were developed for the DTR, extending over a 40-year period up to 2054.

Detailed highway networks were prepared for the base model year (2011) and for future years 2015, 2020, 2025, 2030, 2035 and 2040. Separate traffic assignments were made for morning peak, mid-day, afternoon peak and night conditions in each model year.

Projected future toll rates were then tested in selected years. No changes in toll collection methods were assumed at this stage, e.g. all electronic tolling, peak pricing, tolling un-tolled ramps, etc. All of the traffic assignments listed above were also modeled with the previous period's toll rates (i.e. no toll rate increase) to estimate toll impacts and to aid interpolation. Annual estimates were developed and re-based to the actual annual traffic and revenue observed in Calendar Year 2013 (CY2013).

Table ES-2 provides a summary of annual traffic and revenue estimates for the DTR under the Projected Toll Rate Schedule. In CY2013, total annual transactions that occurred on the DTR system amounted to approximately 98.7 million. This translated to annual toll revenues approaching $127.1 million in CY2013.

Taking account of the 2014 $0.75 Main Line toll increase, annual total transactions are estimated to decrease by 2.3% to approximately 96.5 million per year. These transactions would produce about $151.6 million in annual toll revenues. By 2019, annual transactions are expected to be an estimated 96.3 million per year generating annual toll revenues of $205.0 million.

In 2023, annual total transactions number almost 92.5 million. In the same year, the amount of toll revenue generated is over $256.5 million. By 2033, the forecasted annual toll revenues exceed $400.0 million based on over 96.5 million annual transactions.

CDM Smith also performed a series of sensitivity tests to test the potential impacts on estimated toll revenue in model years 2015 and 2035 associated with hypothetical changes in certain assumptions or basic study inputs. These tests cover a range of potential risk factors, such as alternative economic growth, lower values of time, gas price increases and accelerated capital investments in other transportation projects.

Table ES-1
Projected Toll Rate Schedule

	Main Line		Ramps	
	Tolls	Change	Tolls	Change
1984-2005	$0.50	..	$0.35/$0.25	..
2005-2009	0.75	**+ $ 0.25**	0.50	**+ $ 0.15**
2010	**1.00**	**+ $ 0.25**	**0.75**	**+ $ 0.25**
2011	1.25	**+ $ 0.25**	0.75	..
2012	1.50	**+ $ 0.25**	0.75	..
2013	**1.75**	**+ $ 0.25**	**1.00**	**+ $ 0.25**
2014	**2.50**	**+ $ 0.75**	1.00	..
2015	2.50	..	1.00	..
2016	2.50	..	1.00	..
2017	2.50	..	1.00	..
2018	2.50	..	1.00	..
2019	**3.25**	**+ $ 0.75**	**1.50**	**+ $ 0.50**
2020	3.25	..	1.50	..
2021	3.25	..	1.50	..
2022	3.25	..	1.50	..
2023	**4.00**	**+ $ 0.75**	**2.00**	**+ $ 0.50**
2024	4.00	..	2.00	..
2025	4.00	..	2.00	..
2026	4.00	..	2.00	..
2027	4.00	..	2.00	..
2028	**4.75**	**+ $ 0.75**	**2.50**	**+ $ 0.50**
2029	4.75	..	2.50	..
2030	4.75	..	2.50	..
2031	4.75	..	2.50	..
2032	4.75	..	2.50	..
2033	**5.50**	**+ $ 0.75**	**3.25**	**+ $ 0.75**
2034	5.50	..	3.25	..
2035	5.50	..	3.25	..
2036	5.50	..	3.25	..
2037	5.50	..	3.25	..
2038	**6.25**	**+ $ 0.75**	**3.75**	**+ $ 0.50**
2039	6.25	..	3.75	..
2040	6.25	..	3.75	..
2041	6.25	..	3.75	..
2042	6.25	..	3.75	..
2043	**7.00**	**+ $ 0.75**	**4.25**	**+ $ 0.50**
2044	7.00	..	4.25	..
2045	7.00	..	4.25	..
2046	7.00	..	4.25	..
2047	7.00	..	4.25	..
2048	**7.75**	**+ $ 0.75**	**4.75**	**+ $ 0.50**
2049	7.75	..	4.75	..
2050	7.75	..	4.75	..
2051	7.75	..	4.75	..
2052	7.75	..	4.75	..
2053	7.75	..	4.75	..
2054	7.75	..	4.75	..

Table ES-2
Dulles Toll Road Traffic and Toll Revenue Estimates 2009-2054

Forecast Year	Calendar Year	Main/Ramp[1] Tolls	Total[2] Transactions	% p.a.	Total[3] Revenue	% p.a.	Average[4] Revenue
-5	2009	$0.75 / $0.50	108,718,207		64,705,148		0.00
-4	2010	$1.00 / $0.75	104,686,184	-3.7%	88,038,167	+36.1%	0.84
-3	2011	$1.25 / $0.75	101,534,955	-3.0%	94,659,539	+7.5%	0.93
-2	2012	$1.50 / $0.75	99,891,072	-1.6%	101,596,089	+7.3%	1.02
-1	2013	$1.75 / $1.00	98,676,217	-1.2%	127,059,341	+25.1%	1.29
0	2014	$2.50 / $1.00	96,454,000	-2.3%	151,601,000	+19.3%	1.57
1	2015	$2.50 / $1.00	98,040,000	+1.6%	154,166,000	+1.7%	1.57
2	2016	$2.50 / $1.00	99,775,000	+1.8%	156,972,000	+1.8%	1.57
3	2017	$2.50 / $1.00	102,527,000	+2.8%	161,425,000	+2.8%	1.57
4	2018	$2.50 / $1.00	103,598,000	+1.0%	163,545,000	+1.3%	1.58
5	2019	$3.25 / $1.50	96,265,000	-7.1%	205,006,000	+25.4%	2.13
6	2020	$3.25 / $1.50	96,729,000	+0.5%	206,563,000	+0.8%	2.14
7	2021	$3.25 / $1.50	97,995,000	+1.3%	209,868,000	+1.6%	2.14
8	2022	$3.25 / $1.50	99,746,000	+1.8%	213,685,000	+1.8%	2.14
9	2023	$4.00 / $2.00	92,493,000	-7.3%	256,533,000	+20.1%	2.77
10	2024	$4.00 / $2.00	94,314,000	+2.0%	261,683,000	+2.0%	2.77
11	2025	$4.00 / $2.00	96,161,000	+2.0%	266,904,000	+2.0%	2.78
12	2026	$4.00 / $2.00	98,485,000	+2.4%	273,474,000	+2.5%	2.78
13	2027	$4.00 / $2.00	100,866,000	+2.4%	280,204,000	+2.5%	2.78
14	2028	$4.75 / $2.50	97,000,000	-3.8%	327,278,000	+16.8%	3.37
15	2029	$4.75 / $2.50	99,246,000	+2.3%	334,997,000	+2.4%	3.38
16	2030	$4.75 / $2.50	100,246,000	+1.0%	338,433,000	+1.0%	3.38
17	2031	$4.75 / $2.50	101,161,000	+0.9%	341,575,000	+0.9%	3.38
18	2032	$4.75 / $2.50	101,892,000	+0.7%	344,088,000	+0.7%	3.38
19	2033	$5.50 / $3.25	96,552,000	-5.2%	400,200,000	+16.3%	4.14
20	2034	$5.50 / $3.25	97,739,000	+1.2%	405,209,000	+1.3%	4.15
21	2035	$5.50 / $3.25	98,946,000	+1.2%	410,304,000	+1.3%	4.15
22	2036	$5.50 / $3.25	99,664,000	+0.7%	413,339,000	+0.7%	4.15
23	2037	$5.50 / $3.25	100,402,000	+0.7%	416,451,000	+0.8%	4.15
24	2038	$6.25 / $3.75	97,556,000	-2.8%	462,898,000	+11.2%	4.74
25	2039	$6.25 / $3.75	98,202,000	+0.7%	466,021,000	+0.7%	4.75
26	2040	$6.25 / $3.75	98,872,000	+0.7%	469,257,000	+0.7%	4.75
27	2041	$6.25 / $3.75	99,464,000	+0.6%	472,120,000	+0.6%	4.75
28	2042	$6.25 / $3.75	100,065,000	+0.6%	475,021,000	+0.6%	4.75
29	2043	$7.00 / $4.25	97,920,000	-2.1%	524,171,000	+10.3%	5.35
30	2044	$7.00 / $4.25	98,282,000	+0.4%	526,144,000	+0.4%	5.35
31	2045	$7.00 / $4.25	98,650,000	+0.4%	528,152,000	+0.4%	5.35
32	2046	$7.00 / $4.25	99,003,000	+0.4%	530,077,000	+0.4%	5.35
33	2047	$7.00 / $4.25	99,361,000	+0.4%	532,029,000	+0.4%	5.35
34	2048	$7.75 / $4.75	97,348,000	-2.0%	580,215,000	+9.1%	5.96
35	2049	$7.75 / $4.75	97,470,000	+0.1%	580,957,000	+0.1%	5.96
36	2050	$7.75 / $4.75	97,596,000	+0.1%	581,724,000	+0.1%	5.96
37	2051	$7.75 / $4.75	97,719,000	+0.1%	582,454,000	+0.1%	5.96
38	2052	$7.75 / $4.75	97,842,000	+0.1%	583,186,000	+0.1%	5.96
39	2053	$7.75 / $4.75	97,968,000	+0.1%	583,942,000	+0.1%	5.96
40	2054	$7.75 / $4.75	98,092,000	+0.1%	584,675,000	+0.1%	5.96

[1] Historical and Projected Toll Rates per MWAA and Financial Advisor
[2] Total Transactions; revenue transactions, violations and non-revenue
[3] Total revenue including violation processing, fees and fines
[4] Average revenue per transaction.

Chapter 1

Introduction

CDM Smith has been re-selected as independent consultants through a competitive procurement process to provide the Metropolitan Washington Airports Authority (Airports Authority or MWAA) with a comprehensive Traffic and Toll Revenue (T&R) Study for the Dulles Toll Road (DTR) facility in northern Virginia. The purpose of the study was to develop updated estimates of traffic and toll revenue over a 40-year forecast horizon with a level of detail sufficient to support a project financing effort.

Pursuant to agreements with the Commonwealth of Virginia (the "Commonwealth"), the Airports Authority has been responsible for the operation and maintenance of the DTR since 2008. The Airports Authority is also responsible for financing the construction of Dulles Corridor Metrorail Project, now officially known as the Silver Line. Funding is being provided by certain local funding partners (the Airports Authority, Fairfax County, and Loudoun County) as well as the Commonwealth and the Federal Government. A significant portion of the funding for the Dulles Corridor Metrorail Project will be provided from proceeds of debt secured by DTR revenues.

This traffic and toll revenue study is the culmination of several detailed studies commissioned by MWAA since June 2011 and brings up to date current assumptions regarding the future toll rates based on expected Federal and Commonwealth funding, the regional economic outlook, and actual traffic and revenue performance through January 2014 including the impacts of the recent toll adjustments. Background information regarding the DTR has also been updated through January 2014.

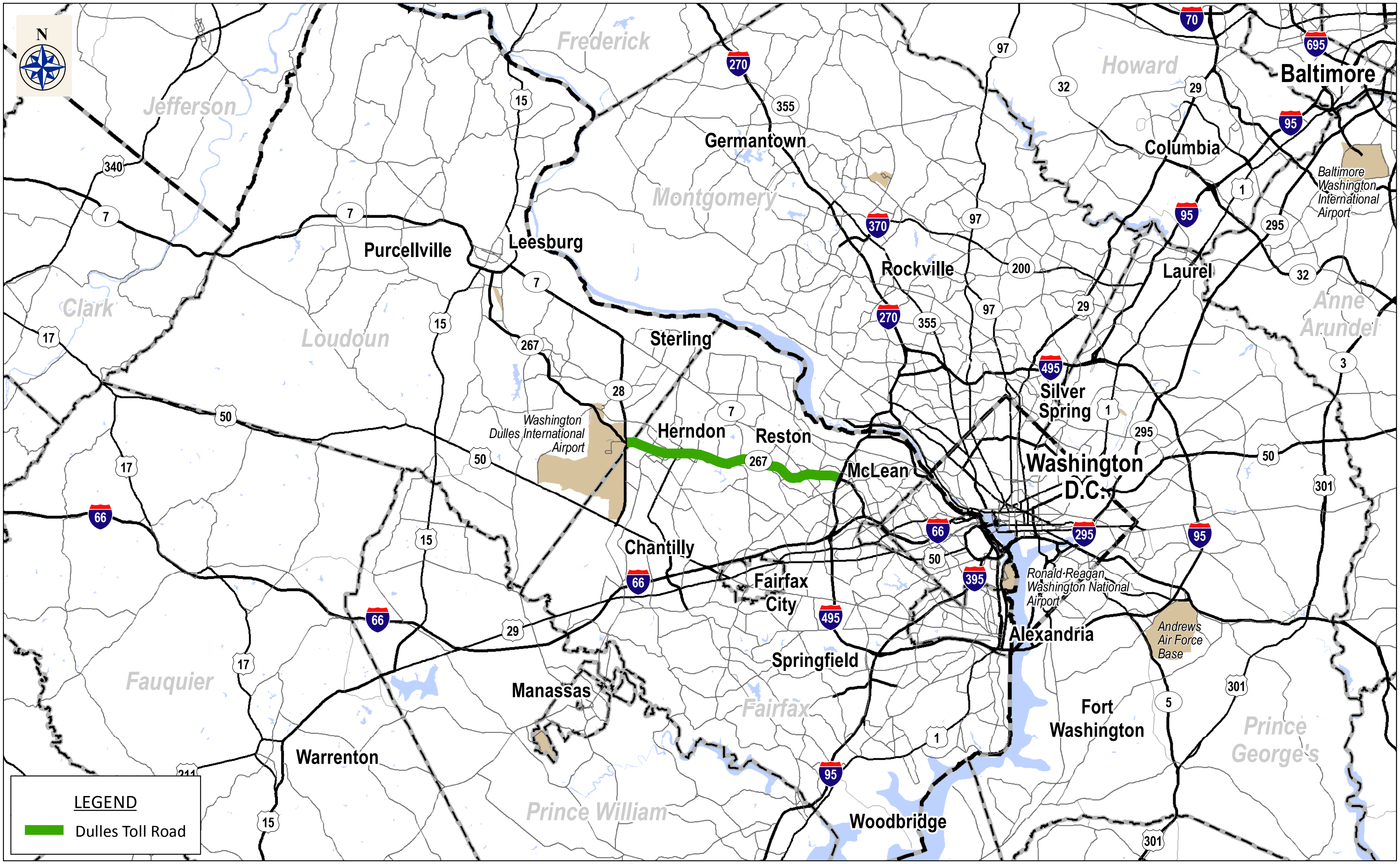
The study analysis was conducted at an investment-grade level and is considered suitable for use in project financing. CDM Smith believes that all information from the original data, including socioeconomic forecasts, has been updated as deemed necessary in order to make the conclusions set forth in this report current as of its date.

DTR Location

State Route (SR) 267 is the official designation of the route corridor on which the DTR is situated. Figure 1-1 shows the roadway in a regional context. The DTR is the major artery of the transportation network in the Dulles Corridor which is home to several of the Washington D.C. metropolitan region's most dynamic activity centers, including Tysons Corner, Washington Dulles International Airport (Dulles International) and the emerging activity centers in Reston, Herndon, and eastern Loudoun County.

The eastern terminus of SR 267 connects with I-66 near the Fairfax County / Falls Church City border and the section east of the Capital Beltway is not tolled. A direct connection from the DTR to the 495 Express Toll Lanes opened in November 2012. The western terminus of the DTR connects to the Dulles Greenway (Greenway) toll road and Dulles International. SR 267 continues west as the Greenway until it intersects US 15/SR 7 in the Town of Leesburg, Virginia.

VA 101944 / 2-11-14 / Regional Location Map.mxd



REGIONAL LOCATION MAP

FIGURE 1-1

Figure 1-2 shows the DTR, the Greenway, and the surrounding major roadway network including the relatively new toll facilities Intercounty Connector and the 495 Express Lanes. Northern Virginia has become a densely populated, high income area with a well developed but congested roadway network. There are several parallel and intersecting roads which influence traffic on the DTR.

Nearby parallel toll-free roadways include:

- Interstate 66 (I-66);
- US Route 29 (Lee Highway);
- US Route 50 (Lee-Jackson Memorial Highway / Arlington Boulevard); and
- State Route 7(Leesburg Pike).

Intersecting roadways that act as complementary feeder routes to the DTR include:

- Interstate 495 (I-495, Capital Beltway);
- 495 Express Lanes (dynamically-priced high occupancy toll lanes in the median of the Virginia side of the Capital Beltway);
- State Route 28 (Sully Road);
- State Route 123 (Chain Bridge Road); and
- State Route 286 (Old Route 7100, Fairfax County Parkway).

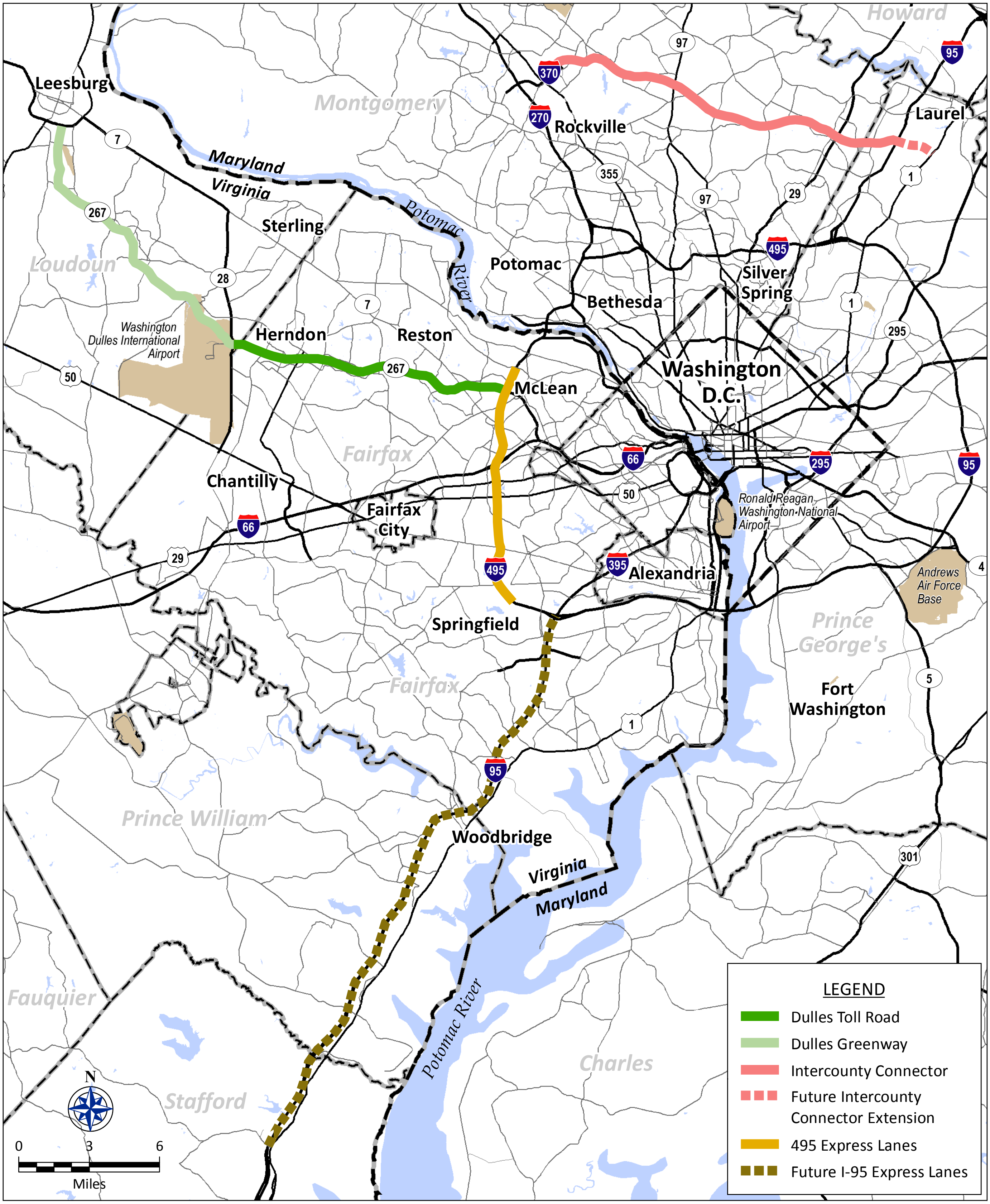
Other major roadways in the area that DTR customers connect with to reach final destinations include:

- Dulles Greenway toll road;
- Interstate 95 (I-95);
- Interstate 395 (I-395);
- George Washington Memorial Parkway (GW Parkway); and
- Interstate 270 (I-270).

It is important to note that during peak hours and in the peak direction, Interstate 66 inside the Beltway is HOV-2+ only resulting in a significant portion of DTR traffic merging with the Capital Beltway to connect with non-HOV routes to/from Arlington and Washington D.C.

DTR History

The Dulles Access Highway, a limited-access highway that is subject to the Airports Authority's jurisdiction under an agreement and deed of lease with the Federal Government, is the primary route to Dulles International. No tolls are collected on the Dulles Access Highway. Prior to the opening of the DTR, VDOT sold stickers to allow commuters to access the Dulles Access Highway but the sticker



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STUDY AREA MAJOR ROADWAY NETWORK

FIGURE 1-2

program was discontinued when the DTR opened. Currently only vehicles with occupants on official airport business and certain public buses may use this highway. Airports Authority police strictly enforce proper usage of the Dulles Access Highway.

In the late 1970s, as development in Fairfax and Loudoun counties created the need for a general use highway in the Dulles Corridor providing direct access to employment centers inside the Capital Beltway, Virginia obtained permission from the Federal Aviation Administration (FAA) to build a toll road within the right-of-way acquired for the Dulles Access Highway resulting in the construction of the DTR in the outer portions of the right-of-way. The new roadway provided an access-controlled toll facility for travelers to and from points in northern Fairfax County. The DTR was opened in 1984 with three lanes in each direction between SR 7 and the Capital Beltway and two lanes in each direction on the remainder of the toll facility. At the time, there were eight full-interchanges on the DTR.

After the construction of Fairfax County Parkway (Old State Route 7100, now Route 286), a north-south route intersecting the DTR, a ninth full-interchange was built. Two additional interchanges, the tenth and eleventh overall, were constructed as partial-interchanges. One provided DTR access for motorists using the Monroe Park & Ride lot (all movements except from the East) and the other provided access to the Wolf Trap Performing Arts Center to and from the east.

Full expansion to six lanes was completed by 1992 and a fourth lane was added in each direction by 1999 resulting in the eight lane configuration seen today.

Originally designed to be a commuter route from northern Fairfax County into Washington D.C., the nature and characteristics of trips along the DTR changed as many residential and commercial developments were constructed in the Dulles corridor. The DTR now has significant peak hour traffic in both directions. Activity centers such as Tysons Corner, the Reston-Herndon area, and eastern Loudoun County have all significantly benefitted from the DTR becoming a multi-use highway.

Dulles Corridor Existing Conditions

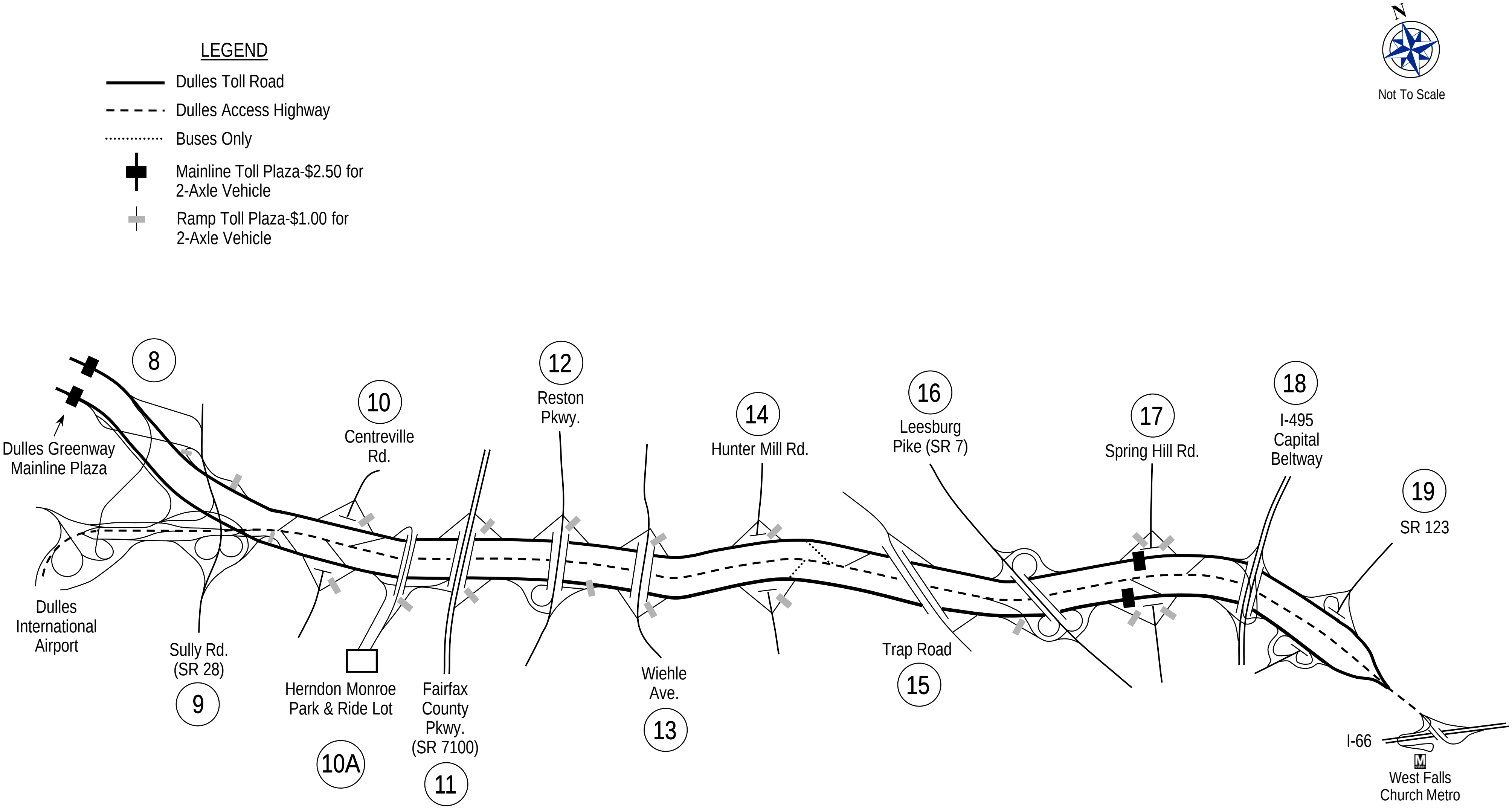
Dulles Toll Road and Dulles Access Highway

Figure 1-3 is a schematic of the Dulles Access Highway and DTR portions of the roadway including interchange numbering.

The Dulles Access Highway is a 16.15-mile roadway that begins at I-66 and ends at Dulles International. Airport users may travel on this roadway at no cost. The Dulles Access Highway consists of two lanes in each direction along its entire length.

The DTR is a 13.43-mile tolled roadway from the Capital Beltway to SR 28 built in the outer portions of the Dulles Access Highway right-of-way. The DTR lanes are separated from the Dulles Access Highway lanes by physical barriers. The DTR is four lanes in each direction along its entire length.

There are several ramps that allow access between the DTR and the Dulles Access Highway for travelers whose origin or destination is Dulles International. These travelers are allowed to travel toll free to and from the airport by way of the Dulles Access Highway. Additionally, there are two barrier-controlled bus-only ramps, one in each direction.



INTERCHANGES ON THE DTR

FIGURE 1-3

In the westbound direction, there are ramps that lead from the DTR to the Dulles Access Highway just west of the Capital Beltway; between Trap Road and Hunter Mill Road; just west of the Monroe Park & Ride lot westbound on-ramp; and west of Centreville Road. The buses-only ramp from the Dulles Access Highway to the DTR is located just east of Hunter Mill Road.

In the eastbound direction, there are ramps that lead from the Dulles Access Highway to the DTR east of SR 28; just east of Centreville Road; and just west of Spring Hill Road. There is a ramp that leads from the Dulles Access Highway directly to SR 7. The buses-only ramp from the DTR to the Dulles Access Highway is located just east of Hunter Mill Road.

The Dulles Access Highway diverges (westbound) and merges (eastbound) with the DTR just east of SR 123. From the merge to I-66, the Dulles Access Highway is two lanes in each direction.

Completing the corridor to Leesburg, the Greenway is a 12.53 mile tolled roadway that continues SR 267 from the end of the DTR near SR 28 until it intersects with US 15/SR 7 in Leesburg. This roadway is owned and operated by a private corporation, Toll Road Investors Partnership II. The Greenway is three lanes in each direction.

During the peak periods, the left-most lane of the DTR west of the Main Line Plaza is reserved for HOV-2+ (two occupants or more) vehicles in the peak direction. The HOV lane is a general-purpose lane at all other times. At the toll plazas, motorists using the HOV lane pay the same toll as all other users of the DTR. However, the advantage for the HOV user is that peak travel speeds can be significantly faster because of peak travel period congestion in the general-purpose lanes. VDOT previously enforced its evening peak HOV restriction between the hours of 4:30 to 6:00 PM. VDOT since expanded that period to 4:00 to 6:30 PM, adding a full hour to the evening peak period. This study assumes that HOV-2+ designation will continue and that all vehicles pay tolls.

DTR Toll Rates

In general, the DTR tolling plan consists of ramp and main line tolls for inbound travel (towards the Capital Beltway) and the reverse trip. However, westbound trips entering at any of the DTR interchanges (towards Dulles International) and the reverse trip are generally toll free. Exceptions occur at the Spring Hill interchange to/from the West and at the eastbound exit at SR 7. These exceptions ensure that toll revenue is collected from all through traffic at the eastern end of the DTR facility and that the DTR Main Line plaza cannot be easily evaded.

Figure 1-4 shows toll plaza locations on the DTR, the current toll rates in effect since January 2014 and previous toll rate changes that took effect in January 2013 and January 2012. In general, motorists traveling eastbound on the DTR will pay to enter the system, while motorists traveling westbound will pay to exit the system.

For a 2-axle vehicle, the ramp tolls are currently $1.00 at each location while at the Main Line plaza, located between Leesburg Pike and Spring Hill Road, the toll for a 2-axle vehicle is $2.50 in each direction. There are eastbound exit tolls at two locations, Leesburg Pike and Spring Hill Road; and there is a westbound entrance toll at Spring Hill Road (these tolls are $1.00 for a 2-axle vehicle).

The schedule for multi-axle vehicles is also shown in Figure 1-4. A 3-axle vehicle pays double the amount of a 2-axle toll rate at all locations. Vehicles with additional axles pay an additional $1.25 per

LEGEND

- Dulles Toll Road
- Dulles Access Highway
- Buses Only
- Mainline Toll Plaza-$2.50 for 2-Axle Vehicle
- Ramp Toll Plaza-$1.00 for 2-Axle Vehicle

2012 DTR Toll Rates

	Ramp Toll	Mainline Toll
2-axle vehicle	$0.75	$1.50
3-axle vehicle	$1.00	$1.75
4-axle vehicle	$1.25	$2.00
5-axle vehicle	$1.50	$2.25
6 or more axles	$1.75	$2.50

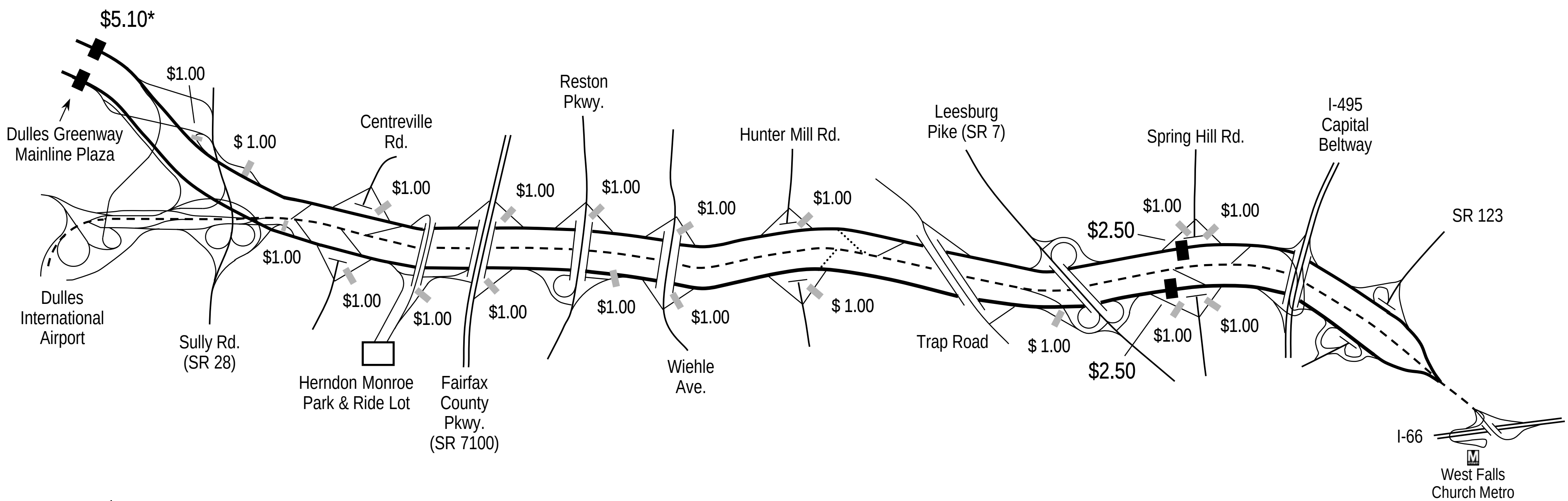
2013 DTR Toll Rates

	Ramp Toll	Mainline Toll
2-axle vehicle	$1.00	$1.75
3-axle vehicle	$2.00	$3.50
4-axle vehicle	$2.50	$4.50
5-axle vehicle	$3.00	$5.25
6 or more axles	$3.50	$6.25

2014 DTR Toll Rates

	Ramp Toll	Mainline Toll
2-axle vehicle	$1.00	$2.50
3-axle vehicle	$2.00	$5.00
4-axle vehicle	$2.50	$6.25
5-axle vehicle	$3.00	$7.50
6 or more axles	$3.50	$8.75

N
Not To Scale



* $5.10 collected ($5.90 during peak period in the peak direction) by the Dulles Greenway for a 2-axle vehicle. This amount includes $1.00 that is remitted to DTR (except to/from Route 28).

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TOLL PLAZA LOCATIONS AND TOLL RATES ON THE DTR

FIGURE 1-4

axle at the Main Line plaza and $0.50 per axle at ramp toll plazas. The maximum toll (for a vehicle with six or more axles) is $8.75 at the Main Line plaza and $3.50 at a ramp plaza. The DTR is predominantly a commuter facility with relatively few multi-axle vehicles – less than 4 per cent in transactions and less than 5 per cent in revenue terms.

At the western end of the DTR, the Greenway has a mainline toll plaza that collects a toll in each direction of either $5.10 (base toll) or $5.90 (congestion management toll - eastbound from 6:30-9:00 am and westbound from 4:00-6:30 pm) for a 2-axle vehicle coming from or going to the DTR. In addition to this amount collected, $1.00 is collected and remitted to the DTR as toll revenue. For vehicles with more than two axles, the appropriate multi-axle toll is collected by the Greenway and remitted to the DTR. The amount collected for the DTR by the Greenway at the Greenway mainline is based on the prevailing DTR ramp toll schedule. The Greenway portion is determined by the Toll Road Investors Partnership II (TRIP II), the operator of the Dulles Greenway and regulated by the Virginia State Corporation Commission (SCC).

Figure 1-5 shows the configurations of each DTR toll plaza including a growing number of dedicated E-ZPass lanes. It should be noted that currently there is no differential toll rate for E-ZPass. Attended lanes at ramp plazas are not staffed between 9:30pm and 5:30am requiring exact change during nighttime hours. MWAA is currently in the process of finalizing the performance specification for its Lane Conversion Project and has Board approval to award a contract to convert 19 exact change lanes to E-ZPass only lanes. The project once awarded is scheduled to take 18 months as part of the contract for routine and on-call hardware and software maintenance of the Dulles Toll Road revenue collection systems.

The Airports Authority has the exclusive right to establish, charge, and collect tolls and other fees for the use of the Dulles Toll Road. Prior to establishing toll rates, the Airports Authority follows its regulatory process, which includes:

- Convening public hearings in the Dulles Corridor; and
- Reporting back to the Board on views collected during public hearings.

The Airports Authority also consults with the Dulles Corridor Advisory Committee (DCAC) in accordance with the DTR Permit and Operating Agreement.

Dulles Greenway

The Greenway is an approximately 14-mile toll road from the Dulles Toll Road on the east to the US15/SR7 on the west. The Greenway is owned and operated by a private corporation, TRIP II. Figure 1-6 shows toll plaza locations on the Greenway and the current toll rates in effect since January 2013.

The Greenway was first conceived in 1970s when more and more regional residents were attracted to Loudoun County because of the relatively low housing costs. In 1988, the Virginia Highway Corporation Act was enacted to authorize the construction of new toll roads without the use of eminent domain under rates set by the Virginia Corporation Commission. A recent amendment to the Act authorizes annual toll increases until 2020 at the maximum of:

A = Attended
U = Unattended
A/U = Attended or Unattended
E = E-ZPass Only

EASTBOUND TO WASHINGTON DC

WESTBOUND TO LEESBURG, VA

Eastbound Lanes	Eastbound Plaza	Plaza	Westbound Plaza	Westbound Lanes
		Sully South Plaza Exit 9A (SR 28)	61	1 A, 2 U
4 A/U, 3 E, 2 E, 1 A	64	Sully Road Plaza Exit 9B (SR 28)	63	1 A, 2 A/U, 3 E
2 U, 1 A	66	Centreville Road Plaza Exit 10 (SR 657)	65	1 A, 2 U
1 A/U	75	Monroe Street Park & Ride Plaza Exit 10A		
2 U, 1 A	68	Fairfax Parkway Plaza Exit 11 (SR 7100)	67	1 A, 2 U, 3 U
2 A/U, 1 A	70	Reston Parkway Plaza Exit 12 (SR 602)	69	1 A, 2 U
2 U, 1 A	72	Wiehle Avenue Plaza Exit 13 (SR 828)	71	1 A, 2 U
2 U, 1 A	74	Hunter Mill Road Plaza Exit 14 (SR 674)	73	1 A, 2 U
				Trap Rd – No Toll Plaza Exit 15 (SR 676)
2 U, 1 A	76	Leesburg Pike Plaza Exit 16 (SR 7)		No Westbound Toll Plaza at SR 7
7 E, 6 A, 5 A, 4 U, 3 U, 2 E, 1 E	78	Main Plaza	77	1 E, 2 E, 3 U, 4 U, 5 A, 6 A, 7 A/U
3 U, 2 U, 1 A	80	Spring Hill East / Admin West Plaza Exit 17A (SR 684)	79	1 A, 2 U, 3 E
3 U, 2 U, 1 A	82	Capital East / Spring Hill West Plaza Exit 17B (SR 684)	81	1 A, 2 U, 3 U

Notes:
1. Ramp plazas are not attended between 9:30 PM and 5:30 AM.
2. Lane 4 at Plaza 64 and Lane 2 at Plaza 70 (Reston Parkway Eastbound) are attended only during the AM and PM peak periods.

19 Ramps, 9 E-ZPass only, 22 attended, 23 unattended, 5 A/U (Attended or Unattended)

Source: MWAA Operations (valid since April 2012).

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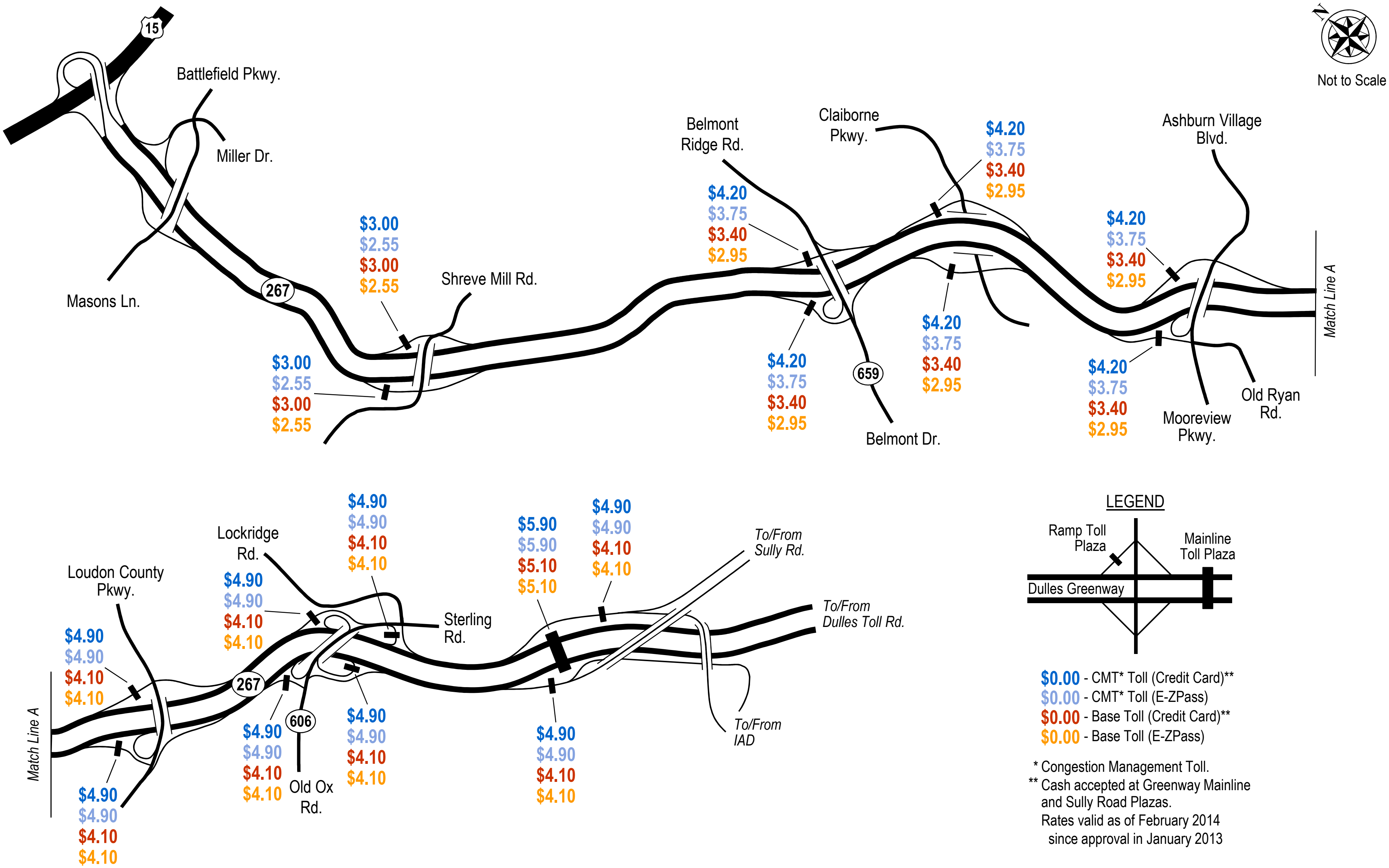
DTR PLAZA DIAGRAM

FIGURE 1-5



TOLL PLAZA LOCATIONS AND TOLL RATES ON THE DULLES GREENWAY

FIGURE 1-6

- Growth in CPI plus one percent;
- GDP growth; or
- 2.8%.

with additional increases if necessary to offset more rapid growth in property taxes or to ensure that TRIP II has sufficient revenues to achieve debt service coverage ratios.

Financed privately, the Greenway construction started in 1993 and the facility opened to traffic in December 1995. The Greenway was initially built as a 4-lane facility with a speed limit of 55 miles per hour. In 1997, the speed limit was increased to 65 miles per hour to attract additional demand. In 2009 a third lane was added in each direction and the entire road was resurfaced. An improved eastbound exit ramp to Dulles International was also added in 2009.

The Greenway connects with DTR at the Greenway mainline toll plaza. In the westbound direction, the direction access ramp from SR 28 northbound and Dulles International to the Greenway merge before the mainline plaza and is the first westbound on ramp. There are on and off ramps from and to SR 606, SR 607, SR 772, Claiborne Pkwy, SR 659, SR 653, and SR 654. Completing the SR 267 corridor to Leesburg, the Greenway connects with US 15/SR7 at the west end with an off ramp to north and a flyover direct connection to south.

In the eastbound direction, the Greenway starts from the on ramp from US 15/ SR 7. There are on and off ramps from and to SR654, SR 653, SR 659, Claiborne Pkwy, SR 772, SR 607, and SR 606. At the east end, the Greenway connects with DTR at the mainline toll plaza. There are separate direct access ramps from the Greenway to SR 28 south and to Dulles International.

Dulles Greenway Toll Rates

The Dulles Greenway opened to traffic on September 29, 1995, with a base toll of $1.75 for 2-axle vehicles and $3.50 for all other vehicles. The following toll adjustments have been made since opening (amounts not including the DTR portion):

- On March 8, 1996, the base toll rate was reduced to $1.00 in order to stimulate additional demand. The authorized maximum was $2.00.
- On October 14, 1997, the base toll rate was increased from $1.00 to $1.15 on weekdays without changing the $1.00 weekend toll.
- Effective September 13, 1999, the weekday toll was increased by $0.25 to $1.40 for all patrons while simultaneously implementing a discount of $0.25 for E-ZPass patrons.
- On April 17, 2000, the toll rate was increased by $0.25 to $1.65 for all methods of payment.
- On September 9, 2002, the weekday and weekend tolls were increased by $0.25 and the discount for E-ZPass users was reduced from $0.25 to $0.10. The weekday base toll was then $1.90.

- On July 6, 2004, the State Corporation Commission of Virginia authorized an increase of the Greenway maximum toll rate from $2.00 to $2.40 and maintained the tariff relationship between vehicles with two axles (automobile) and vehicles with three or more axles (truck), with trucks paying toll rates twice the rate of automobiles.
- The authorized maximum and base toll rate was increased to $2.70 in December 2005.
- Under further authorizations from the SCC, the 2-axle base toll rate increased to $3.00 on July 1, 2007, to $3.40 in January 2009, to $3.70 in July 1, 2010, to $4.00 in January 1, 2012, and to the current level of $4.10 in January 1, 2013.
- A new tariff relationship between automobiles and trucks was implemented on October 1, 2007. Based on the new toll mechanism, 3-axle vehicles pay a multiplier of two times that of the 2-axle vehicle base toll, 4-axle vehicles pay 2.5 times, 5-axle vehicles pay 3 times, and 6-or-more-axle vehicles pay 3.5 times.
- A congestion management toll rate was first introduced on January 1, 2009. An additional $0.60 peak period peak direction surcharge for 2-axle vehicles was implemented and was applied to trucks proportionally. The base toll rate congestion management surcharge increased to $0.80 on July 1, 2010, remaining at that level ever since.

The Greenway recently submitted an application, to the State Corporation Commission, to increase toll rates in early 2014 by 2.8 percent based upon the "Consumer Price Index (CPI) plus one percent" as well as an ad hoc increase of 3.0 percent to pay an increase in property taxes. If approved, based on rounding to nickels, Greenway mainline tolls (excluding the currently $1.00 DTR portion) would increase from $4.10 to $4.25 and from $4.90 to $5.10 during peak periods in the peak direction for 2-axle vehicles.

495 Express Lanes

At the eastern end of the DTR, in the median of the I-495 Capital Beltway, motorists can access the 495 Express Lanes, a 14-mile facility with two High Occupancy Toll (HOT) lanes in each direction that have end points just north of the DTR and west of the I-495 Springfield Interchange with I-95. The toll rate for the 495 Express Lanes is dynamically priced to manage traffic. Since opening in November 2012 demand and toll rates have ramped up. For the last available quarter, ending December 31, 2013, the average weekday toll paid was $2.51 and the maximum toll paid was $9.75 for the full 14-mile route. In the year ended September 30, 2013 VDOT reported a "spike" in transponders issued citing a 52% increase. DTR EZ-Pass usage also has continued to grow partly as a result of increasing transponder usage in the region.

Scope of Study

CDM Smith obtained and reviewed the latest MWCOG travel demand model. In addition, the latest underlying socioeconomic forecasts for the Dulles corridor and the entire MWCOG model region were obtained, reviewed, and compared with multiple other forecasts from official and independent sources.

CDM Smith conducted a comprehensive data collection program during late 2011 focused on evaluating baseline operating conditions in the DTR corridor. This included an extensive traffic count program, entry-exit surveys, together with route reconnaissance and speed and delay studies throughout the Dulles corridor. A series of surveys were undertaken to assess travel patterns and motorist characteristics in the DTR corridor. Two origin-destination surveys were performed: (1) a survey of cash customers on the system; and (2) a survey of E-ZPass customers. A full description of the surveys and their results is provided in Chapter 3 of this report. These surveys were used to refine early year trip tables included with the MWCOG travel demand model amongst other things. The traffic model was updated to reflect the input of both the travel pattern and characteristic surveys. The project configuration was coded, and the model was calibrated to more reasonably represent observed traffic volumes and speeds throughout the Dulles corridor for the model base year of 2011.

Bringing these efforts more up to date, historical traffic trends were reviewed and current information on the latest Transportation Improvement Program (TIP) in the Washington Metropolitan region was obtained from the Metropolitan Washington Council of Governments (MWCOG) and reviewed.

Finally, detailed highway networks were prepared for the base model year (2011) and for future years 2015, 2020, 2025, 2030, 2035 and 2040. In addition to running traffic assignments at each modeled year, additional model runs were conducted to measure the impact of opening of Phase I and Phase II of Dulles Metrorail in 2014 and 2018, respectively. The future-year networks reflect changes envisioned by the TIP and the Constrained Long-Range Plan (CLRP) which contains projects that are expected to be constructed or implemented in the region subject to financial constraints. The projects identified either improve access to the DTR or improve alternate routes. Documentation of the type, scope and timing of these projects is provided in Chapter 5.

CDM Smith's traffic model assignments reflect tolls charged on the DTR by using proprietary toll diversion algorithms. As toll rates are adjusted, toll roads become more or less desirable relative to free roads. The extent to which one type of road is chosen over another is the subject of the toll diversion analysis. The toll algorithms used in this analysis have been applied successfully to a wide range of toll road projects from new construction to existing facilities. The projections made using this approach have been accepted by toll road agencies and funding authorities throughout the United States and around the world.

After re-basing traffic and revenue to actual annual 2013 levels and by making the appropriate traffic model assignments in selected future years, likely volumes in intermediate years were estimated through interpolation. Multiplying volumes at plazas by tolls collected at each plaza yields the revenue at each location. The sum of all those revenue estimates is the basis for the annual toll revenue estimates for the DTR.

An independent evaluation of socioeconomic forecasts for the DTR corridor was conducted in October 2011 and updated in February 2014 as part of the study by the independent local economist, Renaissance Planning Group (RPG). As part of the 2014 traffic and revenue update minor adjustments to traffic and revenue estimates were made to reflect the recommendations of the independent economist.

For this update, a revised future year toll rate schedule was tested based on assumptions provided by the financial advisors to the Airports Authority. Near term projections take account of actual year-to-date traffic and revenues and a growth profile reflecting economic recovery. Beyond 2040, annual traffic and revenue were estimated using nominal assumed rates, traffic growth and estimated toll diversion in the project corridor.

Order of Presentation

Following this introductory chapter, a summary of existing traffic and operating conditions in the DTR corridor is presented in Chapter 2, with Traffic and Toll Revenue Trends updated through January 2014.

Chapter 3, DTR Travel Patterns, summarizes the results of both the travel pattern and characteristic surveys conducted for the various recent studies performed for MWAA.

Chapter 4, Corridor Growth Assessment, presents an overview of corridor economic trends and forecasts. An updated report of the independent economist is also included in Appendix B.

Chapter 5, Estimated Traffic and Toll Revenue, presents the results of the updated weekday and annual traffic and revenue analysis and discreet-year toll sensitivity analysis; and

Chapter 6, Sensitivity Tests, presents the measure of sensitivity of annual transactions and revenue to changes in key study assumptions for discreet model years.

There are four appendices providing additional detail on several key aspects of the study:

- Appendix A contains detailed results from journey time surveys performed on the Dulles Corridor;

- Appendix B summarizes the Stated Preference exercise and results;

- Appendix C is a detailed update of socio-economic growth performed by an independent local economist; and

- Appendix D is a review of transportation plans for the region performed by sub-consultant Kimley-Horn and Associates.

Chapter 2

Traffic and Toll Revenue Trends

This chapter presents historical and recent trends in transactions and toll revenue for the DTR. The statistics are presented on an annual, monthly and daily historical basis as provided by VDOT/MWAA through 2013. In addition, there is an analysis of the typical daily and hourly traffic variations on the DTR that CDM Smith used to develop an average weekday travel profile for the base year models.

Annual Transaction and Revenue Trends

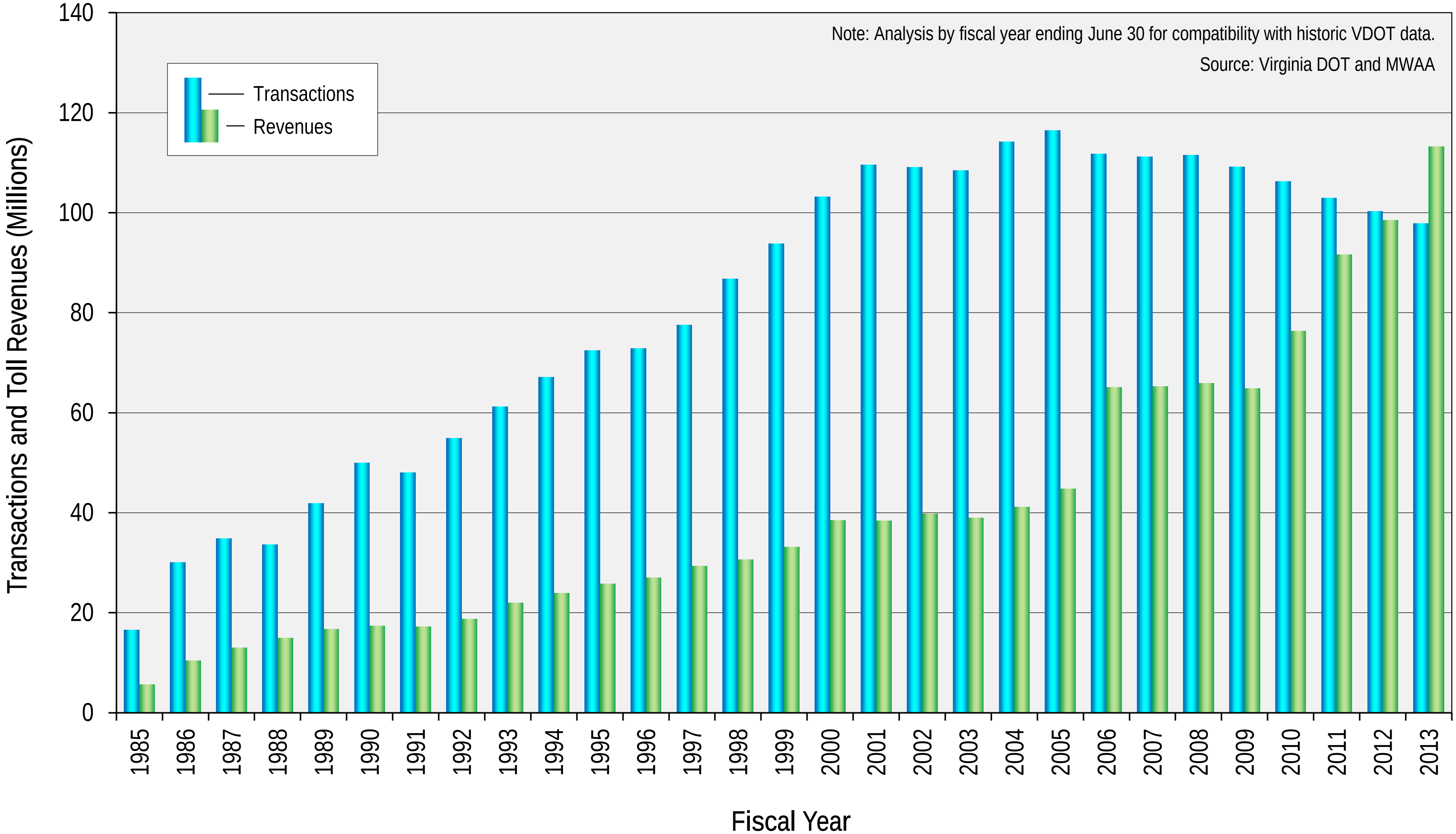
Figure 2-1 presents annual transactions and toll revenue trends on the DTR from Fiscal Year (FY) FY1985 though FY2013. Traffic and revenue data in this bar graph is presented by Fiscal Year ending June 30 for compatibility with historical VDOT reporting. For recent years, detailed trends by toll plaza are provided for the period from calendar year (CY) 2005 through 2013 in further tabulations.

Table 2-1 shows annual transaction trends on the DTR by plaza and annual transactions for the entire system from calendar year CY2005 through CY2013. The total transactions include revenue transactions (i.e., each recorded toll payment, whether Main Line or ramp), non-revenue transactions (such as police, emergency vehicles, and military vehicles) and system-wide violations (i.e., each transaction where the full toll amount was not collected at the time of the transaction, whether due to avoidance or electronic misreading or otherwise, and where the amount was subsequently collected).

As evident from Table 2-1, the Main Line toll plaza processes the most transactions in the system, about 36.3 percent of the total. Transactions have generally declined in recent years predominantly due to toll increases and prevailing economic and financial conditions, but the impact varies by toll plaza. The compound annual growth rate in transactions at the Main Line toll plaza, for example, decreased by only 1.5 percent over the period 2005-2013, even though the Main Line toll rate increased from $0.50 to $1.75 over that period. At Route 28 Sully Road, traffic has been most resilient whereas the Greenway mainline plaza observed reductions from 2005 through 2010 due to Greenway toll adjustments. Some traffic has tended to avoid the Greenway mainline toll in favor of entering or exiting the DTR at the lower ramp toll at Sully Road (Route 28). Greenway traffic has been steady the past few years despite further toll increases. The eastbound Route 7 (Leesburg Pike) ramp plaza also has seen more significant decreases in transactions since 2010 even in years when the ramp toll did not change. Route 7 through Tysons Corner is highly congested throughout most of the day and has had added traffic measures in place during construction of the Dulles Metrorail since 2009 resulting in lower tolled traffic at the Route 7 ramp. Over the same time period the other Tysons ramp plaza, Spring Hill Road, has experienced less of an impact.

Monthly Transaction and Revenue Trends

This section provides detailed trends in transactions and toll revenue by month by individual toll plaza. Tables 2-2 and 2-3 present monthly transactions and toll revenue trends on the Dulles Toll Road from CY2005 through CY2013. The total transactions data includes non-revenue transactions (such as police, emergency vehicles, military vehicles and MWAA) and includes violations.



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DTR TRANSACTIONS AND REVENUES FY 1985 - FY 2013

FIGURE 2-1

Table 2-1
Total Annual Transactions by Plaza, CY2005-CY2013
(in thousands)[1]

PLAZA	CY 2005	Change CY05-06	CY 2006	Change CY06-07	CY 2007	Change CY07-08	CY 2008	Change CY08-09	CY 2009	Change CY09-10	CY 2010	Change CY10-11	CY 2011	Change CY11-12	CY 2012[2]	Change CY12-13	CY 2013[2]	2005-2013[3] CAGR
Sully Rd	15,663	1.5%	15,895	4.8%	16,656	4.9%	17,477	0.9%	17,632	-1.6%	17,353	0.3%	17,402	-0.8%	17,269	-1.1%	17,077	1.1%
Centreville Rd	8,098	-3.2%	7,838	-2.9%	7,607	-1.5%	7,495	0.4%	7,524	-5.8%	7,087	-4.3%	6,782	-2.8%	6,593	-4.1%	6,320	-3.0%
Fairfax Pkwy	7,356	-1.4%	7,251	-1.1%	7,172	-0.5%	7,139	-2.3%	6,975	-7.0%	6,489	-3.7%	6,251	-5.6%	5,899	0.2%	5,910	-2.7%
Reston Pkwy	8,378	-3.6%	8,075	-1.3%	7,966	-2.7%	7,749	-2.9%	7,524	-5.9%	7,080	-3.6%	6,826	-1.6%	6,719	-4.5%	6,418	-3.3%
Wiehle Ave	4,474	-1.2%	4,420	-0.1%	4,417	-1.0%	4,371	-4.3%	4,182	-8.2%	3,838	-3.6%	3,701	-2.8%	3,597	-3.7%	3,462	-3.2%
Hunter Mill Rd	3,748	-1.3%	3,699	0.6%	3,721	-4.2%	3,563	-0.8%	3,536	-6.9%	3,292	-6.1%	3,091	-4.4%	2,953	-2.5%	2,878	-3.2%
Route 7, East	2,944	-4.2%	2,821	-2.5%	2,750	-3.9%	2,643	-4.8%	2,515	-10.9%	2,241	-4.1%	2,149	-3.6%	2,072	-6.7%	1,933	-5.1%
Main Line	39,345	-0.2%	39,274	1.5%	39,882	0.4%	40,056	-2.0%	39,268	-4.0%	37,687	-4.9%	35,839	-2.3%	35,023	-0.6%	34,808	-1.5%
Spring Hill Rd	4,458	-4.4%	4,263	-1.4%	4,204	-1.6%	4,135	0.8%	4,167	-1.0%	4,123	5.9%	4,367	-3.8%	4,200	-2.9%	4,079	-1.1%
Capital Beltway	3,108	-7.3%	2,880	-4.1%	2,762	-0.9%	2,737	-2.8%	2,660	-9.2%	2,415	-3.3%	2,336	-6.6%	2,182	-6.7%	2,037	-5.1%
Greenway (4)	13,850	-4.9%	13,175	-3.6%	12,699	-3.6%	12,236	-6.2%	11,473	-4.4%	10,965	-3.0%	10,633	1.5%	10,789	0.6%	10,848	-3.0%
Revenue Transactions	**111,421**	-1.6%	**109,591**	0.2%	**109,838**	-0.2%	**109,601**	-2.0%	**107,457**	-4.5%	**102,571**	-3.1%	**99,376**	-2.0%	**97,417**	-1.5%	**95,939**	-1.9%
Violations & Non-revenue	2,062	3.4%	2,132	-32.1%	1,448	-17.2%	1,198	5.3%	1,261	67.7%	2,115	2.1%	2,159	14.6%	2,474	10.6%	2,737	3.6%
Total Transactions	**113,483**	-1.6%	**111,723**	-0.4%	**111,286**	-0.4%	**110,799**	-1.9%	**108,718**	-3.7%	**104,686**	-3.0%	**101,535**	-1.6%	**99,891**	-1.2%	**98,676**	-1.7%

Source: VDOT/MWAA reports through December 2013

(1) Violations not specified by plaza.

(2) Totals for CY 2012 and CY 2013 include transactions from Monroe Park & Ride.

(3) "CAGR" denotes compound annual growth rate.

(4) Violations and Non-Revenue for the Greenway plaza included from 2010. This data for the Greenway plaza was not available prior to MWAA prior to transfer from VDOT.

Note: Toll rates adjusted in May 2005, January 2010, January 2011, January 2012 and January 2013.

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Table 2-2
Monthly Transactions, CY2005-CY2013

	CY2005	% Change	CY2006	% Change	CY2007	% Change	CY2008	% Change	CY2009	% Change	CY2010	% Change	CY2011	% Change	CY2012	% Change	CY2013
January	9,196,216	-0.9%	9,109,306	1.0%	9,198,057	0.1%	9,207,781	-8.6%	8,412,824	-1.4%	8,299,024	-5.7%	7,824,547	2.5%	8,022,521	-1.3%	7,919,077
February	8,786,162	-4.1%	8,422,303	-4.7%	8,023,545	8.5%	8,709,460	-3.9%	8,366,392	-20.4%	6,657,821	16.6%	7,764,687	1.6%	7,889,749	-6.1%	7,409,382
March	10,111,654	-1.7%	9,941,362	-2.6%	9,686,308	-3.5%	9,351,455	-1.2%	9,234,614	1.2%	9,349,797	-3.5%	9,018,150	-3.7%	8,687,041	-8.1%	7,979,292
April	9,948,766	-8.3%	9,120,164	1.4%	9,246,736	3.7%	9,585,976	-3.2%	9,283,838	-0.9%	9,199,462	-7.8%	8,483,334	-3.6%	8,181,616	5.1%	8,596,720
May	9,906,511	-1.3%	9,779,415	0.8%	9,856,502	-2.8%	9,578,599	-2.8%	9,306,946	-2.1%	9,115,093	-3.1%	8,835,657	-1.3%	8,717,049	0.7%	8,773,942
June	9,872,015	-1.2%	9,756,929	-1.8%	9,581,354	-2.0%	9,385,082	2.1%	9,579,031	-2.0%	9,389,948	-4.7%	8,949,690	-2.5%	8,726,637	-3.9%	8,388,250
July	9,251,263	-0.6%	9,192,347	1.6%	9,338,507	1.5%	9,478,858	-0.2%	9,462,994	-4.8%	9,011,255	-7.1%	8,375,850	0.5%	8,418,491	0.2%	8,437,968
August	9,698,296	0.1%	9,706,925	-0.1%	9,698,127	-5.6%	9,158,359	1.1%	9,255,019	-2.6%	9,016,174	-3.7%	8,681,495	0.2%	8,700,231	-1.7%	8,550,839
September	9,228,605	-1.8%	9,066,103	0.2%	9,087,941	1.1%	9,185,049	-0.6%	9,126,570	-4.1%	8,748,923	-3.1%	8,476,912	-4.3%	8,113,485	2.2%	8,293,200
October	9,483,395	2.2%	9,692,059	2.2%	9,903,111	-1.7%	9,731,826	-2.1%	9,524,392	-4.0%	9,140,399	-4.5%	8,724,624	-3.4%	8,428,482	3.4%	8,713,861
November	9,041,300	-0.7%	8,976,611	0.6%	9,030,545	-6.1%	8,482,507	2.2%	8,666,127	-2.8%	8,420,491	-3.0%	8,169,587	-0.1%	8,161,592	-2.7%	7,944,233
December	8,959,171	0.0%	8,959,341	-3.6%	8,634,873	3.6%	8,943,949	-5.0%	8,499,460	-1.9%	8,337,797	-1.3%	8,230,422	-4.7%	7,844,178	-2.2%	7,669,453
Total	113,483,354	-1.6%	111,722,865	-0.4%	111,285,606	-0.4%	110,798,901	-1.9%	108,718,207	-3.7%	104,686,184	-3.0%	101,534,955	-1.6%	99,891,072	-1.2%	98,676,217

Notes:
1) Toll rates were adjusted in May 2005, January 2010, January 2011, January 2012, and January 2013.
2) Transactions include violations and non-revenue transactions such as police, emergency vehicles, military vehicles, etc.
Source: VDOT/MWAA

Table 2-3
Monthly Toll Revenues, CY2005-CY2013

	CY2005	% Change	CY2006	% Change	CY2007	% Change	CY2008	% Change	CY2009	% Change	CY2010	% Change	CY2011	% Change	CY2012	% Change	CY2013
January	$3,297,392	60.8%	$5,301,479	1.5%	$5,378,628	1.3%	$5,447,177	-7.7%	$5,026,089	38.1%	$6,943,140	4.5%	$7,252,137	12.8%	$8,178,917	22.9%	$10,053,324
February	3,157,469	55.3%	4,902,731	-4.3%	4,693,424	9.9%	5,155,941	-3.6%	4,967,856	11.3%	5,527,103	30.4%	7,207,088	11.8%	8,054,220	17.2%	9,443,386
March	3,664,214	58.2%	5,796,780	-1.8%	5,692,084	-2.9%	5,529,627	-0.9%	5,478,538	44.7%	7,926,739	5.4%	8,357,690	5.5%	8,819,788	15.7%	10,204,385
April	3,595,505	48.1%	5,323,359	2.8%	5,470,870	3.7%	5,672,881	-2.7%	5,522,113	40.5%	7,758,413	1.8%	7,899,087	6.3%	8,398,229	29.0%	10,830,020
May	4,223,085	35.0%	5,700,406	2.3%	5,828,923	-2.8%	5,668,517	-2.4%	5,535,196	38.8%	7,682,533	7.0%	8,222,220	8.2%	8,900,082	28.2%	11,411,164
June	5,740,241	-1.2%	5,672,049	-0.2%	5,661,723	-1.9%	5,553,988	2.7%	5,703,716	38.2%	7,881,709	6.5%	8,395,804	5.8%	8,884,182	21.4%	10,787,616
July	5,374,708	-0.3%	5,358,591	3.2%	5,529,010	1.6%	5,618,891	-0.2%	5,604,933	35.2%	7,576,203	4.2%	7,897,235	8.6%	8,579,991	26.1%	10,820,010
August	5,639,849	0.8%	5,685,674	0.7%	5,727,274	-5.1%	5,437,933	1.7%	5,530,327	37.7%	7,615,869	6.5%	8,107,776	8.8%	8,824,605	25.9%	11,114,413
September	5,378,577	-1.5%	5,297,288	1.3%	5,367,839	1.3%	5,439,956	0.2%	5,449,731	35.3%	7,374,258	7.4%	7,918,571	4.3%	8,255,318	30.6%	10,778,250
October	5,524,477	2.5%	5,663,442	3.1%	5,841,151	-1.3%	5,766,661	-1.6%	5,675,149	35.2%	7,673,235	6.2%	8,145,202	5.0%	8,549,445	34.4%	11,489,746
November	5,270,808	-0.5%	5,246,330	1.7%	5,334,025	-5.8%	5,023,350	2.7%	5,161,461	39.3%	7,191,951	6.6%	7,665,907	7.4%	8,235,967	25.5%	10,336,620
December	5,207,921	0.5%	5,232,042	-2.5%	5,101,816	4.3%	5,319,170	-5.1%	5,050,039	36.4%	6,887,014	10.2%	7,590,822	4.3%	7,915,344	23.7%	9,790,408
Total	$56,074,246	16.2%	$65,180,171	0.7%	$65,626,767	0.0%	$65,634,092	-1.4%	$64,705,148	36.1%	$88,038,167	7.5%	$94,659,539	7.3%	$101,596,089	25.1%	$127,059,341

Notes:
1) Toll rates were adjusted in May 2005, January 2010, January 2011, January 2012, and January 2013.
2) Includes unaudited figures.
Source: VDOT/MWAA

Variations in Transactions

The number of transactions fell 1.6 percent between CY2005 and CY2006 after the May 2005 toll rate adjustment. The decline in transactions continued with 0.4 percent decreases between the next two years. CY2009 observed a further decline of 1.9 percent resulting in 108.7 million total transactions.

Two events that occurred in CY2010 caused a 3.7 percent negative impact on DTR total traffic. First, there was a $0.25 increase in toll rates at all toll plazas on the DTR, and second, during the month of February 2010 there were adverse weather conditions that caused the Federal Government to close one business day and to permit "delayed arrival" or "unscheduled leave" status for four other days. February 2010 had fewer than 6.7 million transactions, over a 20 percent reduction when compared with February 2009. Most of the non-winter months observed a decrease of between 2.0 to 4.5 percent over the same month of the previous year.

January 2011 had a Main Line toll rate adjustment of $0.25, increasing it to $1.25. As a result there was a decline of 3.0 percent or about 3.2 million transactions from CY2010. The month of January 2011 had a decrease of 5.7 percent from that of January 2010, partly attributed to a couple of major snowstorms that caused the Federal Government to operate on "unscheduled leave" status for two business days. The month of February's significant increase also reflects a comparison to the weather-affected February in 2010. The rest of the months of CY2011 experienced a decline in the range of 3.0 percent to 4.7 percent. The low transaction months of April and July compared to that of CY2010 could be attributed to the fact that these months had one less weekday in CY2011.

Following an additional $0.25 toll increase on the DTR Main Line toll plaza in January 2012, the first month of the year experienced over 8.0 million in total transactions, up 2.5 percent from January 2011. The month of February 2012, which had an extra day due to the leap year, observed a slight increase of 1.6 percent from February 2011. Later in the year the Federal Government closed for two days at the end of the October due to Hurricane Sandy resulting in 3.4% decline in transactions for the month. December 2012 had one less working day compared to the previous year which would account for the most of the 4.7% reduction that month. Overall, the CY2012 experienced a decline of 1.6 percent in total transactions when compared to CY2011.

On January 1, 2013, toll rates were increased by $0.25 at both the Main Line and at all ramps. February transactions were comparatively lower due in part to one fewer day than in the prior leap year. Several significant events also impacted the Washington D.C. region in 2013. First, in March 2013, a series of automatic federal spending cuts known as the Sequester were triggered. To date, despite initial notices to employees, many agencies were able to postpone or avoid any furlough action. The region also was adversely impacted by federal closures on March 6 due to adverse weather, dubbed at the time the "Snowquester". As a result, transactions on the DTR were 8.1% lower in March 2013 versus the prior year. Between October 1 and 16, 2013, because Congress did not enact a FY 2014 budget, the Federal Government was subject to a lapse in appropriations. The impact on operations varied among departments but the Federal Government was fully open again on October 17 by which time DTR transactions were approximately 225 thousand behind the October 2012 same date total. However, the last three days of the month were over 470 thousand higher than in 2012, due to the hurricane in the prior year. The month actually ended up with greater transactions than in 2012 at around 3.4% higher. December had one day of federal closures due to weather and despite the Sequester and October Shutdown, the year ended up just 1.2% lower when compared to 2012.

Variations in Revenue

Table 2-3 shows monthly DTR toll revenues since CY2005. The toll rate adjustment of May 2005 led to higher monthly revenues during the next 12-month period and annual toll revenues leveled off at around $65m through 2009.

The Main Line and ramp plaza toll rate adjustments beginning January 1, 2010, had significant positive impacts. January 2010 experienced a 38.1 percent increase in revenues compared to January 2009. Overall, CY2010 had a 36.1 percent increase in collected toll revenues, reaching a high of $88.0 million compared to $64.7 million in CY2009.

The $0.25 toll rate adjustment of January 1, 2011, at the Main Line toll plaza resulted in a 7.5 percent increase in toll revenues to $94.7 million. The winter months were affected by weather as described earlier but otherwise monthly revenues were typically higher by 5.4% to 7.4% each month.

A further $0.25 toll rate adjustment to the Main Line toll plaza became effective on January 1, 2012. For the month, this resulted in $8.2 million of toll revenues, 12.8 percent higher than revenue collected in January 2011. The month of February 2012 was also up 11.8 percent from February 2011. The rest of the months of CY2012 experienced an increase in toll revenues in the range of 4.3 percent to 8.8 percent when compared to respective months in CY2011. An annual total of $101.6 million in toll revenues was collected in 2012, resulting in a 7.3 percent increase from CY2011 toll revenues.

Toll increases in January 2013 at the Main Line and ramps yielded a significant increase in revenues very similar to the revenue realization that took place in 2010. January 2013 experienced a 22.9 percent increase in revenues compared to January 2012. Overall, CY2013 experienced a 25.1 percent increase in toll revenues, reaching $127.1 million compared to $101.6 million in the prior year.

Monthly Transaction Variations

Table 2-4 provides average daily total transactions on the DTR for each month for the period CY2007 through CY2013. To highlight the relatively small variation in monthly transactions throughout each year, an index has been calculated for each month. Except for an occasional winter month, when weather is often a factor, there is typically a less than 5 percent monthly variation throughout each year.

This index is created by taking the average daily transactions for the month, dividing by the average daily transactions for the year, and multiplying by 100. This produces an index of 100 for any month that equals the annual average number of transactions. Months with an index greater than 100 have more than the annual average number of transactions and months with an index less than 100 have less than the annual average number of transactions. The index provides the relative size of the demand for the month, in comparison to other months for the period CY2007 through CY2013.

As can be noted from Table 2-4, although there has been an overall decrease in average daily transactions throughout the period shown, only slight average daily variations have been observed in each month. Four months from November to February usually had index values lower than 100.0

when traffic levels gain pace beginning the month of March during a given year. March through October generally have average daily traffic at or above the annual daily average.

Table 2-4
Monthly Variations in Average Daily Total Transactions, CY2007 - CY2013

Month	CY2007	*Index*	CY2008	*Index*	CY2009	*Index*	CY2010	*Index*	CY2011	*Index*	CY2012	*Index*	CY2013	*Index*
January	296,712	*97.3*	297,025	*98.1*	271,381	*91.1*	267,710	*93.3*	252,405	*90.7*	258,791	*94.8*	255,454	*94.5*
February	286,555	*94.0*	300,326	*99.2*	298,800	*100.3*	237,779	*82.9*	277,310	*99.7*	272,060	*99.7*	264,621	*97.9*
March	312,462	*102.5*	301,660	*99.6*	297,891	*100.0*	301,606	*105.2*	290,908	*104.6*	280,227	*102.7*	257,397	*95.2*
April	308,225	*101.1*	319,533	*105.6*	309,461	*103.9*	306,649	*106.9*	282,778	*101.7*	272,721	*99.9*	286,557	*106.0*
May	317,952	*104.3*	308,987	*102.1*	300,224	*100.8*	294,035	*102.5*	285,021	*102.5*	281,195	*103.0*	283,030	*104.7*
June	319,378	*104.8*	312,836	*103.3*	319,301	*107.2*	312,998	*109.1*	298,323	*107.2*	290,888	*106.6*	279,608	*103.4*
July	301,242	*98.8*	305,770	*101.0*	305,258	*102.5*	290,686	*101.4*	270,189	*97.1*	271,564	*99.5*	272,193	*100.7*
August	312,843	*102.6*	295,431	*97.6*	298,549	*100.2*	290,844	*101.4*	280,048	*100.7*	280,653	*102.8*	275,834	*102.0*
September	302,931	*99.4*	306,168	*101.1*	304,219	*102.1*	291,631	*101.7*	282,564	*101.6*	270,450	*99.1*	276,440	*102.3*
October	319,455	*104.8*	313,930	*103.7*	307,238	*103.1*	294,852	*102.8*	281,439	*101.2*	271,887	*99.6*	281,092	*104.0*
November	301,018	*98.7*	282,750	*93.4*	288,871	*97.0*	280,683	*97.9*	272,320	*97.9*	272,053	*99.7*	264,808	*98.0*
December	278,544	*91.4*	288,514	*95.3*	274,176	*92.0*	268,961	*93.8*	265,497	*95.4*	253,038	*92.7*	247,402	*91.5*
CY Average	304,892	-	302,729	-	297,858	-	286,811	-	278,178	-	272,926	-	270,346	-

Note: Total transactions include violations and non-revenue transactions.
Source: VDOT/MWAA, December 2013

A few exceptions have been observed, e.g. July 2011, August 2008, etc., where average daily traffic has been observed below the year's average daily levels; this can occur in years when these months have one less weekday in that year as compared to other years. The months of 2013 exhibited a very normal pattern throughout the year.

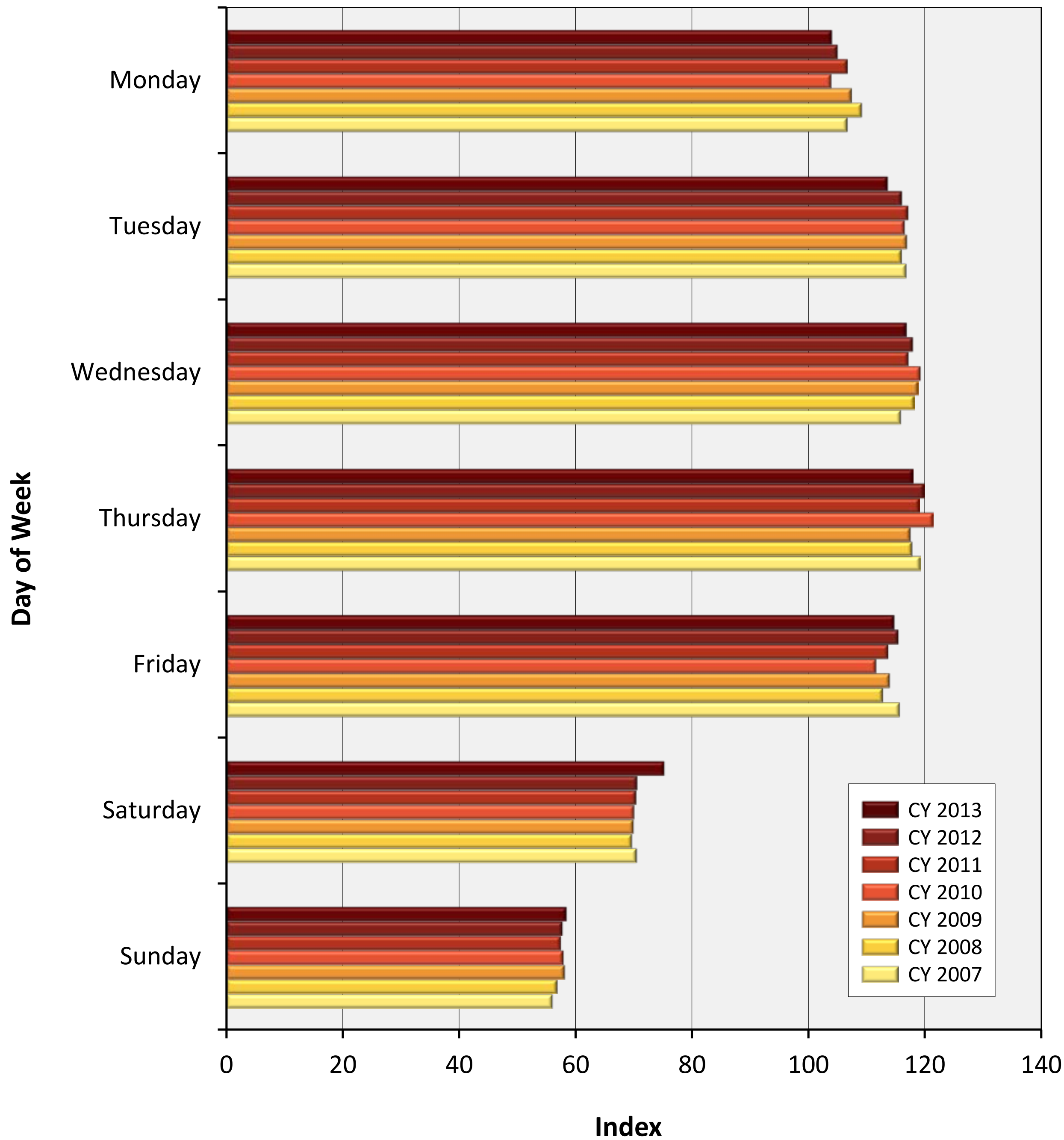
Daily Traffic Trends

Table 2-5 provides average daily total transactions on the DTR for each day of the week for the period CY2007 through CY2013. The index value is calculated in a similar manner described in the section above for monthly variations. Average daily transactions by day of the week were compared against the average daily of each entire year. As can be noted from Table 2-5, three mid-weekdays - Tuesday, Wednesday and Thursday - usually experience the maximum average daily traffic. Over the years, although an overall decrease has been observed in average daily traffic, index values across any particular day have kept relatively constant. Mondays are the quietest weekday and maintain an index value in the range of 103.8 to 109.0, whereas Fridays are slightly higher between 111.5 and 115.5. Index values for Saturdays are around 70.0, whereas Sundays are usually low with index values in high 50's. Graphically, Figure 2-2 presents these index values on a bar chart.

Table 2-5
Total Transactions by Day of Week, CY2007 - CY2013

Day	CY2006	Index	CY2007	Index	CY2008	Index	CY2009	Index	CY2010	Index	CY2011	Index	CY2012	Index	CY2013	Index
Monday	327,908	*106.3*	327,045	*106.5*	331,444	*109.0*	320,220	*107.2*	297,666	*103.8*	296,329	*106.5*	284,055	*104.3*	281,041	*103.9*
Tuesday	358,538	*116.3*	358,127	*116.7*	352,375	*115.8*	348,566	*116.7*	333,781	*116.4*	325,396	*117.0*	315,722	*115.9*	306,959	*113.4*
Wednesday	367,928	*119.3*	355,260	*115.7*	359,161	*118.1*	354,529	*118.7*	341,602	*119.1*	325,470	*117.0*	320,829	*117.8*	315,810	*116.7*
Thursday	368,041	*119.3*	365,643	*119.1*	357,859	*117.6*	350,471	*117.4*	347,973	*121.3*	330,887	*119.0*	326,232	*119.8*	318,800	*117.8*
Friday	355,609	*115.3*	354,658	*115.5*	342,451	*112.6*	339,850	*113.8*	319,796	*111.5*	315,895	*113.6*	314,007	*115.3*	310,060	*114.6*
Saturday	211,187	*68.5*	216,031	*70.4*	211,422	*69.5*	208,337	*69.8*	200,758	*70.0*	195,300	*70.2*	191,886	*70.4*	203,072	*75.0*
Sunday	172,209	*55.8*	171,858	*56.0*	172,560	*56.7*	173,194	*58.0*	165,830	*57.8*	159,407	*57.3*	155,951	*57.3*	157,666	*58.3*
CY Average	308,400	-	304,892	-	302,729	-	297,858	-	286,811	-	278,178		272,926		270,346	

Note: Includes violations and non-revenue transactions.
Source: VDOT/MWAA daily transaction reports



Note: Average day of year Index value = 100

DAILY VARIATION IN TOTAL DTR TRANSACTIONS - CY2007 TO CY2013

FIGURE 2-2

Development of DTR Average Weekday Traffic Profile

An extensive data collection effort was undertaken for the Comprehensive Traffic & Revenue Study by CDM Smith in mid to late 2011. The first in the series of fresh data collection exercises by CDM Smith was conducted in June 2011 and was focused on obtaining traffic profiles on the DTR along with another survey focused on capturing travel patterns on the DTR by tracking vehicles' entry and exit through an automated license plate recording technique. The latter information on entry/exit travel patterns has been summarized in Chapter 3 of this report.

CDM Smith recruited MCV Associates Inc. (MCV) to conduct a 48-hour traffic count along the entire stretch of DTR. Figure 2-3 presents the locations where this 48-hour traffic data collection effort was carried out by MCV on June 14 and 15, 2011. As can be seen from the DTR schematics displayed in Figure 2-3, traffic data was collected at a total of 33 locations including two bi-directional Main Line locations, all slip-ramps in and out of the Dulles Access Highway and all ramps on the DTR interchanges. This detailed information was used to develop a balanced traffic flow profile. MCV collected this information using road tubes on all ramp locations and a "microwave radar unit" for the Main Line locations. These radar units were set on existing poles along the toll road.

Following this field effort, CDM Smith processed the 48-hour traffic count data received from MCV. Also, CDM Smith obtained hourly level transactions information from the DTR for all toll plazas on the system. These sets of information were combined and any necessary adjustments were made and compared to the annual transaction levels at individual plazas to achieve a balanced daily and time period profile for the DTR. Figure 2-4 presents the resulting estimated daily traffic profile on a DTR schematic. Further utilization of this profile along with other information has been discussed in the model calibration section of Chapter 5 in this report.

Hourly Traffic Variation

Following the development of a daily and time period traffic profile for the DTR, an adjusted hourly level traffic distribution was developed for use in model calibration. Figures 2-5 displays directional hourly traffic profiles on DTR Main Line and Greenway mainline plazas in the westbound and eastbound directions. Figure 2-6 displays directional hourly profiles at all ramp locations.

Trends in ETC Utilization

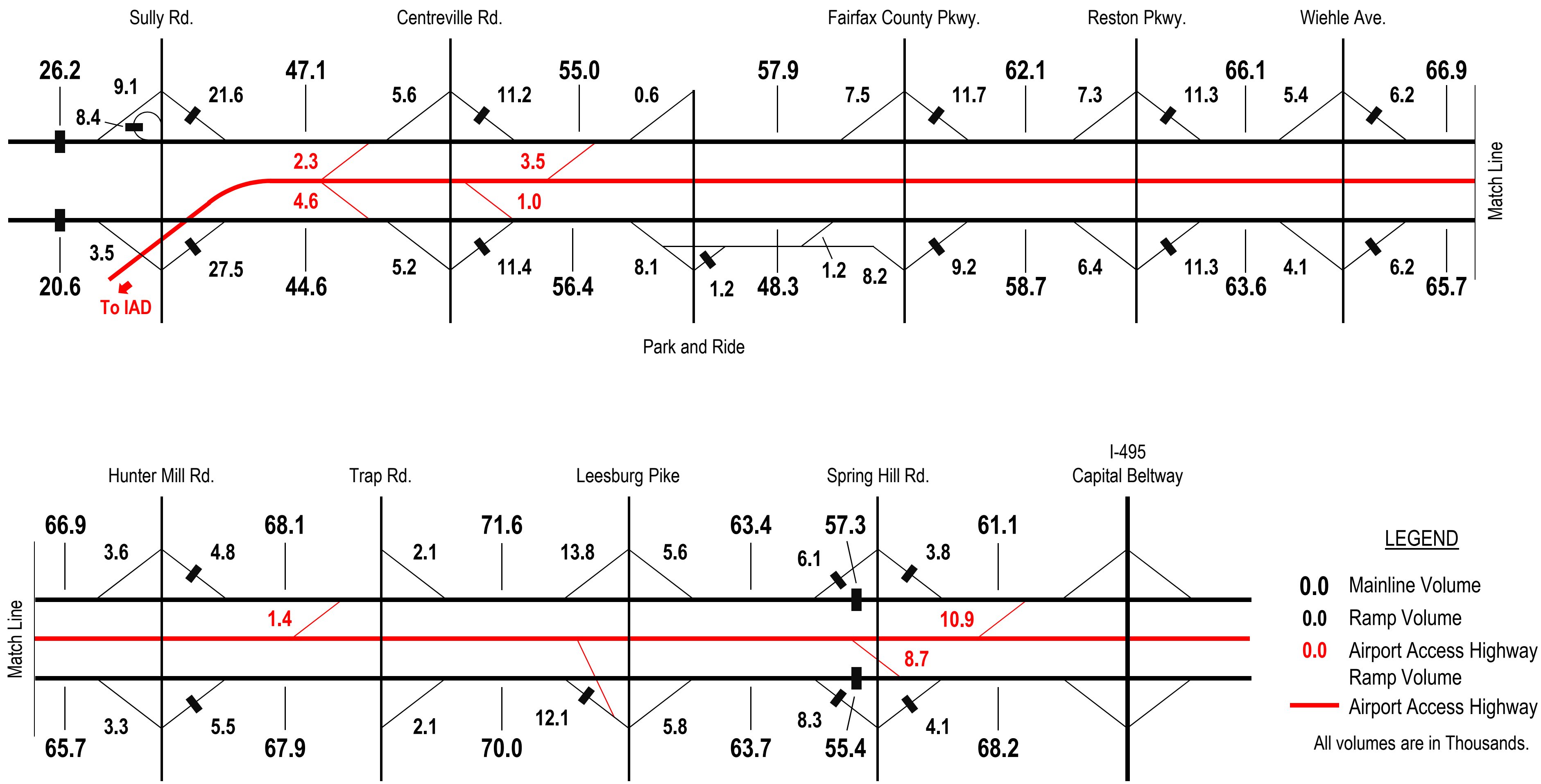
DTR is part of the E-ZPass Interagency Group (IAG). The E-ZPass IAG started with only seven members in 1993 in three States and has now grown to 25 member toll agencies in 15 States with over 24 million devices in circulation.

Table 2-6 shows, for CY1998 through CY2013, toll revenues collected via cash transactions, toll revenues collected via E-ZPass, and the percentage of revenues collected by E-ZPass. Although no discount is given to electronic toll collection (ETC) transactions on DTR, the percentage of revenues collected via E-ZPass increased from 32.6 percent to 81.8 percent over that time period. In CY2011, a total of $22.9 million in cash was collected compared to $70.6 million in E-ZPass payments, resulting in an ETC percentage of 75.5 percent. Further, in CY2012, a total of $21.9 million in cash was collected compared to a significantly higher $78.6 million in E-ZPass payments. A new milestone in electronic toll collection was reached in 2013 when more than 80 percent of customers paid their tolls by E-ZPass.

CDM Smith

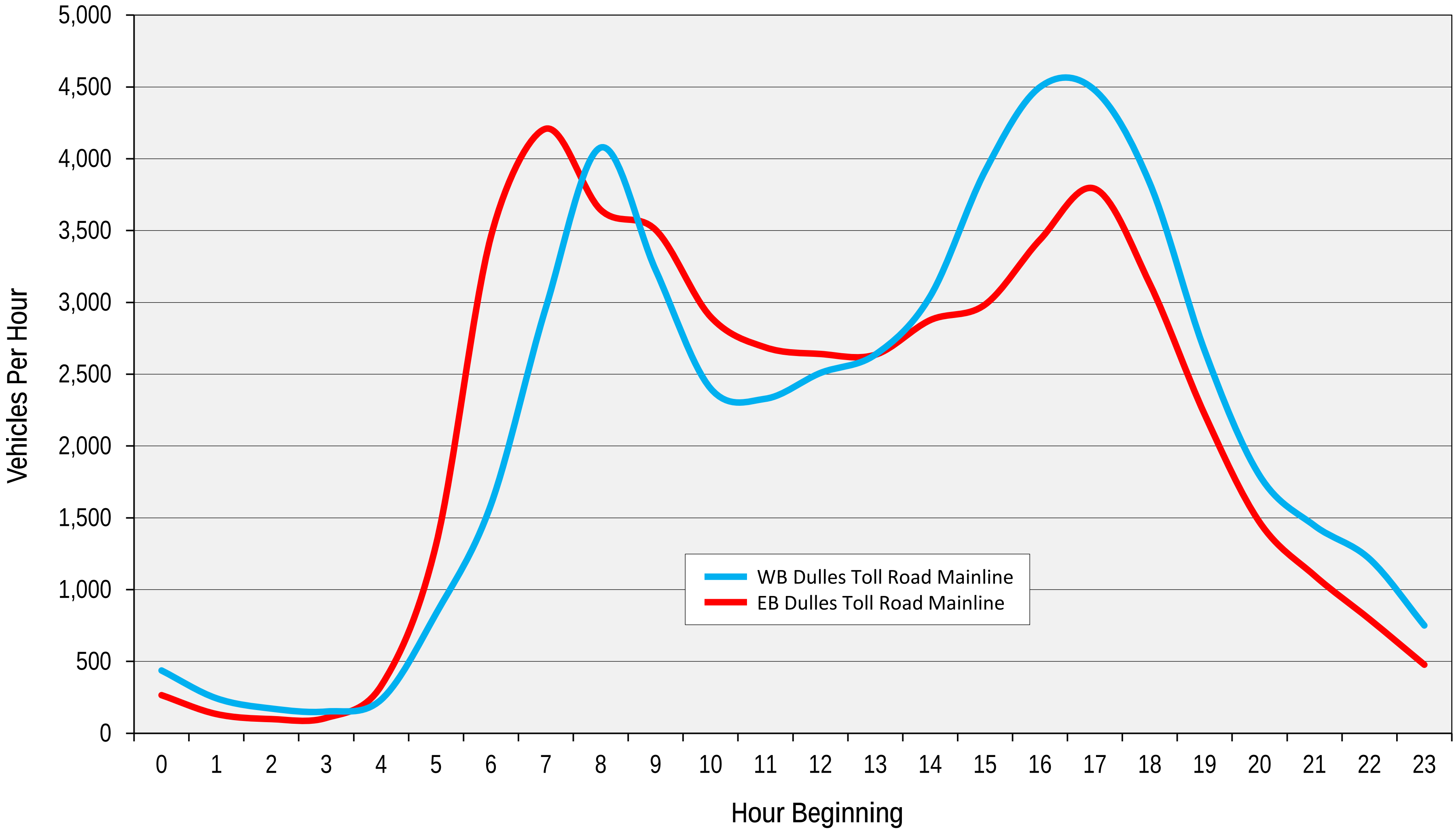
DTR 48 HOUR TRAFFIC COUNT DATA COLLECTION LOCATION MAP

FIGURE 2-3



DTR 2011 WEEKDAY TRAFFIC PROFILE

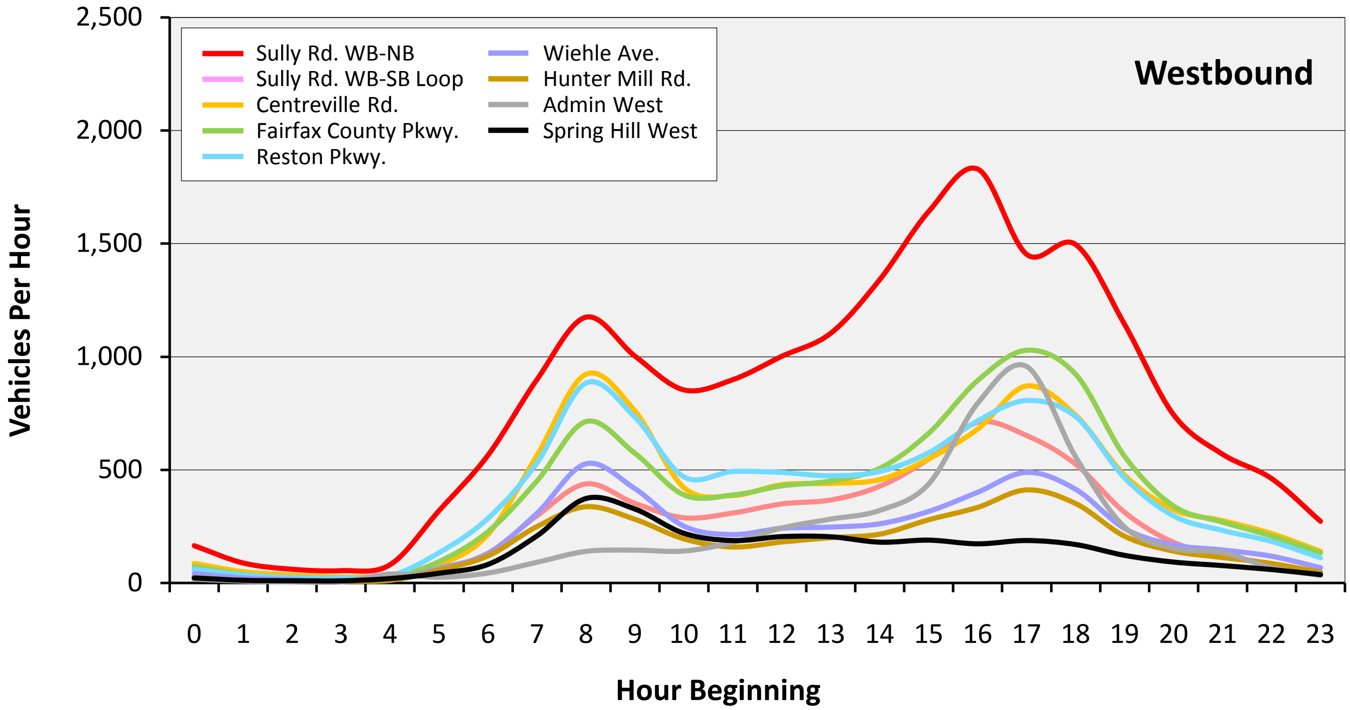
FIGURE 2-4

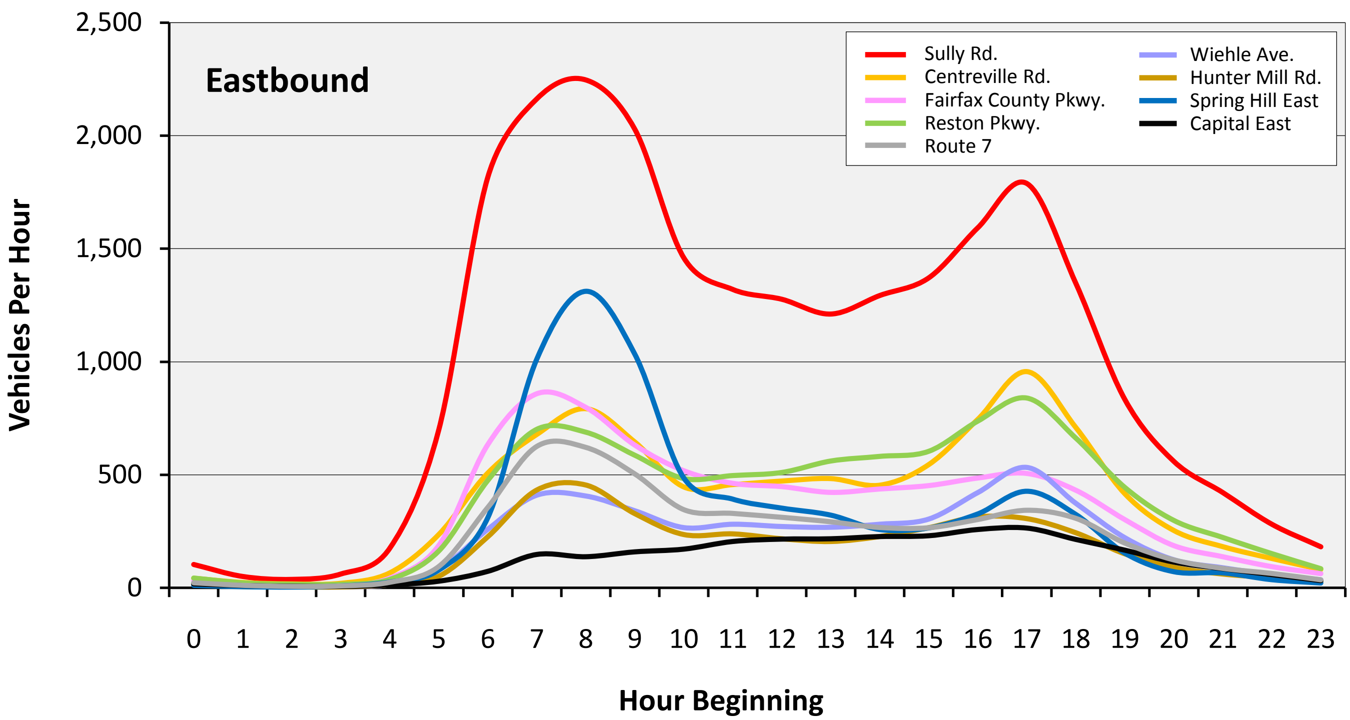


CDM Smith

DTR MAINLINE TOLL PLAZA HOURLY TRAFFIC VARIATIONS

FIGURE 2-5





DTR RAMP PLAZAS
HOURLY TRAFFIC VARIATIONS

FIGURE 2-6

Table 2-6
Total Annual Toll Revenue by Payment Type, CY1998-CY2013

Calendar Year	Cash	E-ZPass	Total Toll Revenue	Percent E-ZPass
1998	$19,797,437	$9,573,897	$29,371,334	32.6%
1999	19,214,273	12,525,594	31,739,868	39.5%
2000	19,317,961	15,131,175	34,449,136	43.9%
2001	18,275,695	16,838,929	35,114,624	48.0%
2002	17,291,901	17,569,887	34,861,789	50.4%
2003	17,143,613	18,140,117	35,283,730	51.4%
2004	18,630,558	23,315,063	41,945,621	55.6%
2005	21,110,421	34,963,825	56,074,246	62.4%
2006	22,371,086	42,809,087	65,180,173	65.7%
2007	21,401,305	44,225,461	65,626,766	67.4%
2008	20,370,348	45,263,742	65,634,091	69.0%
2009	19,137,161	45,567,986	64,705,148	70.4%
2010	23,696,499	63,615,790	87,312,289	72.9%
2011	22,893,363	70,634,024	93,527,387	75.5%
2012	21,892,706	78,613,469	100,506,175	78.2%
2013	22,735,433	102,478,080	125,213,513	81.8%

Source: VDOT/MWAA, March 2014, excludes recovered violation revenues
Note: Toll rates adjusted in May 2005, Jan 2010, Jan 2011, Jan 2012, and Jan 2013.

Table 2-7 shows the number of total transactions at DTR plazas during CY2012 and CY2013. For each plaza, revenue transactions are shown by payment type (cash or E-ZPass). Violations and non-revenue transactions are also shown. Cash payment continues to decline and E-ZPass has increased to 79.4 percent on a transactions basis.

Table 2-7
Transactions by Plaza and Payment Type

	CY2012					CY2013				
Plaza	**Cash**	**E-ZPass**	**Violations**	**Non-Rev**	**Total**	**Cash**	**E-ZPass**	**Violations**	**Non-Rev**	**Total**
Sully Rd	3,768,169	13,500,919	295,628	78,393	17,564,716	3,177,469	13,899,140	355,681	76,905	17,509,195
Centreville Rd	1,810,547	4,781,958	130,906	41,691	6,723,411	1,484,599	4,835,774	144,888	39,511	6,504,772
Monroe Park & Ride	5,987	115,924	16,970	44,784	138,881	6,567	159,905	9,559	78,831	254,862
Fairfax Pkwy	1,134,194	4,764,923	98,346	112,541	5,997,463	934,369	4,975,148	110,812	129,627	6,149,956
Reston Pkwy	1,496,380	5,222,631	116,043	69,252	6,835,054	1,181,529	5,236,482	136,663	74,230	6,628,904
Wiehle Ave	741,159	2,855,988	69,664	82,368	3,666,811	591,253	2,871,200	74,132	83,235	3,619,820
Hunter Mill Rd	451,993	2,501,185	47,033	21,484	3,000,211	356,415	2,521,718	51,113	21,504	2,950,750
Route 7, East	557,299	1,514,915	39,753	8,829	2,111,967	448,824	1,484,508	43,890	7,539	1,984,761
Main Line	8,105,649	26,917,134	733,992	93,986	35,756,775	6,721,884	28,086,175	761,085	94,385	35,663,529
Spring Hill Rd	579,284	3,620,342	70,330	79,894	4,269,956	450,075	3,629,417	72,078	84,476	4,236,046
Capital Beltway	647,728	1,534,171	78,276	51,667	2,260,175	535,286	1,501,235	89,333	48,174	2,174,028
Greenway	1,852,606	8,935,951	24,646	70,750	10,813,203	1,696,549	9,151,565	38,516	110,566	10,997,196
Total	**21,150,995**	**76,266,054**	**1,721,587**	**755,639**	**99,894,275**	**17,584,819**	**78,354,665**	**1,887,750**	**848,983**	**98,676,217**
% of total payments	21.2%	76.3%	1.7%	0.8%		17.8%	79.4%	1.9%	0.9%	

Source: VDOT/MWAA reports through December 2013

Traffic Response to Recent Toll Increases

As part of this study, CDM Smith reviewed in detail the impact, in terms of toll diversion, of the previous three DTR toll adjustments. These were compared to prior CDM Smith forecasts in order to check the validity and accuracy of those forecasts. Overall, the prior forecasts and models were satisfactory with no recalibration of models necessary.

At a more basic level, looking at January data for the past five years, the day of week impact of the four recent toll rate adjustments as compared with 2009 traffic is shown graphically in Figure 2-7. The analysis is done by day of week with the yellow bars showing the situation as now known through January 2013. The least sensitive day through 2013 is Tuesday, showing less than a 10 percent decrease over the period of the four toll adjustments in each year 2010 through 2013. The most sensitive weekday is Thursday at over a 15 percent decrease since 2009 and the most sensitive weekend day is Saturday at over 12 percent. Weekends tend to have a much higher share of discretionary trips and trip purposes with lower values of time, and thus would be expected to display higher reductions in travel than weekdays in response to toll increases.

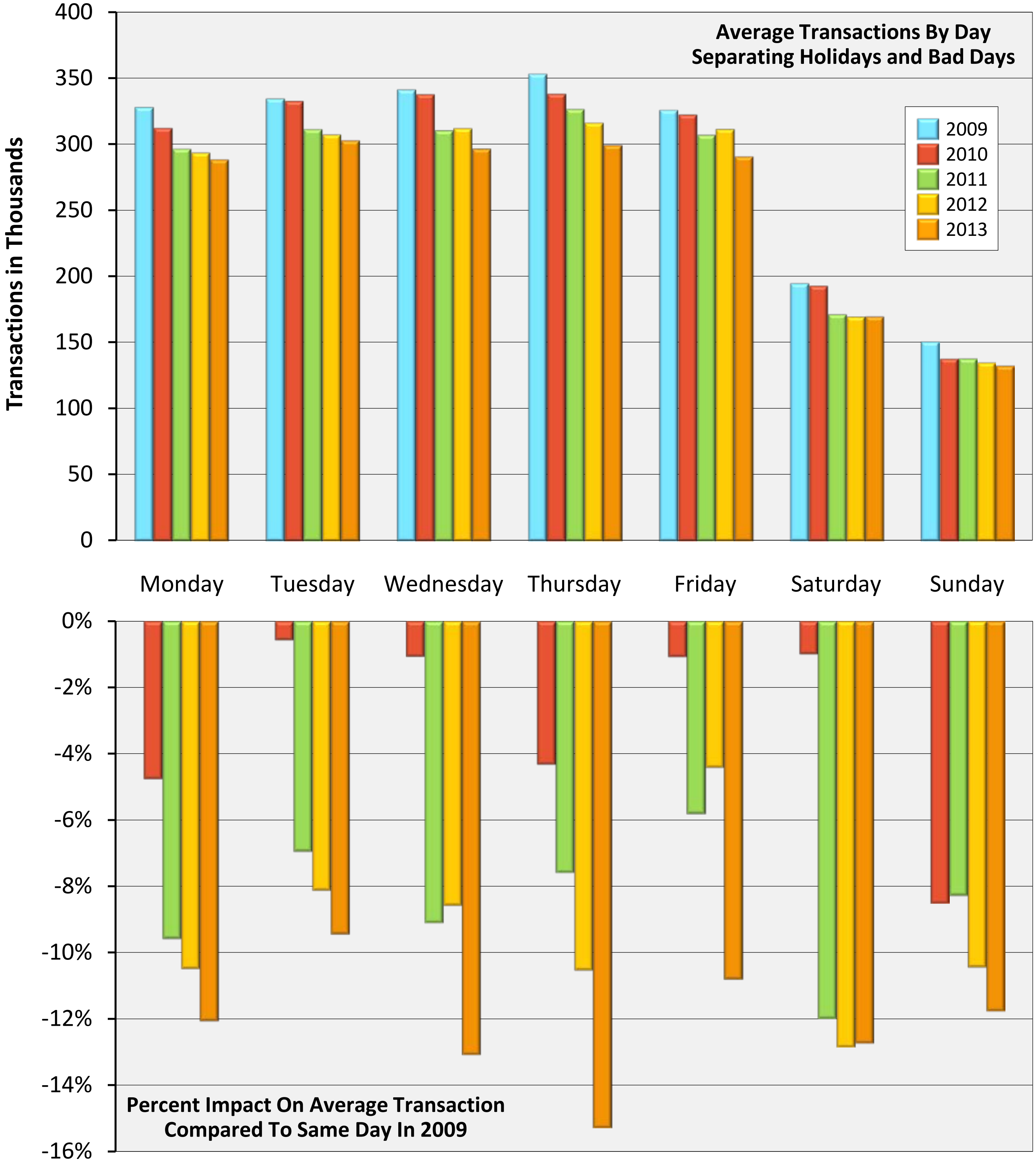
Speed and Delay Studies

Speed and delay studies were conducted in order to understand the nature of operations on the DTR and the surrounding highway network. Due to varying levels of congestion during the day, speeds are generally lower in the peak periods and higher in the off-peak periods. Often, congestion will result in peak traffic slowing to a standstill, causing motorists to encounter substantial delay. In addition, bottlenecks can occur where capacity is exceeded or operational issues occur near interchanges.

Detailed speed data was collected by traveling on key routes as described below during different time periods of the day. CDM Smith recruited MCV to conduct these travel runs in October 2011. Vehicle-mounted GPS units recorded data continually during each trip. Since the exact location and time of each vehicle were known for each datum, the travel speeds and delays are known by calculation along each route.

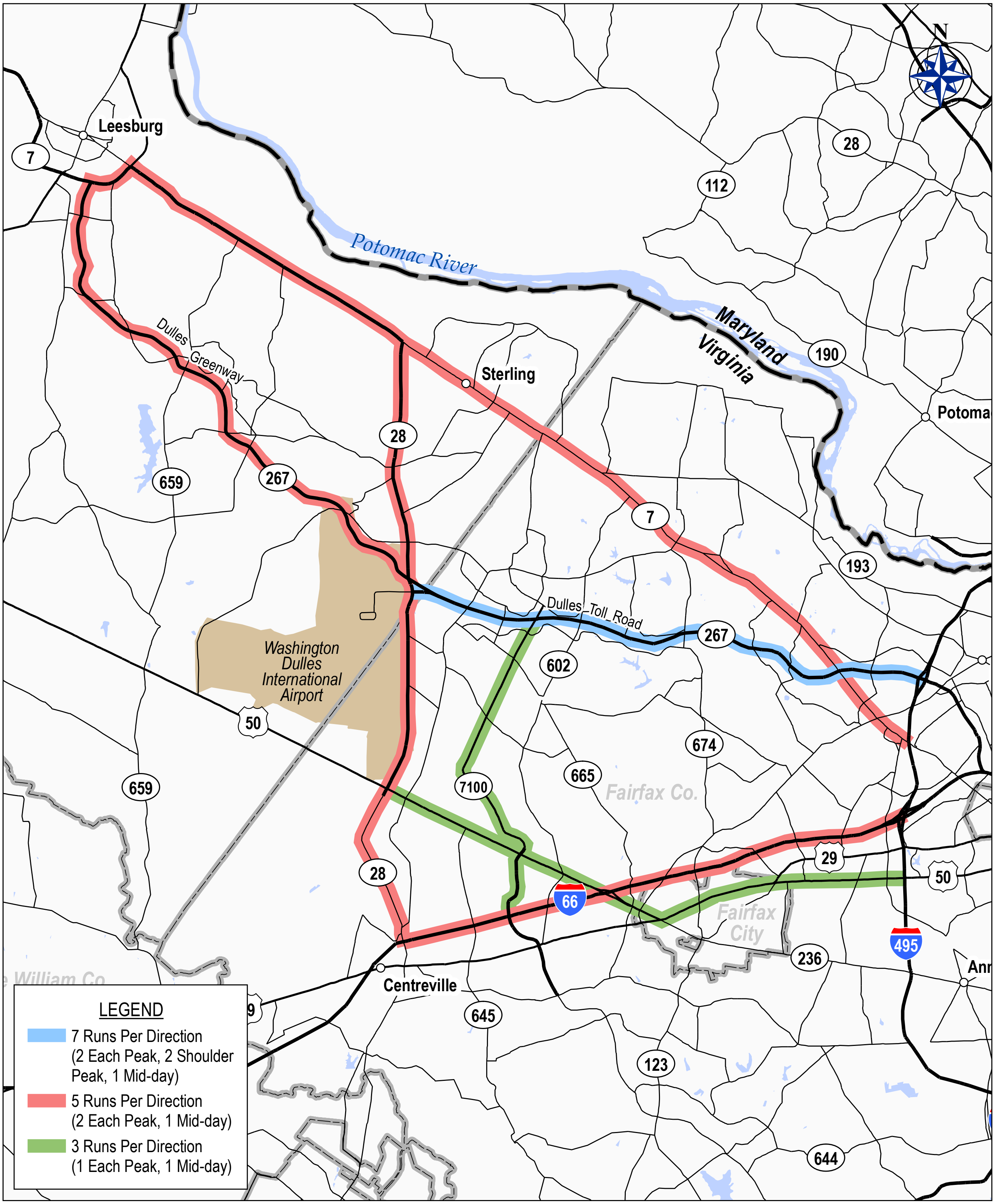
Figure 2-8 presents a map of routes that were chosen to collect speed and delay data in the DTR vicinity. Speed and delay data were gathered through 33 travel runs made on these key routes. This information was supplemented by additional data collected for specific time periods on a few chosen routes in February 2012. The following key routes were surveyed:

- Dulles Toll Road between the Dulles Airport and the Capital Beltway (I-495) consisting of a total of seven runs per direction (two each in the AM and PM peak periods, two in the shoulder of the peak and one during the mid-day).
- Route 7 between Leesburg and the Capital Beltway consisting of a total of five runs per direction (two each in the AM and PM peak periods, and one during the mid-day).
- The Greenway between Leesburg and Route 28 consisting of a total of five runs per direction (two each in the AM and PM peak periods, and one during the mid-day).
- Route 28 between Route 7 and I-66 consisting of a total of five runs per direction (two each in the AM and PM peak periods, and one during the mid-day).



IMPACT OF TOLL INCREASE ON JANUARY TRANSACTIONS

VA 87119 / 3-6-12 / Speed Delay.mxd



CDM Smith

SPEED DELAY SURVEY ROUTE MAP

FIGURE 2-8

- I-66 between Route 28 and Capital Beltway consisting of a total of five runs per direction (two each in the AM and PM peak periods, and one during the mid-day).
- Fairfax County Parkway between Dulles Toll Road and I-66 consisting of a total of three runs per direction (one each in the AM and PM peak periods, and one during the mid-day).
- Route 50 between Route 28 and Capital Beltway consisting of a total of three runs per direction (one each in the AM and PM peak periods, and one during the mid-day).

In addition to the data collected through travel runs, MCV also analyzed journey times using the automatic license plate survey information. Journey time profiles were developed for the DTR from the Capital Beltway to Route 28 (Sully Rd) Exits between the hours of 3:00 PM to 7:00 PM in 5-minute increments. The average time, minimum travel time and maximum travel time along with travel speeds were computed. Also, a microwave radar unit was setup along the westbound DTR just past the Route 7 exit. This unit recorded traffic volumes as well as traffic speeds on the DTR. The speed data from the microwave radar unit was utilized to develop average travel speeds in 15-minute increments between the hours of 6:00 AM and 8:00 PM.

The report by MCV containing detailed summary of speed and delay runs and the above stated analyses has been included as Appendix A of this report and is included for historical information record.

Chapter 3

DTR Customer Surveys

An important objective of the DTR customer surveys was to develop a detailed operating profile of Dulles Toll Road users in the base model year. For this purpose, two types of surveys were conducted to establish detailed travel pattern on the corridor and to collect user and trip purpose characteristics. This chapter presents the results of an origin-destination survey and an entry/exit trip patterns survey which were completed for DTR patrons throughout the second half of 2011.

Origin-Destination Survey

An origin-destination and patron characteristics survey on the eleven DTR tolled locations, including the Greenway mainline plaza, was conducted during the months of September and October, 2011.

The survey was conducted online, with recruitment done in the field, by circulating a survey link via mail and e-mail. This approach was proposed to minimize impacts on mobility along the heavily traveled facility and to make survey collection and processing more efficient. A detailed approach used for data collection has been described in the later sections of this chapter.

The origin-destination survey focused on gaining an understanding of the travel patterns and characteristics of motorists on the DTR corridor. These characteristics included time of day, trip purpose, trip frequency, vehicle occupancy, time saved by using the DTR, reason for choosing the DTR, and likelihood of choosing transit once it becomes available. The answers to these questions were used to determine the values of variables used in the modeling process to estimate future patronage of the DTR under various hypothesized conditions could be estimated.

CDM Smith retained Resource System Group, Inc. (RSG) to program an online origin-destination survey and undertake the internet administration. The survey was administered to cash and E-ZPass customers. This was done through a postcard handout effort at toll plazas to current cash customers and also through an email effort to respondents who had agreed to participate in future studies during prior survey efforts. Both the postcards and the emails contained a brief description of the study and a link to the survey website. At the conclusion of the administration phase, RSG provided the raw survey data files to CDM Smith for further analysis.

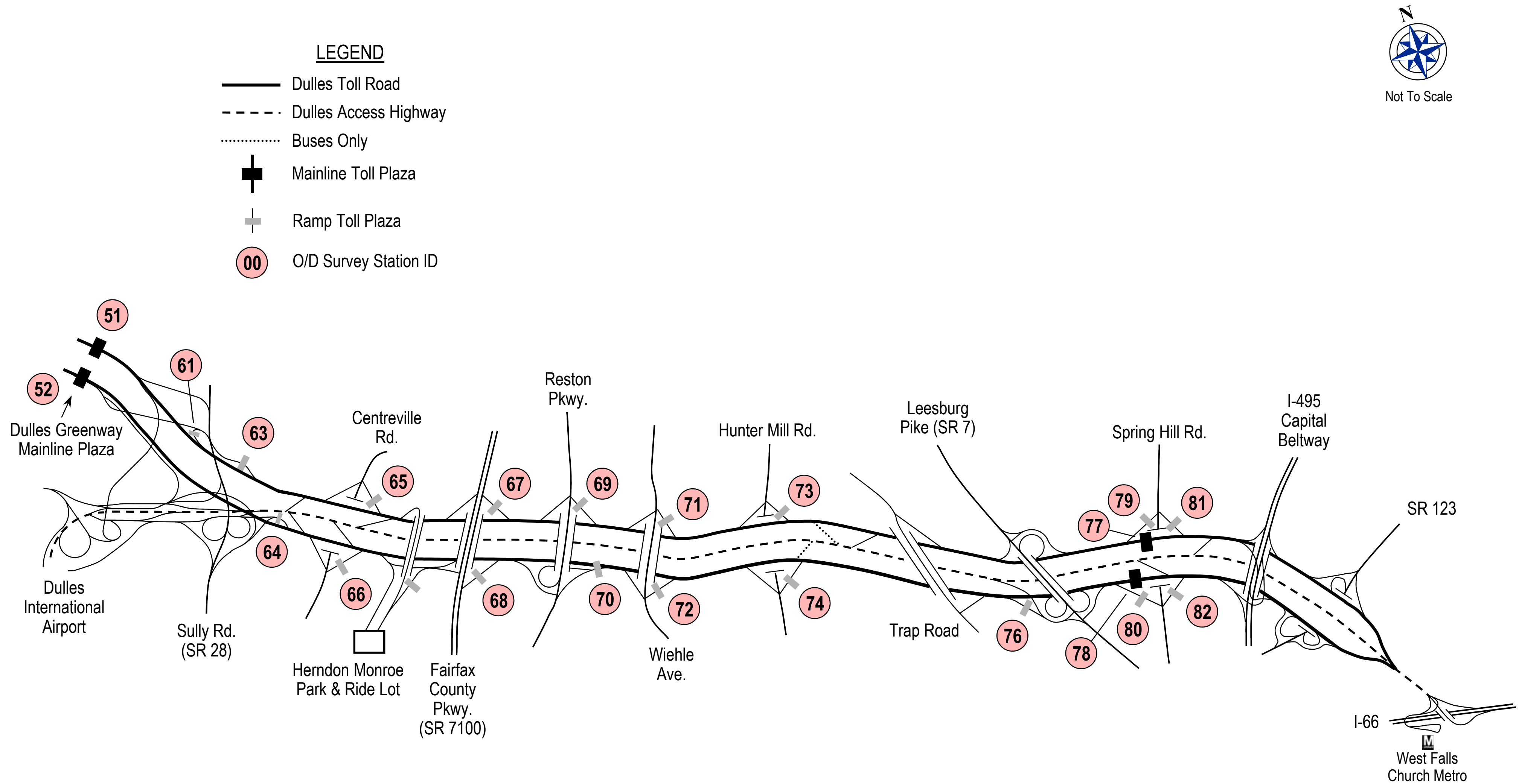
Table 3-1 shows the list of variables that were included in the online survey, along with the purpose for collecting each data element. This included trip information such as origin and destination, timing of trip, trip purpose, frequency, occupancy, and other valuable variables such as why customers chose the DTR and how much time customers estimated they save using the DTR versus their alternate toll-free route.

Table 3-1
Data Elements in Origin-Destination Survey

Data Element	Uses
Origin Address	Shows where the trip began
Destination Address	Shows where the trip terminated
Time of Day	Indicates the time period when the trip was made
Direction	Indicates the direction of travel while making the trip
Day of Week	Indicates the day of the week when the trip was made
Entry Interchange	Indicates where motorist entered the DTR
Exit Interchange	Indicates where motorist departed the DTR
Trip Purpose	Provides the reason for the trip
Days Per Week Trip is Made	Provides trip frequency
Number of People in the Vehicle	Collect data on carpooling
Vehicle Type	Indicates passenger car or commercial vehicle
Reason for Choosing the DTR	Collect data on characteristics that attract patrons
Amount of Time Saved Using DTR	Indicates time advantage for DTR over alternatives
Use of Metrorail	Indicates willingness to use the new Dulles Metrorail
State of Vehicle Registration	Provides indication of non-local users
County of Residence	Rough location of local users
Name and Email Address	For follow-up survey

Figure 3-1 shows a schematic of the DTR, with survey stations marked at toll plazas to which survey data were tabulated and analyzed. MCV Inc. staff managed the field distribution of an estimated 20,000 cards to the cash users. Cards were handed out by DTR cash toll collectors in the attended lanes and MCV staff in unattended lanes on September 29, 2011. The handout process was conducted at both the DTR and Greenway mainline plazas in both directions during the daylight hours. Further cards were handed out on the eastbound ramp plazas by toll collectors during the daylight hours and by MCV staff during the 7:00 am to 10:00 am period on unattended lanes. RSG also distributed an email invite in the following week with the online survey link to almost 4,400 emails obtained from prior survey efforts. A unique password ID was provided on each handout card and email address to track the location where a card was handed out or the email address from which the respondent was recruited. The online survey was administered for an approximate period of three weeks until closed on October 24, 2011. Table 3-2 below presents summaries of cards handed out / emailed by the method of recruitment along with the responses received.

As noted from the Table 3-2 below, despite the passing of several years since the previous survey, email recruiting resulted in a very acceptable response rate of 16.7 percent totaling 731 responses of the 4,365 emails sent. These regular customers would be expected to be more inclined to participate and provide comments despite having responded previously. However, cash customers who were handed cards were significantly less responsive. Of approximately 18,500 cards handed out, a response of 525 was received, or a response rate of 2.8 percent. In total, 1,256 responses were received of which 1,213 (96.6 percent) were found to be valid after processing and validating for the given origin-destination combination. This is a very high valid sample rate.



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2011 DTR O/D SURVEY STATIONS LOCATION MAP

FIGURE 3-1

Table 3-2
2011 DTR O/D Survey Summary

Handout Survey

Station ID	Station Name	DTR total traffic on survey day (1)	DTR cash paying traffic on survey day 6am-7pm (1)	Notecards distributed to Cash users (2)	Number of responses received by RSG (3)	Percentage of responses of total capture	Number of valid responses (4)	Percentage of valid responses
82	Capital Beltway EB On ramp	4,419	991	180	4	2.2%	4	100.0%
80	Spring Hill Rd EB Off ramp	9,703	1,172	713	20	2.8%	20	100.0%
78	DTR Mainline Toll Plaza EB	58,222	10,407	5,180	109	2.1%	107	98.2%
77	DTR Mainline Toll Plaza WB	60,060	10,193	4,255	157	3.7%	145	92.4%
76	Route 7 EB Off ramp	7,314	1,647	560	8	1.4%	7	87.5%
74	Hunter Mill Rd EB On ramp	5,242	731	357	14	3.9%	13	92.9%
72	Wiehle Ave EB On ramp	6,941	1,109	480	15	3.1%	14	93.3%
70	Reston Pkwy EB On ramp	12,038	2,258	1,080	28	2.6%	27	96.4%
68	Fairfax County Pkwy EB On ramp	9,577	1,597	770	24	3.1%	23	95.8%
66	Centreville Rd EB On ramp	11,688	2,510	1,060	41	3.9%	40	97.6%
64	Sully Rd EB On ramp	28,743	2,573	2,375	67	2.8%	62	92.5%
52	Dulles Greenway Mainline Toll Plaza EB (6)	17,681	2,047	345	26	7.5%	22	84.6%
51	Dulles Greenway Mainline Toll Plaza WB (6)	17,681	1,987	1,120	12	1.1%	12	100.0%
	Subtotal	**249,309**	**39,223**	**18,475**	**525**	**2.8%**	**496**	**94.5%**

Email Recruits

Type of survey in 2007	Number of emails contacted				
Handout	659	72	10.9%	66	91.7%
Mailout	3,706	659	17.8%	651	98.8%
Subtotal	**4,365**	**731**	**16.7%**	**717**	**98.1%**

O-D Survey Summary Totals

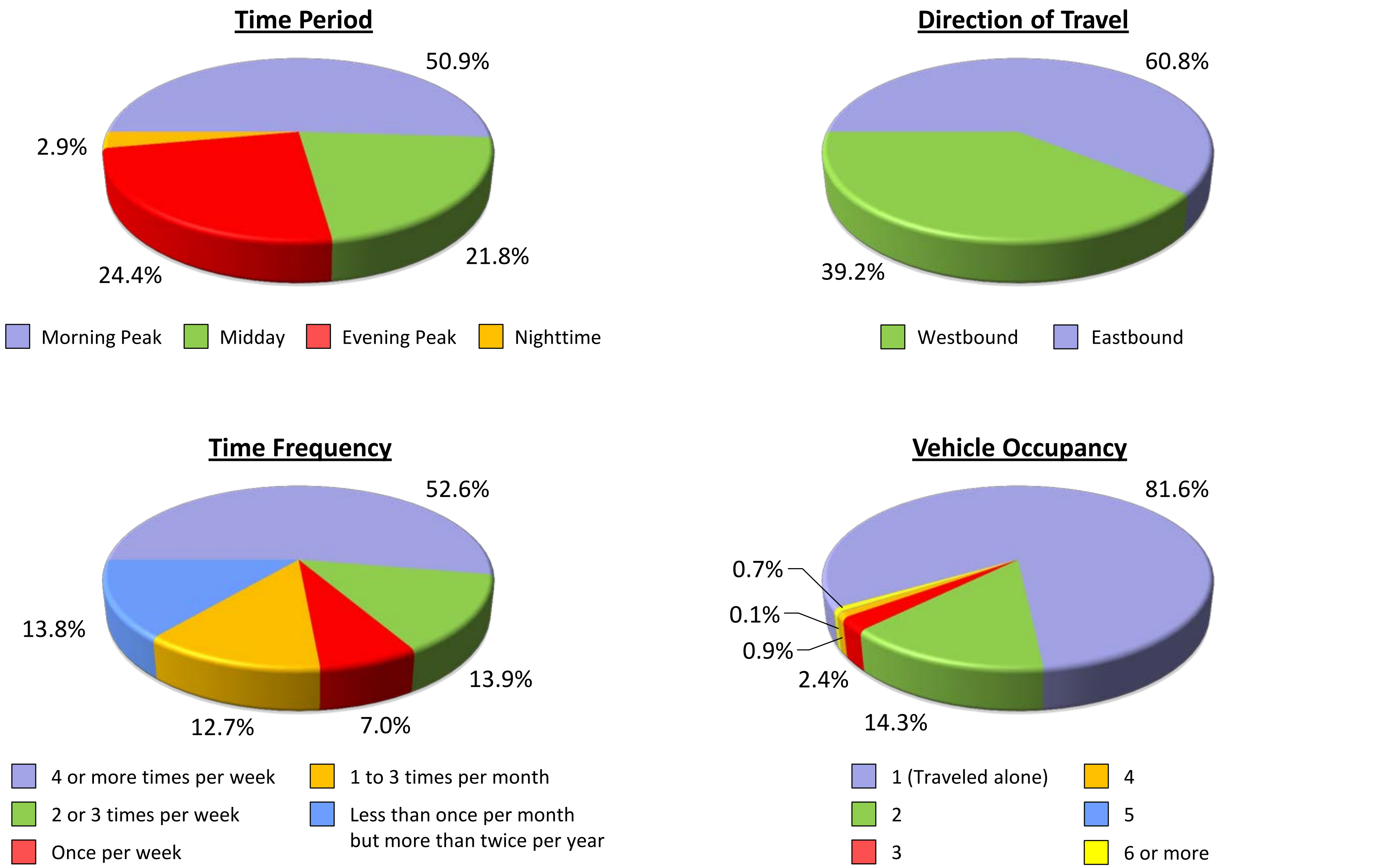
Type of survey	Capture attempted				
Handout	18,475	525	2.8%	496	94.5%
Email Recruits	4,365	731	16.7%	717	98.1%
Grand Total	**22,840**	**1,256**	**5.5%**	**1,213**	**96.6%**

Notes:
1) DTR O-D survey was conducted on Thursday, September 29 2011.
2) Toll collectors and MCV temporary staff to hand out at eastbound ramps only and both directions on DTR and Greenway mainlines.
3) RSG administered the online OD survey for a period of approx. 3 weeks beginning September 29 through October 24 2011, Thursday through Monday.
4) WSA processed and validated the database received from RSG for the given origin-destination combination.
5) Dulles Greenway Mainline transactions estimated from the bi-direction total. Daytime traffic estimated from DTR mainline daytime traffic.

Trip Characteristics

Figures 3-2 and 3-3 show several pie charts developed from the survey data. These include the following:

- *Time of Day.* More than three-quarters (75.4 percent) of the sample was collected for a trip made during a morning or an evening peak period.
- *Direction of Travel.* A total of 60.8 percent of the sample was collected for a trip that was made traveling in the eastbound direction.

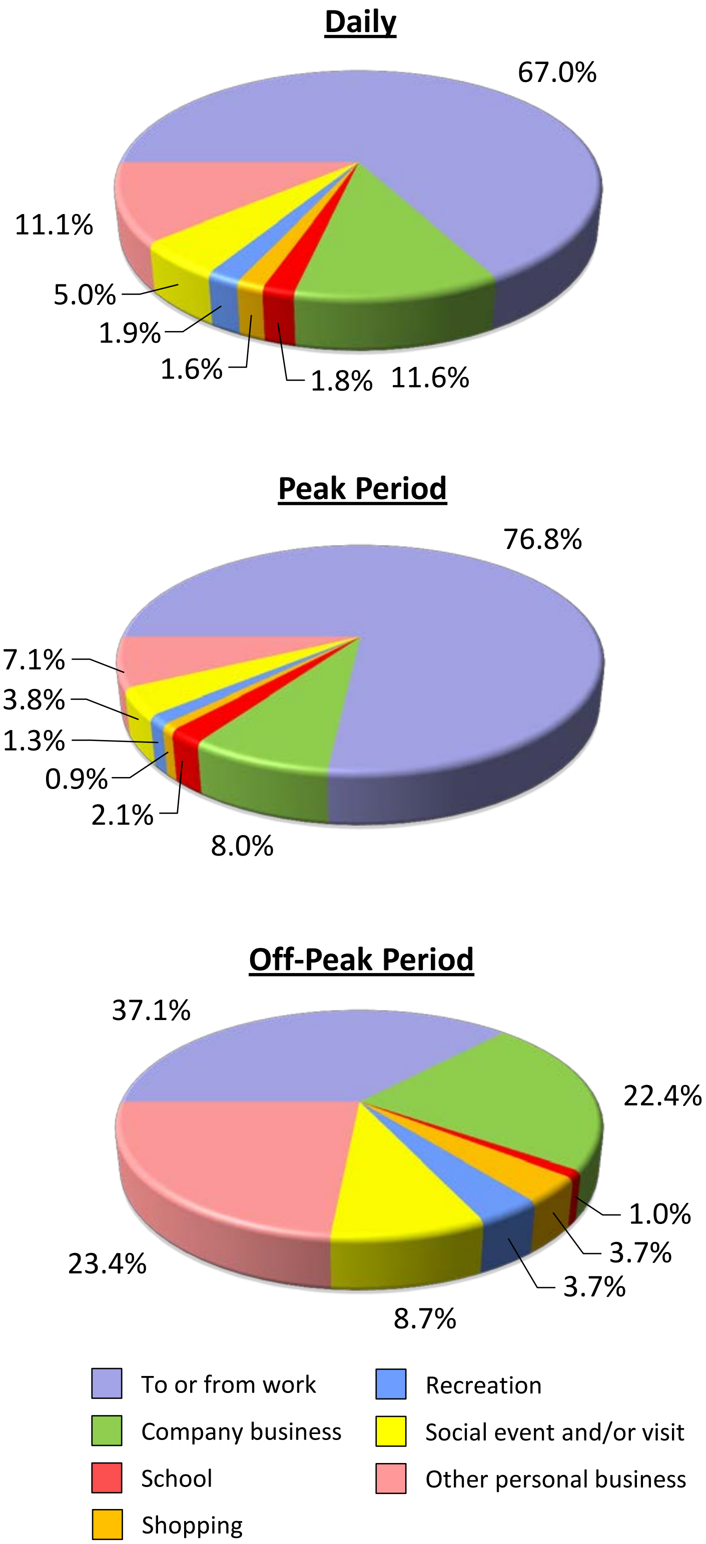


Note: Sample from 2011 DTR O/D Survey

CDM Smith

TRIP CHARACTERISTICS

FIGURE 3-2



Note: Sample from 2011 DTR O/D Survey

TRIP PURPOSE

FIGURE 3-3

- *Trips per Week (Trip Frequency).* Nearly two-thirds (66.5 percent) of the respondents answered that the trip being surveyed occurs two or more times per week indicating a high percentage of regular customers.

- *Vehicle Occupancy.* The vast majority of DTR users (81.6 percent) are the only occupants of their vehicles. Of the remaining respondents, 14.3 percent are in cars with two persons. Only 4.0 percent of respondents reported having three or more occupants in the vehicle.

- *Trip Purpose.* Each respondent was requested to provide the reason for having made the trip during which they had received the survey card. As the first pie chart shows, 67.0 percent of the respondents were using the DTR for a journey to or from work while 11.6 percent were traveling on company business. The remaining 21.5 percent of respondents reported trip purposes split among, social, recreational, shopping, school, and personal business. When tabulated for the trips reported in the peak period, an expected high 76.8 percent of the respondents reported they were commuting to and from work and 8.0 percent reported they were making a company business related trip. However, during the off peak period a total of 40.5 percent respondents reported making a non-work trip.

In addition to the above characteristics-based questions, a few other questions were asked to assess the utility of using the DTR and whether respondents could make use of the new Dulles Metrorail project for trips that they make. Figure 3-4 shows a summary of responses to these questions.

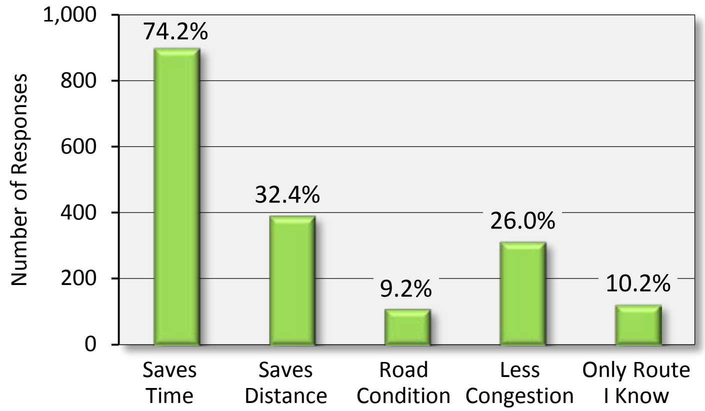
- *Importance of DTR*. Respondents were asked to select all reasons they would choose DTR over the rest of the road network in the region. A significant portion (74.2 percent) of respondents is of the opinion that traveling on the DTR saves them valuable time. About one-third (32.4 percent) think traveling on DTR is a shorter way to their destination, whereas a little over a quarter (26.0 percent) of the respondents think DTR makes their trip convenient by offering lower congestion levels. Opinions were rather low, about 10.0 percent, for choosing DTR over other roads for better road conditions and being less familiar with the region's road network.

- *Alternate Route*. Leesburg Pike (Route 7) being an obvious straight route from Leesburg to Tysons Corner was DTR users' most selected alternative to DTR. I-66 and/or a combination of other routes were selected next, at 28.7 percent and 24.2 percent respectively, for DTR customers' alternative route.

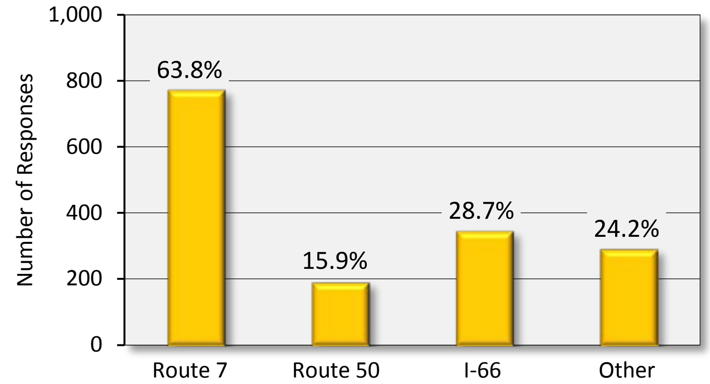
- *Time Savings*. When asked how much time the DTR saved compared to their alternative, 83.4 percent of respondents indicated that the DTR would save them more than 10 minutes. 60.9 percent of the respondents indicated that the amount was more than 15 minutes, whereas 35.0 percent indicated that the amount was 20 minutes or more.

- *Dulles Metrorail*. The new Dulles Metrorail project is being constructed along the median of the Dulles Airport Access Highway as a 23-mile extension of the existing Metrorail system and is envisioned to provide transit connectivity between Ashburn to Dulles Airport to Reston Herndon to Tysons Corner, Virginia's largest employment center. Respondents were asked if they would use the new Dulles Metrorail for their trip. 14.1 percent of the respondents pointed out the Metrorail will not be compatible with their trip and 11.2 percent responded they would always drive to make their trip. One-fifth (20.0 percent) of the respondents were either not

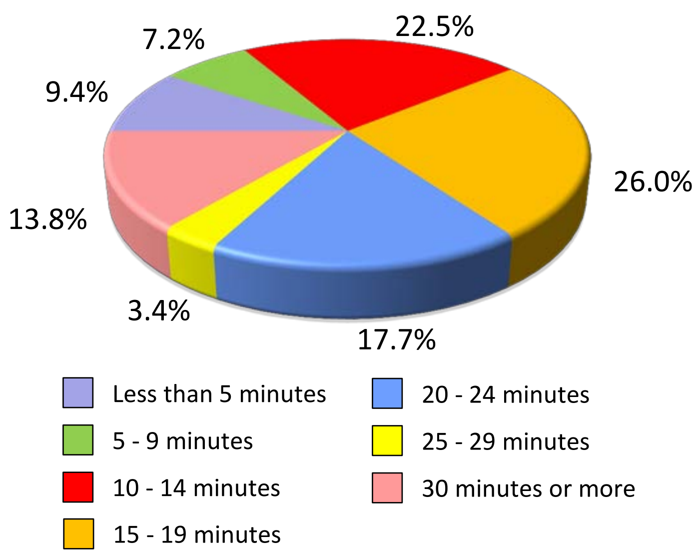
Why Did You Choose DTR?



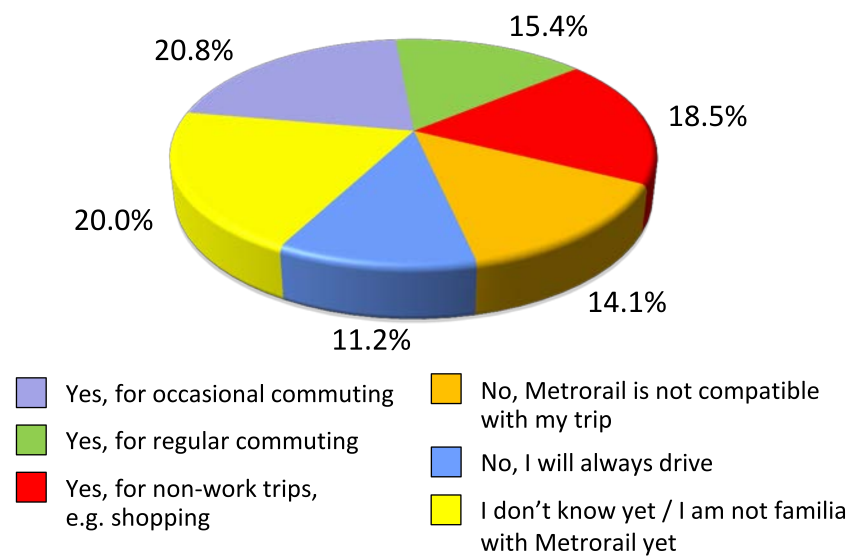
Alternate Route That Could Have Been Used



Time Saved By Using DTR



Would You Use New Dulles Metrorail?



Note: Sample from 2011 DTR O/D Survey

DTR USERS PREFERENCE AND OPINION

FIGURE 3-4

ready to make their decision yet or were not familiar with the Dulles Metrorail project yet. 15.4 percent said they might use it for regular commuting and about 20.8 respondents said they would use the Metrorail for occasional commuting. Finally, 18.5 percent said they would use the system for non-work trips only.

Figure 3-5 shows a summary of where respondent customers' vehicles are registered and their county of residence. Finally, customers were provided the opportunity to provide an email address if they had a desire to participate in a follow-up survey.

- *Vehicle Registration*. Most of the DTR patrons surveyed, or 83.3 percent, have vehicles registered in Virginia. 9.5 percent are registered in Maryland and 2.9 percent are registered in the District of Columbia with the remaining vehicles registered outside the D.C. Area.
- *County of Residence*. Nearly half of the DTR patrons surveyed (45.3 percent) live in the Fairfax County, 27.3 percent came from Loudoun County and 6.3 percent from Arlington County in Virginia. Around 5.2 percent of the respondents live in Montgomery County in Maryland and 3.5 percent are residents of Washington D.C.
- *Future Studies*. 88.1 percent of the respondents agreed to provide contact information and showed willingness to participate in future surveys.

Patterns of Surveyed Trips

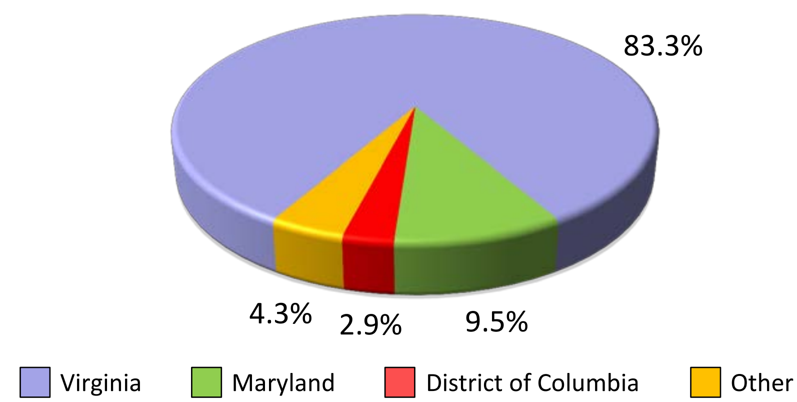
This section presents the results of the travel patterns, as obtained from the survey, by displaying them as origins and destinations at the zonal level.

The morning peak pattern for the surveyed trip origins and destinations in the eastbound direction is shown as a dot-density map in Figure 3-6. A dot-density map places a uniformly sized dot that represents a fixed number of trips at a location within the zone where the trip originates or terminates. When viewed as shading, the map shows heavier shading where the density of trips is heaviest.

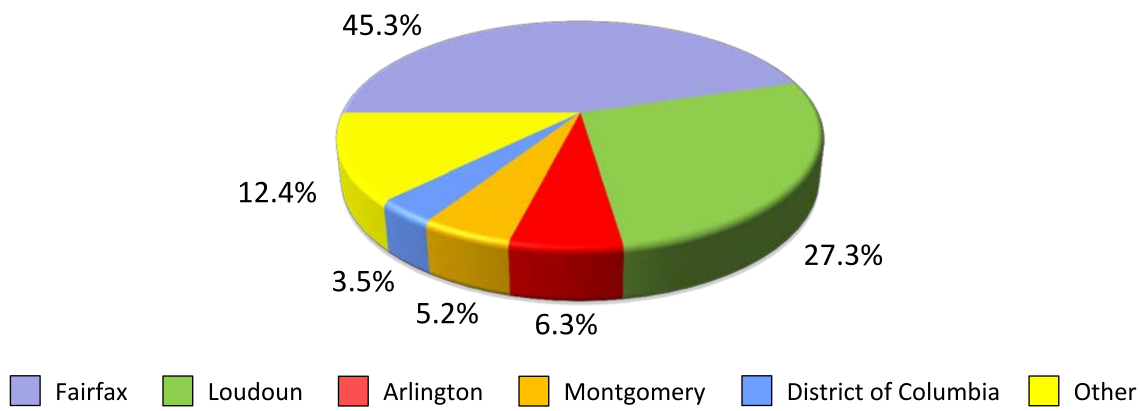
In the morning peak period, travel on the DTR facility is dominated by commuters leaving from home to work. For that reason, the pattern of origins would be dominated by home locations and the pattern of destinations would be dominated by work site locations. Figure 3-6 shows origins, which are predominantly residential, scattered throughout Western Fairfax County and Loudoun County. Further, it shows a very dense set of trip destinations in Tysons Corner, downtown DC, the I-66 Corridor in Arlington, and some concentration around Reston and Herndon. These all represent major employment centers for DTR patrons at work sites where DTR patrons will end their trips in the morning peak.

Table 3-3 shows the percentage of DTR customers intercepted at ramp plazas that also passed through the Main Line plaza based on data collected for the hand-out and mail-out surveys. The data indicates that, in general, the amount of through traffic (longer-distance traffic through the Main Line) reduces with distance from the Main Line toll plaza. An exception can be seen at Route 28 (Sully Road) where traffic avoiding the Greenway mainline toll can access the lower ramp toll on the DTR. Main Line plaza customers that pay by cash (hand-out) are seen to be more prevalent at exits closer to the Main Line, but again Route 28 is an exception.

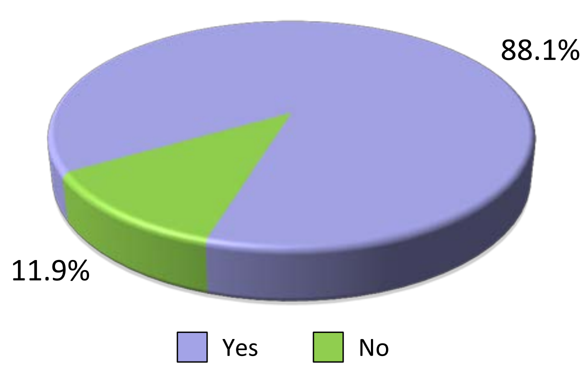
State of Vehicle Registration



County Residence



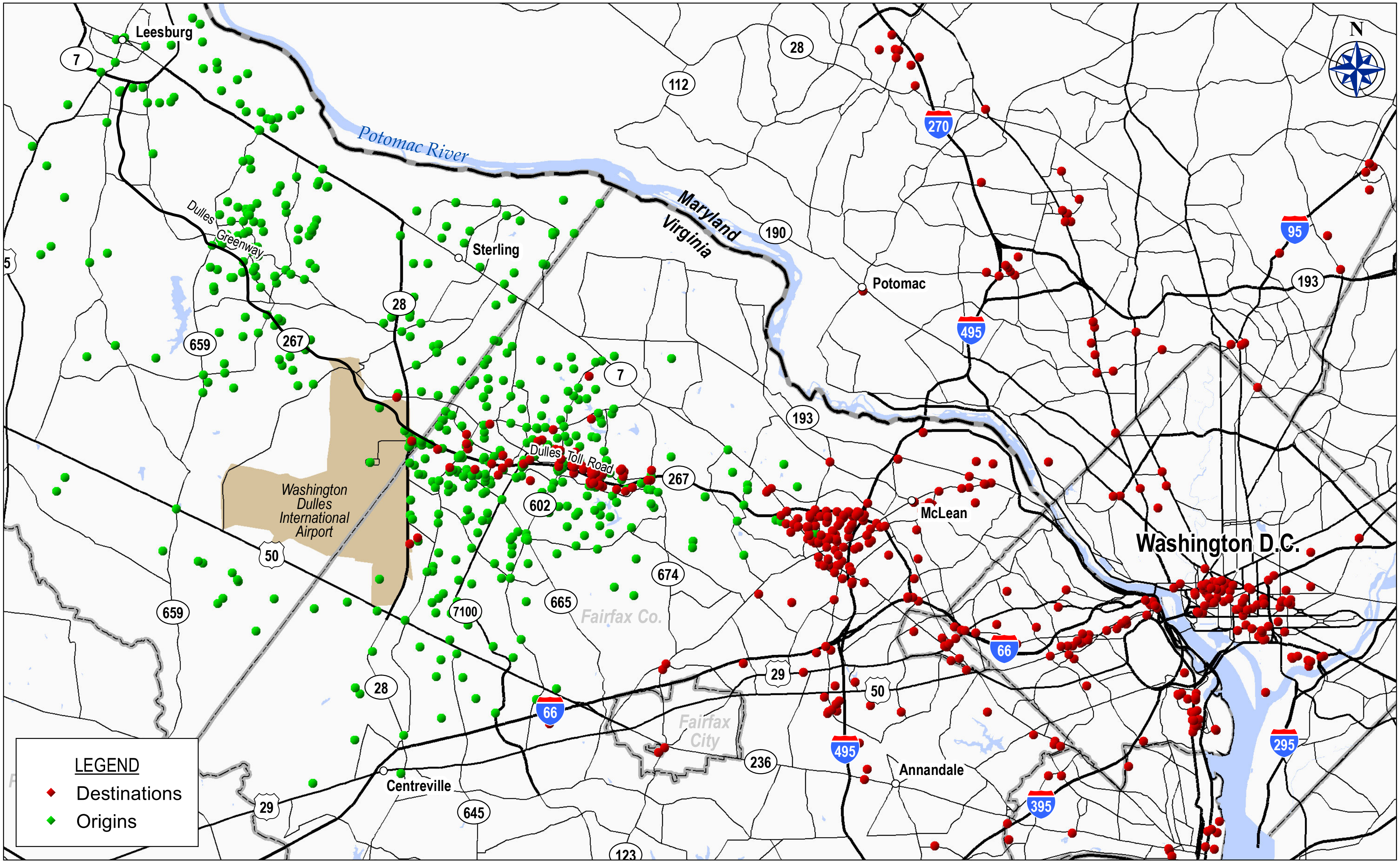
Participate In Future Studies



Note: Sample from 2011 DTR O/D Survey

O-D SURVEY RESPONDENTS CHARACTERISTICS

FIGURE 3-5



DTR O-D SURVEY - AM EASTBOUND TRIPS

FIGURE 3-6

Table 3-3
DTR Through Traffic by Ramp Plaza

	Recruitment Method [1]			
Ramp	**On-site Handout[2]**	**Email Handout[3]**	**Email EZ-Pass[4]**	**Total**
Dulles Greenway	7.1%	13.4%	8.6%	11.1%
Sully Rd	25.0%	22.4%	21.7%	22.2%
Centreville Rd	7.1%	7.7%	18.1%	12.3%
Fairfax County Pkwy	25.0%	18.9%	16.9%	18.3%
Reston Pkwy	25.0%	12.7%	16.9%	15.0%
Wiehle Ave	10.7%	12.2%	10.1%	11.2%
Hunter Mill Rd	0.0%	12.7%	7.7%	10.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**

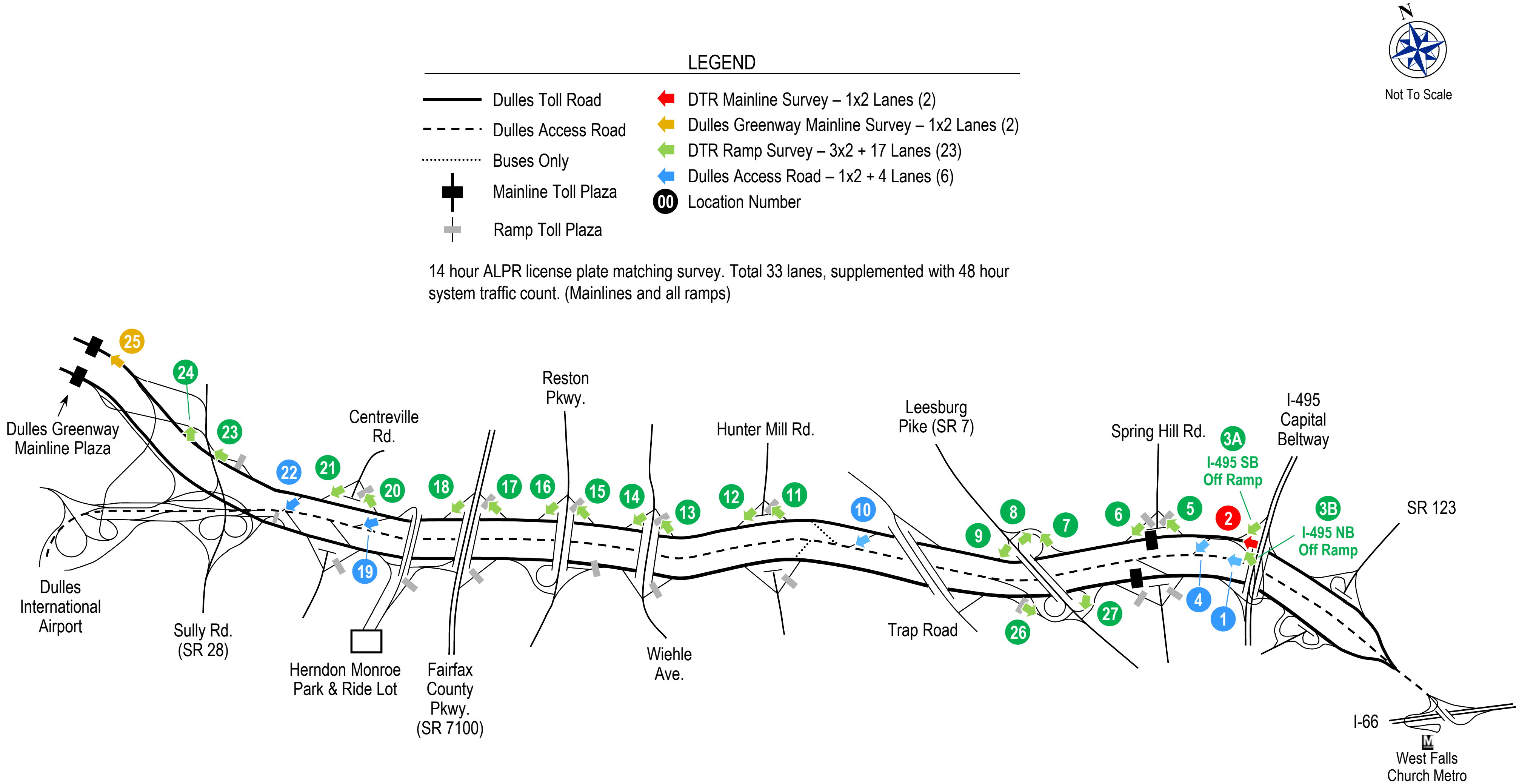
Source: CDM Smith Origin-Destination Survey conducted in Sep-Oct 2011.
[1] Method of recruitment for DTR customers.
[2] CDM Smith recruited MCV Inc. staff for card distribution to cash customers on Sep 29 2011.
[3] RSG distributed an email invite to email IDs received from 2007 survey cash customers.
[4] RSG distributed an email invite to email IDs received from 2007 survey EZ-Pass customers.

Entry/Exit Pattern Surveys

The second type of detailed survey that was conducted by CDM Smith for this study was an Entry/Exit survey to better understand users' specific point-to-point usage of the DTR. This survey was conducted for a 14-hour period using an Automatic License Plate Recognition (ALPR) survey. The survey captured trips made on DTR by matching vehicle's entry and exit points on the DTR. As a result of this survey, a matrix was developed for all entry/exit pairs along the corridor in the given direction. This is very useful information used to further refine the accuracy of trip patterns in the corridor.

Entry/Exit Survey Arrangements

The field work for the Entry/Exit survey was performed by MCV Associates Inc. (MCV). The survey was conducted to capture every entry and exit to the DTR including any to/from the Airport Access Road in the westbound direction. To capture vehicles getting off from Route 7 ramps in the eastbound direction in order to avoid the Main Line plaza, a couple of cameras were placed on this interchange as well. In total, CDM Smith identified 27 locations along the DTR for the license plate survey. Figure 3-7 shows the location map on a DTR schematic where cameras were placed by MCV. As mentioned above, almost all of the locations were in the westbound direction starting from the onramps from the Capital Beltway and Main Line portions of the DTR and the Airport Access Road, and ending near the Greenway mainline plaza. All the on-ramps and off-ramps included in this stretch along with slip ramps from the DTR to the Airport Access Road were included in the survey.



2011 DTR ENTRY/EXIT SURVEY LOCATIONS MAP

FIGURE 3-7

The license plate survey was conducted between the hours of 6:00 am to 8:00 pm (daylight hours) on a Tuesday, June 14 2011. MCV collected the data from these units and performed the cleaning and matching process to come up with matrices showing trips between entry/exit pairs by each time period of the day consistent with model time periods. This data was then used by CDM Smith to calibrate the travel demand model to better reflect DTR travel patterns. Tables 3-4, 3-5 and 3-6 present the surveyed entry/exit patterns of morning peak, mid-day and afternoon peak time periods respectively.

The entry/exit survey was critical in determining a typical weekday traffic profile for the DTR for the 2011 base year. This observed data, along with the origin-destination information, was critical in accurately validating the base year model.

Table 3-4
Entry/exit Survey Pattern - Morning Peak Period Westbound
(6:00am to 9:00am)

Location	1	2	3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
2	-	-	-	-	100	338	-	220	-	-	-	324	-	509	-	797	-	487	-	2	1,076	-	3	461	272	167	**4,756**
3A	-	-	-	-	626	323	-	142	-	-	7	258	-	462	-	683	-	217	-	4	378	-	3	654	479	122	**4,358**
3B	-	-	-	-	302	103	-	158	-	-	-	162	-	275	-	351	-	238	-	3	416	-	1	379	60	96	**2,544**
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
6	-	-	-	-	-	-	-	4	-	-	11	38	-	43	-	71	-	46	-	-	80	-	1	26	68	13	**401**
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
8	-	-	-	-	-	-	-	-	-	-	67	140	-	212	-	101	-	125	-	18	218	-	14	160	127	49	**1,231**
9	-	-	-	-	-	-	-	-	-	-	5	13	-	6	-	24	-	8	-	-	-	-	2	14	40	-	**112**
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
12	-	-	-	-	-	-	-	-	-	-	-	-	-	9	-	99	-	111	-	61	193	-	17	138	134	70	**832**
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	27	-	69	-	27	121	-	15	153	176	57	**645**
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	21	-	135	37	-	26	311	258	88	**876**
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	235	7	-	42	261	372	142	**1,059**
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	273	203	29	55	**560**
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Total	**-**	**-**	**-**	**-**	**1,028**	**764**	**-**	**524**	**-**	**-**	**90**	**935**	**-**	**1,516**	**-**	**2,153**	**-**	**1,322**	**-**	**485**	**2,526**	**-**	**397**	**2,760**	**2,015**	**859**	**17,374**

Location	1	2	3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
2	-	-	-	-	2.1%	7.1%	-	4.6%	-	-	-	6.8%	-	10.7%	-	16.8%	-	10.2%	-	0.0%	22.6%	-	0.1%	9.7%	5.7%	3.5%	**100.0%**
3A	-	-	-	-	14.4%	7.4%	-	3.3%	-	-	0.2%	5.9%	-	10.6%	-	15.7%	-	5.0%	-	0.1%	8.7%	-	0.1%	15.0%	11.0%	2.8%	**100.0%**
3B	-	-	-	-	11.9%	4.0%	-	6.2%	-	-	-	6.4%	-	10.8%	-	13.8%	-	9.4%	-	0.1%	16.4%	-	0.0%	14.9%	2.4%	3.8%	**100.0%**
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
6	-	-	-	-	-	-	-	1.0%	-	-	2.7%	9.5%	-	10.7%	-	17.7%	-	11.5%	-	-	20.0%	-	0.2%	6.5%	17.0%	3.2%	**100.0%**
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
8	-	-	-	-	-	-	-	-	-	-	5.4%	11.4%	-	17.2%	-	8.2%	-	10.2%	-	1.5%	17.7%	-	1.1%	13.0%	10.3%	4.0%	**100.0%**
9	-	-	-	-	-	-	-	-	-	-	4.5%	11.6%	-	5.4%	-	21.4%	-	7.1%	-	-	-	-	1.8%	12.5%	35.7%	-	**100.0%**
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
12	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1%	-	11.9%	-	13.3%	-	7.3%	23.2%	-	2.0%	16.6%	16.1%	8.4%	**100.0%**
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2%	-	10.7%	-	4.2%	18.8%	-	2.3%	23.7%	27.3%	8.8%	**100.0%**
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.4%	-	15.4%	4.2%	-	3.0%	35.5%	29.5%	10.0%	**100.0%**
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.2%	0.7%	-	4.0%	24.6%	35.1%	13.4%	**100.0%**
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	48.8%	36.3%	5.2%	9.8%	**100.0%**
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**

Source: Extry/exit survey performed by MCV Associates Inc. on June 14, 2011.

Table 3-5
Entry/exit Survey Pattern - Midday Peak Period Westbound
(9:00am to 3:00pm)

Location	1	2	3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
2	-	-	-	-	350	683	-	723	-	-	3	577	-	694	-	1,305	-	854	-	23	993	-	24	991	375	735	**8,330**
3A	-	-	-	-	1,616	388	-	502	-	-	35	370	-	483	-	974	-	488	-	16	836	-	26	861	454	551	**7,600**
3B	-	-	-	-	943	289	-	492	-	-	6	224	-	345	-	508	-	350	-	16	590	-	12	602	104	541	**5,022**
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
6	-	-	-	-	-	-	-	69	-	-	57	183	-	172	-	282	-	188	-	10	258	-	4	183	149	145	**1,700**
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
8	-	-	-	-	-	-	-	-	-	-	163	205	-	273	-	504	-	277	-	36	663	-	22	412	275	343	**3,173**
9	-	-	-	-	-	-	-	-	-	-	10	21	-	15	-	31	-	28	-	3	28	-	1	22	46	18	**223**
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
12	-	-	-	-	-	-	-	-	-	-	-	-	-	36	-	205	-	165	-	1	208	-	17	302	176	223	**1,333**
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	81	-	150	-	85	292	-	19	387	332	246	**1,592**
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63	-	174	413	-	40	557	362	371	**1,980**
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	317	270	-	51	573	490	602	**2,303**
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	582	426	127	298	**1,433**
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Total	**-**	**-**	**-**	**-**	**2,909**	**1,360**	**-**	**1,786**	**-**	**-**	**274**	**1,580**	**-**	**2,018**	**-**	**3,890**	**-**	**2,563**	**-**	**681**	**4,551**	**-**	**798**	**5,316**	**2,890**	**4,073**	**34,689**

Location	1	2	3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
2	-	-	-	-	4.2%	8.2%	-	8.7%	-	-	0.0%	6.9%	-	8.3%	-	15.7%	-	10.3%	-	0.3%	11.9%	-	0.3%	11.9%	4.5%	8.8%	**100.0%**
3A	-	-	-	-	21.3%	5.1%	-	6.6%	-	-	0.5%	4.9%	-	6.4%	-	12.8%	-	6.4%	-	0.2%	11.0%	-	0.3%	11.3%	6.0%	7.3%	**100.0%**
3B	-	-	-	-	18.8%	5.8%	-	9.8%	-	-	0.1%	4.5%	-	6.9%	-	10.1%	-	7.0%	-	0.3%	11.7%	-	0.2%	12.0%	2.1%	10.8%	**100.0%**
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
6	-	-	-	-	-	-	-	4.1%	-	-	3.4%	10.8%	-	10.1%	-	16.6%	-	11.1%	-	0.6%	15.2%	-	0.2%	10.8%	8.8%	8.5%	**100.0%**
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
8	-	-	-	-	-	-	-	-	-	-	5.1%	6.5%	-	8.6%	-	15.9%	-	8.7%	-	1.1%	20.9%	-	0.7%	13.0%	8.7%	10.8%	**100.0%**
9	-	-	-	-	-	-	-	-	-	-	4.5%	9.4%	-	6.7%	-	13.9%	-	12.6%	-	1.3%	12.6%	-	0.4%	9.9%	20.6%	8.1%	**100.0%**
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
12	-	-	-	-	-	-	-	-	-	-	-	-	-	2.7%	-	15.4%	-	12.4%	-	0.1%	15.6%	-	1.3%	22.7%	13.2%	16.7%	**100.0%**
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1%	-	9.4%	-	5.3%	18.3%	-	1.2%	24.3%	20.9%	15.5%	**100.0%**
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2%	-	8.8%	20.9%	-	2.0%	28.1%	18.3%	18.7%	**100.0%**
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.8%	11.7%	-	2.2%	24.9%	21.3%	26.1%	**100.0%**
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40.6%	29.7%	8.9%	20.8%	**100.0%**
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**

Source: Extry/exit survey performed by MCV Associates Inc. on June 14, 2011.

Table 3-6
Entry/exit Survey Pattern - Evening Peak Period Westbound
(3:00pm to 8:00pm)

Location	1	2	3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
2	-	-	-	-	557	384	-	933	-	-	3	688	-	732	-	1,092	-	1,421	-	12	937	-	5	846	440	622	**8,672**
3A	-	-	-	-	1,900	315	-	578	-	-	24	555	-	662	-	1,193	-	1,250	-	13	881	-	15	875	610	749	**9,620**
3B	-	-	-	-	1,169	362	-	741	-	-	8	339	-	450	-	593	-	707	-	8	630	-	6	696	148	585	**6,442**
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
6	-	-	-	-	-	-	-	267	-	-	108	428	-	417	-	721	-	654	-	10	515	-	-	492	468	381	**4,461**
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
8	-	-	-	-	-	-	-	-	-	-	302	452	-	519	-	808	-	911	-	55	1,013	-	26	751	647	551	**6,035**
9	-	-	-	-	-	-	-	-	-	-	14	43	-	43	-	183	-	62	-	1	29	-	1	44	29	21	**470**
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
12	-	-	-	-	-	-	-	-	-	-	-	-	-	56	-	158	-	200	-	122	214	-	13	303	176	245	**1,487**
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	215	-	89	333	-	16	607	747	526	**2,533**
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	81	-	238	407	-	42	758	800	852	**3,178**
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	298	245	-	51	655	817	1,147	**3,213**
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	88	691	307	1,117	**2,203**
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
Total	**-**	**-**	**-**	**-**	**3,626**	**1,061**	**-**	**2,519**	**-**	**-**	**459**	**2,505**	**-**	**2,879**	**-**	**4,748**	**-**	**5,501**	**-**	**846**	**5,204**	**-**	**263**	**6,718**	**5,189**	**6,796**	**48,314**

Location	1	2	3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Total
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
2	-	-	-	-	6.4%	4.4%	-	10.8%	-	-	0.0%	7.9%	-	8.4%	-	12.6%	-	16.4%	-	0.1%	10.8%	-	0.1%	9.8%	5.1%	7.2%	**100.0%**
3A	-	-	-	-	19.8%	3.3%	-	6.0%	-	-	0.2%	5.8%	-	6.9%	-	12.4%	-	13.0%	-	0.1%	9.2%	-	0.2%	9.1%	6.3%	7.8%	**100.0%**
3B	-	-	-	-	18.1%	5.6%	-	11.5%	-	-	0.1%	5.3%	-	7.0%	-	9.2%	-	11.0%	-	0.1%	9.8%	-	0.1%	10.8%	2.3%	9.1%	**100.0%**
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
6	-	-	-	-	-	-	-	6.0%	-	-	2.4%	9.6%	-	9.3%	-	16.2%	-	14.7%	-	0.2%	11.5%	-	-	11.0%	10.5%	8.5%	**100.0%**
7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
8	-	-	-	-	-	-	-	-	-	-	5.0%	7.5%	-	8.6%	-	13.4%	-	15.1%	-	0.9%	16.8%	-	0.4%	12.4%	10.7%	9.1%	**100.0%**
9	-	-	-	-	-	-	-	-	-	-	3.0%	9.1%	-	9.1%	-	38.9%	-	13.2%	-	0.2%	6.2%	-	0.2%	9.4%	6.2%	4.5%	**100.0%**
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
12	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8%	-	10.6%	-	13.4%	-	8.2%	14.4%	-	0.9%	20.4%	11.8%	16.5%	**100.0%**
13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.5%	-	3.5%	13.1%	-	0.6%	24.0%	29.5%	20.8%	**100.0%**
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5%	-	7.5%	12.8%	-	1.3%	23.9%	25.2%	26.8%	**100.0%**
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9.3%	7.6%	-	1.6%	20.4%	25.4%	35.7%	**100.0%**
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.0%	31.4%	13.9%	50.7%	**100.0%**
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**

Source: Extry/exit survey performed by MCV Associates Inc. on June 14, 2011.

Stated Preference Surveys

One of the many inputs required for understanding traveler behavior and thereby developing revenue estimates for a toll facility is the drivers' value of time.

Within the modeling process, travel times are estimated on competing non-tolled facilities and compared with the travel time on the tolled facility for various travel movements (origin-destination pairs). The portion of the corridor travel demand comprising motorists willing to pay for the calculated time savings is then allocated to the toll facility. From this, traffic and toll revenue estimates are calculated for the DTR. These estimates of traffic are produced within an iterative equilibrium assignment process, to incorporate the effects of congestion on traveler route choice.

Critical to this process is the ability to estimate the amount of money that members of the travel demand cohort would be willing to pay for a given amount of time savings. This "value of time" may be derived from the analysis of Stated Preference (SP) surveys.

SP surveys were last conducted within the DTR corridor in 2008 prior to any recent toll increases. The timing of this survey was ideal since respondents were less likely at that time to attempt to bias their responses in an attempt to influence the toll setting process. Although the analysis is now nearing the end of its shelf life, the values of time derived from it have been very successful as a key determinate of the toll impacts in prior CDM Smith forecasts; traffic and revenue estimates continue to predict very precisely the impact of the toll adjustments in 2010, 2011, 2012, and 2013. For completeness of reporting the SP analysis is repeated in this report. This section summarizes the process while full details of the SP survey and analysis is contained in Appendix B.

SP Survey Administration Plan

For the present study, a survey panel was created from respondents of the O/D surveys. These respondents had voluntarily provided their email addresses when completing the O/D survey. They were then sent an email invitation to participate in an on-line SP survey. The initial email invitations were sent on February 28, 2008. A second email invitation was sent on March 21, 2008.

From all the surveys that were returned, 659 email addresses were obtained from the hand-out surveys and 3,706 email addresses were obtained from the mail-out surveys. Therefore the on-line SP survey panel began with a base of 4,365 participants.

The initial email invitations sent on February 28, 2008, went to approximately 8 percent of the panel (52 hand-out respondents and 298 mail-out respondents). This group represented a test group for the on-line data recording and processing procedures. As there were no problems with the process and no changes to the on-line survey were required, the responses from the test group were saved and merged with the responses from the main group.

The main group (607 hand-out respondents and 3,408 mail-out respondents) were invited on March 21, 2008, to participate in the on-line survey. Four email addresses were invalid, thus the total number of SP survey invitations sent was 4,361 (658 hand-out respondents and 3,703 mail-out respondents).

By March 31, 2008, enough responses were received to properly model the respondents' preferences. The on-line survey was closed on that day. The number of SP survey responses was 1,067 for a response rate of 24.5 percent.

SP Survey Questionnaire

The SP survey was comprised of four main sections:

- *Trip* Information;
- *Travel Choice SP Survey;*
- *Driving Conditions SP Survey; and*
- *Demographic Information.*

These sections are discussed in greater detail in the following sections.

Trip Information

Details concerning respondents' trips were gathered for two purposes. First, this information was used to evaluate the possibility of bias in the survey sample, by comparing such attributes as trip end-points, departure time, and purpose with data from other sources such as traffic counts, origin-destination surveys, and prior studies. Trip information data also was used as an integral part of the survey's design and logic: parameters of questions in subsequent sections of the survey were varied based on the responses to these questions, to ensure a realistic frame of reference for hypothetical travel options.

General trip information collected was:

- Trip origin and destination;
- 5-digit zip code of the origin and destination;
- Direction of travel on the DTR;
- Type of vehicle;
- DTR entry interchange and exit interchange;
- Day of trip;
- Trip purpose;
- Trip frequency;
- Start time of trip;
- Trip length (time) of trip and time spent on the DTR;
- Estimated trip length (time) if alternate route is used;

- Vehicle occupancy;
- HOV use and E-ZPass use;
- Transfer price (i.e. at what toll rate would someone not use the DTR); and
- Transfer time (i.e. at what time delay would someone not use the DTR).

Figure 3-8 shows the breakdown of origins, destinations, and direction of travel of the respondents to the SP survey. Nearly one-half of the respondents, 47.8 percent, began their trip in Fairfax County. The next most popular trip origin was Loudoun County (26.0 percent). Origins that were noted other than those offered in the survey choices included: Clark County, Falls Church, Fauquier County, Fredrick County, Fredericksburg, Manassas, Prince William County, Purceville, and Winchester in Virginia.

Fairfax County was reported as the destination for 50.8 percent of the respondents. Loudoun County was the second most reported destination (16.7 percent) with Washington DC close behind (11.4 percent).

The direction of travel for the respondents was distributed as 58.3 percent were traveling eastbound and 40.5 percent were traveling westbound. It is normal for respondents to traffic surveys to think of their last home based journey to work or elsewhere when asked about their last trip.

Figure 3-9 shows the trip purpose, trip frequency, and vehicle occupancy of the SP survey respondents. A majority of respondents (71.5 percent) reported that the purpose of the trip was to commute to and from work. Another 9.6 percent reported that the trip was work related.

As expected, because of the large number of commuting trips and work related trips, the trip frequencies were very high. Slightly over two thirds (66.8 percent) of the respondents said they use the DTR for this trip purpose four or more times per week.

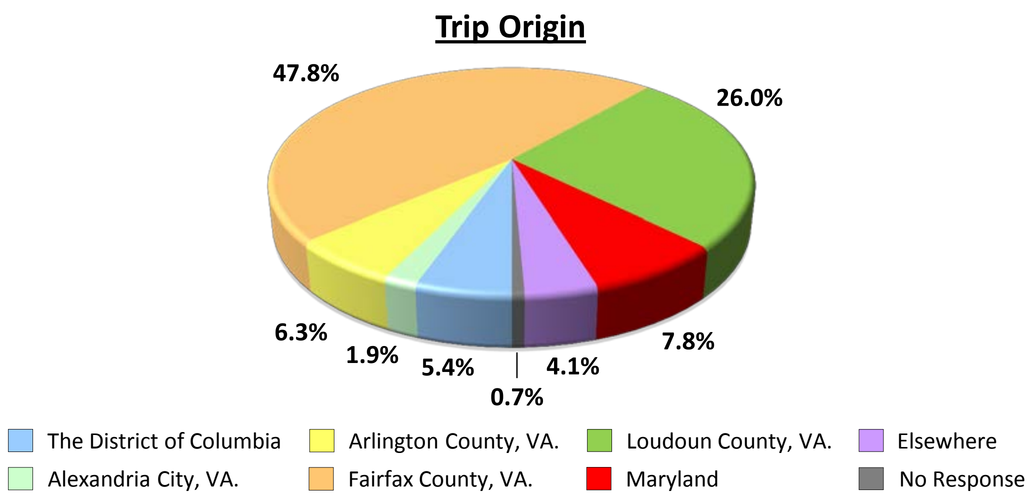
Details of the background questions and responses can be found in Appendix B.

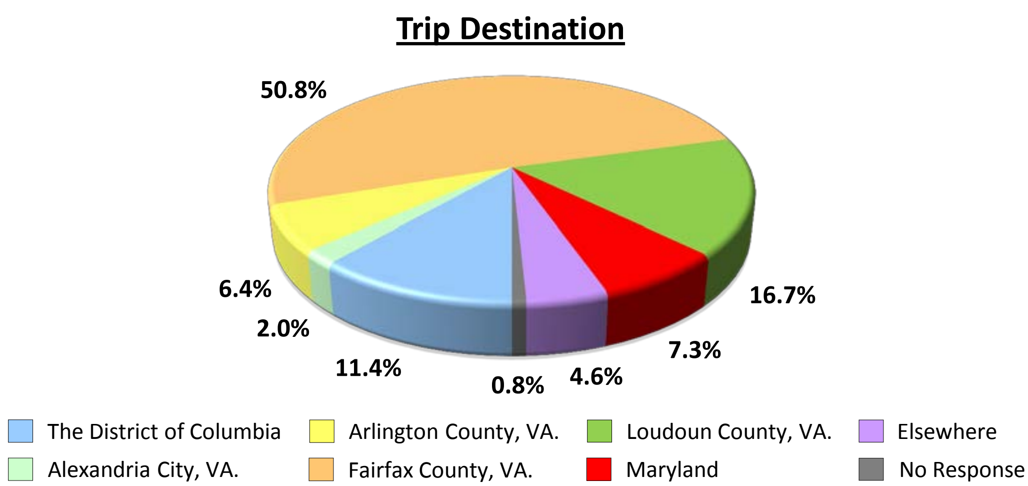
Travel Choice SP Survey

All respondents (regardless of payment mode) completed a series of choice experiments in which they were presented with alternative travel options for the trip they had described earlier in the survey. Depending on the length of time (four different time groups) of the respondent's trip, each respondent within the specific group was presented with a random set of nine scenarios which came from a base of sixty-four scenarios developed for each group.

Trip characteristics varied to produce these scenarios. Not all respondents were presented with all of the following (see details below):

- Fuel cost per gallon;
- General purpose (GP) lane travel time;
- HOV lane travel time;



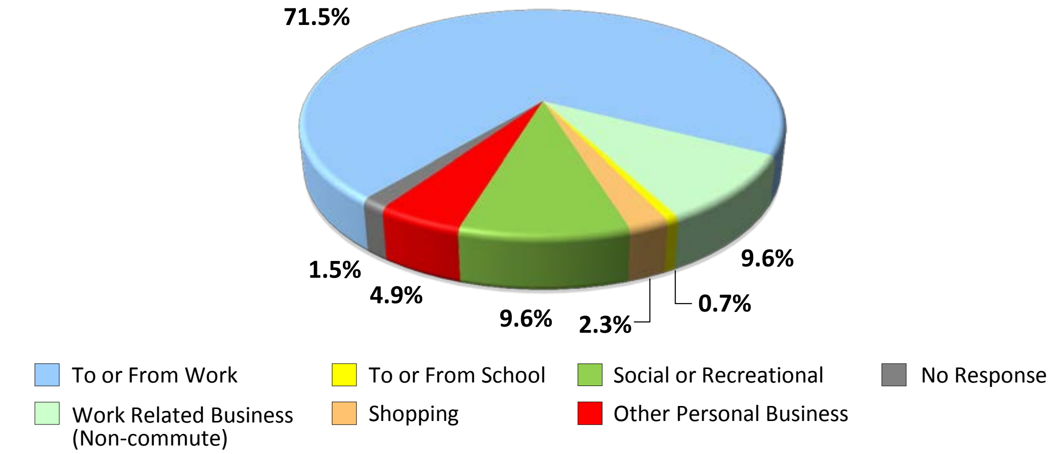


Note: Sample from SP Survey

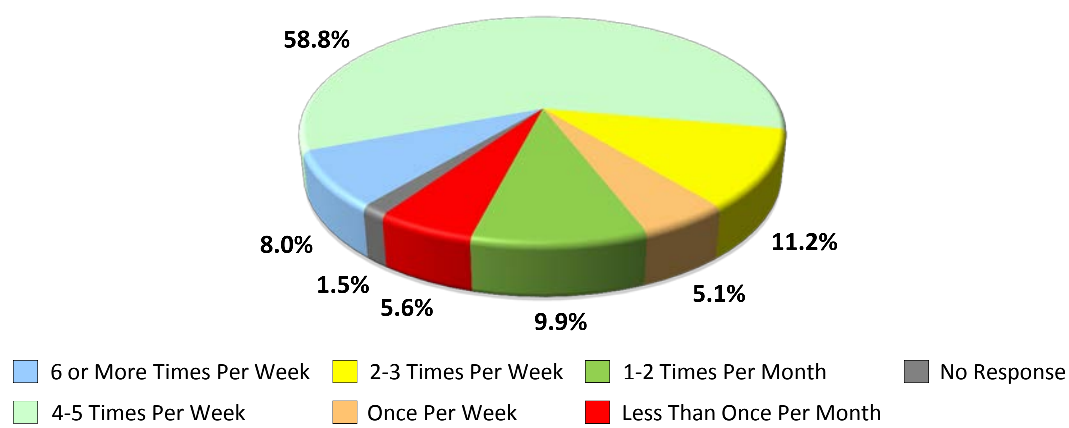
SP SURVEY ORIGINS AND DESTINATIONS

FIGURE 3-8

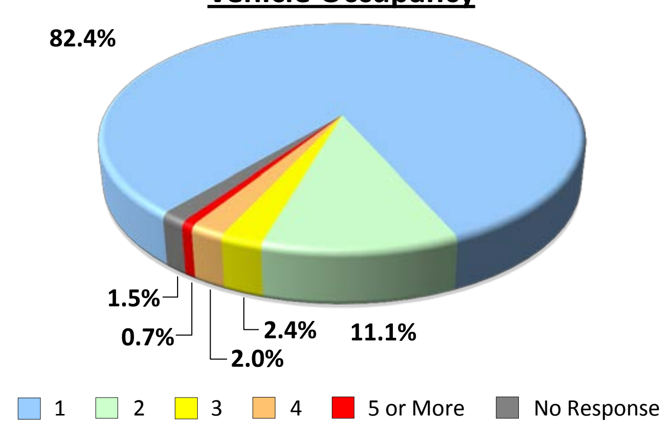
Trip Purpose



Trip Frequency



Vehicle Occupancy



Note: Sample from SP Survey

SP SURVEY TRIP INFORMATION

FIGURE 3-9

- HOV lane toll cost;
- New toll road travel time;
- New toll road toll cost;
- Time-displaced trip travel time;
- Time-displaced trip toll cost;
- Trip departure time displacement;
- Toll-free route travel time;
- Metrorail total travel time;
- Metrorail, on-board travel time;
- Metrorail, travel time to and from the station;
- Metrorail fare; and
- Metrorail train frequency.

For respondents who used the DTR during the AM or PM peak periods, their scenarios contained all six of the following alternatives. Off-peak period patrons (weekday off-peak periods and weekends) were presented with four of the following alternatives. Off-peak travelers were presented four alternative choices and peak travelers were presented six alternative choices. Sample screenshots are shown in the appendix.

1. *DTR, Same Time as Current Trip* – always shown.
2. *DTR, HOV Lane* – shown only to travelers who travelled during the AM or PM peak periods.
3. *New Toll Road* – always shown, although there is no implication that a new toll road would be constructed, oftentimes a respondent reacts positively to the thought of a new toll road versus upgrades to an existing roadway.
4. *DTR, Off-Peak Trip* – shown only for trips taking place during the AM or PM peak periods.
5. *Non-Tolled Road* – always shown.
6. *Metrorail Service* – always shown.

Driving Conditions SP Survey

In this section, respondents were asked to choose between two roadways. One would have a mix to two different driving conditions, e.g. free-flowing traffic for a portion of the trip and stop-and-go traffic for another portion of the trip, while the other roadway would be consistent in its driving condition, e.g. light congestion. Sample screenshot presented to respondents are shown in the appendix.

Eight sets of scenarios were created with the variables between the sets being distance of trip and driving conditions on each roadway. Each set contained nine scenarios where the only variables were the amounts of time which the respondent would spend under a particular driving condition. The appendix contains detailed analyses of the results of both the Travel Choice SP Survey and the Driving Conditions SP Survey portions of the on-line survey.

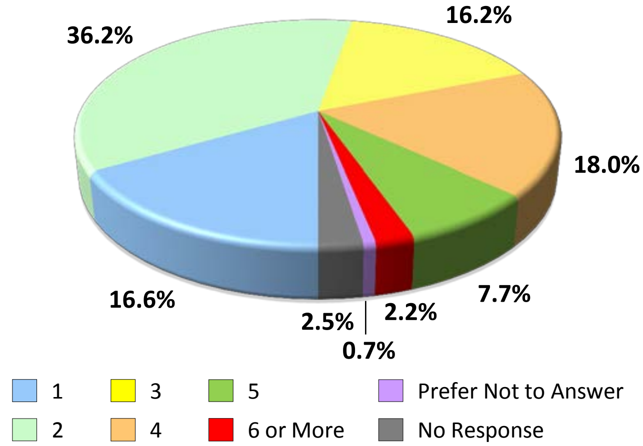
Demographic Information

Finally, several general demographic questions were asked so that demographic variables could be included during model estimation and to assist the application of the model to different population segments. The demographic questions included household size, number of vehicles, age, employment status, and annual household income.

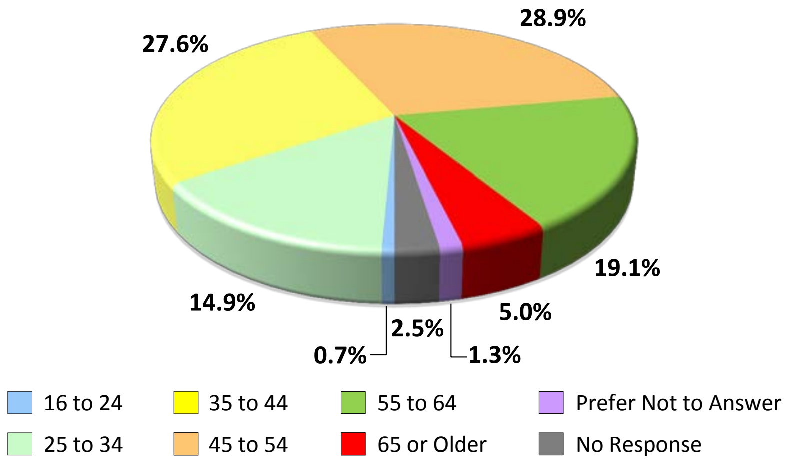
Figure 3-10 shows the results to the questions regarding the size of the respondent's household, the respondent's age, and the annual household gross income. A majority of the respondents either live alone (16.6 percent) or live in a 2-person household (36.2 percent). The largest age groups represented by the respondents are 45 to 54 (28.9 percent) and 35 to 44 (27.6 percent). Keeping these two facts in mind, it should come as no surprise that more than half of the respondents had an annual household income of over $100,000.

More details regarding all the demographic questions can be found in Appendix B.

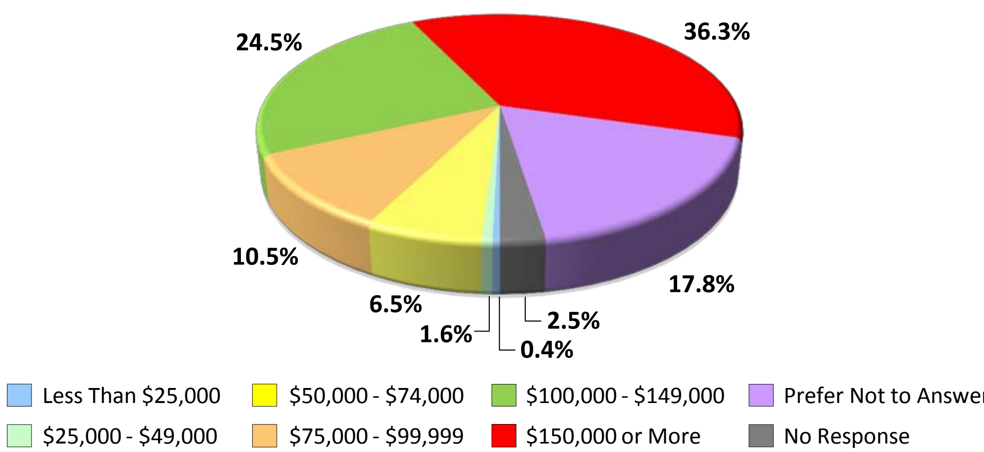
Household Size



Age



Annual Household Gross Income



Note: Sample from SP Survey

SP SURVEY DEMOGRAPHIC INFORMATION

FIGURE 3-10

Chapter 4

Corridor Growth Assessment

Regional growth of population, households, and employment forecasts are all key inputs for the trip generation step in building travel demand model trip tables. These trip tables are the foundation of the travel demand model in key forecasting years and therefore significant resources were devoted to reviewing the underlying demographic assumptions.

The regional socioeconomic forecasts used in the travel demand modeling process were prepared for the Washington D.C. metropolitan area and for the Dulles Corridor in detail. The Metropolitan Washington Council of Governments, known as MWCOG, was established in 1957 as an independent non-profit association to help develop regional solutions to such issues as the transportation, the environment, affordable housing, growth and development, public health, child welfare, public safety, and homeland security.

MWCOG's Cooperative Forecasting Program, established in 1975, is a joint effort with the federal and local governments of the region to produce a consistent set of long-range economic and demographic forecasts for use in metropolitan and local planning programs. The process provides common assumptions about future growth and development in the region and results in forecasts of employment, households and population by five-year increments for the entire MWCOG region, individual member jurisdictions, and small-area traffic zones within each jurisdiction. The latest MWCOG regional zone system is comprised of a total of 3,722 geographic areas (Traffic Analysis Zones or "TAZs") in the Washington region. The current socioeconomic cooperative forecasts prepared for the 3,722 TAZ system is referred to as 'Round 8.2 Cooperative Forecasting', July 2013.

As part of this study, an independent firm, Renaissance Planning Group (RPG) was retained to conduct an independent analysis of the validity of the Round 8.2 socioeconomic data that is used in conjunction with the latest version of the MWCOG regional model. A separate report has been prepared by them and is included in Appendix C of this report.

This chapter of the report begins by describing historical socio-economic trends in the region. For purposes of that discussion, data from Woods & Poole Economics, Inc. and the Bureau of Labor Statistics is generally used. This data is provided for context only and is not an input to the refined CDM Smith model. The remainder of the chapter provides a summary of long-term demographic and economic forecasts from a variety of sources and as well as RPG's findings and adjusted socio-economic forecast for the Washington D.C. metropolitan area and Dulles Corridor, which is used as an input to the CDM Smith model.

Historical Population Growth by Jurisdiction

Table 4-1 shows the historical population trends for major jurisdictions in the Washington D.C. metropolitan area. The total population of these jurisdictions has observed a steady annual growth rate of 1.3 percent from 1970 to 2010, adding over 2.0 million additional residents.

Table 4-1
Historical Population Growth by Jurisdiction
(thousands)

County	1970	CAGR	1980	CAGR	1990	CAGR	2000	CAGR	2008	CAGR	2010	CAGR	2011	1970-2011 CAGR
District of Columbia	755.4	-1.7%	637.2	-0.5%	605.3	-0.6%	572.1	0.2%	580.2	2.1%	604.9	2.2%	618.0	-0.5%
Fairfax County, VA [1]	489.6	2.6%	631.4	3.0%	851.1	1.7%	1,007.5	0.8%	1,077.5	2.0%	1,121.1	1.3%	1,136.0	2.1%
Arlington County, VA	174.3	-1.3%	153.3	1.1%	171.2	1.0%	189.2	0.5%	196.3	3.3%	209.3	3.2%	216.0	0.5%
Alexandria City, VA	110.8	-0.7%	103.6	0.7%	111.5	1.5%	129.2	0.4%	133.0	2.9%	140.9	2.4%	144.3	0.6%
Prince William County, VA [2]	112.7	4.1%	168.6	4.1%	251.6	2.7%	329.8	3.1%	422.4	4.3%	459.1	3.2%	473.6	3.6%
Loudoun County, VA	37.4	4.4%	57.8	4.2%	87.2	7.1%	173.9	6.7%	292.6	3.8%	315.3	3.2%	325.4	5.4%
Montgomery County, MD	525.1	1.0%	582.0	2.8%	765.5	1.4%	877.5	0.9%	942.8	1.7%	975.4	1.5%	989.8	1.6%
Prince Georges County, MD	666.9	0.0%	665.6	0.9%	725.9	1.0%	803.1	0.7%	850.2	0.9%	865.2	0.7%	871.2	0.7%
Frederick County, MD	85.4	3.1%	115.8	2.7%	151.4	2.6%	196.6	1.9%	229.3	1.1%	234.2	1.1%	236.7	2.5%
Total	**2,957.6**	**0.5%**	**3,115.1**	**1.8%**	**3,720.6**	**1.4%**	**4,278.8**	**1.2%**	**4,724.2**	**2.1%**	**4,925.4**	**1.7%**	**5,011.1**	**1.3%**

Source: Population data from Woods & Poole Economics, Inc. (W&P) CEDDS 2013 publication.

[1] Fairfax County + Fairfax City + Falls Church.

[2] Prince William County + Manassas + Manassas Park.

Between 1970 and 1980, the region's population grew at an annual rate of 0.5 percent, adding about 157,600 residents. Loudoun and Prince William counties grew more rapidly than the region in general, exceeding 4.0 percent. Fairfax County grew at 2.6 percent annually in this period.

Then, between 1980 and 1990, the regional population annual growth rate increased to approximately 1.8 percent with Loudoun, Prince William and Fairfax again experiencing the highest growth rates. Population growth continued through the 1990's with 7.1 percent growth in Loudoun County. In these three decades the District of Columbia's population fell from over three quarters of a million residents to about 570,000.

Between 2000 and 2011 strong population growth has continued despite the recent economic slowdown, particularly in the counties immediately west and north of the District. In absolute terms, Loudoun, Prince William, Fairfax, and Montgomery counties saw the highest population increases adding approximately 152,000, 144,000, 129,000 and 112,000 residents, respectively.

Overall, Loudoun and Prince William counties exhibited comparatively higher growth in the past 40-year period with annual average growth rates of 5.4 percent and 3.6 percent respectively. Fairfax County observed an overall population growth of 2.1 percent on an annual basis becoming the most-populated county in the region during the 1980's.

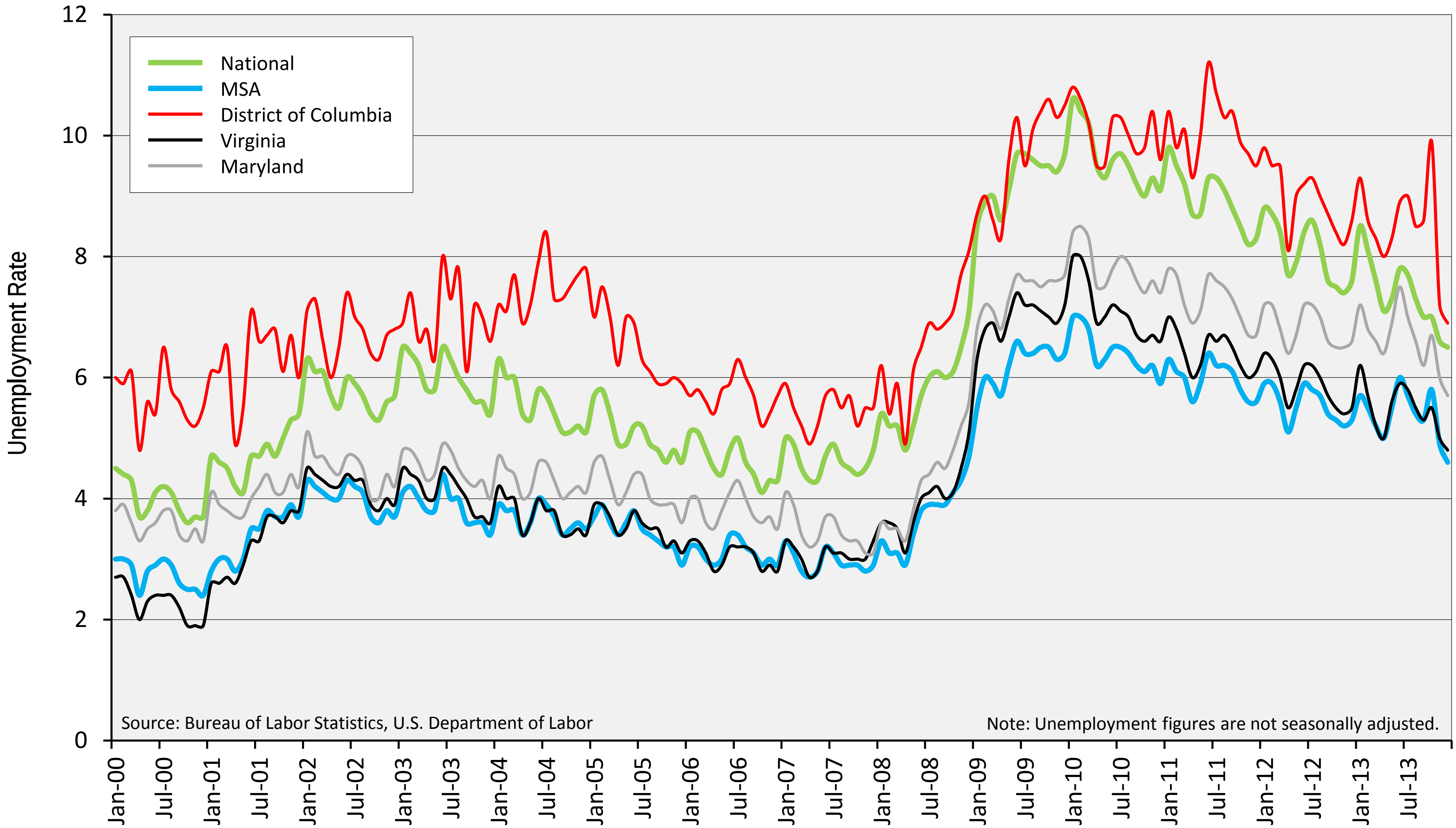
Historical Employment Growth by Jurisdiction

The historical employment trend in the region by county is shown in Table 4-2. Total employment of the nine jurisdictions has increased by more than 2.0 million in the last 40 years shown. This equates to a growth rate of 2.1 percent with a high 3.3 percent in the decade of 1980-1990. Again, the counties of Fairfax, Loudoun, and Prince William maintained high growth rates compared to other counties.

Since 2000, the nine-jurisdiction area gained approximately 433,000 jobs reflecting a growth rate of 1.3 percent. As a result of recent economic conditions, employment levels fell about 0.1 percent between 2008 and 2010. The job market in Prince William, Loudoun and Fairfax counties rebounded successfully through 2011.

Taking a close look at impacts on the Washington D.C. metropolitan region's employment in the recent years, Figure 4-1 below presents the nationwide, statewide, and Washington-Arlington-Alexandria, DC-VA-MD-WV MSA monthly unemployment rates since year 2000. The unemployment rates presented are not seasonally adjusted. It is interesting to note from the general trend that the Washington D.C. metropolitan area has withstood the recent economic slowdown considerably better than the rest of nation as a whole. The unemployment rates of the MSA have generally remained 2.0-4.0 percent lower in the recent years compared to the national average. Washington D.C. however has been equal to or higher than the national average unemployment rate.

As can be noted from Figure 4-1, the Washington D.C. MSA unemployment rate almost mirrored the national unemployment rate pattern from mid-2007 through early-2009. The MSA rebounded earlier than the national employment rate and the gap between the region and the nation increased to as much as 3.7 percent points when the national unemployment rate reached its peak of 10.6 percent in January 2010.



COMPARISON OF UNEMPLOYMENT RATES

FIGURE 4-1

Table 4-2
Historical Employment Growth by Jurisdiction
(thousands)

County	1970	CAGR	1980	CAGR	1990	CAGR	2000	CAGR	2008	CAGR	2010	CAGR	2011	1970-2011 CAGR
District of Columbia	671.8	0.4%	701.1	1.0%	773.2	-0.5%	737.4	1.2%	810.3	0.9%	825.5	0.1%	826.3	0.5%
Fairfax County, VA [1]	148.8	7.4%	303.1	6.3%	556.6	2.9%	741.8	1.6%	845.1	-0.2%	841.9	2.7%	864.3	4.4%
Arlington County, VA	151.2	0.3%	156.4	2.3%	195.4	0.2%	199.8	0.2%	202.7	1.9%	210.5	2.5%	215.8	0.9%
Alexandria City, VA	62.6	2.9%	83.5	2.6%	108.3	0.4%	112.9	1.1%	123.1	-2.0%	118.2	2.7%	121.4	1.6%
Prince William County, VA [2]	34.4	4.9%	55.4	6.4%	103.3	3.1%	140.8	3.5%	185.5	0.6%	187.5	2.7%	192.5	4.3%
Loudoun County, VA	15.8	5.0%	25.8	7.5%	53.1	7.6%	110.6	6.1%	177.3	0.7%	179.7	2.8%	184.7	6.2%
Montgomery County, MD	235.4	4.0%	349.5	3.9%	512.6	1.5%	593.0	1.3%	656.1	-0.6%	647.7	1.2%	655.6	2.5%
Prince Georges County, MD	198.9	2.9%	264.1	3.5%	372.4	0.5%	391.2	1.4%	437.9	-1.6%	424.3	1.3%	429.8	1.9%
Frederick County, MD	33.4	2.8%	44.0	5.1%	72.3	3.7%	103.9	2.9%	130.9	-0.7%	129.2	1.2%	130.7	3.4%
Total	**1,552.3**	**2.5%**	**1,982.8**	**3.3%**	**2,747.3**	**1.3%**	**3,131.2**	**1.6%**	**3,569.0**	**-0.1%**	**3,564.5**	**1.6%**	**3,621.1**	**2.1%**

Source: Employment data from Woods & Poole Economics, Inc. (W&P) CEDDS 2013 publication.
[1] Fairfax County + Fairfax City + Falls Church.
[2] Prince William County + Manassas + Manassas Park.

Since early 2010, the MSA unemployment rate has remained around 6.0 percent with the last quarter of 2011 exhibiting unemployment rates of 5.7, 5.4 and 5.5 percent in the months October through December, respectively. Unemployment rates in Loudoun and Fairfax counties were 3.8 percent and 3.9 percent, respectively, in November 2013.

Table 4-3 shows the historical non-farm employment levels in the Washington D.C. MSA since 2004. Annual average employment has increased by about 222,000 jobs in the Washington D.C. MSA. The Washington D.C. MSA average annual employment rose to 3.0 million in 2008. The MSA lost a total of 50,000 non-farm jobs in 2009 but gained about 123,000 non-farm jobs by the end of year 2013.

Historical Personal Income Growth by Jurisdiction

Travel demand on a toll facility is sensitive to, among other things, the amount of disposable income available in a household. An indicator of an individual's propensity to pay tolls instead of taking a toll-free alternative is his/her personal income. This income is a key input into the assessment of the value of time for a motorist as there is typically a relationship between value of time, income and the motorists' willingness to pay.

The historical regional per capita income trend by county is shown in Table 4-4. As can be noted from the table, the growth in personal per capita income has increased significantly in the last few decades with overall growth in the range of 3.5 percent. Fairfax County, Loudoun County and Prince William County have experienced some of the highest growth in personal income among the jurisdictions listed in Table 4-4.

Long Term Regional Socioeconomic Forecasts

Previous sections of this report discussed population and employment historic growth trends at the county and the regional level for the Washington D.C. metropolitan area undertaken by MWCOG. CDM Smith retained Renaissance Planning Group to conduct an independent economic analysis of the validity of the socioeconomic projections that were used in conjunction with the MWCOG travel demand forecasting model. RPG's analysis includes a test of the reasonableness of the TAZ level and countywide socioeconomic data relative to current economic conditions and trends, the availability of vacant and underutilized land and the propensity for development and redevelopment in different parts of the region.

The economic analysis and socioeconomic data validation / adjustments prepared by RPG were utilized as an integral part of this comprehensive traffic and revenue study. A detailed report prepared by RPG has been included as Appendix C of this report. This section presents a summary of results from RPG's findings and analysis, which formed the basis of CDM Smith's updated traffic and revenue estimates.

Table 4-3
Trends in Washington-Arlington-Alexandria, DC-VA-MD-WV MSA Employment Levels
Total Nonfarm Not Seasonally Adjusted (thousands)

Month	2004	Percent Change	2005	Percent Change	2006	Percent Change	2007	Percent Change	2008	Percent Change	2009	Percent Change	2010	Percent Change	2011	Percent Change	2012	Percent Change	2013
January	2,772.6	2.7%	2,848.3	2.1%	2,908.6	1.2%	2,942.2	0.6%	2,959.2	-0.7%	2,938.4	-1.3%	2,901.3	1.6%	2,948.7	1.1%	2,980.0	1.4%	3,022.7
February	2,784.5	2.7%	2,860.8	2.1%	2,919.7	1.0%	2,948.1	0.7%	2,968.1	-1.1%	2,935.7	-1.9%	2,878.5	2.8%	2,957.7	1.2%	2,993.4	1.3%	3,032.7
March	2,819.3	2.1%	2,879.0	2.4%	2,946.7	0.9%	2,971.9	0.5%	2,985.9	-1.4%	2,944.3	-0.7%	2,924.4	1.9%	2,979.9	1.4%	3,020.2	1.2%	3,057.6
April	2,830.8	2.5%	2,901.2	1.8%	2,953.7	0.8%	2,978.1	0.9%	3,004.4	-2.0%	2,945.2	0.5%	2,961.3	1.5%	3,005.7	0.9%	3,032.5	1.5%	3,077.5
May	2,854.3	2.3%	2,919.4	1.8%	2,971.7	0.8%	2,995.9	0.9%	3,021.5	-2.0%	2,960.9	0.8%	2,985.8	0.7%	3,006.2	1.2%	3,043.6	1.6%	3,090.8
June	2,875.5	2.2%	2,937.6	2.0%	2,996.1	0.6%	3,013.0	0.5%	3,029.1	-1.9%	2,972.1	0.9%	2,999.2	0.8%	3,023.9	1.3%	3,063.6	1.5%	3,108.6
July	2,869.7	2.3%	2,936.5	1.5%	2,979.6	0.7%	3,001.5	0.9%	3,027.4	-1.9%	2,969.1	0.9%	2,996.9	1.2%	3,031.9	0.4%	3,045.1	1.6%	3,095.0
August	2,866.6	2.2%	2,930.0	1.5%	2,972.5	0.6%	2,990.9	0.8%	3,015.6	-2.2%	2,949.5	0.5%	2,964.4	1.4%	3,005.7	1.0%	3,035.1	1.2%	3,070.5
September	2,872.3	2.2%	2,935.6	1.3%	2,973.9	0.5%	2,987.6	0.6%	3,004.5	-2.3%	2,934.1	1.2%	2,969.0	1.8%	3,022.3	0.8%	3,046.5	0.9%	3,072.8
October	2,892.7	1.5%	2,935.7	1.5%	2,980.7	0.8%	3,005.3	0.1%	3,007.2	-1.7%	2,955.2	1.2%	2,990.5	1.3%	3,028.2	1.3%	3,067.1	0.7%	3,087.7
November	2,905.1	1.8%	2,956.9	1.2%	2,992.6	0.9%	3,018.3	-0.3%	3,008.5	-1.3%	2,968.4	1.1%	3,001.8	1.2%	3,038.7	1.2%	3,075.2	0.9%	3,101.5
December	2,915.7	1.8%	2,967.9	1.3%	3,006.9	0.7%	3,029.0	-0.7%	3,006.8	-1.2%	2,970.4	1.2%	3,007.0	1.2%	3,042.8	1.1%	3,075.3	0.8%	3,101.1
Annual Average	**2,854.9**	**2.2%**	**2,917.4**	**1.7%**	**2,966.9**	**0.8%**	**2,990.2**	**0.4%**	**3,003.2**	**-1.7%**	**2,953.6**	**0.4%**	**2,965.0**	**1.4%**	**3,007.6**	**1.1%**	**3,039.8**	**1.2%**	**3,076.5**

Source: Bureau of Labor Statistics; data retrieved February, 2014

Table 4-4
Historical Personal Income Growth by Jurisdiction
(millions 2005 $)

County	1970	CAGR	1980	CAGR	1990	CAGR	2000	CAGR	2008	CAGR	2010	CAGR	2011	1970-2011 CAGR
District of Columbia	$15,844.9	0.5%	$16,712.8	2.7%	$21,817.0	1.7%	$25,770.1	4.9%	$37,647.9	1.1%	$38,504.3	3.4%	$39,800.9	2.3%
Fairfax County, VA [1]	11,236.6	6.0%	20,079.8	6.0%	36,064.8	4.9%	57,926.4	2.2%	69,121.3	-1.3%	67,290.3	3.3%	69,490.1	4.5%
Arlington County, VA	4,709.4	1.1%	5,275.3	3.4%	7,357.3	3.8%	10,704.1	3.7%	14,350.9	2.5%	15,066.0	1.5%	15,287.0	2.9%
Alexandria City, VA	2,583.6	3.4%	3,620.2	2.9%	4,814.2	3.8%	7,018.4	4.0%	9,594.7	0.5%	9,685.1	3.5%	10,027.2	3.4%
Prince William County, VA [2]	1,804.2	8.2%	3,980.0	6.3%	7,350.3	4.6%	11,541.3	4.7%	16,655.9	3.7%	17,913.4	5.3%	18,871.1	5.9%
Loudoun County, VA	694.2	8.4%	1,558.1	7.0%	3,061.6	10.2%	8,076.6	7.0%	13,903.7	4.1%	15,067.4	4.4%	15,726.7	7.9%
Montgomery County, MD	14,596.3	2.9%	19,413.2	5.7%	33,852.3	3.8%	49,152.0	2.6%	60,440.5	-0.9%	59,392.6	2.3%	60,733.0	3.5%
Prince Georges County, MD	13,220.4	1.3%	15,066.1	3.9%	22,103.1	1.7%	26,118.5	1.9%	30,315.6	0.9%	30,879.3	2.4%	31,635.2	2.2%
Frederick County, MD	1,397.1	6.1%	2,530.9	5.4%	4,263.8	5.4%	7,232.4	3.6%	9,612.8	0.5%	9,709.4	1.9%	9,897.4	4.9%
Total	**$66,086.6**	**2.9%**	**$88,236.4**	**4.8%**	**$140,684.4**	**3.8%**	**$203,539.8**	**3.2%**	**$261,643.3**	**0.4%**	**$263,507.9**	**3.0%**	**$271,468.6**	**3.5%**

Source: Personal Income data from Woods & Poole Economics, Inc. (W&P) CEDDS 2013 publication.

(1) Fairfax County + Fairfax City + Falls Church.

(2) Prince William County + Manassas + Manassas Park.

Approach of the Independent Economist

RPG utilized their economic analysis to prepare countywide population and employment estimates for 2010 and prepare forecasts for 2015, 2020, 2025, 2030, 2035, 2040, 2045 and 2050 for the core and suburban counties of the Washington D.C. metropolitan area: Arlington, Fairfax, Loudoun and Prince William Counties in Virginia; Frederick, Montgomery and Prince George's Counties in Maryland; and the District of Columbia. The forecasts have been generated considering 2010 and prior US Decennial Census results, public and private forecasts from a number of sources and the Round 8.2 forecasts created by the MWCOG.

RPG's approach included top down methods for testing and adjusting region-wide and jurisdictional population and employment control totals, bottom up methods of analyzing the supply of land for residential and non-residential development, market-based macroeconomic information on the prospects for short and long term growth, and a forecasting tool integrating a variety of predicting variables that was used to analyze and adjust forecasts at the TAZ level. RPG identified a DTR Primary Market Area based on a critical mass of origins and destinations information obtained from prior DTR patron surveys. RPG then did a detailed assessment at the TAZ level of the socioeconomic variables relative to other sources for establishing new base numbers. Following this, RPG conducted a detailed parcel level evaluation of the existing conditions and supply side factors to validate micro-level MWCOG forecasts in the Primary Market Area. A series of critical steps deployed by RPG in their approach are documented in detail in the attached Appendix C.

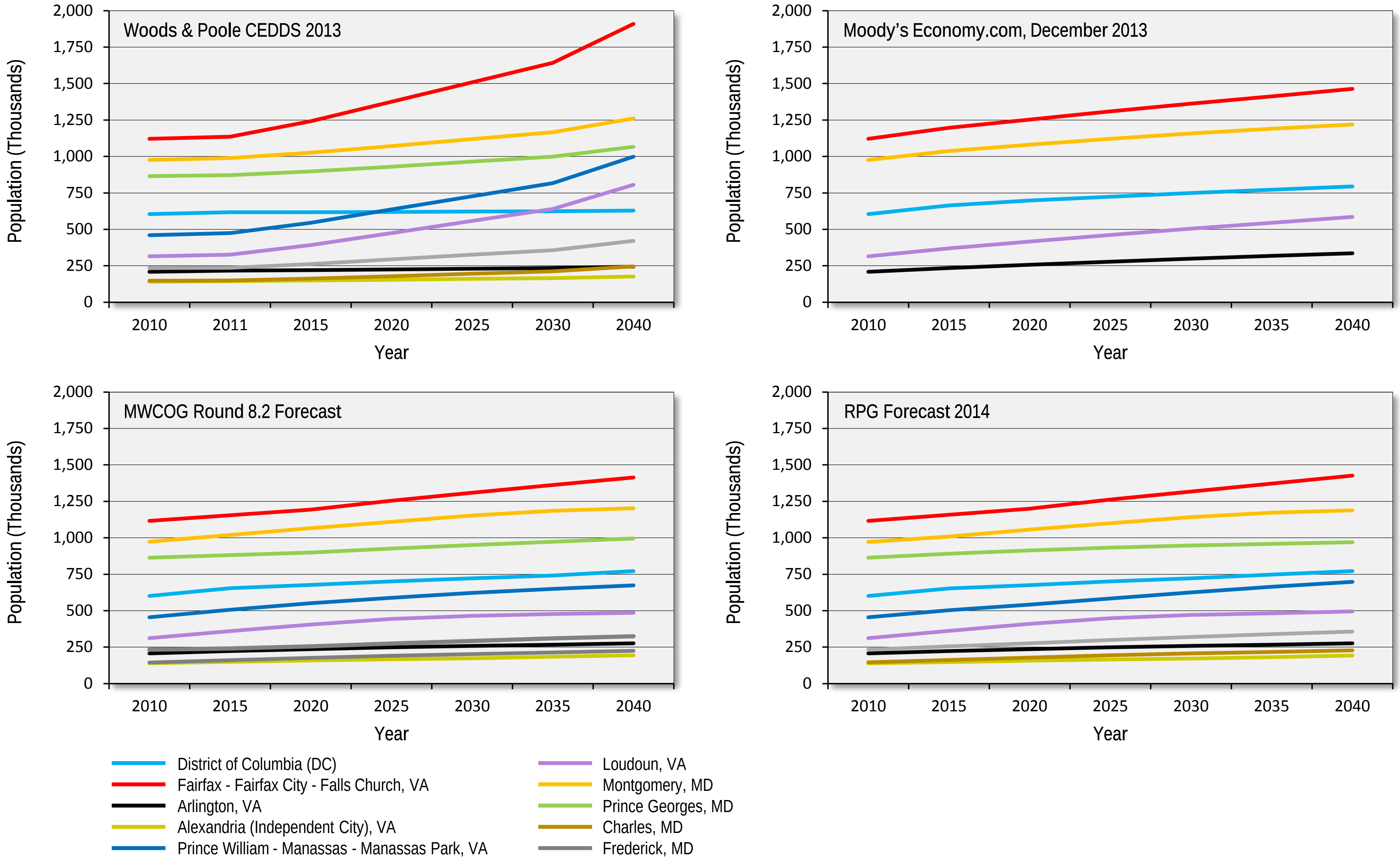
Independent Economist's Socioeconomic Forecasts Adjustments

Tables 4-5 and 4-6 present a summary of jurisdiction level adjusted forecasts for population and employment for the study region, respectively. As can be noted in Table 4-5, the nine-jurisdiction region is expected to add approximately 1.9 million residents by 2050 and Fairfax, Loudoun, Montgomery and Prince William counties are expected to add almost 1.2 million residents. With this forecast, projected annual average population growth over the next 40 years is 0.8% per annum compared to the historical rate of 1.3%.

As can be noted from Table 4-6 below, the nine-jurisdiction region is expected to add about 1.7 million jobs by 2050. Fairfax County alone is expected to add 388,000 jobs. RPG expects a rate of jobs growth of 1.7 percent through 2020. A significant increase of 5.1 percent per annum is projected for Loudoun County in the second half of the current decade.

Figures 4-2 through 4-4 below present a comparison of RPG's forecasts of population, employment and households, respectively (in the lower right block) with MWCOG Round 8.2 forecasts (in the lower left block), Woods and Poole 2013 forecasts (in the upper left block) and Moody's Economy.com forecasts (in the upper right block) obtained in January 2014.

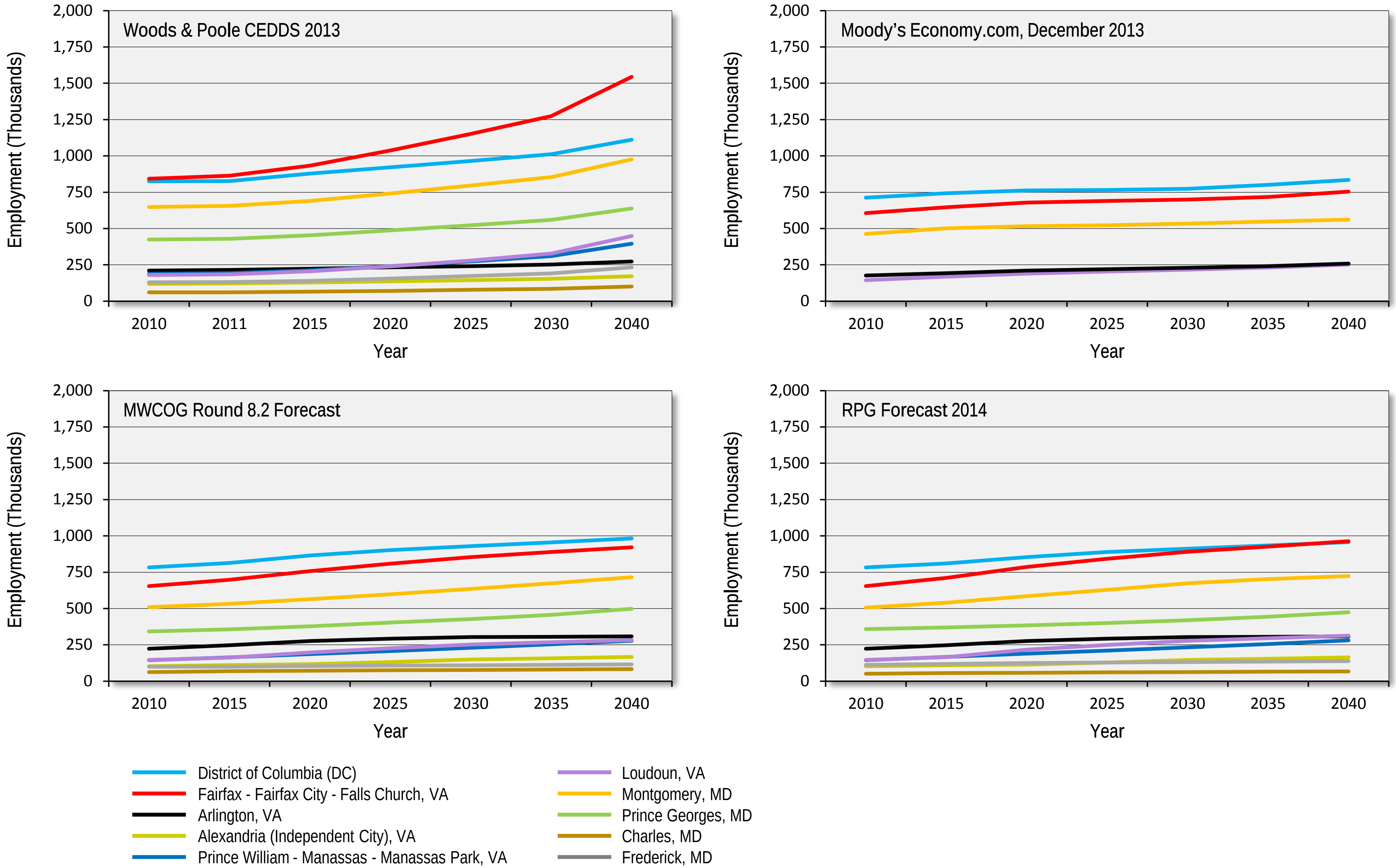
Figures 4-5, 4-6 and 4-7 show thematic maps of the adjusted number of expected residents at TAZ level from 2010 through 2020, 2020 through 2035, and from 2035 through 2050, respectively. These figures graphically expand on what is presented in the population forecast tables above with TAZ-level spatial detail. During the first two periods presented in Figures 4-5 and 4-6 it is clear where growth patterns are expected to occur along the Dulles Corridor and other parts of Loudoun and Fairfax



CDM Smith

POPULATION FORECASTS FROM VARIOUS SOURCES

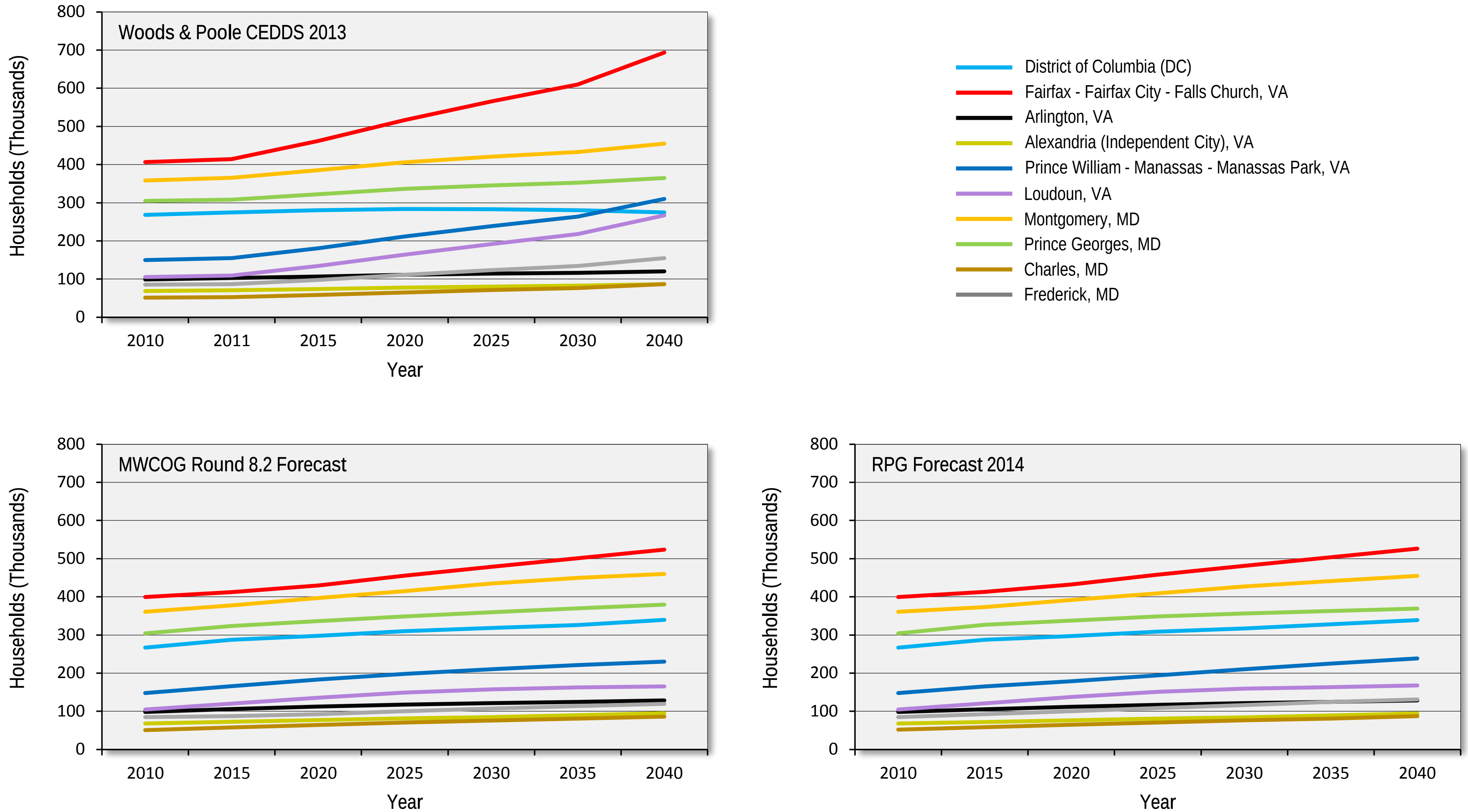
FIGURE 4-2



CDM Smith

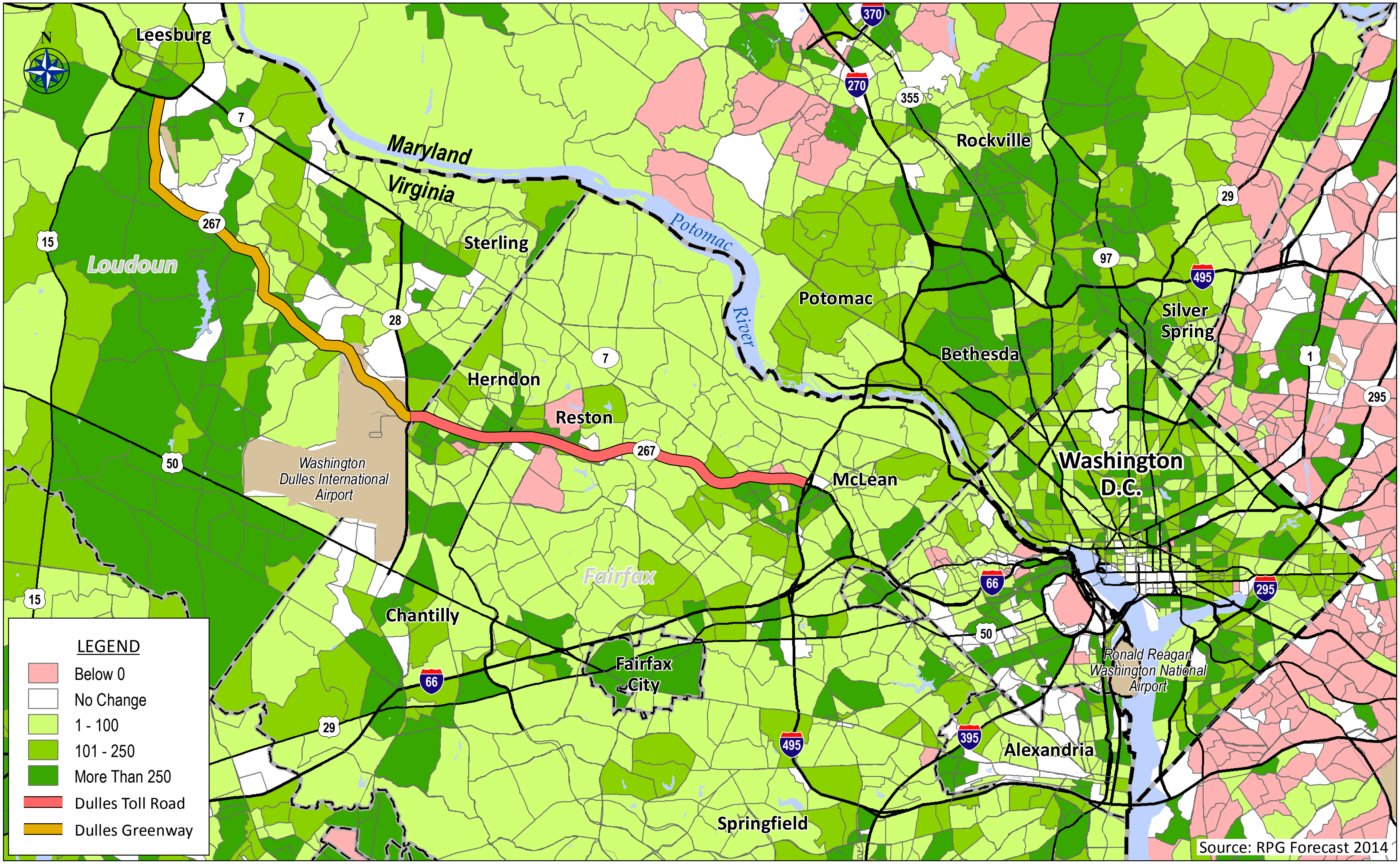
EMPLOYMENT FORECASTS FROM VARIOUS SOURCES

FIGURE 4-3



HOUSEHOLDS FORECASTS FROM VARIOUS SOURCES

FIGURE 4-4



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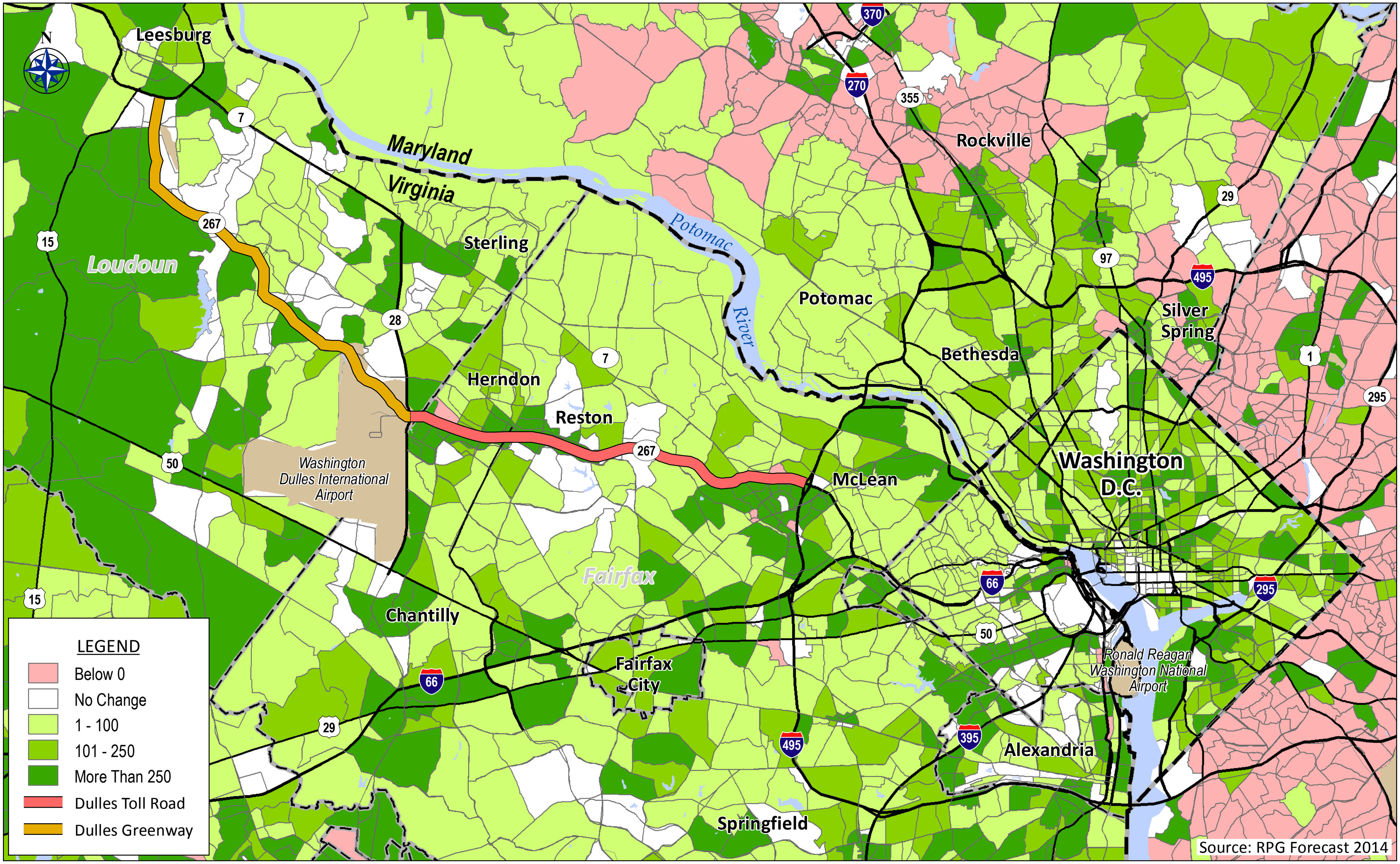
TOTAL GROWTH IN POPULATION, 2010-2020

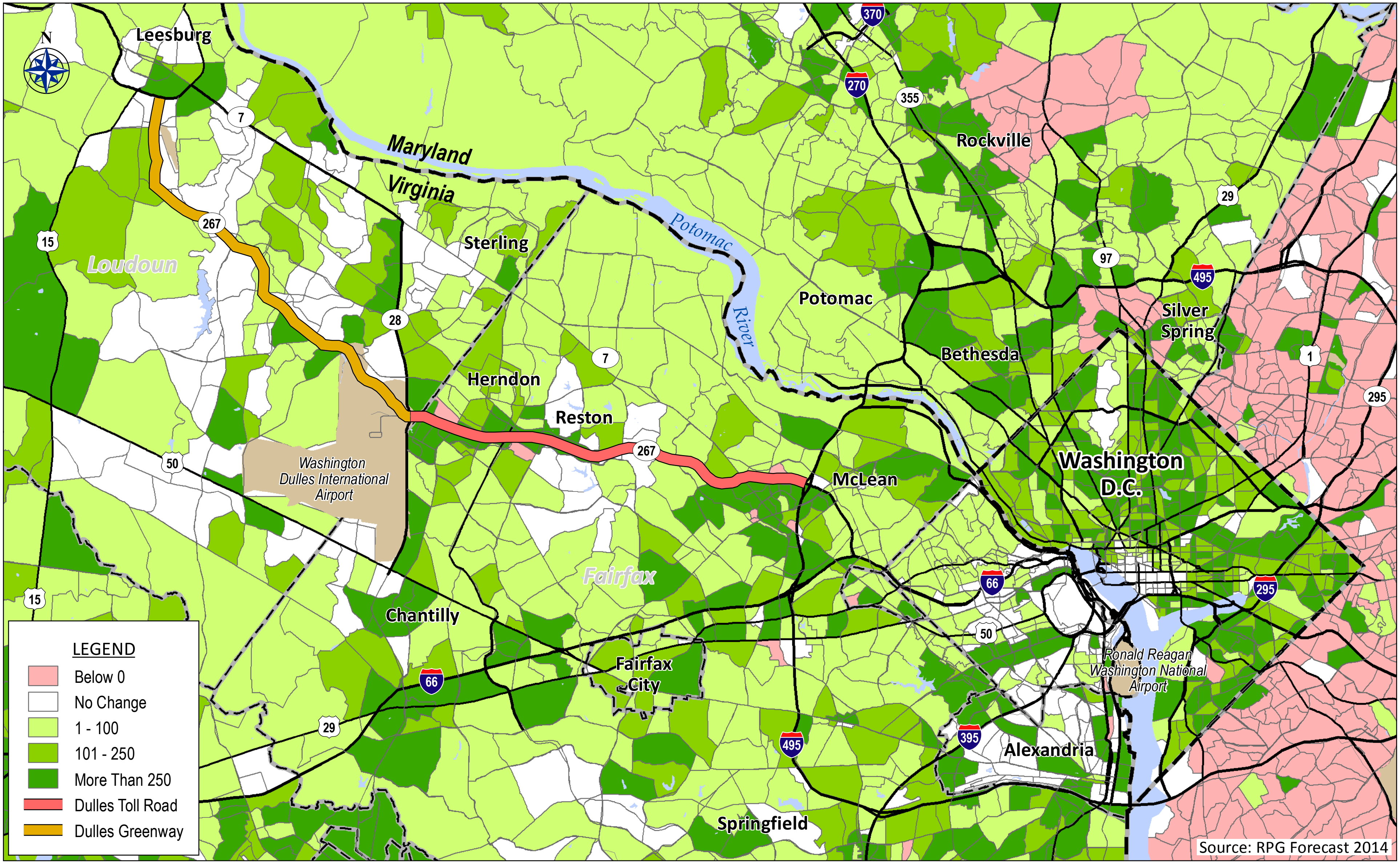
FIGURE 4-5



CDM Smith

TOTAL GROWTH IN POPULATION, 2020-2035

FIGURE 4-6



TOTAL GROWTH IN POPULATION, 2035-2050

FIGURE 4-7

Table 4-5
Population Growth by Jurisdiction
(thousands)

County	2010	CAGR	2015	CAGR	2020	CAGR	2025	CAGR	2030	CAGR	2035	CAGR	2040	CAGR	2045	CAGR	2050	2010-2050 CAGR
District of Columbia	602	2.1%	654	0.6%	675	0.8%	701	0.6%	722	0.7%	747	0.7%	772	0.6%	796	0.6%	821	0.8%
Fairfax County, VA [1]	1,117	0.9%	1,157	0.7%	1,197	1.0%	1,259	0.9%	1,314	0.8%	1,370	0.8%	1,425	0.7%	1,473	0.6%	1,521	0.8%
Arlington County, VA	208	1.8%	223	1.1%	236	1.1%	249	0.8%	259	0.6%	267	0.6%	276	0.6%	284	0.6%	292	0.9%
Alexandria City, VA	140	1.4%	148	1.2%	157	1.1%	165	0.8%	172	1.1%	182	1.1%	192	1.0%	202	1.0%	212	1.0%
Loudoun County, VA	312	3.7%	362	2.5%	410	1.8%	449	0.9%	470	0.5%	483	0.5%	496	0.5%	508	0.5%	521	1.3%
Prince William County, VA [2]	454	2.6%	504	1.5%	542	1.5%	584	1.4%	626	1.2%	664	1.0%	698	1.1%	737	1.1%	779	1.4%
Montgomery County, MD	972	0.9%	1,008	0.9%	1,056	0.8%	1,100	0.8%	1,142	0.5%	1,172	0.3%	1,189	0.4%	1,213	0.4%	1,237	0.6%
Prince Georges County, MD	863	0.8%	891	0.5%	914	0.4%	932	0.3%	947	0.2%	958	0.2%	969	0.2%	981	0.2%	992	0.3%
Frederick County, MD	233	2.2%	255	1.6%	276	1.6%	299	1.4%	320	1.2%	340	1.0%	357	1.1%	377	1.1%	398	1.3%
Total	**4,901**	**1.5%**	**5,201**	**1.0%**	**5,463**	**1.0%**	**5,737**	**0.8%**	**5,973**	**0.7%**	**6,183**	**0.6%**	**6,374**	**0.6%**	**6,572**	**0.6%**	**6,775**	**0.8%**

Source: MWCOG Round 8.2 forecast adjusted by RPG.
[1] Fairfax County + Fairfax City + Falls Church.
[2] Prince William County + Manassas + Manassas Park.

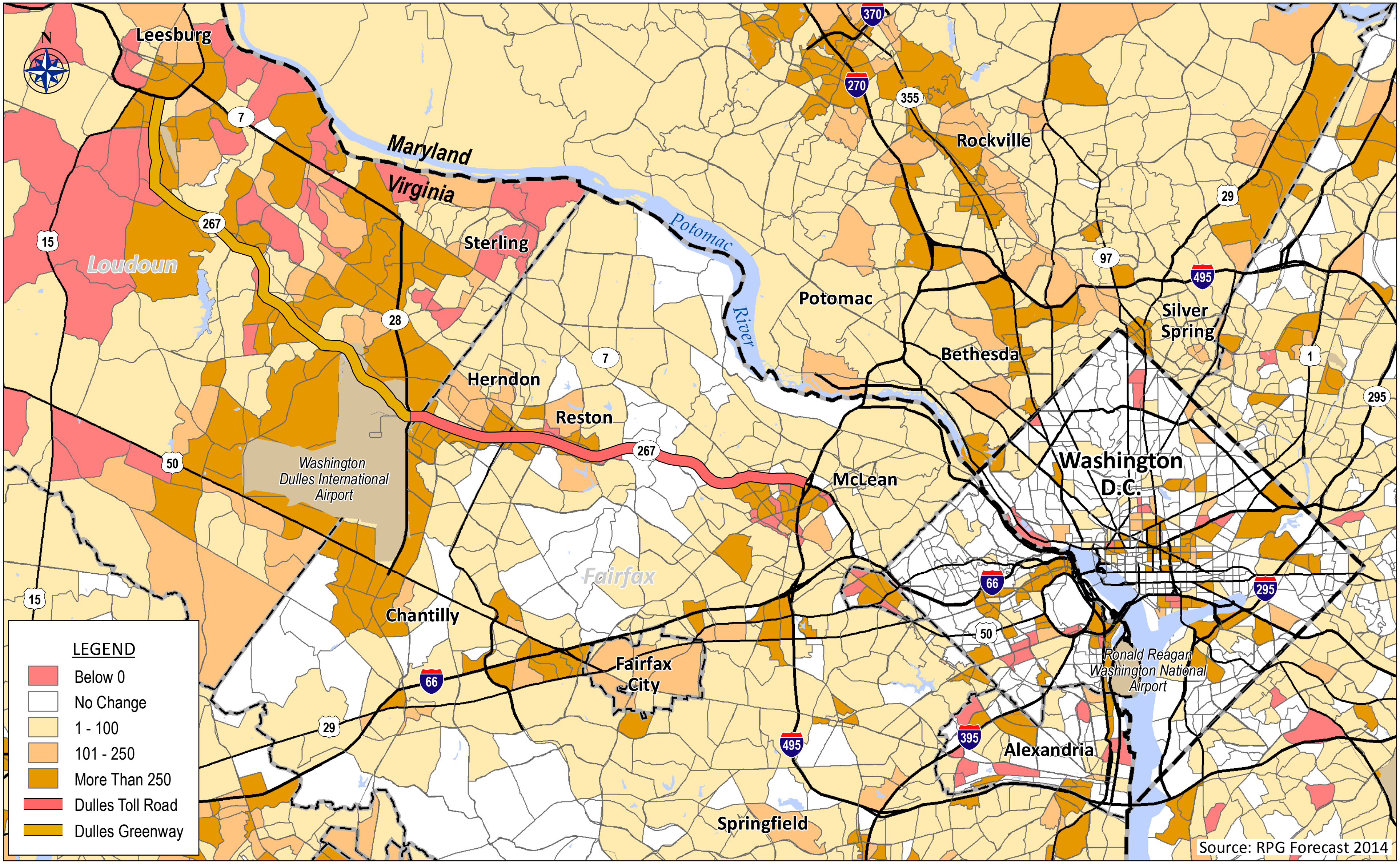
Table 4-6
Employment Growth by Jurisdiction
(thousands)

County	2010	CAGR	2015	CAGR	2020	CAGR	2025	CAGR	2030	CAGR	2035	CAGR	2040	CAGR	2045	CAGR	2050	2010-2050 CAGR
District of Columbia	783	0.8%	810	1.2%	859	0.7%	892	0.5%	913	0.5%	936	0.5%	959	0.5%	981	0.5%	1,004	0.6%
Fairfax County, VA [1]	655	2.1%	711	2.0%	786	1.4%	842	1.1%	890	0.8%	925	0.8%	961	0.8%	1,002	0.8%	1,043	1.2%
Arlington County, VA	223	2.7%	248	2.2%	277	1.1%	293	0.7%	303	0.2%	306	0.2%	309	0.2%	312	0.2%	314	0.9%
Alexandria City, VA	103	1.8%	111	0.8%	115	2.3%	129	2.6%	146	1.2%	155	1.1%	163	1.1%	172	1.0%	181	1.4%
Loudoun County, VA	145	3.6%	168	5.1%	215	2.9%	248	2.2%	277	1.3%	296	1.2%	314	1.1%	332	1.1%	350	2.2%
Prince William County, VA [2]	144	3.6%	167	2.5%	189	2.1%	210	2.1%	233	1.9%	256	1.8%	281	1.9%	308	1.9%	339	2.2%
Montgomery County, MD	506	1.6%	540	1.6%	585	1.4%	628	1.4%	673	0.9%	703	0.6%	723	0.7%	749	0.7%	777	1.1%
Prince Georges County, MD	358	0.8%	370	0.7%	384	0.8%	400	1.0%	420	1.1%	444	1.3%	475	1.2%	505	1.2%	537	1.0%
Frederick County, MD	112	1.6%	119	0.9%	125	0.7%	129	0.5%	132	0.4%	135	0.5%	138	0.5%	141	0.5%	144	0.6%
Total	**3,030**	**1.7%**	**3,243**	**1.7%**	**3,534**	**1.3%**	**3,770**	**1.1%**	**3,986**	**0.8%**	**4,156**	**0.8%**	**4,322**	**0.8%**	**4,503**	**0.8%**	**4,689**	**1.1%**

Source: MWCOG Round 8.2 forecast adjusted by RPG.
(1) Fairfax County + Fairfax City + Falls Church.
(2) Prince William County + Manassas + Manassas Park.

counties. Nearby Montgomery County, MD, is also expected to experience high growth during the next 40 years.

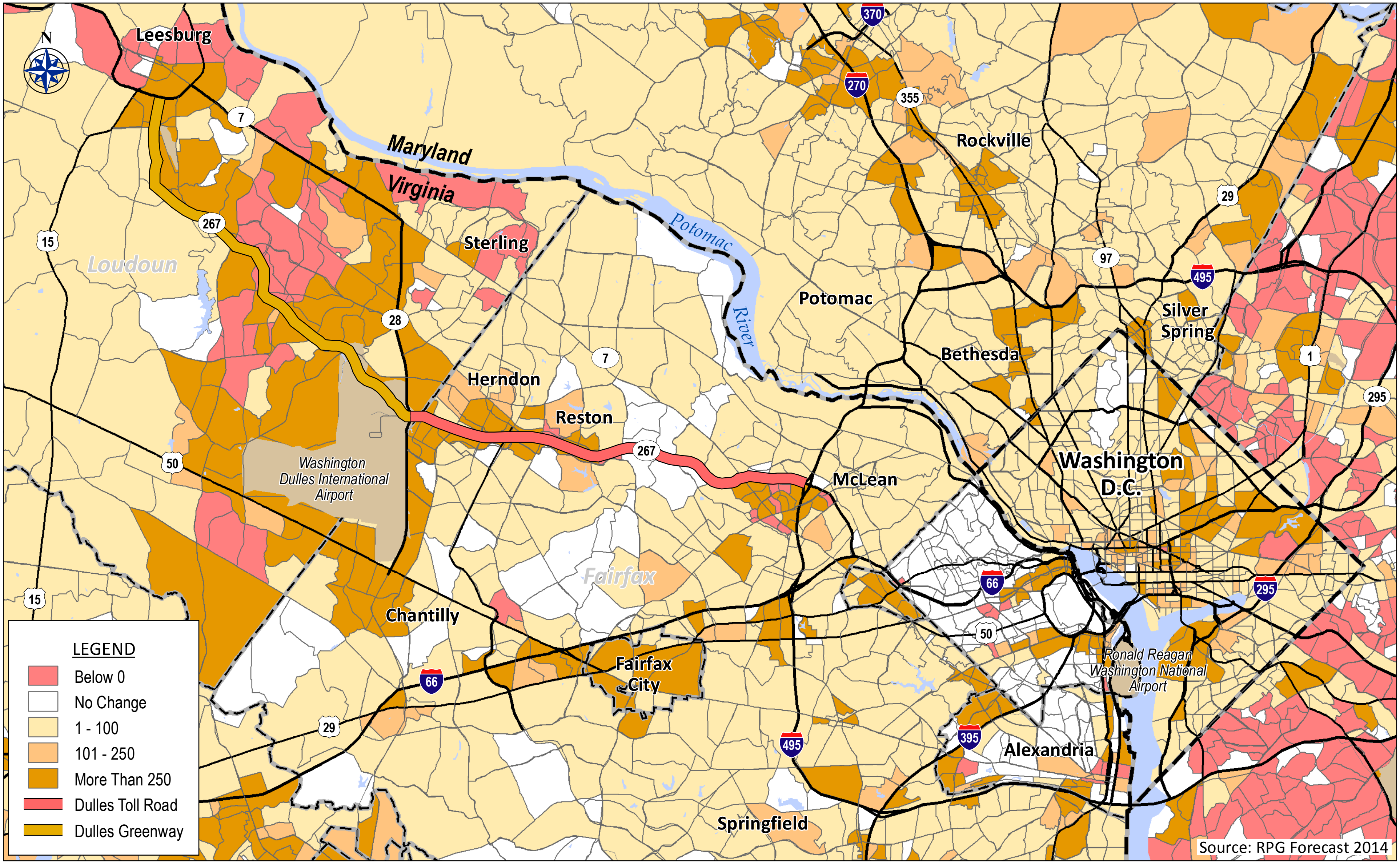
Figures 4-8, 4-9 and 4-10 present graphically, on maps of the study area, the RPG-adjusted growth in the TAZ level employment projections. It is evident from these figures that the Dulles Corridor is expected to experience very favorable employment growth conditions through the forecast horizon. A more detailed discussion and maps covering the socioeconomic review are provided in RPG's report as Appendix C.



CDM Smith

TOTAL GROWTH IN EMPLOYMENT, 2010-2020

FIGURE 4-8

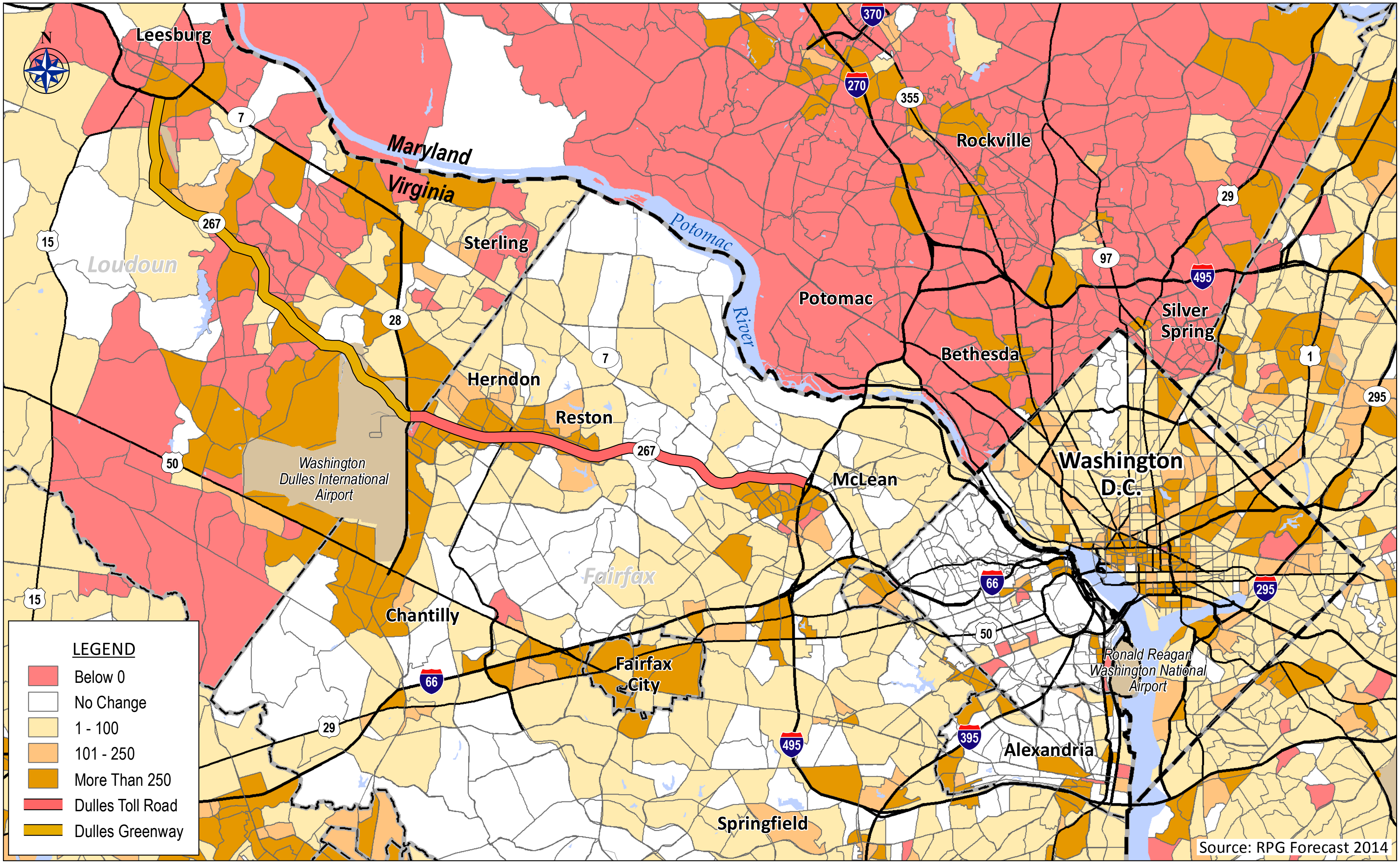


CDM Smith

TOTAL GROWTH IN EMPLOYMENT, 2020-2035

FIGURE 4-9

VA 101944 / 2-11-14 / Employment - 2035-2050.mxd



CDM Smith

TOTAL GROWTH IN EMPLOYMENT, 2035-2050

FIGURE 4-10

Chapter 5

Estimated Transactions and Toll Revenue

This chapter outlines the basic assumptions and key inputs to the travel demand model that CDM Smith used to develop annual traffic and toll revenue estimates for the Dulles Toll Road. It also describes the modeling methodology and analytic process for generating those estimates.

In developing the DTR toll revenue estimates, CDM Smith used a regional travel demand forecasting model provided by the MWCOG. The MWCOG model was refined and enhanced based on the professional experience and judgment of CDM Smith. Key components of that work included calibrating the MWCOG model with existing travel data for the Dulles Corridor, incorporating CDM Smith toll diversion algorithms, and conducting an independent evaluation of the MWCOG socioeconomic forecasts.

Presented at the end of this chapter are the estimated annual toll revenue and toll transactions for the DTR from 2014 through 2052 using a toll rate schedule developed by MWAA and its financial advisors. The assumed toll rates are subject to change. Following the traffic and revenue estimates, this chapter also presents a toll sensitivity analysis that was performed for estimated transactions and toll revenues for the year 2015.

This report also includes a series of sensitivity tests in Chapter 6, to test the potential impacts on toll revenue associated with hypothetical changes in certain assumptions or basic study inputs, such as alternative economic growth, lower values of time and higher fuel prices.

Basic Assumptions

Traffic and toll revenue estimates for the DTR are predicated on the following basic assumptions, all of which are considered reasonable for purposes of this comprehensive traffic and toll revenue study:

1. DTR is assumed to provide four travel lanes in each direction, or a total of eight lanes, over its entire length. No expansion has been considered in the forecast period;

2. The physical configuration of the DTR, will remain broadly unchanged throughout the forecast period;

3. Future toll rates assumed in this study were developed on the instructions and judgment of MWAA and its financial advisors. No dynamic, variable or peak congestion pricing options have been investigated at this stage. Toll rates on the DTR facility are in future year dollars as set forth subsequently in this chapter. Commercial vehicle rates will continue to be incrementally higher than passenger cars based on the current multipliers;

4. No change in toll collection technology or method of payment has been assumed. Toll collection operations are assumed to continue to be actively monitored and strictly enforced to minimize potential revenue losses due to toll evasion and/or system failure;

5. An average annual inflation rate of 2.5 percent has been assumed for the purposes of escalating values of time and calculating vehicle operating costs in future year dollars. Annual toll revenue estimates and toll rates are expressed in future year dollars;

6. Future toll increases on the Greenway will be implemented per the maximum toll schedule set by the Virginia State Corporation Commission through 2020 as described in Chapter 1. Post 2020, maximum toll rates increases are assumed to continue in line with guidelines set by SCC for 2013 through 2020. Future toll increases on other regional toll facilities have been estimated per assumed future toll rate policies and objectives of the other agencies/operators;

7. No adjustments have been made to annual toll revenue estimates included in this report to reflect the impacts associated with changes in future enforcement, changes in toll evasion, or other form of uncollectible tolls. Any improvements made by MWAA would be an upside benefit. It is assumed that enforcement and public relations programs will be undertaken by MWAA to ensure customer satisfaction and minimum diversion as necessary;

8. Annual transactions and toll revenue have not been adjusted to reflect any "ramp-up" characteristics as the DTR is a mature toll road facility;

9. Only those highway improvements which are committed in the regional Six-Year Transportation Improvement Plan (TIP), approved by the TPB on July 17, 2013, for the period FY 2013-2018, and Financially Constrained Long-Range Plan (CLRP) 2013 Update will be implemented during the projection period. Specific improvements assumed in future year networks are described in the following sections of this Chapter. A detailed review of the transportation infrastructure is provided in Appendix D. However, for the purpose of this study, no other major competing highway projects, toll or tax supported toll-free or other significant competing improvements are assumed to be constructed in the DTR corridor during the forecast period. Any improvements to the Dulles Toll Road not assumed herein would be considered an upside;

10. MWCOG's 4-step travel demand model was used as the basis to assess mode choice effects between highway and transit modes. Diversion to Dulles Metrorail (Silver Line) is represented by the adjustments made in the MWCOG highway trip tables generated through the 4-step travel demand modeling process. Fares were assumed as given in the MWCOG model. No other competing or feeder bus line service or service frequency added along the DTR corridor, other than outlined in TIP, CLRP and MWCOG assumptions;

11. Only airport traffic and transit buses will be eligible to use Dulles Airport Access Highway. It is assumed that active monitoring, rigorous airport traffic enforcement and administrative adjudication process will be implemented to avoid potential misuse of Dulles Access Highway for toll evasion and to minimize potential revenue losses;

12. Regional and corridor socioeconomic growth is generally in accordance with forecasts provided by MWCOG, as reviewed and adjusted by the independent consultant, Renaissance Planning Group (RPG);

13. Travel demand modeling was performed by estimating average weekday travel on the DTR and study area. For purposes of annualization of transactions and revenue, it was assumed the base

relationship between weekday and annual trips observed at each toll plaza is constant, including violations and non-revenue transactions (such as police, emergency vehicles, and military vehicles);

14. The DTR will continue to be well-maintained, efficiently-operated and effectively signed and promoted to encourage maximum usage. It is assumed there will be no interruptions in availability of lanes for use by patrons, other than for routine maintenance and average number of incidents;

15. Motor fuel will remain in adequate supply and its price will not increase significantly in real terms; the rate of price increase will not significantly exceed the overall rate of inflation. The base case forecast reflects an assumption of $3.50 per gallon increasing with general prices. Fuel cost sensitivity tests are provided in Chapter 6; and

16. No local, regional or national emergency will arise which would abnormally restrict the use of motor vehicles, or substantially alter economic activity or freedom of mobility.

Any significant departure from the above basic assumptions could materially affect the estimates for traffic and toll revenue on the DTR presented in this report.

Key Model Inputs

Infrastructure Improvements

The most recent regional transportation improvement plan documents were obtained and reviewed to identify any committed improvements which could potentially impact traffic and revenue on the DTR. As necessary, corresponding adjustments were made to the regional transportation model as refined by CDM Smith.

Tables 5-1 below presents a list of major highway capacity improvements assumed to be carried out in future years throughout the study area. Figures 5-1 through 5-3 indicate the locations where significant future roadway improvement projects are assumed to occur. Improvements in transit have been assumed to be in line with those specified in the 'transit improvements' portion of the CLRP.

Dulles Metrorail's Phase I and II are scheduled to be operational in 2014 and 2018, respectively. Model assignments were carried out to test with and without scenarios of Dulles Metrorail in appropriate future assignment years. No other significant improvements in the DTR corridor were included outside the committed TIP and CLRP.

Table 5-1
Future Major Highway Improvement Projects

Facility	Route(s)	From	To	Type of Improvement	Number of Lanes From	Number of Lanes To	Description	Implementation Period
Leesburg Pike	7	Rolling Holly Dr	Reston Ave	Widening	4	6	Widening Route 7 to 6 lanes	2014-2020
Old Ox Road	606	Loudoun County Parkway	Dulles Greenway	Widening	2	4	Reconstruction and widening of Old Ox Rd to 4 lanes	2014-2020
Reston Parkway		Sunrise Valley Drive	Baron Cameron Avenue	Widening	4	6	Widening Reston Parkway to 6 Lanes in Reston Town Center area	2014-2020
Route 28	28	McLearen Road	Dulles Toll Road	Widening	6	8	Widen Route 28 NB from McLearen Rd to Dulles Toll Road	2014-2020
Route 28	28	Dulles Toll Road	US-50	Widening	6	8	Widen Route 28 SB from Dulles Toll Road to Route 50	2014-2020
Spring St		Herndon Parkway East	Fairfax County Parkway	Widening	4	6	Widen Spring Street to 6 lanes	2014-2020
US-50	50	VA-28	VA-742 (Poland Rd)	Widening	4	6	Widening US 50 to 6 lanes west of Route 28	2014-2020
Elden St		Van Buren St (Monroe St)	Fairfax County Pkwy	Roadway	4	4	East Elden St, Herndon (Streetscaping)	2014-2020
I-495	495	End of 495 Express Lanes	American Legion Bridge	Roadway	8	10	I-495 Shoulder Lane to American Legion Bridge	2014-2020
Various		--------------see Appendix D for details --------		Other	-	-	Interchange Improvements, Bridge, and Park&Ride Projects	2014-2020

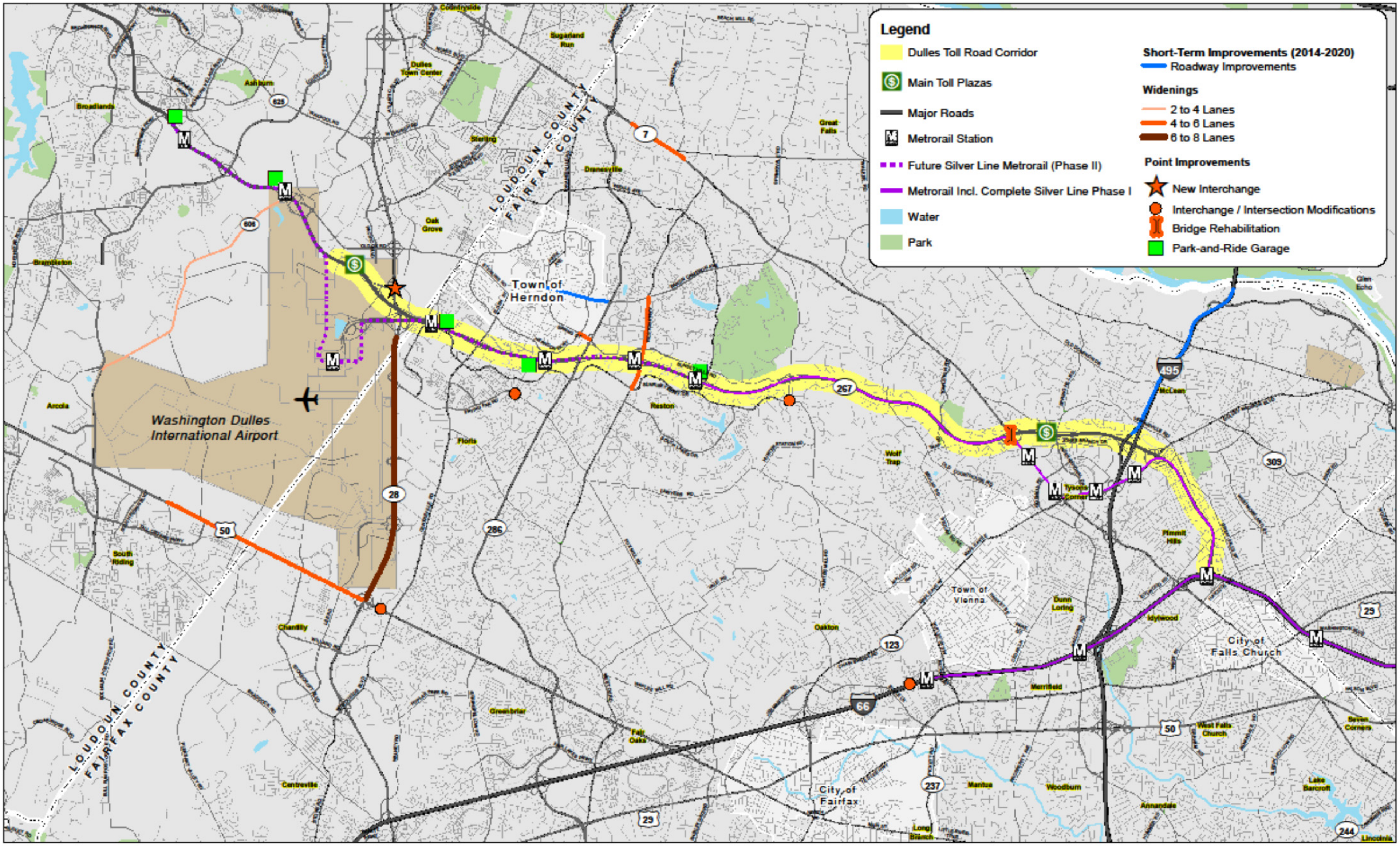
Source: MWCOG 2013 Updated CLRP and FY2013-18 TIP

(….Table 5-1 continued on next page)

Table 5-1 (contintued)
Future Major Highway Improvement Projects

Facility	Route(s)	From	To	Type of Improvement	Number of Lanes From	Number of Lanes To	Description	Implementation Period (note 1)
Route 28	28	I-66	VA-7	Widening+	6	8	Widen to 8 lanes with interchanges (to complete freeway)	2020-2030
Leesburg Pike	7	Brook Rd/Lewinsville Rd	Dulles Toll Road	Widening	4	6	Widening Route 7 to 6 lanes	2020-2030
Leesburg Pike	7	Reston Ave	Dulles Toll Road	Widening	4	6	Widening Route 7 to 6 lanes	2020-2030
Old Ox Road	606	Loudoun County Parkway	Rock Hill Road	Widening	4	6	Widening Old Ox Road to 6 lanes	2020-2030
US-50	50	VA-742 (Poland Rd)	VA 659 Relocated	Widening	4	6	Widening US 50 to 6 lanes	2020-2030
US-50 / Loudoun County Pkwy	50 / 606	-	-	Interchange	-	-	New Interchange US-50 and Loudoun County Parkway	2020-2030
Dulles Greenway	267	VA-28	Leesburg Bypass	Widening	6	8	Widening Dulles Greenway from 6 to 8 lanes	2020-2030 *
Innovation Avenue	209	Route 28	Fairfax County Line	Widening	4	6	Widen Innovation Avenue to 6 lanes, new Metrorail station to Route 28	2020-2030 *
Route 28	28	Old Ox Road	Route 7	Widening	6	8	Widening Route 28 in Loudoun County to 8 lanes	2020-2030 *
Route 28	28	Fairfax County Line	Old Ox Road	Widening	6	10	Widening Route 28 in Loudoun County to 10 lanes in Dulles Toll Road area	2020-2030 *
Pacific Boulevard		Old Ox Road	Innovation Avenue	New Roadway	0	6	Complete Pacific Blvd, Old Ox Rd - Innovation Ave (Route 28 Collector Road)	2020-2030 *
Monroe Street	666	Fox Mill Road	West Ox Road	Widening	2/4	4	Bringing Monroe Street to 4 lanes	2030-2040 *
Old Courthouse Road	677	Gosnell Road	Trap Road	Roadway	2	2	Roadway improvements to Old Courthouse Road in Tysons Corner	2030-2040 *
Route 28	28	I-66	VA-267 / DTR	Widening	6	10	Widen VA-28 to 10 lanes between I-66 and Loudoun County (just south of VA-267)	2030-2040 *
Soapstone Drive	4720	Sunrise Valley Drive	Sunset Hills Rd	New Roadway	0	2	Extend Soapstone Dr across Dulles Toll Road	2030-2040 *
Spring Hill Road		Leesburg Pike	International Drive	Roadway	4	4	Roadway improvements to Spring Hill Road in Tysons Corner	2030-2040 *
Sunrise Valley Drive	5320	Centreville Road	Sayward Boulevard	Widening	2/4	4	Widening Sunrise Valley Drive to 4 lanes near Innovation Center Station	2030-2040 *
Sunset Hills Road	657	Hunter Mill Road	Wiehle Avenue	Widening	2	4	Widening Sunset Hills Road east of Wiehle Ave to 4 lanes	2030-2040 *
Sunset Hills Road	657	Wiehle Avenue	Fairfax County Parkway	Widening	4	6	Widening Sunset Hills Road west of Wiehle Ave to 6 lanes	2030-2040 *
Town Center Parkway		Sunset Hills Rd	Sunrise Valley Drive	New Roadway	0	4	Currently under study - extension of Town Center Parkway under Dulles Toll Road	2030-2040 *
DTR & Greensboro Dr (extend)		-	-	Interchange	-	-	Construct partial grade-separated interchanges at VA-267 and Greensboro Drive and VA-267 and Boone Blvd	2030-2040
DTR & Boone Blvd (extend)		-	-	Interchange	-	-	Construct partial grade-separated interchanges at VA-267 and Greensboro Drive and VA-267 and Boone Blvd	2030-2040
DTR & Jones Branch Dr		-	-	Interchange	-	-	New Partial Interchange between Spring Hill Rd & Beltway with connection to Jones Branch	2030-2040
I-66 & Nutley St		-	-	Interchange	-	-	Reconstruct interchange of I-66 and Nutley St	2030-2040 *
I-66 & VA-123		-	-	Interchange	-	-	Reconstruct interchange of I-66 and VA-123	2030-2040 *
I-66 & US-50		-	-	Interchange	-	-	Reconstruct interchange of I-66 and US-50	2030-2040 *
I-66 & Stringfellow Rd		-	-	Interchange	-	-	Reconstruct interchange of I-66 and Stringfellow Rd	2030-2040 *
I-66 & VA-28		-	-	Interchange	-	-	Reconstruct interchange of I-66 and VA-28	2030-2040
Route 123 & International Drive		-	-	Interchange	-	-	Interchange/ Intersection Study	2030-2040 *
Route 123 & Route 7		-	-	Interchange	-	-	Interchange/ Intersection Study	2030-2040
Route 267 & Centreville Road		-	-	Interchange	-	-	Interchange/ Intersection Study	2030-2040 *
Route 267 & Reston Parkway		-	-	Interchange	-	-	Interchange/ Intersection Study	2030-2040 *

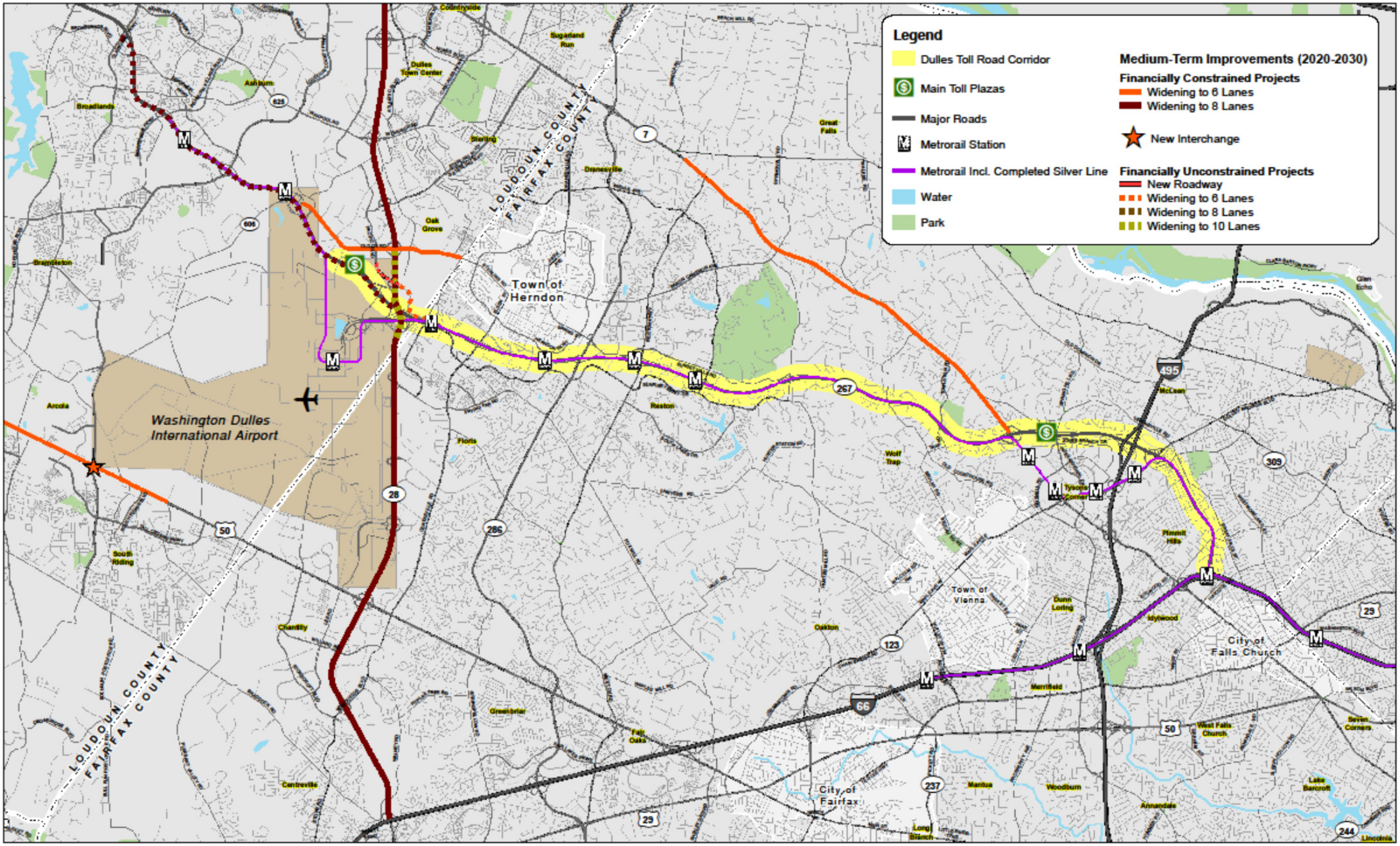
Source: MWCOG 2013 Updated CLRP and FY2013-18 TIP, Note (1) financially unconstrained projects denoted with asterix *.



Short-Term Improvement Projects in the Dulles Toll Road Vicinity

2014 - 2020 Projects (Financially Constrained Projects Only)

FUTURE PROJECT UPDATES COMMENCING IN THE 2014-2020 NETWORK

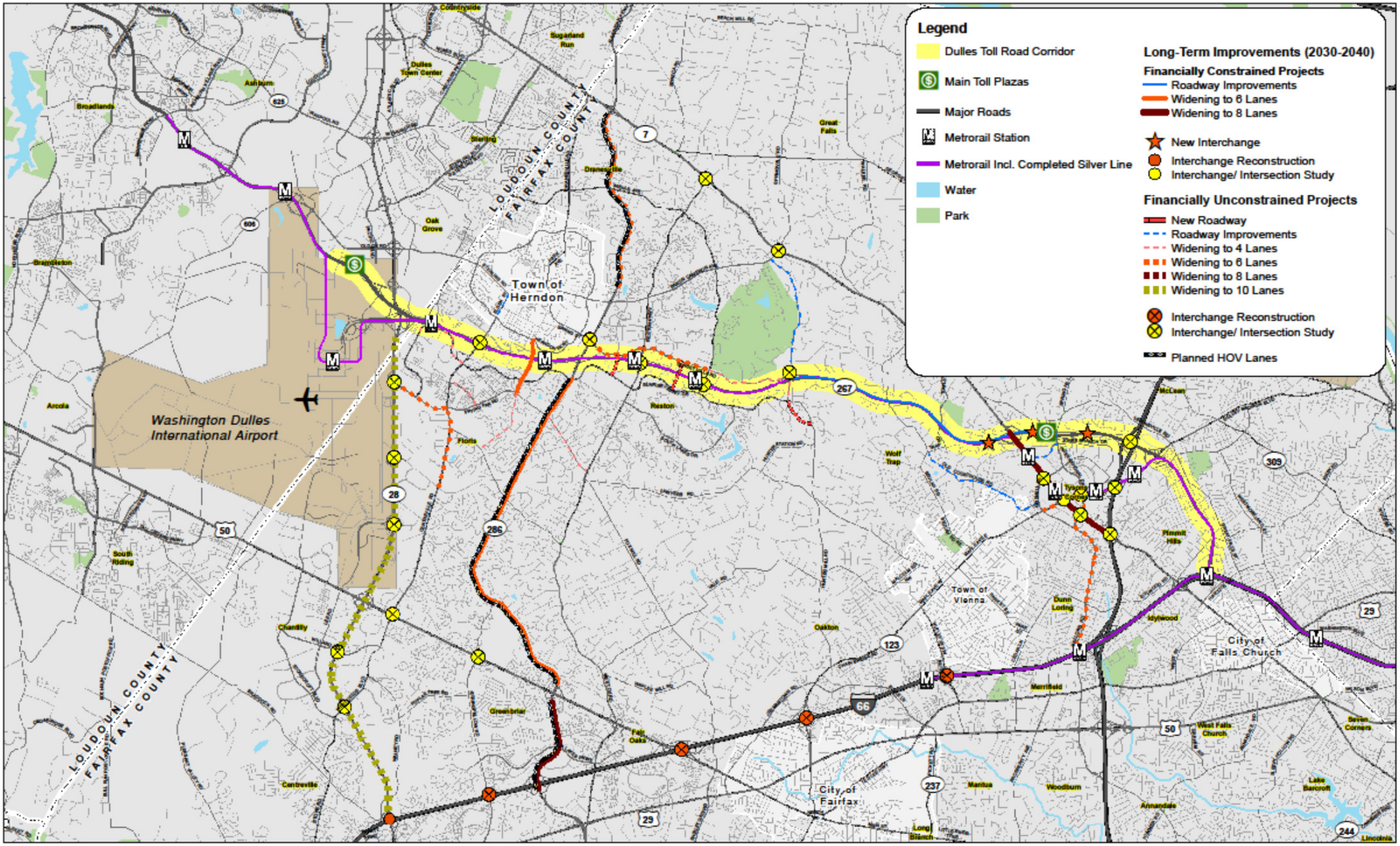


Medium-Term Improvement Projects in the Dulles Toll Road Vicinity

2020 - 2030 Projects (Financially Constrained and Unconstrained)

FUTURE PROJECT UPDATES COMMENCING IN THE 2020-2030 NETWORK

FIGURE 5-2



Long-Term Improvement Projects in the Dulles Toll Road Vicinity

2030 - 2040 Projects (Financially Constrained and Unconstrained)

FUTURE PROJECT UPDATES COMMENCING IN THE 2030-2040 NETWORK

FIGURE 5-3

Toll Rate Schedule

Table 5-2 is the projected 2-axle toll rate schedule provided by MWAA and its financial advisors for estimating traffic and revenue for the DTR.

Table 5-2
Projected Toll Rate Schedule

	Main Line		Ramps	
	Tolls	**Change**	**Tolls**	**Change**
1984-2005	$0.50	..	$0.35/$0.25	..
2005-2009	0.75	**+ $ 0.25**	0.50	**+ $ 0.15**
2010	**1.00**	**+ $ 0.25**	**0.75**	**+ $ 0.25**
2011	1.25	**+ $ 0.25**	0.75	..
2012	1.50	**+ $ 0.25**	0.75	..
2013	**1.75**	**+ $ 0.25**	**1.00**	**+ $ 0.25**
2014	**2.50**	**+ $ 0.75**	1.00	..
2015	2.50	..	1.00	..
2016	2.50	..	1.00	..
2017	2.50	..	1.00	..
2018	2.50	..	1.00	..
2019	**3.25**	**+ $ 0.75**	**1.50**	**+ $ 0.50**
2020	3.25	..	1.50	..
2021	3.25	..	1.50	..
2022	3.25	..	1.50	..
2023	**4.00**	**+ $ 0.75**	**2.00**	**+ $ 0.50**
2024	4.00	..	2.00	..
2025	4.00	..	2.00	..
2026	4.00	..	2.00	..
2027	4.00	..	2.00	..
2028	**4.75**	**+ $ 0.75**	**2.50**	**+ $ 0.50**
2029	4.75	..	2.50	..
2030	4.75	..	2.50	..
2031	4.75	..	2.50	..
2032	4.75	..	2.50	..
2033	**5.50**	**+ $ 0.75**	**3.25**	**+ $ 0.75**
2034	5.50	..	3.25	..
2035	5.50	..	3.25	..
2036	5.50	..	3.25	..
2037	5.50	..	3.25	..
2038	**6.25**	**+ $ 0.75**	**3.75**	**+ $ 0.50**
2039	6.25	..	3.75	..
2040	6.25	..	3.75	..
2041	6.25	..	3.75	..
2042	6.25	..	3.75	..
2043	**7.00**	**+ $ 0.75**	**4.25**	**+ $ 0.50**
2044	7.00	..	4.25	..
2045	7.00	..	4.25	..
2046	7.00	..	4.25	..
2047	7.00	..	4.25	..
2048	**7.75**	**+ $ 0.75**	**4.75**	**+ $ 0.50**
2049	7.75	..	4.75	..
2050	7.75	..	4.75	..
2051	7.75	..	4.75	..
2052	7.75	..	4.75	..
2053	7.75	..	4.75	..
2054	7.75	..	4.75	..

As shown, 2-axle toll rates at Main Line plaza will next increase after Phase 2 of the Silver Line opens in 2019 by $0.75 to $3.25 together with a $0.50 increase at all ramps. Beginning in 2023, and occurring every five years thereafter, there is projected to be a periodic increase of $0.75 at the Main Line toll plaza. Tolls at ramp plazas are also projected to be adjusted every five years beginning in 2023 generally by $0.50, except for the $0.75 increase in 2033. For the purposes of this study truck toll rates are assumed to increase on the same schedule and based on the multiplier between 2-axle and multi-axle rates currently in use.

Modeling Methodology

The National Capital Region Transportation Planning Board (TPB) is the federally designated Metropolitan Planning Organization (MPO) for the region. The TPB model inputs obtained from MWCOG were used by CDM Smith as the basis for the current estimates of traffic and revenue. Critical inputs to the models are the socioeconomic data at the traffic analysis zone level (TAZ) which were reviewed by an independent local economist.

The following sections discuss the modeling framework, review of key model inputs, and the development of highway networks and trip tables. Also provided is an overview of the parameters and traffic assignment and toll diversion process used in this study.

MWCOG Model Framework

The MWCOG/TPB regional transportation model is a computer-based traffic forecasting model designed to forecast traffic volumes in the Washington, D.C. region, which includes parts of Maryland and Virginia as well as the District. The TPB regional model version 2.3.52 includes the latest underlying socioeconomic forecasts of MWCOG. The TPB model includes all inputs and application files required to execute the travel demand model for the MWCOG base year of 2007 and horizon year 2040 as calibrated by MWCOG in 2012.

Mode-Choice and Potential Diversion to Rail

The regional model has a sequential procedure for generating trips based on the traditional four-step transportation demand modeling process (trip generation, trip distribution, mode choice, and highway assignment) with several loop-back steps to take congestion levels into account. Trip tables representing a.m. peak period, p.m. peak period, midday, and overnight travel are developed in the MWCOG model using factors from regional household surveys.

The model predicts mode choice based on the relative costs of each mode. In relative terms, the expected diversion from highway to rail as a result of the introduction of the Silver Line is considered to be very low. Testing of the model confirmed that the transit share of travel mode choice to be low and insensitive to other factors such as tolls. As with the introduction of a new rail service, tolls were also found to have a very insignificant impact on the share of rail versus highway users in the Dulles Corridor.

The passenger capacity of the Silver Line is small relative to the hundreds of thousands of commuters that travel on the Dulles Corridor and competing highway routes on a daily basis. Net diversion from the DTR to Metrorail is expected to be relatively insignificant; current DTR customers have very diverse travel patterns that are not well-served by the Silver Line.

It must also be remembered that any short term diversion away from the DTR will improve its level of performance such that other drivers that previously chose toll free routes would now consider using the DTR. DTR customers are not the target ridership for the new rail service and new development within the Dulles Corridor is expected as a result of the Metrorail extension. It is expected that a percentage of the new residents and employees will be Metrorail customers, perhaps in the range of one-quarter to one-third. However, most of the new residents and employees would be expected to drive. It should also be noted that the new Metrorail project will generate socioeconomic growth that will offset (possibly more than offset) any diversion to Metrorail lost from DTR.

Socio-economic Assumptions

As described in Chapter 4, CDM Smith recruited RPG as an independent economist to develop socioeconomic forecasts to be used in the trip table generation process deployed by CDM Smith. As part of their analysis, RPG reviewed the latest MWCOG Round 8.2 socioeconomic forecasts and applied necessary adjustments to the regional and primary market area numbers. Results of their detailed assessment were summarized in Chapter 4 and a report is attached as Appendix C. New trip tables for each of the forecast years (2015, 2020, 2025, 2030, 2035 and 2040) were generated using the RPG adjusted socioeconomic forecasts for the region and the DTR primary market area.

Highway Network Assumptions

The MWCOG model contains highway networks for a base year 2007 and horizon year 2040 representing the highways, arterial and local streets; and transit infrastructure of the region. The year 2007 network was then reviewed against the transportation improvements through 2011 to develop new base model networks for year 2011 specifically for this study. The year 2011 roadway network was then reviewed and corrected based on posted speed limits and the type and number of roadway lanes. The year 2011 roadway network, in combination with 2011 traffic assignments, was reviewed and adjusted based on average weekday traffic volume and current travel speed observations.

The future year networks were then reviewed against the regional TIP and CLRP to confirm that committed and funded improvements had been included.

Trip Table Adjustments to Reflect DTR Travel Patterns

CDM Smith ran a series of 2011 traffic assignments initially using trips generated solely by the MWCOG model to understand the underlying model. Adjustments were made in order to obtain a better fit between the ground counts at multiple screenline locations and traffic volumes assigned by the model.

The 2011 trip tables were then adjusted to better reflect the entry/exit survey information obtained from the license plate surveys. Trips passing through network links that represent locations where the license plate surveys were collected were extracted and adjusted to match the entry/exit trip pattern from the survey. This ensures that adjusted trip tables are a better reflection of actual trip patterns and trip lengths observed on DTR corridor from the license plate surveys.

The modified trip tables were then adjusted further to better reflect the zone to zone travel pattern information obtained from the origin-destination surveys. Trips passing through links that represent toll plazas, where the travel pattern surveys were conducted, were extracted and adjusted to match the trip patterns achieved from the factored survey. This ensures that the final adjusted trip tables are a better reflection of both the surveys.

Overview of Toll Diversion Assignment Process

A series of tolled diversion assignments in the years 2011, 2015, 2020, 2025, 2030, 2035 and 2040 were run for the toll rate schedule assumed for DTR.

Trip tables were divided into market segments based on different trip purposes including airport trips, passenger car SOV, passenger car HOV-2, passenger car HOV-3, and commercial vehicle traffic. These market segments were assigned to the network using a modified version of a multi-class user equilibrium assignment process. Appropriate toll rates and fees were used for each of these categories of vehicles.

The MWCOG model was updated to include CDM Smith tolling algorithms designed to estimate the share of traffic for each travel movement which would be expected to choose the toll routing at each toll rate. This is specifically designed to assess motorists' willingness to pay tolls at varying toll levels and congestion conditions. The process builds two sets of minimum time paths for each origin-destination zone pair: one using the DTR (where appropriate) and the other using competing toll-free facilities. A proportion of the total trips moving between the zones are assigned to each network path based on the relative total cost between the two paths considering vehicle travel costs (distance), travel time costs, and tolls. As the cost of the tolled routing increases as compared to the competing toll-free routing, the share of traffic using the DTR decreases; and vice versa.

The time cost is equal to the time spent traveling between two zones, multiplied by the value-of-time. The distance cost for each of the two paths is equal to the vehicle operating cost multiplied by the distance traveled for each path.

Values-of-Time and Vehicle Operating Costs

Traffic and revenue on a toll facility is dependent on motorists' willingness to pay a toll for benefits received in using the toll facility. These benefits can include mileage savings, improved quality of travel, safety, and reduced congestion. The motorist's value–of-time, vehicle operating cost, and toll charges are the three key elements in determining the cost of making a particular trip and, therefore, the share of traffic assigned to tolled vs. toll-free paths to travel from the origin to the destination of the trip.

Based on the last study of values of time for the DTR corridor, documented in 2009 DTR Traffic and Revenue Study and reproduced in Appendix B, the overall average value-of-time (VOT) for trips in the corridor was calculated to be $0.21 per minute ($12.60/hr) for motorists traveling for work/business trip purposes (2007 values). VOT for commuting trips was calculated at $0.20 per minute ($12.00/hr). Finally, VOTs were calculated to be $0.17 per minute ($10.20/hr) for leisure trip purposes. Reflective of the relatively high incomes in the corridor, the value of time range is relatively high compared with other areas of the United States. These VOTs were assumed to inflate 2.5 percent each year through the forecast period.

As a further refinement, CDM Smith developed differential values-of-time for the traffic assignments estimated by traffic analysis zone (TAZ), which were developed using income distributions from the MWCOG socioeconomic data files. For each zone, there is a field containing factors that represent the ratio of median household income in that zone as compared to the regional average. This factor was applied to the average value-of-time for the region to develop an estimate of current VOT. In general, zones in the DTR corridor tend to have median household incomes that are greater than the regional average. This enables the modeling process to recognize the variance in incomes in the corridor and throughout the region.

Vehicle operating costs used in the analysis were calculated by taking into account the average per-mile costs of gasoline and oil, and to a lesser extent, maintenance, and wear and tear of tires for the regions' vehicles. Table 5-3 presents vehicle operating costs used in the analysis. Vehicle operating costs were calculated in 2011 dollars for all future year traffic assignments and then inflated to future year levels assuming a 2.5 percent annual inflation rate.

Table 5-3
Vehicle Operating Costs in Future Year Dollars

Year	Passenger Cars	Trucks
2011	$0.195	$0.586
2012	$0.199	$0.597
2013	$0.203	$0.609
2014	$0.207	$0.621
2015	$0.211	$0.633
2017	$0.215	$0.645
2020	$0.222	$0.665
2025	$0.241	$0.722
2030	$0.259	$0.778
2035	$0.281	$0.842
2040	$0.307	$0.920

Notes:

All values are presented in current dollar per mile ($/mile).
CDM Smith estimates are based on AAA driving cost data [(1)].
The estimates also include estimates for increase in fuel efficiency [(3)] over time and changes in passenger car fleet compositions as well as inflation of fuel prices and maintenance cost.
Fuel prices[(2)] and maintenance cost are assumed to increase by 2.5% per year. Truck operating cost is assumed to be 3 times the cost of passenger cars.

Sources:

(1) AAA, Your Driving Costs, 2011 Edition

(2) Bureau of Labor Statistics, Washington-Baltimore Area Gasoline Prices, 2011

(3) National Highway Traffic and Safety Administration, Summary of Fuel Economy Performance Report, April 28, 2011

Assumed ETC Market Shares

Since electronic toll collection (ETC) on DTR is not assumed to have different toll rates, ETC market share is not an important factor in estimating traffic and revenue for the DTR, nor is it an input in the current model process. MWAA is working to increase the number of E-ZPass Only lanes on the DTR to accommodate the growing number of customers that use electronic toll payment.

Toll Differential Assumptions

As indicated, it was assumed for this study that there will continue to be no toll differential between ETC and cash collection. Despite the lack of a cash differential the market share of E-ZPass continues to grow.

However, there is and will be a toll differential between passenger cars and commercial vehicles. Assumptions on multi-axle toll rates have been updated and applied. It should be noted again that the share of commercial vehicles on DTR is extremely low.

Traffic Assignment Process

As noted previously, traffic assignments were run using trip table information supplied by MWCOG and modified for this study by CDM Smith. Future year traffic assignments were run at multiple years when toll rate increases are assumed to occur. To assist in interpolation before each successive increase, a second set of future year traffic assignment was undertaken in these years using toll rates from the prior period.

The assignment results were reviewed for reasonableness, using both select link and screenline corridor share analyses. In the screenline review, special attention was paid to the overall level of growth in traffic throughout the projection period, and the relative share of total screenline demand expected to be accommodated by DTR.

The traffic assignment process utilized the projected toll rate schedule described previously. The future toll rate policy for the adjacent Greenway toll road also were assumed through 2020 and beyond.

Estimated Annual Transactions and Toll Revenue

T&R Estimates

Estimates of annual toll revenue for the DTR under the projected toll rate schedule are presented in Table 5-4 based on the projected toll rate schedule. Total revenue for DTR is presented from 2010 through 2052. In CY2013 total annual transactions that occurred on the DTR system were approximately 98.7 million per year. This translated to annual toll revenues of about $127.1 million in CY2013.

In 2014, with a Main Line toll adjustment, annual total transactions are estimated to decrease to approximately 96.5 million per year. These transactions would produce about $151.6 million in annual toll revenues. By 2019, coinciding with the next expected toll increase, annual transactions are expected to be 96.2 million per year generating annual toll revenues of $205.0 million.

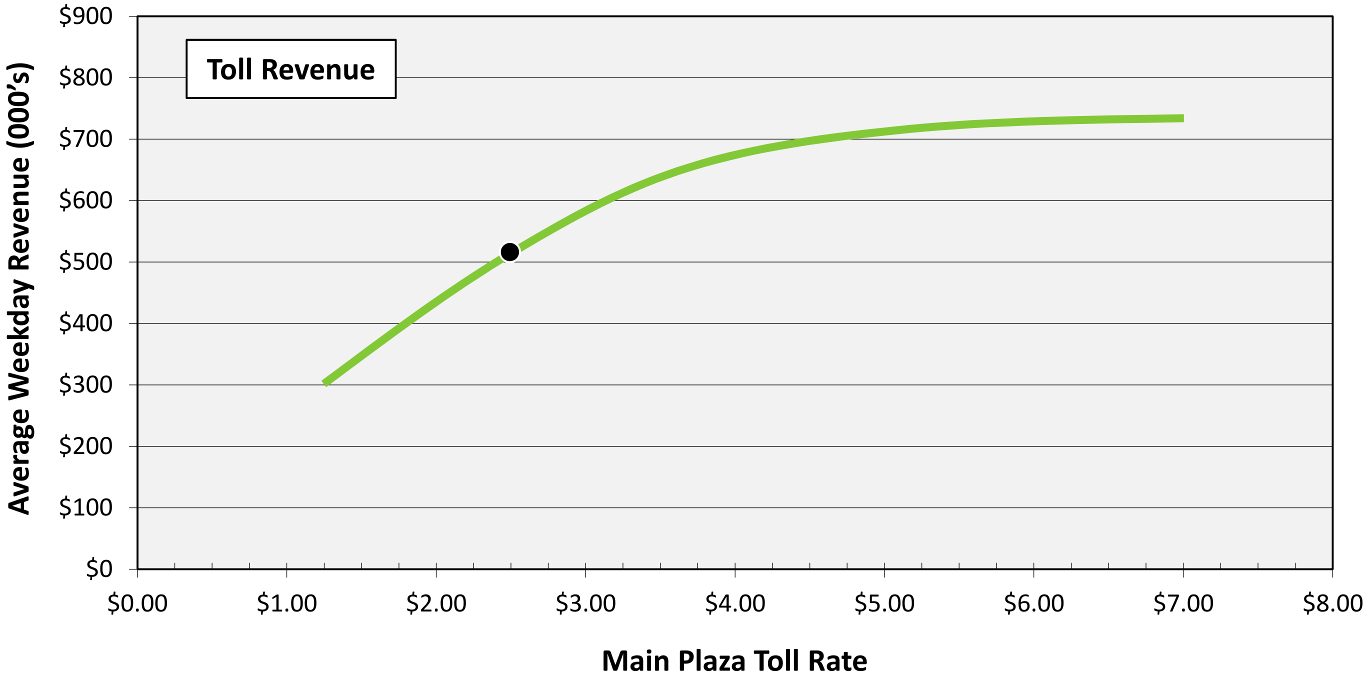
In 2023, annual total transactions are projected to be almost 92.5 million. In the same year, the amount of toll revenue generated is over $256.5 million. By 2033, the forecasted annual toll revenues are estimated to exceed $400 million based on nearly 96.6 million annual transactions. Annual revenues are estimated to exceed $500 million in 2043.

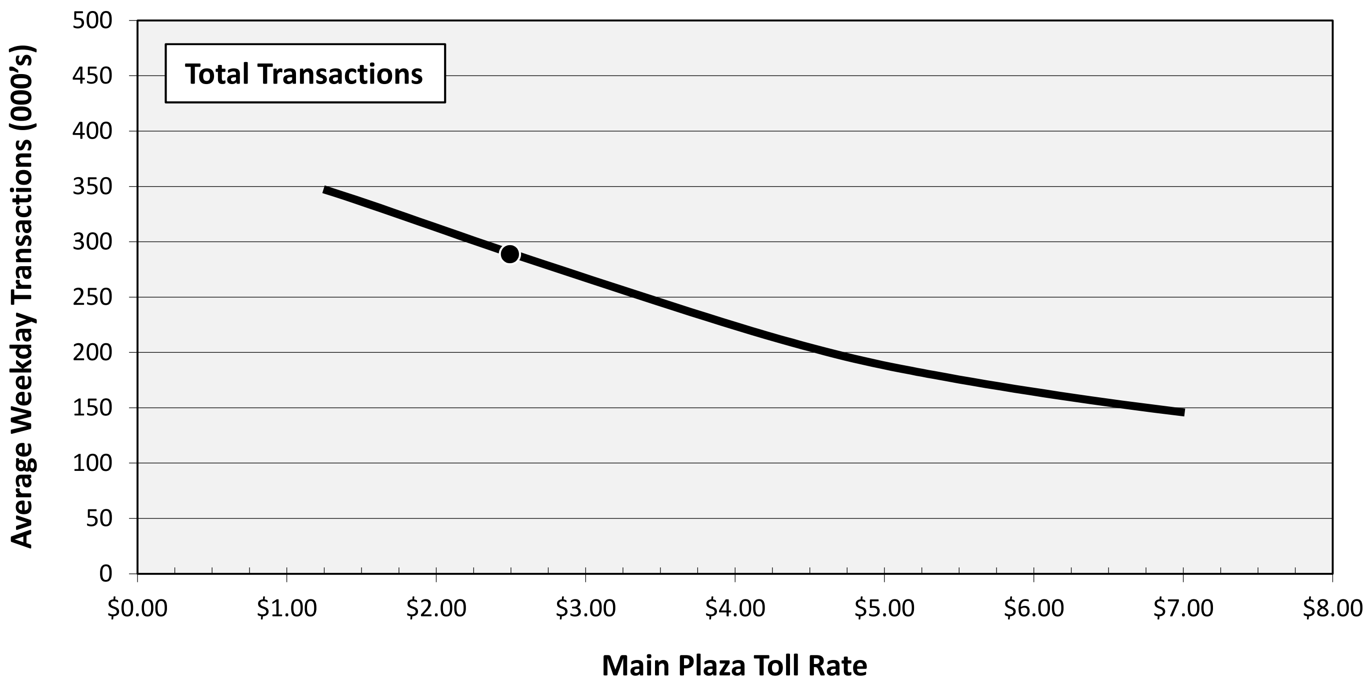
Toll Sensitivity Analysis

Toll sensitivity analyses are helpful in assessing the reasonableness of assumed future toll rates for the DTR. Future year toll sensitivity curves are based on changes in traffic characteristics in the corridor including increasing congestion, value of time, competing facilities, and inflationary trends. These curves are essential in estimating the viability of future toll rate increases.

In general, the toll sensitivity curve suggests that when toll rates increase, a portion of travelers will leave the toll facility in favor of other routes. Therefore, as the toll rate increases transactions would tend to decrease. However, as the toll rates increase, toll revenues increases until a point where a maximum revenue is generated after which additional toll rate increases would generate a decrease in toll revenues. For this purpose, CDM Smith conducted toll sensitivity analysis for the year 2015. Figure 5-4 illustrates the average weekday toll sensitivity curves for these years estimated for the DTR. Main Line toll rates, in nominal year dollars, ranging from $1.00 to $7.00 were analyzed.

The sensitivity analyses results indicate that the assumed future toll rates of DTR are well below the estimated theoretical revenue maximization point. This demonstrates that there would be considerable potential for revenue enhancement through toll increases above current rates and even for those assumed for forecasting purposes, if needed. Using this analysis, revenue-maximizing Main Line tolls are estimated to be in excess of $5.00 in 2015, more than twice the currently projected $2.50 Main Line Toll.





Note: Black dot represents the $2.50 Main Line 2015 toll rate.

2015 TOLL SENSITIVITY CURVES

FIGURE 5-4

Table 5-4
Dulles Toll Road Traffic and Toll Revenue Estimates 2009-2054

Forecast Year	Calendar Year	Main/Ramp[1] Tolls	Total[2] Transactions	% p.a.	Total[3] Revenue	% p.a.	Average[4] Revenue
-5	2009	$0.75 / $0.50	108,718,207		64,705,148		0.00
-4	2010	$1.00 / $0.75	104,686,184	-3.7%	88,038,167	+36.1%	0.84
-3	2011	$1.25 / $0.75	101,534,955	-3.0%	94,659,539	+7.5%	0.93
-2	2012	$1.50 / $0.75	99,891,072	-1.6%	101,596,089	+7.3%	1.02
-1	2013	$1.75 / $1.00	98,676,217	-1.2%	127,059,341	+25.1%	1.29
0	2014	$2.50 / $1.00	96,454,000	-2.3%	151,601,000	+19.3%	1.57
1	2015	$2.50 / $1.00	98,040,000	+1.6%	154,166,000	+1.7%	1.57
2	2016	$2.50 / $1.00	99,775,000	+1.8%	156,972,000	+1.8%	1.57
3	2017	$2.50 / $1.00	102,527,000	+2.8%	161,425,000	+2.8%	1.57
4	2018	$2.50 / $1.00	103,598,000	+1.0%	163,545,000	+1.3%	1.58
5	2019	$3.25 / $1.50	96,265,000	-7.1%	205,006,000	+25.4%	2.13
6	2020	$3.25 / $1.50	96,729,000	+0.5%	206,563,000	+0.8%	2.14
7	2021	$3.25 / $1.50	97,995,000	+1.3%	209,868,000	+1.6%	2.14
8	2022	$3.25 / $1.50	99,746,000	+1.8%	213,685,000	+1.8%	2.14
9	2023	$4.00 / $2.00	92,493,000	-7.3%	256,533,000	+20.1%	2.77
10	2024	$4.00 / $2.00	94,314,000	+2.0%	261,683,000	+2.0%	2.77
11	2025	$4.00 / $2.00	96,161,000	+2.0%	266,904,000	+2.0%	2.78
12	2026	$4.00 / $2.00	98,485,000	+2.4%	273,474,000	+2.5%	2.78
13	2027	$4.00 / $2.00	100,866,000	+2.4%	280,204,000	+2.5%	2.78
14	2028	$4.75 / $2.50	97,000,000	-3.8%	327,278,000	+16.8%	3.37
15	2029	$4.75 / $2.50	99,246,000	+2.3%	334,997,000	+2.4%	3.38
16	2030	$4.75 / $2.50	100,246,000	+1.0%	338,433,000	+1.0%	3.38
17	2031	$4.75 / $2.50	101,161,000	+0.9%	341,575,000	+0.9%	3.38
18	2032	$4.75 / $2.50	101,892,000	+0.7%	344,088,000	+0.7%	3.38
19	2033	$5.50 / $3.25	96,552,000	-5.2%	400,200,000	+16.3%	4.14
20	2034	$5.50 / $3.25	97,739,000	+1.2%	405,209,000	+1.3%	4.15
21	2035	$5.50 / $3.25	98,946,000	+1.2%	410,304,000	+1.3%	4.15
22	2036	$5.50 / $3.25	99,664,000	+0.7%	413,339,000	+0.7%	4.15
23	2037	$5.50 / $3.25	100,402,000	+0.7%	416,451,000	+0.8%	4.15
24	2038	$6.25 / $3.75	97,556,000	-2.8%	462,898,000	+11.2%	4.74
25	2039	$6.25 / $3.75	98,202,000	+0.7%	466,021,000	+0.7%	4.75
26	2040	$6.25 / $3.75	98,872,000	+0.7%	469,257,000	+0.7%	4.75
27	2041	$6.25 / $3.75	99,464,000	+0.6%	472,120,000	+0.6%	4.75
28	2042	$6.25 / $3.75	100,065,000	+0.6%	475,021,000	+0.6%	4.75
29	2043	$7.00 / $4.25	97,920,000	-2.1%	524,171,000	+10.3%	5.35
30	2044	$7.00 / $4.25	98,282,000	+0.4%	526,144,000	+0.4%	5.35
31	2045	$7.00 / $4.25	98,650,000	+0.4%	528,152,000	+0.4%	5.35
32	2046	$7.00 / $4.25	99,003,000	+0.4%	530,077,000	+0.4%	5.35
33	2047	$7.00 / $4.25	99,361,000	+0.4%	532,029,000	+0.4%	5.35
34	2048	$7.75 / $4.75	97,348,000	-2.0%	580,215,000	+9.1%	5.96
35	2049	$7.75 / $4.75	97,470,000	+0.1%	580,957,000	+0.1%	5.96
36	2050	$7.75 / $4.75	97,596,000	+0.1%	581,724,000	+0.1%	5.96
37	2051	$7.75 / $4.75	97,719,000	+0.1%	582,454,000	+0.1%	5.96
38	2052	$7.75 / $4.75	97,842,000	+0.1%	583,186,000	+0.1%	5.96
39	2053	$7.75 / $4.75	97,968,000	+0.1%	583,942,000	+0.1%	5.96
40	2054	$7.75 / $4.75	98,092,000	+0.1%	584,675,000	+0.1%	5.96

[1] Historical and Projected Toll Rates per MWAA and Financial Advisor
[2] Total Transactions; revenue transactions, violations and non-revenue
[3] Total revenue including violation processing, fees and fines
[4] Average revenue per transaction.

Disclaimer

CDM Smith used currently-accepted professional practices and procedures in the development of these traffic and revenue estimates. However, as with any forecast, it should be understood that differences between forecasted and actual results may occur, as caused by events and circumstances beyond the control of the forecasters. In formulating the estimates, CDM Smith reasonably relied upon the accuracy and completeness of information provided (both written and oral) by MWAA. CDM Smith also relied upon the reasonable assurances of independent parties and is not aware of any material facts that would make such information misleading.

CDM Smith made qualitative judgments related to several key variables in the development and analysis of the traffic and revenue estimates that must be considered as a whole; therefore, selecting portions of any individual result without consideration of the intent of the whole may create a misleading or incomplete view of the results and the underlying methodologies used to obtain the results. CDM Smith gives no opinion as to the value or merit of partial information extracted from this report.

All estimates and projections reported herein are based on CDM Smith's experience and judgment and on a review of information obtained from multiple agencies, including MWAA. These estimates and projections may not be indicative of actual or future values, and are therefore subject to substantial uncertainty. Future developments cannot be predicted with certainty, and may affect the estimates or projections expressed in this report, such that CDM Smith does not specifically guarantee or warrant any estimate or projection contained within this report.

While CDM Smith believes that the projections or other forward-looking statements contained within the report are based on reasonable assumptions as of the date of the report, such forward-looking statements involve risks and uncertainties that may cause actual results to differ materially from the results predicted. Therefore, following the date of this report, CDM Smith will take no responsibility or assume any obligation to advise of changes that may affect its assumptions contained within the report, as they pertain to socioeconomic and demographic forecasts, proposed residential or commercial land use development projects and/or potential improvements to the regional transportation network.

CDM Smith is not, and has not been, a municipal advisor as defined in federal law (the Dodd Frank Bill) to MWAA and does not owe a fiduciary duty pursuant to Section 15B of the Exchange Act to MWAA with respect to the information and material contained in this report. CDM Smith is not recommending and has not recommended any action to MWAA. MWAA should discuss the information and material contained in this report with any and all internal and external advisors that it deems appropriate before acting on this information.

Chapter 6

Sensitivity Tests

The base case forecasts for the DTR shown previously in Chapter 5 are based on certain assumptions of future economic growth, gasoline prices and other factors. As noted, any forecast of the future is subject to considerable uncertainty. As such, most traffic and revenue forecasts to be used in support of project financing typically include sensitivity tests; in general these are intended to provide a general measure of the potential impact on the base case revenue forecasts associated with hypothetical changes in certain basic assumptions.

A series of sensitivity tests were run in two future years to provide a measure of the sensitivity of annual transactions and revenue to changes in key study assumptions. These sensitivity tests provide a comparison with base case revenue forecasts previously shown in Chapter 5.

The sensitivity tests were run for two discrete analysis years, namely 2015 and 2035 except for one test that was more appropriate to consider in 2020 and 2035. The assumed Main Line and ramp toll rates of \$2.50|\$1.00 and \$5.50|\$3.25, in 2015 and 2035 respectively, were used in all sensitivity tests presented in this Chapter. Six different sensitivity scenarios were run which are described below.

A summary of the sensitivity tests results is shown in Table 6-1. The upper line in the table shows base case revenue forecast at near-year and out-year levels. For each of the six sensitivity test scenarios described below, an alternative revenue forecast is shown, together with a calculation of the net impact on annual transactions and toll revenue and the percentage impact, plus or minus.

Lower Long Term Economic Growth

The base case forecasts were predicated upon the regional socioeconomic growth forecasts incorporated in the regional travel model as updated and refined by CDM Smith. These socioeconomic forecasts were reviewed for reasonableness and adjusted by the independent economist RPG as previously described. However, CDM Smith also tested alternative economic growth scenarios by lowering the socio-economic growth rate. Two hypothetical cases were simulated by simply lowering the rate of annual growth between the base year 2011 and future years 2015 and 2035 trip tables. First it was assumed that no trip growth would occur beyond the base year and second, trip tables were reduced by 25 percent from the base case trip growth obtained from RPG.

As can be noted from Table 6-1, the assumption of no trip growth results in an estimated 8.8 percent reduction in DTR transactions in 2015 and 27.7 percent in 2035 and demonstrates the contribution economic growth and of increasing congestion on alternate highways to the base case forecast. Toll revenues are estimated to decrease in line with transactions.

Also shown in Table 6-1, a scenario with a much greater likelihood, a decrease of 25% in the underlying trip table growth rate would lower annual transactions by an estimated 3.4 percent in 2015 and 8.5 percent in 2035. Toll revenues would be expected to reduce by an estimated 3.5 percent and 8.6 percent in 2015 and 2035, respectively.

Table 6-1
Sensitivity Test Results
Annual Transactions and Toll Revenue (thousands)

	Total Transactions		Toll Revenue	
Scenario	**2015**	**2035**	**2015**	**2035**
Base Case	98,040	98,950	$154,170	$410,300
Lower Economic Growth - No Growth(1)	89,430	71,580	$140,320	$297,150
Difference	*(8,610)*	*(27,370)*	*(13,840)*	*(113,150)*
Percent Difference	*-8.8%*	*-27.7%*	*-9.0%*	*-27.6%*
Lower Economic Growth - Reduce 25%(2)	94,710	90,580	$148,710	$374,870
Difference	*(3,330)*	*(8,370)*	*(5,460)*	*(35,440)*
Percent Difference	*-3.4%*	*-8.5%*	*-3.5%*	*-8.6%*
Higher Economic Growth - Increase 25%(3)	99,040	108,740	$155,600	$449,920
Difference	*+1,000*	*+9,790*	*+1,440*	*+39,620*
Percent Difference	*+1.0%*	*+9.9%*	*+0.9%*	*+9.7%*
Lower Value of Time - Decrease by 25%(4)	88,650	88,530	$139,070	$367,170
Difference	*(9,390)*	*(10,420)*	*(15,100)*	*(43,130)*
Percent Difference	*-9.6%*	*-10.5%*	*-9.8%*	*-10.5%*
Higher Gasoline Prices(5)	93,920	94,610	$147,460	$391,350
Difference	*(4,120)*	*(4,340)*	*(6,700)*	*(18,960)*
Percent Difference	*-4.2%*	*-4.4%*	*-4.3%*	*-4.6%*
	2020(7)	**2035**	**2020**(7)	**2035**
Accelerate Capital Investments Five Years(6)	95,200	99,470	$150,000	$413,190
Difference	*(2,840)*	*+520*	*(4,170)*	*+2,890*
Percent Difference	*-2.9%*	*+0.5%*	*-2.7%*	*+0.7%*

(1) Assumes no future growth in trips.
(2) Assumes decrease of 25 precent over base trip table growth.
(3) Assumes increase of 25 percent over base trip table growth.
(4) Assumes decrease of 25 percent over base value of time.
(5) Assumes gasoline prices increase to $5/gallon; reduce total regional trips by 4 percent.
(6) Assumes capital improvement projects brought forward by five years.
(7) Near-Year tests generally performed in 2015, except accelerated capital improvements run in 2020.

Higher Long Term Economic Growth

The underlying trip table growth in this hypothetical case was obtained by increasing the rate of annual growth between the base year 2011 and future year trip tables by 25 percent from the base case trip growth obtained from the independent economist RPG. As a result of this, annual transactions would be expected to increase by an estimated 1.0 percent in 2015 and 9.9 percent in 2035. Furthermore, toll revenues would be expected to increase by an estimated 0.9 percent and 9.7 percent in 2015 and 2035, respectively.

Lower Value of Time

CDM Smith has relatively good information on estimated value of time in the Washington D.C. region from previous stated preference surveys. The value of time can be difficult to perfectly predict into the future. As such, one sensitivity test was performed considering the potential impact on the DTR traffic of a 25 percent lower value of time than assumed in the base case.

Traffic assignments were repeated for 2015 and 2035 calendar year levels using a lower value of time, but retaining the toll rates in the base assignments. As noted from Table 6-1, a decrease of 25% in the underlying trip table growth rate could lower the annual transactions by an estimated 9.6 percent in 2015 and 10.5 percent in 2035. Toll revenues would be expected to lower by an estimated 9.8 percent and 10.5 percent in 2015 and 2035, respectively.

Higher Gasoline Prices

The base case forecast reflects an assumption of gasoline prices remaining around the 2011 fuel price average, i.e. approximately $3.50 per gallon and then increase in proportion to general prices thereafter.

A sensitivity test was performed assuming gas prices increase to $5.00 in real terms in 2015 and 2035. Vehicle operating cost factors, of which a component is fuel costs, were adjusted accordingly. More significantly, it was assumed that $5.00 gasoline prices would also result in a reduction in total regional travel of approximately 4 percent for purposes of this test.

Under this hypothetical scenario, total annual transactions are estimated to reduce by 4.2 percent in 2015 and 4.4 percent in 2035 compared to the base case forecast. This loss in annual transactions is estimated to have a negative impact on total toll revenues of approximately 4.3 percent and 4.6 percent in 2015 and 2035 respectively.

Accelerated Capital Investments

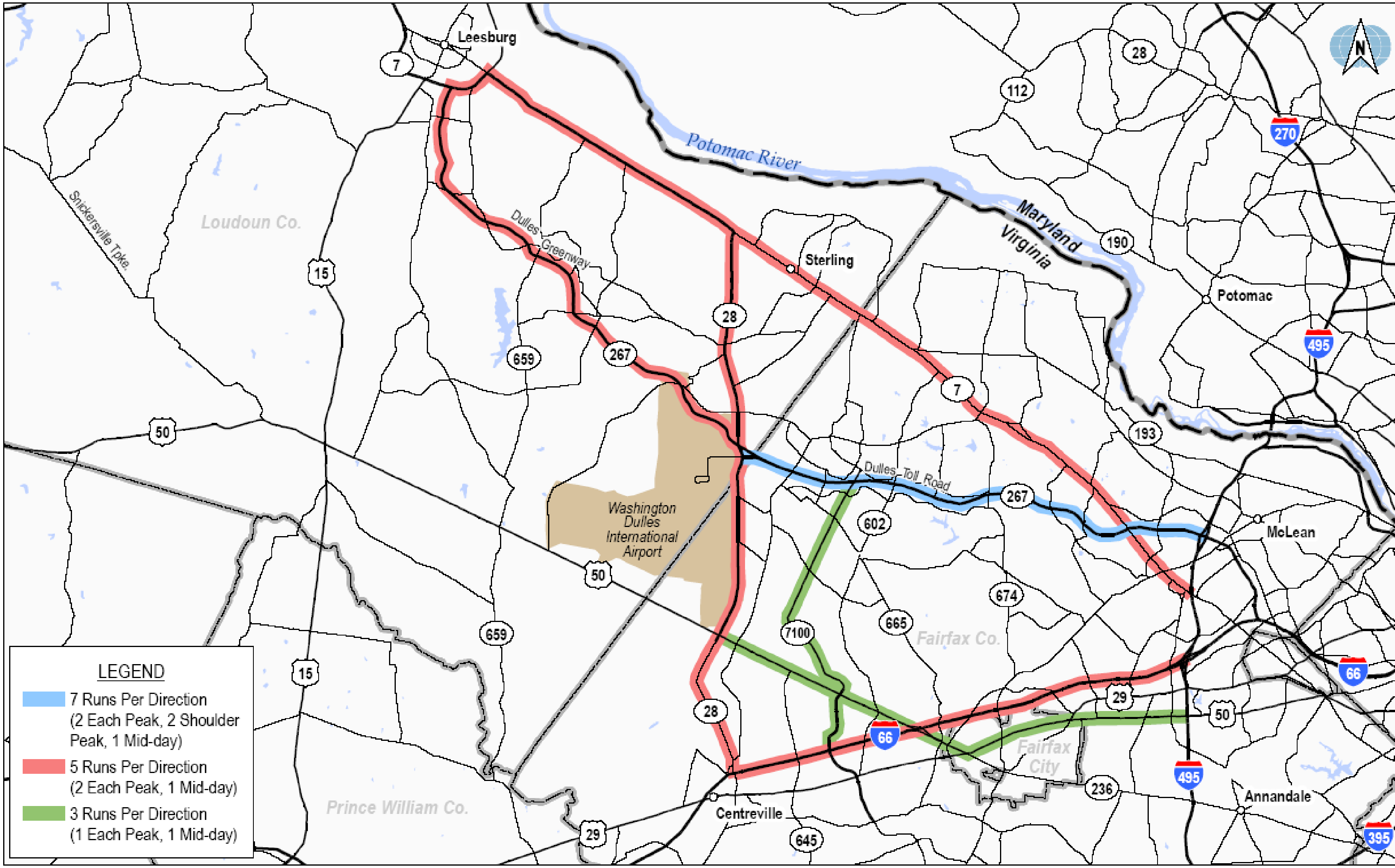
The refined regional travel model developed by CDM Smith contains assumptions on future transportation infrastructure projects that could have an impact on travel in the Dulles Corridor. These include improvements and new infrastructure that could have negative or positive impacts to the Dulles Toll Road. To test the sensitivity of the base case traffic and revenue forecast to the timing of these other projects CDM Smith ran models to estimate the impact. Models were run in 2020 and 2035 with the near-year being considered in 2020 rather than 2015 as it is unrealistic to assume projects could be delivered in 2015; it was decided 2020 would be a more reasonable year in which to test this impact following the assumed opening of Phase 2 of Dulles Metrorail in 2018.

As shown in Table 6-1, accelerating projects by five years is estimated to reduce traffic and toll revenue in 2020 by 2.9 percent and 2.7 percent respectively. This indicates that future projects otherwise assumed to be built in the five years post-2020 will, overall, tend to divert some traffic away from the Dulles Toll Road, albeit small. Conversely, the sensitivity test for 2035 indicates a small positive estimated impact of 0.5 percent to transactions and 0.7% to toll revenues due to accelerating projects that would otherwise have been assumed for the post-2035 period.

Appendix A

Journey Time Survey Results

MCV Associates Inc.



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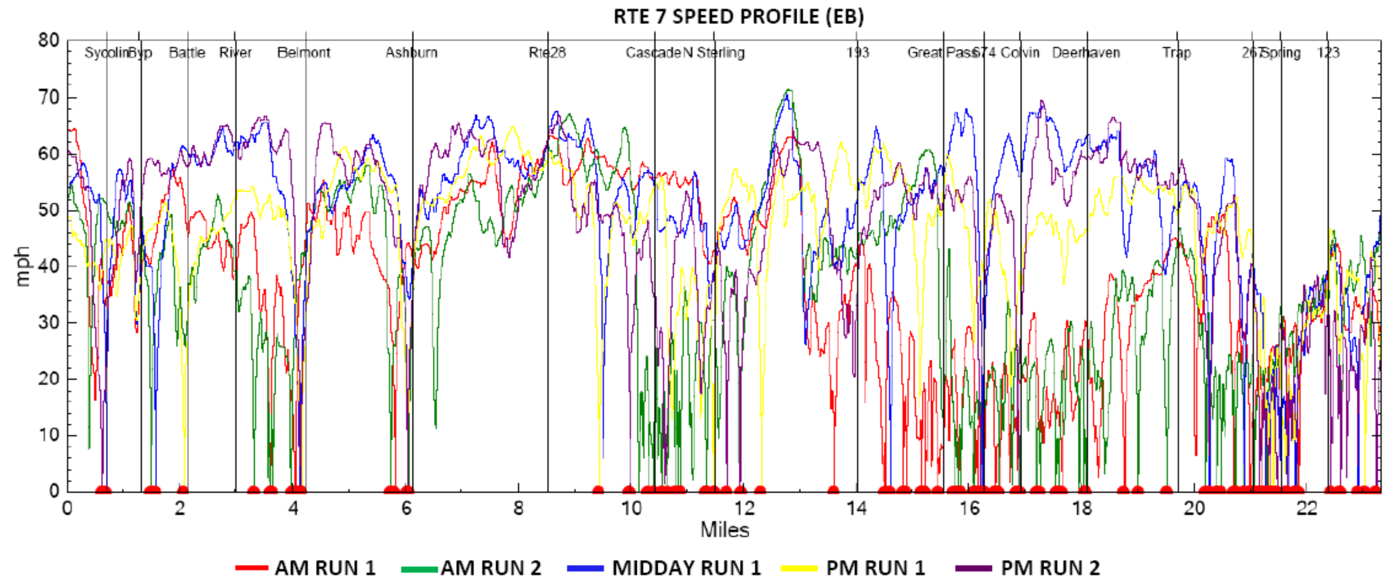
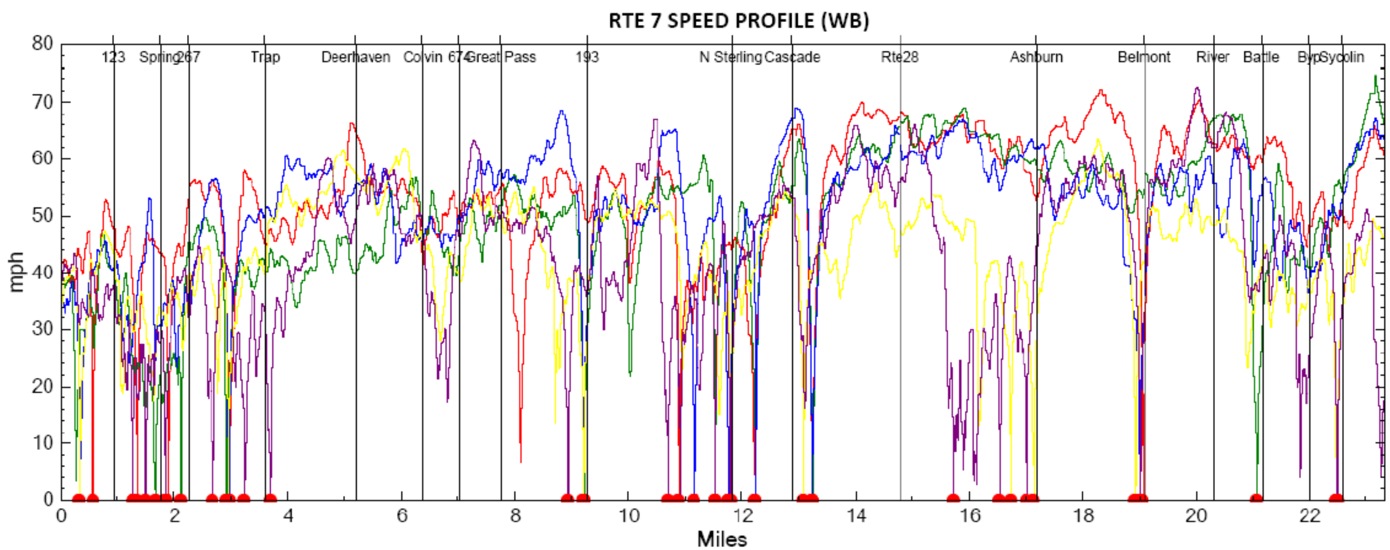
Journey Time Survey Route Map

Exhibit 1





MCV ASSOCIATES, INC
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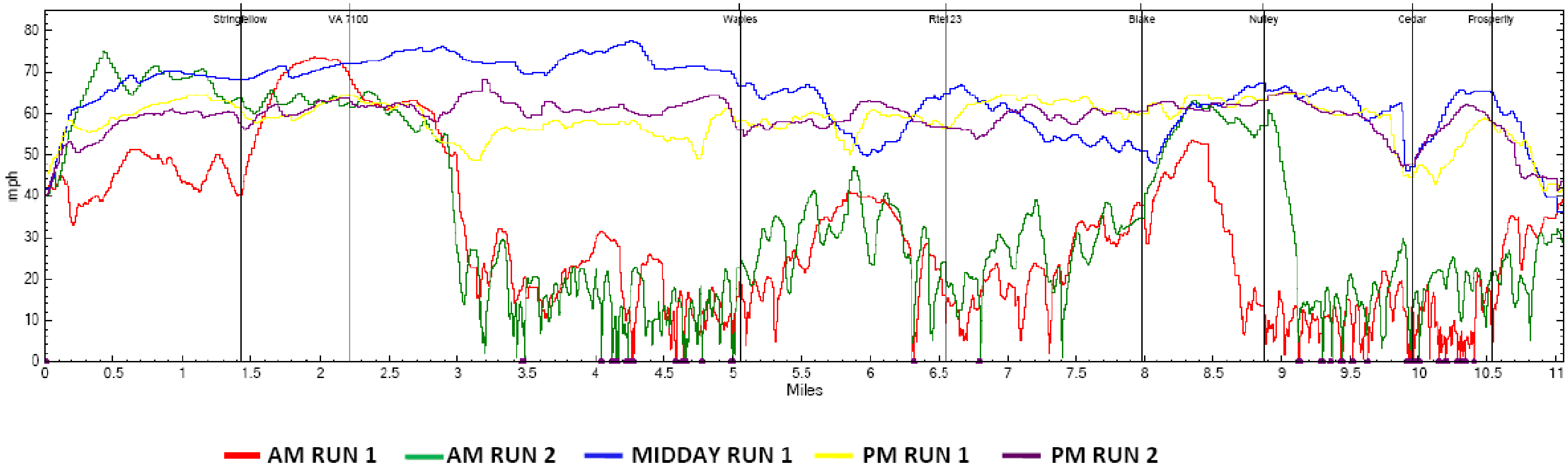
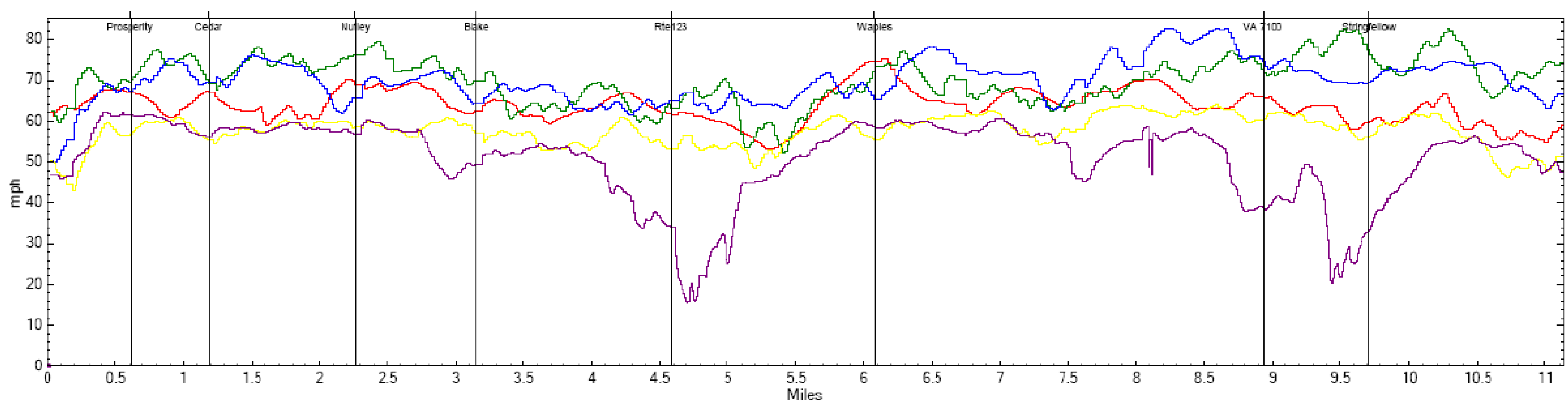
Speed Profile-Rte 7 (EB & WB)

Exhibit 2

I-66 SPEED PROFILE (EB)



I-66 SPEED PROFILE (WB)



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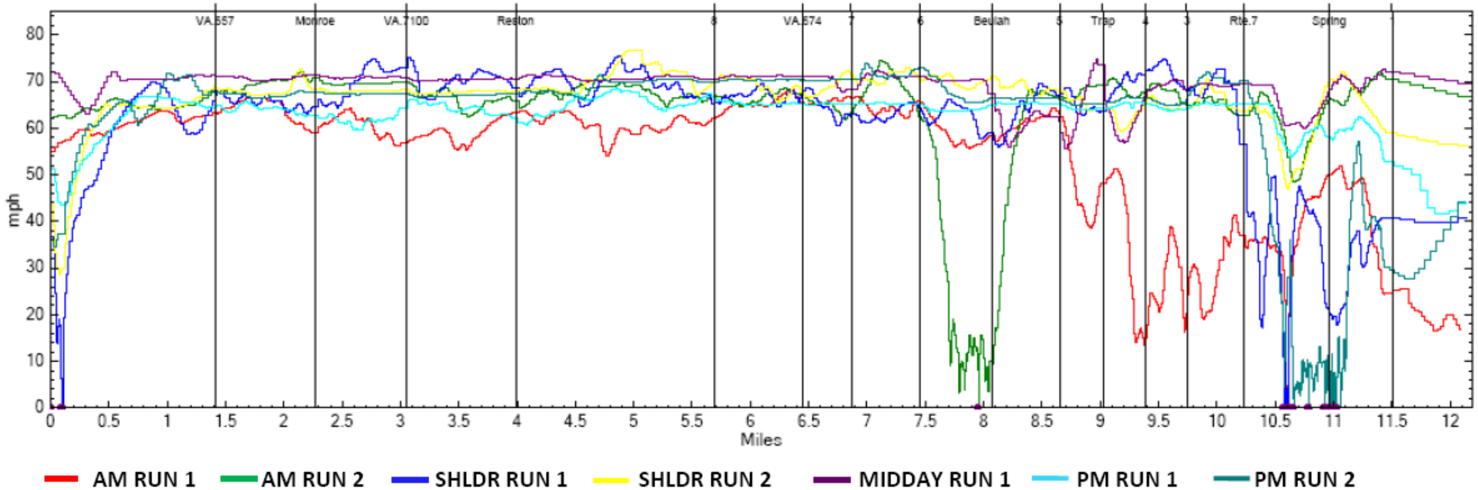
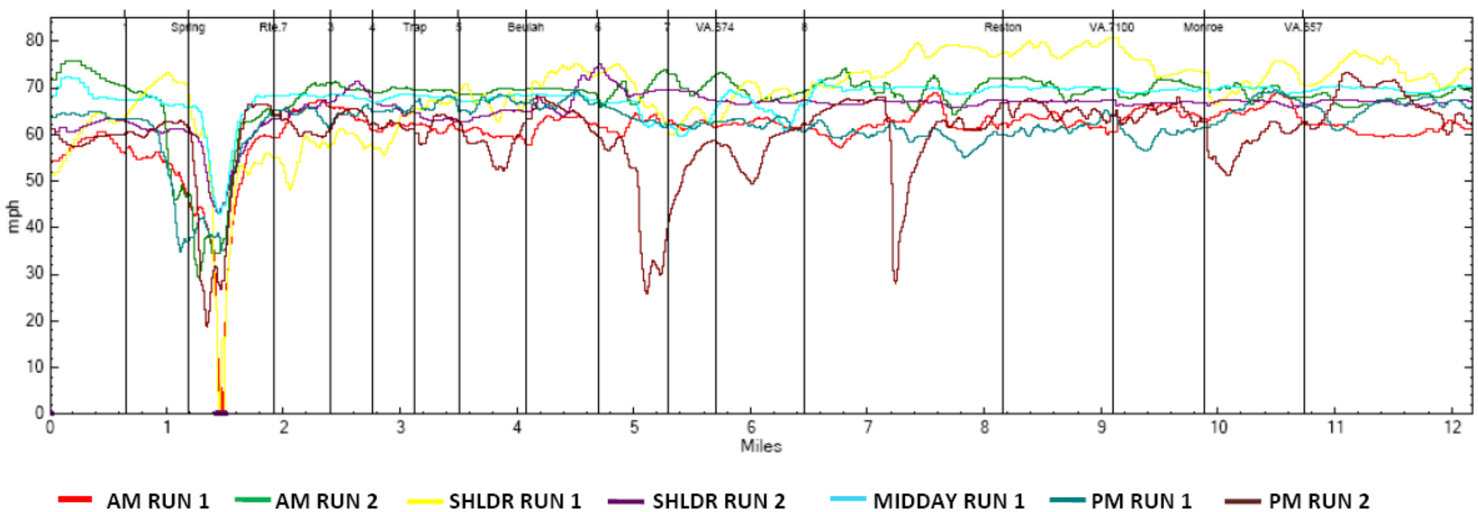
Speed Profile- I-66 (EB & WB)	Exhibit 3

DTR SPEED PROFILE (EB)



DTR SPEED PROFILE (WB)



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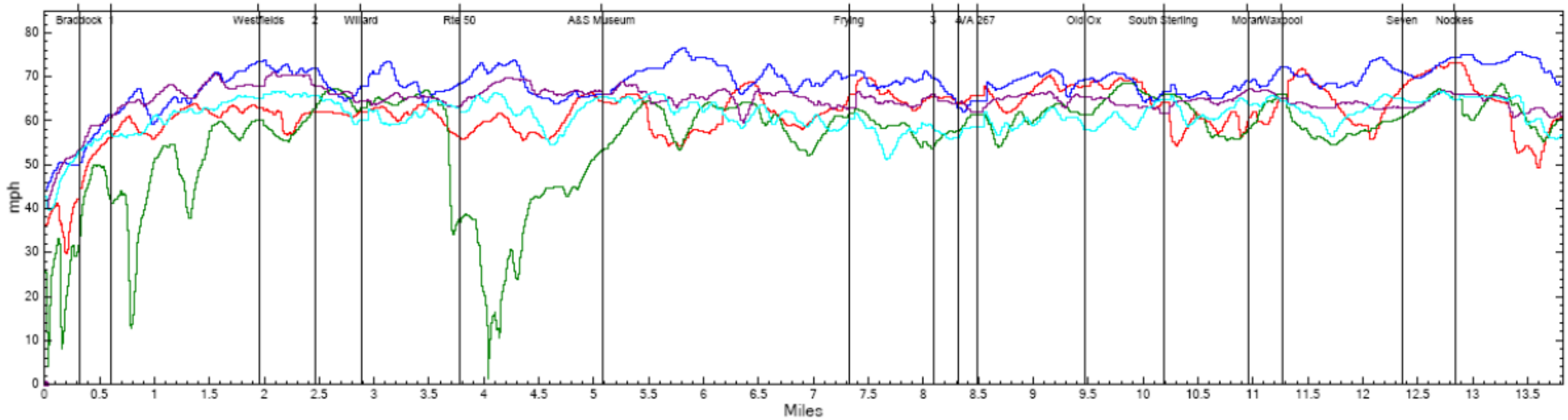
Speed Profile- DTR (EB & WB)

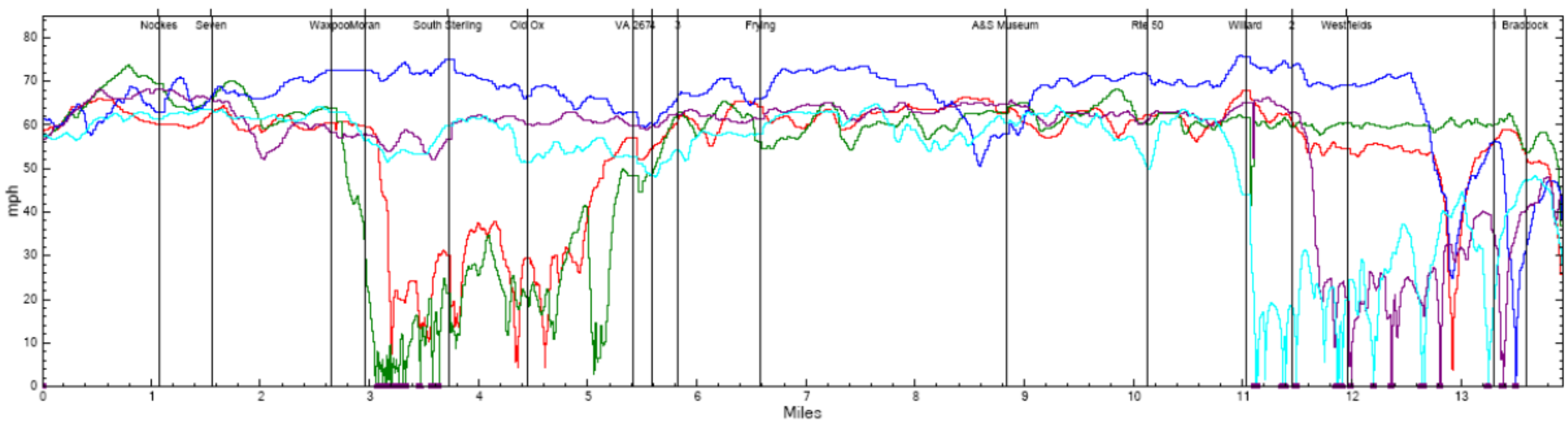
Exhibit 4

RTE 28 SPEED PROFILE (NB)



AM RUN 1 | AM RUN 2 | MIDDAY RUN 1 | PM RUN 1 | PM RUN 2

RTE 28 SPEED PROFILE (NB)



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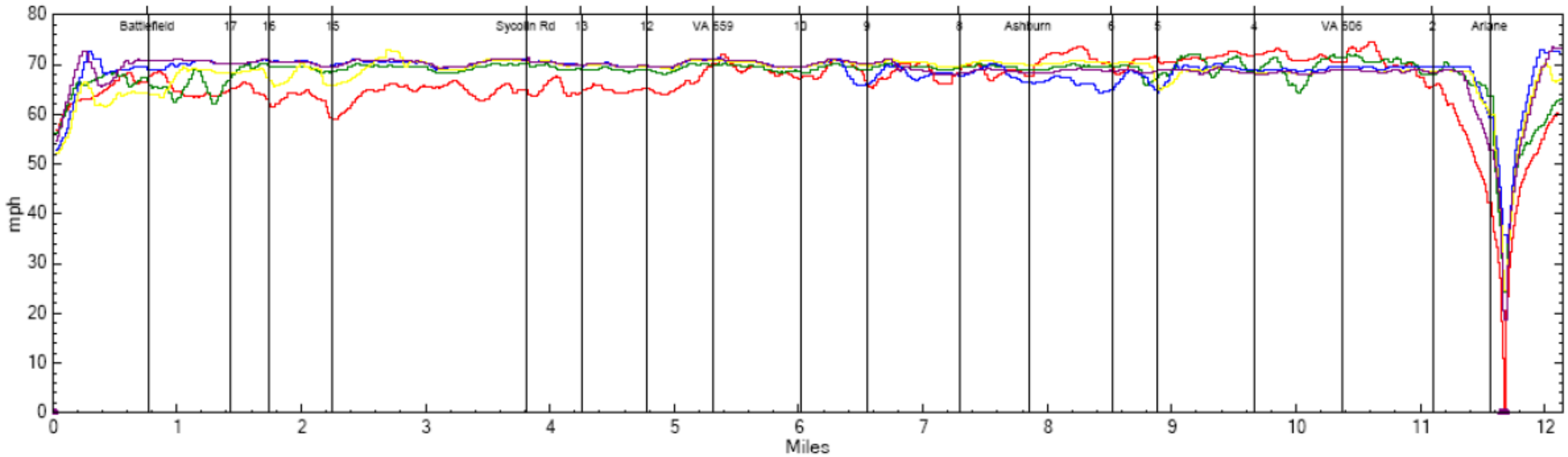
Speed Profile- RTE 28 (NB & SB)

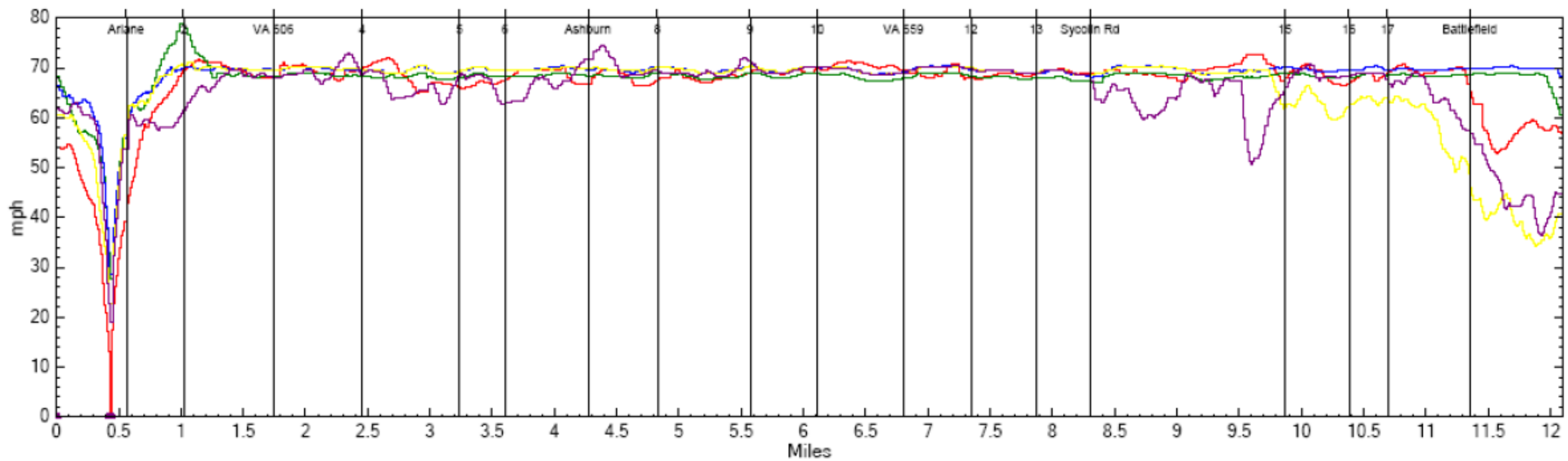
Exhibit 5

GREENWAY SPEED PROFILE (EB)



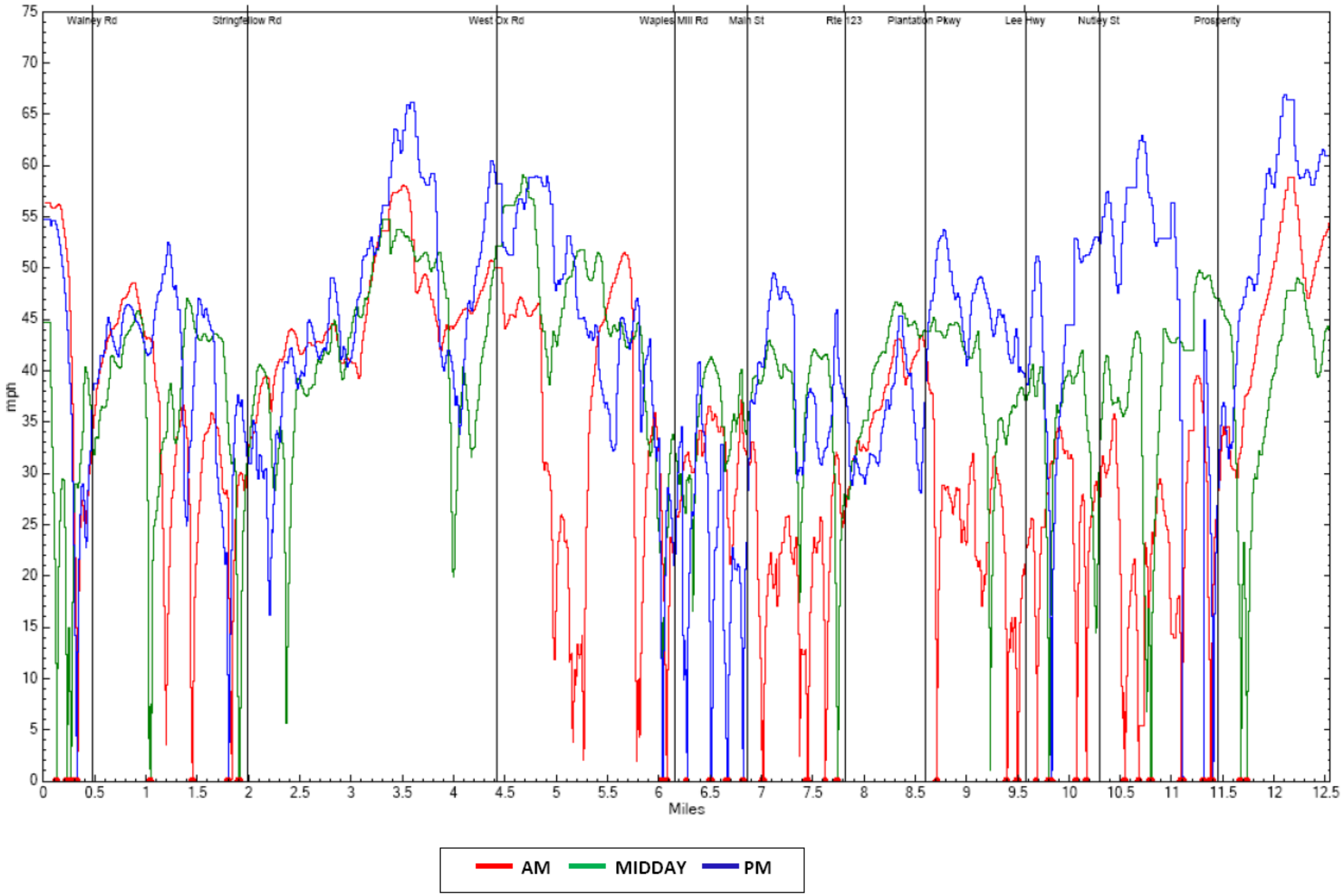
AM RUN 1 AM RUN 2 MIDDAY RUN 1 PM RUN 1 PM RUN 2

GREENWAY SPEED PROFILE (WB)



MCV Associates, Inc Planning . Engineering . Information Technology	Speed Profile- GREENWAY (EB & WB)	Exhibit 6

RTE 50 SPEED PROFILE (EB)



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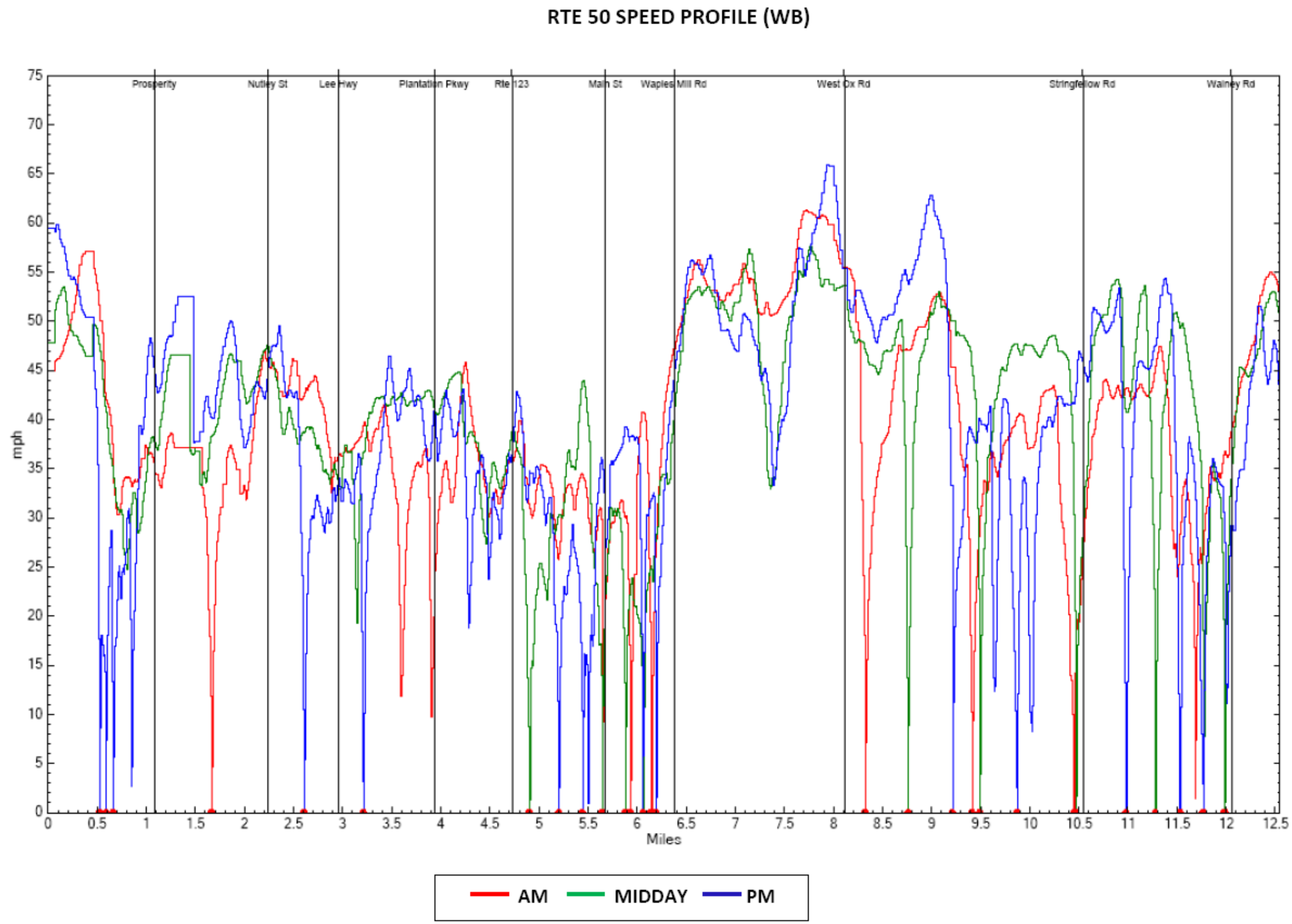
Speed Profile- RTE 50 (EB)

Exhibit 7



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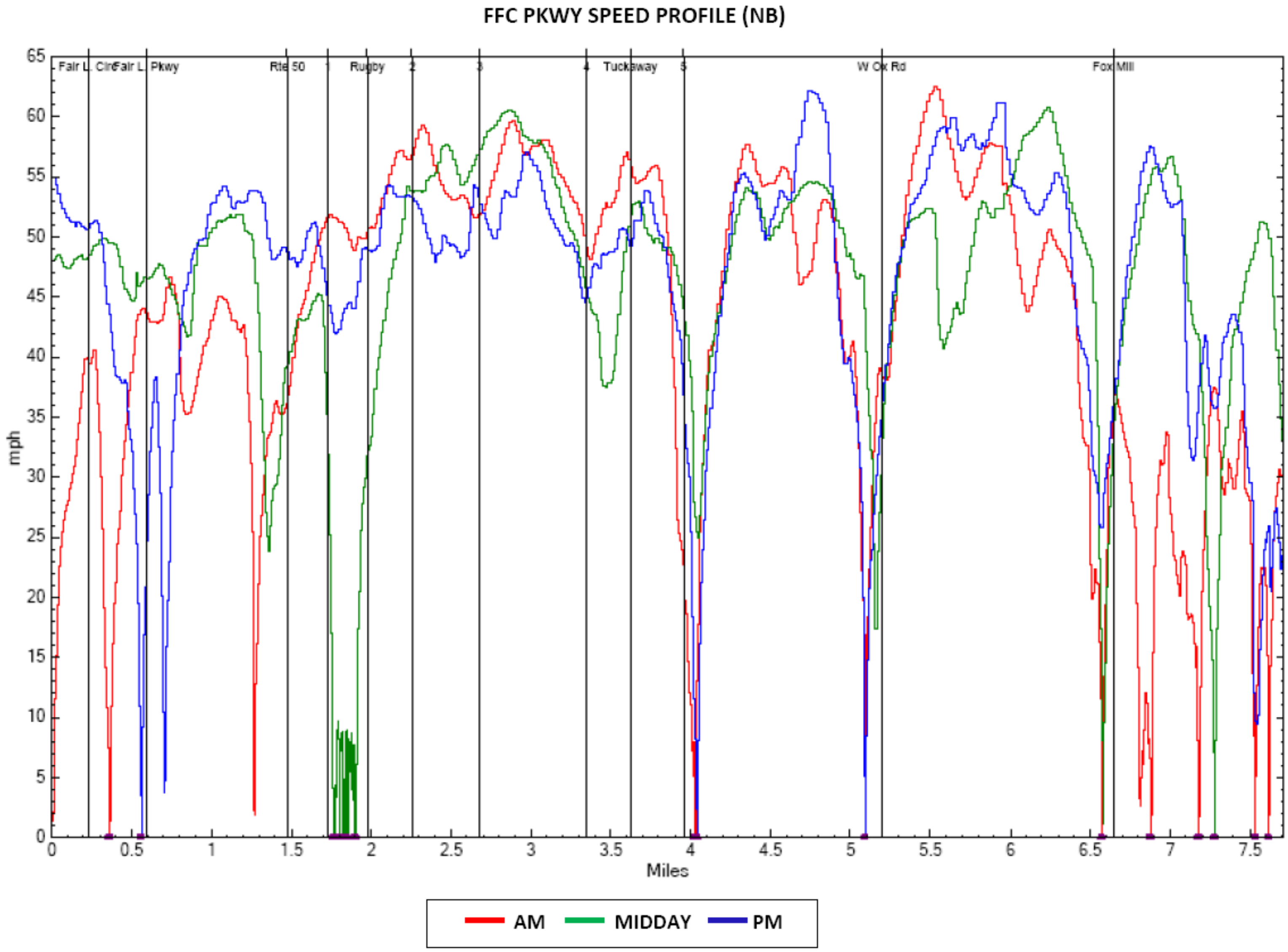
Speed Profile- RTE 50 (WB)

Exhibit 8



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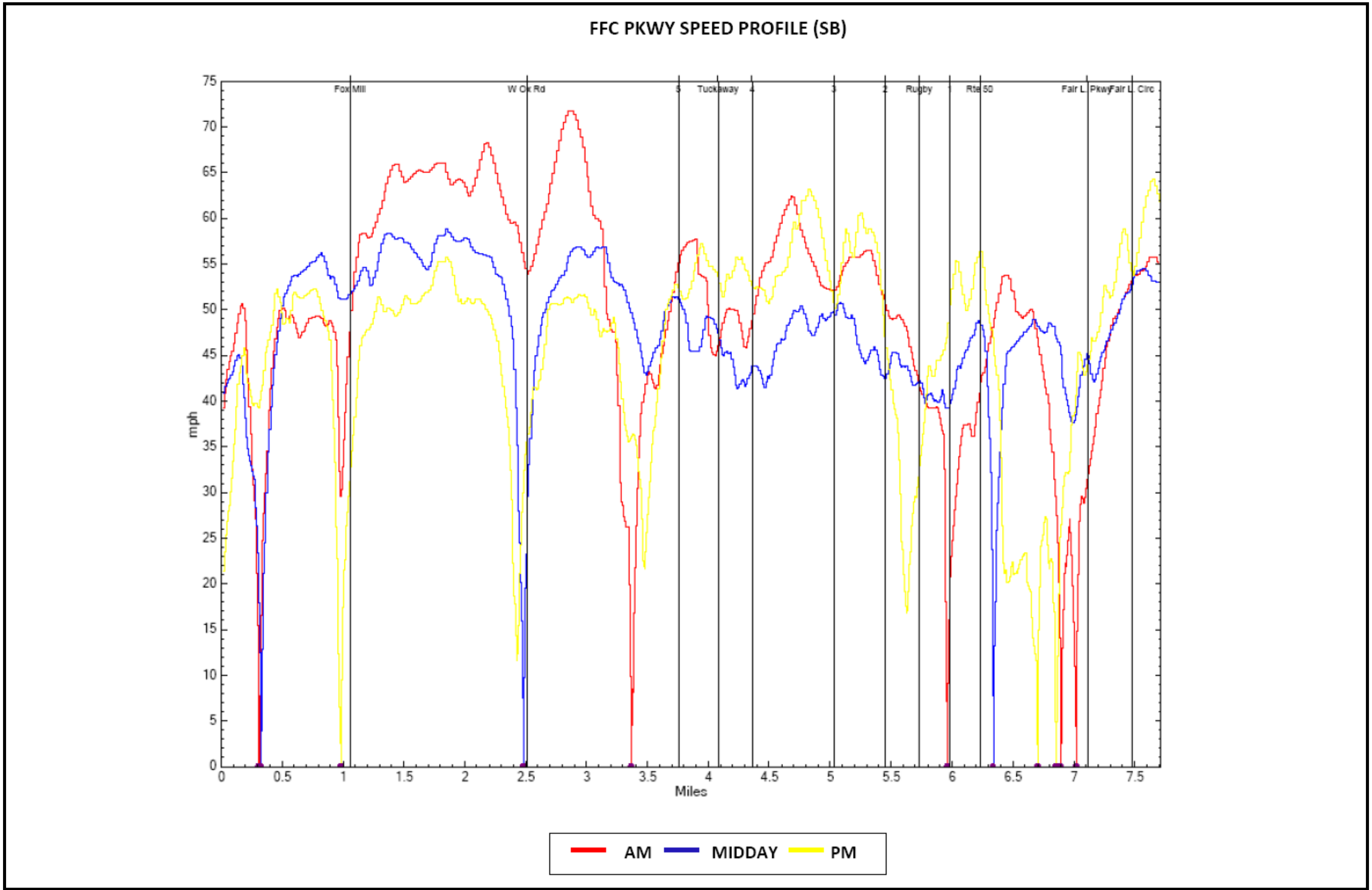
Speed Profile- FFC PKWY (NB)

Exhibit 9



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Speed Profile- FFC PKWY (SB)

Exhibit 10

EB/NB											
				RUN 1 START TIME				**RUN 2 START TIME**			
	CORRIDOR	**BETWEEN**	**DISTANCE (ONEWAY)**	**AM**	**SHOULDER**	**MID DAY**	**PM**	**AM**	**SHOULDER**	**MID DAY**	**PM**
				6-9AM	**9-10AM/2-3PM**	**11-1PM**	**3-7PM**	**6-9AM**	**9-10AM/2-3PM**	**11-1PM**	**3-7PM**
1	Greenway	Rte 28 & Leesburg Bypass	14.5 MILES	8:44 AM		11:57 AM	5:22 PM	9:15 AM			5:58 PM
2	DTR	I495 & Rte 28	12.6 MILES	8:57 AM	9:48 AM	12:09 PM	3:58 PM	9:27 AM	9:58 AM		4:32 PM
3	Rte 28	I 66 & Rte 7	14.5 MILES	6:43 AM		11:13 AM	3:09 PM	7:21 AM			3:54 PM
4	FFC Pkwy	I 66 & DTR	8 MILES	8:04 AM		11:00 AM	3:02 PM				
5	Rte 50	I 495 & Rte 28	13 MILES	6:56 AM		12:32 PM	3:39 PM				
6	I-66	I 495 & Rte 28	12 MILES	8:11 AM		12:18 PM	3:15 PM	8:14 AM			3:55 PM
7	Rte 7	I 495 & Leesburg Bypass	22.5 MILES	6:38 AM		11:43 AM	3:38 PM	8:22 AM			5:26 PM
WB/SB											
				RUN 1 START TIME				**RUN 2 START TIME**			
	CORRIDOR	**BETWEEN**	**DISTANCE (ONEWAY)**	**AM**	**SHOULDER**	**MID DAY**	**PM**	**AM**	**SHOULDER**	**MID DAY**	**PM**
				6-9AM	**9-10AM/2-3PM**	**11-1PM**	**3-7PM**	**6-9AM**	**9-10AM/2-3PM**	**11-1PM**	**3-7PM**
1	Greenway	Rte 28 & Leesburg Bypass	14.5 MILES	8:25 AM		11:39 AM	5:02 PM	8:57 AM			5:40 PM
2	DTR	I495 & Rte 28	12.6 MILES	8:11 AM	9:33 AM	11:28 AM	3:43 PM	8:46 AM	9:44 AM		4:17 PM
3	Rte 28	I 66 & Rte 7	14.5 MILES	7:02 AM		11:31 AM	3:28 PM	7:44 AM			4:13 PM
4	FFC Pkwy	I 66 & DTR	8 MILES	8:27 AM		11:19 AM	3:22 PM				
5	Rte 50	I 495 & Rte 28	13 MILES	6:30 AM		12:04 PM	3:06 PM				
6	I-66	I 495 & Rte 28	12 MILES	6:31 AM		11:00 AM	3:00 PM	7:58 AM			3:38 PM
7	Rte 7	I 495 & Leesburg Bypass	22.5 MILES	6:04 AM		10:55 AM	2:53 PM	7:39 AM			4:25 PM

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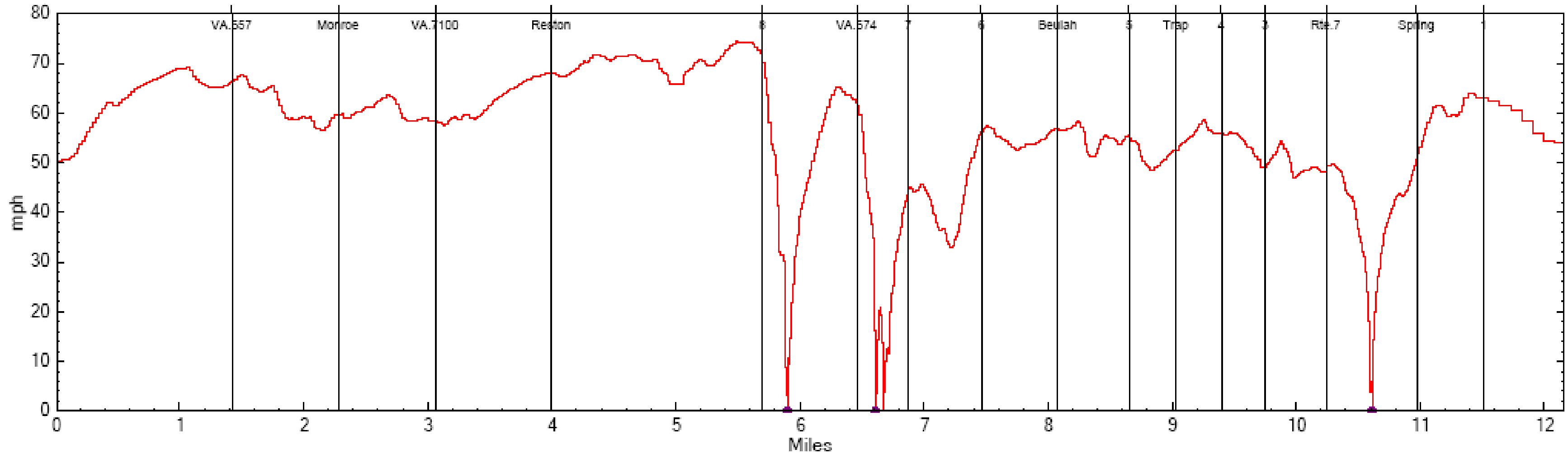
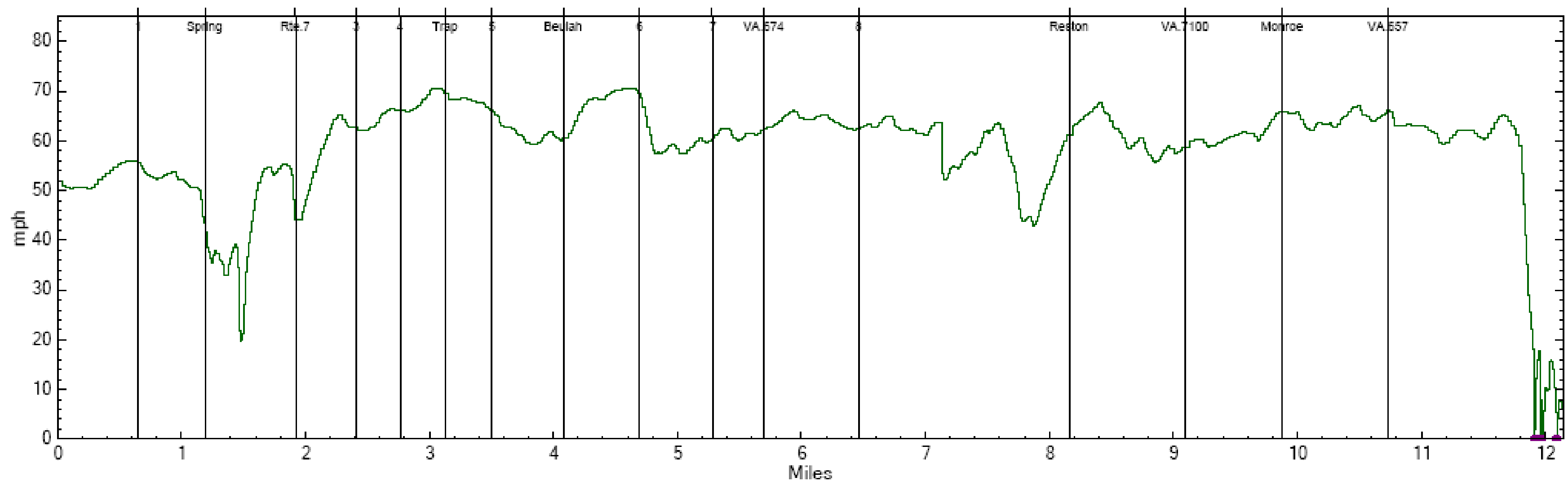
GPS Run Start Time

Exhibit-11



DTR-EB (AM)



DTR-WB (PM)

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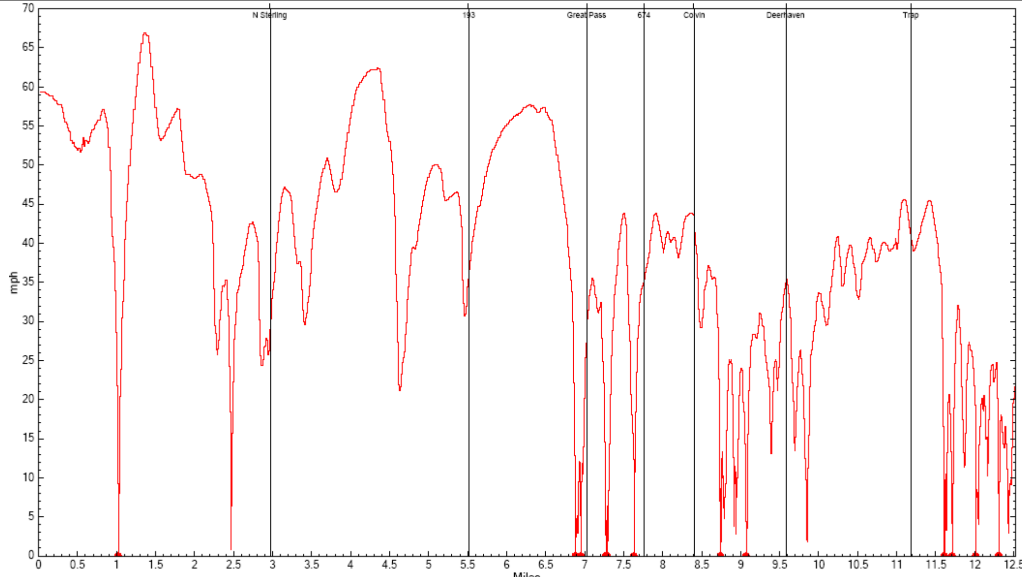
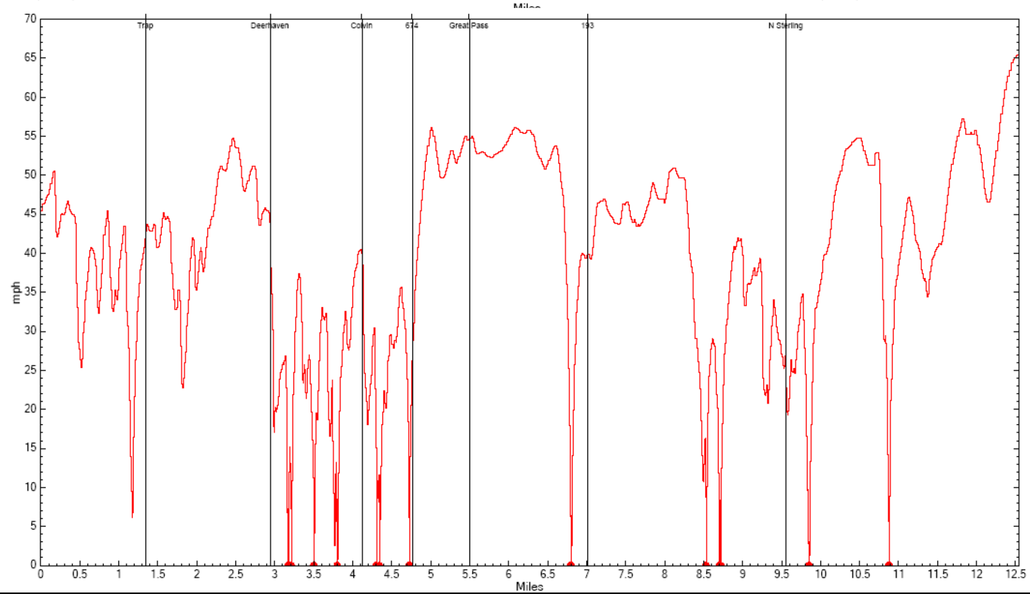
Speed Profile- DTR (EB & WB)

Exhibit-12



Rte. 7-EB (AM)



Rte. 7-WB (PM)

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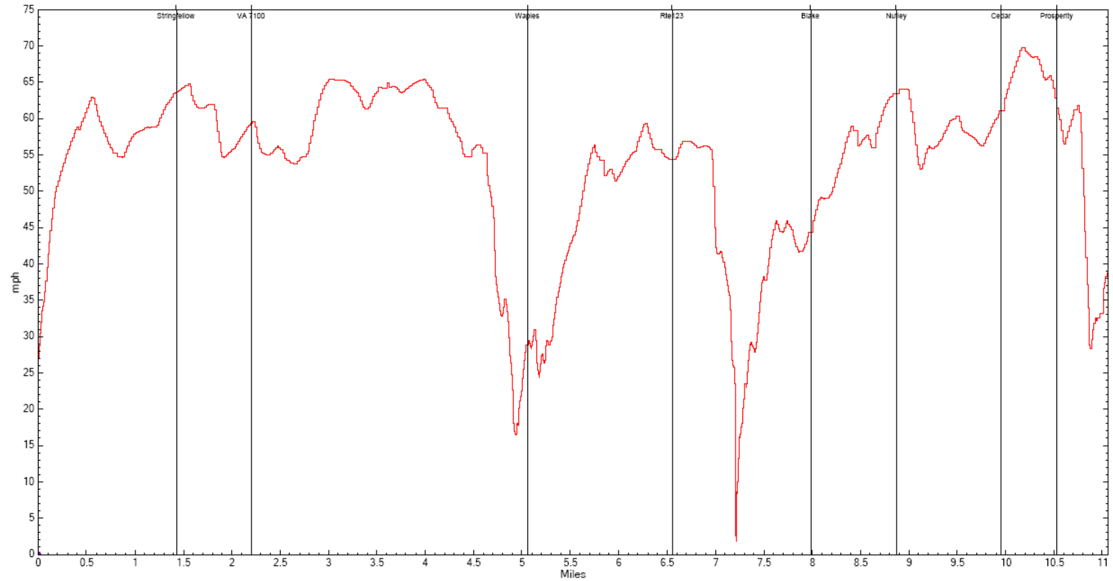
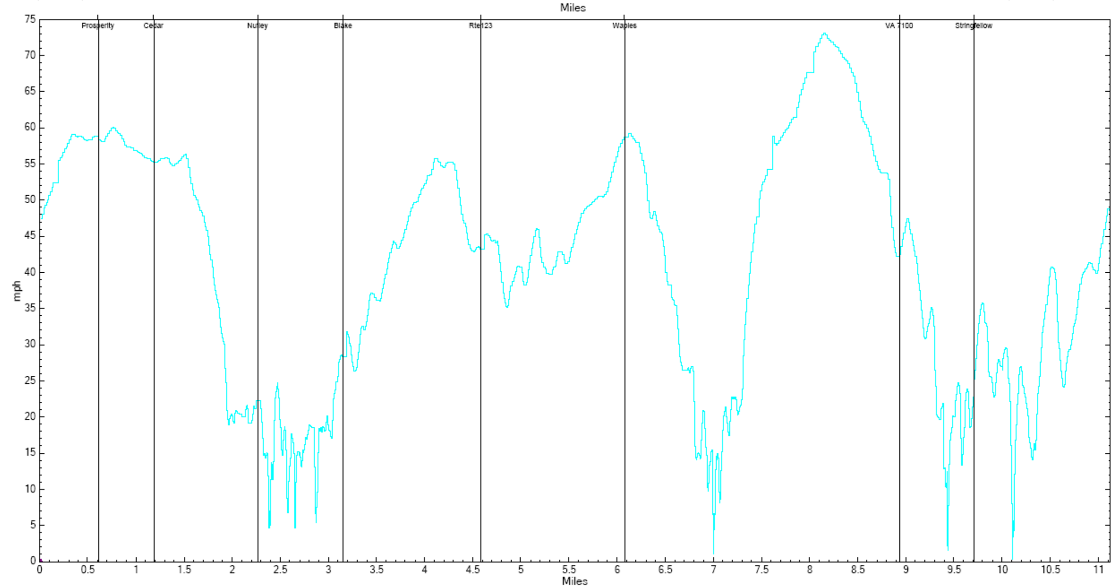
Speed Profile- Rte. 7 (EB & WB)

Exhibit-13



I-66 EB (AM)



I-66 WB (PM)

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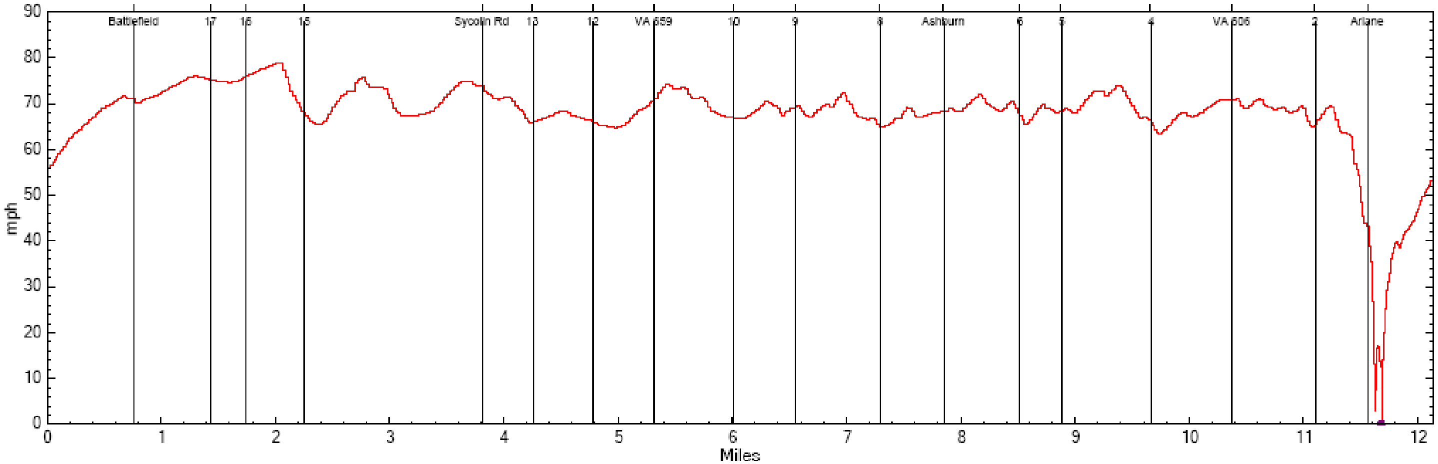
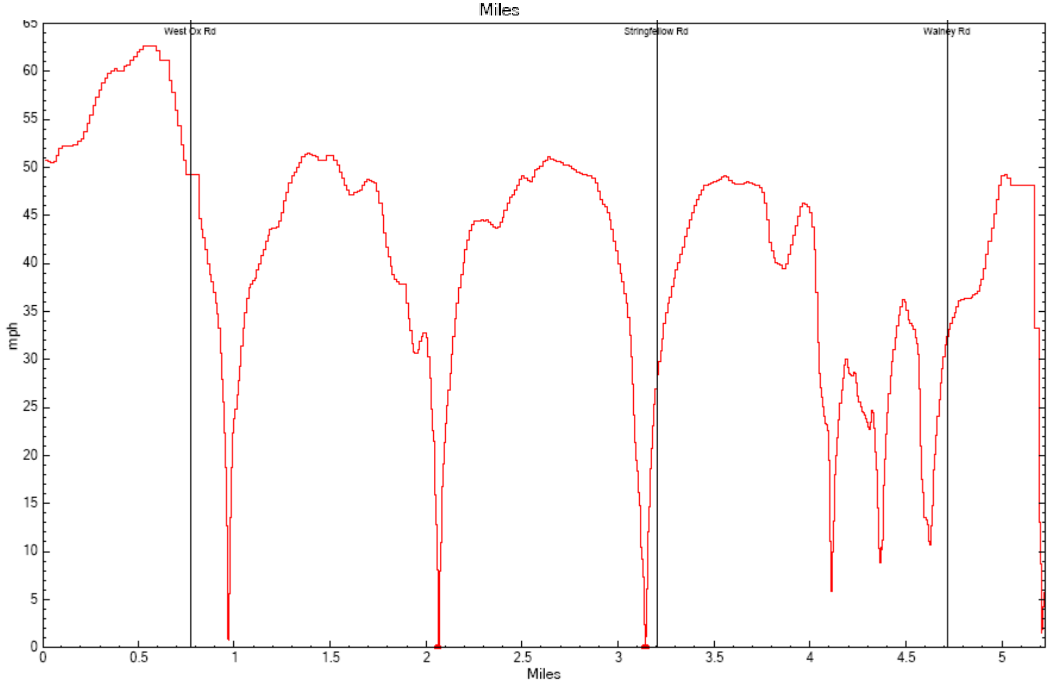
Speed Profile- I-66 (EB & WB)

Exhibit-14

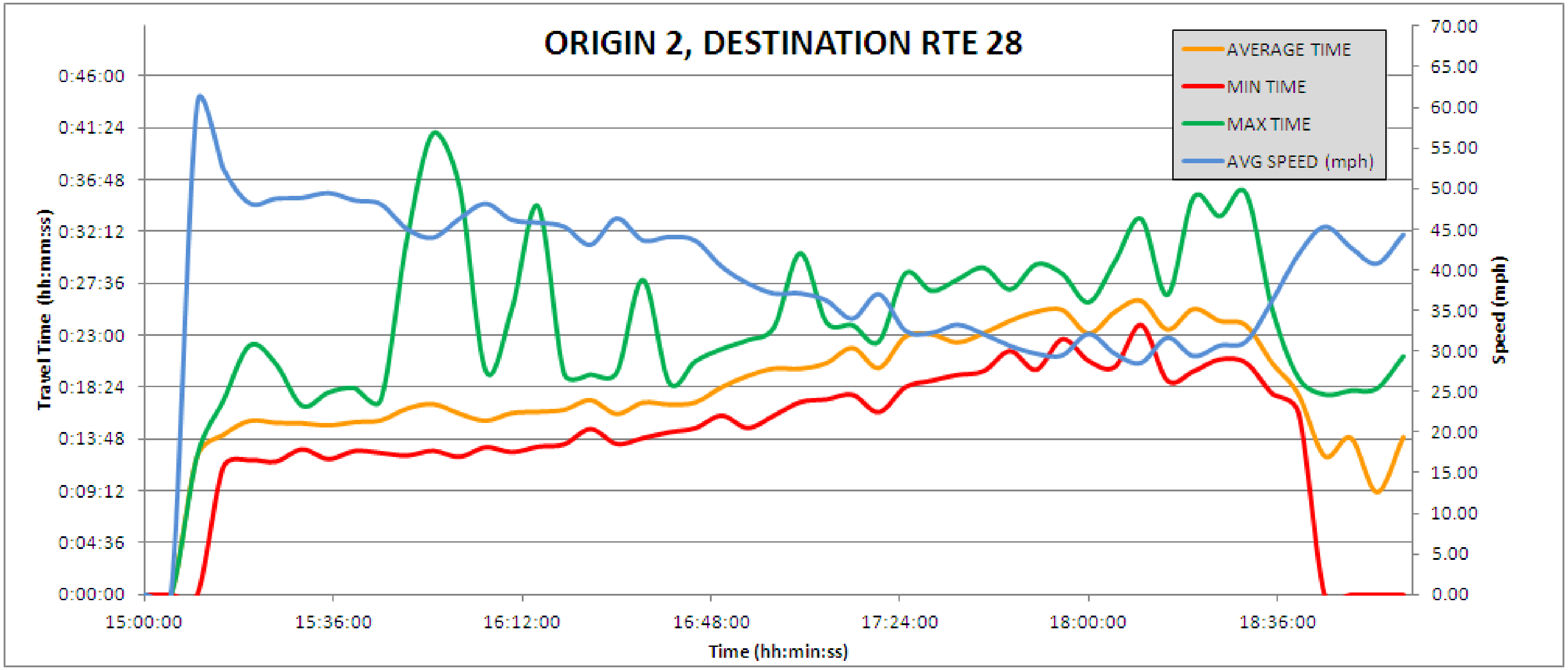


Greenway EB (AM)



Rte 50 WB (PM)

PLANNING . ENGINEERING . INFORMATION TECHNOLOGY	Speed Profile- Greenway EB (AM) & Rte. 50 WB (PM)	Exhibit-15



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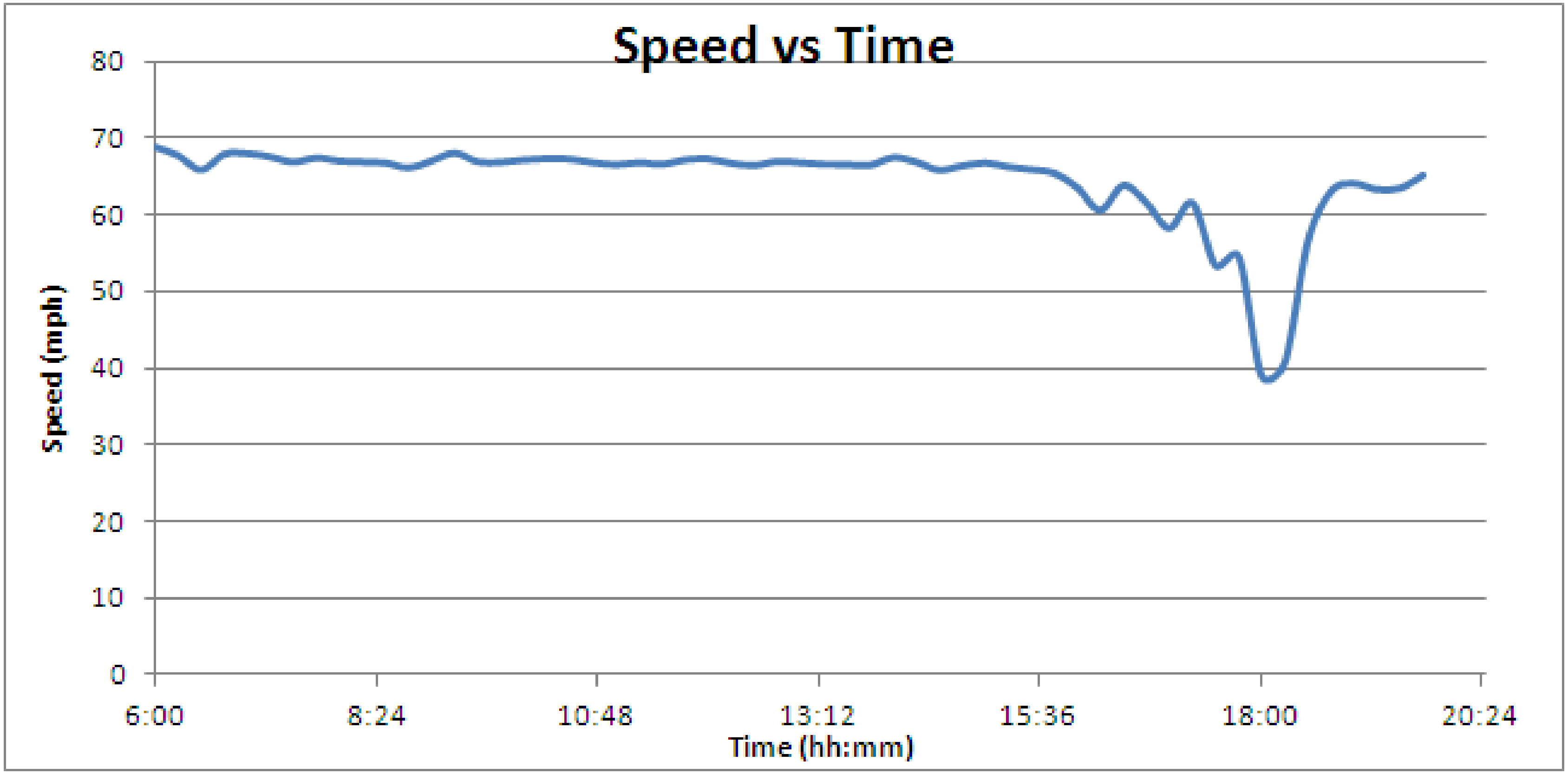
Travel Time/Speed Between Capital Beltway and Rte. 7

Exhibit 16



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Average Speed on DTR WB Near Rt 7

Exhibit 17

Appendix B

Stated Preference Design, Survey, and Results

APPENDIX B

STATED PREFERENCE SURVEY RESULTS

This appendix contains the script and the survey results from the on-line stated preference survey.

MWAA Title	Metropolitan Washington Airports Authority www.mwaa.com STATED PREFERENCE SURVEY – 2008
Intro Page 1	Dear Dulles Toll Road Customer: The Metropolitan Washington Airports Authority (MWAA), in conjunction with the Virginia Department of Transportation (VDOT), are working to improve your driving experience on the Dulles Toll Road (DTR) corridor. As part of this effort, the MWAA previously conducted an origin/destination survey. On that survey, you supplied your e-mail address indicating you would be interested in participating in a follow-up survey. This new survey is intended to seek your input on travel preferences in the DTR corridor. At the end of the survey, you will be given an opportunity to enter into a random drawing for a Visa gift card.
Intro Page 2	The survey has three parts. Part 1. Background Travel Information • This is similar to the survey you responded to before. Part 2. Stated Preference Study • You will be asked to choose between various travel options.

<table>
<tr><td></td><td>Part 3. Demographic Information
This is to ensure a representative sample is collected.
Individual survey responses will not be reported.

The survey will take 15-20 minutes to complete.</td></tr>
<tr><td>Part 1 Intro</td><td>STATED PREFERENCE SURVEY
PART 1 – Background Information

For this part of the survey, please think about the most recent one-way trip you made which included the Dulles Toll Road (e.g. either from home to work or from work to home).

All the questions in this part of the survey will ask you about this trip.</td></tr>
<tr><td>Origin</td><td>Where did this trip begin?

<table>
<tr><th></th><th>Frequency</th><th>Percentage</th></tr>
<tr><td>The District of Columbia</td><td>58</td><td>5.4%</td></tr>
<tr><td>Alexandria City, Virginia</td><td>20</td><td>1.9%</td></tr>
<tr><td>Arlington County, Virginia</td><td>67</td><td>6.3%</td></tr>
<tr><td>Fairfax County, Virginia</td><td>510</td><td>47.8%</td></tr>
<tr><td>Loudoun County, Virginia</td><td>277</td><td>26.0%</td></tr>
<tr><td>Maryland</td><td>83</td><td>7.8%</td></tr>
<tr><td>Elsewhere</td><td>44</td><td>4.1%</td></tr>
<tr><td>No answer</td><td>8</td><td>0.7%</td></tr>
</table>

“Elsewhere” answers included:
Dover, DE
Pennsylvania
North Carolina
Ohio
San Antonio, TX
Charles Town, VA
Clarke County, VA
Falls Church City, VA
Fauquier County, VA
Fredrick County, VA
Fredericksburg, VA
Gainesville, VA
Herndon, VA
Manassas, VA
Purceville [sic], VA
Prince William County, VA
Reston, VA
Richmond, VA
Springfield, VA
Winchester, VA</td></tr>
</table>

	Woodbridge, VA Harpers Ferry, WV Jefferson County, WV Shepherdstown, WV
Destination	Where did this trip end?

	Frequency	Percentage
The District of Columbia	122	11.4%
Alexandria City, Virginia	21	2.0%
Arlington County, Virginia	68	6.4%
Fairfax County, Virginia	542	50.8%
Loudoun County, Virginia	178	16.7%
Maryland	78	7.3%
Elsewhere	49	4.6%
No answer	9	0.8%

Origin Zip

What is the 5-digit zip code in where you began this trip?

If you do not know the zip code, please enter 00000.

Zip codes reported:

10058	18470	19901	20001
20002	20003	20004	20005
20006	20007	20008	20009
20010	20012	20016	20018
20024	20036	20041	20043
20071	20105	20110	20111
20120	20121	20124	20131
20132	20135	20141	20147
20148	20151	20152	20155
20158	20164	20165	20166
20169	20170	20171	20175
20176	20180	20190	20191
20194	20250	20374	20503
20523	20531	20544	20554
20591	20593	20677	20706
20707	20708	20715	20716
20736	20737	20744	20746
20772	20783	20785	20812
20814	20815	20816	20817
20818	20832	20841	20850
20851	20852	20853	20854
20855	20866	20876	20878
20879	20889	20892	20895
20901	20902	20910	20911
21035	21043	21045	21070
21122	21227	21702	21703
21788	21793	22003	22015
22027	22030	22031	22032

	22033 22037 22041 22042 22043 22044 22046 22066 22092 22101 22102 22103 22104 22108 22122 22124 22134 22151 22152 22171 22180 22181 22182 22191 22201 22202 22203 22204 22205 22206 22207 22209 22213 22215 22226 22292 22301 22302 22303 22304 22306 22307 22308 22310 22312 22314 22315 22405 22408 22508 22601 22611 22624 22625 22742 25414 25425 27949 30194 45440 78216
Dest Zip	What is the 5-digit zip code in where your trip ended in <DESTINATION>? If you do not know the zip code, please enter 00000. Zip codes reported: 19901 19958 19966 20001 20002 20003 20004 20005 20006 20007 20008 20009 20010 20015 20016 20018 20024 20026 20032 20036 20037 20049 20066 20105 20109 20110 20120 20122 20124 20139 20141 20142 20142 20147 20148 20151 20152 20163 20164 20165 20166 20170 20171 20172 20175 20176 20180 20184 20190 20191 20192 20194 20196 20197 20212 20220 20223 20229 20240 20250 20271 20301 20311 20319 20374 20375 20388 20418 20426 20431 20433 20460 20502 20515 20520 20523 20530 20536 20540 20544 20546 20552 20560 20571 20580 20585 20590 20591 20593 20706 20742 20747 20755 20760 20770 20783 20794 20814 20815 20816 20817 20818 20837 20850

20852	20853	20854	20876
20878	20879	20882	20886
20891	20892	20894	20895
20902	20906	20910	20914
20993	21000	21030	21043
21047	21202	22003	22010
22015	22030	22031	22033
22036	22037	22041	22042
22043	22044	22046	22060
22061	22066	22067	22070
22079	22091	22101	22102
22103	22106	22107	22108
22124	22150	22151	22153
22159	22175	22180	22181
22182	22191	22193	22201
22202	22203	22204	22205
22206	22207	22209	22213
22226	22302	22304	22308
22311	22312	22314	22315
22332	22554	22611	22625
23850	25411	25414	25425
25427	25428	26851	28182

Direction

What was your direction of travel on the Dulles Toll Road?

	Frequency	Percentage
Eastbound	622	58.3%
Westbound	432	40.5%
No Answer	13	1.2%

Vehicle

What type of vehicle were you driving?

	Frequency	Percentage
2-axle vehicle (car, SUV, motorcycle)	1037	97.2%
2-axle bus, truck, or RV	14	1.3%
2-axle vehicle towing a 1-axle trailer	0	0.0%
2-axle vehicle towing a 2-axle trailer	0	0.0%
3-axle bus or truck	2	0.2%
4-axle truck	1	0.1%
5-axle truck	0	0.0%
6 or more-axle truck	0	0.0%
No Answer	13	1.2%

DTR Entry

For this trip between <ORIGIN> and <DESTINATION>, where did you enter the Toll Road?

	Frequency	Percentage
Dulles Greenway	140	13.1%
Sully Road/Route 28 (Exit 9)	150	14.1%
Centreville Road (Exit 10)	55	5.2%
Fairfax County Parkway/Route 7100 (Exit 11)	86	8.1%
Reston Parkway (Exit 12)	79	7.4%
Wiehle Avenue (Exit 13)	71	6.7%
Hunter Mill Road (Exit 14)	60	5.6%
Trap Road (Exit 15)	5	0.5%
Leesburg Pike/Route 7 (Exit 16)	56	5.2%
Spring Hill Road (Exit 17)	34	3.2%
Capital Beltway/I-495 (Exit 18)	193	18.1%
Route 123 (Exit 19)	25	2.3%
I-66	100	9.4%
No Answer	13	1.2%

DTR Exit

You indicated that you entered the Dulles Toll Road at <DTR ENTRY>. Where did you exit the Toll Road?

	Frequency	Percentage
Dulles Greenway	55	5.2%
Sully Road/Route 28 (Exit 9)	133	12.5%
Centreville Road (Exit 10)	40	3.7%
Fairfax County Parkway/Route 7100 (Exit 11)	80	7.5%
Reston Parkway (Exit 12)	81	7.6%
Wiehle Avenue (Exit 13)	45	4.2%
Hunter Mill Road (Exit 14)	52	4.9%
Trap Road (Exit 15)	4	0.4%
Leesburg Pike/Route 7 (Exit 16)	70	6.6%
Spring Hill Road (Exit 17)	85	8.0%
Capital Beltway/I-495 (Exit 18)	187	17.5%
Route 123 (Exit 19)	68	6.4%
I-66	151	14.2%
No Answer	16	1.5%

Day

What day of the week did you make your trip?

	Frequency	Percentage
Monday	256	24.0%
Tuesday	95	8.9%
Wednesday	106	9.9%
Thursday	193	18.1%
Friday	337	31.6%
Saturday	41	3.8%
Sunday	23	2.2%
No Answer	16	1.5%

Purpose

What was the primary purpose of this trip between <ORIGIN> and <DESTINATION>?

	Frequency	Percentage
Go to/from work	763	71.5%
Work related business (non-commute)	102	9.6%
Go to/from school	7	0.7%
Shopping	25	2.3%
Social or recreational	102	9.6%
Other personal business	52	4.9%
No Answer	16	1.5%

Frequency

How often do you make this trip from <ORIGIN> to <DESTINATION> in this direction?

	Frequency	Percentage
6 or more times per week	85	8.0%
4 - 5 times per week	627	58.8%
2 - 3 times per week	119	11.2%
Once per week	54	5.1%
1 - 2 times per month	106	9.9%
Less than once per month	60	5.6%
No Answer	16	1.5%

Time Trip Started

What time (approximately) did you begin your trip from <ORIGIN> to <DESTINATION>?

	Frequency	Percentage
Before 06:00 am	72	6.7%
06:00 am	70	6.6%
07:00 am	177	16.6%
08:00 am	180	16.9%
09:00 am	86	8.1%
10:00 am	59	5.5%
11:00 am	35	3.3%
12:00 pm	30	2.8%
01:00 pm	25	2.3%
02:00 pm	25	2.3%
03:00 pm	28	2.6%
04:00 pm	66	6.2%
05:00 pm	75	7.0%
06:00 pm	63	5.9%
07:00 pm	28	2.6%
08:00 pm	17	1.6%
09:00 pm	4	0.4%
After 09:00 pm	11	1.0%
No Answer	16	1.5%

Time of Trip	How long did the entire trip from <ORIGIN> to <DESTINATON> take?

	Frequency	Percentage
Less than 15 minutes	42	3.9%
15 - 30 minutes	279	26.1%
31 - 45 minutes	347	32.5%
45 minutes - 1 hour	239	22.4%
1 hour, 1 minute - 1 hour 30 minutes	107	10.0%
1 hour, 31 minutes - 2 hours	23	2.2%
More than 2 hours	14	1.3%
No Answer	16	1.5%

Time on DTR	How much of this time was spent on the Dulles Toll Road?

	Frequency	Percentage
10 minutes or less	253	23.7%
15 minutes	317	29.7%
20 minutes	199	18.7%
25 minutes	114	10.7%
30 minutes	81	7.6%
35 minutes	34	3.2%
40 minutes	27	2.5%
45 minutes	10	0.9%
50 minutes	6	0.6%
55 minutes	4	0.4%
60 minutes or more	6	0.6%
No Answer	16	1.5%

Time Diff Route	If you were to us a different route instead of the Dulles Toll Road, how long do you think your trip from <ORIGIN> to <DESTINATION> would take, door-to-door?

	Frequency	Percentage
Less than 15 minutes	11	1.0%
15 - 30 minutes	97	9.1%
31 - 45 minutes	231	21.6%
46 minutes - 1 hour	287	26.9%
1 hour, 1 minute - 1 hour, 30 minutes	261	24.5%
1 hour, 31 minutes - 2 hours	105	9.8%
More than 2 hours	33	3.1%
I am no aware of another route	20	1.9%
There is no alternate route available	6	0.6%
No Answer	16	1.5%

Why Off Peak

[This was presented only to those whose trip began during the weekday off-peak periods.]

For this trip <DAY> beginning at <ORIGIN>, did you choose to make this trip during an off-peak time period in order to avoid peak period traffic congestion?

	Frequency	Percentage
Yes	202	56.1%
No	158	43.9%

Along or Others

For the majority of this trip from <ORIGIN> to <DESTINATION>, did you …

	Frequency	Percentage
Drive alone	879	82.4%
Drive with others	146	13.7%
Ride with others	26	2.4%
No Answer	16	1.5%

Vehicle Occupancy

[This was presented only to those who did not drive alone.]

How many people were in the vehicle on this trip including yourself?

	Frequency	Percentage
2	118	68.6%
3	26	15.1%
4	21	12.2%
5 or more	7	4.1%

Type of Occupants

[This was presented only to those who did not drive alone.]

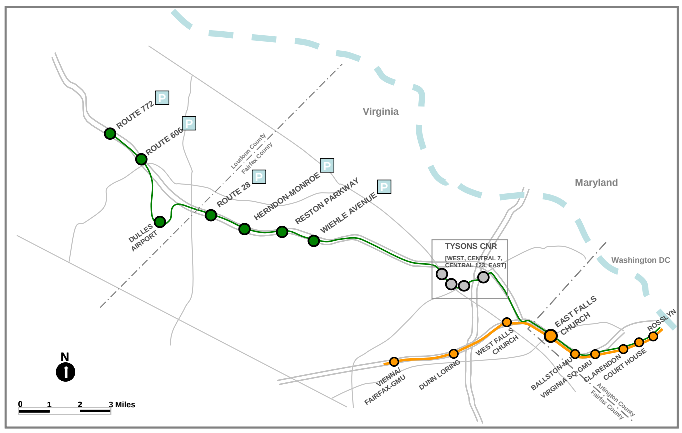
Who was in the vehicle for this trip?

	Frequency	Percentage
Members of household	109	63.4%
Friends or relatives who live elsewhere	21	12.2%
Co-workers	27	15.7%
Other pre-arranged carpoolers	12	7.0%
Casual carpoolers; "Slugs"	3	1.7%

<table>
<tr><td>Carpool Formation</td><td>
[This was presented only to those who did not drive alone.]
Where was the carpool formed for this trip between <ORIGIN> and <DESTINATION>?
<table>
<tr><th></th><th>Frequency</th><th>Percentage</th></tr>
<tr><td>At my home</td><td>119</td><td>69.2%</td></tr>
<tr><td>At someone else's home</td><td>12</td><td>7.0%</td></tr>
<tr><td>At work</td><td>20</td><td>11.6%</td></tr>
<tr><td>Reston South Park & Ride (Lawyers Road and Fox Mill Road)</td><td>0</td><td>0.0%</td></tr>
<tr><td>Reston North Park & Ride (Sunset Hills Road and Wiehle Avenue)</td><td>2</td><td>1.2%</td></tr>
<tr><td>Reston East Park & Ride (Wiehle Avenue and the Dulles Toll Road)</td><td>1</td><td>0.6%</td></tr>
<tr><td>Tysons West Park Transit Station (International Drive and Spring Hill Road)</td><td>0</td><td>0.0%</td></tr>
<tr><td>Herndon-Monroe Park & Ride (between Fairfax County Parkway and Monroe Street)</td><td>7</td><td>4.1%</td></tr>
<tr><td>Another Park & Ride</td><td>0</td><td>0.0%</td></tr>
<tr><td>Elsewhere</td><td>11</td><td>6.4%</td></tr>
</table>
</td></tr>
<tr><td>HOV Use</td><td>
[This was presented only to those who did not drive alone and travelled on the DTR when the HOV lane was operational in their travel direction.]
Did you use the High Occupancy Vehicle (HOV) lane while you were on the Dulles Toll Road?
<table>
<tr><th></th><th>Frequency</th><th>Percentage</th></tr>
<tr><td>Yes</td><td>62</td><td>82.7%</td></tr>
<tr><td>No</td><td>13</td><td>17.3%</td></tr>
</table>
</td></tr>
<tr><td>Cash or EZ</td><td>
How was the toll paid for on this trip from <ORIGIN> to <DESTINATION>?
<table>
<tr><th></th><th>Frequency</th><th>Percentage</th></tr>
<tr><td>Cash</td><td>87</td><td>8.2%</td></tr>
<tr><td>E-ZPass</td><td>964</td><td>90.3%</td></tr>
<tr><td>No Answer</td><td>16</td><td>1.5%</td></tr>
</table>
</td></tr>
</table>

<table>
<tr>
<td>Txfr Price Journey Time</td>
<td>Under current conditions, what increase in the journey time on the Dulles Toll Road would be sufficient to make you switch to an alternate mode of transportation or an alternate, non-tolled route?

Please enter the length of time (in minutes) here:
0 1 2 3
5 7 8 10
15 20 30 35
40 45 50 55
60 70 75 80
90 100 120 125
160 180 240</td>
</tr>
<tr>
<td>SP2A Intro</td>
<td>STATED PREFERENCE SURVEY
PART 2A – Travel Preferences



As the plans for new Metrorail service in the Dulles Toll Road corridor progress, this may become a viable option to driving. The new Metrorail service will extend from the existing Orange Line just east of the West Falls Church station in Fairfax County. The station locations are listed below and shown on the map.

• Tysons East (Route 123 at Scotts Crossing Rd/Colshire Dr)
• Tysons Center 123 (Route 123 at Tysons Blvd)
• Tysons Center 7 (Route 7 just northwest of Route 123)
• Wiehle Avenue (Dulles Toll Road just west of Wiehle Ave)
• Reston Parkway (Dulles Toll Road near Reston Pkwy)
• Herndon-Monroe (Dulles Toll Road and Monroe St)
• Route 28 (Dulles Toll Road near Route 28)
• Dulles Airport (near passenger terminal)
• Route 606 (Dulles Greenway at Route 606)
• Route 772/Ryan Road (Dulles Greenway at Route 772)

For more information on the Dulles Corridor Metrorail, go to</td>
</tr>
</table>

	www.dullesmetro.com.
SP2A Intro 2	You will be presented with nine different scenarios. Each scenario contains different options for travelling through the Dulles Toll Road Corridor. The travel time for each option is your total travel time for a particular trip, not just the time spent on the Dulles Toll Road. The options may include: • Dulles Toll Road peak period • Dulles Toll Road HOV peak period carpool • New toll road peak period • Dulles Toll Road off-peak period • Non-tolled road peak period • Metrorail service peak period Please pay close attention to each screen as gasoline prices, toll prices, travel times, and Metrorail prices may differ in each scenario that is presented to you. Assume that all the alternatives shown are available to you. Choose the one you prefer the most.

OP 30

[Off-peak period SP questions for 15-30 minute trip times. Listed are the possible scenarios, 9 of which were presented at random.]

tollex	tollnew	timeex	timenew	timenon	trnfare	trntime	trnfreq	fuel	ovt
130	200	25	25	40	130	45	5	4	15
220	250	25	20	35	100	35	5	3	10
130	250	30	18	40	100	50	5	3	10
170	250	25	20	35	175	50	15	5	10
100	150	30	25	35	130	35	5	5	10
100	150	35	18	40	175	45	5	3	15
130	200	30	20	45	100	50	5	3	20
220	250	30	18	35	175	35	5	4	10
100	250	25	20	40	100	35	10	3	10
220	150	30	25	40	175	35	10	4	10
130	250	25	20	45	130	45	5	4	10
170	250	30	18	35	100	45	15	3	10
100	200	25	25	45	100	35	15	3	15
100	150	25	20	35	100	35	5	3	10
170	200	30	20	35	100	45	10	3	20
130	200	25	25	45	175	35	10	3	10
100	200	25	18	35	100	35	5	3	20
220	200	35	20	40	130	50	5	3	10
100	200	30	20	35	130	35	5	5	15
220	250	35	25	45	130	50	5	3	20
170	250	35	25	40	100	35	15	4	20
170	200	35	20	35	100	35	5	4	10
220	150	35	18	35	130	50	10	3	15
170	200	25	25	35	130	35	5	3	10
170	200	30	20	40	100	45	5	3	15
100	250	35	25	35	175	45	10	3	20
170	200	25	25	35	175	50	10	5	15
100	150	25	20	45	100	50	5	4	20
100	200	25	18	35	100	50	15	4	10
130	150	25	20	40	175	35	15	3	20
100	250	30	18	45	130	35	10	5	10
100	200	25	25	40	100	50	5	4	10
130	150	30	25	35	100	50	15	3	10
170	250	25	20	45	130	35	15	3	15
130	200	25	18	35	130	45	10	4	20
220	200	35	20	35	130	50	15	3	10
220	200	30	20	45	175	35	15	4	15
220	200	25	25	35	100	35	5	3	15
130	250	25	20	35	175	35	5	3	15
170	200	35	20	45	100	35	10	4	10
170	150	30	25	45	100	45	5	3	10
220	150	25	20	35	100	45	10	5	20
220	200	25	18	45	100	45	5	5	10
130	200	35	20	35	100	35	5	5	10
170	200	25	18	40	130	35	10	3	10
220	250	25	20	40	100	45	5	5	15
130	150	25	20	35	130	45	15	4	10
130	250	35	25	35	100	35	5	5	20
100	250	25	20	35	100	50	10	4	15
130	200	25	18	35	175	35	5	3	10
130	200	35	20	40	100	35	10	5	10
170	150	25	20	40	175	50	5	5	10
170	200	25	18	45	175	50	5	5	20
220	200	30	20	35	175	35	5	4	20
100	200	30	20	40	130	35	15	5	20
220	200	25	25	35	100	45	15	5	10
100	200	35	20	45	175	45	5	3	10
220	150	25	20	45	100	35	10	3	10
130	150	35	18	45	100	35	15	5	15
220	200	25	18	40	100	35	15	3	20
170	150	25	20	35	130	35	5	3	20
130	200	30	20	35	100	50	10	3	15
100	200	35	20	35	175	45	15	3	10
170	150	35	18	35	100	35	5	4	15

Key:
TOLLEX ………… *Toll to use the existing roadway*
TOLLNEW ……… *Toll to use a new toll road*
TIMEEX ………… *Time of trip to use the existing roadway*
TIMENEW ……… *Time of trip to use a new toll road*
TIMENON ……… *Time of trip to use a non-tolled road*
TRNFARE ……… *Metrorail fare for equivalent trip*
TRNTIME ……… *Time of trip on Metrorail*
TRNFREQ ……… *Frequency of trains on Metrorail*
FUEL …………… *Hypothetical gasoline price*
OVT …………… *Time it takes to go to and from the Metrorail station*

OP 45

[Off-peak period SP questions for 45 minute trip times. Listed are the possible scenarios, 9 of which were presented at random.]

tollex	tollnew	timeex	timenew	timenon	trnfare	trntime	trnfreq	fuel	ovt
130	200	40	40	55	130	50	5	4	15
220	250	40	35	50	100	45	5	3	10
130	250	45	30	55	100	60	5	3	10
170	250	40	35	50	175	60	15	5	10
100	150	45	40	50	130	45	5	5	10
100	150	50	30	55	175	50	5	3	15
130	200	45	35	60	100	60	5	3	20
220	250	45	30	50	175	45	5	4	10
100	250	40	35	55	100	45	10	3	10
220	150	45	40	55	175	45	10	4	10
130	250	40	35	60	130	50	5	4	10
170	250	45	30	50	100	50	15	3	10
100	200	40	40	60	100	45	15	3	15
100	150	40	35	50	100	45	5	3	10
170	200	45	35	50	100	50	10	3	20
130	200	40	40	60	175	45	10	3	10
100	200	40	30	50	100	45	5	3	20
220	200	50	35	55	130	60	5	3	10
100	200	45	35	50	130	45	5	5	15
220	250	50	40	60	130	60	5	3	20
170	250	50	40	55	100	45	15	4	20
170	200	50	35	50	100	45	5	4	10
220	150	50	30	50	130	60	10	3	15
170	200	40	40	50	130	45	5	3	10
170	200	45	35	55	100	50	5	3	15
100	250	50	40	50	175	50	10	3	20
170	200	40	40	50	175	60	10	5	15
100	150	40	35	60	100	60	5	4	20
100	200	40	30	50	100	60	15	4	10
130	150	40	35	55	175	45	15	3	20
100	250	45	30	60	130	45	10	5	10
100	200	40	40	55	100	60	5	4	10
130	150	45	40	50	100	60	15	3	10
170	250	40	35	60	130	45	15	3	15
130	200	40	30	50	130	50	10	4	20
220	200	50	35	50	130	60	15	3	10
220	200	45	35	60	175	45	15	4	15
220	200	40	40	50	100	45	5	3	15
130	250	40	35	50	175	45	5	3	15
170	200	50	35	60	100	45	10	4	10
170	150	45	40	60	100	50	5	3	10
220	150	40	35	50	100	50	10	5	20
220	200	40	30	60	100	50	5	5	10
130	200	50	35	50	100	45	5	5	10
170	200	40	30	55	130	45	10	3	10
220	250	40	35	55	100	50	5	5	15
130	150	40	35	50	130	50	15	4	10
130	250	50	40	50	100	45	5	5	20
100	250	40	35	50	100	60	10	4	15
130	200	40	30	50	175	45	5	3	10
130	200	50	35	55	100	45	10	5	10
170	150	40	35	55	175	60	5	5	10
170	200	40	30	60	175	60	5	5	20
220	200	45	35	50	175	45	5	4	20
100	200	45	35	55	130	45	15	5	20
220	200	40	40	50	100	50	15	5	10
100	200	50	35	60	175	50	5	3	10
220	150	40	35	60	100	45	10	3	10
130	150	50	30	60	100	45	15	5	15
220	200	40	30	55	100	45	15	3	20
170	150	40	35	50	130	45	5	3	20
130	200	45	35	50	100	60	10	3	15
100	200	50	35	50	175	50	15	3	10
170	150	50	30	50	100	45	5	4	15

Key:
TOLLEX .... Toll to use the existing roadway
TOLLNEW .... Toll to use a new toll road
TIMEEX .... Time of trip to use the existing roadway
TIMENEW .... Time of trip to use a new toll road
TIMENON .... Time of trip to use a non-tolled road
TRNFARE .... Metrorail fare for equivalent trip
TRNTIME .... Time of trip on Metrorail
TRNFREQ .... Frequency of trains on Metrorail
FUEL .... Hypothetical gasoline price
OVT .... Time it takes to go to and from the Metrorail station

OP 60

[Off-peak period SP questions for 60 minute trip times. Listed are the possible scenarios, 9 of which were presented at random.]

tollex	tollnew	timeex	timenew	timenon	trnfare	trntime	trnfreq	fuel	ovt
130	200	50	50	75	160	70	5	4	15
220	250	50	45	65	125	60	5	3	10
130	250	60	40	75	125	80	5	3	10
170	250	50	45	65	200	80	15	5	10
100	150	60	50	65	160	60	5	5	10
100	150	70	40	75	200	70	5	3	15
130	200	60	45	80	125	80	5	3	20
220	250	60	40	65	200	60	5	4	10
100	250	50	45	75	125	60	10	3	10
220	150	60	50	75	200	60	10	4	10
130	250	50	45	80	160	70	5	4	10
170	250	60	40	65	125	70	15	3	10
100	200	50	50	80	125	60	15	3	15
100	150	50	45	65	125	60	5	3	10
170	200	60	45	65	125	70	10	3	20
130	200	50	50	80	200	60	10	3	10
100	200	50	40	65	125	60	5	3	20
220	200	70	45	75	160	80	5	3	10
100	200	60	45	65	160	60	5	5	15
220	250	70	50	80	160	80	5	3	20
170	250	70	50	75	125	60	15	4	20
170	200	70	45	65	125	60	5	4	10
220	150	70	40	65	160	80	10	3	15
170	200	50	50	65	160	60	5	3	10
170	200	60	45	75	125	70	5	3	15
100	250	70	50	65	200	70	10	3	20
170	200	50	50	65	200	80	10	5	15
100	150	50	45	80	125	80	5	4	20
100	200	50	40	65	125	80	15	4	10
130	150	50	45	75	200	60	15	3	20
100	250	60	40	80	160	60	10	5	10
100	200	50	50	75	125	80	5	4	10
130	150	60	50	65	125	80	15	3	10
170	250	50	45	80	160	60	15	3	15
130	200	50	40	65	160	70	10	4	20
220	200	70	45	65	160	80	15	3	10
220	200	60	45	80	200	60	15	4	15
220	200	50	50	65	125	60	5	3	15
130	250	50	45	65	200	60	5	3	15
170	200	70	45	80	125	60	10	4	10
170	150	60	50	80	125	70	5	3	10
220	150	50	45	65	125	70	10	5	20
220	200	50	40	80	125	70	5	5	10
130	200	70	45	65	125	60	5	5	10
170	200	50	40	75	160	60	10	3	10
220	250	50	45	75	125	70	5	5	15
130	150	50	45	65	160	70	15	4	10
130	250	70	50	65	125	60	5	5	20
100	250	50	45	65	125	80	10	4	15
130	200	50	40	65	200	60	5	3	10
130	200	70	45	75	125	60	10	5	10
170	150	50	45	75	200	80	5	5	10
170	200	50	40	80	200	80	5	5	20
220	200	60	45	65	200	60	5	4	20
100	200	60	45	75	160	60	15	5	20
220	200	50	50	65	125	70	15	5	10
100	200	70	45	80	200	70	5	3	10
220	150	50	45	80	125	60	10	3	10
130	150	70	40	80	125	60	15	5	15
220	200	50	40	75	125	60	15	3	20
170	150	50	45	65	160	60	5	3	20
130	200	60	45	65	125	80	10	3	15
100	200	70	45	65	200	70	15	3	10
170	150	70	40	65	125	60	5	4	15

Key:
TOLLEX .... Toll to use the existing roadway
TOLLNEW .... Toll to use a new toll road
TIMEEX .... Time of trip to use the existing roadway
TIMENEW .... Time of trip to use a new toll road
TIMENON .... Time of trip to use a non-tolled road
TRNFARE .... Metrorail fare for equivalent trip
TRNTIME .... Time of trip on Metrorail
TRNFREQ .... Frequency of trains on Metrorail
FUEL .... Hypothetical gasoline price
OVT .... Time it takes to go to and from the Metrorail station

OP 75	*[Off-peak period SP questions for 75 minute or longer trip times. Listed are the possible scenarios, 9 of which were presented at random.]*

tollex	tollnew	timeex	timenew	timenon	trnfare	trntime	trnfreq	fuel	ovt
130	200	70	60	110	160	80	5	4	15
220	250	70	50	90	125	75	5	3	10
130	250	75	40	110	125	90	5	3	10
170	250	70	50	90	200	90	15	5	10
100	150	75	60	90	160	75	5	5	10
100	150	90	40	110	200	80	5	3	15
130	200	75	50	120	125	90	5	3	20
220	250	75	40	90	200	75	5	4	10
100	250	70	50	110	125	75	10	3	10
220	150	75	60	110	200	75	10	4	10
130	250	70	50	120	160	80	5	4	10
170	250	75	40	90	125	80	15	3	10
100	200	70	60	120	125	75	15	3	15
100	150	70	50	90	125	75	5	3	10
170	200	75	50	90	125	80	10	3	20
130	200	70	60	120	200	75	10	3	10
100	200	70	40	90	125	75	5	3	20
220	200	90	50	110	160	90	5	3	10
100	200	75	50	90	160	75	5	5	15
220	250	90	60	120	160	90	5	3	20
170	250	90	60	110	125	75	15	4	20
170	200	90	50	90	125	75	5	4	10
220	150	90	40	90	160	90	10	3	15
170	200	70	60	90	160	75	5	3	10
170	200	75	50	110	125	80	5	3	15
100	250	90	60	90	200	80	10	3	20
170	200	70	60	90	200	90	10	5	15
100	150	70	50	120	125	90	5	4	20
100	200	70	40	90	125	90	15	4	10
130	150	70	50	110	200	75	15	3	20
100	250	75	40	120	160	75	10	5	10
100	200	70	60	110	125	90	5	4	10
130	150	75	60	90	125	90	15	3	10
170	250	70	50	120	160	75	15	3	15
130	200	70	40	90	160	80	10	4	20
220	200	90	50	90	160	90	15	3	10
220	200	75	50	120	200	75	15	4	15
220	200	70	60	90	125	75	5	3	15
130	250	70	50	90	200	75	5	3	15
170	200	90	50	120	125	75	10	4	10
170	150	75	60	120	125	80	5	3	10
220	150	70	50	90	125	80	10	5	20
220	200	70	40	120	125	80	5	5	10
130	200	90	50	90	125	75	5	5	10
170	200	70	40	110	160	75	10	3	10
220	250	70	50	110	125	80	5	5	15
130	150	70	50	90	160	80	15	4	10
130	250	90	60	90	125	75	5	5	20
100	250	70	50	90	125	90	10	4	15
130	200	70	40	90	200	75	5	3	10
130	200	90	50	110	125	75	10	5	10
170	150	70	50	110	200	90	5	5	10
170	200	70	40	120	200	90	5	5	20
220	200	75	50	90	200	75	5	4	20
100	200	75	50	110	160	75	15	5	20
220	200	70	60	90	125	80	15	5	10
100	200	90	50	120	200	80	5	3	10
220	150	70	50	120	125	75	10	3	10
130	150	90	40	120	125	75	15	5	15
220	200	70	40	110	125	75	15	3	20
170	150	70	50	90	160	75	5	3	20
130	200	75	50	90	125	90	10	3	15
100	200	90	50	90	200	80	15	3	10
170	150	90	40	90	125	75	5	4	15

Key:

TOLLEX .... Toll to use the existing roadway
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TIMEEX .... Time of trip to use the existing roadway
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TRNTIME .... Time of trip on Metrorail
TRNFREQ .... Frequency of trains on Metrorail
FUEL .... Hypothetical gasoline price
OVT .... Time it takes to go to and from the Metrorail station

PP 30

[Peak period SP questions for 15-30 minute trip times. Listed are the possible scenarios, 9 of which were presented at random.]

tollex	tolldiff	tollnew	tollhov	timeex	timediff	timenew	timehov	displace	timenon	trnfare	trntime	trnfreq	fuel	ovt
130	75	200	100	25	25	25	20	2	40	130	45	5	4	15
220	100	250	100	25	20	20	20	1	35	100	35	5	3	10
130	50	250	200	30	20	18	25	1	40	100	50	5	3	10
170	75	250	200	25	20	20	20	1	35	175	50	15	5	10
100	50	150	150	30	30	25	20	2	35	130	35	5	5	10
100	50	150	200	35	20	18	25	3	40	175	45	5	3	15
130	75	200	150	30	20	20	20	1	45	100	50	5	3	20
220	100	250	150	30	25	18	20	3	35	175	35	5	4	10
100	75	250	150	25	25	20	25	2	40	100	35	10	3	10
220	75	150	100	30	20	25	25	1	40	175	35	10	4	10
130	50	250	250	25	30	20	25	3	45	130	45	5	4	10
170	75	250	250	30	30	18	20	2	35	100	45	15	3	10
100	100	200	200	25	30	25	20	3	45	100	35	15	3	15
100	50	150	100	25	20	20	20	1	35	100	35	5	3	10
170	50	200	100	30	25	20	25	3	35	100	45	10	3	20
130	100	200	200	25	25	25	20	1	45	175	35	10	3	10
100	75	200	250	25	20	18	25	1	35	100	35	5	3	20
220	75	200	150	35	20	20	20	3	40	130	50	5	3	10
100	75	200	200	30	25	20	25	3	35	130	35	5	5	15
220	100	250	200	35	20	25	25	2	45	130	50	5	3	20
170	75	250	100	35	20	25	25	3	40	100	35	15	4	20
170	75	200	200	35	25	20	25	1	35	100	35	5	4	10
220	75	150	250	35	25	18	20	1	35	130	50	10	3	15
170	75	200	250	25	20	25	25	2	35	130	35	5	3	10
170	75	200	150	30	20	20	20	1	40	100	45	5	3	15
100	75	250	250	35	30	25	20	1	35	175	45	10	3	20
170	50	200	150	25	20	25	25	1	35	175	50	10	5	15
100	50	150	250	25	25	20	25	1	45	100	50	5	4	20
100	100	200	150	25	20	18	25	2	35	100	50	15	4	10
130	75	150	150	25	30	20	25	1	40	175	35	15	3	20
100	75	250	100	30	20	18	25	1	45	130	35	10	5	10
100	75	200	100	25	30	25	20	1	40	100	50	5	4	10
130	75	150	250	30	25	25	20	3	35	100	50	15	3	10
170	75	250	150	25	25	20	25	1	45	130	35	15	3	15
130	100	200	150	25	20	18	25	1	35	130	45	10	4	20
220	50	200	100	35	30	20	25	1	35	130	50	15	3	10
220	50	200	250	30	20	20	20	1	45	175	35	15	4	15
220	75	200	250	25	20	25	25	1	35	100	35	5	3	15
130	50	250	100	25	20	20	20	2	35	175	35	5	3	15
170	50	200	250	35	20	20	20	2	45	100	35	10	4	10
170	100	150	200	30	20	25	25	1	45	100	45	5	3	10
220	75	150	200	25	20	20	20	2	35	100	45	10	5	20
220	75	200	100	25	25	18	20	1	45	100	45	5	5	10
130	75	200	200	35	30	20	25	1	35	100	35	5	5	10
170	50	200	200	25	30	18	20	1	40	130	35	10	3	10
220	100	250	250	25	30	20	25	1	40	100	45	5	5	15
130	75	150	200	25	20	20	20	1	35	130	45	15	4	10
130	50	250	150	35	25	25	20	1	35	100	35	5	5	20
100	75	250	200	25	20	20	20	3	35	100	50	10	4	15
130	75	200	250	25	20	18	25	3	35	175	35	5	3	10
130	100	200	250	35	20	20	20	3	40	100	35	10	5	10
170	100	150	250	25	25	20	25	2	40	175	50	5	5	10
170	75	200	100	25	30	18	20	3	45	175	50	5	5	20
220	75	200	200	30	30	20	25	2	35	175	35	5	4	20
100	100	200	250	30	20	20	20	1	40	130	35	15	5	20
220	50	200	150	25	20	25	25	3	35	100	45	15	5	10
100	75	200	150	35	20	20	20	2	45	175	45	5	3	10
220	75	150	150	25	30	20	25	3	45	100	35	10	3	10
130	75	150	100	35	20	18	25	2	45	100	35	15	5	15
220	50	200	200	25	25	18	20	2	40	100	35	15	3	20
170	100	150	100	25	20	20	20	3	35	130	35	5	3	20
130	100	200	100	30	30	20	25	2	35	100	50	10	3	15
100	100	200	100	35	25	20	25	1	35	175	45	15	3	10
170	100	150	150	35	30	18	20	1	35	100	35	5	4	15

Key:
TOLLEX - Toll to use the existing roadway
TOLLDIFF - Toll to use the existing roadway during the off-peak
TOLLNEW - Toll to use a new toll road
TOLHOV - Toll to use the HOV lane
TIMEEX - Time of trip to use the existing roadway
TIMEDIFF - Time of trip to use the existing roadway during the off-peak
TIMENEW - Time of trip to use a new toll road
TIMEHOV - Time to use the HOV lane
DISPLACE - 1 = 7 pm – 6 am; 2 = 7 pm – 6 am and 9 am – 4 pm; 3 = 9 pm – 6 am and 11 am – 3 pm
TIMENON - Time of trip to use a non-tolled road
TRNFARE - Metrorail fare for equivalent trip
TRNTIME - Time of trip on Metrorail
TRNFREQ - Frequency of trains on Metrorail
FUEL - Hypothetical gasoline price
OVT - Time it takes to go to and from the Metrorail station

PP 45

[Peak period SP questions for 45 minute trip times. Listed are the possible scenarios, 9 of which were presented at random.]

tollex	tolldiff	tollnew	tollhov	timeex	timediff	timenew	timehov	displace	timenon	trnfare	trntime	trnfreq	fuel	ovt
130	75	200	100	40	40	40	35	2	55	130	50	5	4	15
220	100	250	100	40	35	35	35	1	50	100	45	5	3	10
130	50	250	200	45	35	30	40	1	55	100	60	5	3	10
170	75	250	200	40	35	35	35	1	50	175	60	15	5	10
100	50	150	150	45	45	40	35	2	50	130	45	5	5	10
100	50	150	200	50	35	30	40	3	55	175	50	5	3	15
130	75	200	150	45	35	35	35	1	60	100	60	5	3	20
220	100	250	150	45	40	30	35	3	50	175	45	5	4	10
100	75	250	150	40	40	35	40	2	55	100	45	10	3	10
220	75	150	100	45	35	40	40	1	55	175	45	10	4	10
130	50	250	250	40	45	35	40	3	60	130	50	5	4	10
170	75	250	250	45	45	30	35	2	50	100	50	15	3	10
100	100	200	200	40	45	40	35	3	60	100	45	15	3	15
100	50	150	100	40	35	35	35	1	50	100	45	5	3	10
170	50	200	100	45	40	35	40	3	50	100	50	10	3	20
130	100	200	200	40	40	40	35	1	60	175	45	10	3	10
100	75	200	250	40	35	30	40	1	50	100	45	5	3	20
220	75	200	150	50	35	35	35	3	55	130	60	5	3	10
100	75	200	200	45	40	35	40	3	50	130	45	5	5	15
220	100	250	200	50	35	40	40	2	60	130	60	5	3	20
170	75	250	100	50	35	40	40	3	55	100	45	15	4	20
170	75	200	200	50	40	35	40	1	50	100	45	5	4	10
220	75	150	250	50	40	30	35	1	50	130	60	10	3	15
170	75	200	250	40	35	40	40	2	50	130	45	5	3	10
170	75	200	150	45	35	35	35	1	55	100	50	5	3	15
100	75	250	250	50	45	40	35	1	50	175	50	10	3	20
170	50	200	150	40	35	40	40	1	50	175	60	10	5	15
100	50	150	250	40	40	35	40	1	60	100	60	5	4	20
100	100	200	150	40	35	30	40	2	50	100	60	15	4	10
130	75	150	150	40	45	35	40	1	55	175	45	15	3	20
100	75	250	100	45	35	30	40	1	60	130	45	10	5	10
100	75	200	100	40	45	40	35	1	55	100	60	5	4	10
130	75	150	250	45	40	40	35	3	50	100	60	15	3	10
170	75	250	150	40	40	35	40	1	60	130	45	15	3	15
130	100	200	150	40	35	30	40	1	50	130	50	10	4	20
220	50	200	100	50	45	35	40	1	50	130	60	15	3	10
220	50	200	250	45	35	35	35	1	60	175	45	15	4	15
220	75	200	250	40	35	40	40	1	50	100	45	5	3	15
130	50	250	100	40	35	35	35	2	50	175	45	5	3	15
170	50	200	250	50	35	35	35	2	60	100	45	10	4	10
170	100	150	200	45	35	40	40	1	60	100	50	5	3	10
220	75	150	200	40	35	35	35	2	50	100	50	10	5	20
220	75	200	100	40	40	30	35	1	60	100	50	5	5	10
130	75	200	200	50	45	35	40	1	50	100	45	5	5	10
170	50	200	200	40	45	30	35	1	55	130	45	10	3	10
220	100	250	250	40	45	35	40	1	55	100	50	5	5	15
130	75	150	200	40	35	35	35	1	50	130	50	15	4	10
130	50	250	150	50	40	40	35	1	50	100	45	5	5	20
100	75	250	200	40	35	35	35	3	50	100	60	10	4	15
130	75	200	250	40	35	30	40	3	50	175	45	5	3	10
130	100	200	250	50	35	35	35	3	55	100	45	10	5	10
170	100	150	250	40	40	35	40	2	55	175	60	5	5	10
170	75	200	100	40	45	30	35	3	60	175	60	5	5	20
220	75	200	200	45	45	35	40	2	50	175	45	5	4	20
100	100	200	250	45	35	35	35	1	55	130	45	15	5	20
220	50	200	150	40	35	40	40	3	50	100	50	15	5	10
100	75	200	150	50	35	35	35	2	60	175	50	5	3	10
220	75	150	150	40	45	35	40	3	60	100	45	10	3	10
130	75	150	100	50	35	30	40	2	60	100	45	15	5	15
220	50	200	200	40	40	30	35	2	55	100	45	15	3	20
170	100	150	100	40	35	35	35	3	50	130	45	5	3	20
130	100	200	100	45	45	35	40	2	50	100	60	10	3	15
100	100	200	100	50	40	35	40	1	50	175	50	15	3	10
170	100	150	150	50	45	30	35	1	50	100	45	5	4	15

Key:
TOLLEX .... *Toll to use the existing roadway*
TOLLDIFF .... *Toll to use the existing roadway during the off-peak*
TOLLNEW .... *Toll to use a new toll road*
TOLHOV .... *Toll to use the HOV lane*
TIMEEX .... *Time of trip to use the existing roadway*
TIMEDIFF .... *Time of trip to use the existing roadway during the off-peak*
TIMENEW .... *Time of trip to use a new toll road*
TIMEHOV .... *Time to use the HOV lane*
DISPLACE .... *1 = 7 pm – 6 am; 2 = 7 pm – 6 am and 9 am – 4 pm;*
3 = 9 pm – 6 am and 11 am – 3 pm
TIMENON .... *Time of trip to use a non-tolled road*
TRNFARE .... *Metrorail fare for equivalent trip*
TRNTIME .... *Time of trip on Metrorail*
TRNFREQ .... *Frequency of trains on Metrorail*
FUEL .... *Hypothetical gasoline price*
OVT .... *Time it takes to go to and from the Metrorail station*

PP 60

[Peak period SP questions for 60 minute trip times. Listed are the possible scenarios, 9 of which were presented at random.]

tollex	tolldiff	tollnew	tollhov	timeex	timediff	timenew	timehov	displace	timenon	trnfare	trntime	trnfreq	fuel	ovt
130	75	200	100	50	50	50	45	2	75	160	70	5	4	15
220	100	250	100	50	45	45	45	1	65	125	60	5	3	10
130	50	250	200	60	45	40	50	1	75	125	80	5	3	10
170	75	250	200	50	45	45	45	1	65	200	80	15	5	10
100	50	150	150	60	60	50	45	2	65	160	60	5	5	10
100	50	150	200	70	45	40	50	3	75	200	70	5	3	15
130	75	200	150	60	45	45	45	1	80	125	80	5	3	20
220	100	250	150	60	50	40	45	3	65	200	60	5	4	10
100	75	250	150	50	50	45	50	2	75	125	60	10	3	10
220	75	150	100	60	45	50	50	1	75	200	60	10	4	10
130	50	250	250	50	60	45	50	3	80	160	70	5	4	10
170	75	250	250	60	60	40	45	2	65	125	70	15	3	10
100	100	200	200	50	60	50	45	3	80	125	60	15	3	15
100	50	150	100	50	45	45	45	1	65	125	60	5	3	10
170	50	200	100	60	50	45	50	3	65	125	70	10	3	20
130	100	200	200	50	50	50	45	1	80	200	60	10	3	10
100	75	200	250	50	45	40	50	1	65	125	60	5	3	20
220	75	200	150	70	45	45	45	3	75	160	80	5	3	10
100	75	200	200	60	50	45	50	3	65	160	60	5	5	15
220	100	250	200	70	45	50	50	2	80	160	80	5	3	20
170	75	250	100	70	45	50	50	3	75	125	60	15	4	20
170	75	200	200	70	50	45	50	1	65	125	60	5	4	10
220	75	150	250	70	50	40	45	1	65	160	80	10	3	15
170	75	200	250	50	45	50	50	2	65	160	60	5	3	10
170	75	200	150	60	45	45	45	1	75	125	70	5	3	15
100	75	250	250	70	60	50	45	1	65	200	70	10	3	20
170	50	200	150	50	45	50	50	1	65	200	80	10	5	15
100	50	150	250	50	50	45	50	1	80	125	80	5	4	20
100	100	200	150	50	45	40	50	2	65	125	80	15	4	10
130	75	150	150	50	60	45	50	1	75	200	60	15	3	20
100	75	250	100	60	45	40	50	1	80	160	60	10	5	10
100	75	200	100	50	60	50	45	1	75	125	80	5	4	10
130	75	150	250	60	50	50	45	3	65	125	80	15	3	10
170	75	250	150	50	50	45	50	1	80	160	60	15	3	15
130	100	200	150	50	45	40	50	1	65	160	70	10	4	20
220	50	200	100	70	60	45	50	1	65	160	80	15	3	10
220	50	200	250	60	45	45	45	1	80	200	60	15	4	15
220	75	200	250	50	45	50	50	1	65	125	60	5	3	15
130	50	250	100	50	45	45	45	2	65	200	60	5	3	15
170	50	200	250	70	45	45	45	2	80	125	60	10	4	10
170	100	150	200	60	45	50	50	1	80	125	70	5	3	10
220	75	150	200	50	45	45	45	2	65	125	70	10	5	20
220	75	200	100	50	50	40	45	1	80	125	70	5	5	10
130	75	200	200	70	60	45	50	1	65	125	60	5	5	10
170	50	200	200	50	60	40	45	1	75	160	60	10	3	10
220	100	250	250	50	60	45	50	1	75	125	70	5	5	15
130	75	150	200	50	45	45	45	1	65	160	70	15	4	10
130	50	250	150	70	50	50	45	1	65	125	60	5	5	20
100	75	250	200	50	45	45	45	3	65	125	80	10	4	15
130	75	200	250	50	45	40	50	3	65	200	60	5	3	10
130	100	200	250	70	45	45	45	3	75	125	60	10	5	10
170	100	150	250	50	50	45	50	2	75	200	80	5	5	10
170	75	200	100	50	60	40	45	3	80	200	80	5	5	20
220	75	200	200	60	60	45	50	2	65	200	60	5	4	20
100	100	200	250	60	45	45	45	1	75	160	60	15	5	20
220	50	200	150	50	45	50	50	3	65	125	70	15	5	10
100	75	200	150	70	45	45	45	2	80	200	70	5	3	10
220	75	150	150	50	60	45	50	3	80	125	60	10	3	10
130	75	150	100	70	45	40	50	2	80	125	60	15	5	15
220	50	200	200	50	50	40	45	2	75	125	60	15	3	20
170	100	150	100	50	45	45	45	3	65	160	60	5	3	20
130	100	200	100	60	60	45	50	2	65	125	80	10	3	15
100	100	200	100	70	50	45	50	1	65	200	70	15	3	10
170	100	150	150	70	60	40	45	1	65	125	60	5	4	15

Key:
TOLLEX .... Toll to use the existing roadway
TOLLDIFF .... Toll to use the existing roadway during the off-peak
TOLLNEW .... Toll to use a new toll road
TOLHOV .... Toll to use the HOV lane
TIMEEX .... Time of trip to use the existing roadway
TIMEDIFF .... Time of trip to use the existing roadway during the off-peak
TIMENEW .... Time of trip to use a new toll road
TIMEHOV .... Time to use the HOV lane
DISPLACE .... 1 = 7 pm – 6 am; 2 = 7 pm – 6 am and 9 am – 4 pm;
3 = 9 pm – 6 am and 11 am – 3 pm
TIMENON .... Time of trip to use a non-tolled road
TRNFARE .... Metrorail fare for equivalent trip
TRNTIME .... Time of trip on Metrorail
TRNFREQ .... Frequency of trains on Metrorail
FUEL .... Hypothetical gasoline price
OVT .... Time it takes to go to and from the Metrorail station

PP 75

[Peak period SP questions for 75 minute or longer trip times. Listed are the possible scenarios, 9 of which were presented at random.]

tollex	tolldiff	tollnew	tollhov	timeex	timediff	timenew	timehov	displace	timenon	trnfare	trntime	trnfreq	fuel	ovt
130	75	200	100	70	60	60	55	2	110	160	80	5	4	15
220	100	250	100	70	50	50	55	1	90	125	75	5	3	10
130	50	250	200	75	50	40	65	1	110	125	90	5	3	10
170	75	250	200	70	50	50	55	1	90	200	90	15	5	10
100	50	150	150	75	75	60	55	2	90	160	75	5	5	10
100	50	150	200	90	50	40	65	3	110	200	80	5	3	15
130	75	200	150	75	50	50	55	1	120	125	90	5	3	20
220	100	250	150	75	60	40	55	3	90	200	75	5	4	10
100	75	250	150	70	60	50	65	2	110	125	75	10	3	10
220	75	150	100	75	50	60	65	1	110	200	75	10	4	10
130	50	250	250	70	75	50	65	3	120	160	80	5	4	10
170	75	250	250	75	75	40	55	2	90	125	80	15	3	10
100	100	200	200	70	75	60	55	3	120	125	75	15	3	15
100	50	150	100	70	50	50	55	1	90	125	75	5	3	10
170	50	200	100	75	60	50	65	3	90	125	80	10	3	20
130	100	200	200	70	60	60	55	1	120	200	75	10	3	10
100	75	200	250	70	50	40	65	1	90	125	75	5	3	20
220	75	200	150	90	50	50	55	3	110	160	90	5	3	10
100	75	200	200	75	60	50	65	3	90	160	75	5	5	15
220	100	250	200	90	50	60	65	2	120	160	90	5	3	20
170	75	250	100	90	50	60	65	3	110	125	75	15	4	20
170	75	200	200	90	60	50	65	1	90	125	75	5	4	10
220	75	150	250	90	60	40	55	1	90	160	90	10	3	15
170	75	200	250	70	50	60	65	2	90	160	75	5	3	10
170	75	200	150	75	50	50	55	1	110	125	80	5	3	15
100	75	250	250	90	75	60	55	1	90	200	80	10	3	20
170	50	200	150	70	50	60	65	1	90	200	90	10	5	15
100	50	150	250	70	60	50	65	1	120	125	90	5	4	20
100	100	200	150	70	50	40	65	2	90	125	90	15	4	10
130	75	150	150	70	75	50	65	1	110	200	75	15	3	20
100	75	250	100	75	50	40	65	1	120	160	75	10	5	10
100	75	200	100	70	75	60	55	1	110	125	90	5	4	10
130	75	150	250	75	60	60	55	3	90	125	90	15	3	10
170	75	250	150	70	60	50	65	1	120	160	75	15	3	15
130	100	200	150	70	50	40	65	1	90	160	80	10	4	20
220	50	200	100	90	75	50	65	1	90	160	90	15	3	10
220	50	200	250	75	50	50	55	1	120	200	75	15	4	15
220	75	200	250	70	50	60	65	1	90	125	75	5	3	15
130	50	250	100	70	50	50	55	2	90	200	75	5	3	15
170	50	200	250	90	50	50	55	2	120	125	75	10	4	10
170	100	150	200	75	50	60	65	1	120	125	80	5	3	10
220	75	150	200	70	50	50	55	2	90	125	80	10	5	20
220	75	200	100	70	60	40	55	1	120	125	80	5	5	10
130	75	200	200	90	75	50	65	1	90	125	75	5	5	10
170	50	200	200	70	75	40	55	1	110	160	75	10	3	10
220	100	250	250	70	75	50	65	1	110	125	80	5	5	15
130	75	150	200	70	50	50	55	1	90	160	80	15	4	10
130	50	250	150	90	60	60	55	1	90	125	75	5	5	20
100	75	250	200	70	50	50	55	3	90	125	90	10	4	15
130	75	200	250	70	50	40	65	3	90	200	75	5	3	10
130	100	200	250	90	50	50	55	3	110	125	75	10	5	10
170	100	150	250	70	60	50	65	2	110	200	90	5	5	10
170	75	200	100	70	75	40	55	3	120	200	90	5	5	20
220	75	200	200	75	75	50	65	2	90	200	75	5	4	20
100	100	200	250	75	50	50	55	1	110	160	75	15	5	20
220	50	200	150	70	50	60	65	3	90	125	80	15	5	10
100	75	200	150	90	50	50	55	2	120	200	80	5	3	10
220	75	150	150	70	75	50	65	3	120	125	75	10	3	10
130	75	150	100	90	50	40	65	2	120	125	75	15	5	15
220	50	200	200	70	60	40	55	2	110	125	75	15	3	20
170	100	150	100	70	50	50	55	3	90	160	75	5	3	20
130	100	200	100	75	75	50	65	2	90	125	90	10	3	15
100	100	200	100	90	60	50	65	1	90	200	80	15	3	10
170	100	150	150	90	75	40	55	1	90	125	75	5	4	15

Key:
TOLLEX .... *Toll to use the existing roadway*
TOLLDIFF .... *Toll to use the existing roadway during the off-peak*
TOLLNEW .... *Toll to use a new toll road*
TOLHOV .... *Toll to use the HOV lane*
TIMEEX .... *Time of trip to use the existing roadway*
TIMEDIFF .... *Time of trip to use the existing roadway during the off-peak*
TIMENEW .... *Time of trip to use a new toll road*
TIMEHOV .... *Time to use the HOV lane*
DISPLACE .... *1 = 7 pm – 6 am; 2 = 7 pm – 6 am and 9 am – 4 pm;*
3 = 9 pm – 6 am and 11 am – 3 pm
TIMENON .... *Time of trip to use a non-tolled road*
TRNFARE .... *Metrorail fare for equivalent trip*
TRNTIME .... *Time of trip on Metrorail*
TRNFREQ .... *Frequency of trains on Metrorail*
FUEL .... *Hypothetical gasoline price*
OVT .... *Time it takes to go to and from the Metrorail station*

SP2A Reasonable	You have just completed Part 2A of the Stated Preference Survey – 2008. We would like to receive feedback on these questions. Please think about the nine state preference questions you just answered. How reasonable were the journey times for each option offered?

Dulles Toll Road (existing road option)	Frequency	Percentage
Very Reasonable	137	12.8%
Quite Reasonable	630	59.0%
Not at all Reasonable (too long)	132	12.4%
Not at all Reasonable (too short)	57	5.3%
Not at all Reasonable (varied too much)	64	6.0%
No Answer	47	4.4%

HOV Lane Use (carpool option)	Frequency	Percentage
Very Reasonable	127	11.9%
Quite Reasonable	589	55.2%
Not at all Reasonable (too long)	134	12.6%
Not at all Reasonable (too short)	47	4.4%
Not at all Reasonable (varied too much)	69	6.5%
No Answer	101	9.5%

Off-peak Travel (different time period option)	Frequency	Percentage
Very Reasonable	147	13.8%
Quite Reasonable	600	56.2%
Not at all Reasonable (too long)	120	11.2%
Not at all Reasonable (too short)	34	3.2%
Not at all Reasonable (varied too much)	77	7.2%
No Answer	89	8.3%

Non-tolled Road	Frequency	Percentage
Very Reasonable	73	6.8%
Quite Reasonable	471	44.1%
Not at all Reasonable (too long)	245	23.0%
Not at all Reasonable (too short)	133	12.5%
Not at all Reasonable (varied too much)	69	6.5%
No Answer	76	7.1%

SP2A Difficulty	For the state preference questions answered in this part of the survey, was it difficult to make choices between the options offered?

	Frequency	Percentage
Very Difficult	64	6.0%
Difficult	189	17.7%
Somewhat Difficult	484	45.4%
Not at all Difficult	305	28.6%
No Answer	25	2.3%

SP2B Intro	STATED PREFERENCE SURVEY PART 2B – Driving Conditions In this section, you will be shown driving conditions on two highways. You will be asked to choose between the two highways depending on the length of the trip and the amount of time spent in various driving conditions on each highway. Example: For a 15 mile trip, you may be asked to choose between • Highway A with a mix of Free Flowing Traffic and Stop and Go Traffic; or • Highway B with Light Congestion during the entire length of the trip For the scenario which you are presented, you will be given nine different situations. Each situation will have different travel times on the two highways.
Free Flow, Stop and Go, Light Congestion, 15 mi	*[This is one of eight sets of situations. Each respondent was given a set of situations randomly. Each situation within the set was presented to the respondent.]*

Journey length = 15 miles			
Situation number	Hwy A Free Flowing	Hwy A Stop and Go	Hwy B Light Congestion
1	5 minutes	5 minutes	15 minutes
2	15 minutes	10 minutes	15 minutes
3	10 minutes	15 minutes	15 minutes
4	10 minutes	5 minutes	20 minutes
5	5 minutes	10 minutes	20 minutes
6	15 minutes	15 minutes	20 minutes
7	15 minutes	5 minutes	25 minutes
8	10 minutes	10 minutes	25 minutes
9	5 minutes	15 minutes	25 minutes

Free Flow, Stop and Go, Light Congestion, 25 mi

[This is one of eight sets of situations. Each respondent was given a set of situations randomly. Each situation within the set was presented to the respondent.]

Journey length = 25 miles			
Situation number	Hwy A Free Flowing	Hwy A Stop and Go	Hwy B Light Congestion
1	40 minutes	20 minutes	1 hour
2	1 hour	25 minutes	1 hour
3	50 minutes	30 minutes	1 hour
4	50 minutes	20 minutes	1 hour and 15 minutes
5	40 minutes	25 minutes	1 hour and 15 minutes
6	1 hour	30 minutes	1 hour and 15 minutes
7	1 hour	20 minutes	1 hour and 30 minutes
8	50 minutes	25 minutes	1 hour and 30 minutes
9	40 minutes	30 minutes	1 hour and 30 minutes

Busy Traffic, Gridlock, Heavy Congestion, 15 mi

[This is one of eight sets of situations. Each respondent was given a set of situations randomly. Each situation within the set was presented to the respondent.]

Journey length = 15 miles			
Situation number	Hwy A Busy Traffic	Hwy A Gridlock	Hwy B Heavy Congestion
1	5 minutes	5 minutes	15 minutes
2	15 minutes	10 minutes	15 minutes
3	10 minutes	15 minutes	15 minutes
4	10 minutes	5 minutes	20 minutes
5	5 minutes	10 minutes	20 minutes
6	15 minutes	15 minutes	20 minutes
7	15 minutes	5 minutes	25 minutes
8	10 minutes	10 minutes	25 minutes
9	5 minutes	15 minutes	25 minutes

Busy Traffic, Gridlock, Heavy Congestion, 25 mi

[This is one of eight sets of situations. Each respondent was given a set of situations randomly. Each situation within the set was presented to the respondent.]

Journey length = 25 miles			
Situation number	Hwy A Busy Traffic	Hwy A Gridlock	Hwy B Heavy Congestion
1	40 minutes	20 minutes	1 hour
2	1 hour	25 minutes	1 hour
3	50 minutes	30 minutes	1 hour
4	50 minutes	20 minutes	1 hour and 15 minutes
5	40 minutes	25 minutes	1 hour and 15 minutes
6	1 hour	30 minutes	1 hour and 15 minutes
7	1 hour	20 minutes	1 hour and 30 minutes
8	50 minutes	25 minutes	1 hour and 30 minutes
9	40 minutes	30 minutes	1 hour and 30 minutes

Busy Traffic, Stop and Go, Light Congestion, 15 mi

[This is one of eight sets of situations. Each respondent was given a set of situations randomly. Each situation within the set was presented to the respondent.]

Journey length = 15 miles			
Situation number	Hwy A Busy Traffic	Hwy A Stop and Go	Hwy B Light Congestion
1	5 minutes	5 minutes	15 minutes
2	15 minutes	10 minutes	15 minutes
3	10 minutes	15 minutes	15 minutes
4	10 minutes	5 minutes	20 minutes
5	5 minutes	10 minutes	20 minutes
6	15 minutes	15 minutes	20 minutes
7	15 minutes	5 minutes	25 minutes
8	10 minutes	10 minutes	25 minutes
9	5 minutes	15 minutes	25 minutes

Busy Traffic, Stop and Go, Light Congestion, 25 mi

[This is one of eight sets of situations. Each respondent was given a set of situations randomly. Each situation within the set was presented to the respondent.]

Journey length = 25 miles			
Situation number	Hwy A Busy Traffic	Hwy A Stop and Go	Hwy B Light Congestion
1	40 minutes	20 minutes	1 hour
2	1 hour	25 minutes	1 hour
3	50 minutes	30 minutes	1 hour
4	50 minutes	20 minutes	1 hour and 15 minutes
5	40 minutes	25 minutes	1 hour and 15 minutes
6	1 hour	30 minutes	1 hour and 15 minutes
7	1 hour	20 minutes	1 hour and 30 minutes
8	50 minutes	25 minutes	1 hour and 30 minutes
9	40 minutes	30 minutes	1 hour and 30 minutes

Free Flow, Heavy Congestion, Busy Traffic, 15 mi

[This is one of eight sets of situations. Each respondent was given a set of situations randomly. Each situation within the set was presented to the respondent.]

Journey length = 15 miles			
Situation number	Hwy A Free Flowing	Hwy A Heavy Congestion	Hwy B Busy Traffic
1	5 minutes	5 minutes	15 minutes
2	15 minutes	10 minutes	15 minutes
3	10 minutes	15 minutes	15 minutes
4	10 minutes	5 minutes	20 minutes
5	5 minutes	10 minutes	20 minutes
6	15 minutes	15 minutes	20 minutes
7	15 minutes	5 minutes	25 minutes
8	10 minutes	10 minutes	25 minutes
9	5 minutes	15 minutes	25 minutes

Free Flow, Heavy Congestion, Busy Traffic, 25 mi	*[This is one of eight sets of situations. Each respondent was given a set of situations randomly. Each situation within the set was presented to the respondent.]*

Journey length = 25 miles			
Situation number	Hwy A Free Flowing	Hwy A Heavy Congestion	Hwy B Busy Traffic
1	40 minutes	20 minutes	1 hour
2	1 hour	25 minutes	1 hour
3	50 minutes	30 minutes	1 hour
4	50 minutes	20 minutes	1 hour and 15 minutes
5	40 minutes	25 minutes	1 hour and 15 minutes
6	1 hour	30 minutes	1 hour and 15 minutes
7	1 hour	20 minutes	1 hour and 30 minutes
8	50 minutes	25 minutes	1 hour and 30 minutes
9	40 minutes	30 minutes	1 hour and 30 minutes

Attitude

We would like to ask for your opinion on paying highway tolls. We will be asking several questions about tolls and the Dulles Toll Road.

Please tell us how you feel about each of the following statements.

I object to paying tolls to use a highway.	Frequency	Percentage
Strongly Agree	185	17.3%
Agree	191	17.9%
Neither Agree nor Disagree	272	25.5%
Disagree	321	30.1%
Strongly Disagree	71	6.7%
No Answer	27	2.5%

I think tolls are a sensible way of funding roadway infrastructure (e.g. to maintain the existing roads or to build new roads).	Frequency	Percentage
Strongly Agree	90	8.4%
Agree	495	46.4%
Neither Agree nor Disagree	173	16.2%
Disagree	170	15.9%
Strongly Disagree	112	10.5%
No Answer	27	2.5%

I would object to paying new tolls on existing toll-free roadways.	Frequency	Percentage
Strongly Agree	523	49.0%
Agree	248	23.2%
Neither Agree nor Disagree	134	12.6%
Disagree	106	9.9%
Strongly Disagree	29	2.7%
No Answer	27	2.5%

Demo Intro	YOU'RE ALMOST DONE!

Demo Intro 2	STATED PREFERENCE SURVEY PART 3 – Demographic Information The following questions are used for demographic purposes only. This information will have no bearing on your survey answers, comments, or eligibility in the random drawing for a Visa gift card.
Household	How many people live in your household?
Number of Vehicles	How many cars, motorcycles, pickup trucks, minivans, etc. do you have in your household?
Age	What is your age?

Household – How many people live in your household?

	Frequency	Percentage
1	177	16.6%
2	386	36.2%
3	173	16.2%
4	192	18.0%
5	82	7.7%
6 or more	23	2.2%
Prefer Not to Answer	7	0.7%
No Answer	27	2.5%

Number of Vehicles – How many cars, motorcycles, pickup trucks, minivans, etc. do you have in your household?

	Frequency	Percentage
0	5	0.5%
1	180	16.9%
2	495	46.4%
3	231	21.6%
4	83	7.8%
5 or more	39	3.7%
Prefer Not to Answer	7	0.7%
No Answer	27	2.5%

Age – What is your age?

	Frequency	Percentage
16 to 24	8	0.7%
25 to 34	159	14.9%
35 to 44	294	27.6%
45 to 54	308	28.9%
55 to 64	204	19.1%
65 or older	53	5.0%
Prefer Not to Answer	14	1.3%
No Answer	27	2.5%

<table>
<tr><td>Employment</td><td>What is your employment status?

<table>
<tr><th></th><th>Frequency</th><th>Percentage</th></tr>
<tr><td>Full-time employed</td><td>885</td><td>82.9%</td></tr>
<tr><td>Part-time employed</td><td>39</td><td>3.7%</td></tr>
<tr><td>Self-employed</td><td>45</td><td>4.2%</td></tr>
<tr><td>Student</td><td>0</td><td>0.0%</td></tr>
<tr><td>Student and employed</td><td>3</td><td>0.3%</td></tr>
<tr><td>Retired</td><td>35</td><td>3.3%</td></tr>
<tr><td>Homemaker</td><td>20</td><td>1.9%</td></tr>
<tr><td>Unemployed</td><td>1</td><td>0.1%</td></tr>
<tr><td>Prefer Not to Answer</td><td>12</td><td>1.1%</td></tr>
<tr><td>No Answer</td><td>27</td><td>2.5%</td></tr>
</table></td></tr>
<tr><td>Income</td><td>What is your household’s annual gross income?

<table>
<tr><th></th><th>Frequency</th><th>Percentage</th></tr>
<tr><td>Less than $25,000</td><td>4</td><td>0.4%</td></tr>
<tr><td>$25,000 - $49,999</td><td>17</td><td>1.6%</td></tr>
<tr><td>$50,000 - $74,999</td><td>69</td><td>6.5%</td></tr>
<tr><td>$75,000 - $99,999</td><td>112</td><td>10.5%</td></tr>
<tr><td>$100,000 - $149,999</td><td>261</td><td>24.5%</td></tr>
<tr><td>$150,000 or more</td><td>387</td><td>36.3%</td></tr>
<tr><td>Prefer Not to Answer</td><td>190</td><td>17.8%</td></tr>
<tr><td>No Answer</td><td>27</td><td>2.5%</td></tr>
</table></td></tr>
<tr><td>Comments</td><td>Please enter any additional comments you have for this survey, then click on “NEXT.”

This question is optional; if you do not have any comments, click on “NEXT.”

[Comments received are displayed in separate tables grouped by topic after this table.]</td></tr>
<tr><td>Random Drawing Information</td><td>Thank you for completing the Dulles Toll Road on-line survey. Please enter your information below if you wish to be entered into a random drawing for a Visa gift card.

This information is entirely OPTIONAL.

It is not necessary to enter this information if you do not want to be entered into the random drawing.</td></tr>
</table>

Thank You	Thank you for participating in the Dulles Toll Road State Preference Survey – 2008 conducted by Wilbur Smith Associates www.wilbursmith.com on behalf of Metropolitan Washington Airports Authority www.mwaa.com

DULLES TOLL ROAD STATED PREFERENCE EXERCISE

Mark Wardman and Nicolás Ibáñez

April 2008

1. INTRODUCTION

This work was undertaken on behalf of Wilbur Smith Associates.

Jonathan Pagan of Wilbur Smith Associates commissioned Mark Wardman and Nicolás Ibáñez to design, analyze, and report a stated preference experiment whose purpose was to estimate the value that current toll road users place upon time savings.

The data collection was the responsibility of Wilbur Smith Associates.

The research involved two SP exercises. The first, and main, SP exercise offered time-toll trade-offs between different routes and also a new Metro. This would yield monetary valuations. The second SP exercise offered trade-offs amongst different types of driving time, with the aim of detecting how the value of time varies according to driving conditions.

2. DESIGN

2.1 Main SP Exercise

The main SP exercise offered choices between six alternatives. These were:

- The current freeway
- A new tolled freeway
- An existing but untolled road
- The current freeway at a different time
- A high occupancy vehicle (HOV) lane
- A new Metro service

Peak travelers were offered all alternatives. Thus they were able to achieve a faster journey and sometimes benefit from a lower toll by using the HOV lane whilst there was also the possibility to travel in an off-peak period and experience less congested conditions and also save on the toll.

Off-peak travelers were not offered the alternatives of travelling at a different time or of using the HOV.

Whilst it would have been possible to obtain values of time from an SP exercise that simply offered choices between two alternatives, say the existing freeway and the next best of the listed alternatives, there were two main reasons why we offered this broader range of attributes. Firstly, the purpose of the study might be less obvious and therefore be less likely to attract response bias. Offering a range of options might make the study to appear to be about travel in general rather than simply increasing the toll on an existing route. Secondly, a wider range of time-cost trade-offs can be offered which supports the more precise estimation of model parameters.

The current freeway, new freeway and HOV lane were described in terms of toll and travel time. Additionally, the possibility of travelling at a different time denoted the off-peak times when the toll would be lower and how much lower this toll would be along with the generally quicker journey time. The untolled road was characterized simply in terms of travel time. The fuel cost was offered for all routes, in terms of the cost per gallon. This was not varied across routes. Finally, a Metro option was offered. This was characterized in terms of in-vehicle time, time to and from the Metro, fare and service frequency.

Our view was that we could offer an atypically large number of alternatives, in order to achieve the advantages set out above, because each alternative had only a few attributes and these attributes were often the same across alternatives.

Standard fractional factorial designs were adopted. This ensures that there are no correlations amongst the attributes that characterize each option. Each respondent was offered 10 choice scenarios randomly selected from the total of 64.

Separate designs were used according to the current journey time. This was to ensure that the times offered to respondents related to their current journey in which context the SP exercise was set. The designs centered around 30 minutes, 45 minutes, 60 minutes and 75 minutes, and each of them was comprised of 64 alternatives.

The basic concept behind the SP exercises was that faster alternatives would cost more and that the toll on the existing freeway would be increased to determine behavioural response to it. Thus the existing freeway had its toll increased, with variation in journey time around the current level. The new freeway would generally offer faster times but at the cost of higher tolls whilst the untolled road was cheaper but at the expense of a longer journey. Travelling in the off-peak involves the inconvenience of travelling at a less than desired time but saves on toll and sometimes offers faster journeys. The HOV lane offered faster journey in the peak but this could be at the expense of higher tolls and would only be available to those drivers with other occupants.

The four designs used for the first SP exercise are reproduced in Section 8.

2.2 Supplementary SP Exercise

The purpose of this second SP exercise was to determine whether the disutility of motorists' travel time varies with the conditions in which the time is spent.

Increasingly, SP studies are distinguishing between different types of car travel time. This is because time spent in different conditions will have a different value with implications for valuations of time over time as, due to increasing congestion, the mix between different traffic conditions will vary.

The crudest distinction that can be made is between time spent in free flow traffic and time spent in congested conditions however defined. We here go beyond this, using six categories of time. The same exercise was presented as we have recently used successfully in a study of inter-urban car travelers.

The basic concept is that motorists are offered a choice between two routes for a hypothetical journey. One route has the same travel conditions throughout. The other route has a mix of two types of travel time, one better and one worse than the route with a single type of time.

The six types of time between which we distinguish are:

- Free Flow
- Busy
- Light Congestion
- Heavy Congestion
- Stop Start
- Gridlock

However, any respondent was only offered three types of time. This was in the context of either a 15 or a 25 mile journey.

Section 9 contains more details of this supplementary SP exercise.

3. DATA COLLECTION

A pilot survey was conducted prior to the main survey using 350 survey panel members. This resulted in 95 responses. Models were estimated to this data indicating a value of time of around 20¢ per minute. This seemed reasonable. Given that the results were reasonable and that respondents did not appear to have undue difficulty with the SP exercise, no changes were made prior to the main survey.

The main surveys were conducted in March 2008. The final data set totalled 1,045 respondents from a total survey pool of 4,361 (including responses from the pilot survey). They all completed the SP1 exercise on time-toll trade-offs between different modes, whereas only 1040 of them completed the supplementary SP exercise on travel time valuations. Details of the number of responses obtained from each individual in each exercise are included in Table 1.

Table 1: Number of Choices per Respondent in each SP Exercise

Main SP

Choice sets	Individuals
1	1
2	1
8	1
9	749
10	293
Individuals	1045
Observations	9682

Supplementary

Choice sets	Individuals
1	0
2	0
8	1
9	1039
10	0
Individuals	1040
Observations	9359

The breakdown of these total number of respondents (1,045) by travel purpose is detailed in Table 2.

Table 2: Number of Respondents per Purpose and Departure Time

Departure Time	Purpose	Individuals
Peak	Commuting	597
Peak	Employer's business	40
Peak	Leisure	51
Offpeak	Commuting	161
Offpeak	Employer's business	61
Offpeak	Leisure	135
Total_		1045

More detail on the data collection stage is provided in the main report to this study.

4. ESTIMATION METHOD

We have here estimated discrete choice models to determine the relative importance attached to each of the attributes in our SP exercises. The BIOGEME package has been used.

Decision makers make choices between a set of n alternatives which are each characterized by their utility (U). The alternative with highest utility is chosen. Thus the decision maker i chooses alternative 1 if:

$$U_{i1} > U_{in} \quad for\ all\ n, n \neq 1$$

In turn, the utility for each alternative is made up of the part-worth utilities associated with a vector (**X**) of explanatory variables. Travel alternatives are characterised in terms of the main attributes, which in this context are toll, time, departure time shift and the aspects of the train service. Thus we have:

$$U_{in} = f(\alpha, \mathbf{X})$$

where the vector of parameters (α) denotes the relative importance of each attribute.

Although the utility function can contain a large number of variables, the demand analyst cannot possibly observe all the influences on each decision maker's choices, whilst others are too difficult to measure or too minor to merit inclusion. A residual term (ε_{in}) is therefore introduced to represent the net effect of the unobserved influence on an individual's choices. Hence as far as we are concerned, individual i bases decision making on overall utility (U_{in}) which is made up of an observable component (V_{in}) and the residual:

$$U_{in} = V_{in} + \varepsilon_{in}$$

The analyst can, by definition, proceed only by observation of V_{in}, yet this ignores the influence of what is unobservable but a very real influence on choice. We cannot be sure that alternative 1 is preferred if it has the highest V_{in}, yet the analysis must proceed on the basis of this observable component of utility alone.

The way forward is to specify the problem as one of explaining the probability of an individual choosing a particular alternative. We would expect the likelihood of choosing alternative 1 to increase as its overall random utility increases. The probability that an individual chooses alternative 1 (P_{i1}) from the n on offer can be represented as:

$$P_{i1} = \Pr ob\left[\left(V_{i1} + \varepsilon_{i1}\right) > \left(V_{in} + \varepsilon_{in}\right)\right] \;\; \textit{for all } n, n \neq 1$$

By assuming some probability distribution for the ε_n, the probability of choosing alternative 1 can be specified solely as a function of the observable component of utility. Assuming that the errors associated with each alternative have a type I extreme value distribution and are independently and identically distributed yields the familiar multinomial logit model (MNL):

$$P_{i1} = \frac{e^{\Omega V_{i1}}}{\sum_{k=1}^{n} e^{\Omega V_{ik}}}$$

A feature of this discrete choice model is that the parameters estimated to the components of utility are scaled relative to the residual component as:

$$\Omega = \frac{\Pi}{\sqrt{6}\sigma_k}$$

where σ_k is the standard deviation of the residual component associated with each alternative.

The purpose of Ω is to allow for the effects of the unobserved factors on choices. The greater the unobserved influence on choices, the smaller is Ω and hence the observable variables will have less influence on behaviour.

Note that when we come to calculate relative valuations, such as values of time, then this scale cancels out.

The utility function can take any number of forms. In practice, the most common form is linear-additive with the utility weights assumed to be the same across alternatives. If time (T) and cost (C) influence (route choice) behaviour, then the utility function would take the form:

$$V_{in} = \alpha T_{in} + \beta C_{im}$$

The coefficients themselves have no absolute meaning but instead indicate the relative importance of the different attributes. A relative valuation, such as the money value of time, is derived as the ratio of the marginal utility of the variable in question and the marginal utility of the numeraire variable (here cost). In this special case of a linear-additive function, the marginal value of time is α/β and is constant.

The estimated model can also be used to forecast demand for scenarios that can be depicted by attributes in the choice model along with the choice context it covers. It can also be used to estimate elasticities, which are useful in demand forecasting.

The own point elasticity of demand for alternative 1 with respect to attribute X (η_{1x1}) is:

$$\eta_{1x1} = (1 - P_1)\,\frac{\partial V_1}{\partial X_1}\,X_1$$

Choice models, by their very nature of being based on competition between alternatives, are particularly useful for estimating cross-elasticities. The cross elasticity of demand for alternative 1 with respect to attribute X on alternative 2 (η_{1x2}) implied by the logit model is:

$$\eta_{1x2} = -\,P_2\,\frac{\partial V_2}{\partial X_2}\,X_2$$

The cross-elasticity would depend upon the market share of alternative 2. It will in general also depend upon the level of X on alternative 2.

5. ANALYSIS OF MAIN SP DATA

Table 3 presents the results of the main SP exercise. The variables are specified in dollars and minutes. The goodness of fit (ρ^2) is similar to a value of around 0.1 typically obtained from discrete choice models of travel behavior of the multinomial logit (MNL) type based on similar sample sizes. Almost all of the reported coefficient estimates are highly statistically significant.

We can specify five main alternative specific constants (ASCs) given that we have six alternatives. The base was set to be the existing freeway. The new freeway was not significantly different to the existing freeway and was therefore dropped. The ASC for Metro showed high correlations with other attributes and its inclusion had a generally deleterious effect on several other parameter estimates. It was not therefore retained.

The ASCs for the HOV (ASCHOV), different travel time (ASCDIFF) and untolled road (ASCNON) are all negative. These alternatives, as might be expected, are regarded to be inferior, all other things equal, to the existing freeway.

The time coefficients for car are similar for commuting and employer’s business (EB). Surprisingly, the coefficient is somewhat larger for leisure traveler, denoting that the marginal utility of time is higher for this group. The same pattern is true for Metro. This may be an unaccounted for difference in scale between leisure and non-leisure travel. However, we see that there is a counteracting effect on the toll coefficients such that the values of time for leisure turn out reasonable relative to the other values.

The time coefficients are lower for Metro than car. It seems that there is a preference for spending a time in a train than in a car. The difficulties of driving in congested traffic conditions and the possibility to use time on train usefully, such as reading, might be a factor here.

As expected, out-of-vehicle time (OVT) is valued more highly than in-vehicle time for business and commuting. Headway is relatively highly valued by these respondents. It tends to have a value somewhat nearer a half in-vehicle time. Whilst it may be that this sample of travelers does genuinely have high values of frequency, we must treat the coefficients related to Metro with some caution given that the ASC is not retained, because of correlation problems, and hence the coefficient estimates for Metro could detect, as proxy, elements of the genuine ASC relating to Metro.

Table 3: Main SP Results

	Coeff.	T-ratio
ASCHOV	-1.0470	-23.39
ASCDIFF	-2.2178	-32.35
ASCNON	-0.7189	-8.31
ASCNONLeis	-0.1709	-1.20
TimeCarComm	-0.0572	-28.90
TimeCarEB	-0.0567	-11.01
TimeCarLeis	-0.0882	-18.63
Time_METComm	-0.0381	-16.92
Time_METEB	-0.0327	-6.27
Time_METLeis	-0.0723	-15.20
OVTMET	-0.0535	-9.62
Headway	-0.0333	-5.68
TollComm	-0.2828	-4.06
TollEB	-0.2657	-2.91
TollLeis	-0.5224	-5.52
TollPlus	-0.9812	-14.03
Fuel	-0.1996	-8.21
D1	0.6581	6.83
Fare	-0.7869	-10.43

LL	14106.38	
LL_ASCs	15448.92	0.087
LL_Zeros	16051.14	0.121
Observations		9682

VoTComm	20.23	¢/min
VoTEB	21.34	¢/min
VoTLeis	16.88	¢/min

Turning to the toll, business travelers and commuters have a similar sensitivity to toll. Leisure travelers are somewhat more sensitive, which might be expected on the grounds of generally lower incomes amongst this category.

What is more important here is the coefficient we have termed Tollplus. Motorists tend not to like paying toll, and we understand that an increase in toll to fund the Metro in this context is a highly contentious issue. The Tollplus coefficient is considered when the difference between the toll in the SP exercise and the currently paid toll is positive.

It can be seen that this incremental toll effect is very large and highly significant. It would seem that there is a large protest against paying higher tolls. This is confirmed in the record of responses regarding attitudes to paying Tolls provided at the end of the questionnaire.

The retention of the Tollplus term is justified on a number of grounds. Firstly, we would expect a large amount of hostility to toll increases in this context, although the extent of the effect is perhaps surprising. Secondly, other studies detect such effects. Thirdly, if this effect is not isolated, the values of time become implausibly low. Finally, the toll coefficients and the fuel coefficient are broadly sensible in relation to each other when the incremental toll effect is specified. We would expect the fuel coefficient to be less than toll since not all motorists consider fuel costs when making travel decisions. Nonetheless, the removal of the incremental toll effect would make the toll coefficients around five times the fuel coefficient and this seems less reasonable.

The fare coefficient is quite large, larger than the toll and fuel coefficients. This may be detecting some of the effect attributable to the ASC for Metro as discussed above.

Finally, two terms were specified as to whether the offpeak was 7pm-6am and 9am-4pm (D1) or 7pm-6am and 11am-3pm (D2) relative to a base of the off-peak just being 7pm-6am. D2 was not significant, and presumably the 11am-3pm time period offers little benefit to most travelers. However, there was value in extending the daytime off-peak period to between 9am and 4pm.

As far as the values of time are concerned, these are 20.23 cents per minute for commuting, 21.34 cents per minute for business and 16.88 cents per minute for leisure.

The commuting value of time seems highly plausible. It is typically found that the leisure value of time is not much lower than the commuting value. The leisure value of time also seems plausible. The business value of time is hardly different to the commuting value, when we might expect a much larger premium on the basis of employers' willingness to pay. This is not an uncommon finding in SP studies. Respondents might not have borne in mind that the employer would pay or, more likely, the effort involved in claiming back the toll is not deemed to be worth it and hence the respondent effectively pays for the toll themselves. In this respect, it is not surprising that the value of time for business is similar to commuting. The business value of time might therefore represent a lower bound to willingness to pay for time savings amongst business travelers. For social economic appraisal, the benefits of the time savings can be approximated by the wage rate of those impacted.

6. ANALYSIS OF SUPPLEMENTARY SP DATA

The results of the supplementary SP exercise are reported in Table 4. The goodness of fit, in excess of 0.30, is excellent, although we have removed those who consistently chose the same alternative throughout. The coefficient estimates are all highly significant. There is a slight preference of around a minute in favor of route B, which has just the one type of time.

The results are presented in order of what we expect to be ascending disutility. Parameters (θ) have been estimated to allow for scale differences amongst the four SP exercises and two distance bands. The 15 mile band is denoted A and the 25 mile band denoted B. The base is arbitrarily taken to be the first exercise for 15 miles whereupon θ_{1A} is implicitly one. It was found that the scale did not vary much by SP type but it did vary between time band. Hence the reported model constrains the scale to be the same for each SP type but to vary by time band. The results denote that the longer SP has about 60% more random error. If we did not account for this variation in random error, the effect would be incorrectly attributed to the coefficient estimates.

What is noticeable about the results is that there is a monotonic relationship between the time coefficient and what we expect to be the disutility of driving time. This is an impressive finding, and in line with the results obtained in the same application in Great Britain. The increase in the value of time is of the order of 60%. Not only does this seem plausible, but it is in line with studies which simply distinguish between free flow and an unspecified type of time spent in congested traffic where the premium is around 40%.

Table 4: Supplementary SP Results

	Coeff.	T-ratio	TimeRatio
ASCB	-0.1919	-2.43	
Free Flow	-0.2272	-25.44	1.00
Busy	-0.2297	-25.95	1.11
Light Congestion	-0.2433	-27.09	1.17
Heavy Congestion	-0.2659	-26.33	1.28
StopGo	-0.3244	-21.34	1.57
Gridlock	-0.3341	-18.77	1.61
θ_{1A}	1.0000	Base	
θ_{1B}	0.4102	21.36	
θ_{2A}	1.0000	-	
θ_{2B}	0.4102	21.36	
θ_{3A}	1.0000	-	
θ_{3B}	0.4102	21.36	
θ_{4A}	1.0000	-	
θ_{4B}	0.4102	21.36	

LL	3801.89	
LL_ASCs	5531.94	0.313
LL_Zeros	5532.70	0.313
Observations		7982

7. CONCLUSIONS

Route and mode choice multinomial logit models have been estimated to a large data set of travelers. This model can be used to forecast mode and route choice. However, the primary purpose is to derive values of time for use in network models. The values of time for commuting and leisure travel seem highly plausible. Those for business travel are found to be little different to commuting values. This is often the case in SP studies.

A supplementary SP exercise was conducted to examine how the disutility of travel varies with driving conditions. This has obtained an impressive monotonic relationship between the estimated and expected disutility of time with a maximum premium on the value of time according to driving conditions of 60%.

8. ADDITIONAL INFORMATION: MAIN SP DESIGN

The alternatives offered along with their attributes are:

- Existing Freeway: characterized by toll (TOLLEX) and time (TIMEEX)
- New Freeway: characterized by toll (TOLLNEW) and time (TIMENEW)
- High Occupancy Vehicle (HOV) Lane: characterized by toll (TOLLHOV) and time (TIMEHOV)
- Existing Freeway but off-peak departure: characterized by toll (TOLLDIFF), time (TIMEDIFF) and definition of off-peak period (OFFPEAK).
- Untolled road: characterized by time (TIMENON)
- New Metro service: characterized by train fare (TRNFARE), train time (TRNTIME), train frequency (TRNFREQ) and train out-of-vehicle time (TRNOVT).

TOLLEX covers required toll levels up to $2.20 from $1.

TOLLNEW is generally higher than TOLLEX given that it offers time savings on the existing freeway.

TOLLHOV is sometimes higher than TOLLEX because a time saving can be obtained on HOV (and in any event costs are shared) but it can also be lower sometimes to induce people to switch to this option.

TOLLDIFF is lower to compensate for having to depart at a less desirable time and induce behavioral change.

TIMEEX offers both increases and reductions around the actual (design) journey time of 30, 45, 60 and 75 minutes.

TIMENEW is generally quicker than TIMEEX due to less congestion.

TIMEDIFF is often less than for TIMEEX because of less congestion in the off-peak.

TIMEHOV is less than TIMEEX because there is less congestion on the HOV lane.

TRNFARE is relatively cheap in order to compensate for the longer time

TRNTIME is higher than for car time, which is to be expected.

TRNFREQ is a service headway of every 5, 10 or 15 minutes.

OFFPEAK is specified at three levels. These are 7pm-6am (1), 7pm-6am and 9am-4pm (2), and 7pm-6am and 11am-3pm (3).

Table 5: 30-Minute SP Design

tollex	tolldiff	tollnew	tollhov	timeex	timediff	timenew	timehov	displace	timenon	trnfare	trntime	trnfreq	fuel	trnovt
130	75	200	100	25	25	25	20	2	40	130	45	5	4	15
220	100	250	100	25	20	20	20	1	35	100	35	5	3	10
130	50	250	200	30	20	18	25	1	40	100	50	5	3	10
170	75	250	200	25	20	20	20	1	35	175	50	15	5	10
100	50	150	150	30	30	25	20	2	35	130	35	5	5	10
100	50	150	200	35	20	18	25	3	40	175	45	5	3	15
130	75	200	150	30	20	20	20	1	45	100	50	5	3	20
220	100	250	150	30	25	18	20	3	35	175	35	5	4	10
100	75	250	150	25	25	20	25	2	40	100	35	10	3	10
220	75	150	100	30	20	25	25	1	40	175	35	10	4	10
130	50	250	250	25	30	20	25	3	45	130	45	5	4	10
170	75	250	250	30	30	18	20	2	35	100	45	15	3	10
100	100	200	200	25	30	25	20	3	45	100	35	15	3	15
100	50	150	100	25	20	20	20	1	35	100	35	5	3	10
170	50	200	100	30	25	20	25	3	35	100	45	10	3	20
130	100	200	200	25	25	25	20	1	45	175	35	10	3	10
100	75	200	250	25	20	18	25	1	35	100	35	5	3	20
220	75	200	150	35	20	20	20	3	40	130	50	5	3	10
100	75	200	200	30	25	20	25	3	35	130	35	5	5	15
220	100	250	200	35	20	25	25	2	45	130	50	5	3	20
170	75	250	100	35	20	25	25	3	40	100	35	15	4	20
170	75	200	200	35	25	20	25	1	35	100	35	5	4	10
220	75	150	250	35	25	18	20	1	35	130	50	10	3	15
170	75	200	250	25	20	25	25	2	35	130	35	5	3	10
170	75	200	150	30	20	20	20	1	40	100	45	5	3	15
100	75	250	250	35	30	25	20	1	35	175	45	10	3	20
170	50	200	150	25	20	25	25	1	35	175	50	10	5	15
100	50	150	250	25	25	20	25	1	45	100	50	5	4	20
100	100	200	150	25	20	18	25	2	35	100	50	15	4	10
130	75	150	150	25	30	20	25	1	40	175	35	15	3	20
100	75	250	100	30	20	18	25	1	45	130	35	10	5	10
100	75	200	100	25	30	25	20	1	40	100	50	5	4	10
130	75	150	250	30	25	25	20	3	35	100	50	15	3	10
170	75	250	150	25	25	20	25	1	45	130	35	15	3	15
130	100	200	150	25	20	18	25	1	35	130	45	10	4	20
220	50	200	100	35	30	20	25	1	35	130	50	15	3	10
220	50	200	250	30	20	20	20	1	45	175	35	15	4	15
220	75	200	250	25	20	25	25	1	35	100	35	5	3	15
130	50	250	100	25	20	20	20	2	35	175	35	5	3	15
170	50	200	250	35	20	20	20	2	45	100	35	10	4	10
170	100	150	200	30	20	25	25	1	45	100	45	5	3	10
220	75	150	200	25	20	20	20	2	35	100	45	10	5	20
220	75	200	100	25	25	18	20	1	45	100	45	5	5	10
130	75	200	200	35	30	20	25	1	35	100	35	5	5	10
170	50	200	200	25	30	18	20	1	40	130	35	10	3	10
220	100	250	250	25	30	20	25	1	40	100	45	5	5	15
130	75	150	200	25	20	20	20	1	35	130	45	15	4	10
130	50	250	150	35	25	25	20	1	35	100	35	5	5	20
100	75	250	200	25	20	20	20	3	35	100	50	10	4	15
130	75	200	250	25	20	18	25	3	35	175	35	5	3	10
130	100	200	250	35	20	20	20	3	40	100	35	10	5	10
170	100	150	250	25	25	20	25	2	40	175	50	5	5	10
170	75	200	100	25	30	18	20	3	45	175	50	5	5	20
220	75	200	200	30	30	20	25	2	35	175	35	5	4	20
100	100	200	250	30	20	20	20	1	40	130	35	15	5	20
220	50	200	150	25	20	25	25	3	35	100	45	15	5	10
100	75	200	150	35	20	20	20	2	45	175	45	5	3	10
220	75	150	150	25	30	20	25	3	45	100	35	10	3	10
130	75	150	100	35	20	18	25	2	45	100	35	15	5	15
220	50	200	200	25	25	18	20	2	40	100	35	15	3	20
170	100	150	100	25	20	20	20	3	35	130	35	5	3	20
130	100	200	100	30	30	20	25	2	35	100	50	10	3	15
100	100	200	100	35	25	20	25	1	35	175	45	15	3	10
170	100	150	150	35	30	18	20	1	35	100	35	5	4	15

Table 6: 45-Minute SP Design

tollex	tolldiff	tollnew	tollhov	timeex	timediff	timenew	timehov	displace	timenon	trnfare	trntime	trnfreq	fuel	trnovt
130	75	200	100	40	40	40	35	2	55	130	50	5	4	15
220	100	250	100	40	35	35	35	1	50	100	45	5	3	10
130	50	250	200	45	35	30	40	1	55	100	60	5	3	10
170	75	250	200	40	35	35	35	1	50	175	60	15	5	10
100	50	150	150	45	45	40	35	2	50	130	45	5	5	10
100	50	150	200	50	35	30	40	3	55	175	50	5	3	15
130	75	200	150	45	35	35	35	1	60	100	60	5	3	20
220	100	250	150	45	40	30	35	3	50	175	45	5	4	10
100	75	250	150	40	40	35	40	2	55	100	45	10	3	10
220	75	150	100	45	35	40	40	1	55	175	45	10	4	10
130	50	250	250	40	45	35	40	3	60	130	50	5	4	10
170	75	250	250	45	45	30	35	2	50	100	50	15	3	10
100	100	200	200	40	45	40	35	3	60	100	45	15	3	15
100	50	150	100	40	35	35	35	1	50	100	45	5	3	10
170	50	200	100	45	40	35	40	3	50	100	50	10	3	20
130	100	200	200	40	40	40	35	1	60	175	45	10	3	10
100	75	200	250	40	35	30	40	1	50	100	45	5	3	20
220	75	200	150	50	35	35	35	3	55	130	60	5	3	10
100	75	200	200	45	40	35	40	3	50	130	45	5	5	15
220	100	250	200	50	35	40	40	2	60	130	60	5	3	20
170	75	250	100	50	35	40	40	3	55	100	45	15	4	20
170	75	200	200	50	40	35	40	1	50	100	45	5	4	10
220	75	150	250	50	40	30	35	1	50	130	60	10	3	15
170	75	200	250	40	35	40	40	2	50	130	45	5	3	10
170	75	200	150	45	35	35	35	1	55	100	50	5	3	15
100	75	250	250	50	45	40	35	1	50	175	50	10	3	20
170	50	200	150	40	35	40	40	1	50	175	60	10	5	15
100	50	150	250	40	40	35	40	1	60	100	60	5	4	20
100	100	200	150	40	35	30	40	2	50	100	60	15	4	10
130	75	150	150	40	45	35	40	1	55	175	45	15	3	20
100	75	250	100	45	35	30	40	1	60	130	45	10	5	10
100	75	200	100	40	45	40	35	1	55	100	60	5	4	10
130	75	150	250	45	40	40	35	3	50	100	60	15	3	10
170	75	250	150	40	40	35	40	1	60	130	45	15	3	15
130	100	200	150	40	35	30	40	1	50	130	50	10	4	20
220	50	200	100	50	45	35	40	1	50	130	60	15	3	10
220	50	200	250	45	35	35	35	1	60	175	45	15	4	15
220	75	200	250	40	35	40	40	1	50	100	45	5	3	15
130	50	250	100	40	35	35	35	2	50	175	45	5	3	15
170	50	200	250	50	35	35	35	2	60	100	45	10	4	10
170	100	150	200	45	35	40	40	1	60	100	50	5	3	10
220	75	150	200	40	35	35	35	2	50	100	50	10	5	20
220	75	200	100	40	40	30	35	1	60	100	50	5	5	10
130	75	200	200	50	45	35	40	1	50	100	45	5	5	10
170	50	200	200	40	45	30	35	1	55	130	45	10	3	10
220	100	250	250	40	45	35	40	1	55	100	50	5	5	15
130	75	150	200	40	35	35	35	1	50	130	50	15	4	10
130	50	250	150	50	40	40	35	1	50	100	45	5	5	20
100	75	250	200	40	35	35	35	3	50	100	60	10	4	15
130	75	200	250	40	35	30	40	3	50	175	45	5	3	10
130	100	200	250	50	35	35	35	3	55	100	45	10	5	10
170	100	150	250	40	40	35	40	2	55	175	60	5	5	10
170	75	200	100	40	45	30	35	3	60	175	60	5	5	20
220	75	200	200	45	45	35	40	2	50	175	45	5	4	20
100	100	200	250	45	35	35	35	1	55	130	45	15	5	20
220	50	200	150	40	35	40	40	3	50	100	50	15	5	10
100	75	200	150	50	35	35	35	2	60	175	50	5	3	10
220	75	150	150	40	45	35	40	3	60	100	45	10	3	10
130	75	150	100	50	35	30	40	2	60	100	45	15	5	15
220	50	200	200	40	40	30	35	2	55	100	45	15	3	20
170	100	150	100	40	35	35	35	3	50	130	45	5	3	20
130	100	200	100	45	45	35	40	2	50	100	60	10	3	15
100	100	200	100	50	40	35	40	1	50	175	50	15	3	10
170	100	150	150	50	45	30	35	1	50	100	45	5	4	15

Table 7: 60-Minute SP Design

tollex	tolldiff	tollnew	tollhov	timeex	timediff	timenew	timehov	displace	timenon	trnfare	trntime	trnfreq	fuel	trnovt
130	75	200	100	50	50	50	45	2	75	160	70	5	4	15
220	100	250	100	50	45	45	45	1	65	125	60	5	3	10
130	50	250	200	60	45	40	50	1	75	125	80	5	3	10
170	75	250	200	50	45	45	45	1	65	200	80	15	5	10
100	50	150	150	60	60	50	45	2	65	160	60	5	5	10
100	50	150	200	70	45	40	50	3	75	200	70	5	3	15
130	75	200	150	60	45	45	45	1	80	125	80	5	3	20
220	100	250	150	60	50	40	45	3	65	200	60	5	4	10
100	75	250	150	50	50	45	50	2	75	125	60	10	3	10
220	75	150	100	60	45	50	50	1	75	200	60	10	4	10
130	50	250	250	50	60	45	50	3	80	160	70	5	4	10
170	75	250	250	60	60	40	45	2	65	125	70	15	3	10
100	100	200	200	50	60	50	45	3	80	125	60	15	3	15
100	50	150	100	50	45	45	45	1	65	125	60	5	3	10
170	50	200	100	60	50	45	50	3	65	125	70	10	3	20
130	100	200	200	50	50	50	45	1	80	200	60	10	3	10
100	75	200	250	50	45	40	50	1	65	125	60	5	3	20
220	75	200	150	70	45	45	45	3	75	160	80	5	3	10
100	75	200	200	60	50	45	50	3	65	160	60	5	5	15
220	100	250	200	70	45	50	50	2	80	160	80	5	3	20
170	75	250	100	70	45	50	50	3	75	125	60	15	4	20
170	75	200	200	70	50	45	50	1	65	125	60	5	4	10
220	75	150	250	70	50	40	45	1	65	160	80	10	3	15
170	75	200	250	50	45	50	50	2	65	160	60	5	3	10
170	75	200	150	60	45	45	45	1	75	125	70	5	3	15
100	75	250	250	70	60	50	45	1	65	200	70	10	3	20
170	50	200	150	50	45	50	50	1	65	200	80	10	5	15
100	50	150	250	50	50	45	50	1	80	125	80	5	4	20
100	100	200	150	50	45	40	50	2	65	125	80	15	4	10
130	75	150	150	50	60	45	50	1	75	200	60	15	3	20
100	75	250	100	60	45	40	50	1	80	160	60	10	5	10
100	75	200	100	50	60	50	45	1	75	125	80	5	4	10
130	75	150	250	60	50	50	45	3	65	125	80	15	3	10
170	75	250	150	50	50	45	50	1	80	160	60	15	3	15
130	100	200	150	50	45	40	50	1	65	160	70	10	4	20
220	50	200	100	70	60	45	50	1	65	160	80	15	3	10
220	50	200	250	60	45	45	45	1	80	200	60	15	4	15
220	75	200	250	50	45	50	50	1	65	125	60	5	3	15
130	50	250	100	50	45	45	45	2	65	200	60	5	3	15
170	50	200	250	70	45	45	45	2	80	125	60	10	4	10
170	100	150	200	60	45	50	50	1	80	125	70	5	3	10
220	75	150	200	50	45	45	45	2	65	125	70	10	5	20
220	75	200	100	50	50	40	45	1	80	125	70	5	5	10
130	75	200	200	70	60	45	50	1	65	125	60	5	5	10
170	50	200	200	50	60	40	45	1	75	160	60	10	3	10
220	100	250	250	50	60	45	50	1	75	125	70	5	5	15
130	75	150	200	50	45	45	45	1	65	160	70	15	4	10
130	50	250	150	70	50	50	45	1	65	125	60	5	5	20
100	75	250	200	50	45	45	45	3	65	125	80	10	4	15
130	75	200	250	50	45	40	50	3	65	200	60	5	3	10
130	100	200	250	70	45	45	45	3	75	125	60	10	5	10
170	100	150	250	50	50	45	50	2	75	200	80	5	5	10
170	75	200	100	50	60	40	45	3	80	200	80	5	5	20
220	75	200	200	60	60	45	50	2	65	200	60	5	4	20
100	100	200	250	60	45	45	45	1	75	160	60	15	5	20
220	50	200	150	50	45	50	50	3	65	125	70	15	5	10
100	75	200	150	70	45	45	45	2	80	200	70	5	3	10
220	75	150	150	50	60	45	50	3	80	125	60	10	3	10
130	75	150	100	70	45	40	50	2	80	125	60	15	5	15
220	50	200	200	50	50	40	45	2	75	125	60	15	3	20
170	100	150	100	50	45	45	45	3	65	160	60	5	3	20
130	100	200	100	60	60	45	50	2	65	125	80	10	3	15
100	100	200	100	70	50	45	50	1	65	200	70	15	3	10
170	100	150	150	70	60	40	45	1	65	125	60	5	4	15

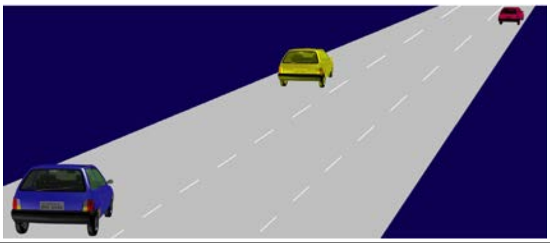
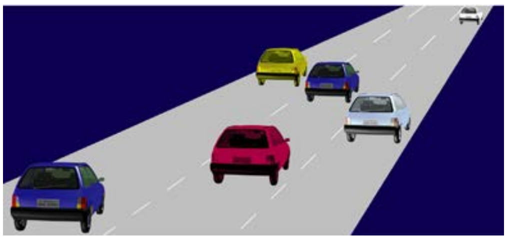
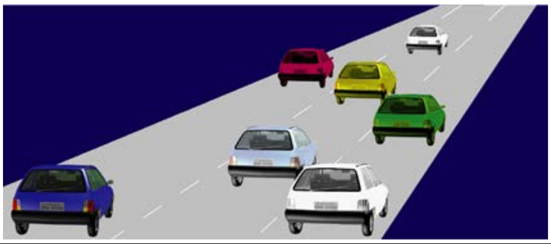
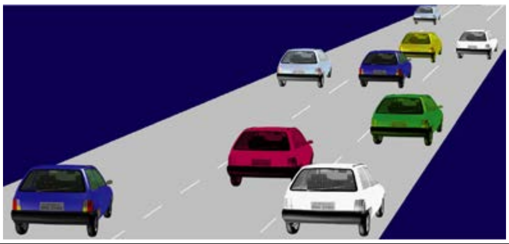
Table 8: 75-Minute SP Design

tollex	tolldiff	tollnew	tollhov	timeex	timediff	timenew	timehov	displace	timenon	trnfare	trntime	trnfreq	fuel	trnovt
130	75	200	100	70	60	60	55	2	110	160	80	5	4	15
220	100	250	100	70	50	50	55	1	90	125	75	5	3	10
130	50	250	200	75	50	40	65	1	110	125	90	5	3	10
170	75	250	200	70	50	50	55	1	90	200	90	15	5	10
100	50	150	150	75	75	60	55	2	90	160	75	5	5	10
100	50	150	200	90	50	40	65	3	110	200	80	5	3	15
130	75	200	150	75	50	50	55	1	120	125	90	5	3	20
220	100	250	150	75	60	40	55	3	90	200	75	5	4	10
100	75	250	150	70	60	50	65	2	110	125	75	10	3	10
220	75	150	100	75	50	60	65	1	110	200	75	10	4	10
130	50	250	250	70	75	50	65	3	120	160	80	5	4	10
170	75	250	250	75	75	40	55	2	90	125	80	15	3	10
100	100	200	200	70	75	60	55	3	120	125	75	15	3	15
100	50	150	100	70	50	50	55	1	90	125	75	5	3	10
170	50	200	100	75	60	50	65	3	90	125	80	10	3	20
130	100	200	200	70	60	60	55	1	120	200	75	10	3	10
100	75	200	250	70	50	40	65	1	90	125	75	5	3	20
220	75	200	150	90	50	50	55	3	110	160	90	5	3	10
100	75	200	200	75	60	50	65	3	90	160	75	5	5	15
220	100	250	200	90	50	60	65	2	120	160	90	5	3	20
170	75	250	100	90	50	60	65	3	110	125	75	15	4	20
170	75	200	200	90	60	50	65	1	90	125	75	5	4	10
220	75	150	250	90	60	40	55	1	90	160	90	10	3	15
170	75	200	250	70	50	60	65	2	90	160	75	5	3	10
170	75	200	150	75	50	50	55	1	110	125	80	5	3	15
100	75	250	250	90	75	60	55	1	90	200	80	10	3	20
170	50	200	150	70	50	60	65	1	90	200	90	10	5	15
100	50	150	250	70	60	50	65	1	120	125	90	5	4	20
100	100	200	150	70	50	40	65	2	90	125	90	15	4	10
130	75	150	150	70	75	50	65	1	110	200	75	15	3	20
100	75	250	100	75	50	40	65	1	120	160	75	10	5	10
100	75	200	100	70	75	60	55	1	110	125	90	5	4	10
130	75	150	250	75	60	60	55	3	90	125	90	15	3	10
170	75	250	150	70	60	50	65	1	120	160	75	15	3	15
130	100	200	150	70	50	40	65	1	90	160	80	10	4	20
220	50	200	100	90	75	50	65	1	90	160	90	15	3	10
220	50	200	250	75	50	50	55	1	120	200	75	15	4	15
220	75	200	250	70	50	60	65	1	90	125	75	5	3	15
130	50	250	100	70	50	50	55	2	90	200	75	5	3	15
170	50	200	250	90	50	50	55	2	120	125	75	10	4	10
170	100	150	200	75	50	60	65	1	120	125	80	5	3	10
220	75	150	200	70	50	50	55	2	90	125	80	10	5	20
220	75	200	100	70	60	40	55	1	120	125	80	5	5	10
130	75	200	200	90	75	50	65	1	90	125	75	5	5	10
170	50	200	200	70	75	40	55	1	110	160	75	10	3	10
220	100	250	250	70	75	50	65	1	110	125	80	5	5	15
130	75	150	200	70	50	50	55	1	90	160	80	15	4	10
130	50	250	150	90	60	60	55	1	90	125	75	5	5	20
100	75	250	200	70	50	50	55	3	90	125	90	10	4	15
130	75	200	250	70	50	40	65	3	90	200	75	5	3	10
130	100	200	250	90	50	50	55	3	110	125	75	10	5	10
170	100	150	250	70	60	50	65	2	110	200	90	5	5	10
170	75	200	100	70	75	40	55	3	120	200	90	5	5	20
220	75	200	200	75	75	50	65	2	90	200	75	5	4	20
100	100	200	250	75	50	50	55	1	110	160	75	15	5	20
220	50	200	150	70	50	60	65	3	90	125	80	15	5	10
100	75	200	150	90	50	50	55	2	120	200	80	5	3	10
220	75	150	150	70	75	50	65	3	120	125	75	10	3	10
130	75	150	100	90	50	40	65	2	120	125	75	15	5	15
220	50	200	200	70	60	40	55	2	110	125	75	15	3	20
170	100	150	100	70	50	50	55	3	90	160	75	5	3	20
130	100	200	100	75	75	50	65	2	90	125	90	10	3	15
100	100	200	100	90	60	50	65	1	90	200	80	15	3	10
170	100	150	150	90	75	40	55	1	90	125	75	5	4	15

9. ADDITIONAL INFORMATION: SUPPLEMENTARY SP DESIGN

Verbal and pictorial definitions were used to represent each type of driving condition. These are set out in Table 9 for each of the six driving conditions.

Table 9: Driving Conditions – Pictorial and Verbal Description

	
1: Free flowing You can travel at your own speed with no problems over-taking.	***2: Busy*** You can travel pretty much at the speed limit, but you are forced to change lanes every now and then.
	
3: Light congestion You can travel close to the speed limit most of the time, but you have to slow down every so often for no apparent reason.	***4: Heavy congestion*** Your speed is noticeably restricted frequent gear changes required.
	
5: Stop start You are forced to drive in a “stop-start” fashion.	***6: Gridlock*** You are only able to move at a crawl at best, and spend quiet a lot of time stationary

Respondents were assigned to one of the four designs in Table 10 below. Option B always has the same type of time whilst option A has two types of time, one of which is better than that in Option B and one of which is worse. In addition, the journey could be of 15 miles or 25 miles.

This approach has the advantage that any individual is only offered three types of time and avoids the tasks becoming too complex which could well occur if all six types of time were offered.

Table 10: Driving Conditions Offered

Option A	Option B
Free Flowing **(I)** and Stop Start **(II)**	Light Congestion
Busy **(I)** and Gridlock **(II)**	Heavy Congestion
Busy **(I)** and Stop Start **(II)**	Light Congestion
Free Flowing **(I)** and Heavy Congestion **(II)**	Busy

Tables 11 and 12 detail the designs used for the 15 mile and 25 mile journeys respectively. Respondents were offered all nine scenarios to evaluate.

Table 11: Design for Shorter Journeys

Option A		Option B
Better **(I)**	Worse **(II)**	
5	5	15
5	10	20
5	15	25
10	5	20
10	10	25
10	15	15
15	5	25
15	10	15
15	15	20

Table 12: Design for Longer Journeys

Option A		Option B
Better **(I)**	Worse **(II)**	
40	20	60
40	25	75
40	30	90
50	20	75
50	25	90
50	30	60
60	20	90
60	25	60
60	30	75

Appendix C

ANALYSIS OF POPULATION AND EMPLOYMENT FORECASTS

Renaissance Planning Group

ANALYSIS OF POPULATION AND EMPLOYMENT FORECASTS

FOR THE WASHINGTON DC REGION 2010 TO 2050

WINTER 2014 UPDATE

BY

RENAISSANCE PLANNING GROUP

FOR

METROPOLITAN WASHINGTON AIRPORTS AUTHORITY

February 17, 2014

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Executive Summary

Renaissance Planning Group has conducted an independent economic analysis of projected growth trends for the Metropolitan Washington Transportation Planning Board travel demand model, updating the forecasts developed in July 2012. These forecasts reflect a synthesis of independent macroeconomic (jurisdiction-level) and microeconomic (TAZ-level) forecasts from local, regional, state, and national firms and agencies. The report compares the RPG forecasts to an aggregation of macroeconomic forecast sources and to the current (Round 8.2) MWCOG microeconomic forecasts. The report identifies pertinent forces that influence the differences among the various sources and between forecasts available through spring 2012 and those available at the end of calendar year 2013. Notable conclusions of the report include the following trends, which are generally consistent across all sources:

- The Washington regional economy remains strong, with steady growth projected in virtually all geographic locations and economic sectors for the foreseeable future
- The effects of the Great Recession and the federal sequester are measurable, but the degree of effect on future economic forecasts have differed across sources and over the past two years. We expect both the recession and the continuing federal fiscal climate to have a fairly minor effect on long term trends and that their effects might appropriately be described as adjustments to the baseline.
- Growth will be increasingly channeled to places that have high levels of multimodal accessibility, including the Washington region's activity clusters, due to both market preferences (affected prominently by both the millennial generation and baby boom generation transition into and out of the workforce, respectively) and public sector policies designed to improve the fiscal sustainability of infrastructure provision.
- Places with high level of multimodal accessibility will increasingly become mixed-use, for the same market preferences and public policy reasons affecting their geographic desirability.
- All sources indicate that growth prospects remain strongest in the Washington DC core and the western suburbs, including the study Primary Market Area, although substantial variance exists across sources and across the past two years regarding the pace of growth for inner core, suburban, and exurban jurisdictions.

Introduction

Renaissance Planning Group has conducted this independent economic analysis of the validity of the socioeconomic data that is used in conjunction with the Metropolitan Washington Transportation Planning Board travel demand forecasting model to forecast future travel demand in the Washington DC Metropolitan Area. The analysis includes a test of the reasonableness of the traffic analysis zone (TAZ) level and countywide socioeconomic data relative to current economic conditions and trends, the availability of vacant and underutilized land and the propensity for development and redevelopment in different parts of the region. This analysis has been conducted in support of a traffic and revenue study conducted for the Metropolitan Washington Airports Authority (MWAA) for the Dulles Toll Road in Fairfax County, Virginia. The economic analysis and socioeconomic data validation and adjustment will be used in the next phase of the traffic and revenue study, which will be undertaken by CDM Smith, Inc. (CDMS). The findings of the analysis will be used by WSA to forecast future vehicle traffic and toll revenue for the Dulles Toll Road.

Based on the economic analysis, Renaissance has prepared countywide population and employment estimates for 2010 and forecasts for 2015, 2020, 2025, 2030, 2035, 2040, 2045 and 2050 for the core and suburban counties of the Washington D.C. metropolitan area: Arlington, Fairfax, Loudoun and Prince William Counties in Virginia, Charles, Frederick, Montgomery and Prince George's Counties in Maryland, and the District of Columbia (Figure 1). The forecasts have been generated considering 2010 and prior US Decennial Census results, public and private forecasts from a number of sources and forecasts created by the Metropolitan Washington Council of Governments (MWCOG) for the purposes of long range regional land use and transportation planning. The purpose of this report is to document the analysis undertaken by Renaissance and present the resulting county and TAZ level adjustments to the adopted population and employment forecasts for the Washington DC Metropolitan Area.

This February 2014 report provides an update to the forecasts developed in July 2012, as summarized in Appendix B to the Comprehensive Traffic and Revenue Study 2012 Update[1] provided by CDM Smith. This update reflects the latest available TAZ-level forecasts adopted by the Metropolitan Washington Council of Governments (MWCOG), known as Round 8.2, as well as jurisdiction-level econometric changes proposed for Round 8.3 which is scheduled for adoption during spring 2014. This update also reflects selected review of additional regional macroeconomic forecast updates, although it does not incorporate a full update of the macroeconomic source data conducted in 2012.

[1] "Comprehensive Traffic and Revenue Study 2012 Update Final Report", CDM Smith for the Metropolitan Washington Airports Authority, January 2013.

Approach

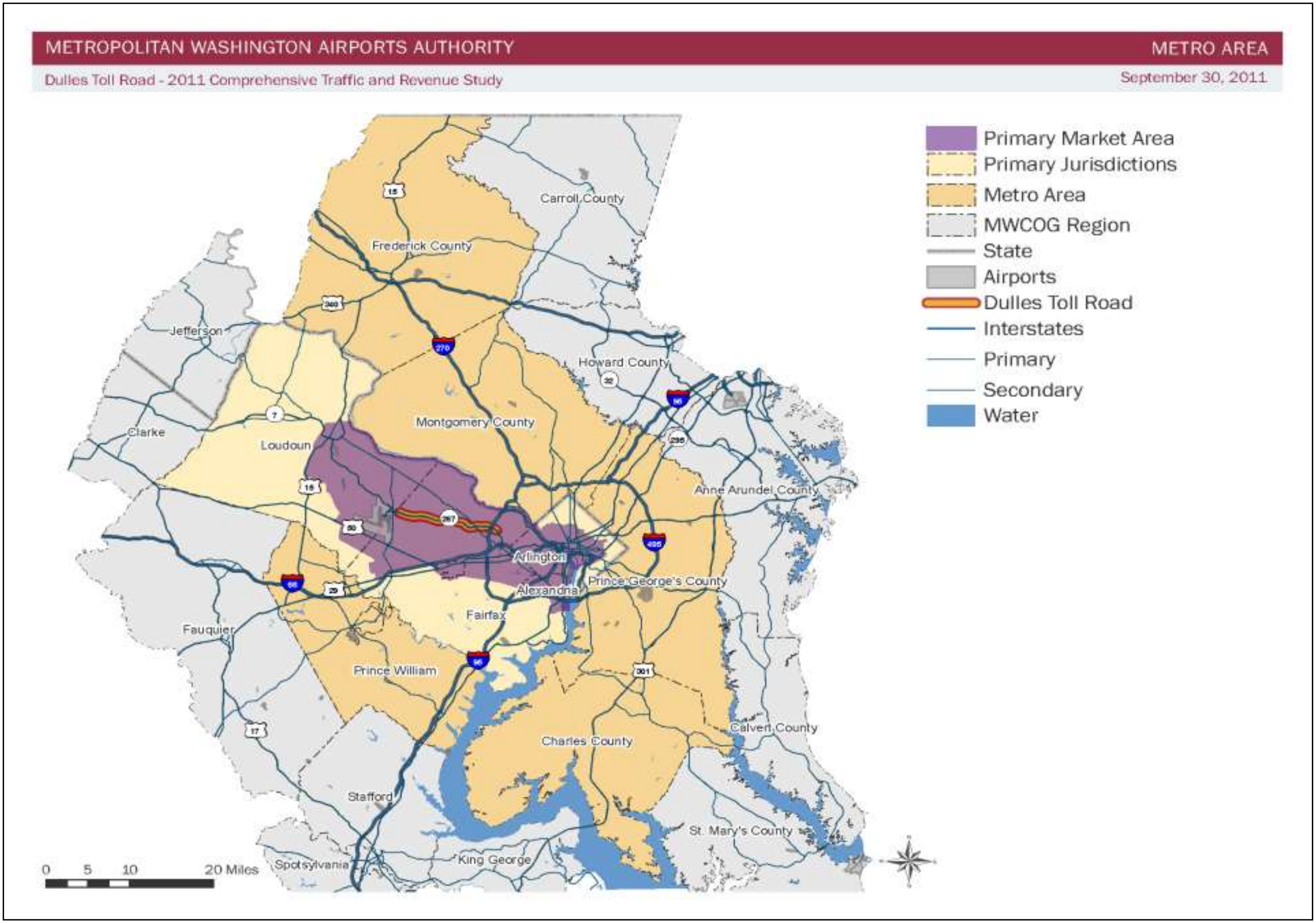
Renaissance assembled a team of professional land use planners, development specialists, transportation planners and geographic information systems analysts to evaluate economic conditions, local market dynamics, land use patterns, land availability and infrastructure investments that will affect the long term population and employment growth in the Washington DC Metropolitan Area. The approach included top down methods by testing and adjusting region-wide and jurisdictional population and employment control totals, bottom up methods analyzing the supply of land for residential and non-residential development, market-based macroeconomic information on the prospects for short and long term growth, and a forecasting tool integrating a variety of predicting variables that was used to analyze and adjust forecasts at the TAZ level. The approach to analyzing and refining the data for the region included several steps as first documented in the July 2012 report and as summarized below:

1. Definition of a Dulles Toll Road Primary Market Area based on a critical mass of origins and destinations for patrons;
2. Interagency and intergovernmental coordination to understand perspectives on MWCOG methods and forecasts;
3. County level evaluation and documentation of MWCOG population an employment forecasts at the jurisdictional level and comparison of those forecasts to a number of other public and private sources;
4. Macroeconomic assessment of past trends, present conditions and near term future prospects for residential development and absorption and job creation within the metropolitan region;
5. Forecast based on macroeconomic factors of population and employment at the jurisdictional level to be used as guidance in preparing the final adjusted forecast;
6. Detailed parcel level evaluation of existing conditions and land supply side factors for the jurisdictions in the Primary Market Area;
7. Methodology for modeling and testing the validity of MWCOG forecasts at the TAZ level for the District of Columbia, the City of Alexandria and Arlington, Fairfax, Loudoun, Prince William, Charles, Frederick, Montgomery and Prince George's Counties;
8. Consideration of notable changes to the observations and conclusions in the 2012 forecasts based on noteworthy trends through 2013; and
9. Final TAZ level jurisdictional and Primary Market Area forecasts based on adjusted 2010 population and employment, supply side analysis, macroeconomic guidance and forecasting model based on MWCOG assumptions.

The 2012 report also included three supplemental sensitivity tests were developed that pivot from the TAZ level jurisdictional and Primary Market Area forecasts to examine a region wide slower-growth scenario, a scenario in which the Silver Line is permanently truncated at Wiehle Avenue (Phase I), and a combination of the slower growth and truncation scenarios.

This update retains the historical trendline information from the July 2012 report for historic context in sections describint Steps 1 through 7, but focuses on the 2014 update to the TAZ level forecasts and the comparison of this update against the Round 8.2 MWCOG forecasts in sections describing Steps 8 and 9.

Figure 1 - Map of Metro Area



Step 1: Dulles Toll Road Primary Market Area

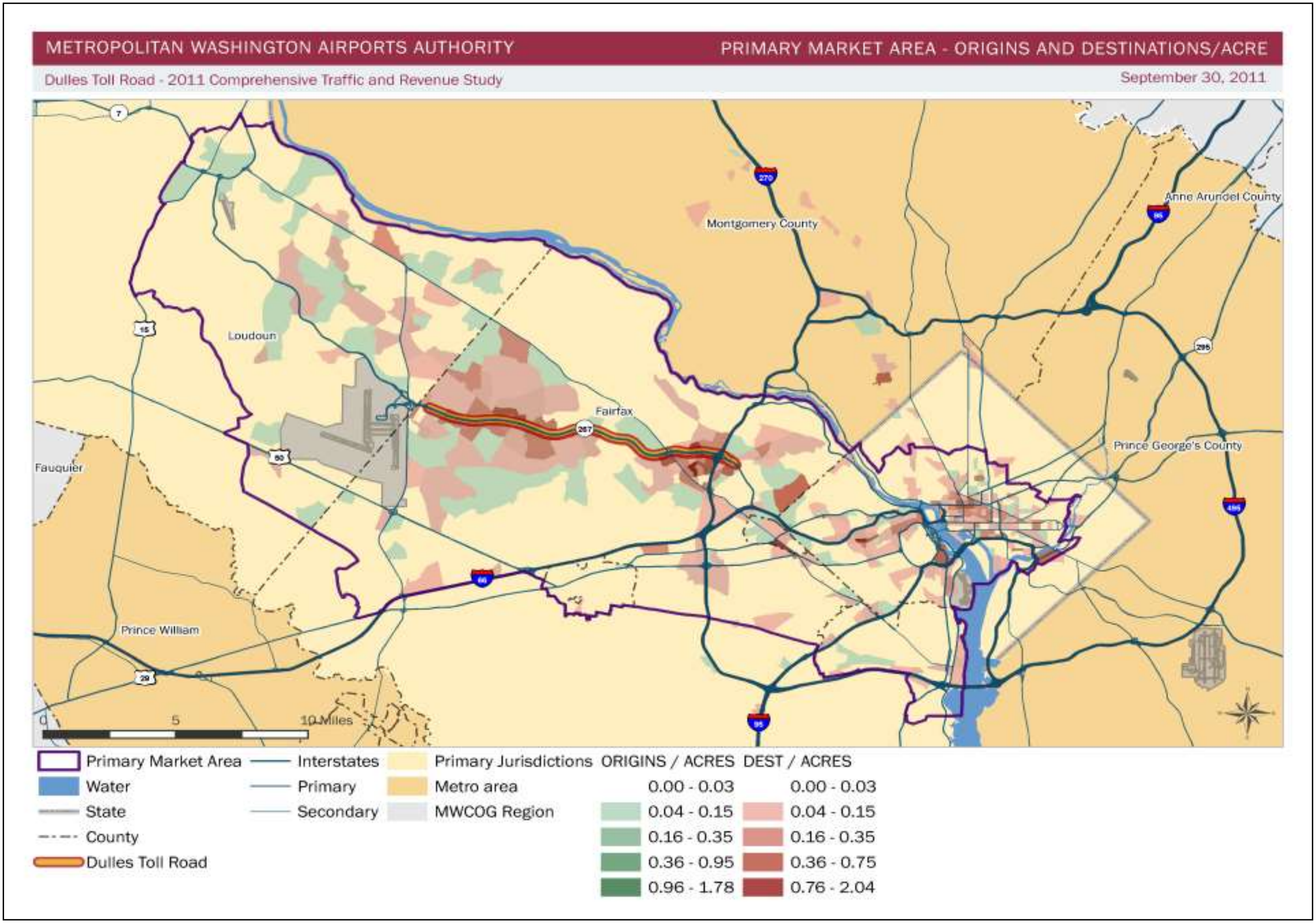
The results of a 2007 Travel Pattern Survey for the Dulles Toll Road were used to identify the Primary Market Area for our analysis. The survey was conducted by Wilbur Smith Associates on behalf of MWAA and VDOT. The survey contained data points for 8,674 trip origins and 8,574 trip destinations within the COG model TAZs. These origins and destination points were mapped, and analyzed both by normalized density per acre, as well as total by TAZs. The Primary Market Area is defined by TAZ boundaries. TAZs with the highest concentration of both origins and destinations were manually selected to comprise the Primary Market Area. Wherever possible, TAZs were selected to form a cohesive study area, avoiding holes and rough edges. The selection process continued until the percent of total origins and destinations were both greater than 85%. The Primary Market Area and densities of origins and destinations by TAZ are depicted in Figure 2. The area includes all or portions of Loudoun County, Fairfax County, Arlington County and the District of Columbia. The entire City of Alexandria is also included in the area. The Primary Market Area definition was retained for the 2014 update.

Step 2: Interagency and Intergovernmental Coordination and Interviews

For both the 2012 and 2014 forecasts, Renaissance contacted a number of agencies and governments to collect information and interview key staff. The interviews and meetings helped us gain perspective on trends and conditions in the housing and commercial development markets and hear their perspective on the MWCOG forecasts. The following is a list of those who were contacted and provided input:

- Arlington County Department of Community Planning, Housing and Development
- City of Alexandria Department of Planning and Zoning
- District of Columbia Office of Planning
- Fairfax County Department of Transportation
- Fairfax County Department of Planning and Zoning
- Loudoun County Department of Management and Financial Services
- Loudoun County Department of Planning
- Metropolitan Washington Council of Governments

Figure 2 – Map of Density of Origins and Destinations in the Primary Market Area



Step 3: County Level Evaluation of MWCOG Forecasts

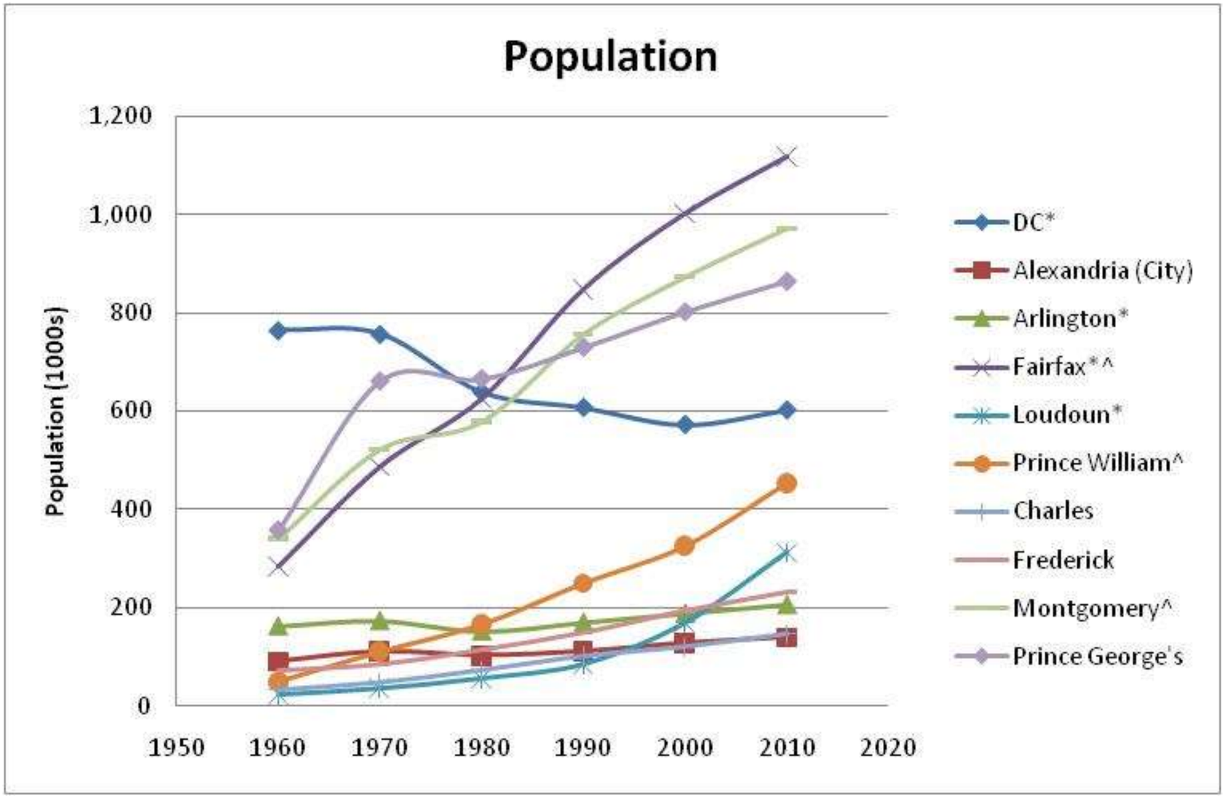
One component of the economic analysis is to conduct a top down evaluation of population and employment forecasts at the regional and jurisdictional level. This section summarizes the data sources used and presents graphs comparing historic trends and forecasts for a select number of jurisdictions within the metropolitan region. For this level of analysis, we have cast a wide net to include jurisdictions that do not have a significant impact on the Dulles Toll Road. The purpose is to ensure we understand the regional dynamics of job formation, population growth, and general trends and preferences that affect the long term prospects for change in the region and within the Primary Market Area for the Dulles Toll Road. These evaluations were performed for the 2012 forecasts and retained for the 2014 update. Notable shifts in these trends incorporated into the 2014 update are discussed in Section 7 of this report..

Population History and Forecasts

Historical population counts and estimates were obtained from the US Census Bureau. The primary historical sources were the decennial population counts, which are considered authoritative. Trends in population between census years were examined by consulting the Census Bureau's annual midyear population estimates, obtained through the US Bureau of Economic Analysis (BEA).

Population forecasts were obtained from four sources, one from the public sector and three from private data providers. The public sector source was the state government data center of either Maryland or Virginia (depending on the county location). No public sector source was identified for the District of Columbia. The State of Maryland forecasts were available in five-year increments extending to 2040. The State of Virginia forecasts were available only in ten-year increments extending to 2030. In order to compare the Virginia forecasts with the other sources which use five-year increments, Renaissance interpolated five-year forecasts using the expressed compound annual growth rate of the Virginia ten-year forecasts. The three private sources were Moody's Analytics, Woods & Poole Economics, and Economic Modeling Specialists, Inc. (EMSI). All produce annual forecasts out to 2040 except for EMSI. Since the standard unit of population measurement is universally understood to be an individual person, all of these sources can be directly compared without any adjustments.

Figure 3 – US Census Historical Population[2]

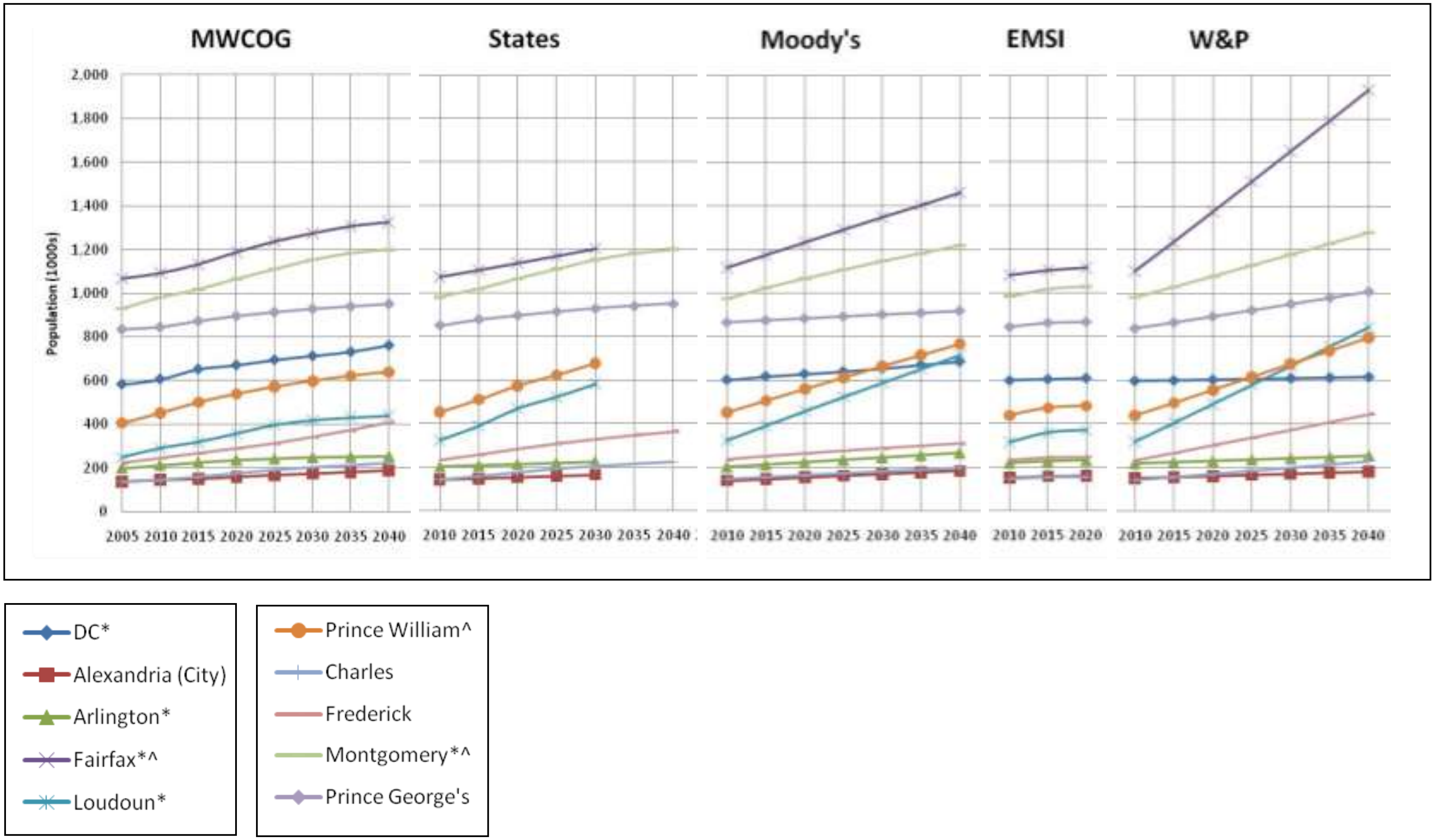


Observations

Visually, the population growth of Fairfax County looks most impressive as it has surpassed Montgomery County, Prince George's County and the District of Columbia. Its overall population growth from 1960 to 2010 was 292 percent. Several other jurisdictions have grown at more intense rates between 1960 and 2010, including Loudoun County (1,175 percent from 1960 to 2010), Prince William County (805 percent), and Charles County (350 percent). Growth rates in Fairfax County have steadily declined, from 71 percent between 1960 and 1970 to 11 percent between 2000 and 2010. Prince George's County experienced rapid growth in the 1960s (85 percent between 1960 and 1970), but has continued to grow at a much slower pace since 1970 (between one and ten percent for each decade). Loudoun County is the only locality experiencing an increasingly faster growth rate. Loudoun County had the highest rate of growth between 2000 and 2010 of all the localities (84 percent between 2000 and 2010). Prince William County was the next highest at 39 percent.

[2] * Primary Market Area jurisdiction; ^ Fairfax County includes City of Fairfax and City of Falls Church; Prince William County includes City of Manassas and City of Manassas Park; Montgomery County includes City of Rockville and City of Gaithersburg

Figure 4 – 2012 Report Population Forecasts from all Sources[3]



[3] * Primary Market Area jurisdiction; ^ Fairfax County includes City of Fairfax and City of Falls Church; Prince William County includes City of Manassas and City of Manassas Park; Montgomery County includes City of Rockville and City of Gaithersburg; State population projections for Maryland are provided by the Maryland Department of Planning through the Maryland State Data Center. State population projections for Virginia are provided by the Virginia Workforce Connection through the State Demographer Projections Decennial Population Data. Projections for 2015 and 2025 were interpolated. No independent local jurisdiction projections available for the District of Columbia.

2012 Report Observations

At the time of the development of the 2012 report, a key focus of the analysis was on comparing baseline 2010 data estimates against preliminary results of the 2010 Census. The 2012 report contains detailed tabulation of the comparative data that was used to develop the overall macroeconomic forecasts for that report, including the following notable conclusions regarding the variance of economic forecast sources:

- Forecasts by W&P were generally identified as outliers, with forecast for exurban and suburban counties such as Loudoun, Fairfax, and Frederick significantly (15% or more) higher than average from 2025 through 2040, and forecasts for DC showing a straight line of about 600K population with very little increase.
- Moody's forecasts were slightly (10-15%) lower than average for Frederick from 2030 to 2040.
- EMSI data are slightly (10-15%) lower than average for Loudoun and Prince William in 2020.
- Projections for Fairfax County varied widely. Even through 2020, the projections are very different. Woods & Poole projects 1.4 million for Fairfax County 2020, whereas EMSI is closer to 1.1 million.
- MWCOG forecasts for Loudoun County appeared to be low outliers, including in the early projection years. MWCOG forecasts show 2015 forecasts for Loudoun around 300k, whereas all other sources are 350k or above.

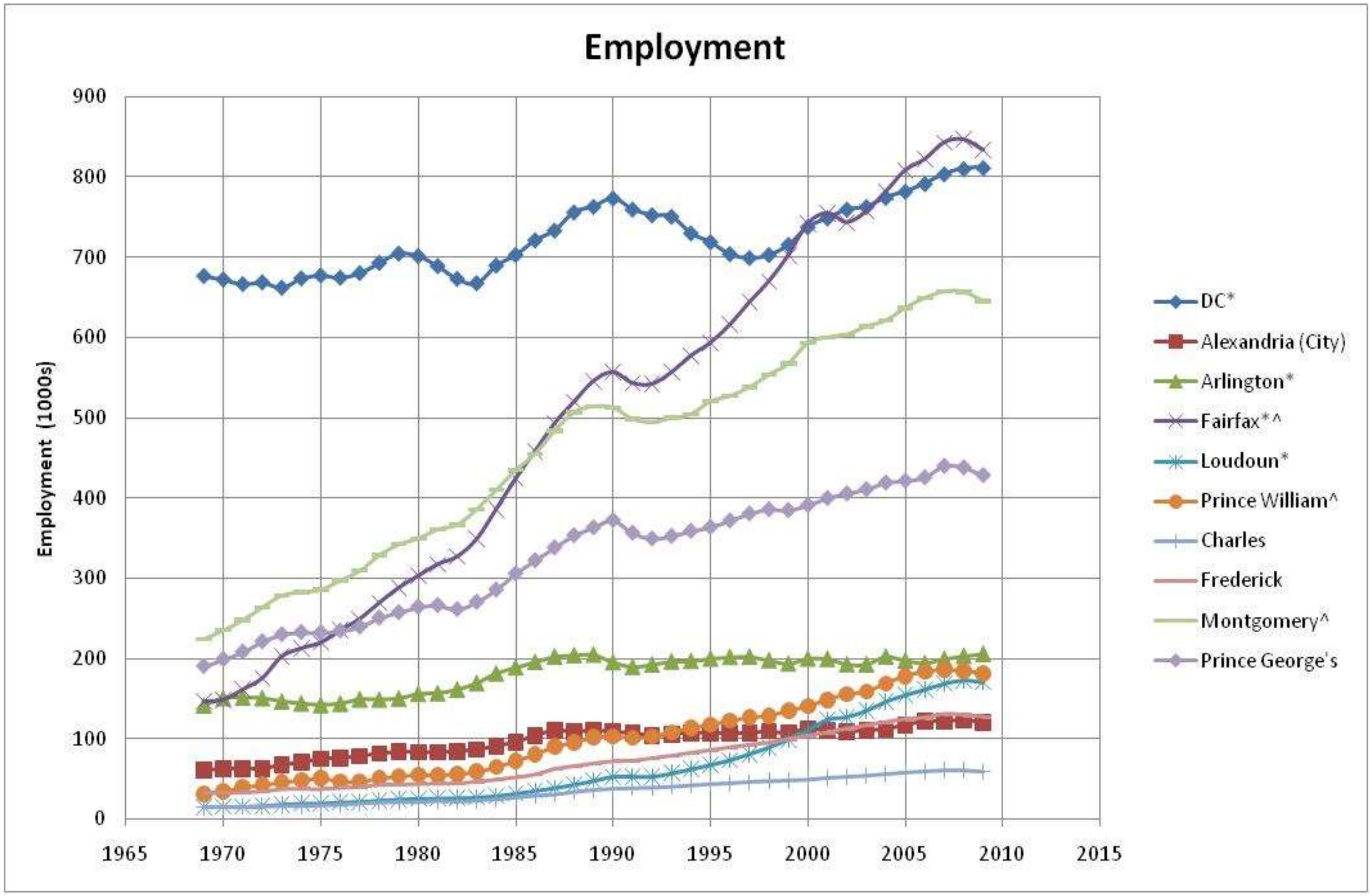
A key variable in the population projections for the western suburbs is the degree to which jurisdictions that are at or near their residential capacity will react to increased housing demand, a topic of interest and concern from a regional perspective for several years. Both Fairfax and Loudoun Counties are reaching the end of their greenfield development phase, in part due to a conscious effort to maintain and preserve a green infrastructure plan that also acknowledges their agrarian histories. Accommodating increased residential development therefore means more infill development as now planned for Tysons Corner. The Woods and Poole forecasts suggest that demand in Fairfax and Loudoun County will be fulfilled by continuing the recent trends toward residential development (whether upwards into high rise or outwards into agricultural reserve). Conversely, the MWCOG forecasts, developed by planning staff in each jurisdiction, are more conservative regarding the ability to accommodate housing demand, a factor that influenced the MWCOG econometric analyses leading to the establishment of Round 8.0 regional control totals. Taking the average of all the forecast sources and combining it with the historical census data shows a continuation of high growth rates in Loudoun County. Fairfax forecasts widely vary, but on average are expected to keep growing at a very high rate.

Employment History and Forecasts

Historical employment estimates and forecasts for future years also were obtained from multiple sources, but comparing these sources required adjustments by Renaissance due to differences in methodology and the definition of "employment" used by each source. Two county-level employment estimates are produced by the federal government: the Quarterly Census of Employment and Wages (QCEW) produced by the US Bureau of Labor Statistics (BLS), and estimates produced by the BEA. The QCEW counts only positions covered by unemployment insurance, meaning that some workers, primarily the self-employed, are excluded. The standard BEA estimates include these "covered" wage and salary positions but also proprietors, which include the self-employed but also business owners and active business partnerships. Thus, the BEA numbers will normally be higher than the QCEW numbers for the same county and year, and they also tend to overstate self-employment due to the inclusion of partnerships. The BEA does report its wage and salary employment estimates separate from proprietors, so those figures were used since they are the most comparable to the QCEW estimates. Both of these sources must then be adjusted upward to account for self-employed workers, to be consistent with the methodology used by MWCOG. This adjustment factor was derived from the 2005-09 American Community Survey (ACS) average of the percentage of self-employed workers across all the counties being studied.

One or both of these two federal sources is the basis for each of the private forecast sources examined for this analysis. Moody's Analytics uses the QCEW, the State of Maryland and Woods & Poole Economics use the BEA, and EMSI uses both along with other sources in a proprietary method that includes a broader definition of employment than the other sources. After adjusting the BEA-based sources to reflect only wage and salary employment, all of the sources except EMSI were adjusted upward to account for self-employed workers. Employment forecasts by county were not available from the State of Virginia or from the District of Columbia. For a 2010 baseline and any historical comparisons, Renaissance determined that the Moody's estimates, adjusted upward for self-employed workers, were the preferred source since the methodology and near-term estimates were most consistent with MWCOG's.

Figure 5 -Bureau of Economic Analysis Historical Employment[4]

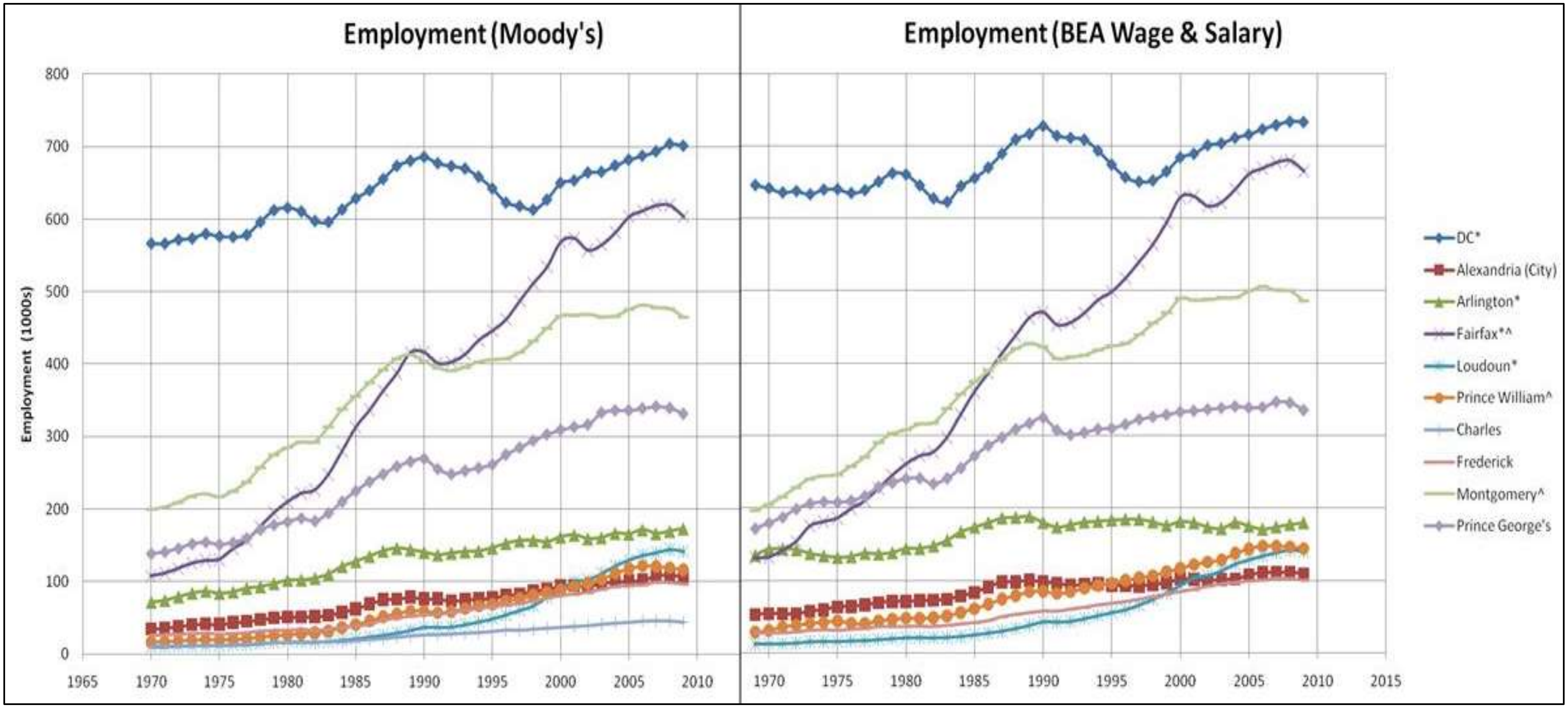


2012 Report Observations

Fairfax County employment is growing much faster than all other localities. DC employment has fluctuated but on average is slowly continuing to rise. Loudoun County employment is also rising at a higher rate than most other localities.

[4] * Primary Market Area jurisdiction; ^ Fairfax County includes City of Fairfax and City of Falls Church; Prince William County includes City of Manassas and City of Manassas Park; Montgomery County includes City of Rockville and City of Gaithersburg

Figure 6 -Comparison of Moody's and Bureau of Economic Analysis Historical Employment[5]

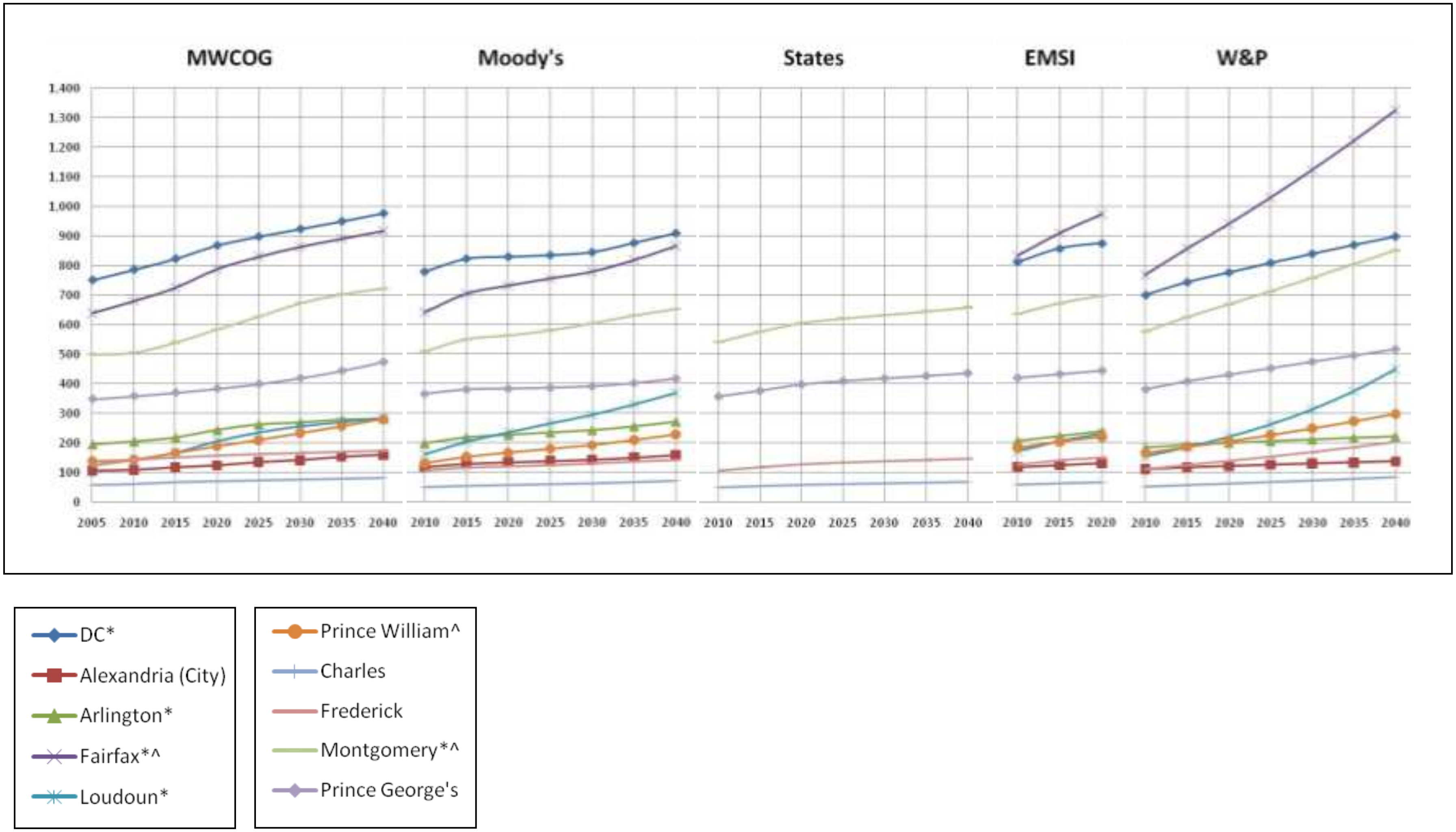


Observations

Moody's and BEA Wage and Salary are comparable sources in terms of methodology (types of jobs included), as opposed to the BEA Total Employment data. BEA total employment data includes proprietors including stock holders and owners of small businesses (e.g. selling beanie babies on e-bay from your basement) as secondary sources of income, whereas the Wage & Salary Data does not include proprietors.

[5] * Primary Market Area jurisdiction; ^ Fairfax County includes City of Fairfax and City of Falls Church; Prince William County includes City of Manassas and City of Manassas Park; Montgomery County includes City of Rockville and City of Gaithersburg

Figure 7 -2012 Report Employment Forecasts from all Sources[6]

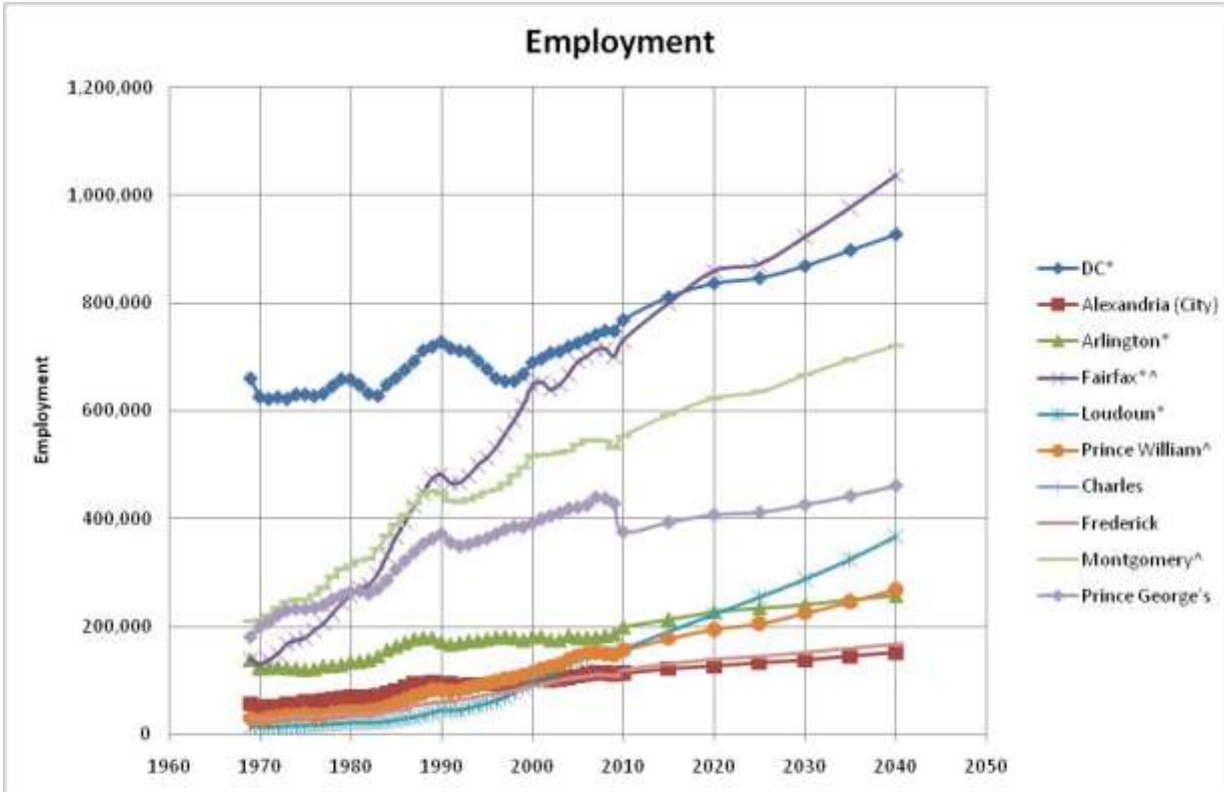


[6]* Primary Market Area jurisdiction; ^ Fairfax County includes City of Fairfax and City of Falls Church; Prince William County includes City of Manassas and City of Manassas Park; Montgomery County includes City of Rockville and City of Gaithersburg; State employment projections for Maryland are provided by the Maryland Department of Planning through the Maryland State Data Center. These values were adjusted to more closely align with the projection methodology of the other sources; other sources were adjusted as well. State employment projections for Virginia and local jurisdiction projections for DC were unavailable.

2012 Report Observations

- W&P data are generally higher than the other forecasts, especially in Fairfax, Loudoun, Frederick, Prince William, Montgomery, and Prince George's.
- W&P data are significantly (10% or more) lower than average for Arlington from 2020 through 2040.
- Moody's data are generally lower than others, especially in Fairfax, Prince William, Frederick, Montgomery and Prince George's.
- MWCOG forecasts for Frederick are significantly (15% or more) higher than average for 2010 to 2015.
- MWCOG forecasts for Loudoun are significantly (15% or more) lower than average for 2035 to 2040.
- EMSI forecasts for Prince William are significantly (15% or more) higher than average for 2010 and 2015 and slightly higher than average for Fairfax and Montgomery for 2010 through 2020.

Figure 8 -Average Employment Forecasts[7]



2012 Report Observations

- Similar to the population forecasts, Fairfax and Loudoun County have the highest projected rates of growth. Between 2010 and 2020, the rate of growth for Montgomery County is also high.
- Despite large fluctuations in DC historical employment, DC employment is projected to continue to grow at a significant pace, especially between 2010 and 2020.
- As a result of the averaging methodology, the average employment from all sources of forecasts for most localities in 2010, and in particular Prince George's County, are significantly lower than the 2009 historical data.

[7] * Primary Market Area jurisdiction; ^ Fairfax County includes City of Fairfax and City of Falls Church; Prince William County includes City of Manassas and City of Manassas Park; Montgomery County includes City of Rockville and City of Gaithersburg

Jobs to Household Ratio

The jobs to household (J/HH) ratio is an indicator of total economic activity when compared to household and employment forecasts. It is one of the measures used to gain perspective on the type of growth (e.g., suburban residential, mixed suburban and employment center, aging urban, new urban) given knowledge of what is happening on the ground in jurisdictions and sub-markets.

2012 Report Observations

- Frederick J/HH ratio rose from 2005 to 2010, but expected to steadily drop through 2040.
- Prince William J/HH ratio dropped from 2005 to 2010, but expected to steadily rise through 2040.
- Loudoun J/HH ratio expected to rise at a faster rate between 2010 and 2020, than in years further out. This is particularly interesting given the fast rate expected for population. It assumes that households will grow fast in Loudoun, but jobs will grow even faster.

Updates to 2012 Report Observations

The changes in jobs-to-housing ratios between the Round 8.0 and Round 8.2 forecasts are generally minor in nature except for the substantial revisions to the Frederick County forecasts previously described.

Step 4: Macroeconomic Assessment

The Washington DC Metropolitan Area is arguably the strongest regional economy and real estate market in the US. Within the Metropolitan Area the inner core is stable. The Primary Market Area of the Dulles Toll Road has been and is anticipated to be long term preferred growth corridor for the region. Infrastructure investments such as the METRO Silver Line will have long term effects on the desirability of the corridor. Washington DC, Alexandria and Arlington all exhibit strength in residential development, employment growth and urban mixed use projects that will increase the density of people and jobs over the long term. Fairfax County has been a primary growth engine within the regional economy. The combined proximity to Washington DC, the strength of job growth in Tysons Corner and the Dulles Toll Road corridor and the overall attractiveness of living there have been contributing factors. Loudoun County is poised for continued residential and employment growth.

Summary of 2012 Report Housing Observations

The housing market has proven to be very resilient in the past few years:

- Housing in the region has comparatively high value relative to other regions;
- Housing values did not decline as much as most markets during the Great Recession and thereafter; and
- Sales appear to be rebounding from recent lows.

Foreclosures and negative equity in the region will have a selective impact as strengths and weaknesses are not spread equally across the area:

- Negative equity will discourage some home sales in the short run;
- Foreclosures are affecting different parts of the region to a different degree; and
- Foreclosures are most prevalent in Prince William, Prince George's, and Loudoun Counties.

Excess inventory of vacant homes is relatively manageable:

- Montgomery and Fairfax should recover in 1-2 years;

- Prince George's has dual impact of a large excess inventory and high foreclosure rate, with an anticipated recovery in 3-4 years; and
- The new home construction market is poised for recovery.

Summary of 2012 Report Employment Observations

Recent trend and projections show that recovery is already here. The metro area made it through the recession relatively unscathed:

- Total employment has returned to the level seen just before the financial crisis of fall 2008; however
- The Washington DC, and Prince George's to a lesser extent, are exceptions.

The local job market is dominated by professional services and government:

- Professional services jobs have increased over the last four years;
- Primary location of growth for these jobs has been Fairfax, some in DC; other employment centers are stable;
- Local-serving sectors like construction, retail, and real estate have borne the brunt of job losses; and
- Federal civilian employment has grown over the past few years, but it is decentralizing and appears to be reaching a cyclical peak.

Summary of 2012 Report Economic Trend Observations

Sales of existing homes have spiked recently during the Spring selling season, though it remains to be seen if this increase in sales activity will be sustained. Home sales prices in the metro area rose higher and faster than even prominent "bubble" markets during the housing boom of 2004-2006, and since the crash have declined much.

- Even with this market resiliency, underwater mortgages and foreclosures will be a drag on the housing market in the near term.
- Foreclosures have been less prevalent in the primary market area than in some of the peripheral counties of the metro area.
- New home construction activity is at a 30-year low relative to population. Residential investment is a key metric in tracking economic recessions and recoveries. While a recovery in the housing market in itself will be a positive development for the regional economy, it is also critical to an overall economic recovery. Looking at the historical trends, each stage of the cycle – expansion, contraction, or stabilization – typically averages around 20 months in duration.
- Residential construction spending in the metro area bottomed out one year before the nation as a whole, potentially setting the stage for an earlier recovery. Arlington and DC peaked the highest, at 6.4 and 5.3, respectively. No other individual county peaked at higher than 2.0. The inner core jurisdictions are showing some signs of life most likely due to multi-family development. The 2010% change from median column shows Washington DC, Alexandria and Arlington are in the strongest position relative to historical levels of new residential construction.
- Full recovery of the housing market is dependent on clearing the excess inventory of vacant homes. A rough estimate shows that at historical absorption rates the metro area overall, and the primary market area in particular, should accomplish this within 1-2 years, which is a relatively manageable time frame compared to other markets. For the overall metro area, the estimated excess units are approximately 29,000. The absorption timeframe for that excess inventory is approximately 1.2 years.
- The metro area has weathered the Great Recession relatively unscathed. On a monthly basis, total employment has returned to the level seen just before the financial crisis of fall 2008. Unemployment has increased, but in nearly all of the jurisdictions that peak was around six percent at most. The exceptions are the District of Columbia and Prince George's County.

- However, the strength in employment is not evenly spread across industries and jurisdictions. While total employment showed a small net increase from 2007-2011, over 43,000 construction jobs, over 17,000 information jobs (telecommunications, publishing, etc.), over 16,000 retail jobs, and almost 10,000 real estate jobs have been lost in that timeframe. Meanwhile, the government sector has added over 42,000 jobs, professional services has added over 32,000 jobs, and health care has added over 26,000 jobs.
- The metro area overall is highly specialized in the professional and technical services sector, and that specialization is focused within the primary study area. A location quotient of 1.0 is equal to the level of concentration in the US overall. Key industry sector concentrations in the Metropolitan Region besides professional services include:
  - NAICS 23 Construction - 2 times or more the national mix in Prince George's, Loudoun, and Prince William and close to 2 times in Charles (1.95) and Frederick (1.85)
  - NAICS 61 Educational Services - DC (3.6) and Arlington (2.2)
  - NAICS 81 Other Services, Except Public Administration - More than 3 times the national mix in DC and Alexandria, 2 times the national mix in Arlington
  - Other Key Sector Concentrations in Specific Counties - Loudoun: Information (2.5) and Transportation (2.3); Charles: Retail Trade (2.0)
  - This specialization is projected to increase, and should reinforce Fairfax County's position as the engine of growth in the metro area.
- Federal civilian employment in the metro area is approaching another historical peak. Even though the proportion of federal employment has declined significantly as the metro economy has grown, the possible local economic implications of federal budget decisions are another key question to consider.
- Employment continues to decentralize from the District of Columbia.

All told, the effects of the Great Recession on the metro area have been relatively mild, and total employment is estimated to have returned the level seen prior to the start of the downturn. The three data sources estimate employment through different methods, so the numerical amounts are not directly comparable. The primary market area is the center of economic strength of what probably is the strongest regional economy in the nation at the current time.

Step 5: Macroeconomic Forecast and Guidance

As part of the 2012 report, the Round 8.0 county-level population and employment control totals for each jurisdiction in the metro area were evaluated through a comparison with long-term forecasts obtained from several different sources. For population, we obtained forecasts from the relevant state government departments of Maryland and Virginia, Woods & Poole Economics, Moody's Analytics, and Economic Modeling Specialists, Incorporated (EMSI). For employment, the sources were the same except that forecasts were not available from the State of Virginia. EMSI forecasts only extend to 2021, so they were used for additional context rather than as a primary source. The employment forecasts were adjusted as necessary to account for differing definitions of "employment" so that they would be relatively comparable.

The basic approach was to plot the Round 8.0 control totals against the various forecast sources for each county and identify jurisdictions and time periods where the Round 8.0 forecasts diverged significantly from a blend of the outside forecasts. Our objective was to highlight places where adjustments to the Round 8.0 control totals seem to be advisable. The intent is to refine the Round 8.0 forecasts to better reflect the macroeconomic trends being projected in the outside forecasts.

Population Adjustments

Starting from the 2010 Census count, we applied the compound annual growth rates within each five-year period of the original Round 8.0 forecasts to produce updated control totals for comparison with the outside forecasts. Our evaluation indicated that adjustments to the following jurisdictions and time periods would be advisable:

- The Round 8.0 forecast for the District of Columbia was dramatically higher than the outside forecasts. Our examination revealed that most of the difference is found primarily in the high rate of growth projected by MWCOG between 2010 and 2015; after 2015 the Round 8.0 growth rate was relatively similar to the outside forecasts. We adjusted the 2010-2015 growth rate down to be consistent with the long-term trend, and made minor adjustments in later periods to maintain a smooth curve.

- For Frederick County, the Round 8.0 forecast projected a significantly faster rate of growth after 2025 than the outside forecasts. We adjusted the growth rates in those periods downward to reflect a slowing growth trend overall.

- The Round 8.0 forecast for Loudoun County was dramatically lower than the outside forecasts, especially in the later periods. We adjusted the growth rates upward in all periods, but assumed a steadily declining growth rate as the forecast moves into the later periods. This general trend of slowing growth is seen in the other counties on the suburban periphery of the metro area.

- For Prince William County, the Round 8.0 forecast projects a slightly slower rate of growth after 2020 than the outside forecasts. We adjusted the growth rates in those periods upward, but still maintained a slowing growth rate overall.

Since the Round 8.0 forecasts only extend to 2040, we extrapolated forecasts for 2045 and 2050 for each county using the average of the compound annual growth rates we assumed for the 2030-2035 and 2035-2040 periods.   Figure 9 shows the growth rates for the Round 8.0 forecasts and Figure 10 shows the adjusted rates.

Figure 9 – Table of Compound Annual Growth Rates for Round 8.0 Population Forecasts

	2010-2015	2015-2020	2020-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
District of Columbia	1.5%	0.6%	0.7%	0.5%	0.5%	0.8%	n/a	n/a
Frederick	1.8%	1.6%	1.6%	1.8%	1.8%	1.8%	n/a	n/a
Montgomery	0.7%	0.9%	0.8%	0.8%	0.5%	0.3%	n/a	n/a
Prince George's	0.6%	0.5%	0.4%	0.3%	0.2%	0.2%	n/a	n/a
Alexandria	0.6%	1.2%	1.0%	0.8%	0.9%	0.8%	n/a	n/a
Arlington	1.2%	0.9%	0.5%	0.5%	0.2%	0.2%	n/a	n/a
Fairfax	0.7%	1.0%	0.8%	0.6%	0.5%	0.3%	n/a	n/a
Loudoun	1.9%	2.3%	2.1%	1.1%	0.6%	0.4%	n/a	n/a
Prince William	2.1%	1.5%	1.2%	0.9%	0.7%	0.6%	n/a	n/a
TOTALS	1.1%	1.0%	0.9%	0.7%	0.6%	0.5%	n/a	n/a

Figure 10 – Table of Adjusted Compound Annual Growth Rates for 2012 Macroeconomic Population Forecasts

	2010-2015	2015-2020	2020-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
District of Columbia	***0.6%***	0.6%	***0.6%***	0.5%	0.5%	***0.5%***	0.5%	0.5%
Frederick	1.8%	1.6%	1.6%	***1.4%***	***1.2%***	***1.0%***	1.1%	1.1%
Montgomery	0.7%	0.9%	0.8%	0.8%	0.5%	0.3%	0.4%	0.4%
Prince George's	0.6%	0.5%	0.4%	0.3%	0.2%	0.2%	0.2%	0.2%
Alexandria	0.6%	1.2%	1.0%	0.8%	0.9%	0.8%	0.8%	0.8%
Arlington	1.2%	0.9%	0.5%	0.5%	0.2%	0.2%	0.2%	0.2%
Fairfax	0.7%	1.0%	0.8%	0.6%	0.5%	0.3%	0.4%	0.4%
Loudoun	***3.5%***	***3.2%***	***2.9%***	***2.5%***	***2.2%***	***1.9%***	2.1%	2.1%
Prince William	2.1%	1.5%	***1.5%***	***1.4%***	***1.2%***	***1.0%***	1.1%	1.1%
TOTALS	1.1%	1.1%	1.0%	0.9%	0.7%	0.6%	0.7%	0.7%

Employment Adjustments

We created updated Round 8 employment control totals using the adjusted 2010 estimates from Moody's Analytics and the original Round 8 compound annual growth rates. Our evaluation of the Round 8 forecasts versus the outside sources suggested the following adjustments:

- While the Round 8 forecast for the District of Columbia tracks closely with Moody's and EMSI from 2010-2015, Round 8 continues at a faster growth rate in later periods than the other two sources, which project a flattening growth rate until after 2030. The two outside sources are updated on a monthly or quarterly basis, and appear to incorporate an assumption of declining federal government employment (one of the major employment drivers in the District). Given the anticipated cuts in federal spending to address budget deficit and debt issues and an approaching cyclical peak in federal civilian employment in the metro area, we believe that this is a reasonable assumption. Therefore, we adjusted the 2015-2030 growth rates down slightly to reflect a flat growth trend.

- The Round 8 forecasts for both Fairfax and Loudoun Counties show lower growth rates than the outside forecasts for the period after 2020. Given Fairfax's position as the primary economic engine of the region and Loudoun's position directly on the path of growth coming from Fairfax, we believe that a forecast of faster growth in the later years for both of these counties is advisable. Furthermore, the Round 8 employment forecasts were deliberately constrained based on assumption that there would be insufficient capacity for household growth needed to fill all of the potential new jobs without resorting to high levels of commuting in from outside of the region. With the construction of the Metrorail Silver Line and corresponding increase in development density around the transit stations, we believe that the justification for the constraint is reduced. Therefore, we adjusted the 2020-2040 growth rates upward for both counties – somewhat more in Loudoun than in Fairfax to reflect the greater availability of developable land.

Again, we prepared 2045 and 2050 forecasts through extrapolation, using the average of the compound annual growth rates from 2030-2035 and 2035-2040. Figure 11 shows the growth rates for the Round 8 forecasts and Figure 12 shows the adjusted rates.

Figure 11 – Table of Compound Annual Growth Rates for Round 8.0 Employment Forecasts

	2010-2015	2015-2020	2020-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
District of Columbia	0.9%	1.1%	0.7%	0.6%	0.6%	0.6%	n/a	n/a
Frederick	1.2%	0.9%	0.6%	0.5%	0.5%	0.5%	n/a	n/a
Montgomery	1.3%	1.6%	1.4%	1.4%	0.9%	0.6%	n/a	n/a
Prince George's	0.6%	0.7%	0.8%	1.0%	1.1%	1.3%	n/a	n/a
Alexandria	1.6%	1.1%	1.8%	1.0%	1.5%	0.9%	n/a	n/a
Arlington	1.2%	2.2%	1.5%	0.5%	0.7%	0.2%	n/a	n/a
Fairfax	1.3%	1.7%	1.0%	0.8%	0.6%	0.6%	n/a	n/a
Loudoun	3.1%	4.3%	2.7%	1.7%	1.1%	1.0%	n/a	n/a
Prince William	2.9%	2.5%	2.1%	2.1%	1.9%	1.9%	n/a	n/a
TOTALS	1.3%	1.6%	1.2%	1.0%	0.9%	0.7%	n/a	n/a

Figure 12 – Table of Adjusted Compound Annual Growth Rates for 2012 Macroeconomic Employment Forecasts

	2010-2015	2015-2020	2020-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
District of Columbia	0.9%	***0.4%***	***0.5%***	***0.5%***	0.6%	0.6%	0.6%	0.6%
Frederick	1.2%	0.9%	0.6%	0.5%	0.5%	0.5%	0.5%	0.5%
Montgomery	1.3%	1.6%	1.4%	1.4%	0.9%	0.6%	0.7%	0.7%
Prince George's	0.6%	0.7%	0.8%	1.0%	1.1%	1.3%	1.2%	1.2%
Alexandria	1.6%	1.1%	1.8%	1.0%	1.5%	0.9%	1.2%	1.2%
Arlington	1.2%	2.2%	1.5%	0.5%	0.7%	0.2%	0.5%	0.5%
Fairfax	1.3%	1.7%	***1.4%***	***1.0%***	***1.0%***	***0.8%***	0.9%	0.9%
Loudoun	3.1%	4.3%	***3.0%***	***2.5%***	***2.0%***	***1.5%***	1.8%	1.8%
Prince William	2.9%	2.5%	2.1%	2.1%	1.9%	1.9%	1.9%	1.9%
TOTALS	1.3%	1.4%	1.3%	1.1%	1.0%	0.8%	0.9%	0.9%

Macroeconomic Forecast

The jurisdiction level macroeconomic population and employment forecasts can be seen in the tables in Step 9.

Step 6: Parcel Level Supply Side Analysis

A supply side analysis of land use in the Primary Market Area was conducted to understand the existing conditions for residential and non-residential development and availability of developable land by TAZ. This analysis identified land that is currently developed and land that has market viability for residential and commercial development. The socio-economic projections for each TAZ were then evaluated in the context of the supply of developable land to provide a TAZ level 'reasonableness check' for the study area. In addition, there were other land use statistics available from this analysis that was inserted into the overall study area evaluation tool.

To conduct the supply side analysis, real estate assessor data were obtained, associated with parcels, and analyzed using GIS. The parcel-level attributes studied were existing property use code classifications, zoning, building (improvement) value and land values. These attributes were queried to determine each parcel's development status, and whether that land was primarily in residential, or employment. Potentially developable lands are areas that are determined to be either vacant or under-utilized. Vacant lands have minimal or no building-to-land value ratio. Underutilized or redevelopable parcels have below average building-to-land value ratio for a jurisdiction. Developed lands are areas that currently have higher than average levels of improvement investment, indicating they are less likely to redevelop or intensify within the project time horizon. Land in public rights-of-way, utilities, in easement, or under some form of protection were considered undevelopable and were netted out of the supply side totals. Parcels were associated with TAZs in order to be able to summarize variables by the model's geography. The land supply side analysis yields the following statistics by TAZ:

- Existing Developed Land (residential, employment);
- Existing Developable Land, including;
- Vacant (residential, employment);
- Under-utilized/Redevelopable (residential and employment);
- Unbuildable land (ROW, Utilities, Easement, Federal Park, etc.);
- Existing net residential households per acre by TAZ;
- Existing net employees per acre by TAZ;
- Future net residential households per acre by TAZ;
- Future net employees per acre by TAZ;
- Total existing investment (building +l and value) of land per acre by TAZ; and
- Land available in existing and planned rail transit station areas.

The results of the supply side analysis provided valuable inputs to the overall study area evaluation. For example, comparison of present to future projected densities allows for a quick reasonableness check. It was also used to identify hot spots and illuminate discrepancies or areas that needed adjustment or additional validation. Figure 13 through Figure 19 show a number of the factors in the jurisdictions that are all or part of the Primary Market Area.

Figure 13 – Map of Existing Residential Development

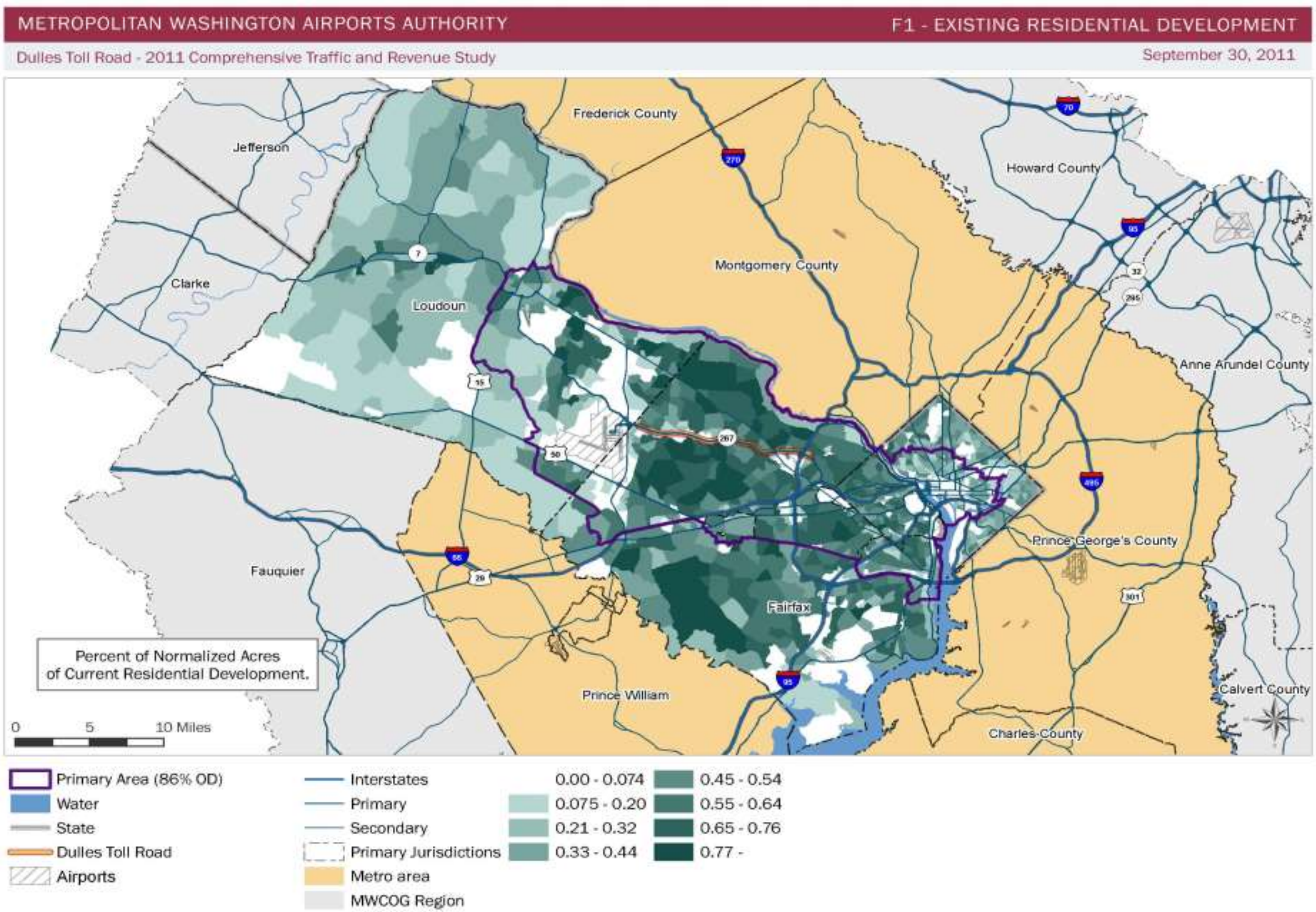


Figure 14 – Map of Existing Mixed Use Development

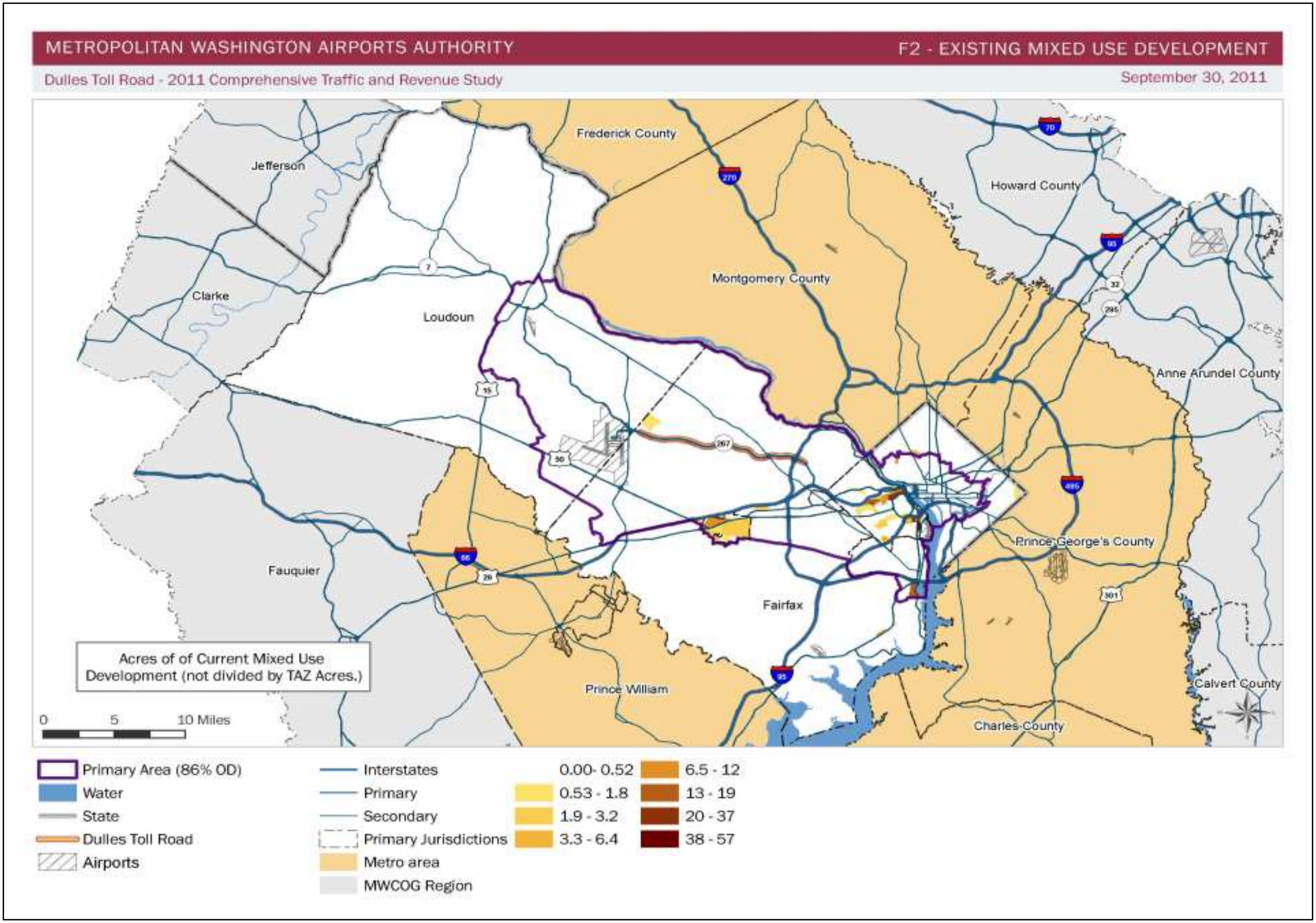


Figure 15 – Map of Total Value of Developed Land Per Acre

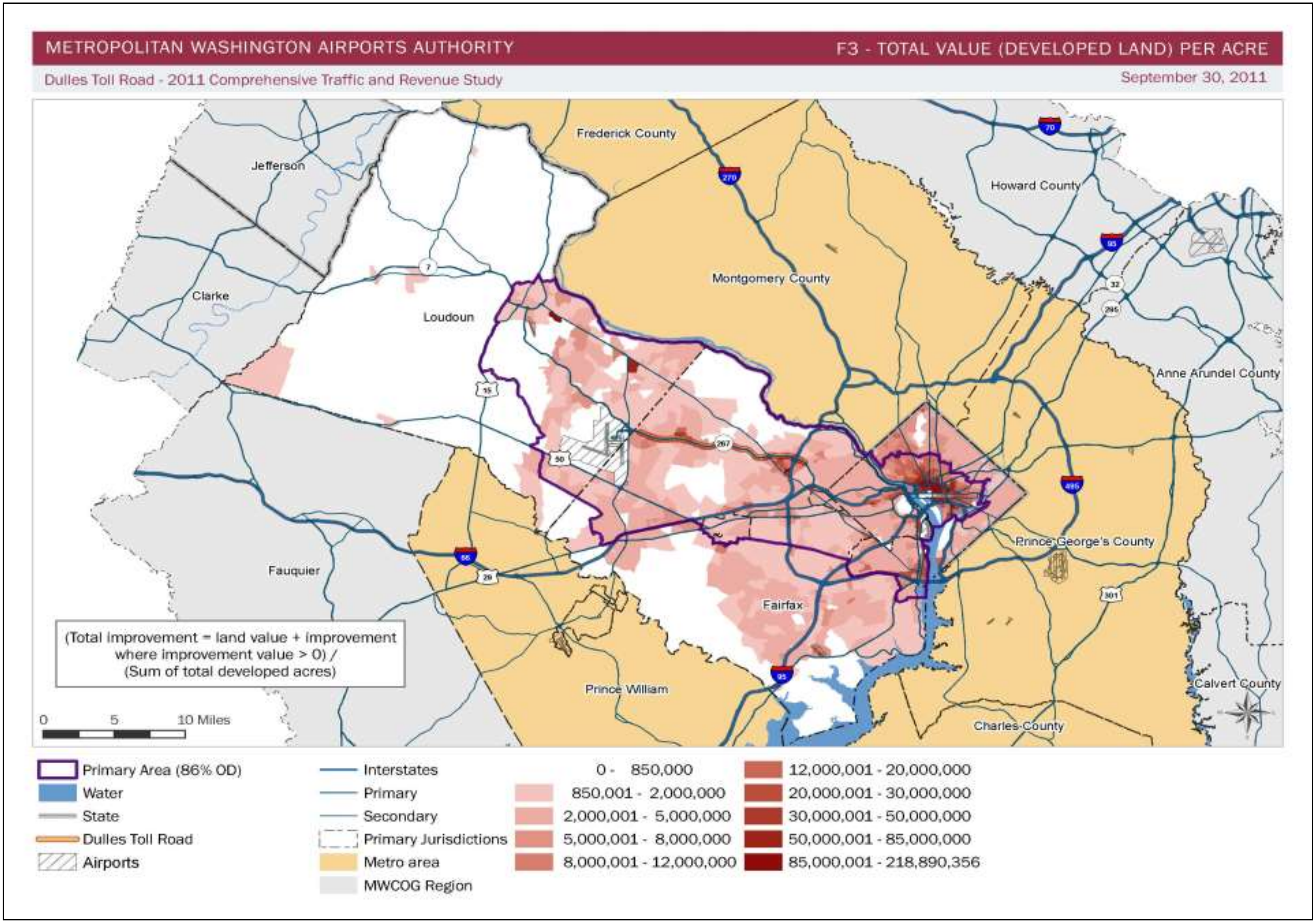


Figure 16 – Map of Percent Vacant and Underutilized Land

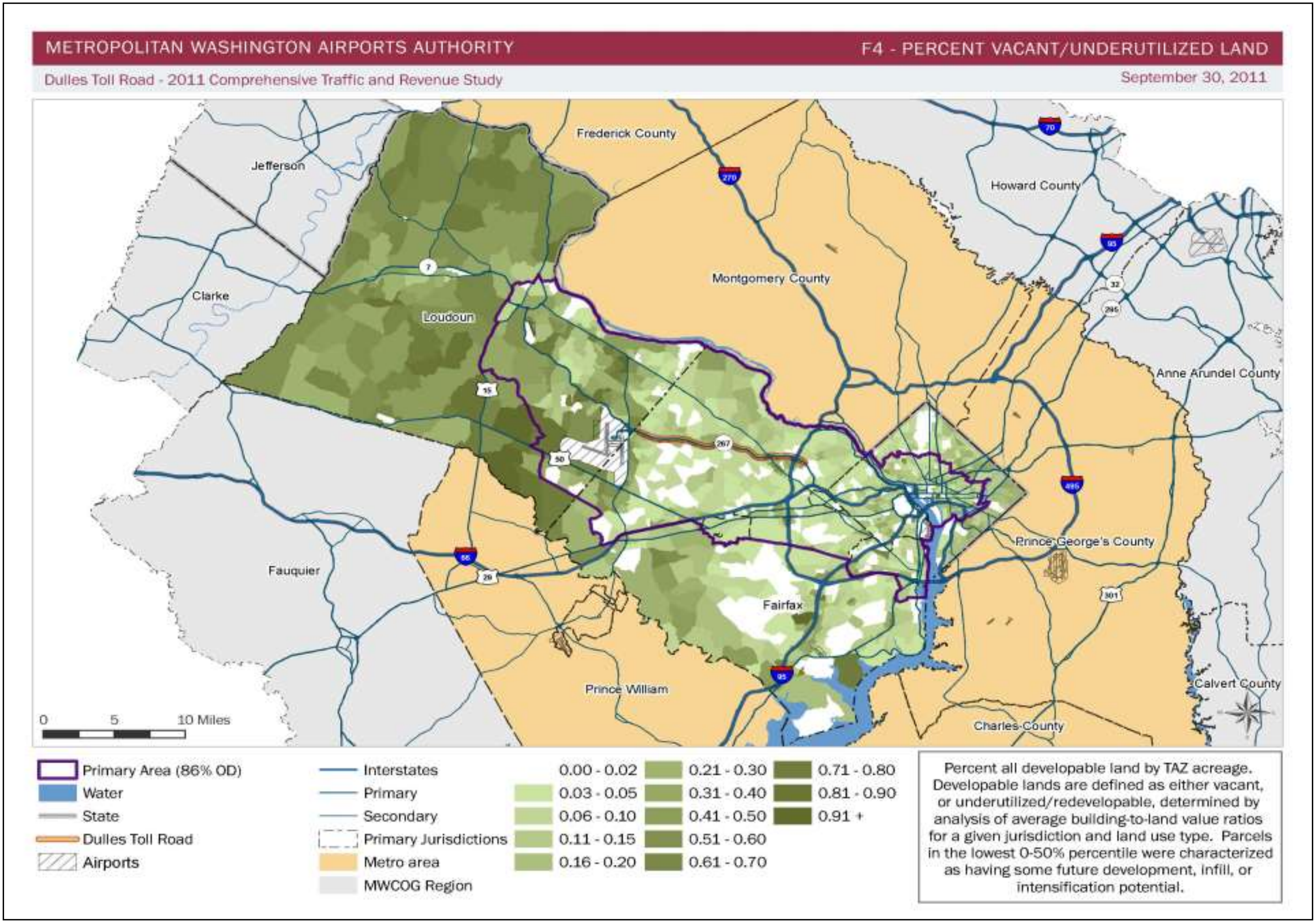


Figure 17 – Map of Employment Growth Suitability

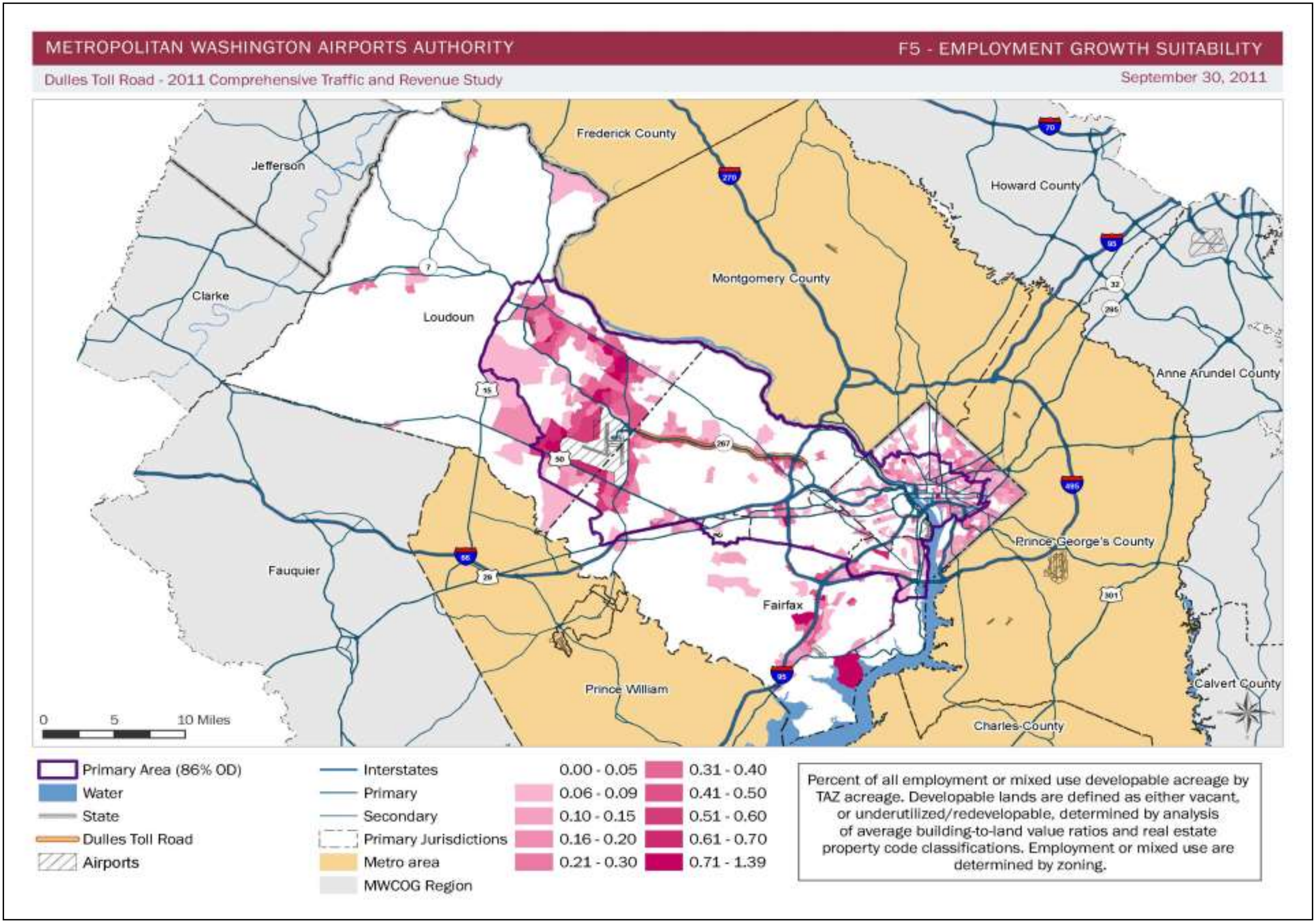


Figure 18 – Map of Existing and Planned Station Area Half Mile Buffers

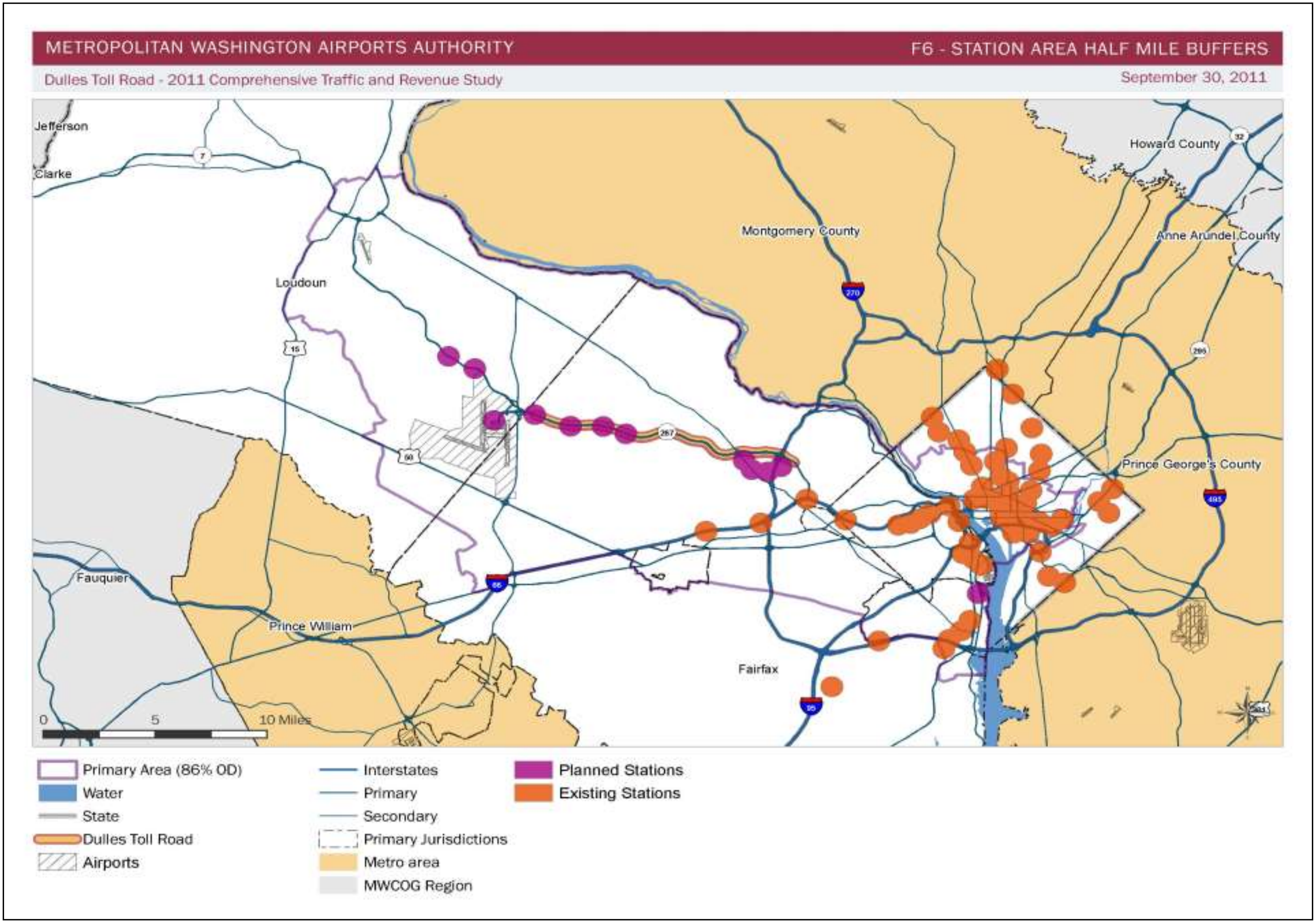
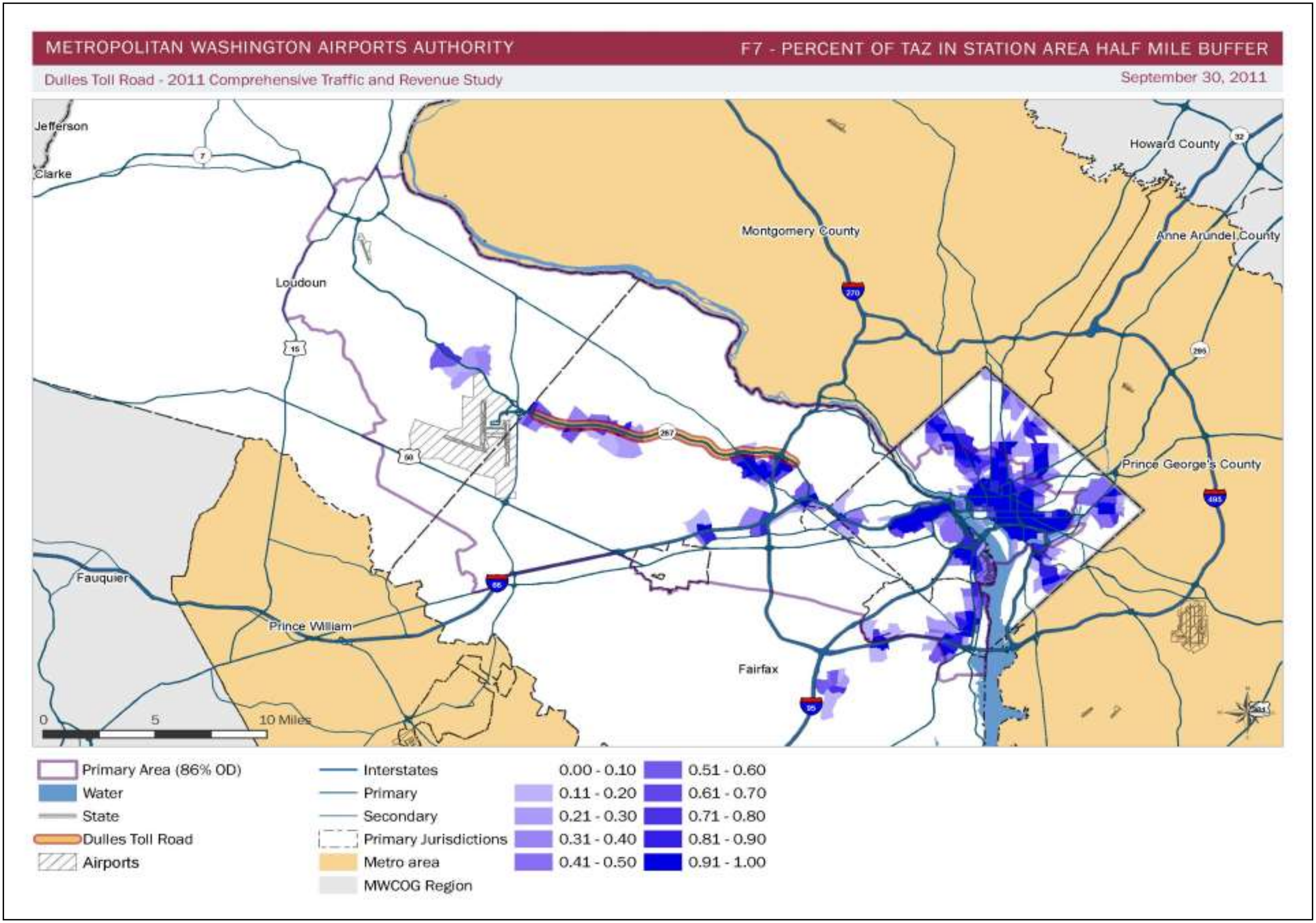


Figure 19 – Map of Percent of TAZ in Station Area Half Mile Buffer



Step 7: Methodology and Tool for Testing MWCOG Forecasts

Land use development patterns and absorption rates are influenced by a wide range of independent policy and market variables. Policy variables include federal agency employment decisions such as the Base Realignment and Closure (BRAC) initiative; local jurisdiction master plans, zoning, and subdivision regulations. Market variables include regional econometric trends, local property characteristics, and the specific interests of individual property owners. The Renaissance approach to the independent economic assessment was to identify the relative effect of those variables.

The approach combines systematic application of independent variables with site-specific local knowledge to derive TAZ-specific forecasts that pivot from the Round 8.0 forecasts to reflect both macroeconomic trends and assumptions regarding site-specific development activity. The forecasting process includes three basic components:

- A top-down analysis of macroeconomic trends used to identify trends at the jurisdictional level
- A bottom-up regression analysis of current property attributes, aggregated at the TAZ level, that explains the growth rates observed in the Round 8.0 forecasts
- Submarket analysis that considers updated base year (2010) conditions, macroeconomic forecasts, and recent or anticipated policy changes to guide the TAZ-level forecasts toward the macroeconomic trends.

The basic unit of the forecasting process is TAZ-level density. In other words, the process forecasts the total number of jobs per TAZ-acre and the total population per TAZ-acre. Development of the forecasting process included three steps. First, Renaissance explored relationships between current parcel data availability, suitability, and value and the growth forecast in Round 8.0 in the 2010 to 2040 timeframe to identify characteristics that were indicators of population or employment growth. Second, we established two user-identified variables to account for local conditions not readily observable from the parcel data. These variables are identified in Figure 20 and Figure 21 for population and employment, respectively.

Figure 20- Independent Variables for Forecasting Population Density

Independent Variable	Description	Relevance
Existing Residential or Mixed-use Development (Figures F1 and F2)	Percent of TAZ acreage currently developed as residential	In most locations in the primary market area, new residential growth is expected to occur in TAZs that already contain a high amount of existing residential or mixed-use development.
Transit Availability (Figures F6 and F7)	Percent of TAZ acreage within a half-mile radius of a Metrorail station, planned densities supportive of fixed-route bus service, and with independent consideration of stations added to the original 103-mile system.	Both employment and residential density increases are linked by both policy and market considerations to locations with good transit access, particularly to the Metrorail system. Growth will be greater at Metrorail stations newest to the system where both policies and the market are still in a reactive mode.
Land development efficiency	User assigned factor based on reflecting efficiency of certain TAZs to calibrate estimated yields based on policy variables such as significant property ownership by government or institutions and policies such as agricultural easements.	Government and institutional properties typically have growth rates that are unrelated to parcel data. Low density zoning and easement programs will continue to protect the more rural wedges of Loudoun and Fairfax Counties
Local market factor	User assigned factor reflecting local market conditions not observable in parcel level data. This factor reflects the incorporation of specific approved or pending projects in the Round 8.0 forecasts	Approximately 7% of the TAZs in the Primary Market Area have targeted Round 8.0 forecast increases in population densities that are substantially different than would otherwise be expected.

Figure 21 - Independent Variables for Forecasting Increases in Employment Density

Independent Variable	Description	Relevance
Land Value (Figure F3)	Average per-acre value of land and improvements for all developed properties (with a nonzero improvement value)	Generally, land available and suitable for commercial development in the primary market area is becoming scarce. New development is therefore likely to occur in locations where a critical mass of investment (both public and private) has already occurred.
Percent Vacant / Redevelopable Land (Figure F4)	Percent of TAZ acreage identified as consisting of vacant or underutilized parcels. Underutilized parcels are identified by the ratio of improvement value to land value.	Much of the forecast growth in the primary market area is occurring as part of infill and redevelopment. New development is likely to occur in areas that have a high proportion of properties with low improvement-to-land ratios (either vacant or already developed).
Employment Growth Suitability (Figure F5)	Percent of TAZ acreage consisting of parcels with employment or mixed-use developable acreage	Employment growth is expected to be generally limited to parcels with commercial, industrial, or mixed use zoning.
Transit Availability (Figures F6 and F7)	Percent of TAZ acreage within a half-mile radius of a Metrorail station, planned densities supportive of fixed-route bus service, and with independent consideration of stations added to the original 103-mile system.	Both employment and residential density increases are linked by both policy and market considerations to locations with good transit access, particularly to the Metrorail system. Growth will be greater at Metrorail stations newest to the system where both policies and the market are still in a reactive mode.
Land development efficiency	User assigned factor based on reflecting efficiency of certain TAZs to calibrate estimated yields based on policy variables such as significant property ownership by government or institutions and policies such as agricultural easements.	Government and institutional properties typically have growth rates that are unrelated to parcel data. Low density zoning and easement programs will continue to protect the more rural wedges of Loudoun and Fairfax Counties
Local market factor	User assigned factor reflecting local market conditions not observable in parcel level data. This factor reflects the incorporation of specific approved or pending projects in the Round 8.0 forecasts	Approximately 6% of the TAZs in the Primary Market Area have targeted Round 8.0 forecast increases in employment densities that are substantially different than would otherwise be expected.

These relationships provide a rough correlation between certain market and policy indicators of growth and the increases in density by TAZ contained in the Round 8.0 forecasts. It is important to note that while these relationships are numerical, they reflect a combination of art and science. The regression analysis provided a useful quick-response tool to aid in the forecasting process, but the approach is not intended to serve as an independent land use model or replacement for the more detailed and time-intensive approach taken by the local jurisdictions in coordination with MWCOG.

Step 8: Notable Updates to 2012 Forecast Trends

As Renaissance revisited the socioeconomic data that support the model of travel demand in the Dulles Toll Road's primary market area, we identified a variety of key trends and topics to consider that could have an influence on patterns of development and travel in the DC region. The discussion below presents an initial overview of some key things to think about and highlights changes that were incorporated into the updated independent economic forecasts over either the short or long term horizons. In general, the changes in macroeconomic and localized trends, while often newsworthy, tend to confirm the assumptions incorporated into the 2012 independent economic forecasts. In general, our forecasts might be characterized as having slightly less volatility than those of other sources reviewed.

Updated MWCOG Regional Forecasts

The current forecasts from the Metropolitan Washington Council of Governments (MWCOG) are labeled Round 8.2 and were adopted by the region's Transportation Planning Board in July 2013. These forecasts are derived from the same general regional econometric forecasts as the Round 8.0 forecasts used as a basis for developing the 2012 independent economic forecasts. The primary difference is that the MWCOG Round 8.2 forecasts have been calibrated to the 2010 Census data as a baseline. The regional changes are therefore relatively minor in nature due to the continued use of the Round 8.0 econometric forecasts as a baseline. A comparison of the primary jurisdictional totals (i.e., including the independent cities with their surrounding counties and excluding the portion of Charles County in the TPB Planning Area) indicates that the 2010 population was reduced by 2.3%. Due to the dampened economic trends, the Round 8.2 population forecast for 2020 was reduced a bit further to be 2.9% below the Round 8.0 forecasts. However, by 2040, the Round 8.2 population forecast was only 0.1% below the Round 8.0 forecast. On the employment side, the Round 8.2 forecasts for 2010 and 2020 were both marginally (0.7% and 0.8%, respectively) higher than Round 8.0. By 2040, the employment forecast for the region was 2.8% higher than in Round 8.0. The trends for the individual jurisdictions are somewhat more varied but follow the same trends for the most part. Notable exceptions include Washington DC and Frederick County, which are described in the following paragraphs.

Washington DC Population Growth

Washington, DC has had near term growth that has exceeded prior expectations, with a 2013 Census estimated population of 646,449; higher than the 2012 report macroeconomic forecast for year 2015 of 620,000 or the Renaissance estimate of 626,300, and nearly as high as the MWCOG Round 8.0 2015 forecast of 651,500. DC has subsequently increased their forecast 2040 population from 760,500 in Round 8.0 to 771,200 in Rounds 8.1/8.2 and then to a substantially higher 896,589 in 2040.

A recent briefing paper by the District of Columbia Office of Planning[8] shows that between April 2010 to July 2012 DC added slightly more population than it did for the entire decade between 2000 and 2010. Equally notable was the age composition of this change. Nearly half of the over 30,000 new residents were age 25-34, and almost another 30% were age nine or younger. (From 2000 to 2010 DC added only 77 new residents under age five, and actually lost 9,238 residents age 5-9.) This fits with the established narrative and observations by commentators that DC is becoming a popular place to live for young professionals who are seeking out an urban lifestyle that puts them in closer proximity to jobs, shopping, and nightlife than does a home in the suburbs.
All economic forecasts concur that this high rate of growth is not sustainable at close to the most recent two-year to three-year rates in the long run, but that

[8] "Population Growth Patterns by Age in the District of Columbia, 2000 to 2012"; Sheres, Daniel and Phillips, Joy; *State Data Center Monthly* Brief; District of Columbia Office of Planning; July 2013

Washington's population growth is likely to exceed its historic high population watermark of 802,000 in 1950. The degree to which the increased population growth will be sustainable is a combination of age cohort preferences and the city's ability to remain marketable to residents of all ages based on a renewed commitment to providing higher quality services, particularly regarding public schools to retain young families. The city has the physical infrastructure to support a population of more than 800,000 residents, but we believe will struggle to compete with both inner core jurisdictions and suburban jurisdictions for families with young children. Our population forecasts indicate that DC will pass the 800,000 mark in population, but not until between 2045 and 2050.

Frederick County Forecasts

Frederick County substantially revised their population and employment growth forecasts as part of the Round 8.1 forecast cycle, reduced their estimated growth forecasts from a 2040 population of 406,400 in Round 8.0 to 325,300 in Round 8.1. Their employment forecasts were also adjusted to reflect improved assumptions for both current and forecast employment, with the 2010 employment estimate adjusted downward from 112,100 to 98,700 and the 2040 employment estimate adjusted downward from 144,200 to 114,900. The 2010 employment estimate of 98,700 was lower than those available from all three independent sources including Woods & Poole (112,100), the State of Maryland (106,400), and Moody's (105,600). We feel that the 2012 macroeconomic forecasts for Frederick County, beyond our Primary Market Area but yet fairly proximate to the Dulles Toll Road commutershed, remain an appropriate set of forecasts; lower than the Round 8.0 forecasts, but higher than the Round 8.2 forecasts.

Comparison of Original and Updated Moody's Forecasts

Our original macroeconomic analysis used population and employment forecasts by county obtained from Moody's Analytics. Moody's updates its county forecast model on a monthly basis, so given the time elapsed it is useful to compare the original and updated forecasts to see what changes have occurred and whether they reflect any of the trends discussed above. The original forecasts were dated 7/29/2011 and the updated forecasts are dated 11/27/2013. Updated forecasts were only obtained for the jurisdictions most relevant to the toll road market area: DC and Arlington, Fairfax, Loudoun, and Montgomery Counties. (Note that Fairfax County includes the Cities of Fairfax and Falls Church.)

The most notable changes can be summarized as follows:

- The new population forecast for DC reflects stronger growth from 2010-2020 than previously projected. In particular, the compound annual growth rate from 2010-2015 was previously 0.5 percent but is now 1.9 percent. The new employment forecast is fairly similar to the original one, with the most noticeable difference being a slower growth rate from 2010-2015 and slightly faster growth from 2015-2020 (most likely reflecting federal budget cutting then some recovery).

- The new population forecast for Arlington County reflects faster growth from 2010-2020 – over twice the previous annual growth rate from 2010-2015 and almost twice the previous rate from 2015-2020. Population growth rates in the years after 2020 are also higher than the original forecast, although not as dramatically as in the earlier years. The new employment forecast is fairly similar, although the new annual growth rate forecast for 2015-2020 is twice what was previously projected.

- The new forecasts for Loudoun County show significantly slower growth in both population and employment than previously projected, particularly for population from 2010-2020 and for employment in nearly all of the years leading up to 2040. Even so, the new growth rates are still higher than any of the other jurisdictions. The most dramatic change is a reduction in the annual employment growth rate from 2010-2015 of 1.5 percentage points.

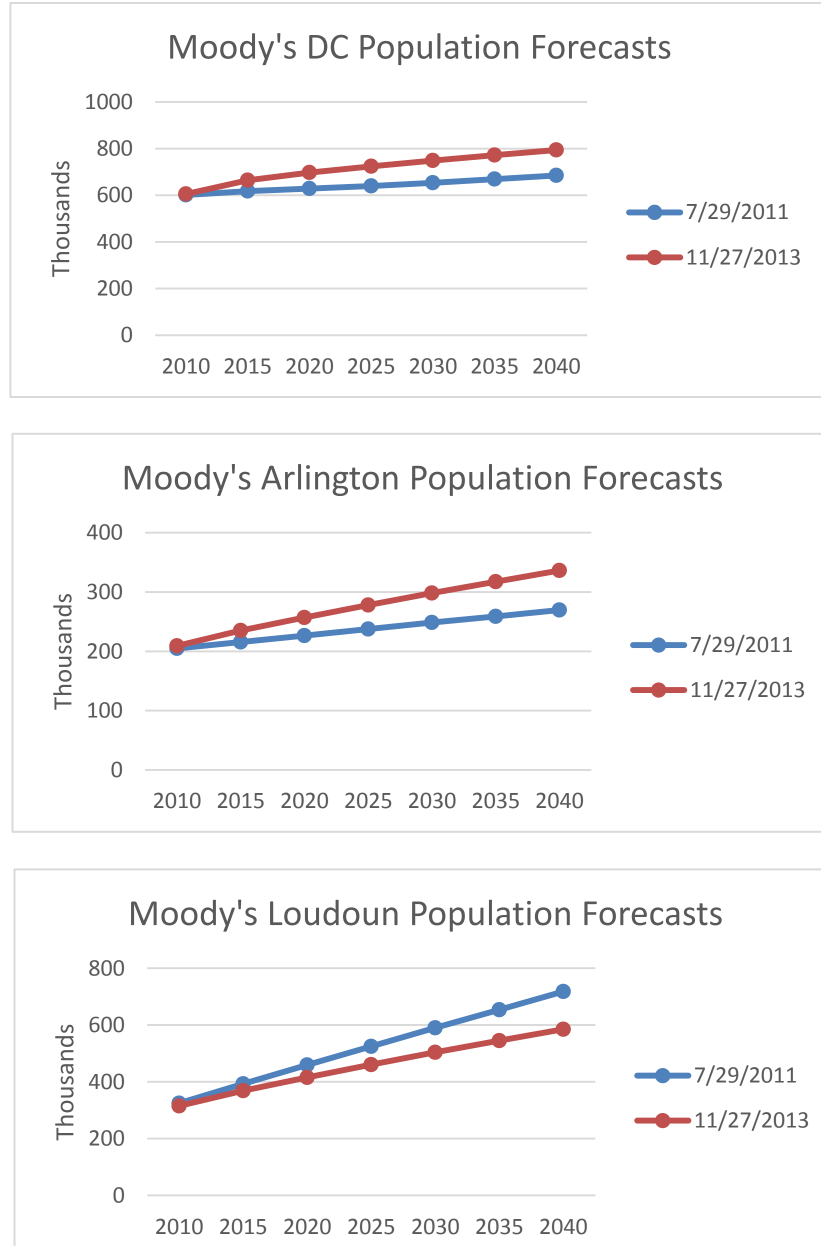
In two of these cases (DC and Loudoun), the revisions to the Moody's forecasts reflect what might be described as regression to the mean, with the 2013 Moody's forecasts shifting toward the Renaissance 2012 forecasts. In the case of Arlington, the original Moody's forecast (269,000) and the revised Moody's forecast (336,200) were both higher than the Renaissance 2012 forecast (250,400). The Renaissance 2014 forecast has been revised upwards to 275,600.

In each of the other jurisdictions examined, the Moody's 2011 and 2013 forecasts were not significantly different for either population or employment. For the purpose of the 2014 update to the independent economic forecasts, therefore, the definition of the macroeconomic forecast was not revised. Rather, the changes in the available forecasts from Moody's generally point toward the reasonableness of the differences between Renaissance forecasts and the 2012 macroeconomic forecasts as presented in Step 9.

Shifting Generational Preferences

Generation Y, also known as the Millennials, is the generation of young adults currently age 18-35 that is poised to have as much of an impact on economic and social trends as the Baby Boom generation did before it. Gen Y makes up one-fourth of the U.S. population and is expected to increase in size since many immigrants come to the U.S. at a young age. Much has been written about the emerging and future influence of this generation, and ULI commissioned two surveys in the past few years to evaluate its current and future housing and shopping preferences. The findings reinforce the narrative of the increasing popularity of urban areas and associated lifestyle, which in

Figure 22 - Notable recent changes to Moody's population forecasts.



this context would be DC and perhaps also close-in walkable areas in Alexandria and Arlington's Rosslyn-Ballston corridor.

In ULI's 2012 survey[9], 39% of Gen-Yers said that they are "city" people in terms of their residential orientation, compared to 29% "suburbanites" and 33% "small-town/country people." As far as where the respondents currently lived, 48% lived either in downtown or near downtown, or in a city neighborhood outside downtown. In terms of where they work, the 2010 survey[10] found that 55% of Gen-Yers expect to be working in central cities in five years, compared to 21% in suburbs and 23% in small towns or rural areas. Interestingly, only 47% of the respondents said that they currently worked in central cities, suggesting as the ULI report puts it "that cities appeal to members of Generation Y as a place to work, even if they prefer not to live in dense urban places." Looking at a place-driven factor independent of the city/suburb distinction, the 2010 survey found that 64% of respondents felt that the walkability of shopping and gathering places was either "essential" or "preferable." These findings reinforce the idea that DC and the closer-in, transit-served employment centers will maintain their strong market positions, and perhaps even strengthen as Generation Y increases its earning power and continues to assert its influence in the marketplace.

However, the jury remains out on how the millenials will choose to balance work, life, and travel as they age. The millennial generation's noted interest in more urban living has been linked in the media to lower automobile ownership rates and vehicle miles of travel, and the supposed causes include both societal changes such as social media as a connectivity replacement for physical travel, cultural changes such as a shift away from celebrating the car as cultural icon and an increased interest in sustainable lifestyles, and policies such as graduated drivers licenses. Evelyn Blumenberg et al from the UCLA Luskin School of Public Affairs compared millennial generation travel patterns to their age cohorts from the prior three editions of the Nationwide Personal Transportation Survey (NPTS) in 1990, 2001, and 2009. They found that folks under the age of 26 are driving less than the same cohort did in 2001, but at about the same rate as young folks did in 1990[11]. They identified the economic changes as the significant cause for the reduced VMT; with the recessionary effects felt strongest at the lowest end of the age spectrum. For instance, in 2001 the employment rate among 16-year olds was 40%; by 2008 it was below 20%. This not only reduces the amount of travel to get to and from those vanishing jobs, but also the amount of discretionary travel to spend that disappearing discretionary income. They cautioned that it's too early to conclude whether the millennial generation will continue to pursue a less travel-intensive lifestyle as they age and the economy improves, or whether they will follow prior age-cohorts and increase per-capita VMT as their economic and familial situations evolve. Similarly, Joel Kotkin examines the current trends facing cities nationwide in his book on accommodating the nation's population increase through 2050[12] and finds good reasons to expect additional markets for full spectrum of land use transects from small town and rural to suburban and urban. We reach similar conclusions in our review of both original research and meta-analyses; the last few years have seen a rising interest in urban lifestyles and development, and we believe those trends will continue, but at a slower pace than the recent past (and a slower pace than some of the macroeconomic sources suggest).

Federal Government Budget/Sequestration Impacts

After being highlighted as one of the few metro economies to make it through the Great Recession relatively unscathed, the Washington, DC region has recently been beset by doubts about its near-term economic performance. Besides a perhaps inevitable slowing of regional investment as other parts of the

[9] "Generation Y: Shopping and Entertainment in the Digital Age", Lachman, M. Leanne and Brett, Deborah L.; Urban Land Institute; 2012
[10] "Generation Y: America's Next Housing Wave"; Lachman, M. Leanne and Brett, Deborah L.; Urban Land Institute; 2010
[11] "What's Youth Got To Do With It? Exploring the Travel Behavior of Teens and Young Adults"; Blumenberg, Evelyn, et al; UC Los Angeles, September 2012.
[12] "The Next Hundred Million: America in 2050"; Kotkin, Joel; Penguin Press, February 2010.

country recover, the primary reason for concern has been the continuing lack of closure in establishing sustainable solutions for the federal government's budget. The across-the-board budget cuts imposed by sequestration starting in March 2013 are the primary symptom garnering media attention. The consequences of sequestration were forecast by George Mason University to be grim in July 2012, and an update in February 2013 projected one million lost jobs over the coming two years due to the reduction in federal spending. But the immediate impacts were somewhat slow to materialize in the national employment statistics and some commentators debated whether sequestration was turning out to be as bad as predicted. As federal agencies implemented their initial responses to the budget control law, prominent analyst Professor Steven Fuller of George Mason University revised his projections of GDP and job losses. While his projected losses were still significant, the March 2013 analysis showed roughly half of the losses he originally projected in July 2012. But there were still negative impacts on the region. The DC-area economy did see a noticeable decrease in employment growth in the professional services sector, which includes government contractors, as well as an outright decrease in federal government employment. In the District itself, which has the largest concentration of federal government employees, sequestration was estimated to have been responsible for the unemployment rate reaching 8.6 percent in July 2013 when it was projected to decline to 8.0 percent. The concerns raised about the near-term future of the DC-area economy as a result of sequestration appear to have been warranted, even if the exact degree of impact turned out to be difficult to predict.

Over a half year after the onset of sequestration, the process appears to have played out with federal agencies utilizing a variety of methods to save jobs, preserve vital programs, and find money to spend in unexpected places. Deferred maintenance, staff cuts through attrition and use of furloughs, among other actions, appear to have moderated the expected impacts of the first round of sequestration-driven budget cuts. But the New York Times noted in October that "while the most dire predictions may not have materialized in 2013, the tricks that many agencies employed… are likely to be exhausted by 2014, when federal departments must trim an additional $24 billion from already tight budgets."

The December 2013 budget agreement passed by Congress essentially institutes a "cease-fire" in the continuing partisan budget battles, finances the government for the next two years, and repeals the sequestration-driven spending cuts that were set to take place in 2014. The bottom line appears to be that there were some negative impacts from the roughly 10 months of sequestration, but the worst cuts have been avoided and policy-makers are poised to begin working on solutions. While fiscal peace is not assured (there is talk of another debt ceiling battle in February) there is at least some progress taking place.

Localized employment forecasts have also been heavily influenced by the continuing rounds of Base Realignment and Closure (BRAC), notably the shift of Department of Defense (DoD) agencies from leased space in Arlington to points further south including the BRAC 133 site in Alexandria's west end and Fort Belvoir North in Fairfax County. As of November 2013, Dr. Andrea Morris, BRAC Coordinator and Director of Community Resilience for Arlington County, indicated that continued short term increases in vacancy rates are likely as BRAC 2005 actions are completed.

The federal budget compromise prohibits initiating another round of BRAC actions, due in part to concerns about the up-front costs of BRAC 2005, which was characterized in May 2013 by Robert Hale, DOD comptroller as a "move around", whereas BRAC 2015, he said, would be a "close-the-bases" BRAC.

The effects of BRAC 2005 were anticipated in the Round 8.0 forecasts and refined in the 2012 independent economic forecasts. It appears that site-specific absorption of commercial space along the I-95 corridor is occurring at a pace that warrants reconsideration of both near term and long term forecasts, particularly given the ability of Fort Belvoir to potentially absorb more DoD jobs in the future.

Decentralization of Office Jobs

While the recent shift in housing has been a slowing in outward regional sprawl and some focusing of residential growth towards the center of the region, the BRAC actions both highlight, and reinforce, a continuing decentralization in the regional commercial market, with Fairfax County located in the center of the region's "favored quarter". The professional and technical services sector is the key driver of the DC-area economy besides government and occupies a large proportion of the region's office space. Examining the location trends of this sector over the past decade should indicate whether office jobs are decentralizing in response to market dynamics that are pushing some workers to the periphery of the metro area and beyond. While such relocation if it is happening would likely be a long-term trend, the large run-up in home prices in the region during the mid-2000s would have been a significant spur to such activity.

The data show that some decentralization of professional services employment has taken place, but in specific ways rather than as a general trend. Fairfax County and DC are the two largest employment centers but their shares of the total professional services job base have moved in different directions from 2002-2012. Fairfax County has increased its share by almost five percentage points, from 32.7% to 37.4%, while DC has lost two points of share, from 25.6% to 23.7%. Loudoun County has nearly doubled its share, but started from a very small base – the increase was from 2.1% to 3.8%. Meanwhile, Montgomery County lost 4.5 points of share, from 17.9% to 13.5%. Prince George's County lost over one point of share, from 5.8% to 4.6%. The other counties – Arlington, Alexandria, Prince William, and Frederick – had minimal change.

Fairfax is a large county and has a large professional services employment base, so an examination of its employment centers over the past decade can highlight any trends in the location of office jobs. The data show that of the top 10 Fairfax County zip codes for professional services employment in 2012, nine of those were also in the top 10 in 2002 (and the tenth was previously in 13th place). Of the 12 zip codes that were in the top 10 in either year, two moved up in the ranking, three stayed the same, and seven moved down in the ranking. Two of the zip codes that stayed the same are the two largest employment centers: Tysons Corner and Chantilly. The two zip codes that moved up in the ranking are McNair (outside the entrance to Dulles Airport; moved up nine places, to fourth) and Reston (moved up three places, to third).

Key conclusions of this examination of office jobs are that Fairfax County is increasing its already largest share, DC is slightly losing share and Montgomery County is losing even more share. Loudoun is increasing but is still small. Other areas, both inner-ring and outlying, are generally maintaining their shares, and many are comparatively small. Within Fairfax County the dominant employment centers at Tysons Corner and near Dulles Airport are maintaining their standings. The largest changes have taken place in the gateway area to the airport (McNair) or approaching it on the toll road (Reston).

Professional services, especially of the high-value type that drive the DC-area economy, tend to benefit from central locations (near federal clients and regional accessibility) and clustering. There is no indication of a general decentralization trend in the employment data. Rather the storyline seems to be one of increasing Fairfax County dominance at the expense of DC and especially Montgomery County, with Loudoun emerging as a new location most likely driven by proximity to Dulles Airport. Broader market trends also appear to be working against job decentralization, especially for the sort of high-value knowledge-based jobs that are the backbone of the DC-area economy. Numerous sources have noted the trend of companies moving into urban centers from the suburbs, to enhance their recruiting appeal with younger workers and capitalize on the greater regional accessibility and lifestyle amenities of central cities. The DC region also is unique in the number and strength of denser, mixed-use suburban employment centers, many of which are served by rail transit. Recent research has shown that these walkable employment centers are outperforming their more auto-oriented peers economically, as measured by the real estate rents/prices they command for office, retail, and housing. Rather than valuing decentralization, the office market in the DC region appears to be valuing concentration more highly, although that concentration is taking place not only in the central city (i.e. the District itself). Walkable suburban office centers with a mix of complementary uses are also desirable locations for office space to concentrate. That is not to say that traditional suburban office centers are on their way out – market data[13] show that is probably not the case for higher quality locations around the nation – but there does not seem to be a basis for a large scale office decentralization trend in the region that would pull significant amounts of office development away from established centers both in the DC core and along its most accessible and multimodal transportation corridors such as the Dulles Toll Road / Silver Line. The ongoing Region Forward planning efforts to steer growth to defined activity centers reinforces this observation.

Office Space Usage

The location and density of future employment in the primary market area could be influenced by trends in companies' usage of office space. Specifically, the average square footage of building space per worker influences individual firm location decisions (based on the amount and characteristics of available space), and also influences projections of future employment in local areas (i.e. TAZs) that are based on estimates of the amount of office space likely to be developed. The common rule of thumb of analysts and brokers has usually been 200 or 250 square feet per worker, but there have been a number of commentators and analysts in recent years offering forecasts that corporate office space usage will decline significantly to 150 square feet or even less per worker[14]. This represents a potentially dramatic reduction in office space demand that could significantly change build-out assumptions in some developing areas.

But a more rigorous, academic approach to the question makes a compelling argument that the future of office space usage is probably going to look a lot like the past. A recent paper by Professor Norm G. Miller of the University of San Diego[15] digs deep into the real-world parameters of how usable office space is measured from the perspectives of developers, brokers, and space users and finds that the traditional rule of thumb is most likely underestimating the true amount of office space companies are occupying per worker. Rather than 200 or 250 square feet per worker, the true figure may be more like 340 square feet per worker. From that adjusted starting point, Miller argues that most companies will not be able to dramatically reduce their office space usage due to the practicalities of fluctuating personnel counts, inefficiencies in space configurations, and the influence on recruitment of new employees. And many companies may not even wish to reduce their office space usage as dramatically as some of the large, high-profile corporate users have been able to simply because of cultural reasons or differing priorities. Miller summarizes his findings thusly: "Based on reduced space usage, the demise of the office market has certainly been exaggerated, and we will likely see a continuation of space demand far in excess of the targets espoused by a few large public corporations and space planners. Moving forward, we will see some firms achieve square feet per worker of less than 100 square feet, but given the cultural impediments and the challenges of predicting growth rates, we are more likely to see figures at double this target for quite a while. It is unlikely in the real world of worker turnover, with both growing and shrinking firms, that typical firms will ever reduce actual space per worker to the stated goals."

[13] . "Once Left For Dead, Suburban Office Making a Comeback"; Drummer, Randyl; CoStar Advisor Newsletter; November 12, 2013

[14]. "Office Space per Worker Will Drop to 100 Square Feet or Below For Many Companies Within Five Years, According to New Research From CoreNet Global."; Corenet Global News Release, February 28, 2012

[15] "Estimating Office Space per Worker: Implications for Future Office Space Demand"; Miller, Norm. G, Ph.D.; University of San Diego; September 17, 2012 draft.

Transportation Investments

One of the characteristics of the MWCOG forecasts is that the land use and transportation forecasts both reflect a fiscally constrained long range transportation plan. Several trends in transportation and technology have evolved over the past two years and made headlines, but are not expected to have significant effects on the independent land use forecasts.

The 2013 legislative sessions in both Maryland and Virginia provided new sources of transportation funding in the term of higher gas taxes in Maryland and a switch from gas to sales taxes in Virginia. The legislation has added \$4.4B to Maryland's six-year Consolidated Transportation Program and \$0.6B to the FY 2014 Commonwealth Transportation Fund in Virginia. The media has stressed the value of the increased revenues for accelerating transportation investments, although in comparison, the 30-year CLRP fiscal plan for the MWCOG is \$223B, or about \$8B per year, and the ~\$1.3B additional annual revenue from the 2013 legislation needs to be distributed statewide across Virginia and Maryland, and is not expected to have a significant effect on accelerating or effecting land use as a whole. In contrast, however, the Dulles Air Cargo Passenger Metro Access Highway, removed from the 2013 CLRP, is a key element of improved arterial network connectivity west of Dulles Airport. Our forecasts presume that in over time, the controversy over specific route purposes, names, alignments, and funding schemes will be resolved as a better arterial network is needed to support planned development.

Similarly, scenario planning often considers changes in fuel prices. The USEIA projects that crude oil costs will rise by about 25% from \$112 per barrel in 2012 to \$141 per barrel (in 2012 dollars) by 2040. Considering continued and offsetting improvements in vehicle efficiency, these changes are not expected to be significant enough to affect land use patterns.

Plans for high speed rail connecting Washington to either the northeast corridor or to Hampton Roads, Charlotte, and/or Atlanta via Richmond have had a series of stops and starts, with the northeast corridor getting more recent attention. The Southeast Corridor focus in the foreseeable future relates to track improvements that will improve existing service speed and reliability for Virginia Railway Express by removing conflicts with CSX freight. For both the northeast and southeast corridors, the nearest stops to downtown Washington for a substantially faster rail service are generally considered to be Thurgood Marshall BWI Airport to the north and Fredericksburg to the south, so no development-related effects associated with intercity rail are expected.

Finally, technological advances in autonomous vehicles are creating pressures for policy changes in the automotive and infrastructure industries, primarily related to risk management. The continued influx of distributed information technology has essentially eliminated the need for autonomous vehicle infrastructure (i.e., separate lanes or in-pavement guidance); the focus is on market readiness. One suggested game-changer is that truly autonomous vehicles would make multitasking equally productive in private autos as for transit, reducing the annoyance factor associated with long auto commutes. However, the shift to autonomous vehicles will be gradual and improvements in technology and comfort will be multimodal, so the evolution in automotive technology is not expected to have a significant land use effect.

Step 9: Assumptions, Forecast Comparisons and Final Adjusted Forecast

The Renaissance forecasts pivot from the Round 8.2 forecasts considering recent or anticipated policy changes such as master plan or zoning changes and macroeconomic source guidance. First, the forecasts reflect 2010 census population and housing numbers, with multiplicative factors developed at the TAD level to adjust each TAZ's 2010 population and housing totals. The forecasts also reflect an adjustment of 2010 employment estimates, with multiplicative factors developed at the jurisdictional level for total jobs by employment category type. The reassessment of 2010 employment conditions also contained a correction factor for Frederick County's current jobs total to better align with at-place employment estimates from the macroeconomic sources.

The forecasts reflect changes to the local market expected to be prompted by master plan and zoning amendments in the primary market area, most notably those recently completed or underway in the Silver Line corridor Metrorail station areas. We applied the forecasting tool as a dashboard to adjust jobs and population densities based on assumed changes to the local market factor described above. And finally, the forecasts are guided by the macroeconomic trends so that the local forecasting tool results generally follow the blended jurisdictional control totals.

The following sections describe the detailed interventions made inside the Primary Market Area, present the forecasts at the jurisdictional level, show the overall jobs to housing balance within the region and each jurisdiction over time, and indicate the effect of population and employment adjustments in the Primary Market Area. These sections are followed by a number of maps that represent the forecasts and their differences at the TAZ level.

Primary Market Area Development Trends and Adjustments

In general, each of the jurisdictions in the Primary Market Area continues to pursue planning and zoning opportunities that direct economic growth towards transit areas, particularly existing and new Metrorail stations. This trend is strongest in the Silver Line / Dulles Toll Road corridor, with master plans for each of the transit station areas along the Dulles Toll Road either adopted (Tysons Corner, 2010; Route 28 Corridor Plan, 2011; Reston Master Plan, 2014) since the Round 8.0 forecasts were developed, or underway (Route 28 Station South study). The maps provided at the end of this report demonstrate the degree to which increased density and development growth is being channeled by all jurisdictions into growth areas in their individual comprehensive plans and collectively described in the MWCOG Region Forward initiatives, including the report on place and opportunity adopted by the MWCOG Board in January 2014[16]. Additional details on expected focal areas for development and notable revisions to the Round 8.2 forecasts regarding local development are summarized in the following paragraphs.

Tysons

The Tysons area is the single largest node for planned new development in the Primary Market Area, with a planned transformation from an auto-oriented commercial center into a more walkable, diverse set of activity centers focused on the four Silver Line stations where Metrorail service is scheduled to start in early 2013. The 2010 Tysons Plan was developed to increase land use density and diversity widely described as accommodating a residential population of 100,000 residents and a daytime population of 200,000 jobs (and retained as a benchmark in the 2013 annual report to the Board of Supervisors[17]. Within walking distance of the four Metrorail stations, zoning density is theoretically unlimited in terms of Floor Area Ratios, but would rather be constrained by other market-based and site development constraints. The Round 8.2 forecasts estimate Tysons will grow from 16,500 residents and 76,100 jobs in 2010 to 72,900 residents and 141,800 jobs in 2040. The Renaissance forecasts for 2040 are slightly lower than those in Round 8.2 for population at 60,300 residents but slightly higher for employment at 145,500 jobs in 2040. We forecast additional growth in Tysons through 2050 for totals of 68,500 residents and 155,600 jobs in 2050. Our forecast trends reflect the fact that Tysons remains one of the most attractive suburban activity centers in both Fairfax County and the region, located in the "favored quarter" midway between downtown Washington and Dulles International Airport, with premium multimodal accessibility provided by the confluence of the Dulles Toll Road and Silver Line for regional radial connectivity and the Capital Beltway for regional circumferential accessibility. Sufficient capacity remains for continued growth beyond 2050.

[16]. "Place + Opportunity: Strategies for Creating Great Communities and a Stronger Region", Metropolitan Washington Council of Governments, January 2014.

[17]. Report to Board of Supervisors on Tysons, Fairfax County Office of Community Revitalization, October 2013.

Notable projects under construction utilizing the development processes in the 2010 Tysons plan include:

- The Residences at Spring Hill Station, a 26-story residential project in the Tysons West District at the Spring Hill Metrorail station
- Phase I of the Tysons Corner Center, including a 22-story office building and a 28-story residential building as well as a lower rise hotel/retail structure, at the Tysons Central/123 District
- Park Crest, a 19-story residential project in the North Central District
- Tysons Overlook, an 11-story residential project also in the North Central District

In summary, about 1,100 new dwelling units and an additional 1.5 million square feet of commercial space is currently under construction in Tysons. The next wave of development, consisting of projects that have received their Final Development Plan (zoning) approvals (but for which only one project has moved through the site plan process, includes another 13,640 dwelling units and 14.4 million square feet of commercial space. Beyond those projects, another 7,000 dwelling units and 6.6 million square feet of development has been included in proposed but unapproved rezoning applications.

Reston / Herndon

Moving west from Tysons, the Silver Line includes stations at Wiehle-Reston East, Reston Town Center, Herndon, and Innovation Center prior to reaching Dulles International Airport. Fairfax County and the Town of Herndon have conducted station area comprehensive plan amendments during the past several years to both promote economic growth that leverages the transportation system investment with suitable private sector investment as well as establish additional public sector needs to address concerns such as adequate public facilities such as streets, schools and parks as well as supporting policies such as affordable housing initiatives. Taken together, these four station areas have a larger area than Tysons (about 3,000 acres in Fairfax County, compared to about 1,900 for Tysons) and slightly lower development levels. The 68,400 forecast 2050 population for these four areas is about the same as for Tysons in 50% greater land area, but the 2050 forecast job total of 139,300 is about 10% lower than for Tysons.

Remaining Fairfax County

The same types of regional, multimodal accessibility that causes our population and jobs forecasts for Tysons to be slightly higher than the Round 8.2 forecasts also applies to the Reston/Herndon and Route 28 corridors. In the Route 28 corridor we see the potential for additional residential development south of the Dulles Toll Road, a concept examined by the Countywide Transit Network Study, reflecting the potential for transit-oriented development in the corridor and the value of introducing land use diversity with residential access to Dulles International Airport into an area currently zoned exclusively for non-residential use.

In the I-95 corridor, the BRAC 2005 activities at Fort Belvoir and Fort Belvoir North will generate additional supporting commercial development in the vicinity of the Fort Belvoir North Area due to its proximity to transportation (both I-95 and the Franconia-Springfield Metrorail station) and relatively underutilized commercial and industrial land. Additional development potential exists at Fort Belvoir for future BRAC actions as being explored by the on-post master planning activities; these changes are likely to be incorporated in Round 8.3 TAZ level forecasts as well.

Overall, we see the trends toward regional decentralization, but into new activity centers and clusters, increasing Fairfax County development above Round 8.2 forecasts at a rate greater than for any other primary market jurisdiction, with 10,700 more residents and 40,100 more jobs in 2040 than included in the Round 8.2 forecasts.

Loudoun County

Growth in Loudoun County can be characterized within four broad categories: the two Metrorail stations west of Dulles International Airport, the Route 28 corridor (including the Loudoun County side of the Innovation Center Metrorail station), the suburban areas (including the independent towns and villages whose form is not typically suburban but where potential growth patterns result in similar density levels), and the rural policy area. Loudoun County continues to be a jurisdiction where westward growth pressures are perhaps the most pervasive, given its proximity, and therefore access, to both Dulles International Airport and the existing and emerging centers along the Silver Line. Absent policy guidance that reinforces the environmental, fiscal, and community interests, the market potential for residential growth would be significantly higher, as noted by the variance in Moody's forecast population growth cited in Step 8 of this report.

The two westernmost Silver Line stations, at Route 772 and Route 606, will both become mixed use, transit-accessible centers, but at far lower levels of density than Silver Line stations east of the airport. We forecast growth through 2040 at these stations at about 15% higher than the MWCOG Round 8.2 levels, but the 2050 totals of 18,800 residents and 27,000 jobs over 1,500 acres remain more suburban, with park-and-ride access (for approximately 3,000 planned spaces at each station) being of higher importance at and near the end of line than at stations further east.

We forecast slightly greater total development in Loudoun County than the Round 8.2 forecasts for both 2040 population (495,600 compared to 484,900) and jobs (322,100 compared to 283,200). We believe the imminent approval of the Route 28 Comprehensive Plan Amendment introducing greater residential development potential into signature sites along the Route 28 corridor and the Silver Line stations will be repeatable at other sites in the corridor where mixed use can facilitate transit-oriented development and 24/7 communities with mixed-use centers facilitating reduced VMT along a future high quality transit corridor parallel to Route 28. Our assessment is that the strongest potential for connectivity would be along Atlantic Boulevard connecting Dulles Town Center to Innovation Center. We also foresee increased value of the rear airport access improvements prompting some increased density as a higher and better use of some of the flex space and data center properties over time.

Washington DC

As described in Step 8, Washington DC is undergoing a residential growth wave of historic proportions, with the recent focus on new construction in the Navy Yard and Southwest neighborhoods. The phased investment in the streetcar system, with 22 miles planned to connect Takoma to Anacostia and Georgetown to Benning Road over the next three decades will help provide additional capacity for intercity trips and continue to focus development in established commercial corridors just beyond the federal core. Redevelopment of Washington DC will continue be strongest adjacent to Metrorail station areas and along these emerging streetcar corridors. Significant growth will be most focused in the NoMa and Convention Center neigbhorhoods, including air-rights development over I-395 and the redevelopment of Union Station. Conversely, redevelopment of the Brentwood yards, Langdon, and Gateway neighborhoods will occur at a slower pace than forecasted in MWCOG Round 8.2. We see the total amount of residential development in DC occurring at a pace just slightly faster than Round 8.2 by 2040 (771,800 residents as compared to 771,200 residents in Round 8.2) but well behind the accelerated growth to 896,600 that is being incorporated in Round 8.3. We see jobs growth in Washington continuing with focal points around the Navy Yard and the New York Avenue gateway corridor, but with total employment by 2040 slightly lower than Round 8.2 (958,700 as compared to 982,600) due to the regional decentralization forces symbolized by the macroeconomic forecasts and leading indicators of federal government fiscal prudence such as relocations associated with BRAC 2005 activities and the more recent moves of the National Science Foundation and the US Fish and Wildlife Service from the Orange Line corridor in Arlington to the Eisenhower Valley and Baileys Crossroads, respectively.

Arlington County
Arlington County is entering the second generation of its nationally recognized focus of development in the Rosslyn-Ballston (Orange Line) and Jeff Davis (Blue/Yellow Line) corridors, as well as expanding visions of high quality transit in the Columbia Pike corridor and beginning to engage in similar considerations for the Lee Highway corridor. The County is currently experiencing the adverse economic effects of both BRAC 2005 in Crystal City as well as the fiscal austerity programs of other federal agencies, ranging from the US Patent and Trademark Office departure from Crystal City in 2006 and the National Science Foundation and U.S. Fish and Wildlife Service departures announced during the past year. We expect these effects to be short-lived, however, due to the continued combination of regional accessibility provided by Metrorail, national accessibility afforded by Washington Reagan National Airport, and combination of quality of life amenities such as nightlife generally associated with a more urban environment and schools generally associated with the suburbs. The additional development along transit corridors is occurring at Potomac Yards and Columbia Pike.

The Rosslyn Renaissance program will build on the confluence of Metrorail lines to produce an increase in both residential and commercial development. We see potential for small amounts of infill residential development spurred by the Columbia Pike Streetcar. Our adjustments to the Arlington Round 8.2 forecasts are the lowest of the Primary Market Area jurisdictions; less than 1% for both 2040 jobs and 2040 residents.

City of Alexandria
Development patterns in the City of Alexandria is oriented along major transportation corridors, notably the Metrorail Yellow/Blue lines and the two planned transitway corridors: the Crystal City/Potomac Yards transitway (i.e., the northern portion of Corridor A) now under construction, the Duke Street Corridor connecting Landmark Mall to Old Town (Corridor B) and the Beauregard/Van Dorn Street corridor connecting the BRAC 133 site, Landmark Mall, and the Van Dorn Metrorail station (Corridor C). Significant vacant or underutilized development sites are located at the Eisenhower Avenue Metrorail station, including the proposed National Science Foundation site.   Continued infill is planned at the other Metrorail station sites.   The BRAC 133 site at Mark Center is a visible catalyst for the Beauregard Small Area plan that will redevelop an affordable housing resource to increase planned density and foster a more integrated mixed-use development along the Corridor C transitway. Commercial and mixed-use redevelopment opportunities will increase in North Old Town including the redevelopment of the Mirant plant site. However, we estimate that phased development at the Potomac Yard station will occur at a slightly slower pace than indicated in the Round 8.2 forecasts. The net effect is a series of 2040 forecasts just slightly lower than those in Round 8.2 (with 192,300 residents and 163,400 jobs as compared to 194,900 residents and 167,600 jobs). Our forecasts for Alexandria's 2010-2040 growth rates are still higher than for any other Primary Market Area jurisdiction except for Loudoun County.

Comparison of Population Forecasts

Figure 23 through Figure 28 present the MWCOG Round 8.2, Macroeconomic and final Renaissance population forecasts. The macroeconomic forecast was used as guidance in generating the final forecasts shown in Figure 26. All tables for population and employment totals report forecasts in thousands.

Figure 23 – Table of Round 8.2 Population Forecasts by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	601.7	653.9	676.3	701.6	722.8	747.0	771.2	n/a	n/a
Montgomery	972.6	1020.0	1038.8	1067.0	1110.0	1153.9	1202.8	n/a	n/a
Prince George's	863.4	881.4	888.7	899.7	926.7	950.0	995.3	n/a	n/a
Arlington	207.6	222.9	236.1	248.7	258.8	267.4	276.1	n/a	n/a
Alexandria	140.0	148.5	158.1	167.1	174.0	184.5	194.9	n/a	n/a
Fairfax	1116.8	1154.2	1193.6	1254.4	1308.9	1361.7	1414.2	n/a	n/a
Loudoun	312.3	360.3	405.2	443.4	464.4	474.7	484.9	n/a	n/a
Prince William	454.1	505.8	524.1	551.5	588.9	621.6	672.9	n/a	n/a
Frederick	233.4	240.8	246.4	254.8	275.1	293.1	324.9	n/a	n/a
TOTALS	4901.9	5187.6	5367.3	5588.2	5829.6	6054.0	6337.1	n/a	n/a

Figure 24 – Table of 2012 Macroeconomic Population Forecasts by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	601.7	620.0	637.4	656.8	673.9	691.4	708.9	727.0	745.7
Montgomery	971.8	1008.5	1056.1	1099.7	1142.3	1172.1	1188.9	1213.0	1237.5
Prince George's	863.4	890.9	913.9	932.0	947.2	958.1	969.4	980.8	992.2
Arlington	207.6	219.9	230.3	236.1	241.9	244.1	246.5	248.8	251.1
Alexandria	140.0	143.9	153.0	161.1	167.3	174.6	181.8	189.5	197.5
Fairfax	1116.6	1156.3	1212.7	1262.0	1300.3	1333.5	1352.6	1379.6	1407.1
Loudoun	312.3	370.9	434.2	500.9	566.7	631.9	694.2	768.4	850.4
Prince William	454.1	503.5	541.9	583.8	625.8	664.3	698.2	737.4	778.9
Frederick	233.4	254.9	276.3	298.5	320.0	339.7	357.0	377.1	398.3
TOTALS	4900.9	5168.7	5455.8	5730.9	5985.5	6209.7	6397.5	6621.5	6858.7

Figure 25 – Table of Difference between 2012 Macroeconomic and Round 8.2 Population Forecasts

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	0.0	-33.9	-38.9	-44.8	-48.9	-55.6	-62.3	n/a	n/a
Montgomery	-0.8	-11.6	17.2	32.7	32.4	18.2	-13.8	n/a	n/a
Prince George's	0.0	9.5	25.2	32.3	20.4	8.1	-25.9	n/a	n/a
Arlington	0.0	-3.0	-5.8	-12.6	-16.9	-23.3	-29.6	n/a	n/a
Alexandria	0.0	-4.6	-5.1	-6.0	-6.7	-9.8	-13.1	n/a	n/a
Fairfax	-0.2	2.1	19.1	7.6	-8.6	-28.2	-61.5	n/a	n/a
Loudoun	0.0	10.7	29.0	57.6	102.3	157.2	209.3	n/a	n/a
Prince William	0.0	-2.2	17.9	32.3	37.0	42.7	25.3	n/a	n/a
Frederick	0.0	14.1	29.9	43.7	44.9	46.6	32.1	n/a	n/a
TOTALS	-1.0	-18.9	88.5	142.7	155.9	155.7	60.4	n/a	n/a

Figure 26 – Table of Renaissance Population Forecasts by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	601.7	653.6	674.9	700.8	722.4	747.2	771.8	796.4	821.0
Montgomery	971.8	1008.5	1056.1	1099.7	1142.3	1172.1	1188.9	1213.0	1237.5
Prince George's	863.4	890.9	913.9	932.0	947.2	958.1	969.4	980.8	992.2
Arlington	207.6	222.9	235.8	248.6	258.7	267.1	275.6	284.0	292.4
Alexandria	140.0	148.0	156.8	165.4	172.0	182.2	192.3	202.4	212.5
Fairfax	1116.8	1156.9	1196.9	1258.9	1314.5	1369.8	1424.9	1473.1	1521.3
Loudoun	312.3	361.8	410.1	448.9	470.4	483.0	495.6	508.1	520.7
Prince William	454.1	503.5	541.9	583.8	625.8	664.3	698.2	737.4	778.9
Frederick	233.4	254.9	276.3	298.5	320.0	339.7	357.0	377.1	398.3
TOTALS	4901.1	5200.9	5462.7	5736.6	5973.3	6183.5	6373.7	6572.3	6774.8

Figure 27 – Table of Difference between Renaissance and Round 8.2 Population Forecasts

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	0.0	-0.3	-1.5	-0.8	-0.4	0.1	0.6	n/a	n/a
Montgomery	-0.8	-11.6	17.2	32.7	32.4	18.2	-13.8	n/a	n/a
Prince George's	0.0	9.5	25.2	32.3	20.4	8.1	-25.9	n/a	n/a
Arlington	0.0	0.0	-0.2	0.0	-0.1	-0.3	-0.5	n/a	n/a
Alexandria	0.0	-0.5	-1.3	-1.6	-2.0	-2.3	-2.6	n/a	n/a
Fairfax	0.0	2.8	3.3	4.5	5.5	8.1	10.7	n/a	n/a
Loudoun	0.0	1.5	4.9	5.5	5.9	8.3	10.6	n/a	n/a
Prince William	0.0	-2.2	17.9	32.3	37.0	42.7	25.3	n/a	n/a
Frederick	0.0	14.1	29.9	43.7	44.9	46.6	32.1	n/a	n/a
TOTALS	-0.8	13.3	95.4	148.5	143.7	129.5	36.5	n/a	n/a

Figure 28 – Table of Difference between Renaissance and Macroeconomic Population Forecasts

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	0.0	33.6	37.5	44.0	48.5	55.8	62.9	69.4	75.4
Montgomery	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Prince George's	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Arlington	0.0	3.0	5.5	12.6	16.8	23.0	29.1	35.2	41.3
Alexandria	0.0	4.1	3.8	4.3	4.8	7.5	10.5	12.9	15.0
Fairfax	0.2	0.7	-15.8	-3.1	14.2	36.3	72.2	93.5	114.2
Loudoun	0.0	-9.1	-24.1	-52.1	-96.4	-148.9	-198.7	-260.3	-329.8
Prince William	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Frederick	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TOTALS	0.2	32.2	6.9	5.7	-12.2	-26.2	-23.9	-49.2	-83.9

Comparison of Employment Forecasts

Figure 29 through Figure 34 present the MWCOG Round 8.2, macroeconomic and final Renaissance employment forecasts. The macroeconomic forecast was used as guidance in generating the final forecasts shown in Figure 32. All tables for population and employment totals report forecasts in thousands.

Figure 29 – Table of Round 8.2 Employment Forecasts by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	783.5	812.9	865.7	902.6	929.6	956.2	982.6	n/a	n/a
Montgomery	510.3	532.0	545.0	564.4	598.8	635.3	715.1	n/a	n/a
Prince George’s	342.6	357.0	365.3	377.9	403.1	427.5	497.7	n/a	n/a
Arlington	223.3	247.5	276.3	292.1	303.0	305.9	308.8	n/a	n/a
Alexandria	102.9	110.2	116.8	131.2	149.6	158.6	167.6	n/a	n/a
Fairfax	654.7	697.3	757.1	809.5	854.3	887.8	921.0	n/a	n/a
Loudoun	145.3	162.8	197.6	225.9	251.7	267.5	283.2	n/a	n/a
Prince William	143.6	163.4	172.5	186.2	207.3	230.0	278.2	n/a	n/a
Frederick	98.7	99.4	101.2	103.9	107.3	109.8	114.9	n/a	n/a
TOTALS	3004.7	3182.4	3397.5	3593.7	3804.8	3978.6	4269.2	n/a	n/a

Figure 30 – Table of 2012 Macroeconomic Employment Forecasts by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	786.0	822.9	839.5	860.7	882.4	907.3	933.2	959.7	987.0
Montgomery	506.0	540.0	585.0	628.0	673.0	703.0	723.0	749.4	776.7
Prince George’s	358.4	370.1	383.6	399.6	419.6	444.1	474.6	504.7	536.8
Arlington	205.2	218.2	243.8	262.4	268.6	278.5	281.1	287.6	294.2
Alexandria	108.9	117.7	124.1	135.4	142.3	153.6	160.4	170.3	180.8
Fairfax	680.0	725.5	788.5	845.3	888.4	933.7	971.6	1016.2	1062.7
Loudoun	143.7	167.6	206.5	239.4	270.8	299.0	322.1	351.3	383.2
Prince William	144.5	166.7	188.8	209.9	232.6	256.1	280.7	308.4	338.7
Frederick	112.1	119.2	124.6	128.7	131.7	134.7	137.8	141.0	144.2
TOTALS	3044.8	3247.9	3484.4	3709.3	3909.4	4110.0	4284.6	4488.6	4704.4

Figure 31 – Table of Difference between 2012 Macroeconomic and Round 8.0 Employment Forecasts

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	2.5	10.0	-26.2	-41.9	-47.2	-48.9	-49.4	n/a	n/a
Montgomery	-4.3	8.0	40.0	63.6	74.2	67.7	7.9	n/a	n/a
Prince George’s	15.8	13.1	18.3	21.7	16.5	16.6	-23.1	n/a	n/a
Arlington	-18.1	-29.3	-32.5	-29.7	-34.4	-27.4	-27.7	n/a	n/a
Alexandria	6.0	7.5	7.3	4.2	-7.3	-5.0	-7.2	n/a	n/a
Fairfax	25.3	28.3	31.4	35.7	34.0	45.9	50.7	n/a	n/a
Loudoun	-1.6	4.8	8.9	13.5	19.2	31.5	38.9	n/a	n/a
Prince William	0.9	3.3	16.3	23.7	25.3	26.1	2.5	n/a	n/a
Frederick	13.4	19.9	23.4	24.8	24.4	24.9	22.9	n/a	n/a
TOTALS	40.1	65.5	86.9	115.7	104.6	131.4	15.5	n/a	n/a

Figure 32 – Table of Renaissance Employment Forecasts by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	783.5	810.3	859.4	892.1	912.8	935.9	958.7	981.4	1004.0
Montgomery	506.0	540.0	585.0	628.0	673.0	703.0	723.0	749.4	776.7
Prince George’s	358.4	370.1	383.6	399.6	419.6	444.1	474.6	504.7	536.8
Arlington	223.3	248.0	276.5	292.6	303.2	306.0	308.8	311.6	314.4
Alexandria	102.9	110.7	115.2	128.9	146.2	154.8	163.4	172.2	181.0
Fairfax	654.7	711.1	785.8	842.1	889.6	925.5	961.1	1002.2	1043.4
Loudoun	145.3	167.5	214.8	248.2	277.3	295.6	313.7	331.8	349.9
Prince William	144.5	166.7	188.8	209.9	232.6	256.1	280.7	308.4	338.7
Frederick	112.1	119.2	124.6	128.7	131.7	134.7	137.8	141.0	144.2
TOTALS	3030.5	3243.6	3533.8	3770.1	3986.0	4155.6	4321.9	4502.7	4689.3

Figure 33 – Table of Difference between Renaissance and Round 8.2 Employment Forecasts

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	0.0	-2.6	-6.3	-10.6	-16.8	-20.4	-23.9	n/a	n/a
Montgomery	-4.3	8.0	40.0	63.6	74.2	67.7	7.9	n/a	n/a
Prince George's	15.8	13.1	18.3	21.7	16.5	16.6	-23.1	n/a	n/a
Arlington	0.0	0.5	0.2	0.5	0.2	0.1	0.0	n/a	n/a
Alexandria	0.0	0.5	-1.6	-2.3	-3.4	-3.8	-4.2	n/a	n/a
Fairfax	0.0	13.8	28.7	32.6	35.2	37.7	40.1	n/a	n/a
Loudoun	0.0	4.7	17.2	22.3	25.7	28.1	30.4	n/a	n/a
Prince William	0.9	3.3	16.3	23.7	25.3	26.1	2.5	n/a	n/a
Frederick	13.4	19.9	23.4	24.8	24.4	24.9	22.9	n/a	n/a
TOTALS	25.8	61.2	136.3	176.4	181.2	177.0	52.7	n/a	n/a

Figure 34 – Table of Difference between Renaissance and Macroeconomic Employment Forecasts

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	-2.5	-12.6	19.9	31.4	30.4	28.5	25.5	21.7	17.1
Montgomery	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Prince George's	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Arlington	18.1	29.8	32.7	30.2	34.6	27.5	27.7	24.1	20.3
Alexandria	-6.0	-7.0	-8.9	-6.5	3.9	1.2	3.0	1.9	0.1
Fairfax	-25.3	-14.4	-2.7	-3.1	1.2	-8.2	-10.5	-13.9	-19.3
Loudoun	1.6	-0.1	8.3	8.9	6.5	-3.5	-8.5	-19.5	-33.3
Prince William	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Frederick	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TOTALS	-14.2	-4.3	49.4	60.7	76.6	45.6	37.2	14.2	-15.1

Primary Market Area Population and Employment Forecast Tables

Figure 35 through Figure 40 present the comparison of Renaissance and Round 8.2 forecasts for the portions of the study area jurisdictions within the Primary Market Area boundary shown on Figure 1.

Figure 35 – Table of Renaissance Primary Market Area Population Totals by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	289.7	318.9	329.3	344.5	358.0	370.3	382.5	394.7	407.0
Arlington	207.6	222.9	235.8	248.6	258.7	267.1	275.6	284.0	292.4
Alexandria	140.0	148.0	156.8	165.4	172.0	182.2	192.3	202.4	212.5
Fairfax	600.1	624.8	653.4	697.9	737.7	777.6	817.3	850.5	883.6
Loudoun	253.0	288.1	317.0	335.9	347.5	354.8	362.1	369.3	376.6
TOTALS	1490.4	1602.7	1692.3	1792.3	1873.9	1952.0	2029.8	2100.9	2172.1

Figure 36 – Table of Round 8.2 Primary Market Area Population Totals by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	289.7	319.4	26.6	345.4	358.5	370.4	382.2	n/a	n/a
Arlington	207.6	222.9	2.9	248.7	258.8	267.4	276.1	n/a	n/a
Alexandria	140.0	148.5	1.8	167.1	174.0	184.5	194.9	n/a	n/a
Fairfax	600.1	623.4	2.4	696.1	735.8	774.0	812.1	n/a	n/a
Loudoun	253.0	286.6	0.7	330.5	341.6	346.6	351.5	n/a	n/a
TOTALS	1490.4	1600.8	34.4	1787.8	1868.7	1942.9	2016.8	n/a	n/a

Figure 37 – Table of Difference Round 8.2 and Renaissance Primary Market Area Population Totals

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	0.0	-0.5	-1.5	-0.9	-0.5	-0.1	0.3	n/a	n/a
Arlington	0.0	0.0	-0.3	-0.1	-0.1	-0.3	-0.5	n/a	n/a
Alexandria	0.0	-0.5	-1.3	-1.7	-2.0	-2.3	-2.6	n/a	n/a
Fairfax	0.0	1.4	1.5	1.8	1.9	3.6	5.2	n/a	n/a
Loudoun	0.0	1.5	4.9	5.4	5.9	8.2	10.6	n/a	n/a
TOTALS	0.0	1.9	3.3	4.5	5.2	9.1	13.0	n/a	n/a

Figure 38 – Table of Renaissance Primary Market Area Employment Totals by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	654.9	679.5	716.1	734.5	743.3	758.8	774.3	789.6	804.8
Arlington	223.3	248.0	276.5	292.6	303.2	306.0	308.8	311.6	314.4
Alexandria	102.9	110.7	115.2	128.9	146.2	154.8	163.4	172.2	181.0
Fairfax	476.6	513.1	569.7	609.0	643.6	670.8	697.9	726.4	754.8
Loudoun	132.8	153.1	198.1	229.8	257.3	274.8	292.3	309.8	327.2
TOTALS	1590.5	1704.4	1875.6	1994.8	2093.6	2165.2	2236.7	2309.6	2382.2

Figure 39 – Table of Round 8.2 Primary Market Area Employment Totals by Jurisdiction

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	654.9	680.5	720.8	743.4	757.2	775.5	793.7	n/a	n/a
Arlington	223.3	247.5	276.3	292.1	303.0	305.9	308.8	n/a	n/a
Alexandria	102.9	110.2	116.8	131.2	149.6	158.6	167.6	n/a	n/a
Fairfax	476.6	504.6	551.2	588.7	622.0	647.4	672.6	n/a	n/a
Loudoun	132.8	148.4	180.9	207.4	231.6	246.8	261.8	n/a	n/a
TOTALS	1590.5	1691.2	1846.0	1962.8	2063.4	2134.2	2204.5	n/a	n/a

Figure 40 – Table of Difference Round 8.2 and Renaissance Primary Market Area Employment Totals

	2010	2015	2020	2025	2030	2035	2040	2045	2050
District of Columbia	0.0	-1.0	-4.7	-8.9	-13.9	-16.7	-19.4	n/a	n/a
Arlington	0.0	0.5	0.2	0.5	0.2	0.1	0.0	n/a	n/a
Alexandria	0.0	0.5	-1.6	-2.3	-3.4	-3.8	-4.2	n/a	n/a
Fairfax	0.0	8.5	18.5	20.3	21.6	23.4	25.3	n/a	n/a
Loudoun	0.0	4.7	17.2	22.4	25.7	28.0	30.5	n/a	n/a
TOTALS	0.0	13.2	29.6	32.0	30.2	31.0	32.2	n/a	n/a

Primary Market Area Jurisdiction Forecast Maps

The remaining figures provide TAZ-level maps showing the extent and type of growth forecast for the Primary Market Area jurisdictions.

Figures 41 through 58 show population and job density by TAZ for the Renaissance and MWCOG Round 8.2 forecasts. These maps demonstrate the importance and influence of relationships both to the regional core and to Dulles International Airport in terms of influencing population and jobs growth. Jobs growth is particularly oriented toward the DC core and activity centers along regional radial corridors including the Silver Line (Dulles Toll Road), Orange Line (I-66) and Blue Line (I-95) corridors as well as along Routes 28, 50, 7, and the Loudoun County Parkway. Residential growth is slightly more dispersed to a broader geographic area but follows the same general patterns.

- Figures 41 through 48 show the MWCOG Round 8.2 forecasts expressed in terms of population and job densities (per acre) for 2010, 2020, 2035, and 2040.
- Figures 49 through 58 show the Renaissance forecasts expressed in terms of population and job densities (per acre) for 2010, 2020, 2035, 2040, and 2050.

Figures 59 through 64 compare the Round 8.2 and Renaissance forecast absolute growth in population and jobs from 2010 to 2040. These maps tell a slightly different story, particularly suggesting a widespread distribution of residential growth throughout Loudoun County, although this impression is influenced by the large TAZ structure in western Loudoun County.

Figures 65 through 70 show the Renaissance forecast absolute growth in population for three intervals: 2010-2020, 2020-2035, and 2035-2050. These maps demonstrate the lengthy absorption period anticipated in most of the planned growth areas where continued development spans all three horizon year intervals.

Figure 41 – Round 8.2 Population Density Per TAZ Acre 2010

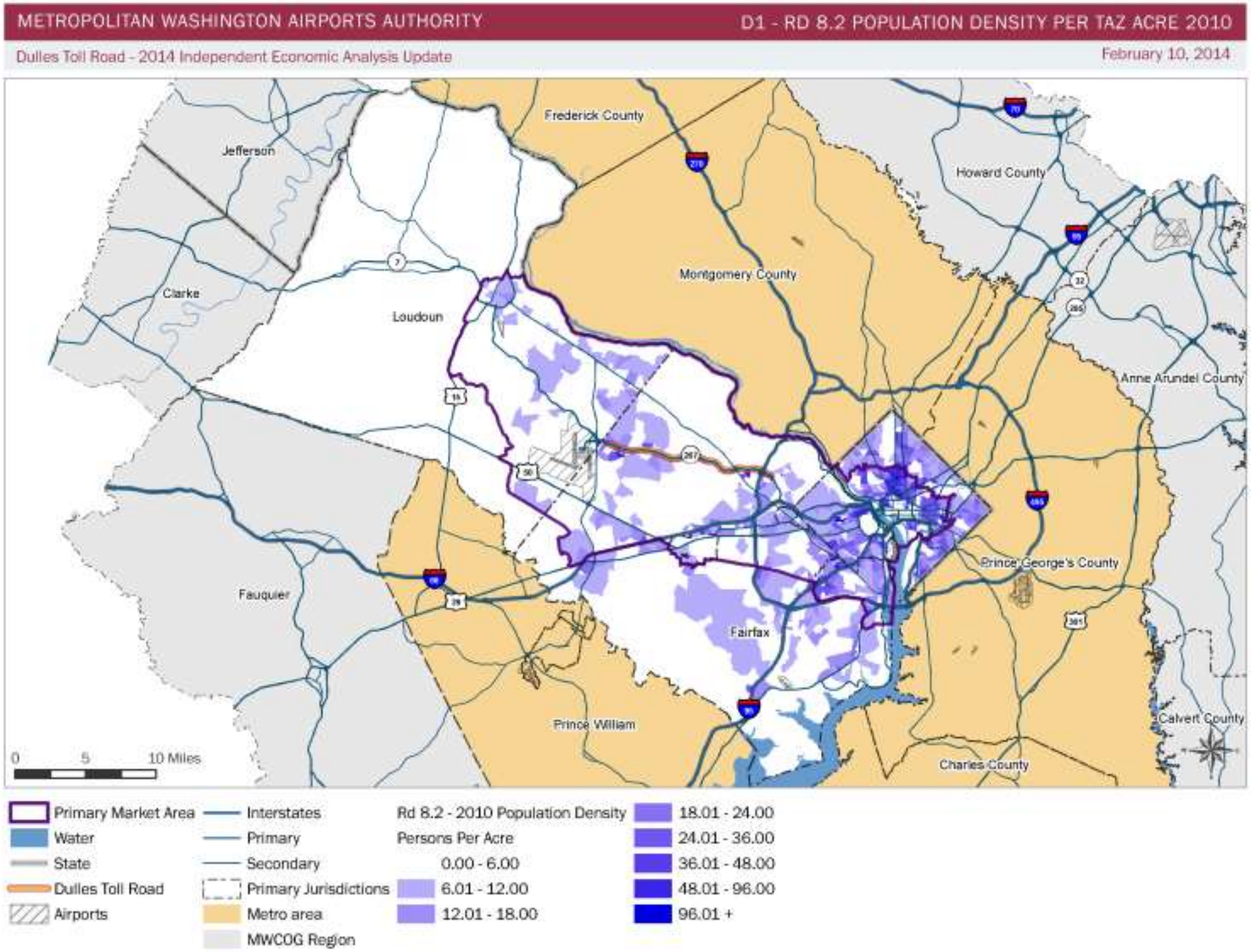


Figure 42 – Round 8.2 Population Density Per TAZ Acre 2020

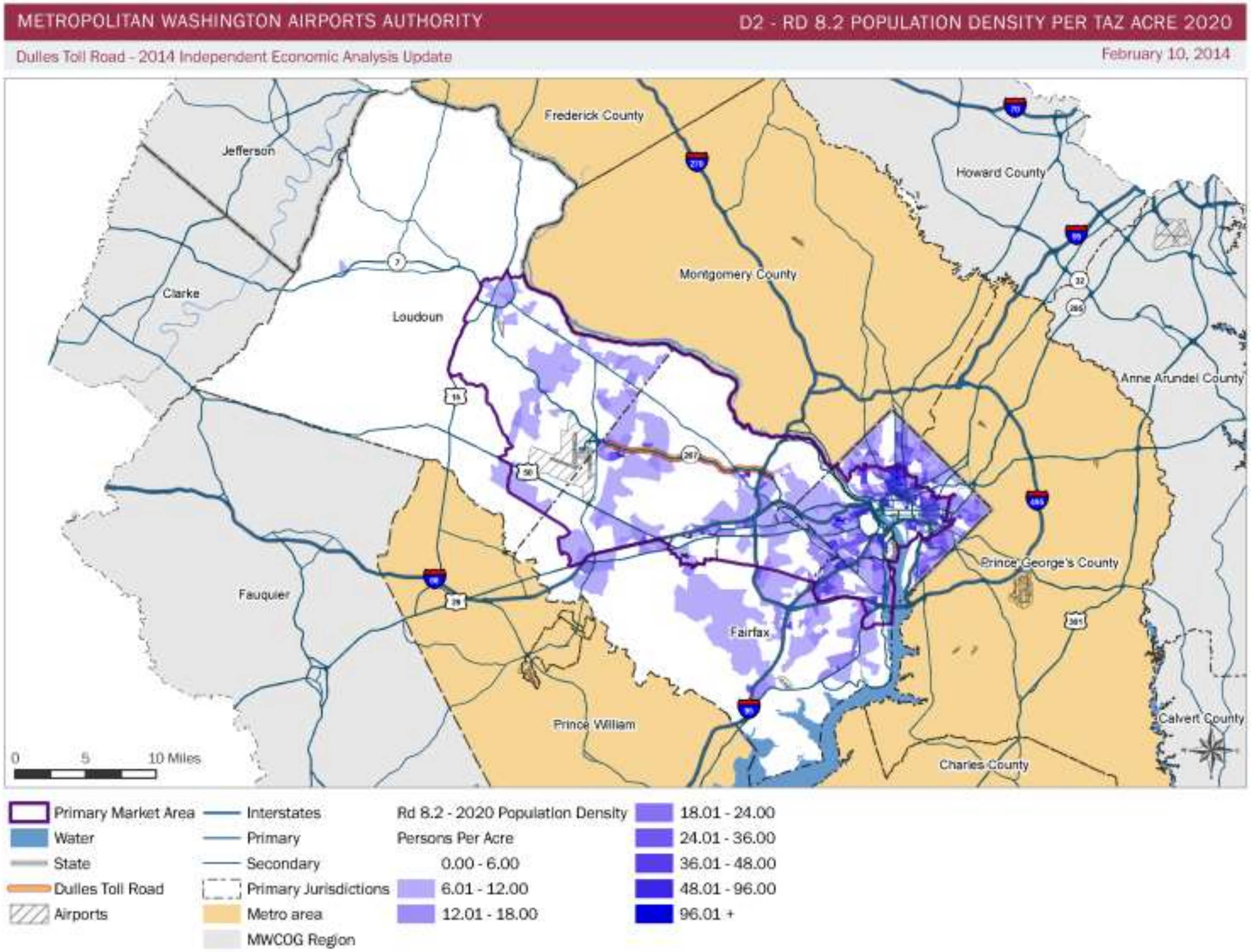


Figure 43 – Round 8.2 Population Density Per TAZ Acre 2035

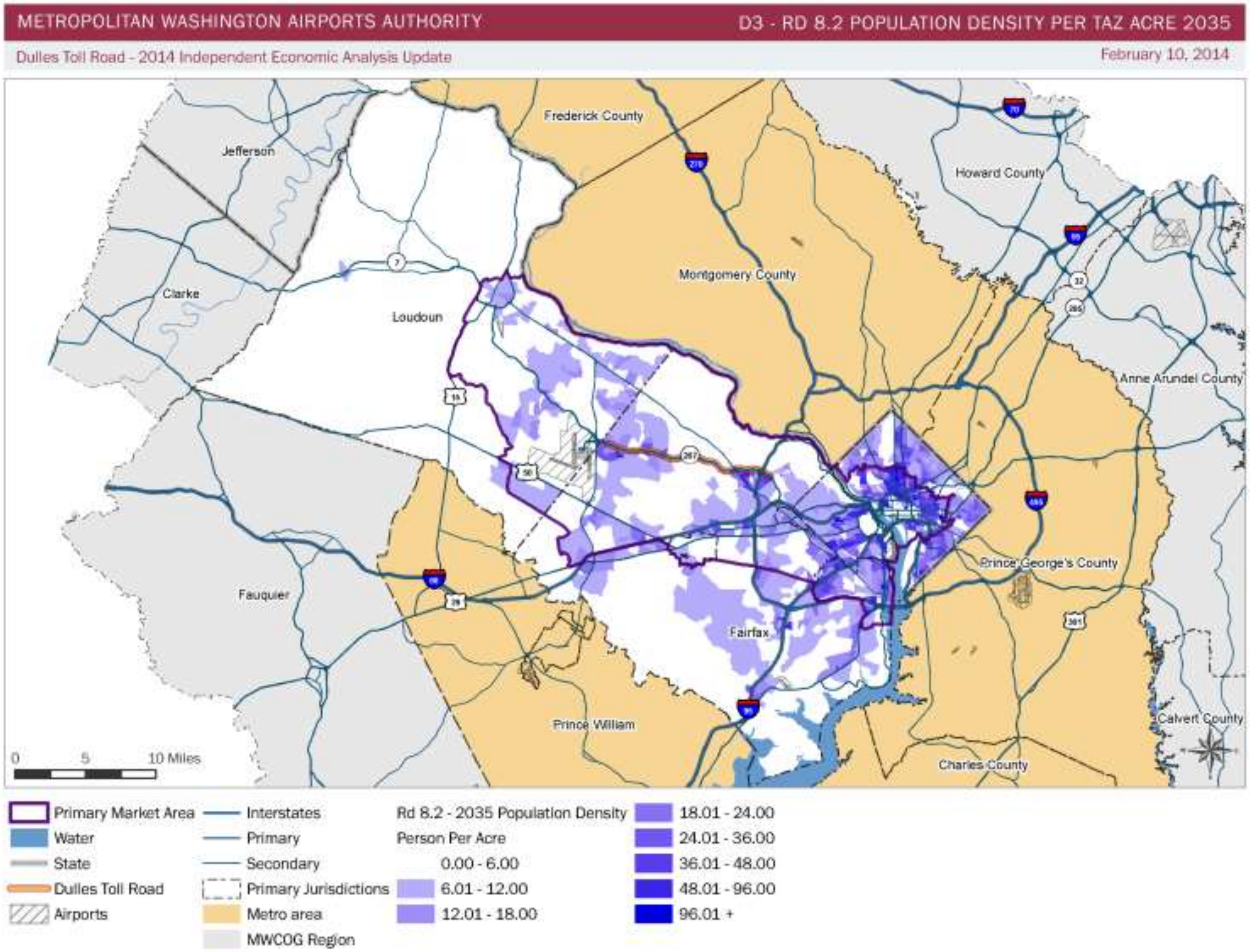


Figure 44 – Round 8.2 Population Density Per TAZ Acre 2040

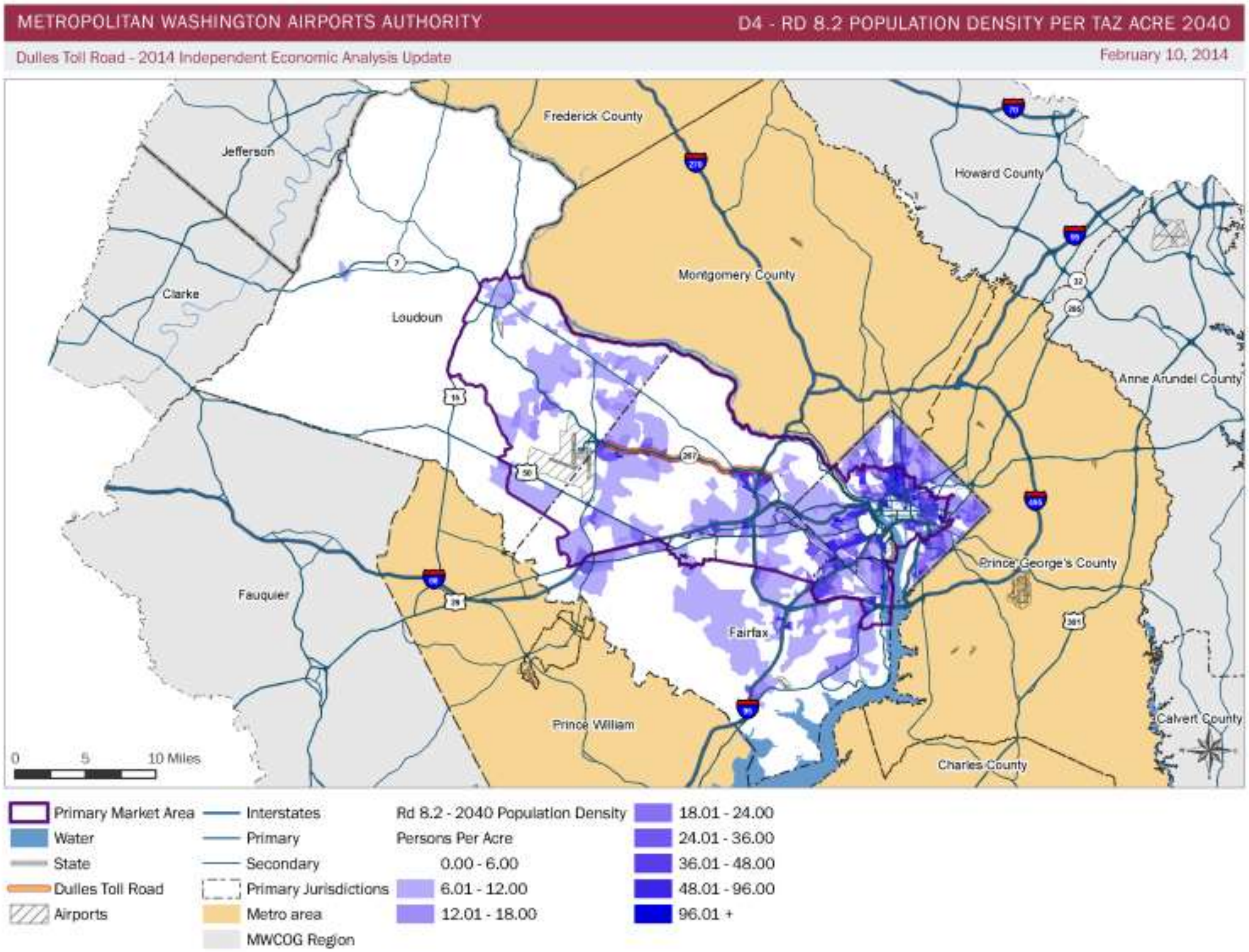


Figure 45 – Round 8.2 Employment Density Per TAZ Acre 2010

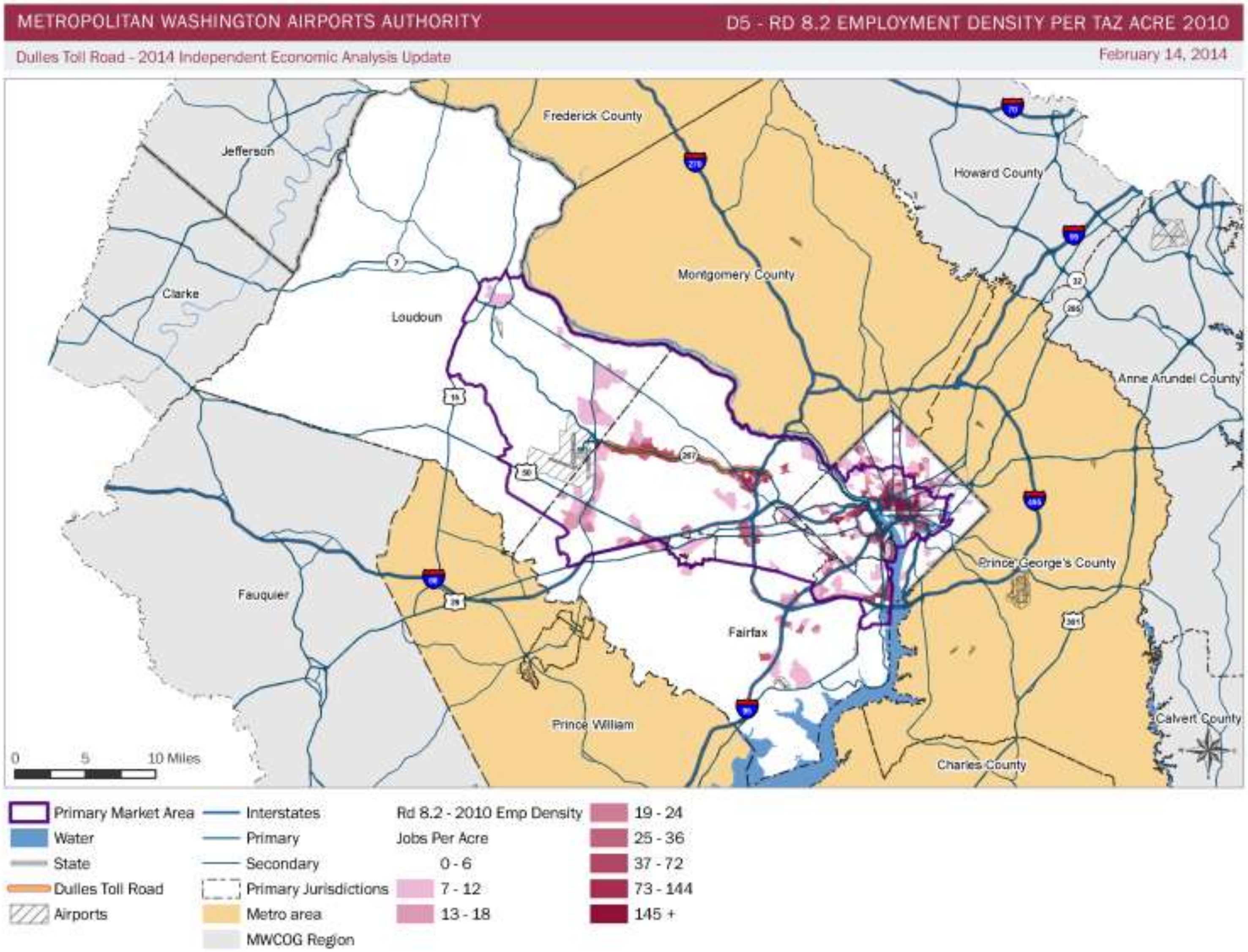


Figure 46 – Round 8.2 Employment Density Per TAZ Acre 2020

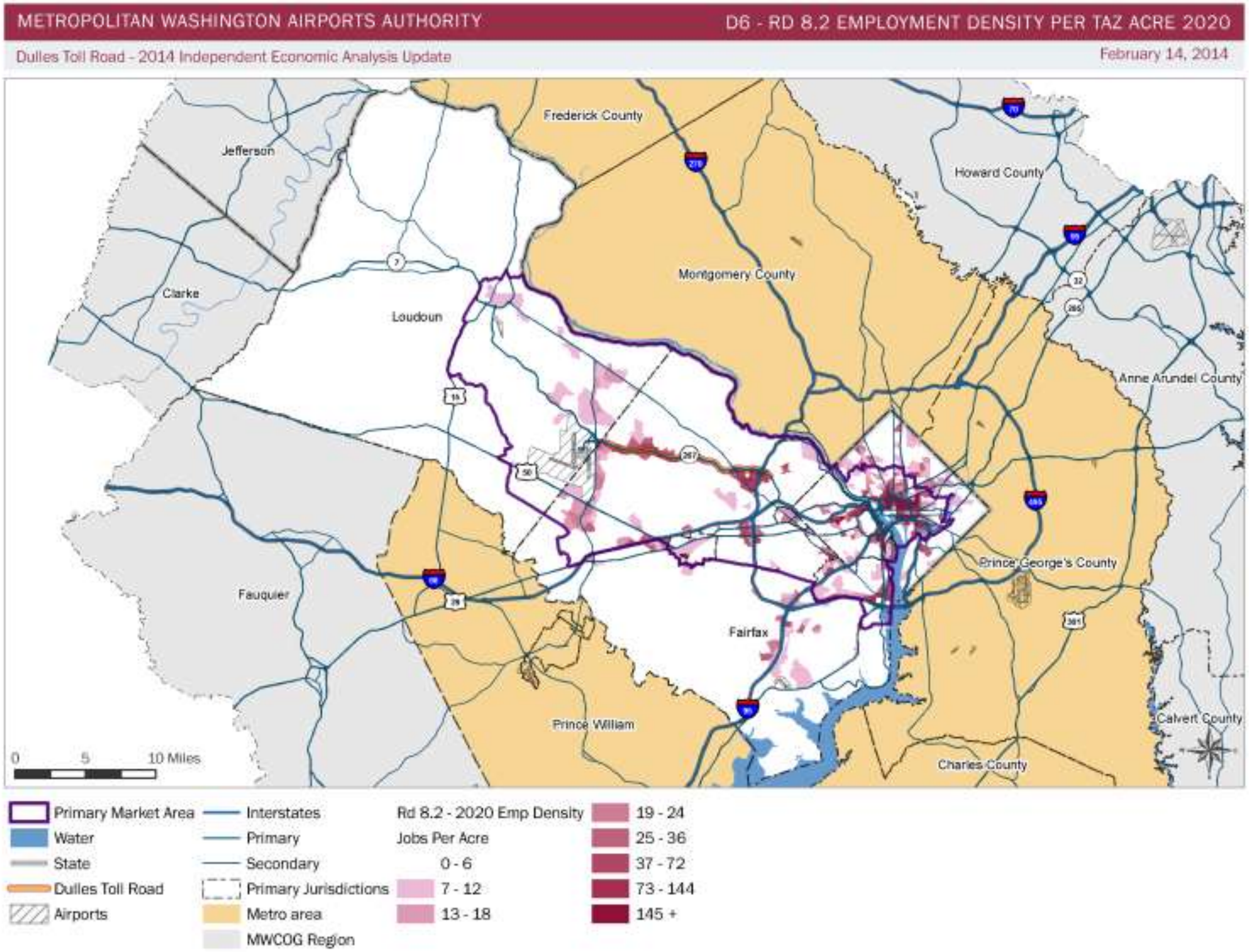


Figure 47 – Round 8.2 Employment Density Per TAZ Acre 2035

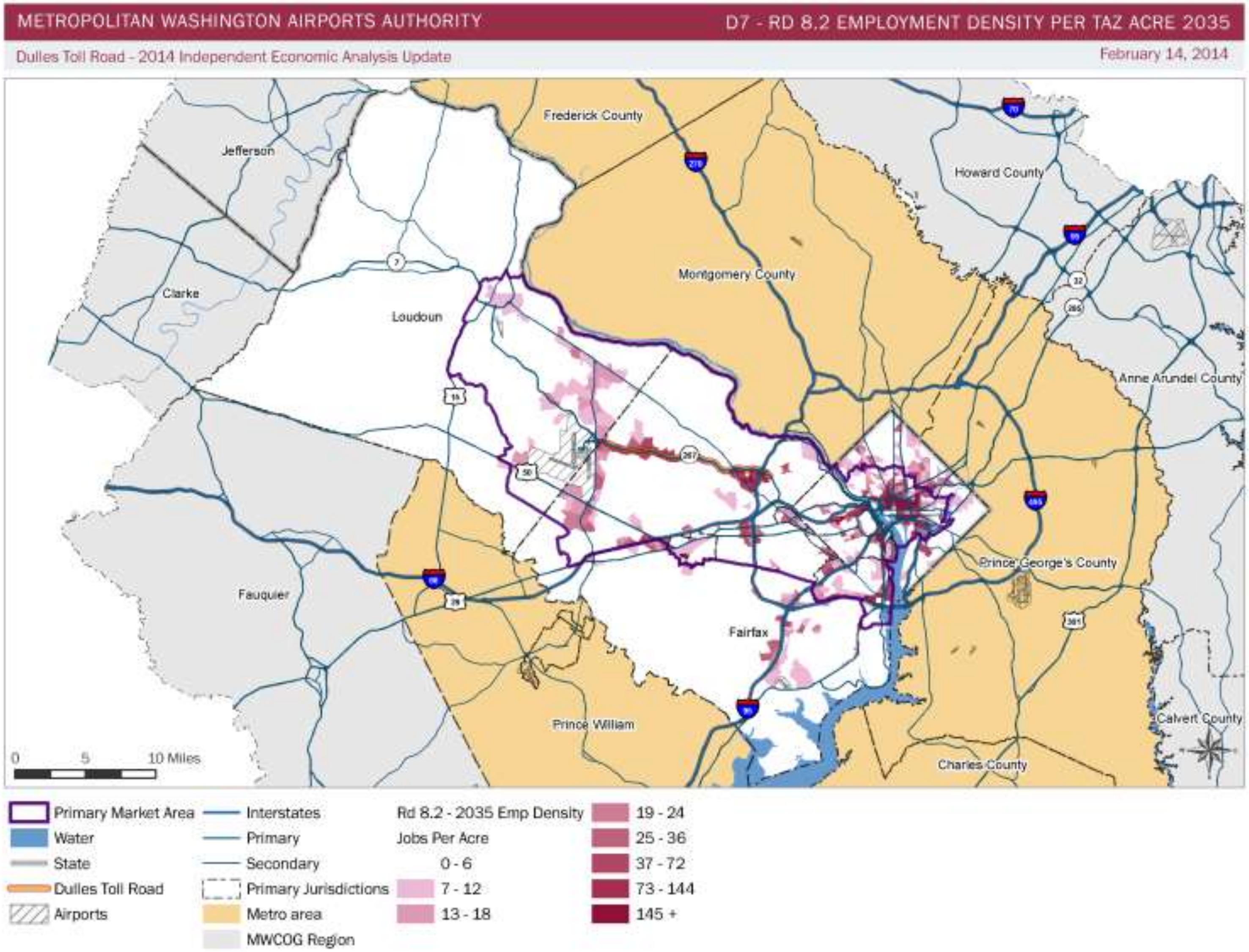


Figure 48 – Round 8.2 Employment Density Per TAZ Acre 2040

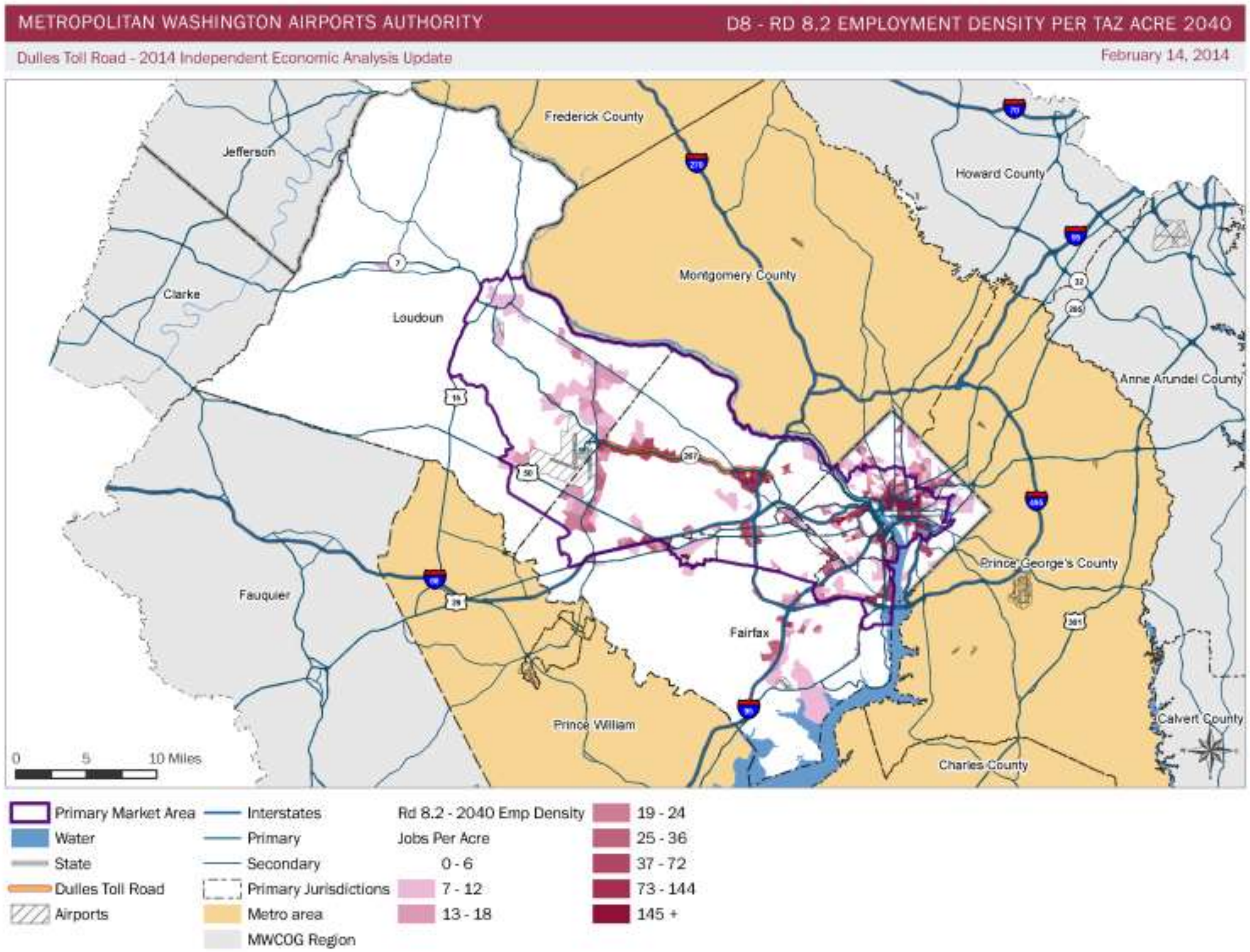


Figure 49 – RPG Population Density Per TAZ Acre 2010

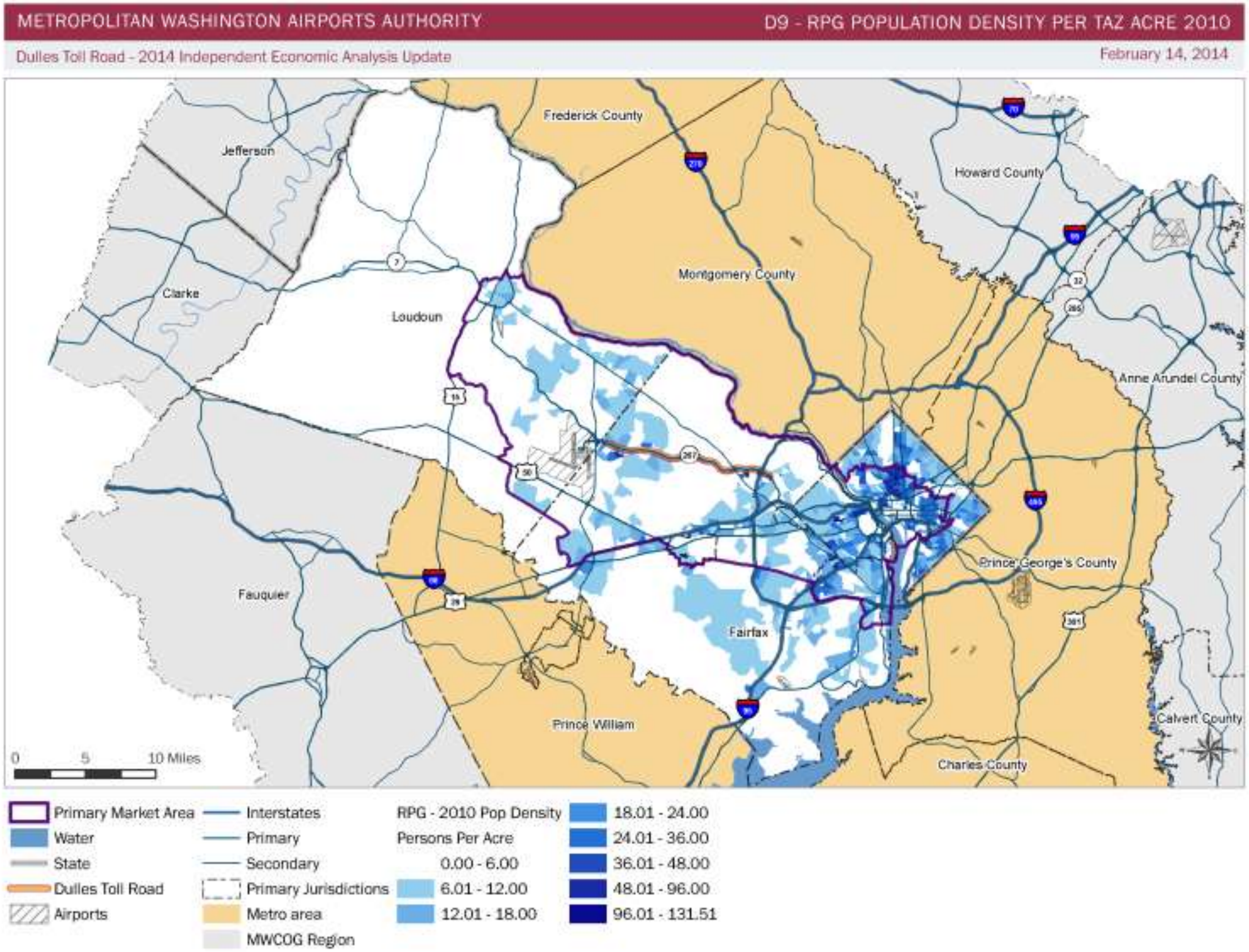


Figure 50 – RPG Population Density Per TAZ Acre 2020

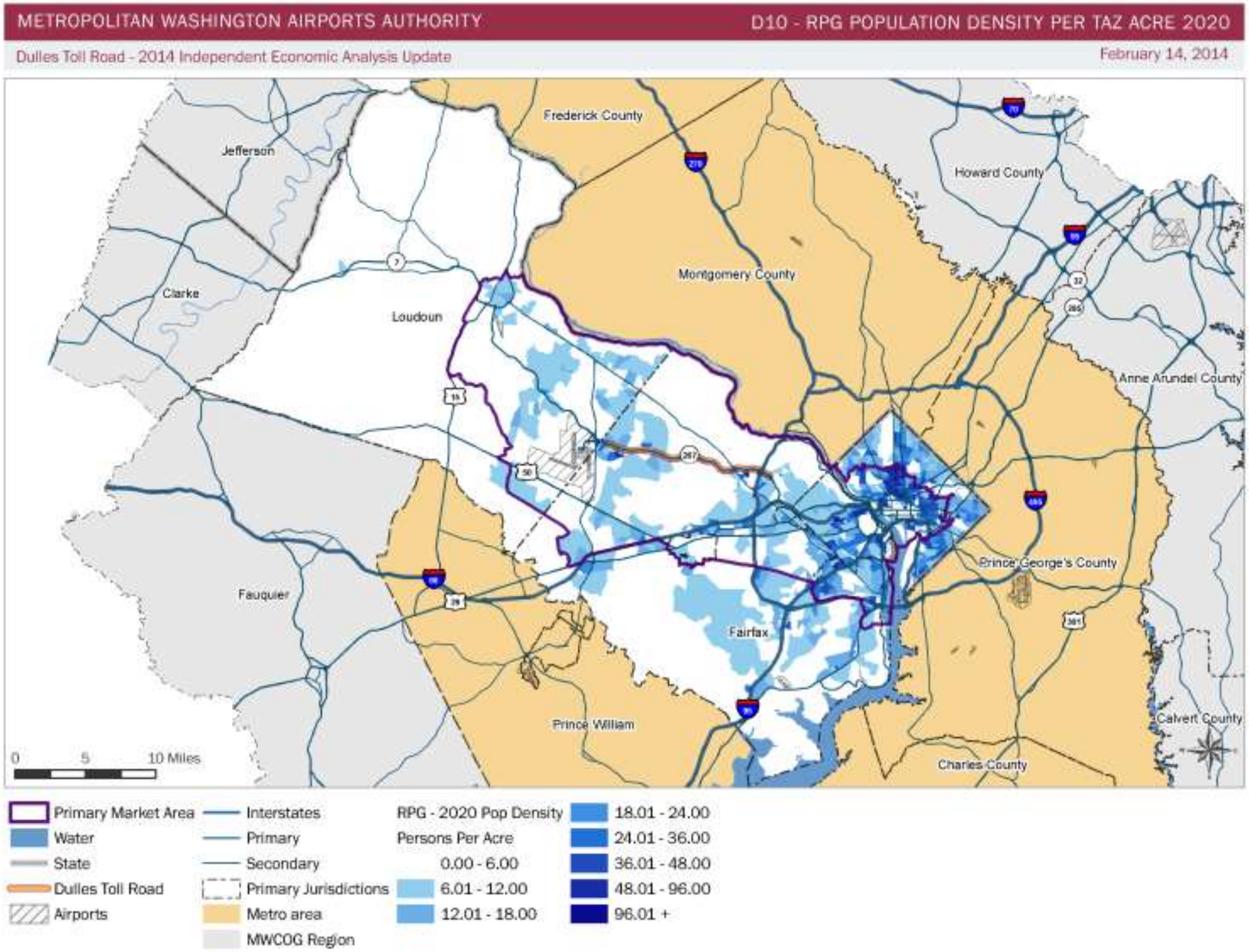


Figure 51 – RPG Population Density Per TAZ Acre 2035

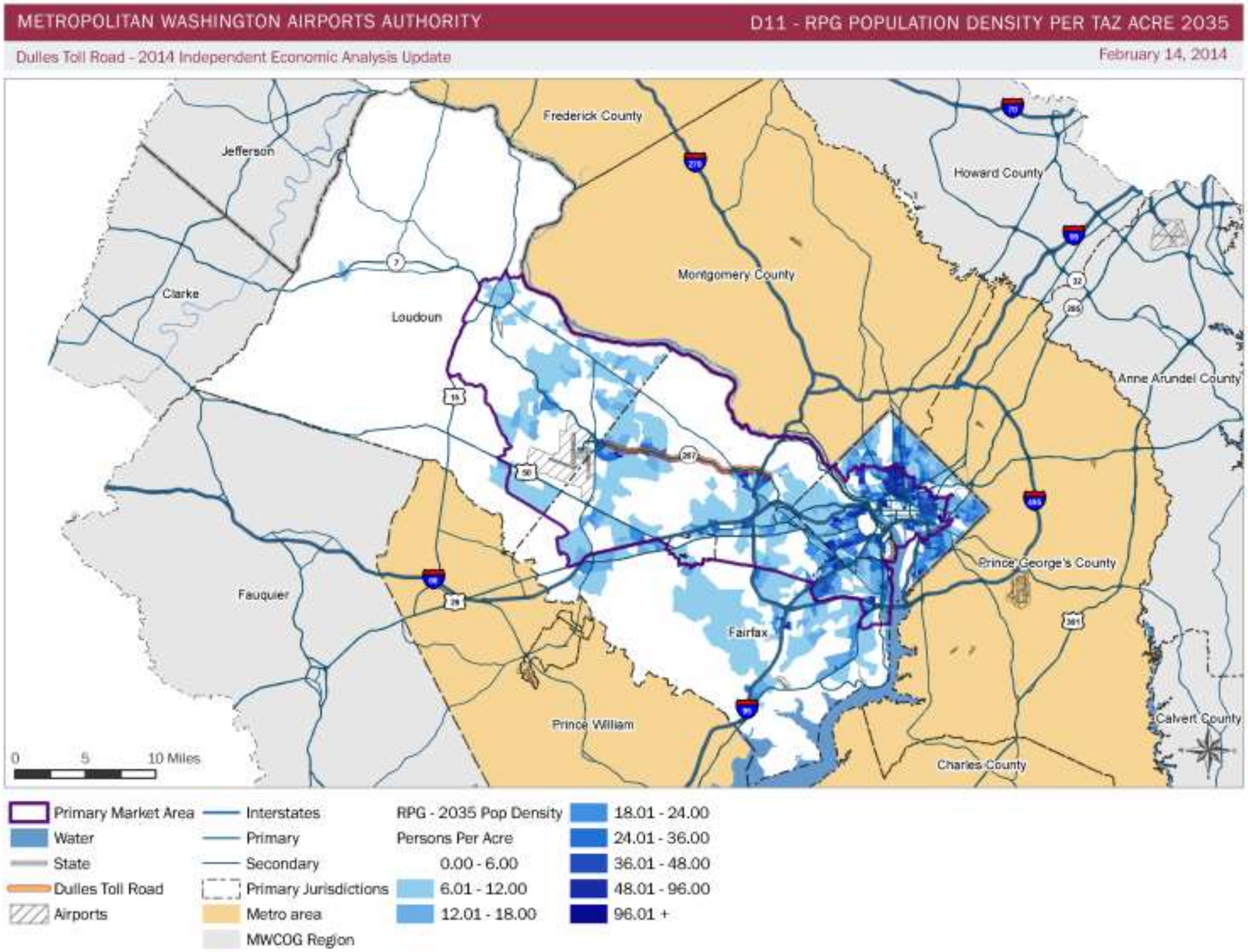


Figure 52 – RPG Population Density Per TAZ Acre 2040

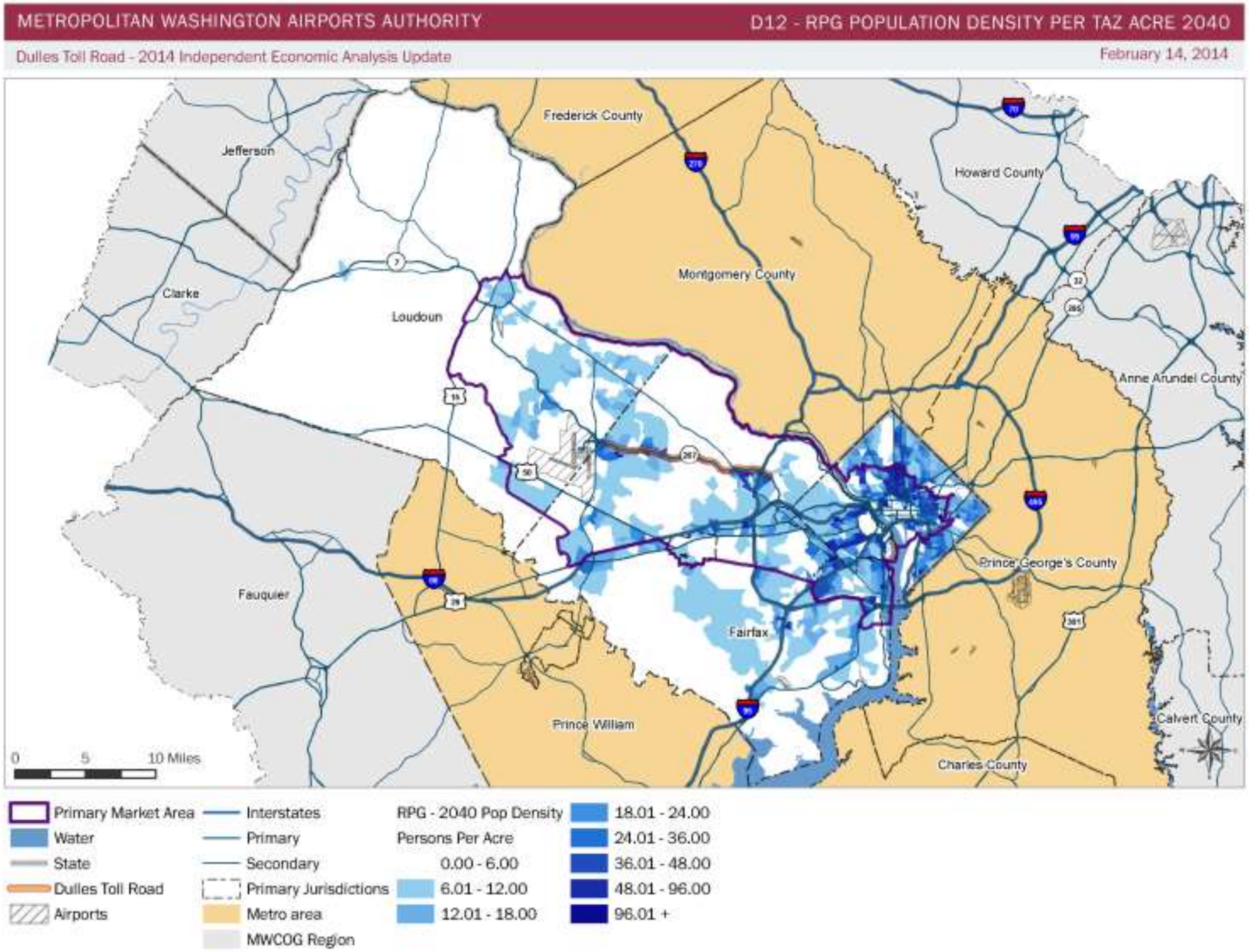


Figure 53 – RPG Population Density Per TAZ Acre 2050

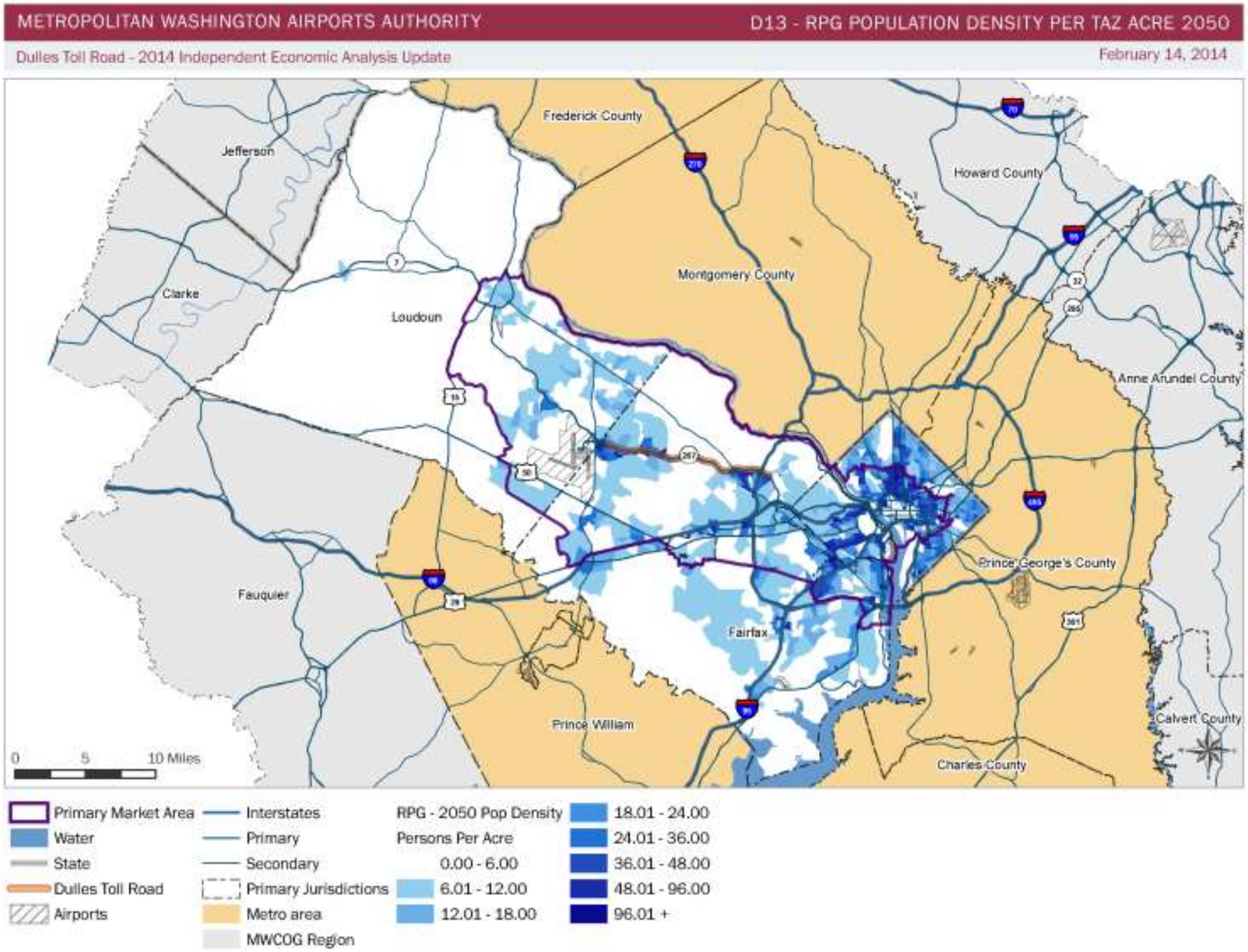


Figure 54 – RPG Employment Density Per TAZ Acre 2010

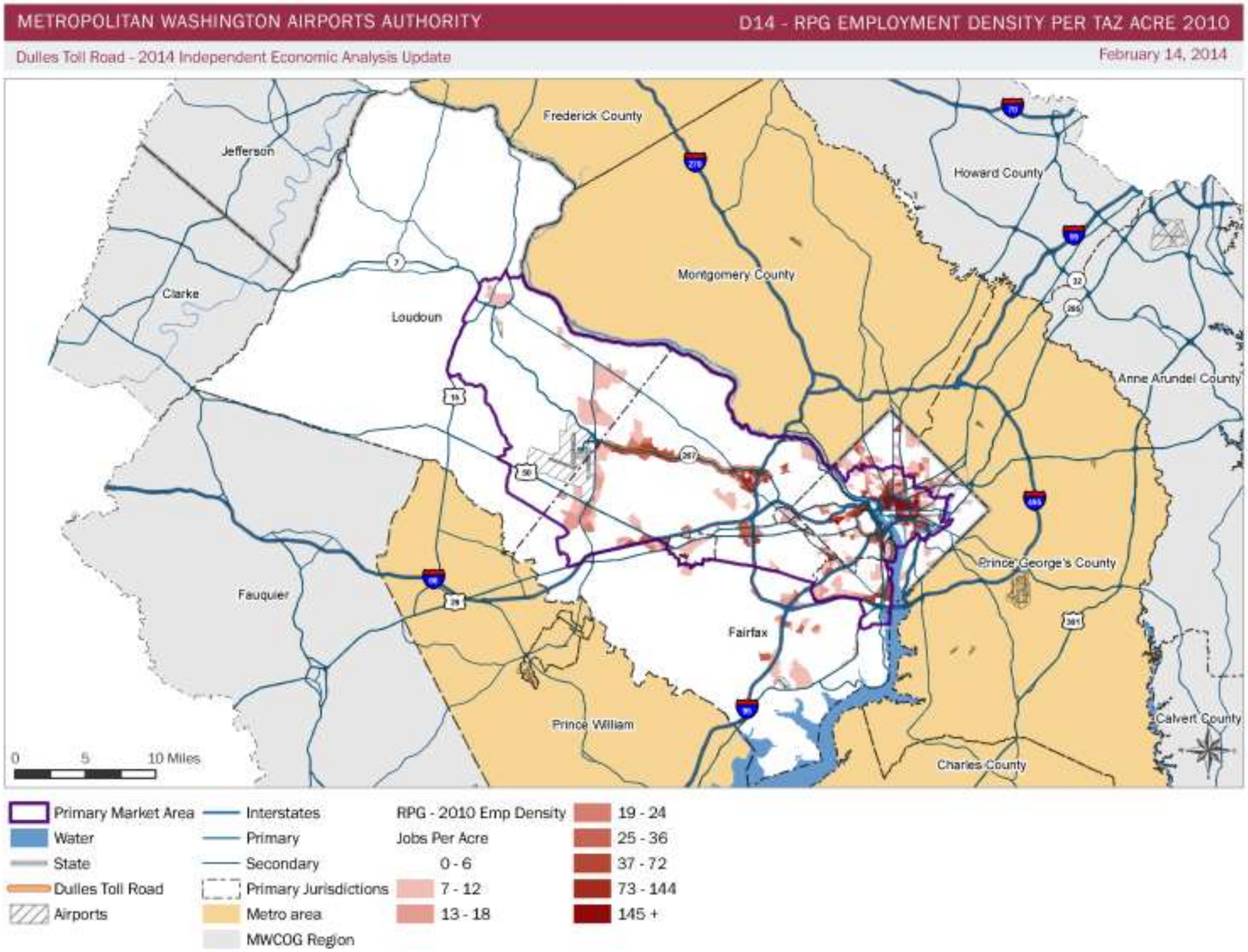


Figure 55 – RPG Employment Density Per TAZ Acre 2020

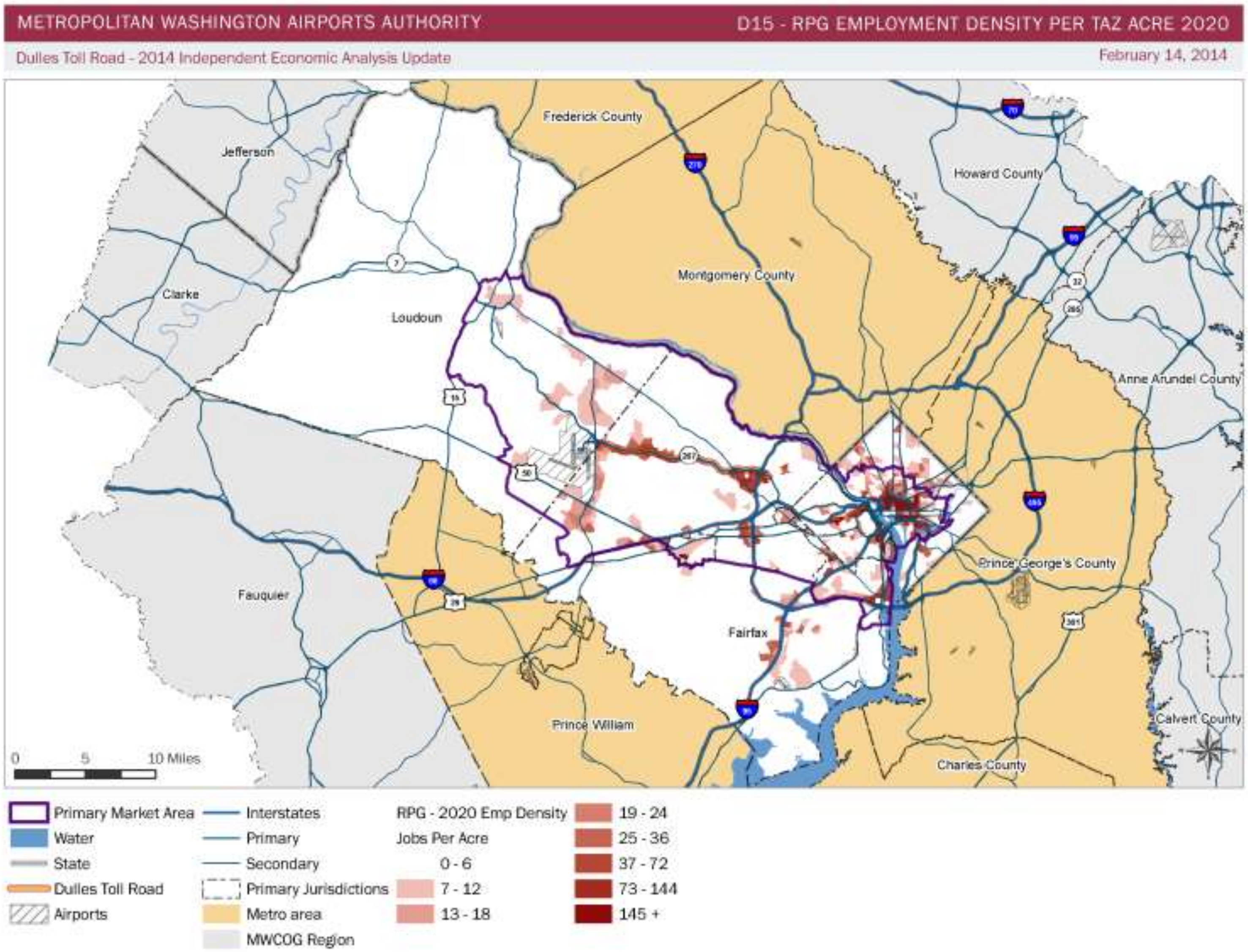


Figure 56 – RPG Employment Density Per TAZ Acre 2035

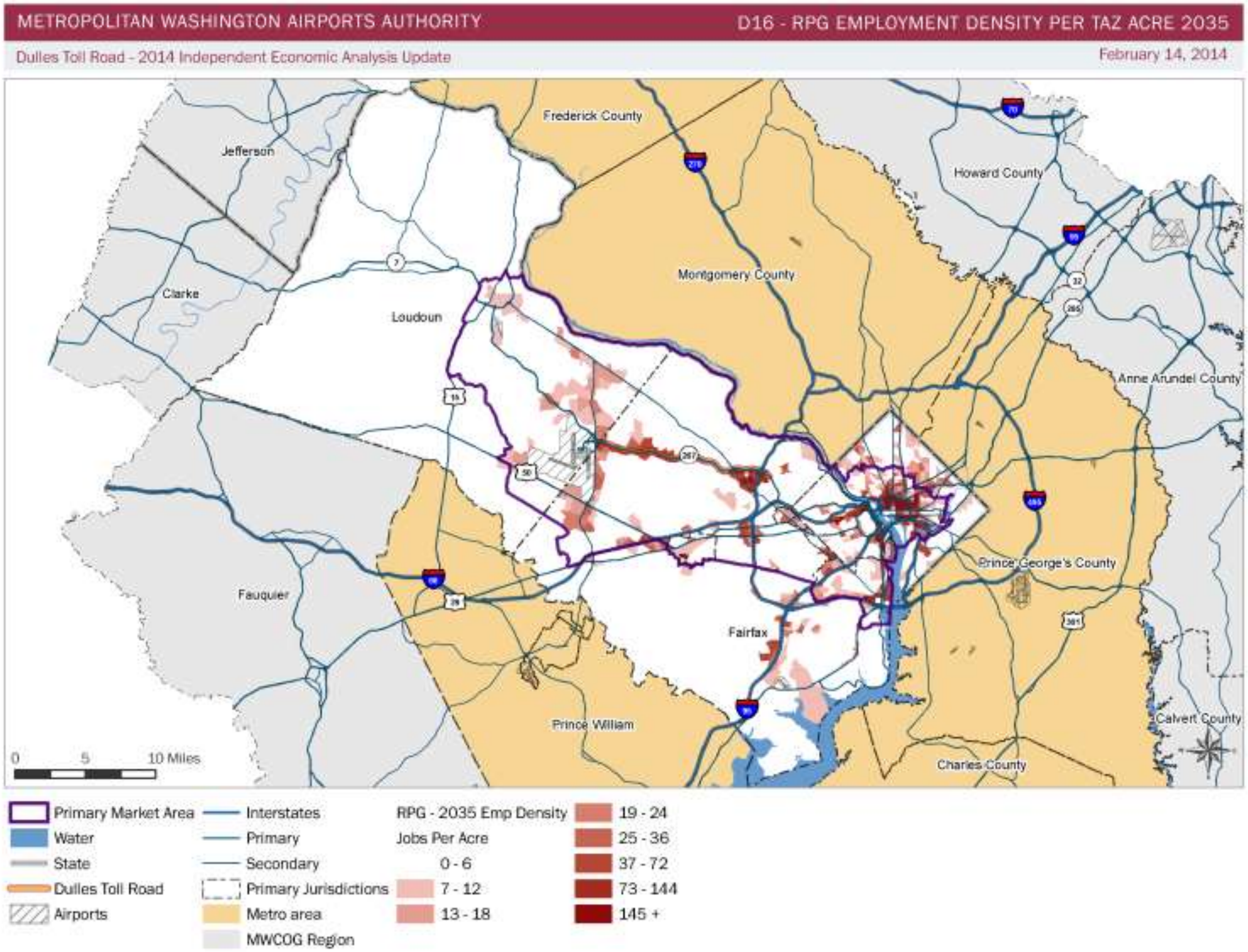


Figure 57 – RPG Employment Density Per TAZ Acre 2040

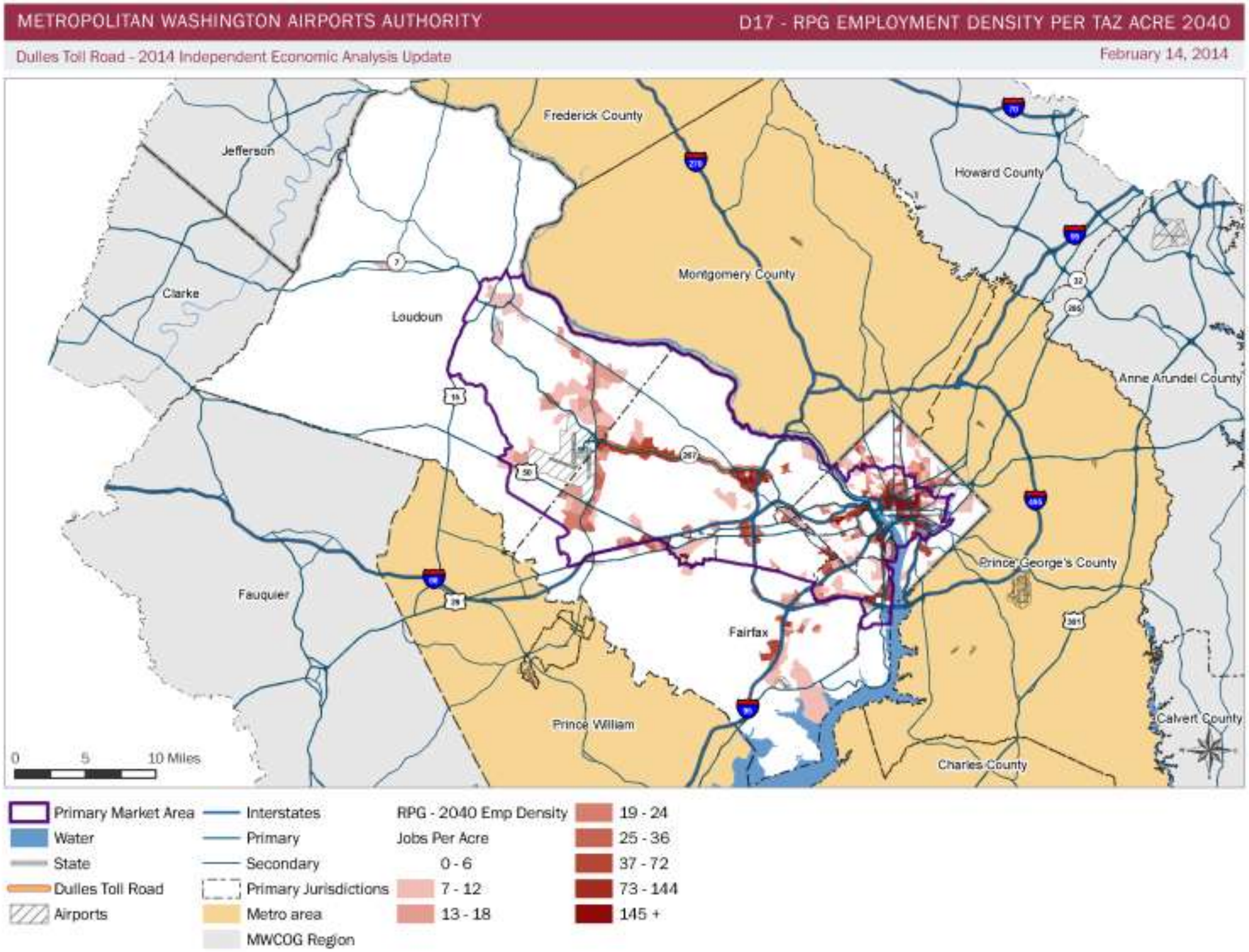


Figure 58 – RPG Employment Density Per TAZ Acre 2050

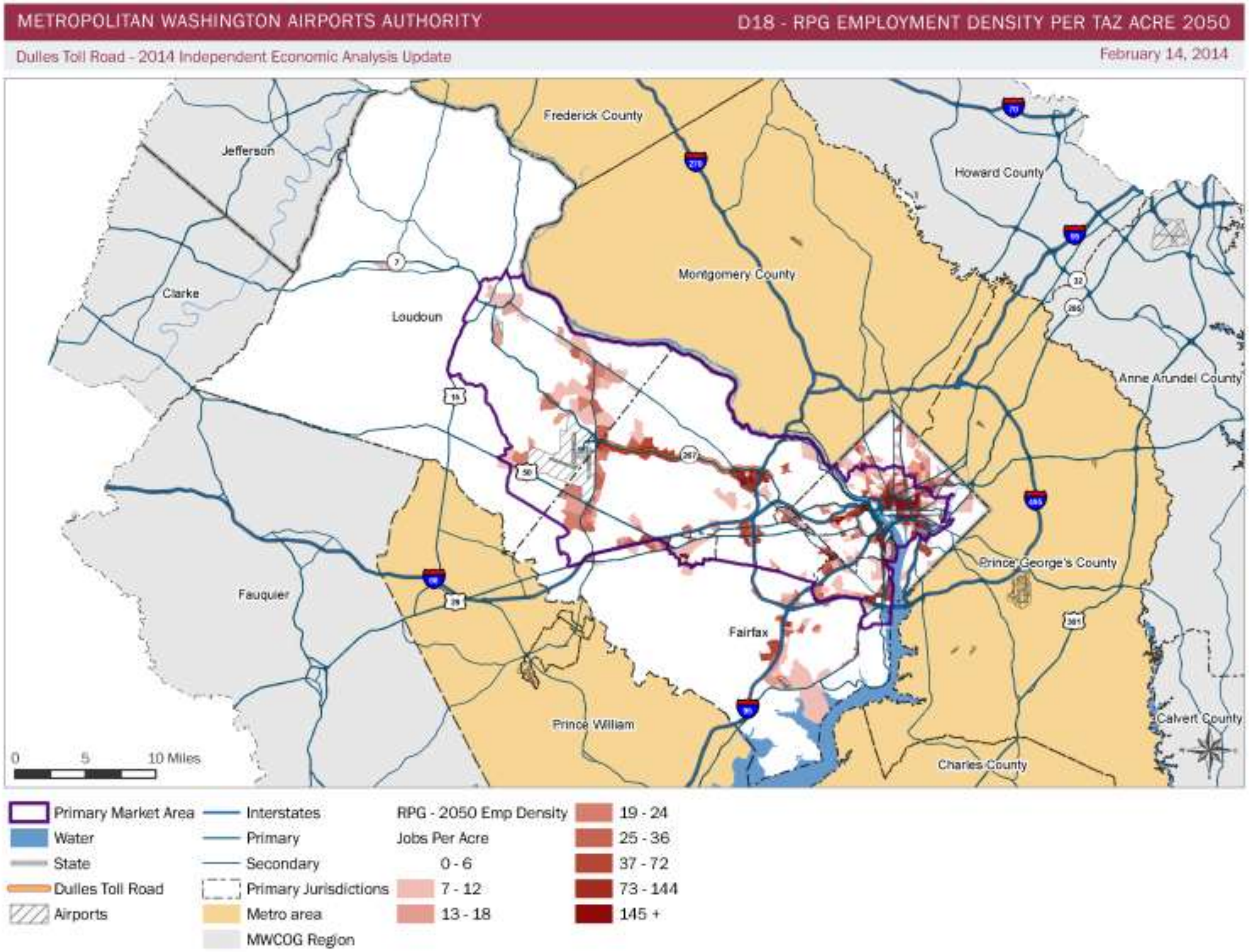


Figure 59 – Round 8.2 Population Increment 2010-2040

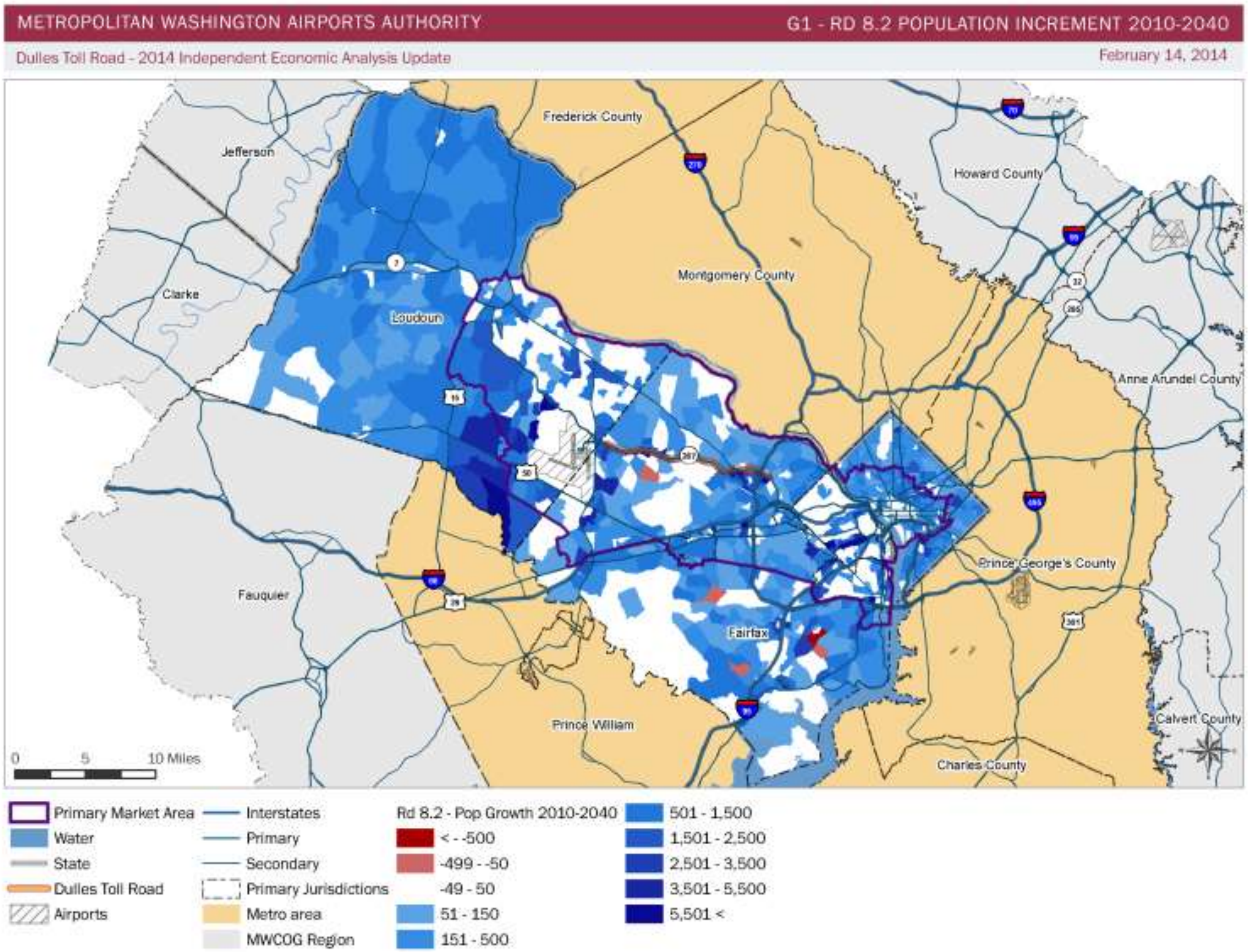


Figure 60 – RPG Population Increment 2010-2040

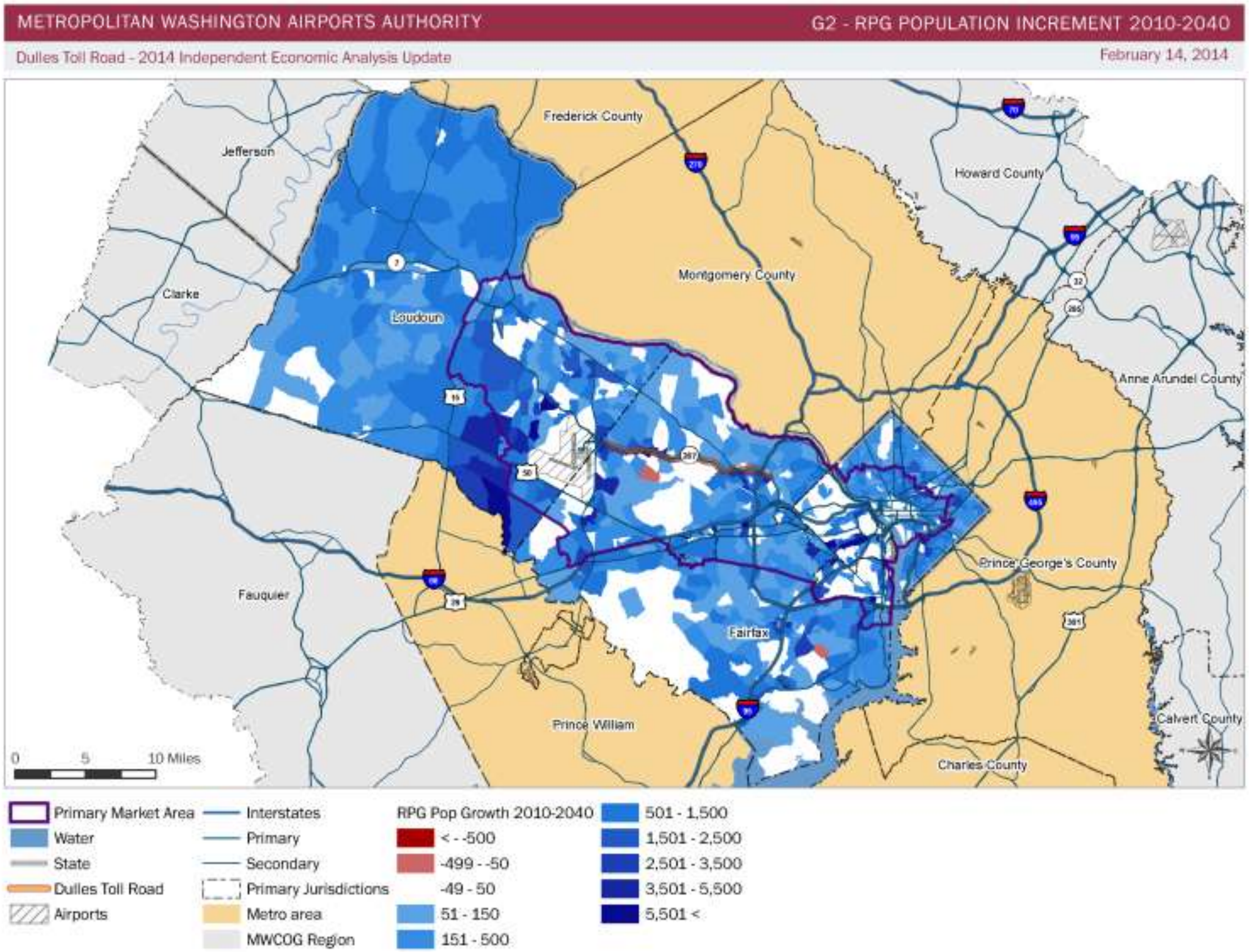


Figure 61 – Difference RPG – Round 8.2 Population 2010-2040

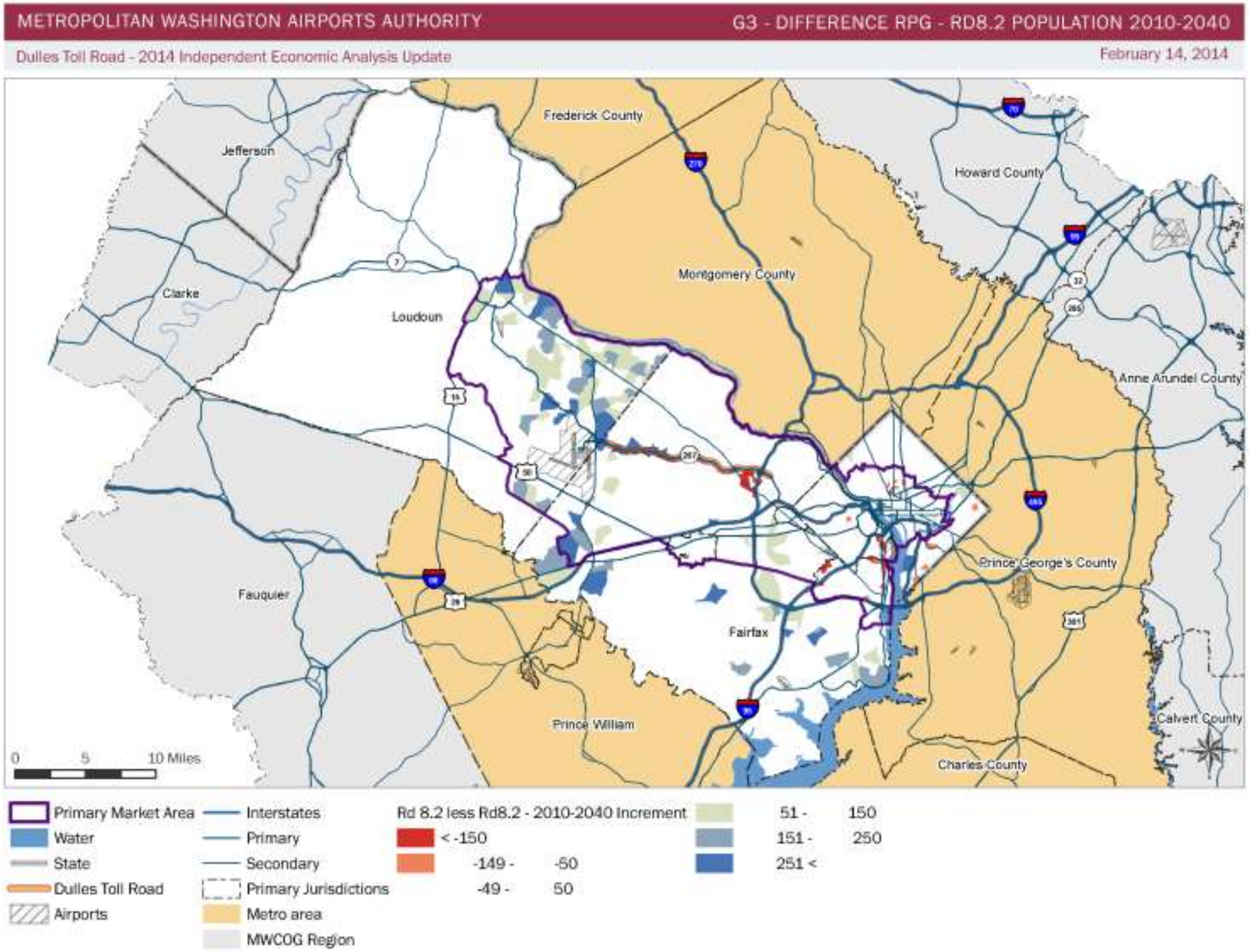


Figure 62 – Round 8.2 Employment Increment 2010-2040

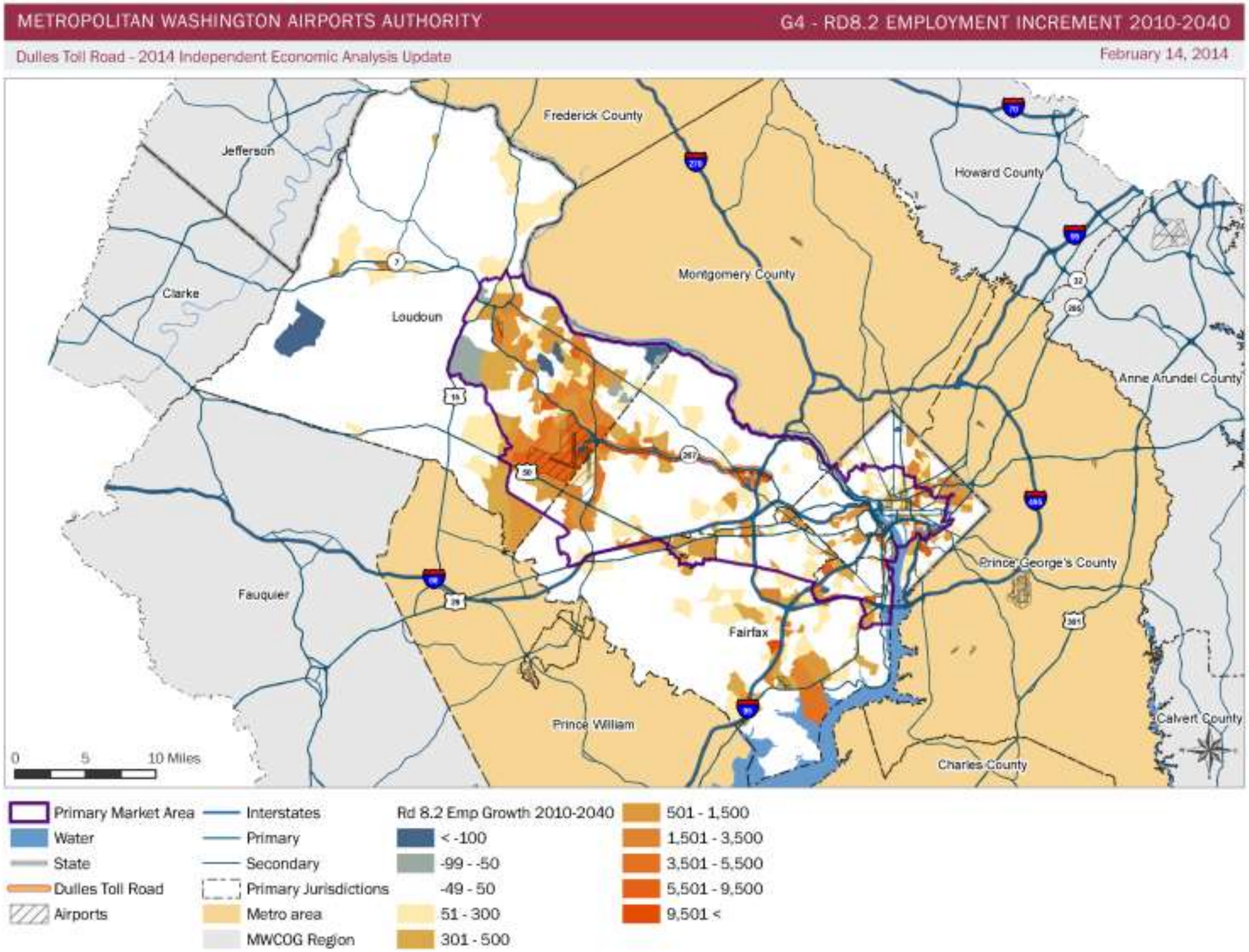


Figure 63 – RPG Employment Increment 2010-2040

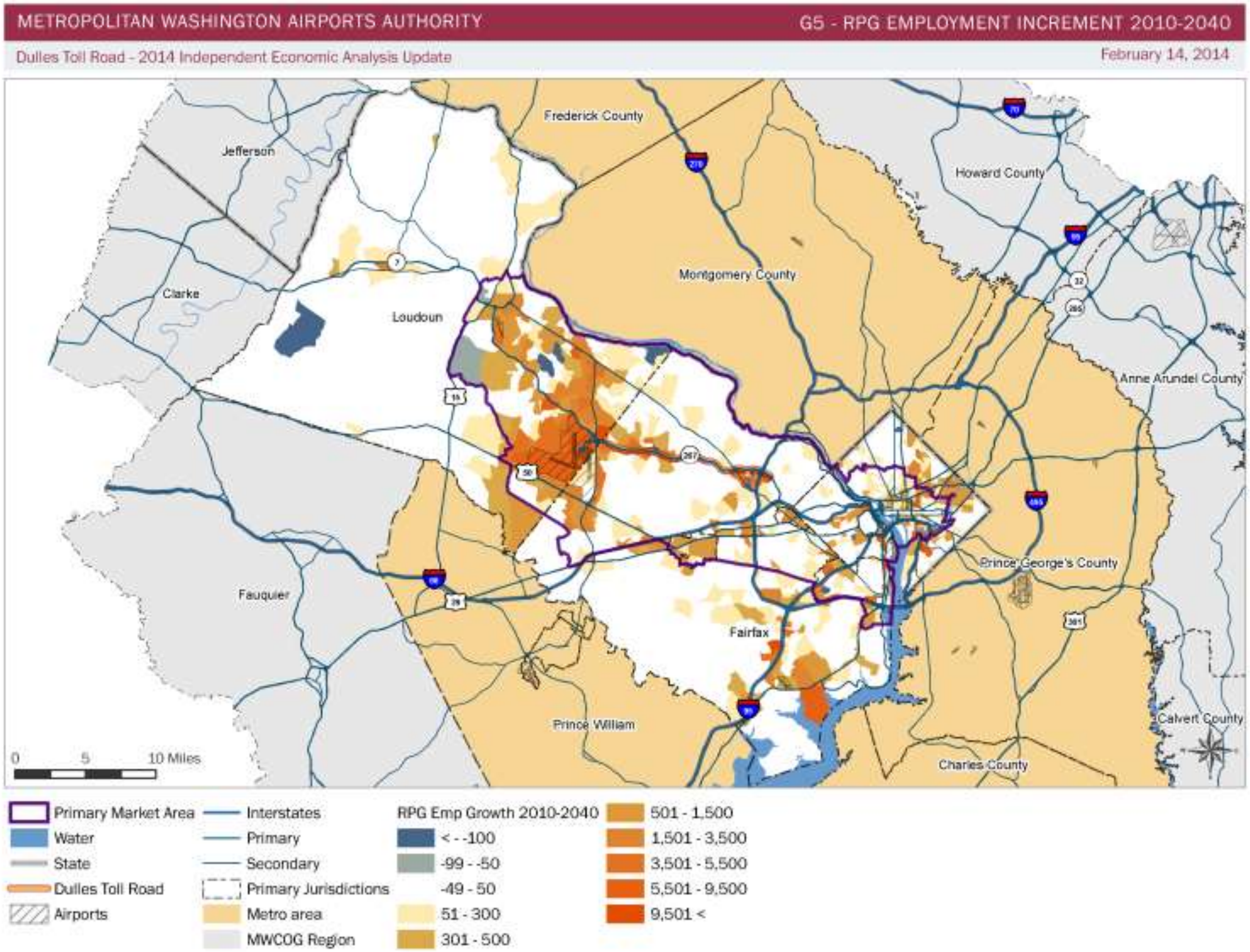


Figure 64 – Difference RPG – Round 8.2 Employment 2010-2040

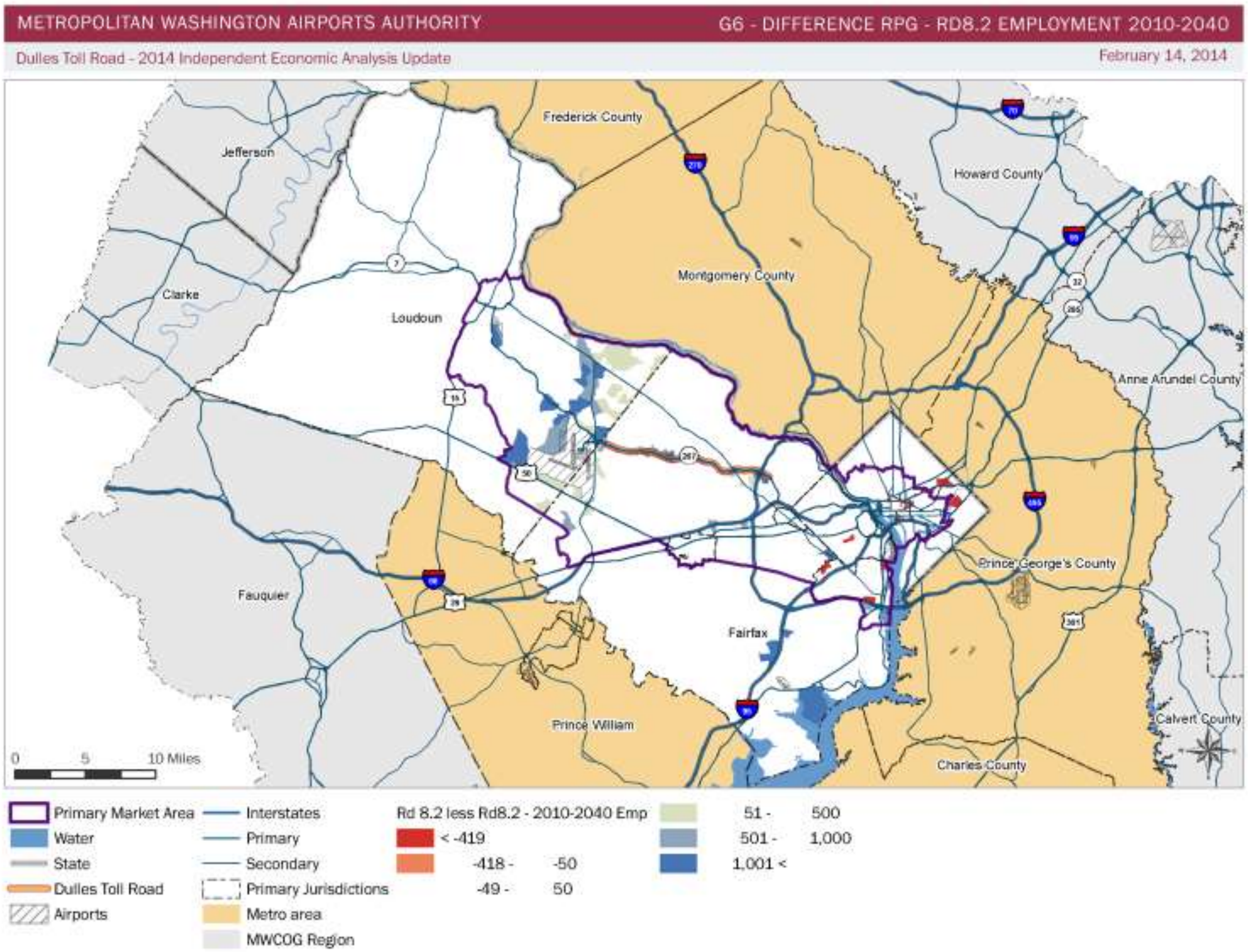


Figure 65 – RPG Population Increment 2010-2020

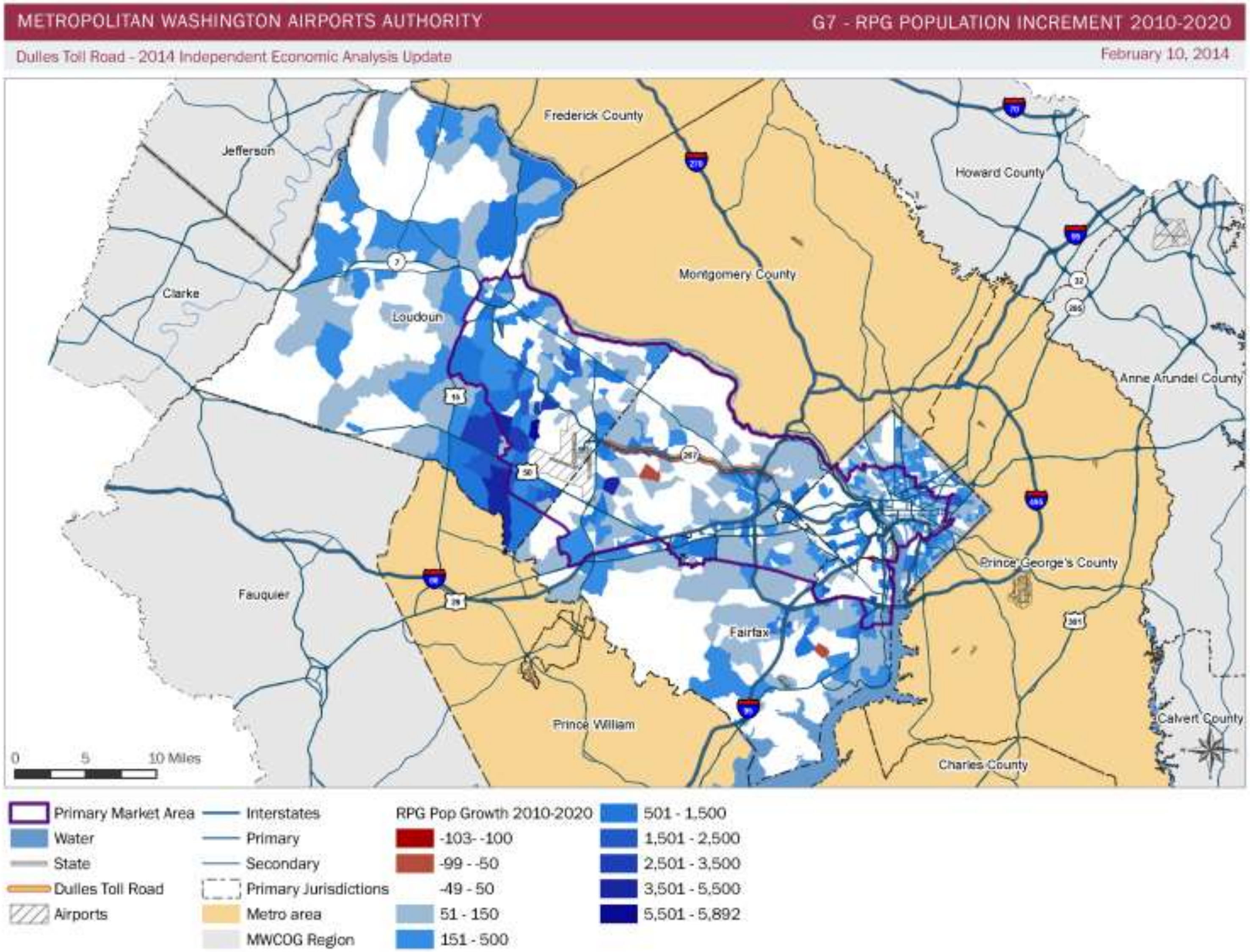


Figure 66 – RPG Population Increment 2020-2035

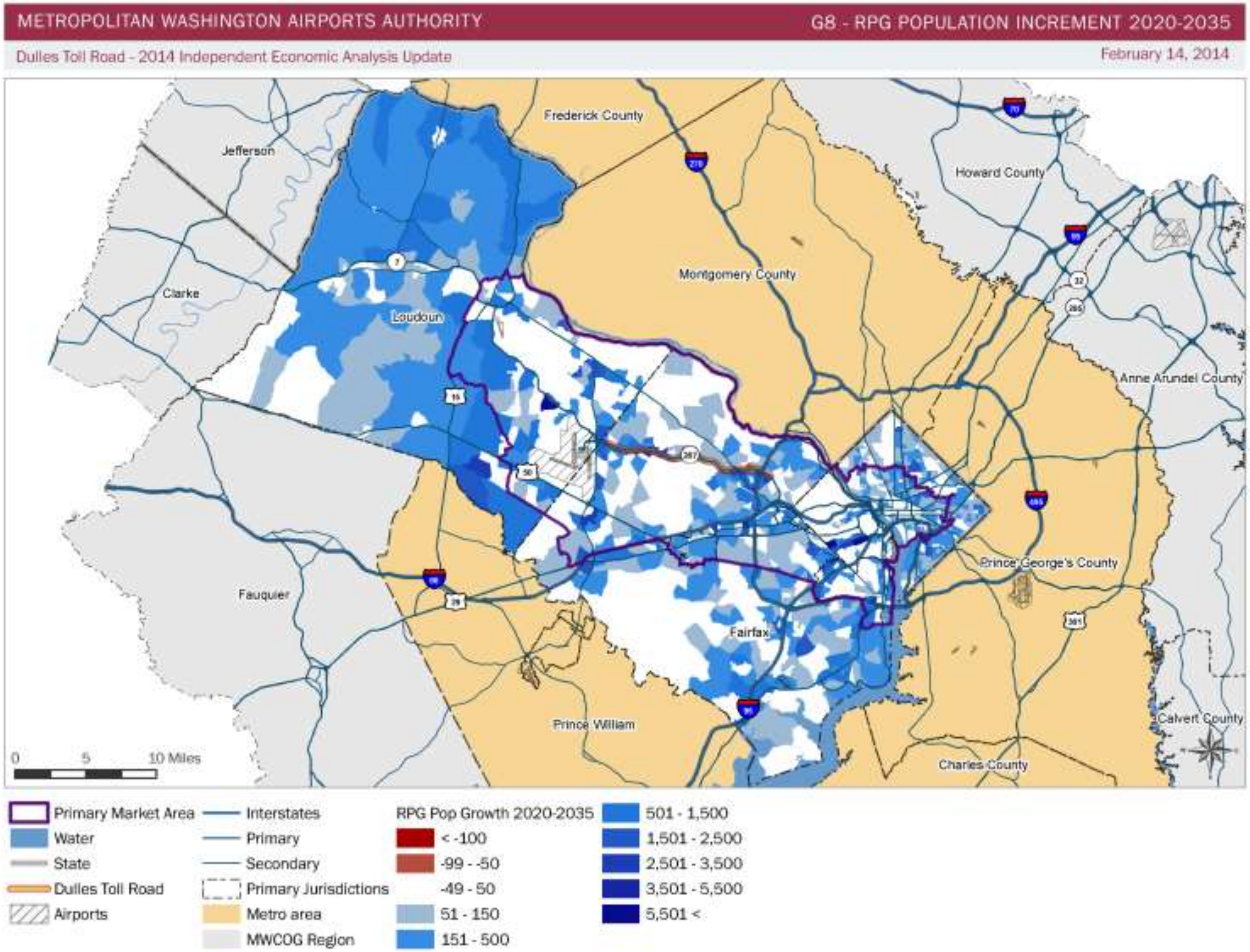


Figure 67 – RPG Population Increment 2035-2050

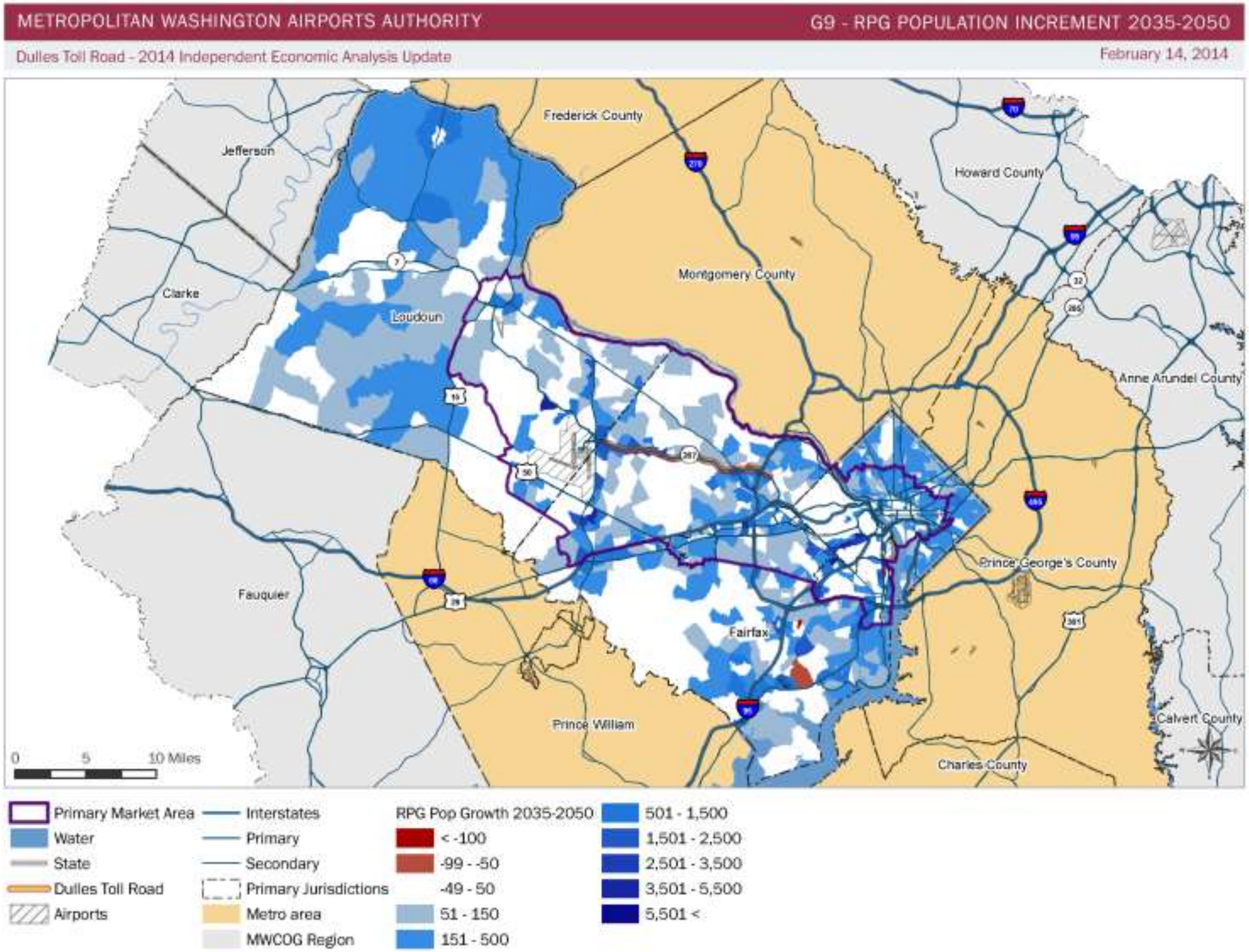


Figure 68 – RPG Employment Increment 2010-2020

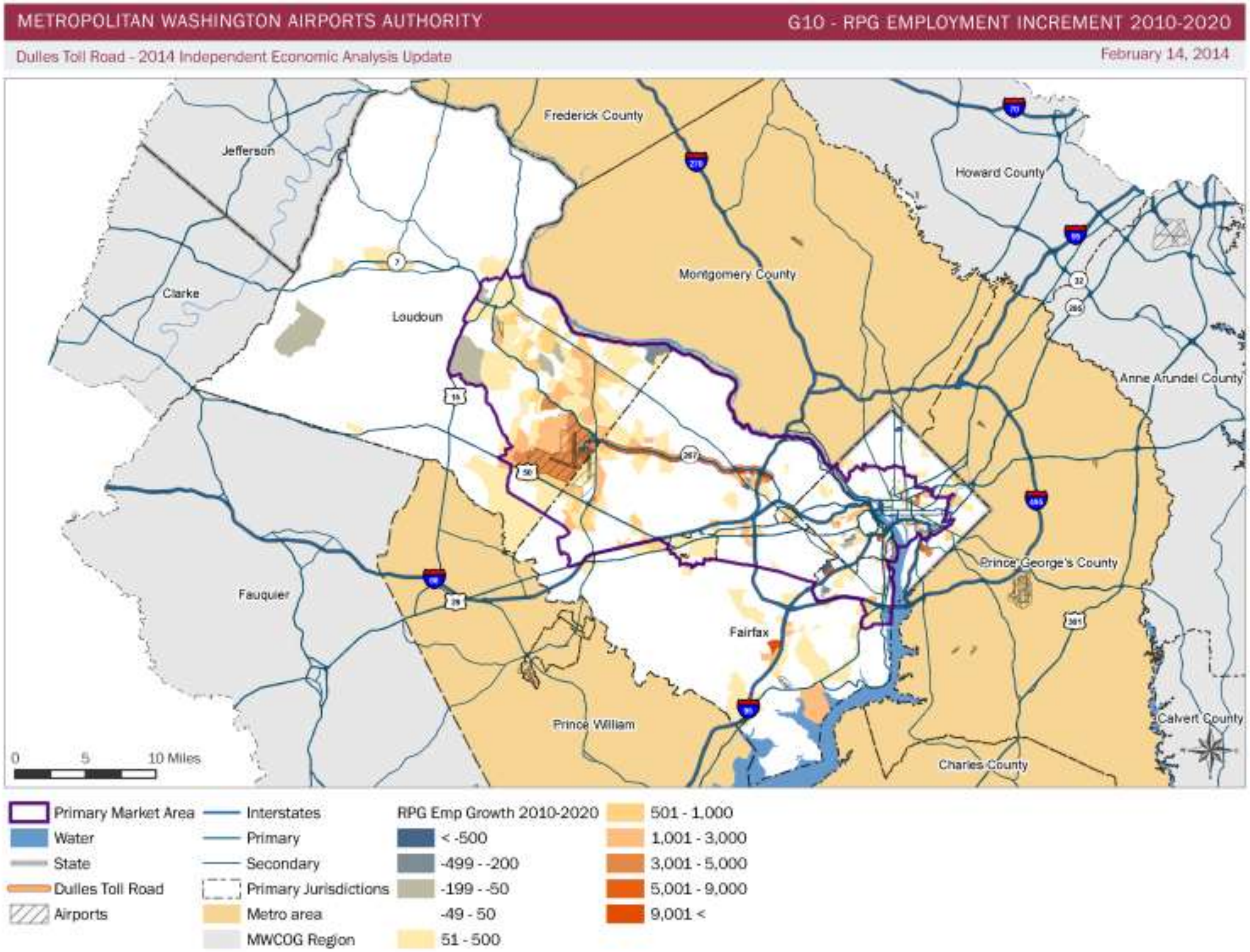


Figure 69 – RPG Employment Increment 2020-2035

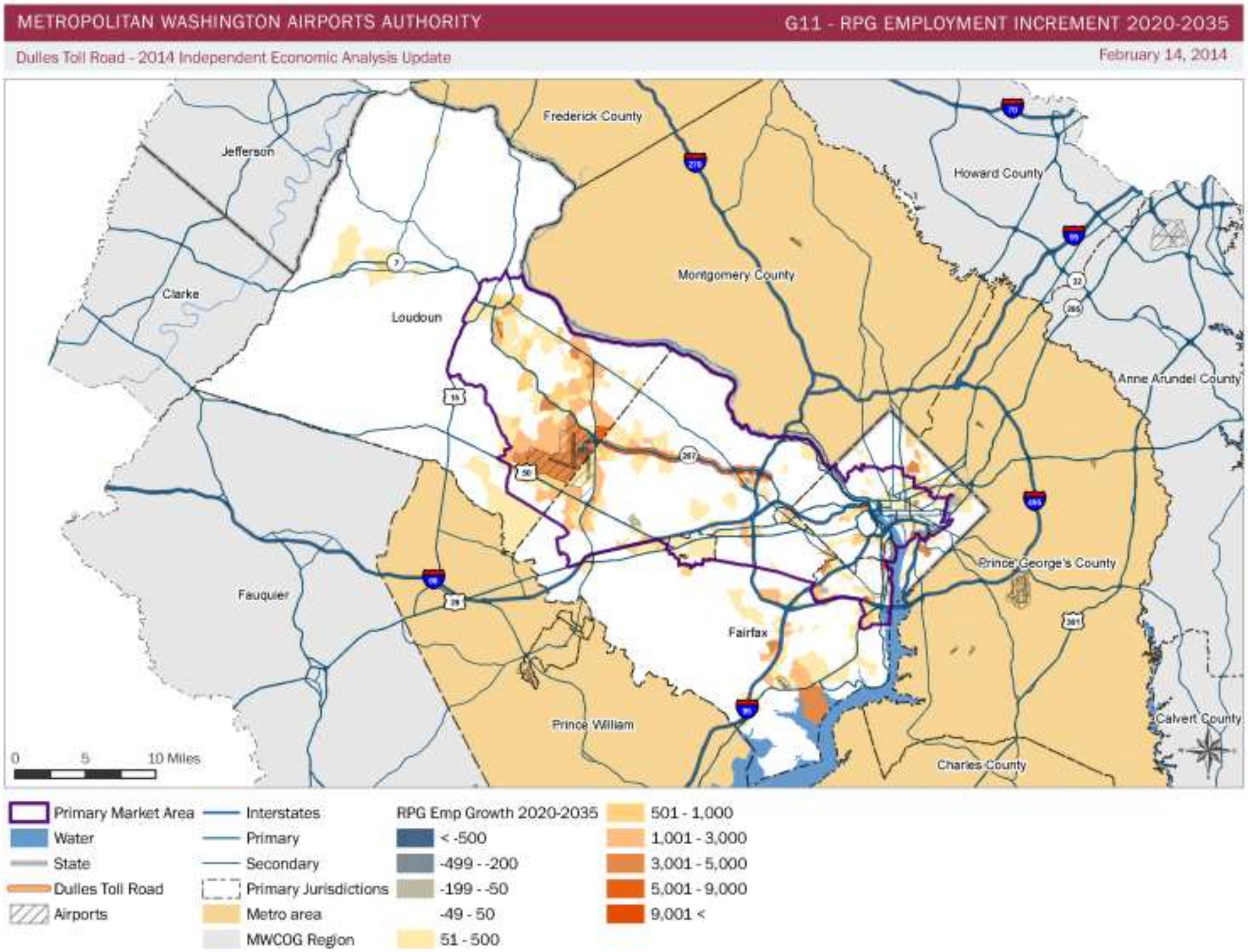
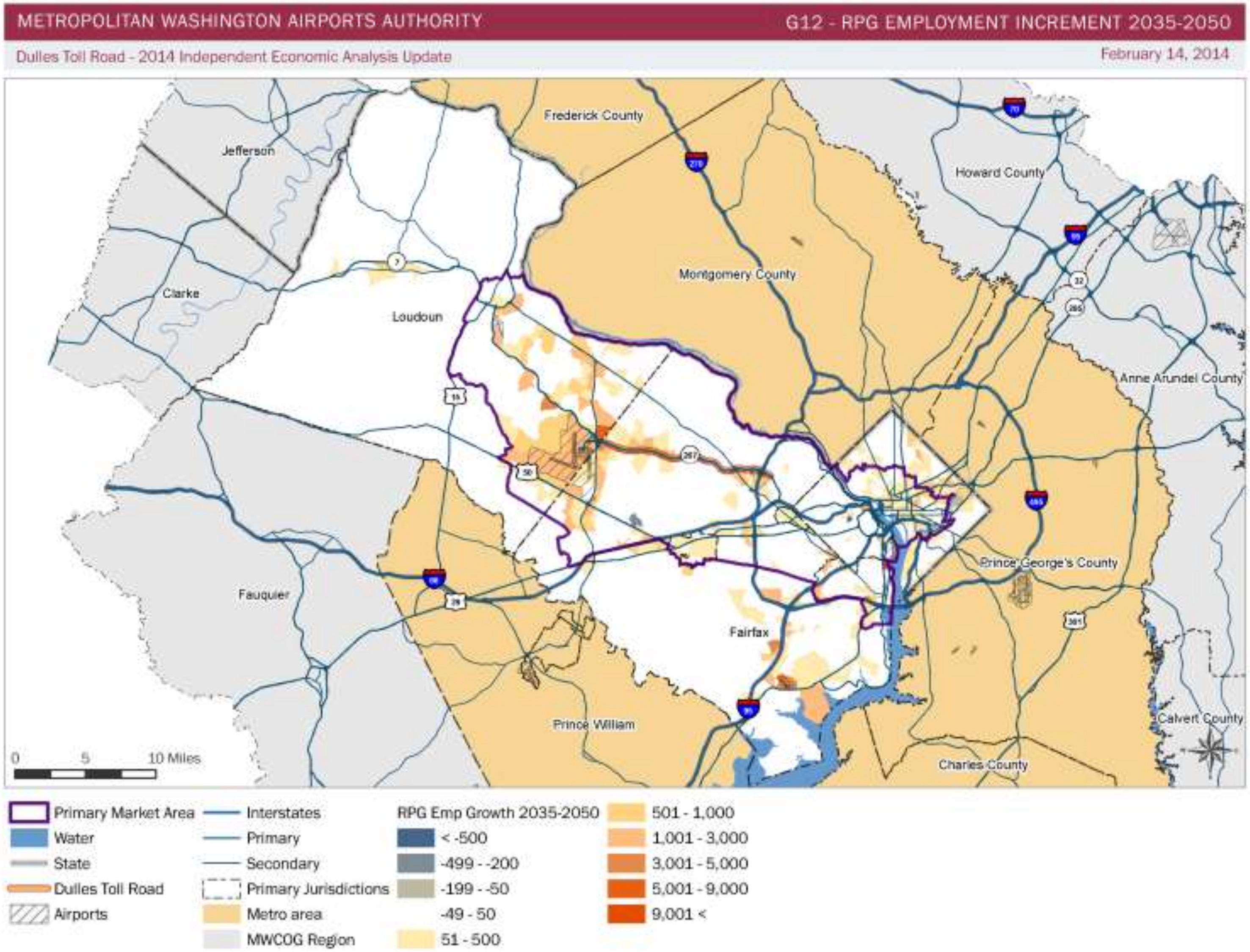


Figure 70 – RPG Employment Increment 2035-2050



Appendix D

Dulles Corridor Transportation Infrastructure and Transportation Improvement Plans

Kimley-Horn Associates

OVERVIEW OF

Dulles Corridor Transportation Infrastructure and Transportation Improvement Plans

FINAL DRAFT
February 2014

Metropolitan Washington Airports Authority

CDM Smith

Kimley-Horn and Associates, Inc.

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Chapter 1: Introduction

The Dulles Toll Road (Route 267) is a limited-access tolling facility that serves as a primary east-west corridor for Northern Virginia travel. The Dulles Toll Road extends from Interstate 66 in the east to the Dulles Greenway in the west, providing connections to Interstate 495, numerous north-south arterials in the counties of Fairfax and Loudoun, and to Dulles International Airport (IAD). In addition to supporting commuter traffic in and out of the urban Washington. D.C. core, the Dulles Toll Road is a vital link connecting residential hubs with growing commercial and economic centers such as Tysons Corner, Reston and the Town of Herndon. Additionally, the Dulles Toll Road and its western feeders, including the Dulles Greenway, provide access to the Northern Virginia region for commuters and other travelers from western Loudoun County, the West Virginia panhandle and Maryland. Major arterials such as Route 28, Centreville Road (Route 657) and Fairfax County Parkway (Route 286) link the Dulles Toll Road Corridor with primarily residential areas to the south and Interstate 66.

The performance and long-term economic success of the Dulles Corridor is contingent on the continued reliability of the Dulles Toll Road to provide an efficient, cost- and time-effective, east-west travel alternative to congested routes. This reliability is affected, in part, by the compatibility of recently completed, planned, and programmed transportation improvements along the corridor.

This report provides a comprehensive study of these improvements and provides commentary on their impact to the Dulles Corridor. Projects were identified from a variety of planning level documents (long-range plans, capital improvement plans, etc.) prepared by nearby jurisdictions, transportation agencies, and regional metropolitan planning organizations.

This report also summarizes improvements to existing access points for the Dulles Toll Road and other major regional projects that may affect/impact the Dulles Toll Road. Specifically, this report provides a qualitative estimate of the local access issues and traffic impact that will be caused in the Dulles Corridor by the operation of the Dulles Metrorail.

The ultimate purpose of this report is to identify both the competing transportation initiatives that may divert traffic away from the toll road and the synergistic transportation improvements that facilitate smoother travel to and from the toll road.

The following sections of this report will describe roadway improvements (recently completed and planned projects between the years 2008 and 2040), descriptions of the existing Dulles Toll Road access points (including future planned improvements along these access points), descriptions of the major regional improvement projects that contextualize the evolving role of the toll road within the greater regional travel, and analysis of the vitality of the Dulles Corridor with respect to these planning projects and initiatives.

Chapter 2: Roadway Improvements

This section contains a breakdown of roadway improvements in the vicinity of the Dulles Toll Road that that have been completed from 2009 to 2013 in addition to projects that are planned for the future. Projects included in this section were located in the vicinity of the Dulles Toll Road corridor area, generally bounded by Route 772 in Loudoun County to the west, Leesburg Pike (Route 7) to the north, and Interstate 66 in Fairfax County to the east and south.

Future projects are broken into two main categories—financially constrained and financially unconstrained. Constrained projects either currently have funding allocated or have been chosen based on the anticipated amount of available funding in the future. Unconstrained plans are based on the anticipated needs of the jurisdiction or agency and are not limited by available funding.

Constrained plans that were used to compile projects include:

- Virginia Department of Transportation (VDOT) Statewide Transportation Improvement Program (TIP)
- VDOT Six-Year Improvement Program
- Metropolitan Washington Council of Governments (MWCOG) Constrained Long Range Plan (2013 Update)
- MWCOG Six-Year TIP
- Northern Virginia Transportation Authority (NVTA) Recommended FY 2014 Program
- NVTA Six-Year Plan
- Fairfax County Capital Improvements Plan (CIP)
- Loudoun County CIP

Unconstrained plans that were used to compile projects include:

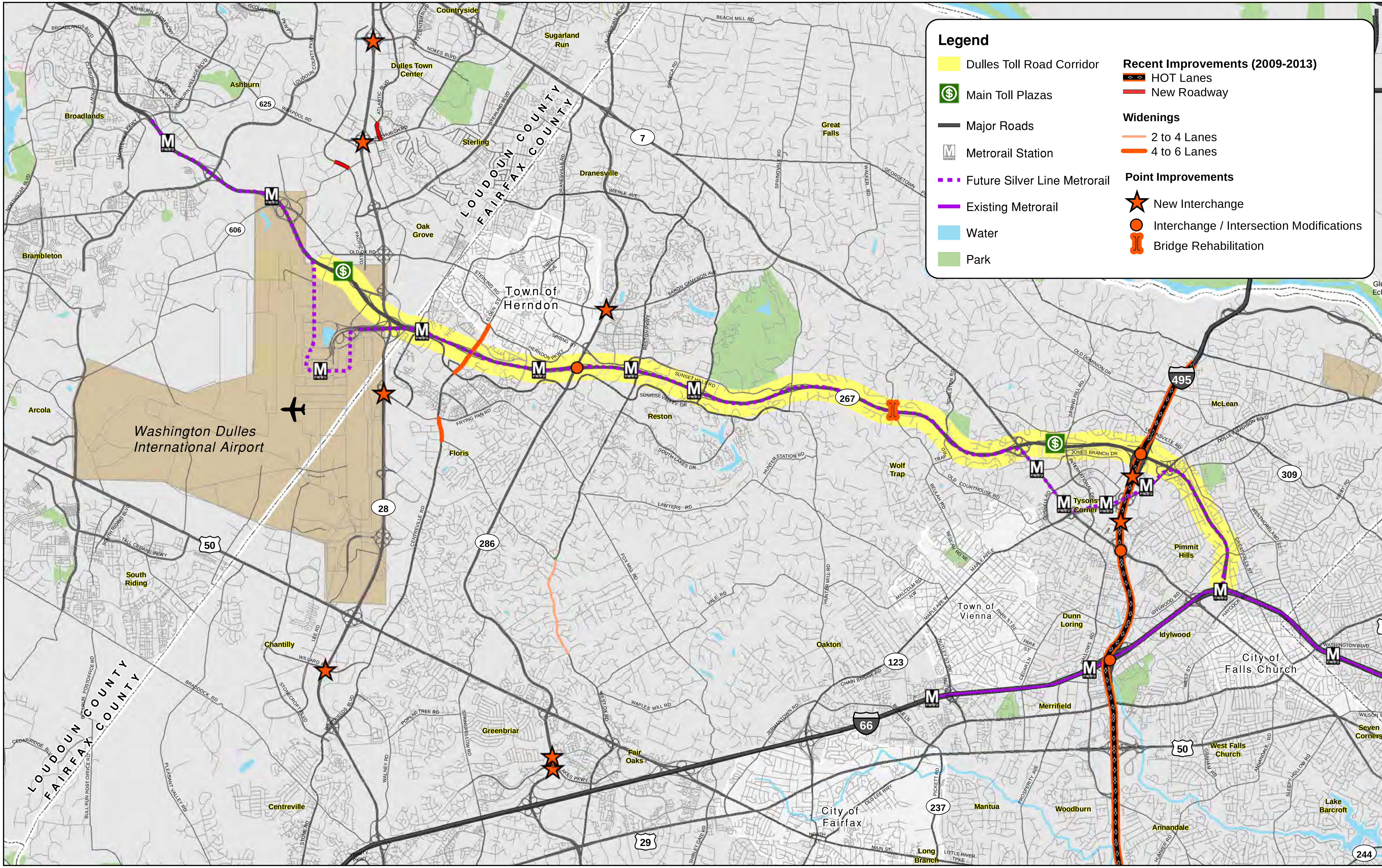
- NVTA TransAction 2040
- Virginia Surface Transportation Plan (2035 Update)
- Fairfax County Comprehensive Plan
- Loudoun County Countywide Transportation Plan (CTP)

Recently Completed Projects

Major projects that were completed from 2009 to 2013 are presented in **Table 1** and **Figure 1**.

Facility / Intersection	Route(s)	From	To	Type of Improvement	Number of Lanes		Description	Constrained / Unconstrained
					From	To		
I-495	495	2 miles south of MD line	Springfield Interchange	HOT Lanes	8	10	2 new HOT lanes in each direction between Springfield Interchange and MD State Line (American Legion Bridge)	N/A
I-66	66	US-29 in Gainesville	VA-234 Business	Widening/ Improvements	4	8	New lanes, HOV lanes & interchange upgrade	N/A
Centreville Rd	657	VA-608 (West Ox Rd)	VA-608 (Frying Pan Rd)	Widening	4	6	Widening Centreville Rd to 6 lanes south of Town of Herndon	N/A
Centreville Rd	657	Sunrise Valley Drive	Herndon Parkway	Widening	4	6	Widening Centreville Rd to 6 lanes south of Town of Herndon	N/A
Elden St		Worldgate Dr	Herndon Pkwy	Widening	4	6	Widening Elden St to 6 lanes between Dulles Toll Road and Herndon Pkwy	N/A
West Ox Rd	608	Ox Trail	Lawyers Rd	Widening	2	4	Widening Ox Rd to 4 lanes	N/A
Atlantic Blvd		Church Rd	Magnolia Rd	New Roadway	0	4	Complete Atlantic Blvd between Magnolia Rd and Church Rd (Route 28 Collector Rd)	N/A
Pacific Boulevard		Relocation Dr	Dresden St	New Roadway	0	4	Complete Pacific Blvd between Relocation Dr and Dresden St (Route 28 Collector Road)	N/A
I-495 HOT Lanes and Jones Branch Drive	495			New Interchange			New Interchange for I-495 HOT Lanes Only	N/A
I-495 HOT Lanes and Westpark Drive	495			New Interchange			New Interchange for I-495 HOT Lanes Only	N/A
Route 28 & Willard Rd	28			New Interchange			New interchange at Willard Rd	N/A
Dulles Toll Road & VA-286 / Fairfax County Pkwy	267 / 286			Interchange Improvements			Redesigned intersection of VA-267 to Fairfax County Parkway SB	N/A
I-495 and Leesburg Pike	495 / 7			Interchange Improvements			Interchange Improvements / additions for I-495 HOT Lanes	N/A
I-495 and VA-267 / Dulles Toll Road	495 / 267			Interchange Improvements			Interchange Improvements / additions for I-495 HOT Lanes	N/A
I-66 & I-495	66 / 495			Interchange Improvements			Reconstruction - access improvements and flyover for I-495 HOT lanes	N/A
Beulah Rd Bridge over Dulles Toll Road	267			Bridge Rehabilitation			Bridge Rehabilitation	N/A

Table 1 - Recently Completed Projects (2009 - 2013)



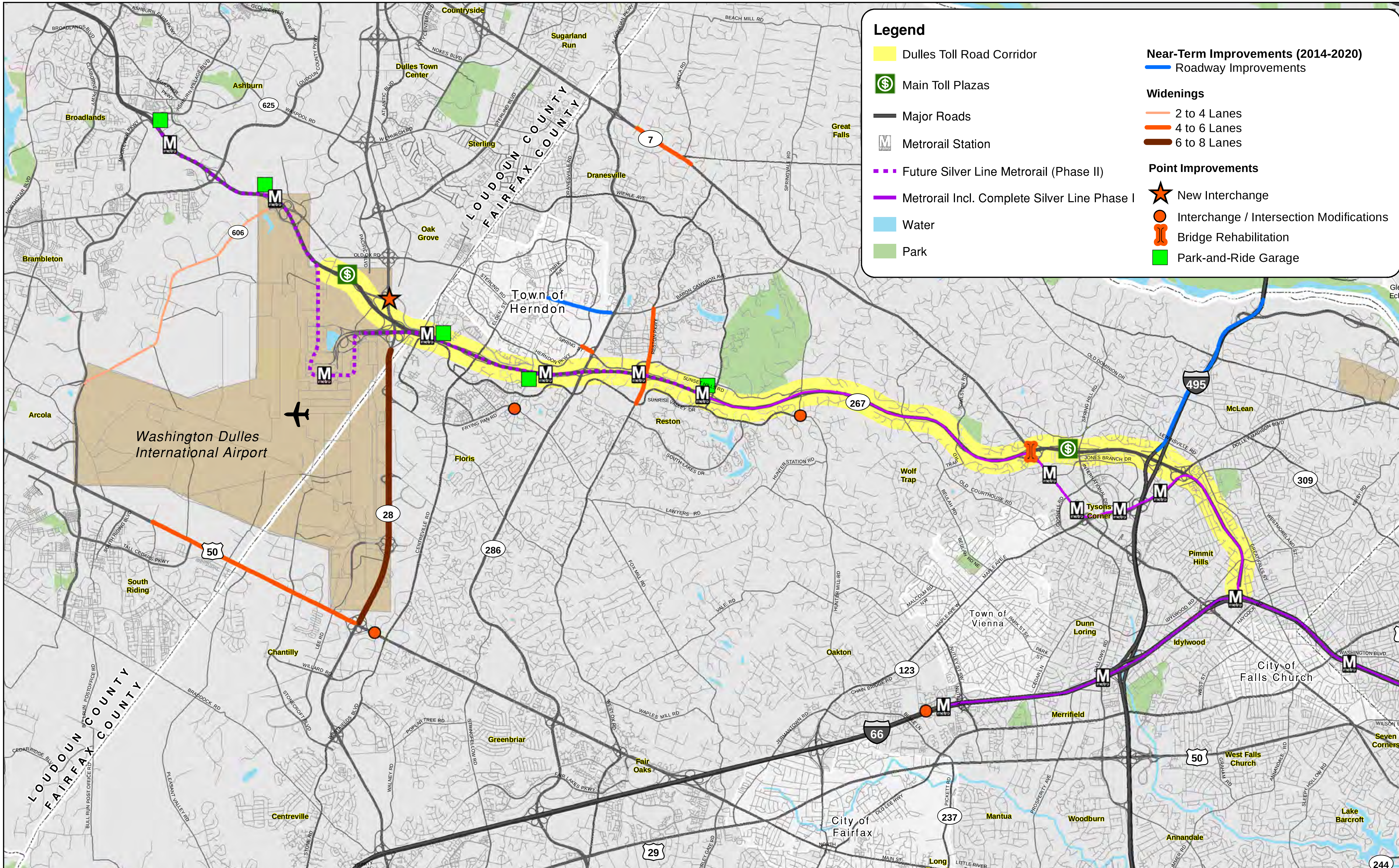
Recently Completed Improvement Projects in the Dulles Toll Road Vicinity (Figure 1)

2009 - 2013 Projects

Near-Term Projects

Projects that are programmed to be implemented from 2014 to 2020 are presented in **Table 2** and **Figure 2**. All of these projects represent constrained projects.

Facility / Intersection	Route(s)	From	To	Type of Improvement	Number of Lanes		Description	Constrained / Unconstrained
					From	To		
Leesburg Pike	7	Rolling Holly Dr	Reston Ave	Widening	4	6	Widening Route 7 to 6 lanes	constrained
Old Ox Road	606	Loudoun County Parkway	Dulles Greenway	Widening	2	4	Reconstruction and widening of Old Ox Rd to 4 lanes	constrained
Reston Parkway		Sunrise Valley Drive	Baron Cameron Avenue	Widening	4	6	Widening Reston Parkway to 6 Lanes in Reston Town Center area	constrained
Route 28	28	McLearen Road	Dulles Toll Road	Widening	6	8	Widen Route 28 NB from McLearen Rd to Dulles Toll Road	constrained
Route 28	28	Dulles Toll Road	US-50	Widening	6	8	Widen Route 28 SB from Dulles Toll Road to Route 50	constrained
Spring St		Herndon Parkway East	Fairfax County Parkway	Widening	4	6	Widen Spring Street to 6 lanes	constrained
US-50	50	VA-28	VA-742 (Poland Rd)	Widening	4	6	Widening US 50 to 6 lanes west of Route 28	constrained
Elden St		Van Buren St (Monroe St)	Fairfax County Pkwy	Roadway Improvements	4	4	East Elden St Improvement Project in Town of Herndon (Streetscaping)	constrained
I-495	495	North of VA-267 (End of Express Lanes)	American Legion Bridge	Roadway Improvements	8	10	Adding 5th lane (shoulder) for use during rush hour between end of Express Lanes and American Legion Bridge	constrained
I-66 & Nutley St (Between Vaden and Blake bridges)	66 / 243			Interchange Improvements			New Construction Roadway - Vienna Metro accessibility and capacity improvements	constrained
Fox Mill Road & Monroe Street Intersection				Intersection Improvements			Install right turn lane WB on Fox Mill Road and add pedestrian improvements	constrained
Hunter Mill Road & Sunrise Valley Drive				Intersection Improvements			Improve signage and signals operations	constrained
US-50 & Sullyfield Circle/ Centerview Dr	50			Intersection Improvements			Pedestrian Intersection Improvements	constrained
Dulles Greenway and Route 606	267 / 606			Park-and-Ride Garage			parking garage for future Metro Station	constrained
Dulles Greenway and Route 772	267 / 772			Park-and-Ride Garage			parking garage for future Metro Station	constrained
Herndon Metrorail Parking Garage	267			Park-and-Ride Garage			parking garage for future Metro Station	constrained
Innovation Center Metrorail Parking Garage	267			Park-and-Ride Garage			parking garage for future Metro Station	constrained
Wiehle Avenue & Dulles Toll Road	267 / 828			Park-and-Ride Garage			parking garage for future Metro Station	constrained
Leesburg Pike Bridge over Dulles Toll Road	7 / 267			Bridge Rehabilitation			Bridge Rehabilitation	constrained



Near-Term Improvement Projects in the Dulles Toll Road Vicinity (Figure 2)

2014 - 2020 Projects (Financially Constrained Projects Only)

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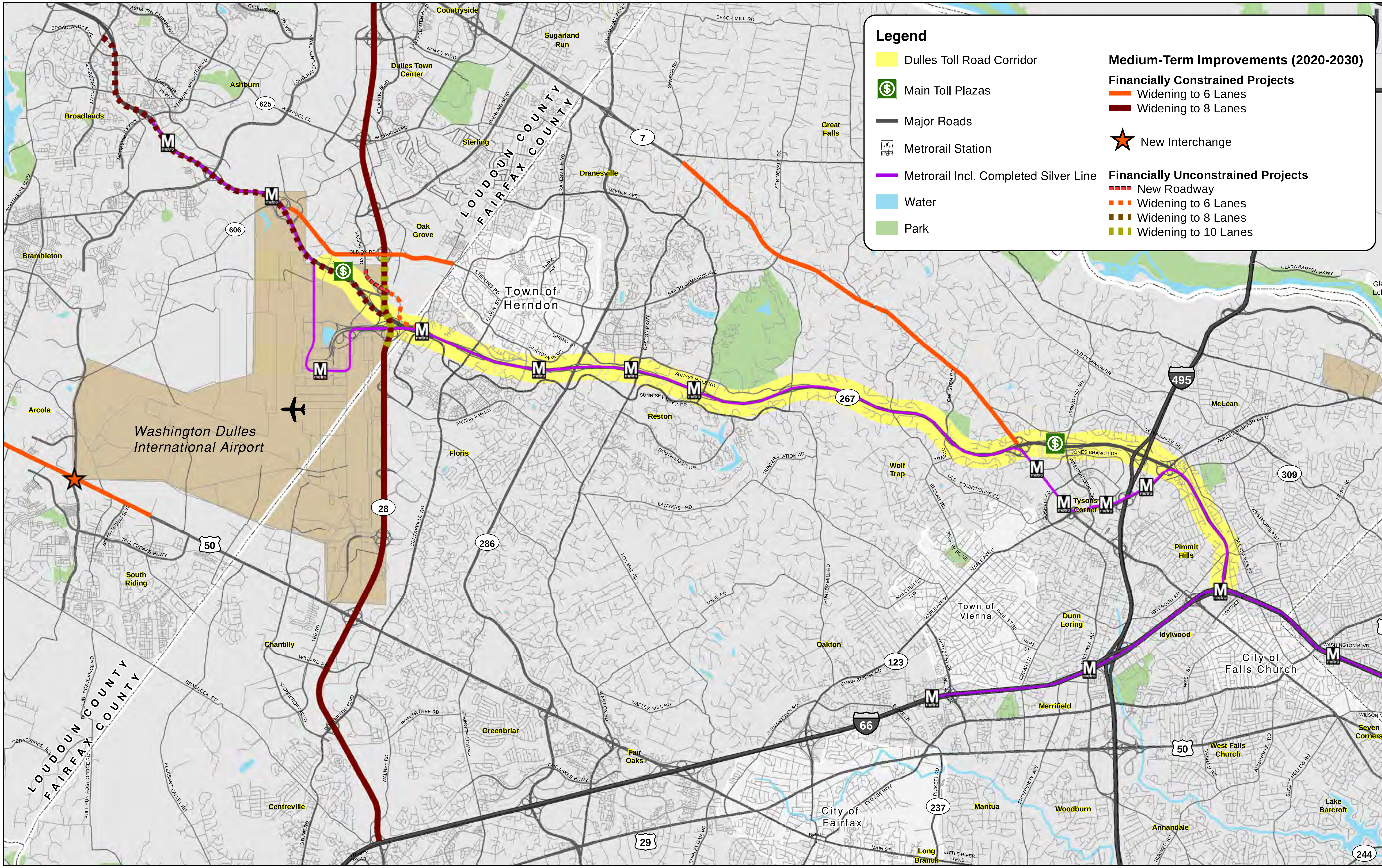
Medium-Term Projects

Projects that are programmed or planned to be implemented in the 2020 to 2030 timeframe are presented in **Table 3** and **Figure 3**. Projects in this term contain constrained and unconstrained projects.

Facility / Intersection	Route(s)	From	To	Type of Improvement	Number of Lanes		Description	Constrained / Unconstrained
					From	To		
Route 28	28	I-66	VA-7	Widening/ Improvements	6	8	Widen to 8 lanes with interchanges (complete freeway)	constrained
Leesburg Pike	7	Brook Rd/Lewinsville Rd	Dulles Toll Road	Widening	4	6	Widening Route 7 to 6 lanes	constrained
Leesburg Pike	7	Reston Ave	Dulles Toll Road	Widening	4	6	Widening Route 7 to 6 lanes	constrained
Old Ox Road	606	Loudoun County Parkway	Rock Hill Road	Widening	4	6	Widening Old Ox Road to 6 lanes	constrained
US-50	50	VA-742 (Poland Rd)	VA 659 Relocated	Widening	4	6	Widening US 50 to 6 lanes	constrained
US-50 and Loudoun County Parkway	50 / 606			New Interchange			New Interchange at US-50 and Loudoun County Parkway	constrained
Dulles Greenway	267	VA-28	Leesburg Bypass	Widening	6	8	Widening Dulles Greenway from 6 to 8 lanes	unconstrained
Innovation Avenue	209	Route 28	Fairfax County Line	Widening	4	6	Widening Innovation Avenue to 6 lanes between new Metrorail station and Route 28	unconstrained
Route 28	28	Old Ox Road	Route 7	Widening	6	8	Widening Route 28 in Loudoun County to 8 lanes	unconstrained
Route 28	28	Fairfax County Line	Old Ox Road	Widening	6	10	Widening Route 28 in Loudoun County to 10 lanes in Dulles Toll Road area	unconstrained
Pacific Boulevard		Old Ox Road	Innovation Avenue	New Roadway	0	6	Complete Pacific Blvd between Old Ox Rd and Innovation Ave (Route 28 Collector Road)	unconstrained

Table 3 - Medium-Term Projects (2020 - 2030)



Medium-Term Improvement Projects in the Dulles Toll Road Vicinity (Figure 3)

2020 - 2030 Projects (Financially Constrained and Unconstrained)

Long-Term Projects

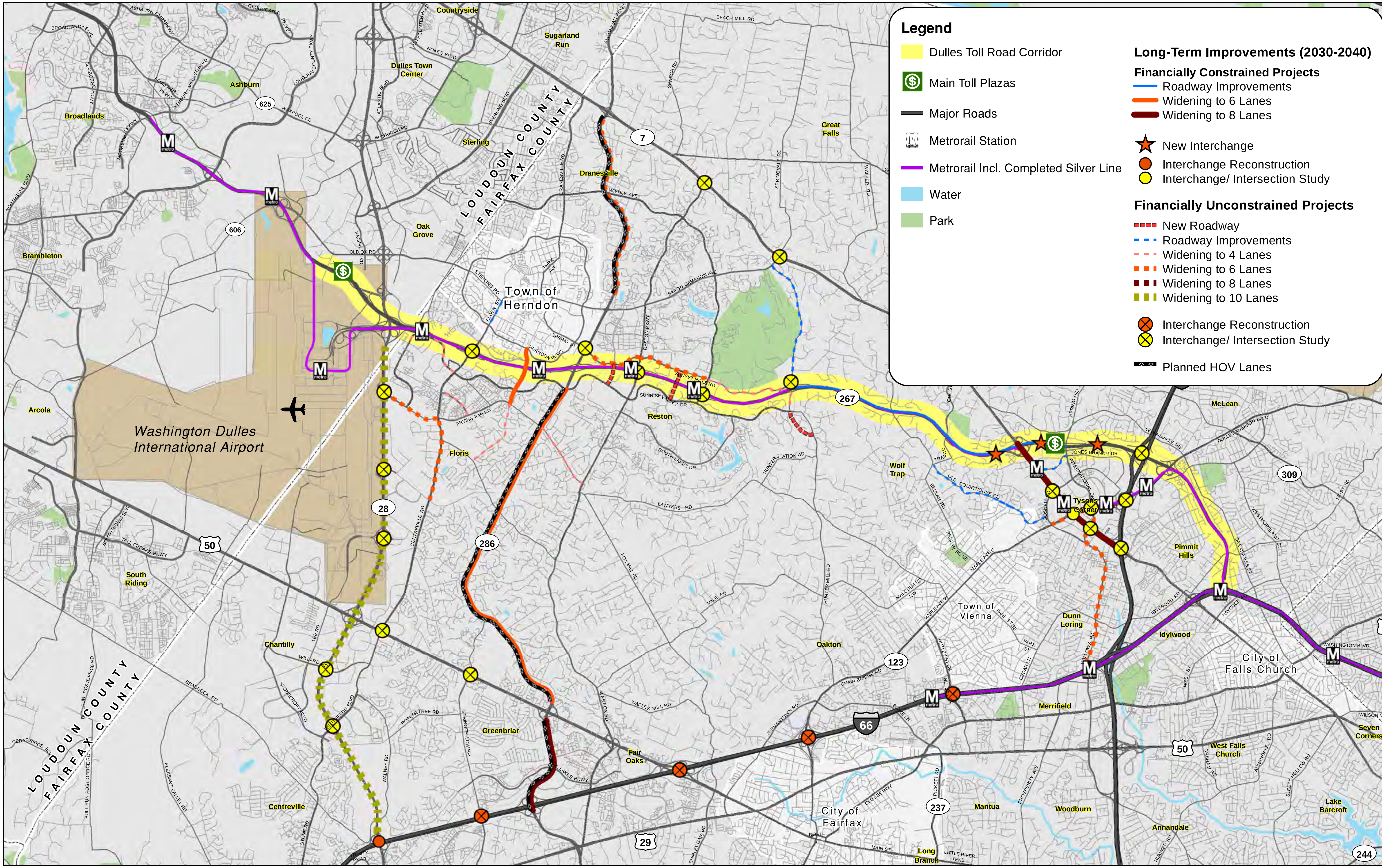
Projects that are programmed or planned to be implemented in the 2030 to 2040 timeframe are presented in **Table 4** and **Figure 4**. Projects in this term contain constrained and unconstrained projects. If unconstrained projects were identified without a date prior to 2040, they were assumed to be implemented in this timeframe.

Facility / Intersection	Route(s)	From	To	Type of Improvement	Number of Lanes		Description	Constrained / Unconstrained
					From	To		
Centreville Rd	657	McLearan Rd	VA-608 (Frying Pan Rd)	Widening	4	6	Widening Centreville Rd to 6 lanes	unconstrained
Chain Bridge Road	123	Old Courthouse Road	Leesburg Pike (Route 7)	Widening	4	6	Widening Route 123 in Tysons Corner west of Leesburg Pike	unconstrained
Chain Bridge Road	123	Leesburg Pike	I-495	Widening	6	8	Widening Route 123 in Tysons Corner east of Leesburg Pike	unconstrained
Coppermine Road	665	Sunrise Valley Drive	Centreville Road	Widening/ Improvements	2/4	4	Bringing Coppermine Road to 4 lanes	unconstrained
Dulles Toll Road	267	Hunter Mill Rd	Greensboro Dr (extended in future)	Roadway Improvements	8	8	Construct collector/distributor roads along Dulles Toll Road from Hunter Mill Rd to Greensboro Dr	constrained
Elden St		Herndon Pkwy	Sterling Rd	Roadway Improvements			Reconstruct South Elden Street from Herndon Parkway to Sterling Rd	unconstrained
Elden St		Center St	Monroe St	Roadway Improvements			Reconstruct Elden Street from Monroe St to Center St	unconstrained
Fairfax County Parkway	286	US-50	VA-267 / Dulles Toll Road	Widening (HOV Lanes)	4	6	Widening and upgrading Fairfax County Parkway between I-66 and the Dulles Toll Road including HOV lanes	constrained
Fairfax County Parkway	286	VA-267 / Dulles Toll Road	VA-7	Widening (HOV Lanes)	4	6	Widen Fairfax County Parkway by adding HOV lanes from Dulles Toll Road to VA-7	unconstrained
Fairfax County Parkway	286	I-66	US-50	Widening (HOV Lanes)	6	8	Widening and upgrading Fairfax County Parkway between I-66 and the Dulles Toll Road including HOV lanes	constrained
Fox Mill Road	665	Reston Parkway	Monroe Street	Widening/ Improvements	2/4	4	Bringing Fox Mill Road to 4 lanes	unconstrained
Frying Pan Rd	608	VA-28	Centreville Rd	Widening	2/4	6	Widen Frying Pan Rd to 6 lanes	unconstrained
Gallows Road	650	Route 7	I-66	Widening/ Improvements	4	6	Widening Gallows Road in Tysons Corner to 6 lanes	unconstrained
Hunter Mill Road	674	Huntrace Way	Sunrise Valley Drive	New Roadway		2	New alignment for Hunter Mill Road just south of Dulles Toll Road	unconstrained
Hunter Mill Road	674	Dulles Toll Road	Baron Cameron Avenue	Roadway Improvements	2	2	Roadway improvements to Hunter Mill Road north of Dulles Toll Road	unconstrained
Hunter Mill Road	674	Sunrise Valley Drive	Dulles Toll Road	Widening	2	4	Widening Hunter Mill Road in immediate vicinity of Dulles Toll Road	unconstrained
International Drive	684	Route 7	Chain Bridge Road	Widening/ Improvements	4	6	Widening International Drive to 6 lanes in Tysons Corner	unconstrained
Leesburg Pike	7	I-495	Dulles Toll Road	Widening	6	8	Widening Route 7 to 8 lanes in Tysons Corner	constrained

Facility / Intersection	Route(s)	From	To	Type of Improvement	Number of Lanes		Description	Constrained / Unconstrained
					From	To		
Monroe Street	666	Herndon Parkway	Fox Mill Road	Widening	4	6	In MWCOG CLRP description notes that project was expected to be complete in 2010, "project to be removed - comp plan only"	constrained
Monroe Street	666	Fox Mill Road	West Ox Road	Widening	2/4	4	Bringing Monroe Street to 4 lanes	unconstrained
Old Courthouse Road	677	Gosnell Road	Trap Road	Roadway Improvements	2	2	Roadway improvements to Old Courthouse Road in Tysons Corner	unconstrained
Route 28	28	I-66	VA-267 / Dulles Toll Road	Widening	6	10	Widen VA-28 to 10 lanes between I-66 and Loudoun County (just south of VA-267)	unconstrained
Soapstone Drive	4720	Sunrise Valley Drive	Sunset Hills Rd	New Roadway	0	2	Extend Soapstone Dr across Dulles Toll Road	unconstrained
Spring Hill Road		Leesburg Pike	International Drive	Roadway Improvements	4	4	Roadway improvements to Spring Hill Road in Tysons Corner	unconstrained
Sunrise Valley Drive	5320	Centreville Road	Sayward Boulevard	Widening/ Improvements	2/4	4	Widening Sunrise Valley Drive to 4 lanes near Innovation Center Station	unconstrained
Sunset Hills Road	657	Hunter Mill Road	Wiehle Avenue	Widening	2	4	Widening Sunset Hills Road east of Wiehle Ave to 4 lanes	unconstrained
Sunset Hills Road	657	Wiehle Avenue	Fairfax County Parkway	Widening	4	6	Widening Sunset Hills Road west of Wiehle Ave to 6 lanes	unconstrained
Town Center Parkway		Sunset Hills Rd	Sunrise Valley Drive	New Roadway	0	4	Currently under study - extension of Town Center Parkway under Dulles Toll Road	unconstrained
Dulles Toll Road & Greensboro Dr (extended in future)				New Interchange			Construct partial grade-separated interchanges at VA-267 and Greensboro Drive and VA-267 and Boone Blvd	constrained
Dulles Toll Road & Boone Blvd (extended in future)				New Interchange			Construct partial grade-separated interchanges at VA-267 and Greensboro Drive and VA-267 and Boone Blvd	constrained
Dulles Toll Road & Jones Branch Dr				New Interchange			New Partial Interchange between Spring Hill Rd & Beltway with connection to Jones Branch	constrained
I-66 & Nutley St				Interchange Reconstruction			Reconstruct interchange of I-66 and Nutley St	unconstrained
I-66 & VA-123				Interchange Reconstruction			Reconstruct interchange of I-66 and VA-123	unconstrained
I-66 & US-50				Interchange Reconstruction			Reconstruct interchange of I-66 and US-50	unconstrained
I-66 & Stringfellow Rd				Interchange Reconstruction			Reconstruct interchange of I-66 and Stringfellow Rd	unconstrained
I-66 & VA-28				Interchange Reconstruction			Reconstruct interchange of I-66 and VA-28	constrained
Route 123 & International Drive				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 123 & Route 7				Interchange/ Intersection Study			Interchange/ Intersection Study	constrained
Route 267 & Centreville Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 267 & Reston Parkway				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained

Facility / Intersection	Route(s)	From	To	Type of Improvement	Number of Lanes		Description	Constrained / Unconstrained
					From	To		
Route 267 & Wiehle Ave				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 28 & Air & Space Museum Parkway				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 28 & Frying Pan Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 28 & McLearen Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 28 & Westfields Boulevard				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 28 & Willard Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 50 & Centreville Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 50 & Stringfellow Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 7 & Gallows Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 7 & Baron Cameron Avenue				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 7 & Reston Parkway				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Route 7 & Westpark Drive				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Sunset Hills Road & Fairfax County Parkway				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
Sunset Hills Road & Hunter Mill Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
I-495 & VA-267 / Dulles Toll Road				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
I-495 & VA-123 / Chain Bridge Rd				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained
I-495 & VA-7 / Leesburg Pike				Interchange/ Intersection Study			Interchange/ Intersection Study	unconstrained

Table 4 - Long-Term Projects (2030 - 2040)



Long-Term Improvement Projects in the Dulles Toll Road Vicinity (Figure 4)

2030 - 2040 Projects (Financially Constrained and Unconstrained)

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Chapter 3: Dulles Toll Road Corridor Access Points

This section describes each access point to the Dulles Toll Road beginning from the west. Each section details:

- **Connections to the Dulles Toll Road Corridor**–Overview of residential and commercial areas served by each access point and the roads that connect them
- **Nearby Planned Development and Attractions**–Future planned growth in the vicinity of each access point
- **Recent and Planned Roadway Improvements**–Roadway improvements that have been completed, are programmed, or are planned around each access point

A map of all of the access points is shown in **Figure 5**. Numbers of the access points correspond to the points listed below.

1. Dulles Greenway

Connections to the Dulles Toll Road Corridor

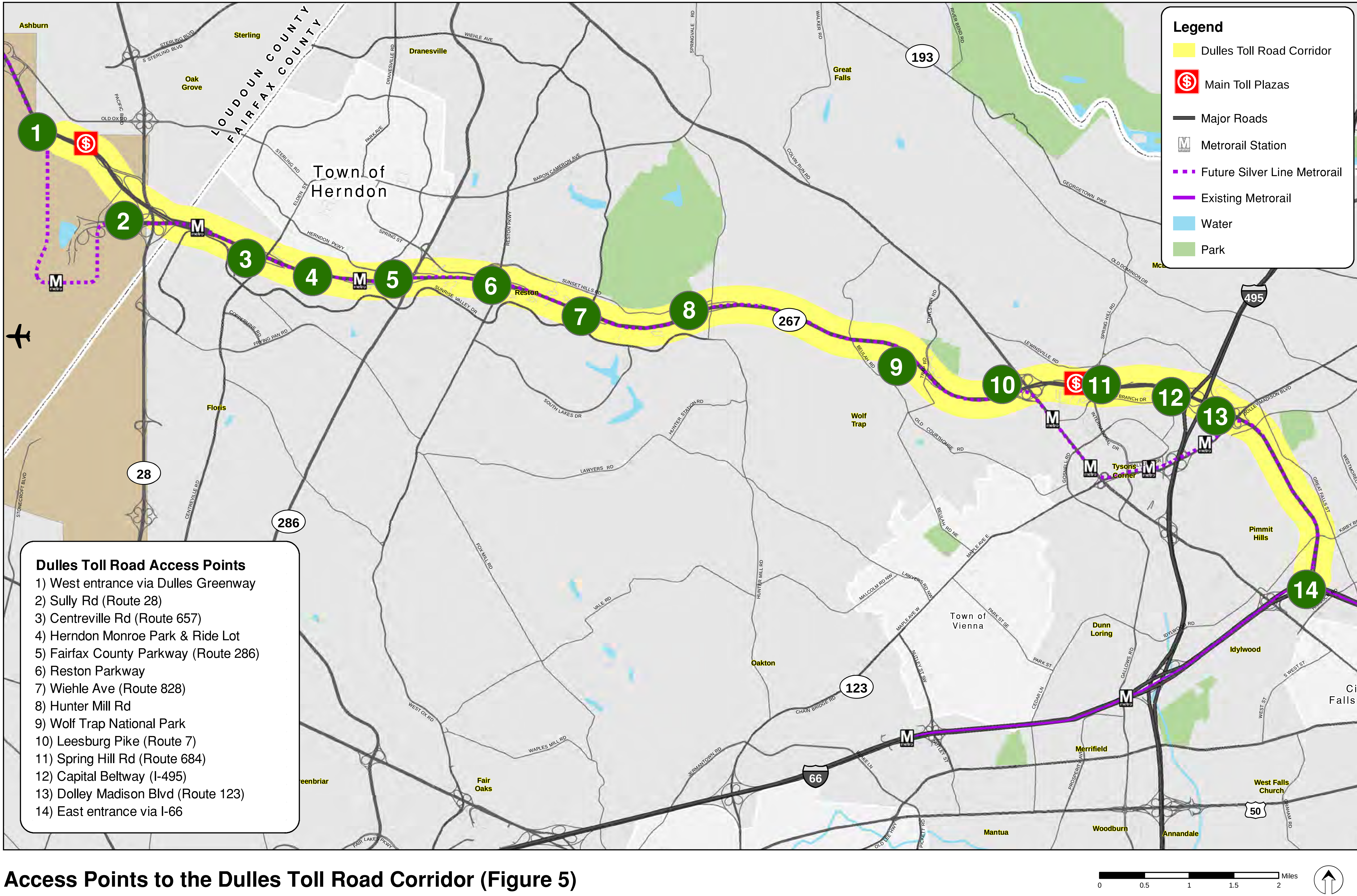
The Dulles Greenway is a six-lane, tolled limited-access facility west of the Dulles Toll Road. The Greenway is a privately-owned and maintained 12-mile extension of the Dulles Toll Road between Dulles Airport and the Town of Leesburg. It opened in 1995 and is considered part of Virginia's State Route 267. The Greenway joins the Dulles Toll Road at a toll plaza just north and east of Dulles Airport, providing a seamless connection to communities such as Ashburn and Leesburg. It also connects to VA Routes 7 and 9 and US Route 15, serving as a feeder into Northern Virginia for the large commuter base from Winchester, Virginia; Frederick, Maryland; and the West Virginia panhandle.

Nearby Planned Development and Attractions

The Dulles Greenway connects to the Dulles Toll Road to Loudoun County, one of the fastest-growing counties in the country. There are eight interchanges between the connecting toll plaza and in Leesburg where it ends at Route 7, also called the Leesburg Bypass. There are also two interchanges with access to future Metrorail stations along Phase II of the Silver Line at Route 772 and Route 606. There are numerous existing and planned large developments in Loudoun County along the Dulles Greenway.

Recent and Planned Roadway Improvements

There are plans to widen the Dulles Greenway from six to eight lanes by 2030, according to the Northern Virginia Transportation Authority's (NVTA) TransAction 2040. Additionally, Phase II of the Metrorail Silver Line will extend past Dulles Airport and be constructed within the median of a segment of the Dulles Greenway. As mentioned, the two final stations along the Silver Line will be located at interchanges along the Greenway at Route 606 and Route 772. Both stations will feature large park-and-ride lots with nearby development and are planned to open in 2019.



Access Points to the Dulles Toll Road Corridor (Figure 5)

2. Sully Road (Route 28)

Connections to the Dulles Toll Road Corridor

Route 28 is a six-lane, north-south limited-access freeway directly east of Dulles Airport. To the south, it connects to the Dulles Toll Road with the growing residential and commercial areas of Chantilly as well as Interstate 66, which is approximately 10 miles south of the Dulles Toll Road. To the north, it provides a freeway connection to the light industrial and commercial community of Sterling before terminating at Harry Byrd Highway (VA Route 7). Route 28 is the major north-south freeway corridor between the Manassas area and Dulles Airport as well as the communities in the vicinity of the airport.

Nearby Planned Development and Attractions

Route 28 is directly west of the future Innovation Center Metrorail Station on the future Silver Line, which is anticipated to open in 2019. Currently, many large office complexes and large hotels exist along the corridor. Due to the anticipated Metrorail Station, several large developments are planned in the nearby vicinity, including the Dulles World Center and Center for Innovative Technology to the north and the Dulles Suburban Center to the south.

Recent and Planned Roadway Improvements

Over the past 10 years, Route 28 has been converted from an arterial with signalized intersections to nearly a full limited-access freeway between Interstate 66 and Harry Byrd Highway. The new interchange providing access to Innovation Avenue, located just north of the Dulles Toll Road, was completed recently. The only signalized intersections remaining along the corridor are immediately north of Interstate 66; these are planned to be eliminated by 2020. Additionally, plans are in place to widen the freeway from six to eight lanes between U.S. 50 and the Dulles Toll Road with construction taking place in 2014. Future constrained plans call for widening the entire corridor to eight and some unconstrained plans represent a need for 10 lanes.

3. Centreville Road (Route 657)

Connections to the Dulles Toll Road Corridor

Centreville Road is a major arterial connecting the Dulles Toll Road with the Town of Herndon to the north. Centreville Road, which becomes Elden Street north of the Toll Road, serves as the primary access point for retail, commercial, and residential traffic to and from the Town. To the south, Centreville Road connects the Toll Road with the dense residential areas of Chantilly and Oak Hill, and continues south to Manassas. Centreville Road is the last exit on the Dulles Toll Road prior to the Dulles Airport/Route 28 exit and serves as an alternate route for north-south travel if Route 28 is congested.

Nearby Planned Development and Attractions

Centreville Road is directly east of the future Innovation Center Metrorail Station on the Silver Line, which is anticipated to open in 2019. Because of this, several large developments are planned in the nearby vicinity, including the Dulles World Center and Center for Innovative Technology to the north and the Dulles Suburban Center to the south. Currently, World Gate Center provides large office complex space, supported by major hotels.

Recent and Planned Roadway Improvements

Centreville Road was recently expanded to three lanes in each direction at its underpass of the Dulles Toll Road. Future expansions are planned along Sunrise Valley Drive just west of Centreville Road in anticipation of the upcoming Metrorail Station and Dulles Suburban Center, including completing the four-lane section of the road and connections to a new grid network of streets near the Metrorail Station.

4. Herndon-Monroe Park-and-Ride

Connections to the Dulles Toll Road Corridor

The Herndon-Monroe park-and-ride is located directly on the south side of the Dulles Toll Road between the Centreville Road interchange and the Fairfax County Parkway interchange. It provides 1,745 free parking spaces for commuters and has direct access to the westbound Toll Road and to and from the Eastbound Toll Road. Many commuters, mostly from the west, use this lot to park and take either the Fairfax Connector or Metrobus to major destinations such as the West Falls Church Metrorail Station, Tysons, District of Columbia, and the Pentagon.

Nearby Planned Development and Attractions

The Herndon Metrorail Station will be located in the median of the Dulles Toll Road across from the existing park-and-ride garage, which is planned to be expanded to approximately 3,500 spaces for the opening of Phase II of the Silver Line in 2019. The Town of Herndon is planning transit-oriented development on the north side of the Toll Road.

Recent and Planned Roadway Improvements

Currently there are no recent or planned roadway improvements that affect the Herndon-Monroe park-and ride facility.

5. Fairfax County Parkway (Route 286)

Connections to the Dulles Toll Road Corridor

Fairfax County Parkway is a major north-south arterial through the most populous county in Virginia. It connects the Dulles Toll road to the north with the Town of Herndon on the east side and Reston Town Center on the west side, continuing to Route 7. To the south, it connects to Interstate 66 and the City of Fairfax. Fairfax County Parkway continues south and provides a western link to the I-95 corridor as an alternative to the Capital Beltway. It is six lanes at its interchange with the Dulles Toll Road and varies from four to six lanes in width throughout Fairfax County.

Nearby Planned Development and Attractions

Fairfax County Parkway will be the closest interchange to the future Herndon Metrorail Station, which will be located just to the west of the interchange. Due to the anticipated Metrorail Station, several mixed-use developments are planned to increase the density of development along the Herndon Parkway corridor, just west of the Fairfax County Parkway and north of the Dulles Toll Road.

Recent and Planned Roadway Improvements

Recent work was completed to upgrade the turn lanes between the Fairfax County Parkway and interchange ramps accessing the Dulles Toll Road. Three new interchanges also were completed along the Parkway at major intersections between Interstate 66 and the Town of Herndon within the past few years. Future constrained plans call for widening Fairfax County Parkway between U.S. 50 and south of the Dulles Toll Road to six lanes with HOV lanes by 2035. Unconstrained long-term plans call for extending the widening of Fairfax County Parkway to six lanes with HOV from the Toll Road to Route 7.

6. Reston Parkway

Connections to the Dulles Toll Road Corridor

Reston Parkway is a major north-south arterial connecting the Dulles Toll Road with Reston Town Center, a large mixed-use planned community, to the north. It serves as the primary access point for retail, commercial, and residential traffic to and from the Town Center. To the south, Reston Parkway becomes Lawyers Road and West Ox Road (Route 608), connecting the Toll Road with residential communities in suburban Fairfax County. Its interchange with the Dulles Toll Road is directly east of the future Reston Town Center Metrorail Station on Phase II of the Metrorail Silver Line. The road extends from Route 7 south through Fairfax County, ultimately connecting with the Fairfax County Parkway south of Interstate 66.

Nearby Planned Development and Attractions

Reston Town Center functions as a “downtown” for the community along the Dulles Toll Road corridor; it is a pedestrian- and bicycle-friendly business district with many restaurants and entertainment lined with high-rise condominiums and businesses. Reston is forecasted to expand with increased mixed-use development north and south of the corridor. The interchange with the Dulles Toll Road provides direct access to the Town Center as well as the adjacent future Reston Town Center Metrorail Station.

Recent and Planned Roadway Improvements

The Reston Town Center Metrorail Station will not feature a park-and-ride lot. Town Center Parkway, a north-south arterial that is directly to the west, is under study to be extended across the Toll Road via an underpass, which would provide a parallel facility to north-south traffic along the corridor and connect the grid of the expanded Reston Town Center.

7. Wiehle Avenue (Route 828)

Connections to the Dulles Toll Road Corridor

Wiehle Avenue is an arterial that provides access to the final stop on Metrorail's Silver Line Phase I, which is expected to open in spring 2014. The station will be located directly west of the interchange in the median of the Dulles Toll Road. It also provides access to several commercial business parks adjacent to the Dulles Toll Road along both the north and south sides of the facility. Wiehle Avenue continues north and serves primarily the residential areas of Reston.

Nearby Planned Development and Attractions

The Wiehle-Reston East Metrorail Station is the final stop on the Silver Line's Phase I and is set to open in the spring of 2014. It is the only stop west of Tysons Corner, approximately 5 miles to the east. A large parking garage with seven stories of parking (about 2,300 spaces) is under construction along the north side of the Dulles Toll Road to allow commuters to take Metrorail. While the new Silver Line may cause some eastbound travelers to shift from using the Dulles Toll Road to travel by rail, the new developments and access to rail could spur additional trips along the Dulles Toll Road. A mixed-use development (Reston Station) also is planned on top of and next to the parking garage. Additionally, Wiehle Avenue provides access to two country clubs and a community college campus.

Recent and Planned Roadway Improvements

To provide access to the parking garage and the planned development, a new signalized intersection has been added between the interchange and Sunset Hills Road. Further multimodal improvements, including pedestrian and bus facilities, are planned or currently in construction along Wiehle Avenue as the Phase I of the Silver Line nears completion.

8. Hunter Mill Road

Connections to the Dulles Toll Road Corridor

Hunter Mill Road is a local two-lane road serving the residential communities of Great Falls to the north and Oakton and Vienna to the south.

Nearby Planned Development and Attractions

Hunter Mill Road provides access to the Reston Zoo, Lake Fairfax, the W&OD Trail, and several local parks.

Recent and Planned Roadway Improvements

Long-term plans call for Hunter Mill Road to be widened from two to four lanes in the vicinity of its interchange with the Dulles Toll Road as well as a realignment with the road south of the interchange to create a four-way intersection with Sunrise Valley Drive.

9. Wolf Trap National Park for the Performing Arts

Connections to the Dulles Toll Road Corridor

A partial interchange serving travelers coming from or heading to the east exists at Trap Road, just south of Wolf Trap National Park for the Performing Arts. Trap Road provides access via local roads to the Tysons Corner business district and can be used as an alternate route to access the park if traveling from Tysons.

Nearby Planned Development and Attractions

Wolf Trap National Park for the Performing Arts is a 130-acre park just north of the Dulles Toll Road with a major indoor/outdoor performing arts venue with seating for 7,000 and a children's theatre. The park hosts frequent performances from the late spring through the early fall.

Recent and Planned Roadway Improvements

A parallel pedestrian and bicycle bridge was completed in 2012 on the west side of Trap Road, providing safer access to the park for travelers from the south.

10. Leesburg Pike (Route 7)

Connections to the Dulles Toll Road Corridor

Leesburg Pike is a major northwest-to-southeast arterial connecting the urban areas of Leesburg, Tysons Corner, Falls Church, and Alexandria. Leesburg Pike is a highly congested alternative to the Dulles Toll Road connecting points northwest to the Capital Beltway. Its interchange with the Toll Road is immediately west of the main toll plaza. Leesburg Pike, a four-lane divided facility at the interchange, provides travelers from the west with access to the main artery through Tysons, the largest business district in Fairfax County and one of the largest shopping and business districts in the country. To the northwest of the interchange, Leesburg Pike runs parallel to the Dulles Toll Road.

Nearby Planned Development and Attractions

Tysons Corner is known for its two large upscale shopping malls and surrounding business district, which employs more than 100,000 people. It is undergoing a rapid redevelopment in conjunction with the construction of phase I of the Metrorail Silver Line. Tysons is forecasted to grow to 200,000 jobs and 100,000 residents by 2050[1]. There are four stops planned in Tysons, including two along Leesburg Pike south of the interchange with the Dulles Toll Road. The Spring Hill Station is the closest station to the interchange. None of the stations in Tysons, which will open in the spring of 2014, will have designated parking garages. A more detailed description of the improvements planned for the Tysons Corner area is provided in the "Major Regional Improvement Projects" section.

[1] Fairfax County Government - http://www.fairfaxcounty.gov/tysons/

Recent and Planned Roadway Improvements

To the northwest of the interchange, Leesburg Pike is currently being widened from four to six lanes between Rolling Holly Drive and Reston Avenue; a future widening to six lanes and intersection reconfigurations all the way to the Toll Road is planned. South of the interchange in Tysons Corner, Leesburg Pike has been in the midst of construction and transformation over the past several years with the aboveground Silver Line rail and station construction taking place in the median of the road. Once the Silver Line is complete, plans call for the road to be widened from six to eight lanes between the Dulles Toll Road and the Capital Beltway. Although, this improvement will provide an increase in capacity due to the expected growth at Tysons, this portion of Route 7 will remain a signalized major arterial.

11. Spring Hill Road (Route 684)

Connections to the Dulles Toll Road Corridor

Spring Hill Road is a four-lane local road that provides a second access point from the Dulles Toll Road to Tysons Corner to the south. It provides more direct access to Tysons Galleria, one of the two major shopping malls in the business district. To the north it serves dense residential areas. Its interchange with the Dulles Toll Road is located immediately east of the main toll plaza.

Nearby Planned Development and Attractions

As mentioned, Spring Hill Road provides direct access from the Dulles Toll Road to Tysons Galleria as well as several dense residential communities in McLean. Tysons Corner is currently a major employment center since more than five times as many people work in Tysons compared to the number who live there. However, it is envisioned to become a major mixed-use, pedestrian-friendly center.

Recent and Planned Roadway Improvements

Long-term plans for the Tysons area call for two additional partial interchanges to be constructed in the immediate vicinity providing additional access to Tysons. Additionally, area comprehensive plans call for realignment of several existing roads and construction of new roads to create a grid-like network in Tysons in the region surrounded by Leesburg Pike to the south and west, the Dulles Toll Road to the north, and the Capital Beltway to the east. More information on these improvements is presented in the "Major Regional Improvement Projects" section

12. Interstate 495 (Capital Beltway)

Connections to the Dulles Toll Road Corridor

Interstate 495, also known as the Capital Beltway, is a major regional thoroughfare and one of the busiest freeways in the country. At its interchange with the Dulles Toll Road, it contains four lanes in each direction, along with two express toll lanes in each direction. Flyover ramps provide a seamless connection from the Dulles Toll Road to both the main and express lanes. The Beltway northbound (called the Inner Loop) provides access to Interstate 270, the cities of and Bethesda and Rockville, and points northwest. It also connects to Interstate 95 with access north to the city of Baltimore. The Beltway southbound (called the Outer Loop) provides access to Interstate 66, Interstate 95, and the cities of Richmond and Alexandria. The Beltway corridor also is a portion of the east coast freeway corridor of I-95 connecting Maine to Florida.

Nearby Planned Development and Attractions

The Capital Beltway provides the main freeway connection from the Dulles Toll Road to attractions in the wider Capital region and the eastern United States.

Recent and Planned Roadway Improvements

The Interstate 495 Express Lanes, a privately-owned and operated toll facility in the center of the Capital Beltway, opened to traffic in 2012. The Express Lanes run from just north of the interchange with the Dulles Toll Road south to the Springfield area interchange with Interstates 95 and 395. Express Lanes are currently being constructed on Interstate 95 south to Stafford County and are scheduled to open in 2015. Once open, travelers will have the option to pay a toll to avoid traffic from the Dulles Corridor seamlessly to Washington suburbs that are to the south and just north of Fredericksburg, Virginia. Additionally, construction is expected to take place in 2014 to allow for travelers to use the shoulder during rush hour as a fifth lane on the Beltway north of the Dulles Toll Road where the Express Lanes merge with the main lanes.

13. Dolly Madison Boulevard (Route 123)

Connections to the Dulles Toll Road Corridor

Dolly Madison Boulevard, primarily referred to as Route 123, intersects with the Dulles Connector Road just east of the Capital Beltway and before Interstate 66. Access at this point is not tolled. Since Route 123 is a main arterial through Tysons to the west, and connects to the George Washington Parkway via the residential areas of McLean and ultimately Washington, DC, it is sometimes used for commuters to DC who are looking to avoid the HOV peak restriction on Interstate 66. During both peaks the interchange between Route 123 and the Dulles Connector Road connector is often very congested and can impede through traffic. To the south, Route 123 connects the Town of Vienna and ultimately Interstate 95.

Nearby Planned Development and Attractions

Tysons Corner is known for its two large upscale shopping malls and surrounding business district, which employs more than 100,000 people. It is undergoing a rapid redevelopment in conjunction with the construction of phase I of the Metrorail Silver Line. Tysons is forecasted to grow to 200,000 jobs and 100,000 residents by 2050. A more detailed description of the improvements planned for the Tysons Corner area is provided in the “Major Regional Improvement Projects” section. To the east, Route 123 connects to the Central Intelligence Agency, other federal government offices, and local schools.

Recent and Planned Roadway Improvements

No major roadway improvements are planned for Route 123 in the vicinity of the interchange.

14. Interstate 66

Connections to the Dulles Toll Road Corridor

Interstate 66 feeds directly into the Dulles Connector Road through a non-tolled northwest-southeast connector. Merging from the Dulles Connector Road onto Interstate 66 in both peak periods and even sometimes on weekends creates a significant bottleneck. Interstate 66 continues west towards Manassas and east to Washington, DC. During peak periods, peak-direction travel is limited to HOV 2+ (between Washington, DC and the Capital Beltway only). Interstate 66 connects DC to Interstate 81, a critical freight corridor that runs north-south through a large portion of Virginia.

Nearby Planned Development and Attractions

Due to its limited access, there are no planned developments that would directly impact the connection between Interstate 66 and the Dulles Connector Road.

Recent and Planned Roadway Improvements

Three “spot improvements” along Interstate 66, inside the Capital Beltway, have been identified in attempts to reduce the bottlenecks without fully widening the road. A multimodal study has been completed that recommends high-occupancy tolling on Interstate 66, but further analysis is needed before specific plans are adopted.

Conclusion

This section briefly described the major access points to the Dulles Toll Toad Corridor. Many of these access points will experience major development and roadway improvements over the years. The opening of the Silver Line will capture some of the existing and future traffic in the corridor. However, in general, these changes will benefit the Dulles Toll Road Corridor through the attraction of more traffic and addressing the roadway conditions that cause bottlenecks.

Access points that will be impacted by major development projects, including transit-oriented development associated with the Metrorail Silver Line include:

- Sully Road (Route 28)
- Centreville Route (Route 657)
- Herndon-Monroe Park-and-Ride
- Fairfax County Parkway
- Reston Parkway
- Wiehle Avenue
- Leesburg Pike (Route 7)

- Spring Hill Road
- Dolly Madison Boulevard

Access points that have been recently or will be impacted with major roadway improvements include:

- Sully Road (Route 28)
- Fairfax County Parkway (Route 286)
- Wiehle Avenue (Route 828)
- Leesburg Pike (Route 7)
- Spring Hill Road (Route 684)
- Interstate 495
- Interstate 66

More information on major regional improvement projects is available in **Chapter 4**.

Chapter 4: Major Regional Improvement Projects

This section describes some of the major projects that are planned in the Northern Virginia region that may impact traffic on the Dulles Toll Road. For each project the following are discussed:

- Description of planned improvements
- Potential effects to the Dulles Toll Road

These improvements are shown on **Figure 6**, and along with other minor projects on the maps in **Chapter 2.**

Dulles Metrorail Corridor (Silver Line)

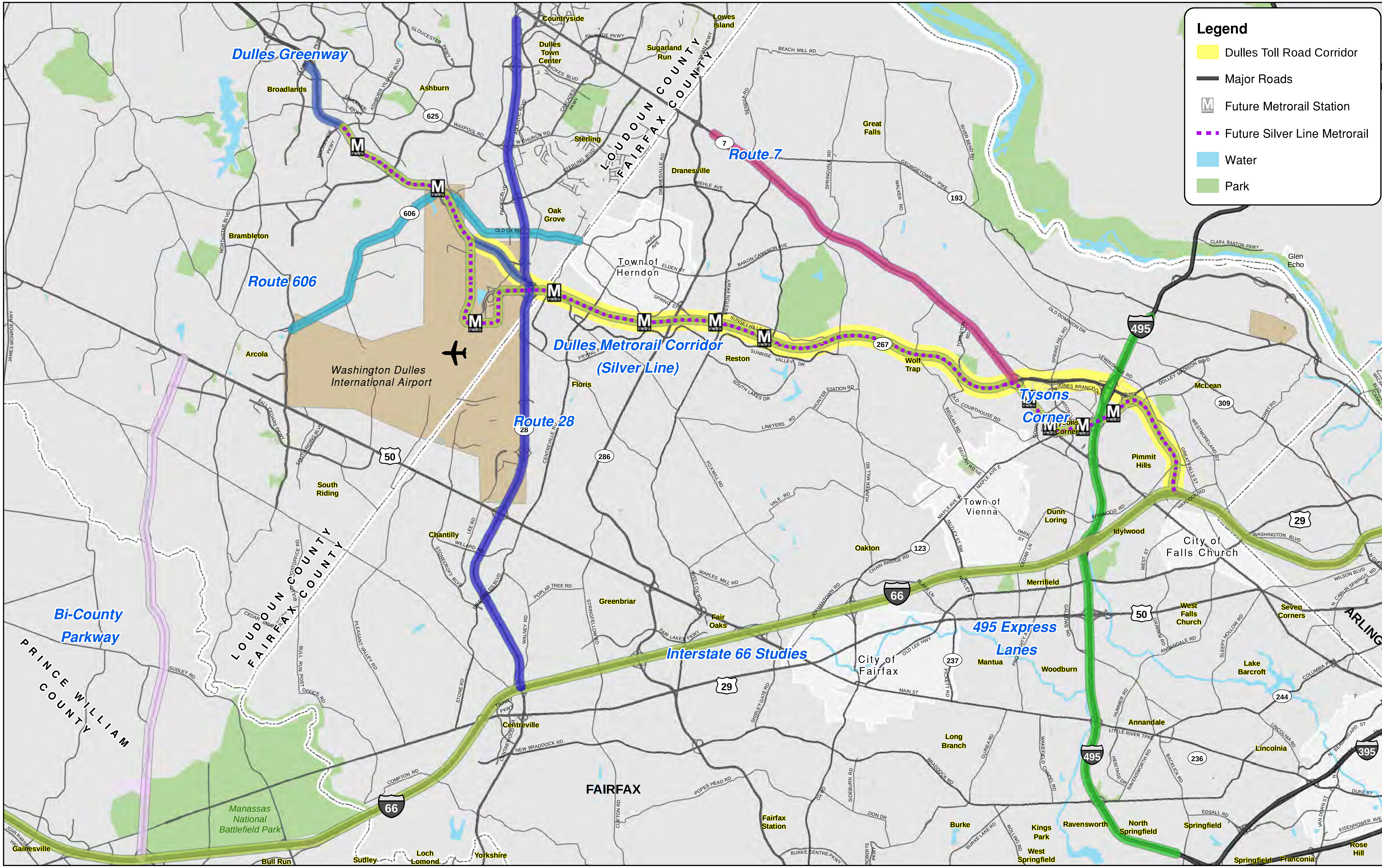
The Dulles Corridor Metrorail project is a radial extension of Washington's rail transit system to the Dulles Toll Road corridor. Known as the Silver Line (to differentiate from other transit lines identified by color), the project is being constructed in two phases (see **Figure 7** below).

Phase I

- It is 11.5 miles long between existing East Falls Church Metrorail Station and the Wiehle-Reston East Station in Reston.
- Expected opening is the spring of 2014.
- It contains five new stations (four in Tysons Corner).
- It is elevated/underground through Tysons Corner and at-grade in the median of the Dulles Toll Road.

Phase II

- 11.6 miles long between Wiehle Avenue in Reston and Route 772 in Loudoun County via Dulles Airport
- Expected to open in 2019
- Six new stations
- Elevated through Dulles Airport and at-grade in the median of the Dulles Toll Road and the Dulles Greenway



Major Regional Improvement Projects (Figure 6)

Miles
0 0.5 1 1.5 2

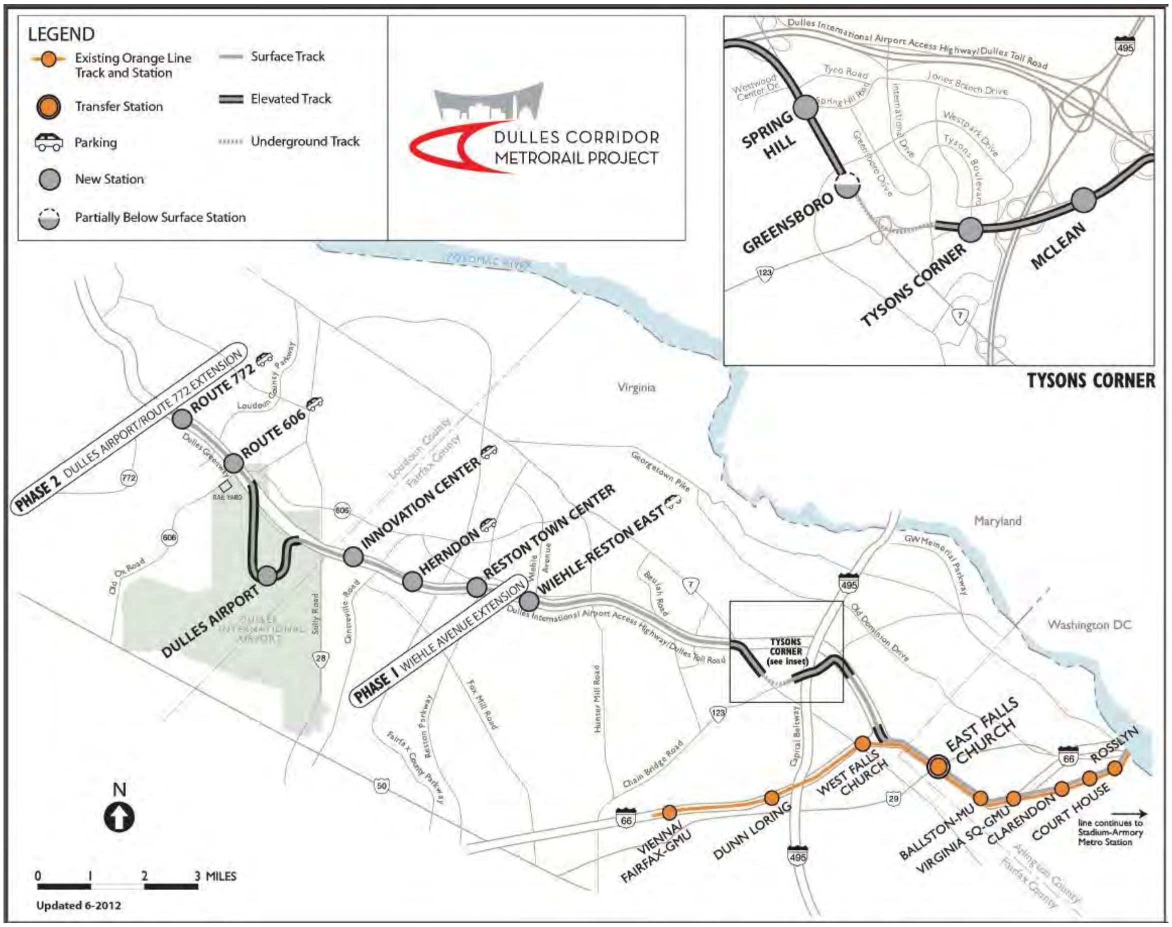


Figure 7 – Planned Silver Line (Phases I and II)

Source: Metropolitan Washington Airports Authority. 2012.

Relationship to the Dulles Toll Road

The Silver Line corridor is expected to provide a new corridor for rail transportation along the northwest commuting corridor into the Washington, D.C. area. Significant transit-oriented development is planned in the vicinity of the future Silver Line stations. A significant amount of the traffic that these developments will attract will likely access the sites using the Dulles Toll Road.

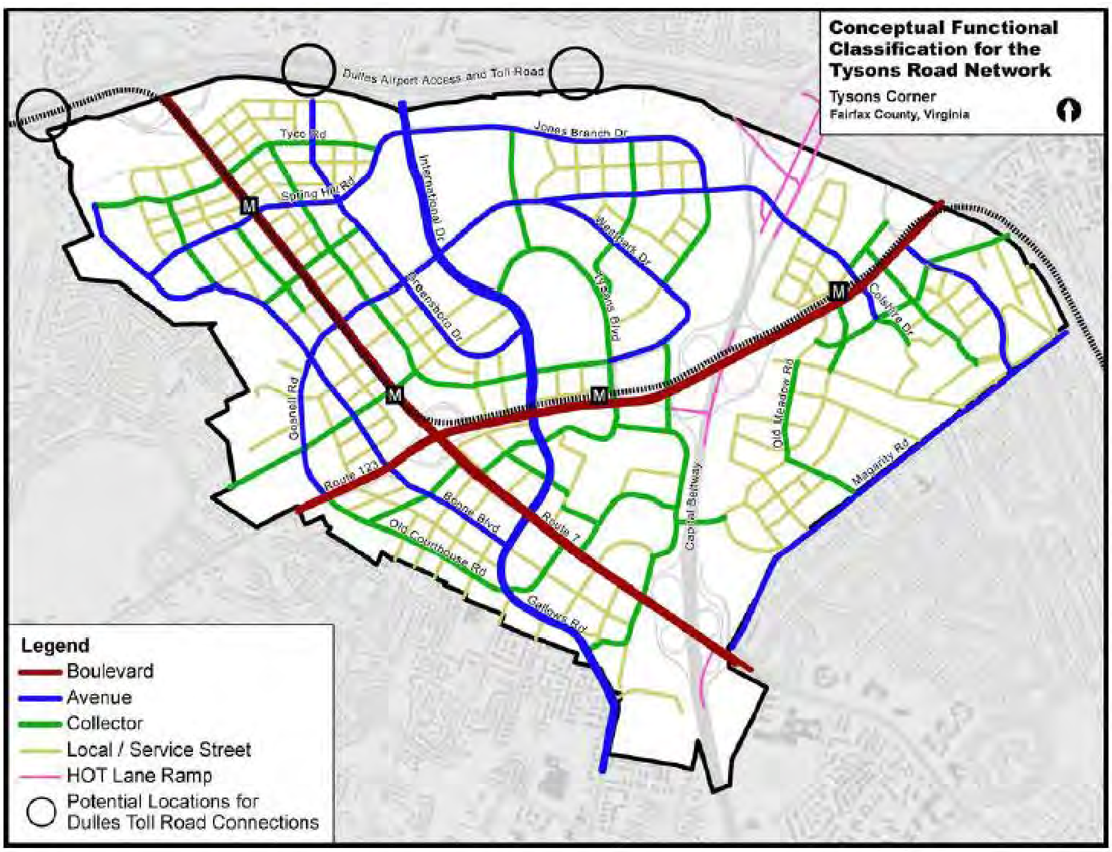
Tysons Corner

Existing Tysons Corner

Tysons Corner is the largest business district in Fairfax County and one of the largest employment centers in the country. Located adjacent to the Dulles Toll Road and the Capital Beltway, the area is undergoing a massive change from its current suburban form of office buildings surrounding two large shopping malls to a more urban setting. The area has become known for its traffic congestion, especially during the rush hours, as it employs more than 100,000 people.

Future Tysons Corner

Fairfax County's vision for "Tysons Urban Center" involves a connected grid of streets (see **Figure 8**), complete with mixed-use, transit-oriented development centered around the four Metrorail Silver Line stations in the area that are opening in 2014. Fairfax County envisions Tysons Corner as an urban center home to up to 100,000 residents and 200,000 jobs by 2050. This growth is expected to bring a significant increase in both rail and highway trips to Tysons.



Note: The Tysons Road Network is subject to change pending results from more detailed analyses of the connections to the DAAR and the Grid of Streets.

MAP 7

Figure 8 – Future Street Grid for Tysons Corner

Source: Fairfax County Comprehensive Plan (Amended Through 2-12-2013).

Relationship to the Dulles Toll Road

The opening of the Silver Line and the lack of parking garages at the Tysons Corner Silver Line Stations will likely support the use of transit to access Tysons Corner. However, automobile traffic will likely continue to dominate with the Dulles Toll Roll remaining a crucial access point to Tysons Corner, especially for those travelling from non-Metro accessible areas. Preliminary operations analysis performed by Fairfax County has indicated that, if the amount of expected growth is achieved, additional capacity on the Dulles Toll Road and the Capital Beltway will be required per the Fairfax County Comprehensive Plan[2]. Three new access points from Tysons Corner to the Dulles Toll Road have been proposed and are currently under study. These three locations are shown on Figure X (above) and are located at:

- Greensboro Drive (to westbound Dulles Toll Road)
- Boone Boulevard (to westbound and from eastbound Dulles Toll Road)
- Jones Branch Drive (to westbound and from eastbound Dulles Toll Road)

Construction of a collector-distributer system between the Leesburg Pike interchange area and the Hunter Mill interchange area also is recommended.

These improvements will provide more access to the Dulles Toll Road. The Boone Boulevard and Greensboro Drive interchanges will be constructed with access points west of the main toll plaza. Investments will have to be made to install toll booths on these approaches.

Interstate 495 Express Lanes

The Interstate 495 Express Lanes are a privately-operated 14-mile expansion of the Capital Beltway in Virginia. In late 2012, the Express Lanes opened from the Interstate 395/Interstate 95 interchange to just north of the Dulles Toll Road (see **Figure 9** blow). It is planned to extend these Express Lanes around the entire Virginia portion of the Capital Beltway. The lanes are built along the inside of the existing Capital Beltway, providing an additional two lanes in each direction. Buses, carpools with three or more people (HOV-3+) and a specialized E-ZPass Flex tag, motorcycles, and emergency vehicles can use the lanes without paying a toll. Drivers with fewer than three total travelers in their vehicle must pay a toll that varies based on the amount of traffic using the lanes so that free-flow speeds are maintained. Trucks with more than two axles are not permitted to use the Express Lanes.

[2] Fairfax County Comprehensive Plan, 2013 Edition. Tysons Corner Urban Center, Amended through 2-12-2013

Figure 9 – Existing (2014) I-495 Express Lanes.

Source: www.495expresslanes.com.

Relationship to the Dulles Toll Road

The Express Lanes provide a variably tolled alternative to the frequently-congested mainline Capital Beltway lanes, especially leading into and out of rapidly-growing Tysons Corner. As mentioned, the Express Lanes are connected to the Dulles Toll Road via flyover ramps and complement the Dulles Toll Road by improving access to the southern Washington suburbs.

The existing bottleneck at the eastern end of the Dulles Toll Road and the Capital Beltway entrances has shown recent improvement in the Interstate 495 southbound direction. The planned continuation of the Express Lanes north to the Maryland border will likely further ease this congestion into Maryland.

Interstate 66 Studies

Interstate 66 is a southern parallel corridor to the Dulles Toll Road, extending from Washington, DC to Front Royal, which is frequently congested during rush hour and on weekends.

Outside the Beltway (I-495 to Haymarket)

A tier 1 environmental impact study was completed in November 2013 for Interstate 66 that examined multimodal improvements to the corridor. It identified ways to improve safety and operations along the corridor. A tier 2 study is expected to take place beginning in 2014.

Inside the Beltway (Washington, DC to Interstate 495)

Inside the Capital Beltway during peak hours, the peak direction is restricted to HOV-2+ vehicles. A multimodal study was completed in 2012 that recommended the addition of high-occupancy or toll (HOT) lanes (potentially in the peak period only) in addition to enhancements for transit and integrated corridor management.

Relationship to the Dulles Toll Road

Improvements to Interstate 66, west of the Capital Beltway, will likely have minimal effects on the Dulles Toll Road due to the distance between the corridors.

Improvements such as HOT lanes inside the Capital Beltway on Interstate 66 could significantly improve the congestion that frequently occurs on the "connector" between Interstate 66 and the Dulles Toll Road.

Leesburg Pike (Route 7)

Leesburg Pike is the main parallel artery to the Dulles Toll Road. Its signalized intersections and congestion are major drivers of usage of the Dulles Toll Road. Several interchanges have been constructed along the corridor between Leesburg and Tysons Corner to relieve some of this congestion, and plans call for future widening of the corridor. The planned improvement projects for Leesburg Pike include:

- Widening from four to six lanes northwest of the Dulles Toll Road
- Widening from six to eight lanes between the Capital Beltway and the Dulles Toll Road
- Truck climbing lane heading west between the Town of Leesburg and Route 9
- Transit alternatives analysis for Tysons Corner to the City of Alexandria

Relationship to the Dulles Toll Road

While major choke points in traffic and multiple signalized intersections still remain along Leesburg Pike, expanding capacity and limiting access could allow it to compete with the Dulles Toll Road for through traffic, especially during nonpeak periods. Truck climbing lanes could ease major evening congestions at the western end of the Dulles Greenway for those traveling west to Winchester and West Virginia. This could make travel on the Dulles Greenway and the Dulles Toll Road more attractive. Transit projects south of Tysons Corner could provide connections to the Silver Line and the Dulles Toll Road.

Route 28

Route 28 is a major north-south route between Interstate 66 and Route 7, providing both corridors with access to Dulles Airport. The route is nearly a full freeway, with the exception of signalized intersections near Interstate 66 that are frequent choke points. Future plans call for:

- Conversion of existing intersections to interchanges
- Reconstructing the Interstate 66 and Route 28 interchange
- Widening the corridor from six to eight lanes (constrained plans)
- Widening the corridor to 10 lanes (unconstrained plans)

Relationship to the Dulles Toll Road

Improvements to this facility could allow for more direct access to the Dulles Toll Road.

Dulles Greenway

The Dulles Greenway is a privately-owned western extension to the Dulles Toll Road between Dulles Airport and the Town of Leesburg. It provides freeway accessibility to the rapidly-growing Loudoun County and feeds the Dulles Toll Road from the west. There are financially unconstrained plans to widen the Dulles Greenway from six to eight lanes.

Relationship to the Dulles Toll Road

The Dulles Greenway is the main corridor that feeds the Dulles Toll Road from the west. The conditions of the Dulles Greenway and the corridors to the west are directly related to the Dulles Toll Road.

Old Ox Road (Route 606)

Route 606 is an arterial that links U.S. 50 to the Dulles Corridor and the Town of Herndon and the Reston area. For trips to and from the west of Dulles Airport and U.S. 50, it feeds the Dulles Toll Road corridor. North and east of the corridor, it functions as a major arterial through downtown Herndon and the Reston area. Planned Improvements include:

- Modifications to the Route 606/Dulles Greenway interchange including construction of the Route 606 Metrorail Station
- Widening from two to four lanes from Loudoun County Parkway to the Dulles Greenway (2020)
- Widening from four to six lanes from Loudoun County Parkway to Rock Hill Road (2030)

Relationship to the Dulles Toll Road

Widening projects along Old Ox Road (Route 606) will improve access to the Dulles Greenway. Direct effects to the Dulles Toll Road are likely given that this is a major feeder route to the Dulles Toll Road.

Bi-County Parkway

The Bi-County Parkway is a proposed new arterial between Prince William and Loudoun Counties to the west of the Dulles Corridor that will connect Interstate 66 to Route 50. It will provide a north-south facility to the west of Dulles Airport. The project is controversial due to its route through the edge of the historic Manassas national Battlefield Park. Supporters of the project hope that it will relieve congestion in the region and provide an outer link for north-south travel in Northern Virginia.

Relationship to the Dulles Toll Road

Completion of the Bi-County Parkway, along with the rest of the "North-South Corridor," a Corridor of Statewide Significance (CoSS) as designated by the Commonwealth, could provide a link to the south from the Dulles Toll Road.

Information Sources

Dulles Metrorail Corridor Website - http://www.dullesmetro.com/

Fairfax County Tysons Corner Website and Comprehensive Plan Updates
http://www.fairfaxcounty.gov/tysons/

495 Express Lanes - https://www.495expresslanes.com/

Virginia Department of Transportation (VDOT) Northern Virginia Projects -
http://www.virginiadot.org/projects/northern%20virginia/default.asp

Loudoun County Countywide Transportation Plan - http://www.loudoun.gov/index.aspx?NID=1068

VDOT Bi-County Parkway Website - http://bicountyparkway.com/

Chapter 5: Conclusion

The Northern Virginia region is undergoing many major development and improvement projects to its corridors and activity centers, especially along the Dulles Toll Road Corridor. Two of the most critical projects in the region to the Dulles Corridor are:

- Metrorail Silver Line - Phase 1 opening in 2014 to Wiehle Avenue in Reston and Phase 2 opening in 2019 to Route 772 in Loudoun County
- Tysons Corner Urban Center Redevelopment—growth to 100,000 residents and 200,000 jobs by 2050

In addition to these major projects, the following are planned in the vicinity of the Dulles Toll Road Corridor:

- Over 50 constrained and unconstrained roadway widening or roadway projects
- 14 new or improved interchanges
- 5 large park-and-ride garages

These projects outlined in this document, will help to improve access to the Dulles Toll Road.