



# CAPITAL BELTWAY SOUTH SIDE MOBILITY STUDY

## PHASE 2

## FINAL REPORT

FEBRUARY 10, 2009

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**MARYLAND STATE HIGHWAY ADMINISTRATION**

**VIRGINIA DEPARTMENT OF RAIL AND PUBLIC TRANSPORTATION**

**MARYLAND TRANSIT ADMINISTRATION**



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# 1 Introduction

The Woodrow Wilson Bridge (WWB) is designed to provide 12 lanes: eight general-use lanes to match the existing I-95/I-495 configuration, two merging/diverging lanes, and two high-occupancy vehicle (HOV)/express bus/rail transit lanes. The lanes are configured in a divided local/express roadway system that allows for the physical separation of local and through traffic. The HOV/express bus/rail transit lanes—the 11th and 12th lanes—are designed with the physical and structural characteristics to allow their use either as roadway lanes restricted to HOV and/or buses or as a link in a rail transit line.

The WWB Project Federal Record of Decision (ROD) documents the decision to proceed with the design and construction of the preferred alternative identified in the 2000 Final Supplemental Environmental Impact Statement/Section 4(f) Evaluation.

The ROD states,

*The HOV/express bus/transit lanes would not be opened until connecting HOV/express bus/transit systems are in place within Maryland and Virginia and would not be used as general purpose lanes except for incident management and maintenance of traffic, where necessary.*

Decisions regarding future vehicular or transit use of the 11th and 12th lanes have yet to be made. In December 2008 the WWB fully opened to general purpose traffic and connecting express HOV/bus/transit systems are not in place and not planned in the near term within the proximity of the WWB. Existing HOV systems are in place and being planned in Virginia but there are no direct connections of these HOV facilities across the WWB. Initially, the 11th and 12th lanes will be used for incident management and maintenance of traffic in conformance with the ROD as stated above.

## **1.1 Purpose of the Phase 2 Market Analysis**

The Capital Beltway South Side Mobility Study (CBSSMS) Phase 2 market analysis addressed the longer-term use of the 11th and 12th lanes. The study provides descriptions of forecasted future trips across the WWB and how compatible they would be with different types of transportation improvements. This was a high-level analysis, starting with an identification of geographic markets and broadly defined transportation modes. The intention was to determine, based on data and assumptions in the currently adopted Metropolitan Washington Council of Governments (MWCOCG) travel model, where demand for travel in the vicinity of the WWB would exist, and what the characteristics of this travel would be.

The market analysis cannot provide all the information necessary to determine the most appropriate transportation improvements in the 11th and 12th lanes. This determination will require considerable effort to define specific transportation modes and technologies, routes, and physical facility designs. Extensive public involvement and thorough review by the many stakeholders will be needed to reach consensus

on these characteristics, and these efforts are beyond the CBSSMS scope, schedule, and resources.

Many previous studies have reviewed transportation improvements that would affect the use of the 11th and 12th lanes. Phase 1 of the CBSSMS catalogued 33 such studies. The Phase 1 report and interactive map can be viewed at [www.southsidecapitalbeltway.org](http://www.southsidecapitalbeltway.org). While the previous studies provide valuable technical information that will contribute to decision-making, none of them addressed all the alternative potential uses for the lanes, included the entire WWB project area, identified the regional geographic area from which users will come, considered all the relevant concerns, compared the alternatives in a systematic way, or provided for comprehensive public involvement.

Planning for the future use of the 11th and 12th lanes on the WWB cannot consider them in isolation but must instead take into account the WWB's connection to the Washington-area's existing and planned regional transportation system. The full WWB project covered by the ROD includes HOV/express bus/rail transit lanes on the mainline, beginning immediately west of Telegraph Road in Virginia, extending east across the Potomac River and just east of the MD 210 Interchange. Figure 1 shows the WWB's place as one link in this broader regional system. The WWB is one of the river crossings linking Maryland, Virginia, and the District of Columbia and carries trips that connect dispersed places in the three jurisdictions. The WWB is also a critical component of the national transportation system on the Eastern Seaboard, serving critical economic, commercial, social, recreational, and security functions. Decisions about the potential use of the 11th and 12th lanes must address this broad context.

Planning for the future use of the 11th and 12th lanes will also require greater definition of potential alternative improvements. Since the ROD was adopted, variations on the HOV theme have been advanced—high-occupancy toll (HOT) lanes are under construction on the Capital Beltway in Virginia, and express toll lanes (ETL) are being considered in Maryland. HOV/HOT/ETL operating policies and physical facility designs to allow compatible operations between Maryland and Virginia will need to be defined if they are to be considered for the 11th and 12th lanes. At the time of this study, these policies had not been formulated and the designs not yet created. In addition, potential transit projects have been planned in previous studies, but none has been formally accepted or adopted as the preferred solution, so alternative transit scenarios remain to be considered.

This market analysis utilized existing data in the Metropolitan Washington Council of Governments (MWCOC) Long Range Transportation Plan 2030 forecasts to assess potential markets for HOV and transit in the WWB market area.

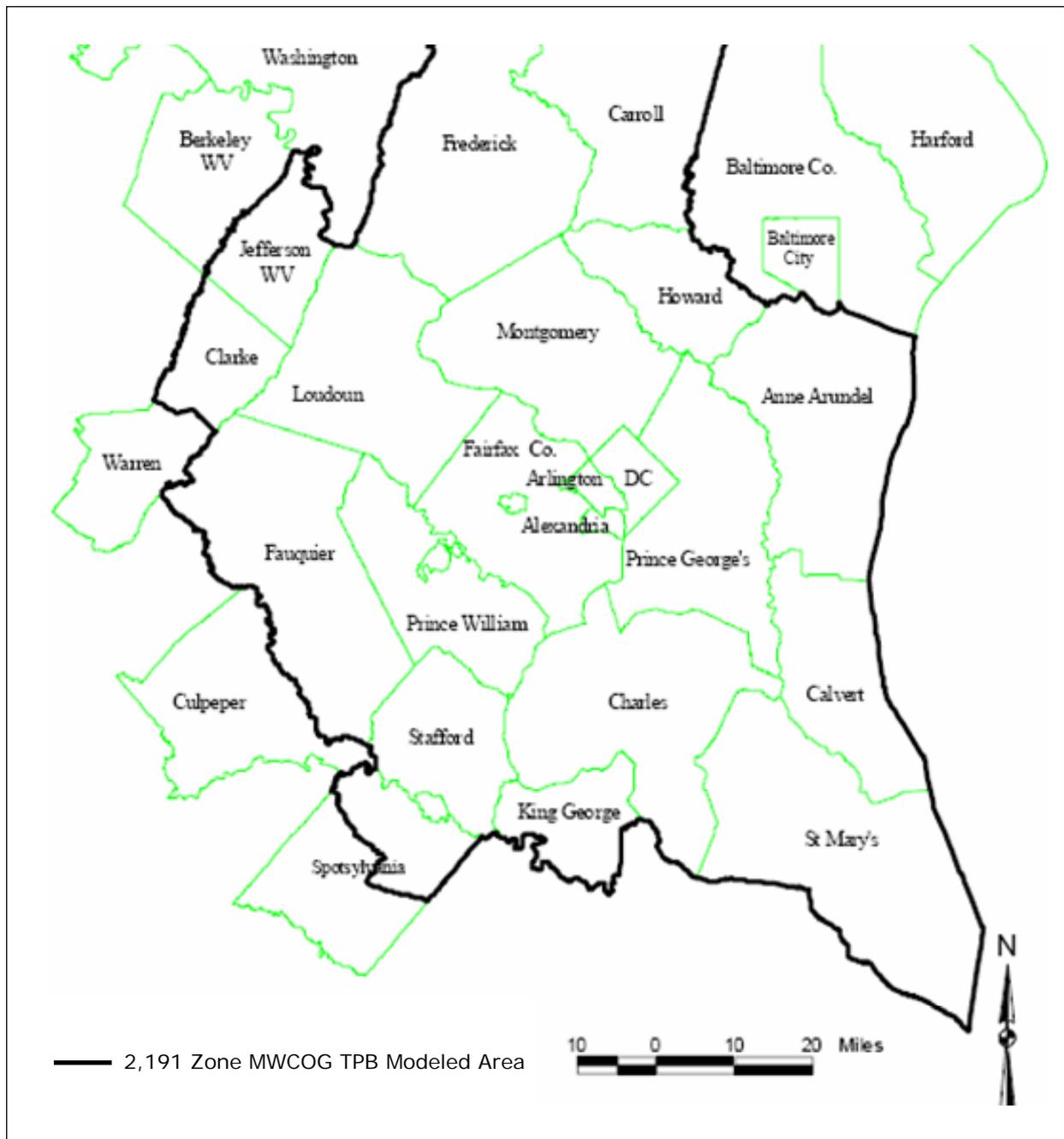
To assess the market for HOV use, the analysis compared forecasted travel volumes across the bridge with and without HOV facilities. The assumed characteristics with HOV are the same as those coded for the MWCOC's adopted Long Range Transportation Plan; that is HOV 3+. The assumed characteristics without HOV are the 10 lanes that initially will be open to local and express (general purpose) traffic.

To assess the market for transit services, the analysis considered three types of data related to the region's travel market:

- Person trips already forecasted to use the WWB,



Figure 2: MWCOG Modeled Area<sup>1</sup>



<sup>1</sup> Source: TPB Travel Forecasting Model, Version 2.2, Specification, Validation, and User's Guide, National Capital Region Transportation Planning Board, March 2008.

### **1.3 Land Use and Growth**

The MWCOG model makes use of base year and forecasted demographic data, including population, households, and employment by employment type. After meeting with MWCOG staff on February 4, 2008, it was decided to use the current MWCOG Model Version 2.2 (late February 2008 release) in forecasting the 2030 year traffic volumes. The MWCOG model is an aggregate, trip-based, four-step model simulating personal and commercial vehicle travel and was used without any post processing of the forecasted volumes. These demographic data are developed at the transportation analysis zone (TAZ) level. TAZs are the basic unit of analysis for modeling travel. The COG model breaks down the demographics into 2,141 internal TAZs,<sup>2</sup> defined to be roughly the same size in terms of total population and employment. The land use forecasts are referred to as “The Round 7.1 Forecasts” and are developed through a well-established cooperative, multijurisdictional process.<sup>3</sup> Round 7.1 was completed in fall 2007 and adopted by the Transportation Planning Board in January 2008. It reflects recommendations of the 2005 Base Realignment Closure (BRAC) Commission, as of August 2007.

Population and employment at the TAZ level are the key factors that influence travel. Density in population and employment is a key factor in supporting transit travel in particular, since the high volume of transit passengers must have easy access to transit stations at both their home and work. Furthermore, forecasted growth in population and employment density in a given geographic area provides an opportunity to adopt planning policies that encourage focused, dense transit-oriented development in areas where future transit facilities are planned.

Figure 3 shows the MWCOG forecasted population density in the central part of the region covered by the MWCOG model, and Figure 4 shows the forecasted change in population density in the same area by 2030.

Figure 5 and Figure 6 show forecasted 2000 employment density and 2030 growth in employment. These figures show a large growth in both population and employment east and west of the WWB. Regionally the MWCOG land use forecasts include the assumption of 3.2 million households and a population of 8.3 million people in 2030. They assume 344,000 zero-car households.

A contributor to the forecasted growth near the WWB is National Harbor, a development that includes 300 acres of residential, retail, dining, office, and entertainment space on the banks of the Potomac River just southeast of the WWB. National Harbor will have an impact on travel patterns in the vicinity of the WWB.

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<sup>2</sup> The model uses 2191 TAZs, of which 2141 are internal and 50 are external. Demographic data are not generated for external zones.

<sup>3</sup> See “Growth Trends to 2030: cooperative Forecasting in the Washington Region,” Fall 2007, COG Publication Number 20078315.

Figure 3: 2000 Population Density

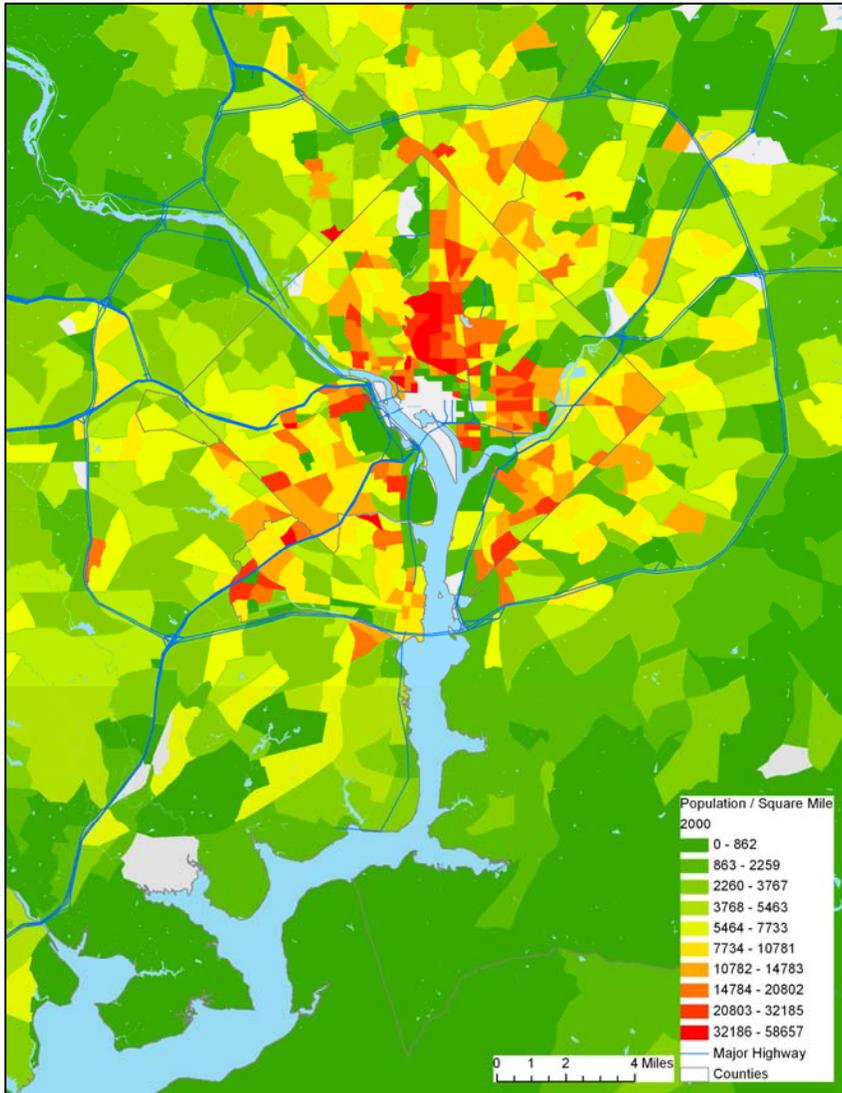


Figure 4: 2030 Change in Population Density

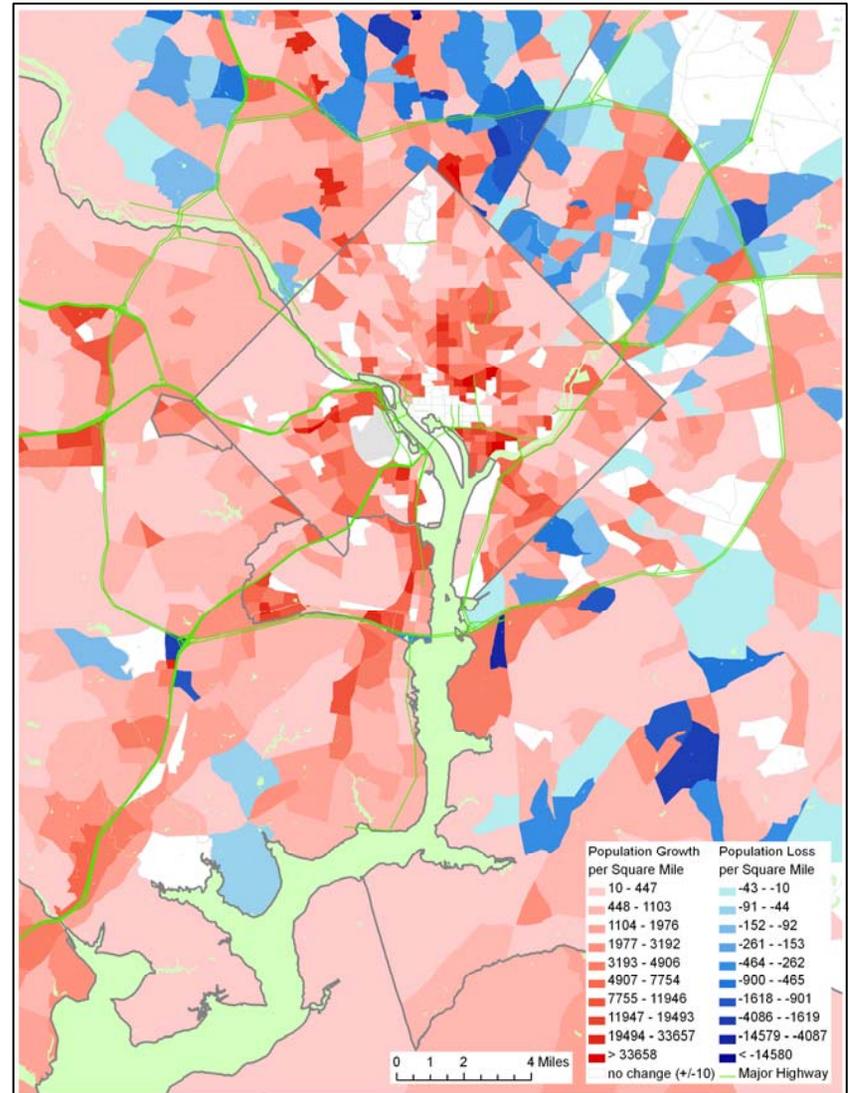


Figure 5: 2000 Employment Density

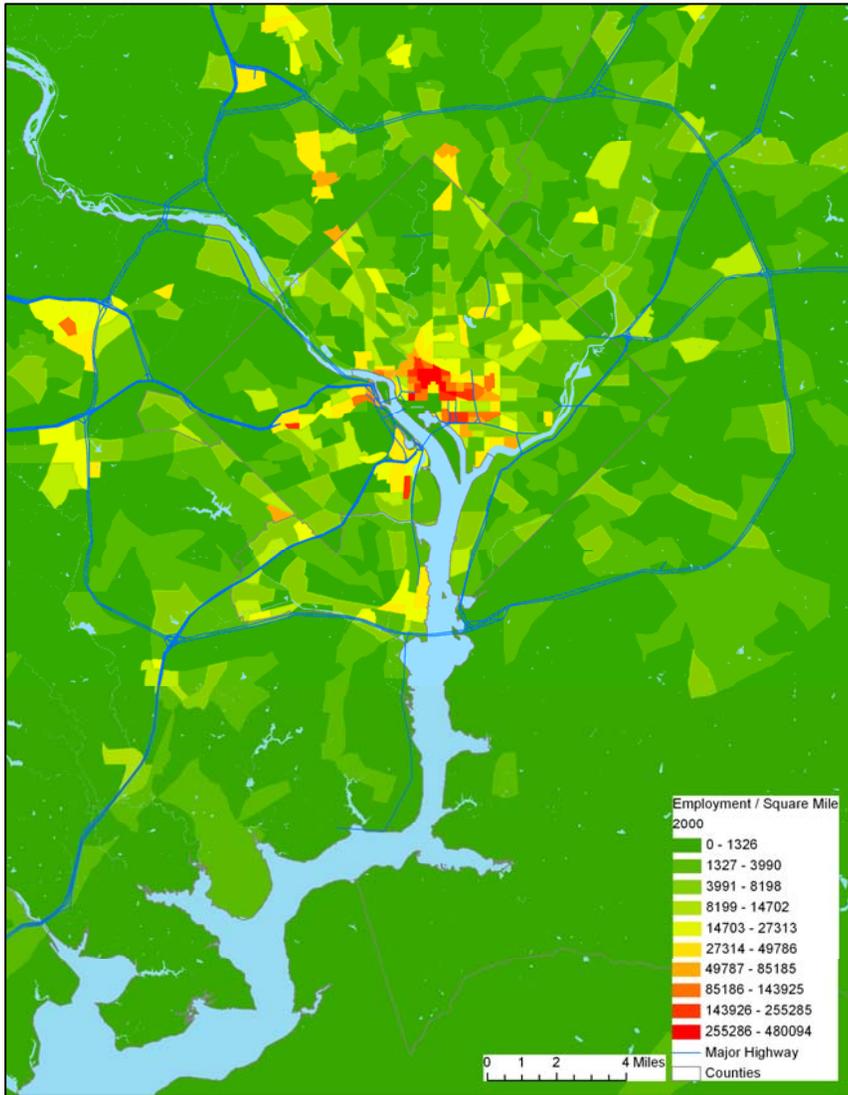
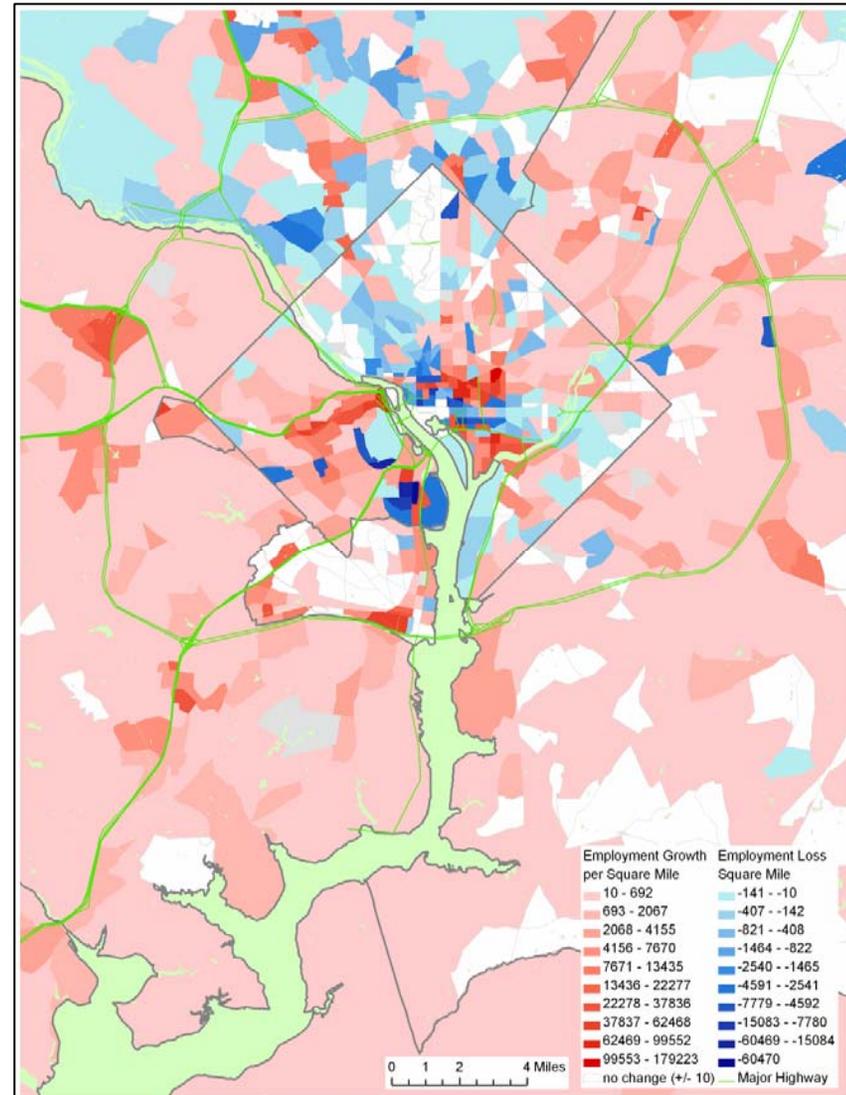


Figure 6: 2030 Change in Employment Density



## 1.4 Travel Characteristics

The MWCOG model forecasts 27.7 million daily vehicle trips regionally in 2030 and a regional transit share of 4.8% or 1.5 million transit trips. Of the 2030 daily home-based work trips, 13.9% are forecasted to be transit trips.

The long-range plan that is supported by the MWCOG model uses a 2030 horizon year, meaning that 2030 is as far into the future as the model can forecast. It also generates forecasts in three time periods: AM peak period (three hours), PM peak period (three hours), and off peak (all other times of day). The AM peak period is generally considered to be the period of the highest transit usage in most regions, and so the AM peak period for the 2030 horizon year was selected as the appropriate time frame for this analysis.

The WWB fully opened to general-purpose traffic in December 2008 with 10 lanes available for general-purpose and express use. The area reserved for the 11th and 12th lanes will be used for incident management and maintenance of traffic. To create a baseline for comparison in this analysis, the forecasted traffic flows on the WWB in the AM peak period were simulated by the MWCOG model for 2030 with this 10-lane configuration. Table 1 summarizes the results. A total of 33,900 personal vehicles with 44,000 passengers plus 8,900 commercial vehicles and trucks are forecasted to use the WWB in the morning peak period.

*Table 1: 2030 Baseline Forecasted Traffic on the WWB (AM Peak Period, 10-lane configuration)*

	Eastbound	Westbound	Total
SOV	11,900	13,800	25,700
HOV	3,100	4,500	7,600
Airport passengers (to and from airport)	300	300	600
Total personal vehicles	15,300	18,600	33,900
Total person trips <sup>4</sup>	19,100	25,300	44,400
Commercial vehicles (7% of SOV)	900	1,000	1,900
Trucks	3,800	3,100	6,900
Commercial vehicles and trucks	4,700	4,100	8,800
Total vehicles	20,000	22,700	42,700

<sup>4</sup> The MWCOG model assumes that HOV trips equal two person trips; HOV3+ vehicles equal 3.35 person trips.

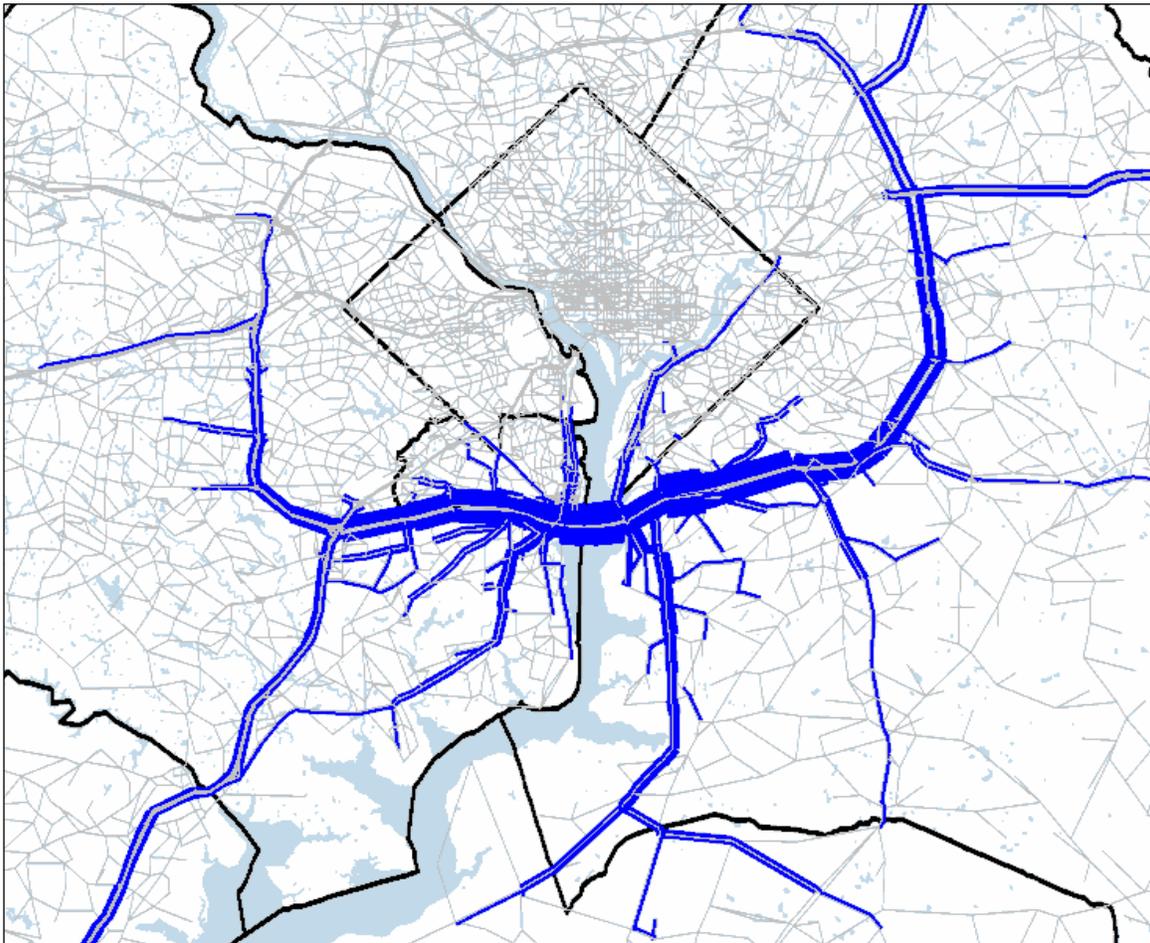
## ***1.5 Select Link Analysis and the WWB Market Area***

A select link analysis was used in this market analysis to identify the origins, destinations, and paths of person trips forecasted to use the WWB in the 2030 AM peak period. The purpose of a select link analysis is to focus on the trips on one link in the regional transportation network—in this case the WWB.

Figure 7 shows the select link volumes on the WWB and the accumulated total number of trips along the paths that are used to approach and exit from the WWB. The blue lines show only those trips that cross the WWB, and the thickness of the lines is proportional to the relative number of vehicles. Only links with more than 500 trips are illustrated here for clarity and to show clear patterns. The select link analysis reveals two main sources for traffic on the WWB:

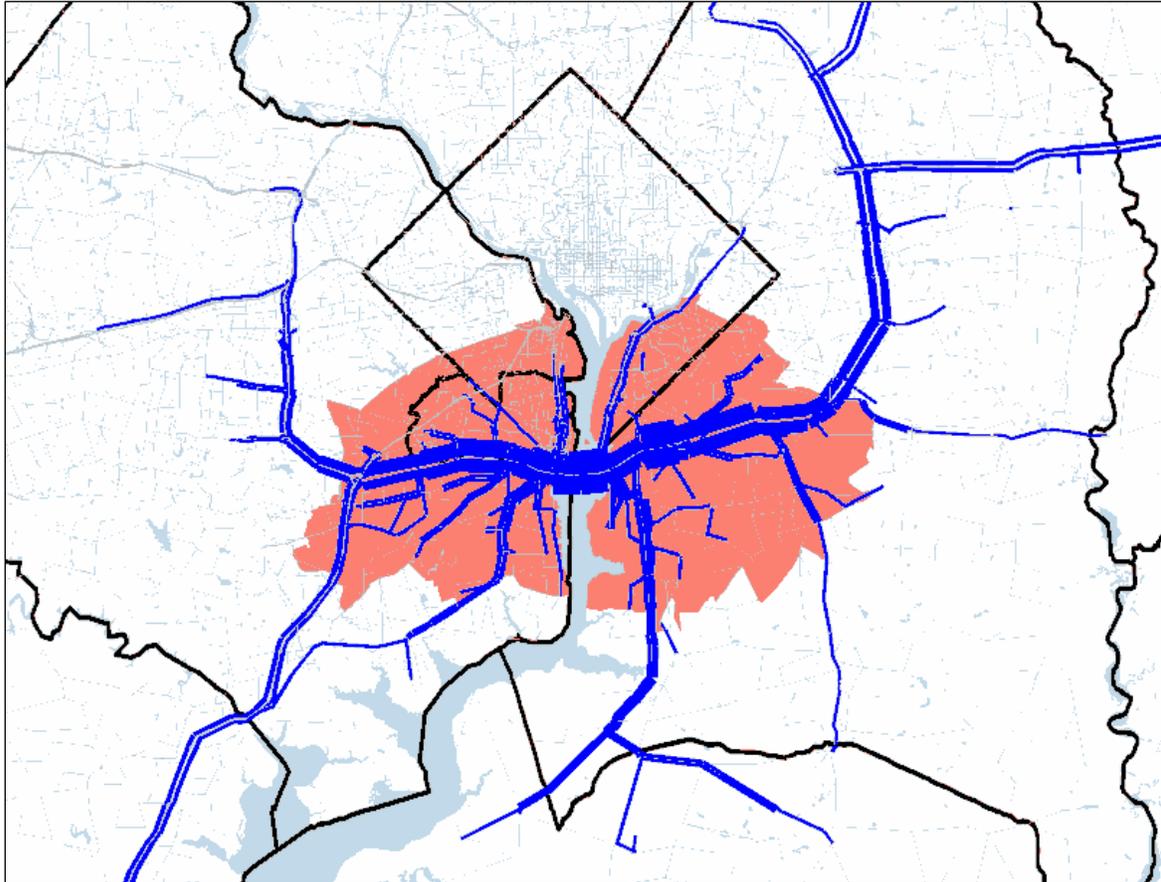
- Long-haul trips travel along the Capital Beltway using I-95 and I-495, and
- Trips from/to local zones in the immediate vicinity of the WWB, particularly downtown Alexandria and National Harbor.

*Figure 7: Select Link Volumes—2030 AM Peak Period*



The zones that are served by the WWB, as identified by the select link bandwidth plot in Figure 7, were identified as the market area for the analysis of transit potential. This market area is highlighted in Figure 8.

Figure 8: Market Area around the WWB



Based on the 2030 select link analysis of trips on the WWB, 18% of the vehicle trips have one or both ends outside the modeled region (Table 2). Twenty-eight percent of all trips on the bridge have both trip ends inside the WWB market area. These 11,900 vehicles represent drivers and passengers that are considered to be most likely to make use of any transit service crossing the bridge because they are going from and to places where demand for travel already exists that is *inside* the general geographic area.

Another 39% have at least one end in the WWB market area and one end in the larger model area. These 16,700 vehicles represent travelers who are less likely to use transit since one end of each trip is to/from locations that are widely dispersed and outside the market area. These are highlighted in the table below.

*Table 2: Geographic Patterns of Vehicle Trips Crossing the WWB in the AM Peak Period in 2030*

Travel Patterns	Vehicles	Portion of Total
Trips internal to market area	11,900	28%
Trips between market area and model area	16,700	39%
Model-area trips external to market area	7,800	18%
Trips between market area and external areas	1,700	4%
Trips passing through model area	4,600	11%
Total	42,700	

The remainder of the vehicles crossing the bridge carry travelers that are much less likely to be able to switch to transit because they are traveling great distances with neither end of their trip in the market area. Eleven percent of the vehicles are completely traversing the model area to/from somewhere south of the Washington region to/from somewhere north of the Washington region.

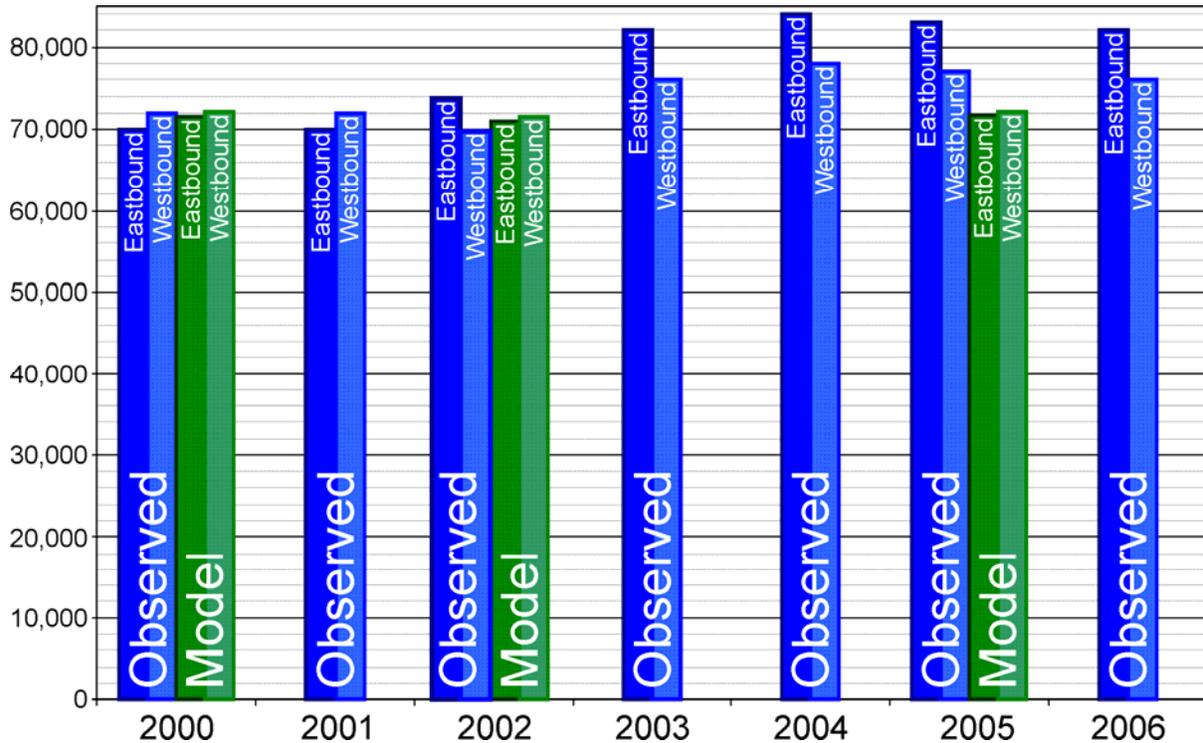
### **1.6 MWCOG Model Verification**

To verify that the MWCOG model is adequate for this localized analysis, estimated volumes on the WWB were checked against observed volumes. The MWCOG model was validated to a 2000 base year with a 2030 horizon forecast year, with several interim forecast years that were considered as well.

Observed volumes were taken from the Virginia Department of Transportation (VDOT) traffic data web site (<http://virginiadot.org/info/ct-TrafficCounts.asp>) in June 2008. The web site provides observed traffic volumes for the years 2000 to 2006. Estimated volumes were available from MWCOG for 2000, 2002, and 2005. Estimated volumes were not available from MWCOG for 2001, 2003, 2004 and 2006.

Figure 9 shows the results of this comparison. In the base year, for which the model is calibrated, the observed and estimated volumes are very close. In 2003 the observed data show an increase in volumes on the WWB, while the MWCOG model forecasted volumes remain relatively unchanged through 2005. However, the 2005 estimated volumes are within 10% of the observed, which is sufficient for purposes of this analysis.

Figure 9: Observed vs. Estimated Volumes on the WWB



MWCOG verified<sup>5</sup> that the land use assumptions in the MWCOG model include the full development of the National Harbor as well as secondary development surrounding National Harbor. From 2000 to 2030 population in the traffic analysis zone that contains National Harbor is forecasted to grow from 7,500 to 21,000 (280%) and employment is forecasted to grow from 1,800 to 14,000 (780%).

To determine whether the basic travel patterns change depending on the function of the 11th and 12th lanes on the WWB, the select link analysis was performed for three scenarios:

- 10 general-purpose lanes, maintenance of traffic/incident management
- 10 general-purpose lanes, HOV 3+ and transit in the 11th and 12th lanes
- 12 general-purpose lanes, with no HOV lanes (*Note: This select link analysis scenario was performed only to establish a baseline and is not being considered as a actual operating condition since it is precluded by the ROD.*)

The select link bandwidth maps for these three scenarios showed the basic person-trip distribution patterns to be similar.

<sup>5</sup> By phone conversation with Greg Goodwin of Metropolitan Washington Council of Governments on April 17, 2008.

This analysis focuses on AM peak-period data from the MWCOG model. Transit markets tend to be the strongest in the AM period and in the home-based work trip purpose. PM peak-period volumes are higher than AM peak-period volumes on the WWB. The difference is found in higher truck and external volumes and in non-work person trips. Home-based work person trips in the MWCOG model in the PM peak period are approximately equal to the AM peak-period person trips. The baseline forecasts illustrated in Table 1 show higher AM volumes in the westbound direction than in the eastbound direction. An analysis of PM volumes reflects the inverse of this pattern.

## 2 Potential for HOV

The potential for HOV was tested with a model run with the 11th and 12th lanes coded as an HOV facility as defined by the adopted MWCOC Long Range Transportation Plan, and as described below:

- Six lanes in each direction for five miles in each direction
  - General-use lanes: three in each direction
  - Express lanes: two in each direction
  - 11th & 12th lanes: HOV 3+ and transit eligibility
- Limits: west of Telegraph Road to east of Indian Head Highway
- Access/exit to or from HOV Lanes possible only at Richmond Highway interchange, with all interchange movements allowed

Table 3 shows the characteristics of the forecasted volumes on the WWB when HOV 3+ is provided. Compared to the baseline forecast with a 10-lane bridge, the HOV facility coded with the assumptions listed in Table 1 above provides an 8% increase in vehicle trips across the WWB in the AM peak period—to 46,000 from 42,700. Total person trips increase by 12% while personal vehicle trips increase by 9%. Congestion levels in the HOV lanes are forecasted to be at or below free-flow conditions in both directions.

The current analysis provides an insight into the order of magnitude of volumes that might be expected if HOV 3+ service is available on the WWB. However, the modeling and analysis performed in this Phase 2 effort is neither a comprehensive look at the entire region, nor is it a comprehensive evaluation of the appropriate managed lanes configuration (HOV 2, HOV 3+, ETL). Should the region choose to move forward with a more definitive modeling and analysis of managed lanes facilities, an extensive process of determining a set of alternatives with defined connectivity, configuration, and operational policies would be required.

*Table 3: 2030 AM Peak-Period HOV Traffic on the WWB*

	Total with 10 lanes (from Table 1)	Total with HOV in 11 and 12	Increase in Trips
SOV	25,700	27,300	6%
HOV	7,600	8,600	13%
Airport passengers (to and from airport)	600	900	50%
Total personal vehi- cles	33,900	36,800	9%
Total personal trips	44,400	49,800	12%
Commercial vehicles (7% of SOV)	1,900	2,100	11%
Trucks	6,900	7,100	3%
Commercial vehicles and trucks	8,800	9,200	3%
Total vehicles	42,700	46,000	8%

### 3 Potential for transit

The analysis of the market potential for transit considered three types of data related to the region’s travel market:

- Person trips already forecasted to use the WWB,
- Potential for improving the mobility of exiting transit riders, and
- Places near the WWB forecasted to have high population and employment densities.

#### 3.1 Person Trips Forecasted to Use the WWB

##### 3.1.1 Potential Transit Market Share on the WWB

One approach to identifying the potential for transit on the WWB is to assume that a percentage of person trips already forecasted to cross the WWB would be diverted from motor vehicles to transit. Detailed ridership forecasts cannot be produced, since an adopted plan for a transit line across the WWB does not exist. But assumptions about travel behavior will lead to some useful insight into the potential for transit on the WWB.

The MWCOC model forecasts a region-wide transit mode share for 2030 home-based work trips of 13.9%. For the purposes of this analysis, a potential transit market was estimated by assuming that the AM peak-period market-area-related traffic on the WWB is mostly home-based work trips and that a full 13.9% of these trips could be diverted to transit. Table 4 shows the results of applying the region-wide 2030 MWCOC mode share to the 2030 MWCOC forecasted AM peak-period person trips (from Table 1) within the WWB market area.

*Table 4: Average Transit Shares Applied to Person Trips Within the Market Area and on the WWB in the AM Peak Period in 2030*

	East-bound	West-bound	Total
AM Peak-Period Person Trips	19,100	25,300	44,400
Portion of Trips within Market Area—28%	5,300	7,100	12,400
Application of Regional Home-Based Work Mode Share—13.9%	700	1,000	1,700

This potential market share is not a ridership forecast. Actual transit ridership across the WWB would be highly dependent upon the system connections and operating characteristics of the transit line, and these attributes have not

been defined. As a result, the market analysis could underestimate the actual ridership potential to some degree. Also, some transit trips could begin or end outside the market area defined in this analysis. Greater density of land development within the market area could increase the total number of trips. The application of the regional transit mode share, however, could overstate the ridership potential, since the regional share reflects the high mode share for trips to the dense regional core.

Because the result of this market analysis is not a ridership forecast, it cannot be directly compared to ridership on existing or planned transit lines. Table 5 shows 2030 Metrorail ridership forecasted by the Washington Metropolitan Area Transit Authority (WMATA) on existing line segments near the WWB. These forecasts are for the AM peak hour, not the peak period. Metrorail AM peak-hour ridership is on average about 38% of the three-hour AM peak period, so the AM peak-hour WWB transit market share calculated in this analysis would be 38% of the 1,700 trips shown Table 4, which is in the range of 600 to 700 trips.

*Table 5: Forecasted AM Peak-Hour Ridership on Selected Metrorail Line Segments in 2030*

<b>Metrorail Line Segment</b>	<b>Forecasted Ridership</b>
Yellow Line, Huntington to Eisenhower	1,947
Yellow Line, Eisenhower to King Street	2,195
Blue Line, Van Dorn to King Street	2,989
Yellow and Blue Lines, King Street to Braddock Road	5,938
Green Line, Branch Avenue to Suitland	1,597
Green Line, Suitland to Naylor Road	3,072
Green Line, Naylor Road to Southern Avenue	3,998
Green Line, Southern Avenue to Congress Heights	5,703

Source: Washington Metropolitan Area Transit Authority

### **3.1.2 Travel on the WWB Between Key Zone Pairs**

A select link analysis was used to identify clusters of zones that are connected by travel across the WWB, potentially representing clusters or corridors of demand that could be connected with transit service. Goals for the select link analysis include:

- Identifying zones on opposite sides of the WWB that are already connected by the highest demand for travel across the WWB
- Determining whether a geographic pattern exists
- Identifying major attractors on each side of the WWB
- Determining the number of trips on the WWB that are forecasted to serve those attractors

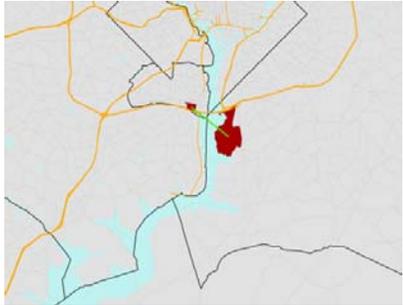
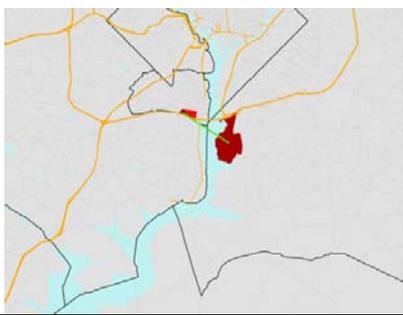
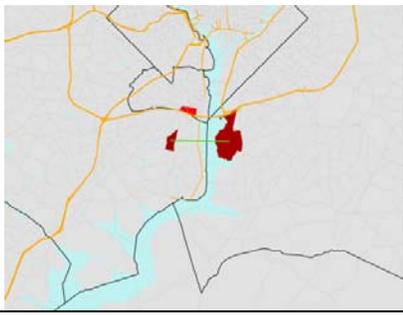
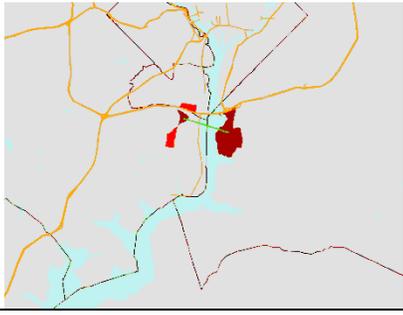
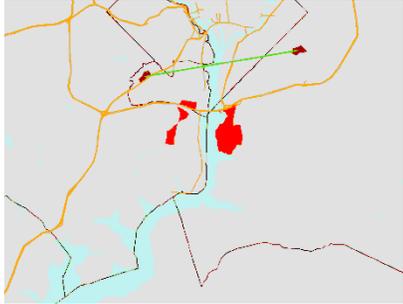
Using the select link analysis results, the origin-destination pairs with the most trips crossing the WWB were ranked from the highest to the lowest person trips across the WWB. For example, of all the trips that cross the WWB, 159 person trips (90 vehicle trips) originate in Zone 859 (National Harbor) and end in Zone 1365 (Downtown Alexandria). This is the zone pair that contributes the most of all zone pairs to the trips on the WWB.

The top 20 zone pairs are illustrated in a series of maps shown in Figure 10, continuing on the subsequent four pages. On each map, the zone pair with the next highest number of trips contributing to the vehicles on the WWB is highlighted in dark red and connected with a green line. The zone numbers of the zone pair with the next highest number of trips are shown in the box to the right of each map. Also in the box next to each map is the total cumulative number of estimated person trips crossing the bridge. These maps are ordered from highest number of trips to the lowest of the top twenty zone pairs.

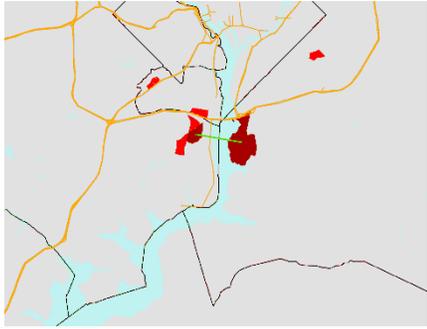
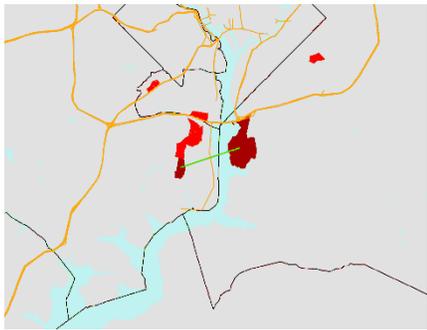
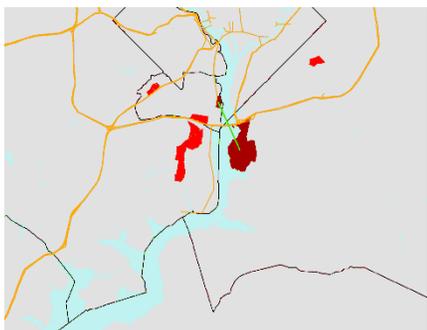
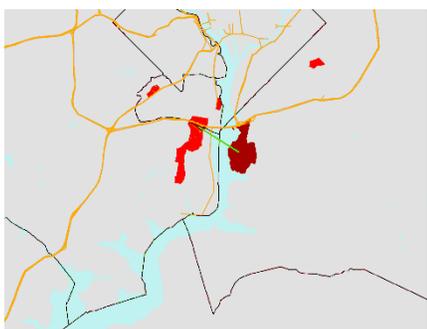
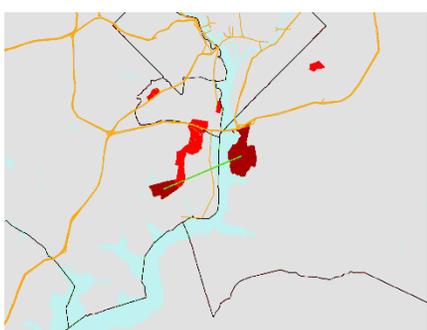
As additional zone pairs are added, two patterns emerge: 1) a corridor that connects the northern part of the Virginia side of the Potomac River with National Harbor and 2) a corridor that connects the southern part of the Virginia side of the Potomac River with National Harbor. Figure 11 illustrates the northern corridor, which represents 211 AM peak-period SOV trips across the WWB. Figure 12 shows the southern corridor, representing 566 AM peak-period SOV trips.

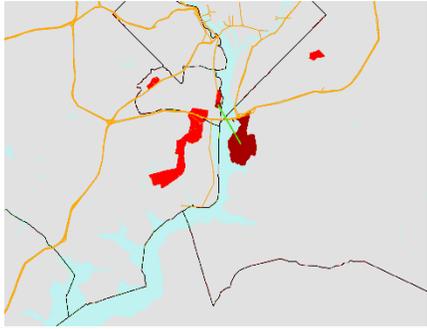
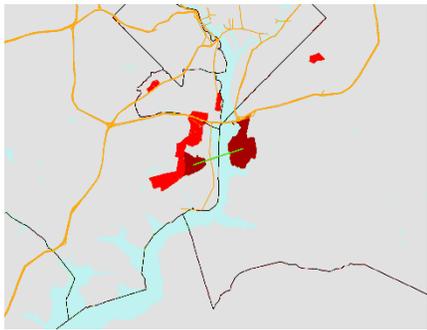
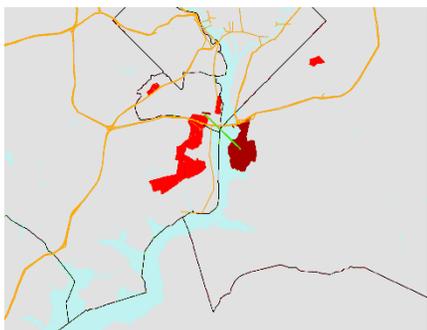
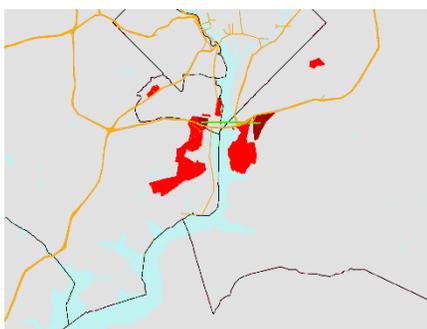
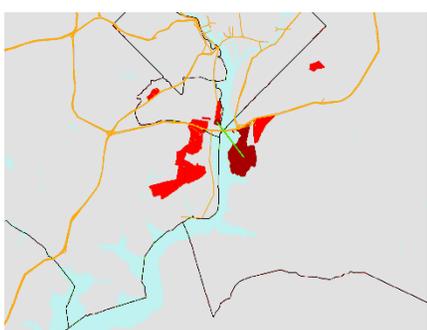
National Harbor clearly drives the demand for travel across the WWB in the local market area in 2030.

Figure 10: Pairs of Zones with the Most Trips on the WWB<sup>6</sup>

	<p>Zone Pair 1 (859-1365)</p> <p>159 person trips</p>
	<p>Zone Pair 2 (859-1366)</p> <p>306 person trips (cumulative)</p>
	<p>Zone Pair 3 (859-1471)</p> <p>420 person trips (cumulative)</p>
	<p>Zone Pair 4 (859-1468)</p> <p>510 person trips (cumulative)</p>
	<p>Zone Pair 5 (754-1387)</p> <p>595 person trips (cumulative)</p>

<sup>6</sup> Assumes an occupancy rate of 2.0 for HOV2 and 3.35 for HOV3+.

	<p>Zone Pair 6 (859-1470)</p> <p>676 person trips (cumulative)</p>
	<p>Zone Pair 7 (859-1472)</p> <p>758 person trips (cumulative)</p>
	<p>Zone Pair 8 (859-1330)</p> <p>832 person trips (cumulative)</p>
	<p>Zone Pair 9 (859-1469)</p> <p>894 person trips (cumulative)</p>
	<p>Zone Pair 10 (859-1551)</p> <p>958 person trips (cumulative)</p>

	<p>Zone Pair 11 (859-1331)</p> <p>1,020 person trips (cumulative)</p>
	<p>Zone Pair 12 (859-1474)</p> <p>1,082 person trips (cumulative)</p>
	<p>Zone Pair 13 (859-1340)</p> <p>1,140 person trips (cumulative)</p>
	<p>Zone Pair 14 (850-1365)</p> <p>1,199 person trips (cumulative)</p>
	<p>Zone Pair 15 (859-1332)</p> <p>1,250 person trips (cumulative)</p>

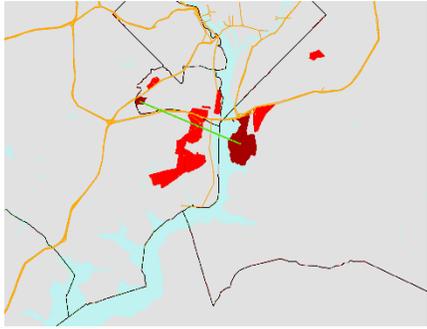
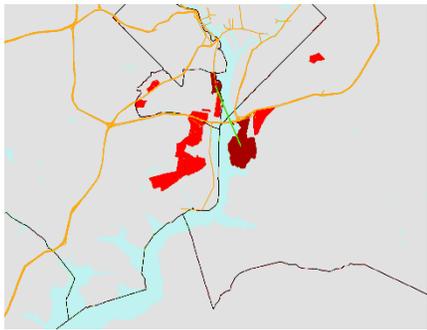
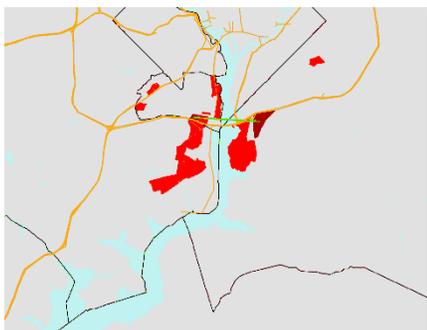
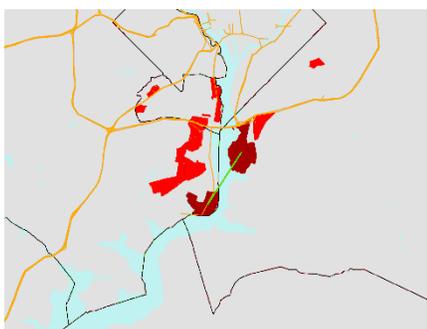
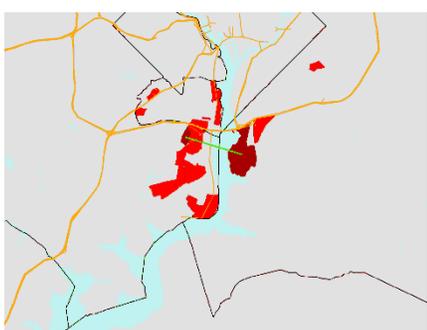
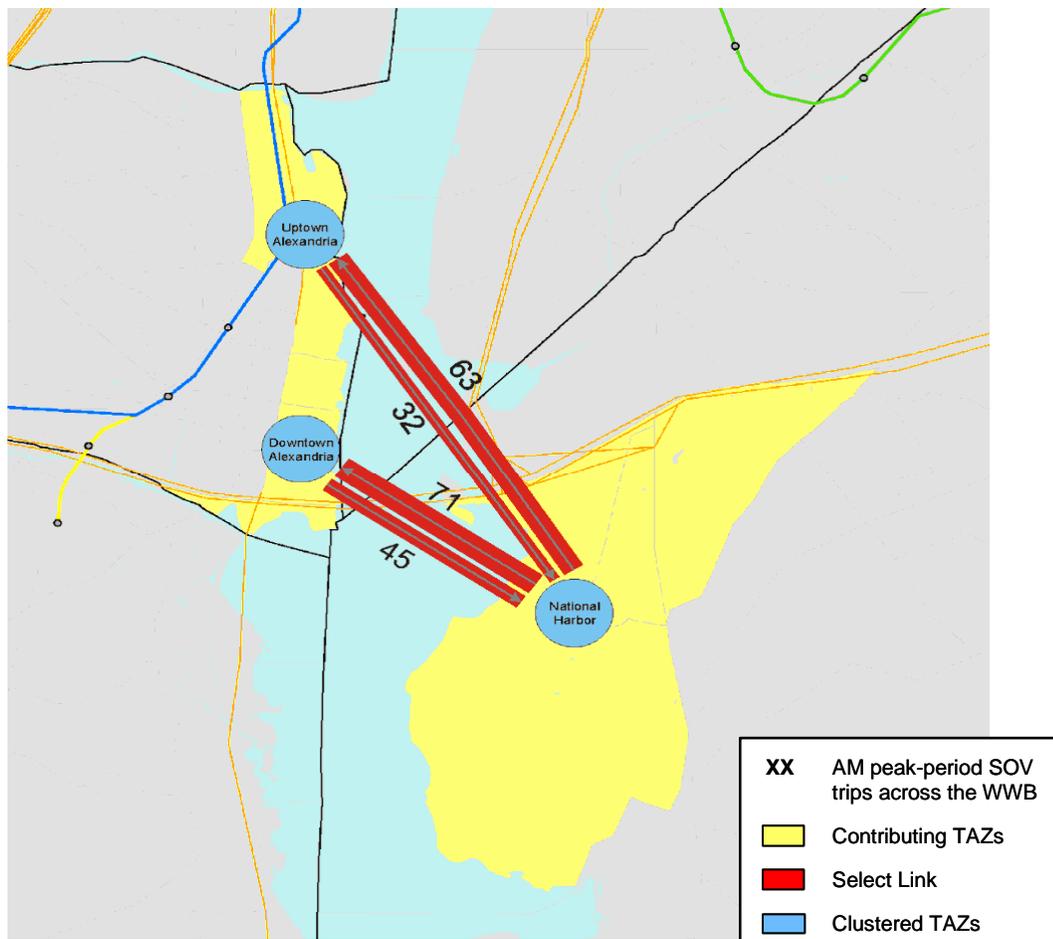
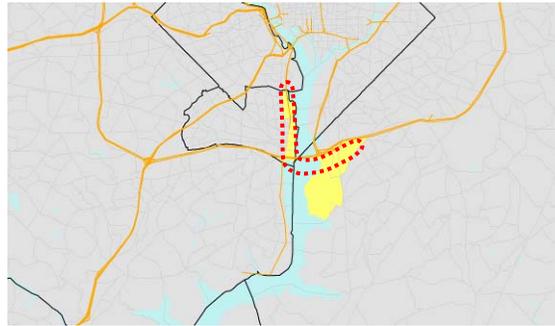
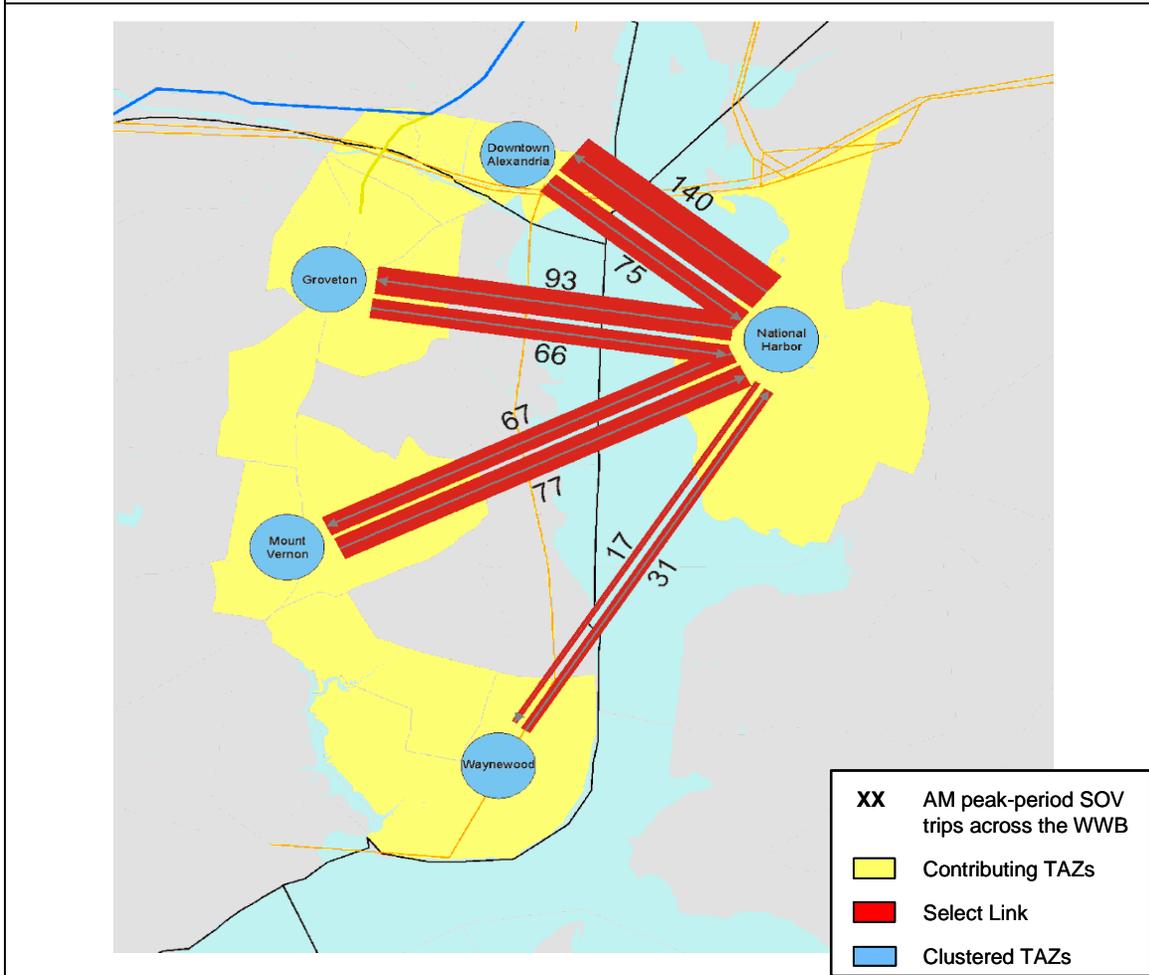
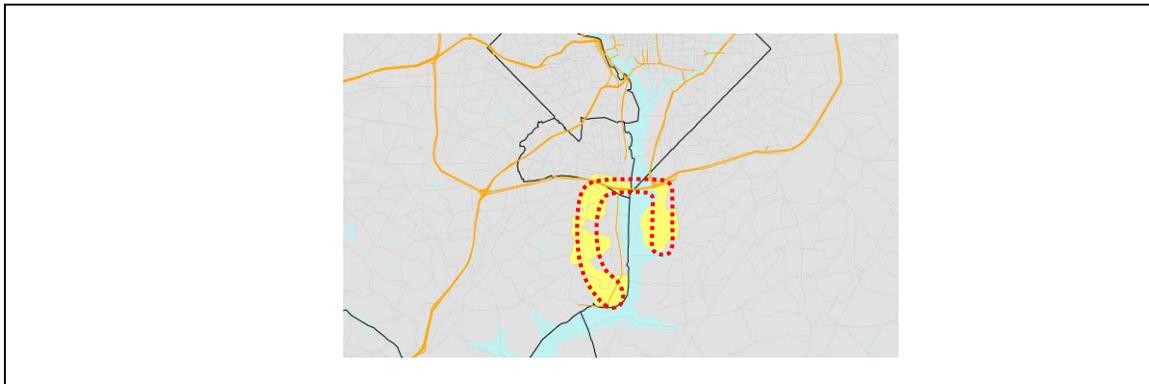
	<p>Zone Pair 16 (859-1376)</p> <p>1,301 person trips (cumulative)</p>
	<p>Zone Pair 17 (859-1359)</p> <p>1,351 person trips (cumulative)</p>
	<p>Zone Pair 18 (850-1366)</p> <p>1,399 person trips (cumulative)</p>
	<p>Zone Pair 19 (859-1556)</p> <p>1,445 person trips (cumulative)</p>
	<p>Zone Pair 20 (859-1480)</p> <p>1,489 person trips (cumulative)</p>

Figure 11: Virginia Side of the Potomac River to/from National Harbor, Northern Corridor



Number of zones connected	9
Current population	47,241
Current employment	42,800
Population growth 2000-2030	+22,336
Employment growth 2000-2030	+18,019
Assigned SOV trips via the WWB, 2030	211

Figure 12: Virginia Side of the Potomac River to/from National Harbor, Southern Corridor

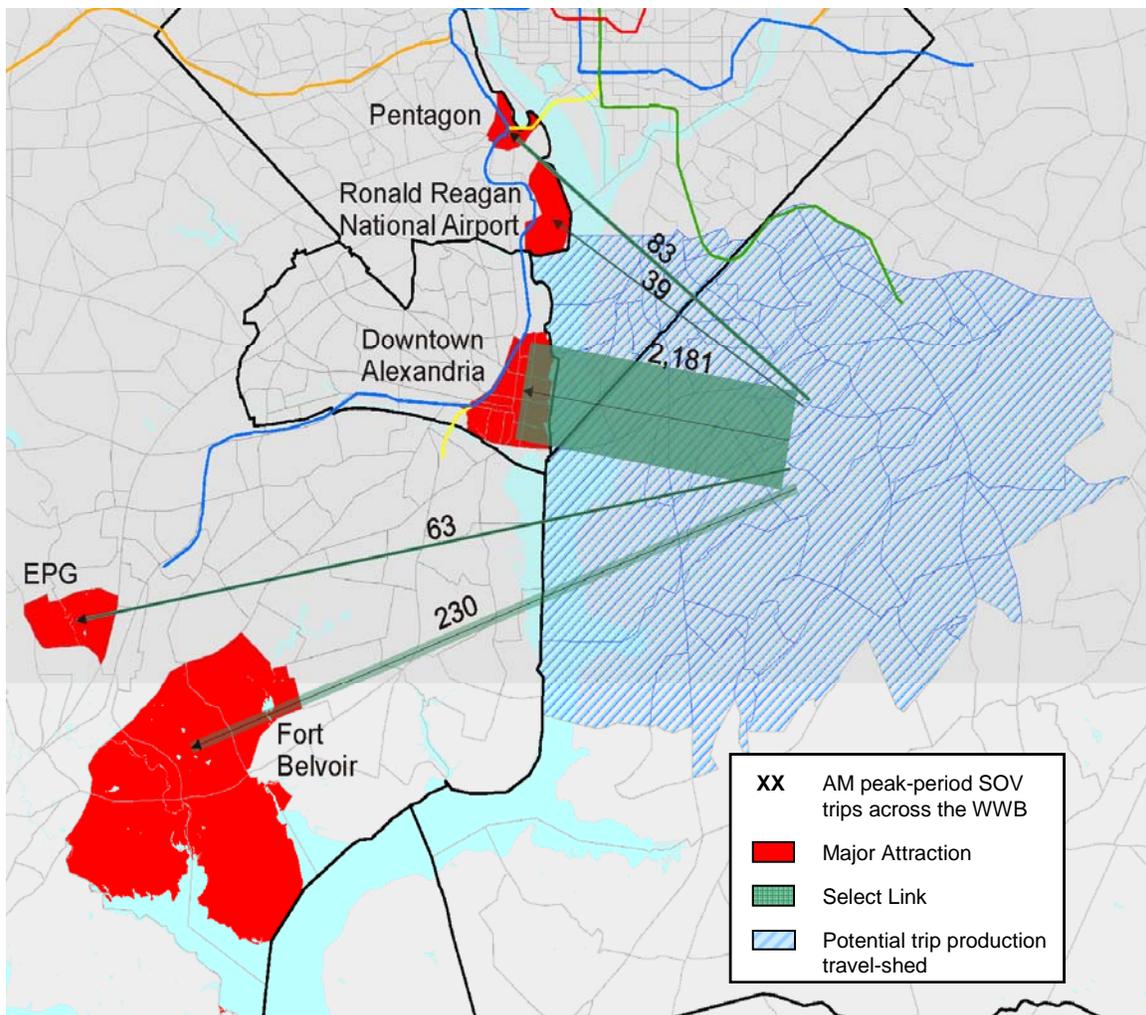


Number of zones connected	16
Current population	102,912
Current employment	63,219
Population growth 2000-2030	+39,981
Employment growth 2000-2030	+26,073
Assigned SOV trips via the WWB, 2030	566

### 3.1.3 Travel on the WWB to Key Attractors

Zone-to-zone trips across the WWB, as described in the previous section, represent a very localized production market for transit. In addition, there is a larger transit market of people who might drive to a park-and-ride lot or take a bus in order to access transit across the WWB to major trip attractors. Major employment attractors in a concentrated zone usually serve as the destination for trips in a more dispersed set of zones. Figure 13 and Figure 14 show the major attractions on the west and east side of the WWB respectively. The potential trip production travel-shed in each case is defined as that part of the market area that is on opposite sides of the WWB. The volumes show the number of SOV trips in the AM peak period.

Figure 13: Major Trip Attractions West of the WWB

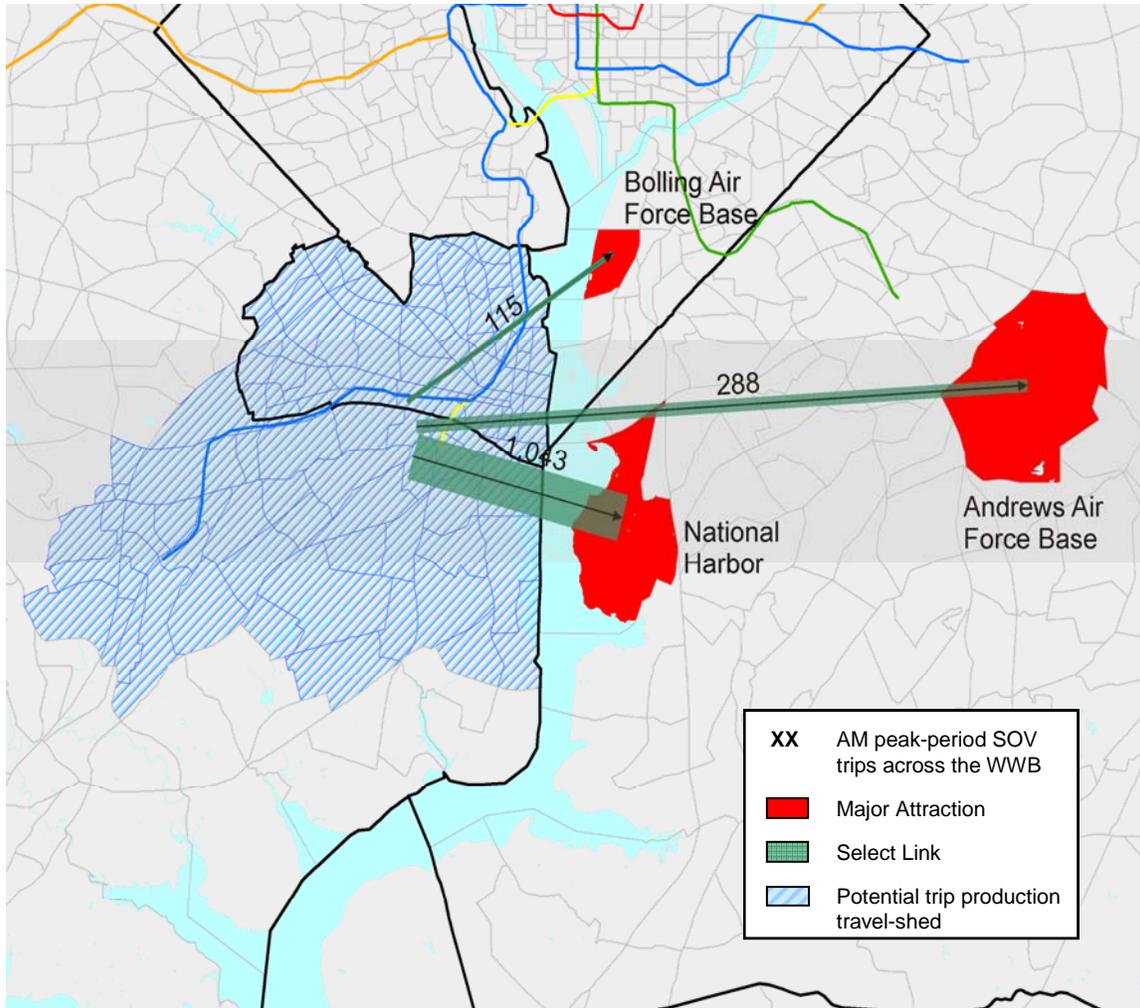


Five major attractors were identified on the west side of the WWB, as shown in Figure 13. Of these, only downtown Alexandria attracts a substantial number of vehicle trips from the eastern side of the market area across the bridge. The 2,181 SOV trips destined to downtown Alexandria from east of the WWB could translate into as many as 300 transit trips during the three-

hour peak period if the 13.9% region-wide transit share discussed in Section 3.1.1 above is to apply. Attracting 13.9% of these trips to transit may be difficult, as a many of these trips would rely on a drive-to-transit or bus-to-transit connection instead of walk-to-transit or transit-to-transit.

Figure 14 shows the major trip attractors on the east side of the WWB: Bolling Air Force Base, Andrews Air Force Base, and National Harbor. National Harbor again appears as a major contributor to trips on the WWB. The MWCOG model 2030 forecasts show 288 SOV trips assigned from the western side of the market area to Andrews Air Force Base.

Figure 14: Major Trip Attractions East of the WWB



### 3.2 Potential to Improve Mobility for Existing Riders

The analysis above in Section 3.1 identifies person trips already forecasted to be on the WWB in 2030 and assumes that some proportion of these trips are candidates for shifting from autos to transit, without identifying the type of transit or service levels. A new transit facility could also draw new riders from

existing transit lines into the corridor and across the WWB if the new facility provided time savings for the existing trips. This study approximates the size of this market, identifying transit users that are not currently using the WWB but who might be expected to shift to transit service on the WWB if it were available.

### **3.2.1 Potential Improvement for Metrorail Riders**

Some travel time savings for existing Metrorail riders are possible if a new transit link were to make a connection between the Yellow/Blue Lines and the Green Line. To identify this market, WMATA fare gate data for 2005 were used to identify by station the number of riders that board on one side of the WWB and alight on the other side.

Four potential connections were considered including:

- King Street (Yellow/Blue line) to/from Congress Heights (Green line),
- King Street (Yellow/Blue line) to/from Southern Avenue (Green line),
- King Street (Yellow/Blue line) to/from Suitland (Green line), and
- King Street (Yellow/Blue line) to/from Branch Avenue (Green line).

Figure 15 illustrates these four potential connections. The alignments for these potential connections are not actual routes, but rather generally defining the links between the connections and points on the WWB. The potential connections and the alignments were created to accomplish this time savings analysis. A connection to Naylor Road was not considered, as the number of passengers boarding and alighting at this station is much smaller relative to the other stations and it would be an extension along the same alignment as the connection to Southern Avenue. The numbers in Figure 15 show the number of passengers boarding and alighting at each station who would save travel time if the line existed. Estimated distances for the potential connections are as drawn on the maps in Figure 15. The four potential transit connections are all shorter alignments between the stations on the Blue/Yellow and Green Lines. Estimating the number of additional riders attracted by a new potential transit service is beyond the scope of this study.

Boardings and alightings from the WMATA fare gate data and station-to-station distances were tabulated to determine average distances and total number of riders from each key station on either side of the WWB. Applying an average Metrorail speed of 35 mph, the estimated total minutes saved during the AM peak period for cross-bridge transit trips is estimated (see Table 6).

The data in Table 6 are based on 2005 observed data. The MWCOC model reports a 47% increase in transit trips between 2005 and 2030, so time saving, in 2030 could be greater than shown in Table 6.

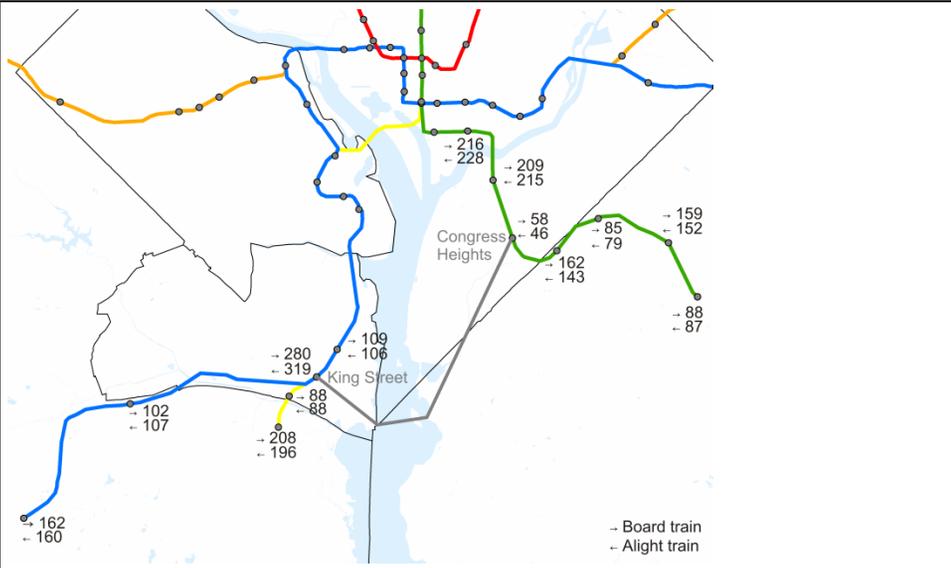
This assessment shows an average time savings for an individual of 5.7 to 8.3 minutes per person per trip. The alignment for these potential lines, the number of stations, dwell times, operating headways and the ease of transit

access, egress, and transfers all would affect and could diminish the total travel time savings shown here.

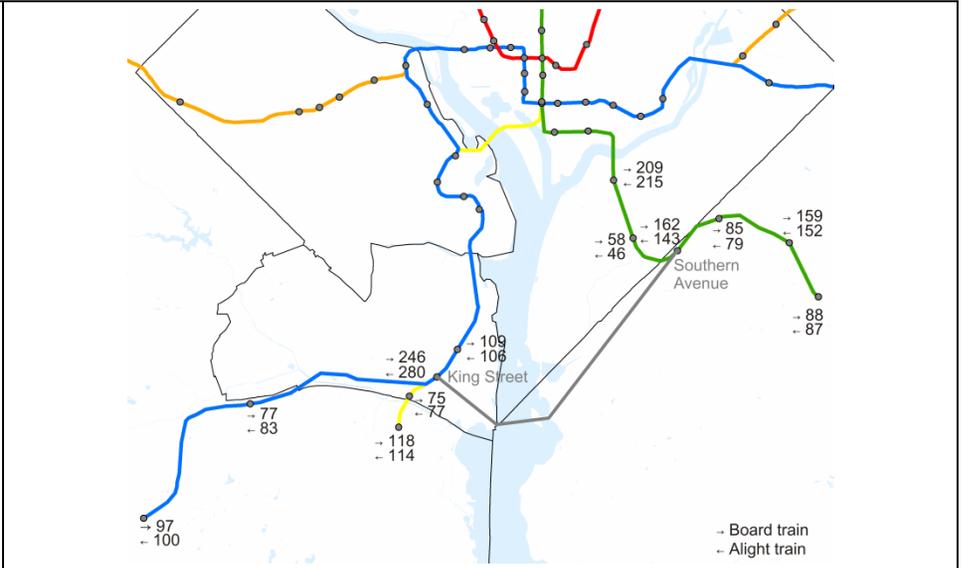
*Table 6: Potential Mobility Improvements with New Connection (based on 2005 data)*

King Street to/from:	Total Riders Saving Travel per Day	Avg. Miles Saved/Rider	Total Person-Miles Saved per Day	Avg. Minutes Saved/Rider (at 35 mph)
Congress Heights	1,925	3.30	6,353	5.7
Southern Avenue	1,481	4.41	6,531	7.6
Suitland	954	4.53	4,322	7.8
Branch Avenue	714	4.84	3,456	8.3

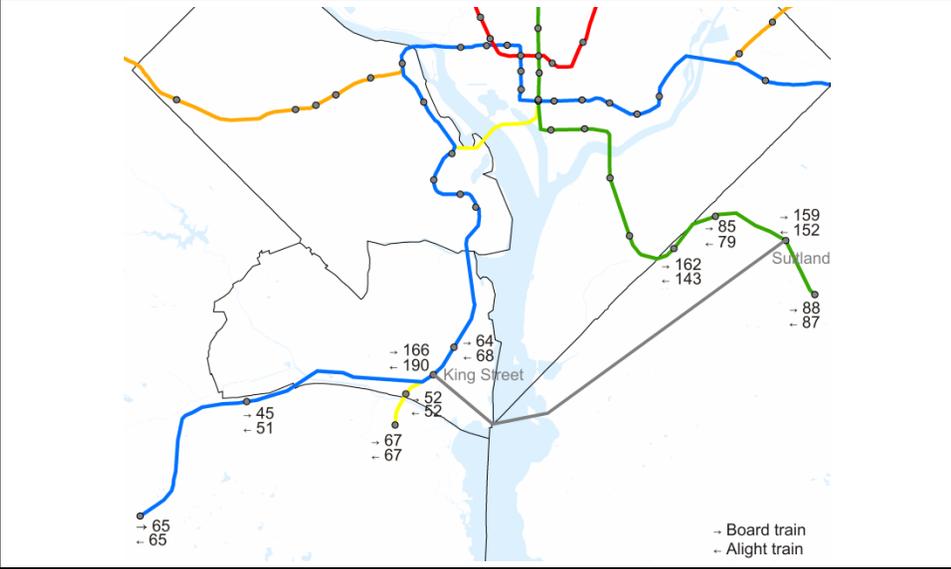
Figure 15: Potential New Transit Connections with Daily Boardings and Alightings that Could Reduce Travel Distance



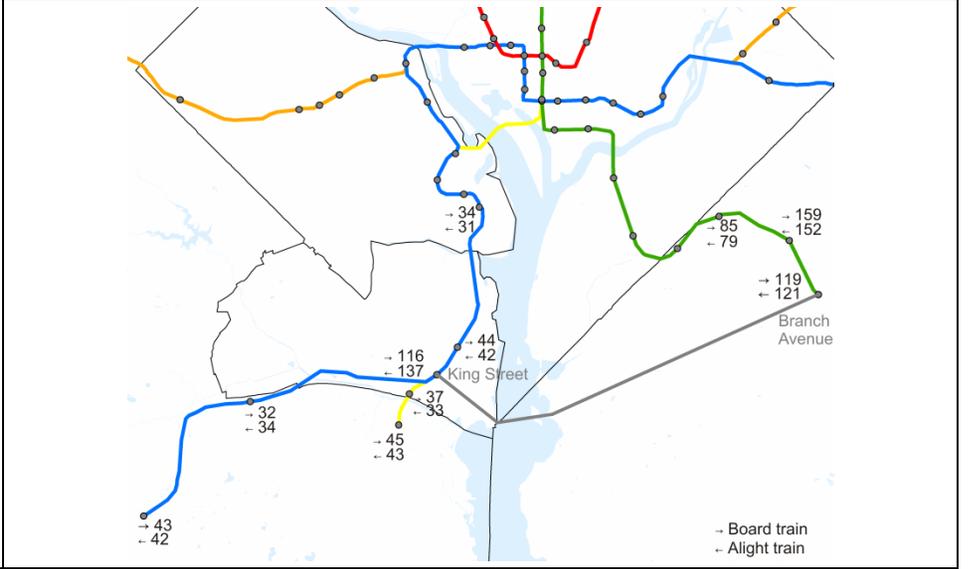
King Street to Congress Heights



King Street to Southern Avenue



King Street to Suitland



King Street to Branch Avenue

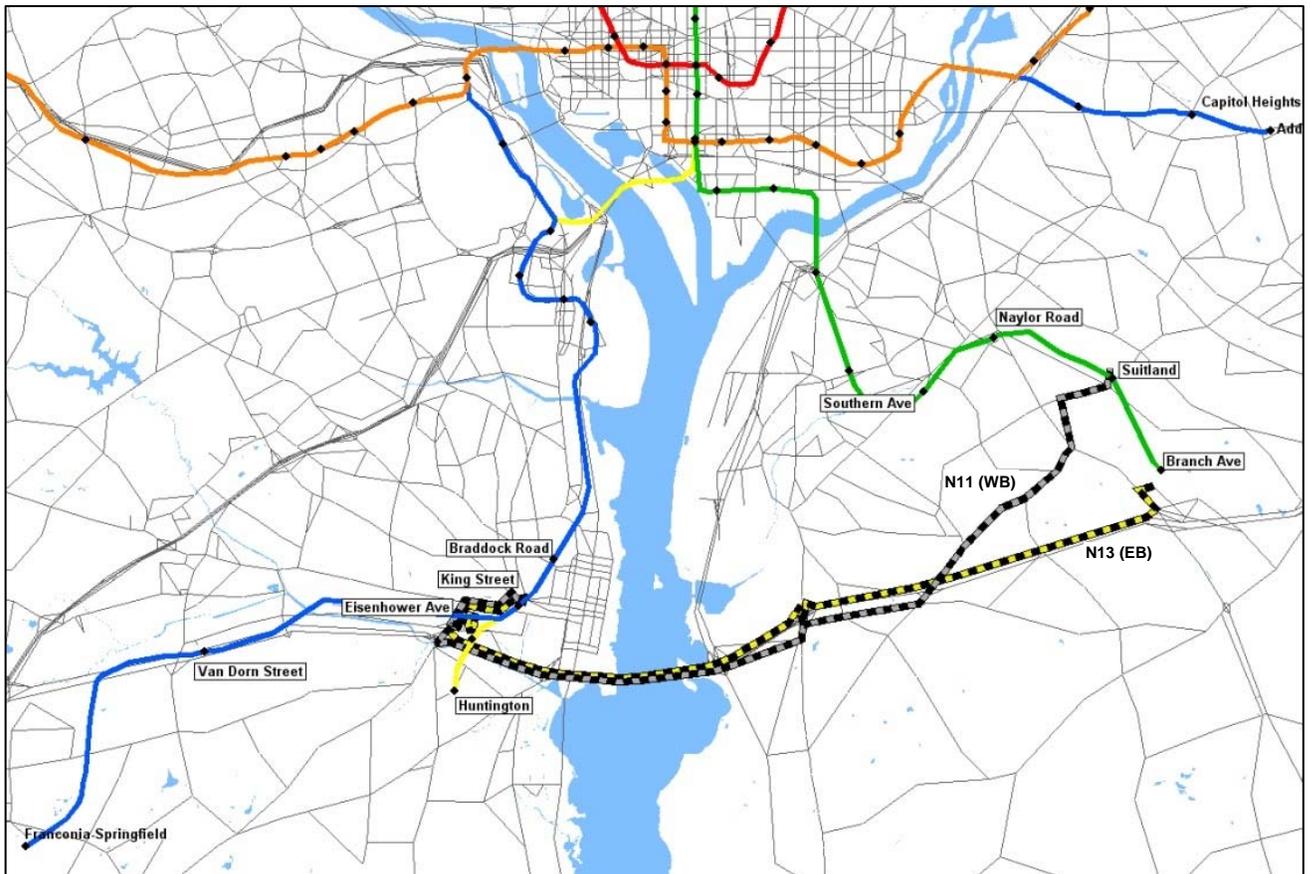
### 3.2.2 Forecasted Bus Route Ridership Across the WWB

Version 2.1 of the MWCOG model included two local bus routes on the WWB in 2030. Figure 16 shows these bus routes and their connections to the Metrorail system. The bus service was coded to run in the general-use lanes since access to local roadway systems is not possible from the express lanes within the proximity of the WWB. These bus routes are not included in the MWCOG model Version 2.2 and are not currently programmed in the MWCOG Long Range Transportation Plan.

Forecasted ridership on these bus lines could offer insight into the potential market for public transit on the 11th and 12th lanes of the WWB. The MWCOG model, however, does not yet allow for transit assignment except with a Transit Component Post Processor. This post processor is not a part of the officially adopted model set but is used by WMATA and other project sponsors to provide transit assignment.

Table 7 summarizes the forecasted ridership volumes as estimated using the Transit Component. The table shows approximately 150 person trips in each direction across the bridge during the AM peak period. These routes are assumed to have 30 minute headways, meaning one bus every 30 minutes, with an average of 25 passengers.

Figure 16: Bus Routes in Previous WWB Planning for 2030



*Table 7: Forecasted 2030 AM Peak-Period Ridership on Bus Routes Across the WWB*

Bus Line	Distance, miles	Network time, minutes	Transit time, minutes	Network speed, mph	Transit speed, mph	Total transit boardings on route	Total transit person trips on WWB
N11 (WB)	11.8	23.0	44.0	30.9	16.1	200	142
N13 (EB)	12.2	27.5	27.0	26.5	27.0	242	151

### **3.3 Places Where New Transit Potential May Exist**

Areas forecasted to experience significant growth and that are expected to have dense development in 2030 may represent opportunities for new transit systems. To determine where these areas may exist, the density of development in zones in the market area was compared to the development densities of zones near existing Metrorail stations.

The population density and employment density for market-area zones and for zones close to existing Metrorail stations was taken from the COG model inputs. Figure 17 shows that some zones in the market area are forecasted to have population densities in the same range as zones that are currently served by Metrorail. Some but not all of these zones are close to existing Metrorail stations. Areas such as western Alexandria, Fort Ward Heights, Groveton, Arlandria, Blue Plains, and Washington Highlands show population densities similar to zones that are close to Metrorail stations outside the market area but are not already immediately adjacent to Metrorail service. Of these areas, western Alexandria, Groveton, and Washington Highlands are forecasted to experience extensive growth (see Figure 4).

Figure 18 shows 2030 employment densities. Again, many of the zones in the market area show forecasted densities that are similar to the employment densities of zones that are close to existing Metrorail stations. Bailey's Crossroads, Fort Ward Heights, Beauregard Street, Fort Belvoir, Groveton, South Alexandria, Bellevue, Bolling Air Force Base, and Old Branch Avenue are locations not immediately adjacent to existing Metrorail stations that would show high employment density. The areas around Bailey's Crossroads and North Beauregard Street in western Alexandria also show substantial employment growth (see Figure 6).

While this shows that there are some zones in the market area that are not currently served by Metrorail and that have densities in population and/or employment that rival zones that are served by Metrorail, caution must be exercised in interpretation. Densities alone are not the only attribute that support transit. All stations along a route are served in different ways and contribute to the viability of the overall route. In addition, the length of the trip, the types of employment, and characteristics of the population will contribute to the viability of a potential route.

Figure 17: Population Densities in the Market Area and Near Metrorail Stations

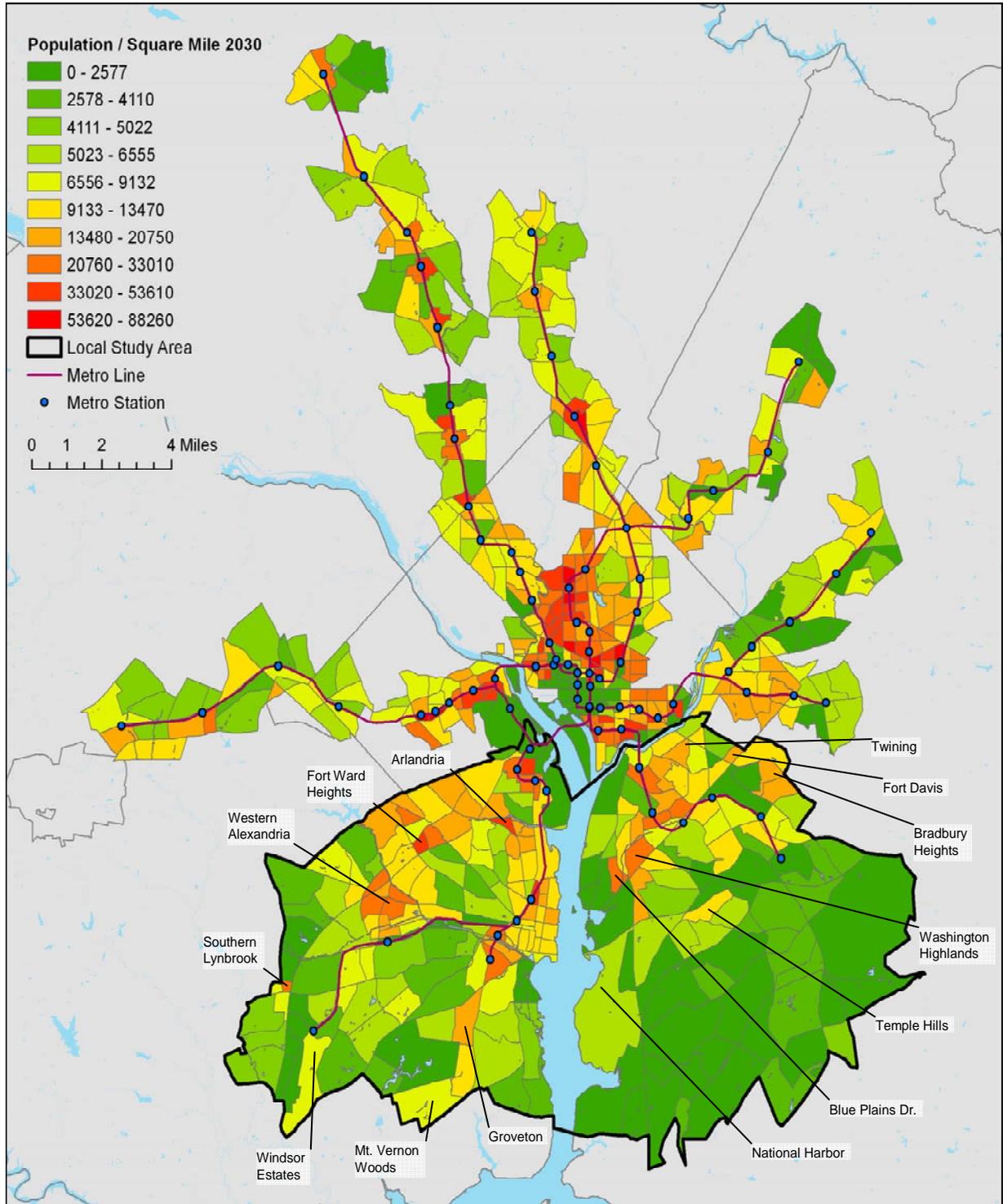
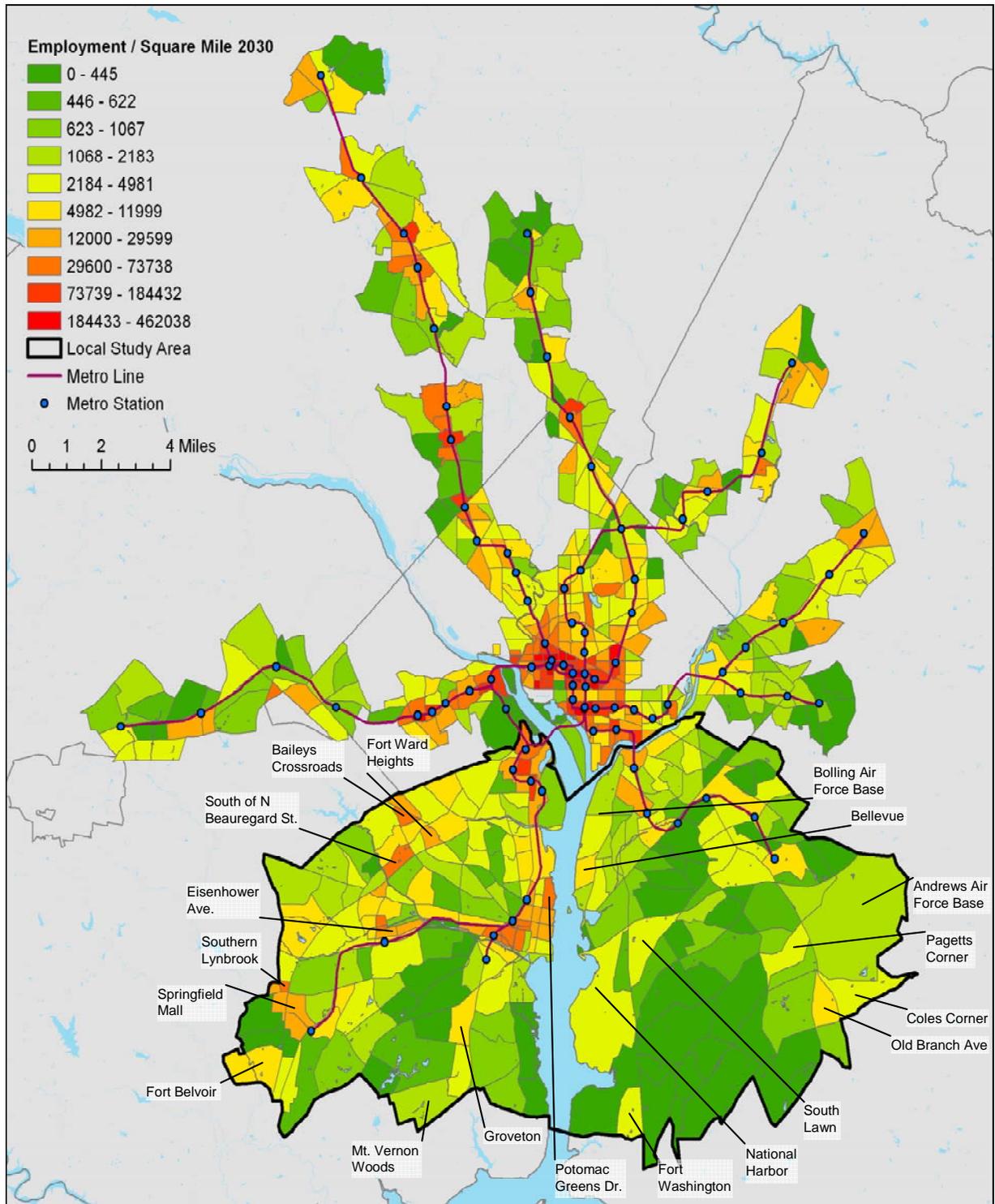


Figure 18: Employment Densities in the Market Area and Near Metrorail Stations



# 4 Summary of Findings

The Capital Beltway South Side Mobility Study Phase 2 Market Analysis provides information regarding the potential use of transit and/or HOV facilities across the WWB. The following summary was jointly prepared and is supported by both by the Virginia Department of Rail and Public Transportation and the Maryland Transit Administration:

### Transit Demand

- There is demand for transit across the WWB.
- The greatest transit demand across the WWB would be created in a market area that is relatively close to the bridge, especially National Harbor and downtown Alexandria. The highest demand would be in two corridors connecting to National Harbor, one connecting to the northern west bank of the Potomac River and the other to the southern west bank. Other nearby major trip generators, such as the military facilities in both Maryland and Virginia, would also contribute to transit demand.

### HOV/Managed Lanes

- There is demand for HOV facilities on the WWB.
- Actual HOV demand could vary depending upon the extent, design, and operating characteristics of the HOV facilities and the connecting facilities on both sides of the bridge. The physical characteristics and management strategies of potential HOT and/or ETL facilities on or near the bridge could affect HOV demand. Decisions about these characteristics and strategies have not yet been made.
- Transit and HOV facilities are not mutually exclusive and there is demand for both. Any HOV facilities should be designed for access and egress for bus stations and locations where bus service can originate and serve.

### Land Use

- Forecasted 2030 land use patterns in the market area are similar to those near existing Metrorail stations, which indicates that a rail facility across the WWB could potentially be considered along with other transit options.
- The growing land use and transit demand in the corridor and the level of development in the area should be continually assessed so that the feasibility and staging of the various transit scenarios are considered at the appropriate time.

## FTA Process

In the future if land use patterns materialize and as they change to reflect the 2030 forecasts, under the current FTA process an Alternatives Analysis would need to be conducted to determine the appropriate transit service for this corridor. Such a study should be a broad and detailed analysis of the comparative benefits of the potential alternative uses, and it should be conducted in an open process with ample opportunity for public review and discussion.

An alternatives analysis should:

- Define the potential for using the 11th and 12th lanes as transit/managed lanes. This analysis should define appropriate lane-management strategies—transit, HOV, HOT, ETL—and determine how and where to connect transit/managed lanes.
- Assess alternative potential transit improvements, including buses on HOV lanes, dedicated BRT lanes, Metrorail, and other rail options.
- Assess the financial feasibility of transit options and identify federal, state, and local funding options for capital and operating expenses.
- Comply with Federal Transit Administration New-Starts policies and procedures and National Environmental Policy Act requirements.
- Foster public consensus on study results by including broad public involvement. The WWB has many stakeholders; they must be at the table when decisions are made about the 11th and 12th lanes.