MOBILITY ASSESSMENT REPORT

FEBRUARY 2017

MONTGOMERY COUNTY PLANNING DEPARTMENT

Table of Contents Page

Executive Summary *9*

Components and Sources of Data 9

Summary of Findings........ 9

Key Terms and Definitions 10

Roadway Congestion 11

Intersections........ 12

Bicycle and Pedestrian 12

Public Transportation 12

Introduction *14*

Transportation Trends 14

Changes in the Transportation Industry 15

Roadway Mobility Analysis........ *17*

County Overview........ 18

Summary of Roadway Conditions in 2015 20

Congestion Trends 20

Aspen Hill and Olney Vicinity........ 21

Norbeck Road (MD-28) from Baltimore Road (northernmost intersection) to MD-182 22

Georgia Ave (MD-97) from Aspen Hill Rd to Brookeville Rd 23

Bethesda Central Business District, Bethesda/Chevy Chase, and Friendship Heights 24

Connecticut Avenue (MD-185) from DC line to Capital Beltway (I-495)........ 25

MD-355 from DC line to Capital Beltway (I-495)........ 26

Clarksburg........ 27

Ridge Road (MD-27) from Brink Road to Davis Mill Road........ 28

Frederick Road (MD-355) from Brink Road to Comus Road 29

Damascus........ 30

Ridge Road (MD-27) from Davis Mill Road to Gue Road 31

Cloverly, Fairland/Colesville, White Oak........ 32

Columbia Pike (US-29) from University Boulevard (MD-193) to Sandy Spring Road (MD-198) 33

New Hampshire Avenue (MD-650) from Capital Beltway (I-495) to Ednor Road 34
Gaithersburg, R&D Village, North Potomac, and Montgomery Village 35
Clopper Road (MD-117) from Longdraft Road to South Summit Avenue 36
Frederick Road (MD-355) from I-370 to Plummer Drive 37
Germantown Town Center, Germantown East, Germantown West 38
Frederick Road (MD-355) from Plummer Road to Brink Road 39
Clopper Road (MD-117) from Longdraft Road to Richter Farm Road 40
North Bethesda, White Flint, Twinbrook, Grosvenor 41
Old Georgetown Road (MD-187) from the Capital Beltway (I-495) to Rockville Pike (MD-355) 42
Randolph Road from Gaynor Road to Rockville Pike (MD-355) 43
Potomac 44
River Road (MD-190) from the Capital Beltway (I-495) to Piney Meetinghouse Road 45
Montrose Road from I-270 to Falls Road (MD-189) 46
Rockville City, Rockville Town Center Shady Grove Metro Center, Derwood 47
Veirs Mill Road (MD-586) from Twinbrook Parkway to Jefferson Street 48
MD-28 from Baltimore Road to Veirs Mill Road (MD-586) and from Rockville Pike (MD-355) to Shady Grove Road 49
Rural East 50
Columbia Pike (US-29) from Sandy Spring Road (MD-198) to the Howard County Border 51
Georgia Avenue (MD-97) from Brookeville Road to Howard County Border 52
Rural West 53
River Road (MD-190) from Piney Meetinghouse Road to Esworthy Road 54
MD-117 from Darnestown Road to Richter Farm Road 55
Silver Spring/Takoma and Silver Spring Central Business District 56
Colesville Road from the Capital Beltway (I-495) to the Washington, D.C. Border 57
Georgia Avenue from the Capital Beltway to the Washington, D.C. Border 58
Wheaton Central Business District, Wheaton/Kensington, and Glenmont 59
Connecticut Avenue (MD-185) between the Capital Beltway (I-495) and Aspen Hill Road 60
Veirs Mill Road (MD-586) from Georgia Avenue (MD-97) to Connecticut Avenue (MD-185) 61
Roadway Level of Service 62
Intersection Mobility Analysis 64

CLV Analysis By Policy Area 65

Overall Intersection Ranking 67

Top Bottlenecks 68

Rockville Pike (MD-355) at First Street/Wootton Parkway 69
New Hampshire Avenue (MD-650) at Powder Mill Road 70
New Hampshire Avenue (MD-650) at Columbia Pike (US-29) 71
Connecticut Ave (MD-185) at Bradley Lane/Boulevard 72
Colesville Road (US-29) at Franklin Avenue 73
Rockville Pike (MD-355) at Strathmore Avenue (MD-547) 74
Connecticut Ave (MD-185) at Capital Beltway (I-495) 75
Rockville Pike (MD-355) at Veirs Mill Road (MD-586) 76
Wisconsin Ave (MD-355) at Bradley Boulevard (MD-191) 77
Georgia Avenue (MD-97) at Randolph Road 78

Pedestrian and Bicycle Mobility 79

Pedestrian and Bicycle Counts 80

Pedestrian Counts 81
Bicycle Counts 82

Capital Bikeshare in Montgomery County 83

Bike Accessibility Analysis 87

Public Transportation 89

Bus Service 89

Coverage of Metro Bus and Ride-On 89

Ridership 93

Ride-On 93
Metro Bus 96

Metrorail 98

Conclusion 100

References 101

List of Tables Page

Table 1: Top 25 Roadway Corridors Based on Average Congestion during 3-hour Peak Period 19
Table 2: Aspen Hill and Olney Top Congested Corridors 21
Table 3: Bethesda and Vicinity Top Congested 24
Table 4: Clarksburg Top Congested Corridors 27
Table 5: Damascus Top Congested Corridors 30
Table 6: Cloverly, Fairland/Colesville, White Oak Top Congested Corridors 32
Table 7: Gaithersburg, R&D Village, North Potomac, and Montgomery Village Top Congested Corridors 35
Table 8: Germantown and Vicinity Top Congested Corridors 38
Table 9: North Bethesda and Vicinity Top Congested Corridors 41
Table 10: Potomac Top Congested Corridors 44
Table 11: Rockville and Vicinity Top Congested Corridors 47
Table 12: Rural East Top Congested Corridors 50
Table 13: Rural West Top Congested Corridors 53
Table 14: Silver Spring and Vicinity Top Congested Corridors 56
Table 15: Wheaton and Vicinity Top Congested Corridors 59
Table 16: Top Intersections in Terms of CLV 67
Table 17: The 20 most impactful bottlenecks 68
Table 18: Top Utilized Bikeshare Stations in Montgomery County (stations in bold are reviewed in Figure 95) 86
Table 19: Bus Headway Coverage summarized by Policy Area 92

List of Figures Page

Figure 1: Annual TTI & PTI by Highway Category: Average am and pm Peaks 10
Figure 2: Annual Speed by Highway Category: Average AM and PM Peaks 11
Figure 3: Change in Average Speed and PTI Between 2011 and 2015 11
Figure 4: VMT Trends In Montgomery County 2005 - 2015 14
Figure 5: Regional Teleworking Trends: Share of Regional Commuters Who Telework at Least Occasionally 15
Figure 6: Roadway Analysis Coverage and Policy Areas 18
Figure 7: Countywide Congestion Summary 20
Figure 8: 2011 and 2015 Countywide PTI and Speed Comparison 20
Figure 9: Corridors Analyzed in Aspen Hill and Olney Analyzed 21
Figure 10: 2011 and 2015 Aspen Hill and Olney average Speed and PTI Comparison 21
Figure 11: Norbeck Road (MD-28) Congestion Summary 22
Figure 12: Georgia Avenue (MD-97) Congestion Summary 23

Figure 13: Corridors Analyzed in Bethesda and Vicinity Analyzed 24
Figure 14: 2011 and 2015 Bethesda and Vicinity Speed and PTI Comparison 24
Figure 15: Connecticut Avenue (MD-185) Congestion Summary 25
Figure 16: MD-355 Congestion Summary 26
Figure 17: Corridors Analyzed in Clarksburg 27
Figure 18: 2011 and 2015 Clarksburg Speed and PTI Comparison 27
Figure 19: Ridge Road (MD-27) Congestion Summary 28
Figure 20: Frederick Road (MD-355) Congestion Summary 29
Figure 21: Corridors Analyzed in Damascus 30
Figure 22: 2011 and 2015 Damascus Speed and PTI Comparison 30
Figure 23: Ridge Road (MD-27) Congestion Summary 31
Figure 24: Corridors Analyzed in Cloverly, Fairland/Colesville and White Oak 32
Figure 25: Cloverly and Vicinity 2011 - 2015 Speed and PTI Comparison 32
Figure 26: US-29 Congestion Summary 33
Figure 27: New Hampshire Avenue (MD-650) Congestion Summary 34
Figure 28: Corridors Analyzed in Gaithersburg Vicinity 35
Figure 29: 2011 and 2015 Gaithersburg Speed and PTI Comparison 35
Figure 30: Clopper Road (MD-117) Congestion Summary 36
Figure 31: Frederick Road (MD-355) Congestion Summary 37
Figure 32: Corridors Analyzed in Germantown and Vicinity 38
Figure 33: 2011 and 2015 Germantown and Vicinity Speed and PTI Comparison 38
Figure 34: Frederick Road (MD-355) Congestion Summary 39
Figure 35: Clopper Road (MD-117) Congestion Summary 40
Figure 36: Corridors Analyzed in North Bethesda, White Flint, Twinbrook, and Grosvenor 41
Figure 37: 2011 and 2015 North Bethesda Speed and PTI 41
Figure 38: Old Georgetown Road (MD-187) Congestion Summary 42
Figure 39: Randolph Road Congestion Summary 43
Figure 40: Corridors Analyzed in Potomac 44
Figure 41: 2011 and 2015 Potomac Speed and PTI Comparison 44
Figure 42: River Road (MD-190) Congestion Summary 45
Figure 43: Montrose Road Congestion Summary 46
Figure 44: Corridors Analyzed in Rockville and Vicinity 47
Figure 45: 2011 and 2015 Rockville and Vicinity Speed and PTI Comparison 47
Figure 46: Veirs Mill Road Congestion Summary 48
Figure 47: MD-28 Congestion Summary 49
Figure 48: Corridors analyzed in Rural East 50
Figure 49: 2011 and 2015 Rural East Speed and PTI Comparison 50
Figure 50: US-29 Congestion Summary 51

Figure 51: MD-97 Congestion Summary 52
Figure 52: 2011 and 2015 Rural West Speed and PTI Comparison 53
Figure 53: Corridors Analyzed in Rural West 53
Figure 54: River Road (MD-190) Congestion Summary 54
Figure 55: MD-117 Congestion Summary 55
Figure 56: Corridors Analyzed in Silver Spring and Vicinity 56
Figure 57: 2011 and 2015 Silver Spring and Vicinity Speed and PTI Comparison 56
Figure 58: Colesville Road Congestion Summary 57
Figure 59: Georgia Avenue Congestion 58
Figure 60: Corridors Analyzed in Wheaton and Vicinity 59
Figure 61: 2011 and 2015 Wheaton and Vicinity Speed and PTI Comparison 59
Figure 62: Connecticut Avenue (MD-185) Congestion Summary 60
Figure 63: Veirs Mill Road (MD-586) Congestion Summary 61
Figure 64: Roadway Level of Service Derived from Vehicle Probe Data 63
Figure 65: Intersection Database Growth 64
Figure 66: RITIS' Bottleneck Diagram[9] 64
Figure 67: Distribution of Volume to Capacity Ratios in Intersection Database 65
Figure 68: Distribution of intersections exceeding CLV Policy Standard 65
Figure 69: Intersections exceeding their CLV Policy Standard 66
Figure 70: Bottleneck #1 Extent 69
Figure 71: Rockville Pike at First Street/Wootton Parkway CLV History 69
Figure 72:New Hampshire Avenue at Powder Mill Road CLV History 70
Figure 73: Bottleneck #2 Extent 70
Figure 74: Bottleneck #3 Extent 71
Figure 75: New Hampshire Avenue at Columbia Pike CLV History 71
Figure 76: Bottleneck #4 Extent 72
Figure 77: Connecticut Ave at Bradley Lane/Boulevard CLV History 72
Figure 78: Bottleneck #5 Extent 73
Figure 79: Colesville Road at Franklin Avenue CLV History 73
Figure 80: Bottleneck #6 Extent 74
Figure 81: Rockville Pike at Strathmore Avenue CLV History 74
Figure 82: Bottleneck #7 Extent 75
Figure 83: MD-185 at I-495 Inner Loop and Outer Loop CLV Comparison 75
Figure 84: Bottleneck #8 Extent 76
Figure 85: Rockville Pike at Veirs Mill Road CLV History 76
Figure 86: Bottleneck #9 Extent 77
Figure 87: Wisconsin Ave at Bradley Boulevard CLV History 77
Figure 88: Bottleneck #10 Extent 78

Figure 89: Georgia Avenue at Randolph Road CLV History 78
Figure 90: Percentage of Residents who Commute by Bicycle or Walking (Census American Community Survey 1 Year Estimates) 79
Figure 91: Pedestrian Heat Map 81
Figure 92: Bicycle Heat Map 82
Figure 93: 2014 – 2015 Capital Bikeshare System Usage in Montgomery County 83
Figure 94: Capital Bikeshare Quarterly and Cumulative Ridership Growth 83
Figure 95: Bikeshare Trip Distribution Map 85
Figure 96: Top Bikeshare Station Flows 86
Figure 97: All Levels of Traffic Stress Bicycle Accessibility 88
Figure 98: Low level of Traffic Stress Bicycle Accessibility 88
Figure 99: Percentage of Workers Who Commute By Public Transportation 89
Figure 100: Peak p.m. Bus Coverage Within 1/3 Network Mile of a Bus Stop 91
Figure 101: Montgomery County FY 2010 - FY 2015 Bus Ridership 93
Figure 102: Ride-On Routes With a 20 Percent or More Ridership Decrease FY 2013 - FY 2015 94
Figure 103: Ride-On Routes With a 10 Percent or More Ridership Increase FY 2013 - FY 2015 95
Figure 104: Metro Bus Routes With a 5 Percent or More Ridership Decrease FY 2013 - FY 2015 96
Figure 105: Metro Bus Routes With a 5 Percent or More Ridership Increase FY 2013 - FY 2015 97
Figure 106: Average Daily Boardings and Exits at Metro Stations in Montgomery County 98
Figure 107: Metrorail Average Weekday Ridership in Montgomery County 99

Abbreviations and Acronyms

BRT – Bus Rapid Transit

CATT – Center for Advanced Transportation Technology

CBD – Central Business District

CLV – Critical Lane Volume

CTP – Consolidation Transportation Program

FY – Fiscal Year

GIS – Geographical Information System

GPS – Global Positioning System

GTFS – General Transit Feed Specification

LATR – Local Area Transportation Review

LOS – Level of Service

MAR – Mobility Assessment Report

PTI – Planning Time Index

RITIS – Regional Integrated Transportation Information System

SSP – Subdivision Staging Policy

TPAR – Transportation Policy Area Review

TTI – Travel Time Index

VMT – Vehicle Miles Traveled

VPPS – Vehicle Probe Project Suite

WMATA – Washington Metropolitan Area Transit Authority

Executive Summary

The 2017 Mobility Assessment Report (MAR) summarizes the trends, data, and analysis used to track and measure transportation mobility conditions in Montgomery County. The purpose of this report is to provide information to residents and public officials regarding the current state of the county's transportation system, showing not only how the system is performing, but also how it is changing and evolving. Increased availability of transportation system performance information from both internal and external databases and advances in geospatial analytical tools provide the resources to understand the changing nature of how people are using the county's transportation systems.

Components and Sources of Data

The following transportation conditions and topics in Montgomery County and the region are discussed. Primary sources of data are identified under each topic.

- Emerging transportation technologies and services:
  - Literature review of current events pertinent to transportation.
- Roadway performance:
  - Measured travel speed derived from the I-95 Corridor Coalition Vehicle Probe Project Suite (VPPS)/commercially collected speed data.
- Intersection performance:
  - Montgomery County Planning Department's Intersection Database.
  - VPPS' bottleneck analysis.
- Pedestrian Activity:
  - Montgomery County Planning Department's Intersection Database.
- Bicycle Activity and Accessibility:
  - Montgomery County Planning Department's intersection database.
  - Parcel file database.
  - Capital Bikeshare system data.
- Public transportation trends and coverage:
  - Ride-On provided ridership summaries.
  - Washington Metropolitan Area Transit Authority (WMATA) provided ridership summaries.
  - Ride-On and WMATA General Transit Feed Specification (GTFS).

Summary of Findings

This report uses many of the roadway and intersection variables (Travel Time Index and Critical Lane Volume) that past reports have relied on to inform citizens and provide background information in support of the consideration of recommended modifications to the State's Consolidation Transportation Program (CTP) priorities. Where possible, direct comparisons of metrics are made to previous reports. For example, CLV has been consistently tracked, and therefore, changes in individual intersection utilization are easily summarized.

It should be noted that the vehicle congestion findings in this report are compliant with the policy areas described in the 2012 – 2016 Subdivision Staging Policy (SSP). This recent structural change is a departure from previous reports making it more difficult to conduct direct comparisons with the corridors previously analyzed. In some instances, new transportation system performance metrics are introduced in this document that have not been analyzed in previous versions of this report. This report was being prepared at the time of the development of the new policy areas introduced in the 2016 – 2020 SSP, and hence the current analysis does not reflect the new requirements.

Key Terms and Definitions

A list of key terms and concepts that are discussed throughout the report are provided below.

- **Morning Peak Period:** The period between the hours of 7 a.m. and 10 a.m. Variables and metrics summarized according to the morning peak period represent the average value throughout the entire period. The terms "morning peak period", "a.m. peak period", "morning commute", and "morning rush hour" are often used interchangeably.
- **Evening Peak Period:** The period between the hours of 4 p.m. and 7 p.m. Variables and metrics summarized according to the evening peak period represent the average value throughout the entire period. The terms "evening peak period", "p.m. peak period", "evening commute" and "evening rush hour" are often used interchangeably.
- **Travel Time Index (TTI):** An indicator of congestion, calculated as the ratio of actual travel time to free flow travel time. A travel time index of 1.00 implies free flow travel without any delays, while a travel time index of 1.30 means one must spend 30 percent more time to finish a trip compared to free flow travel time[1].
- **Planning Time Index (PTI):** An indicator of reliability, calculated as the ratio (also able to be expressed as a percentage) of 95th percentile travel time over free flow travel time. The PTI expresses the extra time a traveler should budget in addition to free flow travel time to arrive on time 95 percent of the time[1]. For example, a PTI of 1.8 indicates that a 20-minute trip in free-flow conditions requires 36 total minutes (1.8 x 20 minutes) to guarantee an on-time arrival 95 percent of the time during congested periods.
- **Accessibility:** A particular transportation mode's ability to provide quality opportunities to engage in various land uses. This term is similar to mobility but not the same. Mobility is solely the ability of the transportation system to move products and people from place to place.
- **Critical Lane Volume (CLV):** A level of service (LOS) metric used to assess the performance of an intersection that represents the amount of through and conflicting vehicle movements during a particular period of time.
- **Bottleneck:** Adopted from the Vehicle Probe Project Suite (VPPS). A bottleneck's intensity is a product of the duration of the bottleneck, average maximum length of the bottleneck, and the number of occurrences within a specified time frame. It is intended to identify chokepoints in the transportation system.

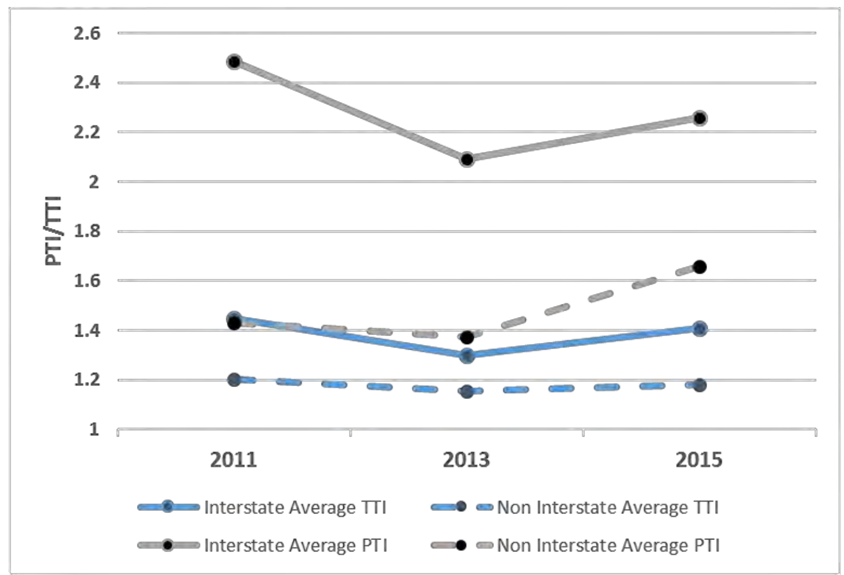


FIGURE 1: ANNUAL TTI & PTI BY HIGHWAY CATEGORY: AVERAGE AM AND PM PEAKS

[1] Metropolitan Washington Council of Governments. (2014). *2014 Congestion Management Process (CMP) Technical Report.* Washington, D.C.: Metropolitan W ashington Council of Governments.

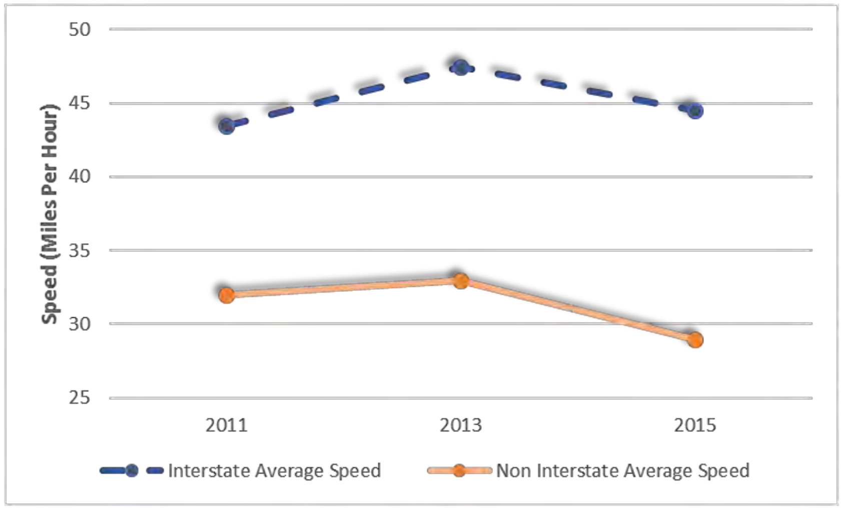


FIGURE 2: ANNUAL SPEED BY HIGHWAY CATEGORY: AVERAGE AM AND PM PEAKS

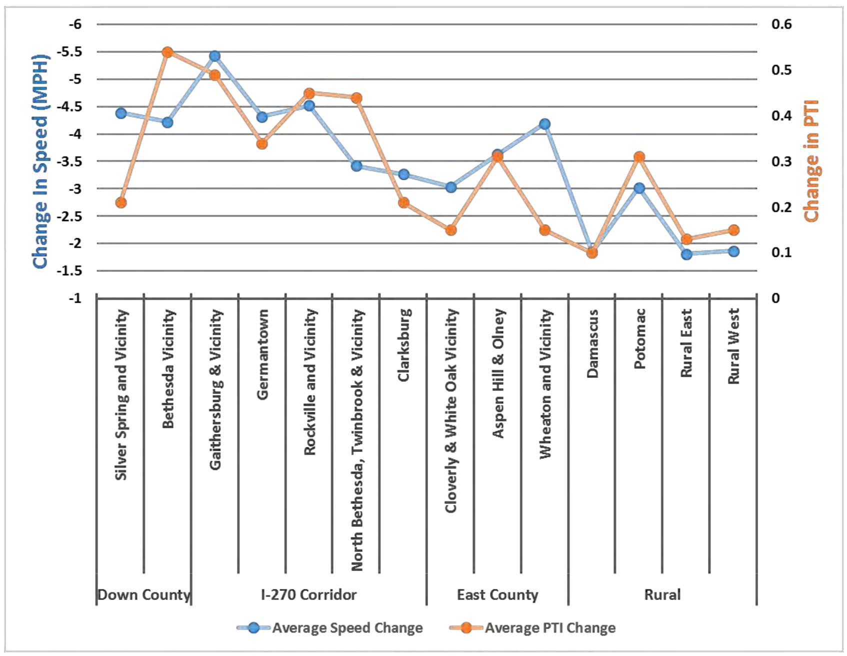


FIGURE 3: CHANGE IN AVERAGE SPEED AND PTI BETWEEN 2011 AND 2015

Roadway Congestion

Congestion remains a prominent part of a traveler's experience throughout the region. Based on vehicle probe data summarized using the VPPS, peak period congestion in Montgomery County decreased between 2011 and 2013, but rebounded in 2015. Both interstates and arterials follow a similar pattern with interstates' reliability exhibiting the most volatility indicating significant swings in extreme congestion events between 2011 and 2015. By 2015, the PTI for non-interstate roads in Montgomery County surpassed its 2013 value (Figure 1). Speed data exhibits a similar pattern with non-interstate roads experiencing a greater relative decrease in speeds between 2013 and 2015 than interstates (Figure 2).

Between 2011 and 2015, the average speed for all time periods has decreased by just over 4 miles per hour throughout the county. Also, the average PTI has increased by an average of four-tenths indicating, perhaps, that unexpected delays and peak congestion are increasing.

Generally, down county areas and the I-270 corridor experience the greatest levels of speed reductions and decreases in travel time reliability. Three of the five policy area groupings in the I-270 corridor saw reductions in average speed greater than down county areas (Figure 3).

Other roadway congestion findings include:

- In 2015, just under 40 percent of roadway miles inside the Capital Beltway exhibited moderate to severe levels of congestion compared to just under 13 percent outside the Beltway during the peak period.
- Of the top 10 congested corridors, seven occur in the Silver Spring or Bethesda vicinity.
- The top congested corridor occurs along MD-27 in Clarksburg between Brink Road and Davis Mill Road. This section of road, however, was under construction during the period in which data was collected, likely affecting the results.

Intersections

In addition to looking at critical lane volume as a measure of mobility, this report utilizes the VPPS bottleneck analysis to identify significant chokepoints. In this regard, some of the major findings include:

- Seven of the top 25 bottlenecks occur along MD-355. The most significant bottleneck occurs at the intersection of Rockville Pike (MD-355) and First Street/Wootton Parkway in the northbound direction. The excess time required to travel through the average length of the bottleneck compared to the free-flow condition is three minutes and 16 seconds during the evening commute and two minutes and 26 seconds during the morning commute.
- Based on the latest count available, the percentage of intersections that exceed the applicable policy area congestion thresholds established in the 2013 Local Area Transportation Review (LATR)/Transportation Policy Area Review (TPAR) Guidelines continues to decrease compared to previous reports. Ten percent of the intersection counts conducted through 2015 (68 total) exceed the CLV threshold specified in the 2013 LATR/TPAR Guidelines. This percentage is less than the 11 percent in the 2014 MAR and 17 percent reported in the 2011 MAR.
- Currently, the Fairland/Colesville and Gaithersburg City Policy Areas have the most intersections that exceed the CLV thresholds established in the 2013 LATR/TPAR Guidelines.
- Most of the intersections in the top 10 list have seen increases in their CLV values since the publication of the last MAR. CLV values overall, however, have decreased. Since the last MAR publication, 319 intersections have had an updated traffic count. On average, the CLV values of these intersections have decreased by an average of 78.

Bicycle and Pedestrian

This report analyzes bike and pedestrian counts that were primarily collected as an element of traffic impact studies conducted during the development approval process. In addition to bike and pedestrian counts, the report conducts a bike accessibility analysis that utilizes the newly developed level of traffic stress (LTS) bike network. The report also analyzes Capital Bike Share data. Some of the major findings include:

- Eleven of the top 20 pedestrian observations occurred at intersections in the vicinity of the Bethesda Metro Station. Per the 2012 Metrorail Passenger Survey, 73 percent of Metrorail riders accessed the Bethesda Metro Station by foot or bike.
- The greatest number of pedestrians observed occurred adjacent to the Silver Spring Metro Station at the intersection of Colesville Rd and 2nd Ave/Wayne Ave where 6,097 pedestrians were recorded during the evening and morning peak hours.
- A majority of the top 20 utilized Capital Bikeshare stations occur within one mile of a Metrorail station. This phenomenon validates Capital Bikeshare’s important role as a last-mile transportation source.
- The greatest non-work accessibility via bicycle occurs predominantly in Wheaton, White Flint, Twinbrook, and Bethesda. However, once the bicycle network is limited to only segments with a low level of traffic stress, accessibility decreases precipitously. The decline in accessibility is lowest in the Germantown East Policy at 74 percent, whereas many urban areas experience a decrease of 90 percent or more.

Public Transportation

This report tracks transit ridership data from the county’s Ride-On bus system and WMATA’s Metro Bus and Rail system. An additional analysis integrates both bus systems to decipher countywide bus coverage in terms of trip frequency. Major findings include:

- Thirty-seven percent of census blocks containing a presumably high incidence of transit dependent residents is accessible to transit services with less than five minute headways during the evening commute. Overall, 64 percent of the same area is accessible to some type of bus coverage within one-third of a mile from a bus stop.
- Ride-On has decreased 6.9 percent since 2010. Metro Bus, however, has seen an increase of almost eleven percent in yearly ridership. In total, bus ridership reached its peak in FY 2014, but saw a slight dip of two percent between FY 2014 and FY 2015.
- Between FY 2010 and FY 2015, average weekday boardings and exits at Metro stations in Montgomery County decreased about 3 percent. The decrease in weekend ridership, however, was more significant. Average weekend boardings and exits decreased 11.5 percent during the same period.

Introduction

Travel is a necessity for economic competitiveness and equal opportunity. The 32,500 businesses in Montgomery County employ nearly 370,000 workers across a range of sectors including technology, professional services and government/federal contractors. Every day, people who live, work, and play in Montgomery County need ways to move around and power this economic engine vital to the Washington metro region. Montgomery County has responsibility to provide mobility resources to not only its residents, but also the thousands of people traveling through the area each day to access jobs and services both inside and outside the county. The county's transportation system is a key to maintaining the county's economic health and competitive edge.

Transportation Trends

The analysis of mobility in Montgomery County described in this report shows that despite a rebounding economy, annual vehicle miles traveled (VMT)[2] **per capita** continues is downward trend. Meanwhile, for the third straight year, annual VMT increased nationally, statewide, and in Montgomery County, highlighting the growing demands on roadway infrastructure. Buoyed by the lower fuel prices and a rebounding economy, the total VMT in Montgomery County is back up to all-time high levels of 2005 and 2006. However, the county has also experienced steady population and job growth, exhibiting a 11 percent decline in VMT **per capita** since 2010. The county's VMT **per capita** compares favorably to the state, with the county's residents driving about 24 percent less than state's average.

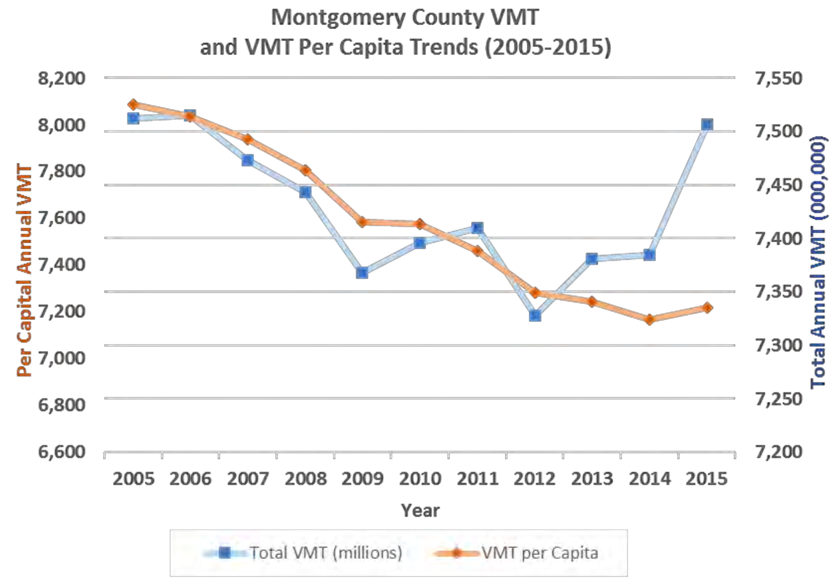


FIGURE 4: VMT TRENDS IN MONTGOMERY COUNTY 2005 - 2015

Advancements in non-transportation related technology such as telecommunications also have an impact on transportation systems (Figure 5). According to the 2016 National Capital Region State of the Commute, the number of teleworkers in the Washington, DC region has grown by more than 200,000 from 2013 to 2015. Most of this growth has occurred in the Federal Government, with the percentage of employees who telework at least occasionally increasing from 27 to 45 percent since 2010[3]. According to Commuter Connections' analysts, an additional 500,000 commuters indicate they would telework more regularly if given the option, which would bring the regional share of workers who regularly telework to 50 percent.

[2] Maryland State Highway Administration. (2016, December 13). Annual Vehicle Miles of Travel Report. Retrieved from http://sha.md.gov/OPPEN/Vehicle_Miles_of_Travel.pdf

[3] National Capital Region Transportation Planning Board. (2016, September 21). National Capitol Region State of the Commute 2016 Survey Highlights. Retrieved from https://www.mwcog.org/assets/1/28/09212016_-_Item_8_-_Presentation_-_2016_SOC_TPB_Presentation.pdf

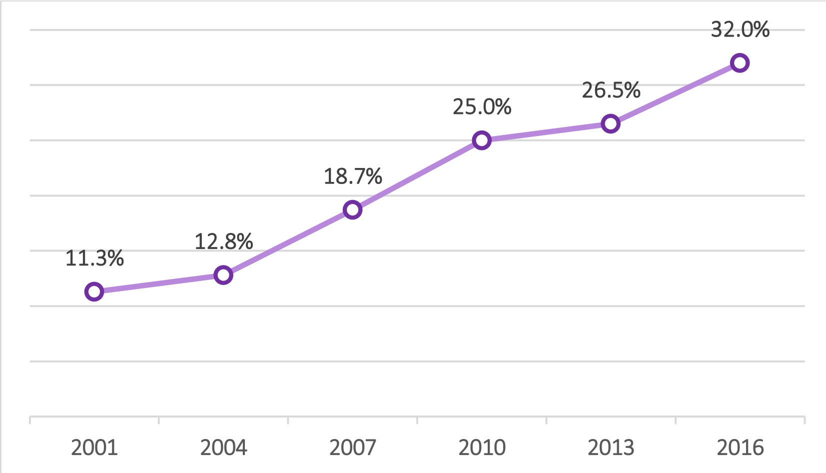


FIGURE 5: REGIONAL TELEWORKING TRENDS: SHARE OF REGIONAL COMMUTERS WHO TELEWORK AT LEAST OCCASIONALLY

Changes in the Transportation Industry

Given the VMT trends observed in the county during the past decade, the question of mobility in an era of steadily advancing technology has led to much discussion about the future of the transportation industry. Will transportation be revolutionized? How will we adapt our built environment? Technology trends and new business models are challenging planners to think about how our communities of tomorrow will be shaped, and the role of transportation in the face of the promise that mobility technology affords.

The Eno Center for Transportation highlights five categories of potentially transformational technological innovations[4]:

1) Autonomous and semi-autonomous driving capabilities;
2) New technology enabled models of taxi services and public transit;
3) Technology affecting freight and urban goods movement;
4) New forms of technology-enabled shared use mobility; and
5) Advances in traveler information, transportation system operations, and travel demand management.

In the near future, the impact of automated vehicles is likely to be uncertain. Both the pace at which this technology is evolving and reactionary policymaking to new uses are emerging. Estimates on the implementation of fully autonomous driving capabilities range from the next five to ten years to the possibility that full automation will never be realized. Autonomous vehicles offer the potential, in the long term, to transform land use impacts, planning, the mobility of senior citizens, and even ownership models for vehicles, which is opening new potential uses and driving behaviors for the road.

Technological changes such as these will require reliable data and projections so that policy makers can help implement the best possible outcomes. Dynamic ride sharing services, such as Uber and Lyft, may provide the template for examining future policies and planning as these services and business models continue to converge with autonomous driving.

Already, public transportation is beginning to work more closely with dynamic ride sharing. In Boston, the Massachusetts Bay Transportation Authority has launched a program to provide flexible and on-demand transportation to paratransit customers through partnerships with Uber and Lyft, shaving costs by 70 percent.[5] WMATA is embarking on a similar approach under a program called Abilities-Ride, moving ahead with plans to partner with third party vendors such as Uber and Lyft to

[4] Eno Center for Transportation. (2016, February). Emerging Technology Trends in Transportation. Retrieved from https://www.enotrans.org/wp-content/uploads/EmergingTech.v13.pdf

[5] Lazo, L. (2016, September 16). The Washington Post. Retrieved from Uber, Lyft partner with transportation authority to offer paratransit customers service in Boston: https://www.washingtonpost.com/news/dr-gridlock/wp/2016/09/16/uber-lyft-partner-with-city-to-offer-paratransit-customers-on-demand-service-in-boston/?utm_term=.4f9c6e5f2ab1

provide subsidized paratransit services.[6] Additionally, a separate partnership between WMATA and Uber will encourage shared rides to or from designated locations at 42 Metrorail stations and provide another option for last-mile coverage.[7] Transit agencies in some of the nation's largest cities are on the leading edge of adopting connected technologies and leveraging partnerships with ride hailing services to streamline costs and expand mobility options to customers.

Even before the advent of fully autonomous vehicles, technology is already enabling innovation in business models and operations for mobility. Short term one-way car rental services, such as car2go, have taken hold in Washington, DC and experienced rapid growth. Car2go counts over 800,000 members in its North American markets, with 57,000 subscribers accessing 800 vehicles in the DC region.[8] Connected technologies enable customers to reserve, start, end, and pay for their trips all from a smartphone application. Changes in parking policies in the District of Columbia and Arlington County have also been critical to the growth of this new model – policies now allow one-way rentals with appropriate permits to park in any legal on-street parking spot for free, providing for greater flexibility to customers and enabling another transportation option to residents of the DC region.

All the changes discussed above will undoubtedly continue to have a strong influence on our region's transportation system in the coming decades. The future success of the county's transportation system will depend on a redundant and adaptable system that can accommodate these changes in behavior and technology, while continuing to provide mobility opportunities for all the county's residents. Unforeseen occurrences such as spikes in gas prices and economic downturns will likely continue to alter short term travel behavior. One fact, however, will remain true. The inextricable link between land use and transportation will continue to prove vastly important in the efficient delivery of finite transportation resources.

[6] Washington Metropolitan Area Transit Authority. (2016, October 11). PlanItMetro. Retrieved from Abilities-Ride Program: An Alternative to MetroAccess: https://planitmetro.com/2016/10/11/abilities-ride-program-an-alternative-to-metroaccess/

[7] Caro, M. D. (2016, December 9). WAMU 99.5. Retrieved from Metro Enters First Partnership With Uber In Bid To Boost Sagging Ridership: http://wamu.org/story/16/12/09/metro-enters-first-partnership-uber-bid-boost-sagging-ridership/

[8] Siddiqui, F. (2016, September 13). *The Washington Post*. Retrieved from Car2Go upgrades its D.C. fleet as usage rises: https://www.washingtonpost.com/news/dr-gridlock/wp/2016/09/13/car2go-upgrades-its-d-c-fleet-as-usage-rises/?utm_term=.4f8a87f798dc

Roadway Mobility Analysis

The 2017 Mobility Assessment Report (MAR) aggregates and synthesizes vehicle speed data for major corridors in Montgomery County collected from the Regional Integrated Transportation Information System's (RITIS) Vehicle Probe Project Suite (VPPS). RITIS was developed by the Center for Advanced Transportation Technology Laboratory at the University of Maryland. RITIS provides jurisdictions an interface to retrieve continuously collected vehicle speed data along corridor segments via Global Positioning System (GPS) enabled vehicle "probes" such as mobile phones and GPS devices in various fleet vehicles throughout Montgomery County and the I-95 corridor. This information is collected by private corporations and made available to member jurisdictions of the I-95 Corridor Coalition via the VPPS.

The 2017 MAR utilizes arterial speed information collected between April 1, 2015 and May 31, 2015, and between September 1, 2015 and October 31, 2015 to derive its roadway congestion findings. The previous MAR only collected data from the month of October. Each roadway segment's measured speed, averaged every 15 minutes, distance, and "free-flow" speed are used to calculate the travel time index (TTI) for each 15-minute interval. This information is then summarized per the peak and non-peak periods for each roadway segment and organized by policy area as defined in the 2012-2016 Subdivision Staging Policy. Since several roadway corridors form the boundaries of two or more policy areas, some policy areas were aggregated for the purposes of summarizing results (Figure 6). In other instances, roadways that straddle policy area boundaries have been arbitrarily assigned to one of the policy areas.

To gain more insight into how congestion has changed in each policy area grouping and throughout the county, this MAR summarizes the Planning Time Index (PTI) and measured speed in 2011 and 2015. The PTI represents the ratio of the 95th travel time percentile to the free-flow travel time. The PTI is a measure of travel time reliability and "compares near-worst case travel time to a travel time in light or free-flow traffic" (Center for Advanced Transportation Technology Laboratory, 2016). For example, a PTI of 1.8 indicates that a 20-minute trip in normal conditions requires 36 total minutes (1.8 x 20 minutes) to guarantee an on-time arrival 95 percent of the time during congested periods.

Finally, for each policy area or grouping, the top two congested roadway corridors are mapped and symbolized according to their average congestion during the morning and evening peak periods.

TRAVEL TIME INDEX

The travel time index (TTI) compares the average travel time of a trip on a segment of road for a particular time period to the travel time of that same trip during "free flow" conditions. The higher the TTI for a given time period, the more time is lost due to congestion. For example, a TTI of 2.0 indicates that a trip that takes 20 minutes in typical traffic will take twice as long, or 40 minutes, in the measured time period.

TTI, although easy to understand and measure, is a fairly narrow metric that ignores other aspects of the transportation & land use system. Most importantly, the metric does not consider the length of trips needed to accomplish daily tasks such as food shopping or commuting to one's job. The metric is therefore solely concerned with mobility and ignores all aspects of accessibility.

The morning peak period is defined as 7 to 10 a.m. and the evening peak period is defined as 4 to 7 p.m. This provides even finer level of granularity to visualize congestion throughout the area.

County Overview

This report analyzes approximately 430 miles of road (bi-directional) across Montgomery County (Figure 6). For the 2017 MAR, several corridors were added to the analysis, including the segments of MD-187 (Old Georgetown Rd), MD-547 (Strathmore/Knowles Ave), MD-119 (Great Seneca Hwy), MD-410 (East-West Hwy), and MD-189 (Falls Rd). The report analyzes 58 individual corridors (both travel directions) segmented by groups of policy areas. Of the top 25 congested corridors in the county (Table 1), 11 occur inside the Capital Beltway in areas that provide good accessibility to jobs and other destinations. The most congested roadway, and newcomer to the top 25, is Ridge Road (MD-27) in Clarksburg between Brink Road and Davis Mill Road during the a.m. peak period. This section of road, however, was under construction during the period when data was collected.

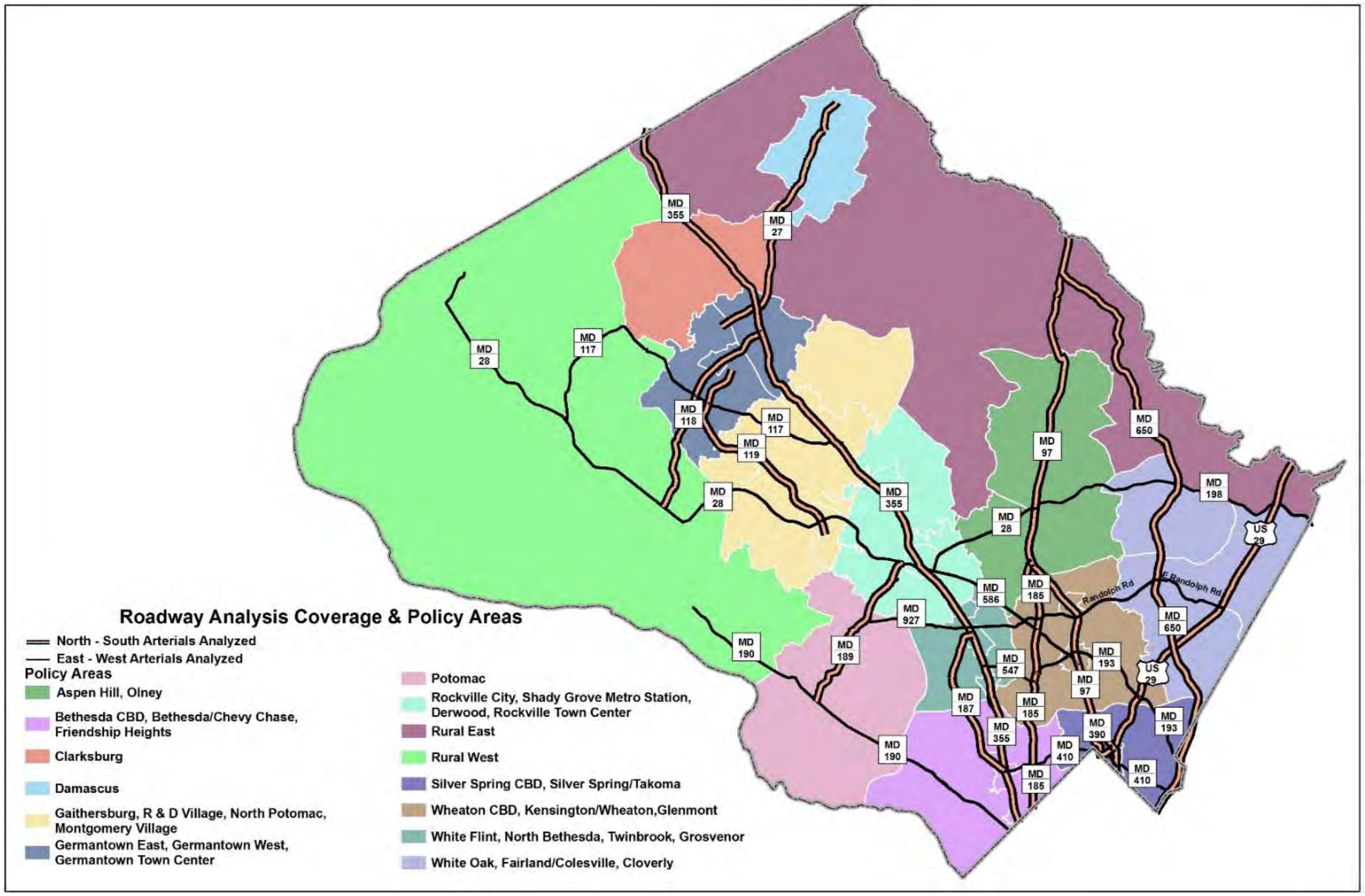


FIGURE 6: ROADWAY ANALYSIS COVERAGE AND POLICY AREAS

TABLE 1: TOP 25 ROADWAY CORRIDORS BASED ON AVERAGE CONGESTION DURING 3-HOUR PEAK PERIOD

Rank	Corridor	Section	Direction	Congestion	Assigned Policy Area Cluster	Peak Period
1	MD-27	Brink Rd to Davis Mill Rd	Southbound	100%	Clarksburg	AM Peak
2	Colesville Road	Capital Beltway to DC Line	Southbound	100%	Silver Spring CBD, Silver Spring/Takoma	PM Peak
3	MD-185	Capital Beltway to DC Line	Southbound	78%	Bethesda CBD, Bethesda/Chevy Chase, Friendship Heights	AM Peak
4	Georgia Avenue	DC Line to Capital Beltway	Northbound	77%	Silver Spring CBD, Silver Spring/Takoma	PM Peak
5	MD-650	DC Line to Capital Beltway	Northbound	76%	Silver Spring CBD, Silver Spring/Takoma	PM Peak
6	MD-185	DC Line to Capital Beltway	Northbound	74%	Bethesda CBD, Bethesda/Chevy Chase, Friendship Heights	PM Peak
7	MD-355	DC Line to Capital Beltway	Northbound	74%	Bethesda CBD, Bethesda/Chevy Chase, Friendship Heights	PM Peak
8	US-29	MD-198 to University Blvd	Southbound	73%	Fairland/Colesville, White Oak & Cloverly	AM Peak
9	MD-355	Capital Beltway to DC Line	Southbound	72%	Bethesda CBD, Bethesda/Chevy Chase, Friendship Heights	PM Peak
10	MD-187	Rockville Pike to Capital Beltway	Southbound	67%	North Bethesda, White Flint, Twinbrook, Grosvenor	PM Peak
11	MD-185	Aspen Hill Rd to Capital Beltway	Southbound	66%	Wheaton CBD, Wheaton/Kensington, Glenmont	AM Peak
12	MD-410	Jones Mill Rd to Wisconsin Ave	Westbound	66%	Bethesda CBD, Bethesda/Chevy Chase, Friendship Heights	AM Peak
13	MD-185	Aspen Hill Rd to Georgia Ave	Northbound	65%	Aspen Hill & Olney	PM Peak
13	MD-355	DC Line to Capital Beltway	Northbound	66%	Bethesda CBD, Bethesda/Chevy Chase, Friendship Heights	PM Peak
14	MD-547	Beach Drive to MD-185	Eastbound	65%	Wheaton CBD, Wheaton/Kensington, Glenmont	PM Peak
15	US-29	University Blvd to Capital Beltway	Southbound	64%	Wheaton CBD, Wheaton/Kensington, Glenmont	AM Peak
16	US-29	Capital Beltway to University Blvd	Northbound	64%	Wheaton CBD, Wheaton/Kensington, Glenmont	PM Peak
17	MD-390/16TH ST	MD-97 to DC Line	Southbound	61%	Silver Spring CBD, Silver Spring/Takoma	PM Peak
18	Randolph Road	MD-355 to Rocking Horse Rd	Eastbound	61%	North Bethesda, White Flint, Twinbrook, Grosvenor	PM Peak
19	MD-28	MD-97 to Baltimore Rd	Westbound	59%	Aspen Hill & Olney	AM Peak
20	US-29	Sandy Spring Road to the county border	Northbound	59%	Rural East	PM Peak
21	MD-187	MD-355 to the Capital Beltway	Northbound	58%	Bethesda CBD, Bethesda/Chevy Chase, Friendship Heights	PM Peak
22	MD-190	Esworthy Rd to Piney Meetinghouse Rd	Eastbound	57%	Rural West	AM Peak
23	MD-586	MD-97 to MD-185	Eastbound	57%	Wheaton CBD, Wheaton/Kensington, Glenmont	PM Peak
24	MD-190	Capital Beltway to Piney Meetinghouse Rd	Eastbound	57%	Potomac	AM Peak
25	MD-187	Capital Beltway to Rockville Pike	Northbound	56%	North Bethesda, White Flint, Twinbrook, Grosvenor	PM Peak

Like the 2014 MAR, categories that indicate the severity of congestion are identified according to the difference between the measured TTI and free-flow traffic conditions (TTI of 1). For example, MD-27 in Clarksburg experiences an average congestion of 100 percent (TTI of 2.00), indicating the average time to travel through this corridor during the morning peak period takes twice as long as free-flow conditions.

Congestion Severity Scale Used Throughout This Section

Uncongested - Light	0%-20%
Light - Moderate	21%-40%
Moderate - Heavy	41%-60%
Heavy - Severe	61%-80%
Severe	80%+

Summary of Roadway Conditions in 2015

Most roadway segments analyzed exhibit an average congestion level of less than 20 percent during the 3-hour peak travel periods. A majority of the congested roadway segments (multiple segments can make up one corridor), occur inside the Capital Beltway. Figure 7 summarizes the percentage of roadway miles that fall into the five levels of congestion severity for a.m. and p.m. peak period conditions. The charts are broken down by the location of the corridor segments (inside or outside the Beltway). A greater percentage of the roadways inside the Beltway experience moderate to heavy levels of congestion compared to the roadways outside the Beltway. During the evening peak period, nearly 40 percent of roadway mileage inside the Beltway experience moderate to heavy or higher levels of congestion compared to approximately 13 percent outside the Beltway.

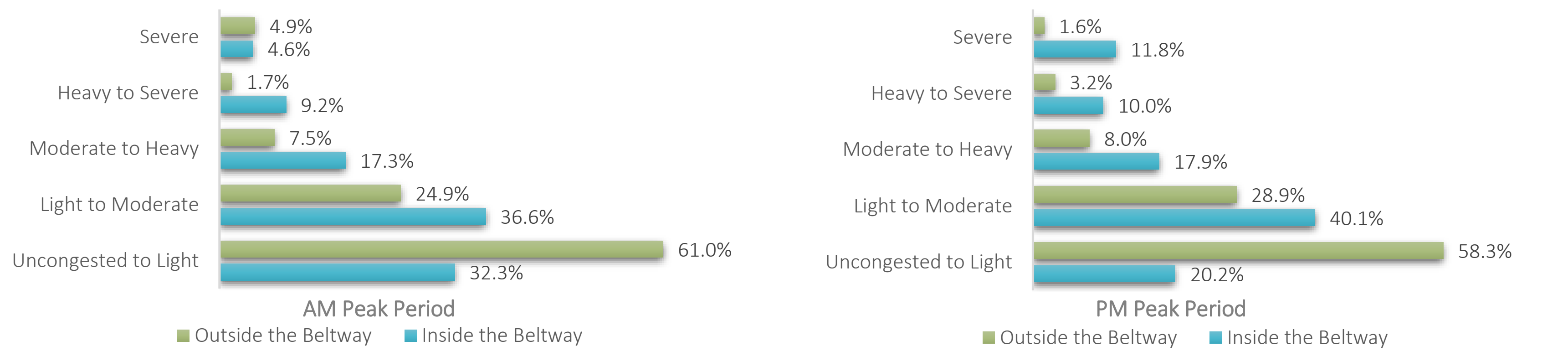


FIGURE 7: COUNTYWIDE CONGESTION SUMMARY

Congestion Trends

The MAR summarizes vehicle probe data for 58 corridors across all time periods in 2011 and 2015. The changes in average speed and PTI for all time periods is summarized below. The average speed in 2015 has decreased an average of approximately four miles per hour countywide since 2011. The PTI has also increased by an average of four-tenths indicating, perhaps, that unexpected delays are increasing. For example, a 15-minute trip in 2011 would require an average of seven additional minutes to arrive on-time with 95 percent confidence in the southbound direction. This increases to an additional 13 minutes in 2015.

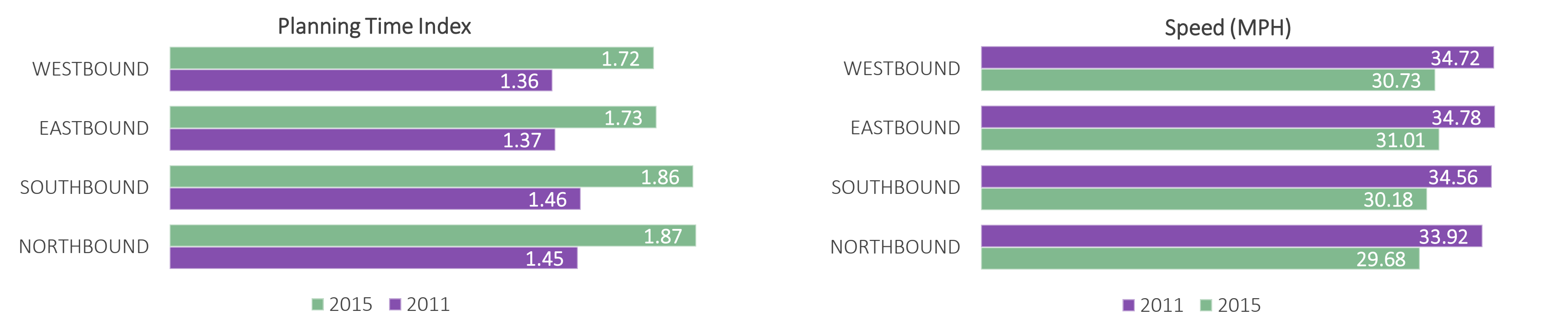


FIGURE 8: 2011 AND 2015 COUNTYWIDE PTI AND SPEED COMPARISON

Aspen Hill and Olney Vicinity

This report analyzes a significant stretch of Georgia Avenue (MD-97) between Randolph Road and Brookeville Road, Norbeck Road (MD-28) between Baltimore Road and Layhill Road, Veirs Mill Road (MD-586) between Twinbrook Parkway and Connecticut Avenue (MD-185), and a small portion of Connecticut Avenue between Aspen Hill Road and Georgia Avenue in Aspen Hill and Olney (Figure 9). The most congested segments are northbound Connecticut Avenue during the evening peak period. On average, it takes approximately 65 percent more time to travel through this short segment of Connecticut Avenue during the peak period as compared to free-flow conditions. Westbound traffic traveling along Norbeck Road during the morning commute experiences a moderate to heavy level of congestion on average throughout the duration of the peak period.

Similar to the countywide analysis, since 2011, the average speed has slightly decreased and the Planning Time Index (PTI) has increased for all directions of travel (Figure 10). The increase in the PTI may indicate that unexpected delays occur more often in 2015 than in 2011. Georgia Avenue (MD-97) and Norbeck Road (MD-28) are analyzed in more detail below to provide more insight into where congestion occurs along the major north/south corridor in this area.

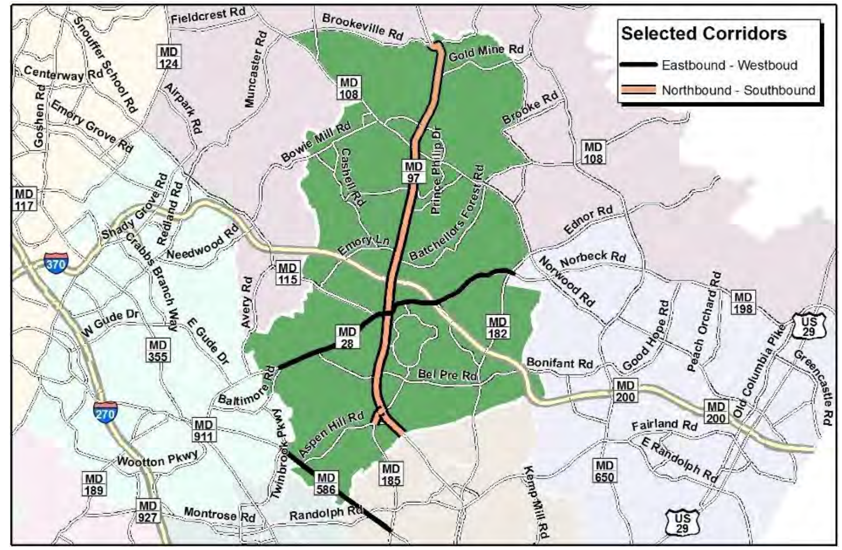


FIGURE 9: CORRIDORS ANALYZED IN ASPEN HILL AND OLNEY

TABLE 2: ASPEN HILL AND OLNEY TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-185	65%	NORTHBOUND	PM Peak
MD-28	59%	WESTBOUND	AM Peak
MD-28	50%	EASTBOUND	PM Peak
MD-97	47%	NORTHBOUND	PM Peak
MD-185	43%	NORTHBOUND	AM Peak
MD-97	40%	SOUTHBOUND	PM Peak
MD-28	39%	EASTBOUND	AM Peak
MD-185	39%	SOUTHBOUND	PM Peak
MD-97	36%	SOUTHBOUND	AM Peak
MD-185	35%	SOUTHBOUND	AM Peak

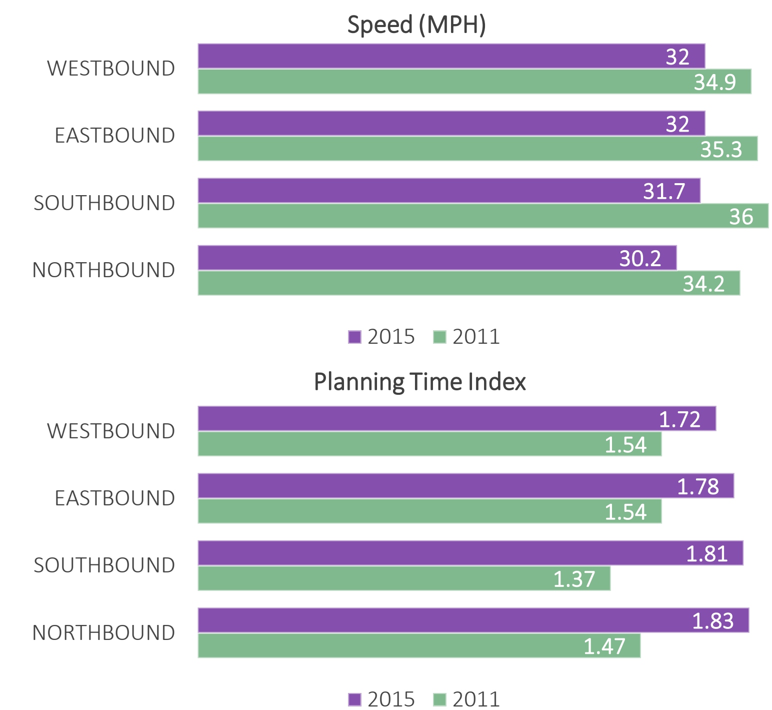
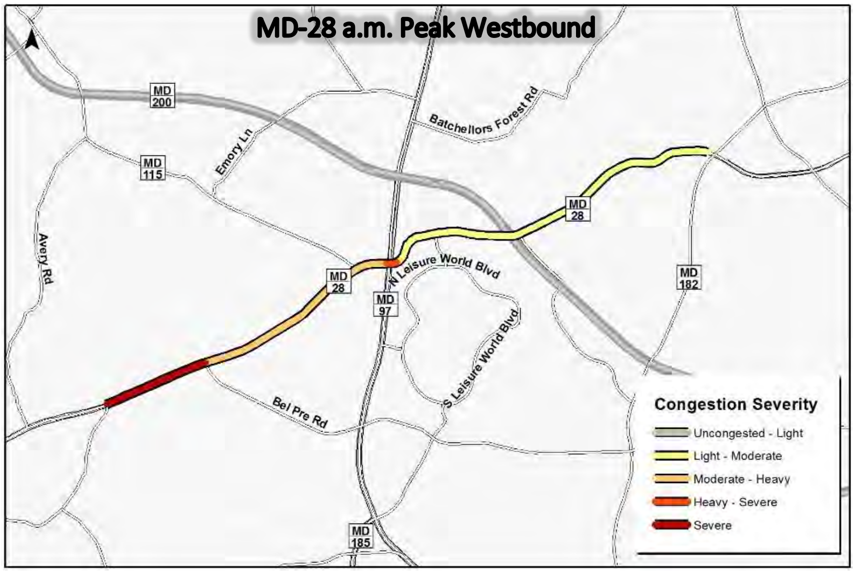
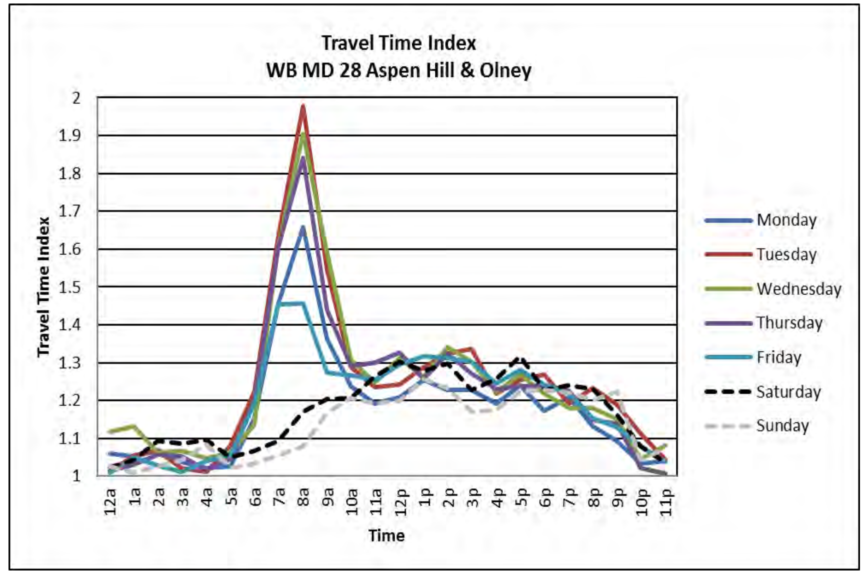


FIGURE 10: 2011 AND 2015 ASPEN HILL AND OLNEY AVERAGE SPEED AND PTI

Norbeck Road (MD-28) from Baltimore Road (northernmost intersection) to MD-182

Traffic traveling along Norbeck Road experiences very severe congestion, particularly in the westbound direction reaching its peak hour at around 8:00 a.m. (top of Figure 11). The congestion appears to be at its worst west of Georgia Avenue, reaching its maximum congestion between Bel Pre and Baltimore Roads. Eastbound congestion during the evening hours is more spread out, and we do not see a sharp spike in peak hour congestion as we during the morning commute in the westbound direction.





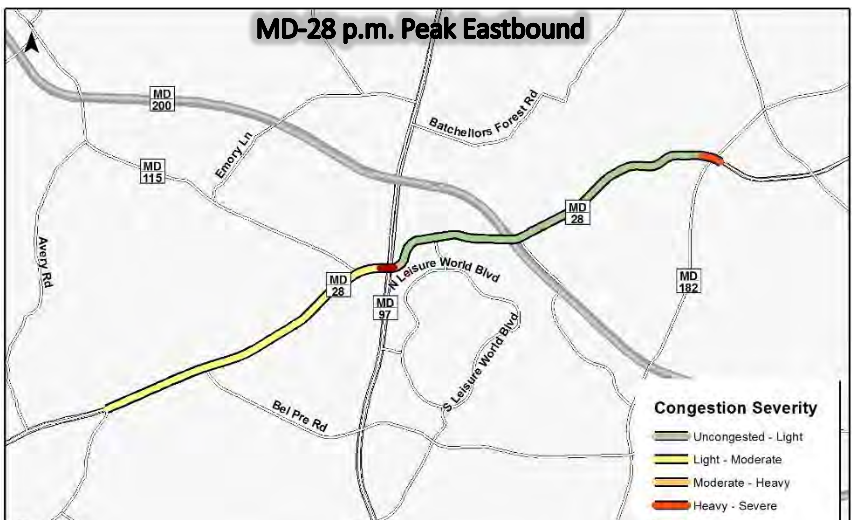
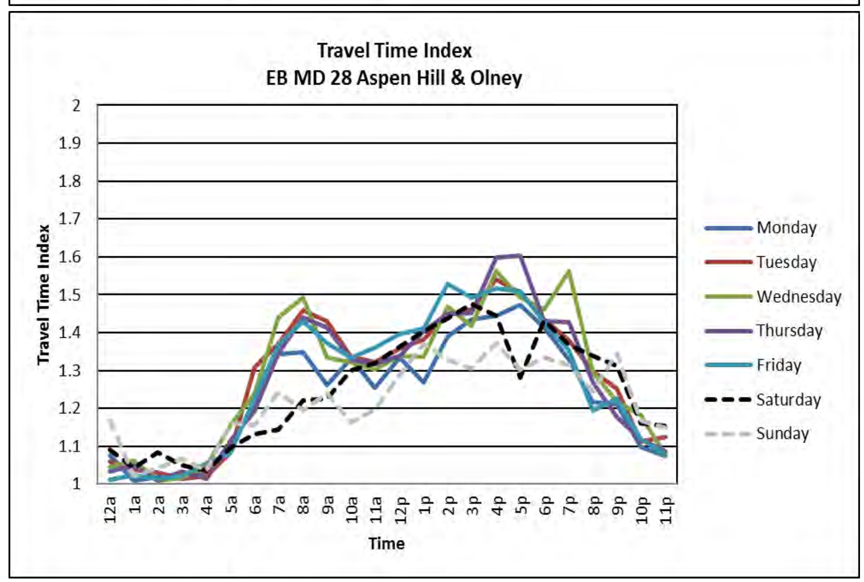


FIGURE 11: NORBECK ROAD (MD-28) CONGESTION SUMMARY



Georgia Ave (MD-97) from Aspen Hill Rd to Brookeville Rd

Traffic traveling northbound along Georgia Avenue experiences its worst congestion between 5 and 6 p.m (Figure 12). The stretch between Norbeck Road and Emory Lane experiences heavy to severe levels of congestion in the northbound direction during the evening hours. The morning commute sees a steady rate of light to moderate congestion reaching periods of heavy congestion around MD-200. The morning commute peaks between 7 and 8 a.m. during weekdays, but the weekend TTI remaining steady from 10 a.m. to 6 p.m.

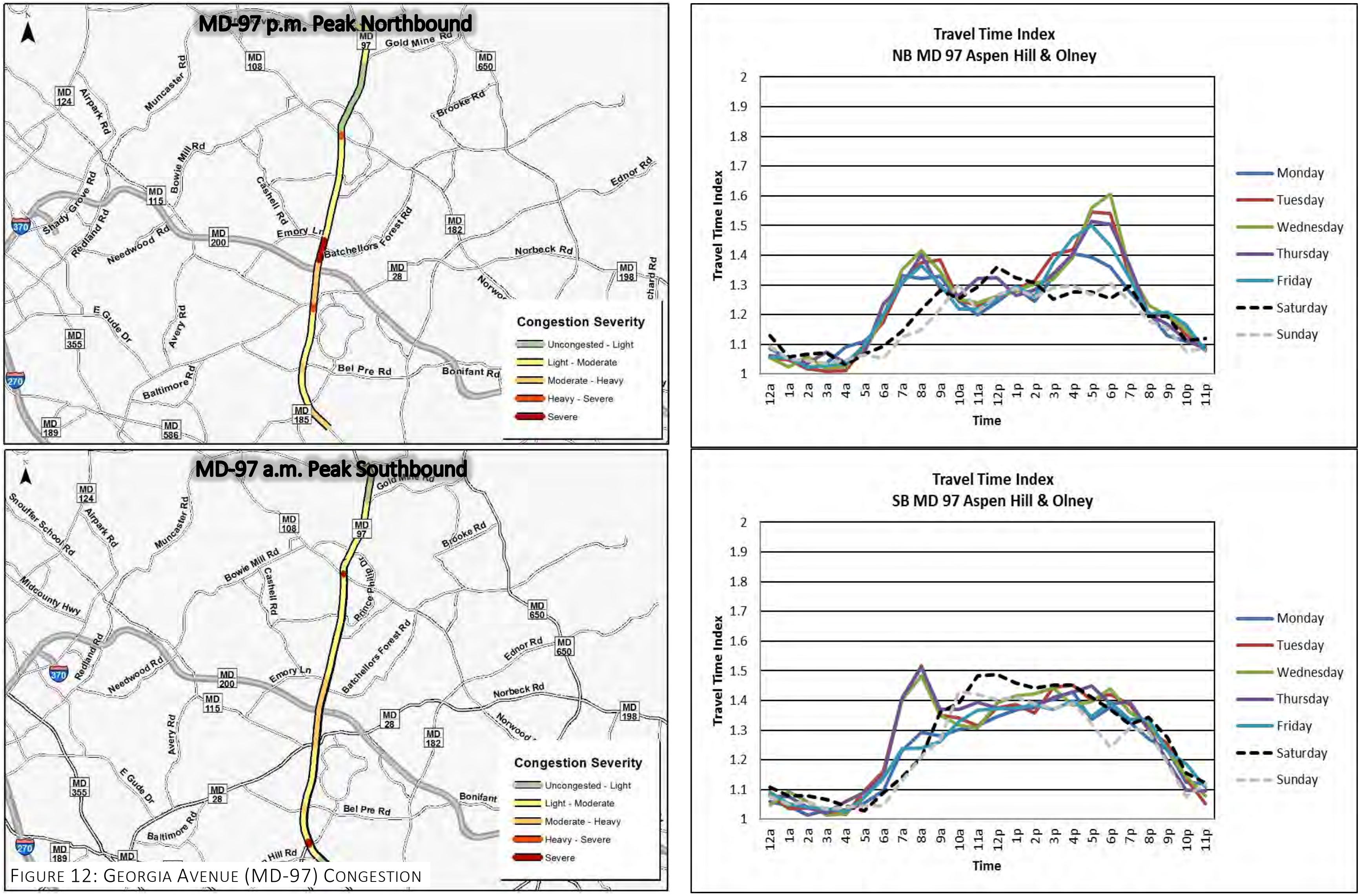


FIGURE 12: GEORGIA AVENUE (MD-97) CONGESTION

Bethesda Central Business District, Bethesda/Chevy Chase, and Friendship Heights

In the Bethesda vicinity, this report analyzes River Road, MD-355, and Connecticut Avenue (MD-185), all between the DC line and the Capital Beltway (I-495). Two other segments are Old Georgetown Road (MD-187) between MD-355 and the Capital Beltway, and East-West Highway (MD-410) between Jones Mill Road and MD-355 (Figure 13). The most congested section is Connecticut Avenue between the Capital Beltway and the DC line in the southbound direction during the morning commute. On average, it takes 78 percent longer to travel through this corridor during the morning rush hour than under free-flow conditions. This level of congestion is closely followed by Connecticut Avenue and MD-355 in the northbound direction during the evening commute (Table 1).

A comparison of the speed data from 2011 and 2015 for all corridors in the Bethesda vicinity indicates that the magnitude of the decrease in average speed across all directions of travel since 2011 is similar to that of the overall county. The PTI, however, has increased greater than that of the overall county (Figure 14). For example, the average PTI for westbound traffic in 2015 was 2.12, indicating that 21 additional minutes should be allocated for a 10-minute trip to guarantee an on-time arrival 95 percent of the time. In 2011, in contrast, only five additional minutes were necessary.

TABLE 3: BETHESDA AND VICINITY TOP CONGESTED

Route	Congestion	Direction	Period
MD-185	78%	SOUTHBOUND	AM Peak
MD-185	74%	NORTHBOUND	PM Peak
MD-355	74%	NORTHBOUND	PM Peak
MD-355	72%	SOUTHBOUND	PM Peak
MD-410	66%	WESTBOUND	AM Peak
MD-187	58%	NORTHBOUND	PM Peak
MD-410	55%	EASTBOUND	PM Peak
MD-355	55%	SOUTHBOUND	AM Peak
MD-190	54%	EASTBOUND	AM Peak
MD-410	47%	WESTBOUND	PM Peak

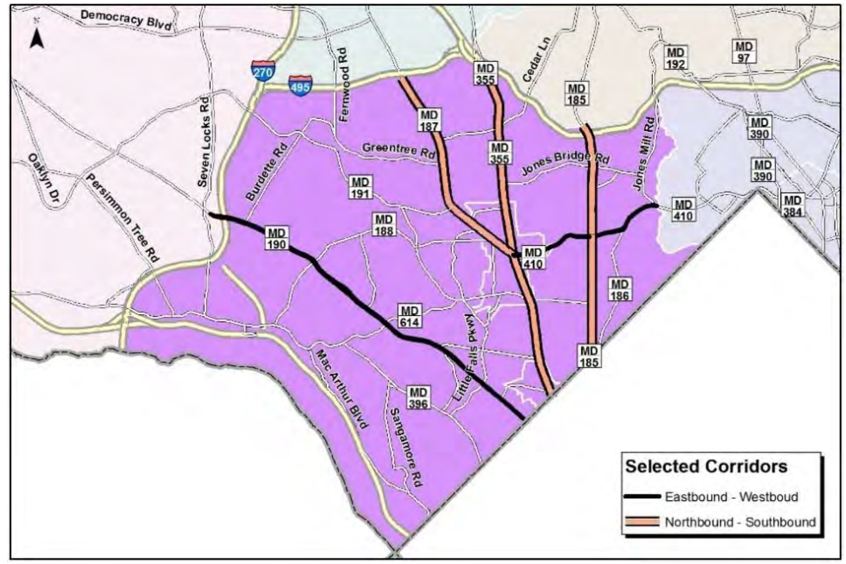


FIGURE 13: CORRIDORS ANALYZED IN BETHESDA AND VICINITY

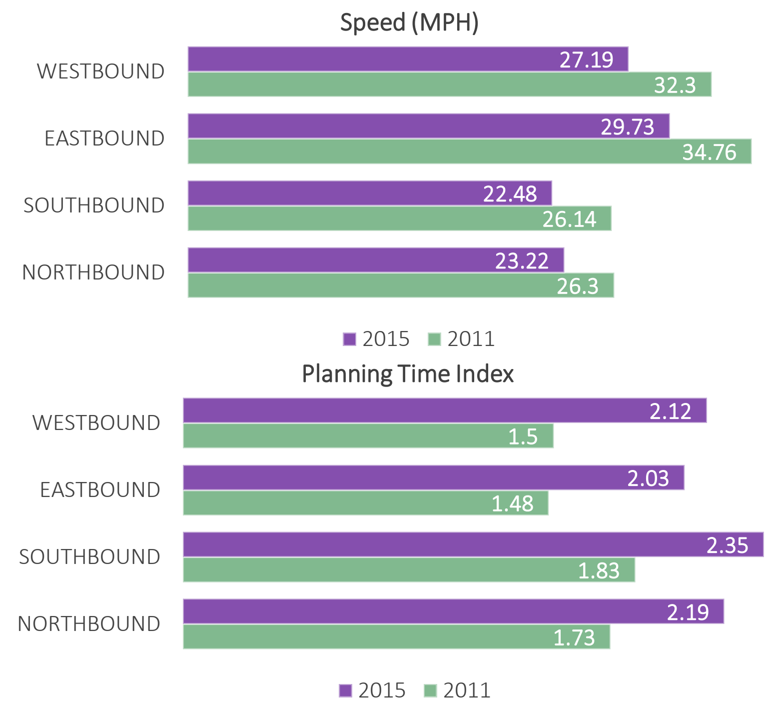


FIGURE 14: 2011 AND 2015 BETHESDA AND VICINITY SPEED AND PTI COMPARISON

Connecticut Avenue (MD-185) from DC line to Capital Beltway (I-495)

Connecticut Avenue experiences two distinct and significant rises in congestion during the morning and evening commutes (Table 15). In the morning, the TTI peaks at over two (100 percent congestion, implying it takes twice as long to traverse this section of road) at 8 a.m. on Tuesdays, Wednesdays, and Thursdays. The worst congestion occurs between the Beltway and East-West Highway. In the evening, the TTI approaches two, particularly on Wednesdays, around 5 p.m. Congestion during the evening is concentrated between the DC line and Jones Bridge Road.

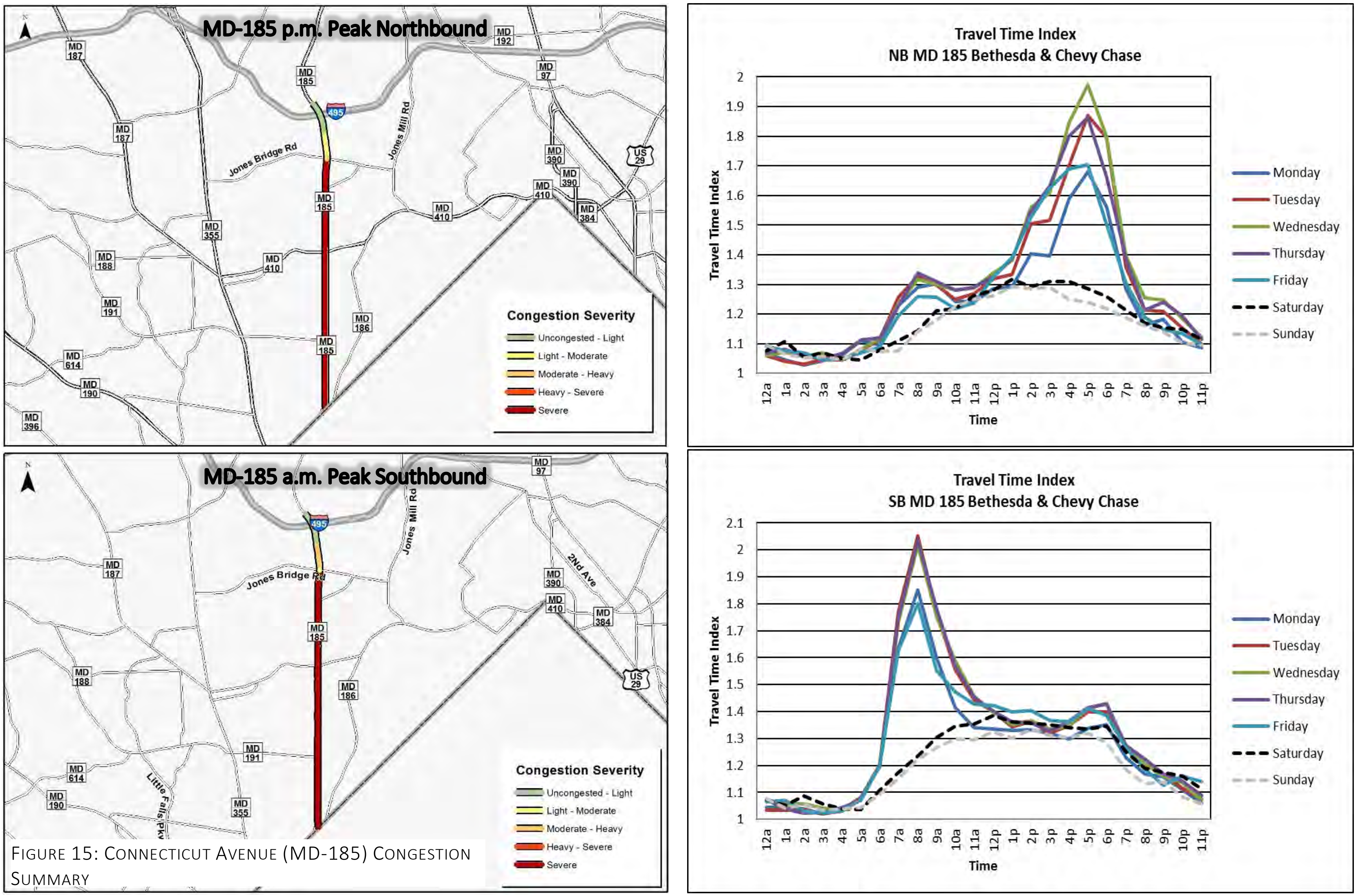


FIGURE 15: CONNECTICUT AVENUE (MD-185) CONGESTION SUMMARY

MD-355 from DC line to Capital Beltway (I-495)

MD-355 is somewhat unusual because both northbound and southbound directions of travel experience similar congestion patterns during the evening commute (Figure 16). This situation is likely due to the extraordinarily large employment center comprising the National Institutes of Health (NIH) and the Walter Reed Medical Center. The pattern of MD-355 southbound congestion is more balanced relative to northbound congestion, having two similar peaks during the morning and evening commutes. Maps depicting the evening commute is shown for both directions.

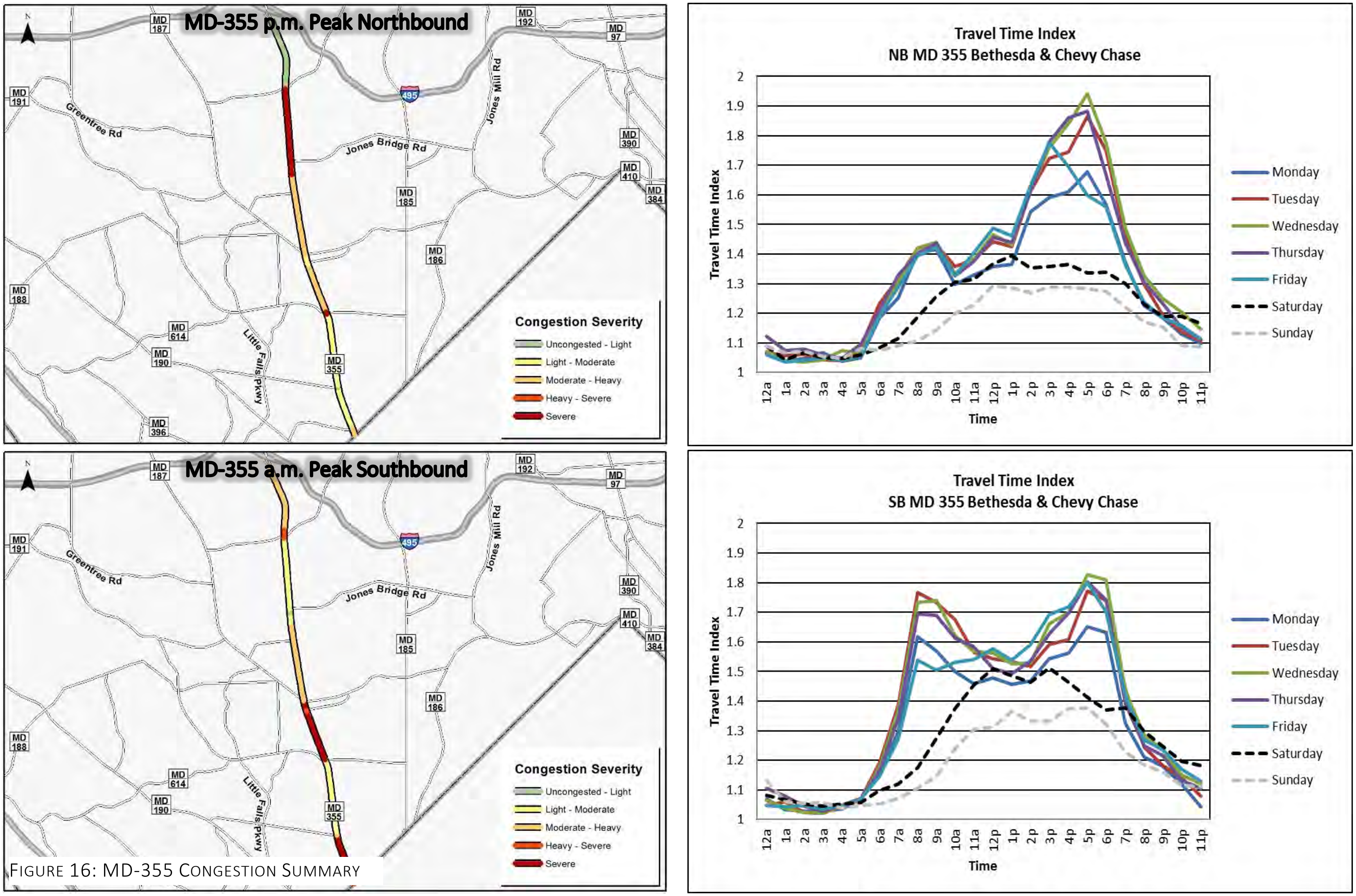


FIGURE 16: MD-355 CONGESTION SUMMARY

Clarksburg

In Clarksburg, this report analyzes speed data along Frederick Road (MD-355) between Brink Road and Comus Road, and Ridge Road (MD-27) between Brink Road and Davis Mill Road (Figure 17). The most congested roadway in Clarksburg is Ridge Road in the southbound direction during the morning commute. According to speed data collected in 2015, commuters can expect travel times to take twice as long as they would under free-flow conditions. These lengthy times were likely in part caused by the construction activity related to the expansion of Ridge Road from the new intersection at Snowden Farm Parkway to Brink Road. Other corridors in Clarksburg experience light to moderate congestion during peak periods (Table 4).

Northbound speed and travel time reliability experienced very little change from 2011 to 2015. Southbound speed and travel time reliability, as indicated by the rise in the PTI, decreased more dramatically than the northbound direction (Figure 18). This decrease in reliability was also likely affected by the construction along Ridge Road. For example, travelers in the southbound direction in 2015 on average needed to allocate 65 percent more time to nearly guarantee an on-time arrival. In 2011, 32 percent more time was necessary to guarantee an on-time arrival.

TABLE 4: CLARKSBURG TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-27	100%	SOUTHBOUND	AM Peak
MD-27	39%	SOUTHBOUND	PM Peak
MD-355	33%	SOUTHBOUND	AM Peak
MD-27	26%	SOUTHBOUND	Off Peak
MD-27	20%	NORTHBOUND	PM Peak
MD-355	10%	NORTHBOUND	PM Peak
MD-27	7%	NORTHBOUND	AM Peak
MD-355	7%	NORTHBOUND	AM Peak
MD-355	6%	SOUTHBOUND	PM Peak
MD-355	6%	NORTHBOUND	Off Peak

FIGURE 17: CORRIDORS ANALYZED IN CLARKSBURG

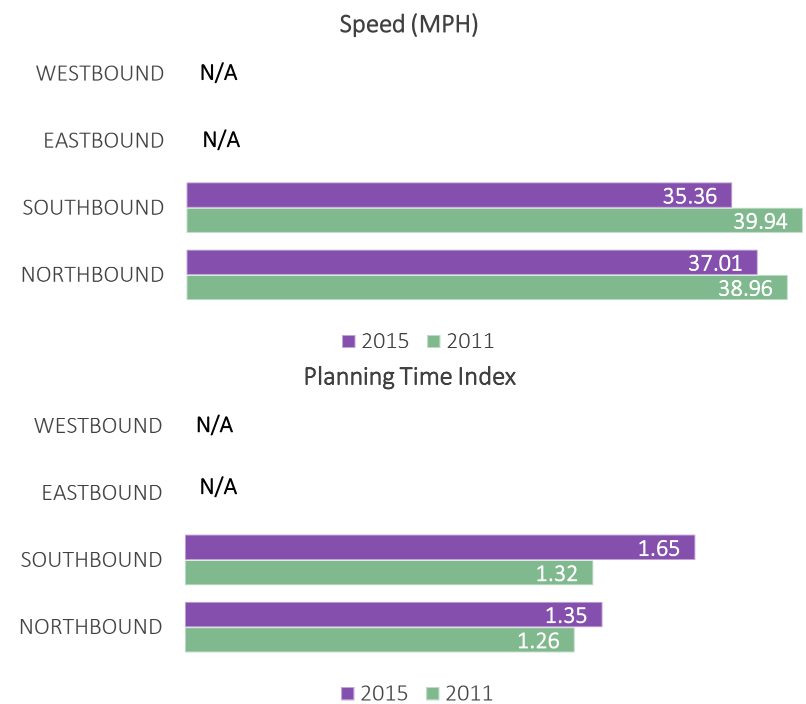


FIGURE 18: 2011 AND 2015 CLARKSBURG SPEED AND PTI COMPARISON

Ridge Road (MD-27) from Brink Road to Davis Mill Road

Ridge Road from Brink Road to Davis Mill Road experiences a spike in congestion during the morning commute at around 8 a.m. in the southbound direction (Figure 19). As mentioned previously, this congestion was partly due to the construction related to the widening of Ridge Road from Snowden Farm Parkway to Brink Road. Ridge Road in the northbound direction experiences an increase in congestion during the evening commute but at levels nowhere close to the southbound morning commute.

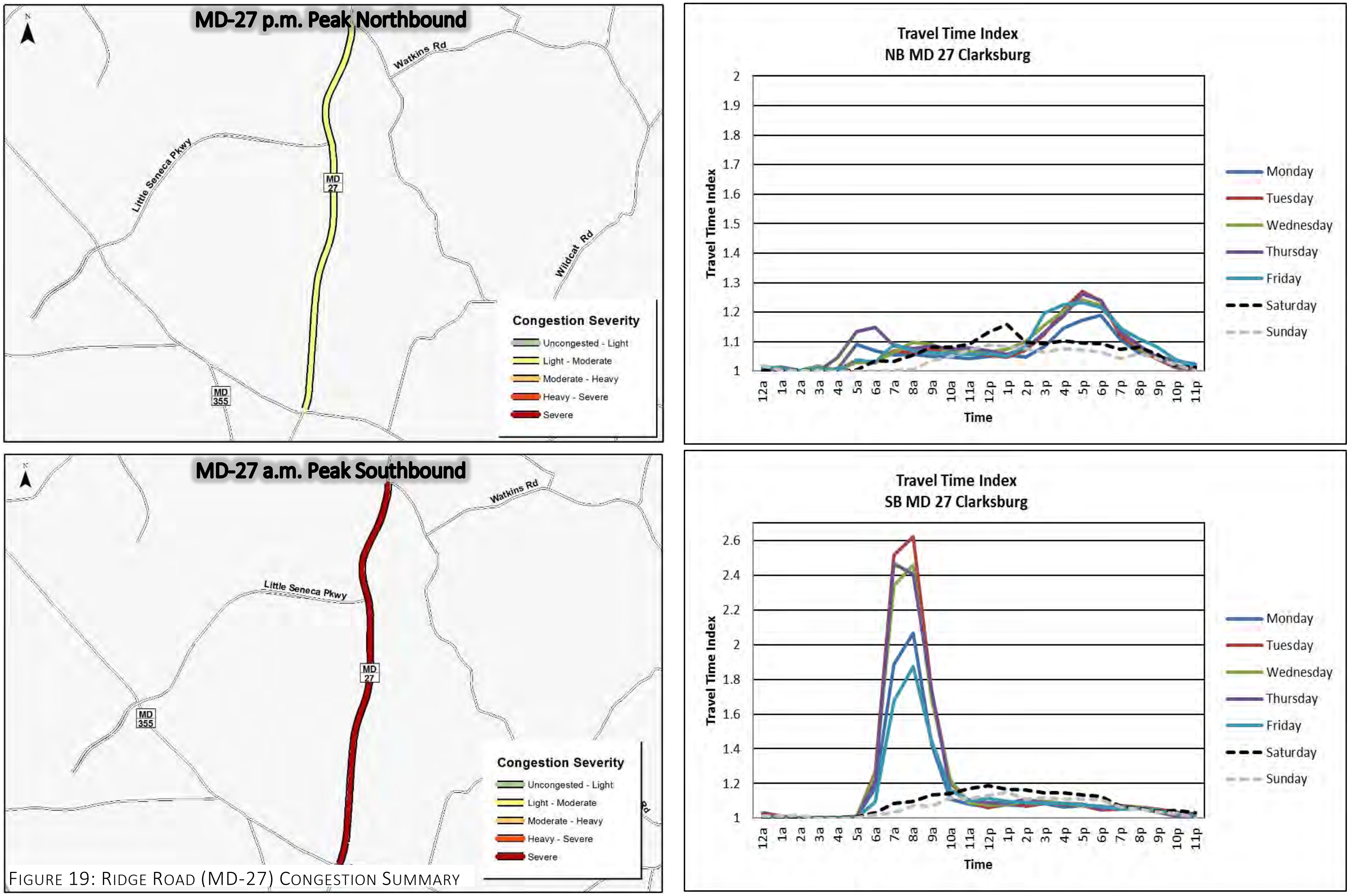


FIGURE 19: RIDGE ROAD (MD-27) CONGESTION SUMMARY

Frederick Road (MD-355) from Brink Road to Comus Road

Frederick Road's morning commute is significantly more congested than the evening commute (Figure 20). Southbound congestion becomes moderate to heavy south of Clarksburg Road during the morning commute and reaches its peak at around 7 a.m. Northbound congestion remains uncongested with the exception of Friday afternoons when congestion reaches the low end of the light to moderate range at about 3 p.m.

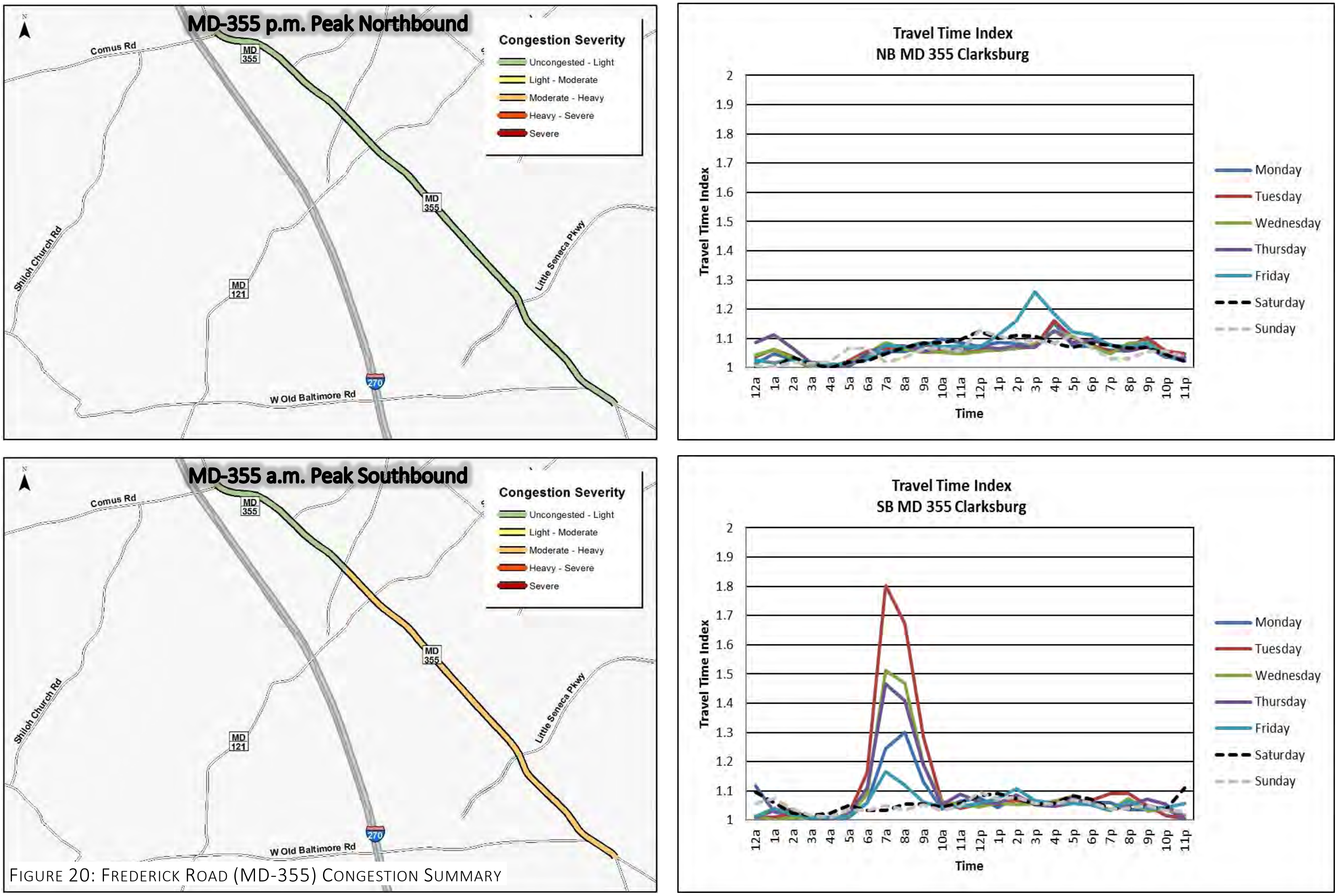


FIGURE 20: FREDERICK ROAD (MD-355) CONGESTION SUMMARY

Damascus

In the Damascus Policy Area, this report analyzes Ridge Road (MD-27) between Davis Mill Road and Gue Road. The southern section of this corridor, although outside of the Damascus Policy Area, was included in this analysis due to the segmentation used by the data provider (Figure 21). Most of the Damascus Policy Area remains rural with a majority of the non-residential development occurring within a mile radius of the intersection of Ridge Road, Woodfield Road (MD-124), and MD-108. The most congested direction and time for Ridge Road is southbound during the morning commute. Congestion during this time is still relatively light with a 10-minute uncongested trip through this corridor only taking an additional 1.6 minutes during the morning commute. This is closely followed by southbound and northbound travel during the evening commute (Table 1).

A comparison of speed data from 2011 to 2015 indicates that the average speed has decreased slightly, but below that of the rate countywide. The PTI has only slightly increased, indicating that Ridge Road's reliability and predictability have remained steady since 2011 (Figure 22). For example, in 2015, a 10-minute southbound trip through the corridor would require a total of 13.5 minutes to almost guarantee an on-time arrival. In 2011, the same trip would have required a total of 12 minutes to guarantee a punctual arrival 95 percent of the time.

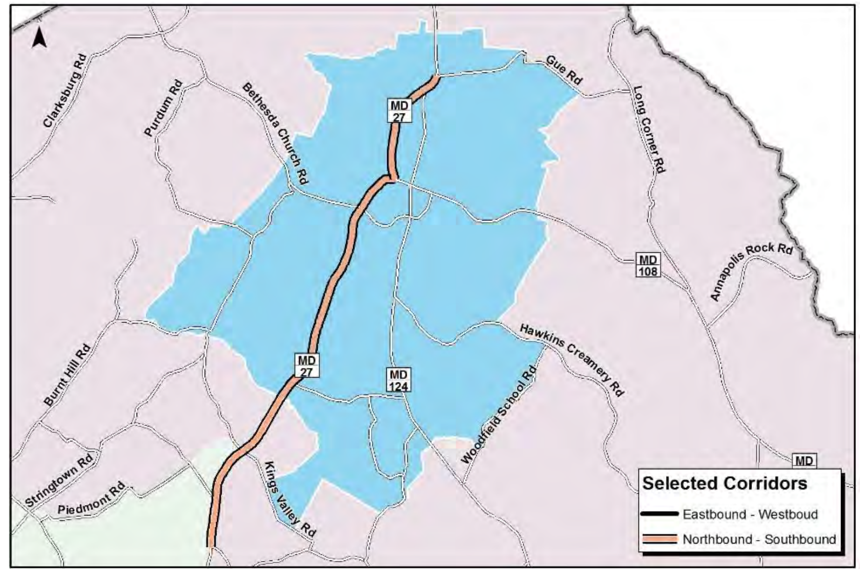


FIGURE 21: CORRIDORS ANALYZED IN DAMASCUS

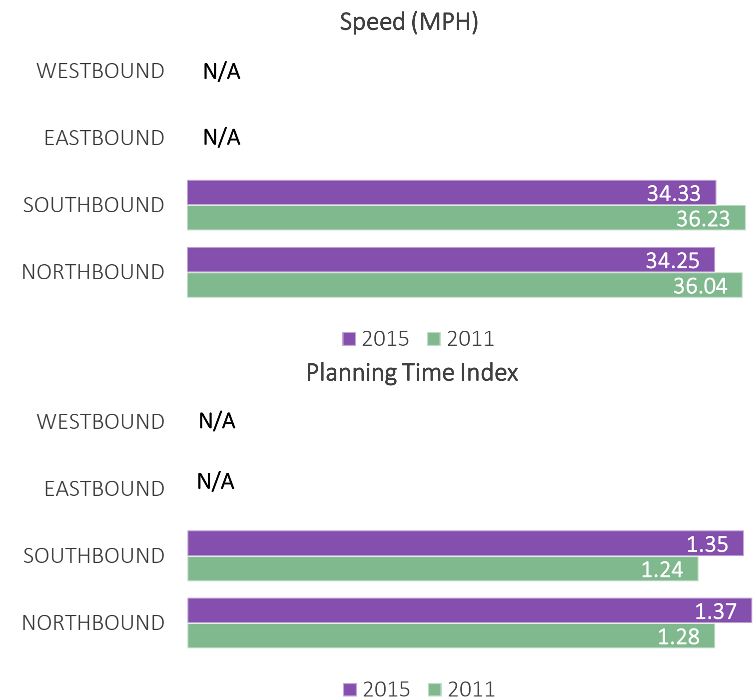


FIGURE 22: 2011 AND 2015 DAMASCUS SPEED AND PTI COMPARISON

TABLE 5: DAMASCUS TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-27	16%	SOUTHBOUND	AM Peak
MD-27	15%	SOUTHBOUND	PM Peak
MD-27	15%	NORTHBOUND	PM Peak
MD-27	11%	NORTHBOUND	AM Peak
MD-27	7%	SOUTHBOUND	Off Peak
MD-27	5%	NORTHBOUND	Off Peak

Ridge Road (MD-27) from Davis Mill Road to Gue Road

Congestion along Ridge Road tapers off significantly compared to the section analyzed in Clarksburg. Southbound congestion during the morning commute is heaviest south of Oak Drive approaching Davis Mill Road, but remains light to moderate. Commuters during the evening rush hours in the northbound direction experience light to moderate congestion north of Oak Drive to downtown Damascus on Ridge Road (Figure 23).

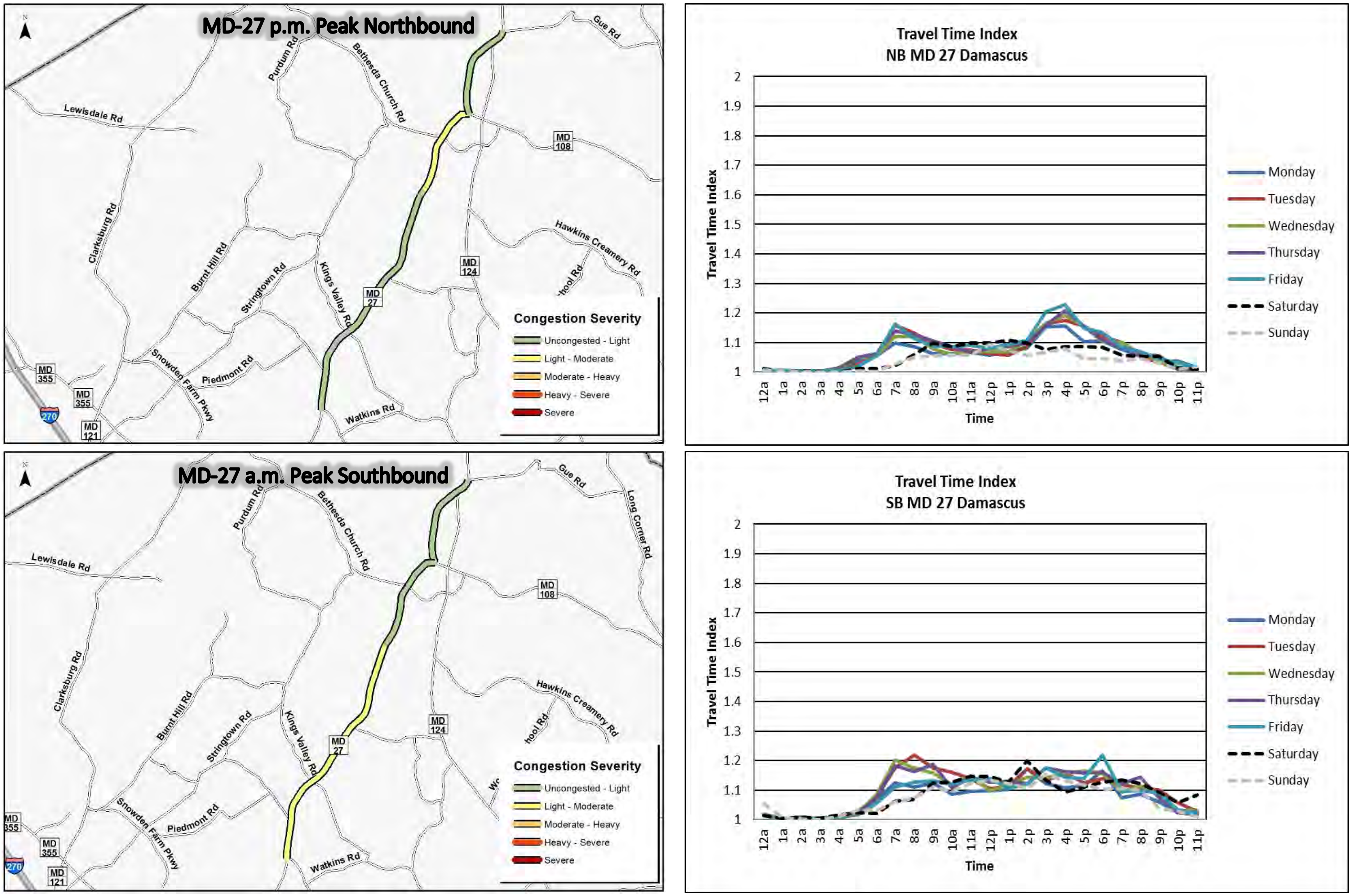


FIGURE 23: RIDGE ROAD (MD-27) CONGESTION SUMMARY

Cloverly, Fairland/Colesville, White Oak

This report analyzes two east-west and two north-south corridors in the Cloverly, Fairland/Colesville, and White Oak Policy Areas. The east-west corridors are MD-198/MD-28 between Layhill Road and the Prince George's County line, and Randolph Road between Kemp Mill Road and Columbia Pike (US-29). The north-south corridors are Columbia Pike between University Boulevard (MD-193) and MD-198 and New Hampshire Avenue (MD-650) between the Capital Beltway (I-495) and Ednor Road (Figure 24). Columbia Pike experiences the greatest amount of delay in the southbound direction during the morning commute with an average congestion of 73 percent. This indicates that it takes, on average, 73 percent more time to commute by car through this corridor in the southbound direction during the morning commute than under normal conditions. As will be shown in the next section, much of the congestion is concentrated in the southern part of the corridor. Southbound New Hampshire Avenue during the morning commute is a distant second at 48 percent congestion (Table 6).

A comparison of 2011 and 2015 data indicates that average speeds have decreased and the PTI has increased more for the northbound/southbound corridors than the eastbound/westbound corridors (Figure 25). Travel times appear to be the most unpredictable, as indicated by a greater PTI, in the southbound direction of travel along New Hampshire Avenue and Columbia Pike.

TABLE 6: CLOVERLY, FAIRLAND/COLESVILLE, WHITE OAK TOP CONGESTED

Route	Congestion	Direction	Period
US-29	73%	SOUTHBOUND	AM Peak
MD-650	48%	SOUTHBOUND	AM Peak
US-29	42%	NORTHBOUND	PM Peak
RANDOLPH RD	40%	EASTBOUND	AM Peak
MD-650	38%	SOUTHBOUND	PM Peak
MD-198	34%	EASTBOUND	PM Peak
MD-650	34%	NORTHBOUND	PM Peak
RANDOLPH RD	33%	WESTBOUND	PM Peak
MD-28	33%	WESTBOUND	AM Peak
MD-198	30%	EASTBOUND	AM Peak

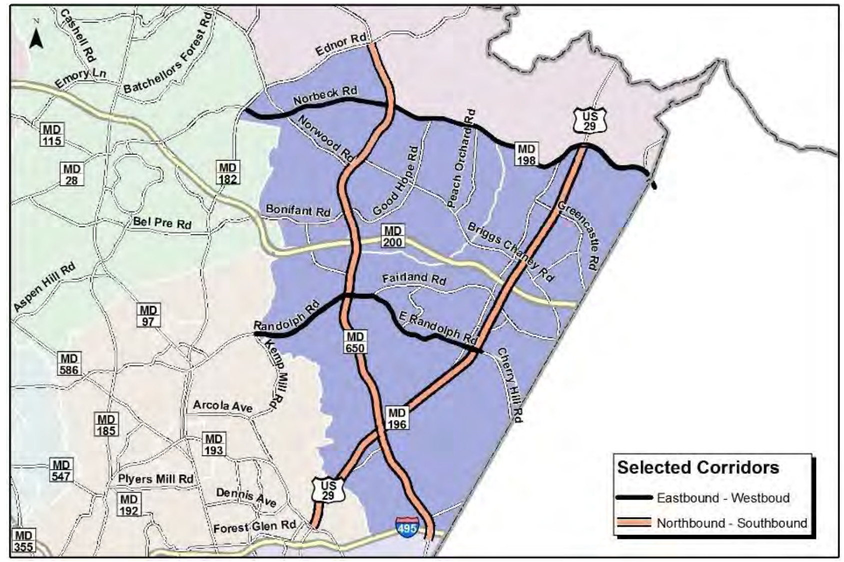


FIGURE 24: CORRIDORS ANALYZED IN CLOVERLY, FAIRLAND/COLESVILLE AND WHITE OAK

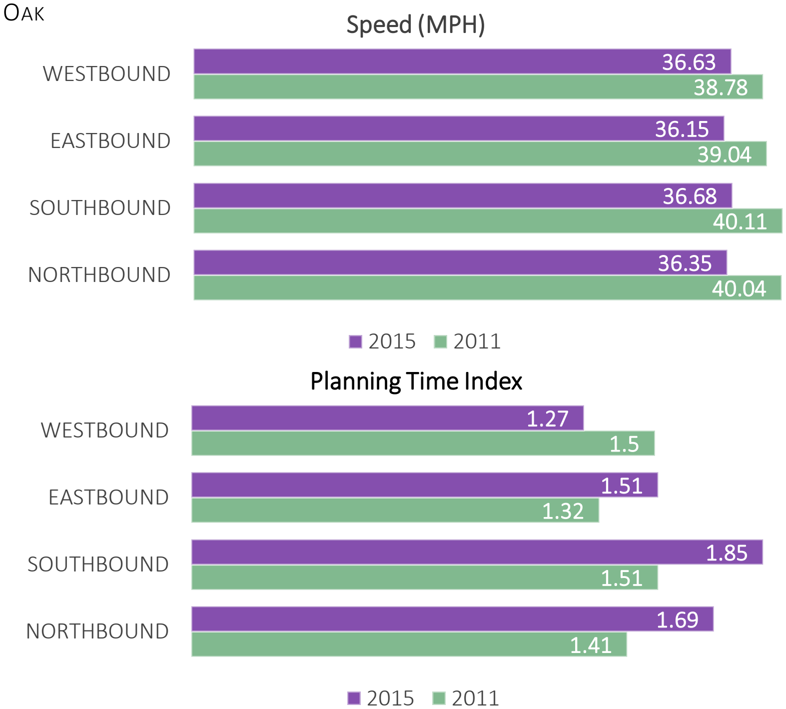


FIGURE 25: CLOVERLY AND VICINITY 2011 - 2015 SPEED AND PTI COMPARISON

Columbia Pike (US-29) from University Boulevard (MD-193) to Sandy Spring Road (MD-198)

Columbia Pike experiences two distinct peak periods. The morning commute sees a swift increase in congestion at around 7 a.m. located primarily south of Randolph/Cherry Hill Road. In this section of the corridor the TTI approaches two (100 percent congestion) indicating it requires double the amount of time to travel through during the morning commute than under free-flow conditions. Car commuters in the northbound direction during the evening commute typically experience the worst congestion between New Hampshire Avenue and Randolph/Cherry Hill Road (Figure 26).

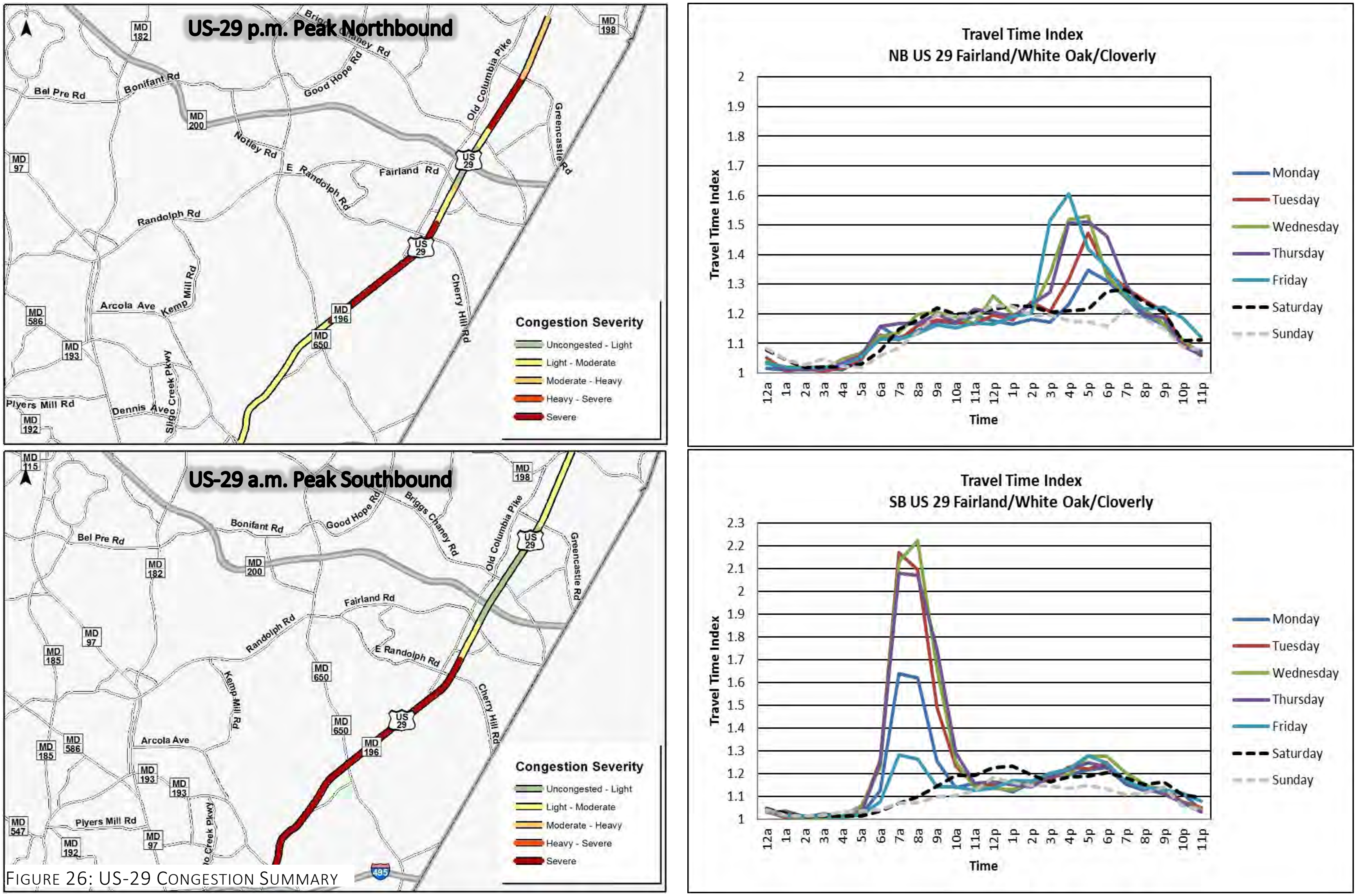
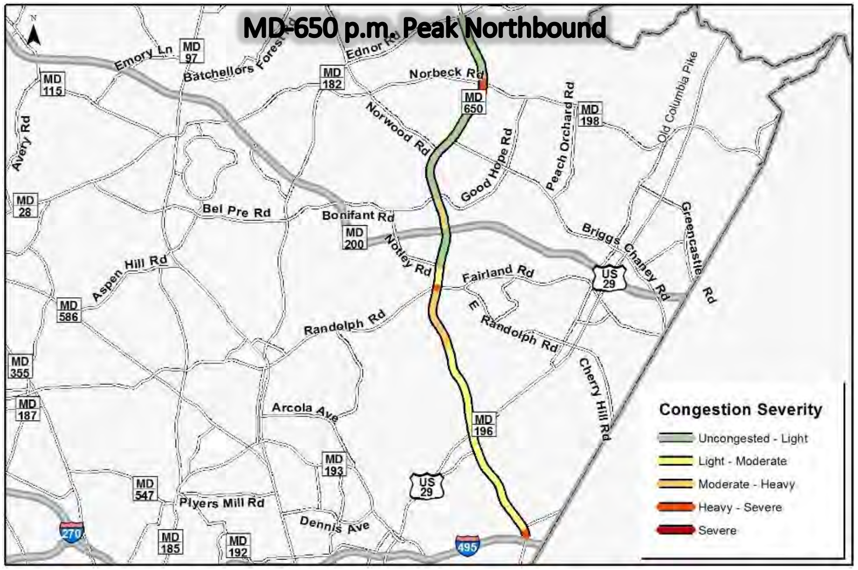
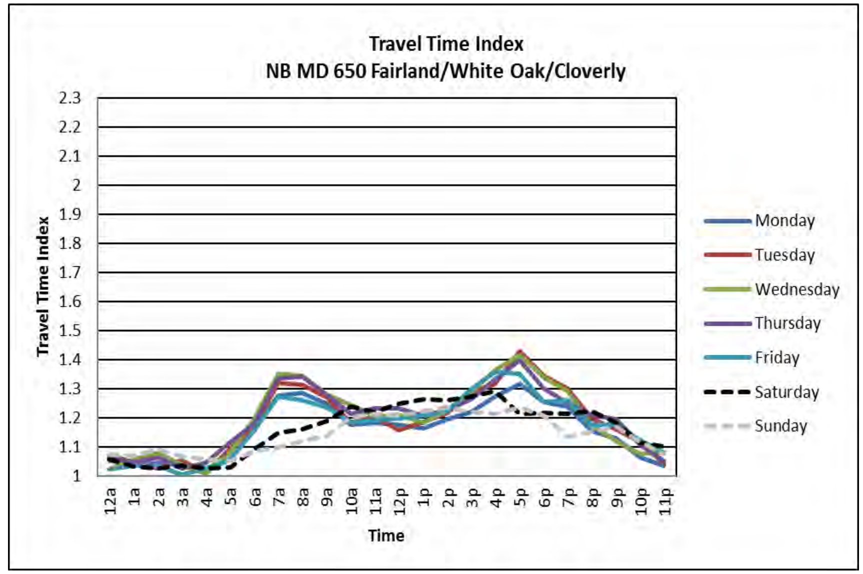


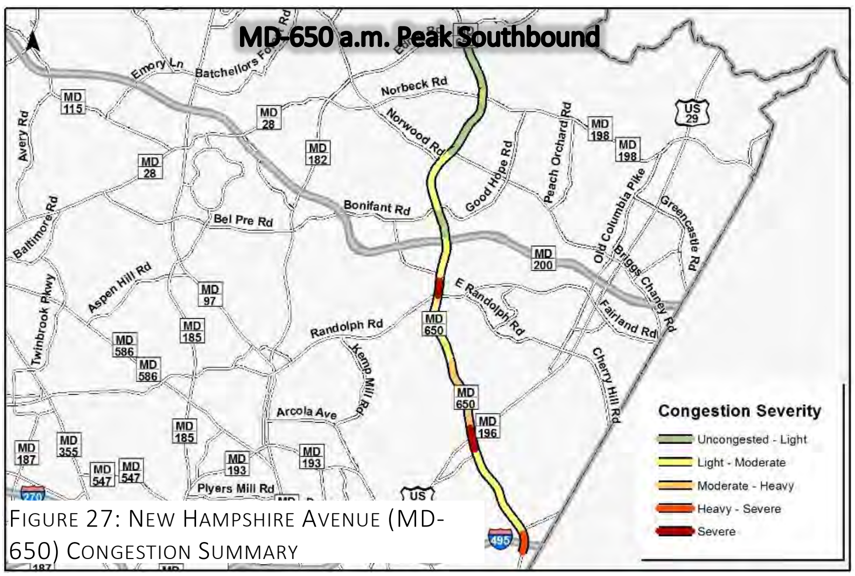
FIGURE 26: US-29 CONGESTION SUMMARY

New Hampshire Avenue (MD-650) from Capital Beltway (I-495) to Ednor Road

New Hampshire Avenue's heaviest congestion occurs during the morning commute in the southbound direction. The congestion shifts from light/moderate to severe congestion along the road from MD-200 south to the Capital Beltway. A moderate to severe level of congestion frequently occurs just to the north of the Food and Drug Administration's (FDA) headquarters. Levels of congestion are similar during the evening commute in both directions, perhaps influenced by FDA commuters accessing the Beltway and points south (Figure 27).







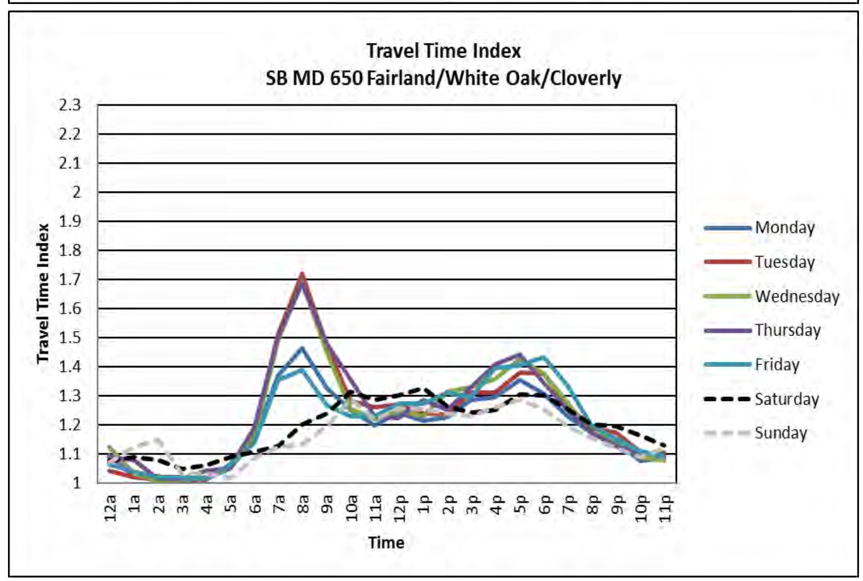


FIGURE 27: NEW HAMPSHIRE AVENUE (MD-650) CONGESTION SUMMARY

Gaithersburg, R&D Village, North Potomac, and Montgomery Village

Two east-west and two north-south corridors in the Gaithersburg, R&D Village, North Potomac, and Montgomery Village areas are summarized. The east-west corridors are Clopper Road (MD-117) between Longdraft Road and South Summit Avenue, and Darnestown Road/Key West Avenue (MD-28) between Jones Lane and Shady Grove Road. The north-south corridors consist of Great Seneca Highway (MD-119) between Longdraft Road and Darnestown Road and Frederick Road (MD-355) between I-370 and Plummer Drive (Figure 28). This section of the county is somewhat unusual in that the top six congested roadways reach their peak during the evening commute. This congestion may indicate that commuters are trip-chaining during the evening commute to fulfill errands (Table 7).

2011 and 2015 data indicates that this area has seen an increase in congestion since 2011 that is greater than what is found throughout other sections of the county. Speeds have decreased an average of 5.4 miles per hour (MPH) across the policy areas with the north and southbound directions experiencing a greater decrease (Figure 29). The PTI has also increased by an average of almost one-half, indicating the travel time reliability was more erratic in 2015 than in 2011.

TABLE 7: GAITHERSBURG, R&D VILLAGE, NORTH POTOMAC, AND MONTGOMERY VILLAGE TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-117	55%	EASTBOUND	PM Peak
MD-117	50%	WESTBOUND	PM Peak
MD-355	50%	NORTHBOUND	PM Peak
GREAT SENECA HWY	49%	NORTHBOUND	PM Peak
MD-355	40%	SOUTHBOUND	PM Peak
MD-28	39%	WESTBOUND	PM Peak
MD-28	37%	WESTBOUND	AM Peak
MD-28	36%	EASTBOUND	PM Peak
GREAT SENECA HWY	35%	SOUTHBOUND	PM Peak
GREAT SENECA HWY	34%	NORTHBOUND	AM Peak

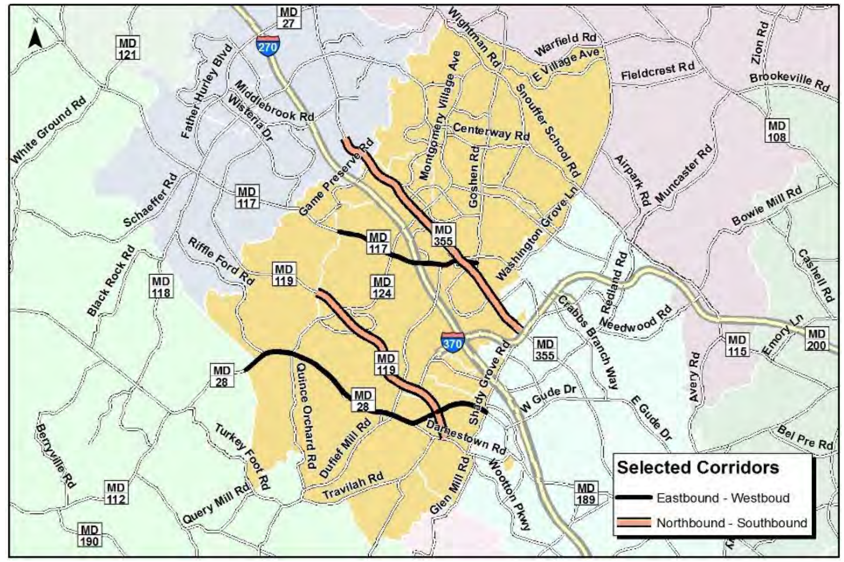


FIGURE 28: CORRIDORS ANALYZED IN GAITHERSBURG VICINITY

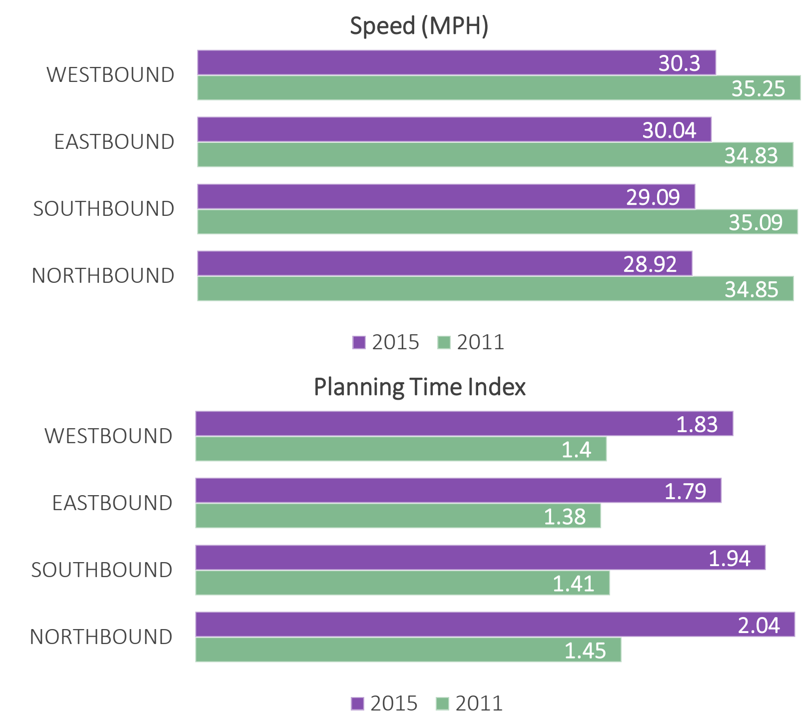


FIGURE 29: 2011 AND 2015 GAITHERSBURG SPEED AND PTI COMPARISON

Clopper Road (MD-117) from Longdraft Road to South Summit Avenue

Clopper Road is most congested during the evening commute in both travel directions. Eastbound congestion is centered east of I-270 and westbound congestion is heaviest west of I-270 during the evening commute (Figure 30). The draw of the National Institute of Standards and Technology, a major employer, coupled with commuters exiting from northbound I-270 to access Gaithersburg to the east and South Germantown to the west likely contributes to this corridor's bi-directional congestion during the evening commute.

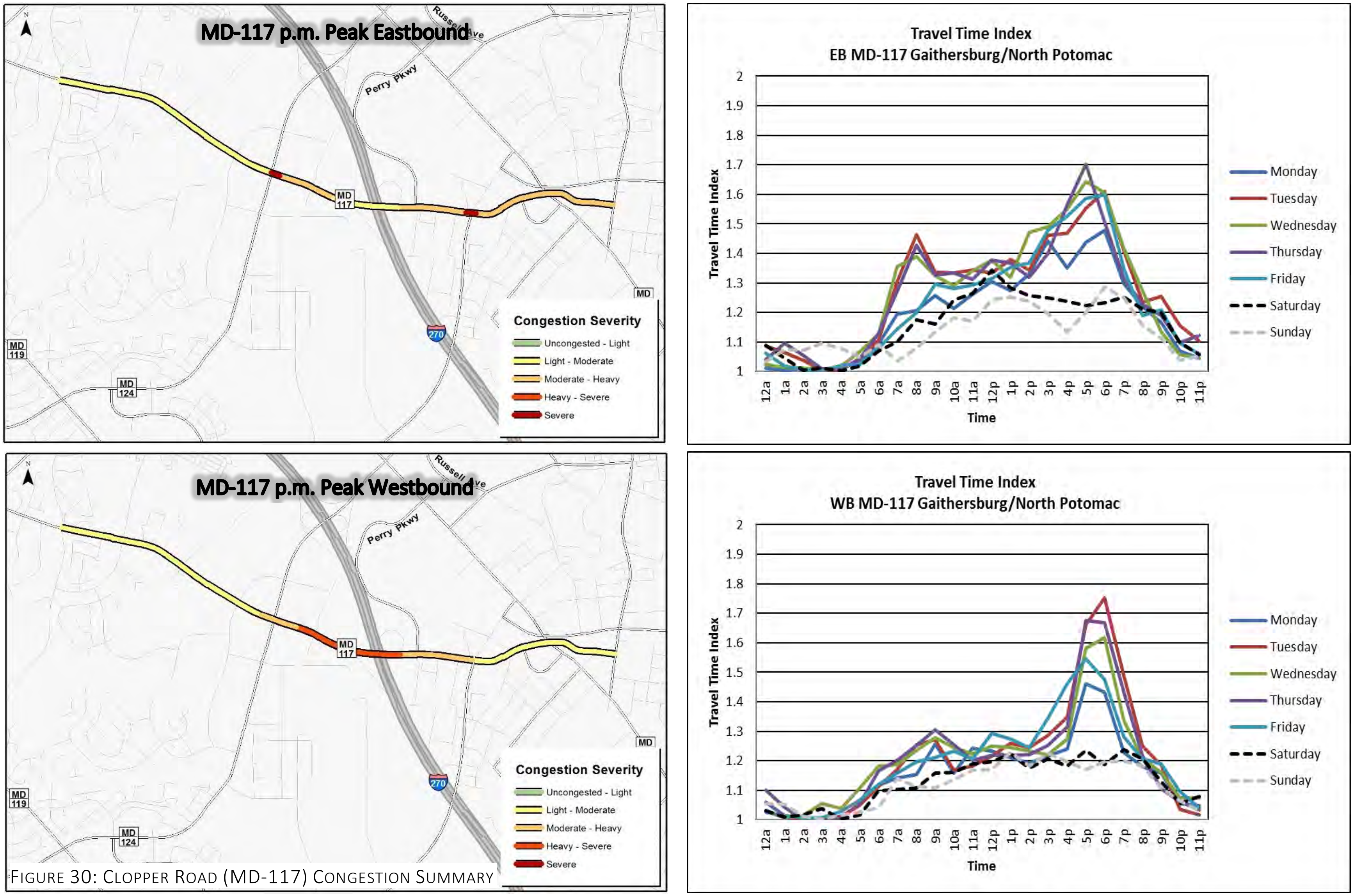


FIGURE 30: CLOPPER ROAD (MD-117) CONGESTION SUMMARY

Frederick Road (MD-355) from I-370 to Plummer Drive

Frederick Road from I-370 to Plummer Drive provides access to many businesses, employment centers, activity centers, apartments, and Gaithersburg High School. Northbound congestion peaks during the evening, but remains steady throughout the day, including on the weekends. Weekend congestion indicates the roadway provides mobility and accessibility for many non-work related trips. Congestion in the southbound direction peaks Tuesdays through Thursdays, but remains consistent throughout the day (Figure 31).

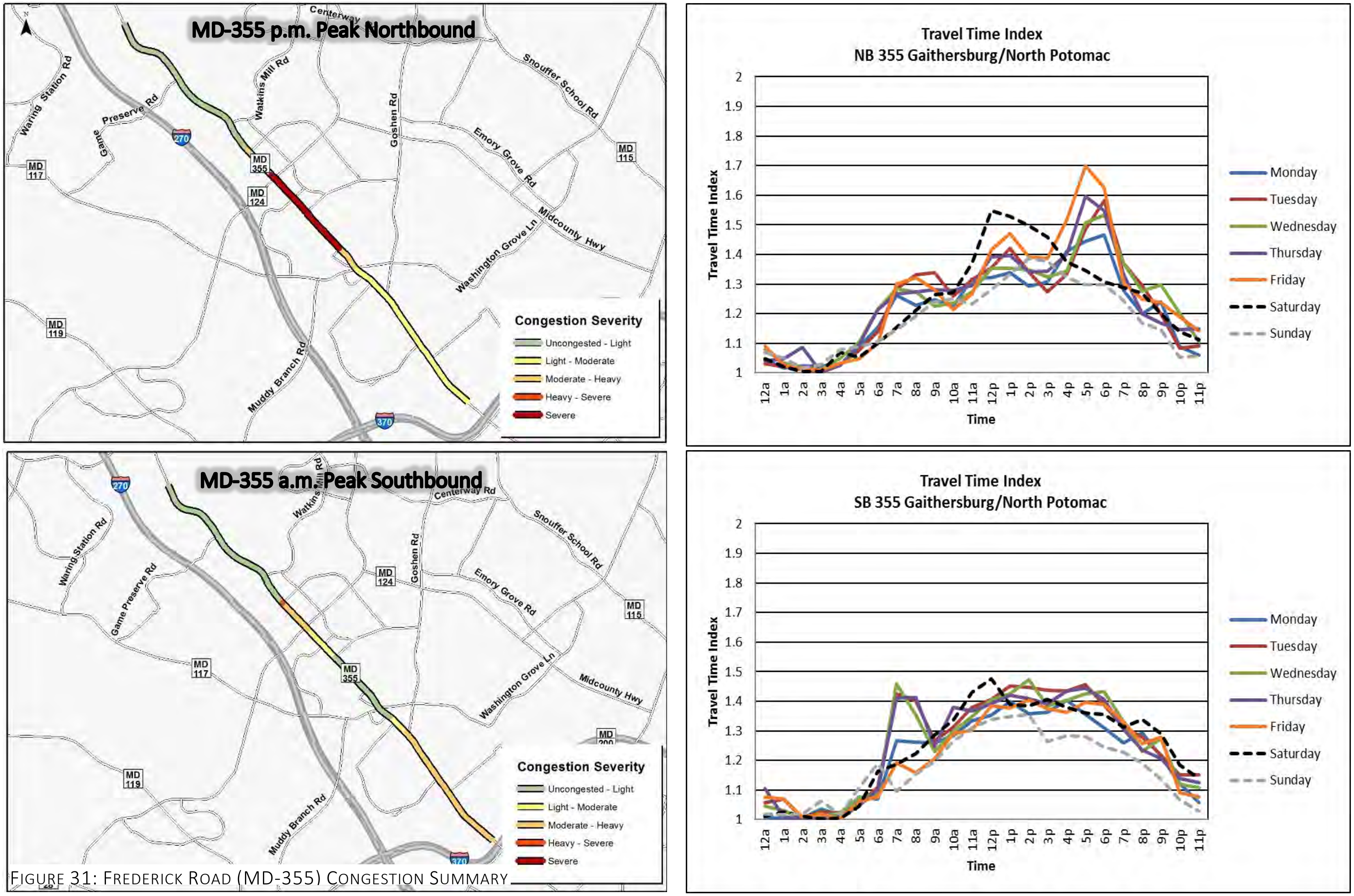


FIGURE 31: FREDERICK ROAD (MD-355) CONGESTION SUMMARY

Germantown Town Center, Germantown East, Germantown West

This report reviews several corridors in the Germantown area. The corridors are Frederick Road (MD-355) from Plummer Road to Brink Road, Ridge Road (MD-27) from Brink Road to Century Boulevard, Germantown Road (MD-118) from Frederick Road to Riffle Ford Road, Great Seneca Highway (MD-119) from Middlebrook Road to Longdraft Road, and Clopper Road (MD-117) from Longdraft Road to Richter Farm Road (Figure 32). Similar to the Gaithersburg area, the top five congested roads all occur during the evening commute, which is a reflection of the significant role that non-work related trips play in the area's congestion. Northbound Frederick Road has the highest congestion rate, taking on average 53 percent longer to travel through the corridor during the evening commute. Clopper Road in the westbound direction, also during the evening commute, takes on average 43 percent longer to travel through (Table 8).

Examination of 2011 and 2015 speed and travel time reliability data indicates that the average speeds have decreased on par with the overall county data in the Germantown area. The PTI has increased, on average, slightly less than the overall county (Figure 33). Northbound congestion has experienced the greatest increases in the PTI and decreases in speed.

TABLE 8: GERMANTOWN AND VICINITY TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-355	53%	NORTHBOUND	PM Peak
MD-117	43%	WESTBOUND	PM Peak
MD-27	39%	NORTHBOUND	PM Peak
MD-355	38%	SOUTHBOUND	PM Peak
MD-118	35%	SOUTHBOUND	PM Peak
MD-118	32%	SOUTHBOUND	AM Peak
GREAT SENECA HWY	30%	NORTHBOUND	AM Peak
MD-117	29%	EASTBOUND	PM Peak
MD-118	29%	NORTHBOUND	PM Peak
MD-355	26%	SOUTHBOUND	AM Peak

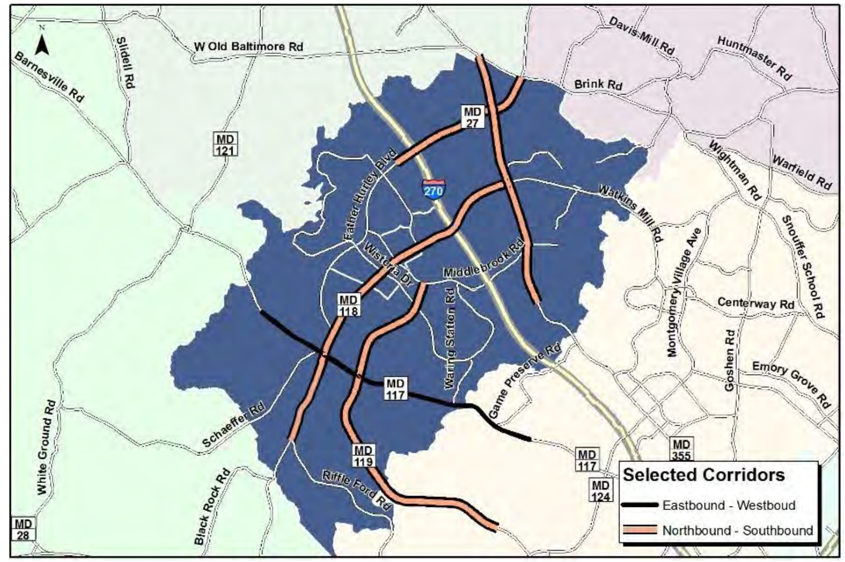


FIGURE 32: CORRIDORS ANALYZED IN GERMANTOWN AND VICINITY

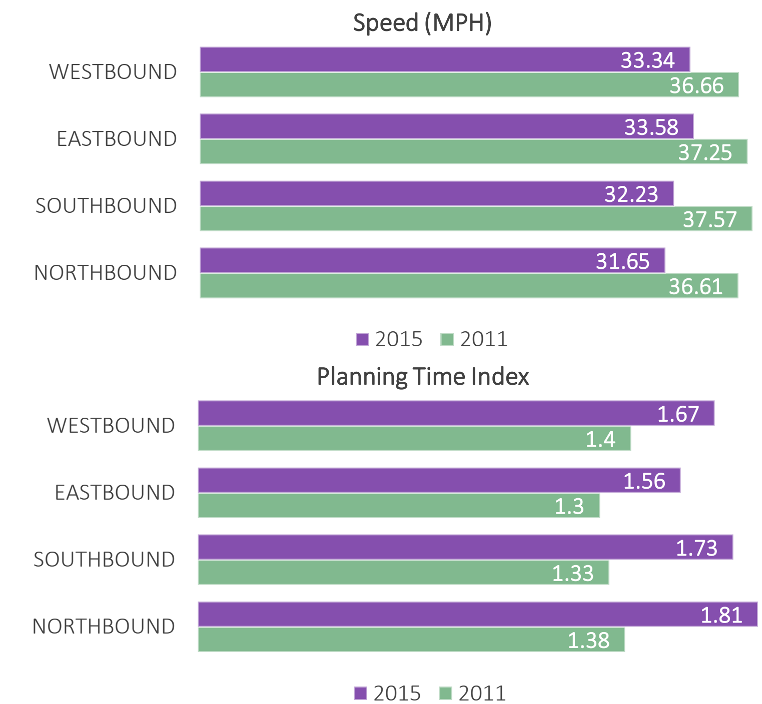


FIGURE 33: 2011 AND 2015 GERMANTOWN AND VICINITY SPEED AND PTI

Frederick Road (MD-355) from Plummer Road to Brink Road

Although northbound Frederick Road in the evening tops the list of congested roadways for the greater Germantown area, a majority of the heaviest congestion occurs between MD-27 and Brink Road. In this segment the congestion rate may reach 120 percent. There is a sharp peak in the TTI between 5 and 6 p.m. Southbound congestion, however, does not see a sharp peak with the heaviest congestion occurring between Germantown and Middlebrook Roads (Figure 34).

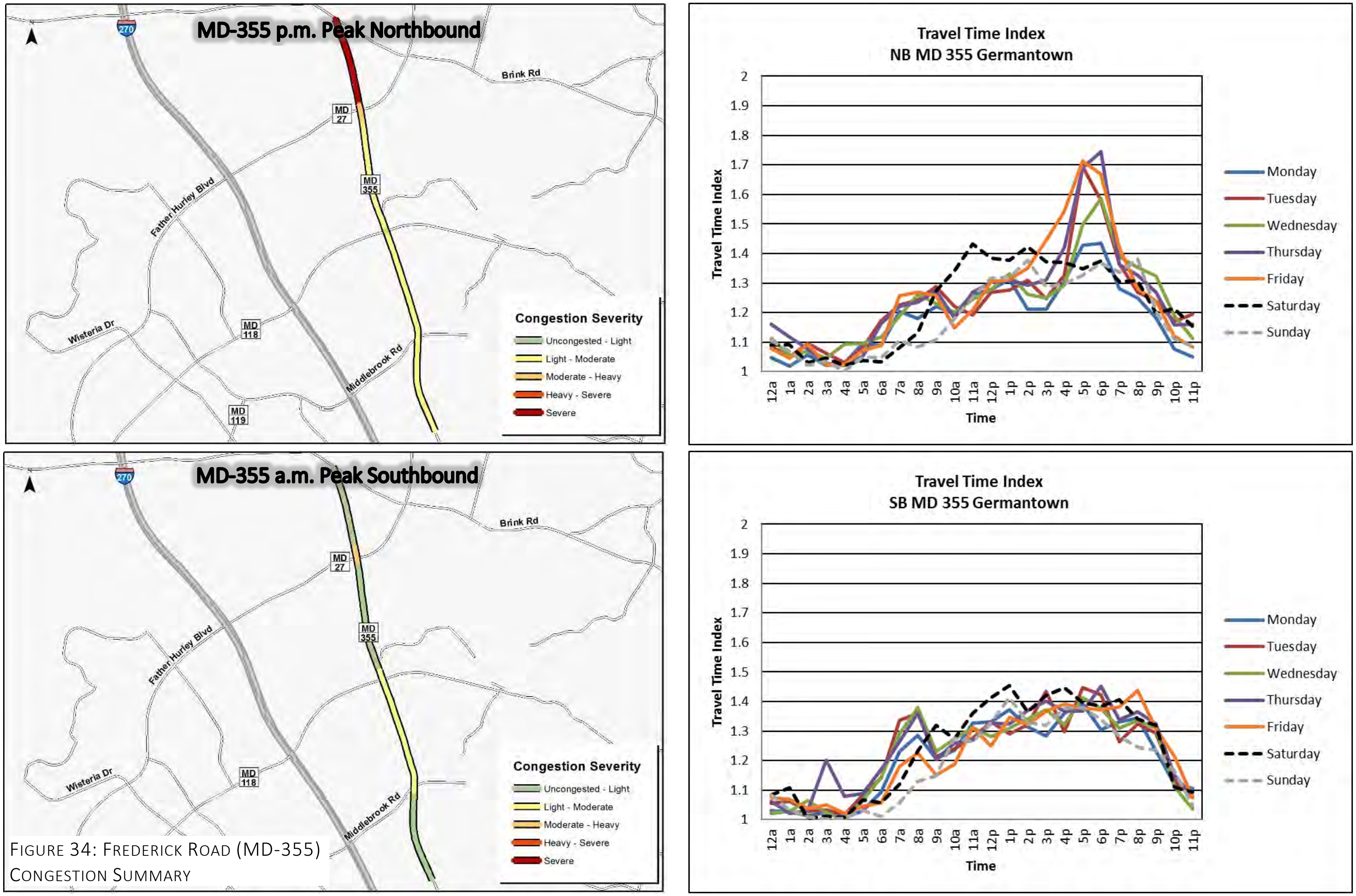


FIGURE 34: FREDERICK ROAD (MD-355) CONGESTION SUMMARY

Clopper Road (MD-117) from Longdraft Road to Richter Farm Road

Clopper Road experiences relatively steady congestion levels in the eastbound direction with subtle peaks in the morning, early afternoon, and evening. The westbound direction sees a more pronounced peak in congestion during the evening commute with significant increases in congestion around the intersections at MD-118 and MD-119 (Figure 35).

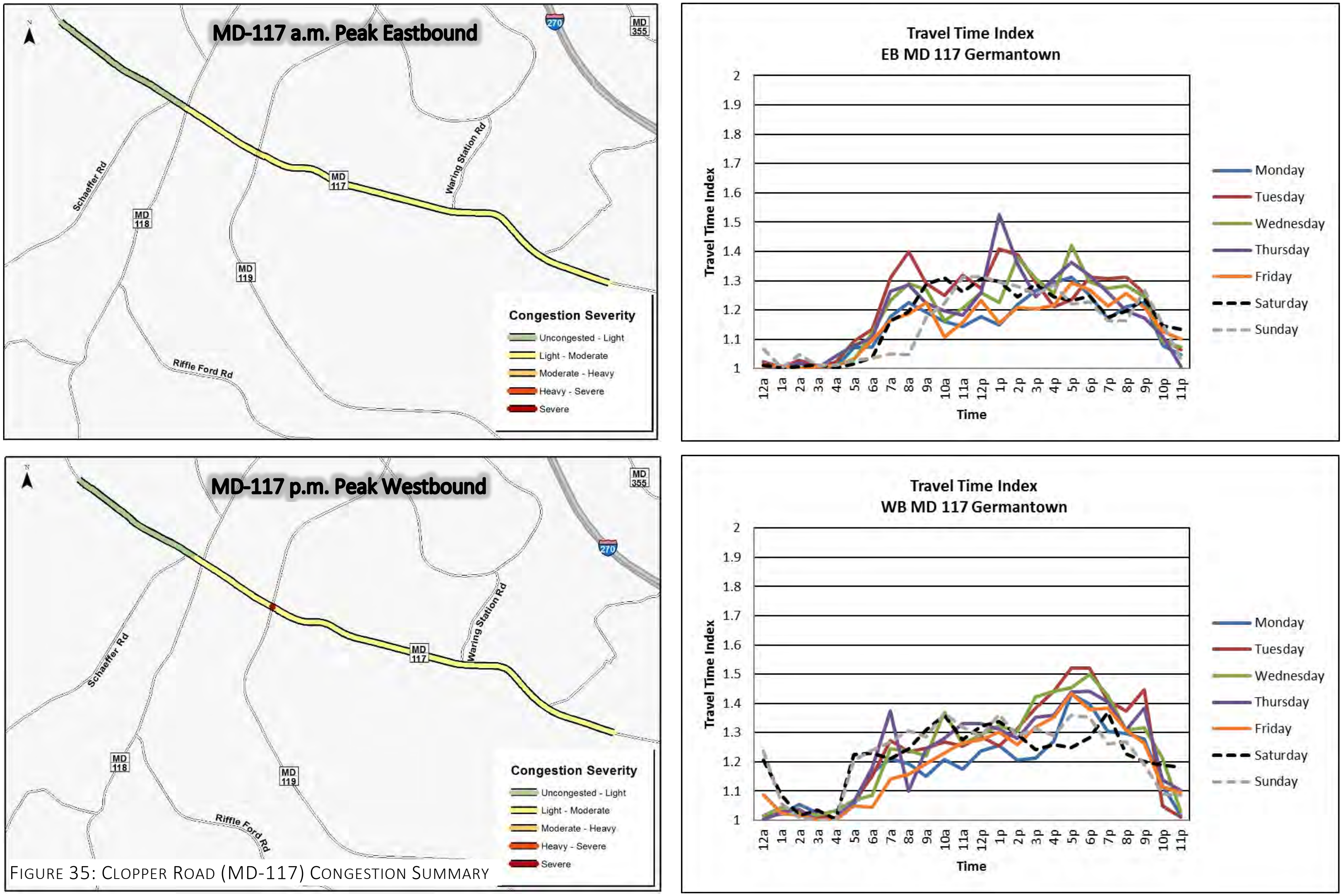


FIGURE 35: CLOPPER ROAD (MD-117) CONGESTION SUMMARY

North Bethesda, White Flint, Twinbrook, Grosvenor

The MAR summarizes two north-south and three east-west corridors in the greater North Bethesda area. The two north-south corridors are Old Georgetown Road (MD-187) from the Capital Beltway (I-495) to Rockville Pike (MD-355), and Rockville Pike from the Capital Beltway to Wootton Parkway. The northern portion of Rockville Pike is included with this analysis because of the data segmentation used by the data provider. The three east-west corridors are Randolph Road from Gaynor Road to Rockville Pike, Montrose Road from Rockville Pike to I-270, and Knowles/Strathmore Ave (MD-547) from Beach Drive to Rockville Pike (Figure 36).

Old Georgetown Road experiences bi-directional moderate to heavy congestion during the evening commute. Randolph Road experiences heavy congestion during the evening commute in the eastbound direction. Montrose Road does not make the top 10 list of congested corridors in the North Bethesda area.

Speed has decreased more in the north and south directions than the east and west directions since 2011. Travel time reliability has also decreased more in the north and south directions (Figure 37). On average, a traveler by car would need to more than double their normal travel time to nearly guarantee a punctual arrival when traveling along the north and south corridors in North Bethesda and its vicinity.

TABLE 9: NORTH BETHESDA AND VICINITY TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-187	67%	SOUTHBOUND	PM Peak
RANDOLPH RD	61%	EASTBOUND	PM Peak
MD-187	56%	NORTHBOUND	PM Peak
MD-187	50%	SOUTHBOUND	AM Peak
RANDOLPH RD	49%	WESTBOUND	PM Peak
RANDOLPH RD	47%	WESTBOUND	AM Peak
MD-187	45%	NORTHBOUND	AM Peak
MD-355	42%	NORTHBOUND	AM Peak
MD-547	42%	WESTBOUND	AM Peak
MD-355	41%	SOUTHBOUND	PM Peak

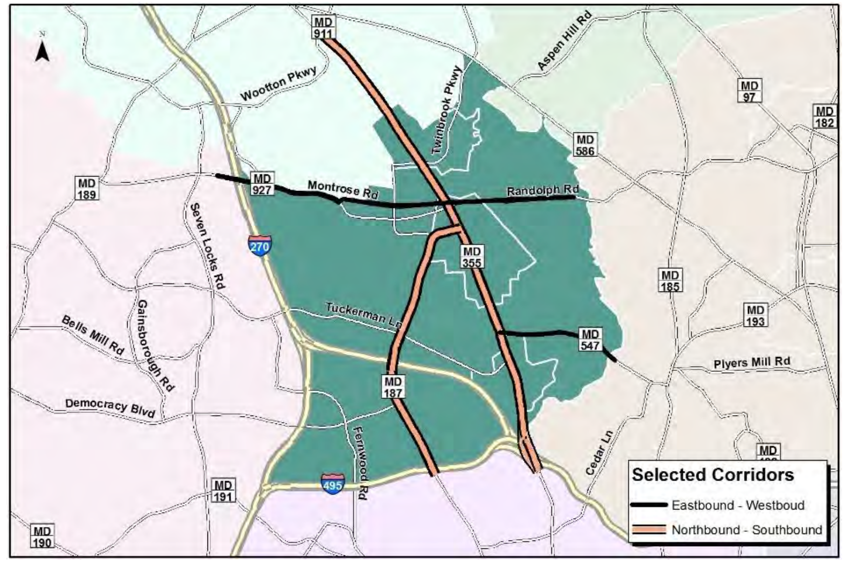


FIGURE 36: CORRIDORS ANALYZED IN NORTH BETHESDA, WHITE FLINT, TWINBROOK, AND GROSVENOR

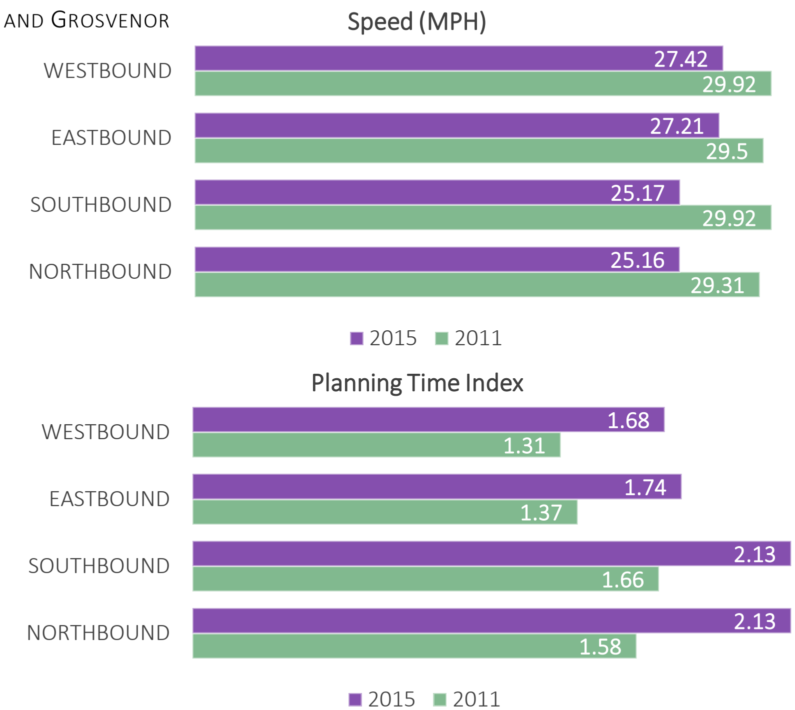
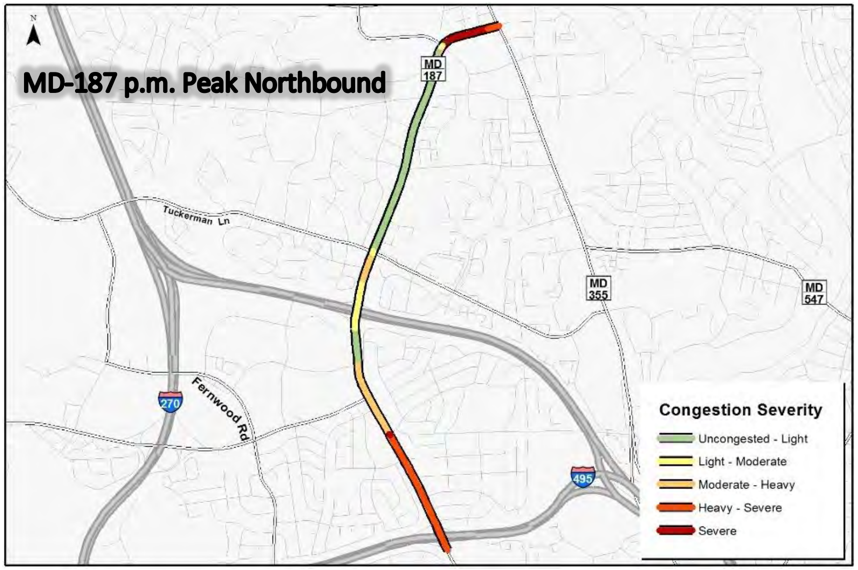
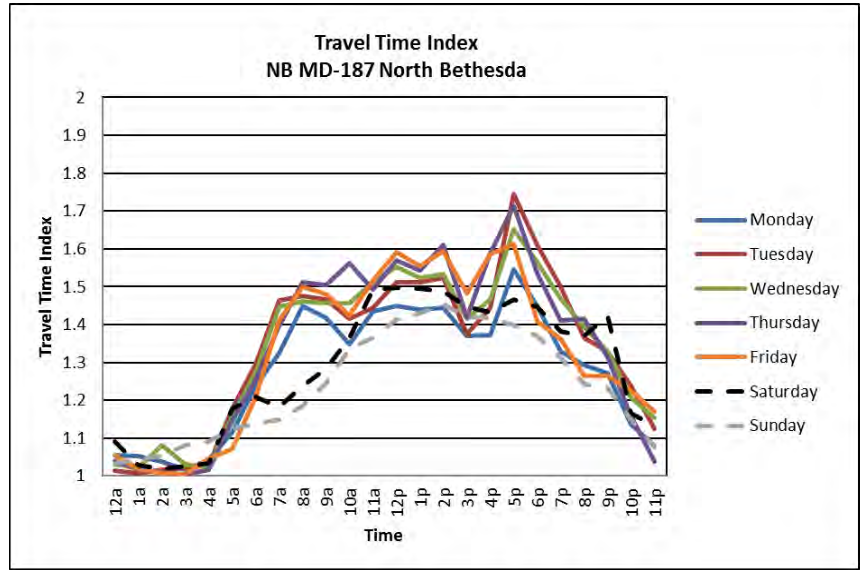


FIGURE 37: 2011 AND 2015 NORTH BETHESDA SPEED AND PTI

Old Georgetown Road (MD-187) from the Capital Beltway (I-495) to Rockville Pike (MD-355)

Old Georgetown Road experiences similar levels of congestion in both directions, particularly during the evening commute. Northbound drivers encounter heavy to severe congestion in the evenings just north of the Capital Beltway interchange and between Executive Boulevard and Rockville Pike. Southbound drivers during the evening face the heaviest congestion just south of the I-270 interchange. Southbound travelers also experience an increase in congestion during the morning commute. Both directions see a steady flow of traffic throughout all days of the week (Figure 38).





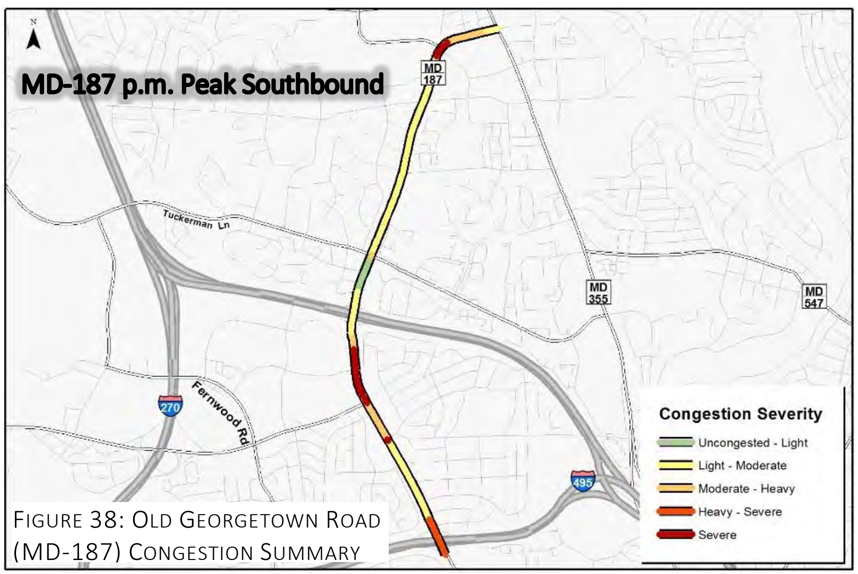
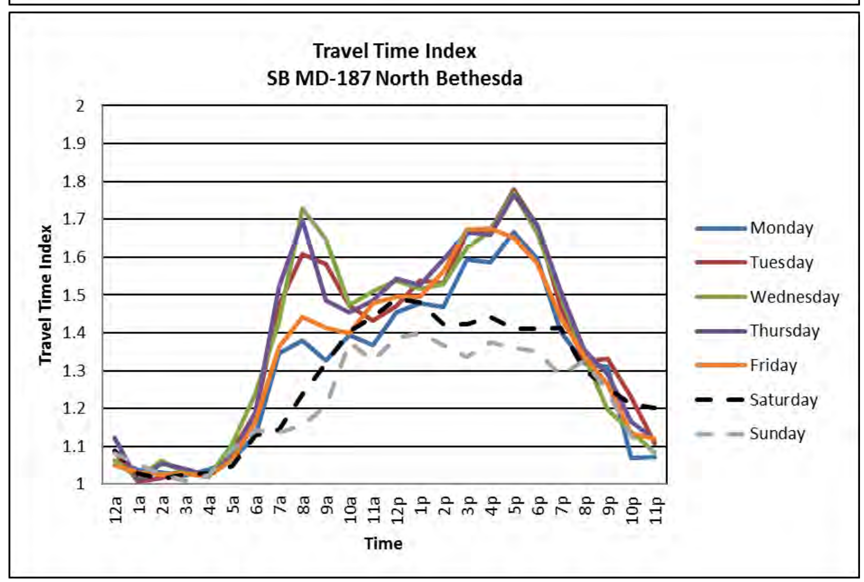
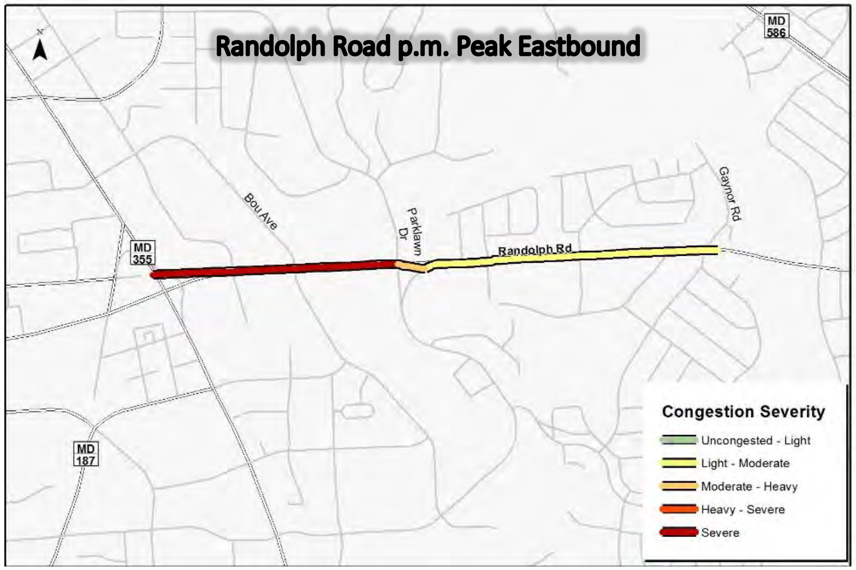


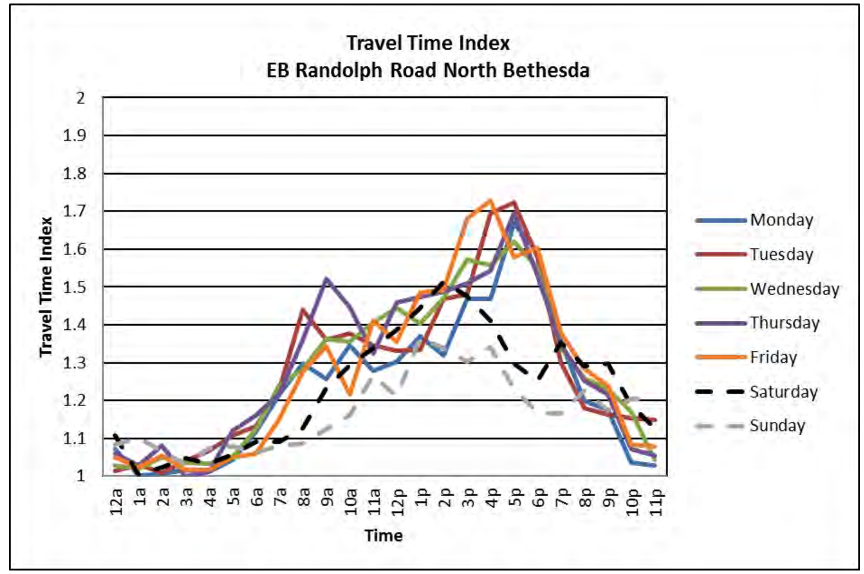
FIGURE 38: OLD GEORGETOWN ROAD (MD-187) CONGESTION SUMMARY



Randolph Road from Gaynor Road to Rockville Pike (MD-355)

The worst congestion along Randolph Road occurs during the evening commute in the eastbound direction between Parklawn Drive and Rockville Pike. On average, congestion along this segment reaches 85 percent, indicating that it takes over two-thirds more time to drive through this portion of the roadway during the evening commute. During the morning commute, travelers can expect moderate to heavy congestion throughout the entire corridor with a section of heavy to severe congestion around the intersection of Parklawn Drive (Figure 39).





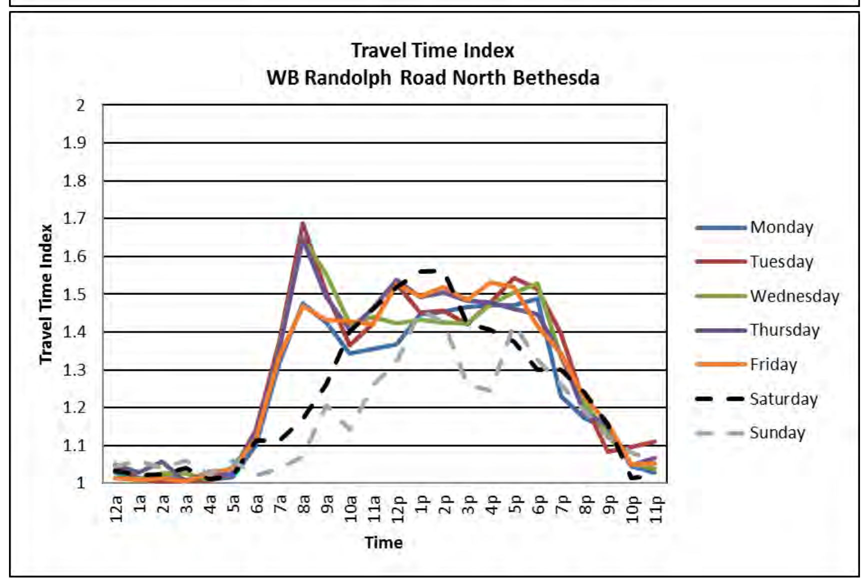


FIGURE 39: RANDOLPH ROAD CONGESTION SUMMARY

Potomac

Corridors explored in Potomac are River Road (MD-190) from the Capital Beltway (I-495) to Piney Meetinghouse Road, Falls Road (MD-189) from River Road (MD-190) to Montrose Road, and Montrose Road from I-270 to Falls Road (Figure 40). The worst congestion occurs along eastbound River Road during the morning commute. Automobile travelers along this segment spend an average 57 percent more time commuting than under free-flow conditions during the morning commute. Westbound Montrose Road within the Potomac Policy Area ranks second during the evening commute. During that time, it takes automobile travelers an average of just over 55 percent more time to travel through the corridor than at free-flow conditions (Table 10).

Examination of 2011 and 2015 data indicates speed has decreased an average of three miles per hour since 2011, a rate less than the county overall. The PTI has slightly increased in all directions indicating that congestion is becoming more varied (Figure 41). The PTI in Potomac, however, is significantly below that of the county overall.

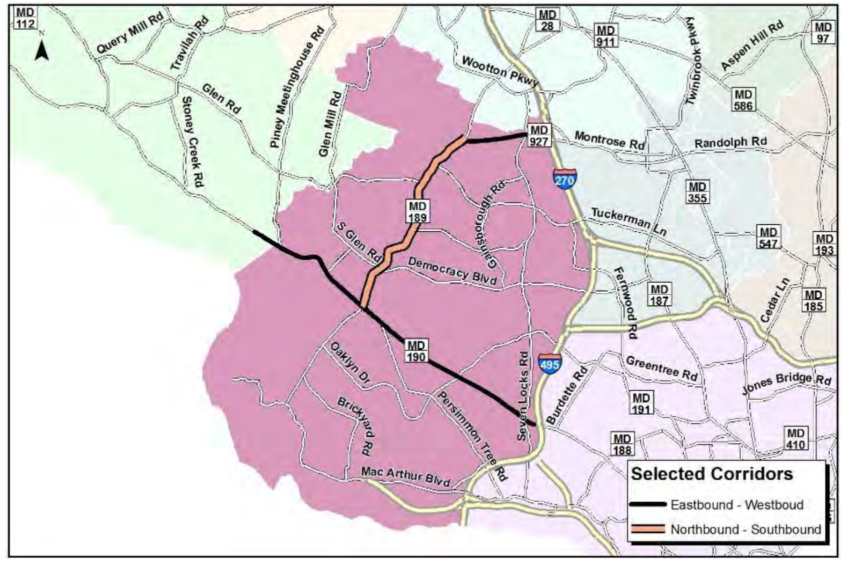


FIGURE 40: CORRIDORS ANALYZED IN POTOMAC

TABLE 10: POTOMAC TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-190	57%	EASTBOUND	AM Peak
MONTROSE RD	55%	WESTBOUND	PM Peak
MD-190	42%	WESTBOUND	PM Peak
MONTROSE RD	38%	WESTBOUND	AM Peak
MD-189	36%	NORTHBOUND	PM Peak
MD-189	36%	SOUTHBOUND	PM Peak
MD-189	31%	NORTHBOUND	AM Peak
MD-189	24%	SOUTHBOUND	AM Peak
MONTROSE RD	20%	WESTBOUND	Off Peak
MD-190	20%	EASTBOUND	PM Peak

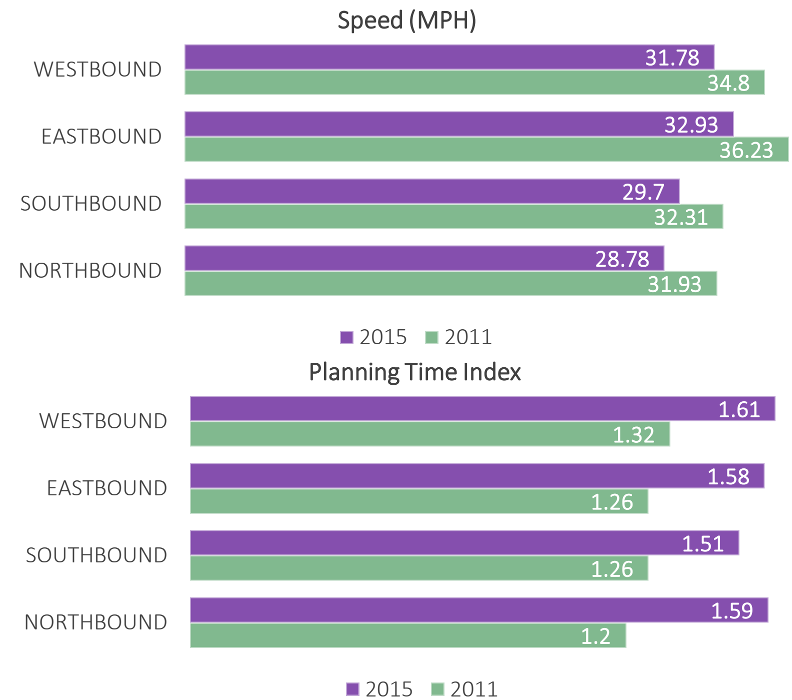


FIGURE 41: 2011 AND 2015 POTOMAC SPEED AND PTI COMPARISON

River Road (MD-190) from the Capital Beltway (I-495) to Piney Meetinghouse Road

River Road is a commuter dominated thoroughfare with two discernible peaks of congestion during the morning and evening commutes. Eastbound travelers in the morning can expect severe congestion for short periods approaching the intersections at Piney Meetinghouse Road and Bradley Boulevard. During the evening commute, westbound travelers experience more sustained moderate to heavy congestion from the Capital Beltway to Falls Road (Figure 42).

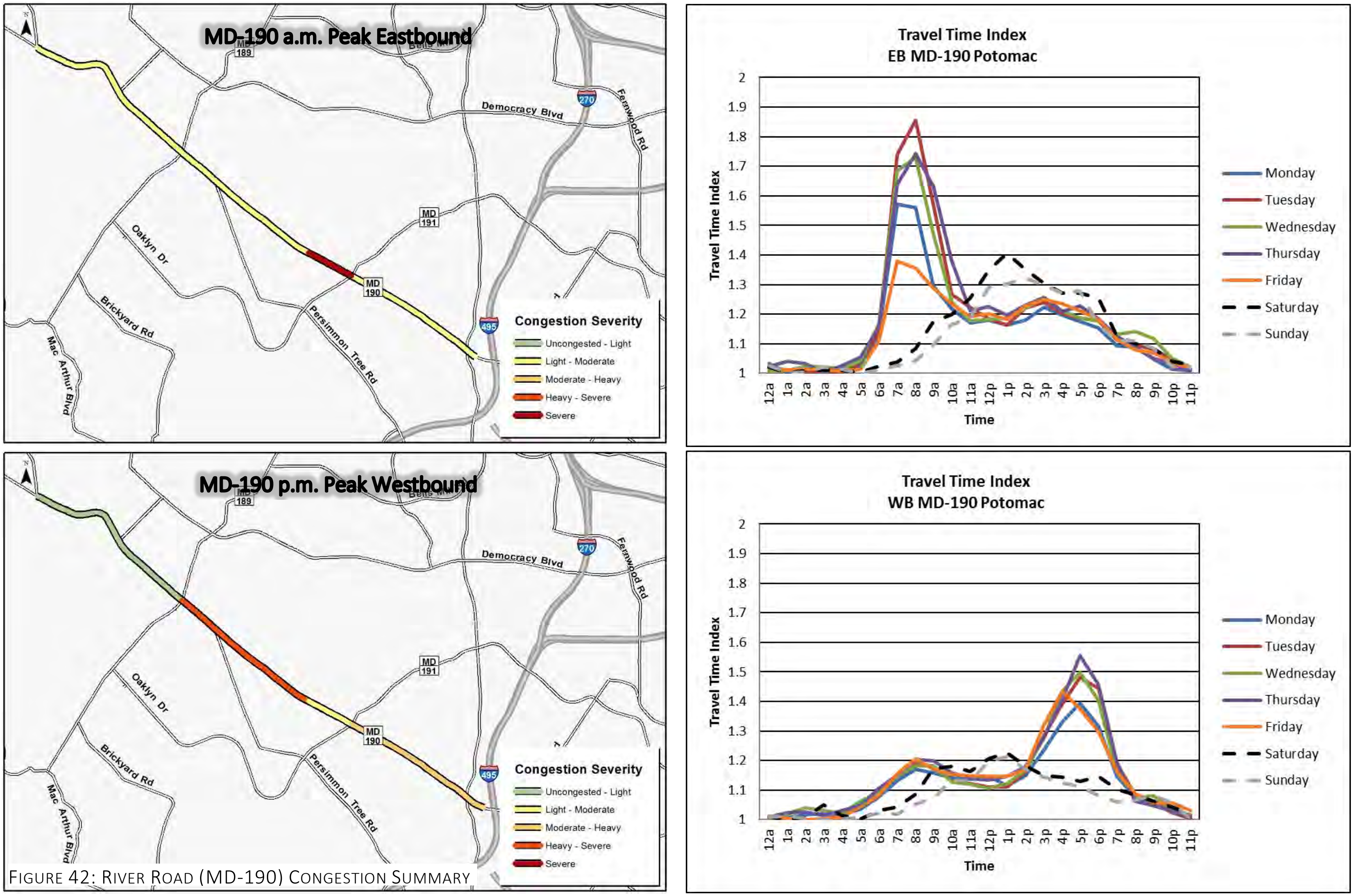


Figure 42: River Road (MD-190) Congestion Summary

Montrose Road from I-270 to Falls Road (MD-189)

This section of Montrose Road is just over one mile in length. Most of the congestion occurs in small sections in the westbound direction during the evening and morning commute near the intersections at Seven Locks Road and River Road, perhaps skewing the overall congestion in this corridor. Congestion remains light in the eastbound direction throughout the day (Figure 43).

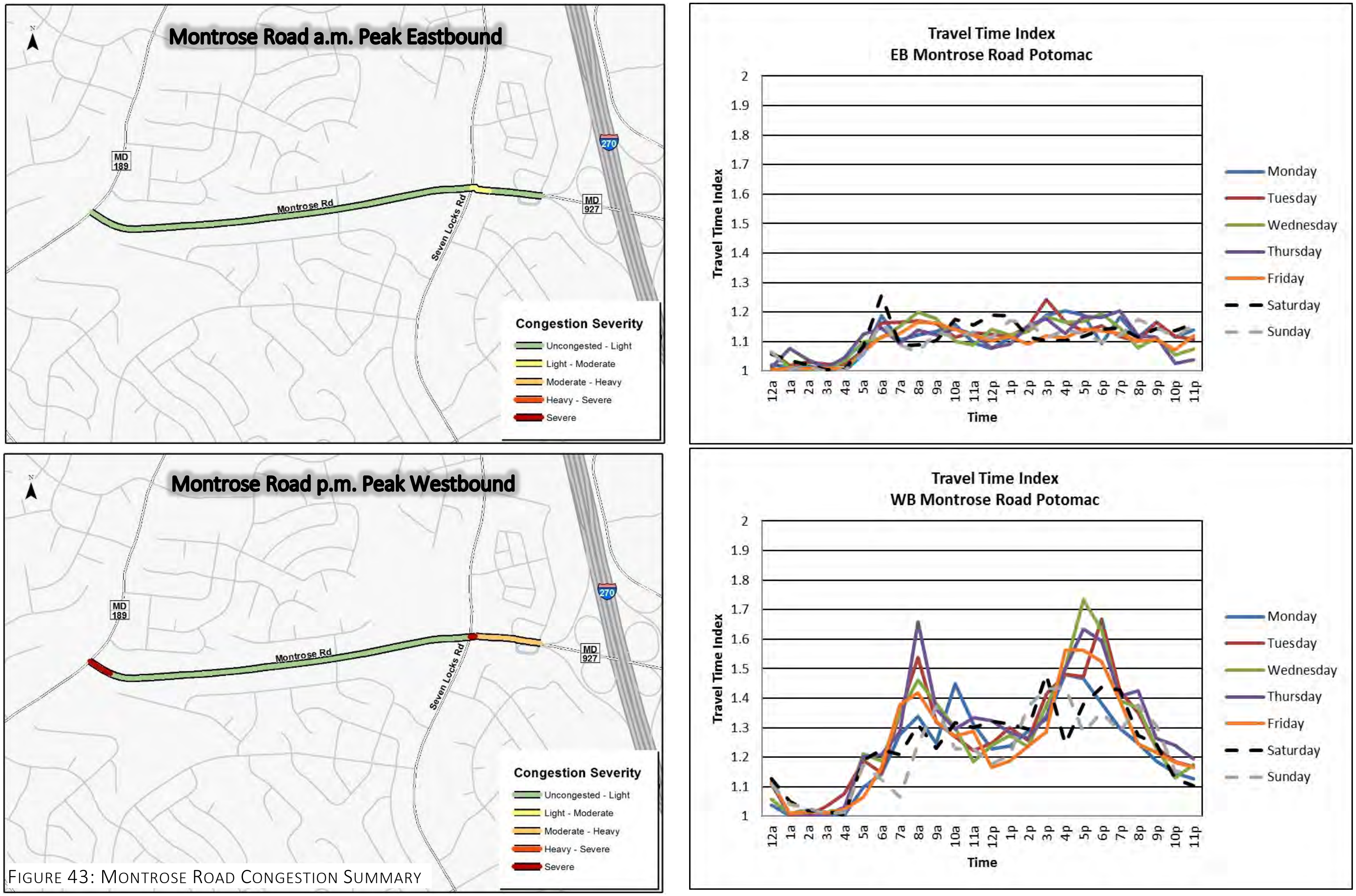


FIGURE 43: MONTROSE ROAD CONGESTION SUMMARY

Rockville City, Rockville Town Center Shady Grove Metro Center, Derwood

This analysis summarizes speed data from four main corridors in the Rockville vicinity. These corridors are MD-28 from Baltimore Road to Veirs Mill Road, and from Rockville Pike (MD-355) to Shady Grove Road. The other corridors are Veirs Mill Road (MD-586)[9] from Twinbrook Parkway to Rockville Pike, Great Falls Road (MD-189) from Montrose Road to Montgomery Ave, and Rockville Pike from Wootton Parkway to I-370 (Figure 44). The most congested section of roadway in the Rockville vicinity is MD-28 during the evening commute in the eastbound direction. As discussed in the next section, most of the congestion on this road occurs between Baltimore Road and Veirs Mill Road. On average, it takes automobile drivers 54 percent more time to travel through the corridor compared to free-flow conditions during the evening commute (Table 11).

2011 and 2015 data indicates that speed has decreased an average of four and one-half miles per hour across all directions since 2011. This is slightly more that the county overall. The PTI has also increased slightly more that the county's rate indicating traffic variability has grown (Figure 45).

TABLE 11: ROCKVILLE AND VICINITY TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-28	54%	EASTBOUND	PM Peak
MD-586	54%	WESTBOUND	AM Peak
MD-355	48%	SOUTHBOUND	PM Peak
MD-586	46%	EASTBOUND	PM Peak
MD-28	43%	EASTBOUND	AM Peak
MD-355	42%	SOUTHBOUND	AM Peak
MD-355	40%	NORTHBOUND	PM Peak
MD-28	39%	WESTBOUND	AM Peak
MD-189	35%	SOUTHBOUND	AM Peak
MD-28	33%	WESTBOUND	PM Peak

[9]For the purposes of this analysis and due to the route assignment of the speed data provider, the section of Veirs Mill Road from Rockville Pike to Jefferson Street is considered MD-586.

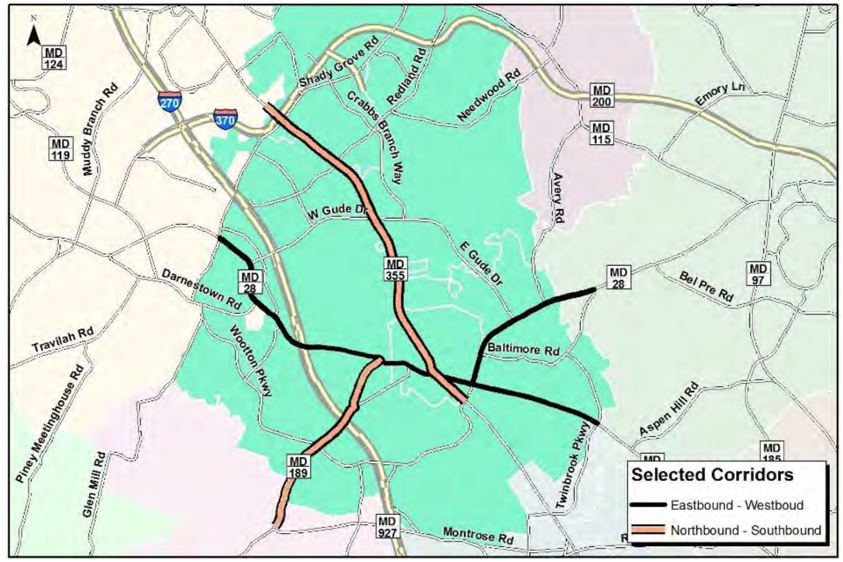


FIGURE 44: CORRIDORS ANALYZED IN ROCKVILLE AND VICINITY

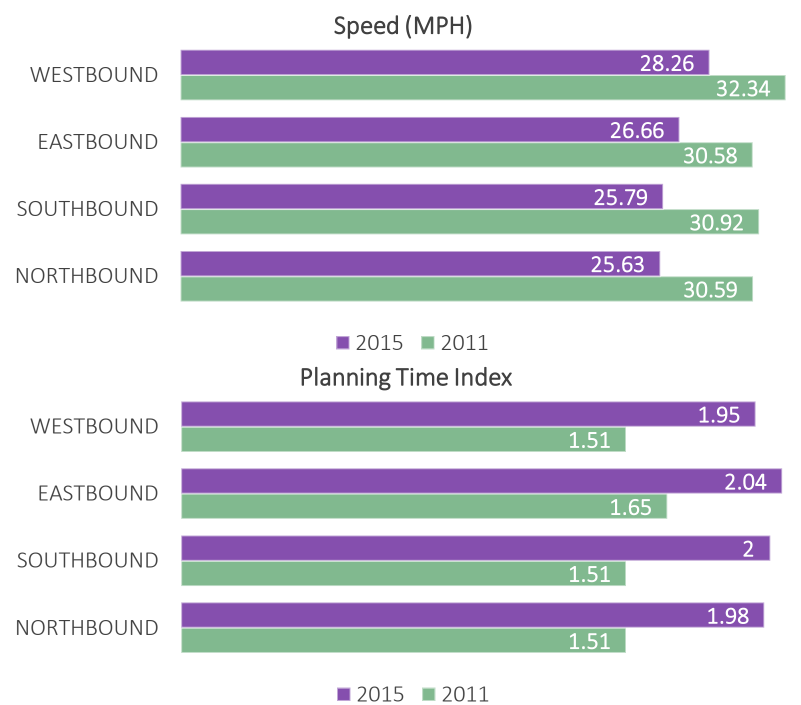
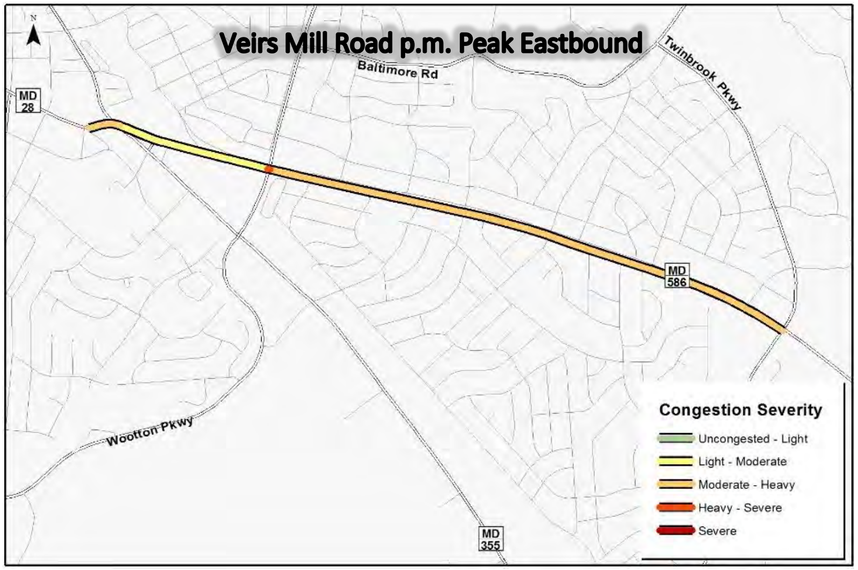
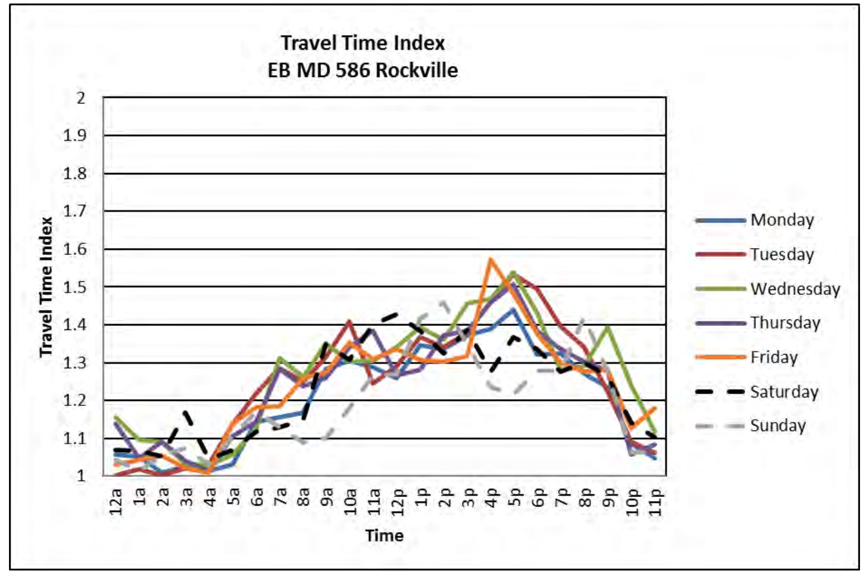


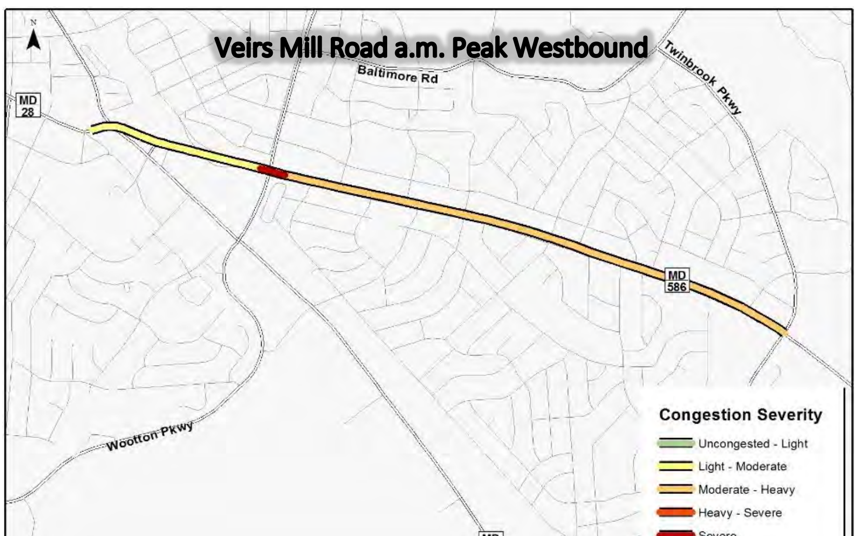
FIGURE 45: 2011 AND 2015 ROCKVILLE AND VICINITY SPEED AND PTI COMPARISON

Veirs Mill Road (MD-586) from Twinbrook Parkway to Jefferson Street

Eastbound Veirs Mill Road gradually increases in congestion from 6 a.m. before reaching its peak during the evening commute at around 5 p.m. Eastbound traffic remains in the moderate range from Wootton Parkway to Twinbrook Parkway. Westbound Veirs Mill Road behaves more like a traditional commuting corridor with a sharp peak during the morning commute. Congestion is heavy beginning at Twinbrook Parkway, reaching a severe level just before the intersection at Wootton Parkway (Figure 46).







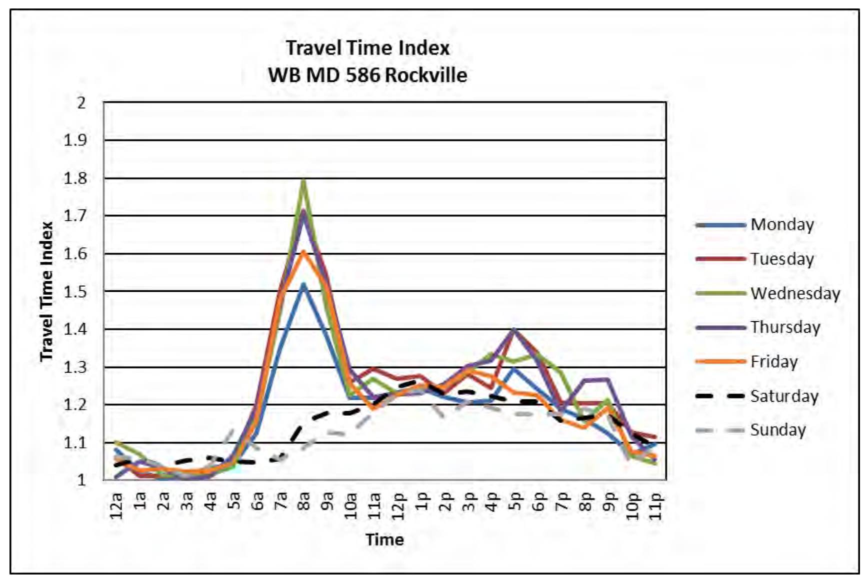
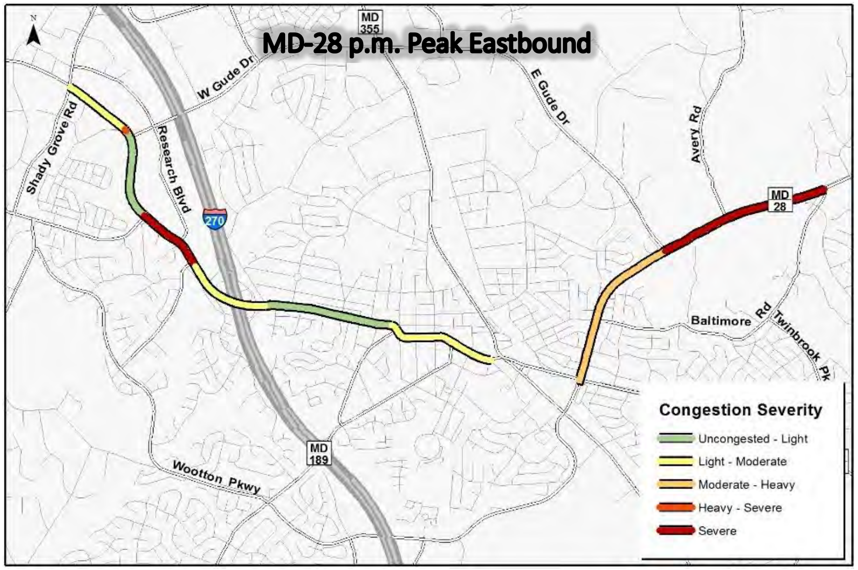
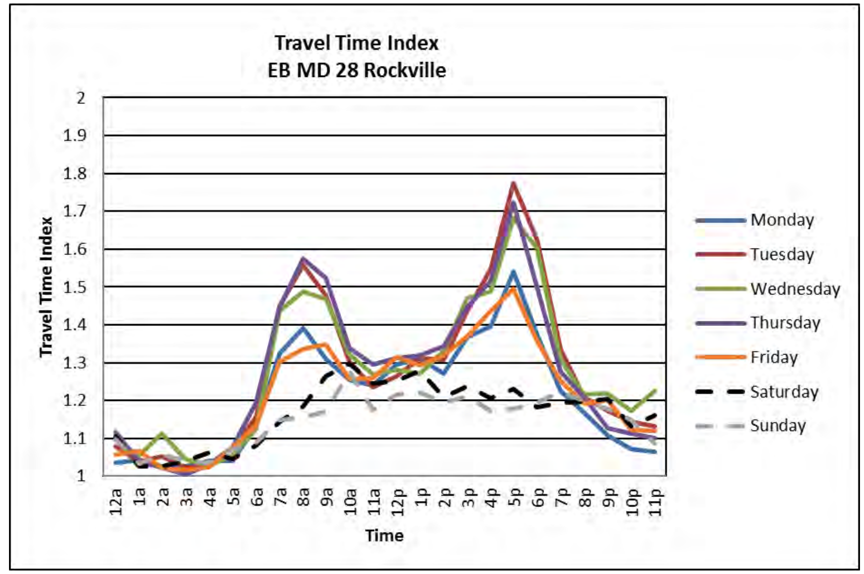


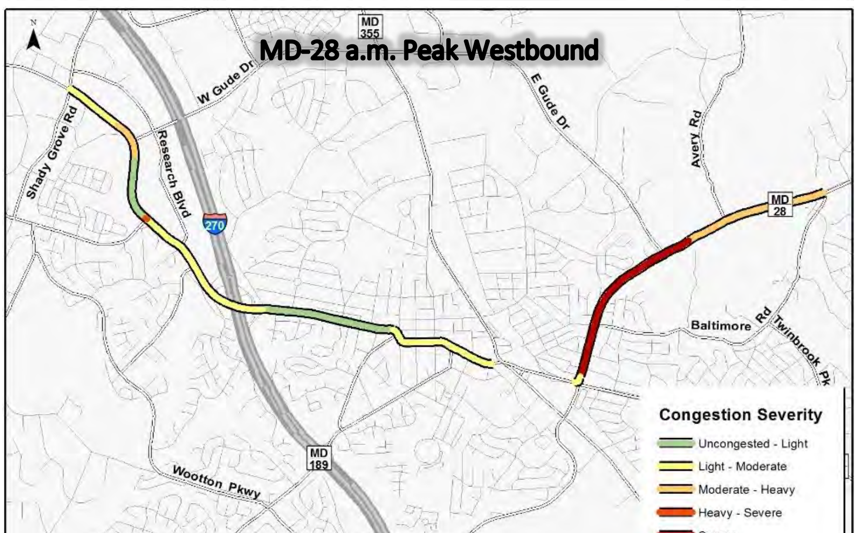
FIGURE 46: VEIRS MILL ROAD CONGESTION SUMMARY

MD-28 from Baltimore Road to Veirs Mill Road (MD-586) and from Rockville Pike (MD-355) to Shady Grove Road

MD-28 is bisected by the Rockville Town Center. Eastbound MD-28 has two peaks with the evening commute reaching nearly 80 percent during the majority of the work week. The most significant congestion in the evening occurs on Norkbeck Road, indicating the effects of people leaving downtown Rockville. Congestion in the morning is heaviest inbound to Downtown Rockville along Montgomery Avenue. Westbound traffic is heaviest during the morning commute inbound along Norbeck Road and First Street with lighter congestion outbound along Montgomery Avenue.







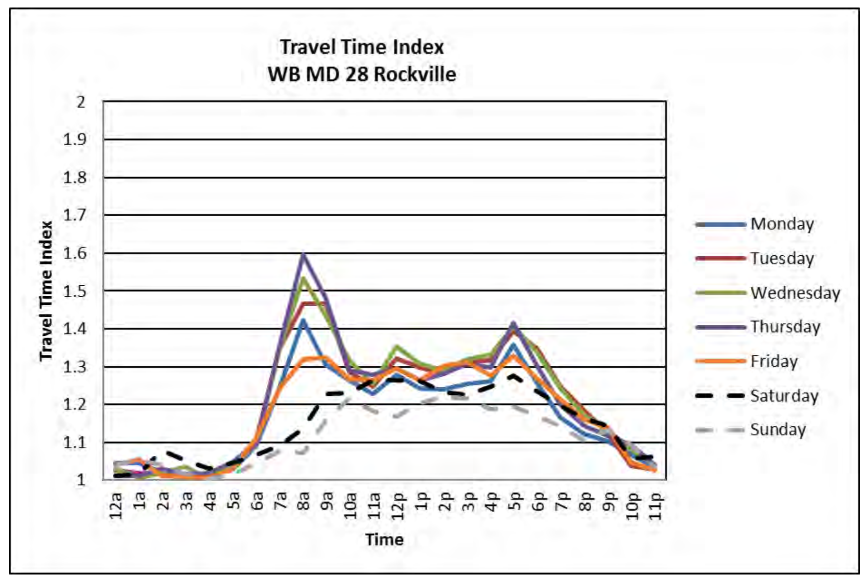


Figure 47: MD-28 Congestion Summary

Rural East

The following analysis summarizes 4 north-south corridors in the Rural East Policy Area in the Rural East Policy Area. The corridors are Columbia Pike (US-29) from Sandy Spring Road to the county border, New Hampshire Avenue (MD-650) from Ednor Road to Georgia Avenue, Georgia Avenue (MD-97) from Brookeville Road to the county border, and Frederick Road (MD-355) from Comus Road to the county border (Figure 48). Congestion in the Rural East Policy Area is mostly limited to sections of Columbia Pike and Georgia Avenue.

Travelers along Columbia Pike experience moderate to heavy congestion on segments of this roadway during the evening commutes whereas Georgia Avenue is busier during the morning commute. Congestion along Columbia Pike between Sandy Spring Road and the county border can become very heavy with the average additional time being spent in traffic at 59 percent more than free-flow conditions in the northbound direction during the evening peak. Congestion along the other arterials remains light (Table 12).

Data from 2011 and 2015 indicates that average speeds have decreased well below that of the overall county. The PTI index has also only slightly increased, indicating the variability of congestion has generally remained constant (Figure 49).

TABLE 12: RURAL EAST TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
US-29	59%	NORTHBOUND	PM Peak
MD-97	39%	SOUTHBOUND	AM Peak
MD-355	27%	SOUTHBOUND	AM Peak
MD-650	18%	SOUTHBOUND	AM Peak
MD-97	16%	NORTHBOUND	PM Peak
MD-650	16%	NORTHBOUND	PM Peak
MD-650	14%	SOUTHBOUND	PM Peak
MD-650	14%	NORTHBOUND	AM Peak
MD-355	13%	NORTHBOUND	PM Peak
MD-97	12%	SOUTHBOUND	PM Peak

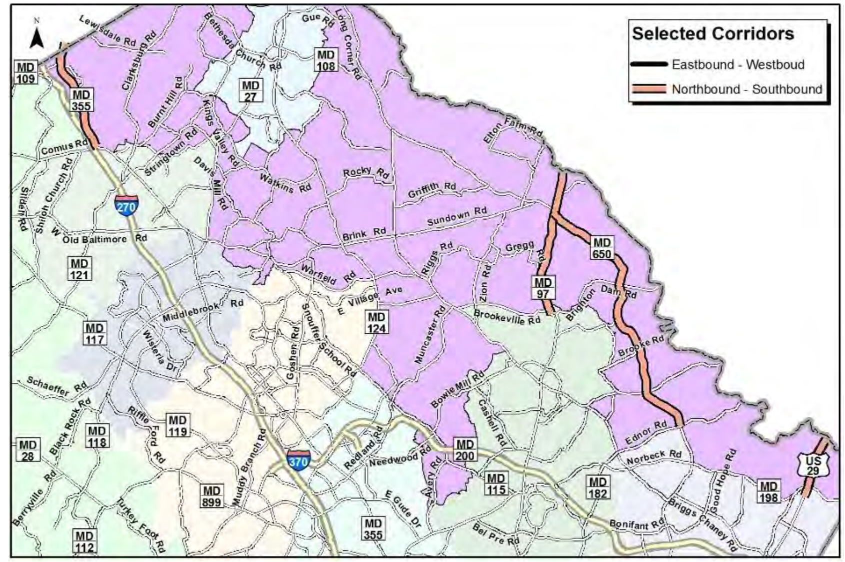


FIGURE 48: CORRIDORS ANALYZED IN RURAL EAST

FIGURE 49: 2011 AND 2015 RURAL EAST SPEED AND PTI COMPARISON

Columbia Pike (US-29) from Sandy Spring Road (MD-198) to the Howard County Border

Columbia Pike experiences an interesting sharp peak in congestion during the evening commute between 4 and 5 p.m. The congestion appears to be significantly worse on Thursday and Friday evenings. The map below indicates a moderate to heavy level of congestion on average during the evening peak period between Sandy Spring Road and Dustin Road in the northbound direction. Southbound congestion is minimal during the morning commute reaching 30 percent on Tuesday mornings (Figure 50).

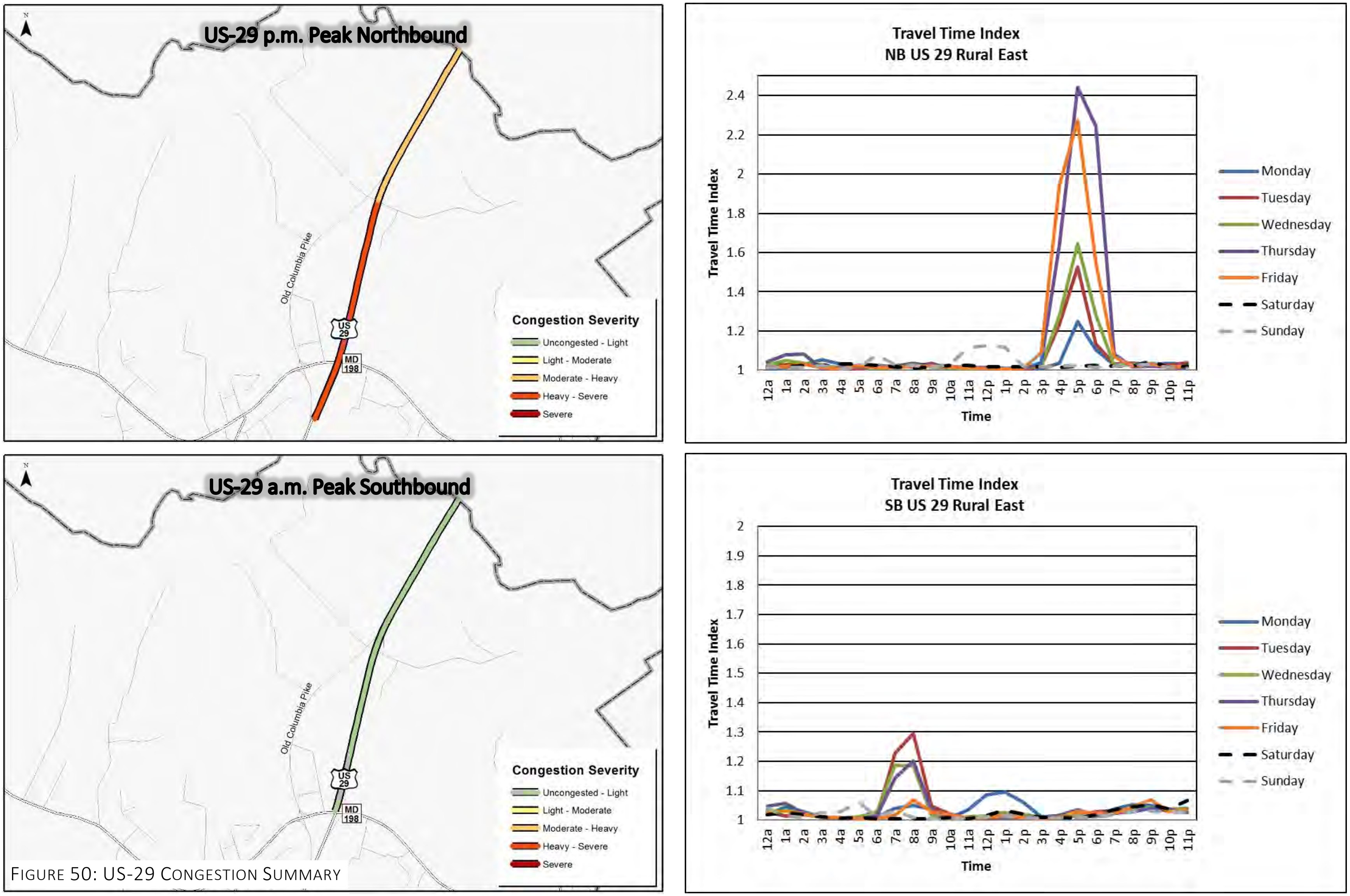


FIGURE 50: US-29 CONGESTION SUMMARY

Georgia Avenue (MD-97) from Brookeville Road to Howard County Border

Georgia Avenue, like with Columbia Pike, reflects the characteristics of a typical commuter route with a sharp peak of congestion during the morning and to a lesser extent, during the evening. The morning commute inbound to Washington D.C. experiences heavy to severe congestion north of the New Hampshire Avenue intersection in Brookeville. Northbound congestion during the evening appears relatively less severe with light to moderate levels of congestion appearing between Gregg Road and Triadelphia Lake Road (Figure 51).

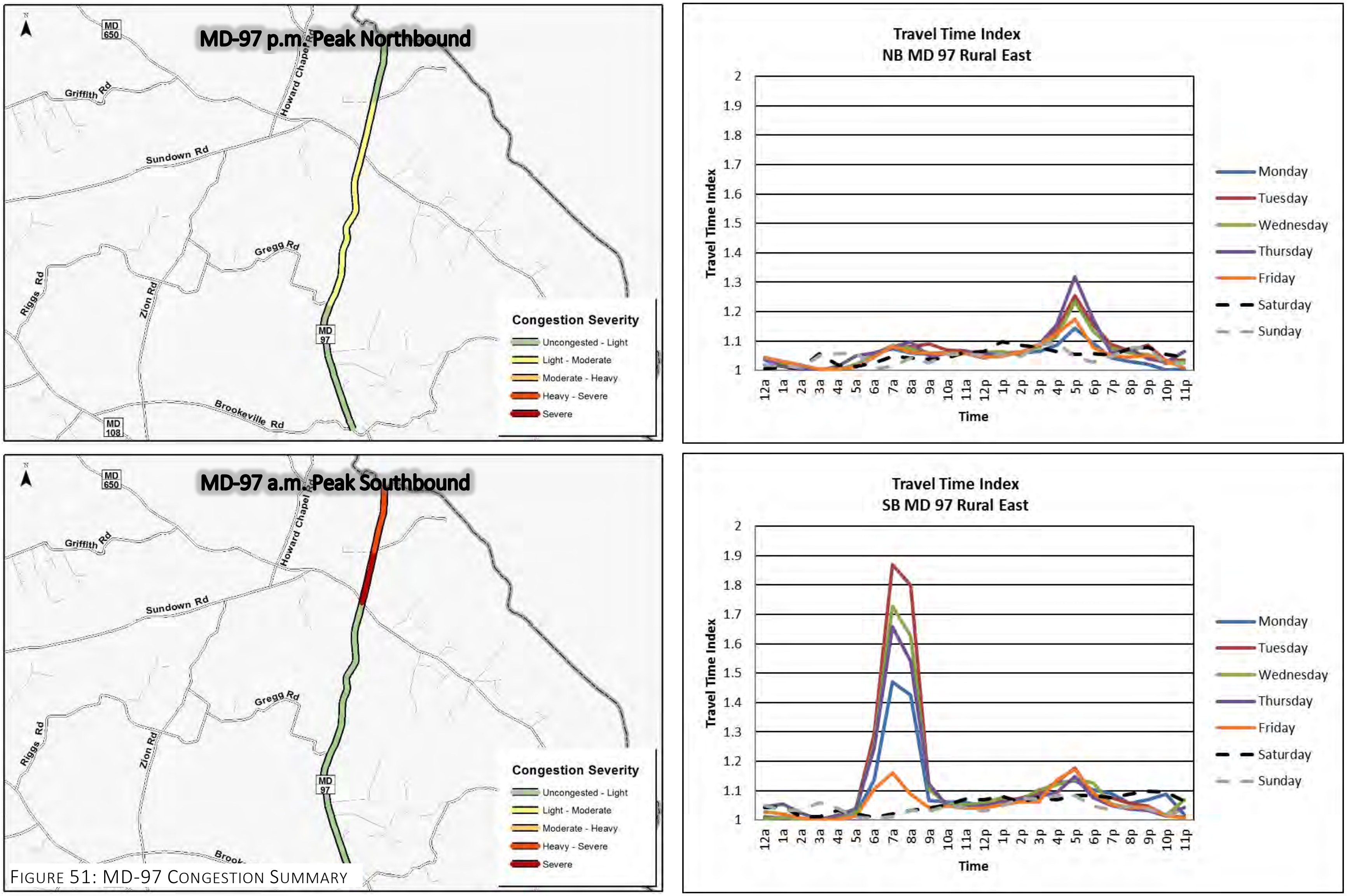


FIGURE 51: MD-97 CONGESTION SUMMARY

Rural West

This report analyzes speed data for four corridors in the Rural West Policy Area. The corridors are River Road (MD-190) from Piney Meetinghouse Road to Esworthy Road, MD-28 from Jones Lane to Mount Ephraim Road, MD-117 from Darnestown Road to Richter Farm Road, and Germantown Road (MD-118) from Riffle Ford Road to Darnestown Road (Figure 53). The Rural West Policy Area serves as a bedroom community for many employees in the greater Washington D.C area. This is evidenced by the fact that congested conditions along the top two congested roadways in this area occur during the morning commute. Other than the morning commute along River Road and MD-117, there is very little congestion in the Rural West Policy Area (Table 13).

Data from 2011 and 2015 indicate that average speed in this area has changed very little since 2011. The one exception is Germantown Road (MD-118) which saw a decrease of about three miles per hour which is still below that of the overall county. Travel time reliability has also remained constant with the biggest changes in PTI occurring in the eastbound and northbound directions (Figure 52). As with speed, the biggest change in PTI occurs northbound along Germantown Road.

TABLE 13: RURAL WEST TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-190	57%	EASTBOUND	AM Peak
MD-117	46%	EASTBOUND	AM Peak
MD-28	12%	EASTBOUND	AM Peak
MD-117	11%	EASTBOUND	Off Peak
MD-118	10%	NORTHBOUND	Off Peak
MD-117	9%	WESTBOUND	AM Peak
MD-117	9%	EASTBOUND	PM Peak
MD-117	7%	WESTBOUND	Off Peak
MD-117	6%	WESTBOUND	PM Peak
MD-118	6%	SOUTHBOUND	AM Peak

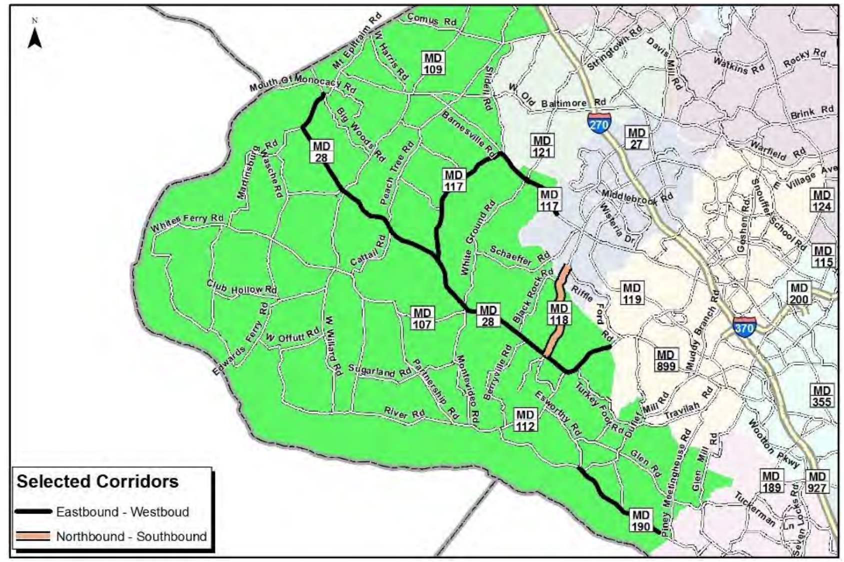


FIGURE 53: CORRIDORS ANALYZED IN RURAL WEST

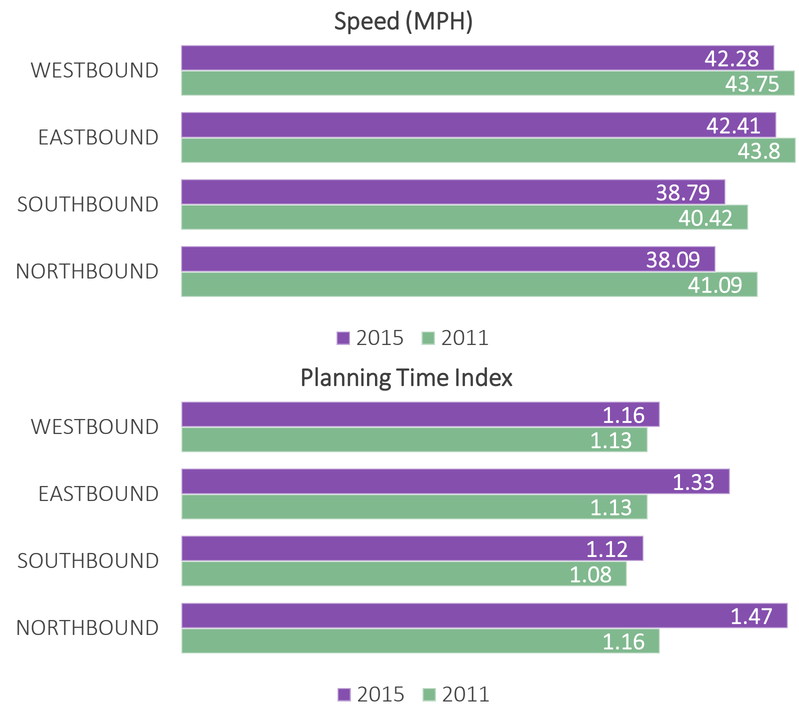
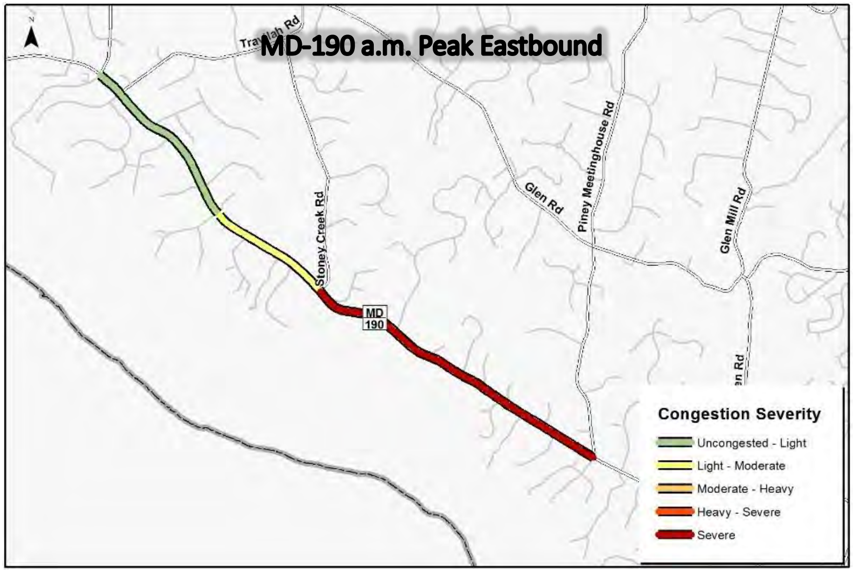
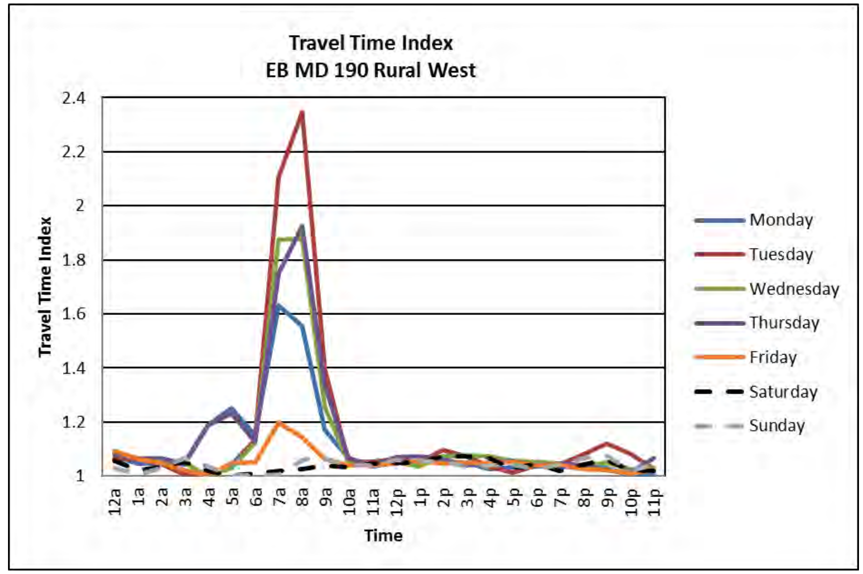


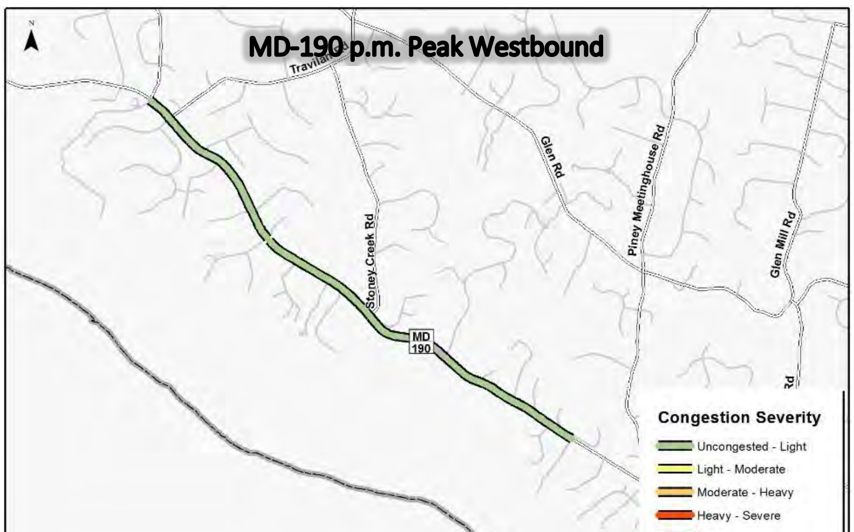
FIGURE 52: 2011 AND 2015 RURAL WEST SPEED AND PTI COMPARISON

River Road (MD-190) from Piney Meetinghouse Road to Esworthy Road

Congestion along eastbound River Road is heaviest between Stoney Creek Road and Piney Meetinghouse Road during the morning commute. On average throughout the entire morning commute, travelers can expect to spend twice the amount of time to travel through this section of River Road compared to free-flow conditions. Interestingly and somewhat puzzling is that westbound congestion has a peak at around 5 a.m. This situation could be due to overnight construction activities during the data collection period (Figure 54).







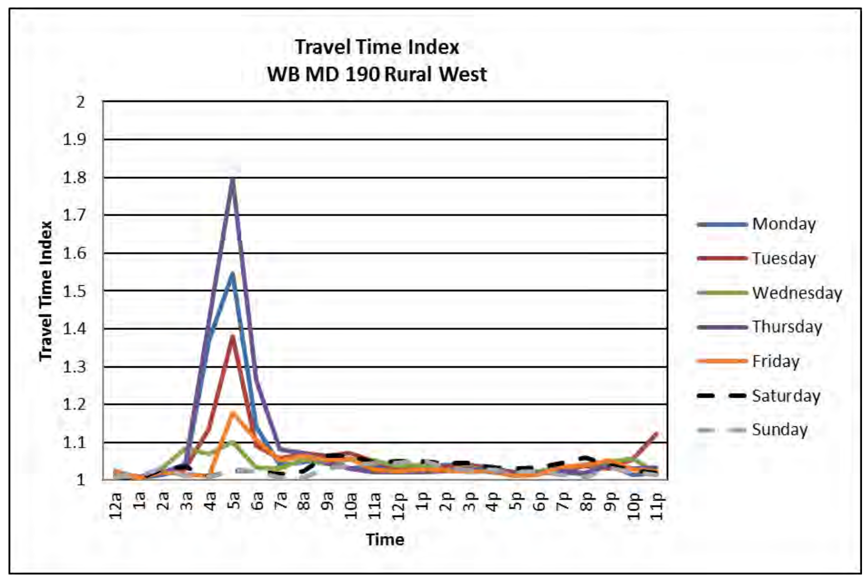
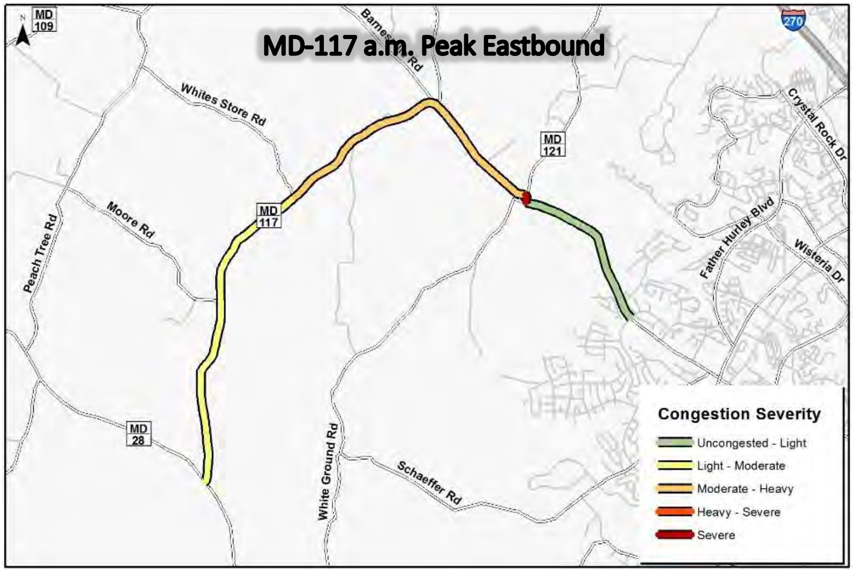
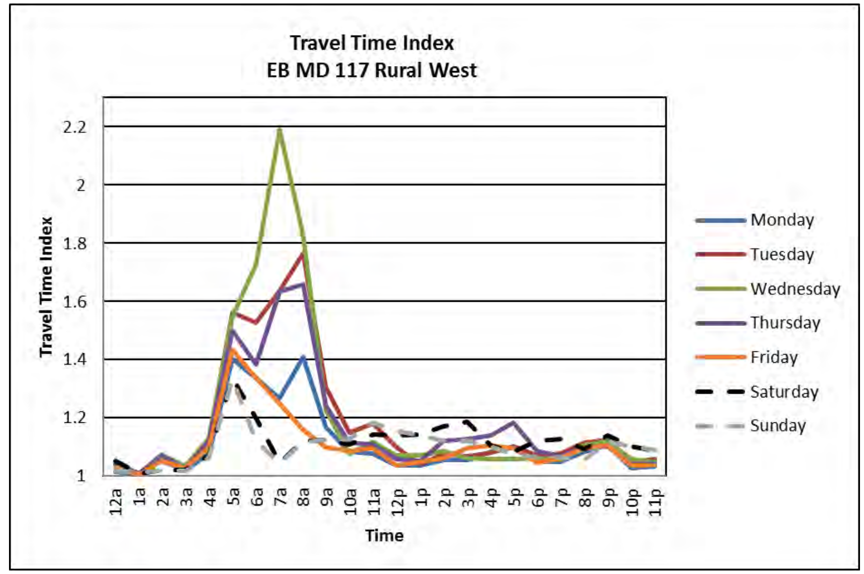


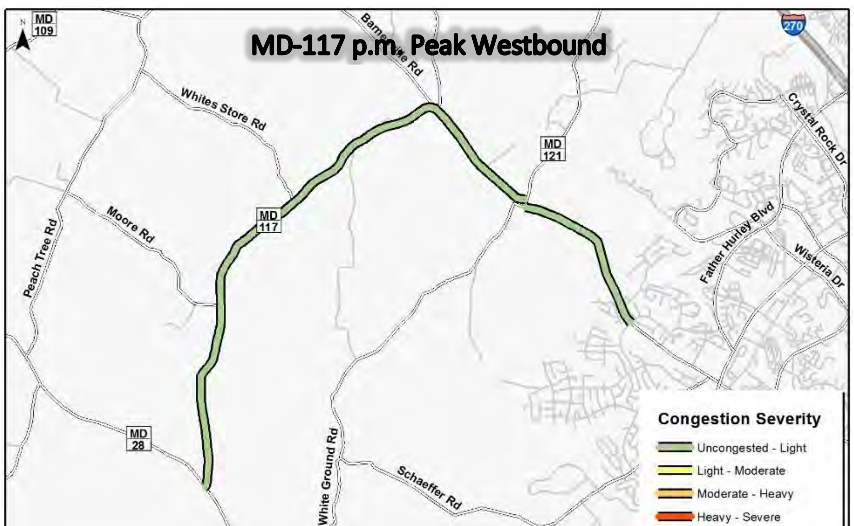
FIGURE 54: RIVER ROAD (MD-190) CONGESTION SUMMARY

MD-117 from Darnestown Road to Richter Farm Road

Congestion along MD-117 peaks in both direction during the morning commute. It is heaviest eastbound and erratic throughout the week. Congestion begins to build at 5 a.m., early compared to other corridors in the county. Eastbound drivers encounter the highest average TTI between Whites Store Road to the intersection of Clarksburg Road where a small segment of heavy to severe congestion can be found. Congestion during the evening is very light in both directions (Figure 55).







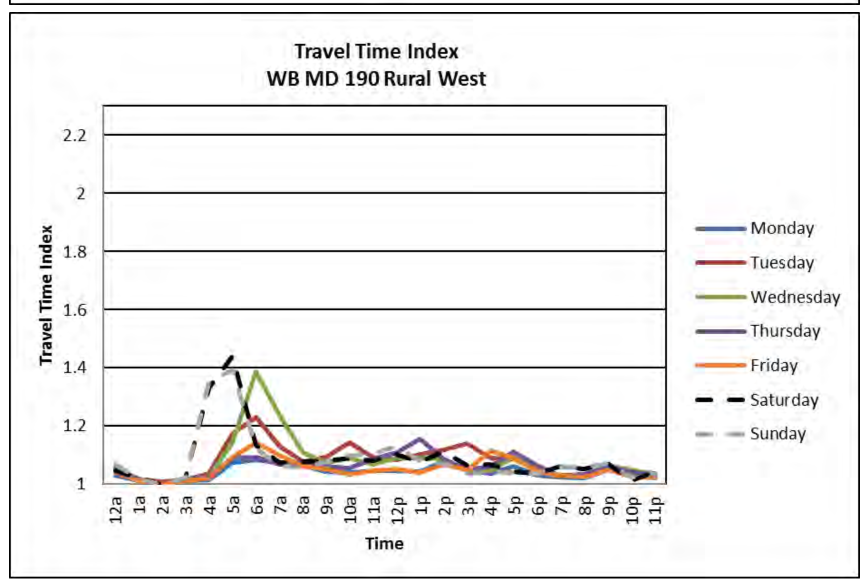


FIGURE 55: MD-117 CONGESTION SUMMARY

Silver Spring/Takoma and Silver Spring Central Business District

The following analysis summarizes six corridors in the Silver Spring and Takoma area. East-west corridors are MD-410 from the Prince George's County's border to Beach Drive and University Boulevard (MD-193) from New Hampshire Avenue (MD-650) to the Capital Beltway (I-495). The north-south corridors are Colesville Road (US-29) from the Capital Beltway to the District's border, Georgia Avenue (MD-97) from the Capital Beltway to the District's border, 16th Street from Georgia Avenue to the District's border, and New Hampshire Avenue from the Capital Beltway to the District border (Figure 56).

A majority of the top congested corridors in the greater Silver Spring area occur during the evening commute. This condition is similar to some of the other suburban and urban policy areas that offer a mix of housing, commercial, office, and retail uses. Southbound automobile travelers on Colesville Road during the evening commute can expect a trip to take twice as long to travel through the area on average as compared to free-flow conditions. The only morning commute that makes it in the top five congested corridors is Northbound Georgia Avenue (Table 14). Data from 2011 and 2015 indicates that speed has decreased on average across all directions by just under 4.5 miles per hour since 2011, slightly more than the overall county (Figure 57). The PTI has increased but less than that of the county overall.

TABLE 14: SILVER SPRING AND VICINITY TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
Colesville Road	100%	SOUTHBOUND	PM Peak
Georgia Ave	77%	NORTHBOUND	PM Peak
MD-650	76%	NORTHBOUND	PM Peak
MD-390/16TH ST	61%	SOUTHBOUND	PM Peak
MD-193	55%	WESTBOUND	PM Peak
Colesville Road	54%	NORTHBOUND	AM Peak
MD-193	53%	EASTBOUND	PM Peak
Colesville Road	52%	NORTHBOUND	PM Peak
MD-390/16TH ST	51%	SOUTHBOUND	AM Peak
MD-650	47%	NORTHBOUND	AM Peak

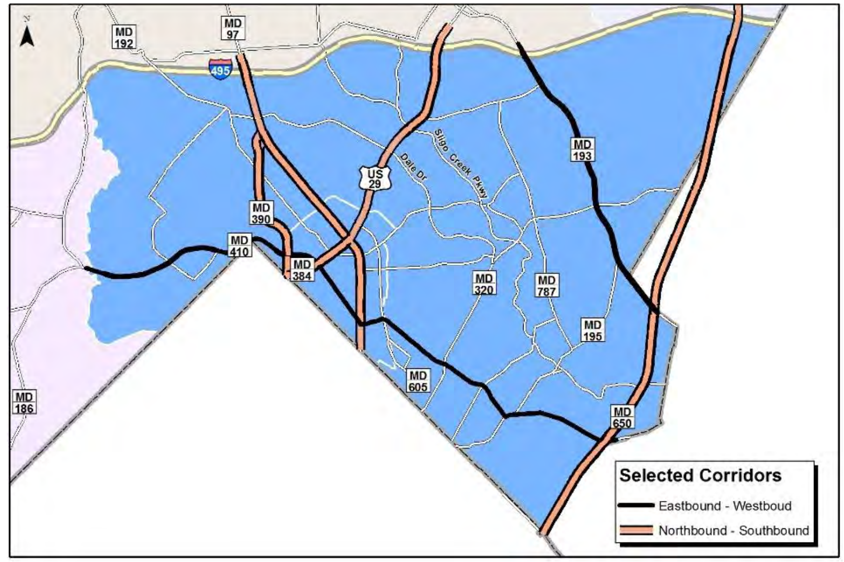


FIGURE 56: CORRIDORS ANALYZED IN SILVER SPRING AND VICINITY

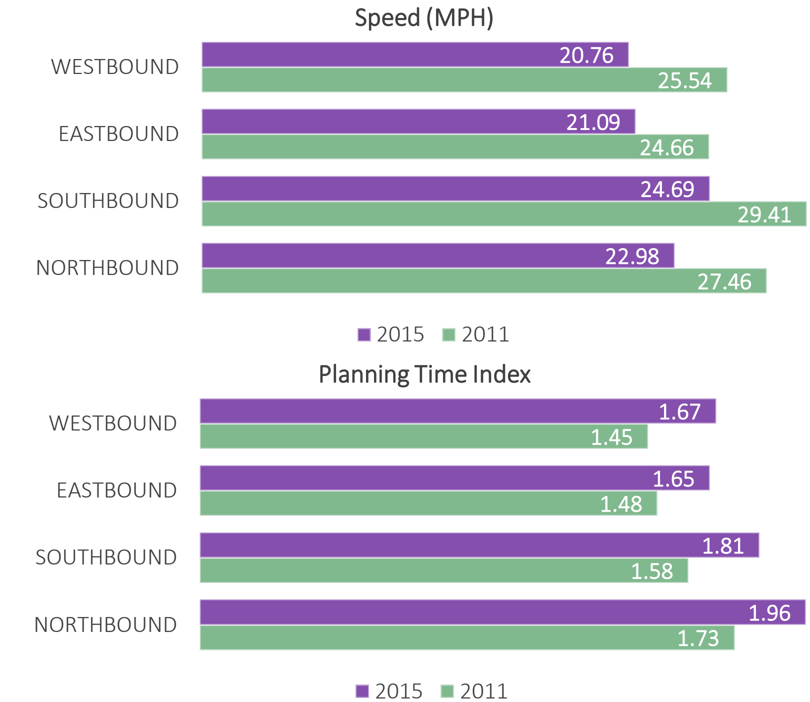
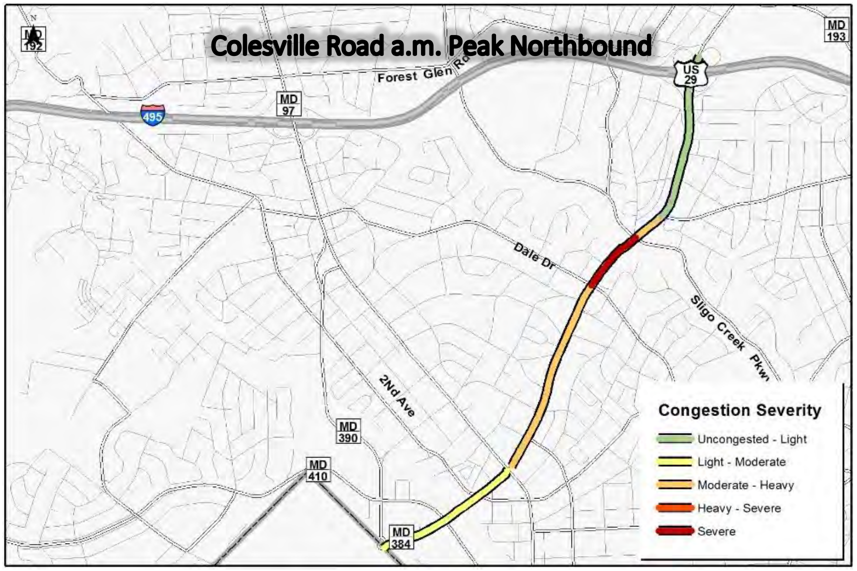
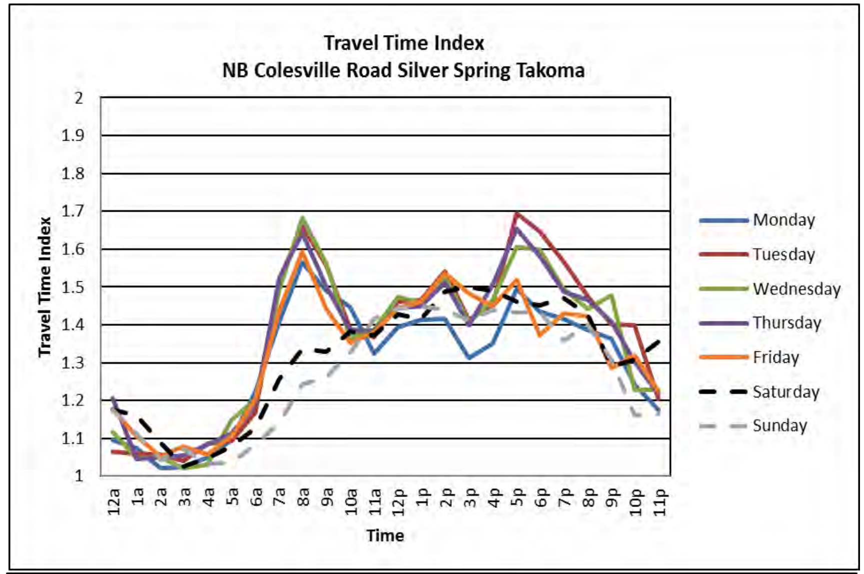


FIGURE 57: 2011 AND 2015 SILVER SPRING AND VICINITY SPEED AND PTI

Colesville Road from the Capital Beltway (I-495) to the Washington, D.C. Border

Southbound Colesville Road during the evening commute is the second most congested corridor analyzed as part of the 2017 MAR. The corridor is congested an average of 87 percent throughout the duration of the evening commute with congestion reaching 140 percent during the peak hour of some weekdays. The southbound direction has more of a dichotomous congestion profile than the northbound direction. Congestion along northbound Colesville road reaches similar levels during the morning and evening commutes (Figure 58).





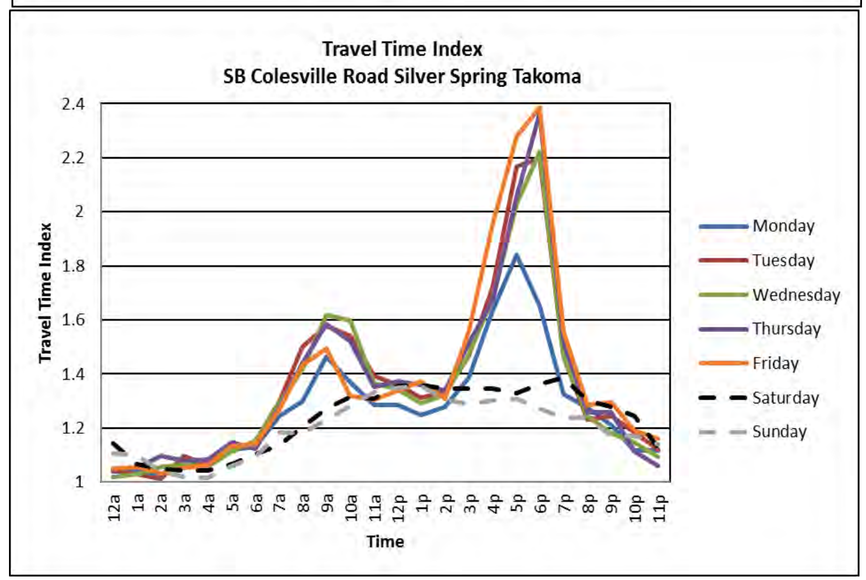


FIGURE 58: COLESVILLE ROAD CONGESTION SUMMARY

Georgia Avenue from the Capital Beltway to the Washington, D.C. Border

Both directions of Georgia Avenue experience two peaks of congestion during the morning and evening commutes. The congestion during both periods is heavier in the northbound direction and reaches severe levels between Thayer Avenue and Colesville Road, and again between 16th Street and the Capital Beltway. In the southbound direction, congestion remains at similar levels throughout the day, indicating this corridor is heavily utilized for non-work trips (Figure 59).

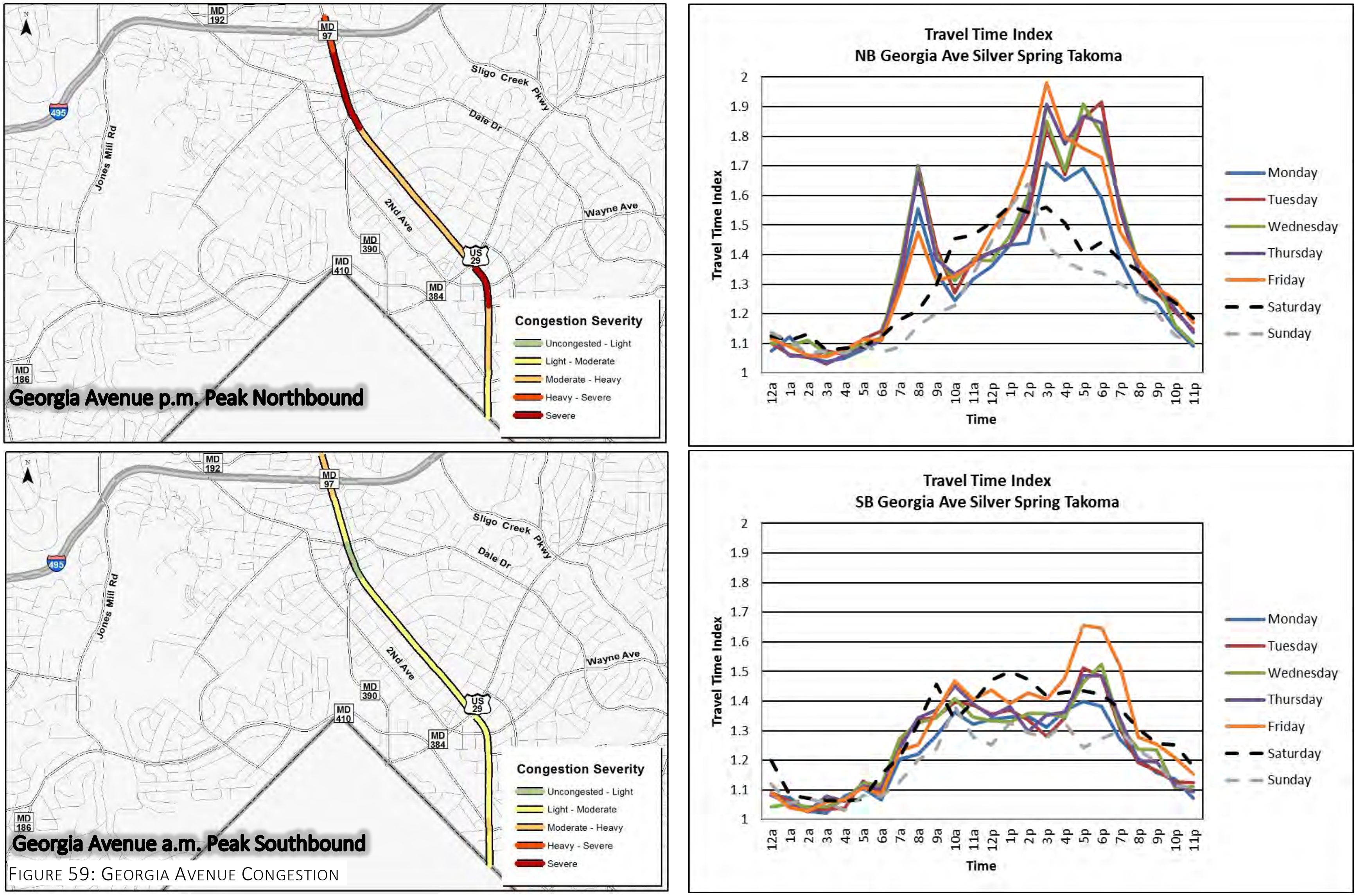


FIGURE 59: GEORGIA AVENUE CONGESTION

Wheaton Central Business District, Wheaton/Kensington, and Glenmont

The final policy areas evaluated are Wheaton CBD, Wheaton/Kensington, and Glenmont. Due to data segmentation, very short segments of Colesville Road (US-29) between the Capital Beltway (I-495) and University Boulevard (MD-193), and Knowles Ave (MD-547) between Connecticut Avenue (MD-185) and Beach Drive are included with this area analysis. The other corridors analyzed are Connecticut Avenue (MD-185) between the Capital Beltway and Aspen Hill Road, Georgia Avenue (MD-97) between the Capital Beltway and Hewitt Avenue, University Avenue between the Capital Beltway and Connecticut Avenue, Randolph Road between Kemp Mill Road and Rocking Horse Road, and Veirs Mill Road (MD-586) between Georgia Avenue and Connecticut Avenue (Figure 60).

Southbound Connecticut Avenue during the morning commute is the most congested corridor in the greater Wheaton/Kensington/Glenmont area. Knowles Avenue during the evening commute and Colesville Road during the evening and morning commute are the second, third, and fourth most congested corridors (Table 15). This finding is certainly impacted by the short distances and location between major intersections. Due to their more substantive lengths, Connecticut Avenue and Veirs Mill Road are analyzed in more detail in the next section.

TABLE 15: WHEATON AND VICINITY TOP CONGESTED CORRIDORS

Route	Congestion	Direction	Period
MD-185	66%	SOUTHBOUND	AM Peak
MD-547	65%	EASTBOUND	PM Peak
US-29	64%	SOUTHBOUND	AM Peak
US-29	64%	NORTHBOUND	PM Peak
MD-586	57%	EASTBOUND	PM Peak
MD-586	55%	WESTBOUND	PM Peak
MD-193	53%	WESTBOUND	AM Peak
MD-586	49%	EASTBOUND	AM Peak
MD-586	49%	WESTBOUND	AM Peak
RANDOLPH RD	47%	WESTBOUND	AM Peak

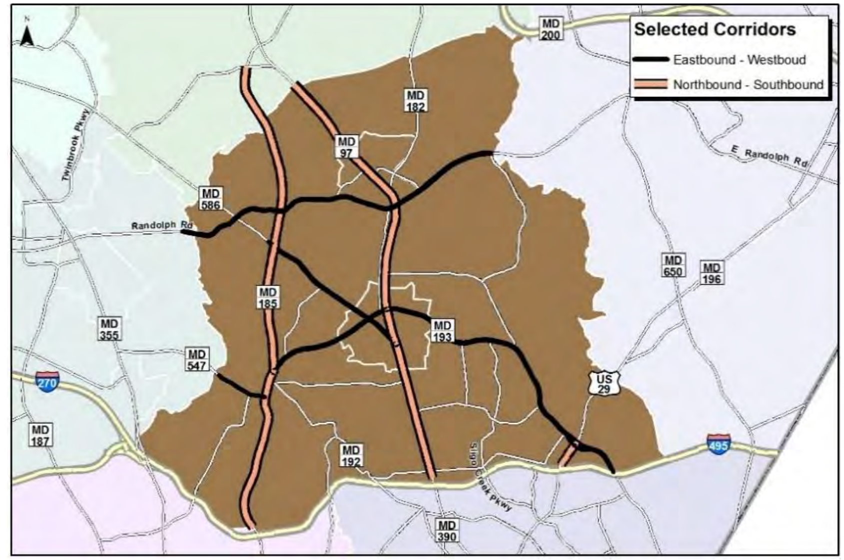


FIGURE 60: CORRIDORS ANALYZED IN WHEATON AND VICINITY

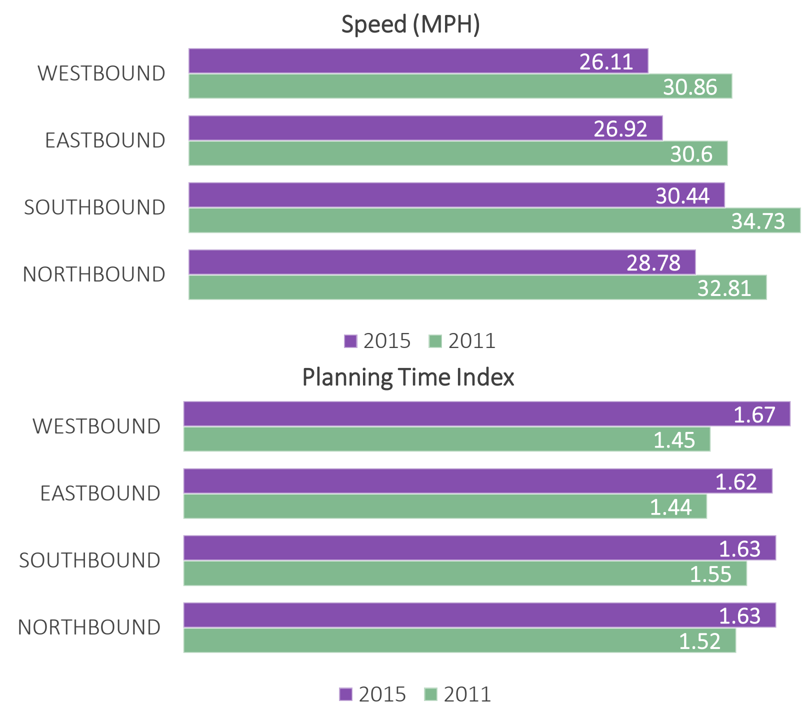


FIGURE 61: 2011 AND 2015 WHEATON AND VICINITY SPEED AND PTI COMPARISON

Connecticut Avenue (MD-185) between the Capital Beltway (I-495) and Aspen Hill Road

Connecticut Avenue generally exhibits a typical commuting congestion profile. The longest delay occurs during the inbound morning commute when the average congestion can reach almost 100 percent during Wednesday and Thursday mornings. Travelers tend to experience severe congestion between Veirs Mill Road and University Boulevard in the mornings and again approaching the Capital Beltway. Outbound traffic reaches its peak between 5 and 6 p.m. with the worst congestion occurring between Saul Road and Dupont Avenue (Figure 62).

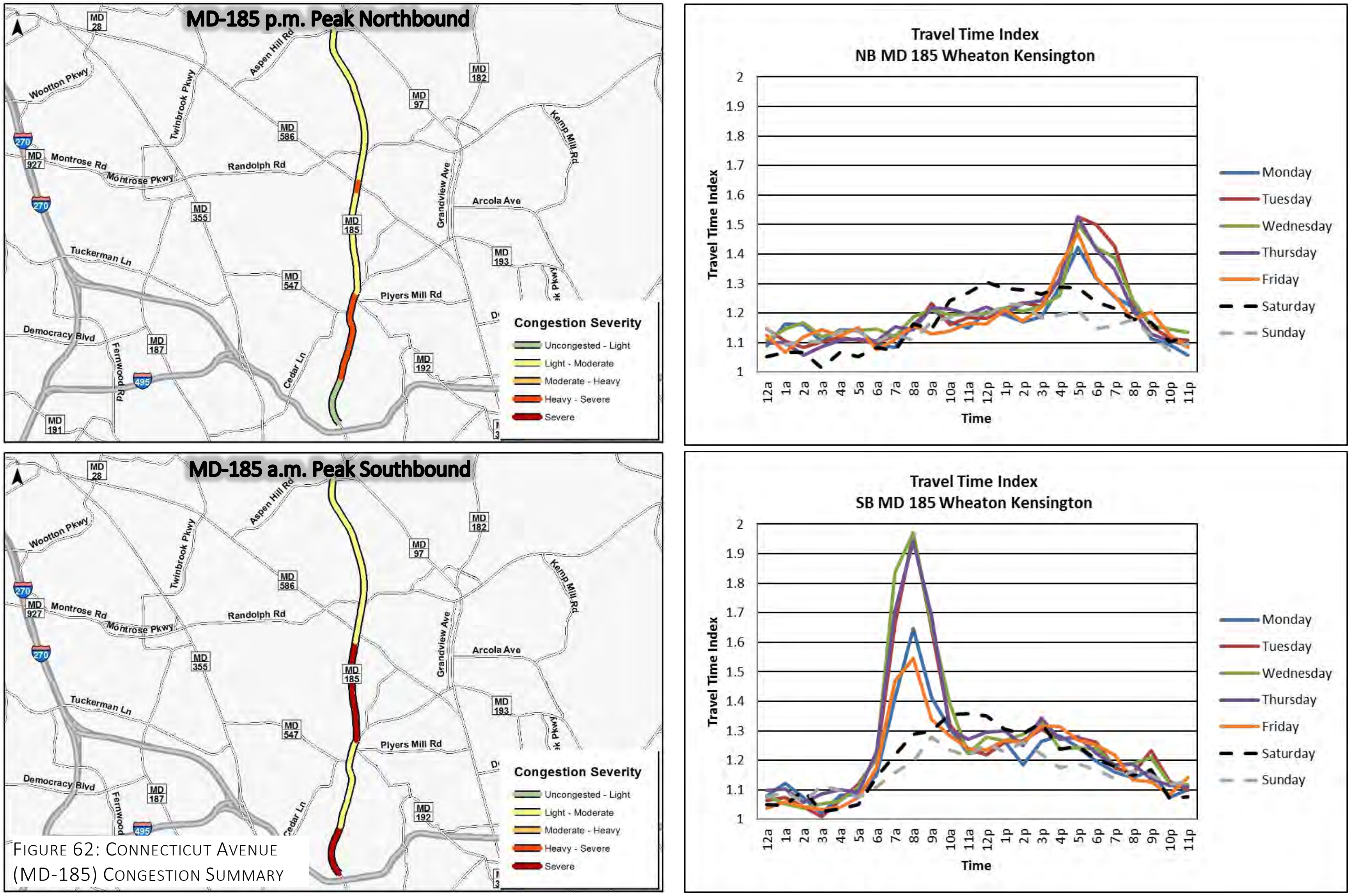


FIGURE 62: CONNECTICUT AVENUE (MD-185) CONGESTION SUMMARY

Veirs Mill Road (MD-586) from Georgia Avenue (MD-97) to Connecticut Avenue (MD-185)

Veirs Mill Road is somewhat unusual in that both directions experience very similar congestion profiles for the evening and morning commutes. Average congestion during the evening and morning commutes is the same for both directions. As indicated by the TTI profiles below, weekend congestion is also fairly significant, an indication that the Viers Mill Road Corridor is used for many non-work trips, serving as a connection between two commercial and retail centers, Wheaton and Rockville. Congestion is often at its worse between MD-193 and MD-97 (Figure 63).

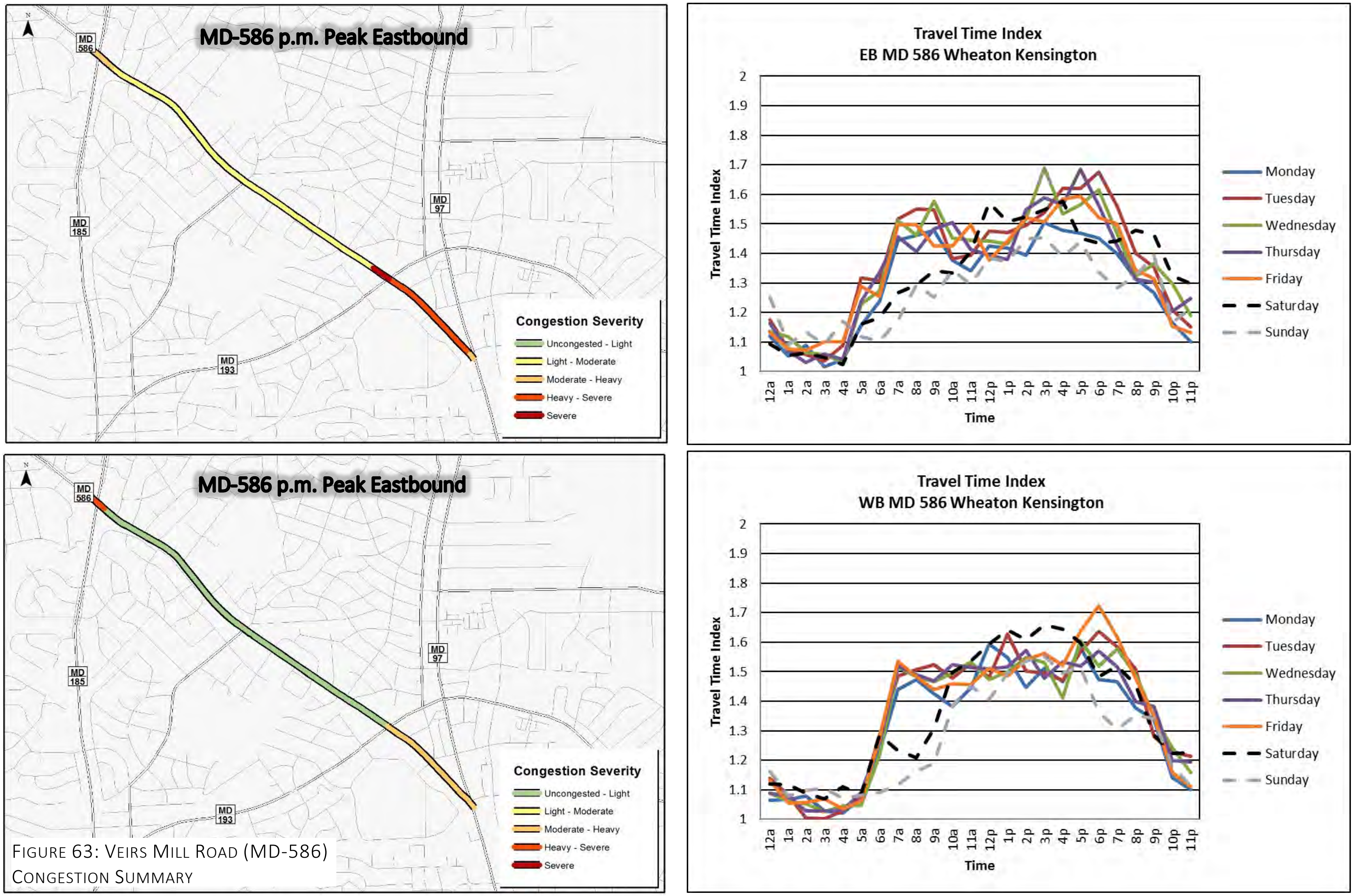


FIGURE 63: VEIRS MILL ROAD (MD-586) CONGESTION SUMMARY

Roadway Level of Service

The 2012-2016 SSP introduced the Transportation Policy Area Review (TPAR) process. The TPAR process defined roadway adequacy standards that vary across rural, suburban, and urban policy areas throughout the county. Roadway adequacy is determined by the average evening peak period congestion for the peak directions of travel in each policy area. For any particular roadway segment (called "link" in the travel demand model) and direction of travel, congestion is calculated by taking the average modeled link-speed and dividing it by the "free-flow speed." Each policy area's congestion weighted average (weighted by vehicle miles travelled) of each roadway segment is then categorized into six levels of service (LOS), A to F, according to the Transportation Research Board's *Highway Capacity* Manual (HCM). Roadway adequacy for the 2012-2016 SSP was based on the modeling outputs using the year 2022 regional cooperative development forecast assumptions and year 2018 programmed transportation improvements. The roadway LOS calculated in support of the 2012-2016 SSP reflects conditions expected in the year 2022.

Transportation planners analyzed the observed 2015 INRIX data to determine the LOS for each policy area by approximating the methodology used in the 2012 SSP. Congestion, as defined in the 2012-2016 SSP, was calculated for each segment direction during the evening commute analyzed as part of the 2017 MAR. The segments were then averaged for each policy area grouping defined in this report. It is important to note, however, that there are differences between the two methodologies as follows:

1. The LOS estimated in the 2012-2016 SSP is derived from modeling inputs. One important input is the "free-flow" speed. The free-flow speed is inconsistent between the INRIX data and what was used to model the 2022 roadway adequacy standards.
2. The 2012 SSP employed a weighted average to determine the final LOS for each policy area using vehicle miles of travel. The methodology employed in this report does not employ a weighted average.
3. Peak directions of travel were explicitly defined in the SSP. The MAR methodology does not define a peak direction but rather displays the results for all directions during the evening commute.
4. The spatial level of aggregation between the 2012 SSP and 2015 data employed in the 2017 MAR is different.

A majority of the policy area groupings for all directions during the evening commute has an average LOS of B or greater. Only the Silver Spring/Takoma and Bethesda/Chevy Chase groupings' northbound direction of travel falls within the LOS C category. Using observed 2015 data, all of the policy area groupings fell well above the adequacy standard set in the 2012-2016 SSP (Figure 64). It is important to remember that the roadway LOS results described in the 2012-2016 SSP represent expected conditions in the year 2022 and are derived from statistical modeling techniques. These current results also represent an average for each direction across the entire span of the evening commute (4 to 7 p.m.). Stretches of corridors during shorter time periods may experience a LOS well below the results presented here.

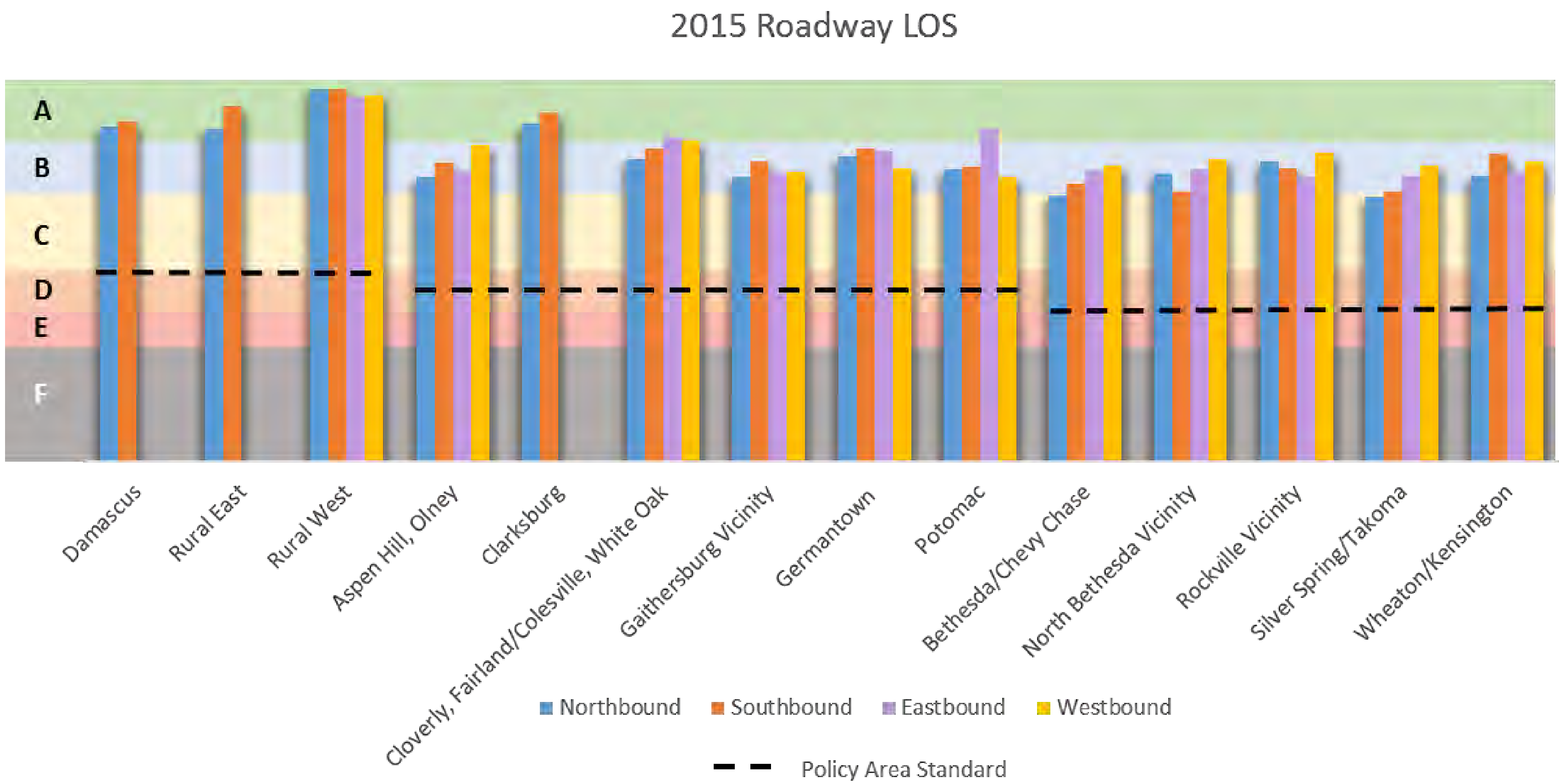


FIGURE 64: ROADWAY LEVEL OF SERVICE DERIVED FROM VEHICLE PROBE DATA

Intersection Mobility Analysis

In past reports, the critical lane volume (CLV) has been used as an indicator of mobility at intersections. CLV provides a fairly simple screening tool to evaluate if an intersection may be operating at or below capacity. For many years, the Local Area Transportation Review (LATR) guidelines have set CLV standards that vary from policy area to policy area across the county. Projects that exceed a particular impact to the transportation network are required to demonstrate that the proposed development will not cause adjacent intersections to exceed the CLV standard for the particular policy area. Over time, as part of the development review process and Maryland State Highway Administration's ongoing Traffic Monitoring System, the county has amassed a database of more than 2,200 individual counts for 694 signalized intersections.

As with past reports, the 2017 MAR analyzes and summarizes intersections according to their most recent CLV and their relationship to the applicable policy area performance standard. For the 2017 MAR, however, an additional analysis of intersections is included.

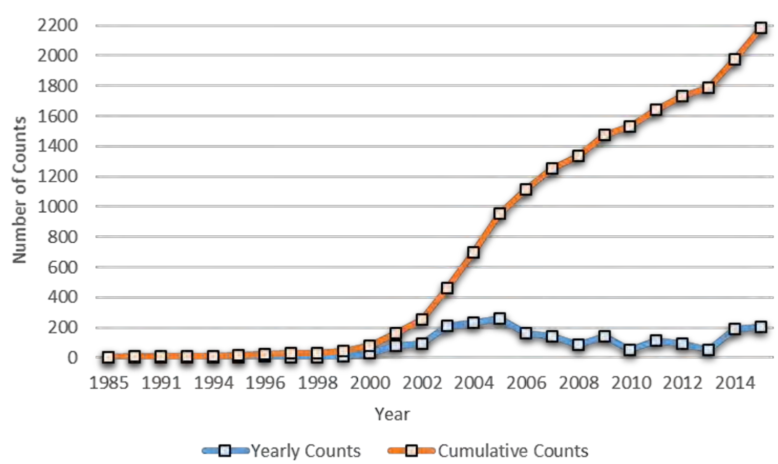


FIGURE 65: INTERSECTION DATABASE GROWTH

There has been some discussion that CLV does not convey an adequate amount of information regarding what motorists' experience at congested intersections. For this report, the top bottlenecks, as determined by the RITIS Vehicle Probe Project Suite, are investigated. According to RITIS, "bottleneck conditions are determined by comparing the current reported speed to the reference speed for each segment of road. If the reported speed falls below 60% of the reference, the road segment is flagged as a potential bottleneck. If the reported speed stays below 60 percent for five minutes, the segment is confirmed as a bottleneck location"[10]. Once a bottleneck is confirmed, adjacent road segments meeting the same condition are consolidated to form the "bottleneck" queue. The ranking of the bottlenecks is determined by an "impact factor" calculated by RITIS. The impact factor is a product of the average duration of the queue, the average maximum length of the queue, and the number of occurrences within the specified timeframe (March 1, 2015 – May 31, 2015). The top 10 bottlenecks, as determined by RITIS, are investigated further to determine changes in the CLV over time, and the amount of extra time spent in the bottleneck queue during peak periods.

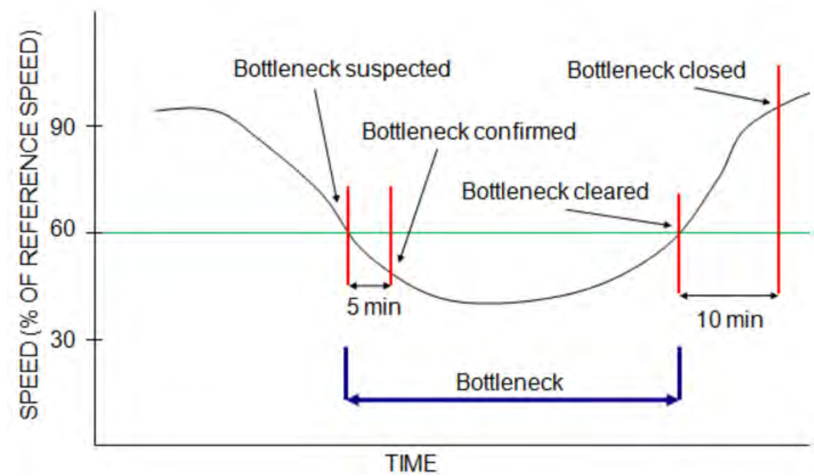


FIGURE 66: RITIS' BOTTLENECK DIAGRAM[9]

[10] Center for Advanced Transportation Technology Laboratory. (2016, December 14). Vehicle Probe Project Suite. Retrieved from Bottlenecks: https://vpp.ritis.org/suite/help/#bottlenecks

CLV Analysis By Policy Area

This section summarizes the percentage of intersections that exceed the CLV standards for the various policy areas. CLV standards for policy areas are typically updated as part of the SSP process. Intersections are first summarized according to their volume to capacity ratio (V/C ratio). The volume represents the latest CLV value in the intersection database and the capacity is the CLV congestion standard as specified in the latest SSP/LATR guidelines. If the V/C ratio is more than one, then the volume exceeds the CLV policy standard.

As indicated by Figure 67, the percentage of intersections in the database that exceed the policy area threshold, based on the latest count available, continues to decrease compared to what was reported in previous MARs. Ten percent of intersection counts through 2015 (68 total) exceed the applicable CLV threshold as specified in the 2013 LATR guidelines. This percentage is compared to 11 percent in the 2014 MAR and 17 percent reported in the 2011 MAR. The percentage of intersections falling within the least congested category has increased by eleven percent compared to what was reported in the 2011 MAR. The reduction in intersections exceeding their policy area standard can be due to changes in the LATR guidelines since 2011, and the addition of newer counts in the intersection database.

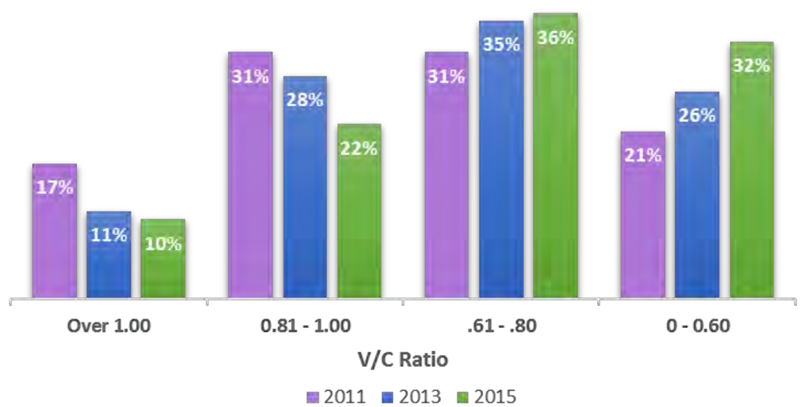


FIGURE 67: DISTRIBUTION OF VOLUME TO CAPACITY RATIOS IN INTERSECTION DATABASE

Only considering the most recent count information, there are 68 intersections in the database that exceed their LATR policy area standard (Figure 69). No intersections within the CBDs and/or Metro Station Policy Areas exceed the LATR CLV standard of 1800. A limited amount of count information was collected as early as May, 2006; however, a majority of the counts have occurred since 2010. Currently, both the Fairland/Colesville and Gaithersburg City Policy Areas have nine intersections that exceed the CLV thresholds established in the LATR guidelines. They are followed by Rockville City and the Silver Spring/Takoma Policy areas with six intersections that exceed the LATR guidelines.

Of the 68 intersections that exceed the LATR threshold, 26 exceed the CLV standard only during the morning peak period, 29 exceed the LATR threshold only in the evening peak period, and 13 exceed the LATR threshold during the evening and morning peak periods.

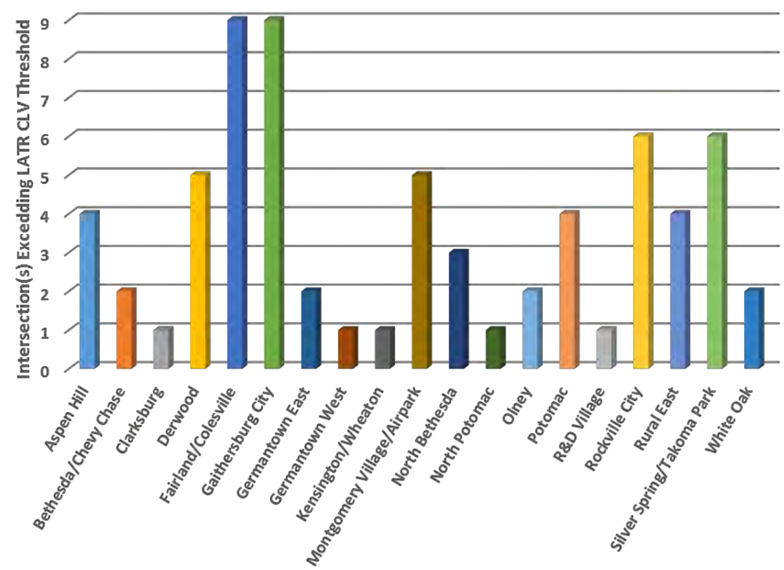


FIGURE 68: DISTRIBUTION OF INTERSECTIONS EXCEEDING CLV POLICY STANDARD

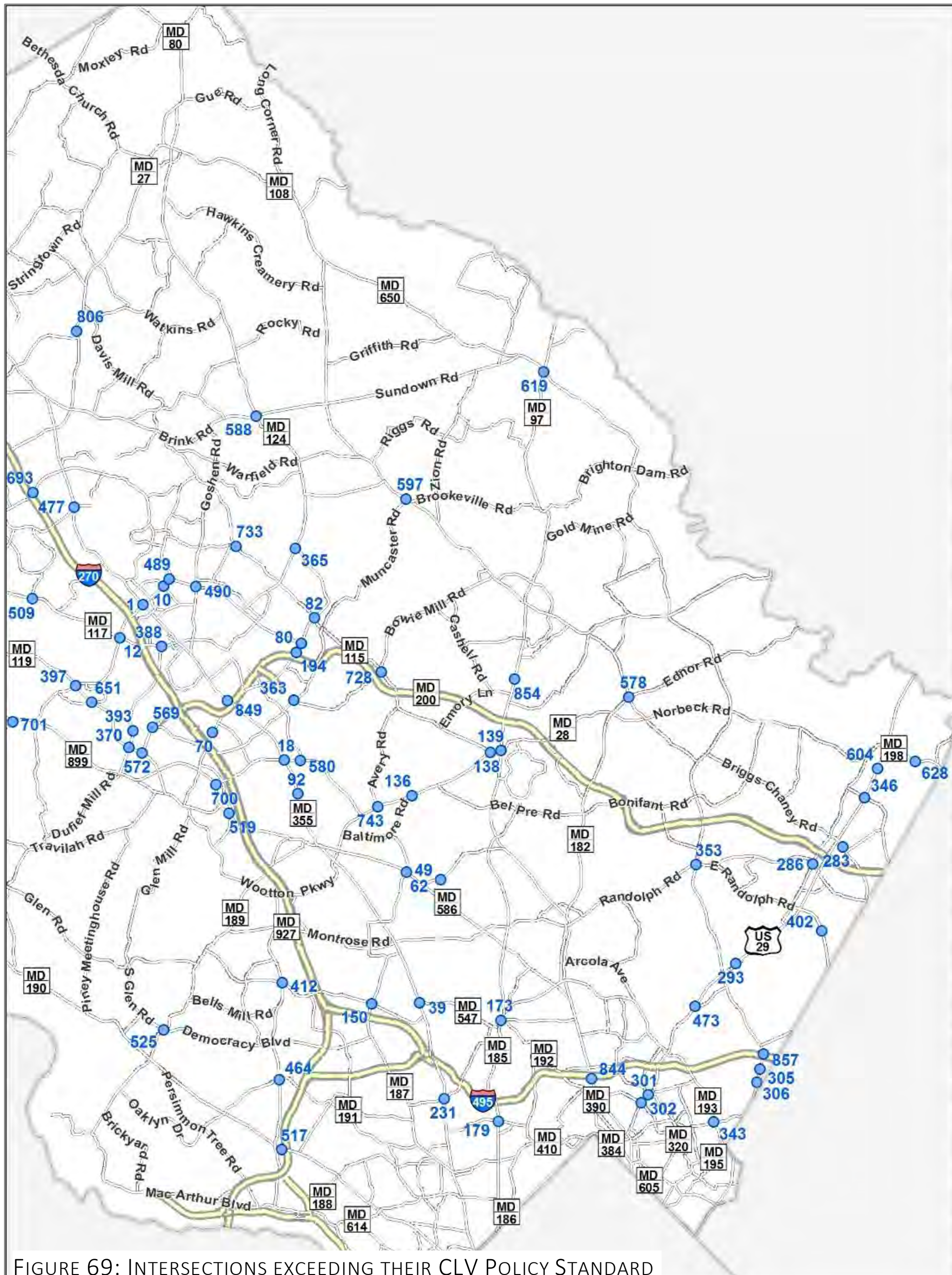


FIGURE 69: INTERSECTIONS EXCEEDING THEIR CLV POLICY STANDARD

ID	Intersection	Policy Area	CLV Standard	AM CLV	PM CLV
1	Frederick Ave at Montgomery Village Ave	Gaithersburg City	1425	1387	1818
10	Mont. Village Ave at Chris/Lost Knife	Montgomery Village	1425	1037	1454
12	Clopper Rd at Quince Orchard Rd	Gaithersburg City	1425	1427	1512
18	Hungerford Ln at Gude Dr	Rockville City	1500	1533	1258
39	Rockville Pike at Strathmore Ave	North Bethesda	1550	1455	1580
49	Aspen Hill Rd at Arctic Ave	Aspen Hill	1475	1609	1467
62	Veirs Mill Rd at Twinbrook Pkwy	North Bethesda	1550	1426	1721
70	Shady Grove Rd at Choke Cherry Ln	Rockville City	1500	1363	1853
80	Shady Grove Rd at Midcounty Hwy	Derwood	1475	1644	1323
82	Shady Grove Rd at Muncaster Mill/Airpark Rd	Derwood	1475	1530	1274
92	Hungerford Dr at Manakee St	Rockville City	1500	1533	1052
136	Norbeck Rd at Bauer Dr	Aspen Hill	1475	1626	1372
138	Norbeck Rd at Muncaster Mill Rd	Aspen Hill	1475	1536	1351
139	Georgia Ave at Norbeck Rd	Aspen Hill	1475	1524	1778
150	Old Georgetown Rd at Tuckerman Ln	North Bethesda	1550	1568	1487
173	Connecticut Ave at Plyers Mill Rd	Kensington/Wheaton	1600	1700	1829
179	Connecticut Ave at Jones Bridge Rd	Bethesda/Chevy Chase	1600	1767	1827
194	Shady Grove Rd at Epsilon/Tupelo	Derwood	1475	1704	1403
231	Rockville Pike at W Cedar Ln	Bethesda/Chevy Chase	1600	1868	1523
283	Briggs Chaney Rd at Automobile/Castle Dr	Fairland/Colesville	1475	1117	1511
286	Fairland Rd at Old Columbia Pike	Fairland/Colesville	1475	1557	1327
293	Columbia Pike at Milestone/Stewart	Fairland/Colesville	1475	1245	1600
301	Colesville Rd at Sligo Creek Pkwy	Silver Spring/Takoma Park	1600	1508	1624
302	Colesville Rd at Dale Dr	Silver Spring/Takoma Park	1600	1572	1736
305	New Hampshire Ave at Oakview Dr	Silver Spring/Takoma Park	1600	1334	1654
306	New Hampshire Ave at Adelphi Rd/Dilston Rd	Silver Spring/Takoma Park	1600	1554	1626
343	University Blvd at Piney Branch Rd	Silver Spring/Takoma Park	1600	1354	1774
346	Columbia Pike at Greencastle Rd	Fairland/Colesville	1475	1738	1637
353	Randolph Rd at New Hampshire Ave	Fairland/Colesville	1475	1440	1580
363	Redland Rd at Needwood Rd	Derwood	1475	1497	925
365	MD 124 at Airpark Rd	Montgomery Village	1425	1595	843
370	Great Seneca Hwy at Muddy Branch Rd	Gaithersburg City	1425	1413	1791
388	W Diamond Ave at Muddy Branch/Chestnut	Gaithersburg City	1425	1040	1434
393	Muddy Branch Rd at Diamondback Dr	Gaithersburg City	1425	1563	1195
397	Great Seneca Hwy at Quince Orchard Rd	Gaithersburg City	1425	1731	1081
402	Cherry Hill Rd at Broadbirch Dr/Calverton Blvd	White Oak	1475	1397	1747
412	Seven Locks Rd at Tuckerman Ln	Potomac	1450	1499	1487
464	Seven Locks Rd at Bradley Blvd	Potomac	1450	1278	1651
473	Columbia Pike at Lockwood Dr	Fairland/Colesville	1475	1491	1495
477	MD 355 at Middlebrook (N)	Germantown East	1425	1547	1515
489	Midcounty Hwy at Montgomery Village Ave	Montgomery Village	1425	783	1491
490	Midcounty Hwy at Goshen Rd	Montgomery Village	1425	1349	1486
509	Clopper Rd at Waring Station Rd	Germantown West	1425	1636	1589
517	River Rd at I-495 ramp	Potomac	1450	1681	1269
519	W Montgomery Ave at Research Blvd	Rockville City	1500	916	1666
525	Democracy Blvd at Falls Rd/S Glen Rd	Potomac	1450	1594	1167
569	Sam Eig Hwy at Fields Rd	Gaithersburg City	1425	1456	1297
572	Great Seneca Hwy at Sam Eig Hwy	R&D Village	1450	1320	1779
578	Layhill Rd at Ednor Rd/Norwood Rd	Olney	1450	1579	1425
580	E Gude Dr at Crabbs Branch/Cecil	Derwood	1475	1742	1211
588	Woodfield Rd at Brink Rd	Rural East	1350	1323	1462
597	Muncaster Rd at MD 108	Rural East	1350	1401	1381
604	Columbia Pike at Blackburn Rd	Fairland/Colesville	1475	1559	1481
619	Georgia Ave at New Hampshire Ave	Rural East	1350	1210	1520
628	Sandy Spring Rd at Mcknew	Fairland/Colesville	1475	1462	1489
651	Great Seneca Hwy at Kentlands Blvd	Gaithersburg City	1425	1498	1252
693	Germantown Rd at I-270 NB Ramp	Germantown East	1425	1050	1441
700	W Montgomery Ave at W Gude Dr	Rockville City	1500	1687	1799
701	Darnestown Rd at Riffle Ford Rd	North Potomac	1450	1188	1715
728	Muncaster Mill Rd at Needwood Rd	Rural East	1350	1322	1393
733	Snouffer School Rd at Centerway Rd	Montgomery Village	1425	1816	932
743	Norbeck Rd at Avery Rd	Rockville City	1500	1509	1023
806	Ridge Road at Skylark Rd	Clarksburg	1350	1501	1226
844	Georgia Ave at I-495 EB Off/On Ramp	Silver Spring/Takoma Park	1600	1590	1656
849	S Frederick Ave at Oneill Dr/I-370	Gaithersburg City	1475	1501	1012
854	Georgia Ave Emory Church Rd	Olney	1450	1700	1312
857	New Hampshire Ave at I-495 WB Off Ramps	White Oak	1475	1618	1770

Overall Intersection Ranking

The top congested intersection in terms of CLV continues to be Rockville Pike at West Cedar Lane. This intersection held the same position in the 2014 MAR and has been in the top five since 2009. This intersection, however, is in the final stages of a $16 million improvement that will increase vehicular capacity. Of the top 10 intersections with updated counts since the previous MAR, four, five, and four are also named as a top ten congested intersection in the 2014, 2011, and 2009 MAR respectively.

Three of the top 10 current intersections are making their appearance in the top 10 for the first time since the 2009 MAR.

Most of the intersections in the top 10 list have seen increases in their CLV values since the publication of the last MAR. CLV values overall in the database, however, have decreased. Since the last MAR publication 319 intersections have had an updated count. On average, the CLV values of these intersections have decreased by an average of 78. A full list of the top congested intersections based on CLV can be found in appendix B.

TABLE 16: TOP INTERSECTIONS IN TERMS OF CLV

Report Year Ranking				Intersection Name	Previous MAR Count Date	Previous MAR CLV	Current Count Date	Current CLV	CLV Standard	Policy Area
2009	2011	2014	2017							
2	4	1	1	Rockville Pike at W Cedar Lane[11]	11/6/2013	1957	9/16/2015	1868	1600	Bethesda/Chevy Chase
*[12]	3	5	2	Shady Grove Road at Choke Cherry Lane	5/19/2010	1853	5/19/2010	1853	1500	Rockville City
4	17	14	3	Connecticut Avenue at Plyers Mill Road	6/1/2011	1710	4/8/2014	1829	1600	Kensington/Wheaton
9	8	21	4	Connecticut Avenue at Jones Bridge Road/Kensington Parkway	2/29/2012	1672	2/4/2015	1827	1600	Bethesda/Chevy Chase
16	62	9	5	Frederick Avenue at Montgomery Village Avenue	4/25/2012	1795	10/23/2014	1818	1425	Gaithersburg City
169	175	171	6	Snouffer School Road at Centerway Road	4/19/2012	1342	11/5/2014	1816	1425	Montgomery Village/Airpark
28	7	8	7	Great Seneca Hwy at Muddy Branch Road	1/4/2011	1800	4/25/2013	1791	1425	Gaithersburg City
167	74	70	8	Great Seneca Hwy (MD-119) at Sam Eig Hwy	2/3/2009	1515	2/25/2014	1779	1450	R&D Village
5	5	25	9	Georgia Avenue at Norbeck Road	9/11/2012	1656	10/29/2015	1778	1475	Aspen Hill
73	14	16	10	University Boulevard at Piney Branch Road	1/22/2009	1703	10/7/2015	1774	1600	Silver Spring/Takoma Park

[11] Intersection improvements are slated to be complete in the Fall of 2016

[12] * No intersection count was available at the time of the MAR publication

Top Bottlenecks

This section analyzes 10 major bottlenecks from Table 17 as determined by the RITIS Vehicle Probe Project Suite using vehicle probe data. Bottleneck rankings are determined by its impact factor. The impact factor is a product of the average duration of the queue, average maximum length of the queue, and the number of occurrences within the specified time frame (March 1 – May 31, 2015). This evaluation is intended to investigate potential chokepoints in the transportation system.

TABLE 17: THE 20 MOST IMPACTFUL BOTTLENECKS

Rank	Location	Direction	Impact factor	Average max length (miles)	Average duration	Occurrences	All Events/Incidents
1	MD-355 @ 1ST ST/WOOTTON PKWY	NORTHBOUND	73,776.29	2.27	51 m	638	23
2	MD-650 @ POWDER MILL RD	NORTHBOUND	72,782.87	0.89	1 h 28 m	932	5
3	MD-190 @ WESTERN AVE[13]	EASTBOUND	58,650.18	1.34	1 h 19 m	552	4
4	MD-650@US-29/COLUMBIA PIKE	NORTHBOUND	58,223.16	1.78	1 h 41 m	323	2
5	MD-185 @ MD-191/BRADLEY LN	SOUTHBOUND	42,582.24	1.77	1 h 20 m	301	9
6	MD-355 @ WESTERN AVE[12]	SOUTHBOUND	40,778.04	0.80	1 h 14 m	687	2
7	US-29 @ MD-516/FRANKLIN AVE	NORTHBOUND	39,047.50	0.81	1 h 27 m	551	0
8	MD-355 @ MD-547/STRATHMORE AVE	SOUTHBOUND	36,715.01	1.56	44 m	535	9
9	MD-185 @ I-495	NORTHBOUND	33,629.59	1.03	1 h 06 m	496	16
10	MD-355 @ MD-28/VEIRS MILL RD/E JEFFERSON ST	SOUTHBOUND	32,503.14	1.01	56 m	576	6
11	MD-355 @ MD-191/BRADLEY LN	SOUTHBOUND	31,057.34	0.88	1 h 09 m	509	26
12	MD-97 @ RANDOLPH RD	NORTHBOUND	30,137.52	0.58	49 m	1062	21
13	MD-355 @ GRAFTON ST	SOUTHBOUND	29,606.43	1.63	2 h 25 m	125	26
14	MD-190 @ DORSET AVE	WESTBOUND	28,184.74	0.93	56 m	541	40
15	US-29 @ OLD COLUMBIA RD	NORTHBOUND	28,172.00	4.24	2 h 03 m	54	7
16	MD-355 @ CHRISTOPHER AVE	NORTHBOUND	28,047.91	0.58	56 m	869	0
17	US-29 @ I-495	SOUTHBOUND	27,799.22	1.18	1 h 00 m	394	8
18	MD-190@ MD-191/BRADLEY BLVD	WESTBOUND	26,181.52	2.25	1 h 05 m	179	2
19	MD-355 @ GROSVENOR LN	SOUTHBOUND	25,811.42	1.44	44 m	408	1
20	MD-97 @ I-495/CAPITAL BELTWAY	NORTHBOUND	25,564.42	0.48	1 h 02 m	858	3

[13] Historical CLV data is not available and therefore not reviewed in further detail.

Rockville Pike (MD-355) at First Street/Wootton Parkway

Nine of the top 20 bottlenecks, as determined by the RITIS Vehicle Probe Project Suite, occur along Rockville Pike. The most significant bottleneck on the list occurs along northbound Rockville Pike with its headway occurring at Wootton Parkway/First Street. The average duration of the bottleneck is 51 minutes with an average length of just under 2.5 miles. The average speed of adjoining segments was measured to fall below 60 percent of the reference speed 638 times between March 1 and May 31, 2015.

The excess time traveling through the average length of the bottleneck compared to free-flow conditions is three minutes and 16 seconds during the evening commute and two minutes and 26 seconds during the morning commute. Currently, there are three traffic counts that have occurred at the intersection in the historical traffic count database. CLV has decreased since 2002, particularly during the evening (Figure 71).

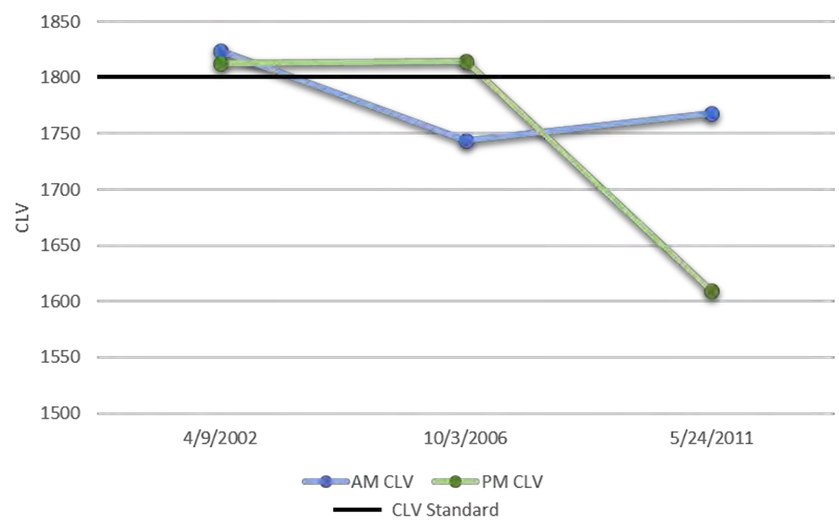


FIGURE 71: ROCKVILLE PIKE AT FIRST STREET/WOOTTON PARKWAY CLV HISTORY

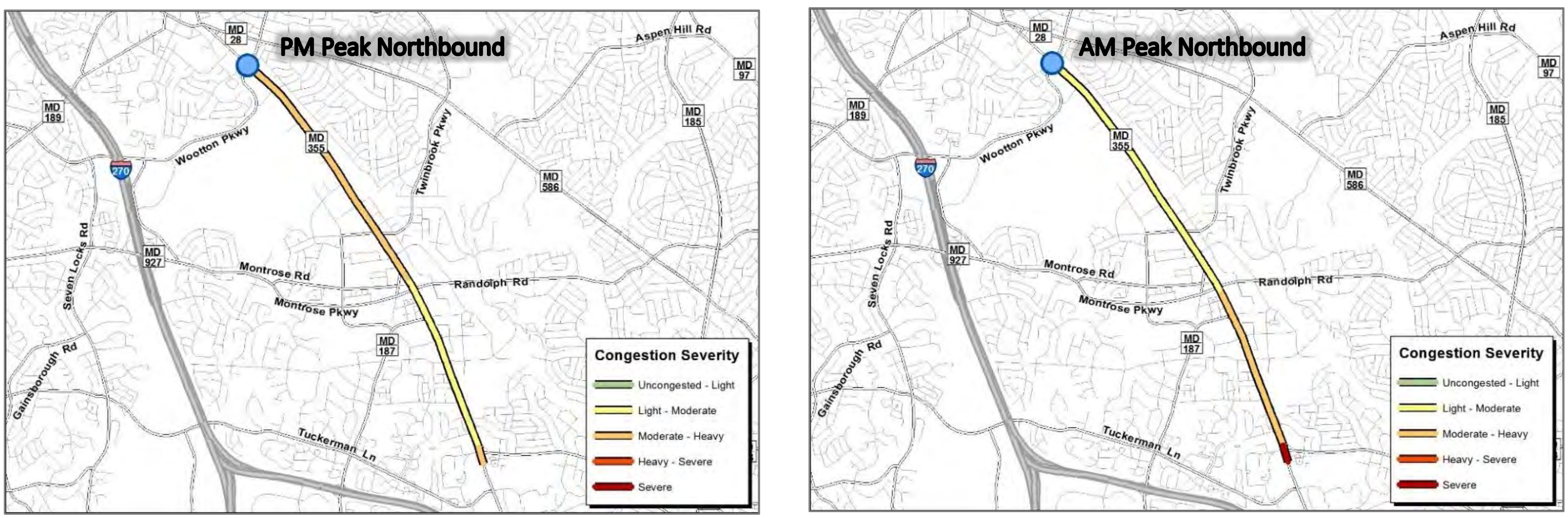


FIGURE 70: BOTTLENECK #1 EXTENT

New Hampshire Avenue (MD-650) at Powder Mill Road

The second most noteworthy bottleneck occurs at the intersection of New Hampshire Avenue (MD-650) and Powder Mill Road. Although the average maximum queue length is relatively short, the bottleneck's long average duration and number of occurrences cause its impact factor to be the second highest in the county. Average measured speeds of adjacent roadway segments dropped below 60 percent of their free-flow speed 932 times over a 91-day period between March 1 and May 31, 2015.

CLV values have remained below their policy area standard since 2003, with an overall trend of declining congestion values. Morning CLV values reached their peak in 2003 and evening peak CLV values reached their peak in 2007 (Figure 72). The excess time traveling through the average length of the bottleneck compared to free-flow condition is 1 minute and 35 seconds during the evening commute and 1 minute and 8 seconds during the morning commute.

Adjustments to the intersection's lane assignments were made in 2003 to improve the intersection's performance.

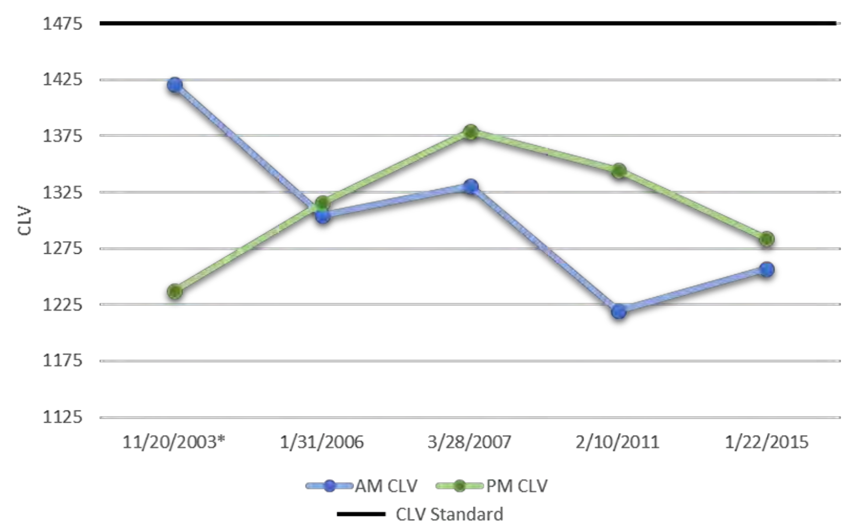


FIGURE 72:NEW HAMPSHIRE AVENUE AT POWDER MILL ROAD CLV HISTORY

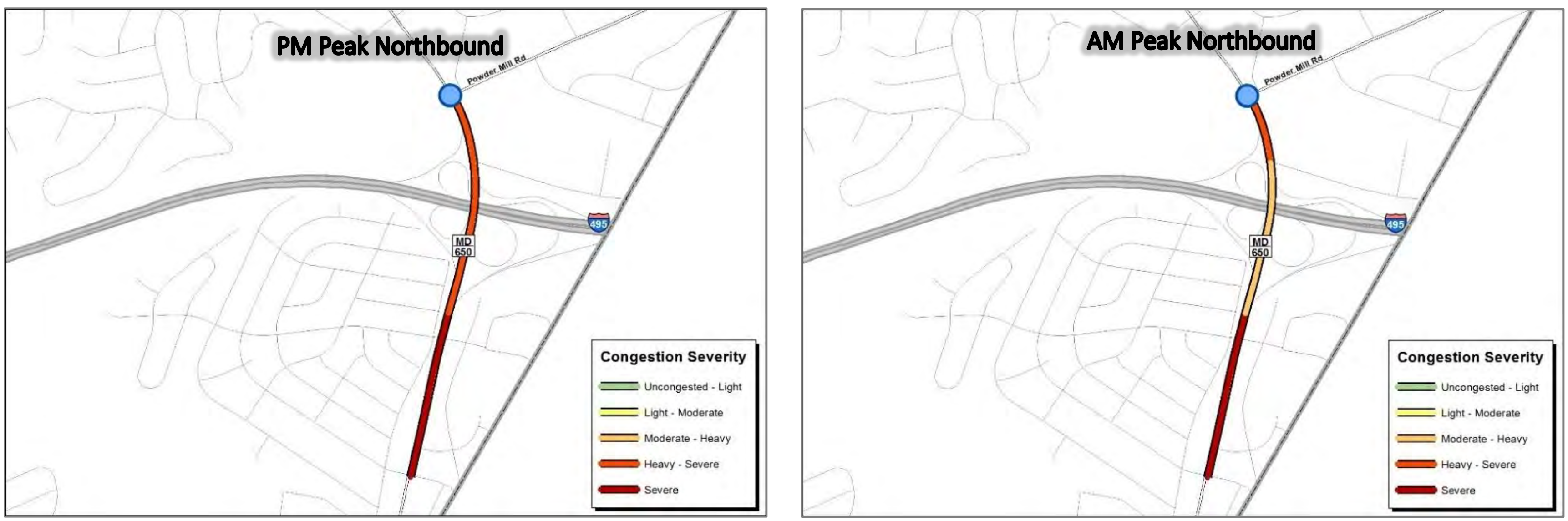


FIGURE 73: BOTTLENECK #2 EXTENT

New Hampshire Avenue (MD-650) at Columbia Pike (US-29)

The fourth rated bottleneck, per RITIS's bottleneck impact factor, occurs at the interchange of New Hampshire Avenue and Columbia Pike. The average maximum length of the bottleneck along northbound MD-650 is near 2 miles. The average duration of a bottleneck is 1 hour and 41 minutes with 323 occurrences flagged between March 1 and May 31, 2015.

Examining the average excess time spent traveling through this corridor and the CLV values collected in 2014 during the evening and morning commutes indicates congestion is less significant than other corridors throughout the county. The MD-650 and US-29 interchange is made up of several ramps and one signalized intersection. The CLV measurements represent the signalized intersection at US-650 northbound and the US-29 southbound on-ramp. The CLV has decreased dramatically during the p.m. peak period since intersection improvements were completed in the early 2000s (Figure 75).

On average, it takes an extra one minute during the evening commute and 33 seconds during the morning commute to travel through the bottleneck on MD-650 in the northbound direction. The high bottleneck ranking could be the result of the combined impact of several intersections along this section of MD-650 including Lockwood Drive and the entrance to the Food and Drug Administration headquarters.

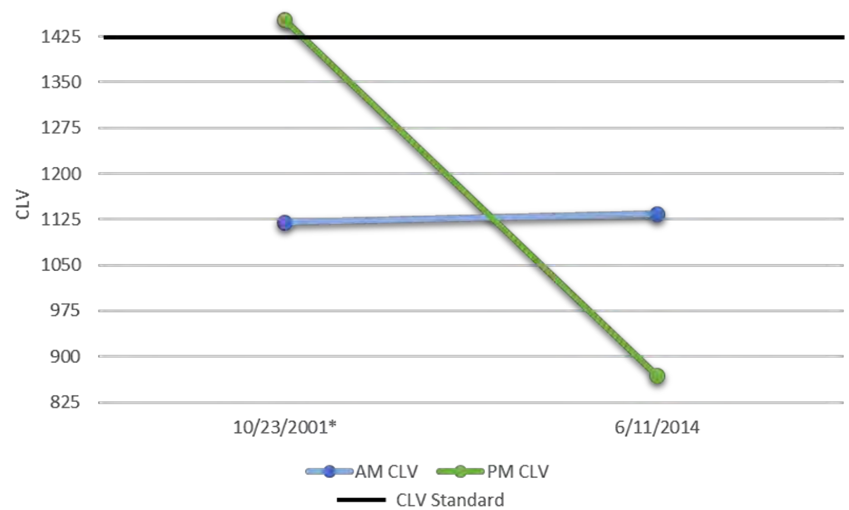
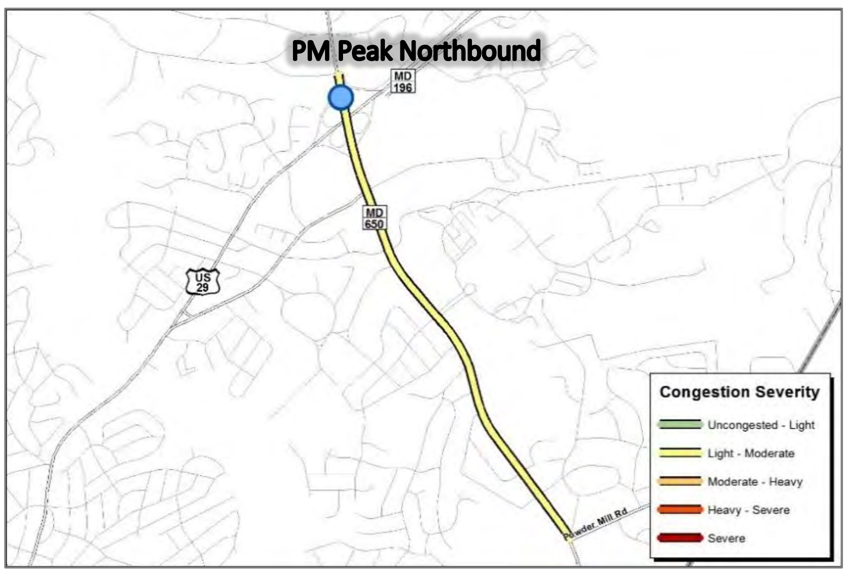


FIGURE 75: NEW HAMPSHIRE AVENUE AT COLUMBIA PIKE CLV HISTORY



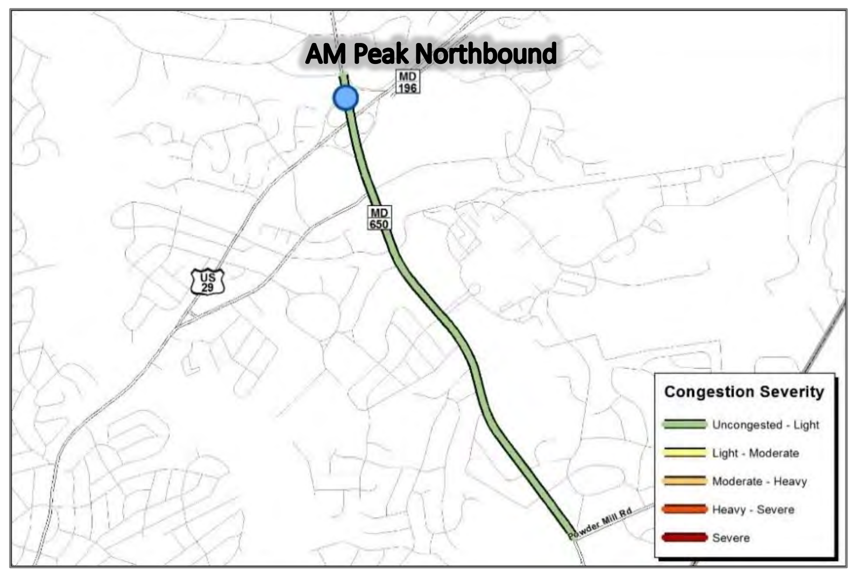


FIGURE 74: BOTTLENECK #3 EXTENT

Connecticut Ave (MD-185) at Bradley Lane/Boulevard

The fifth most impactful bottleneck occurs along southbound Connecticut Avenue with its headway occurring at the intersection with Bradley Lane. The average maximum length of the queue is near two miles, bringing its culmination to just south of the Capital Beltway. This section of Connecticut Avenue is also ranked in the top 20 congested corridors discussed in the previous section. The average duration of each bottleneck before it clears is 1 hour and 20 minutes.

Historical CLV measurements show a steady decline during the a.m. peak period since 2004. CLV has been a bit more erratic during the evening commute, but both have remained below the 2012 policy standard (Figure 77). On average, the extra time spent traveling through this bottleneck during the evening commute is 2 minutes and 18 seconds, and 3 minutes and 15 seconds during the morning commute. This bottleneck incurs the second most additional time spent in congestion for all bottlenecks analyzed.

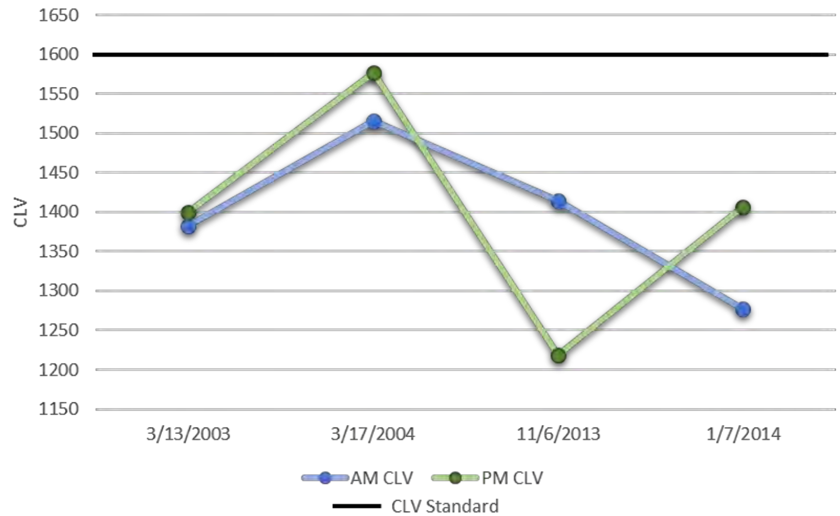


FIGURE 77: CONNECTICUT AVE AT BRADLEY LANE/BOULEVARD CLV HISTORY

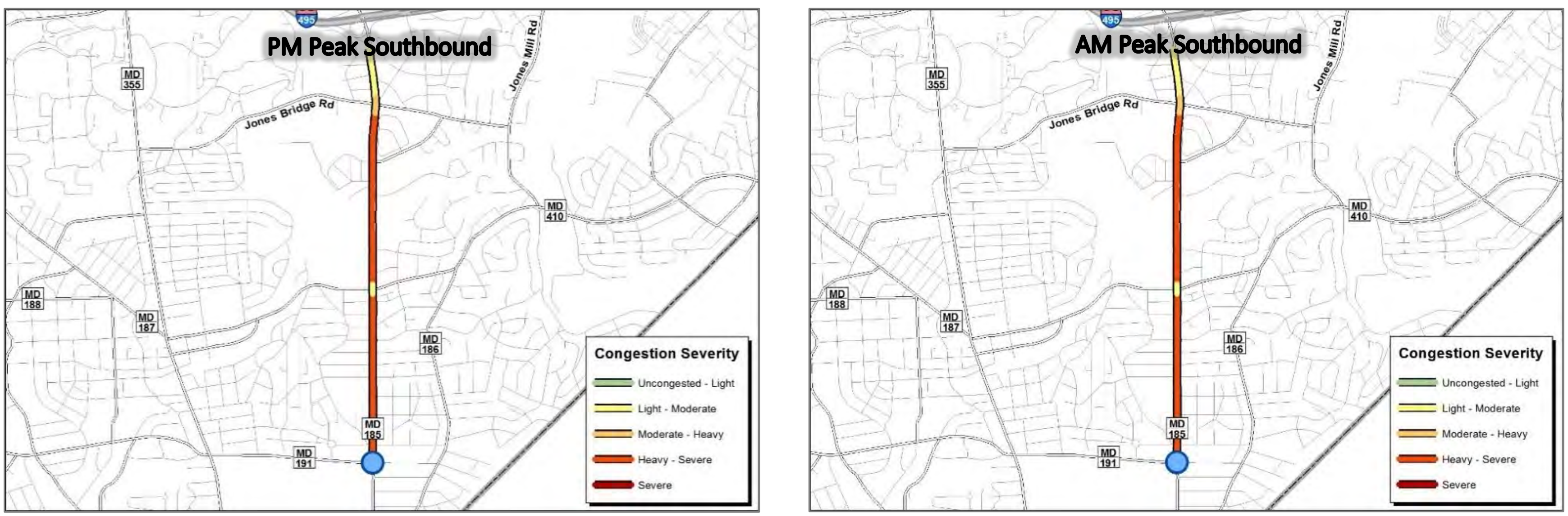


FIGURE 76: BOTTLENECK #4 EXTENT

Colesville Road (US-29) at Franklin Avenue

The seventh ranked bottleneck occurs along northbound Colesville Road in Silver Spring with its origin occurring at the intersection with Franklin Avenue. The average maximum length of the queue is just under one mile, extending to Georgia Avenue. This section of Colesville Road is part of the larger corridor that is second in the top 20 congested corridors discussed in the previous section. The average duration of each bottleneck before it clears is 1 hour and 27 minutes.

Past CLV measurements show an erratic morning commute CLV pattern. The p.m. peak CLV has been more consistent with values ranging between 1347 and 1571 (Figure 79). There are several other intersections along the bottleneck that experience a higher CLV, including Dale Drive (1736) and Sligo Creek Parkway (1624). On average, the extra time spent traveling through this bottleneck during the p.m. peak period is slightly below two minutes. The average extra time spent traveling through this bottleneck during the morning commute is 1 minute and 27 seconds.

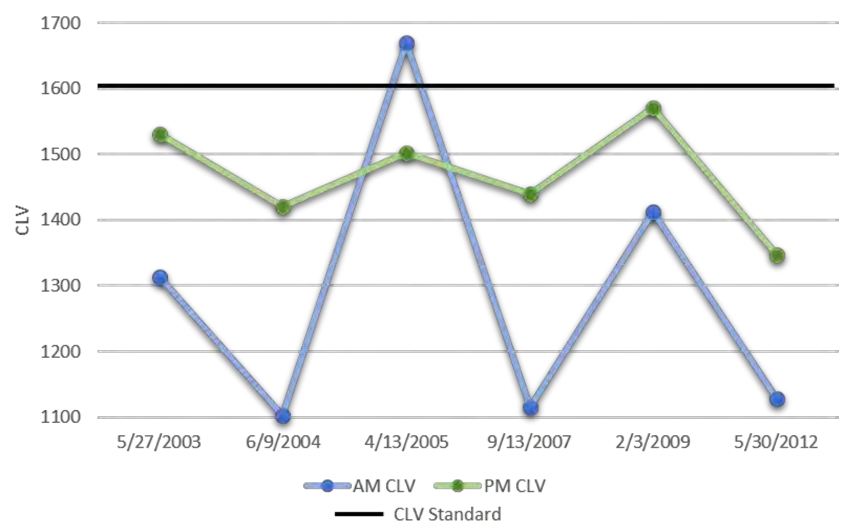
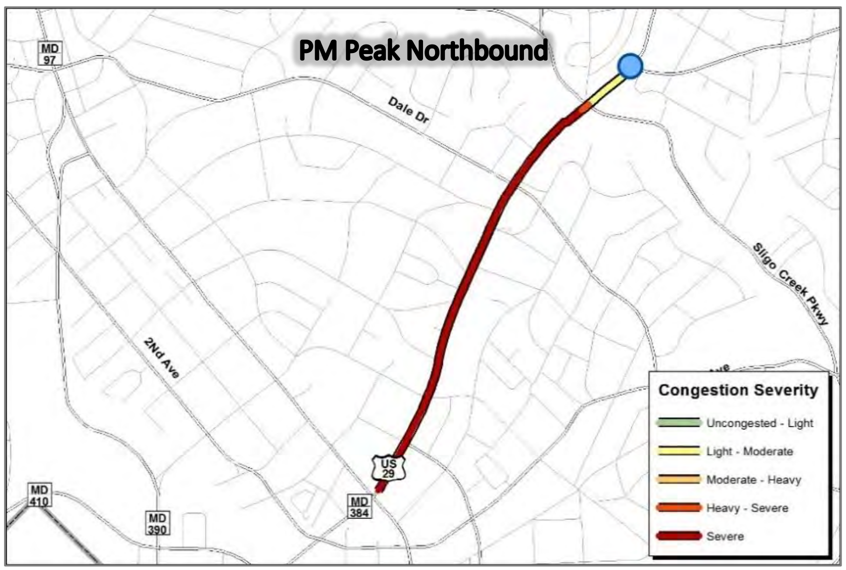


FIGURE 79: COLESVILLE ROAD AT FRANKLIN AVENUE CLV HISTORY



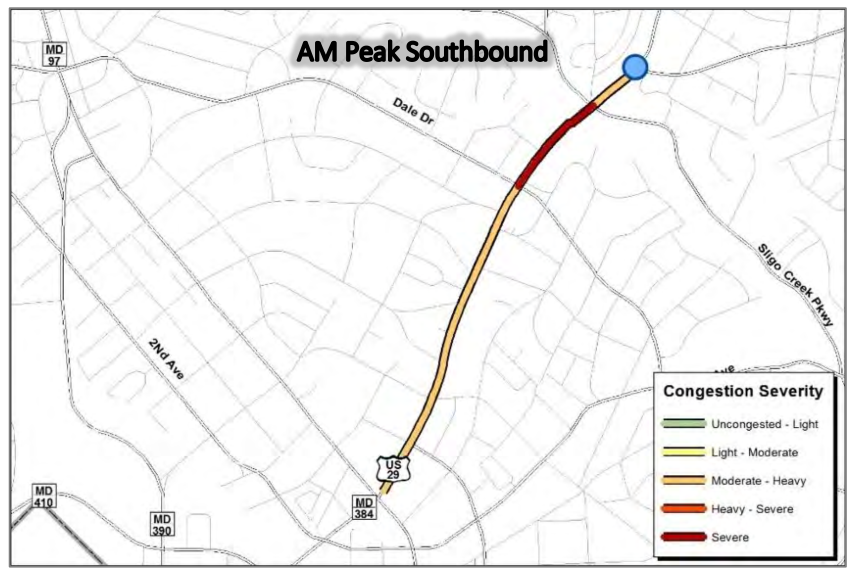


FIGURE 78: BOTTLENECK #5 EXTENT

Rockville Pike (MD-355) at Strathmore Avenue (MD-547)

The eighth most impactful bottleneck occurs along southbound Rockville Pike with its headway occurring at the intersection with Strathmore Avenue. The average maximum length of the queue is just over 1.5 miles. The average duration of a bottleneck is 44 minutes. Average speeds along segments downstream from the intersection with Strathmore Avenue dropped below 60 percent of the free-flow speed 535 times between March 1 and May 31, 2015, an average of just under six bottlenecks per day.

Historical morning and evening CLV measurements show a steady decline between 2003 and 2009. A steady increase, however, is observed since 2009 with the evening CLV in 2014 exceeding the policy area standard (Figure 81). The average extra time spent traveling through this bottleneck during the evening commute is just over 4 minutes and only 1.5 minutes during the morning commute. This bottleneck incurs the most additional time spent in congestion for all bottlenecks analyzed.

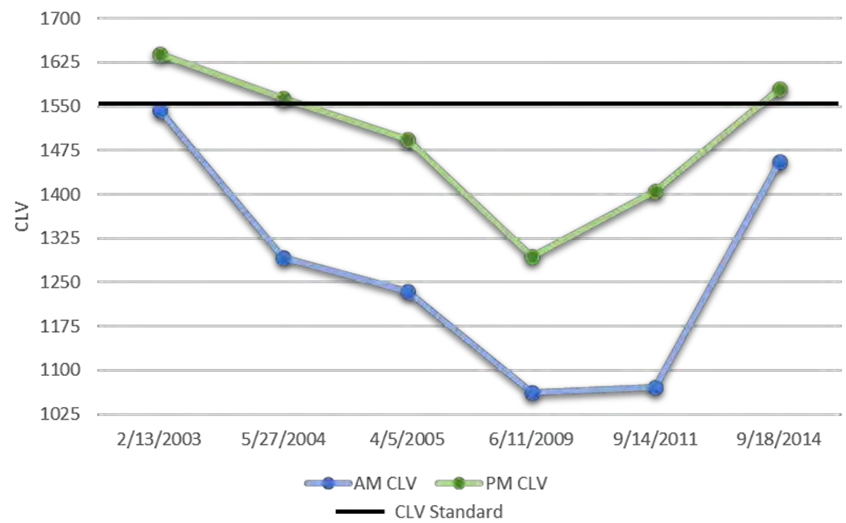


FIGURE 81: ROCKVILLE PIKE AT STRATHMORE AVENUE CLV HISTORY

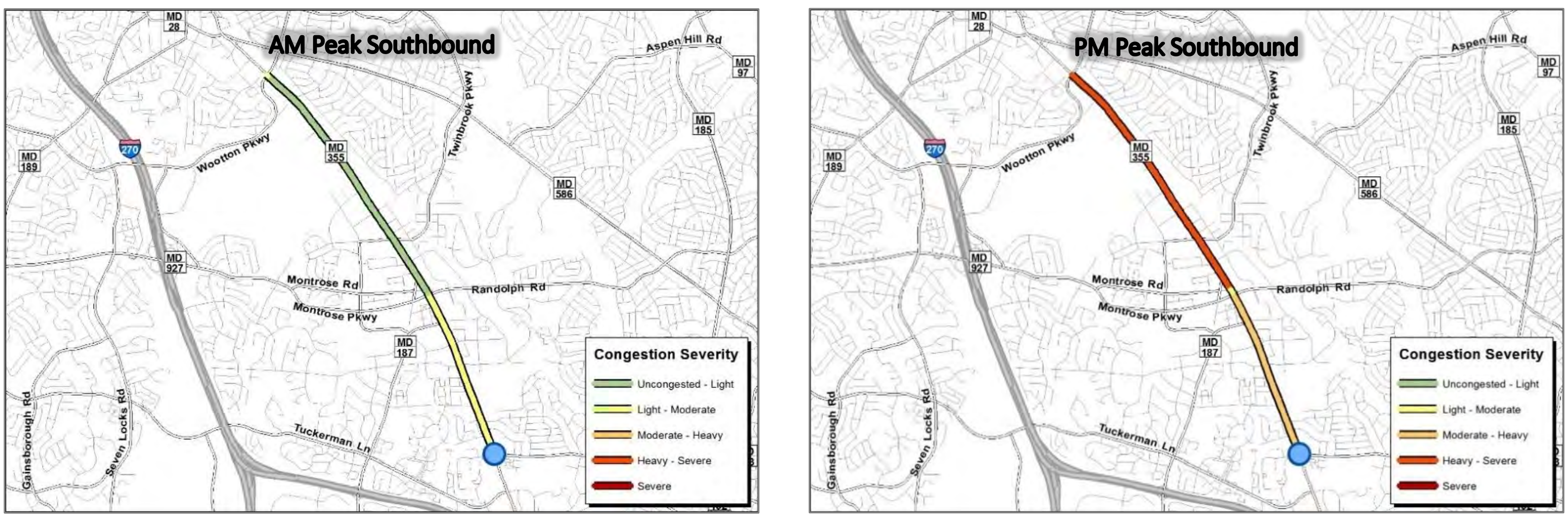


FIGURE 80: BOTTLENECK #6 EXTENT

Connecticut Ave (MD-185) at Capital Beltway (I-495)

The ninth most significant bottleneck occurs along northbound Connecticut Avenue, terminating at the intersection with the Capital Beltway. The interchange includes two signalized intersections each controlling traffic exiting the inner or outer loop of the Beltway. The average maximum length of each flagged bottleneck is approximately one mile with an average duration of 1 hour and 6 minutes. Average speeds along segments downstream from the interchange with the Capital Beltway dropped below 60 percent of the free-flow speed 496 times between March 1 and May 31, 2015, an average of approximately 5.5 bottlenecks a day.

Historical CLV measurements in the intersection database are limited for the interchange. Only one count exists for each of the two signalized intersections that make up the interchange and were both collected in 2005 (Figure 83). The southernmost intersection managing traffic exiting the inner loop experiences a higher CLV both during the evening and morning commute. The average extra time spent traveling through this bottleneck during the morning commute is approximately 38 seconds and near 2 minutes during the evening commute.

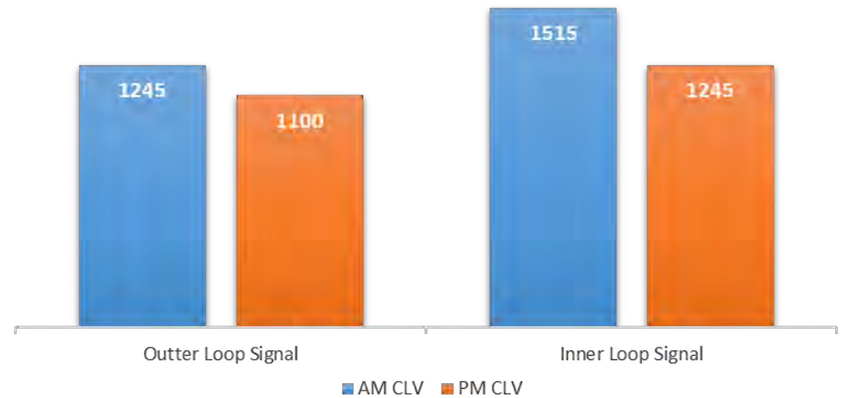


FIGURE 83: MD-185 AT I-495 INNER LOOP AND OUTER LOOP CLV COMPARISON

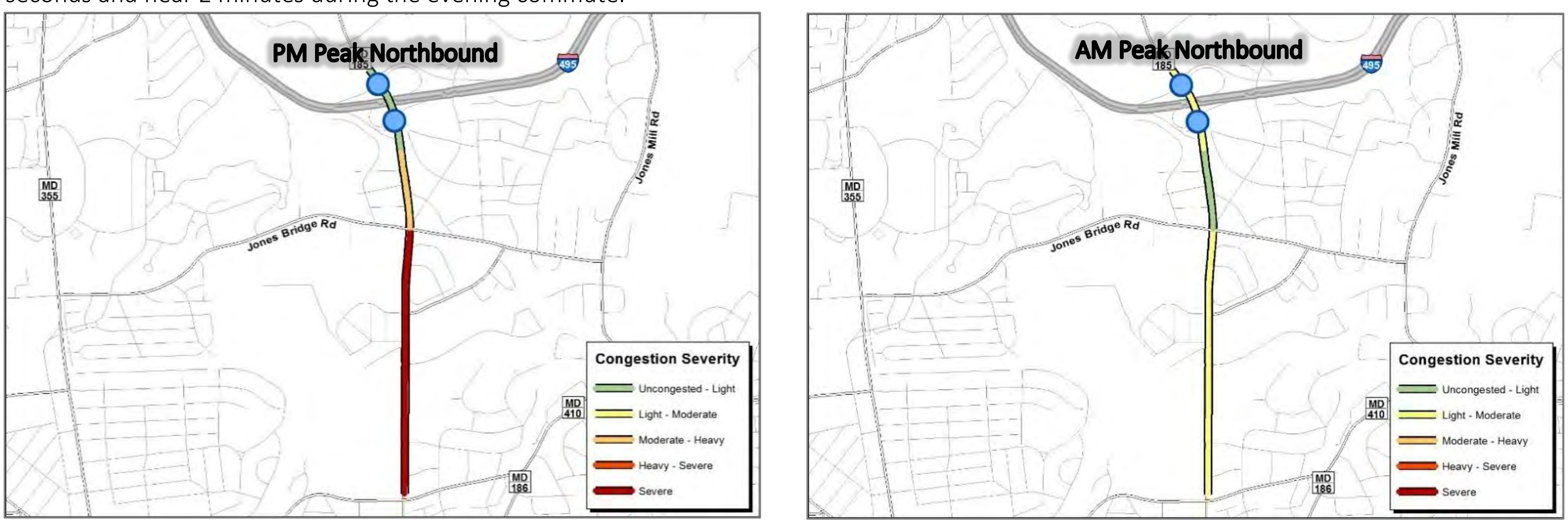


FIGURE 82: BOTTLENECK #7 EXTENT

Rockville Pike (MD-355) at Veirs Mill Road (MD-586)

The tenth most impactful bottleneck occurs along southbound Rockville Pike terminating at the intersection with Veirs Mill Road. The average maximum length of the bottleneck is one mile with an average duration of just under one hour. Speeds along the bottleneck frequently fall below 60 percent of the free-flow speed with an average of over six occurrences per day between March 1 and May 31, 2015.

Examining the average excess time spent traveling through this corridor and the last CLV values during the evening and morning commutes indicates congestion may be less of a factor compared to other corridors throughout the county. CLV has decreased significantly since 2009 and have remained steady in since 2014 (Figure 85). CLV has remained well below the policy area standard for Rockville Town Center The average amount of excess time spent in congestion in the bottleneck is just over one minute during the evening commute and 25 seconds during the morning commute.

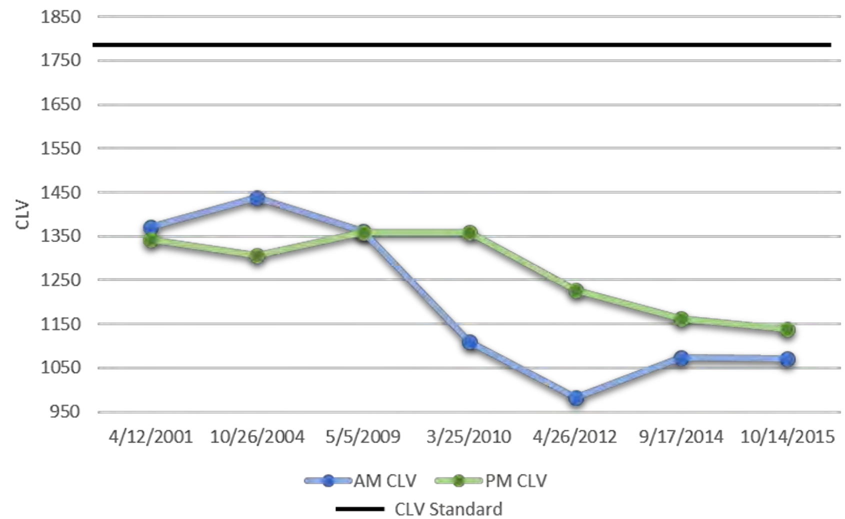
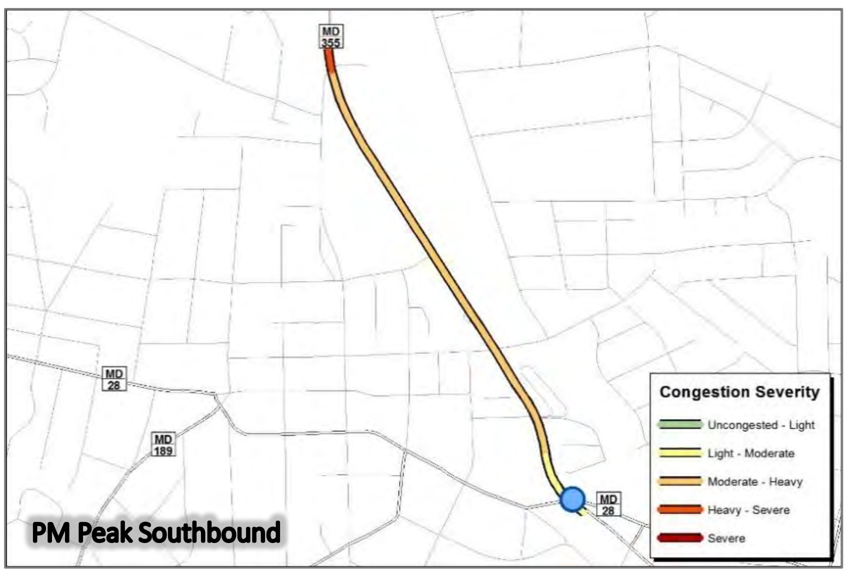


Figure 85: Rockville Pike at Veirs Mill Road CLV History



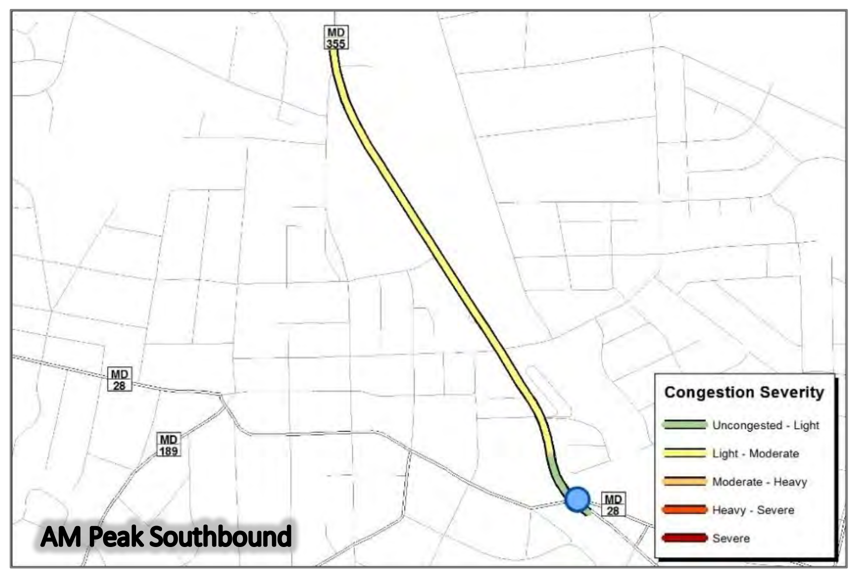


Figure 84: Bottleneck #8 Extent

Wisconsin Ave (MD-355) at Bradley Boulevard (MD-191)

The eleventh most impactful bottleneck occurs along southbound Wisconsin Avenue, originating at the intersection with Bradly Boulevard. The average maximum length of the bottleneck is near one mile and the average duration is 1 hour and 9 minutes. Speeds along the bottleneck frequently fall below sixty percent of the free-flow speed with an average of over 5.5 occurrences per day between March 1 and May 31, 2015.

The lengthy CLV history of the intersection shows a fairly steep decline in volume from 1995 through 2005. Since 2005, volume has oscillated but has stayed below levels prior to 2003 (Figure 87). The average additional time spent traveling through the bottleneck during the evening commute is 3 minutes and 14 seconds. The excess time during the a.m. peak period is 1 minute and 38 seconds. The bottleneck is part of the larger Wisconsin Avenue corridor that is number seven on the list of top congested roadways in the county.

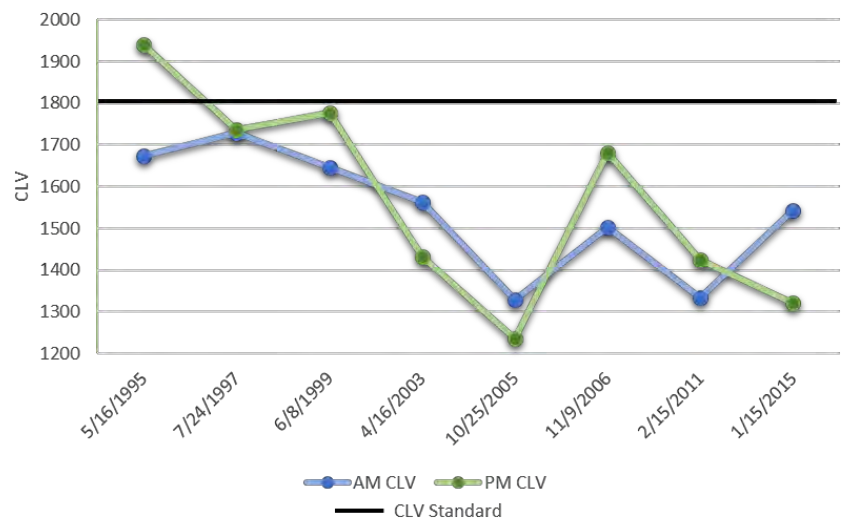
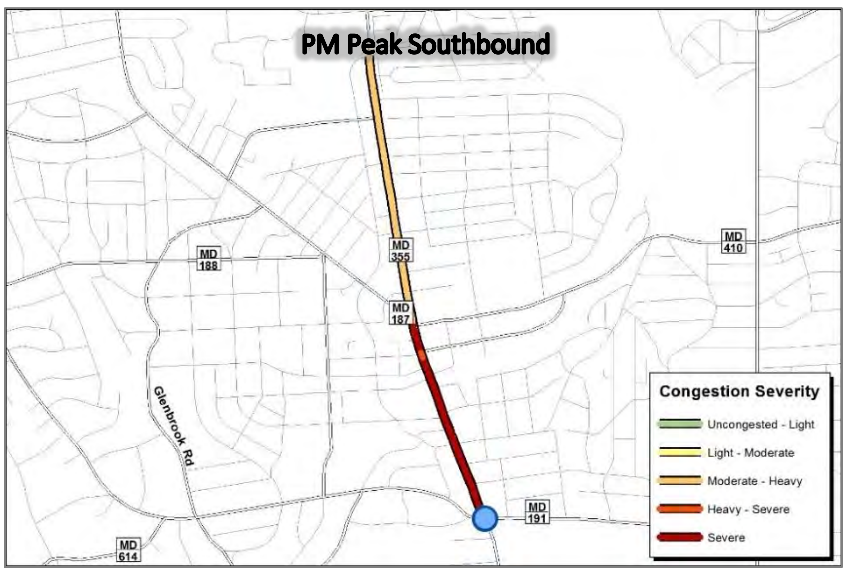


Figure 87: Wisconsin Ave at Bradley Boulevard CLV History



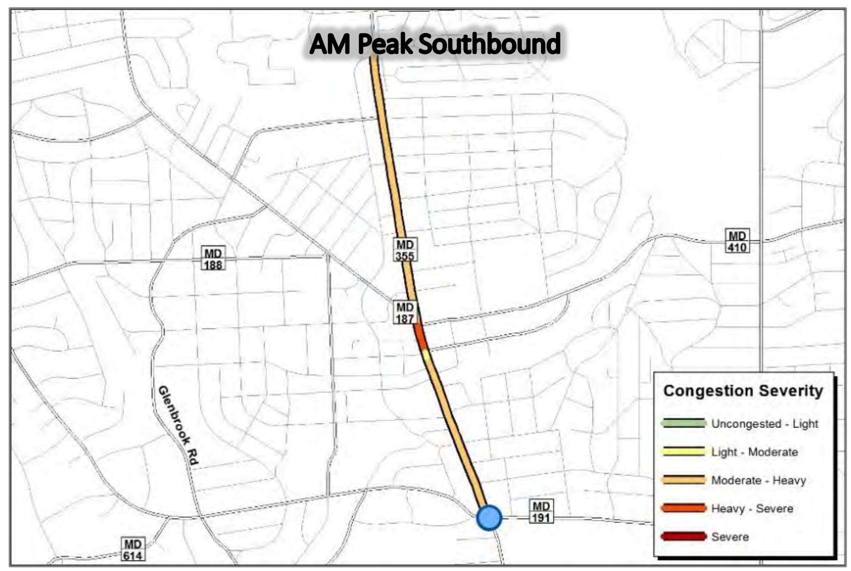


Figure 86: Bottleneck #9 Extent

Georgia Avenue (MD-97) at Randolph Road

The twelfth most impactful bottleneck and the final one examined in detail occurs along northbound Georgia Avenue, originating at the intersection with Randolph Road. The average maximum length of the bottleneck is quite small at barely over one half mile. The bottleneck, however, occurs more often than any other bottleneck (tied with Georgia Avenue at MD-108) in the top 20. Speeds along the bottleneck fall below 60 percent of the free-flow speed an average of over 11.5 times per day between March 1 and May 31, 2015. The average bottleneck duration is 49 minutes.

Volume exceeded the policy area threshold (on the boundary between Grosvenor MSPA and Kensington/Wheaton) during the 2006 turning movement count. Since 2006, however, volume has declined (Figure 89). This intersection is currently undergoing a $77 million reconstruction that will replace the existing signalized configuration by repositioning Randolph Road to allow through traffic to go under Georgia Avenue. New turn lanes and ramps will provide turning movements. The project is estimated to be completed by the end of 2017.

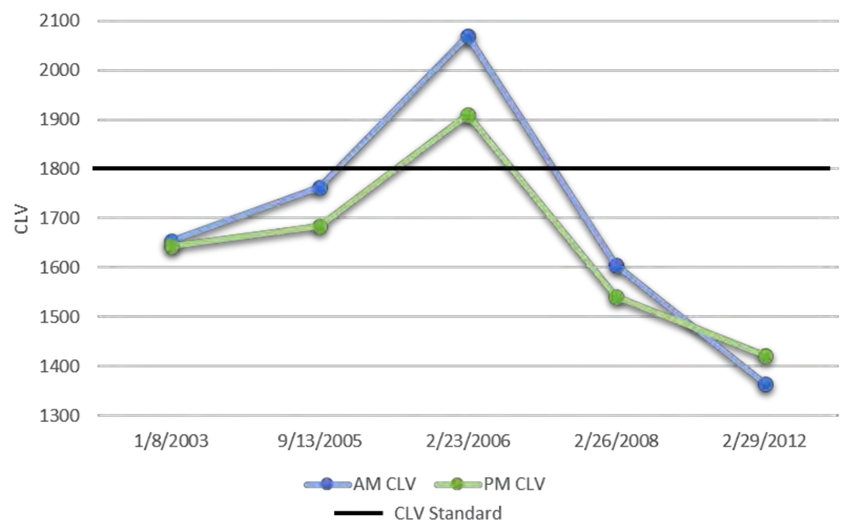
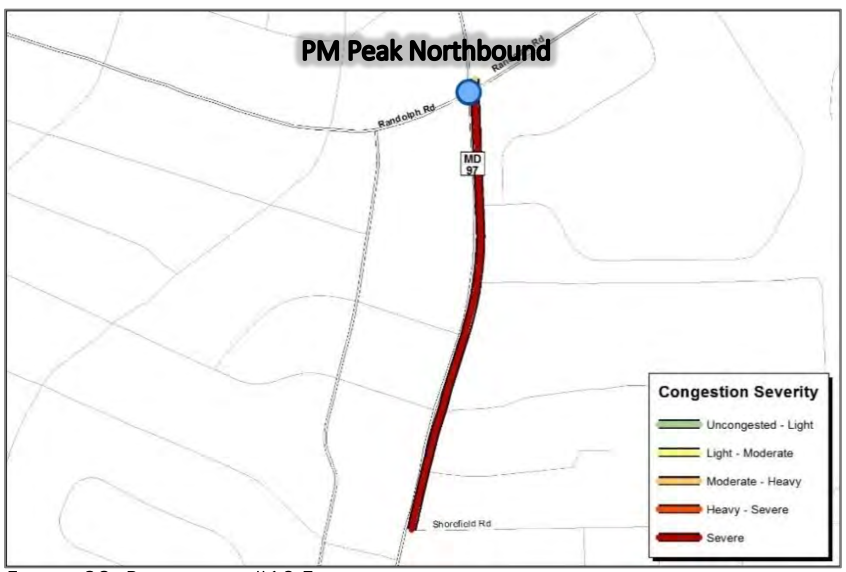


FIGURE 89: GEORGIA AVENUE AT RANDOLPH ROAD CLV HISTORY



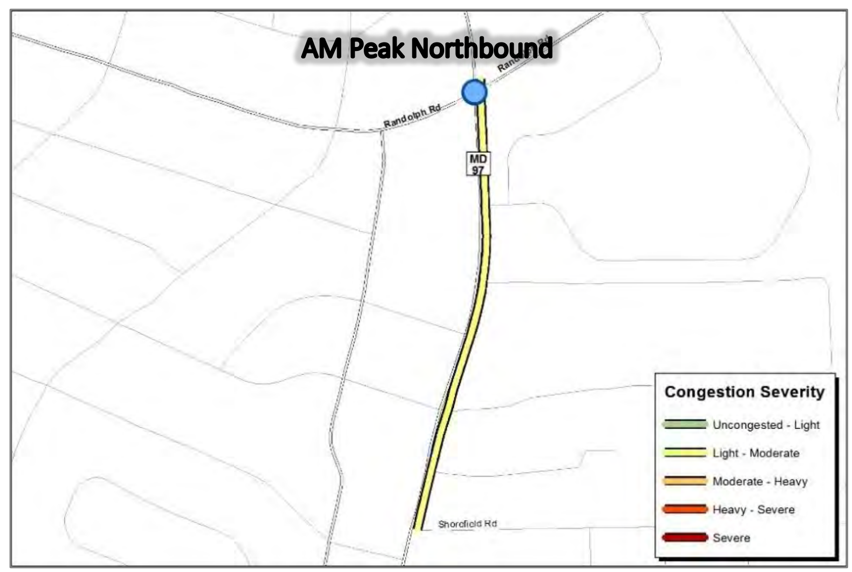


FIGURE 88: BOTTLENECK #10 EXTENT

Pedestrian and Bicycle Mobility

A well-functioning and efficient transportation system provides a variety of mobility options and resources. The private automobile, through the application of metrics and modeling techniques, has been given precedence over the past 70 years. The automobile-dominant epoch in the transportation planning industry has created many positive benefits, however, many negative externalities have also resulted. Recent concerns about traffic congestion, air pollution, climate change, transportation revenue shortfalls, and health issues are challenging the way development and transportation investments are made.

The 1964 General Plan - *On Wedges & Corridors: A General Plan for the Maryland-Washington Regional District in Montgomery and Prince George's Counties* – extolled that the "automobile dominated transportation system" in Los Angeles had transformed "two-thirds of the city's downtown [into] streets and loading facilities" bus was not a viable solution to bi-county transportation challenges. Objective "F" of the 1969 update to the Plan calls on M-NCPPC to "recognize the need for non-motorized transportation forms to support health and recreation objectives and to provide visual contrast to vehicular movement." Guideline One of Objective F instructs planners to "encourage the use of non-motorized ways to schools, shopping areas, parks, libraries and other community facilities."

The Montgomery County Departments of Transportation and Planning recognize the importance of having a diverse and efficient transportation system that provides accessibility and mobility to its citizenry, while also providing mobility to the many commuters that pass through the county each day. The importance of this commitment is punctuated by the fact that over the past five years, the typical new resident moving to Montgomery County is a young adult (20 to 34 years of age) of non-Caucasian decent who holds a college degree[14]. Studies indicate that millennials are tending to drive less than their older counterparts. They show that millennial "lifestyle-related demographic shifts, including decreased employment, explain 10 to 25 percent of the decrease in driving; millennial-specific factors such as changing attitudes and use of virtual mobility (online shopping, social media) explain 35 to 50 percent of the decrease; and the general dampening of travel demand that has occurred across all age groups accounts for the remaining 40 percent"[15]. Research indicates that millennials favor areas where destinations are accessible by a plethora of travel options, including biking and walking.

Active transportation modes are a growing component of the county's aim to become more sustainable. Montgomery County has invested significant resources and directed policies toward reducing single-occupancy vehicle use, and as urban areas of the county continue to develop, bicycling and walking are key to meeting performance goals for Non-Auto Driver Mode Share metrics set out in master plans, sector plans, and the Subdivision Staging Policy.

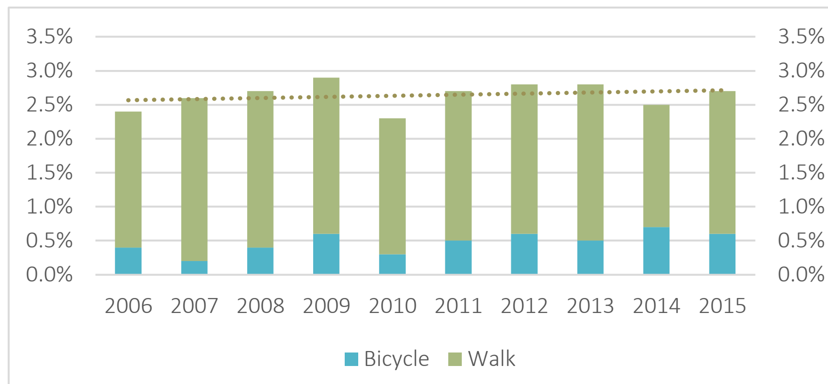


FIGURE 90: PERCENTAGE OF RESIDENTS WHO COMMUTE BY BICYCLE OR WALKING (CENSUS AMERICAN COMMUNITY SURVEY 1 YEAR ESTIMATES)

[14] The Maryland-National Capital Park and Planning Commission. (2016). *2016 Subdivision Staging Policy.* Silver Spring: The Maryland-National Capital Park and Planning Commission.

[15] Noreen C. McDonald (2015) Are Millennials Really the "GoNowhere" Generation?, Journal of the American Planning Association, 81:2, 90-103, DOI: 10.1080/01944363.2015.1057196

With the Planning Department slated to release recommendations in 2017 for bicycle facilities as part of the Bicycle Master Plan, Montgomery County is well-positioned to emerge as a leader in bicycling among suburban jurisdictions.

The county has invested in many capital construction projects, regulatory changes, planning methods and data that seek to encourage a more robust and diverse transportation system. Some of these investments include:

1. Bicycle Pedestrian Priority Areas (BiPPA): BiPPAs are geographical areas where the enhancement of bicycle or pedestrian mobility is a priority. Thirty BiPPAs have been designated in Montgomery County with five locations having undergone extensive evaluation. BiPPA improvements for the Silver Spring Central Business District (CBD) have been funded and are expected to begin construction in spring 2017.
2. Local Area Transportation Review Guidelines approved in 2013 as part of the 2012-2016 Subdivision Staging Policy require applicants to submit a pedestrian and bicycle impact statement to ensure safe and efficient pedestrian and bicycle access and circulation to and within the site. Also, new development applications are required to submit counts of pedestrian/bicycle crossing volumes in 15-minute intervals covering the typical weekday peak periods.
3. The Planning Department is currently preparing the Bicycle Master Plan for Montgomery County. The plan's approved framework relies on quantitative metrics to measure progress in meeting various objectives. Many of the metrics relate to the utilization of a digital countywide level of traffic stress bike network that allows for a sophisticated analysis of bicycle mobility and accessibility.
4. Several capital improvement projects currently underway support bicycle and pedestrian travel, including the following;
    a. Frederick Road sidewalk: Rehabilitation and design for one-half mile section of continuous sidewalk along both sides of Frederick Road (MD-355) between Hyattstown Mill Road and Montgomery/Frederick county line. Completion is slated for July 2018.
    b. Frederick Road Bike Path: Construction of a 10-foot-wide shared-use path along the west side of Frederick Road (MD-355) between Stringtown Road and Brink Road. Completion is anticipated in 2018.
    c. Needwood Road Bike Path: Construction of a shared-use path of approximately 1.7 miles in two phases along the south side of Needwood Road. Phase one, expected to be completed in early 2017, will provide an 8-foot-wide shared use path from the beginning of the nature trail, west of Lake Needwood to the Intercounty Connector (ICC) Trail. Phase two provides an 8-foot wide shared use path from Deer Lake Road to the beginning of the Nature Trail, and continues from the eastern ICC trail terminus to Muncaster Mill Road. This project provides a key off-road connection for east-west travel, connecting ICC trail users to recreational opportunities at Rock Creek Regional Park.

Pedestrian and Bicycle Counts

The LATR Guidelines distributed in 2013 as part of the 2012 SSP update require development applicants to conduct intersection traffic counts and include pedestrian and bicycle observations as part of their traffic impact studies. Transportation planners are also required to incorporate intersection counts from Maryland State Highway Administration's (SHA) Traffic Monitoring System.

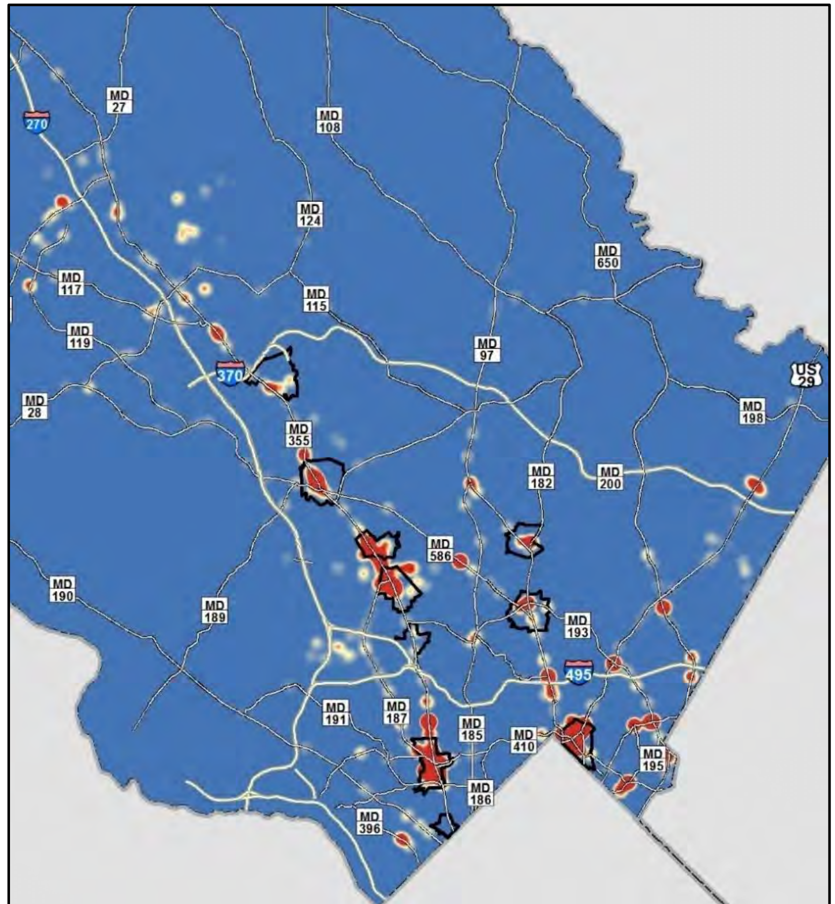
Since 2015, SHA has collected pedestrian and bicycle observations at intersections, although, the agency does not record detailed bicycle movements. For the purposes of this report, SHA's bicycle counts, although not incorporated into the Planning intersection Department's intersection database, are utilized to identify the total bicycle observations at intersections during the morning and evening hours.

Since 2013, the intersection count database has continued to grow with bicycle and pedestrian observations. As of the writing of this report, 374 distinct intersections are recorded as having at least one pedestrian observation during the latest traffic count. Seventy-nine intersections are recorded as having at least one bicycle observation during the latest traffic count (excluding SHA observations). Due to the inconsistent hours for which pedestrian and bike observations are recorded in the intersection database and SHA's Traffic Monitoring System, bike and pedestrian counts are only considered between 6:30 a.m. to 10 a.m. and 4 p.m. to 7 p.m.

Pedestrian Counts

Eleven of the top 20 intersections with the highest pedestrian use occur in the Bethesda CBD Policy Area. According to the 2012 Metorail Passenger Survey, 73 percent of riders accessed the Bethesda Metro by foot or bike. The largest number of pedestrians recorded in the Bethesda CBD occurred adjacent to the Bethesda Metro Station at Wisconsin Avenue (MD-355) at East-West Highway (MD-410)/Old Georgetown Road (MD-187) with 4,124 observations. This location is closely followed by MD-355 at Elm Street/Waverly Street and Wisconsin Avenue at Montgomery Lane/Montgomery Avenue. The greatest number of pedestrians observed in the database, however, occurred adjacent to the Silver Spring Metro Station at the intersection of Colesville Road at 2nd Ave/Wayne Ave where 6,097 pedestrians were recorded in the evening and morning hours. In total, four of the top 20 intersections with the highest pedestrian observations occurred within the Silver Spring CBD Policy Area (61 percent non-motorized Metro station access rate).

The largest number of observed pedestrians outside of the Silver Spring and Bethesda Metro Station Policy Areas occurred at the intersection of Rockville Pike and Marinelli Road, adjacent to the White Flint Metro



Rank	Intersection	Pedestrians	Date
1	Colesville Rd at 2nd Ave/Wayne Ave	6097	9/10/2014
2	Wisconsin Ave at East-West Hwy/Old Georgetown Rd	4124	5/10/2016
3	MD 355 at Elm St/Waverly St	3570	5/10/2016
4	Wisconsin Ave at Montgomery Ln/Montgomery Ave	3570	5/10/2016
5	Colesville Rd at Georgia Ave	3525	9/15/2015
6	Rockville Pike at Marinelli Rd	3147	4/16/2015
7	Old Georgetown Rd at Commerce Ln/Edgemoor Ln	3114	9/10/2015
8	East-West Hwy at Blair Park Plz/NOAA	2916	9/1/2015
9	Woodmont Ave at Hampden Ln	2859	5/10/2016
10	Old Georgetown Rd at Woodmont Ave	2650	9/10/2015
11	Woodmont Ave at Bethesda Ave	2592	5/10/2016
12	Woodmont Ave at Elm St	2506	5/10/2016
13	Rockville Pike at South Dr/Southwood Rd	2307	7/1/2014
14	Colesville Rd at Fenton St	1751	9/1/2015
15	East-West Hwy at Waverly	1679	5/10/2016
16	Hungerford Dr at Middle Ln/Park Rd	1622	9/17/2014
17	Wisconsin Ave at Cheltenham Dr	1495	9/17/2014
18	MD 355 at Halpine Rd	1287	9/30/2014
19	Georgia Ave at Forest Glen Rd	1284	10/20/2015
20	Arlington Rd at Elm St	1259	5/10/2016

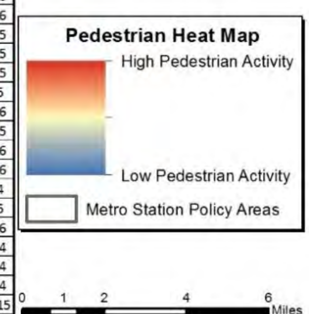


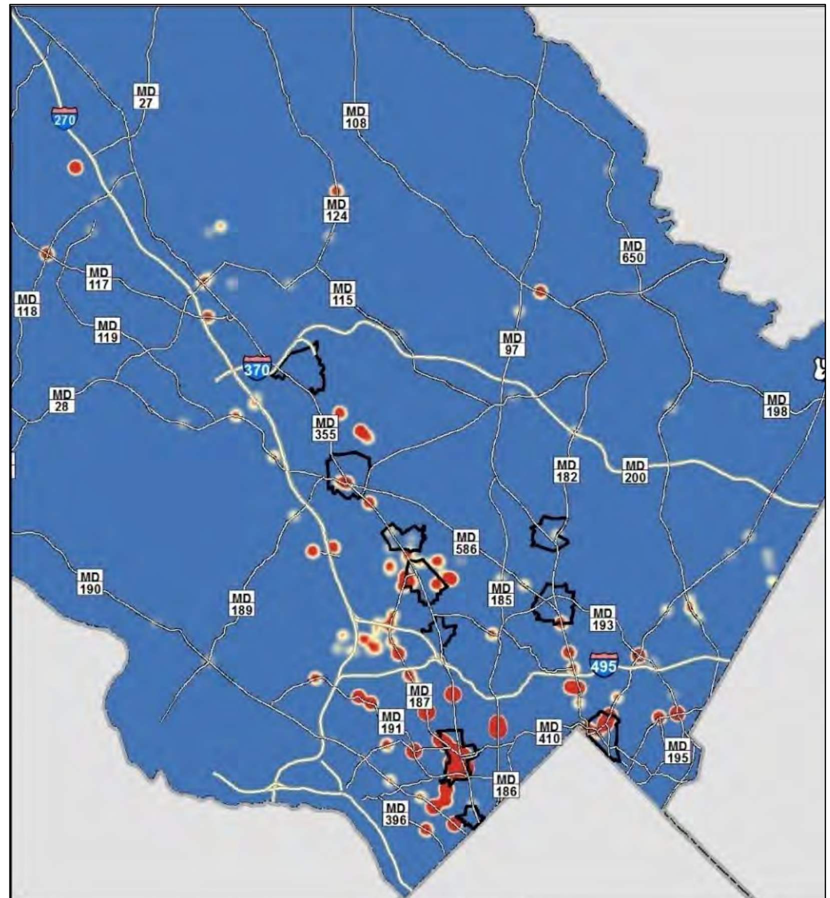
FIGURE 91: PEDESTRIAN HEAT MAP

Station (62 percent non-motorized access rate). All the other top pedestrian observations occurred at intersections adjacent to Metro stations, including Forest Glen (44 percent non-motorized access rate), Twinbrook (53 percent non-motorized access rate), Rockville (36 percent non-motorized access rate), and Medical Center (72 percent non-motorized access rate). According to the Washington Metropolitan Transit Authority (WMATA), walking is the leading mode of access to the Metrorail system. Approximately 37 percent of riders access a Metro station on foot during the a.m. peak period[16]; however, as discussed, all of the stations surpass noted above surpass the system's average. Other pedestrian hot spots include the area around Piney Branch Road and Flower Avenue/University Boulevard and Randolph Road at Veirs Mill Road.

Bicycle Counts

The highest concentration of bicycle activity in the intersection database occurs in the Bethesda CBD Policy Area. The highest amount of activity occurs near where the Capital Crescent Trail (CCT) transitions into the Georgetown Branch section at Woodmont Avenue and Bethesda Avenue. Three hundred and seventy-five bicyclists were observed during the morning and evening hours. This location is closely followed by Wisconsin Avenue at Leland Street with 355 observed bicyclists. Overall, 12 of the top 20 bicycle observations occurred in the Bethesda Metro Station Policy Area.

The third highest observation of bicyclists occurred outside of the Bethesda CBD, however, is also along the CCT at the intersection of Connecticut Avenue and Chevy Chase Lake Drive. Significant activity is observed along several other intersections with the CCT. Significant bike activity is also observed along Georgia Avenue from Silver Spring to



Rank	Intersection	Bicyclists	Date
1	Woodmont Ave at Bethesda Ave	375	5/10/2016
2	Wisconsin Ave at Leland St/Woodmont Ave	355	5/10/2016
3	Connecticut Ave at Chevy Chase Lake Dr	239	10/6/2015
4	Woodmont Ave at Elm St	178	5/10/2016
5	Old Georgetown Rd at South/Greentree	141	7/21/2015
6	Woodmont Ave at Hampden Ln	133	5/10/2016
7	MD 355 at Elm St/Waverly St	93	5/10/2016
8	Connecticut Ave at Manor Rd	85	10/7/2015
9	Wisconsin Ave at Montgomery Ln/Montgomery Ave	83	5/10/2016
10	Wisconsin Ave at East-West Hwy/Old Georgetown Rd	78	5/10/2016
11	Rockville Pike at W Cedar Ln	77	9/16/2015
12	Bradley Blvd at Wilson Ln	64	3/9/2016
13	Colesville Rd at Georgia Ave	54	9/15/2015
14	Old Georgetown Rd at Auburn St	53	9/10/2015
15	Wisconsin Ave at Bethesda/Willow	51	5/10/2016
16	Old Georgetown Rd at Commerce Ln/Edgemoor Ln	51	9/10/2015
17	University Blvd at Piney Branch Rd	47	10/7/2015
18	Old Georgetown Rd at Battery Ln	45	9/10/2015
19	Old Georgetown Rd at Woodmont Ave	44	9/10/2015
20	River Rd at Willard Ln/Greenway	42	10/28/2014

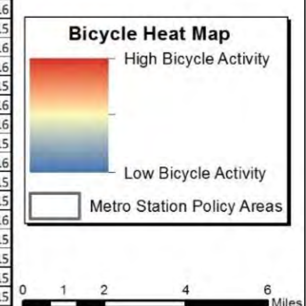


FIGURE 92: BICYCLE HEAT MAP

[16] WMATA. (2013, September 30). *PlanItMetro*. Retrieved from How Do Metrorail Riders Get to Their Station in the Morning?: https://planitmetro.com/2013/09/30/how-do-metrorail-riders-get-to-their-station-in-the-morning/

Wheaton and again along Old Georgetown Road from Bethesda to Rockville Pike (MD-355). There is very little activity along US-29, Connecticut Avenue, and East-West Highway, and New Hampshire Avenue outside of the Silver Spring and Bethesda central business districts.

Capital Bikeshare in Montgomery County

Capital Bikeshare opens cycling to the public in a way that is potentially lower cost and more easily accessible than bike ownership, making it attractive for people to choose it as a mode of transportation. Capital Bikeshare users can rent and return bicycles at any station in the system. In 2013, Montgomery County installed its first Capital Bikeshare stations in the Rockville and Shady Grove areas of the county. Today, the system within the county contains 57 stations and roughly 500 bicycles. This report analyzes trips that occurred in Montgomery County in 2014 and 2015.

A total of 121,027 trips utilized a bikeshare station in Montgomery County at the end and/or beginning of the journey during 2014 and 2015. System utilization in 2015 was greater than in 2014 during each of the four quarters (Figure 94). Many trips that occurred in 2014 and

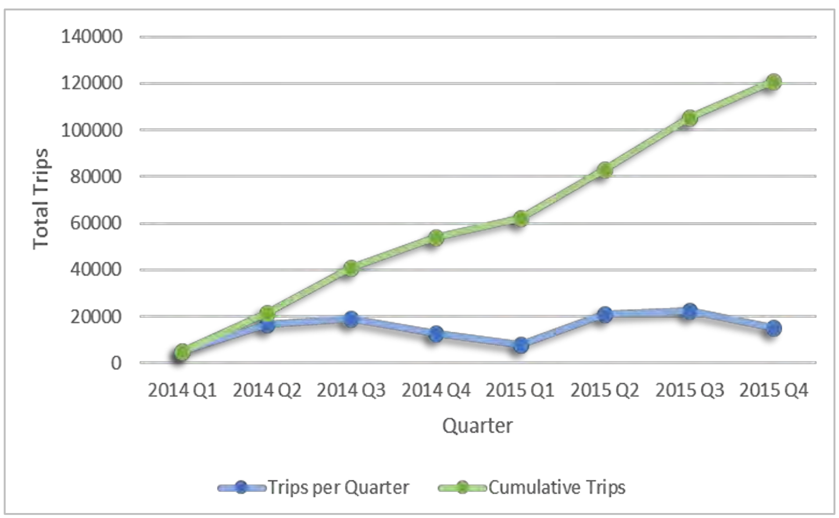


FIGURE 94: CAPITAL BIKESHARE QUARTERLY AND CUMULATIVE RIDERSHIP GROWTH

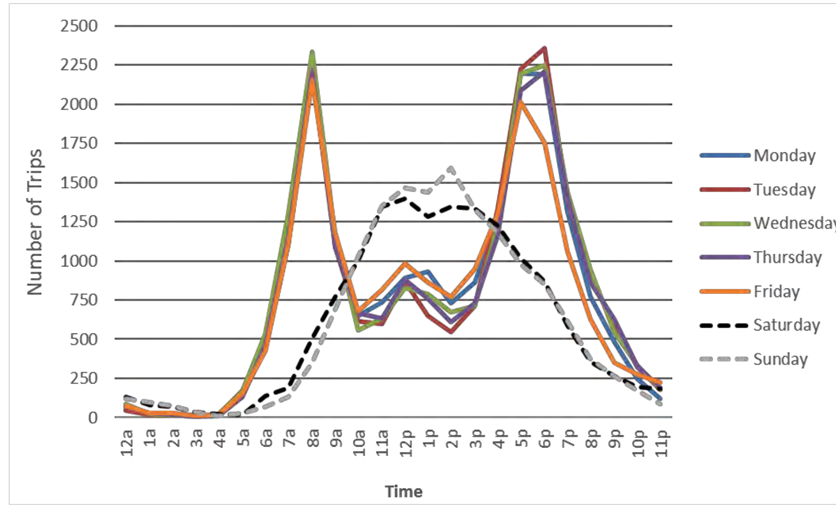


FIGURE 93: 2014 – 2015 CAPITAL BIKESHARE SYSTEM USAGE IN MONTGOMERY COUNTY

2015 began and ended in Bethesda's CBD (17.9 percent) or Silver Springs's CBD (12.5 percent). Just over 14 percent of trips occurred between Washington, DC and Silver Spring/Takoma Park. Overall, just over 56 percent of trips that occurred in 2014 and 2015 both started and ended in Montgomery County. Approximately 43 percent of trips either started or ended in Washington, DC.

A temporal analysis of all the trips that occurred in 2014 and 2015 indicates a usage pattern similar to private automobiles (Figure 93) indicating that trips during the work week are utilitarian. Capital Bikeshare usage during the work week is dichotomous with a sharp and quick morning peak and a slightly broader evening peak. Utilization during the weekend begins to build during the morning hours before leveling off and reaching its peak between the hours of 11 a.m. and 3 p.m.

For clarity, station utilization analysis was visualized by the top four performing stations in the CBDs and jurisdictions that saw the most usage: Takoma, Bethesda, Friendship Heights, Silver Spring. Bikeshare stations in the Rockville and Shady Grove areas saw significantly lower ridership, with the Shady Grove Metro station (3,843 trips) as the highest ridership station in either of these areas from 2014 through 2015.

With 21,668 trips ending or beginning in Montgomery County from 2014 through 2015, the Takoma bikeshare station had more travel volume than any other station analyzed, and nearly twice as much volume as the next closest station. While this station is geographically located in DC, it has been included in this analysis due to the high volume of trip flows to Montgomery County. The most frequent trips over the two-year span in Montgomery County were between the Takoma Metro Station and Carroll Avenue / Ethan Allen Avenue (6,071 trips), followed by Takoma Metro Station and Fenton Street / New York Avenue (5,122 trips). This activity is a strong indicator of bikeshare users augmenting their transit trips into Takoma Park and Montgomery College with the last mile connection.

The Bethesda Metro bikeshare station saw 11,456 trips from 2014 through 2015. Top destinations from this station are primarily within the Bethesda CBD as last mile connections, as well as to the Friendship Heights CBD. There is also a significant portion of trips to 34th and Water Street, NW, in the Georgetown neighborhood in Washington, DC, suggesting bikeshare usage along the Capital Crescent Trail. The Friendship Heights Metro bikeshare station tells a similar story to bikeshare at the Bethesda Metro station, but across a wider distribution of destinations. This station saw 11,667 trips over the measured period, and was the second most utilized station in Montgomery County. Last mile usage patterns arise again, with high volumes of trips to stations in the immediate surrounding area. Trip flows to and from Washington, DC comprised most of the usage (9,235 trips), including destinations in Upper Northwest DC west of Rock Creek, the Capital Crescent Trail in Georgetown, and even as far east as Silver Spring.

At 10,378 trips, the Fenton Street and Ellsworth Drive bikeshare station was the busiest within the Silver Spring CBD. The connection between this station and Fenton Street / New York Avenue at Montgomery College was the 9th most used route (1,628 trips), suggesting a key connection for members of the college community as well as users of the Metropolitan Branch Trail. Destination pairs for this station are widely distributed in each direction, including last mile connections within the Silver Spring CBD, Takoma Park, and Northwest DC east of Rock Creek.

On the following page is a table that displays the top 20 stations that produce and attract trips in Montgomery County. All of the top 20 utilized stations occur within one mile of a metro station or major trail. These locations continue to validate Capital Bikeshare's important role as a last-mile transportation source. Finally, the top station origin/destination flows illustrated on the next page further reveal the last mile phenomenon and the role of the Capital Crescent Trail (CCT) in providing a non-motorized connection between Washington, DC and Montgomery County.

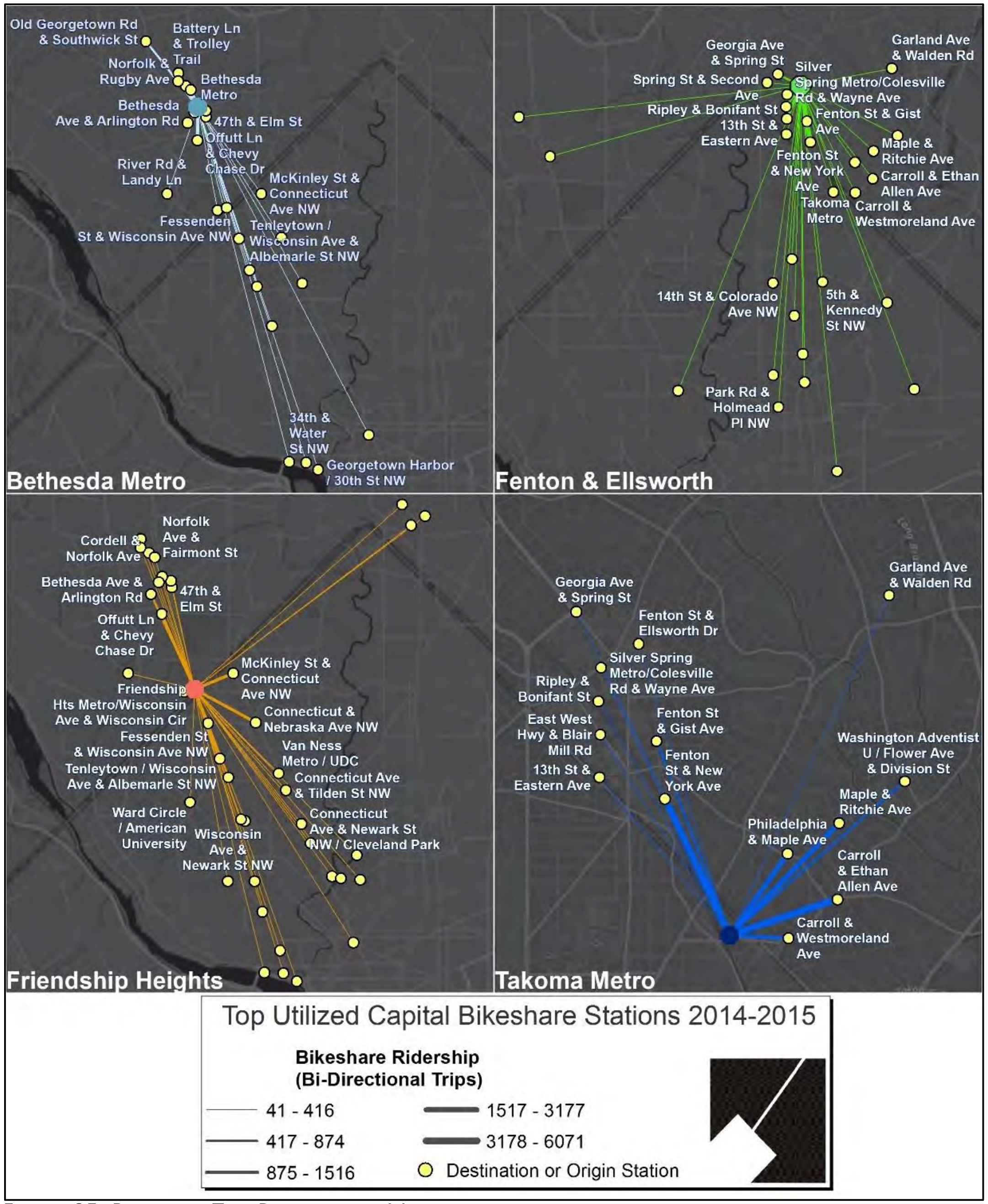


FIGURE 95: BIKESHARE TRIP DISTRIBUTION MAP

TABLE 18: TOP UTILIZED BIKESHARE STATIONS IN MONTGOMERY COUNTY (STATIONS IN BOLD ARE REVIEWED IN FIGURE 95)

Station	Origins	Destinations	Total	Percent of total trips
Takoma Metro	11182	10486	21668	17.9%
Friendship Heights Metro/Wisconsin Ave & Wisconsin Cir	6005	5672	11677	9.6%
Fenton St & New York Ave	6536	5012	11548	9.5%
Bethesda Metro	6902	4554	11456	9.5%
Bethesda Ave & Arlington Rd	4823	5584	10407	8.6%
Fenton St & Ellsworth Dr	4936	5442	10378	8.6%
Carroll & Ethan Allen Ave	4863	4478	9341	7.7%
River Rd & Landy Ln	3607	3571	7178	5.9%
Cordell & Norfolk Ave	3356	3550	6906	5.7%
Montgomery Ave & Waverly St	3636	2620	6256	5.2%
Carroll & Westmoreland Ave	3621	2511	6132	5.1%
Battery Ln & Trolley Trail	2952	2716	5668	4.7%
Montgomery & East Ln	2965	2199	5164	4.3%
Offutt Ln & Chevy Chase Dr	2646	2488	5134	4.2%
Norfolk Ave & Fairmont St	2621	2288	4909	4.1%
East West Hwy & Blair Mill Rd	2888	1923	4811	4.0%
Silver Spring Metro/Colesville Rd & Wayne Ave	2197	2067	4264	3.5%
Fenton St & Gist Ave	2415	1762	4177	3.5%
47th & Elm St	2193	1922	4115	3.4%
Friendship Blvd & Willard Ave	2135	1911	4046	3.3%

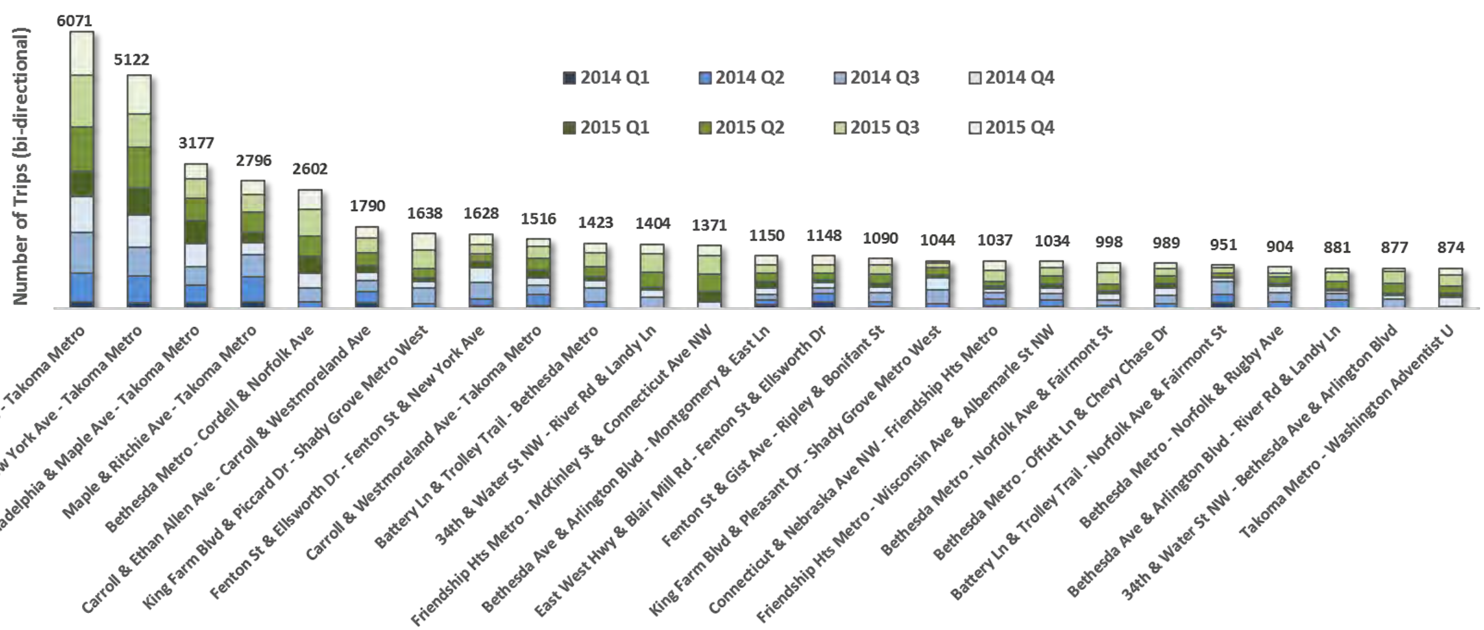


FIGURE 96: TOP BIKESHARE STATION FLOWS

Bike Accessibility Analysis

Transportation planners at the Montgomery County Planning Department have developed a digital bicycle level of traffic stress (LTS) network for use in geographic information systems (GIS). Based on several attributes, including posted speed limit, number of traffic lanes, and presence of bicycle facilities, a LTS value is assigned to each network segment in the database.

Levels of traffic stress range from none (everyone will bicycle) to very high (very few adults will bicycle). Most adults will only bike on roadway segments up to a low level of traffic stress. Although approximately 70 percent of the roadway network in Montgomery County provides an environment of low or very low levels of traffic stress for bicyclists, much of the network comprises neighborhood streets creating isolated pockets of bikeable segments. Many of these pockets do not provide connectivity to jobs, shopping, or other important destinations such as schools and parks.

Using a grid of points equally spaced one-half mile by one-half mile across the entire county and a retail/community organization subset of the countywide property data, transportation planners leveraged the LTS bike network to develop two continuous accessibility surfaces. For each grid point, the amount of building square footage within three bike network miles was found and a distance decay function was applied to calculate an accessibility metric.

Then, an interpolation technique was applied to create a continuous accessibility surface over the entire county. This step was done using all levels of traffic stress (excluding interstates) and low levels of traffic stress. The two surfaces were then compared to calculate the percentage lost in accessibility for the county.

The highest levels of non-work accessibility occur predominantly in Wheaton, White Flint, Twinbrook, and Bethesda. However, once the network is limited to only segments with a low LTS, accessibility decreases precipitously. The Germantown East Policy Area experiences the least amount of accessibility loss with a decrease of 74 percent. This relatively limited decrease is primarily due to the side paths along Ridge Road (MD-27) and Frederick Road (MD-355) where many of the businesses are situated. The more urban CBDs, however, see a decrease of 90 percent or more in non-work accessibility. This exercise can be improved in the future to measure various bike improvements' impacts. Various scenario tests can help prioritize improvements.

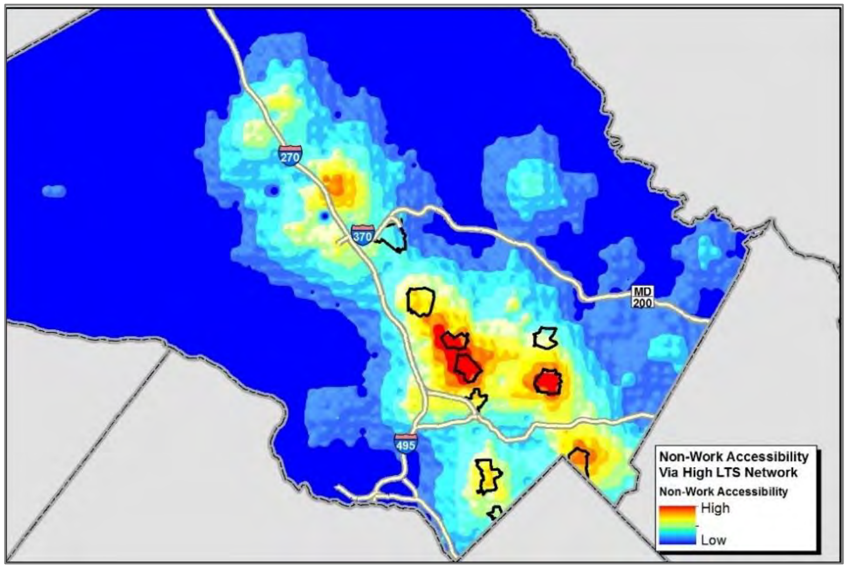


FIGURE 97: ALL LEVELS OF TRAFFIC STRESS BICYCLE ACCESSIBILITY

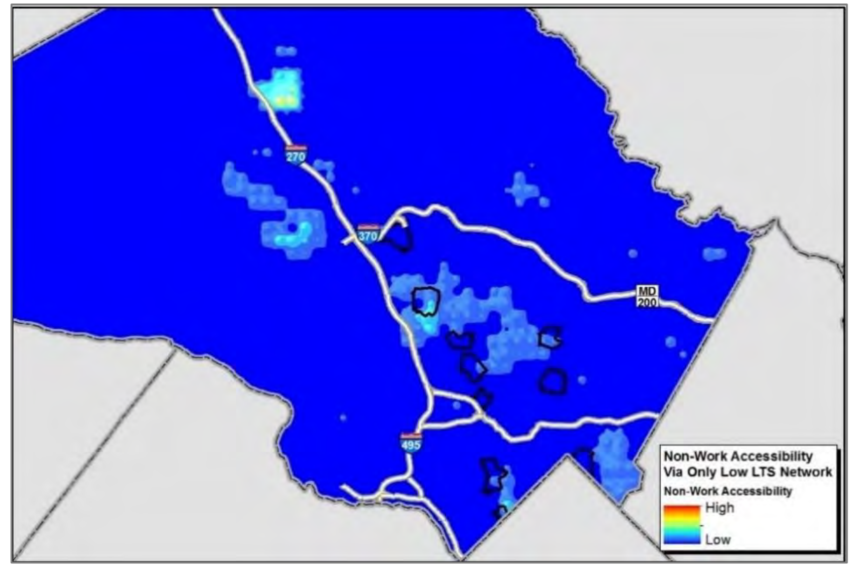


FIGURE 98: LOW LEVEL OF TRAFFIC STRESS BICYCLE ACCESSIBILITY

Public Transportation

This section examines the third pillar of a diverse and efficient transportation system, public transportation. Montgomery County is home to a robust public transportation system, comprising of Metrorail and bus, the county's Ride-On bus system, and Maryland Transit Administration's MARC commuter train services. The Ride-On system alone provides more than 80 local routes that augment the regional system provided by Metro. In 2015, the American Public Transportation Association ranked the Washington, DC metropolitan area as the fourth largest transit system in the country in terms of unlinked passenger trips, and fifth largest in terms of total passenger miles[17].

Public transportation in Montgomery County provides an alternative to the private automobile for thousands of residents each year. According to the 2011 – 2015 American Community Survey 5-year estimate, 15.8 percent of residents take public transportation for a majority of their daily work commute. Areas in Silver Spring, Grosvenor, and Friendship Heights witness more than 40 percent of residents commuting by public transportation (Figure 99). Future and ongoing investments in bus rapid transit (BRT) and the Purple Line light rail will further augment existing services and provide new opportunities for citizens to travel via transit.

This section primarily analyzes ridership data from WMATA and Ride-On for fiscal years 2010 – 2015. At this time, data from MTA's MARC commuter train system is not included. Although there have been recent declines in transit ridership both within the region and nationwide, the data suggests that the decline is not as pronounced in Montgomery County, largely due to the continued growth of Metro Bus for routes that serve the county[18]. According to the WMATA Office of Planning, Montgomery County residents make up approximately 16 percent of the total system ridership (bus and rail). The percentage of riders from Montgomery County will likely rise as development continues to occur within Metro Station Policy areas.

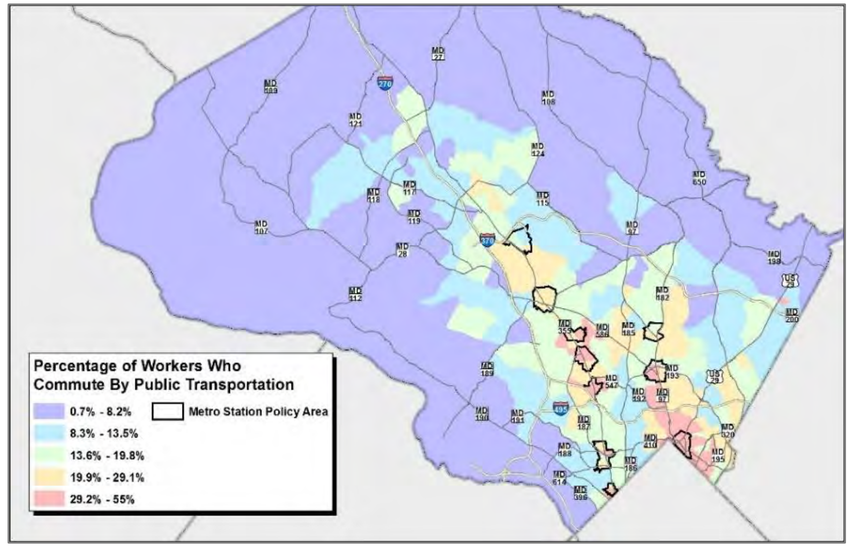


FIGURE 99: PERCENTAGE OF WORKERS WHO COMMUTE BY PUBLIC TRANSPORTATION

Bus Service

Coverage of Metro Bus and Ride-On

A component of the Transportation Policy Area Review (TPAR) transit adequacy test in the 2012-2016 Subdivision Staging Policy is coverage of bus service. Per the *2012 Transportation Policy Area Review: A Synopsis of the Area-wide Transportation Test*[19], coverage indicates how close service is to potential users and is defined as the amount of area within 1/3 of a mile of a bus stop (in addition to the area within one mile of a rail station).

[17] American Public Transportation Association. (2016, December 6). Public Transportation Fact Book. Retrieved from 2015 Public Transportation Fact Book: http://www.apta.com/resources/statistics/Documents/FactBook/2015-APTA-Fact-Book.pdf

[18] The Metro Bus routes examined as part of this report are the C2, C4, C8, F4, F6, K6, K9, Z2, Z6, Z8, Z9, Z29, Z11, J1, J2, J3, J4, J5, J7, J9, L8, Q1, Q2, Q3, Q4, A5, Q6, T2, Y2, Y7, and Y8

[19] M-NCPPC. (2012, April). 2012 Transportation Policy Area Review: A Synopsis of the Area-wide Transportation Test. Retrieved from http://montgomeryplanning.org/document-

For this analysis, 1/3 network mile service areas around Ride-On and Metro Bus stations were created[20]. Network service areas are different and superior to traditional Euclidean distance buffers because the extents are based on the surrounding transportation network (see Appendix D). Interstates were excluded from the network prior to conducting the analysis.

Once the network service areas around bus stops were complete, the number of bus trips per hour reachable within each service area (from all stops) during the evening peak period (4 to 7 p.m.) was summarized (Figure 100). The highest frequency of bus service during the evening peak period is adjacent to the Paul Sarbanes Transit Center in Silver Spring. Trip frequency around the transit center can reach upwards of 225 bus trips per hour.

Other areas of concentrated bus frequency exist within most Metro Station Policy Areas, particularly in Friendship Heights, Wheaton, Shady Grove, and Rockville where bus frequencies reach more than 70 trips per hour. Bus frequencies around the new Takoma-Langley Crossroads Transit Center also reach upwards of more than 70 trips per hour. The Veirs Mill Corridor often sees a frequency of 35 trips per hour.

The bus service coverage areas are summarized by census blocks and policy areas as defined by the Transit Capacity and Quality of Service Manual, 3rd Edition (Table 19). Even with this modified and more stringent coverage methodology (network buffer rather than straight-line buffer), several urban areas reach the 80 percent coverage adequacy standard as defined in the 2012 SSP. These areas include Bethesda CBD, Rockville Town Center, Silver Spring CBD, Silver Spring/Takoma Park and Wheaton CBD. Policy areas that meet the 70 percent coverage adequacy standard for "suburban" areas include Friendship Heights, Germantown Center, Grosvenor, and Twinbrook.

[20] This is different than the intent and standards specified in the 2013 LATR/TPAR Guidelines. In the Guidelines, coverage is defined as "the percentage of the "transit-supportive area" of a policy area that is within ¼-mile of a bus stop or ½-mile of a transit station.

This methodology can be applied to track changes in bus coverage and headway in subsequent MARs.

The amount of bus coverage is also determined for census tracts with 10 percent or more of households having no access to a vehicle. According to the analysis, 37 percent of the total census tract area examined has less than five minute headways during the evening commute. Overall, 64 percent of the area with a presumably high incidence of transit dependency has some type of bus service coverage. The results of this analysis indicate that the combination of Ride-On and Metro Bus services offer significant coverage with frequent bus service.

This analysis, however, does not consider the headways of individual routes, specific destinations, or the spacing of the arrival and departure of buses. Bus frequency is calculated for all routes that are reachable within 1/3 mile from a bus stop. Therefore, if all 13 of the scheduled buses arrive at a stop within the first 5 minutes of the hour, this would be calculated as having less than a 5-minute headway for all areas within 1/3 of a network mile from the stop. This example, although extreme, illustrates that the spacing of arrival and departures are an important aspect of measuring transit level of service from the passenger perspective.

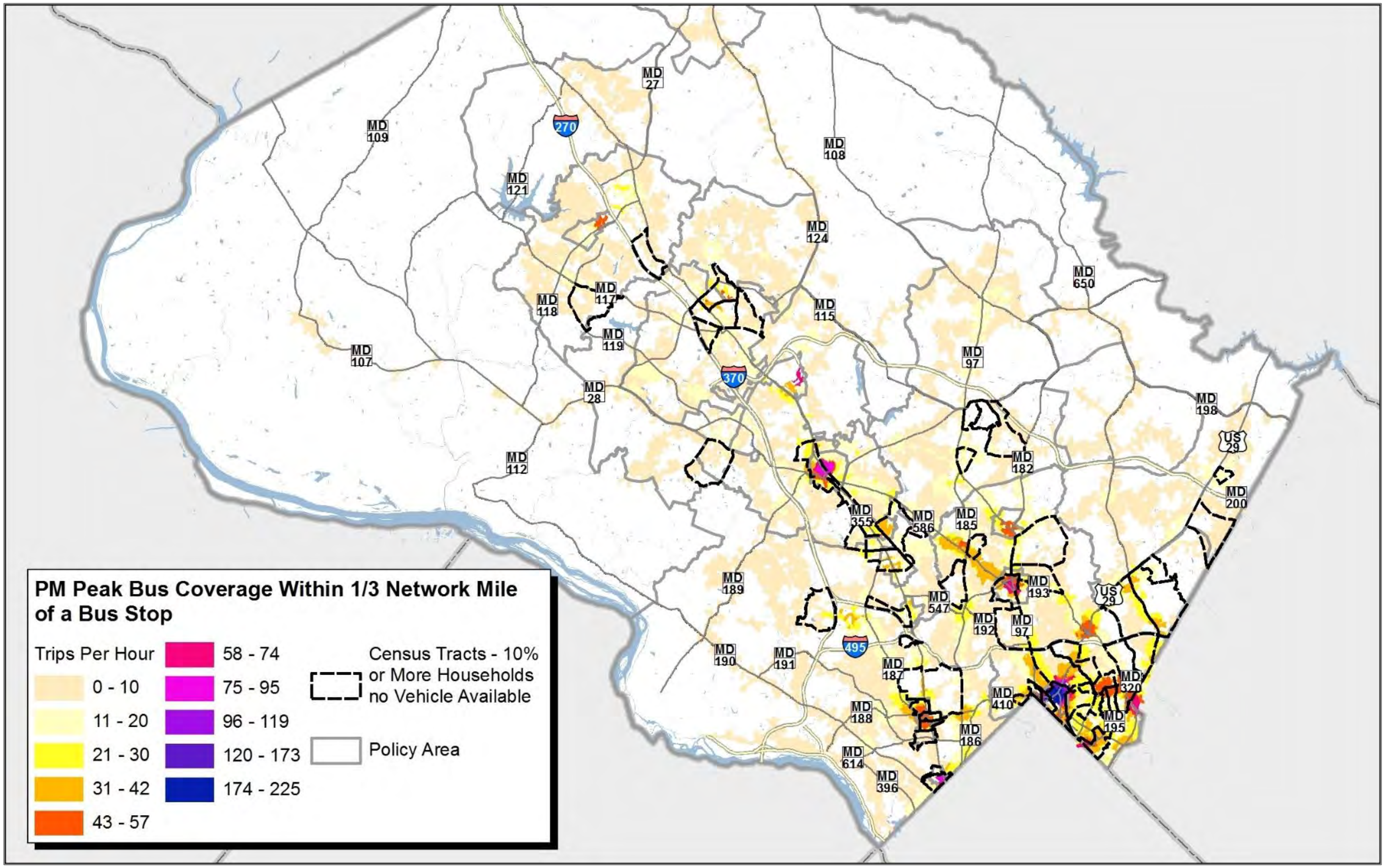


FIGURE 100: PEAK P.M. BUS COVERAGE WITHIN 1/3 NETWORK MILE OF A BUS STOP

TABLE 19: BUS HEADWAY COVERAGE SUMMARIZED BY POLICY

	Percentage of Area With Average Headway							
	≤5 Min:	>5-10 Min:	11-15 Min	16 - 30 Min	31-59 Min	60 Min	>60 Min	Total
Aspen Hill	12.3%	16.0%	12.4%	3.9%	0.6%	0.3%	0.0%	45.5%
Bethesda CBD	70.6%	14.0%	5.7%	7.2%	1.6%	0.0%	0.0%	99.1%
Bethesda/Chevy Chase	14.9%	18.4%	18.5%	4.1%	1.1%	0.4%	0.1%	57.4%
Clarksburg	0.0%	0.6%	6.6%	6.3%	2.8%	0.0%	0.1%	16.4%
Cloverly	0.0%	1.2%	2.0%	16.4%	2.1%	0.0%	0.0%	21.7%
Damascus	0.0%	0.0%	2.0%	13.3%	0.0%	0.0%	1.4%	16.6%
Derwood	9.1%	20.2%	4.0%	1.4%	1.1%	0.1%	0.0%	35.8%
Fairland/Colesville	5.3%	15.9%	11.7%	9.9%	1.0%	0.0%	0.3%	44.0%
Friendship Heights	57.5%	15.2%	0.0%	1.5%	0.0%	0.0%	0.0%	74.1%
Gaithersburg City	11.7%	22.1%	15.3%	1.8%	0.7%	0.0%	0.1%	51.8%
Germantown East	5.7%	17.3%	9.1%	13.6%	0.0%	0.0%	0.1%	45.8%
Germantown Town Center	45.3%	15.7%	15.8%	0.0%	0.0%	0.0%	0.0%	76.9%
Germantown West	2.7%	20.0%	18.6%	9.7%	0.1%	0.0%	0.2%	51.3%
Glenmont	63.7%	8.5%	0.0%	0.0%	0.0%	0.0%	0.0%	72.2%
Grosvenor	60.7%	12.1%	4.8%	0.0%	0.0%	0.0%	1.3%	79.0%
Kensington/Wheaton	29.5%	18.2%	10.9%	3.6%	4.1%	0.0%	0.0%	66.2%
Montgomery Village/Airpark	5.7%	13.2%	27.2%	5.6%	2.6%	0.0%	0.1%	54.4%
North Bethesda	22.8%	16.7%	9.5%	4.8%	0.0%	0.0%	0.0%	53.8%
North Potomac	0.0%	3.7%	5.4%	9.2%	5.3%	0.0%	0.2%	23.8%
Olney	2.5%	6.2%	4.1%	12.8%	4.2%	0.0%	0.5%	30.4%
Potomac	0.2%	9.4%	5.7%	5.9%	0.0%	0.0%	0.4%	21.6%
R & D Village	10.0%	24.1%	10.4%	3.1%	2.8%	0.0%	0.1%	50.5%
Rockville City	20.2%	21.0%	13.9%	4.4%	0.0%	0.1%	0.7%	60.4%
Rockville Town Center	77.6%	14.1%	3.6%	1.6%	0.0%	0.0%	0.0%	96.9%
Rural East	0.1%	0.1%	1.1%	1.3%	0.6%	0.0%	0.1%	3.2%
Rural West	0.0%	0.0%	0.7%	0.3%	0.0%	0.0%	0.1%	1.2%
Shady Grove Metro Station	28.7%	12.8%	0.1%	0.0%	0.0%	0.0%	0.0%	41.6%
Silver Spring CBD	92.9%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	93.4%
Silver Spring/Takoma Park	61.1%	8.3%	6.5%	3.5%	0.5%	2.5%	0.2%	82.5%

	Percentage of Area With Average Headway							
	≤5 Min:	>5-10 Min:	11-15 Min	16 - 30 Min	31-59 Min	60 Min	>60 Min	Total
Twinbrook	71.0%	2.8%	1.3%	4.6%	0.0%	0.0%	0.0%	79.7%
Wheaton CBD	74.3%	8.0%	1.1%	0.8%	1.2%	0.0%	0.3%	85.7%
White Flint	41.9%	16.0%	0.5%	5.8%	0.0%	0.0%	0.2%	64.5%
White Oak	23.1%	5.1%	8.6%	1.7%	0.0%	0.0%	0.0%	38.5%
Census Blocks	37.1%	14.6%	5.6%	3.9%	1.4%	.86%	.19%	64.0%

Ridership

Both Ride-On and Metro Bus have seen services cut, expanded, and modified over the past five years. Ride-On reduction of service over the past five years include the elimination of all or portions of the 94, 42, 98, and 83 routes. Since 2010, ridership on Ride-On has decreased 6.9 percent. Metro Bus, however, has seen an increase in yearly ridership of almost 11 percent. In total, bus ridership reached its peak in FY 2014, but saw a slight dip of two percent between FY 2014 and FY 2015[21].

Ride-On

In FY 2015, Ride-On averaged 82,586 weekday boardings on its fixed-route services. This number is a decrease of approximately six percent from the 87,975 weekday boardings in FY 2013. The three most popular routes in terms of weekday ridership continues to be the 55 (7,748 weekday riders), 59 (3,682 weekday riders), and the 46 (3381 weekday riders). These routes combine to serve the vicinity of the MD-355 corridor from Germantown to Medical Center Metro Station.

This report also examines changes in ridership for individual routes. Routes that saw a weekday ridership decline of 20 percent or greater are identified (Figure 102). Many of the routes are located within the Beltway including the 19 (-20.3 percent), 1 (-22.4 percent), 3 (-38.6 percent), and 24 (-23.6 percent). Several routes serving the Shady Grove Metro center have also seen significant decreases in ridership including the 78 (-39.8 percent), 60 (-21 percent), and 58 (23.7 percent).

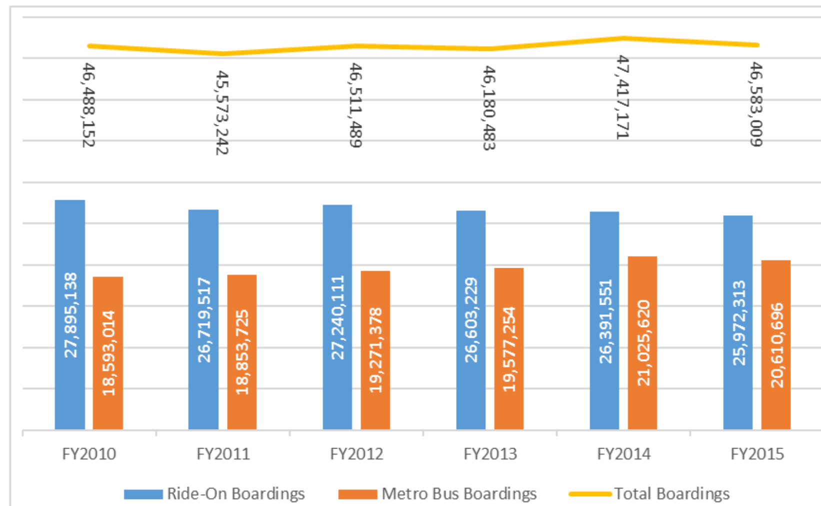


FIGURE 101: MONTGOMERY COUNTY FY 2010 - FY 2015 BUS RIDERSHIP

[21] Due to a gap in data collection, Figure 101 does not reflect Metro Bus weekend ridership for April, May, and June of 2013

.

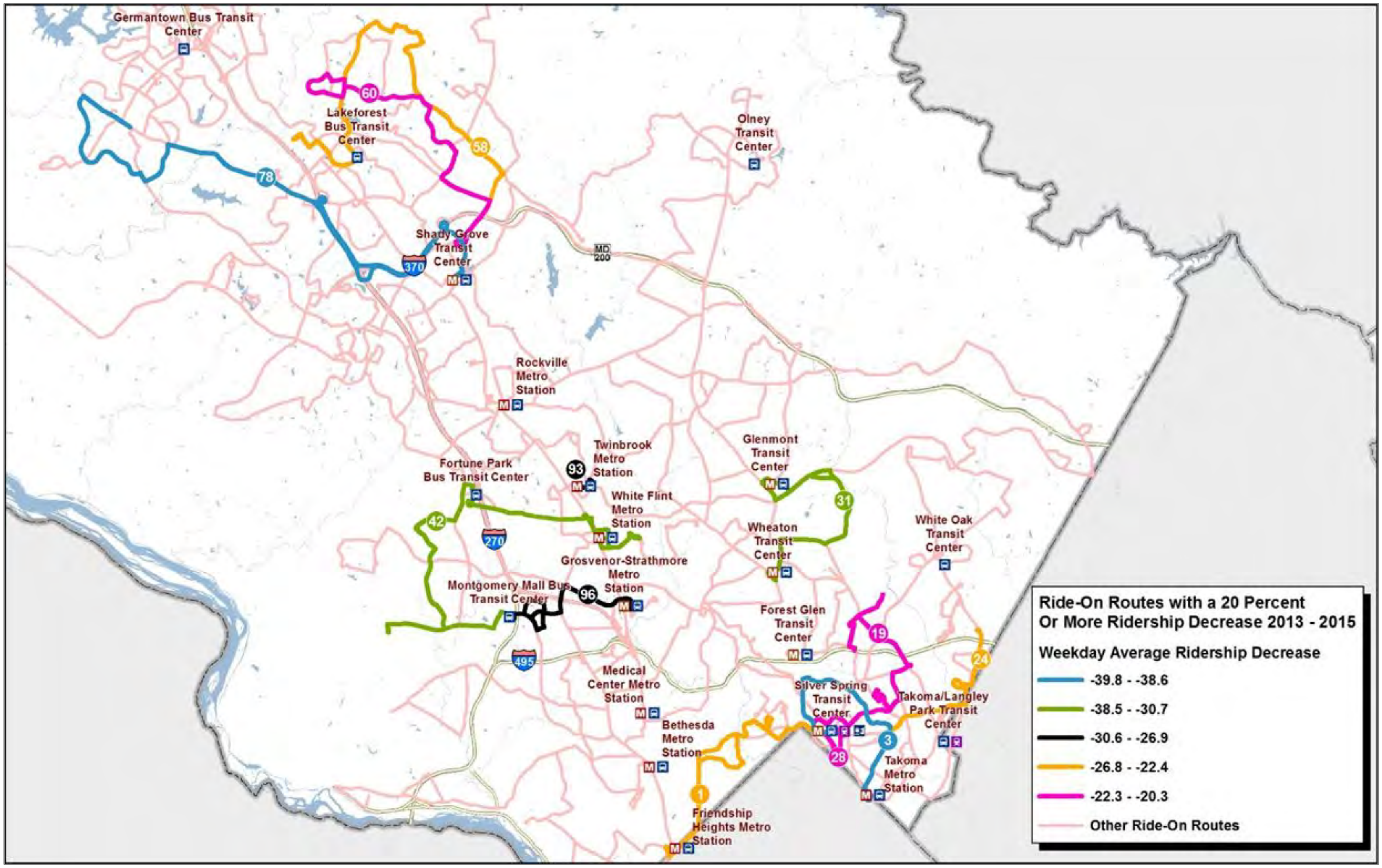


FIGURE 102: RIDE-ON ROUTES WITH A 20 PERCENT OR MORE RIDERSHIP DECREASE FY 2013 - FY 2015

Routes that saw an increase of weekday ridership of at least 10 percent were also identified (Figure 103). A majority of the routes that saw a significant increase in ridership serve areas outside the Capital Beltway. Clarksburg and Olney saw significant gains, as well as eastern and western portions of the county. Routes serving upper parts of the county with increased ridership are the 94 (816.7 percent), 79 (64.9 percent), 71 (11.7 percent), and 52 (10.5 percent). Route 94's service began approximately halfway through FY 2013 resulting in the extremely large increase in ridership. Routes that serve eastern portions of the county that saw large increases in ridership are the 39 (46.5 percent), 21 (19.3 percent), and 7 (26 percent increase). Routes serving the western section of the county are the 36 (41.2 percent) and 32 (11.9 percent). The only route serving areas primarily within the Capital Beltway that saw an increase in ridership is 25 (10.2 percent). This rise may indicate that citizens in more rural sections of the county are beginning to rely on transit more for their commuting purposes.

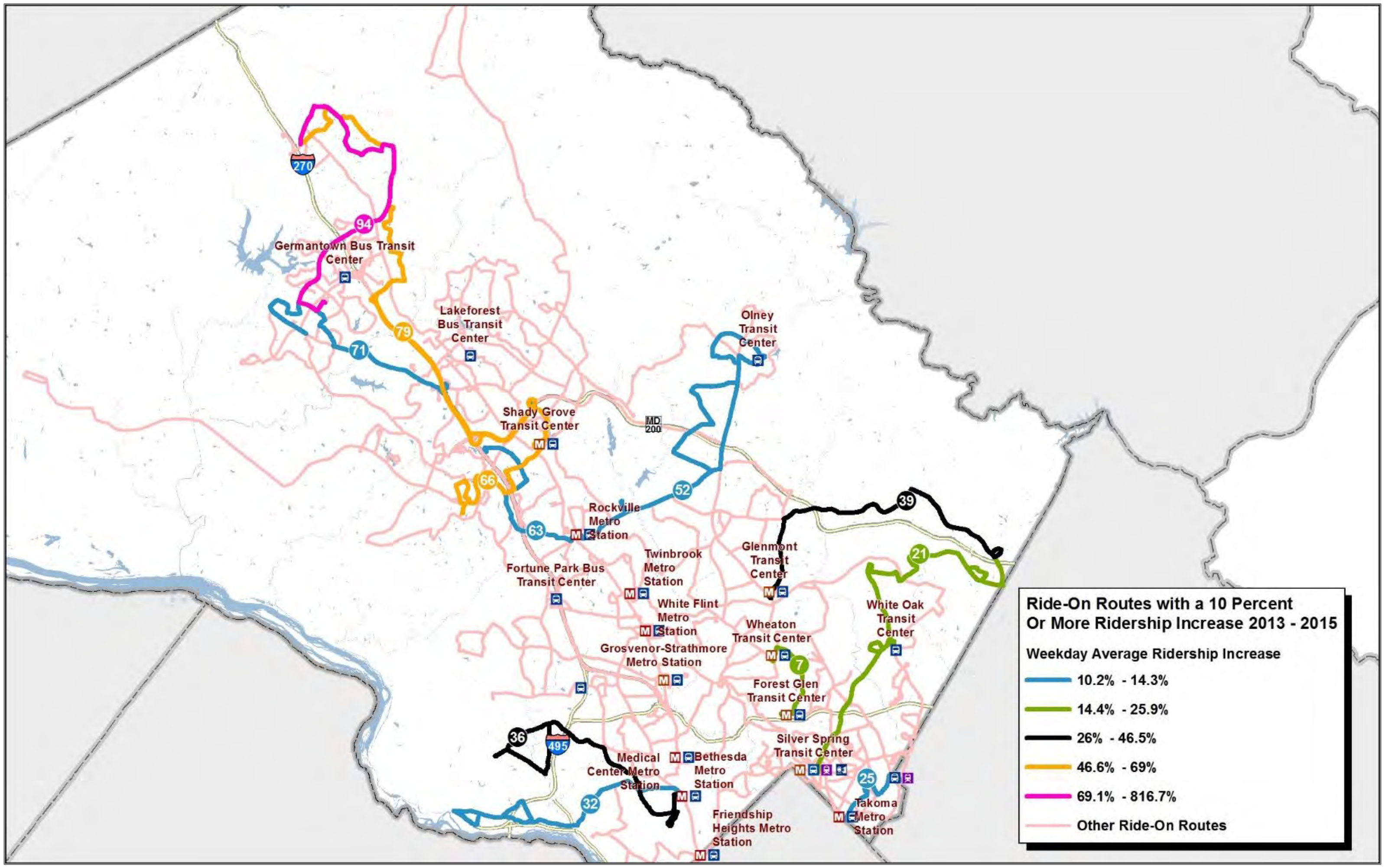


FIGURE 103: RIDE-ON ROUTES WITH A 10 PERCENT OR MORE RIDERSHIP INCREASE FY 2013 - FY 2015

Metro Bus

In FY 2015, Metro Bus averaged 67,293 weekday riders on its fixed-route services in Montgomery County. This number is an increase of approximately .5 percent from the 66,953 weekday riders in FY 2013. It is, however, a 10.5 percent increase over FY 2010 weekday patrons. The three most popular routes in terms of weekday ridership continue to be the C2 and C4 (11,194 weekday riders) connecting Greenbelt with Twinbrook, Q routes (8,529 weekday riders) servicing the Veirs Mill corridor, and the Y routes (8,376 weekday riders) servicing Georgia Avenue.

Individual routes that saw weekday ridership loses of 5 percent or more are the Z11 and Z13 (-26.4 percent), Z2 (-10.7 percent), L8 (-5.9 percent), and the J7 and J9 (116.4 percent). The reduction in ridership along the Z11/Z13 routes is likely affected by the modification of the Z11 schedule and elimination of the Z11 route during the fourth quarter of FY 2015.

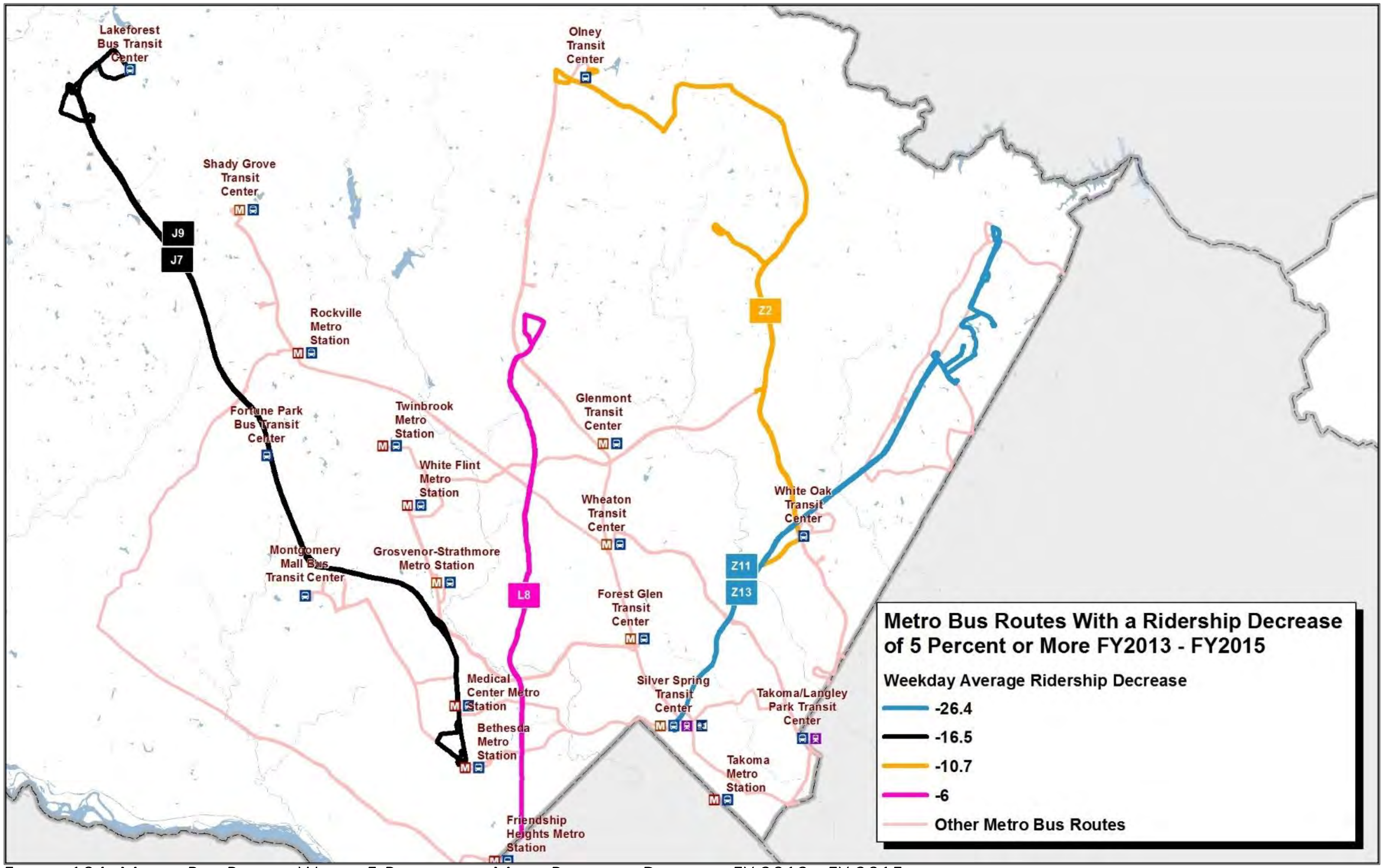


FIGURE 104: METRO BUS ROUTES WITH A 5 PERCENT OR MORE RIDERSHIP DECREASE FY 2013 - FY 2015

Several Metro Bus routes saw increases in ridership between FY 2013 and FY 2015. Three of the routes terminate/originate at the Silver Springs Transit Center. These are the J5 (26.1 percent), the Y routes (9.5 percent), and Z9/Z29 (6.1 percent). The J4, which follows a very similar route as the proposed Purple Line, saw an increase in ridership of 6.5 percent. The K9, an express bus servicing New Hampshire Avenue, was launched at the beginning of the third quarter of FY 13, causing its ridership to increase by almost 250 percent.

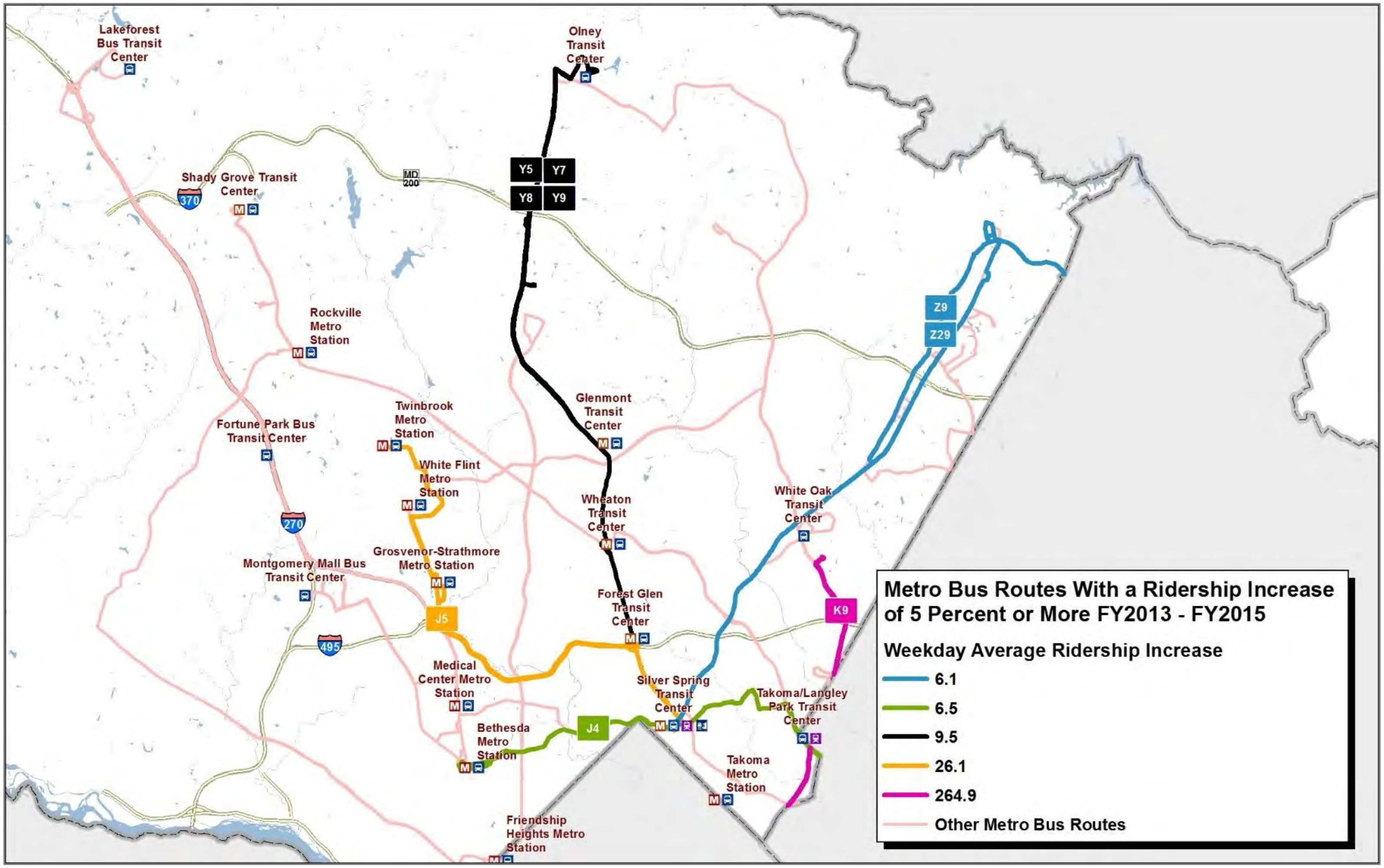


FIGURE 105: METRO BUS ROUTES WITH A 5 PERCENT OR MORE RIDERSHIP INCREASE FY 2013 - FY 2015

Metrorail

According to WMATA, 82 percent of Metrorail trips by Montgomery County residents utilize the system to access Washington D.C. Metrorail is utilized by residents across the county including in rural areas. Between FY 2010 and FY 2015, average weekday boardings and exits at Metro stations in Montgomery County decreased three percent. Average weekend boardings and exits decreased at a higher rate of 11.5 percent. The only period that saw a growth in weekend and weekday ridership was between FY 2013 and FY 2014. Weekend ridership has particularly been hard hit, reaching its lowest point over the past 5 years during FY 2013. Over the past five years, weekday ridership peaked in FY 2012. Weekend ridership was at its highest in FY 2010.

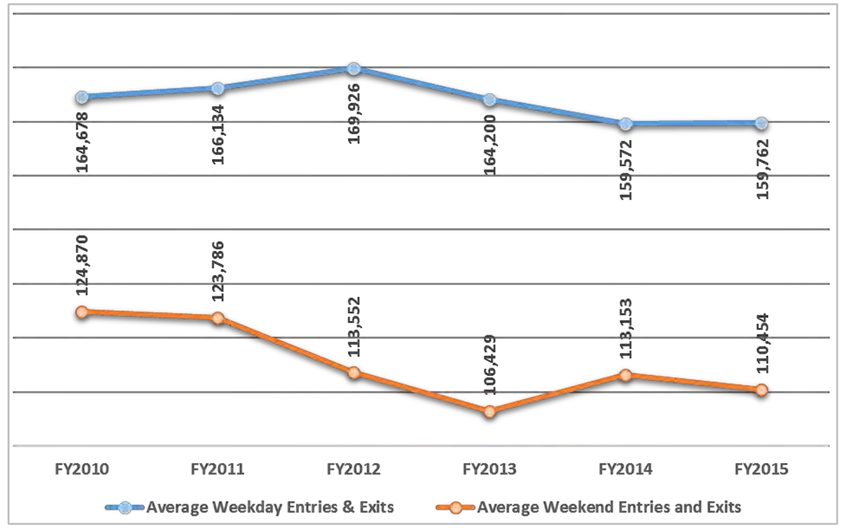
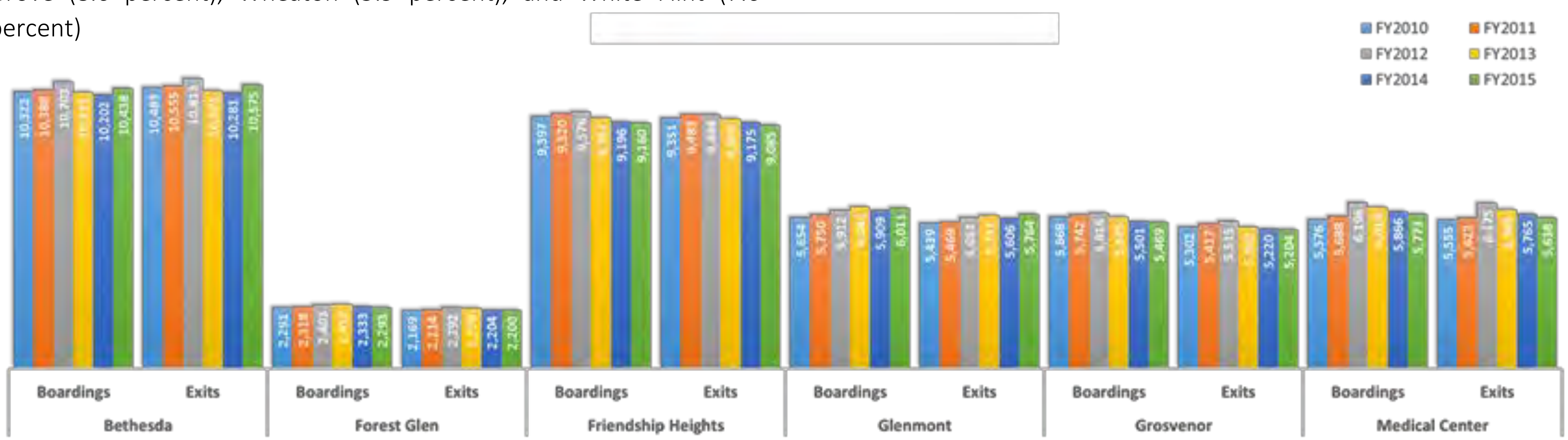


FIGURE 106: AVERAGE DAILY BOARDINGS AND EXITS AT METRO STATIONS IN MONTGOMERY COUNTY

The reductions in ridership, however, have not been uniform across the system in Montgomery County. Stations that saw an increase in weekday boardings between FY 2010 and FY2015 include Bethesda, Forest Glen, Glenmont, and Medical Center. Glenmont saw the largest increase in boardings at 6.3 percent. All other stations, however, saw a reduction in weekday boardings. The largest decrease in boardings between FY 2010 and FY 2015 occurred at Rockville (7.6 percent), Shady Grove (8.6 percent), Wheaton (5.9 percent), and White Flint (7.6 percent)



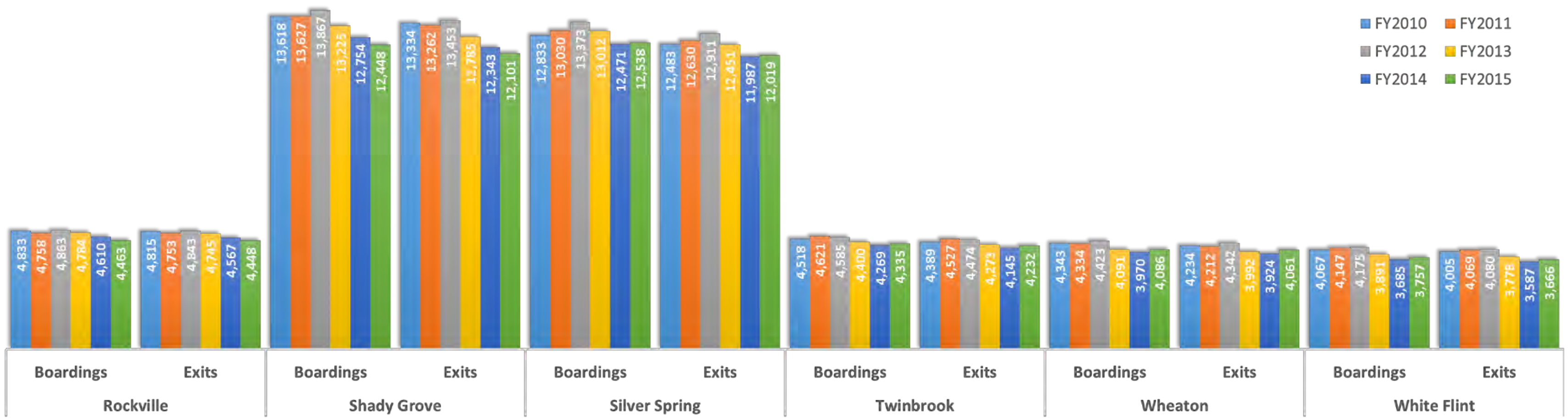


FIGURE 107: METRORAIL AVERAGE WEEKDAY RIDERSHIP IN MONTGOMERY COUNTY

Conclusion

This edition of the MAR attempts to introduce new metrics to better reflect the traveler's experience. Although this report does not make specific recommendations for transportation investments, it synthesizes many large datasets that can be used for such decisions at any time. Transportation is an industry that is constantly evolving, and recent technological advancements suggest that Montgomery County will soon be grappling with some profound issues and changes. This document is a snapshot of a limited window in time, and recent ridership and travel trends can be affected by several factors including shifting demographics, fuel prices and the economy.

Although congestion remains a significant part of the county's transportation challenges, it is an indication of economic growth and prosperity. Certainly, congestion inhibits mobility. Mobility, however, is only one aspect to a sustainable and equitable transportation system. According to Dutch engineer Mark Zuidgeest from the University of Twente's Geo-Information Science and Earth Observation Organization in the Netherlands, a holistic transportation system must consider[22]:

1. Affordability – Whether transport options have financial costs within the targeted users' budget.
2. Availability – Whether transport options exist at the location and time users require.
3. Access – Whether transport options accommodate users' abilities, including people with disabilities and special needs, taking into account the total journey (i.e., door-to-door), i.e. integration of modes.
4. Accessibility – Whether transport options available provide access to destinations people need/want to go to.
5. Acceptability – Whether transport options are considered suitable to users.

The availability of data products related to transportation behavior (mainly derived from smart phones) are becoming more ubiquitous. Given this accessible data and ongoing advancements in geographical information systems, future MARs may have an opportunity to reveal and analyze more aspects of Montgomery County's transportation systems. In future MARs, it is important to develop metrics that are holistic and consider all aspects of an equitable and sustainable transportation system to adequately guide future investments.

---

[22] Zuidgeest, M. (2016, December 15). *United Nations Environment Programme - Share The Road.* Retrieved from From Mobility to Accessibility: http://www.unep.org/Transport/sharetheroad//PDF/courseware_nmt/Lecture2_mobility_accessibility_Zuidgeest.pdf

References

American Public Transportation Association. (2016, December 6). *Public Transportation Fact Book.* Retrieved from 2015 Public Transportation Fact Book: http://www.apta.com/resources/statistics/Documents/FactBook/2015-APTA-Fact-Book.pdf

Caro, M. D. (2016, December 9). *WAMU 99.5*. Retrieved from Metro Enters First Partnership With Uber In Bid To Boost Sagging Ridership: http://wamu.org/story/16/12/09/metro-enters-first-partnership-uber-bid-boost-sagging-ridership/

Center for Advanced Transportation Technology Laboratory. (2016, August 8). *The Vehicle Probe Project Suite*. Retrieved from Data Types: https://vpp.ritis.org/suite/help/#data-types

Center for Advanced Transportation Technology Laboratory. (2016, December 14). *Vehicle Probe Project Suite*. Retrieved from Bottlenecks: https://vpp.ritis.org/suite/help/#bottlenecks

Eno Center for Transportation. (2016, February). *Emerging Technology Trends in Transportation.* Retrieved from https://www.enotrans.org/wp-content/uploads/EmergingTech.v13.pdf

Lazo, L. (2016, September 16). *The Washington Post*. Retrieved from Uber, Lyft partner with transportation authority to offer paratransit customers service in Boston: https://www.washingtonpost.com/news/dr-gridlock/wp/2016/09/16/uber-lyft-partner-with-city-to-offer-paratransit-customers-on-demand-service-in-boston/?utm_term=.4f9c6e5f2ab1

Maryland Department of Commerce. (2016, 12 3). *Brief Economic Facts*. Retrieved from Montogmery County, Maryland: http://commerce.maryland.gov/Documents/ResearchDocument/MontgomeryBef.pdf

Maryland State Highway Administration. (2016, 12 13). *Annual Vehicle Miles of Travel Report*. Retrieved from http://sha.md.gov/OPPEN/Vehicle_Miles_of_Travel.pdf

Metropolitan Washington Council of Governments. (2014). *2014 Congestion Management Process (CMP) Technical Report.* Washington, D.C.: Metropolitan Washington Council of Governments.

National Capital Region Transportation Planning Board. (2016, September 21). *4 Ways Commuting in the Washingon region Has (or Hasn't) Changed Over the last 3 Years* . Retrieved from http://www.tpbne.ws/featured/4-ways-commuting-in-the-washington-region-has-or-hasnt-changed-over-the-last-3-years/

National Capital Region Transportation Planning Board. (2016, September 21). *National Capitol Region State of the Commute 2016 Survey Highlights*. Retrieved from https://www.mwcog.org/assets/1/28/09212016_-_Item_8_-_Presentation_-_2016_SOC_TPB_Presentation.pdf

Regional Integrated Transportation Information System . (2016, December 14). *Vehicle Probe Project Suite*. Retrieved from Data Types: https://vpp.ritis.org/suite/help/#data-types

Siddiqui, F. (2016, September 13). *The Washington Post*. Retrieved from Car2Go upgrades its D.C. fleet as usage rises: https://www.washingtonpost.com/news/dr-gridlock/wp/2016/09/13/car2go-upgrades-its-d-c-fleet-as-usage-rises/?utm_term=.4f8a87f798dc

The Maryland-National Capital Park and Planning Commission. (2012, April). *2012 Transportation Policy Area Review: A Synopsis of the Area-wide Transportation Test.* Retrieved from http://montgomeryplanning.org/document-viewer/#http://www.montgomeryplanning.org/research/subdivision_staging_policy/2012/documents/tpar.pdf

The Maryland-National Capital Park and Planning Commission. (2016). *2016 Subdivision Staging Policy.* Silver Spring: The Maryland-National Capital Park and Planning Commission.

Washington Metropolitan Area Transit Authority. (2016, October 11). *PlanItMetro*. Retrieved from Abilities-Ride Program: An Alternative to MetroAccess: https://planitmetro.com/2016/10/11/abilities-ride-program-an-alternative-to-metroaccess/

WMATA. (2013, September 30). *PlanItMetro*. Retrieved from How Do Metrorail Riders Get to Their Station in the Morning?: https://planitmetro.com/2013/09/30/how-do-metrorail-riders-get-to-their-station-in-the-morning/

Zuidgeest, M. (2016, December 15). *United Nations Environment Programme - Share The Road.* Retrieved from From Mobility to Accessibility: http://www.unep.org/Transport/sharetheroad//PDF/courseware_nmt/Lecture2_mobility_accessibility_Zuidgeest.pdf

MOBILITY ASSESSMENT REPORT | FEBRUARY 2017

MONTGOMERY COUNTY PLANNING DEPARTMENT