Old Town North Small Area Plan Update

Transportation Study

June 2017

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Executive Summary

Old Town North is a vibrant and transforming urban area with established residential neighborhoods, scenic open spaces and parks, aging industrial buildings with redevelopment potential, and new retail and residential buildings. This community features access to key transportation infrastructure including the N. Washington Street/George Washington Memorial Parkway corridor, Mt. Vernon Trail, Capital Bikeshare, and a grid of urban streets. The community is well served by local transit and is in close proximity to the Braddock Road Metrorail station and the Metroway bus rapid transit (BRT) service.

The City has initiated a Small Area Plan (SAP) update to review the progress from the 1992 SAP, re-evaluate the goals and recommendations, and update the transportation strategies based on current City multimodal transportation policies.

The purpose of this Multimodal Transportation Study is to provide context for the existing and future transportation conditions within the Old Town North Small Area Plan Update and to evaluate the suitability of the transportation network to accommodate the planned growth and redevelopment.

Study Area and Study Parameters

The transportation study area is generally defined by Fayette Street in west, Princess Street in the south, Slaters Lane in the north, and the Potomac River in the east. The boundary for the transportation study is slightly larger than the area included in the Small Area Plan Update to consider the broader traffic impacts and opportunities associated with the N. Patrick Street and N. Henry Street (US Route 1) regional corridor as well as the Madison Street and Montgomery Street one-way corridors. The following existing intersections were considered in this study:

- N. Washington Street and Slaters Lane
- N. Washington Street and Bashford Lane
- N. Washington Street and First Street
- N. Washington Street and Montgomery Street
- N. Washington Street and Madison Street
- N. Washington Street and Wythe Street
- N. Washington Street and Pendleton Street
- N. Washington Street and Oronoco Street
- N. Washington Street and Princess Street
- N. Saint Asaph Street and First Street
- N. Pitt Street and First Street
- N. Henry Street and Montgomery Street
- N. Patrick Street and Montgomery Street
- N. Columbus Street and Montgomery Street
- N. Saint Asaph Street and Montgomery Street
- N. Pitt Street and Montgomery Street
- N. Royal Street and Montgomery Street
- N. Fairfax Street and Montgomery Street
- N. Fayette Street and Madison Street
- N. Henry Street and Madison Street
- N. Patrick Street and Madison Street
- N. Columbus Street and Madison Street
- N. Saint Asaph Street and Madison Street
- N. Pitt Street and Madison Street
- N. Saint Asaph Street and Wythe Street
- N. Pitt Street and Bashford Lane
- N. Royal Street and Bashford Lane

This study considered two analysis years—the existing year 2016 and the forecast year 2040. The year 2040 represents a time horizon by which the land use and transportation network envisioned in the Small Area Plan Update could be reasonably expected to be implemented.

This study also considered three future year 2040 scenarios, including baseline conditions, build conditions, and build conditions with improvements. The baseline scenario assumes the maximum amount of development that can be achieved under the current zoning and Small Area Plan. The build scenario assumes the maximum amount of development that can be achieved under the Small Area Plan

Update including the redevelopment of the power plant site. The build with improvement scenario includes potential improvements to the transportation network, as necessary, to mitigate traffic impacts associated with build conditions.

Vehicular operations analyses were performed for the weekday AM and PM commuter peak periods using both the Synchro and VISSIM software packages. Synchro is a macroscopic analysis tool used to analyze traffic flow that considers aggregated traffic stream characteristics such as speed, flow, and density to evaluate roadway conditions using *Highway Capacity Manual* methodologies (i.e. based on control delay experienced at signalized and unsignalized intersections). Synchro 9.1 was used to analyze the 15 non-N. Washington Street intersections. VISSIM is a microscopic analysis tool used to simulate the characteristics and interactions of individual vehicles. It includes algorithms and rules describing how vehicles move and interact within the transportation network, including acceleration, deceleration, and lane changing. VISSIM allows for flexibility to develop a wide range of roadway networks with respect to vehicle movements and roadway geometry and is one of the recommended tools for analyzing oversaturated conditions. VISSIM was used to analyze the nine intersections along N. Washington Street.

Per the City's Transportation Planning Administrative Guidelines, the use of VISSIM is preferred for streets that are approaching capacity (volume to capacity ratio greater than 0.85), for streets where queue spill back is a concern, or for streets where large vehicle or transit operations are prevalent.

VISSIM models were calibrated using geometric, traffic control, driver behavior, traffic volume, queue, travel time, and field observation data in accordance with City of Alexandria parameters contained in the Transportation Planning Administrative Guidelines for Multimodal Transportation Studies.

Existing Conditions

The existing transportation network includes an urban street grid with travel options for transit, pedestrians and bicycles, and vehicles.

The study area is well served by local bus routes including the Metroway; Metrobus routes 10A, 10E, 10B, and 11Y; and DASH routes AT2, AT3, AT 4, AT5, and AT8. Rail transit is provided west and south of Old Town North via the Braddock Road Metrorail Station and the King Street-Old Town Metrorail station. Both stations provide access to the Washington Metropolitan Area Transit Authority (WMATA) Yellow and Blue Lines.

Old Town North contains a well-connected sidewalk and trail network. The study area has an extensive street grid that helps to distribute car traffic (reducing volume) and creates a network of connections for people traveling by foot or bike. There are plans to improve the few gaps (missing sidewalks) in the pedestrian network. In addition to the sidewalk network, pedestrians are served by the Mt. Vernon Trail and Mt. Vernon Trail spur.

Dedicated bicycle facilities are limited, with gaps in connections within the neighborhood and to other parts of the City. The study area streets accommodate slow-moving traffic, making them comfortable for bicycling; however, many lack signage or protected space for bicyclists. The exception is a designated bicycle route with shared lane markings on Pendleton Street between N. West Street and N. Union Street. An east-west bicycle connection is lacking between the Braddock Road Metrorail Station and the Mt. Vernon Trail/Waterfront area.

Old Town North has a set of Capital Bikeshare stations, providing access to the regional bike sharing network. The three 14-dock stations are located at the intersections of N. Saint Asaph Street with Pendleton Street and Madison Street, and the intersection of N. Fairfax Street and Madison Street. There

are several public bike racks throughout the study area, though all but two of them are located south of Montgomery Street.

Based on a review of previously conducted traffic counts, the peak hours of traffic were identified as 7:15 AM to 8:15 AM and 5:00 PM to 6:00 PM. These hours represent the continuous 60-minute periods when the largest amount of vehicular traffic is present at all study intersections during the commuter peak periods.

The existing conditions analysis results demonstrate that most study area intersections operate at acceptable levels of service during the weekday AM and PM peak periods with the exception of the intersection of N. Washington Street and Bashford Lane during the AM peak period. This is in part due to northbound queuing that originates from the George Washington Memorial Parkway, north of the study area, and that spills back along N. Washington Street and E. Abingdon Drive.

2040 Baseline Conditions

2040 Baseline Conditions represent the future conditions and traffic associated with the full land development potential of OId Town North that can be accomplished under the existing Small Area Plan (with existing zoning and site plan approvals). The baseline condition transportation network also assumes City-identified planned and programmed transportation improvements that can be reasonably assumed to occur by 2040 without the implementation of the Small Area Plan Update, consistent with the City's Transportation Master Plan, DASH's Comprehensive Operations Analysis (COA), and the City's Complete Streets Program:

- Construction of pedestrian access and bus bay improvements at King Street-OId Town Metrorail Station
- Construction of the Potomac Yard Metrorail Station
- Construction of the missing segment of Mt. Vernon Trail along the east side of E. Abingdon Drive
- Completion of a missing gap in sidewalk network along Wythe Street
- Implementation of an enhanced bicycle corridor along Madison Street
- Implementation of a neighborhood bikeway along Royal Street
- Deployment of additional Capital Bikeshare stations
- Implementation of transit signal priority along US Route 1
- Provision of the OId Town circulator transit service between the King Street Metrorail station and Braddock Road Metrorail station
- Improvements to DASH transit headways
- Implementation of strategic management of parking to support retail and right-sizing of parking

Based on a block-by-block land use forecast developed by the City of Alexandria's Department of Planning and Zoning, the increase in density that can be accommodated under the existing Small Area Plan consists of approximately 207 net new hotel rooms, 253,000 square feet of net new commercial/retail use, 613 net new apartment units, 16 net new residential condominium/townhouse units, 391,000 square feet of net new office space, and 126,000 square feet of net new light industrial use. This results in a total net development increase of 1,723,897 square feet under 2040 Baseline Conditions.

The person trips generated by the new development were calculated using applicable land use codes from the Institute of Transportation Engineers (ITE) *Trip Generation Manual, Volume 9*. Person trips were

converted into vehicle trips using mode split assumptions that have been previously approved by the City. The resulting vehicle trips were assigned to study area streets based on specific trip distributions for each land use type.

In addition to traffic generated specifically by new development, an annual growth factor of three percent was applied to N. Washington Street northbound and southbound through movements to approximate the growth in regional, non-specific traffic. This growth factor was derived from a review of the Metropolitan Washington Council of Governments (MWCOG) regional travel demand model.

The 2040 Baseline Conditions analysis results demonstrate that the additional future traffic will generally lead to higher delays at study area intersections. Despite this, and consistent with existing conditions, most study area intersections will operate at acceptable levels of service during the weekday AM and PM peak periods with the exception of the intersection of N. Washington Street and Bashford Lane during the AM peak period. This is in part due to northbound queuing that originates from the George Washington Memorial Parkway, north of the study area, and spills back along N. Washington Street and E. Abingdon Drive. This queuing is only worsened by the addition of future traffic.

2040 Build Conditions

2040 Build Conditions represent the future conditions and traffic associated with the full land development potential of OId Town North that can be accomplished under the Small Area Plan Update. The 2040 Build Conditions transportation network assumes all transportation enhancements previously discussed under the 2040 Baseline Conditions well as the following additional enhancements:

- Build-out of power plant site and new street network east of N. Washington Street
- Conversion of Montgomery Street from one-way to two-way
- New DASH Route to provide service to Old Town North, redeveloped power plant site, and the future Potomac Yard Metrorail station
- Conversion of the Norfolk-Southern Rail Spur to a linear park with improved bicycle and pedestrian connectivity to the Mt. Vernon Trail
- Deployment of additional Capital Bikeshare stations in redeveloped power plant site

Based on a block-by-block land use forecasts developed by the City of Alexandria's Department of Planning and Zoning, the proposed land use changes under the Small Area Plan Update, as compared to existing conditions, consists of approximately 46 less hotel rooms, 90,591 square feet of net new commercial/retail use, 2,901 net new apartment units, 168 net new residential condominium/townhouse units, 724,562 square feet of net new office space, and 7,975 less square feet of light industrial use. This results in a total net development increase of 4,291,830 square feet under 2040 Build Conditions over existing conditions.

The person trips generated by the new development was calculated in a manner consistent with the methodology used under the 2040 Baseline Conditions and converted into vehicle trips using the same mode split assumptions.

The resulting 2040 Build Conditions vehicle trips were assigned to study area streets based on specific trip distributions for each land use type.

It is noted that compared to 2040 Baseline Conditions, the 2040 Build Conditions generate 371 and 233 more vehicle trips in the AM and PM peak hours, respectively. The majority of these trips are generated

by the build-out of the power plant site. Regional traffic growth along N. Washington Street also were considered, consistent with the 2040 Baseline Conditions.

The 2040 Build Conditions analysis results demonstrate that the additional future traffic will generally lead to higher delays at study area intersections compared to 2040 Baseline Conditions. Despite this, most study area intersections will operate at acceptable levels of service during the weekday AM and PM peak periods. The exceptions are the intersections of N. Washington Street and Slaters Lane and N. Washington Street and Bashford Lane during the AM peak period. This is in part due to northbound queuing that originates from the George Washington Memorial Parkway, north of the study area, and spills back along N. Washington Street and E. Abingdon Drive. This queuing is only worsened by the addition of future traffic. This also is due to the significant volume of traffic that is traveling to the redeveloped power plant site from the north. The southbound left turning volume along W. Abingdon Drive at Bashford Lane and at Slaters Lane exceeds the capacity of the movements and there is limited opportunity to make the movements under the existing signal timing. This contributes to southbound delays and vehicle congestion that spill back to George Washington Memorial Parkway.

2040 Build Conditions with Improvements

Based on the 2040 Build Conditions analysis results, specific locations identified for mitigations of traffic impacts of the Small Area Plan are:

- Intersection of E. Abingdon Drive and Slaters Lane has significant northbound delays during the AM and PM peak hour
- Intersection of W. Abingdon Drive and Slaters Lane has significant southbound delays, during the AM and PM peak hours resulting in spill back to the George Washington Memorial Parkway
- Intersection of N. Washington Street and Slaters Lane has significant eastbound approach delays during the AM peak hour and significant and westbound approach delays during the PM peak hour. The overall intersection operates at level of services F during the AM peak hour
- Intersection of W. Abingdon Drive and Bashford Lane has significant southbound delays during the AM and PM peak hours resulting in spill back to Slaters Lane
- Intersection of N. Washington Street and Bashford Lane has significant eastbound and westbound approach delays during the AM peak

In addition to the above, there was one location just outside the study area that requires some mitigation to minimize the impacts to the study area. The northbound ramp approach (E. Abingdon Drive) to the George Washington Memorial Parkway experiences significant queuing during the AM peak hour. This queuing extends beyond the intersection of E. Abingdon Drive and Slaters Lane, affecting the operations of both streets.

Much of the traffic impacts at the Slaters Lane and Bashford Lane intersections can be attributed to trips traveling to or from the redeveloped power plant site. The redevelopment of the power plant site will increase the traffic demand to that area and generate a significant amount of vehicular traffic to and from the east of N. Washington Street.

In addition to these vehicular impacts, the 2040 Build Conditions also are missing enhancements to bicycle and pedestrian facilities across Slaters Lane to connect the redeveloped power plant site with neighborhoods west of N. Washington Street. To mitigate these impacts, potential improvements were identified for evaluation:

- Constructing a new east-west street along the rail spur alignment to enhance multimodal connectivity between the power plant site, N. Washington Street, and E./W. Abingdon Drive
- Extending two-lane striping of southbound W. Abingdon Drive approach to intersection with Slaters Lane to increase capacity and accommodate vehicle queues
- Extending two-lane striping along northbound E. Abingdon Drive approach George Washington Memorial Parkway to increase capacity. Will require signalization during all hours of the day in addition to the weekday AM peak period
- Restriping of eastbound/westbound Bashford Lane approaches to increase vehicle capacity
- Extending bicycle lanes and improve pedestrian facilities along Slaters Lane through E./W. Abingdon Drive and N. Washington Street
- Adjusting signal timing to reallocate green time at N. Washington Street intersections

An analysis of 2040 Build Conditions with improvements was performed to evaluate the performance of study area streets.

The proposed new east-west street connection provides additional east-west vehicular capacity to improve access to the power plant site/adjacent properties and also reduces the traffic demand along Slaters Lane and Bashford Lane. This street also provides the opportunity for an additional pedestrian and bicycle connection across N. Washington Street. Lane configuration restriping along E. Abingdon Drive, W. Abingdon Drive, and along Bashford Lane creates additional capacity and improves vehicle throughput.

In addition to the identified improvements, there also are some opportunities that result from the two-way conversion of Montgomery Street. Allowing northbound and southbound left-turn movements at the intersection of N. Washington Street and Montgomery Street, for example, enhances the network connectivity and circulation.

The 2040 Build Conditions with improvements analysis results demonstrate that the potential improvements can improve the study area traffic and congestion, specifically at intersections along Slaters Lane, Bashford Lane, and N. Washington Street. In many instances, delay savings result in conditions that are as good or better than the future baseline results and, in some instances, better than the existing conditions results. It is noted that there are still individual movements or approaches with large delay or queuing results. As traffic volumes grow and as drivers become familiar with traffic patterns, it is reasonable to expect that traffic will redistribute among available routes. This will have the effect of balancing out the delays and queues experienced at adjacent intersections.

Conclusions

Analyses were performed for existing conditions, 2040 Baseline, 2040 Build, and 2040 Build with improvements. The existing analysis results indicated that most intersections in Old Town North operate with good levels of service and that the urban street grid offers many opportunities for vehicular travel. The interconnected network of streets allows for the efficient dispersion of traffic.

Pedestrian facilities such as sidewalks and trails have few gaps and crossing distances are minimal at most intersections. Cyclists have access to bikeshare stations, off-street trails, and generally do not have to contend with higher speed vehicles. Local transit service is prevalent and provides connections to regional activity centers and the regional Metrorail Yellow and Blue Lines.

In the year 2040, with the proposed Small Area Plan Update, most study area streets will continue to operate with acceptable levels of service for vehicular traffic.

The most significant change in the study area, the build-out of the power plant site, may lead to additional traffic pressures along Slaters Lane, Bashford Lane, and N. Washington Street. The traffic pressure associated with this development can be mitigated to provide levels of service as good or better than 2040 Baseline Conditions through the improvements identified in this study.

To achieve and exceed the operational results and mode split targets identified in this study, the following recommendations have been suggested:

- Implement currently planned transportation network enhancements as identified under the 2040 Baseline Conditions
- Implement transportation network enhancements to support the 2040 Build Conditions
- Implement the transportation improvements to minimize traffic impacts associated with the 2040 Build Conditions and provide additional consideration for pedestrians, bicyclists, and transit riders
- Use redevelopment as an opportunity to achieve the desired streetscape along City streets consistent with Complete Streets Typologies
- Require new developments to support the City's transportation demand management goals through participation in a Transportation Management Program (TMP). Such action, would further support the mode split targets discussed in this study and would be consistent with the City's Transportation Master Plan and Environmental Action Plan
- Address the specific phasing, design, and implementation of recommendations as part of the Coordinated Development District approvals
- Conduct updated traffic studies to verify or refine recommendations as specific developments come in for development special use permits.

The preceding transportation recommendations will position the City to achieve the Small Area Plan Update vision and create pedestrian-focused neighborhoods, linked to the rest of the City through a diverse transportation network and a system of alternative transit options. Further the recommendations position the City to achieve a successful build-out of the power plant site with urban scale blocks, a street network that encourages biking and walking, transit accessibility, and minimized impacts to the greater transportation network.

1. Introduction

The Old Town North area is a vibrant and transforming urban area with established residential neighborhoods, scenic open spaces and parks, aging industrial buildings with redevelopment potential, and new retail and residential buildings. This community features access to key transportation infrastructure including the N. Washington Street/George Washington Memorial Parkway corridor, Mt. Vernon Trail, Capital Bikeshare, and grid of urban streets and is in close proximity to the Braddock Road Metrorail station and the Metroway bus rapid transit (BRT) service. The future Potomac Yard Metrorail Station is planned to be constructed approximately 1.5 miles north of Old Town North.

The City has initiated a Small Area Plan (SAP) Update to review the progress from the 1992 SAP, re-evaluate the goals and recommendations, and update the transportation strategies based on current City multimodal transportation policies. The Small Area Plan Update study area is shown in **Figure 1-1**. The Small Area Plan Update aims to guide anticipated new development during the next 20 years in a manner consistent with the goals of the 1974 and 1992 Plans and the overall desire to further create and sustain a vibrant, balanced, mixed use urban neighborhood. The Small Area Plan Update includes eight planning categories which are:

- Planning, Land Use and Design
- Housing
- Open Space, Recreation, and Cultural Activities
- Historic Preservation
- Economic Development
- Infrastructure and Environmental Sustainability
- Transportation
- Implementation

The purpose of this Multimodal Transportation Study is to provide context for the existing and future transportation conditions within the Old Town North Small Area Plan and to evaluate the suitability of the transportation network to accommodate the growth and redevelopment of Old Town North. The Old Town North Small Area Plan Update's governing transportation principle was generated through a community driven process and established early in the larger SAP process by the Old Town North SAP Advisory Group:

> ***To further encourage an integrated multimodal transportation network using the existing street grid, and grid extensions where necessary, to promote a healthy, auto independent lifestyle.***

Additional planning documents that are relevant to the development of this transportation study and the larger transportation vision of the Small Area Plan Update include the City's 2008 Transportation Master Plan, 2016 Pedestrian and Bicycle Master Plan, the City's Complete Street Policy and 2015 Complete Streets Design Guidelines, the new Parking Standards for Multi-Family Development Projects, and the most recent DASH Comprehensive Operations Analysis (COA). This transportation study contains a review of existing multimodal transportation conditions, an evaluation of the 2040 Baseline scenario that includes current and approved redevelopment, an evaluation of the 2040 Build scenario that includes additional redevelopment including the power plant site, and the identification of additional transportation improvements that may be necessary to further support the multimodal transportation network in Old Town North.

Figure 1-1: Old Town North Small Area Plan Update Study Area

Source: Project Brief

2. Existing Transportation Conditions

This chapter documents the existing transportation conditions for the Old Town North study area and includes a summary of the multimodal transportation network, traffic counts, and crash history.

The primary source for the existing conditions information and data is from the City staff Project Brief that was competed for the Small Area Plan Update in December 2015. The project brief served as a compilation of existing conditions, plans, and policies for reference during the Old Town North Small Area Plan Update planning process. The relevant transportation-focused pages of the project brief are included as **Appendix A** of this report.

2.1. Vehicular Transportation Network

The study area for the Old Town North Transportation study is illustrated in **Figure 2-1** and is generally defined by Fayette Street in west, Princess Street in the south, Slaters Lane in the north and the Potomac River in the east. The boundary for the transportation study is slightly larger than the area included in the Small Area Plan Update to document the traffic impacts and opportunities associated with the N. Patrick Street and N. Henry Street (US Route 1) regional corridor as well as the Madison Street and Montgomery Street one-way corridors.

Photo 1: Bashford Lane at Abingdon Drive and N. Washington Street

Photo 2: First Street Looking East from N. Washington Street

2.1.1. Study Area Streets

The Old Town North transportation network includes streets of various functional classes that serve the residential, retail, and employment-driven traffic within the Old Town North study area. This includes many local streets and also streets of higher functional classes which have the capacity to support regional north-south travel. The relevant study area streets and their classifications, based on the Virginia Department of Transportation's (VDOT) 2005 Functional Classification Map for the City of Alexandria, are detailed below:

- **Urban Other Principal Arterial:** George Washington Memorial Parkway, N. Washington Street, N. Patrick Street (US Route 1), N. Henry Street (US Route 1)
- **Urban Minor Arterial:** Montgomery Street (west of N. Washington Street), Wythe Street, Slaters Lane

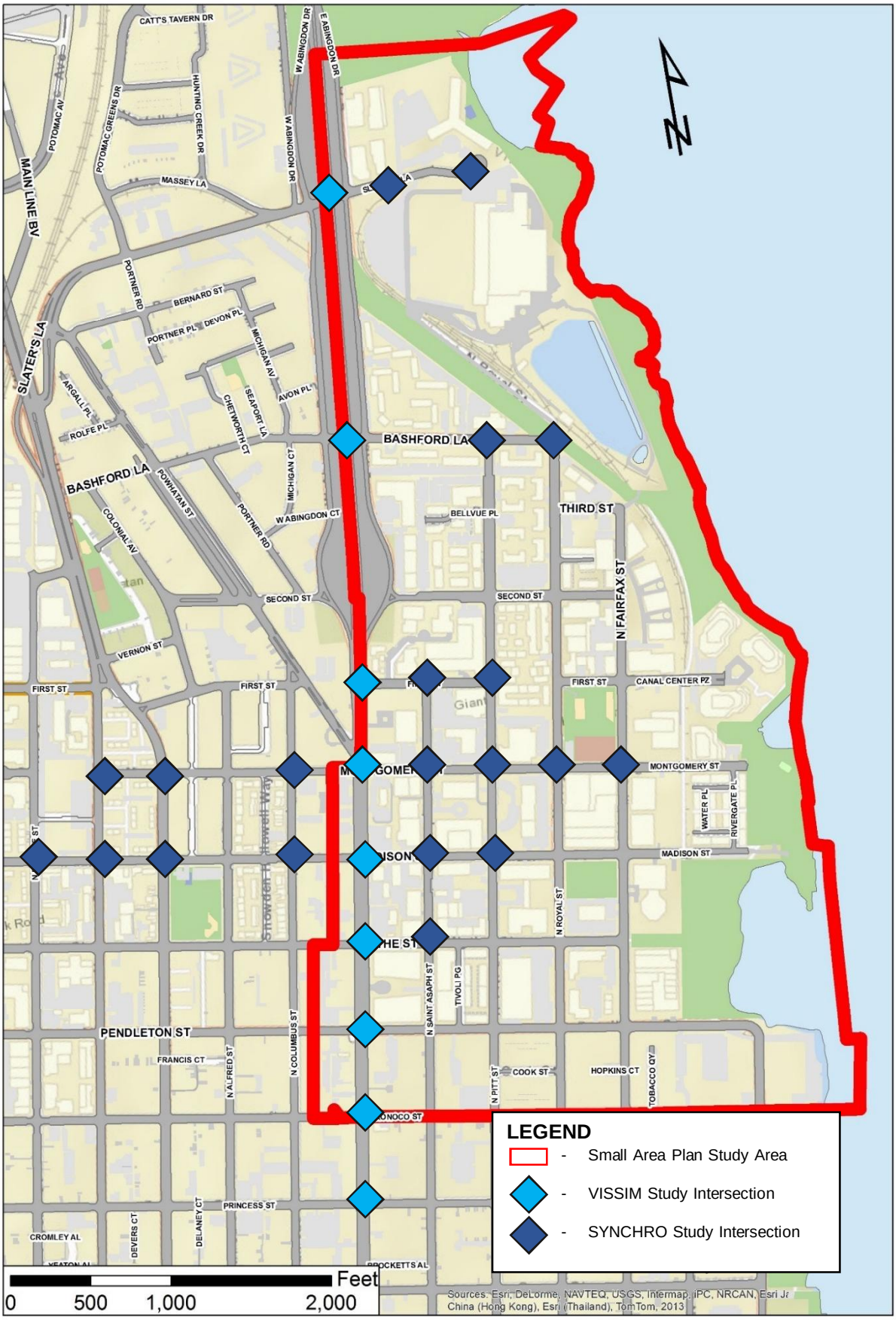


Figure 2-1: Old Town North Transportation Study Area

- **Urban Collector:** Pendleton Street, Montgomery Street (east of N. Washington Street), N. Fairfax Street
- **Local Street:** Abingdon Drive, N. St. Asaph Street, N. Pitt Street, Columbus Street, Powhatan Street, Fayette Street, Slaters Lane, Bashford Lane, 1st Street, Madison Street, Oronoco Street, Princess Street, N. Royal Street

Montgomery Street and N. St. Asaph street have been designated as retail streets during the Small Area Plan Update process.

One-way streets in the transportation study area include Montgomery Street, Madison Street, N. Henry Street, N. Patrick Street, E. Abingdon Drive, and W. Abingdon Drive. The outside lanes of N. Henry Street and N. Patrick Street function as HOV-2+ facilities during the peak periods (northbound direction from 6:00 to 9:00 AM and southbound direction from 3:00 to 7:00 PM). The outside lanes of E. Abingdon Drive, W. Abingdon Drive, and N. Washington Street function as HOV-2+ facilities during the peak periods (northbound direction from 7:00 to 9:00 AM and southbound direction from 4:00 to 6:00 PM). Along N. Washington Street, parking is permitted in the right lane, southbound all day with the exception of 4:00 PM to 6:00 PM south of Madison Street. Along N. Washington Street, parking is permitted in the right lane, northbound all day with the exception of 7:00 AM to 9:00 AM south of Pendleton Street.

2.1.2. Intersections

Study area intersections were identified in coordination with City staff and represent the significant signalized and unsignalized intersections within the transportation study area. The study intersections and lane configurations at each intersection are shown in **Figure 2-2**.

Photo 3: Montgomery Street

Photo 4: N. Washington Street at Madison Street

Photo 5: Intersection of Montgomery Street, N. Washington Street, and Powhatan Street

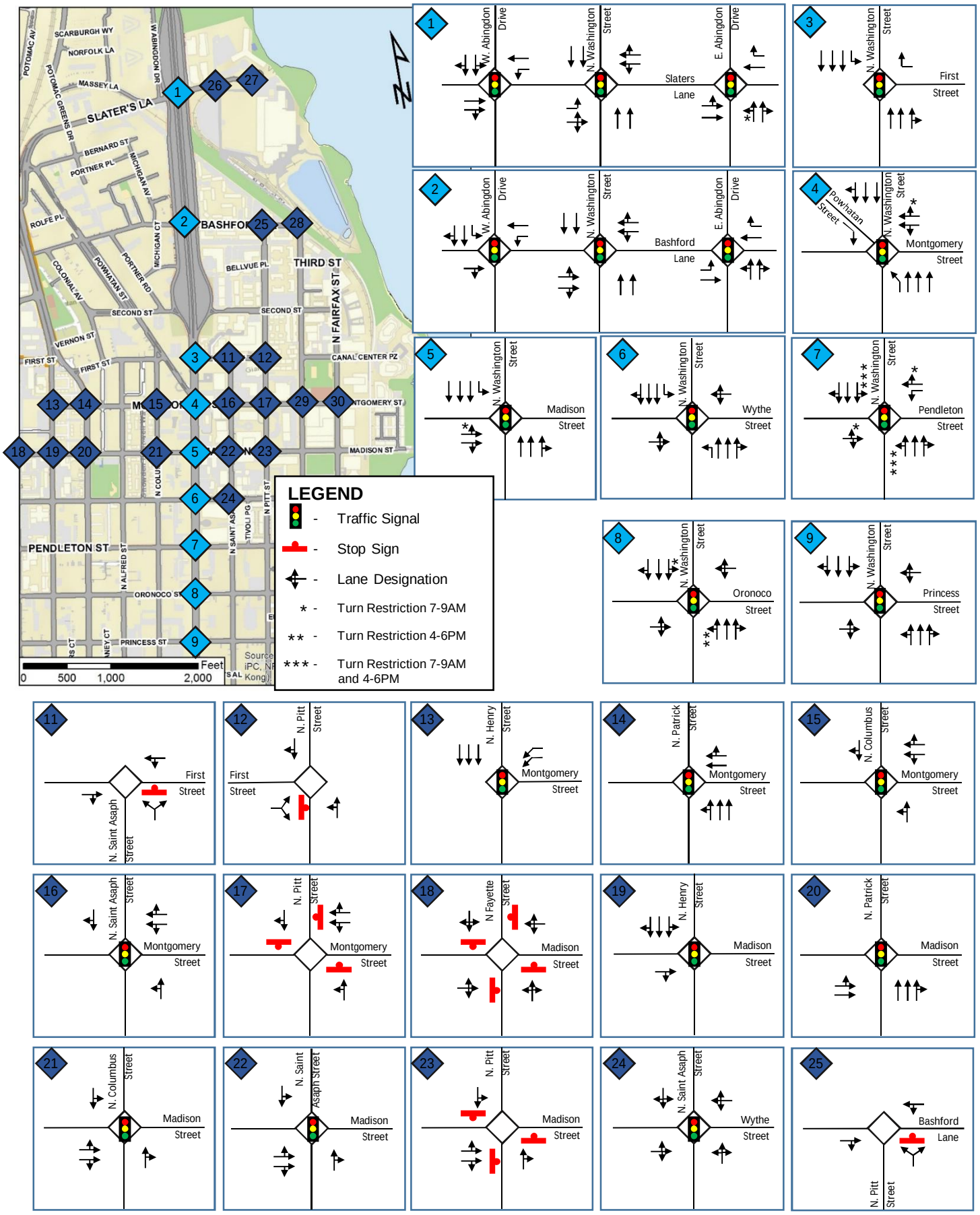
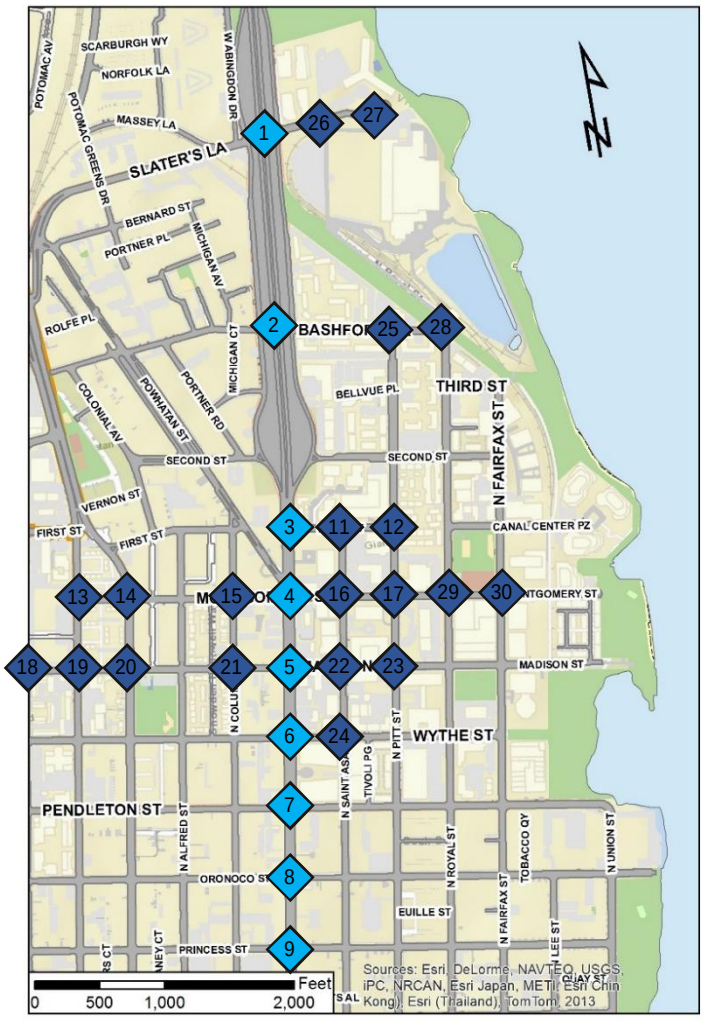


Figure 2-2: Study Area Intersections and Lane Designations

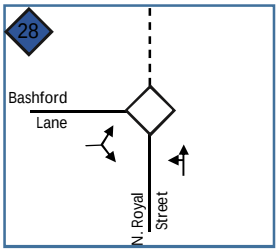


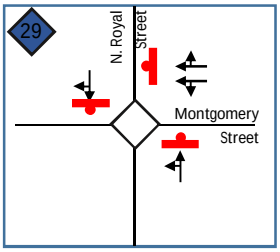
LEGEND

- Traffic Signal
- Stop Sign
- Lane Designation
- * - Turn Restriction 7-9AM
- ** - Turn Restriction 4-6PM
- *** - Turn Restriction 7-9AM and 4-6PM

Not Used in this Figure

Not Used in this Figure





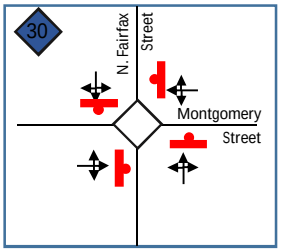


Figure 2-2: Study Area Intersections and Lane Designations

2.1.3. Traffic Counts

The purpose of the existing conditions transportation analysis is to assess the multimodal transportation conditions, particularly during the congested peak periods of travel, typically regarded as 6:00 to 9:00 AM and 4:00 to 7:00 PM. Peak period traffic count data was readily available due to the number of traffic impact studies (TIS) that have been recently prepared, submitted, and approved by the City for new developments or redevelopment in the study area and City provided traffic counts from April and May 2016. Accordingly, no new traffic counts were obtained at study area intersections. The locations of previously completed traffic counts in the study area are shown in **Figure 2-3**.

The data collected as part of the prior transportation studies was synthesized and compiled to determine the peak period traffic volumes in the study area. This included data from the following studies:

- 530 First Street (Edens)
- 1101 N. Washington Street (Old Colony Inn)
- 500/501 N. Union Street (Robinson Terminal)
- 800 N. Washington Street (Towne Motel)
- Braddock Gateway

The traffic data collection sheets associated with these studies are included in **Appendix B**. The traffic data was collected primarily in 2015 and is indicative of existing conditions 2016 traffic volumes.

The total traffic volumes in the study area during the peak periods were reviewed to derive a common network peak hour; i.e. the continuous 60-minute period when the largest amount of vehicular traffic is present at all study intersections. The morning commuter peak hour was determined to be 7:15 to 8:15 AM and the evening commuter peak hour was determined to be 5:00 to 6:00 PM.

The peak hours of traffic are relevant for the *Highway Capacity Manual*-based analyses using the Synchro software package. Synchro analyses were performed for the non-N. Washington Street intersections.

The peak periods of travel are relevant for microsimulation-based analyses using the VISSIM software package. VISSIM microscopic simulation analyses were performed for the N. Washington Street corridor. Per the City's Transportation Planning Administrative Guidelines, the use of VISSIM is preferred for streets that are approaching capacity (volume to capacity ratio greater than 0.85), for streets where queue spill back is a concern, or for streets where large vehicle or transit operations are prevalent.

Additional discussion regarding the rational for two analysis methodologies and the assumptions and results for each software package will be described in subsequent sections of this report.

The peak hour traffic volumes at each intersection along Washington Street were adjusted to balance out the differences in counted vehicles between proximate intersections as required for the VISSIM analyses. No other traffic volumes were adjusted from their common peak hour values due to the presence of driveways. The resulting balanced AM and PM peak hour traffic volumes considered in this study are shown in **Figure 2-4.**

Figure 2-3: Traffic Count Locations

Source: Project Brief

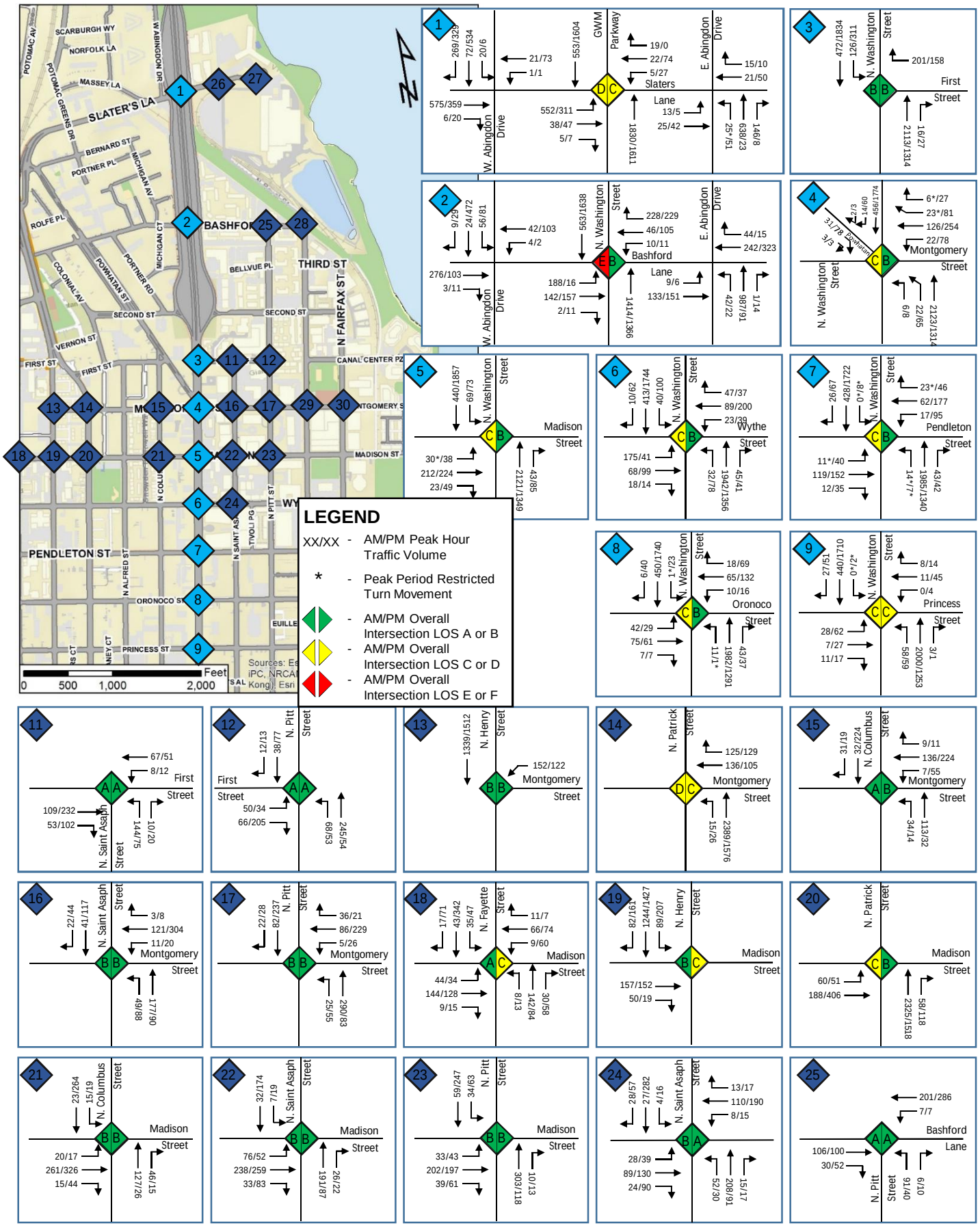
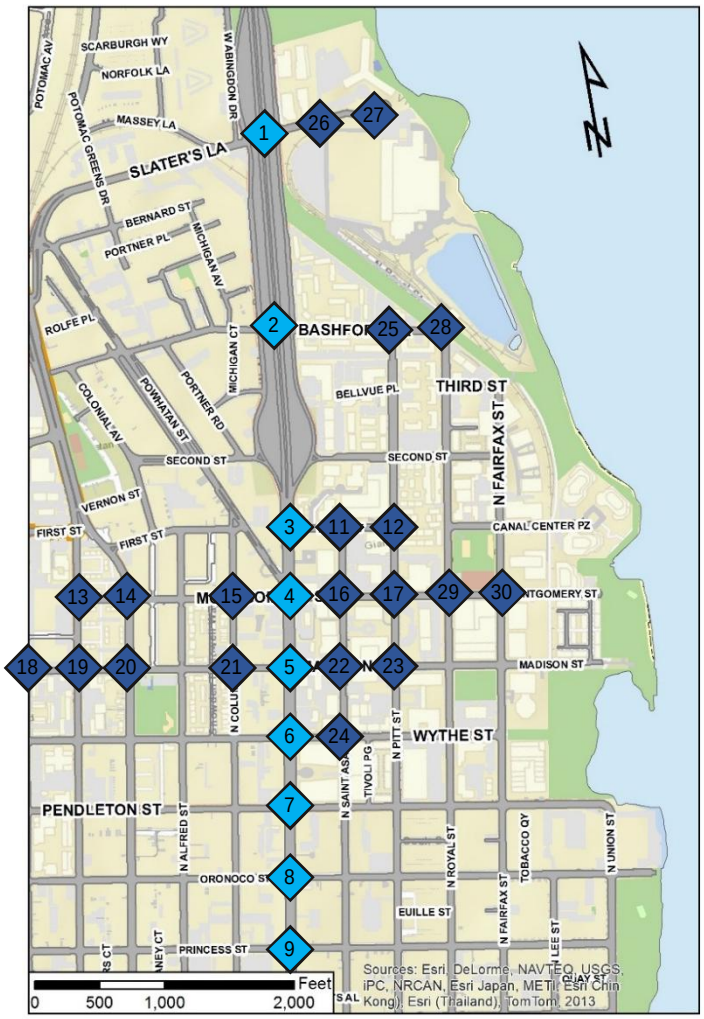


Figure 2-4: Existing Peak Hour Traffic Volumes

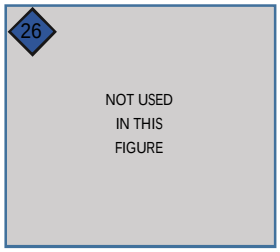


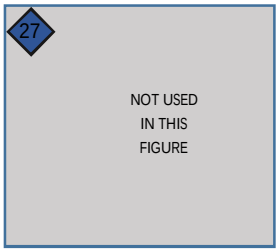
LEGEND

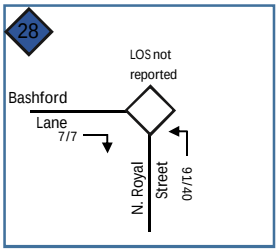
XX/XX - AM/PM Peak Hour Traffic Volume

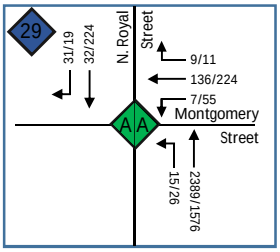
* - Peak Period Restricted Turn Movement

- AM/PM Overall Intersection LOS A or B
- AM/PM Overall Intersection LOS C or D
- AM/PM Overall Intersection LOS E or F









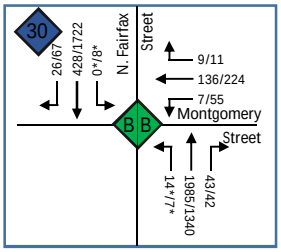


Figure 2-4: Existing Peak Hour Traffic Volumes

2.1.4. Study Area Crash History

Vehicular Crashes

The study area 5-year crash history, from January 2011 through August 2016, was reviewed to identify the number of reported crashes. Annual crashes within the transportation study area at study area streets, are presented in **Figure 2-5** and illustrated in **Figure 2-6**.

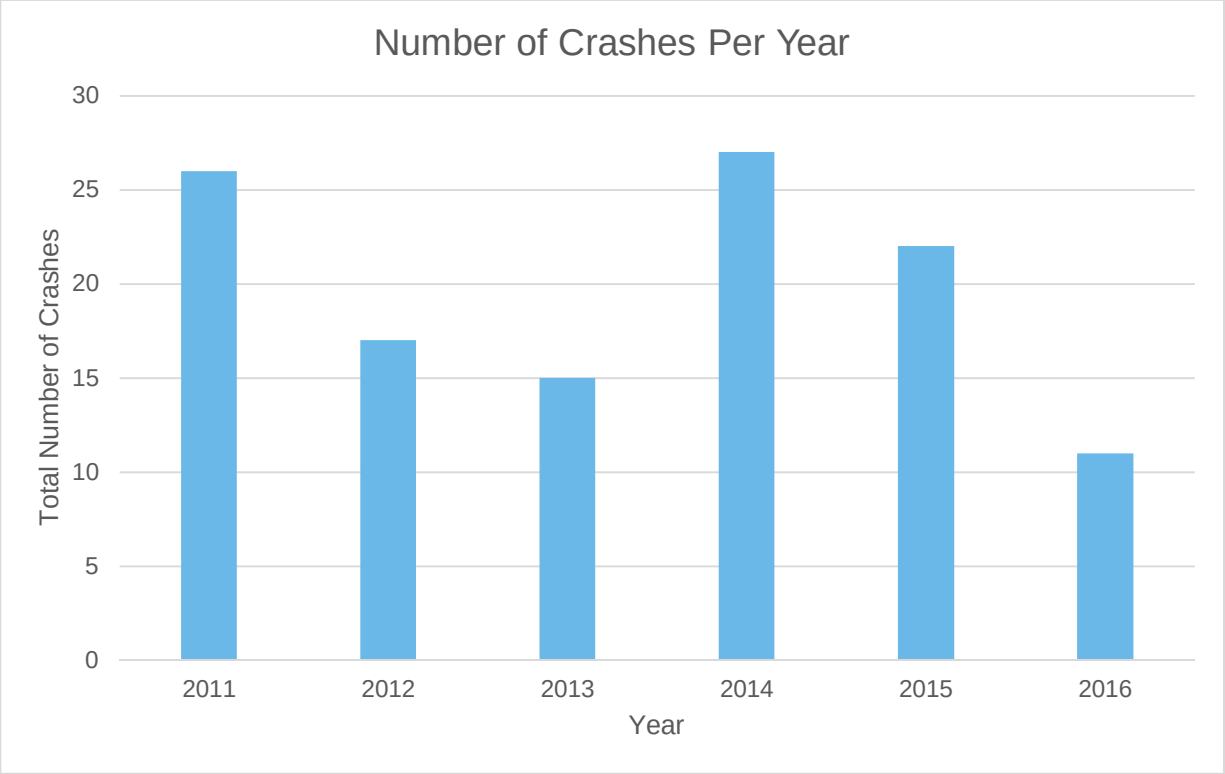


Figure 2-5: Vehicular Crashes by Year January 2011 through August 2016

Pedestrian Crashes

Pedestrian crashes in the City are shown in **Figure 2-7**. Within Old Town North, N. Washington Street has a higher density of pedestrian crashes than the rest of the City, which is partially due to high traffic volumes and large street widths. Other areas with incidences of pedestrian crashes between 2005 and 2014 include N. Fairfax, First, Madison, Oronoco, and Wythe Streets.

Bicycle Crashes

Bicycle crashes in the City are shown in **Figure 2-8**. Old Town North has a lower density of bike crashes than the rest of the City; however, several streets have experienced several bike crashes between 2005 and 2014, including Fairfax, Oronoco, and Pendleton streets.

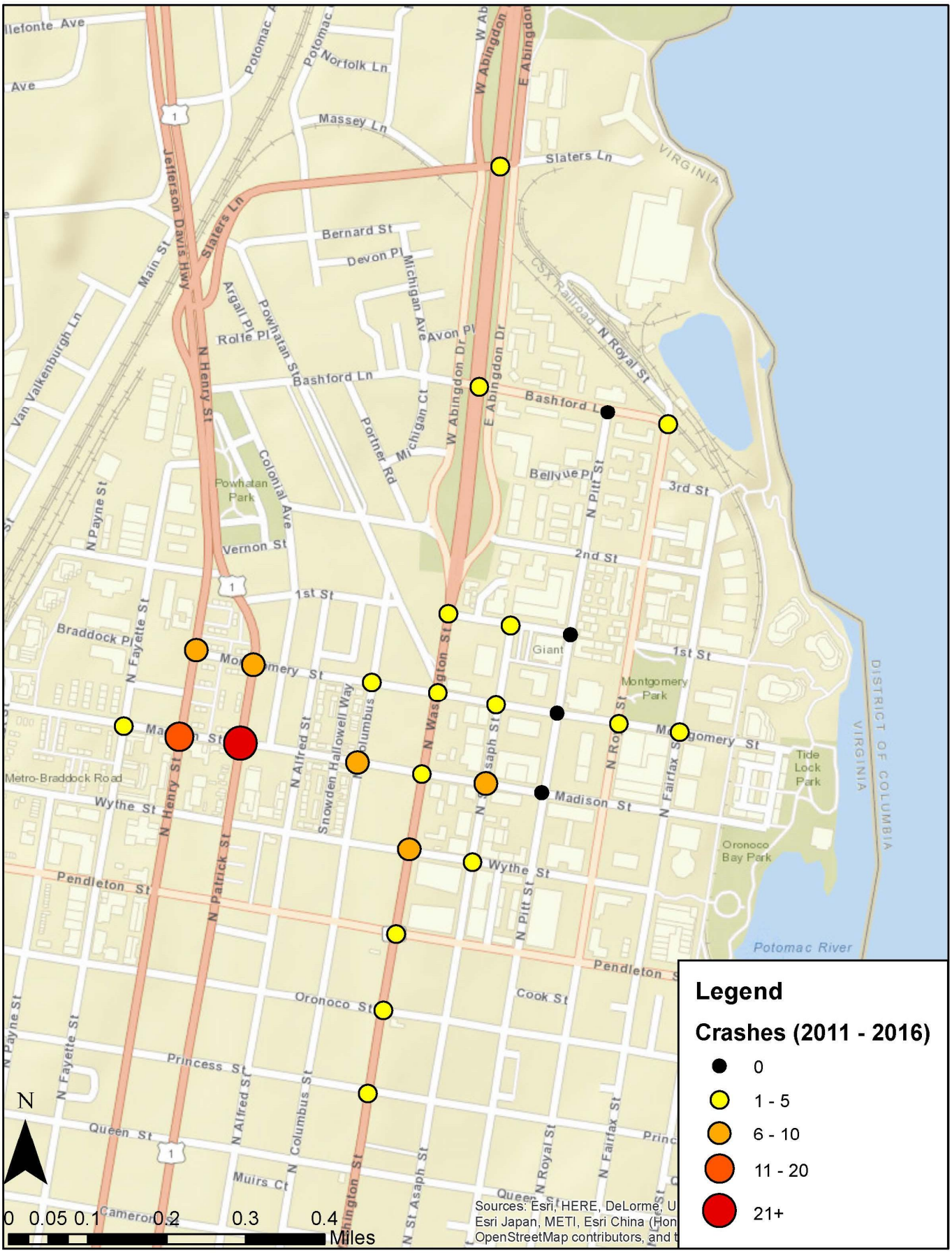
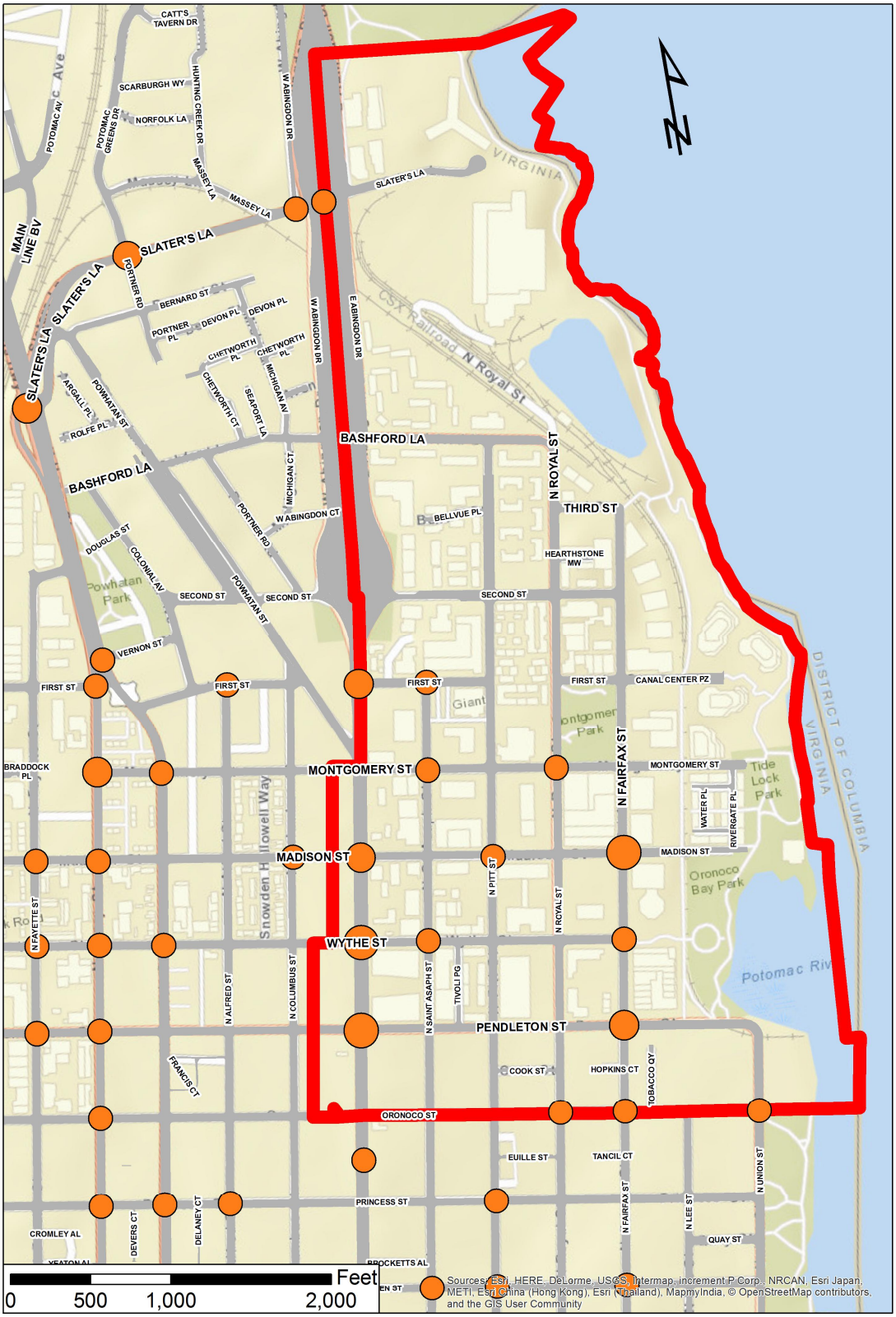


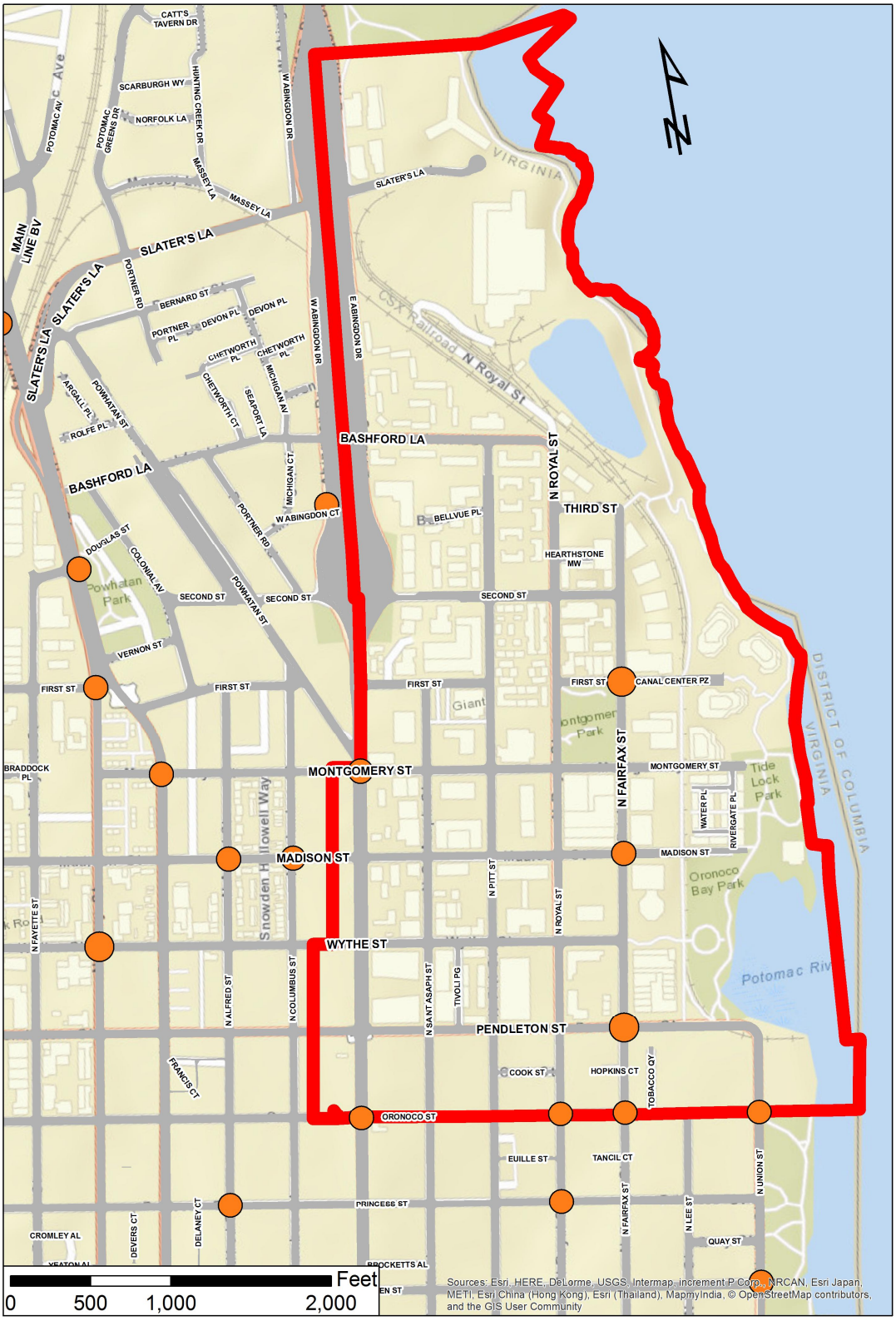
Figure 2-6: Vehicular Crashes at Small Area Plan Study Intersections 2011 – August 2016



Crashes Involving Pedestrians, 2005 - 2014

- 0
- 1
- 2
- 3 - 4
- 5 - 6

Figure 2-7: Pedestrian Crashes 2005-2014



Crashes Involving Bicyclists, 2005 - 2014

- 0
- 1
- 2
- 3 - 4

Figure 2-8: Bicycle Crashes 2005-2014

2.2. Transit Network

The Old Town North study area is served by multiple modes of transit, including Alexandria DASH bus, Washington Metropolitan Area Transit Authority (WMATA) Metrobus, WMATA Metrorail, and Virginia Railway Express (at King Street-Old Town Metrorail Station). Existing transit service in the study area is further described:

- **Metrorail -** The Old Town North area is served by the WMATA Yellow and Blue lines via the Braddock Road and King Street Metrorail stations
  - The *Braddock Road Metrorail station* is located at 700 N. West Street, approximately 0.47 mile west of the boundary of the Small Area Plan study area. Station amenities include short-term vehicle parking, bicycle parking (46 bike racks and 12 lockers), and car sharing. The station is served by WMATA Metrobus (Routes 10A and 10B), the Metroway, and DASH Bus (Routes AT2, AT3/4, AT3, AT4, AT5, and AT 8). The station opens at 4:55 AM Monday to Friday. The first trains depart at 5:05 AM for Mt. Vernon Square 7th Street-Convention Center, at 5:13 AM for Largo Town Center, at 5:35 AM for Franconia-Springfield, and at 5:46 AM for Huntington. The last trains depart at 11:39 PM for Fort Totten, at 11:42 PM for Fort Totten, at 12:31 AM for Franconia-Springfield, and at 12:33 AM for Huntington
  - The *King Street-Old Town Metrorail station* is located at 1900 King Street, approximately 0.80 mile southwest of the boundary of the Small Area Plan study area. Station amenities include short-term vehicle parking, bicycle parking (34 bike racks and 20 lockers), and car sharing. The station is served by WMATA Metrobus (Routes 28A and REX), and DASH Bus (Routes AT2, AT5, AT6, AT7, AT8, AT10, and the King Street Trolley. The station opens at 4:53 AM Monday to Friday. The first trains depart at 5:03 AM for Mt. Vernon Square 7th Street-Convention Center, at 5:11 AM for Largo Town Center, at 5:37 AM for Franconia-Springfield, and at 5:48 AM for Huntington. The last trains depart at 11:37 PM for Fort Totten and at 12:35 AM for Huntington. Reconstruction is planned for the King Street Metrorail station in 2017/2018 to improve pedestrian circulation and safety
- **Metroway -** *Metroway* is WMATA's enhanced bus service that provides service between Pentagon City and the Braddock Road Metrorail Station. The nearest Metroway stops are at the Braddock Road Metrorail Station west of the study area and at the intersection of US Route 1 and Potomac Avenue north of the study area. In the study area, Metroway buses travel along US Route 1. North of the study area the Metroway travels in dedicated bus-only lanes. During the peak periods, Metroway buses run every six minutes from Crystal City to Potomac Yard and every 12 minutes between Braddock Road and Pentagon City. A new stop is planned for the intersection of First Street and N. Fayette Street in the near future
- **Metrobus**
  - *Metrobus Routes 10A* (Alexandria-Pentagon Line) provides service, all-day, between Huntington Metrorail Station and the Pentagon Metrorail station. Through the study area, Route 10A provides service along Madison Street and N. Washington Street. During the weekday morning and evening peak periods Route 10A operates at approximately 30-minute headways
  - *Metrobus Routes 10E* (Alexandria-Pentagon Line) provides peak direction service between the Huntington Towers apartment complex and the Pentagon Metrorail station. Through the study area, Route 10E provides service along Powhatan Street and N. Washington Street. Route 10E operates northbound during the weekday AM peak period and southbound during the PM peak period at approximately 15- to 20-minute headways
  - *Metrobus Route 10B* (Hunting Towers-Ballston Line) provides service between Hunting Towers, Braddock Road Metrorail station, Shirlington, and the Ballston-MU Metrorail station. Through the study area, Route 10B provides service along Madison Street and Washington

Street. During the weekday morning and evening peak periods Route 10A operates at approximately 30-minute headways

- *Metrobus Route 11Y* (Mt. Vernon Express Line) provides service from Mt. Vernon to Potomac Park in the District of Columbia. Through the study area, Route 11Y runs along N. Washington Street/George Washington Memorial Parkway. Route 11Y is an express service running northbound during the weekday AM peak period and southbound during the PM peak period every 15 to 20 minutes. The number of stops is restricted to reduce travel times. Two stops within or in proximity to the study area include near N. Washington Street and King Street and near Abingdon Drive and Slater Lane

- **DASH bus service -** DASH bus service is described below and reflects service changes that went into effect in September 2016. A major component of the service changes was to consolidate transit away from N. Royal Street and onto N. Fairfax Street to support Royal street as a pedestrian and bicycle friendly street.

  - *DASH Route AT2 and AT2 Express* provides service between Lincolnia and Braddock Road Metrorail station via Old Town Alexandria. Through the study area, Route A2 runs along Montgomery Street, Columbus Street, Henry Street, Powhatan Street, Bashford Lane, N. Pitt Street, Second Street, and Fairfax Street. During the weekday morning peak period, the route operates at approximately 30-minute headways. During the weekday evening peak period, the route operates at approximately 15- to 20-minute headways. An AT2 express route operates from 6:13 AM to 9:31 AM and from 3:05 PM to 5:48 PM. The express route offers service between the King Street Metrorail station and Mark Center with limited stops

  - *DASH Route AT3* provides service between Hunting Point, Parkfairfax, and the Pentagon Metrorail station via Old Town Alexandria. Through the study area, Route AT3 runs along Pendleton Street, Royal Street, and Fairfax Street. During the weekday and evening peak periods, the route operates at approximately 20-minute headways

  - *DASH Route AT4* provides service between City Hall in Old Town Alexandria, Parkfairfax, and the Pentagon Metrorail station. Through the study area, Route AT4 runs along Montgomery Street, Madison Street and Fairfax Street. During the weekday morning and evening peak periods, the route operates at approximately 20-minute headways

  - *DASH Route AT3/4 Loop* provides midday service between City Hall in Old Town Alexandria, Parkfairfax, and the Pentagon Metrorail station. Through the study area, Route AT3/4 runs along Pendleton Street, Royal Street, and Fairfax Street. The route operates at 50- to 60-minute headways on weekdays

  - *DASH Route AT5* provides service between Braddock Metrorail Station, Landmark Mall, Van Dorn Metrorail Station, King Street-Old Town Metrorail Station, and Eisenhower Metrorail Station (weekends only). Through the study area, Route AT5 runs along Washington Street, Abingdon Drive, Slater Lane, Henry Street, Fayette Street, and First Street. During the weekday morning peak period, the route operates at approximately 30-minute headways. During the weekday evening peak period, the route operates at approximately 20-minute headways

  - *DASH Route AT8* provides service between Old Town Alexandria, Landmark Mall, Van Dorn Metrorail Station, King Street-Old Town Metrorail Station, and Braddock Road Metrorail Station. Through the study area, Route AT8 runs along Fairfax Street, Madison Street, Montgomery Street, N. Patrick Street, and First Street. During the weekday morning peak period, the route operates at approximately 20-minute headways (with 10-minute headways between King Street and Landmark Mall). During the weekday evening peak period, the route operates at approximately 20-minute headways (with 10-minute headways between King Street and Landmark Mall)

- **DOT Paratransit Program -** DOT is the City of Alexandria's specialized transportation service for residents of the City of Alexandria and visitors who cannot use regular transit buses or rail due to disability. Accommodations are for a cumulative 21-day period, during a 365-day period. Taxicabs and wheelchair-accessible vans provide trips. DOT provides service throughout the City of Alexandria, City of Falls Church, Arlington County, Fairfax County, and Fairfax City. Service operates seven days a week during the following times: 5:30 AM to midnight Monday to Thursdays, 5:30 AM to 3:00 AM Fridays, 6:30 AM to 3:00 AM Saturdays, and 7:00 AM to midnight Sundays

Figure 2-9 shows the transit routes and facilities described above. The map reflects DASH transit service upgrades and route modifications put into effect September 4, 2016. Transit use, in terms of 2013 reported boarding's and alightings, is shown in **Figures 2-10 and 2-11**, respectively. The transit use figures predate the September 2016 DASH service changes and Metroway.

Figure 2-9: Existing Transit Network

Figure 2-10: 2013 Average Daily Transit Boardings

Source: Project Brief

Figure 2-11: 2013 Average Daily Transit Alightings

Source: Project Brief

2.3. Pedestrian Network

Old Town North boasts a thorough and well-connected sidewalk network. The study area has an extensive street grid that helps to distribute car traffic (reducing volume) and creates a dense network of connections for people traveling by foot or bike. Many streets in the study area have street lights and support a comfortable, safe walking experience throughout different weather conditions and different times of day. Overall, the southern portion of the study area is well covered by tree canopy; however, there are some gaps along streets in the northern portion of the study area. Missing sidewalks are rare in the study area. The 2016 Pedestrian and Bicycle Master Plan update identifies two gaps in the sidewalk network:

1) The east side of North Union Street between Oronoco and Pendleton streets – It should be noted that the Robinson Terminal North redevelopment, once constructed, will improve the pedestrian facilities along this block.
2) North side of Wythe Street, near the Exxon station between N. Washington Street and N. St. Asaph Street – There is a funded project to improve this existing sidewalk gap.

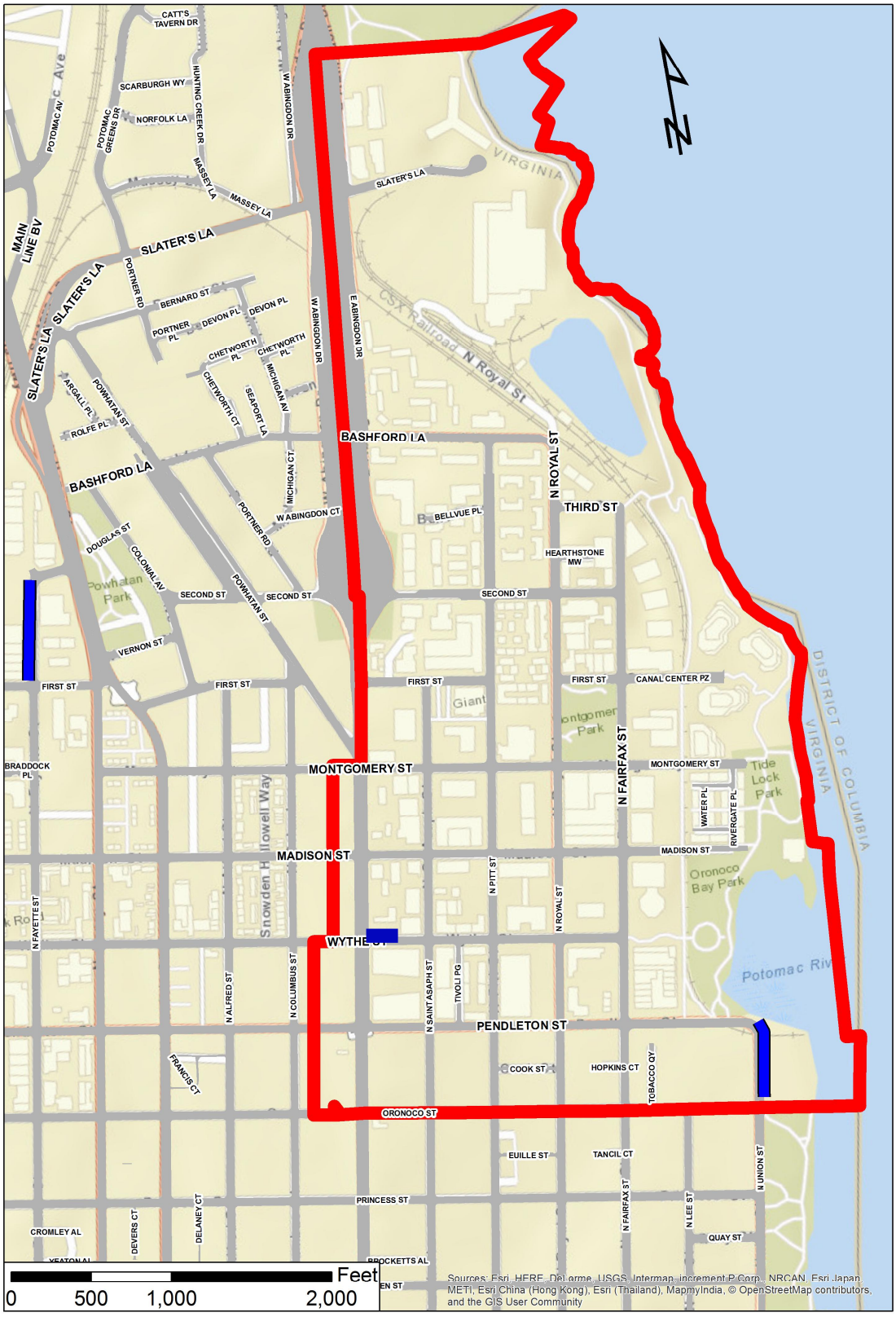
The Old Town North pedestrian network and identified sidewalk gaps are shown in **Figure 2-12.**

The sidewalk network provides connections to the transit stops and stations within and proximate to the study area. Sidewalks also connect Old Town North to its several parks, including Alexandria House Park, Oronoco Bay, Montgomery, Tide Lock, Rivergate, and Wythe Street Plaza as well as the George Washington Memorial Parkway.

Pedestrian counts within the study area are limited. During the collection of vehicular traffic data, the numbers of pedestrians using the study area intersection's crosswalks also was recorded. As previously noted, the peak hours of commuter traffic were identified as 7:15 to 8:15 AM and 5:00 to 6:00 PM. The peak hour pedestrian volumes using crosswalks at the study area are shown in **Figure 2-13.** In addition to the sidewalk network, pedestrians are served by the Mt. Vernon Trail and Mt. Vernon Trail spur described in the bicycle section.

Despite limited count information, data suggests that there is substantial demand for pedestrian access. The 2010-2014 American Community Survey estimates that 3.9 percent of the commuters in the two census tracts that cover Old Town North travel to work by walking.[1] 26 percent of the study area's households make less than $49,999 per year, representing a lower-income population for whom owning and maintaining a private car could be a financial burden. Additionally, 61 percent of users of the Braddock Road Metrorail station, the closest station to Old Town North, access the station via walking. According to student data submitted to the National Center for Safe Routes to School, 30 percent of students in the City of Alexandria walk to school and although there are no schools within the study area, both Jefferson-Houston School (Pre-K to 8th) and George Washington Middle School are within a 1-mile radius, which is equivalent to an approximate 20-minute walk.

[1] Census Tracts 2018.01 and 2018.02, which cover Old Town North, though they include some areas outside the study area.



Missing Sidewalks

Sidewalk Gaps

Figure 2-12: Study Area Sidewalk Gaps

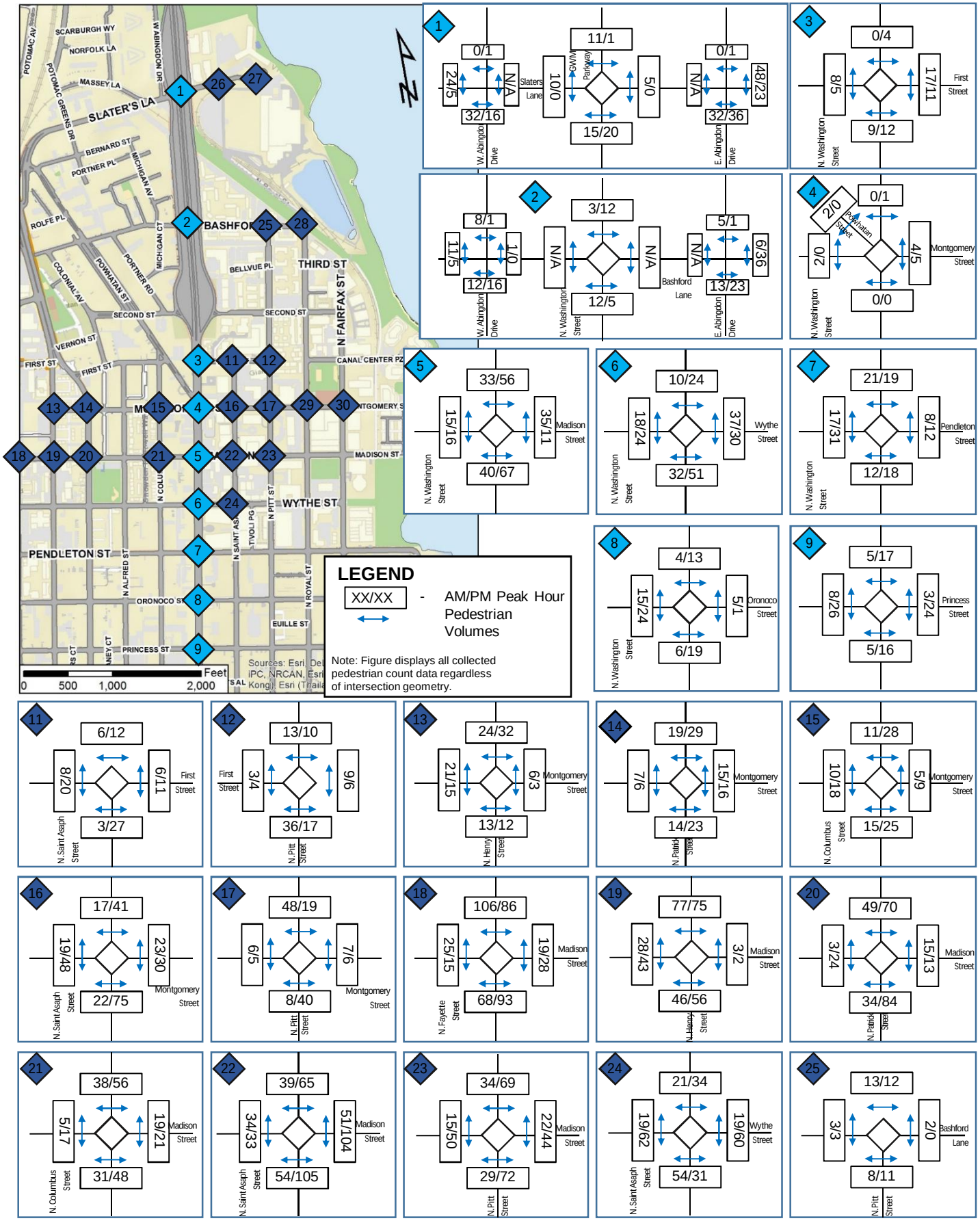


Figure 2-13: Existing Peak Hour Pedestrian Crosswalk Volumes

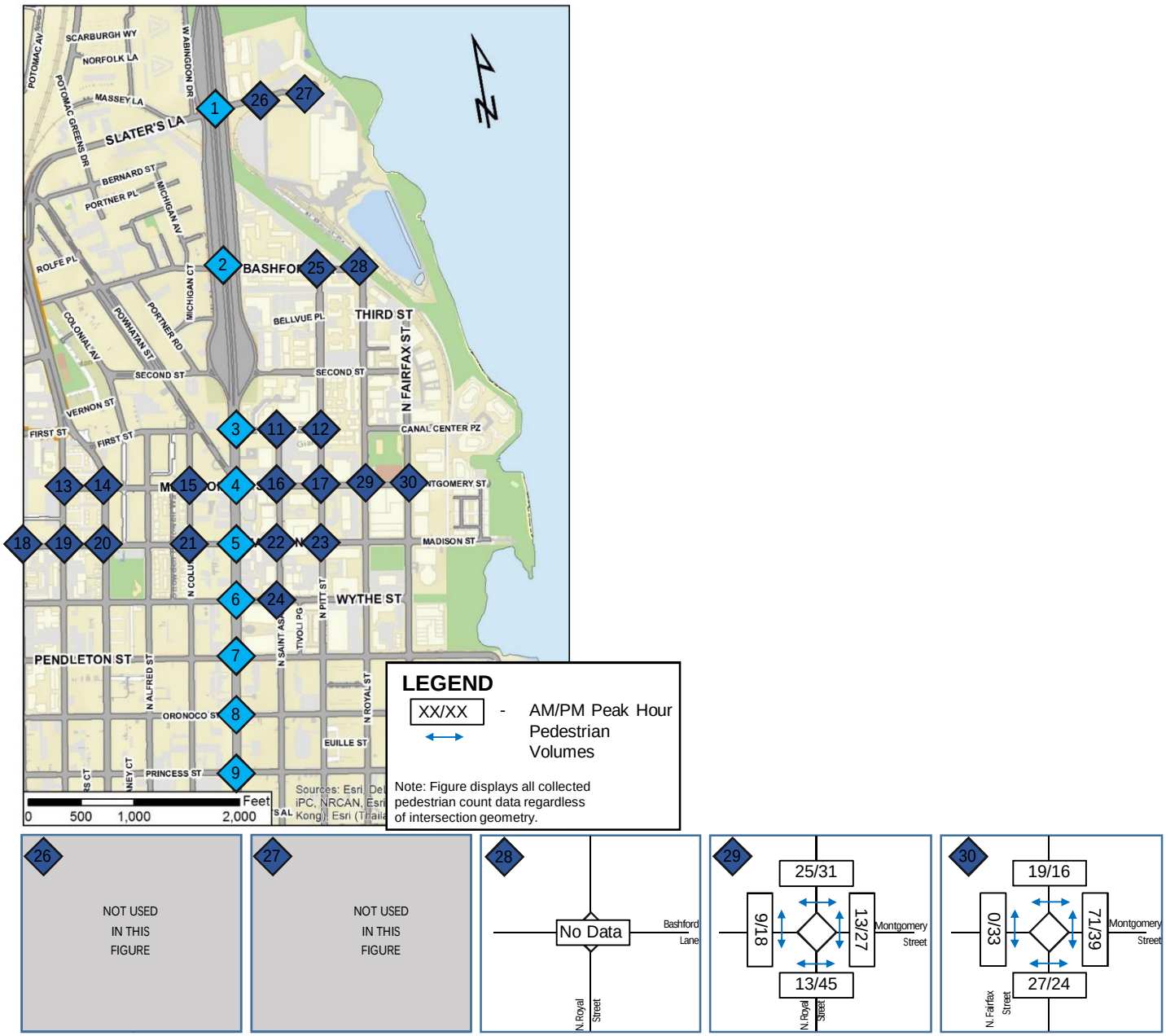


Figure 2-13 Existing Peak Hour Pedestrian Crosswalk Volumes

2.4. Bicycle Network

While Old Town North has a very extensive pedestrian network, the bicycle network in terms of dedicated facilities is very limited, with significant gaps in connections within the neighborhood and to other parts of the City. The Old Town North bicycle network in shown in **Figure 2-14**.

Streets in Old Town North are generally narrow with some wider streets in the northern portion of the study area, such as N. Royal Street between Bashford Lane and Second Street, and Second Street between N. Pitt Street and N. Royal Street. The study area streets accommodate slow-moving traffic, making them comfortable for bicycling; however, many lack signage or protected space for bicyclists. In particular, an east-west bicycle connection is missing between the Braddock Road Metrorail Station and the Mt. Vernon Trail/Waterfront area. The Pedestrian and Bicycle chapter of the Transportation Master Plan has identified Madison Street as the east-west connection because it links the Braddock Road Metrorail Station with the Waterfront. Additional north-south connections are needed in the eastern portion of the study area, particularly near the waterfront along Union Street where congested conditions are uncomfortable. The Pedestrian and Bicycle chapter of the Transportation Master Plan has identified N. Royal Street for a north-south connection due to its direct connections to the Mt. Vernon Trail on both ends.

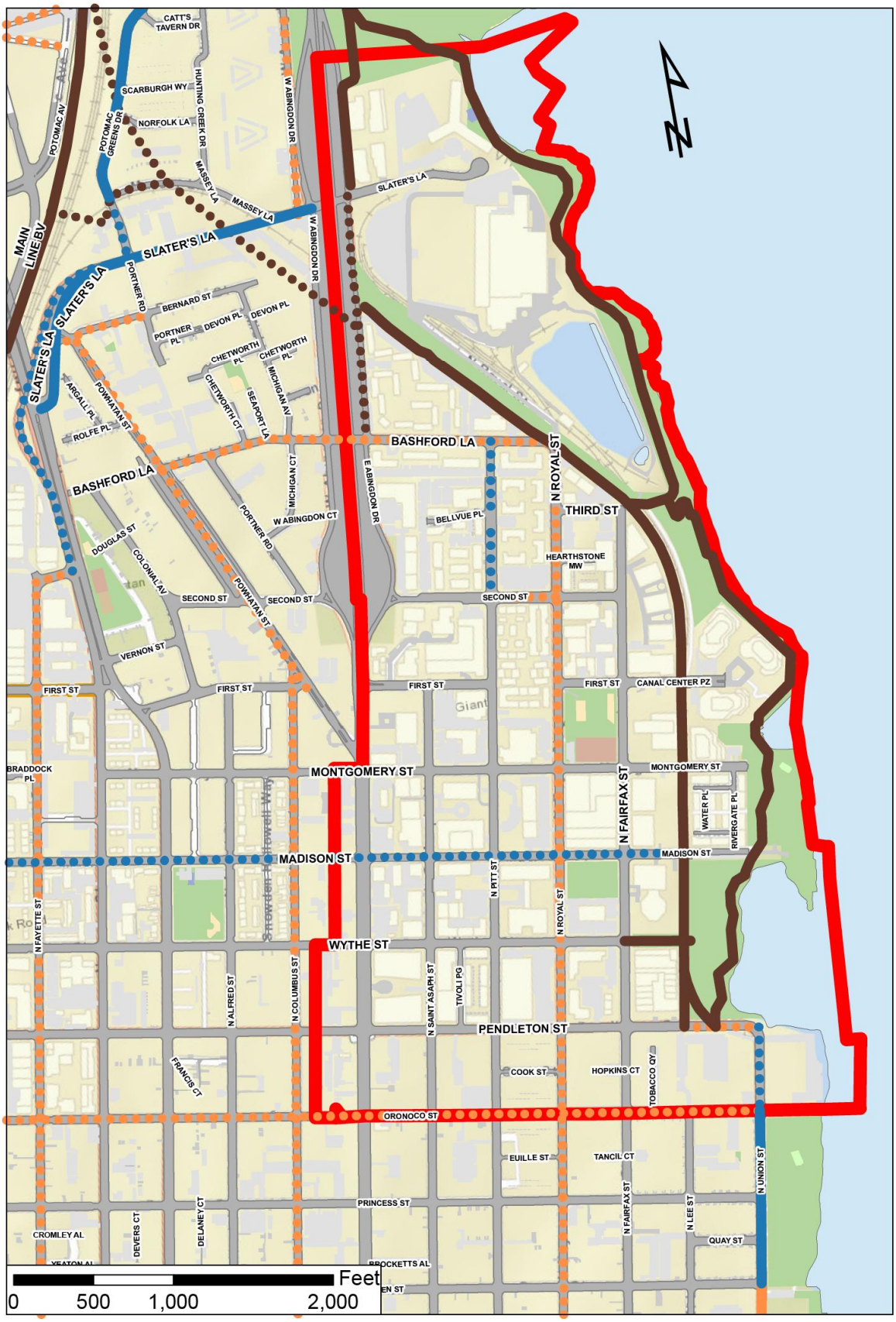
There is a designated bicycle route with shared lane markings on Pendleton Street between N. West Street and N. Union Street. The Pedestrian and Bicycle Master Plan proposes changing the designated bicycle route from Pendleton Street to Oronoco Street. This change is planned to occur with a future resurfacing of both streets. Old Town North has a set of Capital Bikeshare stations, providing access to the regional bike sharing network. The three 14-dock stations are located at the intersections of N. Saint Asaph Street with Pendleton Street and Madison Street, and the intersection of N. Fairfax Street and Madison Street. There are several public bike racks throughout the study area, though all but two of them are located south of Montgomery Street, leaving the north end of the study area lacking bike parking facilities. Capital Bikeshare and bike rack locations are shown in **Figure 2-15**.

During the collection of vehicular traffic data, bicycle turning movements at study area streets also were recorded. The peak hours of commuter traffic were identified as 7:15 to 8:15 AM and 5:00 to 6:00 PM. The bicycle turning movement volumes at the study area intersections during these peak hours are shown in **Figure 2-16**. While bicycle use data is limited, the 2010-2014 American Community Survey estimates that 1.8 percent of the commuters living in the two census tracts that cover Old Town North bike to work.[2] Capital Bikeshare recorded nearly 46,000 trips within the City of Alexandria between November 2014 and October 2015 (the most recent dates for which information is available). Just north of the study area, counts from the Alexandria Bicycle and Pedestrian Committee found that more than 947,000 bicycle trips were made on the Mt. Vernon Trail near Marina Road in 2012, or an average of 2,600 trips per day.[3] Trail users are likely to pass through Old Town North, indicating it is a major avenue for bicycle traffic.

The Mt. Vernon Trail provides a separated trail connection in two segments—the main trail, running north-south along the riverfront and Norfolk-Southern rail tracks to the Old Town North neighborhood, terminating at Pendleton Street, and the spur, running east-west between the George Washington Memorial Parkway and Canal Center Plaza. Pedestrian and bicycle activity along the trail and also the N. Royal Street and Montgomery Street corridors are shown in **Figure 2-17.**

[2] Census Tracts 2018.01 and 2018.02, which cover Old Town North, though they include some areas outside the study area.

[3] https://sites.google.com/site/alexandriabpac/resource-center/2012-city-of-alexandria-bicycle-and-pedestrian-count-report



Existing Bike Facilities

- Trail
- Advisory Bike Lane; Bike lane
- Shared Lane Markings
- Unpaved Nature Trail

Proposed Bike Facilities

- Trail
- Enhanced Bicycle Corridor
- Shared Roadway

Figure 2-14: Existing and Proposed Bicycle Facilities

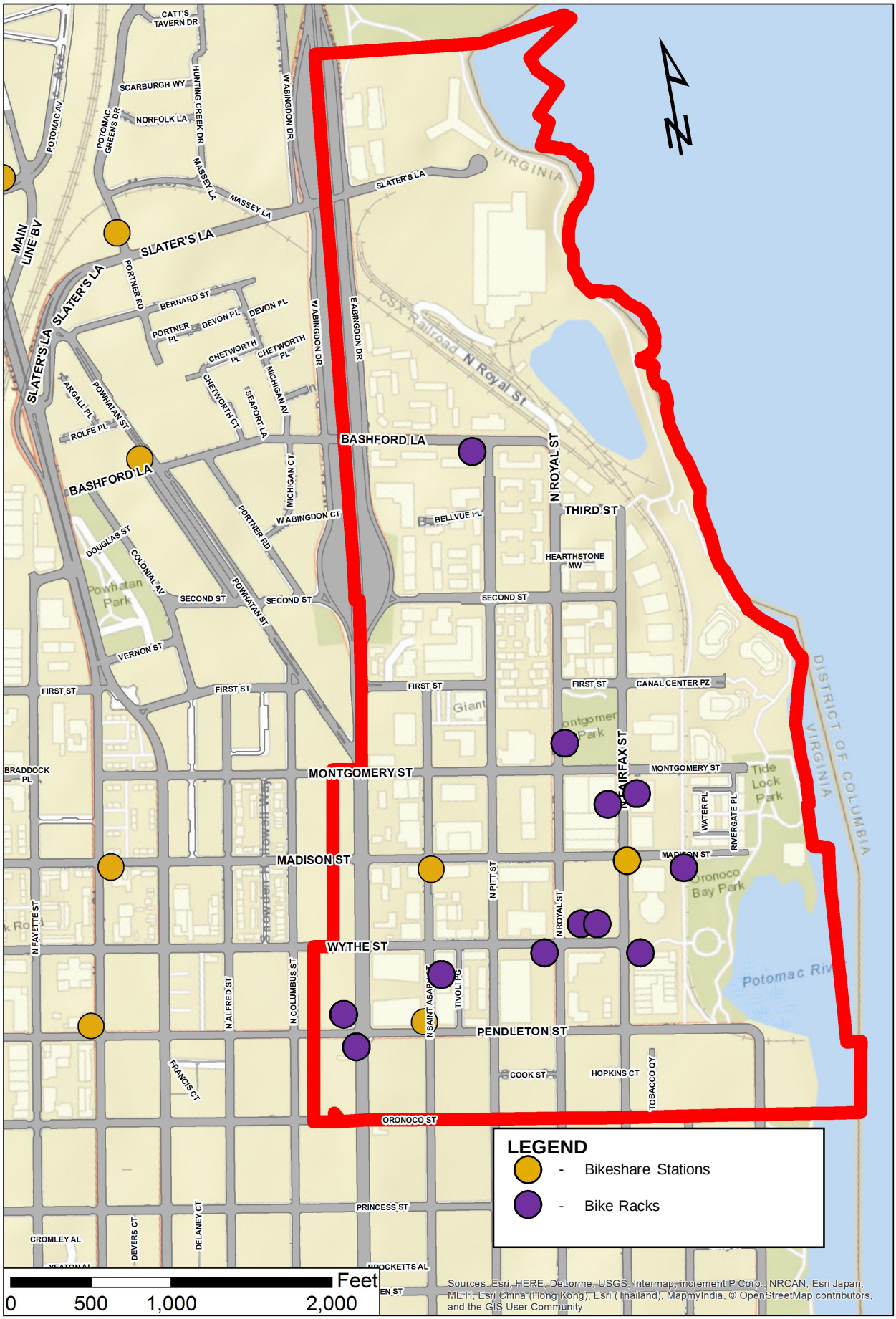


Figure 2-15: Capital Bikeshare and Bike Rack Locations

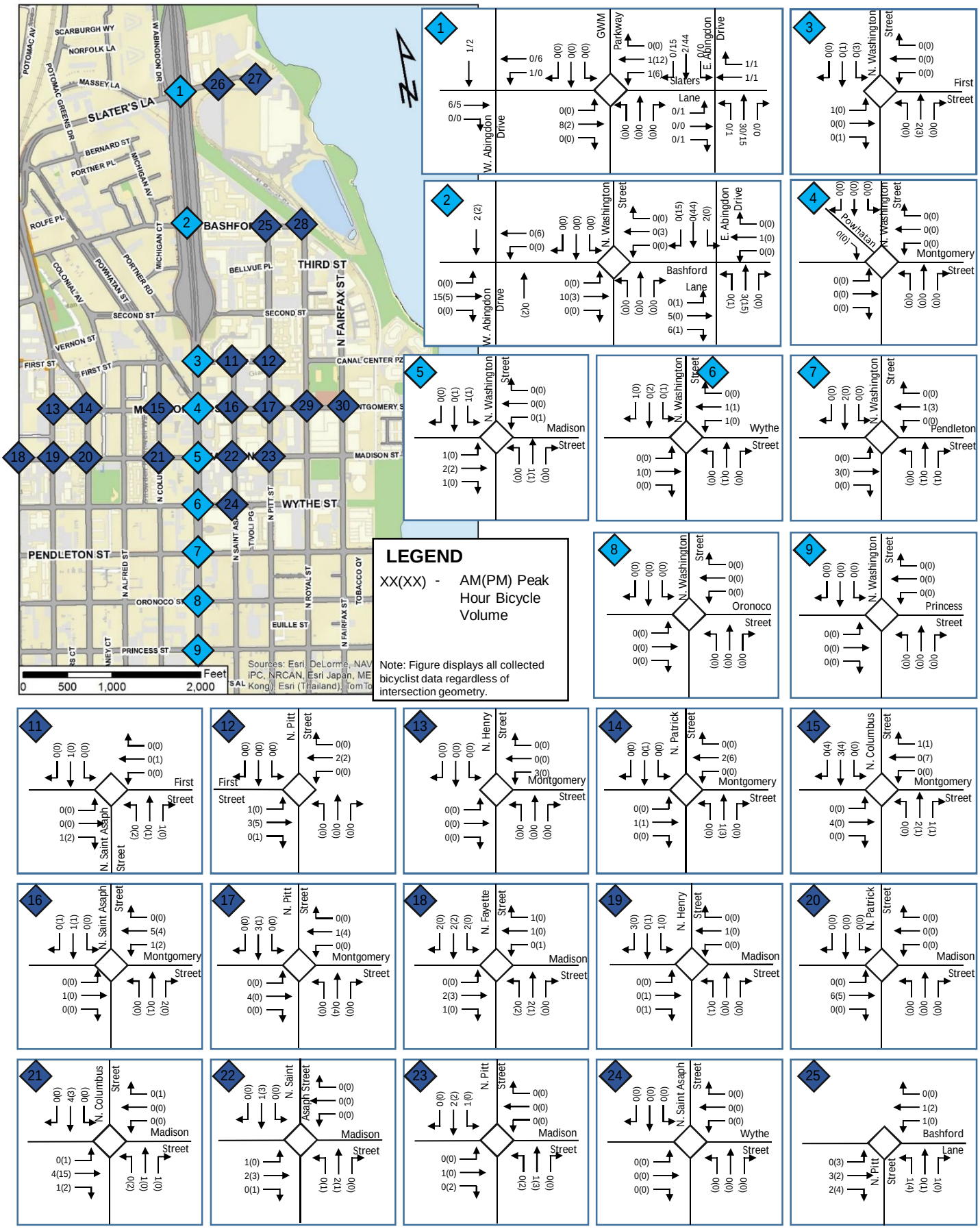
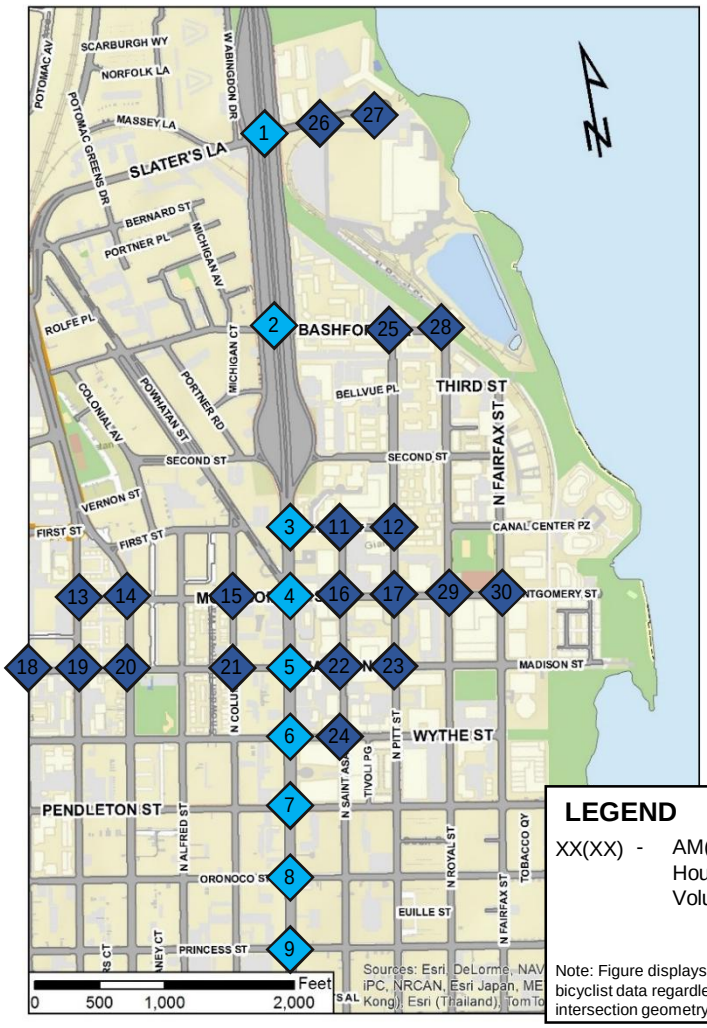


Figure 2-16: Existing Peak Hour Bicycle Volumes



LEGEND

XX(XX) - AM(PM) Peak Hour Bicycle Volume

Note: Figure displays all collected bicyclist data regardless of intersection geometry.

26

NOT USED IN THIS FIGURE

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NOT USED IN THIS FIGURE

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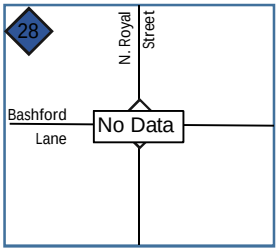

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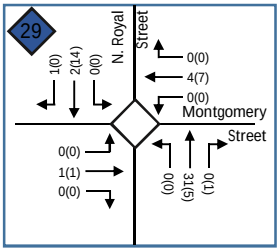

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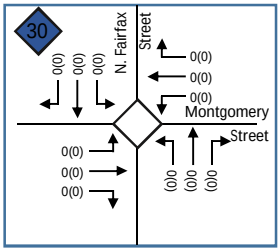
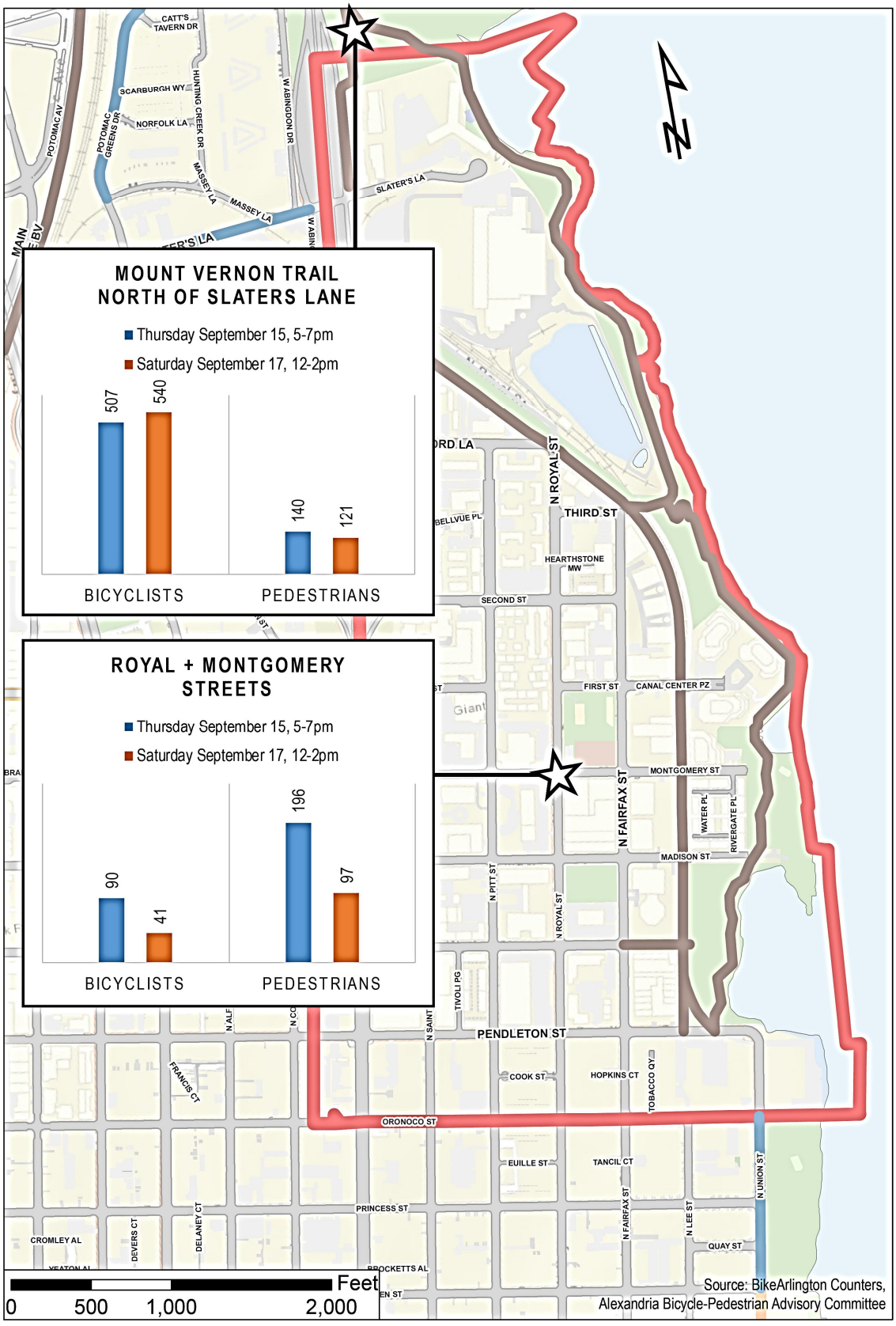


Figure 2-16: Existing Peak Hour Bicycle Volumes



Pedestrian and Bicycle Counts

☆ Count Locations

Figure 2-17: Pedestrian and Bicycle Counts along Mt. Vernon Trail and Royal/ Montgomery Corridor

2.5. Parking

Existing public and private parking facilities in Old Town North are shown on **Figure 2-18**. A parking study was prepared as a separate but related effort from this transportation study for the Old Town North Small Area Plan Update in the summer of 2016 by Fehr and Peers. The parking study was conducted to assess existing conditions, to determine whether there is sufficient parking supply in the Old Town North Area, and to identify parking management strategies for the Small Area Plan Update.

2.5.1. On-Street Parking Findings

The findings of the parking study indicate that there is an on-street parking supply of 1,159 spaces. Approximately one-third of these spaces allow unrestricted parking all-day. The remaining on-street parking spaces restrict parking to two hours or less, with a few blocks that limit parking to three hours. Additionally, the residential permit parking program allows participating District 9 residents to park on-street beyond any time restrictions that may exist on the block.

On-street parking is free in the Old Town North area, with the exception of N. Fairfax Street between First Street and Montgomery Street. The observed peak parking occupancies were 72 percent on a typical weekday (occurring during the hour beginning at 6:00 PM); 52 percent on Friday (also occurring during the 6:00 PM hour); and 67 percent on Saturday (occurring during the noon hour). At 85 percent occupancy, a street would be considered effectively full. Parking occupancy were observed to be lower along the metered block (approximately 33 percent of spaces occupied).

In the retail area, the average duration that a car remained parked ranged from 1.3 hours to 5.1 hours, with the longer durations observed where there were no parking restrictions. On-street parking occupancy during a typical weekday evening peak hour is shown on **Figure 2-19.**

2.5.2. Off-Street Parking Findings

The parking study considered eight off-street parking garages which accounted for a total off-street parking supply of 3,756 spaces. Overall, the area's off-street peak occupancy falls well below 85 percent and indicates a parking surplus. The peak parking occupancy for off-street garage parking was during a weekday morning and ranged between 25 to 82 percent. The observed average parking occupancies in the study area were 14 to 17 percent on a typical weekday evening (between 7:00 PM and 9:00 PM); 12 to 15 percent on typical Friday evening (between 7:00 PM and 9:00 PM);14 to 17 percent on Saturday mid-day (between 12:00 PM and 1:00 PM); and 12 to 15 percent on Saturday evening (between 7:00 PM and 9:00 PM). Additionally, no individual garage exceeded the 85 percent occupancy threshold during any observed time period. Averaged across the study area, the peak occupancy of off-street parking is about 50 percent with almost 1,900 off-street spaces vacant. Off-street parking occupancy during a typical weekday midday is shown on **Figure 2-20**.

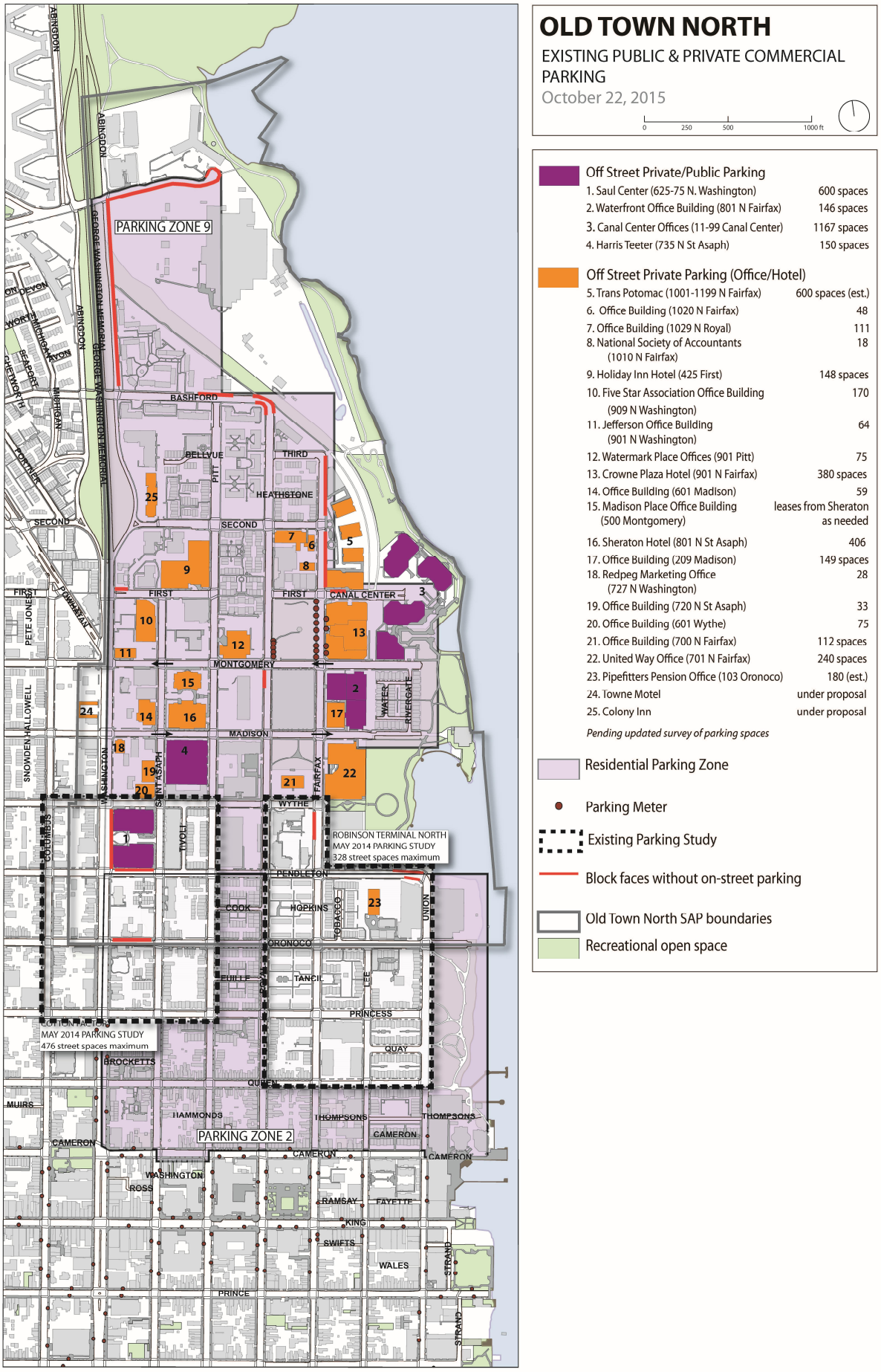


Figure 2-18: Existing Public and Private Commercial Parking Facilities

Source: Project Brief

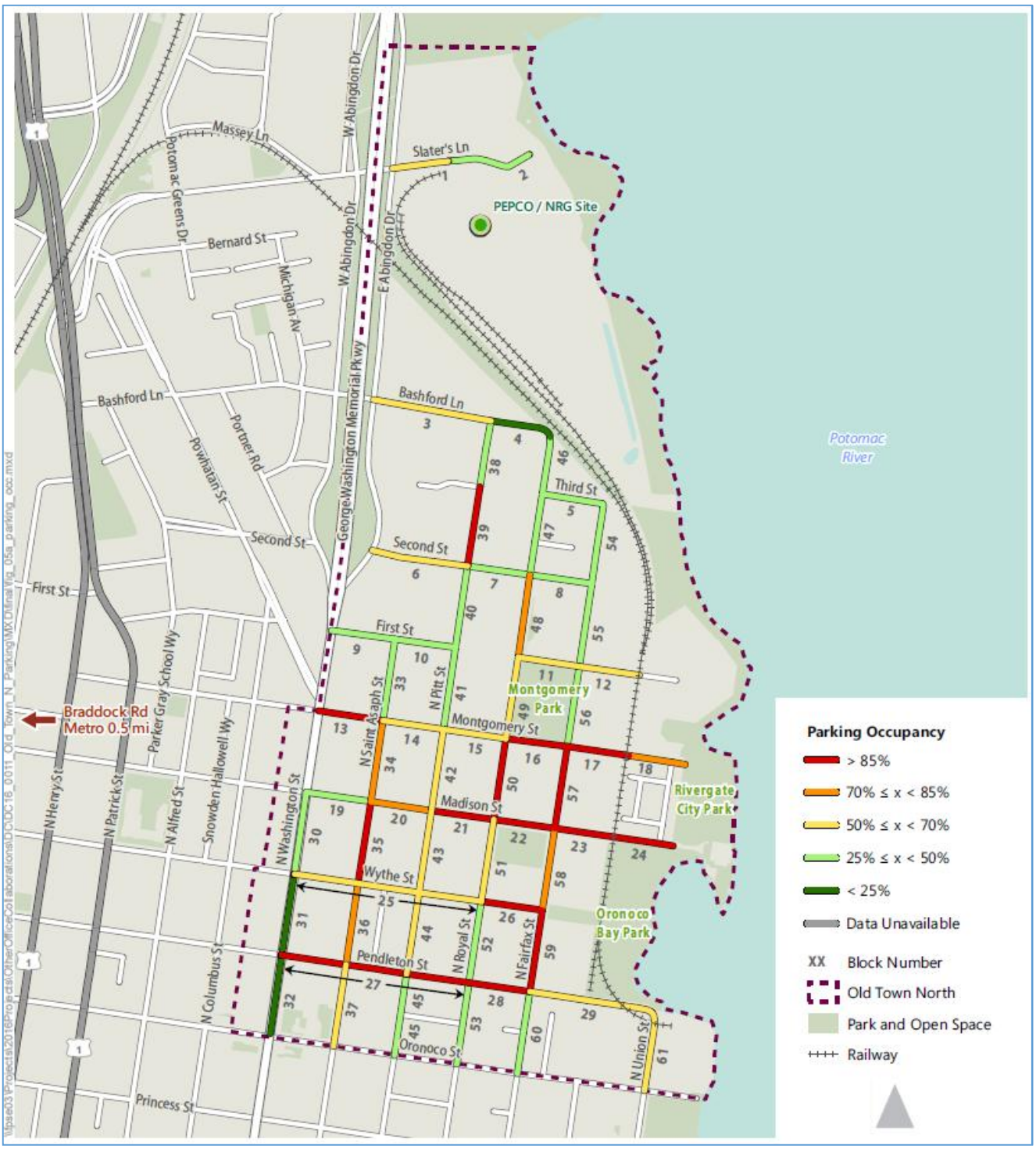


Figure 2-19: Typical Weekday Evening On-Street Parking Occupancy

Source: Old Town North Parking Study (2016)

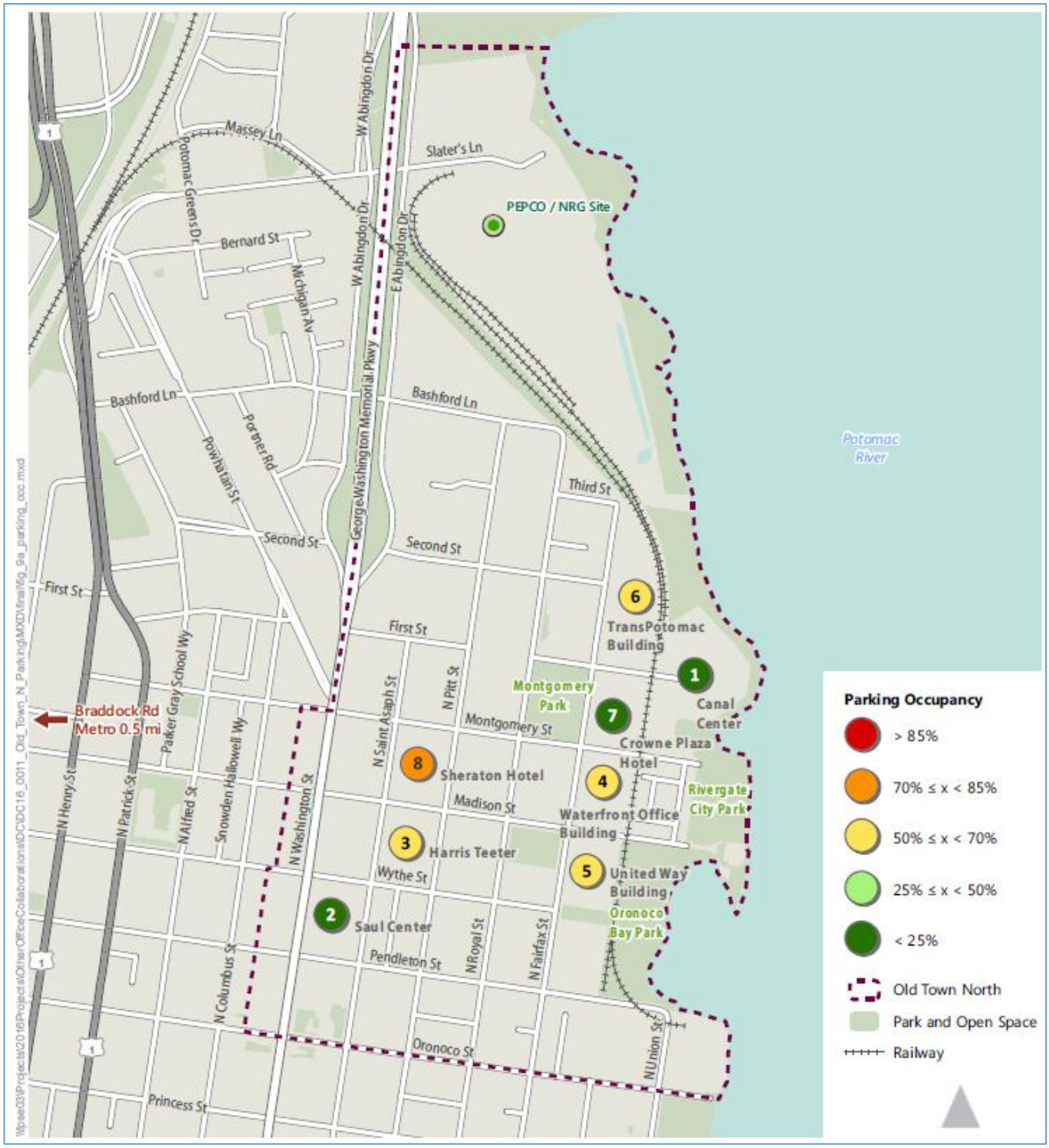


Figure 2-20: Existing Off-Street Weekday Mid-Day Peak Occupancy

Source: Old Town North Parking Study (2016)

3. Analysis of Existing Transportation Conditions

The existing conditions vehicular operations analysis was performed using both the Synchro and VISSIM software packages. A document, which further describes the analysis methodologies and assumptions, is included as **Appendix C**. **Figure 2-1** shows the study intersections and the software tool used for the analysis.

Synchro is a macroscopic analysis tool used to analyze traffic flow that considers aggregated traffic stream characteristics such as speed, flow, and density to evaluate roadway conditions using *Highway Capacity Manual* methodologies (i.e. based on control delay experienced at signalized and unsignalized intersections). Synchro 9.1 was used to analyze the 15 non-N. Washington Street intersections.

VISSIM is a microscopic analysis tool used to simulate the characteristics and interactions of individual vehicles. It includes algorithms and rules describing how vehicles move and interact within the transportation network, including acceleration, deceleration, and lane changing. VISSIM allows for flexibility to develop a wide range of roadway networks with respect to vehicle movements and roadway geometry and is one of the recommended tools for analyzing oversaturated conditions. VISSIM 8 has been used to analyze the nine intersections along N. Washington Street.

3.1. Synchro Analysis

Intersection capacity and queuing were conducted using the existing weekday AM and PM peak hour turning movement volumes for the non-N. Washington street study intersections. The capacity analyses were conducted using Synchro 9.1, which is based on methodologies contained in the *Highway Capacity Manual*, 2010 Edition for signalized and unsignalized intersections. The *Highway Capacity Manual* defines capacity as the maximum number of vehicles that can pass over a road segment or through an intersection within a fixed time duration. Operational conditions are described by a level of service, which is a qualitative measure that describes the operational conditions of an intersection or street and is an indicator of motorist perceptions within a traffic stream. The *Highway Capacity Manual* defines six levels of service, level of service A through F, with A as the best and F the worst. **Table 3-1** shows the level of service delay per vehicle for signalized and unsignalized intersections. The City of Alexandria does not maintain a minimum level of service standard. In most urban areas, level of service D and E are considered acceptable conditions particularly along heavily traveled arterial and collector streets. To run *Highway Capacity Manual* 2010 analyses, Synchro files were updated to NEMA standard phasing.

Table 3-1: Level of Service and Ranges of Delay

Level of Service	Average Control Delay per Vehicle (seconds)		General Service Description for Signalized Intersections
	Signalized Intersection	**Unsignalized Intersection**	
A	≤ 10	≤ 10	Free Flow
B	> 10 – 20	> 10 – 15	Stable Flow (slight delays)
C	> 20 – 35	> 15 – 25	Stable Flow (acceptable delays)
D	> 35 – 55	> 25 – 35	Approaching Unstable Flow (tolerable delays)
E	> 55 – 80	> 35 – 50	Unstable Flow (intolerable Delay)
F	> 80	> 50	Forced Flow (congested and queues fail to clear)
Source: Highway Capacity Manual, 2010 Edition			

Vehicle queuing is a measure of how far stopped vehicles spillback from a controlled approach to an intersection. Of relevance is the 95th percentile queue length, which represents the maximum distance to the back of the queue using 95th percentile traffic volumes. Synchro default parameters assume a queue length of 25 feet per stopped vehicle.

Existing conditions analyses were based on the existing peak hour turning movement volumes, pedestrian and bicycle volumes, lane designations, peak hour factors by approach, heavy vehicle percentages and bus blockage data, and existing traffic control and signal timing at the study intersections. Where information was not available, Synchro default values were used. Synchro analysis reports are provided in **Appendix D**.

The results of the existing conditions level of service and delay analyses are shown graphically in **Figure 2-4** and further detailed in **Table 3-2**. The results indicate that all intersections operate at overall intersection level of service D or better during the weekday AM and PM peak periods. All individual movements and approaches also operate at level of service D or better during the AM and PM peak periods.

The results of the existing conditions queuing analyses are shown in **Table 3-3**. The results indicate that vehicle queuing is not a significant issue at most study area intersections. Separate turn pockets are not present at most of the non-N. Washington Street intersections and existing queues for through and turning movements are accommodated within the available block lengths. Exceptions to this include:

- Northbound approach of N. Patrick Street and Montgomery Street during the AM peak hour – Vehicle queues exceed the available storage by 252 feet, or 10 vehicles. Additionally, because the volume exceeds the capacity of this approach, the actual 95th percentile queue length could be longer than reported. It is noted that the northbound left and through movements operate at level of service D during the AM peak hour
- Northbound approach of N. Patrick Street and Madison Street during the AM peak hour – Vehicle queues exceed the available storage by 330 feet, or 13 vehicles. Additionally, the 95th percentile queues are metered by the upstream signal which indicates that additional vehicles that would be in the vehicle queuing are unable to clear the upstream signal

Table 3-2: Existing Conditions Peak Hour Level of Service and Delay (seconds/vehicle)

Intersection	Mvt/Lane*	AM	PM
11. First Street and N. Saint Asaph Street			
Eastbound *(First Street)*	T	-	-
	R	-	-
	Overall	A (0)	A (0)
Westbound *(First Street)*	L	A (7.7)	A (8.4)
	T	A (0)	A (0)
	Overall	A (0.8)	A (1.6)
Northbound *(N. Saint Asaph Street)*	LR	B (11.9)	B (12.7)
	Overall	B (11.9)	B (12.7)
Overall Intersection		***A (4.2)***	***A (2.9)***
12. First Street and N. Pitt Street			
Eastbound (First Street)	LR	B (12.3)	B (11.3)
	Overall	B (12.3)	B (11.3)
Northbound *(N. Pitt Street)*	L	A (7.5)	A (7.6)
	T	A (0)	A (0)
	Overall	A (1.6)	A (3.7)
Southbound *(N. Pitt Street)*	T	-	-
	R	-	-
	Overall	A (0)	A (0)
Overall Intersection		***A (3.9)***	***A (7.2)***
13. N. Henry Street and Montgomery Street			
Westbound (Montgomery Street)	L	B (10.2)	C (25.5)
	Overall	B (10.2)	C (25.5)
Southbound *(N. Henry Street)*	L*	A (0)	A (0)
	T	B (15.2)	B (12.3)
	Overall	B (15.2)	B (12.3)
Overall Intersection		***B (14.7)***	***B (13.3)***
14. N. Patrick Street and Montgomery Street			
Westbound (Montgomery Street)	L*	A (0)	A (0)
	T	C (21.6)	B (16.7)
	R	C (22.6)	B (18.1)
	Overall	C (22.1)	B (17.5)
Northbound (N. Patrick Street)	L	D (45.9)	C (29.2)
	T	D (47.4)	C (28.5)
	R*	A (0)	A (0)
	Overall	D (46.8)	C (28.8)
Overall Intersection		***D (44.0)***	***C (27.1)***
15. N. Columbus Street and Montgomery Street			
Westbound (Montgomery Street)	L	A (8.7)	B (11.1)
	T	A (0)	A (0)
	R	A (8.6)	B (11.0)
	Overall	A (8.7)	B (11.1)
Northbound (N. Columbus Street)	L	A (5.2)	B (10.3)
	T	A (0)	A (0)
	R*	A (0)	A (0)
	Overall	A (5.2)	B (10.3)
Southbound (N. Columbus Street)	*L**	*A (0)*	*A (0)*
	T	A (0)	A (0)
	R	B (12.5)	B (12.5)
	Overall	B (12.5)	B (12.5)
Overall Intersection		***A (8.0)***	***B (11.6)***

*Illegal movement onto one-way street

Table 3-2: Existing Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/Lane	AM	PM
16. N. Saint Asaph Street and Montgomery Street			
Westbound (Montgomery Street)	L	B (18.2)	B (10.6)
	T	A (0)	A (0)
	R	B (18.1)	B (10.4)
	Overall	B (18.2)	B (10.5)
Northbound (N. Saint Asaph Street)	*L*	B (14.5)	C (20.6)
	T	A (0)	A (0)
	R*	A (0)	A (0)
	Overall	B (14.5)	C (20.6)
Southbound *(N. Saint Asaph Street)*	L*	A (0)	A (0)
	T	A (0)	A (0)
	R	B (18.2)	B (12.6)
	Overall	B (18.2)	B (12.6)
Overall Intersection		***B (16.3)***	***B (13.8)***
17. N. Pitt Street and Montgomery Street			
Westbound (Montgomery Street)	TL	A (9.1)	B (10.4)
	TR	A (9.0)	A (10.0)
	Overall	A (9.0)	B (10.2)
Northbound (N. Pitt Street)	*TL*	B (11.7)	A (9.8)
	Overall	B (11.7)	A (9.8)
Southbound (N. Pitt Street)	*TR*	A (8.5)	B (11.1)
	Overall	A (8.5)	B (11.1)
Overall Intersection		***B (10.5)***	***B (10.5)***
18. N. Fayette Street and Madison Street			
Eastbound (Madison Street)	TLR	B (10.4)	B (12.4)
	Overall	B (10.4)	B (12.4)
Westbound (Madison Street)	TLR	A (8.9)	B (12.5)
	Overall	A (8.9)	B (12.5)
Northbound (N. Fayette Street)	TLR	A (9.9)	B (12.0)
	Overall	A (9.9)	B (12.0)
Southbound (N. Fayette Street)	TLR	A (9.2)	C (21.0)
	Overall	A (9.2)	C (21.0)
Overall Intersection		***A (9.8)***	***C (16.1)***
19. N. Henry Street and Madison Street			
Eastbound (Madison Street)	L*	A (0)	A (0)
	T	A (0)	A (0)
	R	B (14.4)	C (23.1)
	Overall	B (14.4)	C (23.1)
Southbound (N. Henry Street)	L	B (17.7)	C (29.7)
	T	C (20.2)	C (31.0)
	R	B (19.9)	C (30.4)
	Overall	B (19.2)	C (30.3)
Overall Intersection		***B (18.6)***	***C (29.7)***
20. N. Patrick Street and Madison Street			
Eastbound *(Madison Street)*	L	C (20.7)	C (26.4)
	T	C (20.9)	C (26.8)
	R*	A (0)	A (0)
	Overall	C (20.8)	C (26.6)
Northbound *(N. Columbus Street)*	L*	A (0)	A (0)
	T	C (20.6)	B (16.6)
	R	C (23.9)	B (18.3)
	Overall	C (21.9)	B (17.2)
Overall Intersection		***C (21.8)***	***B (19.3)***

*Illegal movement onto one-way street

Table 3-2: Existing Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/Lane	AM	PM
21. N. Columbus Street and Madison Street			
Eastbound *(Madison Street)*	L	B (20.0)	B (11.7)
	T	A (0)	A (0)
	R	B (19.8)	B (11.6)
	Overall	B (19.9)	B (11.7)
Northbound *(N. Columbus Street)*	L*	A (0)	A (0)
	T	A (0)	A (0)
	R	C (20.4)	B (10.3)
	Overall	C (20.4)	B (10.3)
Southbound *(N. Columbus Street)*	L	B (17.9)	B (16.1)
	T	A (0)	A (0)
	R*	A (0)	A (0)
	Overall	B (17.9)	B (16.1)
Overall Intersection		***B (19.9)***	***B (13.4)***
22. N. Saint Asaph Street and Madison Street			
Eastbound *(Madison Street)*	L	B (18.6)	B (17.8)
	T	A (0)	A (0)
	R	B (18.4)	B (17.7)
	Overall	B (18.5)	B (17.8)
Northbound *(N. Saint Asaph Street)*	L*	A (0)	A (0)
	T	A (0)	A (0)
	R	A (5.1)	B (11.6)
	Overall	A (5.1)	B (11.6)
Southbound *(N. Saint Asaph Street)*	L	B (19.3)	B (18.7)
	T	A (0)	A (0)
	R*	A (0)	A (0)
	Overall	B (19.3)	B (18.7)
Overall Intersection		**B (14.1)**	**B (17.0)**
23. N. Pitt Street and Madison Street			
Eastbound (Madison Street)	TL	B (11.3)	B (10.9)
	TR	B (10.5)	B (10.8)
	Overall	B (10.9)	B (10.8)
Northbound (N. Pitt Street)	TR	B (12.9)	A (9.9)
	Overall	B (12.9)	A (9.9)
Southbound (N. Pitt Street)	TL	A (9.7)	B (13.7)
	Overall	A (9.7)	B (13.7)
Overall Intersection		**B (11.6)**	**B (11.9)**

*Illegal movement onto one-way street

Table 3-2: Existing Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/Lane	AM	PM
24. N. Saint Asaph Street and Wythe Street			
Eastbound *(Wythe Street)*	L	B (10.9)	A (3.2)
	T	A (0)	A (0)
	R	A (0)	A (0)
	Overall	B (10.9)	A (3.2)
Westbound *(Wythe Street)*	L	B (10.2)	B (11.0)
	T	A (0)	A (0)
	R	A (0)	A (0)
	Overall	B (10.2)	B (11.0)
Northbound *(N. Saint Asaph Street)*	L	B (13.3)	B (12.1)
	T	A (0)	A (0)
	R	A (0)	A (0)
	Overall	B (13.3)	B (12.1)
Southbound (N. Saint Asaph Street)	L	B (11.1)	A (4.8)
	T	A (0)	A (0)
	R	A (0)	A (0)
	Overall	B (11.1)	A (4.8)
Overall Intersection		**B (11.8)**	**A (6.9)**
25. N. Pitt Street and Bashford Lane			
Eastbound (Bashford Lane)	T	-	-
	R	-	-
	Overall	A (0)	A (0)
Westbound *(Bashford Lane)*	L	A (7.9)	A (7.6)
	T	A (0)	A (0)
	Overall	A (0.3)	A (0.2)
Northbound *(N. Pitt Street)*	LR	B (12.4)	B (12.1)
	Overall	B (12.4)	B (12.1)
Overall Intersection		**A (2.5)**	**A (1.3)**
29. N. Royal Street and Montgomery Street			
Westbound (Montgomery Street)	TL	A (8.8)	A (9.8)
	TR	A (8.5)	A (9.4)
	Overall	A (8.7)	A (9.6)
Northbound (N. Royal Street)	*TL*	B (10.4)	A (9.5)
	Overall	B (10.4)	A (9.5)
Southbound (N. Royal Street)	*TR*	A (7.5)	A (9.1)
	Overall	A (7.5)	A (9.1)
Overall Intersection		**A (9.7)**	**A (9.4)**
30. N. Fairfax Street and Montgomery Street			
Westbound (Montgomery Street)	TL	A (8.8)	A (9.7)
	TR	A (8.4)	A (9.1)
	Overall	A (8.6)	A (9.4)
Northbound (N. Fairfax Street)	*TL*	B (11.7)	A (9.8)
	Overall	B (11.7)	A (9.8)
Southbound (N. Fairfax Street)	*TR*	A (7.9)	B (12.7)
	Overall	A (7.9)	B (12.7)
Overall Intersection		**B (10.8)**	**B (11.4)**

Table 3-3: Existing Conditions Peak Hour Vehicle Queuing (feet)

Intersection	Lane Group	Existing Block Length	AM	PM
11. First Street and N. Saint Asaph Street				
Westbound (First Street)	TL	240	0	0
Northbound (N. Saint Asaph Street)	LR	345	23	18
12. First Street and N. Pitt Street				
Eastbound (First Street)	LR	240	20	38
Northbound (N. Pitt Street)	TL	345	5	3
13. N. Henry Street and Montgomery Street				
Westbound (Montgomery Street)	L	240	m55	m51
Southbound (N. Henry Street)	T	345	221	284
14. N. Patrick Street and Montgomery Street				
Westbound (Montgomery Street)	TL	240	85	66
Northbound (N. Patrick Street)	TR	345	m#597	12
15. N. Columbus Street and Montgomery Street				
Westbound (Montgomery Street)	TL/TR	240	4	m48
Northbound (N. Columbus Street)	TL	345	53	19
Southbound (N. Columbus Street)	TR	340	27	110
16. N. Saint Asaph Street and Montgomery Street				
Westbound (Montgomery Street)	TL/TR	235	51	60
Northbound (N. Saint Asaph Street)	TL	*345*	101	89
Southbound (N. Saint Asaph Street)	TR	345	m67	109
17. N. Pitt Street and Montgomery Street				
Westbound (Montgomery Street)	TL	245	8	25
	TR	245	13	23
Northbound (N. Pitt Street)	TL	*345*	68	23
Southbound (N. Pitt Street)	TR	*345*	13	48
18. N. Fayette Street and Madison Street				
Eastbound (Madison Street)	LTR	555	35	35
Westbound (Madison Street)	LTR	245	13	35
Northbound (N. Fayette Street)	LTR	345	30	40
Southbound (N. Fayette Street)	LTR	365	15	143
19. N. Henry Street and Madison Street				
Eastbound (Madison Street)	TR	245	101	123
Southbound (N. Henry Street)	TR/TL	355	215	0
20. N. Patrick Street and Madison Street				
Eastbound (Madison Street)	TL	235	75	m131
Northbound (N. Columbus Street)	TR	345	#675	282
21. N. Columbus Street and Madison Street				
Eastbound (Madison Street)	TL/TR	240	102	71
Northbound (N. Columbus Street)	TR	345	125	19
Southbound (N. Columbus Street)	TL	345	34	63

m- volume for 95th percentile queue is metered by upstream signal
#- 95th percentile volume exceeds capacity; queue may theoretically be longer. Queue shown is maximum after two cycles

Table 3-3: Existing Conditions Peak Hour Vehicle Queuing (feet) Continued

Intersection	Movement/ Lane	Existing Block Length	AM	PM
22. N. Saint Asaph Street and Madison Street				
Eastbound (Madison Street)	TL/TR	235	m28	25
Northbound (N. Saint Asaph Street)	TR	350	191	36
Southbound (N. Saint Asaph Street)	TL	340	24	123
23. N. Pitt Street and Madison Street				
Eastbound (Madison Street)	TL	230	28	28
	TR	230	28	30
Northbound (N. Pitt Street)	TR	345	70	20
Southbound (N. Pitt Street)	TL	345	15	75
24. N. Saint Asaph Street and Wythe Street				
Eastbound (Wythe Street)	LTR	235	m61	78
Westbound (Wythe Street)	LTR	240	57	90
Northbound (N. Saint Asaph Street)	LTR	345	128	63
Southbound (N. Saint Asaph Street)	LTR	345	2	83
25. N. Pitt Street and Bashford Lane				
Westbound (Bashford Lane)	TL	535	0	0
Northbound (N. Pitt Street)	LR	665	15	8
Eastbound (Bashford Lane)	LR	540	0	0
29. N. Royal Street and Montgomery Street				
Westbound *(Montgomery Street)*	L	230	8	23
	T	230	8	18
Northbound *(N. Royal Street)*	T	345	50	23
Southbound *(N. Royal Street)*	T	345	5	23
30. N. Fairfax Street and Montgomery Street				
Westbound *(Montgomery Street)*	L	240	3	8
	T	240	3	8
Northbound *(N. Fairfax Street)*	T	345	78	33
Southbound *(N. Fairfax Street)*	T	345	10	88

m- volume for 95th percentile queue is metered by upstream signal
#- 95th percentile volume exceeds capacity; queue may theoretically be longer. Queue shown is maximum after two cycles

3.2. VISSIM Analysis

Analysis of existing transportation conditions along N. Washington Street was completed using VISSIM 8. Models for weekday AM and PM peak periods were developed and calibrated to field conditions according to the methodology presented in **Appendix C**. The models include 9 intersections from Slaters Lane to Princess Street. Multiple modes of transportation are included: single-occupancy vehicles, high-occupancy (HOV) vehicles, heavy vehicles, transit bus (existing DASH and Metrobus service), pedestrians, and bicycles. HOV percentages ranges from 25 to 35 percent along N. Washington Street. The traffic count data for the entire Old Town North study area was used to determine the AM and PM network peak hours (as described in Section 2.1) and the simulation period for VISSIM analysis. The analysis includes a 30-minute seeding period (period that populates the model with traffic) and a 2-hour analysis period that spans the peak hour (see **Table 3-4** and **Figure 3-1**).

Table 3-4: VISSIM Simulation Period

	Seeding Period	Peak Hour	Simulation Period
AM	6:30 AM – 7:00 AM	7:15 AM – 8:15 AM	6:30 AM – 9:00 AM
PM	4:00 PM – 4:30 PM	5:00 PM – 6:00 PM	4:00 PM – 6:30 PM

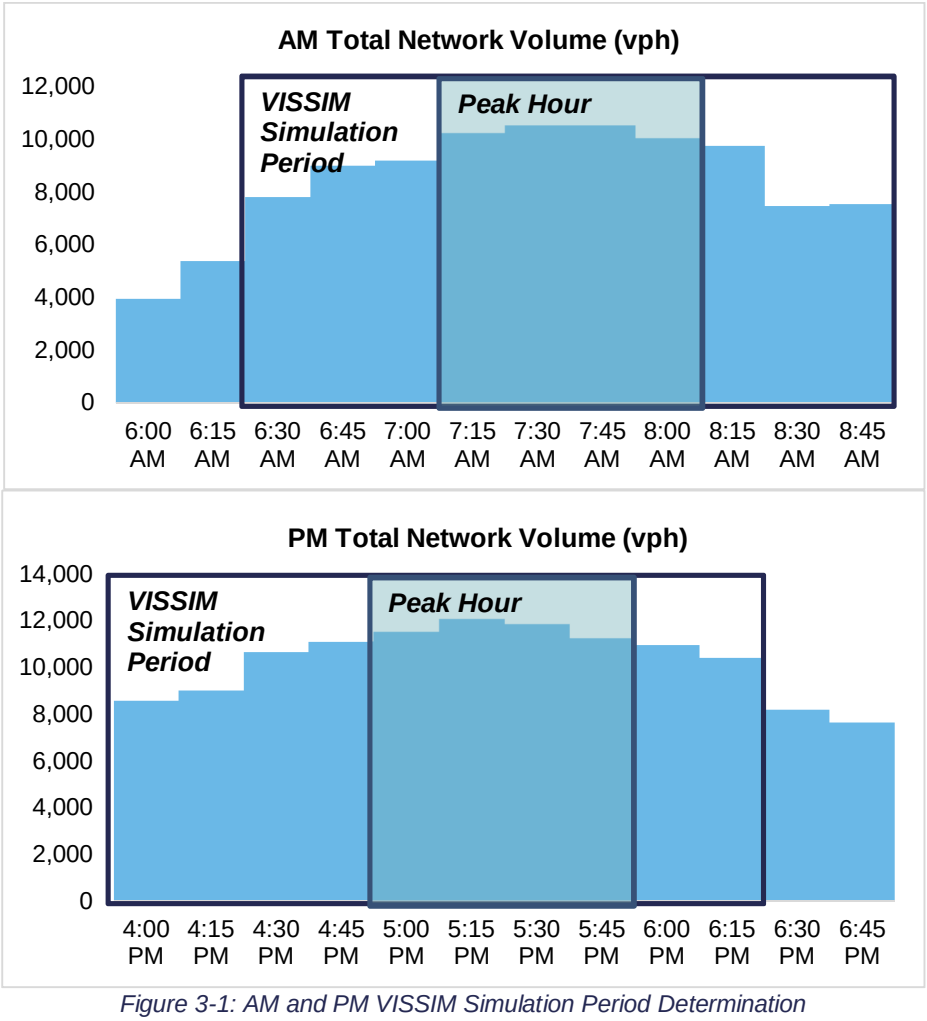


Figure 3-1: AM and PM VISSIM Simulation Period Determination

The measures of effectiveness (MOEs) obtained from the calibrated models include delay and level of service at intersections, travel time for northbound and southbound N. Washington Street, and average and maximum queue length for intersection approaches. Due to the stochastic nature of microsimulation, results presented are from an average of 10 simulation runs.

VISSIM reports control delay in seconds of delay per vehicle (s/veh) rather than in units of passenger car equivalents like a typical *Highway Capacity Manual*-based analysis. Nevertheless, simulated intersection level of service (LOS) is reported using the *Highway Capacity Manual* delay-based LOS thresholds for signalized intersections. The following sections present the steps taken to calibrate the model and the traffic operations of the AM and PM peak period.

3.2.1. Calibration of Existing Conditions Models

The existing condition models were calibrated using guidance provided by the City in the Transportation Planning Administrative Guidelines for Multi-modal Transportation Studies. Calibration was based on the measures of simulated approach volume, sum of simulated approach volumes, travel time, and approach queue length in comparison to field data. Due to the limited field observations conducted for maximum queue length, the focus of calibration was on volume and travel time criteria. Detailed calibration criteria and thresholds for each measure are summarized in the methodology in **Appendix C**.

Calibrating the VISSIM models to meet the thresholds involved adjusting specific parameters to achieve target conditions. The primary parameters adjusted include:

- **Driver behavior:** Car-following parameters effectively change roadway capacity by adjusting vehicle spacing and headways to achieve desired traffic flow conditions. Two car-following parameters were adjusted to create behaviors that essentially adjust the headways vehicles maintain:
  - Additive part of safety distance
  - Multiplicative part of safety distance

A higher capacity behavior was used at select locations in the AM period that effectively reduces vehicle spacing and headway to better replicate more aggressive driving in very congested conditions (e.g., northbound E. Abingdon Drive lane drop upstream of merge with N. Washington Street, eastbound and westbound Bashford Lane). A lower capacity behavior was used on northbound N. Washington Street north of First Street in the AM period that increases vehicle spacing to replicate conditions in this transitional area from closely spaced urban intersections to further spaced intersections at higher desired speeds.

VISSIM also includes parameters for necessary (to make a turning movement) and discretionary (for higher speeds) lane changes. Three lane-changing parameters were modified to create a behavior used in particular model locations:

- Maximum and accepted deceleration between the vehicle making a necessary lane change and the vehicle that is being passed
- Safety reduction factor
- Maximum deceleration rate for cooperative breaking

In areas where significant lane-change conditions were identified (e.g., northbound N. Washington Street at First Street), default driving behavior was adjusted in the traffic simulation model to account for drivers with more aggressive and/or cooperative lane-changing behaviors.

- **Lane-change look-back distance:** Lane-change look-back distance is the distance in VISSIM where a vehicle starts attempting to make a lane change to a target lane prior to a lane drop or change in direction in travel. This parameter was adjusted on a case-by-case basis with the goal of replicating field conditions and removing unrealistic lane-changing behavior creating artificial congestion.
    - **External congestion:** Some locations in the study area operate under constrained conditions due to spillback caused by congestion or intersections outside the study area. It was necessary to replicate this congestion to induce queuing and slower travel times observed in the field. Modification of free-flow speeds at the edge of the network to replicate existing upstream and downstream congestion is an industry-accepted technique used in the calibration process. Exiting speeds at the northern terminus of the network were reduced during the AM period to replicate the northbound congestion on George Washington Memorial Parkway outside of the study area. Speeds were set based on available data in the Regional Integrated Transportation Information System (RITIS) as provided by INRIX, a transportation analytics company. In the PM period, speeds were reduced at the southern terminus of the network to replicate the spillback that occurs from the downstream intersections of Washington Street with King Street and Cameron Street.

An overall summary of the calibration of the existing conditions AM and PM VISSIM models is provided in **Table 3-5** and **Table 3-6**, respectively. Nearly every volume and travel time calibration criterion was met. AM northbound simulated travel time is lower than the field recorded travel time, yet it closely matches INRIX travel time which was aggregated over a longer sample period and concluded to be more representative of existing conditions. Queue length criteria was not met for AM and PM. The field observed queue data was collected as a spot check and observations were likely not long enough to capture the maximum queue estimated by VISSIM. Nevertheless, it is concluded that the models are reasonably calibrated to represent existing conditions.

Table 3-5: AM Calibration Summary

Calibration Item	Basis	Criteria	Subtotal	Total	Percent	Target	Target Met
Simulated Approach Volume	Approaches (n = 38)	Within ± 100 vph for < 700 vph	27	38	100%	100%	**Yes**
		Within ± 15% for ≥ 700 vph to < 2,700 vph	11				
		Within ± 400 vph for ≥ 2,700 vph	0				
		GEH Statistic[4] < 5	38	38	100%	85%	**Yes**
Sum of Simulated Approach Volumes	Approaches (n = 38)	Within 5% of Target	-	-	-	-	**Yes**
		GEH Statistic[1] < 4	-	-	-	-	**Yes**
Simulated Travel Time	Direction	Within ± 15% for average observed travel time of entire corridor	-	1	50%	100%	**No**
Simulated Queue Length	Approaches (n = 29)	Within ± 30% for observed maximum queue lengths	-	7	24%	85%	**No**

Table 3-6: PM Calibration Summary

Calibration Item	Basis	Criteria	Subtotal	Total	Percent	Target	Target Met
Simulated Approach Volume	Approaches (n = 38)	Within ± 100 vph for < 700 vph	19	38	100%	100%	**Yes**
		Within ± 15% for ≥ 700 vph to < 2,700 vph	19				
		Within ± 400 vph for ≥ 2,700 vph	0				
		GEH Statistic[1] < 5	38	38	100%	85%	**Yes**
Sum of Simulated Approach Volumes	Approaches (n = 38)	Within 5% of Target	-	-	-	-	**Yes**
		GEH Statistic[1] < 4	-	-	-	-	**Yes**
Simulated Travel Time	Direction	Within ± 15% for average observed travel time of entire corridor	-	2	100%	100%	**Yes**
Simulated Queue Length	Approaches (n = 29)	Within ± 30% for observed maximum queue lengths	-	6	21%	85%	**No**

[4] The GEH Statistic is calculated as $GEH = \frac{\sqrt{(M-C)^2}}{(M-C)^2}$ where M is the model volume and C is the field count

Volume Calibration

Calibration of model throughput at intersection approaches was accomplished using balanced peak hour traffic volume targets. Approach throughput and the GEH Statistic criteria met the calibration criteria for every approach in the AM and PM, surpassing the 85% threshold. The GEH statistic is an empirical formula used to compare top sets of traffic volumes. The sum of AM simulated approach volume is 26,868 vph compared to the target of 27,478 vph; this is a -2% difference with a GEH Statistic of 3.7. The sum of PM simulated approach volume is 33,810 vph compared to the target of 34,064 vph; this is a -1% difference with a GEH Statistic of 1.4. Tables comparing throughput and balanced traffic counts for individual approaches are included in **Appendix E**.

Travel Time Calibration

Calibration of model travel time for northbound and southbound N. Washington Street between Slaters Lane and Princess Street was accomplished using travel time runs data collected by the City and supplemented with data obtained from INRIX. Six travel time runs for each direction were conducted for each AM and PM periods on Tuesday September 13th and Wednesday September 14th, 2016. An additional three travel time runs were conducted for the AM period on November 2nd, 2016. Due to the noticeably higher travel times that were observed in the field after the AM peak hour, particularly for the northbound segment between First Street and Slaters Lane, northbound AM travel time calibration was based on six travel time runs that spanned the peak hour. **Table 3-7** shows a comparison of simulated travel time and field travel time. Tables comparing simulated and field-measure travel times for individual segments can be found in **Appendix E**.

The calibration threshold of a ± 15% difference in travel time was not met for northbound during the AM peak hour when comparing against field travel time run data. INRIX travel time data was used to supplement calibration. Aggregated INRIX travel time data for weekdays in February through May 2016 shows an average northbound AM peak hour travel time of 7.7 minutes for the segment between King Street and Slaters Lane. King Street is two blocks south of the VISSIM network extent, and free flow travel time between King Street and Queen Street is approximated as 50 seconds. The INRIX travel time between Queen Street and Slaters Lane can be approximated as 6.9 minutes. Therefore, the VISSIM travel time of 8.5 minutes for northbound is slightly more than INRIX but less than the average field travel time run of 11.9 minutes. While the City of Alexandria's guideline for travel time calibration is ± 15% difference, other neighboring jurisdictions and projects have used a larger calibration threshold. Most notably, the Virginia Department of Transportation's Traffic Operations and Safety Analysis Manual specifies a ± 30% allowable difference for travel time calibration on arterials. The northbound AM model travel time meets this criterion when comparing against both INRIX and field travel time runs.

Table 3-7. Existing Conditions Travel Time Calibration

Period	Direction	VISSIM Travel Time (minutes)	Field Travel Time (minutes)	Difference (minutes)	Difference (%)*
AM	Northbound	8.5	11.9	-3.4	-29%
	Southbound	3.3	3.2	-0.1	-5%
PM	Northbound	4.3	3.9	0.4	13%
	Southbound	3.9	3.8	0.1	4%

***Percent difference calculated on unrounded travel time (i.e., seconds not minutes)**

Queue Length Calibration

Calibration of maximum queue lengths was not accomplished using observed queue observations collected by the City. Detailed queue calibration results are included in **Appendix E**. In the AM, the difference target of ± 30% of observed maximum queue length was met for 24% of approaches. The observed queue falls between the average and maximum simulated queue for 66% of approaches. Overall, the queue calibration was able to capture significant queueing at the following locations:

- Northbound queuing from Slaters Lane to First Street
- Northbound queuing on E. Abingdon Drive approaching the merge with Washington Street
- Northbound rolling queues from First Street back several intersections at the end of the peak hour

In the PM, the difference target was met for 21% of approaches. The observed queue falls between the average and maximum simulated queue for 93% of approaches. The calibration was able to capture the significant queuing observed in the following locations:

- Southbound queuing on Washington Street from Slaters Lane to the diverge to W. Abingdon Drive
- Southbound queuing on W. Abingdon Drive spilling back onto southbound Washington Street
- Southbound rolling queues back to Oronoco Street

The majority of observed queue lengths are between the simulated average and maximum queue lengths which indicates that the magnitude of queuing is generally captured by the models. Also, given that nearly all volume and travel time calibration criteria are met, the models are concluded to be reasonably calibrated for existing conditions.

3.2.2. AM Traffic Operations

The AM peak hour operations were evaluated for the N. Washington Street signalized intersections on the basis of simulated average control delay, level of service, and queue length. As noted previously, VISSIM reports control delay in seconds of delay per vehicle (s/veh) rather than in units of passenger car equivalents like a typical *Highway Capacity Manual*-based analysis. Nevertheless, simulated intersection level of service is reported using the *Highway Capacity Manual* delay-based level of service thresholds for signalized intersections described in **Table 3-1**. VISSIM analysis results can be found in **Table 3-8** to **Table 3-10.** VISSIM vehicle throughput results are included in **Appendix F**. Overall intersection level of service are shown graphically in **Figure 2-4**.

The VISSIM analysis shows that all intersections but one, Bashford Lane, operate with average delay equivalent to level of service D or better. The intersection with Bashford Lane operates at level of service E. All approaches operate at level of service E or better with the exception of a few approaches at level of service F in the northern part of the network. This includes northbound E. Abingdon Drive at Slaters Lane, southbound W. Abingdon Drive at Bashford Lane (specifically, the southbound left-turn movement), and eastbound and westbound Bashford Lane. The northbound delays on E. Abingdon Drive at Slaters Lane results from queue spillback from the downstream signal with George Washington Memorial Parkway. The delays at the Bashford Lane approaches result from eastbound and westbound approaches having concurrent green indications and high conflicting turn volumes onto northbound George Washington Memorial Parkway. Additionally, the northbound queue does not completely dissipate to allow the side street movements at Bashford Lane to use the green time to the fullest extent. Other movements with high delay are southbound and northbound left turns from E./W. Abingdon Drive at Bashford Lane and

Slaters Lane. This is a result of the delay vehicles experience after making the turn and waiting for the side street movements to get a green indication.

Rolling northbound queues extend from Slaters Lane back to Montgomery Street during the AM peak hour. This impacts the northbound progression of vehicles throughout the study area by the end of the peak hour. Northbound queueing remains in the second hour of the analysis period (after 8:00 AM) due to reduced speeds on northbound George Washington Memorial Parkway from downstream congestion outside of the study area. Other locations with significant queueing are on E. Abingdon Drive approaching the signal at George Washington Memorial Parkway.

Average travel time for northbound and southbound directions of N. Washington Street also is used to evaluate AM traffic operations as detailed above in the calibration process. The average travel time for the northbound peak direction is 8.5 minutes. The reduced travel time is a result of queue spillback from Slaters Lane which eventually causes northbound rolling queues between intersections throughout the study area. Southbound average travel time is 3.3 minutes.

3.2.3. PM Traffic Operations

Similarly, PM peak hour operations were evaluated for the N. Washington Street signalized intersections on the basis of simulated average control delay, level of service, and queue length. VISSIM analysis results can be found in **Table 3-11** to **Table 3-13.** VISSIM vehicle throughput results are included in **Appendix F**. Overall intersection level of service is shown graphically in **Figure 2-4**. The VISSIM analysis shows that all intersections operate with average delay equivalent to level of service C or better. All approaches operate at level of service D or better and two left-turn movements operate level of service F; these are the southbound left-turn from W. Abingdon Drive onto Slaters Lane (95.2 s/veh) and the protected northbound left-turn at Wythe Street (112.7 s/veh). Other movements with relatively high delay are southbound and northbound left turns from east/west Abingdon Drive at Bashford Lane and Slaters Lane. This is a result of the delay vehicles experience after making the turn and waiting for the side street movements to get a green indication.

Rolling queues occur at the southern end of the study area due to downstream signals at Cameron Street and King Street. These queues spill back several blocks to Pendleton at the peak. The other location with heavy queuing in the PM is in the southbound direction approaching Slaters Lane and W. Abingdon Drive. Maximum queues on W. Abingdon Drive and N. Washington Street extend past the diverge point of these two streets.

The average travel time for the southbound peak direction from Slaters Lane to Princess Street is 3.9 minutes, and the average travel time for northbound from Queen Street to Slaters Lane is 4.3 minutes. The longer travel time in the northbound direction results from vehicle traveling against the signal coordination provided to the southbound direction.

Table 3-8: Existing Conditions AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions	
1. N. Washington Street and Slaters Lane	NB N. Washington St	TH	35.5 (D)	35.5 (D)
	NB E. Abingdon Dr	LT	*157.4 (F)*	*131.1 (F)*
		TH	*139.9 (F)*	
		RT	*87.7 (F)*	
	SB N. Washington St	TH	17.3 (B)	17.3 (B)
	SB W. Abingdon Dr	LT	77.3 (E)	20.5 (C)
		TH	16.8 (B)	
		RT	17.8 (B)	
	EB	LT	42.2 (D)	42.2 (D)
		TH	46.1 (D)	
		RT	40.4 (D)	
	WB	LT	57.8 (E)	45 (D)
		TH	51.1 (D)	
		RT	42.8 (D)	
	Intersection		50.2 (D)	
2. N. Washington Street and Bashford Lane	NB N. Washington St	TH	56.1 (E)	56.1 (E)
	NB E. Abingdon Dr	LT	*179.3 (F)*	36.8 (D)
		TH	30.6 (C)	
		RT	25.3 (C)	
	SB N. Washington St	TH	14.1 (B)	14.1 (B)
	SB W. Abingdon Dr	LT	*138.4 (F)*	*89.7 (F)*
		TH	13.9 (B)	
		RT	3.1 (A)	
	EB	LT	*180.5 (F)*	*150.4 (F)*
		TH	*114.8 (F)*	
		RT	*109.3 (F)*	
	WB	LT	*134.2 (F)*	*198.1 (F)*
		TH	*155.5 (F)*	
		RT	*207.8 (F)*	
	Intersection		60.6 (E)	
3. N. Washington Street and First Street	NB	TH	13.3 (B)	13.3 (B)
		RT	9.9 (A)	
	SB	LT	19.1 (B)	10.1 (B)
		TH	7.7 (A)	
	WB	RT	71.8 (E)	71.8 (E)
	Intersection		16.6 (B)	

Table 3-8: Existing Conditions AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions	
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	LT	75.9 (E)	19 (B)
		TH	18.1 (B)	
		RT		
	SB	LT		21.6 (C)
		TH	21.6 (C)	
		RT to Montgomery St	22.2 (C)	
		RT to Powhatan St	24.1 (C)	
	SEB	RT to Washington St	52.3 (D)	53.4 (D)
		RT to Montgomery St	63.6 (E)	
	EB	LT		
		TH		
		RT		
	WB	LT	37.3 (D)	37.8 (D)
		TH	37.6 (D)	
		RT to Powhatan St	36.3 (D)	
		RT to Washington St	51.5 (D)	
	Intersection		21 (C)	
5. N. Washington Street and Madison Street	NB	TH	23 (C)	22.9 (C)
		RT	19.8 (B)	
	SB	LT	52.5 (D)	10.7 (B)
		TH	4.2 (A)	
	EB	LT	38.6 (D)	37.2 (D)
		TH	38 (D)	
		RT	27.4 (C)	
	Intersection		22.2 (C)	
6. N. Washington Street and Wythe Street	NB	LT	21 (C)	26.6 (C)
		TH	26.8 (C)	
		RT	23 (C)	
	SB	LT	75 (E)	15 (B)
		TH	9.5 (A)	
		RT	10.7 (B)	
	EB	LT	*80.8 (F)*	77.5 (E)
		TH	71.4 (E)	
		RT	70.6 (E)	
	WB	LT	44.7 (D)	38.1 (D)
		TH	38.7 (D)	
		RT	34.1 (C)	
	Intersection		29.9 (C)	

Table 3-8: Existing Conditions AM Peak Hour VISSIM LOS and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions	
7. N. Washington Street and Pendleton Street	NB	LT	32.5 (C)	26 (C)
		TH	26 (C)	
		RT	23.2 (C)	
	SB	LT	0 (A)	10 (A)
		TH	10 (A)	
		RT	10.2 (B)	
	EB	LT	42.9 (D)	37.6 (D)
		TH	39 (D)	
		RT	24 (C)	
	WB	LT	48.1 (D)	36.7 (D)
		TH	36.7 (D)	
		RT	26 (C)	
	Intersection		24.4 (C)	
8. N. Washington Street and Oronoco Street	NB	LT	31.4 (C)	22.3 (C)
		TH	22.3 (C)	
		RT	17.6 (B)	
	SB	LT	34.5 (C)	3.5 (A)
		TH	3.4 (A)	
		RT	2.6 (A)	
	EB	LT	40.5 (D)	37.5 (D)
		TH	36.7 (D)	
		RT	28.1 (C)	
	WB	LT	39.8 (D)	33.2 (C)
		TH	34.5 (C)	
		RT	25.1 (C)	
	Intersection		20.1 (C)	
9. N. Washington Street and Princess Street	NB	LT	44.7 (D)	37.7 (D)
		TH	37.5 (D)	
		RT	30.2 (C)	
	SB	LT	0 (A)	3.4 (A)
		TH	3.4 (A)	
		RT	4.2 (A)	
	EB	LT	49.1 (D)	37.5 (D)
		TH	38.4 (D)	
		RT	9.5 (A)	
	WB	LT	0 (A)	30.7 (C)
		TH	37.4 (D)	
		RT	18.4 (B)	
	Intersection		31.4 (C)	

Table 3-9: Existing Conditions AM Peak Hour VISSIM Travel Times (minutes)

*Results displayed are the average results across 10 microsimulation runs

Segment	Existing Conditions
Northbound N. Washington Street From: Queen Street To: Slaters Lane	8.5
Southbound N. Washington Street From: Slaters Lane To: Princess Street	3.3

Table 3-10: Existing Conditions AM Peak Hour VISSIM Vehicle Queuing (Average and Maximum) (feet)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Available Storage (feet)	Existing Conditions
1. N. Washington Street and Slaters Lane	NB N. Washington St	1080	***4413 (5458)***
	NB E. Abingdon Dr	1100	***703 (1209)***
	SB N. Washington St	3110	32 (207)
	SB W. Abingdon Dr	835	29 (285)
	EB	850	79 (330)
	WB	225	6 (55)
2. N. Washington Street and Bashford Lane	NB N. Washington St	1130	***890 (1231)***
	NB E. Abingdon Dr	700	160 (562)
	SB N. Washington St	1075	25 (283)
	SB W. Abingdon Dr	1055	19 (121)
	EB	730	***318 (745)***
	WB	545	***280 (564)***
3. N. Washington Street and First Street	NB	330	***121 (439)***
	SB	1130	14 (245)
	WB	255	***83 (336)***
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	345	***101 (449)***
	SB	180	29 (164)
	SEB	345	11 (102)
	EB	245	
	WB	240	29 (155)
5. N. Washington Street and Madison Street	NB	345	***176 (452)***
	SB	345	21 (144)
	EB	245	45 (204)
6. N. Washington Street and Wythe Street	NB	340	***177 (458)***
	SB	350	17 (147)
	EB	260	***125 (279)***
	WB	240	35 (211)
7. N. Washington Street and Pendleton Street	NB	345	***200 (458)***
	SB	340	17 (130)
	EB	245	***36 (247)***
	WB	240	20 (182)
8. N. Washington Street and Oronoco Street	NB	345	***183 (467)***
	SB	350	7 (127)
	EB	250	26 (188)
	WB	245	17 (131)
9. N. Washington Street and Princess Street	NB	340	***472 (837)***
	SB	350	8 (102)
	EB	250	7 (82)
	WB	265	2 (48)

Table 3-11*: Existing Conditions PM Peak Hour VISSIM Level of Service and Delay* (seconds/vehicle)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions	
1. N. Washington Street and Slaters Lane	NB N. Washington St	TH	25.5 (C)	25.5 (C)
	NB E. Abingdon Dr	LT	62.6 (E)	44.8 (D)
		TH	15.7 (B)	
		RT	1.3 (A)	
	SB N. Washington St	TH	24.5 (C)	24.5 (C)
	SB W. Abingdon Dr	LT	*95.2 (F)*	32.1 (C)
		TH	33.5 (C)	
		RT	28.4 (C)	
	EB	LT	38.9 (D)	38.9 (D)
		TH	44.8 (D)	
		RT	32.3 (C)	
	WB	LT	45.1 (D)	48.1 (D)
		TH	62.1 (E)	
		RT	4.8 (A)	
	Intersection		28.1 (C)	
2. N. Washington Street and Bashford Lane	NB N. Washington St	TH	13.6 (B)	13.6 (B)
	NB E. Abingdon Dr	LT	66.3 (E)	21.1 (C)
		TH	10.5 (B)	
		RT	5.8 (A)	
	SB N. Washington St	TH	1.3 (A)	1.3 (A)
	SB W. Abingdon Dr	LT	75.8 (E)	22.1 (C)
		TH	13.5 (B)	
		RT	13.6 (B)	
	EB	LT	49.2 (D)	34.2 (C)
		TH	34.4 (C)	
		RT	22 (C)	
	WB	LT	39.1 (D)	37.3 (D)
		TH	37.7 (D)	
		RT	37.1 (D)	
	Intersection		12.7 (B)	
3. N. Washington Street and First Street	NB	TH	10 (A)	10 (A)
		RT	10.1 (B)	
	SB	LT	17.1 (B)	10.4 (B)
		TH	9.3 (A)	
	WB	RT	6.6 (A)	6.6 (A)
	Intersection		10.1 (B)	

Table 3-11: Existing Conditions PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions	
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	LT	48.1 (D)	12.3 (B)
		TH	10.4 (B)	
		RT		
	SB	LT		7.1 (A)
		TH	7.1 (A)	
		RT to Montgomery St	5.7 (A)	
		RT to Powhatan St	7.2 (A)	
	SEB	RT to Washington St	54.5 (D)	54.6 (D)
		RT to Montgomery St	60.2 (E)	
	EB	LT		
		TH		
		RT		
	WB	LT	43.3 (D)	43.9 (D)
		TH	42.4 (D)	
		RT to Powhatan St	45.2 (D)	
		RT to Washington St	56.7 (E)	
	Intersection		14.4 (B)	
5. N. Washington Street and Madison Street	NB	TH	9 (A)	9.8 (A)
		RT	23.1 (C)	
	SB	LT	27.3 (C)	6.6 (A)
		TH	5.8 (A)	
	EB	LT	42.1 (D)	38.2 (D)
		TH	39.2 (D)	
		RT	29.9 (C)	
	Intersection		10.6 (B)	
6. N. Washington Street and Wythe Street	NB	LT	*112.7 (F)*	15.6 (B)
		TH	10.2 (B)	
		RT	21.5 (C)	
	SB	LT	32.7 (C)	9.9 (A)
		TH	8.7 (A)	
		RT	6.5 (A)	
	EB	LT	58.2 (E)	49.2 (D)
		TH	46.5 (D)	
		RT	41 (D)	
	WB	LT	59.8 (E)	50.2 (D)
		TH	50 (D)	
		RT	41.2 (D)	
	Intersection		16.6 (B)	

Table 3-11: Existing Conditions PM Peak Hour VISSIM LOS and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions	
7. N. Washington Street and Pendleton Street	NB	LT	57.2 (E)	11.5 (B)
		TH	11.2 (B)	
		RT	10.2 (B)	
	SB	LT	38.4 (D)	16.6 (B)
		TH	16.6 (B)	
		RT	13.9 (B)	
	EB	LT	47.2 (D)	41.6 (D)
		TH	42.3 (D)	
		RT	32.3 (C)	
	WB	LT	42.7 (D)	36.3 (D)
		TH	37.8 (D)	
		RT	30.6 (C)	
	Intersection		17.9 (B)	
8. N. Washington Street and Oronoco Street	NB	LT	25.7 (C)	9.3 (A)
		TH	9.3 (A)	
		RT	9.9 (A)	
	SB	LT	48.1 (D)	22.8 (C)
		TH	22.6 (C)	
		RT	16.7 (B)	
	EB	LT	47.2 (D)	39.6 (D)
		TH	38.2 (D)	
		RT	23 (C)	
	WB	LT	47.6 (D)	39.8 (D)
		TH	43.4 (D)	
		RT	31 (C)	
	Intersection		19.1 (B)	
9. N. Washington Street and Princess Street	NB	LT	47.8 (D)	15.1 (B)
		TH	13.5 (B)	
		RT	14.6 (B)	
	SB	LT	43.6 (D)	40.2 (D)
		TH	40.3 (D)	
		RT	38.1 (D)	
	EB	LT	49.6 (D)	46.2 (D)
		TH	45.2 (D)	
		RT	33.5 (C)	
	WB	LT	39.3 (D)	35.1 (D)
		TH	38 (D)	
		RT	25.3 (C)	
	Intersection		30.2 (C)	

Table 3-12: Existing Conditions PM Peak Hour VISSIM Travel Times (minutes)

*Results displayed are the average results across 10 microsimulation runs

Segment	Existing Conditions
Northbound N. Washington Street From: Queen Street To: Slaters Lane	4.3
Southbound N. Washington Street From: Slaters Lane To: Princess Street	3.9

Table 3-13: Existing Conditions PM Peak Hour VISSIM Vehicle Queuing (Average and Maximum) (feet)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Available Storage (feet)	Existing Conditions
1. N. Washington Street and Slaters Lane	NB N. Washington St	1080	209 (868)
	NB E. Abingdon Dr	1100	209 (867)
	SB N. Washington St	3110	173 (813)
	SB W. Abingdon Dr	835	*404 (2122)*
	EB	850	51 (214)
	WB	225	13 (99)
2. N. Washington Street and Bashford Lane	NB N. Washington St	1130	0 (0)
	NB E. Abingdon Dr	700	66 (393)
	SB N. Washington St	1075	0 (0)
	SB W. Abingdon Dr	1055	30 (226)
	EB	730	21 (180)
	WB	545	72 (383)
3. N. Washington Street and First Street	NB	330	47 (268)
	SB	1130	53 (726)
	WB	255	5 (88)
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	345	31 (279)
	SB	180	*29 (274)*
	SEB	345	29 (174)
	EB	245	
	WB	240	*74 (274)*
5. N. Washington Street and Madison Street	NB	345	42 (259)
	SB	345	38 (278)
	EB	245	49 (226)
6. N. Washington Street and Wythe Street	NB	340	56 (288)
	SB	350	*47 (412)*
	EB	260	45 (247)
	WB	240	*88 (262)*
7. N. Washington Street and Pendleton Street	NB	345	53 (328)
	SB	340	*107 (446)*
	EB	245	*62 (284)*
	WB	240	*66 (286)*
8. N. Washington Street and Oronoco Street	NB	345	*50 (350)*
	SB	350	*137 (457)*
	EB	250	21 (147)
	WB	245	*54 (272)*
9. N. Washington Street and Princess Street	NB	340	*83 (375)*
	SB	350	*743 (1920)*
	EB	250	27 (161)
	WB	265	11 (115)

4. 2040 Baseline Conditions

This transportation study considers a future year "baseline" condition for the purposes of comparison with the future year "build" condition. The baseline condition includes the traffic associated with the full land development potential of OId Town North that can be accomplished under existing zoning and site plan approvals. The baseline condition transportation network assumes City-identified planned and programmed transportation improvements that can be reasonably assumed to occur by 2040 without the implementation of the Small Area Plan Update. The 2040 Baseline Conditions are further described in this chapter.

4.1. 2040 Baseline Transportation Network

The 2040 Baseline Conditions transportation vehicular network is generally the same as the existing conditions network. It contains the same urban street network and multimodal connections. It is anticipated that any development projects or City transportation initiatives would not greatly alter the physical transportation network. The City's baseline transportation network assumptions are summarized in **Table 4-1**.

Table 4-1. Baseline Transportation Network Assumptions

Project	Description	Type of Project	Implementation Year
King Street-Old Town Metrorail Station Pedestrian Improvements	Reconstruction of the King Street-Old Town Metrorail Station to improve pedestrian circulation and safety	Transit/ Pedestrian	Pending
Potomac Yard Metrorail Station	Construction of a new metrorail station	Transit	2021
Mt. Vernon Trail at East Abingdon	Construct a new trail or cycle track on the east side of E. Abingdon between the existing Mt. Vernon Trail at the rail spur, and Slaters Lane	Bicycle/ Pedestrian	2017-2019
Wythe Street Pedestrian Improvement	New sidewalk along the north side of Wythe Street to complete a missing gap	Pedestrian	Pending
Madison Street Bikeway	Enhanced bicycle corridor on Madison Street between the Braddock Metrorail station and the waterfront. This study assumes no modification to the vehicle street operation	Bicycle	2018
Royal Street Neighborhood Bikeway	Neighborhood bikeway along N. Royal Street between Jones Point Park and Bashford Lane. Include traffic calming improvements. No lane removal and minimal on-street parking impact	Bicycle	2018
Capital Bikeshare	Buildout of Capital Bikeshare throughout City	Bicycle	2021
Route 1 Transit Signal Priority	Transit signal priority to be added on Route 1 between Glebe and First Street	Transit	2016-2018
Corridor A Circulator Service	Circulator transit service in Corridor A south of Braddock Road Metrorail station that focuses on east-west connectivity between the existing and planned Metrorail stations and Old Town (route to use King Street, Fairfax Street, Madison/Montgomery Streets)	Transit	Pending
DASH Transit Improved Headways	Improved transit headways for select AT routes per Comprehensive Operations Analysis	Transit	2025

4.1.1. Vehicular Street Network

The vehicular street network will remain unchanged. It is recognized that the City actively monitors and adjusts signal timing so it is likely that adjustments will occur between now and the year 2040; however, for the purposes of this transportation study, and to compare each scenario, it is assumed that traffic signal timing will remain consistent between existing conditions and the future baseline conditions. This assumption allows any variance in the level of service between existing and future conditions to be only the result of the differences in traffic volumes and roadway geometry. Signal timing adjustments may be addressed as a potential mitigation strategy in subsequent chapters of this report. All other traffic parameters [high-occupancy vehicle (HOV) lane use, turn restrictions, parking locations, etc.] also are unchanged between the existing conditions and the 2040 Baseline Conditions.

4.1.2. Transit Network/Service

Old Town North will continue to offer high-quality transit service under 2040 Baseline Conditions. Transit service adjustments that are assumed to occur under baseline conditions are identified below:

- **Metrorail**
  - Reconstruction of the *King Street-Old Town Metrorail Station* to improve pedestrian circulation and safety. Construction is scheduled for 2017/2018
  - Construction of the *Potomac Yard Metrorail Station*, a new station along the WMATA Blue and Yellow lines that will be located approximately one mile north of Old Town North
- **Metroway –** There is a future planned Metroway stop at First Street and N. Fayette Street. The Metroway route will be realigned to the north to travel through the redeveloped Potomac Yard Property. There also is a City initiative to improve the progression of transit along Route 1 through the implementation of transit signal priority (TSP) between E. Glebe Road and First Street
- **Metrobus** – The Washington Metropolitan Area Transit Authority (WMATA) periodically updates their bus transit service, either with temporary or permanent modifications to routes, new bus service, or improvements to route efficiencies and headway. Based on a review of available information, there are no specific metrobus service changes to be considered for the 2040 Baseline Conditions
- **DASH bus service** (based on a review of the DASH Comprehensive Operations Analysis)
  - Implementing an “Old Town Circulator” Route, providing service to/from *King Street-Old Town Metrorail Station* and *Braddock Road Metrorail Stations* via King Street, Fairfax Street, Montgomery Street, and Madison Street at 10 minute headways. The circulator could be implemented using a realigned AT2, or a combination of AT8 and AT2 in its existing alignment.
  - General improvements to all DASH routes to achieve headways of 15 minutes or better during peak periods.
- **DOT Paratransit Program –** No service changes.

DASH route adjustments for the 2040 Baseline Conditions are shown on **Figure 4-1**.

Figure 4-1: Baseline DASH Route Adjustments

4.1.3. Pedestrian Network

The 2040 Baseline Conditions pedestrian network will continue to improve over time. The City's policies require all new developments to provide street frontage improvements that will enhance the pedestrian facilities. Also, the City has yearly funding for Citywide sidewalk and pedestrian improvements. One such improvement is a new sidewalk along the north side of Wythe Street, near the Exxon station between N. Washington Street and N. St. Asaph Street. This project will complete an existing gap in the pedestrian network. Additionally, the missing sidewalk on the east side of Union Street will be constructed as part of the Robinson Terminal redevelopment. Additionally, a new trail/cycle track will be constructed on the east side of E. Abingdon Drive between the existing Mt. Vernon Trail at the Norfolk-Southern rail spur and Slaters Lane.

4.1.4. Bicycle Network

The 2040 Baseline Future Conditions bicycle network will be enhanced by several project's in the City's Capital Improvement Program. A new trail or cycle track will be implemented along the east side of E. Abingdon Drive between the existing Mt. Vernon Trail at the Norfolk-Southern rail spur and Slaters Lane. It is anticipated that the buildout of Capital Bikeshare, as recommended in the Pedestrian and Bicycle Chapter of the Transportation Master Plan, will be achieved. Planned buildout includes a new location near the intersection of N. Royal Street and Bashford Lane and a new location near First Street and N. Washington Street by FY2021. Per the recommendations of the Transportation Master Plan, additional neighborhood bicycle facilities will be implemented along Madison Street (as an enhanced bicycle corridor) and Royal Street (as a neighborhood bike corridor). Neighborhood bikeways are designed to encourage slow vehicular traffic and be comfortable for people bicycling and walking. The Madison Street bike corridor will be further discussed as part of the build condition.

4.1.5. Parking

To support future redevelopment and make better use of the available on- and off-street parking supply, the following parking recommendations should be considered as part of the baseline conditions:

- Promote shared parking
- Adjust on-street parking restrictions to generate turnover
- Consider a meter zone for the retail area
- Improve wayfinding and information

Future technologies such as connected and autonomous vehicles also will impact the way that people travel as well as have impacts to parking. Autonomous vehicles will likely reduce the amount of on-site parking that is needed for commercial and residential uses, as well as on-street parking, but will likely require additional curbside drop off and pick up areas. These changes will, therefore, require the City to consider streets and parking facilities to be designed in a manner that allows for flexibility to accommodate future needs. It can't be known exactly what this technology will do to future parking needs; however, based on the City's multimodal polices, the City will continue to prioritize non-single occupant vehicle travel and the amount of parking that is needed for future developments.

4.2. 2040 Baseline Conditions Land Use

The 2040 Baseline Conditions assume build-out in the Old Town North study area to the full development potential allowable under existing zoning/site plan approvals. The net increase in development is shown in **Table 4-2.** Based on the land use forecasts developed by the City of Alexandria's Department of Planning and Zoning, the increase in density will consist of approximately 207 net new hotel rooms, 253,000 square feet of net new commercial/retail use, 613 net new apartment units, 16 net new residential condominium/townhouse units, 391,000 square feet of net new office space, and 126,000 square feet of net new light industrial use. The forecasted development associated with the 2040 Baseline Conditions are further detailed, by block and land use, in **Appendix G**.

Table 4-2. 2040 Baseline Net Development Increase

Land Use	Total Intensity
Hotel	207 Rooms
Specialty Retail	253,000 Square Feet
Mid-Rise Apartment	613 Dwelling Units
General Office	390,639 Square Feet
Residential Townhouse	16 DUs
Light Industrial	126,032 Square Feet
Total Net Development Increase	1,723,897 Square Feet

4.3. 2040 Baseline Traffic Forecasts

Traffic volumes were forecasted for the 2040 Baseline Conditions based on regional growth and baseline development generated traffic.

4.3.1. Regional Traffic Growth along N. Washington Street, N. Patrick Street, and N. Henry Street

The Metropolitan Washington Council of Governments (MWCOG) regional travel demand model (Version 2.3.57a with Cooperative Land Use Forecasts Round 8.3) was evaluated to determine the anticipated growth in traffic by 2040 along the regional north-south corridors (Route 1 and N. Washington Street). The MWCOG model includes redevelopment within North Potomac Yard, Oakville Triangle, and Old Town North. Travel demand model Year 2040 volumes were compared to the model Year 2015 volumes to determine growth rates for the AM and PM peak periods.

Table 4-3 shows the percentage growth in traffic during the peak periods along Route 1 and N. Washington Street when comparing the travel demand model traffic volumes for years 2015 and 2040. The weighted average of model results indicates that the forecasted traffic growth along N. Washington Street is approximately 8.7 percent in the AM peak period and 6.0 percent in the PM peak period. The weighted average of model results indicates that the forecasted traffic along Route 1 is expected to decrease by 10.0 percent in the AM peak period and by 6.9 percent in the PM peak period. This decrease in MWCOG model projected traffic volumes along Route 1 may be attributed to additional travel mode shifts due to the City's investment into the multimodal infrastructure, the expansion of Metroway, and the opening of the Potomac Yard Metrorail Station.

It is recognized that the calculated growth percentages in **Table 4-3** include both regional through trips and local development trips. Because the calculation of local development trips is performed as a separate process (discussed in more detail the following sections), an effort was made to isolate the portion of the MWCOG growth that was strictly related to regional through trips. After reviewing baseline

and build traffic projections, local development trips forecasted along N. Washington Street grew by three to four percent. As a result, the additional average growth percentage of three percent was applied to the traffic volumes to approximate the total growth seen in the MWCOG model. The three percent growth rate was only applied to northbound and southbound through movements along N. Washington Street. This was consistently applied in both 2040 Baseline and 2040 Build Conditions.

It also is recognized that the MWCOG network results show negative traffic growth along US Route 1. Rather than applying a factor to reduce the amount of traffic, a zero (flat) regional growth percentage was assumed. Additionally, while there are no additional regional through trips along US Route 1, there are local development trips (in both the 2040 Baseline and 2040 Build Conditions) that are added to US Route 1. This results in a modest increase in US Route 1 traffic compared to existing conditions (where the results of MWCOG model would have led to the expectation of a reduction in traffic). As a result, the analysis considered in this traffic study represents traffic volumes that are more conservative than what would be expected based on MWCOG model. The existing peak hour traffic volumes with regional traffic growth applied are shown in **Figure 4-2**.

Table 4-3. MWCOG Travel Demand Model Growth Rates between 2015 and 2040

Location	AM Peak Period Growth %			PM Peak Period Growth %		
	NB	SB	Bidirectional	NB	SB	Bidirectional
N. Washington Street						
North of Slaters Lane	4.68%	17.50%	8.93%	13.99%	4.69%	8.48%
Between Slaters Lane and Bashford Lane	8.81%	17.01%	12.02%	7.49%	5.55%	6.32%
Between Bashford Lane and Montgomery Street	8.39%	17.54%	11.85%	6.87%	4.23%	5.26%
Between Montgomery Street and Madison Street	4.64%	11.27%	7.06%	5.28%	3.39%	4.27%
Between Madison Street and Wythe Street	4.64%	10.72%	6.83%	4.23%	3.83%	4.01%
Between Wythe Street and Pendleton Street	3.57%	7.32%	4.92%	4.63%	3.66%	4.11%
South of Pendleton Street	4.74%	7.85%	5.89%	8.58%	8.45%	8.51%
Average Growth			8.68%			6.02%
US 1 (N. Patrick Street and N. Henry Street)						
North of Montgomery Street	-6.38%	14.29%	-1.45%	32.29%	21.75%	26.51%
Between Montgomery Street and Madison Street - Non-HOV	-26.17%	-8.41%	-19.0%	9.00%	-13.89%	-6.5%
Between Montgomery Street and Madison Street - HOV						
Between Madison Street and Wythe Street - Non-HOV	-33.97%	-7.64%	-23.36%	9.49%	-25.24%	-13.78%
Between Madison Street and Wythe Street - HOV						
Between Wythe Street and Pendleton Street - Non-HOV	-1.60%	14.68%	4.8%	10.65%	1.19%	5.0%
Between Wythe Street and Pendleton Street - HOV						
South of Pendleton Street - Non-HOV	-4.38%	14.50%	2.6%	8.91%	-1.41%	2.8%
South of Pendleton Street - HOV						
Average Growth			-10%			-6.88%

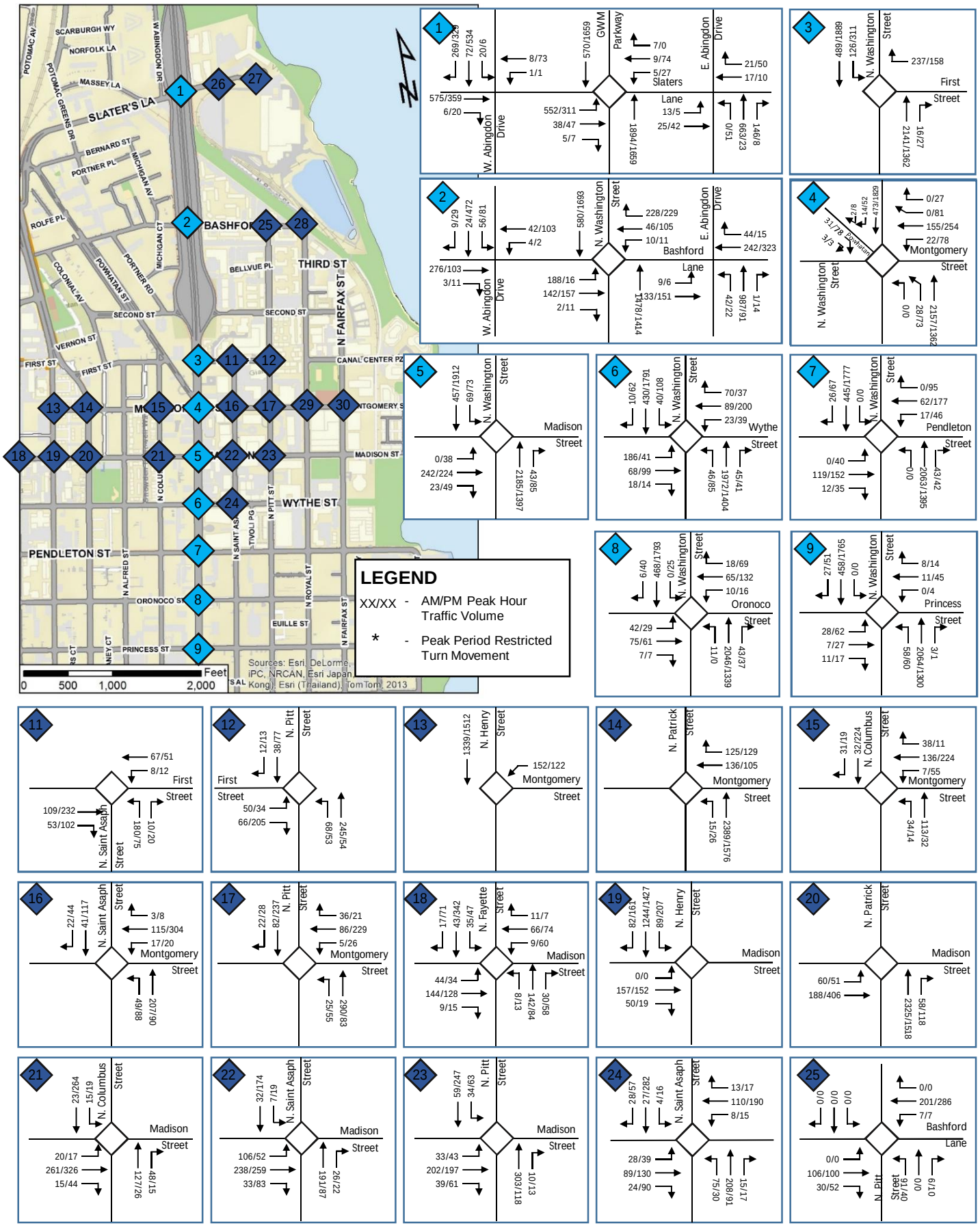
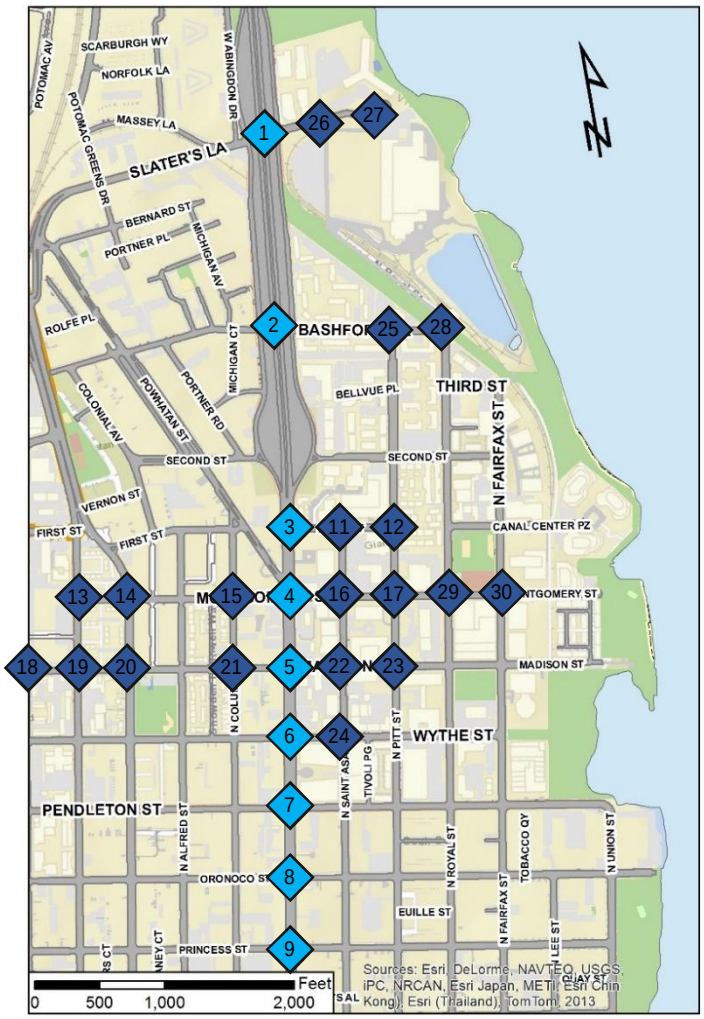


Figure 4-2: Existing Peak Hour Traffic Volumes with Regional Growth



LEGEND

XX/XX - AM/PM Peak Hour Traffic Volume

* - Peak Period Restricted Turn Movement

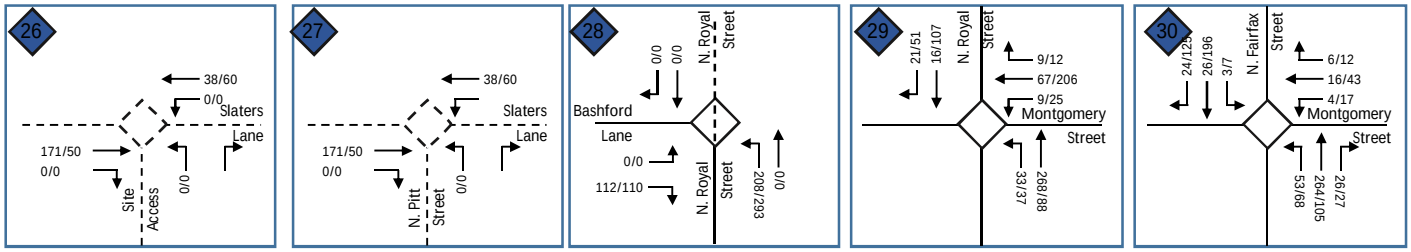


Figure 4-2: Existing Peak Hour Traffic Volumes with Regional Growth

4.3.2. Baseline Development Related Traffic

Development-related traffic for the 2040 Baseline Conditions was developed by applying the rates, equations, and applicable land use codes from the Institute of Transportation Engineers (ITE) *Trip Generation Manual, Volume 9*. This resulted in person trips, calculated for each block in the Old Town North Study area. The resulting summary of person trips for the 2040 Baseline Conditions is shown in **Table 4-4**. A detailed breakdown of person trips by block is included in **Appendix H**.

Table 4-4. 2040 Baseline Development Person Trip Summary

2040 Baseline Land Use	Total Intensity	AM Peak Hour			PM Peak Hour			Weekday
		In	Out	Total	In	Out	Total	
Hotel	207 rooms	65	45	110	63	61	124	1,691
Specialty Retail	253,000 square feet	133	81	214	373	476	849	11,270
Mid-Rise Apartment	613 DUs	60	134	194	143	103	246	2,398
General Office	390,639 square feet	623	85	708	120	598	718	4,906
Residential Townhouse	16 Dwelling Units	2	10	12	9	4	13	131
Light Industrial	126,032 square feet	102	14	116	15	107	122	878
Total Baseline Site Generated Traffic	-	**985**	**369**	**1,354**	**723**	**1349**	**2,072**	**21,274**

4.3.3. Mode Split

Mode split assumptions were applied to the person trips to identify Metrorail, bus transit, pedestrian and bicycle, and vehicular trips. Mode split was applied based on the proximity of each block to transit (either a station or a stop) and the type of land use forecasted on each block. Mode split assumptions are identified in **Table 4-5** and are consistent with mode split factors used in previously submitted Small Area Plans in the City such as the Oakville Triangle / Route 1 Corridor Plan and the North Potomac Yard Small Area Plan Update. The mode split percentages shown below also were reviewed and found to be generally consistent with mode split data from US Census records for the City. For the purposes of this study, the transit-metrorail category represents “linked” trips; i.e. person-trips that start or end at a Metrorail station, but enter and exit the Old Town North Study area via a mixture of other modes (such as bus, walking, cycling, etc.).

There are many current and future trends that support the reduced percentage of single occupancy automobile trips. In recent years, the number of employees that take advantage of opportunities to telework periodically, work from home exclusively, work alternative schedules, carpool, and avoid travel in the traditional peak hours of commuter traffic has increased. This trend lessens the number of vehicles on the road during those weekday commuter peak hours. While no additional mode split assumptions were made for these behaviors in this study, these behaviors support the notion that the ITE values for person-trips (and resulting vehicles-trips) generated by a specific development may not reflect current travel trends, especially in a highly urbanized, multimodal area such as Old Town North.

Future technologies such as connected and autonomous vehicles also will impact the way that people travel as well as have impacts on parking. More efficient traffic operations could reduce congestion and increase travel speed; however, this increased efficiency may result in more vehicles on the road. It can’t be known exactly what this technology will do to future traffic volumes; however, based on the City’s multimodal polices, the City will continue to prioritize non-single occupant vehicle travel and, therefore, the mode split assumptions are valid for planning purposes.

Table 4-5. Mode Split Assumptions for New Development in the Old Town North Study Area

Land Use	Transit – Metrorail*	Transit – Metrobus, DASH, and Metroway	Pedestrian and Bicycle (non-auto)	Auto	Total
Office (adjacent to transit station)	35%	11%	6%	48%	100%
Office (within ¼ mile of transit station)	21%	9%	6%	64%	100%
Residential (adjacent to transit station)	54%	1%	16%	29%	100%
Residential (within ¼ mile of transit station)	48%	1%	15%	36%	100%
Residential (within ¼ mile to ½ mile of transit station)	31%	5%	10%	54%	100%
Hotel	27%	4%	31%	38%	100%
Entertainment (theater)	26%	6%	11%	57%	100%
Retail (all, excluding large format)	29%	8%	27%	36%	100%
Retail (large format)	9%	5%	14%	73%	100%

Source: Kimley-Horn and Associates, Inc., References: WMATA 2005 Development-Related Ridership Study and 2000 U.S.

*Includes "linked" trips: person-trips that start or end at a Metrorail station, but enter and exit the Old Town North Study area via a mixture of other modes (such as bus, walking, cycling, etc.).

The resulting summary of trips generated, by mode, for the 2040 Baseline Conditions is described in **Table 4-6**. A detailed breakdown by mode and block is included in **Appendix H**.

Table 4-6. Baseline Future Trip Generation Summary by Mode

2040 Baseline Land Use	Total Intensity (Rounded)	AM Peak Hour			PM Peak Hour			Weekday
		In	Out	Total	In	Out	Total	
Hotel	**207 rooms**	**65**	**45**	**110**	**63**	**61**	**124**	**1,691**
Transit - Metrorail		17	12	29	18	16	34	457
Transit - Bus		3	1	4	3	2	5	68
Pedestrian and Bicycle		19	14	33	20	19	39	525
Auto		26	18	44	22	24	46	641
Specialty Retail	**253,000 square feet**	**133**	**81**	**214**	**373**	**476**	**849**	**11,270**
Transit - Metrorail		39	23	62	107	139	246	3,270
Transit - Bus		11	5	16	28	39	67	900
Pedestrian and Bicycle		37	24	61	100	129	229	3,044
Auto		46	29	75	138	169	307	4,056
Mid-Rise Apartment	**613 DUs**	**60**	**134**	**194**	**143**	**103**	**246**	**2,398**
Transit - Metrorail		34	69	103	74	56	130	1,271
Transit - Bus		0	1	1	2	0	2	23
Pedestrian and Bicycle		10	22	32	22	17	39	379
Auto		16	42	58	45	30	75	725
General Office	**390,639 square feet**	**623**	**85**	**708**	**120**	**598**	**718**	**4,906**
Transit - Metrorail		219	29	248	44	208	252	1,715
Transit - Bus		70	9	79	15	66	81	540
Pedestrian and Bicycle		39	4	43	9	35	44	294
Auto		295	43	338	52	289	341	2,357
Residential Townhouse	**16 Dwelling Units**	**2**	**10**	**12**	**9**	**4**	**13**	**131**
Transit - Metrorail		1	5	6	5	2	7	71
Transit - Bus		0	0	0	0	0	0	1
Pedestrian and Bicycle		0	2	2	1	1	2	21
Auto		1	3	4	3	1	4	38
Light Industrial	**126,032 square feet**	**102**	**14**	**116**	**15**	**107**	**122**	**878**
Transit - Metrorail		0	0	0	0	0	0	0
Transit - Bus		0	0	0	0	0	0	0
Pedestrian and Bicycle		0	0	0	0	0	0	0
Auto		102	14	116	15	107	122	878
Total Transit - Metrorail		310	138	448	248	421	669	6,784
Total Transit - Bus		84	16	100	48	107	155	1,532
Total Pedestrian and Bicycle		105	66	171	152	201	353	4,263
Total Auto		486	149	635	275	620	895	8,695
Total Baseline Site Generated Traffic		**985**	**369**	**1354**	**723**	**1,349**	**2,072**	**21,274**

4.3.4. Trip Distribution

Trip distribution was prepared to identify origins and destinations of traffic into and out of the Old Town North Small Area Plan Update transportation study area. The trip distributions were based on distributions used in previously submitted and approved transportation impact studies. The distribution from those studies were adjusted for the specific land uses and greater grid network of streets that are under consideration as part of this study. As a result, individual trip distributions for office/industrial land uses, retail/commercial land uses, and residential/hotel land uses were prepared. The distributions are shown on **Figure 4-3, Figure 4-4, and Figure 4-5** respectively.

4.3.5. 2040 Conditions Baseline Development Traffic Volumes

Baseline development site generated, peak hour traffic volumes were prepared by applying the trip distribution to the site generated trips and assigning the traffic through the traffic network. These baseline development site generated peak hour trips are shown on **Figure 4-6**. The baseline development site generated trips were added to the peak hour traffic volumes adjusted for regional growth (**Figure 4-2**) to result in 2040 Baseline Conditions Peak Hour Traffic Volumes as shown on **Figure 4-7.**

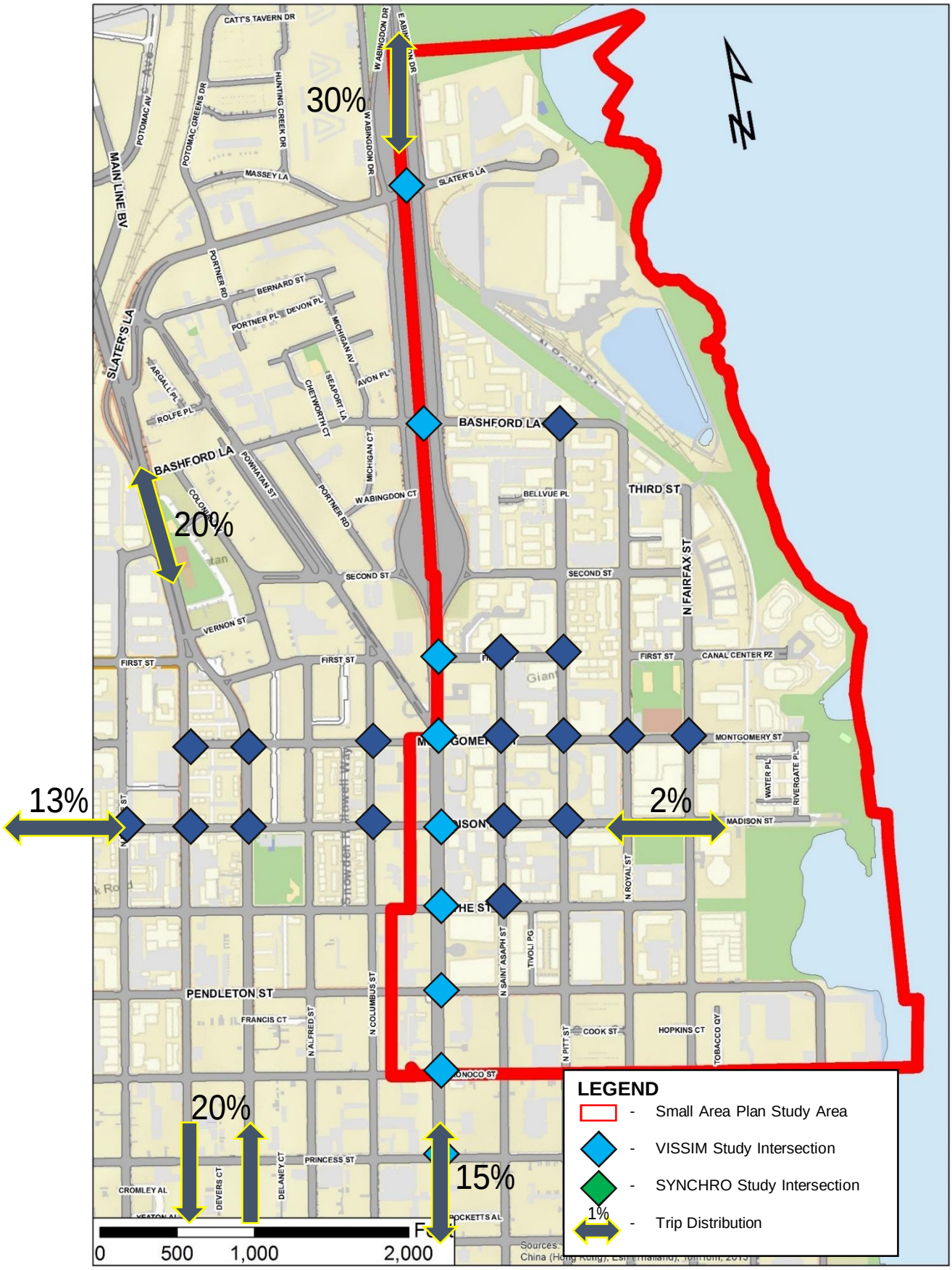


Figure 4-3: Residential/Hotel Development Trip Distribution

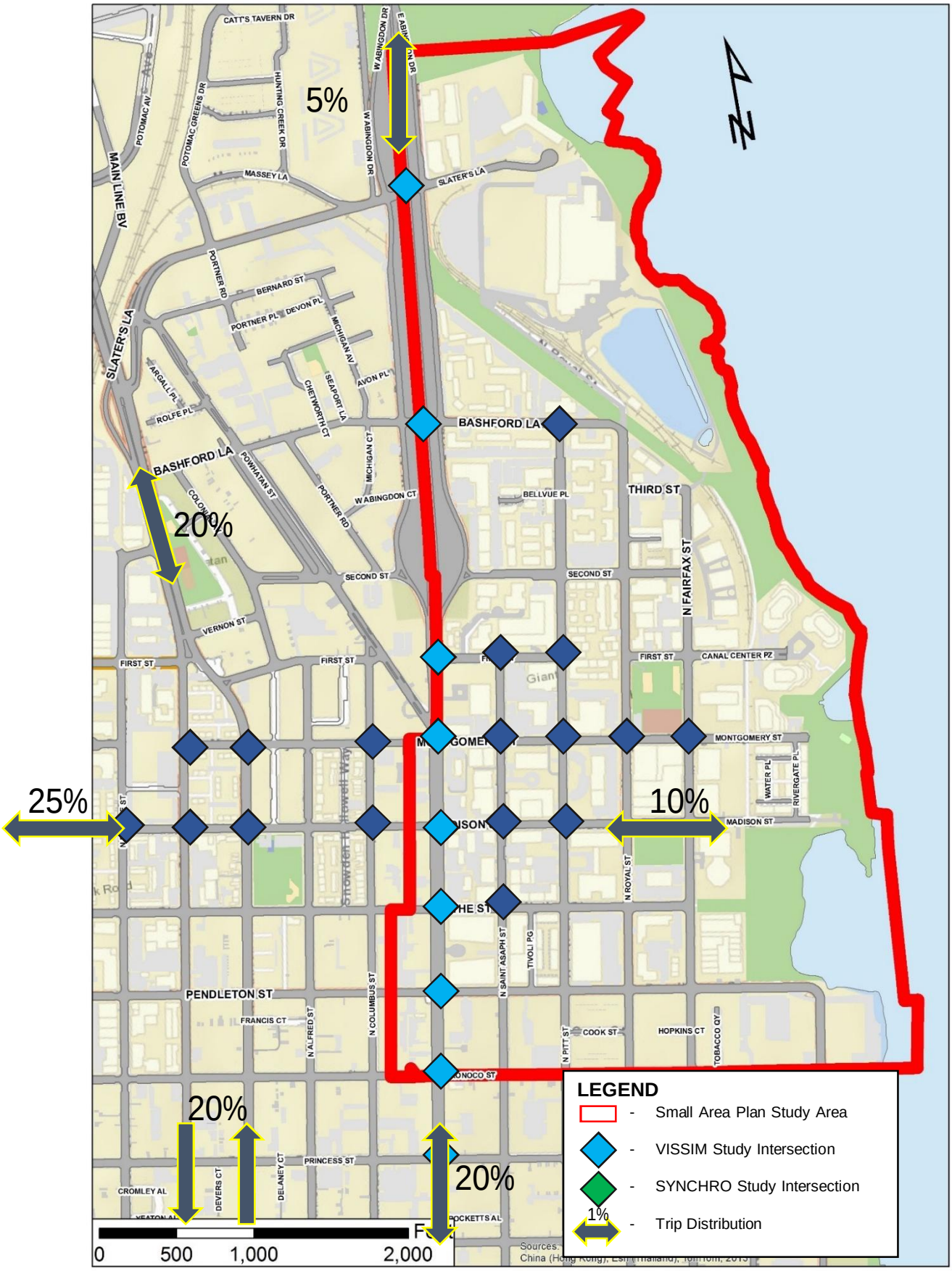


Figure 4-4: Retail Development Trip Distribution

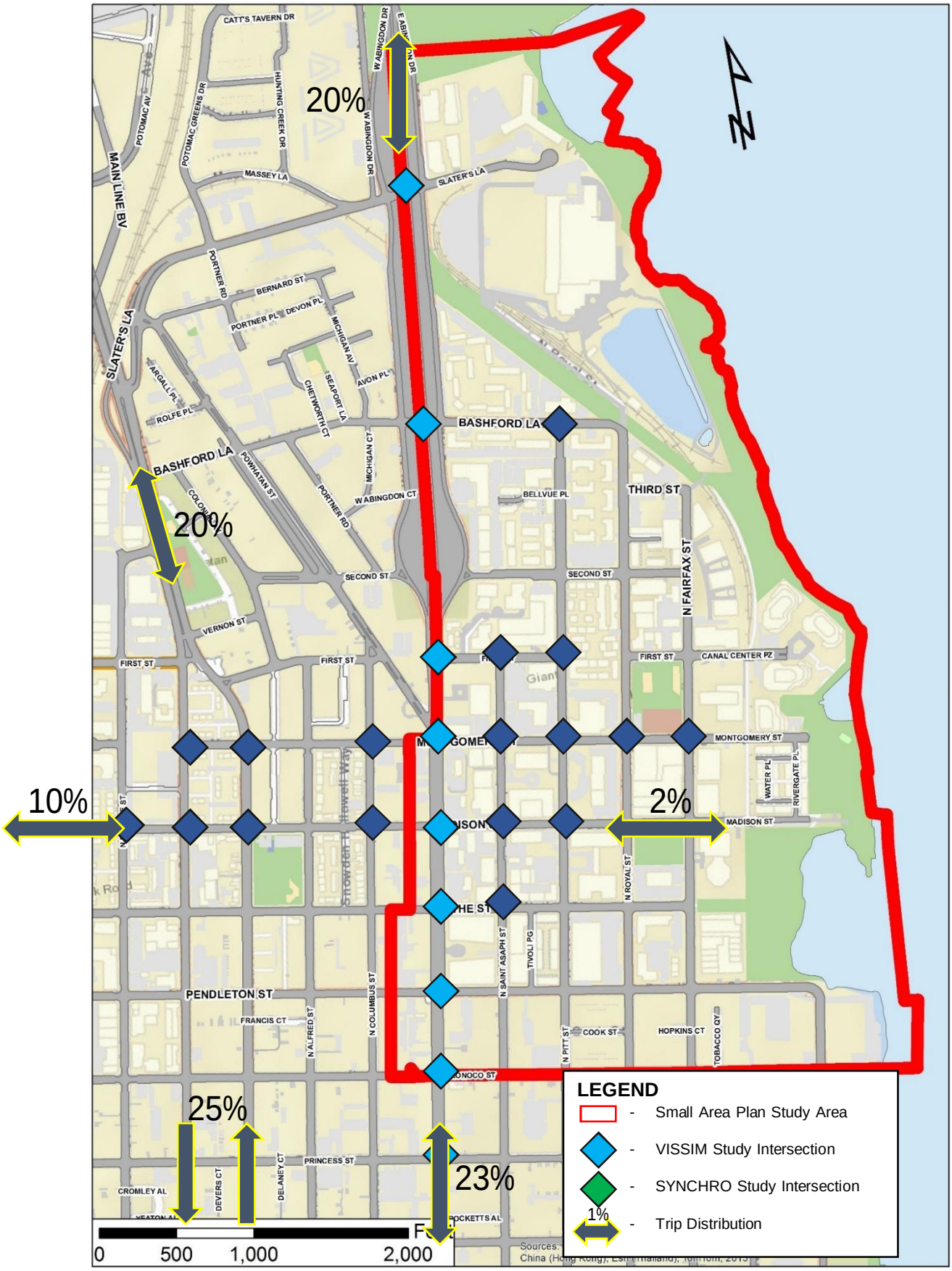


Figure 4-5: Office/Light Industrial Development Trip Distribution

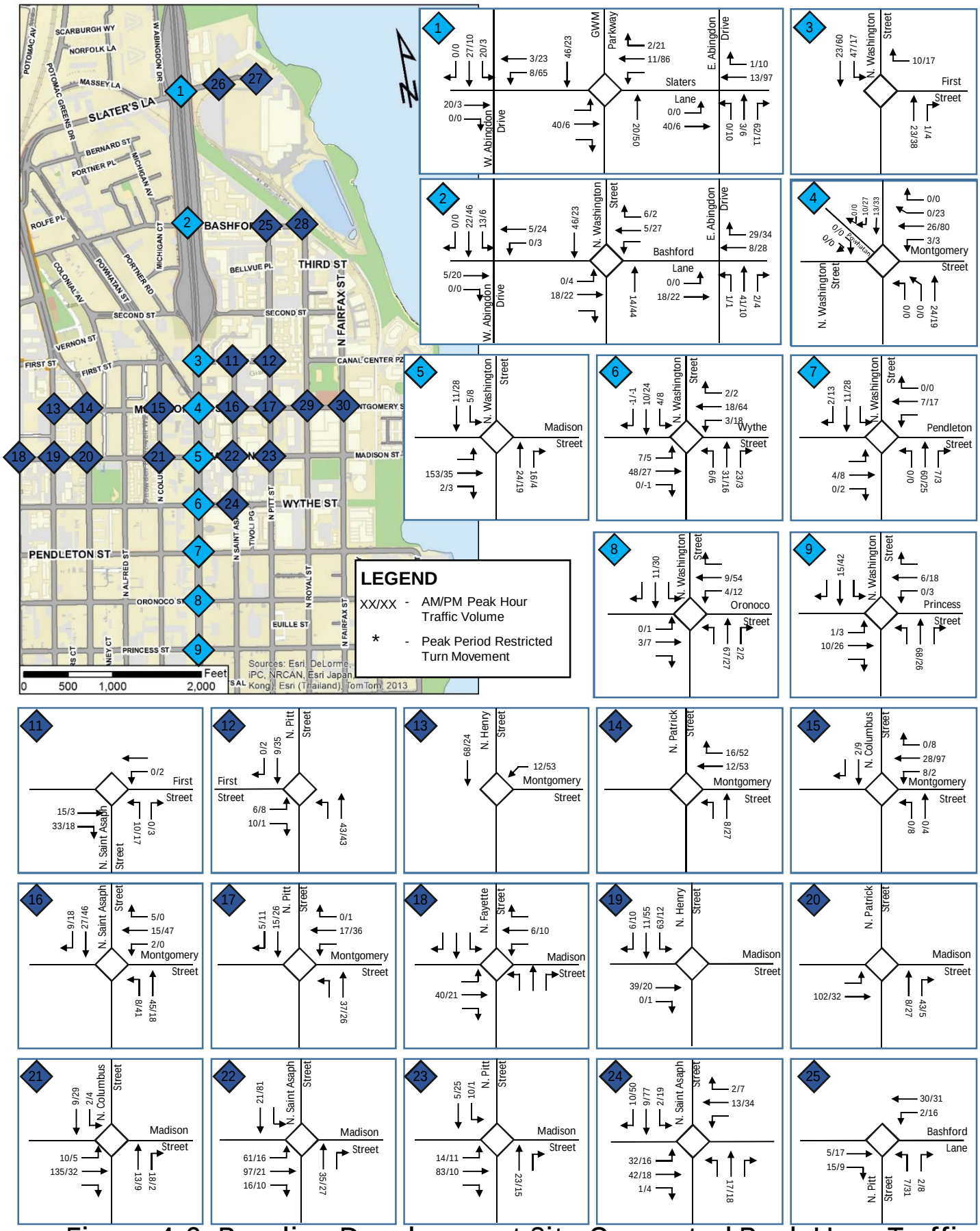
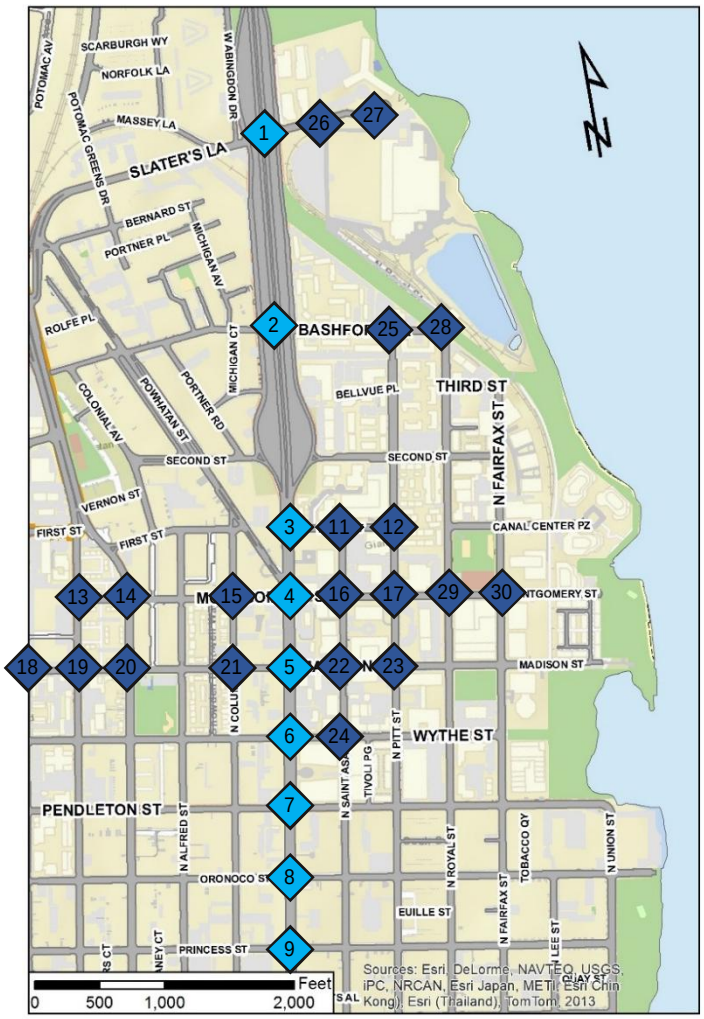


Figure 4-6: Baseline Development Site Generated Peak Hour Traffic Volumes Sheet 1 of 2



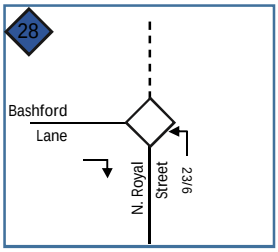
LEGEND

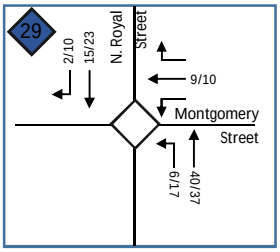
XX/XX - AM/PM Peak Hour Traffic Volume

* - Peak Period Restricted Turn Movement

NOT USED IN THIS FIGURE

NOT USED IN THIS FIGURE





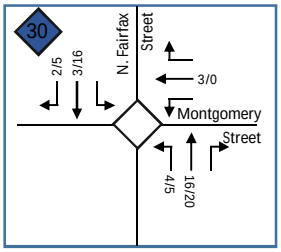


Figure 4-6: Baseline Development Site Generated Peak Hour Traffic Volumes Sheet 2 of 2

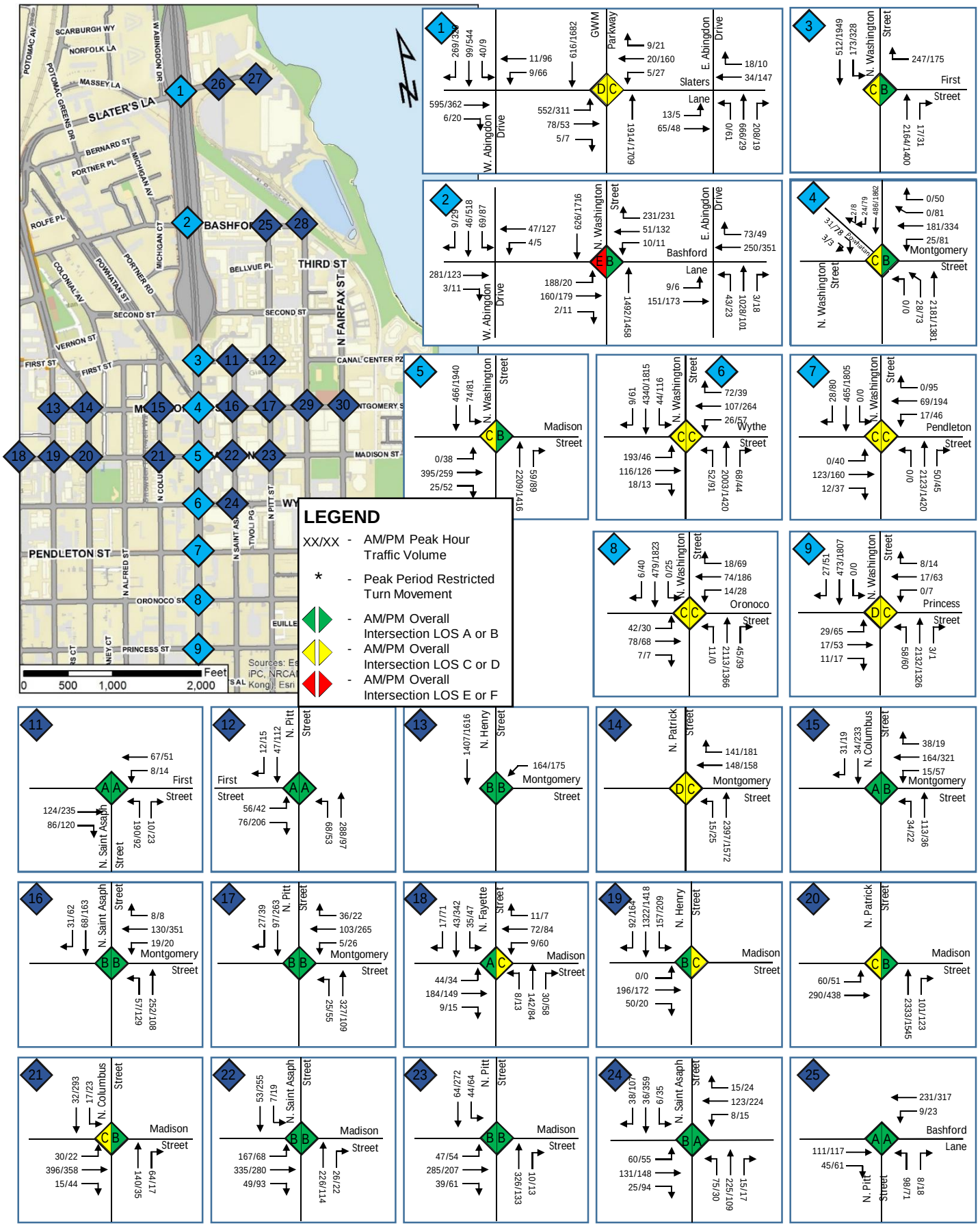
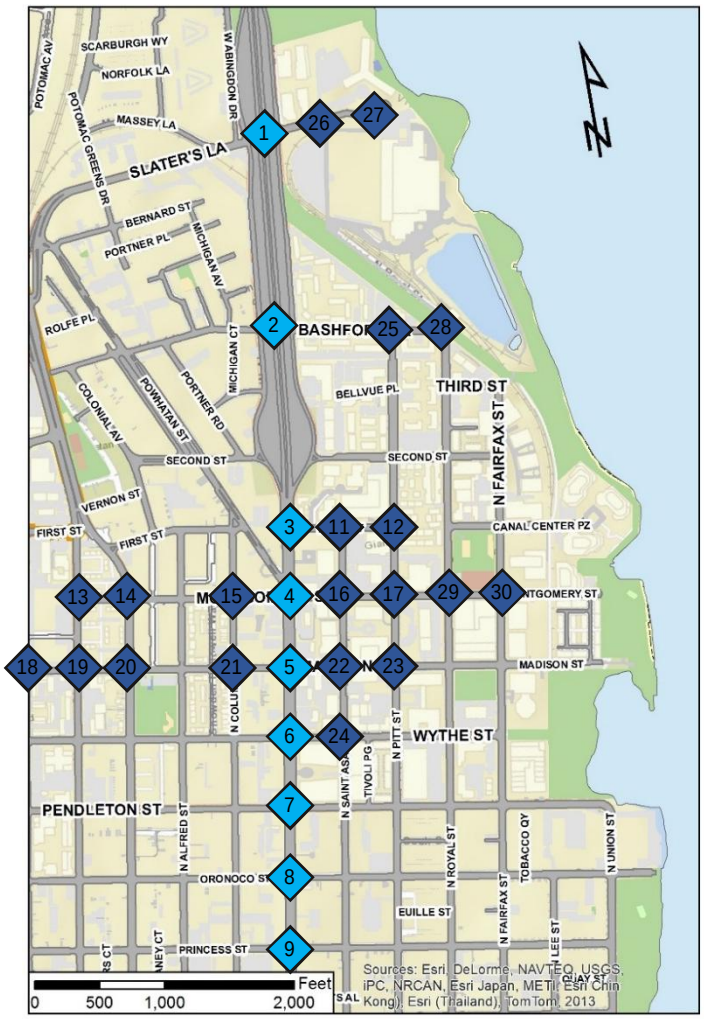


Figure 4-7: 2040 Baseline Conditions Peak Hour Traffic Volumes



LEGEND

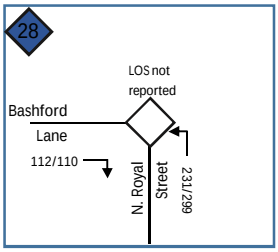
XX/XX - AM/PM Peak Hour Traffic Volume

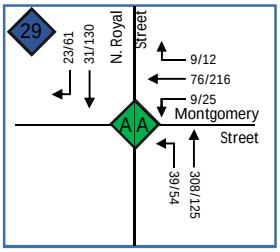
* - Peak Period Restricted Turn Movement

- AM/PM Overall Intersection LOS A or B
- AM/PM Overall Intersection LOS C or D
- AM/PM Overall Intersection LOS E or F

NOT USED IN THIS FIGURE

NOT USED IN THIS FIGURE





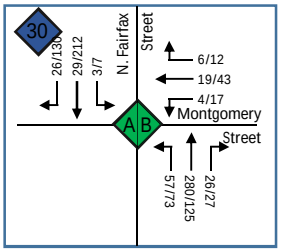


Figure 4-7: 2040 Baseline Conditions Peak Hour Traffic Volumes

Sheet 2 of 2

4.4. Synchro Analysis

2040 Baseline Conditions analyses were evaluated using the future volumes and the existing pedestrian and bicycle volumes, existing lane designations, existing heavy vehicle percentages and bus blockage data, and existing traffic control and signal timing at the study intersections. Where information was not available, Synchro default values were used. Per City guidelines, the existing peak hour factors that were less than 0.95 were increased by 15 percent up to a maximum of 0.95. Synchro analysis reports are provided in **Appendix D**. The results of the 2040 Baseline Conditions level of service and delay analyses are shown graphically in **Figure 4-7** and further detailed in **Table 4-6**.

In comparison to the existing conditions, the addition of traffic generated by the baseline development and regional growth increases vehicle delays at most study area intersections. The intersection of N. Columbus Street and Madison Street is the only intersection to experience a worsening in overall level of service compared to existing conditions because of these delay increases (from B to C during the AM peak hour). All other intersections operate with the same or better overall level of service as existing conditions. It is noted that a few intersections experience a decrease in overall delay when comparing existing and baseline conditions. This apparent improvement in traffic operation may be the result of many factors. For example, illegal movements at restricted turns at or along Washington Street have been redistributed through the grid network to turn at appropriate locations. At other intersections, shifts in traffic patterns increase the traffic volume at lower delay movements, which brings the overall intersection delay (an average) down.

Consistent with existing conditions, results indicate that all intersections operate at overall intersection level of service D or better during the weekday AM and PM peak periods and all individual movements and approaches also operate at level of service D or better during the AM and PM peak periods.

The results of the future baselines conditions queuing analyses are shown in **Table 4-8**. All intersection operates with similar vehicle queuing as in existing conditions. The results indicate that vehicle queuing is not a significant issue at most study area intersections. Separate turn pockets are not present at most of the non-N. Washington Street intersections and existing queues for through and turning movements are accommodated within the available block lengths. Exceptions to this include:

- Northbound approach of N. Patrick Street and Montgomery Street during the AM peak hour – Vehicle queues exceed the available storage by 230 feet, or 9 vehicles. Additionally, because the volume exceeds the capacity of this approach, the actual 95th percentile queue length could be longer than reported. It is noted that the northbound left and through movements operate at level of service D during the AM peak hour
- Northbound approach of N. Patrick Street and Madison Street during the AM peak hour – Vehicle queues exceed the available storage by 355 feet, or 14 vehicles. Additionally, the 95th percentile queues are metered by the upstream signal which indicates that additional vehicles that would be in the vehicle queuing are unable to clear the upstream signal

These findings are consistent with existing conditions results.

Table 4-7: Future Baseline Conditions Peak Hour Level of Service and Delay (seconds/vehicle)

Intersection	Movement/ Lane*	Existing AM	Existing PM	2040 Baseline AM	2040 Baseline PM
11. First Street and N. Saint Asaph Street					
Eastbound *(First Street)*	T	-	-	-	-
	R	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)
Westbound *(First Street)*	L	A (7.7)	A (8.4)	A (7.7)	A (8.4)
	T	A (0)	A (0)	A (0)	A (0)
	Overall	A (0.8)	A (1.6)	A (0.8)	A (1.8)
Northbound *(N. Saint Asaph Street)*	LR	B (11.9)	B (12.7)	B (10.8)	B (12.9)
	Overall	B (11.9)	B (12.7)	B (10.8)	B (12.9)
Overall Intersection		***A (4.2)***	***A (2.9)***	***A (4.3)***	***A (3)***
12. First Street and N. Pitt Street					
Eastbound (First Street)	LR	B (12.3)	B (11.3)	B (12.2)	B (11.5)
	Overall	B (12.3)	B (11.3)	B (12.2)	B (11.5)
Northbound *(N. Pitt Street)*	L	A (7.5)	A (7.6)	A (7.5)	A (7.6)
	T	A (0)	A (0)	A (0)	A (0)
	Overall	A (1.6)	A (3.7)	A (1.4)	A (2.7)
Southbound *(N. Pitt Street)*	T	-	-	-	-
	R	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)
Overall Intersection		***A (3.9)***	***A (7.2)***	***A (3.8)***	***A (6.2)***
13. N. Henry Street and Montgomery Street					
Westbound *(Montgomery Street)*	L	B (10.2)	C (25.5)	B (10.2)	C (26.2)
	Overall	B (10.2)	C (25.5)	B (10.2)	C (26.2)
Southbound *(N. Henry Street)*	L*	A (0)	A (0)	A (0)	A (0)
	T	B (15.2)	B (12.3)	B (15.4)	B (11.7)
	Overall	B (15.2)	B (12.3)	B (15.4)	B (11.7)
Overall Intersection		***B (14.7)***	***B (13.3)***	***B (14.8)***	***B (13.1)***
14. N. Patrick Street and Montgomery Street					
Westbound (Montgomery Street)	L*	A (0)	A (0)	A (0)	A (0)
	T	C (21.6)	B (16.7)	C (21.4)	B (17.3)
	R	C (22.6)	B (18.1)	C (22.4)	B (18.9)
	Overall	C (22.1)	B (17.5)	C (21.9)	B (18.2)
Northbound (N. Patrick Street)	L	D (45.9)	C (29.2)	D (46.3)	C (29.6)
	T	D (47.4)	C (28.5)	D (47.9)	C (28.8)
	R*	A (0)	A (0)	A (0)	A (0)
	Overall	D (46.8)	C (28.8)	D (47.2)	C (29.1)
Overall Intersection		***D (44.0)***	***C (27.1)***	***D (44.4)***	***C (27.2)***
15. N. Columbus Street and Montgomery Street					
Westbound (Montgomery Street)	L	A (8.7)	B (11.1)	A (8.9)	B (11.7)
	T	A (0)	A (0)	A (0)	A (0)
	R	A (8.6)	B (11.0)	A (8.9)	B (11.6)
	Overall	A (8.7)	B (11.1)	A (8.9)	B (11.6)
Northbound (N. Columbus Street)	L	A (5.2)	B (10.3)	A (5.1)	B (10.4)
	T	A (0)	A (0)	A (0)	A (0)
	R*	A (0)	A (0)	A (0)	A (0)
	Overall	A (5.2)	B (10.3)	A (5.1)	B (10.4)
Southbound (N. Columbus Street)	L*	*A (0)*	*A (0)*	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)
	R	B (12.5)	B (12.5)	B (12.4)	B (12.3)
	Overall	B (12.5)	B (12.5)	B (12.4)	B (12.3)
Overall Intersection		***A (8.0)***	***B (11.6)***	***A (8.1)***	***B (11.8)***

*Illegal movement onto one-way street

Table 4-7: Future Baseline Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline	
		AM	PM	AM	PM
16. N. Saint Asaph Street and Montgomery Street					
Westbound (Montgomery Street)	L	B (18.2)	B (10.6)	B (18.2)	B (10.8)
	T	A (0)	A (0)	A (0)	A (0)
	R	B (18.1)	B (10.4)	B (18.2)	B (10.7)
	Overall	B (18.2)	B (10.5)	B (18.2)	B (10.7)
Northbound (N. Saint Asaph Street)	L	B (14.5)	C (20.6)	B (15.4)	C (24)
	T	A (0)	A (0)	A (0)	A (0)
	R*	A (0)	A (0)	A (0)	A (0)
	Overall	B (14.5)	C (20.6)	B (15.4)	C (24)
Southbound *(N. Saint Asaph Street)*	L*	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)
	R	B (18.2)	B (12.6)	B (18.6)	B (13.2)
	Overall	B (18.2)	B (12.6)	B (18.6)	B (13.2)
Overall Intersection		***B (16.3)***	***B (13.8)***	***B (16.8)***	***B (15.2)***
17. N. Pitt Street and Montgomery Street					
Westbound (Montgomery Street)	TL	A (9.1)	B (10.4)	A (9.1)	B (10.6)
	TR	A (9.0)	A (10.0)	A (9.0)	B (10.2)
	Overall	A (9.0)	B (10.2)	A (9.0)	B (10.4)
Northbound (N. Pitt Street)	*LT*	B (11.7)	A (9.8)	B (11.5)	A (10)
	Overall	B (11.7)	A (9.8)	B (11.5)	A (10)
Southbound (N. Pitt Street)	*TR*	A (8.5)	B (11.1)	A (8.6)	B (11.6)
	Overall	A (8.5)	B (11.1)	A (8.6)	B (11.6)
Overall Intersection		***B (10.5)***	***B (10.5)***	***B (10.4)***	***B (10.8)***
18. N. Fayette Street and Madison Street					
Eastbound (Madison Street)	TLR	B (10.4)	B (12.4)	B (10.2)	C (16.5)
	Overall	B (10.4)	B (12.4)	B (10.2)	C (16.5)
Westbound (Madison Street)	TLR	A (8.9)	B (12.5)	A (8.7)	B (13)
	Overall	A (8.9)	B (12.5)	A (8.7)	B (13)
Northbound (N. Fayette Street)	TLR	A (9.9)	B (12.0)	A (9.5)	B (12.7)
	Overall	A (9.9)	B (12.0)	A (9.5)	B (12.7)
Southbound (N. Fayette Street)	TLR	A (9.2)	C (21.0)	A (8.9)	D (25.5)
	Overall	A (9.2)	C (21.0)	A (8.9)	D (25.5)
Overall Intersection		***A (9.8)***	***C (16.1)***	***A (9.6)***	***C (19.1)***
19. N. Henry Street and Madison Street					
Eastbound (Madison Street)	L*	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)
	R	B (14.4)	C (23.1)	B (14.5)	C (23.6)
	Overall	B (14.4)	C (23.1)	B (14.5)	C (23.6)
Southbound (N. Henry Street)	L	B (17.7)	C (29.7)	B (17.6)	C (28.9)
	T	C (20.2)	C (31.0)	B (19.7)	C (30.1)
	R	B (19.9)	C (30.4)	B (19.5)	C (29.5)
	Overall	B (19.2)	C (30.3)	B (18.9)	C (29.5)
Overall Intersection		***B (18.6)***	***C (29.7)***	***B (18.3)***	***C (28.9)***

*Illegal movement onto one-way street

Table 4-7: Future Baseline Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline	
		AM	PM	AM	PM
20. N. Patrick Street and Madison Street					
Eastbound *(Madison Street)*	L	C (20.7)	C (26.4)	C (21.6)	C (26.5)
	T	C (20.9)	C (26.8)	C (21.9)	C (27)
	R*	A (0)	A (0)	A (0)	A (0)
	Overall	C (20.8)	C (26.6)	C (21.8)	C (26.7)
Northbound *(N. Columbus Street)*	L*	A (0)	A (0)	A (0)	A (0)
	T	C (20.6)	B (16.6)	C (21.9)	B (16.6)
	R	C (23.9)	B (18.3)	C (26.1)	B (18.2)
	Overall	C (21.9)	B (17.2)	C (23.5)	B (17.1)
Overall Intersection		***C (21.8)***	***B (19.3)***	***C (23.3)***	***B (19.3)***
21. N. Columbus Street and Madison Street					
Eastbound *(Madison Street)*	L	B (20.0)	B (11.7)	C (21.1)	B (11.9)
	T	A (0)	A (0)	A (0)	A (0)
	R	B (19.8)	B (11.6)	C (20.7)	B (11.8)
	Overall	B (19.9)	B (11.7)	C (20.9)	B (11.9)
Northbound *(N. Columbus Street)*	L*	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)
	R	C (20.4)	B (10.3)	C (20.6)	B (10.3)
	Overall	C (20.4)	B (10.3)	C (20.6)	B (10.3)
Southbound *(N. Columbus Street)*	L	B (17.9)	B (16.1)	B (18)	B (12.9)
	T	A (0)	A (0)	A (0)	A (0)
	R*	A (0)	A (0)	A (0)	A (0)
	Overall	B (17.9)	B (16.1)	B (18)	B (12.9)
Overall Intersection		***B (19.9)***	***B (13.4)***	***C (20.6)***	***B (12.2)***
22. N. Saint Asaph Street and Madison Street					
Eastbound *(Madison Street)*	L	B (18.6)	B (17.8)	C (20.2)	B (18.2)
	T	A (0)	A (0)	A (0)	A (0)
	R	B (18.4)	B (17.7)	B (19.7)	B (18.1)
	Overall	B (18.5)	B (17.8)	B (20)	B (18.1)
Northbound *(N. Saint Asaph Street)*	L*	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)
	R	A (5.1)	B (11.6)	C (23)	A (3.6)
	Overall	A (5.1)	B (11.6)	C (23)	A (3.6)
Southbound *(N. Saint Asaph Street)*	L	B (19.3)	B (18.7)	A (4.1)	B (19.8)
	T	A (0)	A (0)	A (0)	A (0)
	R*	A (0)	A (0)	A (0)	A (0)
	Overall	B (19.3)	B (18.7)	A (4.1)	B (19.8)
Overall Intersection		***B (14.1)***	***B (17.0)***	***B (19.8)***	***B (16.4)***
23. N. Pitt Street and Madison Street					
Eastbound (Madison Street)	TL	B (11.3)	B (10.9)	B (12.2)	B (11.0)
	TR	B (10.5)	B (10.8)	B (11.0)	B (10.6)
	Overall	B (10.9)	B (10.8)	B (11.6)	B (10.8)
Northbound (N. Pitt Street)	TR	B (12.9)	A (9.9)	B (13.2)	A (9.9)
	Overall	B (12.9)	A (9.9)	B (13.2)	A (9.9)
Southbound (N. Pitt Street)	TL	A (9.7)	B (13.7)	A (10.0)	B (13.0)
	Overall	A (9.7)	B (13.7)	A (10.0)	B (13.0)
Overall Intersection		***B (11.6)***	***B (11.9)***	***B (12.0)***	***B (11.6)***

*Illegal movement onto one-way street

Table 4-7: Future Baseline Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline	
		AM	PM	AM	PM
24. N. Saint Asaph Street and Wythe Street					
Eastbound *(Wythe Street)*	L	B (10.9)	A (3.2)	B (11.6)	A (6.1)
	T	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)
	Overall	B (10.9)	A (3.2)	B (11.6)	A (6.1)
Westbound *(Wythe Street)*	L	B (10.2)	B (11.0)	B (10.3)	B (11.4)
	T	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)
	Overall	B (10.2)	B (11.0)	B (10.3)	B (11.4)
Northbound *(N. Saint Asaph Street)*	L	B (13.3)	B (12.1)	B (14.0)	B (12.0)
	T	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)
	Overall	B (13.3)	B (12.1)	B (14.0)	B (12.0)
Southbound (N. Saint Asaph Street)	L	B (11.1)	A (4.8)	B (11.3)	A (8.0)
	T	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)
	Overall	B (11.1)	A (4.8)	B (11.3)	A (8.0)
Overall Intersection		***B (11.8)***	***A (6.9)***	***B (12.3)***	***A (8.8)***
25. N. Pitt Street and Bashford Lane					
Eastbound (Bashford Lane)	T	-	-	-	-
	R	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)
Westbound *(Bashford Lane)*	L	A (7.9)	A (7.6)	A (7.9)	A (7.7)
	T	A (0)	A (0)	A (0)	A (0)
	Overall	A (0.3)	A (0.2)	A (0.3)	A (0.5)
Northbound *(N. Pitt Street)*	LR	B (12.4)	B (12.1)	B (12.5)	B (13.4)
	Overall	B (12.4)	B (12.1)	B (12.5)	B (13.4)
Overall Intersection		***A (2.5)***	***A (1.3)***	***A (2.7)***	***A (2.2)***
29. N. Royal Street and Montgomery Street					
Westbound (Montgomery Street)	TL	A (8.8)	A (9.8)	A (8.9)	A (10.0)
	TR	A (8.5)	A (9.4)	A (8.6)	A (9.5)
	Overall	A (8.7)	A (9.6)	A (8.8)	A (9.8)
Northbound (N. Royal Street)	*TL*	B (10.4)	A (9.5)	B (10.7)	A (10.0)
	Overall	B (10.4)	A (9.5)	B (10.7)	A (10.0)
Southbound (N. Royal Street)	*TR*	A (7.5)	A (9.1)	A (7.7)	A (9.4)
	Overall	A (7.5)	A (9.1)	A (7.7)	A (9.4)
Overall Intersection		***A (9.7)***	***A (9.4)***	***A (10.0)***	***A (9.7)***
30. N. Fairfax Street and Montgomery Street					
Westbound (Montgomery Street)	TL	A (8.8)	A (9.7)	A (8.6)	A (9.5)
	TR	A (8.4)	A (9.1)	A (8.2)	A (9.0)
	Overall	A (8.6)	A (9.4)	A (8.4)	A (9.3)
Northbound (N. Fairfax Street)	*TL*	B (11.7)	A (9.8)	B (10.4)	A (9.8)
	Overall	B (11.7)	A (9.8)	B (10.4)	A (9.8)
Southbound (N. Fairfax Street)	*TR*	A (7.9)	B (12.7)	A (7.6)	B (11.7)
	Overall	A (7.9)	B (12.7)	A (7.6)	B (11.7)
Overall Intersection		***B (10.8)***	***B (11.4)***	***A (9.8)***	***B (10.8)***

**Illegal movement onto one-way street*

Table 4-8: 2040 Baseline Conditions Peak Hour Vehicle Queuing (feet)

Intersection	Lane Group	Existing Block Length	Existing Queue		2040 Baseline Queue	
			AM	PM	AM	PM
11. First Street and N. Saint Asaph Street						
Westbound (First Street)	TL	240	0	0	0	0
Northbound (N. Saint Asaph Street)	LR	345	23	18	25	20
12. First Street and N. Pitt Street						
Eastbound (First Street)	LR	240	20	38	20	35
Northbound (N. Pitt Street)	TL	345	5	3	3	3
13. N. Henry Street and Montgomery Street						
Westbound (Montgomery Street)	L	240	m55	m51	m57	m69
Southbound (N. Henry Street)	T	345	221	284	227	267
14. N. Patrick Street and Montgomery Street						
Westbound (Montgomery Street)	TL	240	85	66	95	93
Northbound (N. Patrick Street)	TR	345	m#597	12	m#575	15
15. N. Columbus Street and Montgomery Street						
Westbound (Montgomery Street)	TL/TR	240	4	m48	2	m74
Northbound (N. Columbus Street)	TL	345	53	19	49	24
Southbound (N. Columbus Street)	TR	340	27	110	30	109
16. N. Saint Asaph Street and Montgomery Street						
Westbound (Montgomery Street)	TL/TR	235	51	60	58	68
Northbound (N. Saint Asaph Street)	TL	*345*	101	89	289	117
Southbound (N. Saint Asaph Street)	TR	345	m67	109	m109	148
17. N. Pitt Street and Montgomery Street						
Westbound (Montgomery Street)	TL	245	8	25	8	28
	TR	245	13	23	13	25
Northbound (N. Pitt Street)	TL	*345*	68	23	63	25
Southbound (N. Pitt Street)	TR	*345*	13	48	15	53
18. N. Fayette Street and Madison Street						
Eastbound (Madison Street)	LTR	555	35	35	38	78
Westbound (Madison Street)	LTR	245	13	35	13	33
Northbound (N. Fayette Street)	LTR	345	30	40	25	38
Southbound (N. Fayette Street)	LTR	365	15	143	13	165
19. N. Henry Street and Madison Street						
Eastbound (Madison Street)	TR	245	101	123	116	136
Southbound (N. Henry Street)	TR/TL	355	215	0	213	26
20. N. Patrick Street and Madison Street						
Eastbound (Madison Street)	TL	235	75	m131	100	m137
Northbound (N. Columbus Street)	TR	345	#675	282	#700	281
21. N. Columbus Street and Madison Street						
Eastbound (Madison Street)	TL/TR	240	102	71	158	78
Northbound (N. Columbus Street)	TR	345	125	19	152	24
Southbound (N. Columbus Street)	TL	345	34	63	40	109

m- volume for 95th percentile queue is metered by upstream signal
#- 95th percentile volume exceeds capacity; queue may theoretically be longer. Queue shown is maximum after two cycles

Table 4-8: 2040 Future Baseline Conditions Peak Hour Vehicle Queuing (feet) Continued

Intersection	Movement/ Lane	Existing Storage/ Block Length	Existing Queue		2040 Baseline Queue	
			AM	PM	AM	PM
22. N. Saint Asaph Street and Madison Street						
Eastbound (Madison Street)	TL/TR	235	m28	25	m43	28
Northbound (N. Saint Asaph Street)	TR	350	191	36	215	40
Southbound (N. Saint Asaph Street)	TL	and340	24	123	29	172
23. N. Pitt Street and Madison Street						
Eastbound (Madison Street)	TL	230	28	28	38	28
	TR	230	28	30	33	28
Northbound (N. Pitt Street)	TR	345	70	20	68	20
Southbound (N. Pitt Street)	TL	345	15	75	15	68
24. N. Saint Asaph Street and Wythe Street						
Eastbound (Wythe Street)	LTR	235	m61	78	m69	m80
Westbound (Wythe Street)	LTR	240	57	90	60	106
Northbound (N. Saint Asaph Street)	LTR	345	128	63	152	74
Southbound (N. Saint Asaph Street)	LTR	345	2	83	12	256
25. N. Pitt Street and Bashford Lane						
Westbound (Bashford Lane)	TL	535	0	0	0	0
Northbound (N. Pitt Street)	LR	665	15	8	0	3
Eastbound (Bashford Lane)	LR	540	0	0	18	15
29. N. Royal Street and Montgomery Street						
Westbound *(Montgomery Street)*	L	230	8	23	8	20
	T	230	8	18	8	18
Northbound *(N. Royal Street)*	T	345	50	23	58	30
Southbound *(N. Royal Street)*	T	345	5	23	5	25
30. N. Fairfax Street and Montgomery Street						
Westbound *(Montgomery Street)*	L	240	3	8	3	8
	T	240	3	8	3	5
Northbound *(N. Fairfax Street)*	T	345	78	33	58	33
Southbound *(N. Fairfax Street)*	T	345	10	88	8	73

m- volume for 95th percentile queue is metered by upstream signal
#- 95th percentile volume exceeds capacity; queue may theoretically be longer. Queue shown is maximum after two cycles

4.5. VISSIM Analysis

The 2040 Baseline Conditions along Washington Street were evaluated using the calibrated VISSIM version 8 models developed for existing conditions analysis. While the vehicular street network is unchanged from existing conditions, the vehicular demand and transit service were updated to reflect 2040 Baseline Conditions. Traffic signal timing remained consistent with existing conditions as previously discussed. AM and PM peak hour operations were evaluated using delay and level of service at intersections, average and maximum queue length for intersection approaches, and travel time for northbound and southbound N. Washington Street. Due to the stochastic nature of microsimulation, results presented are from an average of 10 simulation runs. VISSIM analysis results can be found in **Table 4-9** to **Table 4-14.** VISSIM vehicle throughput results are included in **Appendix F**. Overall intersection level of service is shown graphically in **Figure 4-7**. The following is a summary of key operational findings from the analysis.

4.5.1. AM Traffic Operations

All intersections operate with an average delay equivalent to level of service D or better, except the intersection with Bashford Lane which operates at level of service E. Slightly longer delays are expected particularly on northbound N. Washington Street intersection approaches. Increases in northbound delays and queuing through the corridor result in greater congestion compared to existing conditions.

Existing approaches operating at level of service F remain at level of service F under future baseline conditions; this includes northbound E. Abingdon Drive at Slaters Lane, southbound W. Abingdon Drive at Bashford Lane, and eastbound and westbound Bashford Lane. These approaches operate with the same challenges as existing conditions. Additionally, westbound First Street and eastbound Wythe Street operate at level of service F. Westbound First Street operates with 160.9 seconds per vehicle of delay because of the queue on northbound N. Washington Street. The queue prevents side street turning traffic from freely merging. This results in a westbound queue on First Street that consistently reaches N. Pitt Street. Eastbound Wythe Street operates with 94.8 seconds per vehicle of average delay due to high conflicting demand during concurrent eastbound and westbound green indications, and turning traffic conflicts with pedestrians.

Average northbound travel time from Queen Street to Slaters Lane is 8.9 minutes, or approximately 24 seconds greater than existing conditions. Travel time does not increase significantly because the corridor already operates with oversaturated conditions and the coordinated signal timing controls the northbound flow of traffic. Average southbound travel time from Slaters Lane to Princess Street is 3.4 minutes, compared to a travel time of 3.3 minutes under existing conditions. The Slaters Lane intersection and the downstream congestion on northbound George Washington Memorial Parkway remain a major bottleneck. Northbound queues and reduced speed throughout the study area persist during the peak period. The maximum queue from the bottleneck extends out of the study area network south of Princess Street, or just more than one mile; this is slightly longer than existing conditions.

4.5.2. PM Traffic Operations

All intersections operate with an average delay equivalent to level of service C or better. Southbound intersection approaches have a consistent increase in delays compared to existing conditions.

All but five approaches operate at level of service D or better. The five approaches that operate at level of service E include westbound Slaters Lane, westbound Montgomery Street, southeastbound Powhatan Street, and eastbound and westbound Wythe Street. Westbound Slaters Lane has an increased demand of nearly 110 vehicles per hour; as a result, vehicles occasionally wait for two cycles to clear the

intersection. Montgomery Street is often impacted by the queue on southbound N. Washington Street. The queue through the intersection must clear for Montgomery Street traffic to progress, which causes additional delay compared to existing conditions. Southeastbound Powhatan Street operates similarly to existing conditions, which is on the level of service D/E threshold. Delays on eastbound and westbound Wythe Street increase approximately 10-20 seconds per vehicle for existing conditions due to conflicting demand during concurrent eastbound and westbound green indications and turning traffic conflicts with pedestrians. The movement with the highest average delay (157.4 s/veh) is the protected northbound left-turn onto Wythe Street. This delay is the result of additional turning volume at this intersection related to the 2040 Baseline Conditions.

Downstream congestion from signals outside of the study area (Cameron Street and King Street) cause reduced speed and queueing back to Montgomery Street. The intersection with First Street also is a bottleneck for southbound N. Washington Street and results in queues to Bashford Lane. Queues from the intersection of W. Abingdon Drive and Slaters Lane spill back onto N. Washington Street and reach a maximum length around 2,475 feet.

The average travel time for the southbound peak direction from Slaters Lane to Princess Street is 4.9 minutes, and the average travel time for northbound from Queen Street to Slaters Lane is also 4.9 minutes. Southbound travel times increase by approximately one minute and northbound travel times increase by approximately 36 seconds from existing conditions.

Table 4-9: 2040 Baseline Conditions AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline	
1. N. Washington Street and Slaters Lane	NB N. Washington St	TH	35.5 (D)	35.5 (D)	35.5 (D)	35.5 (D)
	NB E. Abingdon Dr	LT	*157.4 (F)*	*131.1 (F)*	*189.1 (F)*	*132.3 (F)*
		TH	*139.9 (F)*		*146.2 (F)*	
		RT	*87.7 (F)*		*87.4 (F)*	
	SB N. Washington St	TH	17.3 (B)	17.3 (B)	17.2 (B)	17.2 (B)
	SB W. Abingdon Dr	LT	77.3 (E)	20.5 (C)	77.9 (E)	23.8 (C)
		TH	16.8 (B)		17.8 (B)	
		RT	17.8 (B)		18.4 (B)	
	EB	LT	42.2 (D)	42.2 (D)	43.1 (D)	43.6 (D)
		TH	46.1 (D)		54.6 (D)	
		RT	40.4 (D)		41 (D)	
	WB	LT	57.8 (E)	45 (D)	54.2 (D)	46.2 (D)
		TH	51.1 (D)		58 (E)	
		RT	42.8 (D)		37.8 (D)	
	Intersection		50.2 (D)		50.5 (D)	
2. N. Washington Street and Bashford Lane	NB N. Washington St	TH	56.1 (E)	56.1 (E)	56.1 (E)	56.1 (E)
	NB E. Abingdon Dr	LT	*179.3 (F)*	36.8 (D)	*163.8 (F)*	36.8 (D)
		TH	30.6 (C)		31.6 (C)	
		RT	25.3 (C)		18.6 (B)	
	SB N. Washington St	TH	14.1 (B)	14.1 (B)	14.7 (B)	14.7 (B)
	SB W. Abingdon Dr	LT	*138.4 (F)*	*89.7 (F)*	*165.5 (F)*	*93.4 (F)*
		TH	13.9 (B)		11.9 (B)	
		RT	3.1 (A)		5.4 (A)	
	EB	LT	*180.5 (F)*	*150.4 (F)*	*175.6 (F)*	*146.2 (F)*
		TH	*114.8 (F)*		*114.7 (F)*	
		RT	*109.3 (F)*		*110.2 (F)*	
	WB	LT	*134.2 (F)*	*198.1 (F)*	*143.2 (F)*	*178.7 (F)*
		TH	*155.5 (F)*		*153.5 (F)*	
		RT	*207.8 (F)*		*184.4 (F)*	
	Intersection		60.6 (E)		59.7 (E)	
3. N. Washington Street and First Street	NB	TH	13.3 (B)	13.3 (B)	14.6 (B)	14.6 (B)
		RT	9.9 (A)		8.6 (A)	
	SB	LT	19.1 (B)	10.1 (B)	21.1 (C)	12.9 (B)
		TH	7.7 (A)		10.2 (B)	
	WB	RT	71.8 (E)	71.8 (E)	*160.9 (F)*	*160.9 (F)*
	Intersection		16.6 (B)		25.3 (C)	

Table 4-9: 2040 Baseline Conditions AM Peak Hour VISSIM Level of Services and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline	
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	LT	75.9 (E)	19 (B)	*81.3 (F)*	19 (B)
		TH	18.1 (B)		18 (B)	
		RT				
	SB	LT		21.6 (C)		21.6 (C)
		TH	21.6 (C)		21.3 (C)	
		RT to Montgomery St	22.2 (C)		28.9 (C)	
		RT to Powhatan St	24.1 (C)		24.9 (C)	
	SEB	RT to Washington St	52.3 (D)	53.4 (D)	53.4 (D)	54.4 (D)
		RT to Montgomery St	63.6 (E)		63.6 (E)	
	EB	LT				
		TH				
		RT				
	WB	LT	37.3 (D)	37.8 (D)	39.5 (D)	37.6 (D)
		TH	37.6 (D)		37.4 (D)	
		RT to Powhatan St	36.3 (D)		0 (A)	
		RT to Washington St	51.5 (D)		0 (A)	
	Intersection		21 (C)		21.3 (C)	
5. N. Washington Street and Madison Street	NB	TH	23 (C)	22.9 (C)	23.6 (C)	23.6 (C)
		RT	19.8 (B)		22.4 (C)	
	SB	LT	52.5 (D)	10.7 (B)	53.3 (D)	10.6 (B)
		TH	4.2 (A)		3.8 (A)	
	EB	LT	38.6 (D)	37.2 (D)	0 (A)	38.6 (D)
		TH	38 (D)		38.9 (D)	
		RT	27.4 (C)		33 (C)	
	Intersection		22.2 (C)		23.4 (C)	
6. N. Washington Street and Wythe Street	NB	LT	21 (C)	26.6 (C)	24 (C)	27.7 (C)
		TH	26.8 (C)		27.8 (C)	
		RT	23 (C)		26.2 (C)	
	SB	LT	75 (E)	15 (B)	70.9 (E)	17.2 (B)
		TH	9.5 (A)		12.2 (B)	
		RT	10.7 (B)		12.1 (B)	
	EB	LT	*80.8 (F)*	77.5 (E)	*99.4 (F)*	*94.8 (F)*
		TH	71.4 (E)		*89.9 (F)*	
		RT	70.6 (E)		*80.1 (F)*	
	WB	LT	44.7 (D)	38.1 (D)	58.3 (E)	47.6 (D)
		TH	38.7 (D)		48.4 (D)	
		RT	34.1 (C)		42.8 (D)	
	Intersection		29.9 (C)		34.1 (C)	

Table 4-9: 2040 Baseline Conditions AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline	
7. N. Washington Street and Pendleton Street	NB	LT	32.5 (C)	26 (C)	43.6 (D)	29 (C)
		TH	26 (C)		28.9 (C)	
		RT	23.2 (C)		29.3 (C)	
	SB	LT	0 (A)	10 (A)	0 (A)	9.2 (A)
		TH	10 (A)		9.2 (A)	
		RT	10.2 (B)		8.4 (A)	
	EB	LT	42.9 (D)	37.6 (D)	0 (A)	36.5 (D)
		TH	39 (D)		37.9 (D)	
		RT	24 (C)		26.9 (C)	
	WB	LT	48.1 (D)	36.7 (D)	48.9 (D)	39.9 (D)
		TH	36.7 (D)		37.5 (D)	
		RT	26 (C)		0 (A)	
	Intersection		24.4 (C)		26.2 (C)	
8. N. Washington Street and Oronoco Street	NB	LT	31.4 (C)	22.3 (C)	35.8 (D)	27.4 (C)
		TH	22.3 (C)		27.5 (C)	
		RT	17.6 (B)		21.9 (C)	
	SB	LT	34.5 (C)	3.5 (A)	0 (A)	3.1 (A)
		TH	3.4 (A)		3.1 (A)	
		RT	2.6 (A)		2.3 (A)	
	EB	LT	40.5 (D)	37.5 (D)	42.6 (D)	37.7 (D)
		TH	36.7 (D)		36.1 (D)	
		RT	28.1 (C)		28.1 (C)	
	WB	LT	39.8 (D)	33.2 (C)	37.7 (D)	33.6 (C)
		TH	34.5 (C)		34.9 (C)	
		RT	25.1 (C)		25.1 (C)	
	Intersection		20.1 (C)		23.8 (C)	
9. N. Washington Street and Princess Street	NB	LT	44.7 (D)	37.7 (D)	55.7 (E)	48.2 (D)
		TH	37.5 (D)		48 (D)	
		RT	30.2 (C)		41.2 (D)	
	SB	LT	0 (A)	3.4 (A)	0 (A)	3.5 (A)
		TH	3.4 (A)		3.4 (A)	
		RT	4.2 (A)		5.9 (A)	
	EB	LT	49.1 (D)	37.5 (D)	54.8 (D)	41.4 (D)
		TH	38.4 (D)		35.9 (D)	
		RT	9.5 (A)		16.9 (B)	
	WB	LT	0 (A)	30.7 (C)	0 (A)	29.9 (C)
		TH	37.4 (D)		32.7 (C)	
		RT	18.4 (B)		23 (C)	
	Intersection		31.4 (C)		39.4 (D)	

Table 4-10: 2040 Baseline Conditions AM Peak Hour VISSIM Travel Times (minutes)

*Results displayed are the average results across 10 microsimulation runs

Segment	Existing Conditions	2040 Baseline
Northbound N. Washington Street From: Queen Street To: Slaters Lane	8.5	8.9
Southbound N. Washington Street From: Slaters Lane To: Princess Street	3.3	3.4

Table 4-11: 2040 Baseline Conditions AM Peak Hour VISSIM Vehicle Queuing (Average and Maximum) (feet)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Available Storage (feet)	Existing Conditions	2040 Baseline
1. N. Washington Street and Slaters Lane	NB N. Washington St	1080	***4413 (5458)***	***4962 (5749)***
	NB E. Abingdon Dr	1100	***703 (1209)***	***812 (1227)***
	SB N. Washington St	3110	32 (207)	35 (241)
	SB W. Abingdon Dr	835	29 (285)	33 (323)
	EB	850	79 (330)	84 (345)
	WB	225	6 (55)	9 (76)
2. N. Washington Street and Bashford Lane	NB N. Washington St	1130	***890 (1231)***	***927 (1233)***
	NB E. Abingdon Dr	700	160 (562)	170 (608)
	SB N. Washington St	1075	25 (283)	30 (306)
	SB W. Abingdon Dr	1055	19 (121)	40 (191)
	EB	730	***318 (745)***	***320 (770)***
	WB	545	***280 (564)***	***289 (564)***
3. N. Washington Street and First Street	NB	330	***121 (439)***	***129 (439)***
	SB	1130	14 (245)	22 (314)
	WB	255	***83 (336)***	***294 (547)***
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	345	***101 (449)***	***96 (454)***
	SB	180	29 (164)	30 (171)
	SEB	345	11 (102)	11 (100)
	EB	245		
	WB	240	29 (155)	34 (186)
5. N. Washington Street and Madison Street	NB	345	***176 (452)***	***179 (455)***
	SB	345	21 (144)	24 (145)
	EB	245	45 (204)	***69 (283)***
6. N. Washington Street and Wythe Street	NB	340	***177 (458)***	***190 (469)***
	SB	350	17 (147)	21 (172)
	EB	260	***125 (279)***	***196 (278)***
	WB	240	35 (211)	***59 (261)***
7. N. Washington Street and Pendleton Street	NB	345	***200 (458)***	***233 (462)***
	SB	340	17 (130)	16 (125)
	EB	245	***36 (247)***	***34 (252)***
	WB	240	20 (182)	19 (166)
8. N. Washington Street and Oronoco Street	NB	345	***183 (467)***	***239 (469)***
	SB	350	7 (127)	7 (125)
	EB	250	26 (188)	27 (175)
	WB	245	17 (131)	19 (140)
9. N. Washington Street and Princess Street	NB	340	***472 (837)***	***673 (876)***
	SB	350	8 (102)	9 (129)
	EB	250	7 (82)	10 (96)
	WB	265	2 (48)	3 (64)

[1]Queue lengths that exceed available storage are highlighted in red text. Approach storage is the distance to the upstream intersection. VISSIM reported queues that cross multiple intersections are capped at the distance to the stop bar of the upstream intersection. The exception is the queues reported on the extents of the study area - northbound Washington Street at Slaters Lane and southbound Washington Street at Princess Street.

Table 4-12: 2040 Baseline Conditions PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline	
1. N. Washington Street and Slaters Lane	NB N. Washington St	TH	25.5 (C)	25.5 (C)	27.9 (C)	27.9 (C)
	NB E. Abingdon Dr	LT	62.6 (E)	44.8 (D)	71.9 (E)	46.9 (D)
		TH	15.7 (B)		14 (B)	
		RT	1.3 (A)		1.9 (A)	
	SB N. Washington St	TH	24.5 (C)	24.5 (C)	30.1 (C)	30.1 (C)
	SB W. Abingdon Dr	LT	*95.2 (F)*	32.1 (C)	*96.7 (F)*	32.7 (C)
		TH	33.5 (C)		33.8 (C)	
		RT	28.4 (C)		29 (C)	
	EB	LT	38.9 (D)	38.9 (D)	43.1 (D)	43.1 (D)
		TH	44.8 (D)		49.6 (D)	
		RT	32.3 (C)		34.3 (C)	
	WB	LT	45.1 (D)	48.1 (D)	65.6 (E)	59 (E)
		TH	62.1 (E)		71.3 (E)	
		RT	4.8 (A)		28.4 (C)	
	Intersection		28.1 (C)		32.2 (C)	
2. N. Washington Street and Bashford Lane	NB N. Washington St	TH	13.6 (B)	13.6 (B)	16.1 (B)	16.1 (B)
	NB E. Abingdon Dr	LT	66.3 (E)	21.1 (C)	65.2 (E)	19.6 (B)
		TH	10.5 (B)		10.7 (B)	
		RT	5.8 (A)		5.2 (A)	
	SB N. Washington St	TH	1.3 (A)	1.3 (A)	10.6 (B)	10.6 (B)
	SB W. Abingdon Dr	LT	75.8 (E)	22.1 (C)	*87.1 (F)*	23.2 (C)
		TH	13.5 (B)		13.2 (B)	
		RT	13.6 (B)		13.7 (B)	
	EB	LT	49.2 (D)	34.2 (C)	44.8 (D)	36.5 (D)
		TH	34.4 (C)		36.9 (D)	
		RT	22 (C)		26.2 (C)	
	WB	LT	39.1 (D)	37.3 (D)	42.1 (D)	37.6 (D)
		TH	37.7 (D)		38.6 (D)	
		RT	37.1 (D)		36.9 (D)	
	Intersection		12.7 (B)		17.7 (B)	
3. N. Washington Street and First Street	NB	TH	10 (A)	10 (A)	9.9 (A)	9.9 (A)
		RT	10.1 (B)		11.4 (B)	
	SB	LT	17.1 (B)	10.4 (B)	22.4 (C)	21.5 (C)
		TH	9.3 (A)		21.3 (C)	
	WB	RT	6.6 (A)	6.6 (A)	7.2 (A)	7.2 (A)
	Intersection		10.1 (B)		16.5 (B)	

Table 4-12: 2040 Baseline Conditions PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline	
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	LT	48.1 (D)	12.3 (B)	51.3 (D)	13 (B)
		TH	10.4 (B)		11.1 (B)	
		RT				
	SB	LT		7.1 (A)		12.4 (B)
		TH	7.1 (A)		12.5 (B)	
		RT to Montgomery St	5.7 (A)		9.6 (A)	
		RT to Powhatan St	7.2 (A)		6.1 (A)	
	SEB	RT to Washington St	54.5 (D)	54.6 (D)	55.7 (E)	55.8 (E)
		RT to Montgomery St	60.2 (E)		60.2 (E)	
	EB	LT				
		TH				
		RT				
	WB	LT	43.3 (D)	43.9 (D)	66.4 (E)	60.3 (E)
		TH	42.4 (D)		58 (E)	
		RT to Powhatan St	45.2 (D)		57.6 (E)	
		RT to Washington St	56.7 (E)		71.1 (E)	
	Intersection		14.4 (B)		19.8 (B)	
5. N. Washington Street and Madison Street	NB	TH	9 (A)	9.8 (A)	13.3 (B)	15.4 (B)
		RT	23.1 (C)		50.9 (D)	
	SB	LT	27.3 (C)	6.6 (A)	62.2 (E)	13.6 (B)
		TH	5.8 (A)		11.6 (B)	
	EB	LT	42.1 (D)	38.2 (D)	44.4 (D)	39.8 (D)
		TH	39.2 (D)		40.5 (D)	
		RT	29.9 (C)		32.2 (C)	
	Intersection		10.6 (B)		16.7 (B)	
6. N. Washington Street and Wythe Street	NB	LT	*112.7 (F)*	15.6 (B)	*157.4 (F)*	21.9 (C)
		TH	10.2 (B)		13.7 (B)	
		RT	21.5 (C)		33.1 (C)	
	SB	LT	32.7 (C)	9.9 (A)	52.9 (D)	14.6 (B)
		TH	8.7 (A)		12.4 (B)	
		RT	6.5 (A)		9.7 (A)	
	EB	LT	58.2 (E)	49.2 (D)	72.7 (E)	59.8 (E)
		TH	46.5 (D)		56.6 (E)	
		RT	41 (D)		43.5 (D)	
	WB	LT	59.8 (E)	50.2 (D)	77.2 (E)	68.2 (E)
		TH	50 (D)		67.1 (E)	
		RT	41.2 (D)		63.2 (E)	
	Intersection		16.6 (B)		23.9 (C)	

Table 4-12: 2040 Baseline Conditions PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline	
7. N. Washington Street and Pendleton Street	NB	LT	57.2 (E)	11.5 (B)	72.3 (E)	15.6 (B)
		TH	11.2 (B)		15.5 (B)	
		RT	10.2 (B)		12.3 (B)	
	SB	LT	38.4 (D)	16.6 (B)	0 (A)	22.6 (C)
		TH	16.6 (B)		22.8 (C)	
		RT	13.9 (B)		17.9 (B)	
	EB	LT	47.2 (D)	41.6 (D)	51.9 (D)	44.3 (D)
		TH	42.3 (D)		44.2 (D)	
		RT	32.3 (C)		37.1 (D)	
	WB	LT	42.7 (D)	36.3 (D)	46.3 (D)	39.6 (D)
		TH	37.8 (D)		41.3 (D)	
		RT	30.6 (C)		33 (C)	
	Intersection		17.9 (B)		22.8 (C)	
8. N. Washington Street and Oronoco Street	NB	LT	25.7 (C)	9.3 (A)	0 (A)	12.1 (B)
		TH	9.3 (A)		12.1 (B)	
		RT	9.9 (A)		12.5 (B)	
	SB	LT	48.1 (D)	22.8 (C)	61.3 (E)	26.6 (C)
		TH	22.6 (C)		26.4 (C)	
		RT	16.7 (B)		17.3 (B)	
	EB	LT	47.2 (D)	39.6 (D)	53.9 (D)	45.7 (D)
		TH	38.2 (D)		43.8 (D)	
		RT	23 (C)		30.9 (C)	
	WB	LT	47.6 (D)	39.8 (D)	58 (E)	50.2 (D)
		TH	43.4 (D)		50.9 (D)	
		RT	31 (C)		44.9 (D)	
	Intersection		19.1 (B)		23.3 (C)	
9. N. Washington Street and Princess Street	NB	LT	47.8 (D)	15.1 (B)	63.6 (E)	22.3 (C)
		TH	13.5 (B)		20.4 (C)	
		RT	14.6 (B)		10.9 (B)	
	SB	LT	43.6 (D)	40.2 (D)	0 (A)	40.4 (D)
		TH	40.3 (D)		40.5 (D)	
		RT	38.1 (D)		37 (D)	
	EB	LT	49.6 (D)	46.2 (D)	55.8 (E)	52.6 (D)
		TH	45.2 (D)		51.1 (D)	
		RT	33.5 (C)		44 (D)	
	WB	LT	39.3 (D)	35.1 (D)	42.5 (D)	40.6 (D)
		TH	38 (D)		41.5 (D)	
		RT	25.3 (C)		36.1 (D)	
	Intersection		30.2 (C)		33.7 (C)	

Table 4-13: 2040 Baseline Conditions PM Peak Hour VISSIM Travel Times(minutes)

*Results displayed are the average results across 10 microsimulation runs

Segment	Existing Conditions	2040 Baseline
Northbound N. Washington Street From: Queen Street To: Slaters Lane	4.3	4.9
Southbound N. Washington Street From: Slaters Lane To: Princess Street	3.9	4.9

Table 4-14: 2040 Baseline Conditions PM Peak Hour VISSIM Vehicle Queuing (Average and Maximum) (feet)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Available Storage (feet)	Existing Conditions	2040 Baseline
1. N. Washington Street and Slaters Lane	NB N. Washington St	1080	209 (868)	*322 (1352)*
	NB E. Abingdon Dr	1100	209 (867)	10 (102)
	SB N. Washington St	3110	173 (813)	341 (1570)
	SB W. Abingdon Dr	835	*404 (2122)*	*515 (2474)*
	EB	850	51 (214)	57 (225)
	WB	225	13 (99)	*46 (227)*
2. N. Washington Street and Bashford Lane	NB N. Washington St	1130	0 (0)	86 (534)
	NB E. Abingdon Dr	700	66 (393)	6 (82)
	SB N. Washington St	1075	0 (0)	121 (631)
	SB W. Abingdon Dr	1055	30 (226)	32 (243)
	EB	730	21 (180)	28 (217)
	WB	545	72 (383)	84 (433)
3. N. Washington Street and First Street	NB	330	47 (268)	*50 (358)*
	SB	1130	53 (726)	*284 (1145)*
	WB	255	5 (88)	6 (108)
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	345	31 (279)	34 (281)
	SB	180	*29 (274)*	*49 (275)*
	SEB	345	29 (174)	29 (171)
	EB	245		
	WB	240	*74 (274)*	*125 (282)*
5. N. Washington Street and Madison Street	NB	345	42 (259)	80 (334)
	SB	345	38 (278)	*93 (541)*
	EB	245	49 (226)	*58 (260)*
6. N. Washington Street and Wythe Street	NB	340	56 (288)	*103 (352)*
	SB	350	*47 (412)*	*81 (417)*
	EB	260	45 (247)	*69 (277)*
	WB	240	*88 (262)*	*157 (262)*
7. N. Washington Street and Pendleton Street	NB	345	53 (328)	*80 (433)*
	SB	340	*107 (446)*	*141 (448)*
	EB	245	*62 (284)*	*71 (286)*
	WB	240	*66 (286)*	*77 (282)*
8. N. Washington Street and Oronoco Street	NB	345	*50 (350)*	*74 (415)*
	SB	350	*137 (457)*	*176 (464)*
	EB	250	21 (147)	27 (180)
	WB	245	*54 (272)*	*92 (273)*
9. N. Washington Street and Princess Street	NB	340	*83 (375)*	*138 (391)*
	SB	350	*743 (1920)*	*1460 (3713)*
	EB	250	27 (161)	40 (243)
	WB	265	11 (115)	18 (155)

[1]Queue lengths that exceed available storage are highlighted in red text. Approach storage is the distance to the upstream intersection. VISSIM reported queues that cross multiple intersections are capped at the distance to the stop bar of the upstream intersection. The exception is the queues reported on the extents of the study area - northbound Washington Street at Slaters Lane and southbound Washington Street at Princess Street.

5. 2040 Build Conditions

This transportation study considers a future year build condition for the purposes of comparison with the future year baseline condition. The build condition includes the transportation conditions associated with the full development potential of the OId Town North Small Area Plan Update. The build conditions transportation network assumes the City-identified transportation improvements associated with the Small Area Plan Update. The 2040 Build Conditions are further described in this chapter.

5.1. 2040 Build Transportation Network

The 2040 Build transportation network is generally the same as the 2040 Baseline Conditions network for the majority of the Old Town North area. It contains largely the same urban street network and multimodal connections. The two most significant changes to the transportation network include the buildout of the power plant site and new street grid and the conversion of Montgomery Street from one-way to two-way operations between N. Fairfax Street to N. Henry Street.

The 2040 Build Conditions transportation network assumptions, in addition to those already described under the baseline transportation network (see **Table 4-1**) are summarized in **Table 5-1**.

Table 5-1. Build Future Transportation Network Assumptions

Project	Description	Type of Project
Build-Out of Power Plant Site and New Street Network	Redevelopment on the 25-acre power plant site will result in the creation of a street network east of N. Washington Street and south of Slaters Lane. These newly created streets will connect multiple existing study area streets such as to N. Royal Street, N. Pitt Street, Slaters Lane, Bashford Lane, and N. Fairfax Street.	All Travel Modes
Montgomery Street Conversion	Conversion of Montgomery Street from one-way with two lanes in each direction to two-way with one lane in each direction. Includes lane configuration and signal phasing modifications at the intersection of N. Washington Street and Montgomery Street. The two-way conversion supports the SAP Update goals to promote retail land uses along Montgomery Street.	Street
DASH Transit Improvements	North-South new transit route along N. Fairfax Street, providing service between Old Town North, the redeveloped power plant site, and the future Potomac Yard Metrorail Station.	Transit
Conversion of the Norfolk-Southern Rail Spur to a Linear Park	Redevelopment of the rail spur to include a linear park and improved pedestrian and bicycle connectivity to the Mt. Vernon Trail.	Pedestrian and Bicycle
Capital Bikeshare	Construction of two capital Bikeshare stations in the redeveloped power plant site.	Bicycle
Parking Recommendations	Implement a strategic management of parking to support retail corridor and right-size parking.	Parking
All Transportation Network Assumptions in the 2040 Baseline Conditions Transportation Network (See Table 4-1)		

5.1.1. Vehicular Street Network

The vehicular street network will remain largely unchanged from the 2040 Baseline Conditions with the exception of additional streets created with the redevelopment of the power plant site and the conversion of Montgomery Street from one-way to two-way operations.

The power plant site, an approximate 25-acre parcel is currently zoned for industrial uses and is bordered by Slaters Lane, E. Abingdon Drive, Bashford Lane, and the Norfolk-Southern rail spur. Based on the City's transportation policies, the City anticipates a new network of streets to be created as part of the redevelopment of the power plant site. Existing north-south streets (N. Pitt Street, N. Royal Street, and N. Fairfax Street) will be extended across the Norfolk-Southern rail spur and into the power plant site. The proposed power plant site street network is shown graphically on **Figure 5-1**. Final configuration of the street network will be subject to the City's development review process.

As part of the transportation study, an analysis was performed to evaluate the performance of the current and future operation of Montgomery Street and Madison Street as a one-way pair of streets. The purpose of this analysis was to determine if the streets would continue to function well as a one-way pair or if implementing two-way operations on one or both streets would result in more efficient operations, while supporting the City's multimodal and economic goals.

The findings indicated that the conversion of Montgomery Street to two-way operation, while retaining Madison Street as a one-way, two-lane street will maintain acceptable traffic operations, while activating Montgomery Street as a retail corridor, and preserving the future implementation of a bicycle facility along Madison Street. As a result, the two-way operation of Montgomery Street is included within the 2040 Build Conditions. Key changes associated with the two-way conversion include the provision of eastbound and westbound left-turn lanes at the intersection of N. Washington Street and Montgomery Street. It is noted that the provision of these turn lanes may require a limited amount of on-street parking restriction along the south side of the street at the intersection approach. Restricting parking will allow the turn lanes to be implemented within the available paved area with no major widening. The lane configuration associated with the 2040 Build Conditions is shown in **Figure 5-2**.

As part of the public outreach process, the community has raised concerns about existing and potential future issues of delivery trucks blocking travel lanes, primarily east of Washington Street. With the conversion of Montgomery Street, there is concern that trucks will block the travel lane and create safety issues. In the near term, loading zones can be requested and reviewed by the Traffic and Parking Board. With a conversion of Montgomery Street to a two-way operation, the City will designate loading zones for the commercial blocks east of Washington Street as well as require new developments to include loading zones or bays through the development review process

For the purposes of this transportation study and to compare each scenario, it is assumed that traffic signal timing will remain consistent between 2040 Baseline Conditions and the 2040 Build Conditions with the exception of minor adjustments to intersections along Montgomery Street and Madison Street as a result of the two-way conversion. Additional signal timing adjustments may be addressed as a potential mitigation strategy in subsequent chapters of this report. All other traffic parameters [high-occupancy vehicle (HOV) lane use, turn restrictions, parking locations, etc.] were not changed.

Figure 5-1: Proposed Power Plant Site Street Network

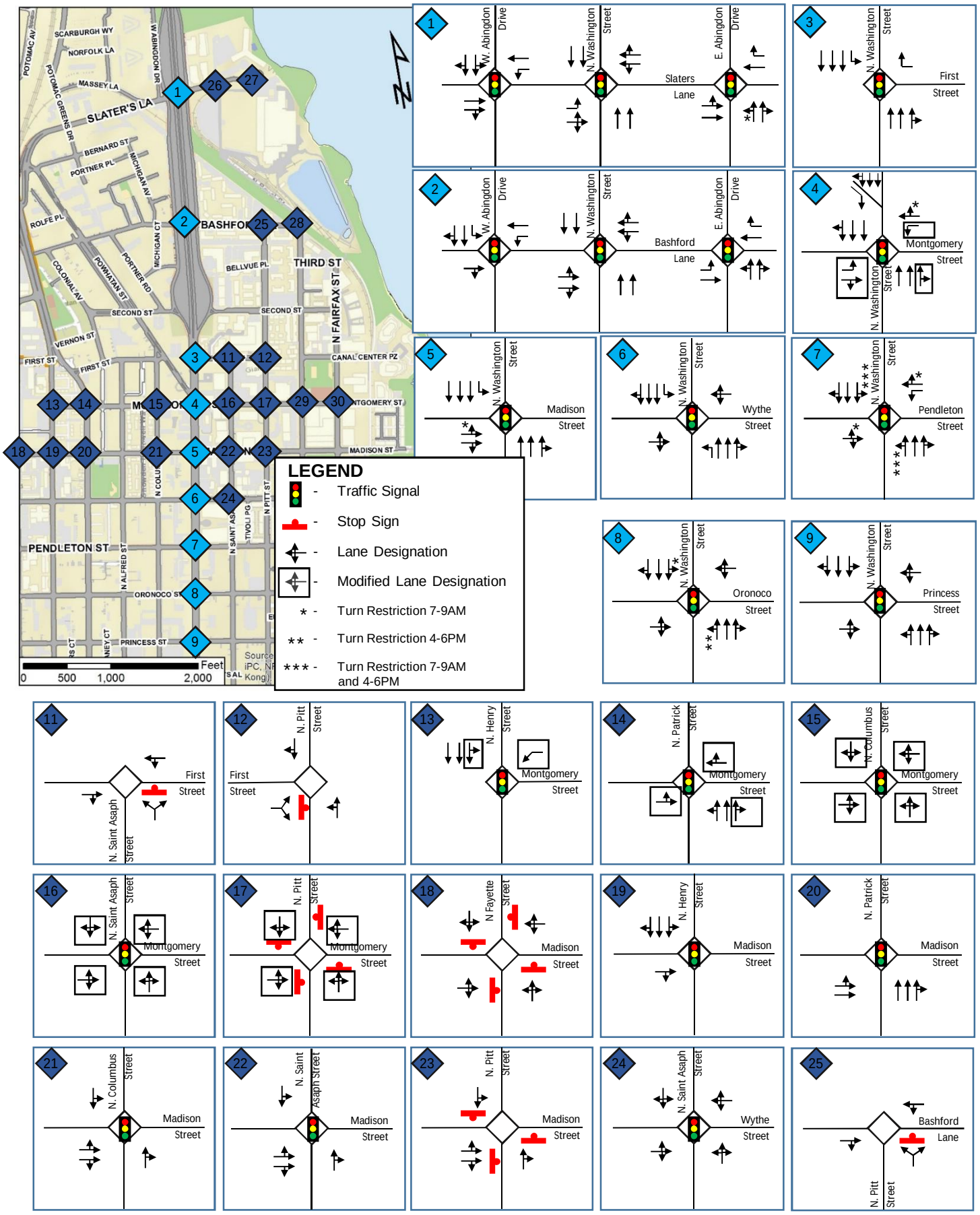
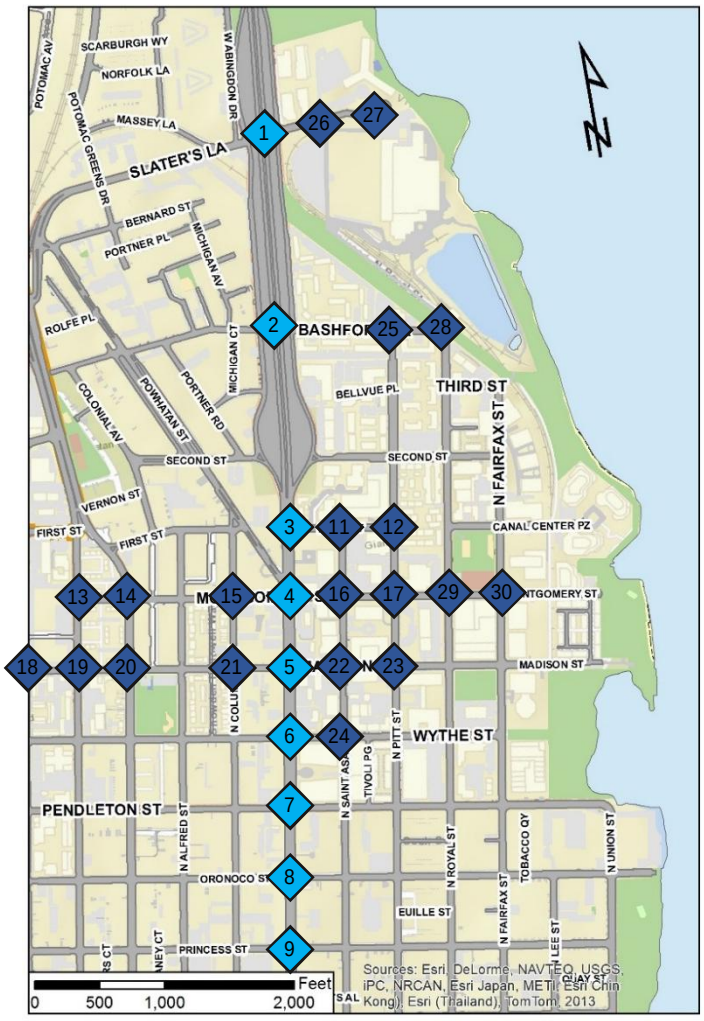
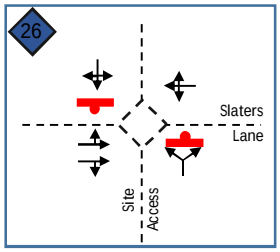


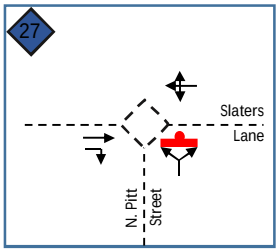
Figure 5-2: 2040 Build Conditions Lane Configuration

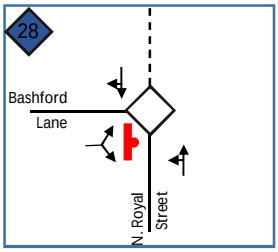


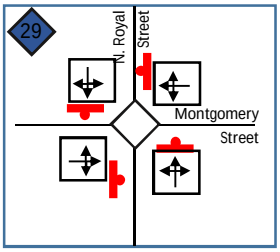
LEGEND

- Traffic Signal
- Stop Sign
- Lane Designation
- Modified Lane Designation
- * - Turn Restriction 7-9AM
- ** - Turn Restriction 4-6PM
- *** - Turn Restriction 7-9AM and 4-6PM









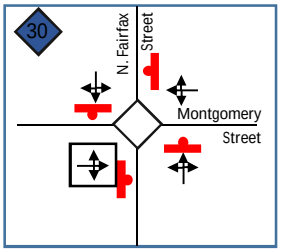


Figure 5-2: 2040 Build Conditions Lane Configuration

5.1.2. Transit Network/Service

The 2040 Build Conditions transit network is largely the same as that described under baseline conditions. Existing DASH and Washington Metropolitan Area Transit Authority (WMATA) and planned DASH routes will serve the Old Town North study area, providing service to the Braddock Road Metrorail Station, Old Town, the District of Columbia, and a variety of other destinations. The only significant change proposed is the development of a new DASH route to serve the power plant site. In addition to the improvements to DASH service, the City investigated a potential future transit option for the Norfolk-Southern rail spur. Any new transit service would be dependent on additional capital and operating funds.

Proposed DASH Route

This route will be a north-south line that runs from a southern terminus to be determined, along N. Fairfax Street, through the power plant site, across Slaters Lane, and terminates at the future Potomac Yard Metrorail Station**.** The proposed route (approximate, final route will be determined later) through the power plant site is shown on **Figure 5-3**. A phasing plan will be identified to align the new service's implementation with power plant site development levels.

Norfolk-Southern Rail Spur Future Transit Evaluation

The existing rail spur includes approximately 1.5 miles of standard gauge track that runs from the north-south rail corridor west of the Old Town North study area to the Robinson Terminal Warehouse near the junction of Pendleton Street and North Union Street. The rail spur previously served industrial areas adjacent to the waterfront, as well as the Potomac River Generating Station located at 14000 N. Royal Street. The right-of-way and tracks are currently owned by Norfolk-Southern. The track crosses multiple roadways, notably at George Washington Parkway and Slaters Lane. The Mt. Vernon Trail runs alongside the existing rail spur from the George Washington Parkway to the track terminus at Pendleton Street, then continues down North Union Street. The rail spur is shown on **Figure 5-4**

The Old Town North Small Area Plan Update calls for the conversion of the rail corridor to a linear trail park, improving the connection between the Parkway and the Mt. Vernon Trail. The community expressed a desire to consider future transit use along the rail corridor as a long-term goal. Transit represents an opportunity to enhance connectivity within the City and to Old Town North.

The following discusses considerations related to the potential long-term transit use for the rail spur:

- **Termini.** Successful urban high-capacity transit services are anchored by large activity centers and/or connectivity to other high-capacity transit services. Logical termini and a continuous alignment must be identified. To the north/west, either Potomac Yard or Braddock Road Metrorail station may be a logical terminus. To the east/west a logical terminus needs to be identified along with an alignment that connects the rail spur and the terminus. Limited rights-of-way and urban development patterns will pose a challenge to locating a transitway south of the existing rail spur limits.
- **Modes.** Two forms of high-capacity transit have been considered for the existing rail spur—light rail and bus rapid transit. As the rail spur is designed to accommodate rail vehicles, the design criteria for the light rail would be easier to meet, given existing conditions. Bus rapid transit requires a narrower right-of-way than light rail, and also may use the existing roadway network including connectivity to US Route 1 and N. Fairfax Street.
- **Compatibility with heavy rail corridor.** Neither light rail or a bus rapid transitway will make use of the existing rails on the existing spur. More importantly, the heavy rail corridor to the west requires a large buffer between mainline and light rail tracks, meaning that the two types of trains cannot share the existing rail right-of-way; therefore, no connection can be made to the Braddock Road Metrorail station or Amtrak/VRE station to the south or along the mainline to the north. As a

result, adding a crossing of the Norfolk-Southern trunk line will require extensive coordination and is likely infeasible at-grade.

- **Amount of rail spur that could be used.** Limited opportunities for connectivity to the north/west will limit the amount of the rail spur that can be used for a high-capacity transitway. The connection will need to consider location in terms of the heavy rail corridor, noted above, and elevation. A planned Virginia Department of Rail and Public Transportation (DRPT) project, DC2RVA, will develop and intercity rail line between Richmond and Washington, DC. This project would likely create additional tracks within the heavy rail corridor, further reducing the amount of rail spur that could be used for the City's purposes.
- **At-grade crossings.** The rail spur currently has at-grade crossings with Potomac Greens Drive, Slaters Lane, West and East Abingdon Drive, the George Washington Memorial Parkway, Royal Street, Canal Center Plaza, Montgomery Street, Madison Street, and Union Street. At-grade crossings are a concern, especially for light rail transit. Each crossing will need to be evaluated in terms of safety and operations and may require signalization or special phasing at existing traffic signals.
- **Right-of-way.** Traditionally, abandoned rail corridors revert to adjacent landowners. Use of the rail spur as a trail may be eligible for railbanking, a voluntary agreement for a railroad company to sell, lease, or donate an out-of-service rail corridor for trail use. Use of the rail spur for transit will require further investigation into right-of-way options and is likely to represent a significant acquisition cost to the City in addition to capital and operating costs of the transit.

The items described above should be considered in coordination with any future studies of the rail spur for transit.

Figure 5-3: Proposed New DASH Route Through Power Plant Site Street Network

Figure 5-4: Norfolk-Southern Rail Spur

5.1.3. Pedestrian Network

The 2040 Build Conditions pedestrian network will be largely the same as under 2040 Baseline Conditions. Consistent with City's transportation policies, it is anticipated that the buildout of the power plant site will result in high-quality pedestrian infrastructure along all new streets and along Slaters Lane.

Recognizing a transit option for the rail spur is not currently being recommended, the City has identified the redevelopment of the rail spur along the power plant site south boundary to improve and enhance the existing Mt. Vernon Trail. The City anticipates that the necessary area for the linear park could be secured through the process of rail-banking in coordination with the rail owner. The Small Area Plan Update recommends a separated pedestrian and bicycle trail through the linear trail park, which may be accommodated by incorporating the existing rail lines. This adaptation also would serve the goal of using elements of the rail as a physical interpretation of the area's industrial heritage in the linear trail park. It is noted that if future transit use for the rail corridor is a long-term goal, the design and development of the linear park would be such that it would not preclude a future transit option.

5.1.4. Bicycle Network

The 2040 Build Conditions bicycle network is largely the same as the 2040 Baseline Conditions. Important components of the 2040 Baseline Conditions bicycle network are bicycle facilities to be implemented along Madison Street (as an enhanced bicycle corridor) and Royal Street (as neighborhood bikeway). In the Build Condition, additional bicycle infrastructure is included as part of the redevelopment of the power plant site. This includes the extension of the N. Royal Street neighborhood bikeway across the rail spur and into the power plant site (with potential for on-street bicycle facilities in the power plant site), the potential extension of bicycle facilities along Slaters Lane, an enhanced multimodal trail along the rail spur, and a shared use path along the waterfront to connect the Mt. Vernon Trail to Slaters Lane. Additionally, it is anticipated that at least two Bikeshare stations will be developed in the redeveloped power plant site—one near Slaters Lane and the other near the waterfront.

The Madison Street enhanced bicycle corridor was evaluated in coordination with the 2040 Build Conditions vehicular street network, using a Bicycle Level of Traffic Stress (BLTS) analysis. A variety of configurations are feasible for the enhanced bicycle corridor incorporating Madison Street and the parallel east-west street of Wythe Street.

BLTS is a tool developed in 2012 by researchers at the Mineta Transportation Institute. BLTS evaluates streets on the hypothetical level of stress experienced by bicyclists riding along a roadway segment. BLTS is scored from one to four (one representing low stress for a bicyclist and four representing high stress for a bicyclist), based on factors such as bicycle facility type, traffic speed, street width, and bike lane width. The combination of these factors contributes to the level of stress that a bicyclist may feel as they travel along a roadway segment. A street with a BLTS score of one provides comfortable and a low stress riding experience for bicyclists of all ages and abilities.

The analysis was conducted on a number of enhanced bicycle configurations ranging from protected bicycle lanes to advisory bicycle lanes that could be implemented along Madison Street and Wythe Street. Factors analyzed included the following:

- Street width (number of lanes per direction, without raised medians)
- Bike lane width (feet, including any buffer space)
- Posted speed limit (miles per hour)
- Sum of parking lane and bike lane (feet, when applicable)

The existing BLTS score for the segments of Madison Street and Wythe Street in the study area is 2. This is consistent with the streets' existing characteristics—2-lane neighborhood streets with a low posted speed limit (25 miles per hour) and no dedicated bicycle facilities. Streets with BLTS of 2 are considered suitable for bicyclists of all ages and abilities. A variety of potential future configurations with dedicated lanes can improve the BLTS score for the corridor to a score of 1 or maintain the existing BLTS score. The provision of such a low stress bicycle corridor will connect Old Town North, the Mt. Vernon Trail, and the adjacent waterfront to the Braddock Road Metrorail station, and Metroway corridor as well as other areas of the city to the west consistent with the Pedestrian and Bicycle Chapter of the City's Transportation Master Plan. A memorandum documenting the calculation of BLTS for various scenarios is included as **Appendix I**. While this plan accounts for a bicycle treatment along Madison Street, the specific design has not been developed yet. The design will be performed at a later date as part of the City standard process including public input.

5.1.5. Parking

To support the retail corridor and make better use of the available on- and off-street parking supply the build conditions should consider the same level of strategic parking planning and planning for the impact of new vehicle technologies as described in the baseline conditions.

5.2. 2040 Build Conditions Land Use

The 2040 Build Conditions assume build-out in the Old Town North study area to meet the zoning and land use goals of the Small Area Plan Update. The net increase in development is shown in **Table 5-2.**

Table 5-2. 2040 Build Net Development Increase

Land Use	Total Intensity
Hotel	-46 rooms
Specialty Retail	90,591 square feet
Mid-Rise Apartment	2,901 Dwelling Units
General Office	724,562 square feet
Residential Townhouse	168 DUs
Light Industrial	-7,975 square feet
Total Net Development Increase	4,291,830 square feet

Based on the land use forecasts developed by the City of Alexandria's Department of Planning and Zoning, the Small Area Plan Update land use assumptions will consist of approximately 46 less hotel rooms, 90,591 square feet of net new commercial/retail use, 2,901 net new apartment units, 168 net new residential condominium/townhouse units, 724,562 square feet of net new office space, and 7,975 less square feet of light industrial use. The forecasted development associated with the 2040 Future Build Conditions are further detailed, by block and land use, in **Appendix G**.

5.3. 2040 Build Traffic Forecasts

Traffic volumes were forecasted for the 2040 Build Conditions based on regional growth, baseline development generated traffic, and traffic diversions associated with the conversion of Montgomery Street from one-way to two-way operation.

5.3.1. Regional Traffic Growth along N. Washington Street, N. Patrick Street, and N. Henry Street

The anticipated regional growth is the same as that described in the discussion of 2040 Baseline Conditions traffic volumes and previously shown in **Figure 4-2**.

5.3.2. Build Development Related Traffic

Development-related traffic for the 2040 Build Condition was developed using the same methodology as the 2040 Baseline Conditions. This resulted in person trips, calculated for each block in the Old Town North Study area. The resulting summary of person trips for the 2040 Build Conditions is shown in **Table 5-3**. A detailed breakdown of person trips by block is included in **Appendix H**.

Table 5-3. 2040 Build Development Net Person Trip Summary

2040 Build Land Use	Total Intensity	AM Peak Hour			PM Peak Hour			Weekday
		In	Out	Total	In	Out	Total	
Hotel	-46 Rooms	-14	-10	-24	-15	-13	-28	-376
Specialty Retail	90,591 square feet	47	28	75	129	166	295	4,057
Mid-Rise Apartment	2,901 DUs	315	705	1,020	724	526	1,250	11,348
General Office	724,562 square feet	905	123	1,028	169	822	991	6,703
Residential Townhouse	168 Dwelling Units	18	99	117	88	44	132	1,317
Light Industrial	-7,975 square feet	-6	-1	-7	-1	-7	-8	-56
Total Net Build Site Generated Traffic		1,265	944	2,209	1,094	1,538	2,632	22,993

It is noted that compared to 2040 Baseline Conditions, the 2040 Build Conditions generate 855 and 560 more peak hour person trips in the AM and PM peak hours, respectively.

5.3.3. Mode Split

Mode split assumptions were applied to the person trips to identify Metrorail, bus transit, pedestrian and bicycle, and vehicular trips using the same methodology discussed under the 2040 Baseline Conditions. The resulting summary of trips generated, by mode, for the 2040 Build Conditions is described in **Table 5-4**. A detailed breakdown by mode and block is included in **Appendix H**.

Table 5-4. 2040 Build Development Trip Generation Summary by Mode

2040 Build Land Use	Total Intensity (Rounded)	AM Peak Hour			PM Peak Hour			Weekday	Weekday Mode Split %
		In	Out	Total	In	Out	Total		
Hotel	**-46 Rooms**	**-14**	**-10**	**-24**	**-15**	**-13**	**-28**	**-376**	-
Transit - Metrorail		-4	-3	-7	-3	-4	-7	-101	27%
Transit - Bus		0	-1	-1	0	-1	-1	-15	4%
Pedestrian and Bicycle		-6	-3	-9	-4	-4	-8	-116	31%
Auto		-4	-3	-7	-8	-4	-12	-144	38%
Specialty Retail	**90,591 square feet**	**47**	**28**	**75**	**129**	**166**	**295**	**4,057**	-
Transit - Metrorail		13	9	22	39	45	84	1,176	29%
Transit - Bus		4	1	5	11	12	23	324	8%
Pedestrian and Bicycle		12	8	20	34	45	79	1,096	27%
Auto		18	10	28	45	64	109	1,461	36%
Mid-Rise Apartment	**2,901 Dwelling Units**	**315**	**705**	**1,020**	**724**	**526**	**1,250**	**11,348**	-
Transit - Metrorail		162	355	517	369	269	638	5,797	51%
Transit - Bus		2	7	9	9	3	12	113	1%
Pedestrian and Bicycle		50	109	159	116	79	195	1,760	16%
Auto		101	234	335	230	175	405	3,678	32%
General Office	**724,562 square feet**	**905**	**123**	**1,028**	**169**	**822**	**991**	**6,703**	-
Transit - Metrorail		209	27	236	42	187	229	1,549	23%
Transit - Bus		81	13	94	18	73	91	616	9%
Pedestrian and Bicycle		72	8	80	14	65	79	535	8%
Auto		543	75	618	95	497	592	4,003	60%
Residential Townhouse	**168 DUs**	**18**	**99**	**117**	**88**	**44**	**132**	**1,317**	-
Transit - Metrorail		10	52	62	46	23	69	687	52%
Transit - Bus		0	0	0	0	0	0	13	1%
Pedestrian and Bicycle		2	14	16	14	7	21	206	16%
Auto		6	33	39	28	14	42	411	31%
Light Industrial	**-7,975 square feet**	**-6**	**-1**	**-7**	**-1**	**-7**	**-8**	**-56**	-
Transit - Metrorail		0	0	0	0	0	0	0	0%
Transit - Bus		0	0	0	0	0	0	0	0%
Pedestrian and Bicycle		0	0	0	0	0	0	0	0%
Auto		-6	-1	-7	-1	-7	-8	-56	100%
Total Transit - Metrorail		390	440	830	493	520	1,013	9,108	40%
Total Transit - Bus		87	20	107	38	87	125	1,051	5%
Total Pedestrian and Bicycle		130	136	266	174	192	366	3,481	15%
Total Auto		658	348	1,006	389	739	1,128	9,353	40%
Total Build Site Generated Traffic		**1,265**	**944**	**2,209**	**1,094**	**1,538**	**2,632**	**22,993**	-

It is noted that compared to 2040 Baseline Conditions, the 2040 Build Conditions generate 371 and 233 more peak hour vehicle trips in the AM and PM peak hours, respectively.

5.3.4. Trip Distribution

The 2040 Build Conditions trip distributions are consistent with those identified under 2040 Baseline Conditions and previously shown on **Figure 4-3, Figure 4-4, and Figure 4-5.**

5.3.5. 2040 Build Development Traffic Volumes

The calculation of 2040 Build development traffic volumes includes two steps—calculating "unadjusted" future volumes (i.e. future volumes prior to the two-way conversion of Montgomery Street) and calculating adjusted volumes (i.e. future volumes considering the two-way conversion of Montgomery street.

Unadjusted Future Volumes

Build development site generated peak hour traffic volumes were calculated by applying the trip distribution to the site generated trips and assigning the traffic through the street network. The AM and PM peak hour build development site generated peak hour trips are shown on **Figure 5-5**. The build development site generated trips were added to the peak hour traffic volumes increased for regional growth (**Figure 4-2**) to result in 2040 Unadjusted Build Conditions Peak Hour Traffic Volumes as shown on **Figure 5-6.**

Adjusted Future Volumes

The conversion of Montgomery Street to two-way operations is anticipated to result in a rerouting of east-west traffic within the Montgomery-Madison corridor. For the purposes of this study, it was assumed that the 40 percent of all traffic that typically travels eastbound along Madison Street would reroute to Montgomery Street. The 40 percent value was arrived at after numerous iterations to demonstrate an appropriate balance of eastbound traffic between Montgomery Street and Madison Street. In general, it is assumed that Madison Street would still carry a greater portion of eastbound traffic (60 percent), due to driver familiarity and the fact the Madison Street extends farther west than Montgomery Street.

To improve operations at the intersection of Montgomery Street and N. Washington Street, the intersection of Powhatan Street at N. Washington Street is recommended to become a right-in, right-out only street. Vehicles that currently turn right into Powhatan Street from Montgomery Street (81 vehicles in the PM peak hour) or left into Powhatan Street from N. Washington Street (28 and 73 vehicles in the AM peak hour and PM hour, respectively) would reroute to access Powhatan Street via a left turn at Wythe Street and then a right turn onto N. Columbus Street. It is noted that the elimination of the northbound left-turn movement allows for few seconds of green time to be reallocated to east-west movements. No changes were made to the phasing or cycle length of the intersection other than the addition of eastbound phases concurrent with westbound phases.

A graphic that shows the rerouted paths of trips associated with the two-way conversion is shown in **Figure 5-7**. Rerouted traffic volumes associated with the conversion of Montgomery Street to two-way operation are shown in **Figure 5-8**. It is noted that no existing peak hour turn restrictions were adjusted as a result of the two-way conversion. Rerouted traffic volumes (**Figure 5-8**) were added to the 2040 Unadjusted Build Conditions Peak Hour Traffic Volumes (**Figure 5-6**) to result in 2040 Build Conditions Peak Hour Traffic Volumes as shown on **Figure 5-9.**

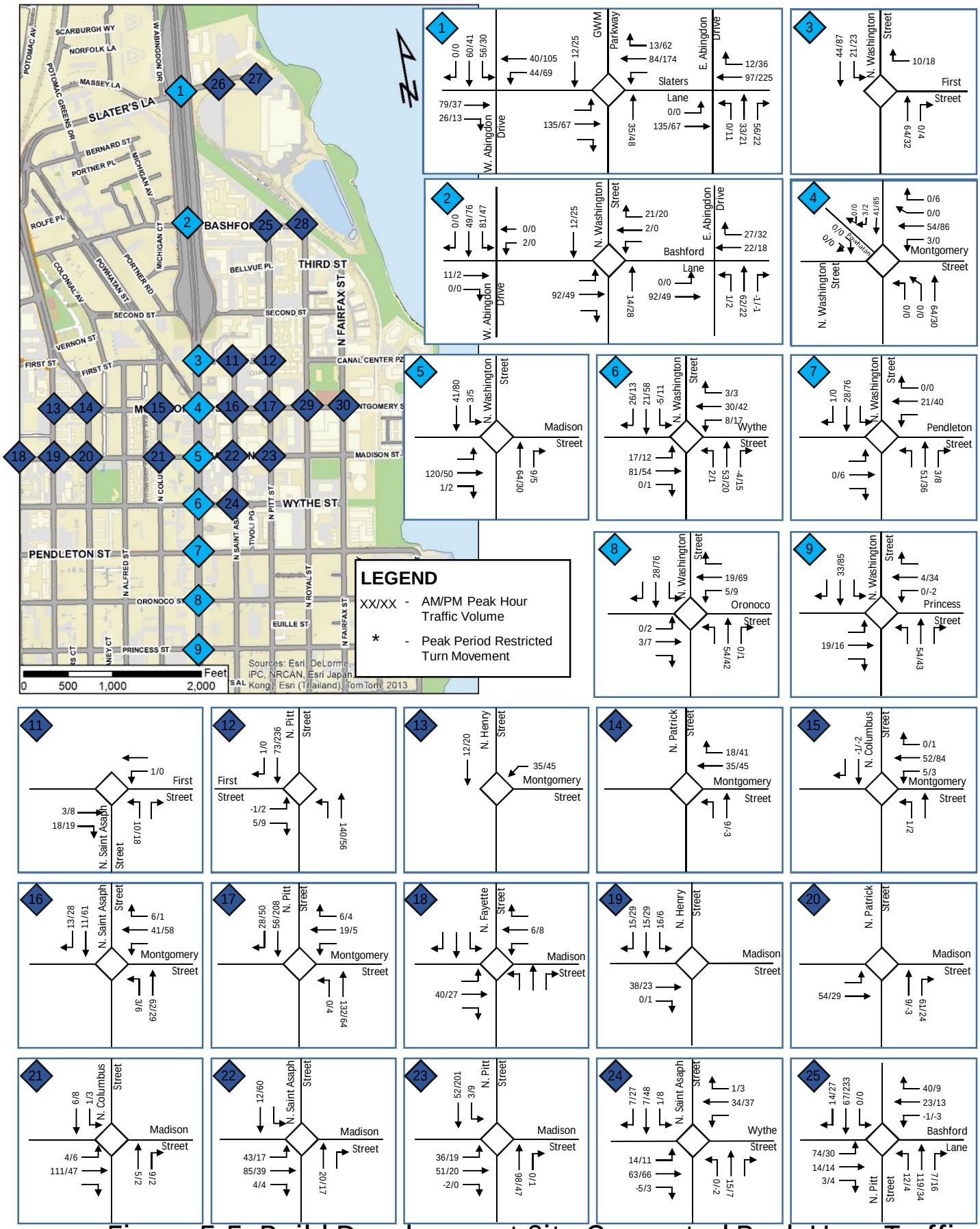
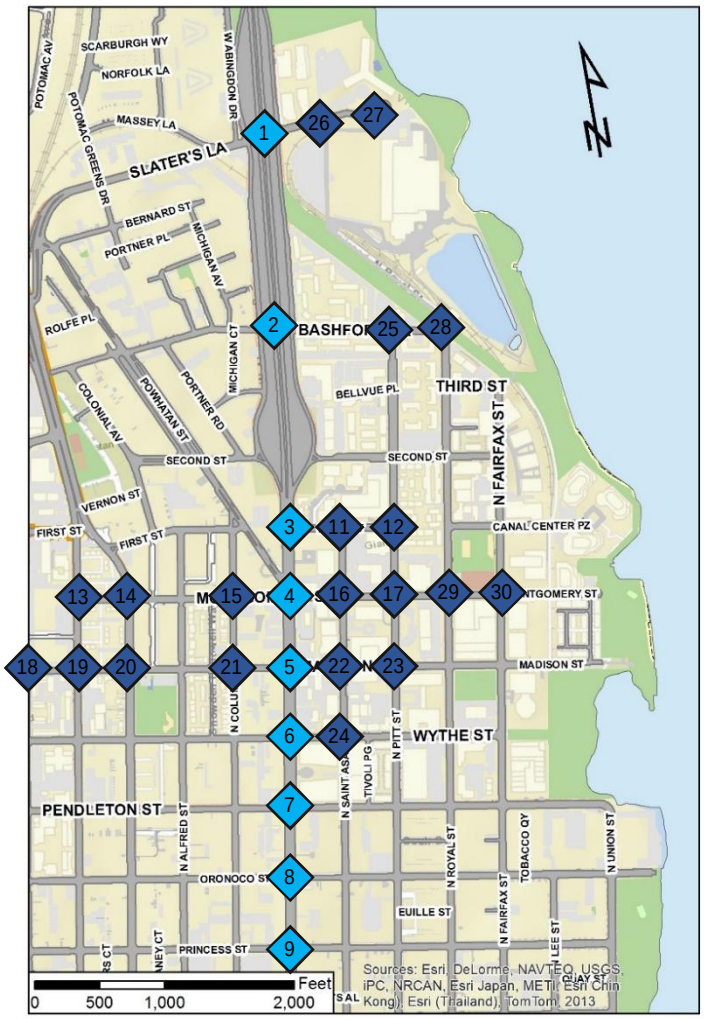


Figure 5-5: Build Development Site Generated Peak Hour Traffic Volumes Sheet 1 of 2



LEGEND

XX/XX - AM/PM Peak Hour Traffic Volume

* - Peak Period Restricted Turn Movement

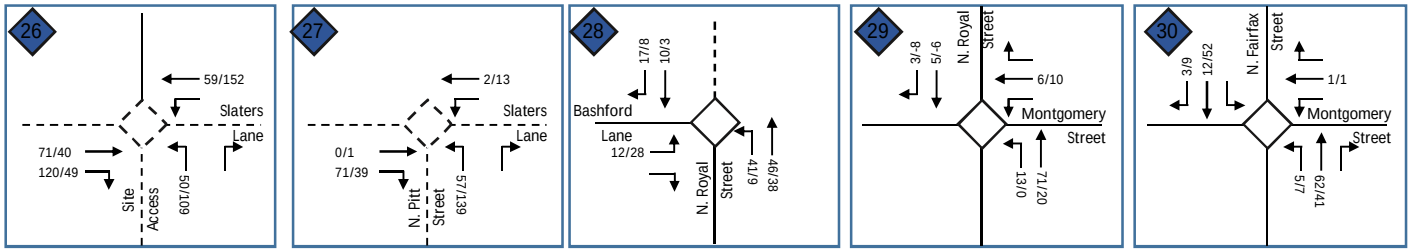


Figure 5-5: Build Development Site Generated Peak Hour Traffic Volumes Sheet 2 of 2

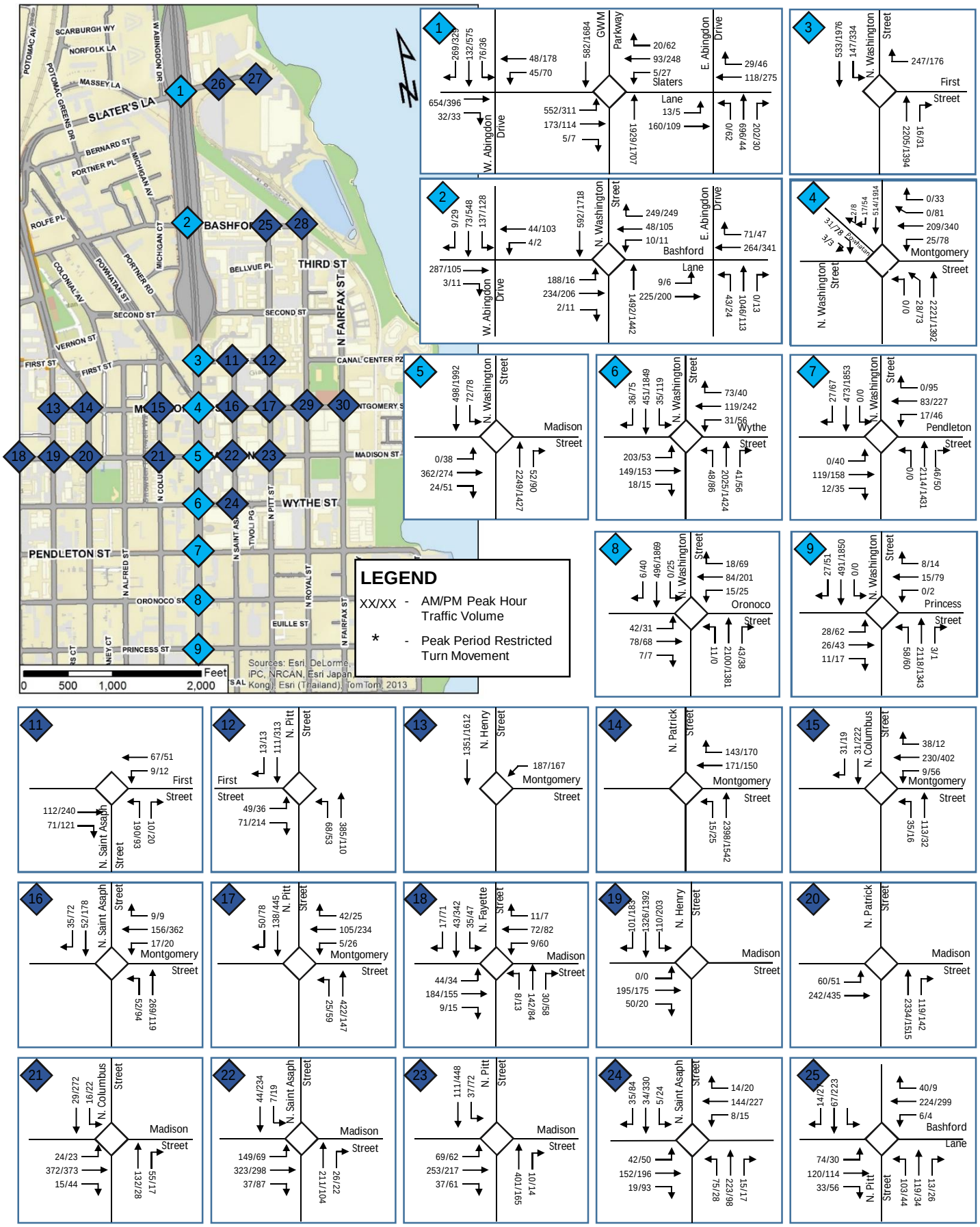
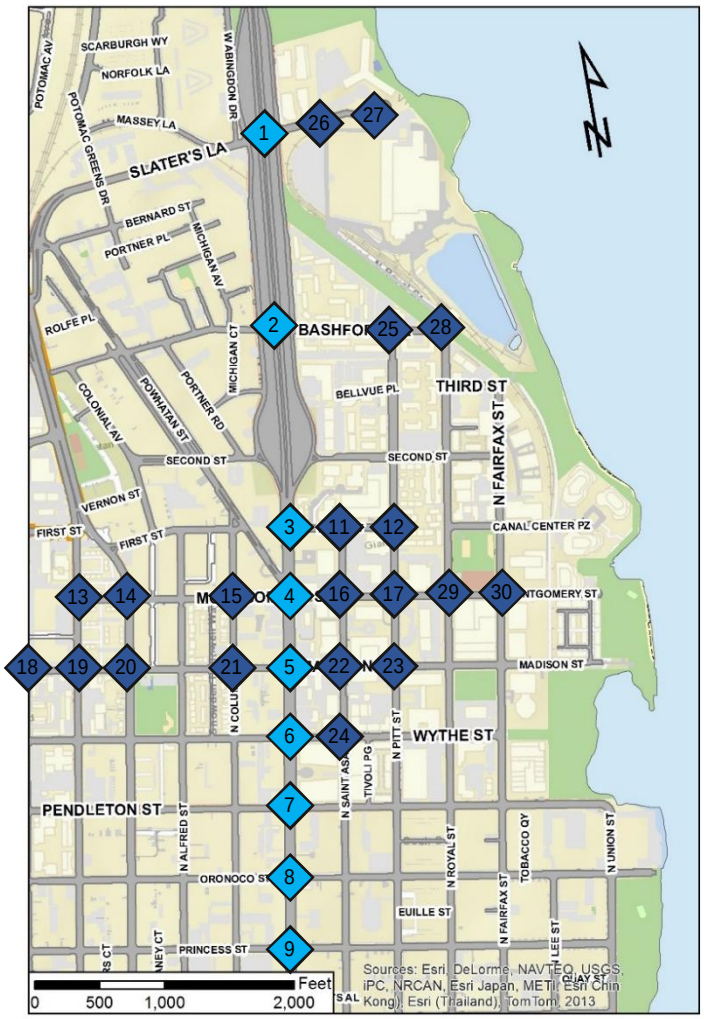


Figure 5-6: 2040 Unadjusted Build Conditions Peak Hour Traffic Volumes



LEGEND

XX/XX - AM/PM Peak Hour Traffic Volume

* - Peak Period Restricted Turn Movement

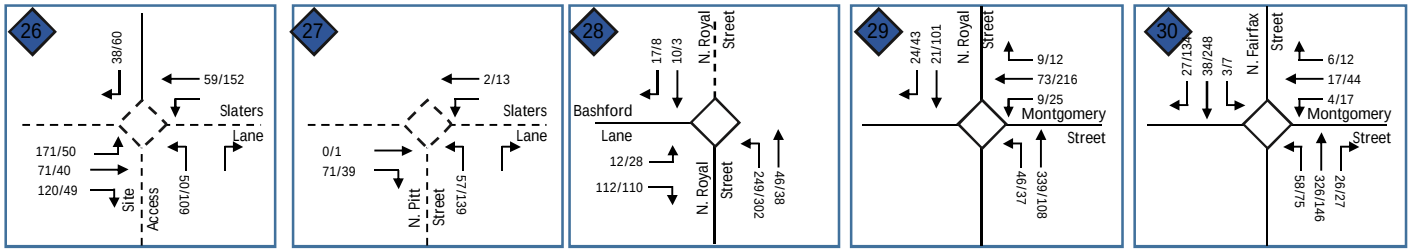
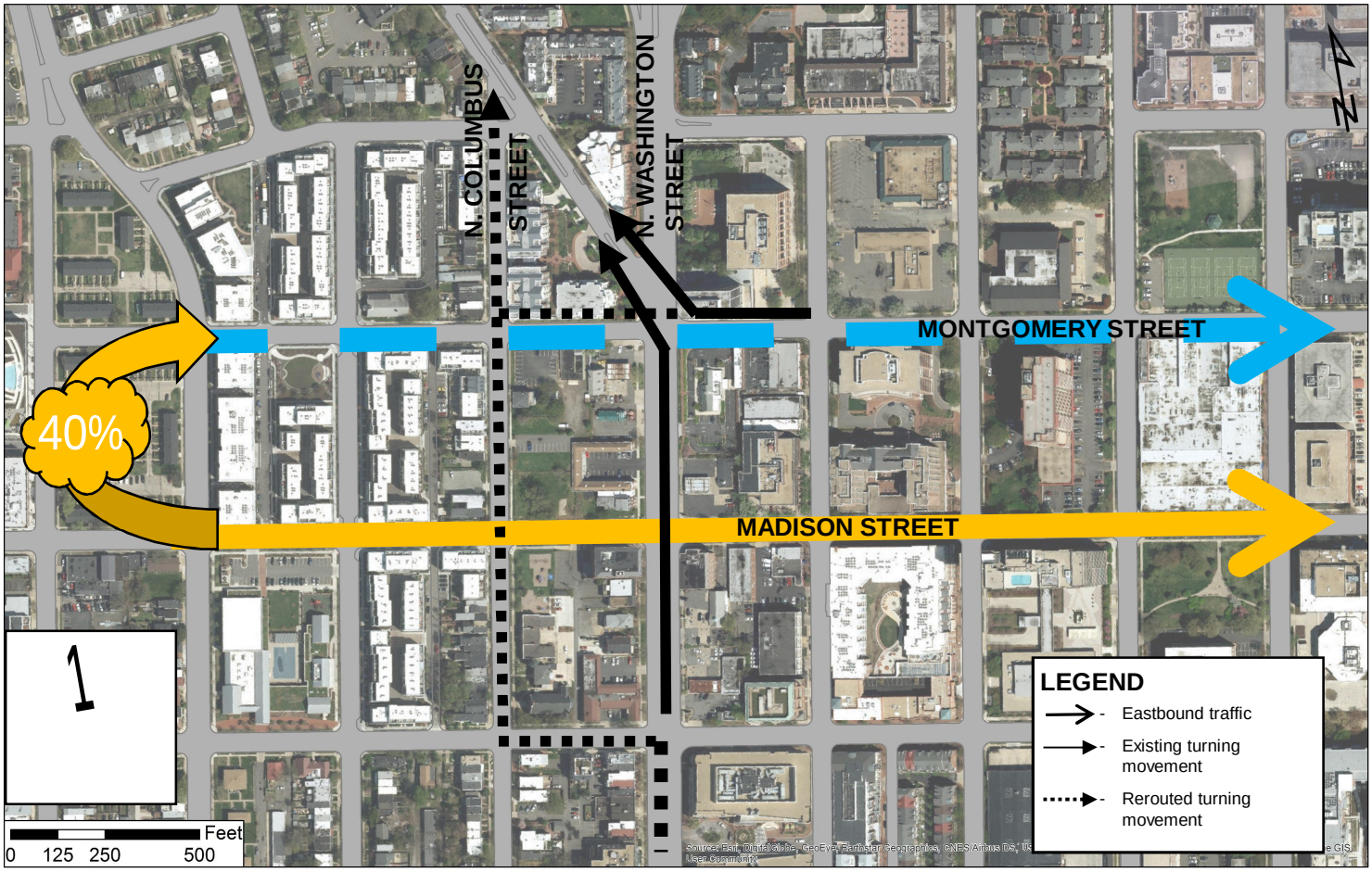


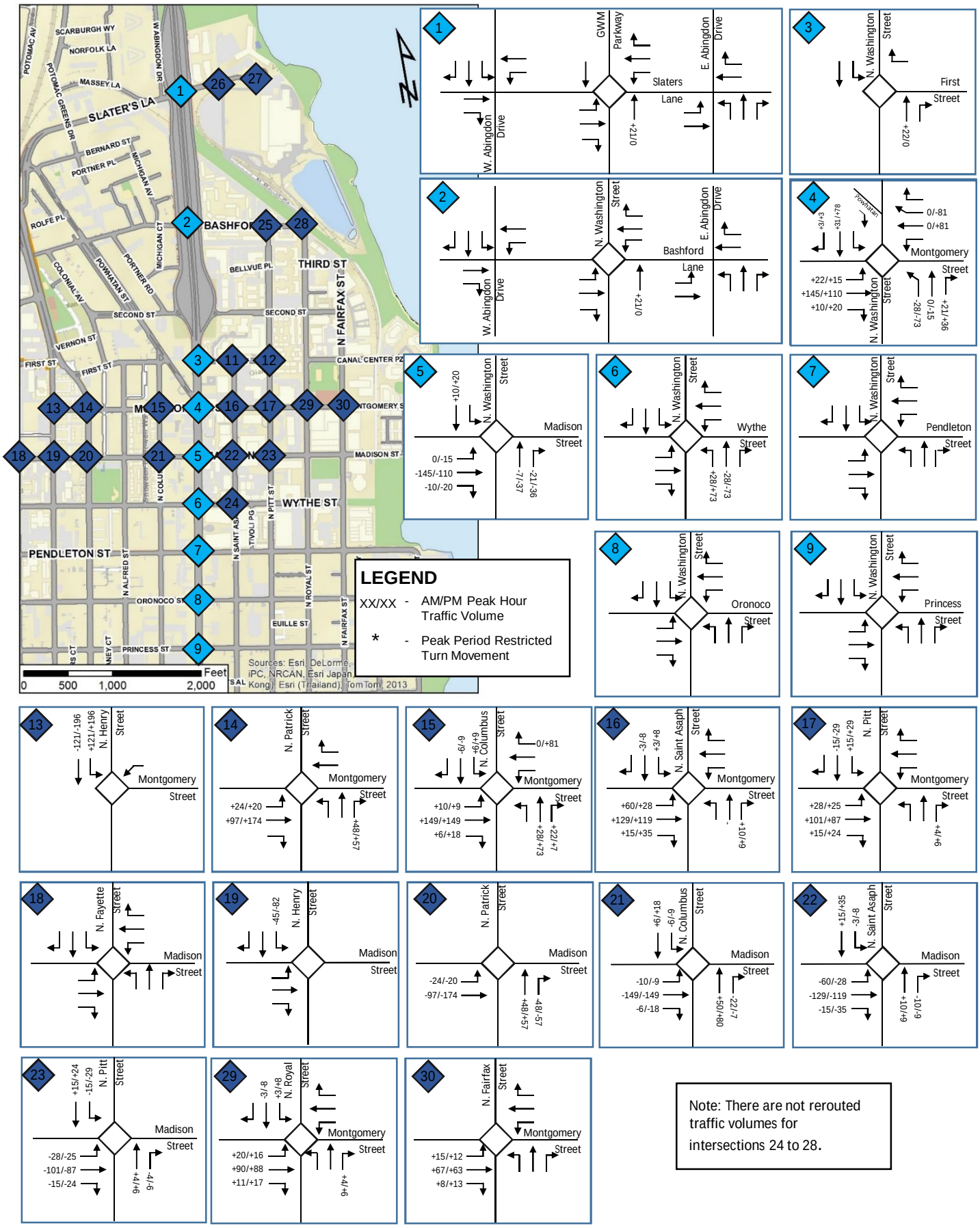
Figure 5-6: 2040 Unadjusted Build Conditions Peak Hour Traffic Volume



Note:
For the purpose of this study, it is assumed that 40 percent of eastbound trips would use Montgomery Street and the remaining 60 percent of eastbound trips would use Madison Street.

- This rerouting of trips will increase the amount of southbound left, northbound right, and eastbound traffic along Montgomery Street, while reducing the amount of southbound through traffic.
- Along Madison Street, the rerouting will reduce the number of northbound right, southbound left, and eastbound traffic, while increasing the amount of northbound through traffic.
- Left turning traffic into Powhatan Street from N. Washington Street will be rerouted to N. Columbus Street via Wythe Street.
- Right turning traffic into Powhatan Street from Montgomery Street will be rerouted to N. Columbus Street.

Figure 5-7: Rerouted Eastbound Trips and Powhatan Street Access Associated with Montgomery Street Two-Way Conversion



Note: There are not rerouted traffic volumes for intersections 24 to 28.

Figure 5-8: Rerouted Peak Hour Traffic Volumes

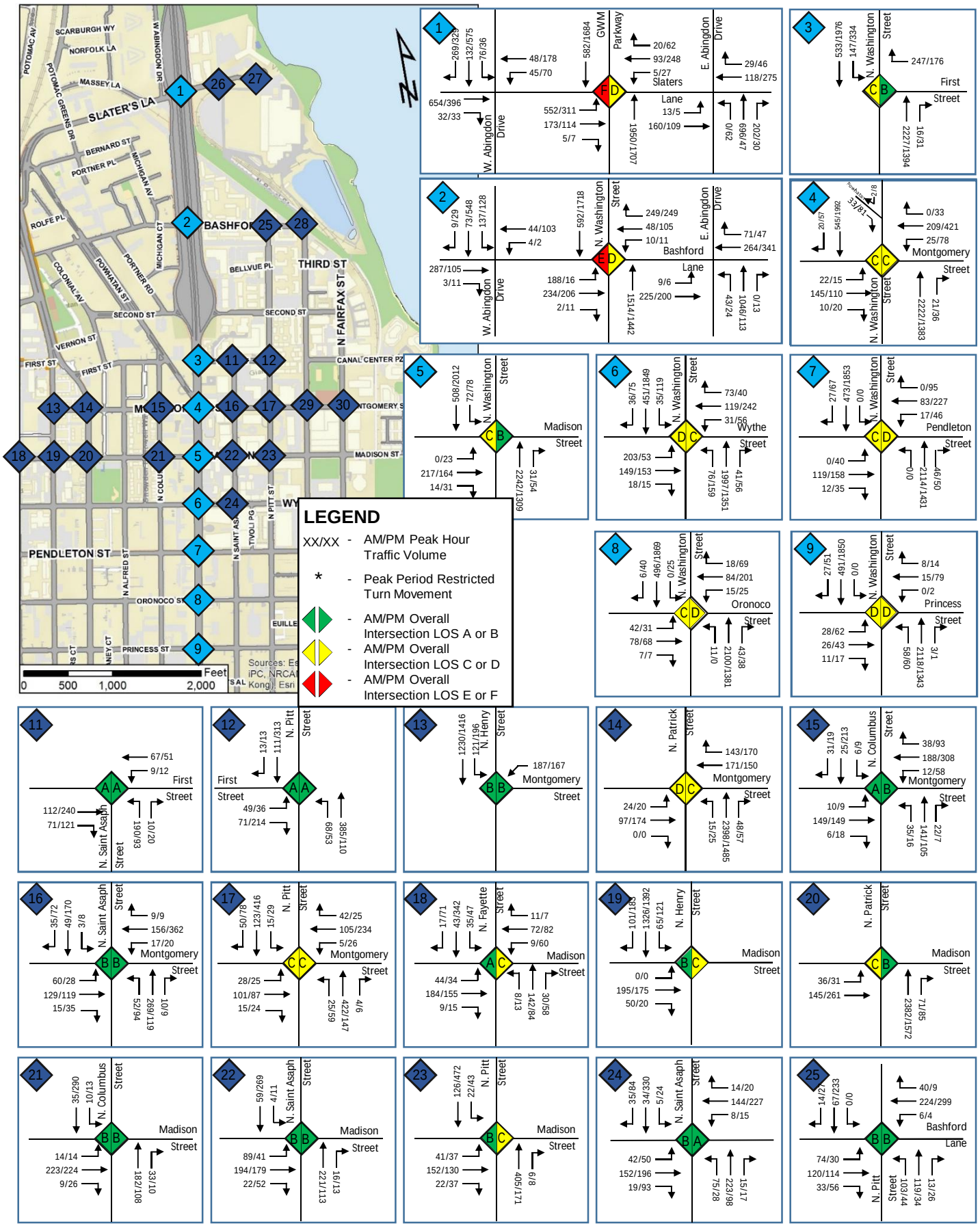
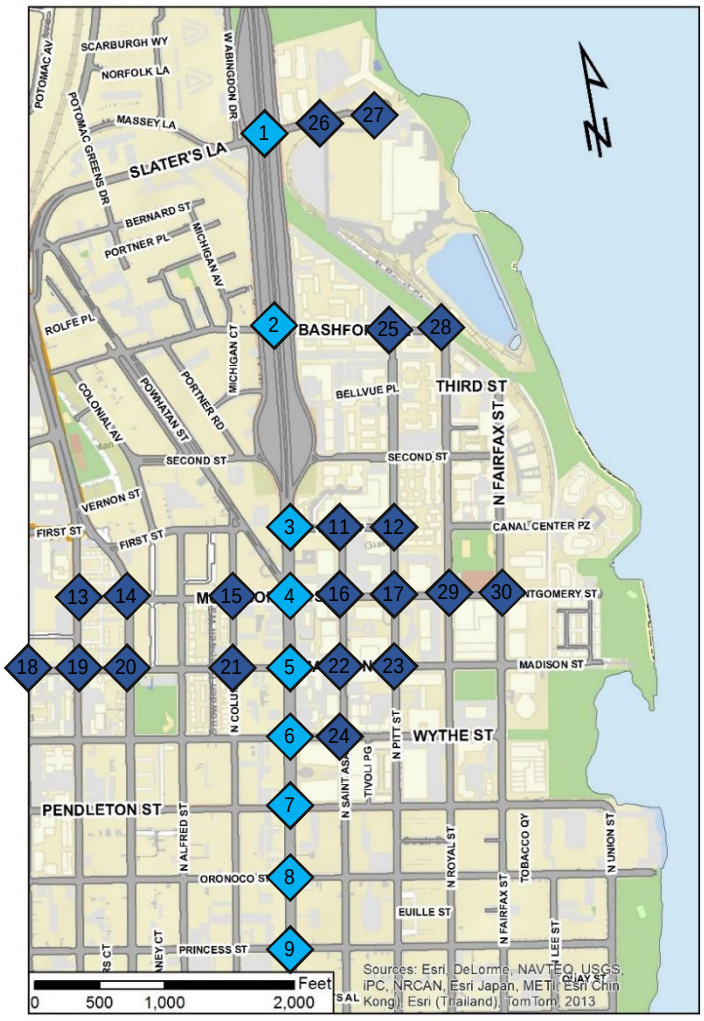


Figure 5-9: 2040 Build Conditions Peak Hour Traffic Volumes

Sheet 1 of 2

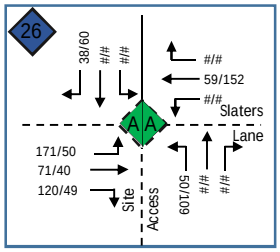


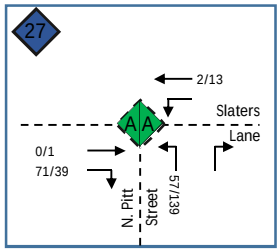
LEGEND

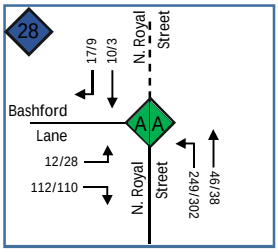
XX/XX - AM/PM Peak Hour Traffic Volume

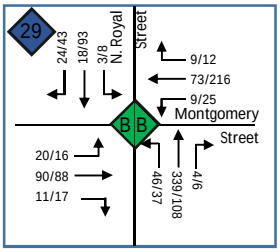
* - Peak Period Restricted Turn Movement

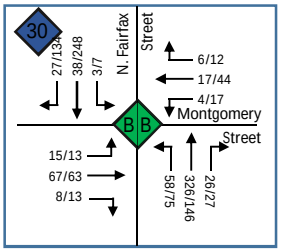
- AM/PM Overall Intersection LOS A or B
- AM/PM Overall Intersection LOS C or D
- AM/PM Overall Intersection LOS E or F











Note:
For the purpose of this study, nominal traffic volumes (represented by the # symbol) were added to the intersection of the Site Access with Slater Lane to show interaction with the current residential property north of Slaters Lane.

Figure 5-9: 2040 Build Conditions Adjusted Peak Hour Traffic Volumes

Sheet 2 of 2

5.4. Synchro Analysis

2040 Future Build Conditions analyses were evaluated using the 2040 Build Conditions traffic volumes and the existing pedestrian and bicycle volumes, 2040 Build Conditions lane designations, existing heavy vehicle percentages and bus blockage data, existing traffic control, and signal timing generally consistent with existing conditions at the study intersections. Analyses for non-Washington street intersections were performed using Synchro 9.1. City Synchro files were updated to NEMA phasing to run *Highway Capacity Manual* 2010 analyses.

It is noted that the traffic models would not be very sensitive to the number of pedestrians/bicyclists that could reasonably be expected to occur in the study area in future years. Accordingly, using the existing pedestrian and bicycle volumes results in models are still valid for future year analyses. Additionally, these modes are specifically addressed with the planned improvements and recommendations for enhanced facilities.

Where information was not available, Synchro default values were used. Per City guidelines, the existing peak hour factors that were less than 0.95 were increased by 15 percent up to a maximum of 0.95. Synchro analysis reports are provided in **Appendix D**. The results of the 2040 Build Conditions level of service and delay analyses are shown graphically in **Figure 5-8** and further detailed in **Table 5-5**.

The traffic generated by the build development of Old Town North results in similar traffic impacts as those noted under baseline conditions. All non-N Washington Street intersections operate at level of service D or better and nearly every non-N. Washington Street intersection operates with the same level of service as under 2040 Baseline Conditions. Exceptions include:

- N. Pitt Street and Montgomery Street (from B to C during the AM and PM peak hour)
- N. Columbus Street and Madison Street (From C to B during the AM peak hour)
- N. Pit Street and Madison Street (from B to C during the PM peak hour)
- N. Pitt Street and Bashford Lane (from A to B during both the AM and PM peak hour)
- N. Royal Street and Montgomery Street (from A to B during the AM and PM peak hour)
- N. Fairfax Street and Montgomery Street (from A to B during the AM peak hour)

It is noted that the 2040 Build Conditions include the extension of N. Pitt Street, N. Royal Street, and N. Fairfax Street into the redeveloped power plant site. Accordingly, it is expected that these streets will serve a greater quantity of north-south vehicles traveling to and from the power plant site. The two-way operation of Montgomery Street also adds eastbound vehicle delays to intersections along Montgomery Street where there were no east-west vehicle conflicts previously.

It is noted that a few intersections experience a decrease in overall delay when compared to 2040 Baseline Conditions. This apparent improvement in traffic operation may be the result of many factors. For example, illegal movements at restricted turns at or along Washington Street have been redistributed through the grid network to turn at appropriate locations. At other intersections, shifts in traffic routing (either associated with the development assumptions or the two-way conversion of Montgomery Street) increase the traffic volume at lower delay movements, which brings the overall intersection delay (an average) down.

The results of the 2040 Build Conditions queuing analyses are shown in **Table 5-6**. Most intersections operate with similar vehicle queuing as in existing and baseline conditions. The results indicate that vehicle queuing is not a significant issue at most study area intersections. Separate turn pockets are not present at most of the non-N. Washington Street intersections and existing queues for through and turning movements are accommodated within the available block lengths. Exceptions to this include:

- Westbound approach of Montgomery Street and N. Patrick Street during the AM peak hour – vehicle queues exceed the available storage by 46 feet, or two vehicles. Compared to 2040 Baseline Conditions, this represents an increase in vehicle queuing of 191 feet. It is noted that the westbound approach operates at level of service C during the AM peak hour.
- Northbound approach of N. Patrick Street and Montgomery Street during the AM peak hour – Vehicle queues exceed the available storage by 228 feet, or 9 vehicles. Compared to 2040 Baseline Conditions, this represents a decrease in vehicle queuing of 2 feet. It is noted that the northbound approach operates at level of service D during the AM peak hour.
- Westbound approach of N. Columbus Street and Montgomery Street during the PM peak hour – Vehicle queues exceed the available storage by 215 feet, or 9 vehicles. Compared to 2040 Baseline Conditions, this represents an increase in vehicle queuing of 381 feet. Additionally, the volume for this approach is metered by upstream intersections. It is noted that the westbound approach operates at level of service B during the PM peak hour.
- Northbound approach of N. Patrick Street and Madison Street during the AM peak hour – Vehicle queues exceed the available storage by 363 feet, or 15 vehicles. Compared to 2040 Baseline Conditions, this represents a decrease in vehicle queuing of 8 feet. It is noted that the northbound approach operates at level of service C during the AM peak hour.

The westbound queues along Montgomery Street are the result of the two-way conversion of Montgomery Street. The remaining queues are consistent with the existing and baseline results.

Table 5-5: 2040 Build Conditions Peak Hour Level of Service and Delay (seconds/vehicle)

Intersection	Movement/ Lane*	Existing AM	Existing PM	2040 Baseline AM	2040 Baseline PM	2040 Build AM	2040 Build PM
11. First Street and N. Saint Asaph Street							
Eastbound *(First Street)*	T	-	-	-	-	-	-
	R	-	-	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
Westbound *(First Street)*	L	A (7.7)	A (8.4)	A (7.7)	A (8.4)	A (7.7)	A (8.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	A (0.8)	A (1.6)	A (0.8)	A (1.8)	A (0.9)	A (1.6)
Northbound *(N. Saint Asaph Street)*	LR	B (11.9)	B (12.7)	B (10.8)	B (12.9)	B (12.3)	B (13.4)
	Overall	B (11.9)	B (12.7)	B (10.8)	B (12.9)	B (12.3)	B (13.4)
Overall Intersection		***A (4.2)***	***A (2.9)***	***A (4.3)***	***A (3)***	***A (5.2)***	***A (3.0)***
12. First Street and N. Pitt Street							
Eastbound (First Street)	LR	B (12.3)	B (11.3)	B (12.2)	B (11.5)	B (13.2)	B (14.8)
	Overall	B (12.3)	B (11.3)	B (12.2)	B (11.5)	B (13.2)	B (14.8)
Northbound *(N. Pitt Street)*	L	A (7.5)	A (7.6)	A (7.5)	A (7.6)	A (7.7)	A (8.2)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	A (1.6)	A (3.7)	A (1.4)	A (2.7)	A (1.2)	A (2.7)
Southbound *(N. Pitt Street)*	T	-	-	-	-	-	-
	R	-	-	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
Overall Intersection		***A (3.9)***	***A (7.2)***	***A (3.8)***	***A (6.2)***	***A (3.0)***	***A (5.6)***
13. N. Henry Street and Montgomery Street							
Westbound *(Montgomery Street)*	L	B (10.2)	C (25.5)	B (10.2)	C (26.2)	B (10.0)	C (25.2)
	Overall	B (10.2)	C (25.5)	B (10.2)	C (26.2)	B (10.0)	C (25.2)
Southbound *(N. Henry Street)*	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	B (15.2)	B (12.3)	B (15.4)	B (11.7)	B (15.0)	B (11.7)
	Overall	B (15.2)	B (12.3)	B (15.4)	B (11.7)	B (15.0)	B (11.7)
Overall Intersection		***B (14.7)***	***B (13.3)***	***B (14.8)***	***B (13.1)***	***B (14.4)***	***B (13.0)***
14. N. Patrick Street and Montgomery Street							
Eastbound (Montgomery Street)	TR	-	-	-	-	C (22.3)	B (18.4)
	Overall	-	-	-	-	C (22.3)	B (18.4)
Westbound (Montgomery Street)	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	C (21.6)	B (16.7)	C (21.4)	B (17.3)	A (0)	A (0)
	R	C (22.6)	B (18.1)	C (22.4)	B (18.9)	C (30.0)	C (22.4)
	Overall	C (22.1)	B (17.5)	C (21.9)	B (18.2)	C (30.0)	C (22.4)
Northbound (N. Patrick Street)	L	D (45.9)	C (29.2)	D (46.3)	C (29.6)	D (42.0)	C (29.3)
	T	D (47.4)	C (28.5)	D (47.9)	C (28.8)	D (37.3)	C (27.9)
	R	A (0)	A (0)	A (0)	A (0)	D (36.0)	C (27.7)
	Overall	D (46.8)	C (28.8)	D (47.2)	C (29.1)	D (38.6)	C (28.3)
Overall Intersection		***D (44.0)***	***C (27.1)***	***D (44.4)***	***C (27.2)***	***D (37.0)***	***C (26.5)***

Table 5-5: 2040 Build Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing AM	Existing PM	2040 Baseline AM	2040 Baseline PM	2040 Build AM	2040 Build PM
15. N. Columbus Street and Montgomery Street							
Eastbound (Montgomery Street)	LTR	-	-	-	-	A (9.8)	B (12)
	Overall	-	-	-	-	A (9.8)	B (12)
Westbound (Montgomery Street)	L	A (8.7)	B (11.1)	A (8.9)	B (11.7)	B (10)	B (16.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (8.6)	B (11.0)	A (8.9)	B (11.6)	A (0)	A (0)
	Overall	A (8.7)	B (11.1)	A (8.9)	B (11.6)	B (10)	B (16.4)
Northbound (N. Columbus Street)	L	A (5.2)	B (10.3)	A (5.1)	B (10.4)	A (5.5)	B (17.1)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	A (5.2)	B (10.3)	A (5.1)	B (10.4)	A (5.5)	B (17.1)
Southbound (N. Columbus Street)	L	*A (0)*	*A (0)*	A (0)	A (0)	B (12.4)	B (12.1)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (12.5)	B (12.5)	B (12.4)	B (12.3)	A (0)	A (0)
	Overall	B (12.5)	B (12.5)	B (12.4)	B (12.3)	B (12.4)	B (12.1)
Overall Intersection		***A (8.0)***	***B (11.6)***	***A (8.1)***	***B (11.8)***	***A (8.9)***	***B (14.7)***
16. N. Saint Asaph Street and Montgomery Street							
Eastbound (Montgomery Street)	LTR	-	-	-	-	C (20.7)	B (11.5)
	Overall	-	-	-	-	C (20.7)	B (11.5)
Westbound (Montgomery Street)	L	B (18.2)	B (10.6)	B (18.2)	B (10.8)	C (20.1)	B (13.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (18.1)	B (10.4)	B (18.2)	B (10.7)	A (0)	A (0)
	Overall	B (18.2)	B (10.5)	B (18.2)	B (10.7)	C (20.1)	B (13.4)
Northbound (N. Saint Asaph Street)	L	B (14.5)	C (20.6)	B (15.4)	C (24)	B (15.8)	B (19.2)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (14.5)	C (20.6)	B (15.4)	C (24)	B (15.8)	B (19.2)
Southbound *(N. Saint Asaph Street)*	L	A (0)	A (0)	A (0)	A (0)	B (18.5)	B (13.6)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (18.2)	B (12.6)	B (18.6)	B (13.2)	A (0)	A (0)
	Overall	B (18.2)	B (12.6)	B (18.6)	B (13.2)	B (18.5)	B (13.6)
Overall Intersection		***B (16.3)***	***B (13.8)***	***B (16.8)***	***B (15.2)***	***B (18.3)***	***B (14.3)***
17. N. Pitt Street and Montgomery Street							
Eastbound (Montgomery Street)	LTR	-	-	-	-	B (11.1)	B (12.8)
	Overall	-	-	-	-	B (11.1)	B (12.8)
Westbound (Montgomery Street)	TL	A (9.1)	B (10.4)	A (9.1)	B (10.6)	B (11.1)	C (17.3)
	TR	A (9.0)	A (10.0)	A (9.0)	B (10.2)	B (11.1)	C (17.3)
	Overall	A (9.0)	B (10.2)	A (9.0)	B (10.4)	B (11.1)	C (17.3)
Northbound (N. Pitt Street)	*LT*	B (11.7)	A (9.8)	B (11.5)	A (10)	C (19.3)	B (14.1)
	Overall	B (11.7)	A (9.8)	B (11.5)	A (10)	C (19.3)	B (14.1)
Southbound (N. Pitt Street)	*TR*	A (8.5)	B (11.1)	A (8.6)	B (11.6)	B (10.9)	E (35.4)
	Overall	A (8.5)	B (11.1)	A (8.6)	B (11.6)	B (10.9)	E (35.4)
Overall Intersection		***B (10.5)***	***B (10.5)***	***B (10.4)***	***B (10.8)***	***C (15.1)***	***C (24.4)***

Table 5-5: 2040 Build Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build	
		AM	PM	AM	PM	AM	PM
18. N. Fayette Street and Madison Street							
Eastbound (Madison Street)	TLR	B (10.4)	B (12.4)	B (10.2)	C (16.5)	B (10.2)	B (12.7)
	Overall	B (10.4)	B (12.4)	B (10.2)	C (16.5)	B (10.2)	B (12.7)
Westbound (Madison Street)	TLR	A (8.9)	B (12.5)	A (8.7)	B (13)	A (8.7)	B (12.0)
	Overall	A (8.9)	B (12.5)	A (8.7)	B (13)	A (8.7)	B (12.0)
Northbound (N. Fayette Street)	TLR	A (9.9)	B (12.0)	A (9.5)	B (12.7)	A (9.5)	B (11.4)
	Overall	A (9.9)	B (12.0)	A (9.5)	B (12.7)	A (9.5)	B (11.4)
Southbound (N. Fayette Street)	TLR	A (9.2)	C (21.0)	A (8.9)	D (25.5)	A (8.9)	C (20.6)
	Overall	A (9.2)	C (21.0)	A (8.9)	D (25.5)	A (8.9)	C (20.6)
Overall Intersection		***A (9.8)***	***C (16.1)***	***A (9.6)***	***C (19.1)***	***A (9.6)***	***C (15.9)***
19. N. Henry Street and Madison Street							
Eastbound (Madison Street)	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (14.4)	C (23.1)	B (14.5)	C (23.6)	B (14.5)	C (23.7)
	Overall	B (14.4)	C (23.1)	B (14.5)	C (23.6)	B (14.5)	C (23.7)
Southbound (N. Henry Street)	L	B (17.7)	C (29.7)	B (17.6)	C (28.9)	B (16.2)	C (27.2)
	T	C (20.2)	C (31.0)	B (19.7)	C (30.1)	B (18.1)	C (28.6)
	R	B (19.9)	C (30.4)	B (19.5)	C (29.5)	B (18.0)	C (28.1)
	Overall	B (19.2)	C (30.3)	B (18.9)	C (29.5)	B (17.4)	C (27.9)
Overall Intersection		***B (18.6)***	***C (29.7)***	***B (18.3)***	***C (28.9)***	***B (17.0)***	***C (27.5)***
20. N. Patrick Street and Madison Street							
Eastbound *(Madison Street)*	L	C (20.7)	C (26.4)	C (21.6)	C (26.5)	B (19.9)	C (24.2)
	T	C (20.9)	C (26.8)	C (21.9)	C (27)	C (20.0)	C (24.4)
	R*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	C (20.8)	C (26.6)	C (21.8)	C (26.7)	B (20.0)	C (24.3)
Northbound *(N. Columbus Street)*	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	C (20.6)	B (16.6)	C (21.9)	B (16.6)	C (22.3)	B (16.4)
	R	C (23.9)	B (18.3)	C (26.1)	B (18.2)	C (26.3)	B (18.0)
	Overall	C (21.9)	B (17.2)	C (23.5)	B (17.1)	C (23.9)	B (17.0)
Overall Intersection		***C (21.8)***	***B (19.3)***	***C (23.3)***	***B (19.3)***	***C (23.6)***	***B (18.1)***
21. N. Columbus Street and Madison Street							
Eastbound *(Madison Street)*	L	B (20.0)	B (11.7)	C (21.1)	B (11.9)	B (19.1)	B (10.9)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (19.8)	B (11.6)	C (20.7)	B (11.8)	B (18.9)	B (10.9)
	Overall	B (19.9)	B (11.7)	C (20.9)	B (11.9)	B (19.0)	B (10.9)
Northbound *(N. Columbus Street)*	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	C (20.4)	B (10.3)	C (20.6)	B (10.3)	C (20.5)	B (10.9)
	Overall	C (20.4)	B (10.3)	C (20.6)	B (10.3)	C (20.5)	B (10.9)
Southbound *(N. Columbus Street)*	L	B (17.9)	B (16.1)	B (18)	B (12.9)	B (17.8)	B (12.7)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (17.9)	B (16.1)	B (18)	B (12.9)	B (17.8)	B (12.7)
Overall Intersection		***B (19.9)***	***B (13.4)***	***C (20.6)***	***B (12.2)***	***B (19.5)***	***B (11.7)***

*Illegal movement onto one-way street

Table 5-5: 2040 Build Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build	
		AM	PM	AM	PM	AM	PM
22. N. Saint Asaph Street and Madison Street							
Eastbound *(Madison Street)*	L	B (18.6)	B (17.8)	C (20.2)	B (18.2)	B (17.8)	B (16.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (18.4)	B (17.7)	B (19.7)	B (18.1)	B (17.6)	B (16.4)
	Overall	B (18.5)	B (17.8)	B (20)	B (18.1)	B (17.7)	B (16.4)
Northbound *(N. Saint Asaph Street)*	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (5.1)	B (11.6)	C (23)	A (3.6)	C (22.7)	A (3.5)
	Overall	A (5.1)	B (11.6)	C (23)	A (3.6)	C (22.7)	A (3.5)
Southbound *(N. Saint Asaph Street)*	L	B (19.3)	B (18.7)	A (4.1)	B (19.8)	A (4.1)	B (13.3)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (19.3)	B (18.7)	A (4.1)	B (19.8)	A (4.1)	B (13.3)
Overall Intersection		***B (14.1)***	***B (17.0)***	***B (19.8)***	***B (16.4)***	***B (18.2)***	***B (12.7)***
23. N. Pitt Street and Madison Street							
Eastbound (Madison Street)	TL	B (11.3)	B (10.9)	B (12.2)	B (11.0)	B (11.1)	B (10.8)
	TR	B (10.5)	B (10.8)	B (11.0)	B (10.6)	A (9.9)	B (10.4)
	Overall	B (10.9)	B (10.8)	B (11.6)	B (10.8)	B (10.6)	B (10.6)
Northbound (N. Pitt Street)	TR	B (12.9)	A (9.9)	B (13.2)	A (9.9)	B (14.2)	B (10.3)
	Overall	B (12.9)	A (9.9)	B (13.2)	A (9.9)	B (14.2)	B (10.3)
Southbound (N. Pitt Street)	TL	A (9.7)	B (13.7)	A (10.0)	B (13.0)	A (10.0)	C (19.5)
	Overall	A (9.7)	B (13.7)	A (10.0)	B (13.0)	A (10.0)	C (19.5)
Overall Intersection		***B (11.6)***	***B (11.9)***	***B (12.0)***	***B (11.6)***	***B (12.4)***	***C (15.7)***
24. N. Saint Asaph Street and Wythe Street							
Eastbound *(Wythe Street)*	L	B (10.9)	A (3.2)	B (11.6)	A (6.1)	B (11.5)	A (3.6)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (10.9)	A (3.2)	B (11.6)	A (6.1)	B (11.5)	A (3.6)
Westbound *(Wythe Street)*	L	B (10.2)	B (11.0)	B (10.3)	B (11.4)	B (10.5)	B (11.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (10.2)	B (11.0)	B (10.3)	B (11.4)	B (10.5)	B (11.4)
Northbound *(N. Saint Asaph Street)*	L	B (13.3)	B (12.1)	B (14.0)	B (12.0)	B (14.0)	B (11.9)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (13.3)	B (12.1)	B (14.0)	B (12.0)	B (14.0)	B (11.9)
Southbound (N. Saint Asaph Street)	L	B (11.1)	A (4.8)	B (11.3)	A (8.0)	B (11.2)	A (6.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (11.1)	A (4.8)	B (11.3)	A (8.0)	B (11.2)	A (6.4)
Overall Intersection		***B (11.8)***	***A (6.9)***	***B (12.3)***	***A (8.8)***	***B (12.2)***	***A (7.4)***

*Illegal movement onto one-way street

Table 5-5: 2040 Build Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Baseline	
		AM	PM	AM	PM	AM	PM
25. N. Pitt Street and Bashford Lane							
Eastbound (Bashford Lane)	TLR	-	-	-	-	A (8.0)	A (8.0)
	T	-	-	-	-	-	-
	R	-	-	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)	A (2.6)	A (1.3)
Westbound *(Bashford Lane)*	TLR	-	-	-	-	A (7.9)	A (7.6)
	L	A (7.9)	A (7.6)	A (7.9)	A (7.7)	-	-
	T	A (0)	A (0)	A (0)	A (0)	-	-
	Overall	A (0.3)	A (0.2)	A (0.3)	A (0.5)	A (0.2)	A (0.1)
Northbound *(N. Pitt Street)*	LR / TLR	B (12.4)	B (12.1)	B (12.5)	B (13.4)	E (36.0)	D (31.2)
	Overall	B (12.4)	B (12.1)	B (12.5)	B (13.4)	E (36.0)	D (31.2)
Southbound *(N. Pitt Street)*	*TLR*	-	-	-	-	C (16.1)	D (32.1)
	Overall	-	-	-	-	C (16.1)	D (32.1)
Overall Intersection		***A (2.5)***	***A (1.3)***	***A (2.7)***	***A (2.2)***	***B (12.5)***	***B (14.2)***
26. Power Plant Site Access and Slaters Lane							
Eastbound (Slaters Lane)	**TL**	-	-	-	-	B (10.5)	A (7.6)
	TR	-	-	-	-	A (8.1)	A (0)
	Overall	-	-	-	-	A (8.2)	A (2.8)
Westbound (Slaters Lane)	**LTR**	-	-	-	-	A (8.2)	A (7.4)
	Overall	-	-	-	-	A (8.2)	A (0.2)
Northbound (N. Pitt Street)	**LTR**	-	-	-	-	A (8.7)	B (14.2)
	Overall	-	-	-	-	A (8.7)	B (14.2)
Southbound (Residential Development)	**LTR**	-	-	-	-	A (7.9)	A (9.8)
	Overall	-	-	-	-	A (7.9)	A (9.8)
Overall Intersection		***-***	***-***	***-***	***-***	***A (9.1)***	***A (5.7)***
27. N. Pitt Street and Slaters Lane							
Eastbound (Slaters Lane)	**LTR**	-	-	-	-	A (7.5)	A (0)
	Overall	-	-	-	-	A (7.1)	A (0)
Westbound	**LTR**	-	-	-	-	A (7.4)	A (7.2)
	Overall	-	-	-	-	A (7.4)	A (1.3)
Northbound (power plant site Access)	**LTR**	-	-	-	-	A (7.6)	A (9.4)
	Overall	-	-	-	-	A (7.6)	A (9.4)
Overall Intersection		-	-	-	-	**A (7.3)**	**A (6.3)**
28. N Royal Street and Bashford Lane							
Eastbound (Bashford Lane)	**LTR**	-	-	-	-	A (9.6)	B (11.1)
	Overall	-	-	-	-	A (9.6)	B (11.1)
Northbound (N. Royal Street)	**LTR**	-	-	-	-	A (7.7)	A (7.8)
	Overall	-	-	-	-	A (6.5)	A (6.9)
Southbound (N. Royal Street)	**LTR**	-	-	-	-	A (0)	A (0)
	Overall	-	-	-	-	A (0)	A (0)
Overall Intersection		***-***	***-***	***-***	***-***	***A (7.0)***	***A (7.9)***

Table 5-5: 2040 Build Conditions Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build	
		AM	PM	AM	PM	AM	PM
29. N. Royal Street and Montgomery Street							
Eastbound (Montgomery Street)	LTR	-	-	-	-	A (9.3)	A (9.6)
	Overall	-	-	-	-	A (9.3)	A (9.6)
Westbound (Montgomery Street)	LTR	-	-	-	-	A (9.0)	B (10.8)
	TL	A (8.8)	A (9.8)	A (8.9)	A (10.0)	-	-
	TR	A (8.5)	A (9.4)	A (8.6)	A (9.5)	-	-
	Overall	A (8.7)	A (9.6)	A (8.8)	A (9.8)	A (9.0)	B (10.8)
Northbound (N. Royal Street)	*TL / LTR*	B (10.4)	A (9.5)	B (10.7)	A (10.0)	B (12.5)	A (9.9)
	Overall	B (10.4)	A (9.5)	B (10.7)	A (10.0)	B (12.5)	A (9.9)
Southbound (N. Royal Street)	*TR / LTR*	A (7.5)	A (9.1)	A (7.7)	A (9.4)	A (8.1)	A (9.5)
	Overall	A (7.5)	A (9.1)	A (7.7)	A (9.4)	A (8.1)	A (9.5)
Overall Intersection		***A (9.7)***	***A (9.4)***	***A (10.0)***	***A (9.7)***	***B (11.1)***	***B (10.1)***
30. N. Fairfax Street and Montgomery Street							
Eastbound (Montgomery Street)	LTR	-	-	-	-	A (8.9)	A (9.5)
	Overall	-	-	-	-	A (8.9)	A (9.5)
Westbound (Montgomery Street)	LTR	-	-	-	-	A (8.4)	A (9.4)
	TL	A (8.8)	A (9.7)	A (8.6)	A (9.5)	-	-
	TR	A (8.4)	A (9.1)	A (8.2)	A (9.0)	-	-
	Overall	A (8.6)	A (9.4)	A (8.4)	A (9.3)	A (8.4)	A (9.4)
Northbound (N. Fairfax Street)	*TL*	B (11.7)	A (9.8)	B (10.4)	A (9.8)	B (11.9)	B (10.6)
	Overall	B (11.7)	A (9.8)	B (10.4)	A (9.8)	B (11.9)	B (10.6)
Southbound (N. Fairfax Street)	*TR*	A (7.9)	B (12.7)	A (7.6)	B (11.7)	A (8.0)	B (12.2)
	Overall	A (7.9)	B (12.7)	A (7.6)	B (11.7)	A (8.0)	B (12.2)
Overall Intersection		***B (10.8)***	***B (11.4)***	***A (9.8)***	***B (10.8)***	***B (10.8)***	***B (11.1)***

Table 5-6: 2040 Build Conditions Peak Hour Vehicle Queuing

Intersection	Lane Group	Block Length	Existing		2040 Baseline		2040 Build	
			AM	PM	AM	PM	AM	PM
11. First Street and N. Saint Asaph Street								
Westbound (First Street)	TL	240	0	0	0	0	0	0
Northbound (N. Saint Asaph Street)	LR	345	23	18	25	20	33	20
12. First Street and N. Pitt Street								
Eastbound (First Street)	LR	240	20	38	20	35	20	53
Northbound (N. Pitt Street)	TL	345	5	3	3	3	5	5
13. N. Henry Street and Montgomery Street								
Westbound (Montgomery Street)	L	240	m55	m51	m57	m69	m79	m148
Southbound (N. Henry Street)	T	345	221	284	227	267	215	268
14. N. Patrick Street and Montgomery Street								
Eastbound (Montgomery Street)	TR	240	-	-	-	-	m63	m39
Westbound (Montgomery Street)	TL	240	85	66	95	93	#286	205
Northbound (N. Patrick Street)	TR	345	m#597	12	m#575	15	m#573	8
15. N. Columbus Street and Montgomery Street								
Eastbound (Montgomery Street)	TLR	240	-	-	-	-	66	76
Westbound (Montgomery Street)	TL/TR	240	4	m48	2	m74	112	m455
Northbound (N. Columbus Street)	TL	345	53	19	49	24	74	72
Southbound (N. Columbus Street)	TR	340	27	110	30	109	29	104
16. N. Saint Asaph Street and Montgomery Street								
Eastbound (Montgomery Street)	TLR	235	-	-	-	-	m40	72
Westbound (Montgomery Street)	TL/TR	235	51	60	58	68	147	181
Northbound (N. Saint Asaph Street)	TL	*345*	101	89	289	117	318	110
Southbound (N. Saint Asaph Street)	TR	345	m67	109	m109	148	m90	159
17. N. Pitt Street and Montgomery Street								
Eastbound (Montgomery Street)	TLR	245	-	-	-	-	25	28
Westbound (Montgomery Street)	TL / TLR	245	8	25	8	28	28	80
	TR	245	13	23	13	25	-	-
Northbound (N. Pitt Street)	TL	*345*	68	23	63	25	135	48
Southbound (N. Pitt Street)	TR	*345*	13	48	15	53	30	230
18. N. Fayette Street and Madison Street								
Eastbound (Madison Street)	LTR	555	35	35	38	78	38	40
Westbound (Madison Street)	LTR	245	13	35	13	33	13	30
Northbound (N. Fayette Street)	LTR	345	30	40	25	38	25	33
Southbound (N. Fayette Street)	LTR	365	15	143	13	165	13	140
19. N. Henry Street and Madison Street								
Eastbound (Madison Street)	TR	245	101	123	116	136	116	139
Southbound (N. Henry Street)	TR/TL	355	215	0	213	26	200	83
20. N. Patrick Street and Madison Street								
Eastbound (Madison Street)	TL	235	75	m131	100	m137	54	m93
Northbound (N. Columbus Street)	TR	345	#675	282	#700	281	#708	279
21. N. Columbus Street and Madison Street								
Eastbound (Madison Street)	TL/TR	240	102	71	158	78	88	48
Northbound (N. Columbus Street)	TR	345	125	19	152	24	165	54
Southbound (N. Columbus Street)	TL	345	34	63	40	109	35	m50

m- volume for 95th percentile queue is metered by upstream signal
#- 95th percentile volume exceeds capacity; queue may theoretically be longer. Queue shown is maximum after two cycles.

Table 5-6: 2040 Build Conditions Peak Hour Vehicle Queuing (feet) Continued

Intersection	Movement/ Lane	Existing Storage/Block Length	Existing		2040 Baseline		2040 Build	
			AM	PM	AM	PM	AM	PM
22. N. Saint Asaph Street and Madison Street								
Eastbound (Madison Street)	TL/TR	235	m28	25	m43	28	m14	20
Northbound (N. Saint Asaph Street)	TR	350	191	36	215	40	212	43
Southbound (N. Saint Asaph Street)	TL	340	24	123	29	172	46	163
23. N. Pitt Street and Madison Street								
Eastbound (Madison Street)	TL	230	28	28	38	28	23	18
	TR	230	28	30	33	28	15	18
Northbound (N. Pitt Street)	TR	345	70	20	68	20	90	28
Southbound (N. Pitt Street)	TL	345	15	75	15	68	23	150
24. N. Saint Asaph Street and Wythe Street								
Eastbound (Wythe Street)	LTR	235	m61	78	m69	m80	m53	m82
Westbound (Wythe Street)	LTR	240	57	90	60	106	69	106
Northbound (N. Saint Asaph Street)	LTR	345	128	63	152	74	151	68
Southbound (N. Saint Asaph Street)	LTR	345	2	83	12	256	40	83
25. N. Pitt Street and Bashford Lane								
Westbound (Bashford Lane)	TL	535	0	0	0	0	0	0
Northbound (N. Pitt Street)	LR	665	15	8	0	3	115	53
Eastbound (Bashford Lane)	LR	540	0	0	18	15	5	3
Southbound (N. Pitt Street)	TLR	-	-	-	-	-	20	130
26. Power Plant Site Access and Slaters Lane								
Eastbound (Slaters Lane)	TL	-	-	-	-	-	18	3
	TR	-	-	-	-	-	35	0
Westbound (Slaters Lane)	TLR	-	-	-	-	-	8	0
Northbound (N. Pitt Street)	LR	-	-	-	-	-	8	23
Southbound (N. Pitt Street)	TLR	-	-	-	-	-	5	8
27. N. Pitt Street and Slaters Lane								
Eastbound (Slaters Lane)	TL	-	-	-	-	-	0	0
	LR	-	-	-	-	-	8	0
Westbound (Slaters Lane)	LR	-	-	-	-	-	3	0
Northbound (N. Pitt Street)	TLR	-	-	-	-	-	5	15
28. N. Pitt Street and Bashford Lane								
Eastbound (Bashford Lane)	TL	-	-	-	-	-	13	18
Northbound (N. Pitt Street)	LR	-	-	-	-	-	15	18

m- volume for 95th percentile queue is metered by upstream signal
#- 95th percentile volume exceeds capacity; queue may theoretically be longer. Queue shown is maximum after two cycles

Table 5-6: 2040 Build Conditions Peak Hour Vehicle Queuing (feet) Continued

Intersection	Movement/ Lane	Existing Storage/ Block Length	Existing		2040 Baseline		2040 Build	
			AM	PM	AM	PM	AM	PM
29. N. Royal Street and Montgomery Street								
Eastbound (Montgomery Street)	LTR	-	-	-	-	-	18	23
Westbound *(Montgomery Street)*	L / LTR	230	8	23	8	20	13	40
	T	230	8	18	8	18	-	-
Northbound *(N. Royal Street)*	T	345	50	23	58	30	75	23
Southbound *(N. Royal Street)*	T	345	5	23	5	25	5	20
30. N. Fairfax Street and Montgomery Street								
Eastbound (Montgomery Street)	LTR	-	-	-	-	-	13	13
Westbound *(Montgomery Street)*	L / LTR	240	3	8	3	8	3	10
	T	240	3	8	3	5	-	-
Northbound *(N. Fairfax Street)*	T	345	78	33	58	33	65	33
Southbound *(N. Fairfax Street)*	T	345	10	88	8	73	8	68

5.5. VISSIM Analysis

The 2040 Build Conditions along N. Washington Street were evaluated using the calibrated VISSIM version 8 models developed for existing conditions analysis. The vehicular street network remained consistent with existing conditions and 2040 Baseline Conditions analyses except for the conversion of Montgomery Street to two-way operations. The vehicular demand and transit service were updated to reflect 2040 Build Conditions. Traffic signal timing remained consistent with existing and 2040 Baseline Conditions except for Montgomery Street as previously discussed. AM and PM peak hour operations were evaluated using delay and level of service at intersections, average and maximum queue length for intersection approaches, and travel time for northbound and southbound N. Washington Street. Due to the stochastic nature of microsimulation, results presented are from an average of 10 simulation runs. VISSIM analysis results can be found in **Table 5-7** to **Table 5-12.** VISSIM vehicle throughput results are included in **Appendix F.** Overall intersection level of service is shown graphically in **Figure 5-9**. The following is a summary of key operational findings from the analysis.

5.5.1. AM Traffic Operations

All intersections operate with an average delay equivalent to level of service D or better during the AM peak hour, except the intersection with Slaters Lane which operates at level of service F and Bashford Lane which operates at level of service E. Operations of these two intersections degrade compared to 2040 Baseline Conditions due to the increased demand destined for the power plant site (southbound left-turn from W. Abingdon Drive and eastbound through traffic). Delays along northbound N. Washington Street increase due to greater demand compared to 2040 Baseline Conditions. Increases in northbound delays and queuing through the corridor result in greater congestion. Southbound demand also is metered north of Slaters Lane due to queue spillback from W. Abingdon Drive.

Several approaches and movements operate with greater delays compared to 2040 Baseline Conditions. Southbound W. Abingdon Drive delays at Slaters Lane (220.8 seconds per vehicle) and Bashford Lane (325 seconds per vehicle) increase due to an increase in left-turn demand and limited opportunity to make the movement with the existing signal phasing. Queues on W. Abingdon Drive extend from Slaters Lane onto southbound George Washington Memorial Parkway and from Bashford Lane to Slaters Lane. Eastbound and westbound approaches of Slaters Lane operate with greater delays due to increased demand, and it often takes two cycles to traverse the intersection. Eastbound delays on Bashford decrease slightly due to decreased left-turn demand onto N. Washington Street. Overall intersection delay increases from 50.5 to 87.8 seconds per vehicle for Slaters Lane and from 59.7 to 75.3 seconds per vehicle for Bashford Lane between 2040 Baseline and 2040 Build Conditions. Delays for the westbound right turn from First Street and the eastbound left turn from Wythe Street onto northbound N. Washington Street also operate with greater delays due to queueing along N. Washington Street.

Compared to 2040 Baseline Conditions, the intersection of Montgomery Street and N. Washington Street continues to operate at level of service C with the conversion of Montgomery Street to two-way operations. The southbound approach and the Powhatan Street approach operate with lower delays compared to future baseline conditions due to the ability to right turn on red. Eastbound and westbound approaches operate with similar delays, consistent with the westbound approach delays in 2040 Baseline Conditions.

Average northbound travel time from Queen Street to Slaters Lane is 9.7 minutes, or approximately 48 seconds greater than 2040 Baseline Conditions. Average southbound travel time from Slaters Lane to Princess Street is 3.3 minutes, or approximately equal to 2040 Baseline Conditions; however, this travel time does not include the greater congestion that exists north of Slaters Lane from queues on W.

Abingdon Drive. The Slaters Lane intersection and the downstream congestion on northbound George Washington Memorial Parkway remains a bottleneck in the AM period resulting in reduced speeds and northbound queues through the peak period.

5.5.2. PM Traffic Operations

All intersections operate with an average delay equivalent to level of service D or better during the PM peak hour. Southbound intersection approaches have a small increase in delays compared to future baseline conditions due to greater demand.

Several intersection approaches operate with greater delays compared to 2040 Baseline Conditions. Similar to AM, the intersections with Slaters Lane and Bashford Lane degrade due to an increase in demand destined for the power plant site. The southbound W. Abingdon Drive approaches at these two intersections operate with delays of 41.3 and 127 seconds per vehicle, respectively. Queues on W. Abingdon Drive are similar to the AM period and extend back onto southbound George Washington Memorial Highway. Delays on westbound Slaters Lane under 2040 Build Conditions increase to 217.4 seconds per vehicle compared to 59.0 seconds per vehicle in 2040 Baseline Conditions. The sustained queue on westbound Slaters Lane also increases delay for northbound left-turning vehicles from E. Abingdon Drive.

Compared to the 2040 Baseline Conditions, the intersection of Montgomery Street and N. Washington Street continues to operate at similar overall delays with the conversion of Montgomery Street to two-way operations. The westbound approach operates with an average delay of 31.5 seconds per vehicle, nearly half of the delay as 2040 Baseline Conditions, from the increased share of the cycle length given to the side street with the elimination of a signal phase. The eastbound approach operates at level of service C.

Delays and queuing at intersections in the southern portion of the study area increase from spillback of the northbound left turn at Wythe Street. Demand for this movement is approximately 70 vehicles per hour greater than 2040 Baseline Conditions because of the elimination and rerouting of left-turns to Powhatan Street from N. Washington Street. Delays on northbound and side street approaches at intersections south of here also increase, particularly eastbound Pendleton Street, westbound Oronoco Street, and eastbound Princess Street. Delays for northbound left turns to Pendleton Street (bus only movement) also increase by approximately 50 seconds from future baseline conditions as a result of northbound queues in the left lane and limited gaps in southbound traffic.

The average travel time for the southbound peak direction from Slaters Lane to Princess Street is 5.5 minutes, and the average travel time for northbound from Queen Street to Slaters Lane is 6.5 minutes. This is a travel time increase of approximately 36 seconds and 96 seconds from 2040 Baseline Conditions for southbound and northbound respectively. The northbound travel time increase is from the congestion caused by additional northbound left turns at Wythe Street.

Table 5-7: 2040 Build Conditions AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build	
1. N. Washington Street and Slaters Lane	NB N. Washington St	TH	35.5 (D)	35.5 (D)	35.5 (D)	35.5 (D)	36.4 (D)	36.4 (D)
	NB E. Abingdon Dr	LT	*157.4 (F)*	*131.1 (F)*	*189.1 (F)*	*132.3 (F)*	*184.4 (F)*	*137 (F)*
		TH	*139.9 (F)*		*146.2 (F)*		*150 (F)*	
		RT	*87.7 (F)*		*87.4 (F)*		*92.2 (F)*	
	SB N. Washington St	TH	17.3 (B)	17.3 (B)	17.2 (B)	17.2 (B)	21 (C)	21 (C)
	SB W. Abingdon Dr	LT	77.3 (E)	20.5 (C)	77.9 (E)	23.8 (C)	*568.7 (F)*	*220.8 (F)*
		TH	16.8 (B)		17.8 (B)		*152.3 (F)*	
		RT	17.8 (B)		18.4 (B)		*152.6 (F)*	
	EB	LT	42.2 (D)	42.2 (D)	43.1 (D)	43.6 (D)	*147.6 (F)*	*152.8 (F)*
		TH	46.1 (D)		54.6 (D)		*181.8 (F)*	
		RT	40.4 (D)		41 (D)		*157.3 (F)*	
	WB	LT	57.8 (E)	45 (D)	54.2 (D)	46.2 (D)	75.3 (E)	57.9 (E)
		TH	51.1 (D)		58 (E)		55.7 (E)	
		RT	42.8 (D)		37.8 (D)		41.9 (D)	
	Intersection		50.2 (D)		50.5 (D)		*87.8 (F)*	
2. N. Washington Street and Bashford Lane	NB N. Washington St	TH	56.1 (E)	56.1 (E)	56.1 (E)	56.1 (E)	60 (E)	60 (E)
	NB E. Abingdon Dr	LT	*179.3 (F)*	36.8 (D)	*163.8 (F)*	36.8 (D)	*187.4 (F)*	40.2 (D)
		TH	30.6 (C)		31.6 (C)		34.2 (C)	
		RT	25.3 (C)		18.6 (B)		0 (A)	
	SB N. Washington St	TH	14.1 (B)	14.1 (B)	14.7 (B)	14.7 (B)	16.2 (B)	16.2 (B)
	SB W. Abingdon Dr	LT	*138.4 (F)*	*89.7 (F)*	*165.5 (F)*	*93.4 (F)*	*532.5 (F)*	*325 (F)*
		TH	13.9 (B)		11.9 (B)		44.2 (D)	
		RT	3.1 (A)		5.4 (A)		39.9 (D)	
	EB	LT	*180.5 (F)*	*150.4 (F)*	*175.6 (F)*	*146.2 (F)*	*151.6 (F)*	*119.2 (F)*
		TH	*114.8 (F)*		*114.7 (F)*		*94.7 (F)*	
		RT	*109.3 (F)*		*110.2 (F)*		*83.1 (F)*	
	WB	LT	*134.2 (F)*	*198.1 (F)*	*143.2 (F)*	*178.7 (F)*	*162.6 (F)*	*188.2 (F)*
		TH	*155.5 (F)*		*153.5 (F)*		*157.6 (F)*	
		RT	*207.8 (F)*		*184.4 (F)*		*193.8 (F)*	
	Intersection		60.6 (E)		59.7 (E)		75.3 (E)	
3. N. Washington Street and First Street	NB	TH	13.3 (B)	13.3 (B)	14.6 (B)	14.6 (B)	17.8 (B)	17.7 (B)
		RT	9.9 (A)		8.6 (A)		10.1 (B)	
	SB	LT	19.1 (B)	10.1 (B)	21.1 (C)	12.9 (B)	22.9 (C)	12.2 (B)
		TH	7.7 (A)		10.2 (B)		9.2 (A)	
	WB	RT	71.8 (E)	71.8 (E)	*160.9 (F)*	*160.9 (F)*	*244.8 (F)*	*244.8 (F)*
	Intersection		16.6 (B)		25.3 (C)		33.6 (C)	

Table 5-7: 2040 Build Conditions AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build	
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	LT	75.9 (E)	19 (B)	*81.3 (F)*	19 (B)		28.6 (C)
		TH	18.1 (B)		18 (B)		28.7 (C)	
		RT					18.7 (B)	
	SB	LT		21.6 (C)		21.6 (C)		19.4 (B)
		TH	21.6 (C)		21.3 (C)		19.5 (B)	
		RT to Montgomery St	22.2 (C)		28.9 (C)		17.7 (B)	
		RT to Powhatan St	24.1 (C)		24.9 (C)		0.7 (A)	
	SEB	RT to Washington St	52.3 (D)	53.4 (D)	53.4 (D)	54.4 (D)	16.6 (B)	16.6 (B)
		RT to Montgomery St	63.6 (E)		63.6 (E)		16.9 (B)	
	EB	LT					*84.4 (F)*	41.7 (D)
		TH					36.6 (D)	
		RT					21.3 (C)	
	WB	LT	37.3 (D)	37.8 (D)	39.5 (D)	37.6 (D)	45.8 (D)	43.9 (D)
		TH	37.6 (D)		37.4 (D)		43.7 (D)	
		RT to Powhatan St	36.3 (D)		0 (A)			
		RT to Washington St	51.5 (D)		0 (A)		0 (A)	
	Intersection		21 (C)		21.3 (C)		29.1 (C)	
5. N. Washington Street and Madison Street	NB	TH	23 (C)	22.9 (C)	23.6 (C)	23.6 (C)	30.7 (C)	30.6 (C)
		RT	19.8 (B)		22.4 (C)		23.6 (C)	
	SB	LT	52.5 (D)	10.7 (B)	53.3 (D)	10.6 (B)	70.5 (E)	12.1 (B)
		TH	4.2 (A)		3.8 (A)		3.5 (A)	
	EB	LT	38.6 (D)	37.2 (D)	0 (A)	38.6 (D)	0 (A)	36.9 (D)
		TH	38 (D)		38.9 (D)		37.1 (D)	
		RT	27.4 (C)		33 (C)		33.1 (C)	
	Intersection		22.2 (C)		23.4 (C)		27.9 (C)	
6. N. Washington Street and Wythe Street	NB	LT	21 (C)	26.6 (C)	24 (C)	27.7 (C)	27.9 (C)	32.3 (C)
		TH	26.8 (C)		27.8 (C)		32.6 (C)	
		RT	23 (C)		26.2 (C)		28 (C)	
	SB	LT	75 (E)	15 (B)	70.9 (E)	17.2 (B)	72.7 (E)	8.2 (A)
		TH	9.5 (A)		12.2 (B)		3.7 (A)	
		RT	10.7 (B)		12.1 (B)		4 (A)	
	EB	LT	*80.8 (F)*	77.5 (E)	*99.4 (F)*	*94.8 (F)*	*137.1 (F)*	*126.5 (F)*
		TH	71.4 (E)		*89.9 (F)*		*113.7 (F)*	
		RT	70.6 (E)		*80.1 (F)*		*118.9 (F)*	
	WB	LT	44.7 (D)	38.1 (D)	58.3 (E)	47.6 (D)	68.5 (E)	59.5 (E)
		TH	38.7 (D)		48.4 (D)		57.3 (E)	
		RT	34.1 (C)		42.8 (D)		59.1 (E)	
	Intersection		29.9 (C)		34.1 (C)		39.5 (D)	

Table 5-7: 2040 Build Conditions AM Peak Hour VISSIM L Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build	
7. N. Washington Street and Pendleton Street	NB	LT	32.5 (C)	26 (C)	43.6 (D)	29 (C)	38.9 (D)	30 (C)
		TH	26 (C)		28.9 (C)		30 (C)	
		RT	23.2 (C)		29.3 (C)		26.6 (C)	
	SB	LT	0 (A)	10 (A)	0 (A)	9.2 (A)	0 (A)	5.7 (A)
		TH	10 (A)		9.2 (A)		5.8 (A)	
		RT	10.2 (B)		8.4 (A)		4.6 (A)	
	EB	LT	42.9 (D)	37.6 (D)	0 (A)	36.5 (D)	0 (A)	37.1 (D)
		TH	39 (D)		37.9 (D)		38.5 (D)	
		RT	24 (C)		26.9 (C)		28 (C)	
	WB	LT	48.1 (D)	36.7 (D)	48.9 (D)	39.9 (D)	47.8 (D)	40.2 (D)
		TH	36.7 (D)		37.5 (D)		38.5 (D)	
		RT	26 (C)		0 (A)		0 (A)	
	Intersection		24.4 (C)		26.2 (C)		26.8 (C)	
8. N. Washington Street and Oronoco Street	NB	LT	31.4 (C)	22.3 (C)	35.8 (D)	27.4 (C)	34.9 (C)	30.6 (C)
		TH	22.3 (C)		27.5 (C)		30.7 (C)	
		RT	17.6 (B)		21.9 (C)		24.2 (C)	
	SB	LT	34.5 (C)	3.5 (A)	0 (A)	3.1 (A)	0 (A)	13.4 (B)
		TH	3.4 (A)		3.1 (A)		13.4 (B)	
		RT	2.6 (A)		2.3 (A)		10.9 (B)	
	EB	LT	40.5 (D)	37.5 (D)	42.6 (D)	37.7 (D)	40.1 (D)	37.5 (D)
		TH	36.7 (D)		36.1 (D)		36.9 (D)	
		RT	28.1 (C)		28.1 (C)		29.1 (C)	
	WB	LT	39.8 (D)	33.2 (C)	37.7 (D)	33.6 (C)	45 (D)	34.5 (C)
		TH	34.5 (C)		34.9 (C)		34.3 (C)	
		RT	25.1 (C)		25.1 (C)		27.7 (C)	
	Intersection		20.1 (C)		23.8 (C)		28.2 (C)	
9. N. Washington Street and Princess Street	NB	LT	44.7 (D)	37.7 (D)	55.7 (E)	48.2 (D)	59 (E)	53.1 (D)
		TH	37.5 (D)		48 (D)		53 (D)	
		RT	30.2 (C)		41.2 (D)		39.9 (D)	
	SB	LT	0 (A)	3.4 (A)	0 (A)	3.5 (A)	0 (A)	2.9 (A)
		TH	3.4 (A)		3.4 (A)		2.8 (A)	
		RT	4.2 (A)		5.9 (A)		4.6 (A)	
	EB	LT	49.1 (D)	37.5 (D)	54.8 (D)	41.4 (D)	59.3 (E)	42.9 (D)
		TH	38.4 (D)		35.9 (D)		37.4 (D)	
		RT	9.5 (A)		16.9 (B)		16.9 (B)	
	WB	LT	0 (A)	30.7 (C)	0 (A)	29.9 (C)	0 (A)	31.2 (C)
		TH	37.4 (D)		32.7 (C)		33.7 (C)	
		RT	18.4 (B)		23 (C)		26.1 (C)	
	Intersection		31.4 (C)		39.4 (D)		43.6 (D)	

Table 5-8: 2040 Build Conditions AM Peak Hour VISSIM Travel Times (minutes)

*Results displayed are the average results across 10 microsimulation runs

Segment	Existing Conditions	2040 Baseline	2040 Build
Northbound N. Washington Street From: Queen Street To: Slaters Lane	8.5	8.9	9.7
Southbound N. Washington Street From: Slaters Lane To: Princess Street	3.3	3.4	3.3

Table 5-9: 2040 Build Conditions AM Peak Hour VISSIM Vehicle Queuing (Average and Maximum) (feet)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Available Storage (feet)	Existing Conditions	2040 Baseline	2040 Build
1. N. Washington Street and Slaters Lane	NB N. Washington St	1080	***4413 (5458)***	***4962 (5749)***	***5288 (5780)***
	NB E. Abingdon Dr	1100	***703 (1209)***	***812 (1227)***	***858 (1342)***
	SB N. Washington St	3110	32 (207)	35 (241)	32 (350)
	SB W. Abingdon Dr	835	29 (285)	33 (323)	***3178 (4904)***
	EB	850	79 (330)	84 (345)	***630 (879)***
	WB	225	6 (55)	9 (76)	39 (213)
2. N. Washington Street and Bashford Lane	NB N. Washington St	1130	***890 (1231)***	***927 (1233)***	***991 (1239)***
	NB E. Abingdon Dr	700	160 (562)	170 (608)	197 (674)
	SB N. Washington St	1075	25 (283)	30 (306)	27 (408)
	SB W. Abingdon Dr	1055	19 (121)	40 (191)	496 (940)
	EB	730	***318 (745)***	***320 (770)***	217 (725)
	WB	545	***280 (564)***	***289 (564)***	***302 (567)***
3. N. Washington Street and First Street	NB	330	***121 (439)***	***129 (439)***	***177 (440)***
	SB	1130	14 (245)	22 (314)	17 (311)
	WB	255	***83 (336)***	***294 (547)***	***454 (594)***
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	345	***101 (449)***	***96 (454)***	***135 (462)***
	SB	180	29 (164)	30 (171)	***28 (193)***
	SEB	345	11 (102)	11 (100)	2 (70)
	EB	245			***37 (267)***
	WB	240	29 (155)	34 (186)	***72 (284)***
5. N. Washington Street and Madison Street	NB	345	***176 (452)***	***179 (455)***	***216 (454)***
	SB	345	21 (144)	24 (145)	26 (146)
	EB	245	45 (204)	***69 (283)***	40 (186)
6. N. Washington Street and Wythe Street	NB	340	***177 (458)***	***190 (469)***	***204 (460)***
	SB	350	17 (147)	21 (172)	12 (145)
	EB	260	***125 (279)***	***196 (278)***	***226 (278)***
	WB	240	35 (211)	***59 (261)***	***82 (263)***
7. N. Washington Street and Pendleton Street	NB	345	***200 (458)***	***233 (462)***	***227 (459)***
	SB	340	17 (130)	16 (125)	9 (109)
	EB	245	***36 (247)***	***34 (252)***	34 (244)
	WB	240	20 (182)	19 (166)	22 (167)
8. N. Washington Street and Oronoco Street	NB	345	***183 (467)***	***239 (469)***	***252 (470)***
	SB	350	7 (127)	7 (125)	23 (221)
	EB	250	26 (188)	27 (175)	27 (175)
	WB	245	17 (131)	19 (140)	22 (150)
9. N. Washington Street and Princess Street	NB	340	***472 (837)***	***673 (876)***	***685 (871)***
	SB	350	8 (102)	9 (129)	8 (114)
	EB	250	7 (82)	10 (96)	12 (103)
	WB	265	2 (48)	3 (64)	3 (56)

[1]Queue lengths that exceed available storage are highlighted in red text. Approach storage is the distance to the upstream intersection. VISSIM reported queues that cross multiple intersections are capped at the distance to the stop bar of the upstream intersection. The exception is the queues reported on the extents of the study area—northbound Washington Street at Slaters Lane and southbound Washington Street at Princess Street.

Table 5-10: 2040 Build Conditions PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build	
1. N. Washington Street and Slaters Lane	NB N. Washington St	TH	25.5 (C)	25.5 (C)	27.9 (C)	27.9 (C)	28.9 (C)	28.9 (C)
	NB E. Abingdon Dr	LT	62.6 (E)	44.8 (D)	71.9 (E)	46.9 (D)	*274.4 (F)*	*132.4 (F)*
		TH	15.7 (B)		14 (B)		23.7 (C)	
		RT	1.3 (A)		1.9 (A)		6.6 (A)	
	SB N. Washington St	TH	24.5 (C)	24.5 (C)	30.1 (C)	30.1 (C)	30.3 (C)	30.3 (C)
	SB W. Abingdon Dr	LT	*95.2 (F)*	32.1 (C)	*96.7 (F)*	32.7 (C)	*129.1 (F)*	41.3 (D)
		TH	33.5 (C)		33.8 (C)		40 (D)	
		RT	28.4 (C)		29 (C)		34.4 (C)	
	EB	LT	38.9 (D)	38.9 (D)	43.1 (D)	43.1 (D)	52.4 (D)	52.4 (D)
		TH	44.8 (D)		49.6 (D)		59.6 (E)	
		RT	32.3 (C)		34.3 (C)		39.7 (D)	
	WB	LT	45.1 (D)	48.1 (D)	65.6 (E)	59 (E)	*244.4 (F)*	*217.4 (F)*
		TH	62.1 (E)		71.3 (E)		*250.6 (F)*	
		RT	4.8 (A)		28.4 (C)		*155.2 (F)*	
	Intersection		28.1 (C)		32.2 (C)		45.4 (D)	
2. N. Washington Street and Bashford Lane	NB N. Washington St	TH	13.6 (B)	13.6 (B)	16.1 (B)	16.1 (B)	27.4 (C)	27.4 (C)
	NB E. Abingdon Dr	LT	66.3 (E)	21.1 (C)	65.2 (E)	19.6 (B)	65 (E)	19.6 (B)
		TH	10.5 (B)		10.7 (B)		10.7 (B)	
		RT	5.8 (A)		5.2 (A)		5.9 (A)	
	SB N. Washington St	TH	1.3 (A)	1.3 (A)	10.6 (B)	10.6 (B)	13.5 (B)	13.5 (B)
	SB W. Abingdon Dr	LT	75.8 (E)	22.1 (C)	*87.1 (F)*	23.2 (C)	*670.5 (F)*	*127 (F)*
		TH	13.5 (B)		13.2 (B)		28.7 (C)	
		RT	13.6 (B)		13.7 (B)		21.9 (C)	
	EB	LT	49.2 (D)	34.2 (C)	44.8 (D)	36.5 (D)	46.9 (D)	33.5 (C)
		TH	34.4 (C)		36.9 (D)		33.5 (C)	
		RT	22 (C)		26.2 (C)		25.1 (C)	
	WB	LT	39.1 (D)	37.3 (D)	42.1 (D)	37.6 (D)	32.3 (C)	38.2 (D)
		TH	37.7 (D)		38.6 (D)		39.5 (D)	
		RT	37.1 (D)		36.9 (D)		37.9 (D)	
	Intersection		12.7 (B)		17.7 (B)		38.3 (D)	
3. N. Washington Street and First Street	NB	TH	10 (A)	10 (A)	9.9 (A)	9.9 (A)	9.4 (A)	9.4 (A)
		RT	10.1 (B)		11.4 (B)		7.4 (A)	
	SB	LT	17.1 (B)	10.4 (B)	22.4 (C)	21.5 (C)	27.1 (C)	22.1 (C)
		TH	9.3 (A)		21.3 (C)		21.2 (C)	
	WB	RT	6.6 (A)	6.6 (A)	7.2 (A)	7.2 (A)	6.2 (A)	6.2 (A)
	Intersection		10.1 (B)		16.5 (B)		16.9 (B)	

Table 5-10: 2040 Build Conditions PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build	
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	LT	48.1 (D)	12.3 (B)	51.3 (D)	13 (B)		16.4 (B)
		TH	10.4 (B)		11.1 (B)		16.5 (B)	
		RT					12 (B)	
	SB	LT		7.1 (A)		12.4 (B)		19.5 (B)
		TH	7.1 (A)		12.5 (B)		19.7 (B)	
		RT to Montgomery St	5.7 (A)		9.6 (A)		14.3 (B)	
		RT to Powhatan St	7.2 (A)		6.1 (A)		7 (A)	
	SEB	RT to Washington St	54.5 (D)	54.6 (D)	55.7 (E)	55.8 (E)	61.7 (E)	61.9 (E)
		RT to Montgomery St	60.2 (E)		60.2 (E)		71.7 (E)	
	EB	LT					52.6 (D)	27.7 (C)
		TH					25.5 (C)	
		RT					20.6 (C)	
	WB	LT	43.3 (D)	43.9 (D)	66.4 (E)	60.3 (E)	34.9 (C)	31.5 (C)
		TH	42.4 (D)		58 (E)		30.7 (C)	
		RT to Powhatan St	45.2 (D)		57.6 (E)			
		RT to Washington St	56.7 (E)		71.1 (E)		33.6 (C)	
	Intersection		14.4 (B)		19.8 (B)		21.3 (C)	
5. N. Washington Street and Madison Street	NB	TH	9 (A)	9.8 (A)	13.3 (B)	15.4 (B)	8.1 (A)	8.4 (A)
		RT	23.1 (C)		50.9 (D)		15 (B)	
	SB	LT	27.3 (C)	6.6 (A)	62.2 (E)	13.6 (B)	19 (B)	15.8 (B)
		TH	5.8 (A)		11.6 (B)		15.7 (B)	
	EB	LT	42.1 (D)	38.2 (D)	44.4 (D)	39.8 (D)	44.1 (D)	38.7 (D)
		TH	39.2 (D)		40.5 (D)		39.1 (D)	
		RT	29.9 (C)		32.2 (C)		32 (C)	
	Intersection		10.6 (B)		16.7 (B)		14.6 (B)	
6. N. Washington Street and Wythe Street	NB	LT	*112.7 (F)*	15.6 (B)	*157.4 (F)*	21.9 (C)	*280.1 (F)*	34.6 (C)
		TH	10.2 (B)		13.7 (B)		9.2 (A)	
		RT	21.5 (C)		33.1 (C)		24.2 (C)	
	SB	LT	32.7 (C)	9.9 (A)	52.9 (D)	14.6 (B)	48.4 (D)	20.3 (C)
		TH	8.7 (A)		12.4 (B)		18.8 (B)	
		RT	6.5 (A)		9.7 (A)		13 (B)	
	EB	LT	58.2 (E)	49.2 (D)	72.7 (E)	59.8 (E)	71.3 (E)	64.3 (E)
		TH	46.5 (D)		56.6 (E)		62.6 (E)	
		RT	41 (D)		43.5 (D)		57.1 (E)	
	WB	LT	59.8 (E)	50.2 (D)	77.2 (E)	68.2 (E)	*91.5 (F)*	76.1 (E)
		TH	50 (D)		67.1 (E)		74.5 (E)	
		RT	41.2 (D)		63.2 (E)		63.9 (E)	
	Intersection		16.6 (B)		23.9 (C)		32.4 (C)	

Table 5-10: 2040 Build Conditions PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build	
7. N. Washington Street and Pendleton Street	NB	LT	57.2 (E)	11.5 (B)	72.3 (E)	15.6 (B)	*119.8 (F)*	44.2 (D)
		TH	11.2 (B)		15.5 (B)		44.8 (D)	
		RT	10.2 (B)		12.3 (B)		17.7 (B)	
	SB	LT	38.4 (D)	16.6 (B)	0 (A)	22.6 (C)	0 (A)	30.3 (C)
		TH	16.6 (B)		22.8 (C)		30.6 (C)	
		RT	13.9 (B)		17.9 (B)		21.3 (C)	
	EB	LT	47.2 (D)	41.6 (D)	51.9 (D)	44.3 (D)	*100 (F)*	*82.9 (F)*
		TH	42.3 (D)		44.2 (D)		*81.9 (F)*	
		RT	32.3 (C)		37.1 (D)		68.7 (E)	
	WB	LT	42.7 (D)	36.3 (D)	46.3 (D)	39.6 (D)	48.3 (D)	44.2 (D)
		TH	37.8 (D)		41.3 (D)		45.3 (D)	
		RT	30.6 (C)		33 (C)		39.7 (D)	
	Intersection		17.9 (B)		22.8 (C)		39.8 (D)	
8. N. Washington Street and Oronoco Street	NB	LT	25.7 (C)	9.3 (A)	0 (A)	12.1 (B)	0 (A)	36.9 (D)
		TH	9.3 (A)		12.1 (B)		37.2 (D)	
		RT	9.9 (A)		12.5 (B)		25.8 (C)	
	SB	LT	48.1 (D)	22.8 (C)	61.3 (E)	26.6 (C)	61 (E)	30 (C)
		TH	22.6 (C)		26.4 (C)		29.8 (C)	
		RT	16.7 (B)		17.3 (B)		19.3 (B)	
	EB	LT	47.2 (D)	39.6 (D)	53.9 (D)	45.7 (D)	*82.6 (F)*	58 (E)
		TH	38.2 (D)		43.8 (D)		49.8 (D)	
		RT	23 (C)		30.9 (C)		38.3 (D)	
	WB	LT	47.6 (D)	39.8 (D)	58 (E)	50.2 (D)	67.9 (E)	69.4 (E)
		TH	43.4 (D)		50.9 (D)		68.9 (E)	
		RT	31 (C)		44.9 (D)		71.2 (E)	
	Intersection		19.1 (B)		23.3 (C)		36.6 (D)	
9. N. Washington Street and Princess Street	NB	LT	47.8 (D)	15.1 (B)	63.6 (E)	22.3 (C)	*97.7 (F)*	59.6 (E)
		TH	13.5 (B)		20.4 (C)		57.8 (E)	
		RT	14.6 (B)		10.9 (B)		26.8 (C)	
	SB	LT	43.6 (D)	40.2 (D)	0 (A)	40.4 (D)	0 (A)	44 (D)
		TH	40.3 (D)		40.5 (D)		44.2 (D)	
		RT	38.1 (D)		37 (D)		35.6 (D)	
	EB	LT	49.6 (D)	46.2 (D)	55.8 (E)	52.6 (D)	*96.2 (F)*	*82.8 (F)*
		TH	45.2 (D)		51.1 (D)		71.9 (E)	
		RT	33.5 (C)		44 (D)		55.6 (E)	
	WB	LT	39.3 (D)	35.1 (D)	42.5 (D)	40.6 (D)	60.2 (E)	48 (D)
		TH	38 (D)		41.5 (D)		45.8 (D)	
		RT	25.3 (C)		36.1 (D)		58.3 (E)	
	Intersection		30.2 (C)		33.7 (C)		50.9 (D)	

Table 5-11: 2040 Build Conditions PM Peak Hour VISSIM Travel Times (minutes)

*Results displayed are the average results across 10 microsimulation runs

Segment	Existing Conditions	2040 Baseline	2040 Build
Northbound N. Washington Street From: Queen Street To: Slaters Lane	4.3	4.9	6.5
Southbound N. Washington Street From: Slaters Lane To: Princess Street	3.9	4.9	5.5

Table 5-12: 2040 Build Conditions PM Peak Hour VISSIM Vehicle Queuing (Average and Maximum) (feet)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Available Storage (feet)	Existing Conditions	2040 Baseline	2040 Build
1. N. Washington Street and Slaters Lane	NB N. Washington St	1080	209 (868)	*322 (1352)*	*240 (1089)*
	NB E. Abingdon Dr	1100	209 (867)	10 (102)	97 (282)
	SB N. Washington St	3110	173 (813)	341 (1570)	472 (2409)
	SB W. Abingdon Dr	835	*404 (2122)*	*515 (2474)*	*1337 (3437)*
	EB	850	51 (214)	57 (225)	78 (295)
	WB	225	13 (99)	*46 (227)*	*323 (387)*
2. N. Washington Street and Bashford Lane	NB N. Washington St	1130	0 (0)	86 (534)	136 (551)
	NB E. Abingdon Dr	700	66 (393)	6 (82)	6 (83)
	SB N. Washington St	1075	0 (0)	121 (631)	*156 (1080)*
	SB W. Abingdon Dr	1055	30 (226)	32 (243)	631 (1009)
	EB	730	21 (180)	28 (217)	21 (182)
	WB	545	72 (383)	84 (433)	82 (423)
3. N. Washington Street and First Street	NB	330	47 (268)	*50 (358)*	42 (243)
	SB	1130	53 (726)	*284 (1145)*	*261 (1242)*
	WB	255	5 (88)	6 (108)	5 (101)
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	345	31 (279)	34 (281)	56 (268)
	SB	180	*29 (274)*	*49 (275)*	*74 (379)*
	SEB	345	29 (174)	29 (171)	21 (163)
	EB	245			19 (163)
	WB	240	*74 (274)*	*125 (282)*	*105 (276)*
5. N. Washington Street and Madison Street	NB	345	42 (259)	80 (334)	30 (201)
	SB	345	38 (278)	*93 (541)*	*169 (516)*
	EB	245	49 (226)	*58 (260)*	39 (153)
6. N. Washington Street and Wythe Street	NB	340	56 (288)	*103 (352)*	*298 (454)*
	SB	350	*47 (412)*	*81 (417)*	*126 (454)*
	EB	260	45 (247)	*69 (277)*	*91 (280)*
	WB	240	*88 (262)*	*157 (262)*	*167 (262)*
7. N. Washington Street and Pendleton Street	NB	345	53 (328)	*80 (433)*	*240 (453)*
	SB	340	*107 (446)*	*141 (448)*	*200 (450)*
	EB	245	*62 (284)*	*71 (286)*	*140 (290)*
	WB	240	*66 (286)*	*77 (282)*	*98 (278)*
8. N. Washington Street and Oronoco Street	NB	345	*50 (350)*	*74 (415)*	*210 (460)*
	SB	350	*137 (457)*	*176 (464)*	*200 (462)*
	EB	250	21 (147)	27 (180)	32 (198)
	WB	245	*54 (272)*	*92 (273)*	*131 (273)*
9. N. Washington Street and Princess Street	NB	340	*83 (375)*	*138 (391)*	*276 (401)*
	SB	350	*743 (1920)*	*1460 (3713)*	*2210 (5435)*
	EB	250	27 (161)	40 (243)	53 (229)
	WB	265	11 (115)	18 (155)	24 (171)

[1]Queue lengths that exceed available storage are highlighted in red text. Approach storage is the distance to the upstream intersection. VISSIM reported queues that cross multiple intersections are capped at the distance to the stop bar of the upstream intersection. The exception is the queues reported on the extents of the study area - northbound Washington Street at Slaters Lane and southbound Washington Street at Princess Street.

6. 2040 Build Conditions with Improvements

Reviewing the 2040 Build Conditions analysis results, there were locations where the Small Area Plan Update impacts the Old Town North transportation operations. The following locations in the study area require some mitigation to minimize these impacts:

- Along Slaters Lane between E. and W. Abingdon Drive
  - Intersection of E. Abingdon Drive and Slaters Lane has significant northbound delays during the AM and PM peak hour
  - Intersection of W. Abingdon Drive and Slaters Lane has significant southbound delays, during the AM and PM peak hours resulting in spill back to the George Washington Memorial Parkway
  - Intersection of N. Washington Street and Slaters Lane has significant eastbound approach delays during the AM peak hour and significant and westbound approach delays during the PM peak hour. The overall intersection operates at level of service F during the AM peak hour
- Along Bashford Lane between E. and W. Abingdon Drive
  - Intersection of W. Abingdon Drive and Bashford Lane has significant southbound delays during the AM and PM peak hours resulting in spill back to Slaters Lane
  - Intersection of N. Washington Street and Bashford Lane has significant eastbound and westbound approach delays during the AM peak

In addition to the above, there is one location just outside the study area that requires some mitigation to minimize the impacts to the study area:

- Along E. Abingdon Drive, approaching the George Washington Memorial Parkway
  - The ramp approach to the George Washington Memorial Parkway experiences significant queuing during the AM peak hour. This queuing extends beyond the intersection of E. Abingdon Drive and Slaters Lane, affecting the operations of both streets

Much of the traffic impacts at Slaters Lane and Bashford Lane can be attributed trips traveling to or from the redeveloped power plant site. The redevelopment of the power plant site will increase the traffic demand to that area and generate a significant amount of vehicular traffic to and from the east of N. Washington Street. Based on the analysis of 2040 Build Conditions, the trips generated by this redevelopment, in addition to all other 2040 Build Conditions traffic, create undesirable traffic operations. Locations along W. Abingdon Drive, E. Abingdon Drive, Slaters Lane, and Bashford Lane experience increased delays and queuing. This is related to the movements of vehicles going to or coming from the north or west and destined to or leaving from the power plant site. These movements are provisionally served by only two access points to the broader transportation network (along Slaters Lane or Bashford Lane).

During VISSIM model analysis, queuing along E. Abingdon Drive that originated north of the study area was observed to spillback to Slaters Lane. This is a result of the merge between E. Abingdon Drive ramp and George Washington Memorial Parkway. E. Abingdon Drive narrows from two lanes to one lane at the approach to the merge. The ramp approach is signalized in the weekday AM peak period only and yield controlled at all other times. While this location is not specifically within the study area, the delay and queue impacts study area intersections.

The 2040 Build Conditions traffic volumes also create significant eastbound and westbound approach delays at N. Washington Street intersections towards the southern portion of the study area. These intersections include Wythe Street, Pendleton Street, and Princess Street.

In addition to these vehicular impacts, the 2040 Build conditions also are missing enhancements to bicycle and pedestrian facilities across Slaters Lane to connect the redeveloped power plant site with neighborhoods west of N. Washington Street.

To mitigate these impacts, potential improvements were identified for evaluation. The following sections describe the potential multimodal improvements evaluated for the revised Small Area Plan.

6.1. Build Transportation Network with Potential Improvements

The potential improvements identified are summarized in **Table 6-1**.

Table 6-1. Potential Improvements Summary

Improvement	Description	Type of Project
Northbound and southbound left-turn movements along N. Washington at Montgomery Street	Modification of lane designations and signal phasing at the intersection of N. Washington Street and Montgomery Street to allow northbound and southbound left-turn movements to Montgomery Street. This will enhance mobility where many turns along Washington Street are currently restricted. Northbound left-turn movements to Powhatan Street would be restricted.	Vehicular
New east-west street (connecting W. Abingdon Drive to the redeveloped power plant site)	Construction of a new east-west street along the rail spur alignment to enhance multimodal connectivity between the power plant site, N. Washington Street, and E./W. Abingdon Drive	All modes
Lane configuration restriping along southbound W. Abingdon Drive at Slaters Lane	Extend two-lane striping of southbound W. Abingdon Drive approach to intersection with Slaters Lane to increase vehicle queue capacity	Vehicular
Lane configuration restriping along Bashford Lane	Restriping of eastbound/westbound Bashford Lane approaches to increase vehicle capacity between E. and W. Abingdon Drive.	Vehicular
General Transit	Update COA and Transportation Master Plan as redevelopment occurs.	Transit
Pedestrians improvements and bicycle lanes on Slaters Lane	Extend bicycle lanes and improve pedestrian facilities along Slaters Lane through E./W. Abingdon Drive and N. Washington Street.	Bicycle and Pedestrian
Signal timing adjustments	Signal timing adjustments to reallocate green time to better serve east-west movements at certain intersections along N. Washington Street, maintaining north-south progression, and phasing changes associated with other improvements.	Vehicular
Lane configuration restriping along northbound E. Abingdon Drive at George Washington Memorial Parkway	Extend two-lane striping of northbound E. Abingdon Drive approach to intersection with George Washington Memorial Parkway to increase vehicle queue capacity. Will require signalization during all hours of the day in addition to the weekday AM peak period.	Vehicular

6.1.1. Potential Improvements to the Vehicular Street Network

The potential vehicular street network improvements are described in more detail below.

Northbound and Southbound Left Turns at the Intersection of N. Washington Street and Montgomery Street

As previously discussed in the 2040 Build Conditions, the City intends to convert Montgomery Street to a two-way operation. This two-way conversion creates the opportunity to allow northbound and southbound left-turn movements at the intersection of N. Washington Street and Montgomery Street. Access to Powhatan Street would be via Montgomery Street and N. Columbus Street (the ability to turn northbound left into Powhatan Street would be restricted). Allowing a left turn at this location also would potentially attract some northbound left-turning vehicles from the Wythe Street intersection. The southbound left-turn movements would allow for a rebalancing of southbound left-turning traffic among First Street, Montgomery Street, and Madison Street.

It is noted that a northbound left-turn lane already exists along Washington Street at this intersection. A southbound left-turn lane appears to be able to be accommodated within the existing cross-section with no impacts to existing curbs (this matches the same cross-section south of the intersection). A concept drawing showing the resulting lane configuration at the intersection of N. Washington Street and Montgomery Street is shown in **Figure 6-1**.

New East-West Connection Between Slaters Lane and Bashford Lane

To add a new connection to the power plant site and reduce traffic along Slaters Lane and Bashford Lane, a new east-west connection has been identified, located south of Slaters Lane and north of Bashford Lane, approximately along the alignment of the rail spur corridor. This new connection would serve to rebalance the site trips attracted to the redeveloped power plant site among three east-west corridors instead of the existing two corridors, and would be designed to include pedestrian and bicycle facilities to connect with the proposed linear park. A conceptual drawing with the location of the potential connection is shown in **Figure 6-2**. The proposed east-west connection would require coordination and all necessary approvals from the National Park Service (NPS). The analysis also acknowledges that there may be other improvements, such as widening of the Abingdon Drive service road to address the traffic conditions at Slaters Lane and the service road; however, because of the desire to maintain pedestrian-oriented streets and enhanced connectivity, the study recommends the new east-west connection. The analysis also recognizes that the new east-west connection would be located in close proximity to Slater Lane. The specific location of the new east-west connection would have to be refined to fit well within the coordinated signal network and not cause undue disruption to Slaters Lane or Bashford Lane operations. The design and timing of the new east-west connection should be established as part of the development approvals for the former power plant site.

Lane Configuration Improvements along W. Abingdon Drive

The southbound approach of W. Abingdon Drive service road to Slaters Lane experiences long queues in the 2040 Build Conditions. In existing conditions, vehicle queues were observed to form in two lines along the ramp, even though the roadway is one lane and only striped for two lanes starting 60 feet ahead of the intersection. To increase queue capacity, a potential improvement is restriping southbound W. Abingdon Drive to have two lanes along the ramp from the George Washington Memorial Parkway. This lane configuration can be accommodated with the existing roadway, requiring no widening of the cross-section. A conceptual drawing of the W. Abingdon Drive improvements is shown in **Figure 6-3**.

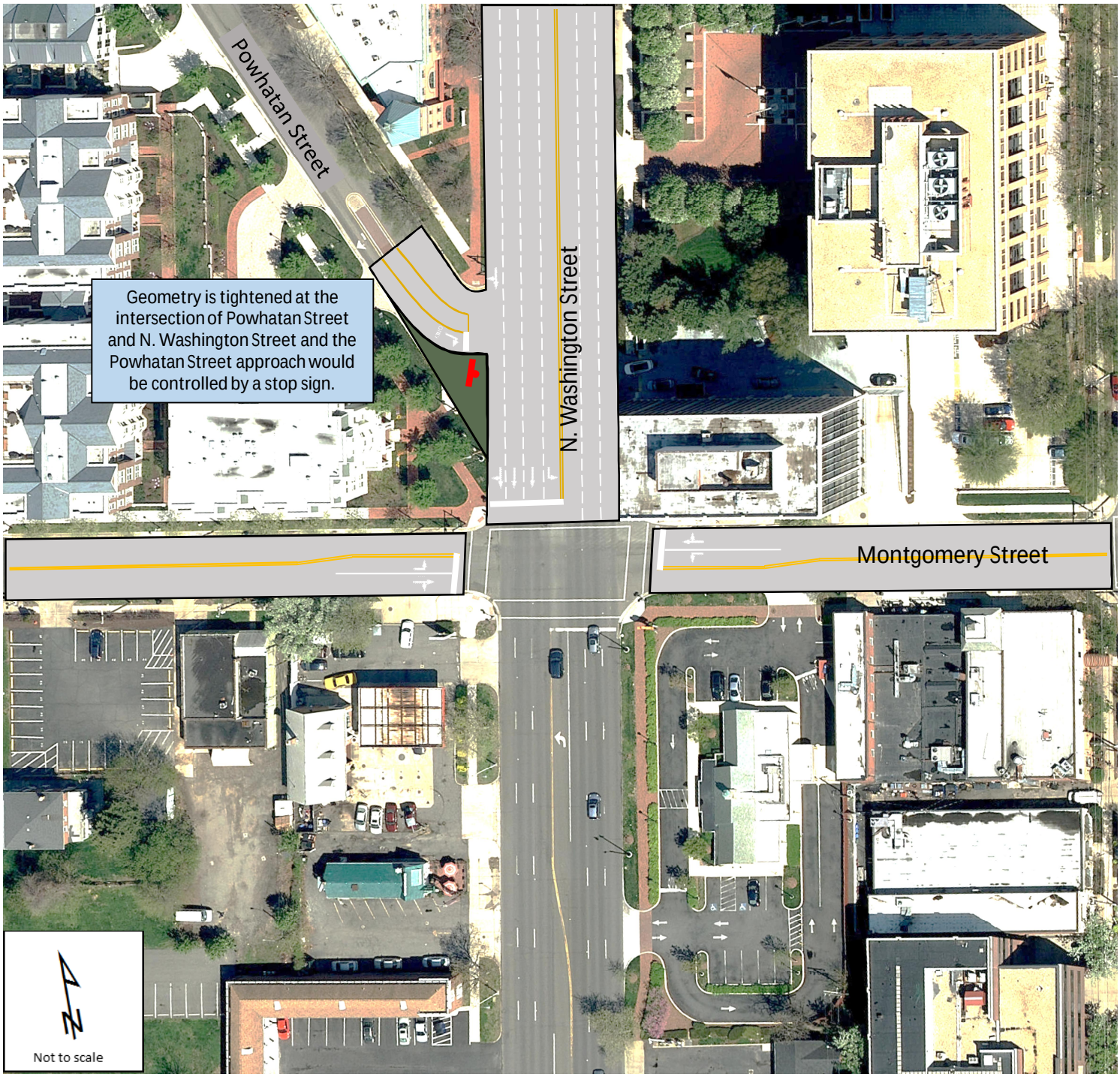
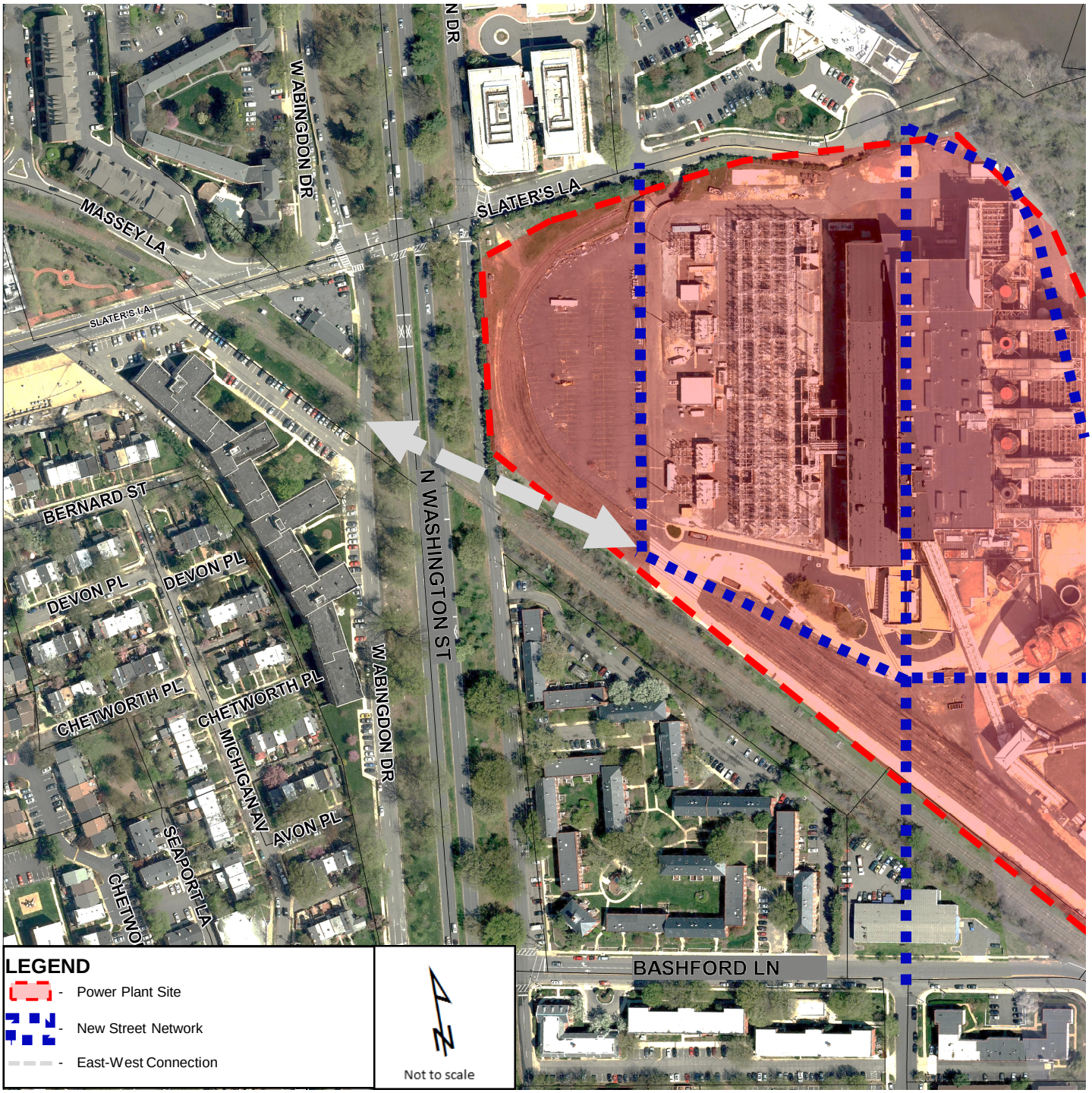
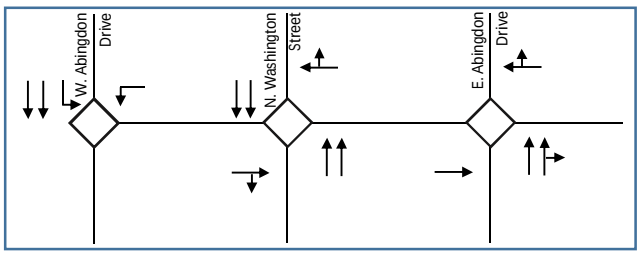


Figure 6-1: N. Washington Street and Montgomery Street Northbound and Southbound Lane Configuration Concept



Lane Configuration Concept



Note: East-west connectivity is provided for pedestrians and bicycles access to existing Mt. Vernon Trail and Power Plant site recreational facilities

Figure 6-2: New East-West Connection

Existing

Improvement Concept

Figure 6-3: E. Abingdon Drive and W. Abingdon Drive Improvement Concept

Lane Configuration Improvements along Bashford Lane

The 2040 Build Conditions traffic results indicate long eastbound and westbound delays along Bashford Lane. While much of these delays would be mitigated with the provision of the new east-west connection and the associated reassignment of traffic volumes, additional improvements to the capacity and throughput of these approaches can be achieved through a minor restriping effort. The restriping would delineate the eastbound and westbound approaches as two lanes between E. and W. Abingdon Drive, and also convert the westbound approach at E. Abingdon Drive from a through and right-turn lane to a through and a shared through-right lane. These improvements can be accomplished with no widening along Bashford Lane. A concept drawing of the Bashford Lane improvements is shown in **Figure 6-4.**

Lane Configuration Improvements along E. Abingdon Drive

The northbound approach of E. Abingdon Drive to George Washington Memorial Parkway experiences long queues in the 2040 Build Conditions. E. Abingdon Drive currently narrows from two lanes to one lane using only pavement markings. To increase queue capacity, a potential improvement is restriping northbound E. Abingdon Drive to extend the two lanes along the full ramp approach to George Washington Memorial Parkway. This lane configuration can be accommodated with the existing roadway, requiring no widening. A conceptual drawing of the E. Abingdon Drive improvements also is shown in **Figure 6-3**. The existing signal would need to operate all day as part of the improvement.

6.1.2. Potential Improvements to the Transit Network/Service

To support the future transit network envisioned as part of the 2040 Build Conditions scenario, the City of Alexandria should continue their commitment to transportation demand management (TDM) strategies and GO Alex, the City's program to improve the commuter experience and assist employees with creating and supporting viable transportation alternatives. Further, the City should continue to explore transit stop improvements and technologies such as expanding transit signal priority (TSP) and real time bus data to further enhance transit service and reliability. At the power plant site, there is an opportunity to provide a multimodal transportation hub that would include a transit stop.

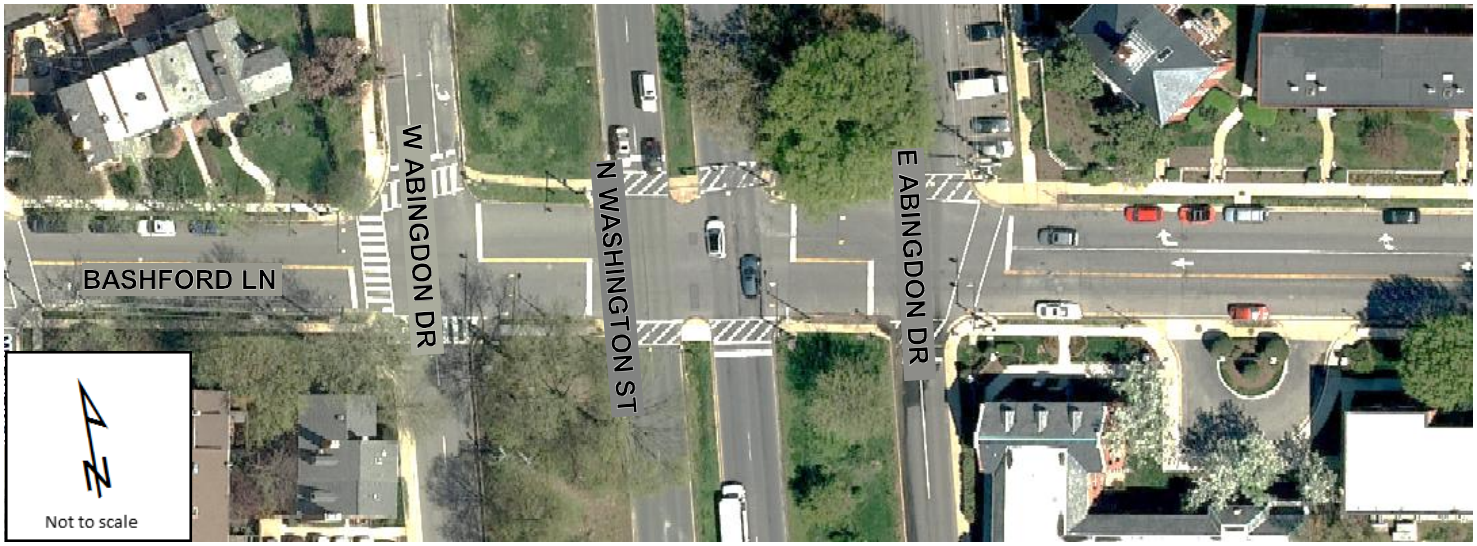
6.1.3. Potential Improvements to the Pedestrian Network

To support the future pedestrian network, the City should build upon the recommendations of the pedestrian and bicycle chapter of the Transportation Master Plan and complete streets design guidelines. Pedestrian or multimodal paths also should be constructed along both sides of the new east-west connection to enhance the connectivity of the pedestrian network between W. Abingdon Drive and the redeveloped power plant site.

6.1.4. Potential Improvements to the Bicycle Network

To support the future bicycle network, the City should build upon the recommendations of the pedestrian and bicycle chapter of the Transportation Master Plan and complete streets design guidelines. Bicycle lanes should be extended along Slaters Lane from W. Abingdon Drive to the redeveloped power plant site. Similarly, bicycle facilities, either on-street or off-street, should be constructed along both sides of the new east-west connection to enhance the connectivity of the bicycle network between W. Abingdon Drive and the redeveloped power plant site. These bicycle connections across N. Washington Street and W. and E. Abingdon Drive will provide more connectivity to the future Potomac Yard Metrorail Station.

Existing



Improvement Concept

Figure 6-4: Bashford Lane Eastbound/Westbound Improvement Concept

6.2. 2040 Build Conditions with Improvements Traffic Volumes

Two of the potential improvements identified will create new traffic movements. The following describes the assumptions and the traffic volumes forecasted for these new movements to develop the 2040 Build Conditions with Improvements traffic volumes.

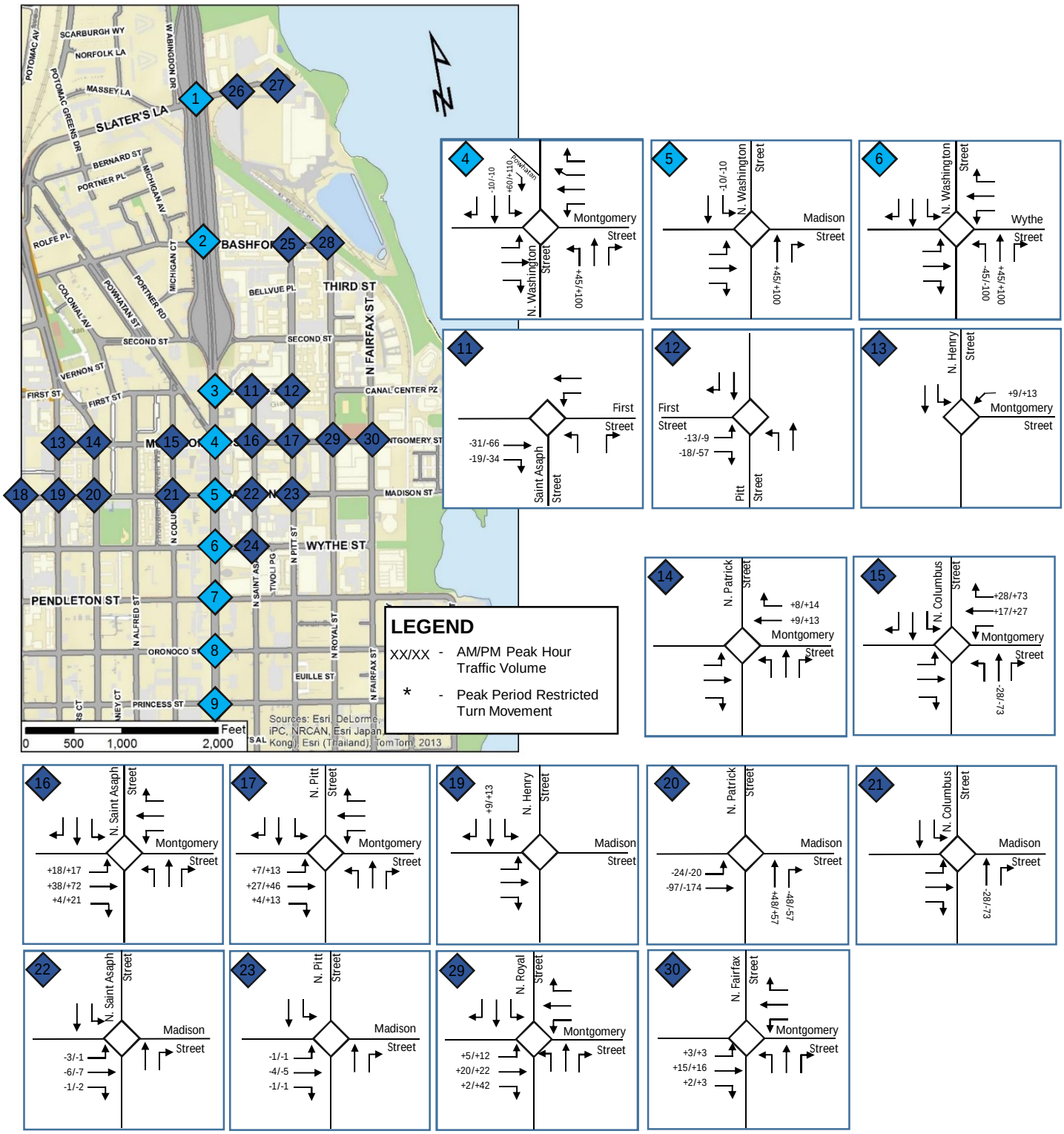
6.2.1. Traffic Volume Reassignments Based on the Northbound and Southbound Left Turns at the Intersection of N. Washington Street and Montgomery Street

The Montgomery Street two-way conversion creates the opportunity to allow northbound and southbound left-turn movements at the intersection of N. Washington Street and Montgomery Street. The northbound left-turn volume at this intersection was assumed to draw approximately 60 percent of the northbound left turns from N. Wythe Street. The southbound left-turn volume at this intersection was assumed to draw approximately 30 to 35 percent of southbound left turns from First Street and approximately 10 percent of southbound left turns from Madison Street. The values were arrived at through iteration to show an appropriate balance in the number of turning movements occurring at adjacent intersections. The peak hour traffic volume reassignments associated with the new northbound and southbound left turns are shown in **Figure 6-5**.

6.2.2. Traffic Volume Reassignments Based on the New East-West Street Connection

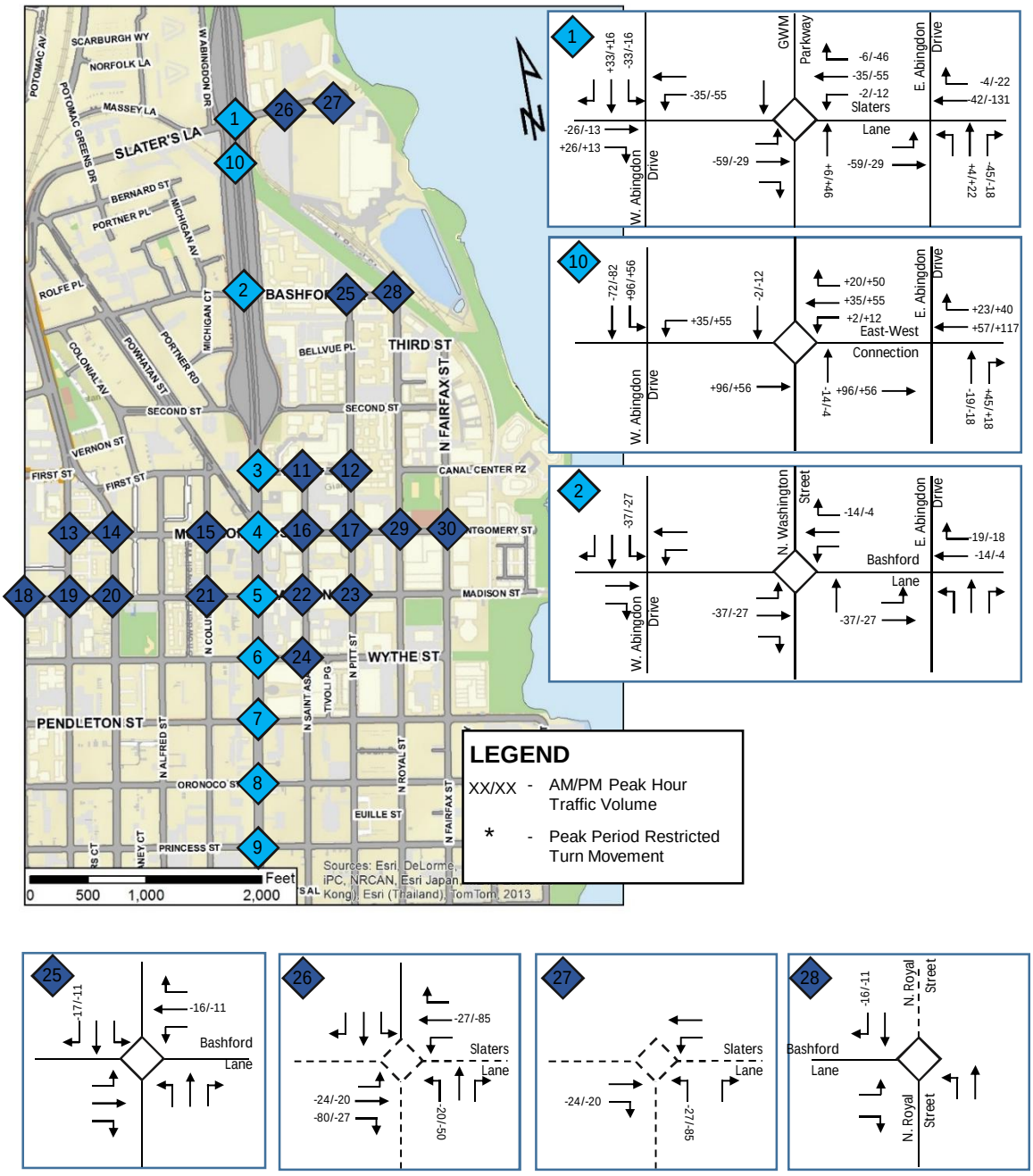
The new street connection will rebalance the site trips attracted to the redeveloped power plant site among three east-west corridors instead of the existing two corridors (Slaters Lane and Bashford Lane). The traffic volumes using the new east-west connection were developed by reassigning the trips specifically attracted to or generated from the redeveloped power plant site that were assigned to Slaters Lane or Bashford Lane under the 2040 Build Conditions (Chapter 5). Based on the connectivity of the three parallel corridors, it was assumed that the new east-west street would generally attract 60 percent of power plant site trips while Slaters Lane and Bashford Lane would each attract 20 percent of power plant site trips. The new east-west connection would be a more attractive option for power plant site trips compared to Slaters Lane (due to existing trips and congestion) and compared to Bashford Lane (based on proximity to the power plant site). The 60 percent assumption was determined after testing various threshold of volumes on the three streets to achieve balance in the level of service results at the three streets. Accordingly, the appropriate percentage of power plant site trips currently assigned to Slater Lane or Bashford Lane were reassigned to the new east-west connection. The reassigned Slaters Lane, Bashford Lane, and new east-west connection peak hour traffic volumes are shown on **Figure 6-5**.

Applying the reassignments from both improvements shown in **Figures 6-5** and **6-6** to the 2040 Build Conditions traffic volumes, the 2040 Build Conditions with Improvements traffic volumes were calculated and are shown in **Figure 6-7**.



Note: There are no rerouted traffic volumes for intersections not shown.

Figure 6-5: Reassigned Northbound and Southbound Left Turn Volumes for N. Washington Street and Montgomery Street



Note: There are no rerouted traffic volumes for intersections not shown.

Figure 6-6: Reassigned Traffic Peak Hour Traffic Volumes for the New East-West Connection

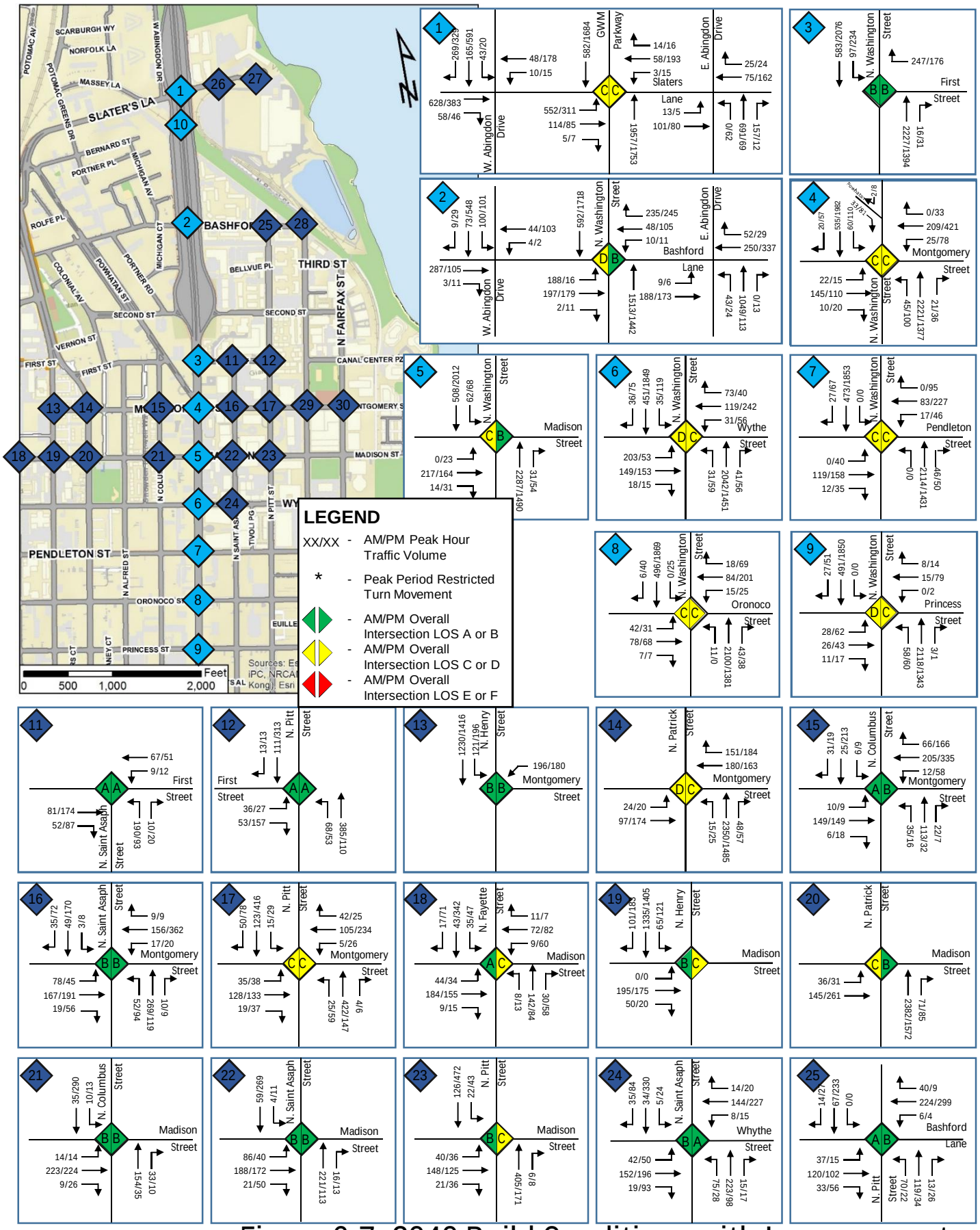
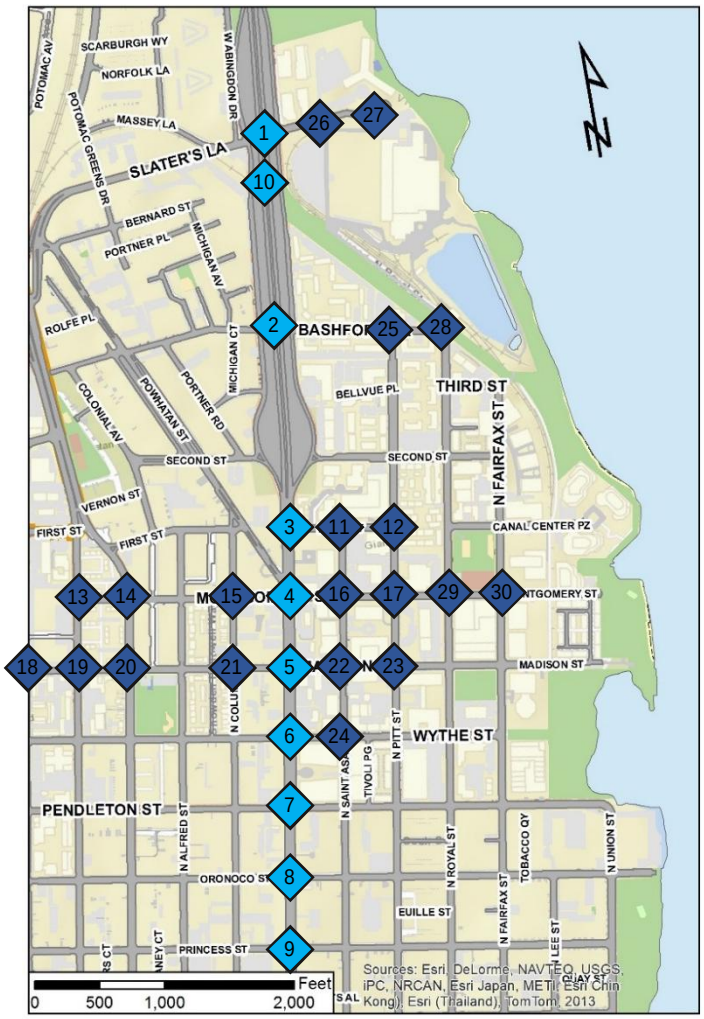
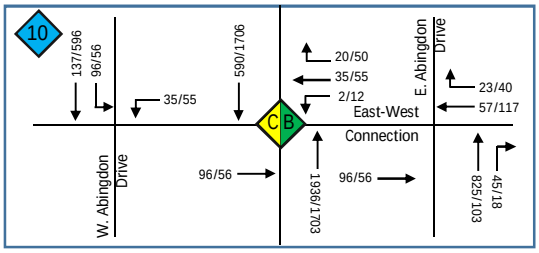


Figure 6-7: 2040 Build Conditions with Improvements Peak Hour Traffic Volumes Sheet 1 of 2



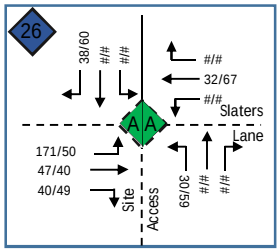


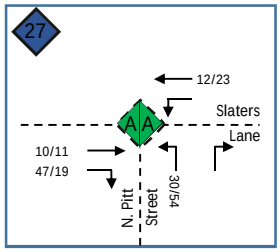
LEGEND

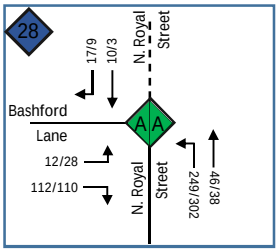
XX/XX - AM/PM Peak Hour Traffic Volume

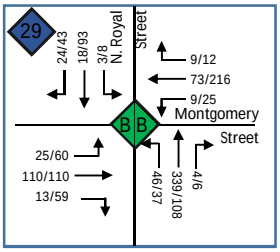
* - Peak Period Restricted Turn Movement

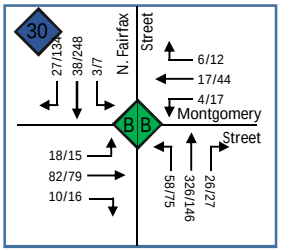
- AM/PM Overall Intersection LOS A or B
- AM/PM Overall Intersection LOS C or D
- AM/PM Overall Intersection LOS E or F











Note:
For the purpose of this study, nominal traffic volumes (represented by the # symbol) were added to the intersection of the Site Access with Slater Lane to show interaction with the current residential property north of Slaters Lane.

Figure 6-7: 2040 Build Conditions with Improvements Peak Hour Traffic Volumes Sheet 2 of 2

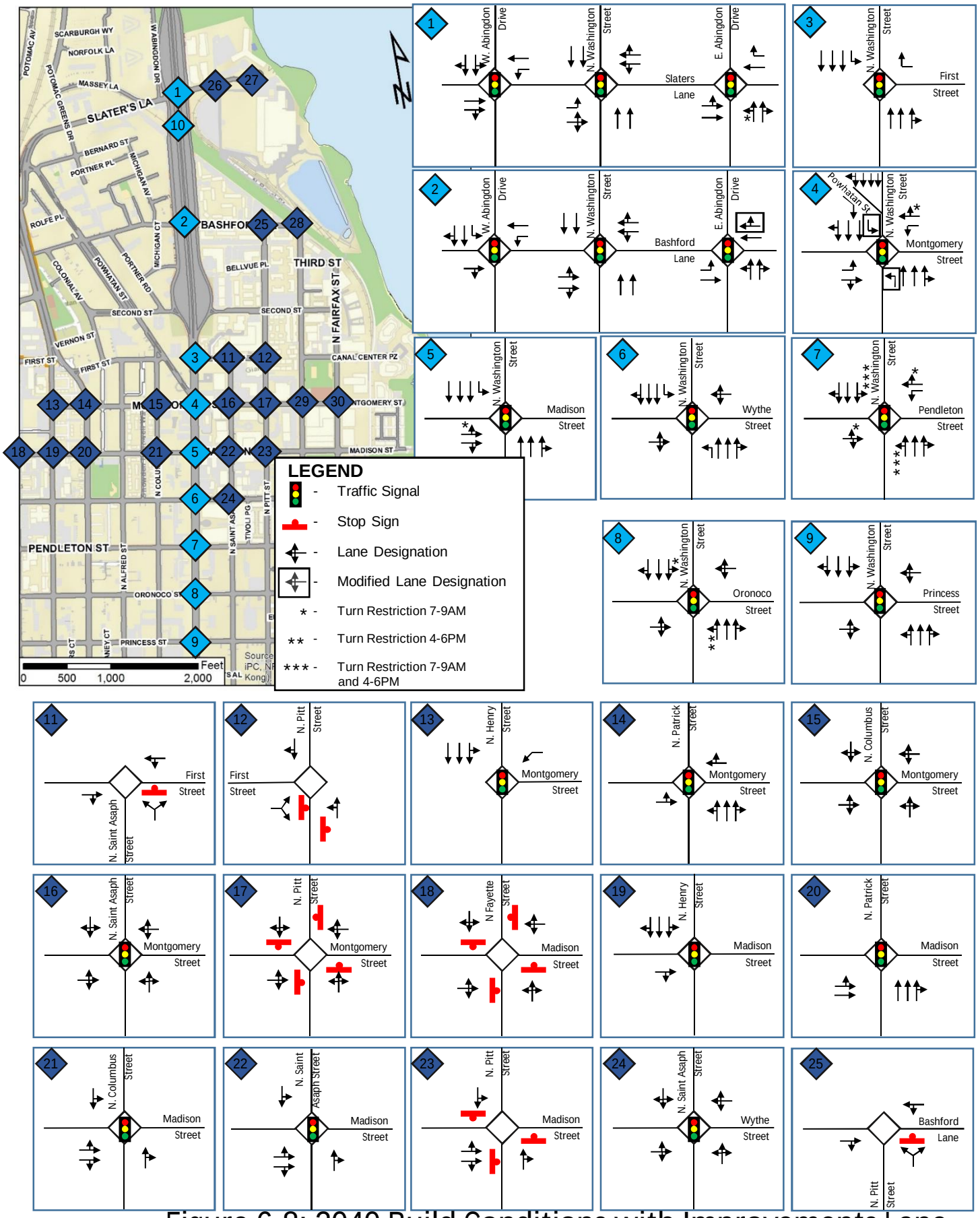
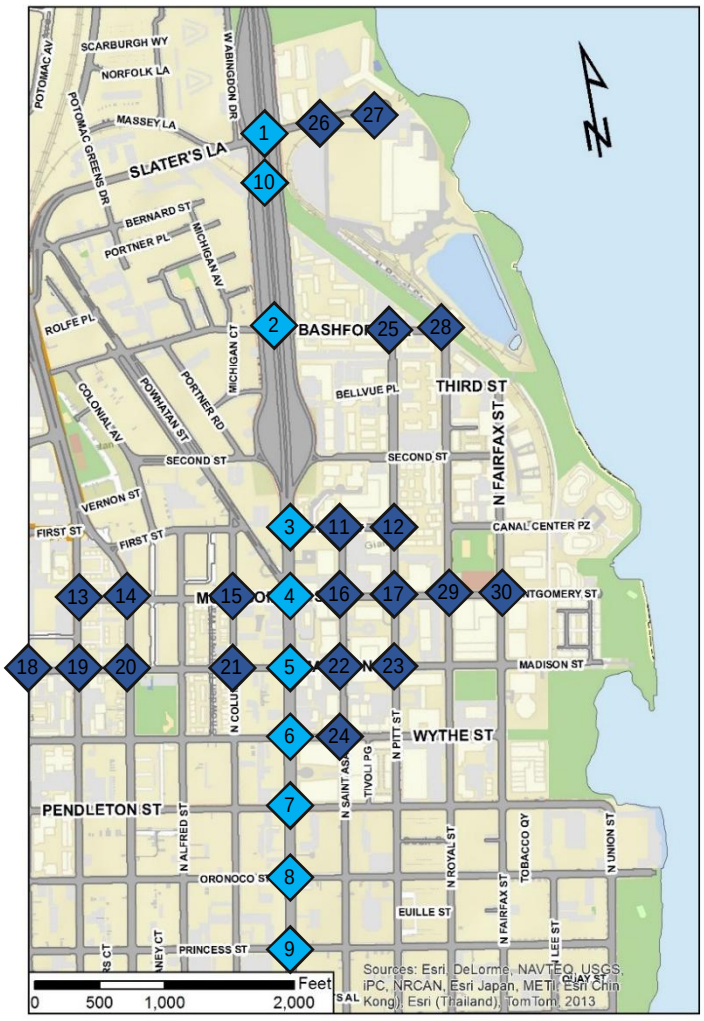
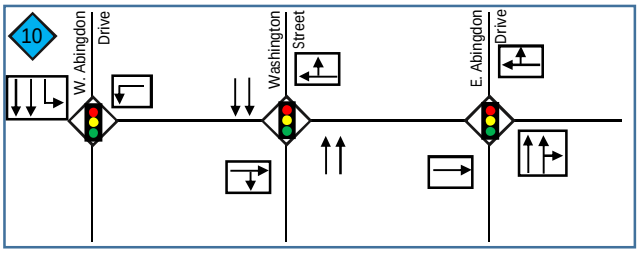


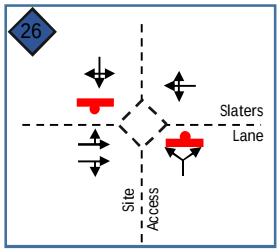
Figure 6-8: 2040 Build Conditions with Improvements Lane Configuration Sheet 1 of 2

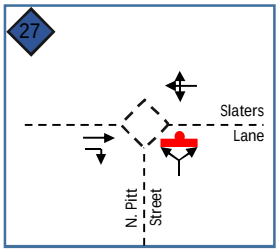


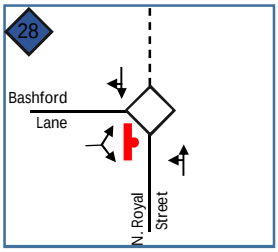


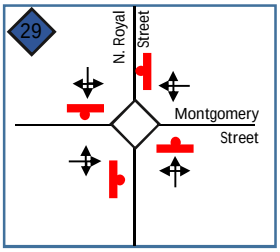
LEGEND

- Traffic Signal
- Stop Sign
- Lane Designation
- Modified Lane Designation
- * - Turn Restriction 7-9AM
- ** - Turn Restriction 4-6PM
- *** - Turn Restriction 7-9AM and 4-6PM









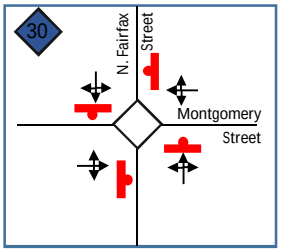


Figure 6-8: 2040 Build Conditions with Improvements Lane Configuration Sheet 2 of 2

6.3. Synchro Analysis

2040 Build Conditions with Improvements analyses were evaluated using the 2040 Build Conditions with modified lane configurations, shown on **Figure 6-8**, and updated peak hour traffic volumes, shown on **Figure 6-7**, that consider the reassignment of traffic volumes associated with the potential improvements. Analyses for non-Washington street intersections were performed using Synchro 9.1. City Synchro files were updated to NEMA phasing to run *Highway Capacity Manual* 2010 analyses. The analysis was otherwise consistent with the 2040 Build Conditions analysis with the exception of signal timing resulting from the potential improvements. Synchro analysis reports are provided in **Appendix D**. The results of the 2040 Build Conditions with potential improvements level of service and delay analyses are shown graphically in **Figure 6-7** and further detailed in **Table 6-2.** Queuing analyses are shown in **Table 6-3**. The analysis results indicate negligible impacts to the non- N. Washington Street intersections as a result of the potential improvements. This is expected; the improvements that have been suggested are in response to level of service or queuing issues observed along N. Washington Street, E. or W. Abingdon Drive, Slaters Lane, or Bashford Lane. The N. Washington Street analysis results are captured in the VISSIM analysis section. As a result, the traffic operations at non-N. Washington Street intersections are consistent with the 2040 Build Conditions and representative of acceptable conditions in an urban street network.

Table 6-2: 2040 Build Conditions with Potential Improvements Peak Hour Level of Service and Delay (seconds/vehicle)

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
		AM	PM	AM	PM	AM	PM	AM	PM
11. First Street and N. Saint Asaph Street									
Eastbound *(First Street)*	T	-	-	-	-	-	-	-	-
	R	-	-	-	-	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
Westbound *(First Street)*	L	A (7.7)	A (8.4)	A (7.7)	A (8.4)	A (7.7)	A (8.4)	A (7.5)	A (8.1)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	A (0.8)	A (1.6)	A (0.8)	A (1.8)	A (0.9)	A (1.6)	A (0.9)	A (1.5)
Northbound *(N. Saint Asaph Street)*	LR	B (11.9)	B (12.7)	B (10.8)	B (12.9)	B (12.3)	B (13.4)	B (12.2)	B (12.0
	Overall	B (11.9)	B (12.7)	B (10.8)	B (12.9)	B (12.3)	B (13.4)	B (12.2)	B (12.0)
Overall Intersection		***A (4.2)***	***A (2.9)***	***A (4.3)***	***A (3)***	***A (5.2)***	***A (3.0)***	***A (5.8)***	***A (3.3)***
12. First Street and N. Pitt Street									
Eastbound (First Street)	LR	B (12.3)	B (11.3)	B (12.2)	B (11.5)	B (13.2)	B (14.8)	B (12.6)	B (13.3)
	Overall	B (12.3)	B (11.3)	B (12.2)	B (11.5)	B (13.2)	B (14.8)	B (12.6)	B (13.3)
Northbound *(N. Pitt Street)*	L	A (7.5)	A (7.6)	A (7.5)	A (7.6)	A (7.7)	A (8.2)	A (7.7)	A (8.2)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	A (1.6)	A (3.7)	A (1.4)	A (2.7)	A (1.2)	A (2.7)	A (1.2)	A (2.7)
Southbound *(N. Pitt Street)*	T	-	-	-	-	-	-	-	-
	R	-	-	-	-	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
Overall Intersection		***A (3.9)***	***A (7.2)***	***A (3.8)***	***A (6.2)***	***A (3.0)***	***A (5.6)***	***A (2.5)***	***A (4.3)***
13. N. Henry Street and Montgomery Street									
Westbound *(Montgomery Street)*	L	B (10.2)	C (25.5)	B (10.2)	C (26.2)	B (10.0)	C (25.2)	A (9.9)	C (25.2)
	Overall	B (10.2)	C (25.5)	B (10.2)	C (26.2)	B (10.0)	C (25.2)	A (9.9)	C (25.2)
Southbound *(N. Henry Street)*	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	B (15.2)	B (12.3)	B (15.4)	B (11.7)	B (15.0)	B (11.7)	B (15.0)	B (11.7)
	Overall	B (15.2)	B (12.3)	B (15.4)	B (11.7)	B (15.0)	B (11.7)	B (15.0)	B (11.7)
Overall Intersection		***B (14.7)***	***B (13.3)***	***B (14.8)***	***B (13.1)***	***B (14.4)***	***B (13.0)***	***B (14.4)***	***B (13.1)***
14. N. Patrick Street and Montgomery Street									
Eastbound (Montgomery Street)	TR	-	-	-	-	C (22.3)	B (18.4)	C (22.0)	B (17.8)
	Overall	-	-	-	-	C (22.3)	B (18.4)	C (22.0)	B (17.8)
Westbound (Montgomery Street)	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	C (21.6)	B (16.7)	C (21.4)	B (17.3)	A (0)	A (0)	A (0)	A (0)
	R	C (22.6)	B (18.1)	C (22.4)	B (18.9)	C (30.0)	C (22.4)	C (31.5)	C (23.4)
	Overall	C (22.1)	B (17.5)	C (21.9)	B (18.2)	C (30.0)	C (22.4)	C (31.5)	C (23.4)
Northbound (N. Patrick Street)	L	D (45.9)	C (29.2)	D (46.3)	C (29.6)	D (42.0)	C (29.3)	D (42.0)	C (29.3)
	T	D (47.4)	C (28.5)	D (47.9)	C (28.8)	D (37.3)	C (27.9)	D (37.3)	C (27.9)
	R	A (0)	A (0)	A (0)	A (0)	D (36.0)	C (27.7)	D (36.0)	C (27.7)
	Overall	D (46.8)	C (28.8)	D (47.2)	C (29.1)	D (38.6)	C (28.3)	D (38.6)	C (28.3)
Overall Intersection		***D (44.0)***	***C (27.1)***	***D (44.4)***	***C (27.2)***	***D (37.0)***	***C (26.5)***	***D (37.1)***	***C (26.6)***

Table 6-2: 2040 Build Conditions with Potential Improvements Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
		AM	PM	AM	PM	AM	PM	AM	PM
15. N. Columbus Street and Montgomery Street									
Eastbound (Montgomery Street)	LTR	-	-	-	-	A (9.8)	B (12)	A (9.3)	B (11.4)
	Overall	-	-	-	-	A (9.8)	B (12)	A (9.3)	B (11.4)
Westbound (Montgomery Street)	L	A (8.7)	B (11.1)	A (8.9)	B (11.7)	B (10)	B (16.4)	A (1.5)	C (20.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (8.6)	B (11.0)	A (8.9)	B (11.6)	A (0)	A (0)	A (0)	A (0)
	Overall	A (8.7)	B (11.1)	A (8.9)	B (11.6)	B (10)	B (16.4)	A (1.5)	C (20.4)
Northbound (N. Columbus Street)	L	A (5.2)	B (10.3)	A (5.1)	B (10.4)	A (5.5)	B (17.1)	A (5.4)	B (10.3)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	A (5.2)	B (10.3)	A (5.1)	B (10.4)	A (5.5)	B (17.1)	A (5.4)	B (10.3)
Southbound (N. Columbus Street)	L	*A (0)*	*A (0)*	A (0)	A (0)	B (12.4)	B (12.1)	B (12.4)	B (12.1)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (12.5)	B (12.5)	B (12.4)	B (12.3)	A (0)	A (0)	A (0)	A (0)
	Overall	B (12.5)	B (12.5)	B (12.4)	B (12.3)	B (12.4)	B (12.1)	B (12.4)	B (12.1)
Overall Intersection		***A (8.0)***	***B (11.6)***	***A (8.1)***	***B (11.8)***	***A (8.9)***	***B (14.7)***	***A (5.4)***	***B (16.3)***
16. N. Saint Asaph Street and Montgomery Street									
Eastbound (Montgomery Street)	LTR	-	-	-	-	C (20.7)	B (11.5)	C (21.5)	A (3.3)
	Overall	-	-	-	-	C (20.7)	B (11.5)	C (21.5)	A (3.3)
Westbound (Montgomery Street)	L	B (18.2)	B (10.6)	B (18.2)	B (10.8)	C (20.1)	B (13.4)	C (20.1)	B (13.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (18.1)	B (10.4)	B (18.2)	B (10.7)	A (0)	A (0)	A (0)	A (0)
	Overall	B (18.2)	B (10.5)	B (18.2)	B (10.7)	C (20.1)	B (13.4)	C (20.1)	B (13.4)
Northbound (N. Saint Asaph Street)	L	B (14.5)	C (20.6)	B (15.4)	C (24)	B (15.8)	B (19.2)	B (15.8)	B (19.2)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (14.5)	C (20.6)	B (15.4)	C (24)	B (15.8)	B (19.2)	B (15.8)	B (19.2)
Southbound *(N. Saint Asaph Street)*	L	A (0)	A (0)	A (0)	A (0)	B (18.5)	B (13.6)	B (18.5)	B (13.6)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (18.2)	B (12.6)	B (18.6)	B (13.2)	A (0)	A (0)	A (0)	A (0)
	Overall	B (18.2)	B (12.6)	B (18.6)	B (13.2)	B (18.5)	B (13.6)	B (18.5)	B (13.6)
Overall Intersection		***B (16.3)***	***B (13.8)***	***B (16.8)***	***B (15.2)***	***B (18.3)***	***B (14.3)***	***B (18.7)***	***B (12.0)***
17. N. Pitt Street and Montgomery Street									
Eastbound (Montgomery Street)	LTR	-	-	-	-	B (11.1)	B (12.8)	B (12.1)	C (16.2)
	Overall	-	-	-	-	B (11.1)	B (12.8)	B (12.1)	C (16.2)
Westbound (Montgomery Street)	TL	A (9.1)	B (10.4)	A (9.1)	B (10.6)	B (11.1)	C (17.3)	B (11.4)	C (19.9)
	TR	A (9.0)	A (10.0)	A (9.0)	B (10.2)	B (11.1)	C (17.3)	B (11.4)	C (19.9)
	Overall	A (9.0)	B (10.2)	A (9.0)	B (10.4)	B (11.1)	C (17.3)	B (11.4)	C (19.9)
Northbound (N. Pitt Street)	*LT*	B (11.7)	A (9.8)	B (11.5)	A (10)	C (19.3)	B (14.1)	C (20.7)	C (16.0)
	Overall	B (11.7)	A (9.8)	B (11.5)	A (10)	C (19.3)	B (14.1)	C (20.7)	C (16.0)
Southbound (N. Pitt Street)	*TR*	A (8.5)	B (11.1)	A (8.6)	B (11.6)	B (10.9)	E (35.4)	B (11.2)	E (48.6)
	Overall	A (8.5)	B (11.1)	A (8.6)	B (11.6)	B (10.9)	E (35.4)	B 11.2)	E (48.6)
Overall Intersection		***B (10.5)***	***B (10.5)***	***B (10.4)***	***B (10.8)***	***C (15.1)***	***C (24.4)***	***C (15.9)***	***D (30.8)***

Table 6-2: 2040 Build Conditions with Potential Improvements Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
		AM	PM	AM	PM	AM	PM	AM	PM
18. N. Fayette Street and Madison Street									
Eastbound (Madison Street)	TLR	B (10.4)	B (12.4)	B (10.2)	C (16.5)	B (10.2)	B (12.7)	B (10.2)	B (12.7)
	Overall	B (10.4)	B (12.4)	B (10.2)	C (16.5)	B (10.2)	B (12.7)	B (10.2)	B (12.7)
Westbound (Madison Street)	TLR	A (8.9)	B (12.5)	A (8.7)	B (13)	A (8.7)	B (12.0)	A (8.7)	B (12.0)
	Overall	A (8.9)	B (12.5)	A (8.7)	B (13)	A (8.7)	B (12.0)	A (8.7)	B (12.0)
Northbound (N. Fayette Street)	TLR	A (9.9)	B (12.0)	A (9.5)	B (12.7)	A (9.5)	B (11.4)	A (9.5)	B (11.4)
	Overall	A (9.9)	B (12.0)	A (9.5)	B (12.7)	A (9.5)	B (11.4)	A (9.5)	B (11.4)
Southbound (N. Fayette Street)	TLR	A (9.2)	C (21.0)	A (8.9)	D (25.5)	A (8.9)	C (20.6)	A (8.9)	C (20.6)
	Overall	A (9.2)	C (21.0)	A (8.9)	D (25.5)	A (8.9)	C (20.6)	A (8.9)	C (20.6)
Overall Intersection		***A (9.8)***	***C (16.1)***	***A (9.6)***	***C (19.1)***	***A (9.6)***	***C (15.9)***	***A (9.6)***	***C (15.9)***
19. N. Henry Street and Madison Street									
Eastbound (Madison Street)	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (14.4)	C (23.1)	B (14.5)	C (23.6)	B (14.5)	C (23.7)	B (14.5)	C (23.7)
	Overall	B (14.4)	C (23.1)	B (14.5)	C (23.6)	B (14.5)	C (23.7)	B (14.5)	C (23.7)
Southbound (N. Henry Street)	L	B (17.7)	C (29.7)	B (17.6)	C (28.9)	B (16.2)	C (27.2)	B (16.3)	C (27.3)
	T	C (20.2)	C (31.0)	B (19.7)	C (30.1)	B (18.1)	C (28.6)	B (18.3)	C (28.8)
	R	B (19.9)	C (30.4)	B (19.5)	C (29.5)	B (18.0)	C (28.1)	B (18.1)	C (28.3)
	Overall	B (19.2)	C (30.3)	B (18.9)	C (29.5)	B (17.4)	C (27.9)	B (17.5)	C (28.1)
Overall Intersection		***B (18.6)***	***C (29.7)***	***B (18.3)***	***C (28.9)***	***B (17.0)***	***C (27.5)***	***B (17.1)***	***C (27.6)***
20. N. Patrick Street and Madison Street									
Eastbound *(Madison Street)*	L	C (20.7)	C (26.4)	C (21.6)	C (26.5)	B (19.9)	C (24.2)	B (19.9)	C (24.2)
	T	C (20.9)	C (26.8)	C (21.9)	C (27)	C (20.0)	C (24.4)	C (20.0)	C (24.4)
	R*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	C (20.8)	C (26.6)	C (21.8)	C (26.7)	B (20.0)	C (24.3)	C (20.0)	C (24.3)
Northbound *(N. Columbus Street)*	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	C (20.6)	B (16.6)	C (21.9)	B (16.6)	C (22.3)	B (16.4)	C (22.3)	B (16.4)
	R	C (23.9)	B (18.3)	C (26.1)	B (18.2)	C (26.3)	B (18.0)	C (26.3)	B (18.0)
	Overall	C (21.9)	B (17.2)	C (23.5)	B (17.1)	C (23.9)	B (17.0)	C (23.9)	B (17.0)
Overall Intersection		***C (21.8)***	***B (19.3)***	***C (23.3)***	***B (19.3)***	***C (23.6)***	***B (18.1)***	***C (23.6)***	***B (18.1)***
21. N. Columbus Street and Madison Street									
Eastbound *(Madison Street)*	L	B (20.0)	B (11.7)	C (21.1)	B (11.9)	B (19.1)	B (10.9)	B (19.1)	B (10.9)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (19.8)	B (11.6)	C (20.7)	B (11.8)	B (18.9)	B (10.9)	B (18.9)	B (10.9)
	Overall	B (19.9)	B (11.7)	C (20.9)	B (11.9)	B (19.0)	B (10.9)	B (19.0)	B (10.9)
Northbound *(N. Columbus Street)*	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	C (20.4)	B (10.3)	C (20.6)	B (10.3)	C (20.5)	B (10.9)	C (20.0)	B (10.2)
	Overall	C (20.4)	B (10.3)	C (20.6)	B (10.3)	C (20.5)	B (10.9)	C (20.0)	B (10.2)
Southbound *(N. Columbus Street)*	L	B (17.9)	B (16.1)	B (18)	B (12.9)	B (17.8)	B (12.7)	B (17.7)	B (12.7)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (17.9)	B (16.1)	B (18)	B (12.9)	B (17.8)	B (12.7)	B (17.7)	B (12.7)
Overall Intersection		***B (19.9)***	***B (13.4)***	***C (20.6)***	***B (12.2)***	***B (19.5)***	***B (11.7)***	***B (19.3)***	***B (11.7)***

*Illegal movement onto one-way street

Table 6-2: 2040 Build Conditions with Potential Improvements Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
		AM	PM	AM	PM	AM	PM	AM	PM
22. N. Saint Asaph Street and Madison Street									
Eastbound *(Madison Street)*	L	B (18.6)	B (17.8)	C (20.2)	B (18.2)	B (17.8)	B (16.4)	B (17.7)	B (16.3)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	B (18.4)	B (17.7)	B (19.7)	B (18.1)	B (17.6)	B (16.4)	B (17.5)	B (16.3)
	Overall	B (18.5)	B (17.8)	B (20)	B (18.1)	B (17.7)	B (16.4)	B (17.6)	B (16.3)
Northbound *(N. Saint Asaph Street)*	L*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (5.1)	B (11.6)	C (23)	A (3.6)	C (22.7)	A (3.5)	C (22.7)	A (3.5)
	Overall	A (5.1)	B (11.6)	C (23)	A (3.6)	C (22.7)	A (3.5)	C (22.7)	A (3.5)
Southbound *(N. Saint Asaph Street)*	L	B (19.3)	B (18.7)	A (4.1)	B (19.8)	A (4.1)	B (13.3)	A (4.1)	B (13.3)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R*	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (19.3)	B (18.7)	A (4.1)	B (19.8)	A (4.1)	B (13.3)	A (4.1)	B (13.3)
Overall Intersection		***B (14.1)***	***B (17.0)***	***B (19.8)***	***B (16.4)***	***B (18.2)***	***B (12.7)***	***B (18.2)***	***B (12.6)***
23. N. Pitt Street and Madison Street									
Eastbound (Madison Street)	TL	B (11.3)	B (10.9)	B (12.2)	B (11.0)	B (11.1)	B (10.8)	B (11.0)	B (10.7)
	TR	B (10.5)	B (10.8)	B (11.0)	B (10.6)	A (9.9)	B (10.4)	A (9.9)	B (10.3)
	Overall	B (10.9)	B (10.8)	B (11.6)	B (10.8)	B (10.6)	B (10.6)	B (10.5)	B (10.5)
Northbound (N. Pitt Street)	TR	B (12.9)	A (9.9)	B (13.2)	A (9.9)	B (14.2)	B (10.3)	B (14.0)	B (10.3)
	Overall	B (12.9)	A (9.9)	B (13.2)	A (9.9)	B (14.2)	B (10.3)	B (14.0)	B (10.3)
Southbound (N. Pitt Street)	TL	A (9.7)	B (13.7)	A (10.0)	B (13.0)	A (10.0)	C (19.5)	A (9.9)	C (19.3)
	Overall	A (9.7)	B (13.7)	A (10.0)	B (13.0)	A (10.0)	C (19.5)	A (9.9)	C (19.3)
Overall Intersection		***B (11.6)***	***B (11.9)***	***B (12.0)***	***B (11.6)***	***B (12.4)***	***C (15.7)***	***B (12.2)***	***C (15.6)***
24. N. Saint Asaph Street and Wythe Street									
Eastbound *(Wythe Street)*	L	B (10.9)	A (3.2)	B (11.6)	A (6.1)	B (11.5)	A (3.6)	B (11.5)	A (3.6)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (10.9)	A (3.2)	B (11.6)	A (6.1)	B (11.5)	A (3.6)	B (11.5)	A (3.6)
Westbound *(Wythe Street)*	L	B (10.2)	B (11.0)	B (10.3)	B (11.4)	B (10.5)	B (11.4)	B (10.5)	B (11.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (10.2)	B (11.0)	B (10.3)	B (11.4)	B (10.5)	B (11.4)	B (10.5)	B (11.4)
Northbound *(N. Saint Asaph Street)*	L	B (13.3)	B (12.1)	B (14.0)	B (12.0)	B (14.0)	B (11.9)	B (14.0)	B (11.9)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (13.3)	B (12.1)	B (14.0)	B (12.0)	B (14.0)	B (11.9)	B (14.0)	B (11.9)
Southbound (N. Saint Asaph Street)	L	B (11.1)	A (4.8)	B (11.3)	A (8.0)	B (11.2)	A (6.4)	B (11.2)	A (6.4)
	T	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	R	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)	A (0)
	Overall	B (11.1)	A (4.8)	B (11.3)	A (8.0)	B (11.2)	A (6.4)	B (11.2)	A (6.4)
Overall Intersection		***B (11.8)***	***A (6.9)***	***B (12.3)***	***A (8.8)***	***B (12.2)***	***A (7.4)***	***B (12.2)***	***A (7.4)***

*Illegal movement onto one-way street

Table 6-2: 2040 Build Conditions with Potential Improvements Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
		AM	PM	AM	PM	AM	PM	AM	PM
25. N. Pitt Street and Bashford Lane									
Eastbound (Bashford Lane)	TLR	-	-	-	-	A (8.0)	A (8.0)	A (7.9)	A (8.0)
	T	-	-	-	-	-	-	-	-
	R	-	-	-	-	-	-	-	-
	Overall	A (0)	A (0)	A (0)	A (0)	A (2.6)	A (1.3)	A (1.5)	A (007)
Westbound *(Bashford Lane)*	TLR	-	-	-	-	A (7.9)	A (7.6)	A (7.9)	A (7.6)
	L	A (7.9)	A (7.6)	A (7.9)	A (7.7)	-	-	-	-
	T	A (0)	A (0)	A (0)	A (0)	-	-	-	-
	Overall	A (0.3)	A (0.2)	A (0.3)	A (0.5)	A (0.2)	A (0.1)	A (0.2)	A (0.1)
Northbound *(N. Pitt Street)*	LR / TLR	B (12.4)	B (12.1)	B (12.5)	B (13.4)	E (36.0)	D (31.2)	C (22.2)	C (18.8)
	Overall	B (12.4)	B (12.1)	B (12.5)	B (13.4)	E (36.0)	D (31.2)	C (22.2)	C (18.8)
Southbound *(N. Pitt Street)*	*TLR*	-	-	-	-	C (16.1)	D (32.1)	B (14.4)	D (27.3)
	Overall	-	-	-	-	C (16.1)	D (32.1)	B (14.4)	D (27.3)
Overall Intersection		***A (2.5)***	***A (1.3)***	***A (2.7)***	***A (2.2)***	***B (12.5)***	***B (14.2)***	***A (7.9)***	***B (11.2)***
26. Power Plant Site Access and Slaters Lane									
Eastbound (Slaters Lane)	**TL**	-	-	-	-	B (10.5)	A (7.6)	B (10.1)	A (7.5)
	TR	-	-	-	-	A (8.1)	A (0)	A (7.4)	A (0)
	Overall	-	-	-	-	A (8.2)	A (2.8)	A (9.4)	A (4.0)
Westbound (Slaters Lane)	**LTR**	-	-	-	-	A (8.2)	A (7.4)	A (7.8)	A (7.3)
	Overall	-	-	-	-	A (8.2)	A (0.2)	A (7.8)	A (0.5)
Northbound (N. Pitt Street)	**LTR**	-	-	-	-	A (8.7)	B (14.2)	A (8.1)	B (11.3)
	Overall	-	-	-	-	A (8.7)	B (14.2)	A (8.1)	B (11.3)
Southbound (Residential Development)	**LTR**	-	-	-	-	A (7.9)	A (9.8)	A (7.6)	A (9.2)
	Overall	-	-	-	-	A (7.9)	A (9.8)	A (7.6)	A (9.2)
Overall Intersection		**-**	**-**	**-**	**-**	***A (9.1)***	***A (5.7)***	***A (8.9)***	***A (5.9)***
27. N. Pitt Street and Slaters Lane									
Eastbound (Slaters Lane)	**LTR**	-	-	-	-	A (7.5)	A (0)	A (7.4)	A (0)
	Overall	-	-	-	-	A (7.1)	A (0)	A (7.0)	A (0)
Westbound	**LTR**	-	-	-	-	A (7.4)	A (7.2)	A (7.3)	A (7.2)
	Overall	-	-	-	-	A (7.4)	A (1.3)	A (7.3)	A (1.3)
Northbound (power plant site Access)	**LTR**	-	-	-	-	A (7.6)	A (9.4)	A (7.4)	A (9.0)
	Overall	-	-	-	-	A (7.6)	A (9.4)	A (7.4)	A (9.0)
Overall Intersection		**-**	**-**	**-**	**-**	***A (7.3)***	***A (6.3)***	***A (7.2)***	***A (4.8)***
28. N Royal Street and Bashford Lane									
Eastbound (Bashford Lane)	**LTR**	-	-	-	-	A (9.6)	B (11.1)	A (9.6)	B (11.1)
	Overall	-	-	-	-	A (9.6)	B (11.1)	A (9.6)	B (11.1)
Northbound (N. Royal Street)	**LTR**	-	-	-	-	A (7.7)	A (7.8)	A (7.7)	A (7.8)
	Overall	-	-	-	-	A (6.5)	A (6.9)	A (6.5)	A (6.9)
Southbound (N. Royal Street)	**LTR**	-	-	-	-	A (0)	A (0)	A (0)	A (0)
	Overall	-	-	-	-	A (0)	A (0)	A (0)	A (0)
Overall Intersection		**-**	**-**	**-**	**-**	***A (7.0)***	***A (7.9)***	***A (7)***	***A (7.9)***

Table 6-2: 2040 Build Conditions with Potential Improvements Peak Hour Level of Service and Delay (seconds/vehicle) Continued

Intersection	Movement/ Lane*	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
		AM	PM	AM	PM	AM	PM	AM	PM
29. N. Royal Street and Montgomery Street									
Eastbound (Montgomery Street)	LTR	-	-	-	-	A (9.3)	A (9.6)	A (9.7)	B (10.7)
	Overall	-	-	-	-	A (9.3)	A (9.6)	A (9.7)	B (10.7)
Westbound (Montgomery Street)	LTR	-	-	-	-	A (9.0)	B (10.8)	A (9.1)	B (11.3)
	TL	A (8.8)	A (9.8)	A (8.9)	A (10.0)	-	-	-	-
	TR	A (8.5)	A (9.4)	A (8.6)	A (9.5)	-	-	-	-
	Overall	A (8.7)	A (9.6)	A (8.8)	A (9.8)	A (9.0)	B (10.8)	A (9.1)	B (11.3)
Northbound (N. Royal Street)	*TL / LTR*	B (10.4)	A (9.5)	B (10.7)	A (10.0)	B (12.5)	A (9.9)	B (12.8)	B (10.4)
	Overall	B (10.4)	A (9.5)	B (10.7)	A (10.0)	B (12.5)	A (9.9)	B (12.8)	B (10.4)
Southbound (N. Royal Street)	*TR / LTR*	A (7.5)	A (9.1)	A (7.7)	A (9.4)	A (8.1)	A (9.5)	A (8.2)	A (10.0)
	Overall	A (7.5)	A (9.1)	A (7.7)	A (9.4)	A (8.1)	A (9.5)	A (8.2)	A (10.0)
Overall Intersection		***A (9.7)***	***A (9.4)***	***A (10.0)***	***A (9.7)***	***B (11.1)***	***B (10.1)***	***B (11.3)***	***B (10.7)***
30. N. Fairfax Street and Montgomery Street									
Eastbound (Montgomery Street)	LTR	-	-	-	-	A (8.9)	A (9.5)	A (9.1)	A (9.9)
	Overall	-	-	-	-	A (8.9)	A (9.5)	A (9.1)	A (9.9)
Westbound (Montgomery Street)	LTR	-	-	-	-	A (8.4)	A (9.4)	A (8.4)	A (9.5)
	TL	A (8.8)	A (9.7)	A (8.6)	A (9.5)	-	-	-	-
	TR	A (8.4)	A (9.1)	A (8.2)	A (9.0)	-	-	-	-
	Overall	A (8.6)	A (9.4)	A (8.4)	A (9.3)	A (8.4)	A (9.4)	A (8.4)	A (9.5)
Northbound (N. Fairfax Street)	*TL*	B (11.7)	A (9.8)	B (10.4)	A (9.8)	B (11.9)	B (10.6)	B (12.1)	B (10.8)
	Overall	B (11.7)	A (9.8)	B (10.4)	A (9.8)	B (11.9)	B (10.6)	B (12.1)	B (10.8)
Southbound (N. Fairfax Street)	*TR*	A (7.9)	B (12.7)	A (7.6)	B (11.7)	A (8.0)	B (12.2)	A (8.0)	B (12.5)
	Overall	A (7.9)	B (12.7)	A (7.6)	B (11.7)	A (8.0)	B (12.2)	A (8.0)	B (12.5)
Overall Intersection		***B (10.8)***	***B (11.4)***	***A (9.8)***	***B (10.8)***	***B (10.8)***	***B (11.1)***	***B (10.9)***	***B (11.4)***

Table 6-3: 2040 Build Conditions with Potential Improvements Peak Hour Vehicle Queuing

Intersection	Lane Group	Block Length	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
			AM	PM	AM	PM	AM	PM	AM	PM
11. First Street and N. Saint Asaph Street										
Westbound (First Street)	TL	240	0	0	0	0	0	0	0	0
Northbound (N. Saint Asaph Street)	LR	345	23	18	25	20	33	20	30	18
12. First Street and N. Pitt Street										
Eastbound (First Street)	LR	240	20	38	20	35	20	53	15	33
Northbound (N. Pitt Street)	TL	345	5	3	3	3	5	5	5	5
13. N. Henry Street and Montgomery Street										
Westbound (Montgomery Street)	L	240	m55	m51	m57	m69	m79	m148	m78	m159
Southbound (N. Henry Street)	T	345	221	284	227	267	215	268	215	268
14. N. Patrick Street and Montgomery Street										
Eastbound (Montgomery Street)	TR	240	-	-	-	-	m63	m39	m63	m35
Westbound (Montgomery Street)	TL	240	85	66	95	93	#286	205	#309	226
Northbound (N. Patrick Street)	TR	345	m#597	12	m#575	15	m#573	8	m#573	8
15. N. Columbus Street and Montgomery Street										
Eastbound (Montgomery Street)	TLR	240	-	-	-	-	66	76	64	73
Westbound (Montgomery Street)	TL/TR	240	4	m48	2	m74	112	m455	78	m392
Northbound (N. Columbus Street)	TL	345	53	19	49	24	74	72	60	22
Southbound (N. Columbus Street)	TR	340	27	110	30	109	29	104	29	104
16. N. Saint Asaph Street and Montgomery Street										
Eastbound (Montgomery Street)	TLR	235	-	-	-	-	m40	72	m89	m91
Westbound (Montgomery Street)	TL/TR	235	51	60	58	68	147	181	148	181
Northbound (N. Saint Asaph Street)	TL	*345*	101	89	289	117	318	110	306	109
Southbound (N. Saint Asaph Street)	TR	345	m67	109	m109	148	m90	159	m81	124
17. N. Pitt Street and Montgomery Street										
Eastbound (Montgomery Street)	TLR	245	-	-	-	-	25	28	35	55
Westbound (Montgomery Street)	TLR	245	8	25	8	28	28	80	28	90
	TR	245	13	23	13	25	-	-	-	-
Northbound (N. Pitt Street)	TL	*345*	68	23	63	25	135	48	142	55
Southbound (N. Pitt Street)	TR	*345*	13	48	15	53	30	230	33	278
18. N. Fayette Street and Madison Street										
Eastbound (Madison Street)	LTR	555	35	35	38	78	38	40	38	40
Westbound (Madison Street)	LTR	245	13	35	13	33	13	30	13	30
Northbound (N. Fayette Street)	LTR	345	30	40	25	38	25	33	25	33
Southbound (N. Fayette Street)	LTR	365	15	143	13	165	13	140	13	140
19. N. Henry Street and Madison Street										
Eastbound (Madison Street)	TR	245	101	123	116	136	116	139	116	139
Southbound (N. Henry Street)	TR/TL	355	215	0	213	26	200	83	201	87
20. N. Patrick Street and Madison Street										
Eastbound (Madison Street)	TL	235	75	m131	100	m137	54	m93	54	m92
Northbound (N. Patrick Street)	TR	345	#675	282	#700	281	#708	279	#708	279
21. N. Columbus Street and Madison Street										
Eastbound (Madison Street)	TL/TR	240	102	71	158	78	88	48	88	48
Northbound (N. Columbus Street)	TR	345	125	19	152	24	165	54	142	23
Southbound (N. Columbus Street)	TL	345	34	63	40	109	35	m50	38	m48

m- volume for 95th percentile queue is metered by upstream signal
#- 95th percentile volume exceeds capacity; queue may theoretically be longer. Queue shown is maximum after two cycles.

Table 6-3: 2040 Build Conditions with Potential Improvements Peak Hour Vehicle Queuing (feet) Continued

Intersection	Movement/ Lane	Existing Storage/ Block Length	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
			AM	PM	AM	PM	AM	PM	AM	PM
22. N. Saint Asaph Street and Madison Street										
Eastbound (Madison Street)	TL/TR	235	m28	25	m43	28	m14	20	m12	20
Northbound (N. Saint Asaph Street)	TR	350	191	36	215	40	212	43	207	43
Southbound (N. Saint Asaph Street)	TL	340	24	123	29	172	46	163	50	150
23. N. Pitt Street and Madison Street										
Eastbound (Madison Street)	TL	230	28	28	38	28	23	18	20	18
	TR	230	28	30	33	28	15	18	15	15
Northbound (N. Pitt Street)	TR	345	70	20	68	20	90	28	88	28
Southbound (N. Pitt Street)	TL	345	15	75	15	68	23	150	23	148
24. N. Saint Asaph Street and Wythe Street										
Eastbound (Wythe Street)	LTR	235	m61	78	m69	m80	m53	m82	m82	m85
Westbound (Wythe Street)	LTR	240	57	90	60	106	69	106	69	106
Northbound (N. Saint Asaph Street)	LTR	345	128	63	152	74	151	68	151	68
Southbound (N. Saint Asaph Street)	LTR	345	2	83	12	256	40	83	46	83
25. N. Pitt Street and Bashford Lane										
Westbound (Bashford Lane)	TL	535	0	0	0	0	0	0	0	0
Northbound (N. Pitt Street)	LR	665	15	8	0	3	115	53	68	25
Eastbound (Bashford Lane)	LR	540	0	0	18	15	5	3	3	0
Southbound (N. Pitt Street)	TLR	-	-	-	-	-	20	130	18	113
26. Power Plant Site Access and Slaters Lane										
Eastbound (Slaters Lane)	TL	-	-	-	-	-	18	3	30	3
	TR	-	-	-	-	-	35	0	8	0
Westbound (Slaters Lane)	TLR	-	-	-	-	-	8	0	5	0
Northbound (N. Pitt Street)	LR	-	-	-	-	-	8	23	5	10
Southbound (N. Pitt Street)	TLR	-	-	-	-	-	5	8	5	8
27. N. Pitt Street & Slaters Lane										
Eastbound (Slaters Lane)	TL	-	-	-	-	-	0	0	0	0
	LR	-	-	-	-	-	8	0	5	0
Westbound (Slaters Lane)	LR	-	-	-	-	-	3	0	3	0
Northbound (N. Pitt Street)	TLR	-	-	-	-	-	5	15	3	5
28. N. Pitt Street & Bashford Lane										
Eastbound (Bashford Lane)	TL	-	-	-	-	-	13	18	13	18
Northbound (N. Pitt Street)	LR	-	-	-	-	-	15	18	15	18

m- volume for 95th percentile queue is metered by upstream signal
#- 95th percentile volume exceeds capacity; queue may theoretically be longer. Queue shown is maximum after two cycles

Table 6-3: 2040 Build Conditions with Potential Improvements Peak Hour Vehicle Queuing (feet) Continued

Intersection	Movement/ Lane	Existing Storage/ Block Length	Existing		2040 Baseline		2040 Build		2040 w/ Improvement	
			AM	PM	AM	PM	AM	PM	AM	PM
29. N. Royal Street and Montgomery Street										
Eastbound (Montgomery Street)	LTR	-	-	-	-	-	18	23	20	38
Westbound *(Montgomery Street)*	L / LTR	230	8	23	8	20	13	40	13	45
	T	230	8	18	8	18	-	-	-	-
Northbound *(N. Royal Street)*	T	345	50	23	58	30	75	23	78	23
Southbound *(N. Royal Street)*	T	345	5	23	5	25	5	20	5	23
30. N. Fairfax Street and Montgomery Street										
Eastbound (Montgomery Street)	LTR	-	-	-	-	-	13	13	15	18
Westbound *(Montgomery Street)*	L / LTR	240	3	8	3	8	3	10	3	10
	T	240	3	8	3	5	-	-	-	-
Northbound *(N. Fairfax Street)*	T	345	78	33	58	33	65	33	75	40
Southbound *(N. Fairfax Street)*	T	345	10	88	8	73	8	68	8	75

6.4. VISSIM Analysis

The 2040 Build Conditions with potential improvements along N. Washington Street were evaluated using the VISSIM models developed for 2040 Build Conditions analysis. The vehicular street network was updated from 2040 Build Conditions analyses to include the improvements:

- Northbound and southbound left-turn movements at the intersection of N. Washington and Montgomery Street
- New east-west connection between W. Abingdon Drive and the redeveloped power plant site
- Lane configuration restriping along Bashford Lane
- Lane configuration restriping along southbound W. Abingdon Drive
- Lane configuration restriping along northbound E. Abingdon Drive

The vehicular demand was updated to reflect reassignment of traffic associated with the improvements. Traffic signal timing adjustments were made to reallocate green time to better serve east-west movements while maintaining north-south progression along N. Washington Street. Delay, level of service, queue length, and travel time were used as a basis to evaluate the improvements against previous analysis scenarios. VISSIM analysis results can be found in **Table 6-4** to **Table 6-9.** VISSIM vehicle throughput results are included in **Appendix F.** Overall intersection level of service is shown graphically in **Figure 6-7**.

The VISSIM analysis results demonstrate the improvements can be implemented in manner that will reduces overall intersection vehicle delays at many study area intersections. In many instances, these delay savings result in conditions that are as good or better than the baseline future results and, in some instances, better than the existing conditions results.

It is noted that there are still individual movements or approaches with large delay or queuing results. As traffic volumes grow and as drivers become familiar with traffic patterns, it is reasonable to expect that traffic will redistribute among available routes. This will have the effect of balancing out the delays and queues experienced at adjacent intersections. The following is a summary of key operational findings from the analysis.

6.4.1. AM Traffic Operations

Under 2040 Build Conditions with potential improvements, the intersection of N. Washington Street and Montgomery Street operates with delays and level of service similar to or better than 2040 Baseline Conditions. The protected southbound left turn operates with a delay of 55.2 seconds per vehicle (level of service E) and the permissive northbound left turn operates with minimal delay (level of service B). Eastbound and westbound approaches operate at level of service D, which is similar to the one-way westbound operations in 2040 Baseline Conditions.

The proposed new east-west connection to the power plant site operates at level of service C (21.1 seconds per vehicle), consistent with Slaters Lane and Bashford Lane results. The new connection reduces delays at the N. Washington Street and Abingdon Drive intersections with Slaters Lane and Bashford Lane, particularly eastbound, westbound, and southbound left-turn movements from W. Abingdon Drive. It is likely that as people become more familiar with the network and available capacity, demand would further disburse between the three east-west connections to the power plant site to balance out delays.

The combination of the new east-west connection, lane configuration restriping along Bashford Lane and W. Abingdon Drive, and signal timing adjustments result in reduced delays and queuing at the Slaters Lane and Bashford Lane intersections. Overall delays at Slaters Lane are 31.0 seconds per vehicle (level of service C), and better than existing and 2040 Baseline Conditions. Delays on southbound W. Abingdon Drive decrease by approximately three minutes from 2040 Build Conditions to a level of service D, and the queue is contained well within storage. Eastbound and westbound approaches operate at level of service E compared to level of service D in 2040 Baseline Conditions. Westbound delays may be further mitigated by signal timing adjustments to allow vehicles to fully clear the intersection in one cycle.

Overall delays at Bashford Lane are 39.0 seconds per vehicle (level of service D), an improvement of approximately 20.7 and 21.6 seconds per vehicle when compared to existing and 2040 Baseline Conditions. Much of the reductions in delay are a result of signal timing adjustments at neighboring intersections to improve the northbound progression along N. Washington Street. This reduces northbound queues and allows eastbound and westbound vehicles to freely turn onto N. Washington Street. Delays and queues on southbound W. Abingdon Drive improve from 2040 Build Conditions, yet this approach remains at level of service F. The delays for southbound left turns from W. Abingdon Drive would likely further decrease as drivers use the available capacity of the new east-west connection.

Under 2040 Build Conditions with potential improvements, the potential improvements also result in benefits to the overall corridor of N. Washington Street. Nearly all northbound through demand is served during the AM peak hour. Northbound N. Washington Street travel time from Queen Street to Slaters Lane reduces to 8.3 minutes, or slightly less than existing conditions. A marginal decrease in southbound N. Washington Street travel time to 3.0 minutes also is expected.

6.4.2. PM Traffic Operations

Under 2040 Build Conditions with potential improvements, the intersection of N. Washington Street and Montgomery Street operates with delays and level of service similar to 2040 Baseline Conditions. The protected northbound left turn operates with a delay of 62.6 seconds per vehicle (level of service E) and the permissive southbound left turn operates with a delay of 37.4 seconds per vehicle (level of service D). Eastbound and westbound approaches operate at level of service D, which is better than 2040 Baseline Conditions and similar to existing conditions. The allowable northbound left-turn movement reduces delays along N. Washington Street compared to 2040 Build Conditions because the northbound left turn at Wythe Street is no longer over capacity.

The proposed new east-west connection to the power plant site operates at level of service B (11.1 seconds per vehicle). The new connection reduces delays into and out of the power plant site from Slaters Lane and Bashford Lane compared to 2040 Build Conditions. As stated in the AM traffic operations summary, it is likely that demand would further distribute between the three east-west connections to the power plant site to balance out delays.

Altogether the potential improvements result in overall delays of approximately 32.1 seconds per vehicle (level of service C) at Slaters Lane, or the same as 2040 Baseline Conditions. Queues on southbound W. Abingdon Drive are reduced from the previous analyzed scenario. Maximum queue lengths just reach N. Washington Street, but do not spill back into the intersection. Eastbound and westbound delays reduce from 2040 Build Conditions but remain at level of service D and F, respectively. Westbound delays may be further mitigated by signal timing adjustments to allow vehicles to fully clear the intersection in one cycle and redistribution of demand to the new east-west connection. This also would provide benefits to the northbound left-turn movement from E. Abingdon Drive that remains at level of service F.

Overall delays at Bashford Lane are 20.0 seconds per vehicle (level of service C), which is nearly the same as 2040 Baseline Conditions (17.7 seconds per vehicle). Southbound W. Abingdon Drive delays reduce by approximately 90.7 seconds per vehicle from 2040 Build Conditions to 36.3 seconds per vehicle (level of service D). This is slightly greater than 2040 Baseline Conditions and can be further mitigated by redistribution of demand to the new east-west connection. Eastbound and westbound approaches operate with delays similar to existing and 2040 Baseline Conditions.

Under 2040 Build Conditions with potential improvements, the average travel time for the southbound peak direction of N. Washington Street from Slaters Lane to Princess Street is 5.7 minutes, and the average travel time for northbound N. Washington Street from Queen Street to Slaters Lane is 4.7 minutes. Southbound N. Washington Street travel time increases by approximately 45 seconds from 2040 Baseline Conditions due to greater southbound demand. Northbound N. Washington Street travel time is approximately the same as 2040 Baseline Conditions and is reduced from 2040 Build Conditions with alleviated congestion that was previously caused by northbound left turns at Wythe Street.

6.4.3. Supplemental Analysis for E. Abingdon Drive Improvement

A supplemental analysis was prepared to document the benefits of the E. Abingdon Drive service road improvement separately from all other improvements. The supplemental analysis considers the same volumes as the 2040 Build with Improvement Conditions, extrapolated further north to the merge/intersection of E. Abingdon Drive and the George Washington Memorial Parkway, which is just outside the study area. The supplemental analysis considers the queuing and level of service at this intersection as well as impacts to intersection along Slaters Lane, which is the next adjacent street that is within the study area.

The supplemental analysis compares the result of 2040 Build Conditions with improvements conditions with and without the E. Abingdon Drive improvement. The supplemental analysis is shown in **Table 6-10**. The results indicate that the E. Abingdon Drive restriping will significantly improve vehicle operations during the AM peak hour.

North of the study area, at the E. Abingdon Drive ramp to the George Washington Memorial Parkway, the northbound E. Abingdon Drive approach will experience a delay reduction of 25.1 seconds, improving from level of service E to D. Average and maximum queuing will be significantly reduced along the northbound E. Abingdon Drive approach, by approximately 1,950 and 2,325 feet respectively. The addition of a second lane along E. Abingdon Drive will have negligible impacts to the northbound George Washington Memorial Parkway approach at the intersection/merge.

Within the study area and during the AM peak hour, the E. Abingdon Drive improvements will have positive impacts on Slaters Lane operation. The northbound E. Abingdon Drive approach at Slaters Lane will experience a significant delay reduction of 114.8 seconds, improving from level of service F to B and average and maximum vehicle queuing will be reduced by approximately 255 and 276 feet, respectively. Overall vehicle delays at the N. Washington Street and Slaters Lane intersection will decrease by 17.8 seconds, improving the intersection level of service from D to C. The addition of a second lane along E. Abingdon Drive will have negligible impacts to the northbound N. Washington Street at Slaters Lane. Vehicle delays and queuing slightly increase based on model results.

During the PM peak hour, The E. Abingdon Drive improvement modifies the E. Abingdon Drive approach operation from yield control to signalized. This results in additional northbound E. Abingdon Drive delays at the George Washington Memorial Parkway. Delays increase by 13.6 seconds, changing level of service from C to D. It is noted that level of service D is still considered acceptable operation. All other impacts resulting from the improvement are negligible during the PM peak hour. Vehicle queuing is slightly reduced along E. Abingdon Drive and along the George Washington Memorial Parkway while overall intersection level of service remains consistent and for the study area intersections.

Table 6-4: 2040 Build Conditions with Potential Improvements AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build		2040 Build with Improvements	
1. N. Washington Street and Slaters Lane	NB N. Washington St	TH	35.5 (D)	35.5 (D)	35.5 (D)	35.5 (D)	36.4 (D)	36.4 (D)	25.7 (C)	25.7 (C)
	NB E. Abingdon Dr	LT	*157.4 (F)*	*131.1 (F)*	*189.1 (F)*	*132.3 (F)*	*184.4 (F)*	*137 (F)*	53.1 (D)	11.1 (B)
		TH	*139.9 (F)*		*146.2 (F)*		*150 (F)*		11.5 (B)	
		RT	*87.7 (F)*		*87.4 (F)*		*92.2 (F)*		8.5 (A)	
	SB N. Washington St	TH	17.3 (B)	17.3 (B)	17.2 (B)	17.2 (B)	21 (C)	21 (C)	16.3 (B)	16.3 (B)
	SB W. Abingdon Dr	LT	77.3 (E)	20.5 (C)	77.9 (E)	23.8 (C)	*568.7 (F)*	*220.8 (F)*	*161 (F)*	42.9 (D)
		TH	16.8 (B)		17.8 (B)		*152.3 (F)*		54 (D)	
		RT	17.8 (B)		18.4 (B)		*152.6 (F)*		17.6 (B)	
	EB	LT	42.2 (D)	42.2 (D)	43.1 (D)	43.6 (D)	*147.6 (F)*	*152.8 (F)*	67.3 (E)	69.1 (E)
		TH	46.1 (D)		54.6 (D)		*181.8 (F)*		*87.3 (F)*	
		RT	40.4 (D)		41 (D)		*157.3 (F)*		66.3 (E)	
	WB	LT	57.8 (E)	45 (D)	54.2 (D)	46.2 (D)	75.3 (E)	57.9 (E)	*116.9 (F)*	63.7 (E)
		TH	51.1 (D)		58 (E)		55.7 (E)		*82.5 (F)*	
		RT	42.8 (D)		37.8 (D)		41.9 (D)		26 (C)	
	Intersection		50.2 (D)		50.5 (D)		*87.8 (F)*		31 (C)	
2. N. Washington Street and Bashford Lane	NB N. Washington St	TH	56.1 (E)	56.1 (E)	56.1 (E)	56.1 (E)	60 (E)	60 (E)	50.5 (D)	50.5 (D)
	NB E. Abingdon Dr	LT	*179.3 (F)*	36.8 (D)	*163.8 (F)*	36.8 (D)	*187.4 (F)*	40.2 (D)	54.4 (D)	16.9 (B)
		TH	30.6 (C)		31.6 (C)		34.2 (C)		15.4 (B)	
		RT	25.3 (C)		18.6 (B)		0 (A)		0 (A)	
	SB N. Washington St	TH	14.1 (B)	14.1 (B)	14.7 (B)	14.7 (B)	16.2 (B)	16.2 (B)	0.6 (A)	0.6 (A)
	SB W. Abingdon Dr	LT	*138.4 (F)*	*89.7 (F)*	*165.5 (F)*	*93.4 (F)*	*532.5 (F)*	*325 (F)*	*199.7 (F)*	*113.7 (F)*
		TH	13.9 (B)		11.9 (B)		44.2 (D)		10.2 (B)	
		RT	3.1 (A)		5.4 (A)		39.9 (D)		5.4 (A)	
	EB	LT	*180.5 (F)*	*150.4 (F)*	*175.6 (F)*	*146.2 (F)*	*151.6 (F)*	*119.2 (F)*	*93.2 (F)*	79.6 (E)
		TH	*114.8 (F)*		*114.7 (F)*		*94.7 (F)*		69.5 (E)	
		RT	*109.3 (F)*		*110.2 (F)*		*83.1 (F)*		57.2 (E)	
	WB	LT	*134.2 (F)*	*198.1 (F)*	*143.2 (F)*	*178.7 (F)*	*162.6 (F)*	*188.2 (F)*	42.5 (D)	58.4 (E)
		TH	*155.5 (F)*		*153.5 (F)*		*157.6 (F)*		30.4 (C)	
		RT	*207.8 (F)*		*184.4 (F)*		*193.8 (F)*		63.7 (E)	
	Intersection		60.6 (E)		59.7 (E)		75.3 (E)		39 (D)	
3. N. Washington Street and First Street	NB	TH	13.3 (B)	13.3 (B)	14.6 (B)	14.6 (B)	17.8 (B)	17.7 (B)	13.3 (B)	13.3 (B)
		RT	9.9 (A)		8.6 (A)		10.1 (B)		11.2 (B)	
	SB	LT	19.1 (B)	10.1 (B)	21.1 (C)	12.9 (B)	22.9 (C)	12.2 (B)	17.6 (B)	9.3 (A)
		TH	7.7 (A)		10.2 (B)		9.2 (A)		7.9 (A)	
	WB	RT	71.8 (E)	71.8 (E)	*160.9 (F)*	*160.9 (F)*	*244.8 (F)*	*244.8 (F)*	*94.9 (F)*	*94.9 (F)*
	Intersection		16.6 (B)		25.3 (C)		33.6 (C)		18.7 (B)	

Table 6-4: 2040 Build Conditions with Potential Improvements AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build		2040 Build with Improvements	
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	LT	75.9 (E)	19 (B)	*81.3 (F)*	19 (B)		28.6 (C)	11.9 (B)	22 (C)
		TH	18.1 (B)		18 (B)		28.7 (C)		22.3 (C)	
		RT					18.7 (B)		14.9 (B)	
	SB	LT		21.6 (C)		21.6 (C)		19.4 (B)	55.2 (E)	18.7 (B)
		TH	21.6 (C)		21.3 (C)		19.5 (B)		15.1 (B)	
		RT to Montgomery St	22.2 (C)		28.9 (C)		17.7 (B)		10.8 (B)	
		RT to Powhatan St	24.1 (C)		24.9 (C)		0.7 (A)		2.4 (A)	
	SEB	RT to Washington St	52.3 (D)	53.4 (D)	53.4 (D)	54.4 (D)	16.6 (B)	16.6 (B)	14.5 (B)	14.3 (B)
		RT to Montgomery St	63.6 (E)		63.6 (E)		16.9 (B)		11.9 (B)	
	EB	LT					*84.4 (F)*	41.7 (D)	*87.8 (F)*	44.6 (D)
		TH					36.6 (D)		39.5 (D)	
		RT					21.3 (C)		24.9 (C)	
	WB	LT	37.3 (D)	37.8 (D)	39.5 (D)	37.6 (D)	45.8 (D)	43.9 (D)	56.7 (E)	49.3 (D)
		TH	37.6 (D)		37.4 (D)		43.7 (D)		48.5 (D)	
		RT to Powhatan St	36.3 (D)		0 (A)					
		RT to Washington St	51.5 (D)		0 (A)		0 (A)		0 (A)	
	Intersection		21 (C)		21.3 (C)		29.1 (C)		24.7 (C)	
5. N. Washington Street and Madison Street	NB	TH	23 (C)	22.9 (C)	23.6 (C)	23.6 (C)	30.7 (C)	30.6 (C)	21.1 (C)	21.1 (C)
		RT	19.8 (B)		22.4 (C)		23.6 (C)		18.7 (B)	
	SB	LT	52.5 (D)	10.7 (B)	53.3 (D)	10.6 (B)	70.5 (E)	12.1 (B)	67.1 (E)	11 (B)
		TH	4.2 (A)		3.8 (A)		3.5 (A)		3.8 (A)	
	EB	LT	38.6 (D)	37.2 (D)	0 (A)	38.6 (D)	0 (A)	36.9 (D)	0 (A)	36.7 (D)
		TH	38 (D)		38.9 (D)		37.1 (D)		37 (D)	
		RT	27.4 (C)		33 (C)		33.1 (C)		32 (C)	
	Intersection		22.2 (C)		23.4 (C)		27.9 (C)		20.4 (C)	
6. N. Washington Street and Wythe Street	NB	LT	21 (C)	26.6 (C)	24 (C)	27.7 (C)	27.9 (C)	32.3 (C)	26.7 (C)	32.6 (C)
		TH	26.8 (C)		27.8 (C)		32.6 (C)		32.7 (C)	
		RT	23 (C)		26.2 (C)		28 (C)		29.5 (C)	
	SB	LT	75 (E)	15 (B)	70.9 (E)	17.2 (B)	72.7 (E)	8.2 (A)	68 (E)	11 (B)
		TH	9.5 (A)		12.2 (B)		3.7 (A)		7.1 (A)	
		RT	10.7 (B)		12.1 (B)		4 (A)		6.2 (A)	
	EB	LT	*80.8 (F)*	77.5 (E)	*99.4 (F)*	*94.8 (F)*	*137.1 (F)*	*126.5 (F)*	*83.7 (F)*	80 (E)
		TH	71.4 (E)		*89.9 (F)*		*113.7 (F)*		75.7 (E)	
		RT	70.6 (E)		*80.1 (F)*		*118.9 (F)*		75.6 (E)	
	WB	LT	44.7 (D)	38.1 (D)	58.3 (E)	47.6 (D)	68.5 (E)	59.5 (E)	59.2 (E)	51.9 (D)
		TH	38.7 (D)		48.4 (D)		57.3 (E)		52.2 (D)	
		RT	34.1 (C)		42.8 (D)		59.1 (E)		48.3 (D)	
	Intersection		29.9 (C)		34.1 (C)		39.5 (D)		35.6 (D)	

Table 6-4: 2040 Build Conditions with Potential Improvements AM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build		2040 Build with Improvements	
7. N. Washington Street and Pendleton Street	NB	LT	32.5 (C)	26 (C)	43.6 (D)	29 (C)	38.9 (D)	30 (C)	36.4 (D)	27 (C)
		TH	26 (C)		28.9 (C)		30 (C)		27 (C)	
		RT	23.2 (C)		29.3 (C)		26.6 (C)		25 (C)	
	SB	LT	0 (A)	10 (A)	0 (A)	9.2 (A)	0 (A)	5.7 (A)	0 (A)	3.9 (A)
		TH	10 (A)		9.2 (A)		5.8 (A)		3.9 (A)	
		RT	10.2 (B)		8.4 (A)		4.6 (A)		3.7 (A)	
	EB	LT	42.9 (D)	37.6 (D)	0 (A)	36.5 (D)	0 (A)	37.1 (D)	0 (A)	37.1 (D)
		TH	39 (D)		37.9 (D)		38.5 (D)		38.5 (D)	
		RT	24 (C)		26.9 (C)		28 (C)		28.1 (C)	
	WB	LT	48.1 (D)	36.7 (D)	48.9 (D)	39.9 (D)	47.8 (D)	40.2 (D)	47.2 (D)	40.8 (D)
		TH	36.7 (D)		37.5 (D)		38.5 (D)		39.3 (D)	
		RT	26 (C)		0 (A)		0 (A)		0 (A)	
	Intersection		24.4 (C)		26.2 (C)		26.8 (C)		23.8 (C)	
8. N. Washington Street and Oronoco Street	NB	LT	31.4 (C)	22.3 (C)	35.8 (D)	27.4 (C)	34.9 (C)	30.6 (C)	33.1 (C)	27 (C)
		TH	22.3 (C)		27.5 (C)		30.7 (C)		27 (C)	
		RT	17.6 (B)		21.9 (C)		24.2 (C)		22.6 (C)	
	SB	LT	34.5 (C)	3.5 (A)	0 (A)	3.1 (A)	0 (A)	13.4 (B)	0 (A)	12.2 (B)
		TH	3.4 (A)		3.1 (A)		13.4 (B)		12.3 (B)	
		RT	2.6 (A)		2.3 (A)		10.9 (B)		7.1 (A)	
	EB	LT	40.5 (D)	37.5 (D)	42.6 (D)	37.7 (D)	40.1 (D)	37.5 (D)	40.9 (D)	37.7 (D)
		TH	36.7 (D)		36.1 (D)		36.9 (D)		36.9 (D)	
		RT	28.1 (C)		28.1 (C)		29.1 (C)		28.2 (C)	
	WB	LT	39.8 (D)	33.2 (C)	37.7 (D)	33.6 (C)	45 (D)	34.5 (C)	44.4 (D)	34.3 (C)
		TH	34.5 (C)		34.9 (C)		34.3 (C)		34.1 (C)	
		RT	25.1 (C)		25.1 (C)		27.7 (C)		27 (C)	
	Intersection		20.1 (C)		23.8 (C)		28.2 (C)		25 (C)	
9. N. Washington Street and Princess Street	NB	LT	44.7 (D)	37.7 (D)	55.7 (E)	48.2 (D)	59 (E)	53.1 (D)	53.9 (D)	49 (D)
		TH	37.5 (D)		48 (D)		53 (D)		48.9 (D)	
		RT	30.2 (C)		41.2 (D)		39.9 (D)		33.4 (C)	
	SB	LT	0 (A)	3.4 (A)	0 (A)	3.5 (A)	0 (A)	2.9 (A)	0 (A)	4 (A)
		TH	3.4 (A)		3.4 (A)		2.8 (A)		4 (A)	
		RT	4.2 (A)		5.9 (A)		4.6 (A)		3.8 (A)	
	EB	LT	49.1 (D)	37.5 (D)	54.8 (D)	41.4 (D)	59.3 (E)	42.9 (D)	50 (D)	38.2 (D)
		TH	38.4 (D)		35.9 (D)		37.4 (D)		36.1 (D)	
		RT	9.5 (A)		16.9 (B)		16.9 (B)		15.5 (B)	
	WB	LT	0 (A)	30.7 (C)	0 (A)	29.9 (C)	0 (A)	31.2 (C)	0 (A)	30.8 (C)
		TH	37.4 (D)		32.7 (C)		33.7 (C)		32.9 (C)	
		RT	18.4 (B)		23 (C)		26.1 (C)		26.6 (C)	
	Intersection		31.4 (C)		39.4 (D)		43.6 (D)		39.8 (D)	
10. N. Washington Street and Proposed New East-West Connection	NB N. Washington St	TH							29.4 (C)	29.4 (C)
	NB E. Abingdon Dr	TH							14 (B)	13.9 (B)
		RT							12.1 (B)	
	SB N. Washington St	TH							0.6 (A)	0.6 (A)
	SB W. Abingdon Dr	LT							69.1 (E)	31.5 (C)
		TH							6.3 (A)	
	WB	LT							48 (D)	35.3 (D)
		RT							25 (C)	
	Intersection								21.1 (C)	

Table 6-5: 2040 Build Conditions with Potential Improvements AM Peak Hour VISSIM Travel Times (minutes)

*Results displayed are the average results across 10 microsimulation runs

Segment	Existing Conditions	2040 Baseline	2040 Build	2040 Build with Improvements
Northbound N. Washington Street From: Queen Street To: Slaters Lane	8.5	8.9	9.7	8.3
Southbound N. Washington Street From: Slaters Lane To: Princess Street	3.3	3.4	3.3	3.0

Table 6-6: 2040 Build Conditions with Potential Improvements AM Peak Hour VISSIM Vehicle Queuing (Average and Maximum) (feet)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Available Storage (feet)	Existing Conditions	2040 Baseline	2040 Build	2040 Build with Improvements
1. N. Washington Street and Slaters Lane	NB N. Washington St	1080	*4413 (5458)*	*4962 (5749)*	*5288 (5780)*	*3501 (5736)*
	NB E. Abingdon Dr	1100	*703 (1209)*	*812 (1227)*	*858 (1342)*	*32 (172)*
	SB N. Washington St	3110	32 (207)	35 (241)	32 (350)	30 (206)
	SB W. Abingdon Dr	835	29 (285)	33 (323)	*3178 (4904)*	83 (332)
	EB	850	79 (330)	84 (345)	*630 (879)*	168 (515)
	WB	225	6 (55)	9 (76)	39 (213)	27 (161)
2. N. Washington Street and Bashford Lane	NB N. Washington St	1130	*890 (1231)*	*927 (1233)*	*991 (1239)*	*745 (1234)*
	NB E. Abingdon Dr	700	160 (562)	170 (608)	197 (674)	67 (418)
	SB N. Washington St	1075	25 (283)	30 (306)	27 (408)	0 (62)
	SB W. Abingdon Dr	1055	19 (121)	40 (191)	496 (940)	91 (294)
	EB	730	*318 (745)*	*320 (770)*	217 (725)	129 (593)
	WB	545	*280 (564)*	*289 (564)*	*302 (567)*	71 (299)
3. N. Washington Street and First Street	NB	330	*121 (439)*	*129 (439)*	*177 (440)*	*139 (448)*
	SB	1130	14 (245)	22 (314)	17 (311)	13 (149)
	WB	255	*83 (336)*	*294 (547)*	*454 (594)*	*171 (553)*
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	345	*101 (449)*	*96 (454)*	*135 (462)*	*108 (456)*
	SB	180	29 (164)	30 (171)	*28 (193)*	*23 (185)*
	SEB	345	11 (102)	11 (100)	2 (70)	2 (68)
	EB	245			*37 (267)*	*40 (269)*
	WB	240	29 (155)	34 (186)	*72 (284)*	*80 (285)*
5. N. Washington Street and Madison Street	NB	345	*176 (452)*	*179 (455)*	*216 (454)*	*159 (448)*
	SB	345	21 (144)	24 (145)	26 (146)	25 (140)
	EB	245	45 (204)	*69 (283)*	40 (186)	40 (186)
6. N. Washington Street and Wythe Street	NB	340	*177 (458)*	*190 (469)*	*204 (460)*	*220 (458)*
	SB	350	17 (147)	21 (172)	12 (145)	15 (121)
	EB	260	*125 (279)*	*196 (278)*	*226 (278)*	*186 (279)*
	WB	240	35 (211)	*59 (261)*	*82 (263)*	*72 (263)*
7. N. Washington Street and Pendleton Street	NB	345	*200 (458)*	*233 (462)*	*227 (459)*	*208 (465)*
	SB	340	17 (130)	16 (125)	9 (109)	7 (93)
	EB	245	*36 (247)*	*34 (252)*	34 (244)	34 (244)
	WB	240	20 (182)	19 (166)	22 (167)	22 (167)
8. N. Washington Street and Oronoco Street	NB	345	*183 (467)*	*239 (469)*	*252 (470)*	*234 (467)*
	SB	350	7 (127)	7 (125)	23 (221)	24 (206)
	EB	250	26 (188)	27 (175)	27 (175)	27 (175)
	WB	245	17 (131)	19 (140)	22 (150)	22 (149)
9. N. Washington Street and Princess Street	NB	340	*472 (837)*	*673 (876)*	*685 (871)*	*660 (870)*
	SB	350	8 (102)	9 (129)	8 (114)	11 (122)
	EB	250	7 (82)	10 (96)	12 (103)	11 (107)
	WB	265	2 (48)	3 (64)	3 (56)	3 (56)
10. N. Washington Street and Proposed New East-West Connection	NB N. Washington St	720				*529 (930)*
	NB E. Abingdon Dr	725				45 (316)
	SB N. Washington St	300				1 (35)
	SB W. Abingdon Dr	250				42 (223)
	WB	225				10 (114)

[1]Queue lengths that exceed available storage are highlighted in red text. Approach storage is the distance to the upstream intersection. VISSIM reported queues that cross multiple intersections are capped at the distance to the stop bar of the upstream intersection. The exception is the queues reported on the extents of the study area—northbound Washington Street at Slaters Lane and southbound Washington Street at Princess Street.

Table 6-7: 2040 Build Conditions with Potential Improvements PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build		2040 Build with Improvements	
1. N. Washington Street and Slaters Lane	NB N. Washington St	TH	25.5 (C)	25.5 (C)	27.9 (C)	27.9 (C)	28.9 (C)	28.9 (C)	13.2 (B)	13.2 (B)
	NB E. Abingdon Dr	LT	62.6 (E)	44.8 (D)	71.9 (E)	46.9 (D)	*274.4 (F)*	*132.4 (F)*	*182.4 (F)*	*92.1 (F)*
		TH	15.7 (B)		14 (B)		23.7 (C)		22.2 (C)	
		RT	1.3 (A)		1.9 (A)		6.6 (A)		4.8 (A)	
	SB N. Washington St	TH	24.5 (C)	24.5 (C)	30.1 (C)	30.1 (C)	30.3 (C)	30.3 (C)	32 (C)	32 (C)
	SB W. Abingdon Dr	LT	*95.2 (F)*	32.1 (C)	*96.7 (F)*	32.7 (C)	*129.1 (F)*	41.3 (D)	*121.3 (F)*	38.1 (D)
		TH	33.5 (C)		33.8 (C)		40 (D)		34.6 (C)	
		RT	28.4 (C)		29 (C)		34.4 (C)		39.3 (D)	
	EB	LT	38.9 (D)	38.9 (D)	43.1 (D)	43.1 (D)	52.4 (D)	52.4 (D)	49.9 (D)	50.7 (D)
		TH	44.8 (D)		49.6 (D)		59.6 (E)		61.3 (E)	
		RT	32.3 (C)		34.3 (C)		39.7 (D)		42.6 (D)	
	WB	LT	45.1 (D)	48.1 (D)	65.6 (E)	59 (E)	*244.4 (F)*	*217.4 (F)*	*87.1 (F)*	*87.8 (F)*
		TH	62.1 (E)		71.3 (E)		*250.6 (F)*		*105.1 (F)*	
		RT	4.8 (A)		28.4 (C)		*155.2 (F)*		32.9 (C)	
	Intersection		28.1 (C)		32.2 (C)		45.4 (D)		32.1 (C)	
2. N. Washington Street and Bashford Lane	NB N. Washington St	TH	13.6 (B)	13.6 (B)	16.1 (B)	16.1 (B)	27.4 (C)	27.4 (C)	20.4 (C)	20.4 (C)
	NB E. Abingdon Dr	LT	66.3 (E)	21.1 (C)	65.2 (E)	19.6 (B)	65 (E)	19.6 (B)	63.1 (E)	18.7 (B)
		TH	10.5 (B)		10.7 (B)		10.7 (B)		9.9 (A)	
		RT	5.8 (A)		5.2 (A)		5.9 (A)		5.7 (A)	
	SB N. Washington St	TH	1.3 (A)	1.3 (A)	10.6 (B)	10.6 (B)	13.5 (B)	13.5 (B)	8.4 (A)	8.4 (A)
	SB W. Abingdon Dr	LT	75.8 (E)	22.1 (C)	*87.1 (F)*	23.2 (C)	*670.5 (F)*	*127 (F)*	*178.2 (F)*	36.3 (D)
		TH	13.5 (B)		13.2 (B)		28.7 (C)		12.5 (B)	
		RT	13.6 (B)		13.7 (B)		21.9 (C)		11.9 (B)	
	EB	LT	49.2 (D)	34.2 (C)	44.8 (D)	36.5 (D)	46.9 (D)	33.5 (C)	48.8 (D)	34.6 (C)
		TH	34.4 (C)		36.9 (D)		33.5 (C)		34.5 (C)	
		RT	22 (C)		26.2 (C)		25.1 (C)		25.6 (C)	
	WB	LT	39.1 (D)	37.3 (D)	42.1 (D)	37.6 (D)	32.3 (C)	38.2 (D)	40.6 (D)	36.8 (D)
		TH	37.7 (D)		38.6 (D)		39.5 (D)		35.1 (D)	
		RT	37.1 (D)		36.9 (D)		37.9 (D)		37.3 (D)	
	Intersection		12.7 (B)		17.7 (B)		38.3 (D)		20 (B)	
3. N. Washington Street and First Street	NB	TH	10 (A)	10 (A)	9.9 (A)	9.9 (A)	9.4 (A)	9.4 (A)	9.5 (A)	9.5 (A)
		RT	10.1 (B)		11.4 (B)		7.4 (A)		9.3 (A)	
	SB	LT	17.1 (B)	10.4 (B)	22.4 (C)	21.5 (C)	27.1 (C)	22.1 (C)	24.1 (C)	22.4 (C)
		TH	9.3 (A)		21.3 (C)		21.2 (C)		22.2 (C)	
	WB	RT	6.6 (A)	6.6 (A)	7.2 (A)	7.2 (A)	6.2 (A)	6.2 (A)	6.4 (A)	6.4 (A)
	Intersection		10.1 (B)		16.5 (B)		16.9 (B)		16.9 (B)	

Table 6-7: 2040 Build Conditions with Potential Improvements PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build		2040 Build with Improvements	
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	LT	48.1 (D)	12.3 (B)	51.3 (D)	13 (B)		16.4 (B)	62.6 (E)	17.5 (B)
		TH	10.4 (B)		11.1 (B)		16.5 (B)		14.6 (B)	
		RT					12 (B)		9.2 (A)	
	SB	LT		7.1 (A)		12.4 (B)		19.5 (B)	37.4 (D)	19.7 (B)
		TH	7.1 (A)		12.5 (B)		19.7 (B)		18.9 (B)	
		RT to Montgomery St	5.7 (A)		9.6 (A)		14.3 (B)		14 (B)	
		RT to Powhatan St	7.2 (A)		6.1 (A)		7 (A)		5 (A)	
	SEB	RT to Washington St	54.5 (D)	54.6 (D)	55.7 (E)	55.8 (E)	61.7 (E)	61.9 (E)	65.2 (E)	65 (E)
		RT to Montgomery St	60.2 (E)		60.2 (E)		71.7 (E)		56.4 (E)	
	EB	LT					52.6 (D)	27.7 (C)	*82.5 (F)*	38.7 (D)
		TH					25.5 (C)		34.7 (C)	
		RT					20.6 (C)		27.7 (C)	
	WB	LT	43.3 (D)	43.9 (D)	66.4 (E)	60.3 (E)	34.9 (C)	31.5 (C)	60.6 (E)	53.4 (D)
		TH	42.4 (D)		58 (E)		30.7 (C)		51.5 (D)	
		RT to Powhatan St	45.2 (D)		57.6 (E)					
		RT to Washington St	56.7 (E)		71.1 (E)		33.6 (C)		61 (E)	
	Intersection		14.4 (B)		19.8 (B)		21.3 (C)		24.4 (C)	
5. N. Washington Street and Madison Street	NB	TH	9 (A)	9.8 (A)	13.3 (B)	15.4 (B)	8.1 (A)	8.4 (A)	8.1 (A)	8.4 (A)
		RT	23.1 (C)		50.9 (D)		15 (B)		15.3 (B)	
	SB	LT	27.3 (C)	6.6 (A)	62.2 (E)	13.6 (B)	19 (B)	15.8 (B)	21.9 (C)	17.1 (B)
		TH	5.8 (A)		11.6 (B)		15.7 (B)		16.9 (B)	
	EB	LT	42.1 (D)	38.2 (D)	44.4 (D)	39.8 (D)	44.1 (D)	38.7 (D)	44.9 (D)	38.7 (D)
		TH	39.2 (D)		40.5 (D)		39.1 (D)		39.1 (D)	
		RT	29.9 (C)		32.2 (C)		32 (C)		31.4 (C)	
	Intersection		10.6 (B)		16.7 (B)		14.6 (B)		14.8 (B)	
6. N. Washington Street and Wythe Street	NB	LT	*112.7 (F)*	15.6 (B)	*157.4 (F)*	21.9 (C)	*280.1 (F)*	34.6 (C)	61.3 (E)	12.4 (B)
		TH	10.2 (B)		13.7 (B)		9.2 (A)		10.1 (B)	
		RT	21.5 (C)		33.1 (C)		24.2 (C)		21.5 (C)	
	SB	LT	32.7 (C)	9.9 (A)	52.9 (D)	14.6 (B)	48.4 (D)	20.3 (C)	41.5 (D)	20.5 (C)
		TH	8.7 (A)		12.4 (B)		18.8 (B)		19.5 (B)	
		RT	6.5 (A)		9.7 (A)		13 (B)		13.4 (B)	
	EB	LT	58.2 (E)	49.2 (D)	72.7 (E)	59.8 (E)	71.3 (E)	64.3 (E)	66.6 (E)	59.9 (E)
		TH	46.5 (D)		56.6 (E)		62.6 (E)		58.2 (E)	
		RT	41 (D)		43.5 (D)		57.1 (E)		53.4 (D)	
	WB	LT	59.8 (E)	50.2 (D)	77.2 (E)	68.2 (E)	*91.5 (F)*	76.1 (E)	*87.9 (F)*	75.2 (E)
		TH	50 (D)		67.1 (E)		74.5 (E)		73.8 (E)	
		RT	41.2 (D)		63.2 (E)		63.9 (E)		65.1 (E)	
	Intersection		16.6 (B)		23.9 (C)		32.4 (C)		23.8 (C)	

Table 6-7: 2040 Build Conditions with Potential Improvements PM Peak Hour VISSIM Level of Service and Delay (seconds/vehicle) Continued

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Movement	Existing Conditions		2040 Baseline		2040 Build		2040 Build with Improvements	
7. N. Washington Street and Pendleton Street	NB	LT	57.2 (E)	11.5 (B)	72.3 (E)	15.6 (B)	*119.8 (F)*	44.2 (D)	62.2 (E)	11.2 (B)
		TH	11.2 (B)		15.5 (B)		44.8 (D)		11.1 (B)	
		RT	10.2 (B)		12.3 (B)		17.7 (B)		8.7 (A)	
	SB	LT	38.4 (D)	16.6 (B)	0 (A)	22.6 (C)	0 (A)	30.3 (C)	0 (A)	33.4 (C)
		TH	16.6 (B)		22.8 (C)		30.6 (C)		33.7 (C)	
		RT	13.9 (B)		17.9 (B)		21.3 (C)		24.3 (C)	
	EB	LT	47.2 (D)	41.6 (D)	51.9 (D)	44.3 (D)	*100 (F)*	*82.9 (F)*	71.1 (E)	66.3 (E)
		TH	42.3 (D)		44.2 (D)		*81.9 (F)*		67.4 (E)	
		RT	32.3 (C)		37.1 (D)		68.7 (E)		56.4 (E)	
	WB	LT	42.7 (D)	36.3 (D)	46.3 (D)	39.6 (D)	48.3 (D)	44.2 (D)	45.8 (D)	39.3 (D)
		TH	37.8 (D)		41.3 (D)		45.3 (D)		40.8 (D)	
		RT	30.6 (C)		33 (C)		39.7 (D)		32.6 (C)	
	Intersection		17.9 (B)		22.8 (C)		39.8 (D)		27.5 (C)	
8. N. Washington Street and Oronoco Street	NB	LT	25.7 (C)	9.3 (A)	0 (A)	12.1 (B)	0 (A)	36.9 (D)	0 (A)	10.9 (B)
		TH	9.3 (A)		12.1 (B)		37.2 (D)		10.9 (B)	
		RT	9.9 (A)		12.5 (B)		25.8 (C)		11.5 (B)	
	SB	LT	48.1 (D)	22.8 (C)	61.3 (E)	26.6 (C)	61 (E)	30 (C)	62.6 (E)	32.3 (C)
		TH	22.6 (C)		26.4 (C)		29.8 (C)		32.2 (C)	
		RT	16.7 (B)		17.3 (B)		19.3 (B)		21.4 (C)	
	EB	LT	47.2 (D)	39.6 (D)	53.9 (D)	45.7 (D)	*82.6 (F)*	58 (E)	56.5 (E)	45 (D)
		TH	38.2 (D)		43.8 (D)		49.8 (D)		41.5 (D)	
		RT	23 (C)		30.9 (C)		38.3 (D)		31.4 (C)	
	WB	LT	47.6 (D)	39.8 (D)	58 (E)	50.2 (D)	67.9 (E)	69.4 (E)	50 (D)	44.4 (D)
		TH	43.4 (D)		50.9 (D)		68.9 (E)		46.8 (D)	
		RT	31 (C)		44.9 (D)		71.2 (E)		35.7 (D)	
	Intersection		19.1 (B)		23.3 (C)		36.6 (D)		25.3 (C)	
9. N. Washington Street and Princess Street	NB	LT	47.8 (D)	15.1 (B)	63.6 (E)	22.3 (C)	*97.7 (F)*	59.6 (E)	58.8 (E)	19 (B)
		TH	13.5 (B)		20.4 (C)		57.8 (E)		17.2 (B)	
		RT	14.6 (B)		10.9 (B)		26.8 (C)		19.9 (B)	
	SB	LT	43.6 (D)	40.2 (D)	0 (A)	40.4 (D)	0 (A)	44 (D)	0 (A)	44.3 (D)
		TH	40.3 (D)		40.5 (D)		44.2 (D)		44.5 (D)	
		RT	38.1 (D)		37 (D)		35.6 (D)		36.6 (D)	
	EB	LT	49.6 (D)	46.2 (D)	55.8 (E)	52.6 (D)	*96.2 (F)*	*82.8 (F)*	61.6 (E)	57.2 (E)
		TH	45.2 (D)		51.1 (D)		71.9 (E)		55.8 (E)	
		RT	33.5 (C)		44 (D)		55.6 (E)		43.2 (D)	
	WB	LT	39.3 (D)	35.1 (D)	42.5 (D)	40.6 (D)	60.2 (E)	48 (D)	71.1 (E)	41.4 (D)
		TH	38 (D)		41.5 (D)		45.8 (D)		42.3 (D)	
		RT	25.3 (C)		36.1 (D)		58.3 (E)		32.1 (C)	
	Intersection		30.2 (C)		33.7 (C)		50.9 (D)		34.5 (C)	
10. N. Washington Street and Proposed New East-West Connection	NB N. Washington St	TH							18.1 (B)	18.1 (B)
	NB E. Abingdon Dr	TH							11.4 (B)	10.4 (B)
		RT							3.5 (A)	
	SB N. Washington St	TH							3.4 (A)	3.4 (A)
	SB W. Abingdon Dr	LT							48.8 (D)	7.4 (A)
		TH							3.4 (A)	
	WB	LT							41.6 (D)	32.7 (C)
		RT							26 (C)	
	Intersection								11.1 (B)	

Table 6-8: 2040 Build Conditions with Potential Improvements PM Peak Hour VISSIM Travel Times (minutes)

*Results displayed are the average results across 10 microsimulation runs

Segment	Existing Conditions	2040 Baseline	2040 Build	2040 Build with Improvements
Northbound N. Washington Street From: Queen Street To: Slaters Lane	4.3	4.9	6.5	4.7
Southbound N. Washington Street From: Slaters Lane To: Princess Street	3.9	4.9	5.5	5.7

Table 6-9: 2040 Build Conditions with Potential Improvements PM Peak Hour VISSIM Vehicle Queuing (Average and Maximum) (feet)

*Results displayed are the average results across 10 microsimulation runs

Intersection	Approach	Available Storage (feet)	Existing Conditions	2040 Baseline	2040 Build	2040 Build with Improvements
1. N. Washington Street and Slaters Lane	NB N. Washington St	1080	209 (868)	*322 (1352)*	*240 (1089)*	*115 (860)*
	NB E. Abingdon Dr	1100	209 (867)	10 (102)	97 (282)	*61 (190)*
	SB N. Washington St	3110	173 (813)	341 (1570)	472 (2409)	417 (1954)
	SB W. Abingdon Dr	835	*404 (2122)*	*515 (2474)*	*1337 (3437)*	*176 (919)*
	EB	850	51 (214)	57 (225)	78 (295)	76 (309)
	WB	225	13 (99)	*46 (227)*	*323 (387)*	*75 (305)*
2. N. Washington Street and Bashford Lane	NB N. Washington St	1130	0 (0)	86 (534)	136 (551)	109 (473)
	NB E. Abingdon Dr	700	66 (393)	6 (82)	6 (83)	6 (83)
	SB N. Washington St	1075	0 (0)	121 (631)	*156 (1080)*	57 (554)
	SB W. Abingdon Dr	1055	30 (226)	32 (243)	631 (1009)	80 (308)
	EB	730	21 (180)	28 (217)	21 (182)	22 (189)
	WB	545	72 (383)	84 (433)	82 (423)	57 (255)
3. N. Washington Street and First Street	NB	330	47 (268)	*50 (358)*	42 (243)	53 (275)
	SB	1130	53 (726)	*284 (1145)*	*261 (1242)*	*337 (1185)*
	WB	255	5 (88)	6 (108)	5 (101)	5 (99)
4. N. Washington Street and Montgomery Street/ Powhatan Street	NB	345	31 (279)	34 (281)	56 (268)	53 (257)
	SB	180	*29 (274)*	*49 (275)*	*74 (379)*	*74 (385)*
	SEB	345	29 (174)	29 (171)	21 (163)	24 (148)
	EB	245			19 (163)	27 (188)
	WB	240	*74 (274)*	*125 (282)*	*105 (276)*	*173 (270)*
5. N. Washington Street and Madison Street	NB	345	42 (259)	80 (334)	30 (201)	37 (250)
	SB	345	38 (278)	*93 (541)*	*169 (516)*	*180 (534)*
	EB	245	49 (226)	*58 (260)*	39 (153)	39 (153)
6. N. Washington Street and Wythe Street	NB	340	56 (288)	*103 (352)*	*298 (454)*	46 (254)
	SB	350	*47 (412)*	*81 (417)*	*126 (454)*	*131 (456)*
	EB	260	45 (247)	*69 (277)*	*91 (280)*	*84 (278)*
	WB	240	*88 (262)*	*157 (262)*	*167 (262)*	*165 (262)*
7. N. Washington Street and Pendleton Street	NB	345	53 (328)	*80 (433)*	*240 (453)*	*59 (412)*
	SB	340	*107 (446)*	*141 (448)*	*200 (450)*	*219 (449)*
	EB	245	*62 (284)*	*71 (286)*	*140 (290)*	*111 (289)*
	WB	240	*66 (286)*	*77 (282)*	*98 (278)*	*87 (279)*
8. N. Washington Street and Oronoco Street	NB	345	*50 (350)*	*74 (415)*	*210 (460)*	*68 (405)*
	SB	350	*137 (457)*	*176 (464)*	*200 (462)*	*218 (469)*
	EB	250	21 (147)	27 (180)	32 (198)	26 (164)
	WB	245	*54 (272)*	*92 (273)*	*131 (273)*	*85 (273)*
9. N. Washington Street and Princess Street	NB	340	*83 (375)*	*138 (391)*	*276 (401)*	*115 (386)*
	SB	350	*743 (1920)*	*1460 (3713)*	*2210 (5435)*	*2359 (4536)*
	EB	250	27 (161)	40 (243)	53 (229)	40 (218)
	WB	265	11 (115)	18 (155)	24 (171)	21 (158)
10. N. Washington Street and Proposed New East-West Connection	NB N. Washington St	720				126 (581)
	NB E. Abingdon Dr	725				6 (85)
	SB N. Washington St	300				42 (280)
	SB W. Abingdon Dr	250				17 (139)
	WB	225				26 (188)

[1]Queue lengths that exceed available storage are highlighted in red text. Approach storage is the distance to the upstream intersection. VISSIM reported queues that cross multiple intersections are capped at the distance to the stop bar of the upstream intersection. The exception is the queues reported on the extents of the study area—northbound Washington Street at Slaters Lane and southbound Washington Street at Princess Street.

Table 6-10: 2040 Build Conditions with Improvements Conditions with and without the E. Abingdon Drive Improvement

AM Results	2040 Build Conditions with Improvements			2040 Build Conditions with Improvements and E. Abingdon Drive Restriping		
	Delay (Seconds)	Avg. Queue (Feet)	Max. Queue (Feet)	Delay (Seconds)	Avg. Queue (Feet)	Max. Queue (Feet)
Northbound E. Abingdon Drive at Slaters Lane	131.1 (F)	287	448	16.3 (B)	32	172
Northbound N. Washington Street at Slaters Lane	22.9 (C)	3235	5734	25.7 (C)	3501	5736
N. Washington Street/Slaters Lane Overall Intersection	**48.8 (D)**			**31.0 (C)**		
Northbound E. Abingdon Drive at George Washington Memorial Parkway	78.8 (E)	2085	2800	53.7 (D)	135	475
Northbound George Washington Memorial Parkway at E. Abingdon Drive	5.8 (A)	635	1722	8.9 (A)	362	1542
George Washington Memorial Parkway/E. Abingdon Drive Overall Intersection	**19.6 (B)**			**19.7 (B)**		
PM Results	**2040 Build Conditions with Improvements**			**2040 Build Conditions with Improvements and E. Abingdon Drive Restriping**		
	Delay (Seconds)	**Avg. Queue (Feet)**	**Max. Queue (Feet)**	**Delay (Seconds)**	**Avg. Queue (Feet)**	**Max. Queue (Feet)**
Northbound E. Abingdon Drive at Slaters Lane	93.6 (F)	64	196	92.1 (F)	61	190
Northbound N. Washington Street at Slaters Lane	13.2 (B)	115	890	13.2 (B)	115	860
N. Washington Street/Slaters Lane Overall Intersection	**32.5 (C)**			**32.1 (C)**		
Northbound E. Abingdon Drive at George Washington Memorial Parkway	30.8 (C)	16	156	54.4 (D)	21	109
Northbound George Washington Memorial Parkway at E. Abingdon Drive	0.9 (A)	0	0	0.5 (A)	1	44
George Washington Memorial Parkway/E. Abingdon Drive Overall Intersection	**2.2 (A)**			**2.9 (A)**		

6.5. 2040 Build Conditions with Improvements Conclusions

The potential improvements discussed in this chapter have a direct benefit to the multimodal operations of the Old Town North study area. Allowing northbound and southbound left-turn movements at the intersection of N. Washington Street and Montgomery Street enhances the network connectivity and circulation. The proposed new east-west street connection provides additional east-west vehicular capacity to improve access to the power plant site/adjacent properties and also reduces the traffic demand along Slaters Lane and Bashford Lane. This street also provides the opportunity for an additional pedestrian and bicycle connection across N. Washington Street. Lane configuration restriping along E. Abingdon Drive, W. Abingdon Drive, and along Bashford Lane creates additional capacity and improves vehicle throughput.

The traffic analysis results demonstrate that the combination of these potential improvements will result in overall improvement of traffic operations with reduced vehicle delay and queuing for many overcapacity movements and approaches and improvements in levels of service. This results in vehicle operations with levels of service that are as good or better than the 2040 Baseline Conditions traffic analysis and a few instances where levels of service are better than existing conditions; therefore, all the multimodal improvements identified are recommended to be implemented as part of the Small Area Plan Update to offset the transportation impacts.

7. Conclusions

Analyses were performed for existing conditions, 2040 Baseline, 2040 Build, and 2040 Build with Improvements. The existing analysis results indicated that most intersections in Old Town North operate with good levels of service and that the urban street grid offers many opportunities for vehicular travel. The interconnected network of streets allows for the efficient dispersion of traffic.

Pedestrian facilities such as sidewalks and trails have few gaps and crossing distances are minimal at most intersections. Cyclists have access to bikeshare stations, off-street trails, and generally do not have to contend with higher speed vehicles. Local transit service is prevalent and provides connections to regional activity centers and the regional Metrorail Yellow and Blue Lines. In the year 2040, with the proposed Small Area Plan Update, most study area streets will continue to operate with acceptable levels of service for vehicular traffic.

The most significant change in the study area, the build-out of the power plant site, may lead to additional traffic pressures along Slaters Lane, Bashford Lane, and N. Washington Street. The traffic pressure associated with this development can be mitigated to provide levels of service as good or better than 2040 Baseline Conditions through the improvements identified in this study. To achieve and exceed the operational results and mode split targets identified in this study, the City should implement the recommendations described in this study.

The identified recommendations will position the City to achieve the Small Area Plan Update vision and create pedestrian-focused neighborhoods, linked to the rest of the City through a diverse transportation network and a system of alternative transit options. Further, the recommendations position the City to achieve a successful build-out of the power plant site with urban scale blocks, a street network that encourages biking and walking, transit accessibility, and minimized impacts to the greater transportation network.