Armed Forces Retirement Home Master Plan Traffic Impact Study

Comprehensive Transportation Review

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District Department of Transportation

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Executive Summary

The Armed Forces Retirement Home (AFRH) prepared a Master Plan (Plan) in 2008 for the development of its site at 3700 North Capitol Street, NW in Washington, DC. Revenue from the development of the unused portions of the site is needed to sustain AFRH and its primary source of funding, the AFRH Trust Fund. AFRH's fixed-income sources are insufficient to fund campus operations, capital needs, and infrastructure improvements. Its mission to operate a resident-focused retirement community also requires additional funds. In the Fiscal Year 2002 National Defense Authorization Act, Congress recognized these needs and provided the Secretary of Defense with the authority to sell, lease, or otherwise dispose of real property excess to AFRH's needs.

AFRH's Plan will leverage its real estate and be the basis for facilitating and directing future development by the private sector to increase Trust Fund revenue. The Plan program consists of alternatives discussed in the 2007 Draft and Final Environmental Impact Statements (EIS) and the consultation undertaken pursuant to Section 106 of the National Historic Preservation Act (NHPA). The alternatives seek to consider compatibility with the AFRH mission, historic resources and existing environmental conditions, and surrounding land uses and analysis of real estate market conditions in the area. A preferred alternative was identified through ongoing public outreach, the environmental review process, the Master Planning process, and review of concepts proposed by developers for Zone A, a currently underutilized portion of the AFRH campus, located in the southeast quadrant of the property that has been designated for redevelopment.

PURPOSE AND METHODOLOGY

This Comprehensive Transportation Review (CTR) has been developed for use in compiling a revised Draft and Final Environmental Impact Statement (EIS) that will reflect the most current site master plan elements. It analyzes the potential transportation system impacts of the preferred alternative for the redevelopment zone of the AFRH campus (Zone A), and identifies, assesses, and recommends strategies to reduce the impact of the site on the transportation system.

This document analyzes the potential transportation system impacts of the preferred alternative in 2045, the future horizon analysis year of the EIS. In the full build-out condition, as series of transportation system upgrade options are recommended, including roadway improvements, pedestrian and bicycle facility improvements, transit enhancements, and transportation demand management strategies. These mitigation options are then analyzed and a phasing strategy is development based on the potential impact of the site at 20%, 40%, 60%, and 80% of full build under two scenarios. The first scenario assumes that the existing roadway network would remain, while the second scenario assumes a series of improvements associated with the District of Columbia Department of Transportation (DDOT) *Crosstown Multimodal Transportation Study*, which calls for significant modifications to the study Irving Street/Michigan Avenue corridors to enhance pedestrian, bicycle, and transit accessibility.

It should be noted that a developer for the site has not yet been selected and that a final program and phasing strategy has not yet been determined. Therefore, this CTR should be considered a "master plan-level" study which may need refining once a final program and phasing strategy has been developed. The mitigation strategies recommended in this document should be considered preliminary. They represent options that a developer could implement to offset the site impacts. Further coordination between the selected developer, DDOT, WMATA, and other agencies will be required once a site phasing plan has been established.

CONCLUSION

This redevelopment project, in combination with other projects in the area, would begin the transformation of this section of the District of Columbia from a suburban-style, auto-oriented corridor, considered a barrier between the northeast and northwest sections of the City, to a more urban environment where people can live, work, and play.

The results of the analyses contained in this document indicate that the proposed site would generate a significant number of additional vehicle, pedestrian, bicycle, and transit trips that would need to be accommodated on a network that has existing capacity deficiencies. Therefore, the site developer must engage DDOT, WMATA, and other stakeholders to utilize a combination of mitigation strategies that would address the transportation system capacity deficiencies while also attempting to reduce the number of additional vehicle trips that would be generated by the site through transportation demand management.

Since a developer for the site has not yet been selected, an exact phasing plan has not yet been developed. Therefore, the potential mitigation strategies shown in the Table E-1, and identified in this report, should be considered preliminary. The analysis presented in this CTR is for the maximum allowable density on the AFRH site which may or may not be achieved based on market forces. Furthermore, improvements to the transportation network within the study area may occur as part of other DDOT projects. Thus, additional coordination between DDOT and the developer would be required as a final site plan is developed. A developer may choose to implement these potential measures or may develop other mitigation measures to vet through DDOT based on the current conditions of the transportation network.

Table E-1: Vehicle Mitigation Measure Implementation Strategy

Threshold (% of Full Build Trips)	Potential Vehicle Mitigation Measures		Potential Transit Mitigation Measures	Potential Pedestrian/Bicycle Mitigation Measures*
	With Existing Network	**With Crosstown Network**		
20%	• Upgrade all study area signalized intersections to be fully actuated and optimize phasing and offsets. • Option 1: At the intersection of Irving Street NW and First Street NW, provide an additional westbound left-turn lane, two northbound left-turn lanes, and an eastbound right-turn lane. OR • Option 2: Divert vehicles from the intersection of First Street NW and Irving Street NW by providing a secondary entrance to the Washington Hospital Center Campus from the North Capitol Street/Irving Street interchange.** • Provide a double left-turn lane at the intersection of Irving Street NW and Driveway 3. All traffic entering the site from eastbound Irving Street NW must do so at this intersection. • Signalize the intersections of Park Place NW and Hobart Place NW, Hobart Place NW and the Ramp to Michigan Avenue, and Michigan Avenue NW and the Ramp from Hobart Place/Park Place NW. Widen the Ramp to Michigan Avenue NW.	• Upgrade all study area signalized intersections to be fully actuated and optimize phasing and offsets. • Modify the proposed North Capitol Street/Irving Street interchange to provide additional connections between Irving Street, North Capitol Street and the Washington Hospital Center. • At the intersection of Irving Street NW and First Street NW, provide separate through and left-turn lanes. Restrict eastbound left-turns and move them to the signalized intersection of Irving Street NW and Proposed Driveway 3. • Provide a connection into the Washington Hospital Center from Park Place.	• Begin working with WMATA to extend Route D8, realign H2 along Irving Street, and implement the Tenleytown to Brookland and Union Station to Brookland circulator routes. • Begin shuttle service to/from Brookland-CUA and Columbia Heights Metro stations, and the Route 80 stop at the intersection of Irving Street NE and Michigan Avenue NE. Shuttle service should be provided during the AM and PM peak periods (6:00 AM – 10:00 AM and 3:00 PM – 7:00 PM) at 15-minute headways. • Begin to work with WMATA to identify potential transit vehicle storage and maintenance space needs.	• Provide marked crosswalks across all approaches at all internal intersections. • Provide sidewalks on both sides of all internal roadways with a minimum width of 16 feet along building frontages, and 11 feet along areas of open space. • Provide dedicated bike lanes or paths on primary roadways within the site, as well as roadways which connect to the external transportation network. Shared bike lanes should be used on minor roadways. • Incorporate Capital Bikeshare stations within the site along internal roadways as well as within parking facilities. • Provide bicycle parking for every building as well as shower facilities for office buildings. • Construct a 10-foot wide multi-use path along the north side of Irving Street/Kenyon Street between Park Place and Michigan Avenue NE. • Construct a 10-foot wide multi-use path on the west side of North Capitol Street between Irving Street and Harewood Road. The path would connect to the proposed path on Irving Street, as well as Scale Gate Road, and provide a new north-south connection. • Provide dedicated bike lanes and sidewalks on both sides of Scale Gate Road between the AFRH site and Harewood Road. • Provide crosswalks across the west leg of the intersection of First Street NW and Irving Street NW, and across the east leg of the intersection Pershing Drive and Irving Street NW. Provide a minimum 16-foot wide pedestrian refuge median for both crosswalks. • Work with WMATA and DDOT to provide last-mile pedestrian and bicycle facilities to transit services. • Work with Capital Bikeshare to provide both offsite bikeshare stations near transit stops and other destinations.
40%	• Provide an additional northbound through lane at the intersection of North Capitol Street and New Hampshire Avenue NE. • Eliminate the Hawaii Avenue northbound left-turn movement at the intersection with North Capitol Street.	• Provide an additional northbound through lane at the intersection of North Capitol Street and New Hampshire Avenue NE. • Eliminate the Hawaii Avenue northbound left-turn movement at the intersection with North Capitol Street.	• Extend Route D8 and realign H2 along Irving Street. Continue coordination with WMATA regarding circulator routes if they have not yet been implemented. • Increase capacity on Route D8 by decreasing headways to 10 minutes during AM and PM peak periods. • Enhance service to/from Brookland-CUA and Columbia Heights Metro stations, and the Route 80 stop at the intersection of Irving Street and Michigan Avenue by providing midday service between 10:00 AM and 3:00 PM at 30 minute headways.	
60%	• Replace the Scale Gate Road bridge over North Capitol Street to incorporate two lanes in each direction, as well as full sidewalks. Signalize the diamond interchange ramp intersections with Scale Gate Road. • Provide an additional southbound left-turn lane and westbound right-turn lane at the intersection of Michigan Avenue NW and First Street NW.	• Provide an additional southbound through lane at the intersection of North Capitol Street and Harewood Road. • Replace the Scale Gate Road bridge over North Capitol Street to incorporate two lanes in each direction, as well as full sidewalks. Signalize the diamond interchange ramp intersections with Scale Gate Road.	• Tenleytown to Brookland and Union Station to Brookland circulator routes should be operational. • Enhance shuttle service to/from Brookland-CUA and Columbia Heights Metro stations, and the Route 80 stop at the intersection of Irving Street NE and Michigan Avenue NE by providing 12 minute peak period headways and 15 minute midday headways. Work with residential, retail, and office tenants to determine if weekend and/or evening services are needed.	

Threshold (% of Full Build Trips)	Potential Vehicle Mitigation Measures		Potential Transit Mitigation Measures	Potential Pedestrian/Bicycle Mitigation Measures*
	With Existing Network	With Crosstown Network		
		• Provide an additional southbound left-turn lane and westbound right-turn lane at the intersection of Michigan Avenue NW and First Street NW.	• Work with WMATA to re-evaluate need for articulated buses on Route 80 once Route 80X service begins. • Construct onsite transit hub.	
80% - Full Build	• Provide an additional southbound through lane at the intersection of North Capitol Street and Harewood Road. • Implement traffic adaptive or demand responsive signals on North Capitol Street.	• Implement traffic adaptive or demand responsive signals on North Capitol Street.	• Realign Route H1 to travel along Irving Street and begin dual direction peak period service as recommended. • Enhance shuttle service to/from Brookland-CUA and Columbia Heights Metro stations, and the Route 80 stop at the intersection of Irving Street NE and Michigan Avenue NE by providing weekend and evening services at maximum headways of one hour. • Begin articulated bus service on Route 80.	

*Pedestrian and bicycle facilities should be constructed in conjunction with site development, as well as the implementation of off-site improvements.

** It should be noted that some improvements require coordination with MedStar, a private property owner. If an agreement cannot be reached with MedStar to provide the secondary entrance to the hospital campus, the developer may need to consider other internal site enhancements to divert traffic away from the intersection of Irving Street and First Street. For example, restricting through and left-turn movements exiting the site at the intersection could be used to divert exiting traffic to one of the adjacent driveways.

1.0 INTRODUCTION

The Armed Forces Retirement Home (AFRH) prepared a Master Plan (Plan) in 2008 for the development of its site at 3700 North Capitol Street, NW in Washington, DC. Revenue from the development of the unused portions of the site is needed to sustain AFRH and its primary source of funding, the AFRH Trust Fund.

Located on 272 acres, the Washington, DC campus contains more than 100 buildings and ancillary structures. It is currently home to approximately 1,200 military veterans and includes features such as health-related facilities, private rooms for residents, a bank, chapels, a convenience store, a post office, laundry facilities, a barber shop and beauty salon, dining rooms, a golf course, fishing ponds, and 24-hour security and staff presence.

However, AFRH's fixed-income sources are insufficient to fund campus operations, capital needs, and infrastructure improvements. Its mission to operate a resident-focused retirement community also requires additional funds. In the Fiscal Year 2002 National Defense Authorization Act, Congress recognized these needs and provided the Secretary of Defense with the authority to sell, lease, or otherwise dispose of real property excess to AFRH's needs.

AFRH's Plan will leverage its real estate and be the basis for facilitating and directing future development by the private sector to increase Trust Fund revenue. The Plan program consists of alternatives discussed in the 2007 Draft and Final Environmental Impact Statements (EIS) and the consultation undertaken pursuant to Section 106 of the National Historic Preservation Act (NHPA). The alternatives seek to consider compatibility with the AFRH mission, historic resources and existing environmental conditions, and surrounding land uses and analysis of real estate market conditions in the area. A preferred alternative was identified through ongoing public outreach, the environmental review process, the Master Planning process, and review of concepts proposed by developers for Zone A, a currently underutilized portion of the AFRH campus, located in the southeast quadrant of the property that has been designated for redevelopment.

1.1 PURPOSE AND METHODOLOGY

This Comprehensive Transportation Review (CTR) has been developed for use in compiling a revised Draft and Final Environmental Impact Statement (EIS) that will reflect the most current site master plan elements. It analyzes the potential transportation system impacts of the preferred alternative for the redevelopment zone of the AFRH campus (Zone A), and identifies, assesses, and recommends strategies to reduce the impact of the site on the transportation system.

This document analyzes the potential transportation system impacts of the preferred alternative in the 2045 horizon analysis year of the EIS. A series of transportation system improvement options, including roadway improvements, pedestrian and bicycle facility improvements, transit enhancements, and transportation demand management strategies are developed for the full

build condition. These options are then analyzed and a phasing strategy is development based on the potential impact of the site at 20%, 40%, 60%, and 80% of full build under two scenarios. The first scenario assumes that the existing roadway network would remain, while the second scenario assumes a series of improvements associated with the District of Columbia Department of Transportation (DDOT) *Crosstown Multimodal Transportation Study*, which calls for significant modifications to the study Irving Street/Michigan Avenue corridors to enhance pedestrian, bicycle, and transit accessibility.

It should be noted that a developer for the site has not yet been selected and that a final program and phasing strategy has not yet been determined. Therefore, this CTR should be considered a "master plan-level" study which may need refinement once a final program and phasing strategy has been developed. The mitigation strategies recommended in this document should be considered preliminary. They represent options that a developer could implement to offset the site impacts. Further coordination between the selected developer, DDOT, WMATA, and other agencies will be required once a phasing plan has been established.

2.0 STRATEGIC PLANNING ELEMENTS

Several plans and studies were reviewed to inform the development of this CTR. Brief summaries of the plans, as well as the impact of the proposed AFRH development on the plans, are provided in the sections below.

2.1 PLANS/STUDIES REVIEWED

DC Comprehensive Plan Rock Creek East Element (2006)

The District's Comprehensive Plan is a general policy document that provides overall guidance for future planning and development of the city and its ten geographic areas. The most recent plan was approved in 2006 and amended in 2011. For the Rock Creek East area, the plan recommends the redevelopment of the Armed Forces Retirement Home property, but stresses that any improvements should consider area context, density, resource protection, and open space conservation. Any continuing redevelopment should also coordinate with other documents and update master plans as necessary.

Brookland-CUA Small Area Plan (2008)

The 2006 DC Comprehensive Plan called for a study that would "guide future development in the [Brookland/CUA Metro] station vicinity that respects the low density scale of the nearby residential area, mitigates parking and traffic impacts, and improves connections to nearby institutions and shopping areas." The Brookland/CUA Metro Station Small Area Plan was completed in 2008 through the community-based planning process to guide the growth, development, and revitalization of under-utilized areas within a quarter-mile walkshed of the Brookland/CUA Metro Station. Part of the designated walkshed includes Irving Street NE/NW and Michigan Avenue NE/NW within the study area. The plan proposes the installation of grade-separated bicycle lanes along these roadways to encourage more safe multi-modal connections. The plan also provides other recommendations and an implementation strategy to meet its goals for all stakeholders, including residents, land owners, developers, and local officials.

2005 Bicycle Master Plan

The 2005 Bicycle Master Plan is a guide to establishing high-quality bicycle facilities and programs from 2005 to 2015 through facility improvements, policy changes, and education, promotion, and enforcement. The plan shows that the following facilities currently exist on the roadway network within the study area:

1. Off-street multi-use trails and signed bicycle routes on Irving Street St NE/NW and Michigan Avenue NE/NW,
2. Signed bicycle routes on Hobart and Kenyon Streets NW, and

3. Signed bicycle routes on Park Place NW and Warder Street NW.

The plan proposes dedicated bicycle lanes on Park Place NW and Warder Street NW and bridge access improvements on Michigan Avenue NW over the Hobart Place NW/5th Street NW/Columbia Road NW interchange. However, it notes that the Armed Forces Retirement Home and MedStar Washington Hospital Center present barriers to bicycles within the study area.

2012 DDOT Bike Map, 2014 Bikeways Map, and 2014 Proposed Bike Lanes Map

These maps show that the study area roadway network has mostly fair or poor cycling conditions. Currently, there are dedicated bike lanes on Park Place NW and Warder Street NW and signed routes on Kenyon Street NW, Irving Street NW, and Gallatin Street NW/NE.

2009 Pedestrian Master Plan

The 2009 Pedestrian Master Plan serves as the foundation for DDOT's pedestrian programs and represents the first comprehensive city-wide effort to address pedestrian safety challenges and related issues. The goals of the plan are to reduce the number of pedestrian fatalities and injuries associated with motor vehicle crashes and to increase pedestrian activity by creating a comfortable and accessible environment for walking throughout all parts of the District.

Through an analysis of existing conditions, the plan identifies the study area to have medium pedestrian activity with medium, low, or not-evaluated pedestrian facility deficiencies. It also identifies New Hampshire Avenue NW as a priority corridor for curb ramp, traffic signal, and bus stop improvements. In addition, it notes multiple sidewalk gaps on one of both sides of the roadway, especially along North Capitol Street.

2014 DC Circulator Transit Development Plan

The DC Circulator is a subsidized bus system within the District that brings riders to popular attractions and the liveliest neighborhoods for business, culture, and entertainment. In 2011, DDOT published the first comprehensive transit development plan (TDP) to guide the growth of the Circulator system. This 2014 update identifies six new routes and four route extensions for the 10-year growth plan, including a connection between the Green/Yellow and Red Metro lines. This route would run through the study area and be called Columbia Heights – Washington Hospital Center – Brookland – NoMa. It should be noted that this area was also identified in the 2011 DC Circulator TDP as a recommended corridor because the Brookland-CUA Metro station is an activity center.

2013 Metrorail System Map and August 2015 Metrobus System Map

These maps show that, in general, the study area has access to transit. However, no transit connections exist for the AFRH property. The three closest Metro stations are Columbia Heights, Georgia Avenue-Petworth, and Brookland-CUA. Six major Metrobus routes (80, E4, H2, H3, H4,

and K6), four local Metrobus routes (60, 64, D8, H8), and two commuter Metrobus routes (H1 and K2), a total of 12 routes, run throughout the study area but do not have stops in proximity to AFRH.

moveDC

Published in October 2014, moveDC was a collaborative effort led by DDOT to present a vision and improvement course for the District's transportation system over the next 25 years. moveDC focuses on more travel options, reliability of transportation systems, safety for all, and efficiency of investments. The plan proposes more than 200 new miles of bicycle facilities, a 22-mile streetcar system with the possibility of extension lines, and more than 40 miles of High Capacity Transit. It also contains progress updates to the 2005 Bicycle and 2009 Pedestrian Master Plans as of December 2013.

moveDC recognizes that it is essential to maintain a balance between pedestrian, bicycle, transit, and vehicular modal activity on the City's transportation network to turn its vision into a reality. The study proposes various improvements to create this balance within the study area, including:

- Sidewalks to improve pedestrian and bicycle connections on one or both sides of the roadway,
- Cycle tracks and dedicated bike lanes to improve bicycle connections,
- High-capacity transit network to improve transit connections, and
- Lane reductions and other priority modal improvements to discourage excessive vehicular traffic.

Brookland-Edgewood Livability Study

This study, conducted as part of DDOT's Livability Program, addresses the safety problems and quality of life issues within the Brookland and Edgewood neighborhoods and recommends short-term solutions while identifying long-term opportunities. Within the study area, it proposes enhancements and improvements to pedestrian facilities along Michigan Avenue NE and Franklin Street NE, including installation of a HAWK signal at the intersection of Michigan Avenue NE and Trinity Washington University driveway, north of the Notre Dame Chapel, and completion of sidewalk connections along Michigan Avenue NE and Franklin Street NE. In addition, improvements to bicycle facilities along 4th Street NE, including a new Capital Bikeshare at Franklin Street NE and extension of bicycle lanes up to Michigan Avenue NE may contribute to better multimodal connections within the study area.

New Communities Initiatives: Park Morton

The New Communities Initiative is a District government program designed to revitalize severely distressed subsidized housing and redevelop communities plagued with concentrated poverty, high crime, and economic segregation. Park Morton, in Ward 1, is one such neighborhood. The Park Morton Redevelopment Initiative Plan proposes new and a one-for-one replacement of all

housing units within the Park Morton site, for a total of 477 homes that will support mixed-use development around the Georgia Avenue-Petworth Metro Station.

2016 DC Crosstown Multimodal Transportation Study

DDOT is currently engaged in a study to evaluate current and future transportation demand between Brookland and Columbia Heights and address existing and future project deficiencies with east-west travel across this section of the City. The purpose of the study is to identify short-term and long-term multimodal improvements to the east-west crosstown corridors in the study area. Although the planning study is still ongoing, several key recommendations are likely to impact the AFRH site, particularly along Irving Street, including a reduction in travel lanes along Irving Street, modifications to the Irving Street/Hobart Street/Michigan Avenue interchange, modifications to the Irving Street/North Capitol Street interchange, and pedestrian/bicycle facilities.

2.2 POTENTIAL IMPACT OF PROPOSED DEVELOPMENT ON PLANS

Ultimately, the redevelopment of the AFRH property would support the recommendations and findings of these planning documents and studies. The proposed development considers the character and history of the site, maintains viewsheds, and will contribute to increasing activity and walkability within the area. Proposed plans include a variety of uses that would require improvements to the transportation network (roadway, transit, and bicycle and pedestrian infrastructure) in the study area, which has been prescribed in many of the studies discussed in the previous section.

3.0 ROADWAY NETWORK, CAPACITY, & OPERATIONS

3.1 VEHICLE STUDY AREA

Although the AFRH is officially located in Ward 5 of the northwest quadrant of the District, the limits of the study area, shown in Figure 1, encompass all or part of eight neighborhoods (Fort Totten, Petworth, Pleasant Hill, Catholic University, Edgewood, Washington Hospital Center, Park - View, and Armed Forces Retirement Home), three wards (1, 4, and 5), and two quadrants (NW and NE). The area is primarily bounded by Irving Street (NW and NE) to the north, Michigan Avenue (NW and NE) to the south, North Capitol Street to the east, and Park Place NW to the west. However, it also extends in three directions to include segments of major corridors that the proposed development would affect:

- In the northerly direction along North Capitol Street to New Hampshire Avenue,
- In the easterly direction along Irving Street to the intersection with Michigan Avenue NE, and
- In the westerly direction along Columbia Road NW to the intersection with Warder Street NW.

Characteristics of the major corridors within the study area were obtained from maps on the DDOT website denoting functional classification, 2013 AADT, number of lanes, speed limits, and truck routes/loading zones. This information is summarized in Table 1. It should be noted that parking is prohibited on all roadways within the study area except Park Place NW, Michigan Avenue NE (off-peak between North Capitol Street NE and Irving Street NE), and North Capitol Street NW/NE (off-peak north of Rock Creek Church Road).

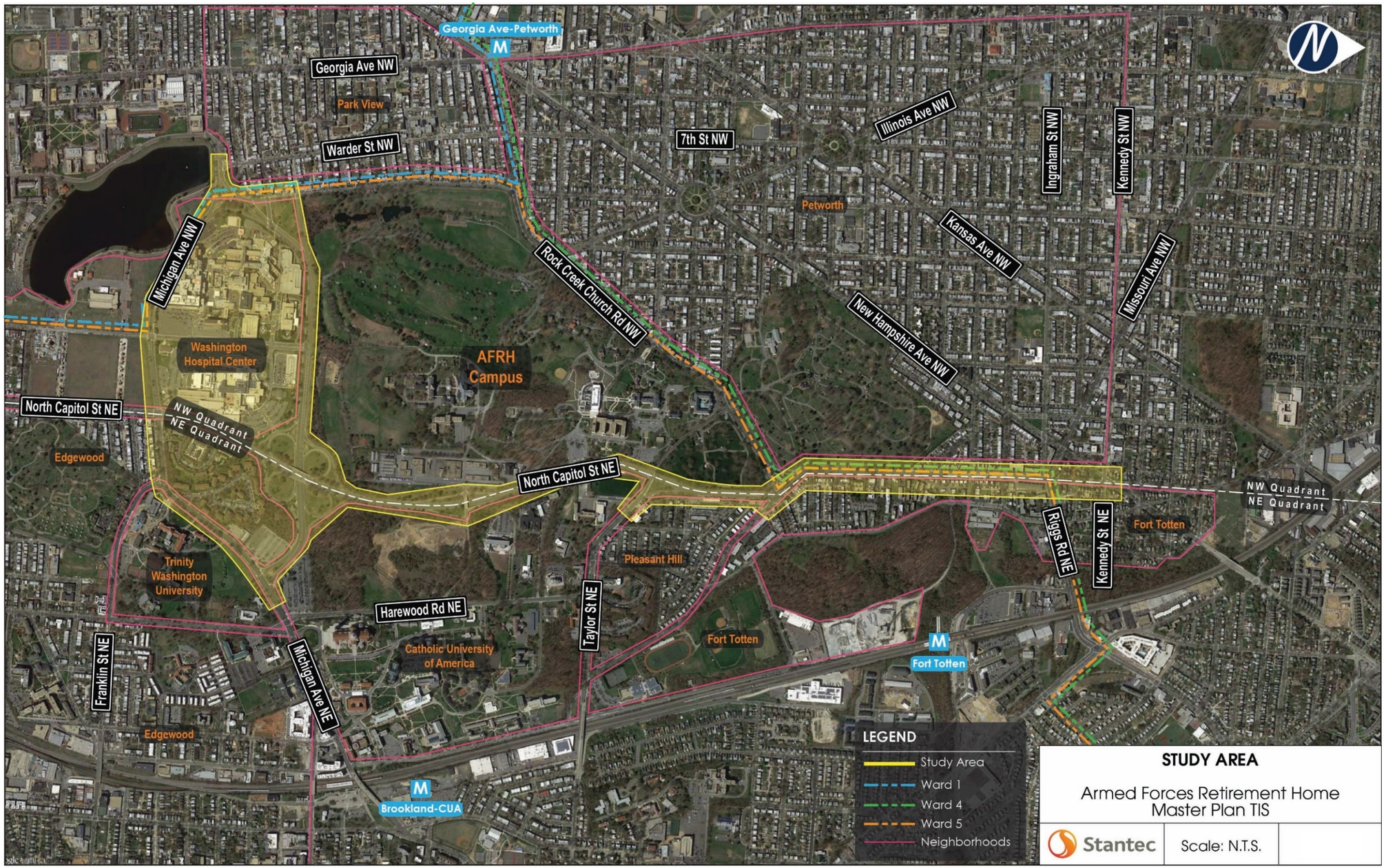


Figure 1: Armed Forces Retirement Home Master Plan TIS Study Area

Table 1: Study Area Major Corridor Characteristics

Roadway	Functional Class	2013 AADT	Number of Lanes, Median	Speed Limit (mph)	Primary Truck Route/Designated Loading Zones?
North Capitol Street	Principal Arterial	37.6/38.4/45.1	5, None 6, Grass	25/30	Yes/No
New Hampshire Avenue NW	Principal Arterial	13.6	4, None	30	Yes/No
New Hampshire Avenue NE	Minor Arterial	18.8	4, None	25	Yes/No
Kennedy Street NW	Collector	4.5	2, None	25	No/No
Missouri Avenue NW	Principal Arterial	27.2	4, None	25	Yes/No
Riggs Road NE	Principal Arterial	26.3	4, None	25	Yes/No
Hawaii Avenue NE	Collector	6.3	2, None	25	No/No
Rock Creek Church Road NW	Collector	3.5	3, None	25	No/No
Harewood Drive NW	Collector	4.5	2, One Way, None	25	No/No
Fort Drive NE	Minor Arterial	10.8	4, None	25	No/No
Scale Gate Road	Local	-	2, None	25	No/No
Irving Street (NW and NE)	Minor Arterial	7.3/28/19.7	6, Grass	25	Yes/No
Michigan Avenue (NW and NE)	Minor Arterial	27/22.1	4-6, None	25	Yes/No
Franklin Street NE	Minor Arterial	12	2, None	25	No/No
First Street NW	Collector	-	4, Grass/Concrete	25	No/No
Columbia Road NW	Minor Arterial	3	1, None	25	No/No
Hobart Place NW	Minor Arterial	7.3	2, Grass	25	No/No
Warder Street NW	Collector	5.3	1, None	25	No/No
Park Place NW	Minor Arterial	7.1	1, None	25	No/No
Kenyon Street NW	Minor Arterial	-	1, None	25	No/No

3.2 DATA COLLECTION AND HOURS OF ANALYSIS

Stantec conducted a comprehensive data collection program to establish "average day" baseline conditions for vehicular, transit, pedestrian, and cyclist traffic within the study area. The program consisted of automatic traffic recorder counts, manual turning movement counts, and queuing observations. All data were collected on typical weekdays when District schools and Congress were in session.

3.2.1 Automatic Traffic Recorder Counts

Automatic traffic recorder (ATR) counts were collected on Tuesday, June 2, 2015 for 24 consecutive hours at the North Capitol Street and Irving Street, North Capitol Street and Scale Gate Road, and Michigan Avenue NW/Columbia Road NW and Hobart Place NW interchanges. Appendix C contains the count location map and the raw count data. Volume for ramps that did not have an ATR was calculated by balancing the volumes between the count locations.

3.2.2 Turning Movement Counts

Manual turning movement counts were collected during the AM peak period (7:00AM – 10:00AM) and PM peak period (4:00PM – 7:00PM) at the following 14 intersections during the first two weeks of June 2015 while schools were still in session:

1. North Capitol Street and New Hampshire Avenue (NW/NE) and Kennedy Street NW
2. North Capitol Street and Missouri Avenue NW/Riggs Road NE
3. North Capitol Street and Hawaii Avenue NE/Rock Creek Church Road NW
4. Clermont Drive and Hawaii Avenue NE/Allison Street NE
5. North Capitol Street/Clermont Drive and Harewood Road NW/Fort Drive NE
6. North Capitol Street and Michigan Avenue (NW/NE)
7. Michigan Avenue NE and Franklin Street NE
8. Michigan Avenue NE and Irving Street NE
9. Irving Street NW and First Street NW
10. Kenyon Street NW and Park Place NW
11. Park Place NW and Irving Street
12. Irving Street NW and Hobart Place NW
13. Warder Street NW and Columbia Road NW/Michigan Avenue NW
14. Michigan Avenue NW and First Street NW

Appendix C contains the raw count data. An analysis of the data revealed that the individual intersection AM and PM peak period hours varied throughout the study area. To be conservative, individual peaks were utilized. Volumes were balanced between intersections where appropriate.

3.2.3 Queuing

Queuing observations were conducted on Wednesday, November 18, 2015 in order to determine if additional unmet demand would need to be considered in the traffic analysis. According to *moveDC*, queuing is prevalent within the study area, especially during the PM peak period in the northern portion where North Capitol Street intersects Missouri Avenue NW/Riggs Road NE, New Hampshire Avenue, and Kennedy Street NW. Table 2 summarizes where queuing issues were observed during each peak period and reflects the approaches for which additional unmet demand volume was added. The final 2015 Existing Condition AM and PM peak hour volume diagrams are contained in Exhibits 2 and 3 in Appendix A.

Table 2: Observed Queuing

Intersection	Approach	Peak Period
Irving Street NW & First Street NW	Irving Street NW WB	AM
North Capitol Street NE & Michigan Avenue NE	North Capitol Street NB	AM
Irving Street NE & Michigan Avenue NE	Irving Street NE EB Michigan Avenue NE NB	PM
North Capitol Street & Michigan Avenue NE	Michigan Avenue EB North Capitol Street NB	PM
Clermont Drive & Hawaii Avenue	Clermont Drive NB Hawaii Avenue WB	AM & PM AM
North Capitol Street & New Hampshire Avenue NW	New Hampshire Avenue SWB Kennedy Street EB	AM & PM PM
North Capitol Street and Missouri Avenue NW/Riggs Road NE	Missouri Avenue NW North Capitol Street NB Riggs Road NE WB,	AM & PM
North Capitol Street & Harewood Road NW	Harewood Road WB Harewood Road EB	AM PM

Appendix C contains the queue observation data.

3.3 ANALYSIS METHODOLOGY

3.3.1 Merge, Diverge, and Weaving Ramp Segments

The capacity analyses conducted for the merge, diverge, and weaving ramp segments at the North Capitol Street interchanges with Irving Street (NW and NE) and Scale Gate Road was conducted utilizing Highway Capacity Software (HCS) 2010. Levels of service (LOS) for merge/diverge and weaving segments is defined in terms of density for all cases of stable operation (LOS A-E). When LOS F exists, queues form on both the ramp and main line freeway as demand exceeds capacity. Table 3 lists the criteria and description for each level of service.

Table 3: Merge, Diverge, and Weaving Segments LOS Criteria

LOS	Density (pc/mi/ln)	Description
A	≤10	Unrestricted operations
B	>10-20	Maneuvers noticeable to drivers
C	>20-28	Decline of influence area speeds
D	>28-35	Intruding influence area turbulence
E	>35	Turbulence felt by all drivers
F	Demand exceeds capacity	Ramp and freeway queues form

Source: 2010 Highway Capacity Manual

3.3.2 Signalized and Unsignalized Intersections

While both ramp junctions and weaving segments used HCS 2010 for analysis, capacity analyses performed for the signalized and unsignalized intersections in the study area used Synchro 9 traffic analysis software. This software package provides average control delay, queues, and level of service (LOS) for each lane group and for the overall intersection. LOS is an evaluation of the quality of operation of an intersection and is a measure of the average delay a driver experiences while traveling through the intersection. LOS is dependent upon a range of defined operating conditions such as traffic demand, lane geometry, and traffic signal timing and phasing.

Utilizing Synchro instead of the more basic Highway Capacity Software (HCS) is preferable for transportation networks with a series of closely-spaced signalized intersections, as well as for networks with complex intersections with more than four legs, such as those within the study area. Under these conditions, Synchro is able to more accurately model the effects that the traffic operations (such as poor LOS or extensive queuing) at one intersection have on operations at an adjacent intersection.

LOS can range from A to F and is based on the average control delay per vehicle. For a signalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay in excess of 80 seconds per vehicle at signalized intersections and 50 seconds per vehicle at unsignalized intersections, or a v/c ratio greater than 1.0. Table 4 summarizes the 2010 HCM delay criteria for signalized and unsignalized intersections.

Table 4: LOS Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	
	Signalized	**Unsignalized**
A	≤ 10.0	≤ 10.0
B	> 10.0 and ≤ 20.0	> 10.0 and ≤ 15.0
C	> 20.0 and ≤ 35.0	> 15.0 and ≤ 25.0
D	> 35.0 and ≤ 55.0	> 25.0 and ≤ 35.0
E	> 55.0 and ≤ 80.0	> 35.0 and ≤ 50.0
F	> 80.0 or v/c > 1.0	>50.0 or v/c>1.00

Source: *2010 Highway Capacity Manual*

While LOS D or better operations are generally deemed satisfactory from a traffic operations perspective, LOS E or F operations are often indicative of queuing and congestion. Improvements as recommended in this study seek to maintain or improve traffic operations to LOS D or better, with minimal queuing, as reported by Synchro.

Signal plans and timing directives were provided by DDOT and were field-verified in order to accurately model signal operation type, phasing, detection, and cycle length.

3.4 DEVELOPMENT SCENARIOS

3.4.1 2015 Existing Condition

2015 Existing Condition volumes for the AM and PM peak hours, shown in Figures 2 and 3 (and Exhibits 2 and 3 in Appendix A), were modeled in HCS 2010 and Synchro 9 to produce capacity analysis results, summarized in Exhibits 4 and 5 in Appendix A. All HCS and Synchro capacity analysis outputs are available upon request.

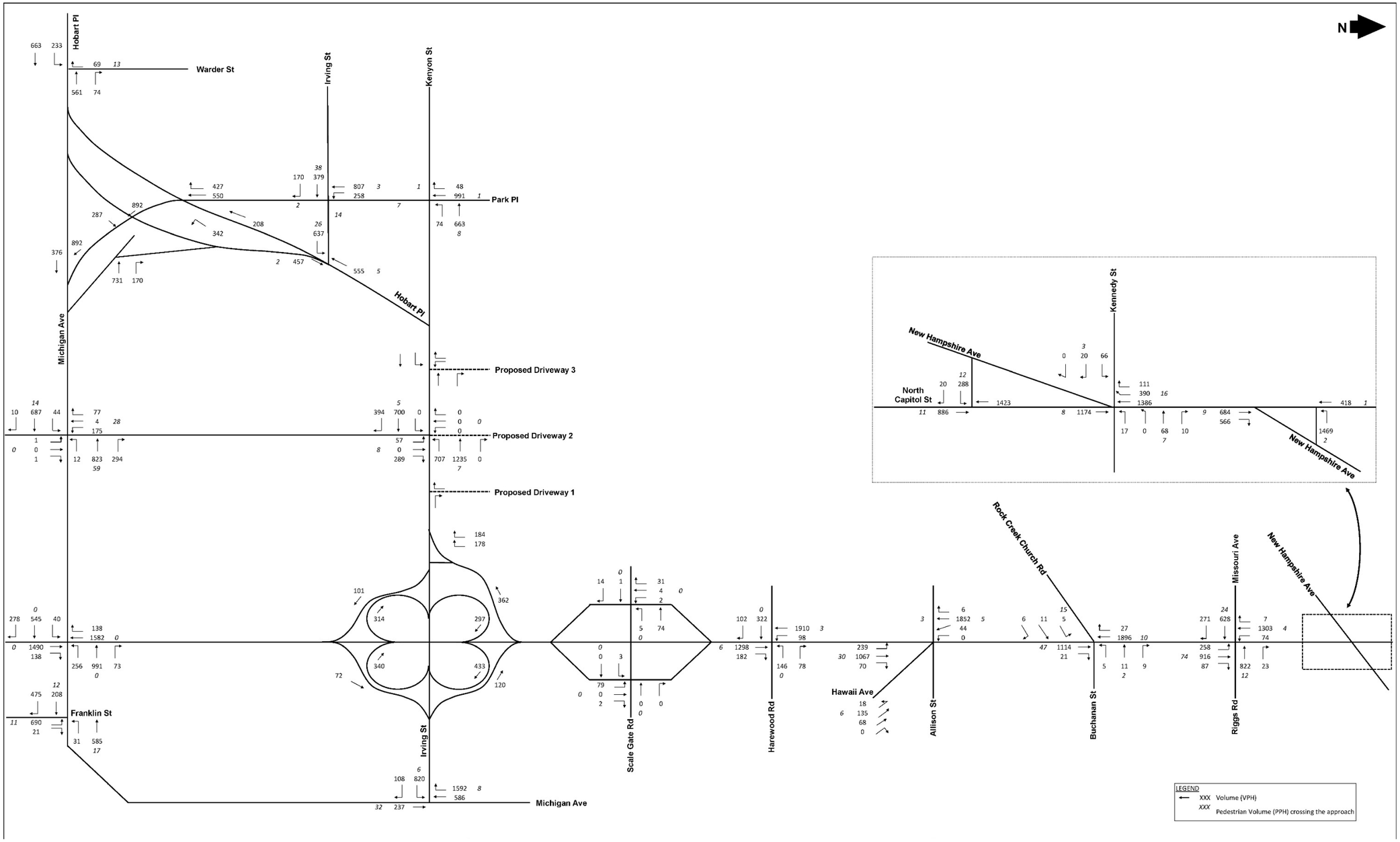


Figure 2: 2015 Existing Condition Volumes – AM Peak Hour

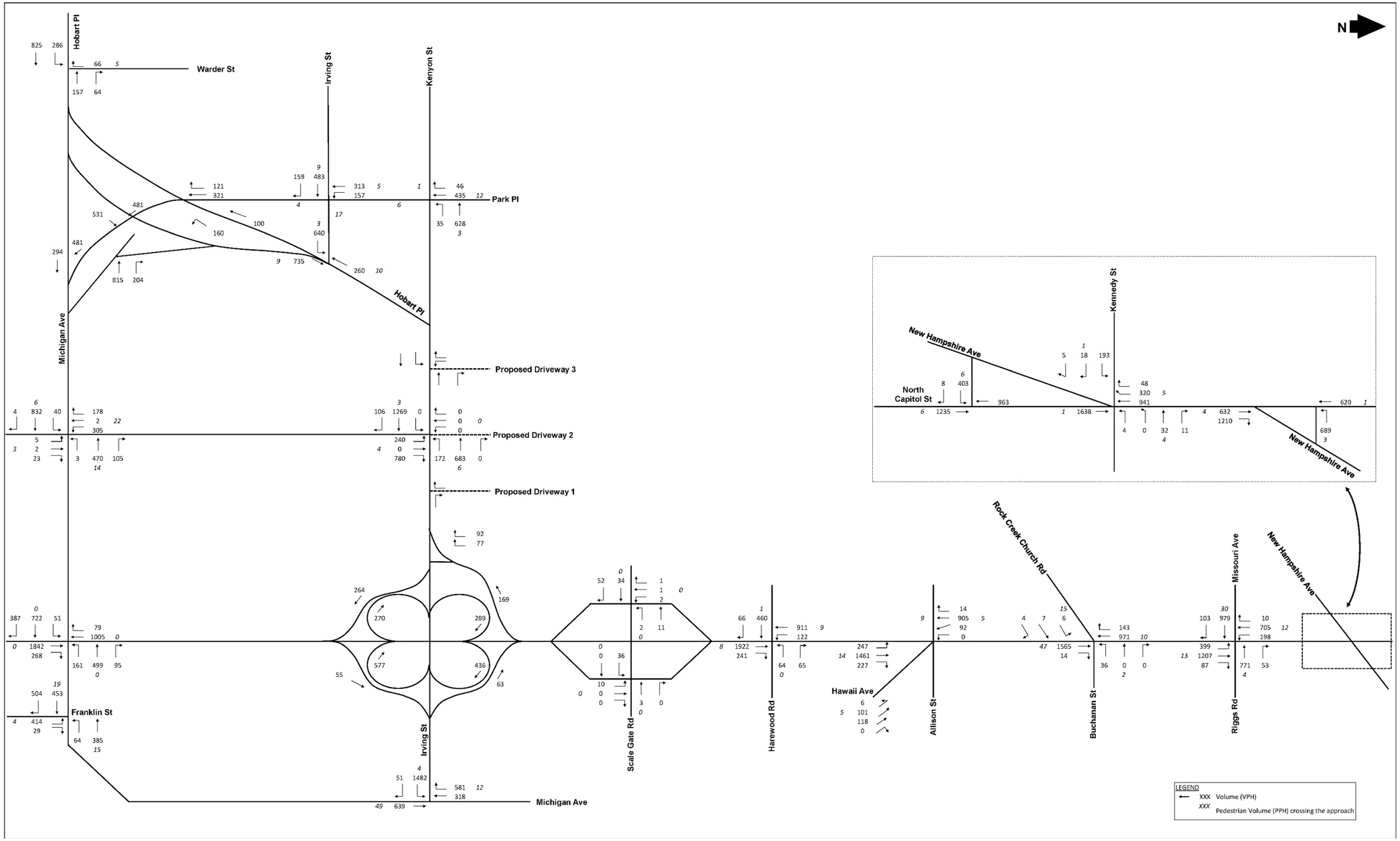


Figure 3: 2015 Existing Condition Volumes – PM Peak Hour

The results show that all intersections currently operate at an overall LOS D or better. Table 5 below indicates the intersections that operate at an overall LOS of E or F (failing condition).

Table 5: 2015 Existing Condition Intersections Operating at Overall LOS E or F

Intersection	2015 Existing Condition	
	AM	PM
North Capitol Street and New Hampshire Avenue NW	F	E
North Capitol Street and Hawaii Avenue NE/Allison Street NE	F	E
North Capitol Street and Harewood Road NW	-	E
Ramp to Michigan Avenue NW and Hobart Place NW	E	F

The results of the HCS capacity analysis are shown in Exhibit 5 and indicate that all ramp merge, diverge, and weave segments at the North Capitol Street/Irving Street and North Capitol Street/Scale Gate Road interchanges operate at LOS B or better in both peak hours.

3.4.1.1 V/C Evaluation

In addition to LOS, volume-to-capacity (v/c) ratios are used to evaluate mobility and quality of travel on a roadway or segment of roadway. They compare demand (volume) with supply (capacity) and are expressed as a decimal, usually less than 1.00. A v/c ratio at or above 1.00 indicates that the roadway is operating at or above capacity.

The table presented in Chapter 45, Section 45.4(3) of the DDOT Design and Engineering Manual (DEM) shows the threshold capacity for different arterial designations, from local residential roadway to major arterial. Stantec used this table, the official DDOT Traffic Volume Map 2013, and the official DDOT Functional Classification Map provided on the DDOT website to estimate the current volume/capacity ratio for all roadways within the study area. Table 6 lists these ratios and highlights those that are above 1.00.

Table 6: v/c Ratio for Study Area Roadways

Roadway	Functional Class	2013 AADT	Threshold Capacity	v/c Ratio
North Capitol Street, north of Hawaii Avenue NE	**Principal Arterial**	**45,100**	**45,000**	**1.00**
New Hampshire Avenue NW	Principal Arterial	13,600	30,000	0.45
New Hampshire Avenue NE	Minor Arterial	18,800	20,000	0.94
Kennedy Street NW	Collector	4,500	10,000	0.45
Missouri Avenue NW	Principal Arterial	27,200	30,000	0.91
Riggs Road NE	Principal Arterial	26,300	30,000	0.88
Hawaii Avenue NE	Collector	6,300	20,000	0.32
Rock Creek Church Road NW	Collector	3,500	10,000	0.35
Clermont Drive	Principal Arterial	38,400	45,000	0.85
Harewood Drive NW	Collector	4,500	10,000	0.45
Fort Drive NE	**Minor Arterial**	**10,800**	**10,000**	**1.08**
Scale Gate Road	Local Non-Residential	N/A	2,500	N/A
Irving Street NW	**Minor Arterial**	**28,000**	**20,000**	**1.40**
Irving Street NE	Minor Arterial	19,700	20,000	0.99
Irving Street NW, east of Hobart Place NW	Minor Arterial	7,300	20,000	0.37
North Capitol Street, south of Fort Drive NE	Principal Arterial	37,600	45,000	0.84
Michigan Avenue NW	**Minor Arterial**	**27,000**	**20,000**	**1.35**
Michigan Avenue NE	**Minor Arterial**	**22,100**	**20,000**	**1.10**
Franklin Street NE	Minor Arterial	12,000	20,000	0.60
First Street NW	Collector	8,700	20,000	0.44
Hobart Place NW	Minor Arterial	7,300	20,000	0.37
Warder Street NW (one-way)	**Collector**	**5,300**	**5,000**	**1.06**
Park Place NW (one-way)	Minor Arterial	7.1	10,000	0.71
Kenyon Street NW (one-way)	Minor Arterial	N/A	10,000	N/A

3.4.2 2045 Background/No Build Condition

The selected horizon year of 2045 corresponds to the horizon year identified in the Draft EIS. Stantec obtained forecast data from the Metropolitan Washington Council of Governments (MWCOG) model to determine the background growth factor. This model uses future population and employment projections that reflect a regional perspective on growth and development. In addition to background growth, DDOT identified several nearby redevelopment projects that would likely impact traffic within the study area. Stantec reviewed

other studies and master plans for proposed developments that are expected to have an impact on traffic volumes in the study area. These include:

- Catholic University of America Master Plan
- Catholic University of America South Campus Redevelopment
- VA Medical Center Master Plan
- 818 Michigan Avenue
- McMillian Sand Filtration Site
- Howard University Campus Master Plan
- Michigan at Irving PUD

The MWCOG model includes many of the redevelopment sites within the study area, including the AFRH, thus a growth rate estimate generated by the model, when combined with the site-specific information, would likely result in an over-inflated future traffic volumes. In order to account for the developments that are contained within the model, Stantec removed additional model inputs for traffic analysis zones (TAZs) that contain the developments. Utilizing this methodology, a revised annual growth rate of 0.3% was calculated between 2015 and 2045 (30 years).

Base background growth volumes were combined with the trip generation, trip distribution, and corresponding mode splits obtained from site-specific development reports. Exhibits 1 through 18 in Appendix B show how all anticipated development trips were distributed through the existing roadway network.

Project background growth volumes and development volumes were summed to obtain 2045 Background/No Build Condition volumes for the AM and PM peak hours, shown in Figures 4 and 5 (and Exhibits 6 and 7 in Appendix A). These volumes were modeled in HCS 2010 and Synchro 9 to produce capacity analysis results, summarized in Exhibits 8 through 9 in Appendix A. These models also included all proposed signalized intersections and roadway improvements recommended in the transportation impact studies for the above-referenced development. In addition, signal timing and coordination was optimized across the study area roadway network because it was assumed that signal operations would be updated before 2045.

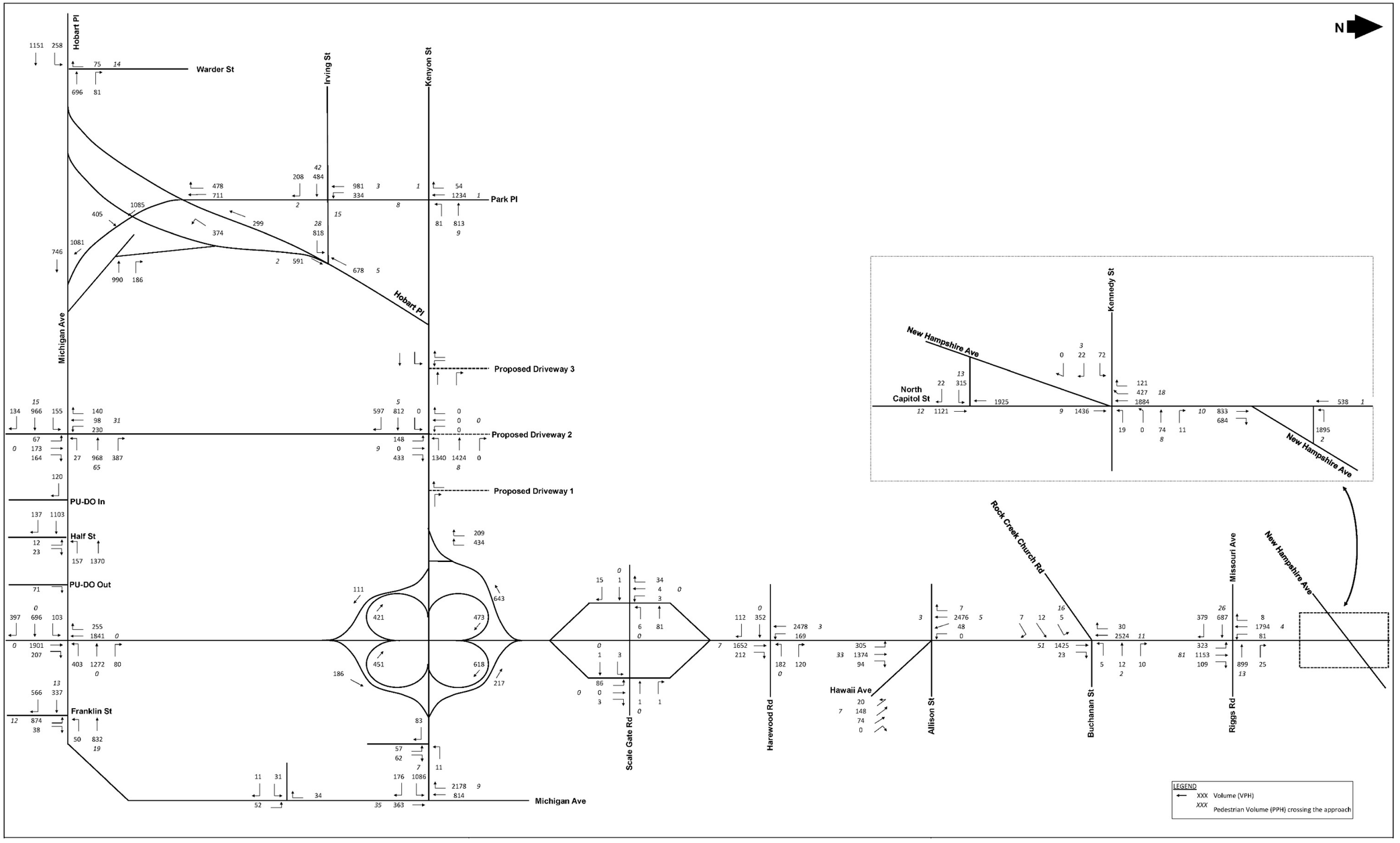


Figure 4: 2045 No Build Condition Volumes – AM Peak Hour

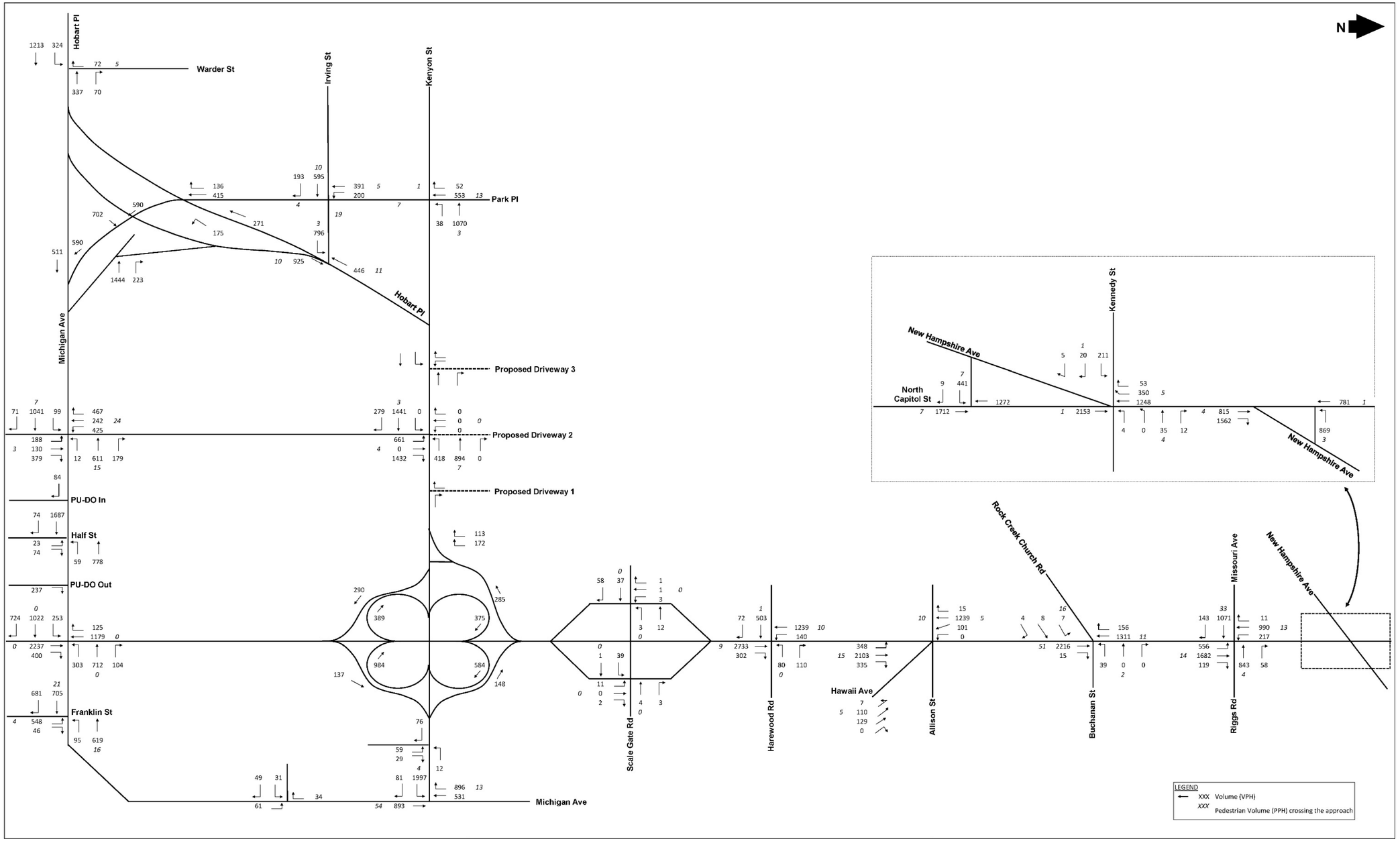


Figure 5: 2045 No Build Condition Volumes – PM Peak Hour

The results of the capacity analysis indicate that the North Capitol Street corridor, as well as the Michigan Avenue/Hobart Street interchange area would experience significant increases in delay and queuing. All study area intersections would operate at an overall LOS D or better, except for the intersections shown in Table 7.

Table 7: 2045 No Build Condition Intersections Operating at Overall LOS E or F

Intersection	2015 Existing Condition		2045 No Build Condition	
	AM	PM	AM	PM
North Capitol Street and New Hampshire Avenue NE	-	-	F	-
North Capitol Street and New Hampshire Avenue NW	F	E	F	F
North Capitol Street and Riggs Road NE	-	-	F	F
North Capitol Street and Rock Creek Church Road NW and Buchanan Street NE	-	-	-	E
North Capitol Street and Hawaii Avenue NE/Allison Street NE	F	E	F	F
North Capitol Street and Harewood Road NE	-	-	-	E
North Capitol Street and Harewood Road NW	-	E	E	F
Irving Street NW and First Street NW	-	-	-	E
Hobart Place NW and Park Place NW	-	-	F	-
Ramp to Michigan Avenue NW and Hobart Place NW	E	F	F	F
Michigan Avenue NW and First Street NW	-	-	E	E
Michigan Avenue and North Capitol Street	-	-	F	F

The results of the HCS capacity analysis are shown in Exhibit 9 and indicate that all ramp merge, diverge, and weave segments at the North Capitol Street/Irving Street and North Capitol Street/Scale Gate Road interchanges would operate at LOS C or better in both peak hours.

3.4.3 2045 Future Build Condition

3.4.3.1 Site Access

Access to the site via the AFRH campus would be prohibited by a security barrier. Exhibit 10 in Appendix A shows that the proposed mixed-use development would be accessed via four driveways, including the reactivation of two former entries on Irving Street NW and Scale Gate Road and the construction of two new driveways on Irving Street NW. Because the project is in preliminary planning stages, the locations of the two new driveways on Irving Street NW are approximate at this time. Therefore, loading areas and access, modal conflicts, internal access, and sight distances are not known. Table 8 lists the known details of each access point.

Table 8: Proposed Site Access Points

Access		Existing Curb Cuts		Proposed Curb Cuts	
Location	**Control**	**Utilized**	**Abandoned**	**Proposed**	**Width & Radii**
Irving Street NW & Site Driveway (East of First Street NW)	Right-in/ Right-out	No	None	TBD	TBD
Irving Street NW & First Street NW	Signal	Reactivate Former Entry	None	TBD	TBD
Irving Street NW & Site Driveway (West of First Street NW)	TBD	No	None	TBD	TBD
North Capitol Street & Scale Gate Road	Diamond Interchange with Stop-Controlled Ramps	Reactivate Former Entry	None	TBD	TBD

3.4.3.2 Trip Generation, Distribution, and Assignment

3.4.3.2.1 Trip Generation

The site is expected to be fully developed by 2045 with a mix of uses including residential condominiums and apartments, general and medical offices, retail, assisted living, and hotel and conference center. Stantec used the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 9th ed. to estimate the total number of trips that would be generated by each use, as shown in Table 10. It should be noted that because the project is in the preliminary phase, only general square footages are available. Stantec assumed the number of residential units, assisted living beds, and hotel rooms based on a comparison of square footages for residential, assisted living, and hotel rooms in the general area. The actual square footage, number of units, and land use may change as the project progresses.

Typically, initial trip generation estimates assume that all trips to the site are new auto trips. However, many developments can claim a reduction or "credit" in new trips for pass-by trips and trips made by alternative modes, such as transit, walking, or bicycling. ITE defines pass-by trips as those trips that are made as intermediate stops on the way from an origin to a primary trip destination without a route diversion, and are calculated for retail uses only. Using the ITE Trip Generation Manual *User Guide and Handbook*, 9th ed., Stantec determined that a 30% retail pass-by rate was applicable to this site during the PM peak hour. This means that of the total number of site-generated trips, 30% would already be on the roadway network during the PM peak hour.

Another credit can be claimed for trips that will be made by modes other than driving, including transit, bicycle, and walking. A non-auto driver mode split for the general and medical offices

and institutional uses was calculated utilizing the 2005 Development Related Ridership Survey by WMATA (Table 9). A non-auto driver mode split for residential uses was calculated utilizing Census Transportation Planning Package (CTPP) data for census tracts 23.01 ad 23.02 (Table 9) (raw data is included in Appendix D).

It was discussed at an August 2015 meeting with DDOT that the mode splits shown in Table 9 are not currently feasible due to the lack of transit service and pedestrian/bicycle infrastructure and isolated nature of the site. Instead, these splits would be considered targets and enhancements to transit and pedestrian/bicycle infrastructure should be explored. Stantec prepared a technical memorandum entitled "Armed Forces Retirement Home Master Plan – Preliminary Assessment of Potential Transportation Improvements" (Appendix D) that discusses the potential transportation enhancement measures to meet these targets. Further discussion of potential pedestrian/bicycle and transit enhancements are contained in Sections 4 and 5, respectively.

Table 9: Targeted Mode Splits

Mode	Split – Office/Medical Office/Institutional/Retail	Split – Residential
Auto	75%	63%
Bus	9%	12%
Metro	10%	21%
Walk/Bike/Other	6%	4%

Table 10: Mixed-Use Development (Zone A) Trip Generation (With Trip Credits)

Land Use	ITE LUC	Quantity	Methodology	AM			PM		
				In	Out	Total	In	Out	Total
Residential Apartments	220	2,280,477 SF 2,280 Units*	Equation	224	897	1,121	827	445	1272
Non-Auto Trip Credit (37%)				83	332	415	306	165	471
Subtotal New Residential Vehicle Trips				**141**	**565**	**706**	**521**	**280**	**801**
Office	710	1,191,391 SF	Equation	1,222	167	1,389	240	1,173	1,413
Medical Office	720	290,650 SF	Average Rate/ Equation	549	146	695	213	548	761
Subtotal Office				1,771	313	2,084	453	1,721	2,174
Non-Auto Trip Credit (25%)				443	78	521	113	430	543
Subtotal New Office Vehicle Trips				**1,328**	**235**	**1,563**	**340**	**1,291**	**1,631**
Retail	820	264,086 SF	Equation	175	107	282	551	597	1,148
Assisted Living	254	214,000 SF 285 Rooms	Average Rate	26	14	40	59	75	134
Hotel	310	126,391 SF 235 Rooms	Average Rate	73	52	125	72	69	141
Heating Plant (Retail)	820	40,798 SF	Equation	56	34	90	158	171	329
Subtotal New Vehicle Trips				**1,799**	**1,007**	**2,806**	**1,701**	**2,483**	**4,184**
30% Retail Pass-By (from ITE Trip Generation Manual User Guide)				0	0	0	222	222	443
Total				**1,799**	**1,007**	**2,806**	**1,479**	**2,261**	**3,741**

*Assume 1,000 SF per unit based on assessment of nearby proposed development.
**Heating plant assumed as retail, to be conservative.

The two credits were applied to the initial trip generation rates to calculate the total number of new vehicle trips that are expected to access the development (Table 10). A total (both ingress and egress) of 2,806 vehicle trips are expected in the AM peak hour and 3,741 vehicle trips are expected in the PM peak hour.

3.4.3.2.2 Trip Distribution

Stantec obtained origin and destination trip tables from the MWCOG regional travel demand model for the 2040 horizon year. The trip tables were utilized to estimate the distribution of trips on the various ingress and egress points within the study area by peak period, assuming that trip distribution would not be altered significantly between 2040 (the model horizon year) and 2045 (the Master Plan horizon year). The distribution at intersections was calculated using the regional model results with modifications based on peak hour volumes. It should also be noted that non-

auto modes were distributed as pedestrians on the network to show activity to/from existing transit stops. Appendix D contains data supporting the distribution.

3.4.3.2.3 Trip Assignment

Stantec assigned the generated trips to the study area network based on the trip distribution discussed in Section 3.4.3.1.2. The trip assignments include vehicle and pedestrian trips only, and take credits for pass-by and alternative mode trips. These volumes were added to the 2045 No Build Condition volumes to obtain 2045 Future Build Condition Volumes. Exhibits 11 through 15 in Appendix A graphically show the AM and PM peak hour trip distribution.

3.4.3.3 Mitigation Scenarios

The total site trips were added to the 2045 No Build Condition traffic volumes to generate 2045 Build Condition traffic volumes (Figures 6 and 7 in this report and Exhibits 16 and 17 in Appendix A). Two mitigation scenarios were examined to determine the extent of improvements needed on the roadway network to accommodate the proposed traffic: 2045 Future Build Condition without and with Mitigation. The 2045 Future Build Condition without Mitigation includes roadway improvements proposed for other developments, site access, and an overall signal timing optimization throughout the study area. The 2045 Future Build Condition with Mitigation includes without Mitigation improvements and additional geometric roadway improvements that seek to alleviate congestion within the study area due to site-generated traffic.

3.4.3.3.1 Without Mitigation

The 2045 Future Build Condition without Mitigation scenario consists of proposed roadway network improvements as needed for other proposed developments, site access points, and an overall signal timing optimization throughout the study area. Stantec modeled this scenario in HCS 2010 and Synchro 9 to obtain capacity analysis results (Exhibit 18 in Appendix A). The HCS and Synchro capacity analysis outputs are available upon request. Based on the results of the capacity analysis, all study area intersections would operate at an overall LOS D or better, except for the intersections listed in Table 11.

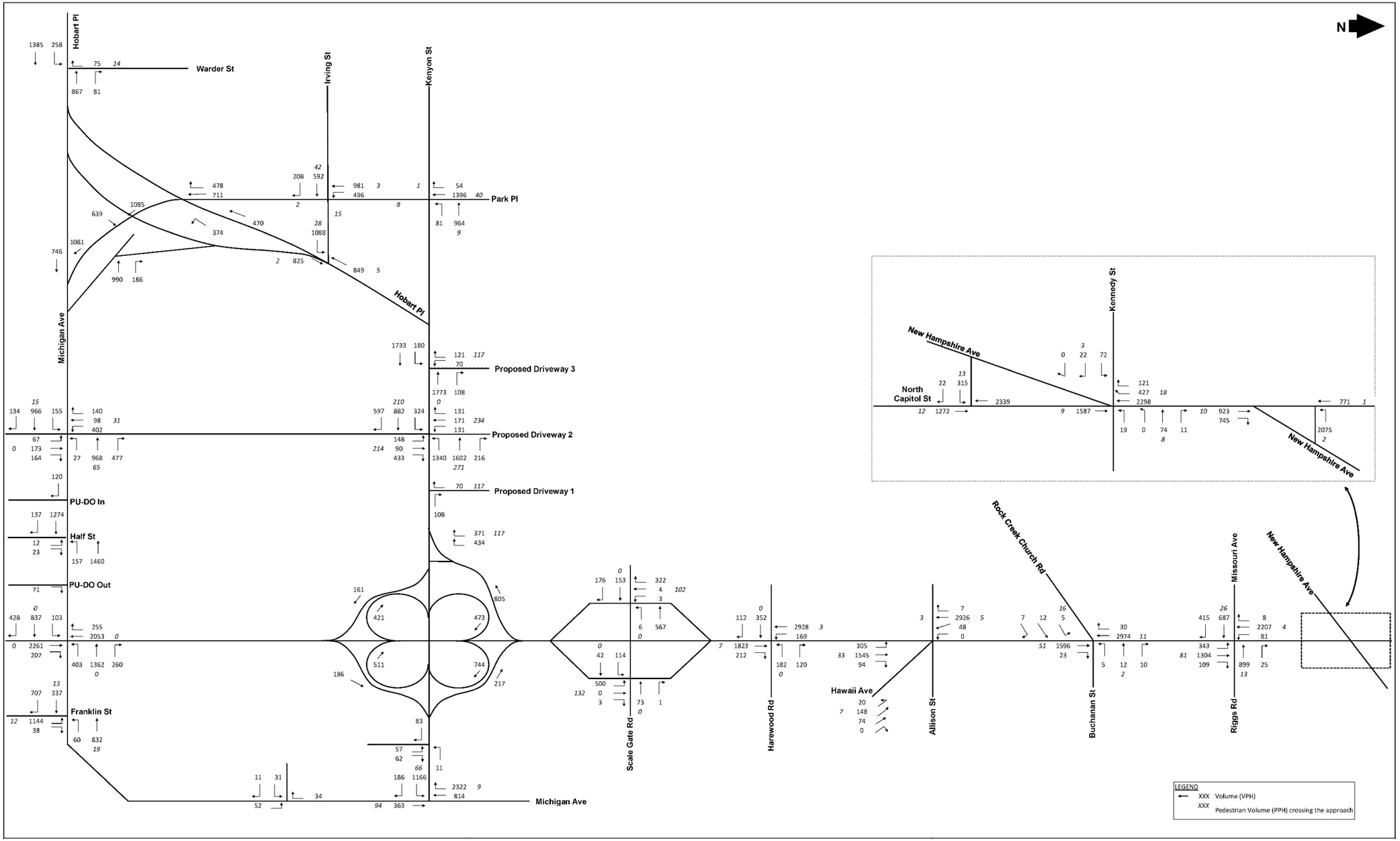


Figure 6: 2045 Build Condition Volumes – AM Peak Hour

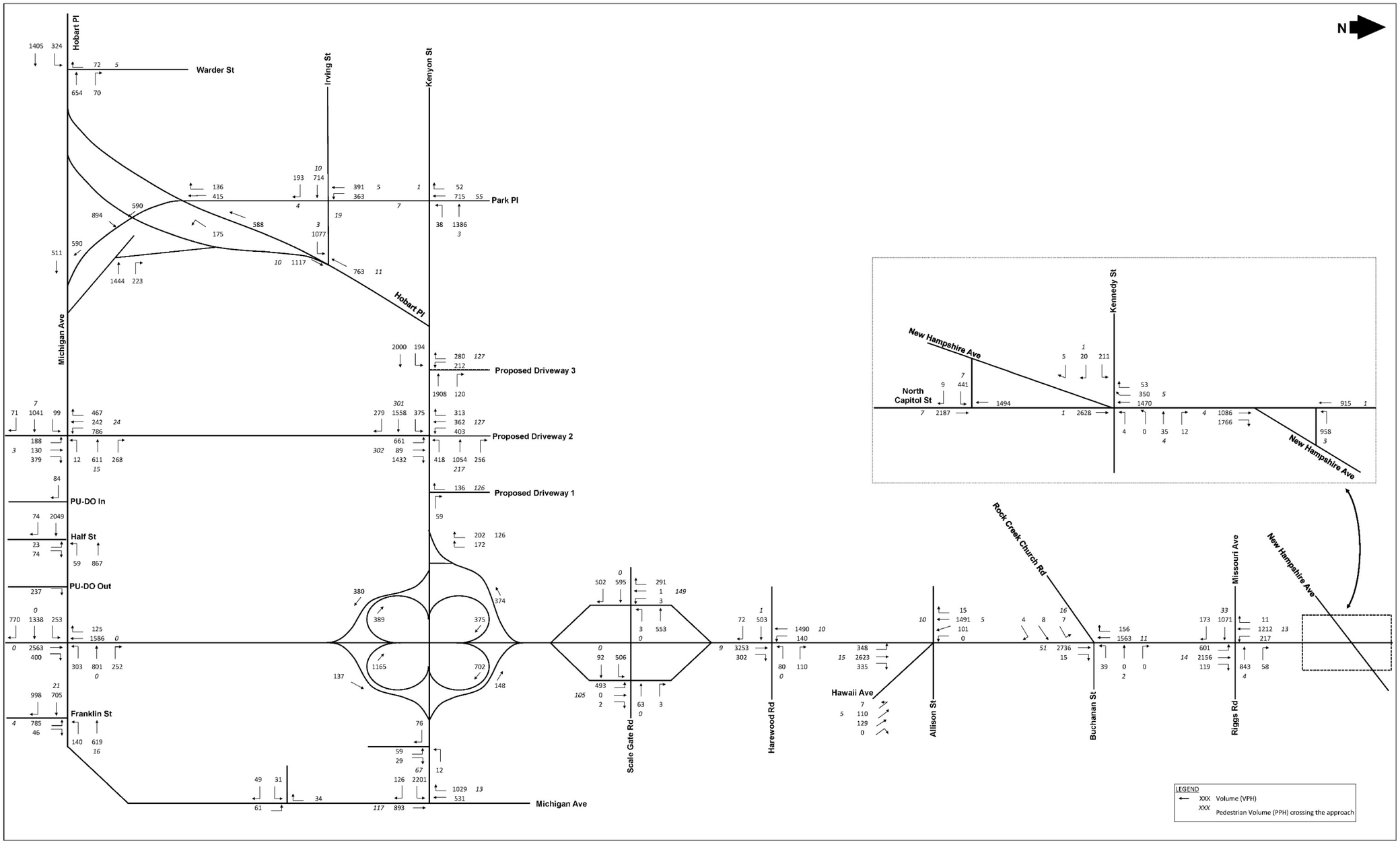


Figure 7: 2045 Build Condition Volumes – PM Peak Hour

Table 11: 2045 Build without Mitigation Intersections Operating at Overall LOS E or F

Intersection	2045 No Build Condition		2045 Build without Mitigation	
	AM	PM	AM	PM
North Capitol Street and New Hampshire Avenue NE	F	-	F	E
North Capitol Street and Kennedy Street	-	-	E	E
North Capitol Street and New Hampshire Avenue NW	F	F	F	F
North Capitol Street and Riggs Road NE	F	F	F	F
North Capitol Street and Rock Creek Church Road NW and Buchanan Street NE	-	E	E	F
North Capitol Street and Hawaii Avenue NE/Allison Street NE	F	F	F	F
North Capitol Street and Harewood Road NE	-	E	-	F
North Capitol Street and Harewood Road NW	E	F	F	F
North Capitol Street SB Ramps and Scale Gate Road	-	-	F	-
North Capitol Street NB Ramps and Scale Gate Road	-	-	F	F
Irving Street NW and First Street NW	-	E	E	F
Hobart Place NW and Park Place NW	F	-	F	F
Ramp to Michigan Avenue NW and Hobart Place NW	F	F	F	F
Michigan Avenue NW and First Street NW	E	E	F	F
Michigan Avenue and North Capitol Street	F	F	F	F

The results of the HCS capacity analysis are shown in Exhibit 9 in Appendix A and indicate that all ramp merge, diverge, and weave segments at the North Capitol Street/Irving Street and North Capitol Street/Scale Gate Road interchanges would operate at LOS C or better in both peak hours.

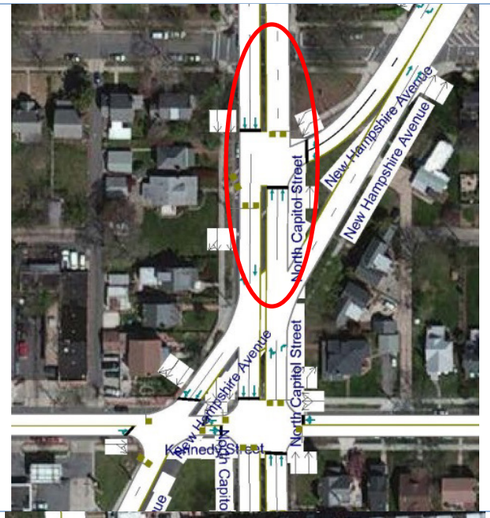
3.4.3.3.2 With Mitigation

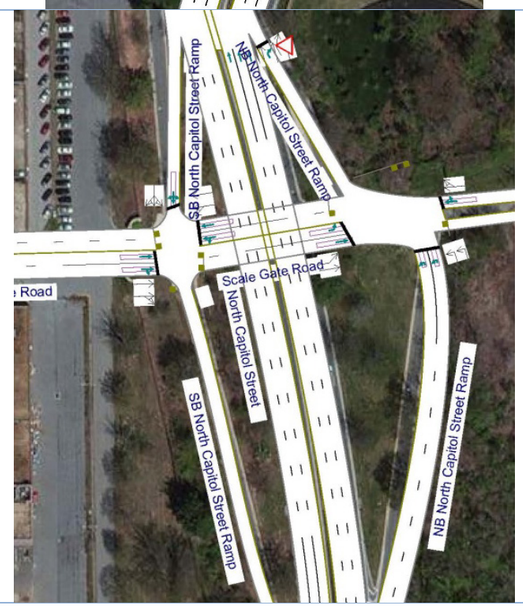
DDOT requires that mitigation be provided for intersections that experience an overall increase in delay of more than five seconds per vehicle. However, since the study area roadway network experiences significant congestion in the 2045 No Build Condition, any additional trips added to the network would result in an exponential increase delay, and would likely require mitigation measures, such as additional travel lanes, that would not be appropriate or desirable for the study area transportation network. Therefore, Stantec developed and evaluated mitigation measures that would address the additional intersection delay while considering multi-modal transportation needs and potential ROW impacts. It should be noted that this section identifies

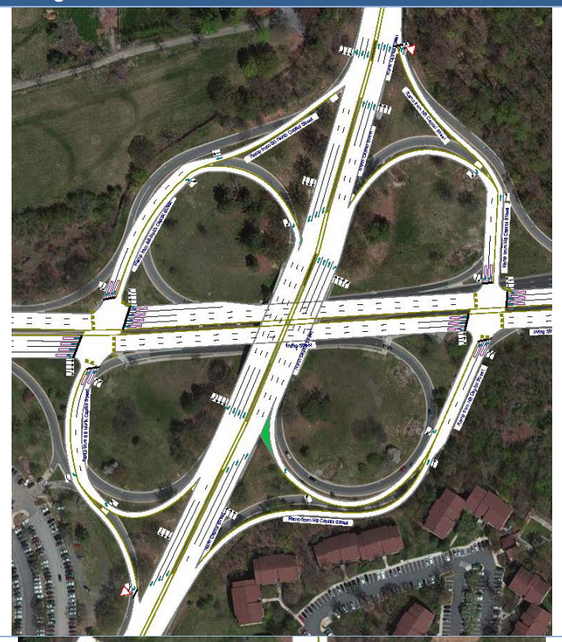
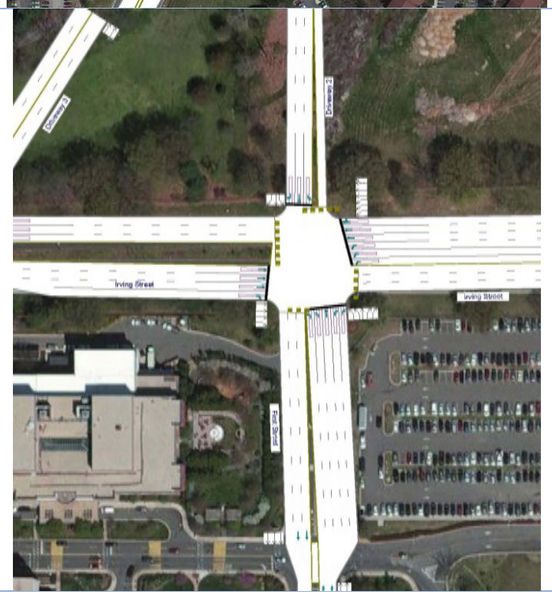
vehicle mitigation measures. Pedestrian/bicycle improvements are discussed in Section 4, and transit improvements are discussed in Section 5.

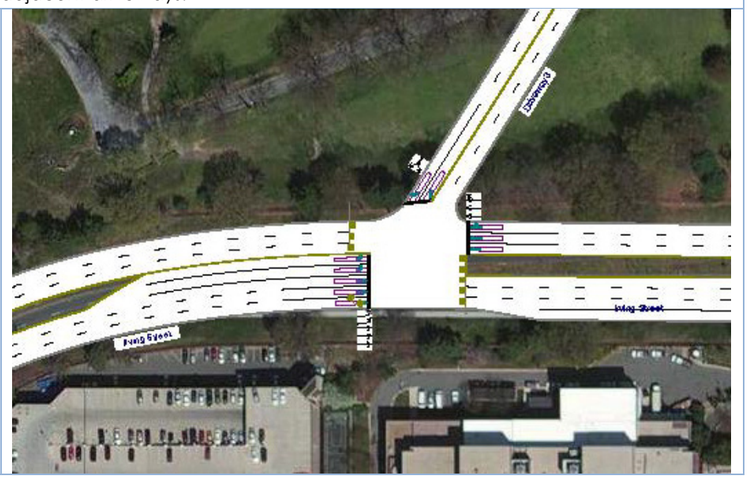
The mitigation options shown in Table 12 should be considered preliminary as a developer has not yet been selected for the site. The analysis presented in this CTR is for the maximum allowable density on the AFRH site which may or may not be achieved based on market forces. Furthermore, improvements may be made to the study area transportation network as part of other DDOT projects. Thus, additional coordination between DDOT and the developer would be required as a final site plan is developed. A developer may choose to implement these options or may develop other mitigation measures to vet through DDOT based on the current conditions of the transportation network.

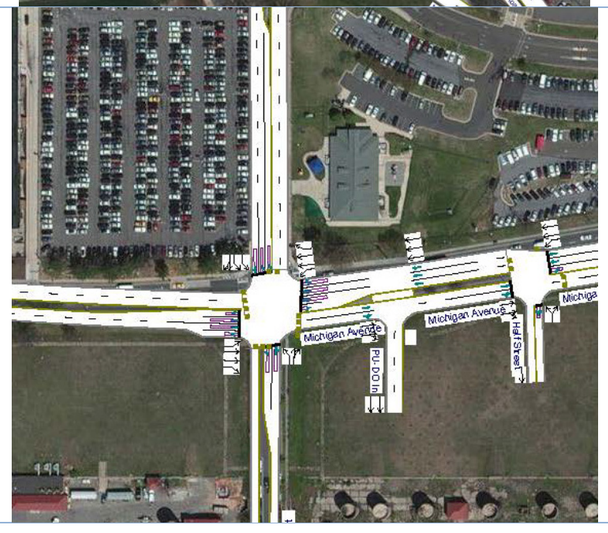
Table 12: Potential Mitigation Measures

Mitigation Measure	
A. Upgrade all study area signalized intersections to be fully actuated and optimize phasing and offsets.	
B. Implement traffic adaptive or demand responsive signals on North Capitol Street.	
C. Provide an additional northbound through lane at the intersection of North Capitol Street and New Hampshire Avenue NE.	
D. Eliminate the westbound Buchanan Street approach and the Hawaii Avenue northbound left-turn movement at the intersection with North Capitol Street.	

Mitigation Measure	
E. Provide an additional southbound through lane at the intersection of North Capitol Street and Harewood Road.	
F. Replace the Scale Gate Road bridge over North Capitol Street to incorporate two lanes in each direction, as well as full sidewalks. Signalize the diamond interchange ramp intersections with Scale Gate Road.	

Mitigation Measure	
G. Modify the proposed North Capitol Street/Irving Street interchange to eliminate the free ramp movements on Irving Street to provide safer and more controlled pedestrian/ bicycle crossing. It should be noted that, at a minimum, the improvements to the northwest quadrant of the interchange will be required.	
H. Option 1: At the intersection of Irving Street NW and First Street NW, provide an additional westbound left-turn lane, two northbound left-turn lanes, and an eastbound right-turn lane.	

Mitigation Measure	
Option 2: Divert vehicles from the intersection of First Street NW and Irving Street NW by providing a secondary entrance to the Washington Hospital Center Campus from the North Capitol Street/Irving Street interchange. *	
* It should be noted that Improvement H Option 2 would require coordination with MedStar, a private property owner; therefore, this option may not be possible. If an agreement cannot be reached with MedStar to provide the secondary entrance to the hospital campus, the developer may need to consider other internal site enhancements to divert traffic away from the intersection of Irving Street and First Street. For example, restricting through and left-turn movements exiting the site at the intersection could be used to divert exiting traffic to one of the adjacent driveways.	
I. Provide a double left-turn lane at the intersection of Irving Street NW and Driveway 3. All traffic entering the site from eastbound Irving Street NW must do so at this intersection.	

Mitigation Measure	
J. Signalize the intersections of Park Place NW and Hobart Place NW, Hobart Place NW and the Ramp to Michigan Avenue, and Michigan Avenue NW and the Ramp from Hobart Place/Park Place NW. Widen the Ramp to Michigan Avenue NW.	
K. Provide an additional southbound left-turn lane and westbound right-turn lane at the intersection of Michigan Avenue NW and First Street NW.	

Capacity analysis results are contained in Exhibits 19 and 20 in Appendix A and show delay, v/c ratio, LOS and queuing by lane group. Based on the analysis results all study area intersections operate at an overall LOS D or better, except for the intersections shown in Table 13.

Table 13: 2045 Build with Mitigation Intersections Operating at Overall LOS E or F

Intersection	2045 Build without Mitigation		2045 Build with Mitigation	
	AM	PM	AM	PM
North Capitol Street and New Hampshire Avenue NE	F	E	F	-
North Capitol Street and Kennedy Street	E	E	E	E
North Capitol Street and New Hampshire Avenue NW	F	F	F	F
North Capitol Street and Riggs Road NE	F	F	F	F
North Capitol Street and Rock Creek Church Road NW and Buchanan Street NE	E	F	-	E
North Capitol Street and Hawaii Avenue NE/Allison Street NE	F	F	F	F
North Capitol Street and Harewood Road NE	-	F	-	F
North Capitol Street and Harewood Road NW	F	F	-	F
North Capitol Street SB Ramps and Scale Gate Road	F	-	-	-
North Capitol Street NB Ramps and Scale Gate Road	F	F	-	E
Irving Street NW and First Street NW	E	F	-	F
Hobart Place NW and Park Place NW	F	F	-	-
Ramp to Michigan Avenue NW and Hobart Place NW	F	F	-	-
Michigan Avenue NW and First Street NW	F	F	-	-
Michigan Avenue and North Capitol Street	F	F	F	F

The results of the HCS capacity analysis are shown in Exhibit 21 in Appendix A and indicate that all ramp merge, diverge, and weave segments at the North Capitol Street/Irving Street and North Capitol Street/Scale Gate Road interchanges would operate at LOS C or better in both peak hours.

3.4.3.4 Phased Implementation

As noted previously in this document, no developer has been selected yet; therefore a final phasing plan is not available. Therefore, Stantec developed a phasing strategy for the proposed mitigation measures listed in Section 3.4.3.3 based on trip thresholds. The phasing strategy is

intended to outline the mitigation measures that would be required when the site meets the threshold of 20%, 40%, 60%, and 80% of full build site generated vehicle trips and act as a guide for the site developer. The developer may choose to implement the mitigation measures identified in this study, or work with DDOT to identify other potential measures that could be implemented in place of the mitigation options presented in this study. Given the potential variability in the timeline of the site development, it is likely that additional coordination with DDOT would be required.

The selection of the vehicle mitigation measures for each threshold is based on a combination of the additional delay as a result of site generated traffic, as well as the site generated traffic as a percentage of the total traffic at the intersection, which was necessary to scale the level of investment in the study area roadway network with the size of the site. Intersection mitigation measures were recommended for intersections where the share of site-generated trips exceeded 10% of the total intersection volume, or where the No Build condition is so congested that it would have a significant impact on the ability for vehicles to access the AFRH site. It should be noted that this section identifies vehicle mitigation measures. Pedestrian/bicycle improvements are discussed in Section 4, and transit improvements are discussed in Section 5.

Table 14 identifies which mitigation measure identified in Section 3.4.3.3 would be applicable to each threshold. The 20%, 40%, 60%, and 80% traffic volumes are shown in Exhibits 22 through 29 in Appendix A. Intersection capacity analysis results for each of the threshold conditions are contained in Exhibits 19 and 20 in Appendix A, while the freeway segment capacity analysis results are shown in Exhibit 21 in Appendix A.

Table 14: Vehicle Mitigation Measure Implementation Strategy

Threshold	Mitigation Measure
20%	A. Upgrade all study area signalized intersections to be fully actuated and optimize phasing and offsets (DDOT). H. Option 1: At the intersection of Irving Street NW and First Street NW, provide an additional westbound left-turn lane, two northbound left-turn lanes, and an eastbound right-turn lane. OR Option 2: Divert vehicles from the intersection of First Street NW and Irving Street NW by providing a secondary entrance to the Washington Hospital Center Campus from the North Capitol Street/Irving Street interchange. (Developer) I. Provide a double left-turn lane at the intersection of Irving Street NW and Driveway 3. All traffic entering the site from eastbound Irving Street NW must do so at this intersection. (Developer) J. Signalize the intersections of Park Place NW and Hobart Place NW, Hobart Place NW and the Ramp to Michigan Avenue, and Michigan Avenue NW and the Ramp from Hobart Place/Park Place NW. Widen the Ramp to Michigan Avenue NW (DDOT).
40%	C. Provide an additional northbound through lane at the intersection of North Capitol Street and New Hampshire Avenue NE (Developer). D (partial). Eliminate the Hawaii Avenue northbound left-turn movement at the intersection with North Capitol Street (Developer).
60%	F. Replace the Scale Gate Road bridge over North Capitol Street to incorporate two lanes in each direction, as well as full sidewalks. Signalize the diamond interchange ramp intersections with Scale Gate Road (Developer). J. Provide an additional southbound left-turn lane and westbound right-turn lane at the intersection of Michigan Avenue NW and First Street NW (Developer).
80%	E. Provide an additional southbound through lane at the intersection of North Capitol Street and Harewood Road (Developer). B. Implement traffic adaptive or demand responsive signals on North Capitol Street (DDOT).

3.4.4 Crosstown Study Network Condition

As noted in Section 2.0, DDOT is currently engaging in a study that will redefine the Irving Street and Michigan Avenue corridors within the AFRH study area. As such, DDOT requested that Stantec evaluate the impact of the proposed project on a potential modified network utilizing the preliminary concepts from the 2016 Crosstown Multimodal Transportation Study (Figure 8). It should also be noted that the Crosstown Multimodal Transportation Study was ongoing at the time that this CTR was prepared. Therefore, network elements depicted in this CTR may differ from the final recommendations of the Crosstown Study.

3.4.4.1 2045 Crosstown Study Background/No Build Condition

Background traffic volumes as well as adjacent site volumes were distributed on the revised Crosstown Study network. The resulting 2045 AM and PM Peak Hour No Build Traffic Volumes are

shown in Figures 9 and 10 in this report (and Exhibits 30 and 31 in Appendix A). The 2045 Crosstown No Build Condition reflects anticipated modifications to the study area roadway network without the additional AFRH site traffic. Capacity analysis results are contained in Exhibit 32 and show delay, v/c ratio, LOS and queuing by lane group. Based on the analysis results the study area intersections would operate at an overall LOS D or better, except intersections shown in Table 15.

Table 15: 2045 No Build Condition with Crosstown Study Network Intersections Operating at Overall LOS E or F

Intersection	2045 No Build Condition	
	AM	PM
North Capitol Street and New Hampshire Avenue NE	F	-
North Capitol Street and New Hampshire Avenue NW	F	F
North Capitol Street and Riggs Road NE	F	F
North Capitol Street and Rock Creek Church Road NW and Buchanan Street NE	-	E
North Capitol Street and Hawaii Avenue NE/Allison Street NE	F	F
North Capitol Street and Harewood Road NE	-	E
North Capitol Street and Harewood Road NW	-	F
Irving Street and North Capitol Street Connector	-	-
Irving Street NW and First Street NW	-	E
Michigan Avenue NW and First Street NW	E	F
Michigan Avenue and North Capitol Street	F	F

The results of the HCS capacity analysis are shown in Exhibit 33 and indicate that all ramp merge and diverge segments at the North Capitol Street/Scale Gate Road interchange operate at LOS C or better in both peak hours.

The results of the No Build Condition analysis reveal that the overall Crosstown Study modifications would result in acceptable operations with the exception of the connector roadway between Irving Street NE and North Capitol Street. A closer examination of the capacity analysis results presented in Exhibit 32 reveal that several movements would operate at a v/c ratio greater than 1.0 (LOS F). These capacity deficiencies are not present in the existing interchange configuration because the multiple ramp movements disperse vehicle volume over multiple points, while the connector roadway would concentrate that volume at two intersections). Therefore, it would be prudent to coordinate with DDOT during the planning and design of the improvements recommended in the Crosstown Study to identify opportunities to improve the balance of volume at the Irving Street /North Capitol Street interchange.

Figure 8: Crosstown Study Network

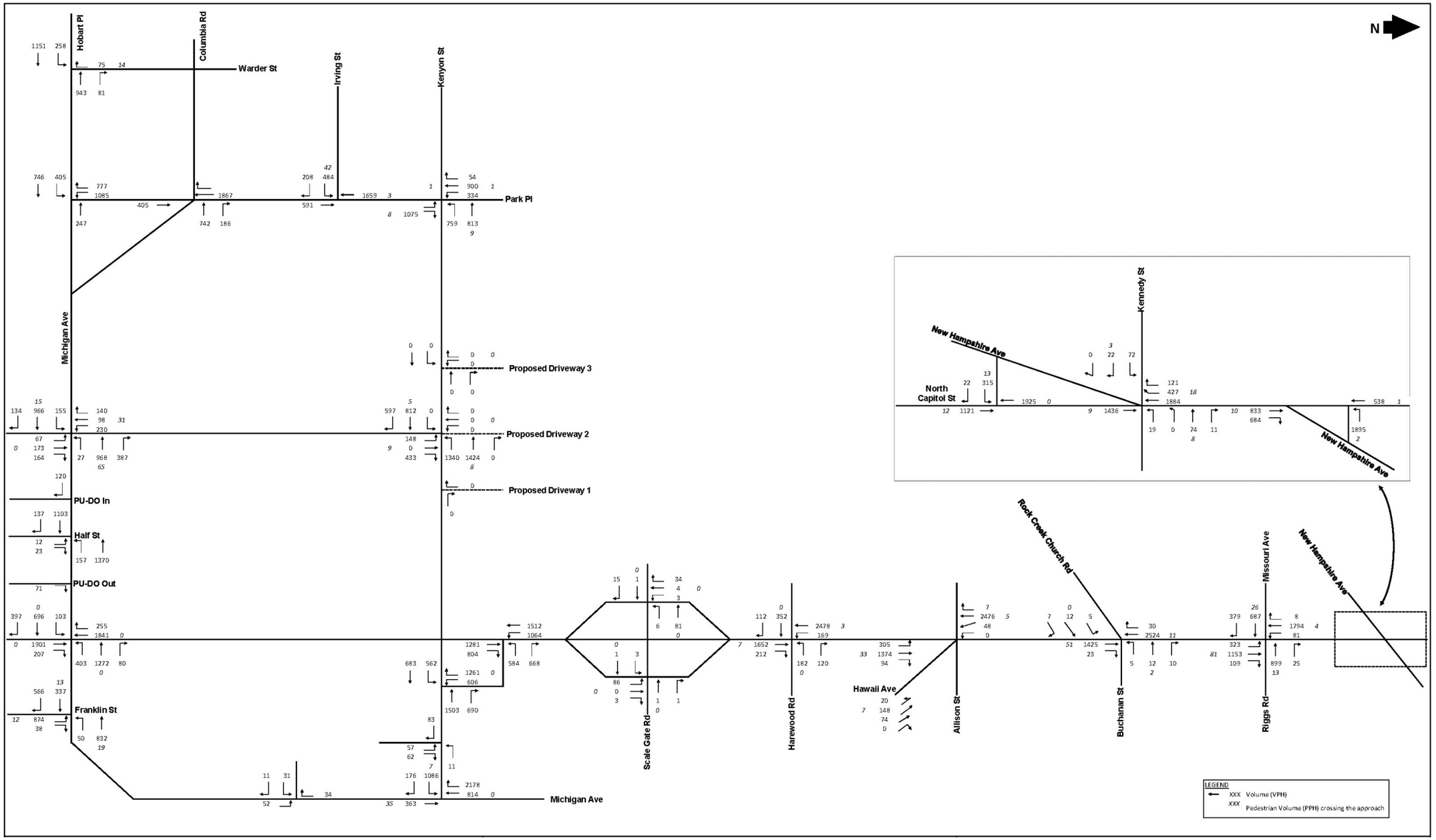


Figure 9: 2045 No Build Condition Volumes – Crosstown Network, AM Peak Hour

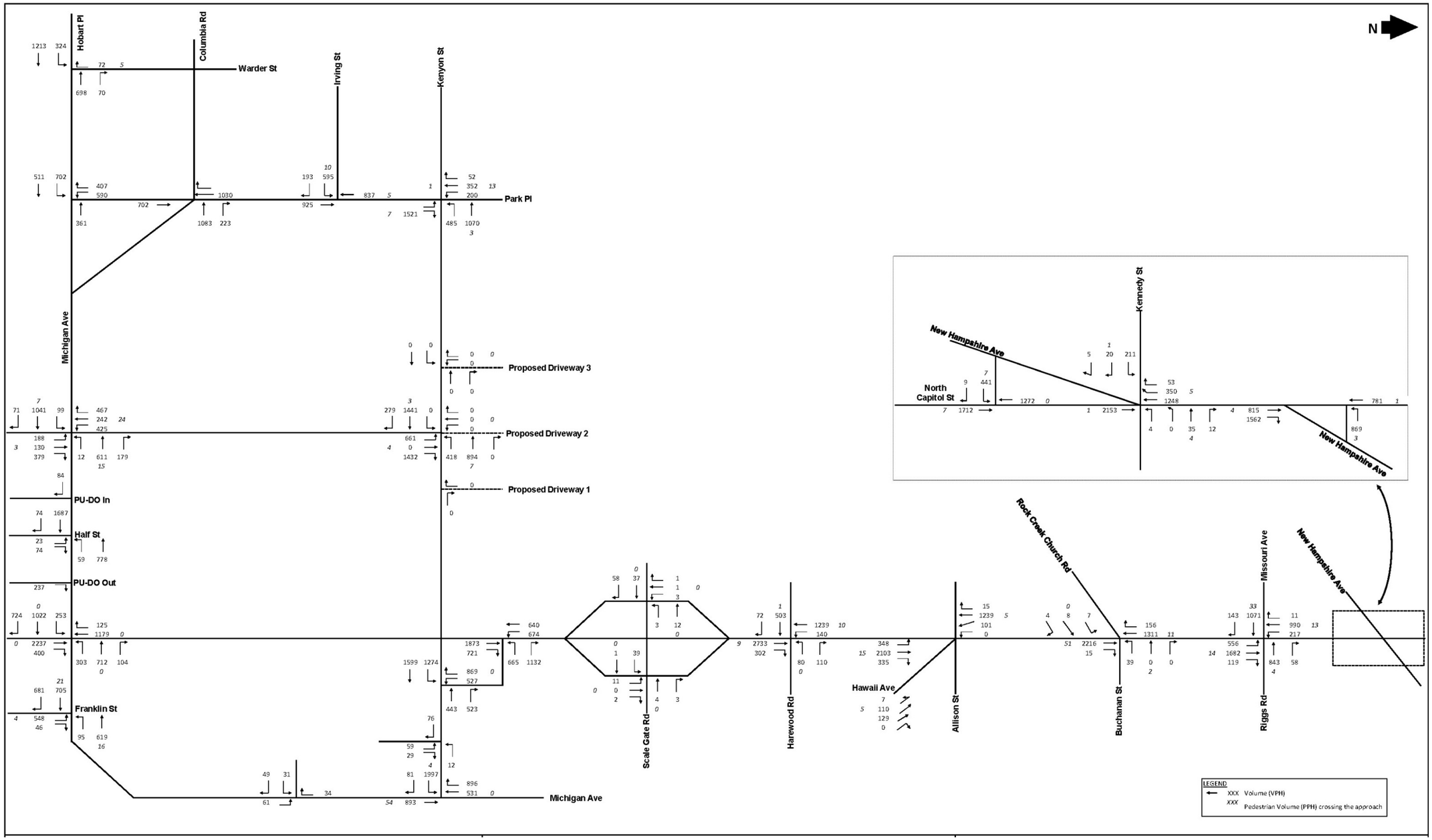


Figure 10: 2045 No Build Condition Volumes – Crosstown Network, PM Peak Hour

3.4.4.2 2045 Crosstown Study Full Build Condition – Without Mitigation

The 2045 Crosstown Study Build Condition reflects anticipated modifications to the study area roadway network with the additional AFRH site traffic. Site generate trips were distributed over the Crosstown Study network to generate 2045 Crosstown Study Build Condition (Exhibits 34 and 35 in Appendix A). Capacity analysis results are contained in Exhibit 36 in Appendix A and show delay, v/c ratio, LOS and queuing by lane group. Based on the analysis results all study area intersections operate at LOS D or better, except the intersections shown in Table 16.

Table 16: 2045 No Build without Mitigation with Crosstown Study Network Intersections Operating at Overall LOS E or F

Intersection	2045 No Build Condition		2045 Build without Mitigation	
	AM	PM	AM	PM
North Capitol Street and New Hampshire Avenue NE	F	-	F	E
North Capitol Street and Kennedy Street	-	-	E	E
North Capitol Street and New Hampshire Avenue NW	F	F	F	F
North Capitol Street and Riggs Road NE	F	F	F	F
North Capitol Street and Rock Creek Church Road NW and Buchanan Street NE	-	E	E	F
North Capitol Street and Hawaii Avenue NE/Allison Street NE	F	F	F	F
North Capitol Street and Harewood Road NE	-	E	-	F
North Capitol Street and Harewood Road NW	-	F	F	F
North Capitol Street SB Ramps and Scale Gate Road	-	-	-	-
North Capitol Street NB Ramps and Scale Gate Road	-	-	F	F
North Capitol Street and North Capitol Street Connection	-	-	E	F
Irving Street and North Capitol Street Connector	F	-	F	F
Irving Street NW and First Street NW	-	E	F	F
Michigan Avenue NW and First Street NW	E	F	F	F
Michigan Avenue and North Capitol Street	F	F	F	F

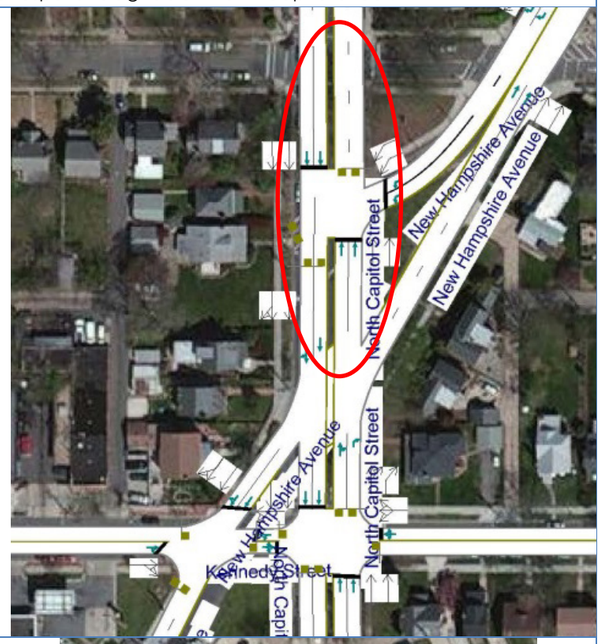
The results of the HCS capacity analysis are shown in Exhibit 33 and indicate that all ramp merge and diverge segments at the North Capitol Street/Scale Gate Road interchange operate at LOS C or better in both peak hours.

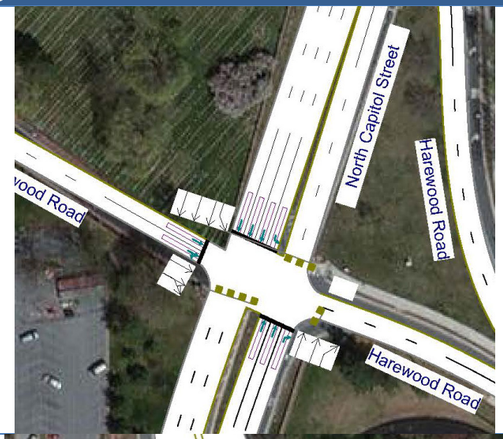
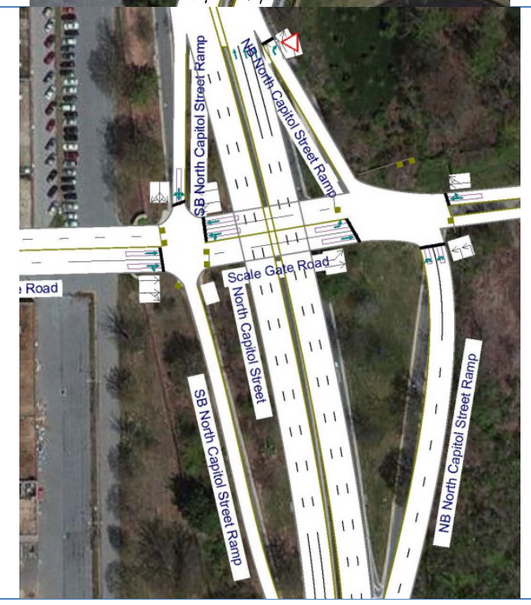
3.4.4.3 2045 Crosstown Study Full Build with Mitigation

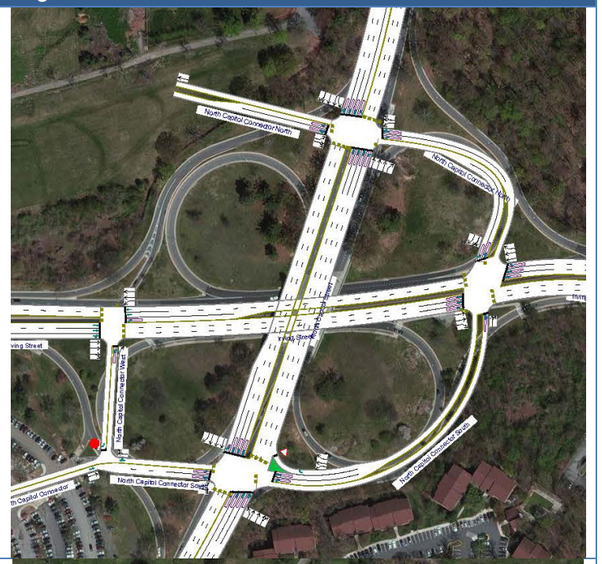
DDOT requires that mitigation be provided for intersections that experience an overall increase in delay of more than five seconds per vehicle. However, the study area roadway network experiences significant congestion in the 2045 No Build Condition, thus any additional trips added to the network would result in an exponential increase delay, likely requiring mitigation measures, such as travel lanes that would not be appropriate or desirable for the study area transportation network. Therefore, Stantec developed and evaluated mitigation measures that would address the additional intersection delay while considering multi-modal transportation needs and potential ROW impacts. It should be noted that this section identifies vehicle mitigation measures. Pedestrian/bicycle improvements are discussed in Section 4, and transit improvements are discussed in Section 5.

The potential mitigation options shown in Table 17 should be considered preliminary as a developer has not yet been selected for the site. The analysis presented in this CTR is for the maximum allowable density on the AFRH site which may or may not be achieved based on market forces. These mitigation options should be considered preliminary as a developer has not yet been selected for the site. The analysis presented in this CTR is for the maximum allowable density on the AFRH site which may or may not be achieved based on market forces. Furthermore, improvements may be made to the study area transportation network as part of other DDOT projects. Thus, additional coordination between DDOT and the developer would be required as a final site plan is developed. A developer may choose to implement these options or may develop other mitigation measures to vet through DDOT based on the current conditions of the transportation network.

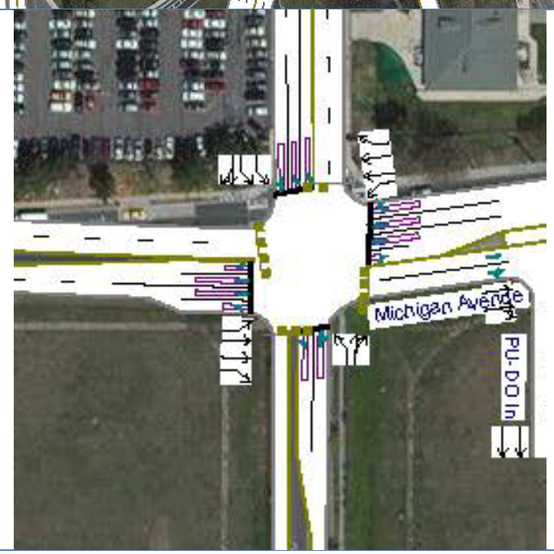
Table 17: Mitigation Measures

Mitigation Measure
A. Upgrade all study area signalized intersections to be fully actuated and optimize phasing and offsets.
B. Implement traffic adaptive or demand responsive signals on North Capitol Street.
C. Provide an additional northbound through lane at the intersection of North Capitol Street and New Hampshire Avenue NE. 
D. Eliminate the westbound Buchanan Street approach and the Hawaii Avenue northbound left-turn movement at the intersection with North Capitol Street. 

Mitigation Measure
E. Provide an additional southbound through lane at the intersection of North Capitol Street and Harewood Road. 
F. Replace the Scale Gate Road bridge over North Capitol Street to incorporate two lanes in each direction, as well as full sidewalks. Signalize the diamond interchange ramp intersections with Scale Gate Road. 

Mitigation Measure	
G. Modify the proposed North Capitol Street/Irving Street interchange to provide additional connections between Irving Street, North Capitol Street and the Washington Hospital Center.*	
H. At the intersection of Irving Street NW and First Street NW, provide separate through and left-turn lanes. Restrict eastbound left-turns and move them to the signalized intersection of Irving Street NW and Proposed Driveway 3.	

* It should be noted that Improvement G would require coordination with MedStar, a private property owner; therefore, this option may not be possible. If an agreement cannot be reached with MedStar to provide the secondary entrance to the hospital campus, the developer may need to consider other internal site enhancements to divert traffic away from the intersection of Irving Street and First Street. For example, restricting through and left-turn movements exiting the site at the intersection could be used to divert exiting traffic to one of the adjacent driveways. Completing the northwest quadrant of the North Capitol Street/Irving Street interchange could also be considered.

Mitigation Measure	
I. Provide a connection into the Washington Hospital Center from Park Place.	
J. Provide an additional southbound left-turn lane and westbound right-turn lane at the intersection of Michigan Avenue NW and First Street NW.	

Capacity analysis results are contained in Exhibits 37 and 38 in Appendix A and show delay, v/c ratio, LOS, and queuing by lane group. Based on the analysis results all study area intersections operate at an overall LOS D or better, except for those listed in Table 18.

Table 18: 2045 Build without Mitigation vs. Build with Mitigation with Crosstown Study Network Intersections Operating at Overall LOS E or F

Intersection	2045 Build without Mitigation		2045 Build with Mitigation	
	AM	PM	AM	PM
North Capitol Street and New Hampshire Avenue NE	F	E	F	-
North Capitol Street and Kennedy Street	E	E	-	E
North Capitol Street and New Hampshire Avenue NW	F	F	F	F
North Capitol Street and Riggs Road NE	F	F	F	F
North Capitol Street and Rock Creek Church Road NW and Buchanan Street NE	E	F	E	-
North Capitol Street and Hawaii Avenue NE/Allison Street NE	F	F	F	F
North Capitol Street and Harewood Road NE	-	F	-	F
North Capitol Street and Harewood Road NW	F	F	-	F
North Capitol Street SB Ramps and Scale Gate Road	-	-	-	-
North Capitol Street NB Ramps and Scale Gate Road	F	F	-	-
North Capitol Street and North Capitol Street Connection	E	F	-	F
Irving Street and North Capitol Street Connector	F	F	-	-
Irving Street NW and First Street NW	F	F	-	F
Michigan Avenue NW and First Street NW	F	F	-	-
Michigan Avenue and North Capitol Street	F	F	F	F

The results of the HCS capacity analysis are shown in Exhibit 39 in Appendix A and indicate that all ramp merge and diverge segments at the North Capitol Street/Scale Gate Road interchange operate at LOS C or better in both peak hours.

3.4.4.4 Phased Implementation

As previously noted, no developer has been selected at this time; therefore, a final phasing plan is not available. As a result, Stantec developed a phasing strategy for the proposed mitigation

measures listed in Section 3.4.4.3 based on trip thresholds. The phasing strategy is intended to outline the mitigation measures that would be required when the site meets the threshold of 20%, 40%, 60%, and 80% of full build site-generated vehicle trips and act as a guide for the site developer. The developer may choose to implement the mitigation measures identified in this study, or work with DDOT to identify other potential measures that could be implemented in place of the mitigation options presented in this study. Given the potential variability in the timeline of the site development, it is likely that additional coordination with DDOT would be required.

The selection of the vehicle mitigation measures for each threshold is based on a combination of the additional delay as a result of site-generated traffic as well as the site-generated traffic as a percentage of the total traffic at the intersection. This was necessary to scale the level of investment in the study area roadway network with the size of the site. It should be noted that this section identifies vehicle mitigation measures. Pedestrian/bicycle improvements are discussed in Section 4, and transit improvements are discussed in Section 5.

Table 19 identifies which mitigation measure identified in Section 3.4.4.3 would be applicable to each threshold. The 20%, 40%, 60%, and 80% traffic volumes are shown in Exhibits 40 through 47 in Appendix A. Intersection capacity analysis results for each of the threshold conditions are contained in Exhibits 37 and 38 in Appendix A, and freeway capacity analysis results are shown in Exhibit 39 in Appendix A.

Table 19: Vehicle Mitigation Measure Implementation Strategy

Threshold	Mitigation Measure
20%	A. Upgrade all study area signalized intersections to be fully actuated and optimize phasing and offsets (DDOT). G. Modify the proposed North Capitol Street/Irving Street interchange to provide additional connections between Irving St., North Capitol St. and the Washington Hospital Center (DDOT). H. At the intersection of Irving Street NW and First Street NW, provide separate through and left-turn lanes. Restrict eastbound left-turns and move them to the signalized intersection of Irving Street NW and Proposed Driveway 3 (Developer). I. Provide a connection into the Washington Hospital Center from Park Place (Developer).
40%	C. Provide an additional northbound through lane at the intersection of North Capitol Street and New Hampshire Avenue NE (Developer). D(partial). Eliminate the Hawaii Avenue northbound left-turn movement at the intersection with North Capitol Street (Developer).
60%	E. Provide an additional southbound through lane at the intersection of North Capitol Street and Harewood Road (Developer). F. Replace the Scale Gate Road bridge over North Capitol Street to incorporate two lanes in each direction, as well as full sidewalks. Signalize the diamond interchange ramp intersections with Scale Gate Road (Developer). J. Provide an additional southbound left-turn lane and westbound right-turn lane at the intersection of Michigan Avenue NW and First Street NW (Developer).

Threshold	Mitigation Measure
80%	B. Implement traffic adaptive or demand responsive signals on North Capitol Street (DDOT).