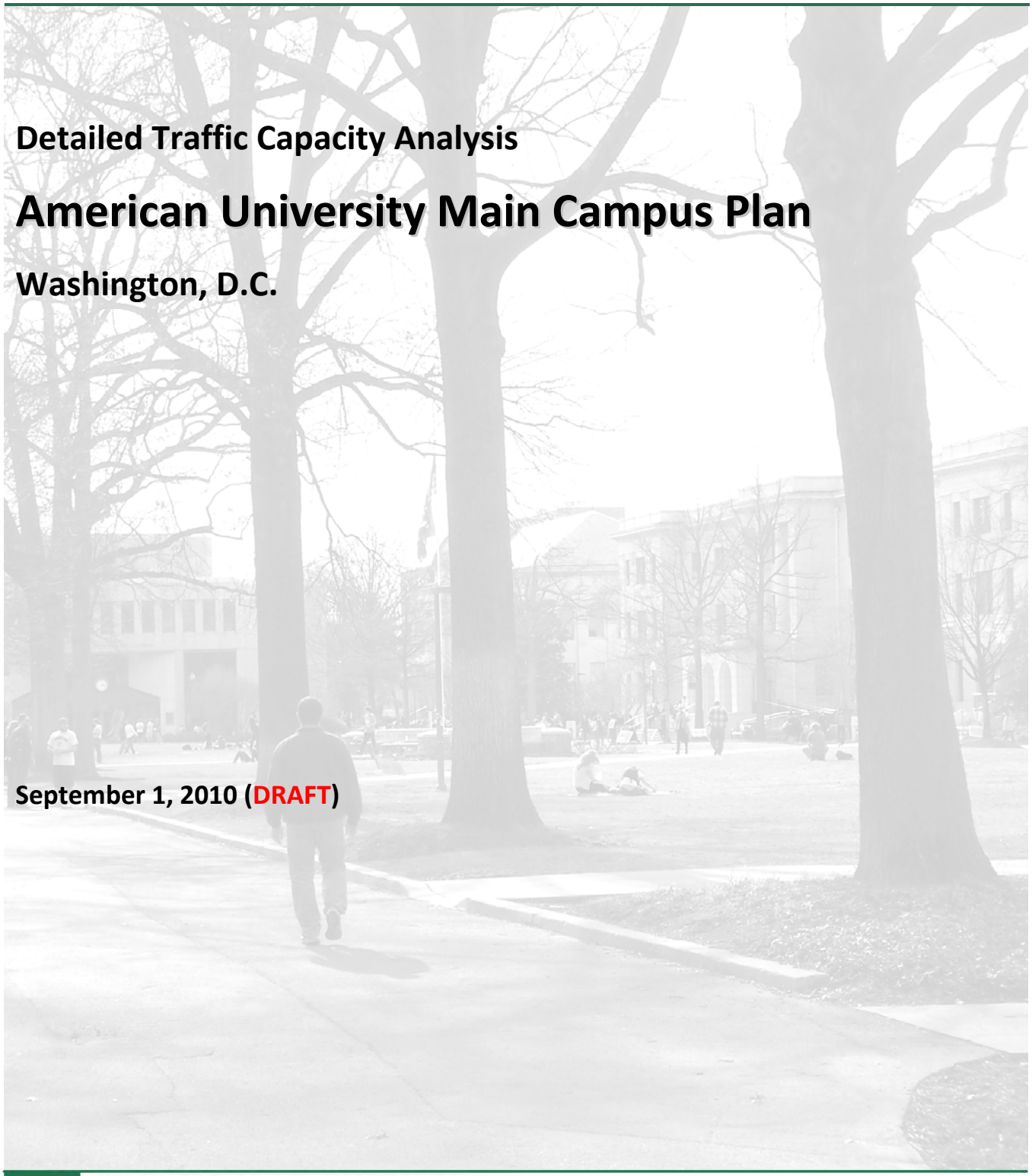

Detailed Traffic Capacity Analysis

American University Main Campus Plan

Washington, D.C.

September 1, 2010 (DRAFT)

GOROVE / SLADE
Transportation Planners and Engineers

Prepared by:

1140 Connecticut Avenue NW
Suite 600
Washington, DC 20036
Tel: 202.296.8625
Fax: 202.785.1276

3914 Centreville Road
Suite 330
Chantilly, VA 20151
Tel: 703.787.9595
Fax: 703.787.9905

7001 Heritage Village Plaza
Suite 220
Gainesville, VA 20155
Tel: 703.787.9595
Fax: 703.787.9905

www.goroveslade.com

TABLE OF CONTENTS

List of Figures ii

List of Tables iii

Executive Summary iv

Introduction 1

Existing Conditions 4

- Site Access and Existing Road Network 4
- Existing Traffic Volumes 13
- Field Observations 13
- Existing Vehicular Capacity Analysis 17
  - Summary of Existing Vehicular Capacity Analysis Results 23
  - Comparison of 2008 and 2000 Capacity Analysis Results 23
  - Comparison of 2008 and 2005 Capacity Analysis Results 25
- Existing Pedestrian Analysis Results 25
  - Summary of Existing Pedestrian Analysis Results 27

Future Conditions without Development 28

- Future Conditions without Development Traffic Volumes 28
- Future Conditions without Development Vehicular Capacity Analysis 28
  - Summary of Future without Development Vehicular Capacity Analysis Results 42
- Future without Development Pedestrian Analysis Results 42
  - Summary of Future without Development Pedestrian Analysis Results 43

Future Conditions with Development 44

- Future with Development Traffic Volumes 44
- Future Conditions with Development Vehicular Capacity Analysis 46
  - Summary of Future with Development Vehicular Capacity Analysis Results 60
- Future with Development Pedestrian Analysis Results 60
  - Summary of Future with Development Pedestrian Analysis Results 61

Summary and Conclusions 62

- Mitigation Measures and Next Steps 63

LIST OF FIGURES

Figure 1: American University Site Location 3
Figure 2: Functional Class and Average Annual Weekday Volumes 5
Figure 3: Existing Traffic Controls, Lane Designations, and Peak Hour Traffic Volumes (1 of 4) 6
Figure 4: Existing Traffic Controls, Lane Designations, and Peak Hour Traffic Volumes (2 of 4) 7
Figure 5: Existing Traffic Controls, Lane Designations, and Peak Hour Traffic Volumes (3 of 4) 8
Figure 6: Existing Traffic Controls, Lane Designations, and Peak Hour Traffic Volumes (4 of 4) 9
Figure 7: Existing Number of Travel Lanes for the AU Main Campus 10
Figure 8: Site Access Locations for the AU Main Campus 12
Figure 9: Existing Lane Configurations and Peak Hour Capacity Analysis Results (1 of 4) 19
Figure 10: Existing Lane Configurations and Peak Hour Capacity Analysis Results (2 of 4) 20
Figure 11: Existing Lane Configurations and Peak Hour Capacity Analysis Results (3 of 4) 21
Figure 12: Existing Lane Configurations and Peak Hour Capacity Analysis Results (4 of 4) 22
Figure 13: Future without Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (1 of 4) 29
Figure 14: Future without Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (2 of 4) 30
Figure 15: Future without Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (3 of 4) 31
Figure 16: Future without Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (4 of 4) 32
Figure 17: Future without Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (1 of 4) 33
Figure 18: Future without Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (2 of 4) 34
Figure 19: Future without Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (3 of 4) 35
Figure 20: Future without Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (4 of 4) 36
Figure 21: Future without Development Lane Configurations and Peak Hour Capacity Analysis Results (1 of 4) 38
Figure 22: Future without Development Lane Configurations and Peak Hour Capacity Analysis Results (2 of 4) 39
Figure 23: Future without Development Lane Configurations and Peak Hour Capacity Analysis Results (3 of 4) 40
Figure 24: Future without Development Lane Configurations and Peak Hour Capacity Analysis Results (4 of 4) 41
Figure 25: Future with Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (1 of 4) 47
Figure 26: Future with Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (2 of 4) 48
Figure 27: Future with Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (3 of 4) 49
Figure 28: Future with Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (4 of 4) 50
Figure 29: Future with Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (1 of 4) 51
Figure 30: Future with Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (2 of 4) 52
Figure 31: Future with Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (3 of 4) 53
Figure 32: Future with Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (4 of 4) 54
Figure 33: Future with Development Lane Configurations and Peak Hour Capacity Analysis Results (1 of 4) 56
Figure 34: Future with Development Lane Configurations and Peak Hour Capacity Analysis Results (2 of 4) 57

Figure 35: Future with Development Lane Configurations and Peak Hour Capacity Analysis Results (3 of 4) 58
Figure 36: Future with Development Lane Configurations and Peak Hour Capacity Analysis Results (4 of 4) 59

LIST OF TABLES

Table 1: Existing Conditions (2008) Vehicular Levels of Service 18
Table 2: Level of Service Results from 2000 Campus Plan 24
Table 3: Existing Conditions (2008) Pedestrian Levels of Service for Signalized Intersections 26
Table 4: Existing Conditions (2008) Pedestrian Levels of Service for Unsignalized Intersections 26
Table 5: Future Conditions (2020) without Development Vehicular Levels of Service 37
Table 6: Future Conditions (2020) without Development Pedestrian Levels of Service for Signalized Intersections 42
Table 7: Future Conditions (2020) without Development Pedestrian Levels of Service for Unsignalized Intersections 43
Table 8: Vehicular Trips Removed 44
Table 9: Vehicular Trips Added 45
Table 10: Pedestrian Trips Added to the East Campus 46
Table 11: Other Pedestrian Trips Added 46
Table 12: Future Conditions (2020) with Development Vehicular Levels of Service 55
Table 13: Future Conditions (2020) with Development Pedestrian Levels of Service for Signalized Intersections 60
Table 14: Future Conditions (2020) with Development Pedestrian Levels of Service for Unsignalized Intersections 61

EXECUTIVE SUMMARY

This report presents the preliminary findings of a traffic impact analysis conducted for the American University Main Campus Plan for the years 2010-2020.

A review of the proposed Campus Plan study area found the following:

- Traffic in the study area is heavily commuter-based, especially on Nebraska Avenue and Massachusetts Avenue.
- Traffic controls in the study area operate under acceptable conditions (defined as level of service of "E" or better) during the morning and afternoon peak hours, though a few approaches operate under unacceptable conditions during one or more peak hour.
- All signalized crosswalks in the study area operate under acceptable conditions during the morning and afternoon peak hours, although some experience a moderate to high likelihood of non-compliance, so signal timing improvements may be investigated at these intersections in order to improve the pedestrian level of service.
- The majority of unsignalized crosswalks in the study area operate at unacceptable levels of service during one or more peak hour, which indicates a moderate to very high likelihood of risk-taking behavior by pedestrians. Although pedestrians have the right-of-way in all crosswalks in the District and vehicles must yield to pedestrians in the crosswalk, the LOS F calculated for the unsignalized approaches of Ward Circle during the morning and afternoon peak hours indicates an unfriendly and intimidating environment for pedestrians.

A capacity analysis was performed within a study area of 16 intersections comparing conditions at intersections and crosswalks in the year 2020 with and without development of the proposed Campus Plan; the results were as follows:

- All study area intersections operate at acceptable levels of service in the future with the proposed Campus Plan changes. However, five approaches will operate under unacceptable conditions. Four of these approaches operate under unacceptable conditions for the future without the proposed Campus Plan changes.
- The site access driveways and gates will operate at acceptable levels of service.
- All signalized crosswalks operate at acceptable levels of service in the future with the proposed Campus Plan changes.
- The majority of unsignalized crosswalks operate at unacceptable levels of service in the future with the proposed Campus Plan changes. However, all of these crosswalks operate under unacceptable conditions for the future without the proposed Campus Plan changes.

This report will be updated in the Fall of 2010 as part of the transportation report filed with the Campus Plan application. This revised report will consist of a revised analysis, which will include the following updates:

- Update pedestrian trip generation rates by counting activity on campus at residence halls and retail sites, with the Fall 2010 semester underway;
- Perform additional existing peak hour traffic counts, including Ward Circle, with the Fall 2010 semester underway;
- Separate out the SIS Garage into two phases of development in order to remove the approved portion of the development from the Campus Plan site-generated trips, and place these trips in the future background conditions;

- May add an additional access point for the East Campus parking lot as a right-in/right-out driveway along Massachusetts Avenue. This intersection may be signalized in order to assist pedestrians crossing Massachusetts Avenue, which will also create additional vehicular gaps along the roadway that will aid vehicles entering and exiting Westover Place; and
- Update the Tenley Campus background trips.

The revised report will also include a set of recommended mitigation measures that respond to the analysis results. This will likely consist of short-term improvements (signal timing and site access changes) and long-term improvements (recommendations for further study).

INTRODUCTION

This report presents the findings of a Traffic Impact Analysis (TIA) conducted for the American University Main Campus Plan for the years 2010-2020. The American University Main Campus is located in Ward #3 in northwest Washington, DC. Figure 1 shows a map of American University and the surrounding study area. The proposed Campus Plan consists of the removal of the Nebraska Avenue parking lot (East Campus) and small parking areas on the Main Campus, to be replaced by new residence halls, student-oriented retail, and a new parking lot on the East Campus and new residence halls on the Main Campus.

The primary objectives of this study are to evaluate the transportation conditions near the American University Main Campus and to identify the impacts to the transportation network due to the proposed development. This report focuses on the existing transportation network in the vicinity of the University, the transportation elements of the proposed Campus Plan, and the possible impacts to the transportation network.

A review of the proposed Campus Plan study area found the following:

- Traffic in the study area is heavily commuter-based, especially on Nebraska Avenue and Massachusetts Avenue.
- Traffic controls in the study area operate under acceptable conditions (defined as level of service of "E" or better) during the morning and afternoon peak hours, though a few approaches operate under unacceptable conditions during one or more peak hour.
- All signalized crosswalks in the study area operate under acceptable conditions during the morning and afternoon peak hours, although some experience a moderate to high likelihood of non-compliance, so signal timing improvements may be investigated at these intersections in order to improve the pedestrian level of service.
- The majority of unsignalized crosswalks in the study area operate at unacceptable levels of service during one or more peak hour, which indicates a moderate to very high likelihood of risk-taking behavior by pedestrians. Although pedestrians have the right-of-way in all crosswalks in the District and vehicles must yield to pedestrians in the crosswalk, the LOS F calculated for the unsignalized approaches of Ward Circle during the morning and afternoon peak hours indicates an unfriendly and intimidating environment for pedestrians.

Gorove/Slade Associates, Inc. undertook the following steps while preparing for this study:

- Performed field reconnaissance of existing roadway and intersection geometrics, traffic controls, and operations;
- Observed traffic conditions during the morning and afternoon peak periods on a typical weekday;
- Conducted peak hour turning movement counts at study intersections;
- Analyzed the existing transportation network;
- Described and quantified the impacts of other (non-University) development and infrastructure changes on the future transportation network;
- Calculated the trip generation for the proposed development;
- Detailed the transportation elements of the proposed Campus Plan;
- Forecasted future traffic volumes with and without the proposed Campus Plan changes to the campus;
- Estimated the difference in peak hour traffic with and without the proposed Campus Plan changes to the campus;

- Calculated future levels of service at the study intersections with and without the proposed Campus Plan changes to the campus; and
- Recommended mitigation measures, if necessary, based on the future transportation analysis.

Sources of data for this study include traffic counts and observations conducted by Gorove/Slade, plans from Goulston & Storrs, previous studies performed by HNTB, studies from ITE, and the files/library of Gorove/Slade.

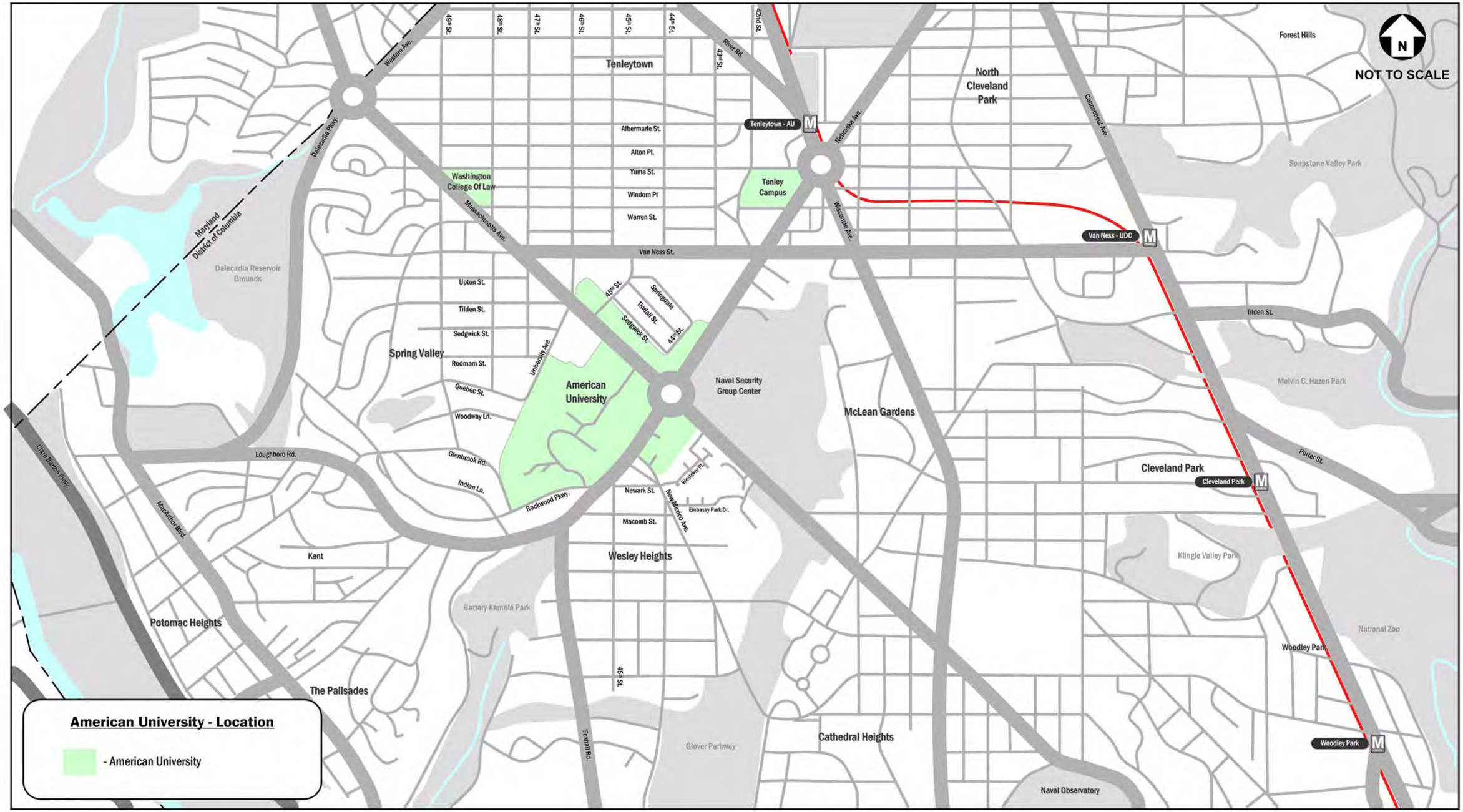

Figure 1: American University Site Location

EXISTING CONDITIONS

Site Access and Existing Road Network

Regional access for the American University main campus is provided primarily by Massachusetts Avenue and Nebraska Avenue. Local access is also provided by 46th Street, Tilden Street, University Avenue, New Mexico Avenue, 45th Street, Rockwood Parkway, Newark Street, and Glenbrook Road. Figure 2 shows the street network hierarchy for the study area, as well as the average annual weekday traffic volumes for the heavily travelled roadways.

Gorove/Slade conducted field reconnaissance to obtain the existing lane usage and traffic controls at the intersections within the main campus study area. Figure 3, Figure 4, Figure 5, and Figure 6 present the roadway lane configurations and traffic control devices provided at the study intersections. Figure 7 presents the number of travel lanes on the roadways surrounding the AU main campus. For the purpose of this report, Nebraska Avenue is assumed to have a north-south orientation and Massachusetts Avenue is assumed to have an east-west orientation. The physical and service characteristics of the key roadways providing local site access are as follows:

- *Massachusetts Avenue*
  Massachusetts Avenue is a 4-lane arterial, which runs along the north side of the American University main campus. The roadway is classified by DDOT as a primary arterial with average annual weekday traffic of 20,900 vehicles. Within the limits of the study area, Massachusetts Avenue runs from 46th Street to Nebraska Avenue.

- *Nebraska Avenue*
  Nebraska Avenue is a 4-lane arterial, which runs along the east side of the American University main campus. The roadway is classified by DDOT as a primary arterial with average annual weekday traffic of 24,500 vehicles. Within the limits of the study area, Nebraska Avenue runs from Massachusetts Avenue to Rockwood Parkway.

- *46th Street*
  North of the American University main campus, 46th Street is a 2-lane roadway. The roadway is classified by DDOT as a collector with average annual weekday traffic of 2,300 vehicles. Within the limits of the study area, 46th Street intersects Massachusetts Avenue on the northwest corner of the main campus.

- *Tilden Street*
  Tilden Street is a 2-lane roadway, west of the American University main campus. The roadway is classified by DDOT as a local road. Within the limits of the study area, Tilden Street intersects Massachusetts Avenue on the northwest corner of the main campus.

- *University Avenue*
  University Avenue is a 2-lane roadway, west of the American University main campus. The roadway is classified by DDOT as a local road. Within the limits of the study area, University Avenue intersects Massachusetts Avenue on the northwest corner of the main campus.

- *New Mexico Avenue*
  New Mexico Avenue is a 4-lane roadway, east of the American University main campus. The roadway is classified by DDOT as a minor arterial with average annual weekday traffic of 9,600 vehicles. Within the limits of the study area, New Mexico Avenue intersects Nebraska Avenue on the southeast side of the main campus.

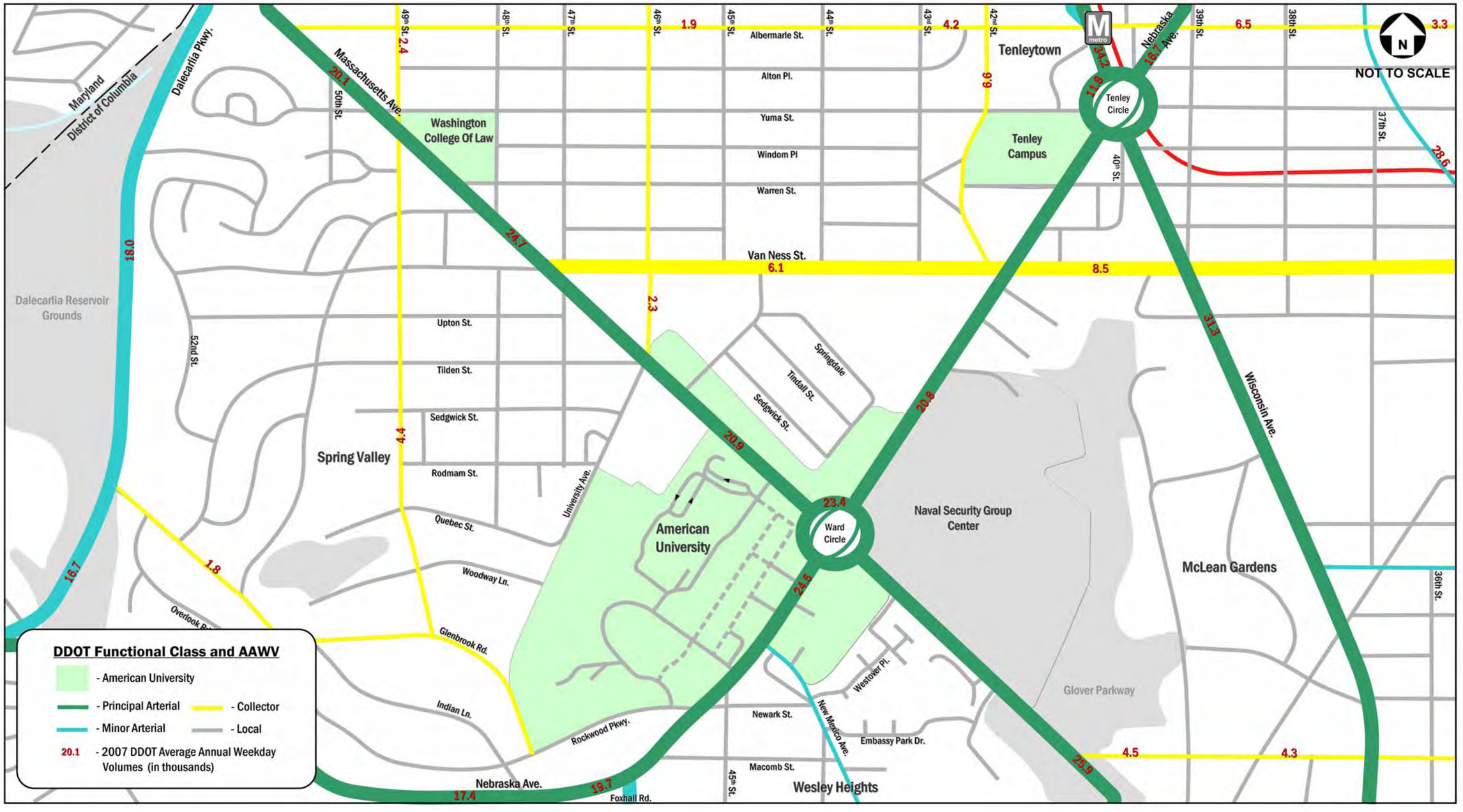

Figure 2: Functional Class and Average Annual Weekday Volumes

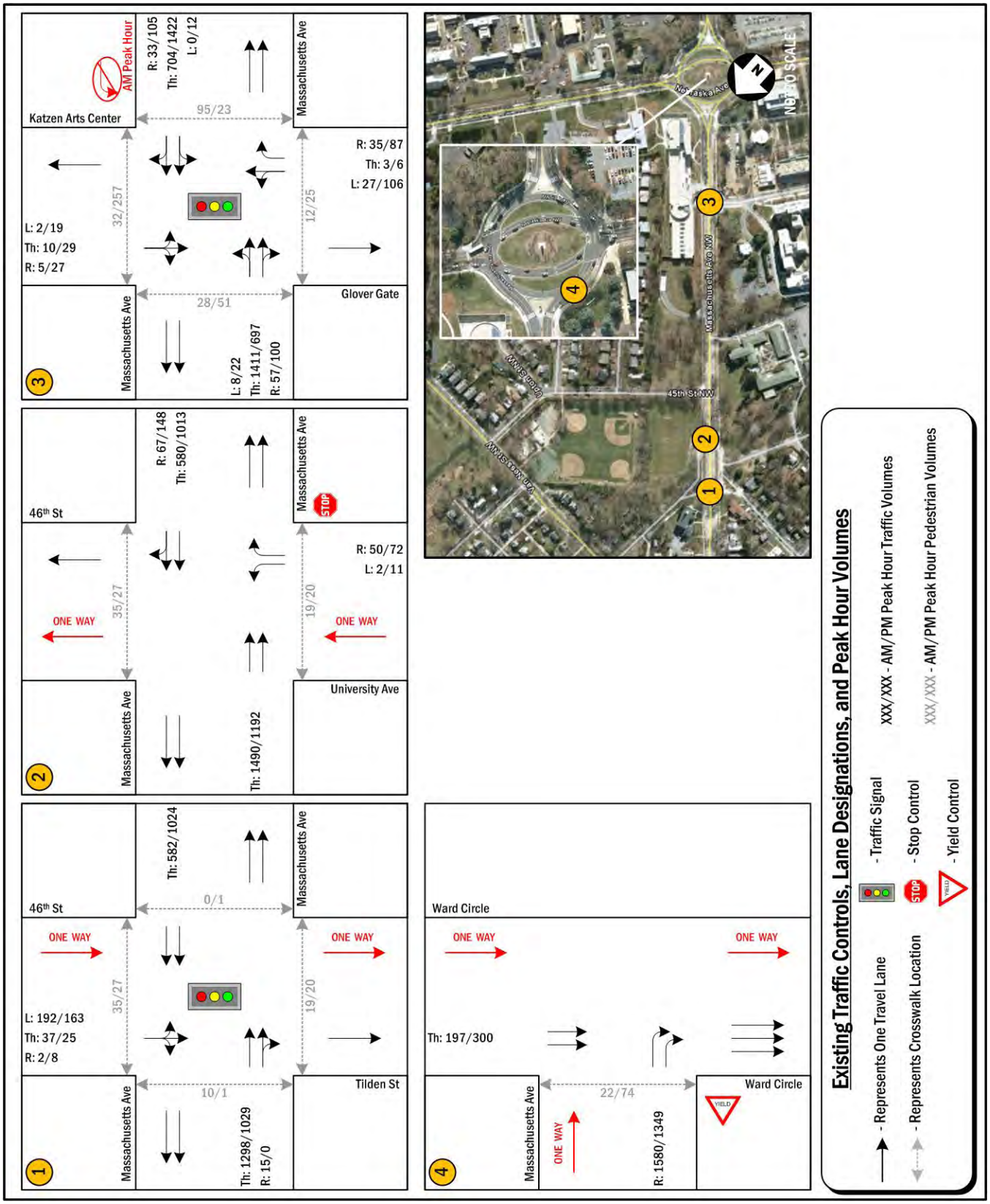

Figure 3: Existing Traffic Controls, Lane Designations, and Peak Hour Traffic Volumes (1 of 4)

Figure 4: Existing Traffic Controls, Lane Designations, and Peak Hour Traffic Volumes (2 of 4)

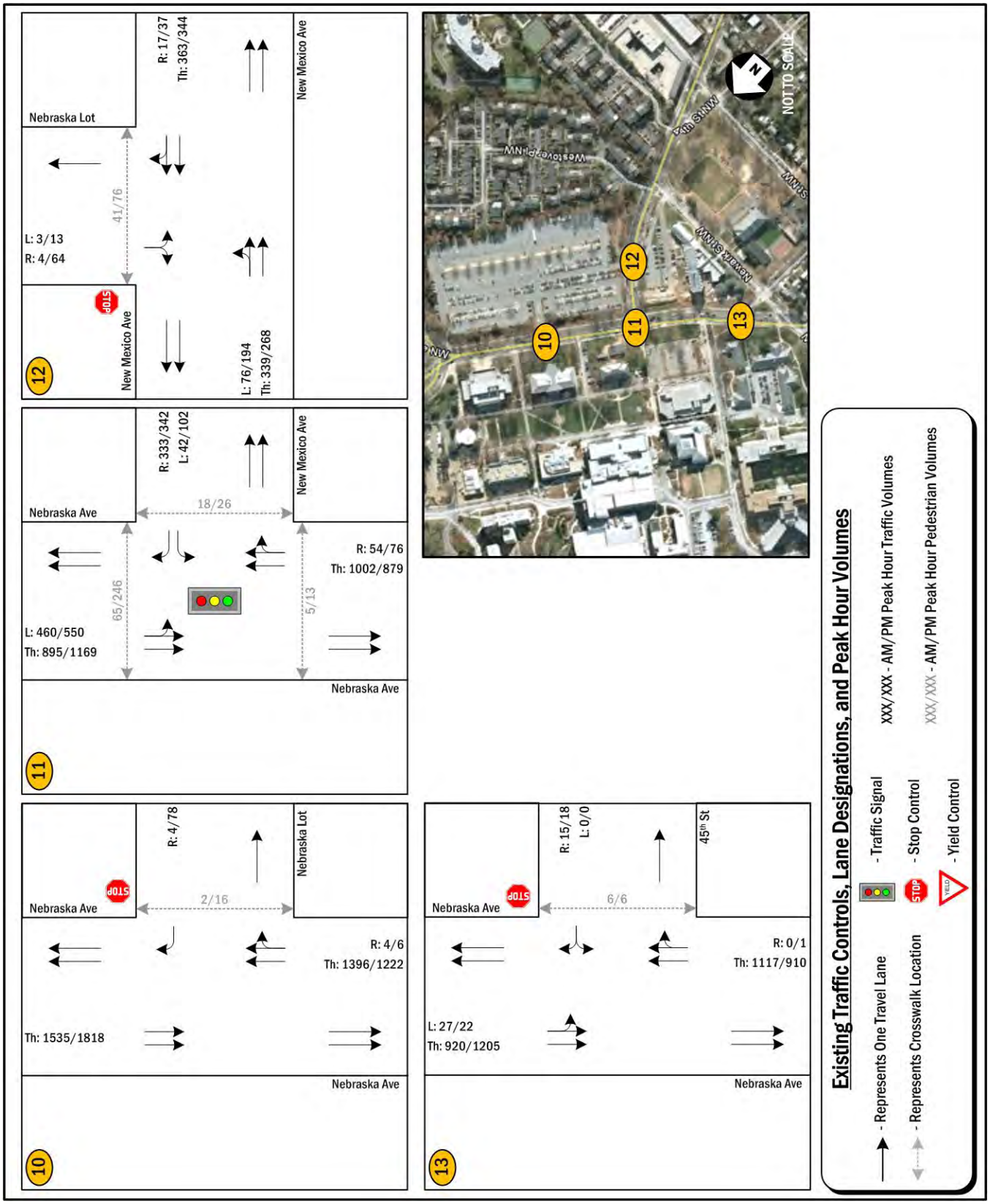

Figure 5: Existing Traffic Controls, Lane Designations, and Peak Hour Traffic Volumes (3 of 4)

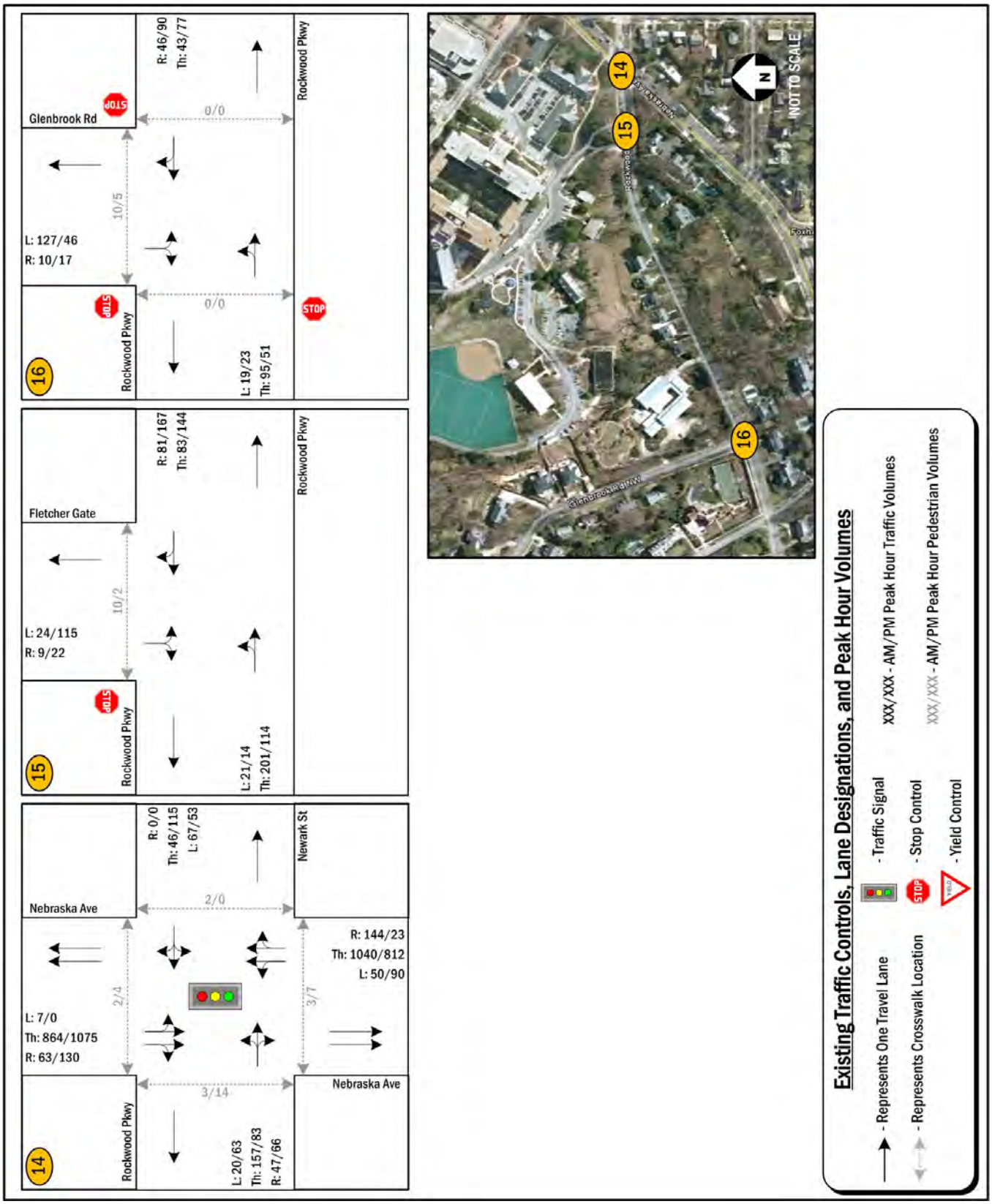

Figure 6: Existing Traffic Controls, Lane Designations, and Peak Hour Traffic Volumes (4 of 4)

Figure 7: Existing Number of Travel Lanes for the AU Main Campus

- *45th Street*

  South of the American University main campus, 45th Street is a 2-lane roadway. The roadway is classified by DDOT as a local road. Within the limits of the study area, 45th Street intersects Nebraska Avenue on the southeast corner of the main campus.

- *Rockwood Parkway*

  Rockwood Parkway is a 2-lane roadway, south of the American University main campus. The roadway is classified by DDOT as a collector with average annual weekday traffic of 1,800 vehicles. Within the limits of the study area, Rockwood Parkway runs from Glenbrook Road to Nebraska Avenue.

- *Newark Street*

  Newark Street is a 2-lane roadway, south of the American University main campus. The roadway is classified by DDOT as a local road. Within the limits of the study area, Newark Street intersects Nebraska Avenue on the southeast corner of the main campus.

- *Glenbrook Road*

  Glenbrook road is a 2-lane roadway, west of the American University main campus. The roadway is classified by DDOT as a collector. Within the limits of the study area, Glenbrook Road intersects Rockwood Parkway on the southwest corner of the main campus.

- *Yuma Street*

  Yuma Street is a 2-lane roadway, north of the American University Tenley campus. The roadway is classified by DDOT as a local road. Within the limits of the study area, Yuma Street runs from 42nd Street to Nebraska Avenue.

- *Warren Street*

  Warren Street is a 2-lane roadway, south of the American University Tenley campus. The roadway is classified by DDOT as a local road. Within the limits of the study area, Warren Street runs from 42nd Street to Nebraska Avenue.

- *42nd Street*

  West of the American University Tenley campus, 42nd Street is a 2-lane roadway. The roadway is classified by DDOT as a collector, with an average daily traffic of 6,600 vehicles. Within the limits of the study area, 42nd Street runs from Yuma Street to Warren Street. The posted speed limit in the vicinity of the site is 25 mph.

Site access for the main campus is provided by three gates that provide direct access to campus, as well as two access points to the Nebraska Avenue Parking Lot. Figure 8 shows the primary access points on the AU main campus.

The primary access is Glover Gate, which is located on the north side of the American University main campus, along Massachusetts Avenue. Glover Gate intersects Massachusetts Avenue at a signalized intersection, across from access to the Katzen Arts Center and parking garage. Secondary access to the main campus is Fletcher Gate, which is located on the south side of the American University main campus, along Rockwood Parkway. Fletcher Gate intersects Rockwood Parkway at an unsignalized intersection. Woods Gate along the east side of the main campus provides access to a small parking lot but not the remainder of campus. All other campus gates are closed to vehicular traffic. Access to the Nebraska Avenue Parking Lot is provided by a right-in, right-out intersection on Nebraska Avenue and a full access unsignalized intersection on New Mexico Avenue.

Figure 8: Site Access Locations for the AU Main Campus

Existing Traffic Volumes

Traffic counts, including vehicular and pedestrian volumes, were conducted at the key study intersections between the hours of 6:00 to 9:00 AM and 3:00 to 7:00 PM on Tuesday-Wednesday, November 18-19, 2008. These count dates represent a typical weekday when classes are in session for the University. The results of the traffic counts are included in the Technical Appendix. The morning and afternoon peak hours for the system of intersections being studied occur between 7:45 and 8:45 AM and 5:00 and 6:00 PM, respectively. Peak hour traffic volumes are shown on Figure 3, Figure 4, Figure 5, and Figure 6.

Field Observations

Observations of the study intersections were performed by Gorove/Slade in order to determine the lane configurations and signal timings. During these observation periods, remarks were noted in regards to signal operation. These observations were used to confirm the capacity analysis results for the existing conditions. The following observations were recorded for the intersections within the study area.

- *Massachusetts Avenue and Tilden Street/46th Street*

  During the morning peak period, the intersection operated under acceptable conditions. The intersection was most heavily trafficked by vehicles traveling eastbound on Massachusetts Avenue. Vehicles arrived mostly in platoons from an upstream intersection. Eastbound progression along Massachusetts Avenue was timed well, with platoons arriving as the signal turned to a green phase. Traffic traveling westbound on Massachusetts Avenue was not as heavy. Vehicles traveling westbound also arrived in platoons from an upstream intersection. The east- and westbound movements experienced short queue development of 3-4 vehicles. The majority of vehicles traveling southbound from 46th Street turned left onto Massachusetts Avenue eastbound. Southbound vehicles did not incur an unacceptable amount of delay, though long queues of 8-10 vehicles developed during the east- and westbound green time.

  During the afternoon peak period, the intersection also operated under acceptable conditions. The intersection was most heavily trafficked by vehicles traveling westbound on Massachusetts Avenue. Traffic traveling eastbound on Massachusetts Avenue was significant but not as heavy. The east- and westbound movements experienced short queue development of 3-4 vehicles. Southbound vehicles did not incur an unacceptable amount of delay, with queues of 4-6 vehicles developing during the east- and westbound green time.

  Very little pedestrian activity was observed during the morning and afternoon peak periods.

- *Massachusetts Avenue and University Avenue/46th Street*

  During the morning peak period, the intersection operated under acceptable conditions. East- and westbound traffic free-flowed through the intersection, incurring little to no delay. A small amount of traffic was observed traveling northbound. Vehicles did not experience an unacceptable amount of delay due to large gaps in east- and westbound traffic.

  During the afternoon peak period, similar traffic conditions were observed. East- and westbound traffic free-flowed through the intersection, and a small amount of traffic was observed traveling northbound. Vehicles did not experience an unacceptable amount of delay.

  Very little pedestrian activity was observed during the morning and afternoon peak periods.

- *Massachusetts Avenue and Glover Gate/Katzen Arts Center*

  The intersection operated under acceptable conditions during the morning peak period. The majority of traffic was traveling eastbound on Massachusetts Avenue. The eastbound approach experienced a small amount of delay during the north- and southbound green time. The westbound approach had a high volume of vehicles as well, with a small amount of delay incurred during the north- and southbound green time. East- and westbound queues of 3-4 vehicles developed. Only a small number of vehicles were observed traveling north- and southbound.

  The intersection operated under similar conditions during the afternoon peak period. However, the majority of traffic was traveling westbound on Massachusetts Avenue. East- and westbound queues of 3-4 vehicles developed during the north- and southbound green time. An increase in north- and southbound vehicular traffic was observed, with vehicles exiting the campus. North- and southbound queues of approximately 3-4 vehicles developed.

  The green time allocated to the north- and southbound approaches appeared to be provided for pedestrian traffic. There were few vehicles observed during the morning and afternoon peak hours on the north- and southbound approaches of the intersection. However, the signal remained green in order to provide adequate time for pedestrians to cross Massachusetts Avenue. The majority of pedestrians observed during the morning and afternoon peak periods appeared to travel across Massachusetts Avenue from the bus stop adjacent to the intersection. Some east- and westbound pedestrians were observed. Most of the pedestrians appeared to utilize the crosswalks and pedestrian signals.

- *Ward Circle – Massachusetts Avenue and Nebraska Avenue*

  Ward Circle experienced an acceptable amount of delay during the morning peak period. The east- and westbound approaches at the yield-controlled intersections of Massachusetts Avenue with the Circle experienced a small amount of delay due to heavy traffic volumes within the Circle. Eastbound queues of 4-6 vehicles and queues of approximately 2-3 vehicles developed. The north- and southbound approaches at the signalized intersections of Nebraska Avenue with the Circle incurred a higher amount of delay due to vehicles stuck within the through movement of the Circle. The vehicles within the Circle cleared the intersection during the allotted north- and southbound green time. Queues of 6-8 vehicles developed for the north- and southbound approaches. Near the end of the morning peak period, a high amount of delay was observed for the northbound approach of Nebraska Avenue. This was due to vehicles parked along the northbound lanes, constricting the roadway from 2 lanes to 1 lane north of Ward Circle. In addition to the roadway constriction, an event was observed at the Japanese Embassy on Nebraska Avenue north of Massachusetts Avenue, which caused traffic to back up behind vehicles turning left into the Embassy.

  Ward Circle operated near capacity during the afternoon peak period. The east- and westbound approaches (yield to traffic in circle) appeared to experience a small amount of delay due to heavy traffic volumes within the circle. East- and westbound queues of 4-6 vehicles developed. The north- and southbound approaches appeared to incur a higher amount of delay due to vehicles stuck within the through movement of the circle, which caused queues of 8-10 vehicles to develop.

  Few pedestrians were observed in Ward Circle during the morning peak period. The majority crossed Nebraska Avenue going westbound on Massachusetts Avenue from the commuter parking lot toward campus. A larger number of pedestrians were observed during the afternoon peak period. The majority crossed Nebraska Avenue

going eastbound on Massachusetts Avenue from campus toward the commuter parking lot. Due to heavy traffic volumes, pedestrians appeared to utilize both crosswalks and pedestrian signals during both the peak hours.

- *Nebraska Avenue and the Nebraska Avenue Parking Lot*

  The intersection experienced little to no delay during the morning peak period. Due to the right-in/right-out configuration of the intersection, southbound traffic did not incur any delay. Very little traffic entered the parking lot from the northbound approach. During the observation, no traffic was observed exiting the parking lot.

  The intersection also experienced little to no delay during the afternoon peak period. Very little traffic entered the parking lot from the northbound approach. Traffic exiting the parking lot experienced some delay, with queues of 3-4 vehicles developing. Occasional northbound queues from Ward Circle extended back to the intersection, blocking exiting traffic.

  Some pedestrian activity was observed, with the majority of pedestrians traveling southbound on Nebraska Avenue. Although pedestrians are prohibited from crossing Nebraska Avenue at the intersection, some crossings were observed with pedestrians weaving in between stopped vehicles.

- *Nebraska Avenue and New Mexico Avenue*

  The intersection experienced an acceptable amount of delay during the morning peak hour. The majority of traffic was traveling northbound on Nebraska Avenue. The northbound approach did not experience a significant amount of delay during the peak period. However, near the end of the morning peak period, northbound vehicles experienced delay extending from Ward Circle. This caused a long northbound queue to develop of 8-10 vehicles. Due to the southbound leading left-turn, the southbound movement was able to clear the intersection during the majority of the green time. Some southbound queuing was observed with 8-10 vehicles waiting to make the southbound left-turn. Only a small number of vehicles were observed traveling westbound. Due to pedestrians and northbound queues extending from Ward Circle, some queuing developed in the westbound right-turn lane of approximately 3-4 vehicles.

  The intersection experienced an acceptable amount of delay during the afternoon peak hour as well. The majority of traffic was traveling north- and southbound on Nebraska Avenue. The northbound approach did not experience a significant amount of delay. Significant southbound queuing was observed of 8-10 vehicles, which was caused by vehicles waiting to make the southbound left-turn. Occasional northbound queues from Ward Circle extended back to the intersection, blocking vehicles turning right from New Mexico Avenue. Due to pedestrians and northbound queues extending from Ward Circle, some queuing developed in the westbound right-turn lane of 3-4 vehicles. Overall, westbound queues developed of 4-6 vehicles per cycle.

  A significant number of pedestrians were observed during both the morning and afternoon peak periods, with the majority crossing westbound and eastbound, respectively, between the Main Campus and the Nebraska Avenue Parking Lot and an adjacent bus stop. Most of the pedestrians appeared to utilize the crosswalks and pedestrians signals due to heavy traffic volumes along the north- and southbound approaches.

- *New Mexico Avenue and the Nebraska Avenue Parking Lot*

  The intersection experienced little to no delay during the morning peak hour. The majority of traffic entering the parking lot was traveling eastbound on New Mexico Avenue, with very little traffic entering from the westbound approach. Some queuing was observed for the eastbound left-turn movement, with 3-4 vehicles yielding to pedestrians in the crosswalk. During the observation, no traffic was observed exiting the parking lot.

Similar to the morning peak period, the intersection experienced little to no delay during the afternoon peak hour. The majority of traffic exiting the parking lot turned right and traveled westbound on New Mexico Avenue. During the observation, no traffic was observed entering the parking lot.

Some pedestrian activity was observed during the morning and afternoon peak periods, with the majority of pedestrians traveling westbound and eastbound, respectively, on New Mexico Avenue between the Main Campus and the parking lot.

- *Nebraska Avenue and 45th Street*

  During the morning peak period, the intersection experienced little to no delay. Minor queuing was observed for the southbound left-turn movement on Nebraska Avenue, with 2-3 vehicles yielding to opposing northbound traffic. The northbound approach was heavily trafficked, but did not incur any delay. During the observation, very little traffic was observed on 45th Street.

  During the afternoon peak period, the intersection also experienced little to no delay. The north- and southbound approaches of Nebraska Avenue and the westbound approach of 45th Street was observed to operate similar to the morning peak period.

  No pedestrian traffic was observed during the morning and afternoon peak periods.

- *Nebraska Avenue and Rockwood Parkway*

  The intersection did not experience an unacceptable amount of delay during the morning peak period. The majority of traffic was traveling northbound on Nebraska Avenue. The southbound approach had a high volume of vehicles as well. North- and southbound queues of 1-2 vehicles and east- and westbound queues of 3-4 vehicles developed. Only a small number of vehicles were observed traveling east- and westbound, with a majority of those vehicles turning onto Nebraska Avenue.

  The intersection did not appear to experience an unacceptable amount of delay during the afternoon peak period as well. The majority of traffic was traveling north- and southbound on Nebraska Avenue. North- and southbound queues of 6-8 vehicles and east- and westbound queues of 4-6 vehicles developed. Occasional northbound queues extended from the intersection of Nebraska Avenue and New Mexico Avenue. Only a small number of vehicles were observed traveling east- and westbound, with a majority of those vehicles turning onto Nebraska Avenue.

  Very little pedestrian traffic was observed during the morning and afternoon peak periods. Most of the pedestrians appeared to utilize the crosswalks and pedestrian signals.

- *Rockwood Parkway and Fletcher Gate*

  The intersection did not experience any delay during the morning peak period. The majority of traffic was traveling on Rockwood Parkway toward Nebraska Avenue. Only a small number of vehicles were observed turning into Fletcher Gate. A small number of vehicles were also observed exiting campus from Fletcher Gate, with little to no queue development.

  The intersection did not experience any delay during the afternoon peak period as well. The majority of traffic was also traveling on Rockwood Parkway toward Nebraska Avenue. A small number of vehicles were observed exiting campus from Fletcher Gate, with queue development of 2-3 vehicles.

Very few pedestrians were observed during both the morning and afternoon peak periods, although all appeared to be travelling to and from campus via the Fletcher Gate.

- *Rockwood Parkway and Glenbrook Road*

  The intersection did not experience any delay during the morning peak hour. The majority of traffic appeared to be traveling on Rockwood Parkway toward Nebraska Avenue. Only a small number of vehicles were observed on Glenbrook Road, with little to no queue development.

  The intersection did not experience any delay during the afternoon peak hour as well. The majority of traffic was traveling on Rockwood Parkway toward Nebraska Avenue. Only a small number of vehicles were observed on Glenbrook Road, with little to no queue development.

  Very few pedestrians were observed during the morning and afternoon peak periods.

Existing Vehicular Capacity Analysis

Intersection capacity analyses were performed for the existing conditions at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 7.0* was used to analyze the study intersections based on the Highway Capacity Manual (HCM) methodology. The results of the capacity analyses are expressed in level of service (LOS) and delay (seconds per vehicle) for each approach. A LOS grade is a letter grade based on the average delay (in seconds) experienced by motorists traveling through an intersection. LOS results range from "A" being the best to "F" being the worst. LOS E is typically used as the acceptable LOS threshold in the District; although LOS F is sometimes accepted in urbanized areas.

The existing LOS capacity analyses were based on: (1) the existing lane use and traffic controls; (2) the peak hour turning movement volumes; and (3) the Highway Capacity Manual (HCM) methodologies (using *Synchro 7* software). An average delay (of each approach) and LOS for the signalized intersections is also shown for an overall intersection LOS grade. The HCM does not give guidelines for calculating the average delay for a two-way stop-controlled intersection, as the approaches without stop signs would technically have no delay. Detailed LOS descriptions and the analysis worksheets are contained in the Technical Appendix.

Table 1 shows the results of the capacity analyses, including LOS and average delay per vehicle (in seconds). The capacity analysis results are also shown on Figure 9, Figure 10, Figure 11, and Figure 12. The capacity analyses results indicate that all study area intersections operate at acceptable levels of service during both the morning and afternoon peak hours.

Table 1: Existing Conditions (2008) Vehicular Levels of Service

Intersection (Approach)	(Approach)	Existing Conditions (2008) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/Tilden St	**Overall**	**15.5**	**B**	**10.8**	**B**
	Eastbound	16.8	B	8.8	A
	Westbound	7.1	A	7.8	A
	Southbound	28.9	B	37.5	D
Massachusetts Ave & 46th St/University Ave	Northbound	11.9	B	13.8	B
Massachusetts Ave & Glover Gate/Katzen Arts	**Overall**	**10.3**	**B**	**13.8**	**B**
Center	Eastbound	7.0	A	5.3	A
	Westbound	15.0	B	14.0	B
	Northbound	29.6	C	38.5	D
	Southbound	29.3	C	35.6	D
Ward Circle:					
Massachusetts Ave & Ward Circle	Eastbound Right	32.6	D	34.2	D
Nebraska Ave & Ward Circle	**Overall**	**27.1**	**C**	**22.9**	**C**
	Eastbound	16.3	B	16.8	B
	Northbound	56.3	E	40.1	D
	Southbound	12.3	B	15.3	B
Massachusetts Ave & Ward Circle	Westbound Right	12.1	B	41.6	E
Nebraska Ave & Ward Circle	**Overall**	**19.1**	**B**	**33.1**	**C**
	Westbound	13.1	B	16.7	B
	Northbound	11.6	B	11.2	B
	Southbound	30.4	C	66.3	E
Nebraska Ave & Commuter Lot (RIRO)	Westbound Right	9.4	A	9.8	A
Nebraska Ave & New Mexico Ave	**Overall**	**21.0**	**C**	**31.3**	**C**
	Westbound	28.4	C	30.1	C
	Northbound	14.4	B	16.1	B
	Southbound	24.0	C	40.1	D
New Mexico Ave & Commuter Lot	Eastbound Left	3.8	A	7.0	A
	Southbound	12.9	B	14.2	B
Nebraska Ave & 45th St	Southbound Left	1.3	A	0.8	A
	Westbound	9.4	A	9.8	A
Nebraska Ave & Rockwood Pkwy	**Overall**	**11.4**	**B**	**12.2**	**B**
	Eastbound	39.4	D	41.6	D
	Westbound	39.4	D	38.7	D
	Northbound	11.1	B	10.9	B
	Southbound	1.7	A	4.3	A
Rockwood Pkwy & Fletcher Gate	Eastbound Left	0.8	A	1.0	A
	Southbound	10.7	B	12.1	B
Rockwood Pkwy & Glenbrook Rd	**Overall**	**8.2**	**A**	**7.7**	**A**
	Eastbound	8.2	A	7.7	A
	Westbound	7.6	A	7.7	A
	Southbound	8.5	A	7.8	A

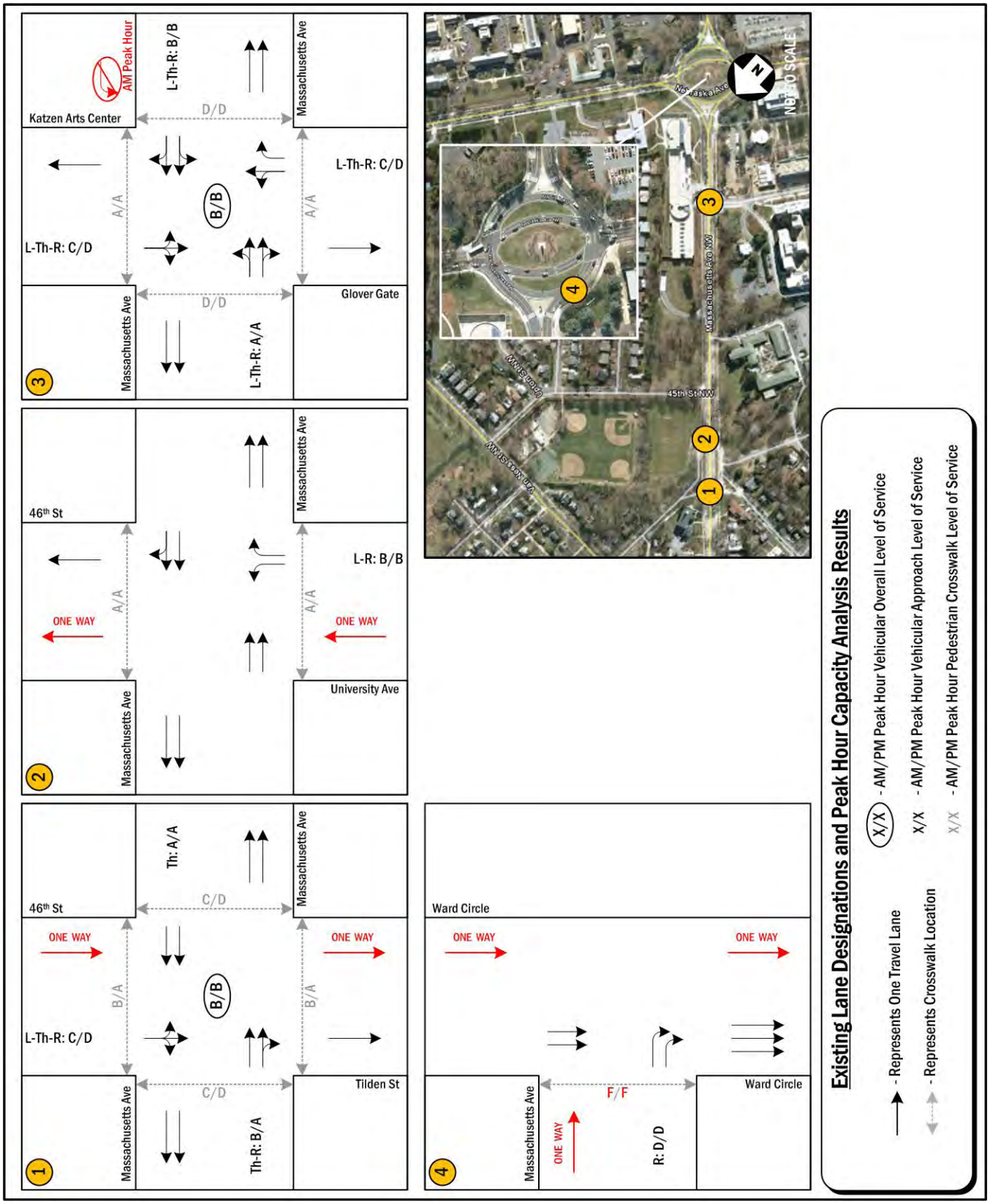

Figure 9: Existing Lane Configurations and Peak Hour Capacity Analysis Results (1 of 4)

Figure 10: Existing Lane Configurations and Peak Hour Capacity Analysis Results (2 of 4)

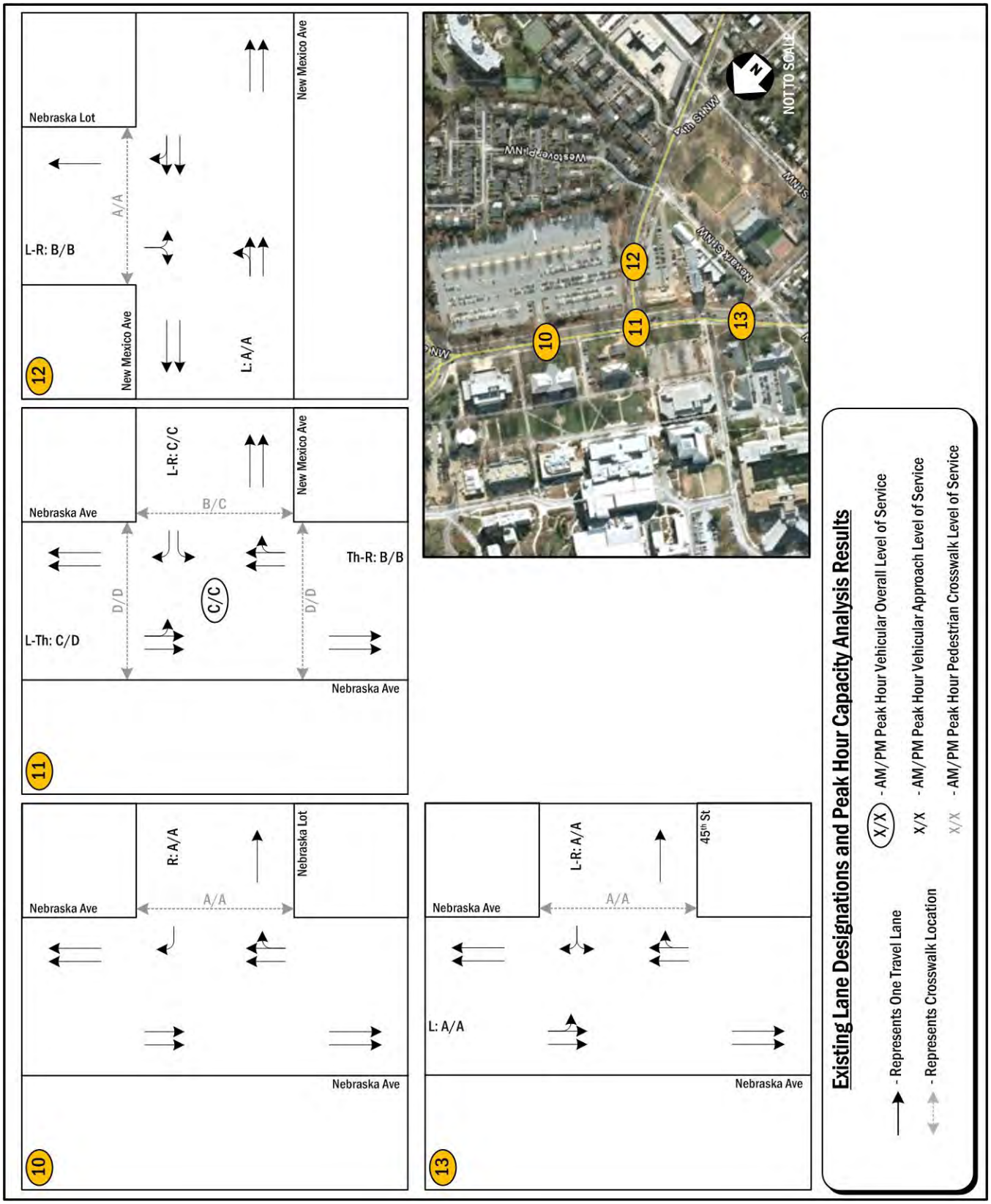

Figure 11: Existing Lane Configurations and Peak Hour Capacity Analysis Results (3 of 4)

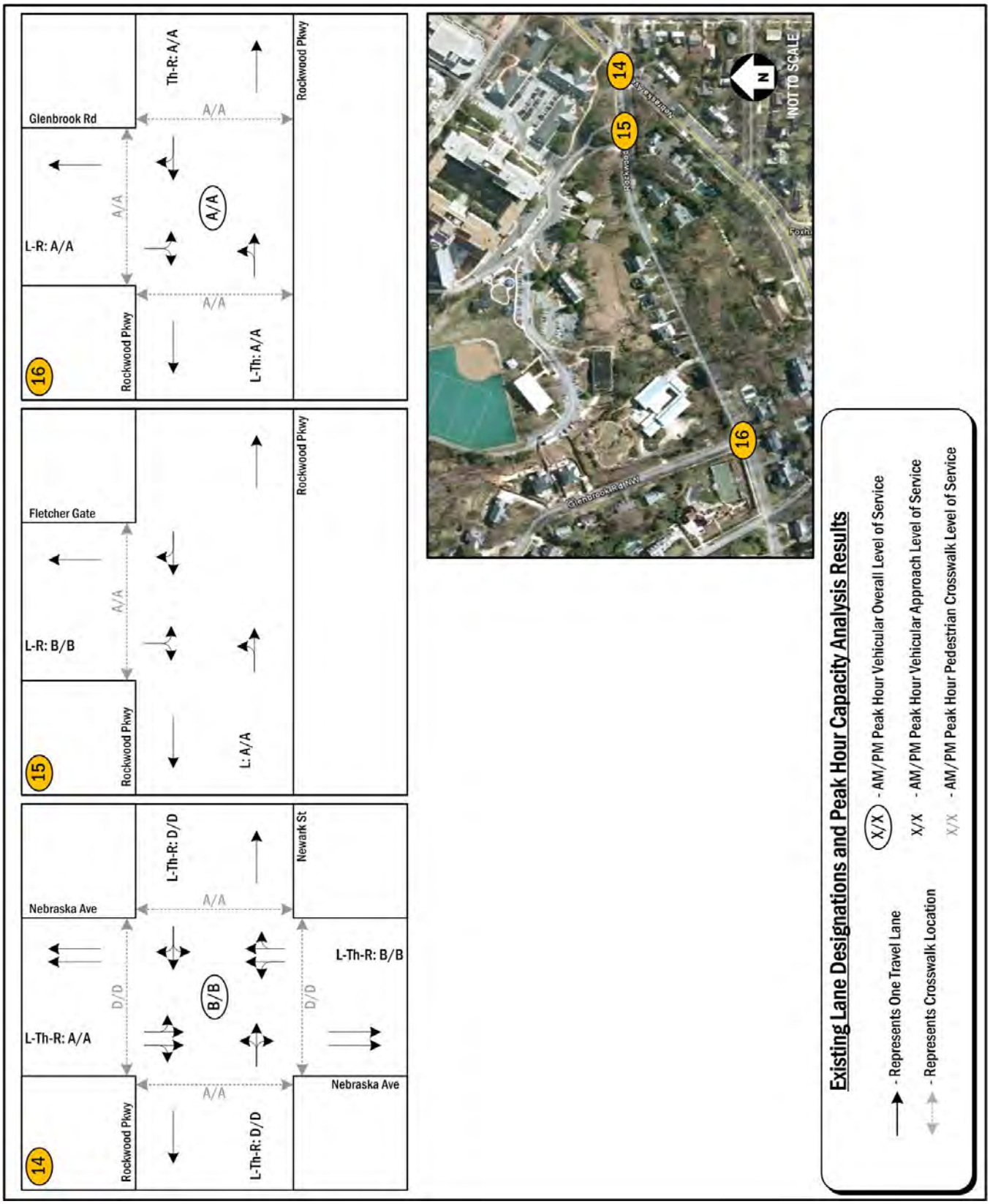

Figure 12: Existing Lane Configurations and Peak Hour Capacity Analysis Results (4 of 4)

Summary of Existing Vehicular Capacity Analysis Results

For the purpose of this analysis, it is desirable to achieve a level of service (LOS) of "E" or better on each approach. As stated previously, all study area intersections operate at acceptable levels of service during the morning and afternoon peak hours. The results from the capacity analyses confirm what was observed in the field.

- All of the study intersections operate at acceptable conditions during both the morning and afternoon peak hours.
- The eastbound approach at Ward Circle (Massachusetts Avenue and Nebraska Avenue) operates near capacity during the morning and afternoon peak periods. The westbound approach also operates near capacity during the morning peak period and at capacity during the afternoon peak period. These were observed in the field, with vehicles queuing in the east- and westbound approaches due to heavy traffic within the circle and conflicting pedestrian movements.
- The northbound approach at Ward Circle operates at capacity during the morning peak period and near capacity during the afternoon peak period. The southbound approach also operates at capacity during the afternoon peak period. These were observed in the field, with north- and southbound vehicles queuing at Ward Circle due to heavy traffic volumes and vehicles stuck within the Circle.
- The southbound approach at Nebraska Avenue and New Mexico Avenue experiences operates near capacity during the afternoon peak hour. This was observed in the field, with southbound vehicles queuing due to vehicles turning left onto New Mexico Avenue.

Comparison of 2008 and 2000 Capacity Analysis Results

The results of the existing capacity analysis show some notable changes from the capacity analysis performed for the 2000 Campus Plan, as shown in Table 2. The intersections of Nebraska Avenue & Rockwood Parkway and of Rockwood Parkway & Fletcher Gate did not experience any significant changes in level of service between the 2000 and 2008 capacity analyses. The following changes in level of service were observed between the 2000 and 2008 capacity analyses:

- *Massachusetts Avenue & 46th Street/Tilden*
  Morning peak hour overall LOS improved from LOS C in 2000 to LOS B in 2008.
- *Massachusetts Avenue & 46th Street/University*
  Morning and afternoon peak hour northbound LOS improved from LOS F in 2000 to LOS B in 2008.
- *Massachusetts Avenue & Glover Gate/Katzen Arts Center*
  Morning peak hour overall LOS degraded from LOS A in 2000 to LOS C in 2008. Northbound afternoon peak hour LOS degraded from LOS C in 2000 to LOS D in 2008.
- *Massachusetts Avenue & Nebraska Avenue (Ward Circle)*
  Morning and afternoon peak hour LOS improved from LOS E/F and E/C in 2000 to LOS C/C and B/C in 2008 at the southern and northern signalized intersections within Ward Circle.
- *Nebraska Avenue & Commuter Lot*
  Morning and afternoon peak hour LOS improved from LOS B/C in 2000 to LOS A/A in 2008 for the westbound right-turn.

- *Nebraska Avenue & New Mexico Avenue*

  Morning peak hour overall LOS degraded from LOS B in 2000 to LOS C in 2008. Southbound afternoon peak hour LOS degraded from LOS C in 2000 to LOS D in 2008.

- *New Mexico Avenue & Commuter Lot*

  Morning and afternoon peak hour LOS for the southbound approach improved from LOS C/C in 2000 to LOS B/B in 2008.

Table 2: Level of Service Results from 2000 Campus Plan

Intersection (Approach)	(Approach)	Campus Plan (2000) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/Tilden St	**Overall**	**21.2**	**C**	**14.0**	**B**
	Eastbound	22.9	C	10.0	B
	Westbound	17.6	B	15.4	B
	Southbound	22.8	C	26.9	C
Massachusetts Ave & 46th St/University Ave	Northbound	60.1	F	51.0	F
Massachusetts Ave & Glover Gate/Katzen Arts Center	**Overall**	**9.3**	**A**	**12.6**	**B**
	Eastbound	10.0	A	10.1	B
	Westbound	5.6	A	12.4	B
	Northbound	30.5	C	26.6	C
	Southbound	--	--	--	--
Ward Circle:					
Nebraska Ave & Ward Circle	**Overall**	**67.2**	**E**	**80.1**	**F**
	Eastbound	17.1	B	15.6	B
	Northbound	151.8	F	135.4	F
	Southbound	46.4	D	85.5	F
Nebraska Ave & Ward Circle	**Overall**	**62.5**	**E**	**33.1**	**C**
	Westbound	14.5	B	17.9	B
	Northbound	37.1	D	38.8	D
	Southbound	125.1	F	51.4	D
Nebraska Ave & Commuter Lot (RIRO)	Westbound Right	14.7	B	16.3	C
Nebraska Ave & New Mexico Ave	**Overall**	**16.4**	**B**	**22.7**	**C**
	Westbound	15.9	B	21.7	C
	Northbound	26.6	C	26.3	C
	Southbound	7.2	A	20.8	C
New Mexico Ave & Commuter Lot	Eastbound Left	8.4	A	8.7	A
	Southbound	16.3	C	15.2	C
Nebraska Ave & Rockwood Pkwy	**Overall**	**15.4**	**B**	**16.5**	**B**
	Eastbound	38.1	D	48.8	D
	Westbound	30.6	D	38.1	D
	Northbound	12.7	B	11.5	B
	Southbound	9.2	A	10.4	B
Rockwood Pkwy & Fletcher Gate	Eastbound Left	8.1	A	8.0	A
	Southbound	13.6	B	12.5	B

Changes in LOS between the 2000 and 2008 capacity analyses are due to several factors, including changes in traffic volumes and traffic patterns, as well as changes to signal timings. Volume increases are generally shown along Nebraska Avenue south of Ward Circle, New Mexico Avenue east of Nebraska Avenue, and Rockwood Parkway east of Nebraska Avenue. Volume decreases are generally shown along Massachusetts Avenue west of Ward Circle and Rockwood Parkway

west of Nebraska Avenue. Changes in LOS between the capacity analyses could also be due to improvements in the software used to estimate the delays and levels of service of the study area intersections. Overall, signal timing changes have had the largest impact.

Comparison of 2008 and 2005 Capacity Analysis Results

The results of the existing capacity analysis show some changes from the capacity analyses performed for the 2005 School of International Services (SIS) Parking Study. The SIS Parking Study consisted of 4 study intersections near campus. There were no changes in level of service at the intersection of Nebraska Avenue & Commuter Lot. The following changes in level of service were observed between the 2005 and 2008 capacity analyses:

- *Massachusetts Avenue & Glover Gate/Katzen Arts Center*
  Morning peak hour overall LOS degraded from LOS A in 2005 to LOS B in 2008.

- *Nebraska Avenue & New Mexico Avenue*
  Morning and afternoon peak hour overall LOS degraded from LOS B/B in 2005 to LOS C/C in 2008.

- *Nebraska Avenue & Rockwood Parkway*
  Afternoon peak hour overall LOS improved from LOS C in 2005 to LOS B in 2008.

Changes in LOS between the 2005 and 2008 capacity analyses could be due to several factors, including changes in traffic volumes and traffic patterns, as well as changes to signal timings. Similar to the capacity analysis performed for the 2000 Campus Plan, the LOS at Massachusetts Avenue and Glover Gate/Katzen Arts Center degraded in the morning peak hour from LOS A in 2005 (and 2000) to LOS B in 2008. This is most likely due to the construction of the Katzen Arts Center Parking Garage. Also similar to the 2000 capacity analysis, LOS at the intersection of Nebraska Avenue and New Mexico Avenue for the morning and afternoon peak hours degraded from LOS B/B in 2005 (LOS B/C in 2000) to LOS C/C in 2008, which could be due to volume increases on Nebraska Avenue and New Mexico Avenue.

Existing Pedestrian Analysis Results

Pedestrian analyses were performed for the existing conditions at the intersections contained within the study area during the morning and afternoon peak hours. The analysis was based on "Chapter 13: Pedestrians" of the Highway Capacity Manual (HCM).

The methodology for signalized intersections was used in order to estimate the average delay experienced by a pedestrian at a signalized crosswalk (the amount of time waiting for a "Walk" sign). This calculation is based on the effective green time programmed for pedestrians and the cycle length and rated by the amount of delay experienced. As stated in the HCM, pedestrian delay is not constrained by capacity, even when pedestrian flow rates reach 5,000 pedestrians per hour (pph). The results of the signalized intersection analyses are expressed in level of service (LOS) and delay (seconds) for each crosswalk. LOS results range from "A" being the best to "F" being the worst. The delay and LOS show the likelihood that a pedestrian will not comply with a traffic-control device (i.e. jaywalking).

The methodology for unsignalized intersections was used in order to estimate the average delay experienced by a pedestrian at an uncontrolled crosswalk. This methodology applies to unsignalized intersections with a pedestrian crossing against a free-flowing traffic stream or an approach not controlled by a stop-sign. The unsignalized intersection methodology does not apply to zebra-striped crossings at unsignalized intersections or at crossings against a traffic stream controlled by a stop-sign because pedestrians have the right-of-way and therefore experience no delay. It should be noted

that in the District, pedestrians have the right-of-way at all crosswalks, including those against a free-flowing traffic stream, and therefore, theoretically experience no delay. However, the analysis was performed at pedestrian crossings against free-flowing traffic streams and yield-controlled approaches in order to evaluate the theoretical delay experienced by pedestrians. The calculation for average pedestrian delay at an unsignalized crossing is based on the average pedestrian walking speed, crosswalk length, assumed pedestrian lost time (start-up and end clearance time), and conflicting vehicular flow rate. The results of the unsignalized intersection analyses are expressed in level of service (LOS) and delay (seconds) for each crosswalk. LOS results range from "A" being the best to "F" being the worst. The delay and LOS show the likelihood that a pedestrian will engage in risk-taking behavior (i.e. accepting a short gap between vehicles).

Table 3 and Table 4 show the results of the capacity analyses, including LOS and average delay (in seconds). The capacity analysis results are also shown on Figure 9, Figure 10, Figure 11, and Figure 12.

Table 3: Existing Conditions (2008) Pedestrian Levels of Service for Signalized Intersections

Intersection (Approach)	(Parallel Approach)	Existing Conditions (2008) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/Tilden St	Eastbound	12.0	B	8.0	A
	Westbound	12.0	B	8.0	A
	Northbound	27.4	C	34.4	D
	Southbound	27.4	C	34.4	D
Massachusetts Ave & Glover Gate/Katzen Arts Center	Eastbound	7.6	A	5.8	A
	Westbound	8.0	A	6.1	A
	Northbound	35.3	D	39.6	D
	Southbound	35.3	D	39.6	D
Ward Circle:					
Nebraska Ave & Ward Circle	Eastbound	16.2	B	16.8	B
Nebraska Ave & Ward Circle	Westbound	16.2	B	16.8	B
Nebraska Ave & New Mexico Ave	Eastbound	39.6	D	39.6	D
	Westbound	39.6	D	39.6	D
	Northbound	19.8	B	21.1	C
Nebraska Ave & Rockwood Pkwy	Eastbound	37.8	D	37.8	D
	Westbound	37.8	D	37.8	D
	Northbound	8.8	A	8.8	A
	Southbound	8.8	A	8.8	A

Table 4: Existing Conditions (2008) Pedestrian Levels of Service for Unsignalized Intersections

Intersection (Approach)	(Approach)	Existing Conditions (2008) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/University Ave	Eastbound	N/A - Stop controlled crossing, LOS A			
	Westbound	N/A - Stop controlled crossing, LOS A			
Ward Circle:					
Massachusetts Ave & Ward Circle	Southbound	160.2	F	94.7	F
Massachusetts Ave & Ward Circle	Northbound	192.0	F	81.3	F
Massachusetts Ave & Ward Circle	Northbound	24.2	D	76.2	F
Massachusetts Ave & Ward Circle	Southbound	18.2	C	54.3	F
Nebraska Ave & Commuter Lot (RIRO)	Northbound	N/A - Stop controlled crossing, LOS A			
New Mexico Ave & Commuter Lot	Westbound	N/A - Stop controlled crossing, LOS A			
Nebraska Ave & 45th St	Northbound	N/A - Stop controlled crossing, LOS A			

Intersection (Approach)	(Approach)	Existing Conditions (2008) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
New Mexico Ave & Commuter Lot	Westbound	N/A - Stop controlled crossing, LOS A			
Rockwood Pkwy & Fletcher Gate	Westbound	N/A - Stop controlled crossing, LOS A			
	Northbound	N/A - Stop controlled crossing, LOS A			
	Southbound	N/A - Stop controlled crossing, LOS A			

Summary of Existing Pedestrian Analysis Results

The analysis results indicate that all signalized crosswalks in the study area operate at acceptable levels of service during both the morning and afternoon peak hours. This indicates a low (LOS A and B) to moderate (LOS C and D) likelihood of non-compliance by pedestrians, which is reflected by pedestrians jaywalking across the intersection. The study intersections with crosswalks operating at LOS D will experience a moderate to high likelihood of non-compliance, so signal timing improvements may be investigated at these intersections in order to improve the pedestrian LOS.

The analysis results also indicate that the majority of the unsignalized crosswalks in the study area operate at unacceptable levels of service during one or more peak hours. This indicates a moderate (LOS C and D) to very high (LOS F) likelihood of risk-taking behavior for pedestrians, which is reflected in pedestrians dashing between vehicles during short gaps in traffic. As stated previously, pedestrians have the right-of-way in all crosswalks in the District, so vehicles must yield to pedestrians in the crosswalk at the study intersections listed in Table 4. However, the LOS F calculated for the unsignalized approaches of Ward Circle during the morning and afternoon peak hours indicates an unfriendly and intimidating environment for pedestrians. Signing and striping improvements may be investigated in order to promote vehicular compliance and make pedestrians feel more comfortable.

FUTURE CONDITIONS WITHOUT DEVELOPMENT

The American University Campus Plan projects the future growth and development on the campus for 2010-2020. In order to determine the impact of the proposed development on campus, the future conditions without development are investigated as a benchmark.

Future Conditions without Development Traffic Volumes

The traffic generated by nearby developments and inherent growth on the roadways within the study area are accounted for in the future without development traffic projections. The background developments included are the Wisconsin Avenue Giant and the American University Tenley Campus, as agreed upon during a scoping meeting with the District Department of Transportation (DDOT) on April 29, 2010. Future site-generated traffic volumes for the Wisconsin Avenue Giant were obtained from the *Transportation Impact Study* performed by Wells & Associates, Inc. in May 2008. Future site-generated traffic volumes for the development occurring on the AU Tenley Campus were obtained from the *American University Campus Plan Traffic and Parking Analysis* performed by Gorove/Slade in December 2000. Other traffic increases due to inherent growth was accounted for with a 1% and 0.5% growth rate for through volumes on Nebraska Avenue and Massachusetts Avenue, respectively, compounded annually over the 12-year period of analysis (2008 to 2020). These rates were determined by comparing existing vehicular volumes travelling along Nebraska Avenue and Massachusetts Avenue to volumes from previous studies, including the 2000 Campus Plan and the 2005 School of International Services (SIS) Parking Study.

The traffic volumes generated by the Wisconsin Avenue Giant, the AU Tenley Campus, and the inherent growth were added to the existing (2008) traffic volumes in order to establish the future (2020) traffic volumes without the proposed development on the AU Main Campus. The traffic volumes for the future conditions without development are shown on Figure 13, Figure 14, Figure 15, and Figure 16 for the morning peak hour and on Figure 17, Figure 18, Figure 19, and Figure 20 for the afternoon peak hour.

Future Conditions without Development Vehicular Capacity Analysis

Intersection capacity analyses were performed for the future conditions without development at the intersections contained within the study area during the morning and afternoon peak hours, following the methodology outlined previously. The LOS capacity analyses for the future conditions without development were based on: (1) the existing lane use and traffic controls; (2) the addition of a protected right-turn movement for vehicles exiting Ward Circle on to Nebraska Avenue to separate vehicles and pedestrians and the corresponding lane marking changes at the northern intersection of Nebraska Avenue and Ward Circle, which was discussed with DDOT to be included in future scenarios; (3) the peak hour turning movement volumes described previously; and (4) the Highway Capacity Manual (HCM) methodologies (using *Synchro 7* software). Detailed LOS descriptions and the analysis worksheets are contained in the Technical Appendix.

Table 5 shows the results of the capacity analyses, including LOS and average delay per vehicle (in seconds). The capacity analysis results are also shown on Figure 21, Figure 22, Figure 23, and Figure 24. The capacity analyses results indicate that all study area intersections operate at acceptable levels of service during both the morning and afternoon peak hours. However, some approaches operate at unacceptable levels of service during one of more peak period.

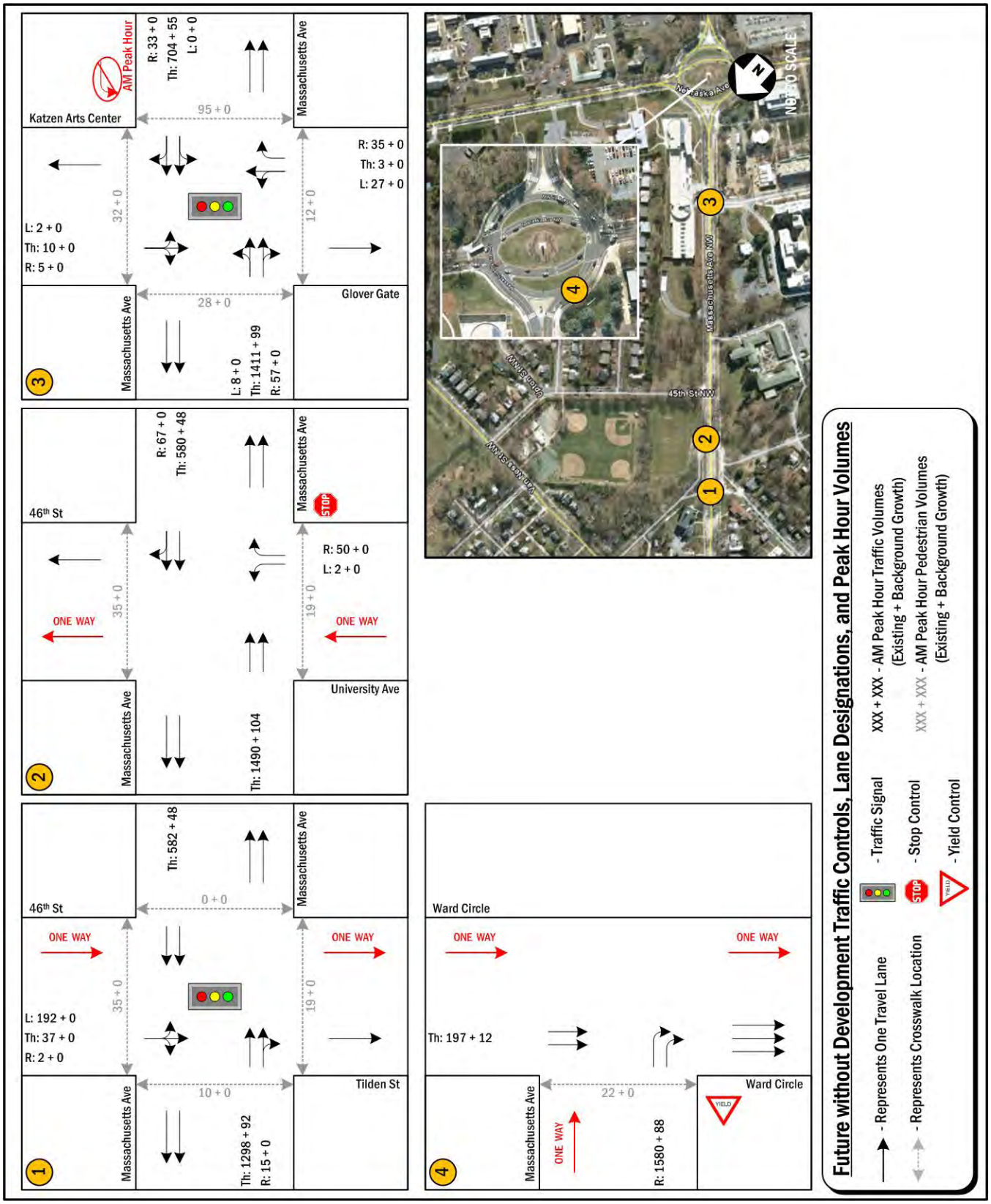

Figure 13: Future without Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (1 of 4)

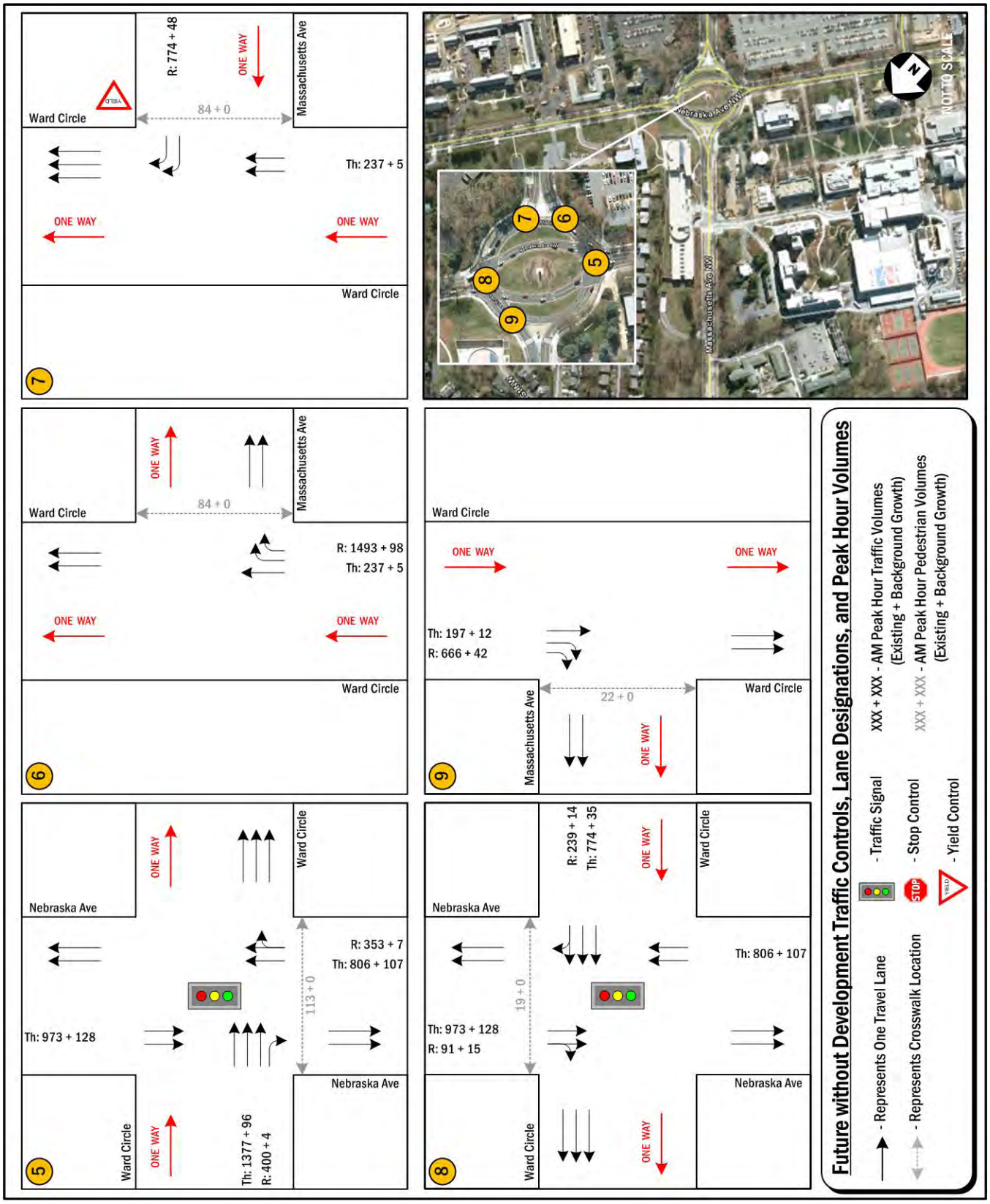

Figure 14: Future without Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (2 of 4)

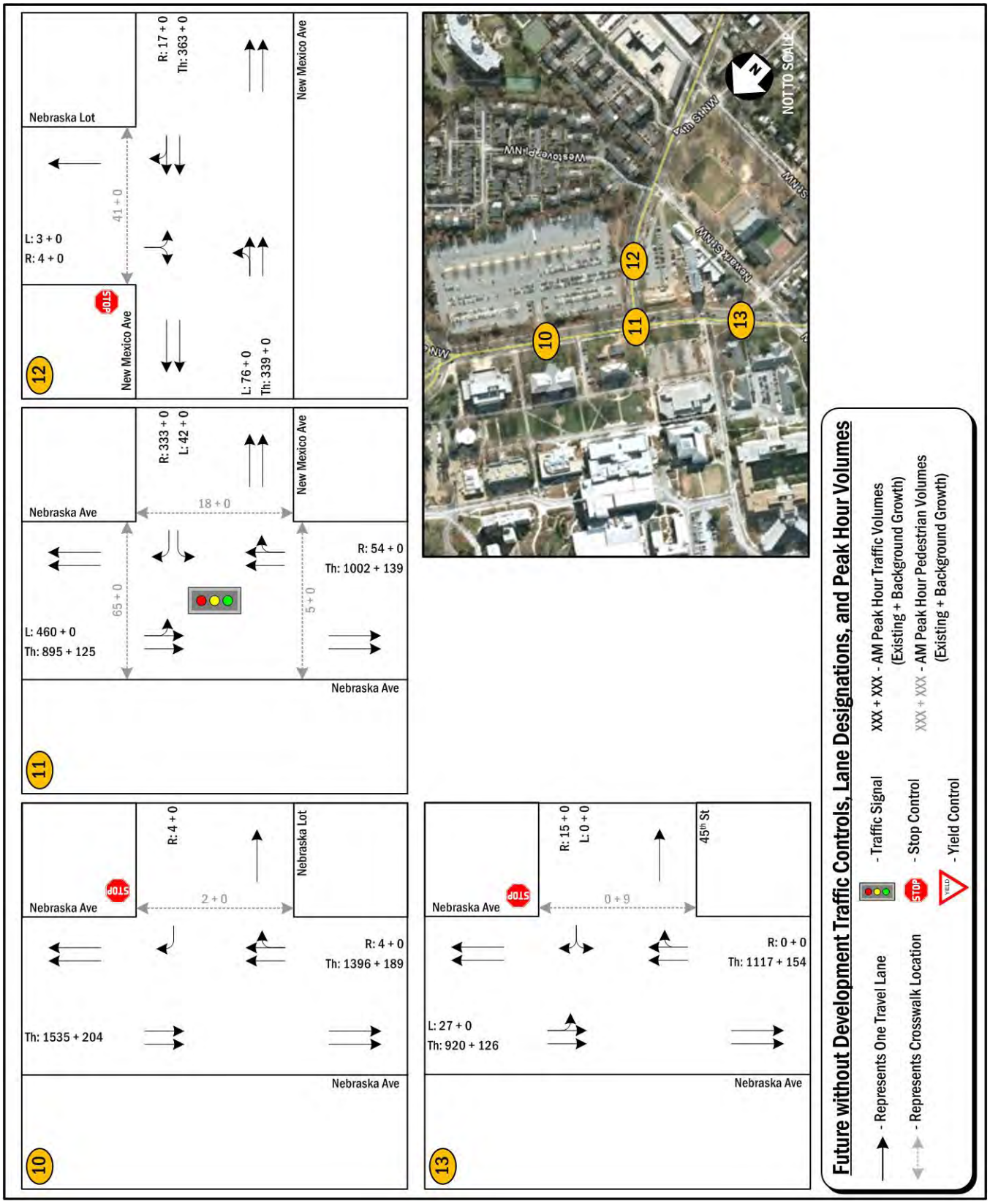

Figure 15: Future without Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (3 of 4)

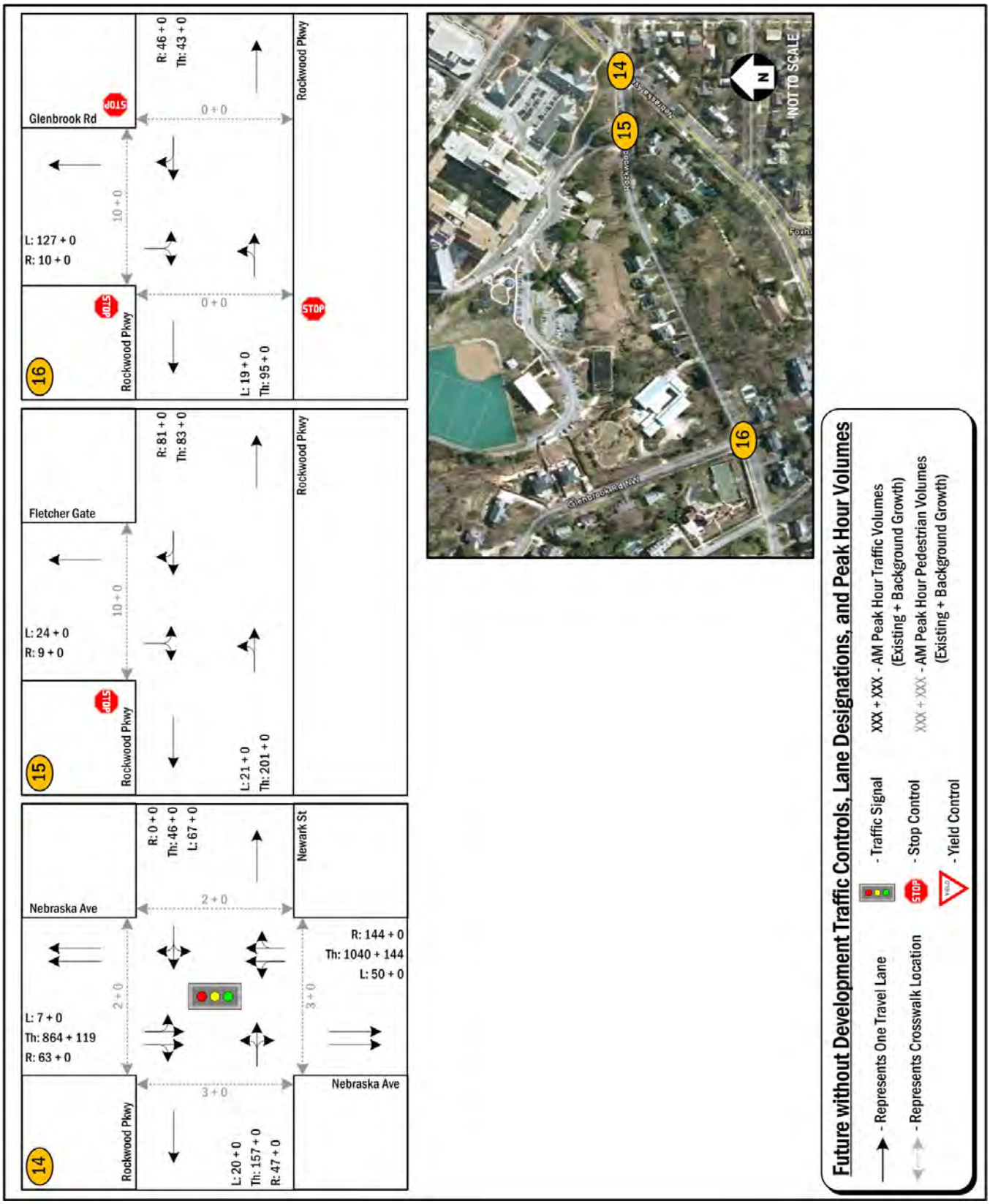

Figure 16: Future without Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (4 of 4)

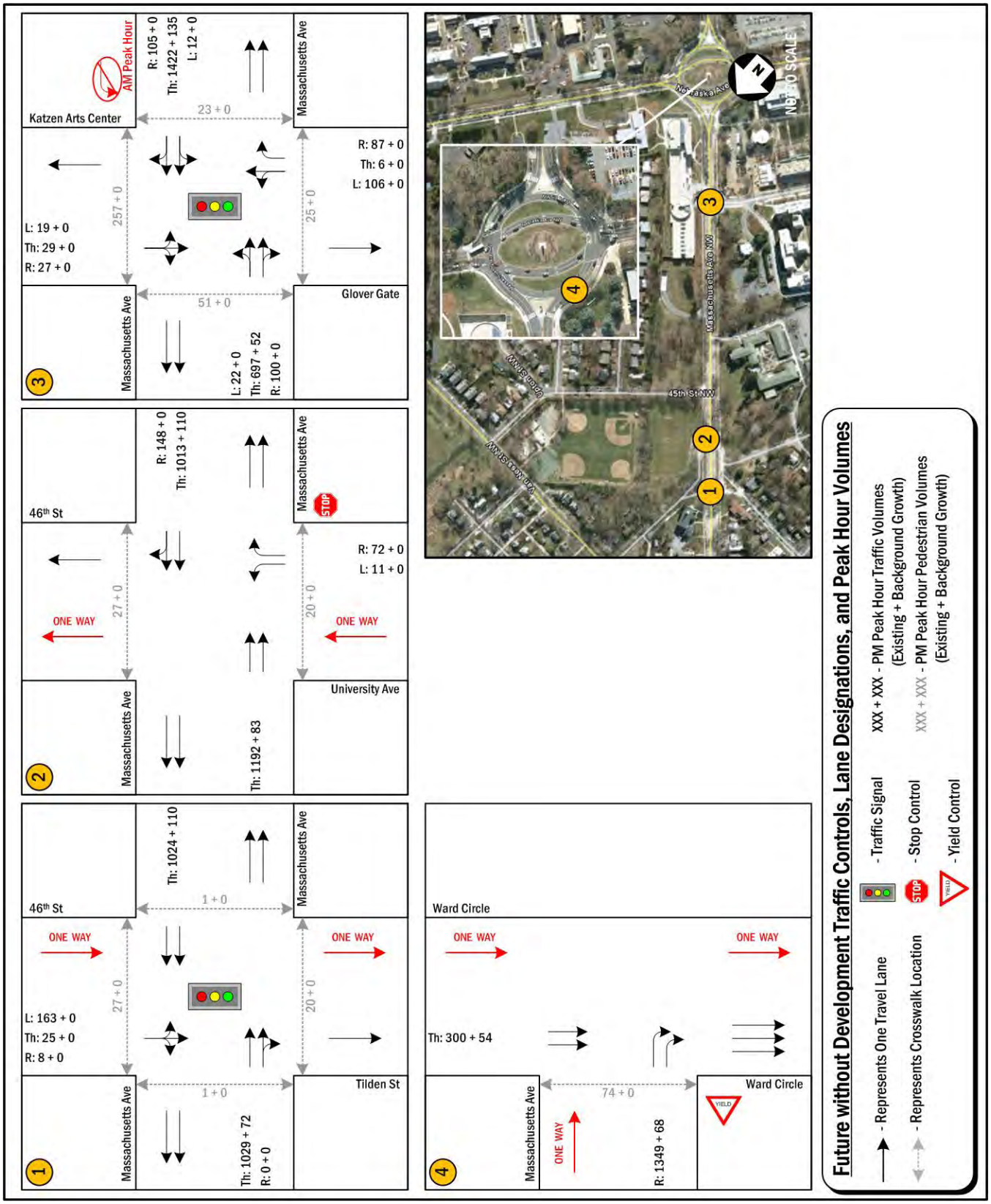

Figure 17: Future without Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (1 of 4)

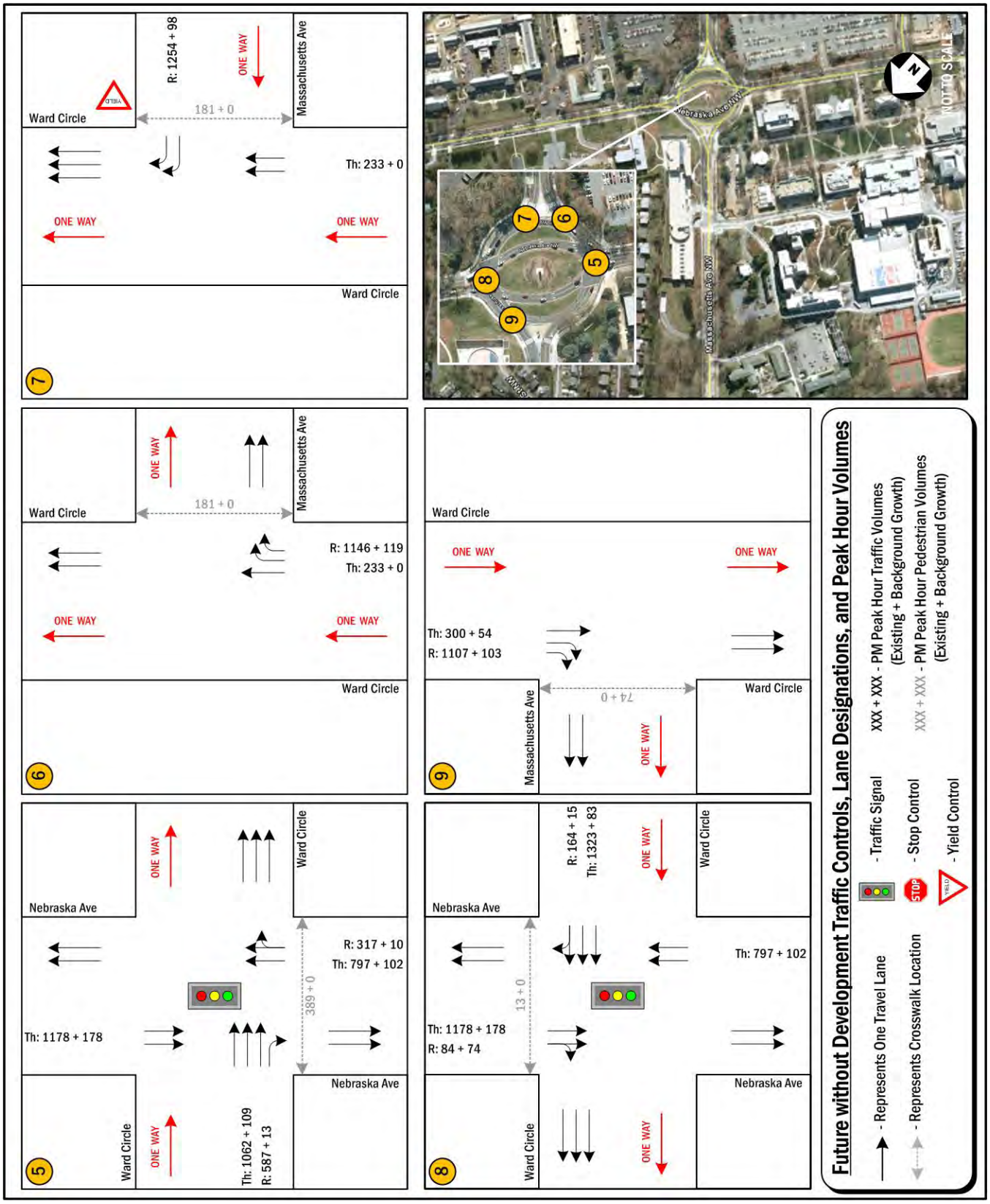

Figure 18: Future without Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (2 of 4)

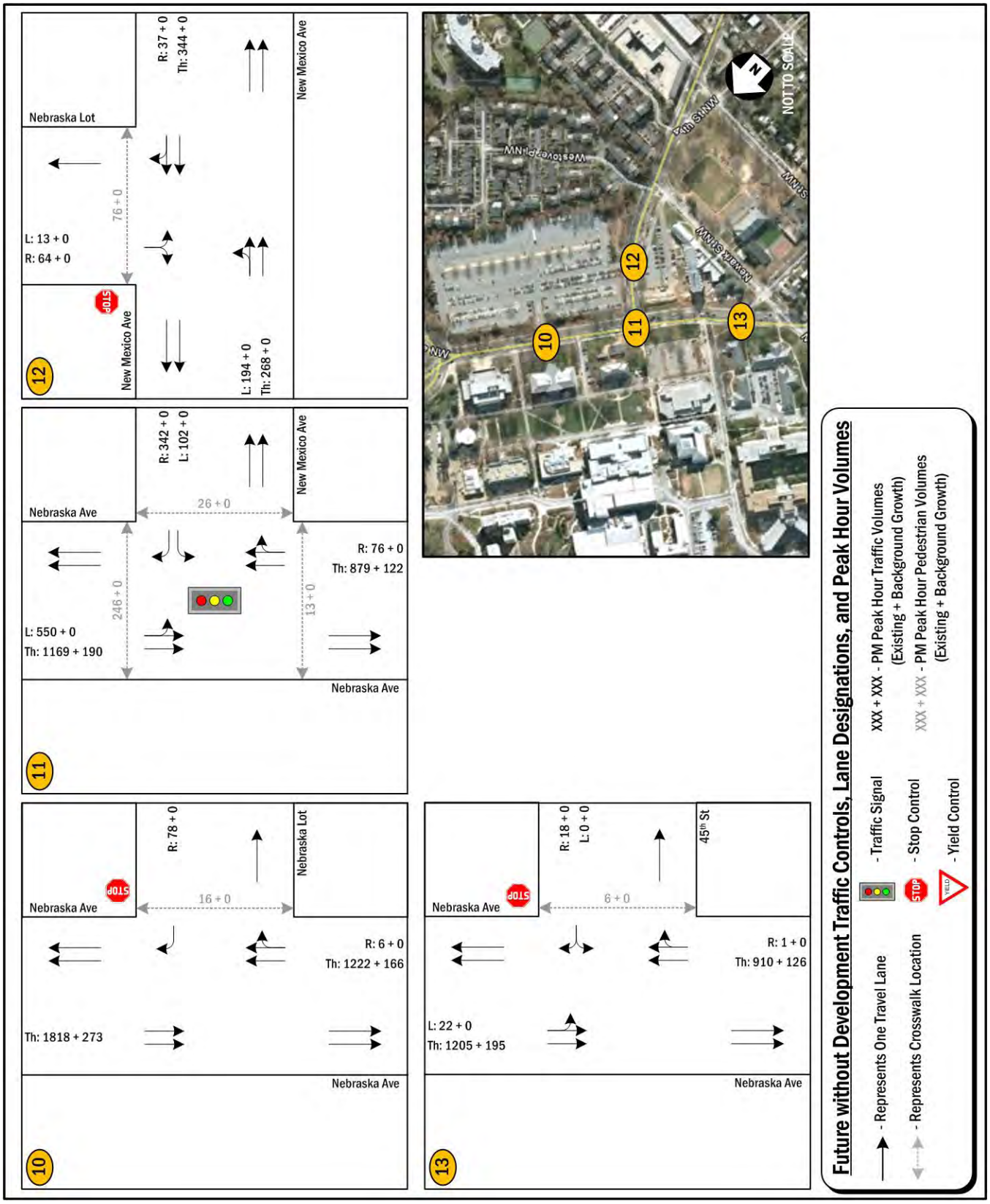

Figure 19: Future without Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (3 of 4)

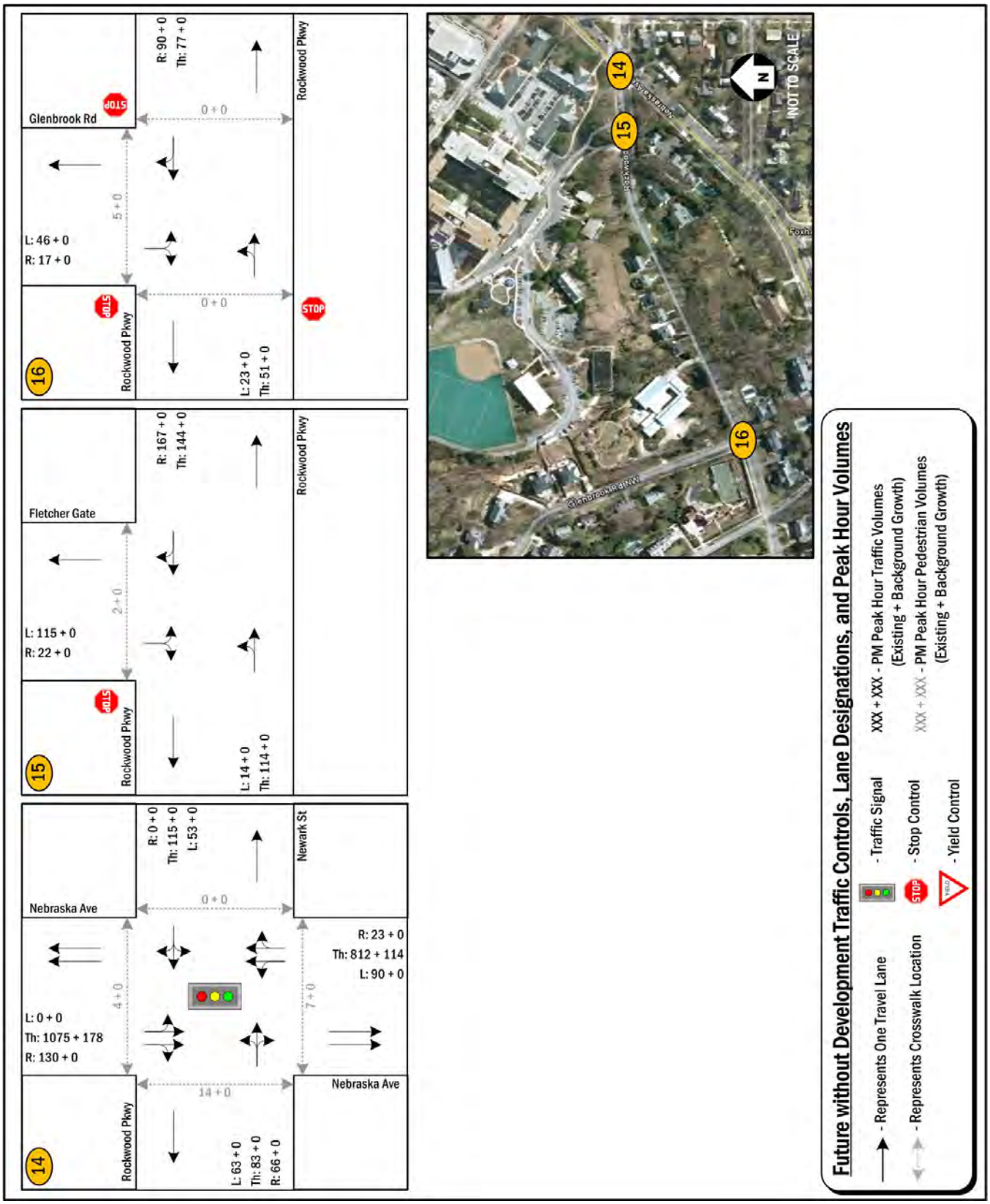

Figure 20: Future without Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (4 of 4)

Table 5: Future Conditions (2020) without Development Vehicular Levels of Service

Intersection (Approach)	(Approach)	Future Background (2020) LOS			
		AM Peak Hour		*AM Peak Hour*	
		Delay		Delay	
Massachusetts Ave & 46th St/Tilden St	**Overall**	**16.5**	**16.5**	**16.5**	**16.5**
	Eastbound	17.9	17.9	17.9	17.9
	Westbound	9.0	9.0	9.0	9.0
	Southbound	28.9	28.9	28.9	28.9
Massachusetts Ave & 46th St/University Ave	Northbound	12.5	12.5	12.5	12.5
Massachusetts Ave & Glover Gate/Katzen Arts Center	**Overall**	**11.0**	**11.0**	**11.0**	**11.0**
	Eastbound	7.3	7.3	7.3	7.3
	Westbound	16.5	16.5	16.5	16.5
	Northbound	29.6	29.6	29.6	29.6
	Southbound	29.3	29.3	29.3	29.3
Ward Circle:					
Massachusetts Ave & Ward Circle	Eastbound Right	42.6	E	49.7	E
Nebraska Ave & Ward Circle	**Overall**	**39.7**	**D**	**48.2**	**D**
	Eastbound	19.9	B	26.2	C
	Northbound	91.1	F	59.2	E
	Southbound	13.9	B	67.1	E
Massachusetts Ave & Ward Circle	Westbound Right	12.5	B	56.1	F
Nebraska Ave & Ward Circle	**Overall**	**30.6**	**C**	**69.5**	**E**
	Westbound	14.9	B	23.0	C
	Northbound	12.9	B	11.8	B
	Southbound	57.9	E	152.4	F
Nebraska Ave & Commuter Lot (RIRO)	Westbound Right	9.7	A	10.0	A
Nebraska Ave & New Mexico Ave	**Overall**	**24.5**	**C**	**58.8**	**E**
	Westbound	28.7	C	30.4	C
	Northbound	15.7	B	17.5	B
	Southbound	30.6	C	88.7	F
New Mexico Ave & Commuter Lot	Eastbound Left	3.8	A	4.3	A
	Southbound	12.9	B	14.2	B
Nebraska Ave & 45th St	Southbound Left	1.4	A	0.9	A
	Westbound	9.4	A	9.9	A
Nebraska Ave & Rockwood Pkwy	**Overall**	**11.9**	**B**	**12.7**	**B**
	Eastbound	39.4	D	41.6	D
	Westbound	39.4	D	38.7	D
	Northbound	12.7	B	13.3	B
	Southbound	1.9	A	4.6	A
Rockwood Pkwy & Fletcher Gate	Eastbound Left	0.8	A	1.0	A
	Southbound	10.7	B	12.1	B
Rockwood Pkwy & Glenbrook Rd	**Overall**	**8.2**	**A**	**7.7**	**A**
	Eastbound	8.2	A	7.7	A
	Westbound	7.6	A	7.7	A
	Southbound	8.5	A	7.8	A

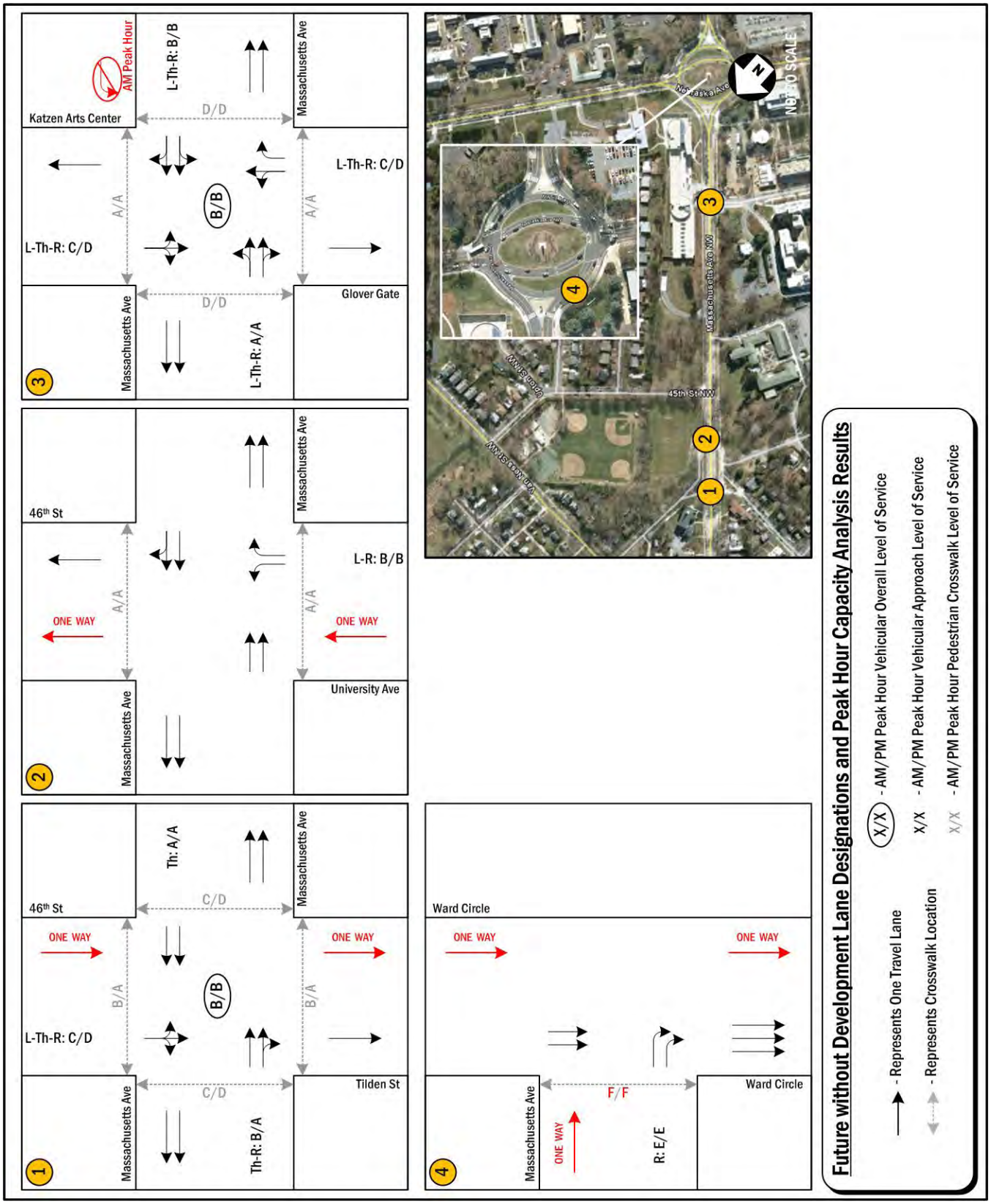

Figure 21: Future without Development Lane Configurations and Peak Hour Capacity Analysis Results (1 of 4)

Figure 22: Future without Development Lane Configurations and Peak Hour Capacity Analysis Results (2 of 4)

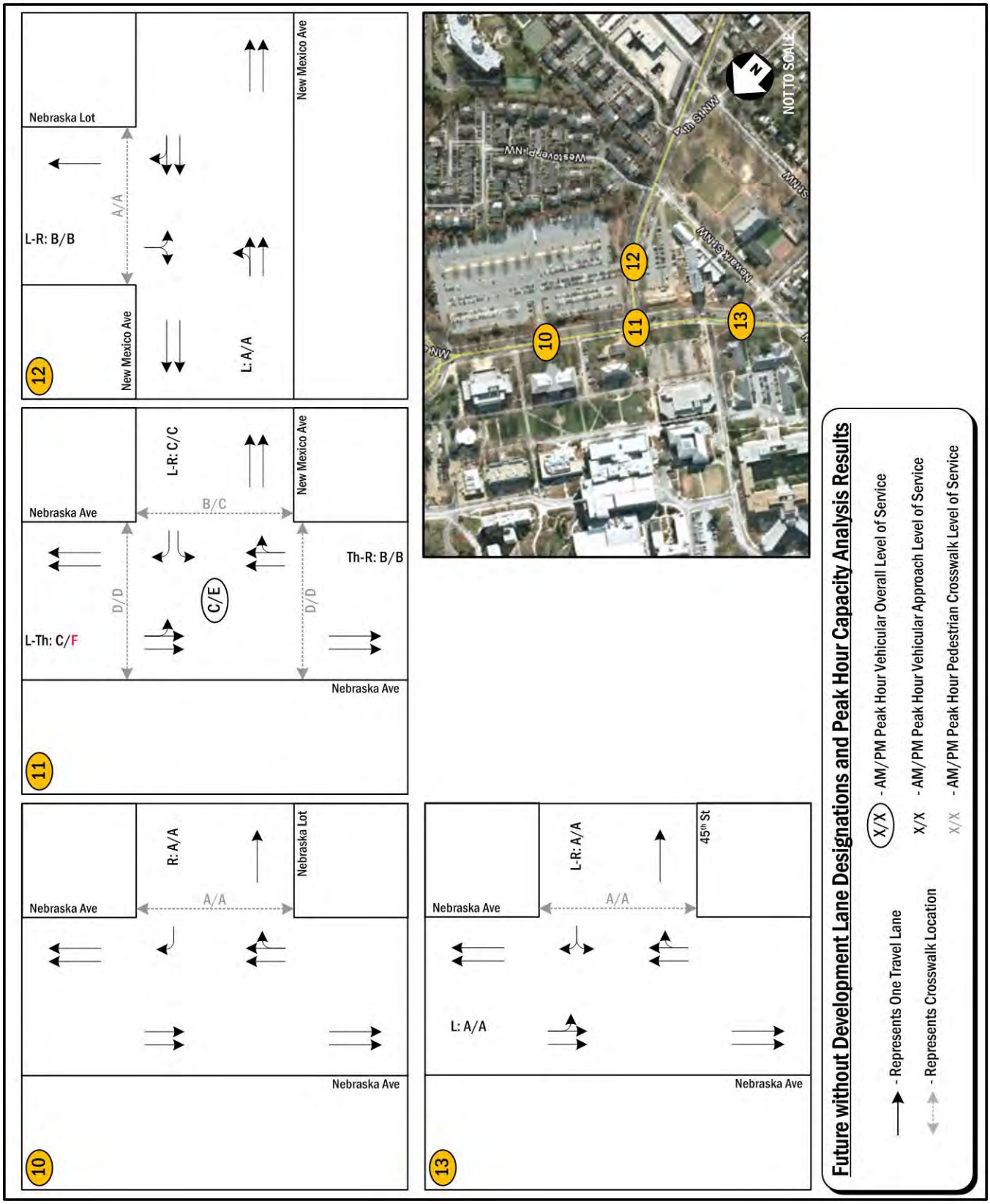

Figure 23: Future without Development Lane Configurations and Peak Hour Capacity Analysis Results (3 of 4)

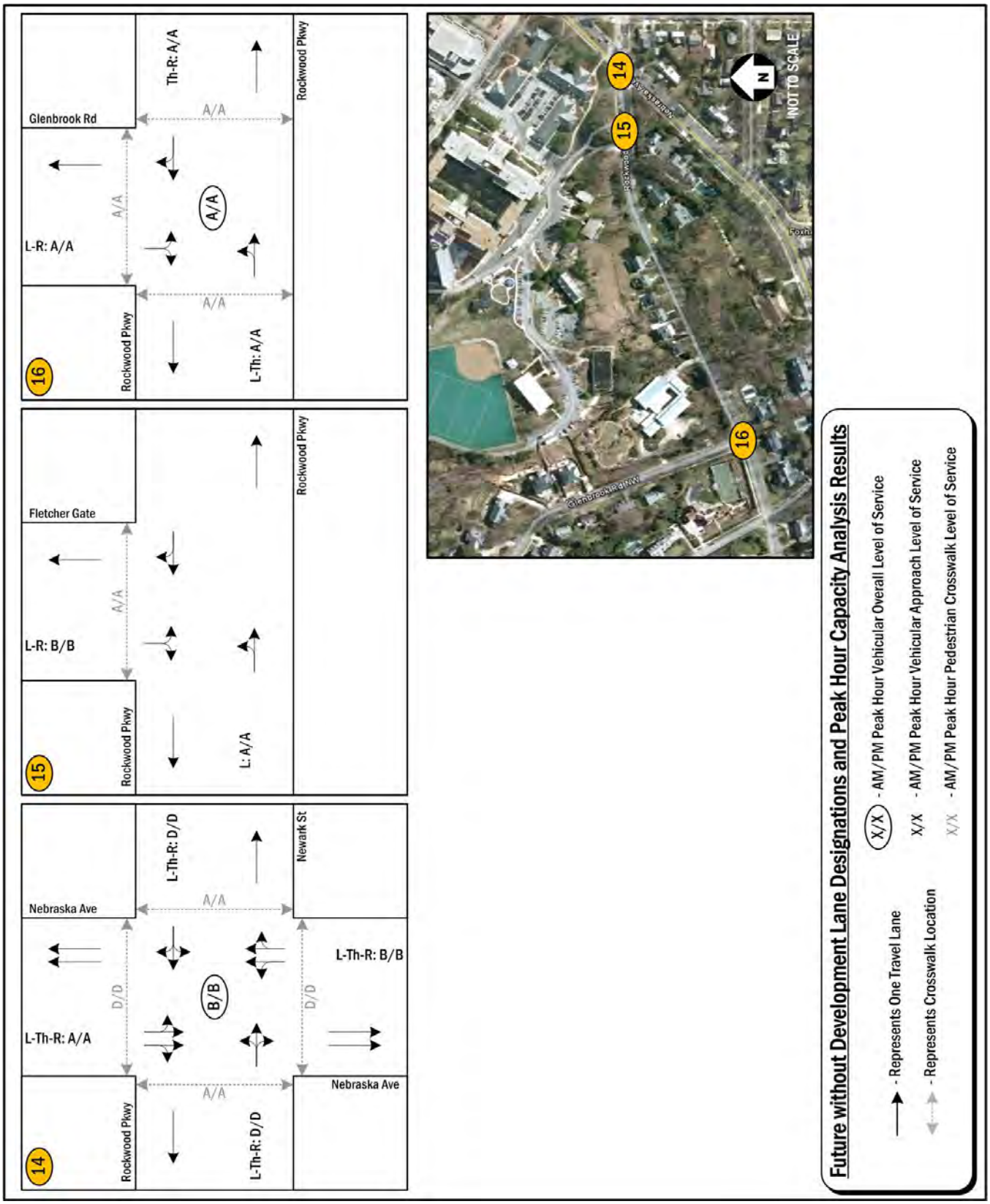

Figure 24: Future without Development Lane Configurations and Peak Hour Capacity Analysis Results (4 of 4)

Summary of Future without Development Vehicular Capacity Analysis Results

For the purpose of this analysis, it is desirable to achieve a level of service (LOS) of "E" or better on each approach. The following approaches operate at unacceptable LOS during either the morning or afternoon peak period:

1. Northbound approach at Nebraska Avenue & Ward Circle eastbound
2. Westbound right-turn at the intersection of Massachusetts Avenue & Ward Circle northbound
3. Southbound approach at Nebraska Avenue & Ward Circle westbound
4. Southbound approach at Nebraska Avenue & New Mexico Avenue

Signal timing improvements may be investigated as these study area intersections in order to mitigate the impact of future background growth.

Future without Development Pedestrian Analysis Results

Pedestrian analyses were performed for the future without development conditions at the intersections contained within the study area during the morning and afternoon peak hours. The analysis was based on "Chapter 13: Pedestrians" of the Highway Capacity Manual (HCM), as outlined previously.

Table 6 and Table 7 show the results of the capacity analyses, including LOS and average delay (in seconds). The capacity analysis results are also shown on Figure 21, Figure 22, Figure 23, and Figure 24.

Table 6: Future Conditions (2020) without Development Pedestrian Levels of Service for Signalized Intersections

Intersection (Approach)	(Parallel Approach)	Future Background (2020) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/Tilden St	Eastbound	12.0	B	8.0	A
	Westbound	12.0	B	8.0	A
	Northbound	27.4	C	34.4	D
	Southbound	27.4	C	34.4	D
Massachusetts Ave & Glover Gate/Katzen Arts Center	Eastbound	7.6	A	5.8	A
	Westbound	8.0	A	6.1	A
	Northbound	35.3	D	39.6	D
	Southbound	35.3	D	39.6	D
Ward Circle:					
Nebraska Ave & Ward Circle	Eastbound	39.6	D	39.6	D
Nebraska Ave & Ward Circle	Westbound	39.6	D	39.6	D
Nebraska Ave & New Mexico Ave	Eastbound	39.6	D	39.6	D
	Westbound	39.6	D	39.6	D
	Northbound	19.8	B	21.1	C
Nebraska Ave & Rockwood Pkwy	Eastbound	37.8	D	37.8	D
	Westbound	37.8	D	37.8	D
	Northbound	8.8	A	8.8	A
	Southbound	8.8	A	8.8	A

Table 7: Future Conditions (2020) without Development Pedestrian Levels of Service for Unsignalized Intersections

Intersection (Approach)	(Approach)	Future Background (2020) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/University Ave	Eastbound	N/A - Stop controlled crossing, LOS A			
	Westbound	N/A - Stop controlled crossing, LOS A			
Ward Circle:					
Massachusetts Ave & Ward Circle	Southbound	195.8	F	110.6	F
Massachusetts Ave & Ward Circle	Northbound	244.7	F	109.3	F
Massachusetts Ave & Ward Circle	Northbound	27.3	D	95.4	F
Massachusetts Ave & Ward Circle	Southbound	20.4	D	68.9	F
Nebraska Ave & Commuter Lot (RIRO)	Northbound	N/A - Stop controlled crossing, LOS A			
New Mexico Ave & Commuter Lot	Westbound	N/A - Stop controlled crossing, LOS A			
Nebraska Ave & 45th St	Northbound	N/A - Stop controlled crossing, LOS A			
New Mexico Ave & Commuter Lot	Westbound	N/A - Stop controlled crossing, LOS A			
Rockwood Pkwy & Fletcher Gate	Westbound	N/A - Stop controlled crossing, LOS A			
	Northbound	N/A - Stop controlled crossing, LOS A			
	Southbound	N/A - Stop controlled crossing, LOS A			

Summary of Future without Development Pedestrian Analysis Results

The analysis results indicate that all signalized crosswalks in the study area operate at acceptable levels of service during both the morning and afternoon peak hours. This indicates a low (LOS A and B) to moderate (LOS C and D) likelihood of non-compliance by pedestrians, which is reflected by pedestrians jaywalking across the intersection. The study intersections with crosswalks operating at LOS D will experience a moderate to high likelihood of non-compliance, so signal timing improvements may be investigated at these intersections in order to improve the pedestrian LOS.

The analysis results also indicate that the majority of the unsignalized crosswalks in the study area operate at unacceptable levels of service during one or more peak hours. This indicates a moderate (LOS C and D) to very high (LOS F) likelihood of risk-taking behavior for pedestrians, which is reflected in pedestrians dashing between vehicles during short gaps in traffic. As stated previously, pedestrians have the right-of-way in all crosswalks in the District, so vehicles must yield to pedestrians in the crosswalk at the study intersections listed in Table 4. However, the LOS F calculated for the unsignalized approaches of Ward Circle during the morning and afternoon peak hours indicates an unfriendly and intimidating environment for pedestrians. Signing and striping improvements may be investigated in order to promote vehicular compliance and make pedestrians feel more comfortable.

FUTURE CONDITIONS WITH DEVELOPMENT

The American University Campus Plan outlines future growth and development on the campus for the years 2010-2020. This includes a few development projects that will affect the future roadway and traffic conditions.

Future with Development Traffic Volumes

In order to determine the impact of the proposed changes to the AU Campus, vehicular trips were generated based on changes in parking inventory at the university and not on growth of population. Although multiple development changes are proposed in the Campus Plan, including new residence halls and academic buildings, these sources are not expected to generate any additional vehicular trips. Instead, any change in vehicular trip generation will be due to the proposed parking modifications. The proposed parking changes for the AU Campus includes an overall reduction in approximately 45 parking spaces. These changes are accounted for by the following trip-generation sources:

- Remove existing 903 parking spaces on Nebraska Avenue Lot;
- Remove approximately 100 parking spaces from the Main Campus due to construction of new residence halls on South Campus and Clark Site on existing surface parking lots;
- Add 458 new parking spaces to the School of International Services (SIS) Garage: 283 spaces currently built with possible expansion of 175 spaces under future academic/administration building, all spaces for faculty/staff; and
- Add 500 new parking spaces to the East Campus (Nebraska Avenue lot): 100 for on-campus students, 330 for commuter students, and 70 for faculty/staff.

Trips generated by the proposed parking changes were estimated based on existing (2008) driveway counts at the University Gates (Glover Gate on Massachusetts Avenue, Tilden Gate on Rockwood Parkway, and Nebraska Avenue Lot on Nebraska and New Mexico Avenues) and on trip generation rates used in the *Transportation Analysis of the SIS Parking Facility* performed by HNTB in March 2005. This trip generation rate was assumed to be 0.30 trips per space during the morning peak hour (0.25 inbound and 0.05 outbound) and 0.50 trips per space during the afternoon peak hour (0.20 inbound and 0.30 outbound).

The existing Nebraska Avenue parking lot trips were removed based on the driveway counts outlined previously. The trips generated by the 100 Main Campus parking spaces to be removed were estimated by the trip generation rates outlined above. Table 8 shows the trips removed from the study area. Trips generated by the proposed SIS Garage and by the East Campus Development were also estimated based on the trip generation rates outlined above. Table 9 shows the trips added to the study area.

Table 8: Vehicular Trips Removed

Trips Removed					
Source	**Size**	*AM Peak Hour*		*PM Peak Hour*	
		In	Out	In	Out
Nebraska Avenue Lot	903 Spaces	97	11	200	155
South Campus & Clark Site	100 Spaces	25	5	20	30
Total	**1003 Spaces**	**122**	**16**	**220**	**185**

Table 9: Vehicular Trips Added

Trips Added					
Source	**Size**	*AM Peak Hour*		*PM Peak Hour*	
		In	Out	In	Out
East Campus	500 Spaces	125	25	100	150
SIS Garage	458 Spaces	115	23	92	137
Total	**958 Spaces**	**240**	**48**	**192**	**287**

Existing travel patterns in the study area and trip distribution percentages used in the *Transportation Analysis of the SIS Parking Facility* performed by HNTB in March 2005 were analyzed in order to determine the trip distribution for the trips added and removed from the AU Main Campus study area. Based on this review, the site-generated trips were distributed through the study area intersections. It was assumed that the SIS Garage would be accessed by a right-in/right-out driveway constructed as the fourth leg at the intersection of Nebraska Avenue and New Mexico Avenue. The East Campus parking lot will be accessed by the existing curb cut on New Mexico Avenue, with the existing right-in/right-out driveway on Nebraska Avenue removed.

Similar to the changes to vehicular trip generation, pedestrian trip generation is not based on an increase in overall population on campus. For pedestrian trips, it was assumed that the major trip generation changes would be due to the parking modifications described previously, in addition to the construction of new residence halls and student-oriented retail. The proposed development for the AU Main Campus includes the following pedestrian trip-generation sources:

- Existing pedestrians crossing Nebraska Avenue at New Mexico Avenue subtracted due to removed parking spaces in Nebraska Avenue Lot (East Campus);
- Trips added to East Campus by new Residence Halls adding 860 total beds;
- Trips added to East Campus by new parking: assumed only commuter-student spaces would generate pedestrian trips crossing Nebraska Avenue to Main Campus so as not to double-count on-campus student spaces, assumed faculty/staff spaces would be provided to those working at Admissions & Enrollment services (45 employees), Alumni Center (15 employees), Welcome Center, and retail sources;
- Other source of trip generation on East Campus would be retail uses consisting of 27,000 square-foot Campus Store and 20,000 square-feet of additional student-oriented retail; and
- Additional trips generated by 120 beds added at Nebraska Hall.

Pedestrian trips were generated using the vehicular trip generation rates outlined previously in order to estimate the pedestrian trips due to parking changes. Trips generated by the new residence halls and the retail uses were estimated using the methodology outlined in the Institute of Transportation Engineers' (ITE) *Trip Generation*, 8th Edition. Because no specific rate for residence halls exists, these trips were estimated using the "Apartment" trip generation rates. The retail trips were estimated using the "Specialty Retail" trip generation rates. Table 10 shows the pedestrian trips added to the East Campus, and Table 11 shows the other pedestrian trips added to the study area.

Trip distribution for the pedestrian trips added by the East Campus was based on an approximate 75%/25% split of pedestrians between the New Mexico Avenue and Ward Circle crossings, respectively, due to the layout of the site. Pedestrians added by the Nebraska Hall addition were assumed to use the western crosswalk at Massachusetts Avenue and Ward Circle to travel between the residence hall and Main Campus. These splits are shown in Table 10 and Table 11.

Table 10: Pedestrian Trips Added to the East Campus

Trips Added to East Campus			
Source	**Size**	**AM Peak Hour**	**PM Peak Hour**
East Campus Residence Hall 1	160 Beds	82	106
East Campus Residence Hall 2	130 Beds	67	89
East Campus Residence Hall 3	280 Beds	141	172
East Campus Residence Hall 4	290 Beds	146	177
Student-Oriented Retail	47,000 SF	34	134
(Internal Synergy: 20% reduction during PM)		--	*(27)*
East Campus Parking	330 Spaces	99	165
Total		**569**	**816**
Crossing Nebraska Avenue at New Mexico Avenue		430	615
Crossing Nebraska Avenue at Ward Circle		140	200

Table 11: Other Pedestrian Trips Added

Other Pedestrian Trips			
Source	**Size**	**AM Peak Hour**	**PM Peak Hour**
Nebraska Hall	120 Beds	63	84
Total		**63**	**84**
Crossing Massachusetts Avenue at Ward Circle		63	84

The traffic volumes for the future (2020) conditions with development were calculated by adding the site-generated traffic volumes to the future (2020) without development traffic volumes and subtracting the trips displaced by the proposed developments. The future (2020) traffic volumes with the proposed development on the AU Main Campus are shown on Figure 25, Figure 26, Figure 27, and Figure 28 for the morning peak hour and Figure 29, Figure 30, Figure 31, and Figure 32 for the afternoon peak hour.

Future Conditions with Development Vehicular Capacity Analysis

Intersection capacity analyses were performed for the future conditions with development at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 7.0* was used to analyze the study intersections based on the Highway Capacity Manual (HCM) methodology, as outlined previously. The LOS capacity analyses for the future conditions with development were based on: (1) the future without development lane use and traffic controls; (2) the addition of the right-in/right-out driveway for the SIS Garage at the intersection of Nebraska Avenue and New Mexico Avenue; (3) the removal of the existing right-in/right-out driveway for the Nebraska Avenue Lot along Nebraska Avenue; (4) the peak hour turning movement volumes described previously and (5) the Highway Capacity Manual (HCM) methodologies (using *Synchro 7* software). Detailed LOS descriptions and the analysis worksheets are contained in the Technical Appendix.

Table 12 shows the results of the capacity analyses, including LOS and average delay per vehicle (in seconds). The capacity analysis results are also shown on Figure 33, Figure 34, Figure 35, and Figure 36. The capacity analyses results indicate that all study area intersections operate at acceptable levels of service during both the morning and afternoon peak hours. However, some approaches operate at unacceptable levels of service during one of more peak period.

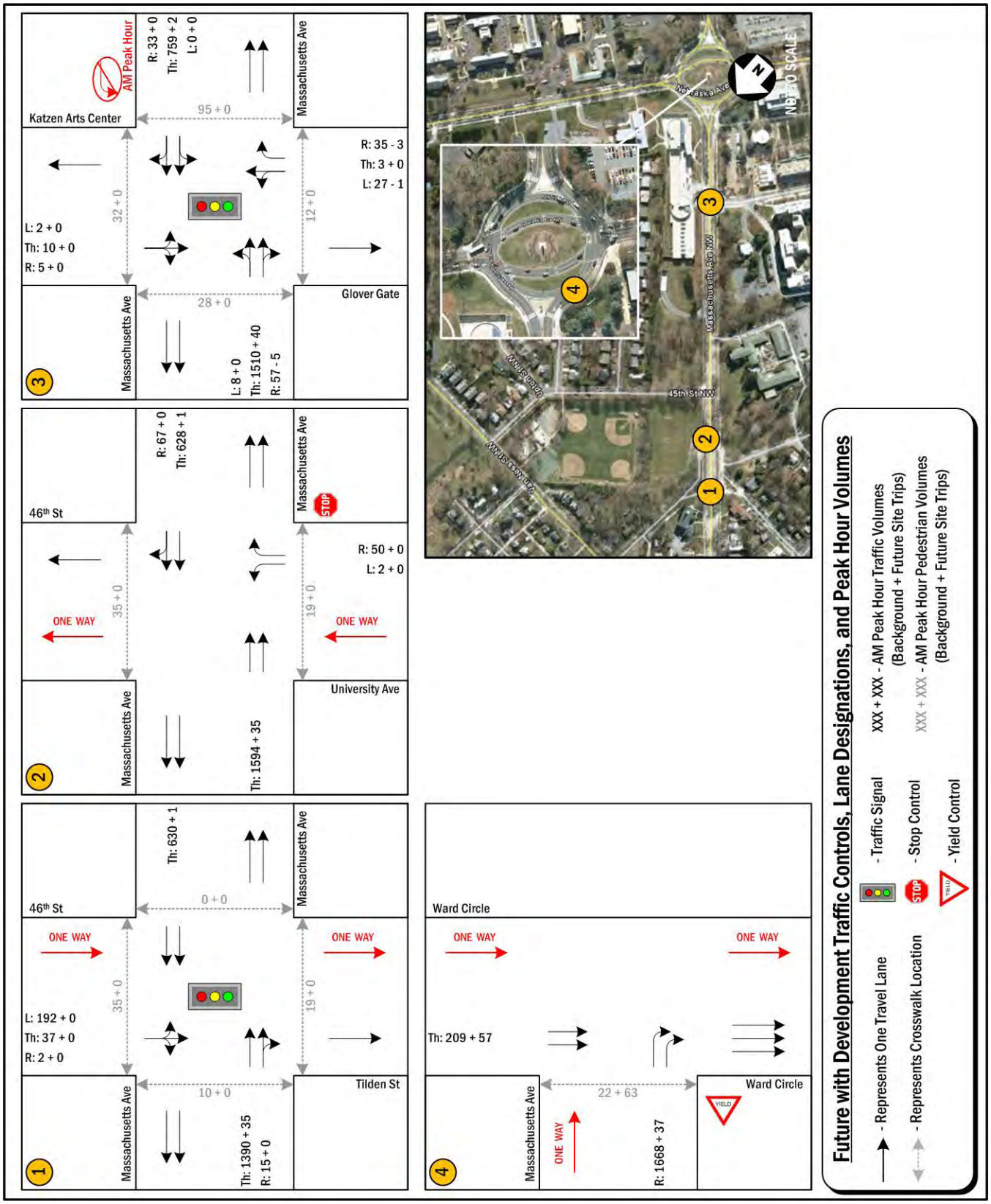

Figure 25: Future with Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (1 of 4)

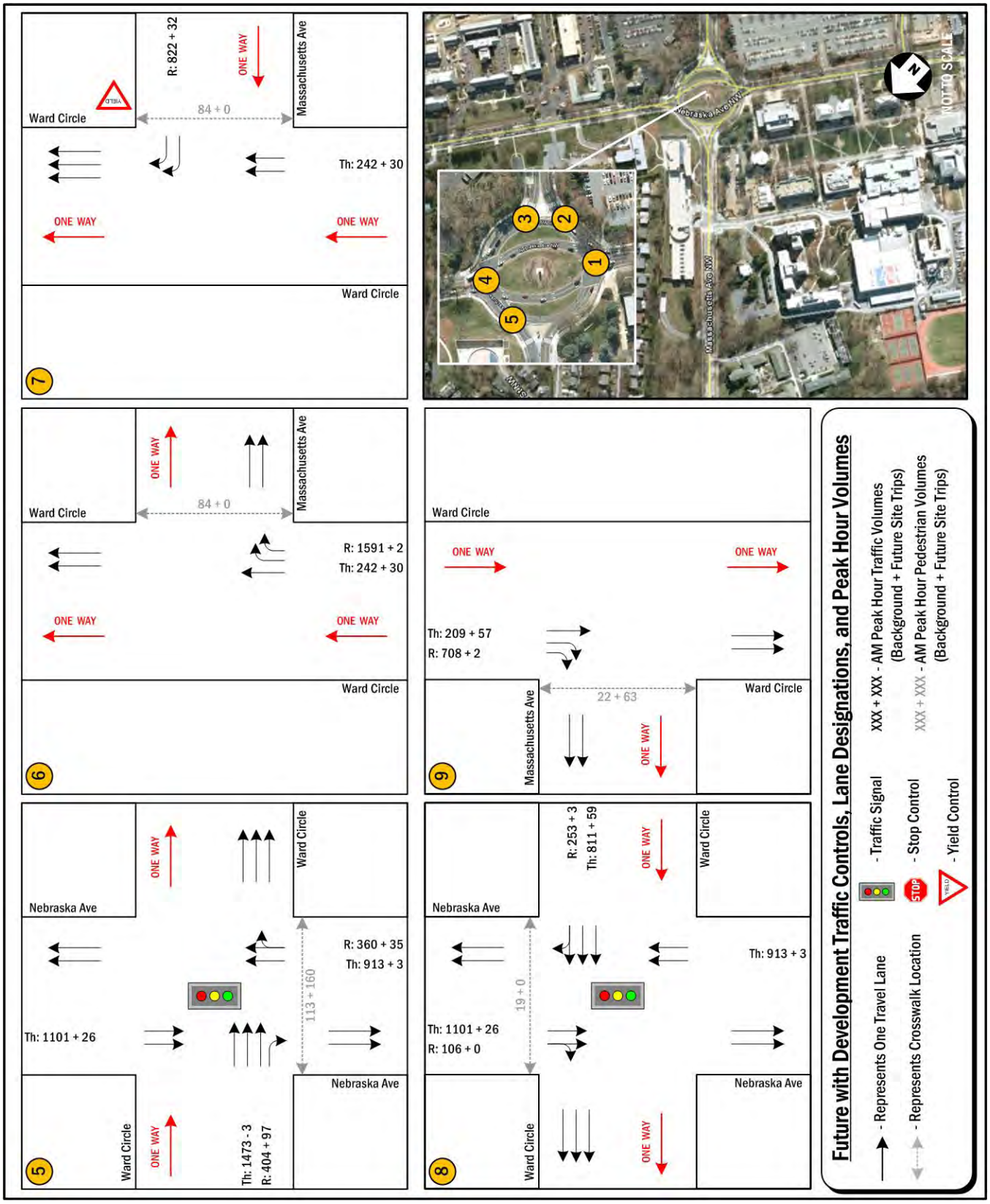

Figure 26: Future with Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (2 of 4)

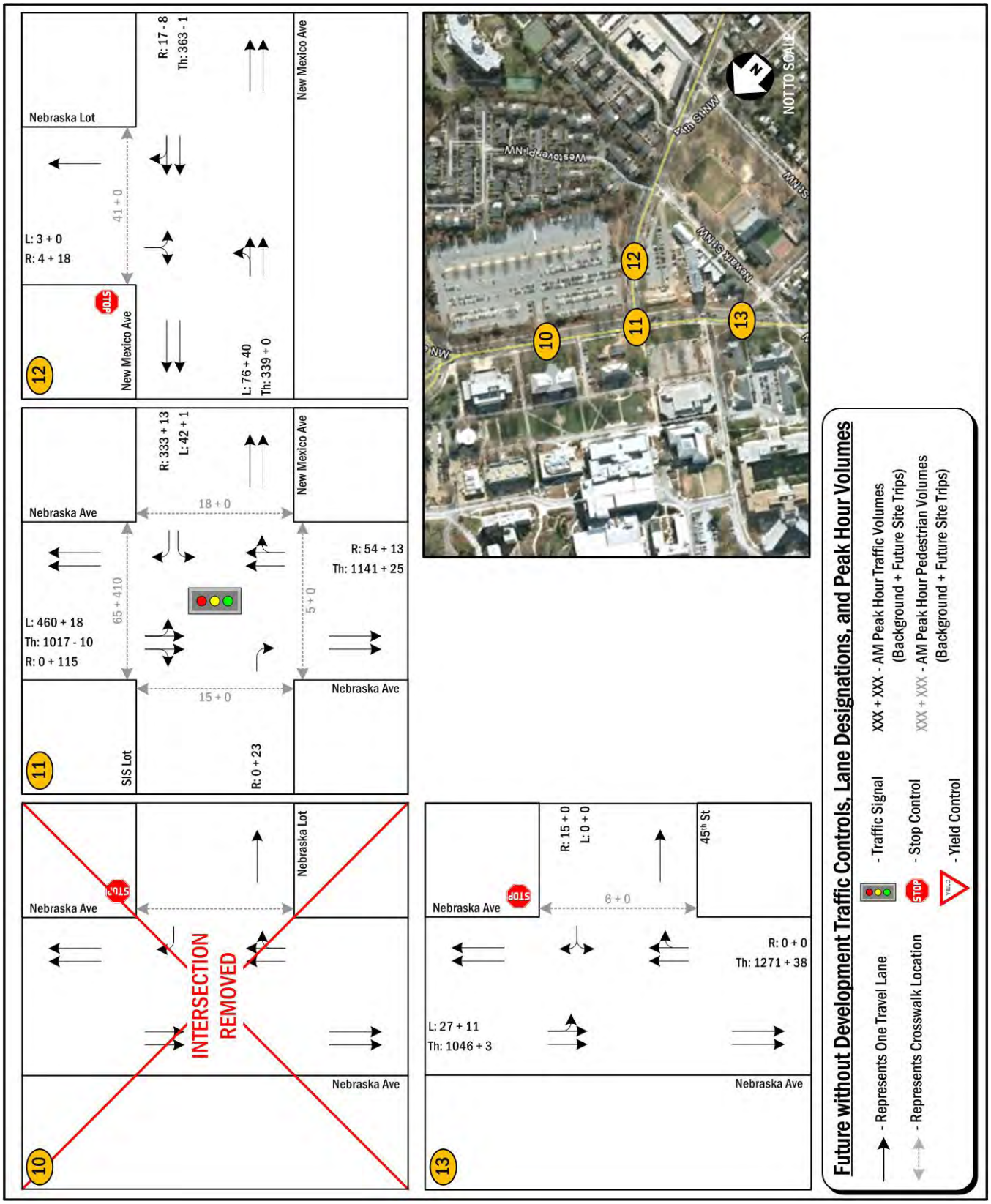

Figure 27: Future with Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (3 of 4)

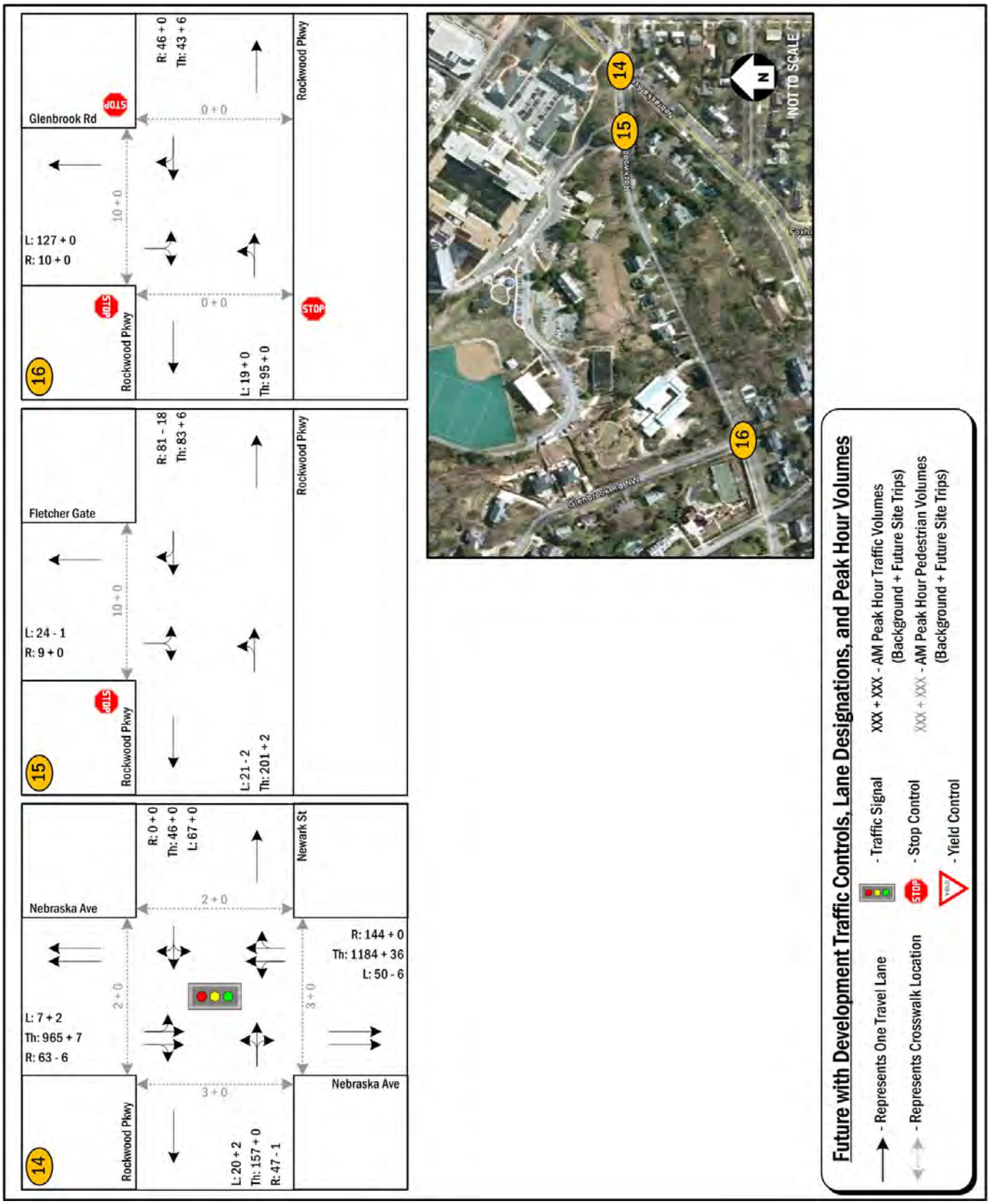

Figure 28: Future with Development Traffic Controls, Lane Designations, and AM Peak Hour Traffic Volumes (4 of 4)

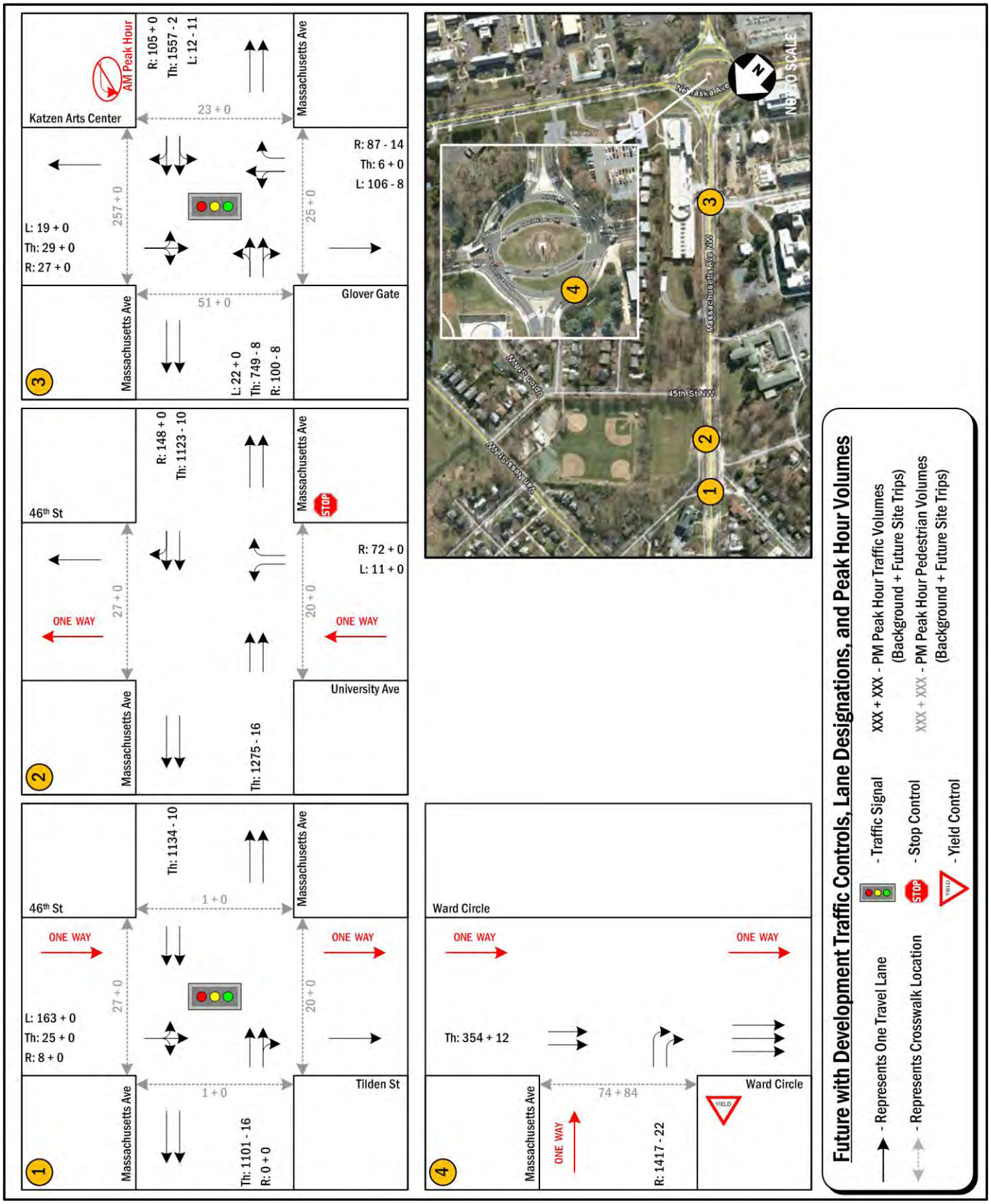

Figure 29: Future with Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (1 of 4)

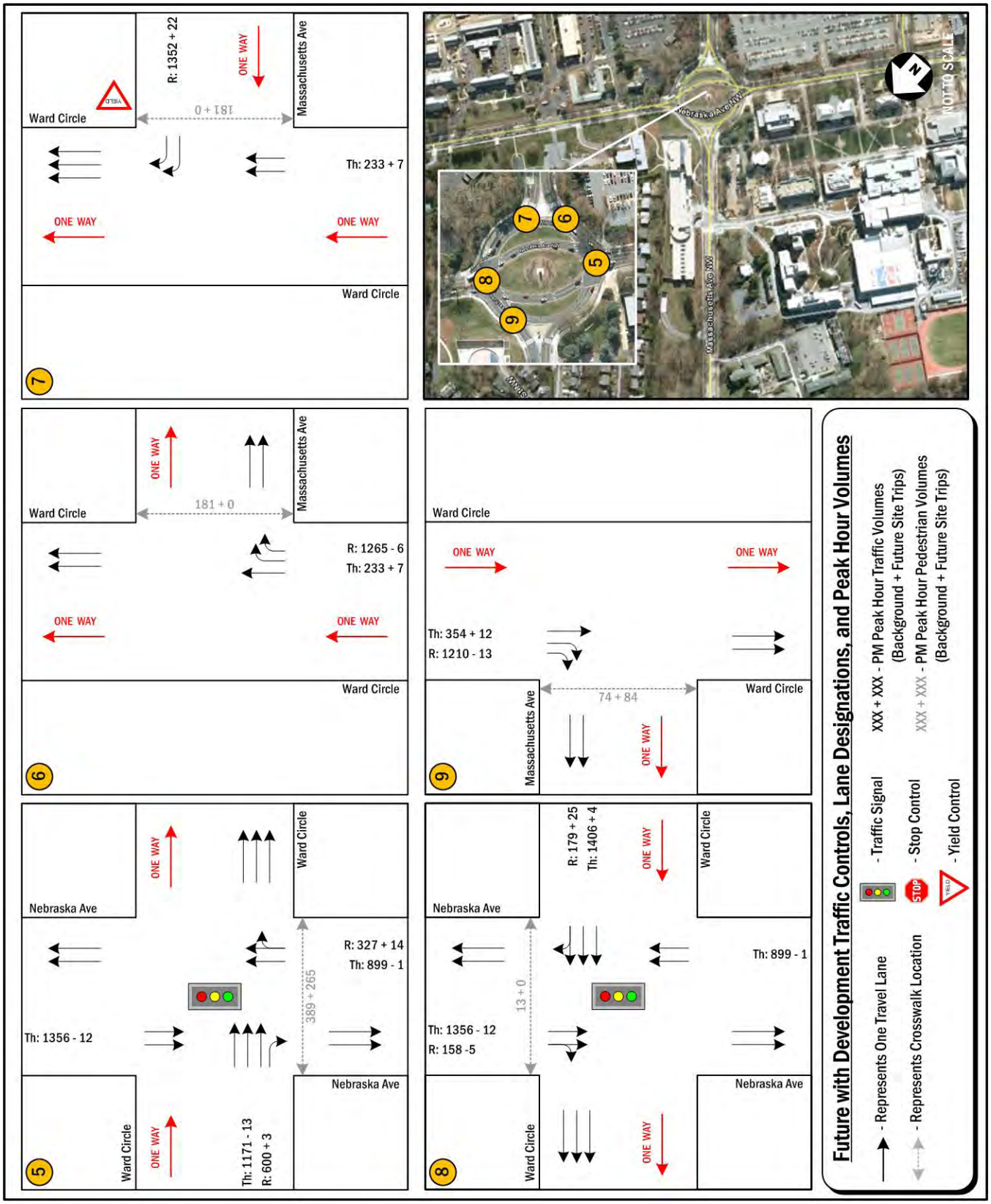

Figure 30: Future with Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (2 of 4)

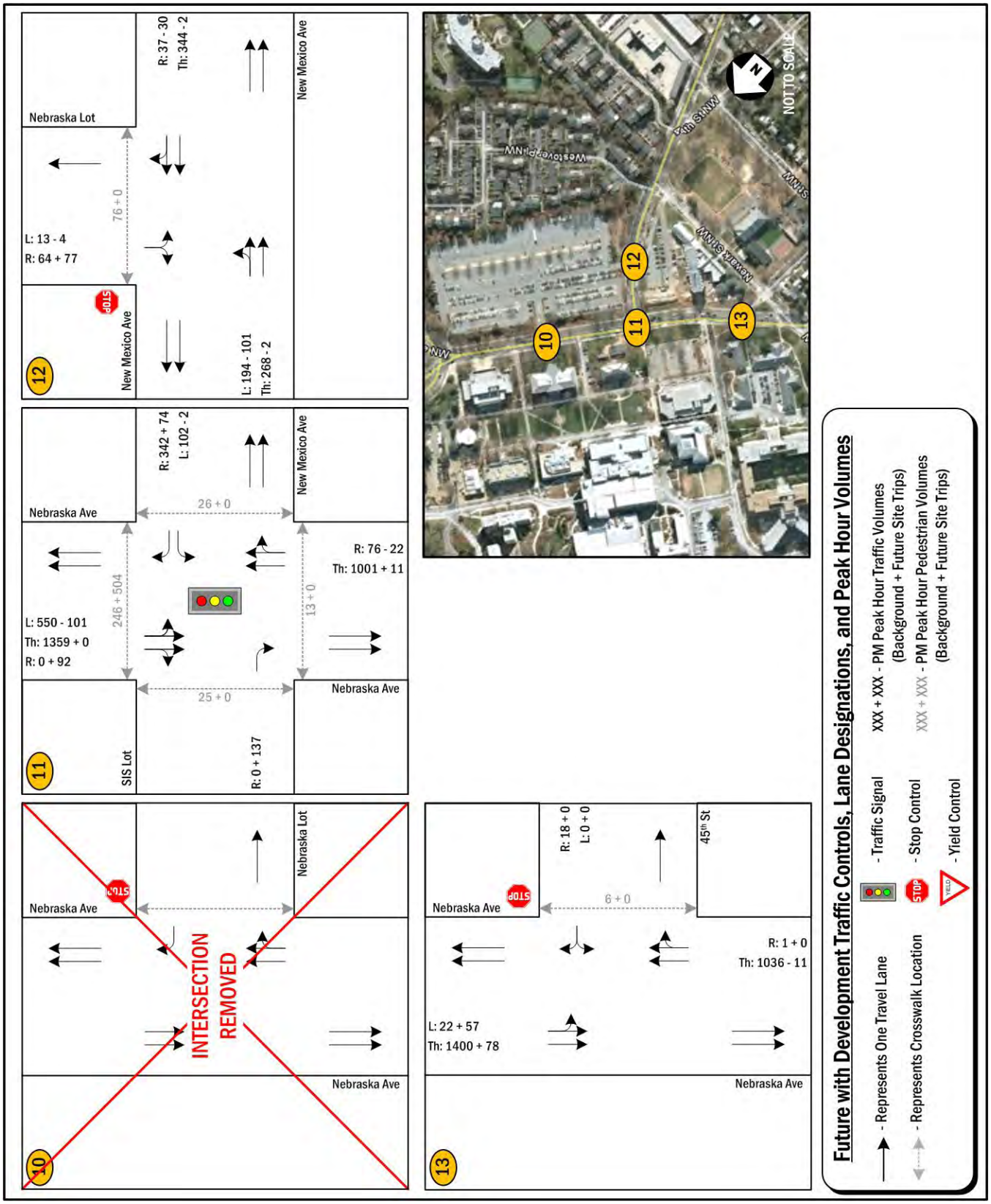

Figure 31: Future with Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (3 of 4)

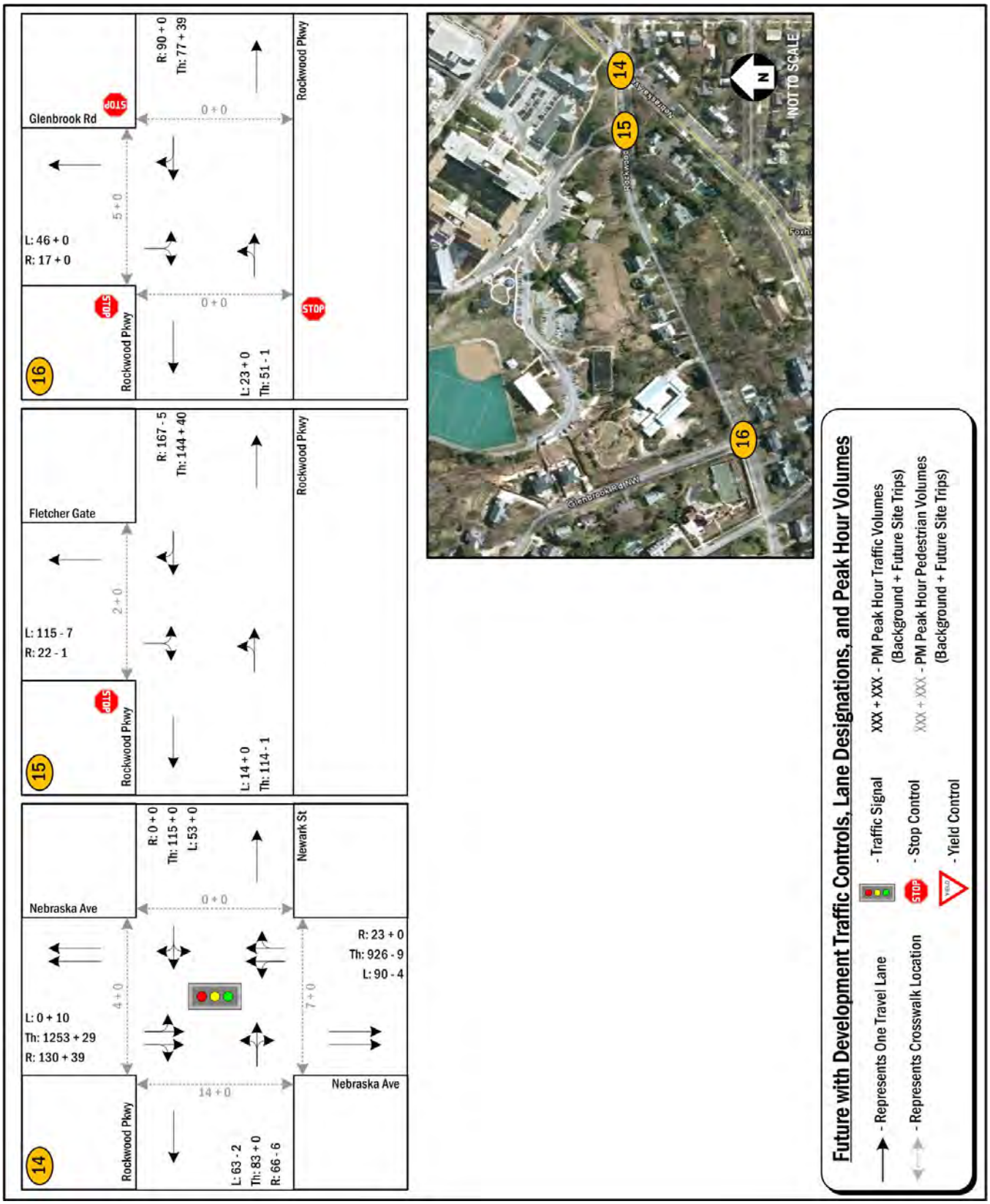

Figure 32: Future with Development Traffic Controls, Lane Designations, and PM Peak Hour Traffic Volumes (4 of 4)

Table 12: Future Conditions (2020) with Development Vehicular Levels of Service

Intersection (Approach)	(Approach)	Total Future (2020) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/Tilden St	**Overall**	**17.0**	**B**	**11.3**	**B**
	Eastbound	18.4	B	9.1	A
	Westbound	9.4	A	8.9	A
	Southbound	28.9	C	37.5	D
Massachusetts Ave & 46th St/University Ave	Northbound	12.8	B	13.3	B
Massachusetts Ave & Glover Gate/Katzen Arts Center	**Overall**	**11.3**	**B**	**13.2**	**B**
	Eastbound	7.4	A	5.4	A
	Westbound	17.3	B	13.5	B
	Northbound	29.6	C	38.1	D
	Southbound	29.3	C	35.9	D
Ward Circle:					
Massachusetts Ave & Ward Circle	Eastbound Right	93.5	F	87.6	F
Nebraska Ave & Ward Circle	**Overall**	**45.0**	**D**	**50.5**	**D**
	Eastbound	21.9	C	26.0	C
	Northbound	105.3	F	72.5	E
	Southbound	15.2	B	62.5	E
Massachusetts Ave & Ward Circle	Westbound Right	13.1	B	61.7	F
Nebraska Ave & Ward Circle	**Overall**	**33.6**	**C**	**66.3**	**E**
	Westbound	15.1	B	23.3	C
	Northbound	13.1	B	11.3	B
	Southbound	65.7	E	145.7	F
Nebraska Ave & New Mexico Ave	**Overall**	**28.0**	**C**	**60.9**	**E**
	Eastbound Right	36.3	D	39.8	D
	Westbound	31.7	C	35.7	D
	Northbound	16.3	B	17.4	B
	Southbound	36.0	D	93.7	F
New Mexico Ave & Commuter Lot	Eastbound Left	4.9	A	4.9	A
	Southbound	11.2	B	12.3	B
Nebraska Ave & 45th St	Southbound Left	2.0	A	2.9	A
	Westbound	9.4	A	9.9	A
Nebraska Ave & Rockwood Pkwy	**Overall**	**12.0**	**B**	**13.4**	**B**
	Eastbound	39.5	D	40.9	D
	Westbound	39.4	D	38.5	D
	Northbound	12.6	B	13.3	B
	Southbound	2.3	A	6.8	A
Rockwood Pkwy & Fletcher Gate	Eastbound Left	0.8	A	1.0	A
	Southbound	10.7	B	12.4	B
Rockwood Pkwy & Glenbrook Rd	**Overall**	**8.2**	**A**	**8.0**	**A**
	Eastbound	8.2	A	7.8	A
	Westbound	7.6	A	8.1	A
	Southbound	8.5	A	7.9	A

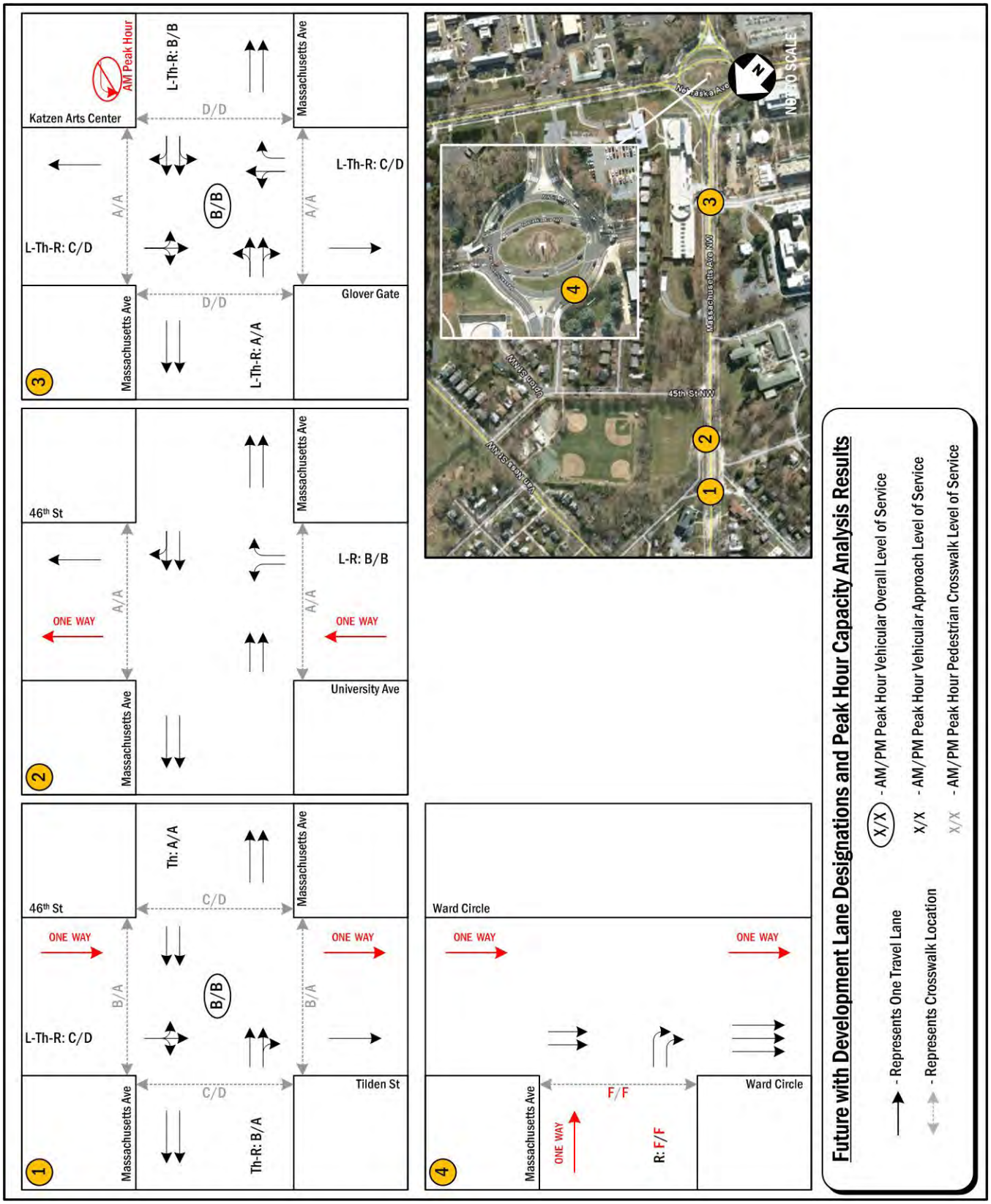

Figure 33: Future with Development Lane Configurations and Peak Hour Capacity Analysis Results (1 of 4)

Figure 34: Future with Development Lane Configurations and Peak Hour Capacity Analysis Results (2 of 4)

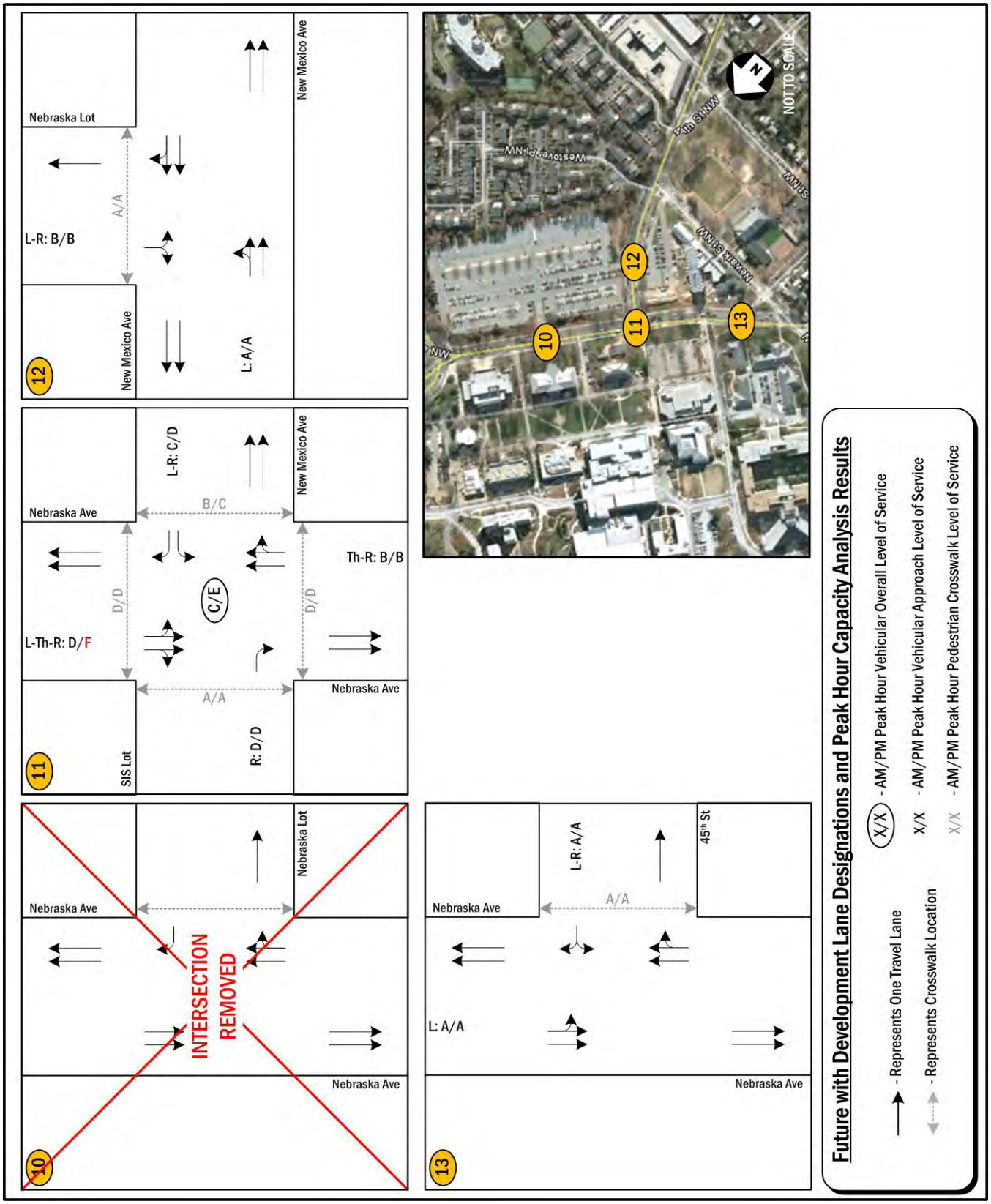

Figure 35: Future with Development Lane Configurations and Peak Hour Capacity Analysis Results (3 of 4)

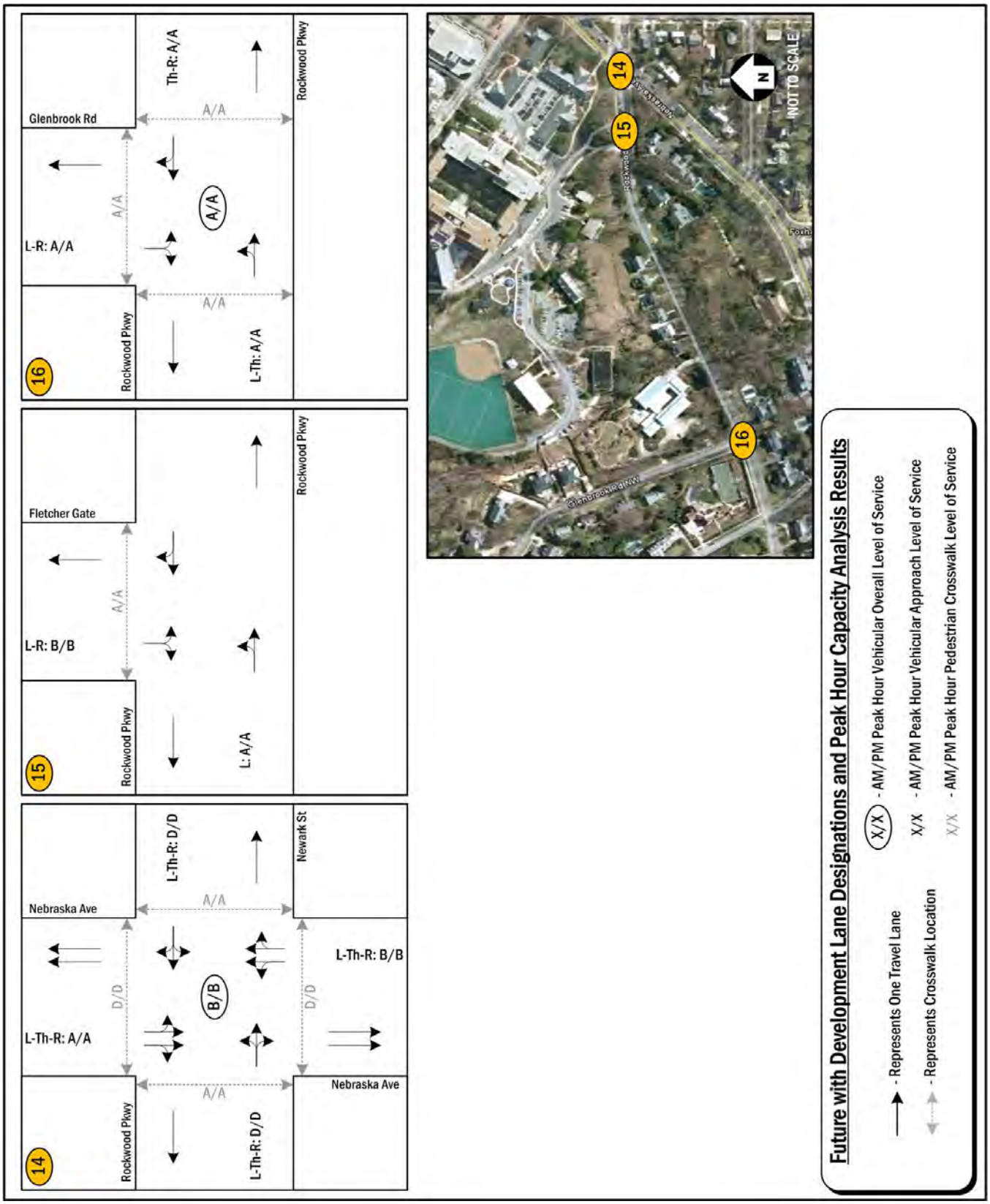

Figure 36: Future with Development Lane Configurations and Peak Hour Capacity Analysis Results (4 of 4)

Summary of Future with Development Vehicular Capacity Analysis Results

For the purpose of this analysis, it is desirable to achieve a level of service (LOS) of "E" or better on each approach. Five approaches operate under unacceptable LOS for the future conditions with development; however, only one of these is due to the addition of the proposed development on the AU Main Campus.

The most notable impact of the proposed development on the AU Main Campus is seen at the westbound right-turn at the intersection of Massachusetts Avenue & Ward Circle southbound, which is degraded from LOS E to LOS F due to the addition of pedestrians crossing the approach and a small increase in vehicular volumes. The approaches at Nebraska Avenue & Ward Circle and Nebraska Avenue & New Mexico Avenue operate under unacceptable LOS for the future conditions without development. The impacts for the four other approaches that operate under unacceptable conditions are equal to a 15.6%, 10.0%, -4.4%, and 5.6% increase (or decrease) in delay.

Future with Development Pedestrian Analysis Results

Pedestrian analyses were performed for the future without development conditions at the intersections contained within the study area during the morning and afternoon peak hours. The analysis was based on "Chapter 13: Pedestrians" of the Highway Capacity Manual (HCM), as outlined previously.

Table 13 and Table 14 show the results of the capacity analyses, including LOS and average delay (in seconds). The capacity analysis results are also shown on Figure 33, Figure 34, Figure 35, and Figure 36.

Table 13: Future Conditions (2020) with Development Pedestrian Levels of Service for Signalized Intersections

Intersection (Approach)	(Parallel Approach)	Total Future (2020) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/Tilden St	Eastbound	12.0	B	8.0	A
	Westbound	12.0	B	8.0	A
	Northbound	27.4	C	34.4	D
	Southbound	27.4	C	34.4	D
Massachusetts Ave & Glover Gate/Katzen Arts Center	Eastbound	7.6	A	5.8	A
	Westbound	8.0	A	6.1	A
	Northbound	35.3	D	39.6	D
	Southbound	35.3	D	39.6	D
Ward Circle:					
Nebraska Ave & Ward Circle	Eastbound	39.6	D	39.6	D
Nebraska Ave & Ward Circle	Westbound	39.6	D	39.6	D
Nebraska Ave & New Mexico Ave	Eastbound	39.6	D	39.6	D
	Westbound	39.6	D	39.6	D
	Northbound	19.8	B	21.1	C
Nebraska Ave & Rockwood Pkwy	Eastbound	6.5	A	7.2	A
	Westbound	37.8	D	37.8	D
	Northbound	37.8	D	37.8	D
	Southbound	8.8	A	8.8	A

Table 14: Future Conditions (2020) with Development Pedestrian Levels of Service for Unsignalized Intersections

Intersection (Approach)	(Approach)	Total Future (2020) LOS			
		AM Peak Hour		*PM Peak Hour*	
		Delay	LOS	Delay	LOS
Massachusetts Ave & 46th St/University Ave	Eastbound	N/A - Stop controlled crossing, LOS A			
	Westbound	N/A - Stop controlled crossing, LOS A			
Ward Circle:					
Massachusetts Ave & Ward Circle	Southbound	213.0	F	105.2	F
Massachusetts Ave & Ward Circle	Northbound	245.9	F	107.7	F
Massachusetts Ave & Ward Circle	Northbound	29.6	D	100.3	F
Massachusetts Ave & Ward Circle	Southbound	20.5	D	66.9	F
Nebraska Ave & Commuter Lot (RIRO)	Northbound	N/A - Stop controlled crossing, LOS A			
New Mexico Ave & Commuter Lot	Westbound	N/A - Stop controlled crossing, LOS A			
Nebraska Ave & 45th St	Northbound	N/A - Stop controlled crossing, LOS A			
New Mexico Ave & Commuter Lot	Westbound	N/A - Stop controlled crossing, LOS A			
Rockwood Pkwy & Fletcher Gate	Westbound	N/A - Stop controlled crossing, LOS A			
	Northbound	N/A - Stop controlled crossing, LOS A			
	Southbound	N/A - Stop controlled crossing, LOS A			

Summary of Future with Development Pedestrian Analysis Results

The analysis results indicate that all signalized crosswalks in the study area operate at acceptable levels of service during both the morning and afternoon peak hours. This indicates a low (LOS A and B) to moderate (LOS C and D) likelihood of non-compliance by pedestrians, which is reflected by pedestrians jaywalking across the intersection. The study intersections with crosswalks operating at LOS D will experience a moderate to high likelihood of non-compliance, so signal timing improvements may be investigated at these intersections in order to improve the pedestrian LOS.

The analysis results also indicate that the majority of the unsignalized crosswalks in the study area operate at unacceptable levels of service during one or more peak hours. This indicates a moderate (LOS C and D) to very high (LOS F) likelihood of risk-taking behavior for pedestrians, which is reflected in pedestrians dashing between vehicles during short gaps in traffic. As stated previously, pedestrians have the right-of-way in all crosswalks in the District, so vehicles must yield to pedestrians in the crosswalk at the study intersections listed in Table 4. However, the LOS F calculated for the unsignalized approaches of Ward Circle during the morning and afternoon peak hours indicates an unfriendly and intimidating environment for pedestrians. Signing and striping improvements may be investigated in order to promote vehicular compliance and make pedestrians feel more comfortable.

SUMMARY AND CONCLUSIONS

This report presents the preliminary findings of a traffic impact analysis conducted for the American University Main Campus Plan for the years 2010-2020.

A review of the proposed Campus Plan study area found the following:

- Traffic in the study area is heavily commuter-based, especially on Nebraska Avenue and Massachusetts Avenue.
- Traffic controls in the study area operate under acceptable conditions (defined as level of service of "E" or better) during the morning and afternoon peak hours, though a few approaches operate under unacceptable conditions during one or more peak hour.
- All signalized crosswalks in the study area operate under acceptable conditions during the morning and afternoon peak hours, although some experience a moderate to high likelihood of non-compliance, so signal timing improvements may be investigated at these intersections in order to improve the pedestrian level of service.
- The majority of unsignalized crosswalks in the study area operate at unacceptable levels of service during one or more peak hour, which indicates a moderate to very high likelihood of risk-taking behavior by pedestrians. Although pedestrians have the right-of-way in all crosswalks in the District and vehicles must yield to pedestrians in the crosswalk, the LOS F calculated for the unsignalized approaches of Ward Circle during the morning and afternoon peak hours indicates an unfriendly and intimidating environment for pedestrians.

In order to determine the impact of the proposed changes to the AU Campus, vehicular trips were generated based on changes in parking inventory at the university and not on growth of population. Although multiple development changes are proposed in the Campus Plan, including new residence halls and academic buildings, these sources are not expected to generate any additional vehicular trips. Instead, any change in vehicular trip generation will be due to the proposed parking modifications. The proposed Campus Plan consists of the following changes that will affect vehicular trip generation for the Main Campus:

- Remove existing 903 parking spaces on Nebraska Avenue Lot;
- Remove approximately 100 parking spaces from the Main Campus due to construction of new residence halls on South Campus and Clark Site on existing surface parking lots;
- Add 458 new parking spaces to the School of International Services (SIS) Garage: 238 spaces currently built with possible expansion of 175 spaces under future academic/administration building, all spaces for faculty/staff; and
- Add 500 new parking spaces to the East Campus (Nebraska Avenue lot): 100 for on-campus students, 330 for commuter students, and 70 for faculty/staff.

Similar to the changes to vehicular trip generation, pedestrian trip generation is not based on an increase in overall population on campus. For pedestrian trips, it was assumed that the major trip generation changes would be due to the parking modifications described previously, in addition to the construction of new residence halls and student-oriented retail. The following changes will also affect pedestrian trip generation for the Main Campus:

- Existing pedestrians crossing Nebraska Avenue at New Mexico Avenue subtracted due to removed parking spaces in Nebraska Avenue Lot (East Campus);
- Trips added to East Campus by new Residence Halls adding 860 total beds;

- Trips added to East Campus by new parking: assumed only commuter-student spaces would generate pedestrian trips crossing Nebraska Avenue to Main Campus so as not to double-count on-campus student spaces, assumed faculty/staff spaces would be provided to those working at Admissions & Enrollment services (45 employees), Alumni Center (15 employees), Welcome Center, and retail sources;
- Other source of trip generation on East Campus would be retail uses consisting of 27,000 square-foot Campus Store and 20,000 square-feet of additional student-oriented retail; and
- Additional trips generated by 120 beds added at Nebraska Hall.

Site access for the proposed East Campus development will be provided by the existing driveway on New Mexico Avenue. The existing right-in/right-out driveway on Nebraska Avenue will be removed. Site access for the Main Campus will remain the same as existing at the Glover Gate on Massachusetts Avenue and the Fletcher Gate on Rockwood Parkway. An additional right-in/right-out driveway will be constructed for the School of International Services (SIS) Garage as the fourth leg of the Nebraska Avenue and New Mexico Avenue intersection.

A capacity analysis was performed within a study area of 16 intersections; the results were as follows.

- All study area intersections operate at acceptable levels of service in the future with the proposed Campus Plan changes. However, five approaches will operate under unacceptable conditions. Four of these approaches operate under unacceptable conditions for the future without the proposed Campus Plan changes.
- The site access driveways and gates will operate at acceptable levels of service.
- All signalized crosswalks operate at acceptable levels of service in the future with the proposed Campus Plan changes.
- The majority of unsignalized crosswalks operate at unacceptable levels of service in the future with the proposed Campus Plan changes. However, all of these crosswalks operate under unacceptable conditions for the future without the proposed Campus Plan changes.

Mitigation Measures and Next Steps

This report will be updated in the Fall of 2010 as part of the transportation report filed with the Campus Plan application. This revised report will consist of a revised analysis, which will include the following updates:

- Update pedestrian trip generation rates by counting activity on campus at residence halls and retail sites, with the Fall 2010 semester underway;
- Perform additional existing peak hour traffic counts, including Ward Circle, with the Fall 2010 semester underway;
- Separate out the SIS Garage into two phases of development in order to remove the approved portion of the development from the Campus Plan site-generated trips, and place these trips in the future background conditions;
- May add an additional access point for the East Campus parking lot as a right-in/right-out driveway along Massachusetts Avenue. This intersection may be signalized in order to assist pedestrians crossing Massachusetts Avenue, which will also create additional vehicular gaps along the roadway that will aid vehicles entering and exiting Westover Place; and
- Update the Tenley Campus background trips.

The revised report will also include a set of recommended mitigation measures that respond to the analysis results. This will likely consist of short-term improvements (signal timing and site access changes) and long-term improvements (recommendations for further study).