Transportation Analysis – Final Report

Lincolnia Community Business Center Transportation Study

Lincolnia, Virginia

June 2019

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Lincolnia Community Business Center Study

Lincolnia, Virginia

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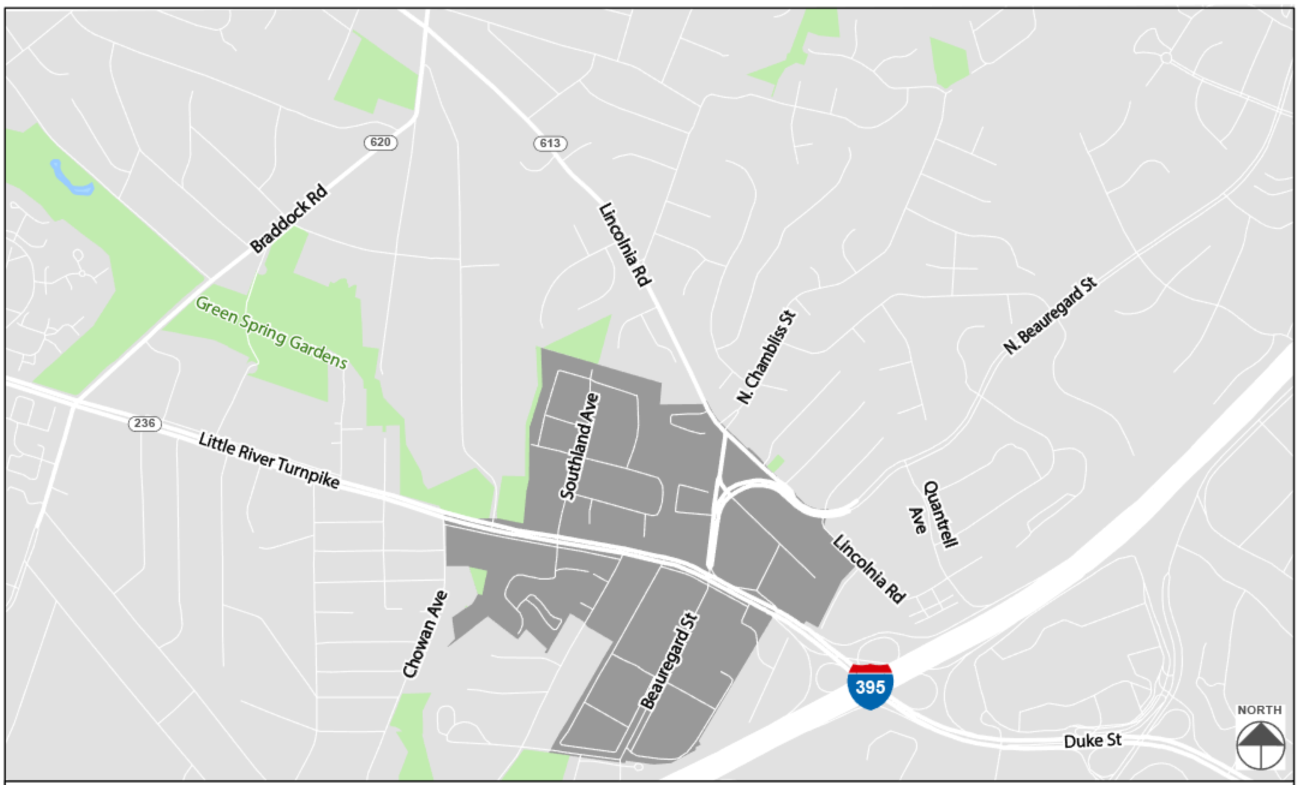
EXECUTIVE SUMMARY

ES.1 INTRODUCTION

Lincolnia is located in Fairfax County on the western side of Interstate-395 (I-395) adjacent to Little River Turnpike (Route 236). Land use in the area is comprised of strip style shopping and small office centers surrounded mostly by multi-family apartments. On August 29, 2017, the Lincolnia Planning District Study Task Force unanimously adopted a recommendation to designate a Community Business Center (CBC) in the area surrounding the intersection of Little River Turnpike/N. Beauregard Street. The CBC and surrounding study area are shown on **Figure Executive Summary-1**.

Figure Executive Summary-1. Lincolnia Community Business Center and Study Area



The Task Force designated the CBC in order to:

1. Create a vibrant neighborhood destination with public open spaces, parks, outdoor dining and cafes, and entertainment areas.
2. Strategically focus appropriate growth to protect Lincolnia's low density residential neighborhoods from development pressure.
3. Create an integrated multimodal approach to transportation challenges in the area.
4. Create an attractive neighborhood through quality urban design guidance.
5. Preserve and expand Lincolnia's housing affordability.

Fairfax County's current Comprehensive Plan recommends a grade separated interchange at the intersection of Little River Turnpike and N. Beauregard Street to address congestion and includes the widening of Little River Turnpike from four lanes to six lanes. However, the Comprehensive Plan recommendations are not compatible with the Task Force's community objectives. The transportation study team has been tasked with identifying improvements to the transportation network to facilitate the community objectives outlined by the Task Force while improving the operation of the transportation network in the study area.

ES.2 OVERVIEW OF PROCESS

A multi-tiered approach to analysis and alternative development was utilized to create, refine and advance potential changes to the transportation network in Lincolnia. The first step in this process was to rigorously evaluate current and baseline conditions, focusing on quantifying traffic congestion in the study area. Following this, the team created ten (10) sketch level alternatives. With input from FCDOT through an in-person work shop on the sketch level alternatives, six alternatives were selected for a high-level overview focusing primarily on qualitative metrics. With further input from FCDOT and the Task Force, three of these alternatives were selected for a more detailed analysis using more quantitative assessments.

ES.3 ALTERNATIVES

Initial efforts produced ten (10) sketch level alternatives that envisioned a variety of approaches to potentially address traffic congestion in the area within the context of the Task Force's vision for the area. In general, these sketch level alternatives considered providing various types of street grids, alternative intersections, roadway connections outside the study area, as well as grade separation. Ultimately, six of the sketch level alternatives were chosen to further develop into alternatives as noted in Error! Reference s ource not found..

In general, the sketch-level alternatives incorporated some form of a street grid to address the traffic congestion in the area while remaining consistent with guidance provided by the Task Force.

A rigorous multi-modal transportation analysis was performed for the alternatives, where a variety of qualitative and quantitative performance metrics were evaluated. Of these six alternatives, three were advanced for more detailed analysis. The results of the analysis that were used for the refinement are summarized in **Figure Executive Summary-3**. These included the first three alternatives. The first two provide a full street grid with two-way traffic on all streets and the third alternative included a set of one-way paired streets as shown in **Figure Executive Summary-4**.

Figure Executive Summary-2. Six Sketch-Level Alternatives

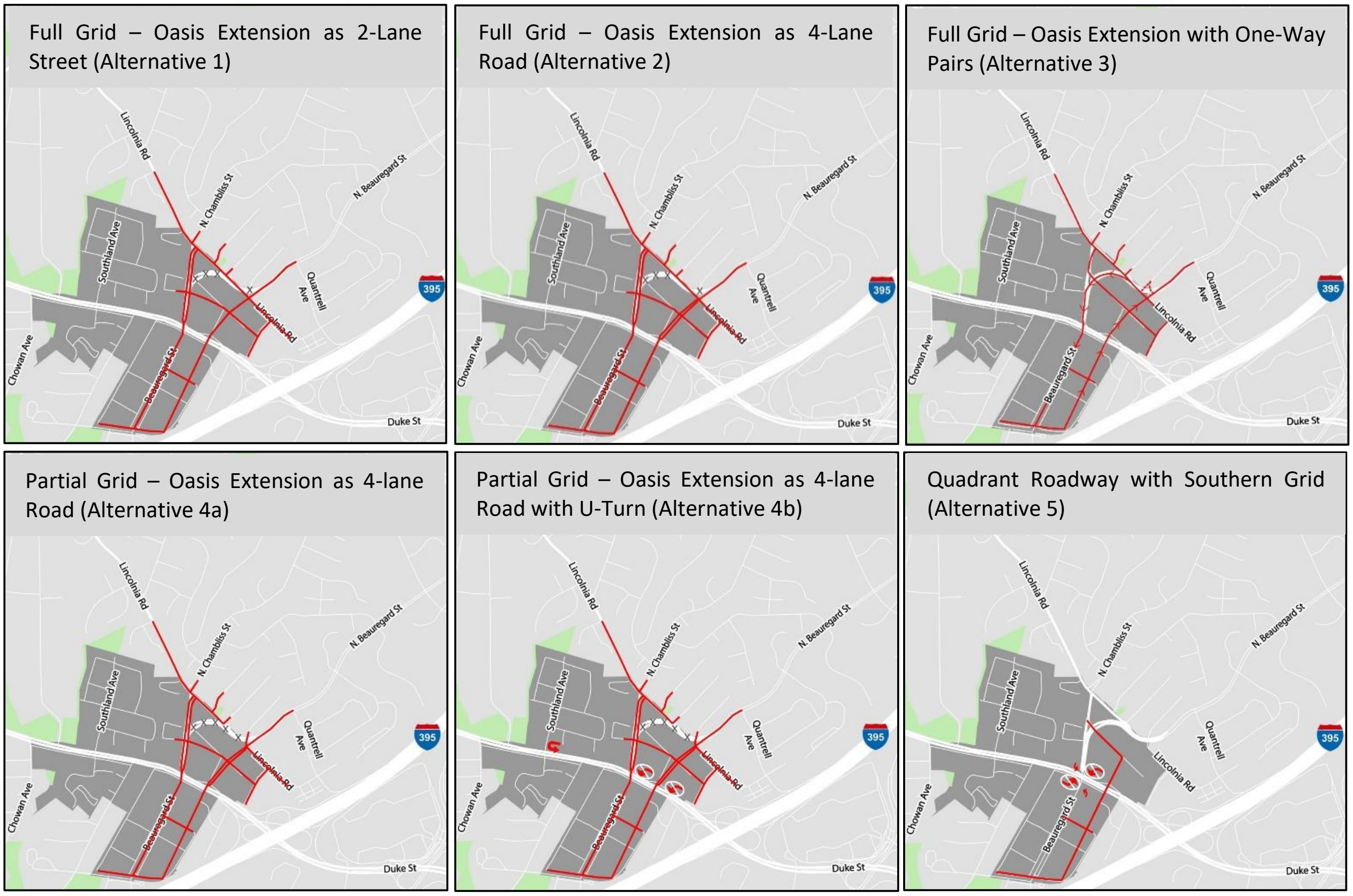


Figure Executive Summary-3. Sketch-Level Alternatives Performance

CRITERIA	Alt 1	Alt 2	Alt 3	Alt 4a	Alt 4b	Alt 5
Traffic Ops	Fair	Average	Good	Average	Good	Fair
Ped Connectivity	Good	Average	Good	Average	Average	Fair
Feasibility for Low-Stress Bike Facilities	Good	Average	Good	Average	Average	Average
Transit	Good	Average	Average	Fair	Fair	Average
Minimal Construction Cost and Disruption	Fair	Fair	Fair	Fair	Fair	Average
Can Advance Context-Sensitive Solutions	Good	Good	Average	Good	Good	Average

INDEX	
● (green)	Good
● (yellow)	Average
● (orange)	Fair
● (red)	Poor

Figure Executive Summary-4. Three Alternatives for Detailed Analysis

ES.4 SUMMARY OF FINDINGS

The detailed analyses of the three alternatives with the Comprehensive Plan land use indicated that Alternative 1 results in very high vehicle delays, in particular during the PM peak hour, and is unable to mitigate the bottleneck at the intersection of Little River Turnpike and Beauregard Street. Therefore, Alternative 1 was not carried forward for the detailed analysis with the new land use envisioned for the CBC (i.e., Alternative land use). The other two alternatives, however, resulted in promising results under the Comprehensive Plan land use scenario, and thus were carried forward.

The results from the Alternative land use scenario showed that both alternatives (Traditional Grid as 4-lane road and One-Way Pairs) provide improved travel conditions considerably over the baseline while generally remaining consistent with the established goals for the CBC. The one-way pairs provide the least vehicular delay, where all intersections operate with LOS E or better both during the AM and PM peak hours; however, they would pose implementation challenges and potential issues for non-motorized users that were not quantified as part of this study.

ES.5 CONCLUSIONS AND RECOMMENDATIONS

The analysis of the 2040 future conditions began with evaluating the baseline travel conditions of what could be expected in the future. Baseline travel conditions assumed the build-out of the Comprehensive Plan transportation network and land use, except for the grade separated interchange at the Little River Turnpike/N. Beauregard Street intersection. As previously discussed, this interchange is not perceived to be compatible with the community objectives for the area, and it would be an expensive project to construct.

Next, after the refinement of initial transportation alternatives, the two network alternatives were identified and analyzed in more detail with the new land use envisioned for the CBC. Both alternatives reduced vehicle delays and increased the total number of vehicles served in the study area compared to the Baseline travel conditions. Furthermore, major bicycling and walking opportunities are created with both alternatives through the recommended grid of streets.

Based on the findings of the analyses along with the input gathered from the Task Force, it is recommended to move forward with the Full-Grid – Oasis Extension as 4-lane road alternative as this concept does not require the development of south side of Little River Turnpike.

Section 1
Introduction

1 INTRODUCTION

1.1 PROJECT DESCRIPTION

Lincolnia is located in Fairfax County on the western side of Interstate-395 (I-395) adjacent to Little River Turnpike (Route 236). Land use in the area is comprised of strip style shopping and small office centers surrounded mostly by multi-family apartments. Lincolnia is bifurcated by the major arterial Little River Turnpike, which connects Fairfax County with the City of Alexandria and provides a connection to the regional freeway system. Little River Turnpike and the surrounding transportation network are characterized by high levels of vehicular traffic. Little River Turnpike also supports bus service to and through Lincolnia but prioritizes motorized modes of travel and does not facilitate a walkable environment. The approximate location of the area within Fairfax County is shown in

Figure 1-1.

On August 29, 2017, the Lincolnia Planning District Study Task Force unanimously adopted a recommendation to designate a Community Business Center (CBC) in the area surrounding the intersection of Little River Turnpike/N. Beauregard Street. The extents of the CBC and surrounding study area are shown in **Figure 1-2**.

Figure 1-1. Lincolnia Area within Fairfax County

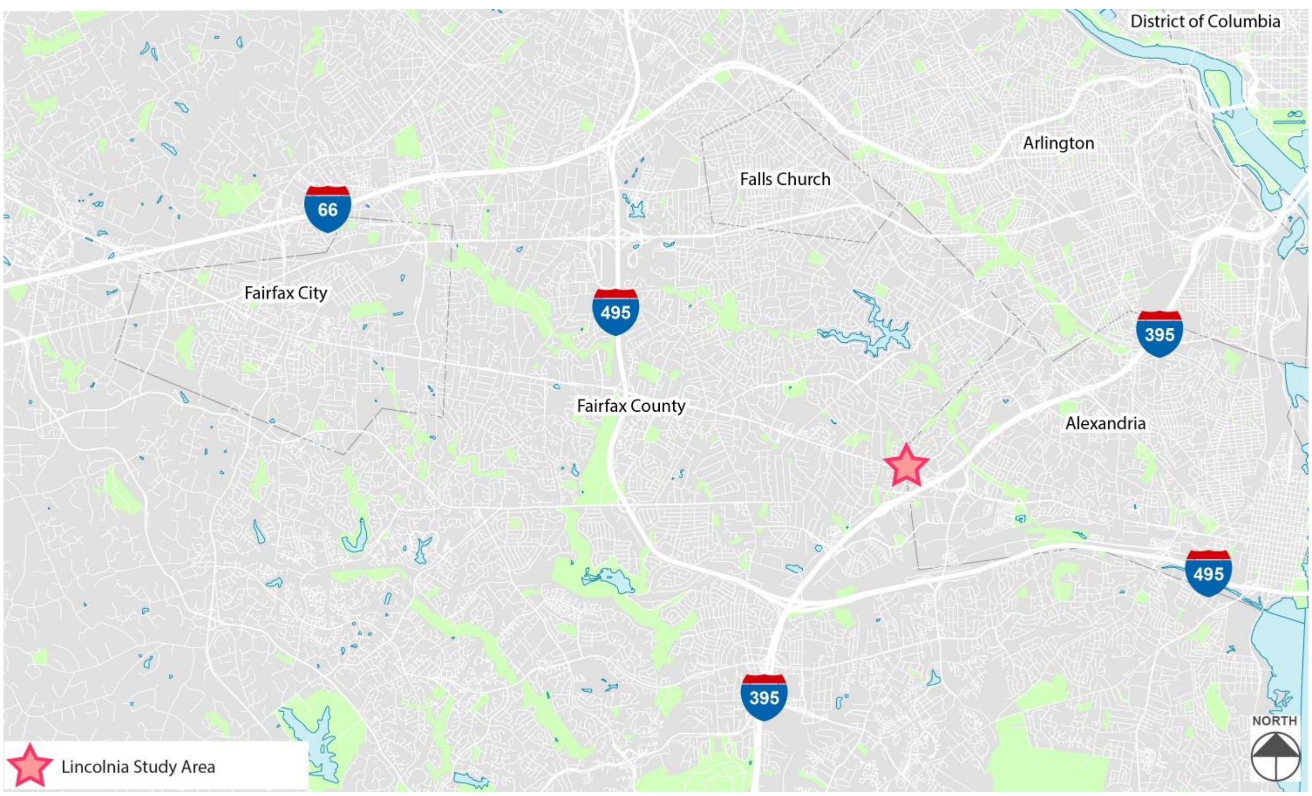
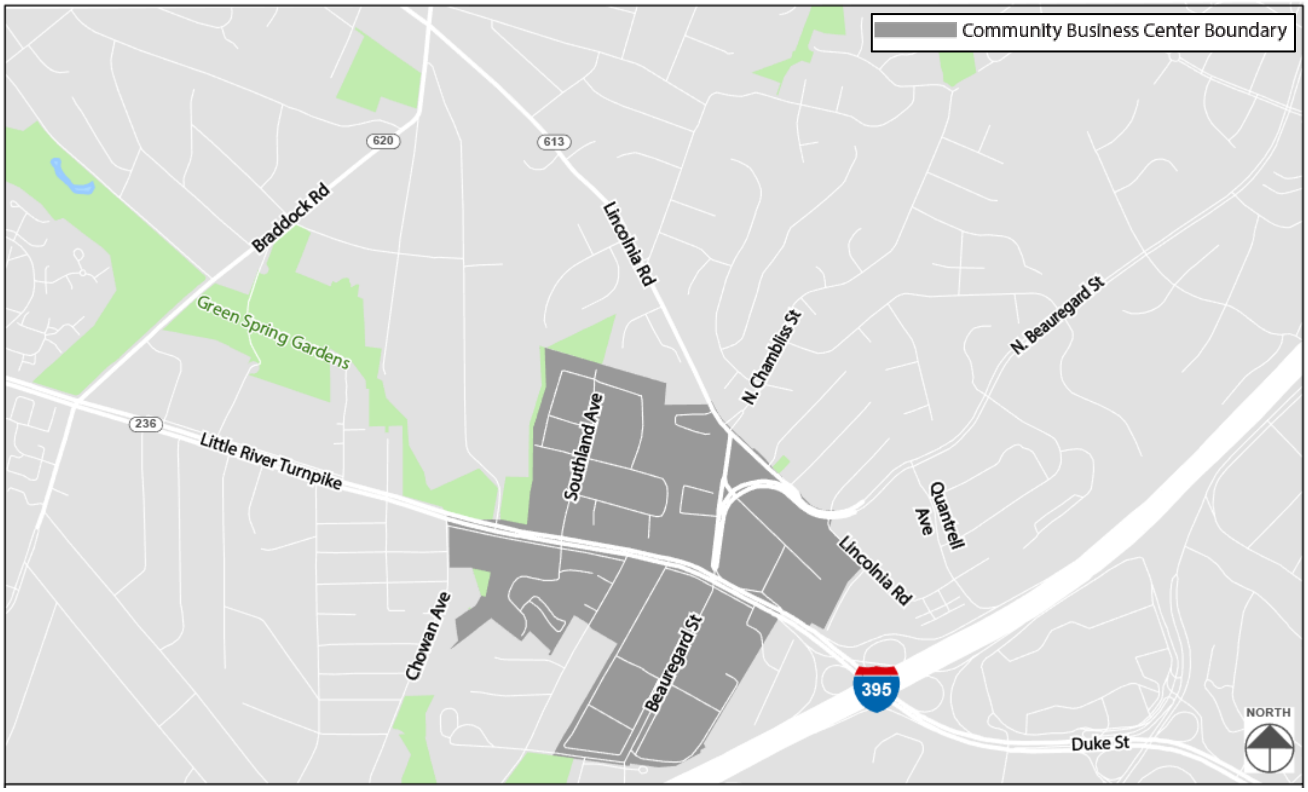


Figure 1-2. Lincolnia Community Business Center and Study Area



1.1.1 Community Business Center (CBC) Objectives

In recommending the establishment of a CBC, the Task Force identified the following five (5) community objectives:

1. Create a vibrant neighborhood destination with public open spaces, parks, outdoor dining and cafes, and entertainment areas.
2. Strategically focus appropriate growth to protect Lincolnia's low density residential neighborhoods from development pressure.
3. Create an integrated multimodal approach to transportation challenges in the area.
4. Create an attractive neighborhood through quality urban design guidance.
5. Preserve and expand Lincolnia's housing affordability.

1.2 OVERVIEW OF PROCESS AND ALTERNATIVES

This phase of the Lincolnia study examined how the Task Force objectives can be achieved. As part of this effort to transition land uses, the Fairfax County Department of Transportation (FCDOT) completed the Lincolnia CBC Transportation Analysis presented herein. This analysis was completed to evaluate potential changes to the transportation network that could achieve the community's objectives. The Lincolnia CBC Transportation Analysis consisted of the following steps to formulate recommendations:

- Goals, Objectives, and MOEs **(Section 2)**,
- 2017 Existing Conditions Analysis **(Section 3)**,
- 2040 Baseline Conditions Analysis **(Section 4)**,
- Development and Analysis of 2040 Transportation Alternatives **(Section 5)**, and
- 2040 Alternative Land Use Analysis with the recommended transportation alternatives **(Section 6)**.

In the Development and Analysis of 2040 Transportation Alternatives **(Section 5)**, a two-tiered approach was used to select alternatives. In the first tier, ten alternatives were developed and shared with FCDOT. This included an evaluation of the alternatives using conceptual, sketch-level assessments. With input from FCDOT, six alternatives were selected for a high-level overview focusing primarily on qualitative metrics. With input from the Task Force, three of these alternatives were selected for the second tier of analysis. In the second tier, the three alternatives were evaluated in more detail using more quantitative assessments.

This report follows the analysis structure above and summarizes the results of the Lincolnia CBC Transportation Analysis. Key findings and recommendations are included to identify multi-modal transportation improvements that can facilitate the more vibrant neighborhood envisioned for Lincolnia while minimizing traffic congestion.

1.3 PLANNING HISTORY

Previous planning efforts in the Lincolnia area have prioritized motorized modes of travel. The Fairfax County Comprehensive Plan recommendations for the area show a new interchange at the Little River Turnpike/N. Beauregard Street intersection and the widening of Little River Turnpike to six lanes. This approach supported the strip shopping center and land use design of the 1970s, but may not be compatible with the community's vision for the area. The 2040 Baseline Conditions Analysis section (Section 4) addresses these recommendations in more detail.

Other planned roadway improvements were reviewed to ensure the recommendations of the Lincolnia CBC Transportation Analysis account for changes being implemented in the area. Two important projects were identified and are discussed in more detail below.

1.3.1 Interstate-395 Southbound Widening - Duke Street to Edsall Road

In conjunction with the project to add a fourth southbound lane to Interstate 395 from Duke Street to Edsall Road, the Virginia Department of Transportation (VDOT) recently completed an Interchange Modification Report (IMR) for the interchange of I-395 and Route 236.[1] The IMR proposed changes at

[1] I-395 Southbound Additional Through Lane Interchange Modification Report. May 2017. Virginia Department of Transportation.

this interchange including the removal of the southbound I-395 loop ramp to eastbound Duke Street and combining this movement with the I-395 southbound off-ramp to Little River Turnpike. In order to allow for access to Duke Street from I-395 southbound, the IMR recommends an additional signal at Little River Turnpike east of where the I-395 off-ramp to westbound Route 236 joins Little River Turnpike. The IMR was approved by the Federal Highway Administration in May 2017, and the project was under construction at the date of publication of this report.

1.3.2 N. Beauregard Street at N. Chambliss Street Intersection Improvements

VDOT, FCDOT, and Lincolnia residents participated in a multi-tier traffic and safety analysis to identify improvements at the intersection of N. Beauregard Street and N. Chambliss Street. Operational analyses and a safety evaluation completed in November 2017 found that this intersection currently lacks pedestrian signals and exposes pedestrians to greater risk due to an unsignalized slip lane crossing of southbound N. Chambliss Street. Multiple alternatives were reviewed including geometric modifications that would eliminate the existing slip lane; however, only striping modifications to the Little River Turnpike and N. Beauregard Street are being pursued at this time.

1.4 SCOPE OF THE REPORT

The primary goal of this transportation analysis is to support the proposed CBC by identifying multi-modal transportation improvements that can support the future land use and facilitate the more vibrant neighborhood envisioned for Lincolnia by the Task Force. Specifically, this process will propose and evaluate alternative approaches to an interchange at Little River Turnpike/Beauregard Street. These alternatives will be evaluated on their ability to preserve the functionality of the transportation network while advancing the goals for the study area.

Section 2
Goals, Objectives, Measures of Effectiveness (MOEs), and Methodology

2 GOALS, OBJECTIVES, MEASURES OF EFFECTIVENESS (MOES), AND METHODOLOGY

This section outlines goals, objectives, and measures of effectiveness (MOEs) in conducting the transportation analysis for the proposed Lincolnia CBC. In addition, consistent with the identified MOEs, this section presents the methodology followed to conduct the transportation analysis.

The goals, objectives, and MOEs were developed based on the community objectives identified by the Task Force on August 29, 2017, when designating the CBC area. The community objectives helped guide the creation of the goals, objectives, and MOEs. As described in the Introduction **(Section 1),** these community objectives include:

1. Create a vibrant neighborhood destination with public open spaces, parks, outdoor dining and cafes, and entertainment areas.
2. Strategically focus appropriate growth to protect Lincolnia’s low density residential neighborhoods from development pressure.
3. Create an integrated multimodal approach to transportation challenges in the area.
4. Create an attractive neighborhood through quality urban design guidance.
5. Preserve and expand Lincolnia’s housing affordability.

Goals, objectives, and MOEs were developed with the input of FCDOT and presented to the Task Force. The goals, objectives, and MOEs listed in **Table 2-1** were developed to be comprehensive, multi-modal, and consistent with the vision of the Task Force.

In identifying a new transportation network for the CBC, it was important to establish MOEs that would support the selection process. Therefore, a two-tiered approach was used to select a preferred alternative. The first tier of evaluation consisted of a high-level overview all six alternatives under consideration, focusing primarily on qualitative metrics or sketch-level measures, as discussed below in detail. Except for traffic operations, Tier 1 evaluated alternatives using qualitative measures of effectiveness, which was consistent with objectives identified by the Task Force and FCDOT. To evaluate traffic conditions under each alternative, Synchro was used. This allowed the larger group of initial alternatives to be considered and refined in a timely and cost-effective manner. Three of the five initial alternatives were selected from the initial tier based on the results of goals and objectives analysis. These alternatives were evaluated in more detail in the second tier. **Table 2-1** shows the recommended objectives along with the selected MOEs for the Tier 1 and Tier 2 analysis. The table also includes the associated tool/software that was utilized to obtain the selected measures.

Table 2-1. Goals, Objectives, and Measures of Effectiveness (MOEs)

Objectives	Tier 1 MOEs	Tier 1 Tools/Software	Tier 2 MOEs	Tier 2 Tools/Software
Improve traffic operations	• Peak hour volumes and intersection volume to capacity (v/c) ratio	• Critical Lane Volume (CLV) analysis • Synchro	• LOS and delay by intersection and approach • 95th percentile queues by movement • Corridor travel time • Vehicle throughput • Network delay • Network throughput	• Synchro • VISSIM
Enhance pedestrian connectivity	• Pedestrian delay (estimated from signal timing using a spreadsheet tool) • Pedestrian crossing distance • Block/intersection density	• Excel/HCM • GIS	• Pedestrian delay (calculated directly from VISSIM) • Pedestrian crossing distance • Block/intersection density	• VISSIM • GIS
Provide low-stress bike facilities	• Feasibility for low-stress bike facilities in the alternative	• Qualitative evaluation	• Feasibility for low-stress bike facilities in the alternative	• Qualitative evaluation
Enhance transit service	• Ability for riders to easily access transit stops	• Qualitative evaluation	• Ability for riders to easily access transit stops	• Qualitative evaluation
Minimize construction cost and disruption	• Order of magnitude cost • Time for implementation	• Quantitative analysis based on literature review and comparable projects	• Phasing and disruption during implementation	• Quantitative analysis based on literature review and comparable projects
Transportation facilities that can advance context-sensitive solutions	• Fit with the identified community objectives	• Qualitative analysis	• Fit with the identified community objectives	• Qualitative analysis

2.1 DATA AND ANALYSIS METHODOLOGY

An extensive data collection effort was undertaken to fully understand existing, baseline, and alternative land use conditions in the area. Details regarding the data and analysis methodology used are provided in **Appendix 1**.

To establish current vehicular conditions, turning movement counts were conducted at the study intersections in November 2017 and 48-hour tube counts were conducted at an additional five locations. This data was used to conduct the 2017 Existing Conditions Analysis **(Section 3)**. The data collection locations are shown in **Figure 2-1**.

2.1.1.1 Quantitative Vehicular Analysis

Volumes were used to analyze twelve (12) study intersections identified for detailed vehicular analysis using Synchro and VISSIM software. The core of the study area experiences severe congestion and frequent queue spillbacks. In addition, due to the proximity to the I-395 ramps, heavy weaving flows exist on Little River Turnpike in both directions. Seven of the twelve intersections are in the core area. As a result, these seven intersections were analyzed in VISSIM, as Synchro has limitations analyzing more complicated intersections. The remaining intersections were analyzed using Synchro as these intersections are more isolated and generally not affected by queue intersections. **Figure 2-2** shows the VISSIM and Synchro intersections in the study area.

These twelve intersections were analyzed as part of the 2017 Existing Conditions Analysis **(Section 3)**, 2040 Baseline Conditions Analysis **(Section 4)**, and 2040 Alternative Land Use Analysis **(Section 6)**. Only the core VISSIM study intersections were evaluated in the Development of Transportation Alternatives **(Section 5)**. The Fairfax County Travel Demand Model was used to develop traffic forecasts for the analysis of future conditions.

Figure 2-1. Turning Movement and Tube Count Locations

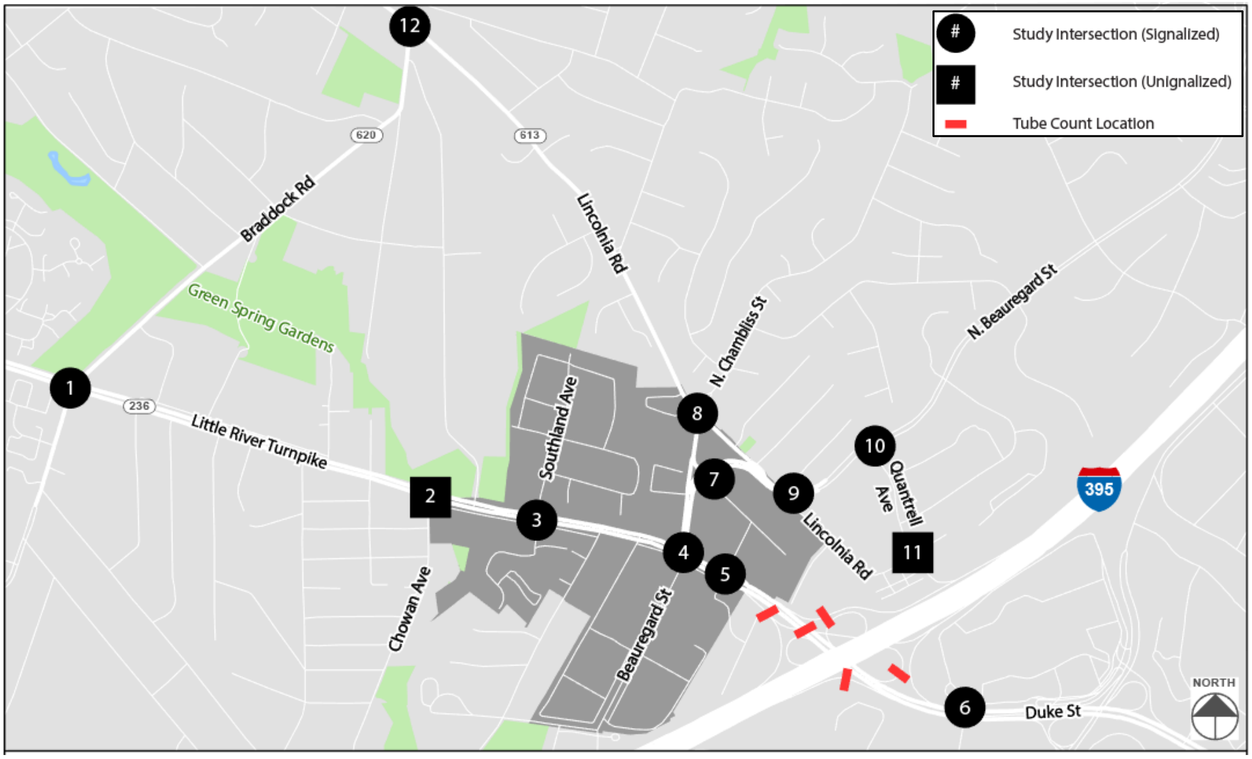
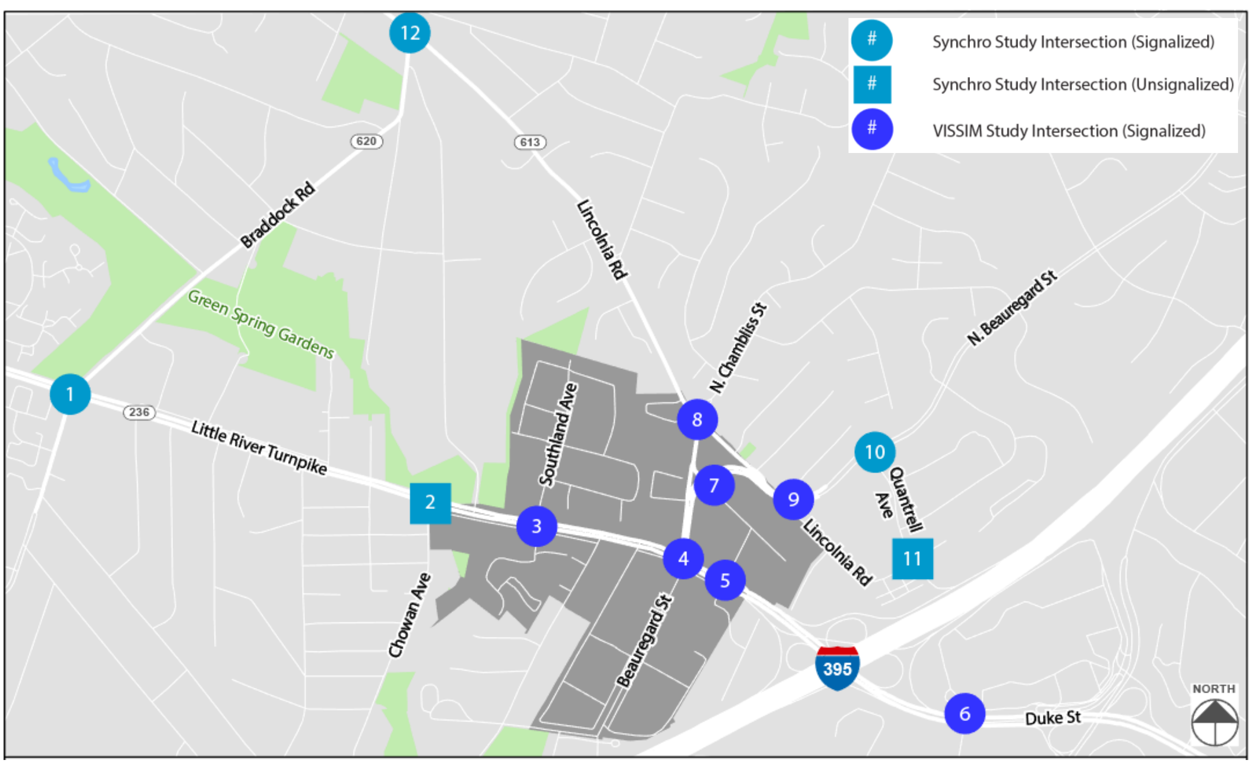


Figure 2-2. Synchro and VISSIM Study Intersections



2.1.1.2 Multi-modal Assessment

Qualitative and quantitative assessments of multi-modal performance were also included in the Development of Future Transportation Alternatives **(Section 5)** and conducting the 2040 Alternative Land Use Analysis **(Section 6)**. For these steps in the Lincolnia CBC Transportation Analysis, each alternative was evaluated based on its ability to achieve the goals of the study. Consistent with the identified goals discussed above, six assessment criteria were identified:

- ***Traffic Operations (Traffic Ops)*** – Assessment of traffic conditions such as intersection delay, level of service, and vehicle queues
- ***Pedestrian Connectivity (Ped Connectivity)*** – Qualitative assessment of walkability and connectivity of alternatives
- ***Feasibility for Low-Stress Bike Facilities*** – Feasibility of implementing bicycle friendly (i.e., low-stress) facilities
- ***Transit*** – Qualitative assessment of accessibility to bus stops and effect of alternatives on bus operations (for example, route changes leading to longer and more circuitous routes due to new roadway configurations)
- ***Minimal Cost and Disruption*** – Qualitative assessment of cost and disruption to the CBC associated with each alternative
- ***Can Advance Context-Sensitive Solutions*** – Qualitative assessment of whether the alternative fits with the established community objectives

Assessments were based on the performance of each alternative relative to another. For example, if an alternative was likely to improve traffic operations considerably compared to other alternatives, it was assumed to perform well. Qualitative performance for the criteria are symbolized as:

- ***Green –*** Will likely perform well
- ***Yellow*** – May perform well
- ***Orange*** – May not perform well
- ***Red*** – Will likely not perform well

Section 3
2017 Existing Conditions Analysis

3 2017 EXISTING CONDITIONS

Analysis was performed across the modes identified in the Lincolnia study area consistent with the methodologies described in detail in **Appendix 1**. This section presents existing conditions results from the analysis.

3.1 PEDESTRIAN CONDITIONS

Sidewalks exist along most of the major roadways in the corridor, along some of the more minor roadways, and on some neighborhood streets. However, there are many gaps in the sidewalk network. Specifically, there are major gaps along Little River Turnpike between Southland Avenue and Seminole Avenue in the westbound direction. Further, there are worn walking paths along the road where sidewalks do not exist indicating a lack of sidewalk space or pedestrian desire lines not being served **(Figure 3-1)**.

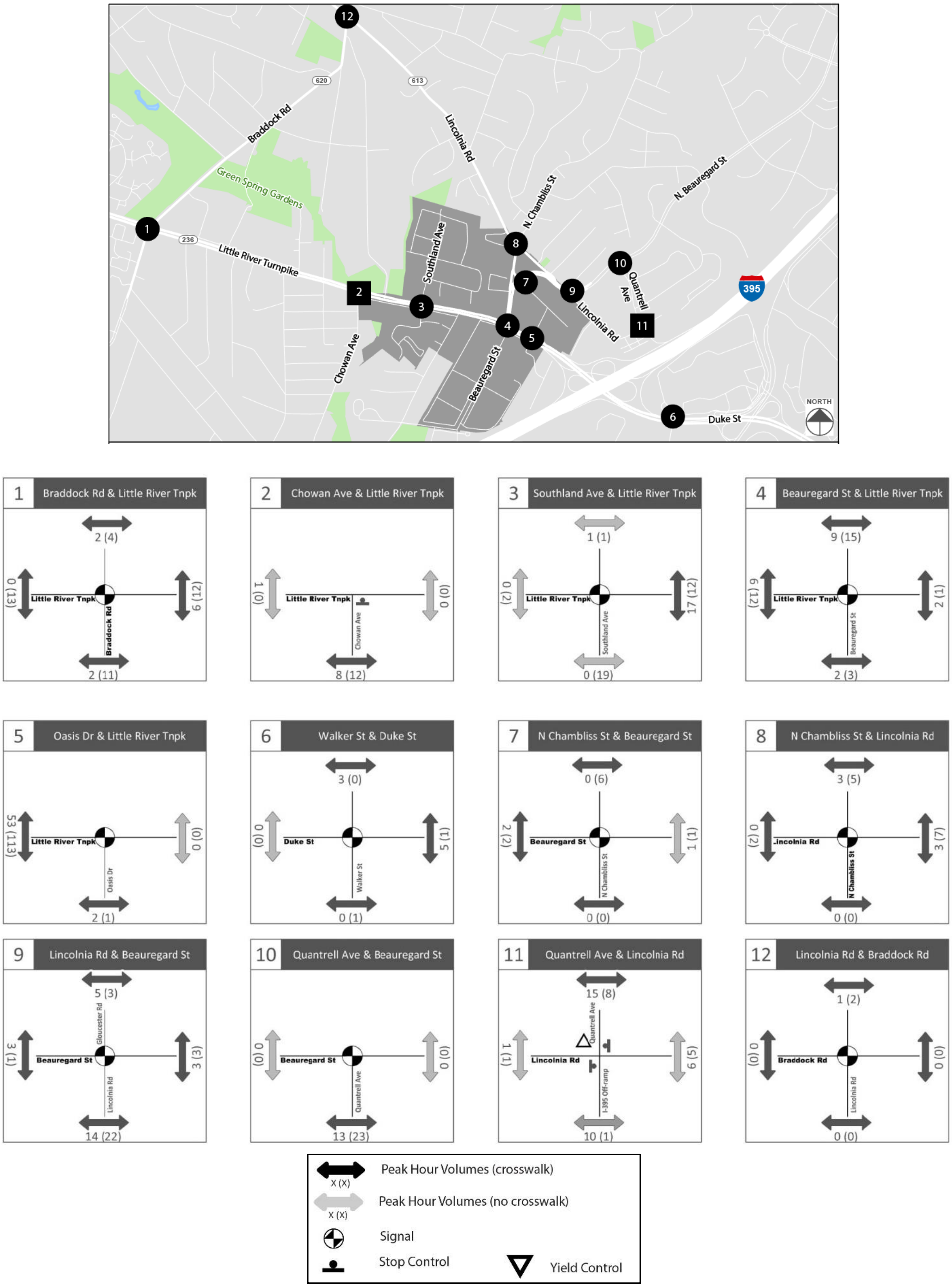
Figure 3-1: Narrow sidewalks that are adjacent to Little River Turnpike create uncomfortable walking environment for pedestrians (source: Google Earth)

There are few controlled or easy crossing points of Little River Turnpike. There are crossings at Beauregard Street and Oasis Drive; however, pedestrians experience extensive delay in crossing due to the long signal cycle lengths along Little River Turnpike intersections (more than 3-minute cycle length both in the AM and PM peak). The next marked crossing of Little River Turnpike is about a quarter mile to the west at Southland Avenue leaving a significant distance between marked crossings.

Crossing Little River Turnpike is difficult due to the width of the roadway, with the crossing distance generally reaching 90 feet. For many of these longer crossings, there is no protected refuge in the middle making longer crossings more difficult. These long crossings make accessing the facility’s bus stops much more difficult as it is necessary for at least one leg of a trip to cross the wide facility.

Pedestrian volumes are generally light in the area during both peak periods. Most intersection crossings have low pedestrian volumes (less than 5-10 pedestrians) utilizing them in the peak hours. The exception is the Little River Turnpike and Oasis Drive intersection where there are significant crossings, as shown in Intersection 5 in **Figure 3-2**. There are more than 50 AM and more than 100 PM peak hour crossings of the west leg. In general, this is an average of approximately 2-3 pedestrians crossing in the AM peak period per cycle and 5-6 crossings per PM peak period cycle. Given the bus stop boarding and alighting at this location, it is likely the high volume of pedestrian crossings is associated with transit riders from adjacent shopping centers and residents accessing the bus stops at Oasis Drive.

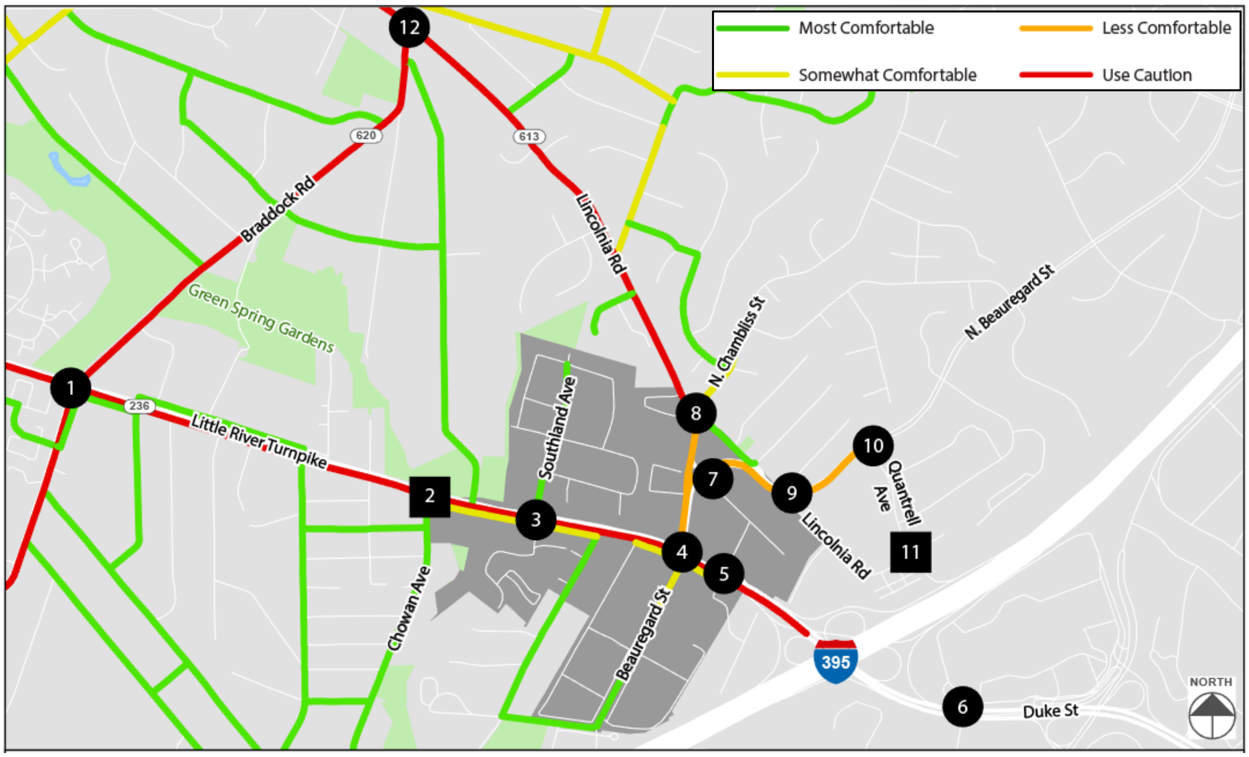
Figure 3-2. AM and PM Peak Hour Pedestrian Volumes



3.2 BICYCLE CONDITIONS

Bicycle Level of Traffic Stress (LTS) GIS information is available on Fairfax County's website. As shown in **Figure 3-3**, all the major roadways such as Little River Turnpike, Lincolnia Road, and Beauregard Street are rated as "Less Comfortable" or "Use Caution". However, collector streets tend to be rated "Most Comfortable" with some rated as "Somewhat Comfortable". Note that LTS data was not available for the City of Alexandria, so not all roads in the study area could be mapped.

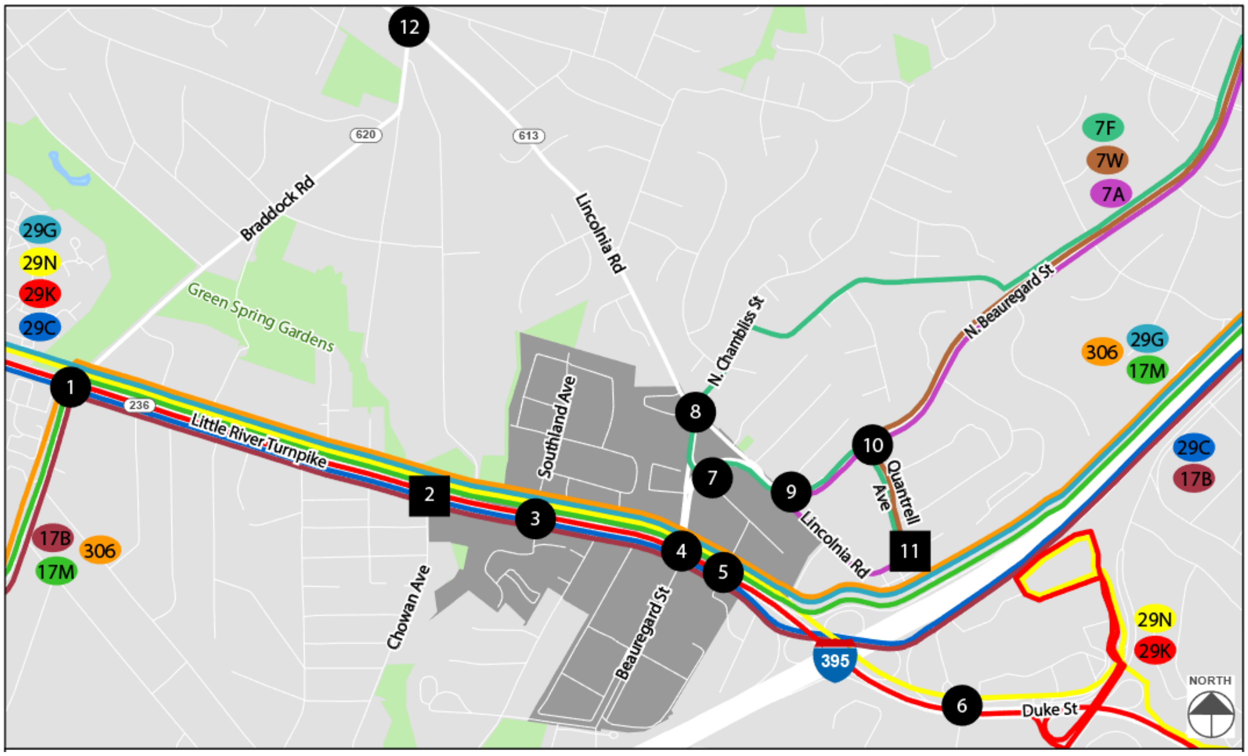
Figure 3-3. Existing Study Area Bicycle Level of Traffic Stress (LTS)



3.3 TRANSIT CONDITIONS

Transit service in the corridor is provided by three operators, Fairfax Connector, Washington Metropolitan Area Transit Authority (WMATA), and Driving Alexandria Safely Home (DASH). In general, WMATA service is more of a commuter-based service, operating only during the peak period and peak direction or with very low frequency service during the off-peak hours. WMATA service is generally focused on moving riders to and from the Pentagon Metro Station, providing a direct Metrorail connection to Washington, D.C. DASH service is a local service operated from the eastern portion of the area and connects to the Van Dorn Metro Station. The Fairfax Connector operates local service primarily along Little River Turnpike and Braddock Road. **Figure 3-4** shows the bus routes operating in the study area.

Figure 3-4. WMATA and Fairfax Connector Bus Routes in the Lincolnia Study Area



Average aggregate frequency of all bus service within the study area during the AM peak period and PM peak period are shown in **Figure 3-5** and **Figure 3-6**, respectively. In aggregate, there are buses approximately every five minutes in the peak period and peak direction within the study area. Multiple bus routes overlap between Southland Avenue and Oasis Drive on Little River Turnpike and as a result, that segment has the highest frequency of bus service.

Daily bus ridership data was aggregated from WMATA and Fairfax Connector, and is displayed in **Figure 3-7**. The majority of riders in the study area use the bus stops at the Little River Turnpike/Oasis Drive intersection. On both the north and south sides of the street, approximately 440 total boarding and alighting occur on a daily basis at each stop. In comparison, the next most utilized bus stops have approximately 150 daily boarding and alighting.

Figure 3-5. AM Peak Average Bus Headways (7:00 – 9:00 AM)

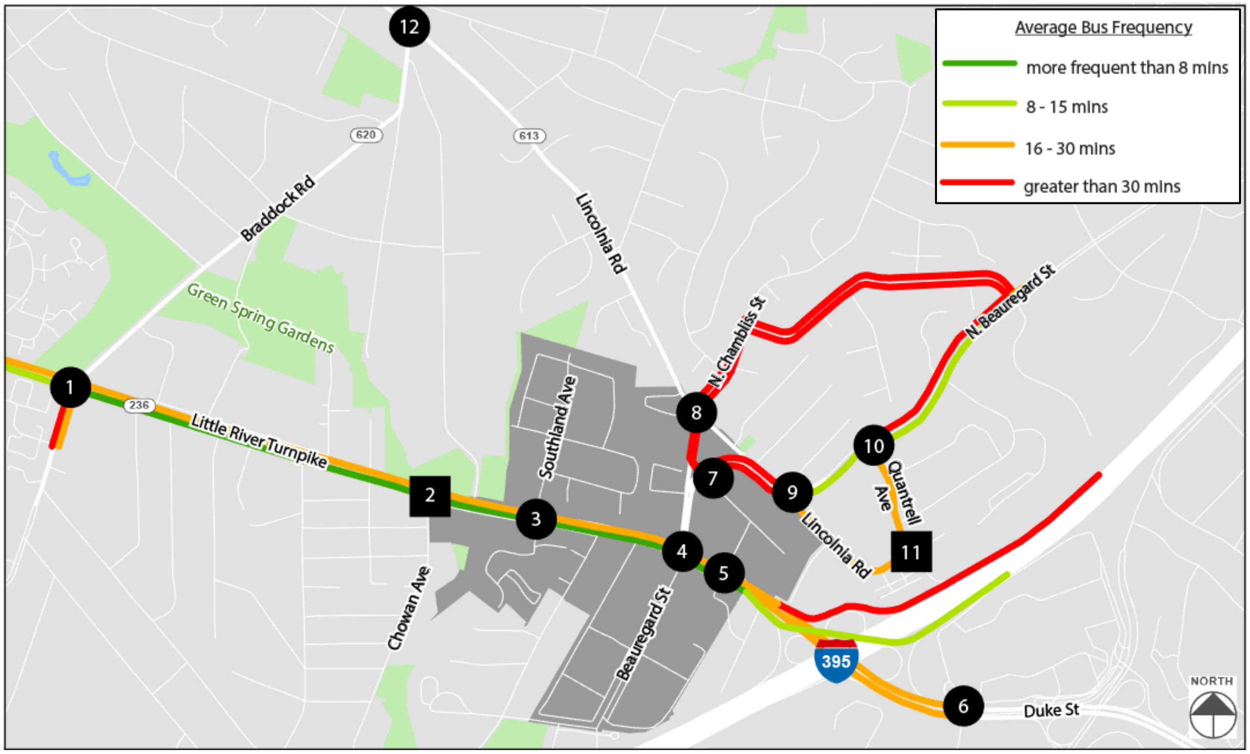


Figure 3-6. PM Peak Average Bus Headways (4:00 – 6:00 PM)

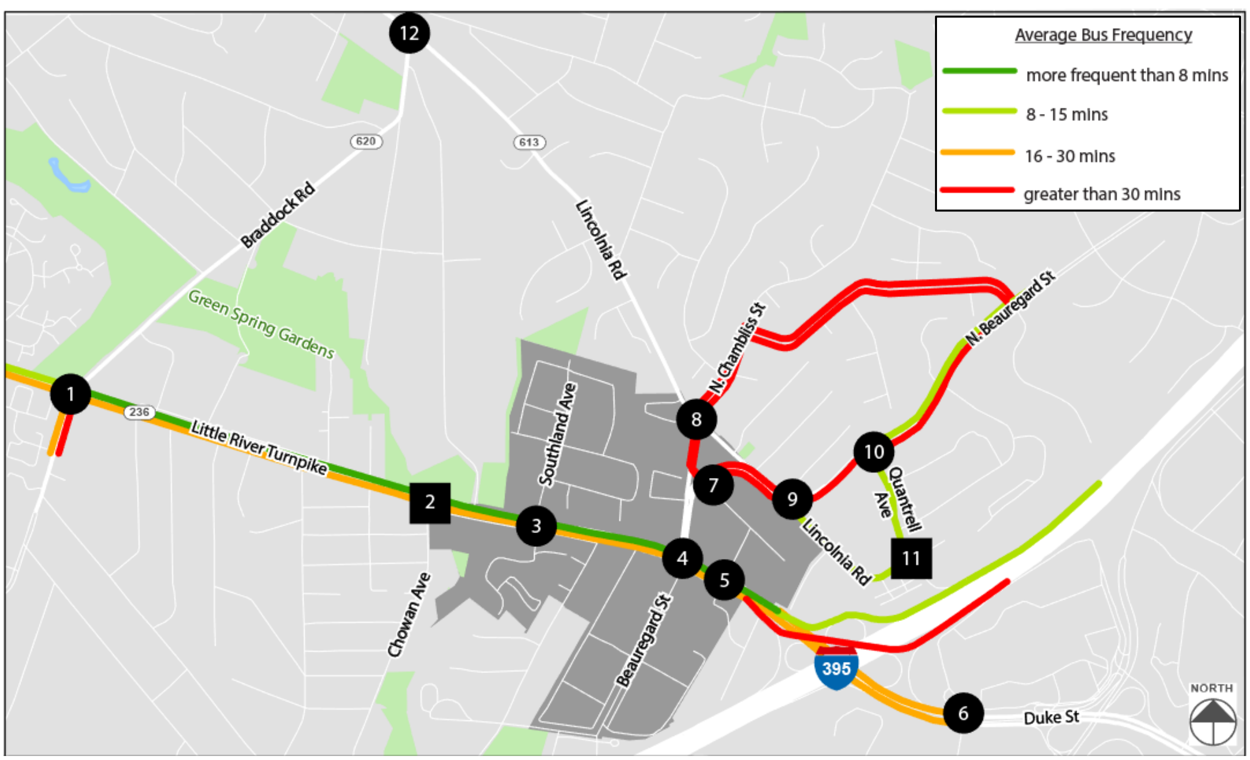
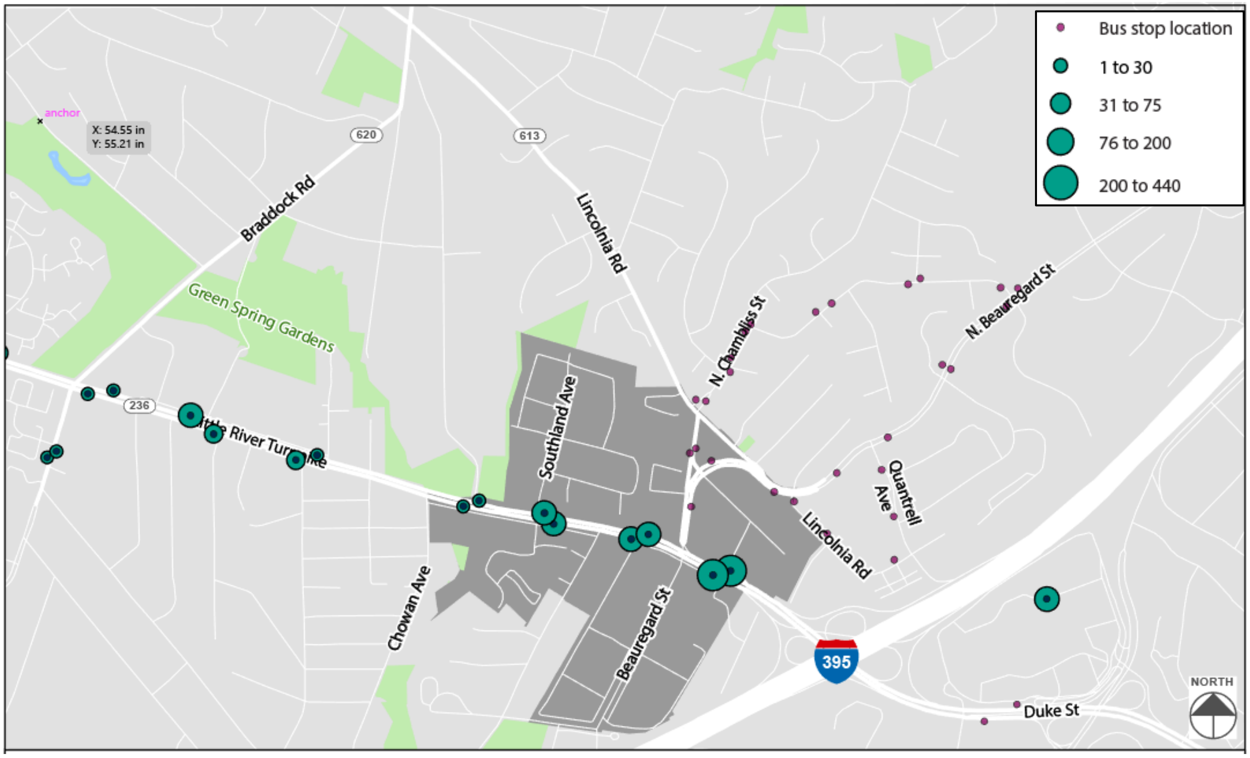


Figure 3-7. Daily Bus Stop Boarding and Alighting (WMATA and Fairfax Connector)



3.4 VEHICULAR CONDITIONS

Turning movement counts were collected at the study intersections and analyzed during the AM and PM peak hours using Synchro and VISSIM, as detailed in **Appendix 1.** The complete set of operation results and model output data for existing conditions, including vehicle delay by approach and by movement, and 95th percentile queue by movement can be found in **Appendix 2**.

3.4.1 Peak Hour Volumes

Turning movement counts during the AM and PM peak hour are shown in **Figure 3-8**. High vehicular volumes are typically observed at the major intersections such as Little River Turnpike/Beauregard Street and Little River Turnpike/Braddock Road.

The intersection of Little River Turnpike/Beauregard Street in particular is a major bottleneck in the study area. The congestion is worsened by the weaving on southbound Beauregard Street after its intersection with Chambliss Street. The major AM peak hour movements and other conflicts can be seen in **Figure 3-9**. Major PM peak hour movements and other conflicts are depicted in **Figure 3-10**.

Figure 3-8. 2017 Existing Conditions – Peak Hour Volumes

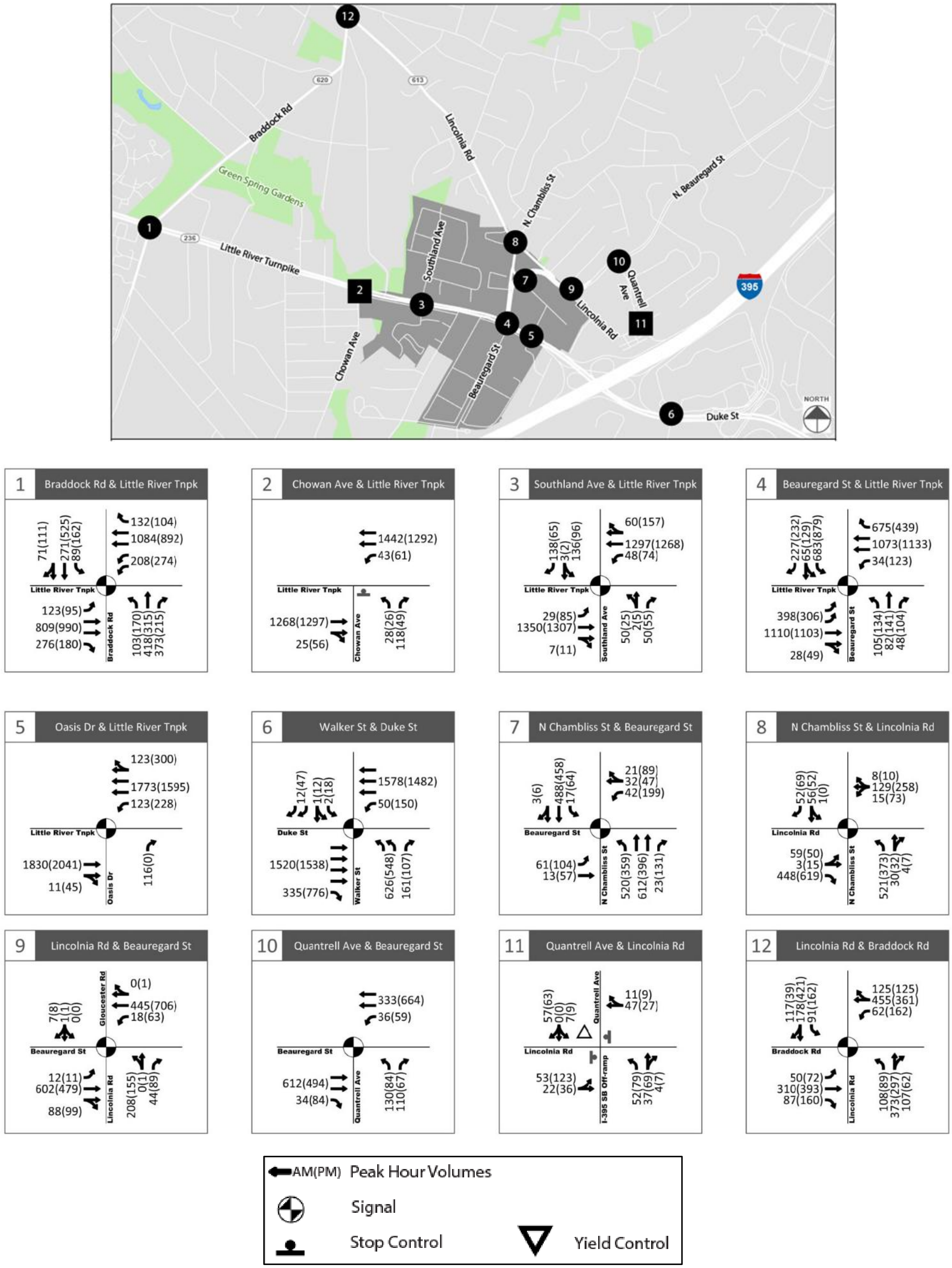


Figure 3-9. AM Major Travel Movements and Conflicts

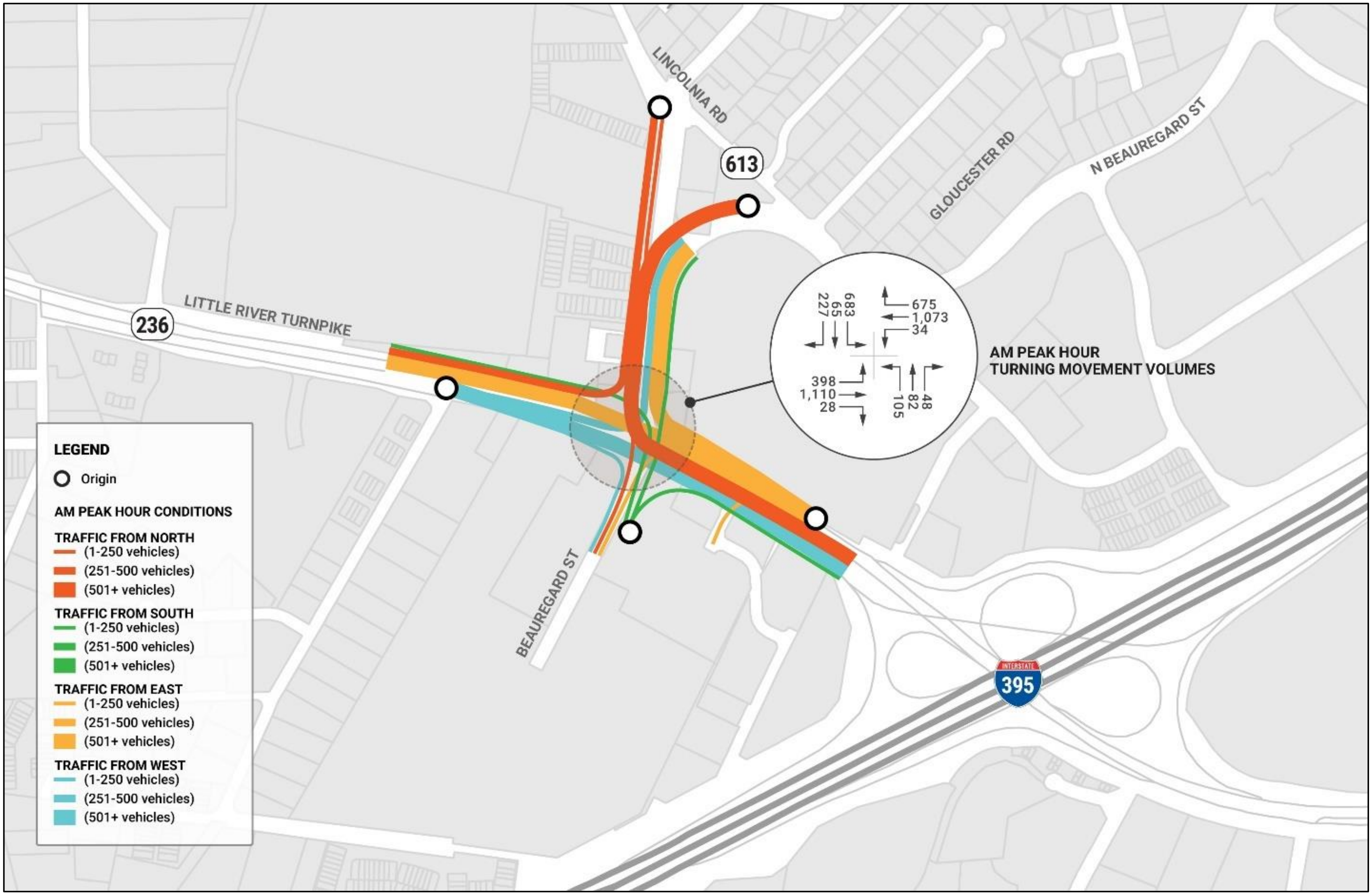
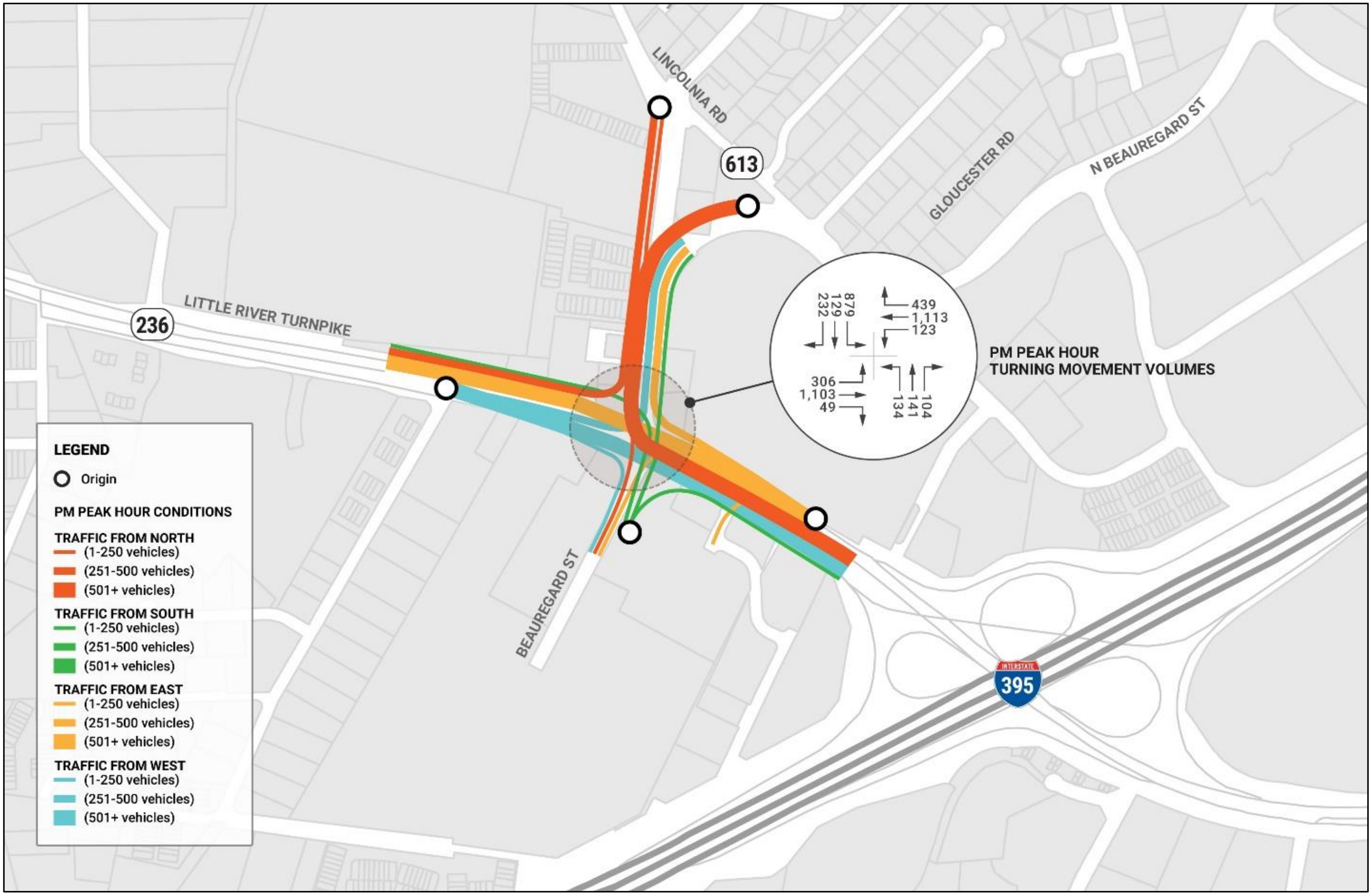


Figure 3-10. PM Major Travel Movements and Conflicts



3.4.2 Traffic Operations

Weekday AM and PM peak hour levels of service (LOS) and average intersection delay for the study area intersections under the existing conditions are shown in **Figure 3-11** and **Figure 3-12**, respectively.

The analysis of existing traffic conditions indicates the Little River Turnpike/Beauregard Street intersection experiences long queues and severe congestion, resulting in LOS F during the PM peak hour and LOS E during the AM peak hour. The most critical movement at the intersection contributing to high intersection delay is the heavy southbound left-turn, which operates at LOS F during both AM and PM peak hours. This is due to a combination of factors including high demand of southbound left-turn combined with the heavy eastbound-westbound volumes, unbalanced lane utilization at the southbound approach where the outer left-turn lane mainly serves the demand heading towards I-395, and the inefficient allocation of green time.

Little River Turnpike and Chowan Avenue intersection also experiences LOS F in the PM peak hour. However, it should be noted that this is an unsignalized intersection in which LOS is measured for the movement with the highest delay (typically stop-controlled movements), therefore does not reflect overall intersection delay.

The congestion contributes to major queue spillback on Beauregard Street, worsening traffic operations at the upstream intersection. As a result, during the PM peak hour, the Beauregard Street/Chambliss Street intersection operates with LOS E with an average intersection delay of 57 seconds.

Maximum queues are highlighted in **Figure 3-13**. While queuing exists in both the AM and PM peak periods, there is significant PM queuing, as shown below. Specifically, the PM queuing extends along Beauregard Street from the Little River Turnpike to and along Lincolnia Road and along Beauregard Street, reaching the Gloucester Road intersection.

In addition to the Little River Turnpike/Beauregard Street intersection, Little River Turnpike/Braddock Road is another intersection that experiences high delay (71 seconds of intersection delay in the PM peak and 54 seconds in the AM peak). The remaining study intersections are generally operating below capacity.

Figure 3-11. Existing Peak Hour Levels of Service (LOS)

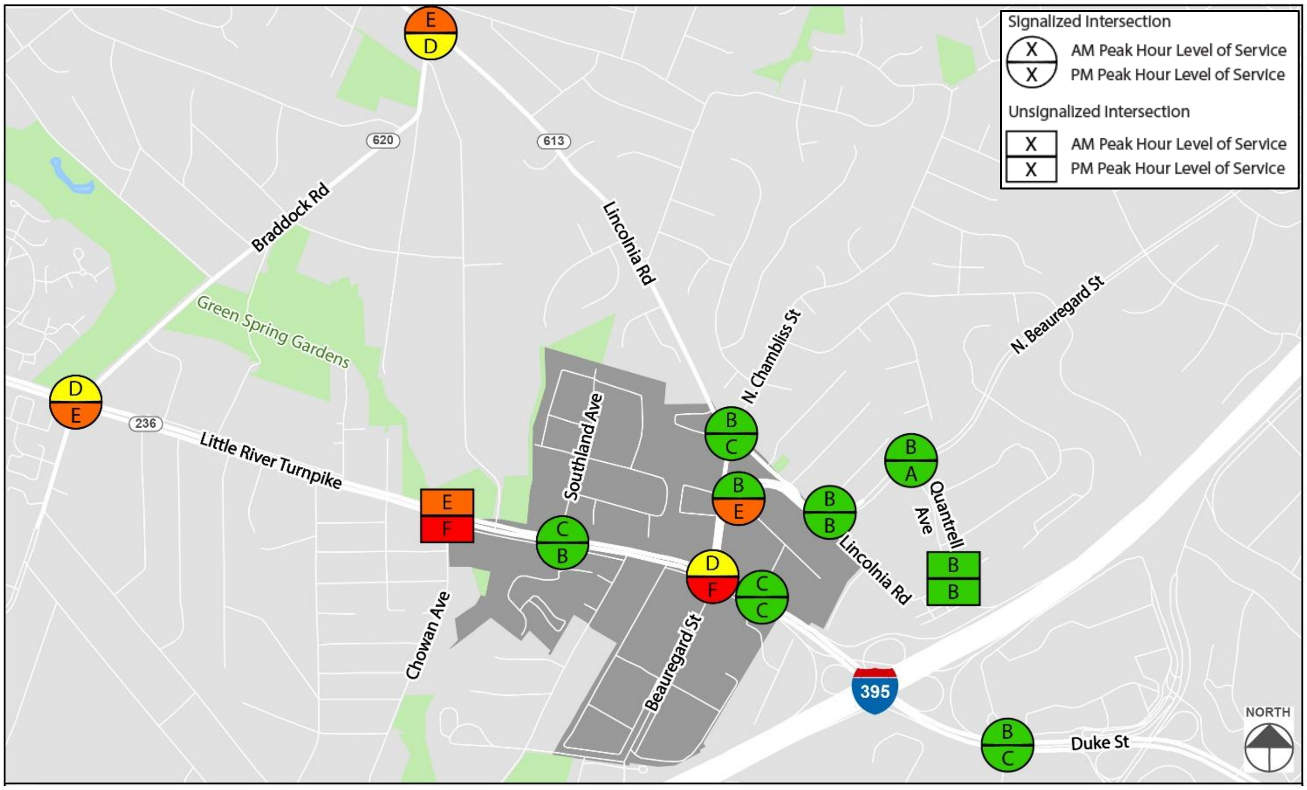


Figure 3-12. Existing Peak Hour Intersection Delay (in seconds)

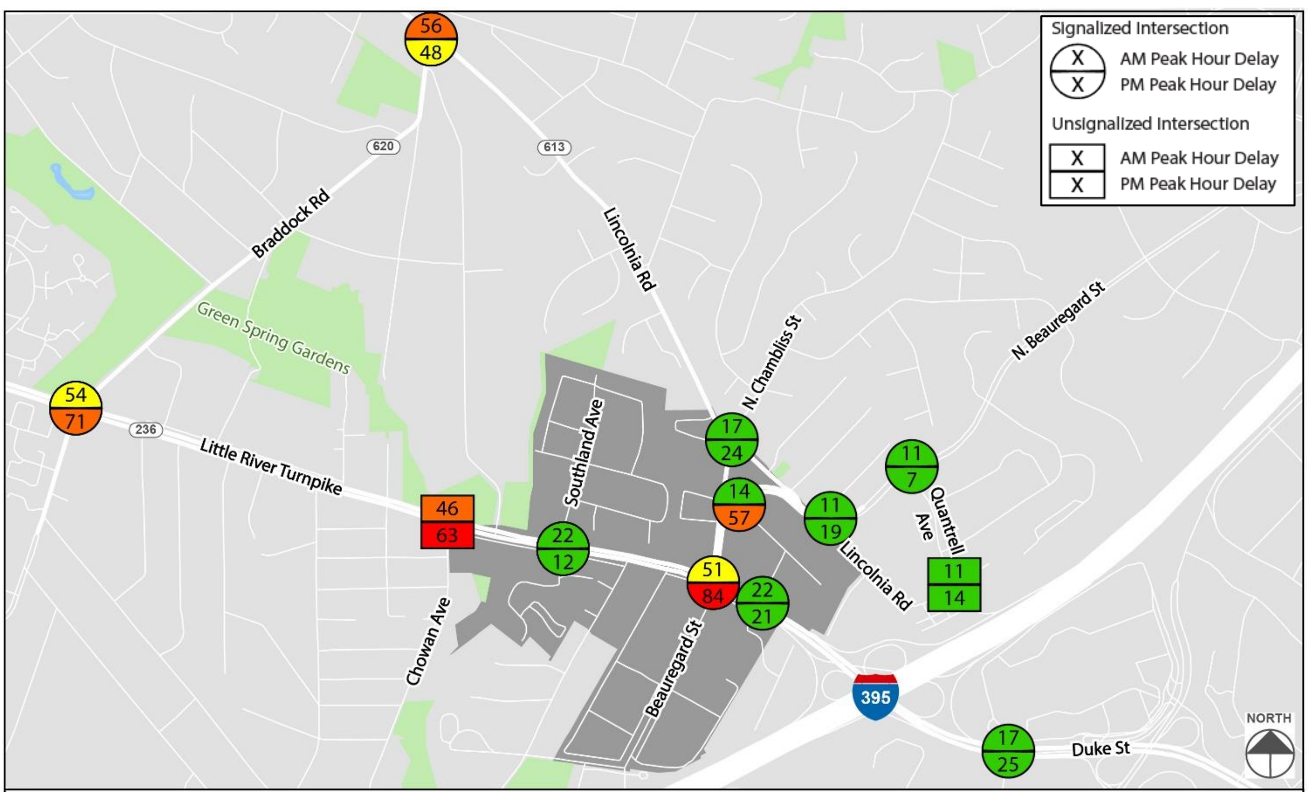
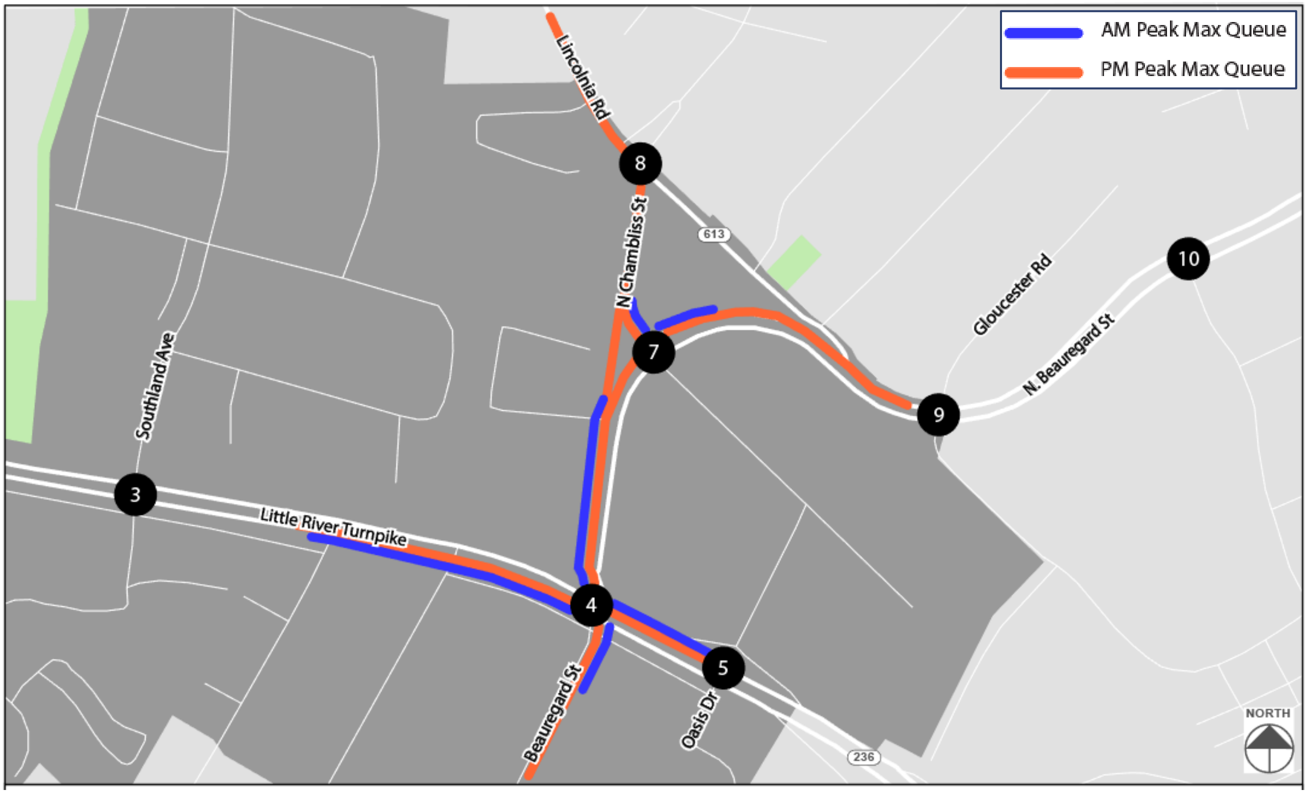


Figure 3-13. Beauregard Street Southbound Queuing



3.4.3 Network Performance Measures

Intersection level performance measures generally provide important insight into the traffic operations; however, they tend to be more microscopic and may fail to capture the overall network performance, especially under oversaturated conditions. Network performance measures identified in this study are shown in **Table 3-1**. Similar to the previous findings, the PM peak hour experiences higher average vehicle delay and latent demand (i.e., unserved vehicles) due to the congestion.

Table 3-1. Network Performance Measures

Network Performance Measure	AM Peak Hour	PM Peak Hour
Average Vehicle Delay (sec/vehicle)	65.7	90.1
Average Pedestrian Delay (sec/pedestrian)	108.3	94.4
Latent Demand (unserved number of vehicles)*	11	27
Vehicles Served**	8,251	9,465

* Indicates the number of unserved vehicles during the simulation due to very long queues, preventing vehicles from entering the simulation network.

** Indicates the total number of vehicles served during the analysis period. This measure is generally used as a proxy to network throughput when intersections are oversaturated.

Another important finding is that while pedestrians only go through one signalized intersection in the network, unlike vehicles that travel through multiple intersections, average pedestrian delay is much higher than the average vehicle delay. This can be attributed to the long cycle lengths within the study area that favor vehicular traffic, resulting in very long average pedestrian delay.

Section 4
2040 Baseline Conditions Analysis

4 2040 BASELINE CONDITIONS

2040 Baseline conditions were analyzed to understand baseline transportation conditions and identify deficiencies in the transportation network. The results of the 2040 Baseline Conditions were also utilized as the basis for the development of future transportation alternatives. This section first presents the scenarios analyzed and then provides a summary of transportation conditions under each scenario.

Three transportation network scenarios were considered and analyzed, as summarized below, as part of the 2040 Baseline analysis. The 2040 Comprehensive Plan land use was assumed as part of the modeling effort. The three network scenarios discussed in this section are:

- Comprehensive Plan scenario, which includes a flyover from N. Beauregard Street SB to the I-395 ramps and the widening of Little River Turnpike from four to six lanes (**Section 4.2.1**),
- Modified Comprehensive Plan scenario, which primarily replicates the existing transportation network within the Lincolnia CBC (**Section 4.2.2**), and
- True Baseline scenario, which includes the widening of Little River Turnpike from four travel lanes to six travel lanes but without the flyover noted in the Comprehensive Plan (**Section 4.2.3**). This scenario is consistent with the Metropolitan Washington Council of Government's (MWCOG) Constrained Long Range Plan (CLRP).

4.1 2040 BASELINE LAND USE ASSUMPTIONS

For all three scenarios, the Travel Demand Model land use input was updated using information provided in the FCDOT 2040 Comprehensive Plan. This information includes number of households, population, and employment by Traffic Analysis Zone (TAZ). A detailed comparison of the land use inputs and corresponding map of TAZ locations are included in **Appendix 1**.

In general, there are subtle differences between the existing land use and the 2040 baseline scenarios. Overall in the study network, the increase in employment is approximately seven percent and the increase in population is less than one percent compared to existing conditions.

4.2 2040 BASELINE TRANSPORTATION NETWORK ASSUMPTIONS

Changes to the transportation network within the study area are included with the Comprehensive Plan, the Modified Comprehensive Plan, and the True Baseline scenarios. The details of the transportation network changes are discussed below.

4.2.1 Comprehensive Plan Scenario

The Comprehensive Plan identifies two major modifications to the roadway network, as summarized below:

i. Widening of Little River Turnpike from four through lanes to six through lanes[2], and
ii. Construction of a flyover at the intersection of N. Beauregard Street/Little River Turnpike to accommodate the southbound left turn traffic (i.e., not grade-separation for the entire intersection).

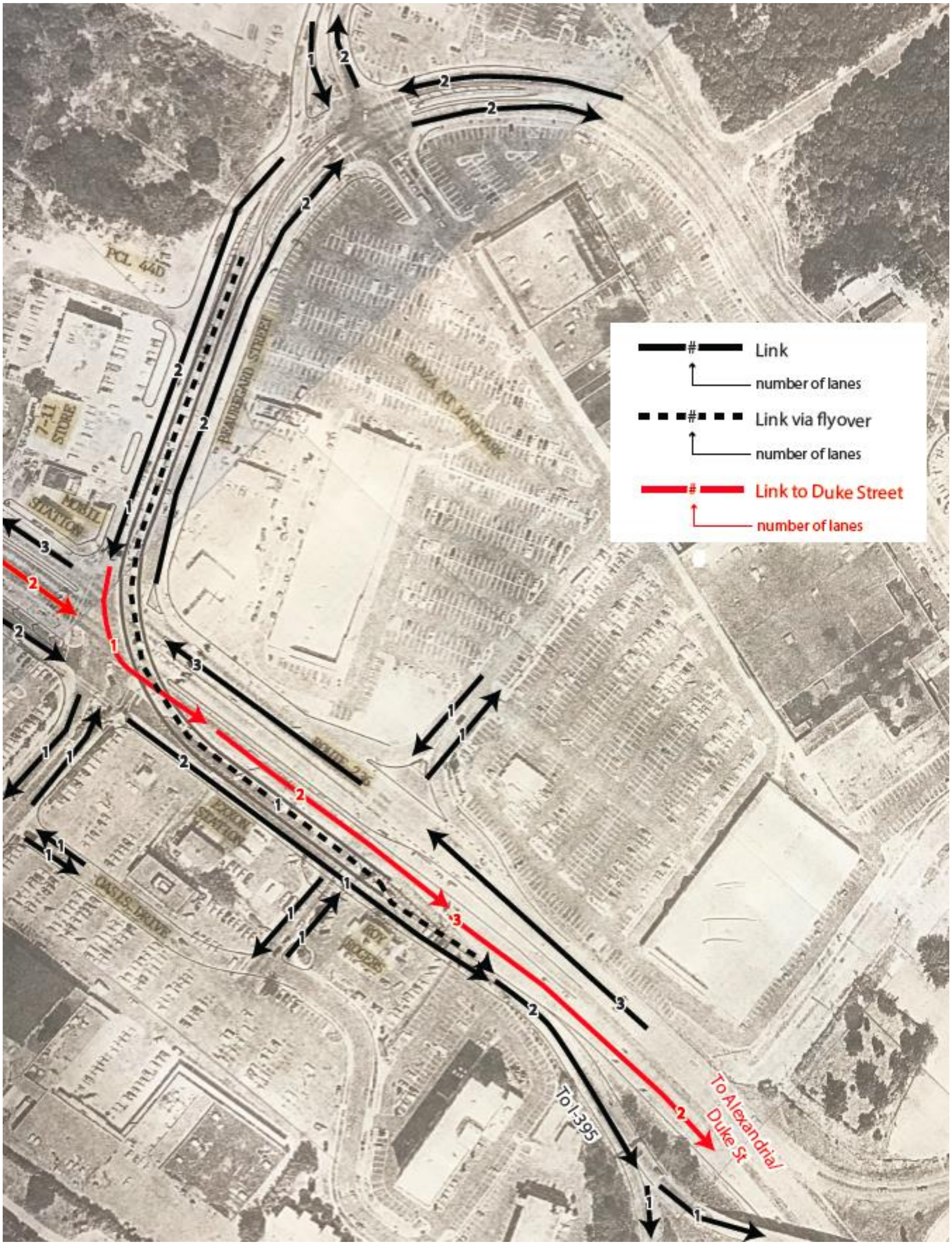
Based on the information provided by the County staff related to the previous planning efforts for the flyover and using our team's experience on urban flyover concepts, a conceptual design for a flyover was developed for the Little River Turnpike and Beauregard Street intersection, as depicted in **Figure 4-1**. The flyover shown below (in dashed lines) provides a direct access to the I-395 on-ramps from Beauregard Street; however, the southbound vehicles traveling towards eastbound Duke Street still need to use the signalized intersection located at Little River Turnpike and Beauregard Street.

In addition to the flyover and the widening of Little River Turnpike, the Virginia Department of Transportation (VDOT) recently completed an Interchange Modification Report (IMR) for the interchange of I-395 and Little River Turnpike,[3] related to the I-395 widening project. The IMR proposed changes at this interchange including the removal of the southbound I-395 loop ramp to eastbound Duke Street and combining this movement with the I-395 southbound off-ramp to westbound Little River Turnpike. The IMR also recommended an additional signal at Little River Turnpike east of where the I-395 off-ramp joins Little River Turnpike to allow for access to eastbound Duke Street from I-395 southbound. These modifications are currently under construction.

[2] In order to accommodate the flyover proposed with the Comprehensive Plan, a small portion of Little River Turnpike was assumed to have seven through lanes (four in the eastbound direction and three in the westbound direction). This assumption was made when considering the conceptual design of the flyover and was determined in coordination with County staff.

[3] http://www.virginiadot.org/I-395_Southbound_Additional_Through_Lane_Interchange_Modificaiton_Report.pdf

Figure 4-1. Comprehensive Plan Scenario Roadway Network



4.2.2 Modified Comprehensive Plan Scenario

The Modified Comprehensive Plan scenario is essentially very similar to the existing transportation network with the goal of assessing future transportation performance if no transportation improvements were made in the study area. As a result, the flyover is not included in this scenario. In addition, the widening of Little River Turnpike from four lanes to six lanes was only considered west of the Braddock Road intersection. In other words, the number of lanes on Little River Turnpike from Braddock Road to the City of Alexandria (i.e., our study area) continued to be four lanes for the Modified Comprehensive Plan scenario.

4.2.3 True Baseline Scenario

The True Baseline scenario reflects improvements included in the regional CLRP. Therefore, the flyover is not included in this scenario. However, the widening of Little River Turnpike from four lanes to six lanes from Braddock Road to the City of Alexandria (including the widening within our study area) was assumed for the True Baseline scenario.

4.3 2040 BASELINE TRANSPORTATION CONDITIONS

Analysis was performed in the Lincolnia study area consistent with the methodologies described in **Appendix 1**. In summary, turning movement counts were developed using the Travel Demand Model and analyzed at twelve (12) intersections using VISSIM and Synchro. The complete set of operation results and model output data for 2040 Baseline Conditions, including vehicle delay by approach and by movement, and 95th percentile queue by movement can be found in **Appendix 3.**

It should be noted that while there are qualitative differences between the scenarios with respect to the operation of pedestrian, bicycle, and transit modes of travel, the analysis primarily focused on the quantitative measures of assessment for vehicles, and thus the results provided below reflect vehicular conditions. The Development of Transportation Alternatives, discussed in **Section 5**, incorporates measures beyond automobiles, consistent with the Goals, Objectives, and MOE's discussed in **Section 2**.

4.3.1 Comprehensive Plan Scenario Conditions

4.3.1.1 Peak Hour Vehicular Volumes

There is limited access from the north side of the study area to get to/from the City of Alexandria and I-395, creating a major bottleneck at the intersection of Little River Turnpike and Beauregard Street. The major AM peak hour movements and other conflicts can be seen in **Figure 4-2.** Major PM peak hour movements and other conflicts are depicted in **Figure 4-3**. Key major travel movements are summarized as follows:

- Similar to the existing conditions, the heavy movements are the eastbound and westbound through movements, the westbound right turn, and the southbound left turn movement.

- The flyover relieves the southbound left turn volumes by separating the southbound left turn vehicles travelling to I-395 from the vehicles going towards Duke Street. As shown below, the flyover carries approximately 430 vehicles in the AM peak hour and 475 vehicles in the PM peak hour.

AM and PM peak hour volumes for the 2040 Comprehensive Plan scenario are shown in **Figure 4-4.** The flyover volume for the southbound left vehicles at Little River Turnpike and Beauregard Street (Intersection #4) is shown in dashed line. The flyover volume is shown separately because the flyover provides a direct connection to the I-395 on-ramps, preventing vehicles from going through the intersection of Little River Turnpike and Beauregard Street.

Figure 4-2. AM Major Travel Movements and Conflicts for the Comprehensive Plan Scenario

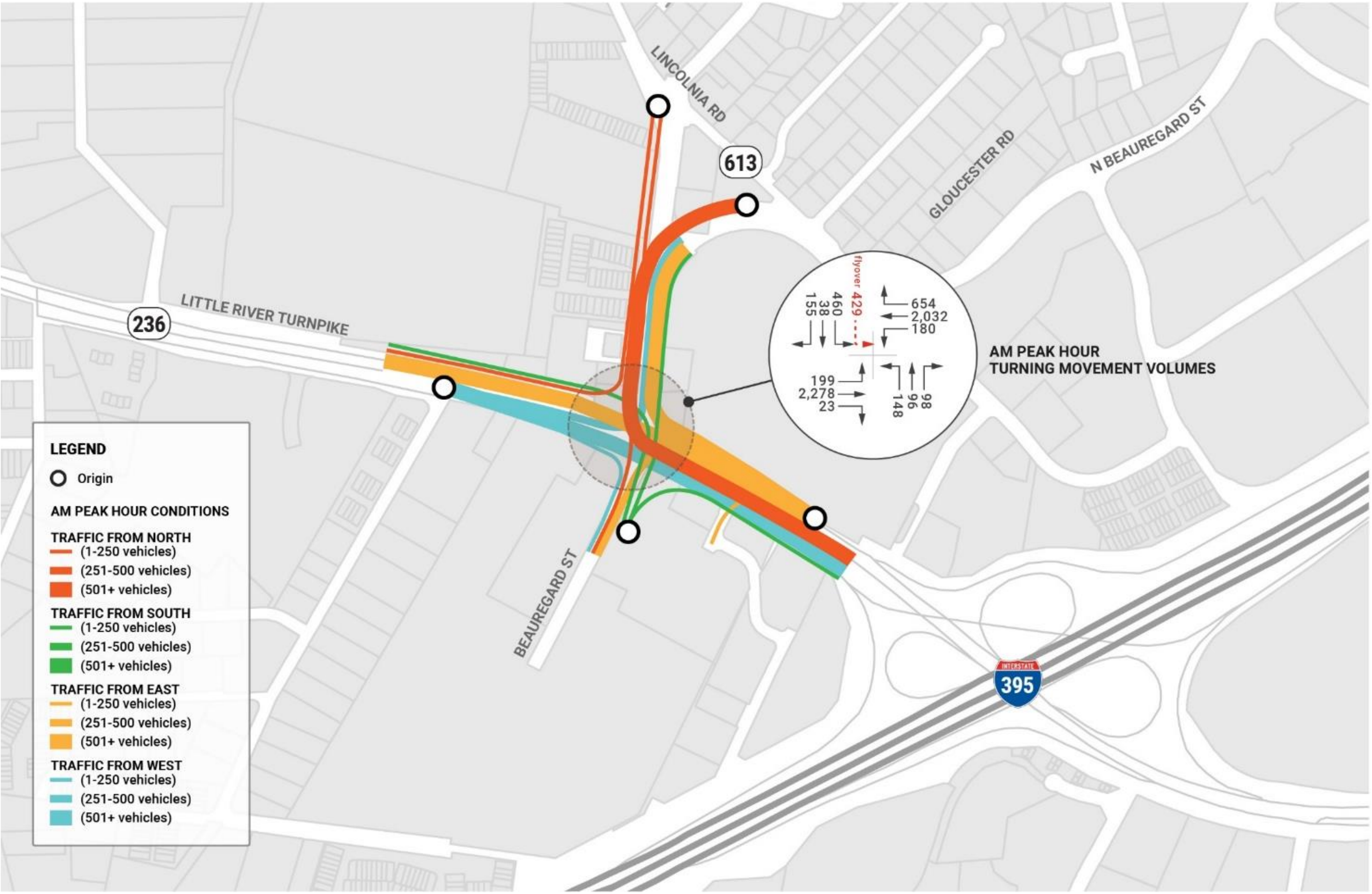


Figure 4-3. PM Major Travel Movements and Conflicts for the Comprehensive Plan Scenario

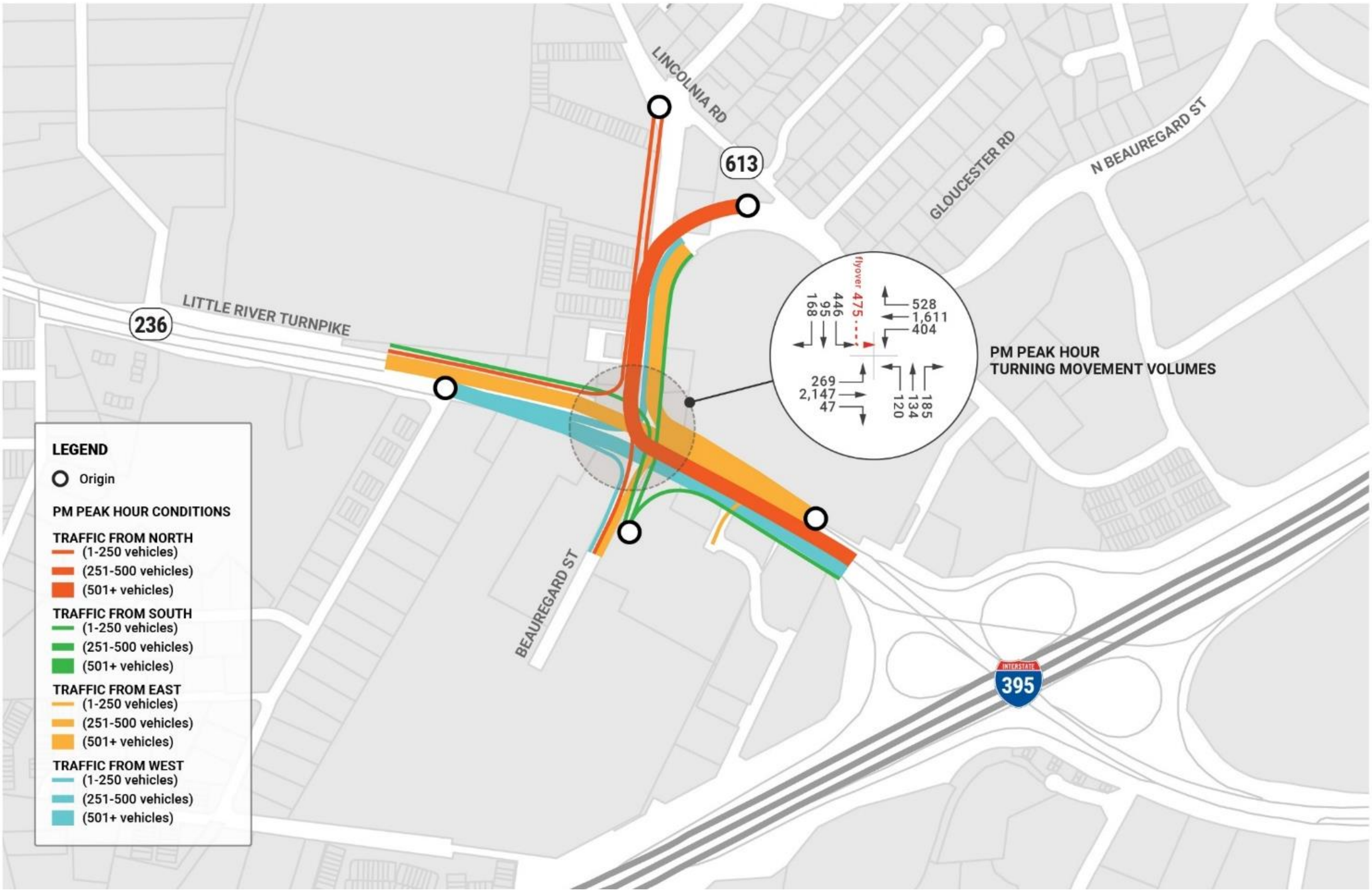
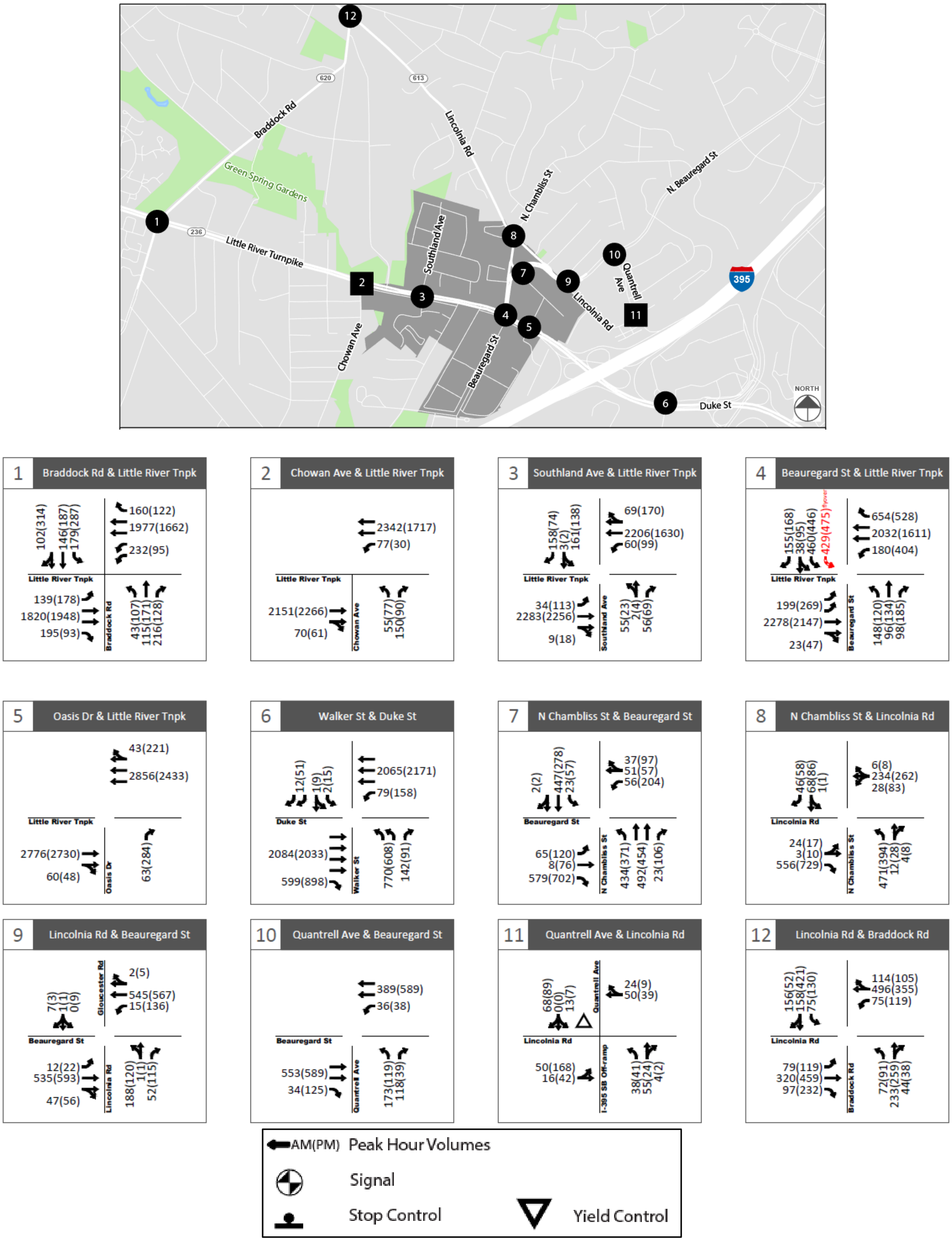


Figure 4-4. 2040 Comprehensive Plan Scenario – Peak Hour Volumes



Key observations based on the comparison of the Comprehensive Plan peak hour volumes and the existing peak hour volumes are summarized as follows:

- The volumes on Little River Turnpike significantly increase in year 2040 under the Comprehensive Plan scenario. This can be attributed to the increase in regional population and employment along with the increase in the number of lanes on Little Rive Turnpike.
- The volumes on Lincolnia Road stay almost the same at most locations. This can also be attributed to the increase in number of lanes on Little River Turnpike as vehicles potentially prefer using Little River Turnpike instead of the Lincolnia Road since Little River Turnpike has higher posted speeds and capacity.
- The volumes on Braddock Road decrease within the study area. The primary reason for the volume reduction on Braddock Road is the increase in the number of lanes on both Little River Turnpike and I-395, diverting traffic from Braddock Rd and shifting vehicles to mainly I-395 due to the increase in capacity.

4.3.1.2 Traffic Operations

Weekday 2040 AM and PM peak hour intersection level of service (LOS) for the study intersections and average intersection delay for the Comprehensive Plan scenario are depicted in **Figure 4-5** and **Figure 4-6**, respectively. Key findings from the Comprehensive Plan scenario are summarized as follows:

- All signalized intersections operate at LOS E or better both during the AM and PM peak hours.
- Little River Turnpike and Beauregard Street intersection experiences some level of congestion, in particular during the PM peak with average intersection delay of 63 seconds; however, intersection operations improved considerably compared to the Existing scenario (84 seconds of delay in the PM peak and 51 seconds in the AM peak).
- Little River Turnpike and Chowan Avenue is the only intersection with LOS F. This is due to the fact that LOS is calculated differently for unsignalized intersections, as explained above.
- The network changes at Little River Turnpike and Beauregard Street intersection also improved delay and LOS at upstream intersections by limiting queue spillbacks to neighboring intersections, in particular during the PM peak (**Figure 4-7**).

Figure 4-5. 2040 Comprehensive Plan Scenario – Peak Hour Intersection Level of Service

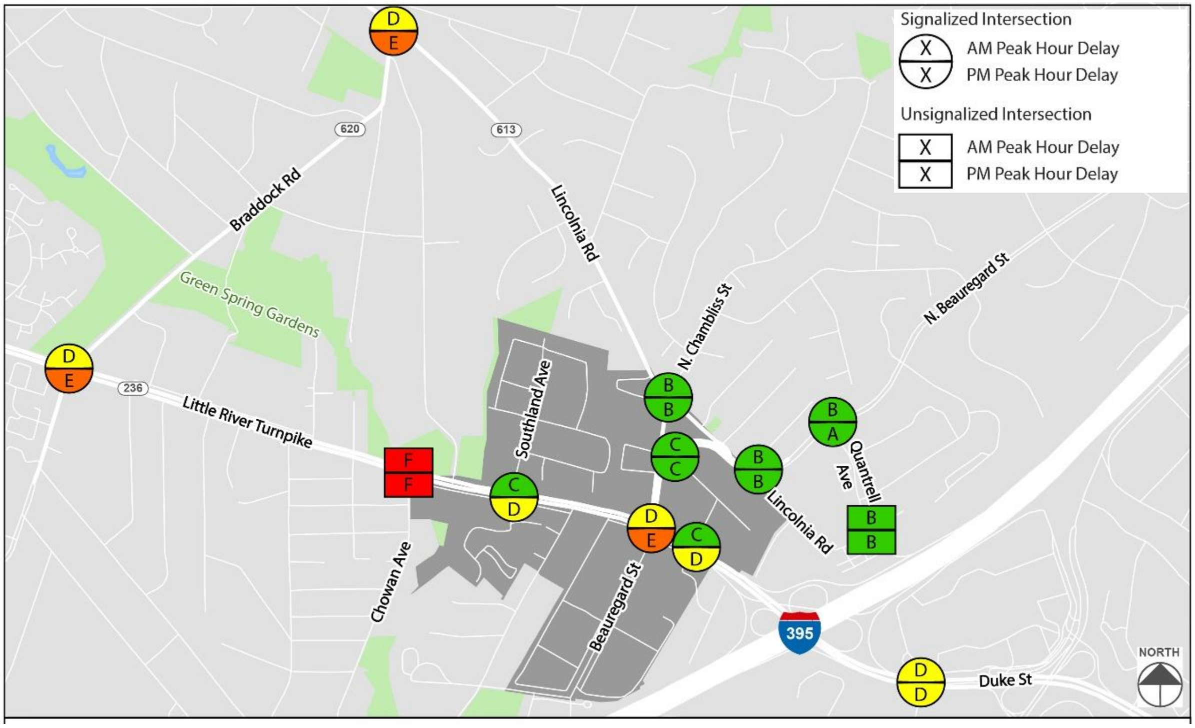


Figure 4-6. 2040 Comprehensive Plan Scenario – Peak Hour Average Intersection Delay (in seconds)

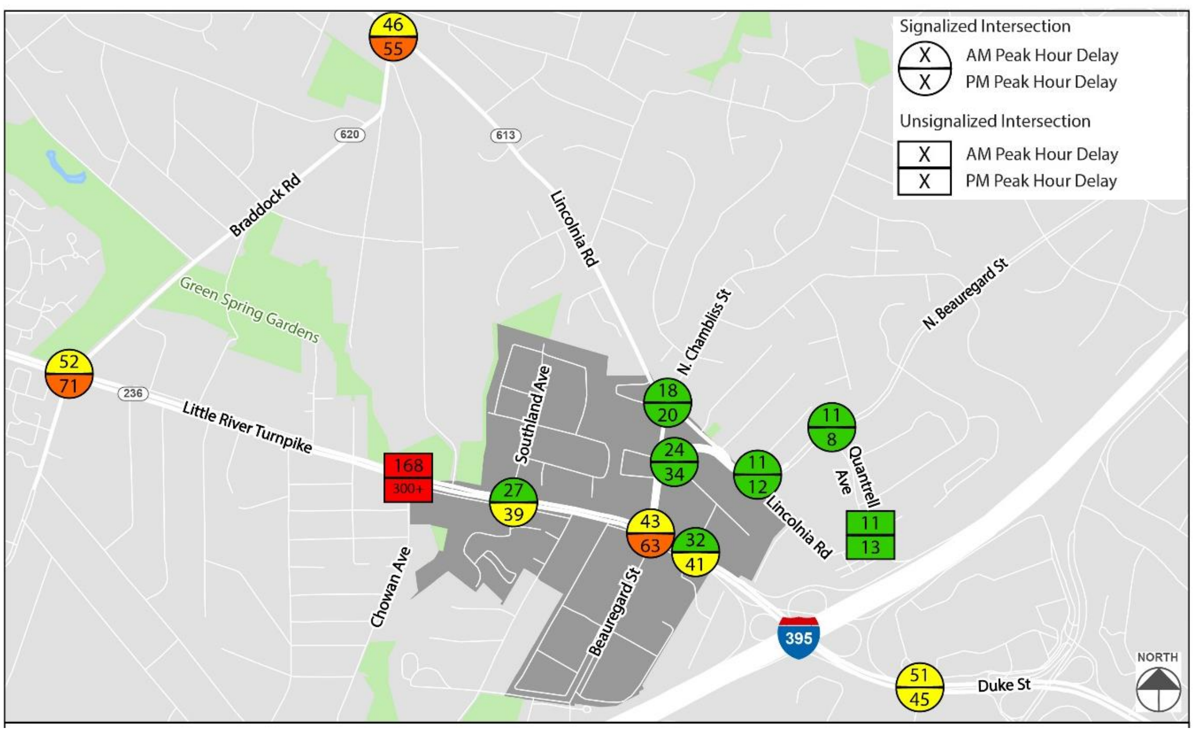
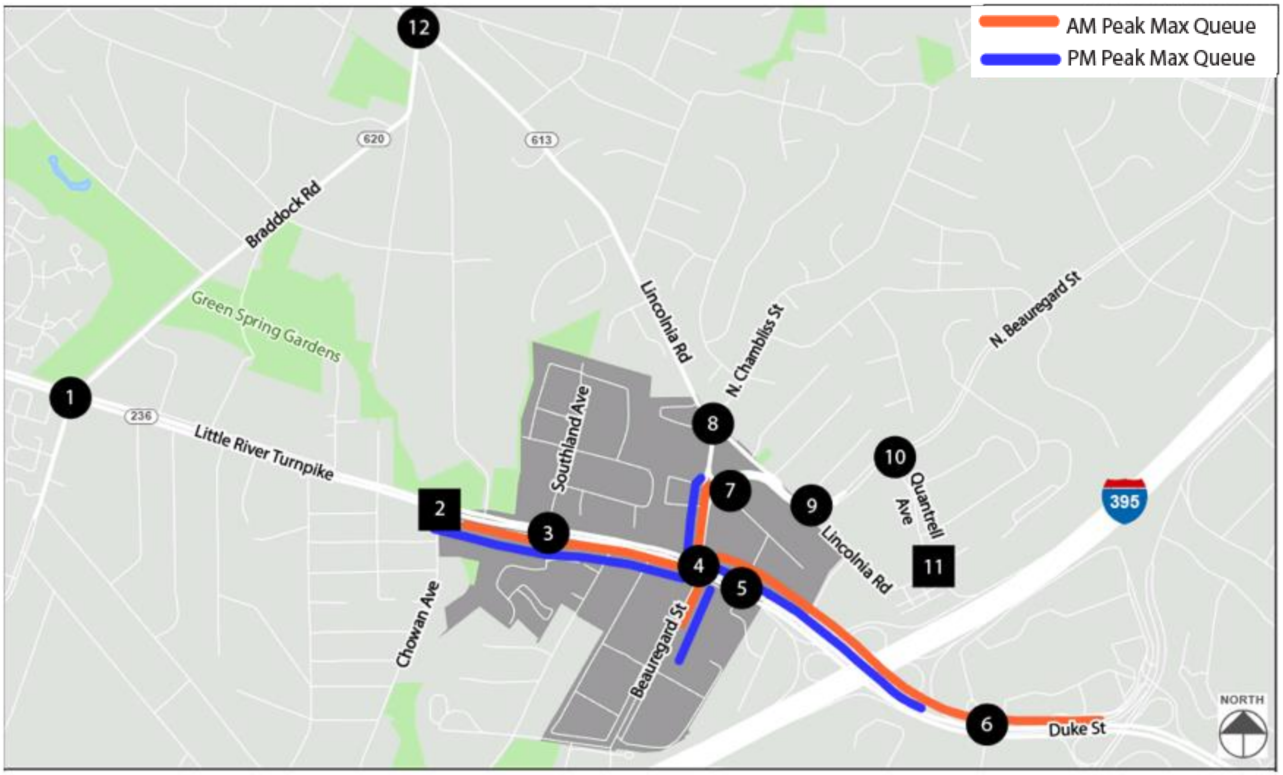


Figure 4-7. Maximum Queue Lengths for the Comprehensive Plan Scenario



4.3.2 Modified Comprehensive Plan Scenario Conditions

4.3.2.1 Peak Hour Vehicular Volumes

The major AM peak hour movements and other conflicts can be seen in **Figure 4-8**. Major PM peak hour movements and other conflicts are depicted in **Figure 4-9.** Key observations include:

- Travel patterns are very similar to the Comprehensive Plan scenario, where the eastbound through, westbound through, westbound right, and the southbound left movements are contributing to the bottleneck.
- Compared to the Comprehensive Plan scenario, the southbound left turn volume going through the intersection is higher since all the left turn movements are occurring at grade without the flyover.

Volumes during the AM and PM peak hours are shown for the 2040 Modified Comprehensive Plan scenario in **Figure 4-10**.

Figure 4-8. AM Major Travel Movements and Conflicts for the Modified Comprehensive Plan Scenario

Figure 4-9. PM Major Travel Movements and Conflicts for the Modified Comprehensive Plan Scenario

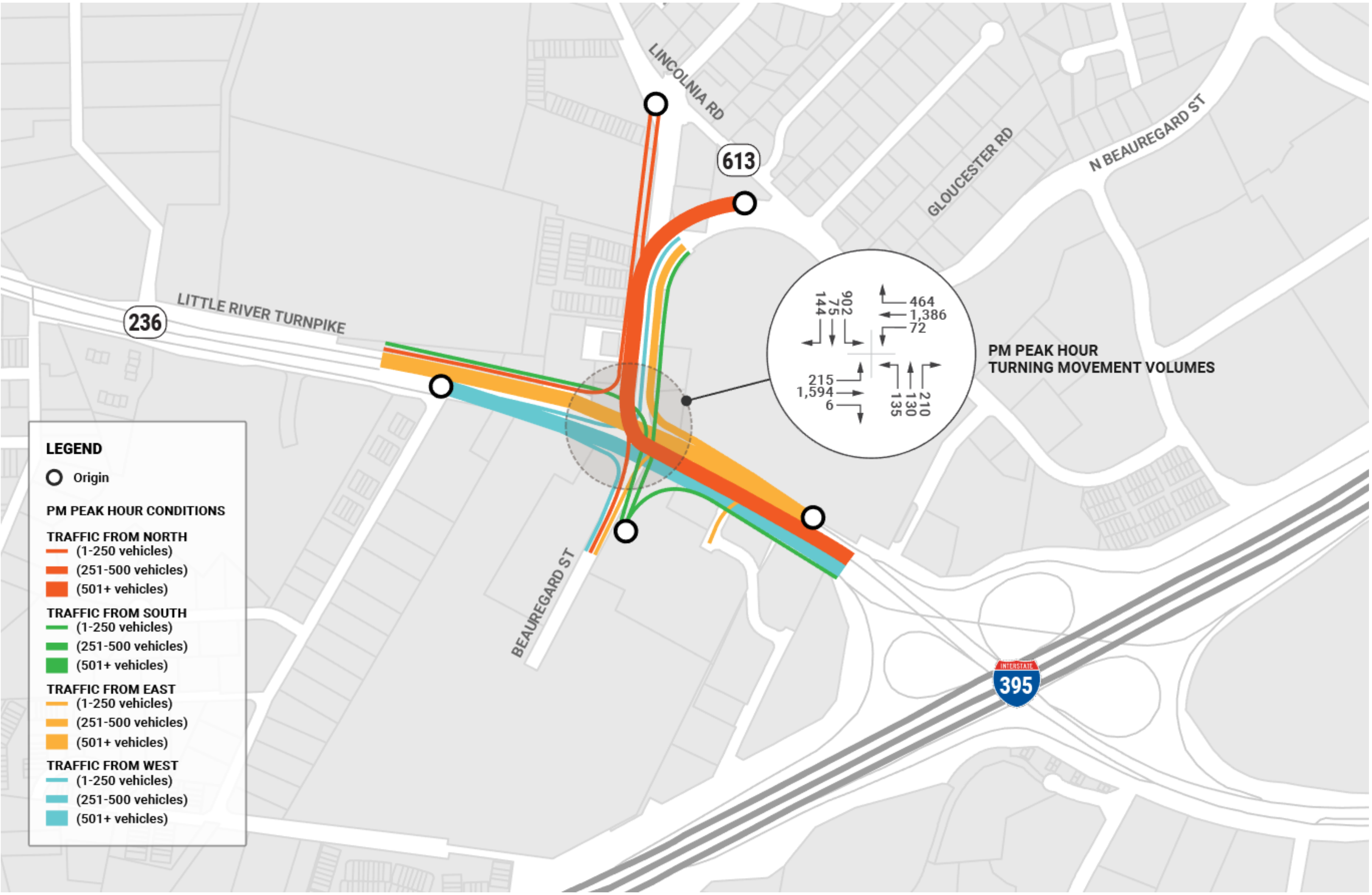
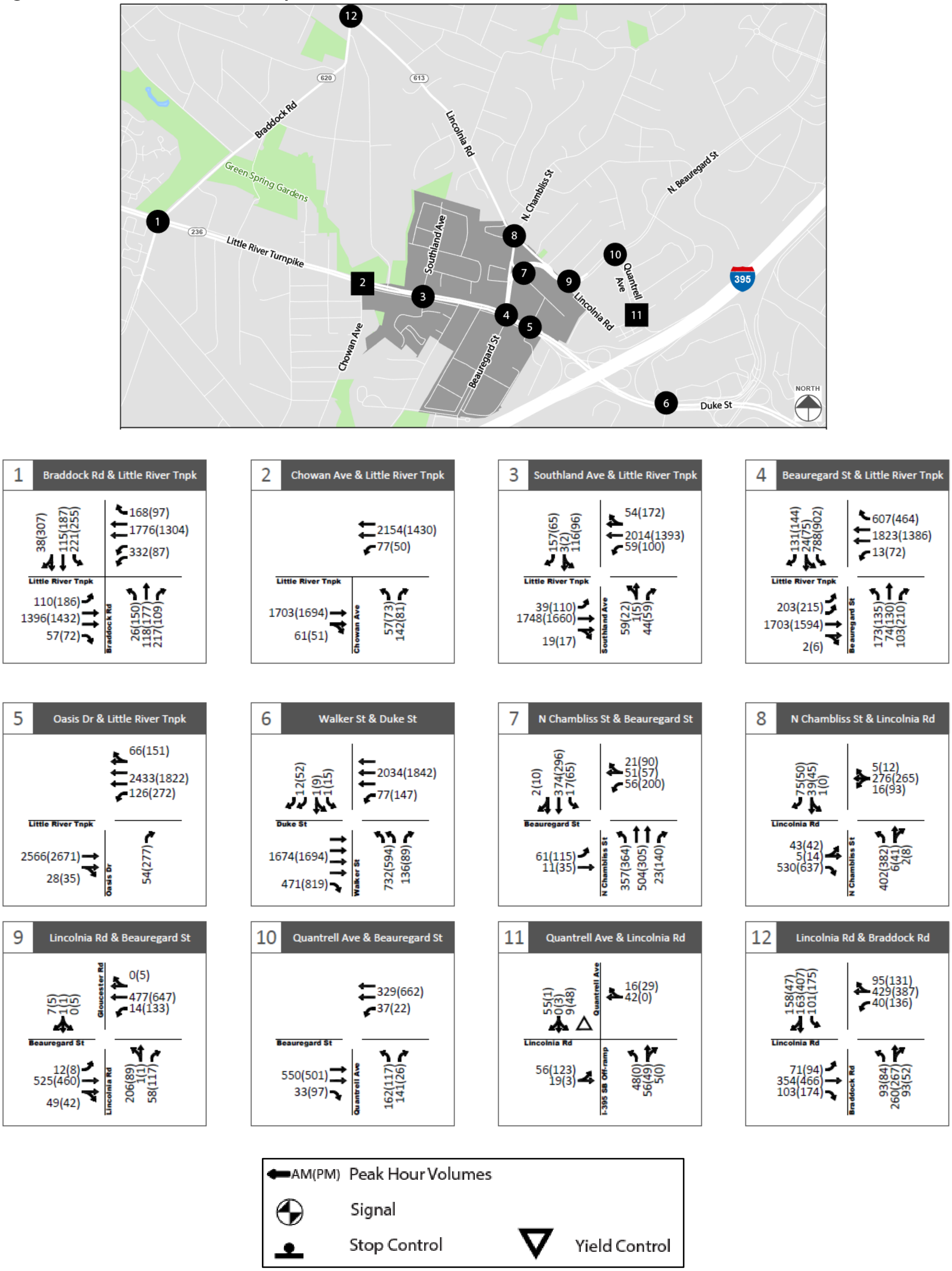


Figure 4-10. 2040 Modified Comprehensive Plan Scenario – Peak Hour Volumes



Key peak hour vehicular volume observations for the Modified Comprehensive Plan are summarized as follows:

- The traffic pattern is quite similar to the Comprehensive Plan scenario, as discussed above.
- The volumes on Little River Turnpike also increased considerably compared to the Existing Volumes due to the increase in the number of lanes on Little River Turnpike (not in the section between Braddock Rd and I-395 off-ramp, but west of Braddock Road). However, the volume increase is less pronounced in the Modified Scenario compared to the Comprehensive Plan since the lane increase is limited to the west of Braddock Road.

4.3.2.2 Traffic Operations

Intersection LOS results for the Modified Comprehensive Plan scenario are depicted in **Figure 4-11**. Weekday AM and PM peak hour average intersection delay for the Modified Comprehensive Plan scenario are shown in **Figure 4-12.**

Figure 4-11. 2040 Modified Comprehensive Plan Scenario – Peak Hour Intersection Level of Service

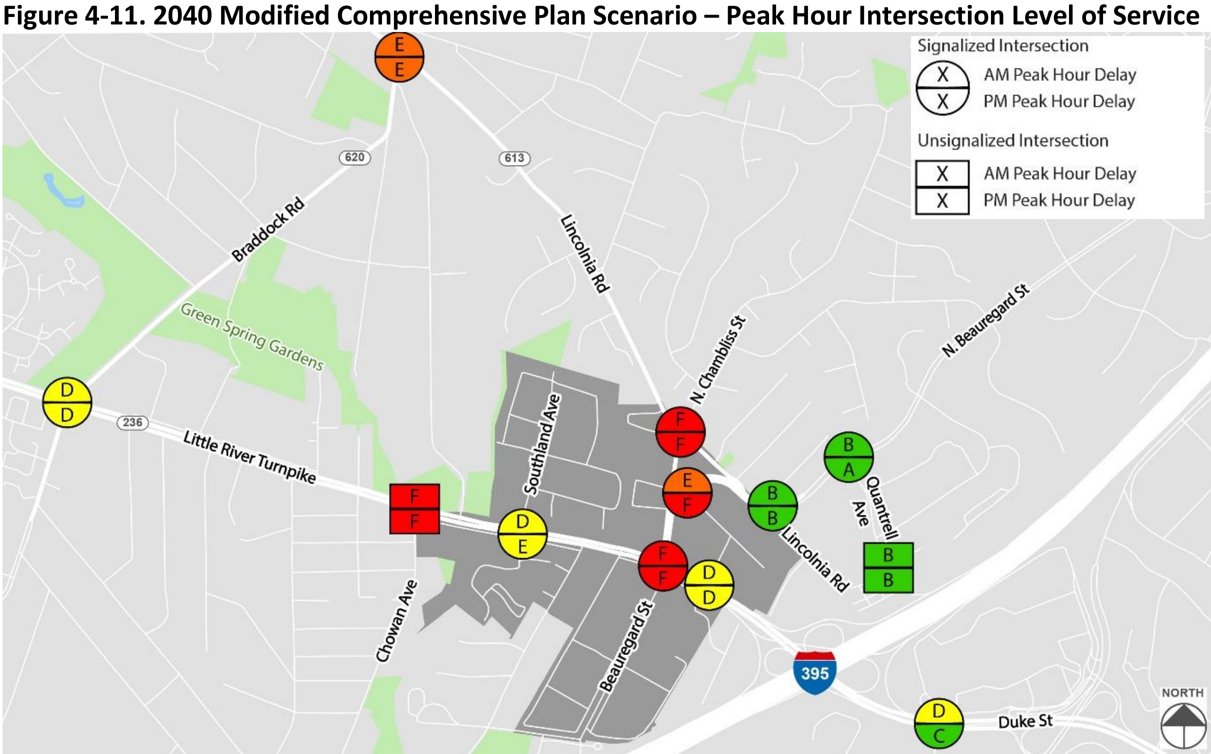
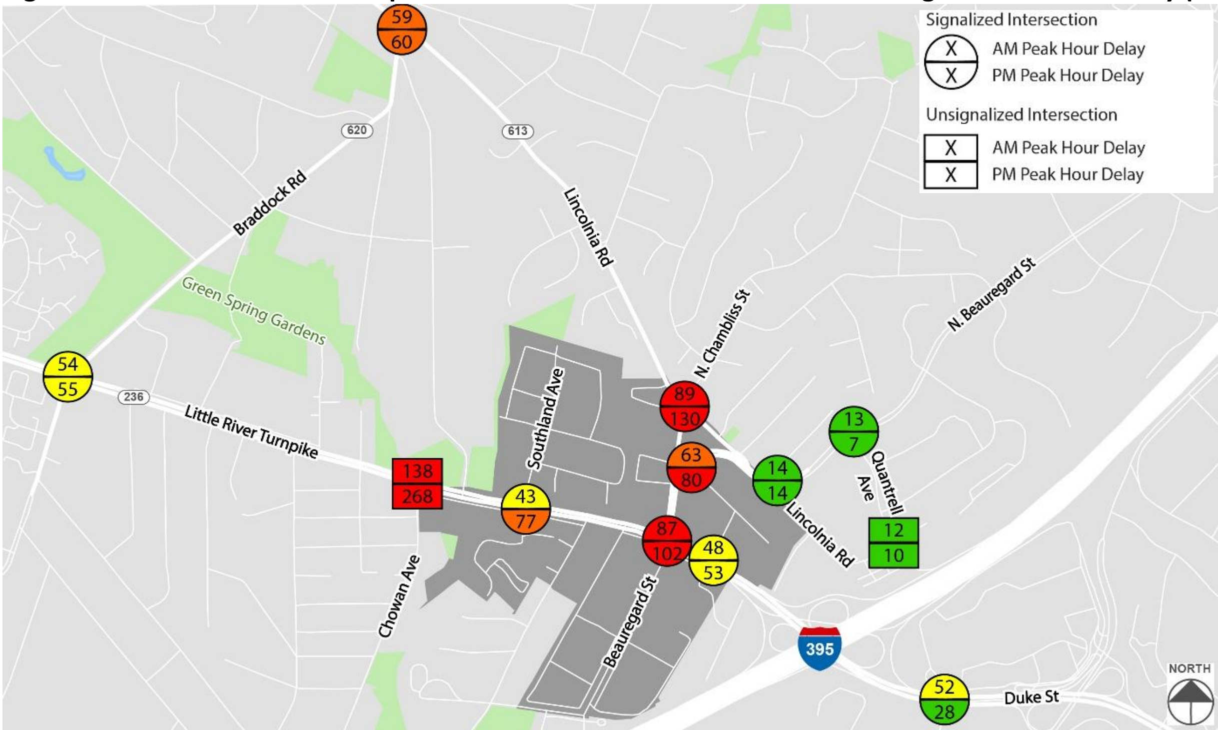


Figure 4-12. 2040 Modified Comprehensive Plan Scenario – Peak Hour Average Intersection Delay (seconds)



Key findings from the Modified Comprehensive Plan scenario are summarized as follows:

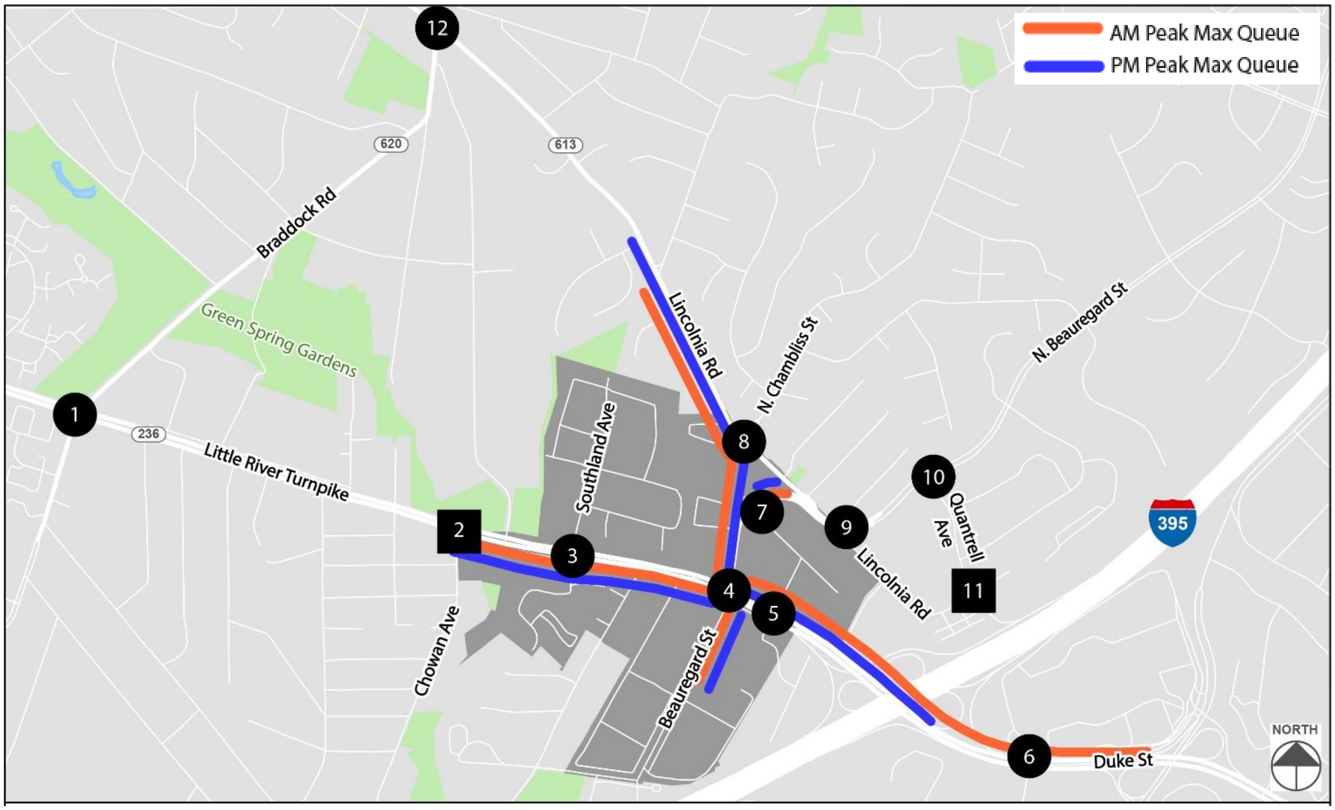
- With the increase in traffic volumes in 2040, Little River Turnpike and Beauregard Street intersection operates with LOS F both in the morning and evening peak hours. Average intersection delay is 87 seconds and 100 seconds during the AM and PM peak hour, respectively.

- Similar to the Comprehensive Plan scenario, the unsignalized Little River Turnpike and Chowan Avenue experiences LOS F under the Modified Comprehensive Plan scenario as a result of the high delay experienced by the northbound left turn movement.

- Duke Street and Walker Street intersection operates better in the Modified Comprehensive Plan scenario compared to the Original Comprehensive Plan. This can be attributed to the higher eastbound and westbound volumes on Duke Street in the Comprehensive Plan scenario as a result of increase in the number of lanes (therefore capacity) on Little River Turnpike.

- Little River Turnpike and Beauregard Street intersection experiences long queues, in particular for the southbound and westbound directions (**Figure 4-13**). The long queues lead to major queue spillbacks at the upstream locations, especially in the southbound direction. Long queues and queue spillback prevent vehicles from clearing the intersection, and restricts queue discharge, thereby resulting in long delays at Lincolnia Road and Chambliss Street (LOS F during both peak hours) and Beauregard Street and Chambliss Street intersections (LOS E during the AM peak hour and LOS F during the PM peak hour).

Figure 4-13. Maximum Queue Lengths for the Modified Comprehensive Plan Scenario



4.3.3 True Baseline Scenario

4.3.3.1 Peak Hour Vehicular Volumes

The major AM peak hour movements and other conflicts can be seen in **Figure 4-14**. Major PM peak hour movements and other conflicts are depicted in **Figure 4-15**. Key observations are discussed below:

- Travel patterns are very similar to the Comprehensive Plan scenario, where the eastbound through, westbound through, westbound right, and the southbound left movements are contributing to the bottleneck. Through volumes on Little River Turnpike are also higher than the Modified Comprehensive Plan scenario, due to the widening.

- Compared to the Comprehensive Plan scenario, the southbound left turn volume going through the intersection is higher since all the left turn movements are occurring at grade without the flyover.

Volumes during the AM and PM peak hours are shown for the 2040 True Baseline scenario in **Figure 4-16**.

Figure 4-14. AM Major Travel Movements and Conflicts for the True Baseline Scenario

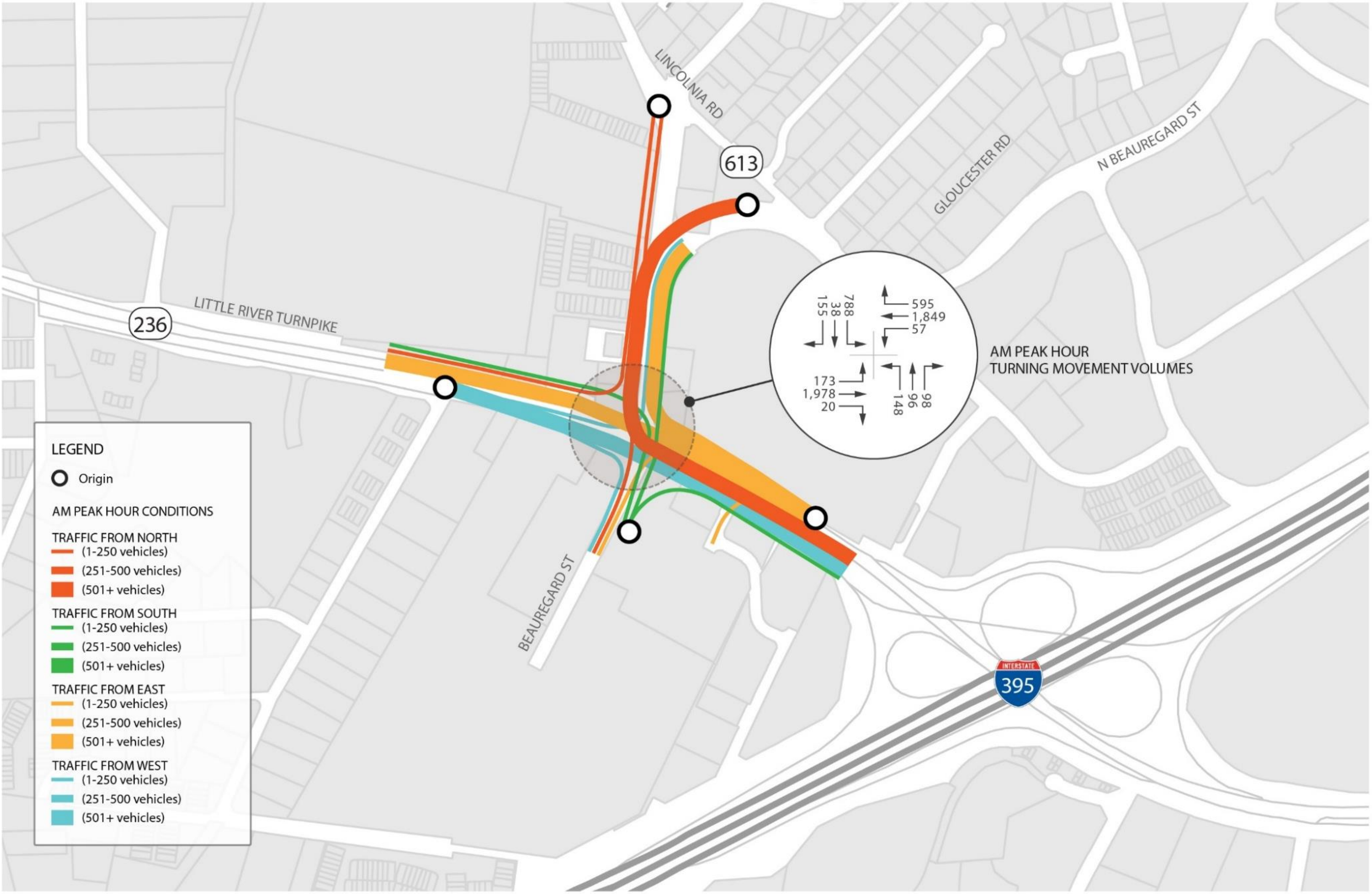


Figure 4-15. PM Major Travel Movements and Conflicts for the True Baseline Scenario

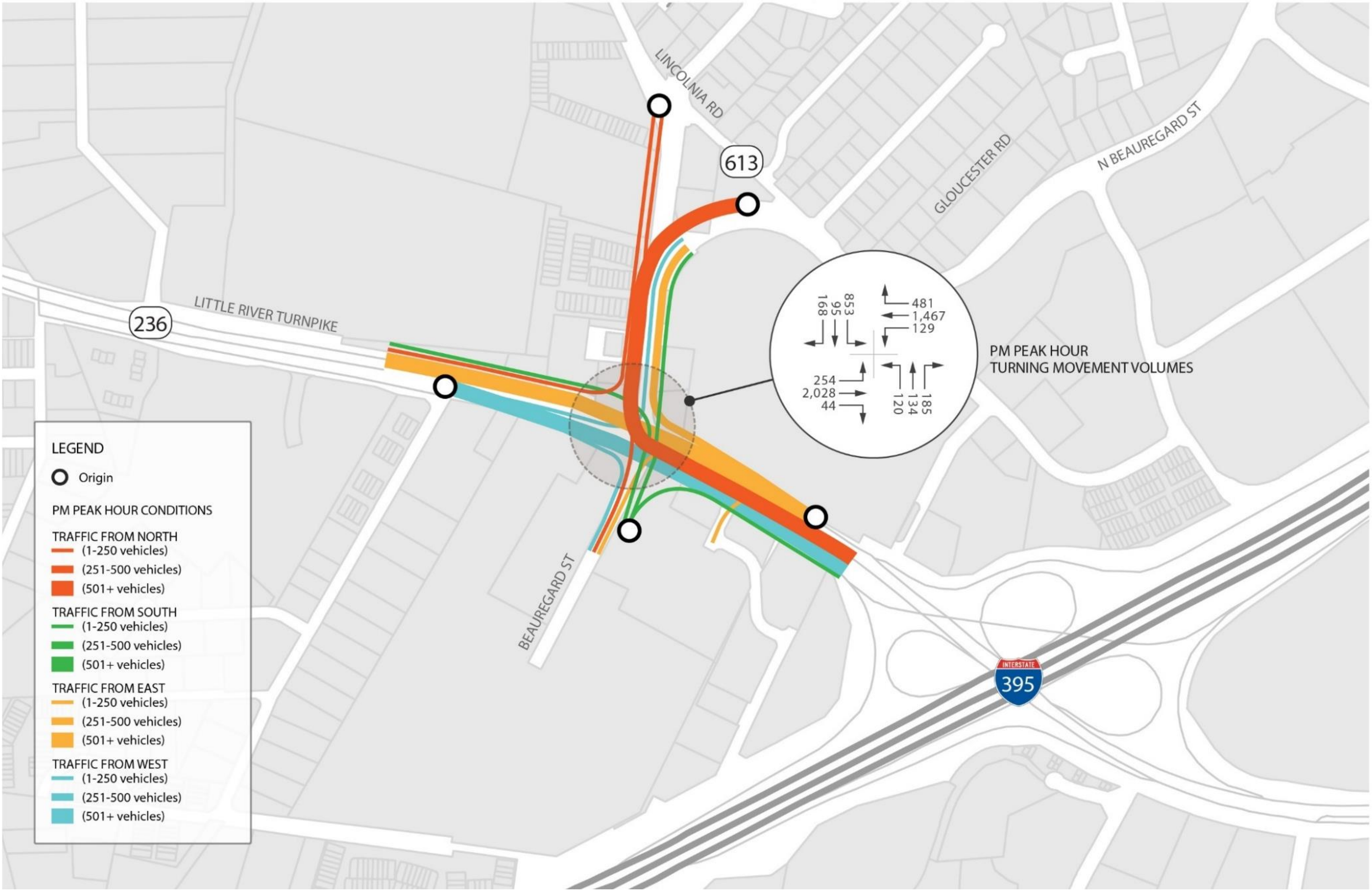
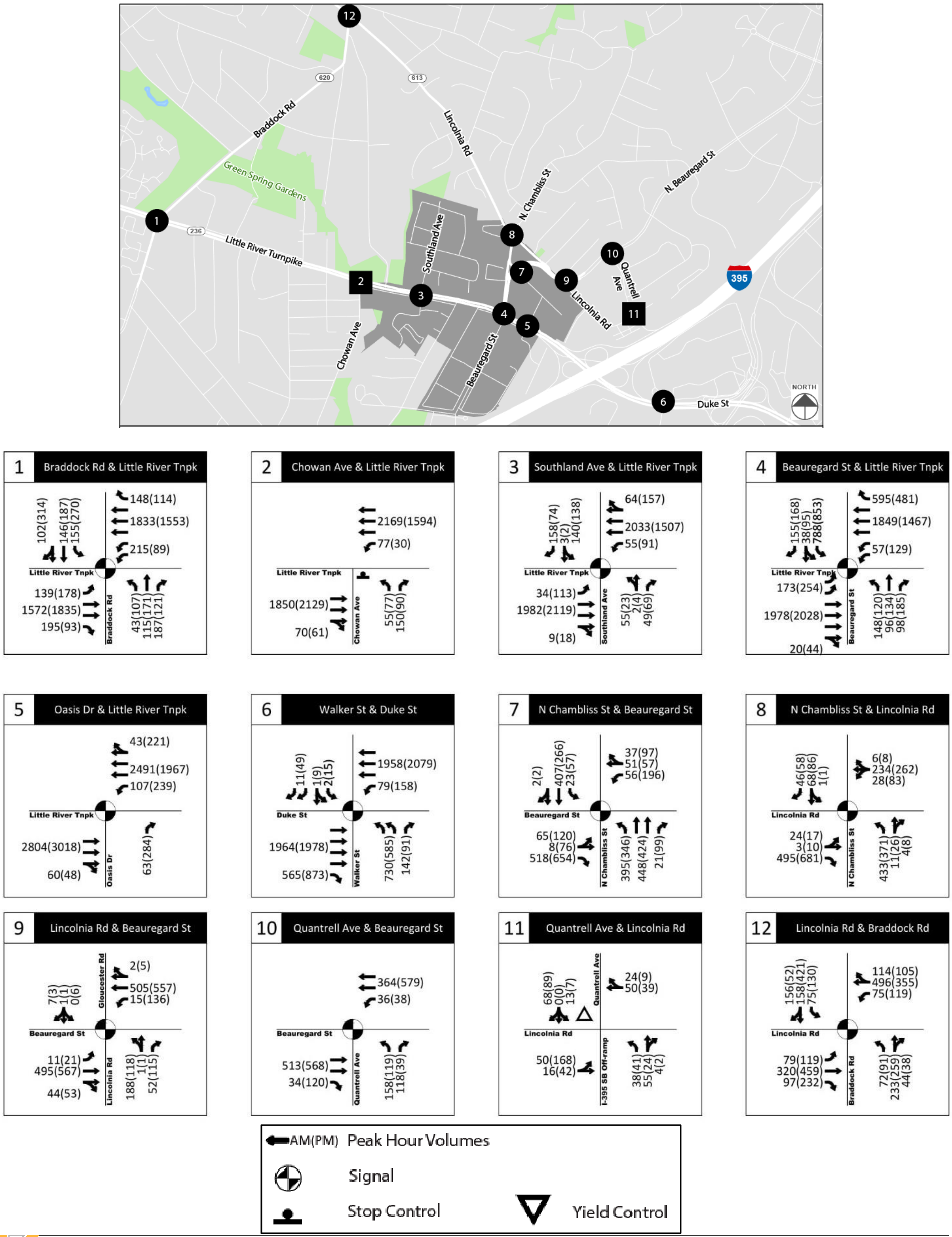


Figure 4-16. 2040 True Baseline Scenario – Peak Hour Volumes



4.3.3.2 Traffic Operations

Intersection LOS results for the True Baseline scenario are depicted in **Figure 4-17**. Weekday AM and PM peak hour average intersection delay for the True Baseline scenario are shown in **Figure 4-18.**

Figure 4-17. 2040 True Baseline Scenario – Peak Hour Intersection Level of Service

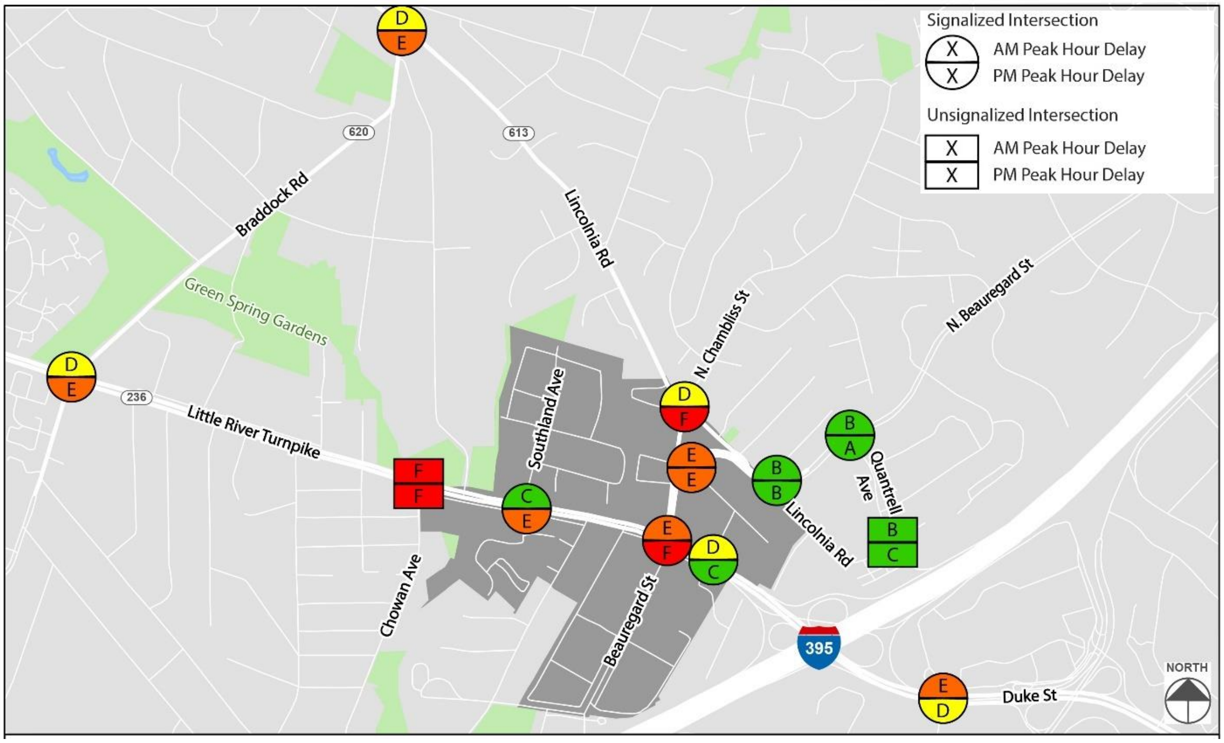
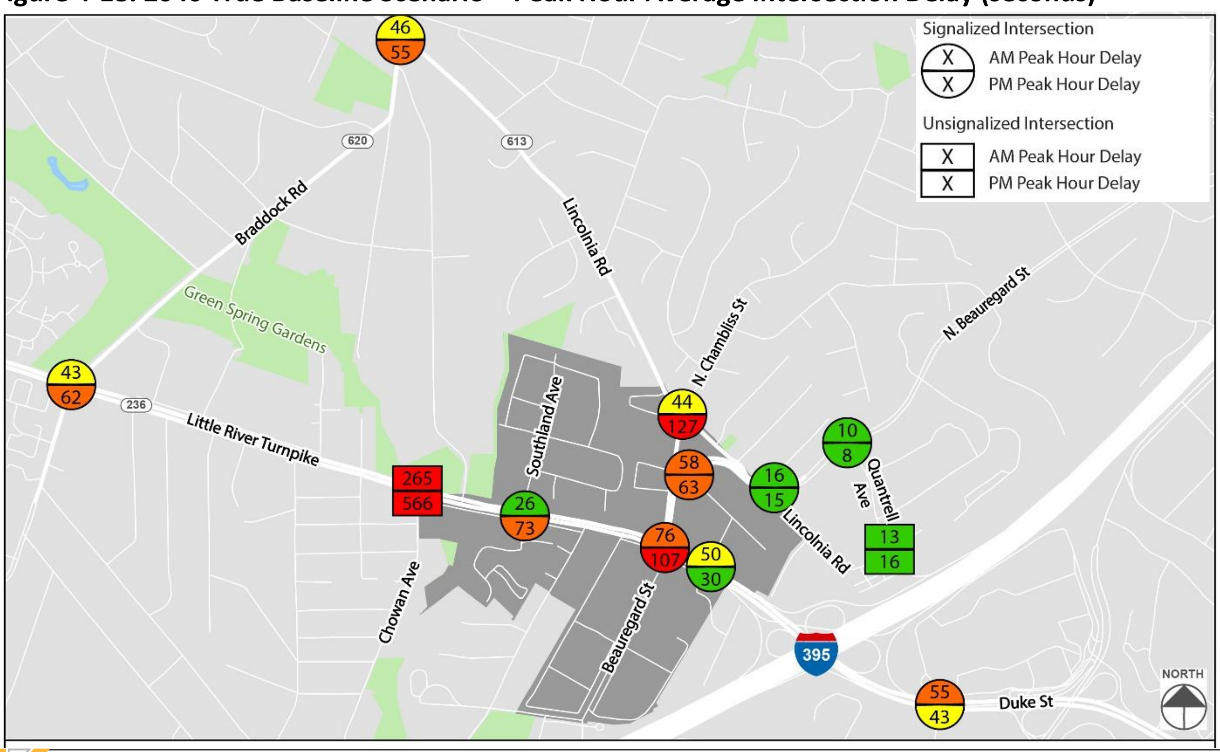


Figure 4-18. 2040 True Baseline Scenario – Peak Hour Average Intersection Delay (seconds)



Key findings from the True Baseline scenario are summarized as follows:

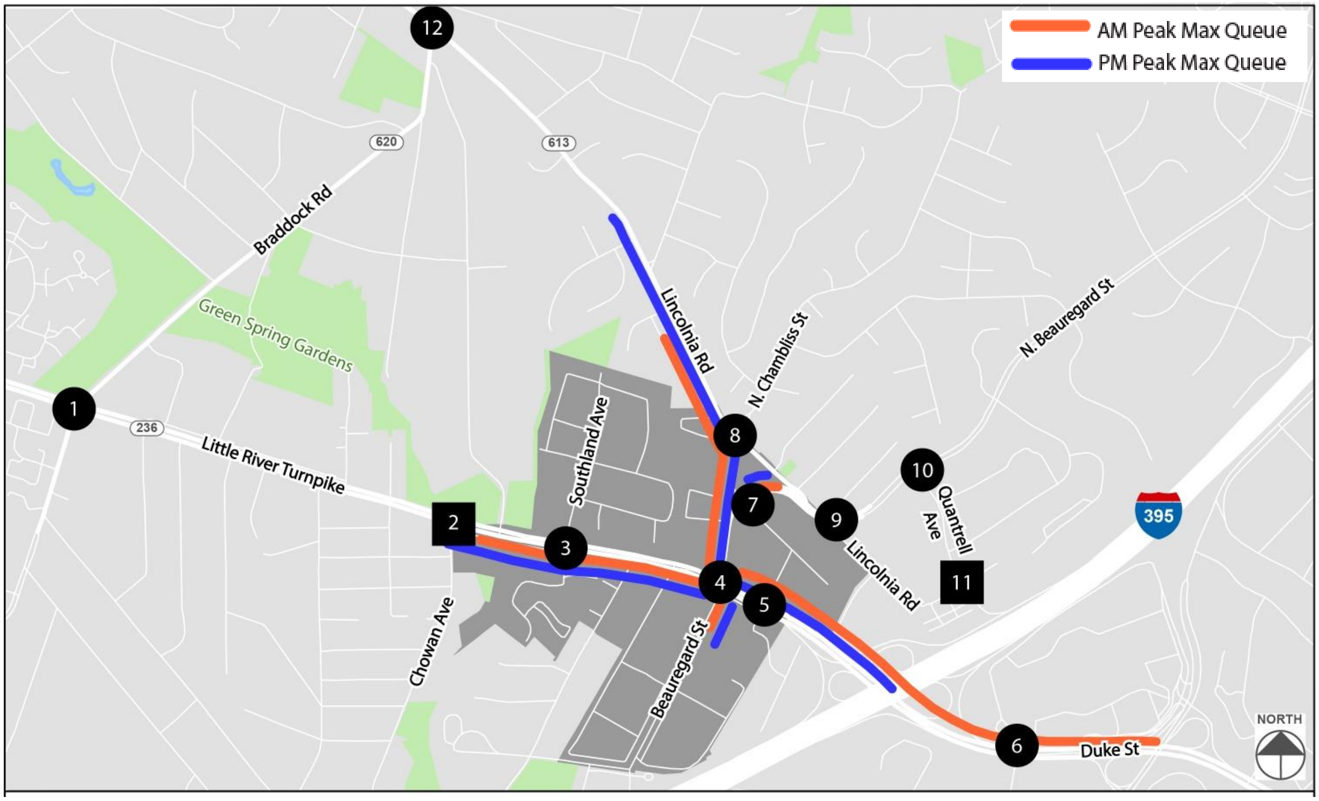
- With the increase in traffic volumes in 2040, Little River Turnpike and Beauregard Street intersection operates with LOS E in the morning peak hour and LOS F in the evening peak hours. Average intersection delay is over 100 seconds during the evening peak hour.

- Similar to the Comprehensive Plan and Modified Comprehensive Plan scenarios, Little River Turnpike and Chowan Avenue experiences LOS F under the True Baseline scenario as a result of the high delay experienced by the northbound left turn movement. As noted above, LOS for un-signalized intersections were calculated based on the movement with the highest delay.

- Duke Street and Walker Street intersection operates worse in the True Baseline scenario compared to the Modified Comprehensive Plan and Comprehensive Plan scenarios. This can be attributed to the higher eastbound and westbound volumes on Duke Street in the True Baseline scenario as a result of increase in the number of lanes (therefore capacity) on Little River Turnpike. However, unlike the Comprehensive Plan Scenario there is no flyover to alleviate capacity constraints at Little River Turnpike/Beauregard Street.

- Little River Turnpike and Beauregard Street intersection experiences long queues, in particular for the southbound and westbound directions (**Figure 4-19**). The long queues lead to major queue spillbacks at the upstream locations, especially in the southbound direction. Long queues and queue spillback prevent vehicles from clearing the intersection, and restricts queue discharge, thereby resulting in long delays at Lincolnia Road and Chambliss Street (LOS E during both peak hours) and Beauregard Street and Chambliss Street intersections (LOS D during the AM peak hour and LOS F during the PM peak hour).

Figure 4-19. Maximum Queue Lengths for the True Baseline Scenario



4.3.4 Summary of Findings

A comparison of the results between the 2040 Baseline Conditions scenarios and the Existing Conditions was conducted. Vehicular volumes, intersection-level operations, and network-wide performance were considered in comparing the vehicular operations.

4.3.4.1 Vehicular Volumes Summary

Peak hour travel patterns were assessed and compared between the Baseline scenarios to observe the impacts of the transportation networks on travel patterns. Key peak hour volume observations are summarized as follows:

- Traffic volumes increased considerably under all scenarios compared to the existing conditions, however the increase is much more pronounced in the Comprehensive Plan scenario due to the additional roadway capacity provided.
- Volumes varied substantially between each scenario due to lane assumptions. Therefore, it is important to consider volume changes when comparing intersection LOS across scenarios.

- The Comprehensive Plan Scenario, which includes the flyover, relieves the southbound left turn volumes by separating the southbound left turn vehicles travelling to I-395 from the vehicles going towards Duke Street.

4.3.4.2 Intersection Level of Service (LOS) and Delay Summary

Table 4-1 summarizes the peak hour levels of service and delays at the study intersections. Existing condition results are also provided for comparison purposes. With the increasing traffic demand in the year 2040, traffic performance within the study area will generally deteriorate. The intersection of Little River Turnpike and N. Beauregard Street continues to be the major bottleneck in the study area.

4.3.4.2.1 Flyover Alleviates Traffic Congestion to a Certain Extent at Little River Turnpike/Beauregard Street

Under the Comprehensive Plan scenario, the proposed flyover provides a direct connection for vehicles traveling from southbound Beauregard Street and Lincolnia Road to the I-395 on-ramp, alleviating the congestion at southbound Beauregard Street to a certain extent (compared to the Existing and Modified Comprehensive Plan). As a result, the intersection is anticipated to operate at LOS D during the AM peak hour and LOS E during the PM peak hour. Operations at the upstream intersections (N. Chambliss St at Beauregard St and N. Chambliss St at Lincolnia Road) improved as well due to the prevention of southbound queue spillback with the flyover.

4.3.4.2.2 Flyover Poses Challenges to Non-Motorized Users

As mentioned earlier, the analysis presented here only focuses on the vehicular aspects. While the flyover concept alleviates traffic congestion in the study corridor, it also introduces challenges to non-motorized operation (i.e., limiting accessibility and connectivity, creating barriers), does not support the vision for the Lincolnia CBC, and may not be a cost-effective solution. Therefore, additional measures will be considered during the development and refinement of transportation alternatives to preserve the functionality of the transportation network while advancing the goals for the study area.

4.3.4.2.3 Little River Turnpike and Beauregard Street Intersection Continues to be a Major Bottleneck in the Modified Comprehensive Plan and True Baseline Scenarios

Under the Modified Comprehensive Plan and True Baseline, congestion along Little River Turnpike continues to be concentrated at the intersection of Little River Turnpike and N. Beauregard Street. Little River Turnpike/Beauregard Street is anticipated to operate at LOS E or F in year 2040.

The widening of Little River Turnpike under the True Baseline scenario results in higher through vehicular volumes, which contributes to increased delay at study intersections. As a result, the True Baseline scenario performs similarly to the Modified Comprehensive Plan at an intersection level, in particular for the PM peak, at the intersection of Little River Turnpike and Beauregard Street. The network performance measures, discussed in the next section, provide additional context to understand how the True Baseline and Modified Comprehensive Plan scenarios operate in aggregate.

4.3.4.2.4 Stop-Controlled Movements Experience High Delay at Chowan Avenue/Little River Turnpike

In addition to the Little River Turnpike and N. Beauregard Street intersection, Chowan Ave and Little River Turnpike is another intersection that experiences high delay in 2040. This unsignalized intersection is anticipated to operate at LOS F under all three scenarios. As previously discussed, the methodology to estimate LOS for unsignalized intersections is different in that LOS and intersection delay are calculated based on the movement with the highest delay. Thus, the results provided below from Chowan Avenue are for the northbound movement that is stop-controlled. In other words, vehicles on Chowan Avenue turning onto Little River Turnpike experience this delay.

Table 4-1. Peak Hour Intersection Level of Service (and Vehicle Delay) Comparison

Intersection	Analysis Tool Used	AM Peak Hour				PM Peak Hour			
		Existing	Comprehensive Plan	Modified Plan	True Baseline	Existing	Comprehensive Plan	Modified Plan	True Baseline
Braddock Rd & Little River Tnpk	Synchro	D (54)	D (52)	D (54)	D (43)	**E (71)**	**E (71)**	D (55)	**E (62)**
Chowan Ave & Little River Tnpk*	Synchro	C (25)	**F (168)**	**F (138)**	**F (265)**	D (34)	**F (1,453)**	**F (268)**	**F (566)**
Southland Ave/Little River Tnpk	VISSIM	C (22)	C (27)	D (43)	C (26)	B (13)	D (39)	**E (77)**	**E (73)**
Beauregard St/Little River Tnpk	VISSIM	D (51)	D (43)	**F (87)**	**E (76)**	**F (86)**	**E (63)**	**F (102)**	**F (107)**
Oasis Dr/Little River Tnpk	VISSIM	C (22)	C (32)	D (48)	D (50)	C (21)	D (41)	D (53)	C (30)
Walker St/Duke St	VISSIM	B (17)	D (51)	D (52)	**E (55)**	C (26)	D (45)	C (28)	D (43)
N. Chambliss St/Beauregard St	VISSIM	B (14)	C (24)	**E (63)**	**E (58)**	**E (56)**	C (34)	**F (80)**	**E (63)**
N. Chambliss St/Lincolnia Rd	VISSIM	B (17)	B (18)	**F (89)**	D (44)	C (24)	B (20)	**F (130)**	**F (127)**
Lincolnia Rd/Beauregard St	VISSIM	B (11)	B (11)	B (14)	B (16)	B (18)	B (12)	B (14)	B (15)
Quantrell Ave/Beauregard St	Synchro	B (11)	B (11)	B (13)	B (10)	A (7)	A (7)	A (7)	A (8)
I-395 SB Off-ramp/Quantrell Ave/Lincolnia Rd*	Synchro	B (11)	B (11)	B (12)	B (13)	B (14)	B (13)	B (10)	C (16)
Lincolnia Rd/Braddock Rd	Synchro	**E (56)**	D (46)	**E (59)**	D (46)	D (48)	**E (55)**	**E (60)**	**E (55)**

* Unsignalized intersection where intersection delay and LOS was calculated based on the worst movement with the highest delay.

4.3.4.3 Network Performance Measures Summary

Table 4-2 provides a comparison of network performance measures. Key findings from the network performance measures are summarized below:

- In all 2040 baseline scenarios, the latent demand, that is the number of unserved vehicles in the network due to very long queues (i.e., residual queues) increased substantially compared to the existing conditions. However, it is worth noting that the number of vehicles served also increased substantially due to the increase in projected traffic volumes.

- Pedestrian delay is generally consistent across the scenarios, with some improvements under the Modified Plan and the True Baseline scenarios. Differences in pedestrian delay are primarily attributed to minor signal timing adjustments and reduction in cycle length.

- Overall, the Comprehensive Plan scenario operates relatively better than the other two scenarios with lower delays and higher number of vehicles served during both the AM and PM peak hours.

- Average vehicle delay under the True Baseline is lower than the Modified Comprehensive Plan in the AM peak and almost the same in the PM peak. The number of vehicles served, however, is considerably higher under the True Baseline than the Modified Comprehensive Plan, suggesting the True Baseline scenario performs better as it can accommodate more vehicles with the same vehicle delay in the PM and reduced delay in the AM peak hour.

Table 4-2. Comparison of Network Performance Measures

Network Performance Measure	AM Peak Hour				PM Peak Hour			
	Existing	Comprehen-sive Plan	Modified Plan	True Baseline	Existing	Comprehen-sive Plan	Modified Plan	True Baseline
Average Vehicle Delay (sec/vehicle)	65.0	112.6	163.5	146.6	91.6	110.5	155.0	155.4
Average Pedestrian Delay (sec/pedestrian)	72.2	78.4	52.9	52.6	75.6	78.4	67.6	58.3
Latent Demand (unserved number of vehicles)*	52	176	300	138	32	295	601	461
Vehicles Served **	8,214	10,239	9,283	9,654	9,461	11,446	10,012	11,014

* Indicates the number of unserved vehicles during the simulation due to very long queues, preventing vehicles from entering the simulation network.

** Indicates the total number of vehicles served during the analysis period. This measure is generally used as a proxy to network throughput when intersections are oversaturated.

Section 5
Development and Analysis of 2040 Transportation Alternatives

5 DEVELOPMENT AND ANALYSIS OF 2040 TRANSPORTATION ALTERNATIVES

In order to address deficiencies and transportation needs described in the Existing Conditions **(Section 3)** and 2040 Baseline Conditions **(Section 4)**, various transportation network alternatives were created that could improve the transportation conditions in the study area. In general, these alternatives can be broken into three groups:

i. Alternatives that add a street grid around the core CBC and provide additional streets to make turn movements;

ii. Alternatives that can divert traffic away from the congested Little River Turnpike and Beauregard intersection; and

iii. Alternatives that can enhance intersection capacity through some form of alternative intersection types and removal of turn movements.

A two-tiered approach was used to select a preferred alternative. The first tier included developing ten (10) conceptual transportation network alternatives. These alternatives were discussed with staff from several divisions in FCDOT and six (6) transportation network alternatives were selected based on a high-level evaluation of these concepts. These six alternatives were then presented to the Lincolnia Task Force on June 12, 2018, where their two preferred transportation networks were identified.

The second tier consisted of a detailed traffic analysis for the preferred alternatives using the VISSIM software. Given the analyses conducted were preliminary and the focus was the transportation conditions within the CBC, the vehicular study area was limited to intersections in the core of the CBC.

5.1 DRAFT 2040 TRANSPORTATION NETWORK ALTERNATIVES (TIER 1)

The initial step in developing alternatives was to identify ten (10) transportation network alternatives that have the potential to address network deficiencies for all roadway users. The alternatives were developed and assessed consistent with the Goals, Objectives, and MOE's **(Section 2).**

5.1.1 Guiding Principles for the Development of Transportation Alternatives

The transportation alternatives were developed such that they are consistent with the objectives identified by the Task Force for the study area, summarized as follows:

- Create a vibrant neighborhood destination,
- Strategically focus appropriate growth to protect Lincolnia's low density residential neighborhoods from development pressure, and

- Create an integrated multimodal approach to transportation challenges in the area, with a particular focus on the Little River Turnpike and Beauregard Street intersection.

To achieve these objectives, it became clear that one of the guiding principles should be to provide additional north-south capacity without creating barriers for non-motorized users. This was done to address heavy vehicle travel movements and the limited north south capacity. As a result, most of the concepts recommended grids of streets north of Little River Turnpike. In addition, a spectrum of alternatives was considered. While some of the alternatives would require more construction and right-of-way, some alternatives focused on minor street changes or travel restrictions such as alternative intersections.

5.1.1.1 Preliminary Assessment

Each of the ten original alternatives include a preliminary assessment of the criteria developed with the Goals, Objectives, and MOE's **(Section 2)**. Qualitative performance for the criteria are symbolized as:

- ***Green*** – Will likely perform well
- ***Yellow*** – May perform well
- ***Orange*** – May not perform well
- ***Red*** – Will likely not perform well

It should be noted that the assessment was based on the performance of each alternative relative to one another. For example, if an alternative is likely to improve traffic operations considerably compared to the other alternatives, even though it may not be able to alleviate traffic congestion completely, a green category was assigned for that alternative for traffic operations.

The qualitative performance for each concept is shown in the upper right-hand corner of each sketch. For this stage of assessment, it should be noted no Synchro or GIS analyses were performed and the qualitative assessment was based on professional judgment.

5.1.2 Preliminary 2040 Transportation Network Alternatives

Ten (10) preliminary network alternatives were prepared for FCDOT review, as well as the preliminary assessments presented. The six alternatives selected by FCDOT staff for refinement are identified at the end of this section. The ten (10) preliminary network alternatives are as follows:

i. Alternative 1a (Full Grid – Oasis Extension as 2-lane Street)
ii. Alternative 1b (Full Grid – Oasis Extension as 4-lane Road)
iii. Alternative 2a (Partial Grid – Oasis Extension as 2-lane Street)
iv. Alternative 2b (Partial Grid – Oasis Extension as 4-lane Road)
v. Alternative 3 (Enhanced North-South Connections via Southland and Brookside)

vi. Alternative 4a (Simple Quadrant Roadway)

vii. Alternative 4b (Quadrant Roadway with Southern Grid)

viii. Alternative 4c (Simple Quadrant Roadway – No Northbound Beauregard)

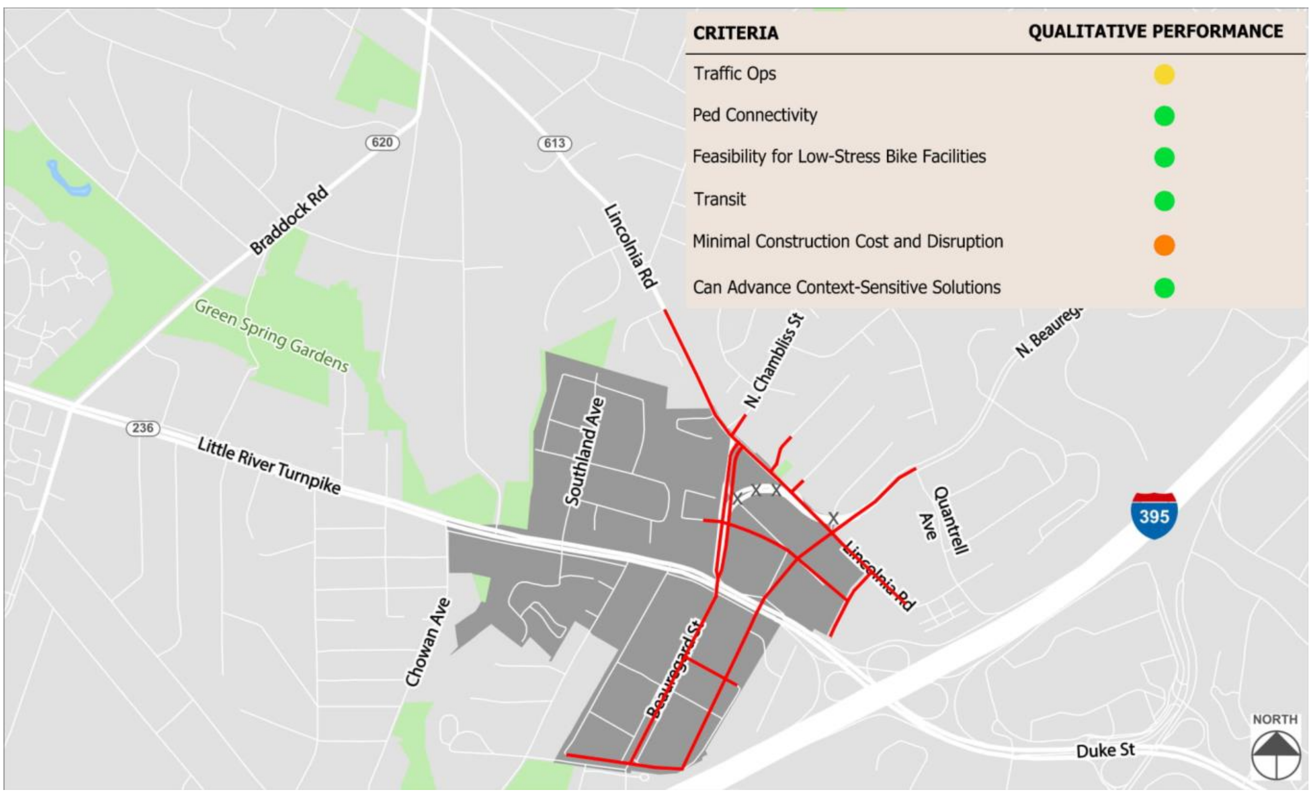
ix. Alternative 5 (Little River Turnpike Jughandles)

x. Alternative 6 (Oasis Underpass – No Left Turns at Little River Turnpike/N. Beauregard)

5.1.2.1 Alternative 1a (Full Grid – Oasis Extension as 2-lane Street)

This alternative would introduce a new connection between N. Beauregard Street and Oasis Drive with one travel lane in each direction. This alternative would also create a new street grid on both sides of Little River Turnpike. In addition, it removes the curved section of N. Beauregard Street, and fully connects Lincolnia Road (**Figure 5-1**). This concept is expected to perform well across most of the criteria, except for construction cost and disruption; however, it should be noted that it is anticipated that this new connection would be constructed as part of a redevelopment of the site. Therefore, the cost and disruption is in fact due to the redevelopment of the site. In addition, traffic congestion may still remain an issue due to the limited capacity provided with single travel lanes.

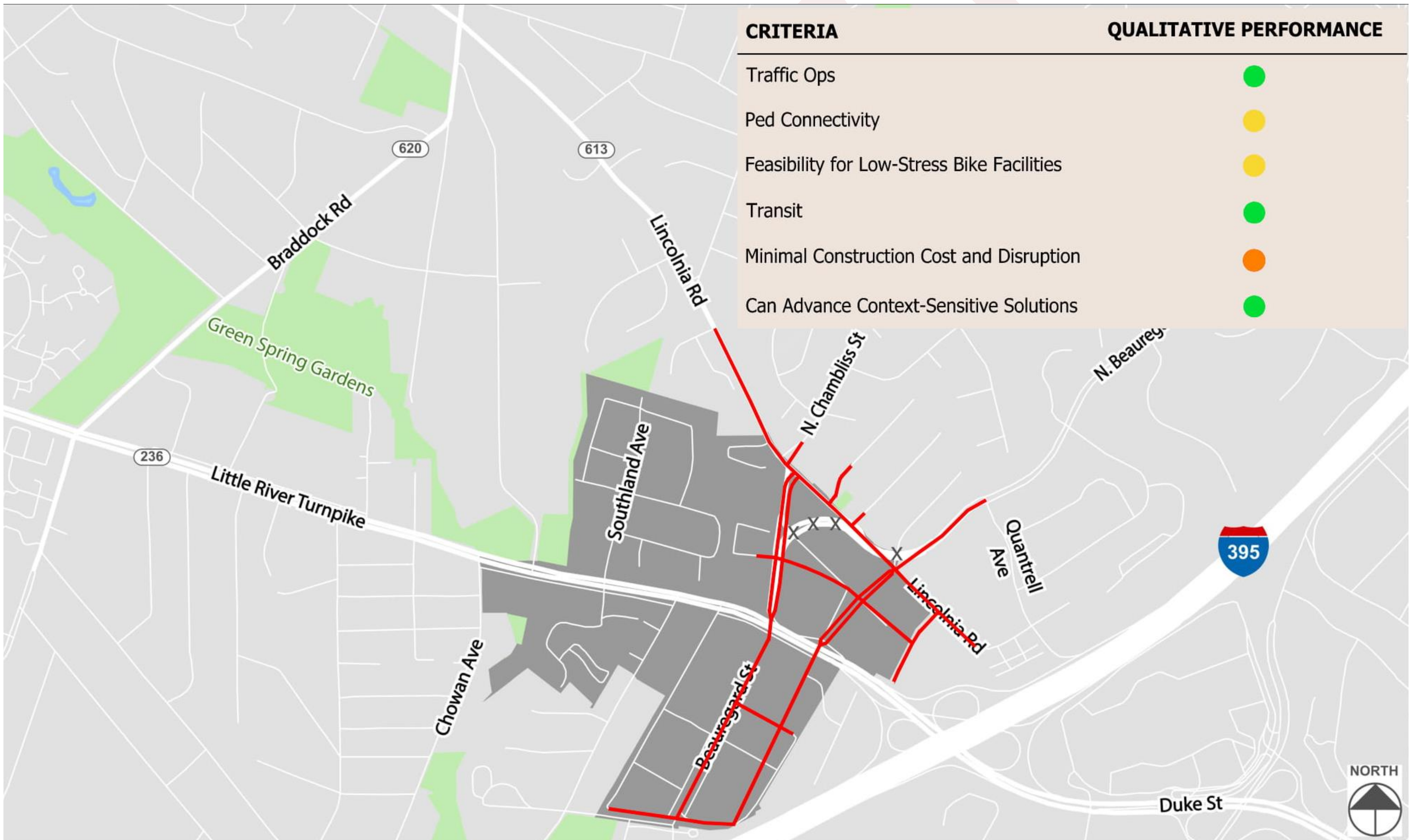
Figure 5-1. Alternative 1a (Full Grid – Oasis Extension as 2-lane Street)



5.1.2.2 Alternative 1b (Full Grid – Oasis Extension as 4-lane Road)

This alternative is similar to Alternative 1a, with the exception of the new road being constructed with two travel lanes in each direction to add additional north-south capacity north of Little River Turnpike (**Figure 5-2**). This alternative is expected to perform well across several criteria like Alternative 1a. However, traffic operations are expected to perform better while pedestrian and bicycle conditions may not be as favorable due to the increased right-of-way resulting from the additional travel lane.

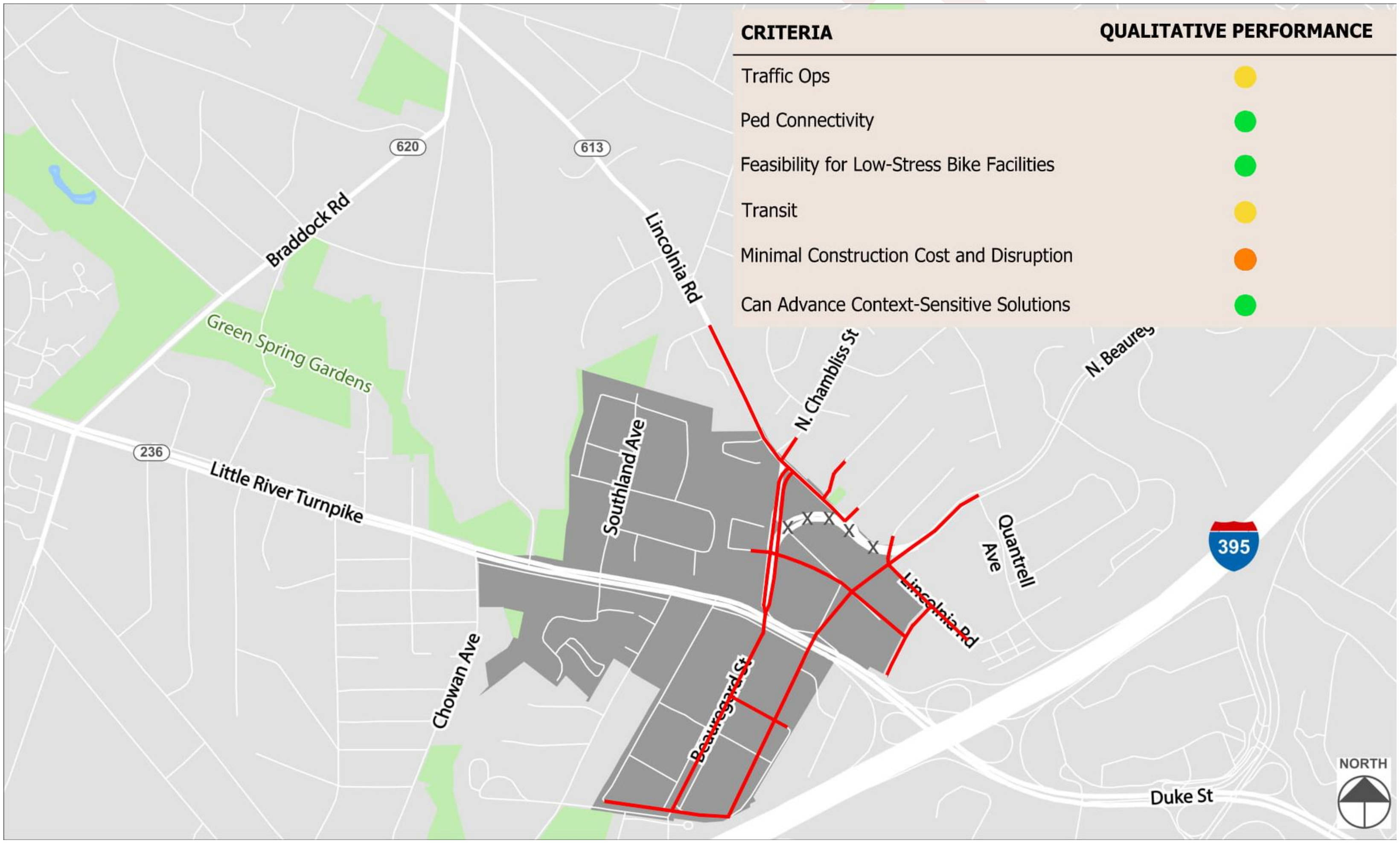
Figure 5-2. Alternative 1b (Full Grid – Oasis Extension as 4-lane Road)



5.1.2.3 Alternative 2a (Partial Grid – Oasis Extension as 2-lane Street)

Under this alternative, a new road would be constructed to connect N. Beauregard Street to Oasis Drive with one travel lane in each direction. This concept would also create a new street grid on both sides of Little River Turnpike and remove the curved sections of N. Beauregard Street (**Figure 5-3**). Under this alternative, however, the Lincolnia Road is not fully connected as shown below.

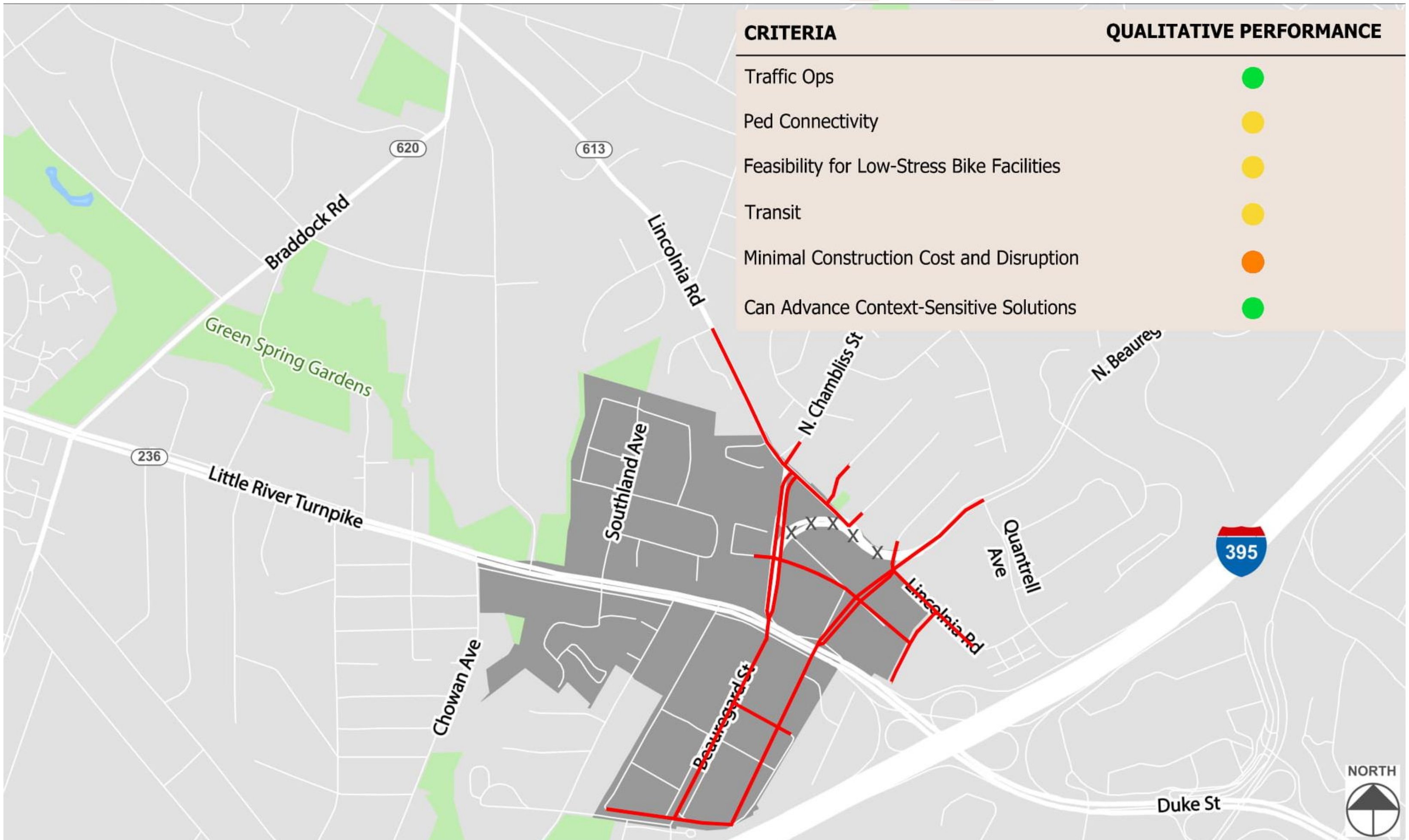
Figure 5-3. Alternative 2a (Partial Grid – Oasis Extension as 2-lane Street)



5.1.2.4 Alternative 2b (Partial Grid – Oasis Extension as 4-lane Road)

This alternative is similar to Alternative 2a, with the exception of the new road being constructed with two travel lanes in each direction for added capacity (**Figure 5-4)**. This alternative is expected to perform moderately well across several criteria like Alternative 2a. Traffic operations are expected to perform better, while pedestrian and bicycle conditions may not be as favorbale due to the increased right-of-way.

Figure 5-4. Alternative 2b (Partial Grid – Oasis Extension as 4-lane Road)

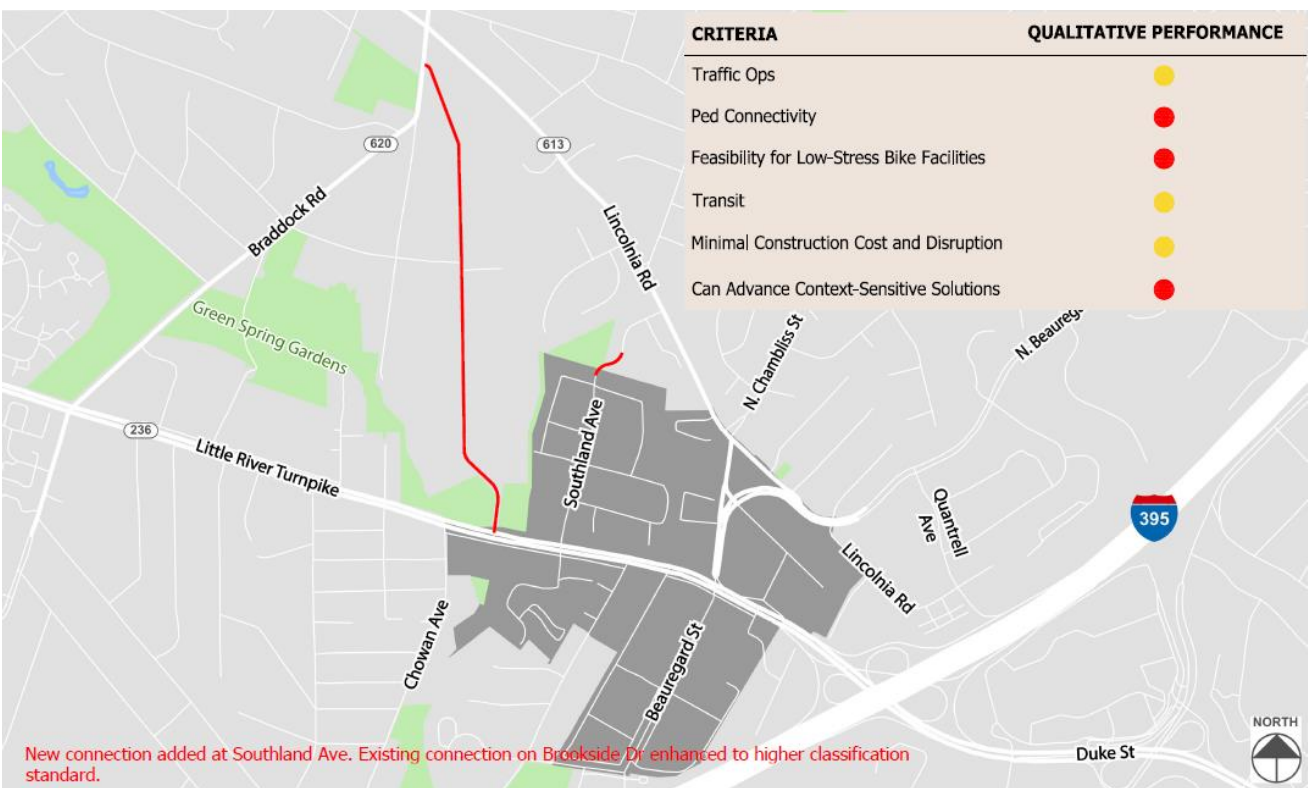


5.1.2.5 Alternative 3 (Enhanced North-South Connections via Southland and Brookside)

This alternative would create additional north-south connection to improve the existing north-south capacity between Lincolnia Road and Little River Turnpike (**Figure 5-5**). Southland Avenue and Brookside Drive were considered as alternative routes to facilitate this north-south connection. This could be achieved by completing the roadway connection at Southland Avenue thereby providing a direct connection from Lincolnia Road to Little River Turnpike via Southland Avenue, and also by constructing Brookside Drive to a higher classification standard (Brookside Drive today lacks shoulder lanes and has narrow travel lanes).

This alternative is not expected to perform well across several criteria. While traffic and transit may perform well, pedestrian and bicycle criteria are not expected to improve from existing conditions as there are marginal network changes within the CBC. Thus, issues related to non-motorized travel within the CBC will remain unchanged. Another drawback of this alternative is that the proposed roadway changes primarily lie outside the CBC boundaries and would not create redevelopment opportunities within the CBC, one of the goals identified by the Task Force and county.

Figure 5-5. Alternative 3 (Enhanced North-South Connections via Southland and Brookside)

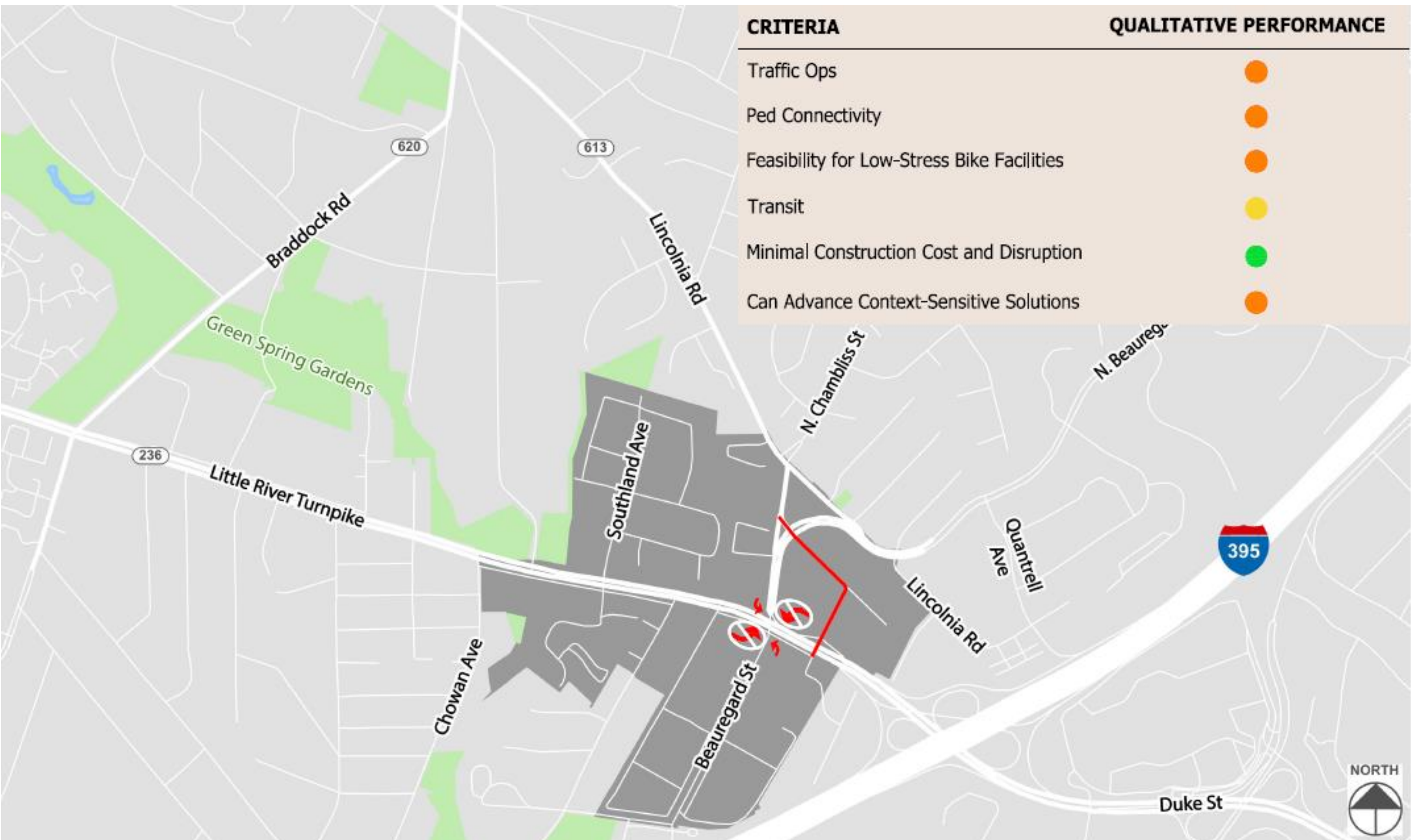


5.1.2.6 Alternative 4a (Simple Quadrant Roadway)

Under this alternative, a new road would be constructed to connect the existing intersection of N. Beauregard/Chambliss Street with Oasis Drive (**Figure 5-6**). This alternative would also include turn restrictions for eastbound left (EBL) and westbound left (WBL) turns at the Little River Turnpike/N. Beauregard Street intersection to improve capacity at Little River Turnpike and Beauregard Street intersection.

This alternative is not expected to perform well across several criteria. While traffic operations may be improved to a certain extent, it is very likely that Little River Turnpike and Beauregard Street intersection will stay as a bottleneck. In addition, pedestrian connectivity, and bike criteria may not perform well with this concept due to the limited opportunities for enhanced pedestrian and bicycle conditions.

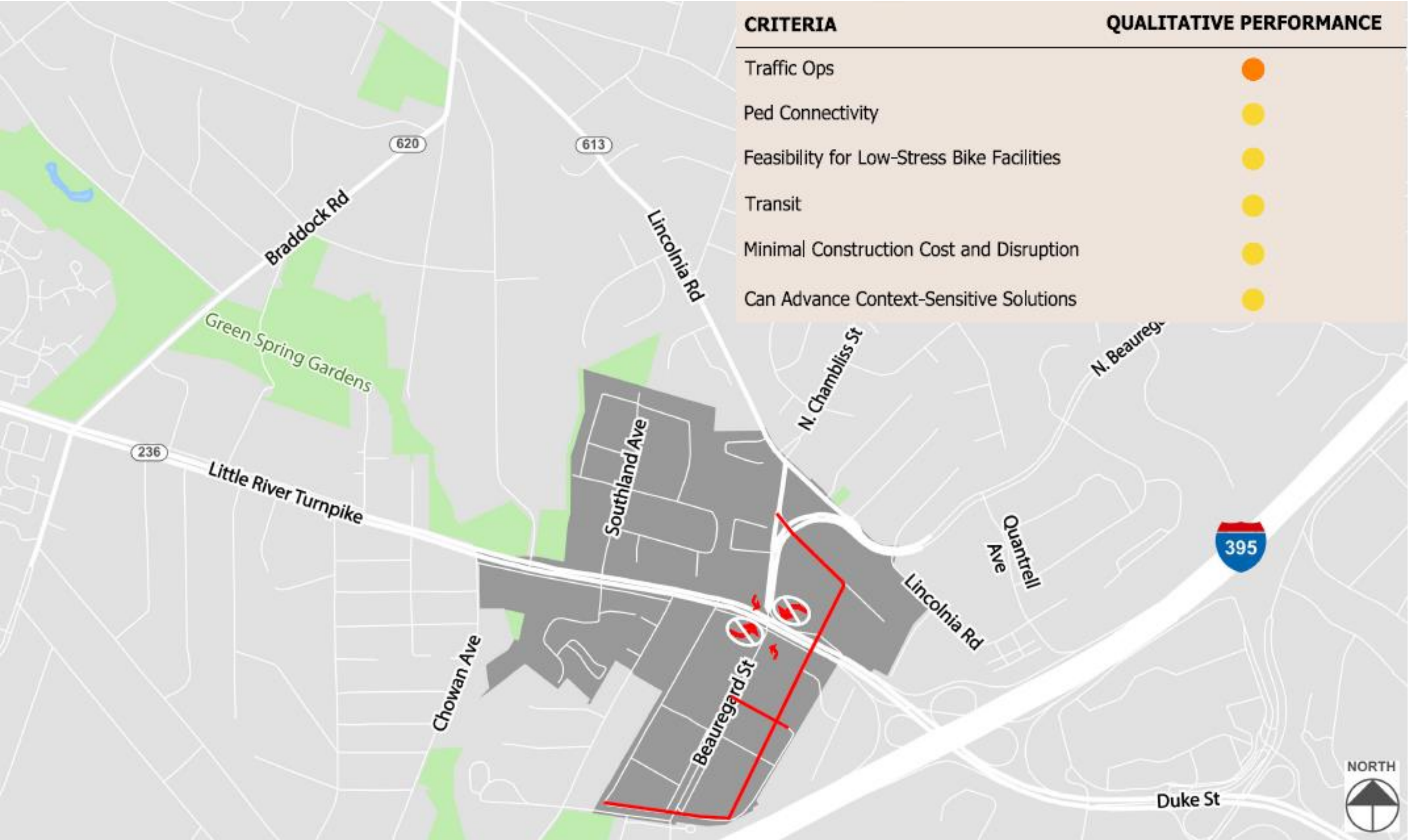
Figure 5-6. Alternative 4a (Simple Quadrant Roadway)



5.1.2.7 Alternative 4b (Quadrant Roadway with Southern Grid)

This alternative is similar to 4a, with the exception of a grid system being added south of Little River Turnpike (**Figure 5-7**). The turn restrictions would still be in effect at the Little River Turnpike/N. Beauregard Street intersection. It is expected this alternative may perform well across all the criteria, with the exception of traffic operations. Similar to 4a, it is expected that there would not be a significant gain from traffic operations perspective as the main traffic movements would still be concentrated at a single intersection, likely causing operational challenges.

Figure 5-7. Alternative 4b (Quadrant Roadway with Southern Grid)

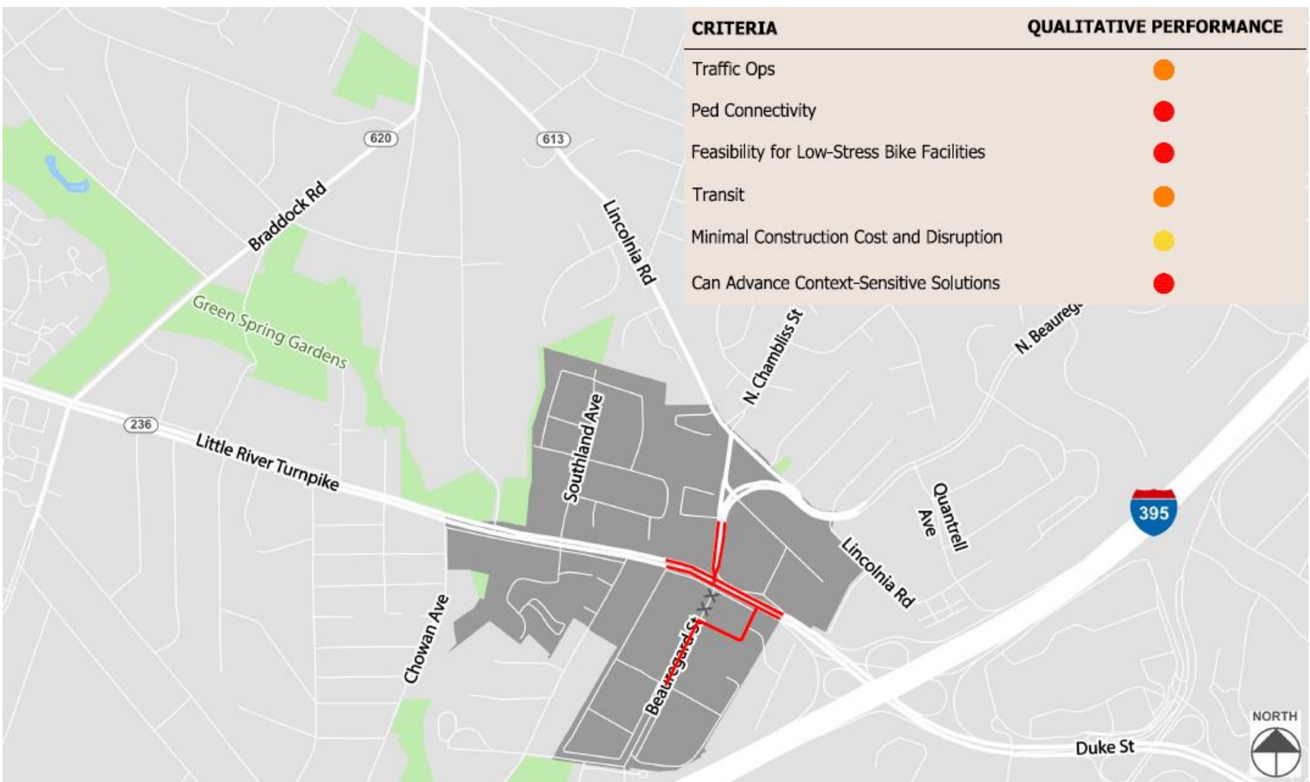


5.1.2.8 Alternative 4c (Simple Quadrant Roadway – No Northbound Beauregard)

Under this alternative, the northbound leg of the Little River Turnpike /N. Beauregard Street intersection would be eliminated (**Figure 5-8**). The northbound traffic would instead be rerouted via a quadrant roadway to the existing intersection at Oasis Drive. The motivation for eliminating the northbound leg in this alternative is to increase intersection capacity at Little River Turnpike /N. Beauregard by reallocating the green time required for the northbound phase to other conflicting phases.

This alternative is not expected to perform well across several criteria. The removal of the northbound leg of the Little River Turnpike/N. Beauregard Street intersection would also require the removal of a crosswalk to cross Little River Turnpike, which would impact ped connectivity. From a traffic perspective, while minor improvements are expected, it is likely that intersections within CBC, in particular Little River Turnpike /N. Beauregard intersection, would still experience congestion and high delays.

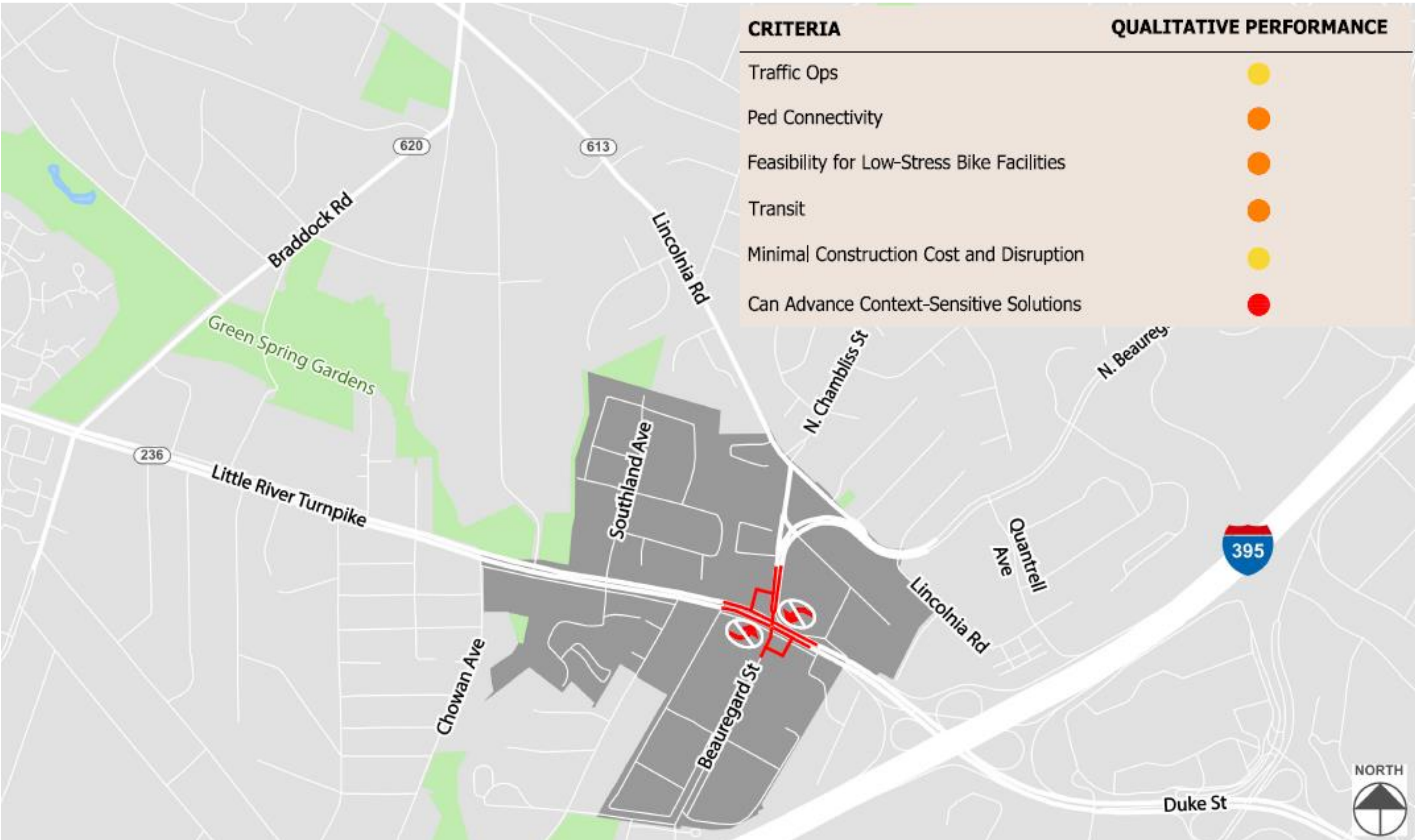
Figure 5-8. Alternative 4c (Simple Quadrant Roadway – No NB Beauregard)



5.1.2.9 Alternative 5 (Little River Turnpike Jughandles)

Under this alternative, EBL and WBL turns at the Little River Turnpike /N. Beauregard Street intersection would be restricted (**Figure 5-9**). These movements would instead be made by continuing through the intersection and using jughandles to turn right, then turn right again. This alternative is not expected to perform well across several criteria, including pedestrian, bicycle, and transit modes. In addition, this alternative would likely not advance context-sensitive solutions and may only provide moderate traffic operations benefits.

Figure 5-9. Alternative 5 (Little River Turnpike Jughandles)

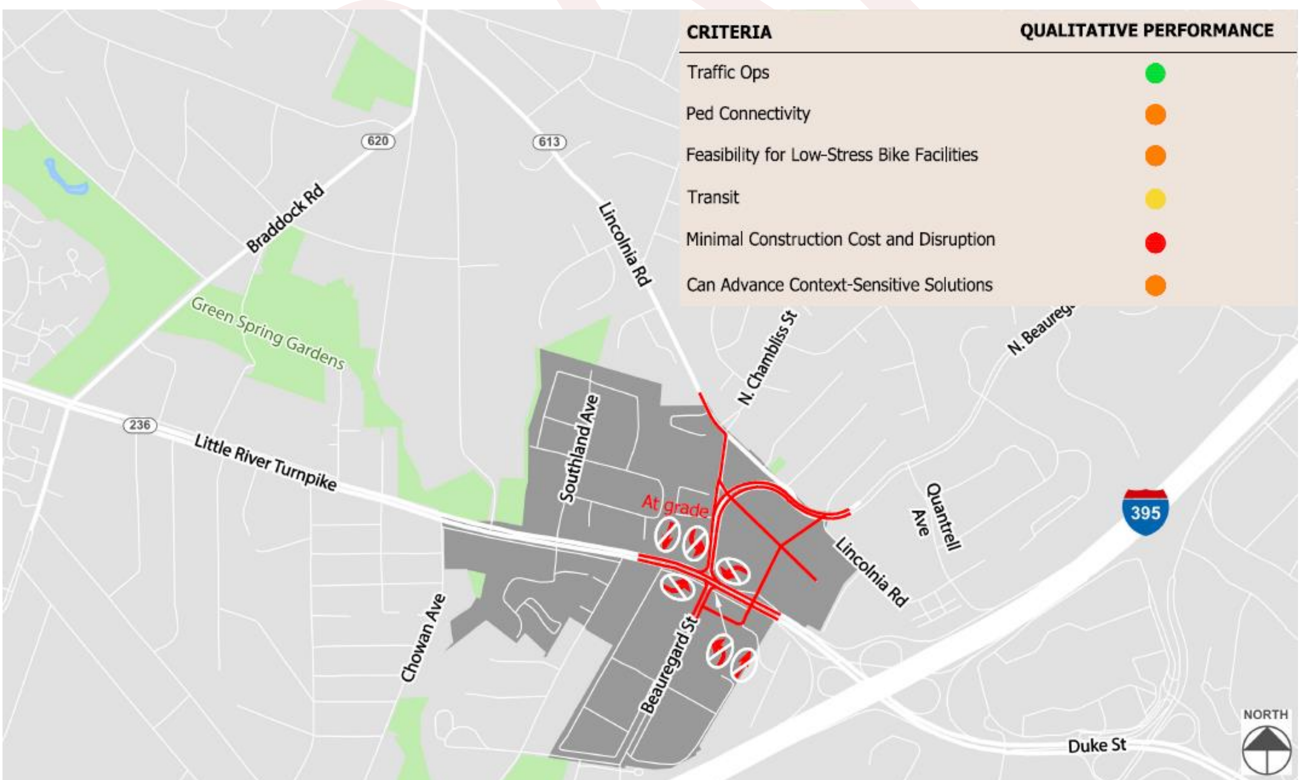


5.1.2.10 Alternative 6 (Beauregard Underpass – No Left Turns at Little River Turnpike/N. Beauregard)

Under this alternative, all turns would be restricted at the Little River Turnpike /N. Beauregard Street intersection. This could be achieved by grade separating the roadway, such that N. Beauregard is an underpass at Little River Turnpike. Through movements on Little River Turnpike would continue through the intersection without conflicting with left or through movements on N. Beauregard Street. Similarly, the Beauregard underpass would allow through movements to continue on N. Beauregard Street without conflicting with Little River Turnpike traffic (**Figure 5-10**). To accommodate the existing left turn movements on N. Beauregard Street, the existing signal at Oasis Drive would be converted to a full-movement intersection to provide turning opportunities for movements that would no longer be permitted at the newly grade-separated intersection.

It is expected this alternative may not perform well across several criteria. The underpass would be costly due to the construction cost. In addition, it may not be as desirable for pedestrians as crossings need to happen through the underpass (less direct and may pose safety issues) rather than happening at-grade. As a result, it is less likely to advance context-sensitive solutions. However, from a traffic perspective, this alternative may be an appropriate proxy for the flyover concept included in the current Comprehensive Plan.

Figure 5-10. Alternative 6 (N. Beauregard Underpass – No Left Turns at N. Beauregard/ Little River Turnpike)

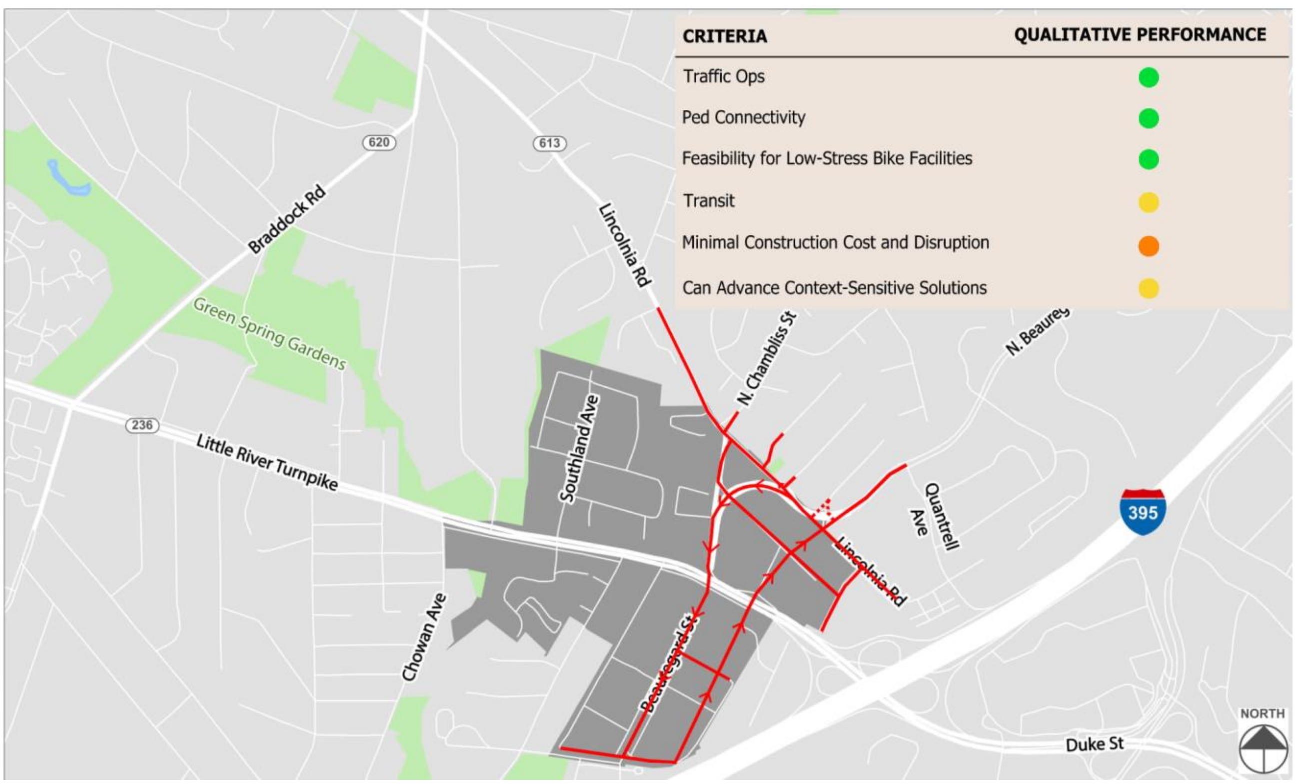


5.1.3 Selection of Six Alternatives

An internal in-person work session was conducted with the FCDOT staff on May 9, 2018 to present these alternatives and qualitative performance assessments. The vision established by the Task Force calls for a transportation network that is walkable and can create opportunities for bicycle friendly (i.e., low-stress) facilities while also adequately providing capacity for all modes. The alternatives with street grids generally address this concern, as the grids help distribute vehicular traffic relatively well while also being relatively simple to implement and sensitive to a more walkable context. As a result, urban-type grid concepts were preferred and advanced over non-grid alternatives.

There were concerns with the proposed network alternatives' ability to address traffic congestion issues. As such, a new alternative that focused on a system of one-way streets was created to provide better traffic operations. This new alternative is labeled as Alternative 1c and is depicted in **Figure 5-11**. It is very similar to Alternatives 1a and 1b in that it includes a similar grid of streets.

Figure 5-11. Alternative 1c (Full Grid – Oasis Extension with One-Way Pairs)



However, in this scenario, the new Oasis extension and existing Beauregard Street serve as one-way pairs to eliminate some of the signal phases and increase intersection capacity along Little River Turnpike and the direct connection for Beauregard to connect across Little River Turnpike is preserved. This alternative is expected to perform well across several criteria, including traffic, pedestrian, and bicycle criteria; however access and local circulation for vehicles may be a challenge due to the one-way street system.

Further it was seen that eliminating the curved section of N. Beauregard Street would result in several additional turn movements that would pose traffic operational challenges due to the one-way streets, especially with regards to accommodating traffic coming from north of the CBC towards N. Beauregard Street. These changes would likely result in the minimization of travel benefits from this alternative, therefore the curved section of N. Beauregard Street was maintained in this option.

5.1.3.1 Selected Six Alternatives

Based on the feedback provided by FCDOT and internal discussions and the guidance principles outlined above, the following six (6) alternatives were selected for a preliminary evaluation using Synchro, with the objective of selecting two of the alternatives for a detailed evaluation using VISSIM. The selected alternatives generally include grids of streets or grid-type network for the CBC and allow for future development, particularly east of Beauregard Street.

- ***Alternative 1***: Full Grid – Oasis Extension as 2-lane Street
- ***Alternative 2***: Full Grid – Oasis Extension as 4-lane Road
- ***Alternative 3***: Full Grid – Oasis Extension with One-Way Pairs
- ***Alternative 4a***: Partial Grid – Oasis Extension as 4-lane Road
- ***Alternative 4b***: Partial Grid – Oasis Extension as 4-lane Road with U-Turn
- ***Alternative 5***: Quadrant Roadway with Southern Grid

5.1.4 Refined 2040 Transportation Network Alternatives

To provide more insights into the alternatives, additional analyses were performed for the six alternatives. The Comprehensive Plan land use was assumed for these analyses and used to develop preliminary traffic volumes for each alternative. Analyses for each alternative include refined traffic assessments using Synchro software and spatial analyses of average block lengths to conduct a high-level assessment of pedestrian connectivity. As these analyses were preliminary, only intersections within the core of the CBC were studied. Based on these analyses and further refinements, the qualitative performance for each criterion has been updated for each alternative.

Six (6) alternatives were presented to the Lincolnia Task Force, including the results of the assessments criteria described above. The two preferred alternatives selected by the Task Force for detailed analysis are identified at the end of this section.

5.1.4.1 Alternative 1: Full Grid – Oasis Extension as 2-lane Street

Synchro intersection delay results were assessed for the weekday peak hours and are shown in **Figure 5-12** for this alternative. Several intersections are still expected to operate with a level-of-service (LOS) E or worse under this alternative. As the traffic operations may not perform well, the traffic ops qualitative performance was refined to the “orange” category. Alternative 1 and its expected performance are also depicted in **Figure 5-12**. As noted earlier, the assessment was conducted based on the relative performance of each alternative (i.e., relative to one another).

5.1.4.2 Alternative 2: Full Grid – Oasis Extension as 4-lane Road

Synchro intersection delay results for this alternative are shown in **Figure 5-13**. The intersection LOS results are consistent with results of Alternative 1, but intersection delays are partially alleviated by the added vehicular capacity.

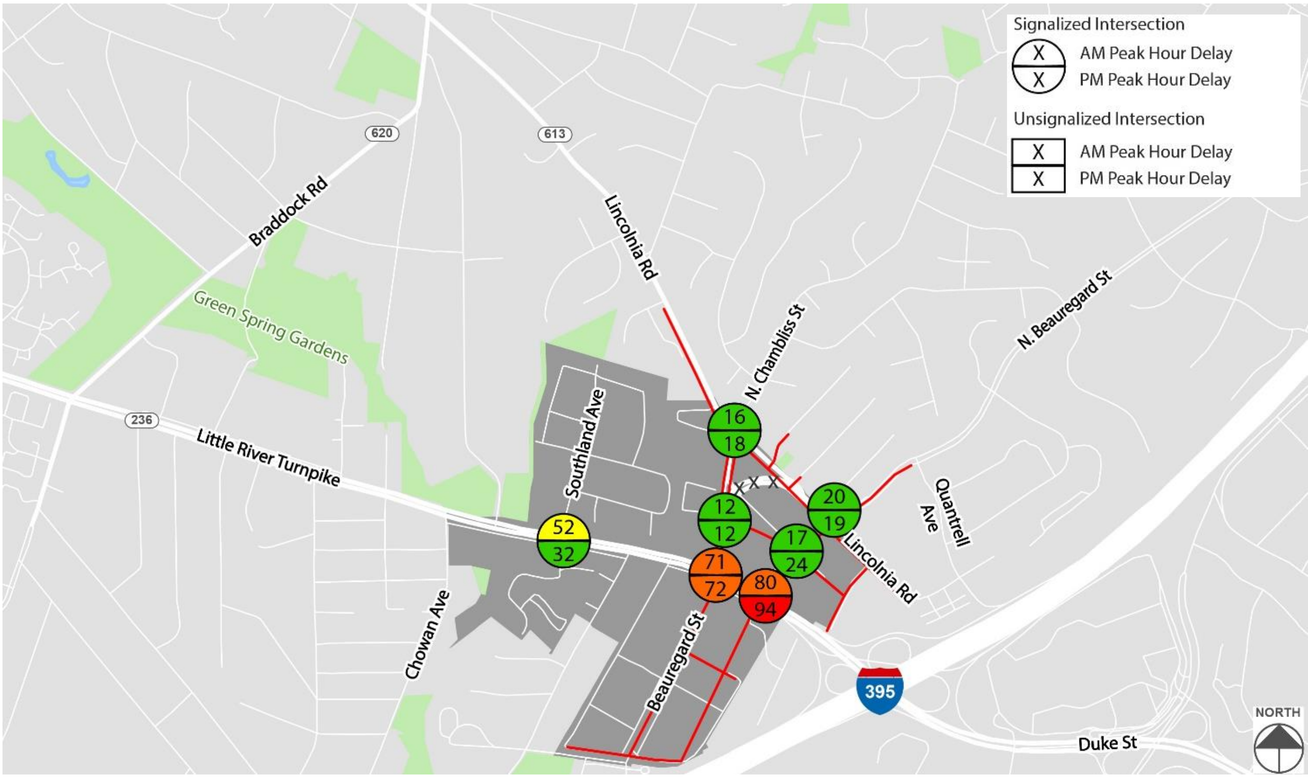
As the traffic and transit operations may perform well, the traffic operations and transit qualitative performance were refined to the “yellow” category. Prior to conducting Synchro analyses, it was expected this alternative would likely perform well with both criteria. Alternative 2 and its expected performance are depicted in **Figure 5-13**.

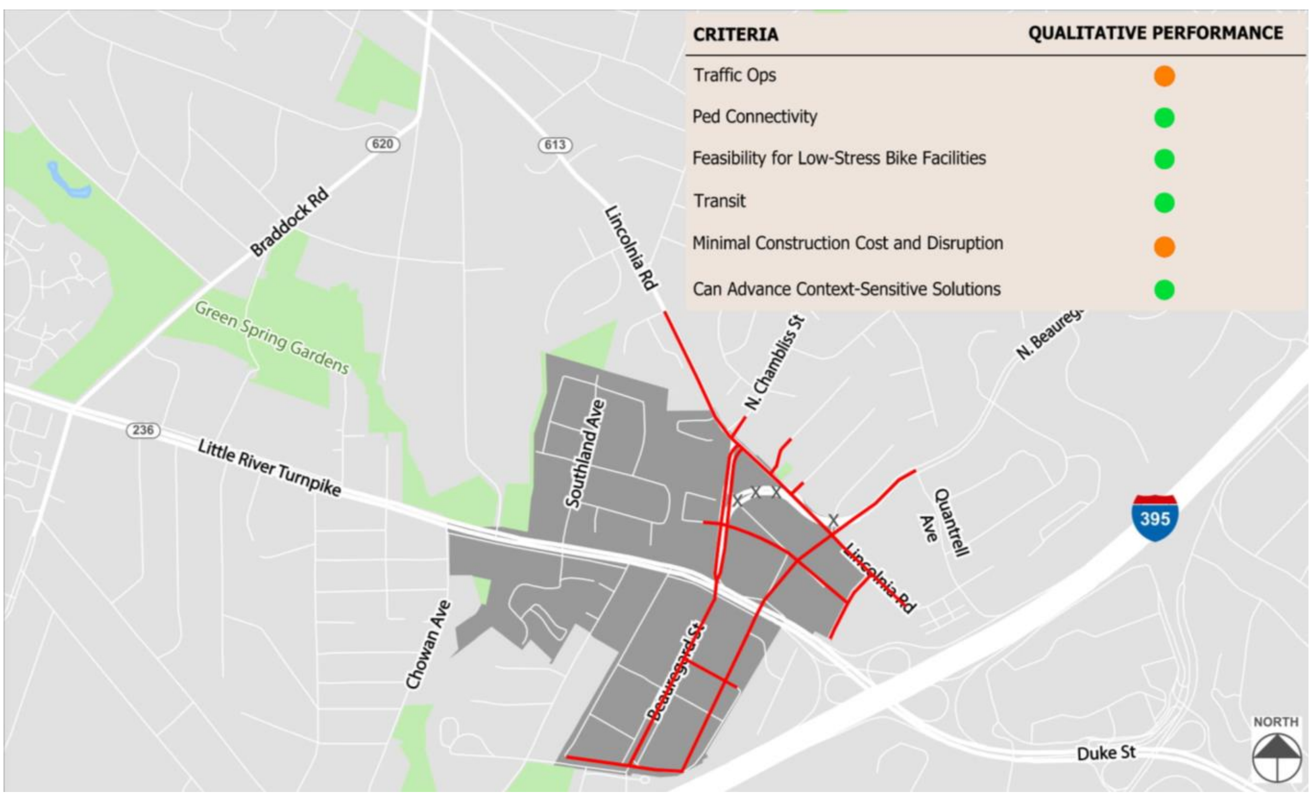
5.1.4.3 Alternative 3: Full Grid – Oasis Extension with One-Way Pairs

Synchro intersection delay results for this alternative are shown in **Figure 5-14.** The intersection LOS results show an improvement from Alternatives 1 and 2, although several intersections are expected to operate at LOS E, especially in the PM peak hour.

The qualitative performance of this option reflects these Synchro analyses, with traffic, pedestrian, and bicycle criteria expected to perform better than Alternative 2. While pedestrian connectivity is expected to perform well, other factors may affect pedestrians with this alternative. For example, this option concentrates right-and-left turning movements at intersections, which could create greater pedestrian conflicts. Overall, the grid system does improve pedestrian connectivity in the CBC. The sketch for Alternative 3 and its expected performance are also depicted on **Figure 5-14.**

Figure 5-12. Alternative 1 Synchro Results and Refined Assessment (Full Grid – Oasis Extension as 2-lane Street)





5.1.4.4 Alternative 4a: Partial Grid – Oasis Extension as 4-lane Road

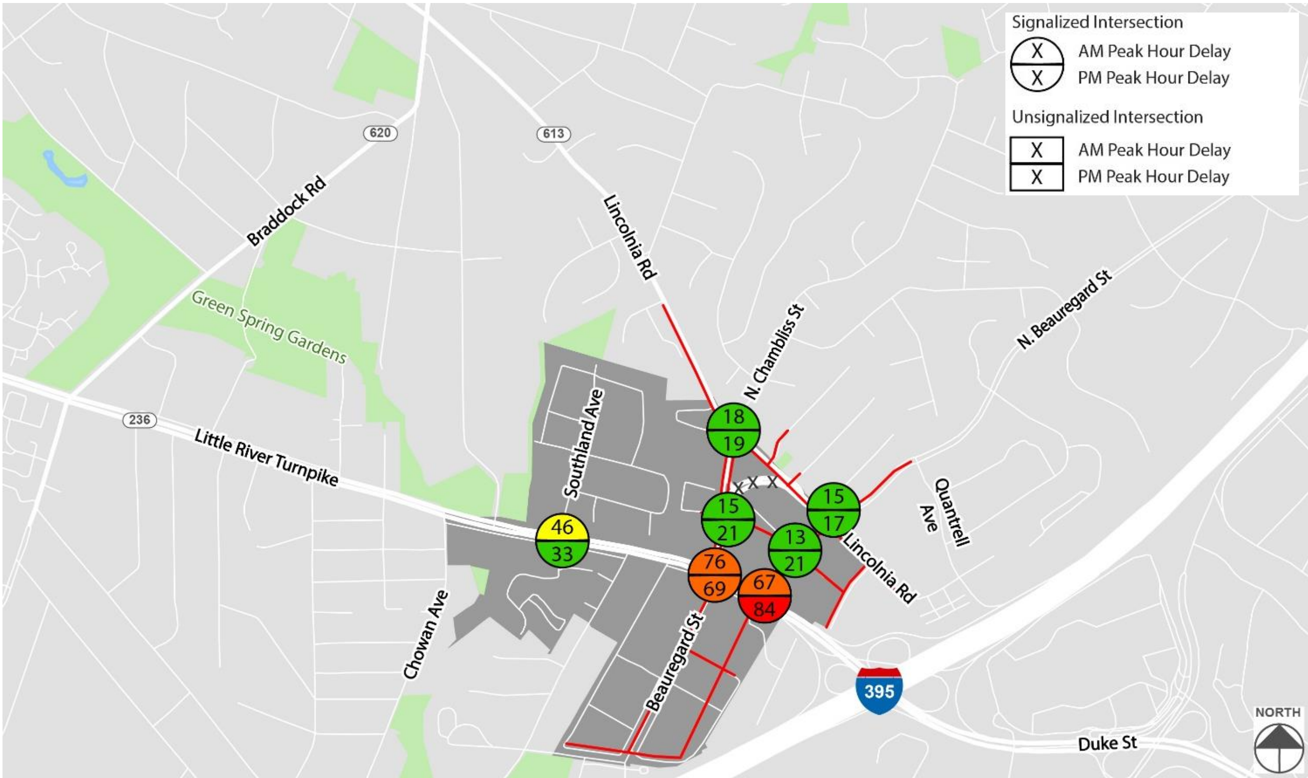
Synchro intersection delay results for this alternative are shown on **Figure 5-15.** Several intersections are still expected to operate with LOS E or worse under this alternative. The qualitative performance of this option was therefore refined to reflect reduced performance for traffic and transit criteria. Alternative 3 and its expected performance are also depicted on **Figure 5-15**.

In testing Alternative 4a, WBL restrictions on Little River Turnpike at Oasis Drive and N. Beauregard Street show an improvement in traffic operations. To allow these movements to occur away from the congested intersections, a partial median U-turn (MUT) could be implemented at Southland Avenue. This alternative is discussed as Alternative 4b.

5.1.4.5 Alternative 4b: Partial Grid – Oasis Extension as 4-lane Road with Partial MUT

Synchro intersection delay results for this alternative are shown on **Figure 5-16.** The intersection LOS results show an improvement from previous alternatives at Little River Turnpike/N Beauregard intersection, although several intersections are expected to operate at LOS E, including the intersection of Little River Turnpike/Southland Avenue due to the high U-turn volume in the westbound direction. As shown on **Figure 5-16**, the qualitative performance is consistent with Alternative 4a except for improved traffic operations.

Figure 5-13. Alternative 2 Synchro Results and Refined Assessment (Full Grid – Oasis Extension as 4-lane Road)



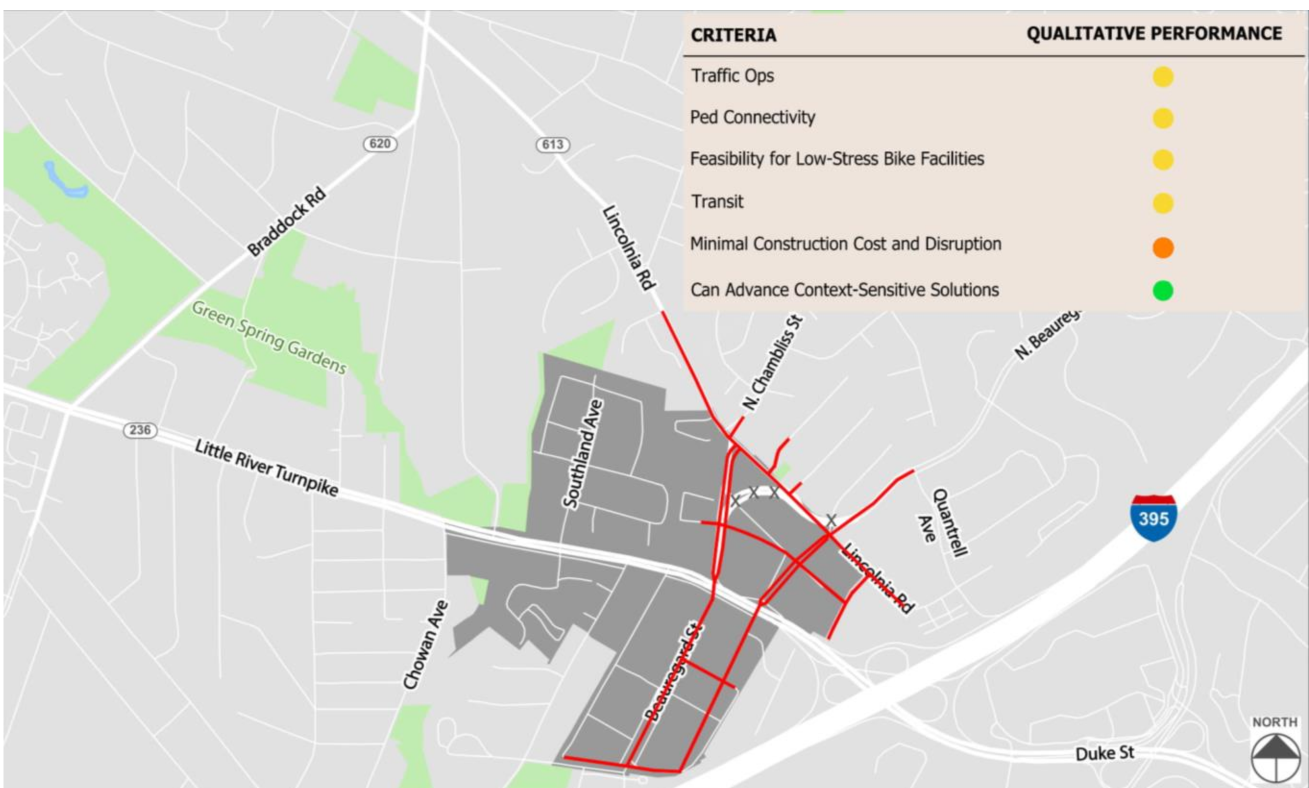
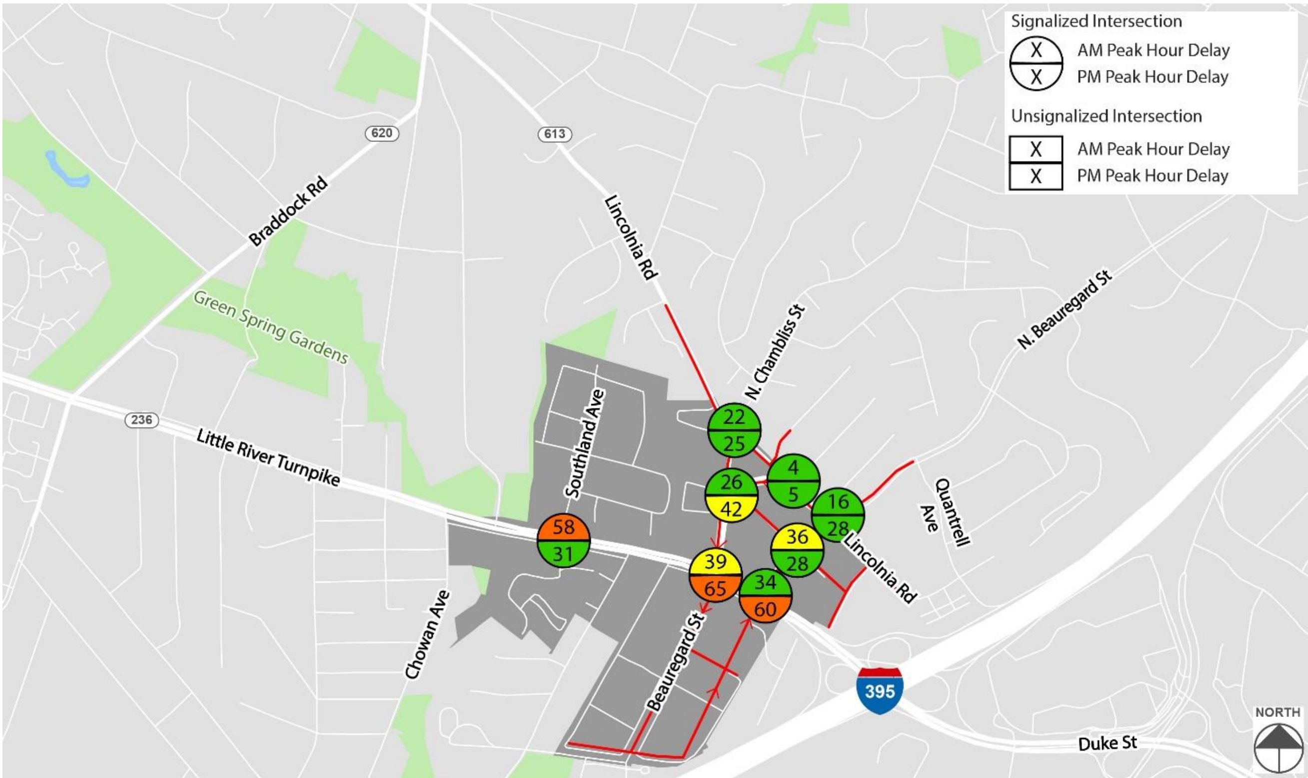


Figure 5-14. Alternative 3 Synchro Results and Refined Assessment (Full Grid – Oasis Extension with One-Way Pairs)



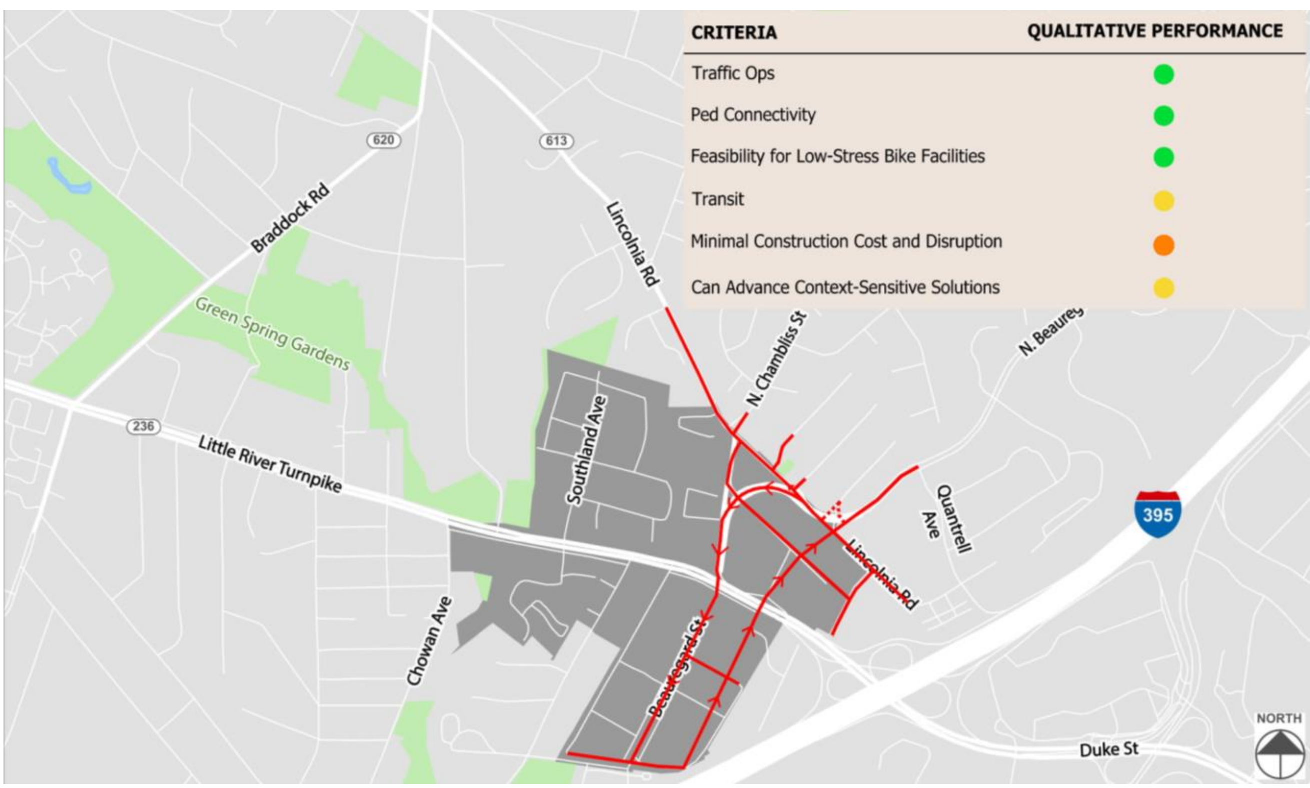
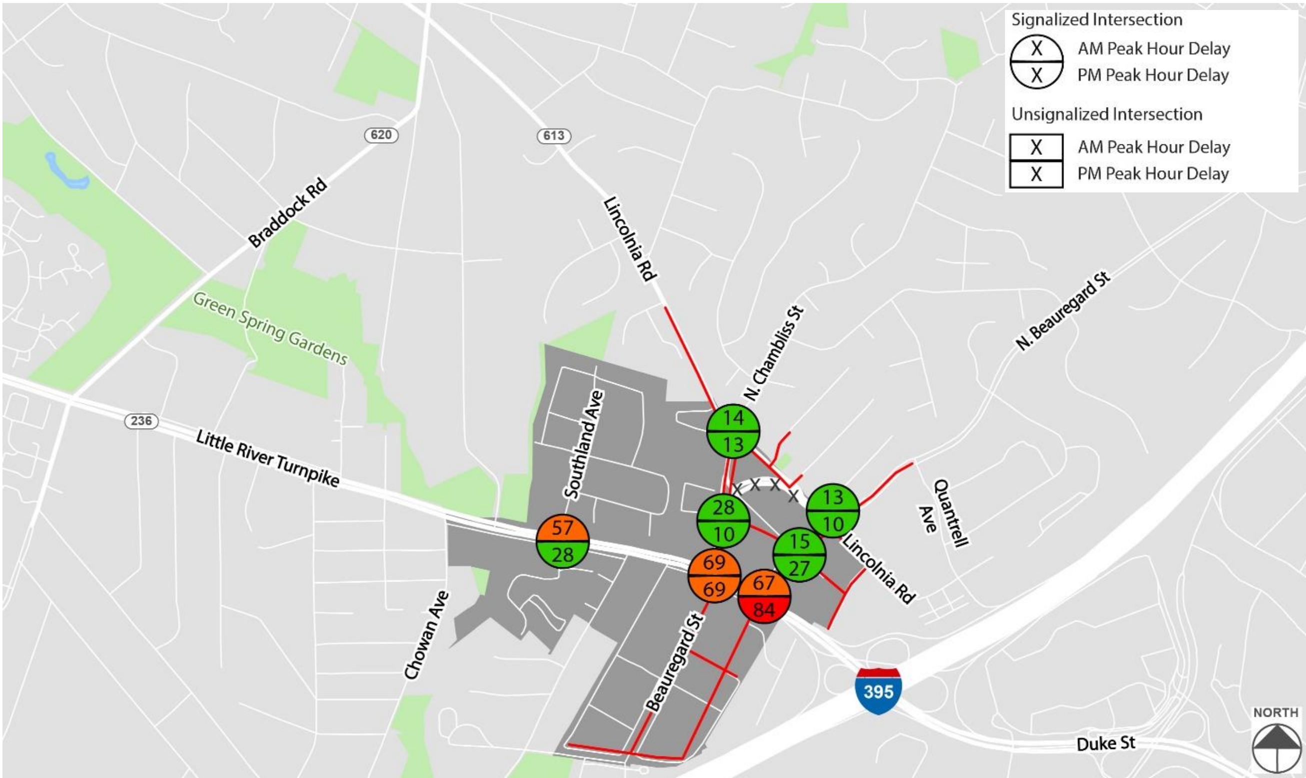


Figure 5-15. Alternative 4a Synchro Results and Refined Assessment (Partial Grid – Oasis Extension as 4-lane Road)



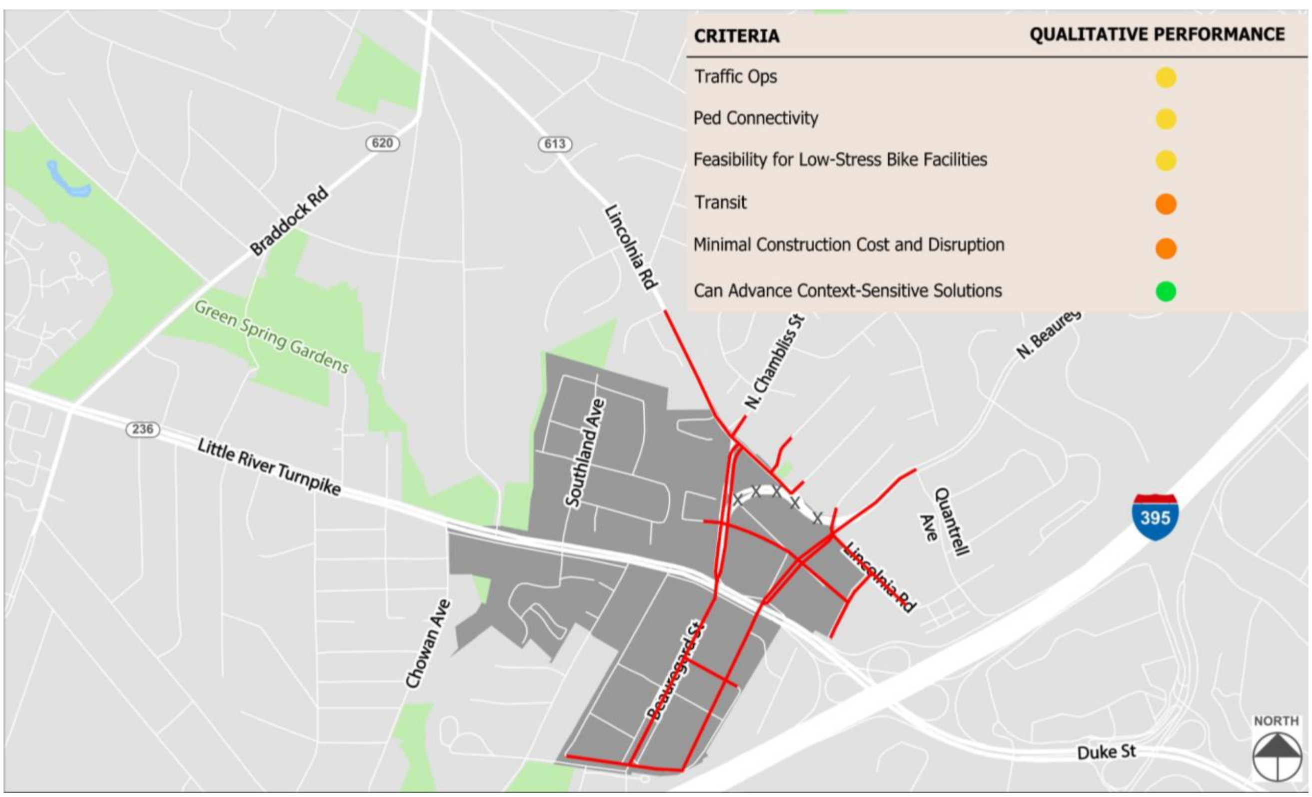
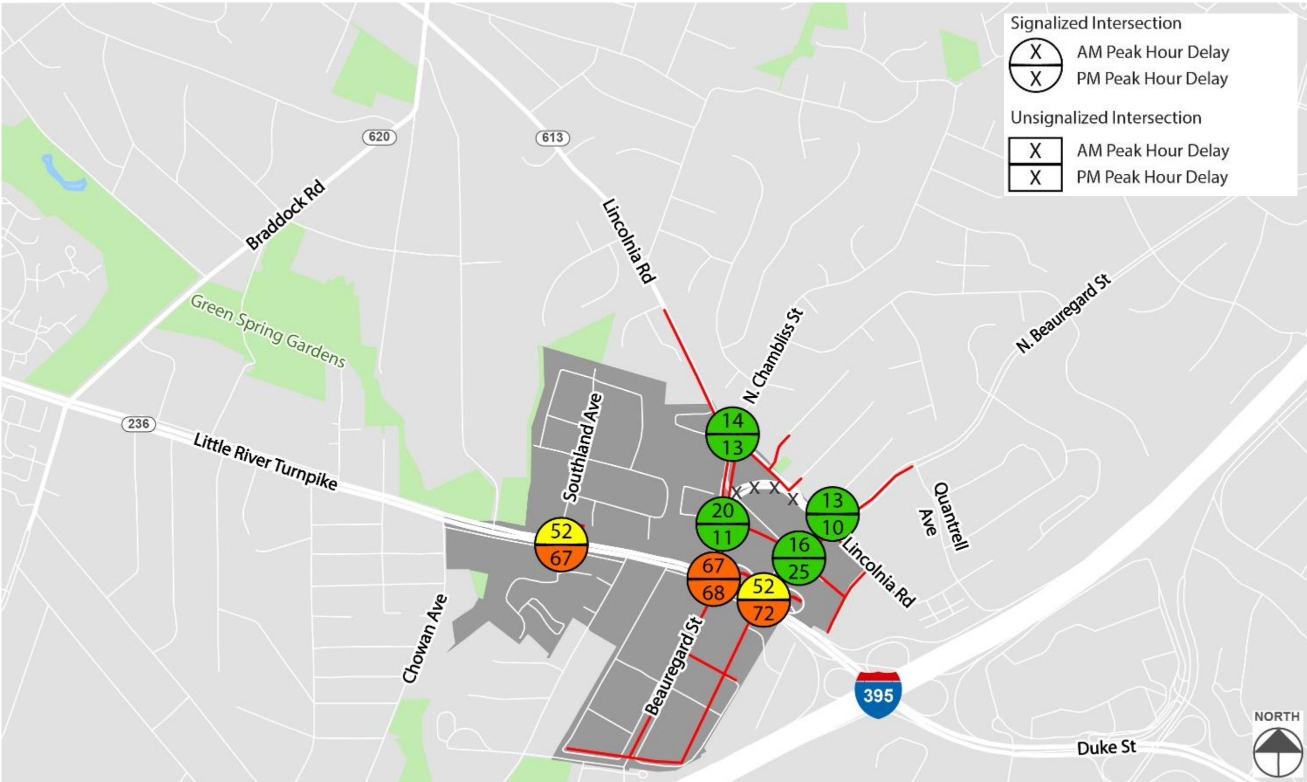
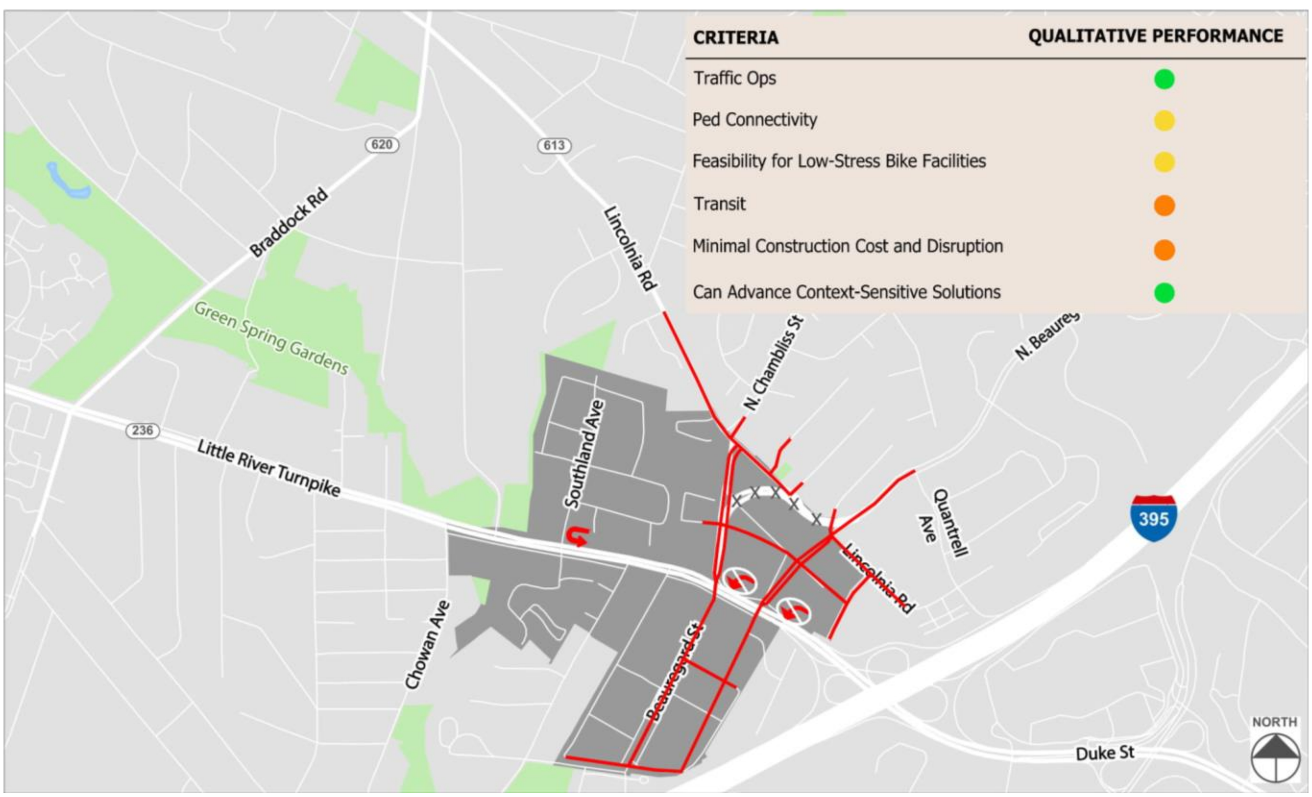


Figure 5-16. Alternative 4b Synchro Results and Refined Assessment (Partial Grid – Oasis Extension as 4-lane Road with Partial MUT)

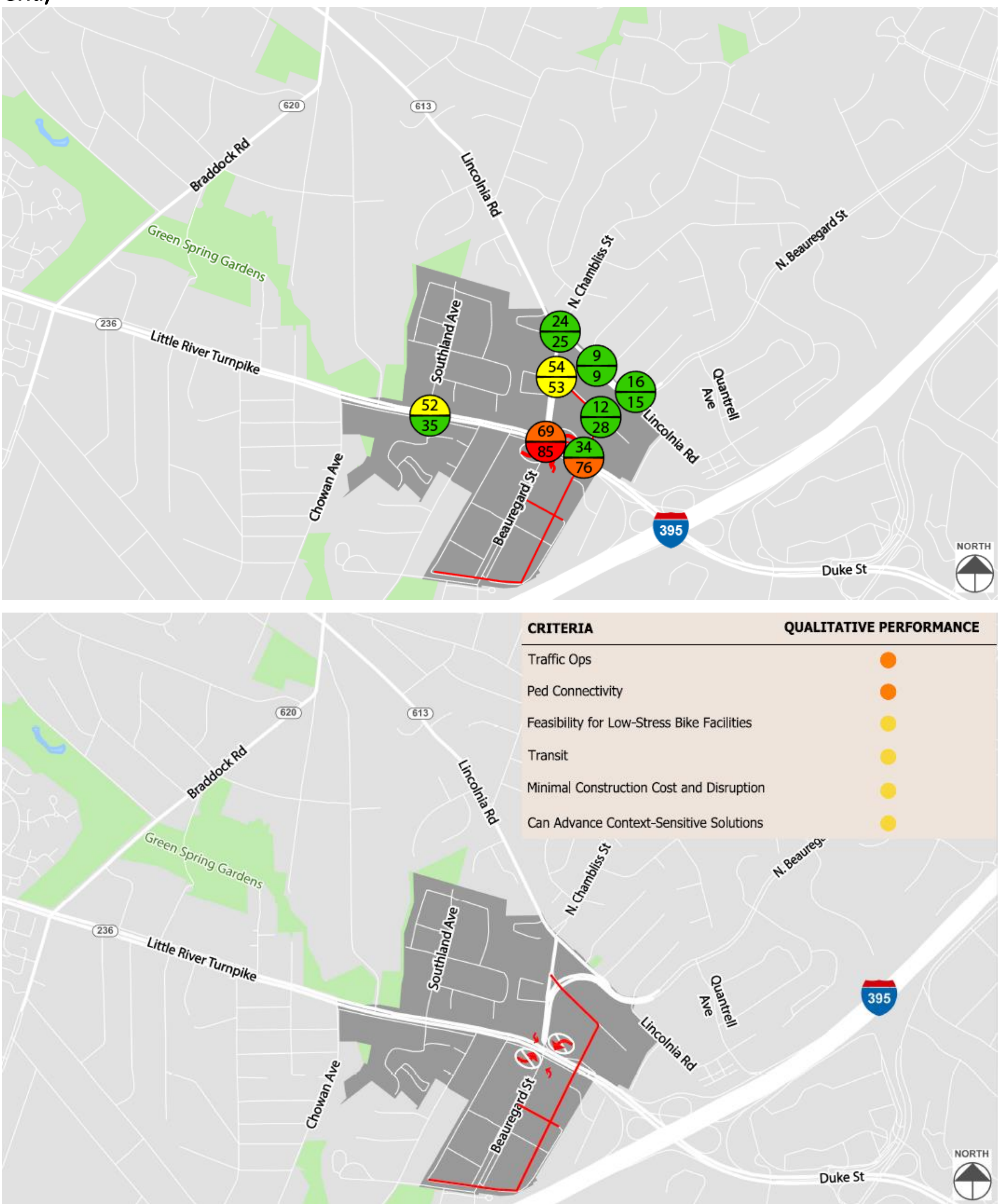




5.1.4.6 Alternative 5: Quadrant Roadway with Southern Grid

Synchro intersection delay results were assessed for the weekday peak hours and are shown on **Figure 5-17** for this alternative. Several intersections are still expected to operate with LOS E or worse under this alternative, which is consistent with previous thinking on how traffic operations would perform.

Figure 5-17. Alternative 5 Synchro Results and Refined Assessment (Quadrant Roadway with Southern Grid)



Based on spatial analyses of expected block length, this alternative is expected to provide the least pedestrian connectivity. To reflect this, the qualitative performance for pedestrian connectivity was downgraded. Alternative 5's expected performance is also depicted on **Figure 5-17.**

5.1.4.7 Alternatives Comparison: Block Length Analysis

Spatial analyses were conducted in the CBC subarea where there will be more development potential and roadway changes to determine the changes in average block length for each alternative as a way of assessing pedestrian connectivity. The CBC subarea generally encompasses the area where the new grid network is proposed and is depicted on **Figure 5-18.**

The new roadway networks were drawn for each alternative using ArcGIS. To provide a comparison for baseline conditions, Alternative 0 (2040 Baseline Network) was used to represent the 2040 baseline roadway conditions. As shown in **Table 5-1**, all alternatives are expected to reduce average block length, potentially reducing walking distances and improving pedestrian connectivity. In general, the alternatives provide similar improvements with respect to average block length when compared to each other. The percent change realized under Alternative 5 is less pronounced, but the remaining alternatives are roughly equal in comparison.

Figure 5-18. Block Length Study Area

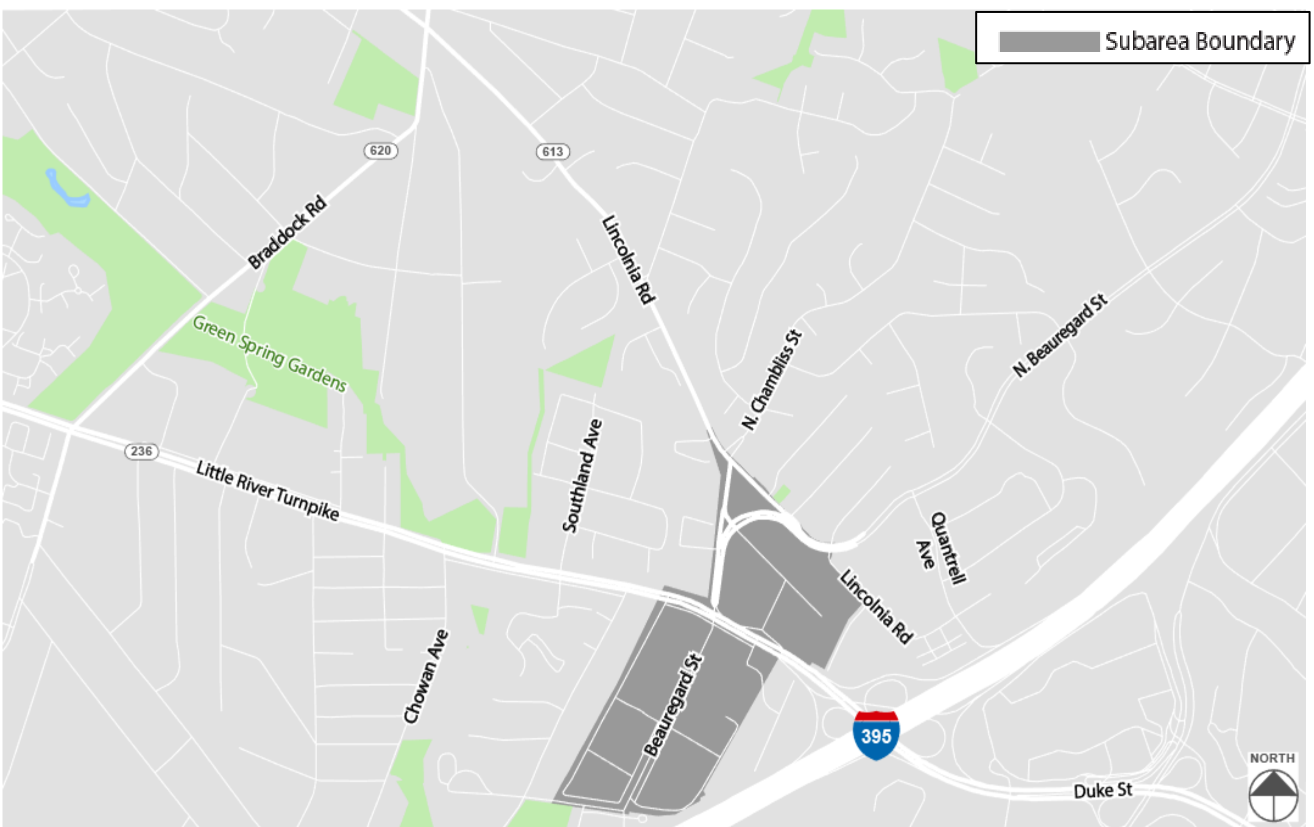


Table 5-1. Average Block Length Summary

Alternative	Average Block Length (ft)	% Change from Alternative 0
Alternative 0: 2040 Baseline	537	-
Alternative 1: Full Grid – Oasis Extension as 2-lane Street	491	9%
Alternative 2: Full Grid – Oasis Extension as 4-lane Road	491	9%
Alternative 3: Full Grid – Oasis Extension with One-Way Pairs	496	8%
Alternative 4a: Partial Grid – Oasis Extension as 4-lane Road*	491	9%
Alternative 5: Quadrant Roadway with Southern Grid	505	6%

*Alternative 4a and 4b has the same geometry and block spacing. Therefore, results are only shown for Alternative 4a.

5.1.4.8 Alternatives Assessment Summary

These alternatives and qualitative performance assessments were presented to the Lincolnia Task Force on June 12, 2018. **Table 5-2** was presented to the Lincolnia Task Force to compare the alternatives and identify two preferred alternatives for more detailed analyses.

Table 5-2. Alternatives Comparison

CRITERIA	Alt 1	Alt 2	Alt 3	Alt 4a	Alt 4b	Alt 5
Traffic Ops	🟠	🟡	🟢	🟡	🟢	🟠
Ped Connectivity	🟢	🟡	🟢	🟡	🟡	🟠
Feasibility for Low-Stress Bike Facilities	🟢	🟡	🟢	🟡	🟡	🟡
Transit	🟢	🟡	🟡	🟠	🟠	🟡
Minimal Construction Cost and Disruption	🟠	🟠	🟠	🟠	🟠	🟡
Can Advance Context-Sensitive Solutions	🟢	🟢	🟡	🟢	🟢	🟡

The Task Force showed a general preference towards grid alternatives since they support the vision for the study area. The Task Force believed that the one-way pair concept (Alternative 3) should be analyzed in detail as it has the most potential to improve traffic operations while generally performing well in other categories. Alternative 1 was the second preferred alternative. As shown above in the comparison matrix, while Alternative 1 may not be able to address the issue of traffic congestion completely, it performed well in most other categories. Further, Alternative 1 helped create a transportation network that would support the vision of the Lincolnia CBC. As a result, the following two alternatives were identified as the preferred alternatives:

- ***Alternative 1***: Full Grid – Oasis Extension as 2-lane Street
- ***Alternative 3***: Full Grid – Oasis Extension with One-Way Pairs

These alternatives are advanced into detailed VISSIM analysis in Task 4.2 as discussed in the next section. However, there was concern that Alternative 1 would not be able to accommodate the level of vehicle traffic necessary. To address this potential issue, Alternative 2, which adds more capacity and improves traffic operations, was also included into the detailed analysis as a third alternative.

5.2 2040 TRANSPORTATION NETWORK ANALYSIS (TIER 2)

Detailed VISSIM analyses were conducted for the selected alternatives. In addition to these alternatives, both the Task Force and FCDOT expressed interest in analyzing Alternative 2 (Full Grid – Oasis Extension as 4-lane Road) as there were concerns about Alternative 1's capability to address traffic issues in the network.

5.2.1 Guiding Principles for the Analysis of Transportation Alternatives

Through initial sensitivity testing of the PM peak hour conditions in VISSIM (the critical peak with the highest traffic volumes), Alternative 1 was found to yield inadequate operational results with very high vehicular delay at several intersections. As a result, Alternative 2, which provides additional north-south capacity, was considered and analyzed in detail in VISSIM both for the AM and PM peak hours. No further analyses were performed for Alternative 1 for the AM peak hour and this alternative was not carried forward.

5.2.1.1 Refined Assessment

Similar to the preliminary assessment done in Tier 1, the alternatives were assessed based on the criteria developed with the Goals, Objectives, and MOE's **(Section 2)**. Performance for the criteria are symbolized as:

- ***Green*** – Will likely perform well
- ***Yellow*** – May perform well
- ***Orange*** – May not perform well
- ***Red*** – Will likely not perform well

It should be noted that the assessment was based on the performance of each alternative relative to one another. For example, if an alternative is likely to improve traffic operations compared to the other 2040 Network scenarios, even though it may not be able to alleviate traffic congestion completely, a green category was assigned for that alternative for traffic operations.

5.2.1.2 Development of 2040 Traffic Volumes for Each Alternative

The projected intersection volumes (based on the travel demand model and the NCHRP methodology) developed for the 2040 Baseline Conditions **(Section 4)** was used as the basis during this task. To develop projected intersection volumes for each alternative, 2040 Baseline Conditions **(Section 4)** volumes were manually reassigned onto the roadway networks for each alternative based on link capacities and engineering judgment. For Alternative 1, for example, lower vehicular volumes were assumed on the Oasis Drive extension to account for the reduced capacity and the desire to limit traffic traveling through the CBC. Alternative 2, on the other hand was assigned a larger percentage of traffic than Alternative 1, due to the additional through lanes (and capacity) assumed for the Oasis extension. The assumed traffic volumes for each alternative are presented in subsequent sections of this memorandum with the results of the detailed traffic analysis.

5.2.2 Network Assumptions

As models were developed in VISSIM, further network assumptions were required for refining each transportation alternative. This was done in order to prevent extreme congestion, where the network was oversaturated and queues extending beyond the simulation boundaries in all directions. These network assumptions are described as follows:

5.2.2.1 Alternative 1 (Full Grid – Oasis Extension as 2-lane Street) Network Assumptions

The number of lanes assumed along with the peak hour vehicular volumes at each intersection is shown in **Figure 5-19.** The following key assumptions were made for Alternative 1:

- For pedestrians crossing Little River Turnpike, crosswalks were assumed only on the west legs of the Beauregard Street and Oasis Drive (consistent with the existing conditions).
- Westbound left turns were prohibited at the Little River Turnpike/Oasis Drive intersection to increase eastbound green time and limit queue spillback to the Little River Turnpike/Beauregard Street intersection.

The existing cycle lengths (200 seconds for the AM and 210 seconds for the PM) were maintained for the existing intersections. Half cycle lengths were assumed at the new adjacent intersections.

5.2.2.2 Alternative 2 (Full Grid – Oasis Extension as 4-lane Road) Network Assumptions

The number of lanes assumed and the peak hour vehicular volumes for each intersection is shown in **Figure 5-20**. Key network assumptions for Alternative 2 are summarized below:

- Westbound left turns were prohibited at the Little River Turnpike/Oasis Drive intersection to increase eastbound green time and limit queue spillback to the Little River Turnpike/Beauregard Street intersection.
- Dual westbound left turn lanes were assumed at the Little River Turnpike/Beauregard Street intersection.
- For the PM peak, the existing cycle lengths of 210 seconds were maintained for the intersections on Little River Turnpike. It was assumed that adjacent intersections would operate with half cycles (105 seconds).

- For the AM peak, the cycle lengths for intersections on Little River Turnpike were reduced to 170 seconds. It was assumed the adjacent intersections would operate with half the cycle length (85 seconds).

5.2.2.3 Alternative 3 (Full Grid – Oasis Extension with One-way Pairs) Network Assumptions

The peak hour traffic volumes developed for this alternative and the lane configurations are shown in **Figure 5-21.** The following assumptions were made in refining the Alternative 3 transportation network:

- For pedestrians crossing Little River Turnpike, crosswalks were assumed only on the west leg of the Beauregard Street and Little River Turnpike intersection. This assumption was made to take advantage of one-way operation and eliminate signal phasing that would otherwise be required to provide pedestrian crossings on the east leg.
- For the PM peak, intersection cycle lengths on Little River Turnpike were reduced from 210 seconds to 150 seconds to reduce pedestrian delay. It was assumed that adjacent intersections would operate with half cycle lengths (75 seconds).
- For the AM peak, intersection cycle lengths on Little River Turnpike were reduced from 200 seconds to 140 seconds to reduce pedestrian delay. It was assumed that adjacent intersections would operate with half cycle lengths (70 seconds).

Figure 5-19. Alternative 1 (Full Grid – Oasis Extension as 2-lane Street) Traffic Volumes

Figure 5-20. Alternative 2 (Full Grid – Oasis Extension as 4-lane Road) Traffic Volumes

Figure 5-21. Alternative 3 (Full Grid – Oasis Extension with One-way Pairs) Traffic Volumes

5.2.3 Traffic Operations

The results of the VISSIM analysis for all three alternatives are discussed below. These results focus on traffic operations during the AM and PM peak hours.

5.2.3.1 Alternative 1 (Full Grid – Oasis Extension as 2-lane Street) Network Results

Weekday 2040 PM peak hour intersection level of service (LOS) for the study intersections and average intersection delay for Alternative 1 are depicted in **Figure 5-22** and **Figure 5-23**, respectively. It should be noted only PM conditions were analyzed as they represent the worst-case scenario. Therefore, only PM peak hour conditions are presented here. After the analysis of the PM conditions, it was concluded that the transportation network is unable to accommodate traffic demand or address traffic concerns. Key findings from the detailed analysis of Alternative 1 are summarized as follows:

- Five signalized intersections operated at LOS E or worse during the PM peak hour;
- The Little River Turnpike/Beauregard Street intersection experienced a notable level of congestion with a PM peak hour average intersection delay of 99 seconds; and
- Queues originating from the Little River Turnpike/Beauregard Street intersection spilled onto the adjacent intersections, causing higher delays and degraded intersection performance at the surrounding intersections.

Figure 5-22. Alternative 1 (Full Grid – Oasis Extension as 2-lane Street) Level of Service

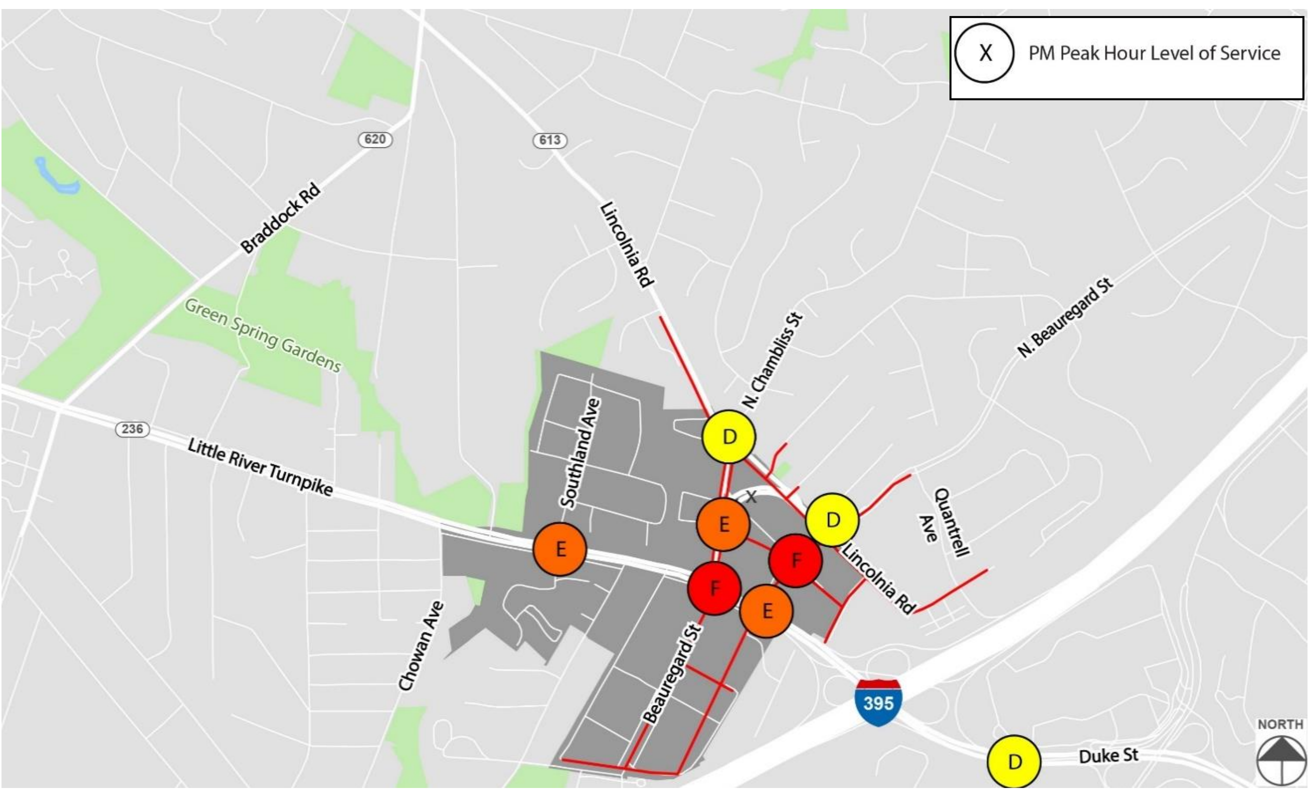
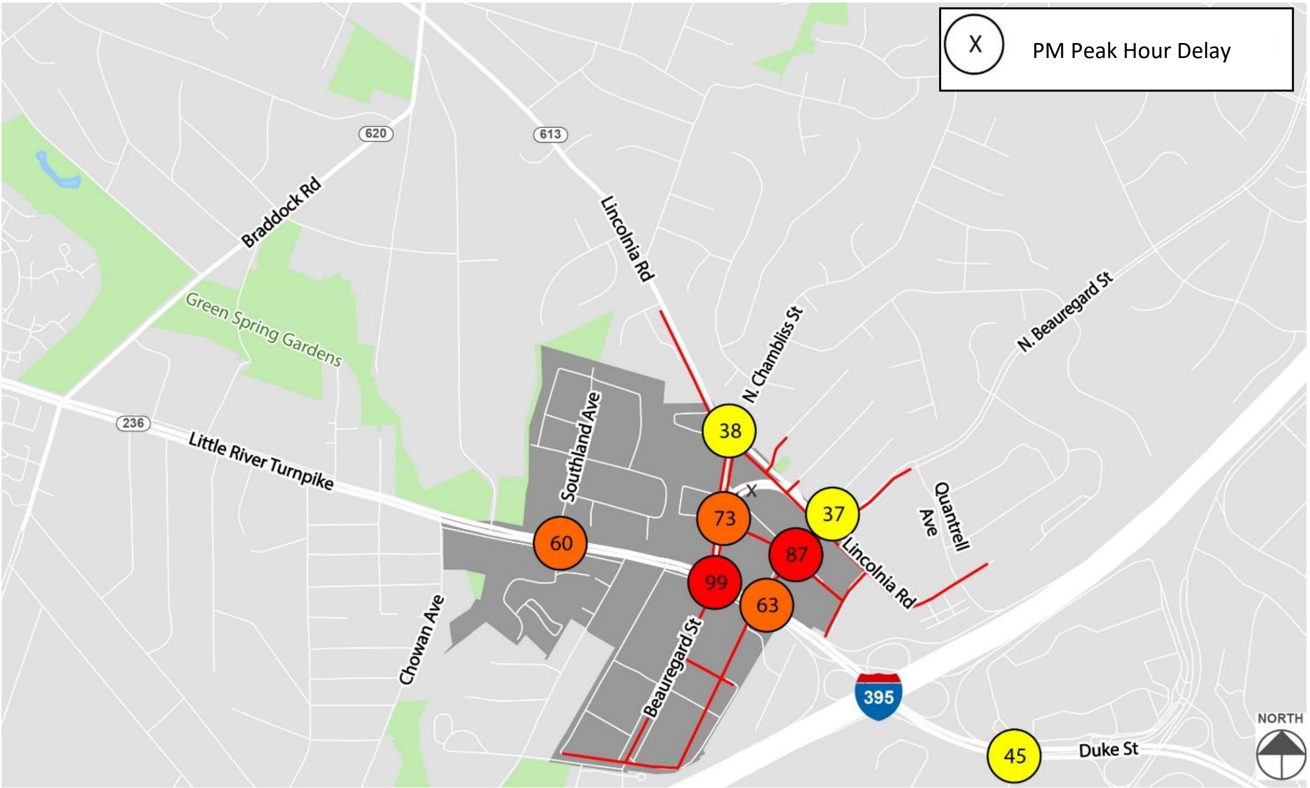


Figure 5-23. Alternative 1 (Full Grid – Oasis Extension as 2-lane Street) Delay



Detailed intersection performance results including vehicle delay by movement and by approach, and maximum queue length by movements are provided in **Appendix 4**.

5.2.3.2 Alternative 2 (Full Grid – Oasis Extension as 4-lane Road) Network Results

Weekday 2040 peak hour intersection level of service (LOS) for the study intersections and average intersection delay for Alternative 2 are depicted in **Figure 5-24** and **Figure 5-25**, respectively. Key findings from the detailed analysis of Alternative 2 are summarized as follows:

- With the additional capacity on Oasis Extension, traffic conditions improve considerably in the network. Three signalized intersections operate at LOS E or worse during the PM peak hour;
- While the Little River Turnpike/Beauregard Street intersection still operates with LOS F, intersection delay is reduced from 99 seconds under Alternative 1 to 90 seconds during the PM peak hour;
- The issue of queue spillback from Little River Turnpike/Beauregard Street intersection to neighboring intersections are less pronounced, resulting in reduction in intersection delay, especially in the PM peak hour. For example, intersection delay at the Beauregard Street/Chambliss Street intersection reduced from 127 seconds in the True Baseline scenario to 24 seconds under Alternative 2; and
- All intersections operate at LOS D or better during the AM peak hour.

Figure 5-24. Alternative 2 (Full Grid – Oasis Extension as 4-lane Road) Level of Service

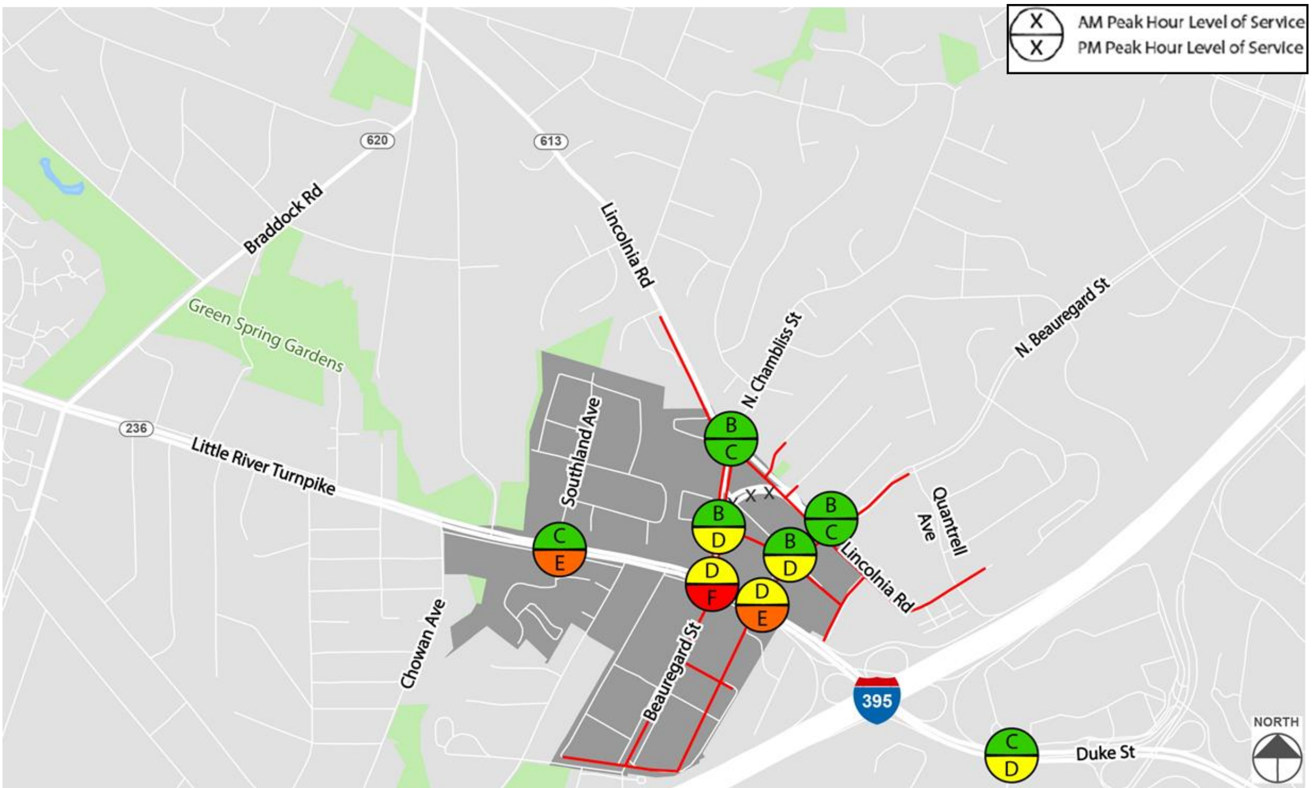
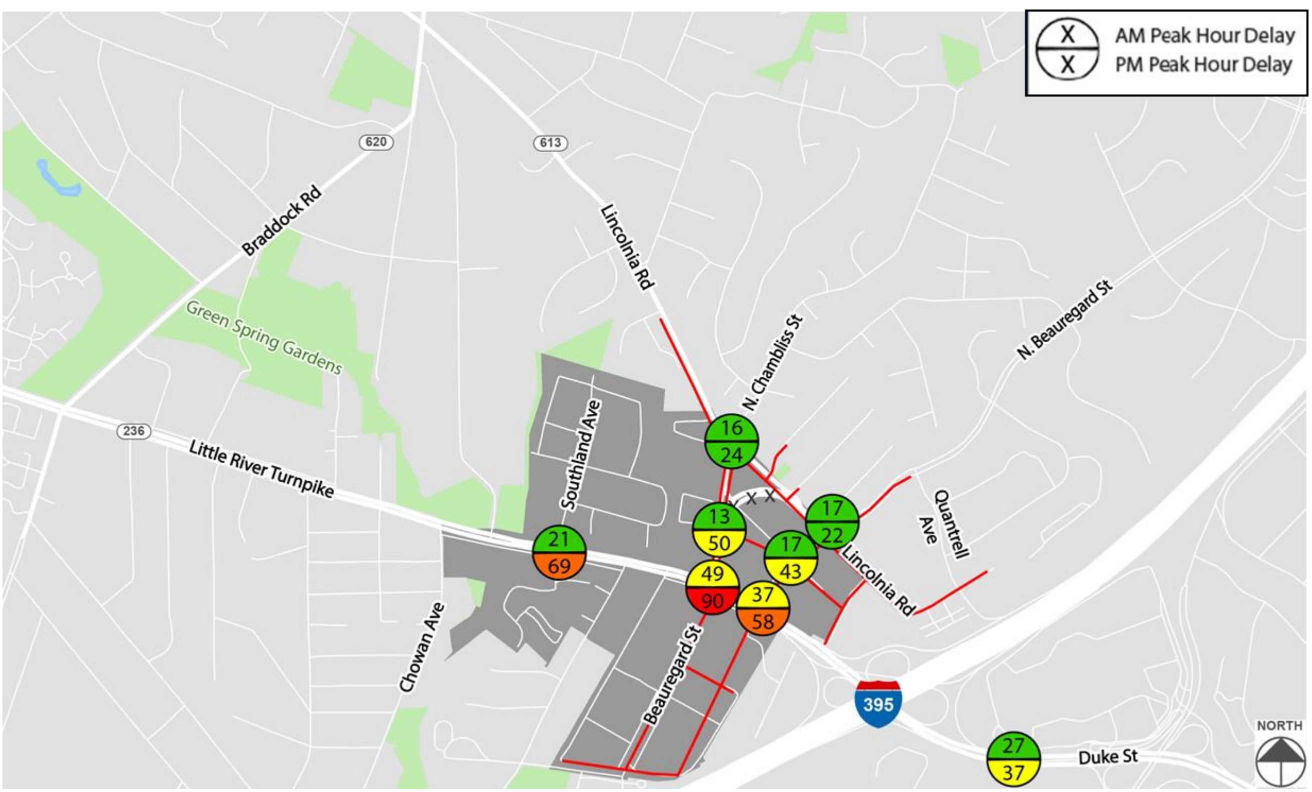


Figure 5-25. Alternative 2 (Full Grid – Oasis Extension as 4-lane Road) Delay



While there are still intersections that operate with LOS E or worse during the PM peak hour, it was determined this alternative would still be preferable to Alternative 1. Potential mitigation measures to improve traffic conditions for this alternative were prepared. These measures included:

- Removing the crosswalk on the east leg of the Little River Turnpike/Beauregard Street intersection to provide additional green time for other conflicting phases,
- Restricting left turns from Little River Turnpike to the south and adding a median U-Turn at Southland Avenue,
- Rerouting Little River Turnpike left turns through potential jughandles,
- Developing strategies to reduce auto dependency and decrease automobile trips such as improving transit conditions, promoting mixed-use development, and designing for active transportation modes.

These potential measures could be analyzed in future tasks should this network alternative be identified for further analysis. Detailed intersection performance results for Alternative 2 including vehicle delay by movement and by approach, and maximum queue length by movements are provided in **Appendix 4**.

5.2.3.3 Alternative 3 (Full Grid – Oasis Extension with One-Way Pairs) Network Results

Weekday 2040 peak hour intersection level of service (LOS) for the study intersections and average intersection delay for Alternative 3 are depicted in **Figure 5-26** and **Figure 5-27**, respectively. Key findings from the Alternative 3 detailed analysis are summarized as follows:

- All signalized intersections operate at LOS E or better during the PM peak hour;
- Intersection delay at the Little River Turnpike/Beauregard Street intersection is reduced substantially during the PM peak hour compared to Alternative 1 (99 seconds vs. 73 seconds) and Alternative 2 (90 seconds vs. 73 seconds); and
- Some of the intersections in the network experience higher delay (e.g., Beauregard Street and Chambliss intersection has 58 seconds of delay under Alternative 3 during PM compared to 50 seconds under Alternative 2). This can be explained by the fact that one-way pair results in higher traffic volumes at certain intersections due to the limited circulation and fewer roadway/ alternatives; and
- All intersections operate at LOS C or better during the AM peak hour.

Detailed intersection performance results for Alternative 3 including vehicle delay by movement and by approach, and maximum queue length by movements are provided in **Appendix 4**.

Figure 5-26. Alternative 3 (Full Grid – Oasis Extension with One-Way Pairs) Level of Service

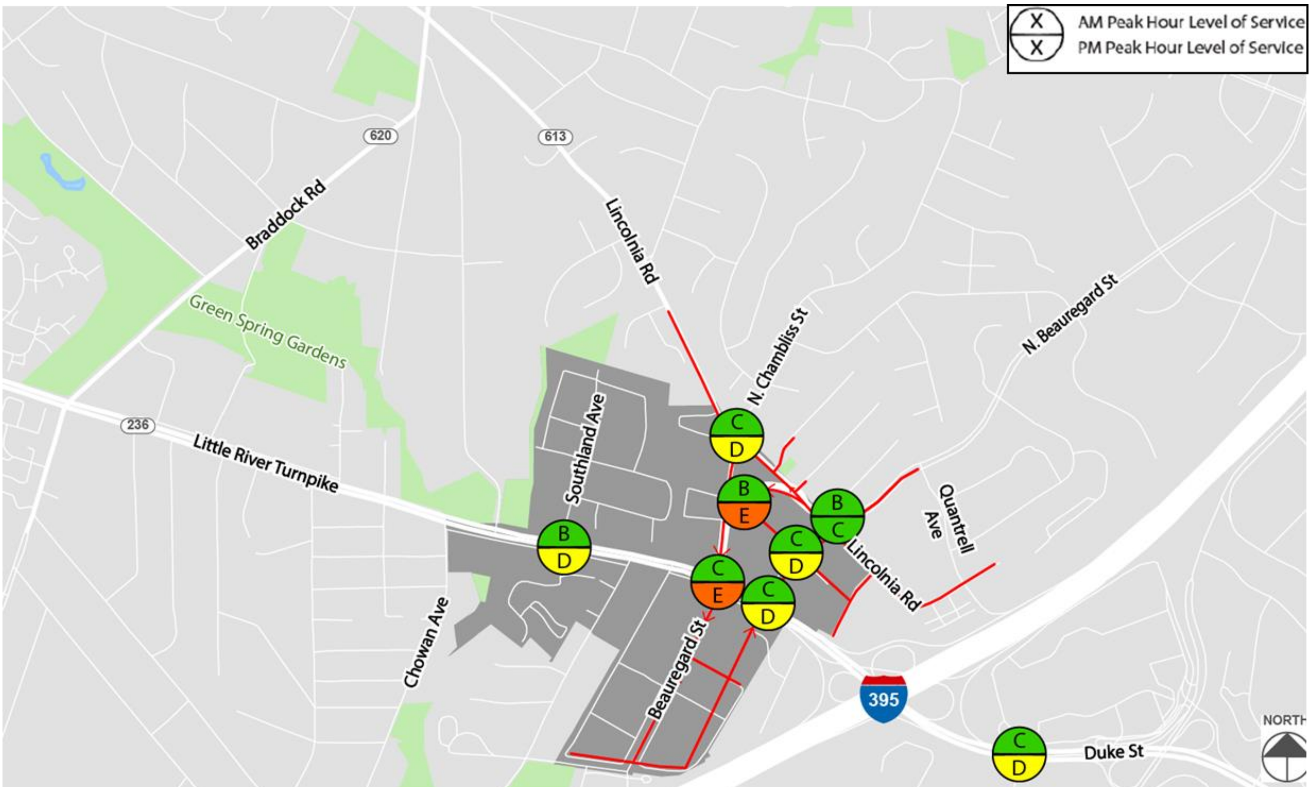
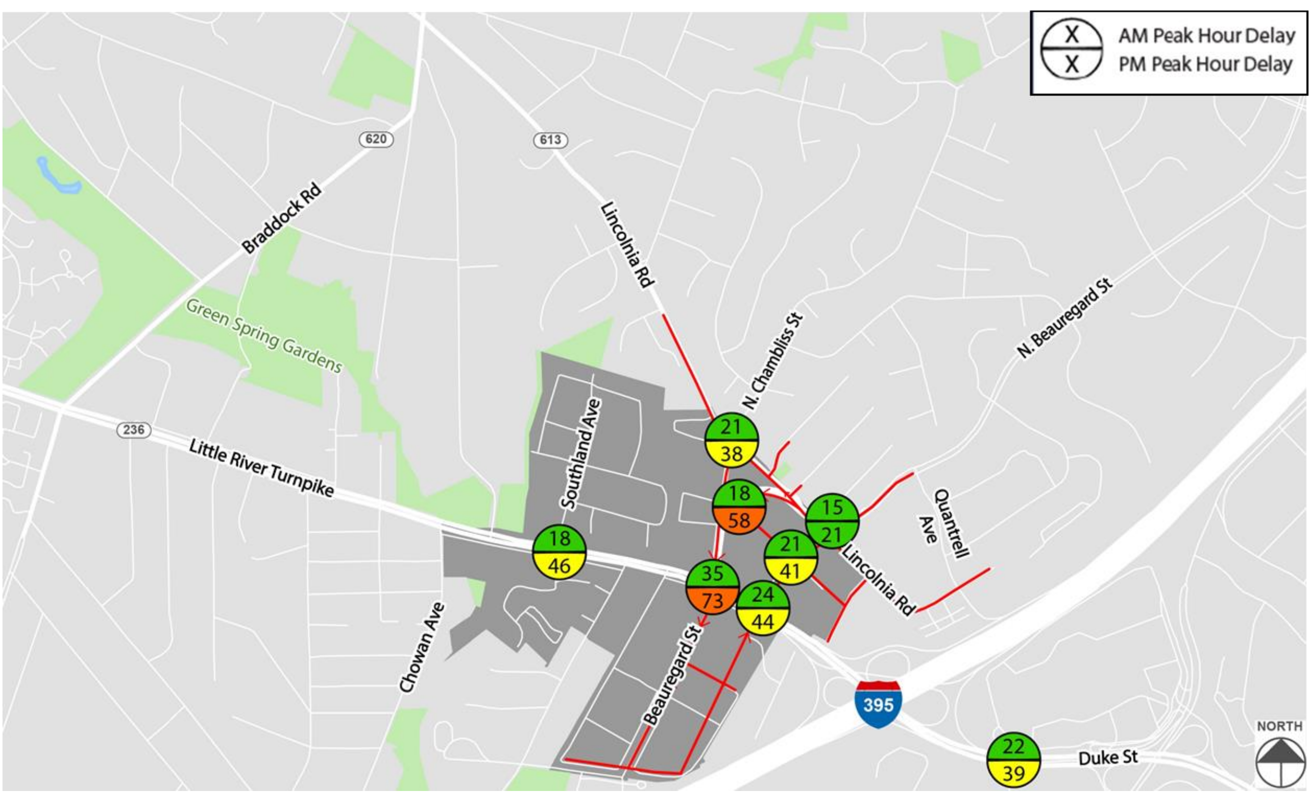


Figure 5-27. Alternative 3 (Full Grid – Oasis Extension with One-Way Pairs) Delay



5.2.3.3.1 Alternative 3 (Full Grid – Oasis Extension with One-Way Pairs) Crosswalk Test

To take full advantage of one-way concepts on traffic operations, the east leg crosswalk was eliminated at Little River Turnpike/N. Beauregard Street intersection. While this alternative does perform better from a vehicular standpoint, the elimination of the existing crosswalk on the east leg of the Little River Turnpike/Beauregard Street intersection is not ideal. To understand the trade-offs to vehicular performance if this crosswalk is retained, a supplemental analysis was performed assuming the crosswalk is not eliminated. The following assumptions were made in conducting the analysis:

- Only the PM peak hour was analyzed since PM is the critical peak hour;
- A cycle length of 210 seconds was assumed consistent with the existing cycle length, the True Baseline, and Alternative 2;
- Pedestrian crosswalks were assumed on all legs of the intersection; and
- 20 pedestrians per hour were assumed crossing on the east leg to make sure there is a pedestrian call approximately every cycle (to assess the worst-case traffic conditions). Note that this was the same assumption followed for other scenarios.

The results of this analysis (with the crosswalk) are presented in **Table 5-3**, along with the original results for Alternative 3 (without the crosswalk). As shown in the table, providing the crosswalk significantly degrades traffic operations at several intersections in the study area. While retaining this crosswalk may be preferable for pedestrian accommodations, the impact on vehicular operations is significant.

Table 5-3: Crosswalk Test Intersection Level of Service (and Vehicle Delay) Comparison

Intersection	Delay / LOS	
	Alternative 3 (without the east leg crosswalk)	Alternative 3 – Test (with the east leg crosswalk)
Southland Ave & Little River Tnpk	46/ D	**82 / F**
Beauregard St & Little River Tnpk	**73/ E**	**93 / F**
Oasis Drive & Little River Tnpk	44/ D	50 / D
Walker St & Duke St	39 / D	36 / D
N. Chambliss St & Beauregard St	**58 / E**	**76 / E**
N. Chambliss St & Lincolnia Rd	38 / D	44 / D
Lincolnia Rd/Gloucester Rd & Beauregard St	21 / C	23 / C
Oasis Extension at Plaza	41 / D	53 / D

5.2.4 Alternatives Comparison

The results of the detailed analysis were compared for the three network alternatives. A comparison of the network performance measures is also included.

5.2.4.1 Alternatives Assessment Summary

The results of the detailed analysis were presented to the Task Force on July 24, 2018. **Table 5-4** was presented to the Task Force to provide a comparison of alternatives.

Table 5-4: Comparison of Network Alternatives

Criteria	Alt 1	Alt 2	Alt 3
Traffic Ops	🔴	🟠	🟢
Ped Connectivity	🟡	🟠	🟠
Feasibility for Low-Stress Bike Facilities	🟢	🟡	🟢
Transit	🟢	🟡	🟡
Minimal Construction Cost and Disruption	🟠	🟠	🟠
Can Advance Context-Sensitive Solutions	🟡	🟢	🟡

Alternative 1 does not perform as well from a vehicular perspective. While Alternative 3 does perform well compared to Alternative 2, one-way street systems do have drawbacks related to access and circulation and in certain cases heavy turn volumes conflicting with pedestrians. It should also be noted there may be opportunities to improve the vehicular performance of Alternative 2 by pursuing mitigation measures.

5.2.4.2 Network Performance Measures

Table 5-5 provides a comparison of the AM and PM network performance measures under the Existing, Comprehensive Plan (Comp Plan), Modified Comprehensive Plan (Modified Comp Plan), True Baseline, and three Alternative scenarios. Note no results are shown for Alternative 1 during the AM peak hour.

While the alternatives, particularly in the PM, may not appear to perform significantly better than the Existing, Comp Plan, or Modified Comp Plan scenarios from a vehicular delay perspective, other performance measures provide context. For example, the number of total vehicles served is substantially higher for the alternatives compared to the Existing conditions. In addition, both Alternative 2 and Alternative 3 reduce the number of vehicles that were unable to enter the network (denied vehicles) along with their associated delay, indicating queues are more bounded within the network under the alternatives. Furthermore, results show considerable reduction in average pedestrian delay for the three alternatives due to the reduction in intersection cycle lengths, both in the AM and PM peak hours.

Table 5-5: Comparison of Network Performance Measures

Scenario	Avg Vehicle Delay (s/veh)	Avg Ped Delay (s/ped)	Total Vehicles Served*	Delay for Vehicles Unable to Enter the Network (veh.hrs)	Demand for Vehicles Unable to Enter the Network (vehs)**
AM Peak Hour					
Existing	65.7	78.3	8,251	2.8	11
Comp Plan	112.6	78.4	10,239	71.7	176
Modified Comp Plan	163.5	52.9	9,283	105.8	300
True Baseline	146.6	52.6	9,654	40.0	138
Alternative 1 – Full Grid Oasis Extension as 2 lane street	-	-	-	-	-
Alternative 2 - Full Grid Oasis Extension as 2 lane road	90.9	42.1	10,008	2.0	8
Alternative 3 – Full Grid Oasis Extension with one-way pairs	69.3	33.5	10,076	0.9	1
PM Peak Hour					
Existing	90.7	76.5	9,465	11.0	27
Comp Plan	110.5	78.4	11,446	135.9	295
Modified Comp Plan	155.0	67.6	10,012	275.4	601
True Baseline	155.4	58.3	11,014	187.2	461
Alternative 1 – Full Grid Oasis Extension as 2 lane street	156.3	53.0	11,182	146.6	351
Alternative 2 - Full Grid Oasis Extension as 2 lane road	139.5	53.8	11,394	83.6	230
Alternative 3 – Full Grid Oasis Extension with one-way pairs	122.5	40.4	11,457	35.3	92

* Indicates the total number of vehicles served during the analysis period. This measure is generally used as a proxy to network throughput when intersections are oversaturated.

** Indicates the number of unserved vehicles during the simulation due to very long queues, preventing vehicles from entering the simulation network.

Based on the comparison of alternatives and key findings, the Task Force selected Alternative 3 (one-way concept) and Alternative 2 (four-lane concept) to be analyzed under the alternative land use **(Section 6)**.

Section 6
2040 Alternative Land Use Analysis

6 2040 ALTERNATIVE LAND USE ANALYSIS

The analysis presented in this section assumes an updated 2040 land use identified by Fairfax County for the Lincolnia CBC that can support the vision established for the Lincolnia CBC and the future transportation networks identified and selected by the Task Force for future analyses previously. Analysis of these conditions will provide a comprehensive picture of future conditions from a transportation network perspective. The alternatives analyzed were as follows:

- Oasis Extension with One-Way Pairs with Alternative Land Use
- Oasis Extension as 4-Lane Road (traditional grid) with Alternative Land Use

To compare these Alternative 2040 Land Use scenarios, previous 2040 True Baseline and 2040 Transportation Network (with Comp Plan Land Use) analyses were used as a reference when appropriate.

6.1 2040 ALTERNATIVE LAND USE ASSUMPTIONS

Based on conversations with the Lincolnia Task Force and the intended vision for the area, Fairfax County Department of Planning & Zoning (DPZ), prepared an Alternative Land Use plan for the area through 2040. To provide an accurate comparison, the general land use changes between the current 2040 Comprehensive Plan and 2040 Alternative Land Use are summarized below in **Table 6-1**. It should be noted that numbers shown below are only for the CBC area.

Table 6-1. Current Comprehensive Plan and Alternative Land Use Comparison

Scenario	Non-Residential (Square Feet)				Residential (Dwelling Units)		
	Office	Retail	Industrial	Institution	Detached	Attached	Multi-family
Current Comprehensive Plan	98,400	586,300	0	0	0	0	0
Alternative Land Use	143,400	373,100	0	0	0	0	1,468
Change in Land Use	+45,000	-213,200	0	0	0	0	+1,468

As shown, the current CBC has no residential uses and is dominated by retail space, and the alternative land use increases residential uses considerably within the CBC with slight increase in office space and reduction in retail use.

6.2 2040 ALTERNATIVE TRANSPORTATION NETWORK ASSUMPTIONS

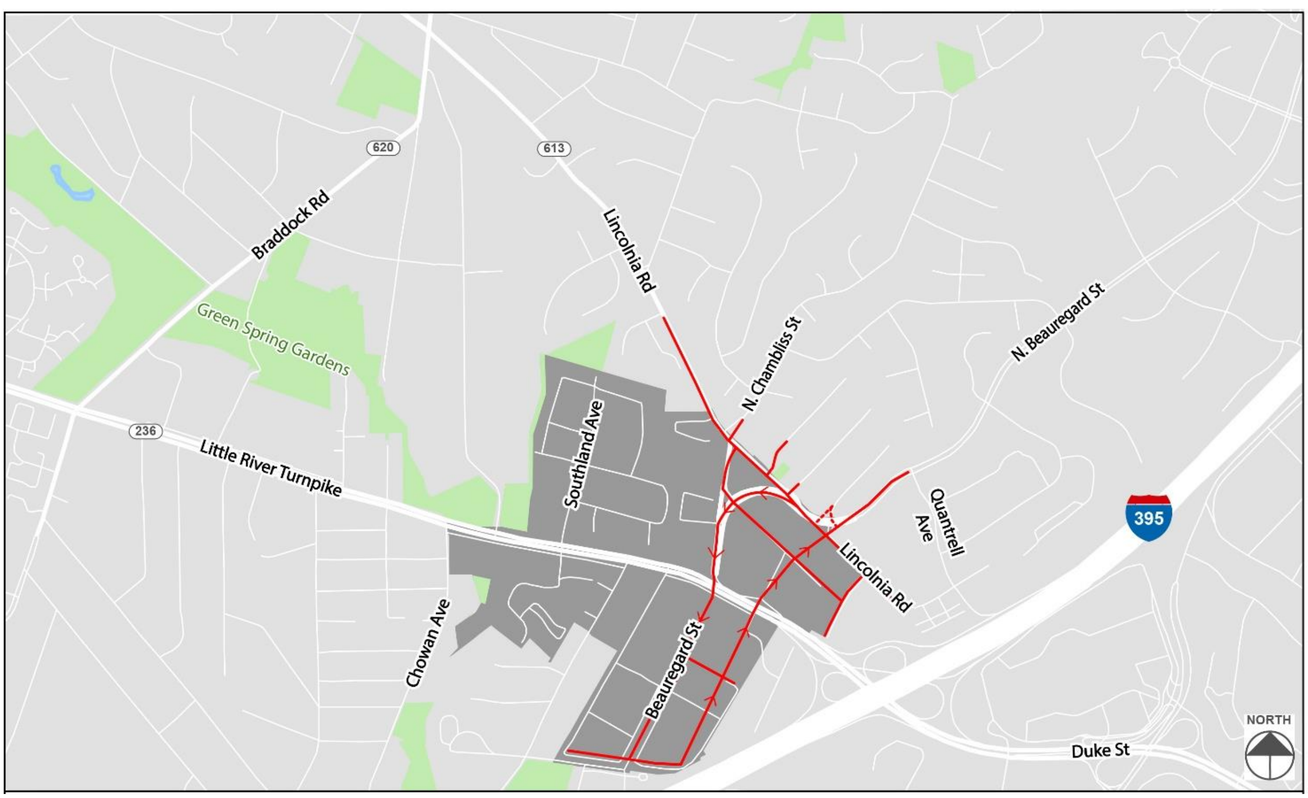
Before conducting the transportation analysis, it was necessary to establish key assumptions for the transportation alternatives to be analyzed. Changes to the transportation network for each alternative are described below.

6.2.1 Oasis Extension with One-Way Pairs

The first transportation alternative analyzed under the alternative land use was the Oasis Extension with One-Way Pairs network (**Figure 6-1**). The assumptions made in modeling the transportation network were consistent with assumptions made for the previous Development and Analysis of 2040 Transportation Alternatives **(Section 5)**:

- For pedestrians crossing Little River Turnpike, crosswalks were assumed only on the west leg of the Beauregard Street/Little River Turnpike intersection. This assumption was made to take advantage of the one-way operation and eliminate signal phasing that would otherwise be required to provide pedestrian crossings on the east leg.
- For the PM peak, intersection cycle lengths on Little River Turnpike were reduced from 210 seconds to 150 seconds to reduce pedestrian delay. It was assumed that adjacent intersections would operate with half cycle lengths (75 seconds).
- For the AM peak, intersection cycle lengths on Little River Turnpike were reduced from 200 seconds to 140 seconds to reduce pedestrian delay. It was assumed that adjacent intersections would operate with half cycle lengths (70 seconds).

Figure 6-1. Oasis Extension with One-Way Pairs



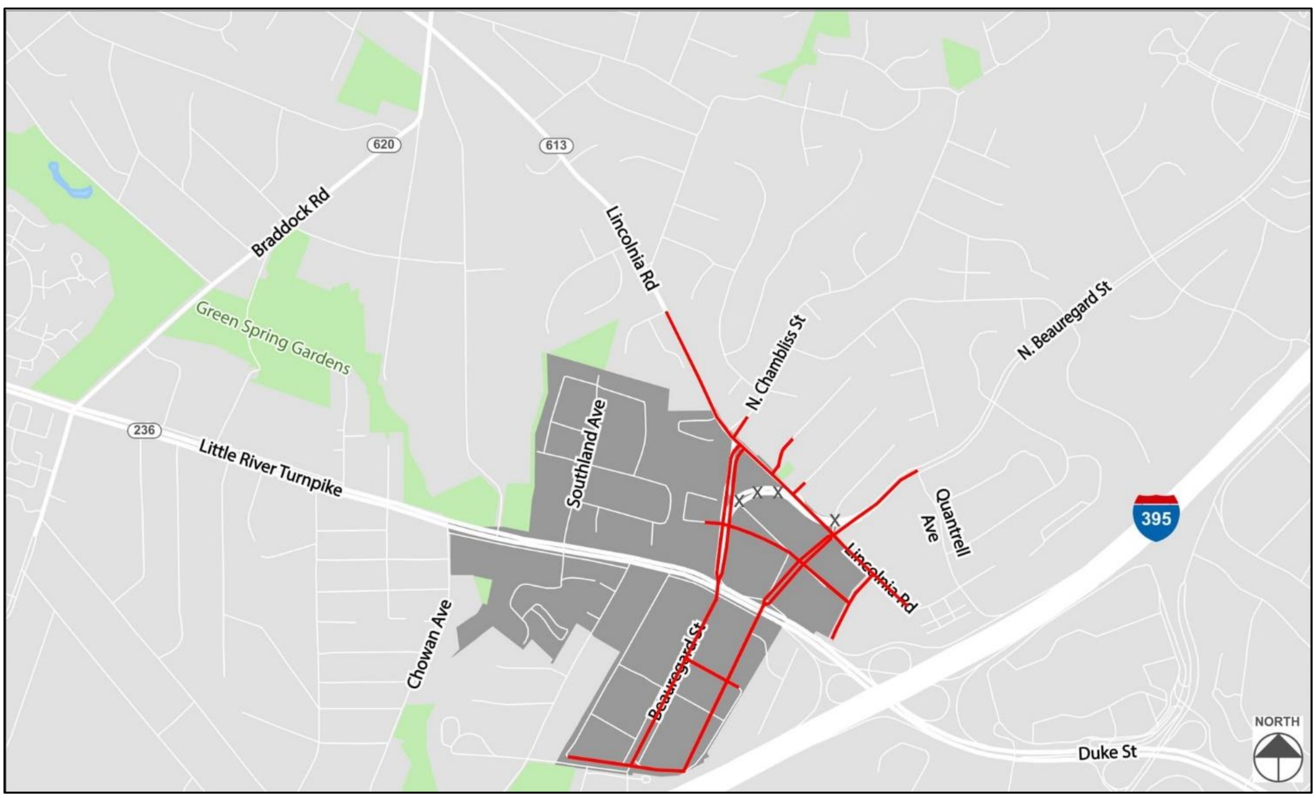
6.2.2 Oasis Extension as 4-Lane Road

The second transportation alternative analyzed was the Oasis Extension as 4-Lane Road network (**Figure 6-2**). The following assumptions were made in modeling the transportation network:

- Westbound left turns were prohibited at the Little River Turnpike/Oasis Drive intersection to increase eastbound green time and limit queue spillback to the Little River Turnpike/Beauregard Street intersection.
- Dual westbound left turn lanes were assumed at the Little River Turnpike/Beauregard Street intersection.
- For the PM peak, the existing cycle lengths of 210 seconds were maintained for the intersections on Little River Turnpike. It was assumed that adjacent intersections would operate with half cycles (105 seconds).

For the AM peak, the cycle lengths for intersections on Little River Turnpike were reduced to 170 seconds. It was assumed the adjacent intersections would operate with half the cycle length (85 seconds).

Figure 6-2. Oasis Extension as 4-Lane Road



6.3 2040 ALTERNATIVE TRANSPORTATION CONDITIONS

Analysis was performed in the Lincolnia study area consistent with the methodologies described in **Appendix 1**. In summary, volumes were developed using the Travel Demand Model and analyzed at twelve (12) intersections using VISSIM and Synchro. The complete set of operation results and model output data for the 2040 Alternative Land Use Analysis, including vehicle delay by approach and by movement, and 95th percentile queue by movement can be found in **Appendix 5**.

An assessment of multi-modal performance was also conducted based on the six assessment criteria identified in the Goals, Objectives, and MOE's **(Section 2)**. Assessments were based on the performance of each alternative relative to another. Performance for the criteria are symbolized as:

- ***Green –*** Will likely perform well
- ***Yellow*** – May perform well
- ***Orange*** – May not perform well
- ***Red*** – Will likely not perform well

6.3.1 Oasis Extension with One-Way Pairs

The Oasis Extension with One-Way Pairs network was analyzed first with the Alternative Land Use. Peak hour intersection volumes during the AM and PM peak hours for the One-Way Pair network are shown below in **Figure 6-3**.

The peak hour intersection levels of service and delay are shown on **Figure 6-4** and **Figure 6-5**, respectively. The complete set of operational results and VISSIM model output data for scenario, including vehicle delay by approach and by movement as well as the 95th percentile queue by movement can be found in **Appendix 5**. Key findings from the Oasis Extension with One-Way Pairs scenario are summarized as follows:

- The Little River Turnpike/Beauregard Street intersection is still expected to be the most congested intersection in the study area, operating at LOS E during the evening peak hour with an average intersection delay of 74 seconds.
- The Little River Turnpike/Oasis Drive intersection is also expected to operate at LOS E during the evening peak hour. The average intersection delay is less than the neighboring Beauregard Street intersection, with 59 seconds of delay.
- Five of the six remaining intersections are forecast to operate at LOS D during the evening peak hour.
- During the morning peak hour, all intersections are expected to operate acceptably. Only one intersection (Little River Turnpike/Beauregard Street) is forecast to operate at LOS D.

Figure 6-3. Alternative 2040 Land Use and Oasis Extension with One-Way Pairs – Peak Hour Volumes

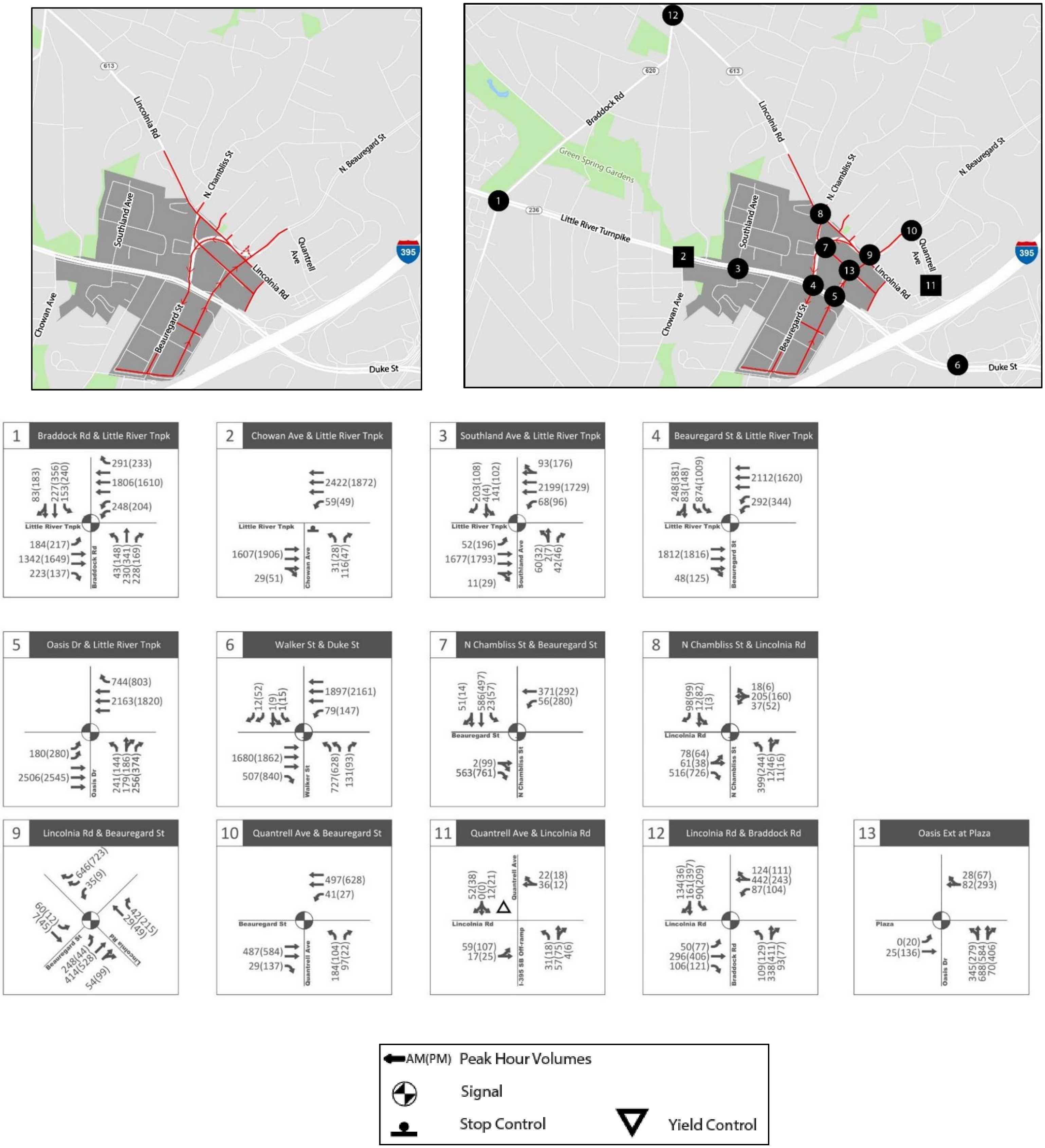


Figure 6-4. Alternative 2040 Land Use and Oasis Extension with One-Way Pairs – Intersection Level of Service

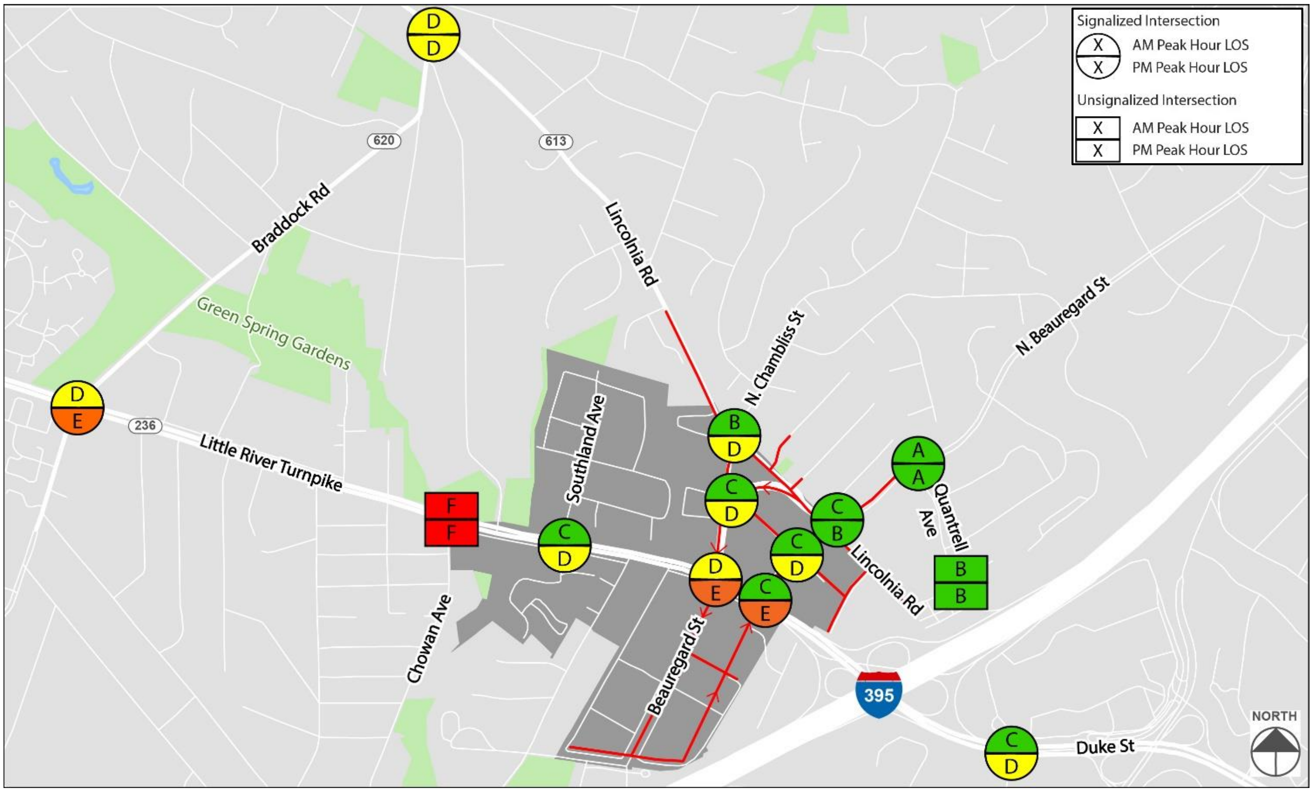
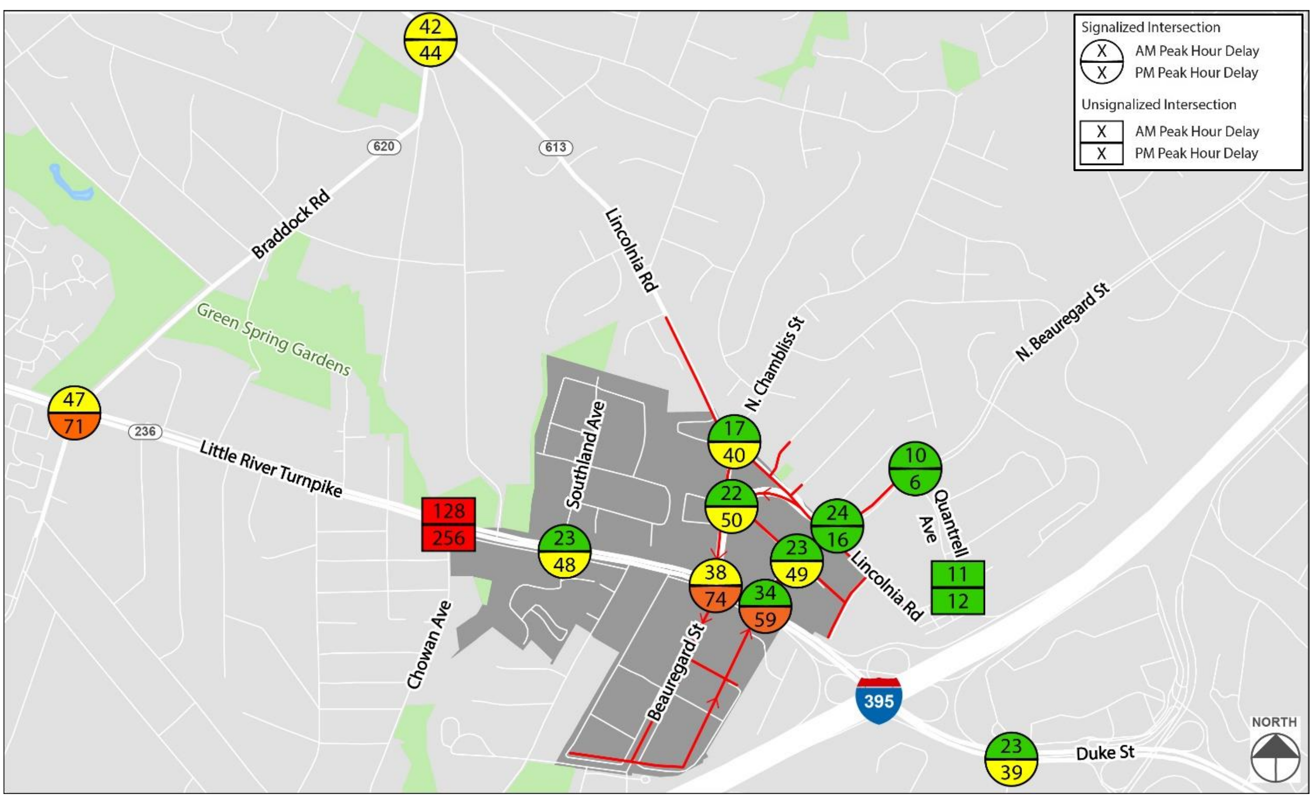


Figure 6-5. Alternative 2040 Land Use and Oasis Extension with One-Way Pairs – Intersection Delay



6.3.2 Oasis Extension as 4-Lane Road

The Oasis Extension with 4-Lane Road network was analyzed next with the Alternative Land Use. Peak hour intersection volumes during the AM and PM peak hours for the Oasis Extension as a 4-Lane Road network are shown below in **Figure 6-6**.

The peak hour intersection levels of service and delay are shown on **Figure 6-7** and **Figure 6-8**, respectively. The complete set of operational results and VISSIM model output data for scenario, including vehicle delay by approach and by movement as well as the 95th percentile queue by movement can be found in **Appendix 5**. Key findings from the Oasis Extension as 4-Lane Road scenario are summarized as follows:

- The Little River Turnpike/Beauregard Street intersection is still expected to be the most congested intersection in the study area, operating at LOS F during the evening peak hour with an average intersection delay of 96 seconds.
- The Little River Turnpike/Oasis Drive intersection is expected to operate at LOS E during the evening peak hour. The average intersection delay is less than the neighboring Beauregard Street intersection, with 65 seconds of delay.
- Three of the six remaining intersections are forecast to operate at LOS E during the evening peak hour.
- During the morning peak hour, only one intersection (Little River Turnpike/Beauregard Street) is forecast to operate at LOS E. All other intersections are expected to operate acceptably.

Figure 6-6. Alternative 2040 Land Use and Oasis Extension as 4-Lane Road – Peak Hour Volumes

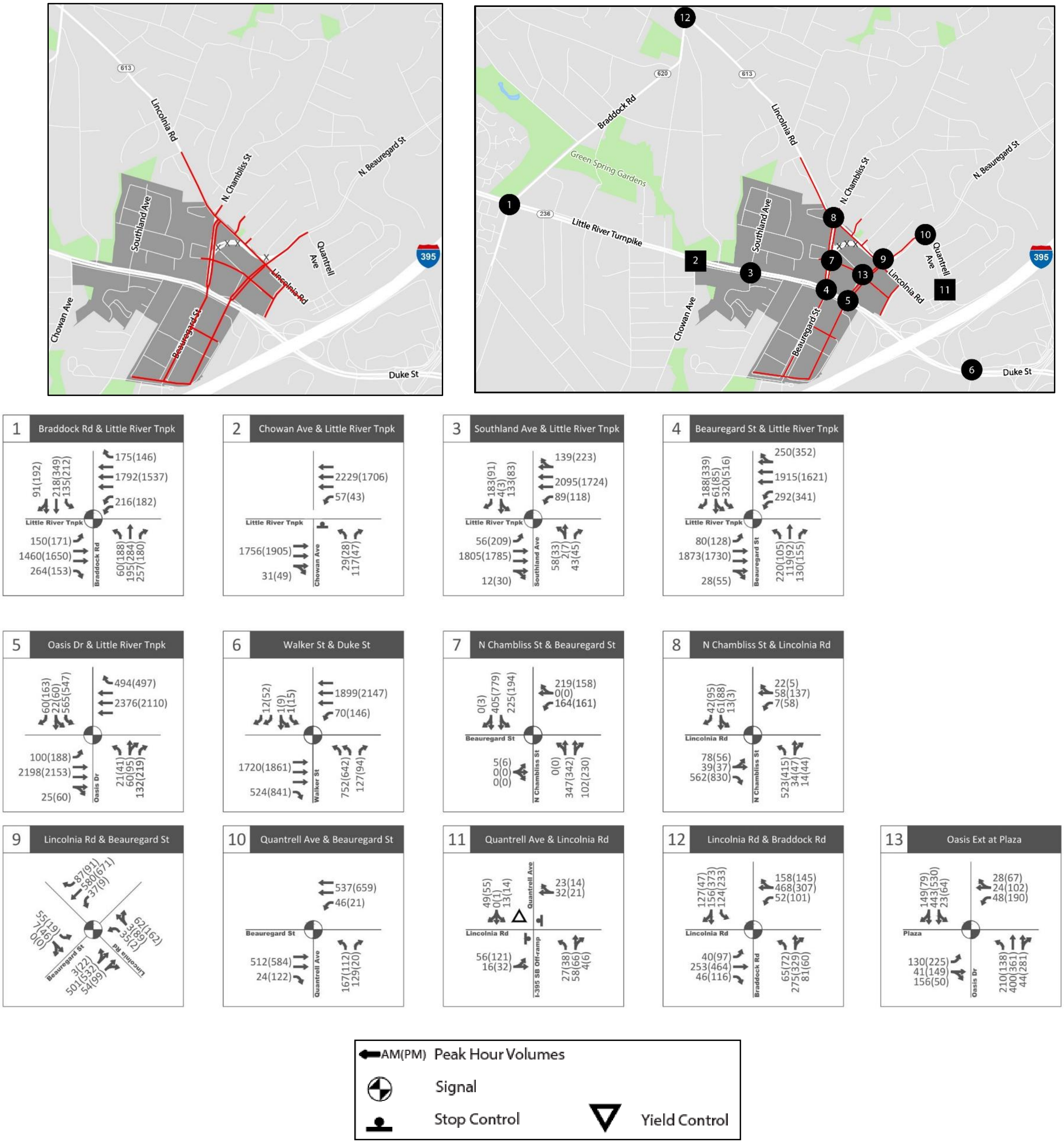


Figure 6-7. Alternative 2040 Land Use and Oasis Extension as 4-Lane Road – Intersection Level of Service

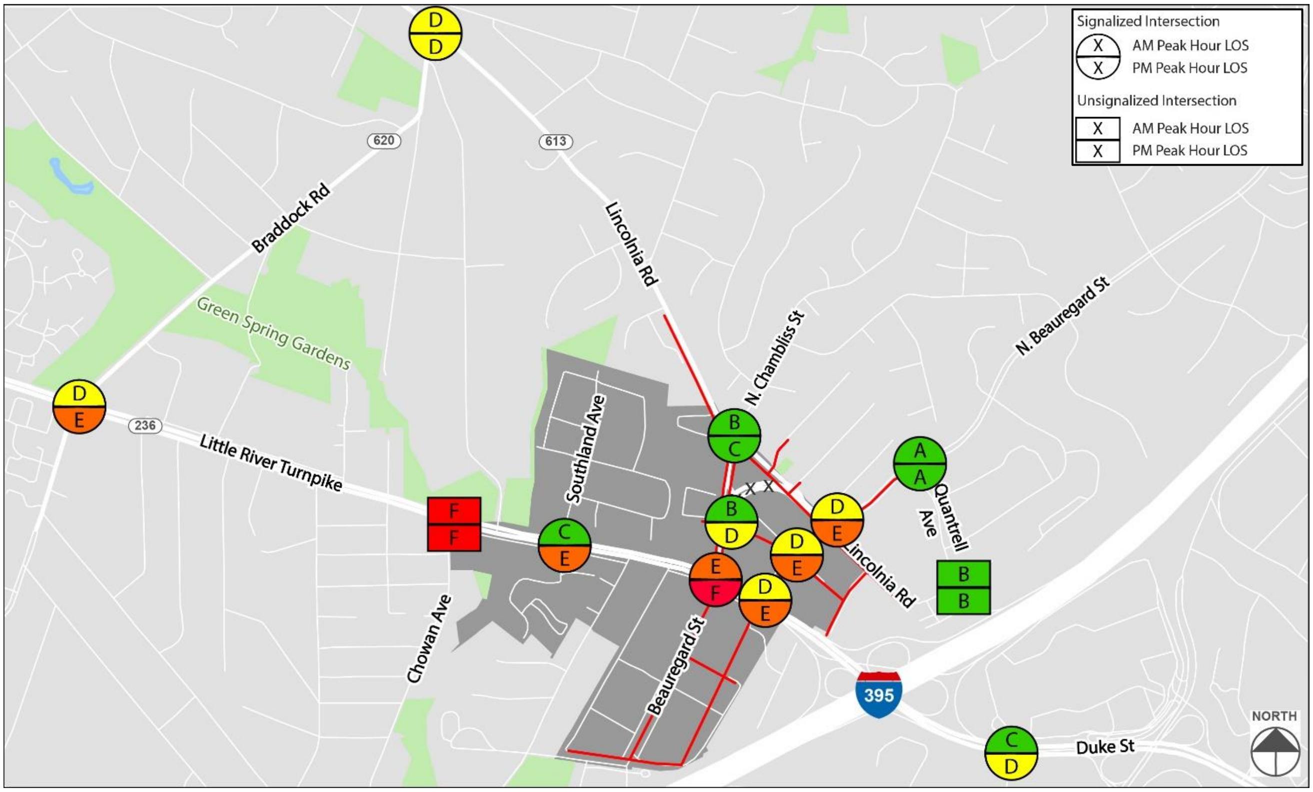
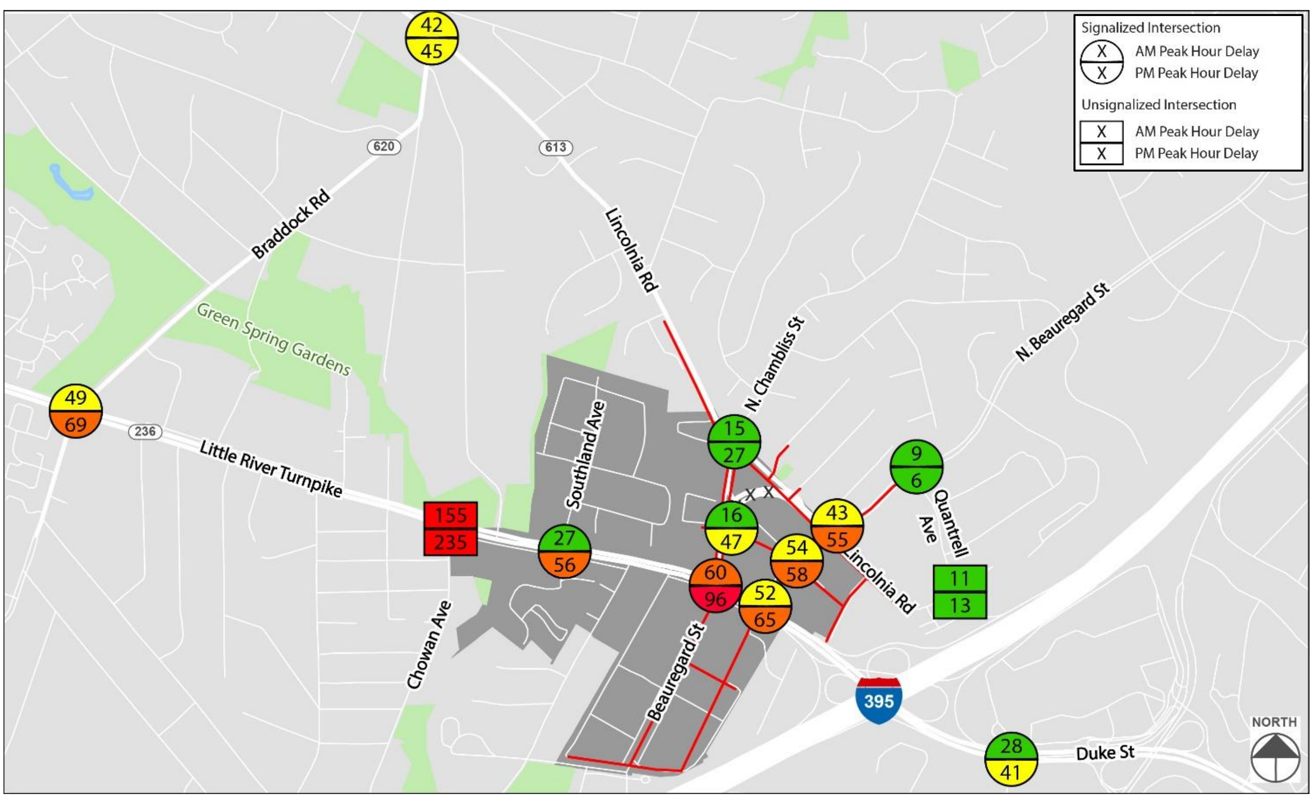


Figure 6-8. Alternative 2040 Land Use and Oasis Extension as 4-Lane Road – Intersection Delay



6.3.3 Network Comparisons

To better understand the results of the 2040 Alternative Land Use scenario, peak hour travel patterns along with the vehicular results were compared with each other and with the 2040 True Baseline **(Section 4)** and Development of 2040 Transportation Alternatives **(Section 5)** scenarios. Transportation conditions were considered at an intersection level, network performance level, and multi-modal/implementation level.

6.3.3.1 Peak Hour Travel Patterns

Peak hour travel patterns were assessed and compared between the Comprehensive Plan land use and the Alternative Land Use as well as for each alternative transportation network to observe the impacts of the Alternative Land Use on travel patterns. A variety of critical roadway segments within the study area were selected to provide a general comparison of peak hour volumes between the scenarios. **Table 6-2** includes link volumes for key segments within the study area.

Table 6-2. Link Volume Scenario Comparisons

Scenario	Eastbound Little River between Southland and Beauregard	Westbound Little River between I-395 and Oasis	Southbound Beauregard between Chambliss and Little River Turnpike	Southbound Oasis between Plaza and Little River Turnpike	Westbound Beauregard between Quantrell and Lincolnia
AM Peak Hour					
True Baseline	2,171	2,641	981	10	522
One-way with Comp Plan	2,171	2,641	991	-	522
Traditional Grid with Comp Plan	2,171	2,641	572	419	522
One-way with Alternative Land Use	1,860	2,907	1,205	-	681
Traditional Grid with Alternative Land Use	1,981	2,870	569	647	704
PM Peak Hour					
True Baseline	2,326	2,427	1,116	110	698
One-way with Comp Plan	2,326	2,427	1,226	-	698
Traditional Grid with Comp Plan	2,326	2,427	676	550	698
One-way with Alternative Land Use	1,941	2,623	1,538	-	732
Traditional Grid with Alternative Land Use	1,913	2,607	940	770	771

Key peak hour vehicular volume observations that can be derived from **Table 6-2** are summarized as follows:

- The side street volumes for Oasis Drive and Beauregard Street are similar for the True Baseline and for the Comprehensive Plan scenarios but increase under the Alternative Land Use since more trips originate and end in the Lincolnia CBC in the Alternative Land Use.
- Travel demand to and from the Lincolnia CBC increases under the Alternative Land Use as seen by the increases in southbound Beauregard and Oasis Drive volumes.
- The increase in side street volume along Little River Turnpike for the Alternative Land use inhibits more regional travel flows by reducing roadway capacity available for these trips, especially in the eastbound direction of Little River Turnpike. This results in lower eastbound volumes on Little River Turnpike under the Alternative Land Use.

6.3.3.2 Traffic Operations

Table 6-3 summarizes the peak hour intersection level of service and delay at the study intersections. Key findings are described below.

Alternative 2040 Land Use Scenarios Have Small Impacts on Vehicle Performance

The effect of the alternative land use scenarios is generally small with a slight increase in intersection delay at the study intersections. Core CBC intersections (i.e., Little River Turnpike at Beauregard Street and Little River Turnpike at Oasis Drive) experience slightly increased delays as a result of increased volumes to/from CBC.

Little River Turnpike/Beauregard Street Intersection Congestion can be Alleviated

The Little River Turnpike/Beauregard Street intersection remains consistently the major bottleneck in the study area for all the scenarios. Under the two Alternative 2040 Land Use scenarios, delay at the Little River Turnpike/Beauregard Street intersection is substantially reduced from the True Baseline scenario.

Queue Spillback from Little River Turnpike/Beauregard Street Intersection can be Limited in Future Scenarios

For the first two transportation network alternatives under the Comprehensive Plan as well as the Alternative Land Use, queues originating from the Little River Turnpike/Beauregard Street intersection are prevented from spilling back to upstream intersections. This results in considerably lower delays at upstream intersections such as the Little River Turnpike/Southland Avenue intersection or the N Chambliss Street/Lincolnia Road intersection.

Table 6-3. Peak Hour Intersection Level of Service (and Vehicle Delay) Comparison for the Core Intersections

Intersection	AM Peak Hour					PM Peak Hour				
	True Baseline with Comp Plan	One-way with Comp Plan	Traditional Grid with Comp Plan	One-way with Alternative Land Use	Traditional Grid with Alternative Land Use	True Baseline with Comp Plan	One-way with Comp Plan	Traditional Grid with Comp Plan	One-way with Alternative Land Use	Traditional Grid with Alternative Land Use
Southland Ave/Little River Tnpk	C (26)	B (18)	C (21)	C (23)	C (27)	**E (73)**	D (46)	**E (69)**	D (48)	**E (56)**
Beauregard St/Little River Tnpk	**E (76)**	C (35)	D (49)	D (38)	**E (60)**	**F (107)**	**E (73)**	**F (90)**	**E (74)**	**F (96)**
Oasis Dr/Little River Tnpk	D (50)	C (24)	D (37)	C (34)	D (52)	C (30)	D (44)	**E (58)**	**E (59)**	**E (65)**
Walker St/Duke St	**E (55)**	C (22)	C (27)	C (23)	C (28)	D (43)	D (39)	D (37)	D (39)	D (41)
N. Chambliss St/Beauregard St	**E (58)**	B (18)	B (13)	C (22)	B (16)	**E (63)**	**E (58)**	D (50)	D (50)	D (47)
N. Chambliss St/Lincolnia Rd	D (44)	C (21)	B (16)	B (17)	B (15)	**F (127)**	D (38)	C (24)	D (40)	C (27)
Lincolnia Rd/Beauregard St	B (16)	B (15)	B (17)	C (24)	D (43)	B (15)	C (21)	C (22)	B (16)	**E (55)**
New Oasis Intersection	-	C (21)	B (17)	C (22.8)	D (54)	-	D (41)	D (43)	D (49)	**E (58)**

6.3.3.3 Network Performance Measures

Table 6-4 provides a comparison of network performance measures under the True Baseline, One-Way Pairs network, and Traditional Grid network, both with the Comprehensive Plan land use and the Alternative land use.

Table 6-4. Comparison of Network Performance Measures

Scenario	Average Vehicle Delay (sec/vehicle)	Average Pedestrian Delay (sec/pedestrian)	Latent Demand (unserved number of vehicles)*	Vehicles Served **
AM Peak Hour				
True Baseline	146.6	52.6	138	9,654
One-way with Comp Plan	69.3	33.5	1	10,076
Traditional Grid with Comp Plan	90.9	42.1	8	10,008
One-way with Alternative Land Use	84.5	32.9	9	10,341
Traditional Grid with Alternative Land Use	114.6	45.3	36	10,239
PM Peak Hour				
True Baseline	155.4	58.3	461	11,014
One-way with Comp Plan	122.5	40.4	92	11,457
Traditional Grid with Comp Plan	139.5	53.8	230	11,394
One-way with Alternative Land Use	129.4	39.8	232	11,683
Traditional Grid with Alternative Land Use	156.8	50.8	214	11,522

Key findings from the network performance measures are summarized below:

- In the first two 2040 Alternative Land Use scenarios, the latent demand, that is the number of unserved vehicles in the network due to very long queues (i.e., residual queues), decreased substantially compared to the True Baseline scenario. This indicates long queues and spillbacks are generally eliminated.

- Pedestrian delay for the 2040 Alternative Land Use scenarios is substantially less than the True Baseline scenario. Furthermore, pedestrian delay is lower under the One-Way Pairs network than the Traditional Grid network as a result of lower intersection cycle lengths. However, it is important to note under the One-Way Pairs network, an existing crosswalk (the east leg) is removed at the Little River Turnpike/Beauregard Street intersection, limiting accessibility.

- Overall, the One-Way Pairs network operates relatively better with lower delays and a higher number of vehicles served during the AM and PM peak hours.

- However, the Traditional Grid network does operate considerably well compared to the True Baseline with substantial reduction in average vehicle delay and increase in the number of vehicles served.

6.3.3.4 Multi-modal and Implementation Considerations

The vehicular analyses provide valuable insight into how the 2040 Alternative Land Use scenarios operate from a vehicular perspective. Based on this analysis, both networks have the potential to enhance the transportation network. To better compare the One-Way Pairs and Traditional Grid networks, it is also important to consider the other assessment criteria. **Table 6-5** shows a comparison of the 2040 True Baseline and 2040 Alternative Land Use scenarios under each assessment criteria. The MOEs are consistent with the measures identified by the Task Force earlier in the project.

Table 6-5. 2040 True Baseline and 2040 Alternative Land Use Scenarios Comparison

Criteria	Baseline	Alt 2	Alt 3
Traffic Ops	🔴	🟠	🟢
Ped Connectivity	🔴	🟠	🟠
Feasibility for Low-Stress Bike Facilities	🟠	🟡	🟢
Transit	🟡	🟡	🟡
Minimal Construction Cost and Disruption	🟢	🟠	🟠
Can Advance Context-Sensitive Solutions	🔴	🟢	🟡

The One-Way Pairs network performs the best from a vehicular perspective and requires minimal right-of-way, providing space and opportunities for future low-stress bicycle facilities. However, the One-Way Pairs network also has certain drawbacks, as noted below:

- To realize the benefits of the one-way pair, the north and south sides of Little River Turnpike would need to be redeveloped simultaneously, making the implementation more challenging,

- The east leg crosswalk was eliminated at Little River Turnpike/Beauregard Street intersection in order to eliminate signal phasing and derive the most vehicular benefit from the one-way streets. However, eliminating a crosswalk limits pedestrian accessibility and connectivity in the study area,

- One-way streets may result in higher speeds and potentially lead to safety issues, and

- One-way streets tend to result in a higher volume of turning vehicles, and therefore higher number of conflicts with the turning vehicles. As a result, they have some disadvantages from a non-motorized perspective.

The Traditional Grid network provides additional grid capacity by providing additional number of lanes, particularly in the north-south direction, which improves traffic operations to a certain extent. The additional grid capacity does require more right-of-way compared to the One-Way Pairs network, which may be less ideal for pedestrians and bicyclists. However, the Traditional Grid network provides greater flexibility for redevelopment as it only requires development occur on the north side of Little River Turnpike.

Section 7
Conclusions and Recommendations

7 CONCLUSIONS AND RECOMMENDATIONS

This section provides primary findings, conclusions and recommendations of the Lincolnia CBC transportation study.

7.1 CONCLUSIONS

Key findings from the study are summarized as follows:

- Vehicle movements in the study area are concentrated at the Little River Turnpike and Beauregard Street intersection, causing congested conditions and very high vehicle delay for the Existing and Baseline conditions. While sidewalks exist within the study area, sidewalk facilities are narrow and often immediately adjacent to a travel lane of the adjacent roadway, leading to uncomfortable walking conditions. In addition, there is limited low-stress bicycle facilities that encourage biking.

- To alleviate vehicle congestion and eliminate the bottleneck conditions without creating barriers for non-motorized users, additional north-south capacity in the form of grid of streets is required. As a result, the recommended transportation concepts included new streets north of Little River Turnpike.

- Based on an evaluation of how alternative transportation networks would perform with currently projected 2040 land uses, two transportation network scenarios were identified and evaluated in more detail with the proposed CBC land use scenario. These scenarios are:

    i. *Full Grid – Oasis Extension as 4-lane Road*, which includes a new road being constructed with two travel lanes in each direction to add additional north-south capacity north of Little River Turnpike through Oasis Extension, and
    ii. *Full Grid – Oasis Extension with One-Way Pairs*, which includes a similar grid of streets, but assumes the new Oasis Extension and existing Beauregard Streets serve as one-way pairs (functioning counter-clockwise) to eliminate some of the signal phases and increase intersection capacity along Little River Turnpike.
- Both transportation alternatives perform better than the baseline conditions when considering the potential land use growth in the CBC, which results in a decrease in vehicle delays and an increase in the number of vehicles served. Relative to one another, the One-Way Pairs alternative lead to even lower vehicle delay and increases the number of vehicles served. Furthermore, major bicycling and walking opportunities are created with both alternatives through the recommended grid of streets.

7.2 RECOMMENDED PATH FORWARD

While the One-Way Pairs network results in the best vehicular performance, its implementation introduces challenges. As previously noted, the One-Way Pairs network requires the development of the north and south sides of Little River Turnpike simultaneously to realize the benefits of the one-way pair. This makes implementation more challenging and thus this alternative requires greater consideration. Additionally, the east leg crosswalk would be eliminated at the Little River Turnpike/N. Beauregard Street intersection under this alternative to take advantage of one-way streets and increase intersection capacity. This would limit pedestrian accessibility and connectivity in the area. One-way streets may result in other behaviors, such as encouraging higher travel speeds that potentially lead to safety issues. One-way streets generally result in higher turning vehicle volumes, and therefore a higher number of pedestrian conflicts with vehicles. As a result, this alternative may not perform as well from a non-motorized perspective.

Considering the implementation challenges and potential non-motorized issues associated with the One-Way Pairs that are not quantified, it is recommended to move forward with the Full-Grid – Oasis Extension as 4-lane road alternative as this concept does not require the development of south side of Little River Turnpike.

Appendix 1
Data and Analysis Methodology

APPENDIX 1: DATA ANALYSIS AND METHODOLOGY

A1.1 2017 EXISTING CONDITIONS

An extensive multi-modal data collection effort was undertaken to fully understand the existing conditions of the area. The data included both quantitative and qualitative sources across vehicular, transit, pedestrian, and bicycle modes. Vehicle travel conditions were evaluated utilizing a combination of various tools including VISSIM, Synchro, and the Fairfax County Travel Demand Model. Transit conditions were evaluated utilizing schedule along with ridership data. In addition, bicycle conditions were evaluated utilizing the County's Bicycle Level of Traffic Stress analysis protocols, and pedestrian conditions were reviewed mostly qualitatively through field visits.

A1.1.1 Pedestrian Data

Pedestrian volumes were also collected at the twelve study intersections during the same time interval when vehicular turning movement counts were conducted on November 9, 2017. Data collection was included the AM peak hour and PM peak hour pedestrian volumes, which were used for the traffic analysis, as explained below in detail.

A1.1.2 Bicycle Data and Methodology

Level of Traffic Stress (LTS) data provided by Fairfax County was mapped using GIS. LTS is a methodology developed by the Mineta Transportation Institute to evaluate the stress that bicyclists experience on roadway segments, intersection approaches, and unsignalized crossings. Using this approach, a street network can be classified into four stress levels, ranging from low stress to high stress. For a bicycle network to attract the broadest segment of the population, it must provide low stress connectivity, defined as "providing routes between people's origins and destinations that do not require cyclists to use links that exceed their tolerance for traffic stress, and that do not involve an undue level of detour."

FCDOT has adjusted the described LTS methodology slightly and applied it to their roadway facilities. LTS was created for a typically highly urbanized, city context and may not be directly applicable outside the context of its intended use. The LTS methodology utilized by FCOT identifies four stress levels based on key facility and traffic factors:

- Use Caution — High stress, only suitable for experienced bicyclists.
- Less Comfortable — Moderate traffic stress for all bicyclists.
- Somewhat Comfortable — Low traffic stress and suitable for most adults.
- Most Comfortable — Requires little attention to surroundings; suitable for most children.

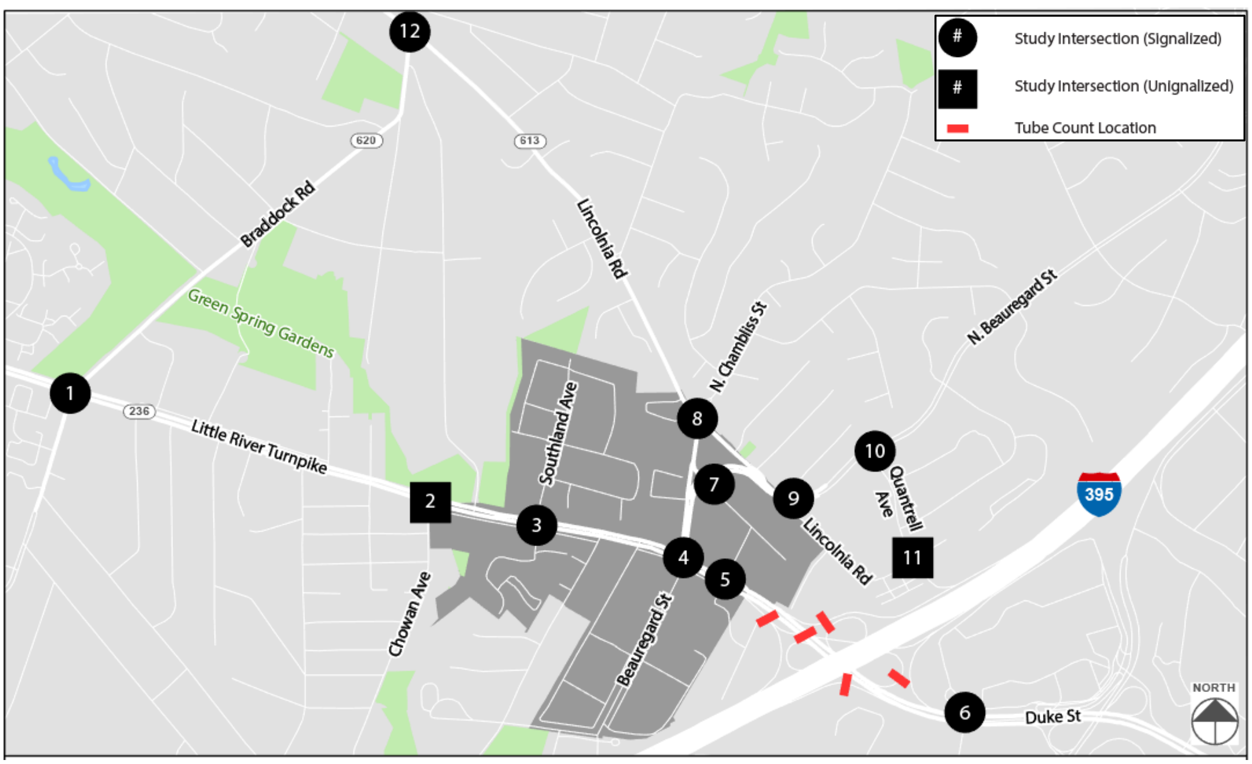
A1.1.3 Transit Data and Methodology

Washington Metropolitan Area Transit Authority (WMATA) and Fairfax Connector bus routes that operate within the study area were reviewed and information from the timetables were aggregated to determine the average bus headways during the peak periods. Ridership data from automated passenger counters from July and August 2017 was used to assess average boarding and alighting at stops in the Lincolnia area. Data for each route were then aggregated to determine stop level activity on a typical weekday.

A1.1.4 Vehicular Data

Turning movement counts were conducted at the twelve (12) study intersections on November 9, 2017, from 6:00 AM to 7:00 PM, this time includes the 7:30 – 8:30 AM morning peak hour and 4:45 – 5:45 PM evening peak hour. To determine on and off ramp volumes for the I-395 ramps, 48-hour tube counts were conducted at five locations. Data were collected at these five locations from November 15 – 16, 2017. Turning movement and tube count locations, along with the broader study area, are illustrated in **Figure Appendix 1: Data Analysis and Methodology-1**.

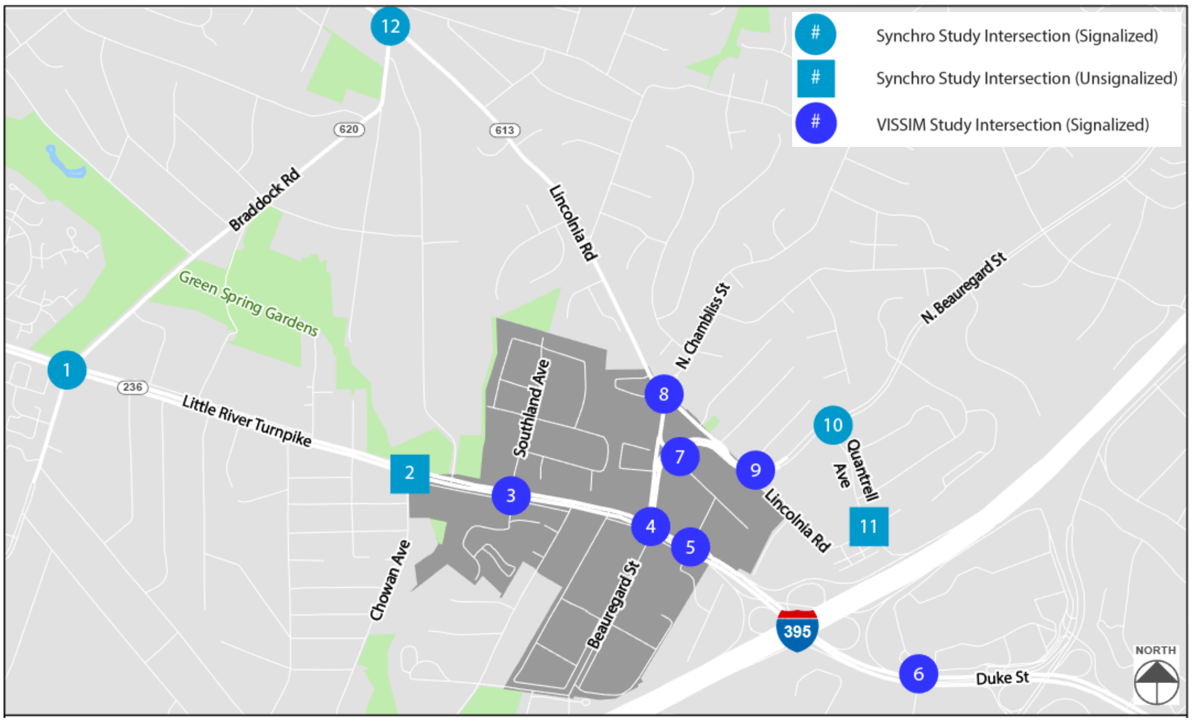
Figure Appendix 1: Data Analysis and Methodology-1. **Turning Movement and Tube Count Locations**



A1.1.5 Vehicular Methodology

Twelve (12) study intersections were identified. These intersections were evaluated with various analysis methodologies. The core of the study area, focused on Beauregard Street and Little River Turnpike, experiences severe congestion and frequent queue spillbacks. These intersections were analyzed in VISSIM to better capture the effect of queue interactions and provide more detailed results. The remaining intersections were analyzed using Synchro as these intersections are more isolated and generally not affected by queue interactions. **Figure Appendix 1: Data Analysis and Methodology-2** displays VISSIM and Synchro intersections within the study area.

Figure Appendix 1: Data Analysis and Methodology-2. VISSIM and Synchro Study Intersections



Vehicle analysis was performed utilizing both Highway Capacity Manual (HCM) and microsimulation methodologies. Synchro was utilized for the HCM analysis and VISSIM was utilized for the microsimulation analysis.

For both the Synchro and VISSIM analysis, AM peak hour (7:30 AM – 8:30 AM) and PM peak hour (4:45 – 5:45 PM) were considered for the assessment of existing conditions. For the VISSIM analysis, a warm-up period of 15 minutes (900 seconds) was applied prior to the analysis period to allow for the model to populate with a sufficient number of vehicles to better represent field conditions. The 15-minute warm-up period is selected to ensure all vehicles will be able to enter and exit the network when travelling from one end to another during the warm-up duration. The measures of effectiveness (MOEs) were not collected during the warm-up period.

A1.1.5.1 VISSIM Methodology

For the development of VISSIM models, volume balancing was performed to prevent any volume discrepancies between intersections. While turning movement counts were generally consistent since the traffic data was collected on the same day for all the study intersections, there were minor differences due to the presence of driveways that are not part of the VISSIM model. Minor adjustments were made to the VISSIM volumes to make sure volumes are balanced. For the Synchro intersections, however, no volume balancing was performed to analyze the highest peak volume within each intersection.

For the analysis of the VISSIM models, ten simulation runs were performed with different random seeds. The adequacy of the number of runs was assessed by the tool provided by the Virginia Department of Transportation (VDOT) Traffic Operations and Safety Analysis Manual (TOSAM)[4] for the AM and PM peak hours (please see the VISSIM calibration memo submitted separately for details). As mentioned previously, the simulation run time was conducted for a one-hour peak period during the AM and PM periods, following the 15-minute warm-up time. In addition, a simulation resolution of ten runs is used in existing condition models and the same value will be used in future analyses. Dwell times for the transit routes operating in the study area were also modeled in the VISSIM network. Using the ridership data mentioned previously, an average dwell time is estimated for each bus route and coded in VISSIM.

A1.1.5.2 Synchro Analysis

For the Synchro analysis, peak hour factor (PHF) was calculated and entered by approach for each intersection. Since the turning movement data did not include heavy vehicle proportions, a two percent heavy vehicle percentage was assumed for the study intersections both for the VISSIM and Synchro analysis. To obtain results from the Synchro models, the HCM 2000 methodology was used for the signalized intersections. This was because the new versions of the HCM methodology (i.e., HCM 2010 or the 6th Edition) were unable to generate results for certain intersections. For unsignalized intersections, the results were based on the HCM 2010 methodology.

A1.1.5.3 Level of Service (LOS) Criteria

Intersection LOS is defined in terms of average total vehicle delay of all movements through the intersection. The assigned LOS value reflects the average delay experienced per vehicle at the intersection during the analysis period (typically a one-hour AM and one-hour PM peak). LOS A can be considered free-flow or near free-flow (less than 10 seconds of average delay per vehicle) and LOS F indicates highly congested conditions, with more than 80 seconds of average delay at a signalized intersection. It should be noted that LOS for unsignalized intersections was determined based on the critical movement that experiences the highest delay, consistent with the HCM LOS methodology for unsignalized intersections. A summary of LOS delays for signalized and unsignalized intersections is provided in **Table Appendix 1**: Data Analysis and Methodology-1.

[4] http://www.virginiadot.org/business/resources/TOSAM.pdf

Table Appendix 1: Data Analysis and Methodology-1. LOS Delay Summary (Signalized and Unsignalized Intersections)

Level of Service (LOS)	Signalized	Unsiganalized
A	<10.0	<10.0
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

A1.1.6 Field Data

Multiple field visits were made to the study area. Field visits were conducted on November 9, 15, and 16, 2017 from 6:00 – 9:00 AM and from 4:00 – 7:00 PM to observe queuing at intersections for the calibration of the VISSIM microsimulation model used for the traffic analysis. Additional field visits were made on Thursday January 18, 2018, during the AM and PM peak hours and on Thursday January 31, 2018 during the PM peak hour to observe queuing and collect field travel times along the corridor. In addition, observations of pedestrian and transit facilities and behavior were also made.

Travel time runs were also conducted during the AM and PM peak periods to be used for the calibration of the VISSIM models. Runs were done from the Lincolnia Road/N. Beauregard Street intersection to the Little River Turnpike/Beauregard Street intersection. In addition, runs were completed in both directions along Little River Turnpike between Chowan Avenue and Duke Street.

A1.1.7 VISSIM and Fairfax County Travel Demand Model Calibration

Both the VISSIM microsimulation model and Fairfax County Travel Demand Model required calibration prior to utilization.

A1.1.7.1 VISSIM Calibration

The development of existing condition VISSIM models requires a proper calibration effort to closely replicate real-world conditions. The calibration efforts were conducted focusing on the following elements per guidance from TOSAM.

- ***Simulated Traffic Volume*** – compares the traffic volumes at critical links within the model to field counts.
- ***Simulated Travel Time*** – compares simulated vehicle travel times to those collected in the field along specified routes.
- ***Simulated Queue Length*** – compares average and maximum queue lengths at critical links to field measurements.

- ***Visual Calibration*** – compares qualitative traffic patterns, observed in the field, that have notable influence on the traffic operations in the study area (e.g., yielding behavior, queuing, etc.).

VISSIM models are deemed to be calibrated when they have achieved specified targets across these elements which have been agreed to be sufficient to represent real world traffic conditions.

A1.1.7.2 Fairfax County Travel Demand Model Calibration

The Fairfax County Travel Demand Model was obtained from the County to develop future year model volumes in the study area. It is important to note that the County's travel demand model was not used to evaluate existing conditions, but only utilized to validate the model to the existing conditions.

To adequately reflect field conditions, the number of lanes, limit codes, free-flow speed of certain roadway links, and the location of centroids/centroid connectors were adjusted to match the real-world conditions including the traffic volumes obtained from the field data and Average Daily Traffic Counts (AADT) acquired from the Virginia Department of Transportation (VDOT). Modifications concentrated on Little River Turnpike, Lincolnia Road and major intersecting streets.

Eleven intersections within study area were used to validate the Fairfax County Travel Demand Model by comparing the model results against AADT measurements. Percent root mean square error (RMSE) were reported before and after the network revisions for the validation locations. **Table Appendix** 1: Data Analysis and Methodology-2 summarizes the percent root mean square error (%RMSE) for different volume groups (categorized by field AADT counts of roadway links).

Table Appendix 1: Data Analysis and Methodology-2. Volume Comparison for the Study Corridor

Volume Groups	%RMSE Target*	Total Field Counts	Updated Model		Original Model	
			%RMSE	Meet Target?	%RMSE	Meet Target?
Less than 5,000	100%	10,200	61%	**Yes**	158%	**No**
5,000-9,999	45%	11,700	8%	**Yes**	69%	**No**
10,000-14,999	35%	50,000	21%	**Yes**	25%	**Yes**
15,000-19,999	30%	154,000	18%	**Yes**	33%	**No**
20,000-29,999	27%	41,000	22%	**Yes**	73%	**No**
30,000-49,999	25%	422,000	7%	**Yes**	13%	**Yes**
50,000-59,999	20%	112,000	5%	**Yes**	21%	**No**

*Source: Virginia Transportation Modeling (VTM) Policies and Procedures Manual

Results indicate that the model forecasts in the modified model are much closer to the field measurement than the original model (i.e., the RMSE of the modified model is much smaller than the original model).

The modified model meets the %RMSE targets for all volume group; while the original model only meets the %RMSE targets for the third and sixth volume groups within the study area and is considerably off from the targets for the first, second, and fifth groups. The results indicate that the updates/modifications made within study area significantly reduce the variances between model volumes and field counts. As a result, the modified model provides more realistic volume forecasts in existing and future years as it can replicate the existing street network and field conditions more accurately.

A1.2 2040 BASELINE CONDITIONS

As changes to the 2040 baseline scenarios are primarily vehicular, the analysis methodology for the baseline conditions was focused on vehicular and network performance measures.

Consistent with the existing conditions analysis, vehicular analysis was conducted at twelve study intersections. Within the core study area, the intersection of Beauregard Street and Little River Turnpike experiences severe congestion and frequent queue spillbacks. Therefore, these intersections were analyzed in VISSIM to better capture the effect of queue interactions and provide more detailed results. The remaining intersections were analyzed using Synchro.

Highway Capacity Manual (HCM) 2000 methodology was used for the signalized intersections to obtain results from the Synchro models. This was because the new version of the HCM methodology (i.e., HCM 2010 or the 6th Edition) was unable to generate results for certain signalized intersections. For unsignalized intersections, the results were based on the HCM 2010 methodology.

Network performance measures were also determined for baseline conditions using VISSIM. These calculations were conducted for all three baseline scenarios to provide operational insights that otherwise cannot be derived from analyzing individual intersection performance.

Vehicular projections for the 2040 baseline scenarios were developed using the Travel Demand Model. The outputs of the travel demand model were post-processed using the NCHRP 255 methodology to develop peak hour turning movement counts at the study intersections. Detailed information related to the travel demand modeling land use inputs is provided below.

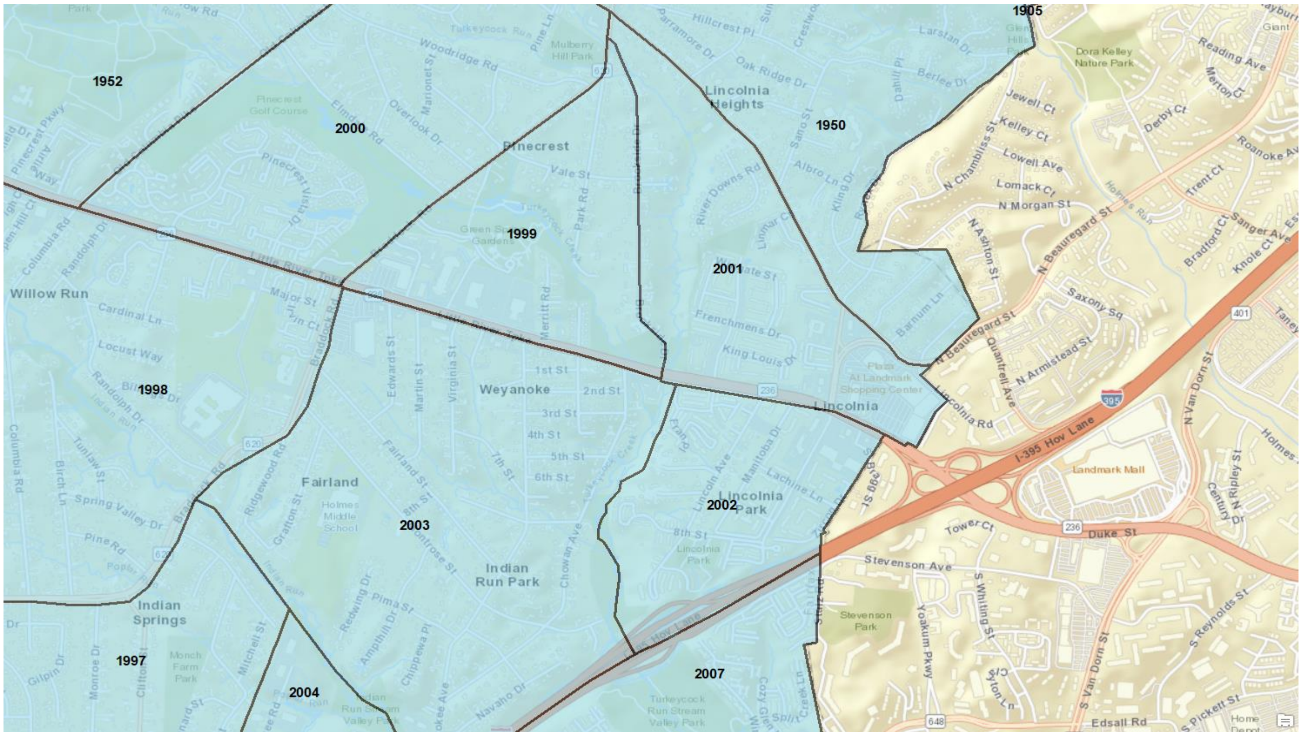
A1.2.1 Fairfax County Travel Demand Model Land Use Inputs

To develop volumes for the 2040 Baseline Conditions, the Travel Demand Model land use input was updated using the information provided in **Table Appendix** 1: Data Analysis and Methodology-3. The Corresponding TAZs are shown in **Figure Appendix 1**: Data Analysis and Methodology-3.

Table Appendix 1: Data Analysis and Methodology-3. Land Use Comparison for the Existing (2015) and 2040 Baseline Scenarios

Subzone ID	Attributes	Description	Existing (2015)	2040 Baseline Scenarios	Change from Existing (%)
1999	SUB_HH	Subzone households	128	128	–
	SUB_HHP	Subzone household population	384	383	-0.3%
	SUB_GQ	Subzone group quarters population	0	0	–
	SUB_POP	Subzone total population	384	383	-0.3%
	SUB_IND	Subzone industrial employment	50	165	230.0%
	SUB_RT	Subzone retail employment	341	267	-21.7%
	SUB_OF	Subzone office employment	440	227	-48.4%
	SUB_OT	Subzone other employment	60	0	-100.0%
	SUB_TE	Subzone total employment	891	659	-26.0%
2001	SUB_HH	Subzone households	1112	1071	-3.7%
	SUB_HHP	Subzone household population	2916	2750	-5.7%
	SUB_GQ	Subzone group quarters population	0	0	–
	SUB_POP	Subzone total population	2916	2750	-5.7%
	SUB_IND	Subzone industrial employment	39	0	-100.0%
	SUB_RT	Subzone retail employment	471	881	87.0%
	SUB_OF	Subzone office employment	193	62	-67.9%
	SUB_OT	Subzone other employment	113	351	210.6%
	SUB_TE	Subzone total employment	816	1294	58.6%
2002	SUB_HH	Subzone households	1287	1342	4.3%
	SUB_HHP	Subzone household population	4605	4787	4.0%
	SUB_GQ	Subzone group quarters population	0	0	–
	SUB_POP	Subzone total population	4605	4787	4.0%
	SUB_IND	Subzone industrial employment	24	0	-100.0%
	SUB_RT	Subzone retail employment	59	135	128.8%
	SUB_OF	Subzone office employment	154	237	53.9%
	SUB_OT	Subzone other employment	54	114	111.1%
	SUB_TE	Subzone total employment	291	486	67.0%

Figure Appendix 1: Data Analysis and Methodology-3. Locations of the County Model Subzones with the Land Use Changes between the 2015 Existing and 2040 Baseline Scenarios in the Study Area



A1.3 DEVELOPMENT OF 2040 TRANSPORTATION ALTERNATIVES

The analysis methodology for the development of alternatives was based on a two-tiered approach. Both tiers included quantitative and qualitative assessments of the six criteria established with the Goals, Objectives, and MOEs. These criteria included:

- ***Traffic Operations (Traffic Ops)*** – Assessment of traffic operations
- ***Pedestrian Connectivity (Ped Connectivity)*** – Qualitative assessment of walkability and connectivity of alternatives
- ***Feasibility for Low-Stress Bike Facilities*** – Feasibility of implementing bicycle friendly facilities
- ***Transit*** – Qualitative assessment of accessibility to bus stops and effect of alternatives on bus operations (for example, route changes leading to longer and more circuitous routes due to new roadway configurations)
- ***Minimal Cost and Disruption*** – Qualitative assessment of cost to County and disruption to the CBC associated with each alternative
- ***Can Advance Context-Sensitive Solutions*** – Qualitative assessment of whether the alternative fits with the established community objectives

Assessments were based on the performance of each alternative relative to another. For example, if an alternative was likely to improve traffic operations considerably compared to other alternatives, it was assumed to perform well. Qualitative performance for the criteria are symbolized as:

- ***Green –*** Will likely perform well
- ***Yellow*** – May perform well
- ***Orange*** – May not perform well
- ***Red*** – Will likely not perform well

To evaluate traffic operations, there were slight differences in the methodology used between the Tier 1 and Tier 2 evaluations. For both evaluations, vehicular projections were based on volumes from the 2040 baseline scenarios and rerouted by hand based on sketch-level travel pattern assumptions. The slight differences in methodology between Tier 1 and Tier 2 are discussed below.

A1.3.1 Tier 1 Vehicular Methodology

In the first tier, Synchro analysis was conducted within the core of the study area. For alternatives that would introduce new signalized intersections, those intersections were also analyzed.

Highway Capacity Manual (HCM) 2000 methodology was used for the signalized intersections to obtain results from the Synchro models. This was because the new version of the HCM methodology (i.e., HCM 2010 or the 6th Edition) was unable to generate results for certain signalized intersections.

A1.3.2 Tier 2 Vehicular Methodology

In the second tier, VISSIM analysis was conducted within the core of the study area. Similar to Tier 1, new signalized study intersections were also analyzed.

A1.4 2040 ALTERNATIVE LAND USE ANALYSIS

The analysis methodology for 2040 Alternative Land Use Analysis (with recommended transportation alternatives) included quantitative and qualitative assessments consistent with the Development of 2040 Transportation Alternatives.

Consistent with the existing and baseline conditions analyses, vehicular analysis was conducted at twelve study intersections. Within the core study area, the intersection of Beauregard Street and Little River Turnpike experiences severe congestion and frequent queue spillbacks. Therefore, these intersections were analyzed in VISSIM to better capture the effect of queue interactions and provide more detailed results. The remaining intersections were analyzed using Synchro.

Highway Capacity Manual (HCM) 2000 methodology was used for the signalized intersections to obtain results from the Synchro models. This was because the new version of the HCM methodology (i.e., HCM

2010 or the 6th Edition) was unable to generate results for certain signalized intersections. For unsignalized intersections, the results were based on the HCM 2010 methodology.

Network performance measures were also determined for the alternative land use using VISSIM. These calculations were conducted for all three alternatives to provide operational insights that otherwise cannot be derived from analyzing individual intersection performance. Note the network performance measures were not determined for Alternative 1 during the AM Peak hour, as preliminary testing screened out this option.

Vehicular projections for the 2040 alternative land use scenarios were developed using the Travel Demand Model. The outputs of the travel demand model were post-processed using the NCHRP 255 methodology to develop peak hour turning movement counts at the study intersections.

Appendix 2
Existing Detailed Intersection Results

Appendix 3
2040 Baseline Detailed Intersection Results

Appendix 4
Development of Future Alternatives Detailed Intersection Results

Appendix 5
2040 Alternative Land Use
Detailed Intersection Results