



BRANDON



CORRIDORS & MIXED-USE
CENTERS PILOT PROJECT

Mobility Improvement Option Evaluation

Technical Memo 8

Prepared by:

HDR

On behalf of:



Hillsborough MPO
Metropolitan Planning
for Transportation



Hillsborough County
City-County
Planning Commission

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CONTENTS

- 1. Introduction 1
- 2. Existing Conditions 2
- 3. Lumsden Road 2
 - 3.1 Existing Conditions..... 2
 - 3.2 Proposed Improvement..... 4
 - 3.3 Right-of-Way Impacts 4
 - 3.4 Environmental Screening 6
 - 3.5 Preliminary Construction Cost Estimate 7
 - 3.6 Safety Impacts 7
 - 3.7 Summary of Findings 7
- 4. Bloomingdale Avenue 8
 - 4.1 Existing Conditions..... 8
 - 4.2 Reversible Lane Overview 8
 - 4.3 Reversible Lane Screening..... 8
 - 4.4 Special Considerations for Implementation..... 14
 - 4.5 Reversible Lanes Configurations Considered 14
 - 4.6 Other Treatment Options Considered 23
 - 4.7 Summary of Findings 26
- 5. Lithia Pinecrest Road-Bryan Road 27
 - 5.1 Existing Conditions..... 27
 - 5.2 Roundabout Configurations Considered..... 28
 - 5.3 Traffic Operational Analysis 28
 - 5.4 Roundabout Preliminary Layouts..... 32
 - 5.5 Other Treatment Options Considered 32
 - 5.6 Summary of Findings 34
- 6. Lithia Pinecrest Road-Bryan Road
One-Way Pair at SR 60..... 35
 - 6.1 One-Way Pair Configurations Considered 35
 - 6.2 Traffic Operational Analysis 38
 - 6.3 Special Considerations for Implementation..... 39
 - 6.4 Other Treatment Options Considered 39
 - 6.5 Summary of Findings 39
- 7. Other Improvement Options 40
- 8. Sources 41
- 9. Attachments 41

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1. INTRODUCTION

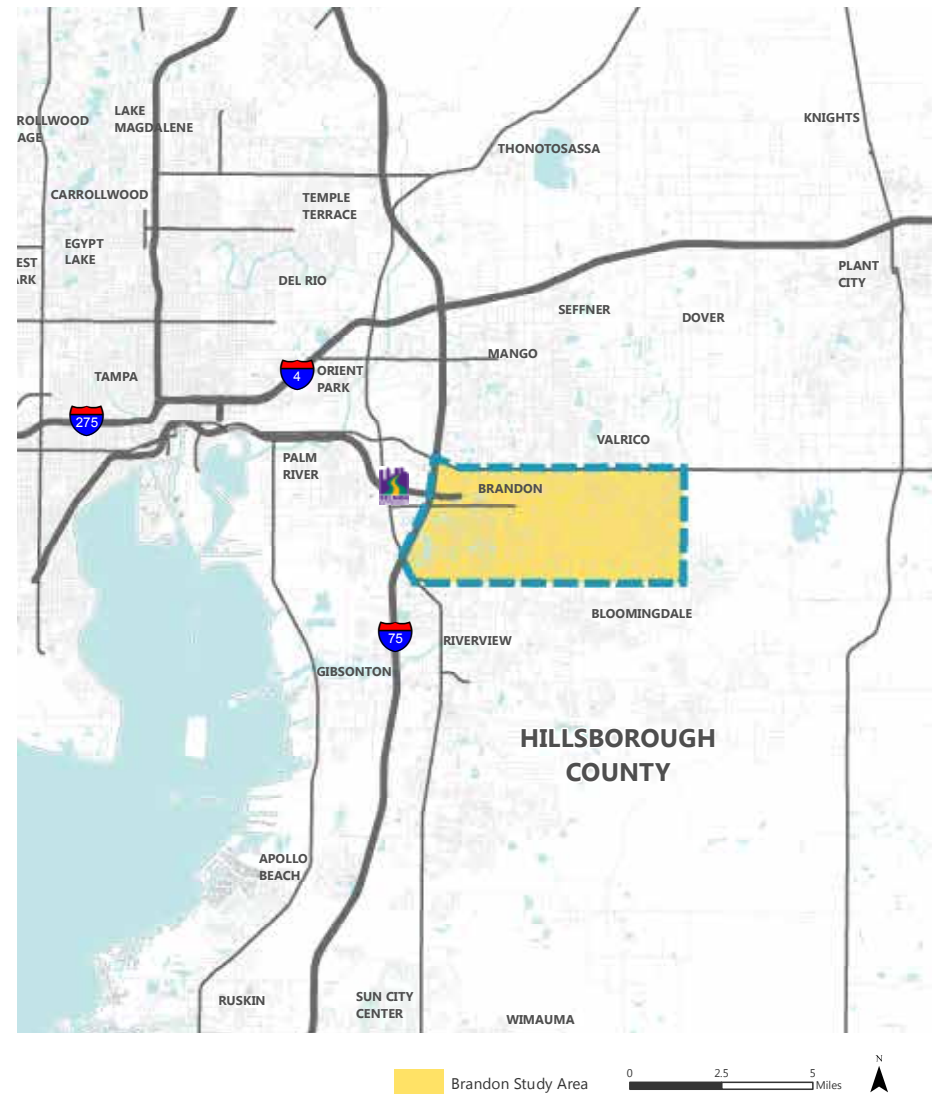
The Brandon Corridors and Mixed-Use Centers Study is joint pilot project from the Hillsborough County Metropolitan Planning Organization (MPO) and the Hillsborough County City-County Planning Commission (Planning Commission). The purpose of the study is to better coordinate the envisioned land use pattern with planned transportation improvements along major corridors within the Brandon Study Area. As shown in Figure 1, the study area is located at a key location within eastern Hillsborough County. The study area is a three-mile by six-mile area located east of Interstate 75 (I-75) between State Road 60 (SR 60)/Brandon Boulevard and Bloomingdale Avenue. The eastern limit of the study area is Dover Road/Little Road.

This memo documents the study team’s efforts to analyze several transportation or mobility improvements within the study area. A high-level assessment of each option is provided, including the overall feasibility and analysis of potential impacts. The options considered focus on improvements to roadway capacity and traffic operations for the study area’s major east-west corridors. Many of the mobility options have been previously proposed in the LRTP or planning documents. The following improvements were considered:

- Widen Lumsden Road between Kings Avenue and Lithia Pinecrest Road.
- Convert median/center turn lane on Bloomingdale Avenue to a reversible lane during peak periods.
- Reconstruct Lithia Pinecrest Road/Bryan Road intersection as roundabout and/or one-way pairs.

The next phase of analysis will include the development of mobility improvement scenarios and traffic modeling to evaluate the performance of these improvements, along with other bicycle, pedestrian, safety, north-south roadways, secondary roadway network, and enhanced transit service improvements.

Figure 1. Study Area Regional Context Map



2. EXISTING CONDITIONS

The Brandon Study Area has a number of mobility challenges, including significant capacity issues on the three east-west corridors (SR 60, Lumsden Road, and Bloomingdale Avenue), safety, bicycle and pedestrian connectivity, and a limited secondary roadway network.

Traffic volumes within the study area are high, and residential developments to the south and southeast of the study area place additional pressure on the transportation system. These high volumes create significant peak period capacity challenges on all of the major roadways in the study area due to a lack of options for regional trips within this area of Hillsborough County. The area's limited major roadways (e.g., Bloomingdale Avenue, Lithia Pinecrest Road, Lumsden Road, and SR 60) are the only options that many area residents have between their neighborhoods and regional destinations.

Additionally, the study area has a limited secondary roadway network, so local trips must also compete on the major roadways, causing even more congestion. While many local destinations are clustered along the major corridors, there is a lack of connectivity between nearby retail and commercial establishments. For vehicles, pedestrians, or bicyclists, the roadway network offers few options for short distance east-west trips. The study area has more north-south corridor options, but these roads have limited capacity. Finally, the Brandon Study Area has low overall residential and employment densities, which makes providing high-quality or meaningful transit service challenging.

The roadway network issues are described in more detail in *Technical Memo 3: Network Evaluation and Planned Improvements*. Transit service related challenges and opportunities are discussed in *Technical Memo 7: Transit Service Analysis*. The following sections offer analysis of several options for mobility improvements to address these challenges and issues.

3. LUMSDEN ROAD

Lumsden Road is a major east-west arterial in the center of the study area that provides access to the Selmon Expressway from the central and eastern portions of the study area. The study team evaluated the feasibility of widening of Lumsden Road between Kings Avenue and Lithia Pinecrest Road (see Figure 2) from a four-lane divided roadway with a center landscaped median and turn lanes to a six-lane divided roadway with bicycle lanes and sidewalks.

3.1 Existing Conditions

Lumsden Road between Kings Avenue and Lithia Pinecrest Road is currently a divided, four-lane roadway with a center median with alternating, channelized left-turn lanes. As shown in Figure 3, the travel lanes are 12-foot-wide and the median is approximately 20-foot-wide. Concrete sidewalks are provided on both sides of the roadway for the entire length of the corridor segment. This segment has no existing bicycle facilities. The total existing right-of-way width throughout the segment is 96 feet. West of Kings Road, Lumsden Road widens to a divided six-lane roadway with a center median with alternating, channelized left-turn lanes. Lumsden Road narrows to an undivided two-lane roadway east of Lithia Pinecrest Road.

The capacity of Lumsden Road between Kings Avenue and Lithia Pinecrest Road is not sufficient to meet the existing and future traffic volumes. In 2015, this segment of Lumsden Road carried an average of 34,237 vehicles per day. This segment is currently operating at a level of service (LOS) F. All four of the major intersections (Kings Avenue, John Moore Road/Parsons Avenue, Bryan Road, and Lithia Pinecrest Road/Bell Shoals Road) along this segment of Lumsden Road were included on the Imagine 2040 LRTP's Congested Intersections Map. By 2040, the anticipated traffic volumes will be greater than 50 percent of the roadway's capacity.



Figure 2. Lumsden Road Widening Evaluation Limits

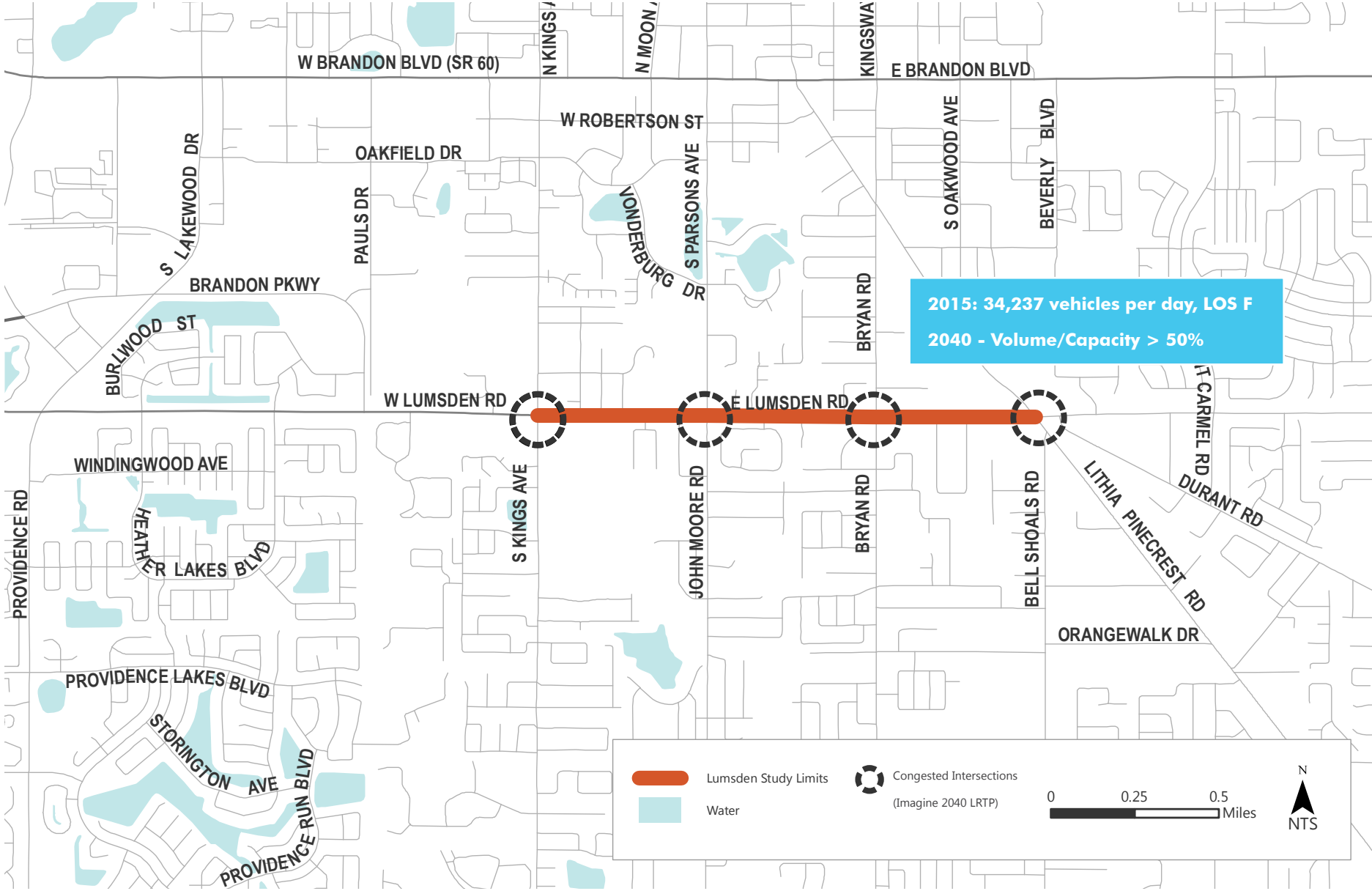
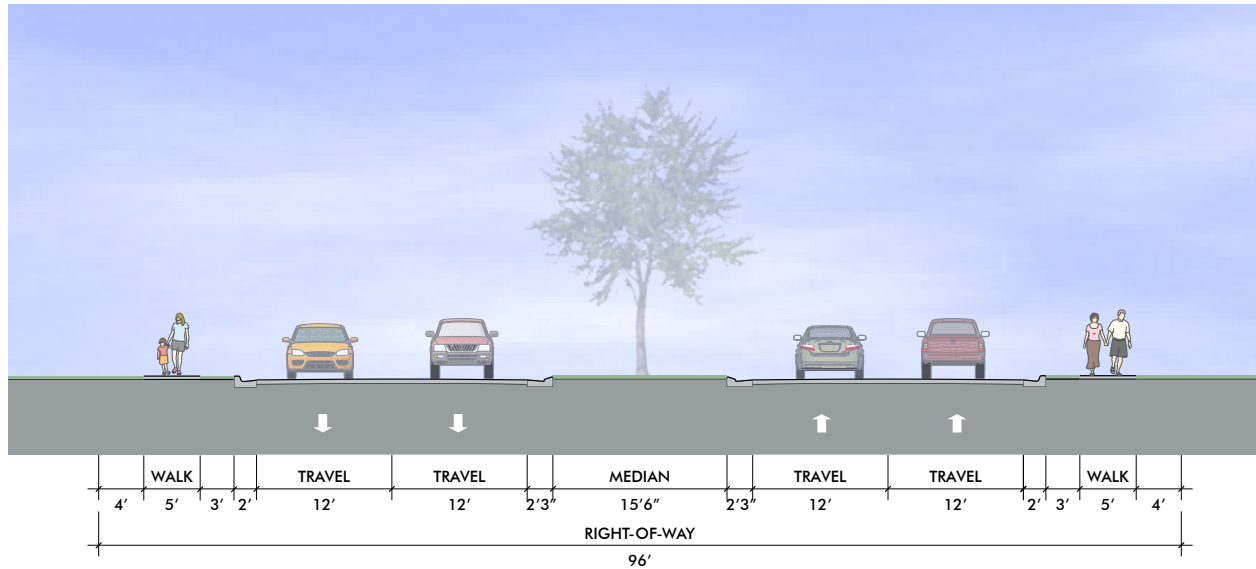


Figure 3. Lumsden Road Existing Typical Section



As shown in Figure 4, the existing land use on this corridor is predominately single-family residential. Some commercial retail and office uses are located at the intersections of Kings Avenue, Parsons Avenue, Bryan Road, and Lithia Pinecrest Road. Institutional uses such as churches, schools, and recreational facilities are also located along the corridor.

3.2 Proposed Improvement

The proposed improvement option for widening of Lumsden Road between Kings Avenue and Lithia Pinecrest Road was developed using the Hillsborough County standard for suburban arterial roadway. As shown in Figure 5, the proposed typical section includes a six-lane divided roadway with a center median with alternating channelized left-turn lanes. Each travel lane is 12-foot-wide and the center median, inclusive of curb and gutter is 22-foot-wide. A five-foot-wide sidewalk is

provided on the south side of the roadway and a 12-foot-wide multi-use path is provided on the north side. The total right-of-way width for this proposed typical section is 145 feet.

3.3 Right-of-Way Impacts

Based on the application of the proposed typical section, additional right-of-way would be required. Based on the number of existing residential properties and the development pattern on the south side of the roadway, the additional fifty feet of right-of-way would be needed on the north side of Lumsden Road.

As shown in Figure 4, a total of forty parcels would be impacted on the north side of Lumsden Road. Based on the amount of the parcels that are impacted, thirty eight parcels were determined to be required as part of a potential right-of-way take. This includes 13 commercial,



Figure 4. Lumsden Road Existing Land Use and Proposed Right-of-Way Impacts

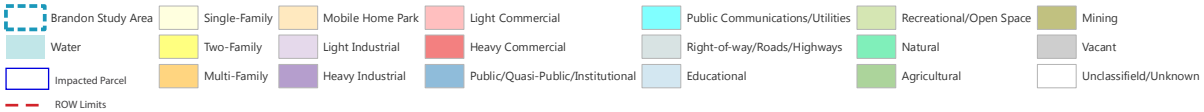
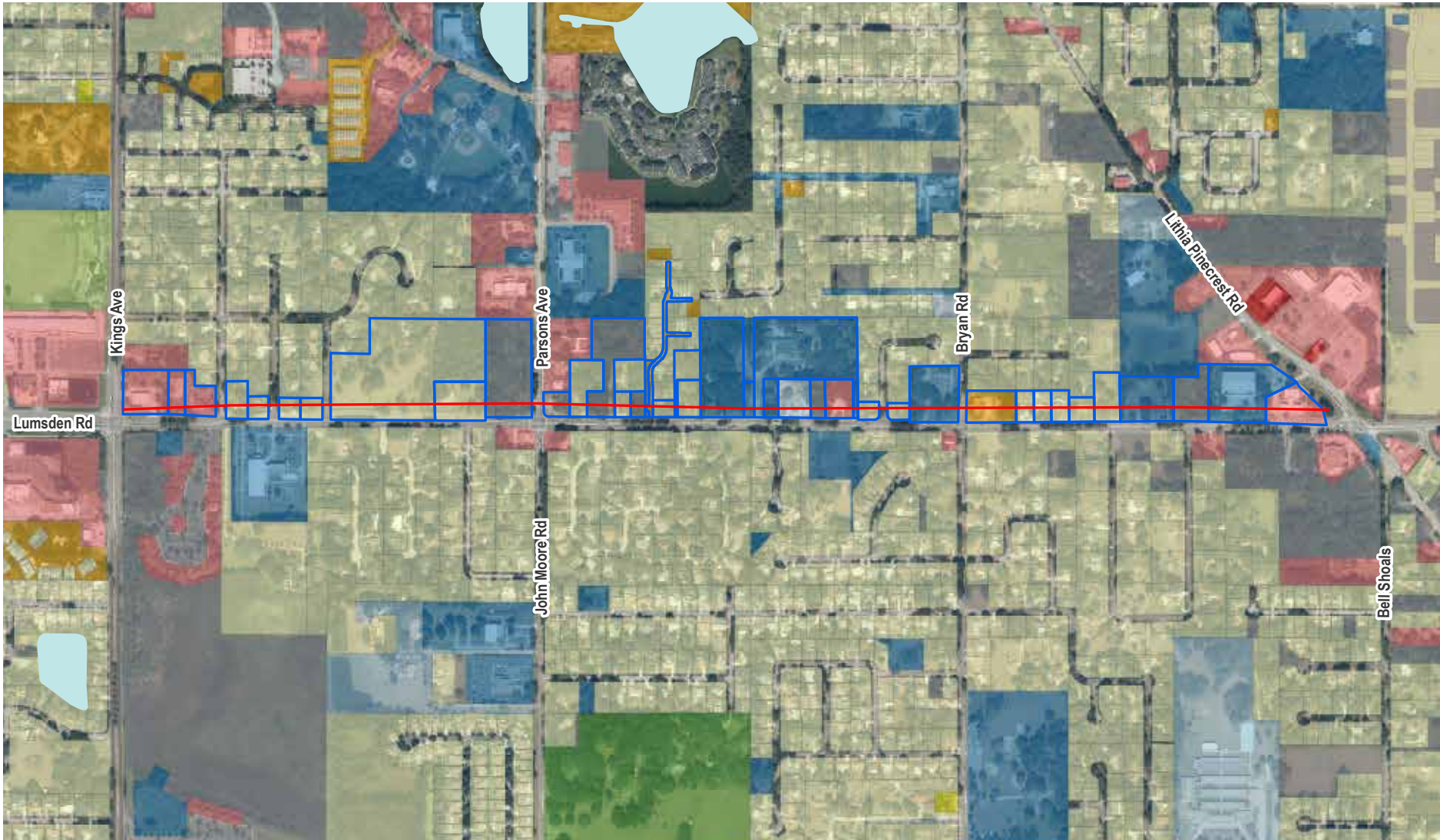
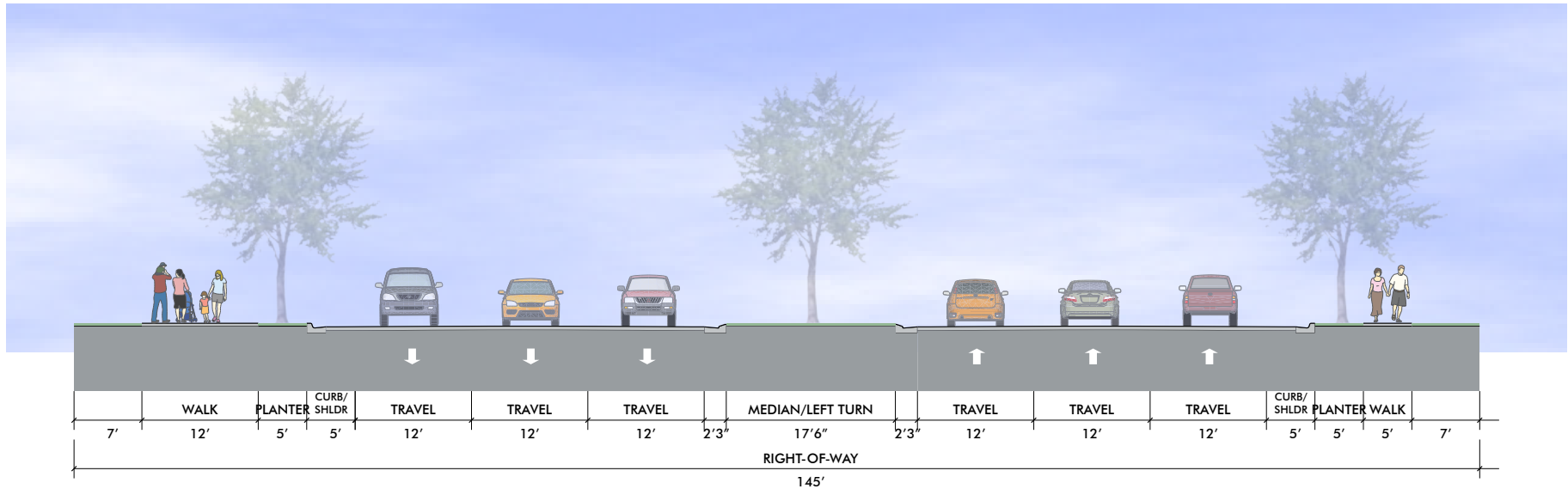


Figure 5. Lumsden Road Proposed Typical Section



21 residential, and 4 unimproved parcels. Sixteen businesses and sixteen residences would be affected and would require relocation. The estimated cost for right-of-way acquisition is \$24.8 million, including land, demolition, processing, support, and relocation costs. The complete right-of-way estimate is provided in Attachment 1.

3.4 Environmental Screening

The Florida Department of Transportation (FDOT) Efficient Transportation Decision Making (ETDM) Environmental Screening Tool (EST) was used for a desktop evaluation of potential environmental issues along the corridor. An Area of Interest was established in the EST composed of a 600-foot buffer along Lumsden Road (CR 676) between Kings Avenue and Lithia Pinecrest Road (CR 640) covering an Area of Interest of approximately 0.18 square miles. An EST Geographic Information System (GIS) analysis report was run by FDOT District

7 and provided to the study team on February 24, 2017. An ETDM Planning Screen was not initiated and circulated to the Environmental Technical Advisory Team (ETAT) for agency review and comment.

A preliminary environmental evaluation of the results of the EST GIS analysis report was completed. Using a Type 2 Categorical Exclusion evaluation form as guidance, the environmental evaluation considered socio-economic, cultural, natural, and physical impacts. The key findings of the evaluation include the following potential impacts or concerns:

- **Relocation Potential.** An estimated 16 business and 16 residential relocations would be required and the estimated right-of-way cost is approximately \$24.8 million.
- **Noise.** The area has multiple residential noise receptors and there is a potential for increased roadway traffic noise as a result of the potential improvement. A noise study report would



be required to determine the potential impact to noise sensitive receptors and if noise abatement would be required.

- **Contamination.** Three potential contamination sources have been identified in the Area of Interest. One has received a No Further Action Site Rehabilitation Completion Order closure status and one has received a No Cleanup Required closure status. The third site (1001 Lithia Pinecrest Road) has a Natural Attenuation. However, this site is outside the area of direct impact and there are no monitoring wells along the corridor.
- **Aesthetics.** The existing roadway corridor is characterized by areas of mature trees. Removal of the tree canopy for the roadway widening would represent a change in the aesthetic character of the community. The potential effects would need to be vetted through community involvement and local government coordination.

More details on the evaluation and the complete screening reports and mapping are provided in Attachment 1.

3.5 Preliminary Construction Cost Estimate

A preliminary construction cost estimate was prepared for the widening of the 1.49-mile-long segment of Lumsden Road between Kings Avenue and Lithia Pinecrest Road from a four lane divided roadway to a six lane divided roadway. The estimated cost for construction is \$13,470,000 or approximately \$1.5 million per lane mile. The cost estimate is based on FDOT construction cost tables. More details are provided in Attachment 1.

3.6 Safety Impacts

Generally, the rate of crashes on the corridor is anticipated to decline if the proposed improvement is implemented. This segment of Lumsden Road was not identified as a high frequency or top severe injury crash

corridor (more than 35 severe crashes between 2006 and 2010). The proposed addition of two travel lanes on Lumsden may result in higher traffic volumes, which could result in higher numbers of crashes along this corridor. However, if the intersections along the corridor are improved as part of the widening project, the addition of crosswalks, turn lanes, or other features could help reduce the number or severity of crashes.

Additionally, the widening will include access related improvements as well as the addition of a seven-foot-wide bike lane, a 10-foot-wide multi-use path on the north side of the road, and five-foot-wide sidewalk on the south side of the road. These improvements will improve safety for bicyclists and pedestrians.

3.7 Summary of Findings

Right-of-way impacts and acquisition costs are a significant consideration in the feasibility of the widening of Lumsden Road between Kings Avenue and Lithia Pinecrest Road. The majority of the impacted parcels would require acquisition, at a cost of almost \$25 million. Construction is estimated to cost an additional \$13.5 million. Since roadways that feed into Lumsden Road to the east of this segment would not be widened, the potential benefit of increased capacity or travel times on this segment may be limited. Congestion may increase at the Lithia Pinecrest Road/Lumsden Road intersection or on roadways east of the widened segment. Capacity analysis on the roadway and network should be considered to evaluate the benefit of this improvement option.

4. BLOOMINGDALE AVENUE

Bloomington Avenue is a major east-west arterial that forms the southern edge of the Brandon Study Area. It carries a significant number of commuter and local trips from the study area and residential areas to the south and southeast to US 301 and I-75 to the west. The study team evaluated the feasibility of converting the center turn lane and median to a reversible lane to accommodate peak period traffic volumes. The Bloomington Avenue reversible lanes study limits are shown on Figure 6.

4.1 Existing Conditions

As a major east-west arterial, Bloomington Avenue carries a heavy amount of commuter traffic from the study area and adjacent areas during the AM and PM peak periods. Bloomington Avenue is a four-lane arterial with a two-way left-turn lane (TWLTL) through its center west of Bell Shoals Drive and directional median openings east of Bell Shoals Drive. The speed limit on Bloomington Avenue is 45 miles per hour (mph). Reversible lanes are being considered on this corridor because it is highly congested during peak periods, constrained from widening options due to the adjacent developments on both the north and south sides of the corridor, and earlier studies indicated that it had a relatively high directional split in the peak periods.

4.2 Reversible Lanes Overview

Reversible lanes corridors exist throughout the country with different levels of signing and lane control, including no lane controls, minimal lane controls, signalized lane control, or physical separation. They are intended to add peak-hour capacity and may be applied to limited access facilities or arterials.

Some examples include the following locations (as shown in Figure 7):

- Connecticut Avenue – six-lane cross section in Washington, D.C.;
- Jarvis Street – five-lane cross section in Toronto, Ontario;
- UT 173 – seven-lane cross section in Salt Lake City, Utah;
- Bay Street – four-lane cross section in Jacksonville, Florida;
- South Atlanta Street – three-lane cross section in Roswell, Georgia; and
- Fall Creek Parkway North Drive – five-lane cross section in Indianapolis, Indiana.

The existing five-lane cross section and traffic patterns on Bloomington Avenue make this corridor a good candidate for reversible lanes consideration. The following sections outline the screening process for implementation of reversible lanes on Bloomington Avenue.

4.3 Reversible Lane Screening

A preliminary screening was conducted to evaluate the feasibility of reversible lanes along Bloomington Avenue from US 301 to Lithia Pinecrest Road. The screening process was based on research methodology from the National Cooperative Highway Research Program (NCHRP). *NCHRP Synthesis 340: Convertible Roadways and Lanes*, identifies a list of warrants that are used to determine the viability of reversible lanes implementation along a corridor. The warrants relate to peak-hour traffic characteristics and existing network conditions.

Based on input from the *NCHRP Synthesis 340*, the following criteria or considerations were evaluated during the preliminary screening process:

- Directional traffic split during peak periods;
- Average operating speed reduction during peak periods;



Figure 6. Bloomingdale Avenue Reversible Lane Evaluation Limits

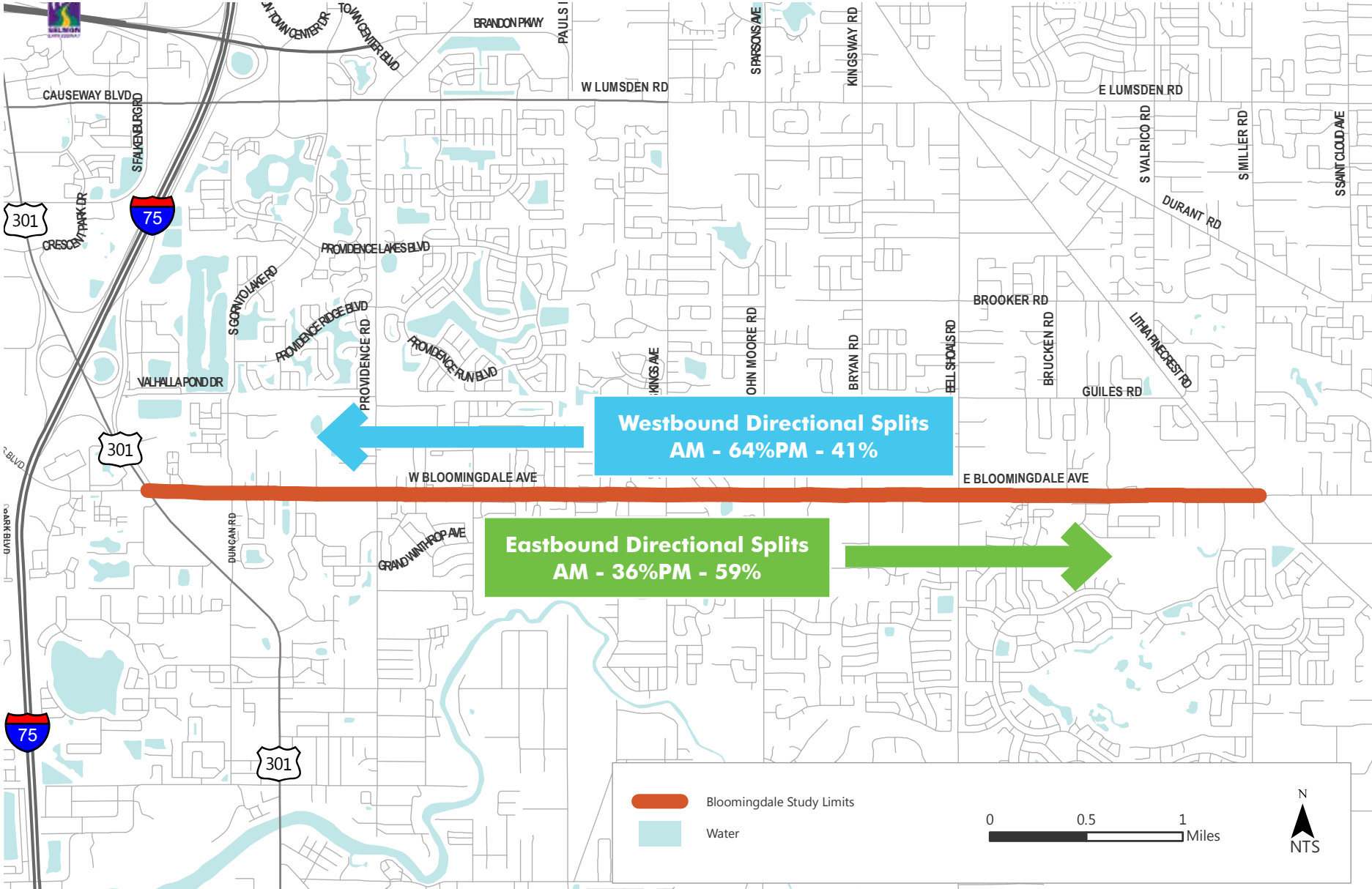


Figure 7. Reversible Lane Examples

Connecticut Avenue in Washington, D.C.



Jarvis Street in Toronto, Ontario



UT 173 in Salt Lake City, Utah



Bay Street in Jacksonville, Florida



South Atlanta Street in Roswell, Georgia



Fall Creek Parkway North Drive in Indianapolis, Indiana





- Qualitative assessment of traffic operations, such as the number of commuter-related trips or other options for improvements; and
- Other considerations for implementation of reversible lanes, such as left-turn lane movement restrictions and other design considerations.

Details on how Bloomingdale Avenue meets these criteria is provided in this section.

4.3.1 DIRECTIONAL TRAFFIC SPLIT CRITERIA

The directional traffic split is the percentage of vehicles traveling in the peak direction versus the off-peak direction; the larger the disparity (during both AM and PM peak periods) the more appropriate reversible lanes implementation may be. The *NCHRP Synthesis 340* has compiled a list of values from the *American Association of State Highway and Transportation Officials (AASHTO) Green Book*, the Institute of Transportation Engineers (ITE), and the *Manual on Uniform Traffic Control Devices (MUTCD)* of directional traffic splits that indicate when reversible lanes might be a viable option, as shown in Table 1. Based on the recommendations of these sources, reversible lanes may be appropriate if at least 65 percent of traffic in the peak period is flowing in the peak direction.

The directional traffic splits were calculated on each segment along Bloomingdale Avenue between US 301 and Lithia Pinecrest Road using traffic volumes from the *FDOT District Seven Districtwide Traffic Signal Retiming Report for the US 301 and Bloomingdale Avenue Corridors* (April 2016). Global (systemwide) AM and PM peak hour directional splits were established using a weighted average of the two-way segment peak-hour volumes and the measured directional splits.

The AM peak direction was determined to occur in the westbound direction with a weighted average of 64 percent. The PM peak direction was determined to occur in the eastbound direction with a weighted average of 59 percent. During the AM peak hour, five segments had a directional split greater than or equal to 65 percent

Table 1. Directional Traffic Splits – Recommended Ranges for Reversible Lanes

Source	Range
AASHTO Green Book	> 65%
ITE	66 - 75%
MUTCD	66 - 75%

and the directional splits ranged from 57 to 74 percent. During the PM peak hour, none of the segments had a directional split greater than or equal to 65 percent and the directional splits ranged from 55 to 61 percent. Figure 6 shows the directional splits graphically. Although the directional traffic split criterion is not met globally or for every segment, the global AM peak hour directional split is just below the thresholds identified in Table 1 with a maximum segment split near the upper end of the recommended ranges. Therefore, reversible lanes should not be dismissed on this criterion alone.

4.3.2 SPEED REDUCTION CRITERIA

The average operating speed of a corridor is also an important factor in determining the feasibility of reversible lane implementation. The *NCHRP Synthesis 340* recommends that if the average operating speed of the corridor decreases by at least 25 percent during the peak periods, reversible lanes may be warranted.

The *FDOT District Seven Districtwide Traffic Signal Retiming Report for the US 301 and Bloomingdale Avenue Corridors* shows travel time results for the peak and free-flow conditions. These results show that the average free-flow travel speeds along Bloomingdale Avenue between US 301 and Lithia Pinecrest Road are approximately 43 mph in both the westbound and eastbound directions. The peak direction average travel speeds (with signals retimed for optimal operations) along Bloomingdale Avenue between US 301 and Lithia Pinecrest Road are approximately 26 and 22 mph in the AM and PM peak hours,

respectively. These peak-hour peak direction speeds are approximately 40 and 49 percent reductions of the average operating speed of 43 mph in the AM and PM peak hours, respectively. Therefore, the speed reduction criterion is met, since there is a large reduction in the average operating speeds during the AM and PM peak periods, as shown in Table 2.

4.3.3 QUALITATIVE CRITERIA

Some of the reversible lanes screening criteria proposed by the *NCHRP Synthesis 340* are qualitative. These criteria include:

- **Periodic and Predictable Traffic Patterns.** The first criteria is whether traffic congestion is periodic and predictable. Along Bloomingdale Avenue traffic is periodic and predictable, since AM and PM peak hours occur consistently at the same times during weekdays.
- **High Proportion of Commuters.** Reversible lane corridors should contain a high proportion of commuter-type traffic that desire to traverse the area without turns or stops. This corridor has a high number of commuters, mainly flowing to and from regional employment centers including MacDill Air Force Base, downtown Tampa, and Westshore in Tampa during the weekdays.
- **No Other Alternatives/Corridors to Relieve Traffic.** Introduction of reversible lanes are acceptable if there are no other acceptable alternative, including widening, construction of a parallel roadway, or reconfiguring an adjacent street to work as a one-way pair. Widening of Bloomingdale Avenue is not a feasible option due to the expected right-of-way impacts. Brandon is nearly built out with no viable options for adding a new parallel route that would be expected to relieve Bloomingdale Avenue. Lumsden Road and SR 60 (Brandon Boulevard) are the only other routes that traverse Brandon completely from east to west, and they are located several miles to the north. Additionally, there is no other street adjacent to Bloomingdale Avenue that may be considered as a one-way pair

Table 2. Bloomingdale Avenue Operating Speeds

Peak Period	Average Free-Flow Speed (mph)	Peak Direction Average Speed (mph)	Allowable Free-Flow Speed Reduction (%)	Actual Free-Flow Speed Reduction (%)	Allowable Free-Flow Speed Reduction (mph)	Actual Free-Flow Speed Reduction (mph)
AM	43	26	25%	40%	11	17
PM	43	22	25%	49%	11	21

option. However, minor improvements at intersections, adding new signals, or implementing innovative intersection treatments may be viable options for relieving Bloomingdale Avenue. These treatments are discussed in more detail in Section 4.6.

- **Sensible Termini.** The reversible lanes terminal conditions must be appropriately designed to provide easy transition between normal and reverse flow lanes. If reversible lanes were implemented along this corridor, the US 301/Bloomingdale Avenue intersection would need to be improved or reconfigured to prevent it from acting as a choke point, especially for westbound traffic during the AM peak period. This intersection also meters eastbound traffic during the PM peak period. I-75/US 301 interchange improvements may also need to be incorporated as part of the US 301/Bloomingdale Avenue intersection improvements to ensure that the ramps do not act as choke points.

The Bloomingdale Avenue/Gornto Lake Road intersection provides a sensible western terminus due to its cross section change to six lanes on the west side of the intersection. There are two sensible eastern terminal options available: the Bloomingdale Avenue/Lithia Pinecrest Road intersection or the Bloomingdale Avenue/Bell Shoals Road intersection.



The Bloomingdale Avenue/Lithia Pinecrest Road intersection was considered as a potential eastern terminus due to its cross section change on the east side of the intersection to two lanes, undivided. Alternatively, the Bloomingdale Avenue/Bell Shoals Road intersection may also be used as a potential eastern limit due to its cross section change on the east side of the intersection to include landscaped raised medians with directional left-turn openings and the presence of Bloomingdale High School, which has school bus traffic and novice drivers using this driveway. Bell Shoals Drive also has a high volume of northbound left traffic accessing Bloomingdale Avenue and is planned to be widened to four lanes from Boyette Road to Bloomingdale Avenue, according to the Hillsborough County MPO 2015-2019 *Transportation Improvement Program* (TIP).

4.3.4 SUMMARY OF BLOOMINGDALE AVENUE REVERSIBLE LANES SCREENING

Table 3 shows a summary of the reversible lanes screening results for the Bloomingdale Avenue corridor from US 301 to Lithia Pinecrest Road in Hillsborough County. All screening criteria are met with the exceptions of the directional traffic split threshold and no other feasible improvement options available.

If reversible lanes were implemented, the US 301/Bloomingdale Avenue intersection would need to be improved or reconfigured to prevent it from acting as a choke point, especially for westbound traffic during the AM peak period. This intersection also meters eastbound traffic during the PM peak period. I-75/US 301 interchange improvements may also need to be incorporated as part of the US 301/Bloomingdale Avenue intersection improvements to ensure that the ramps do not act as choke points.

Although the directional traffic split criterion is not met globally or for every segment, the AM peak hour does show a heavy traffic flow in the westbound direction. The PM peak hour does not show as great of a disparity, perhaps due to a metering condition at the US 301/

Table 3. Reversible Lane Screening Criteria

Criteria	Met?
Quantitative Criteria	
Directional traffic split > 65%	no
Reduction in average operating speed > 25% during peak hours	yes
Qualitative Criteria	
Congestion is periodic and predictable	yes
High commuter-type traffic	yes
No other feasible improvement options	no
Reversible lanes terminals provide easy transition	yes

Bloomingdale Avenue intersection and/or more activity at recreational and commercial land uses during this time. The high reduction in average operating speeds and observed delay during the peak periods indicate that a reversible lanes system may provide operational benefits, even without meeting this criterion.

While minor improvements at intersections, adding new signals, or implementing innovative intersection treatments may be viable options for relieving Bloomingdale Avenue congestion, traditional improvements that would provide a major relief to this corridor, such as widening, construction of a new parallel roadway, or reconfiguring an adjacent street to work as a one-way pair are not feasible options.

Since most of the reversible lanes screening criteria are met or nearly met, the Bloomingdale Avenue corridor was advanced to identify other special considerations for implementing reversible lanes and to conduct a high-level traffic analysis to determine the operational benefits of their implementation on this corridor. Other potential intersection treatment options were also further explored.

4.4 Special Considerations for Implementation

In addition to the screening criteria for determining reversible lane feasibility, the *NCHRP Synthesis 340* identifies some other qualitative considerations for designing a reversible lanes system, as described in the following section.

- **Left-Turn Movements.** Restricting or prohibiting left-turn maneuvers off the mainline at major and mid-block intersections is desirable on a reversible lanes corridor. Allowing these maneuvers can result in increased sideswipe, head-on, and angle type crashes due to drivers not recognizing which lane is the appropriate turn lane. There may also be increased queuing while the left-turning vehicle waits for an acceptable gap, which reduces the operational benefits of a reversible lanes system.
- **Minimum Number of Lanes in Each Direction.** The *NCHRP Synthesis 340* advises keeping at least two lanes open in each direction on reversible lanes facilities, regardless of the volumes in the off-peak direction. This is to prevent congestion that may arise from a turning vehicle, crash, or heavy vehicle/bus operations. A single lane in the off-peak direction could result in excessive queuing and delay and capacity analysis should be conducted to determine the expected impacts of implementing reversible lanes with one lane in the off-peak direction.

Prohibiting on-street parking is also recommended since it can increase the capacity of the corridor by allowing more through lanes. It also reduces the potential for crashes involving a parked vehicle. There is currently no on-street parking on the Bloomingdale Avenue corridor.

- **Transition Period Logistics.** The transition period is the period of time when the traffic is switched from one direction to the other. This procedure allows vehicles within the lane that is being reversed to clear the system before allowing the opposing movement access to that lane. At a minimum, the transition period must include the time required for the last vehicle entering

the reversible lanes limits to traverse the system completely and exit. Police or service vehicles are usually the first and last to enter and exit the segment, although advanced signal control systems and movable barriers have also been used on existing reversible lanes corridors.

- **Traffic Control Devices.** Traffic control devices are essential to ensuring safe and efficient reversible lanes facility operations. All signal heads at signalized intersections within the reversible lanes limits must be updated to control all of the possible lane configurations (AM and PM peak periods and off-peak periods). In addition to the signal head updates, overhead gantries should be placed at frequent intervals that allow at least one signal indication (preferably two) to be within the driver's view at any point along the corridor, including vehicles turning from cross streets and driveways onto Bloomingdale Avenue. These gantries are used to indicate which lanes are specifically reserved for each directional use.

4.5 Reversible Lanes Configurations Considered

Two reversible lanes configurations were considered for Bloomingdale Avenue. Figure 8 shows the plan view of each configuration during the AM and PM peak periods and off-peak periods.

- **3/2 Reversible Lane Configuration.** The first configuration consists of three lanes in the peak direction and two lanes in the off-peak direction (3/2 Configuration).
- **3/1 TWLTL/1 Reversible Lane Configuration.** The second configuration consists of three lanes in the peak direction, one two-way left-turn lane (TWLTL), and one lane in the off-peak direction (3/1 TWLTL/1 Configuration). The outside lane in both the eastbound and westbound directions would be maintained as a permanent lane in those respective directions under both configurations. During off peak periods, the Bloomingdale Avenue cross section would consist of two lanes in each direction and one TWLTL in the middle lane (2/1 TWLTL/2).

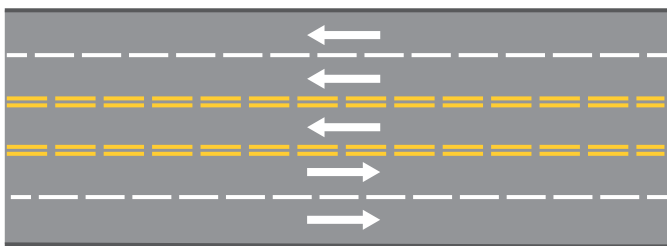


Figure 8. Bloomingdale Avenue Reversible Lane Configuration Concepts

3/2 Reversible Lane Configuration

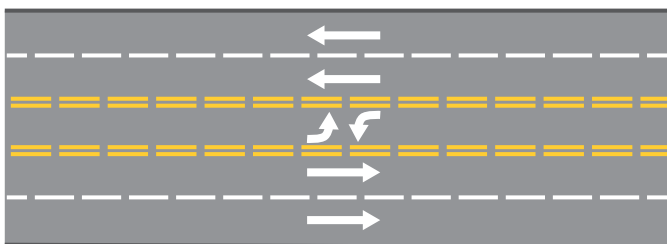
AM Peak Period

3 westbound lanes, 2 eastbound lanes, no left turn lane



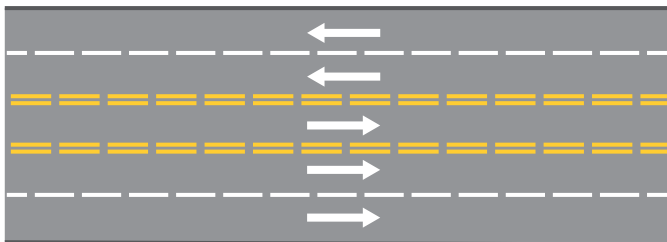
Off Peak Period

2 westbound lanes, 2 eastbound lanes, two-way left turn lane



PM Peak Period

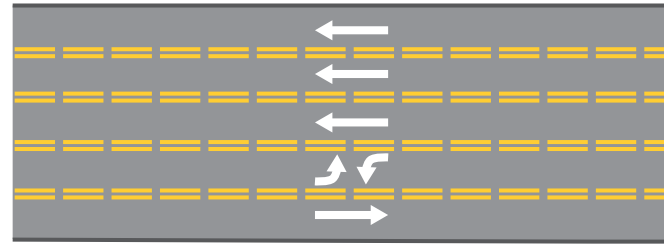
2 westbound lanes, 3 eastbound lanes, no left turn lane



3/1 TWLTL/1 Reversible Lane Configuration

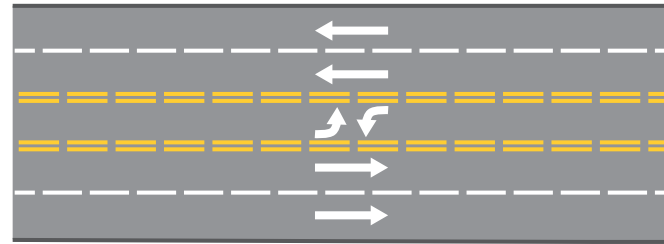
AM Peak Period

3 westbound lanes, 1 eastbound lane, two-way left turn lane



Off Peak Period

2 westbound lanes, 2 eastbound lanes, two-way left turn lane



PM Peak Period

1 westbound lane, 3 eastbound lanes, two-way left turn lane

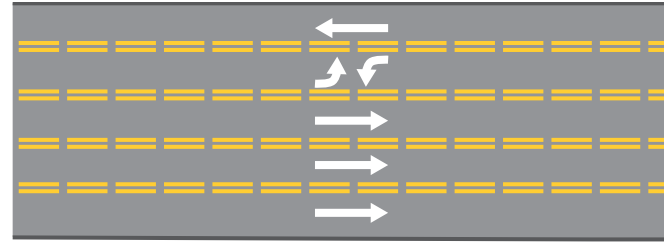


Figure 9. Signing Schematic Example with TWLTL Shifted During Peak Periods



Figure 9 shows a signing schematic example for a configuration where the TWLTL is shifted during peak periods, similar to the 3/1 TWLTL/1 configuration. Figure 10 shows the signing schematic from the cross section view for the 3/2 and 3/1 TWLTL/1 configurations.

4.5.1 TRAFFIC OPERATIONAL ANALYSIS

Existing year (2016) traffic was used for the analysis to estimate the immediate impacts of relieving the corridor. The evaluation focused on the AM peak period since it is the worst case for Bloomingdale Avenue as traffic is metered in the PM by the US 301/Bloomingdale Avenue intersection. Two different analysis measures were considered for each of the reversible lane configurations:

- Travel time was selected as the analysis measure for the 3/2 configuration because the main benefit of this configuration includes providing an additional through lane, but the main drawback is that left-turn movements must be restricted while the center lane is reversed. Travel time captures whether or not the benefits outweigh the drawbacks.

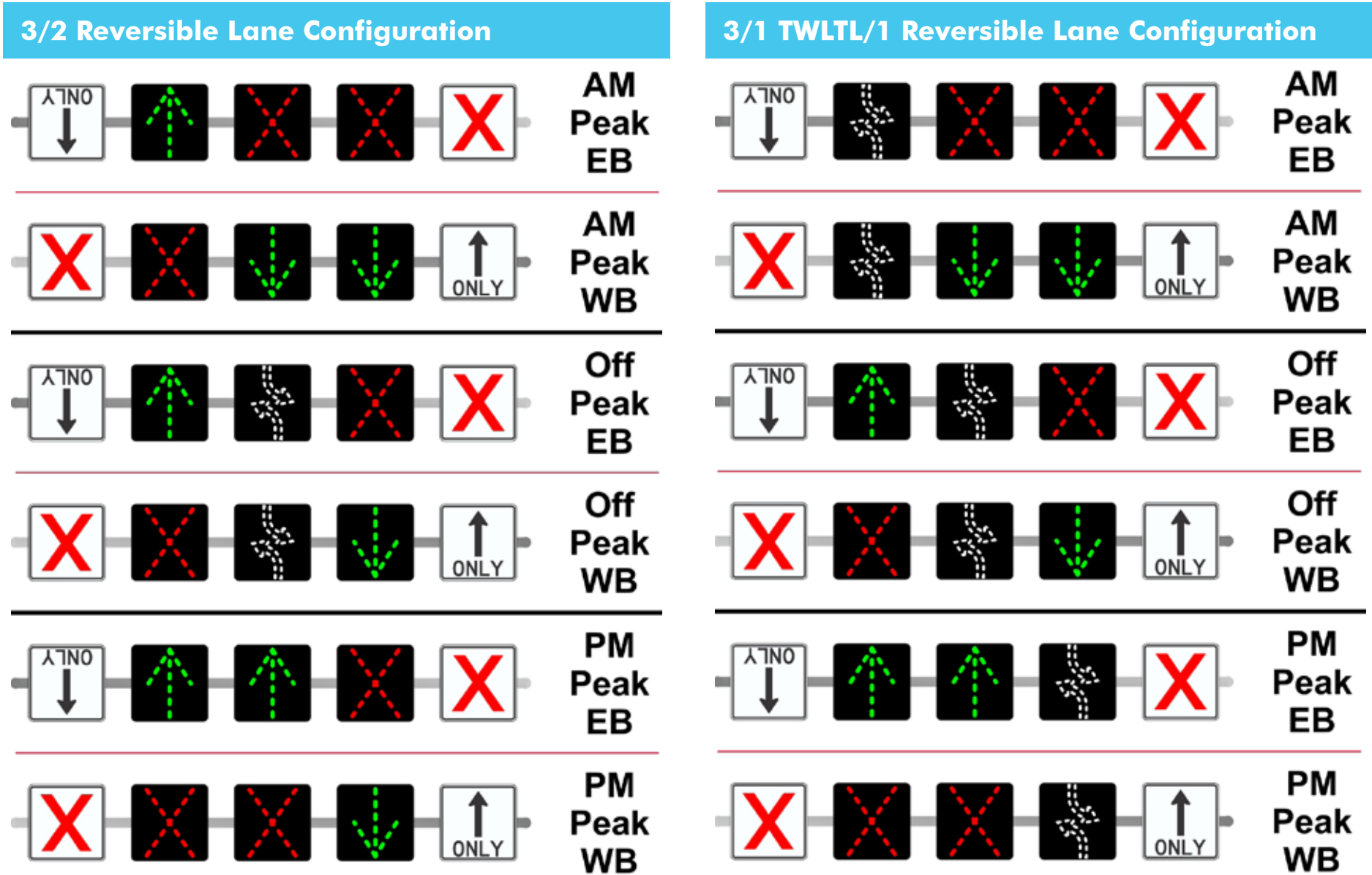
- Volume-to-capacity ratios (v/c_s) were selected as the analysis measures for the 3/1 TWLTL/1 configuration because the main drawback is that one of the through lanes in the off peak direction is used as a TWLTL while the lanes are reversed. V/c_s capture whether or not this lane reduction causes the off peak direction to exceed capacity.

3/2 Reversible Lanes Configuration

The 3/2 reversible lanes configuration was analyzed by travel time of the entire network and westbound Bloomingdale Avenue in the AM peak hour. No eastbound or westbound left-turn movements were allowed from Bloomingdale Avenue in this analysis as the existing left-turn lanes would be used as the reversible through lane under this configuration. These left-turn movements were instead accommodated by Median U-Turn (MUT) intersections on the north and south legs of all signalized intersections along Bloomingdale Avenue that were in the Synchro models provided by Hillsborough County.



Figure 10. Bloomingdale Avenue Reversible Lanes Signing



MUT intersections require eastbound and westbound left-turning vehicles to turn right onto the cross streets, make U-turns, and continue through from the northbound and southbound approaches, respectively, to execute their original desired left-turn movement. Figure 11 shows a schematic of eastbound and westbound left turn movements routed through a MUT intersection. MUT intersections may require additional right-turn capacity at the master intersection to accommodate the increased volume due to the rerouted left-turn movements. Right-of-way may also be required on the north and south legs of the cross streets.

These MUT intersections are necessary under this configuration due to the lack of a grid system in this area for vehicles to use to reposition themselves for their desired movement. The MUT intersections were coded in the Synchro model as either signalized or unsignalized intersections, although a roundabout may also be a viable option. The Synchro travel time estimates, shown in Table 4, illustrate that while a travel time reduction would occur on westbound Bloomingdale Avenue in the AM peak hour with a 3/2 reversible lane configuration, the overall networkwide travel times would see an increase. This is due to the large number of anticipated left-turns that would be required to make right turns at intersections followed by median u-turns. The travel

Table 4. 3/2 Reversible Lanes Configuration Travel Times in AM Peak Hour

Scenario	Existing Configuration Travel Times	3/2 Configuration Travel Times
Networkwide */** AM Peak Hour	1,695 hours	1,850 hours
Westbound Bloomingdale Avenue */** AM Peak Hour	671 hours	582 hours

* MUTs assumed on all north-south legs to remove left-turns from Bloomingdale Avenue.

** MUT lefts do not include additional mid-block lefts that are currently using the TWLTL.

Figure 11. Median U-Turn (MUT) Intersection Schematic

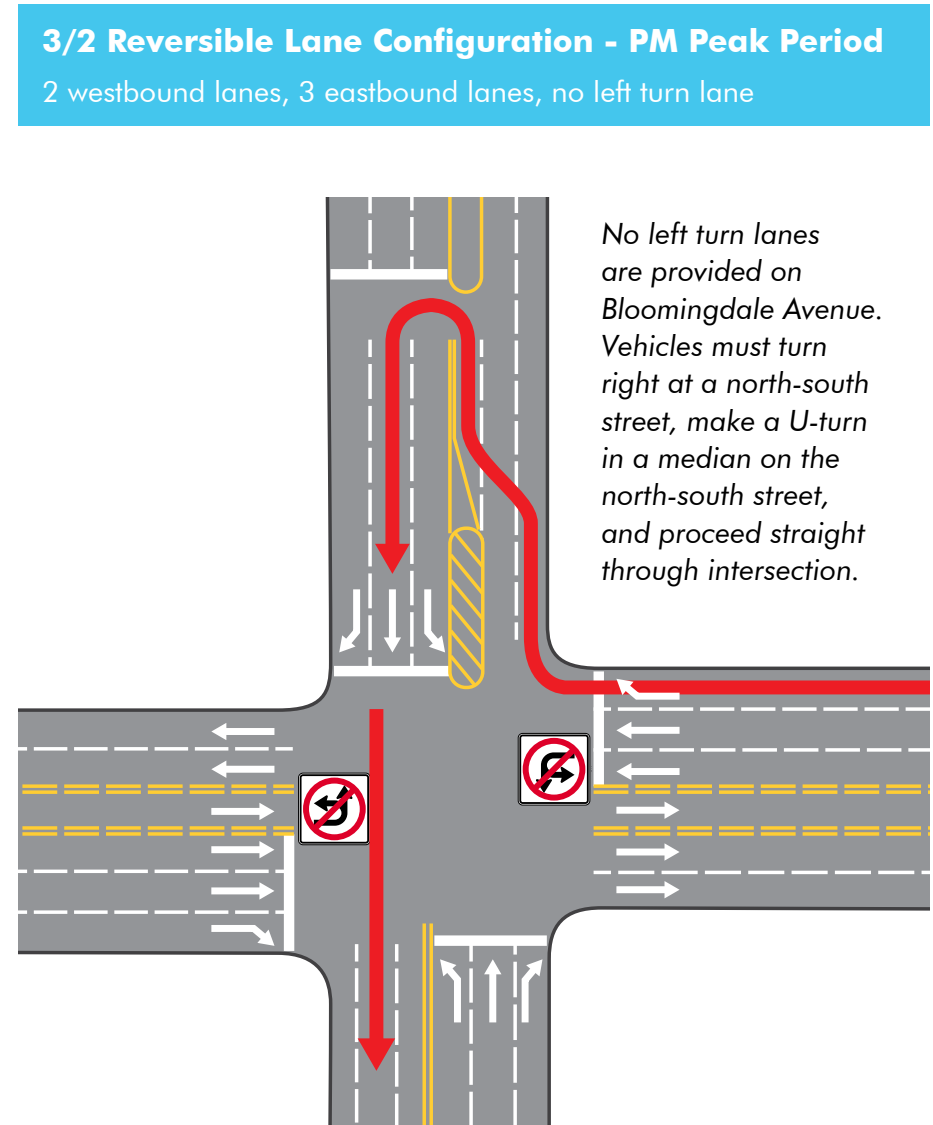




Figure 12. Bloomingdale Avenue TWLTL Rerouted Volume Schematic



**Note that the rerouted left-turn movements are not accounted for in the Table 4 results.*

time estimates do not include mid-block lefts currently using the TWLTL that would be restricted under this configuration and instead filtered through signalized intersections and MUTs to access their destination, as shown in Figure 12. This means the 3/2 configuration networkwide travel times would likely be even higher than the analysis results show.

With the 3/2 configuration in place, approximately 100 driveways that currently allow left turns movements in would not be accessible via left-turn-in maneuvers from Bloomingdale Avenue while the lanes are reversed from US 301 to Bell Shoals Road and another 20 from Bell Shoals Road to Lithia Pinecrest Road. Many of these properties would not be accessible via another drive from a cross street and would need to be accessed via the MUT intersections to eventually make a right-turn-in maneuver at the desired destination.

3/1 TWLTL/1 Reversible Lanes Configuration

The 3/1 TWLTL/1 reversible lanes configuration was analyzed by v/c of the off-peak direction (eastbound) in the AM peak hour using LOS service volumes from the 2013 FDOT Quality/Level of Service (Q/LOS) Handbook as capacity threshold estimates. The average volume traveling in the eastbound direction on Bloomingdale Avenue in the AM peak hour is 1,250 veh/h from Gornto Lake Road to Bell Shoals Road. Table 5 shows that a lane reduction from tin the eastbound direction during the AM peak period would cause this lane to be nearly 60 percent over capacity.

Table 5. 3/1 TWLTL/1 Reversible Lanes Configuration Off Peak Capacity Reduction in AM Peak Hour

Scenario	Average Volume (veh/h)	Capacity (veh/h)*	AM Eastbound v/c
Existing Configuration	1,250	1,800	0.697
3/1 TWLTL/1 Configuration	1,250	792	1.584

* Capacity for existing (2 lanes - 1,800) and 3/1/1 configurations (1 lane - 792) based on 2013 FDOT Q/LOS Handbook, Table 7

4.5.2 IMPACTS AND IMPLICATIONS OF EACH REVERSIBLE LANES CONFIGURATION

Reversible lanes implementation on Bloomingdale Avenue has some impacts and implications common to both lane configuration options that should be carefully considered. The US 301/Bloomingdale Avenue intersection and I-75/US 301 interchange currently act as a bottleneck/meter and would need to be improved or reconfigured prior to implementing reversible lanes. Also, overhead gantries would be required at frequent intervals and signal-related hardware upgrades (example shown in Figure 13) would be required at existing signalized intersections.

intersections. These upgrades, especially at the signalized intersections, may require other additional geometric adjustments in order for the intersection to safely comply with design standards.

Left-turn movements at unsignalized driveways between signalized intersections may need to be prohibited during transition periods, even under the 3/1 TWLTL/1 configuration. This could be difficult to enforce and may eliminate access to some destinations temporarily. Although a pattern of increased crashes or head-on collisions has not been observed relating to reversible lanes retrofits, potential safety concerns may arise. Driver behavior varies by location and local users' awareness and adaption to this type of new configuration should be carefully monitored. Public outreach, engagement, and education are essential for facilitating users' and stakeholders' thorough understanding of this treatment method.

3/2 Reversible Lanes Configuration

The 3/2 reversible lanes configuration provides an additional through lane with the expectation of adding more capacity to the peak direction through movement. As shown in Table 4, travel time is improved for AM westbound Bloomingdale Avenue traffic, although network-wide

Figure 13. Reversible Lanes Signalized Intersection Hardware Example





travel time worsens under this configuration compared to the existing configuration. Although this configuration offers some benefits to the peak direction through movement, there are also several drawbacks.

No left-turn movements would be allowed from Bloomingdale Avenue at signalized intersections or midblock driveways. MUT intersections, or a similar treatment, would be needed on the north and south legs of all signalized intersections to facilitate those prohibited left turns. This would allow the master intersection (existing signalized intersection on Bloomingdale Avenue) to operate as a three-phase signal. However, the MUT traffic would include left-turns currently being made from the TWLTL. All driveway counts between signalized intersections would be needed along Bloomingdale Avenue to accurately analyze the MUT intersections and their master intersections using the fully expected

demand volume, which would include the increase in left turns. Right-of-way may be required on the north and south legs of signalized intersections to construct the MUT intersections for the appropriate design vehicle.

Prohibiting left-turn movements on Bloomingdale Avenue also may be difficult to enforce with no physical barrier present and may be too restrictive in allowing drivers to access their desired destinations. Drivers may attempt to make left-turn movements from the inside through lanes if the TWLTL was removed, which would be detrimental to the system's operations as it would reduce the capacity of the inside through lane in each direction and the full intended benefit of the 3/2 configuration would not be realized.

Figure 14. Driveway Turns onto Bloomingdale Avenue Under 3/2 Configuration (AM Peak Period)



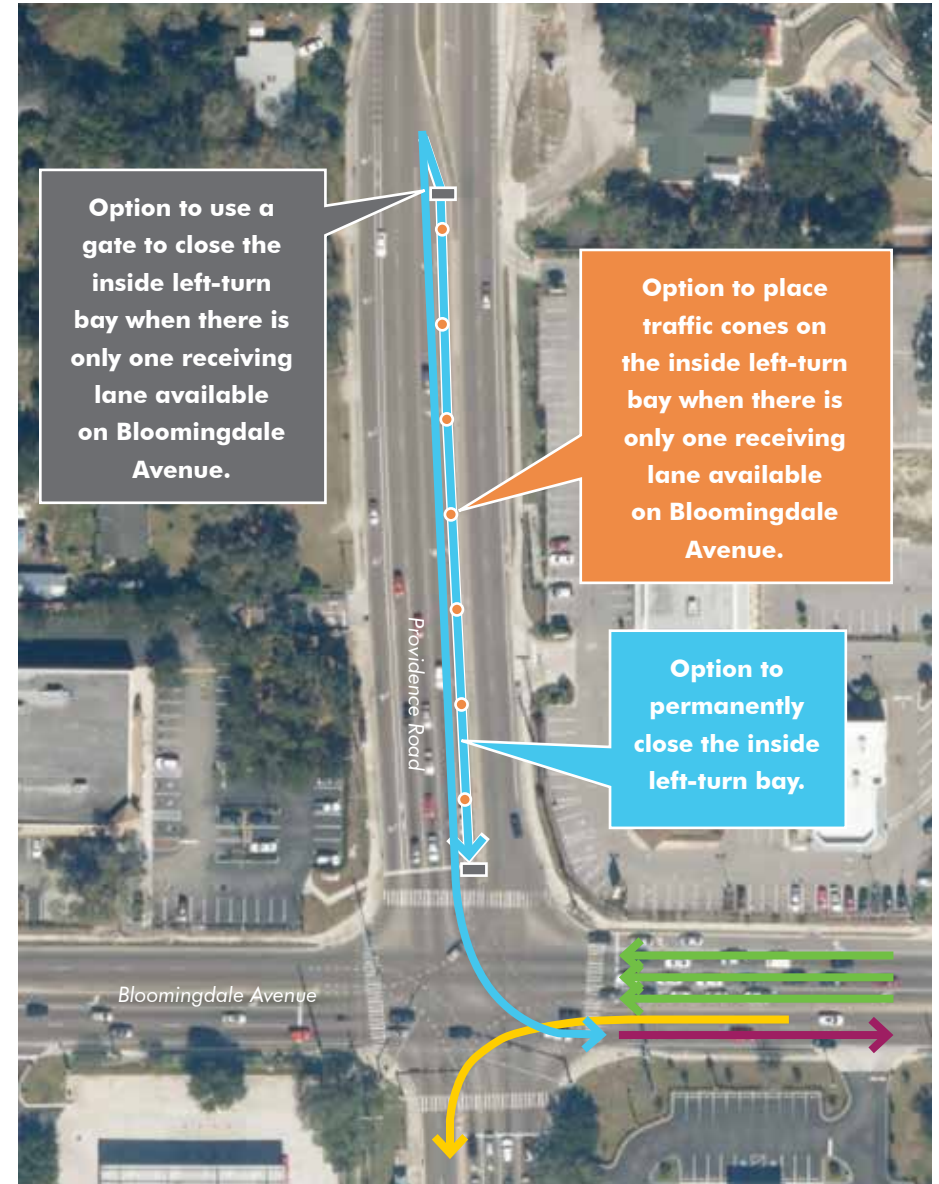
Additionally, there is a potential for increased crashes for vehicles turning onto Bloomingdale Avenue from midblock driveways or houses as there is no TWLTL available to receive them and eastbound AM traffic will be dispersed amongst 3 lanes instead of 2 and conversely for westbound PM traffic, making it more difficult to choose a gap in the traffic stream. Figure 14 depicts this situation. Special consideration should be given to allowing turns from driveways onto Bloomingdale Avenue when the reversed lanes are activated. Right-in/right-out restrictions should be considered during the peak periods when the lanes are reversed.

3/1 TWLTL/1 Reversible Lanes Configuration

The TWLTL remains open and access to businesses is maintained under this configuration. However, the minimum recommended two lanes is not able to be maintained in each direction at all times under this configuration. A single lane in the off-peak direction is expected to operate greatly over capacity. Excessive delay and queuing in the off-peak direction could occur in the event of an accident or due to bus stops. In these cases, vehicles may attempt to go around the obstruction via the TWLTL.

Left-turn movements at signalized intersections from Bloomingdale Avenue and cross streets may be possible to maintain, but should be given careful consideration for safety and geometric compliance with design standards. Since Bloomingdale Avenue has a five-lane cross section, dual left turns from north-south cross streets at signalized intersections would need to be removed or controlled with a gate to only allow one left-turn lane to be in operation when only one receiving lane is available. Traffic cones may also be manually placed in the closed left-turn lane as shown in Figure 15. The receiving lane for single left-turn lanes from Bloomingdale Avenue's signalized cross streets should be the designated permanent lane for both the eastbound and westbound directions for consistency and repeatability in line with driver expectations. Left-turn movements from

Figure 15. Dual Left Turns onto Bloomingdale Avenue Under 3/1 TWLTL/1 Configuration





Bloomington Avenue's unsignalized cross streets should also be given careful consideration for potential conversion to right-in/right-out configurations.

4.6 Other Treatment Options Considered

Although several of the reversible lanes criteria were met during the screening, there were numerous concerns associated with implementing reversible lanes on Bloomington Avenue under both configurations that were considered. Therefore, other congestion mitigation strategies were considered for this corridor. Minor intersection improvements at signalized intersections along Bloomington Avenue were analyzed and are expected to relieve some of the existing congestion. However, these short-term improvements are not intended to be ultimate solutions to Bloomington Avenue's congestion. The TWLTL was also screened for locations with high crash frequencies where a new signal may facilitate movements off of Bloomington Avenue or onto Bloomington Avenue from midblock driveways.

A more elaborate concept has also been considered at a high-level for a potential long-term solution. This concept involves exploring opportunities to reduce phases at signalized intersections along Bloomington Avenue via innovative techniques, such as quadrant roads, displaced left-turns, and/or MUT intersections. The TWLTL would be able to remain open with these treatments implemented as well and the existing four-phase intersections could be reduced to two or three phases, depending on the changes implemented.

4.6.1 SHORT-TERM IMPROVEMENTS

Various improvements were considered at signalized intersections along Bloomington Avenue for congestion mitigation using traffic volumes from the *FDOT District Seven Districtwide Traffic Signal Retiming Report for the US 301 and Bloomington Avenue Corridors*. These improvements are expected to lower the delay (intersection and

approach), reduce the intersection v/c ratio, and/or improve the LOS. It is expected that these improvements can be constructed within the existing right-of-way, but would need to be verified during preliminary layout.

- **Gornto Lake Road-Duncan Road.** Change the eastbound, northbound, and southbound permitted rights to permitted overlaps and retime signal.
- **Providence Road.** Add an eastbound right-turn bay, change the eastbound, westbound, and southbound permitted rights to permitted overlaps, and retime signal.
- **Watson Road.** Add a left-turn bay to the northbound approach and change the northbound left to protected and the southbound left to permitted-protected and retime signal.
- **Kings Avenue.** Add a right-turn bay to the westbound approach and retime signal.
- **John Moore Road.** Add an exclusive right-turn bay to the southbound approach and change the westbound, northbound, and southbound permitted rights to permitted overlaps.
- **Bryan Road.** Redesignate the southbound approach lanes from a left-turn lane, a shared left-through lane, and a right-turn lane to dual left-turn lanes and a shared through-right lane.
- **Bell Shoals Road.** Add an exclusive right-turn bay to the southbound approach; redesignate the southbound through-right lane to a through only. Change the westbound, northbound, and southbound permitted rights to permitted overlaps.
- **Culbreath Road.** Redesignate the southbound approach lanes from a left-turn lane and a shared through-right lane to a shared left-through lane and a right-turn lane.
- **Lithia-Pinecrest Road.** Add an exclusive right-turn bay to the westbound and southbound approaches; redesignate the westbound and southbound shared through-right lanes to through lanes only. Change the westbound and southbound permitted rights to permitted overlaps.

4.6.2 ADDING NEW SIGNALS

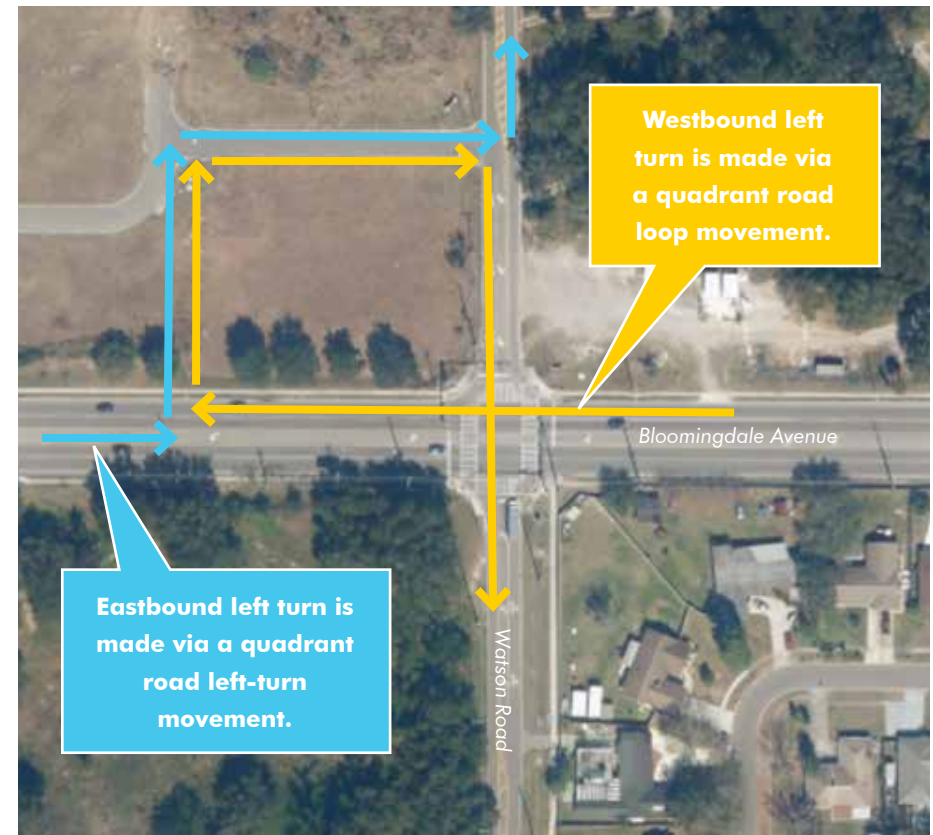
The TWLTL was screened for locations with high crash frequencies using 2010-2015 crash data provided by the Hillsborough MPO that would potentially benefit from a new signal to facilitate easier movements off of Bloomingdale Avenue or onto Bloomingdale Avenue from midblock driveways. However, the crash frequencies in the TWLTL were low and sporadic without a clear pattern or indication that there is a repetitive safety concern that could be addressed through physical improvements to the network. Therefore, new signal options were not further explored as they could potentially increase the delay and travel times along Bloomingdale Avenue unnecessarily, as well as add conflict points that could lead to a safety concern where one currently does not exist.

4.6.3 INNOVATIVE INTERSECTION TREATMENTS/MEDIAN U-TURN CORRIDOR

Quadrant roads, displaced left-turns, and MUT intersections are gaining popularity throughout the country as effective methods for mitigating congestion through their ability to reduce traditional four-phase intersections to three or two phases, depending on how many movements are modified, thereby increasing an intersection's capacity. While quadrant road and displaced left-turn opportunities may be available and suitable at certain intersections along Bloomingdale Avenue, their potential impacts should also be taken into consideration.

Quadrant roads can require a large amount of space and right-of-way if an existing road alignment, such as a driveway for a development or grid-style network, is not already in place. Pavement improvements may be required on an existing alignment being used as a quadrant road to accommodate the increased traffic loadings. Figure 16 shows an example of how vehicles may be routed through a quadrant road intersection. Note that there are many variations of quadrant road intersection configurations and multiple movements may be accommodated with one quadrant road, including left and right turns.

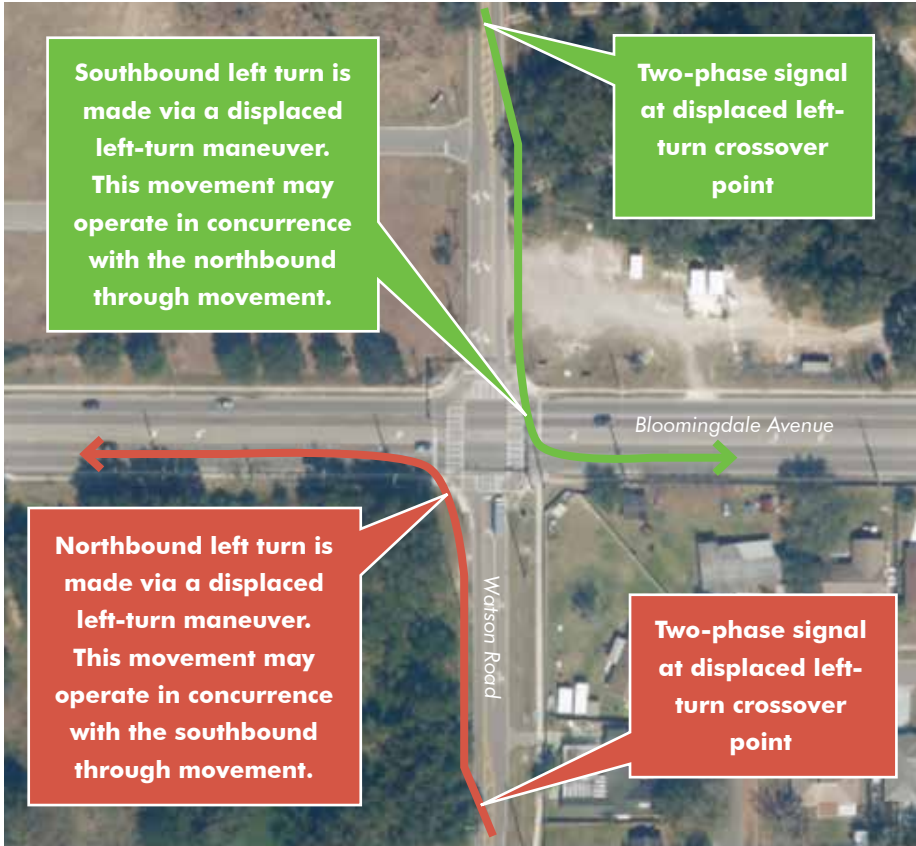
Figure 16. Quadrant Road Intersection Route Example at Bloomingdale Avenue/Watson Road



Displaced left-turn lanes typically require an additional signal where the crossover occurs, space to generate an appropriate crossover angle, a physical buffer between the displaced left-turn lane itself and the adjacent lane carrying traffic in the reverse direction, and may restrict access into businesses. For example, right-in/right outs may be impacted by displacing a left-turn lane. Figure 17 shows an example of how vehicles may be routed through a displaced left-turn intersection.

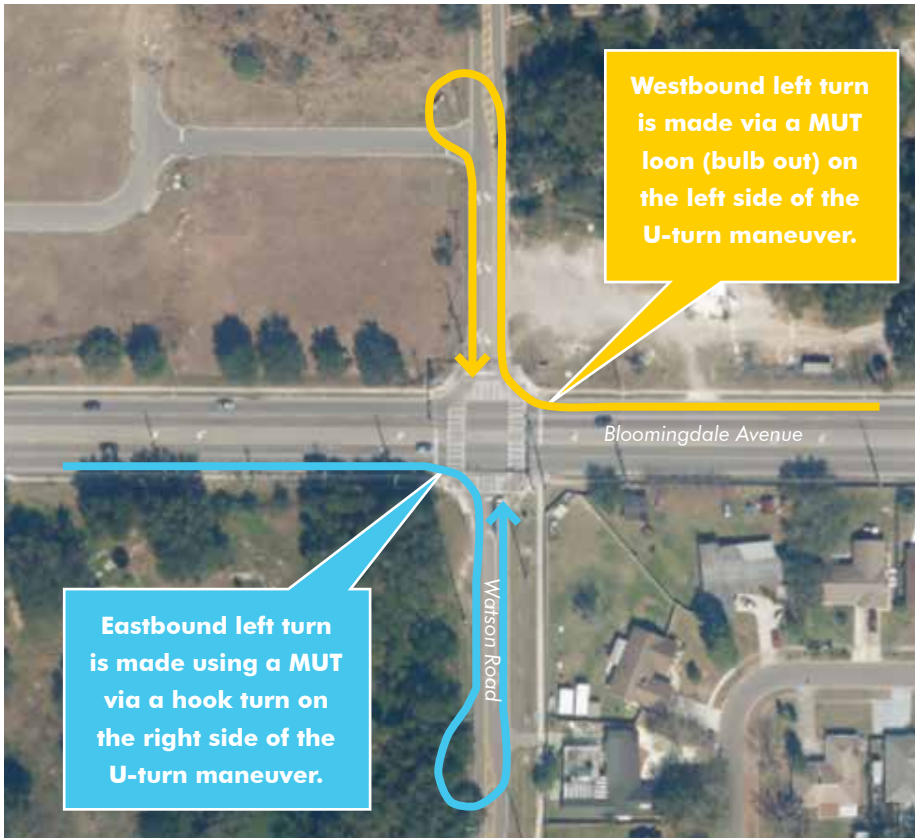


Figure 17. Displaced Left-Turn Route Example at Bloomingdale Avenue/Watson Road



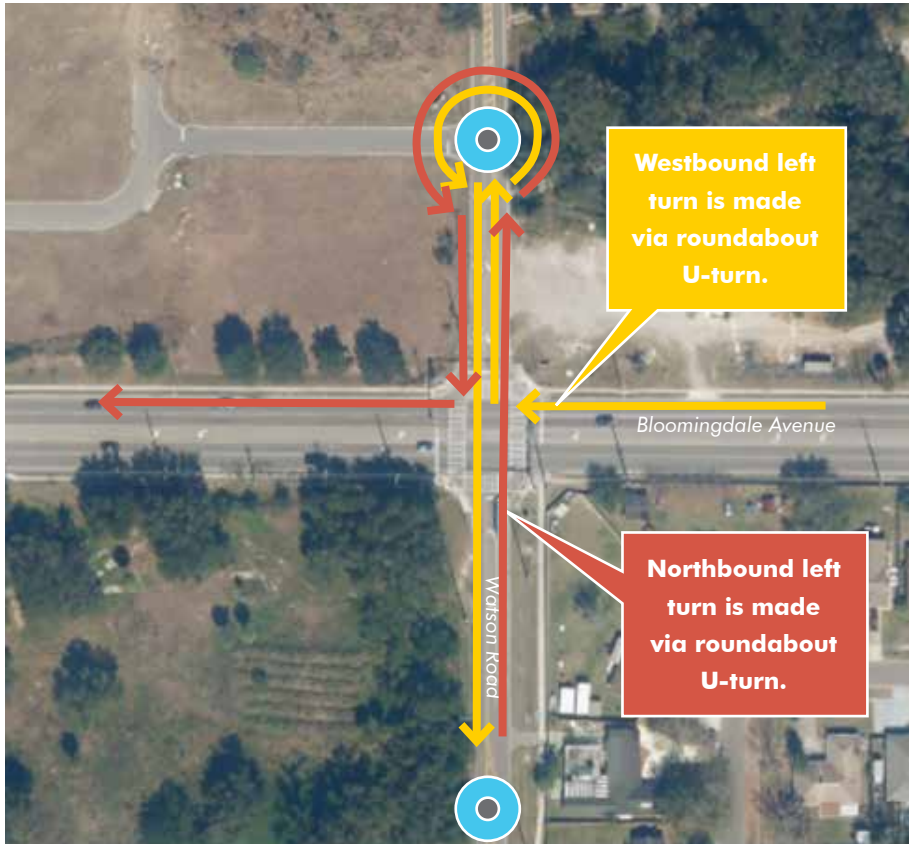
MUT intersections often require an awkward piece of right-of-way to accommodate large turning radii for trucks via a loon or bulb out, add travel distance to particular movements, and route certain movements through multiple signals and the same master intersection twice. However, given that the Bloomingdale Avenue corridor and many of its cross streets are constrained on right-of-way and built out with developments, MUT intersections may be the most cost-effective solution out of these three treatment styles at most locations.

Figure 18. MUT Example at Bloomingdale Avenue/Watson Road



MUT intersections are generally anticipated to have the fewest right-of-way impacts in this study area out of the three treatments discussed as only one concentrated space is required for a loon or bulb out rather than a strip of right-of-way. The U-turn movement may also be executed via a "hook" turn which stores U-turning vehicles in a turn bay to the right of the through lane where they will eventually cross in front of the through lane to make their maneuver as shown in Figure 18.

Figure 19. Bowtie Intersection Example at Bloomingdale Avenue/Watson Road



MUT intersections may operate under signalized, unsignalized, or roundabout control, depending on the traffic volumes, geometric constraints, and safety impacts. The MUT intersections should ideally be located approximately 500-800 feet away from the master intersection. This distance range allows further flexibility in selecting right-of-way with minimal impacts (i.e., a driveway or parking lot may be avoided by shifting the U-turn location further north or south on an approach to an area with grass only). Figure 19 shows an example

of how vehicles may be routed through a MUT intersection with roundabout terminals, commonly called a bowtie intersection.

MUT intersections also offer potential safety benefits. They provide additional (possibly signal-protected) mid-block crossing opportunities for pedestrians and also reduce the number of conflict points at the master intersection. They also may act as a traffic calming feature as U-turning traffic must slow down to negotiate the U-turn, which also creates a safer environment for all users.

Signal timing is essential to achieving a successful MUT intersection and an advanced microsimulation program should be used to fully analyze any location under consideration for this type of treatment to verify that vehicle queues are properly controlled and that the U-turning movements are experiencing reasonable progression. Note that an additional right-turn bay may be needed at the master intersection, in some cases, if left-turn volumes that are instead rerouted through a right-turn lane at the master intersection are great enough to warrant an additional right-turn lane. Quadrant road and displaced left-turn treatments should also be fully analyzed using an advanced microsimulation program for locations where they are being considered. MUT intersections should be further explored at all possible signalized intersections along Bloomingdale Avenue as they are anticipated to be a safe, cost-effective solution to the existing congestion.

4.7 Summary of Findings

Based on the preliminary screening the reversible lane concept was advanced to more detailed evaluation. Two reversible lane configurations were developed:

- 3/2 configuration that would eliminate the left turns from Bloomingdale Avenue and require MUTs on intersecting roadways; and



- 3/1 TWLTL/1 configuration that would reduce the off peak directional traffic to a single lane, but maintain the TWLTL on Bloomingdale Avenue.

The evaluation revealed that while both options improve travel time or capacity for peak hour directional traffic, each have significant impacts on the network. While there would be travel time savings for westbound traffic on Bloomingdale Avenue in the AM peak hour in the 3/2 configuration, the overall networkwide travel times would increase. This configuration would require MUT intersections, or a similar treatment, to facilitate the prohibited left turn movements. The loss of the TWLTL would impact the ability of traffic to safely turn onto Bloomingdale Avenue from mid-block locations.

For the 3/1 TWLTL/1 configuration, the analysis shows that the v/c ratio for eastbound traffic on Bloomingdale in the AM peak hour would increase to nearly 60 percent over capacity due to the loss of one travel lane. Dual left turns from cross streets would need to be eliminated onto Bloomingdale Avenue and many mid-block locations or unsignalized intersections may need to be evaluated for right-in/right-out configurations.

In addition to the two reversible lanes configurations that were considered, other improvement options including innovative intersection concept and minor timing and turn bay improvements at signalized intersections, were evaluated for implementation. Given the significant access impacts that would be required for implementation of a reversible lane configuration, this improvement option may not be the most effective or feasible option. Based on the qualitative and quantitative analysis, Bloomingdale Avenue may be a good candidate as a MUT corridor. Intersections could be analyzed on a case by case basis for MUTs and other innovative treatments as funding becomes available.

5. LITHIA PINECREST ROAD/BRYAN ROAD

The Lithia Pinecrest Road/Bryan Road intersection was analyzed under its existing configuration and as a roundabout intersection. The analysis used traffic volumes provided in the *FDOT District Seven Districtwide Traffic Signal Retiming Report for the US 301 and Bloomingdale Avenue Corridors* as the basis for future volume development. A 2.0 percent growth rate, obtained from the Bureau of Economic and Business Research (BEBR), was used to develop design year (2040) traffic volumes. Figure 20 shows the roadway network around the analysis area. Some of the roundabout configurations that were considered involved one-way pair approaches, which are discussed in more detail in the following section of this memo.

5.1 Existing Conditions

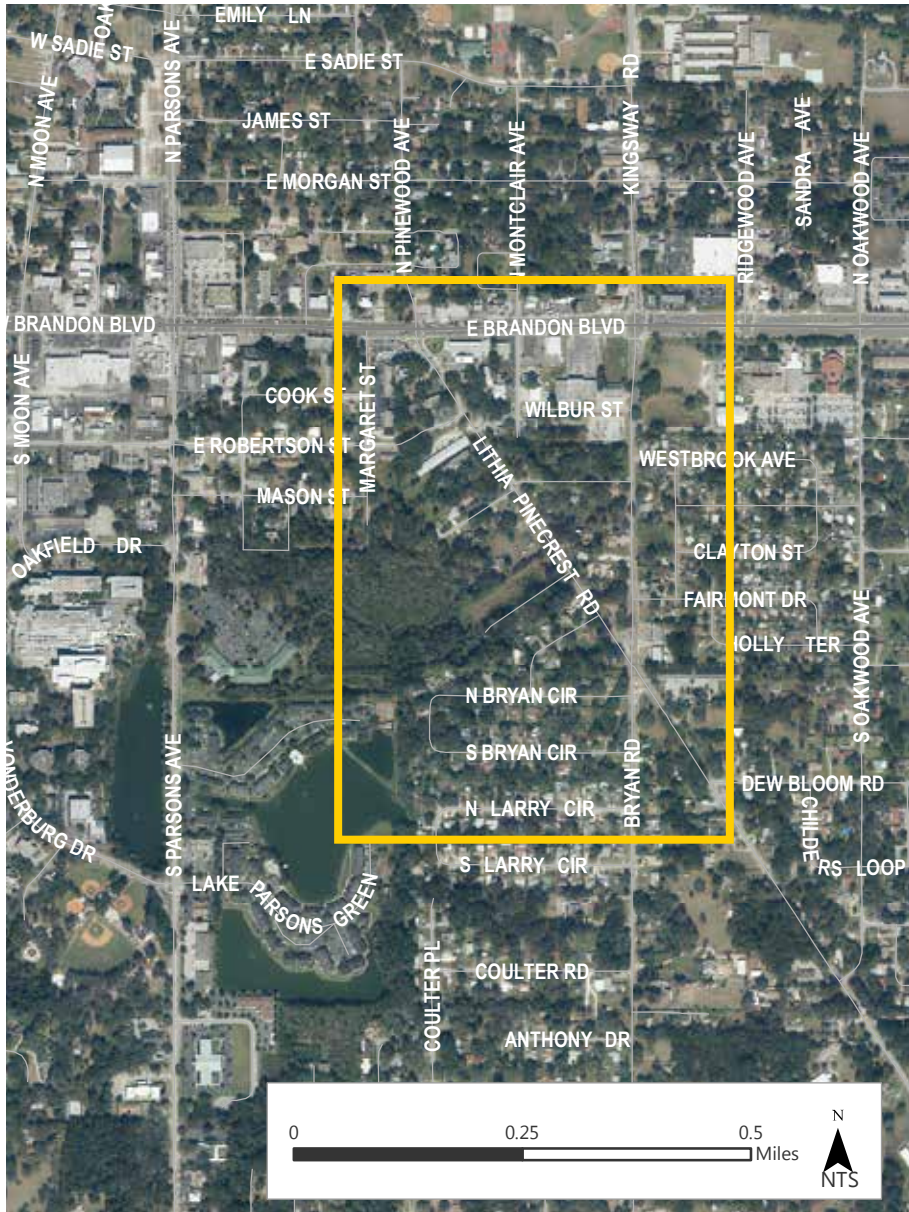
The Brandon Boulevard (SR 60) Compatibility Study (December 2013) recommended an evaluation of roundabout and one-way pair option at Lithia Pinecrest Road and Bryan Road to address capacity and safety issues on a constrained segment of SR 60 (Kings Avenue to Bryan Road).

The Lithia Pinecrest Road/Bryan Road intersection currently operates at an acceptable level in the existing year and does not show any prominent crash pattern that would indicate an existing safety issue, with only four crashes (all rear-end crashes) in the six-year span from 2010-2015. Table 6 shows the LOS and intersection delay results.

Table 6. Lithia Pinecrest Road/Bryan Road Existing Configuration Delay and LOS

Existing Configuration	2016 Delay (s/veh)	2016 LOS	2016 Max v/c
AM Peak Hour – Overall Intersection	21.0	C	0.79
PM Peak Hour – Overall Intersection	18.5	B	0.75

Figure 20. Roundabout and One-Way Pair Study Area



5.2 Roundabout Configurations Considered

Six different roundabout layouts were considered at the Lithia Pinecrest Road/Bryan Road intersection. Figures 21 through Figure 26 show the lane geometry for each roundabout option that was considered.

5.3 Traffic Operational Analysis

SIDRA 6.1 was used as the roundabout analysis software tool. The six roundabout configurations were analyzed in existing year (2016) and/or design year (2040) for the AM and PM peak hours. The Synchro files provided by Hillsborough County were used for analyzing the intersection as a signal under its existing configuration.

5.3.1 EXISTING YEAR (2016)

All roundabout options besides the one-lane roundabout were advanced to the 2040 analysis, as they show acceptable LOS and volume-to-capacity (v/c) results in existing year (2016). Based on the analysis, a one-lane roundabout would not provide enough capacity due to similar through movement flows on all approaches, leading to high circulating flows. The v/c ratios are greater than the desirable maximum v/c, 0.90, on the northwestbound and southeastbound approaches. Table 7 shows the existing year (2016) analysis results.

5.3.2 DESIGN YEAR (2040)

The Lithia Pinecrest Road/Bryan Road intersection is expected to operate at LOS E or better in the design year (2040) under its existing configuration. The one-lane roundabout options are not expected to operate at acceptable levels, showing LOS F in either the AM or PM peak hour and v/c greater than 1.00. The two-lane roundabout options are expected to operate at acceptable levels in both the AM and PM peak hours, with the exception of the two-lane roundabout option with a one-way pair with Bryan Road southbound and Lithia Pinecrest Road northwestbound, which has a v/c greater than 1.00.



Figure 21. One-Lane Roundabout

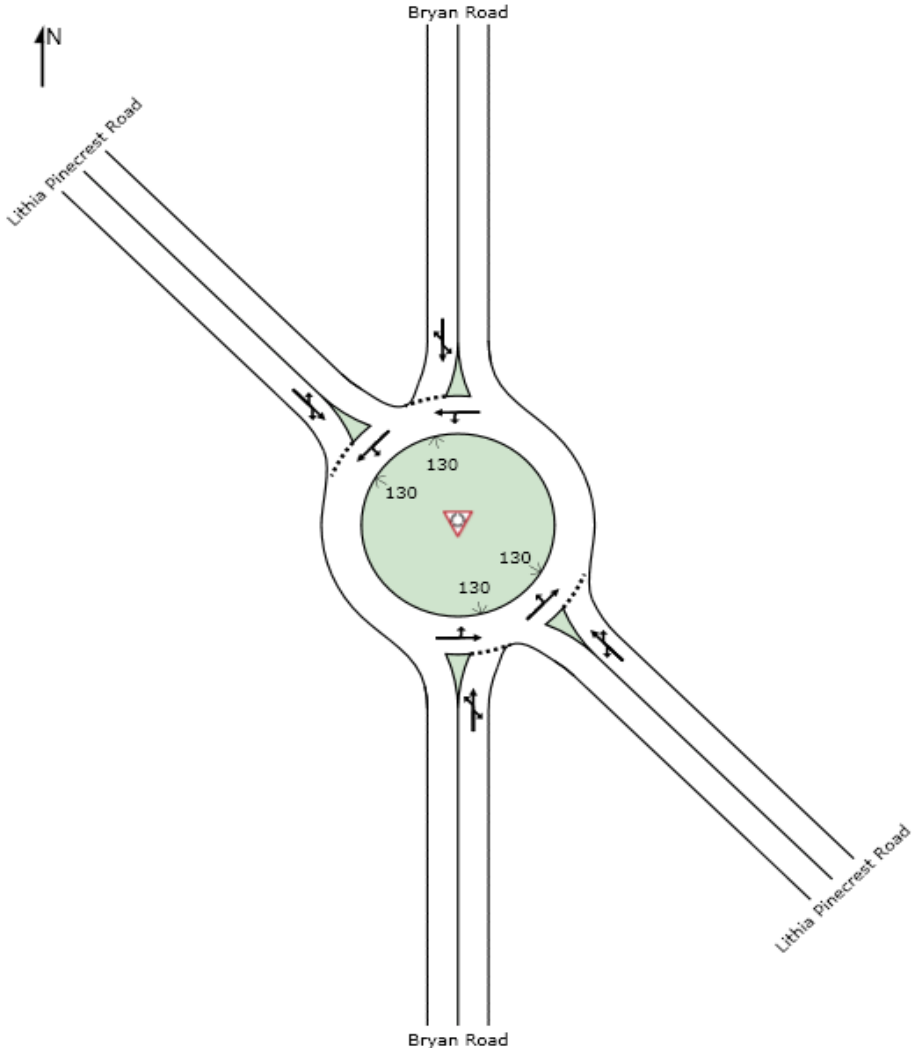
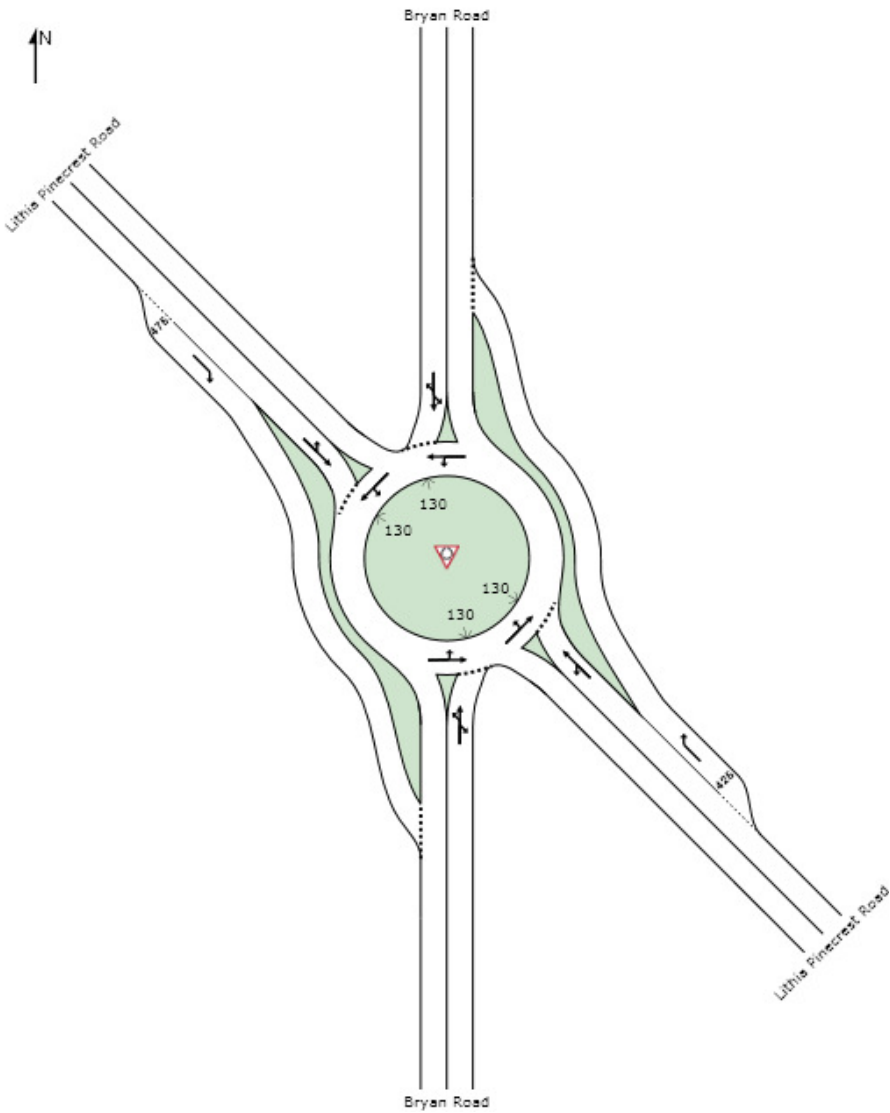


Figure 22. One-Lane Roundabout with Right-Turn Bypass Lanes



**Figure 23. One-Lane Roundabout with One-way Pair
(Bryan Road Northbound, Lithia Pinecrest Road
Southeastbound)**

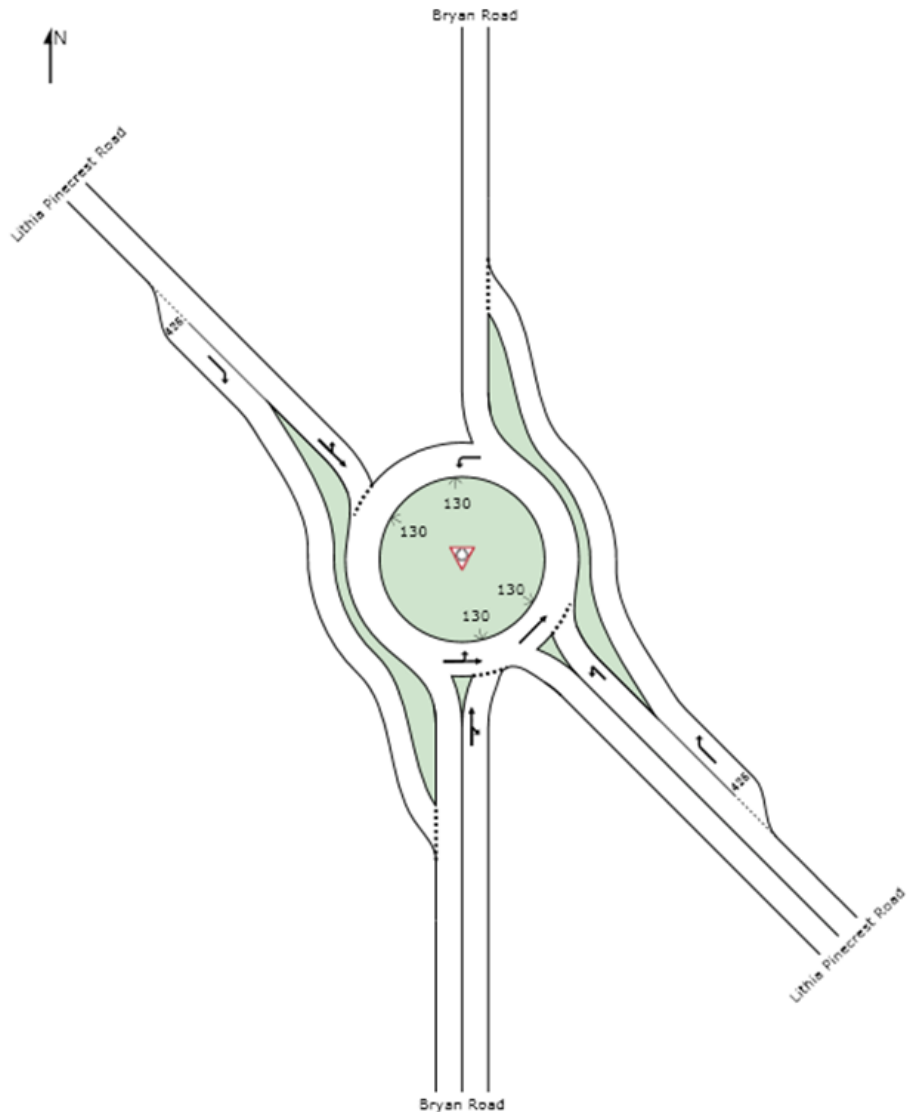


Figure 24. Two-Lane Roundabout

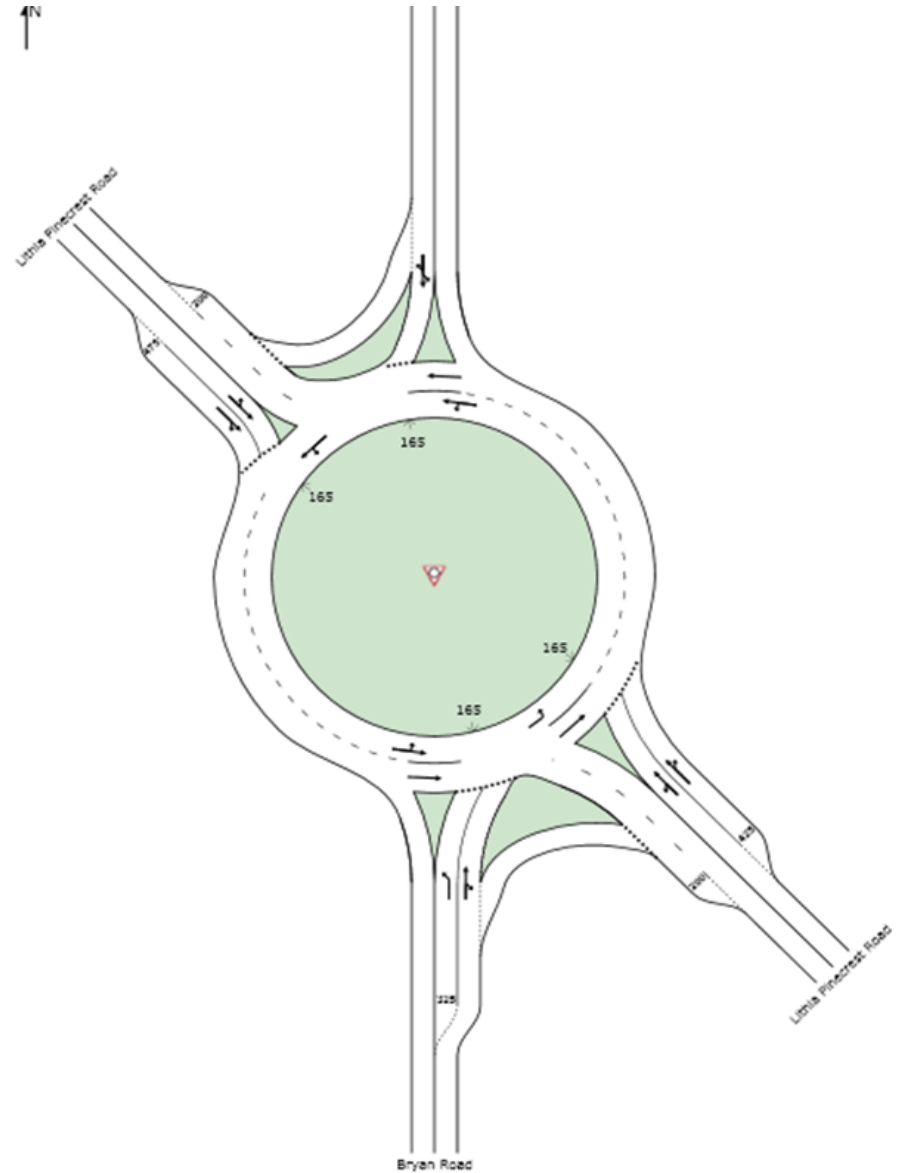




Figure 25. Two-Lane Roundabout with One-Way Pair (Bryan Road Northbound, Lithia Pinecrest Road Southeastbound)

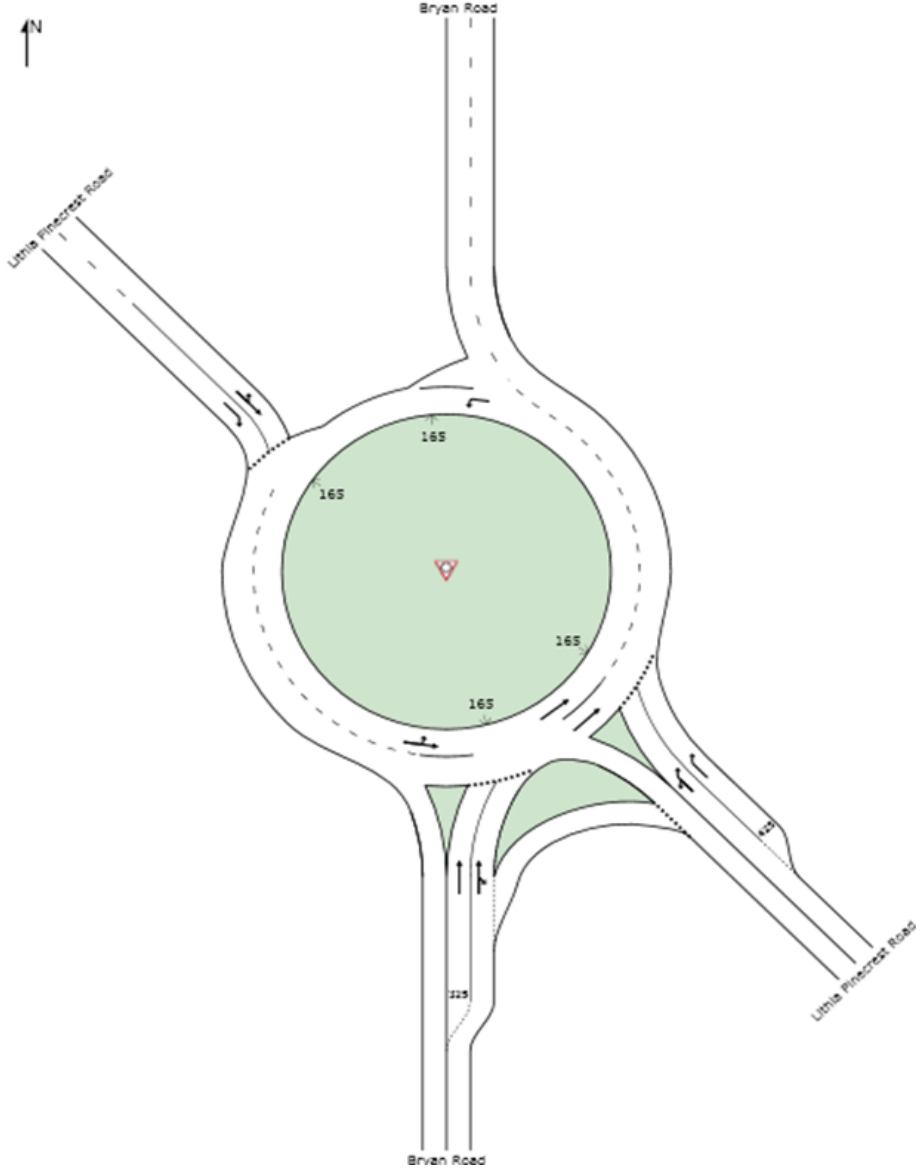


Figure 26. Two-Lane Roundabout with One-Way Pair (Bryan Road Southbound, Lithia Pinecrest Road Northwestbound)

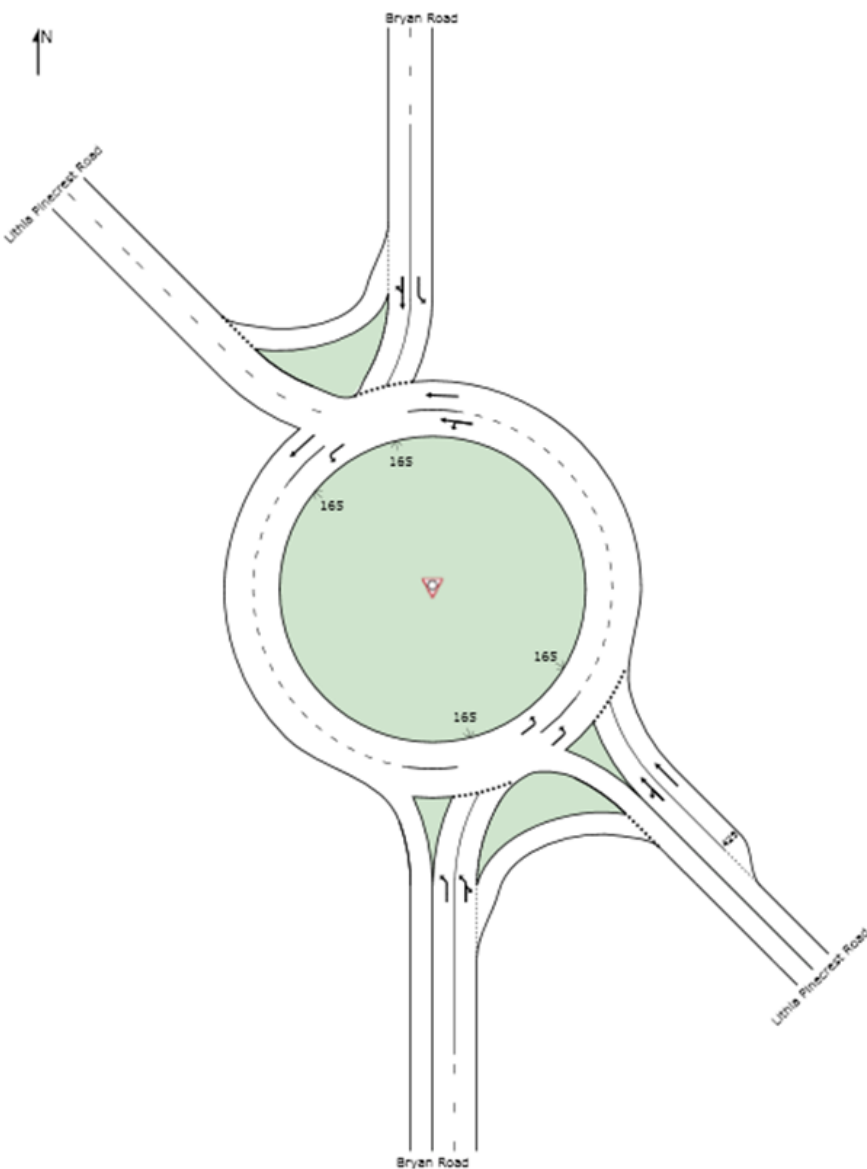


Table 7. Lithia Pinecrest Road/Bryan Road Roundabout 2016 Analysis Results

Layout Description	2016 AM LOS	2016 PM LOS	2016 AM Max v/c	2016 PM Max v/c	Advance to 2040 Analysis?
One-Lane Roundabout	C	B	1.08	0.96	No
One-Lane Roundabout with Right-Turn Bypass Lanes	A	A	0.71	0.86	Yes
One-Lane Roundabout with One-way Pair (Bryan Road Northbound, Lithia Pinecrest Road Southeastbound)	A	A	0.90	0.72	Yes
Two-Lane Roundabout	A	A	0.64	0.75	Yes
*Two-Lane Roundabout with One-Way Pair (Bryan Road Northbound, Lithia Pinecrest Road Southeastbound)	N/A	N/A	N/A	N/A	Yes
*Two-Lane Roundabout with One-Way Pair (Bryan Road Southbound, Lithia Pinecrest Road Northwestbound)	N/A	N/A	N/A	N/A	Yes
Existing Configuration (not a roundabout)	C	B	0.79	0.75	Yes

*Not analyzed for 2016.

The roundabout would need to be expanded to two lanes within the vicinity of the intersection for acceptable operations, although the four-lane widening on Lithia Pinecrest Road is planned to end at Lumsden Road. Table 8 shows the design year (2040) analysis results. Two roundabout options were advanced to the preliminary layout stage.

5.4 Roundabout Preliminary Layouts

The roundabout options were also checked for geometric feasibility using school buses and fire trucks for the design vehicles as Lithia Pinecrest Road is a truck-restricted corridor. Using these parameters, two preliminary two-lane roundabout draft layouts were developed, a two-lane roundabout without a one-way pair (Figure 27), and a two-lane roundabout with a one-way pair, with Bryan Road northbound and Lithia Pinecrest Road southeastbound (Figure 28). Challenges with approach and departure deflection due to skewed intersection angle led to the split configuration geometry of the two-lane roundabout without a one-way pair.

These two-lane roundabout options do not appear to be feasible at this location because the entry and exit segments overlap due to the skewed intersection angle of about 34 degrees. To alleviate this issue, the diameter of the roundabout would need to be bigger than the maximum needed for the design vehicle, at which point it would be over-designed and the right-of-way impacts would be increased. It is expected that a benefit-to-cost analysis would not justify the right-of-way takes required to implement a roundabout at the Lithia Pinecrest Road/Bryan Road intersection. Access impacts to the driveway on the south side of this intersection are also anticipated.

5.5 Other Treatment Options Considered

The existing configuration is expected to operate at LOS E in the AM peak hour and LOS D in the PM peak hour in the design year (2040).



Table 8. Lithia Pinecrest Road/Bryan Road Roundabout 2040 Analysis Results

Layout Description	2040 AM LOS	2040 PM LOS	2040 AM Max v/c	2040 PM Max v/c	Advance to Geometric Layout?
*One-Lane Roundabout	-	-	-	-	-
One-Lane Roundabout with Right-Turn Bypass Lanes	E	F	1.20	1.65	No
One-Lane Roundabout with One-way Pair (Bryan Road Northbound, Lithia Pinecrest Road Southeastbound)	F	C	1.39	1.10	No
Two-Lane Roundabout	A	A	0.84	0.80	Yes
Two-Lane Roundabout with One-Way Pair (Bryan Road Northbound, Lithia Pinecrest Road Southeastbound)	A	A	0.60	0.57	Yes
Two-Lane Roundabout with One-Way Pair (Bryan Road Southbound, Lithia Pinecrest Road Northwestbound)	B	D	0.78	1.22	No
Existing Configuration (not a roundabout)	E	D	1.17	1.16	N/A

*The one-lane roundabout configuration was not advanced to the 2040 analysis as it failed the 2016 analysis

Therefore, the need for improvements at the Lithia Pinecrest Road/Bryan Road intersection should be carefully monitored. If improvements are determined to be needed, expanding Lithia Pinecrest Road to two

Figure 27. Two-Lane Roundabout Draft Layout

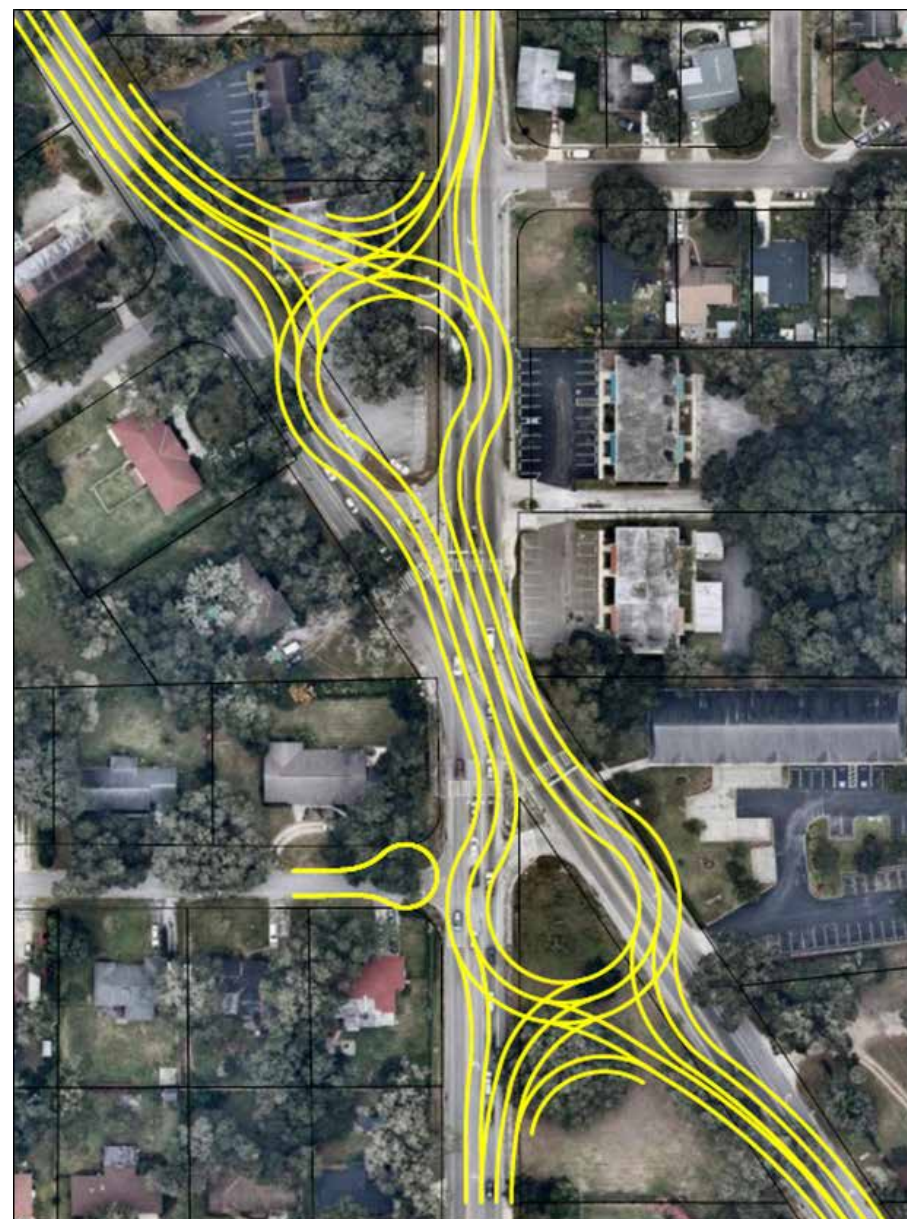


Figure 28. Two-Lane Roundabout with One-Way Pair (Bryan Road Northbound, Lithia Pincrest Road Southeastbound) Draft Layout

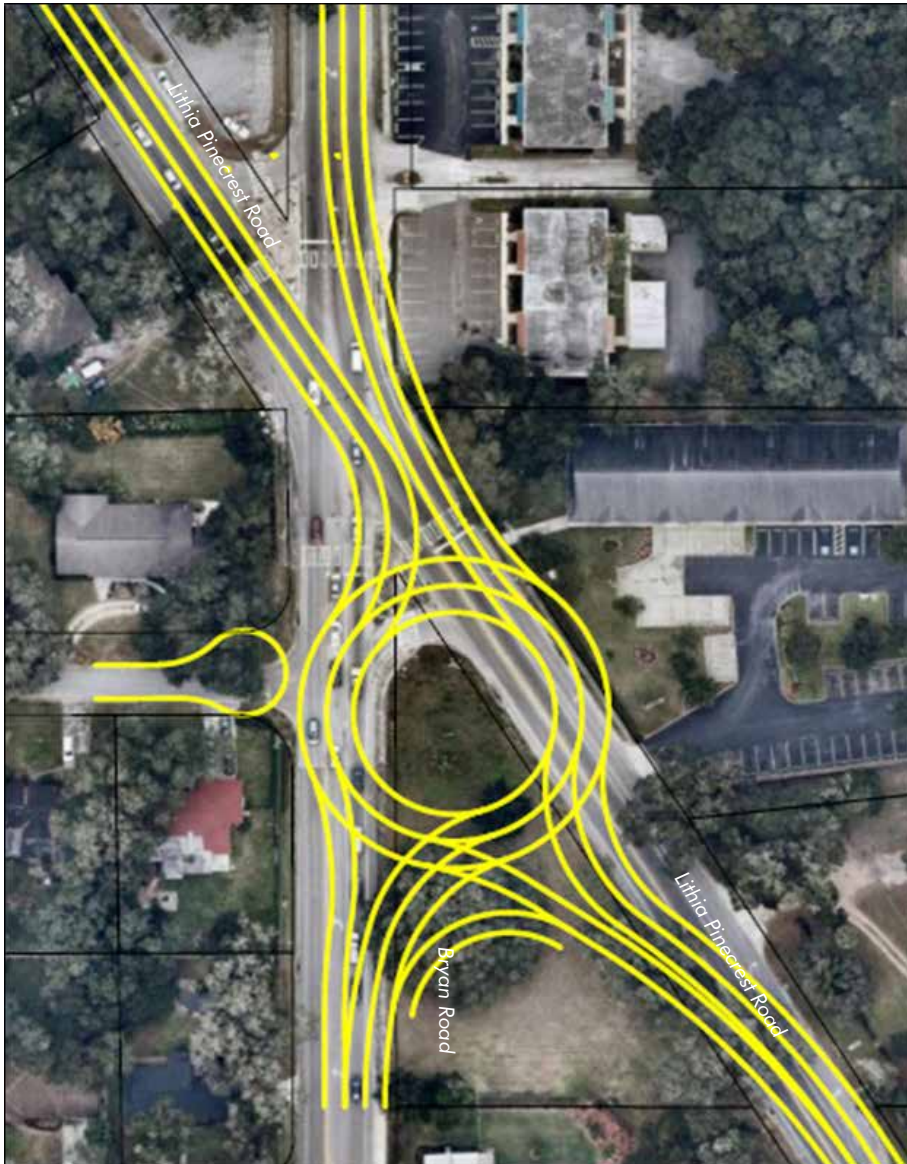
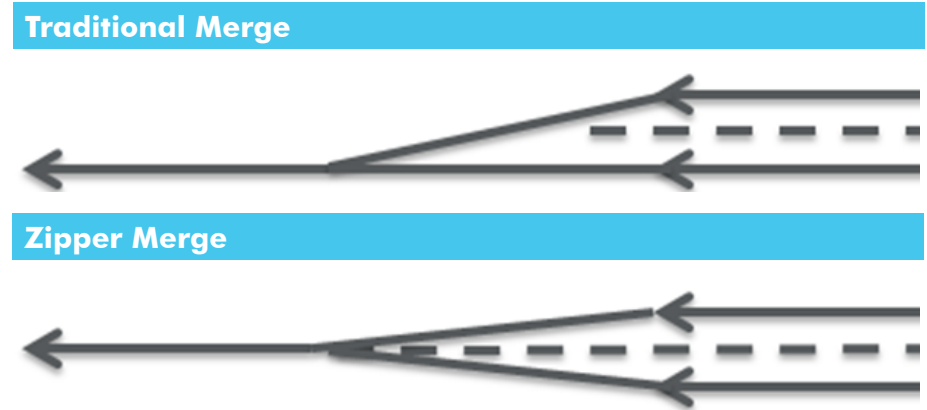


Figure 29. Traditional Merge vs. Zipper-Style Merge



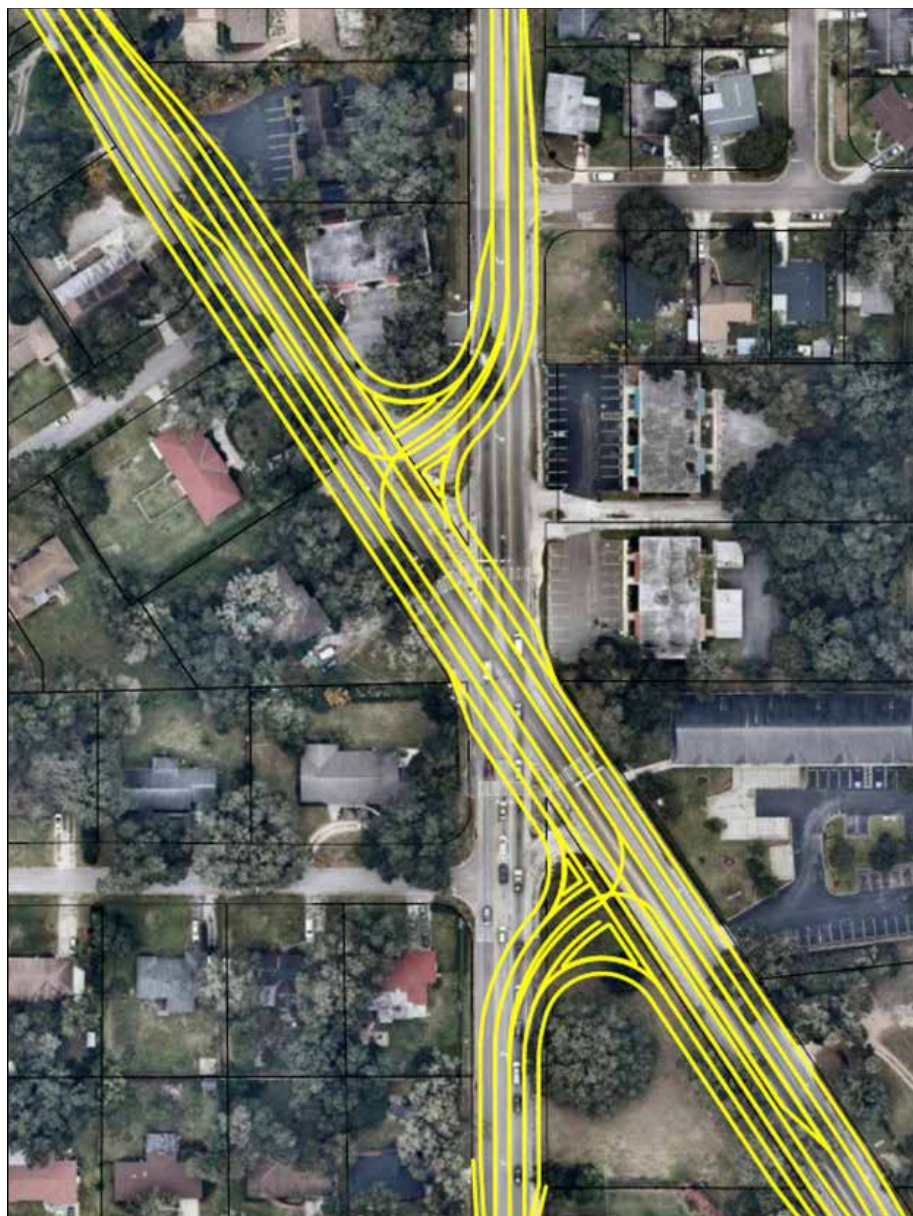
lanes in each direction just before Bryan Road and tying back down to one lane in each direction just after may be considered as a viable option. A zipper-style merge on the departures of Lithia Pincrest Road may be used to intentionally make it vague for which vehicle is to yield, with the goal of better lane utilization on the approaches. Figure 29 shows the difference between a traditional merge from right to left and a zipper-style merge. A Split Tee configuration concept may also be considered as a viable option, as shown in Figure 30. Both of these treatment options have anticipated right-of-way impacts.

5.6 Summary of Findings

While the two-lane roundabouts operated acceptably, they showed geometric complications due to the skew angle of the intersection. Since this intersection is currently not showing safety concerns or major operational deficiencies, it is recommended that congestion continue to be monitored before improvements are further considered. The most beneficial improvement options appear to include widening through the intersection with a zipper-style merge or a split tee configuration.



Figure 30. Split Tee Intersection Layout



6. LITHIA PINECREST ROAD-BRYAN ROAD ONE-WAY PAIR AT SR 60

In addition to the roundabout analysis at the Lithia Pinecrest Road/Bryan Road intersection, the study team evaluated an option to convert segments of Lithia Pinecrest Road (northwest leg of the Lithia Pinecrest Road/Bryan Road intersection) and Bryan Road (north leg of the Lithia Pinecrest Road/Bryan Road intersection) to a one-way pair in order to mitigate the existing congestion. The intersections of SR 60/Lithia Pinecrest Road-Pinewood Avenue and SR 60/Bryan Road-Kingsway Road were analyzed under one-way pair configurations using the same volume development methodology as the roundabout analysis. The existing year (2016) AM and PM peak hour volumes are shown on Figure 31. The design year (2040) AM and PM peak hour volumes are shown on Figure 32.

6.1 One-Way Pair Configurations Considered

Two one-way pair configurations were considered:

- Option 1 includes Bryan Road flowing in the northbound direction and Lithia Pinecrest Road flowing in the southeastbound direction, as shown on Figure 33.
- A second one-way pair option was also considered with Bryan Road flowing in the southbound direction and Lithia Pinecrest Road flowing in the northwestbound direction, as shown on Figure 34.

The SR 60/Lithia Pinecrest Road-Pinewood Avenue and SR 60/Bryan Road-Kingsway Road intersections were analyzed first to determine the best one-way pair configuration. Then the Lithia Pinecrest Road/Bryan Road intersection was analyzed with the preferred one-way pair option under a signalized and roundabout configuration to verify that this intersection operated acceptably through the design year (2040).

Figure 31. SR 60 One-Way Pair Traffic Volumes, 2016

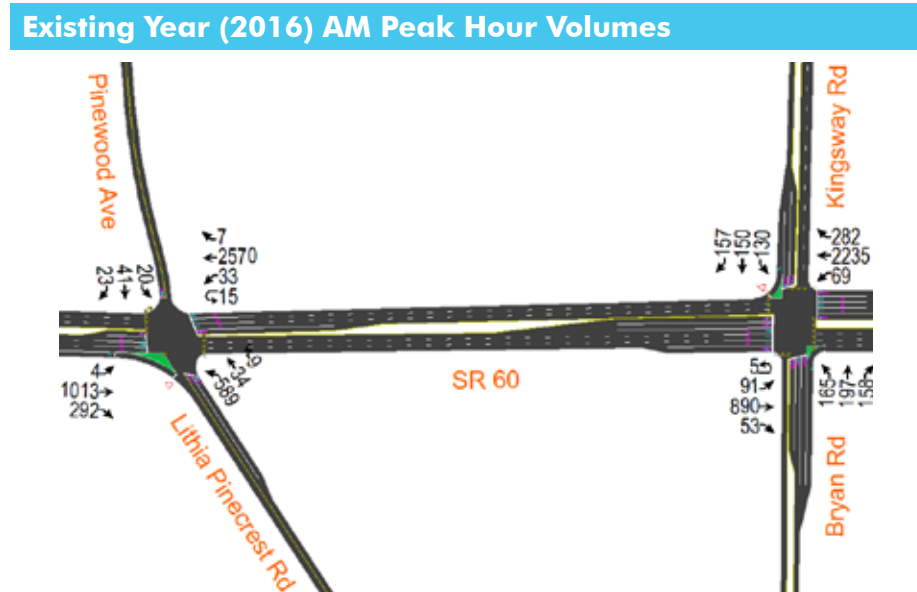


Figure 32. SR 60 One-Way Pair Traffic Volumes, 2040

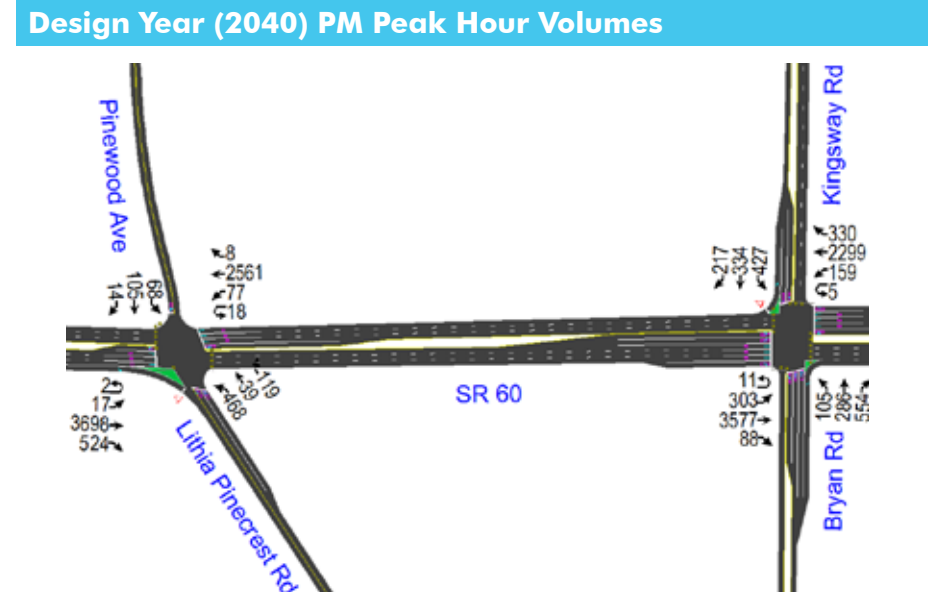
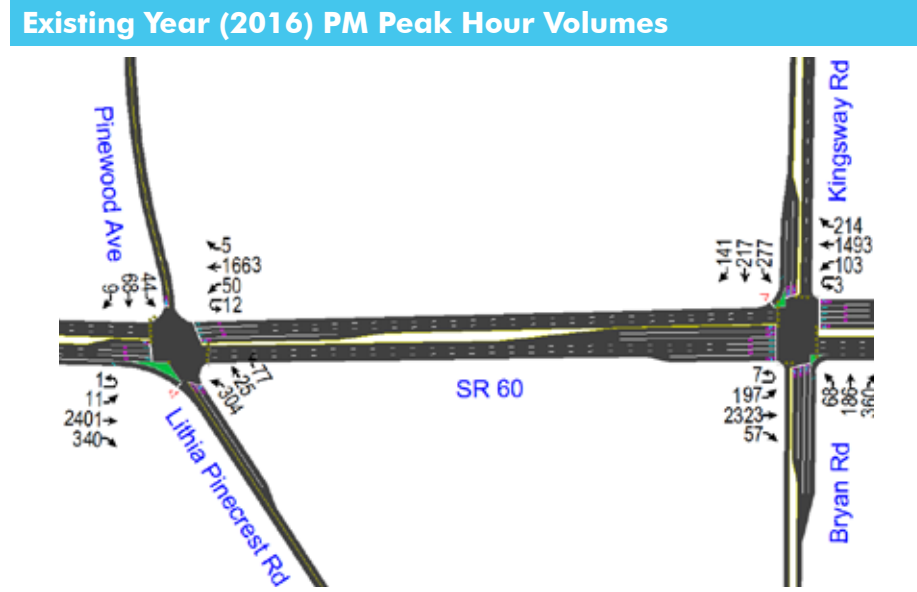
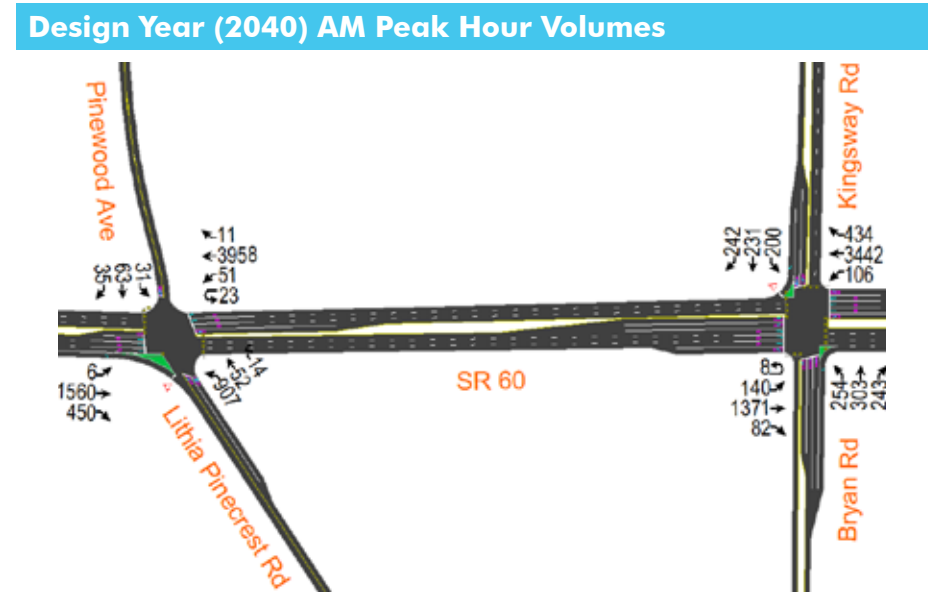




Figure 33. One-Way Pair Option 1

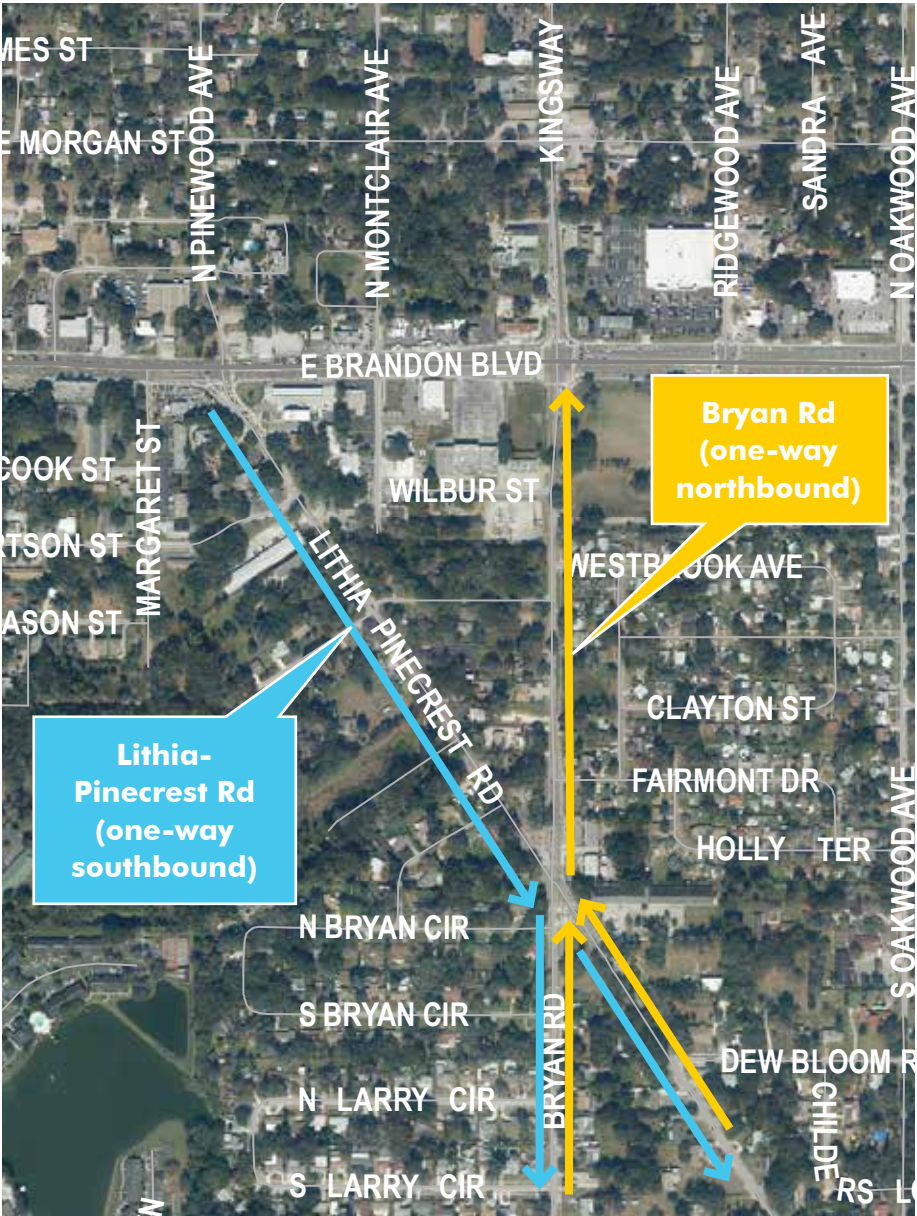
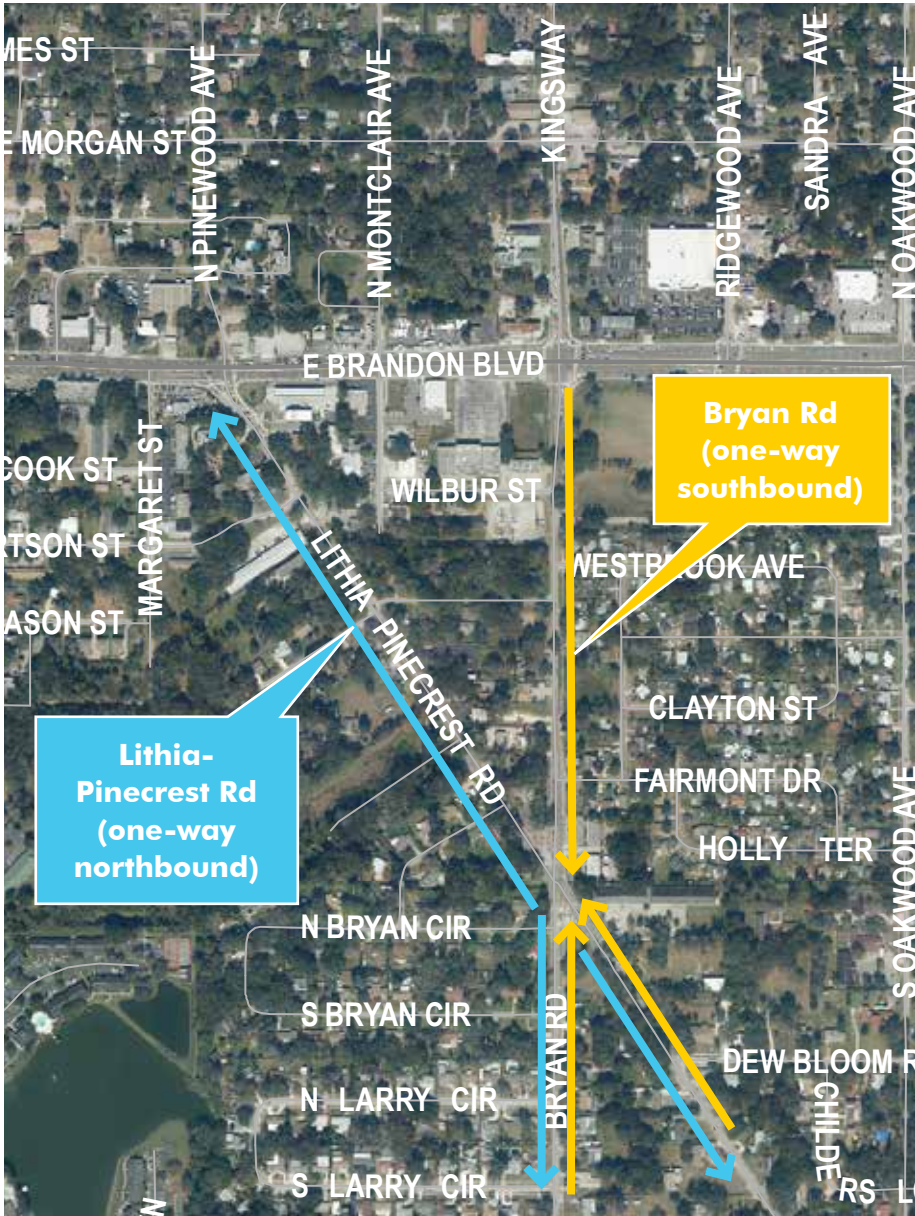


Figure 34. One-Way Pair Option 2



6.2 Traffic Operational Analysis

The SR 60/Lithia Pinecrest Road-Pinewood Avenue and SR 60/Bryan Road-Kingsway Road intersections were assessed for feasibility in the existing year (2016). The two one-way pair configurations that were considered were analyzed in existing year (2016) and/or design year (2040) for the AM and PM peak hours. The Synchro files provided by Hillsborough County were used for the intersection delay and LOS analyses. The cycle length of 190 seconds was maintained to ensure coordination along SR 60. The red-time formula methodology was used to determine the intersection queue lengths.

6.2.1 EXISTING YEAR (2016)

Although Option 1 operates similarly to the existing configuration in the existing year (2016), the rerouted volume leads to higher volume conflicts at the SR 60/Bryan Road-Kingsway Road intersection due to the high northbound left-turn movement at Bryan Road. This would cause Bryan Road to have increased volume from the rerouted northbound left and northbound through movements from the SR 60/Lithia Pinecrest Road-Pinewood Avenue intersection. Also, the southbound approach on Kingsway Road shows somewhat high volumes, compared to Pinewood Avenue, that lead to a high conflict between the northbound left and southbound through movements. Therefore, this one-way pair configuration is not expected to improve operations and was not advanced to the design year (2040) operational analysis stage.

Option 2 operates similarly to the existing configuration in the existing year (2016), with comparable delay, LOS, and v/c results. Table 9 shows the existing year (2016) delay, LOS and maximum v/c results. An assessment of the critical volume conflicts shows similar results to the existing configuration as well. Therefore, Option 2 was advanced to the design year (2040) operational analysis stage.

Table 9. Existing Year (2016) Analysis Results

Description of Option	2016 AM Delay (s/veh)	2016 PM Delay (s/veh)	2016 AM LOS	2016 PM LOS	2016 AM Max v/c	2016 PM Max v/c
Existing Configuration						
SR 60/Pinewood Avenue	59.7	21.1	E	C	1.02	0.91
SR 60/Kingsway Road	31.9	24.6	C	C	0.85	1.11
One-Way Pair with Lithia Pinecrest Road southeastbound (Option 1)						
SR 60/Pinewood Avenue	11.4	18.9	B	B	0.82	1.00
SR 60/Kingsway Road	65.1	27.2	E	C	1.11	0.91
One-Way Pair with Lithia Pinecrest Road northwestbound (Option 2)						
SR 60/Pinewood Avenue	27.9	60.6	C	E	0.97	1.19
SR 60/Kingsway Road	20.8	32.6	C	C	0.76	0.93

6.2.2 DESIGN YEAR (2040)

Since Option 2 operates similarly to the existing configuration in the existing year (2016), an additional analysis was performed for the design year (2040). The design year (2040) analysis shows mixed results with neither option showing a greater overall benefit. Table 10 shows the design year (2040) delay, LOS, and maximum v/c results.

Although Option 2 did not show a clear improvement benefit, it was determined to be the more viable of the two one-way pair options, as Option 1 reroutes volumes in a way that leads to higher critical volume conflicts. Therefore, Option 2 was considered in combination with a



Table 10. Design Year (2040) Analysis Results

Description of Option	2016 AM Delay (s/veh)	2016 PM Delay (s/veh)	2016 AM LOS	2016 PM LOS	2016 AM Max v/c	2016 PM Max v/c
Existing Configuration						
SR 60/Pinewood Avenue	151.8	125.4	F	F	1.57	1.43
SR 60/Kingsway Road	90.5	112.8	F	F	1.25	2.07
One-Way Pair with Lithia Pinecrest Road northwestbound (Option 2)						
SR 60/Pinewood Avenue	119.2	253.5	F	F	1.53	1.87
SR 60/Kingsway Road	59.5	133.0	E	F	1.11	1.43

signal and with a roundabout at the Lithia Pinecrest Road/Bryan Road intersection. The Section 3.3 results showed that a roundabout at the Lithia Pinecrest Road/Bryan Road intersection operates acceptably with Option 1, but not with Option 2, due to the v/c being 1.22. A roundabout that is over capacity is vulnerable to locking up and there are fewer possibilities for adding new geometry (i.e. turn bays) to improve the congestion. A signalized intersection at the Lithia Pinecrest Road/Bryan Road intersection shows a v/c less than 1.10 in combination with Option 2.

6.3 Special Considerations for Implementation

Other qualitative considerations for converting Lithia Pinecrest Road and Bryan Road to a one-way pair configuration are access, safety, and costs. With regards to access, converting two existing two-way streets into one-way streets will require traffic to circulate more in order

to get to the desired location. Making vehicles travel on southbound Bryan Road to turn right onto northwestbound Lithia Pinecrest Road routes more vehicles onto segments where they would not have driven under the existing configuration. It may be inconvenient for the vehicles destined for or originating from locations on the one-way pair segments that are under consideration. This also limits access to side streets that connect to residences and businesses. There is also an increased possibility for wrong-way maneuvers at the Lithia Pinecrest Road/Bryan Road intersection and SR 60, as drivers become familiar with the new configuration. A B/C analysis should be conducted to determine if Option 2 should be advanced to the next stages.

6.4 Other Treatment Options Considered

As with Bloomingdale Avenue, intersection types that involve two- or three-phase signal schemes may be considered at the SR 60/Lithia Pinecrest Road-Pinewood Avenue and SR 60/Bryan Road-Kingsway Road intersections, including quad roads, MUTs, and displaced left-turn movements. Also, extending S Montclair Avenue south to connect with Lithia Pinecrest Road may improve circulation and relieve the northbound right-turn movements at Pinewood Avenue and the northbound left-turn movements at Bryan Road-Kingsway Road.

Alternatively, widening or a reversible lane configuration may be considered along SR 60 as there is a bottleneck from Kings Avenue to Bryan Road-Kingsway Road, with lanes reduced from four each way to three each way in that segment. Close consideration should be given to the directional access openings if a reversible lanes option is further considered as they would likely need to be converted to a TWLTL.

6.5 Summary of Findings

The two-way pair analysis for the SR 60 intersections with Bryan Road and Lithia Pinecrest Road revealed that no clear pattern of

improvement was identified. A roundabout at the Lithia Pinecrest Road/Bryan Road intersection does not show acceptable operations in conjunction with the more viable one-way pair option, Option 2 with Lithia Pinecrest Road in the northwestbound direction and Bryan Road in the southbound direction. Other improvement options may include implementing innovative intersection concepts by reducing signals to two- or three-phase timing schemes, widening SR 60 in the bottleneck area from Kings Avenue to Bryan Road-Kingsway Road, a reversible lane in the SR 60 bottleneck area, and/or extending S Montclair Avenue south to connect with Lithia Pinecrest Road.

7. MOBILITY SCENARIO TESTING

In addition to the mobility improvement options that were analyzed as part of this study, a number of other improvements were considered and evaluated as part of the mobility scenario development and testing that was conducted as part of this study. This includes the potential addition of a separate transitway for bus rapid transit (BRT) service on SR 60 that was discussed in *Technical Memo 7: Network Evaluation*.

The mobility scenario traffic modeling evaluated the performance of a number of improvements. Seven different scenarios were developed to evaluate the potential of different mobility improvement options. In addition to a No Build option that included just the improvements proposed as part of the LRTP, the scenarios include different combinations of improvements including the introduction of a reversible lane on Bloomingdale Avenue, widening of Lumsden Road, Lithia Pinecrest Road, and John Moore Road, addition of a BRT dedicated guideway on SR 60/Oakfield Road, and construction of a new 2-lane east-west roadway between Providence Lakes Road and Brooker Road.

The analysis of each scenario included an evaluation of the anticipated 2040 traffic volumes and roadway capacity for the roadway network in the Brandon Study Area and adjacent areas. The Tampa Bay Regional Planning Model, version 8.1 (TBRPMv8.1) was updated to include the seven scenarios in the AM and PM time of day models to approximate volumes during the AM and PM peak periods. These models represent the expected 2040 traffic volumes based on a variety of factors, such as socioeconomic data and roadway geometry. The output from each of these models was processed and the volume-to-capacity (v/c) ratio was determined. The v/c ratio value represents the degree of saturation of a roadway; generally, a v/c ratio of 0.90 or less indicates that there is sufficient capacity for the vehicle demand and significant delays and queue lengths are not expected. However, as the v/c ratio approaches 1.00, traffic may become unstable, with higher delays and queue



lengths occurring. Once demand surpasses the available capacity of the roadway (v/c ratio greater than 1.00), excessive queuing and delay is expected.

Seven mobility scenarios were developed and tested:

1. No Build (2040 as is).
2. Reconstruct Bloomingdale Avenue with reversible lane (between Lithia Pinecrest Road and US 301), widen Lumsden Road (6 lanes between Kings Road and Lithia Pinecrest Road), and add BRT dedicated guideway along SR 60.
3. Widen Lumsden Road (6 lanes between Kings Road and Lithia Pinecrest Road), widen Lithia Pinecrest Road (4 lanes between Bloomingdale Avenue and Lumsden Road), and add BRT dedicated guideway along SR 60.
4. Widen Lithia Pinecrest Road (4 lanes between Bloomingdale to Lumsden) and add BRT dedicated guideway along SR60/Oakfield Road.
5. Construct new 2-lane east-west road between Providence Lakes Road and Brooker Road.
6. Reconstruct Bloomingdale with reversible lane (between Lithia Pinecrest Road and US 301), widen Lumsden Road (6 lanes between Kings Road and Lithia Pinecrest Road), widen Lithia Pinecrest Road (4 lanes between Bloomingdale Avenue and Lumsden Road), widen John Moore Road (4 lanes between Bloomingdale Avenue and SR 60).
7. Reconstruct Bloomingdale with reversible lane (between Lithia Pinecrest Road and US 301), widen Lumsden Road (6 lanes between Kings Road and Lithia Pinecrest Road), widen Lithia Pinecrest Road (4 lanes between Bloomingdale Avenue and Lumsden Road), widen John Moore Road (4 lanes between Bloomingdale Avenue and SR 60), construct new 2-lane road between Providence Lakes Road and Brooker Road.

A summary of the analysis results for each scenario is provided in Table 11. The results of the v/c analysis for each of the seven scenarios are shown in Figures 36 to 49. The graphics show either the AM or PM peak period v/c ratios for major roadways within and adjacent to the study area. The table provides a comparison of v/c ratios for several major roadways between the No Build scenario and the six improvement scenarios for the AM and the PM peak hour periods.

Based on the results of the analysis, each scenario delivers at least modest improvements in peak period travel over the baseline No Build (2040) scenario. Based on a system-wide comparison, Scenario 7, which offers the greatest increases in capacity, sees highest improvements in v/c ratios on the network roadways. Scenario 5, which only provides a new east-west connection through the central portion of the study area, also offers high levels of improvement on other east-west corridors. However, this scenario does result in an increase along Gornto Lake Road south of Lumsden Road.

Further operational analyses should be conducted on innovative concepts that are further considered using a high-end microsimulation program, such as VISSIM, for a final analysis to compare the concepts being considered in order to identify the preferred concept. VISSIM should be used because of its ability to replicate operations of complex traffic patterns, allow signals to be highly customized, and capture specific route travel times. Geometric feasibility should also be carefully considered when identifying a preferred innovative intersection concept.

Figure 35. Mobility Scenario Options

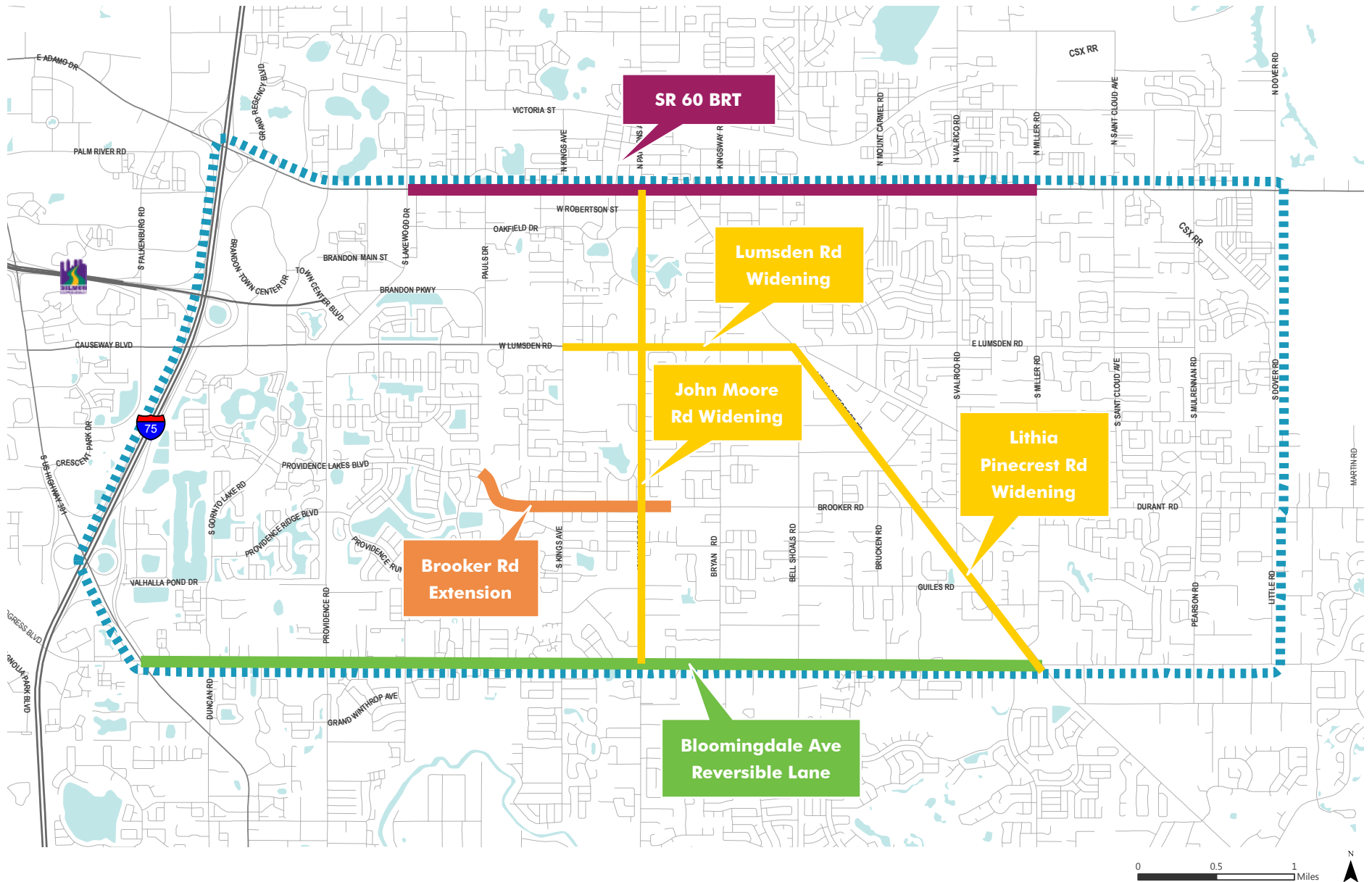




Table 11. Mobility Scenario Summary – Major Roadways Volume-to-Capacity Ratio Comparison (AM and PM Peak)

Area	Roadway Name	Scenarios						
		1 No Build	2 Bloomingdale, Lumsden & SR 60 BRT	3 Lumsden, Lithia Pinecrest & SR 60 BRT	4 Lithia Pinecrest & SR 60 BRT	5 Brooker Extension	6 Bloomingdale, Lumsden, Lithia Pinecrest, John Moore	7 Bloomingdale, Lumsden, Lithia Pinecrest, John Moore, Brooker
AM PEAK PERIOD								
Study Area	Bloomingdale Ave (WB)	Majority >1.0	Majority >1.0	Majority >1.0. Slight decrease between Bells Shoals and Parsons	Majority >1.0	Majority >0.9	Majority >0.9	Majority >0.9
	Brooker Rd Extension (WB)	N/A	N/A	N/A	N/A	Majority >1.3	N/A	Majority >1.1
	Lumsden Rd (WB)	Majority >1.5	Majority >1.3. Slight improvement between Lithia Pinecrest and Kings	Majority >1.3. Slight improvement between Lithia Pinecrest and Kings but decrease between Kings and Brandon Parkway	Majority >1.5	Majority >1.3. Slight improvement between Lithia Pinecrest and Kings	Majority >1.3. Slight improvement between Lithia Pinecrest and Kings	Majority >1.3. Slight improvement between Lithia Pinecrest and Kings
	SR 60 (WB)	Majority >1.3	Majority >1.1. Slight improvement between Kings and Valrico	Majority >1.3	Majority >1.3	Majority >1.1. Slight improvement between Kings and Valrico	Majority >1.1. Slight improvement between Kings and Valrico	Majority >1.1. Slight improvement between Kings and Valrico
	Lithia Pinecrest Rd (NB)	Majority >1.3	Majority >1.1. Slight improvement between Lumsden and SR 60	Majority >1.1. Slight improvement between Brooker and SR 60	Majority >1.1. Slight improvement between Brooker and Lumsden	Majority >1.1. Slight improvement between Brooker and SR 60	Majority >1.1. Slight improvement between Brooker and SR 60	Majority >1.0. Slight improvement between Bloomingdale and SR 60

Area	Roadway Name	Scenarios						
		1 No Build	2 Bloomingdale, Lumsden & SR 60 BRT	3 Lumsden, Lithia Pinecrest & SR 60 BRT	4 Lithia Pinecrest & SR 60 BRT	5 Brooker Extension	6 Bloomingdale, Lumsden, Lithia Pinecrest, John Moore	7 Bloomingdale, Lumsden, Lithia Pinecrest, John Moore, Brooker
	Kings Ave (NB)	Majority > 1.1	Majority > 1.0	Majority > 1.0	Majority > 1.1	Majority > 1.0. Slight improvement of segment between Bloomingdale Ave and Brooker Rd extension.	Majority > 1.0	Majority > 0.9
	Providence Rd (NB)	Majority > 1.3	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1
	Gornto Lake Rd (NB)	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.5	Majority > 1.1	Majority > 1.1
Adjacent Area	Lithia Pinecrest Rd (NB)	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1
	Bell Shoals Rd (NB)	Majority > 1.5	Majority > 1.5	Majority > 1.3. Slight improvement between Glenhaven and Bloomingdale	Majority > 1.3. Slight improvement on segment between Glenhaven and Bloomingdale	Majority > 1.3. Slight improvement between Glenhaven and Greenhollow	Majority > 1.5	Majority > 1.5
	US 301 (NB)	Majority > 1.5	Majority > 1.5	Majority > 1.5.	Majority > 1.5	Majority > 1.5	Majority > 1.5	Majority > 1.5
	I-75 (NB)	Majority > 1.1	Majority > 1.1	Majority > 1.1.	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1
PM Peak Period								
Study Area	Bloomingdale Ave (EB)	Majority > 1.0	Majority > 0.9. Slight improvement between Kings and Cade	Majority > 1.1	Majority > 1.1	Majority > 0.9	Majority > 0.9	Majority > 0.9
	Brooker Rd Extension (EB)	N/A	N/A	N/A	N/A	Majority > 1.1	N/A	Majority > 1.1



Area	Roadway Name	Scenarios						
		1 No Build	2 Bloomingdale, Lumsden & SR 60 BRT	3 Lumsden, Lithia Pinecrest & SR 60 BRT	4 Lithia Pinecrest & SR 60 BRT	5 Brooker Extension	6 Bloomingdale, Lumsden, Lithia Pinecrest, John Moore	7 Bloomingdale, Lumsden, Lithia Pinecrest, John Moore, Brooker
	Lumsden Rd (EB)	Majority > 1.1	Majority > 1.1. Slight improvement between Kings and Lithia Pinecrest	Majority > 1.3	Majority > 1.5	Majority > 1.1	Majority > 1.1	Majority > 1.1
	SR 60 (EB)	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1
	Lithia Pinecrest Rd (SB)	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.0	Majority > 1.0. Slight improvement between Lumsden and Brooker	Majority > 1.0. Slight improvement between Lumsden and Bloomingdale	Majority > 1.0. Slight improvement between SR 60 and Bloomingdale
	Kings Ave (SB)	Majority > 1.0	Majority > 0.9	Majority > 0.9	Majority > 0.9	Majority > 1.0	Majority > 0.9	Majority > 0.9
Study Area	Providence Rd (SB)	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 0.9
	Gornto Lake Rd (SB)	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1
Adjacent Area	Lithia Pinecrest Rd (SB)	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1
	Bell Shoals Rd (SB)	Majority > 1.3	Majority > 1.3	Majority > 1.3	Majority > 1.1. Slight improvement between Bloomingdale and Glenhaven	Majority > 1.3	Majority > 1.3	Majority > 1.3
	US 301 (SB)	Majority > 1.3	Majority > 1.3	Majority > 1.3	Majority > 1.3	Majority > 1.3	Majority > 1.3	Majority > 1.3
	I-75 (SB)	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1	Majority > 1.1

Figure 36. Scenario 1 (No Build: 2040 LRTP) - 2040 Volume-to-Capacity Ratio (AM Peak Period)

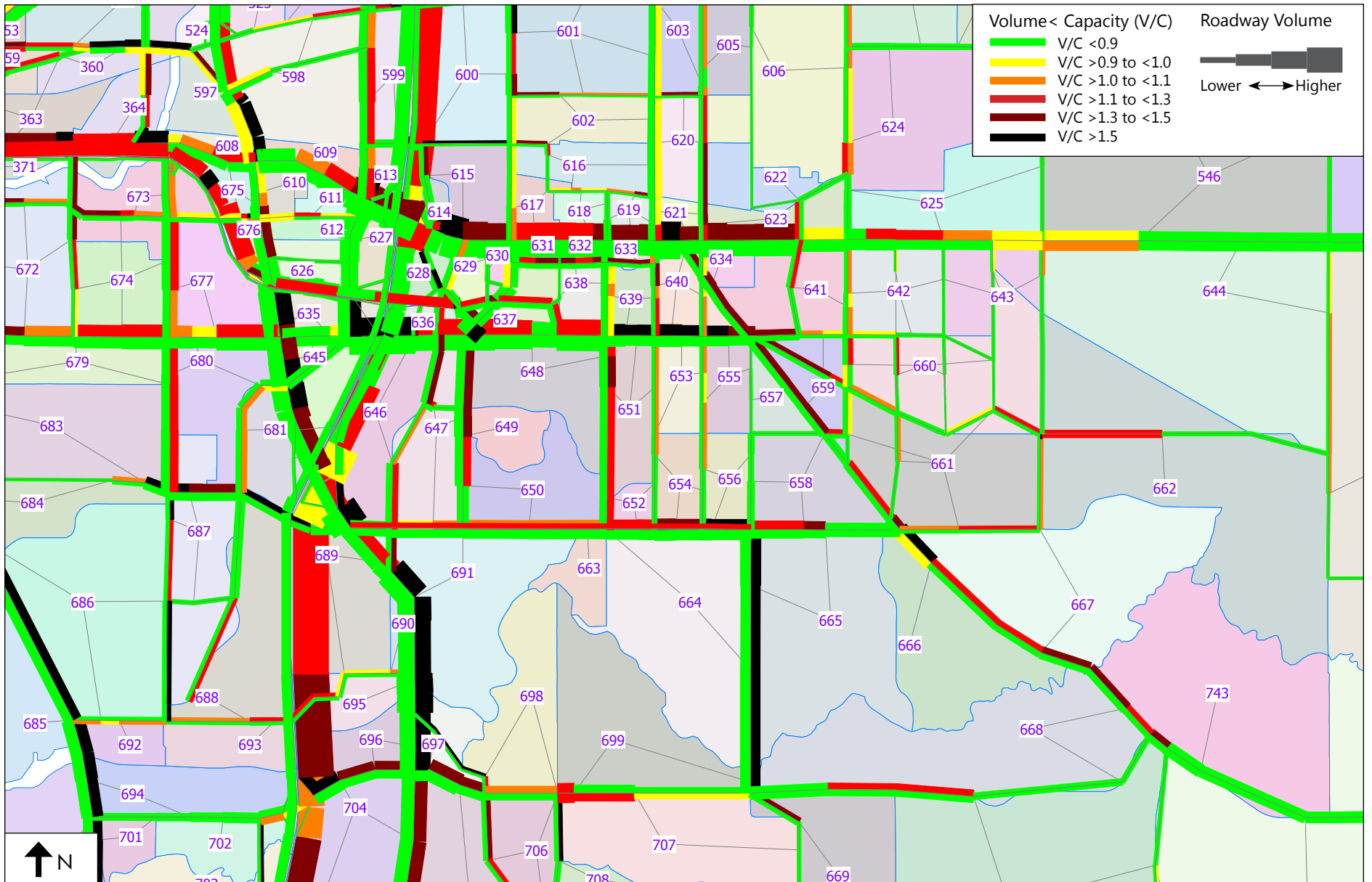




Figure 37. Scenario 1 (No Build: 2040 LRTP) - 2040 Volume-to-Capacity Ratio (PM Peak Period)

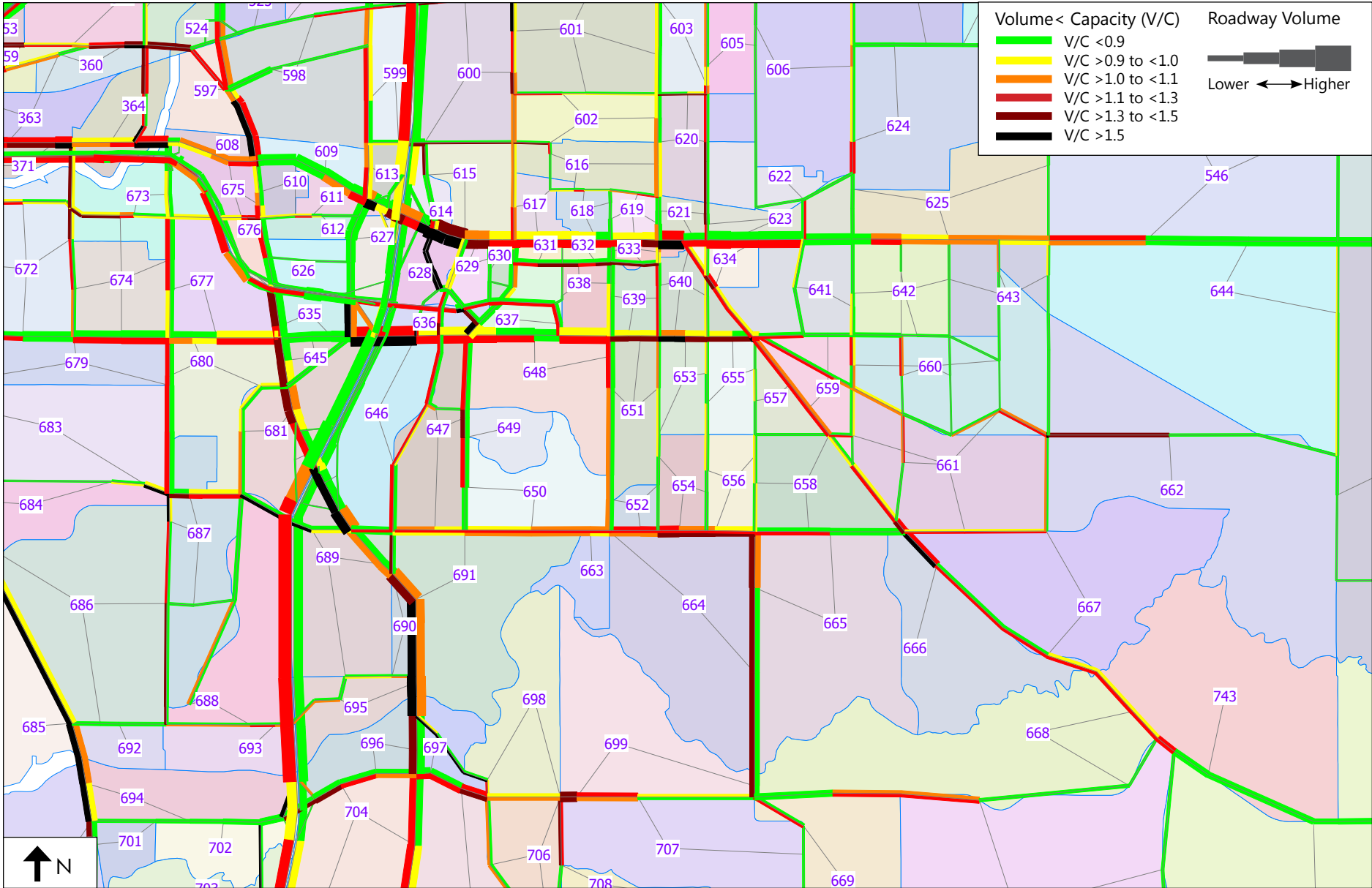


Figure 38. Scenario 2 (Bloomingdale Reversible, Widen Lumsden Road, SR 60 BRT) - 2040 Volume-to-Capacity Ratio (AM Peak Period)

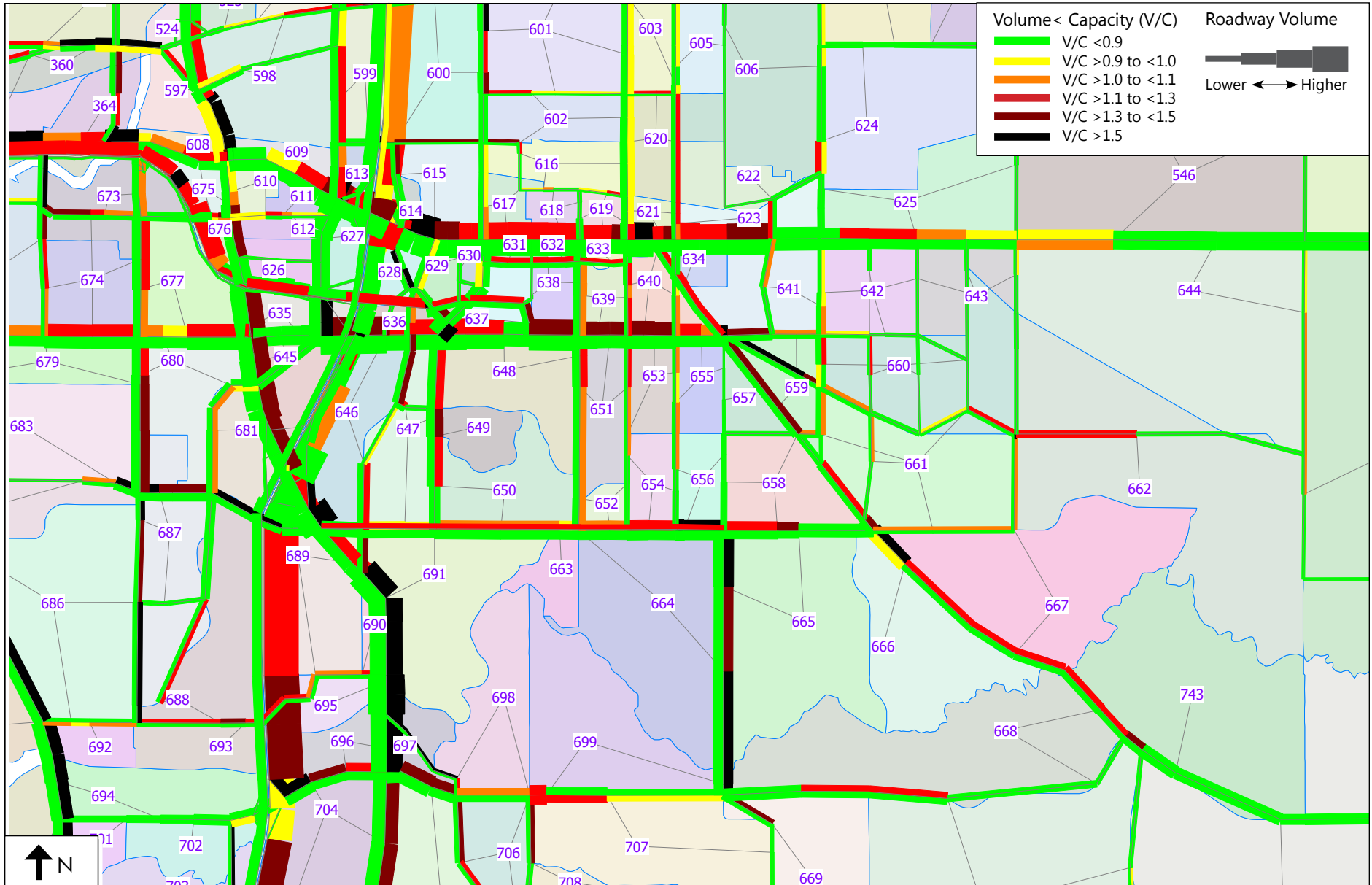




Figure 39. Scenario 2 (Bloomingdale Reversible, Widen Lumsden Road, SR 60 BRT) - 2040 Volume-to-Capacity Ratio (PM Peak Period)

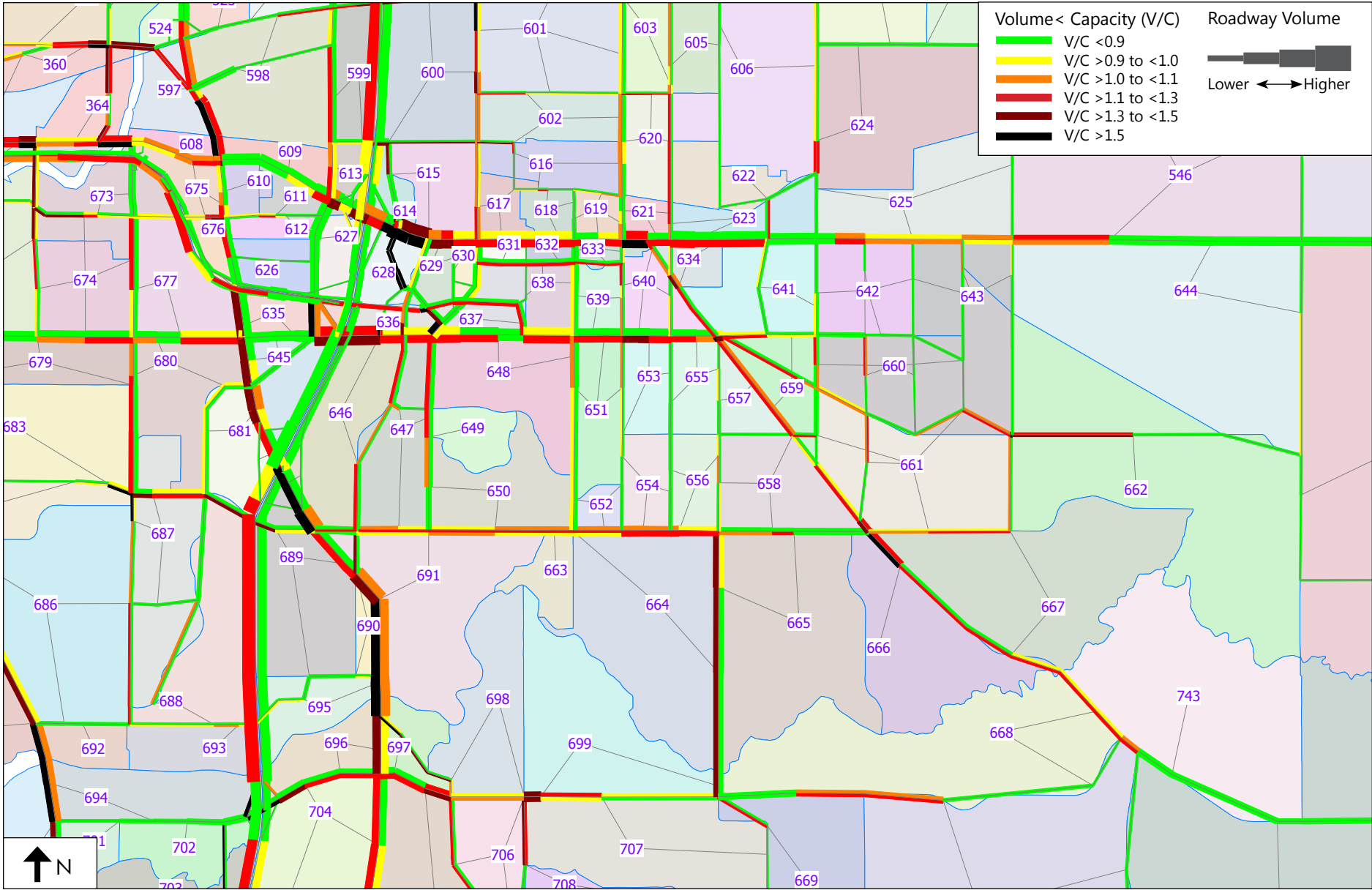


Figure 40. Scenario 3 (Widen Lumsden Road and Lithia Pinecrest Road and SR 60 BRT) - 2040 Volume-to-Capacity Ratio (AM Peak Period)

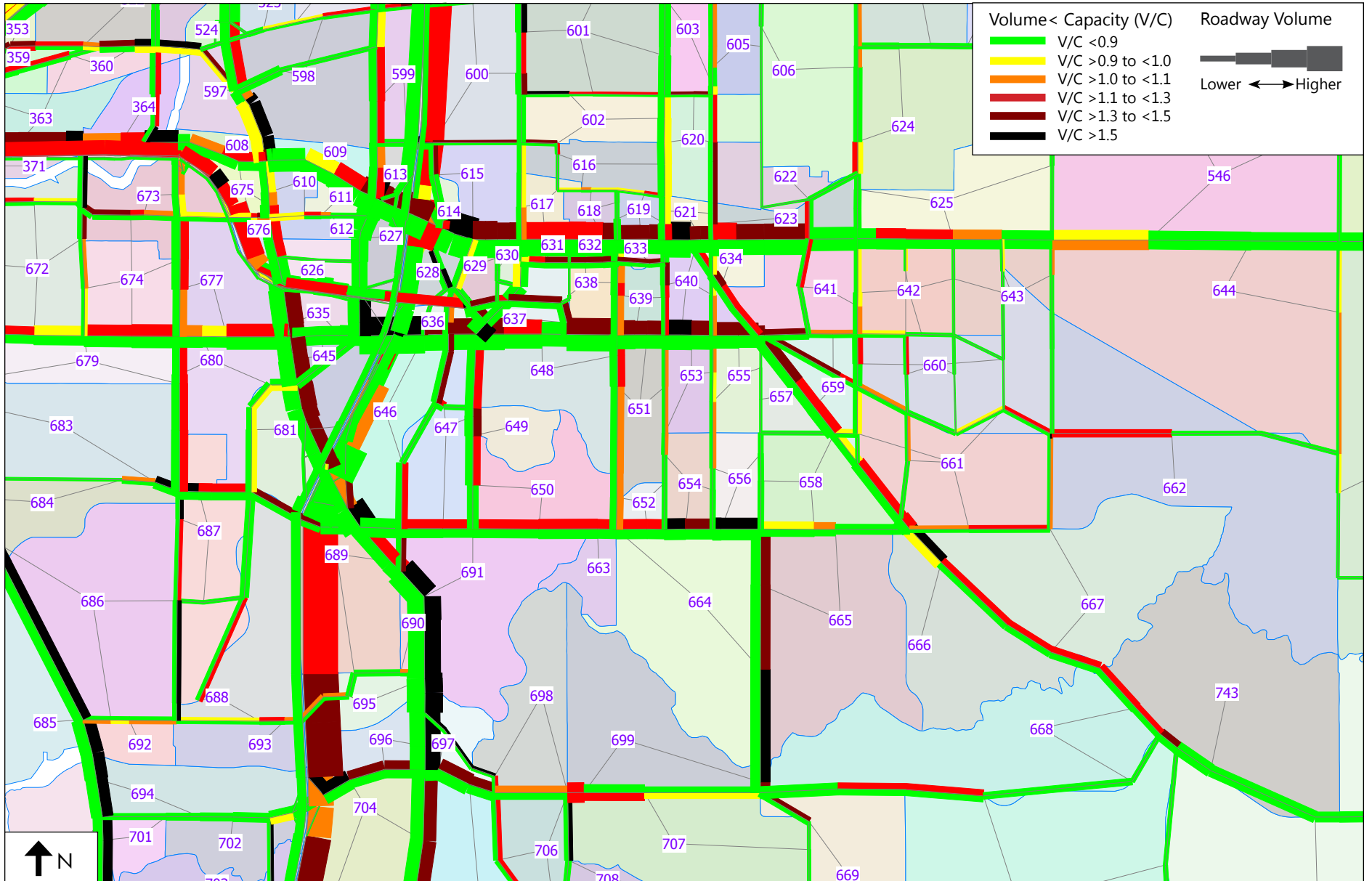




Figure 41. Scenario 3 (Widen Lumsden Road and Lithia Pinecrest Road and SR 60 BRT) - 2040 Volume-to-Capacity Ratio (PM Peak Period)

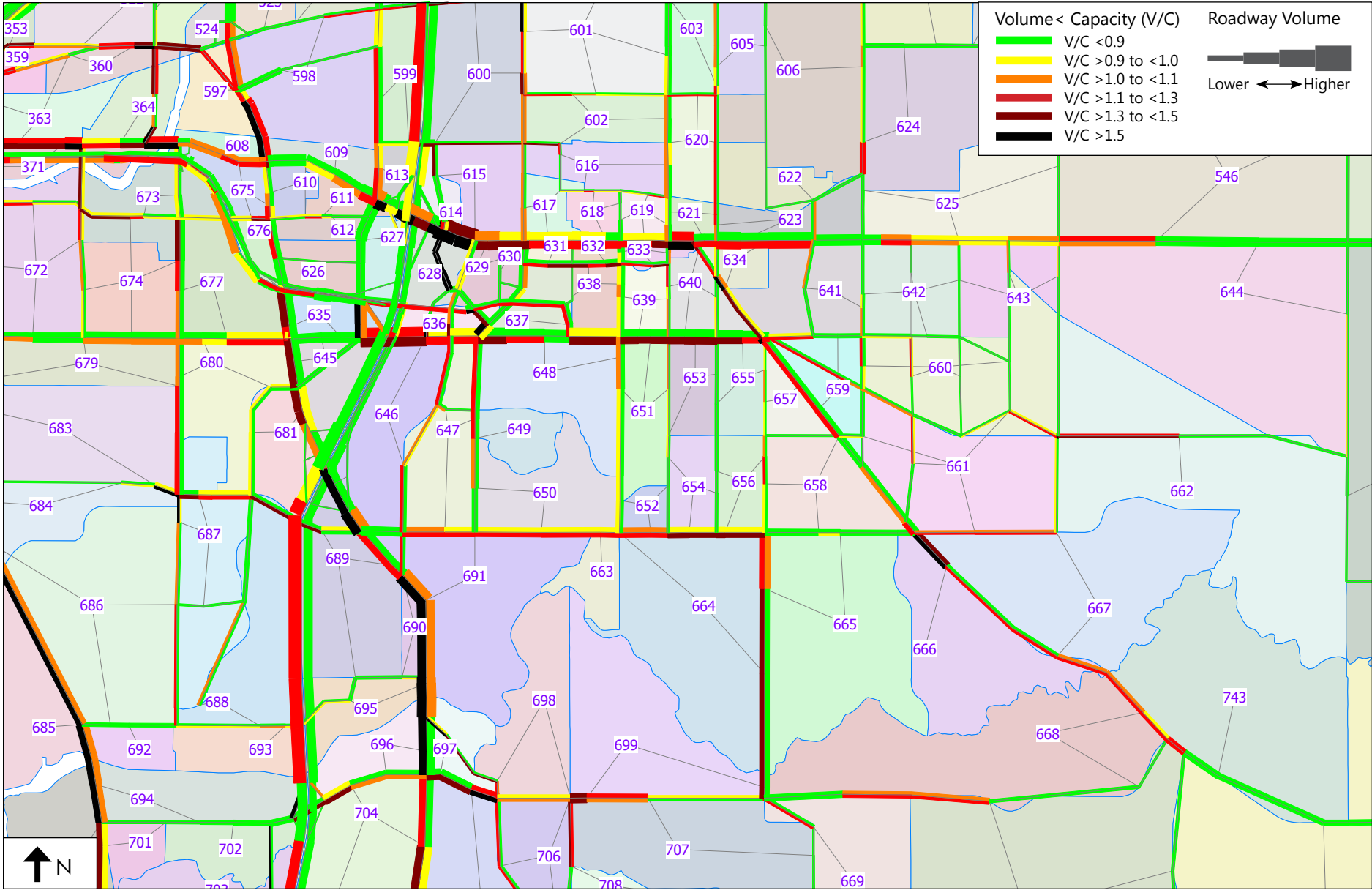


Figure 42. Scenario 4 (Widen Lithia Pinecrest and SR 60 BRT) - 2040 Volume-to-Capacity Ratio (AM Peak Period)

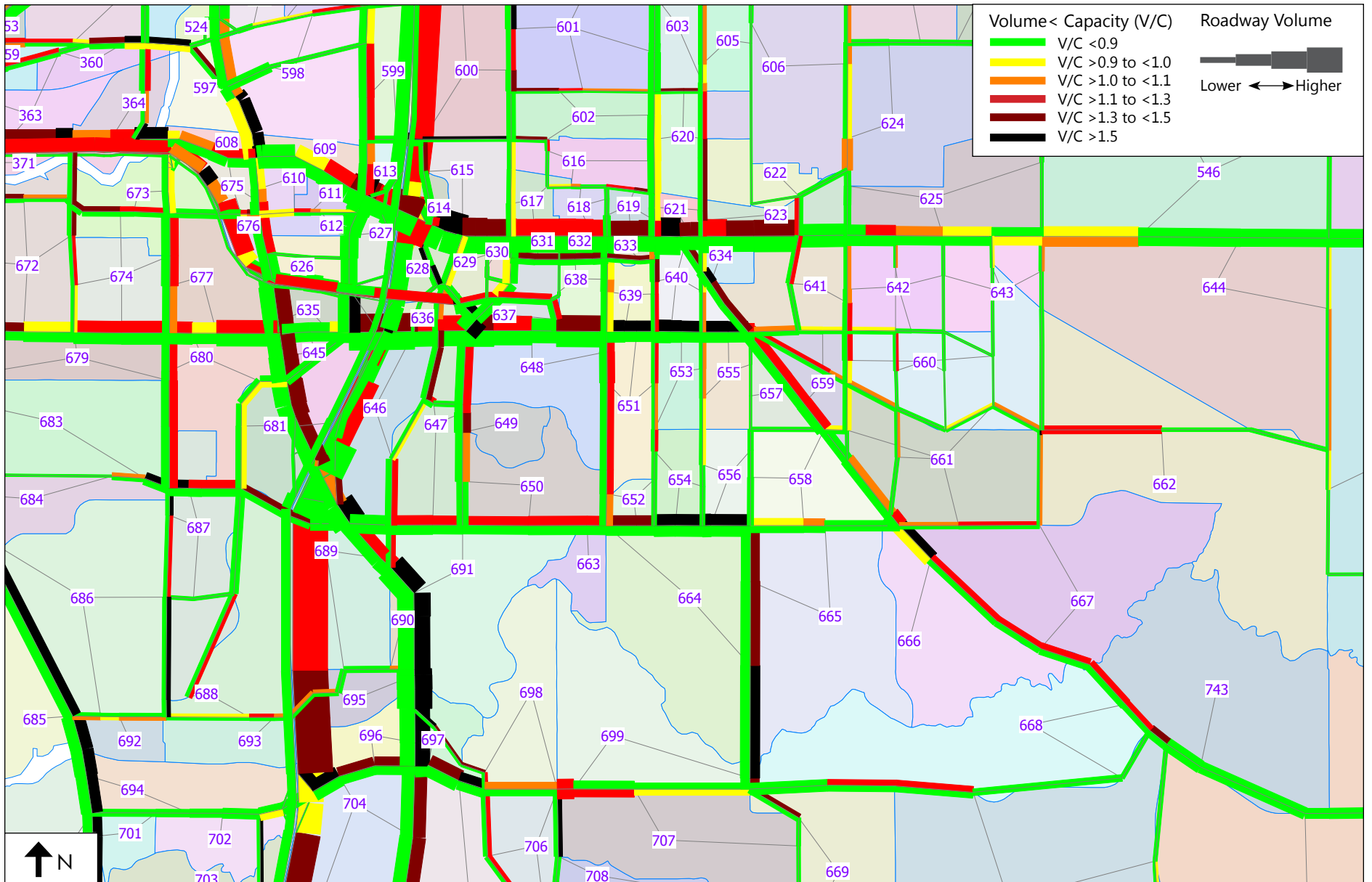




Figure 43. Scenario 4 (Widen Lithia Pinecrest and SR 60 BRT) - 2040 Volume-to-Capacity Ratio (PM Peak Period)

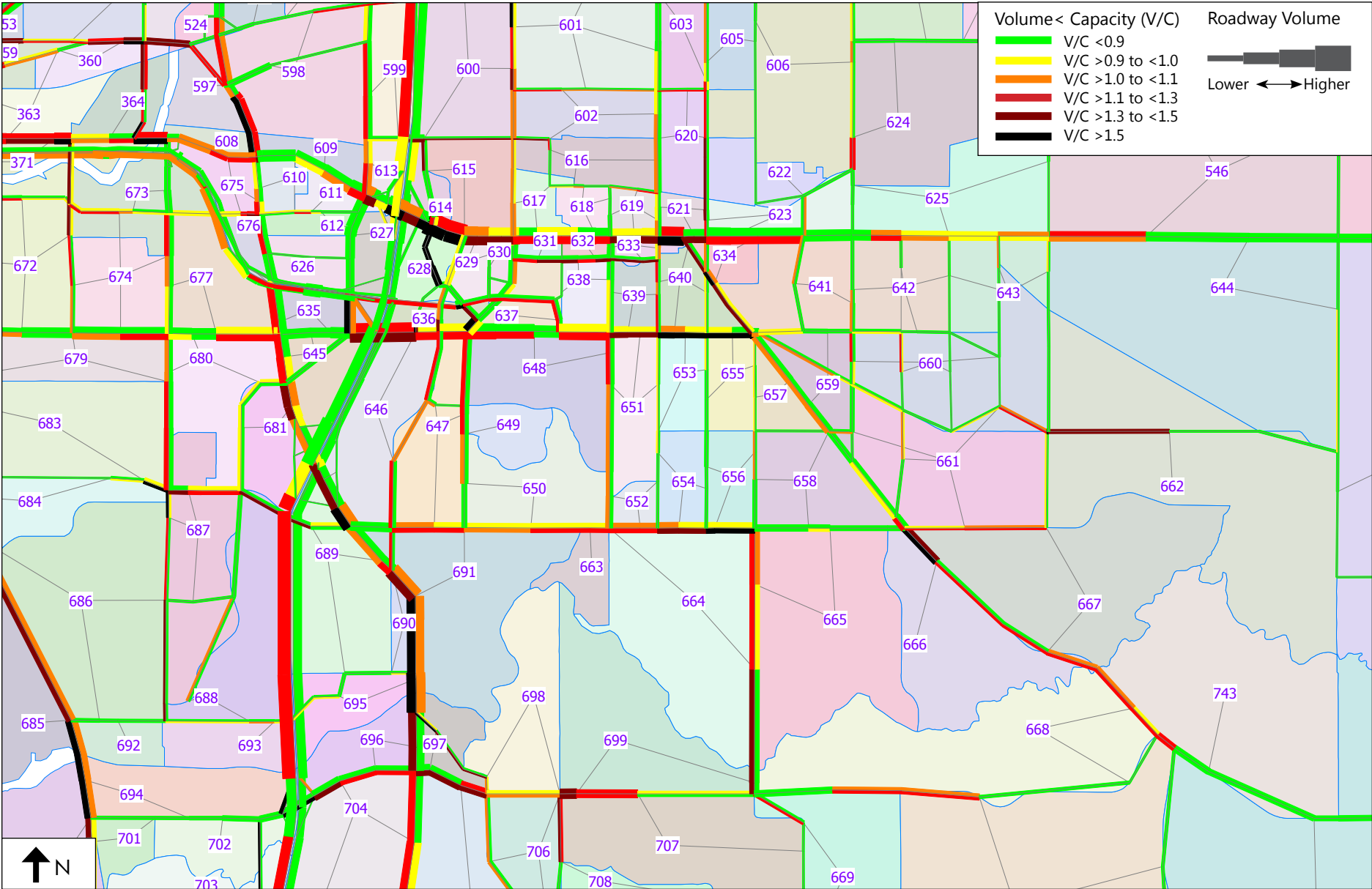


Figure 44. Scenario 5 (New 2-lane Road) - 2040 Volume-to-Capacity Ratio (AM Peak Period)

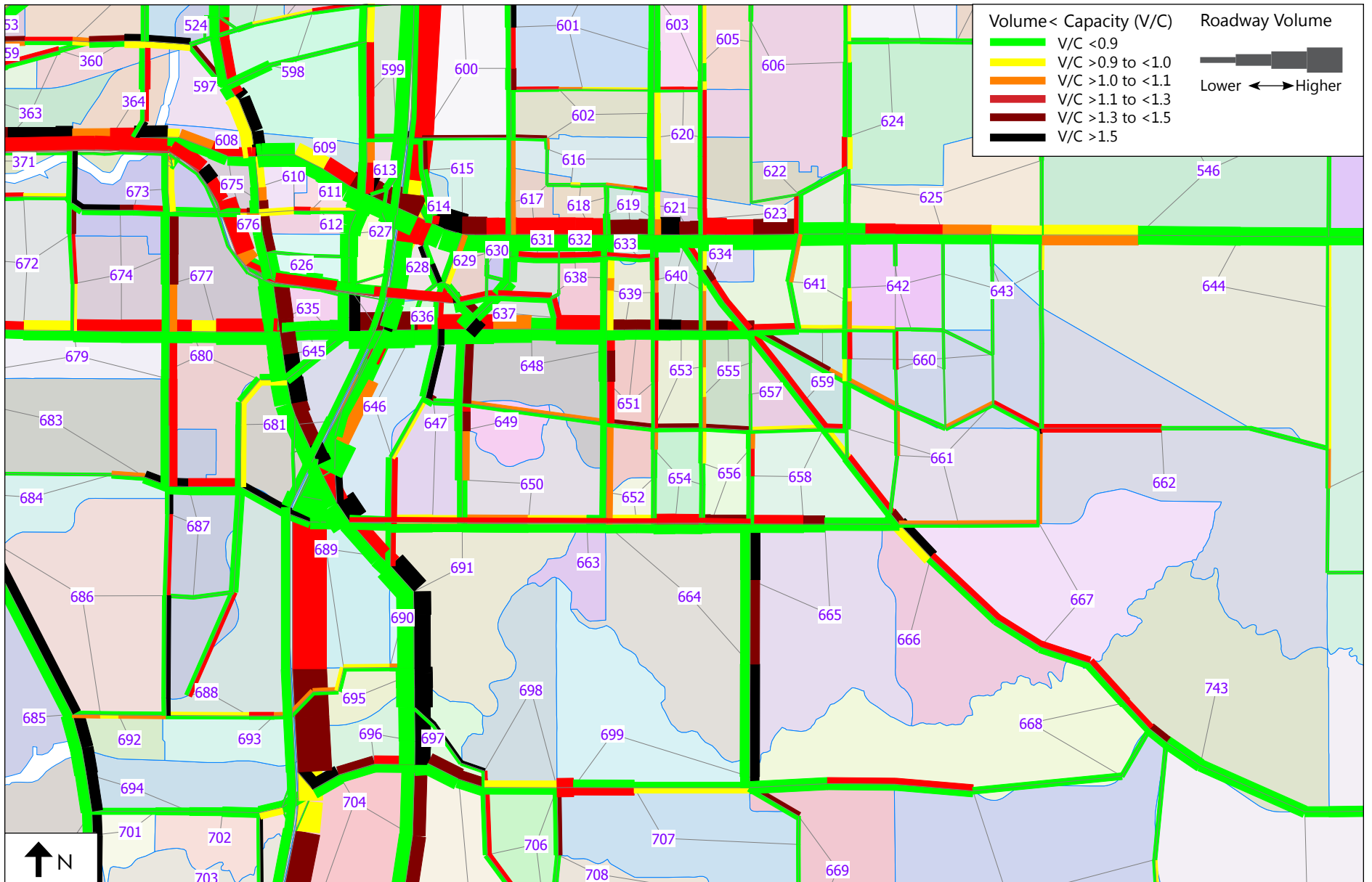




Figure 45. Scenario 5 (New 2-lane Road) - 2040 Volume-to-Capacity Ratio (PM Peak Period)

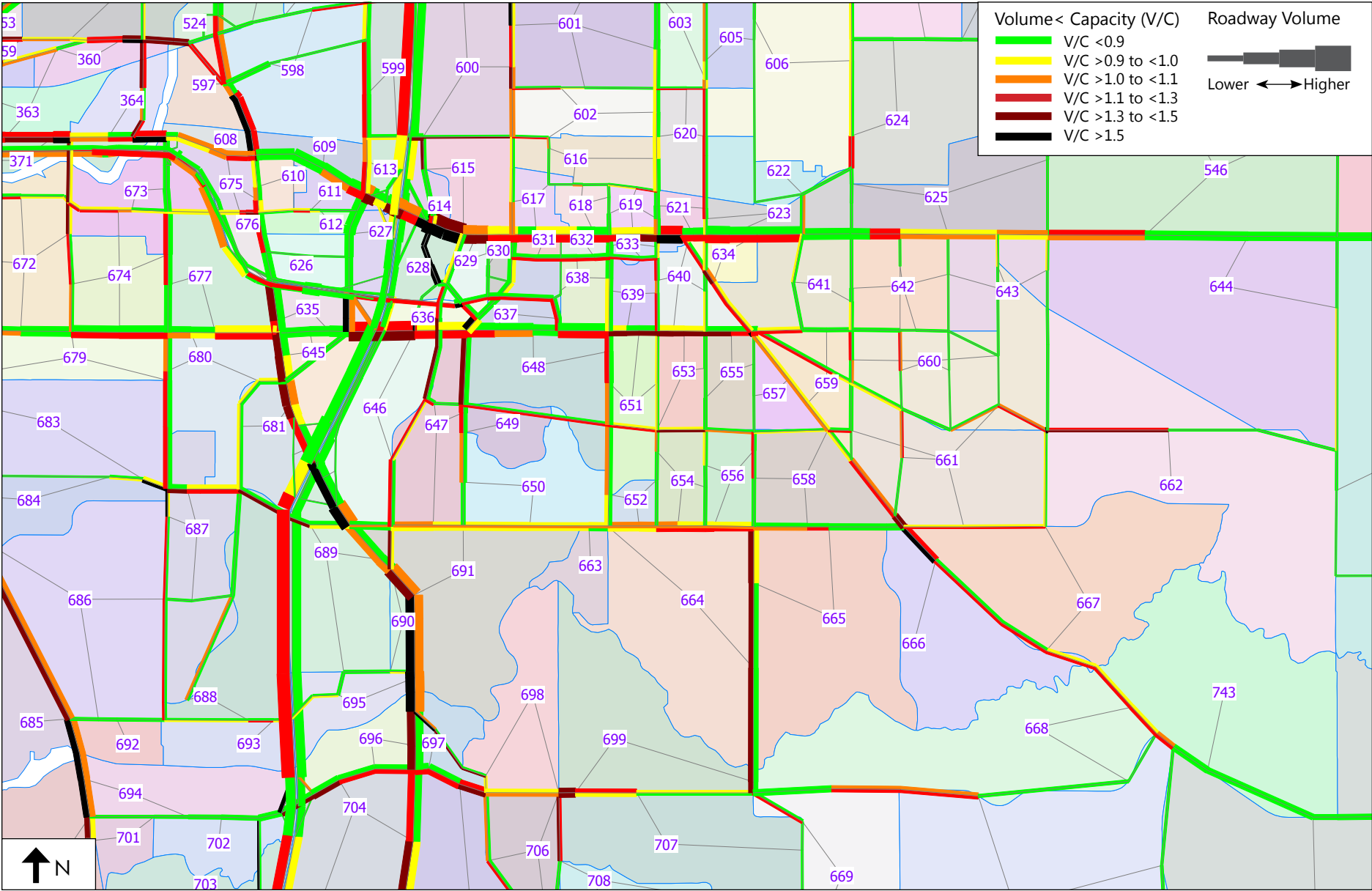


Figure 46. Scenario 6 (Bloomingdale Reversible, Widen Lumsden Road, Lithia Pinecrest Road & John Moore Road, and SR 60 BRT) - 2040 Volume-to-Capacity Ratio (AM Peak Period)

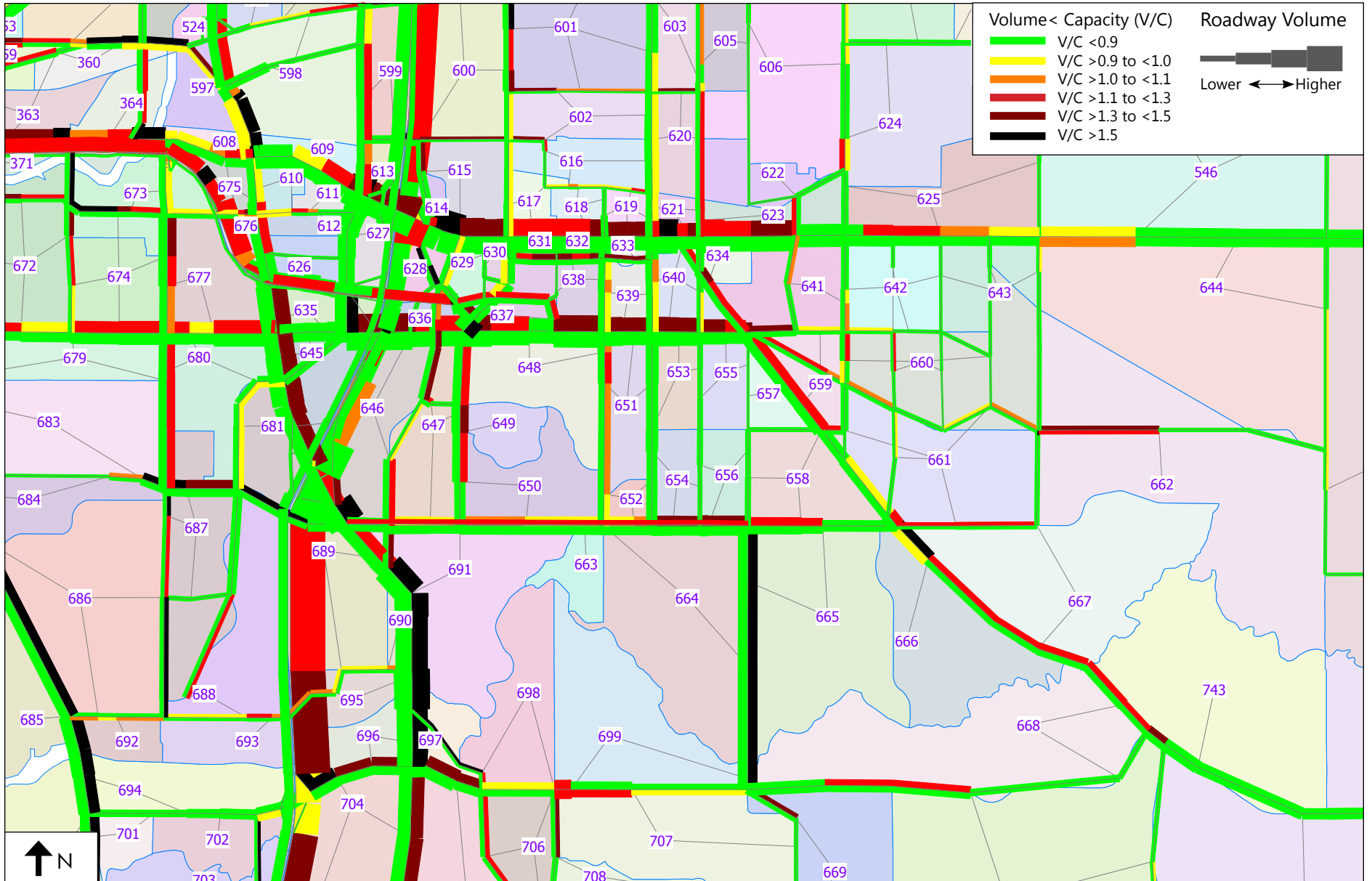




Figure 47. Scenario 6 (Bloomingdale Reversible, Widen Lumsden Road, Lithia Pinecrest Road & John Moore Road, and SR 60 BRT) - 2040 Volume-to-Capacity Ratio (PM Peak Period)

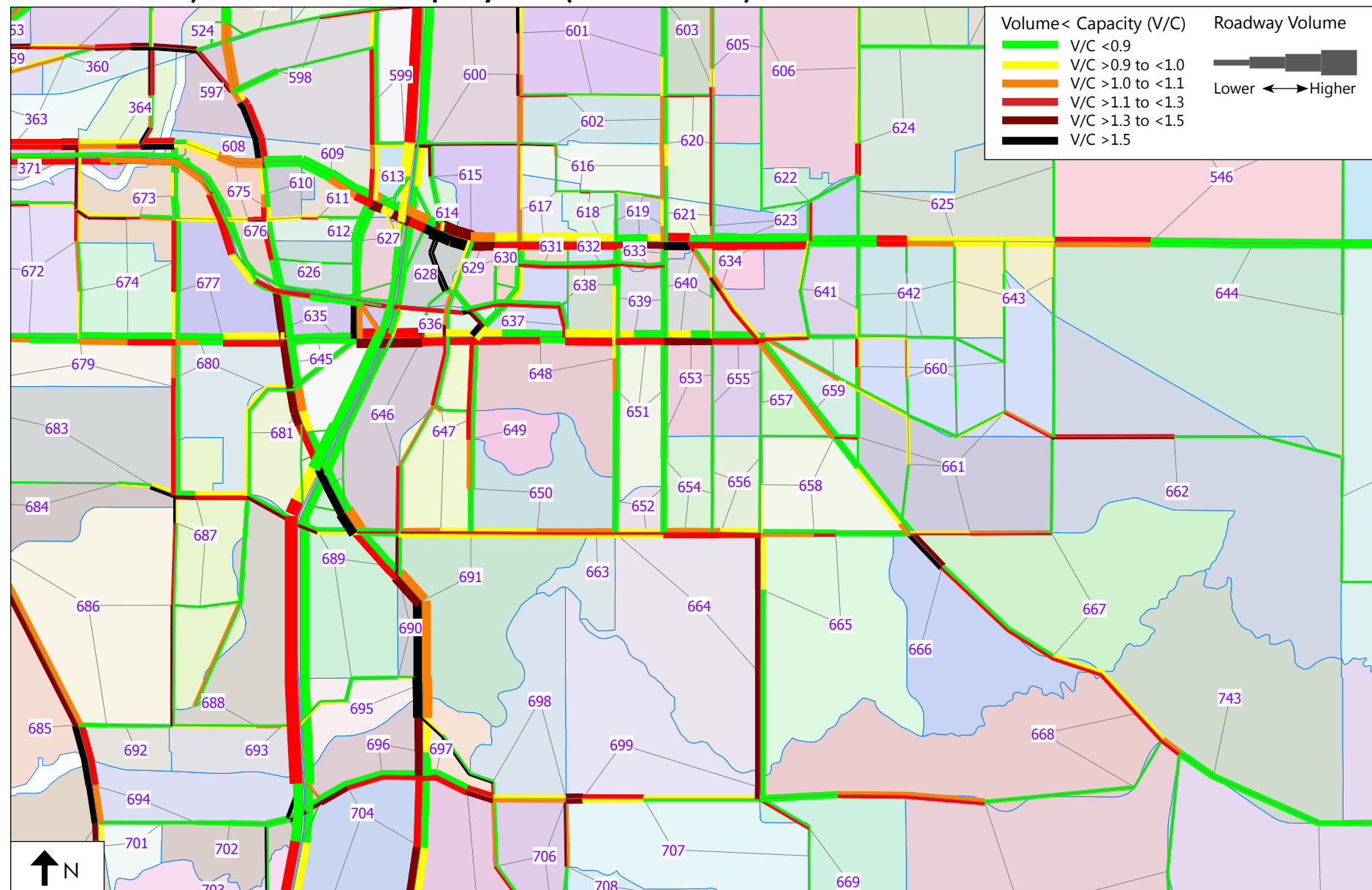


Figure 48. Scenario 7 (Bloomingdale Reversible, Widen Lumsden Road, Lithia Pinecrest Road & John Moore Road, and SR 60 BRT) - 2040 Volume-to-Capacity Ratio (AM Peak Period)

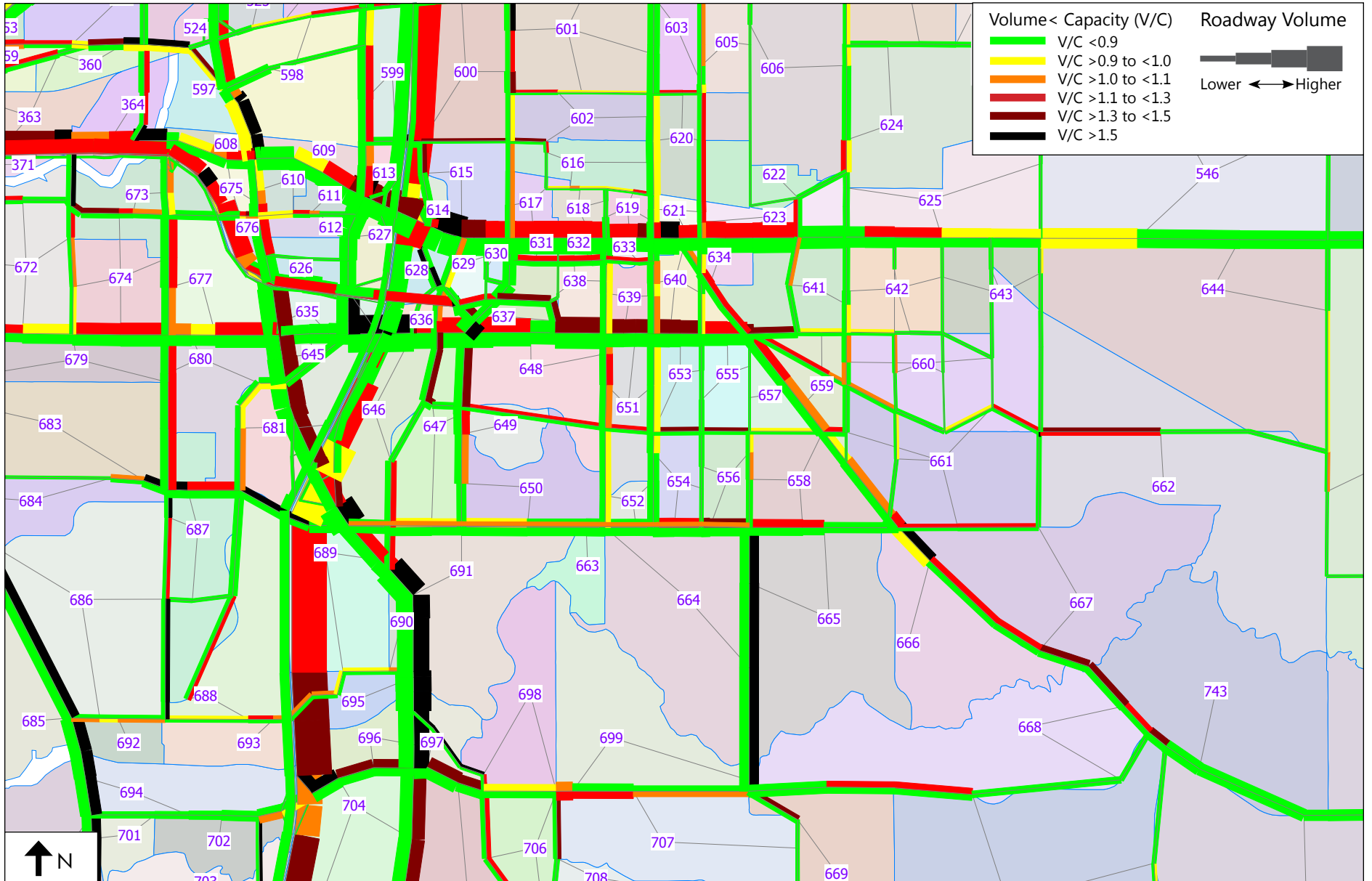
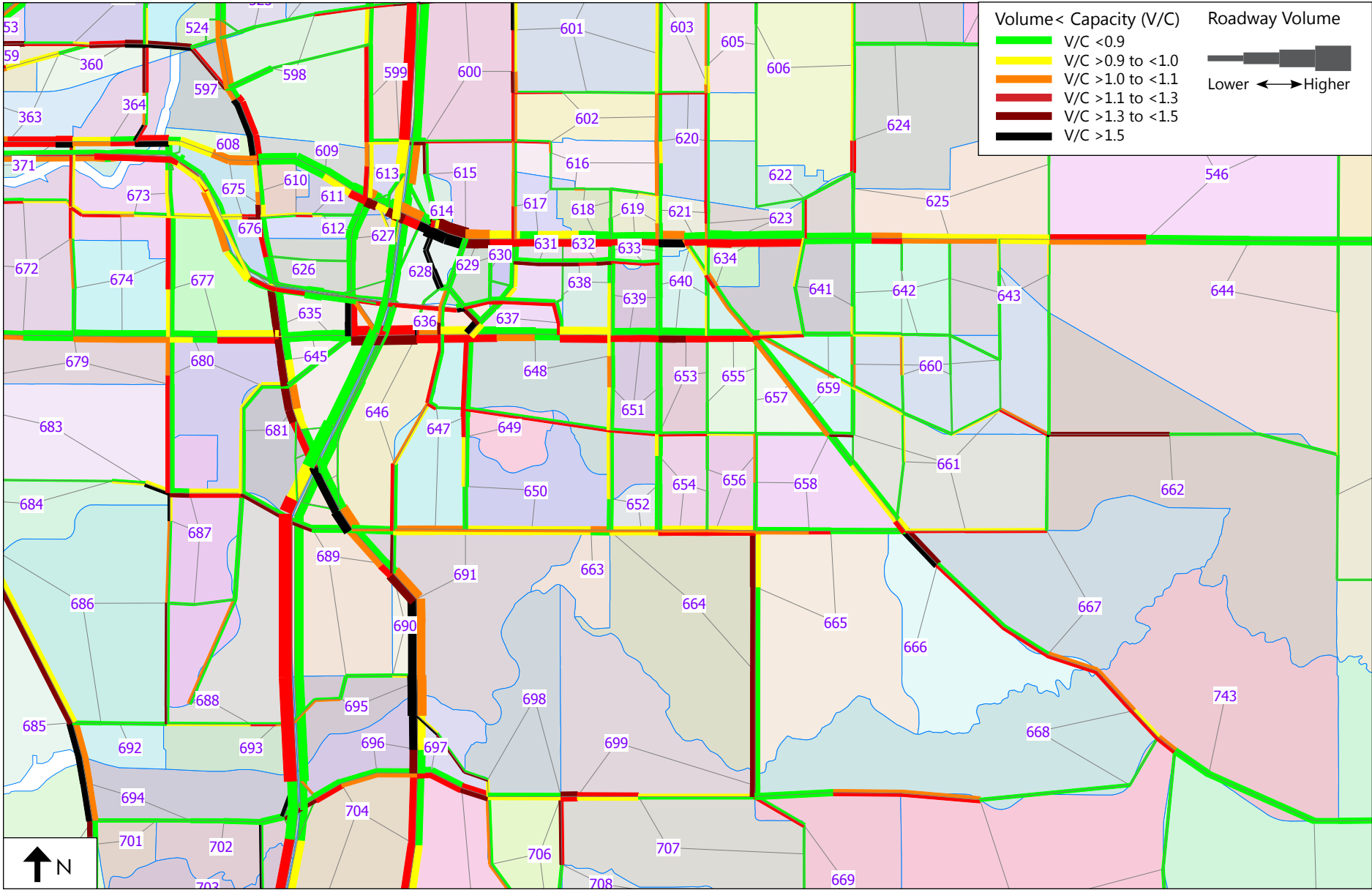




Figure 49. Scenario 7 (Bloomingdale Reversible, Widen Lumsden Road, Lithia Pinecrest Road & John Moore Road, and SR 60 BRT) - 2040 Volume-to-Capacity Ratio (AM Peak Period)



8. SOURCES

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- FDOT District Seven Districtwide Traffic Signal Retiming Report for the US 301 and Bloomingdale Avenue Corridors (April 2016)
- Trafficware Ltd. Synchro plus SimTraffic. Version 8.0.
- SIDRA Solutions. SIDRA Intersection. Version 6.1.

9. ATTACHMENTS

- Attachment 1 - Lumsden Road Right-of-Way Estimate, Lumsden Road Environmental Evaluation, & Lumsden Road Preliminary Construction Costs