ROUTE 419

CORRIDOR PLAN

FINAL DRAFT March 2010

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"The preparation of this report has been financed in part through grant[s] from the Federal Highway Administration and Federal Transit Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 [or Metropolitan Planning Program, Section 104(f)] of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation."

"This report was funded in part through grant[s] from the Federal Highway Administration [and Federal Transit Administration], U.S. Department of Transportation. The views and opinions of the authors [or agency] expressed herein do not necessarily state or reflect those of the U. S. Department of Transportation."

Kimley-Horn and Associates, Inc.

Baker

RENAISSANCE PLANNING GROUP

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1 EXECUTIVE SUMMARY

INTRODUCTION

In the summer of 2008, the Roanoke Valley Area Metropolitan Planning Organization (RVAMPO) and the Salem District of the Virginia Department of Transportation (VDOT) agreed to cooperatively develop a multimodal transportation plan for the Route 419 Corridor. Through the Virginia Multimodal Grant Program and VDOT on-call consultant contracts, the firms of Kimley-Horn and Associates and the Renaissance Planning Group were contracted to support the planning process.

Study Area Description - Route 419 is a 9.5-mile, 4-lane divided state highway that extends west from the US 220 Expressway in southern Roanoke County, along the limits of the City of Roanoke, then northwest through the City of Salem, and terminating just north of I-81. The corridor is fronted by a variety of land uses, including commercial, residential, and industrial. It was first proposed in the 1963 Roanoke Valley Regional Area Transportation Study as a 4-lane, divided circumferential route that would connect southwest Roanoke County with the City of Salem and I-81. It was constructed as an extension and improvement of Virginia Route 119 with several new terrain sections. The entire corridor was completed in 1972. Since its construction, traffic volumes have increased tremendously on certain portions of the corridor and several 419 intersections are ranked in the top ten in accident rates in the VDOT Salem District. Until this plan, there had not been a detailed analysis of the Route 419 corridor in 20 years, and over that period there has been a significant increase in traffic, vehicle accidents, and land development.

Public Involvement - To ensure that the corridor plan considered citizen concerns and interests, input was solicited from the general public, as well as through a steering committee, a technical committee, VDOT, RVAMPO, elected officials, focus groups, and other stakeholders. Two general public meetings were held: one to solicit input on existing conditions and generate a vision for the future of the corridor, and a second to present plan recommendations and record citizen comments and suggestions.

Vision and Goals - The vision and goals of the Route 419 Multimodal Corridor Plan are based on analysis of existing conditions, comments from local officials and citizens, as well as priorities of the Commonwealth of Virginia.

Route 419 will provide safe and efficient mobility for drivers, pedestrians, bicyclists, and transit riders, while providing adequate access to businesses and residential areas.

EXISTING CONDITIONS

CORRIDOR CONTEXT

Land Use - The existing land use in the study area is characterized primarily by commercial/business and industrial along the frontage of Route 419, with low to medium density residential neighborhoods located just off the corridor. The following land use categories and percentages are present within a half-mile of the corridor: 51% Residential; 18% Business/Commercial; 9% Multifamily Residential; 9% Vacant; 7% Industrial; and 6% Agricultural.

Demographics – According to the 2000 US Census, 56,944 people live within a half-mile of the Route 419 corridor and make up 27.7% of the combined populations of Roanoke County and the Cities of Roanoke and Salem. Of the 56,944 living in the corridor, 17.2% are over age 65, 15.6% have a disability, 6.8% live in low income households, and 2.1% do not own an automobile. Citizens in these four categories are likely to depend upon public transportation, either now or sometime in the near future. Taken collectively, these categories represent 23,721 potentially transit dependent people and make up 42% of the population within the Route 419 corridor.

Population and employment density is often seen as the optimal determinant to define areas suitable for transit service. This study found that population and employment density along Route 419 is lower on average than both the rest of the MPO area and Valley Metro service areas. However, there are visible pockets of activity along Route 419. Notably, the intersections with Route 11 and 221 show high levels of density, as well as near the southern terminus of 419. Population and employment are sparse in the northern end of 419, but there is increased density along I-81, which intersects 419 near its northern terminus.

TRAFFIC OPERATIONS

Level of Service – Traffic congestion and delay has been an increasing concern for residents living along the corridor and other commuters. To objectively quantify the situation, traffic counts were collected and levels of service (LOS) were calculated for all road segments and intersections on Route 419. It was found that almost all intersections currently operate at an overall acceptable level of service (A, B, C, or D); however there was several that do not. In the mornings, the intersections with Apperson Drive, McVitty Road, and the US 220 southbound ramp operate with unacceptable levels of traffic congestion (LOS E or F). In the evenings, the intersections with Roanoke Boulevard, Apperson Drive, Carriage Lane, McVitty Road, Colonial Avenue, and US 220 operate with unacceptable levels of traffic congestion (LOS E or F).

Geometric and Access Management Deficiencies – Almost all intersections studied were found to have left and right turn lane lengths that do not meet current VDOT standards. Similarly, the spacing of most intersections and driveways along the corridor were found to be much shorter than the recently enacted VDOT Access Management regulations.

Crash Analysis – Crash data for the corridor from 2005 to 2008 was reviewed to determine the location, type, and severity of traffic accidents on the corridor. Nine hundred and ninety-nine accidents were reported over the three-year period, with the largest percentage of them being rear end (54%) and angle (25%) collisions. The top three intersections with the highest number of crashes include: Apperson Drive with a total of 154 accidents; Roanoke Boulevard with a total of 115 accidents; and Tanglewood Mall Entrance/Elm View Road with a total of 90 accidents.

MULTIMODAL OPERATIONS

Bicycle and Pedestrian Accommodations - Currently, the Route 419 corridor within the study section does not have bicycle accommodations directly along the corri-

dor. Sidewalks and pedestrian signals are only provided in the immediate vicinity of the East Main Street intersection. At major signalized intersections along the corridor, curb ramps exist although pedestrian signalization is not provided. South of Keagy Road a paved shoulder is provided along both sides of the roadway, although this pavement is formally utilized for right turn lanes, it is also often used by bicyclists. Formal pedestrian counts were not conducted, however, desire lines (worn trails beside the road) were noted at along numerous segments of the corridor.

Transit and Park-and-Ride – Presently, there are no fixed transit routes serving the entire length of the Route 419 corridor; however, there are multiple Valley Metro bus routes that cross the corridor or provide service to destinations in close proximity. Route 91 and 92 are the only routes that travel along the corridor for any significant distance. Ridership data collected in 2008 showed that four routes with service crossing the corridor were ranked in the top ten most active routes in the system. The Smart Way Commuter Bus connects travelers from Roanoke to Blacksburg and crosses Route 419 as it travels to pick up passengers at the I-81 Exit 140 park-and-ride lot. The Exit 140 and Orange Market (Rt. 419/Rt. 311) park-and-ride lots are presently the only ones near the corridor. A 2009 survey found that the number of automobiles parked at the Exit 140 lot exceeded its capacity 145%.

Freight and Rail – On the whole, the Route 419 corridor has a relatively low percentage of truck traffic as compared with I-81 and other highways and arterials in the region. The northern portion of the corridor, from I-81 south to US 460 (E. Main St.), has the highest percentage of truck traffic at 5.6%. This is consistent with the location of most of the corridor's manufacturing and industrial properties. Norfolk Southern rail lines cross the corridor near Apperson Drive and are designated as part of the greater Heartland Corridor, connecting Virginia to Illinois.

FUTURE CONDITIONS

CORRIDOR CONTEXT

Land Use – Based on the Comprehensive Plans of the three localities along Route 419, land use along the corridor is projected to change little over the coming decades. The amount of residential development will likely increase some, while the percentage of commercial and industrial will hold constant. Notable increases in residential development are projected to occur near the activity centers of Roanoke Boulevard, Main Street, Glen Heather Drive, and Brambleton Avenue.

Demographics – Based on historic population growth in the Roanoke Valley, the number of people living within a half mile of the corridor is projected to increase 10% by the year 2035. Over the same period, the amount of employment is expected to increase by 20%. Similarly, the density of population and employment per acre will also increase. Much of the increase in population will occur near the activity centers of Roanoke Boulevard, Main Street, Glen Heather Drive, and Brambleton Avenue.

TRAFFIC OPERATIONS

Level of Service – Future traffic conditions in the years 2018 and 2035 were projected for the corridor under two different scenarios: (1) no additional improvements ("no build") and (2) implementation of plan recommendations. Under the No Build scenario, over half of the signalized intersections are projected to operate at LOS E or F, in either the AM or PM peak hours, by 2018. BY 2035, close to three quarters of the signalized intersections will operate at LOS E or F during both AM and PM peaks. It was also found that the following roadway segments within the corridor will have unacceptable LOS by 2035: Route 311 to I-81, Brambleton Avenue to Starkey Road, and Starkey Road to US 220.

However, if the recommendations of this plan are implemented a majority of the intersections in the corridor will operate at an overall acceptable level of service of D or better. However, eight AM peak intersections and 10 PM peak intersections still operate with unacceptable levels of traffic congestion (LOS E or F). Many of these intersections showed slight improvement in LOS from the No-Build to Build scenarios, however, not substantial enough to receive an acceptable LOS.

Road Segment Capacity – The level of service was calculated for each segment of Route 419 using 2035 traffic volumes. A majority of the segments are projected to operate at an acceptable LOS, however, the following segments were found to have an LOS E-F by 2035: Route 311 to I-81, Brambleton Avenue to Starkey Road, and Starkey Road to US 220.

MULTIMODAL OPERATIONS

Bicycle and Pedestrian Accommodations – Future bicycle and pedestrian demand analysis was based largely on proximity to proposed greenways and proposed priority bicycle corridors, as shown in regional plans. Areas with high bicycle and pedestrian demand included the activity centers of Route 311, East Main Street, Roanoke Boulevard, Apperson Road, Brambleton Avenue, and the segments between East Main Street to Lynchburg Turnpike and Chaparral Drive to US 220.

Transit and Park and Ride – Projected demand for transit service on the Route 419 corridor was projected based on industry standards equating transit ridership with annual average traffic counts. It was observed that transit demand steadily increases from East Main Street south and east to US 220, with the highest demand occurring from Route 221 to Tanglewood Mall. Demand in 2035 for park and ride lots within the Route 419 corridor was projected for two different utilization methods. One examines traditional commutes from the study area to the City of Roanoke central business district (CDB). The other evaluates potential park and ride demand for workers commuting to or within the corridor. The first analysis found that there is a high concentration of trips to the CBD from the areas near Glen Heather Drive, Brambleton Avenue, and Tanglewood Mall. In the second, it was projected that there will be a high concentration of people that live near East Main Street, Glen Heather Drive, and Brambleton Avenue; and they also work at a location within one half mile of the corridor.

RECOMMENDED IMPROVEMENTS

After evaluating the existing conditions and projecting potential deficiencies of the corridor, the Steering Committee and the Project Team developed a series of recommended improvements for Route 419. Draft recommendations were presented to citizens in a public meeting on December 3, 2009 and comments were taken in person for over a month. Based on the public comments and stakeholder review of the draft plan, certain recommendations were modified.

The recommendations are organized by roadway, bicycle, pedestrian, transit and park-and ride improvements. They are listed by corridor segment, intersection and implementation time frame (short-, mid-, and long-term). Examples of short-term recommendations (0-5 years) include: signage, pavement markings, traffic control changes, minor intersection improvements, traffic signal installation, traffic signal timings, minor pedestrian improvements, street lighting, access modifications, median closure, access management strategies, and minor policy changes. Mid-term recommendations (5-10 years) often require detailed plans and will require some right-of-way acquisition, with cost up to $2-3 million including turn-lane improvements with right-of-way acquisition, crossover adjustments, access consolidation, minor multimodal facilities, sidewalks, street enhancements, and access management strategies. Long-term recommendations (10 to 20 years) require detailed planning, design and public involvement with costs in excess of $3 million, including: roadway widening, realignments, curve flattening, major access improvements, interchange improvements/ modifications, interchange reconstruction, and major multi-modal facilities.

ROADWAY IMPROVEMENTS

The following is a list of some of the most significant mid- and long-term, roadway improvements proposed for Route 419.

- Route 311 to I-81 Interchange - Widen from a two-lane, undivided to a four-lane roadway with a raised median.
- I-81 Interchange - Construct an acceleration lane to accommodate the eastbound channelized right turn free flow lane exiting off southbound I-81.
- Apperson Drive – Complete reconfiguration of the intersection, including dual left turn lanes in both north and southbound directions, and reconstruction of the Apperson Drive bridge over the Roanoke River.
- Brambleton Avenue to US 220 Interchange: Widen from a four-lane, divided roadway to a six-lane, divided facility.
- US 220 Interchange – Complete reconfiguration of the interchange with an additional lane added to both the north and southbound ramps.
- Traffic Signals – Upgrade and coordinate traffic signals in order to facilitate corridor-wide signal timing coordination.

MULTIMODAL IMPROVEMENTS

The following is a list of some of the most significant mid- and long-term, multimodal improvements proposed for Route 419.

- Pedestrian Accommodations – Construct sidewalks or multiuse paths on at least one side of Route 419 from East Main Street south to US 220. Pedestrian crossing improvements are recommended at 22 signalized intersections.
- Bicycle Accommodations – Explore formalizing the use of the shoulder on certain sections of the corridor as a signed bicycle accommodation. On-street bicycle accommodations should be considered during the design of any lane widening project.
- Transit Service – Establish commuter transit service along the entire length of Route 419. Extend the route of the Smart Way to serve the Orange Market Park and Ride and extend Valley Metro routes 61 and 62 to service the Cave Spring Corners area.
- Park and Ride Locations – Primary locations at the Orange Market and Tanglewood Mall. Accessory locations near East Main Street, Roanoke Boulevard, and Brambleton Avenue.

LAND USE

Development land use patterns that promote multimodal access at key intersections, designated as Activity Centers.

IMPLEMENTATION

The implementation of the recommended plan will require the partnership of a number of entities including Roanoke County, the Cities of Salem and Roanoke, the Roanoke Valley Area Metropolitan Planning Organization (RVAMPO), the Virginia Department of Transportation (VDOT), Valley Metro, private transportation providers, neighborhood residents, elected officials, private land owners, developers, and other parties. Achieving success along the corridor will require cooperation, coordination, compromise, and investment. The corridor plan will need to be further developed through detailed engineering studies and designs and through public outreach associated with design efforts.

INTRODUCTION

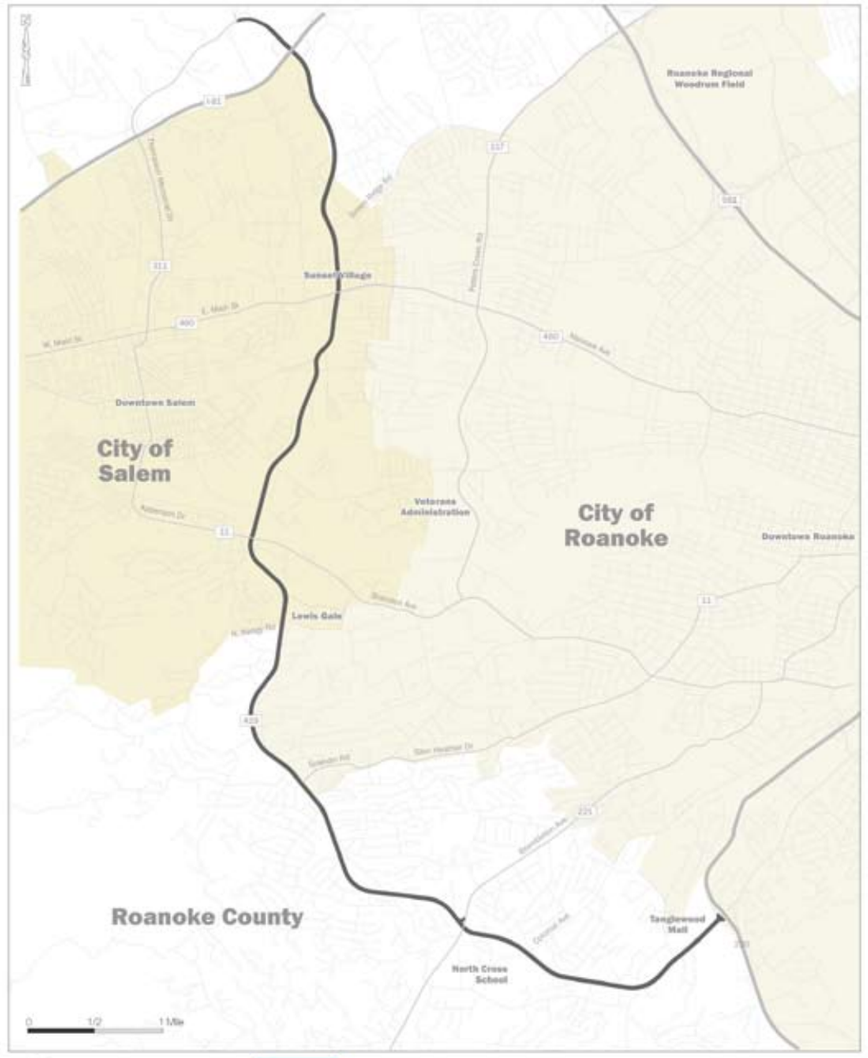
II INTRODUCTION

STUDY AREA DESCRIPTION + PROJECT OVERVIEW

The VA Route 419 corridor spans 9.5 miles from its intersection with US 220 to the south and Interstate-81 to the north. The corridor was first proposed as a circumferential route that would connect southwest Roanoke County with the City of Salem and I-81. US 220 and I-81 are heavily traveled roads that accommodate the bulk of regional travel in the area. As a connector between these corridors, Route 419 safety and capacity issues are increasingly becoming of concern to regional planning agencies.

Route 419 traverses three jurisdictions — City of Roanoke, Roanoke County, and City of Salem — and passes through a variety of conditions along this stretch. The study corridor is a 4-lane, divided principal arterial that traverses three jurisdictions within the Roanoke Valley Metropolitan Planning Organization urbanized area. The study area extends south from Route 311, connecting I-81 in Roanoke County to the City of Salem, the City of Roanoke and ultimately the US 220 Expressway. The City of Roanoke and City of Salem's

Figure 2.1 Regional Map



downtowns are located within 5 miles and 1.5 miles respectively of the corridor. In addition the corridor is home to some of the largest activity centers in the region, including Lewis Gale Medical Center and Tanglewood Mall. The corridor is fronted by a variety of land uses, including commercial, residential, and industrial.

There has not been a detailed analysis of the Route 419 corridor in 20 years, and over that period of time there have been significant increases in traffic volume, vehicle accidents, and land development that have produced critical mobility, safety, and bicycle and pedestrian accommodation issues. Currently, Route 419 provides access to secondary roads for local travel, accommodates regional travelers, serves as a commercial strip shopping corridor, and acts as a trucking route as well.

Currently the corridor only accommodates automobile travel, and a multimodal approach is desired to increase capacity and offer motorists an option in their travel behavior. The Route 419 Multimodal Corridor Plan evaluates various transportation modes and issues along Route 419 and recommends improvements to be implemented over a 25 year planning horizon. The modes examined include vehicular, public transportation, walking, bicycling, and freight. Issues such as traffic signal coordination, traffic accidents, congestion, and transportation system management are also considered.

Figure 2.1 depicts the study corridor and its location relative to local political boundaries and transportation infrastructure. (Note: data provided by the RVAMPO was used to create all maps presented in this plan)

PUBLIC INVOLVEMENT

Meaningful public involvement is essential in developing community-focused corridor plans. A community's citizens have an intimate knowledge of the places where they live and travel and of the transportation problems they encounter.

To make sure that the corridor plan considered citizen concerns and interests, input was solicited from

the general public as well as through the steering committee, a technical committee, VDOT, RVAMPO, elected officials, and other stakeholders. The following summarizes steps taken to inform, educate and involve the public in the corridor planning process. A summary of the activities and input received is further described in the Appendix.

Steering Committee – RVAMPO Policy Board
The Roanoke Valley Area Metropolitan Planning Organization acted as the steering committee for the overall development of the 419 Multimodal Plan. It approved the overall plan scope and schedule, as well as the findings and recommendations. The Policy Board has elected representatives from each local government in the Roanoke Urbanized Area, as well as representatives from VDOT, the Virginia Department of Rail and Public Transportation (DRPT), Valley Metro, and the Federal Highway and Transit Administrations (FHWA and FTA).

419 Technical Committee - RVAMPO Transportation Technical Committee
The Technical Committee worked in an advisory capacity to the Policy Board and provided information and guidance on the development the technical elements of the Plan. The Technical Committee is made up of planning and transportation staff from each local government and representatives of Valley Metro, RADAR, the Greenway Commission, the Roanoke Regional Airport, the Virginia Department of Aviation, VDOT, DRPT, FHWA, and FTA. The Technical Committee met on a monthly basis and had multiple special-called meetings to review plan development.

Focus Groups
VDOT, RVAMPO, and local government staff met with a variety of stakeholder groups in an effort to provide information to them and solicit their feedback on the development of the plan. Comments from each stakeholder were recorded and integrated in the plan. Some of the groups included:

- Roanoke Regional Chamber of Commerce – Transportation Advocacy Committee
- Roanoke Valley Regional Bicycle Advisory Committee
- Roanoke Valley Greenway Commission
- International Council of Shopping Centers - Roanoke Chapter

Web 1.0 & 2.0
The RVAMPO developed a project website that included meeting dates, background information, presentations, draft documents and maps, comment forms, and contact information. All meeting information and opportunities for public comment were broadcast out through Facebook and Twitter social networking media.

Property Owner and Business Notification
Letters were sent to property owners and over 20 of the largest employers in the 419 corridor that described the plan development process and encouraged them to submit their feedback using a self-addressed comment form. Over 200 notices were mailed to Roanoke County property owners along 419 to invite them to review the draft plan and attend the second public meeting.

419 Public Workshop – April 21, 2009
To kick off the study, the first public workshop was

held on April 21, 2009, from 6:30 PM to 9:00 PM at the Hidden Valley Middle School Cafeteria, which is located at the approximate midpoint of the corridor. Citizens were asked to stay for the entirety of the workshop in order to participate in intensive small group, visioning exercises. The evening began with an overview of presentation of the characteristics and deficiencies of the 419 corridor. Then the citizens and project/local government staff were divided into small groups and asked to provide their comments and vision for the corridor on three key issue areas: existing and future land use, traffic conditions, and multimodal opportunities. See Appendix 1 for a summary of their comments.

419 Citizen's Meeting – December 3, 2009

A second public workshop was held on December 3, 2009 from 6:00 PM to 8:00 PM at the Brambleton Center Community Room to review and gather feedback on the draft plan. This meeting was held in an open-house format with three stations for citizens to visit: highway segment maps with recommendations, multimodal recommendations, and an investment game. The maps contained proposed roadway and pedestrian improvements by corridor segments, existing and future level of service, and capacity level of service. All future levels of service shown reflected conditions without any improvements. The multimodal maps showed the overall proposed improvements for bicycle, pedestrian, transit, and park and ride facilities. Lastly, citizens were directed to play an investment game. They were given $10, in $1 increments, and instructions to allocate their money as they desired to major categories of multimodal transportation investments/strategies by phase. Over 50 citizens attended the meeting and provided substantial comments on the draft recommendations. See Appendix 1 for a summary of their comments.

Route 419 Input Sessions Begin

What can be done to make Route 419 from Tanglewood Mall to I-81 in Salem a better stretch of highway? That's the question VDOT and the Roanoke Valley-Alleghany Regional Commission will be posing to local residents over the coming months, asking for input on the 9.5 mile road that handles much of the traffic in southwest Roanoke County.

During the first public input session held recently, attendees were split into groups, poring over maps at Hidden Valley Middle School as they discussed topics such as bike lanes, more sidewalks, natural buffers, park and rides, connections to greenways and road improvements like better traffic light coordination.

"From my house I'd like to get to Tanglewood [by bicycle]," said Barbara Duerk as she helped draw lines for bike nets.

The session was called a "visioning exercise," and the ideas will be digested by VDOT and the Regional Commission, which is helping to devise an overall transportation plan for the valley.

"This is really a 'first pass,'" said Jake Gilmer, a planner for the Regional Commission, and part of a team that will meet with planning commissioners, county supervisors, chambers of commerce and other groups to share the public's vision of what a better 419 might look like.

"We're looking at a long range plan that would cover a 20-30 year time frame," said Gilmer. Some of the near-term action items could include more turning lanes and better traffic light timing, while land-use decisions along the corridor are more long term. "Most people that live here or drive [on 419] daily think about the traffic congestion, and accidents and safety. That's the primary thing people come to the table with."

Expect another public meeting to be scheduled in the next few months in an effort to move the process along. Two consultant groups have been mapping the corridor, analyzing who uses the road and when.

Gilmer would like to get a local government "buy in" this summer, then have a document produced that can help guide decision making in the future when it comes to development along the Rt. 419 corridor.

"This is fairly new for our area," said Gilmer of the public input process on a road that has frustrated many a driver. "We're hoping to get more in depth."

By Gene Marrano
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Photo by Gene Marrano

Jim Lee, Liz Belcher and Barbara Duerk look at possible bike lanes and greenways in the 419 corridor.

VISION AND GOALS

The vision and goals of the Route 419 Multimodal Corridor Plan are based on analysis of existing conditions, comments from local officials and citizens, as well as priorities of the Commonwealth of Virginia.

Vision

Route 419 will provide safe and efficient mobility for drivers, pedestrians, bicyclists, and transit riders, while providing adequate access to businesses and residential areas.

Goals

1. Alleviate traffic congestion and delay at problem intersections and segments.

2. Identify opportunities for regional cooperation among local governments and VDOT to improve mobility.

3. Reduce traffic accidents.

4. Provide safe and convenient accommodation for pedestrians and bicyclists at appropriate locations on the corridor.

5. Improve the connectivity between modes of transportation: automobile, walking, bicycling, and transit.

6. Provide enhanced transit service in the corridor.

7. Protect and enhance the scenic and natural beauty of the streetscape.

8. Improve overall operations and management of traffic.

9. Identify and prioritize cost-effective transportation improvements (near- and long-term) to be implemented by local governments, VDOT, or the private sector.

10. Consider the social, economic, and environmental effects of transportation decisions.

EXISTING CONDITIONS

III EXISTING CONDITIONS

CORRIDOR CONTEXT

Essential to the creation of a multimodal corridor plan for Route 419 is a good understanding of the context of the surrounding community. This includes past planning efforts, regional travel characteristics, jurisdictional responsibility, community resources and focal points, existing land use and development character, and various socioeconomic characteristics of residents.

PAST STUDIES

Since the completion of Route 419 in 1972, there has been a significant amount of commercial and residential development along the corridor. By 1987, the development and traffic increases were serious enough to require the development of a Route 419 Corridor Study, which was completed by the Fifth Planning District Commission (now the Roanoke Valley-Alleghany Regional Commission). This plan evaluated the existing and future travel demand and supply, as well as levels of service and accident rates. It recommended both geometric improvements and operations management systems, some of which were constructed in the 1990's.

Also in 1987, Roanoke County developed a 419 Frontage Development Plan that recommended guidelines for the future development of frontage parcels along Route 419. It included guidelines for land use, urban design, transportation, and environmental quality. The transportation guidelines considered frequency of driveways, driveway spacing, access controls, and traffic impact analysis. These guidelines were used to guide the County's zoning and code enforcement process.

The last examination of the Route 419 corridor was by VDOT in 2001 and consisted of conceptual level design plans for the entire corridor. The plans were created in-house and were not based on rigorous traffic analysis or projections. The VDOT Salem district office indicates that the study was not completed or adopted and is only to be used for informational purposes.

TRAVEL CHARACTERISTICS

Census Transportation Planning Package (CTPP) data was analyzed to investigate regional commuting habits and mode choice. This analysis reveals that a larger percentage of workers along the Route 419 corridor drive alone on their commute to work than workers throughout the rest of the region. Within a half mile of Route 419, 91% of workers drive alone to work, compared to 85% in the region. Likewise, less than 1% of workers along 419 use transit, compared to 2% throughout the region. This may be caused by lack of transit service along the corridor, but also suggests a heavily auto-centric culture among corridor residents.

Travel times and time of day also differ slightly between corridor workers and the region as a whole. For example, travel time to work, measured in minutes, shows a slightly shorter commute time for workers living along Route 419. Commute trips lasting less than 20 minutes are typical for 63% of workers living along Route 419, compared to 59% within the region. The most typical time leaving for work for both Route 419 and the region is between 7:30 and 8:00 in the morning. However, a larger percentage of residents along Route 419, 23%, leave at this time. Comparatively, only 20%

of the region's residents leave at this time. Other than these differences, travel times and commute patterns follow similar trends between Route 419 residents and the region.

TRANSPORTATION SYSTEM

Route 419 is a 4-lane divided state highway that begins, at its north end, near Hanging Rock at the intersection of Route 311. Just one mile north of its intersection with Interstate 81, Route 419 begins as a two lane road and quickly turns to a 4-lane divided highway, as it remains for the majority of the route. The route traverses the City of Salem and Roanoke County and has a few smaller segments in the City of Roanoke. Some of its major intersections include: Interstate 81, US 460, US 11, US 221, and Colonial Avenue. Route 419 terminates, at its southern end, with the intersection of US 220 near Tanglewood Mall.

Most of the Route 419 corridor has 2- to 6-foot paved shoulders and, with the exception of small segments in Salem, no sidewalks or on- or off-road bicycle accommodations. It has 27 signalized intersections from Route 311 to 220 that are separately managed by VDOT and the City of Salem. Only a few of these intersections have marked pedestrian crosswalks and generally no sidewalks are provided; however, there are several proposed or existing greenways that cross the corridor. Similarly, there is no fixed transit service that serves the entire corridor, but transit routes do cross Route 419 at several locations. There are a total of 2 park and ride facilities within the study area.

JURISDICTIONS

The study corridor traverses three jurisdictions. The majority of its length is located in Roanoke County and the City of Salem, with smaller segments located in the City of Roanoke. Jurisdictional boundaries are shown on Figure 2.1.

COMMUNITY FOCAL POINTS

Route 419 is surrounded by a number of community focal points that play a large part in the corridor's place-making potential. The location of major activity centers and their proximity to Route 419 is illustrated in Figure 3.2.

EXISTING LAND USE & DESIGN

In order to better facilitate a development pattern supportive of multimodal transportation, it is necessary to examine the existing land use mix and design of development along the corridor. The map on the following page (Figure 3.3) shows the existing land use within a half mile of Route 419 and is based on generalized zoning provided by the each of the study area's jurisdictions.

The existing land use in the study area is characterized as primarily business/retail commercial and industrial along the frontage of Route 419, with low to medium density residential neighborhoods generally located just off the corridor. While the residential and commercial uses are adjacent, there are few connections between them and little mixed-use development.

Most of the retail/commercial uses, such as Tanglewood Mall and Sunset Village are auto-oriented, older suburban strip developments with large expanses of parking. Some of the newer developments, such as Keagy Village and Colonial Avenue exhibit more mixed-use characteristics, combining office and retail uses with some improved design features. However, they still remain auto-oriented and disconnected from the surrounding areas.

The northern portion of the corridor consists of lower density single-family residential uses, as well as some agricultural use. The central and southern portions of the corridor contain more multifamily residential uses.

The Route 419 corridor is also home to a number of office and industrial uses. Several large employers, such as General Electric, Yokohama Tire, Lewis Gale Medical Center, Allstate Insurance and others are concentrated around the intersection with US 11. Many of these important destinations are designed as business parks set back from the road either by large expanses of parking or lawn.

The following table (Table 3.1) and graph (Figure 3.1) show both the total acreage and percentage of land use within 1/2 mile of the corridor.

Table 3.1 Rt. 419 Corridor – Existing Land Use

RT 419 CORRIDOR - EXISTING LAND USE		
Generalized Zoning	**Acres**	**Percentage of Total**
Agriculture	462	6%
Business/Commercial	1278	18%
Industrial	475	7%
Multi-Family Residential	674	9%
Single-Family Residential	3707	51%
Transitional Business	25	0%
University	4	0%
Vacant	654	9%
Total	7279	100%

Figure 3.1 Percentage of Generalized Existing Land Use

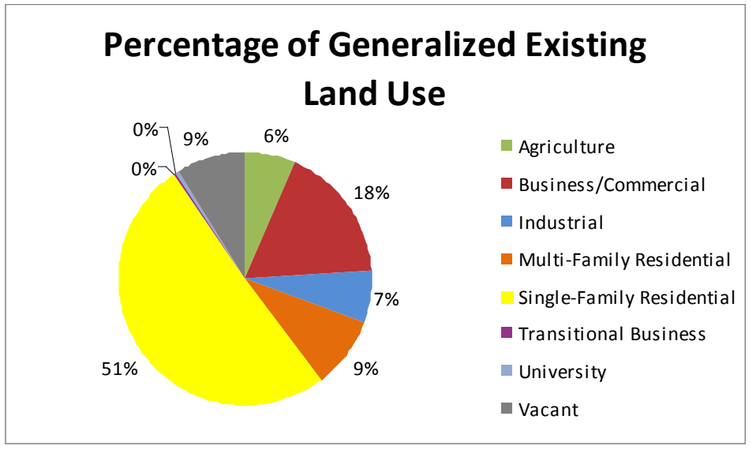


Figure 3.2 Major Activity Centers

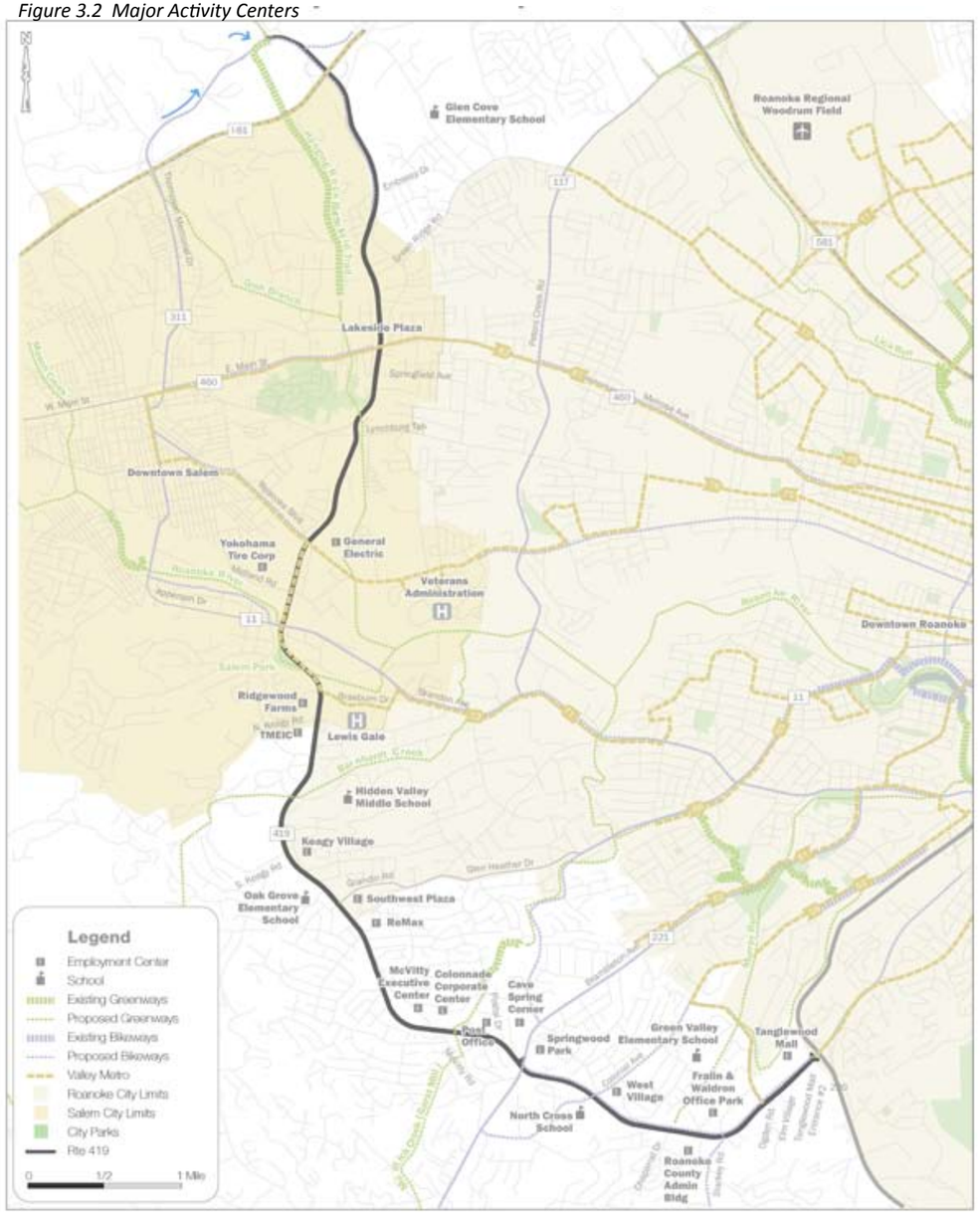
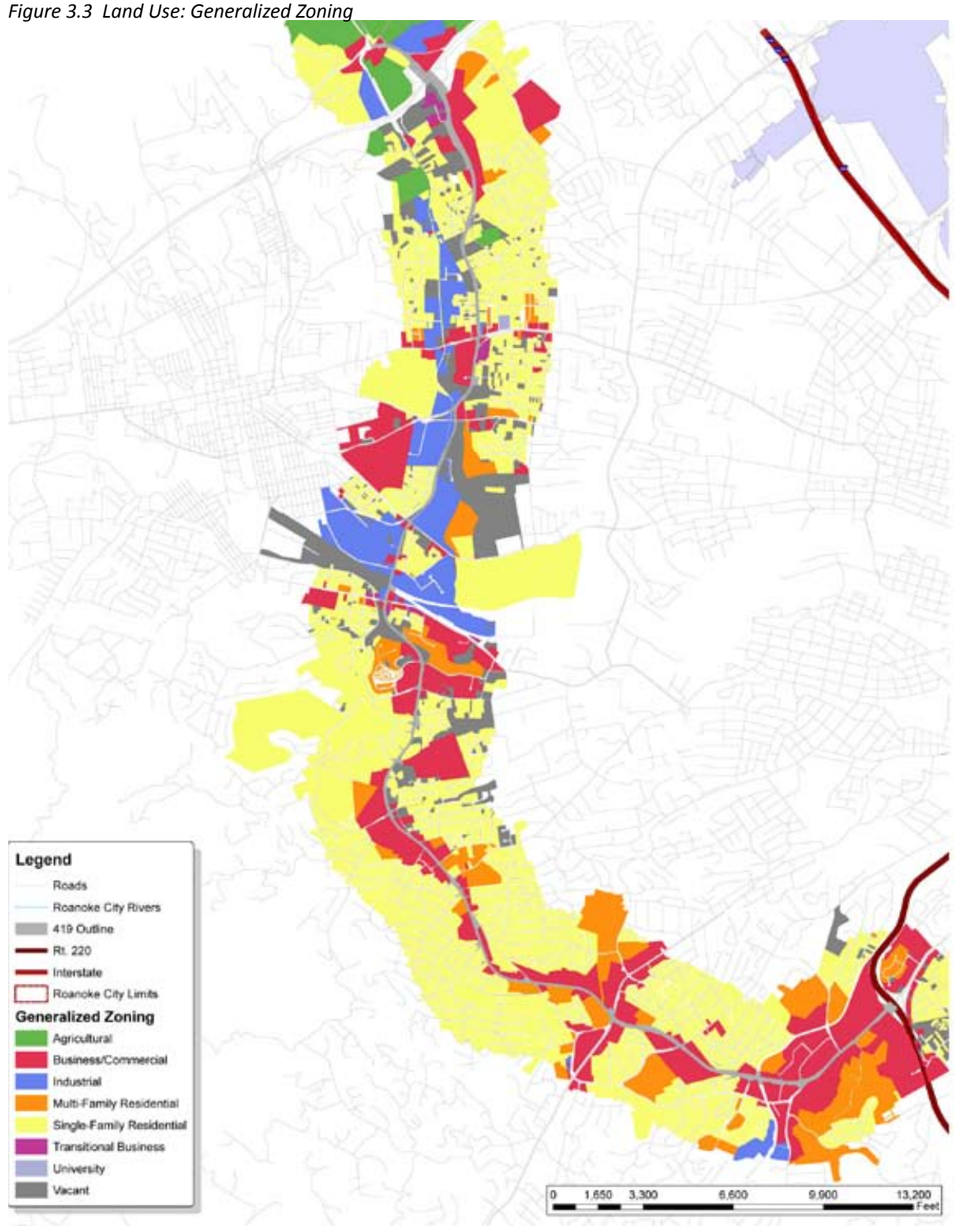


Figure 3.3 Land Use: Generalized Zoning



SOCIOECONOMIC CHARACTERISTICS

Available socioeconomic data for areas surrounding the corridor were examined to get better insight into the transportation needs and characteristics of the community. This was accomplished by acquiring Census data at the block group level. The 2006 American Community Survey was not conducted in the City of Salem, therefore the 2000 Decennial Census remains the most recent and comprehensive data for the study area. In addition, census data from 1990 was utilized to uncover population growth rates and trends. Specifically, four basic demographic characteristics were analyzed: low income households, households with no access to automobiles, the elderly, and the disabled. It is crucial to observe these segments of the population, including both their size and geographic distribution, as these groups typically rely on other modes of transportation besides the automobile to meet their personal transportation needs.

Table 3.2 compares demographic data throughout the region and within a half mile of the Route 419 corridor. The table illustrates the high concentration of the elderly population along the corridor, 29.9% of the total elderly population in the region reside within a half mile of Route 419. Comparatively, the general population that lives within a half mile of the corridor is only 27.7% of the total population in the region. This concentration of elderly residents is most likely the result of the corridor's proximity to both the Lewis Gale and Veterans Hospital and the associated nursing and retirement facilities located nearby. The remaining populations are smaller within the corridor than throughout the region. Low income households (households earning less than 50% of the regional median income of $38,395) and households with no access to automobiles comprised 9.9% and 3.6% of the total population respectively. Within the corridor these figures drop to 6.8% and 2.1% within a half mile of the corridor.

Table 3.3 shows growth rates by comparing 1990 and 2000 census data. The growth rates between 1990 and 2000 in each category were used to project population figures to 2030. The table shows a population growth rate of approximately 3% between 1990 and 2000. This change in population is relatively slight compared to the change in the elderly population and the number of households without access to automobiles. The elderly population grew over 7.2%, over twice the rate of the general population. Households without automobile access declined at an even faster pace of 10%. Although this decreases the numbers of people who rely on other modes of transportation, more automobiles on the road potentially creates increased congestion, which could lead to more demand for other modes.

In sum, these figures highlight a need to provide for multiple transportation choices along the corridor.

Table 3.2 Demographic Data within a Half-Mile of Rt. 419

	Study Area	Percent of Total	Within Half-Mile of Corridor	Percent in Corridor
Total Population	205,436	100	56,944	27.7
Elderly (65+)	33,325	16	9,787	29.4
Median Income	38,395	19	47,387	0.0
Low Income Households	20,386	10	3,846	18.9
Disabled (5+ Non-Institutionalized)	39,961	19	8,881	22.2
Households with no Auto Access	7,418	4	1,207	16.3

Table 3.3 Select Population Growth Rates

	1990	2000	Percent Change	2010	2020	2030
Total Population	199,485	205,436	2.98	211,565	217,876	224,376
Elderly (65+)	31,066	33,325	7.27	35,748	38,348	41,136
Low Income Households	20,130	20,386	1.27	20,645	20,908	21,174
Households with no Auto Access	8,243	7,418	-10.01	6,676	6,007	5,406

POPULATION AND EMPLOYMENT

Population and employment densities are often seen as the optimal determinant to define areas suitable for promoting multimodal transportation. To analyze population and employment densities, Transportation Analysis Zone (TAZ) data was provided by the Roanoke Valley Area Metropolitan Planning Organization (RVAMPO). Table 3.4 shows a comparison of population and employment density within the region between 2005 and 2035. Density was measured by acre for three different regions: RVAMPO's, Route 419, and Valley Metro Service Area. Per acre calculations are based on the average density per TAZ in each analysis region. Based on these calculations, population and employment densities along Route 419 are lower on average than both the rest of the MPO area and Valley Metro service areas.

Population and employment densities were also analyzed spatially throughout the study area. Both population and employment are focused around Roanoke's downtown area. However, there are visible pockets of activity along Route 419. Notably, the intersections with US 11 and US 221 show high levels of density, as well as near the southern terminus of Route 419. Population and employment are sparse in the northern end of Route 419, but there is increased density along I-81, which intersects Route 419 near its northern terminus. Although growth occurs between 2005 and 2035, the spatial pattern remains constant.

Table 3.4 Population and Employment Densities

		Population	Population/ Acre	Employment	Employment/ Acre
2005	Route 419	55,581	2.4	31,944	2.4
	Roanoke MPO	223,747	2.7	129,058	2.7
	Valley Metro Service Area	162,363	3.3	112,304	3.6
2035	Route 419	61,269	2.6	38,267	2.9
	Roanoke MPO	247,502	2.8	158,977	3.2
	Valley Metro Service Area	171,473	3.5	135,070	4.3

TRAFFIC CONDITIONS

The 2008 average daily traffic (ADT) volumes range from 10,500 vehicles near its terminus with Route 311 up to 45,500 vehicles near the intersection with US 220. Based on historic data, an understanding of area wide land use potential, recently approved or planned developments, and conversations with VDOT, an annual growth rate of 1%-1.2% was applied to the existing ADT volumes in order to calculate 2035 ADT traffic volumes. Based on the annual growth rate, ADT traffic volumes are projected to increase in 2035 to 13,500 vehicles near Route 311 up to 60,500 vehicles near the intersection with US 220. Based on the future 2035 traffic volumes, traffic is projected to increased by approximately 30% - 50%. The segments along Route 419 with 50% growth are in areas with the most potential for development mainly located between Route 311 and East Main Street.

EXISTING LEVEL OF SERVICE

Analyses were completed to determine the operating characteristics of study area intersections using Synchro Professional 7.0, which uses methodologies contained in the 2000 Highway Capacity Manual (HCM). Intersection turning movement counts, with existing geometry, and existing signal timing plans provided by VDOT were utilized to determine the existing levels of service. The existing volumes and geometry at all of the study area intersections along Route 419 are illustrated in Figures 3.4 through 3.12.

Level of service (LOS) describes traffic conditions by the amount of traffic congestion at an intersection or on a roadway. LOS ranges from A to F, with A indicating a condition of little or no congestion, and F indicating a condition with severe congestion, unstable traffic flow, and stop-and-go conditions. For intersections, LOS is based on the average delay experienced by all traffic using the intersection during the busiest (peak) 15-minute period. LOS A through D are generally considered acceptable.

The results are presented for existing AM Peak Hour LOS in Table 3.5 and existing PM Peak Hour LOS in Table 3.6.

According to Table 3.5, all but three intersections operate at an overall acceptable level of service D or above in the AM peak hour. The three signalized intersections operating below an overall acceptable level of service are Apperson Drive, McVitty Road/ Route 1642, and the US 220 southbound ramp. All three of these intersections are signalized intersections located along Route 419. Apperson Drive functions at an overall LOS F during the AM peak hour with an intersection delay of 80.9 seconds per vehicle, with both northbound and southbound approaches operating at an unacceptable LOS F and LOS E, respectively. The intersection of McVitty Road/Route 1642 operates at an overall LOS F with a delay of 108.2 seconds per vehicle with both the northbound and southbound approaches operating at LOS F with a 609.3 second delay and a LOS E with a 65.3 second delay, respectively. The signalized intersection at the US 220 southbound ramp functions at an overall LOS E with a delay of 55.2 seconds per vehicle, with the southbound approach operating at an LOS F with a 134.4 second delay.

While all other intersections operate at an overall acceptable LOS D or above, almost all intersections have approaches operating unacceptably with a LOS E or LOS F during the AM peak hour with the exception of only seven intersections. The seven intersections operating with acceptable LOS for all approaches are I-81 southbound ramp, Lynchburg Turnpike, Roanoke Boulevard, Ridgewood Farms, Bernard Drive, Madison Square, and US 220 northbound ramp. Generally, the failing approaches are located at the adjacent streets rather than along Route 419. Most notably the signalized intersections with approaches operating at LOS F are Green Ridge Road westbound approach, Apperson Drive northbound approach, and McVitty Road/Rt. 1642 northbound approach, and US 220 southbound off-ramp as mentioned above. In addition, the four unsignalized intersection approaches operating at LOS F are Grandin Road Extended eastbound and westbound approaches, Glen Heather Drive eastbound and westbound approaches, McVitty Road/Rt. 1647 southbound approach, and Promenade Park eastbound approach. The aforementioned unsignalized intersections typically operate at unacceptable levels of service due to high mainline volumes and the limited amount of gaps available for vehicles exiting from the minor street.

According to Table 3.6, all but six intersections operate at or above an overall acceptable LOS D in the PM peak hour. The six intersections along Route 419 operating at an overall LOS E or F are all signalized intersections and are located at Roanoke Boulevard, Apperson Drive, Carriage Lane/Grandin Road, McVitty Road/Route 1642, Colonial Avenue, and the US 220 southbound ramp. Roanoke Boulevard, Apperson Drive, and Colonial Avenue all operate at an overall LOS E, with each approach operating at LOS D or E. Carriage Lane/Grandin Road and McVitty Road/Route 1642 operate at an overall LOS E, with one or more approaches operating at LOS F. At McVitty Road/Route 1642 the northbound approach operates at LOS F with a 483.3 second delay. The US 220 southbound ramp intersection is operating at an overall intersection LOS F, with the southbound approach operating at LOS F with a delay of 267.3 second delay.

While all other intersections operate at an overall acceptable LOS D or above, almost all intersections have approaches operating unacceptably with a LOS E or LOS F during the PM peak hour with the exception of only six intersections. The six intersections operating with acceptable LOS for all approaches are I-81 southbound and northbound ramps, Ridgewood Farms, Bernard Drive, Madison Square, and US 220 northbound ramp. Similar to the AM peak hour, the PM peak hour failing approaches are generally located at the adjacent streets rather than along Route 419. Most notably, the signalized intersections operating with approaches at LOS F are Keagy Road North, and previously mentioned McVitty Road/Rt. 1642 and US 220 southbound ramp. In addition, the four unsignalized intersections in the AM peak hour continue to have approaches operate with a LOS F in the PM peak hour. As mentioned previously, these four unsignalized intersections are Grandin Road Extended, Glen Heather Drive, McVitty Road/Rt. 1647, and Promenade Park. In the future analysis years of 2018 and 2035 a signal warrant analysis will be completed to verify if these four intersections may need to be signalized in the future.

Figure 3.4 – Segment 1 (Kessler Mill Road to Sheraton Drive) Existing Geometry and Traffic Volumes

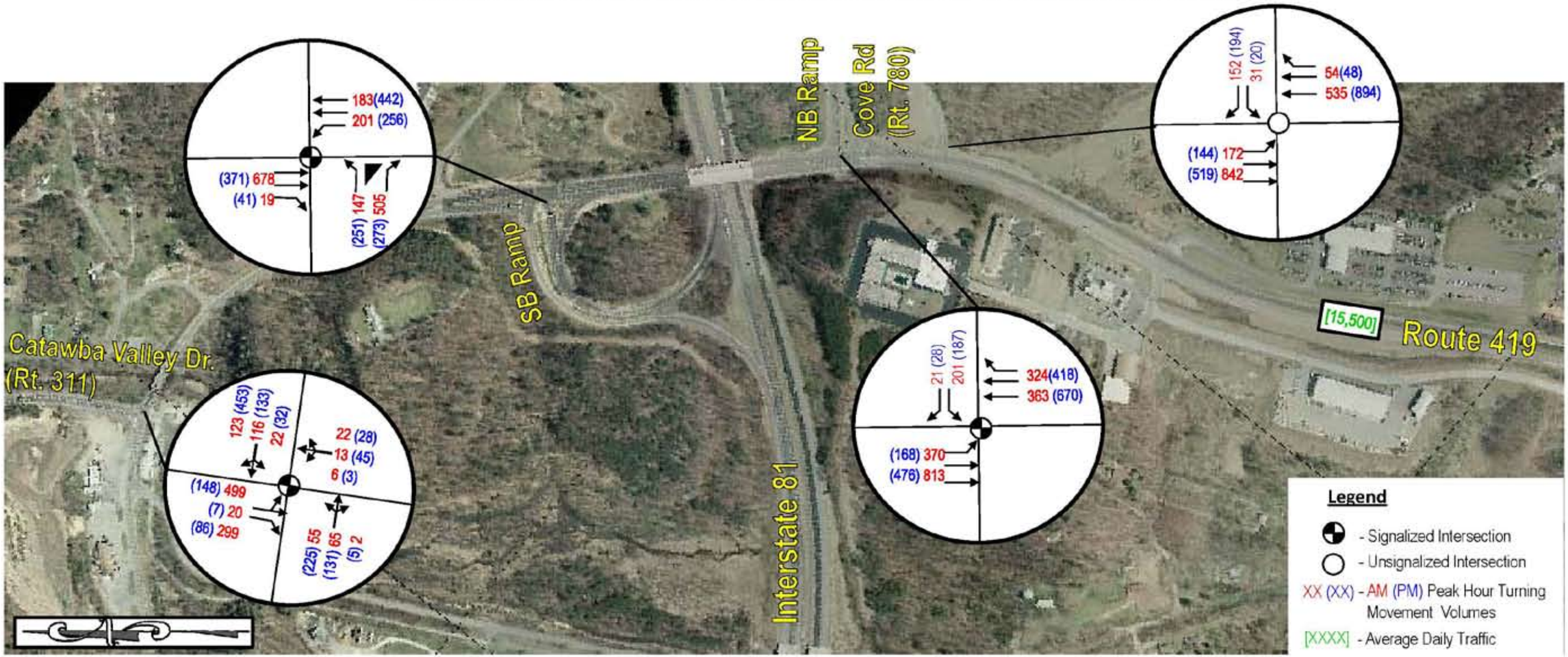


Figure 3.5 – Segment 2 (Locke Street to Millbrook Street) Existing Geometry and Traffic Volumes

Figure 3.6 – Segment 3 (East Main Street to St. John's Place Commerce Center) Existing Geometry and Traffic Volumes

Figure 3.7 – Segment 4 (GE Parking Entrance to Apperson Drive) Existing Geometry and Traffic Volumes

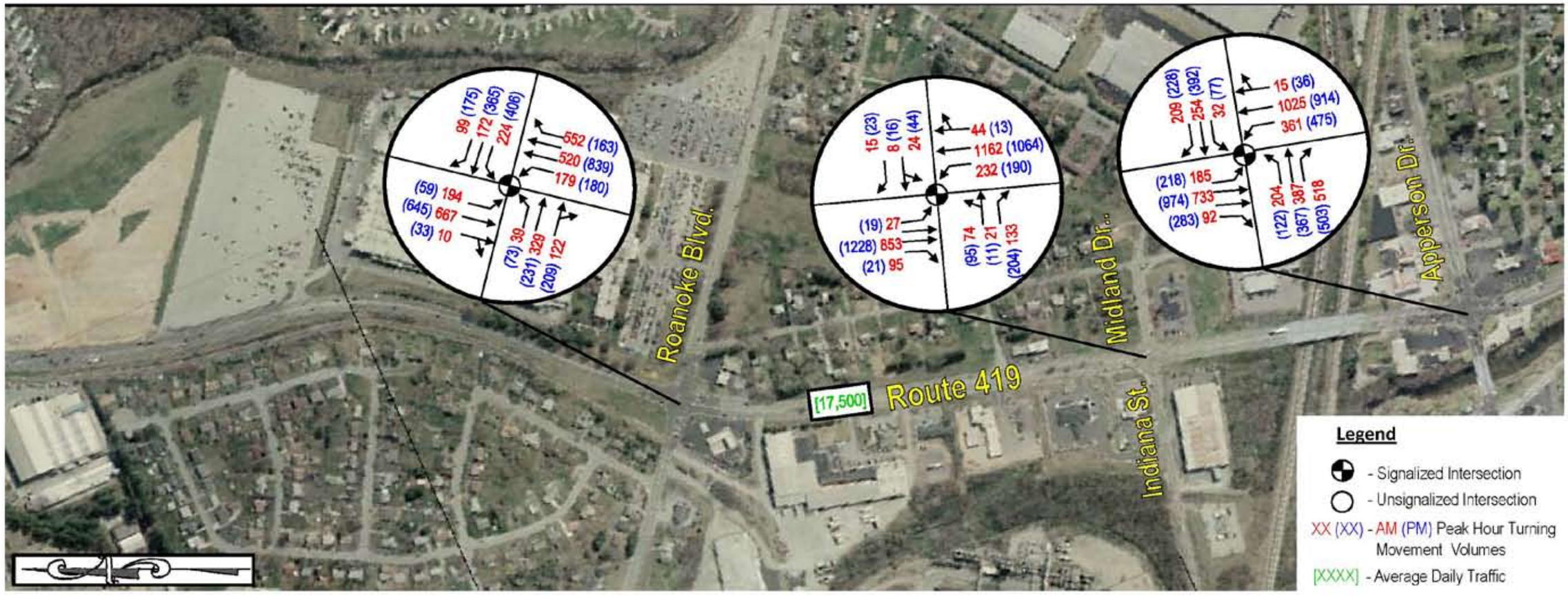


Figure 3.8 – Segment 5 (Riverview Drive to Dean Road) Existing Geometry and Traffic Volumes

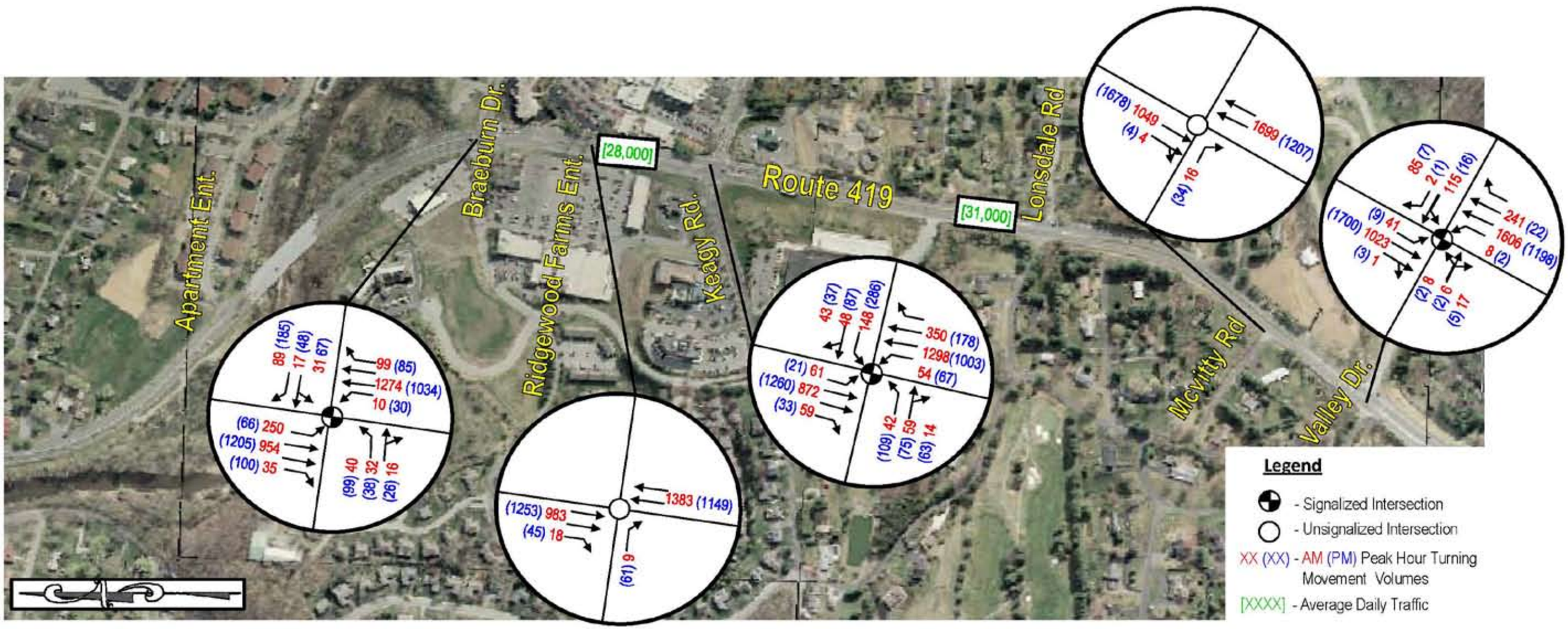


Figure 3.9 – Segment 6 (Mcvitty Road to Bower Road) Existing Geometry and Traffic Volumes

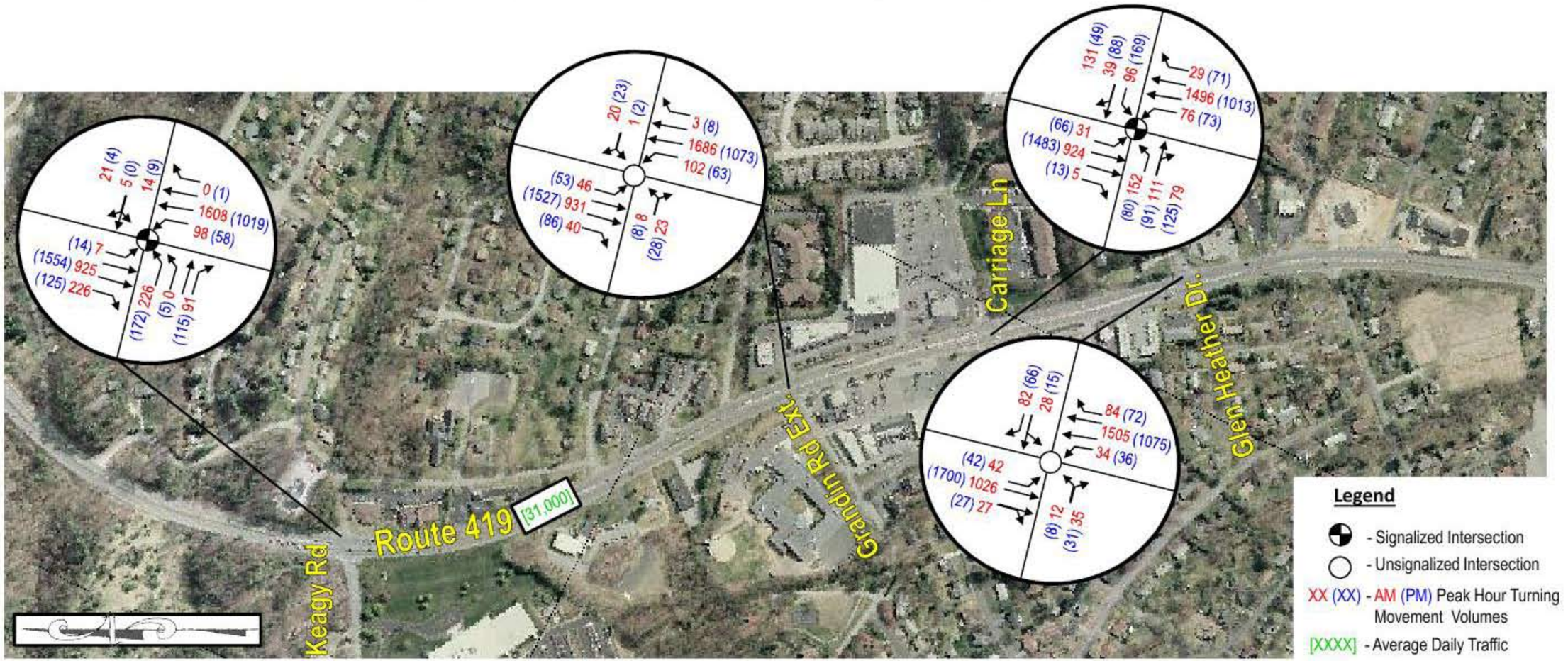


Figure 3.10 – Segment 7 (Cordell Drive to Normandy Lane) Existing Geometry and Traffic Volumes

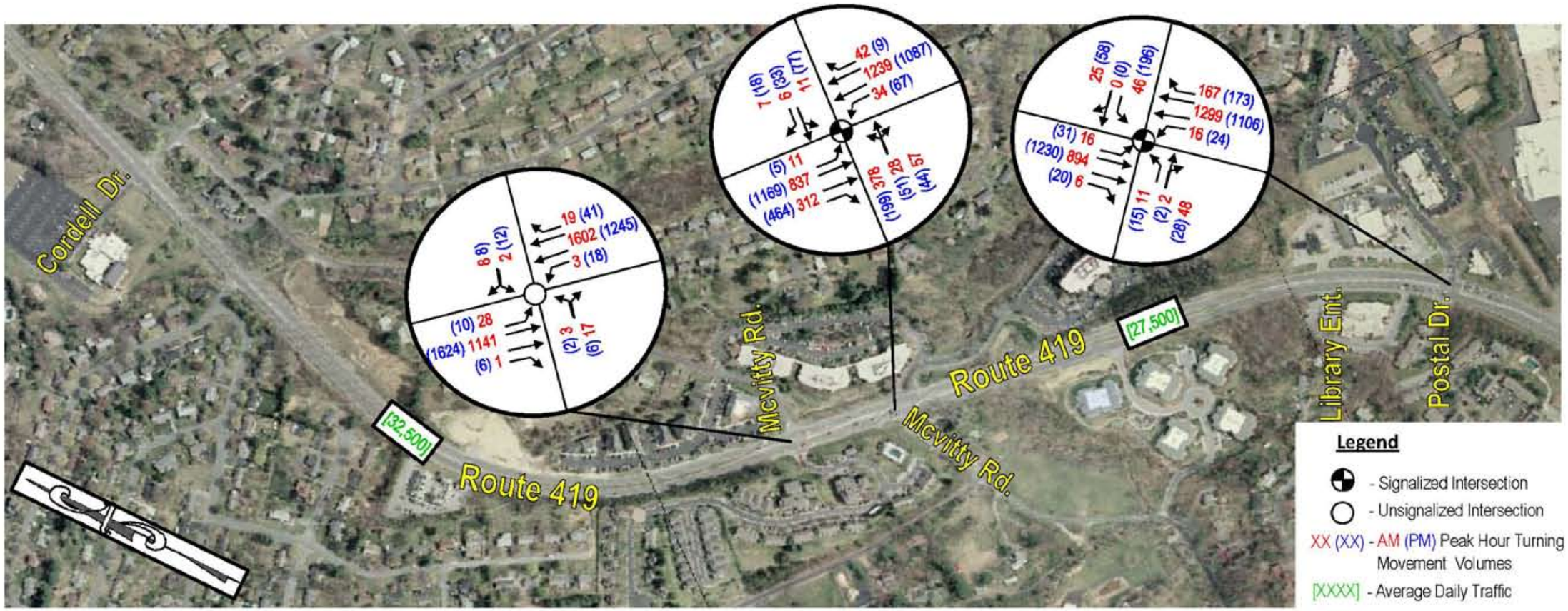


Figure 3.11 – Segment 8 (Brambleton Avenue to Chaparral Drive) Existing Geometry and Traffic Volumes

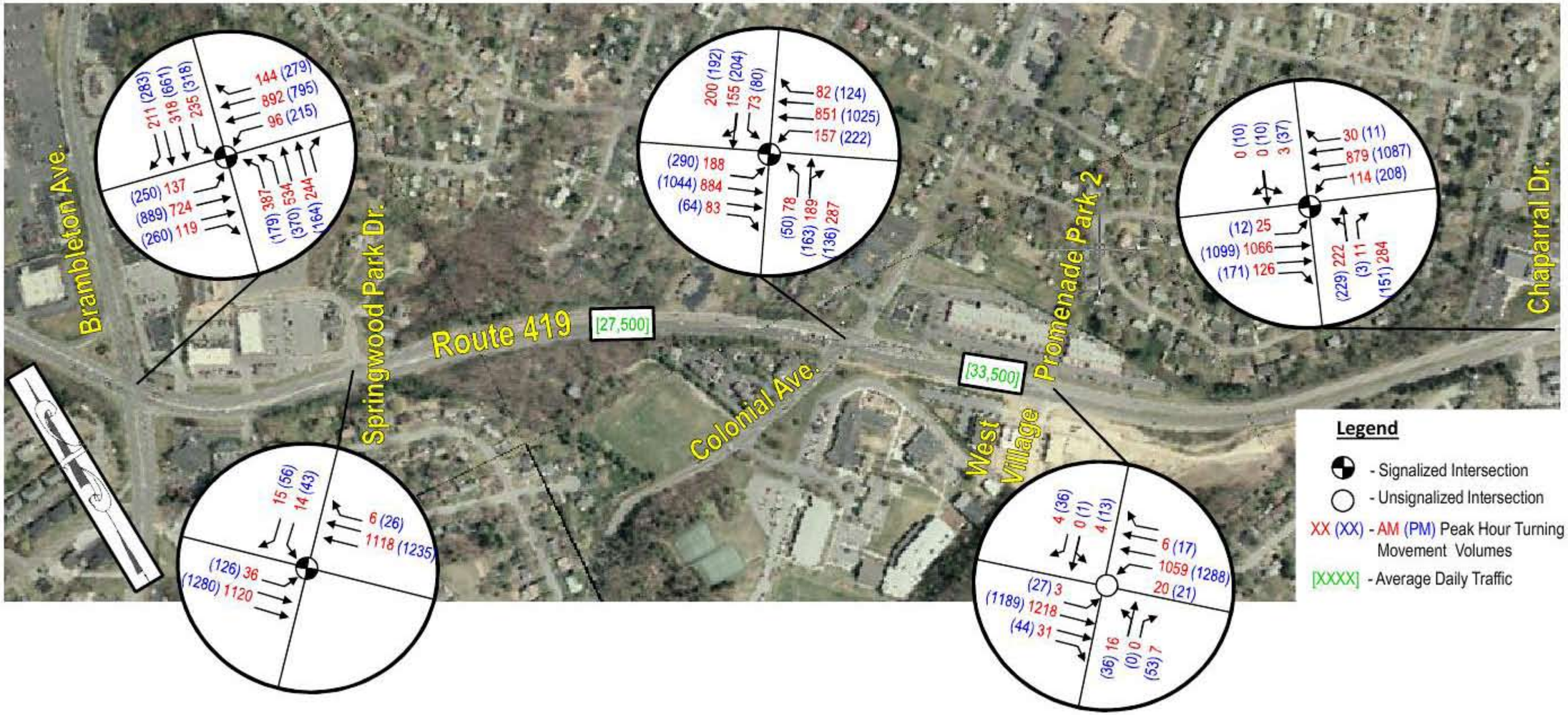


Figure 3.12 – Segment 9 (Bernard Drive to Franklin Road) Existing Geometry and Traffic Volumes

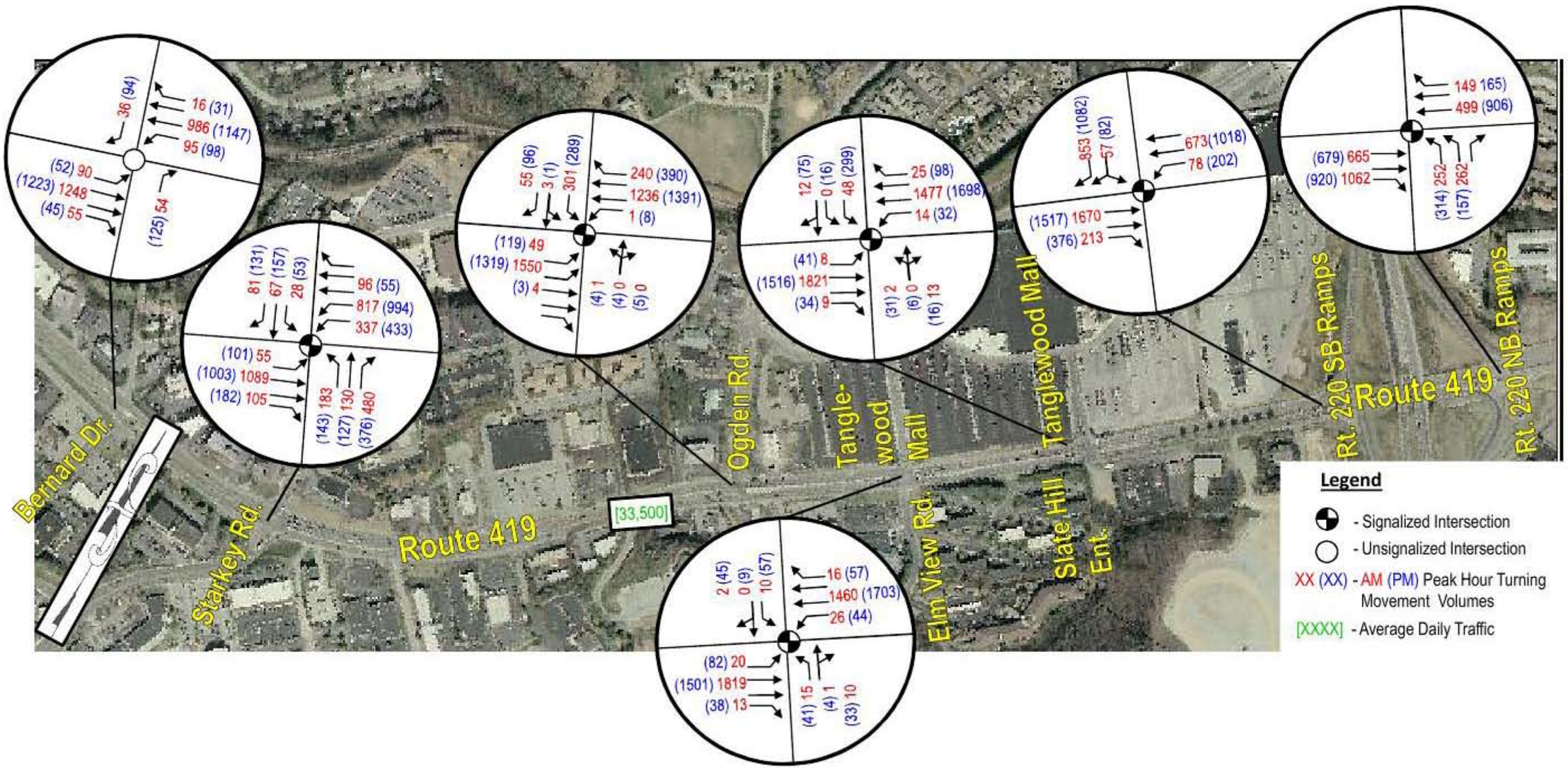


Table 3.5 Route 419 AM Peak Hour Existing Level of Service

Intersections along Route 419	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM PEAK HOUR					
Route 311 (signalized)	**C (34.7)**	C (24.2)*	C (27.5)*	E (62.7)	D (36.4)
I-81 SB Ramp (signalized)	**C (33.0)**	D (48.0)	-	C (31.5)*	B (19.7)*
I-81 NB Ramp (signalized)	**C (25.1)**	-	E (56.2)	C (24.2)*	B (19.7)*
Greenridge Road (signalized)	**C (23.8)**	A (0.0)	F (92.5)	A (7.7)*	A (8.1)*
East Main Street (signalized)	**C (34.3)**	D (37.6)	E (58.8)	C (23.9)*	C (25.2)*
Lakeside Plaza Entr. (signalized)	**A (7.8)**	D (51.7)	E (57.6)	A (3.4)*	A (5.6)*
Lynchburg Turnpike (signalized)	**C (23.6)**	D (48.8)	D (48.6)	B (15.6)*	B (18.0)*
Roanoke Boulevard (signalized)	**D (42.8)**	D (48.5)	C (32.3)	D (43.0)*	D (45.2)*
Indiana Street (signalized)	**C (28.5)**	E (60.9)	E (55.0)	C (26.8)*	B (15.5)*
Apperson Drive (signalized)	**F (80.9)**	C (34.4)	D (45.7)	F (132.5)*	E (76.3)*
Braeburn Drive (signalized)	**C (27.8)**	E (68.8)	D (51.0)	C (27.6)*	C (22.4)*
Ridgewood Farms (unsignalized)	**A (0.1)**	A (10.0)	-	A (0.0)*	A (0.0)*
Keagy Road North (signalized)	**C (27.7)**	E (60.2)	E (56.2)	C (25.0)*	B (19.3)*
Valley Drive/Rt.1442 (signalized)	**B (19.9)**	E (65.9)	E (57.8)	B (14.2)*	B (17.3)*
Keagy Road South (signalized)	**C (23.7)**	E (60.9)	E (66.5)	B (14.7)*	C (25.4)*
Grandin Road Extended (unsignalized)	**A (2.7)**	F (105.1)	F (60.5)	A (0.7)*	A (0.7)*
Carriage Lane/ Grandin Road (signalized)	**D (49.2)**	E (70.6)	E (65.2)	D (42.0)*	D (47.5)*
Glen Heather Drive (unsignalized)	**D (29.0)**	F (113.2)	F (687.8)	A (0.2)*	A (0.6)*
McVitty Road/Rt.1647 (unsignalized)	**A (1.1)**	A (0.4)*	A (0.0)*	E (35.4)	F (80.7)
McVitty Road/Rt.1642 (signalized)	**F (108.2)**	B (14.9)*	A (9.0)*	F (609.3)	E (65.3)
Postal Drive (signalized)	**B (11.1)**	A (8.5)*	A (7.7)*	E (59.9)	E (66.4)
Brambleton Avenue (signalized)	**D (50.3)**	D (42.3)*	D (44.4)*	E (59.9)	D (54.8)
Springwood Park (signalized)	**A (5.1)**	A (1.8)*	A (7.0)*	E (66.8)	-
Colonial Avenue (signalized)	**D (45.9)**	D (51.3)	E (55.5)	D (48.2)*	D (37.6)*
Promenade Park (unsignalized)	**A (1.1)**	F (84.1)	E (42.6)	A (0.2)*	C (0.0)*
Chaparral Drive (signalized)	**C (24.8)**	B (11.1)*	C (27.6)*	D (51.4)	E (73.9)
Bernard Drive (unsignalized)	**A (1.2)**	A (0.7)*	A (1.1)*	A (9.6)	A (9.9)
Starkey Road (signalized)	**D (45.8)**	D (45.6)*	C (27.7)*	E (72.6)	E (55.8)
Madison Square (unsignalized)	**A (0.4)**	A (0.0)*	A (0.5)*	A (0.0)	D (26.2)
Ogden Road (signalized)	**B (16.8)**	B (11.5)*	B (11.1)*	E (70.7)	E (63.4)
Tanglewood Mall West/ Elm View (signalized)	**A (5.6)**	A (6.9)*	A (2.5)*	E (67.1)	E (67.4)
Tanglewood Mall East (signalized)	**B (10.6)**	A (3.8)*	B (16.2)*	E (72.7)	E (66.0)
Route 220 SB Ramp (signalized)	**E (55.2)**	C (27.5)*	C (21.7)*	-	F (134.4)
Route 220 NB Ramp (signalized)	**B (13.3)**	A (3.0)*	B (10.7)*	D (50.6)	-

Source: Kimley-Horn and Associates, Inc.

NOTE: * Route 419

Table 3.6 Route 419 PM Peak Hour Existing Level of Service

Intersections along Route 419	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
PM PEAK HOUR					
Route 311 (signalized)	**C (27.3)**	C (23.3)*	B (14.6)*	E (64.7)	E (56.7)
I-81 SB Ramp (signalized)	**C (31.2)**	D (48.4)	-	C (25.0)*	B (19.7)*
I-81 NB Ramp (signalized)	**C (21.1)**	-	D (51.7)	B (16.2)*	B (19.5)*
Greenridge Road (signalized)	**C (20.1)**	E (66.1)	E (60.4)	B (13.4)*	B (13.0)*
East Main Street (signalized)	**D (42.8)**	D (54.7)	E (71.9)	C (25.9)*	C (26.0)*
Lakeside Plaza Entr. (signalized)	**B (13.1)**	E (59.1)	D (53.3)	A (7.8)*	A (8.0)*
Lynchburg Turnpike (signalized)	**D (37.6)**	E (70.9)	E (64.1)	C (29.8)*	C (21.4)*
Roanoke Boulevard (signalized)	**E (60.5)**	E (63.8)	E (63.9)	E (65.1)*	D (46.3)*
Indiana Street (signalized)	**C (24.8)**	E (64.1)	E (67.4)	B (14.2)*	B (20.0)*
Apperson Drive (signalized)	**E (58.4)**	D (48.9)	E (75.1)	E (64.0)*	D (52.1)*
Braeburn Drive (signalized)	**C (30.9)**	E (78.7)	E (64.9)	C (23.0)*	C (23.7)*
Ridgewood Farms (unsignalized)	**A (0.3)**	A (9.7)	-	A (0.0)*	A (0.0)*
Keagy Road North (signalized)	**D (45.0)**	E (63.8)	F (160.7)	C (21.0)*	C (27.5)*
Valley Drive/Rt.1442 (signalized)	**A (8.7)**	E (67.5)	E (67.8)	A (3.4)*	B (10.6)*
Keagy Road South (signalized)	**C (23.3)**	E (60.8)	E (68.3)	A (9.5)*	C (24.1)*
Grandin Road Extended (unsignalized)	**C (20.0)**	F (1214.4)	F (285.9)	A (1.0)*	A (0.3)*
Carriage Lane/ Grandin Road (signalized)	**E (63.7)**	E (71.6)	E (62.4)	C (32.8)*	F (83.3)*
Glen Heather Drive (unsignalized)	**A (6.3)**	F (340.9)	F (62.5)	A (0.5)*	A (0.3)*
McVitty Road/Rt.1647 (unsignalized)	**A (1.4)**	A (0.1)*	A (0.2)*	F (107.1)	F (116.1)
McVitty Road/Rt.1642 (signalized)	**E (78.7)**	C (26.2)*	B (10.1)*	F (483.3)	E (62.0)
Postal Drive (signalized)	**C (26.0)**	C (30.7)*	B (11.1)*	D (43.4)	E (66.0)
Brambleton Avenue (signalized)	**D (54.3)**	E (58.5)*	D (47.6)*	E (55.5)	E (55.8)
Springwood Park (signalized)	**B (10.6)**	A (5.3)*	B (12.3)*	E (64.3)	-
Colonial Avenue (signalized)	**E (60.5)**	D (52.3)	E (54.2)	E (68.7)*	E (56.5)*
Promenade Park (unsignalized)	**A (8.5)**	F (203.5)	F (91.0)	A (0.2)*	A (0.3)*
Chaparral Drive (signalized)	**C (31.0)**	B (14.0)*	D (38.5)*	E (57.4)	E (67.1)
Bernard Drive (unsignalized)	**A (1.4)**	A (0.4)*	A (0.9)*	B (10.7)	A (9.8)
Starkey Road (signalized)	**D (49.4)**	D (52.9)*	C (39.4)*	E (59.8)	E (60.0)
Madison Square (unsignalized)	**A (0.6)**	A (0.4)*	A (0.5)*	B (12.7)	C (16.6)
Ogden Road (signalized)	**C (22.0)**	B (12.5)*	C (20.8)*	E (70.1)	E (62.0)
Tanglewood Mall West/ Elm View (signalized)	**B (15.4)**	B (12.8)*	B (12.7)*	E (64.9)	E (62.7)
Tanglewood Mall East (signalized)	**C (31.8)**	B (14.4)*	D (39.6)*	E (69.8)	E (60.8)
Route 220 SB Ramp (signalized)	**F (102.2)**	D (41.3)*	C (27.3)*	-	F (267.3)
Route 220 NB Ramp (signalized)	**B (16.1)**	A (2.9)*	B (18.8)*	D (52.0)	-

Source: Kimley-Horn and Associates, Inc.

NOTE: * Route 419

GEOMETRIC DEFICIENCIES

Geometric deficiencies were identified through aerial photographs and video of the study area and compared to current VDOT standards. The right and left-turn storage lengths were compared to the typical VDOT standards of 200 feet of storage length with a 200 foot taper length for a left-turn lane and 150 feet of storage length with a 200 foot taper length for a right turn. In addition to the storage deficiencies sight distance was also reviewed along the corridor.

The following is a summary of the study area intersections that have storage and/or taper length deficiencies which do not meet the VDOT typical standards as listed above:

- **Postal Drive** – northbound left-turn (storage, taper), northbound right-turn (storage, taper), southbound left-turn (storage, taper), and southbound right-turn (taper)
- **McVitty Road** – northbound left-turn (storage, taper), northbound right-turn (taper), southbound left-turn (storage, taper), and southbound right-turn (taper)
- **McVitty Road** (unsignalized) – northbound left-turn (storage/ taper), southbound left-turn (storage/ taper), and southbound right-turn (taper)
- **Grandin Road** (unsignalized) – northbound left-turn (storage/ taper), northbound right-turn (storage/ taper), southbound left-turn (storage/ taper), and southbound right-turn (storage/ taper)
- **Keagy Road** – northbound left-turn (taper), northbound right-turn (storage/ taper), and southbound left-turn (storage/ taper)
- **Hidden Valley School Road** – northbound left-turn (storage/ taper), northbound right-turn (taper), and southbound left-turn (taper)
- **Keagy Road** – northbound left-turn (storage/ taper), northbound right-turn (taper), and southbound left-turn (taper)
- **Braeburn Drive** – northbound left-turn (taper), northbound right-turn (taper), southbound left-turn (taper), and southbound right-turn (taper)
- **Apperson Drive** – northbound left-turn (taper), southbound left-turn (taper), and southbound right-turn (taper)
- **Indian Street** – northbound left-turn (taper), southbound left-turn (storage/ taper), and southbound right-turn (taper)
- **Roanoke Boulevard** – northbound left-turn (taper), northbound right-turn (storage/ taper), and southbound left-turn (taper)
- **Lynchburg Turnpike** – northbound left-turn (storage/ taper), northbound right-turn (taper), and southbound left-turn (storage/ taper)
- **Lakeside Plaza** – northbound left-turn (storage/ taper), southbound left-turn (storage/ taper), and southbound right-turn (taper)
- **East Main Street** –northbound right-turn (taper) and southbound left-turn (storage/ taper)
- **Green Ridge Road** – northbound left-turn (taper) and southbound left-turn (taper)
- **I-81 Ramp Northbound** –northbound right-turn (taper) and southbound left-turn (taper)
- **I-81 Ramp Southbound** – northbound left-turn (taper) and southbound right-turn (storage/ taper)

- **Brambleton Avenue** – northbound left-turn (taper), northbound right-turn (taper), southbound left-turn (taper), and southbound right-turn (taper)
- **Colonial Avenue** – northbound left-turn (storage/ taper), southbound left-turn (taper), and southbound right-turn (taper)
- **Promenade Park/West Village** – northbound left-turn (taper), southbound left-turn (storage/ taper), and southbound right-turn (taper)
- **Chaparral Drive** – northbound left-turn (storage/ taper), northbound right-turn (storage/ taper), and southbound left-turn (taper)
- **Bernard Drive** (unsignalized) – northbound left-turn (storage/ taper), southbound left-turn (storage/ taper), and southbound right-turn (taper)
- **Starkey Road** – northbound left-turn (taper), northbound right-turn (taper), southbound left-turn (storage/ taper), and southbound right-turn (taper)
- **Ogden Road** –northbound right-turn (taper) and southbound left-turn (taper)
- **Tanglewood Entrance 1** – northbound left-turn (storage/ taper), northbound right-turn (taper), southbound left-turn (taper), and southbound right-turn (taper)
- **Tangelwood Entrance 2** – northbound left-turn (storage/ taper), northbound right-turn (taper), and southbound left-turn (taper)
- **I-220 Ramp Northbound** – northbound right-turn (taper) and southbound right-turn (taper)
- **I-220 Ramp Southbound** – northbound left-turn (taper) and southbound right-turn (taper)
- **Heather Glen** – northbound left-turn (storage/ taper), northbound right-turn (storage/ taper), and southbound left-turn (storage/ taper)
- **Grandin Road** – northbound left-turn (taper), northbound right-turn (storage/ taper), southbound left-turn (taper), and southbound right-turn (taper)

SPEED AND VEHICLE CLASSIFICATION

As previously mentioned, average daily traffic (ADT) counts were taken in January 2009 using automated counting tubes at four locations along Route 419; speed classifications were recorded concurrently with the ADT counts at the same locations. These four segments include McVitty Road/Postal Drive, Hidden Valley School Road/Keagy Road, Apperson Drive/ Braeburn Drive, and Greenridge Road/East Main Street. Speeding concerns are typically identified when the 85th percentile speed exceeds the posted speed. The results shown in Table 3.7, indicate that the two segments that experience excessive speeding of 10 mph or more are Hidden Valley School Road/Keagy Road and Apperson Drive/Braeburn Drive.

HEAVY VEHICLE CLASSIFICATION

Like the ADT counts, heavy vehicle classifications were recorded at four locations along Route 419, two of which were permanent count stations. The "heavy vehicle" classifications are the percentage of vehicles that are associated with the FHWA class group 4 through 15, and the percentages are calculated based on the ratio of heavy vehicles over the total traffic volume. FHWA class groups 4 through 15 include buses, single unit trucks, and various combinations of tractors and trailers. A summary of the findings of the heavy vehicle classification at each segment is presented in Table 3.8. which shows that the I-81 Ramp NB/Green Ridge Road segment experiences the highest heavy vehicle percent of 5.6 percent with all of the other segments experiencing less than 3 percent heavy vehicle traffic.

Table 3.7 Road Segment Speed Data

Segment		Direction	Posted Speed (MPH)	Mean (MPH)	Median (MPH)	85th % (MPH)
McVitty Road	Postal Drive	Northbound	45	42	43	50
		Southbound	45	44	44	50
Hidden Valley School Road	Keagy Road	Northbound	45	49	50	54
		Southbound	35	45	45	50
Apperson Drive	Braeburn Drive	Northbound	35	41	41	45
		Southbound	35	40	40	45
Greenridge Road	East Main Street	Northbound	45	42	42	47
		Southbound	45/35	40	40	45

Source: Kimley-Horn and Associates, Inc.

Table 3.8 Heavy Vehicle Classification Data

Segment		Direction	% Heavy Vehicle
Starkey Road	Ogden Road	Northbound	2.9%
		Southbound	2.4%
Brambleton Avenue	Colonial Avenue	Northbound	1.7%
		Southbound	1.7%
I-81 Ramp NB	Green Ridge Road	Bi-Directional	5.6%
Promenade Park/ West Village	Chaparral Drive	Bi-Directional	2.2%

Source: Kimley-Horn and Associates, Inc.

CRASH ANALYSIS

Approximately three years of crash data was collected and reviewed from VDOT's Highway Transportation Records and Inventory System (HTRIS) and the City of Salem for the Route 419 corridor study. The study area for the crash analysis is approximately 9.5 miles and is essentially from Route 311 to US 220. The accident data collected ranges from approximately June 2005 through June 2008 and includes data from three jurisdictions (City of Salem, City of Roanoke, and Roanoke County). The accident data collected was based on the standard police crash report format, and included a summary of date of collision, collision type, surface conditions, injuries, and fatalities.

A total of 999 accident reports were reviewed for the crash analysis. The 999 accidents included 549 rear end collisions, 243 angle collisions, 91 sideswipe collisions, 55 fixed object collisions, 27 deer collisions, 16 backed-into collisions, 4 pedestrian collisions, 4 head-on collisions, 7 non-collisions, 2 others, and 1 train collision. The "other" category includes crashes that do not fall into the four main categories, such as striking a non-deer animal, running off the roadway but not striking a fixed object, or striking and being damaged by debris on the roadway. Approximately 27% of all the accidents resulted in an injury with a total of 2 fatalities. Figure 3.13 illustrates accident severity and Figure 3.14 illustrates collision types along the corridor. The top three intersections with the highest crashes include Apperson Drive with a total of 154 accidents, Roanoke Boulevard with a total of 115 accidents, and Tanglewood Mall Entrance/Elm View Road with a total of 90 accidents.

Figures 3.15-3.23 show the crash analysis by segment for the corridor.

Figure 3.13

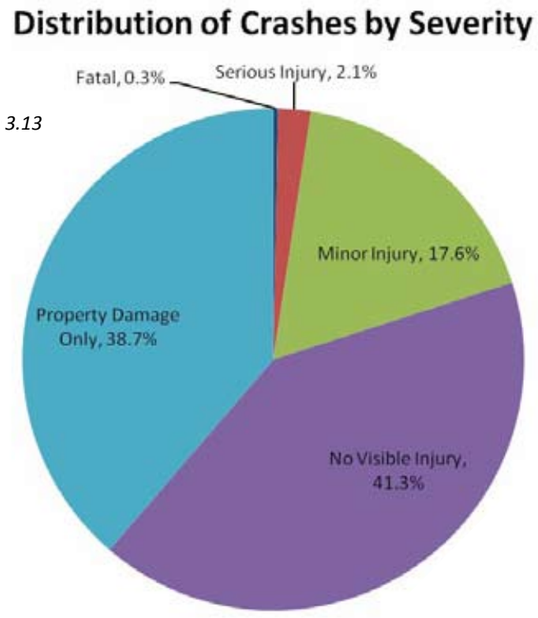


Figure 3.14

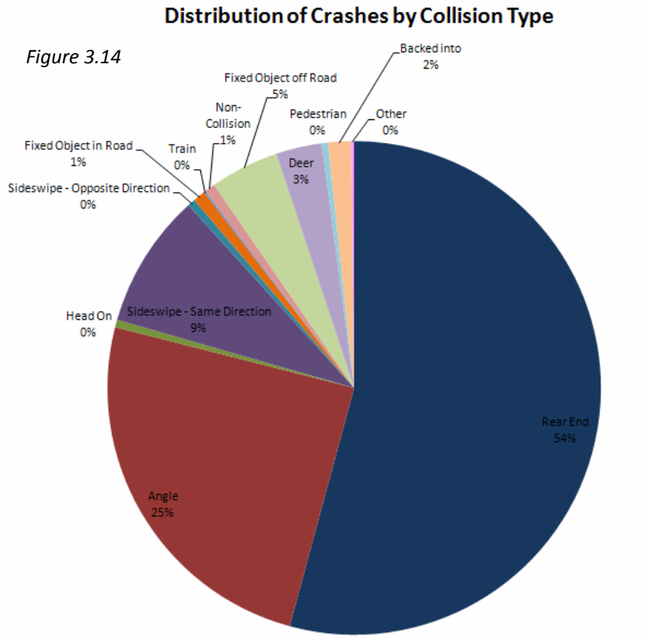
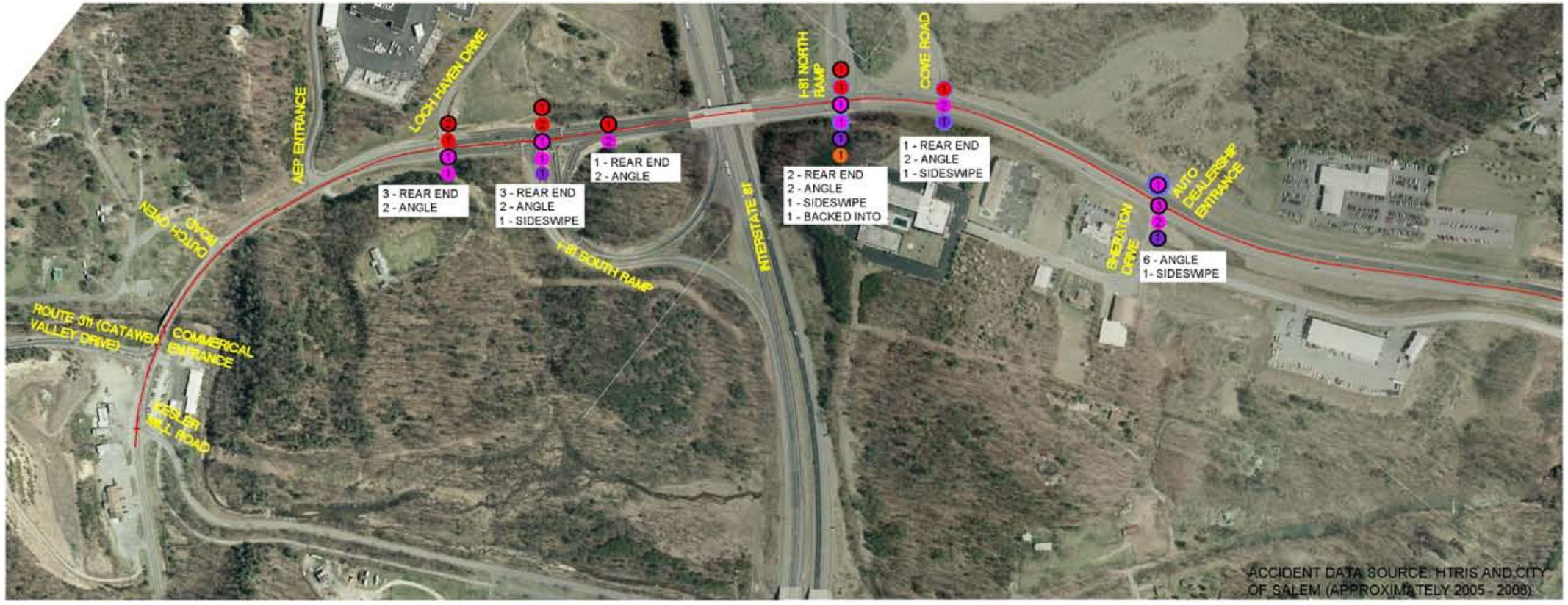


Figure 3.15 Accident Analysis - Segment 1, Kessler Mill Road to Sheraton Drive



LEGEND		SUMMARY OF SEGMENT 1			
REAR END	BACKED INTO	10 - REAR END	0 200 400 800	ACCIDENT ANALYSIS	SEGMENT 1 (FROM KESSLER MILL ROAD TO SHERATON DRIVE)
ANGLE	OTHER	16 - ANGLE	1 INCH = 400 FEET		
HEAD ON	RAIN	4 - SIDESWIPE			
SIDESWIPE	SLEET	1 - BACKED INTO			
FIXED OBJECT	SNOW				
TRAIN	ICY				
NON-COLLISION	MUDDY				
DEER	INJURY				
PEDESTRIAN	FATAL				
	NUMBER OF CRASHES				

Figure 3.16 Accident Analysis - Segment 2, Locke Street to Millbrook Street

LEGEND		SUMMARY OF SEGMENT 2			
REAR END	BACKED INTO	3 - REAR END	0 200 400 800	ACCIDENT ANALYSIS	SEGMENT 2 (FROM LOCKE STREET TO MILLBROOK STREET)
ANGLE	OTHER	9 - ANGLE	1 INCH = 400 FEET		
HEAD ON	RAIN	3 - SIDESWIPE			
SIDESWIPE	SLEET	2 - FIXED OBJECT			
FIXED OBJECT	SNOW	3 - DEER			
TRAIN	ICY	1 - BACKED INTO			
NON-COLLISION	MUDDY				
DEER	INJURY				
PEDESTRIAN	FATAL				
	NUMBER OF CRASHES				

Figure 3.17 Accident Analysis - Segment 3, E. Main Street to St. John's Place Commerce Center

LEGEND

- REAR END
- ANGLE
- HEAD ON
- SIDESWIPE
- FIXED OBJECT
- TRAIN
- NON-COLLISION
- DEER
- PEDESTRIAN
- BACKED INTO
- OTHER
- RAIN
- SLEET
- SNOW
- ICY
- MUDDY
- INJURY
- FATAL
- (#) NUMBER OF CRASHES

SUMMARY OF SEGMENT 3

38 - REAR END
48 - ANGLE
1 - HEAD ON
10 - SIDESWIPE
10 - FIXED OBJECT
1 - TRAIN
4 - DEER
1 - PEDESTRIAN
3 - BACKED INTO

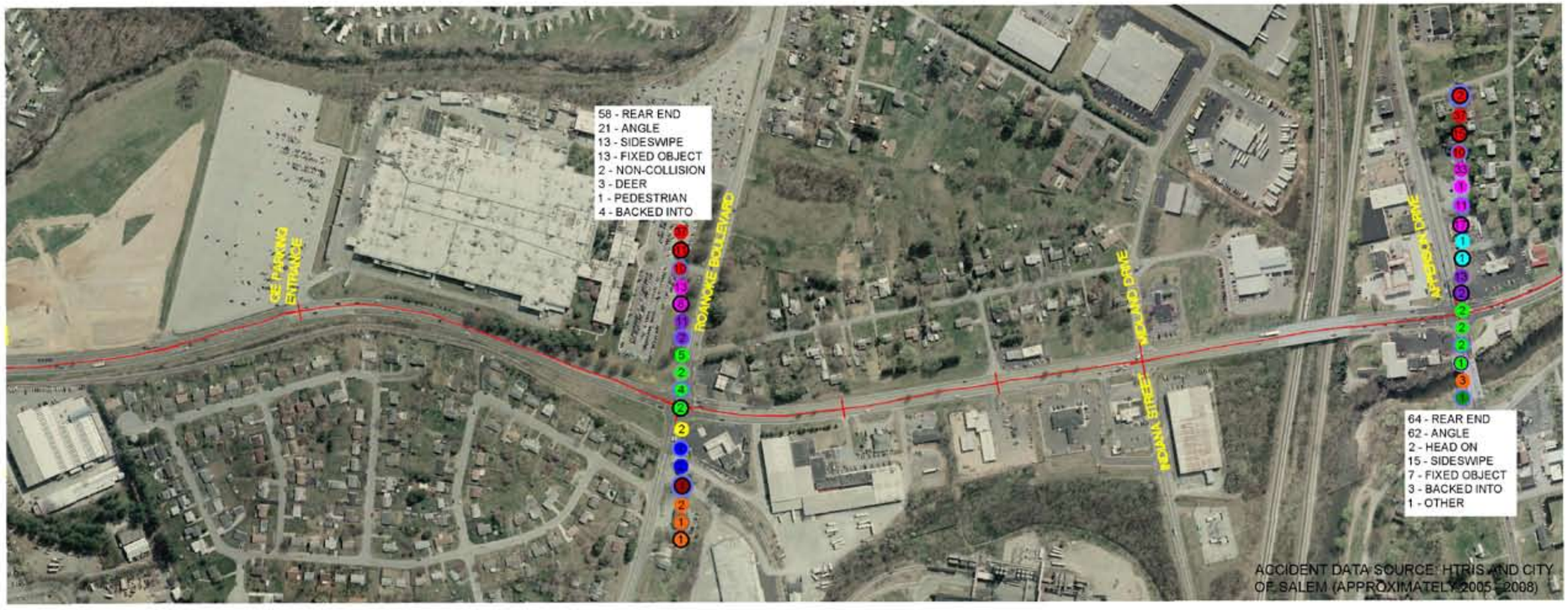
0 200 400 800

1 INCH = 400 FEET

ACCIDENT ANALYSIS

SEGMENT 3
(FROM E MAIN STREET TO ST. JOHN'S PLACE COMMERCE CENTER)

Figure 3.18 Accident Analysis - Segment 4, GE Parking Entrance to Apperson Drive



LEGEND

- REAR END
- ANGLE
- HEAD ON
- SIDESWIPE
- FIXED OBJECT
- TRAIN
- NON-COLLISION
- DEER
- PEDESTRIAN
- BACKED INTO
- OTHER
- RAIN
- SLEET
- SNOW
- ICY
- MUDDY
- INJURY
- FATAL
- NUMBER OF CRASHES

SUMMARY OF SEGMENT 4

122 - REAR END
83 - ANGLE
2 - HEAD ON
28 - SIDESWIPE
20 - FIXED OBJECT
2 - NON-COLLISION
3 - DEER
1 - PEDESTRIAN
7 - BACKED INTO
1 - OTHER

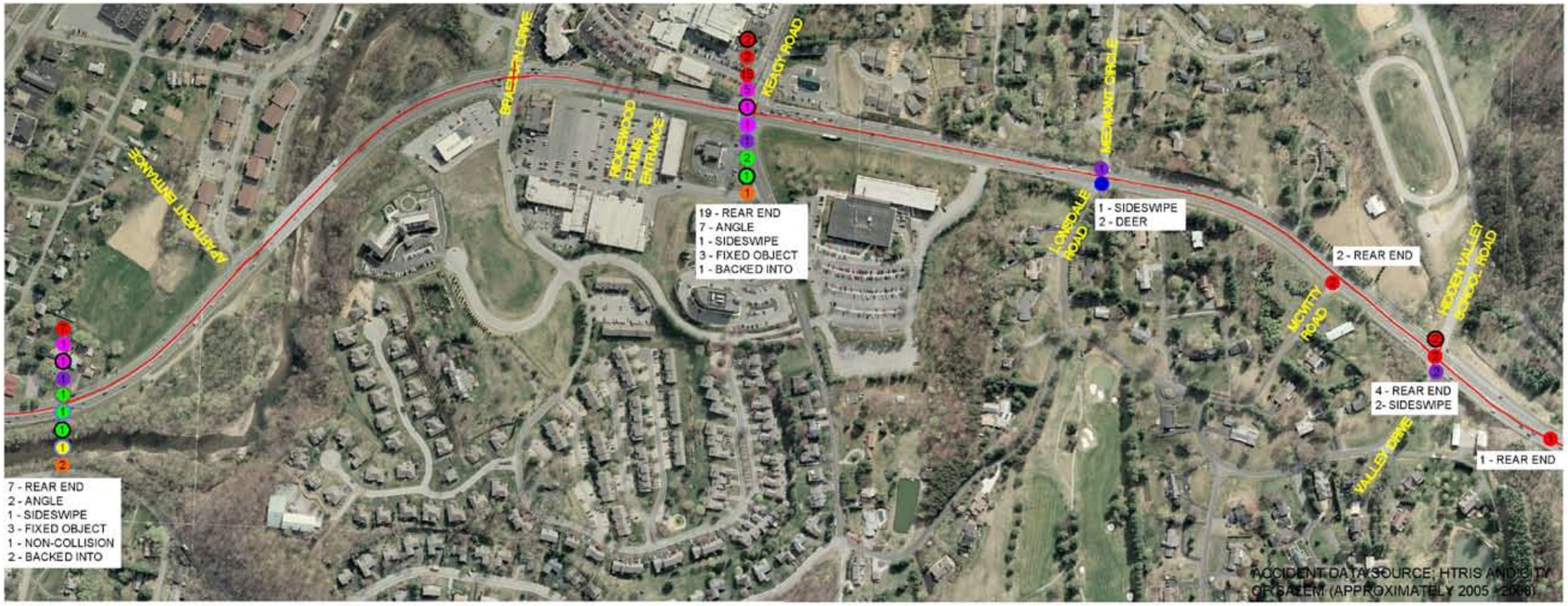
0 200 400 800

1 INCH = 400 FEET

ACCIDENT ANALYSIS

SEGMENT 4
(FROM GE PARKING ENTRANCE TO APPERSON DRIVE)

Figure 3.19 Accident Analysis - Segment 5, Riverview Drive to Dean Road



LEGEND

- REAR END
- ANGLE
- HEAD ON
- SIDESWIPE
- FIXED OBJECT
- TRAIN
- NON-COLLISION
- DEER
- PEDESTRIAN
- BACKED INTO
- OTHER
- RAIN
- SLEET
- SNOW
- ICY
- MUDDY
- INJURY
- FATAL
- NUMBER OF CRASHES

SUMMARY OF SEGMENT 5

33 - REAR END
9 - ANGLE
5 - SIDESWIPE
6 - FIXED OBJECT
1 - NON-COLLISION
2 - DEER
3 - BACKED INTO

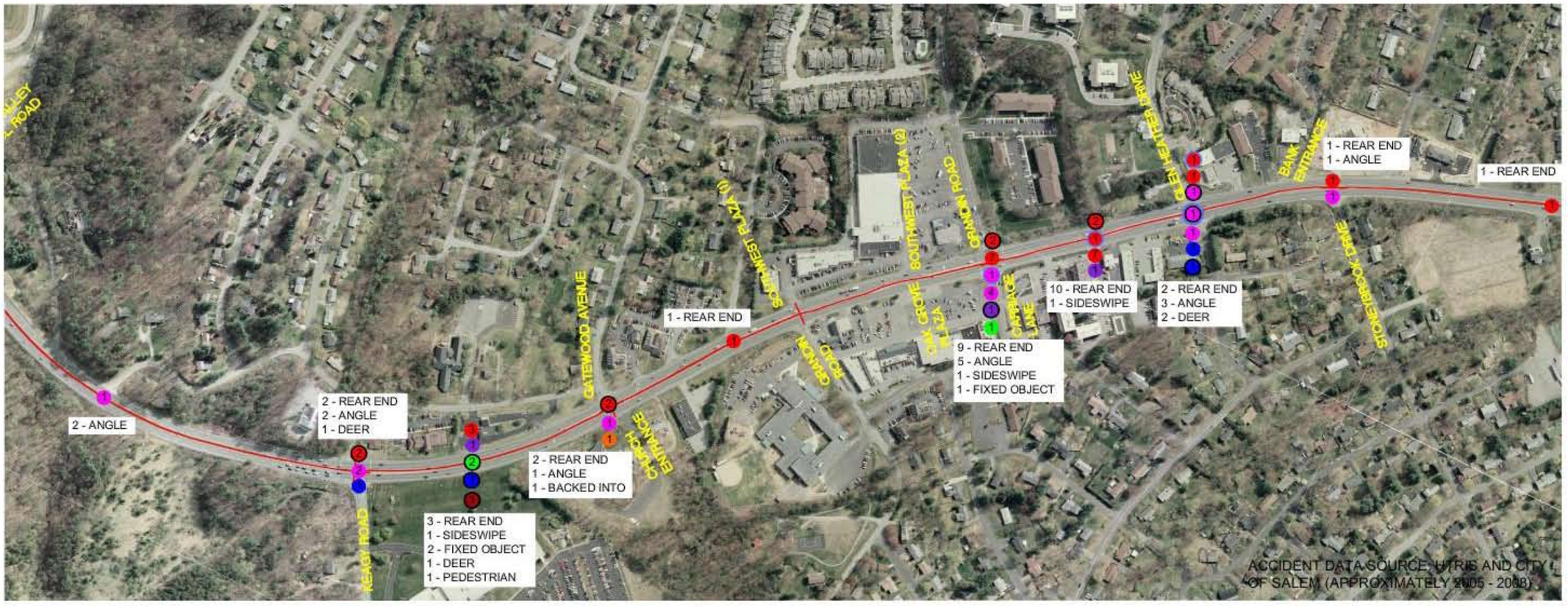
0 200 400 800

1 INCH = 400 FEET

ACCIDENT ANALYSIS

SEGMENT 5
(FROM RIVERVIEW DRIVE TO DEAN ROAD)

Figure 3.20 Accident Analysis - Segment 6, McVitty Road to Bower Road



LEGEND

- REAR END
- ANGLE
- HEAD ON
- SIDESWIPE
- FIXED OBJECT
- TRAIN
- NON-COLLISION
- DEER
- PEDESTRIAN
- BACKED INTO
- OTHER
- RAIN
- SLEET
- SNOW
- ICY
- MUDDY
- INJURY
- FATAL
- (#) NUMBER OF CRASHES

SUMMARY OF SEGMENT 6

- 31 - REAR END
- 14 - ANGLE
- 3 - SIDESWIPE
- 3 - FIXED OBJECT
- 4 - DEER
- 1 - PEDESTRIAN
- 1 - BACKED INTO

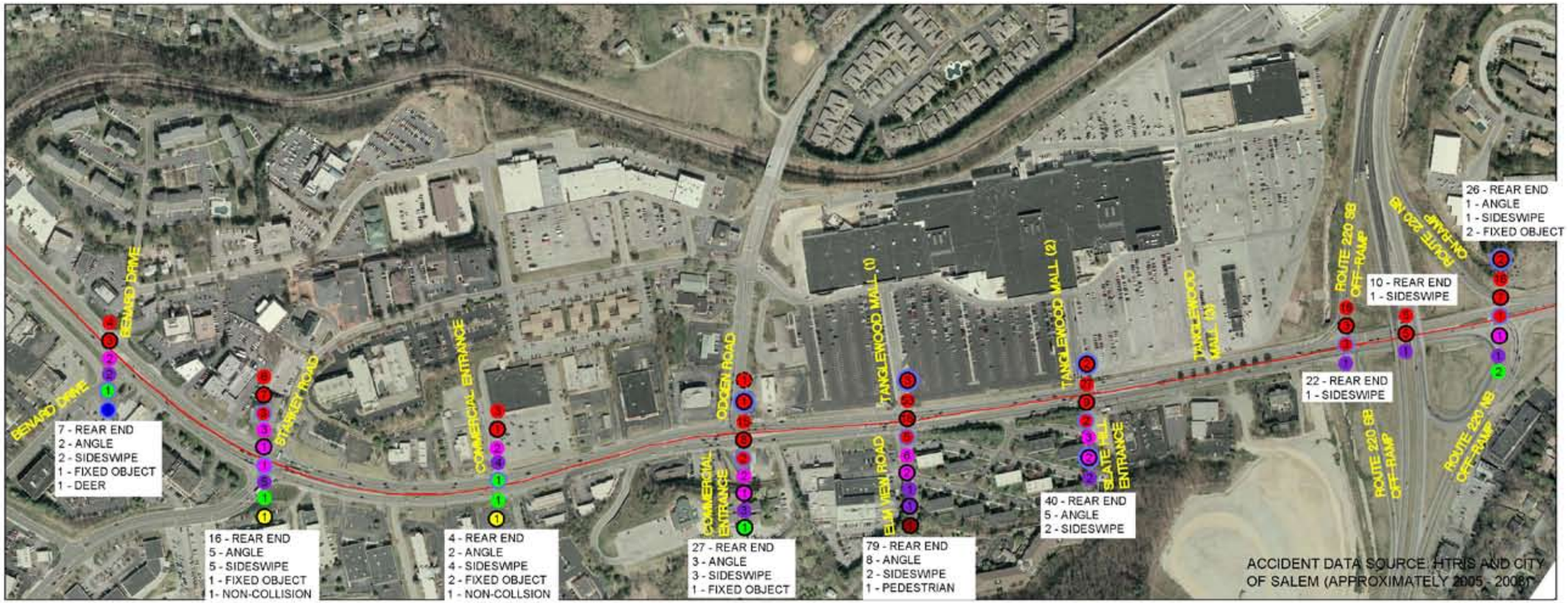
0 200 400 800

1 INCH = 400 FEET

ACCIDENT ANALYSIS

SEGMENT 6
(FROM MCVITTY ROAD TO BOWER ROAD)

Figure 3.21 Accident Analysis - Segment 9, Bernard Drive to Franklin Road



LEGEND

- REAR END
- ANGLE
- HEAD ON
- SIDESWIPE
- FIXED OBJECT
- TRAIN
- NON-COLLISION
- DEER
- PEDESTRIAN
- BACKED INTO
- OTHER
- RAIN
- SLEET
- SNOW
- ICY
- MUDDY
- INJURY
- FATAL
- (#) NUMBER OF CRASHES

SUMMARY OF SEGMENT 9

231 - REAR END
26 - ANGLE
21 - SIDESWIPE
7 - FIXED OBJECT
2 - NON-COLLISION
1 - DEER
1 - PEDESTRIAN

0 200 400 800

1 INCH = 400 FEET

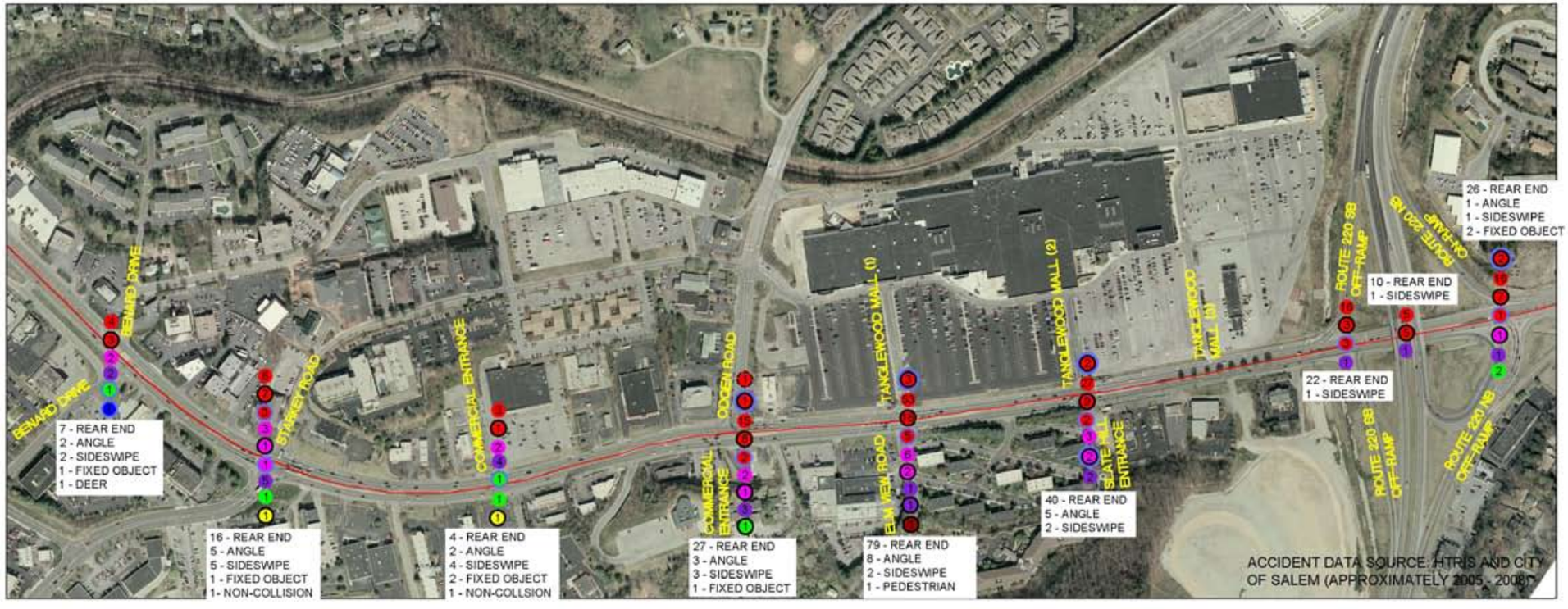
ACCIDENT ANALYSIS

SEGMENT 9
(FROM BERNARD DRIVE TO FRANKLIN ROAD)

Figure 3.22 Accident Analysis - Segment 8, Brambleton Avenure to Chaparral Drive

LEGEND		SUMMARY OF SEGMENT 8			
REAR END	BACKED INTO	61 - REAR END	0 200 400 800	ACCIDENT ANALYSIS	SEGMENT 8 (FROM BRAMBLETON AVENUE TO CHAPARRAL DRIVE)
ANGLE	OTHER	29 - ANGLE	1 INCH = 400 FEET		
HEAD ON	RAIN	13 - SIDESWIPE			
SIDESWIPE	SLEET	4 - FIXED OBJECT			
FIXED OBJECT	SNOW	1 - NON-COLLISION			
TRAIN	ICY	2 - DEER			
NON-COLLISION	MUDDY	1 - OTHER			
DEER	INJURY				
PEDESTRIAN	FATAL				
	NUMBER OF CRASHES				

Figure 3.23 Accident Analysis - Segment 9, Bernard Drive to Franklin Road



LEGEND

- REAR END
- ANGLE
- HEAD ON
- SIDESWIPE
- FIXED OBJECT
- TRAIN
- NON-COLLISION
- DEER
- PEDESTRIAN
- BACKED INTO
- OTHER
- RAIN
- SLEET
- SNOW
- ICY
- MUDDY
- INJURY
- FATAL
- (#) NUMBER OF CRASHES

SUMMARY OF SEGMENT 9

231 - REAR END
26 - ANGLE
21 - SIDESWIPE
7 - FIXED OBJECT
2 - NON-COLLISION
1 - DEER
1 - PEDESTRIAN

0 200 400 800

1 INCH = 400 FEET

ACCIDENT ANALYSIS

SEGMENT 9
(FROM BERNARD DRIVE TO FRANKLIN ROAD)

ACCESS MANAGEMENT

In 2007, the Virginia General Assembly approved legislation authorizing VDOT to develop and publish access management regulations and standards for the Commonwealth. The goals of these regulations are to reduce traffic congestion, enhance public safety, support economic development, and maximize the performance of existing facilities. These regulations were published in December 2007 and as of July 1, 2008 these regulations were put into effect for all VDOT maintained facilities functionally classified as principal arterials. Within the study area, Route 419 is a two-lane undivided rural major collector from Route 311 (Catawba Valley Drive) to I-81 and a four-lane divided urban principal arterial with a median and turn lanes from I-81 to US Route 220. The segments of Route 419 from I-81 to US Route 220 would therefore fall under the new access management regulations. VDOT regulations stipulate that access points must meet both VDOT standards and any local standards. VDOT access spacing standards are provided under the access management regulations based on posted speed limit and the intersection and driveway type for principal arterials. Table 3.9 provides a summary of the access spacing standards for an urban principal arterial.

Based on the posted speed limits in the study area, the required centerline to centerline spacing for driveways falls under the 35-45 MPH posted speed limit category. Intersection and driveway spacing along the corridor were estimated and compared to the VDOT minimum required spacing. Locations where the provided spacing is less than the required spacing are shown in Table 3.10. Based on the observations of intersection spacing relative to the VDOT established spacing requirements, along Route 419 there are 18 signalized intersections and 18 unsignalized intersections with spacing deficiencies.

s

Posted Speed Limit	Required Centerline to Centerline Spacing (feet)		
	Signalized Intersections	Unsignalized Intersections & Full Access Entrances	Partial Access One or Two Way Entrances
30 MPH and Lower	1,760	1,050	270
35 MPH to 45 MPH	**2,640**	**1,320**	**325**
50 MPH and Higher	2,640	1,320	510

Table 3.9 VDOT Access Management Spacing Requirements

Table 3.10 - Intersection Spacing Deficiencies for Signalized and Unsignalized Intersections

Route 419 Segment		Required Spacing (ft)	Approximate Spacing Provided (ft)	Additional Spacing Needed (ft)
From	To			
Signalized Intersection Spacing Deficiencies				
Green Ridge Road	East Main Street	2,640	2,520	120
East Main Street	Springfield Avenue	2,640	970	1,670
Springfield Avenue	Lynchburg Turnpike	2,640	2,280	360
Roanoke Boulevard	Midland Drive	2,640	1,815	825
Midland Drive	Apperson Drive	2,640	1,230	1,410
Braeburn Drive	Keagy Road	2,640	930	1,710
Hidden Valley School Drive	Keagy Road	2,640	2,070	570
McVitty Road	Postal Drive	2,640	2,140	500
Postal Drive	Brambleton Avenue	2,640	1,080	1,560
Brambleton Avenue	Springwood Park Drive	2,640	890	1,750
Springwood Park Drive	Colonial Avenue	2,640	1,890	750
Colonial Avenue	Promenade Park/ West Village	2,640	770	1,870
Promenade Park/ West Village	Chaparral Drive	2,640	2,150	490
Chaparral Drive	Starkey Road	2,640	1,880	760
Starkey Road	Ogden Road	2,640	1,820	820
Ogden Road	Tanglewood Entrance 1	2,640	660	1,980
Tanglewood Entrance 1	Tanglewood Entrance 2	2,640	720	1,920
Tanglewood Entrance 2	Route 220 SB Off-Ramp	2,640	1,080	1,560
Unsignalized and Full Access Intersection Spacing Deficiencies				
I-81 Northbound Ramp	Cove Road	1,320	360	960
Cove Road	Sheraton Drive	1,320	950	370
Green Ridge Road	Lakehurst Avenue	1,320	870	450
East Main Street	Lakeside Plaza (2)	1,320	650	670
St. John's Place Commerce	Commercial Entrance	1,320	690	630
Commercial Entrance	GE Parking Entrance	1,320	530	790
Keagy Road	Gatewood Avenue	1,320	1,040	280
Gatewood Avenue	Grandin Road Extension	1,320	820	500
Grandin Road Extension	Grandin Road	1,320	770	550
Grandin Road	Glen Heather Drive	1,320	800	520
Glen Heather Drive	Stoneybrook Drive	1,320	560	760
Cordell Drive	Brookwood Drive	1,320	550	770
Brookwood Drive	Commercial Entrance	1,320	920	400
McVitty Road	McVitty Road	1,320	440	880
Library Entrance	Postal Drive	1,320	480	840
Postal Drive	Normandy Lane	1,320	400	920
Chaparral Drive	Bernard Drive	1,320	1,170	150
Starkey Road	Commercial Entrance	1,320	940	380

MULTIMODAL NETWORK

BICYCLES AND PEDESTRIANS

Bicycle and pedestrian accommodations can be provided in various forms along a transportation corridor. For bicycles, typical accommodations could be either on-street using a widened pavement area adjacent to the vehicular travel lane, or via a side path on one or both sides of the road. Pedestrian accommodations usually consist of sidewalks or sidepaths/trails with pedestrian ramps and signals provided at major street crossings. Greenways can also provide opportunities for walking and biking.

Currently, the Route 419 corridor within the study section does not have bicycle accommodations directly along the corridor. Sidewalks and pedestrian signals are only provided in the immediate vicinity of the East Main Street (Business 460) intersection. At major signalized intersections along the corridor, curb ramps exist although pedestrian signalization is not provided. South of Keagy Road a paved shoulder is provided along both sides of the roadway although this pavement is utilized for right turn lanes at the

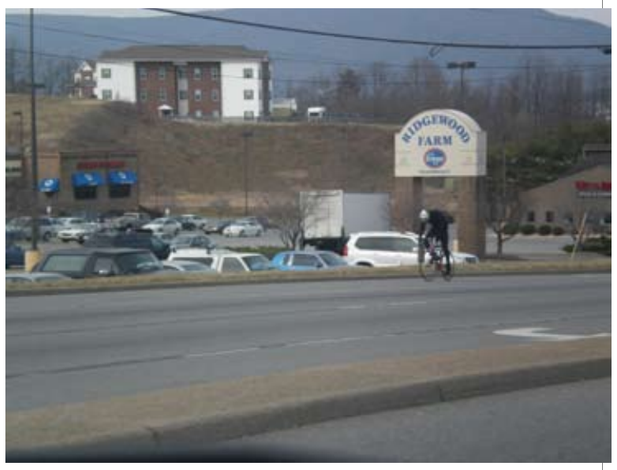
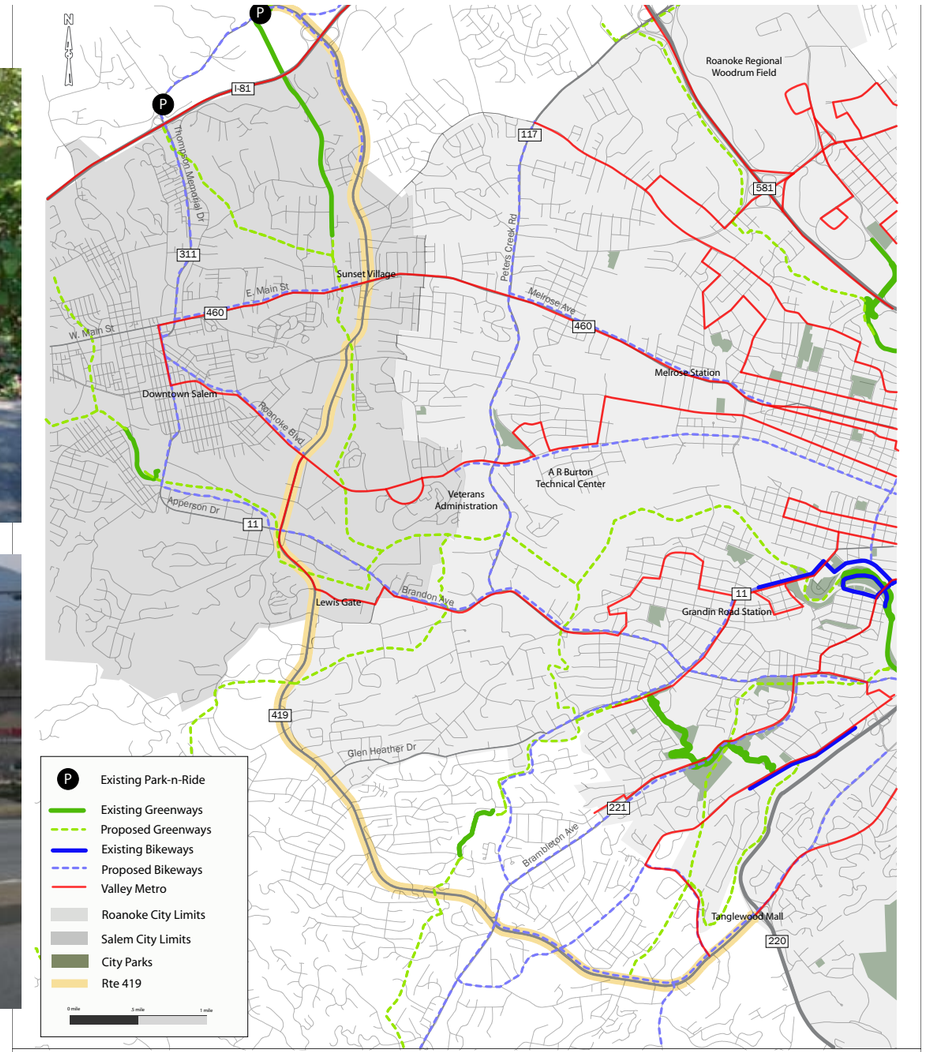


Figure 3.24 Existing and Planned Multimodal Facilities



intersections. Despite the current lack of facilities, there are a number of bicycle and pedestrian facilities that are planned or proposed. Figure 3.24 shows all of the existing and planned multimodal transportation facilities (greenways and bikeways) within the corridor.

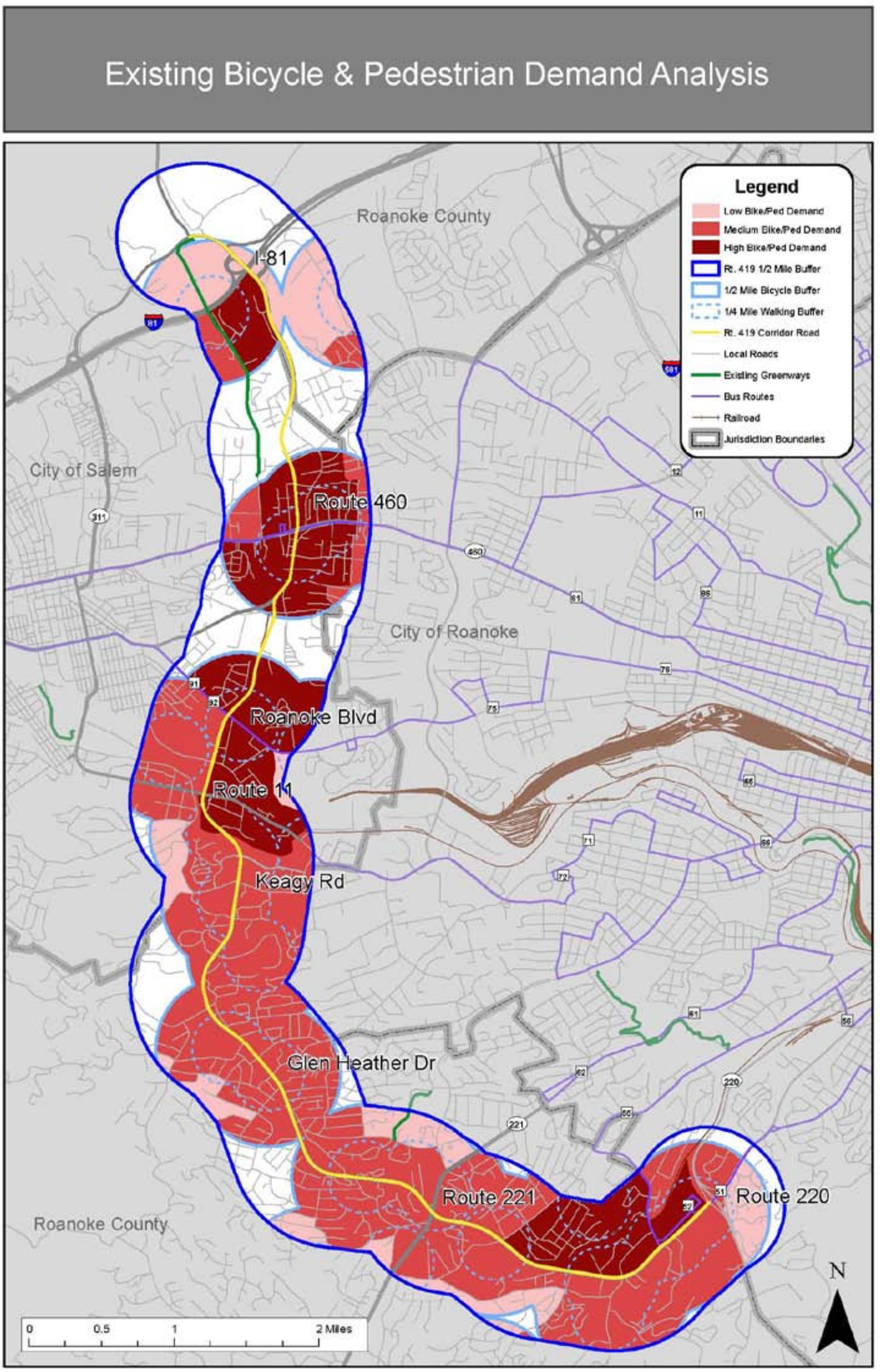
EXISTING BICYCLE AND PEDESTRIAN DEMAND

From field observations, it appears that there is a desire to walk portions of the corridor as evidenced by "desire lines" along the grass adjacent to the curb lines. These are essentially trails in the grass caused by repeated walk trips. These desire lines were observed along Route 419 at the following locations:

- West side of Route 419 north of the US 11/ US 460 split
- West side of Route 419 between the railroad overpass and Indiana Street
- East side of Route 419 between the railroad overpass and US 11.
- Both sides of Route 419 between Salem Park / Lancing Drive and Braeburn Drive
- Southwest quadrant of the intersection of Route 419 with Brambleton Avenue
- South side of Route 419 east of Colonial Avenue

In addition to field observations which revealed obvious places where sidewalks are needed, demand analysis was performed to determine areas of high, medium, and low potential for bicycle and pedestrian use within the Rt. 419 Corridor. The GIS-based analysis was based on existing and readily available data sets. Several factors of bicycle and pedestrian use were selected. These factors include housing unit density, housing unit vacancy, housing units, households, total population, those who own no automobiles, those who are age 65 or older, those who are living below the poverty line, and proximity to existing bus routes obtained by buffering an existing GIS layer. The results (Figure 3.25) indicate that demand is highest near the intersections of 1-81, US 460, US 11 and US 220. Recommendations for specific sidewalk and bicycle accommodations are discussed later in the document.

Figure 3.25


Existing Bicycle & Pedestrian Demand Analysis
Legend
Low Bike/Ped Demand
Medium Bike/Ped Demand
High Bike/Ped Demand
Rt. 419 1/2 Mile Buffer
1/2 Mile Bicycle Buffer
1/4 Mile Walking Buffer
Rt. 419 Corridor Road
Local Roads
Existing Greenways
Bus Routes
Railroad
Jurisdiction Boundaries
Roanoke County
I-81
City of Salem
Route 460
City of Roanoke
Roanoke Blvd
Route 11
Keagy Rd
Glen Heather Dr
Route 221
Route 220
Roanoke County
0
0.5
1
2 Miles
N

TRANSIT FACILITIES

The Greater Roanoke Transit Company, more commonly known as Valley Metro, is the public transit provider for the greater Roanoke area. Their operations began in 1975 when Roanoke City took over operations of the private organization Roanoke City Lines. All local governments in the area had the opportunity to invest in Valley Metro, however, only Roanoke City decided to seize the opportunity and remains the sole owner of Valley Metro today. As a result, surrounding localities may contract services as needed, but, in general, Valley Metro services target city residents and destinations.

Valley Metro offers a range of public transportation services including fixed route bus service, special/ paratransit service for the disabled, special event shuttle buses, and commuter bus service to and from the New River Valley. In addition to fare box revenue and advertising sales, Valley Metro is primarily funded through operating and capital grants from state, local, and federal agencies. Headquartered on in downtown Roanoke, Valley Metro operates over 30 routes with its fleet of 42 buses.

Valley Metro has designed its fixed route service as a "hub-and-spoke" system from Campbell Court Transportation Center. A hub and spoke system, often associated with air travel, creates a focal point for bus transfers at Campbell Court Transportation Center. Bus routes travel to and from the hub, like spokes on a wheel, to service outlying areas. This system is often seen as a more user friendly, and less expensive design, as it utilizes fewer routes and buses to service the same areas as direct fixed route service. Valley Metro has added several unique elements in the numbering and organization of their routes to give riders a system that is easy to use and understand. As illustrated by the Valley Metro System Map (Figure 3.26), routes have been color coded and numbered depending on their origin and destination. For example, the lowest numbered routes, colored green, travel approximately at 12 o'clock on the face of a clock. As route numbers increase they move around the face of a clock, the red routes are at 2 o'clock, purple at 3 o'clock, and so

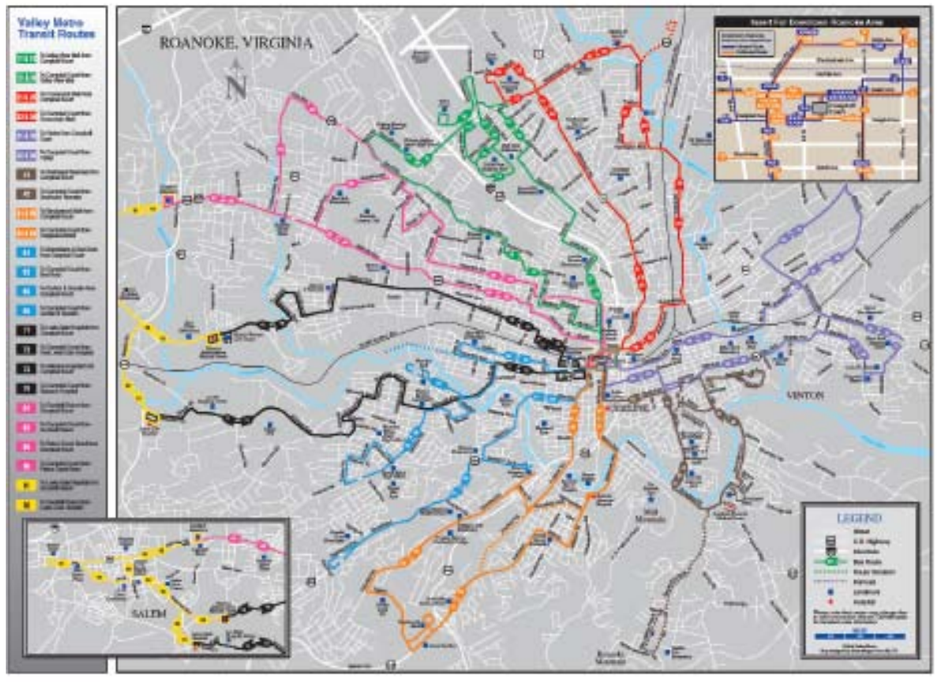


Figure 3.26 Valley Metro System Map

forth. Additionally, all even numbered routes travel in-bound, toward the Campbell Court hub, and all odd numbered routes travel away from the hub. This design and coordination allows Valley Metro users to understand the general origin/destination of routes throughout the system without intimate knowledge of each specific route.

Several routes in the system serve locations along Route 419: the yellow routes, 91 & 92, are the only routes in the system to travel along the corridor for any amount of time as they connect users from Salem via Roanoke Blvd and US 460; the SmartWay commuter, travels along I-81 from downtown Roanoke to the New River Valley, which intersects 419; the black routes, 71 & 72, travel along US 11 to the Lewis Gale Medical Center, and 75 & 76 travel along Salem Turnpike to Veterans Hospital (just off the corridor); pink routes 81 & 82 cross 419 while traveling to Goodwill Industries via US 460; and, the orange routes, 51, 52, 55 & 56, travel parallel to US 220 on their way to Tanglewood Mall. This synopsis is comprehensively illustrated in Table 3.11 below.

Exact performance measures for Valley Metro were unavailable. However, limited ridership information regarding daily boardings per route was collected and analyzed. This information was collected via an onboard survey conducted throughout the Valley Metro system between July 2007 and June 2008. Due to collection procedures and original purpose

Table 3.11 Bus Route Service in the Study Area

Route Number	Route Color	Travel Path	Service to:
51	Orange	Jefferson/Avenhern	Tanglewood Mall at Southern Terminus
52	Orange	Jefferson/Avenhern	Tanglewood Mall at Southern Terminus
55	Orange	Franklin/Colonial	Tanglewood Mall at Southern Terminus
56	Orange	Franklin/Colonial	Tanglewood Mall at Southern Terminus
71	Black	Route 11	Lewis Gale Hospital at Keagy & 419
72	Black	Route 12	Lewis Gale Hospital at Keagy & 419
75	Black	Loudon/Salem Trpk	Veterans Medical Center (.7 mi from 419)
76	Black	Loudon/Salem Trpk	Veterans Medical Center (.7 mi from 419)
81	Pink	Route 460	Goodwill Industries at 460 & 419
82	Pink	Route 460	Goodwill Industries at 460 & 419
91	Yellow	Route 460/Roanoke Blvd	460/419 via Salem City to Lewis Gale Hospital
92	Yellow	Route 460/Roanoke Blvd	460/419 via Salem City to Lewis Gale Hospital
Smartway	n/a	I-81	New River Valley (crosses 419)

Table 3.12 Top Ten Valley Metro Bus Routes by Activity Level

	Inbound Routes		Outbound Routes		Total	
Rank	Route	Activity	Route	Activity	Route	Activity
1	Route 12	306	Route 11	541	Route 11	541
2	Route 16	278	Route 15	479	Route 15	479
3	Route 76	250	Route 81	284	Route 12	306
4	Route 72	249	Route 41	237	Route 81	284
5	Route 22	216	Route 71	229	Route 16	278
6	Route 86	213	Route 91	202	Route 76	250
7	Route 52	191	Route 31	192	Route 72	249
8	Route 26	183	Route 61	191	Route 41	237
9	Route 56	182	Route 51	184	Route 71	229
10	Route 36	174	Route 85	168	Route 22	216

of the survey, results cannot be utilized to estimate ridership for existing or future routes. However, for the purpose of this analysis, survey results were condensed by route, and boardings and alightings were totaled, depicting a route activity level. The activity level can be used to compare the relative popularity of routes in the system. Table 3.12 ranks the top ten inbound, outbound, and system wide routes, by activity level. Four routes that serve the 419 corridor were ranked in the top ten most active routes system wide. Route 81, ranked highest at fourth, is an outbound route traveling along 460 through several urban residential neighborhoods before terminating just west of 419 at Goodwill Industries. Routes 76 and 72, ranked sixth and seventh respectively, are both inbound routes that serve medical centers along Route 419 and traverse areas with a high concentration of elderly residents. Route 71, ranked ninth overall, is an outbound route following the same path as Route 72, serving Lewis Gale Medical Center.

PARK AND RIDE FACILITIES

Within the study area there are a total of two park and ride facilities. Located around the northern terminus of Route 419 near its intersection with I-81, there is one official lot and one unofficial lot. Park and ride lots are classified as official when the lot is owned or leased by VDOT, whereas unofficial lots are recognized by VDOT as commuter parking facilities but are not designed and operated as formal park-and-ride lots (Ride Solutions 2009, 6). The official VDOT park and ride lot is located at exit 140 on I-81, and the unofficial lot at Orange Market is located near the intersection of Route 311 and 419.

The official VDOT lot at exit 140 is a transit stop for the SmartWay bus route, which provides service between downtown Roanoke and Squires Student Center on Virginia Tech's campus. Data on facility usage suggest that providing transit service to a park and ride lot may increase space demand and use. For example, at the exit 140 facility users exceed the number of total parking spaces by 145% on average. The Orange Market facility, however, only reaches about 50% capacity on a regular basis (Ride Solutions 2009, 11).

The issue of use may also be influenced by facility amenities and upkeep. Figure 3.13 illustrates the difference in amenities and conditions between the Orange Market and exit 140 facilities. The increased

Table 3.13 Park and Ride Facility Comparison

Lot Name	Amenities	Condition		Security		
		Lot	Pavement	Lighting	Visibility	Activity
Orange Market	Lights	Fair	Bad	Poor	Good	High
I-81 Exit 140	Lights 1 Bus Stop Information Signs Trash Receptacles	Fair	Excellent		Good	High

signage, infrastructure, and pavement condition may influence user habits.

Census Transportation Planning Package (CTPP) data was analyzed to investigate regional commuting habits and mode choice. This analysis reveals that a larger percentage of workers along the Route 419 corridor drive alone on their commute to work than workers throughout the rest of the study area. Within a half mile of 419, 91% of workers drive alone to work, compared to 85% throughout the study area. Likewise, less than 1% of workers along 419 use transit, compared to 2% throughout the study area. This may be caused by a lack of transit service along the corridor, but also suggests an auto-centric culture among corridor residents.

Travel times and time of day also differ slightly between corridor workers and the study area as a whole. For example, travel time to work, measured in minutes, shows a slightly shorter commute time for workers living along route 419. Commute trips lasting less than 20 minutes are typical for 63% of workers living along Route 419, compared to 59% within the study area. The most typical time leaving for work for both Route 419 and the study area is between 7:30 and 8:00 in the morning. However, a larger percentage of residents along 419 (23%) leave at this time. Comparatively, only 20% of study area residents leave at this time. Other than these differences, travel times and commute patterns follow similar trends between Route 419 residents and the study area.

Industry standards suggest that bus ridership for rural/suburban transit routes is approximately 1% of the total daily trips. Daily trips are calculated using the AADT figures multiplied by the average number of passengers per vehicle. However, data regarding passenger count for the study area is unavailable, therefore only AADT data was utilized. The 1%

Table 3.14 Approximate Bus Ridership for 2005

Road Segment	2005 AADT	% Truck Traffic	2005 AADT (no truck)	Approx. Bus Ridership
Rt 311/419 to US 460	13,667	0.05	12,983	130
US 460 to Roanoke Blvd	24,858	0.04	23,864	239
Roanoke Blvd to Keagy Rd	31,000	0.03	30,070	301
Glen Heather Drive to US 221	32,000	0.02	31,360	314
US 221 to Tanglewood Mall	40,000	0.01	39,600	396
Corridor Average	28,305	0.03	27,575	276

industry standard is supported by data gathered in the study area as well. As previously discussed, the average percent of commuters using transit is approximately 2%. Along the corridor this percent drops to almost 0% transit use. Using 1% as a benchmark to approximate ridership is about halfway between the regional and the corridor transit use average.

Table 3.13 depicts the results of these calculations and illustrates approximate usage of bus ridership along Electric Road. The number of trips made by trucks was excluded from the calculations since commercial and freight truck trips are unlikely to utilize bus service as an alternative means of transportation. The table illustrates a similar pattern to many other spatial analyses of the corridor, showing higher levels of activity occurring along the southern segments of the corridor.

Ridership is lowest between the Orange Market park and ride lot, at the corner of Route 311 and 419, and the intersection of 419 and 460. Approximate ridership increases steadily moving south along the corridor and has the most potential for ridership in the southern most roadway segment analyzed, between US 221 and Tanglewood Mall.

RAIL

Norfolk Southern (NS) Rail lines cross the corridor near Apperson Drive and just east of Chaparral Drive. Both of these are grade-separated crossings, with the rail line at Apperson crossing under the roadway, while the Chaparral crossing is elevated over the roadway. The NS rail line near Apperson Drive is approximately 2 miles west of Shaffer's Crossing, a classification yard in the City of Roanoke.

This line is also the proposed route of the Heartland Corridor, which is a project to increase intermodal freight capacity by raising vertical clearances in 28 tunnels on a Norfolk Southern rail line between the port of Hampton Roads, VA and Chicago. When the project is complete, containerized freight moving in double-stack trains will be able to shave off about 200 miles and up to a day's transit time between the East Coast and the Midwest. Currently, double-stack trains must take longer routes by way of Harrisburg, PA, or Knoxville, TN. The Heartland Corridor goes across Virginia, through southern West Virginia and north through Columbus, OH.

As part of the Heartland Corridor project the Commonwealth of Virginia is partnering with Norfolk Southern to construct an intermodal facility in the Roanoke Valley. The preferred site is in Elliston, VA in Montgomery County. The purpose of the rail intermodal facility is to transfer freight shipping containers between rail to trucks, thereby quickly providing access to consumers or the world marketplace.

Increasingly, product distribution warehouses are being located in close proximity to these facilities, and because of the short distance between the Route 419 corridor and Elliston, some warehouses may be located within the corridor. This could mean an increase in the amount of truck traffic on Route 419.

FUTURE CONDITIONS

III FUTURE CONDITIONS

FUTURE LAND USE PLANS

Local planning documents regarding land use and design principles suggest that the basic landscape of Route 419 is expected to change little in the coming decades. The future land use maps for both Roanoke County and the City of Salem reveal a fairly consistent approach to growth along the corridor: commercial growth is located at major intersections with additional commercial/industrial growth located in the spaces between commercial nodes. Both the City of Salem and Roanoke's Deyerle neighborhood also identify small pockets of residential development along the corridor. While the overall approach to future growth along the corridor is consistent, the specific policies of each jurisdiction vary widely.

CITY OF ROANOKE

The City of Roanoke's Comprehensive Plan (Roanoke Vision 2001-2020) places heavy emphasis on quality design principles as the basis for future land use, zoning, and transportation improvements. Typical land use designations are absent from this plan, and replaced by distinct character districts (i.e. Village Center, etc), each with its own set of design principles to guide future infill, new development, street improvements, and redevelopment of underused sites. While specific land use designations are not mapped, numerous policies reinforce the need for compact urban development, with bicycle and pedestrian amenities as keys to reducing automobile trips. Specifically, the plan calls for future commercial development along arterial roads at major intersections rather than strip commercial development along corridors.

As an element of the City's Comprehensive Plan, the Greater Deyerle Neighborhood Plan identifies Southwest Plaza as an ideal location for a village center (specifically mixed-use office, retail and residential complex) should the property redevelop in the future. The plan also prioritizes off-street pedestrian improvements (greenways, trails) to link residential areas with the edges of the neighborhood.

ROANOKE COUNTY

Roanoke County cites Route 419 as an emerging major corridor in the region. Much of Roanoke County's approach to guiding land use in the future is to preserve resources, land, and traditional neighborhoods. Guidelines have been developed to ensure that future development blends with its surroundings and does not cause undue harm to the natural and social environment. Roanoke County's Comprehensive Plan (2005) designates land use categories with supporting design guidelines that emphasize such elements as site development, relationship of proposed land uses to adjoining land uses and buildings to adjoining buildings, relationship of buildings to their site, site layout, parking lots, landscaping, building design, lighting, and signs. This may promote infill development along 419 with human scale construction.

Within the study area, the two primary land use designations are Core and Transition. Primary commercial nodes within the County are designated as Core areas. These suburban centers of high intensity urban development are located near major intersections (I-81, US 211, US 581) and are primarily commercial/retail in nature (i.e. planned shopping centers). Design guidelines for this designation support the inclusion of greenways, bike and pedestrian trails into their designs and encourage developers to provide links to surrounding neighborhoods/sites.

Between the Core areas on the 419 corridor in Roanoke County, land is designated as Transition. This designation is intended to improve the design and development in places where there is pressure for future strip development. In these areas, office, institutional and small-scale, coordinated retail uses are encouraged. Design guidelines focus on improving access and aesthetics to avoid unappealing forms of strip development and encourage vehicular and pedestrian movement among adjacent sites. There is no mention of bicycle accommodation.

CITY OF SALEM

The City of Salem notes that one of its objectives for future land use development is to "provide additional space for the development or expansion of industrial and commercial business." (Salem 2003, 58) The future land use map suggests that the area between US 11 and US 460 may be an integral part of this goal. Similar to Roanoke County's approach, the City of Salem's Comprehensive Plan encourages commercial development at intersections with industrial and some residential development in between. Commercial areas generally designate the location of existing and desired future retail, service and office areas (including downtown, highway commercial and neighborhood commercial areas). Industrial areas are used for a variety of manufacturing, processing and storage activities. While the plan provides a general idea of the types of uses that are encouraged within each district, there is little guidance related to community design that would foster bicycle and pedestrian activity. The Goals, Objectives, and Strategies related to Land Use focus more heavily on community appearance and landscaping. With no guidance related to the design of such uses, the industrial designation along the corridor may serve as an impediment to bicycle and pedestrian activity. There is some interest, however, in the creation of a sidewalk/bikeway/greenway system in the Plan, though no specific goal exists solely for the promotion of multimodal transportation, nor do they provide any guidance on the location of such facilities.

While the plans of all three jurisdictions demonstrate an interest in developing bicycle and pedestrian networks (albeit in varying degrees), the regulatory documents generally contain no requirements or incentives for doing so. All three plans have language to revise the zoning and subdivision standards to encourage sidewalks, bikeways, and greenways, but to date only the City of Roanoke's Subdivision Standards require sidewalks with street improvements (the only exception is within subdivisions along existing streets in an RA, R-12, or ROS district.) There is no mention of bicycle improvements. The City of Roanoke contains additional language to develop a manual of street design and streetscape standards to guide street improvements. Neither Roanoke County nor the City of Salem contains any requirements for bicycle and pedestrian accommodation in their ordinances. Both defer to VDOT in their subdivision standards for streets.

Roanoke County has language in its Comprehensive Plan to create incentives that would encourage developers to include dedicated lands and connected greenways in all new development projects. The City of Salem has language in its Comprehensive Plan to encourage, through incentives, new neighborhood styles and preservation of open space. Though not specified, this could serve as a catalyst for bicycle

and pedestrian facilities. The City of Roanoke's plan contains language for developing incentives and programs to encourage attractive commercial redevelopment.

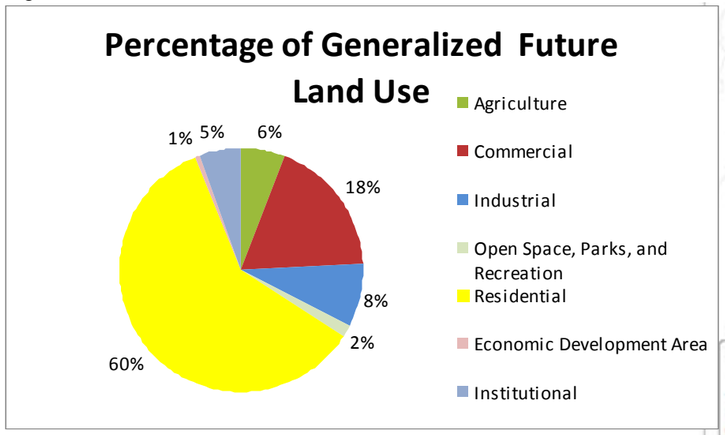
Each plan makes reference to the need for regional coordination. A number of opportunities exist to strengthen coordination between jurisdictions related to transportation plans and policies. These include continued support for the Roanoke Valley Greenway system, adoption and participation in review of the Bikeway Plan for the RVAMPO, and generally continued participation in the MPO's transportation planning initiatives.

Table 4.1 shows both the total acreage and percentage of generalized future land use (based on zoning and future land use) within 1/2 mile of the corridor.

Table 4.1

RT 419 CORRIDOR - FUTURE LAND USE		
Generalized Future Land Use	**Acres**	**Percentage of Total**
Agriculture	409	6%
Commercial	1256	18%
Industrial	573	8%
Open Space, Parks, and Recreation	129	2%
Residential	4131	60%
Economic Development Area	35	1%
Institutional	380	5%
Total	6913	100%

Figure 4.1



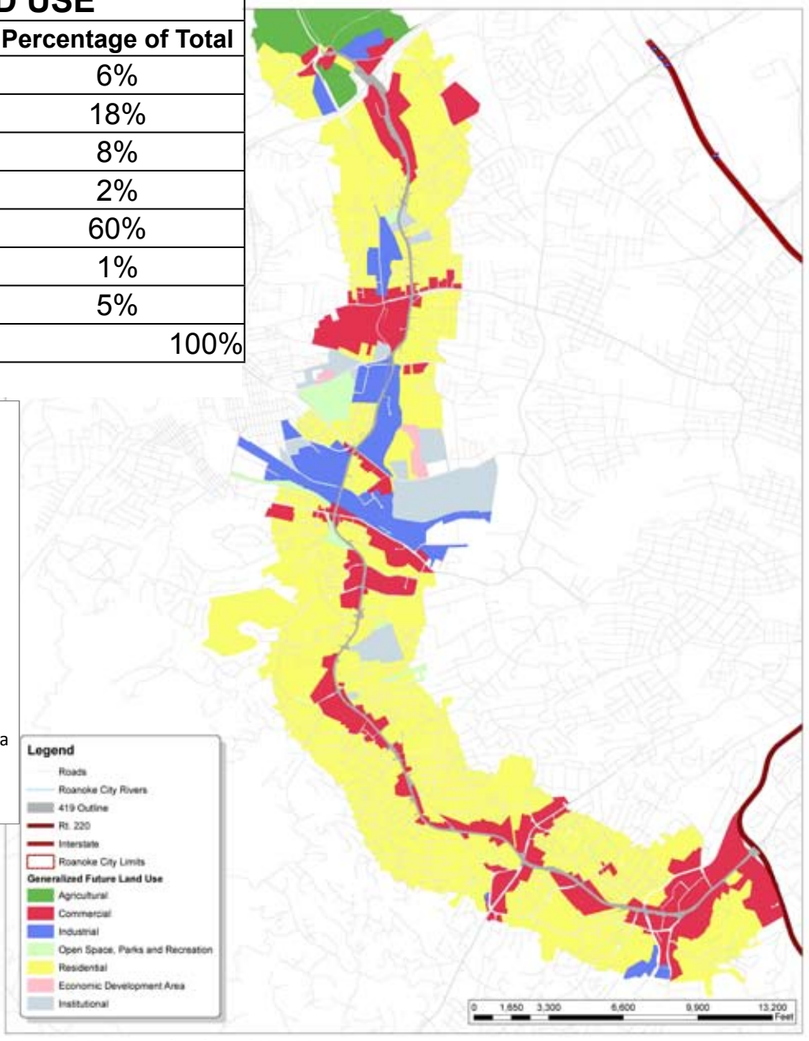


Figure 4.2: Generalized Land Use Map

2018 + 2035 NO BUILD TRAFFIC LEVEL OF SERVICE

Analyses were completed to determine the traffic operational characteristics of the study area intersections using Synchro Professional 7.0, which uses methodologies contained in the 2000 Highway Capacity Manual (HCM). Intersection turning movement counts, with existing geometry, and optimized signal timing plans were utilized to determine the 2018 and 2035 No Build level of service. Level of service (LOS), describes traffic conditions by the amount of traffic congestion at an intersection or on a roadway. LOS ranges from A to F, with A indicating a condition of little or no congestion, and F indicating a condition with severe congestion, unstable traffic flow, and stop-and-go conditions. For intersections, LOS is based on the average delay experienced by all traffic using the intersection during the busiest (peak) 15-minute period. LOS A through D are generally considered acceptable.

The results are presented for 2018 AM No Build Peak Hour LOS in Table 4.2 and 2018 PM No Build Peak Hour LOS in Table 4.3. The results are presented for 2035 AM No Build Peak Hour LOS in Table 4.4 and 2035 PM No Build Peak Hour LOS in Table 4.5.

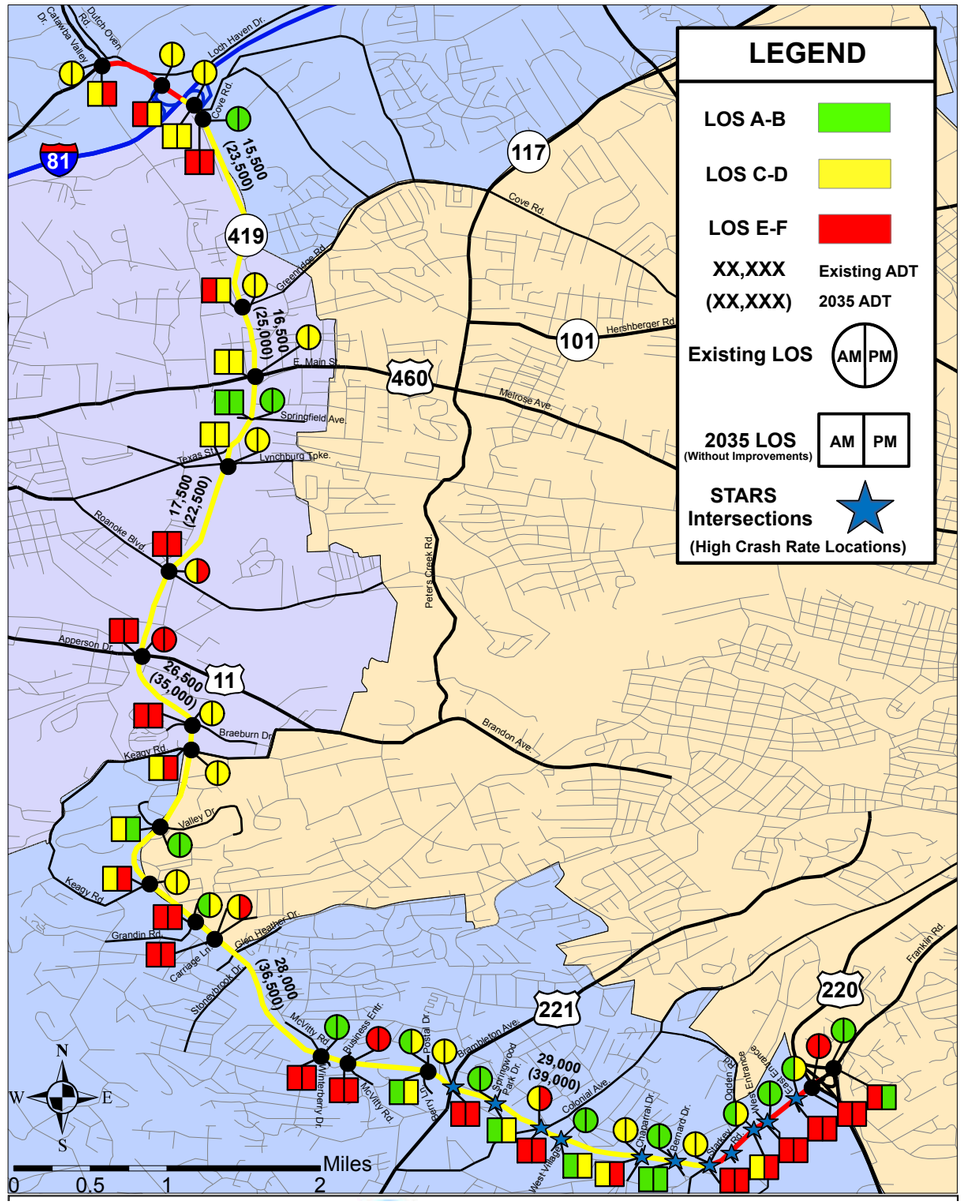


Table 4.2 - Route 419 AM Peak Hour 2018 No Build Level of Service

Intersections along Route 419	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM PEAK HOUR					
Route 311 (signalized)	**C (32.1)**	C (30.5)*	D (35.9)*	D (52.9)	C (29.0)
I-81 SB Ramp (signalized)	**C (30.6)**	D (35.1)	-	C (24.5)*	C (29.7)*
I-81 NB Ramp (signalized)	**C (22.4)**	-	C (32.4)	C (30.4)*	B (15.7)*
Greenridge Road (signalized)	**B (13.9)**	A (0.0)	C (21.8)	B (12.8)*	B (11.7)*
East Main Street (signalized)	**C (32.6)**	C (31.9)	D (43.0)	C (25.4)*	C (31.2)*
Lakeside Plaza Entr. (signalized)	**A (9.9)**	C (31.0)	D (36.2)	A (5.4)*	B (10.0)*
Lynchburg Turnpike (signalized)	**C (24.7)**	D (36.0)	C (34.8)	B (18.8)*	C (23.9)*
Roanoke Boulevard (signalized)	**D (44.2)**	D (54.3)	D (40.3)	D (39.9)*	D (47.1)*
Indiana Street (signalized)	**C (23.8)**	E (55.8)	E (55.0)	B (17.6)*	B (18.2)*
Apperson Drive (signalized)	**E (56.3)**	E (56.6)	E (73.4)	D (35.2)*	E (75.6)*
Braeburn Drive (signalized)	**B (18.9)**	E (59.9)	D (39.1)	B (13.8)*	B (18.9)*
Ridgewood Farms (unsignalized)	**A (0.1)**	A (9.6)	-	A (0.0)*	A (0.0)*
Keagy Road North (signalized)	**B (13.6)**	D (49.4)	D (44.9)	A (8.1)*	A (8.9)*
Valley Drive/Rt.1442 (signalized)	**C (21.8)**	E (56.1)	E (72.5)	C (21.8)*	A (8.1)*
Keagy Road South (signalized)	**C (25.5)**	E (60.9)	E (57.4)	B (19.8)*	B (18.9)*
Grandin Road Extended (unsignalized)	**C (17.3)**	F (>600)	F (478.8)	A (0.8)*	A (0.9)*
Carriage Lane/ Grandin Road (signalized)	**D (50.1)**	E (78.1)	F (85.3)	E (57.9)*	B (16.2)*
Glen Heather Drive (unsignalized)	**F (349.9)**	F (486.9)	F (>600)	A (0.2)*	A (0.8)*
McVitty Road/Rt.1642 (signalized)	**D (53.7)**	C (34.9)*	E (64.5)*	E (70.3)	D (35.5)
Postal Drive (signalized)	**A (8.9)**	A (9.0)*	A (3.4)*	D (52.9)	E (73.1)
Brambleton Avenue (signalized)	**D (46.9)**	C (30.7)*	D (43.0)*	E (60.8)	D (52.2)
Springwood Park (signalized)	**A (3.5)**	A (2.5)*	A (3.1)*	E (56.6)	-
Colonial Avenue (signalized)	**D (40.0)**	D (37.7)	E (59.0)	D (37.9)*	D (36.3)*
Promenade Park (signalized)	**A (4.4)**	C (25.0)	C (23.5)	A (3.6)*	A (3.6)*
Chaparral Drive (signalized)	**C (26.4)**	C (23.6)*	C (20.4)*	D (45.2)	E (62.4)
Bernard Drive (unsignalized)	**A (1.3)**	A (0.8)*	A (1.3)*	B (10.3)	A (9.5)
Starkey Road (signalized)	**D (50.4)**	D (43.0)*	D (52.3)*	E (59.3)	D (50.6)
Madison Square (unsignalized)	**A (0.5)**	A (0.0)*	A (0.7)*	A (0.0)	C (21.4)
Ogden Road (signalized)	**B (14.0)**	B (13.7)*	A (3.0)*	E (60.1)	E (61.6)
Tanglewood Mall West/ Elm View (signalized)	**A (8.5)**	B (11.5)*	A (3.6)*	E (57.0)	E (57.3)
Tanglewood Mall East (signalized)	**C (31.1)**	D (46.5)*	B (12.4)*	E (57.6)	E (57.3)
Route 220 SB Ramp (signalized)	**E (63.5)**	D (44.3)*	C (21.6)*	-	F (131.7)
Route 220 NB Ramp (signalized)	**B (11.9)**	A (3.3)*	B (11.3)*	D (40.5)	-

Source: Kimley-Horn and Associates, Inc.

NOTE: * Route 419

Table 4.3 - Route 419 PM Peak Hour No Build Level of Service

Intersections along Route 419	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
PM PEAK HOUR					
Route 311 (signalized)	**E (56.4)**	E (74.6)*	B (18.7)*	E (74.8)	F (122.1)
I-81 SB Ramp (signalized)	**C (23.7)**	C (28.0)	-	B (16.9)*	C (30.0)*
I-81 NB Ramp (signalized)	**C (21.7)**	-	D (38.7)	C (21.8)*	B (15.4)*
Greenridge Road (signalized)	**B (19.7)**	D (46.4)	C (33.1)	B (18.3)*	B (15.7)*
East Main Street (signalized)	**D (44.8)**	D (50.6)	E (66.3)	C (33.3)*	C (32.0)*
Lakeside Plaza Entr. (signalized)	**B (14.8)**	C (23.1)	C (23.8)	B (13.2)*	B (14.4)*
Lynchburg Turnpike (signalized)	**C (28.2)**	D (52.3)	E (68.7)	B (17.2)*	C (24.1)*
Roanoke Boulevard (signalized)	**D (48.6)**	E (66.2)	E (55.1)	D (43.2)*	D (37.5)*
Indiana Street (signalized)	**E (73.8)**	E (66.2)	E (55.1)	D (43.2)*	D (37.5)*
Apperson Drive (signalized)	**F (112.9)**	F (141.3)	F (151.4)	F (158.1)*	D (40.1)*
Braeburn Drive (signalized)	**E (61.3)**	E (69.7)	E (62.1)	C (29.4)*	F (82.3)*
Ridgewood Farms (unsignalized)	**A (0.9)**	C (16.9)	-	A (0.0)*	A (0.0)*
Keagy Road North (signalized)	**F (102.4)**	F (284.6)	F (376.2)	B (20.0)*	D (44.4)*
Valley Drive/Rt.1442 (signalized)	**B (11.8)**	E (72.4)	E (71.5)	B (12.3)*	B (10.1)*
Keagy Road South (signalized)	**F (94.3)**	F (212.0)	E (73.9)	D (51.8)*	F (81.5)*
Grandin Road Extended (unsignalized)	**F (>600)**	F (>600)	F (>600)	A (2.7)*	A (0.4)*
Carriage Lane/ Grandin Road (signalized)	**F (215.2)**	F (188.4)	F (253.2)	D (45.0)*	F (319.5)*
Glen Heather Drive (unsignalized)	**F (144.8)**	F (>600)	F (862.4)	A (0.7)*	A (0.3)*
McVitty Road/Rt.1647 (unsignalized)	**F (162.4)**	A (0.1)*	A (0.4)*	F (>600)	F (>600)
McVitty Road/Rt.1642 (signalized)	**E (55.7)**	E (70.5)*	B (18.6)*	F (125.2)	D (40.0)
Postal Drive (signalized)	**D (53.2)**	E (71.9)*	A (5.9)*	D (48.7)	F (160.2)
Brambleton Avenue (signalized)	**F (105.5)**	F (110.9)*	E (62.1)*	F (147.1)	F (119.5)
Springwood Park (signalized)	**C (34.5)**	A (7.4)*	E (63.5)*	E (67.6)	-
Colonial Avenue (signalized)	**F (103.1)**	E (65.8)	F (213.6)	F (90.3)*	F (86.4)*
Promenade Park (signalized)	**C (24.5)**	F (128.1)	C (29.2)	B (17.2)*	A (6.8)*
Chaparral Drive (signalized)	**F (80.2)**	F (94.5)*	D (51.7)*	F (127.9)	F (90.4)
Bernard Drive (unsignalized)	**A (2.3)**	A (0.7)*	A (2.3)*	B (13.4)	B (12.4)
Starkey Road (signalized)	**E (68.5)**	E (55.3)*	C (24.6)*	F (181.1)	F (94.8)
Madison Square (unsignalized)	**A (2.0)**	A (1.2)*	A (1.4)*	C (24.4)	F (92.5)
Ogden Road (signalized)	**E (67.1)**	E (64.0)*	E (69.4)*	E (71.8)	E (68.5)
Tanglewood Mall West/ Elm View (signalized)	**E (76.3)**	D (38.8)*	F (107.1)*	E (70.5)	F (129.5)
Tanglewood Mall East (signalized)	**F (216.2)**	F (161.6)*	F (239.1)*	F (362.2)	F (237.5)
Route 220 SB Ramp (signalized)	**F (200.0)**	F (216.1)*	F (85.1)*	-	F (303.3)
Route 220 NB Ramp (signalized)	**B (19.7)**	A (7.2)*	C (28.8)*	D (41.3)	-

Source: Kimley-Horn and Associates, Inc.

NOTE: * Route 419

Table 4.4 - Route 419 AM Peak Hour 2035 No Build Level of Service

Intersections along Route 419	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM PEAK HOUR					
Route 311 (signalized)	D (42.2)	D (53.3)*	D (50.4)*	E (58.2)	D (35.9)
I-81 SB Ramp (signalized)	E (73.3)	F (120.2)	-	D (47.4)*	D (38.5)*
I-81 NB Ramp (signalized)	C (33.0)	-	E (60.7)	D (38.6)*	C (23.7)*
Cove Road/Rt.780 (unsignalized)	F (53.8)	-	F (511.3)	A (0.0)*	A (2.2)*
Greenridge Road (signalized)	F (133.0)	A (0.0)	F (>600)	A (5.5)*	A (4.7)*
East Main Street (signalized)	D (40.1)	D (43.7)	D (52.5)	C (29.6)*	D (38.1)*
Lakeside Plaza Entr. (signalized)	B (10.4)	D (50.4)	E (61.9)	A (4.9)*	A (9.0)*
Lynchburg Turnpike (signalized)	C (30.0)	D (50.4)	E (61.7)	B (19.8)*	C (25.9)*
Roanoke Boulevard (signalized)	E (68.5)	D (53.2)	E (65.2)	E (65.2)*	F (82.7)*
Indiana Street (signalized)	D (48.4)	E (56.6)	E (58.3)	E (61.8)*	C (20.4)*
Apperson Drive (signalized)	F (146.8)	E (77.1)	E (65.7)	F (270.8)*	F (90.6)*
Braeburn Drive (signalized)	E (57.6)	E (69.7)	D (45.2)	F (93.7)*	C (24.9)*
Ridgewood Farms (unsignalized)	A (0.1)	B (10.2)	-	A (0.0)*	A (0.0)*
Keagy Road North (signalized)	C (20.9)	E (59.3)	E (66.5)	A (10.0)*	C (21.1)*
Valley Drive/Rt.1442 (signalized)	D (40.7)	E (67.4)	E (65.0)	D (49.8)*	B (20.0)*
Keagy Road South (signalized)	C (33.3)	F (81.1)	E (71.3)	C (23.9)*	C (26.9)*
Grandin Road (unsignalized)	F (273.1)	F (>600)	F (>600)	A (1.0)*	A (2.1)*
Carriage Lane (signalized)	F (123.2)	F (90.8)	F (96.5)	F (168.3)*	E (78.5)*
McVitty Road/Rt.1647 (unsignalized)	F (174.3)	A (0.6)*	A (0.0)*	F (>600)	F (>600)
McVitty Road/Rt.1642 (signalized)	F (83.9)	D (37.6)*	E (75.6)*	F (236.2)	D (36.5)
Postal Drive (signalized)	B (11.5)	A (9.6)*	A (8.1)*	E (57.0)	E (65.5)
Brambleton Avenue (signalized)	F (82.7)	E (71.9)*	F (105.6)*	E (61.7)	F (95.9)
Springwood Park (signalized)	A (4.8)	A (3.0)*	A (5.2)*	E (67.1)	-
Colonial Avenue (signalized)	E (62.0)	D (38.2)	E (65.3)	E (62.9)*	E (72.1)*
Promenade Park (signalized)	B (16.1)	C (30.3)	C (28.0)	C (20.1)*	B (11.5)*
Chaparral Drive (signalized)	D (48.5)	D (38.7)*	E (57.4)*	D (53.3)	E (75.2)
Bernard Drive (unsignalized)	A (1.8)	A (1.0)*	A (2.1)*	B (11.7)	B (10.3)
Starkey Road (signalized)	F (86.5)	F (105.0)*	C (31.9)*	F (152.0)	E (60.3)
Madison Square (unsignalized)	A (1.3)	A (0.1)*	A (2.2)*	A (0.0)	E (45.3)
Ogden Road (signalized)	D (54.9)	F (83.8)*	C (21.2)*	E (70.7)	E (64.2)
Tanglewood Mall West/ Elm View (signalized)	E (58.8)	F (83.9)*	C (27.7)*	E (65.4)	E (67.8)
Tanglewood Mall East (signalized)	F (88.8)	F (143.9)*	C (25.4)*	E (74.7)	E (69.5)
Route 220 SB Ramp (signalized)	F (183.1)	F (107.6)*	C (29.0)*	-	F (447.2)
Route 220 NB Ramp (signalized)	E (71.8)	F (82.3)*	B (15.9)*	F (103.2)	-

Source: Kimley-Horn and Associates, Inc.

NOTE: * Route 419

Table 4.5 - Route 419 PM Peak Hour 2035 No Build Level of Service

Intersections along Route 419	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
PM PEAK HOUR					
Route 311 (signalized)	**F (159.1)**	F (401.2)*	E (61.9)*	E (73.5)	E (62.8)
I-81 SB Ramp (signalized)	**D (47.2)**	E (61.5)	-	D (48.9)*	C (24.0)*
I-81 NB Ramp (signalized)	**C (30.8)**	-	E (77.5)	C (24.4)*	C (24.6)*
Cove Road/Rt.780 (unsignalized)	**F (111.0)**	-	F (>600)	A (0.0)*	A (4.8)*
Greenridge Road (signalized)	**C (25.6)**	E (70.6)	E (79.5)	B (18.3)*	B (15.1)*
East Main Street (signalized)	**D (49.4)**	D (49.1)	E (74.4)	D (41.3)*	D (35.5)*
Lakeside Plaza Entr. (signalized)	**B (16.6)**	E (55.4)	D (45.4)	B (12.3)*	B (12.4)*
Lynchburg Turnpike (signalized)	**D (42.4)**	E (63.0)	E (69.2)	D (43.2)*	C (25.6)*
Roanoke Boulevard (signalized)	**E (71.1)**	E (74.7)	F (102.4)	D (52.6)*	E (59.9)*
Indiana Street (signalized)	**D (40.6)**	F (90.8)	E (74.8)	C (26.4)*	C (31.6)*
Apperson Drive (signalized)	**F (112.9)**	F (141.3)	F (151.4)	F (158.1)*	D (40.1)*
Braeburn Drive (signalized)	**E (61.3)**	E (69.7)	E (62.1)	C (29.4)*	F (82.3)*
Ridgewood Farms (unsignalized)	**A (0.9)**	C (16.9)	-	A (0.0)*	A (0.0)*
Keagy Road North (signalized)	**F (102.4)**	F (284.6)	F (376.2)	B (20.0)*	D (44.4)*
Valley Drive/Rt.1442 (signalized)	**B (11.8)**	E (72.4)	E (71.5)	B (12.3)*	B (10.1)*
Keagy Road South (signalized)	**F (94.3)**	F (212.0)	E (73.9)	D (51.8)*	F (81.5)*
Grandin Road (unsignalized)	**F (>600)**	F (>600)	F (>600)	A (2.7)*	A (0.4)*
Carriage Lane (signalized)	**F (215.2)**	F (188.4)	F (253.2)	D (45.0)*	F (319.5)*
McVitty Road/Rt.1647 (unsignalized)	**F (162.4)**	A (0.1)*	A (0.4)*	F (>600)	F (>600)
McVitty Road/Rt.1642 (signalized)	**E (55.7)**	E (70.5)*	B (18.6)*	F (125.2)	D (40.0)
Postal Drive (signalized)	**D (53.2)**	E (71.9)*	A (5.9)*	D (48.7)	F (160.2)
Brambleton Avenue (signalized)	**F (105.5)**	F (110.9)*	E (62.1)*	F (147.1)	F (119.5)
Springwood Park (signalized)	**C (34.5)**	A (7.4)*	E (63.5)*	E (67.6)	-
Colonial Avenue (signalized)	**F (103.1)**	E (65.8)	F (213.6)	F (90.3)*	F (86.4)*
Promenade Park (signalized)	**C (24.5)**	F (128.1)	C (29.2)	B (17.2)*	A (6.8)*
Chaparral Drive (signalized)	**F (80.2)**	F (94.5)*	D (51.7)*	F (127.9)	F (90.4)
Bernard Drive (unsignalized)	**A (2.3)**	A (0.7)*	A (2.3)*	B (13.4)	B (12.4)
Starkey Road (signalized)	**E (68.5)**	E (55.3)*	C (24.6)*	F (181.1)	F (94.8)
Madison Square (unsignalized)	**A (2.0)**	A (1.2)*	A (1.4)*	C (24.4)	F (92.5)
Ogden Road (signalized)	**E (67.1)**	E (64.0)*	E (69.4)*	E (71.8)	E (68.5)
Tanglewood Mall West/ Elm View (signalized)	**E (76.3)**	D (38.8)*	F (107.1)*	E (70.5)	F (129.5)
Tanglewood Mall East (signalized)	**F (216.2)**	F (161.6)*	F (239.1)*	F (362.2)	F (237.5)
Route 220 SB Ramp (signalized)	**F (200.0)**	F (216.1)*	F (85.1)*	-	F (303.3)
Route 220 NB Ramp (signalized)	**B (19.7)**	A (7.2)*	C (28.8)*	D (41.3)	-

Source: Kimley-Horn and Associates, Inc.

NOTE: * Route 419

2035 CAPACITY ANALYSIS

Route 419 has two typical cross sections: a two-lane, undivided section and a four-lane, median divided section. From Route 311 to Interstate 81 a two-lane, undivided section extends roughly 0.5 miles; at Interstate 81 Route 419 transitions to a four-lane, divided facility for the remainder of the study corridor. The four-lane facility typically has a landscaped median with several crossovers and channelized left-turn lanes.

Using HCM2000 methodology, the existing laneage was analyzed using future (2035) ADT volumes. Level of Service (LOS) was examined for each segment of Route 419 and in cases where the result was LOS E or LOS F, laneage was altered to until a LOS D was achieved. Findings show it may be necessary to widen Route 419 in order to accommodate future demand. The results of the HCM2000 analysis are found below in Table 4.6.

Table 4.6 - 2035 Capacity Analysis

From	To	Existing ADT (Average Daily Traffic)	Existing Laneage in Each Direction	Proposed 2035 ADT (Average Daily Traffic)	Proposed Lanes in Each Direction	2035 Segment Level of Service Analysis (with Proposed Widening)
Rt. 311	I-81	10,500	1	14,000	2*	D
I-81	NCL Salem	15,500	2	23,500	2	D
NCL Salem	E. Main St.	16,500	2	25,000	2	C
E. Main St.	Lynchburg Trnpk.	21,000	2	28,000	2	D
Lynchburg Trnpk.	Roanoke Blvd.	17,500	2	22,500	2	C
Roanoke Blvd.	Apperson Dr.	23,500	2	30,500	2	C
Apperson Dr.	Keagy Rd. (Rt. 685)	26,500	2	35,000	2	D
Keagy Rd. (Rt. 685)	Brambleton Ave. (US 221)	28,000	2	36,500	2	D
Brambleton Ave. (US 221)	Starkey Rd. (Rt. 904)	29,000	2	39,000	3*	D
Starkey Rd. (Rt. 904)	WCL Roanoke (US 220)	45,300	2	60,500	3*	D

*Proposed Widening

As shown in Table 4.6, three sections do not have the laneage to accommodate 2035 ADT volumes. From Route 311 to Interstate 81 geometric improvements should be made to extend the four-lane, median divided section of Route 419 past the Route 311 intersection. Additionally, east of Brambleton Avenue it is recommended that an additional lane be added in each direction. This would result in Route 419 being a six-lane, median divided facility between Brambleton Avenue and US 220.

2035 BUILD LEVEL OF SERVICE

Analyses were completed to determine the operating characteristics of study area intersections using Synchro Professional 7.0, which uses methodologies contained in the 2000 Highway Capacity Manual (HCM). Intersection turning movement counts were grown to a build year of 2035, with proposed geometry, and proposed signal timing plans were utilized to determine the future 2035 Build levels of service.

Level of service (LOS), describes traffic conditions by the amount of traffic congestion at an intersection or on a roadway. LOS ranges from A to F, with A indicating a condition of little or no congestion, and F indicating a condition with severe congestion, unstable traffic flow, and stop-and-go conditions. For intersections, LOS is based on the average delay experienced by all traffic using the intersection during the busiest (peak) 15-minute period. LOS A through D are generally considered acceptable.

The results are presented for 2035 AM Peak Hour LOS in Table 4.7 and 2035 PM Peak Hour LOS in Table 4.8. All proposed recommended improvements have been included.

Table 4.7 shows that all but eight intersections operate at an overall acceptable level of service D or above in the AM peak hour. The eight signalized intersections operating below an overall acceptable level of service are Roanoke Boulevard, Apperson Drive, Braeburn Drive, Grandin Road, McVitty Road/ Route 1642, Brambleton Avenue, Starkey Road, and the US 220 southbound ramp. All eight of these intersections are signalized intersections located along Route 419; and all but one of these intersections shows improvement over the 2035 No Build scenario. McVitty Road/Route 1642 has an increase in delay of .2 seconds between the 2035 No Build scenario and the 2035 Build scenario. No geometry or timing changes were made at McVitty Road/Route 1642, and the 0.2 second difference in the overall delay is attributed to an update to Synchro 7.0 which had a minor impact on some intersection results. Three intersections function at a LOS E during the AM peak hour. These intersections are Route 419 and Roanoke Boulevard, Braeburn Drive, and Brambleton Avenue. At Brambleton Avenue, however, the level of service improved from a LOS F to LOS E in the 2035 Build scenario.

Seven intersections which had an unacceptable LOS in the 2035 No Build scenario have an acceptable LOS in the 2035 Build scenario for the AM peak hour. These intersections are: I-81 southbound ramps, Green Ridge Road, Grandin Road Extension, Colonial Avenue, Tanglewood Mall West / Elm View, Tanglewood Mall East, and US 220 northbound ramps. Green Ridge Road improves from a LOS F to a LOS B, and Grandin Road Extension improves from a LOS F with a delay of over 250 seconds, to a LOS A thanks to a median closure at that location. Additionally, both Tanglewood Mall entrances improve to LOS B from an unacceptable LOS.

Table 4.7 - Route 419 AM Peak Hour 2035 Level of Service

Intersections along Route 419	Overall LOS	Level of Service by Approach (Delay in sec/veh) Eastbound	Westbound	Northbound	Southbound
AM PEAK HOUR					
Route 311 (signalized)	D (39.6)	C (31.6)*	D (47.5)*	E (56.5)	D (36.6)
I-81 SB Ramp (signalized)	C (31.4)	C (34.9)	-	C (28.2)*	C (29.5)*
I-81 NB Ramp (signalized)	C (24.3)	-	D (38.5)	C (32.7)*	B (16.2)*
Greenridge Road (signalized)	B (11.5)	A (0.0)	C (26.2)	A (9.5)*	A (7.6)*
East Main Street (signalized)	D (37.9)	D (43.2)	D (47.6)	C (28.3)*	C (36.3)*
Lakeside Plaza Entr. (signalized)	B (10.7)	D (35.9)	D (47.0)	A (5.3)*	B (10.7)*
Lynchburg Turnpike (signalized)	C (29.3)	D (43.6)	D (53.5)	C (20.7)*	C (26.9)*
Roanoke Boulevard (signalized)	E (55.6)	D (45.3)	C (28.2)	E (58.4)*	E (71.0)*
Indiana Street (signalized)	D (48.0)	E (56.6)	E (58.3)	E (60.9)*	C (20.6)*
Apperson Drive (signalized)	F (101.0)	E (61.4)	D (41.8)	F (183.6)*	E (59.0)*
Braeburn Drive (signalized)	E (56.1)	E (69.7)	D (45.2)	F (94.1)*	C (21.4)*
Keagy Road North (signalized)	B (18.3)	E (58.5)	D (50.3	A (8.5)*	B (19.8)*
Valley Drive/Rt.1442 (signalized)	D (41.2)	E (67.4)	E (65.0)	D (50.2)*	C (20.6)*
Keagy Road South (signalized)	C (30.0)	F (81.1)	E (71.3)	C (20.7)*	C (21.7)*
Grandin Road Extended (unsignalized)	A (0.4)	C (17.4)	B (11.6)	A (0.0)*	A (0.0)*
Carraige Lane/ Grandin Road (signalized)	F (111.6)	E (79.9)	E (684)	F (158.2)*	E (69.5)*
Glen Heather Drive (unsignalized)	-	C (19.6)	E (42.0)	A (0.0)*	A (0.0)*
McVitty Road/ Rt.1647 (unsignalized)	-	A (0.0)*	A (0.0)*	E (38.0)	F (58.7)
McVitty Road/ Rt.1642 (signalized)	F (84.1)	D (37.6)*	E (76.0)*	F (236.2)	D (36.5)
Postal Drive (signalized)	B (11.5)	A (9.6)*	A (8.1)*	E (57.1)	E (65.7)
Brambleton Avenue (signalized)	E (65.9)	E (55.1)*	F (89.6)*	E (58.1)	E (56.7)
Springwood Park (signalized)	A (6.0)	A (3.4)*	A (7.3)*	E (67.1)	-
Colonial Avenue (signalized)	D (43.9)	D (50.6)	D (46.2)	D (39.1)*	D (44.2)*
Promenade Park (unsignalized)	A (1.1)	F (84.1)	E (42.6)	A (0.2)*	C (0.0)*
Chaparral Drive (signalized)	D (46.0)	D (35.4)*	D (54.7)*	D (53.0)	E (70.8)
Bernard Drive (unsignalized)	A (1.8)	A (1.0)*	A (2.1)*	B (11.8)	B (10.3)
Starkey Road (signalized)	F (80.8)	F (102.5)*	C (32.0)*	F (131.7)	D (54.9)
Madison Square (unsignalized)	A (0.4)	A (0.0)*	A (0.5)*	A (0.0)	D (26.2)
Ogden Road (signalized)	D (54.0)	F (83.8)*	B (19.2)*	E (70.7)	E (64.2)
Tanglewood Mall West/ Elm View (signalized)	B (12.4)	A (7.2)*	B (17.6)*	E (65.4)	E (72.0)
Tanglewood Mall East (signalized)	B (18.5)	C (23.6)*	A (9.2)*	E (68.0)	E (69.5)
US 220 SB Ramp (signalized)	F (139.5)	C (22.6)*	C (29.0)*	-	F (447.2)
US 220 NB Ramp (signalized)	C (24.1)	A (2.4)*	B (15.9)*	F (103.2)	-

Source: Kimley-Horn and Associates, Inc.

NOTE: * Route 419

Table 4.8 shows that all but ten intersections operate at or above an overall acceptable LOS D in the PM peak hour. The eleven intersections along Route 419 operating at an overall LOS E or F are all signalized intersections and are located at Braeburn Drive, Keagy Road South, Carriage Lane/Grandin Road, McVitty Road/Route 1642, Brambleton Avenue, Colonial Avenue, Chaparral Drive, Starkey Road, Ogden Road, Tanglewood Mall 2, and the US 220 southbound ramp. Of these intersections, however, all except for Braeburn Drive had a reduction in delay between the 2035 No-Build and Build scenarios. The increase in Braeburn Drive's delay was 0.3 seconds from 61.3 seconds to 61.6 seconds. This increase can be attributed to an updated version of Synchro 7.0 and can be found at other intersections as well. Eight of the eleven intersections below an acceptable level of service operate at a LOS E during the 2035 PM Build scenario. The three intersections operating at a LOS F are Carriage Lane/Grandin Road (signalized), Brambleton Avenue and US 220 southbound ramps. At Carriage Lane the LOS F can be attributed to the median closures at Grandin Road Extension and Glen Heather Drive, thus diverting traffic away from those intersections and to the nearest major intersection, Carriage Lane/Grandin Road at Route 419.

Many intersections show significant improvement in the 2035 Build scenario. Five intersections which were operating at an unacceptable LOS in the 2035 No Build scenario operate at an acceptable LOS in the 2035 Build scenario. These five intersections are Route 311, Roanoke Boulevard, Apperson Drive, Keagy Road North, and Tanglewood Mall West / Elm View. Tanglewood Mall West / Elm View shows the most improvement; it's overall delay and LOS in the 2035 No Build scenario was 76.3 seconds, LOS E. In the 2035 Build scenario this intersection operates at an LOS B with an overall delay of 18.4 seconds.

Table 4.8—Route 419 PM Peak Hour 2035 Level of Service

Intersections along Route 419	Overall LOS	Level of Service by Approach (Delay in sec/veh) Eastbound	Westbound	Northbound	Southbound
PM PEAK HOUR					
Route 311 (signalized)	D (36.9)	B (15.7)	C (34.0)	E (73.5)	E (62.8)
I-81 SB Ramp (signalized)	C (23.6)	C (28.4)	-	B (17.2)	C (28.6)
I-81 NB Ramp (signalized)	C (23.7)	-	D (48.6)	C (21.1)	B (19.0)
Greenridge Road (signalized)	B (17.8)	D (53.4)	D (37.6)	B (15.5)	B (13.0)
East Main Street (signalized)	D (43.1)	E (49.1)	E (55.4)	E (37.4)	C (32.8)
Lakeside Plaza Entr. (signalized)	B (18.2)	C (28.5)	C (28.7)	B (16.7)	B (17.3)
Lynchburg Turnpike (signalized)	D (42.3)	E (63.9)	E (68.5)	D (43.0)	C (25.4)
Roanoke Boulevard (signalized)	D (51.5)	E (54.9)	D (52.5)	D (49.1)	D (50.3)
Indiana Street (signalized)	D (42.4)	F (90.8)	E (74.8)	C (25.9)	D (36.9)
Apperson Drive (signalized)	D (53.2)	F (90.7)	E (59.2)	D (41.7)	D (38.5)
Braeburn Drive (signalized)	E (61.6)	E (69.7)	E (62.1)	C (29.8)	F (82.6)
Keagy Road North (signalized)	D (44.8)	F (85.8)	F (84.2)	B (19.3)	D (44.4)
Valley Drive/Rt.1442 (signalized)	B (12.4)	E (72.4)	E (71.5)	B (11.8)	B (11.5)
Keagy Road South (signalized)	E (78.9)	F (212.0)	E (73.9)	C (20.9)	E (70.8)
Grandin Road Extended (unsignalized)	-	C (15.3)	D (29.3)	A (0.0)*	A (0.0)*
Carraige Lane/ Grandin Road (signalized)	F (179.3)	E (70.3)	F (93.9)	E (66.0)	F (294.1)
Glen Heather Drive (unsignalized)	-	C (19.4)	F (52.8)	A (0.0)*	A (0.0)*
McVitty Road/ Rt.1647 (unsignalized)	-	A (0.0)*	A (0.0)*	F (97.0)	F (68.9)
McVitty Road/ Rt.1642 (signalized)	E (55.7)	E (70.5)	B (18.8)	F (125.2)	D (40.0)
Postal Drive (signalized)	D (53.2)	E (71.8)	A (6.0)	D (48.7)	F (160.2)
Brambleton Avenue (signalized)	F (81.9)	F (92.4)	D (54.8)	F (118.6)	E (75.3)
Springwood Park (signalized)	C (34.9)	A (7.2)	E (64.4)	E (67.6)	-
Colonial Avenue (signalized)	E (63.9)	D (50.8)	D (54.7)	E (71.8)	E (62.8)
Promenade Park (unsignalized)	A (8.5)	F (203.5)	F (91.0)	A (0.2)*	A (0.3)*
Chaparral Drive (signalized)	E (65.0)	E (78.7)	D (42.4)	F (94.9)	E (70.6)
Bernard Drive (unsignalized)	A (2.3)	A (0.7)*	A (2.3)*	B (13.9)	B (12.4)
Starkey Road (signalized)	E (60.8)	D (55.0)	C (24.3)	F (141.6)	F (87.9)
Madison Square (unsignalized)	A (2.0)	A (1.2)	A (1.4)	C (24.4)	F (92.5)
Ogden Road (signalized)	E (60.8)	E (55.4)	E (61.9)	E (71.8)	E (77.9)
Tanglewood Mall West/ Elm View (signalized)	B (18.4)	B (13.3)*	B (13.1)*	E (70.5)	F (129.5)
Tanglewood Mall East (signalized)	E (62.0)	C (30.2)	D (50.3)	F (95.9)	F (237.5)
US 220 SB Ramp (signalized)	F (183.9)	F (180.1)	F (85.1)	-	F (303.3)
US 220 NB Ramp (signalized)	B (18.6)	A (5.2)	C (28.8)	D (41.3)	-

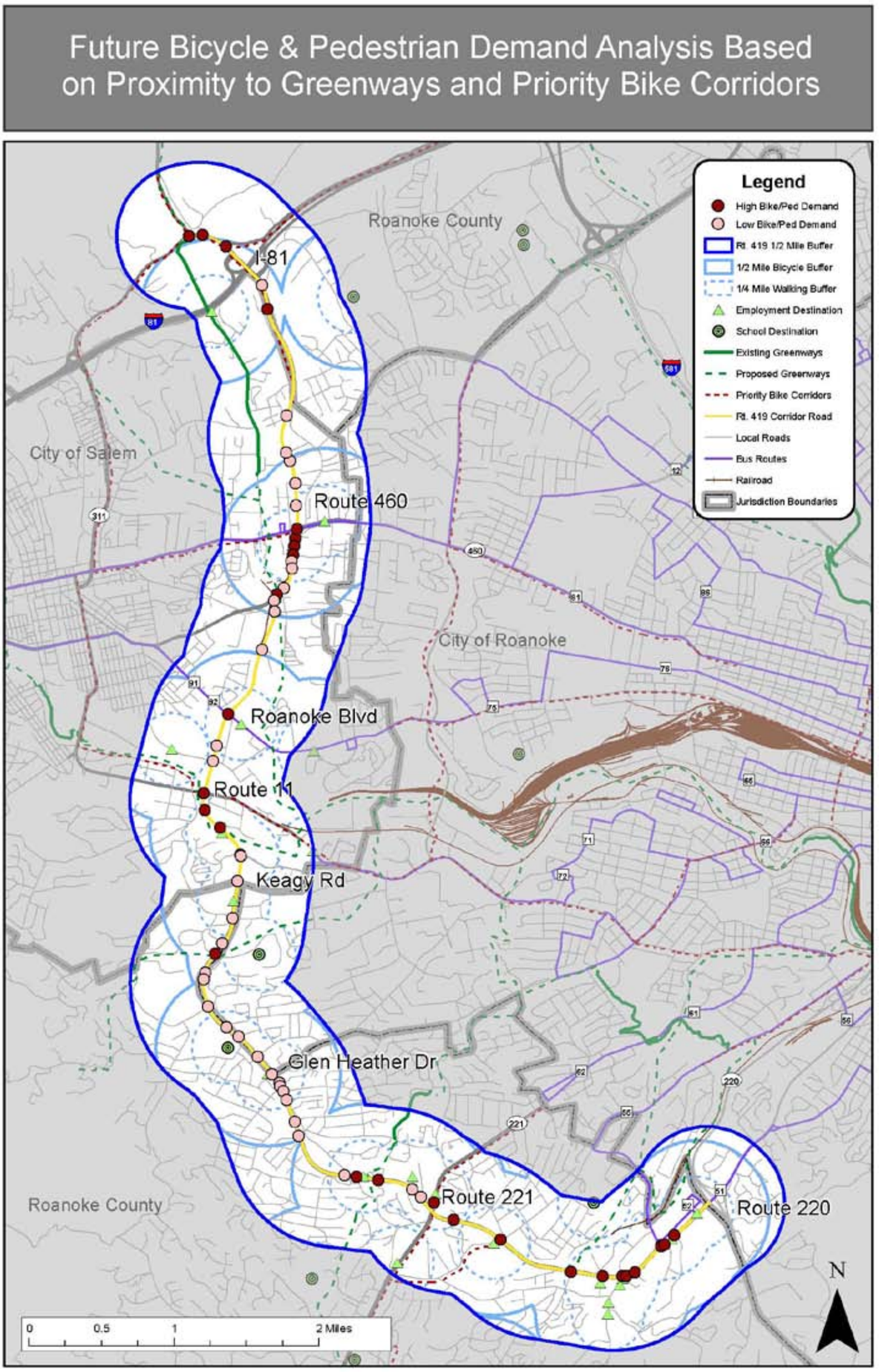
Source: Kimley-Horn and Associates, Inc.

NOTE: * Route 419

FUTURE DEMAND FOR BICYCLES AND PEDESTRIANS

Given that there was a limited amount of future data for the area along the Route 419 corridor the future bicycle and pedestrian demand analysis was based largely on proximity to proposed greenways and proposed priority bicycle corridors. For this analysis a GIS shapefile was created containing points for every intersection in the Rt. 419 corridor that was within the half mile buffers of major destinations, similar to the existing conditions analysis. It was determined that every intersection was within a half mile of a proposed greenway or priority bike corridor. In order to prioritize the intersections based on their needs for bicycle accommodations the intersecting roads were further analyzed. If a proposed greenway or priority bicycle corridor started or stopped at an intersection it was classified as a high priority area. If one of the roads making up the intersection eventually connected to the proposed greenway or priority bicycle corridor it was also classified as a high priority because it was deemed to have direct access to the proposed greenways or bicycle corridors. If an intersection or its other roads did not directly meet a proposed greenway or bicycle corridor it was classified as a low priority.

Figure 4.3


Future Bicycle & Pedestrian Demand Analysis Based on Proximity to Greenways and Priority Bike Corridors
Legend
High Bike/Ped Demand
Low Bike/Ped Demand
Rt. 419 1/2 Mile Buffer
1/2 Mile Bicycle Buffer
1/4 Mile Walking Buffer
Employment Destination
School Destination
Existing Greenways
Proposed Greenways
Priority Bike Corridors
Rt. 419 Corridor Road
Local Roads
Bus Routes
Railroad
Jurisdiction Boundaries
Roanoke County
I-81
City of Salem
Route 460
City of Roanoke
Roanoke Blvd
Route 11
Keagy Rd
Glen Heather Dr
Route 221
Route 220
Roanoke County
0
0.5
1
2 Miles
N

PARK AND RIDE AND TRANSIT DEMAND ANALYSIS

The following outlines a current and future demand analysis for park and ride and transit service on the Route 419 corridor. Data analysis includes travel demand model trip generation by TAZ provided by the Roanoke Valley Alleghany Regional Commission and AADT counts from the Virginia Department of Transportation.

PARK AND RIDE SERVICE

An indication of high demand for park and ride service along Route 419 is the ability for the lots to be used in multiple ways. In particular, park and ride lots along 419 could be used by residents commuting to Roanoke's central business district and by residents commuting to employers located along 419. Based on these two different types of park and ride utilization methods, two different demand analyses were conducted. The first was a traditional demand evaluation that analyses commute trips to the central business district. The second was an analysis that evaluates the potential park and ride use for workers commuting to Electric Road. Both analyses evaluate the current and future demand of park and ride service along 419.

Central Business District Analysis

For the purpose of this analysis both existing lots were analyzed along with six potential park and ride locations identified along Electric Road. The potential sites occur at the intersection of US 460, Roanoke Boulevard, Keagy Road, Glen Heather Drive, US 221, and Tanglewood Mall. These locations were chosen based on attributes such as the presence of transit service, high traffic flow, and/or existing facilities to support a park and ride lot.

As seen in Table 4.9 below, population and trips going to the central business district of Roanoke were calculated for TAZs within 1 mile of each existing and potential park and ride location. A ratio of the number of parking spaces used to the population within 1 mile of each park and ride lot was used to predict relative demand at each site. Results of the analysis suggest that transit service may play a vital role in park and ride utilization.

Table 4.9 - TAZ Analysis within 1 mile of Park and Ride Location (2005)

	2005				
	Population (w/in 1 Mile)	Trips to CBD	Lot Spaces	Spaces Used	Population/Use
Exit 140	5657	561	59	48	0.84%
Route 311/419	6092	776	67	36	0.59%
US 460	11795	1399	n/a	100	0.84%
Roanoke Boulevard	11215	1618	n/a	95	0.84%
Keagy Road	13663	2113	n/a	115	0.84%
Glen Heather Drive	14253	1698	n/a	85	0.59%
US 221	21818	2909	n/a	130	0.59%
Tanglewood Mall	20049	4470	n/a	169	0.84%

Table 4.1 projects these figures to 2035 to represent the future demand of each site. The same population to use ratio calculated for 2005 was used to project the effect the increase in population will have on demand for park and ride services. The Orange Market park and ride lot analysis zone is expecting considerable growth, which will potentially increase lot usage by almost 12%. Adding transit service to the lot may have an even greater effect on this increased use. Additionally, the potential sites in the southern part of the corridor show more growth than sites in the north. This suggests that placement of park and ride service in the southern part of the corridor may capture more use in the future than elsewhere.

The findings above are also supported spatially. Figure 4.4 depicts the existing and potential park and ride lot locations, their proximity to major corridors, bus routes, and number of trips going to TAZs in Roanoke's central business district in 2005. Supported by the table above, Figure 4.4 shows the greatest number of trips going to the CBD in TAZs around Tanglewood Mall and the US 221/Route 419 intersection. Other pockets of moderate activity level occur near Keagy Rd, Roanoke Blvd, and US 460. Additional TAZs with high activity levels are located near Roanoke's downtown and therefore would most likely not utilize a park and ride lot, particularly not one located along Electric Road. In comparison, Figure 4.5 depicts TAZ activity level in 2035. Although overall figures are higher, the spatial patterns remain consistent.

Table 4.1 TAZ Analysis within 1 mile of Park and Ride Location (2035)

	2035					Increase in Use
	Population (w/in 1 Mile)	Trips to CBD	Lot Spaces	Spaces Used	Population/ Use	
Exit 140	6023	617	59	51	Exit 140	6.47%
Route 311/419	6819	891	67	40	Route 311/419	11.93%
US 460	12272	1575	n/a	104	0.84%	4.04%
Roanoke Boulevard	11840	1865	n/a	100	0.84%	5.57%
Keagy Road	14895	2459	n/a	126	0.84%	9.02%
Glen Heather Drive	15862	1970	n/a	94	0.59%	11.29%
US 221	24603	3448	n/a	146	0.59%	12.76%
Tanglewood Mall	22650	5223	n/a	191	0.84%	12.97%

Figure 4.4

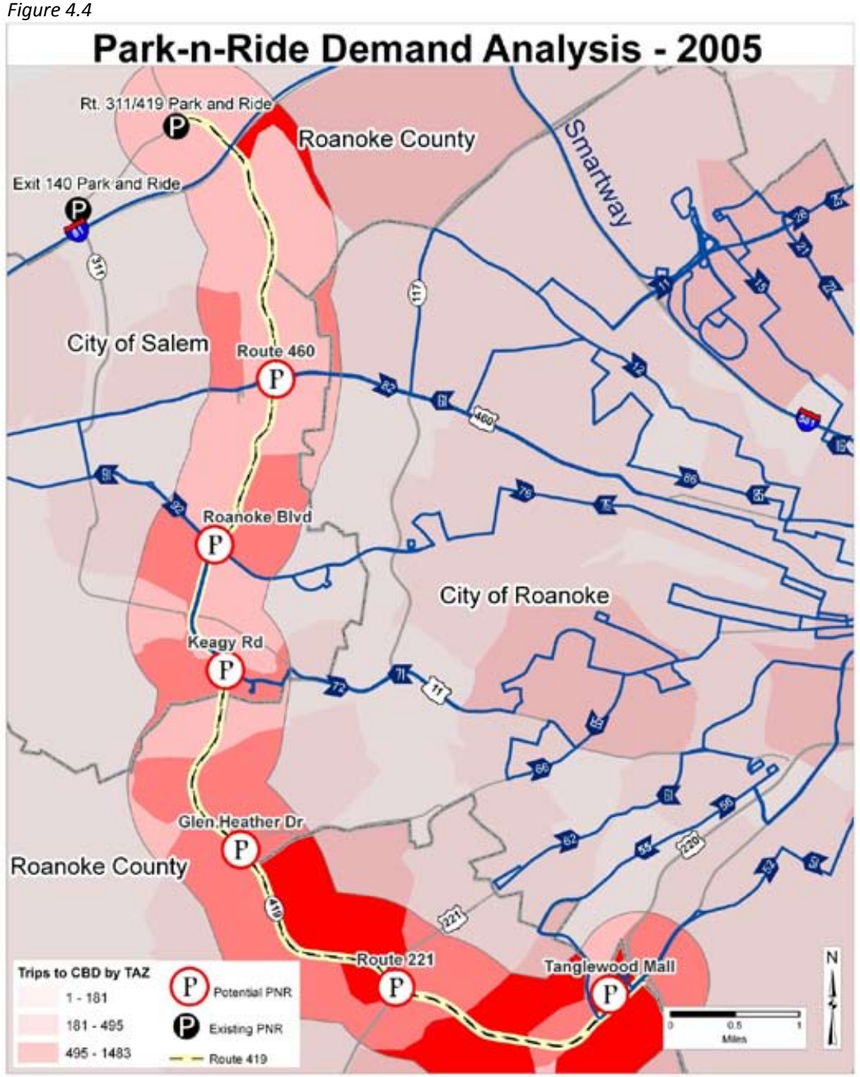


Figure 4.14

Figure 4.5

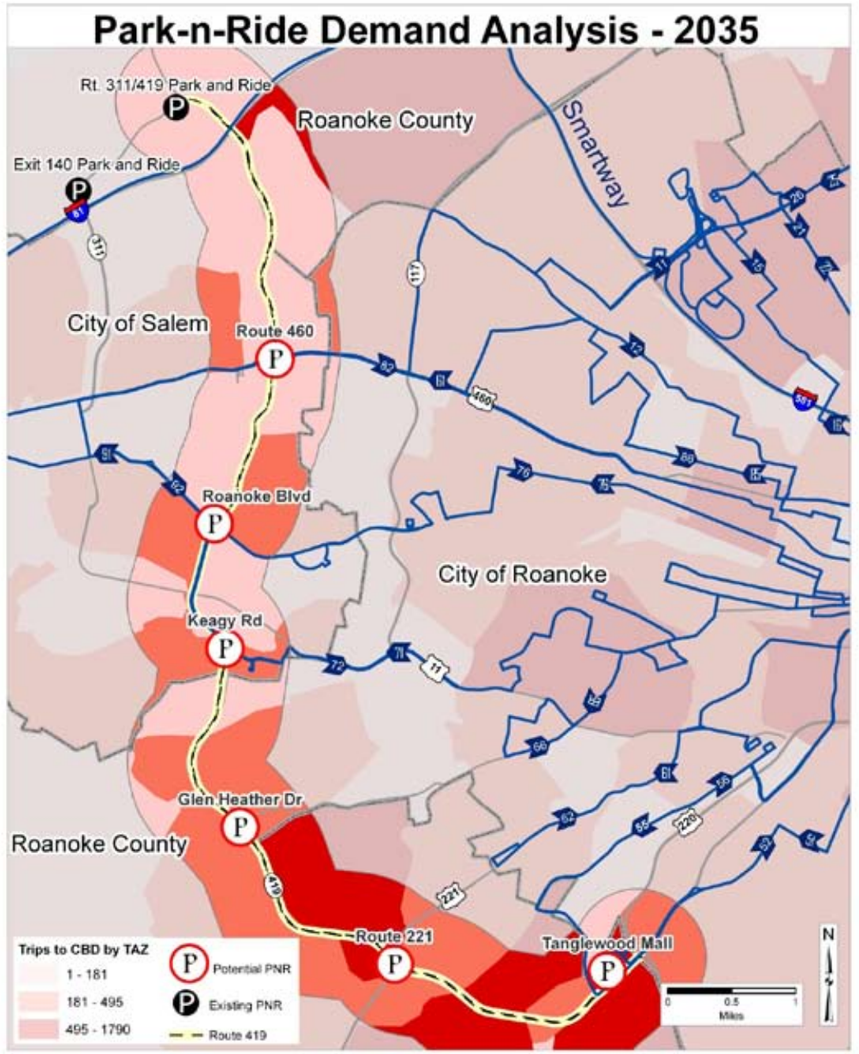


Figure 4.15

Corridor Analysis

The park and ride corridor demand analysis focuses on context sensitive data by targeting citizens that both work and live along the corridor. The utilization of park and ride service for these residents is directly linked with the potential for transit service along Electric Road. The combination of park and ride service and transit service will help disseminate the nearly 11,000 workers along the corridor and provide connections to several existing transit routes; granting additional mobility to the region.

Regional TAZ data and Census 2000 block data was utilized in this analysis. Census 2000 block data was used to target the specific number of residents living within a half mile of the corridor whose employment sites are also along Route 419. This census data was spatially joined with the TAZ data used in the Central Business District Analysis so that an employment growth rate could be applied to the census data and project these figures to 2035. The data was then summarized by the two existing park and ride lots and the six potential park and ride locations discussed above. Table 4.11 shows the results of this analysis.

Table 4.11 depicts the number of workers that live in TAZs within a half mile of each park and ride lot location. As a result, many of the workers could potentially walk or bike to park and ride locations or take advantage of very short driving distances. In 2000, there was a total of 2,447 workers that lived within a half mile of each lot location. By 2035, this number increases to nearly 3,000. Consistent with the activity levels along Route 419, few workers live in the northern part of the corridor near the existing park and ride lots. However, the number of workers increases sharply at US 460 and is also high around Glen Heather Drive and US 221. Notably, the number of workers is expected to increase by nearly 60% around the intersection with Roanoke Boulevard.

Table 4.11 - Route 419 Workers Living in TAZs within a ½ mile of Park & Ride Locations along the Corridor

	Route 419 Workers within a 1/2 Mile		
	2000	2035	Growth Rate
Exit 140	53	59	11.3%
Route 311/419	11	12	9.1%
US 460	419	466	11.2%
Roanoke Boulevard	195	306	56.9%
Keagy Road	183	195	6.6%
Glen Heather Drive	574	674	17.4%
US 221	704	845	20.0%
Tanglewood Mall	308	362	17.5%

TRANSIT SERVICE

In order to predict transit demand along the Route 419 roadway, the corridor was divided into 5 sections in accordance with the intersections referenced in the park and ride demand analysis. Traffic counts from each section of the roadway were collected and averaged to reflect the average daily traffic

for each segment. These segment traffic counts were used to approximate bus ridership and to compare different levels of activity occurring along the corridor.

Industry standards suggest that bus ridership for rural/suburban transit routes is approximately 1% of the total daily trips. Daily trips are calculated using the AADT figures multiplied by the average number of passengers per vehicle. However, data regarding passenger count for the study area is unavailable, therefore only AADT data was utilized. The 1% industry standard is supported by data gathered in the study area as well. As previously discussed in Chapter 3, the average percent of commuters using transit is approximately 2%, along the corridor this percent drops to almost 0% transit use. Using 1% as a benchmark to approximate ridership is about halfway between the regional and the corridor transit use average.

Traffic count estimates from 2035 were also used to predict the future demand for transit along the corridor. The number of trips made by trucks was excluded from the calculations since commercial and freight truck trips are unlikely to utilize bus service as an alternative means of transportation. Table 4.12 illustrates a similar pattern to many other spatial analyses of the corridor, showing higher levels of activity occurring along the southern segments of the corridor. Potential for ridership is lowest between the Orange Market park and ride lot, at the corner of Route 311 and 419, and the intersection of 419 and 460. Approximate ridership increases steadily moving south along the corridor and has the most potential for ridership in the southern most roadway segment analyzed, between US 221 and Tanglewood Mall.

Table 4.12 - Approximate Bus Ridership for 2035

Road Segment	2035 AADT	% Truck Traffic	2035 AADT (no truck)	Approx. Bus Ridership	Change
Rt 311/419 to US 460	19,401	0.05	18,431	184	54
US 460 to Roanoke Blvd	27,872	0.04	26,757	268	29
Roanoke Blvd to Keagy Rd	37,135	0.03	36,021	360	60
Glen Heather Drive to US 221	40,340	0.02	39,533	395	82
US 221 to Tanglewood Mall	53,980	0.01	53,440	534	138
Corridor Average	35,746	0.03	34,673	347	71

RECOMMENDATIONS

V RECOMMENDED IMPROVEMENTS

The previous chapter described the traffic operations and demand analysis for multimodal accommodations on the corridor. This chapter describes the recommended transportation improvements for roadway, bicycle, pedestrian, transit and park-and ride services on the corridor.

Short, mid, and long-term recommendations have been developed for the Route 419 corridor intersections as listed on the following pages. These recommendations were assembled from multiple sources, as well as from field visits and observations by the project team. Listed below is a general description of the short, mid, and long-term categories. Please note that depending on the phasing of the improvements, many items listed can overlap between the three categories (short, mid, and long-term improvements). For example, the recommendation to have an existing span wire traffic signal to a mast arm would push the installation of pedestrian signal heads to a short-term and mid-term improvement.

Short-Term Recommendation Description:
Short-term (0 to 5 years) – low cost, quick to implement, similar to Traffic System Management (TSM) that includes signage, pavement markings, traffic control changes, minor intersection improvements (turn lanes within right-of-way and curb radii improvements), traffic signalization installation, traffic signal interconnection, traffic signal timings, minor pedestrian improvements (crosswalks, ADA compliance, countdown heads, signing and pavement markings), street lighting, access modifications, median closure, access management strategies, minor policy changes.

Mid-Term Recommendation Description:
Mid-term (5 to 10 years) – often require detailed plans and will require some right-of-way acquisition, with costs up to $2-3 million including turn-lane improvements with right-of-way acquisition, crossover adjustments, access consolidation, accommodations for minor multi-modal facilities (bus stops and pull-outs), sidewalk, maintenance programs, street enhancements, access management strategies.

Long-Term Recommendation Description:
Long-term (10 to 20 years) – requires detailed planning, design and public involvement that will take a minimum 3-5 years and costs typically in excess of $3 million including roadway widening, realignments, curve flattening, bridge/culvert modifications, major access improvements, interchange improvements/modifications, interchange reconstruction, major multi-modal facilities, and access management strategies.

ROADWAY IMPROVEMENTS

The roadway improvements presented on the following pages include recommendations to improve sidewalk and pedestrian features associated with right of way and intersection improvements. All improvements shall be designed to VDOT standards and specifications and all recommended turn lanes will need to meet minimum design standards.

For purposes of this study and for clarity, Route 419 will be referenced as a north/south corridor throughout the recommendations.

Figures 5.1 through 5.4 show the existing geometries and illustrate the recommendations described in this chapter.

Planning-level estimates of probable costs have been included for all recommendations with the exception of the sidewalk improvements and pedestrian and bicycle trails which are included at the end of this section. These planning-level cost estimates have been based on VDOT's statewide two-year cost averages, the VDOT Transportation & Mobility Planning Division's "Statewide Planning Level Cost Estimates" worksheet, and familiarity with similar projects and improvements throughout Virginia. Due to fluctuations in the costs of labor, materials, and equipment, fluctuations in the market and the outcome of competitive bidding, and the general planning-level nature of the recommendations, these estimated costs are neither exact nor guaranteed. Variation between actual and estimated costs will change as time passes, and the time value of money has not been taken into account. Cost estimations performed using the "Statewide Planning Level Cost Estimates" worksheet include right-of-way acquisition cost estimates developed with the sheet's methodology. The cost breakdown per scenario includes engineering costs, landscaping costs, pavement marking costs, roadway costs, rigid material costs (milling, overlay, sidewalks, channelization, etc.), and signal costs (timing and construction). Furthermore, a 40 percent contingency was applied to each item which includes costs for PE, Construction, Mobilization, and MOT. For each intersection the cost estimate has been rounded to the nearest $100 and has been broken down into short, mid-, and long-term improvements. Right-of-Way costs were based on a breakdown of approximately 25%-35% for rural sections, 50% - 65% for the residential/suburban low density, and 60%-100% for the outlying business/suburban high density areas. A detailed breakdown of the estimated probable costs is included in the Appendix.

OVERALL SHORT-TERM IMPROVEMENTS

The segments of Route 419 from I-81 to US 220 fall under the new VDOT Access Management Regulations. VDOT regulations stipulate that access points must meet both VDOT standards and any local standards. All new development along the corridor must follow these new standards.

In addition, regular maintenance of the roadway shoulders, including debris removal, should be undertaken to ensure safe bicycle accommodations.

1. ROUTE 311 (SIGNALIZED)

Short-Term Improvements – ($125,000 - $165,000)

- Install street name signs on mast arms.
- Restripe entire intersection (including stop bars and pavement arrows).
- Repair guardrail on the northwest and southwest corner of Route 311/Route 419 and on the north and south side of Route 419 southeast of Route 311/Route 419
- Replace broken signal head backplate on southbound approach.
- Install pedestrian count-down signal heads/push-buttons and pedestrian crossing signs on each corner of the intersection.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($500,000 - $600,000)

- Construct a southbound left-turn lane on Route

311 to accommodate future traffic volume.

- Construct a northbound right-turn lane on Route 419 to accommodate future traffic volumes (projected over 500 veh in PM peak hour).
- Install a pedestrian and bicycle crossing to connect the Hanging Rock Battlefield Trail and the Masons Creek Greenway. Future improvements may be made to the Rt. 311 Bridge over Masons Creek to accommodate pedestrians and connect to the Hanging Rock Battlefield Memorial.
- Replace all mast arms. Existing mast arms are rusted and in poor condition.

2. I-81 SB ON-OFF RAMPS (SIGNALIZED)

Short-Term Improvements

The crash history at the intersection of I-81 SB Ramps/Route 419 has two rear ends and two angle collisions due to the current yield sign at the SB Off-Ramp.

Alternative 1 – ($6,000 - $8,000)

- Restripe northbound approach at intersection (including stop bars and pavement arrows).
- Restripe the southbound exit ramp right-turn lane with a stop bar remove the "YIELD" sign and install a "STOP" (R1-1) sign.

Alternative 2 – ($4,500 - $6,500)

- Restripe intersection to provide one southbound lane on Route 419 and stripe the second southbound lane to accommodate a free flow right-turn for the SB Off-Ramp. The future capacity of striping one southbound through lane is valid up to 2035 analysis year when two southbound lanes will be needed to provide adequate capacity.

Mid-Term Improvements – ($150,000 – $190,000)

- Construct eastbound dual left-turn lanes (SB I-81 exit ramp) to accommodate future volumes in 2035 (PM).

Long-Term Improvements - ($2,500,000 - $3,000,000)

- Construct an acceleration lane on Route 419 to accommodate the eastbound channelized right-turn free flow lane exiting off SB I-81 (projected over 700 veh in the PM peak hour). Restripe approach and install "Yield' (R1-2) sign. This recommendation will require for the I-81 Bridge to be widened to accommodate an additional southbound lane on Route 419 and to provide an adequate transition distance.

3. I-81 NB ON-OFF RAMPS (SIGNALIZED)

Short-Term Improvements – ($10,500 - $12,500)

- Restripe northbound and southbound approaches (including stop bars, pavement arrows, and mini skips – pavement markings that guide left-turn traffic).
- Install R4-7, "Keep Right" sign and median delineators in south median to increase visibility. Based on current median nose configuration, it appears to have been hit multiple times.

Mid-Term Improvements – ($150,000 – $190,000)

- Construct westbound dual left-turn lanes (NB I-81 exit ramp) to accommodate future volumes in 2035 (AM).

4. GREEN RIDGE ROAD (SIGNALIZED)

Mid-Term Improvements – ($150,000 – $190,000)

- Construct westbound dual left-turn lanes on Green Ridge Road to accommodate future volumes in 2035 (AM).
- Construct sidewalk south of the intersection on the east side of Route 419.

5. EAST MAIN STREET (SIGNALIZED)

Short-Term Improvements – ($2,500 - $3,000)

- Replace street name signs on mast arms so they are an acceptable size based on the intersection size.

Mid-Term Improvements – ($140,000 - $180,000)

- Construct a westbound right-turn lane on East Main Street to accommodate future volumes.
- Construct sidewalk south of the intersection to Lakeside Plaza Driveway/Springfield Avenue on the west side of Route 419.

6. LAKESIDE PLAZA DRIVEWAY/ SPRINGFIELD AVENUE (SIGNALIZED)

Short-Term Improvements– ($100,000 - $110,000)

- Install street name signs on all mast arms.
- Replace guardrail and median markers south of Lakeside Plaza.
- Upgrade traffic signal to include pedestrian count-down signal heads/pushbuttons and pedestrian crossing signs on each corner of the intersection.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements– ($25,000 - $30,000)

- Relocate existing access point located on the southeast corner of intersection. This access needs to be reconfigured perpendicular to Springfield Avenue and at least a few hundred feet from the intersection.
- Construct sidewalk south of the intersection to Lynchburg Turnpike on the west side of Route 419.

7. LYNCHBURG TURNPIKE (SIGNALIZED)

Short-Term Improvements – ($13,000 - $17,000)

- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($75,000 - $95,000)

- Construct sidewalk south of the intersection to Roanoke Boulevard on the west side of Route 419.
- Existing eastbound through-right-turn lane is very short. Consider lengthening the through-right-turn lane and adding additional storage to standardize this approach and separate the shared through-right-turn traffic from the left-turn storage lane.

8. ROANOKE BOULEVARD (SIGNALIZED)

Short-Term Improvements – ($95,000 - $110,000)

- Consider retiming intersection to resolve queuing issues on the eastbound approach. Long queue observed in the AM peak hour.
- Upgrade traffic signal to include pedestrian

count-down signal heads/pushbuttons and pedestrian crossing signs on each corner of the intersection.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($550,000 - $600,000)
- Construct westbound dual left-turn lanes on Roanoke Boulevard to accommodate future PM volumes.
- Construct eastbound right-turn lane on Roanoke Boulevard to accommodate future traffic volumes.
- Based on conversations with City of Salem, the railroad tracks that exist on the west leg on Roanoke Boulevard are still in use. Even though the frequency is not high, due to safety issues it is recommended railroad emergency preemption devices and gates are installed along the west leg of Roanoke Boulevard. Currently the railroad tracks are located approximately 100 feet west of the intersection of Roanoke Boulevard and Route 419.
- Construct sidewalk south of the intersection to Indiana Street on the both sides of Route 419.

9. INDIANA STREET (SIGNALIZED)

Short-Term Improvements – ($95,000 - $105,000)
- Install crosswalks, pedestrian signal heads, and ADA ramps to accommodate pedestrian activity.

Mid-Term Improvements – ($375,000 - $425,000)
- Replace span wire traffic signal with mast-arm traffic signal and include pedestrian count-down signal heads/pushbuttons and pedestrian crossing signs on each corner of the intersection.
- Install street names signs on mast arms. Include intersection street lighting.
- Construct sidewalk south of the intersection to Apperson Drive on the west side of Route 419.

10. APPERSON DRIVE (SIGNALIZED)

Northbound left is projected to be 180% capacity with many other movements well over 100% capacity.

Short-Term Improvements – ($18,000 - $22,000)
- Consider retiming signal to accommodate heavy northbound left-turn and eastbound right-turn volumes.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($375,000 - $425,000)
- Replace span wire traffic signal with mast-arm traffic signal and include pedestrian count-down signal heads/pushbuttons and pedestrian crossing signs on each corner of the intersection. Include intersection street lighting.
- Install street names signs on mast arms.
- Construct sidewalk on both the east and west sides of Route 419 both north and south of the intersection providing connectivity to adjacent intersections.

Long-Term Improvements - ($4,000,000 - $5,000,000)
Complete reconfiguration of intersection
(See Figures 5.1 and 5.2)

- Construct a continuous right-turn free-flow lane on Apperson Drive in the eastbound direction. A transition lane is recommended on Route 419 to allow traffic to merge into the existing two lanes in the southbound direction on Route 419.
- Construct northbound dual left-turn lanes on Route 419 to accommodate future 2035 volumes (AM). To create proper alignment, also construct southbound dual left-turn lanes on Route 419. This requires reconstruction of the bridge over the Roanoke River and widening of Apperson Drive to accommodate dual receiving lanes.
- Construct eastbound dual left-turn lanes on Apperson Drive to accommodate future 2035 volumes (AM). This requires widening of Apperson Drive and the reconstruction of the bridge over the Roanoke River.
- When the Apperson Bridge reconstruction occurs it is recommended the Roanoke River Greenway is connected to Route 419.

11. BRAEBURN DRIVE (SIGNALIZED)

Short-Term Improvements – ($15,000 - $17,000)

- Add an R4-7, "Keep Right" sign on the north leg of the intersection.
- Install "Intersection Ahead" or W3-3 signage along the southbound approach of Route 419 to address sight distance issues.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements– ($575,000 - $625,000)

- Construct dual left-turn lanes in the southbound direction along Route 419 to accommodate 2035 volumes (AM).
- Install street names signs on mast arms.
- The intersection of Route 419 and Braeburn Drive presently has crosswalk striping on the south side of Rt. 419, however does not have a pedestrian signal phase or push-button activation. This area has many pedestrian generators and attractors, such as Lewis Gale Medical Center, apartment complexes, and shopping centers. There are also several Valley Metro stops near this intersection.
- It is recommended that the span wire traffic signal is replaced with mast-arm traffic signal and include pedestrian count-down signal heads/pushbuttons and pedestrian crossing signs on each corner of the intersection. Include intersection street lighting.
- Construct sidewalk north of the intersection on both the east and west sides of Route 419 and south of the intersection on the east and west sides of Route 419 to North Keagy Road.

12. NORTH KEAGY ROAD SIGNALIZED)

Short-Term Improvements – ($14,500 - $16,500)

- Install a R4-7, "Keep Right" sign on the west leg of the intersection.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($750,000 - $800,000)

- Construct westbound dual left-turn lanes on Keagy Road North to accommodate 2035 volumes (PM).
- Construct an eastbound right-turn lane on Keagy Road North.
- Replace span wire traffic signal with mast-arm

traffic signal and include pedestrian count-down signal heads/pushbuttons and pedestrian crossing signs on each corner of the intersection. Include intersection street lighting.

- Install street names signs on mast arms.
- The intersection of Route 419 and Keagy Road presently has crosswalk striping on the north side of Rt. 419, however does not have a pedestrian signal phase or push-button activation. This area has many pedestrian generators and attractors, such as Lewis Gale Medical Center, apartment complexes, and shopping centers. It is recommended a pedestrian signal phase is added, along with pedestrian push-button activation.
- Construct sidewalk on both the east and west sides of Route 419 north to Braeburn Drive. South of the intersection construct sidewalk on the east side approximately 800 feet to the full access driveway, and on the west side connecting to the proposed Barnhardt Creek Greenway.

13. HIDDEN VALLEY SCHOOL ROAD / VALLEY DRIVE (SIGNALIZED)

Short-Term Improvements – ($100,000 - $150,000)

- Restripe entire intersection (including stop bars and pavement arrows).
- Trim surrounding trees on both the east and west legs to increase driver visibility and increase intersection safety.
- Replace guardrail just south of Hidden Valley School Road on the east side of the intersection at locations where it is worn or damaged.
- Install ADA compliant sidewalk ramps, pedestrian count-down signal heads/pushbuttons with pedestrian crossing signs, and pedestrian crosswalks on each of the intersection.

Mid-Term Improvements – ($15,000 - $16,000)

- The Route 419 intersection with Hidden Valley School Road may be the future crossing point for the proposed Barnhardt Creek Greenway and could accommodate students that may choose to walk or bicycle to the Hidden Valley Middle School.
- Construct sidewalk on both the east and west sides of Route 419 both north and south of the intersection providing connectivity to adjacent intersections.
- Install W3-3 Signal Ahead warning signs with controller actuated beacons.

14. SOUTH KEAGY ROAD (SIGNALIZED)

Recently improved by northwest development- Keagy Village.

- The eastbound approach was reconfigured from a shared through-left and an exclusive right-turn lane to dual left-turn lanes a through lane and an exclusive right-turn lane.
- The traffic signal was modified to include new geometry for west leg.

Short-Term Improvements – ($80,000 - $120,000)

- Replace guardrail to the north of South Keagy Road on the east side where it is currently damaged.
- There is a high concentration of new development around the Rt. 419 and Keagy Road intersection, including the almost finished Keagy Village that contains both retail and office uses. Allstate also

has a very large office near the intersection that has over 500 employees. It is recommended pedestrian push buttons, ADA ramps, and crosswalks be added at this location to accommodate future pedestrian volumes.

Mid-Term Improvements – ($175,000 - $225,000)

- Construct northbound dual left-turn lanes on Route 419 to accommodate future traffic volumes (2035 volumes AM).
- Construct sidewalk on the east side connecting north to the proposed Barnhardt Creek Greenways. Construct sidewalk on both sides of Route 419 to the south of the intersection providing connectivity to adjacent intersections.

15. GRANDIN ROAD EXTENSION (UNSIGNALIZED)

It is recommended the current median opening at Grandin Road Extended be closed. The closure is due to the limited visibility at the intersection and limited gaps in traffic during peak hours. It was observed in the field many vehicles had issues with making a left-turn. It is recommended this access be closed in the future. Traffic will be able to utilize Hackney Lane to Carriage Drive/Grandin Road to make a left-turn.

Short-Term Improvements – ($1,700 - $1,900)

- Install an R4-7, "Keep Right" sign on the north leg of intersection.
- Install left and right-turn pavement arrows.

Mid-Term Improvements (see Table 5.4)

- There are no recommendations for turn lanes since the long-term recommendation is to convert this intersection to a right-in / right-out only access. This will be accomplished by closing the median opening at Grandin Road Extended.
- The vicinity around the Route 419 and Grandin Road Extension intersection has a high concentration of retail and residential development and presently has a noticeable amount of pedestrian activity.
- Construct sidewalk on both sides of Route 419 both northwest and southeast of the intersection providing connectivity to adjacent intersections.

Long-Term Improvements – ($25,000 - $30,000)

- Close median opening to only allow a right-in/ right-out access

16. GRANDIN ROAD / CARRIAGE LANE (SIGNALIZED)

Recent Intersection Modifications

Intersection is now operating as a six phase intersection with Grandin Road split phased.

Short-Term Improvements – ($38,000 - $42,000)

- Restripe entire intersection (including stop bars and pavement arrows).
- Install an R4-7, "Keep Right" sign on the north and south legs on Route 419.
- Replace damaged guardrail located on the southeast corner.
- From the westbound leg of this intersection there are right-turn sight distance issues. Install a "No Turn on Red" sign on the eastbound leg to prevent sight distance related crashes.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($300,000 - $350,000)

- Construct an exclusive eastbound and westbound right-turn lane to accommodate future traffic volumes.
- Construct sidewalk on both the east and west side of Route 419 both north and south of the intersection providing connectivity to adjacent intersections.

17. GLEN HEATHER DRIVE (UNSIGNALIZED)

It is recommended the current median opening at Glen Heather Drive be closed. The closure is due to the limited visibility concerns that were observed in the field for the eastbound approach heading in the northbound direction.

Short-Term Improvements – ($20,000 - $25,000)

- Restripe entire intersection (including stop bars and pavement arrows).
- Install a W2-1 "Intersection Warning" signage until sight distance issues can be resolved.
- Trim plant life on the southwest corner to improve visibility and safety for eastbound traffic.

Mid-Term Improvements (see Table)

- There are no recommendations for turn lanes since the long-term recommendation is to limit access and convert the intersection to a left-in/right-in/right-out only.
- Construct sidewalk on sides of Route 419 both northwest and southeast of the intersection.

Long-Term Improvements – ($25,000 - $30,000)

- Close median opening to only allow a right-in/right-out access

18. MCVITTY ROAD (NORTH) (UNSIGNALIZED)

Short-Term Improvements – ($1,500 - $2,000)

- Install pavement arrows at all turn lanes at intersection.
- Install R4-7 "Keep Right" sign on the south leg.

Mid-Term Improvements

- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

19. MCVITTY ROAD (SOUTH) / COLONNADE DRIVE (SIGNALIZED)

Short-Term Improvements – ($100,000 - $150,000)

- Restripe entire intersection (including stop bars and pavement arrows).
- Install R4-7, "Keep Right" signs on both north and south medians on Route 419.
- Replace damaged guardrail on the northeast corner of the intersection.
- Install ADA compliant sidewalk ramps, pedestrian count-down signal head/pushbuttons with pedestrian crossing signs and pedestrian crosswalks on each of the corners.

Mid-Term Improvements (see Table 5.4)

- The intersection of Route 419 and McVitty Road may be used as future crossing point for the proposed Mudlick Creek Greenway. It also has an increasing concentration of residential and commercial development in the vicinity.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

20. POSTAL DRIVE (SIGNALIZED)

The mast arm installation may already be under design due to the STARS program.

Short-Term Improvements – ($35,000 - $40,000)

- Restripe entire intersection (including stop bars and pavement arrows).
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($375,000 - $425,000)

- Replace span wire traffic signal with mast-arm traffic signal and include pedestrian count-down signal heads/pushbuttons and pedestrian crossing signs on each corner of the intersection. Include intersection street lighting.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

21. BRAMBLETON AVENUE (SIGNALIZED)

Short-Term Improvements – ($18,000 - $22,000)

- Install R4-7, "Keep Right" sign in median for both north and south legs.
- Increase the size of the existing Yield sign on slip ramp shown on the right side of the channelized right-turn lane.
- Remove merge sign and add a new Yield sign in its place.
- Replace stop bars on all approaches.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks

Mid-Term Improvements – ($900,000 - $950,000)

- Construct southbound dual left-turn lanes on Route 419 to accommodate future traffic (2035 volumes PM).
- Construct westbound dual left-turn lanes on Brambleton Avenue to accommodate future traffic volumes (2035 volumes PM).
- Create acceleration lane for southbound right turn.
- Replace span wire traffic signal with mast arm traffic signal and include pedestrian count-down signal heads/pushbuttons and pedestrian crossing signs on each corner of the intersection. The mast arm installation may already be under design due to the STARS program.
- Install street names signs on mast arms.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

22. SPRINGWOOD PARK DRIVE (RUBY TUESDAY'S ENTRANCE) (SIGNALIZED)

Short-Term Improvements – ($2,000 - $2,500)

- Install R4-7, "Keep Right" sign in median on the east leg Springwood Park Drive.
- Install pavement arrows on the east leg Springwood Park Drive.
- Restripe mini-skips for southbound Electric Road (Route 419) left turns. Existing mini-skips are faded.
- Remove the existing right-turn arrow located within the hatched pavement markings on northbound Route 419.

Mid-Term Improvements – ($45,000 - $55,000)

- Install intersection lighting.
- Modify signal to "protected only" left-turn for southbound movement along Route 419 due to the limited sight distance. Monitor hatched pavement markings, intended to discourage use of the right-most lane of Springwood Park Drive as a continuous right-turn lane to northbound Route 419 for impact on safety.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

23. COLONIAL AVENUE (SIGNALIZED)

Recent Intersection Modifications

Intersection is now operating with protected/permissive left-turns and also the north leg has been restriped to include left-thru and an exclusive right-turn lane.

Short-Term Improvements – ($80,000 - $120,000)

- Install pedestrian count-down signal heads/push-buttons and pedestrian crossing signs on each corner of the intersection. Mast arm installation was recently completed at this intersection.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian cross-walks.
- Repair guardrail on northwest quadrant.

Mid-Term Improvements – ($625,000 - $725,000)

- Construct southbound dual left-turn lanes on Route 419 based on projected 2035 volumes (PM). Based on this recommendation an additional receiving lane on Colonial Avenue will need to be constructed to accommodate dual left-turn lanes. Without improvements the projected capacity for this movement is 130%.
- Construct northbound dual left-turn lanes on Route 419 based on projected 2035 volumes (PM). Based on this recommendation an additional receiving lane on Colonial Avenue will need to be constructed to accommodate dual left-turn lanes. Without improvements the projected capacity of this movement is 130%.
- Construct eastbound exclusive right-turn lane on Colonial Avenue based on future volume projections (projected to be constructed Summer of 2010).
- Consider closing Manassas Drive and redirect traffic to adjacent streets.
- Install street names signs on mast arms.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

24. PROMENADE PARK/WEST VILLAGE, COMMERCIAL ENTRANCE (UNSIGNALIZED)

Currently the intersection is not signalized, but is approved by VDOT. Although the traffic signal has already been approved it does not meet the current VDOT Access Management Guidelines. In the future the traffic signal would be recommended to be moved closer to Chaparral to meet current standards.

Short-Term Improvements – ($4,000 - $4,500)

- Install R4-7, "Keep Right" sign in median in both directions on Route 419.

- Install pavement arrows at all turn lanes at intersection.
- Install stop signs on both side street approaches.

Mid-Term Improvements (see Table 5.4)

- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

25. CHAPARRAL DRIVE (SIGNALIZED)

Recent Intersection Modifications

Intersection is now operating with protected/permissive left-turns.

Short-Term Improvements – ($17,000 - $21,000)

- Move stop bar for Chaparral Drive shared through and left-turn lane back about eight feet to improve sight distance for right turns.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.
- Install street names signs on mast arms.

Mid-Term Improvements – ($700,000 - $800,000)

- Construct dual northbound left-turn lanes on Route 419 or lengthen left-turn lane to accommodate future volumes (2035 PM). This would require an additional westbound receiving lane on Chaparral Drive.
- Remove tear drop island on the Chaparral Drive approach/south leg.
- Improve capacity of Chaparral Drive by providing dual eastbound left-turns. The additional lane would be accommodated by widening Chaparral Drive on the west side.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

26. BERNARD DRIVE (UNSIGNALIZED)

Short-Term Improvements – ($800 - $1,100)

- Install R4-7, "Keep Right" sign in median on northbound Route 419.
- Currently a stop sign exists in the westbound median (on the left) of Bernard Drive. It is recommended that a stop sign also be installed in the westbound direction on the north curb (on the right).

Mid-Term Improvements – ($1800 - $2,200)

- Construct a northbound right-turn lane on Route 419 to accommodate existing volumes. Currently there is pavement that is striped as a shoulder that can be utilized to construct the exclusive right-turn lane. Consider installing a minimum of 50 foot taper for Route 419 northbound right turns due to steep grade. Assumed that no right-of-way was needed.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

27. STARKEY ROAD (SIGNALIZED)

Recent Intersection Modifications

Intersection is now operating as a six phase intersection with Starkey as split phased. Lane use for both the north and south legs of Starkey Road were restriped to include an exclusive left-turn lane, and shared left-thru lane, and an exclusive right-turn lane.

Short-Term Improvements – ($100,000 - $150,000)

- Install R4-7, "Keep Right" sign in median on northbound Route 419.
- Install pedestrian count-down signal heads/push-buttons and pedestrian crossing signs on each corner of the intersection. Mast arm installation was recently completed at this intersection.
- Install street names signs on mast arms.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($450,000 - $500,000)

- Install a northbound channelized right turn lane on Route 419 and acceleration lane based on projected 2035 volumes (AM).
- Extend southbound left-turn lane on Route 419.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

28. MADISON SQUARE, COMMERCIAL ENTRANCE (UNSIGNALIZED)

Short-Term Improvements – ($8,000 - $8,500)

- Install object marker along northbound direction of Route 419 to mark the presence of the exposed drainage structure.
- Install R4-7, "Keep Right" signs in median in both directions on Route 419
- Install stop signs on both side street approaches.
- Restripe westbound approach side street approach to include lane lines, arrows, and stop bars.

Mid-Term Improvements – ($600,000 - $650,000)

- Extend southbound left-turn median nose to reduce conflicts between drivers accessing the Shell gas and with other commercial entrances.
- Lengthen southbound left-turn lane.
- Restrict turn movements at median crossover (median opening) to the left-in operation only. This will allow the intersection to operate as a right-in/right-out/left-in access.
- Replace exposed drainage ditch to provide proper protection to drivers. This improvement will require the exposed concrete V paved ditch to be buried and curb and gutter installed with drop inlets.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

29. OGDEN ROAD (SIGNALIZED)

Recent Intersection Modifications

Ogden Road was restriped to include an exclusive left-turn lane, a shared left- thru, and exclusive right-turn lane. Also traffic signal was modified to include a lead/lag phase for left-turns.

Short-Term Improvements – ($25,000 - $30,000)

- Remove "No Parking" signs on Ogden Road.
- Install "Do Not Block the Intersection" sign or a similar sign on traffic signal pole.
- Install street name signs on mast arms.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements – ($15,000 - $20,000)

- Install short median (200') on Ogden Road to prohibit turns into and out of commercial entrances. A R4-7, "Keep Right" sign will also be installed to increase visibility of the new median
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

30. TANGLEWOOD MALL ENTRANCE #1 (WESTERN ENTRANCE) (SIGNALIZED)

Short Term Improvements – ($22,000 - $28,000

- Remove hatching and pavement markings located between Ogden Road and Mall Entrance in the northbound outside lane to convert to a through lane to improve capacity. Remove northbound "Right-Turn Only" sign from Route 419. Currently a wide shoulder exists that is recommended to be restriped as a through-right turn lane to increase northbound capacity along Route 419.
- Replace stop bars on Tanglewood Mall Entrance approach.
- Install ADA compliant sidewalk ramps on each corner of the intersection and pedestrian crosswalks.

Mid-Term Improvements - ($900,000 - $1,300,000)

- Construct southbound through lane for added capacity from just south of Ogden Road, eventually tying into the US 220 on-ramp.
- Modify drainage ditch on south side of Route 419 to accommodate the additional southbound through lane.
- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.

31. TANGLEWOOD ENTRANCE #2 (EASTERN ENTRANCE) (SIGNALIZED)

Short-Term Improvements – ($125,000 - $175,000)

- Repair curb in northeast quadrant.
- Install R4-7, "Keep Right" sign in northbound direction to clarify intended lane usage as through and right along this section northbound Route 419.
- Remove hatching and pavement markings between the Tanglewood Mall Entrances in the northbound outside lane to convert to a through lane to improve capacity.
- Remove northbound "Right-Turn Only" sign from Route 419. Currently a wide shoulder exists that is recommended to be restriped as a through-right turn lane to increase northbound capacity along Route 419.

Mid-Term Improvements - ($1,200,000 - $1,600,000)

- Construct an exclusive eastbound right-turn lane on Slate Hill Entrance to accommodate future development volume.
- Construct southbound through lane for added capacity from just south of Odgen Road, eventually tying into the US 220 on-ramp.
- Provide pedestrian access to/from mall to/from apartments with crosswalk, pedestrian signals, and ADA requirements.
- Modify drainage ditch on south side of Route 419 to accommodate the additional southbound through lane. Replace exposed drainage ditch to provide proper protection to drivers. This improvement will require for the exposed concrete

V paved ditch to be buried and curb and gutter installed with drop inlets.

- Construct sidewalk on both the north and south sides of Route 419 both east and west of the intersection providing connectivity to adjacent intersections.
- Construct a northbound exclusive right-turn lane.

32. US 220 SOUTHBOUND RAMPS (SIGNALIZED)

US 220 and Route 419 intersection capacity is approximately 130%. A total redesign of this interchange will be necessary to allow this interchange to function without long delays in the future.

Short-Term Improvements – ($18,000 - $22,000)

- Repair or replace damaged guardrails in the vicinity of the US 220 Southbound Ramps.
- Restripe and remove pavement marking symbols located between US 220 and the Eastern Mall Entrance to convert the northbound outside lane to a through lane to increase capacity.

Mid-Term Improvements – ($30,000 - $35,000)

- Restripe intersection to allow the southbound right-turn movement to run as a continuous free flow movement.
- Close the furthest east access to Tanglewood Mall closest to US 220 Southbound.
- Remove traffic signal located at the southbound US 220 off-ramp approach.

Long-Term Improvements
(Combined with the Long-Term Improvements from Northbound Ramps) – ($5,000,000 - $6,000,000)

Complete reconfiguration of intersection
(See Figures 5.3 and 5.4)

- Remove traffic signal located at the southbound US 220 off-ramp approach.
- Modify the eastbound right-turn movement located at the US 220 On-Ramp. The turning radius will need to be increased to allow the diverge point to be located further south from its current location.
- Construct southbound through lane for added capacity from just south of Odgen Road, eventually tying into the US 220 on-ramp.
- Construct an additional southbound lane along Route 419 from the southbound US 220 on-ramp to the northbound US 220 on-ramp. The additional lane should be constructed and striped to provide dual northbound on-ramp lanes for the eastbound traffic heading north on US 220. US 220 will need to be widened to provide adequate merging distance for the additional northbound on-ramp lane. The northbound US 220 On-Ramp will need to be reconstructed when US 220 is widened for the additional merge lane.

33. US 220 NORTHBOUND RAMPS (SIGNALIZED)

US 220 and Route 419 intersection capacity is approximately 130%. A total redesign of this interchange will be necessary to allow this interchange to function without long delays in the future.

Short-Term Improvements – ($12,000 - $16,000)

- Restripe stop bars on all approaches including ramps.
- Repair or replace damaged guardrails on multiple corners of the intersection

Long-Term Improvements
(Combined with the Long-Term Improvements from Northbound Ramps) – ($5,000,000 - $6,000,000)

Complete reconfiguration of intersection
(See Figures 5.3 and 5.4)

- Construct an additional southbound lane along Route 419 from the southbound US 220 on-ramp to the northbound US 220 on-ramp. The additional lane should be constructed and striped to provide dual northbound on-ramp lanes for the eastbound traffic heading north on US 220. US 220 will need to be widened to provide adequate merging distance for the additional northbound on-ramp lane. The northbound US 220 On-Ramp will need to be reconstructed when US 220 is widened for the additional merge lane.

OVERALL LONG-TERM RECOMMENDATIONS

TRAFFIC SIGNALS

($500,000 – $700,000) - Cost includes signal retiming plans and updating all traffic signal lights to LED lights. (Does not include updating signal system equipment or ATMS Feasibility Study)

- Currently a uniform signal system does not exist along the corridor. It is recommended that all municipalities consider updating their system to be consistent with one another to improve progression along the corridor. Coordination between VDOT and City of Salem is necessary in order to accomplish adequate progression. It is recommended that traffic signals a maximum of half mile apart be coordinated. It is common to see traffic signals coordinated in half mile spacing in suburban areas. It is recommended a signal timing study be completed and revised signal timing plans be implemented.
- Upgrade all signal lights to LED lights when possible. LED lights are brighter and require less energy (saving cost to the municipality). In addition to the reduced cost, signal visibility is increased and may help reduce total crashes along the corridor.

RECOMMENDED WIDENING

- Widen Route 419 from a two-lane, undivided to a four-lane roadway with a raised median from Route 311 to I-81 interchange. ($2,500,000 – $3,000,000)
- Widen Route 419 from a four-lane, divided roadway to a six-lane, divided from Brambleton Avenue to the US 220 interchange. ($50,000,000 – $55,000,000) – (Please see Mid-Term Improvements for the segment between Ogden Road and US 220)
- Turn lanes at major streets/driveways will also need to be constructed.
- As widening occurs, provide bicycle and pedestrian accommodations.

ACCESS MANAGEMENT

It is recommended that all new developments and redevelopments along the corridor follow the new VDOT access management guidelines. The safety and efficiency of the corridor depends heavily on the effective management of access to adjacent developments. Access points introduce conflicts and friction into the traffic stream. Vehicles entering and leaving the main roadway often slow the through traffic, and the difference in speeds between the through and turning traffic increases accident potential. The new access management guidelines preserve the flow of traffic on the surrounding roadways, improve safety, and maintain mobility. It is believed that increasing the spacing between access points improves arterial flow and safety by reducing the number of conflict points per mile, by providing greater distance to anticipate and recover from turning maneuvers, and by providing opportunities for use of turn lanes. Many studies that have been completed prove that an increase in the number of access points along a corridor directly translates into higher accident rates.

Currently a traffic signal has been approved at the intersection of Route 419 and West Village/Promenade Park and does not meet the new VDOT Access Management Guidelines. In the future, VDOT would recommend the traffic signal to be relocated further south along Route 419 closer to Chaparral Drive. Since most intersections along the corridor do not meet the access management guidelines, it is recommended that as redevelopment occurs in the future, access points be consolidated wherever feasible. In particular, access between Brambleton Avenue and Route 220 should be reviewed closely due to the closely spaced signalized intersections and the heavy congestion in this area.

U-TURNS

VDOT along with most state agencies do not have a formal policy for designing and locating median openings that makes a specific reference to U-Turn maneuvers. Based on the National Cooperative Highway Research Program (NCHRP) Report 524, it was found that the following factors would need to be taken into consideration in order to determine if a U-Turn maneuver should be allowed at an intersection:

- Spacing between median openings
- Intersection sight distance
- Stopping Sight Distance
- Operating speeds
- Length of turn lanes
- Right-turn conflict overlap at a signalized intersection
- Median width/median openings

The safe provision of u-turns is of critical importance to maintain access to the commercial properties along the corridor. As access management techniques are considered which may restrict turn movements at crossovers, it may be necessary to construct safety and operational improvements for adjacent crossovers.

INCIDENT MANAGEMENT DEVICES

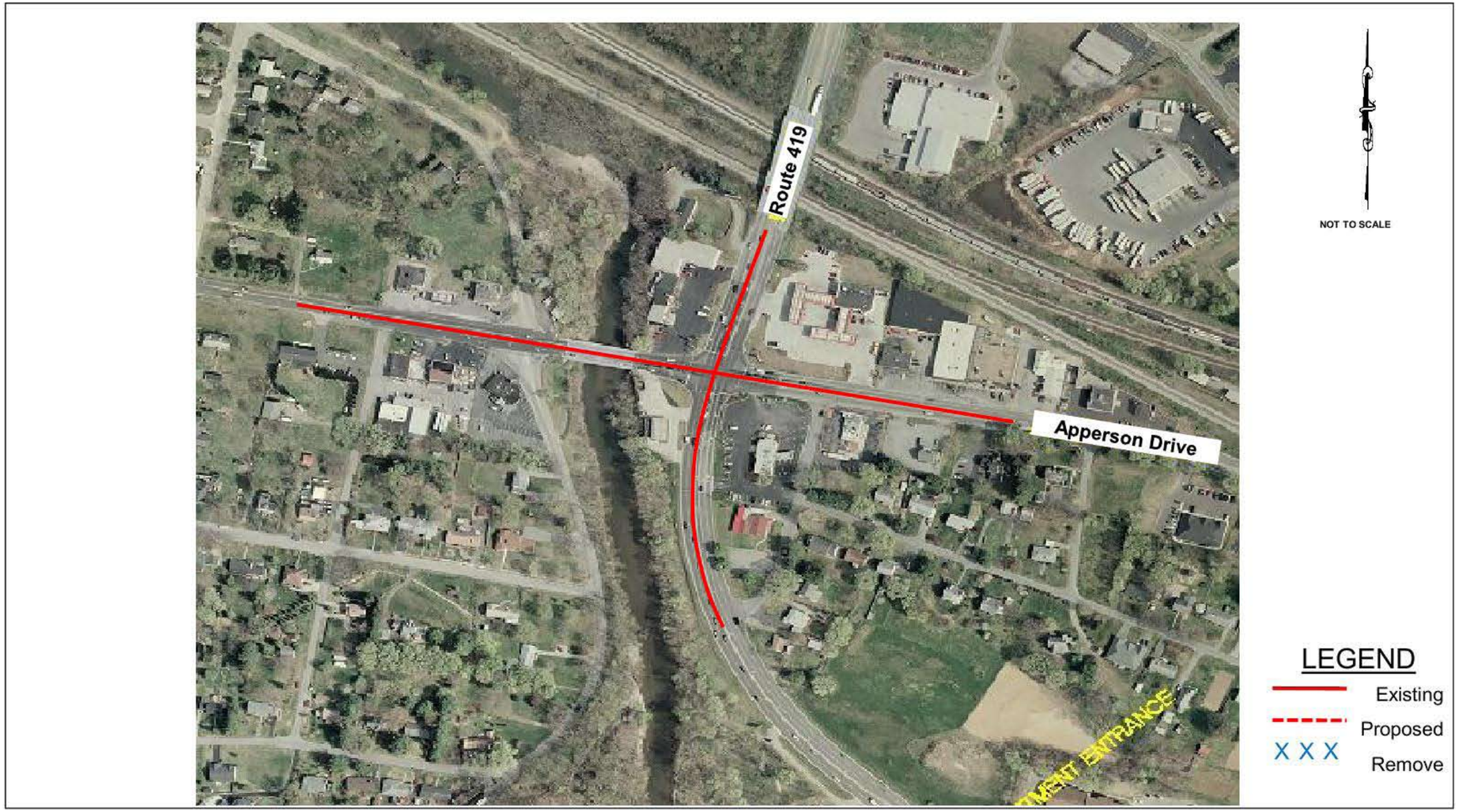
It is recommended that incident management message boards be installed along the corridor to provide motorists with alternative route information to upcoming congestion and to warn motorist of long delays. The incident management message boards should be installed in a location along the corridor that provides motorist enough time to make a deci-

sion of an alternative route around the congestion and should be located ahead of an area that motorists typically experience peak hour congestion and long delays. When considering these key elements, it was recommended that the incident message boards be installed near Main Street.

MODERN ROUNDABOUT

VDOT is converting more and more standard intersections to modern roundabouts due to the safety, efficiency, and low maintenance the modern roundabout provides. The modern roundabout operates with a yield traffic control at the entry points, gives priority to vehicles within a roundabout, and reduces the severity of accidents when compared to a standard intersection. Based on our review, it is currently not recommended that any of the study area intersections convert to the modern roundabout due to the limited right-of-way and character of Route 419.

Figure 5.1 Route 419/Apperson Drive – Existing Geometry



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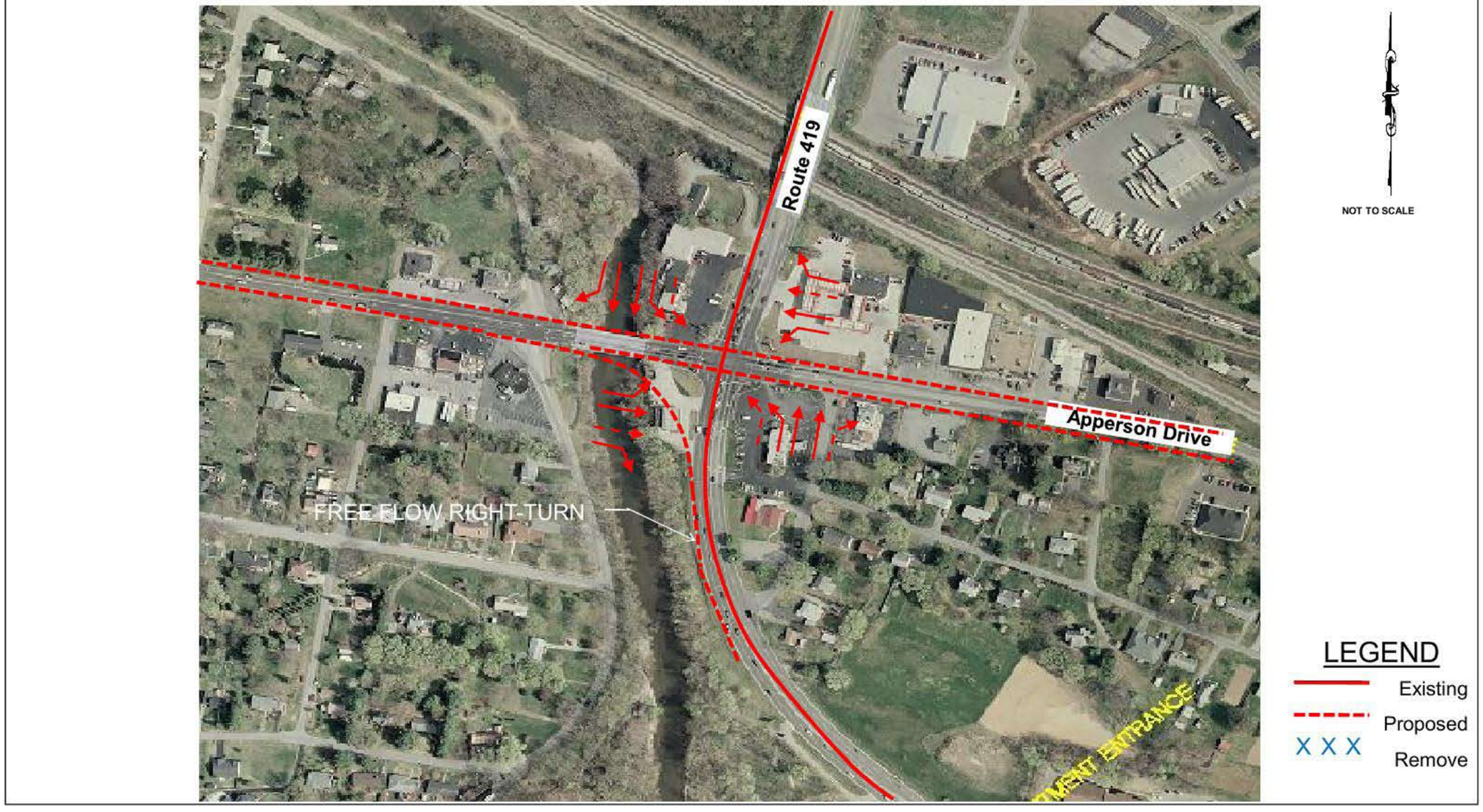
ROUTE 419
RECOMMENDED IMPROVEMENTS

EXISTING
GEOMETRY

Figure 5.2 Route 419/Apperson Drive – Option A



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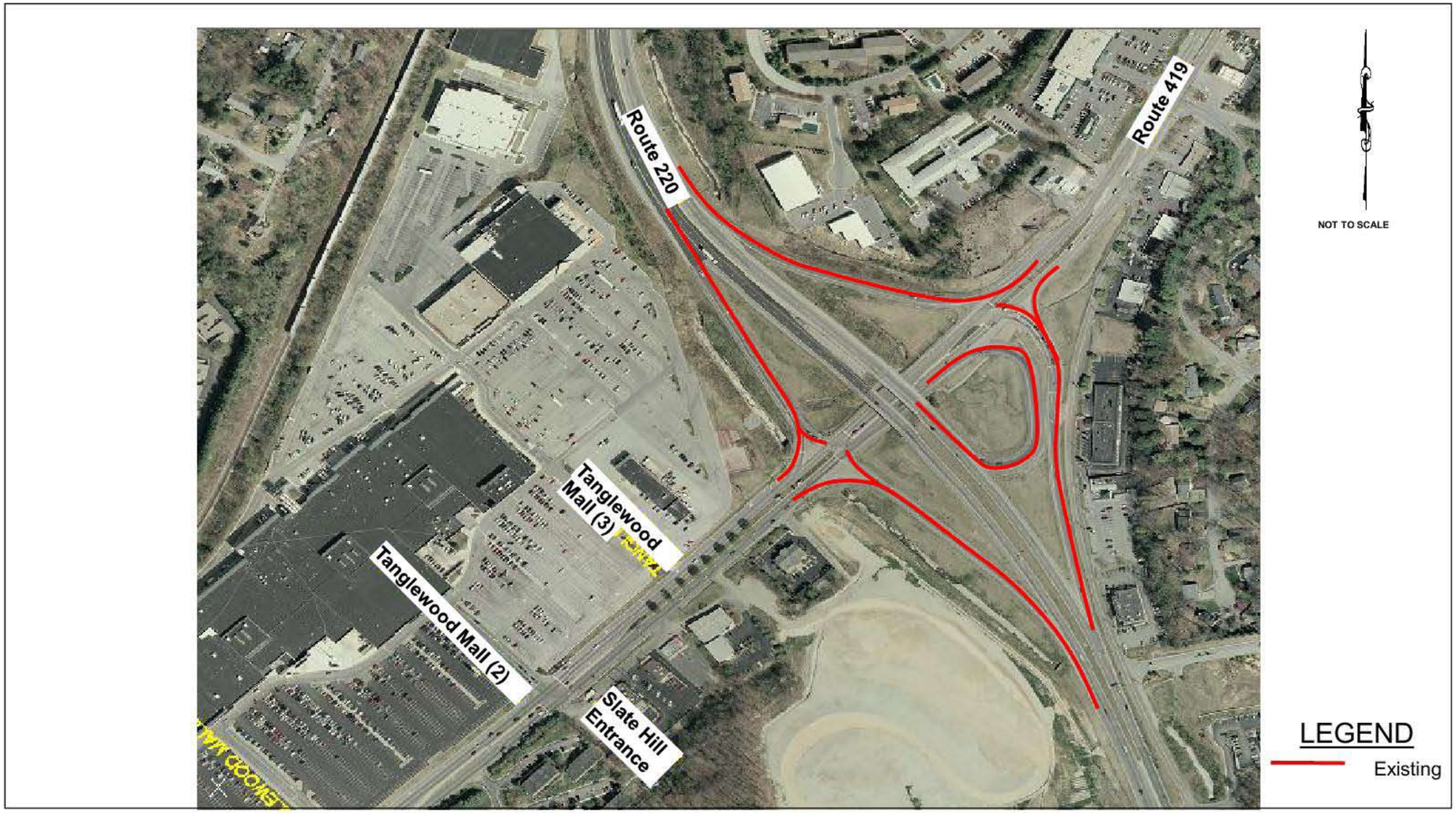
ROUTE 419
RECOMMENDED IMPROVEMENTS

Option A

Figure 5.3 Route 419/US 220 – Existing Geometry



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ROUTE 419
RECOMMENDED IMPROVEMENTS

EXISTING GEOMETRY

Figure 5.4 Route 419/US 220 – Option A

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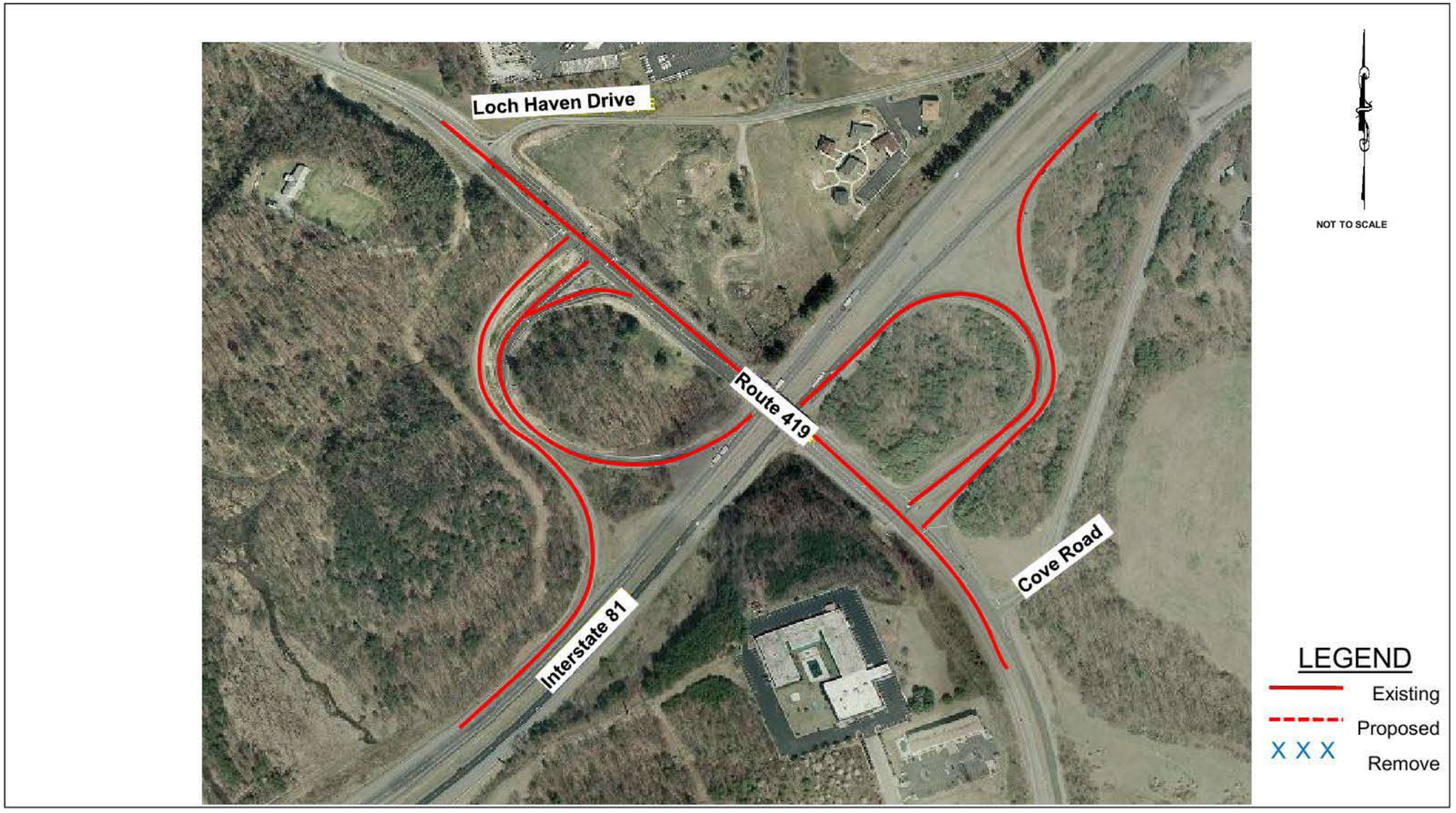
ROUTE 419
RECOMMENDED IMPROVEMENTS

Option A

Figure 5.5 Route 419/I-81 – Existing Geometry



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ROUTE 419
RECOMMENDED IMPROVEMENTS

EXISTING
GEOMETRY

Figure 5.6 Route 419/I-81 – Option A

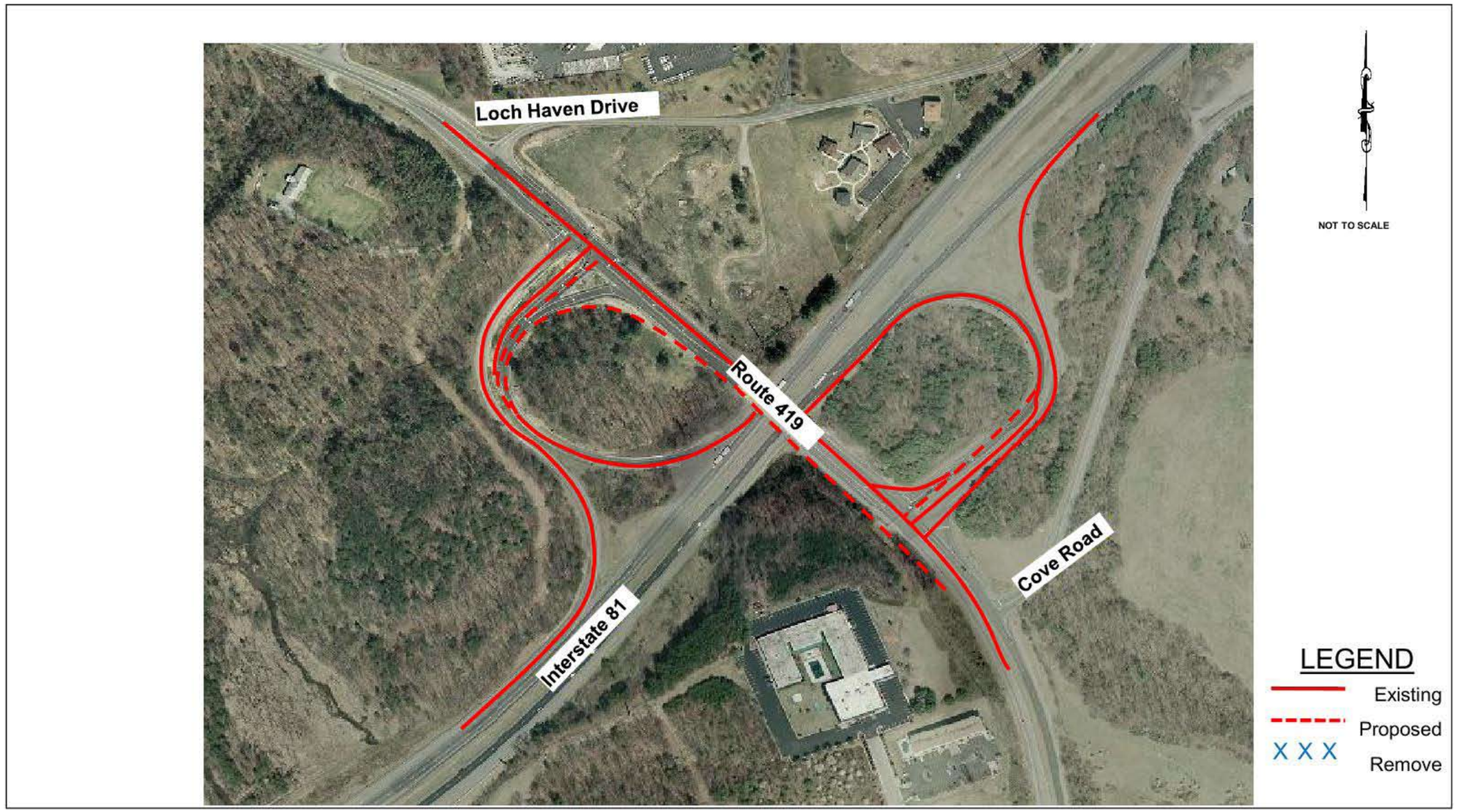

Figure 5.7 Recommended Improvements - Segment 1

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ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 1: Corridor Recommendations

Figure 5.8 Recommended Improvements - Segment 2

LEGEND

- Existing Laneage
- Proposed Laneage/Widening
- X X X Remove
- Proposed Sidewalk
- Install Intersection Lighting
- Pedestrian Improvements
- Upgrade to Mast Arm
- Repair Guardrail
- Drainage Ditch Improvements
- Emergency Railroad Preemption
- Restripe Intersection

0 200' 400' 800'

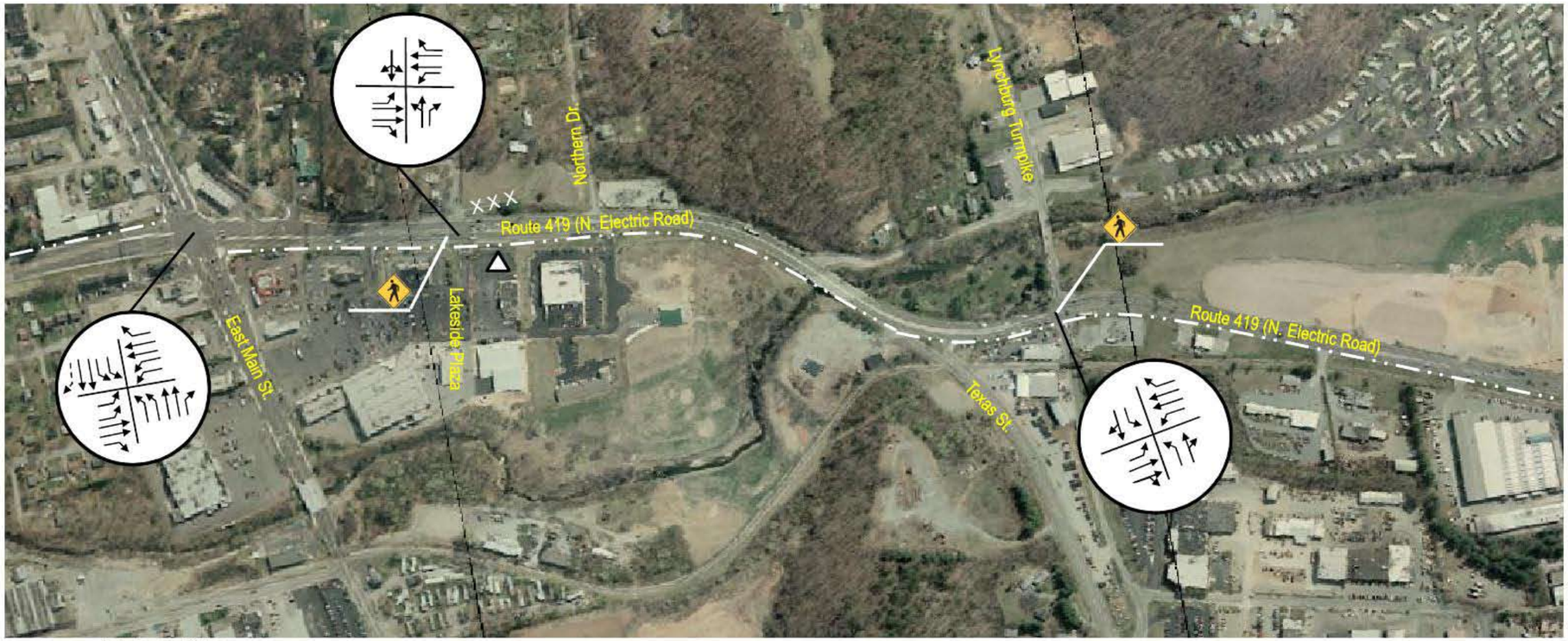
1 INCH = 400 FEET

Kimley-Horn and Associates, Inc.

ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 2: Corridor Recommendations

Figure 5.9 Recommended Improvements - Segment 3



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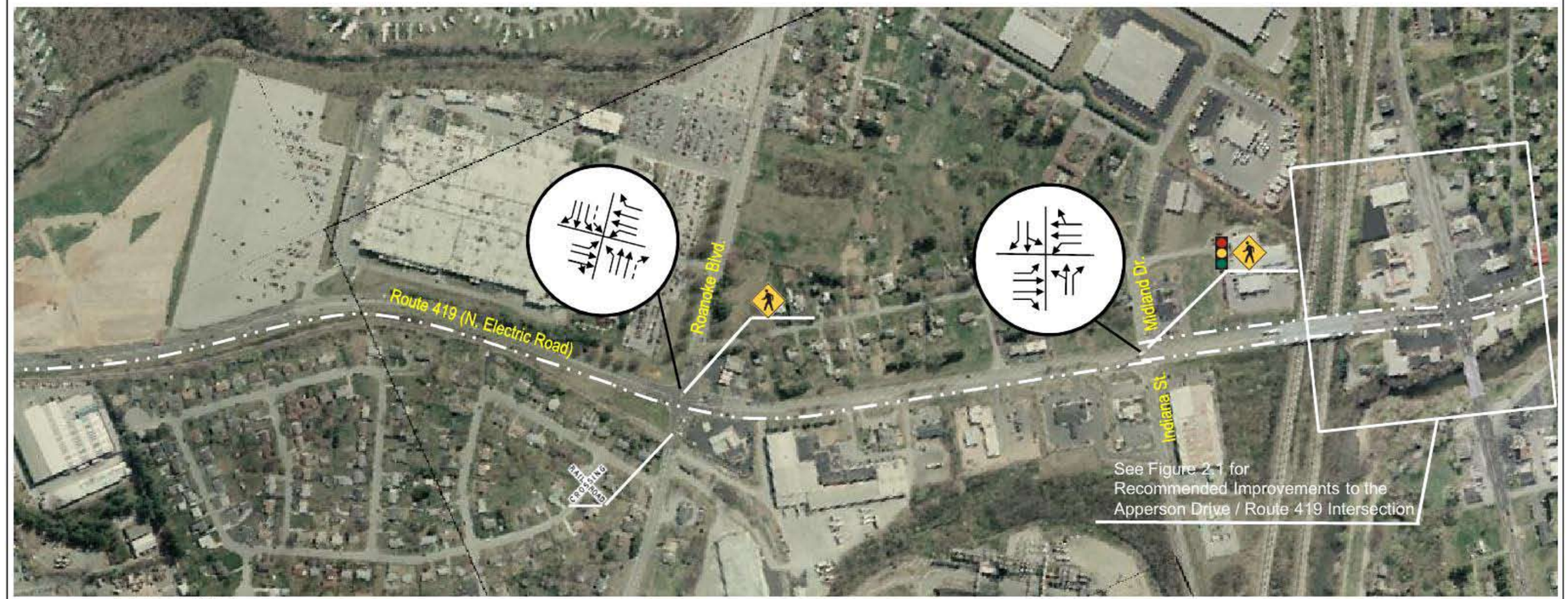
ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 3: Corridor Recommendations

Figure 5.10 Recommended Improvements - Segment 4



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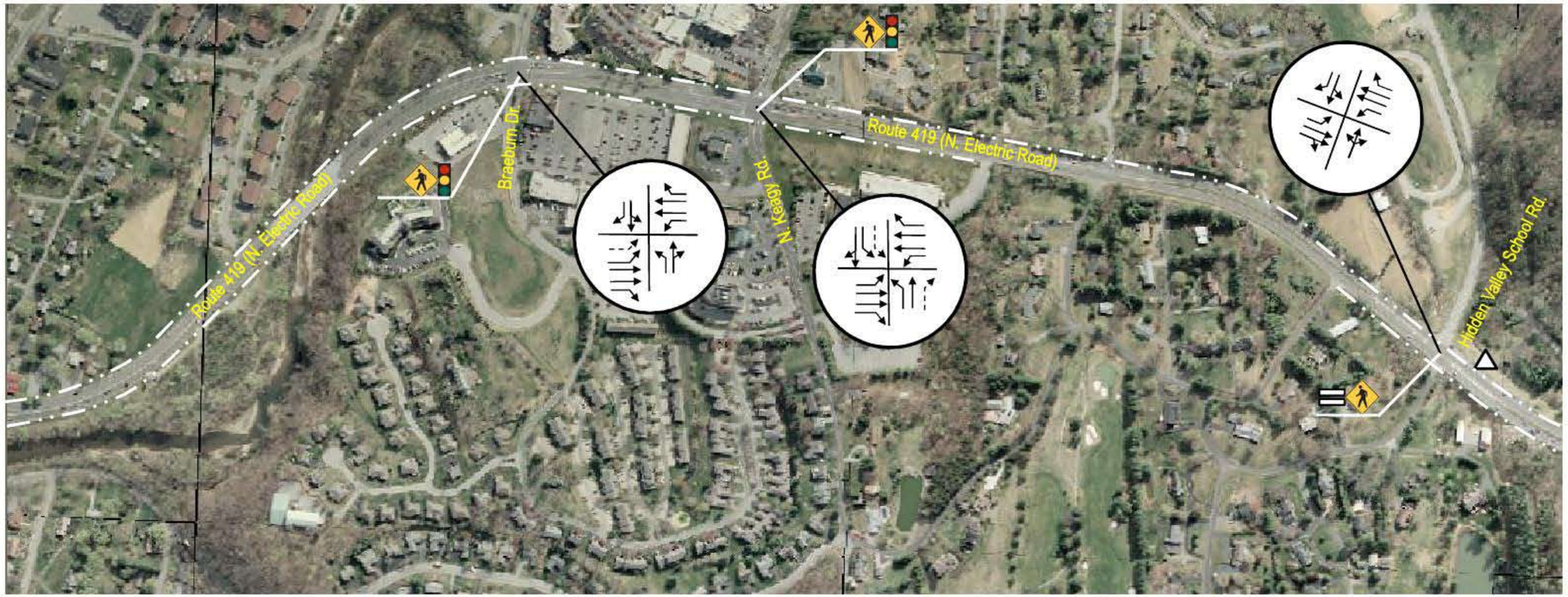
ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 4: Corridor Recommendations

Figure 5.11 Recommended Improvements - Segment 5



LEGEND

- Existing Laneage
- Proposed Laneage/Widening
- XXX Remove
- Proposed Sidewalk
- Install Intersection Lighting
- Pedestrian Improvements
- Upgrade to Mast Arm
- Repair Guardrail
- Drainage Ditch Improvements
- Emergency Railroad Preemption
- Restripe Intersection

0 200' 400' 800'

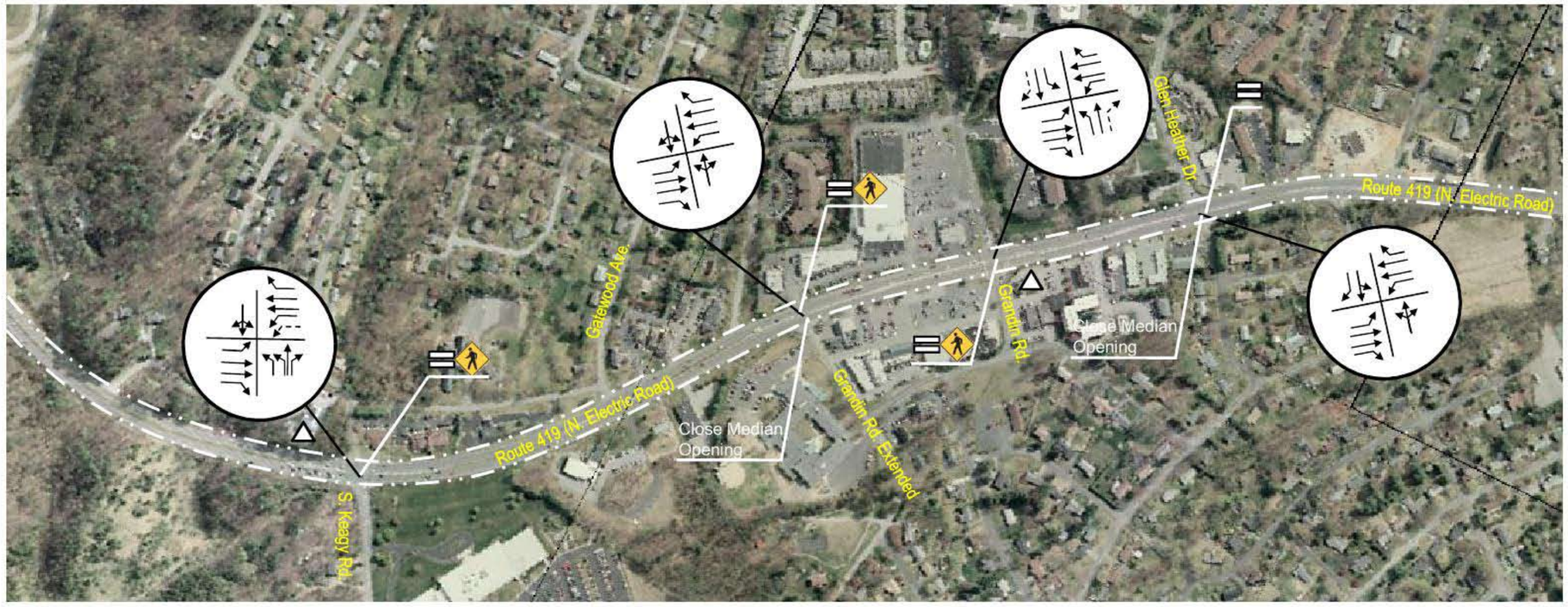
1 INCH = 400 FEET

Kimley-Horn and Associates, Inc.

ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 5: Corridor Recommendations

Figure 5.12 Recommended Improvements - Segment 6

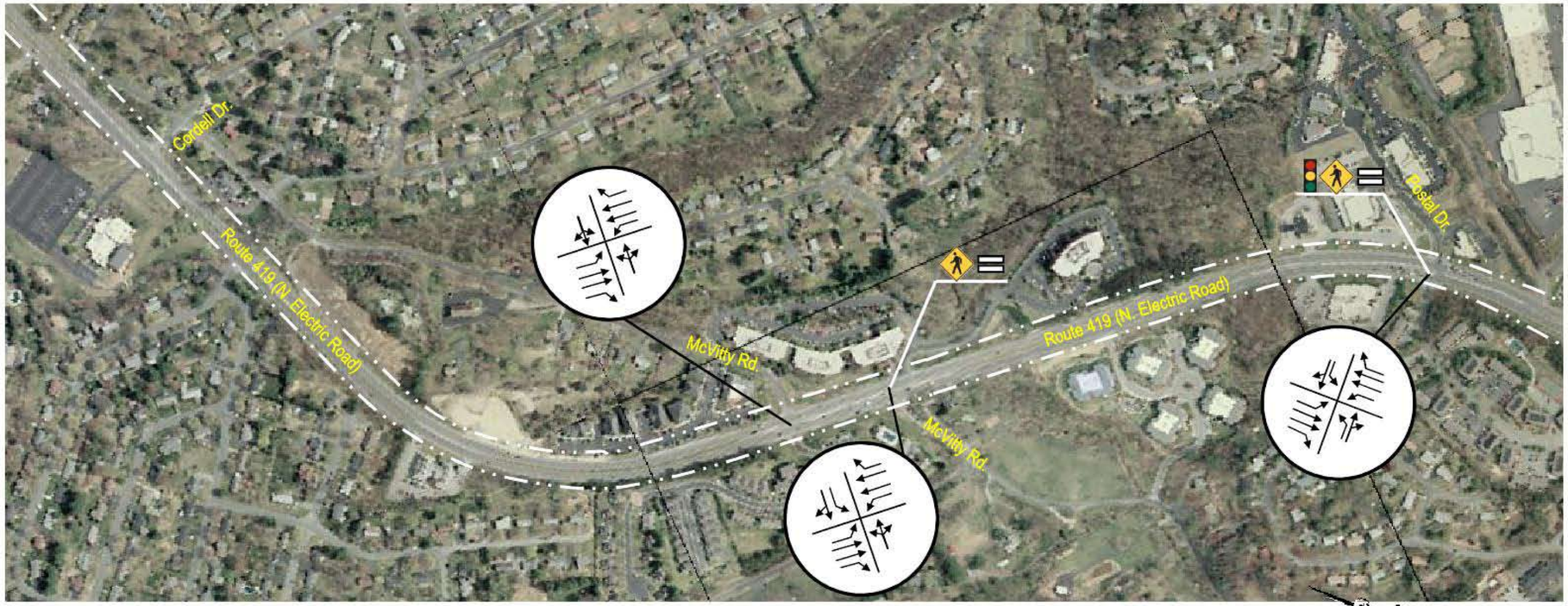


Kimley-Horn and Associates, Inc.

ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 6: Corridor Recommendations

Figure 5.13 Recommended Improvements - Segment 7



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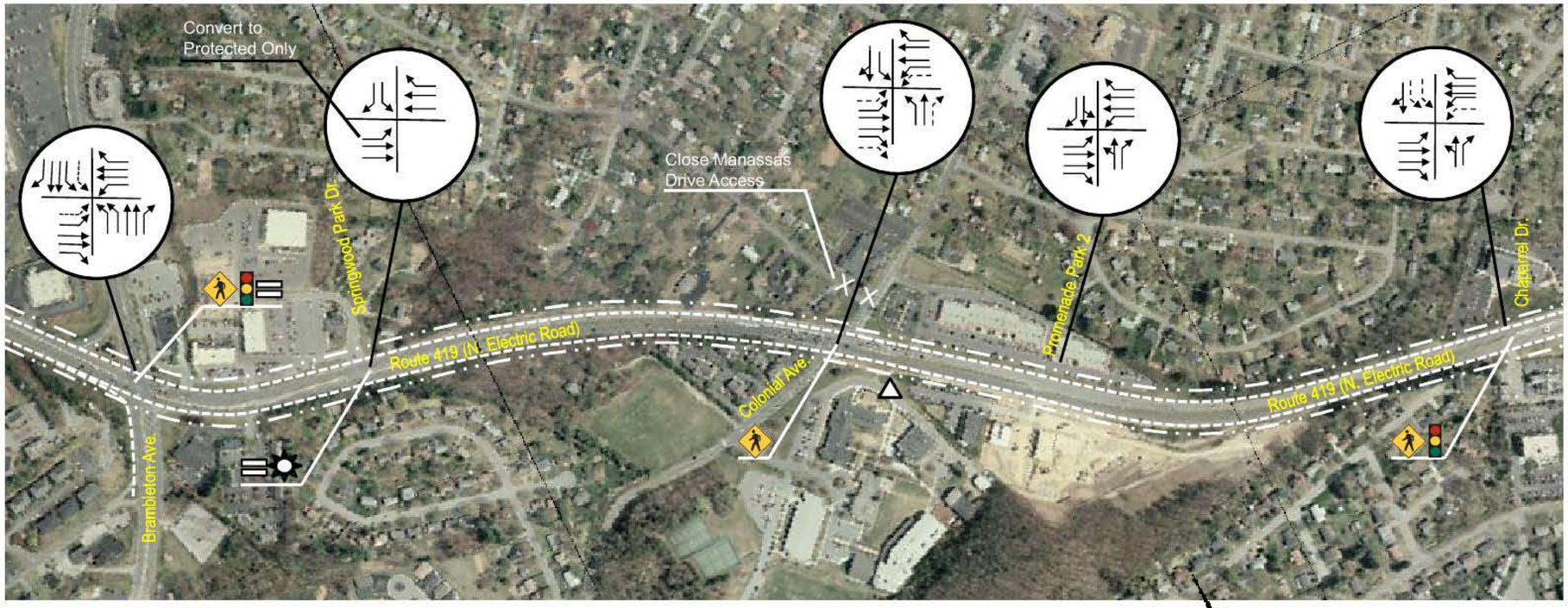
ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 7: Corridor Recommendations

Figure 5.14 Recommended Improvements - Segment 8



LEGEND

- Existing Laneage
- Proposed Laneage/Widening
- X X X Remove
- Proposed Sidewalk
- Install Intersection Lighting
- Pedestrian Improvements
- Upgrade to Mast Arm
- Repair Guardrail
- Drainage Ditch Improvements
- Emergency Railroad Preemption
- Restripe Intersection

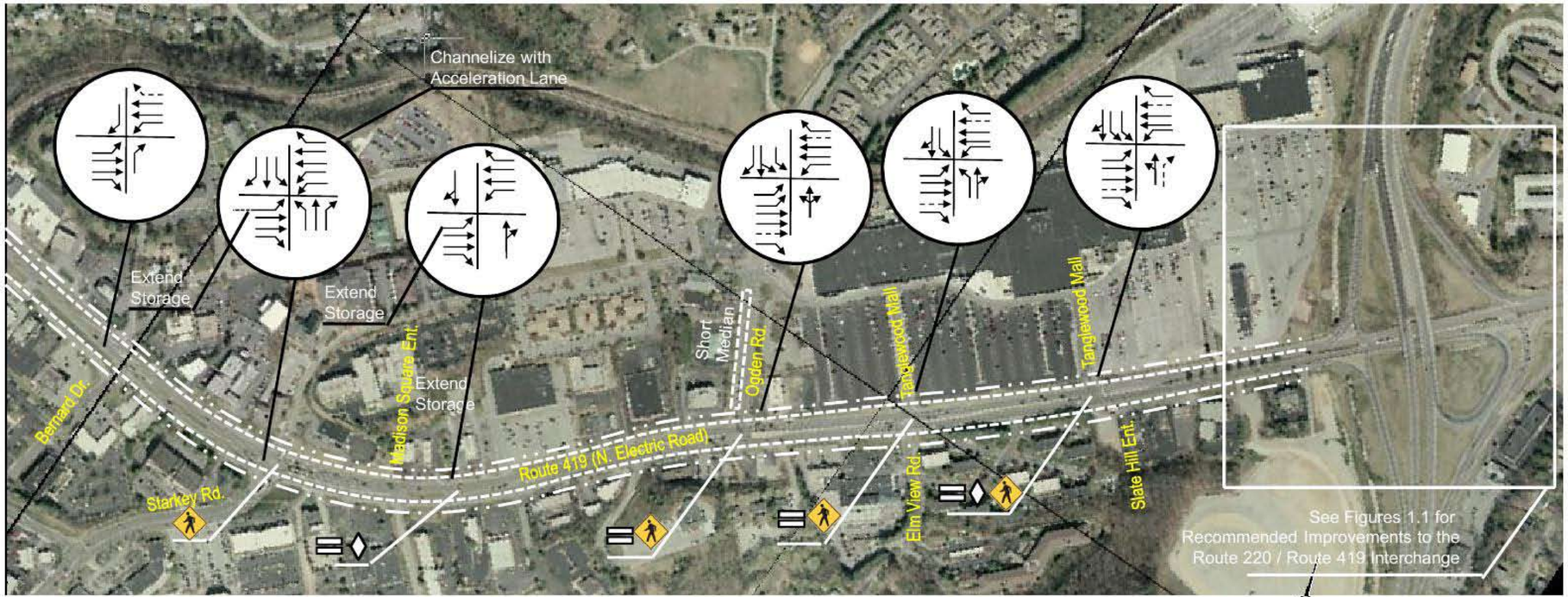
0 200' 400' 800'
1 INCH = 400 FEET

Kimley-Horn and Associates, Inc.

ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 8: Corridor Recommendations

Figure 5.15 Recommended Improvements - Segment 9



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ROUTE 419
RECOMMENDED IMPROVEMENTS

Segment 9: Corridor Recommendations

TRANSIT SERVICE

ROUTING

Develop Transit along Route 419

Bus service should operate along the length of Route 419 between the intersection with Route 311 at its northern terminus and the southern terminus at Tanglewood Mall. One of Electric Road's greatest strengths is its relationship with the existing transportation infrastructure in the Roanoke Valley. Its central location and intersections with several major corridors and transit routes make it a vital link in the overall transportation network. In order to build on this strength, the scheduled stops for the new bus line must coordinate with existing and planned transportation infrastructure, major corridors, bus routes, park and ride lots, greenways, and bikeways should be specifically targeted for the placement of bus stops.

Table 5.1 illustrates the major corridor intersections and the existing and planned multimodal infrastructure at each location. These stops should be treated as major transfer points along the service lines. Infrastructure such as benches, coverings, and route information kiosks should be provided at these hubs. In total, the proposed route is approximately ten miles in length.

Table 5.1 Multimodal Infrastructure by Intersection with Route 419

Intersection	Existing Infrastructure	Planned Infrastructure
Route 311	Park-n-Ride Bikeway	
US 460	Transit Routes: 81,82, 91 & 92	Bikeway Greenway
Roanoke Blvd	Transit Routes: 91 & 92	Bikeway
US 11		Bikeway Greenway
Ridgewood Farms	Transit Routes: 71, 72, 91 & 92	Greenway
Mcvitty (North of 221)		Greenway
US 221		Bikeway
Chaparral (South of 221)		Bikeway
US 220 @ Tanglewood Mall	Transit Routes: 51,52, 55 & 56	Bikeway Greenway

Expand Existing Transit Services

There are a few sites along 419 that are very close to multimodal access, but are not currently serviced directly by transit. These sites are the Orange Market Park and Ride Lot and the intersection with US 221. Valley Metro routes 61 and 62 provide service to and from Downtown Roanoke and the intersection of Red Rock and Brambleton/221. This intersection is approximately 1.2 miles away from Brambleton's intersection with 419. Service should be extended to Route 419 to create a transfer point with 419 bus service and provide residents along Electric Road with an additional service to downtown Roanoke. Likewise, the SmartWay bus, during service between Roanoke and Blacksburg along I-81, bypasses the Orange Market Park and Ride Lot. Making an additional stop at the Orange Market lot would create a truly multimodal transfer center; accessible by bike, bus, and automobile. The limited extension of these routes would greatly increase the multimodal accessibility of the region and Route 419.

The SmartWay bus will utilize Exit 141 on I-81, travel north on Electric Road, at the intersection with Route 311 the bus will merge left and stop at the Orange Market park and ride lot. After collecting passengers, service will continue southwest on Route 311, traveling approximately one mile before stopping

Figure 5.16

SmartWay Proposed Route Alignments

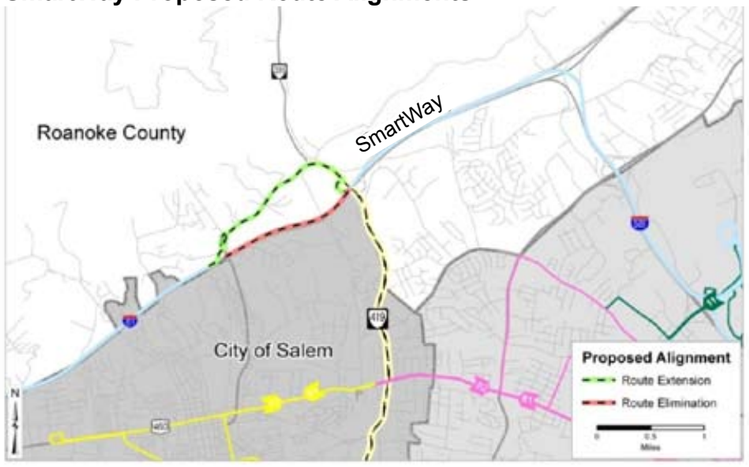
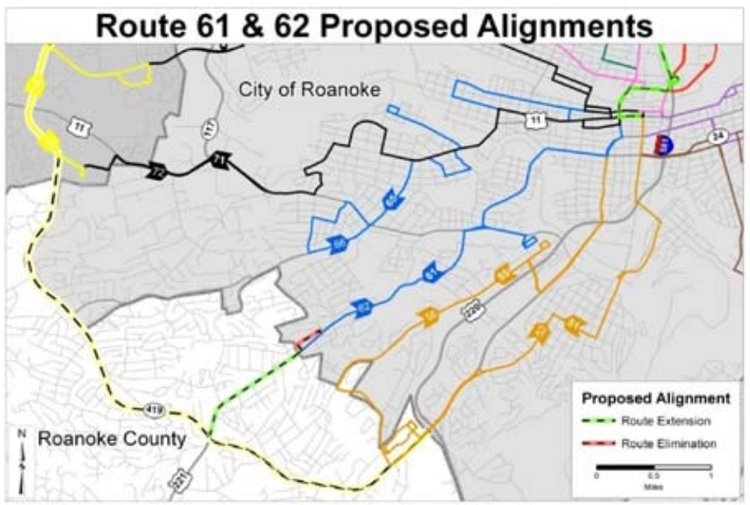


Figure 5.17



to service the Exit 140 park and ride lot. Service will resume original routing after collecting passengers at the Exit 140 park and ride lot. Route 61 and 62 will continue beyond its terminus at the Roanoke County line and continue 1.2 miles to the intersection with 419. Both route extensions are depicted in the following figures.

MATCH CAPACITY WITH DEMAND

Limited Commuter Bus Service

Transit service along 419 should operate as a limited bus service aimed at commuters in order to maintain a proper cost to revenue ratio. With the low density, auto oriented landscape, and lower rates of transit-dependent populations around 419, it is unlikely that bus service along the corridor would be used adequately for non-work related trips. Therefore, planned transit service will be offered during AM and PM peak commute times only. Census data illustrates that the peak morning commute time occurs between 6:00 and 9:00 am. This 3-hour AM peak period will be complemented by a 3-hour PM service operation between the hours of 4:00 and 7:00 pm. Operating bus service for only 6 hours a day will cut fuel consumption costs and transit operator salary costs.

Smaller Buses

In order to further streamline the cost to revenue ratio, a smaller bus will be used to match bus capacity with rider demand. In this regard, 40 foot standard buses will not be utilized along Route 419, instead small buses with 30 seats or less will be used. The result of a survey conducted by the TCRP, illustrated in Table 5.2, suggests that the number one reason why transit agencies use smaller buses is to match demand with capacity. Matching demand with capacity is helpful in two very different ways. First, a smaller bus costs less to operate and to purchase. With better fuel efficiency and lower capital costs, smaller buses are a fiscally responsible choice when demand does not require a large bus. Second, a smaller bus portrays a positive image of heavy route usage. Community members are often concerned that public transit is a costly and often underutilized service. Smaller buses fill with passengers more quickly, which portrays an appropriate demand/capacity ratio.

Table 5.2: Reasons for Purchasing Small Buses

Survey Choice	1st or 2nd Rank
Matching demand with capacity	50
Maneuverability on small streets	39
Marketing image	17
Complaints for community (re: noise, etc)	17
Lower operation/maintenance costs	11
Lower capital costs	10
Funding allowing experimentation	2
Other	6

Small Bus

A noteworthy advantage of utilizing smaller vehicles is the reduced capital cost of purchasing new buses. Much of the existing Valley Metro bus stock is 35 foot Gillig buses which can cost approximately $300,000. However, smaller buses can be purchased for as little as $50,000. For example, Carpenter Bus Sales, www.carpenterbus.com, shows the average sale cost of smaller buses as under $60,000. These buses are between 25 and 27 feet in length and carry, on average, 26 passengers.

OPERATION

Valley Metro Service

According to its website, Valley Metro already operates multi jurisdictional bus routes in the Roanoke Valley. Valley Metro is in charge of operation and logistics, whereas the localities enter into a financial contract with Valley Metro to pay for service. Much of Valley Metro's funding comes from State and Federal sources, as well as farebox revenue. In addition to these sources a small percentage of funding is provided by a local match from the City of Roanoke and the City of Salem. To implement service along Route 419, Valley Metro service should be contracted based on the number of miles bus service will operate in each jurisdiction. Based on linear route measurements in GIS, 56% of the route is within Roanoke County boundaries, 38% in City of Salem and the remaining 6% is in the City of Roanoke. Valley Metro can acquire the necessary buses, equipment and personnel to fulfill their contracted obligations.

Timetable

The new route should also coordinate transfer times with the other transit services operating in the area. In particular, transfer points currently exist at the intersection with 460 where service is provided by Valley Metro routes 81, 82, 91, and 92. Other transfer points include; Roanoke Boulevard, served by routes 91 and 92; Lewis Gale Hospital, served by routes 71 and 72; and Tanglewood Mall served by routes 51, 52, 55, and 56. Additionally, this plan proposes extended service of the SmartWay bus at Orange Market and routes 61 and 62 at US 221. All of the existing and proposed transfer points should be considered when determining the exact route timetable for 419.

According to a study of eleven transit agencies around the country conducted by Vanasse Hangen Brustlin, the average vehicle speed is 13.05 miles per hour. Applying this average speed to the 419 route approximates a 45 minute total drive time. Considering this total route time, and allowing for a 15 minute driver break at the end of each route, using 2 buses along the corridor creates 1 hour headways

for the route. Buses will begin their route at 5:45 am from both Tanglewood Mall and the US 460 intersection. A start time of 5:45am will allow for coordination with the existing transit routes serving the corridor, creating the opportunity for transfers. The PM service will begin at 3:45pm to coordinate with the same routes. Service will run at hour headways for 3 hours at both the AM and PM peak.

Hour headways are commensurate with the off-peak headways for the other existing routes in the area. In particular, routes 51, 52, 55, 56, 71, 72, 81, 82, 91 and 92 all operate on 1 hour headways during off-peak hours. However, during peak hours these routes decrease headways to a half-hour. It is recommended that in the near term bus service along Route 419 should initiate at 1 hour headways. After service has been established and performance of the route evaluated it is recommended that if necessary service decrease headways to a half-hour to match the existing peak hour services. This will require 2 additional buses to operate along the corridor and therefore should be implemented after the evaluation of initial route ridership and performance.

PARK AND RIDE SERVICE

PRIMARY LOTS

Since the Route 419 bus service will be aimed toward serving commute trips, park and ride service will be a critical connection for regional commuters. Data analysis suggested that two factors significantly affect park and ride lot usage: VDOT sponsorship and a multimodal connection.

Orange Market

Orange Market, at the northern terminus of Route 419, will be officially adopted by VDOT. This will reinforce to potential users that the lot is open for public use. Orange Market has the opportunity to become a truly multimodal station. The lot will have access to the SmartWay bus, as outlined above, and already has access for cyclists. The 2009 Draft Park and Ride Study for the Roanoke Valley suggests that the Orange Market park and ride lot has a unique opportunity for bicycle access. A majority of park and ride lots are located along highways which makes bicycle access dangerous. However, the Orange Market lot is accessible via the Hanging Rock Battlefield Greenway trail system. Bicycle racks should be installed so that commuters can securely lock their bikes before boarding the bus.

Signage on 419 and 81 should be posted to alert motorists to the presence of the park and ride lots and indicate that the SmartWay bus connects with the lot. Additional amenities such as trash receptacles, benches, coverings, and route information signs should be included.

Tanglewood Mall

A new lot will be adopted at the southern terminus of the corridor near the intersection with US 220. Currently there are no official or unofficial park and ride lots at the southern terminus of 419. However, a large parking lot at Tanglewood regional mall is a potential site for a shared use park-n-ride lot. Shared use park and ride lots have been known to increase commercial sales at the site of the park and ride lots. Lot users find it convenient to run errands at the commercial site before driving home. Research suggests that on average users will shop once a week during the use of shared use lots. As a result, shared use lots

have been mutually beneficial for both commuters and commercial sites.

VDOT and the Tanglewood Mall owners must reach a contracted agreement for use of the parking lot as a shared use lot. The agreement must address liability of parking lot use, maintenance issues, and the appropriate parking spaces that commuters should use. Once an agreement has been reached, information signs should direct commuters to the lot and the specific parking spaces. A bus stop at Tanglewood Mall already exists and should be the focus for developing a shared use lot and multimodal transfer point. The stop should be equipped with benches, coverings, information signs, and bike racks.

Accessory Lots

Additional park and ride lots should be established along Electric Road to support the new bus service and support regional multimodal options. In order to reduce maintenance costs and the need for additional infrastructure; these accessory lots should operate as shared use lots and it is not necessary for the lots to be officially sponsored by VDOT. Lot location should coordinate with the existing and planned multimodal transportation network and available parking spaces. The following locations could potentially support a shared use accessory park and ride lot:

Lakeside Plaza: A commercial center located at the southwest corner of Route 419 and US 460. Lakeside Plaza is the northern terminus of the proposed 419 bus route, is currently served directly by Valley Metro Routes 81, 82, 91 & 92, and bikeway and greenway have also been planned for this location. The plaza has a large parking lot and commercial uses include a Kroger, CVS, McDonald's, Subway, a hair salon and other retail and convenience uses.

General Electric: Located at the corner of Roanoke Boulevard and Electric Road, has a few large parking lots that could possibly accommodate park and ride users. This intersection includes the major employment center of General Electric and a couple of gas stations/convenience stores, is served by Valley Metro Routes 91 and 92, and is a planned bikeway.

Lewis Gale Medical Center: With the presence of the hospital, the intersection of Keagy and Electric Road is a major attractor of trips in the region. The hospital is served by transit routes 71, 72, 91 & 92 and is part of a planned greenway. The facilities at the medical center include several large parking lots, but there are also large parking facilities at TMEIC, a branch of General Electric, and the Ridgewood Farm commercial center, which includes a grocery store, restaurants and other conveniences.

Brambleton Ave: The intersection of Brambleton Ave and Route 419 is a popular commercial, retail and entertainment center. There are a wide variety of commercial uses here, including: Ruby Tuesday, Arby's, El Rodeo, Pizza Hut, Kobe Japanese Steakhouse, Kroger, Walgreens, Goodwill, and Hollywood Video. Associated with all of these uses are many large parking lots that could be utilized for park and ride purposes. Currently, no transit serves the corridor, but a bikeway is planned.

All of these locations are ideal due to the resources that exist in each location. Data analysis suggests

that these areas have multimodal connections, multiple land uses, major activity centers, and infrastructure that would support park and ride use. However, park and ride use would depend on coordination with the owners of the parking facilities. As with the proposed Tanglewood Mall shared use lot, a contract agreement must be met to address liability of parking lot use, maintenance issues, and the appropriate parking spaces that commuters should use.

Cost Estimates

Table 5.3 shows the approximate capital and operating expense for the proposed Route 419 transit service. The table includes both the initial service proposal and the potential expanded service proposal.

There is no proposed new construction of park and ride facilities outlined in this plan. In case of the shared use park and ride facilities, parking spaces already exist and no new spaces should be added. Cost estimates for bus stop infrastructure at these sites are included in the table above. Likewise, exclusive park and ride lots referenced in this plan already exist. However, the RVAMPO's Constrained Long-Range Transportation Plan 2035 does indicate that $156,000 could be used to update the existing Orange Market park and ride lot with 30 new spaces and a bus shelter. This construction may be necessary to properly accommodate this plan's proposal to create a multimodal transfer center at the existing park and ride lot.

Table 5.3 Capital and Operating Cost of Proposed Transit Service

Capital and Operating Cost of Proposed Transit Service						
Proposal	Number	Cost per Unit	Hours of Operation	Cost Per Hour	Total Capital Cost	Total Operating Cost per Year*
1 Hour Headways	2	$60,000	12	$70	$120,000	$218,400
0.5 Hour Headways	4	$60,000	24	$70	$240,000	$436,800
Transit Stop Infrastructure	10	$12,000	n/a	n/a	$120,000	n/a

*Daily operating cost multiplied by 260 (average number of weekdays in a year)

PROPOSED FUTURE BIKE AND PEDESTRIAN ACCOMMODATIONS

BICYCLE ACCOMMODATIONS

Due to physical constraints, widening of Route 419 for the sole purpose of providing dedicated bicycle lanes was deemed to be infeasible. However, as traffic enhancements are planned for Route 419, there is an opportunity to design and construct bike lanes with the additional traffic lanes. For example, south of Brambleton Avenue (US 221), the future vehicular volumes will warrant widening Route 419 to a six lane section. This widening project can provide an opportunity to provide on-street bicycle lanes in each direction.

In other areas, there are numerous existing and planned designated bikeways, greenways, and/or trails that are in proximity to the corridor that can provide a mobility option for bicyclists. In addition, the existing typical section of Route 419 south of the northern intersection with Keagy Road provides wide shoulders that could be used for bicycle travel. Regular maintenance and debris removal within the shoulders is recommended to make this a safe and viable travel option for cyclists.

The following provides a summary of bicycle mobility considerations for segments of the study corridor.

I-81 south to US 460

Along the northern portion of the study area, between I-81 and East Main Street (US 460), the Hanging Rock trail presently provides a safe and convenient off-street travel way for bicycle travel. In the future, it is anticipated that this trail will continue to provide the means to traverse near the northern portion of this study area. Also, two parallel corridors, Peters Creek Road and Thompson Memorial Drive, both within approximately one mile offset from Route 419, are designated as bikeway corridors.

US 460 south to Braeburn Drive

The proposed extension of the Hanging Rock Trail will cross beneath Route 419 north of Lynchburg Turnpike, then continue south to join the Roanoke River Greenway north of Apperson Drive. Bicycles will then be able to use the proposed Roanoke River greenway to traverse back to the west to Route 419 north of Braeburn Drive. As an alternative, the proposed Thompson Memorial Drive bikeway will provide bicycle mobility west of Route 419 from points north to Apperson Drive.

Braeburn Drive / Keagy Road south to US 221

Along this section of Route 419, a wide shoulder exists along the links between the intersections. At the major intersections, the wide shoulder is used for right turn lanes. No greenways are proposed to parallel this section of Route 419.

US 221 South to US 220

The traffic analysis for this section of Route 419 indicates that widening to six lanes will be required in the future. This widening project will provide an opportunity to create dedicated bicycle lanes within the roadway typical section.

PEDESTRIAN/SIDEWALK ACCOMMODATIONS

The development of sidewalk recommendations included consideration of latent demand factors as analyzed through a GIS based routine as described in the appendix of this document. In addition to that analysis, consideration was also given to: field observations of existing "desire lines" (paths indicating the presence of pedestrians), locations of current and future activity centers, locations of existing and potential future transit stops, proximity to existing and proposed greenways, and observed pedestrian activity along the corridor.

At present, there are very few pedestrian accommodations in the corridor. The intersection of Route 419 with US 460 includes pedestrian signalization and crosswalks, and the intersection of North Keagy Road at Route 419 has pedestrian signalization and crosswalks across one of the approaches. Also, the intersection of Route 419 with Braeburn has crosswalk striping on the south side, however, does not have pedestrian signalization.

The following table summarizes the recommendations for providing sidewalks and pedestrian features throughout the corridor. The level of priority is indicated by either short, mid, and long term. The majority of improvements are shown as mid-term (5 to 10 years). However, the design effort could start in the short term (within 2 to 5 years) to allow for construction to occur closer to the five year planning horizon.

Figure 5.19 summarizes all multimodal improvements identified in the plan.

LAND USE RECOMMENDATIONS

Development patterns that promote multimodal access at key intersections, designated Activity Centers on the map (Figure 5.18) are recommended as part of the long term strategy for the corridor.

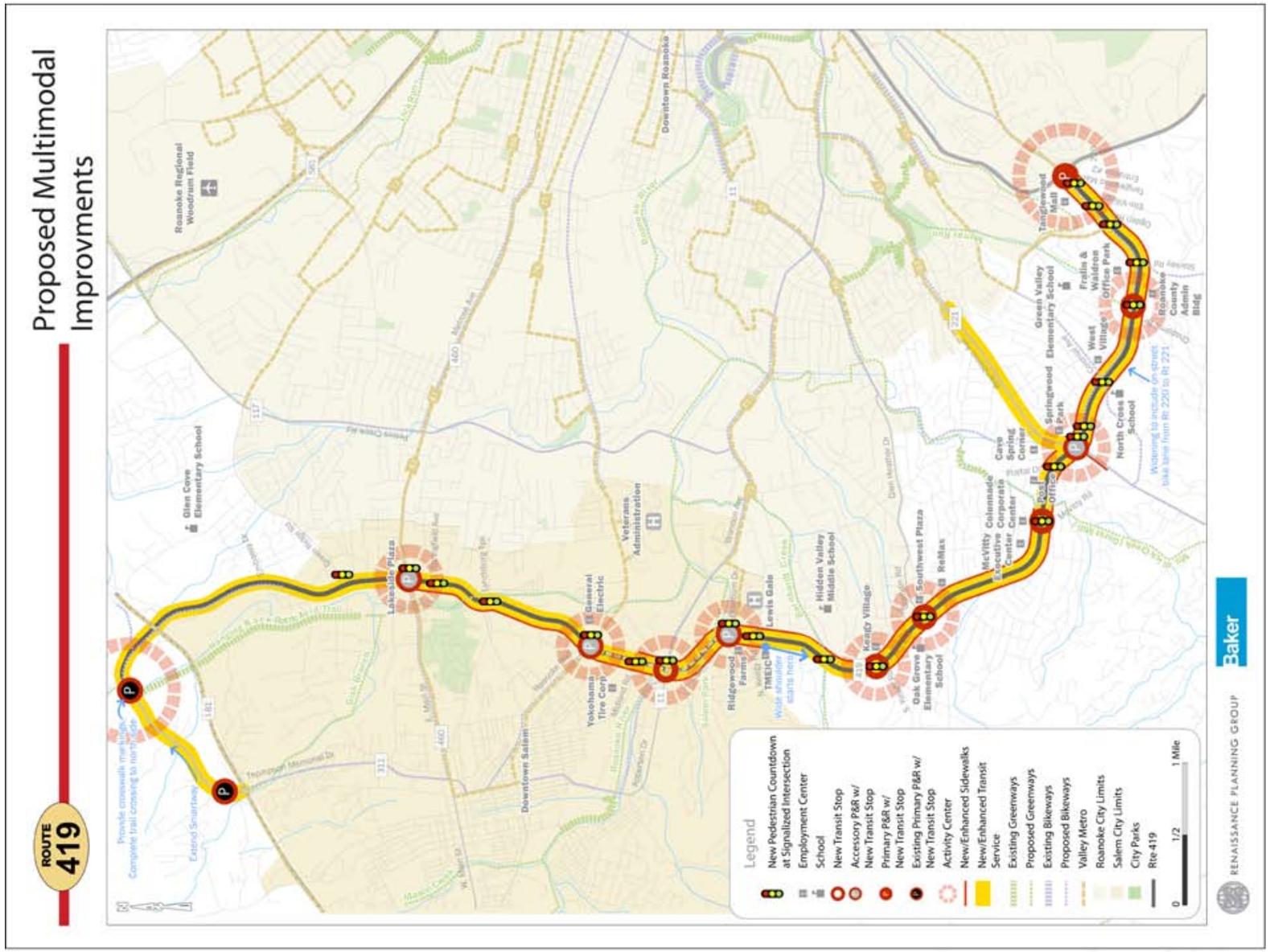
Traditional separation of land uses requires travel between sites, such as office and retail areas, which in turn puts pressure on the transportation corridors that connect those areas. When development sites allow a mixture of uses, such as jobs, housing, restaurants and shopping within a compact area, some of those trips occur off the main transportation corridors and a portion of trips may be able to shift away from the auto mode entirely.

To be successful, mixed use development must utilize both vertical (multiple floors) and horizontal (adjacent buildings) mixed use; include an interconnected street network that enhances the opportunities for pedestrians and cyclists and allows users to park once and walk between several uses in one trip; and provide a balance between activities that occur between the daytime, evening, and weekend hours, fostering a busier, safer, and more exciting environment at all times of the day. Concentrating land uses of appropriate intensity and density to generate transit ridership and produce a high level of pedestrian activity are also encouraged.

Figure 5.18 Lewis Gale Hospital Vicinity Visualization

The visualization below shows a potential of how development could occur to better support multimodal transportation in the area around Lewis Gale Hospital. Key features include crosswalks, sidewalks, streetscaping, access management features, and buildings fronting the street to create a more pleasant pedestrian environment.

Figure 5.19 Proposed Multimodal Improvements



SUMMARY OF SIDEWALK AND PEDESTRIAN IMPROVEMENTS

Segment / Intersection	Improvement	Length	Priority (S/M/L)	cost
I-81 South to Green Ridge Road	Consider sidewalk connections in conjunction with new development of the vacant property on the northeast section of this segment. Could include connection to adjacent neighborhood via a connection to Embassy Drive.	1,700	L	$175,409
Green Ridge Road to US 460	On Green Ridge Road, construct sidewalk along south side of the road to connect to existing sidewalks near the Church. Construct a sidewalk or multi-use trail connection between Green Ridge Road and US Route 460 along the east side of the road.	3,000	M	$309,545
US Route 460 to Roanoke Blvd.	Extend sidewalk south from US Route 460 along the west side of the road to Roanoke Blvd. Connect to future extension of the Hanging Rock Battlefield Trail at the bridge. Provide pedestrian features at the intersection of Texas Avenue. Widen sidewalk on bridge.	6,800	M	$801,371
Springfield Avenue, Lynchburg Turnpike,	Provide pedestrian features at the intersections of Springfield Avenue (west side), Lynchburg Turnpike (west and north sides).	N/A	M	$40,000
Roanoke Blvd to Apperson Drive	Provide sidewalk along west side of Route 419 to Apperson Drive. Also provide a sidewalk between Midland Road and Apperson Drive along the east side of Route 419. Provide pedestrian signalization and features along the western leg of Roanoke Blvd, all four legs of Midland Drive, and all four legs at Apperson Drive.	4,400	M	$660,000
Apperson Drive to Braeburn Drive	Provide sidewalks on both sides of Route 419. Provide pedestrian signalization and features on all four legs at the Braeburn Drive intersection. Connect the sidewalk near Apperson Drive to the Roanoke River Greenway near the Roanoke River bridge.	5,000	M	$624,091
Braeburn Drive to North Keagy Road	Provide a sidewalk on the east side of Route 419 for approximately 50' to provide access to the adjacent parking lot and business. Provide sidewalk along the west side of Route 419 between Braeburn Drive and North Keagy Road. Construct pedestrian signalization and features on all approaches at the North Keagy Road intersection	1,000	M	$156,818
Hidden Valley Drive to South Keagy Road	Provide sidewalks on the east side of Route 419 to connect the future Bernhard Creek trail to the South Keagy Road intersection.	1,900	L	$221,955
South Keagy Road to Grandin Road	Provide pedestrian signalization and features at both signalized intersections. Construct sidewalk on both sides of Route 419 between the intersections.	5,000	M	$664,091
Grandin Road to McVitty Road	Provide sidewalks on both sides of Route 419.	5,000	L	$584,091
McVitty Road to Postal Drive	Construct sidewalk between the two intersections along the south side of Route 419. Construct pedestrian signalization and features at the intersections.	2,500	M	$297,955
Postal Drive to Brambleton Avenue	Construct sidewalk on both sides of Route 419 between the two intersections. Construct pedestrian signalization and features.	1,150	M	$174,341
Brambleton Avenue to Route 220	Construct sidewalks with the 6 lane widening project.	11,300	M	$1,165,955
Chaparral Drive, Stakey Road, Ogden Road, Elmview Road, and Mall entrance	Construct pedestrian signalization and features at the intersections	N/A	M	$160,000
	Total			$6,035,621

IMPLEMENTATION TOOLKIT

The corridor plan for Route 419 includes recommendations to remedy safety, capacity, aesthetic, and other issues in addition to identifying measures to accommodate future travel demand by all modes of transportation. The recommended plan takes a multimodal approach to accommodating growth in travel demand by focusing on vehicular improvements as well as enhancements to support greater transit use and more convenience and safety for pedestrians and bicyclists.

Implementation of the recommended plan will require the partnership of a number of entities including Roanoke County, the Cities of Salem and Roanoke, the RVAMPO, the Virginia Department of Transportation (VDOT), Valley Metro, private transportation providers, neighborhood residents, elected officials, private land owners, developers, and other parties. Achieving success along the corridor will require cooperation, coordination, compromise, and investment. The corridor plan will need to be further developed through detailed engineering studies and designs and through public outreach associated with design efforts. Key steps in implementation include the following:

- Acceptance/Adoption/Approval of the Plan: The Cities of Salem and Roanoke, Roanoke County, and RVAMPO should approve/adopt the corridor study. It should be referenced as a part of other local and regional planning documents.

- Allocation/Programming: Funds for design and construction should be programmed by Roanoke County, the Cities of Salem and Roanoke, RVAMPO, and VDOT. In addition, as new development is approved along the corridor, right-of-way should be reserved and segments of the future cross section should be constructed as appropriate.

- Organization: The corridor spans three jurisdictions. A deliberate effort should be undertaken to coordinate project programming and design activities to support the logical and efficient implementation of the corridor plan.

- Design: The corridor study document contains a relatively specific set of recommendations. Engineering plans will need to be prepared prior to advancing any project to construction.

- Acquisition: Along some sections of Route 419, it will be necessary to acquire right-of-way to construct the recommended plan. Further studies will be necessary to verify precise right-of-way impacts and property acquisition needs.

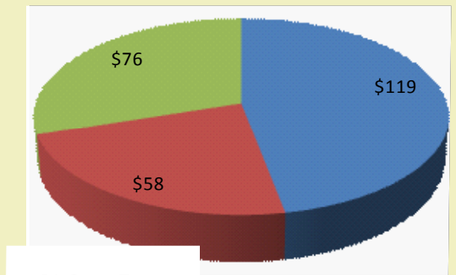
- Construction/Operations: Once plans and studies are complete and funding is available, modifications would be constructed.

In addition to the steps needed to implement the physical improvements for multimodal transportation, other steps will be necessary to realize the quality of development that will be necessary to support the improvements described in the plan. Policy recommendations, regulatory changes, public-private partnerships, neighborhood revitalization mechanisms, economic development goals, and business recruitment and retention strategies are key components to this aspect of implementation.

THE PUBLIC WEIGHS IN ON IMPLEMENTATION PRIORITIES

As part of the Route 419 Multimodal Corridor Study, the second community workshop was held on the evening of December 3, 2009 to give community members an opportunity to express their thoughts on draft recommendations for improving the Route 419 Corridor and provide feedback on their project priorities through an investment game (see Appendix for overview of Investment Game and full results).

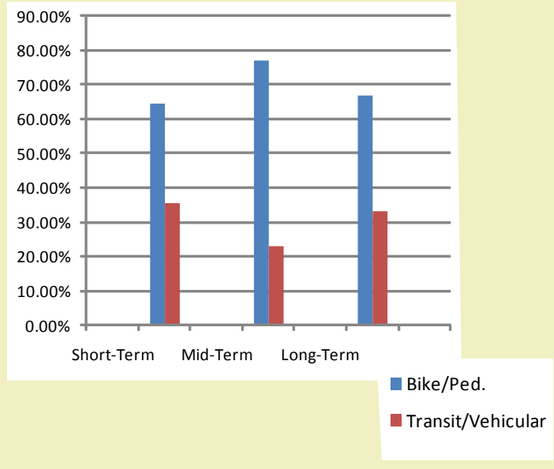
DISTRIBUTION OF INVESTMENTS OVER TIME

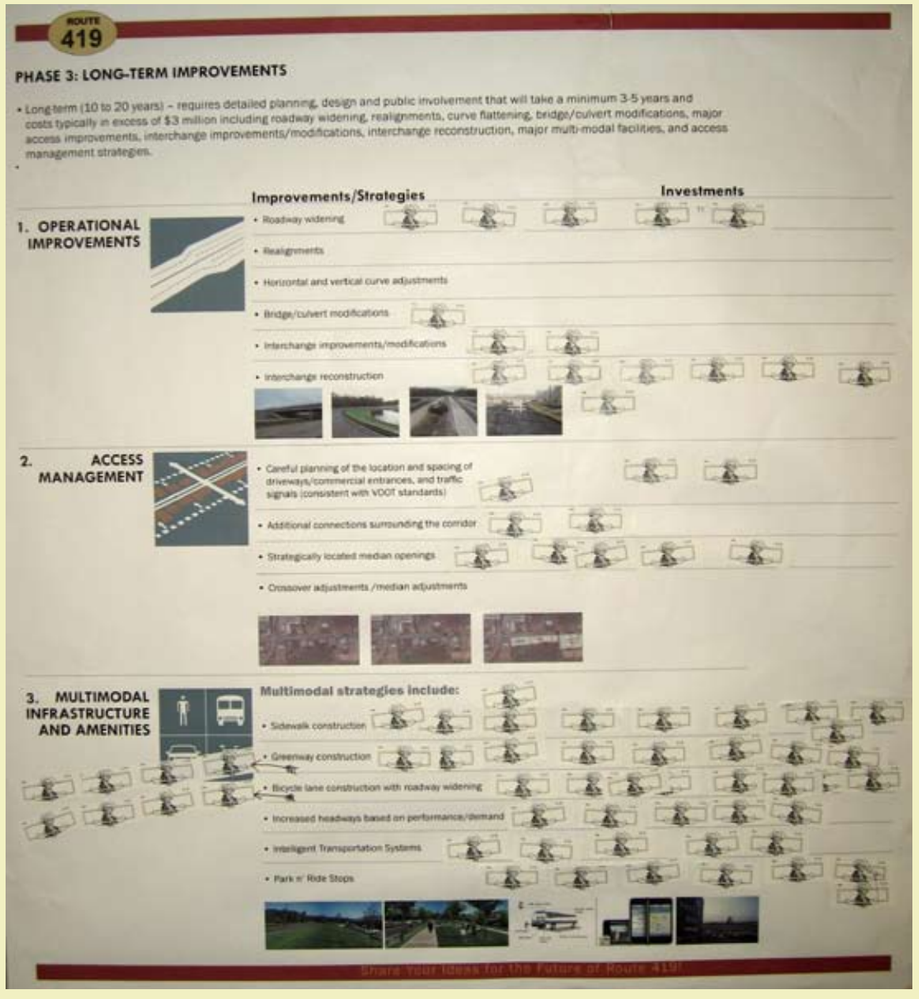


• A total of $253 dollars were spent in the investment game. Nearly half of all investment was made on short-term improvements., with operational and multimodal receiving similar investment, and Access Management somewhat less.

• In the mid- and long-term, there is a shift in investment towards Multimodal Improvements. In all phases, two-thirds of all dollars spent in the multimodal improvement category were allocated to bike and pedestrian improvements and one-third allocated to transit or vehicular oriented improvements

MULTIMODAL INVESTMENTS OVER TIME





The public could provide comment on different categories of improvements in the short, medium, and long term.

POLICY AND REGULATORY CHANGES

1. APPLICATION OF THE CORRIDOR PLAN.

It is recommended that the Route 419 corridor plan be included as an amendment to each jurisdiction's Comprehensive Plan. For physical roadway improvements within the existing public right-of-way ("off-site" of a particular development tract) such as widening the roadway, adding lanes, or adding turn lanes, the fundamental implementation tool is to adopt the recommended road improvements as elements shown in the Comprehensive Plan.

Adopting the desired improvements into the Comprehensive Plan provides the basis for accepting road improvements, improved design features and other amenities, and multimodal infrastructure as proffers through the conditional zoning process. In sum, this plan sends an important message to property owners and residents that elected officials and community members support the initiative and that the jurisdictions intend to implement its principles. City and County staff and members of the Planning Commissions have a clear direction to instruct applicants to meet the goals of the Plan.

2. ZONING REGULATIONS

The review of existing zoning regulations and site analysis indicated that in many cases the zoning along the corridor does not match either the goals of the community to create mixed use centers or the form necessary to support a multimodal environment. Corridor jurisdictions should consider amending their zoning regulations in order to achieve the vision set out in the Corridor Plan and to assure that public improvements that are necessary to serve new development are provided as components of new development or redevelopment projects

There are three types of zoning adjustments that should be considered: (1) Market-based adjustments to allow activity that meets the objectives of the Corridor Plan; (2) Requirements that prescribe standards and procedures; and (3) Incentives to encourage activity of a type that cannot be required.

(1) Market-based Regulatory Adjustments: To the extent that there are actions currently prohibited that might be taken by private property owners, in response to market conditions, that would promote public objectives for the Route 419 Corridor, zoning regulations may be adjusted to allow these actions. For example allowing residential development in commercial districts.

(2) Regulatory Requirements: Zoning regulations can also be adjusted in a manner that requires new development (or redevelopment) to meet more rigorous standards, and/or to provide public infrastructure that will be needed as a result of the development. While requirements for off-site improvements and expanded landscaping requirements, or to mitigate traffic impacts through contribution to the development of the greenway network or operation of the transit system cannot be required, they can be voluntarily profferred through conditional zoning.

(3) Regulatory Incentives: Zoning regulations can be adjusted in a manner that provides incentives for property owners to take actions that are in the public interest. Incentives could take the form of (1) Less stringent requirements if characteristics of proposed development are consistent with policy objectives; (2) streamlined process if development is proposed

that is consistent with policy objectives; (3) Modifications of regulations and requirements if certain findings are met; and/or (4) Public participation in the financing of required infrastructure.

Form based zoning is an emerging land use tool that is appropriate for redevelopment and infill development, particularly in areas where the goal is to promote multimodal development patterns. A Form Based Code is a land development regulatory tool that places primary emphasis on the physical form of the built environment. Conventional zoning strictly controls land-use, through abstract regulatory statistics, which can result in very different physical environments. The base principle of form-based coding is that standards regulating use are relaxed in favor of promoting a particular urban form. Simple and clear graphics that address how close buildings are to the street, window and door openings on walls facing the street, particularly at street level, and how buildings relate to public spaces. The width and design of streets is also regulated to ensure that buildings and streets are properly designed to create a pedestrian and transit-friendly environment. Multiple uses are encouraged in buildings so that residential areas are not separated from employment or shopping activities.

Figure 6.1 Tanglewood Mall Vicinity Visualization

The visualization below shows a potential of how infill development could occur to better support multimodal transportation in conjunction with roadway widening in the area around Tanglewood Mall.

While it may be difficult to implement a Form Based Code for the entire corridor, a form based code may be appropriate for activity center locations depicted on the multimodal map. A Form Based Code would allow by-right development of property in congruence with standards set forth in the code. A Form Based Code would streamline the process of getting projects approved because of the investment in public process and consensus that the Plan incorporates. The corridor jurisdictions should consider amending their Zoning Ordinances to include a Form Based Code in areas where very specific design and development objectives, such as designated activity centers, override the need for cash proffers associated with rezonings.

3. STREET DESIGN MANUALS

The Virginia Department of Transportation (VDOT) has taken numerous steps in recent years to better accommodate multiple modes in its transportation planning and design process. Two notable examples of their commitment to multimodal planning include: Virginia's Statewide Transportation Plan (VTRANS 2025) and the adopted Policy for Integrating Bicycle and Pedestrian Accommodations.

The Road Design Manual is VDOT's most useful tool for regulating the design of the transportation network at the local level, and has recently undertaken a number of revisions to better implement its multimodal policies. Specifically, revisions to the Subdivision Street Requirements (Appendix B of the VDOT Road Design Manual) include provisions for a connected transportation system and street network, and alternative transportation options (driving, transit, bicycling or walking). VDOT also recently revised its Access Management Standards for Principle Arterials (Appendix F of the Road Design Manual), which provide spacing standards for entrances, intersections, and median openings, signal spacing, entrance locations, and rules for vehicular, and where appropriate, pedestrian circulation between adjoining properties. As these, and other, policies evolve, the Cities/County should work with VDOT to find ways to incorporate multimodal transportation improvements within their own manuals. This could include working with VDOT on changes to the Secondary Street Requirements, granting exceptions within the development review process to foster multimodal improvements, or including multimodal facilities concurrent with planned roadway improvements.

4. PROMOTE THE CORRIDOR PLAN

Continuing to spread the word about this plan and successful initial projects is vital for implementation. A variety of media are recommended - brochures, Internet, or TV are some common methods to promote the plan so it will start to take on a life of its own and continue to work for the region for years to come.

5. FUNDING MECHANISMS

To achieve the goals of the Plan, funding will be necessary. The State and national financial crisis is limiting traditional funding sources for major capital projects, such as Capital Improvement Programs and RVAMPO's Transportation Improvement Program (TIP). Recognizing the need for new ways to complement and address gaps in traditional funding sources, VDOT and localities will need to look to a number of innovative funding and financing tools for transportation improvements. According to the Federal Highway Administration (FHWA), innovative financing encompasses a combination of techniques and mechanisms that include new or nontraditional sources of revenue; new financing mechanisms

Table 6.1 Federal and State Transportation Financing Programs

Program	Applicability	Additional Information
Federal and State Transportation Financing Programs		
Safety Programs	The Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users (P.L. 109-59) establishes DOT's Highway Safety Improvement Program as a core program. SAFETEA-LU provides flexibility to allow states to target funds to their most critical needs. States are required to create State Strategic Highway Safety Plans (SHSPs) to identify and analyze highway safety problems, which will enable them to allocate up to 10% of their Highway Safety Improvement Program (HSIP) funds for behavioral and other safety programs (after addressing rail grade and infrastructure safety issues identified in the SHSP). There are a number of programs identified within SAFETEA-LU that provide for the funding of bicycle and pedestrian projects.	http://www.fhwa.dot.gov/safetealu/summary.htm Recreational Trails Program http://www.dcr.virginia.gov/recreational_planning/trailfnd.shtml Congestion Mitigation/Air Quality Program http://www.fhwa.dot.gov/environment/cmaqpgs/08guide.htm
Regional Surface Transportation (RSTP) Funds	The federal Surface Transportation Program, which authorized about $6.47 billion in federal funds in 2008, allocates resources based on lane miles and vehicle miles traveled on federal highways. The Regional Surface Transportation Program (RSTP) allocates funds based on population for urbanized areas with more than 200,000 people. It also provides flexibility to shift funds from highway to transit expenses. Examples of projects to which RSTP funds can be applied include: • Road widening; • Repaving; • Bicycle and pedestrian improvements (including on-street facilities, off-road trails, sidewalks, crosswalks, bicycle and pedestrian signals, parking, and the modification of sidewalks to comply with the requirements of the Americans with Disabilities Act); • Transit capital; and • Research.	http://www.fhwa.dot.gov/safetealu/factsheets/stp.htm http://www.fhwa.dot.gov/legsregs/directives/notices/n4510674.htm
Earmarking	Earmarks consist of line items written into federal, state or local legislation designating funding for specific projects. These allocations circumvent the standard competitive assignment of funds normally required for projects. While there are earmarks for improvements to the Route 50/Route 15 interchange at Gilbert's Corner, the federal Office of Management and Budget does not list any federal earmarks within the immediate project area.	http://earmarks.omb.gov/

Table 6.1 (continued) Federal and State Transportation Financing Programs

Program	Applicability	Additional Information
Federal and State Transportation Financing Programs		
Transportation Funding and Reform Act of 2007	The Transportation Funding and Reform Act of 2007 (HB 3202) allows counties to raise commercial property taxes as much as $0.25. For FY 2009, the Fairfax County Board of Supervisors approved a tax rate increase of $0.11, and is expected to generate approximately $52 million transportation projects. Funds can be spent on roadway, pedestrian and transit projects.	https://leg1.state.va.us/cgi-bin/legp504.exe?071+ful+CHAP0896 http://www.fairfaxcounty.gov/dmb/adopted/FY2009/PDF/Volume2/sr_124.pdf
Transportation Partnership Opportunity Fund (TPOF)	The legal framework for the TPOF begins with Chapter 845 of the 2005 Acts of Assembly. The TPOF is to be used by the Governor of Virginia through the Design-Build provisions of the Virginia Code (§33.1-12(2)(b)) pursuant to the Public Private Partnership Act of 1995 (Virginia Code § 56-556 et seq.). The Governor can also use TPOF monies for transportation aspects of economic development projects. Grants can be up to $5 million, while loans up to $30 million can be obtained interest free, but require repayment within 7 years. While flexible, TPOF funds are limited to use when the capacity of existing funding mechanisms has been exceeded.	http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+33.1-221.1C8 http://www.virginiadot.org/projects/resources/tpoflmplementationGuidelines10-2005.pdf
Revenue Sharing	The Virginia Department of Transportation Revenue-Sharing Program is authorized under Virginia Code §33.1-2305. The program allows for Virginia Department of Transportation funds to match locality funds for improvement, construction or reconstruction on any functional class of roadway. A locality can request funds for projects in other localities. The program is currently funded at a level of $50 million; each locality may request up to $1 million.	http://www.virginiadot.org/business/resources/local_assistance/Revenue_Sharing_Guide_2008.pdf
VDOT Primary and Secondary Roadways[1]	VDOT Funds both primary and secondary roadways. Primary roads are designated by route numbers 1 – 599; secondary roads are designated by route numbers 600 and up. Funds for primary roads are allocated through a formula based 70% on vehicle miles traveled (VMT), 25 % on lane miles, and 5% on primary need. Project selections for secondary road projects, while funded by VDOT, are the responsibility of county boards and supervisors. No local match is required. The formula for allocating secondary road funding is 80% population, 20% land area. For urban roadways – those within the boundaries of cities and towns – a 2% match is required. Only a small percentage of secondary roads qualify for federal funding.	http://www.virginiadot.org/projects/reports-budget.asp

[1] The urban roadway system receives approximately 30% of state funding; these monies are allocated to cities and towns based on population.

Table 6.2 Local Transportation Financing Programs

Program	Applicability	Additional Information
	Local Transportation Financing Programs	
Community Development Authorities (CDA)	CDAs may be established by the governing body upon petition from 51% of the land area or assessed value of land in any tract or tracts of land in a proposed district. The main powers of a CDA are to finance, fund, plan, construct, operate, and maintain the infrastructure improvements enumerated in the ordinance establishing the district. These can include acquisition of land; construction or improvement of roads, bridges, parking facilities, curbs, gutters, sidewalks, traffic signals, storm water management and retention systems, gas and electric lines and street lights. The CDA may provide that the locality annually collect a special tax on real property within the CDA's jurisdiction to finance the services and facilities provided by the authority. Unless requested by every property owner within the proposed district, the rate of the special tax can not be more than $.25 per $100 of the assessed fair market value of any taxable real estate.	See Code of Virginia § 15.2-5152.
Service Districts	Any locality may by ordinance, create service districts within the locality. The locality must hold a public hearing prior to the creation of any district. (Note that two localities may jointly act to create such a district located in both localities). Service districts are created to provide additional, more complete or more timely services of government than are desired in the locality as a whole. Once an ordinance creating a service district is adopted, the governing body has additional powers pertaining to the district, including: • to construct, maintain, and operate such facilities and equipment as may be necessary or desirable to provide additional, more complete, or more timely governmental services within a service district. • to provide construction, maintenance, and general upkeep of streets and roads, public transportation systems serving the district, including the acquisition of real estate necessary to provide such services. • to levy and collect an annual tax upon any property in the service district subject to local taxation to pay for providing the additional governmental services. Note, however, in contrast with the Community Development Authority provisions, such annual tax shall not be levied for or used to pay for schools, police, or general government services.	See Code of Virginia § 15.2-2400.

Table 6.2 (continued) Local Transportation Financing Programs

Program	Applicability	Additional Information
	Local Transportation Financing Programs	
County General Obligation Bonds	General obligation bonds provide up-front capital financed through a revenue stream backed by local government tax revenues (primarily property tax). In 2004, Fairfax County issued about $165 million in transportation bonds. Another $110 million in bonds for transportation was approved by voters in 2007.	http://www.fairfaxcounty.gov/dmb/bonds.html http://www.fairfaxcounty.gov/dmb/adopted/FY2009/pdf/Volume1/00140.pdf
Increment Financing/Urban Renewal Funds	Tax Increment Financing (TIF) is a tool to use future gains in taxes to finance the current improvements that will create those gains. When a public project (e.g., sidewalk improvements) is constructed, surrounding property values generally increase and encourage surrounding development or redevelopment. The increased tax revenues are then dedicated to finance the debt created by the original public improvement project. Tax Increment Financing typically occurs within designated Urban Renewal Areas (URA) that meet certain economic criteria and approved by a local governing body. To be eligible for this financing, a project (or a portion of it) must be located within the URA.	
System Development Charges/Developer Impact Fees	System Development Charges (SDCs), also known as Developer Impact Fees, represent another potential local funding source. SDCs are typically tied to trip generation rates and traffic impacts produced by a proposed project. A developer may reduce the number of trips (and hence impacts and cost) by paying for on- or off-site pedestrian improvements that will encourage residents to walk or use transit rather than drive. In-lieu parking fees may be used to help construct new or improved pedestrian facilities. Establishing a clear nexus or connection between the impact fee and the project's impacts is critical in avoiding a potential lawsuit.	
Proffers	Proffers are a form of conditional zoning authorized under the Virginia Code (§15.2-2298 – 2303). Proffer rates are negotiated by localities and can include cash amounts, dedicated land, or capital improvements; Fairfax and Loudoun Counties are principle users of proffers to support transportation projects.	http://www.loudoun.gov/Portals/0/docs/Budget/DraftFY09/Proffer.pdf http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+15.2-2298
Private Funding Sources and Volunteer Services	Local businesses can help defray some of the costs associated with trail and greenway development and operation. Some examples include: • Cash donations • Donations of services, equipment, and labor • Discounted materials • Contribution of employee volunteer time Community organizations can be very successful at hosting fundraisers and providing volunteer labor for trail building and maintenance activities. Local examples include 4-H, Boy Scouts of America, Rotary Club, university service clubs, equestrian and cycling groups and others.	

Table 6.2 (continued) Local Transportation Financing Programs

Program	Applicability	Additional Information
	Local Transportation Financing Programs	
Non-Profit Corporations (IRS Rule 63-20) ***Note: not necessarily a funding source, but a strategy for raising funds for capital projects.***	This rule permits nonprofit corporations to raise tax exempt bonds and enter into agreements with contractors for infrastructure provision. The corporation must develop a facility that serves a public purpose, and be expressly authorized by the state. The completed facility is then leased back to the state, with the lease payments covering the debt service. At the end of the lease/debt service repayment, the facility becomes the property of the state. VDOT used this financing strategy for construction of the Pocahontas Parkway. The use of 63-20 corporations provides added flexibility with respect to project delivery methods and project timing. But a report by the state of Washington suggests that these entities incur higher financing costs than debt issued directly by a government agency.	http://www.wa.gov/tre/BondDebt/bnd_63-20cof.pdf http://www.fhwa.dot.gov/innovativeFinance/ifq62.htm

designed to leverage resources; new funds management techniques; and new institutional arrangements. It also includes new approaches to more traditional instruments, such as new bonding authorities.

The table on the following pages highlights numerous funding sources that could be applicable to the Route 419 corridor. Each funding source comes with unique requirements and qualification processes. In all likelihood, the ultimate funding of the recommended improvements will be satisfied through a combination of methods.

TRANSIT

Capital Investment

According to the 2007 National Transit Database, Valley Metro capital expenses are funded with 80% federal assistance, 15% state funds, and 5% local funds. Proposed bus service along Route 419 initially requires 2 buses to operate on hourly headways, with the potential expansion to 4 buses to operate on half-hour headways. The cost of each purchased bus is approximately $60,000; based on the average price for 26 passenger buses from Carpenter Bus Sales. In addition, capital investment in bus stop infrastructure is necessary to support the proposed route. According to the RVAMPO's Constrained Long-Range Transportation Plan 2035 approximate cost for bus shelters is $12,000.

Operation and Maintenance

Unlike capital investments, which are funded almost entirely from State and Federal sources, operations costs are funded by multiple sources of revenue. According to the 2007 National Transit Database, Valley Metro operating expenses are funded with 23% fare revenues, 16% local funds, 18% state funds, 35% federal funding, and 8% through other additional funds. A system-wide average for Valley Metro operating cost is $70/hour. However, RADAR, which operates the on-demand paratransit service for the Roanoke region has an average operating cost of $45/hour. For the purpose of this analysis, $70/hour will be used to formulate conservative cost estimates. However, due to the hybrid nature of the proposed transit service for 419, which combines traditional fixed route service and the use of smaller buses, the per hour operation cost would likely be less than $70/hour. Proposed operation of 419 transit service is 6 hours per bus, per day.

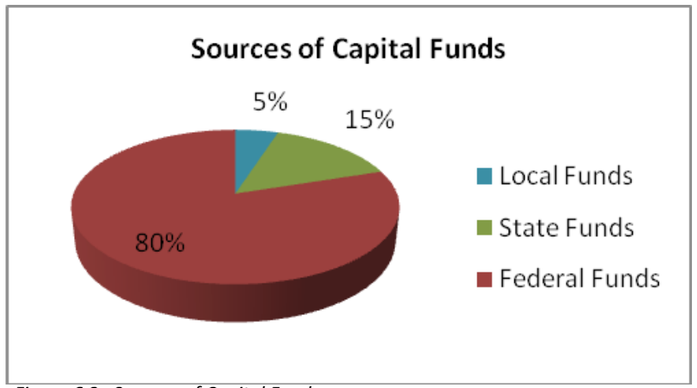


Figure 6.2 Sources of Capital Funds

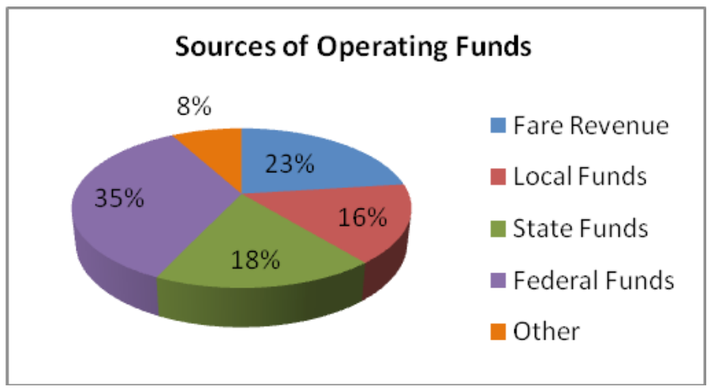


Figure 6.3 Sources of Operating Funds

Funding Sources

There are several grant programs administered by the Virginia Department of Rail and Public Transportation (DRPT) that can serve as sources of funding for public transit. These grant programs function at the State and Federal level and include funding for both capital and operating expenses. Not all of

these grant programs are applicable to the proposed transit and park and ride service along 419; however several grants are likely sources of funding. Specifically the State Aid Grant Programs include: Operating and Capital Assistance, TDM/Commuter Assistance, and Transportation Efficiency Improvement Funds. Further details regarding these State Aid Grant Programs are provided in Table 6.3. Likewise, not all Federal Aid Grant Programs are applicable, but several are likely sources of funding for the proposed Route 419 service. These Federal programs include; FTA Section 5307 – Small Urban Areas Program, FTA Section 5311 – Rural Areas, and FTA Section 5316 – Jobs Access and Reverse Commute Program. These programs are detailed in Table 6.4. Valley Metro and the jurisdictions in which transit operations exist, may already utilize these programs to secure funding for transit services.

Table 6.3 : DRPT Administered State Aid Grant Programs

State Aid Grant Program	Program Description	Eligible Recipients	Matching Ratios
Operating Assistance	Supports costs borne by eligible recipients for operating related public transportation expenses	Local and State Government Transportation District Commissions Public Service Corporations	Up to 95% of eligible expenses
Capital Assistance	Supports costs borne by eligible recipients for public transportation capital projects	Local and State Government Transportation District Commissions Public Service Corporations	Up to 95% of eligible expenses
Demonstration Project Assistance	Assists communities in preserving and revitalizing public or private-public transportation service by implementing innovative projects	Local and State Government Transportation District Commissions Public Service Corporations	Up to 95% of eligible expenses
Public Transportation Intern Program	Supports increased awareness of public transportation as a career choice	Local and State Government Transportation District Commissions Public Service Corporations Planning District Commissions Human Service Agencies Involved in Rural Public Transportation	Up to 95% of eligible expenses
Technical Assistance	Supports planning or technical assistance to help improve or initiate public transportation related services	Local and State Government Transportation District Commissions Public Service Corporations Planning District Commissions Human Service Agencies Involved in Rural Public Transportation	Up to 50% of eligible expenses Federal Funds may be provided to support 80% of project costs
TDM/Commuter Assistance	Supports administration of existing or new local and regional Transportation Demand Management/ Commuter Assistance programs	Local and State Government Transportation District Commissions Public Service Corporations Planning District Commissions	Up to 80% of eligible expenses
Transportation Efficiency Improvement Funds (TEIF)	Supports Transportation Demand Management projects and programs that encourage the reduction of single occupant vehicle travel	Local and State Government Transportation District Commissions Public Service Corporations Planning District Commissions Transportation Management Associations	Up to 80% of eligible expenses
Senior Transportation Program	Supports projects and programs that improve mobility for senior citizens	Local and State Government Transportation District Commissions Public Service Corporations Private Non-Profit Organizations	Up to 95% of eligible expenses

Table 6.4 : Federal Aid Grant Programs

Federal Aid Grant Program	Program Description	Eligible Recipients	Matching Ratios
FTA Section 5303 – Metropolitan Planning	Supports transit planning expenses	Metropolitan Planning Organizations	Up to 80% of eligible expenses
FTA Section 5304 – Statewide Planning	Supports local and statewide transit planning projects	Local and State Government Transportation District Commissions Public Service Corporations Planning District Commissions	Up to 80% of eligible expenses
FTA Section 5307 – Small Urban Areas Program	Supports operating and capital costs of transit operators in small urban areas	Local and State Government Transportation District Commissions Public Service Corporations Planning district commissions	Up to 50% of net operating expenses Up to 80% of eligible capital expenses
FTA Section 5310 – Transportation for Elderly Persons and Persons with Disabilities	Supports the purchase of vehicles and equipment	Private non-profit operators of transit services for the elderly and persons with disabilities.	Up to 80% of eligible expenses
FTA Section 5311 – Rural Areas	Supports operating and capital costs of transit operators in non-urbanized areas	Local and State Government Transportation District Commissions Public Service Corporations Private Non-Profit Organizations	Up to 50% of net operating expenses Up to 80% of eligible capital expenses
FTA Section 5316 - Jobs Access and Reverse Commute Program	Supports the operating and capital costs of special programs designed to connect unemployed people to jobs	Recipients eligible for Section 5311: Local and State Government Transportation District Commissions Public Service Corporations Private Non-Profit Organizations Recipients eligible for Section 5307: Local and State Government Transportation District Commissions Public Service Corporations Private Non-Profit Organizations	Up to 50% of eligible operating expenses Up to 80% of eligible capital expenditures
FTA Section 5317- New Freedom Program	Supports capital and operating costs of new public transportation services and new public transportation alternatives beyond those required by the Americans with Disabilities Act of 1990.	Local and State Government Public Service Corporations Private non-profit organizations	Up to 50% of eligible operating expenses Up to 80% of eligible capital expenses

Source: Public Transportation and Commuter Assistance Grant Program Application Guidance. DRPT, November 2008.

In addition to traditional funding sources for capital and operating expenses – such as fare box recovery, Federal and State funds, and local match funds – other sources of revenue are available to fund public transportation services. Some of the alternative funding sources for transit include development impact fees, business partnerships and advertising.

Development Impact Fees

The Route 419 corridor has several planned development sites and several more sites with the potential for development. Impact fees and proffers can be administered on new development sites since the increased residential or commercial activity of the new development will benefit from the presence of transit and/or park and ride service. Impact fees are most often collected as a one-time fee to help fund the construction or expansion of transportation services. When introducing impact fees to fund service it is important to create a nexus, or relationship, between the impact fees charged and the transportation improvement. In other words, "impact fees may only be imposed for capital expenses necessitated by and directly attributable to the cost of system improvements needed to serve new growth and development." Impact fees must be approved by the Virginia General Assembly for each locality.

Business Partnerships/Advertising

Partnerships with local commercial and employment centers can also serve as a source of funding for transit in several different ways. Businesses along the corridor create a significant portion of the trips on Route 419 each day by attracting customers/employees and handling shipping and receiving. As a result, the private sector has a vested interest in improving mobility along the corridor. In addition, their interest is not limited by county and city boundaries. To illustrate a business's interest to support transportation investment, in 2008 the Chicago area reported a $7.3 billion loss, measured in fuel cost and lost time for businesses and commuters as a result of congestion.

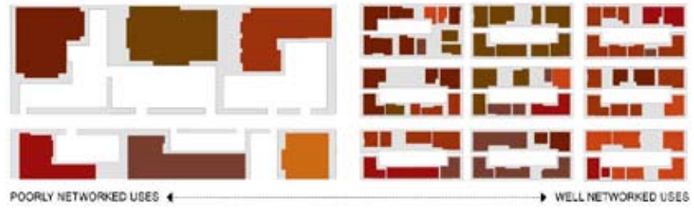
In that regard, there is an incentive for business owners to support improved public transportation service. There are two basic ways a business can fund transit: direct or indirect financing. Direct financing occurs when a business supports services directly either through a donation or franchise taxes. Indirect financing can occur in a number of ways. For example, businesses can subsidize transit fare for their employees. Fare subsidization supports transit by increasing the potential ridership, but also allows business to offer additional benefits to employees, which helps with worker retention and attraction. Another example would be the purchase of advertising space on buses. This creates an additional revenue stream for the transit agency, but also provides another marketing opportunity for local businesses. In either case, fostering a relationship between local business and public transit agencies can be a mutually beneficial affiliation.

BEST PRACTICES

General Principles

The following section provides an introduction to the principles of ***Connectivity***, ***Site Design***, ***Land Use***, and ***Open Space***. The successful integration of these principles into land use and transportation planning helps to set the framework for a multi-modal environment.

1. CONNECTIVITY



Well-connected areas promote multi-modal activity by making connections between destinations accessible and convenient. In a typical suburban condition density and diversity exist, but there are few direct, integrated connections. (see diagram on the left). Creating a more interconnected network allows for more transportation choices, in turn making it possible to reduce lane widths and reduce vehicle speeds. In the diagram on the right, the interconnected street network creates direct connections between buildings and parking is tucked behind, and separated from, the street edge. Traffic is spread over several streets to minimize the conflict between various modes of transportation. More streets will disperse traffic and transform the streetscape into a place for pedestrians and bicyclists to safely move between destinations.

2. SITE DESIGN

Successful site design balances auto and pedestrian accessibility and creates a presence that is welcoming to both from the street. A key factor is the organization of buildings, parking, and transit stations relative to adjacent streets. Frequently, single-story buildings are set far back from the road, leaving a large, open expanse of parking visible to the roadway. A more desirable alternative reverses this placement, drawing the building to the street edge and moving parking to the rear, in turn providing a more intimate pedestrian-friendly frontage along the roadway. In this way, buildings are used to frame the street and enhance the pedestrian environment with storefronts, entrances, and transit stops accessible from the sidewalk. It is important to note that standard parking requirements can lead to an oversupply of parking spaces and open expanses of asphalt. Reducing minimum off-street parking requirements and setting average-usage standards in place of peak-usage standards reduces parking needs and required development area. Additionally, on-street parking should be counted towards the required number of parking spaces.

3. LAND USE

Walkable centers typically include a careful balance of land uses, combining jobs, living, and shopping within close proximity. Mixed-Use development provides a diverse range of commercial stores, shops, restaurants, and housing within a compact, walkable area. To be successful, mixed-use development must provide strong connections between different uses, allowing residents, employees, and patrons to naturally overlap and cross between uses. Creating a compact and interconnected street network also enhances opportunities for pedestrians, cyclists, and transit user to park once and walk between several uses in a single trip. Additionally, the diversity of uses balances activity between the daytime, nighttime, and weekend hours, fostering a busier, safer, and more exciting environment for all residents, employees, and visitors and at all times of day.

4. OPEN SPACE

greenway

neighborhood park

Open space is a broad classification for public spaces ranging from community recreational areas to town squares. Formal civic spaces, such as town squares, should be located in urban settings serving areas of highest intensity, while recreational facilities, greenways, and preserved open spaces should be strategically placed to serve the community at large. Often, environmental and natural features are integrated into open space planning. Viewsheds and natural features, including water bodies, wetlands, and steep slopes, should be preserved as open public space wherever possible.

Open spaces serve a variety of uses as connectors - such as greenways - and community spaces - such as a neighborhood park. Open spaces and parks should be located to serve a broad population and provide maximum access to natural features.

MULTIMODAL BEST PRACTICES BY ROADWAY TYPE AND MODE OF TRANSPORTATION

As new centers develop along the 419 corridor in the future, planning for a multi-modal network will need to include a broad variety of roadway types. Streets must provide an efficient and balanced network for vehicles, bicycles, and pedestrians to make connections on and off of Route 419.

The following section provides general guidelines for accommodating multi-modal activity along urban to rural roadway types. Not all of these roadway types will apply to areas on or near the 419 corridor. However, the full range is included for reference. Additionally, a summary section further details recommendations for sidewalks, bicycle lanes, and transit.

B. MULTI-MODAL BEST PRACTICES BY ROADWAY TYPE

Streets and corridors provide a framework for development in a given area. Effective street design is critical to the viability of walkable, mixed-use areas and should reinforce the transition from urban to rural areas. The street types in this section are intended to provide recommendations for a range of urban and rural conditions that may exist now or in future centers along our study area. Street types developed for bicycle and pedestrian-friendly areas include the Commercial Street, Main Street, and Residential Street. These types carry lower speed traffic and have unique requirements for balancing the mobility needs of automobiles, bicycles, and pedestrians. Street types intended for rural use include the Parkway and Rural Road. These types have specific guidelines for integrating with rural settings and optimizing the movement of vehicles at higher speeds and over longer distances.

Key Features

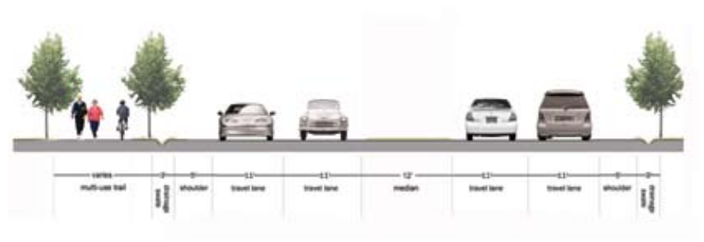
Streets must balance vehicular and pedestrian traffic

Narrow lane widths reduce vehicle speeds

Street Trees and On-Street parking create a buffer between the pedestrian realm and vehicular traffic

B1. PARKWAY

A Parkway provides longer distance connections between concentrated centers. Parkways are characterized by their rural qualities, and are often bordered by open tracts of farmland, preservation areas, or otherwise undeveloped land. Because of higher travel speeds, a multi-use path may be used to provide bicycle and pedestrian connections along a parkway. A multi-use path is a paved facility that is separate from vehicle travel lanes, though it may or may not be within the right-of-way of a road.



target speed **45-55 mph**

The design of a multi-use path is highly flexible, but they should be at least 10-12' wide and should have at least 4' horizontal clearance on each side.

B2. COMMERCIAL STREET

A Commercial Street provides short distance, medium speed connections through pedestrian-oriented areas. Bicycle lanes and street trees are appropriate, and emphasize the balance between cars, cyclists, and pedestrians. It is important along commercial streets to minimize the number of individual driveways that interrupt the pedestrian and bicycle pathways. Instead, parking to the rear of buildings, preferrably accessed via an access road or alleyway, will provide minimal interruption to the bike/ped network.

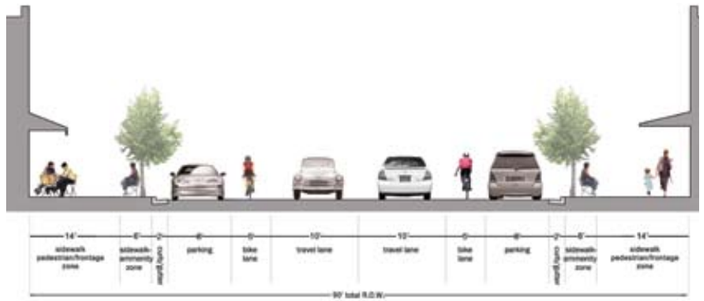
target speed **25-35 mph**

Bicycle lanes on streets without on-street parking should be a minimum of 4' wide. Striping, signing, and special pavement markings shall be used to designate a bicycle lane for the exclusive use of bicyclists.

Additionally, on wider commercial streets, buffering sidewalks with street trees and other landscaping treatment will help to increase the perceived safety felt by pedestrians along the sidewalk, thus activating the pedestrian realm.

B3. MAIN STREET

A Main Street is a low-speed, pedestrian-oriented street operating within a high density mixed-use area. Main Streets traditionally serve as a focal point for surrounding areas. The narrow street width, on-street parking, street trees, and small setbacks create spatial enclosure along the sidewalk. Pedestrian and bicycle crossings are a critical element of the pedestrian network. Safe, convenient, and highly visible crosswalks make a sidewalk system usable and appealing, encouraging pedestrian activity.



target speed **20-30 mph**

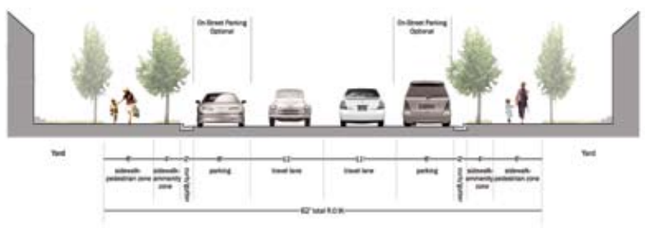
Bicycle lanes on streets with on-street parking should be a minimum of 5' wide. Striping, signing, and special pavement markings shall be used to designate a bicycle lane for the exclusive use of bicyclists.

Sidewalk bulb-outs may be used to minimize pedestrian crossing distances. Crosswalks should be provided at all intersections.

B4. NEIGHBORHOOD STREET

A Neighborhood Street is a local low-speed thoroughfare connecting residential and mixed-use areas. Neighborhood Streets may typically include sidewalks, street trees, and residential on-street parking. Small building setbacks, such as dooryard or stoop fronts, contribute to the street's spatial enclosure.

On residential streets, bicycle facilities vary depeneding on the presence of on-street parking, the width and speed of the street and the level of traffic. Options for bicyclists include having a designated striped lane, a paved shoulder, or sharing the vehicular lane width.

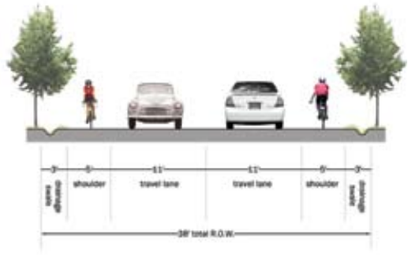


target speed **20-30 mph**

The use of "share the road" signage is useful to alert motorists to the likely and legitimate presence of bicyclists and to encourage cooperation between motorists and bicyclists. Additionally, undesignated bicyle lane marking arrows can be useful to define the likely travel corridor of bicyclists within the lane.

B5. RURAL ROAD

A Rural Road is a small-scale, low speed connector. Rural roads may be lined with existing trees and natural vegetation and take on the profile of the surrounding landscape. Roads provide frontage for low-density buildings such as houses. This lower-density land use tends to be incompatible with everyday walking to and from a destination. However, biking is often a viable option along the soft shoulders of the roadway.

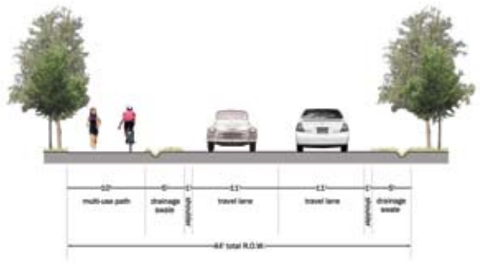


target speed 25-40 mph

The use of "share the road" signage is useful to alert motorists to the likely and legitimate presence of bicyclists and to encourage cooperation between motorists and bicyclists. Additionally, undesignated bicycle lane marking arrows can be useful to define the likely travel corridor of bicyclists within the lane.

B6. RURAL ROAD WITH MULTI-USE PATH

A Rural Road with a multi-use path incorporates a dedicated path to the side of the roadway for bicyclists, pedestrians, and recreational uses. The multi-use path is separated from the roadway by an open drainage swale. At points, the path can split a considerable distance from the roadway to incorporate drainage, significant natural features, and the greater network of paths and greenways.



target speed 25-40 mph

The design of a multi-use path is highly flexible, but they should be at least 10-12' wide and should have at least 4' horizontal clearance on each side.

B7. OFF ROAD GREENWAY TRAIL

Greenways provide places for recreation and help maintain the scenic quality of landscapes. It is important from a transportation mobility and access perspective that greenways function by connecting places where people want to go: neighborhoods, business centers, shopping areas, schools and parks. Typically, greenways that traverse environmentally sensitive lands can be considered "rural greenways" and corridors surrounding roadway networks can be considered "urban greenways." Multi-use trails will incorporate bicycle and pedestrian supportive design elements. The intersection of each greenway and multi-use trail should create a sense of place through pocket park facilities or a commercial node.

The design of a multi-use path is highly flexible, but they should be at least 10-12' wide and should have at least 4' horizontal clearance on each side.

Paved or unpaved paths are appropriate depending on the intended use.

B8. SUMMARY OF BEST PRACTICES: SIDEWALK

CRITERIA	ENCOURAGED STANDARDS
WIDTH	Residential areas: 6' minimum, unobstructed Commercial/Mixed-Use: 8' minimum, unobstructed
LOCATION	Both sides of: all arterial, major, and minor collector roads (where pedestrian activity is anticipated). All local roads and all roads within 1/4 mile of a school or a park
LIGHTING	8-12' tall light poles placed no further than 30' apart with full spectrum light bulbs Maximum of 10-15,000 lumens
SHADE	Awnings, arcades, and street trees spaced 30' on center
AMENITIES	Benches, newspaper boxes, and planters Transit shelters, where appropriate
BUFFER	Minimum of 5' in width for planting street trees. On-street parking and bike lanes also help to buffer the sidewalk.

1. Buffer: on-street parking and landscaping help to provide a comfortable pedestrian realm separated from vehicular traffic.

2. Width: sidewalk width on a typical mixed use street is unobstructed and adequate for pedestrian movement.

3. Lighting: pedestrian scaled lighting safely guides pedestrians to and along walkways. Lighting also contributes to the character of the streetscape as a pedestrian-oriented environment.

4. Building orientation: building is oriented to the pedestrian creating spatial enclosure and reducing walking distances between potential destinations.

B9. SUMMARY OF BEST PRACTICES: DESIGNATED BIKE LANES

CRITERIA	ENCOURAGED STANDARDS
WIDTH	4' from lip of gutter; 5' when on-street parking is present
LOCATION	Arterial and collector roads; Local roads where ROW permits
PAVEMENT MARKINGS	Stencil with bike lane text and symbol; Embedded flashers/reflectors in areas with high automobile traffic
PARKING	Sheltered bike racks are preferred to protect bicycles Smaller, convenient racks may be placed to the side of pedestrian traffic flow for ease of transition between modes.


Unobstrucing parking


Good pavement markings


Existing street


Enhanced street

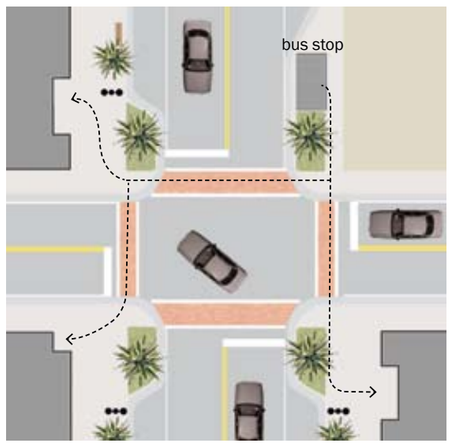
1. Pavement markings: bike lanes are clearly marked with lines and symbols to alert drivers and harmonize modes of transportation

2. Parking: sidewalk bike parking is convenient for switching modes of transportation. Parking facility should not obstruct the sidewalk.

3. Location: biking can occur along a variety of roadways. On less built roadways, bike lanes serve as an alternative mode to get to a destination or may be used solely for recreational purposes.

B10. SUMMARY OF BEST PRACTICES: TRANSIT

CRITERIA	ENCOURAGED STANDARDS
BUS STOPS	Curb-Side: appropriate along slower-speed more pedestrian oriented roadways; Length: allow 50' per bus length Bus Bays: along higher speed roadways to allow greater continuous traffic flow Width: 12' Length: 50' per bus length
SHELTER	Shelters should provide protection from the elements, seating for at least 2 people and should not obstruct pedestrian movement along the sidewalk.
LOCATION	Along the sidewalk; ideally located on a bulb out or on additional paving on the far side of the right of way.
CONNECTIONS	Transition between modes should be accommodated with accessible sidewalks, crosswalks, and bicycle racks. Lighting should be provided for safety and visibility.



1. Location of Bus Bays: bus bays should be located a distance from the intersection. This is to prevent bay use as a right turn acceleration lane and to allow room for sidewalk bulb-outs at intersections.

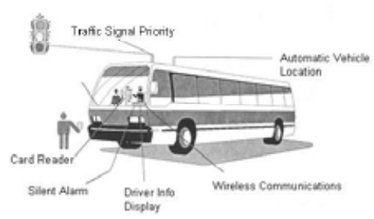
2. Location of shelters: shelters and bus stops should be coordinated for ease of accessibility. Shelters should be located close to a crosswalk for transition between modes and access to destinations.

Transit Service Best Practices - Capture Choice Riders

In many instances transit users have access to additional forms of transportation and must actively choose to utilize transit service. Therefore, capturing choice riders is necessary for successful implementation of transit.

Marketable Identity: Creating a unique identity for transit service creates a positive, memorable image for potential users. Creating a marketable brand name and logo and using unique buses such as trolleys are all ways to create a unique and attractive identity to capture choice riders.

Customer Amenities: Customer amenities can also help increase transit ridership. Example amenities include bus stop infrastructure such as benches, shelters, system mapping, route schedules and sidewalks; on board storage such as bike racks and overhead luggage racks; safety measures including on board cameras and proper lighting at bus stops; ride quality involving friendly bus drivers, comfortable seating, on board information, and low board buses; and operating efficiency such as on time reliability and fare collection procedures.



Intelligent Transportation System (ITS): According to the Research and Innovative Technology Administration's website, ITS improves safety and mobility by integrating advanced communication technologies in the transportation system. Examples of ITS for transit include on board GPS devices, which allows for bus movement monitoring, more efficient transfers, and closer schedule adherence. Transit agencies can quickly direct maintenance crews to assist with a vehicle break down and can provide real time information to patrons waiting at transit stops. Automatic Passenger Counters (APCs) can be used to monitor boarding and alighting information, allowing transit agencies to refine service location and hours. Traffic signal priority is also a benefit of ITS.

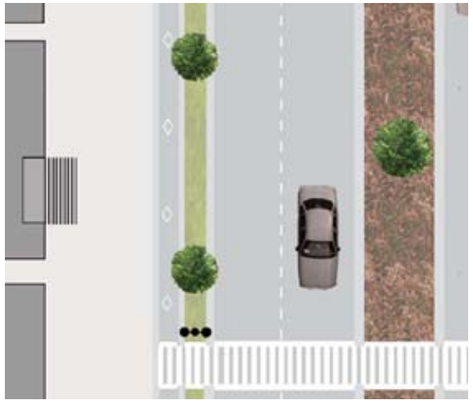
SUMMARY OF BEST PRACTICES: CROSSINGS

Crosswalk Types

Crosswalks are important links in the pedestrian network that enhance accessibility between and among destinations and other transportation networks.

A variety of types are included in the following section. To choose the appropriate type of crosswalk for a specific location, consider the intended function of the roadway, the presence or absence of nearby destinations, and its role as part of a complete pedestrian or multi-modal network.

C1. MARKED CROSSWALK

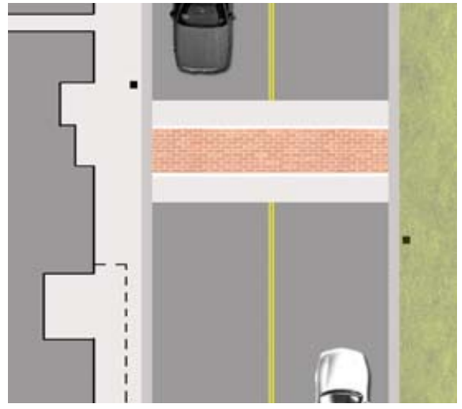


INTENT: Intended for general crossings of major and minor streets with limted pedestrian traffic. Typically used at street and highway crossings without medians in areas without high pedestrian traffic

C2. HIGH VISIBILITY CROSSWALK

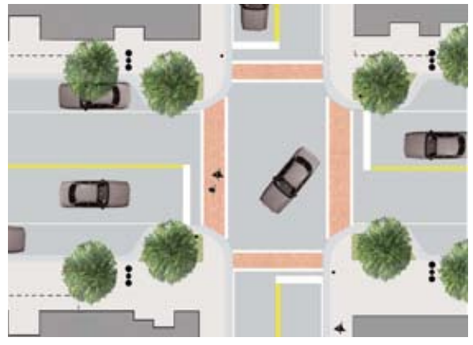
INTENT: Intended for higher use crosswalks where limited traffic calming is an objective. Typically used on main throughways to calm traffic and safely move pedestrians and bicycles

C3. RAISED CROSSWALK



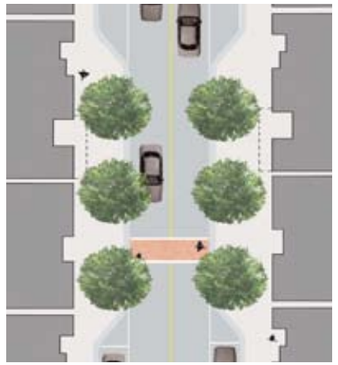
INTENT: Intended for high use crosswalks where traffic calming is a significant objective. Typically used on main throughways to calm traffic and safely move pedestrians across

C4. CURB EXTENSION



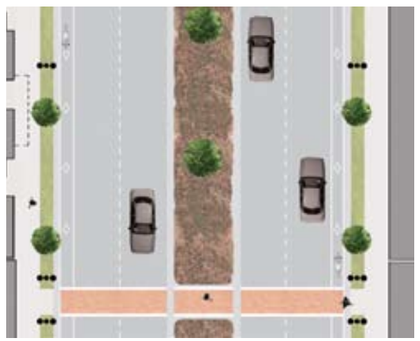
INTENT: Intended for high-use pedestrian crossings at intersections with adjacent on-street parking.

C5. CHOKER



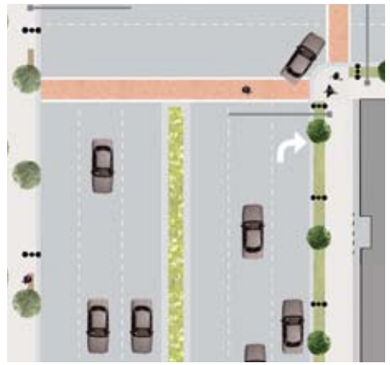
INTENT: Intended for urban streets with high pedestrian activity to slow traffic and make crossings safer.

C6. MEDIAN REFUGE



INTENT: Intended for higher use crosswalks between intersections on rural highways where limited traffic calming is an objective. Typically used on main throughways to calm traffic and safely move pedestrians and bicycles across

C7. PEDESTRIAN-ACTIVATED SIGNAL (AT INTERSECTION)



INTENT: Intended for higher use crosswalks at intersections that do not have existing traffic signals. Typically used on main highways to calm traffic and safely move pedestrians and bicycles across

C8. PEDESTRIAN-ACTIVATED SIGNAL (MID-BLOCK)

INTENT: Intended for higher use crosswalks between intersections Typically used on main highways to calm traffic and safely move pedestrians and bicycles across

C9. SUMMARY - CROSSINGS

CRITERIA	ENCOURAGED STANDARDS
SPACING	Arterial: 1/2 mile spacing Collector: 1/4 mile spacing Local: 500 feet spacing
GEOMETRY	Curb cut radius of 15'-25' (where pedestrian activity is expected)
CROSSWALKS	Perpendicular to the sidewalk; Minimum of 6 ' wide at all signalized intersections
BIKE/PED SIGNALS	Walk/don't walk signals at all signalized intersections; Leading pedestrian interval
VEHICULAR MOVEMENT	No right turns on a red light in downtown or urban mixed-use areas
SIGNAGE	Cross-walks, no turn on red, pedestrian signals and bike sensors to trigger signals.
MATERIAL	Painted and textured cross-walks
OTHER	Employ bulb-outs to decrease pedestrian crossing distance

1. Pavement: crosswalks should be clearly marked with lines or colored pavers to alert alert drivers to pedestrian crossings

2. Location: locating crosswalks at signalized intersections provides an opportunity to coordinate pedestrian and bicycle movement with vehicular traffic

3. Signals: walk, don't walk signals alert pedestrians to when it is safest to cross the street.

4. Vehicular movement: eliminating right turns on red at intersections with cross-walks enhances pedestrian safety

PRINCIPLES INTO PRACTICE

Examples

D1. RETROFITTING A RURAL STRIP CENTER INTO A NEIGHBORHOOD MIXED-USE CENTER

A Neighborhood Mixed-Use center incorporates mutliple uses into a walkable, pedestrian-friendly environment with compact block sizes. Ideally, Neighborhood Mixed-Use areas will include a mix of retail and office uses at the center, with connected residential uses at the edge. A centralized public space is encouraged to establish the identity of the center as a focal point and important civic space in the community.

Through a series of steps, a conventional suburban area may be transformed into a more vibrant and diverse Neighborhood Mixed-Use center. Beginning with a new approach to the pedestrian enviro-nent, the area develops a character of walkability. Continued improvements and infill development restablish the site as a new Mixed-Use Center with great opportunity for multi-modal transit.

D2. RETROFITTING A SUBURBAN STRIP CENTER INTO A REGIONAL MIXED-USE CENTER

The Regional Mixed-Use Center is a focal point for the larger region and reinforces this through its scale of development, and rich range of land uses. Regional mixed-use development is characterized by a higher intensity and mixture of land uses than surrounding areas. Compact blocks oriented around a mixed-use Main Street define the core of a walkable center. A Main Street must provide a comfortable pedestrian environment between small shops, stores, and offices.

Sidewalks, street trees and furniture begin the transformation of this suburban strip into a diverse pedestrian and bicycle friendly center. Over time, mixed-use development fills in, bringing the new center to life.

D3. RETROFITTING AUTO-ORIENTED TO PEDESTRIAN-ORIENTED EMPLOYMENT

A Regional Employment Center is predominately devoted to employment uses, but still maintains a small mixed-use component to serve employees and surrounding residents. Employment uses may include professional office space, research facilities, storefront offices, and warehouse and light-industrial uses. Office uses are recommended at the core while warehousing and light industry are appropriate at the periphery. It is important to link larger single-use areas with adjacent mixed-use development. Live-work units are recommended to maximize the residential capacity of Regional Employment Centers. Although some uses may require large block sizes, smaller block sizes should be maintained wherever possible.

Where people can live and work in closer proximity, pedestrian and bicycle-focused improvements develop as the area grows into a new identity.

Appendix: PUBLIC INVOLVEMENT

ROUTE 419 MULTI-MODAL CORRIDOR STUDY

April 21, 2009

6:00 p.m. – 9:00 p.m.

As part of the Route 419 Multimodal Corridor Study, the first of two community workshops was held on the evening of April 21, 2009 to give community members an opportunity to express their thoughts for improving the Route 419 Corridor.

Presentations on the existing conditions related to land use, traffic, and multimodal transportation options were followed by small-group exercises where participants could voice their opinions about different issues and opportunities. A summary of these issues/opportunities can be found on the following pages.

Transit

Connect park and ride with transit

Expand bus service to the County

Add a new route between Lewis Gale and Tanglewood mall

Local transit service to mixed use areas

Trolley connection to fixed lines

Bus Route connecting Tanglewood to existing route on 221

Need a transit route along 419

Park and Ride

At crossroads

Add park and ride at Tanglewood and Oak Grove

Park and Ride at Sunset Village

Park and Ride at Brambleton

Provide bike boxes.

Sidewalks

Along entire corridor

Along mixed use areas

Along near Glen Heather

Add pushbuttons and heads to signals

Sidewalk from Apperson to Tanglewood Mall

Add greenway connection around Keagy

Change policies in Roanoke County to provide for SW maintenance.

Roanoke County should change policies regarding sidewalks.

Ped crossing at East Main doesn't feel safe.

Sidewalks between Tanglewood to greenways

Crosswalks at Lewis Gale

Add Crosswalks at Greenway crossing 419 south of Lewis Gale

Add crosswalks at Glen Heather and at Tanglewood

Bicyclists

Bicyclists are currently present throughout corridor

Add bike facilities that are separated from traffic by barrier

Bike lane Lewis Gale to greenway north west of Brambleton

Remove no-bike signs from 220

Greenways are East-West and 419 is North-South – therefore, need to accommodate bikes to provide for connectivity between greenways.

Potentially use the wide shoulder section for the bike lanes, or sidewalks.

General

Lighting landscaping corridor wide

Pave shoulder needs to be same surface at the vehicular traffic

Consider roundabouts

Prioritize sidewalks providing access to hospitals and schools

Traffic

Some areas with high speeds

Need to improve signal timing

Prefer to improve timing over widening

Improve access management at many locations

Safety concerns at 460, between Apperson and Lewis Gale

Speed issues around Lewis Gale

Improve left turn issues new Lewis Gale

Improve signage at Lewis Gale

Better entrance around the hospital

Safety issues at 460/419

Add a signal at the Glen Heather

At Brambleton, coordinate the left turns

Improve timing of lights between Tanglewood and Starkey

Dangerous left turn coming out of west village

New light makes the above worst.

Ped features needed at Glen Heather

NB angle crashes at Grandin Extension are bad

Safety issues around shell gas station at Grandin

Throughway congestion between Lewis Gale to Apperson

Safety at Apperson

More storage for left turn movements at SB approach to Apperson

Dual lefts needed NB at Apperson

Indiana Street intersection congestion

Add third lane along 419 the entire length

Consider a new circumferential road further out

Congestion at Lynchburg/Salem Turnpike, Roanoke Blvd, Lewis Gale, Grandin Road, Brambleton, and Tanglewood.

Throughway congestion between Tanglewood and Starkey.

At Colonial Avenue safety issue with the turn lane lengths (SB Right)

Brambleton bad place for another signal, also queue length issues

Safety issue at Stoneybrook Drive, add a no u-turn sign

Throughway congestion at Tanglewood, feels dangerous

Add a right turn lane at Chaparral

Colonial need more northbound left storage

Median opening at Grandin is difficult (left turn out)

Queuing issues at Apperson all the way around, 419 approaches are particularly bad

Safety issues around Glen Heather

Intersection congestion at Brambleton, Colonial Avenue West Village and two other locations near Ranch Viejo and also Hardees

Throughway congestion between Stoneybrook and McVitty

Signal progression improvements between Keagy to US 220

Access Management around Tanglewood

Intersection congestion at Tanglewood, Colonial, Apperson, and Roanoke Blvd (event traffic)

Poor signal timing at I-81 end

Need a left turn lane in the area around Route 311

Safety – Apperson, Lewis Gale, Grandin Extension and Stoneybrook

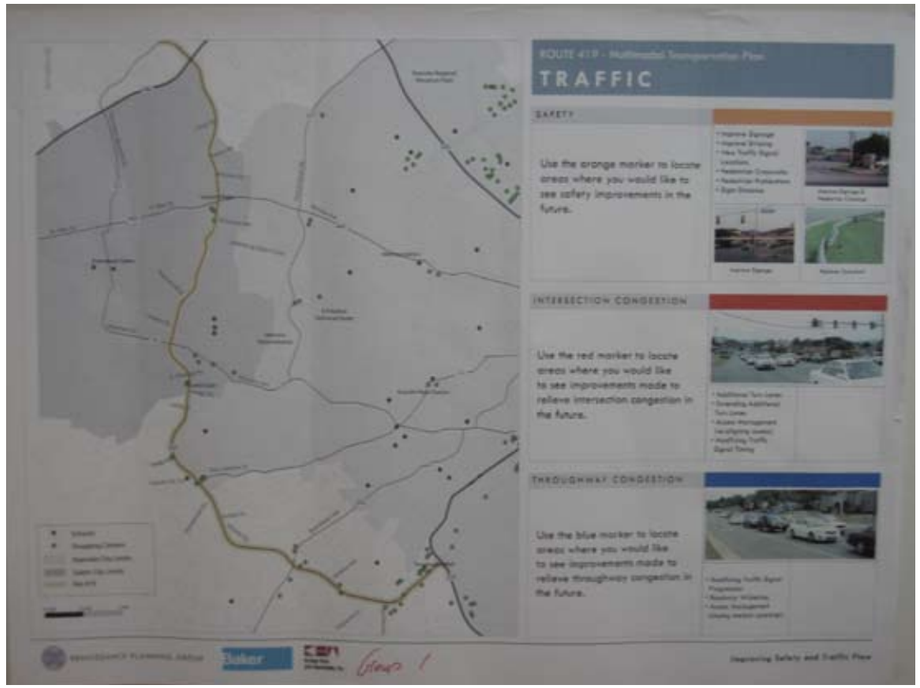
Add a crosswalk at Grandin and Lewis Gale

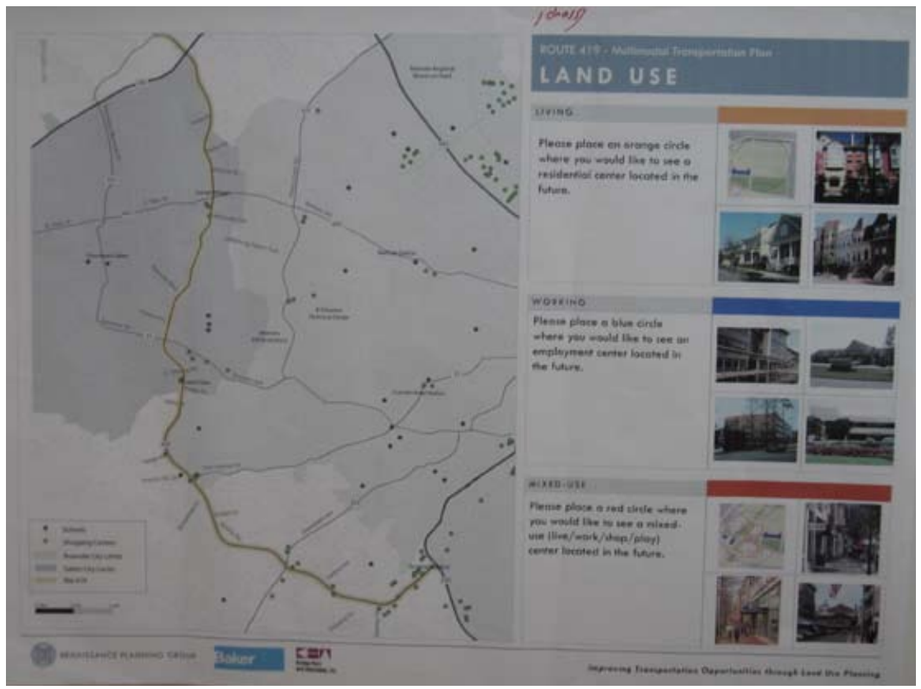
Land Use

Reduce strip use type development

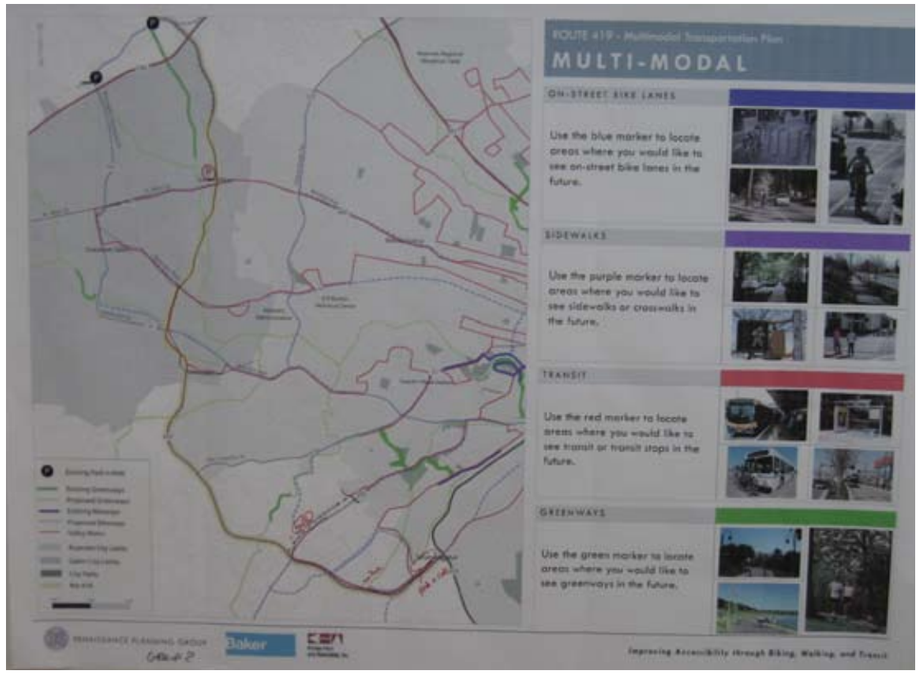
Add MU developments along the corridor in the future

Put access management in place before development occurs


ROUTE 419 - Multimodal Transportation Plan
TRAFFIC
SAFETY
Use the orange marker to locate areas where you would like to see safety improvements in the future.
INTERSECTION CONGESTION
Use the red marker to locate areas where you would like to see improvements made to relieve intersection congestion in the future.
THROUGHWAY CONGESTION
Use the blue marker to locate areas where you would like to see improvements made to relieve throughway congestion in the future.
Baker
Improving Safety and Traffic Flow


ROUTE 419 - Multimodal Transportation Plan
LAND USE
LIVING
Please place an orange circle where you would like to see a residential center located in the future.
WORKING
Please place a blue circle where you would like to see an employment center located in the future.
MIXED-USE
Please place a red circle where you would like to see a mixed-use (live/work/shop/play) center located in the future.
Baker
Improving Transportation Opportunities through Land Use Planning


ROUTE 419 - Multimodal Transportation Plan
MULTI-MODAL
ON-STREET BIKE LANES
Use the blue marker to locate areas where you would like to see on-street bike lanes in the future.
SIDEWALKS
Use the purple marker to locate areas where you would like to see sidewalks or crosswalks in the future.
TRANSIT
Use the red marker to locate areas where you would like to see transit or transit stops in the future.
GREENWAYS
Use the green marker to locate areas where you would like to see greenways in the future.
Baker
Improving Accessibility through Biking, Walking, and Transit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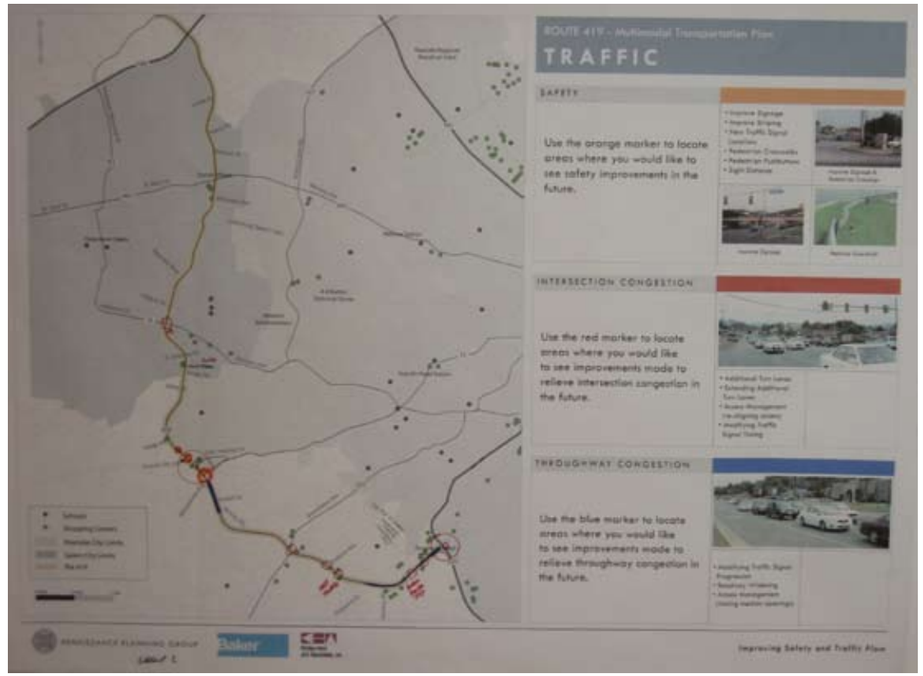
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THROUGHWAY CONGESTION
Use the blue marker to locate areas where you would like to see improvements made to relieve throughway congestion in the future.
Improving Safety and Traffic Flow


ROUTE 419 - Multimodal Transportation Plan
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LIVING
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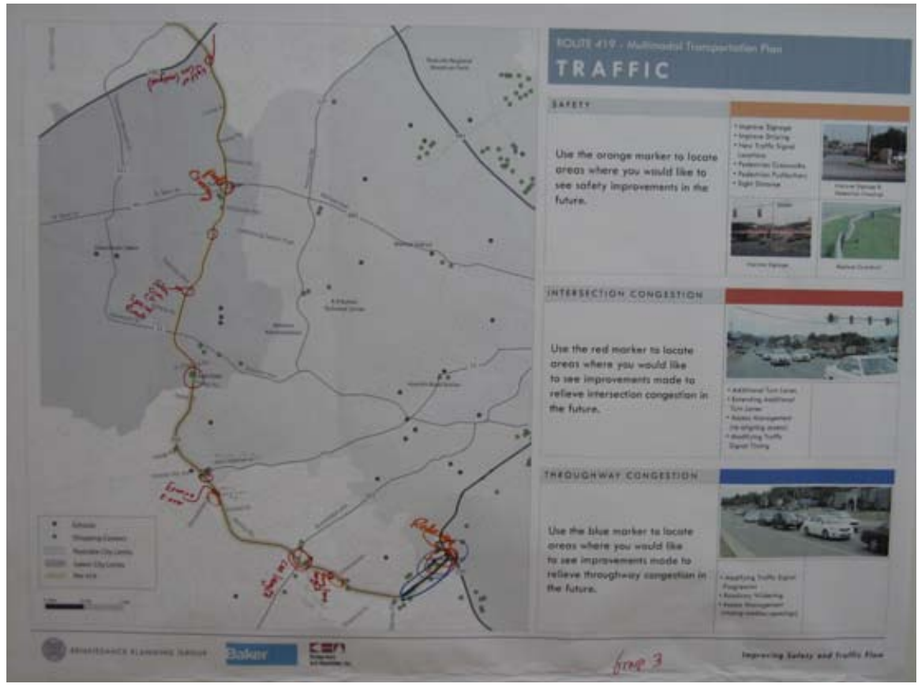
MIXED-USE
Please place a red circle where you would like to see a mixed-use (live/work/shop/play) center located in the future.
Improving Transportation Opportunities through Land Use Planning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Improving Safety and Traffic Flow


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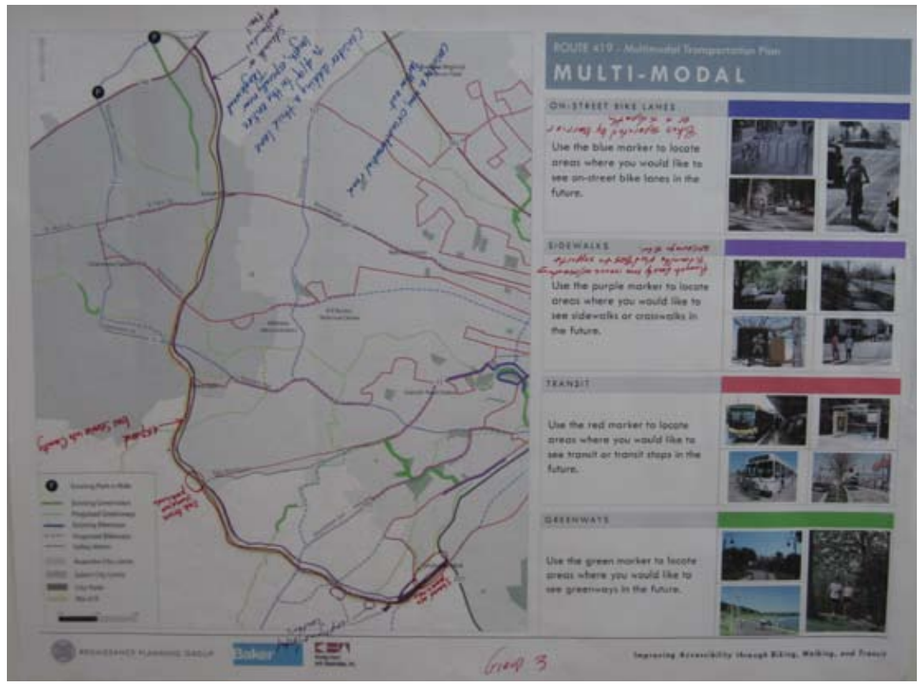
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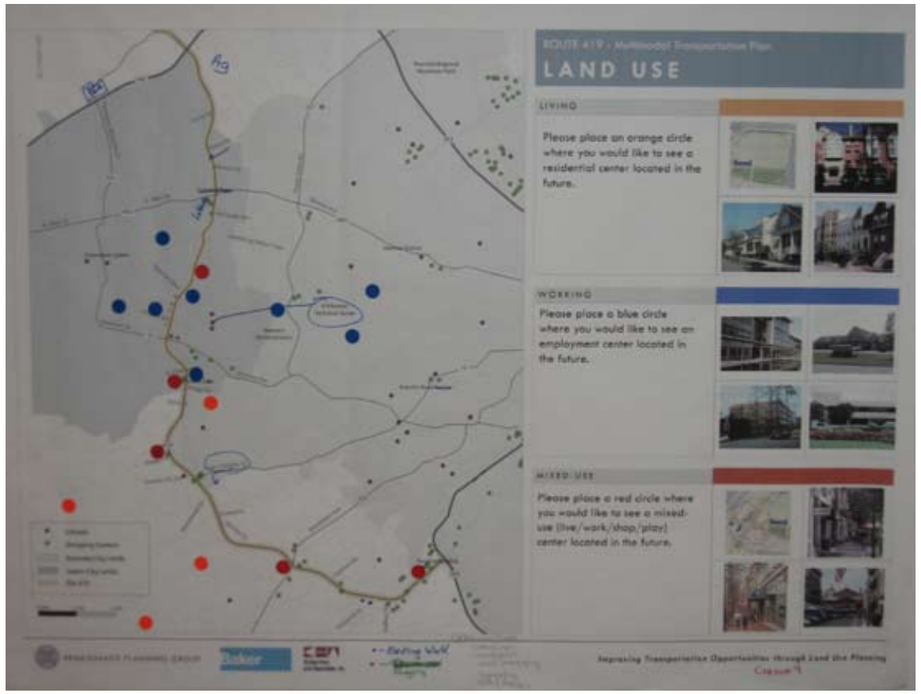
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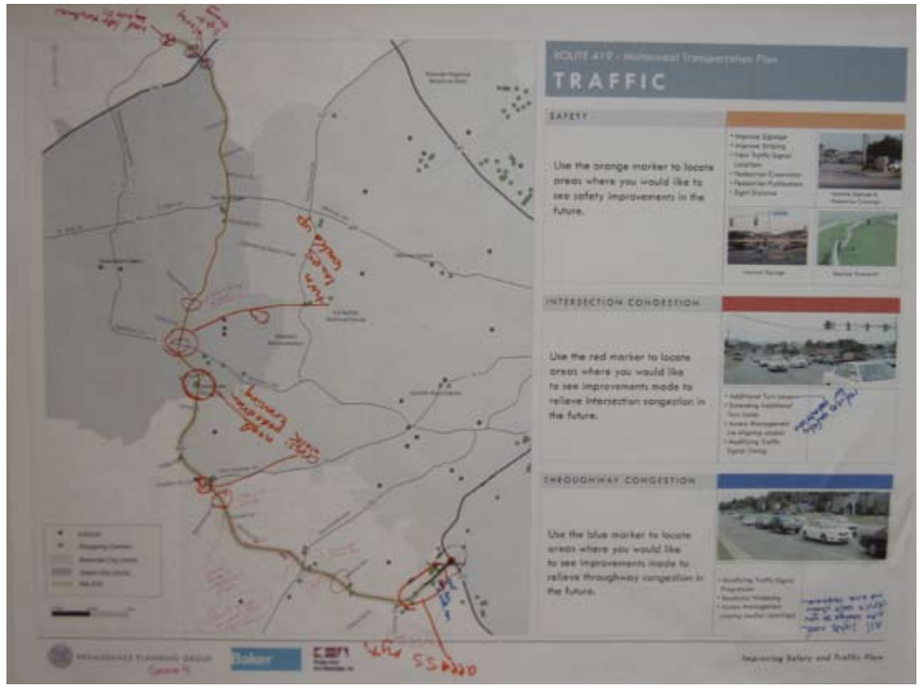
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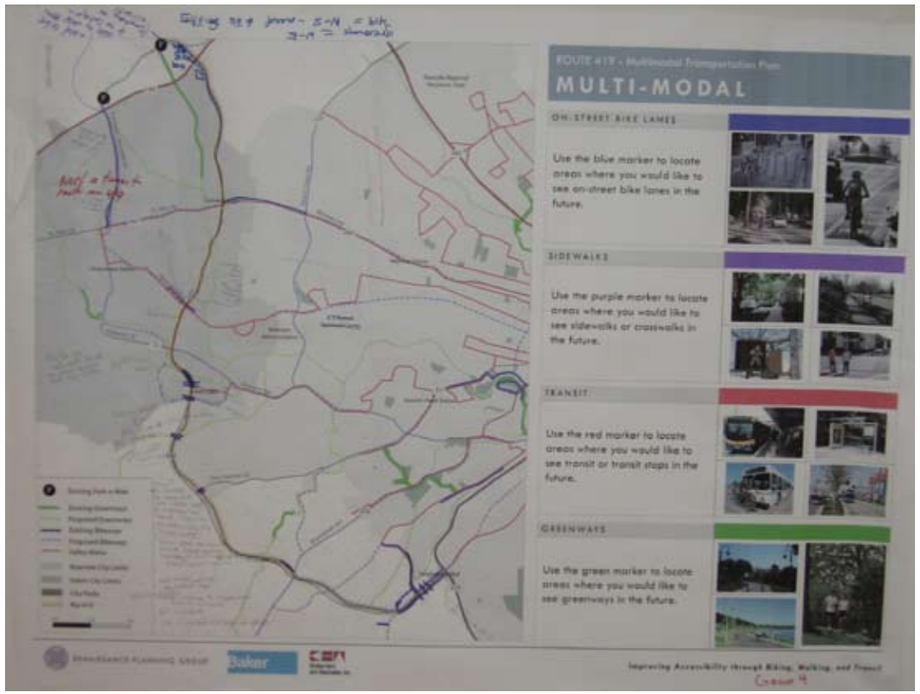
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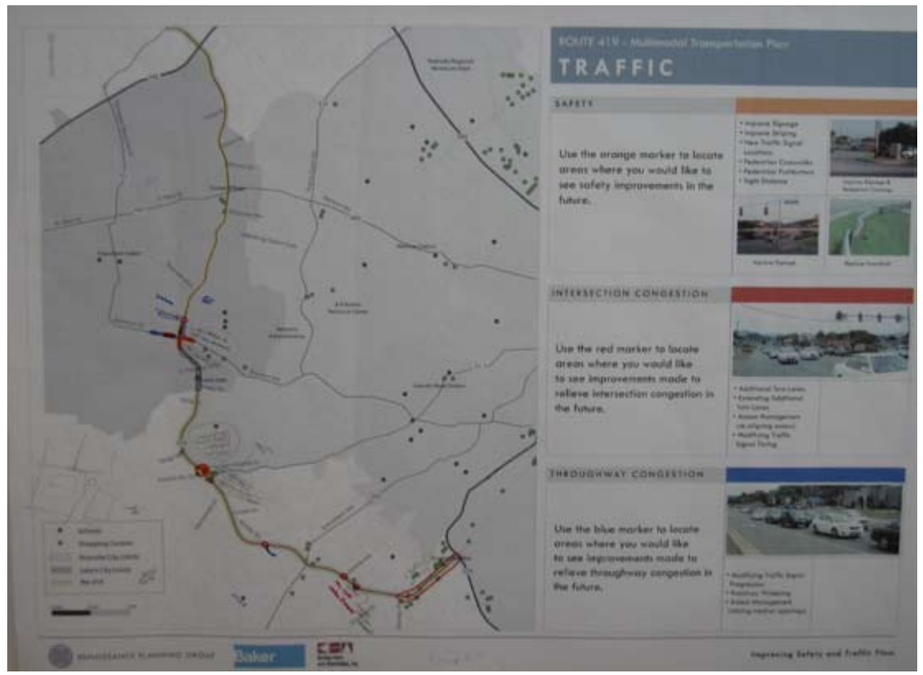
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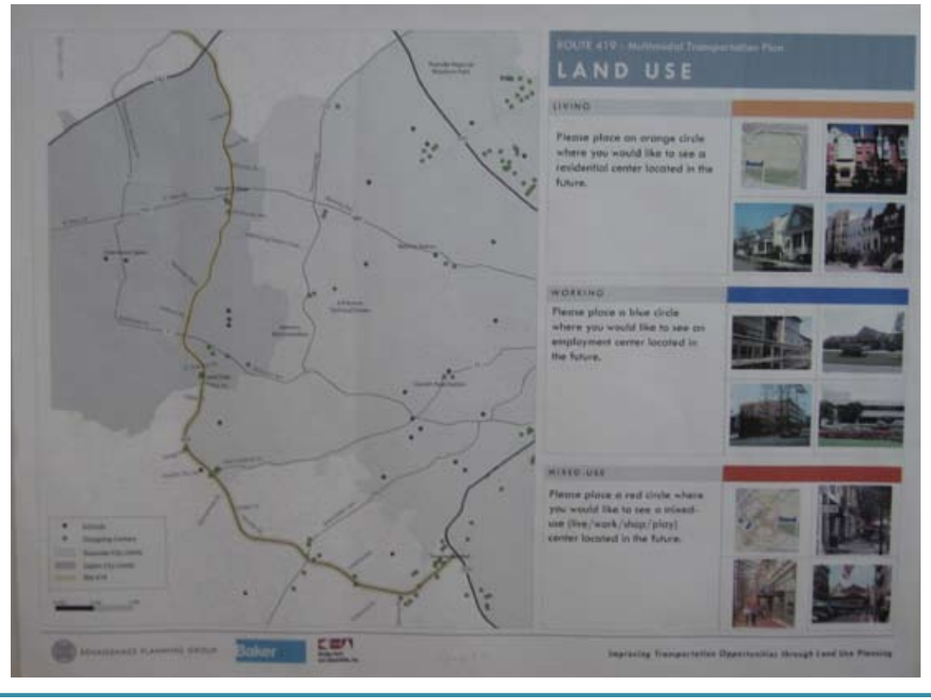
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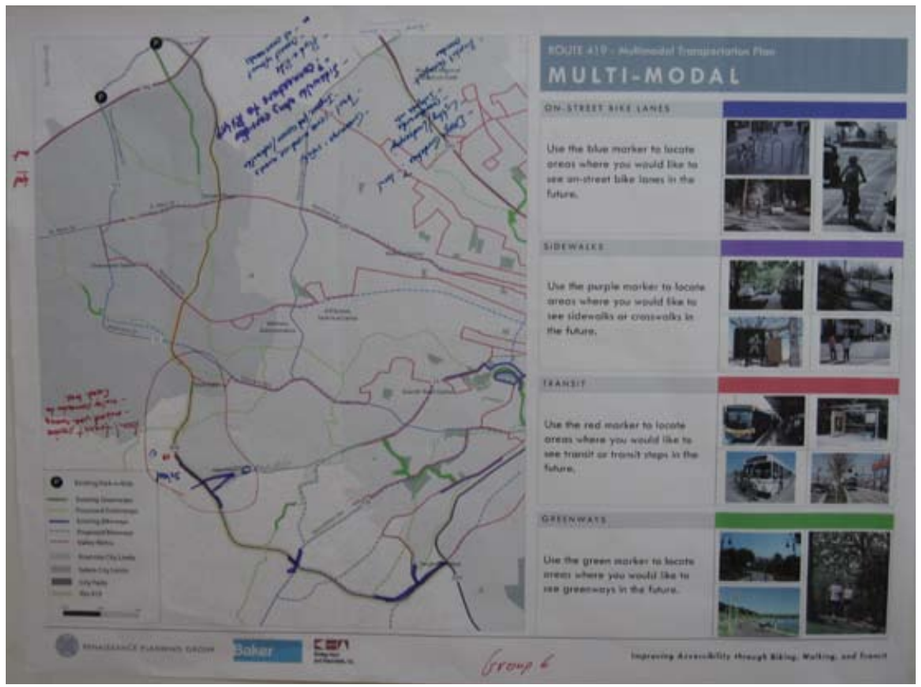
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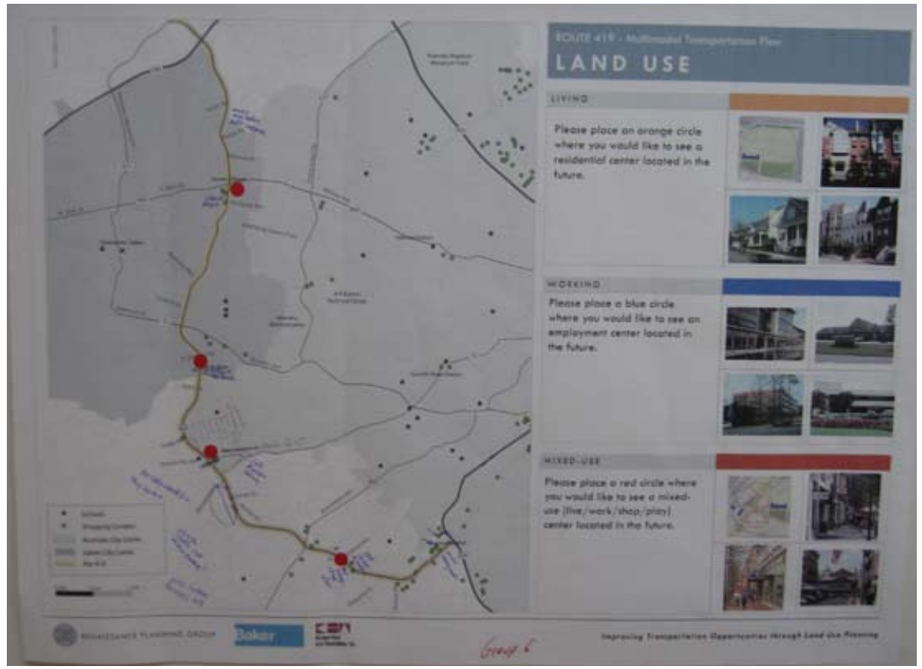
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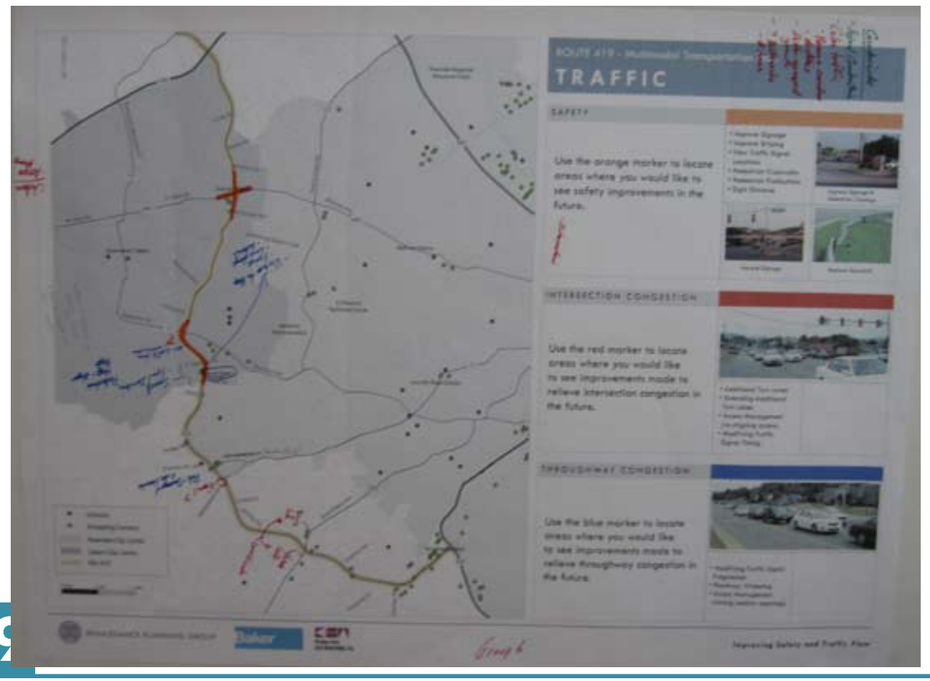
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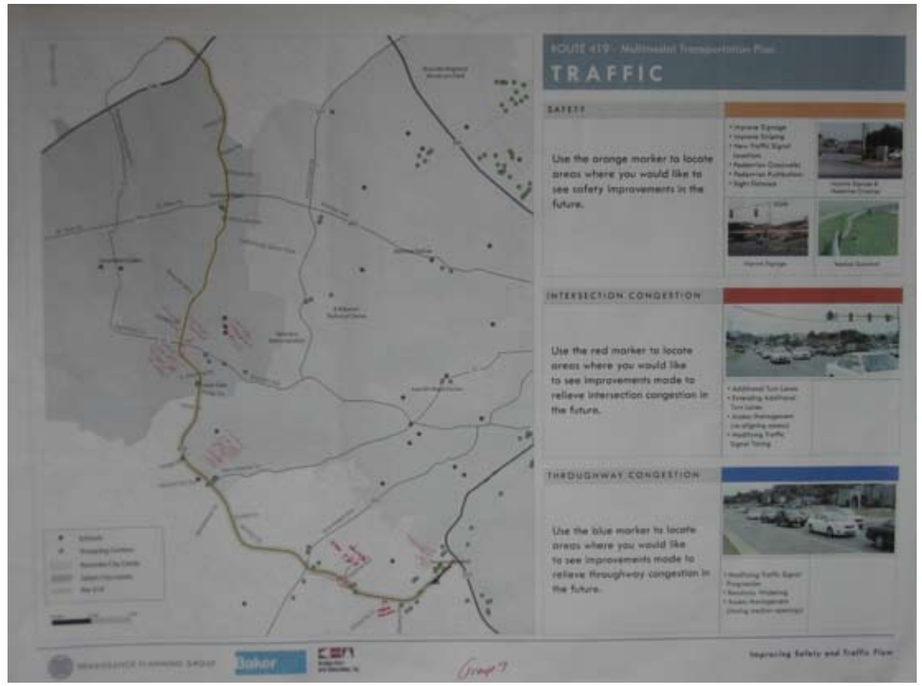
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ROUTE 419 MULTI-MODAL CORRIDOR STUDY

December 3, 2009 6-8PM

Brambleton Center, Roanoke County

As part of the Route 419 Multimodal Corridor Study, the second community workshop was held on the evening of December 3, 2009 to give community members an opportunity to express their thoughts on draft recommendations for improving the Route 419 Corridor. The meeting was conducted in an open-house style, with distinct stations to review and comment on both the operational (roadway) and multimodal recommendations. At each station participants had the opportunity to review the recommendations, ask questions, and provide comments. There were facilitators to prompt participants to comment on what they like, dislike and would change. Comments were recorded on the flip charts/maps and are presented on the following pages. In addition, participants provided feedback on their project priorities through an investment game. Details about the game and results are provided on the following pages.

The objectives of the meeting were to:

- Discuss what citizens like, dislike, would change about the project recommendations.
- Prioritize general investments and strategies for project implementation.
- Share ideas of ways to maximize limited funding.
- Get energized about moving forward with the plan.

Roadway Segment Maps: There were maps on the walls showing the recommended roadway and pedestrian improvements by corridor segment.

Multimodal Improvement Map: There was a map on the wall showing the overall improvements for bicycle, pedestrian, transit, and park and ride.

Investment Game Station: There were posters describing roadway, multimodal and access management improvements for the short, medium, and long-term.

Flip Chart Comments from all stations:

- Fig 4.8: Do not close Manassas Dr… not a problem.
- The old concept of the "South Salem Circumferential" is still valid to take traffic out off 419. But it doesn't have to be so far into the mountains.
- Fig 1.1: Rt. Turn from Franklin onto 220 South is unneeded… it would just take traffic to the "Lowes" bottleneck quicker.
- Wide shoulders for bicycle traffic.
- Fig 4.8: 6 Lanes is too wide considering development along it. Needs added loop farther "out" to take added traffic that needs to get from downtown to Bent Mt. area. Added 3rd lane would omit left turn lanes unless road widened too far impinging on developed property. Plus, the promenade traffic will be installed shortly at higher cost. Why not tie it into future plans?
- Fig 4.8: "Protected" light at Springwood is not needed.
- Fig 1.1: Need to start 3rd lane north on 220 at entrance from Franklin Road. Keep thru traffic on 220 to 2 left lanes leaving designated 3rd lane on right for unimpeded entrance and no need for added entrance lanes.
- Monument at Hanging Rock Battlefield and Park
- Sidewalks- YES!! Also pedestrian traffic signals.
- Bike lanes- PLEASE
- Greenways- Keep on building more of them- connect to schools.
- Need traffic signals that sense bicycles.
- Consider future development potential and pedestrian accommodations north end (S.W. I-81 Quadrant). Also Cove Road needs to be connected. –Edward Rose Rezoning-Talk with Tim Beard.
- Bikeway stops on 419 at Salem should continue.
- DO NOT encourage park n' ride bus routes along 419. Take the existing rail lines and put the lots along them. Ultimately that will be necessary to relieve congestion on 419 even if it means putting in more rail at existing routes… quicker and much more efficient.
- Buses to Tanglewood would not draw patrons to then wait and go downtown. They won't do it.
- Sign small road bike routes.
- Rumble strip between car and bike lane/shoulder.
- In many cases, shoulders have segments missing- complete them (for bikes).
- Sweep shoulders after snow season.
- Concern about free-flow right at I-81 safety issues for cyclists. Add share-road

marking to designate bike route.

- Short term- remove debris, routine maintenance (ie. Bridge crossing at I-81 and 311) of shoulder.
- Shoulder in danger of washing away- short term fix.
- Support for proposed bikeway in N. section.
- Lots of unofficial parking sports at VDOT lot- report underestimated demand.
- Concern that bus will further slow traffic on the corridor.
- SW: both sides south of GE
- SW: both sides north of Keagy
- Greenway shown wrong side of river near Apperson. Fix greenway map.
- Widen the road for bike lanes- entire corridor.
- Add S.W. to Roanoke Blvd to Civic Center
- Caveat- if opportunities arise, consider shared use trails in lieu of S.W.
- Regular Maintenance
- Bicycle- pavement markings
- Improve signal at Springwood
- Improve crosswalks between Copper-Croft and Tanglewood.
- Separate with rumble strips
- Preserve shoulder and maintain
- Signage that you can see!
- Do sidewalks in short term.
- Drainage at Manassas and Hammond Lane and Girard Lane.
- Better grade of paint- when it's raining and dark it's difficult to see the paint.
- There is some funding available NOW for greenways- why not a short term improvement?
- Park n' Ride for RAIL, not bus.

Investment Game Overview, Results and Comments from Public:

Overview of Investment Game: Participants were given $10 in $1 increments and instructions to allocate their money as they desire to the following major categories of multimodal transportation investments/ strategies by phase: Roadway, Multimodal, Access Management. The instructions recognized that all strategies are not created equal (some are policy implications that cost little to nothing, others are much more cost intensive). The purpose of this exercise was to understand the general investment priorities by mode and phase. Participants were asked to review the general types of recommendations that are included in the plan for each phase and invest their money by placing a dollar (or multiple dollars if they desire) next to their high priority strategies across all phases. Black flip charts were located next to each table on which participants or the table facilitator could jot down comments or ideas.

Summary of Investment Game Results:

- Overall, nearly half of all investment was made in the short-term
  - Short-term investment was generally balanced, with Operational and Multimodal improvements receiving similar investment, and Access Management somewhat less
  - In the short-and mid-term, there was a strong investment in the "careful planning of entrances and signals" category of Access Management
- In the mid- and long-term, there is a shift in investment towards Multimodal
  - More than half of the total investment over time was made in multimodal improvements
  - Consistently across time, two-thirds of all dollars spent in the multimodal improvement category were allocated to bike and pedestrian improvements and one-third allocated to transit or vehicular oriented improvements

Investment over Time

Phase	Dollars Spent	Percentage of Total
P1. Short-Term	119	47.04%
P2. Medium-Term	58	22.92%
P3. Long-Term	76	30.04%
Totals:	253	100.00%

Overall Improvement Type Preference

Type of Improvement	Dollars Spent	Percentage of Total
Operational	69	27.27%
Access Mgmt.	49	19.37%
Multimodal	135	53.36%
Totals:	253	100.00%

Improvement Type by Timeframe

	Operational	Access Management	Multimodal	
P1. Short-Term	38.66%	23.53%	37.82%	100.00%
P2. Mid-Term	13.79%	18.97%	67.24%	100.00%
P3. Long-Term	19.74%	13.16%	67.11%	100.00%

Access Management Category Detail

Access Management	Short-Term	Mid-Term	Long-Term	Overall
Careful Planning	71.43%	45.45%	30.00%	57.14%
Additional Connections		9.09%	20.00%	6.12%
Median Openings	21.43%	18.18%	50.00%	26.53%
Crossover Med./Adj.		27.27%	0.00%	6.12%
Median Closures	7.14%			4.08%
	100.00%	100.00%	100.00%	100.00%

Multimodal Category Analysis

Multimodal	Short-Term	Mid-Term	Long-Term	Overall
Bike/Ped.	64.44%	76.92%	66.67%	68.89%
Transit/Vehicular	35.56%	23.08%	33.33%	31.11%
	100.00%	100.00%	100.00%	100.00%

LIST OF ADDITIONAL APPENDICES

Visit the RVARC Web Site to view supporting documents related to the 419 Corridor Plan. This documentation includes the following appendices:

2. Synchro/HCS
3. Turning Movement Counts
4. Crash Data
5. Bicycle/Pedestrian Methodology
6. Photos of Intersections for Improvements
7. Cost Estimates