Roanoke Valley Transportation
PLANNING ORGANIZATION
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Vision 2040: Roanoke Valley Transportation

DRAFT 6-14-17

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Vision 2040: Roanoke Valley Transportation Executive Summary

"Vision 2040: Roanoke Valley Transportation" is a metropolitan transportation plan (MTP) and a fiscally constrained long-range multimodal transportation plan (CLRMTP) for federal surface transportation funds. All urban areas within the United States are required by federal regulations to maintain and update a regional metropolitan transportation plan with a minimum of a 20-year planning horizon. The CLRMTP for the Roanoke Valley Transportation Planning Organization (RVTPO) includes the urbanized areas in Bedford County, Botetourt County, the City of Roanoke, Roanoke County, the City of Salem, and the Town of Vinton.

The most recent federal law pertaining to federal transportation funding and policy is the Fixing America's Surface Transportation Act ("FAST Act") that was signed into law on December 4, 2015. The FAST Act has several major frameworks, concepts or initiatives that apply to the Vision 2040 plan:

- The Federal Planning Factors
- Ladders of Opportunity
- Performance Measures Based Planning
- Freight Planning

Federal Planning Factors:
According to the Metropolitan Transportation Planning Final Rule (dated May 27, 2016) there are 10 Planning Factors in 23 CFR Part 450.206:

1. Support the economic vitality of the United States, the States, metropolitan areas, and nonmetropolitan areas, especially by enabling global competitiveness, productivity, and efficiency;
2. Increase the safety of the transportation system for motorized and non-motorized users;
3. Increase the security of the transportation system for motorized and non-motorized users;
4. Increase accessibility and mobility of people and freight;
5. Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns;
6. Enhance the integration and connectivity of the transportation system, across and between modes throughout the State, for people and freight;
7. Promote efficient system management and operation;
8. Emphasize the preservation of the existing transportation system;
9. Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation; and
10. Enhance travel and tourism.

Ladders of Opportunity:
The following summary of the Ladders of Opportunity Concept is from the US Department of Transportation (USDOT) website:

> *America's highways, railways, airports, ports and transit systems help drive our economy. There is a regrettable legacy of aligning and designing transportation projects that separated Americans along economic and even racial lines. At a time when our nation has so much infrastructure to repair and replace, we have a chance to do so in a much more inclusive way that will simultaneously expand economic opportunity and socioeconomic mobility throughout America. The choices we make about future transportation projects, the people they touch and places they connect, will play a role in determining how widely opportunity expands throughout America. Together, we can build a stronger and more connected nation, a healthier economy, and more vibrant communities.*

This concept can be further expressed in three contexts:
- **Work** - Infrastructure investment creates jobs and paves the way for business, particularly small and disadvantaged business enterprises.
- **Connect** - A multimodal transportation system provides Americans with safe, reliable, and affordable connections to employment, education, healthcare, and other essential services.
- **Revitalize** - Transportation infrastructure can lift up neighborhoods and regions by attracting new opportunities, jobs, and housing. (https://www.transportation.gov/opportunity accessed 06/08/2016).

Clearly the concept of aligning transportation planning and workforce development efforts are an important part of the ladders of opportunity concept. Sometimes what appears at first glance to be a transportation issue is actually a workforce issue and vice-versa.

Performance-Based Planning:
The Metropolitan Transportation Planning Final Rule (dated May 27, 2016) greatly increases the importance of Performance-Based planning for Metropolitan Transportation Plans (MTPs) which is their terminology for long-range transportation plans such as the Vision 2040 plan. RVTPO has participated in the Virginia Department of Transportation's (VDOT's) Performance Measures Reporting System in which we have produced an RVTPO Regional Performance Measures Report annually since 2012. However, this state level performance measurement reporting system is not completely in alignment with the new Metropolitan Transportation Planning Final Rule (dated May 27, 2016); therefore, a transition in performance measures and performance based planning will be needed. This Vision 2040 plan is the first step in that transition. This document will set the stage for the RVTPO Performance Based planning to align with the new federal rule. RVTPO's performance based planning system is discussed further in Part 2. In many ways performance-based planning will constitute a feedback loop whereby the system is constantly updated and improved.

Freight Planning:

The FAST Act includes a renewed interest in Freight Planning at the Transportation Planning Organization and the State Levels. The idea is to ensure adequate planning support to the vital logistics and supply chain system that benefits economic competitiveness and economic development. The RVTPO has a history of including freight in our planning effort and products including a 2012 Freight Generation Study and a 2014-15 "Western Virginia Intermodal Study." In addition, a Commercial Vehicle Model was added to the 2016 update of RVTPO Travel Demand Model. RVTPO will continue to expand freight planning activities over the coming years. Reliability of the logistics and supply chain is of utmost importance to many businesses who have business models that rely on low levels of inventory and timely availability of inputs.

This CLRMTP contains two parts that address these four initiatives. Part 1 is a summary that is geared toward the average citizen. It is organized around the following eight questions:

1. Where are we today with transportation in the Roanoke Valley?
2. What other plans have been done related to transportation, and how has the public been involved?
3. What do these plans say to guide transportation and land use decisions going forward?
4. What are the possibilities for the future?
5. What do these possibilities mean for transportation?
6. What funding is available to our region to make necessary investments in our transportation system?
7. What projects will best meet the needs identified for today; and, as best we can tell, for the future?
8. Do these projects have any anticipated benefits or burdens from an Environmental Justice perspective?

Part 2 contains the full technical details and data that federal and state stakeholders require. It is organized around the following subject areas: demographics, land use and environmental mitigation, performance measures, multimodal transportation system, transportation demand management, congestion management process, environmental justice assessment, travel demand model, and future considerations for transportation.

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Vision 2040: Roanoke Valley Transportation Part 1

1.0 Where are we today with transportation?

In many ways the Roanoke Valley is near a tipping point in transportation. Unfortunately, it is difficult to see which way the tipping point is headed. The Baby Boomers have started to retire and will all retire by 2040. The Millennials, currently in their teens and early twenties, are more numerous than the Baby Boomers. Early indications are that the Millennials get their driver's license later, drive less and prefer more compact urban environments more than recent generations. But, will this pattern hold when Millennials form families and have children? Prototypes of self-driving vehicles from Google and others have already proven feasible. But, how long will it take before most vehicles are at least partially automated? And, will this let us get enough extra capacity out of the buses and roads that we already have to not have to build so many new roads in the future? Or, is this just hope in "gee whiz" technology and reality will be similar to today?

The purpose of the Vision 2040 plan is not to predict the future exactly. Instead, the purpose of the plan is to anticipate plausible possibilities for the future, and to help elected officials, citizens and other stakeholders to wisely think through the investments in transportation infrastructure that should be made to make the most of future opportunities. In a very real and tangible way, transportation is our physical connection to economic development, community development and livability.

A congested road with single-occupant vehicles (top left) may not serve very many people given the space required (bottom left). The same number of people require less space when able to travel by other modes: transit (top right) and walking/bicycling (bottom right).

A more down-to-earth answer of “Where we are today with transportation?” is that we have a mixed bag of bottlenecks and spot congestion. Also, we have some accessibility to jobs and goods/services issues. However, we don’t generally have the stark congestion and delay issues that other larger metropolitan areas experience. **Part of the goal of Vision 2040 is to help guide transportation investment decisions so that the debilitating congestion that plagues other regions does not become a reality in the Roanoke Valley.**

The vision for transportation in the Roanoke Valley through 2040 is as follows:

The Roanoke Valley enjoys a seamless regional multimodal transportation system that is safe, cost-effective, environmentally conscious, maintainable, inclusive of all users, and conducive to the economic vitality of the community.

The vision for transportation in the Roanoke Valley complements the region's broader vision for a Livable Roanoke Valley stated below.

"We are living the dream. Beautiful mountains. Clean rivers and streams. People who care. The Roanoke Valley is filled with promise. To make the most of these opportunities, we will work to provide quality education, access to healthcare, work and career opportunities, responsible stewardship of the environment, and greater regional cooperation. As we strive to fulfill our promises, we will be the destination for individuals, families and businesses who share our same dream."

To help provide direction toward meeting this vision and on strategies and programs to be incorporated, the Virginia long-range, statewide multimodal transportation plan, VTrans, offers the following guiding principles:

GP1. Optimize Return on Investments
Implement the right solution at the right price, striving to meet current needs while advancing long-term prosperity and livability.

GP2. Ensure Safety, Security, and Resiliency
Provide a transportation system that is safe for all users, responds immediately to short-term shocks such as weather events or security emergencies, and adapts effectively to long-term stressors such as sea level rise.

GP3. Efficiently Deliver Programs
Deliver high-quality projects and programs in a cost-effective and timely manner.

GP4. Consider Operational Improvements and Demand Management First
Maximize capacity of the transportation network through increased use of technology and operational improvements as well as managing demand for the system before investing in major capacity expansions.

GP5. Ensure Transparency and Accountability, and Promote Performance Management
Work openly with partners and engage stakeholders in project development and implementation, and establish performance targets that consider the needs of all communities, measure progress towards targets, and to adjust programs and policies as necessary to achieve the established targets.

GP6. Improve Coordination Between Transportation and Land Use
Encourage local governments to plan and manage transportation-efficient land development by providing incentives, technical support, and collaborative initiatives.

GP7. Ensure Efficient Intermodal Connections
Provide seamless connections between modes of transportation to harness synergies.

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To accomplish the vision for transportation in the year 2040 in the Roanoke Valley, the RVTPO Policy Board sets forth the following goals:

GOALS	RELATED VTRANS NEED TYPES	APPLICABLE PERFORMANCE MEASURES
A. Economic Competitiveness and Prosperity Invest in a transportation system that supports a robust and diversified economy, enables global competitiveness, productivity, and efficiency, and enhances travel and tourism.	Corridor Reliability Network Connectivity Redundancy & Mode Choice Access to Transportation Networks beyond the UDA	Airport Facility Usage Movement of Freight Jobs-to-Housing Ratio
B. Accessible and Connected Places Provide opportunities for people to access jobs, services, and activity centers and for businesses to access distribution hubs and the region's workforce.	Network Connectivity Circulation and Access within the UDA Access to Transportation Networks beyond the UDA	Jobs and Housing Access to Transit Jobs and Housing Access to Pedestrian Facilities
C. Safety and Security Provide a safe and secure transportation system for all travel modes.	Safety	Safety
D. Proactive and Efficient System Management Maintain the transportation system in good condition and leverage technology to optimize system performance and operations.	Travel Demand Management Congestion Bottlenecks	Congestion Reduction HOV Usage
E. Healthy Environment Protect the agricultural, natural, historic, and cultural environment; preserve good air quality; minimize stormwater impacts and promote active living through multimodal transportation options.	Redundancy & Mode Choice Walkability/Bikeability	Bicycle and Pedestrian Facility Usage Transit Usage Air Quality
F. Resiliency and Reliability Maintain transportation system resiliency and reliability.	Corridor Reliability Redundancy & Mode Choice Congestion Bottlenecks	Congestion Reduction Jobs and Housing Access to Transit Jobs and Housing Access to Pedestrian Facilities

2.0 What other plans have been done related to transportation and how has the public been involved?

The long-range transportation planning process is a continuous process with new "long-range transportation plans" being approved every five years. This continuous work often manifests itself through specific plans and studies such as corridor and area studies or vision plans. These plans often have their own public involvement process that allow for continuous public involvement in the planning process in between long-range plans. Several new and significant planning initiatives have taken place since the adoption of the 2035 long-range transportation plan in June 2012. Highlights of major public involvement successes follow:

- **Livable Roanoke Valley**
  http://rvarc.org/livableroanoke/
  The Livable Roanoke Valley public involvement process took place over three years during which a Livable Roanoke Valley Summary Summary Plan was produced. Livable Roanoke Valley Actively Engaged over 1,500 citizens in the Roanoke Valley during the development of the plan. Many of these citizens were engaged through a statistically significant randomized telephone survey.

- **Congestion Management Process (CMP) Plan**
  http://rvarc.org/transportation
  The region's first ever CMP plan was produced in 2013-14. The main citizen outreach was an online congestion sentiment survey where citizens were asked where they experienced traffic congestion, where bottlenecks occur and other similar questions. Hundreds of citizens participated in these surveys.

- **Roanoke Valley Transit Vision Plan**
  http://rvarc.org/transportation/transit/
  The region's first ever Transit Vision Plan was adopted by the TPO Policy Board in September 2016. The plan was guided by a steering committee made up of people representing local governments, non-profit organizations, health and business interests. An extensive public outreach process spanned three years and involved people throughout the multiple phases of the plan's development. Citizens were engaged via traditional public meetings, focus groups, online discussion forums, and public surveys administered online, on transit vehicles, and in person. In total, over 4,000 responses guided the region's vision for transit.

- **Regional Pedestrian Vision Plan**
  http://rvarc.org/transportation/bicycle-pedestrian-greenways/regional-pedestrian-vision-plan/
  The region's first ever Pedestrian Vision Plan was adopted by the TPO Policy Board in January 2015. As part of this planning effort, over 450 citizens responded to a public survey about the

importance of walking for transportation in the Roanoke Valley and where improvements to walking infrastructure are most needed. Staff participated in local events to promote the plan and solicit input, and the TPO's Transportation Technical Committee served as the plan's steering committee.

- **Bikeway Plan for the Roanoke Valley Area MPO - 2012 Update**
  http://rvarc.org/wp-content/uploads/2013/12/RVAMPO-BikewayPlan-2012Update-web.pdf
  In March 2012, the TPO Policy Board adopted an update to its 2005 Bikeway Plan. A bicycle user survey guided the plan's recommendations with over 300 people responding to the survey. The Bikeway Plan addresses on-street accommodations whereas the Greenway Plan addresses off-street bike accommodations.

- **Roanoke Valley Conceptual Greenway Plan - 2007 Update**
  http://greenways.org/wp-content/uploads/2014/12/2007greenwayplan.pdf
  In 2007, the Greenway Plan was updated from its original 1995 plan. In developing the 2007 Update, over 200 people participated in the public input meetings. Input was also sought from local government staff and elected officials as well as corporations.

- **Roanoke Centre for Industry and Technology/Blue Hills Transportation Survey Analysis Report** (February 2014)
  http://rvarc.org/wp-content/uploads/2014/11/RCIT-Blue-Hills-Survey-Analysis-Report.pdf
  A special purpose transportation survey was carried out in a major economic development park in the City of Roanoke in order to estimate potential public transit demand. A total of 528 employees responded to the survey and a demonstration transit service project (Route 31X) began operating in January 2016.

- **Bonsack Area Public Transit Survey Analysis Report** (December 2014)
  http://rvarc.org/wp-content/uploads/2016/08/Bonsack-Area-Public-Transit-Survey-Analysis-Report.pdf
  As a follow-up to the previous survey conducted for RCIT/Blue Hills, a survey of businesses further east along Route 460 in the Bonsack/EastPark area took place to identify the need and interest of employers of transit service. Of the 28 businesses surveyed, eight in Botetourt County and 16 in Roanoke County provided input.

The following resources are provided from the Virginia Department of Transportation – Salem District for guidance related to improving Interstate 81.

- **Interim Report: Listing of I-81 Corridor Projects Addressing Safety and Congestion** (October 15, 2014)
  http://rvarc.org/wp-content/uploads/2017/06/I-81-Interim-Report_2014-October.pdf

- **Overview of HB-2 and Salem District I-81 Potential Candidate Projects** (August 27, 2015)
  http://rvarc.org/wp-content/uploads/2017/06/I-81-VDOT-Presentation-Candidate-Projects_2015-August.pdf

- **I-81 Salem District VDOT – For RVTPO: Potential SMART SCALE Projects** (July 2016)
  http://rvarc.org/wp-content/uploads/2017/06/I-81-Potential-SMARTSCALE-Projects_RVTPO_2016-July.pdf

For the purpose of this long-range planning effort, RVARC staff conducted a transportation priorities survey to gauge where citizens see the need for investments. The survey asked citizens to prioritize categories of projects that receive transportation funding and rank them from 1 (most important) to 6 (least important) indicating where limited transportation funding should be spent. A total of 569 people participated in the survey between September 1, 2016 – January 31, 2017 through focus groups, interviews in-person at community events, or online. These survey results are provided below.

1 - I-81 Improvements
2 - Pedestrians/Bicycles/Access to Transit (on-road)
3 - Other Roads/Highways
4 - Greenways (off-road)
5 - Transit (Buses and Transfer Facilities)
6 - Intelligent Transportation Solutions

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Transportation Priorities Survey

Please rank the following categories where limited transportation funding should be spent.

1 = most important, 6 = least important	
	I-81 Improvements
	Other Roads/Highways
	Intelligent Transportation Solutions
	Greenways (off-road)
	Pedestrians/Bicycles/Access to Transit (on-road)
	Transit (Buses and Transfer Facilities)

3.0 What do these plans say to guide transportation and land use decisions going forward?

The general theme that stands out from the plans listed in the previous section is one of access to jobs and access to goods/services via an interconnected easy and convenient multimodal transportation system that provides people multiple options for moving around the Roanoke Valley.

There are situations in which people who are in the market for particular jobs live in a different part of the region from where employers are offering these jobs. This is often referred to as "spatial mismatch." These plans also highlight the potential for infill development and redevelopment, which is critical for reducing longer distance travel demands. One approach to "spatial mismatch" is to get people from where they live to where they work which is a transportation approach. Another approach is to encourage employers to locate close to where potential employees live via redevelopment which is a community development approach. Sometimes a situation that gets labeled as a transportation issue is really a community development opportunity.

In short, these regional plans encourage investment in transportation infrastructure (pedestrian, bicycle, transit and roadway) and investment in community development, housing and economic development initiatives in areas that are planned or already well-developed activity centers.

Going forward, the vision for the Roanoke Valley is one that generally discourages sprawl (i.e. development that is designed and built at low densities with the automobile as the only realistic means of access); infrastructure is too expensive for the public sector to continue building and maintaining in a low-density sprawling environment.

Infrastructure usually has high fixed construction costs with low incremental costs for each additional individual user up to the point of congestion. For this reason, it is much more efficient to spread the fixed costs out over a concentration of users, rather than a dispersed set of users.

4.0 What are the possibilities for the future?

We are likely at a tipping point of technological and societal change that could profoundly impact future transportation demand, infrastructure and services. The interplay between these demographic, cultural and technological trends are complex; so, there is no one simple answer for what the future holds. In order to make sense of this complexity scenario planning is used. Transportation projects can be compared and contrasted across a variety of possible future conditions, and the relative merits and tradeoffs can be intelligently discussed.

It may often appear that big changes are on the way, yet the changes do not always materialize. Though there are more that warrant discussion, below are three very good reasons to think that big change could be around the corner. The first two reasons have to do with transportation demand and the other with transportation supply.

Baby Boomer Retirement AND Millennials (Gen Y) Entering their Prime Working Years
The Baby Boom Generation (born 1945-64) will be in full retirement between now and 2040. As such their transportation demand is likely to change in both kind (fewer work trips) and degree (fewer trips in general). However, accessibility to destinations and timing of trips (i.e. to keep appointments or attend social activities) may be of increased importance.

Millennials (born Early 80s through 2000s), who as a group are a little bigger than the Baby Boomers, will enter their prime career and family forming years between now and 2040. So, will the Millennials just "smooth out" the transportation demand changes brought on by the Baby Boomers? There are early indications that Millennial tastes and preferences for urban amenities and transportation modes are different than past generations. In some cases, Baby Boomer and Millennials may amplify transportation demand in a similar direction, rather than cancel each other out. It has often been observed that both young professionals and active empty nester retirees want to live downtown or in other urban settings with social activities and amenities nearby.

Internet Shopping ("The Amazon Effect")
People are increasingly comfortable with shopping online. Traditional retail will likely continue to play a role in the foreseeable future due to the sociability and experiential aspects of retail that are hard to replicate online. Nevertheless, it is reasonable to assume that an increasing percentage, compared with current levels, of items will be purchased online from now until 2040. In traditional retail large trucks deliver thousands of items to a retail location, and individual consumers typically purchase multiple items in one shopping trip. Each online purchase potentially represents a separate package shipped through services such as UPS, Federal Express or the US Postal Service, thus increasing small package freight transportation demand.

- **Automation and Intelligent Transportation Systems** - The prospect of automated vehicles is not an all-or-nothing situation. There are a spectrum of possibilities. The various possibilities of automation are typically grouped into five levels. The National Highway Traffic Safety Administration (NHTSA) has proposed a formal classification system for the levels of vehicular automation.

Level 0	The driver completely controls the vehicle at all times
Level 1	Individual vehicle controls are automated, such as electronic stability control or automatic braking.
Level 2	At least two controls can be automated in unison, such as adaptive cruise control in combination with lane keeping.
Level 3	The driver can fully cede control of all safety-critical functions in certain conditions.
Level 4	The vehicle performs all safety-critical functions for the entire trip, with the driver not expected to control the vehicle at any time.

Source: https://en.wikipedia.org/wiki/Autonomous_car#cite_note-10

TIMEFRAME	TECHNOLOGY AND MARKET TRENDS	POSSIBLE EFFECTS	RULES OF THUMB FOR PRIORITIZATION PROCESS
2016 to 2020	Early Adopters have "Super Cruise Control" and similar technologies.	Safety enhancements are anticipated but few traffic flow improvements are anticipated.	None – technology won't materially increase capacity on existing facilities.
2020 to 2030	Level 2 Technologies for Majority and Level 3 Technologies for Early Majority.	Increase in capacity of existing transportation network (collector and above) by 10% due to better traffic flow and fewer accidents.	If existing facilities are forecasted within 10% of transitioning from LOS E to D then technology improvements may avoid the need for roadway widening.
2030 to 2040	Level 3 for Majority and Level 4 "full automation" for Early Adopters.	Increase in capacity of existing transportation network by 20% due to better traffic flow and much better safety.	If existing facilities are forecasted within 20% of transitioning from LOS E to D then technology improvements may avoid the need for roadway widening.

Part 2 of this plan further discusses future considerations for transportation.

5.0 What do these possibilities mean for transportation?

It would be undesirable to look naive or unimaginative to future generations for failing to have foreseen possible impacts of demographic changes, technology and automation on transportation. It would also be detrimental to the community to build unnecessary roads because technology, enhanced public transit or demographic trends sufficiently reduce traffic congestion. Great uncertainty surrounds the extent to which new technology will improve mobility and reduce traffic congestion in the future.

What is known is that citizens in the Roanoke Valley have spoken loud and clear through many public input opportunities that more and improved multimodal transportation options are greatly desired and needed. Plans such as the Roanoke Valley Transit Vision Plan, the Roanoke Valley Pedestrian Vision Plan, the 2012 Update to the Bikeway Plan for the RVAMPO, and the 2007 Update to the Conceptual Greenway Plan for the Roanoke Valley, for example, all provide recommendations for improving the multimodal characteristics of the Roanoke Valley's transportation network, and their successful implementation will be evident in the ease with which people can transfer easily between any combination of a car, a bus, a train, walking, and biking. The same needs exist for freight and goods movement.

The interconnectedness and ease of mobility between one mode of transportation with another is essential to the region's evolving transportation network and growing economy.

6.0 What funding is available to our region to make necessary investments in our transportation system?

Funding systems have changed since the 2035 long-range transportation plan. There are no longer financially constrained categories such as "City of Roanoke Urban System", "Roanoke County Secondary System", "Interstate System", "Primary System," etc. for every locality in the Study Area. The financial constraint is now done on a regional basis reflecting recent statewide prioritization and project selection procedures through Virginia's "System for the Management and Allocation of Resources for Transportation" which will hereafter be referred to by its acronym SMART SCALE. This is better for regional decision making and should strengthen the role of the RVTPO's Vision 2040 plan over time. The Vision 2040 plan's role will also change in response to a combination of SMART SCALE and the fact that the vast majority of anticipated future funding will be used for maintenance rather than new construction. This will likely mean that very few large-scale new terrain transportation projects will be built in the future. Rather, many transportation projects will be smaller incremental improvements.

The new financially constrained categories are as follows along with the total amount constrained from 2016 until 2040; the amounts reflect projections determined by VDOT.

FUNDING PROGRAM	TOTAL FUNDS AVAILABLE
Administrative	$88,272,296
SMART SCALE District Grant Program	$91,151,525
SMART SCALE High Priority Projects	$91,151,525
Maintenance - Localities	$411,870,834
Maintenance - VDOT	$1,698,097,653
Other Discretionary Construction	$196,149,537
Regional Surface Transportation Program (RSTP)	$79,443,881
RSTP-Match	$20,960,436
State of Good Repair	$133,520,967
Transportation Alternatives (TA Set-Aside)	$6,617,752
FY16 Constrained Long-Range Multimodal Transportation Plan TOTALS	**$2,817,236,406**

Funding categories from the preceding table such as administrative, maintenance and state of good repair are not available for adding capacity or new construction. They are included in the Vision 2040 plan because federal surface transportation funds are being used and federal regulations require their disclosure. The funding categories available for additional capacity or new equipment are depicted in the following table. It is especially noteworthy that this total is much smaller than the preceding total that includes both maintenance and state of good repair. In fact, maintenance alone (VDOT and Localities) makes up almost 75% of the financial constraint. This is a clear indication that lifecycle costs of transportation infrastructure are a very important consideration.

Maintaining existing infrastructure before constructing new infrastructure is the first priority. The Roanoke-Blacksburg Regional Airport tunnel over State Route 118/Airport Road NW is a key project for the Roanoke Valley that will require long-term maintenance though a sustainable funding source for its maintenance has not been identified. The airport provides a vital connection to the Roanoke Valley for people and freight and finding a sustainable way to fund tunnel maintenance is essential.

Only 25% of the total funds available are for "new construction"; thus, the number of large-scale transportation projects in RVTPO are limited.

FUNDING SOURCES AVAILABLE FOR NEW CONSTRUCTION	TOTAL FUNDS AVAILABLE
SMART SCALE District Grant Program	$91,151,525
SMART SCALE High Priority Projects	$91,151,525
Other Discretionary Construction	$196,149,537
Regional Surface Transportation Program (RSTP)	$79,443,881
RSTP-Match	$20,960,436
Transportation Alternatives (TA Set-Aside)	$6,617,752
TOTAL	**$485,474,656**

The amounts depicted above are sum totals from Fiscal Year 2016 through Fiscal Year 2040. These funding categories already account for inflation on the revenue side because each year that makes up the total is already in future dollars (Year of Expenditure Dollars - YOE) for that year.

A 3% annual inflation rate for project costs has been assumed in consultation with VDOT using their standard assumptions for planning level project cost inflation. The 3% annual inflation for project costs is higher than the growth rate of revenue using state level revenue collection assumptions. This means that the "purchasing power" will erode over time with respect to new transportation projects. In other words, the money available to the region will buy fewer projects in the out years of this long-range plan solely due to inflation.

The situation is even more striking with regards to public transit. Revenues for the maintenance and operation of existing public transit services is expected to remain flat. Therefore, inflation will take a larger toll on the purchasing power of future year transit dollars than on the transportation construction side. Operating budget projections needed to sustain current services for the Greater Roanoke Transit Company through 2040 are shown in Appendix B.

A one-year snapshot (FY 2016) of public transit specific funding for the Roanoke Valley is shown in the following table; estimated revenue projections were provided by the Virginia Department of Rail and Public Transportation.

FISCAL CONSTRAINT DEMONSTRATION – RVTPO REGION

	FY 2016[2]			
	Estimated Federal Revenue	Non-Federal Revenue		Total Estimated Revenue
		Estimated State Revenue	Estimated local Revenue	
Section 5303[3]	$ 125,542	$ 15,693	$ 15,693	$ 156,928
Section 5307[4]	$ 2,449,772	$ 306,222	$ 306,222	$ 3,062,215
Section 5311[5]	$ 694,958	$ -	$ 334,958	$ 1,029,916
Section 5339 [4]	$ 268,621	$ 53,724	$ 13,431	$ 335,776
Section 5310	$ 221,013	$ -	$ 55,253	$ 276,266
TOTAL	**$ 3,759,906**	**$ 375,639**	**$ 725,557**	**$ 4,861,102**

[1] Calculations in this spreadsheet are based on FTA apportionments only and do not include CMAQ or STP funds that have been flexed into 5307. We have opted for a conservative approach and are showing FY2016-19 allocations at the level of FY2016 funding, without an inflation factor.

[2] Designates State fiscal year. Includes FTA apportionments from the Federal Register dated August 27, 2015.

[3] Section 5303 for FY 2016 based on approved FY 2016 Six Year Improvement Plan, FY2017-19 based on FTA apportionments from the Federal Register dated August 27, 2015.

[4] State and local match ratios depend on DRPT's current year match rate.

[5] Secion 5311 capital allocations are discretionary, therefore this forecast only includes 5311 operating assistance based on the approved 2016 Six Year Improvement Plan.

Summing up the fiscal years from FY 2016 through FY 2040 (25 years) gives us the following aggregate financial constraint for public transit specific funding sources (Note: due to rounding cents to the dollar, the totals below may be slightly different than a simple calculation of FY 2016 * 25.).

FISCAL CONSTRAINT DEMONSTRATION – RVTPO REGION

	Total from FY 2016 through FY 2040			
	Estimated Federal Revenue	Non-Federal Revenue		Total Estimated Revenue
		Estimated State Revenue	Estimated local Revenue	
Section 5303[3]	$ 3,138,550	$ 392,325	$ 392,325	$ 3,923,200
Section 5307[4]	$ 61,244,300	$ 7,655,538	$ 7,655,538	$ 76,555,375
Section 5311[5]	$ 17,373,950	$ -	$ 8,373,950	$ 25,747,900
Section 5339 [4]	$ 6,715,525	$ 1,343,105	$ 335,776	$ 8,394,406
Section 5310	$ 5,525,325	$ -	$ 1,381,331	$ 6,906,656
TOTAL	**$ 93,997,650**	**$ 9,390,968**	**$ 18,138,920**	**$ 121,527,538**

Many projects associated with public transit such as service expansion buses, bus replacement, bus stop improvements, accessibility improvements, transfer centers and multimodal centers can be funded through the SMART SCALE District Grant Program or High Priority Program, RSTP, TA Set-Aside and/or other construction and new project related funding sources. The FTA 5303,07,10,11, and 39 family of funding can be reserved for service maintenance and provision purposes. Other non 53** funding can and should be used for public transit supportive projects.

7.0 What projects will best meet the needs identified for today; and, as best we can tell, for the future?

There are two basic frameworks to keep in mind in identifying which projects will best meet our current and future needs: 1) Project selection and prioritization; and 2) Performance Based Planning over successive long-range transportation plans.

Project Selection and Prioritization

Transportation project ideas may come from a variety of sources including but not limited to:

- The Regional Travel Demand Model (TDM);
- Other regional transportation plans;
- Local government comprehensive, neighborhood, community and strategic plans.

There are typically more candidate projects than there are funds to consider for the financially constrained list of projects. Worthy projects that are not selected for the financially constrained list are placed on the vision list of projects. The purpose of the vision list is to provide ready to go projects should unanticipated additional funding be made available in the future to enlarge the financially constrained list.

Should projects receive funding that are not included in the Vision 2040 plan, they will need to be amended into the plan and the financially constrained list modified accordingly. *A project selection process and a Vision 2040 plan amendment process are currently under development.*

The initial project selection process used for this financially constrained list considered the projects that have already received funding in the Commonwealth Transportation Board's Six-Year Improvement Program as well as the projects for which funding has been applied through 2016. The project selection process for the vision list considered how well the projects meet the goals of the Vision 2040 plan, public input received from the previously mentioned planning process as well as additional input received specific to this CLRMTP, and the six factors found in Virginia's SMART SCALE system (see: http://vasmartscale.org/) which are: **Safety, Congestion Mitigation, Accessibility, Environmental Quality, Economic Development and Land Use**.

The financial constraint, for both public transit and transportation facility construction, functions at two levels. Some transportation projects are regionally significant and need to be listed individually in the financially constrained list of projects. Other projects such as spot improvements, adding bicycle and pedestrian accommodations to existing corridors, signal timings and various similar projects are to-be-determined based on applications in future funding cycles. Many smaller projects are financially constrained by virtue of being grouped in a financially constrained category with project selection to be determined by the appropriate funding program's own selection and scoring procedures.

Determining which projects are "regionally significant" for the purposes of being listed individually in the Vision 2040 plan and which are grouped into a category involves the participation of Federal and State partners in the continuing, cooperative and comprehensive "3-C" process. The key distinction is between transportation projects that fall in either Category A or Category B:

- **Category A: "specifically referenced in"** the Vision 2040 plan (i.e identified individually such as but not limited to new road construction, interchange projects, fixed guideway transit projects, etc.); and,
- **Category B:** Projects that are **"consistent with"** the Vision 2040 plan.
  These projects are **not** the type that must be identified individually, *"i.e. specifically referenced in,"* (i.e including but not limited to: typical intersection improvements, signal timing, pedestrian and biking projects, bus shelters or other transit access enhancements, etc.), then the project should be compatible with the vision, strategies and goals of the Vision 2040 plan.

Performance-Based Planning

RVTPO constrained long-range multimodal transportation plans have at least a 20-year horizon. However, these plans are updated at least every five (5) years with each successive plan potentially moving the 20-year planning horizon out an additional five years. As such, an initial selection of constrained list projects in any given CLRMTP needs to be linked to subsequent decisions in future CLRMTPs. The best way to do this is to use performance measures in Performance-Based Planning.

This Vision 2040 plan will establish the initial list of performance measures (as referenced in the RVTPO's Annual Performance Measures Report) and targets that will measure the success of the long-range transportation planning process. Future CLRMTPs may amend or expand these measures. Annual updates on the performance measures should inform choices in future CLRMTPs in conjunction with the six SMART SCALE project selection factors. With this information, more informed and robust choices can be made regarding transportation.

The RVTPO has been reporting performance measures annually since 2012. Annual performance measures reports can be found on the Roanoke Valley-Alleghany Regional Commission's website (http://rvarc.org/transportation/mpo_urban_transportation/performace_measures). The goal of the Vision 2040 plan and other regional plans is to propose new relevant performance measures and otherwise advance performance-based planning. This will develop a positive feedback loop with regional transportation plans and the annual performance measures reports, so that the annual reports serve to integrate and track the measures developed in the planning process.

The fiscally constrained list of projects and the vision list of projects are provided in Appendix A.

8.0 Do these projects have any anticipated benefits or burdens from an Environmental Justice perspective?

Environmental Justice (EJ) has a slightly misleading name. It is more of a social justice and fairness concept. It does have a connection to the physical environment through emphasizing that traditionally underrepresented communities, low-income and minority communities, should not be adversely affected by disproportionate exposure to pollution, or other adverse impacts, from transportation projects. However, the central meaning behind EJ is more about not disrupting the social fabric, cohesion and development of traditionally underrepresented communities. Disruption could occur by separating communities with large thoroughfare transportation projects that don't directly serve the communities and may serve as barriers.

At its core EJ seeks to learn from the mistakes of the "Urban Renewal" era of the 1960s and 70s in which vibrant and successful urban neighborhoods were divided by freeways and highways subsequently harming the economic health and social fabric of the neighborhoods. More information about the official history of the EJ concept with its origins in Title VI of the Civil Rights Act of 1964 and Executive Orders 12898 and 13166 in the late 90s and early 2000s can be found in the RVTPO Title VI, Environmental Justice and Limited English Proficiency (LEP) Plan.

EJ concepts extend beyond the planning phase through the project development, engineering and construction phases. EJ concepts will primarily be implemented at two separate levels:

- In the CLRMTP, at the planning level, with the development of the financially constrained list of projects (and related amendments); and,
- When the RVTPO implements the CLRMTP by endorsing or approving projects for federal funding through the available federal funding programs, as reflected in the Transportation Improvement Program (TIP) and the Annual Obligations Report.

These two levels enable the continuous evaluation of projects and their EJ impacts. The EJ Framework will primarily identify red flags and screen out any potentially inappropriate projects from the long-range plan. Before projects are endorsed for federal funding programs, the TPO Policy Board can evaluate the projects again, in a more robust manner, and modify the scope of the project to address any additional EJ concerns that arise. Part 2 of this plan contains more information about Environmental Justice.

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Vision 2040: Roanoke Valley Transportation Part 2

1.0 Demographics

The RVTPO area is based on 2010 US Census "urbanized" areas. According to the Census, these areas are delineated based on a multi-step process that considers:

- Initial delineation of urban cores based on population density (500 to 1000 people per square mile)
- Inclusion of impervious qualifying blocks
- Inclusion of additional qualifying Blocks by hops and jumps Inclusion of qualifying enclaves.

Populations by Selected Years and Areas	2010 Urbanized	2015 Urbanized	2015 Study Area
Bedford County	478	478	1,751
Botetourt County	11,857	11,857	17,923
Montgomery County	699	699	1,398
City of Roanoke	96,919	99,681	99,681
Roanoke County*	67,123	67,018	76,035
City of Salem	24,848	25,438	25,438
Town of Vinton	8,057	8,231	8,231
Total	**209,981**	**213,402**	**230,457**

Sources:
2010 US Census Urbanized Area or Block Data
2015 Weldon Cooper Center for Public Service, UVA
2015 Weldon Cooper Center minus 2015 US Census Town Estimate
2015 US Census American Community Survey Estimate
**Excludes Vinton*
***2010 Urbanized** = 2010 US Census Urbanized Area*
2015 Urbanized = 2015 Populations for 2010 Urbanized Area
2015 Study Area = 2015 Populations for 2040 Urbanized Area

Figure 1-1 Population by year and area

All areas with an urbanized population over 50,000 are required to have a metropolitan planning organization, which is the RVTPO. All areas within the urbanized area are required to be included in the RVTPO. Figure 1-1 shows the population in 2010 that is included in the urbanized boundary. The second column shows the 2015 population that is estimated to be in the urbanized area. Because the two cities and town are wholly contained in this boundary, population estimates for 2015 are easily obtained. Unfortunately, estimates for the urbanized portions of the counties are not available after 2010. Further complicated demographics is the fact that the TPO is required to adopt a "study area boundary". This area must include the urbanized area and the areas expected to be urbanized in the next 20 years. The current study area boundary is defined for the year 2040. Both the urbanized area boundary and study area boundary can be seen in Figure 1-2.

The final column in Figure 1-1 lists the estimated population in the study area boundary by locality. Again, the counties estimated based on 2010 Census block data since they are only portions of the counties, while the cities and towns are based on 2015 locality specific estimates. The variety of geographies, sources, and data years makes it difficult to cite definitive population totals.

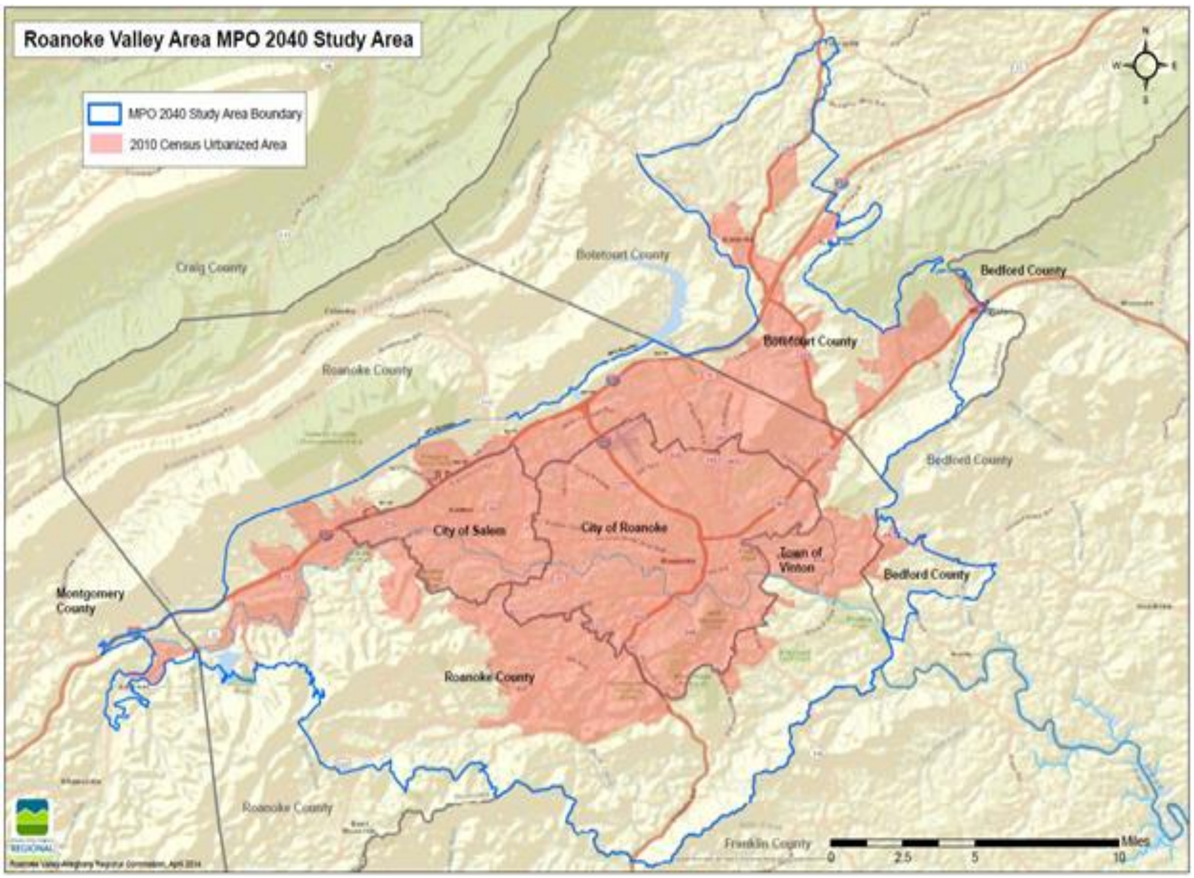


Figure 1-2 Map of Urbanized Area and 2040 Study Area Boundary

Using software called Business Analyst by ESRI Inc., a demographic overview was generated for the region using the 2040 study area boundary (Figure 1-3). Population for 2016 was estimated to be 238,943. Population is expected to grow at a slower rate than the state and national rates. Recent census data has shown that the population growth rates in the region from 2010-2016 are only about half the growth rate of the previous decade. As baby boomers age, the median age for the region is expected to increase as well. The racial composition is about 80% white, 13% Black or African American, and 2% Asian (Figure 1-4). About 4.4% of people are of Hispanic origin. Further details on minority populations can be found in the Environmental Justice section.

The economy is considered diverse with employment distributed across a wide range of industries such as retail trade, health care, manufacturing, and government.

Summary	**Census**		**2016**		**2021**
Population	230,934		238,743		245,806
Households	96,889		99,669		102,432
Families	60,715		61,889		63,258
Average Household Size	2.32		2.33		2.34
Owner Occupied Housing Units	64,559		64,665		66,202
Renter Occupied Housing Units	32,330		35,003		36,230
Median Age	41.1		42.3		43.1
Trends: 2016 - 2021 Annual Rate	**Area**		**State**		**National**
Population	0.58%		0.97%		0.84%
Households	0.55%		0.93%		0.79%
Families	0.44%		0.86%		0.72%
Owner HHs	0.47%		0.89%		0.73%
Median Household Income	-1.74%		2.35%		1.89%
		2016		**2021**	
Households by Income		Number	Percent	Number	Percent
<$15,000		13,053	13.1%	14,945	14.6%
$15,000 - $24,999		10,134	10.2%	9,987	9.7%
$25,000 - $34,999		11,744	11.8%	10,408	10.2%
$35,000 - $49,999		15,758	15.8%	21,665	21.2%
$50,000 - $74,999		18,739	18.8%	11,048	10.8%
$75,000 - $99,999		12,385	12.4%	13,665	13.3%
$100,000 - $149,999		10,969	11.0%	12,328	12.0%
$150,000 - $199,999		3,579	3.6%	4,465	4.4%
$200,000+		3,308	3.3%	3,920	3.8%
Median Household Income		$48,906		$44,804	
Average Household Income		$64,930		$68,465	
Per Capita Income		$27,874		$29,278	

Figure 1-3 Demographic overview

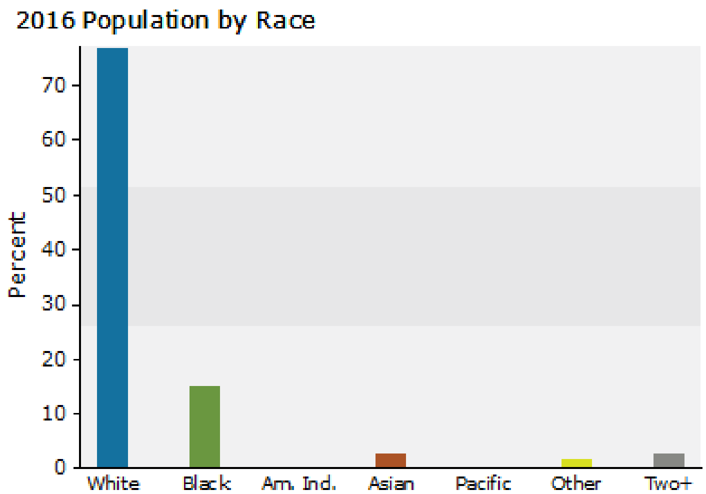


Figure 1-4. Population by Race. (Hispanic Origin 4.4%)

1.1 Transportation Planning Data

Transportation planning data for the Roanoke Valley Transportation Planning Organization (TPO) area is a special tabulation of socioeconomic information intended to aid transportation planners in planning and designing responsive multimodal transportation services and facilities in the community. Transportation planning and design agencies use this data in the four-step Transportation Planning Process to assess the impact of changes in the transportation system on present demand. The four steps are trip generation, trip distribution, mode choice, and trip assignment. This process is of great importance in the Roanoke Valley's development and evaluation of urban transportation plans, policies, and investments.

Transportation planning data serves many other related transportation and regional planning purposes. The data provides dependable background information for large sub-area studies, public transportation and facilities plans, transportation demand analysis, and land use and rezoning studies. Historical comparisons of transportation planning data provide an indicator of the ongoing health of the region's socioeconomic assets.

Under the direction of the Roanoke Valley TPO, the staff of the Roanoke Valley-Alleghany Regional Commission compiles transportation planning data for the TPO study area. Previously known as Data Maintenance Reports (DMR), the data has been updated and documented over the past four decades. The availability of the Census data greatly simplifies the data collection process and, with continual maintenance, provides the most reliable source of data for modeling the Roanoke urban area transportation system.

Data is obtained from the US Census Bureau's Census Transportation Planning Package (CTPP).

Historically, this product is released four to six years after each decennial census. In mid-decade updates, staff must estimate data based on the most recent Census data. More recently, the data is based on the American Community Survey, which is sampled and released for a three- or five-year period.

1.1.1 The Census Transportation Planning Package

The CTPP is a special set of tabulations designed primarily for transportation planners, policy analysts and engineers. It is developed by the Bureau of the Census using decennial census data, and provides detailed population, housing, worker, and commuter characteristics for a number of geographic levels. Because some of the data is based on the "long form", it is considered sampled data that contains a margin of error. The CTPP data is compiled by place of work and by place of residence. The data also contains journey to work data.

The urban element of the CTPP contains selected information at the Traffic Analysis Zone (TAZ) level. The urban element is especially designed to assist MPOs in carrying out their planning responsibilities. In 2009, Commission staff participated in a US Census Bureau program to better redefine TAZ boundaries. The 2010 Census data was then compiled using these new TAZ boundaries.

1.1.2 Traffic Analysis Zones (TAZ)

> The US Census Bureau defines a TAZ the following way:
> *A traffic analysis zone (TAZ) is a special area delineated by state and/or local transportation officials for tabulating traffic-related data- especially journey-to-work and place-of-work statistics. A TAZ usually consists of one or more census blocks, block groups, or census tracts.*

As previously mentioned, information collected for the Transportation planning data is published at the Traffic Analysis Zone (TAZ) level. TAZs are geographic units representing sizable portions of the region, which impact, or in some cases are predicted to impact, the transportation networks. For this reason, TAZs in more heavily developed areas and rapid growth areas tend to be smaller than those in outlying zones. TAZs have distinct geographic boundaries with relatively few access points to the region's overall transportation network. Ideal boundaries often include limited access highways, railroad lines, water boundaries and ridgelines. Because the impact of different types of trips (e.g. home to work, home to shopping, etc.) may be assessed, TAZs should be of fairly homogeneous land use. Of course, no urban area follows these ideal criteria. Therefore, a good deal of judgment is involved in determining appropriate TAZ boundaries. Two additional principles should be observed in delineated TAZ boundaries. First, TAZ boundaries should coincide with jurisdictional boundaries. Second, in order to compare previously developed Transportation Planning Data, adjusting TAZ boundaries should be avoided, if possible. This does not preclude the subdivision of existing zones, a natural process of individual zone urbanization. Because the 2010 Census required the use of new boundaries, TAZ comparison to prior years is now not possible.

Table 1 Growth Rates

Locality	2010-2040 Growth VEC Growth Rate
Bedford County	20%
Botetourt County	20%
City of Roanoke	6%
Roanoke County	20%
City of Salem	13%
Montgomery County	20%

The Roanoke Valley Area TPO has 201 Census TAZs, down from 224 in 2000. It is important to note that the US Census Bureau numbering system may be different than the numbering system used in the modeling software used by VDOT. Furthermore, some Census TAZ boundaries were adjusted in 2015 to comply with VDOT modelling requirements. Outlying TAZs were split to conform to the TPO study area boundary and downtown (urban) TAZs were split into smaller TAZs. Thus, the study area has 205 TAZs that are used in the VDOT model and they do not correspond completely with the TAZs and data compiled by the US Census Bureau. The new VDOT TAZ configuration should be submitted for the 2020 Census delineation if the opportunity exists.

1.2 Base Year Data

Population

The population for each TAZ was derived from 2010 Census data and is considered accurate. Since the area has experienced little growth, these numbers were used for the 2012 base year.

Employment

Employment data is based on the 2006-2010 American Community Survey and is based on sampled data. Some TAZs without residential population were also reported to have zero employment in the CTPP data. An effort was made by TPO staff to review the TAZ data for errors in employment. In some cases employment numbers were adjusted based on local knowledge or other employment databases. More detailed information on these adjustments can be found in some versions of the data tables.

1.3 Methodology for 2040 Updates

Population projections for 2040 were based on Virginia Employment Commission population projections for each locality.

Population Growth Rates 2010-2040

Each locality reviewed the 2010 Census data on population and employment by TAZ (Table 1). Using Virginia Employment Commission 2040 population projections as a benchmark, each locality was given the opportunity to adjust individual TAZ projections on population and employment based on local knowledge of future development.

Bedford County examined county-wide growth patterns and recommended 12% growth for the TAZs within the study area. They also examined planned development in each TAZ to arrive at adjusted numbers.

Projections for the City of Roanoke were adjusted by City staff based on proposed development. About 31 TAZs were adjusted. Several 2010 employment numbers of “0” were also corrected based on current employment.

In Roanoke County, few adjustments were made to the 2040 projected numbers. Several 2010 employment numbers of “0” were corrected based on current employment. For example, the Tanglewood Mall area had employment listed as “0”.

In the City of Salem, six TAZs were adjusted by City staff based on planned development.

No changes were made to the Botetourt County or Montgomery County 2040 projections.

Finally, as the TPO staff worked with VDOT on the model development, further refinements were made to the data in regards to TAZ splits, exclusion of group quarters and other adjustments. Data for the U.S. 460 East (Orange Avenue and Challenger Avenue) corridor was adjusted in model calibration.

2.0 Land Use and Environmental Mitigation

Transportation is integrally connected with Land Use and the Environment. This section discusses how the decisions made about land use are linked to the Roanoke Valley's transportation system and the environment.

2.1 Clean Air Act and Background and History

In 1997, the Environmental Protection Agency (EPA) made an amendment to the Clean Air Act's National Ambient Air Quality Standards (NAAQS). The amendment essentially replaced the 1-hour ozone standard with a more stringent 8-hour standard. In the late 1990s the ozone levels taken at an air quality monitor in the Roanoke area had exceeded the newer 8-hour standard. Due to these high ozone levels, the RVTPO and its member localities worked with the Virginia Department of Environmental Quality (DEQ) to establish a nonattainment boundary for the Roanoke area. This agreed upon boundary encompassed the entire Roanoke Metropolitan Statistical Area (1990 definition – Counties of Roanoke and Botetourt, Cities of Roanoke and Salem and Town of Vinton.) The EPA required that all areas exceeding the new standard establish a nonattainment boundary and submit it to them for review. The recommended boundary for the Roanoke area was submitted along with the others from around the Commonwealth of Virginia in June 2000.

In the fall of 2002 the EPA extended an opportunity to regions which were to be designated nonattainment under the 8-hour standard, but which were in attainment for the previous 1-hour standard, to pursue an Ozone Early Action Compact (EAC) followed by an Ozone Early Action Plan (EAP). This opportunity extends from a protocol that was developed in EPA's Region 6 and subsequently extended through administrative action to other EPA Regions in the country. The RVTPO is located in EPA's Region 3.

The EAP is essentially an agreement between local governments, the DEQ and the EPA to pursue an Ozone EAP before an air quality plan would have been otherwise required under traditional nonattainment designation. The EAP will be incorporated into the State Implementation Plan (SIP).

In early March 2008 the Federal EPA revised the nationwide 8-hour Ozone Standard to 75 parts per billion (ppb) based on a three-year average. The Roanoke Region's three-year average for the 2006, 2007 and 2008 Ozone seasons were at 74 ppb, within the new nationwide standard.

In 2015, the Federal EPA ruled that the primary and secondary 8-hour Ozone Standard levels are 0.070 ppm (parts per million). Since this rule was enacted, the Roanoke Region is currently within the standard.

As Roanoke Valley leaders seek future economic growth, more people will move to and work in the region. Such growth in population and business will generate more personal and freight trips putting a greater demand on the current transportation network. Larger metropolitan regions have shown that land use development and transportation investments that focus on driving as the only practical way for people to move from origin to destination have negative environmental consequences, particularly for air quality, among other quality of life downfalls.

To maintain the region's current healthy air quality, the RVTPO and local governments have developed future land use plans, identified where urban growth is desired, and where multimodal transportation options would be most realistic and beneficial.

2.2 Roanoke Valley Land Use

Pursuant to Code of Virginia §15.2-2223, all localities in the Roanoke Urbanized Area must adopt a Comprehensive Plan with a land use plan. Individually, the existing and future land use maps are contained in a locality's Comprehensive Plan which serve as a guide for current and long-range development. The available existing and future land use maps for each member locality are provided in this section to reflect the impact land use has on transportation (Figures 2-1 through 2-5).

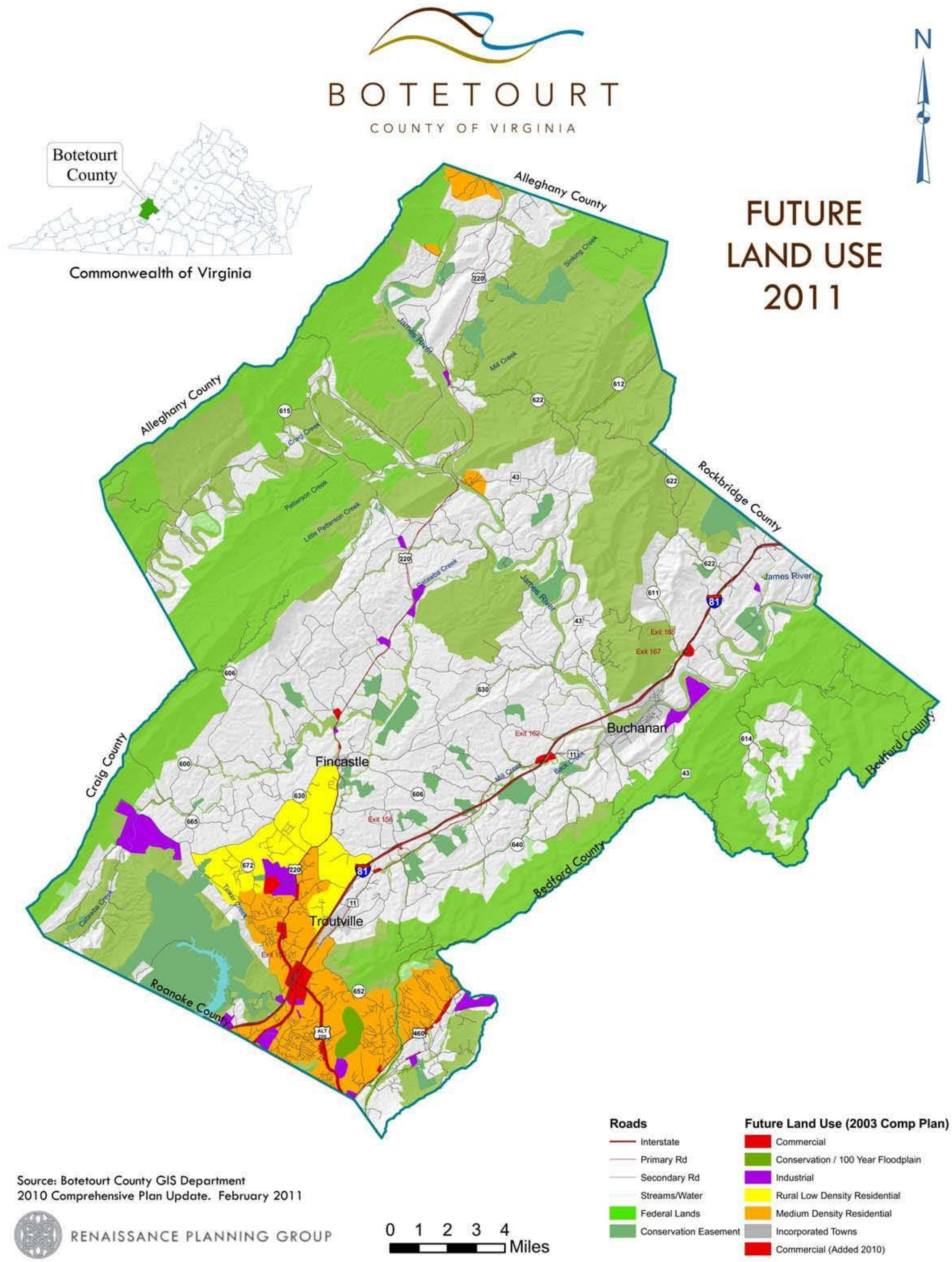


Figure 2-1 Botetourt County Future Land Use

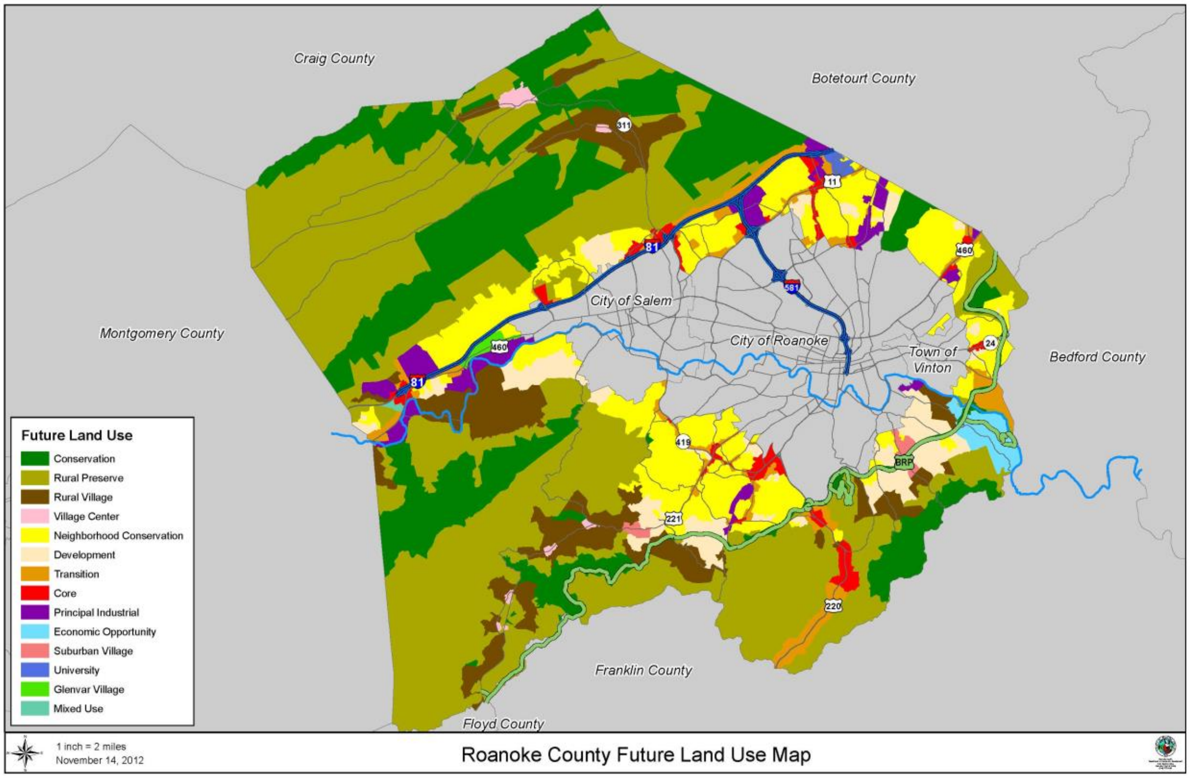


Figure 2-2. Roanoke County Future Land Use

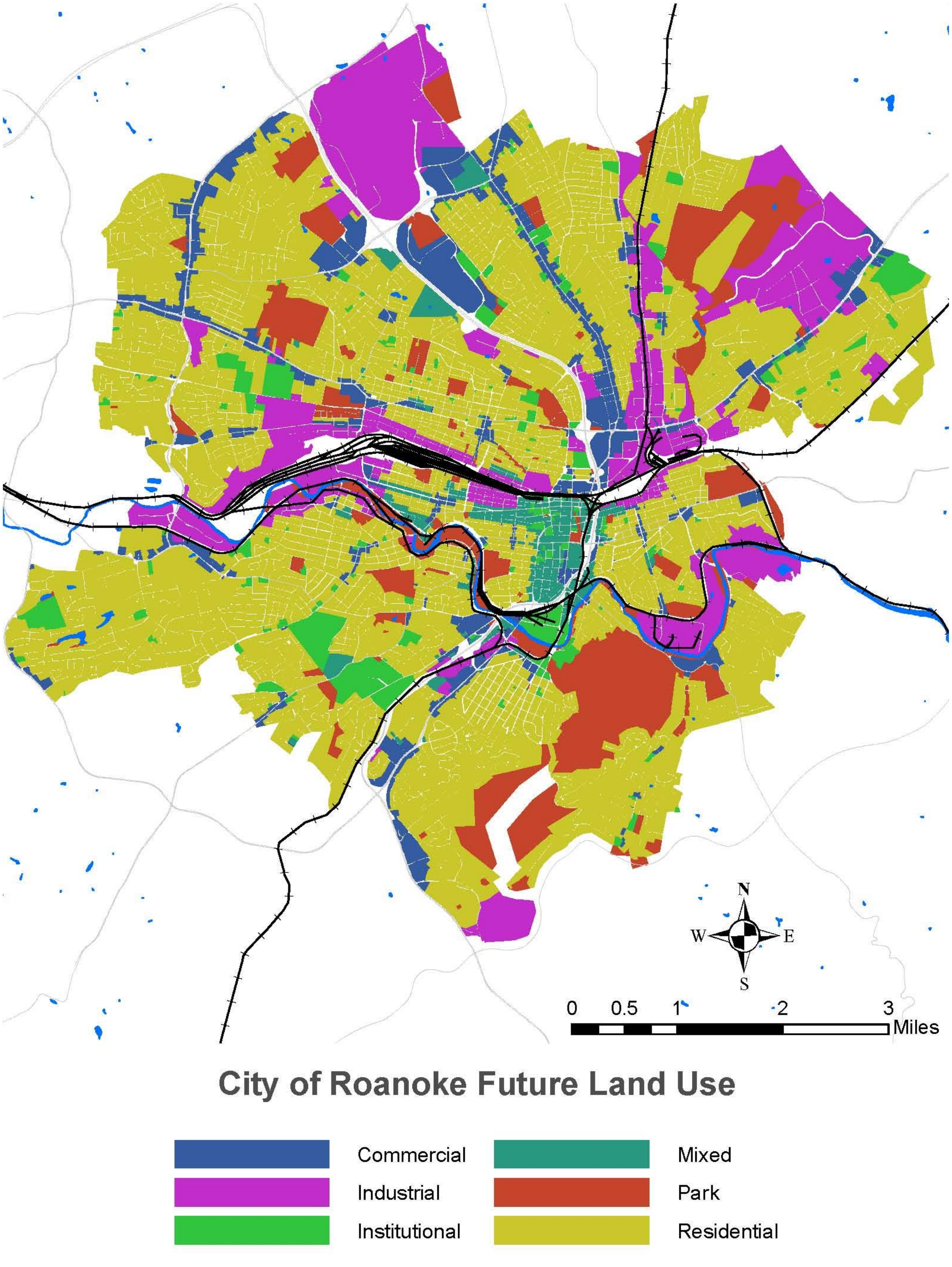


Figure 2-3. City of Roanoke Future Land Use

The City of Roanoke and RVARC are developing a city-wide future land use map. Local future land use designations are provided throughout the city's 28 Neighborhood and Area Plans.

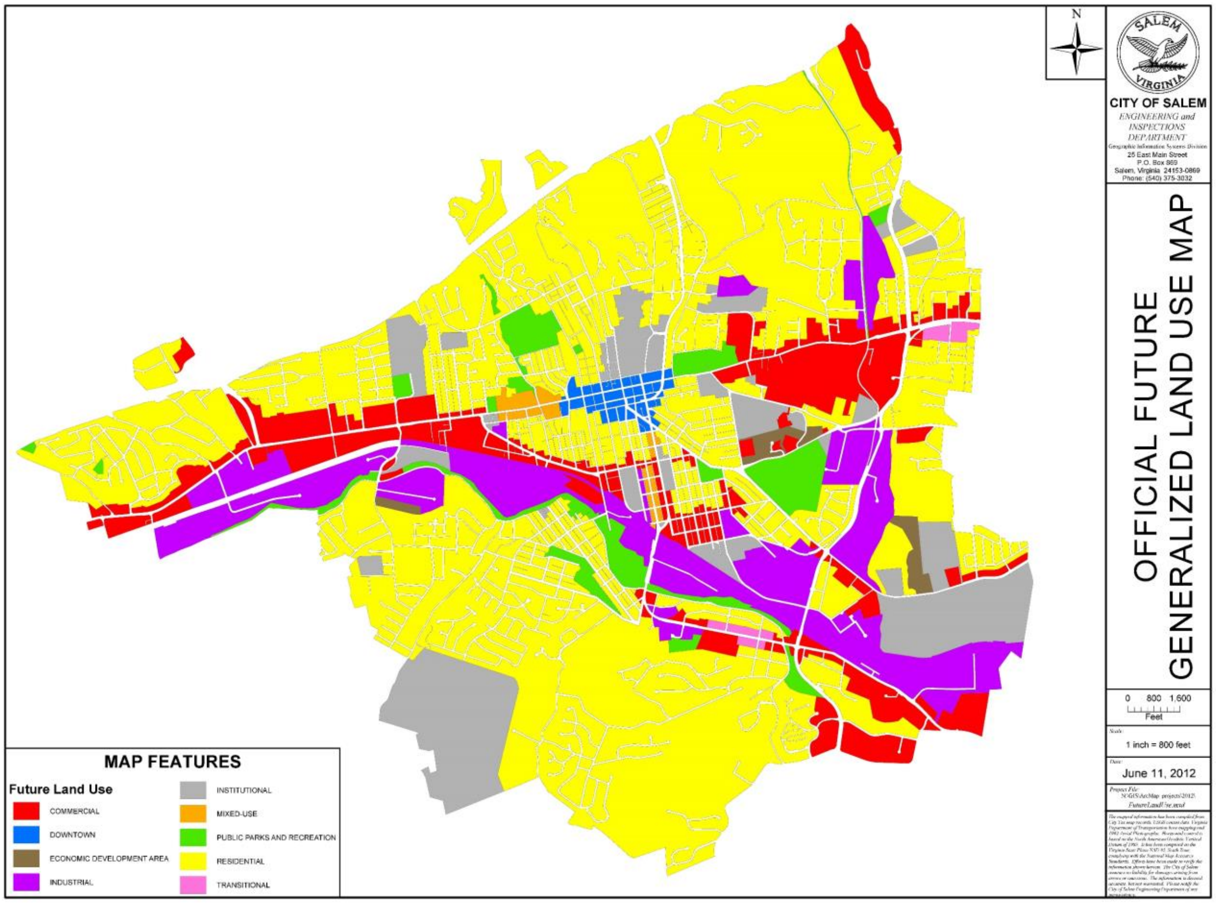


Figure 2-4. City of Salem Future Land Use

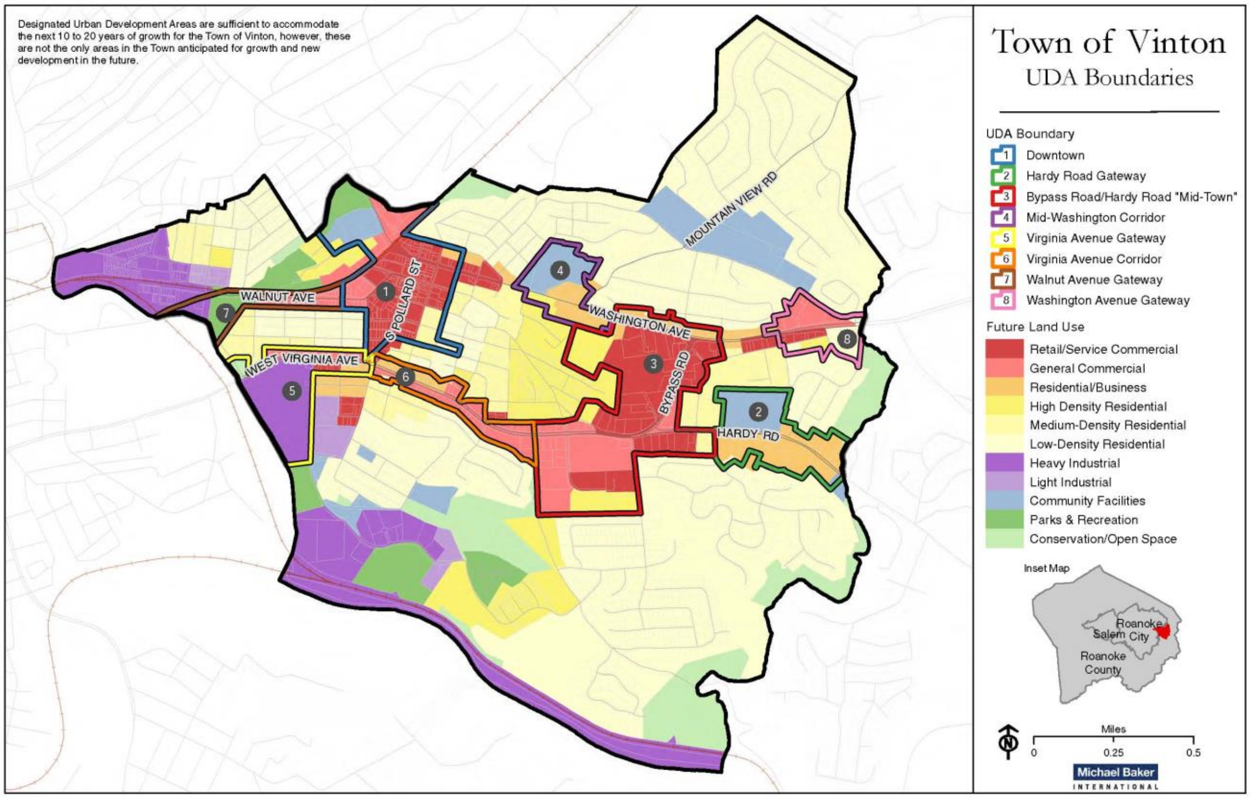


Figure 2-5. Town of Vinton Future Land Use

2.3 Multimodal Centers and Districts

On January 22, 2015, the Roanoke Valley Transportation Planning Organization (RVTPO) Policy Board approved the designation of Multimodal Centers and Districts. This concept originates from the Virginia Department of Rail and Public Transportation's Multimodal System Design Guidelines which encourages the planning and implementation of an integrated transportation system including automobiles, public transit, bicycles, and walking.

In using this resource to plan for a multimodal transportation system, RVTPO staff worked with local government staff to assess the future density of jobs and people across the region, identify areas with moderate to high levels of density and good multimodal connectivity, and define these areas as Multimodal Districts or Multimodal Centers where activity is most concentrated. The Multimodal Districts and Centers represent areas of current and future targeted growth within which destinations are close enough where walking and biking are viable modes of transportation and where transit service could also be provided.

The definitions of each are as follows:

- Multimodal District: Any portion of a city or region with land use characteristics that support multimodal travel, such as higher densities and mixed uses, and where it is relatively easy to make trips without needing a car as gauged by the number of bus routes available, and safe walking or biking paths – either currently or proposed in the future.
- Multimodal Center: A smaller area of even higher multimodal connectivity and more intense activity, roughly equivalent to a 10-minute walk or a one-mile area.

In January 2015, the RVTPO Policy Board approved the designated multimodal centers and districts for the 2040 TPO study area as shown in Figure 2-6.

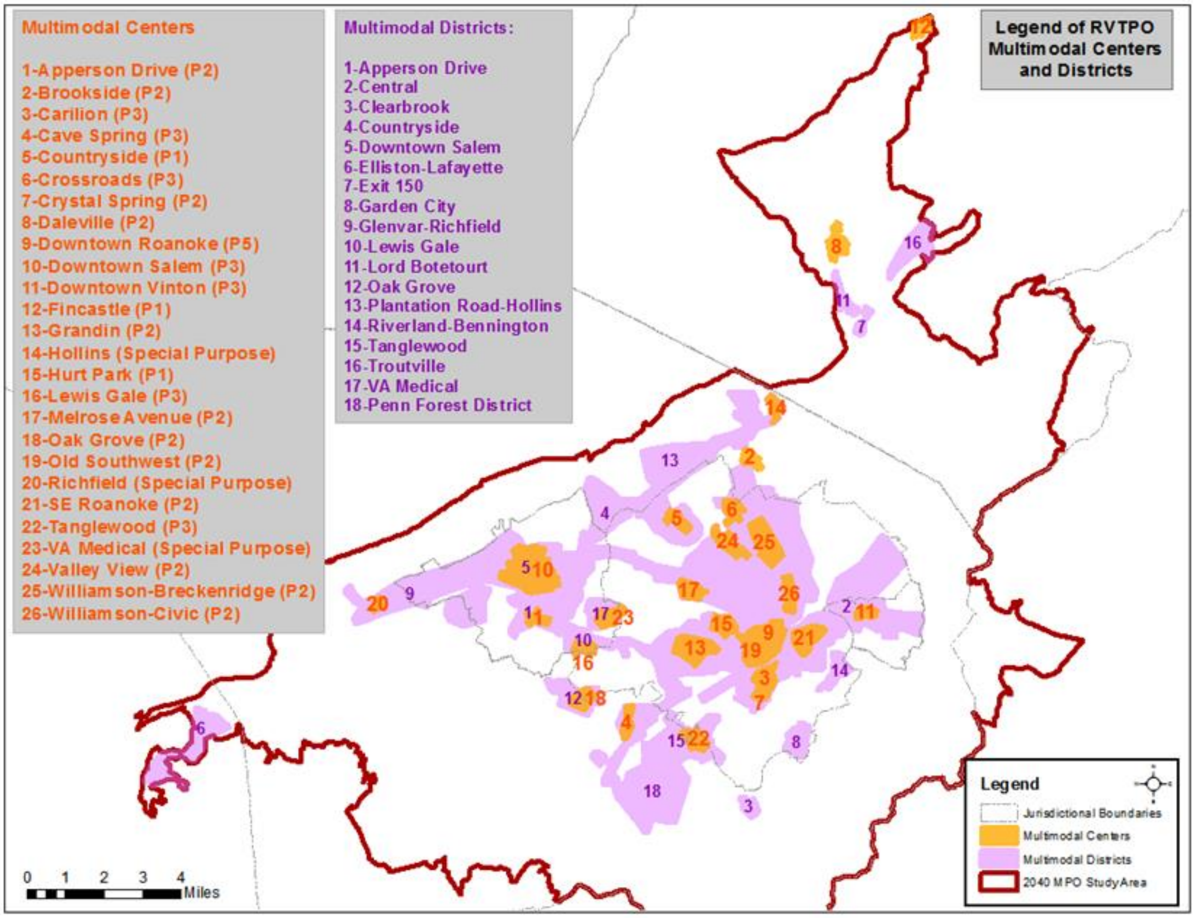


Figure 2-6. Multimodal Centers and Districts

2.4 Designation of Urban Development Areas

The designation of urban development areas or designated growth areas has become a focus of local governments in the past couple years due to a new link between receiving transportation funding and the location of projects within areas of growth. This section reviews why and where growth and development areas are being identified in the Roanoke Valley.

2.1 Background and History: VTrans2040, SMART SCALE, and UDAs

VTrans2040 is the long-range, statewide multimodal policy plan that provides the vision and goals for transportation in the Commonwealth. It identifies transportation conditions and trends anticipated over the coming years and their potential impact on transportation.

VTrans2040 defines goals, objectives, and guiding principles to achieve a vision of the transportation system. It provides direction to state and regional transportation agencies on strategies and policies to be incorporated into their plans and programs, such as this CLRMTP.

VTrans2040 has five goals which are supported through the efforts of the RVTPO and through the CLRMTP:

1. Economic Competitiveness and Prosperity - Invest in a transportation system that supports a robust, diverse, and competitive economy.
2. Accessible & Connected Places - Increase the opportunities for people and businesses to efficiently access jobs, services, activity centers, and distribution hubs.
3. Safety for All Users - Provide a safe and secure transportation system for passengers and goods on all travel modes.
4. Proactive System Management - Maintain the transportation system in good condition and leverage technology to optimize existing and new infrastructure.
5. Healthy and Sustainable Communities - Support a variety of community types promoting local economies and healthy lifestyles that provide travel options, while preserving agricultural, natural, historic, and cultural resources.

In 2014, legislation was approved which affects the way projects are prioritized in the VDOT Six-Year Improvement Program (SYIP). Under the Code of Virginia §33.1-23.5:5. Statewide prioritization process for project selection, this legislation created a system for project prioritization to guide decision making by the Commonwealth Transportation Board (CTB). Public hearings were held throughout the Commonwealth in September and October 2014 to receive citizen and stakeholder input as well as to inform the public of the new prioritization legislation, more commonly known as SMART SCALE. The six prioritization factors included in SMART SCALE are: congestion mitigation, economic development, accessibility, safety, environmental quality, and land use/transportation coordination.

House Bill 1887

HB 1887, approved by the General Assembly in February 2015, replaces the current $500 million annual allocation made by the CTB and its corresponding formula and the old 40-30-30 allocation formula to the primary, secondary, and urban highways with a new formula that allocates the following:

- 45% of funds to the newly established state of good repair purposes,
- 27.5% to the newly established high-priority projects program,
- 27.5% to the highway construction district grant programs.

The construction district grant programs (as defined in § 33.2-371) refers to projects and strategies solicited from local governments that address a need in the Statewide Transportation Plan. The selection of projects and strategies for funding under this program are to be screened, evaluated, and selected according to the process established pursuant to SMART SCALE.

In this program, candidate projects and strategies from localities within a highway construction district are compared against projects and strategies within the same construction district. The bill specifies an allocation formula based on the old “40-30-30” used to distribute primary, secondary and urban construction funds. It ensures that each district will receive the same percentage share of funds under the Construction District Grant Program as they would have received under the old “40-30-30” formula.

The High-Priority Projects Program (as defined in § 33.2-370) refers to projects of regional or statewide significance that address a transportation need identified for a corridor of statewide significance or a regional network in the Statewide Transportation Plan VTrans2040. The selection of projects and strategies for funding under this program are to be screened, evaluated, and selected according to the process established pursuant to SMART SCALE.

VTrans2040, has an initial screening process for potential SMART SCALE projects. The three basic “screens”, as it were, are:

- Corridors of Statewide Significance
- Regional Networks
- Urban Development Areas

For purposes of discussion in this chapter, Urban Development Areas will be further examined.

Section 15.2-2223.1 of the Code of Virginia (1950), as amended, provides for local establishment of Urban Development Areas (UDA), in which growth is permitted, incentivized, or otherwise directed. A locality may establish a UDA by amending their comprehensive plan to establish and graphically identify UDAs on their Future Land Use Map.

The UDA is an area that is appropriate for higher density development due to its proximity to transportation facilities, the availability of a public water and sewer system, or a developed area, to be used for redevelopment or infill development. A UDA contains land appropriate for development of residential densities of four or more single family dwelling units, six townhouses, 12 apartments or condominiums per acre and commercial floor area ratios of 0.4 or greater.

The UDA should meet projected residential and commercial growth in the locality for 10 to 20 years. Coinciding with the five-year review of a locality’s comprehensive plan and according to the most recent population estimates and projections, each UDA shall be reexamined and revised (if deemed necessary).

UDAs, when established, must include principles of traditional neighborhood design, some of which include but are not limited to:

- Pedestrian-friendly road design;
- Interconnection of new local streets with existing street network;
- Connectivity of road and pedestrian networks;
- Preservation of open space and natural areas;

- Mixed-use neighborhoods, with a range of housing types, and affordable housing to meet the projected family income distributions of future residential growth;
- Reduction of front and side yard setbacks; and
- Reduction of subdivision street widths and turning radii at subdivision street intersections.

The comprehensive plan shall describe any financial and other incentives for development in the urban development areas.

2.2 RVTPO Localities with UDAs/DGAs

The following localities have designated urban development areas (UDAs) or designated growth areas (DGAs) within their boundaries.

Botetourt County
In 2016, Botetourt County designated two UDAs: Daleville Town Center and Gateway Crossing. These UDAs had been previously identified as Mixed Use Target Areas in the Comprehensive Plan's Future Land Use Map.

City of Roanoke
In 2015, Roanoke City designated the entire boundary, minus the conservation area (Mill Mountain Park) as a UDA. The size of the UDA is 41.9 square miles.

Roanoke County
In 2015, Roanoke County designated six Designated Growth Areas, including Route 419/221/Cave Spring/Windsor Hills area, the Route 24/116/Vinton/Mount Pleasant area, the Route 220 South/Clearbrook area, the Village Centers area, the Route 460 East/Bonsack area, and the I-81/Glenvar/Hollins area. The total area of the six DGAs is 64 square miles.

City of Salem
In 2015, the City of Salem developed three UDAs, which are:

- The East Main Street UDA East Main Street is located adjacent to Downtown Salem and bisected by Route 460 and 419, respectively. The size of the UDA is 0.42 square miles.
- Apperson Drive UDA Apperson Drive UDA is located adjacent to Route 419 and East of the Roanoke River. This UDA's size is 0.31 square miles.
- Downtown UDA This 1.8 square mile UDA is north of the Roanoke River and bisected by Route 311.

Town of Vinton
In 2016, the Town of Vinton designated eight UDAs totaling 0.5 square miles. These UDAs are described as follows:

- Downtown UDA is approximately 65.2 acres and its boundary includes all of the Central Business District and is defined by a roadway network that includes Gus Nicks Blvd, Washington Avenue and South Pollard Street.
- Hardy Road East Gateway UDA is approximately 18.3 acres and its boundary includes parcels adjacent to the Wolf Creek Greenway.
- Mid-Town: Bypass Road/Hardy Road UDA is approximately 125.3 acres, its boundary is defined by the areas adjacent to Washington Avenue, Bypass Road and Hardy Road. The 2004 Economic and Community Development Plan provided objectives of revitalization of the River Park Shopping Center between the intersections of Bypass Road/Washington Avenue and Bypass Road/Hardy Road, as a potential Town Center.
- Mid-Washington Avenue Corridor UDA is approximately 18.9 acres and its boundary includes all of the former Vinton Library and War Memorial sites, as well as additional parcels located along Washington Avenue towards South Mitchell Road.
- Virginia Avenue West Gateway UDA is approximately 39.9 acres, its boundary is
- Defined by the parcels adjacent to West Virginia Avenue, between Tinker Creek Greenway and South Pollard Street.
- Virginia Avenue/Hardy Road Corridor UDA is approximately 20.9 acres, its boundary
- Is defined by the parcels adjacent to Virginia Avenue, between South Pollard Street and Niagara Road.
- Walnut Avenue West Gateway UDA is approximately 13.6 acres, its boundary is
- Defined by the parcels adjacent to Walnut Avenue, between Tinker Creek Greenway and 2nd Street.
- Washington Avenue East Gateway UDA is approximately 18.3 acres and its boundary includes parcels adjacent to the Wolf Creek Greenway.

Figure 2-7 shows all of the UDAs/DGAs within the Roanoke Valley 2040 Study Area.

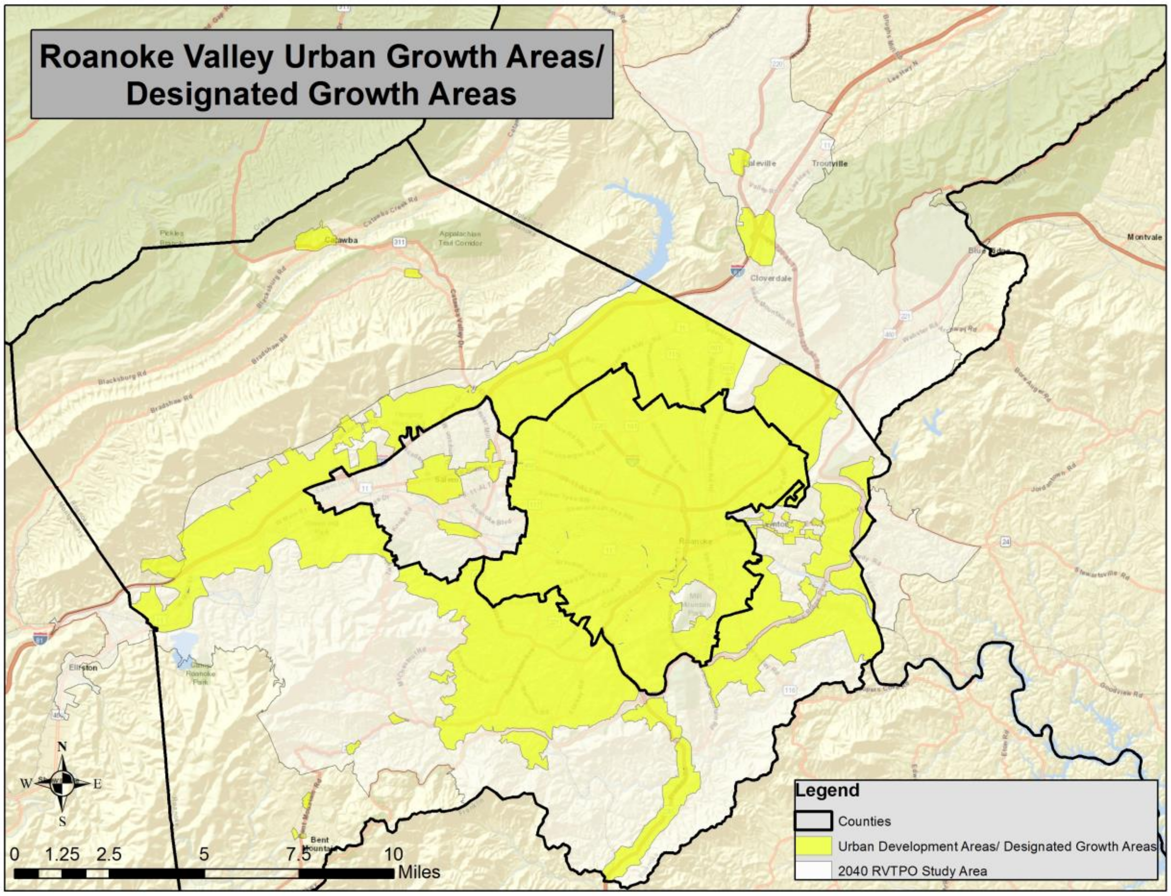


Figure 2-7. UDAs/DGAs Adopted (as of May 2017)

2.3 Broadband and Future Development

Through a collaborative effort started by the Roanoke Valley-Alleghany Regional Commission and the Cities of Roanoke, Salem and the Counties of Botetourt and Roanoke, the Roanoke Valley Broadband Authority (RVBA) was formed in 2012. The purpose of the RVBA is to development the region's first open-access fiber optic network.

RVBA vendors completed the Outdoor Plant construction on April 5, 2016 at the Valley View Point of Presence (POP) location. Completing the new network's "outside plant" marked a significant milestone in the RVBA's regional investment. This project was designed to spur regional economic development by increasing access to extremely secure, high-speed, affordable and unthrottled fiber-optic internet access.

The new conduit network has been threaded with 144 threads of fiber-optic line, each thread capable of delivering secure, private, terabit-level upload and download connections for future RVBA customers. The new open-access network has also been designed to spur additional private sector telecommunications investment by lowering the barriers of entry required to deliver competitive services in the Roanoke Valley.

Figure 2-8 shows the existing and future segments of the Roanoke Valley broadband network.

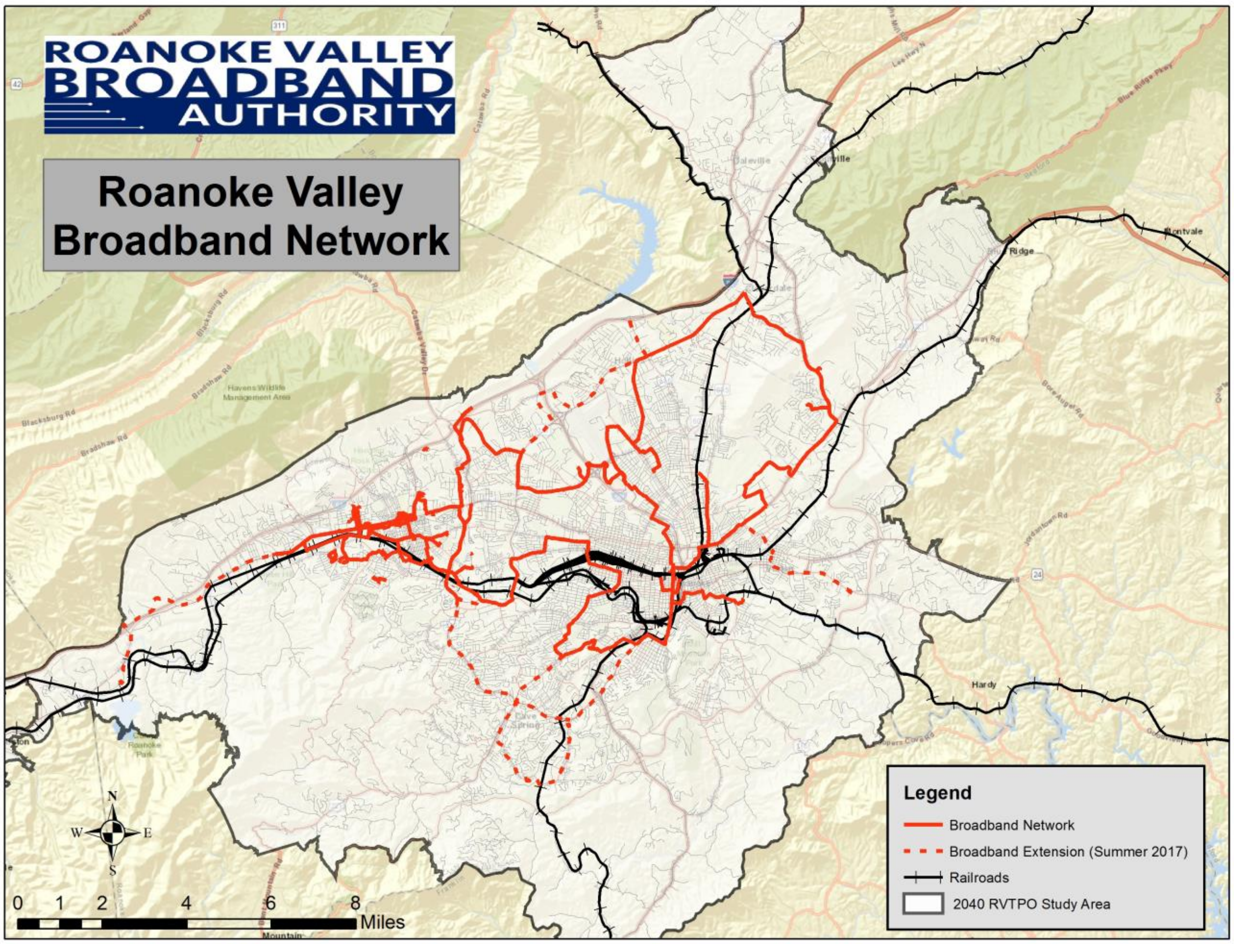


Figure 2-8. Broadband Network

As development and redevelopment occurs throughout the region, a determinant of such will be the existing and planned broadband infrastructure. With new businesses comes new jobs and new opportunity for growth within our region. The Roanoke Valley has many organizations actively engaging businesses and the addition of the RVBA open-access network is one more advantage for choosing to start a business in this region.

In the open-access network, the RVBA owns, maintains, and services the actual and physical fiber network. However, this "last mile" delivery of Internet services to individual businesses is managed by individual Internet Service Providers (ISP) who purchase access to the RVBA infrastructure. This arrangement allows for new and smaller ISPs to break into an already established market and encourages market competition among Internet providers.

An open market for fiber Internet means that business owners, invested localities, and community members reap the benefits of a more robust ISP market. Since an open-access model promotes competition, greater consumer choice, lower prices, and greater transparency, this business model allows for new and innovative ISPs to enter the market and offer the customer the best and most affordable Internet access available.

2.4 Environmental Mitigation

As a result of the enactment of the Fixing America's Surface Transportation Act of 2015 (FAST Act), this CLRMTP is addressing environmental mitigation activities. Pursuant to the Code of Federal Regulations §450.324 (g)(10) - Development and content of the Metropolitan Transportation Plan, the CLRMTP will include:

> *A discussion of types of potential environmental mitigation activities and potential areas to carry out these activities, including activities that may have the greatest potential to restore and maintain the environmental functions affected by the metropolitan transportation plan. The discussion may focus on policies, programs, or strategies, rather than at the project level. The MPO(s) shall develop the discussion in consultation with applicable Federal, State, and Tribal land management, wildlife, and regulatory agencies. The MPO(s) may establish reasonable timeframes for performing this consultation.*

Moving forward, the RVTPO will consult with the appropriate agencies such as the Virginia Departments of Transportation, Rail and Public Transportation, Environmental Quality, and Game and Inland Fisheries to identify and develop mitigation strategies and targets for areas and systems affected by the CLRMTP.

Detailed environmental analysis is not required during the Metropolitan Planning Process, and occurs at a later stage in the process. There are, however, some fundamental types of environmental impact included for an analysis as follows:

- Neighborhoods/communities
- Housing units
- Businesses
- Historic properties/archaeological sites
- Wetlands and other protected water resources
- Forestal and other natural lands
- Agricultural areas
- Endangered/threatened species

- Air quality

Environmental mitigation is the process of remedying environmentally damaged areas as a result of transportation projects. Examples of potential environmental mitigation activities include:

- Reducing the project's scope and size
- Avoiding any negative impacts altogether
- Resolving reversible impacts
- Precautionary measures to reduce overall impact
- Employ operational management techniques to reduce impacts
- Employ ITS strategies to reduce or alleviate impacts
- Providing offsite improvements with an equal or greater environmental value

2.5 Environmental Features in the Roanoke Valley

This section addresses the preservation of key environmental features: threatened and endangered species, wetlands, and parks and conservation areas. Maps related to these features are provided.

2.5.1 Threatened and Endangered Species

According to information maintained at Virginia Tech in connection with its Pesticide Safety Education Program, there are eight different threatened or endangered species in the Roanoke Urbanized Area. Table 2 illustrates the name, species, and geographic location of these protected organisms.

Table 2 Threatened and endangered species

Common Name	Scientific Name	Taxa	Locality
Bat, Indiana	Myotis sodalis	Mammal	Botetourt, Montgomery, Roanoke Co, Salem
Bulrush, Northeastern	Scirpus ancistrochaetus	Monocot	Botetourt
Pogonia, Small Whorled	Isotria medeoloides	Monocot	Botetourt
Coneflower, Smooth	Echinacea laevigata	Dicot	Botetourt, Montgomery, Roanoke Co.
Spinymussel, James River	Pleurobema collina	Bivalve	Botetourt
Butterfly, Mitchell's Satyr	Neonympha mitchellii	Insect	Montgomery
Logperch, Roanoke	Percina Rex	Fish	Montgomery, Roanoke Co., Salem

Bat, Virginia Big Eared	Corynorhinus (=Plecotus) townsendii virginianus	Mammal	Montgomery

2.5.2 Wetlands

In the Roanoke Urbanized Area there is a significant wetland or riverine environment--the Roanoke River. Wetlands are defined as those ecosystems which are formed through water-saturated lands. These lands become habitats for various fish and wildlife. Wetlands are natural filters because of their ability to replenish groundwater and slowly return floodwater and snow melt to a more purified state.

2.5.3 Parklands and Conservation Areas

A variety of local, state, and federal agencies and conservation groups have identified active and passive parks, wildlife, and conservation areas in the region as protected lands when considering transportation projects. When projects do have an impact on these lands, state and federal environmental processes are activated to mitigate severe impacts.

2.5.4 Environmental Features Maps

Figure 2-9 and Figure 2-10 show environmental features and habitats of endangered species.

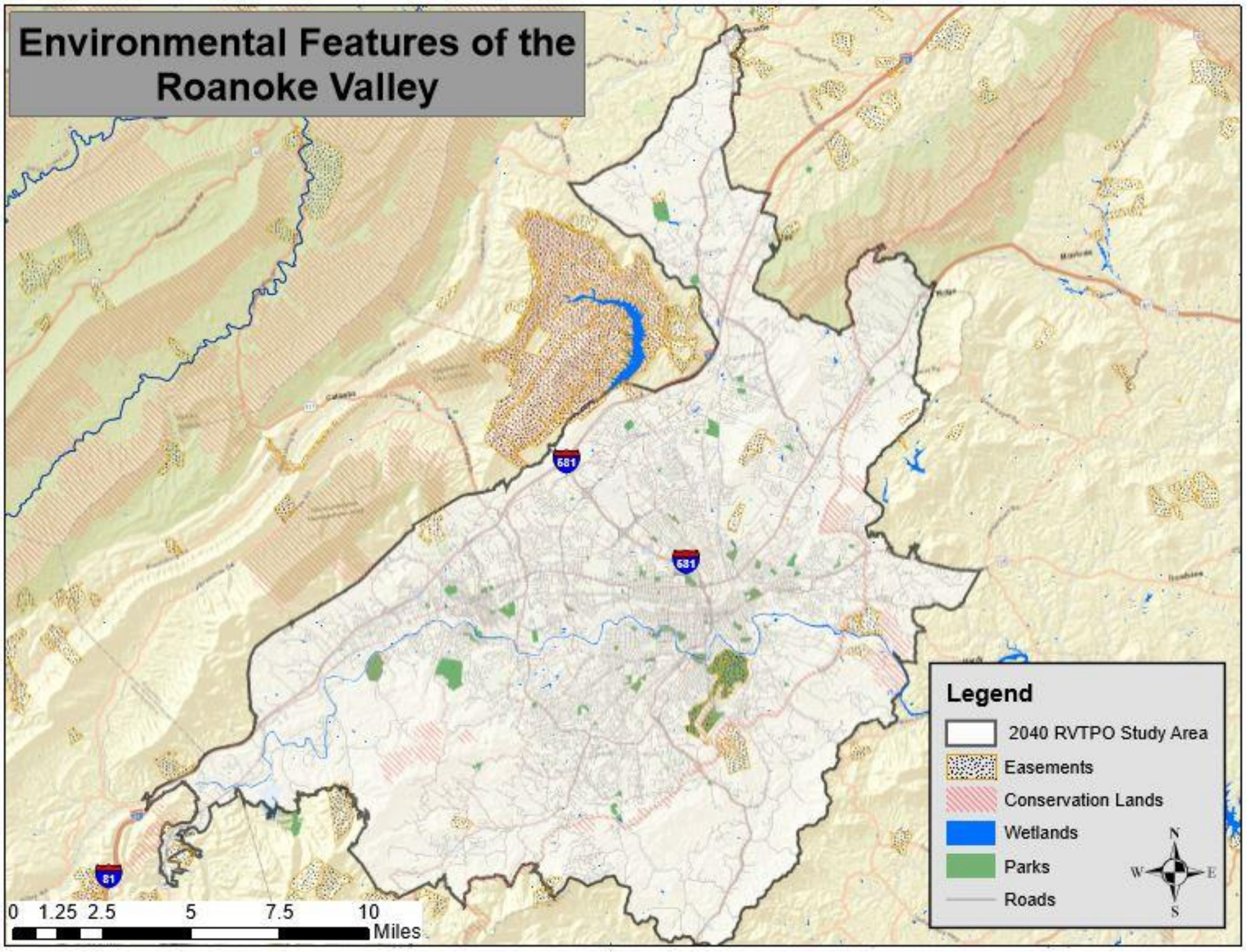


Figure 2-9. Environmental Features

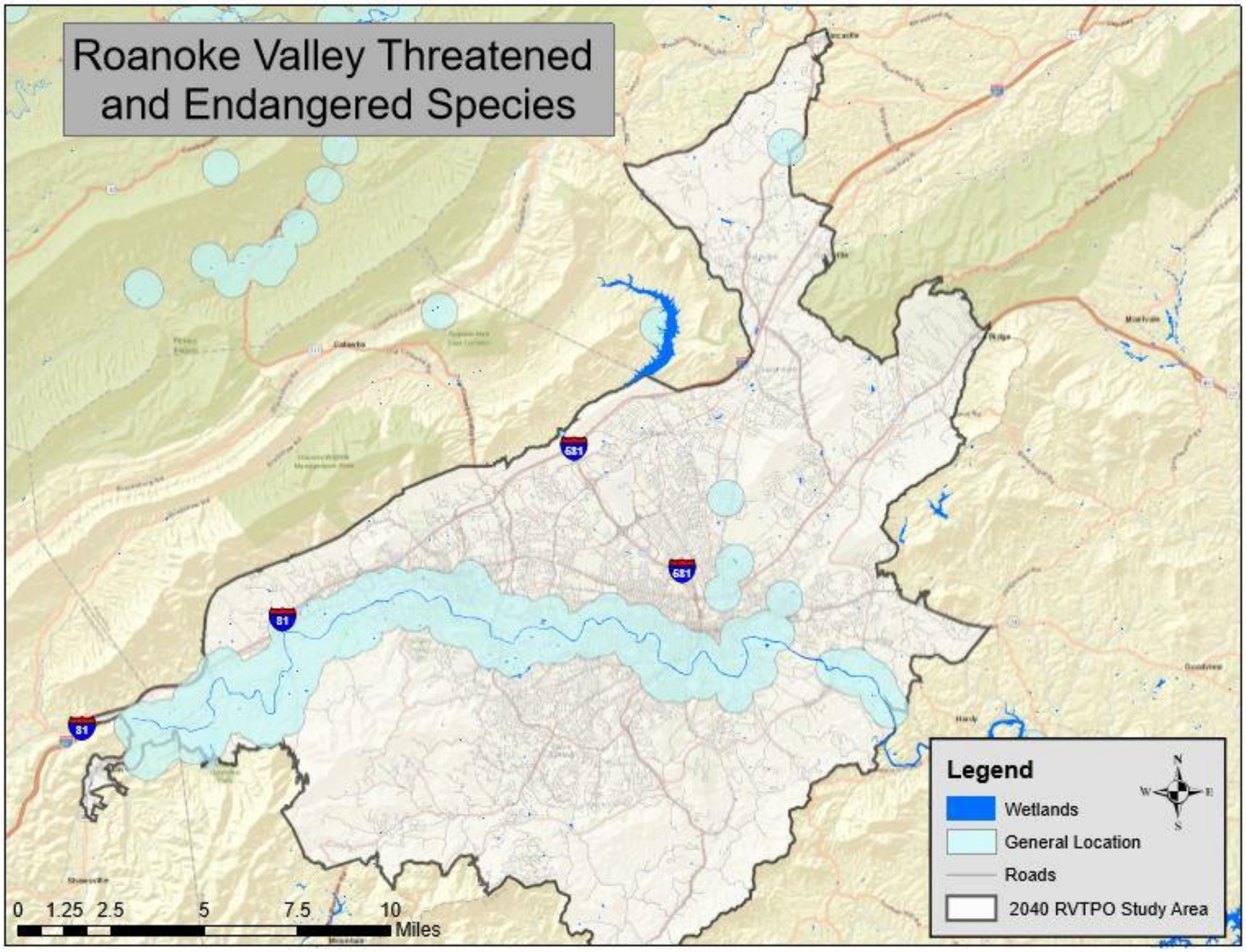


Figure 2-10. Threatened and Endangered Species

2.6 Transportation/Land Use/Environmental Mitigation Coordination Strategies

This section of the Land Use and Environmental Mitigation chapter is designed to provide a toolbox for implementing sound decisions regarding land use and transportation. Due to the differing political climates and land use/development regulations in each of the RVTPO localities, these strategies are not intended to be suitable or uniformly utilized in every locality. Table 3 lists potential coordination strategies and their applicability to improving transportation, land use, and environmental coordination:

Table 3 Coordination strategies for transportation, land use, and environmental mitigation

Coordination Strategy	**Applicable Use**
VDOT Transportation Efficient Land Use and Design Guide	Utilizing Smart Growth principles which deviate from traditional suburban development, this guide illustrates techniques for improving transportation and land use coordination through emphasizing features such as: • Compact and walkable development patterns • Mixing of land uses • Interconnected networks of streets and blocks • Neighborhood centers • Accessible open spaces
DRPT Multimodal System Design Guidelines	Adopted in 2013 by the Virginia Department of Rail and Public Transportation, these guidelines promote development around activity centers--more specifically mixed-use multimodal Centers and Districts. Utilizing the Transect model, a concept of Smart Growth, development can be regulated from rural/agricultural lands to the urban core.
Comprehensive Plan Amendments	Comprehensive Plan amendments are often utilized to create overlay or special use districts which are designed to function differently and uniquely from adjacent land uses. These districts can steer development into finite areas, while maintained character and compatibility.
Urban Development Areas	One such application of a comprehensive plan amendments is the designation and creation of Urban Development Areas (UDA). These are areas where growth and development are planned to occur within the next 20 years. Designating UDAs in connection with design or land use overlay districts will further define a locality's desire and intent for good development coordination.
Corridor/Area Studies	Corridor and area studies identify and focus on advantages and challenges of a specific area. Coordination strategies and needs may be different than adjacent transportation facilities, so it is sometimes important to find specific solutions.
Local Transportation and Land Use Design Manuals	Design manuals are appropriate for uniform and unique solutions to addressing infrastructure needs with development and redevelopment. They are also tools with which to advise developers when proposing new development.

3.0 Performance Measures

Beginning in 2012 the RVTPO is now required by VDOT to track regional performance measures to evaluate the region's transportation system against its transportation goals and standards and contribute to the Statewide Transportation Plan. This is a new requirement since RVTPO became a Transportation Management Area Metropolitan Planning Organization (TMA MPO). RVTPO is eligible for funding through sources only available to TMA MPOs and receipt of those funds is contingent upon the TPO's development, and the Commonwealth Transportation Board's approval, of the regional performance measures.

3.1 RVTPO Annual Performance Measures Report

The RVTPO has been tracking performance measures since 2012 and produces an Annual Performance Measures Report every year. In the report, regional performance measures fall under the categories of: Congestion Reduction; Safety; Bicycle and Pedestrian Facility Usage; Transit Usage; HOV Usage; Jobs-to-Housing Ratio; Job and Housing Access to Pedestrian Facilities; Air Quality; and Movement of Freight. Several of the performance measures are required of all TMA MPOs, others the RVTPO has elected to add. For example, after approval of the 2015 Performance Measures Report, RVTPO staff began collecting a series of measures relative to the Roanoke-Blacksburg Regional Airport (enplanements/deplanements, number of flights, etc.).

As the RVTPO develops, maintains and updates major transportation plans, recommended performance measures are considered for measurement and inclusion in the annual report.

3.2 SMART SCALE Project Prioritization and Resulting Performance Measures

Under the System Management and Allocation of Resources for Transportation: Safety, Congestion, Accessibility, Land Use, Environment and Economic Development (SMART SCALE) project prioritization process adopted by the General Assembly in 2014 (Code of Virginia §33.2-214.1), transportation projects are scored and prioritized based on the following factors:

1. Congestion Mitigation
2. Economic Development
3. Accessibility
4. Safety
5. Environmental Quality
6. Land Use Coordination (required for RVTPO - urbanized areas over 200,000)

Evaluation measures fall into each of the six factors above and are guided by the following principles:

- Analyze what matters to people and has a meaningful impact
- Ensure fair and accurate benefit-cost analysis
- Be both transparent and understandable

- Work for both urban and rural areas
- Work for all modes of transportation
- Minimize overlap between measures

For each prioritization factor, there are a series of measures which generate the overall SMART SCALE project score. These measures, and the corresponding factors are shown in Table 4.

Table 4 SMART SCALE Factors

SMART SCALE Factor	Measure
Safety	Equivalent property damage only of fatal and injury crashes
	Equivalent property damage only rate of fatal and injury crashes
Congestion Mitigation	Person throughput
	Person hours of delay
Accessibility	Access to jobs
	Access to jobs for disadvantaged populations
	Access to multimodal choices
Environmental Quality	Air quality and energy environmental effect
	Impact to natural and cultural resources
Economic Development	Project support for economic development
	Intermodal access and efficiency
	Travel time reliability
Land Use Coordination	Transportation efficient land use

Section 3.0 of the SMART SCALE Technical Guide gives a detailed description of the evaluation measures for each of the six prioritization factors.

3.3 Plans and Performance Measures

The RVTPO has a number of plans to guide development of transportation systems, as described in the Citizen's Version of the Long Range Transportation Plan. Not all the plans address performance measures. Those plans which address performance measures are included in this section:

- Regional Pedestrian Vision Plan
- Regional Transit Vision Plan

- Congestion Mitigation Process Plan (discussed in detail in Chapter 6)

3.3.1 Regional Pedestrian Vision Plan

In 2015, the RVTPO and its member localities collaborated to develop a plan to improve walking as a mode of transportation in the Roanoke Valley. The Regional Pedestrian Vision Plan for the Roanoke Valley Transportation Planning Organization, is the region's first plan focusing specifically on promoting walking for everyday trips. The purpose of the Pedestrian Vision Plan is to provide a coordinated and strategic approach to making walking a more widely selected form of transportation. Through the development of a regional pedestrian network, safe and attractive walking environments can exist to enable people to accomplish their daily tasks with greater ease.

Accompanying each of the five goals is a series of suggested performance measures which measure a variety of items which include injuries and fatalities, pedestrian counts, and new pedestrian and transit infrastructure.

3.3.2 Regional Transit Vision Plan

In 2016, the RVTPO Policy Board adopted the region's first Transit Vision Plan. Understanding that the Roanoke region's transit services and public transportation network have largely remained unchanged for 25 years and knowing that a comprehensive analysis of the existing transit network was overdue, the RVTPO initiated a multi-year planning process in 2013. The planning process was designed for regional stakeholders to reflect on the past, evaluate current transit services, identify common values and goals, and to explore opportunities for the improvement and expansion of the Roanoke Valley's transit system. The Roanoke Valley Transit Vision Plan provides a substantive conceptual framework for regional policymakers to consider as they prioritize resources to meet the evolving multimodal transportation needs of the region.

In *Part 6: Implementation Strategies, Chapter 7 Implementation*, of the Transit Vision Plan, there is an extensive list of suggested measures. The broad categories of these performance measures are: Economic, Health, Environmental, Safety, and Mobility.

3.3.3 Congestion Management Process Plan

The Congestion Management Process Plan is discussed in the Congestion Management Process section.

4.0 Multimodal Transportation System

The Roanoke Valley's multimodal transportation system includes all the ways people and goods travel in, out, and around our region. The following sections address each of the transportation modes: driving, riding transit, walking, biking, railroading, and flying.

4.1 Driving

Driving is the primary mode of transportation for most people and the primary mode for moving freight into and out of the Roanoke Valley. For anyone who owns a personal vehicle and for businesses transporting goods to customers or facilities, driving provides the most flexible travel option. Vehicle miles traveled (VMT), safety, commute patterns, economic development, and freight help us understand driving.

Figure 4-1 I-81 and I-581 are a key corridors through the Roanoke Valley March 23, 2017

4.1.1 VMT

As shown in Chart 4-1, national travel trends show a steep and continuous increase in vehicle miles traveled until 2006. From then until 2015, VMT generally remained level due to great economic declines nationwide but has since begun an increase. Gas prices have been less since 2015, which likely has contributed to the rise in VMT again.

VMT trends are similar in the Roanoke Valley as those seen in larger urban areas. The Roanoke Valley is an attractive place to live and work as evidenced by the increasing number of young adults and their families looking to establish themselves here.

According to a March 12, 2017 editorial in the Roanoke Times, "*the Roanoke MSA saw its millennial population grow faster than any other metro area in Virginia . . . Over the past decade, the number of people in the 18-34 age cohort in the Roanoke MSA has grown by 5.2 percent*."

"*The travel behaviors of young adults matter. Today there are more Millennials than there are Baby Boomers. There are 74 million Americans aged 18 to 34, compared to 68 million Americans aged 50 to 68.*"
(Beyond Traffic, 17)

Recent trends suggest that the Roanoke Valley is growing. While historical trends do not necessarily predict future trends, it is likely that with population growth, the demand to travel will also grow.

Without sufficient attractive transportation choices, the result of growth may lead to most new trips conducted by single-occupant driving that produces undesired negative impacts.

Consider the impacts . . . Build it and they will come.

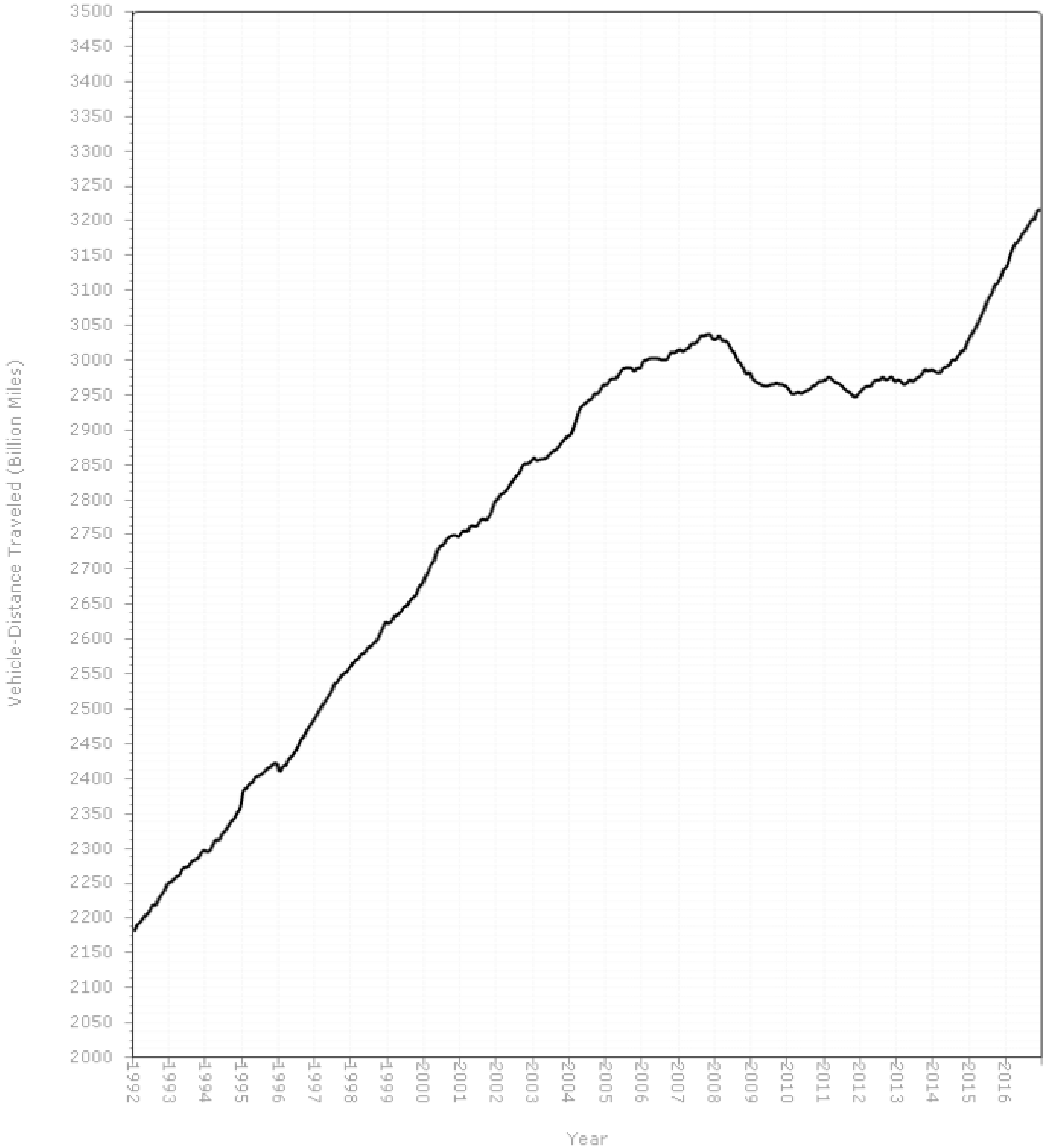


Chart 4-1. National Vehicle Miles Traveled by Year
source: FHWA. "Traffic Volume Trends December 2016 Report." (n.d.): n. pag. FHWA. Web. 6 Mar. 2017

4.2 Safety

The number of traffic crashes, fatalities, and injuries in the Roanoke region has held steady since 2010 (VDOT Crash Report, Table 5).

Table 5 Number of traffic crashes, fatalities, and injuries in the Roanoke region

Year	Crashes	Fatalities	Injuries
2010	12,595	92	6,181
2011	12,983	93	6,027
2012	13,675	135	6,782
2013	12,940	91	6,259
2014	12,498	93	5,892
2015	13,369	102	6,169
2016	13,051	99	6,243

The Virginia Strategic Highway Safety Plan analyzed fatal and severe injury crashes from 2010-2015 in the Salem district, which includes the RVTPO (Table 6).

Table 6 Number of fatal or severe injury crashes in the Salem District 2010-2015

Road type	Number of fatal/ severe injury crashes
Interstate	346
State Highway	1,953
County Road	1,343
City Street	514
Total	**4,156**

Surprisingly, the interstate had the lowest total fatal and severe injury crashes as well as the lowest per VMT (Figure 4-2). City streets also performed well. County roads and state highways saw the highest number of crashes, characterized by roadway departures, curves, speeding, and distracted driving.

Fatal and Severe Injury Crashes
Salem

Fatal and Severe Injury Crashes (2010-2015)	Total Crashes	Interstate	State Highway	County Road	City Street	Night	Adverse Weather, Day	Adverse Weather, Night	Reduced Friction, Clear Weather	Curve	Intersection	Roadway Departure	Speeding	Alcohol	Drugs	Large Vehicle	Bicycle	Pedestrian	Unrestrained	Young Driver	Aging Driver	Motorcycle	Distracted Driver
Total Crashes	4,156	346	1,953	1,343	514	1,086	393	261	135	1,546	1,321	2,471	1,490	816	118	283	62	174	1,003	774	784	392	608
Intersection	1,321	1	696	353	271	303	108	67	33	343		527	361	209	34	54	21	62	250	267	329	109	191
Roadway Departure	2,471	220	939	1,059	253	786	242	190	100	1,314	527		1,147	638	98	118	4	0	829	426	290	191	451
Speeding	1,490	136	551	639	164	469	167	113	51	800	361	1,147		423	55	91	6	10	515	299	170	131	242
Alcohol	816	37	315	358	106	451	31	75	29	385	209	638	423		54	18	6	56	369	107	51	44	134
Drugs	118	4	62	46	6	44	10	6	4	48	34	98	55	54		3	1	0	52	17	6	3	24
Large Vehicle	283	114	124	24	21	45	39	19	7	79	54	118	91	18	3		3	9	37	20	76	5	40
Bicycle	62	0	43	9	10	9	6	4	0	9	21	4	6	6	1	3		2	0	22	8	0	1
Pedestrian	174	7	88	31	48	64	10	14	5	20	62	0	10	56	0	9	2		0	39	24	0	0
Unrestrained	1,003	59	383	450	111	393	71	72	36	462	250	829	515	369	52	37	0	0		199	123	2	196
Young Driver	774	48	336	288	102	228	79	48	29	283	267	426	299	107	17	20	22	39	199		81	28	107
Aging Driver	784	57	444	183	100	88	84	31	18	196	329	290	170	51	6	76	8	24	123	81		54	102
Motorcycle	392	24	205	128	35	65	11	6	12	177	109	191	131	44	3	5	0	0	2	28	54		34
Distracted Driver	608	48	277	204	79	177	43	36	10	245	191	451	242	134	24	40	1	0	196	107	102	34	
Drowsy Driver	164	29	82	44	9	63	5	8	1	69	32	155	45	18	7	14	0	0	51	23	18	1	104

Figure 4-2 Fatal and Severe Injury Crash Heat Map

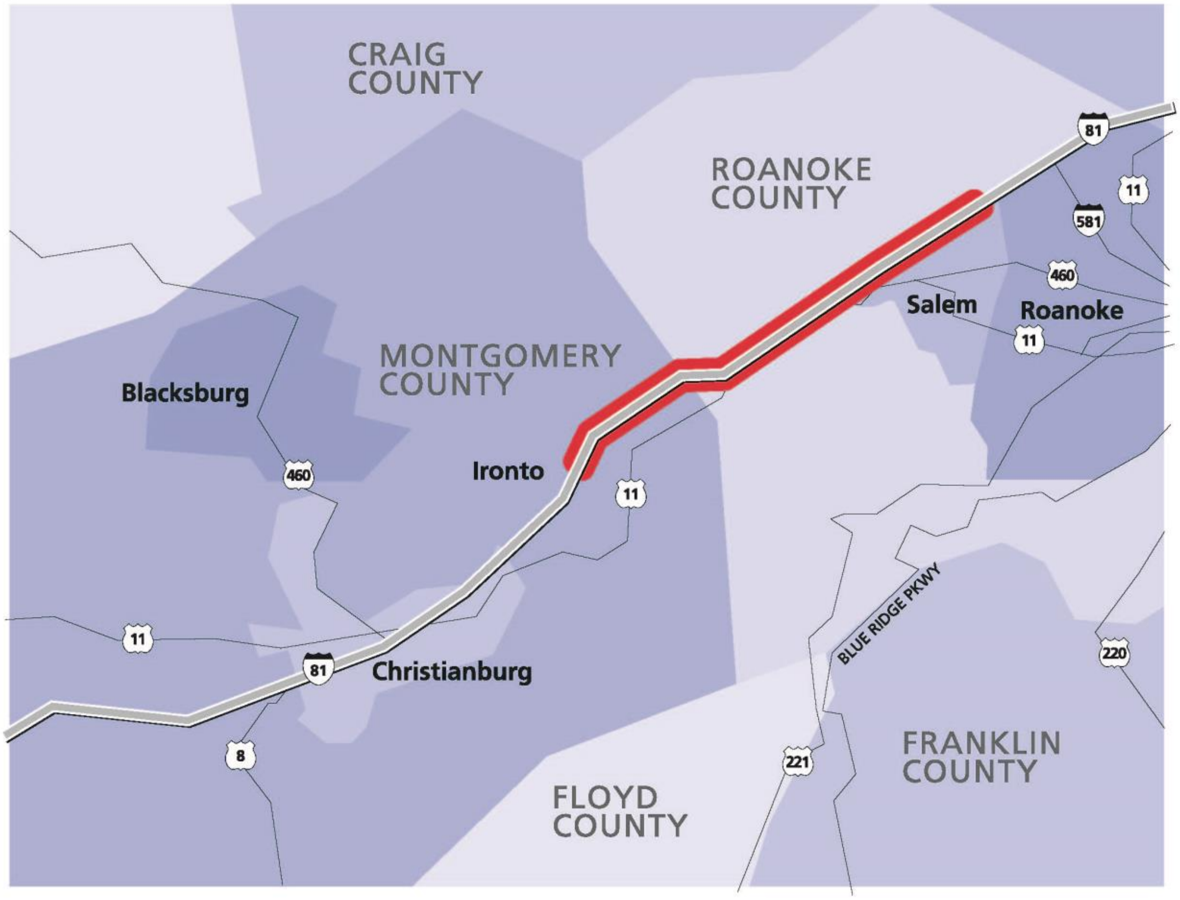


Figure 4-3 I-81 Highway Safety Corridor

Interstates are sufficiently different from other roads to be considered separately. I-81 mileposts 127 - 142 became a designated Highway Safety Corridor in 2004 because it experienced higher numbers of crashes than other roads of its type (Figure 4-3). As a Highway Safety Corridor, this section is subject to increased enforcement and fines. The 5-year rolling average of fatal and injury crashes has decreased from 58 in 2004 to 42 in 2014.

4.3 Commuting

The Roanoke Valley is a hub of economic activity in southwest Virginia. Many people commute to the urban area for work. Figure 4-4 (3 tables) shows related data from the U.S. Census.

Subject	Roanoke, VA Urbanized Area (2010)			
	Total	Car, truck, or van -- drove alone	Car, truck, or van -- carpooled	Public transportation (excluding taxicab)
	Estimate	Estimate	Estimate	Estimate
Workers 16 years and over	100,887	84,721	8,515	1,702
AGE				
16 to 19 years	3.8%	3.3%	7.5%	3.0%
20 to 24 years	8.8%	8.2%	9.5%	16.1%
25 to 44 years	41.9%	42.3%	43.3%	42.4%
45 to 54 years	21.8%	22.0%	21.7%	24.5%
55 to 59 years	9.9%	10.1%	6.7%	6.7%
60 years and over	13.8%	14.1%	11.4%	7.3%
Median age (years)	42.8	43.1	40.6	39.0
SEX				
Male	51.2%	50.8%	53.3%	55.3%
Female	48.8%	49.2%	46.7%	44.7%

Figure 4-4. Means of Transportation to Work by Selected Characteristics
Source: U.S. Census Bureau, 2011-2015 American Community Survey 5-Year Estimates

Subject	Roanoke, VA Urbanized Area (2010)			
	Total	Car, truck, or van -- drove alone	Car, truck, or van -- carpooled	Public transportation (excluding taxicab)
	Estimate	Estimate	Estimate	Estimate
RACE AND HISPANIC OR LATINO ORIGIN				
One race	98.2%	98.4%	96.9%	96.8%
White	80.3%	82.4%	69.7%	29.0%
Black or African American	13.8%	12.4%	18.6%	60.9%
American Indian and Alaska Native	0.2%	0.1%	0.3%	0.3%
Asian	2.8%	2.5%	6.9%	5.2%
Native Hawaiian and Other Pacific Islander	0.1%	0.1%	0.0%	0.0%
Some other race	1.0%	0.9%	1.3%	1.5%
Two or more races	1.8%	1.6%	3.1%	3.2%
Hispanic or Latino origin (of any race)	4.1%	3.5%	8.5%	6.5%
White alone, not Hispanic or Latino	77.5%	79.8%	64.9%	24.0%
EARNINGS IN THE PAST 12 MONTHS (IN 2015 INFLATION-ADJUSTED DOLLARS) FOR WORKERS				
Workers 16 years and over with earnings	100,873	84,721	8,515	1,702
$1 to $9,999 or loss	14.0%	11.8%	19.5%	42.3%
$10,000 to $14,999	8.0%	7.5%	8.1%	15.9%
$15,000 to $24,999	15.9%	15.1%	22.9%	22.9%
$25,000 to $34,999	15.2%	15.4%	16.3%	12.4%
$35,000 to $49,999	18.2%	19.5%	14.2%	2.8%
$50,000 to $64,999	12.6%	13.6%	9.3%	2.7%
$65,000 to $74,999	3.7%	4.1%	2.6%	0.0%
$75,000 or more	12.3%	12.8%	7.2%	0.9%
Median earnings (dollars)	32,451	35,068	24,680	12,373
POVERTY STATUS IN THE PAST 12 MONTHS				
Workers 16 years and over for whom poverty status is determined	100,067	84,524	8,472	1,702
Below 100 percent of the poverty level	6.9%	5.5%	12.7%	22.8%
100 to 149 percent of the poverty level	6.4%	5.5%	12.0%	9.2%
At or above 150 percent of the poverty level	86.7%	89.0%	75.2%	68.0%
Workers 16 years and over	100,887	84,721	8,515	1,702
OCCUPATION				
Management, business, science, and arts occupations	36.4%	38.0%	27.4%	14.6%
Service occupations	18.0%	16.4%	21.3%	44.4%
Sales and office occupations	26.5%	27.4%	20.5%	22.1%
Natural resources, construction, and maintenance occupations	7.0%	6.3%	14.9%	4.8%
Production, transportation, and material moving occupations	12.0%	11.8%	16.0%	14.1%
Military specific occupations	0.1%	0.1%	0.0%	0.0%

(continued) Means of Transportation to Work by Selected Characteristics
Source: U.S. Census Bureau, 2011-2015 American Community Survey 5-Year Estimates

Subject	Roanoke, VA Urbanized Area (2010)			
	Total	Car, truck, or van -- drove alone	Car, truck, or van -- carpooled	Public transportation (excluding taxicab)
	Estimate	Estimate	Estimate	Estimate
CLASS OF WORKER				
Private wage and salary workers	80.8%	80.8%	82.2%	81.8%
Government workers	15.2%	15.9%	13.6%	16.6%
Self-employed workers in own not incorporated business	3.9%	3.3%	4.2%	1.6%
Unpaid family workers	0.1%	0.1%	0.0%	0.0%
PLACE OF WORK				
Worked in state of residence	99.1%	99.2%	99.2%	96.5%
Worked in county of residence	47.9%	44.5%	48.8%	64.2%
Worked outside county of residence	51.3%	54.7%	50.4%	32.3%
Worked outside state of residence	0.9%	0.8%	0.8%	3.5%
Workers 16 years and over who did not work at home	98,121	84,721	8,515	1,702
TIME LEAVING HOME TO GO TO WORK				
12:00 a.m. to 4:59 a.m.	3.1%	3.0%	4.9%	0.4%
5:00 a.m. to 5:29 a.m.	2.3%	2.3%	2.5%	0.6%
5:30 a.m. to 5:59 a.m.	3.8%	3.6%	4.8%	9.6%
6:00 a.m. to 6:29 a.m.	6.8%	6.5%	9.7%	10.7%
6:30 a.m. to 6:59 a.m.	10.2%	10.6%	7.0%	6.3%
7:00 a.m. to 7:29 a.m.	14.7%	15.1%	13.2%	13.9%
7:30 a.m. to 7:59 a.m.	17.8%	18.2%	18.7%	9.2%
8:00 a.m. to 8:29 a.m.	10.8%	11.3%	8.2%	11.0%
8:30 a.m. to 8:59 a.m.	5.7%	5.9%	3.8%	4.5%
9:00 a.m. to 11:59 p.m.	24.8%	23.6%	27.3%	33.8%
TRAVEL TIME TO WORK				
Less than 10 minutes	14.3%	14.0%	9.3%	9.9%
10 to 14 minutes	19.1%	19.4%	18.0%	9.2%
15 to 19 minutes	23.5%	23.5%	28.4%	3.7%
20 to 24 minutes	18.1%	19.1%	14.4%	7.3%
25 to 29 minutes	6.3%	6.6%	5.1%	4.7%
30 to 34 minutes	10.7%	10.5%	13.7%	12.4%
35 to 44 minutes	2.4%	2.2%	2.9%	11.3%
45 to 59 minutes	2.4%	1.9%	3.3%	21.7%
60 or more minutes	3.2%	2.7%	4.8%	19.9%
Workers 16 years and over in households	99,896	84,484	8,468	1,628
HOUSING TENURE				
Owner-occupied housing units	67.0%	69.4%	56.0%	27.2%
Renter-occupied housing units	33.0%	30.6%	44.0%	72.8%

(continued) Means of Transportation to Work by Selected Characteristics
Source: U.S. Census Bureau, 2011-2015 American Community Survey 5-Year Estimates

Some projects to improve driving throughout the Roanoke Valley are noted in the Transportation Improvement Program and the Vision 2040 Constrained and Vision Lists. The experiences of other larger regions show the negative impacts that can stem from an increase in population and land development with few realistic alternatives to motor vehicle travel. The Roanoke Valley's population has not yet grown to a size where the primary reliance on driving for people or freight mobility has hampered quality of life or business, but with every new land development, it is important to plan for a future with mixed uses and multiple modes. These topics are addressed later in this plan.

4.4 Economic development

Companies from around the world have chosen the Roanoke Valley for its amenities, competitive cost of living, and strong business climate. A mix of cultural, social, physical, and natural amenities helps businesses attract and retain skilled and talented workers. Graduates of the 20+ colleges and universities in the greater region are drawn to the Roanoke Valley for many reasons including the availability of jobs, shopping, affordability, beautiful environment, etc. The cultivation of a healthy, active, resourceful, and accessible community is attracting more companies, people, and jobs to the region.

Location and logistics are strong advantages that allow businesses to stay connected to their customers and suppliers while reducing shipping times and expenses. Goods and people move easily over rail, road, or through the air, domestically or internationally. Improving the regional transportation network, including highways, air service, bus service and commuter rail is a crucial component of connecting our region to the world. We have one of the most diverse economies in Virginia and are able to provide low costs and high productivity that meet the needs of industries from electronics to software to shared services and more.

In addition to individual localities' comprehensive plans that illuminate their connections to the surrounding region, regional plans highlight the nexus between transportation and economic development.

Roanoke Valley-Alleghany Regional Comprehensive Economic Development Strategy
The 2016 update to the Roanoke Valley-Alleghany Regional Comprehensive Economic Development Strategy identifies transportation infrastructure for economic development, calling out maintenance and expansion of transportation infrastructure, innovative transit programs, and expansion of existing transit services with the potential to improve economic development, and using infrastructure to increase the intensity of use in already developed areas. The Strategy lists several transportation projects in the TPO as key to economic development. The priority project list and the project vision list include greenways, streetscape improvements, and the Valley View Blvd extension.

Partnership for a Livable Roanoke Valley Plan
The Livability Guiding Principles in the Livable Roanoke Valley Plan calls for transportation choices through improving transportation mobility for freight, travelers, and the workforce by reducing interstate highway congestion, expanding public transportation and the greenway network, providing intermodal freight rail facilities, intermodal passenger facilities, and making air service more reliable and affordable. It highlights the importance of transportation in drawing tourism to outdoor adventure destination, with improved signage and wayfinding and greenway development and maintenance. Finally, transportation is called on to improve our health, promoting active living by providing non-motorized access to schools, work places and facilities.

Looking beyond the boundaries of the RVTPO, the Roanoke region is the economic hub of Southwest Virginia. The RVTPO will continue to facilitate strategic collaboration to identify and prioritize investment in projects that will advance regional economic goals.

4.5 Freight

Freight transportation has an interrelationship with passenger transportation, employment dynamics and economic development implications. Freight vehicles that use the public right-of-way intermingle with passenger vehicles in the same transportation infrastructure. Federal guidance encourages metropolitan planning organizations and rural planning agencies to address transportation planning with a multi-modal lens while incorporating larger community and economic dynamics.

> *"Our freight system is a multimodal engine that we depend on to drive our economy."*
> (Beyond Traffic, 48)

Typically, regional long-range transportation plans are focused on estimating passenger travel demand for a base year and projecting passenger travel demand to a future horizon year typically 20 years or more from the base year. Freight transportation is assessed indirectly in this process through calibration and validation of the computerized 4-step travel demand model (discussed in greater detail in the Travel Demand Model section). Essentially, traffic counts are taken which indicate the proportion of vehicles with 3 or more axles in a traffic flow, and that proportion is reported as a truck percentage. This truck percentage is then converted into passenger car equivalents using equivalents such as: a vehicle with a certain number of axles is the equivalent of three passenger cars as far as traffic flow is concerned. The passenger car equivalents are then assessed during the "Traffic Assignment Step" (Step 4) of the 4-step travel demand model. This conventional indirect method of factoring in freight transportation is likely to be incomplete given current realities of freight transportation demand such as:

- the increasing popularity of supply chain management and logistics management approaches in manufacturing, light manufacturing, distribution and retail businesses;
- the increasing popularity of retail purchases from the internet which require shipment to the purchaser; and,
- the increasing use of third party fulfillment and logistics providers as businesses "outsource" logistics to market providers while focusing on their "core business."

For the aforementioned reasons, researchers and planners strive to more completely assess and estimate freight transportation demand and to incorporate that demand with the passenger travel demand estimated by the conventional 4-step travel demand model. Fully incorporating freight travel demand estimates into the transportation planning process is a complicated and multi-year research endeavor. As a first step in this effort, in 2012 RVTPO staff performed a study that used Ordinary Least Squares (OLS) linear regression analysis, based on a sample of 57 regional businesses of various sizes, to model the relationship between variables in the survey results. The results are fully outlined in the

Regional Freight Study Technical Report – Roanoke Valley Area Metropolitan Planning Organization (RVAMPO) and Roanoke Valley-Alleghany Regional Commission (RVARC) Freight Trip Generation for the Roanoke Valley – Technical Report. There were some relationships that produced statistically significant results and some that did not. Table 7 summarizes the status of the various single variable relationships.

Table 7 Summary of the Status of Various Single Variable Relationships

Calculated Values	Statistical Significance of Inbound Results	Statistical Significance of Outbound Results
Annual Freight Value per Employee	YES - Significant	YES - Significant
Annual Truck Weight per Employee	YES - Significant	Not Significant for entire data set. Significant for subsets i.e. SCTG-33
Annual Volume (#of Shipments) per Employee	Not Significant	Not Significant

An example of the type of OLS linear regression analysis that was done is depicted in Figure 4-5.

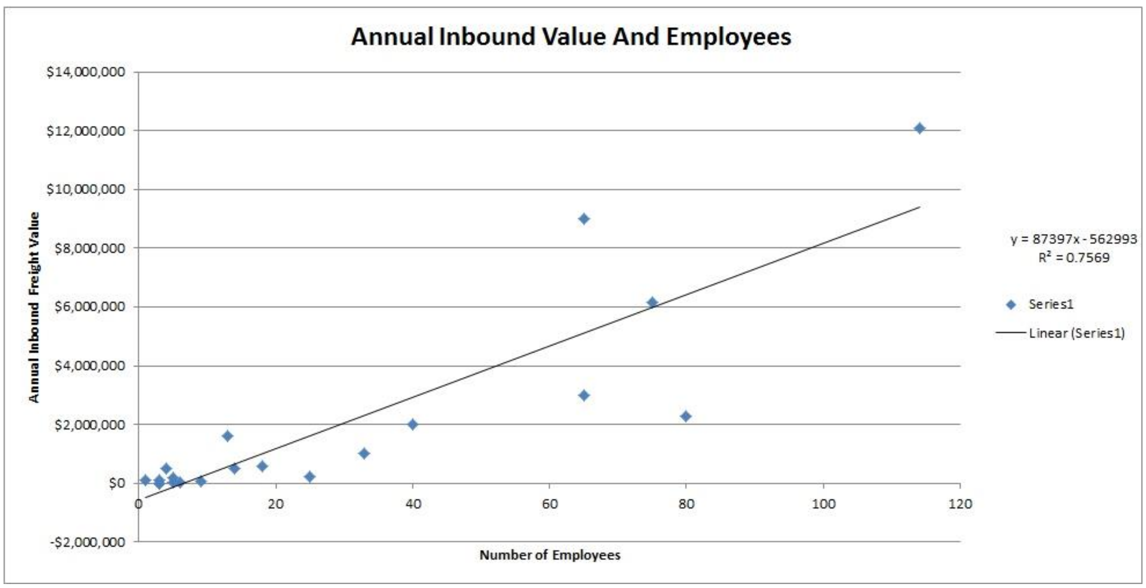


Figure 4-5. Annual Inbound Value and Employees

Interestingly, in some cases when a smaller subset of the data was analyzed, for instance businesses from a single industry, an exponential regression fits the data better than a linear regression. This may indicate a threshold effect in freight generation whereby smaller businesses generate relatively little freight demand and after a threshold start to generate freight demand at an ever increasing rate. Figure 4- illustrates an example of this phenomena.

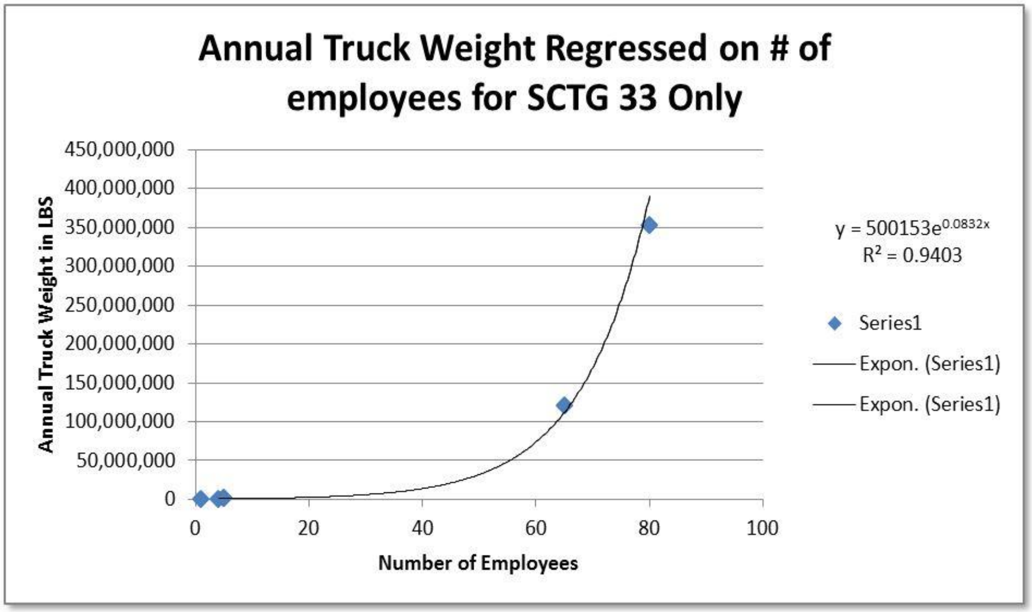


Figure 4-6. Annual Truck Weight Regressed on # of employees for SCTG 33 Only

In the Roanoke Valley, many businesses rely on driving their goods or supplies. A safe and reliable roadway network is essential for businesses to operate smoothly. As new businesses enter the region's market, more freight traffic will be added to roads. I-81 in particular is a key multi-state freight route, and I-581, U.S. 220, and U.S. 460 are key connecting corridors.

4.6 Riding Transit

Transit is provided in the Roanoke Valley via multiple public transportation providers. Where a person lives determines the type of transit options that are available to them. A summary of transit service availability is provided in Table 8.

Bedford County - In Bedford County, the Central Virginia Alliance for Community Living, Inc. (CVACL) provides non-emergency medical transportation services through its Bedford Ride program.

Botetourt County - Public Transportation in Botetourt County originally began through the Botetourt Improvement Associate and is now provided by the County's Parks, Recreation and Tourism Department. The objective of the Senior and Accessible Van Service is to improve the quality of life for Botetourt County residents that are age 55 and older or have a qualifying disability. In 2012, a total of 1,396 participants (760 seniors and 636 people with disabilities) used the service.

Table 8 Transit Service Availability by Locality

	SERVICE AVAILABILITY		
	TRANSIT SERVICE FOR ANYONE	***TRANSIT SERVICE DEPENDS ON AGE***	***TRANSIT FOR ANYONE WITH A DISABILITY***
Bedford County	No	60 and over	Yes
Botetourt County	No	55 and over	Yes
Montgomery County	No	60 and over	Yes
Roanoke County	Limited Area	60 and over	Yes
City of Roanoke	Yes	No	Yes
City of Salem	Yes	No	Yes
Town of Vinton	Yes	No	Yes

Montgomery County - The New River Valley (NRV) Senior Services, a private non-profit organization, provides transportation in Montgomery County and has operated since 1976. Several programs are available to residents.

Funding for the Med-Ride Program is provided by the Carilion Foundation, area United Ways, the Trollinger Trust Fund, the Community Foundation and the C.E. Richardson Foundation.

Local governments provide funding for people with disabilities to receive transportation services. Transportation is also provided for non-emergency medical purposes including dialysis and cancer treatments, and Medicaid is accepted as a payment source. Rides are arranged via Logisticare and provided by NRV Senior Services.

Roanoke County - Roanoke County provides public transportation services for people age 60 and over and anyone with a disability. The service is called CORTRAN (County of Roanoke Transportation) and is provided by Unified Human Services Transportation Systems, Inc. (RADAR). CORTRAN began operating in 1985 initially in four areas and now operates in all parts of the County. As shown in Figure 4-, the number of rides taken on CORTRAN has grown steadily with an 83% increase between 2003 (11,849 rides) and 2013 (21,710 rides). Small portions of Roanoke County are also served by the Greater Roanoke Transit Company and its complementary paratransit service, STAR.

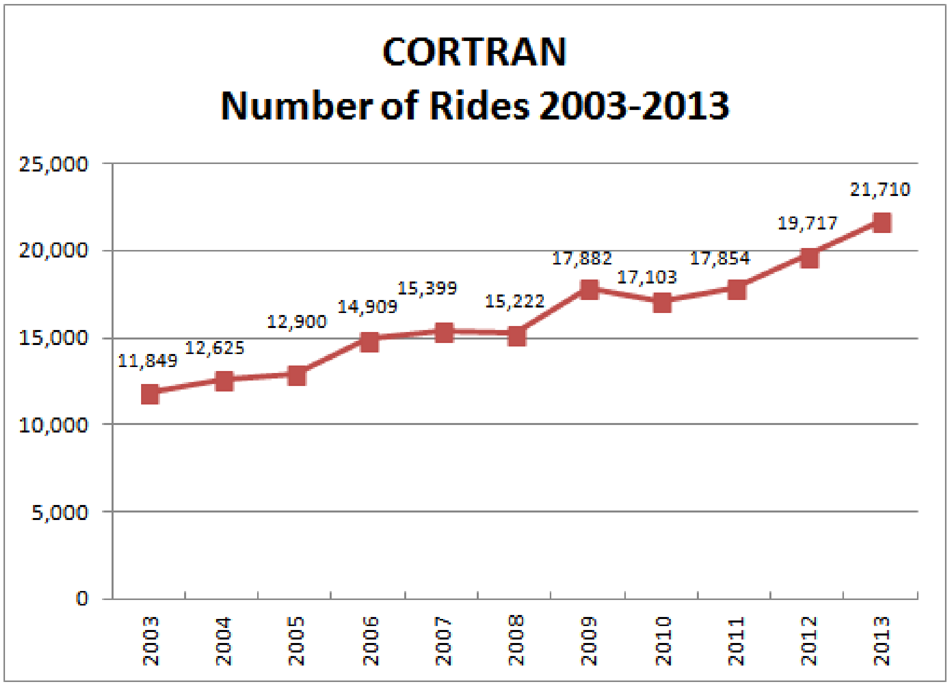


Figure 4-7. Number of CORTRAN Rides 2003-2013

Greater Roanoke Transit Company (Valley Metro) - Public transportation services are open to all residents, employees, and visitors through the local and regional fixed-route transit system operated by the Greater Roanoke Transit Company (Valley Metro). Valley Metro provides the region with a valuable infrastructure through the public transportation network. Without public transportation Roanoke Valley citizens would experience a reduced quality of life. There would be more traffic congestion, worse air quality, greater unemployment, more dependency on social services, less mobility options, greater personal transportation expenses, and the list goes on.

Figure 4-8: Valley Metro provides public transit services in the Roanoke Valley

As noted previously, younger generations in particular have demonstrated around the country that they prefer to live in places where public transportation is a viable option for their mobility. The statistics about millennials moving to the Roanoke Valley and in particular to Downtown Roanoke over the last 10 years shows the trend to live in more pedestrian-friendly and transit-supportive environments exists here too. In planning for the future transportation of the Roanoke

Valley, public transportation will need to evolve into a greater regional asset in order to support the travel needs of a growing economy and community.

Valley Metro contracts with RADAR to provide transportation for people with disabilities who are unable to use the fixed-route transit service. This type of service is referred to nationally as paratransit and locally is called STAR service.

Intercity Bus Transportation – Three operators (Greyhound, Megabus, and Valley Metro) provide intercity bus transportation to and from the Roanoke Valley. Intercity bus service is long-distance public transportation connecting major destinations with few or no stops in between.

Greyhound – Greyhound provides intercity bus transportation from the Campbell Court Transportation Center in Downtown Roanoke to destinations as shown in the network map below. Access to Greyhound is available by Valley Metro fixed-route buses and Smart Way Commuter buses. Greyhound is a valuable service to citizens in the Roanoke Valley providing affordable long-distance transportation options.

Megabus – Megabus provides a valuable long-distance travel option for citizens in the Roanoke Valley. Megabus is a low-cost, express bus service that offers trips from the Exit 118B Christiansburg Park and Ride Lot to Washington DC, Knoxville, and Atlanta. Megabus connections to points beyond are available from these cities. Citizens from the Roanoke Valley can access the service using the Smart Way Commuter bus.

Valley Metro Smart Way Connector – The Smart Way Connector provides a link between the New River Valley, the Roanoke Valley, and Bedford to the Kemper Street Amtrak station in Lynchburg. The service began in July 2009 with the purpose of providing connecting service to passenger rail.

Figure 4-9 Passengers disembark the train and board the bus to Bedford, Roanoke, and the New River Valley June 24, 2012

The Connector bus has provided a much desired service and its success helped prove the need to extend passenger rail service to Roanoke. Initial ridership expectations of 19 passengers per day (RVARC Bus Connector Staff Report 2009) were greatly surpassed with the Connector bus carrying an average of 35 passengers per day in its first full month of service (August 2011). After five years of service, the estimate was 47 passengers per day. However, less than four years after service initiation, the Connector is averaging 55 passengers per day.

When Amtrak service is extended to Roanoke in 2017, there will no longer be a need for passenger rail connector service between Roanoke and Lynchburg to meet the current Northeast Regional morning departures and evening arrivals in Lynchburg. A connecting service will still be needed between Blacksburg and Roanoke; however, this could be incorporated by extending the service already provided by the Smart Way Commuter bus.

Thus far, there has been no expressed need to provide a bus connector service for the Crescent train service in Lynchburg. This is likely due to the late night departures and early morning arrivals that make the demand for this service much less.

Given the success of the current Northeast Regional train, a second Northeast Regional train to Lynchburg has been contemplated. If a second train is provided, there may be sufficient demand to provide Connector bus service to meet that train's departures and arrivals.

Valley Metro Smart Way Commuter – The Smart Way Base Commuter connects the Roanoke Valley and the New River Valley. Several places along the route are available for park and ride access to the Smart Way. The Smart Way is the only transit service currently available to the Roanoke-Blacksburg Regional Airport.

Related Plans and Studies

Adopted in 2013, the Bus Stop Accessibility Study, a collaboration of the Roanoke Valley-Alleghany Regional Commission, the Blue Ridge Independent Living Center, RADAR, and Valley Metro, identified the key bus stops in need of accessibility accommodations, the improvements needed and the estimated costs, examples from other places on how to make bus stops more accessible, and funding sources for making accessibility improvements.

In 2013, the RVTPO Policy Board approved Regional Surface Transportation Program (RSTP) funds for a Downtown Roanoke Intermodal Transportation Study, undertaken by the City of Roanoke and the Greater Roanoke Transit Company (Valley Metro). The Study analyzed the current and future needs associated with transit and passenger rail in Downtown Roanoke and was completed in 2015.

The 2016 Roanoke Valley-Alleghany Regional Comprehensive Economic Development Strategy (CEDS) identifies transit as a key strategy toward meeting one of its goals:

> *CEDS Goal: Ensure the region has adequate infrastructure in place to facilitate the growth of higher-wage industry clusters and to ensure connectivity with regions nationally and globally.*

Strategy: Promote innovative transit programs and expansion of existing transit services in the region where such investments will improve economic development potential.

To support economic development, in addition to many other goals, the Roanoke Valley Transit Vision Plan was developed with the help of many stakeholders, local governments, citizens, Valley Metro, and RADAR. The RVTPO Policy Board approved the region's first Transit Vision Plan in September 2016 which includes a number of short-, medium-, and long-term recommendations to develop transit in the Roanoke Valley.

4.7 Walking

Walking is the most basic form of transportation and the foundation of a good multimodal transportation system. Recent research (Walkability, EfficientGov) on urban walkability highlights the economic and social value of pedestrian-friendly design. Namely, cities with high walkability rankings report:

- An average of 38 percent higher GDP per capita compared to low ranking cities
- Office rent at a 74 percent higher premium per square foot over drivable suburban areas
- Higher percentages of college-educated graduates over the age of 25 in the population
- Lower housing and transportation costs for residents
- Higher property tax revenues generated than in drivable locations

Despite such research, much of the Roanoke Valley's current development practices neglect the opportunities that building walkable places within our community could bring to the regional economy. Many new developments in the urban area are still built solely for vehicle access. Developing a walkable community, however, must go beyond simply building pedestrian infrastructure; without connected nearby adjacent land developments that encourage residents and employees to use the walkway for daily trips (e.g. for work, food, shopping, etc.), such pedestrian infrastructure will have little transportation utility. There are many places in the Roanoke Valley where a greater mix and closer proximity of land uses could easily make walking to destinations sensible and where attractive pedestrian environments can be created.

For so many reasons, the future of walking in the Roanoke Valley needs to be more than simply something people do to get from their car to the building or a leisure activity. The Livable Roanoke Valley Plan cites the following goal, strategy and action:

Goal: "Mobilize community resources to improve access to care, coordination of services, and promote a culture of wellness."
Strategy: "Broaden wellness support services"
Action: "Promote active living by providing non-motorized access to schools, workplaces and facilities"

Figure 4-10 Pedestrians walk to access destinations in the Roanoke Valley

To improve walking as a mode of transportation in the Roanoke Valley, the RVTPO and member local jurisdictions joined together to develop a plan. The Roanoke Valley Pedestrian Vision Plan was adopted by the RVTPO Policy Board in January 2015 and is the region's first plan focused specifically on promoting walking for everyday trips. Several regional plans were reviewed and influenced the content and recommendations of this Plan including the Constrained Long-Range Transportation Plan (2011), Congestion Management Plan (2014), Roanoke Valley Conceptual Greenways Plan (2007), Bikeway Plan (2012), Route 419 Corridor Plan (2010), and the Study on Pedestrian Access to Commercial Centers (2006). Additionally, 43 local plans were also reviewed to identify adopted policies, recommendations, and projects related to pedestrian facilities. Close to 500 citizens responded to a public input survey providing valuable input to the plan.

The purpose of the Pedestrian Plan is to provide a coordinated and strategic approach to making walking a more widely chosen form of transportation. Through the development of a regional pedestrian network, safe and attractive walking environments can exist to enable people to accomplish their daily tasks with greater ease.

It is unrealistic to expect that all parts of the Roanoke Valley will be retrofitted or newly developed to be pedestrian-friendly places. The region is mountainous and often the landscape causes significant challenges to developing walkable environments. However, places like San Francisco show that where there is an interest and a demand, walkable environments can be created in any terrain.

In the Roanoke Valley, much land has already been developed at low densities with the intent that people should only drive to get to and from those locations. Trying to retrofit these areas to create realistic pedestrian transportation options is an expensive and difficult task. Given the limits on available transportation funding and the challenges of retrofitting pedestrian-unfriendly areas, the Roanoke Valley Pedestrian Vision Plan identifies where pedestrian infrastructure investments are most needed based on the density of land development and the number of current and project future residents. With the knowledge that a 10-minute walk is generally the maximum that people will practically walk in the course of daily activities, the RVTPO's Multimodal Centers and Districts represent the places in the Roanoke Valley where walking for transportation to a destination is most realistic.

Pedestrian recommendations are shown on the Vision 2040 Multimodal System Map and explained in the Roanoke Valley Pedestrian Vision Plan. Although several strategies for funding and implementing recommendations are presented in the Pedestrian Plan, the simplest way to improve the pedestrian network is for local governments to incorporate pedestrian infrastructure into new developments during the development review process. As part of the Pedestrian Plan, a search for pedestrian references within local government zoning and subdivision ordinances was conducted. In comparing the pedestrian language between jurisdictions, there are clearly more details incorporated in some ordinances than others, and there is room for much improvement. As the region continues to grow and develop/re-develop more land, local governments are encouraged to review the language in these ordinances and make revisions to make pedestrian infrastructure improvements a key component of new developments, particularly those within a multimodal center or district.

In an article published in USA Today (Szabo), U.S. Surgeon General Dr. Vivek Murthy acknowledges that our country must shift its focus from treating health problems to preventing them particularly by promoting physical activity. He laments that many neighborhoods are not safe for walking, and he hopes to find partners among employers, city planners and others to encourage the development of pedestrian-friendly communities. Dr. Murthy released a "Call to Action on Walking and Walkable Communities" on September 9, 2015 but asking communities and their leaders to "***Step it Up***!"

As will discussed in the Land Use section, the coordination and planning between local land development practices and transportation investments are undoubtedly the critical tools to make walking to places within the community a common part of people's day which in turn supports people's health. Decisions made today have the ability to shape the future so that one day walking can be a natural transportation choice for more people in all the region's localities.

4.8 Biking

The Bikeway Plan for the RVAMPO - 2012 Update and the 2007 Update to the Conceptual Greenway Plan provide the framework for the region's bicycling network. The Bikeway Plan focuses on on-road accommodations whereas the complementary Greenway Plan focuses on off-road accommodations. In addition to hard-surface accommodations used for bicycle transportation, the Greenway Plan also features natural-surface accommodations for recreational uses such as mountain biking, hiking, or equestrian riding. In addition, the Roanoke Valley Transit Vision Plan (2016) discusses bikeshare systems which RideSolutions, the City of Roanoke, and private partners have been actively pursuing. An initial bikeshare service launch is planned for May 2017.

Figure 4-11 Bicyclists ride along the Roanoke River Greenway March 18, 2011 *(top); A bicyclist connects with transit at Campbell Court* August 20, 2015 *(bottom)*

A coordinated and strategic approach to the development of the bicycle mode of the region's transportation network will provide a realistic transportation option for accomplishing daily trips. These plans should be used in conjunction with other state, regional, and local plans, policies, and practices to better accommodate cyclists within the regional transportation network. Examples include but are not limited to the following documents:

- RVAMPO Transportation Improvement Plan
- City of Roanoke Complete Streets Policy
- City of Roanoke Street Design Guideline
- Annual Paving Schedules (local governments)
- CTB Policy for Integrating Bicycle and Pedestrian Accommodations
- VDOT State Bicycle Policy Plan

- VDOT annual paving schedule
- VDOT Maintenance and Construction Policy

The Roanoke Valley Transportation Organization (RVTPO) Regional Interactive Bicycle Map provides information on the region's biking infrastructure and related biking resources to facilitate biking as an efficient, safe, economical, healthy, and environmentally responsible means of transportation.

Oftentimes the simplest way to provide a bicycle accommodation on roadways is to stripe a bike lane, wide travel lane, or sharrow during a repaving and restriping project. The City of Roanoke has accomplished many bicycle facilities using this method, and Roanoke County has initiated the practice as well such as the recent repaving of Brambleton Avenue which now includes bike lanes north of Route 419.

Arterial streets often present challenges to accommodating bicyclists due to more travel lanes, more vehicles, and higher speeds. Route 419 shown in the photo is one such example where bicycle accommodations are desired but how to provide safe, continuous, and cost-efficient accommodations is a challenge.

Figure 4-12 Cyclist on Route 419

One example for providing accommodations is the seven-foot sidewalk along Hershberger Road across I-581 which was planned to accommodate bicyclists and pedestrians. Given the existing infrastructure, this was the maximum width possible to provide a critical bicycle connection between the northwest and northeast sides of the region. Off-road accommodations are very attractive for bicyclists who would shy away from riding along arterial streets; an example is the Lick Run Greenway which connects key multimodal areas like Valley View as shown in the following figure. Off-road biking accommodations can complement the on-road network to facilitate easier access to the region’s key activity centers.

Figure 4-13 Hershberger Road wide sidewalk and Lick Run Greenway near Valley View provide space for walking and biking

Examples from Other Places

It is important to recognize the methods for improving infrastructure from other places that may benefit bicyclists in the Roanoke Valley. In Delaware, the Department of Transportation has recently provided new guidance for accommodating bicycles along roadways where the shoulder is used as the bicycle facility. Conflicts typically take place at the intersection when the shoulder becomes a right-turn lane and insufficient space allows for a continuous bike lane left of the right-turn lane. Where there is a wide shoulder along much of the road, there is insufficient space to provide a dedicated bicycle lane. Striping techniques such as those shown in the following figures provide options for accommodating bicyclists where space is limited.

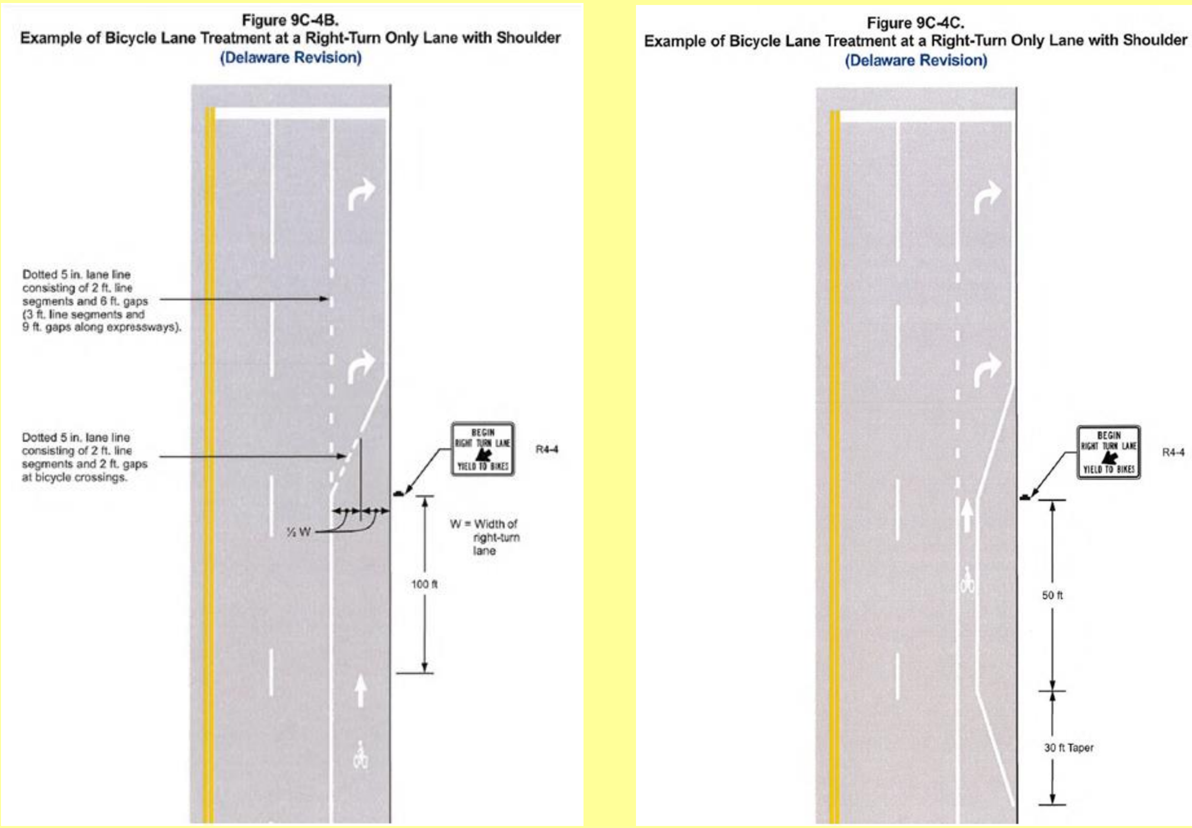


Figure 4-14 Examples of Alternative Bike Accommodations

4.9 Rail

The Roanoke Valley was built around the convergence of many rail lines. Historically, both passenger and freight rail have been important to our region. The following figure shows the railroads that pass through the Roanoke Valley.

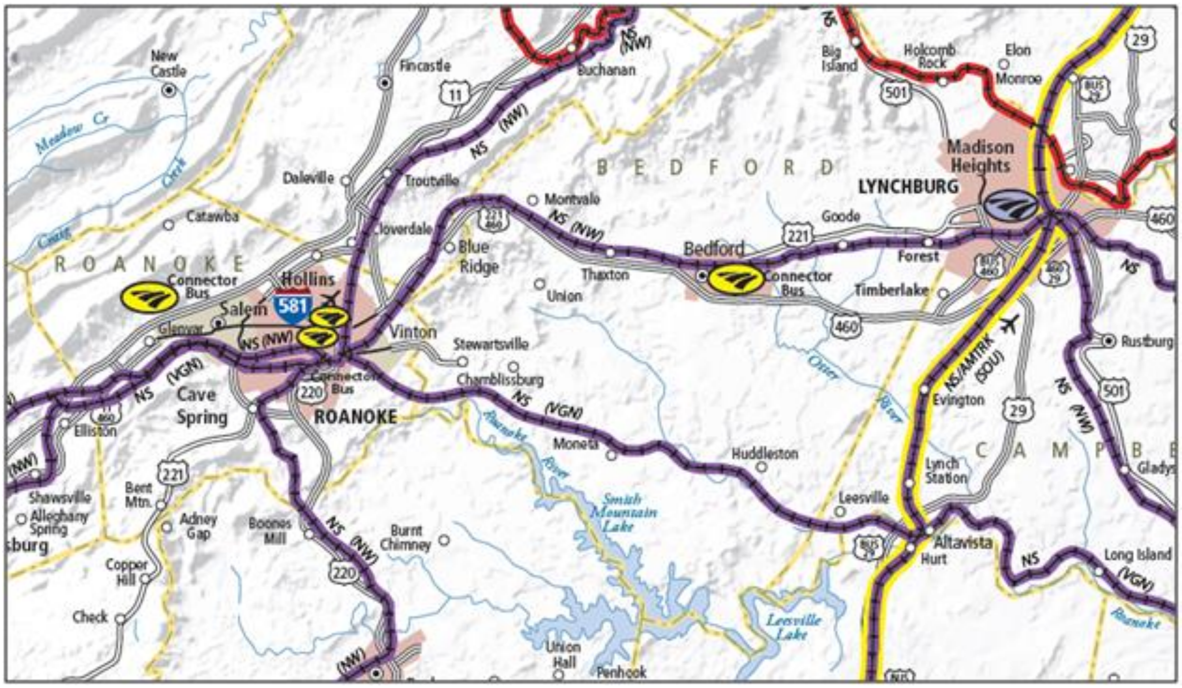


Figure 4-15 Excerpt from Official Virginia State Railroad Map, 2012

4.9.1 Freight rail

The potential for building spur lines off of the main lines is an opportunity for new industrial developments. A great amount of freight moves through the Roanoke Valley to connect with other regions. The railroad creates a valuable redundancy in our transportation network with railroads that parallel I-81 for north-south movements as well as several east-west lines. The potential for an intermodal facility in Elliston was studied (Western Virginia Intermodal Study 2015); to support the potential new facility as well as to have a better way for fire and rescue to access I-81, road improvements were made between the intermodal site and I-81. Such a connection would facilitate truck access to rail should plans ever move forward to construct a facility. For now, there are no plans to move ahead though many still find it to be an attractive economic development opportunity.

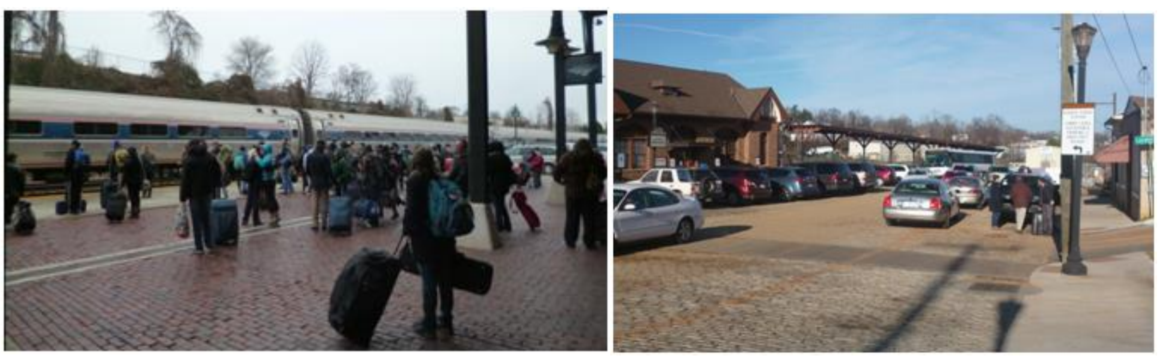
4.9.2 Passenger rail

Since 1979 Roanoke citizens have longed to bring passenger rail service back to the Star City. In February 2013, the Virginia General Assembly passed HB 2313, which changed the way transportation was funded in the Commonwealth. The bill enabled the expansion and growth of intercity passenger rail service including the extension of Amtrak from Lynchburg to Roanoke. The announcement was made official on August 9, 2013 in a News Release from the Governor's Office. The news was met with great excitement and some surprise. While having passenger rail service return to Roanoke has been a desire for a long time, as of the last Constrained Long-Range Transportation Plan in 2012, there was still no train arriving for the foreseeable future. The 2013 transportation bill was the catalyst to make the service a reality.

Around the same time, Norfolk Southern had been working with the Virginia Department of Rail and Public Transportation to add freight capacity and to upgrade signals to its rail yard in Downtown Roanoke to improve the efficiency of freight operations. Constructing a side track and platform for passenger rail became a relatively simple add-on.

In the previous railroad map, the yellow Amtrak symbols represent where there is connecting bus service to an Amtrak station which is marked with a grey Amtrak symbol. In order to achieve passenger rail service extension, improvements to the tracks on the Norfolk Southern VGN (Virginian Railway) line between Altavista and Roanoke were made to accommodate double-stack trains. By making those improvements, more freight trains could use the VGN tracks making room for passenger service on the Norfolk Southern NW (Norfolk and Western Railway) line.

The photos in the following figure show the activity before a departure at the Lynchburg station. In late 2017, Roanoke will become the new end-of-the-line for the Northeast Regional train which will attract riders from far distances. Communities south of Roanoke Valley are also interested in having Amtrak extended into Christiansburg and to Bristol. Should the Amtrak service be extended further south, this extension would provide another way for travelers from southwest Virginia to access the Roanoke Valley and vice versa.



December 14, 2013 *December 28, 2013*

Figure 4-16 Kemper Street Station in Lynchburg (top left), Kemper St. when the train arrives (top right)

January 26, 2015 *January 26, 2015*

June 24, 2012

Figure 4-17 Norfolk Avenue in Downtown Roanoke prior to being modified to accommodate the passenger rail platform (top left), future location of the passenger rail platform (top right), passenger rail platform typical section (bottom left), and passenger rail platform concept (bottom right)

Unlike the typical section in Figure 4-6, the Roanoke AMTRAK stop will feature a high-boarding platform, a key element to ease boarding/alighting the train for people with challenges walking up steps. No decision has been made regarding a station, although a multimodal station to support waiting for the train and travel to/from the train is recommended in the 2015 Downtown Roanoke Intermodal Study (also mentioned previously in the Riding Transit section).

4.10 Flying

People and cargo fly into and out of the Roanoke Valley via the Roanoke-Blacksburg Regional Airport. Airports enable passengers and freight to move by aircraft to distant regional destinations and are natural multimodal transportation hubs. Passengers board aircraft to get to their ultimate destinations, but they also arrive or leave the airport by personal vehicles, taxis, limos, buses, rental cars or shuttles.

Airports are intermodal logistics centers and play a key role in the supply chain when perishables and high valued products must get to destinations faster than by any other transportation mode. Cargo can come in the belly of passenger aircraft or by cargo-only aircraft, which is then transferred to trucks for delivery. Distribution warehouses with truck docks are often located on or near airports to conveniently make the transfer of goods from air to land.

As the only full service airport in Western Virginia, Roanoke-Blacksburg Regional Airport is centrally located to the many communities. The Airport offers approximately 40 scheduled daily arrivals and departures, providing nonstop service to eight (8) major cities. The regional affiliates of American, United Airlines, and Delta fly out of the Airport daily. Allegiant Air also provides full sized jets and frequent service to two destinations in Florida. A total of 38,607 take-offs and landings were recorded in 2014. Over 18,000 of these operations were by private and business aircraft. Airport statistics are shown Table 9.

Table 9 Roanoke Regional Airport Commission Monthly Statistical Report - December 2016

	2016
Enplaned Passengers	304,520
Deplaned Passengers	303,768
Enplaned Total Cargo	6,228.70 tons
Deplaned Total Cargo	6,651.29 tons
Air Carrier Landings and Takeoffs	18,056
General Aviation Landings and Takeoffs	27,004

4.11 Connecting the Travel Modes

Ultimately, the various transportation modes should complement each other to enable travel opportunities within one broad multimodal system. The multimodal transportation system map combines all of the existing and proposed accommodations for driving, riding transit, walking, bicycling, railroading, and flying so that linkages and transfer opportunities between modes can be determined and improved. Furthermore, new technologies will influence the interactions of modes as well as the modes themselves. Specifically, the transit system may integrate new ride sharing technologies.

Critical elements of the multimodal transportation system are the “Corridors of Statewide Significance” as defined in VTrans which are eligible for high priority statewide funding as well as the elements that constitute the “regional network” also defined in VTrans and eligible for district grant funding.

The existing and proposed Roanoke Valley Multimodal Transportation System Maps can be found in Figure 4-6 and Figure 4-7.

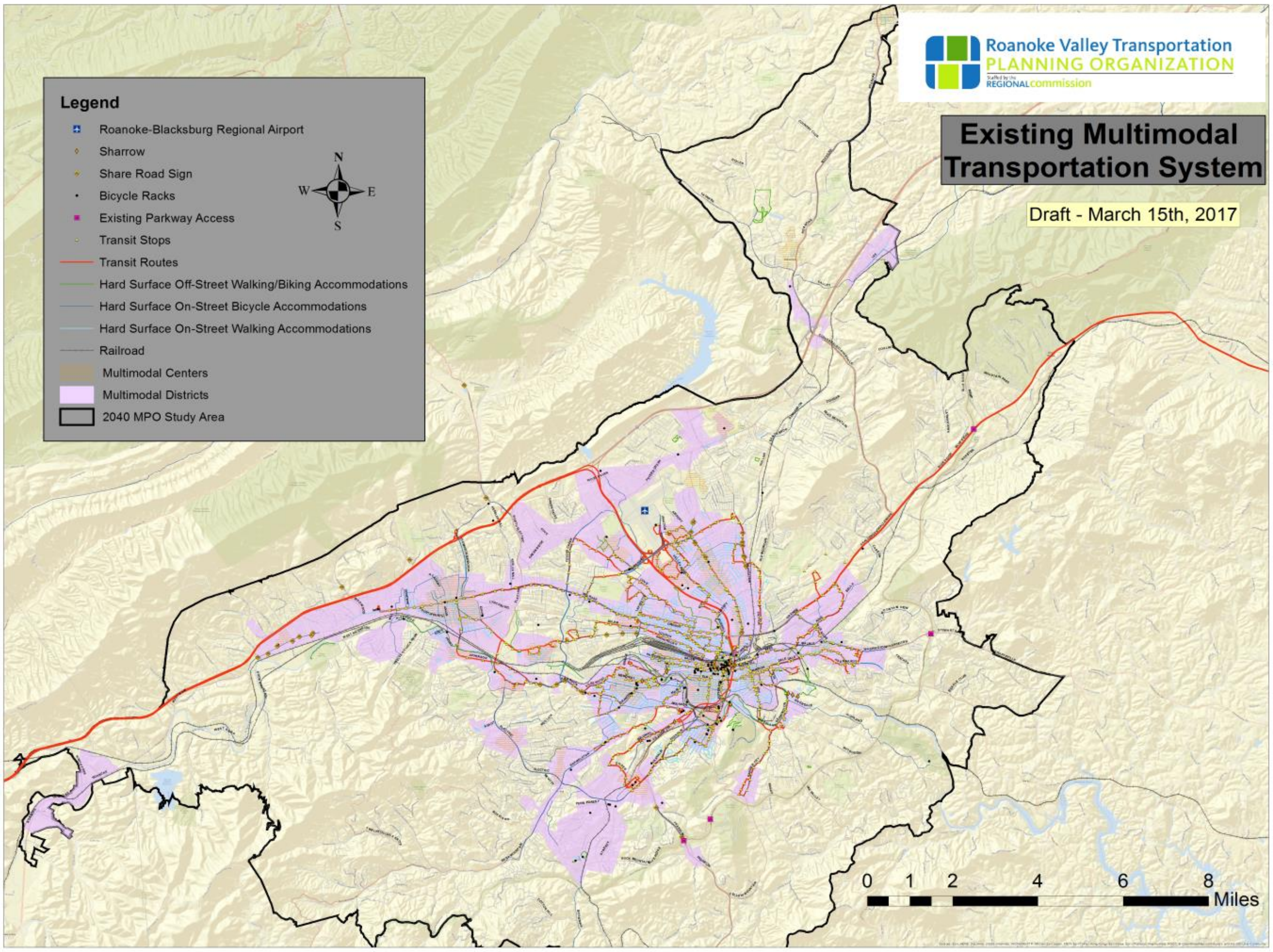


Figure 4-6 Existing Roanoke Valley Multimodal Transportation System

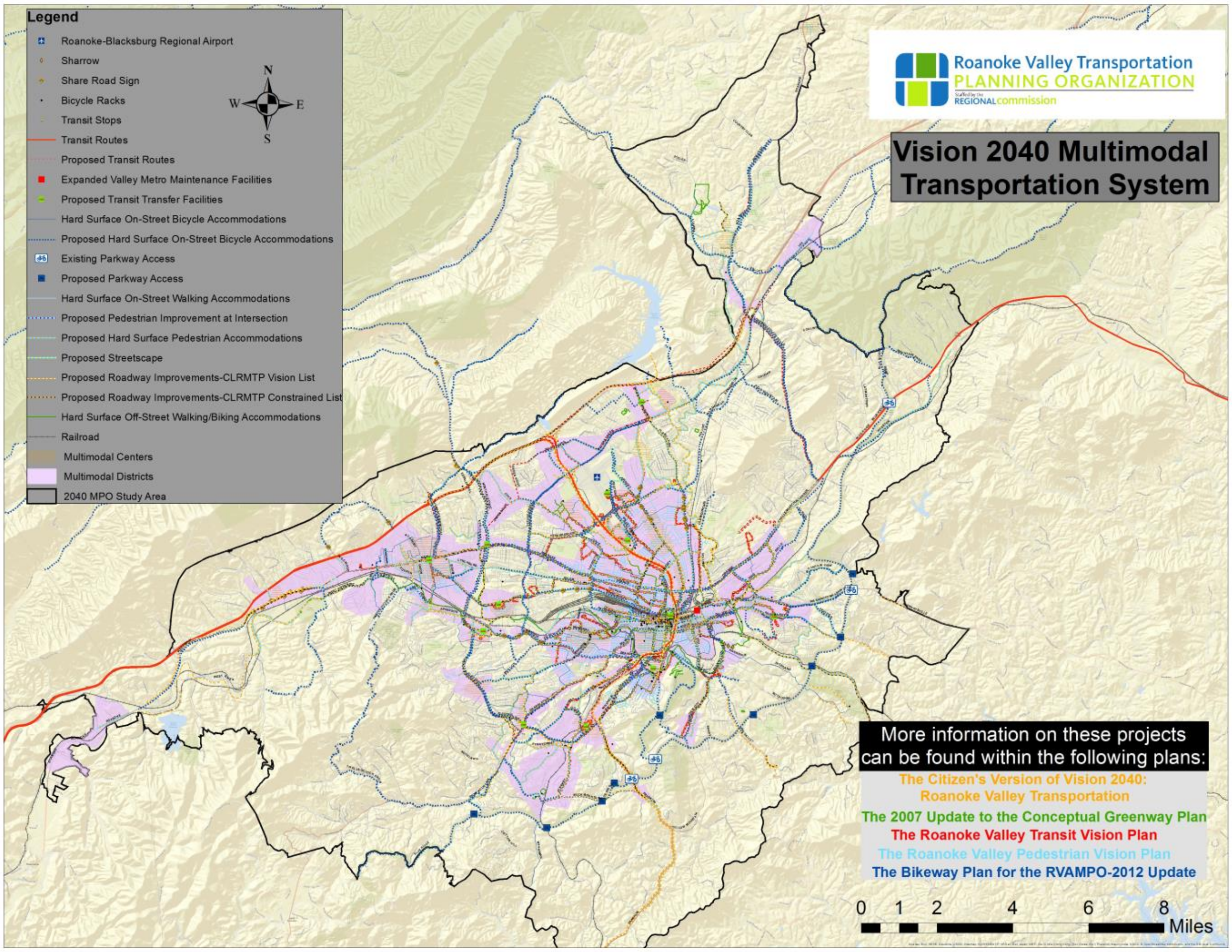


Figure 4-7 Proposed Roanoke Valley Multimodal Transportation System

5.0 Transportation Demand Management

Transportation Demand Management, or TDM, is a set of strategies to encourage travelers to use less intensive modes of transportation. Less intensive here can mean migrating to a high-occupancy vehicle (HOV) mode (such as carpooling, vanpool, transit), walking or cycling; or, it could mean deferring intensive trips altogether through telework or through encouraging the adoption of alternative work schedules that will spread trips out over non-peak times. TDM is traditionally commuter focused as these are the most common and predictable trips to offset, but increasingly TDM is concerned with non-work trips as well.

At its core, TDM is a marketing program aimed at changing the behavior of travelers through education, promotions, and incentives. TDM can also reach its goals via policy. Sometimes, this is policy implemented at the local government level, such as through Complete Streets initiatives that create amenities for cyclists and pedestrians, or the implementation of Bus Rapid Transit (BRT) or other services that improve the performance and competitiveness of high-occupancy modes. More commonly, TDM programs work with the private sector to implement policies at the employer level that encourage the adoption of high-occupancy modes. Examples of such policies might be compressed work weeks, parking buyouts, carpool matching, or offering transportation fringe benefits to employees. In general, TDM is most successful when all three stakeholders - local governments, the TDM program, and employers - work together to create, market, and incentivize useful services.

5.1 Economic Impacts of Transportation Demand Management

Of course, as seen throughout this document, the Roanoke Valley's transportation system has a critical impact on its economic prosperity. Transportation Demand Management contributes to this in three broad ways:

- According to the U.S. Energy Information Administration (www.eia.gov/petroleum/gasdiesel/) The vast majority of the cost of a gallon of gas - approaching 90% - leaves the local economy. Some stays in or returns to the Roanoke Valley in the form of taxes, but most of what the consumer pays goes to cover drilling, refining, shipping, and other related expenses. When Transportation Demand Management shifts drivers from single-occupant to higher-occupancy transportation modes, not only do those drivers save money, what they save is more likely to stay in the local economy. For example, if we were able to get 10% of 10,000 daily commuters to shift mode, travelling at an average of 10 miles a day on a round trip commute, this change could bring approximately $400,000 a year back into the local economy based on a gallon of gas costing $3.00 a gallon. Obviously, for longer commutes, the impact is greater.

- Increasingly, as we show later, transportation choice is as much a lifestyle choice as it is a practical one. In choosing where they live and how they get around, people - especially the Millennial generation - are making statements about their values. Decisions to live in urban centers, to commute by foot or by bike, or to use transit, may reflect not only economic decisions, but preferences for local businesses and local goods, concern for the environment and climate change, or a commitment to physical fitness. In all of these cases, a TDM program that actively encourages and facilitates transportation behavior change not only can enable people to make that change, but also serves as a marketing program to external audiences that a community is ready and able to meet these needs. An active TDM program in the Roanoke Valley not only helps its citizens reduce their "consumption" of transportation, it gives the region a competitive edge in attracting talent - both individuals and businesses - for whom transportation choice is a critical tool.

- The robust mode offerings encouraged by Transportation Demand Management do more than simply offer choices to existing commuters, they provide services to people with no or limited access to an automobile. Services like public transportation and vanpooling present mode shift opportunities by moving existing commuters out of single-occupant vehicles and into buses and vans, while also providing seat capacity to transit-dependent commuters. Without one class of rider, the service would likely not be viable; yet by coordinating trips a single TDM strategy can have both VMT reduction and employment benefits.

5.2 Trends in Transportation Behavior

For most of its history, TDM has been a congestion mitigation strategy, though the last decade - both industry wide and in the Roanoke Valley - its focus has broadened. earlier, it was noted that vehicle miles travelled annually have been flat or shrinking since approximately 2008, reversing a consistent trend of year-over-year increases in mileage that has been seen since records started being kept. This has occurred despite continued population growth and appears tied into several broader trends:

- Millennials, compared to previous generations, appear less interested in car ownership and are more likely to turn to alternative modes, technology, and more dense living patterns to reduce their dependence on automobiles. This demographic cohort is a complicated one and behavior may vary widely from region to region, but a December 2016 article in the L. A. Times (Etehad) reveals that when Millennials aren't eschewing car ownership altogether, they seem to at least be delaying

Figure 5-1 The Exit 140 Park and Ride Lot is used by many commuters who carpool or ride transit
September 18, 2015

purchase until later in life than previous generations. This suggests that, in the short term at least, access to alternative modes will be an important amenity for this cohort.

- 2010 U.S. Census data shows a shift in population back to urban centers. In some cases these are historic downtowns or other traditional urban centers, in other cases these may be developments in traditional suburban development that attempt to emulate the multi-use land use of urban centers. In either case, population is shifting back to communities that are more walkable, bikeable, and transit-friendly, and which contain a broader array of amenities in a denser environment.

  In the Roanoke Valley, the story of Downtown Roanoke proves this trend. Residential occupancy in downtown has grown from 50 to 1,500 over the eight years preceding 2015. This has followed a series of redevelopment projects, enabled largely by historic tax credits, that have converted a number of underused or derelict buildings into multi-use structures. The Hancock Building, Cotton Mill Lofts, Patrick Henry Hotel, Parkway 301, Ponce de Leon, and more are all examples of new residential buildings that have almost immediately leased out all of their units before the buildings were complete. Along with this has come a return in services, such as the downtown Roanoke Natural Foods Co-Op market, the Big Lick Pharmacy, and other basic services. Further, the City of Roanoke has extended the boundaries of its downtown zoning designation to include a new development near Carilion Clinic that will include commercial, residential, dining, and recreation amenities. All this is linked by the Star Line Trolley on Jefferson Avenue and a series of greenway sections that augment bicycle and pedestrian accommodations between downtown and its surrounding neighborhoods.

- Economic pressures may be driving younger generations into areas where car ownership isn't a necessity. Besides the price of gasoline, which fluctuates from year to year, the Millennial generation is also graduating college with record-high levels of student debt. This debt load may be deferring decisions about car and home ownership that these demographic cohorts might have made at a much earlier age in previous generations, choosing to go without the debt load of a car, and choosing to rent a home rather than own, both of which are going to encourage settling in denser urban centers.

In all of these cases, TDM will continue to play a strong role, both in terms of identifying and facilitating new accommodations and tools that this group may need, as well as marketing and promoting the accommodations that exist.

5.3 TDM in the Roanoke Valley

Transportation Demand Management activities have been undertaken in the Roanoke Valley through the Roanoke Valley-Alleghany Regional Commission's RIDE Solutions program. Started in 2001, TDM was initially a strategy implemented as part of the then-MPO's Ozone Early Action Compact, focused on reducing vehicle trips to reduce emissions and avoid slipping into ozone non-attainment and its concordant regulatory burden. Early TDM activities focused on promoting carpooling through mass media efforts and early support for the Smart Way commuter bus when that service began. Little attention was paid to bicycle, pedestrian, and local fixed-route transit support. Over time, as it became clear the valley would remain in attainment, RIDE Solutions responded to local market demand by expanding its range of services to include significant bicycle commuter support, employer outreach, and even program expansion.

In 2006 the Regional Commission partnered with the New River Valley Planning District Commission to expand TDM activities into the New River Valley. In 2013 a partnership was formed to expand into the Region 2000 area of greater Lynchburg, and in 2015 RIDE Solutions partnered with the West Piedmont Workforce Investment Board to offer services in southside Virginia. In all cases, expanding the reach of the RIDE Solutions message had a positive effect on transportation demand within the TPO - for example, a key partner in the NRV expansion was Virginia Tech, who draws both employees and commuter students from within the Roanoke Valley, and at the time of the expansion into Region 2000 approximately 10,000 people per day commuted between the two regions.

Commute Sheds: While TDM activities have significant impact within the TPO, they are implemented in a service area that extends far beyond the TPO's boundaries, or even the boundaries of the Regional Commission. RIDE Solutions promotes its services both within the regions it serves and the commute sheds that serve those regions. For the TPO, this means that TDM activities that have an impact on travel demand within its boundaries may be implemented as far west as Radford, as far east as Lynchburg, as far north as Alleghany County, and as far south as Martinsville. When the entirety of the RIDE Solutions service area is taken into account, its commute shed extends from Wytheville, to West Virginia, to Harrisonburg, and North Carolina.

The following shows the daily commute numbers for the top 10 localities in each of the four regions that RIDE Solutions serves, as noted in the RIDE Solutions Six-Year Plan. It should be noted that the Roanoke Valley is a net-intake of commuters each day.

Roanoke

- People who live and work in the area: 104,975
- In-Commuters: 50,744
- Out-Commuters: 28,651
- Net In-Commuters (In-Commuters minus Out-Commuters): 22,093

Top 10 Places Residents are Commuting To:

- Montgomery County, VA: 3,516
- Lynchburg city, VA: 1,540
- Henrico County, VA: 1,348
- Henry County, VA: 1,175
- Fairfax County, VA: 1,056

- Bedford County, VA: 1,028
- Richmond city, VA: 964
- Chesterfield County, VA: 879
- Martinsville city, VA: 797
- Danville city, VA: 769
- **Out-commuting to NRVRC (New River Valley) area: 3,516**
- **Out-commuting to Region 2000 (Lynchburg) area: 2,568**
- **Out-commuting to West Piedmont (Martinsville/Danville) area: 2,741**

Top 10 Places Workers are Commuting From

- Bedford County, VA: 8,323
- Montgomery County, VA: 4,771
- Henry County, VA: 2,322
- Pulaski County, VA: 1,898
- Lynchburg city, VA: 1,566
- Floyd County, VA: 1,493
- Campbell County, VA: 1,334
- Pittsylvania County, VA: 1,152
- Augusta County, VA: 1,116
- Henrico County, VA: 955
- **In-commuting from NRVRC (New River Valley) area: 8,162**
- **In-commuting from Region 2000 (Lynchburg) area: 2,900**
- **In-commuting from West Piedmont (Martinsville/Danville) area: 3,474**

New River Valley

- People who live and work in the area: 44,768
- In-Commuters: 22,786
- Out-Commuters: 19,798
- Net In-Commuters (In-Commuters minus Out-Commuters): 2,088

Top 10 Places Residents are Commuting To:

- Roanoke city, VA: 4,060
- Roanoke County, VA: 2,221
- Salem city, VA: 2,056
- Wythe County, VA: 851
- Tazewell County, VA: 498
- Franklin County, VA: 476
- Carroll County, VA: 421
- Botetourt County, VA: 420
- Lynchburg city, VA: 391
- Mercer County, WV: 386
- **Out-commuting to RVARC (Roanoke) area: 8,853**
- **Out-commuting to Region 2000 (Lynchburg) area: 391**
- **Out-commuting to West Piedmont (Martinsville/Danville) area: 0**

Top 10 Places Workers are Commuting From

- Wythe County, VA: 1,844
- Roanoke County, VA: 1,842
- Roanoke city, VA: 1,368
- Carroll County, VA: 1,226
- Franklin County, VA: 751
- Monroe County, WV: 717
- Mercer County, WV: 682
- Henry County, VA: 646
- Tazewell County, VA: 635
- Patrick County, VA:569
- **In-commuting from RVARC (Roanoke) area: 2,119**
- **In-commuting from Region 2000 (Lynchburg) area: 0**
- **In-commuting from West Piedmont (Martinsville/Danville) area: 646**

Region 2000

- People who live and work in the area: 64,873
- In-Commuters: 25,982
- Out-Commuters: 34,247
- Net In-Commuters (In-Commuters minus Out-Commuters): -8,265

Top 10 Places Residents are Commuting To:

- Roanoke city, VA: 6,188
- Roanoke County, VA: 3,152
- Salem city, VA: 1,560
- Henrico County, VA: 1,529
- Richmond city, VA: 1,042
- Fairfax County, VA: 1,026
- Pittsylvania County, VA: 919
- Chesterfield County, VA: 895
- Franklin County, VA: 833
- Halifax County, VA: 830
- **Out-commuting to RVARC (Roanoke) area: 11,733**
- **Out-commuting to NRVRC (New River Valley) area: 0**
- **Out-commuting to West Piedmont (Martinsville/Danville) area: 0**

Top 10 Places Workers are Commuting From

- Pittsylvania County, VA: 2,707
- Roanoke County, VA: 1,350
- Halifax County, VA: 1,250
- Roanoke city, VA: 924
- Danville city, VA: 882
- Augusta County, VA: 807
- Franklin County, VA: 634
- Chesterfield County, VA: 615

- Botetourt County, VA: 583
- Charlotte County, VA: 565
- **In-commuting from RVARC (Roanoke) area: 2,908**
- **In-commuting from NRVRC (New River Valley) area: 0**
- **In-commuting from West Piedmont (Martinsville/Danville) area: 0**

West Piedmont

- People who live and work in the area: 60,055
- In-Commuters: 22,276
- Out-Commuters: 36,126
- Net In-Commuters (In-Commuters minus Out-Commuters): -13,850

Top 10 Places Residents are Commuting To:

- Roanoke city, VA: 6,027
- Roanoke County, VA: 2,534
- Rockingham County, NC: 2,211
- Campbell County, VA: 2,035
- Salem city, VA: 1,715
- Guilford County, NC: 1,536
- Lynchburg city, VA: 1,525
- Montgomery County, VA: 1,360
- Halifax County, VA: 1,073
- Henrico County, VA: 764
- **Out-commuting to RVARC (Roanoke) area: 10,276**
- **Out-commuting to NRVRC (New River Valley) area: 1,360**
- **Out-commuting to Region 2000 (Lynchburg) area: 3,560**

Top 10 Places Workers are Commuting From

- Halifax County, VA: 1,431
- Caswell County, NC: 1,407
- Rockingham County, NC: 1,334
- Roanoke city, VA: 1,089
- Roanoke County, VA: 1,087
- Bedford County, VA: 1,006
- Campbell County, VA: 647
- Montgomery County, VA: 636
- Lynchburg city, VA: 560
- Guilford County, NC:472
- **In-commuting from RVARC (Roanoke) area: 2,176**
- **In-commuting from NRVRC (New River Valley) area: 636**
- **In-commuting from Region 2000 (Lynchburg) area: 2,213**

When considering impacts on the TPO, it is useful to consider the corridors that TDM activities might impact. RIDE Solutions focuses on three primary corridors: Route 220 from Covington to Martinsville; I-

81 between Roanoke and Radford, and Route 460 between Roanoke and Lynchburg.

5.4 Long and Short Range TDM Activities

Short Range: Over the next 1 to 5 years, the TDM program will concentrate on:

- **Focus on residents in urban cores**: A number of current and planned development projects will bring additional residential units to downtown Roanoke's West End, such as the Locker Room Lofts on Church Avenue, formerly the YMCA, and the former Health Department building on Campbell, which was recently sold to developer Ed Walker, who has a history of successful mixed-use development projects. A focus of Housing and Urban Development funds and other monies in the West End and Hurt Park neighborhoods of Roanoke City may result in improvements for on-road bike infrastructure and pedestrian accommodations, and other improvements in both downtown Salem and Vinton may see additional residential growth in these areas.

  In these cases, TDM activities will focus on supporting implementation of the Roanoke Valley Transit Vision Plan by improving the way transit information is delivered to potential riders as well as improving the overall public perception of Valley Metro through continuing programs like Art by Bus and additional Try Transit Week promotions. Expecting that technology, particularly smartphone technology, will become a necessary, if not primary, way information about transit is delivered, TDM activities will involve constant monitoring of and research into new technologies and improvements to core systems like the General Transit Feed Specification (GTFS), which even now is the standard way transit route information is delivered to a wide variety of platforms.

  Beyond transit, the TDM program will continually make improvements to the ways in which its core service offerings - carpool matching, bike routing assistance, and related products - are delivered.

- **Vanpool Implementation**: Elsewhere in Virginia, vanpooling is a significant presence in most mobility programs. A hybrid of carpooling and public transit, vanpooling can both provide service to an area where commute options don't exist, and augment existing services as a complement to public transit. In Virginia, vanpooling is primarily implemented through a third party - namely, Enterprise Rideshare or vRide (formerly VPSI). RIDE Solutions will engage with each of these providers and, through its regular employer outreach efforts, seek to implement vanpooling with qualified businesses.

  It is likely that early vanpool efforts will have only a minimal impact on the TPO directly, though they will serve employers within the TPO boundaries. Vanpooling is most successful and makes the most economic sense for the riders when passengers are travelling from farther than 30 miles away, so only employers who are drawing employees from outside the urban core will be likely to make use of vanpooling. That said, some major employers in the region - including those located at the Roanoke Centre for Industry and Technology - have identified a need to extend their employment base farther afield in an effort to reach qualified employees. In many cases, the jobs these employers are attempting to fill are entry-level, shift, or seasonable work. To that extent, vanpool implementation - even if its impact on VMT is relatively minor - will be an important job-access tool for these employers.

- **Bikeshare:** In many communities, bikeshare programs like D.C.'s Capital Bikeshare and New York's CitiBike have become a vital "last mile" component of their transit networks, efficiently connecting bus stops to broader commercial and residential areas without the need to run additional buses or increase headways to extend routes. Bikeshare also provides easy access to bicycles for short, one way trips for both residents and visitors. In particular, as rail returns to the Roanoke Valley, RIDE Solutions will investigate the intersection between rail, bus transit, and bikeshare as a way to provide easy, multimodal service to folks traveling into the region from elsewhere, and for folks within the region to connect to rail for travel elsewhere.

- **Technology**: In many ways, TDM modes haven't changed, but the way people access them have. App-based services like Uber and Lyft have changed the way people rideshare and have had a dramatic effect on the taxi market. Google Maps and the now-universally accepted General Transit Feed Specification continue to make it easier for the public to access transit route information. Our TDM efforts will focus on staying on the forefront of this technology so that our core services remain relevant and accessible to our audience.

Medium Range: Over the next 5 to 15 years, the TDM program will concentrate on:

- **Carsharing:** Carsharing is, by now, a fairly common concept; essentially short-term car-rentals, participants in a carsharing service often pay a monthly fee that gives them access, via their computer or smartphone, to the use of a vehicle for small trips. The vehicles are parked in high density areas such as downtowns, village centers, and college campuses. While carsharing serves as an alternative to car ownership for some people, it can also enable the use of alternative transportation for folks who may have need of a car throughout the day. The Roanoke urban core, for example, has a number of professional services jobs in the legal, banking, and engineering fields, the kinds of jobs that may require travel during the day to a jobsite or client meeting. Because of this, employees in such industries may choose not to bike, carpool, or take transit to work because of the need for a personal vehicle for these occasional trips. The presence of carsharing will enable them to make that choice.

  Carsharing is already present in the RIDE Solutions service area at Virginia Tech, though the service does not extend to the Roanoke Valley. RIDE Solutions will complete a market analysis on the viability of carsharing for the downtown Roanoke core and select sites throughout the valley.

- **Parking Policy:** Parking policy can have a tremendous effect on transportation choice, with plentiful free parking effectively subsidizing automobile travel over transit, biking, and walking. Well-considered parking policy, however, can meet both the needs of providing well-managed parking to those who need or choose to drive, as well as appropriate incentives for non-SOV modes such as carpooling and transit.

  In 2017, Downtown Roanoke will undertake a demonstration project examining the feasibility of on-street parking meters in certain areas of the urban core. The demonstration project will determine the feasibility, practical effect, and public response (both citizen and business) to the meters. Already serving on the downtown mobility group which oversees the meter project, RIDE Solutions will continue to engage with all appropriate stakeholders- including PARK Roanoke Downtown Roanoke Inc.

Long Range: *(~15-25 years)*

- **Enhanced Transit Service:** In support of the strategies laid out in the *Transit Vision Plan*, RIDE Solutions will bring its marketing and public relations support to implementing recommendations from that plan.

- **Automated Vehicle Technology**: Although it's unclear in what form automated vehicle technology may come to the region, it is beyond a doubt that it will be here. Automated Vehicles provide exciting possibilities for transportation demand management solutions. In particular, the automated mass transit systems can provide service expansion without the expense of extended driver hours. Further, automated vehicles could provide carpool-like service, where seat capacity is filled via the use of smartphone apps rather than direct commuter facilitation.

More information about the Roanoke Valley's TDM program and initiatives can be found in the adopted plan.

6.0 Congestion Management Process

The Roanoke Valley's first ever Congestion Management Process (CMP) Plan was approved on January 23, 2014. The CMP Plan is a new requirement now that the RVTPO is classified as a Transportation Management Area (TMA) Metropolitan Planning Organization (MPO).

6.1 Types of congestions

Highway congestion can be recurring, non-recurring, and/or freight related. Non-highway congestion is transit or non-motorized congestion.

Recurring Congestion

Recurring congestion follows a fairly consistent pattern. Approximately 45% of congestion is recurring (40% bottlenecks, 5% poor signal timing).

Non-recurring Congestion

Non-recurring congestion is the result of accidents, the weather and other factors that don't follow a predictable pattern. The Federal Highway Administration (FHWA) estimates that up to 55% of congestion is non-recurring in nature (25% traffic incidents, 10% work zones, 15% weather, 5% special events).

Non-recurring congestion is unpredictable, but it can amplify the effects of recurring congestion. The mitigation strategy for non-recurring congestion considers the impacts of established detours when there is an accident or other incident on a major facility such as Interstate 81.

Freight Related Highway Congestion

Private sector businesses increasingly rely on logistics, supply chain management and just-in-time delivery, which requires an uncongested transportation network. Freight vehicles themselves contribute to congestion, more so than other individual vehicles due to their size and

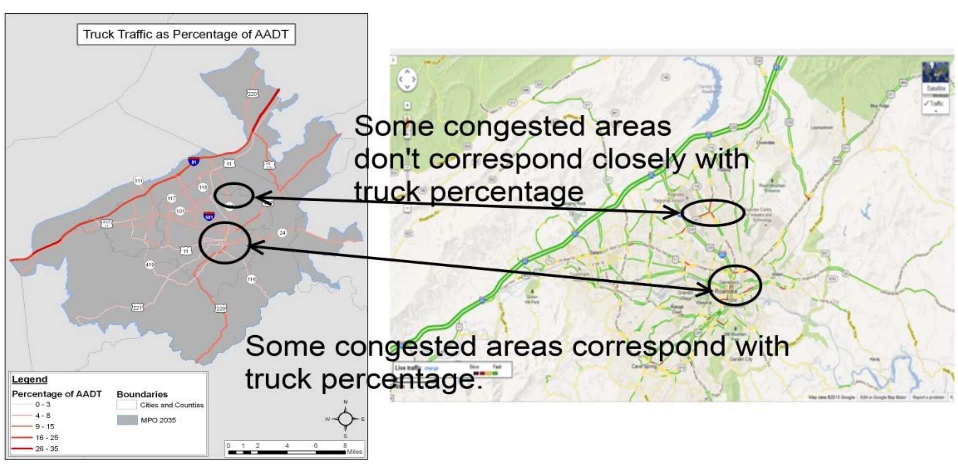


Figure 6-1 Freight can contribute to congestion, but not all congestion corresponds with freight.

slower acceleration (Figure 6-1).

Transit Congestion

The current bus system functions as a hub and spoke system. The hub is the Downtown Roanoke Campbell Court transfer center and the spokes are the transit routes that connect at the facility. In order for the hub (Campbell Court) to function well, two factors are critical: people must intuitively understand how to transfer buses and people must physically be able to easily move throughout the facility.

The Campbell Court facility is at its maximum capacity, with bays that are not wide enough for modern buses and crowded platforms that pose particular challenges for persons with disabilities.

Transit congestion can occur on buses themselves. The #91/#92 bus is particularly congested at almost all times, and other buses become congested at peak travel times.

Non-motorized Congestion

Congestion on greenways and shared use trails leads to conflicts between users, particularly between users traveling at different speeds, such as walkers, joggers, and bicyclists. Factors such as weather, season, and time of day contribute to congestion.

6.2 Areas of Application

The CMP applies to highway, transit, non-motorized transportation, and air quality.

Highway

Highway congestion was assessed through public input, Google traffic analysis, and field verification to identify 10 Areas of Emphasis.

1. Elm Avenue and I-581
2. Hollins to Hershberger
3. Salem
4. Cave Spring Corners
5. Route 419/U.S. 220
6. Apperson Drive and Route 419
7. Route 24/Vinton
8. Orange Ave/Challenger Corridor
9. I-81 Exit 150 and U.S. 11
10. Grandin Road and Brandon Avenue

Other areas were identified for observation, which are not yet as congested as the Areas of Emphasis.

- Towers/Colonial Area
- Peters Creek Corridor

- Hershberger/Valley View Area
- Williamson Road
- I-581 Exits
- Downtown Roanoke (i.e. Campbell Avenue)
- Route 311
- Route 11/460 West of Salem

Transit

Transit can be congested at the facility or on the transit vehicle, but it also plays an important role in alleviating overall traffic congestion. The relationship between vehicles and congestion is not linear when the roadway is near congestion, so shifting 1% of trips from vehicles to transit can reduce traffic congestion by more than just 1% (Figure 6-2).

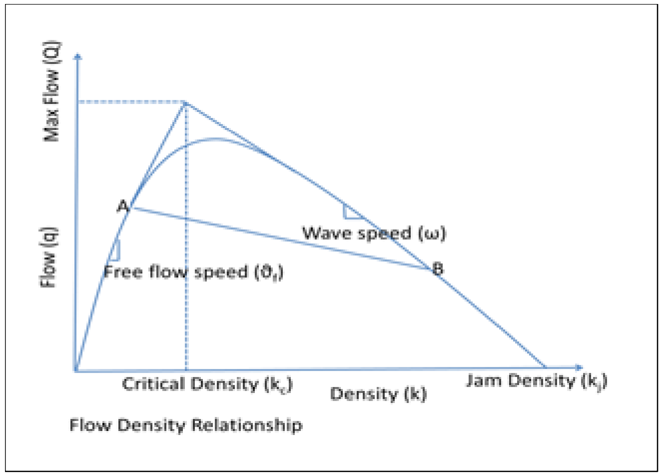


Figure 6-2. Flow Density Relationship

Of particular interest are areas of high employment density that are not currently served by public transit:

- Area of Emphasis #2- Hollins to Hershberger
- Area of Emphasis #4- Cave Spring Corners
- Area of Emphasis #5- Route 419/U.S. 220 (some portions)
- Area of Emphasis #8- Orange Ave/Challenger Corridor (some portions)
- Area of Emphasis #9- I-81 Exit 150 and U.S.11

Non-Motorized Transportation

Non-motorized transportation similarly has a non-linear impact on congested roads. In addition, non-motorized transportation makes other modes such as transit and car sharing possible. Non-motorized transportation itself can experience congestion, primarily through differential speeds.

Air Quality Benefits of Traffic Congestion Reduction

Reducing traffic congestion improves regional air quality. The Roanoke area is in attainment for air quality, although ozone levels exceeded National Ambient Air Quality Standards when the standards were made more stringent in the late 1990s.

6.3 Highway Network

To further explore the areas of highway congestion, staff challenged themselves to explore newly available, yet cost effective, methods for capturing data about our region’s congestion network. Staff identified 10 Areas of Emphasis by analyzing survey responses, identifying trends using Google Traffic, and conducting site visits for each area of emphasis (Figure 6-3).

Ten Areas of Emphasis

The Ten Areas of Emphasis are:

1. Elm Avenue and I-581
2. Hollins to Hershberger
3. Salem
4. Cave Spring Corners
5. Route 419/U.S. 220
6. Apperson Drive and Route 419
7. Route 24/Vinton
8. Orange Avenue/Challenger Corridor
9. I-81 Exit 150 and Route 11
10. Brandon Ave. Corridor

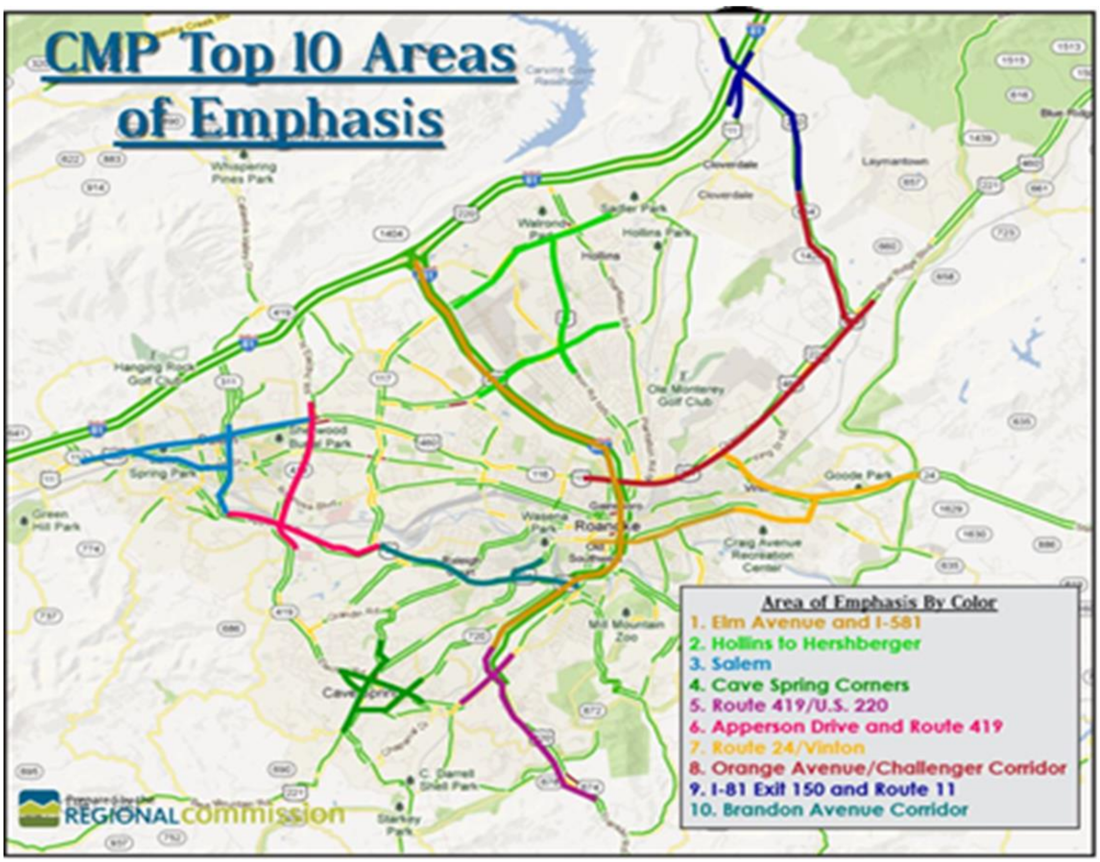


Figure 6-3 Top 10 Areas of Emphasis

Multimodal Districts and Centers

There are clear overlaps between the Areas of Emphasis and the Multimodal Centers and Districts introduced in the Land Use and Development section (Figure 6-4).

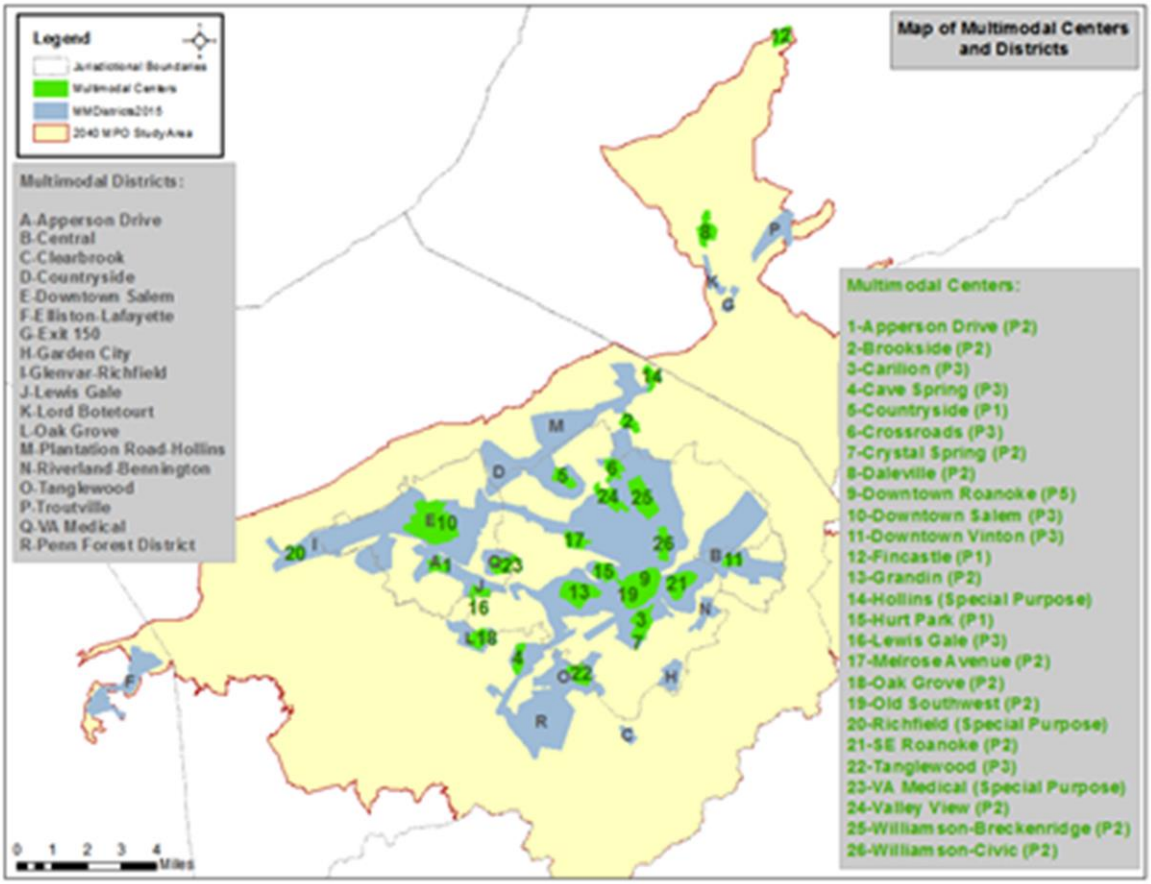


Figure 6-4 Multimodal Centers and Districts

Table 10 below illustrates the connections:

Table 10 Areas of emphasis and multimodal centers and districts

Top 10 Congestion Management Process Plan Areas of Emphasis	**Corresponding Multimodal District**	**Corresponding Multimodal Center**
1. Elm Avenue and I-581	Central District	Downtown Roanoke Center
2. Hollins to Hershberger	Plantation Road - Hollins District	Hollins Center
3. Salem	Downtown Salem District	Downtown Salem Center
4. Cave Spring Corners	Central District	Cave Spring Center
5. Route 419/U.S. 220	Tanglewood District, Clearbrook District	Tanglewood Center
6. Apperson Drive and Route 419	Apperson Drive District	Apperson Drive Center

7. Route 24/Vinton	Central District	Downtown Vinton Center
8. Orange Avenue/Challenger Corridor	Central District	N/A
9. I-81 Exit 150 and Route 11	Exit 150 District, Lord Botetourt District	Daleville Center
10. Brandon Avenue Corridor	Central District	Grandin Center

Congestion Reduction Strategies

Staff researched previous plans and studies to consolidate recommendations for each of the 10 Areas of Emphasis. Strategies to reduce congestion were organized into three broad groups:

CMP Highway Strategies include a variety of approaches including traditional construction (additional lanes, intersection improvements etc.) and Intelligent Transportation Systems (applying operations management and information technology approaches). CMP highway strategies consider both recurring and nonrecurring congestion.

CMP Transit and Transportation Demand Management Strategies consider a variety of non-Single Occupancy Vehicle (SOV) strategies including but not limited to: rideshare, public transportation and park and ride lots. Transit strategies have the potential to alleviate recurring and non-recurring highway congestion by taking additional SOVs off the road.

> *"You can't build your way out of road congestion. More lanes mean more driving. We shouldn't make it easier to drive around the Roanoke Valley. We should make it easier to ride the bus."*
>
> –Survey respondent, 2013 Pedestrian and Transit Vision Plan General Public Survey

CMP Non-motorized Strategies consider pedestrian and bicycle accommodations that can help alleviate for traffic congestion by substituting for SOVs during peak travel hours.

The recommended strategies for each Area of Emphasis can be found in the 2014 CMP Plan.

6.4 Transit Network

The current transit network does not reflect the areas of high congestion as shown previously in the diagram "Proposed Congestion Network". In order for transit to assist with alleviating the traffic in moderate to high congestion corridors (such as Route 419, Orange Avenue, I-581, U.S. 220, Peters Creek Road and Brandon Avenue), the transit system will need to be modified to reflect the real travel patterns within these corridors. Given this new regional focus on traffic congestion the current transit network, when it was designed many decades ago, was not planned with the intent of alleviating traffic congestion. The current network was designed to provide service within three localities: City of Roanoke, City of Salem, and the Town of Vinton. The limits of the present transit service are not sufficient to assist with easing traffic congestion today much less in the future. The Virginia Department of Rail and Public Transportation's Statewide Transit and Transportation Demand Management Update identified the Hollins and Cave Spring areas as currently lacking sufficient transit service based on the 2010 population density. If transit is to be a strategy for managing traffic congestion in addition to providing people with an alternative way to get around, it will be necessary to re-evaluate the transit system as a regional service for the entire TMA.

The region's sole transit transfer facility, Campbell Court, is often at capacity both in terms of the number of people that can be accommodated effectively on the passenger platforms as well as the number of vehicles that can fit, particularly if they are carrying bicycles on the front rack (Figure 6-5). With plans for additional services in the future as well as an increase in the width of future replacement buses, an improvement to the bus transfer center is needed.

Figure 6-5. Passengers experience crowding at Campbell Court.

6.5 Performance measures and monitoring strategies

The ten primary road performance measures identified in the CMP are categorized as traffic congestion, public sentiment, and transportation modes that alleviate road congestion.

Primary traffic congestion performance measures:

1. Average Annual Daily Traffic
2. Volume over Capacity ratio and/or Level of Service
3. Average Travel Time
4. Peak Hour Volume

<u>Public sentiment performance measure:</u>

5. Percent of the population reporting being satisfied or highly satisfied with travel conditions

<u>Road congestion alleviation:</u>

6. Annual Transit Vehicle Revenue Miles Per Capita
7. Annual Transit Passenger Miles Traveled Per Capita
8. Number of Park and Ride Lots and Spaces
9. Bicyclist and Pedestrian Counts on Road Network
10. Bicyclist and Pedestrian Counts on Greenways

<u>Additional CMP Transit Performance Measures:</u>

- Annual Unlinked Passenger Transit Trips
- Annual Unlinked Passenger Transit Trips Per Capita
- Annual Passenger Miles Traveled
- Annual Smart Way Connector Bus Ridership
- On-time performance (not currently measured)
- Passenger crowding (not currently measured)

Trends for road congestion alleviation performance measure (#6-10) and additional transit performance measures are shown in Figure 6-6.

CHANGE IN TRENDS OF REGIONAL PERFORMANCE MEASURES					
No.	**Performance Measure**	**Desired Trend**	**Change from 2012 to 2013**	**Change from 2013 to 2014**	**Change from 2014 to 2015**
	Primary Traffic Congestion Performance Measures				
6	Annual Vehicle Revenue Miles per Capita	Upwards	0.96 or 6%	1.05 or 6%	NO DATA
7	Annual Passenger Miles Traveled per Capita	Upwards	3.79 or 5%	0.52 or 0.6%	NO DATA
8	# of Park and Ride Lots and Spaces	Upwards	220 - Unchanged	Unchanged	Unchanged
9	Number of bicyclists by location③	Upwards	57 or 25%	NO DATA	NO DATA
10	Number of greenway users by location③	Upwards	36,941 or 10%	34,484 or 10%	NO DATA
	Additional CMP Transit Performance Measures				
	Annual Unlinked Passenger Transit Trips	Upwards	107,887 or 5%	3,200 or 0.1%	NO DATA
	Annual Unlinked Passenger Transit Trips Per Capita	Upwards	0.83 or 5%	.02 or 0.1%	NO DATA
	Annual Passenger Miles Traveled	Upwards	492,219 or 5%	67,008 or 6%	NO DATA
	Annual Smart Way Connector Bus Ridership	Upwards	3,489 or 25%	NO DATA	NO DATA

③ Many locations during the 2013 counts had no data, significantly lowering the average, although lower than the previous year.

Figure 6-6. Performance measure trends

Road Congestion Alleviation Performance Measures

Data for individual road congestion alleviation performance measures are published in the RVTPO's Annual Performance Measures Report. CMP performance measures #9 and #10 relate to non-motorized transportation. Non-motorized performance is monitored through the Regional Greenway and Trail Users Count Program (ongoing) and the National Bicycle and Pedestrian Documentation Project (NBPD) (annually). The NBPD has been conducted annually since 2012.

The Regional Greenway and Trail Users Count Program collects:

- total counts
- date and time of each count
- hourly, daily, weekly, and yearly use totals and averages

User counts are conducted at:

- Lick Run Greenway
- Mill Mountain Greenway
- Murray Run Greenway
- Roanoke River Greenway (Roanoke)
- Roanoke River Greenway (Salem)
- Tinker Creek Greenway

Bus Stop Activity

Although not reported on the 2015 Annual Performance Measures or included in the CMP, the National Transit Database (NTD) survey data is collected and analyzed every three years. One outcome of this survey is the Bus Stop Activity Index (Figure 6-7). The activity index indicates the most active bus stops on the system have the greatest potential to diverting vehicle trips to transit and are most likely to experience overcrowding themselves.

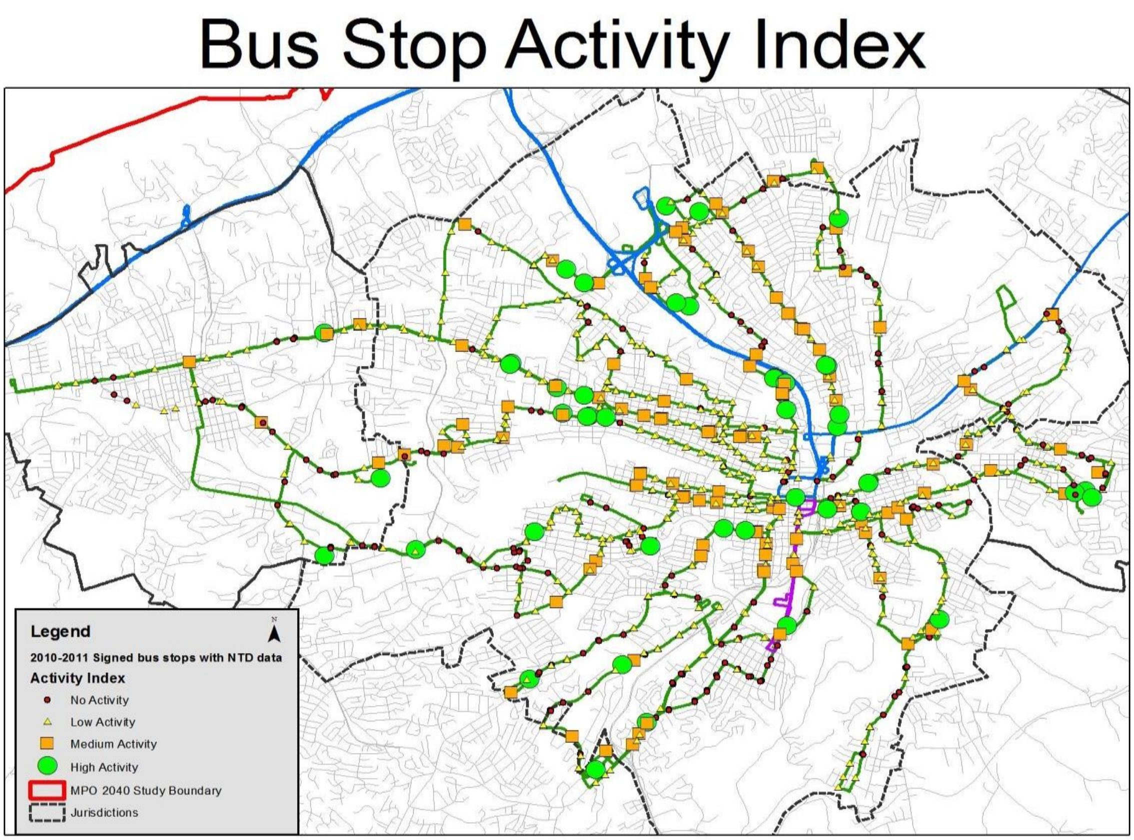


Figure 6-7 Bus Stop Activity Index

6.6 Progress

Since the CMP was adopted in 2014, two projects have been completed that address Area of Emphasis #1: Elm Ave and I-581.

At the Elm Ave and I-581 interchange:

- Widening bridge by one lane on each side (north and south)
- Redesigning and extending entrance and exit ramps to accommodate large trucks
- Constructing new bridges to accommodate additional lanes
- Widening both off-ramps by one lane

Completion of the Valley View Blvd and I-581 interchange:

- Diverging diamond interchange
- Auxiliary northbound lane from Valley View exit to East Hershberger Rd. exit
- Auxiliary southbound lane from Valley View exit to West Orange Ave. exit

7.0 Environmental Justice Assessment

Transportation infrastructure today in the Roanoke Valley is built with intentions of providing an array of benefits to community members. However, like all transportation planners, we face a reality that even well-intended transportation projects may disproportionately burden certain populations, including low-income, minority (non-white), disabled, Limited English Proficiency (LEP), and elderly communities. These communities may suffer from a range of transportation project externalities, including displacement, neighborhood fragmentation, air pollution, noise, diminished housing values, lack of access to services, land degradation, and traffic danger.

It is often the case that these burdens on disadvantaged communities arose not spontaneously from current projects, but instead have developed over decades of deeply-rooted historical systems of economic and social injustice that leave a legacy of built and durable infrastructure that still affect today's neighborhoods. Therefore, even if current urban planning processes and legal structures take environmental justice into account, the accumulated effects of historical environmental injustice on project sites must not be overlooked when planning new projects. Conversely, there are many benefits that come with transportation projects, so a lack of transportation projects may also disproportionately burden these communities, by depriving them access to work, food, and services. Therefore, in order to achieve equitable transportation planning, it is critical to weigh the "benefits and burdens" of transportation plans, in effort to ensure that populations are not disproportionately burdened or deprived of benefits associated with transportation plans.

This assessment of disproportionate burden is not only critical from an ethical standpoint, but is also a federal requirement. In 1994, President Clinton implemented Executive Order 12898, requiring federally funded agencies to identify these disproportionate burdens and to work towards goals of human health and environmental protection for all communities (Federal Register 1994, Executive Order 12898). The federal government made "environmental justice" the official term to describe this goal, and officially defines the term as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." (EPA.gov). Clinton's action expanded upon Title VI of the Civil Rights Act of 1964, which "prohibits discrimination on the basis of race, color, and national origin in programs and activities receiving federal financial assistance" (US Department of Justice, 2015). A number of additional federal and state laws also come into play with environmental justice assessment requirements[1].

These laws establish requirements to assess environmental justice issues, but the ways in which to do so are largely left up to interpretation. To enable planning agencies and municipalities to effectively identify and address environmental justice issues, it is essential that reliable, flexible, and usable environmental justice assessment frameworks are made available. Without effective assessment techniques, there is a risk that environmental justice populations will suffer the consequences if ineffective assessments lead to either approval of disproportionately burdensome projects or cancellation of projects that would have been beneficial. Effective assessment of environmental justice (EJ) in transportation planning requires assessment frameworks that methodologically unify three interests: those of federal and state bodies enforcing EJ assessment requirements, those of metropolitan planners facing capacity constraints, and, most importantly, those of the protected populations themselves.

There are a multitude of theories on how best to measure environmental justice (EJ) for transportation plans. Environmental justice is a qualitative and complex idea, making it very difficult to measure quantitatively. However, even though such effects can never be perfectly measured, the presence of a quantitative framework is still critical for helping to ensure that EJ populations are not disproportionately affected by transportation infrastructure or lack thereof. Within the past decade, a full range of EJ frameworks have been developed that involve a variety of data sources, assessment scales, population indicators, statistical methods, skills needed and effects measured. Based on an analysis of over 30 modern frameworks, most modern EJ frameworks use U.S. Census Bureau data and ever-improving Geographic Information Systems (GIS) software, and include poverty and racial characteristics in their evaluation. Outside of these core elements, there is great variation in the new methods being used across the country. Because each project and each community differs, there is no

[1] National Environmental Policy Act (1969), 23 USC 109(h) Federal-Aid Highway Act (1970), the Uniform Relocation Assistance and Real property Acquisition Policies Act (amended in 1987), the 7CFR 658 Farmland Protection Policy Act (1981, amended in 1994), 23 CFR 771: Environmental Impact and Related Procedures (1987), TA 6640.8A Guidance for Preparing and Processing Environmental and Section 4(f) Documents (1987), FHWA Environmental Policy Statements (1990 & 1994), Intermodal Surface Transportation Efficiency Act (ISTEA) (1991), Proposed Department of Transportation Order on Environmental Justice (1996), TEA-21 (1998) and SAFETEA-LU in 2005

one framework that "best" assesses EJ burdens and benefits. However, there are several new highly recommended methods that each work well in specific contexts.

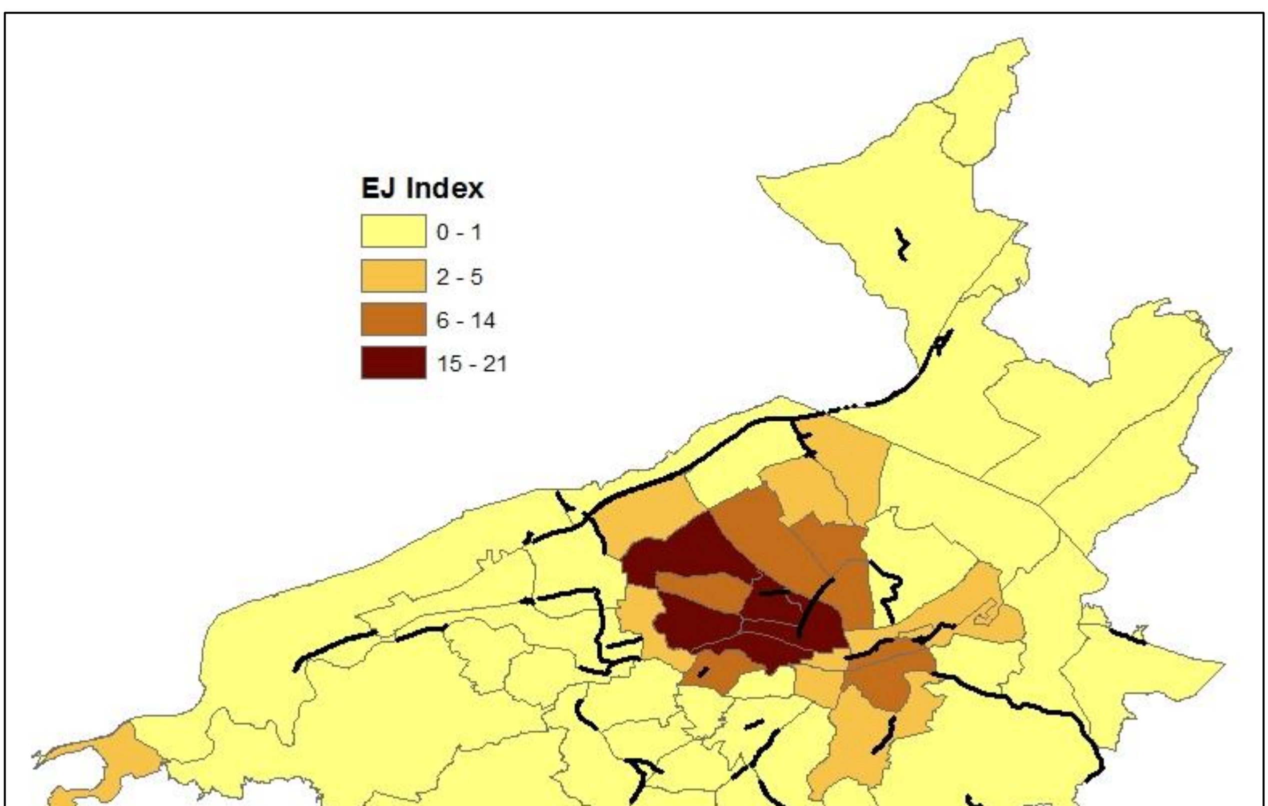
In response to new tools and updated regulations[2], the RVTPO studied:

> What framework can we use to assess environmental justice burdens and benefits of long-range transportation projects in a way that a) fulfills federal and state requirements, b) incorporates the latest "best practices", c) is feasible given constraints on staff and financing, and d) incorporates principles of equity, as defined by the protected populations themselves?

The RVTPO was fortunate to have had a Virginia Tech graduate student intern, Allison Homer, study this question and develop an Equitable Environmental Justice Assessment Model (EEJAM) for her Master's thesis topic. The RVTPO Policy Board formally adopted EEJAM as part of the Title VI Plan in January 2016, where a detailed explanation and description of EEJAM 2016 can be found.

7.1 Community Profile and EJ Index

Tier 1 of EEJAM is Community Profile and EJ Index. The EJ Index for the entire region can be calculated ahead of assessment of individual projects (Figure 7-1). The EJ Index is calculated based on the percentage of total households (for Poverty) or total population (for Race/Ethnicity and Limited English Proficiency). If the percentage of households or population is within 0.25 standard deviations of the average for the region, the score is 0. Every 0.25 standard deviations above the average is 1 point, with a maximum possible of 10 points. The sum of the EJ Indices for Poverty (Figure 7-3), Race/Ethnicity (Figure 7-2), and Limited English Proficiency (Figure 7-4) is used to calculate the EJ Index (Figure 1A). Basing EJ assessment on number, rather than percent, of affected households or population captures densely populated areas and fails to capture more rural areas. Furthermore, creating an index for each of the three separate EJ factors permits combining them into a single EJ factor.



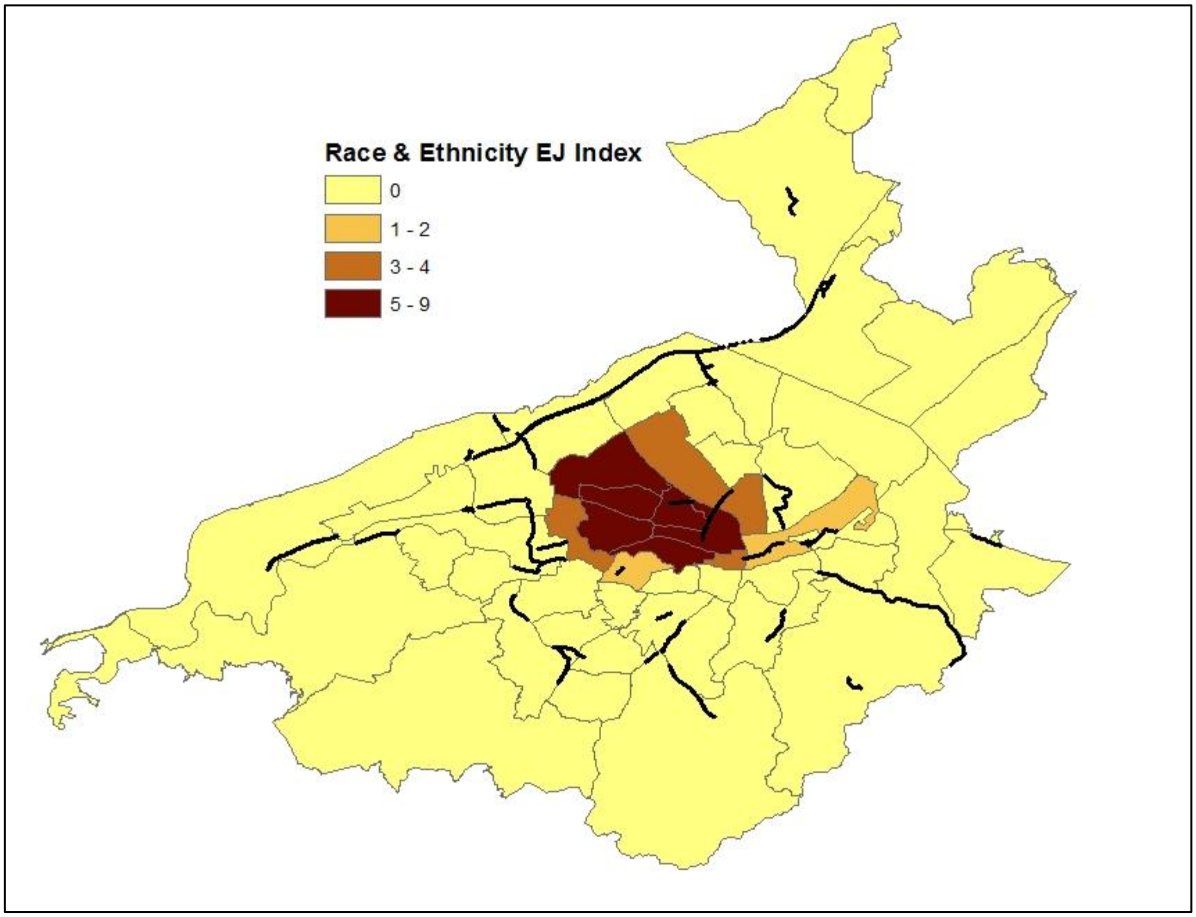


Figure 7-2. EJ Index for race and ethnicity with fiscally constrained list of projects overlaid.

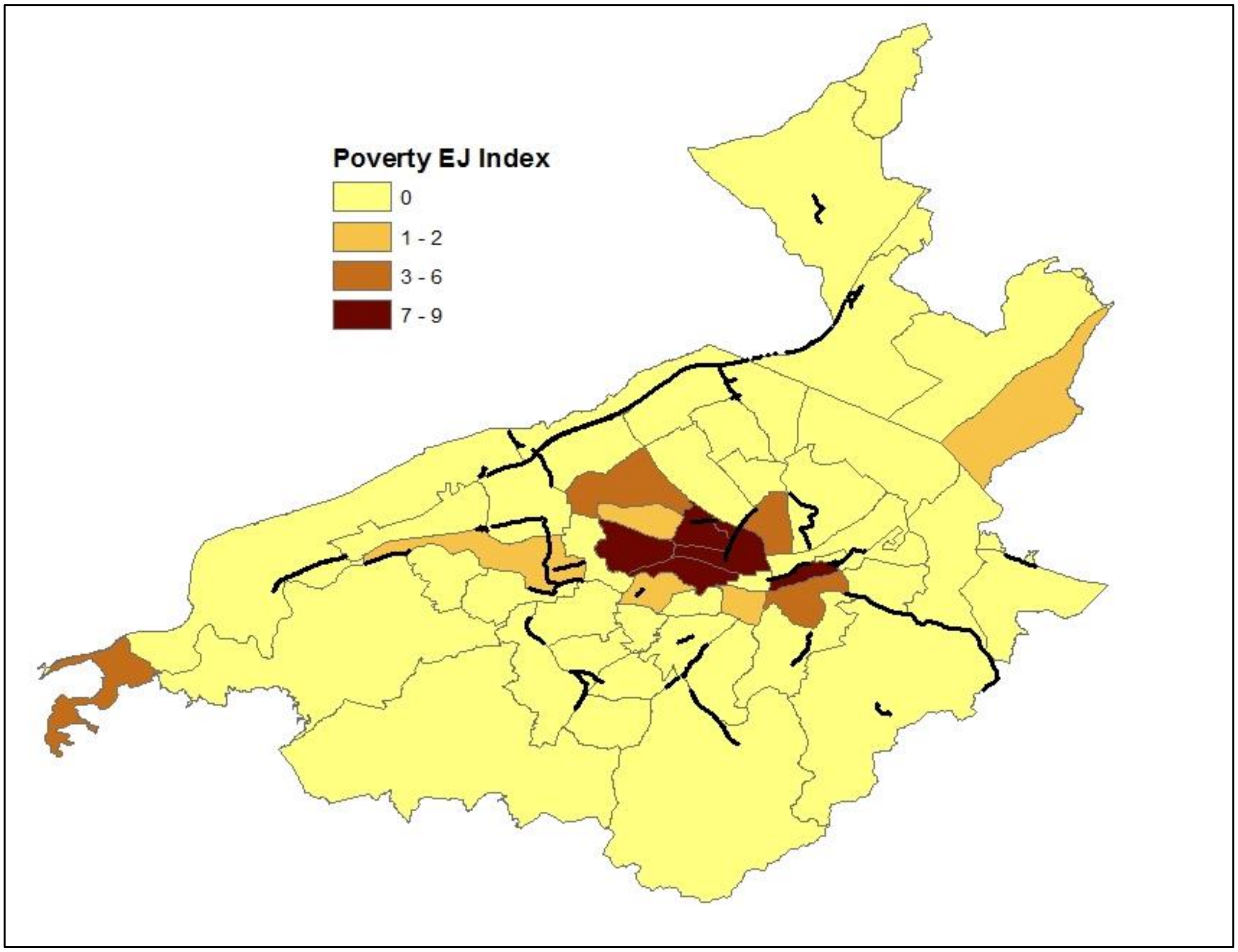


Figure 7-3. EJ Index for poverty with fiscally constrained list of projects overlaid.

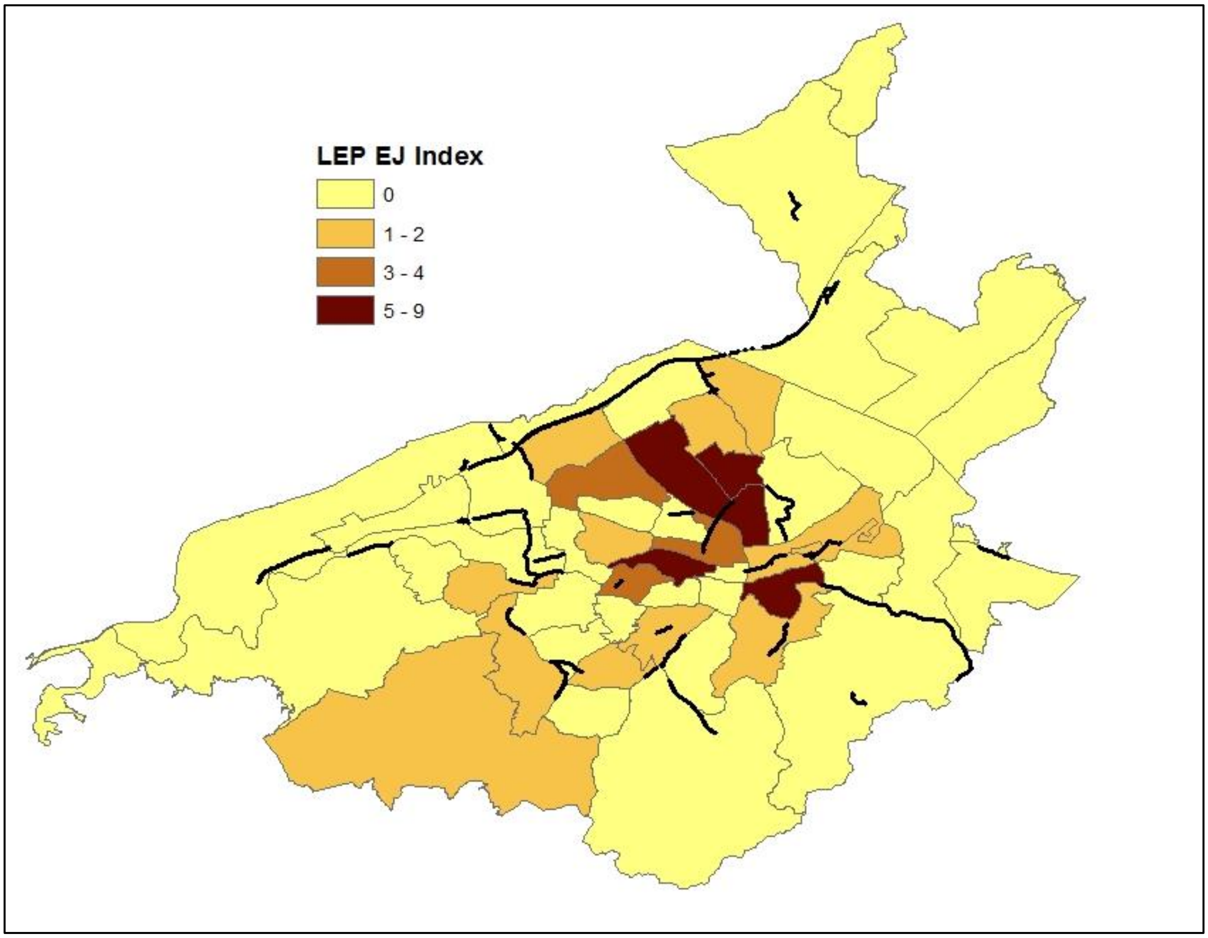


Figure 7-4. EJ Index for limited English proficiency with fiscally constrained list of projects overlaid.

Roanoke Valley Transportation PLANNING ORGANIZATION
Staffed by the REGIONAL commission

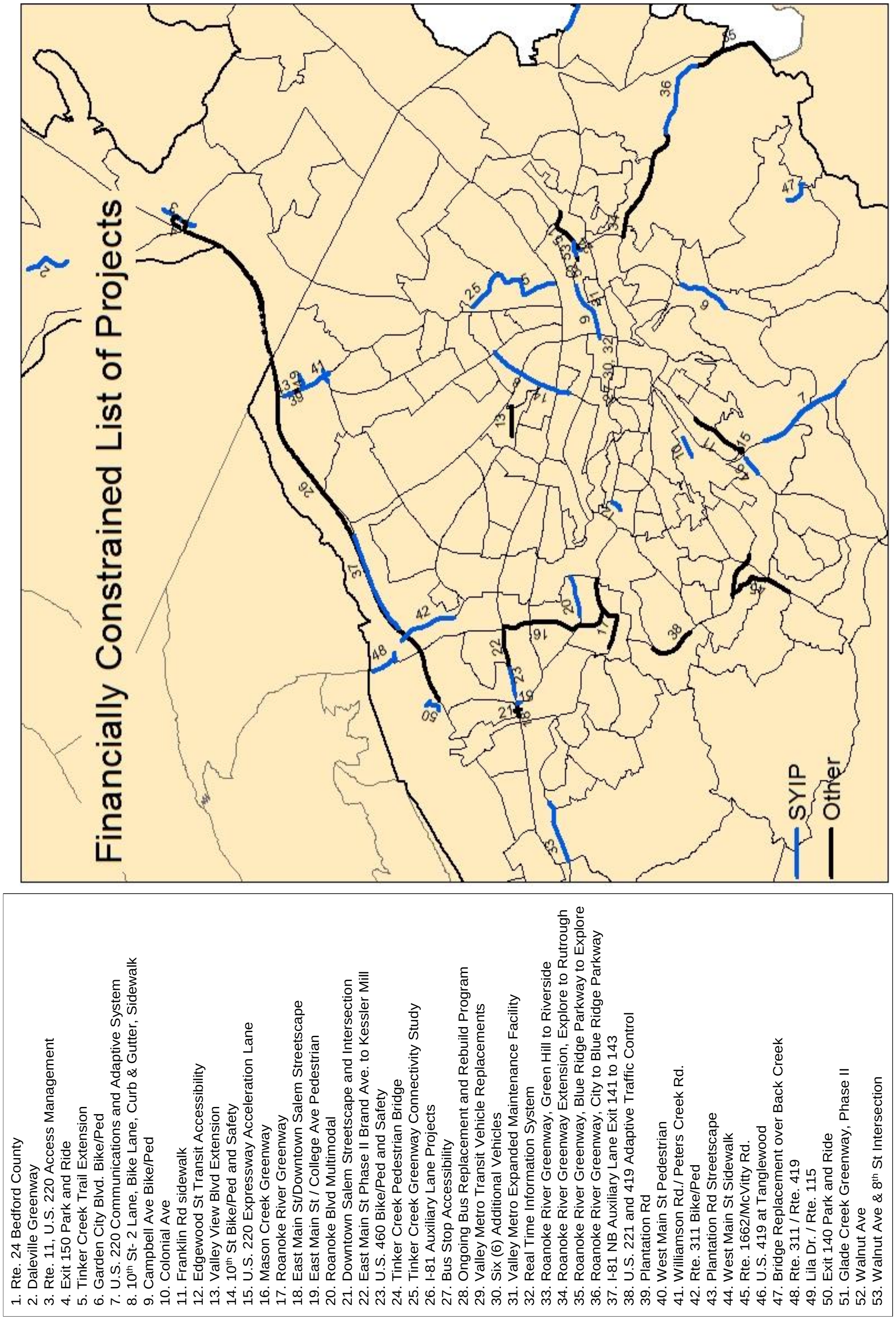


Figure 7-5. Projects on the fiscally constrained list overlaid on census blocks. Projects in blue are also on the Six-Year Improvement Program.

7.2 Assessment Method Flowchart

Funding allocation

Tier 2 of EEJAM is the Assessment Method Flowchart. Answering a series of questions, planners can choose among several tools to assess each of six Environmental Justice Concerns:

- Air Quality,
- Water Quality,
- Safety,
- Accessibility,
- Noise, and
- Land Prices & Property Values.

Most projects will be eligible for Categorical Exclusion, meaning they do not need to be further analyzed for effects on the six concerns. However, a key element of EEJAM is the assessment of benefits as well as burdens. Therefore, the EJ Index (Figure 7-1) was overlaid with projects from the Financially Constrained List (Figure 7-5) to determine which projects are in EJ areas, then determined the percentage of funding allocated to projects within EJ areas (Table 1).

One assumption is that the funding is proportional to the benefits of the project to those areas. A limitation of this assumption is that those *traveling through* the area may experience more of the benefits while those *living in* the area may experience more of the burdens. Funding of projects in the Financially Constrained List is not disproportionally allocated toward non-EJ areas; if anything, it is disproportional toward EJ areas (Table 11).

It is the intent of the RVTPO to explore EJ further in project scoping process for regionally significant projects.

Table 11 Funding allocated to EJ areas

	EJ Areas	**Non-EJ Areas**	**Total**
Population in EJ Tracts	127,155	133,764	260,919
Percent of Total Population	49%	51%	100%
Project Funds*	$195,728,641	$115,341,257	$311,069,898 *
Percent of Total Project Funds	63%	37%	100%

*Financially Constrained List projects that could be mapped. For example, additional buses were not included.

8.0 Travel Demand Model

To estimate travel demand, the RVTPO Travel Demand Model follows a standard four-step process which includes trip generation, trip distribution, and highway assignment. Trip generation determines the total number of trips produced and attracted each day for each trip purpose. Trip distribution finds the number of person trips that go between all pair of zones. Highway assignment determines which route highway and transit trips will follow. Most of the information in this chapter is copied or adapted from the VDOT Technical Methodology Report written by The Corradino Group, a consulting group that is a national leader in transportation engineering.

Figure 8-1 shows the macro flow chart of the RVTPO Travel Demand Model and identifies all the user-supplied input files that are used by each of the modules. It also shows all RVTPO specific programs used in these modules.

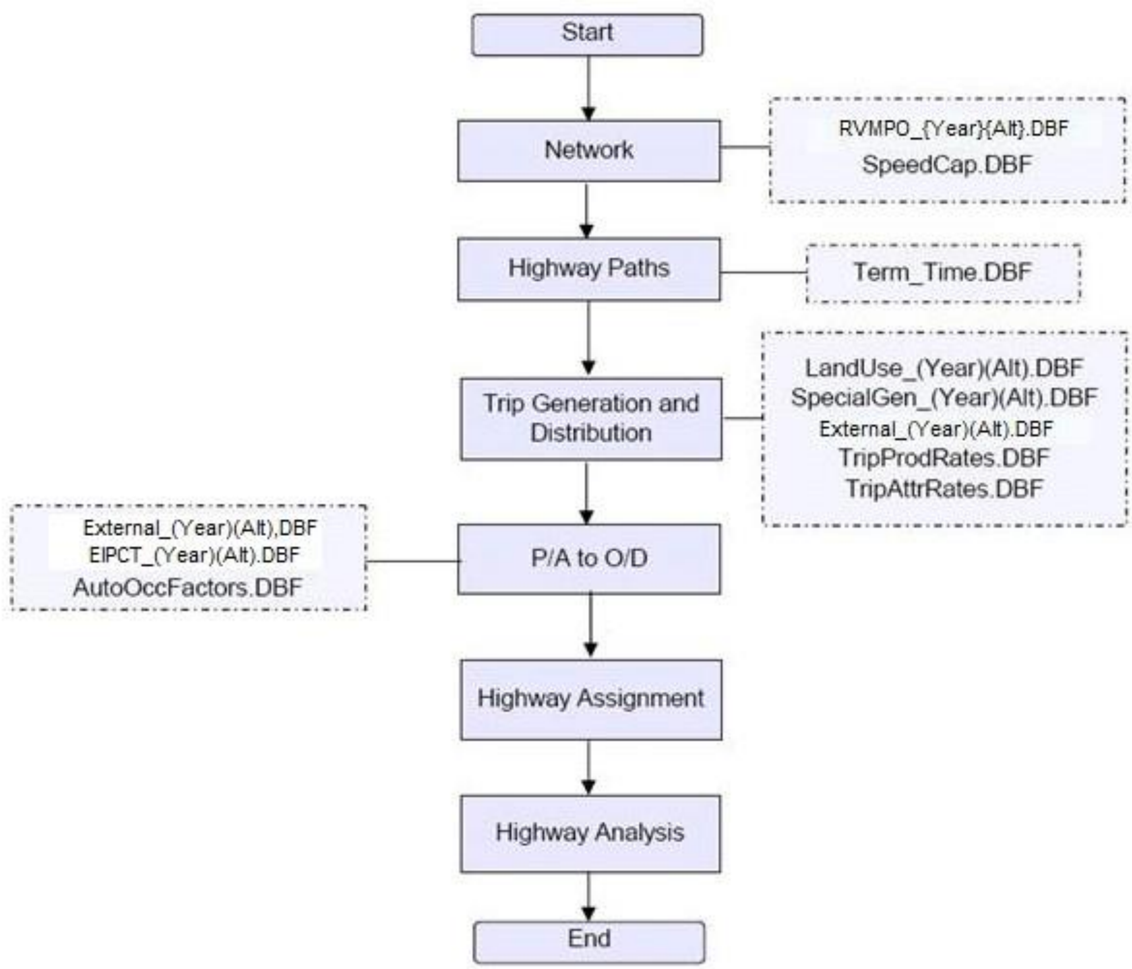


Figure 8-1 Full Model Macro Flow Chart

The RVTPO model quantifies the travel anticipated on the transportation system. The results are then used to estimate the impact of constructing new or improved highway and transit facilities and of implementing new transportation services or demand management activities.

The year-2000 RVTPO Travel Demand Model was updated to a base year of 2005 for the Cube Voyager transportation forecasting platform. It had two main tasks: identifying and implementing short term improvements.

The 2005 RVTPO Travel Demand Mode follows the guidelines as established in the Virginia Travel Demand Modeling Policies and Procedures Manual (PPM). However, guidelines regarding data storage formats and directory structure have not yet been specified in the PPM guidelines. VDOT and The Corradino Group staff jointly established standards for these missing guidelines, and these guidelines have been implemented in other VDOT models -- such as those in Fredericksburg and Hampton Roads -- as well as in the RVTPO Travel Demand Model.

While the Fredericksburg Area MPO (FAMPO) model served as a basis for the RVTPO model, the RVTPO model includes several enhancements and additional features.

8.1 Model Enhancement Summary

The following is a list of the key enhancements and features of RVTPO model:

- The speeds and capacities are contained in an external file, which is read by the NETWORK and HIGHWAY step scripts.
- The trip generation program has been borrowed from the FAMPO model after customizing it for the Roanoke region. The code does not include any hard-coded values for trip rates and other general parameters. All the system parameters are either accessed from Catalog Keys or from external files. The program uses land use data from a Dbase file. The production and attraction rates are accessed from TripProdRates.DBF and TripAttrRates.DBF files, respectively.
- The trip generation program includes special generator trips for all purposes. In the previous version, trip generation program could only handle HBW special generator trips. The special generator trips have been more extensively used in the Roanoke model.
- A Fratar model was developed for creating the analysis year external trip table. This is done by developing traffic estimates for external stations for future years. The base year trip table resides in the “Calibration Constants” folder, while the external traffic count file, (External_(Year)(Alternative).DBF, is a scenario specific file.
- The auto occupancy rates are part of a Dbase file (AutoOccFactors.DBF), which resides in the “Calibration Constants” folder.
- The convergence criteria for the highway assignment process have been revised and include features available in Cube Voyager 5.0.2

8.2 Trip Generation

Trip generation determines the number of person trips that originate or are produced in any specific zone and those that are destined for or attracted to that zone. This section highlights several key processes of the RVTPO trip generation process and summarizes the validated rates and results. The initial step of the model applies the Fratar model, an iterative proportional fitting model, to factor external survey trips to a year-2000 base, which used a combined matrix for external to external (E-E) and external to internal (E-I) trips. Highway external trips are divided into E-I person trip ends and E-E through vehicle trip ends. E-I trip ends are further divided by type of trip end (trip productions and trip attractions.) The E-I trip productions and attractions by trip purpose are distributed and assigned with the I-I trip ends.

External stations are intersections between the network and the study area boundary. These stations serve as ports of entry and exits to/from the study area. Each station was coded with a TAZ number (900

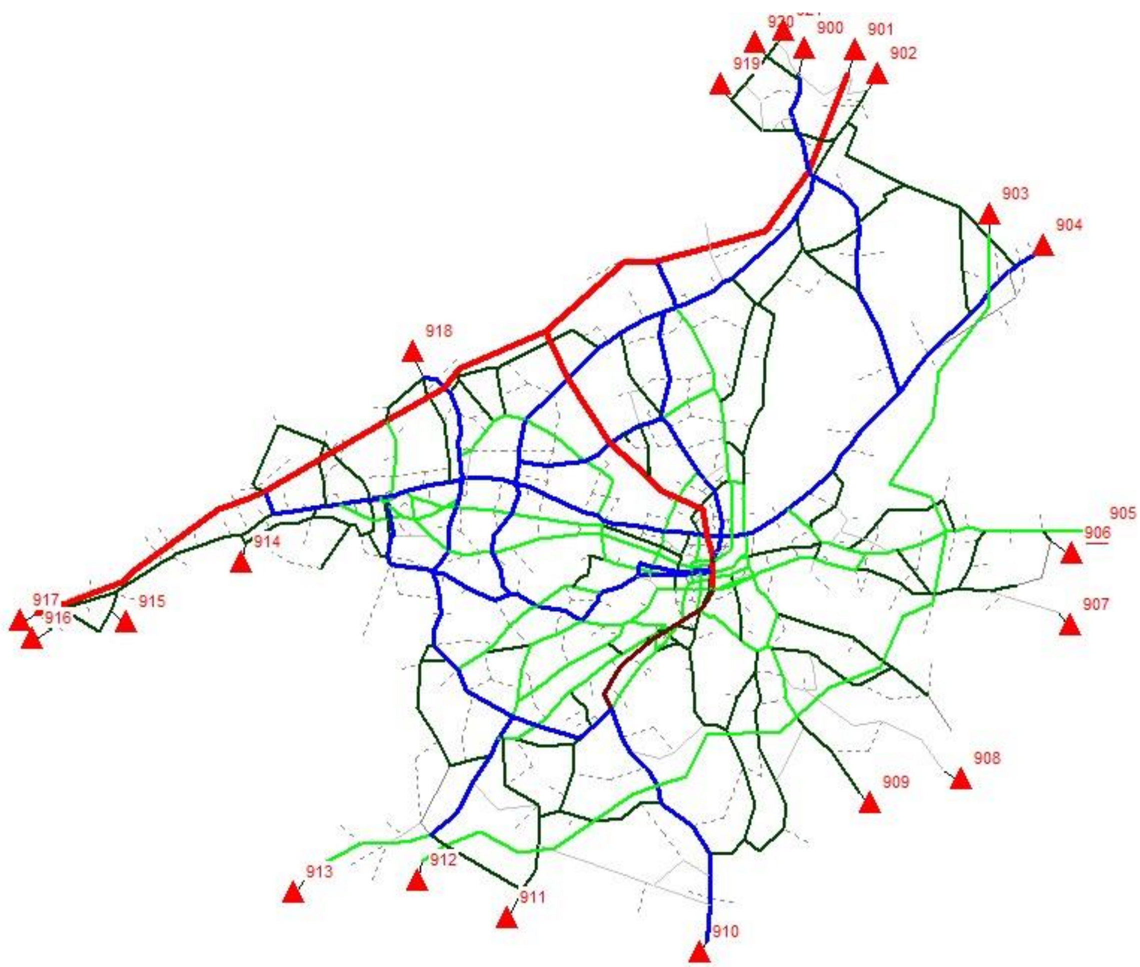


Figure 8-2 External Station Traffic Counts

to 921). Two of these stations (903 & 912) represent the Blue Ridge Parkway and are not used to simulate any external traffic. External stations are shown in Figure 8-2.

8.2.1 Model Enhancements and Validation

Future year scenarios in the RVTPO model have been modified substantially to make better use of available information on traffic flows and to be easier for the user to configure as new data on travel patterns become available. The new process, which starts with a separate E-E matrix, uses a regression model for predicting the E-I trips. The year 2000 E-E matrix serves as the seed matrix, and the analysis year matrix is developed by factoring the seed matrix using a Fratar model, so that the row and column totals match the user supplied traffic counts for E-E trips at that station. These traffic counts contain both E-E and E-I trips. These two trip purposes are allocated by predetermined factors specific to each external station.

The enhancements to both I-E and E-E processes that were adopted in the 2000 model update were also continued in the current model update study. The modified process identifies I-E and E-I as separate trip purposes. The I-E/EI trips in the modified process were modeled as part of the internal trip purpose.

Validation of the E-E trips file was based on extrapolation and professional judgment. The E-E trips file validation generally relied upon recently collected roadside or cordon line surveys to determine the proportion of the vehicle traffic that passes through the study area. The final EETRIPS file is summarized in the following table.

External to External Trips
Initial external station productions and attractions for I-E person trips were developed from traffic counts. After the completion of a simulation run, the assigned volume at the external links may not sum to the counts. The validation of the external model adjusted both the I-E person trips and E-E vehicle trips to match the assigned volumes with the traffic counts.

The distribution process determined the number of I-E trips (present in the internal trip tables.) Some adjustments to productions and attractions were made so that the model produced the desired volumes at the external stations. The travel times on the external connectors represent the average time from the station to a typical destination outside the study area. The trips produced at an external station are assumed to be equal to the attractions (a very standard assumption), which is equal to half the daily volume on that link.

EXTERNAL STATION	TRAFFIC COUNT
900	11,100
901	37,000
902	5,300
903	-
904	15,600
905	8,000
906	3,000
907	4,000
908	100
909	5,400
910	24,500
911	1,400
912	-
913	7,200
914	1,200
915	1,100
916	8,600
917	49,100
918	9,200
919	2,560
920	950
921	1,150

8.2.2 Results and Comparisons

The I-E trip ends were developed by subtracting the E-E trip ends from the count. The I-E trip ends were then divided by two to obtain the directional values and multiplied by an auto occupancy rate to obtain person trips. The splits of I-E and E-I trips are summarized in the following table.

External Internal Traffic Counts - Base Year (2005) Model

EXTERNAL STATION	TRAFFIC COUNT	PERCENT EXTERNAL INTERNAL	EXTERNAL INTERNAL TRIPS
900	11,100	93%	10,367
901	37,000	40%	14,652
902	5,300	95%	5,009
903	-	0%	-
904	15,600	86%	13,369
905	8,000	95%	7,592
906	3,000	98%	2,931
907	4,000	100%	4,000
908	100	99%	99
909	5,400	55%	2,970
910	24,500	100%	24,476
911	1,400	82%	1,144
912	-	74%	-
913	7,200	100%	7,178
914	1,200	99%	1,192
915	1,100	77%	844
916	8,600	95%	8,196
917	49,100	60%	29,607
918	9,200	98%	9,016
919	2,560	98%	2,506
920	950	100%	950
921	1,150	100%	1,150

Adjustments were made at some external stations. The actual I-E trip ends at each external zone were determined by the trip distribution. The trip ends thus had to be adjusted so that post distribution trip ends more closely matched traffic counts.

Several runs were made to validate the external station volumes. The I-E productions, attractions, and extra-regional times for each external station were modified through the validation runs to replicate each of the external station volumes to traffic counts. With the exception of a few low volume roads (within one percent), all external station volumes closely match the actual traffic counts.

This section provides a brief description of the modified trip generation program by explaining the functions of each subroutine. It then provides a discussion of several key issues related to the lifestyle trip generation program.

A combination of simple linear and multiple regression models were used in RVTPO's trip generation model. Simple regression models were used for all trip purposes but one, Non-Home Based. The household and population data at the zonal level was classified into different household occupancy levels. The trip production file contains county-specific trip rates corresponding to different household occupancy levels. Different trip rates were then applied to the household data for all home based trips and employment data from the non-home based trips. The trip generation model estimates productions (trip ends at a person's home) and attractions (trip ends at the non-home end of a trip.) NCHRP 365 suggests using different trip rates for different household occupancy levels because "the variation in trips between household sizes is so large that models without this variable are inferior in approximating travel patterns in a region."

8.2.4 Trip Productions

The trip productions rates from the FAMPO model were applied to the zonal data to get the trip productions. The table below shows the trip production rates for Roanoke. Currently, only trip rates for county 3 are being used for the Roanoke region.

Trips were ultimately categorized into the four traditional purposes of Home Based Work (HBW), Home Based Shopping (HBSH), Home Based Other (HBO), Non-Home Based (NHB), integrating Internal External (IE) and External Internal (EI) counts.

Trip Production Rates

COUNTY	1 PERSON PER HH	2 PERSON PER HH	3 PERSONPER HH	4 PERSONPER HH	5 PERSON PER HH	% IX HBW	% IX HBSH	% IX HBO	% IX NHB	% HBW	% HBSH	% HBO
1	3.43	6.68	12.10	15.60	21.70	0.54	0.08	0.15	0.28	0.18	0.18	0.30
2	3.00	6.20	11.00	15.40	21.20	0.22	0.08	0.15	0.28	0.18	0.18	0.30
3	4.12	7.80	11.40	16.00	19.10	0.20	0.08	0.15	0.28	0.18	0.18	0.30
4	3.48	6.87	11.90	16.50	21.10	0.32	0.08	0.15	0.28	0.18	0.18	0.30
5	3.00	5.90	9.48	13.30	23.30	0.40	0.08	0.15	0.28	0.18	0.18	0.30

8.2.5 Trip Attractions

The HBW trip attraction rates for each of the trip purposes are shown on the next page. The attractions were also borrowed from the FAMPO model. Note that the coefficients for the HBW, HBSH, and HBO trip equations are derived so that the total productions are equal to the total attractions for the respective purpose. Just as in trip production, the Roanoke model uses trip attraction rates from county 3 in the following table.

Trip Attraction Rates

COUNTY	HBW	HBSH	HBO HH	HBO NON-RETAIL	NHB RETAIL	NHB NON-RETAIL	NHB HH	% IX HBW	% IX HBSH	% IX HBO	% IX NHB
1	1.40	6.00	1.90	0.80	7.20	0.70	1.10	0.19	0.06	0.10	0.19
2	1.40	6.00	1.90	0.80	7.20	0.70	1.10	0.22	0.06	0.10	0.19
3	1.40	6.00	1.90	0.80	7.20	0.70	1.10	0.20	0.06	0.10	0.19
4	1.40	6.00	1.90	0.80	7.20	0.70	1.10	0.32	0.06	0.10	0.19
5	1.40	6.00	1.90	0.80	7.20	0.70	1.10	0.40	0.06	0.10	0.19

8.2.6 Generator PROCESS

Activity within some zones is significantly different from the regional averages. The differences in predicted trips would be large enough to change planning decisions on specific roadways or transit facilities. These facilities might include some airports, recreation and amusement areas, regional shopping centers, military and government complexes, hospitals, and colleges and universities. These facilities are often treated as special generators. The result is that the sums of productions and attractions are equal, and the special generator portions of a TAZ's trip attraction are not adjusted. The RVTPO model has a process in which the special generated trips, which are user inputs, are added to the final trips at a zonal level.

8.2.7 Results and Comparisons

The number of unadjusted and adjusted productions and attractions in the 2005 validated model are presented in the following table. In the 2005 model, more than 700,000 person trips are generated. The overall trips per household and employee are 7.28 and 5.23, respectively. The trips per household and trips per employee are lower than recommended by NCHRP, but the characteristics of the Trip Generation Summary RVTPO Model - Base Year (2005) Roanoke area and the final model calibration, in which we compare the model reported volume and ground traffic counts, justify such low trip numbers.

Trip Generation Summary

TRIP PURPOSE	TRIPS
Home Based Work	123,331
Home Based Shopping	142,618
Home Based Other	219,854
Non-Home Based	215,832
Total	**701,635**
Person Trips per Household	7.28
Person Trips per Employee	5.23

8.4 Trip Distribution

Except for through vehicles, RVTPO uses the Cube Voyager distribution program to distribute trips between the production and attraction zones for all trips and purposes. The results of the trip distribution step become an input to the P/A to O/D conversion step, where person trips are converted to vehicle trips. RVTPO trip distribution uses a standard gravity model. The distribution is done using uncongested travel time as a measure of spatial separation.

8.4.1 Highway Paths and Skims

This section describes the enhancements that were used in model validation and then presents the key modeling data. Minimum impedance travel paths are calculated using time over the highway network. In building paths, a turning penalty file is used. Paths are not built through prohibited movements. Initial paths are built using the link free-flow speeds. Terminal times and intrazonal times are also added.

The RVTPO highway path module uses standard Cube Voyager procedures to build time and distance skim matrices for highway paths. The highway paths are defined as the shortest time path through the portion of the highway network available to all vehicles.

To check the network for coding errors and to ensure reasonable paths were built through the network, Cube Voyager determines the shortest path using the network impedance of time or distance with the summation of link impedances computed. Numerous paths were drawn on the computer screen to make sure that paths drawn were “reasonable”.

In RVTPO, in-vehicle travel time variables are considered as significant in determining the minimum paths between any given pair of zones. In-vehicle travel (IVT) time is the primary variable, which is determined as a function of distance and input speed.

8.4.2 Model Enhancements

Enhancements were made to the RVTPO distribution model by improving the key inputs to the model. These enhancements include the following:

- Conversion of Friction Factors format to DBase
- Frequency distribution of trips with time

Attention has been given to refining production and attraction data as well as trip purpose data and to improving the measure of spatial separation to be sensitive to the impacts of future congestion. The following subsections describe the enhancements incorporated into the trip distribution process.

Internal External (I-E) and External-Internal (E-I) trips are instead included in the internal trip productions and attractions. Thus, the external TAZs (900-921) have productions and attractions associated with them. The trip distribution model determines the number of I-E trips. K factors are not used to influence travel between any origin and destination zones.

Treating external-to-internal and internal-to-external trips as internal trips is one of the key enhancements to RVTPO. Benefits realized from this enhancement include the following:

- Permits trips generated inside of study area to be attracted to locations outside.
- Routine external-internal trip productions can now compete with internal-internal trips for attractions.
- Routine internal-external trip attractions can now satisfy some internal trip productions.
- Trip length distributions from external stations will vary based upon the types of trips made at those points.
- The total number of trips generated by a household is no longer influenced by its location in the study area.

8.4.3 Model Calibration and Validation

The gravity model formulation includes friction factors, and calibration of the gravity model centers on the adjustment of the friction factor component of the equation. For RVTPO, K-factors were not considered due to the reasonable aggregate performance of the gravity model with friction factors alone.

The trip distribution model was calibrated using the guidelines from NCHRP 365. The calibrated friction factors are shown in the figure on the next page.

The 2005 validation of the model started with the calibrated gamma function parameters. The trip distribution validation procedure is an iterative process, where a set of travel time factors is developed for each trip purpose. The model computed trip length statistics, which were then compared to the observed/target trip lengths. Based on the results shown in the following table, no further adjustment was made to the friction factors.

Trip Length and Intrazonal Percentages RVTPO Model - Base Year (2005)

TRIP PURPOSE	AVERAGE TRIP LENGTH (MINUTES)	
	MODEL	NCHRP
Home-based Work	14.81	13-15
Home-based Shopping	13.07	13-15
Home-based Other	12.45	10-14
Non-home-based	12.85	13-15
Internal-External	22.43	-

The validation process generally used in other models could be followed if further validation was warranted. The process of this validation uses an iterative adjustment to the friction factors through use of a "Gamma" function (a function most commonly used for synthesized friction factors). The gamma function is defined in the following form:

$$F(I)_p = a_p * (I ** - b_p) * EXP(-c_p * I)$$

Where,

a_p, b_p and c_p = calibration coefficients for trip purpose "p",
$F(I)_p$ = friction factor for impedance value "I" and trip purpose "p",
I = impedance value, and
EXP = exponential function (base of natural logarithm).

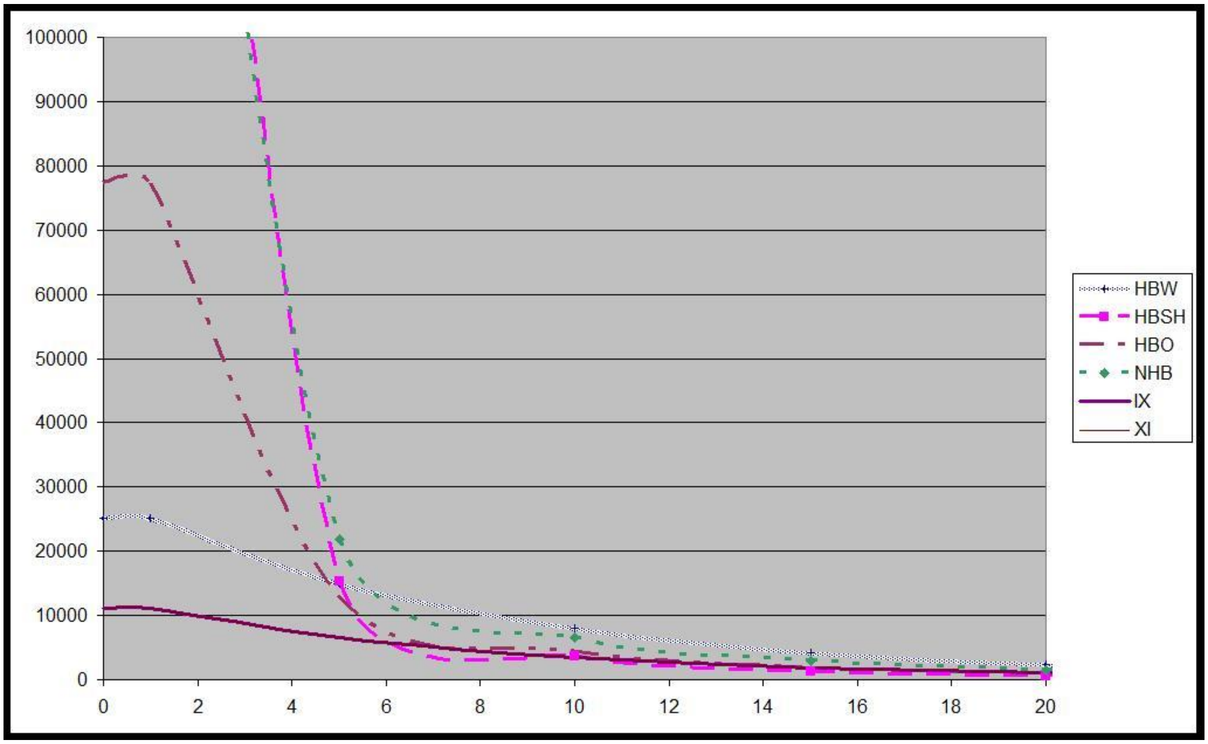


Figure 8-3 Calibrated Friction Factors RVTPO Model - Base Year (2005)

The gamma function usually does a very good job for trip distribution. Further validation of the calibrated friction factors could be done using the “Gamma” function through a non-linear curve fitting technique. This will give the starting point for any adjustment to the calibration coefficient.

The parameter “a” (known as scale factor) can be varied without changing the distribution and is usually not subject to change in model validation. The coefficients b and c, known as shape factors, are usually varied iteratively to match against the target trip lengths and trip length distribution.

8.4.4 Results and Comparisons

In addition to interzonal travel time, the gravity model requires two additional measures of time – intrazonal travel time and out-of-vehicle travel (terminal time). Intrazonal travel time is the time needed for a trip between two sites within the same zone. This time is usually smaller than the interzonal time. Cube Voyager estimates intrazonal time based on the Nearest Neighbor Theory. The theory states that intrazonal travel time is proportional to the amount of time it takes to get to the nearest adjacent zone or zones. The half of the nearest zone IVT time is taken as measure of intrazonal time. In RVTPO, 2 adjacent zones are used to compute the intrazonal travel time during the trip distributions.

Intrazonal trips are not loaded onto network and are effectively subtracted from total trips before assignment. They play a significant role in estimating the local VMT for air pollution analysis. Calibration of intrazonal trips is not easy unless a good sample size of shorter trips exists in the observed database. These trips, in general, are underreported in most household surveys.

Terminal times are the average times required to get in a vehicle and go from the driveway to the street at the origin (production) end of the trip, or to get the average time required to park the vehicle and reach the final destination point at the destination (attraction) end of the trips. Terminal times vary according to the area type of a zone. The values applied for terminal times in the RVTPO are:

AREA TYPE	TERMINAL TIME (MINUTES)	
	ORIGIN	DESTINATION
1. Urbanized Area	2	2
2. Residential	1	1
3. Rural	1	1

Terminal times are added to the in-vehicle travel time for both ends of a trip, resulting in total travel time between a pair of zones. The resulting travel times are ready for input into the gravity model.

Trip length statistics (average and standard deviation) as well as intrazonal trip percentages are summarized for final trip distribution. Since there were no survey reported trip lengths for Roanoke area, the trip lengths were generally compared to NCHRP recommended trip lengths for areas the size of Roanoke.

8.5 Auto Occupancy Factors

Based on the close match between the model trip lengths and target trip lengths as well as reasonable intrazonal trip percentages, calibrated friction factors were not adjusted further in the model validation phase.

Although the final model forecasts only highway auto travel, the initial persontrips developed in the trip generation phase of the model must still be converted to vehicle trips. For the I-E portion of the HBW trips, the auto occupancy factors were derived from the Fredericksburg model, which in turn derived the target numbers from VRE survey data from the Department of Rail and Public Transportation – DPRT. The mode split also includes 1,600 persons (40 busesx40 persons) reported to be using buses (data from GWRPC). This mode split is significant only for the I-X work trips, since this is the only trip purpose with a significant shift to modes other than auto.

The following table shows the final auto occupancies used in the model for all trip purposes. For the internal work trips, the Census and the survey indicated average auto occupancy of 1.14 and 1.13 persons per vehicle, respectively. For the E-I work trips, a value of 1.43 was used since it is probable that less transit and car-pooling would occur for these trips than for the I-E work trips. For the HBO trip purpose, the NCHRP 365 recommends an auto occupancy rate of 1.62 persons per vehicle. The auto occupancy numbers in the Roanoke model are close to NCHRPO recommended numbers.

Auto Occupancy Factors - Base Year (2005) RVTPO Model

PURPOSE	AUTO OCCUPANCY FACTORS
HBW	1.16
HBsh	1.38
HBO	1.55
NHB	1.49
IE	1.43
EI	1.43

8.6 Highway Assignment

The last step of the four-step modeling process is assignment. Highway assignments are normally performed on a daily basis with trips factored to a peak hour for volumeto-capacity calculations. The RVTPO model uses an equilibrium assignment process. Evaluation of the highway assignment model is based on comparisons between traffic counts and model assigned volumes. Simulated traffic volumes are compared to traffic counts in several different ways to determine whether the coded highway network accurately represents the highway systems, and to determine whether the various assumptions used in the model chain are reasonable.

8.6.1 Model Enhancements

The highway assignment model uses an equilibrium assignment algorithm. In equilibrium, all travelers are assigned to their optimum path; no traveler can have a shorter path available. Each assignment of trips from all zones is considered one assignment iteration. Typically, multiple iterations are required before networks can reach full equilibrium. After each assignment's iteration, link speeds are adjusted and the next assignment is performed.

Multiple BPR Curves:

$T_c = T_f + \alpha * (v/c)^b$

Where,

T_c	= congested link travel time
T_f	= link free-flow travel time
v	= assigned volume
c	= link capacity
a,b	= BPR parameters

Link Class	α	β
Centroid Connectors	0.15	4
Freeways/Arterials	0.2	10
Local Streets	0.05	10

An iterative equilibrium technique is used in RVTPO. In this type of assignment, all of the trips are loaded, the paths are revised, the trips are again loaded, and the procedure is repeated until equilibrium is reached. This technique uses the BPR formulation, in which link travel time is recomputed using the following relationship:

$S_c = S_f / \{1 + a (v/c)^b\}$

Where,

S_c	= estimated congested speed
S_f	= link free-flow speed

Another enhancement in the RVTPO highway assignment process is the incorporation of different BPR curves for different types of facilities. This recognizes that each facility type has its own unique characteristics for responding to congestion. For example, freeways can generally handle a higher level of congestion than surface streets before speeds begin to deteriorate. However, with more congestion, speeds deteriorate to stop-and-go conditions much more quickly on freeways than they do on surface streets. It should be noted that the BPR curve is not sensitive to the impacts of signal spacing, timing, and coordination.

The BPR curves determine both the level of congestion (the volume/capacity ratio at which speeds begin to deteriorate) and the rate at which they deteriorate as congestion increases. The adjustment to the BPR curves was done by changing the alpha and the beta values. In addition, speeds and capacities were also adjusted. The facility specific BPR curves, used in the 2005 validated model, are shown in Figure 8-4. A relatively steeper curve was used for freeways, while the curves for arterials were comparatively less steep.

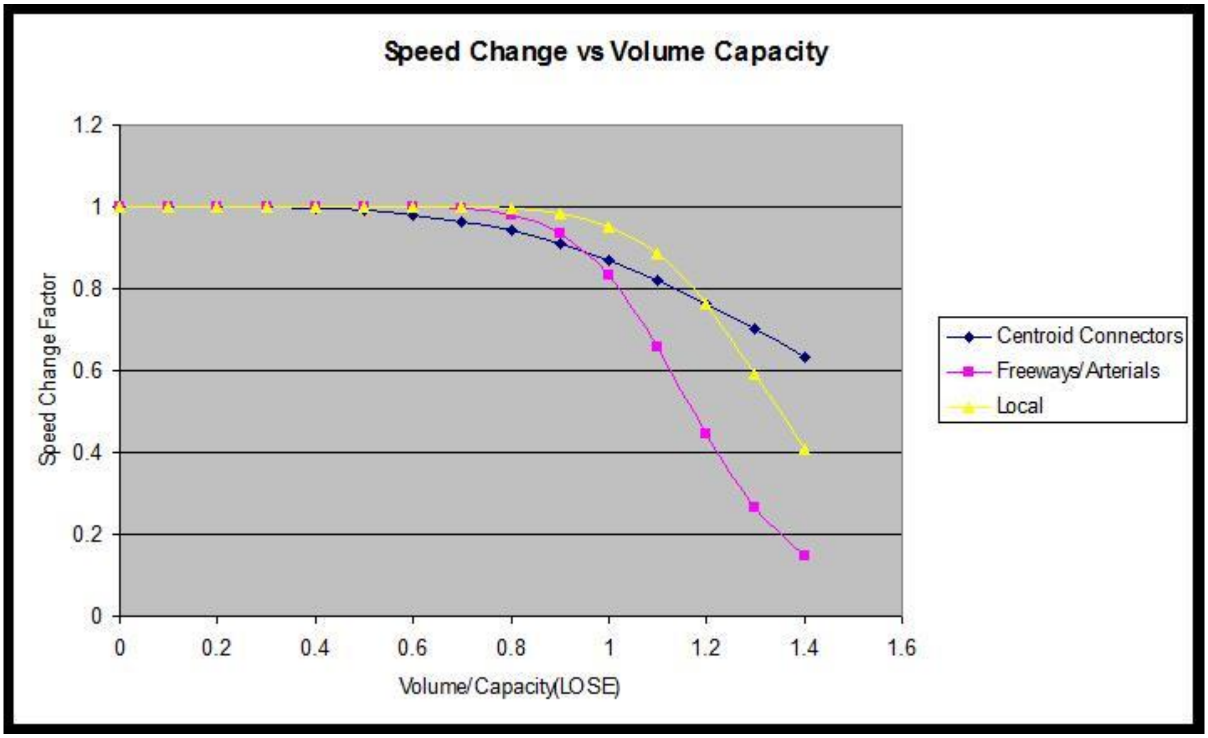


Figure 8-4 Volume-Delay Curves - Base Year (2005) RVTPO Model

For the 24-hour model, Capacity conversion factor (CAPCONFAC) is the ratio between the peak hour traffic and the daily traffic. The programs use the CONFAC parameter to convert hourly capacity to a daily value so that a 24-hour assignment can be made. Historically, the method for obtaining daily capacity restrained traffic assignments has been to multiply the hourly capacity by CAPCONFAC (say, 10) to reflect the daily highway capacity.

8.6.2 Model Calibration

Calibration of a traffic assignment involves an examination of several statistics, most of which are related to actual ground counts taken on various links throughout the network. The traffic counts for RVTPO were identified through a variety of sources. One key to successful highway model validation is the availability of accurate traffic counts, in sufficient quantity. Efforts were made to insure that sufficient counts were included in the model for all available area type and facility type combinations. The percentages of the links with traffic counts by the facility and area types were shown previously in this chapter. Overall, 15 percent of the links have traffic counts. The statistics of number of links and percent of links with traffic counts will be very useful in evaluating the validation results presented in this chapter. For example, there will be less confidence in the evaluation results (say volume-over-count ratio) in locations where fewer links have traffic counts. These counts provide the basis for highway assignment evaluation, and are input into the model as link attributes.

Volume-over-Count and %RMSE (Percent Root Mean Square Error) Statistics

Several indicators are available for determining the overall performance of the highway assignment model. Volume-over-count (V/C) statistics are one of the key indicators. The simple ratio of assigned volume over count was recorded. A ratio of 1.0 indicates exact agreement between the assignment and the traffic count.

PPM recommends a ±15 percent accuracy for assigned VMT to count VMT. It is assumed that each combination of area/facility/number of lanes and link group contains a statistically valid number of links. For link groups having less than 100,000 VMT, only a ±25 percent accuracy level is desired. Assigned V/C ratios by their facility and area type were also analyzed. The analysis was based on a ±10 percent accuracy level, as was recommended for screenlines and cutlines.

The previous version of the model had a very high percent root mean square error (RMSE). The RMSE was equal to 38.6 percent. The consultant observed that error statistics were skewed because of the high number of low volume links. On investigation it was observed that many low volume counts were not taken as point observations, and instead of just being on the actual traffic count station link, they were propagated to the surrounding links as well. This observation was reported to VDOT, and its staff conducted an extensive effort to reconcile count locations with the corresponding links that must store the traffic count information.

Since this project involves short-term improvements, the consultant primarily focused on the traffic volume to count relationship. To check the validity of the trip generation and trip distribution characteristics was beyond the scope of this project and will be part of the future efforts on this model. After the count locations were reconciled, the RMSE dropped to 29.3 percent, which was a positive sign. The consultant observed that the traffic flow to malls in the Roanoke area did not match the ground reality. This was improved by the use of special generator trips. Adjustments were also made to the E-I trips to produce a better match of model volume to traffic counts on I-81.

The overall percent RMSE value is 29.3 percent, which is within the VTM threshold of 30 percent.

The next table shows the volume over count ratios by roadway facilities. It also shows that, with the exception of facility type 6, all facilities (which are local streets) are within five percent and meet the VTM guidelines.

Volume/Count Ratios by Facility Types

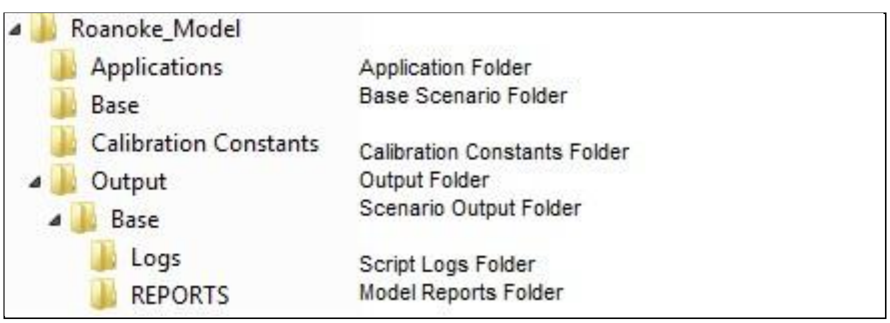
FUNCTIONAL GROUP	MODEL VOLUME	TRAFFIC COUNT	VOLUME/ COUNT	PPM RECOMMENDATION	NUMBER OF OBSERVATIONS
1	1,202,525	1,150,302	1.05	0.9 to 1.10	19
2	313,582	307,128	1.02	0.85 to 1.15	5
3	1,575,596	1,533,320	1.03	0.80 to 1.20	78
4	1,276,048	1,286,982	0.99	0.75 to 1.25	117
5	595,939	623,345	0.96	0.75 to 1.25	116
6	20,930	29,184	0.72	0.75 to 1.25	8
All	4,984,620	4,930,261	1.01	.95-1.05	361

8.6.3 Model Directory Structure

The consultant has made many improvements to the directory structure of the RVTPO model. The structure of the previous version of the model contained a separate directory for each analysis year. There were two analysis years, 2005 as the base year and 2035 as the future year. The directory of each analysis year contained separate Cube applications and scripts. These applications and scripts were accessed from the same catalog file. This was not consistent with the basic idea of Cube catalogs and applications. The Cube Voyager models must have common applications and scripts for all scenarios which, in turn, have their independent data.

The new structure of the RVTPO model has been divided into three sub-folders which reside under the parent folder, “Roanoke Model.” These three folders contain data files, applications, and script files. The catalog file for the model resides in the “Roanoke_Model” folder.

A snapshot of the model directories follows:



8.7 Roanoke Model Folder

This folder contains the Cube Voyager Catalog file, "Roanoke_Regional_Model.cat." It also contains three subfolders, Applications, Base and Calibration Constants.

8.7.1 Applications

This folder contains all the associated applications and scripts for this model. This folder is also known as the working folder of the model because this is where all the intermediate output files are stored. All application files in this folder have an extension *.app and all the script files have an extension *.s.

8.7.2 Base

This folder is called the scenario folder. This folder is created when the first scenario is created from the Scenario Manager in the Cube Catalog. The scenario folder can be accessed from the script by using the {Scenario_dir} key. This folder contains all the scenario-specific input files for this model. All the scenario-specific files have been given a suffix, which is a combination of the scenario year and the one letter scenario identifier. For example: 2000 year scenario B will have a suffix "2000B" at the end of the file name. It should be noted that this suffix is not the extension of the file name. The file name extensions correspond to the file type. A DBase file will have a *.dbf extension.

The files contained in this folder are shown in the following table.

Contents of Input Data Folder

FILE NAME	CONTENTS
RVTPO_(Year)(Alternative).NET	The Input Highway Network
Landuse_(Year)(Alternative).DBF	Land Use Data (Household and Employment)
SpecialGen_(Year)(Alternative).DBF	Special Generator
External_(Year)(Alternative).DBF	External-External Data
EIPCT_(Year)(Alternative).DBF	External-Internal Data

8.7.3 Calibration Constants

This folder contains files that are common across all scenarios and were finalized during model calibration and validation process. These files should not be changed unless there is a need to adjust model behavior across all scenarios. The contents of this folder are shown in the following table.

Contents of Calibration Constants Folder

FILE NAME	CONTENTS
AutoOccFactors.DBF	Auto Occupancy Factors
FFACTORS.DBF	Friction Factors
SPEEDS.DBF	Speed
Term_Time.DBF	Terminal Time
TripAttrRates.DBF	Trip Attraction Rates
TripProdRates.DBF	Trip Production Rates
CAPACITY.DBF	Highway Capacities

8.8 RVTPO Model's New Features

As stated earlier, the previous version of the RVTPO Cube catalog contained two applications: one for the base year 2005, and the other one for the future year 2035. Generally, a model should be developed so that there is only one application. This single application should be applied to multiple scenarios. Scenarios may be different years, networks, or comprehensive alternatives (years, networks, costs, and other assumptions). Sometimes one-time or infrequent procedures are stored as another application, but applications should not generally be used in place of the scenarios. So, the catalog was restructured to use a single parent application. A snapshot of the RVTPO model is shown in Figure 8-5.

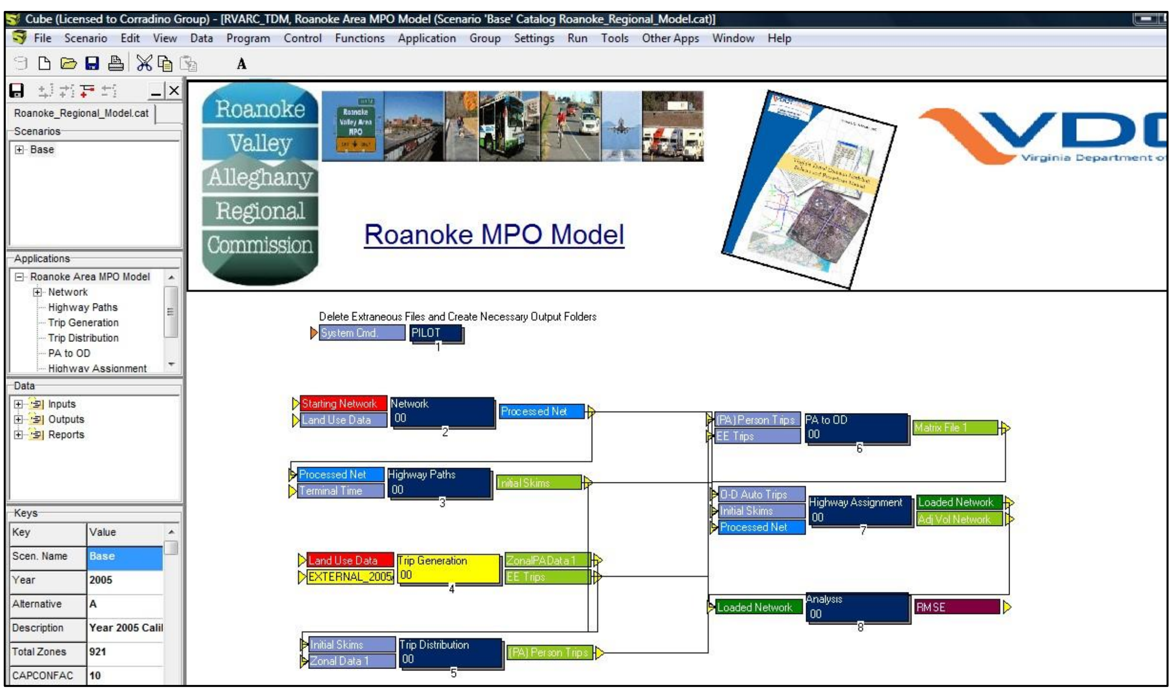


Figure 8-5 RVTPO Model Catalog and Parent Application Snapshot

Various applications in the old RVTPO model were not designed to exploit the full potential of features in Cube Voyager. One of these features is Catalog Keys. The consultant identified all the places in the scripts that needed common values. One example is value of total number of zones, which was hard-coded in the scripts. The consultant replaced all these common values by Catalog Keys to reduce the chances of error by a model user.

The application set has not been changed. There are still as many applications as there were in the previous version. However, changes have been made to link files between various applications. File linking has been made at the parent application. Most of the important input and output files have been made "public," which means that they are visible from the parent model application. This helps a model user better understand the flow of data between various applications and steps. Also for the same reason, wherever applicable, file linking has been made inside applications as well.

The applications in the Catalog window have been given self-explanatory names. The data section in the Catalog has been used to provide quick links to some of the main input and output files. These links have been made scenario specific.

Some new catalog keys have been introduced. These catalog keys can be changed for every scenario. There are a few keys that are scenario specific. The keys are listed in Figure 8-6.

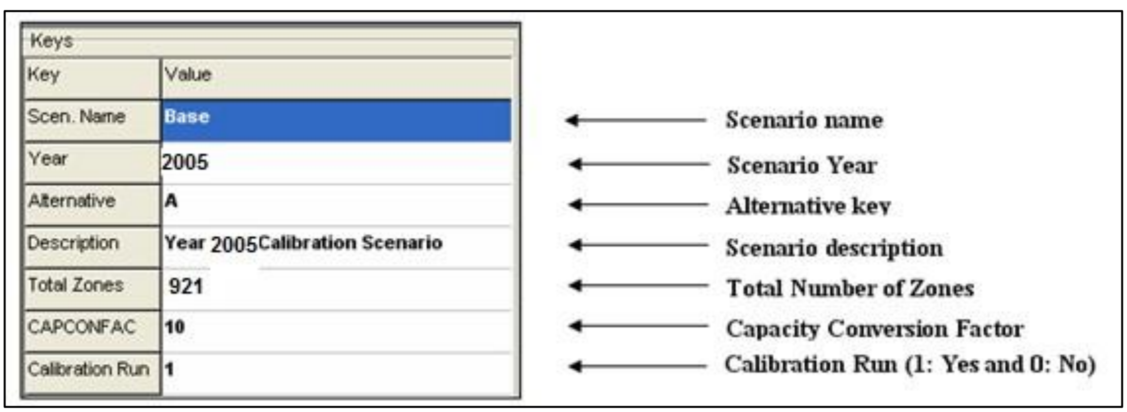


Figure 8-6 RVTPO Model Catalog Keys

8.8.1 Network

In the previous version of the model, the Network application had two steps. The first step converted a MINUTP network to a Voyager network. The second step processed the Voyager network for use in path building. The first step was eliminated because the starting Voyager networks for the base year and the future year are available now, and the second step has been given more functionality.

The Network step now extracts speeds and capacities from speed and capacity tables in SPEEDS.DBF and CAPACITY.DBF, respectively, which reside in the Calibration Constants folder. The speeds and capacities are added to the network based on the speed-capacity classification specified on the links.

8.8.2 Highway Paths

The only change made to this application was removal of hard-coded values of speeds for path building purposes. As mentioned in the Network application, this functionality has been transferred to the Network application.

8.8.3 Trip Generation and Distribution

This application contains both Trip Generation and Trip Distribution. The trip generation script was rewritten to make it more efficient and less prone to errors. The script in the previous version contained repetitive lines of code which were calculating trips by using hard-coded values for coefficients for various zonal data like population and employment. The generation step now reads the zonal socioeconomic, special generator and external-internal data from Dbase files that reside in the Input Data folder inside the scenario folder. These changes to the code have reduced it to a third of its original size. Another important change to this step is removal of the hard-coded values for different purpose-specific trip production and attraction coefficients. These coefficients are now being read from external files, TripProdRates.DBF and TripAttrRates.DBF. These files reside in the Calibration Constants folder and are common across all scenarios.

The distribution step was changed to read friction factors from a Dbase file instead of an ASCII text file. The friction factors file, FFACTORS.DBF, resides in the Calibration Constants folder.

8.8.4 Conversion of P/A to O/D

This application converts the P/A tables to O/D format, and prepares the trip tables for highway assignment. The major change to this step has been addition of a FRATAR step which will create the future external-external trip matrix by "fratarting" the base year trip table to external station traffic volumes specified in External_{Year}(Alternative).DBF.

8.8.5 Highway Assignment

The Highway Assignment application has been modified in consultation with VDOT staff. The lines of code that assigned hard-coded values of speed and capacities for link volumes have been removed. Instead, the speeds and capacities are now being added on the highway network in the Network application. Other changes made to the script involve changes to convergence methodology. In this setup Voyager's Highway program parameters RGAP and RGAPCUTOFF have been used in the CONVERGE phase.

8.9 2017 RVTPO Travel Demand Model

The Systems Analysis Group developed an updated RVTPO travel demand model which became available in March 2017 and will be used for future modeling efforts. The model is a four-step trip based model that includes Trip Generation, Trip Distribution, Mode Choice, and Travel Assignment. The model design follows nationally accepted best practice and was estimated and calibrated using the National Household Travel Survey (NHTS), a transit ridership survey, and mobile phone data collected for the entire state of Virginia. The highway assignment was validated against traffic counts and the transit assignment using observed transit ridership.

9.0 Future Considerations for Transportation

Tomorrow isn't going to be like today.

As mentioned previously in Part 1: Section 4, several changes are in progress that are already affecting transportation and will continue to do so even more as time passes. Transportation needs will change as a result of aging and evolving values between generations, shopping online rather than in-person, and embracing vehicle automation. Additional considerations discussed in this section are the impact of vehicle automation on the transportation system and on land development patterns, the impact of shared mobility, the declining health of increasing numbers of people, and the limited availability of transportation funding.

9.1 Vehicle Automation and the Transportation System

The focus of transportation technology, commonly called Intelligent Transportation Systems (ITS), has shifted over time from a strong operations, management and systems vantagepoint to a blended focus that includes in-vehicle systems. There are many levels of driver-assist technologies before reaching full automation. As the technology evolves so will many other issues related to consumers, infrastructure, government, policy, legal, insurance, and overall society adaptation and acceptance.

The purpose of this section is to anticipate some of the effects and benefits that driver assist and full automation technologies may have on the transportation system over the long-range time horizon including but not limited to:

- Potential benefits for public transportation;
- Effective capacity increase for highways due to automated platooning;
- Improvements in transportation safety;
- Effects on intermodal freight, the supply/logistics chain; and,

- Potential of ITS technologies to both complement and substitute for existing design approaches.

The question of whether we should design for peak transportation demand, which leaves infrastructure underutilized much of the time, or whether we should design for base transportation demand and address peak demand through ITS is at the heart of the aforementioned list. Highway capacity has traditionally been designed for peak hour demand which leaves large highways and thoroughfares underutilized at off peak times such as during the night, midday, or on weekends. Public transit systems have typically had more of a choice concerning whether to design for peak demand or base demand. Public transit systems that design for “peak first” see the peak service as the most fundamental product, while those that design for “base first” see the normal pattern as the fundamental product with the peak demand addressed by supplemental “peak” service (Walker, 77). With drivers being the highest operating expenses for transit, such systems have the potential to be early adopters of automated vehicles.

Traditionally, traffic engineers have heavily favored a “peak first” design for highways and determining number of lanes. However, several technological and environmental changes may allow traffic engineers to favor “base first” design and supplement peak capacity using ITS technologies such as managed lanes, reversible lanes, adaptive speed limits, High Occupancy Tolling (HOT), or in-vehicle systems that allow automated platooning of vehicles.

“Base first” design, supplemented by ITS, would have the added benefit of making it easier to comply with stormwater and impermeable surface regulations. There is a real tension and trade-off between adding transportation capacity and complying with increasingly strict stormwater regulations. “Base first” design coupled with ITS technology could give traffic engineers more choices in design of new facilities. When full automation (i.e. self-driving) vehicles finally arrive in large quantities, “base first” design may become the natural choice with automation addressing peak demands.

One very intriguing prospect of fully autonomous vehicles is that driverless cars do not need to park they simply go on to the next person – vehicles cruising the street looking for parking spots account for an astounding 30% of city traffic (Kanter, January 2015). This dynamic could both increase efficiency of existing infrastructure and free up right-of-way for alternative transportation and redevelopment thereby decoupling parking from other urban land uses (Guerra, 37). Autonomous vehicles may have other workforce and economic development impacts. For instance, taxi companies, freight, and logistics companies may be among the early adopters of driverless technologies because they could drastically lower labor costs (Guerra, 37). This could change industry structures and opportunities available to the entry level work force of the region.

With limited funding available, planning for improved capacity on existing facilities via greater use of intelligent transportation systems (and specifically vehicle automation) rather than adding more lanes or parking spaces has great potential to save valuable resources-financial and environmental. The Roanoke Valley Broadband Authority (RVBA) includes several of the RVTPO's local governments. Although there is great uncertainty with regard to technology's impact on transportation, with the RVBA, the municipal investment in broadband infrastructure may lead to technological opportunities for the Roanoke Valley's future transportation system.

9.2 Vehicle Automation and Land Development Patterns

Will Driverless Vehicles Further Contribute to Sprawl or Get Us Back to the City?

Driverless vehicles have the potential to influence land use patterns and urban densities over time. The technology has the potential to both reinforce agglomeration economies where businesses and housing benefit from being near each other, or to help us further sprawl out depending on the context and circumstances. On the one hand, automated vehicles that are paid for per trip will make travelers consider the full marginal cost of each vehicle trip when deciding whether to use a car. Also, automated vehicles could drop passengers off at their destinations and then go park or wait in off site parking lots and staging areas. This could decouple parking from urban land uses allowing urban land to be used more intensely, and for placemaking to be unshackled from parking constraints (Guerra, 37). On the other hand, people with one or more self-driving vehicles could send their cars out for errands while they are at work or at leisure activities. Or, automated vehicles could become mini offices, a mobile version of a home office, where individuals could live far from urban concentrations commuting over a large region (Guerra, 38).

At this point it is difficult to anticipate which effect will win out overall. It is likely that successful urban areas with a sense of place could further concentrate taking advantage of economies of agglomeration and further enhancing an urban vibe. However, suburbs and exurbs may further expand, if time, trip costs, and inconveniences are diminished by the utility of driverless cars. In this regard driverless and automated vehicle technology will likely amplify and intensify the existing characteristics and comparative advantages of a place rather than change them. So we may have urban areas getting more dense and exurbs sprawling further out at the same time. Each type of place will be attractive to residents that value its particular amenities.

Driverless cars will likely bring expanded mobility for people who do not drive due to age (children/teenagers and elderly), disability, income or personal choice. This is anticipated to be true for urban and rural populations alike (Guerra, 38). This could improve Environmental and Social Justice dimensions of transportation services.

9.3 Shared Mobility

Shared mobility has existed for many years in the form of carpooling, a form of ridesharing, where more two or more people ride together in someone's private vehicle typically with the same origin or destination. Ridesharing also exists in vanpooling, essentially larger scale carpooling though with less degree of familiarity among riders and public funding opportunities to pay expenses. New forms of shared mobility also exist through bikesharing and ridesourcing (also known as Transportation Networking Companies - TNCs or ride-hailing). Common TNCs are Uber and Lyft.

> *"Ridesourcing and ridesharing business models could help to speed the adoption of automated vehicles, as they become available, by lowering costs of ownership and expanding their accessibility. They can also help to supplement transit service in urban areas by providing efficient, direct service for short trips and providing service during transit system off-hours."*
> *(Beyond Traffic, 35)*

Ridesourcing in particular has the potential to become a preferred travel option for many people as vehicle automation becomes common as it increases the convenience of traveling without one's own vehicle while reducing overall transportation expenses. Ridesourcing also has the greatest potential to shift people from otherwise choosing to walk, bike, or ride transit as well as serving as a connection between a transit stop and final destination.

All of these forms of shared mobility offer creative ways that people are finding to accomplish their daily trips without the need for a personal vehicle. As shared mobility options become more common in the Roanoke Valley, people's travel choices will change yet the impact on the transportation network is still to be determined.

9.4 Health

The recent past has shown a decrease in the overall health of many Americans. Chronic diseases are more prevalent in more Americans today and the impact is seen in transportation. In particular, obesity, diabetes, and heart disease affect people's ability to function physically. The transition to automobile-oriented development rather than people-oriented development over the past century has led to many places in the community being accessible only by driving. When people drive, they sit for short or long periods of time; as a sedentary behavior, excessive sitting due to driving contributes to a sedentary lifestyle which can negatively affect a person's health. Local planners and decision-makers contribute to people's lifestyle options with every transportation investment authorization and every land development approval.

Despite increases in cycling among some parts of the population in the Roanoke Valley, increasing numbers of people are unable to walk very far or bicycle at all to accomplish their daily needs. For many people this is due to declining health as a result of age or other personal choices or factors.

In a survey done in 2014, Valley Metro learned that approximately 25% of their riders have a disability, and they also continue to see increasing enrollment in their paratransit services. As people age, disability is more prevalent, and as previously discussed, more of the Roanoke Valley's population will be older in the near future. Thus, more people will be unable to travel as they have in the past and will be looking for alternative transportation options to help them accomplish their daily tasks and allow them to stay in their homes. For people that live in single use low-density residential developments, walking or taking fixed-route transit may be unrealistic due to lack of infrastructure or long travel distances to access destinations or services. As a result of the aging population, a greater need for paratransit or specialized transportation services for elderly or disabled people will likely place a large demand on the region's transportation system in the future.

Although shared mobility options have the potential to help people age in place, they also have the potential to compete against healthier transportation options - walking and biking.

> *"We were running late to our meeting so we caught an Uber instead of walking the 4 blocks like we normally would have. I guess I missed out on a brisk 10 minute walk." -Citizen*

Health is greatly influenced by one's environment and the potential to safely walk or bike to nearby destinations. Good air and water quality are essential to personal health and transportation choices and investments certainly have a direct impact on improving or worsening these critical natural environments. Much can be done in the coordinated planning of land use and transportation to improve people's health, and health impacts should be considered in every development review and transportation investment decision.

9.5 Limited Transportation Funding

The way in which the Roanoke Valley receives transportation funding assistance from federal sources has changed in recent years. With the increasing urbanized area population, the Roanoke Valley became a Transportation Management Area (TMA) and several funding-related changes occurred.

Whereas previously, the Roanoke Valley competed with other small urban areas for a share of federal funds from particularly sources such as the Surface Transportation Program, Transportation Alternatives, and Federal Transit Administration Section 5310 funds, with the change in status, the Roanoke Valley is now apportioned a specific amount.

Additionally, the Greater Roanoke Transit Company (GRTC) became eligible to receive funds directly from the Federal Transit Administration rather than via the Virginia Department of Rail and Public Transportation. As such, GRTC also lost its ability as a small urban grantee to apply for capital support from flexible federal Surface Transportation Program funds. As a large urban grantee, more reliance is placed on the regional apportionment of Surface Transportation Program funds to support capital needs.

A significant change in how funding is distributed throughout Virginia has taken place with the development of the SMARTSCALE system which scores and prioritizes projects based on a number of factors that aim to fund the right transportation projects for the Commonwealth.

The U.S. Congress has not yet identified a new revenue source for transportation so whether the future will still rely on the current cents per gallon funding or something else is to be determined. At the state level, only Northern Virginia and Hampton Roads have been granted the authority to raise revenue for their regions. There are more transportation needs and wants than available funding and the region's current limitations on their ability to raise additional funds is an area of concern for many.

9.6 Transportation Priorities

The TPO expressed interest in identifying regional transportation priorities and approved the following framework on February 23, 2017.

- Transportation Needs
- Priorities (Regional/Local/Both)
- Solutions
- Projects
- Alignment review (meet needs/attain goals)

Regional plans have identified many priorities (see maps in Appendix C) which may provide input into the future discussion on regional priorities.

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APPENDIX A: Fiscally Constrained and Vision Project Lists

Fiscally Constrained List of Projects

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
1	107053	Bedford Co.	Rte. 24 Safety Improvements	Rte. 886 to 0.26 mi. E of Rte. 635 (RVTPO Portion is 0.4 mi. Of 1.5 mi.)	VDOT Project Pool Description: To improve safety by paving existing shoulders, installing rumble strips, and upgrading or replacing deficient guardrail.	$432,000
2	107521	Botetourt Co.	Daleville Greenway	Botetourt Center at Greenfield to Daleville Town Center	Greenway connecting Botetourt Center at Greenfield with neighborhoods and businesses along Route 220 south to the Daleville Town Center. VDOT Project Pool Description: Design and construction of a trail from the intersection of US-220 and Catawba Road to the intersection of US-220 and International Parkway.	$595,000
3	75910	Botetourt Co.	Exit 150 Improvement Project	0.3 mi. S of U.S. 220 to 0.74 mi. N of U.S. 220	Improvements to the safety and traffic flow at the existing intersection and associated northbound movements from and to Interstate 81.VDOT Project Pool Description: improvements for safety and congestion at Exit 150; multiple improvements and changes to the interchange area are included with this project.	$18,038,000

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
4	N/A	Botetourt Co.	Exit 150 Park and Ride	In the vicinity of Exit 150 and U.S. 220	FY18 Smart Scale Application: Construct New Park and Ride facility near Exit 150 in Daleville. The facility will also include bus shelters, bicycle racks, sidewalk, and wayfinding signs.	$9,232,329
5	110101	City of Roanoke	Tinker Creek Greenway Phase 2	Wise Avenue north to Masons Mill Park	Multi-use urban bike/ped recreational trail following the Tinker Creek stream and connecting Fallon Park, Masons Mill Park, and Roanoke's Center for Industry and Technology. VDOT Project Pool Description: The proposed extension to the existing Tinker Creek Trail would provide for a 10' wide asphalt bicycle and pedestrian shared use trail from Fallon Park, located near Wise Avenue, to Masons Mill Park.	$1,620,000
6	106265	City of Roanoke	Garden City Greenway Phase 2	Davenport Ave./ Ivywood St. to Riverland Rd.	8" wide multi-use trail. VDOT Project Pool Description: Design and construction of bicycle and pedestrian facilities on Garden City Boulevard.	$246,000

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
7	108908	City of Roanoke	U.S. 220 Communications and Adaptive System Project	Valley Ave/Southern Hills Dr. SW to Clearbrook Village Ln.	There are five signalized intersections within the study area. In-Sync will monitor and prioritize the queues at each approach of each of the intersections in the system. The project will also install new cameras at all five intersections allowing VDOT to remotely access the traffic volumes and view live traffic to monitor coordination on the corridor. VDOT Project Pool Description: U.S. 220 has heavy directional traffic flow NB in the AM and SB in the PM. In-Sync will monitor and prioritize queues at each approach & prioritize to allow NB AM platoons & SB PM platoons to proceed through the corridor. Additionally, will connect the VDOT Traffic Operations Center (TOC) via Fiber Optic Connection on I-81.	$422,500
8	11908	City of Roanoke	10th Street	0.38 mi. N Andrews Rd. to Williamson Rd.	Street improvements to include geometric changes and the addition of bike lanes, curb and gutter, sidewalk, storm drains and street trees. VDOT Project Pool Description: Reconstruct 10th st. to 2 lanes with C&G, sidewalk, and bike lanes	$12,451,245

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
10	108896	City of Roanoke	Colonial Avenue Improvements	Dogwood Ln. SW to Overland Rd. SW	Streetscape, C&G, sidewalk, drainage, bicycle accommodations. VDOT Project Pool Description: Street, bicycle and pedestrian improvements near Murray Run Greenway, Fishburn Park Elem School and VWCC. Installation of bike lanes, sidewalk to both sides of the street, improved pedestrian crossings, and intersection improvements at Overland Rd, McNeil Rd, and Winding Way Rd.	$2,545,000
11	N/A	City of Roanoke	Franklin Road sidewalk	0.16 mi s. of Beechwood to Penarth	Sidewalk construction. FY18 Smart Scale Application: The project scope includes construction of new sidewalk along the west side of business 220, Franklin Road, from the 3100 block to the 3700 block adjacent to the 220 bypass. Improvements include sidewalk construction, improved pedestrian crosswalks, pedestrian signals, and additional drainage improvements as warranted by sidewalk construction.	$1,313,458
12	109288	City of Roanoke	Edgewood Street Transit Accessibility Improvements	Windsor Ave. to Memorial Ave.	Sidewalk construction. VDOT Project Pool Description: Transit accessibility improvements on Edgewood Street in the City of Roanoke. The project would provide transit stop improvements as well as missing gap sidewalks between the bus stops at Windsor Avenue and at Westover Avenue along Edgewood Street.	$350,811

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
13	N/A	City of Roanoke	Valley View Boulevard Extension	I-581 to Ferncliff Avenue	Street extension to include curb, gutter, sidewalk, drainage and bike lanes.FY18 Smart Application:The Valley View Boulevard Extension project will extend Valley View Blvd approximately 1,000 feet to the west from the Valley View Blvd interchange at I-581 to a point at which potential connections to future development and the local street network can be made. The extension of Valley View Blvd is envisioned as a four-lane "boulevard" street with travel lanes separated by a raised grass median. Turn lanes will be provided as necessary. The typical section includes two travel lanes in each direction, bike lanes, curb and gutter, and sidewalk. This project will also include the construction of a new traffic signal at the southbound I-581 ramps and construction of a complex bridge structure to span Lick Run and the Lick Run Greenway.	$76,987,692
14	709	City of Roanoke	10th Street Improvements	0.018 mi. S of Fairfax Dr. to 0.038 mi. N of Andrews Rd.	Street improvements to include geometric changes and the addition of bike lanes, curb and gutter, sidewalk, storm drains and street trees. VDOT Project Pool Description: reconstruct 10th st. to 2 lanes with C&G, bike lanes, and sidewalk	$3,459,000

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
15	N/A	City of Roanoke (the project is located within Roanoke city limits)	220 Expressway Acceleration Lane Improvement	U.S. 220 and VA 419	Extend southbound Route 419 loop ramp onto northbound U.S. 220, creating a free-flow movement. FY18 Smart Application: Reconstruct paving section to facilitate a dedicated lane for southbound Route 419 loop ramp entry onto northbound Route 220. This work includes improving sub-base pavement structure to support daily traffic load in certain areas that do not have an adequate pavement structure, adjusting lane configuration within existing footprint of the travel way, modifying super elevation to accommodate revised transition, adjusting concrete barrier to accommodate superelevation improvement and milling and overlaying existing pavement between the end of the structure over Route 419 and the end of the improvements in the northbound direction.	$2,646,129
16	N/A	City of Salem	Mason Creek Greenway	Route 460 to Roanoke River Greenway	FY18 Smart Scale Application (Mason Creek Greenway Phase 3 - 419 Multimodal Improvements): Completes the missing link between the Mason Creek Greenway and Hanging Rock Battlefield Trail, and completes missing links to neighborhoods. Improves transit stops at various locations along US 460 and increases 419 mode choice.	$3,929,720

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
17	N/A	City of Salem	Roanoke River Greenway	Rotary Park to Roanoke City Corporate Limit	Complete the greenway between Rotary Park and the Roanoke City Limit.	$3,929,720
18	N/A	City of Salem	East Main Street/ Downtown Salem Streetscape	Downtown Salem	Improvements to intersections, crosswalks, transit, utilities, and streetscape in Downtown Salem.	$9,169,346
19	108853	City of Salem	East Main Street/College Avenue Pedestrian Improvements	Clay St. to Thompson Memorial Blvd.	VDOT Project Pool Description: East Main Street / College Avenue Pedestrian Improvements - Sidewalk replacement, crosswalks	$1,001,000
20	108899	City of Salem	Roanoke Boulevard Multimodal Improvements	McDivitt Rd. to Salem City Limit	VDOT Project Pool Description: Eight-foot-wide sidewalk on the north side of Roanoke Blvd with appropriate amenities (e.g. landing pads, benches, shelters, etc.) at transit stops in front of Salem Health and Rehab, at the intersection of Hemlock Road and Roanoke Blvd, and at the Adult Care Center	$884,881
21	T19837	City of Salem	Downtown Salem Streetscape and Intersection Improvements	East Main St. between N. Market St. & Thompson Memorial Dr.	FY18 Smart Scale Application: Improvements to intersections, transit, turn movements, and streetscape in Downtown Salem.	$358,216

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
22	N/A	City of Salem	East Main Street Phase II	Brand Avenue to Kessler Mill Road	SS/Project Pool Combined: Improve drainage, capacity, and non-motorized trans facilities on E. Main St. from Brand Ave. to Kessler Mill Rd. by adding storm sewer, curbing, sidewalks, bike lanes, and turn lanes	$17,028,786
23	8753	City of Salem	U.S. 460 Widening	0.028 mi. W Rte. 311 to 0.006 mi. W of Brand Ave.	Widening to 3 lanes. VDOT Project Pool Description: Improve drainage, capacity, and non-motorized trans facilities on E. Main St. from Rt. 311 to Brand Ave. by adding storm sewer, curbing, sidewalks, bike lanes, and turn lanes. A traffic signal will be added at Lynchburg Turnpike also.	$2,912,984
24	N/A	Multi-Jurisdictional	Tinker Creek Pedestrian Bridge	Tinker Creek Greenway to Glade Creek Greenway	Construct a bridge across Tinker Creek to connect the Tinker Creek and Glade Creek greenways.	$1,459,500
25	N/A	Multi-Jurisdictional	Tinker Creek Greenway Connectivity Study	Wise Avenue to Daleville Town Center	Location and feasibility study for extension of Tinker Creek Greenway from Mason Mill Park to Daleville Town Center	$400,000
26	N/A	Multi-Jurisdictional	Other I-81 Auxiliary Lane Projects	Exit 140 to Exit 150	Expand the capacity of I-81 by adding auxiliary lanes between exits.	$27,092,054
28	N/A	Multi-Jurisdictional	Ongoing Bus Replacement and Rebuild Program	Systemwide	Ongoing efforts to maintain existing regional public transportation services by replacing or rebuilding transit vehicles as needed.	$44,298,755

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
29	T18675	Multi-Jurisdictional	Transit Vehicle Replacements	Systemwide	Address the short-term need to replace transit vehicles to maintain fixed-route transit services in the Roanoke Valley.	$13,622,784
30	N/A	Multi-Jurisdictional	Transit Vehicle Expansion	Systemwide	Six (6) new vehicles in the short-term to support expansion of current public transportation network.	$3,667,738
31	N/A	Multi-Jurisdictional	Expanded Transit Vehicle Maintenance Facility	Vacant 0.68-acre lot adjacent to current administration facility on Campbell Ave SE	FY18 Smart Scale Application: construct a maintenance expansion facility on vacant 0.68-acre lot adjacent to current admin facility on Campbell Ave SE to address expanding fleet.	$2,626,915
32	N/A	Multi-Jurisdictional	Real-Time Information System	Systemwide	FY18 Smart Scale Application: Put in place an automatic vehicle locator system that includes a set of integrated technologies such as real-time passenger information via smartphone and the internet, automated passenger counters, digital transit service information signs in real-time.	$238,810
33	97171	Roanoke Co.	Roanoke River Greenway	Green Hill Park to Riverside Park	VDOT Project Pool Description: Construction of a section of the Roanoke River Greenway connecting the trail from Green Hill Park in Roanoke County to Riverside Park in the City of Salem.	$4,542,105

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
34	N/A	Roanoke Co.	Roanoke River Greenway	Rutrough Road to Explore Park	FY18 Smart Scale Application: Construct 1.8 miles of a paved, 10-foot-wide, shared use path for bicyclists and pedestrians through Explore Park to Rutrough Rd.	$4,274,439
35	N/A	Roanoke Co.	Roanoke River Greenway	Blue Ridge Parkway to Explore Park	Construct 1.7 miles of Roanoke River Greenway trail section from Highland Road through the Roanoke Valley Resource Authority property, to Explore Park.	$2,029,889
36	91191	Roanoke Co.	Roanoke River Greenway	City of Roanoke limit to Blue Ridge Parkway	VDOT Project Pool Description: Construction of a Roanoke River Greenway Trail section from the City of Roanoke to the Blue Ridge Parkway and Virginia's Explore Park	$1,608,000
37	108906	Roanoke Co.	I-81 NB Auxiliary Lane	I-81 Exit 143 NB to I-81 MM 143 NB	VDOT Project Pool Description: Provide additional capacity between NB Exit 141 & Exit 143 & provide for safer merge movements between Exits. Incl. 12-ft aux. lane & 12-foot outside shoulder. Aux. lane will be extension of entrance ramp @ Exit 141 to extend to Exit 143 onto I-581. Mill & overlay existing travel lanes.	$29,830,716
38	N/A	Roanoke Co.	Route 419 and Route 221 Adaptive Traffic Control	Springwood Park to McVitty Rd. to Carriage Ln. to Valley Dr.	FY18 Smart Scale Application: This project will add Adaptive Traffic Control systems to seven existing traffic signals on Route 419, and to four existing traffic signals on Route 221, in the Cave Spring and Oak Grove areas of Roanoke County.	$663,457

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
39	N/A	Roanoke Co.	Plantation Road Bicycle, Pedestrian and Streetscape Phase II	Walrond Drive to Gander Way	FY18 Smart Scale Application: Continue the Plantation Road Project by constructing sidewalk, curb, gutter, drainage systems and landscaping between Walrond Drive and Gander Way, on the west side of Plantation Road. Add pedestrian signals and crosswalks at the Gander Way signal.	$2,295,237
40	N/A	Roanoke Co.	West Main Street Pedestrian Improvements - Phase II	Daugherty Road to Technology Drive	FY18 Smart Scale Application: Install sidewalk along the north side of West Main Street, from Daugherty Road to Technology Drive. Install standard crosswalk across all secondary street intersections. Also install continental crosswalk and pedestrian signals at Alleghany Drive and Daugherty Road intersections. Install sidewalk along the south side of West Main Street from the Salem city limits to Technology Drive.	$1,182,451
41	107055	Roanoke Co.	Williamson Road / Peters Creek Road Bike/Pedestrian Improvements	Rte. 117 to U.S. 11	VDOT Project Pool Description: Project will upgrade signals, add pedestrian push buttons and crosswalks to existing signalized intersections on Routes 11 & 117 in Roanoke County.	$1,000,000
42	107054	Roanoke Co.	Rt. 311 under I-81 Bike/Ped Improvements	NCL Salem to 0.02 Mi. N of I-81 SB Ramp	VDOT Project Pool Description: Project will construct a sidewalk extension to the Exit 140 Park and Ride in conjunction with the Park and Ride improvement project.	$700,000

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
43	103607	Roanoke Co.	Plantation Road Streetscape Improvements	I-81 Exit 146 to Williamson Rd./U.S. 11	VDOT Project Pool Description: Streetscaping, bicycle and pedestrian improvements along Plantation Road (Rt. 115) in Roanoke County between I-81 and Williamson Road (Rt. 11).	$211,000
44	108882	Roanoke Co.	West Main Street Sidewalk Installation	Daugherty Rd. to Technology Dr.	VDOT Project Pool Description: West Main Street Sidewalk Installation	$1,037,000
45	15187; 15188	Roanoke Co.	Rte. 1662/McVitty Rd. & Rte. 1663/Old Cave Spring Rd. Improvements	McVitty Road to Old Cave Spring Road	VDOT Project Pool Description: Increasing the pavement width, shoulder width, and adding turn lanes to improve the safety of the roadway.	$29,473,906
46	107061	Roanoke Co.	Rte. 419 Safety Improvements at Tanglewood	Rte. 220 to Rte. 867	VDOT Project Pool Description: Improve safety and congestion by upgrading signals, adding pedestrian accommodation, bike lanes, and a third lane along Rte. 419 South, toward Rte 220.	$4,853,432
47	77305	Roanoke Co.	Rte. 116/Jae Valley Rd. over Back Creek - Bridge Replacement	0.285 mi. S Rte. 945 to 0.584 mi. S Rte. 945	VDOT Project Pool Description: Bridge Replacement - Rte. 116 over Back Creek (Ext. Str. ID 14928 - VA Str. No. 1087)	$2,121,000
48	108904	Roanoke Co.	Rte. 311 / Rte. 419 Int. Safety & Congestion Improvements	Int. Rte. 311 & 419 to Int. Rte. 311 & 419	VDOT Project Pool Description: Convert an existing signalized intersection to a roundabout. Access management for the adjacent businesses, paved shoulders for bicycle access, as well as pedestrian crosswalks within refuge islands to connect to businesses and to the Hanging Rock Battlefield Trail (Greenway)	$1,957,006

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
49	108905	Roanoke Co.	Lila Dr. / Rte. 115 Intersection Safety Improvements	Lila Dr. / Plantation Rd. intersection	VDOT Project Pool Description: Install a traffic signal at Rte 115 (Plantation Rd) and Lila Dr. Pedestrian actuated signals and crosswalks. Reconstruct approximately 420' of Lila Dr and access management.	$1,269,396
50	99542	Roanoke Co.	Exit 140 Park and Ride Reconstruction	Int. Rte. 1128 & Rte. 1150 to 0.17 mi. W of Int. Rte. 1128 & 1150	VDOT Project Pool Description: Improvements to exist. lot include add'l parking, designated bus loading area, constr. of bus shelters, & constr. of sidewalk along Rte 311.	$1,502,079
51	N/A	Town of Vinton	Glade Creek Greenway, Phase II	Walnut Ave. to Gus Nicks Blvd.	To provide a 10-foot wide, 0.58 mi. paved trail which will connect to Glade Creek Phase I.	$597,026
52	N/A	Town of Vinton	Walnut Avenue Improvements Project	0.47-mile segment of Walnut Ave, from 5th St, to W. Lee Ave	FY18 Smart Scale Application: Install bicycle and pedestrian improvements along a 0.47-mile segment of Walnut Ave, from 5th St, to W. Lee Ave. Project includes. sidewalk (8900 LF), curb and gutter (1790 LF), lighting (3 new poles), signage (6 signs), CG-12 ADA ramps (7), and pavement marking for crosswalks (120 LF) and bike lanes (striping - 1660 LF).	$3,663,585
53	93160	Town of Vinton	Walnut Ave. Intersection Improvement at 8th Street	Walnut Ave. & 8th St.	VDOT Project Pool Description: intersection improvement	$2,767,813

#	UPC	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	EST. COST IN YEAR OF EXPENDITURE
New	105439	City of Roanoke	Roanoke River Greenway	Aerial Way Dr. to Roanoke Ave. SW Extended	Construction of 0.53 mile of the Roanoke River Greenway from Aerial Way Drive to Roanoke Avenue, SW Extended	$5,075,000
New	T19580	City of Roanoke	Hollins Rd. and Orange Ave. Intersection Improvements	Intersection of Orange Avenue and Hollins Rd.	Addition of an EB right turn lane on Orange Ave. at Hollins Rd. and additional left turn lanes in both directions on Orange Ave., widen / add capacity to Hollins Road in both directions in the immediate vicinity of the intersection.	$3,552,000
New	T19810	Multi-Jurisdictional	Valley Metro 91/92 Vehicle Expansion	City of Roanoke to City of Salem	Provide three (3) new 40' transit vehicles to serve the insufficient capacity currently on Valley Metro routes 91/92.	$1,700,000
New	T19607	Multi-Jurisdictional	Smart Way Vehicle Expansion	City of Roanoke to Town of Blacksburg	Purchase three (3) 40' Over-the-Road (OTR) coaches to support an express commuter connection from Virginia Tech (Blacksburg) to the Virginia Tech Carilion Research Institute in Roanoke.	$618,000
New	N/A	Roanoke County	I-81 Southbound Auxiliary Lane between Exit 143 and 141	Exit 143 to Exit 141	Construct auxiliary lane on I-81 SB from Exit 143 to Exit 141	$32,1168,111
				TOTAL:		$402,208,020

The total constrained amount for new construction ($402,208,020) is lower than the projected available funding as initially provided by VDOT of $485,474,656. The difference is the actual amount that has been allocated for the FY2016-2021 period is significantly less than the projected amount.

Vision List of Projects

DESIRED TIME-FRAME	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	PROJECT COST (2016$)
S to M	City of Roanoke	Campbell Avenue Bicycle and Pedestrian Improvements	Tinker Creek to Williamson Road (Downtown)	Streetscape improvements would consist of sidewalk, curb and gutter, street trees, and milling and resurfacing the existing roadway and any related stormwater improvements.	$3,300,000
M	City of Roanoke	Williamson Road	Orange Ave. to Angell St.	Road diet & streetscape improvements	$9,500,000
M	City of Roanoke	Memorial Avenue	Grandin Rd. to Denniston Ave.	Streetscape improvements	$1,500,000
M	City of Roanoke	Lick Run Greenway Phase 4	Lewiston Road (Countryside Park) to Peters Creek Road	Multi-use bicycle & pedestrian trail	$3,000,000
M	City of Roanoke	Liberty Road	Burrell St. to Hollins Rd.	Add turn lanes, C&G, sidewalk, bike lanes, drainage, reconstruct signal	$7,000,000
M	City of Roanoke	King Street	Gus Nicks Blvd. to Orange Ave.	Add turn lanes, C&G, sidewalk, bike lanes, drainage, reconstruct signal	$7,500,000
M	City of Roanoke	Jefferson Street	Elm Ave. to McClanahan Rd.	Road diet & streetscape improvements	$13,000,000
M to L	City of Roanoke	Hollins Road	Orange Ave. to Liberty Rd.	Widening to 4 lanes w/bicycle lanes	$6,100,000

DESIRED TIME-FRAME	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	PROJECT COST (2016$)
	City of Roanoke	Hershberger Road	Cove Rd. to Peters Creek Rd.	Add turn lanes, C&G, sidewalk, bike lanes, drainage	$6,900,000
L	City of Roanoke	Orange Avenue	0.006 mi. W Int. 11th St. NE to 0.232 mi. E Int. Gus W. Nicks Blvd. NW	Widening to six lanes, reconstruct traffic signals, curb, gutter, sidewalk and drainage improvements	$49,519,000
M	City of Roanoke	Cove Road	Hershberger Rd. to Peters Creek Rd.	Add turn lanes, C&G, sidewalk, bike lanes, drainage	$7,500,000
M	City of Roanoke	Colonial Avenue	Brandon Ave. to Overland	Streetscape, C&G, sidewalk, widen 1-ln., drainage	$5,300,000
M	City of Roanoke	Church Ave	Jefferson St. to 5th St.	Streetscape improvements	$2,800,000
M to L	City of Roanoke	9th St SE	Bridge over Norfolk Southern RR to Riverland Road	Streetscape, pedestrian improvements, road diet	$7,300,000
L	City of Roanoke	13th St./ Hollins Road	Jamison Ave. to 0.08 mi. N of Int. Orange Ave.	Bridge over RR tracks, streetscape, pedestrian and bicycle improvements, drainage	$63,266,000
S to M	City of Roanoke / GRTC	Downtown Roanoke Intermodal Station	Roanoke AMTRAK platform	Multimodal connections to AMTRAK and passenger waiting area.	$10,000,000
	City of Salem	Rt. 311 / Thompson Memorial Improvements	Rt. 311 / Thompson Memorial Dr.	??	$5,000,000

DESIRED TIME-FRAME	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	PROJECT COST (2016$)
M	City of Salem	Braeburn Drive – Transit/Bike/Ped Improvements	Rt. 419 to Keagy Rd.	Improvements to bus stops, pedestrian and biking accommodations.	$500,000
M	City of Salem	Apperson Drive	Rt. 419 to Colorado St.	Streetscape/Multimodal Improvements.	$300,000
S to M	Multi-Jurisdictional	I-81 Auxiliary Lanes	Exit 143 to Exit 150 NB & SB Exit 140 to Exit 141 NB & SB	Added capacity on I-81	$84,486,697
S to M	Multi-Jurisdictional	Bus Stop Accessibility Improvements	Systemwide	Curb ramps, sidewalk connections, accessible landing pads, bus shelters, benches, pedestrian refuge medians, crosswalks, signage or other improvements will be provided as needed by the specific bus stop locations.	$1,000,000
S to M	Roanoke Co.	U.S. 221/Brambleton Ave. pedestrian improvements	Roanoke City Limits to Electric Rd.	Construct sidewalk northbound and southbound along U.S. 221, from Roanoke City limits to Electric Road. Install crosswalks at Secondary street crossings, and pedestrian signals at signalized intersections.	$1,000,000
M to L	Roanoke Co.	U.S. 220 Improvements	Electric Rd. to Franklin County Limits	Improve travel lanes, shoulders and turn lanes at various locations from Rte. 419 to Franklin County.	$136,000,000
M	Roanoke Co.	U.S. 11/Williamson Rd. Urban 2 or 4-lanes & Bike/Ped Improvements	Peters Creek Rd. to Roanoke City Limit	Improve U.S. 11 to either Urban 4-lane, or Urban 2-lane with turn lanes, and construct bicycle and pedestrian improvements, from Peters Creek Road to Roanoke City limits.	$24,000,000

DESIRED TIME-FRAME	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	PROJECT COST (2016$)
M to L	Roanoke Co.	U.S. 11/U.S. 460 Corridor Study	N/A	U.S. 11/U.S. 460 Corridor Study - Implement recommendations of completed VDOT study.	
M to L	Roanoke Co.	Rte. 907/Starkey Rd. Improvements	Rte. 907/Starkey Rd.	Improve Rte. 907 to either Urban 4-lane or Urban 2-lane with turn lanes, and construct bicycle and pedestrian improvements, from existing 5-lane section of Starkey Rd to Merriman Rd.	$12,000,000
M to L	Roanoke Co.	Rte. 687/Penn Forest Rd. - Bicycle and Pedestrian Improvements	Colonial Ave. to Starkey Rd.	Construct bicycle and pedestrian accommodations to Rt 687, from Colonial Av to Starkey Rd.	$1,000,000
M	Roanoke Co.	Rte. 682/Garst Mill Rd. - Bicycle and Pedestrian Improvements	Brambleton Ave. to Grandin Rd.	Construct bicycle and pedestrian accommodations to Rte. 682, from Brambleton Av to Grandin Rd / Roanoke City limits.	$1,100,000
M to L	Roanoke Co.	Rte. 679/Buck Mountain Rd. - urban 2-lane with turn lanes, bicycle and pedestrian improvements	Starkey Rd. to U.S. 220	Improve Rte. 679 to Urban 2-lane with turn lanes, and construct bicycle and pedestrian improvements, from Starkey Rd to U.S. 220.	$1,500,000
M to L	Roanoke Co.	Rte. 634/Hardy Rd. - urban 4-lane or 2-lane with turn lanes, bicycle and pedestrian improvements	Vinton Town Limits to Bedford County Limits	Improve Rte. 634 to Urban 4-lane or Urban 2-lane with turn lanes, and construct bicycle and pedestrian improvements, from Vinton to Bedford County.	$1,200,000

DESIRED TIME-FRAME	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	PROJECT COST (2016$)
M	Roanoke Co.	Rte. 625/Hershberger Rd. - Urban 2-lane with turn lanes, bicycle and pedestrian accommodations	Roanoke City Limits to Plantation Rd.	Improve Rte. 625 to Urban 2-lane with turn lanes, and construct bicycle and pedestrian accommodations, from Plantation Road to Roanoke City limits.	$500,000
M to L	Roanoke Co.	Route 116/Jae Valley Rd. Improvements	Route 116/Jae Valley Rd.	Improve Rte. 116 to Rural 2-lane with shoulder improvements, from Mt Pleasant to Franklin County.	$23,000,000
S to M	Roanoke Co.	Route 115/Plantation Road urban 2 or 4-lane with turn lanes, bike/ped accommodations	Williamson Rd. to Roanoke City Limits	Improve Rte. 115 to either Urban 4-lane, or Urban 2-lane with turn lanes, and construct bicycle and pedestrian accommodations from Williamson Rd to Roanoke City limits.	
S to M	Roanoke Co.	West Main Street/Greenway Connection	West Main Street to Roanoke River Greenway	Construct greenway connection for bicycles and pedestrians, from Roanoke River Greenway to West Main Street sidewalks.	
S to M	Roanoke Co.	Roanoke River Greenway	Green Hill Park to Montgomery County Limits	Construct Roanoke River Greenway from Green Hill Park to Montgomery County limits.	$15,000,000
L	Roanoke Co.	I-73 Partial PE Only	Partial Preliminary Engineering for I-73 in Roanoke County	Partial Preliminary Engineering for I-73 in Roanoke County	$42,459,000

DESIRED TIME-FRAME	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	PROJECT COST (2016$)
M	Roanoke Co.	I-581 & Peters Creek Rd. Interchange Improvements (enhancing access to Valleypointe Dr.)	I-581 at Peters Creek Rd.	Reconstruct interstate interchange to improve turning movements and access to Valleypointe Blvd, Thirlane Rd (Roanoke City), and Thirlane Rd (Roanoke County).	$4,500,000
M to L	Roanoke Co.	Friendship Lane/Carvins Creek Bridge Replacement	Friendship Lane over Carvins Creek	Construct bicycle and pedestrian bridge over Carvins Creek at terminus of Friendship Lane.	$100,000
S to M	Roanoke Co.	Explore Park Access - Secondary Access Points from Rutrough Rd. and Road Circulation Improvements	Various locations at Explore Park	Improve secondary system access points from Rutrough Road.	$5,884,230
M to L	Roanoke Co.	Explore Park Access - Hardy Rd./Blue Ridge Parkway Connection	Hardy Rd at Blue Ridge Parkway	Construct interchange at Hardy Rd and Blue Ridge Parkway to improve access to Explore Park.	$4,885,000
M	Roanoke Co.	Electric Road/419 & Brambleton to Postal Multimodal Improvements	Brambleton Ave. to Postal Dr.		$100,000
M to L	Roanoke Co.	Develop U.S. 460/Challenger Ave. to Urban 6 lanes (continuation of Roanoke City project - from Roanoke City Limits to Botetourt Co.)	Roanoke City Limits to Botetourt County Limits	Improve Rt 460 to Urban 6-lane, with bicycle and pedestrian accommodations from Roanoke City to Botetourt County.	$36,000,000

DESIRED TIME-FRAME	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	PROJECT COST (2016$)
M to L	Roanoke Co.	Rt. 419/Ogden Rd. to Rt. 221 – Urban 6 lane w/bike, pedestrian	Ogden Rd. to Rt. 221	Improve Rte. 419 to Urban 6-lane, with bicycle and pedestrian accommodations.	??
S to M	Roanoke Co.	Rt. 11, Peters Creek to Botetourt Co., Bike/Pedestrian Improvements	Peters Creek Rd. to Botetourt County Limits	Construct bicycle and pedestrian accommodations on U.S. 11, from Peters Creek Rd to Botetourt County.	??
M	Roanoke Co. / GRTC	Roanoke County Transfer Facilities (various)	County-wide	Construct new transit transfer facilities in various locations.	$900,000
M	Multi-Jurisdictional	Brambleton Avenue – Multimodal Improvements			$3,600,000
M	Multi-Jurisdictional	Interchange Lighting at I-81 Exits 137-150	I-81 Exit 137-Exit 150	To provide interchange lighting on I-81 at exits 137, 140, 141, 143, 146, and 150.	$8,400,000
	Multi-Jurisdictional	Tinker Creek Greenway	Masons Mill to Greenfield		$10,000,000
	Town of Vinton	Washington Avenue Pedestrian Crossing	S. Pollard St., 200 & 700 blocks of Washington Ave.	Pedestrian crossing to connect neighborhood to downtown & commercial areas along Washington Ave	
M	Town of Vinton	Walnut Avenue and 8th Street Intersection	Walnut Avenue and 8th Street		$2,300,000
M	Town of Vinton	Virginia Ave./Rte. 24 bicycle improvements	ECL Roanoke City to Chestnut St.		

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DESIRED TIME-FRAME	JURISDICTION	PROJECT TITLE	PROJECT LIMITS	PROJECT DESCRIPTION	PROJECT COST (2016$)
M	Town of Vinton	Hardy Road SRTS Project (to include new signalized intersection)	W.E. Cundiff Elementary School	Pedestrian crossing to connect neighborhood to school & Wolf Creek Greenway	$300,000
ANY	Town of Vinton	Glade Creek Greenway, Phase III	Gus Nicks Blvd. to Vinyard Park		$400,000
M	Town of Vinton	Comprehensive Traffic Intersection Improvements	Major Corridors: Washington and VA Ave., Hardy Rd., & Pollard St.	Re-evaluation to upgrade 11 traffic signals	$2,800,000

APPENDIX B: Greater Roanoke Transit Company Operating Budget Projects

The following table shows the operating budget projections needed to sustain current services for the Greater Roanoke Transit Company through 2040. The projections reflect a 3% annual inflation.

Fiscal Year	Amount
2017	$8,825,180.00*
2018	$9,089,935
2019	$9,362,633
2020	$9,643,512
2021	$9,932,818
2022	$10,230,802
2023	$10,537,726
2024	$10,853,858
2025	$11,179,474
2026	$11,514,858
2027	$11,860,304
2028	$12,216,113
2029	$12,582,596
2030	$12,960,074
2031	$13,348,877
2032	$13,749,343
2033	$14,161,823
2034	$14,586,678
2035	$15,024,278
2036	$15,475,007
2037	$15,939,257
2038	$16,417,434
2039	$16,909,957
2040	$17,417,256

* This number comes from the Virginia Commonwealth Transportation Board FY17 Rail and Public Transportation Improvement Program

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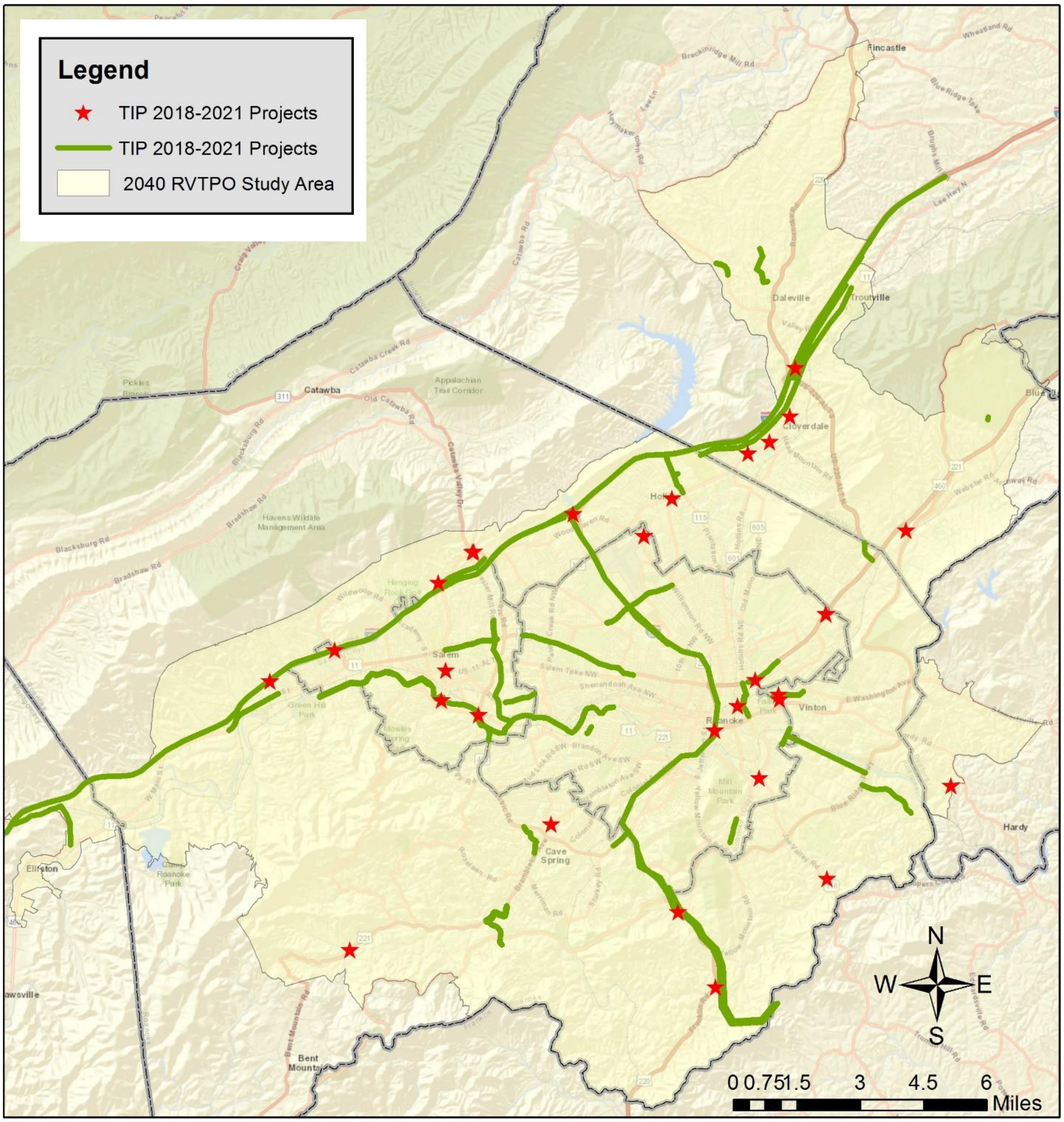
APPENDIX C: Maps of Priorities per Regional Plans



FY 2018-2021 Transportation Improvement Program

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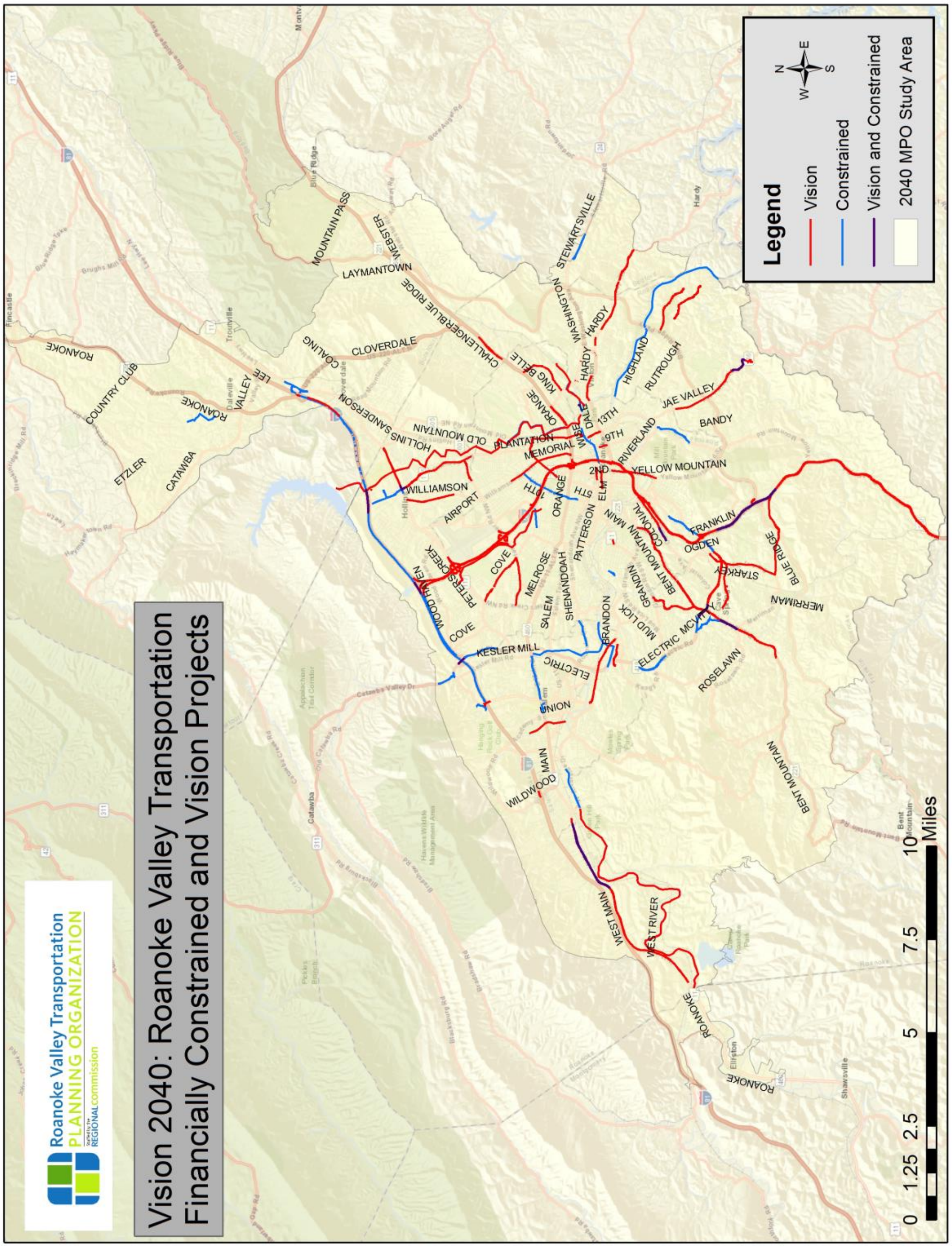

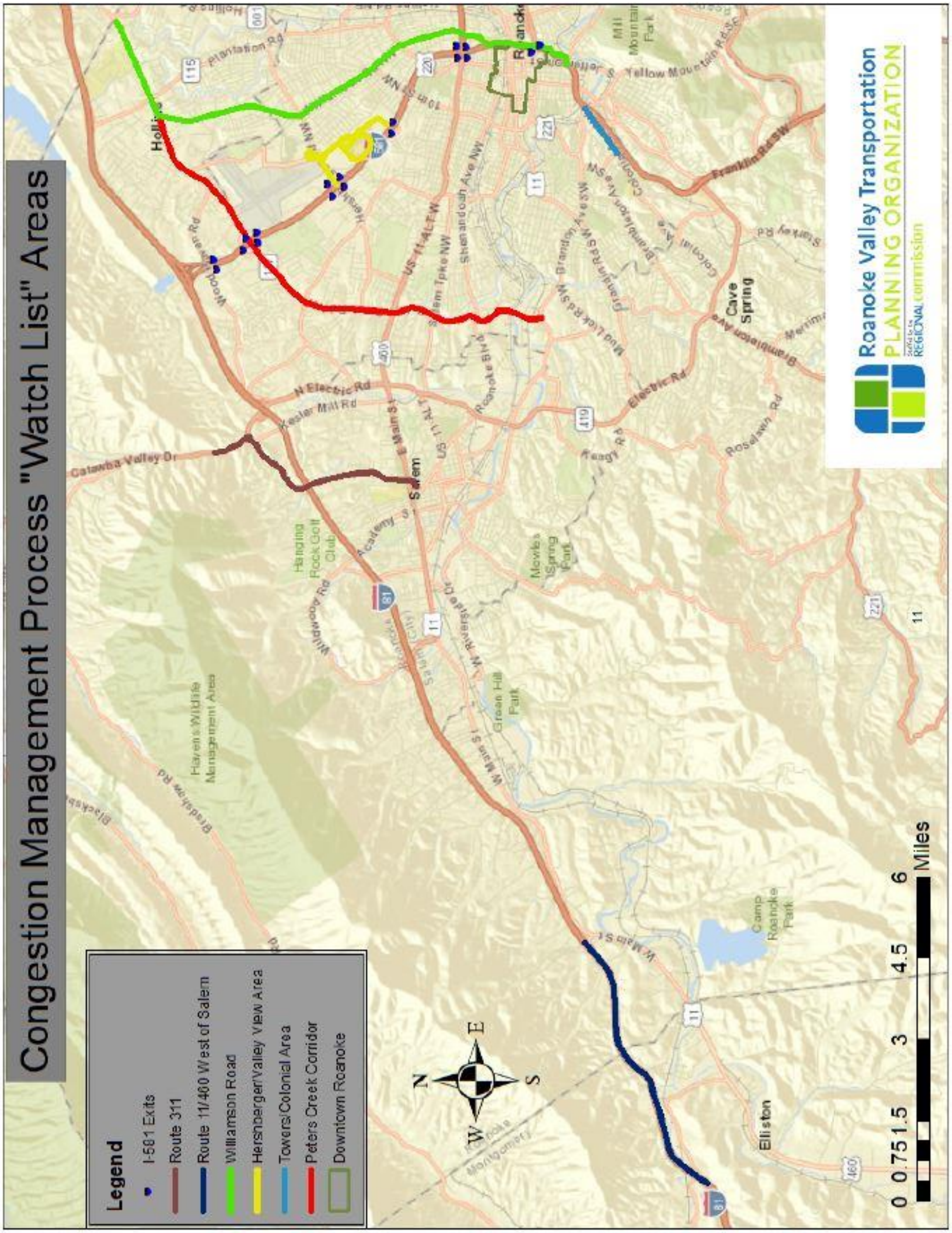
Congestion Management Process "Watch List" Areas
Legend
I-581 Exits
Route 311
Route 11/460 West of Salem
Williamson Road
Hershberger/Valley View Area
Towers/Colonial Area
Peters Creek Corridor
Downtown Roanoke
0 0.75 1.5 3 4.5 6
Miles
Roanoke Valley Transportation
PLANNING ORGANIZATION
Salem
Cave Spring
Elliston
Hollins
Roanoke

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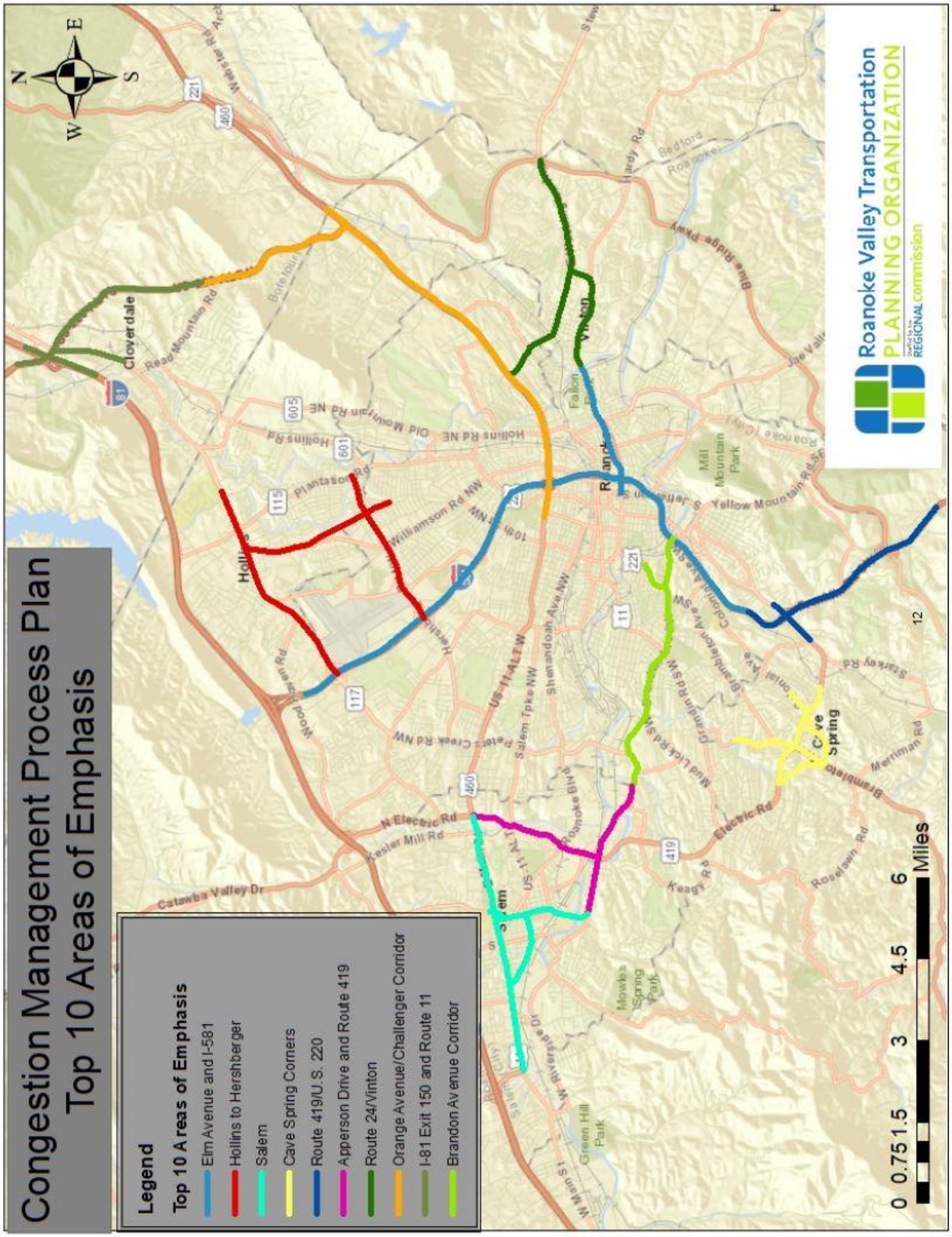
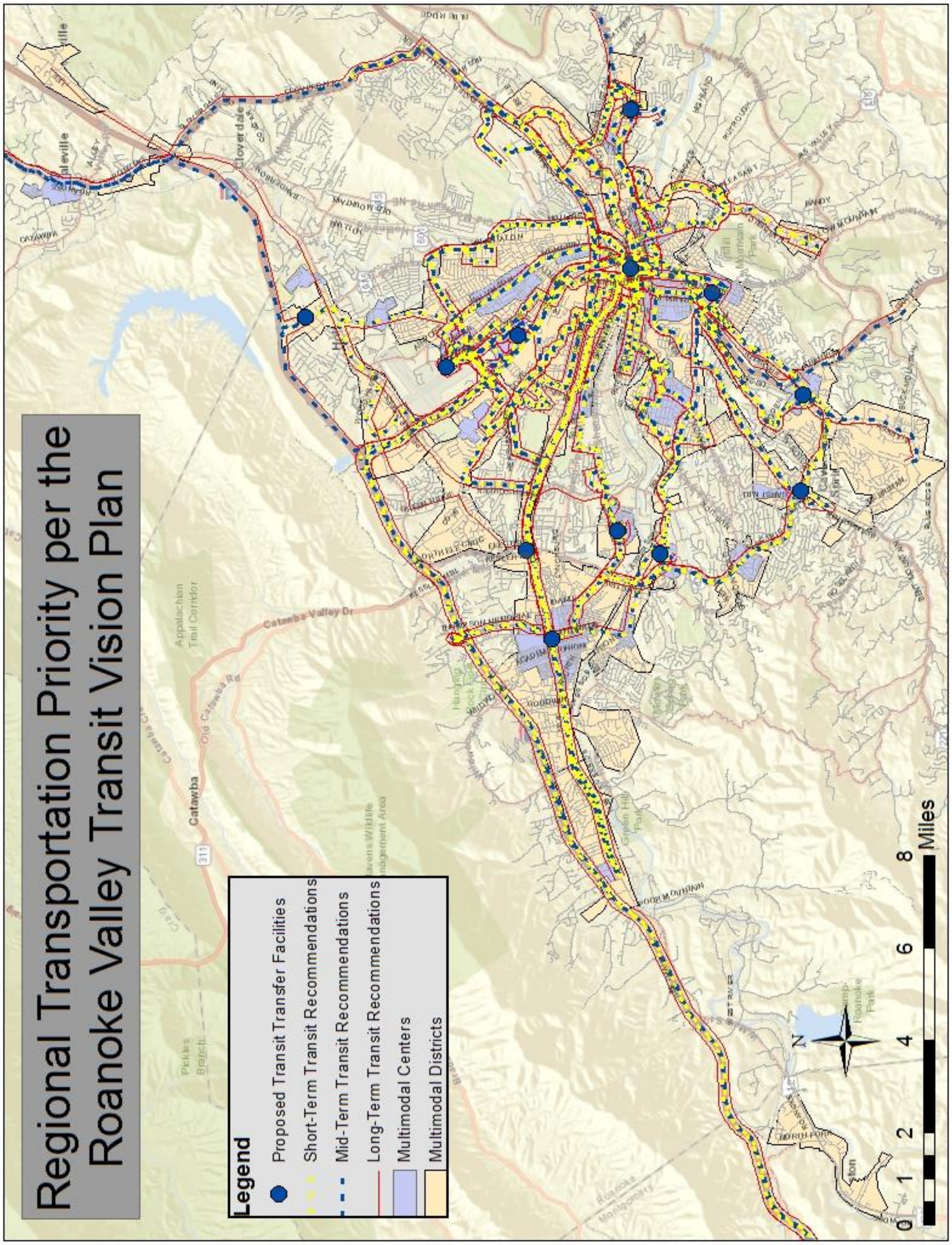
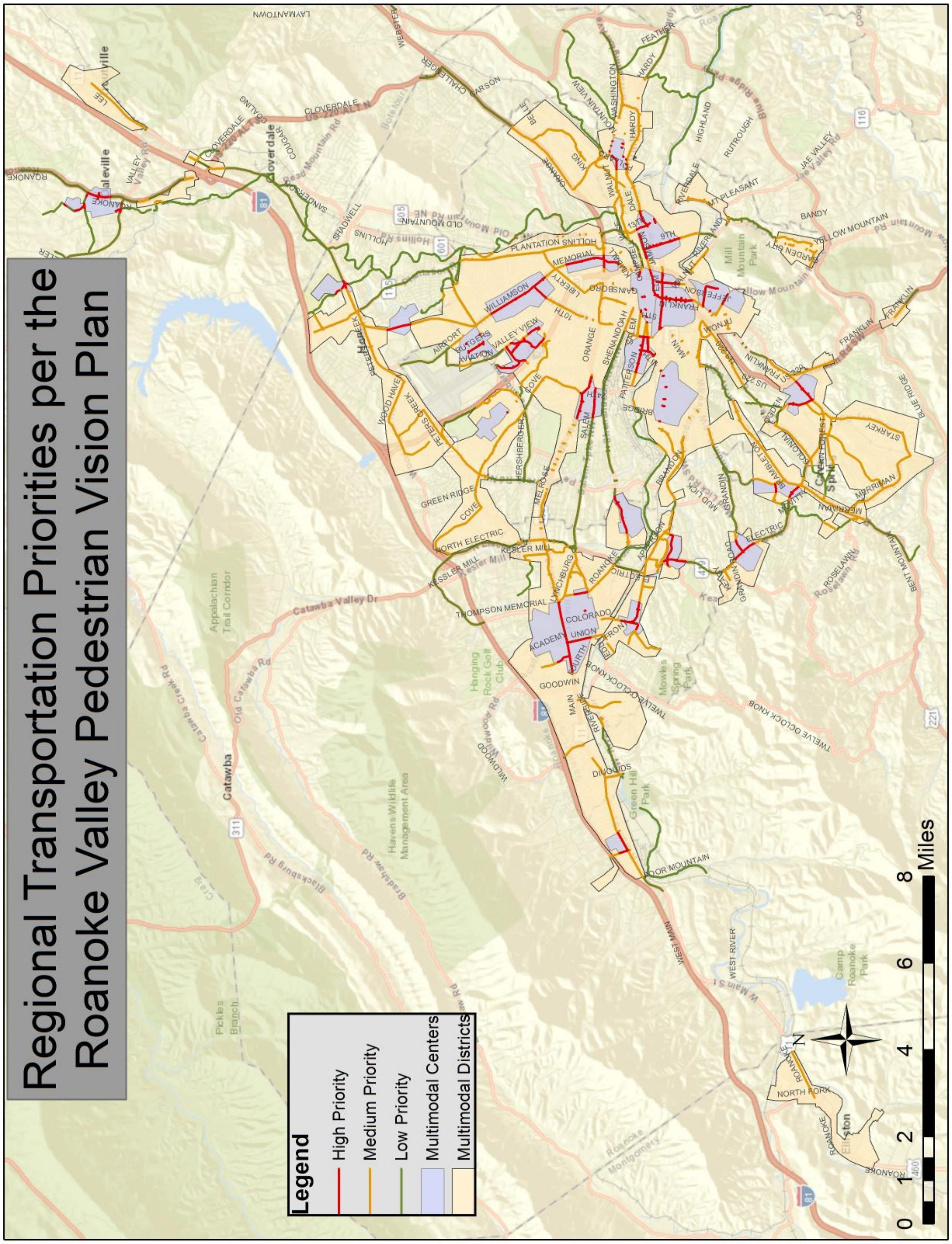
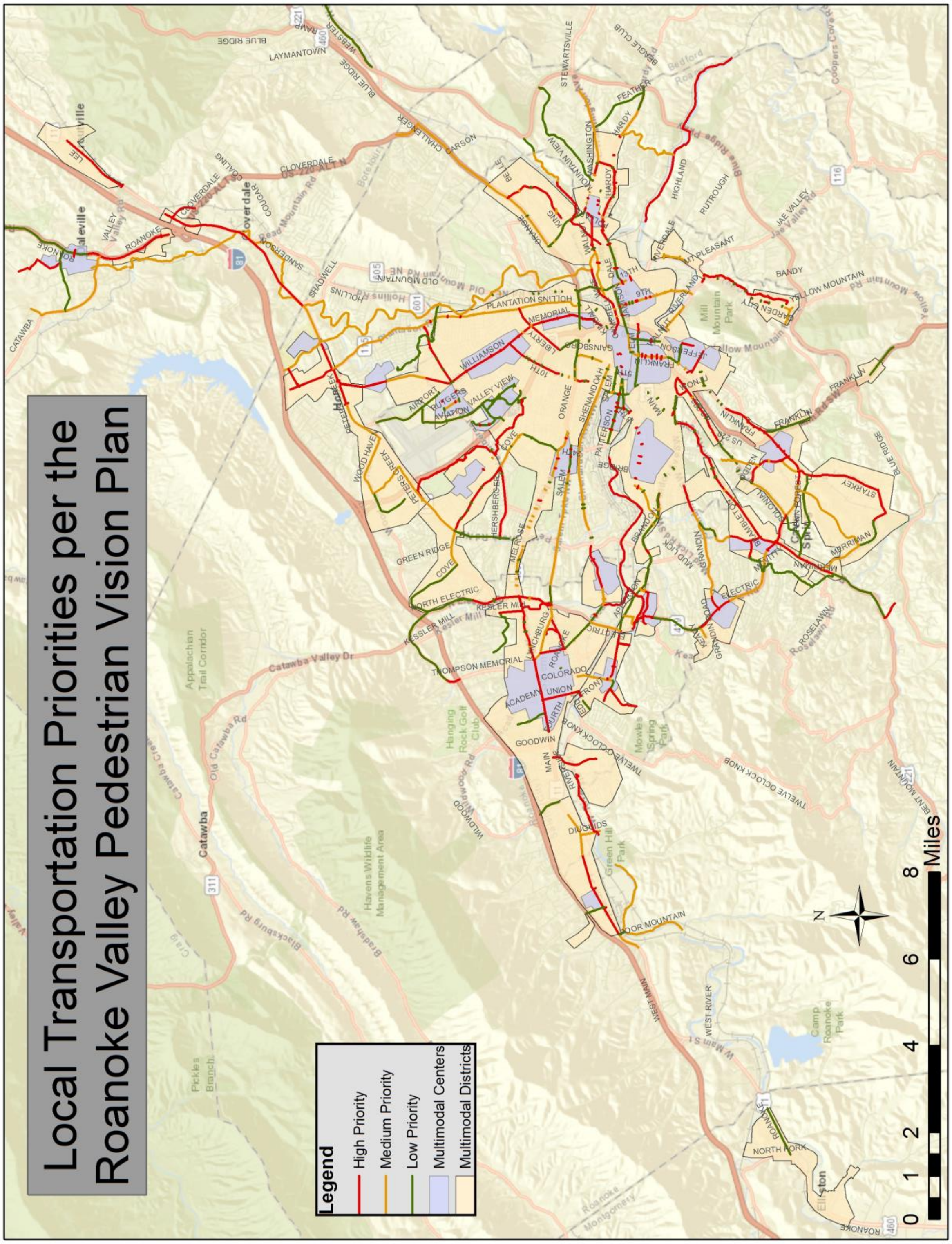
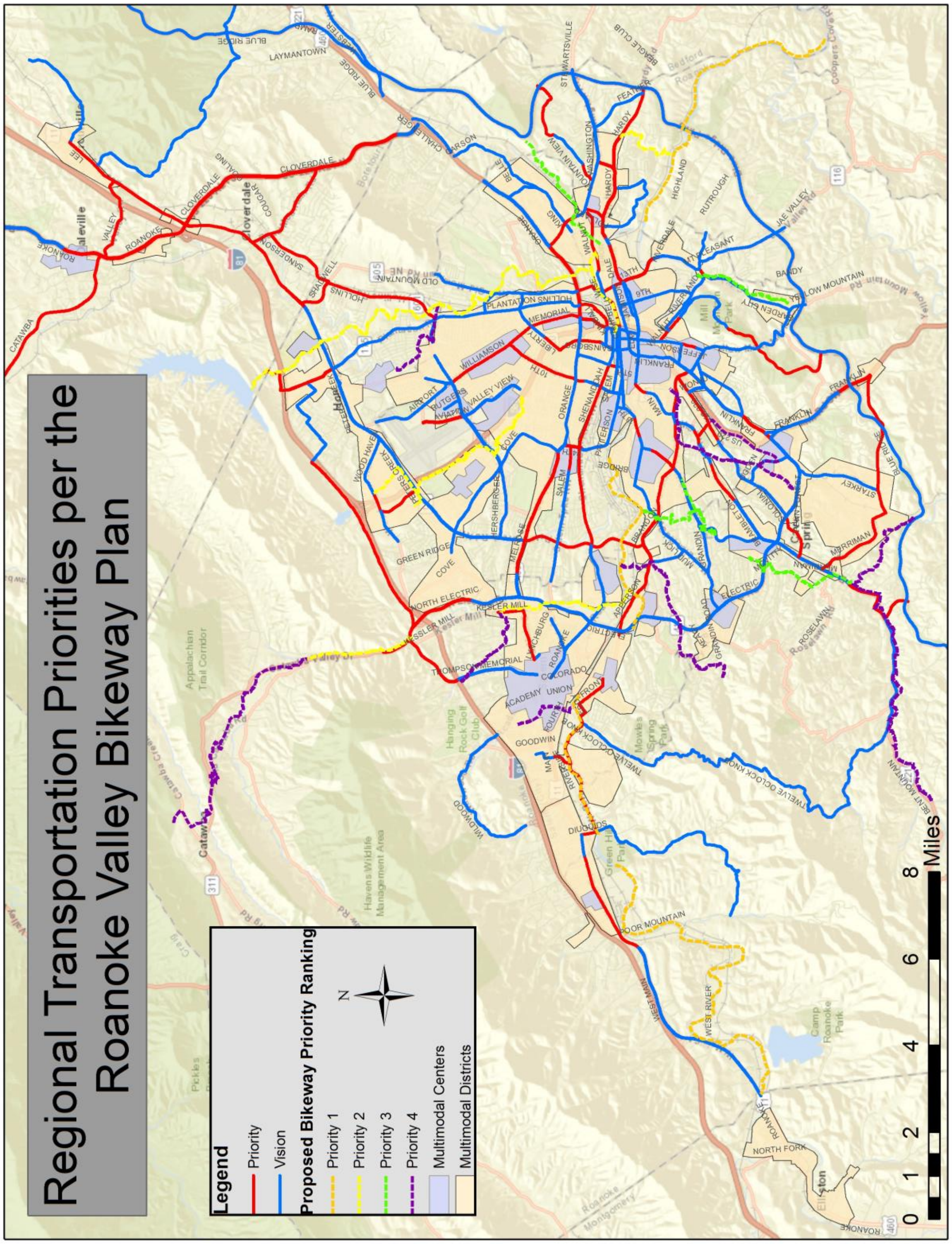



Regional Transportation Priority per the Roanoke Valley Transit Vision Plan
Legend
Proposed Transit Transfer Facilities
Short-Term Transit Recommendations
Mid-Term Transit Recommendations
Long-Term Transit Recommendations
Multimodal Centers
Multimodal Districts
0 1 2 4 6 8 Miles
N


Regional Transportation Priorities per the Roanoke Valley Pedestrian Vision Plan
Legend
High Priority
Medium Priority
Low Priority
Multimodal Centers
Multimodal Districts
0 1 2 4 6 8 Miles
N


Local Transportation Priorities per the
Roanoke Valley Pedestrian Vision Plan
Legend
High Priority
Medium Priority
Low Priority
Multimodal Centers
Multimodal Districts
N
0 1 2 4 6 8
Miles


Regional Transportation Priorities per the
Roanoke Valley Bikeway Plan
Legend
Priority
Vision
Proposed Bikeway Priority Ranking
Priority 1
Priority 2
Priority 3
Priority 4
Multimodal Centers
Multimodal Districts
N
0 1 2 4 6 8 Miles

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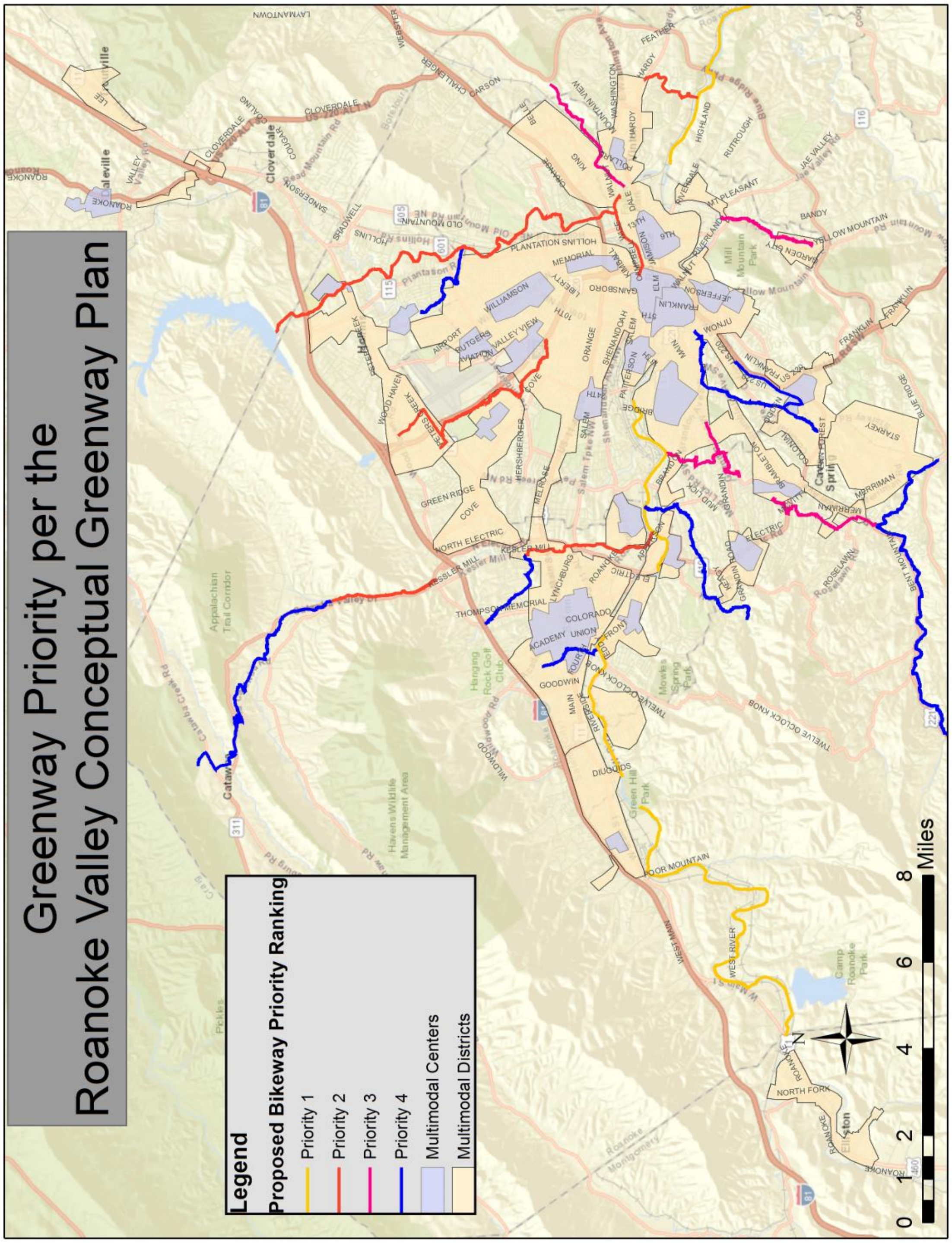

Note: The 2007 Update to the Conceptual Roanoke Valley Greenway Plan is currently being updated and is expected to be completed by late 2017/2018.