Traffic Congestion Management Process

2020

Roanoke Valley Transportation
PLANNING ORGANIZATION
Staffed by the REGIONALcommission

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Roanoke Valley Transportation
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The 22th day of October 2020

RESOLUTION

Approving the Congestion Management Process for the Roanoke Valley Transportation Planning Organization

WHEREAS, the Roanoke Valley Transportation Planning Organization was classified as a Transportation Management Area (TMA) by the federal government in July 2012 based on the increase in population of the Roanoke urbanized area as documented by Census 2010; and

WHEREAS, TMA classification resulted in additional planning responsibilities, including the development of a regional Congestion Management Process; and

WHEREAS, the region's Congestion Management Process, first adopted in 2014, is a multi-modal approach to traffic congestion, which provides ample discussion of the role of highway, public transportation, non-motorized, and transportation demand management approaches to reducing traffic congestion; and

WHEREAS, the Congestion Management Process should be updated from time to time in response to changes technology, regulations, and traffic congestion;

NOW THEREFORE BE IT RESOLVED that the Policy Board of the Roanoke Valley Transportation Planning Organization does hereby approve the updated Congestion Management Process as presented.

Billy W. Martin, Sr.
Chairman

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1. Introduction

RVTPO Congestion Goal:
The Roanoke Valley does not have much severe traffic congestion and the RVTPO wants to keep it that way!

The Roanoke Valley's vision for transportation is "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."[1] Traffic congestion impedes people from accessing destinations. Thus, traffic congestion management is needed to ensure people's timely access to destinations. Preventing or managing traffic congestion is essential to fulfilling the long-range vision and meeting performance goals for transportation system reliability.

Fortunately, compared with other urban areas, the Roanoke Valley does not have much severe traffic congestion, and the Roanoke Valley Transportation Planning Organization (RVTPO) wants to keep it that way. Residents view short travel times as a quality of life benefit. Due to the success of economic development and tourism efforts to attract people and businesses to the Roanoke Valley, traffic and travel times may increase. The Congestion Management Process described in this document aims to proactively implement traffic congestion prevention strategies and efficiently manage the conditions that result in traffic delays even as the population and the economy grow in the Roanoke Valley.

Free flow traffic on U.S. 460 / Main Street

Traffic on Route 419 regularly backs up near the U.S. 220 interchange

When the population of the urbanized area of the Roanoke Valley[2] exceeded 200,000, the Roanoke Valley became a Transportation Management Area subject to additional federal requirements including developing a Congestion Management Process for traffic congestion. The RVTPO adopted its first Congestion Management Process in 2014. At the time, technologies of assessing traffic

[1] Vision 2040: Roanoke Valley Transportation, The Constrained Long-Range Multimodal Transportation Plan for the Roanoke Valley Transportation Planning Organization (2017)
[2]The urbanized area of the Roanoke Valley as defined by the 2010 U.S. Decennial Census includes the City of Roanoke, Salem, Vinton, and portions of Roanoke, Botetourt, Bedford, and Montgomery Counties.

congestion using data from GPS-equipped vehicles and smart phones were in their infancy. Changes in technology and changes in federal requirements prompted this update of the Congestion Management Process.

Table 1. Federal Highway Administration process model actions for congestion management

Action	Location
Develop Regional Objectives for Congestion Management	Section 5
Define the Congestion Network	Section 2.3
Develop Multimodal Performance Measures	Section 6
Collect Data/Monitor System Performance	Section 2.2
Analyze Congestion Problems and Needs	Section 0
Identify and Assess Strategies	Section 6
Program and Implement Strategies	Section 6
Evaluate Strategy Effectiveness	Section 7

The RVTPO carries out the continuing, cooperative, and comprehensive transportation planning process in agreement[3] with the Commonwealth of Virginia, the Greater Roanoke Transit Company, and Unified Human Services Transportation Systems, Inc. The Federal Highway Administration outlines the eight actions of the Process Model in "Congestion Management Process: A Guidebook" and assesses compliance with federal requirements using this eight-action model. The eight actions are incorporated into this document (Table 1).

1.1 Progress since 2014

The 2014 Congestion Management Process Plan identified Top Ten Areas of Emphasis-corridors identified through public input as having issues with traffic congestion. Many projects intended to address traffic congestion in the Top Ten Areas of Emphasis have been completed or are underway (Table 2, Figure 1). Local governments continue to invest in pedestrian and bicycling infrastructure such as sidewalks, greenway trails, and bike lanes which may give some people an alternative to driving for short trips. An on-board transit GIS system and route modifications are among general improvements to the transit system that influence mode choice and affect the region including and beyond the Top-Ten Areas of Emphasis. In addition to the Top Ten Areas of Emphasis, several widening projects to address traffic congestion on Interstate 81 have been funded or are under construction as part of the I-81 Corridor Improvement Plan.

Table 2. Congestion management area updates since 2014

Area of Emphasis	Progress
#1 Elm Avenue and I-581	I-581/Elm Avenue Interchange ramp capacity / operational improvements completed.
#1 Elm Avenue and I-581	The Smart Way Commuter transit route was extended to the VTCRI medical school and a new Smart Way Express service was added. Real-time passenger information was added to the Smart Way services.
#1 Elm Avenue and I-581	Valley View interchange completed adding access from I-581 SB to Valley View Blvd. and from Valley View Blvd. to I-581 NB.

[3] 3C Agreement, 2018.

Area of Emphasis	Progress
#2 Hollins to Hershberger	Pedestrian signals and crosswalks have been installed at the Williamson Road and Plantation Road intersection. Sidewalk on Williamson Road is funded from this location for about one mile to Dent Road/Clubhouse Drive, with pedestrian signals and crosswalks planned for the Peters Creek Road intersection.
#3 Salem	Downtown Salem Intersection & Streetscape Improvements: Intersection and turning movement improvements, transit stops and a transit transfer facility, and streetscape on Main Street between Broad St. and Thompson Memorial Dr. Construction anticipated in 2021.
#3 Salem	Transit vehicle size increased for routes #91/#92.
#4 Cave Spring Corners	Traffic signals on Route 419 and Route 221 have been coordinated to improve traffic flow and reduce congestion. SMART SCALE project completed in 2020.
#5 Route 419/U.S. 220	Five signals on U.S. 220 in the City of Roanoke and in Roanoke County coordinated.
#5 Route 419/U.S. 220	Route 419 and Route 220 Diverging Diamond Interchange[4] project funded through SMART SCALE round 3; construction anticipated in 2028.
#5 Route 419/U.S. 220	Route 419 Widening, Safety and Multimodal Improvements Project: Upgrade signals, pedestrian accommodation, bike lanes, and a third lane between U.S. 220 and Ogden Rd. Construction underway.
#5 Route 419/U.S. 220	Four signals on U.S. 220 in the City of Roanoke and in Roanoke County will be changed to thru-cut configurations with a reduction in signal phases, which will reduce congestion. Construction anticipated in 2021.
#6 Apperson Drive and Route 419	No progress.
#7 Route 24/Vinton	Transit routes #31/#32 and #35/#36 rerouted for more efficient and direct service to popular destinations.
#8 Orange Ave / Challenger Corridor	Turning lanes and signals added at Blue Hills Drive/Orange Avenue.
#8 Orange Ave / Challenger Corridor	Route 460 signals coordinated through the City of Roanoke and Roanoke County.
#8 Orange Ave / Challenger Corridor	Transit route #31/#32 rerouted connecting downtown Roanoke and the Roanoke Centre for Industry & Technology.
#9 Exit 150 and Route 11	Exit 150 Access Management Improvements Project completed, including a roundabout at Exit 150 on Route 11.
#10 Brandon Avenue Corridor	No progress.

[4] Diverging Diamond Interchange is described in Innovative Intersections and Interchanges, Virginia Department of Transportation. http://www.virginiadot.org/innovativeintersections/

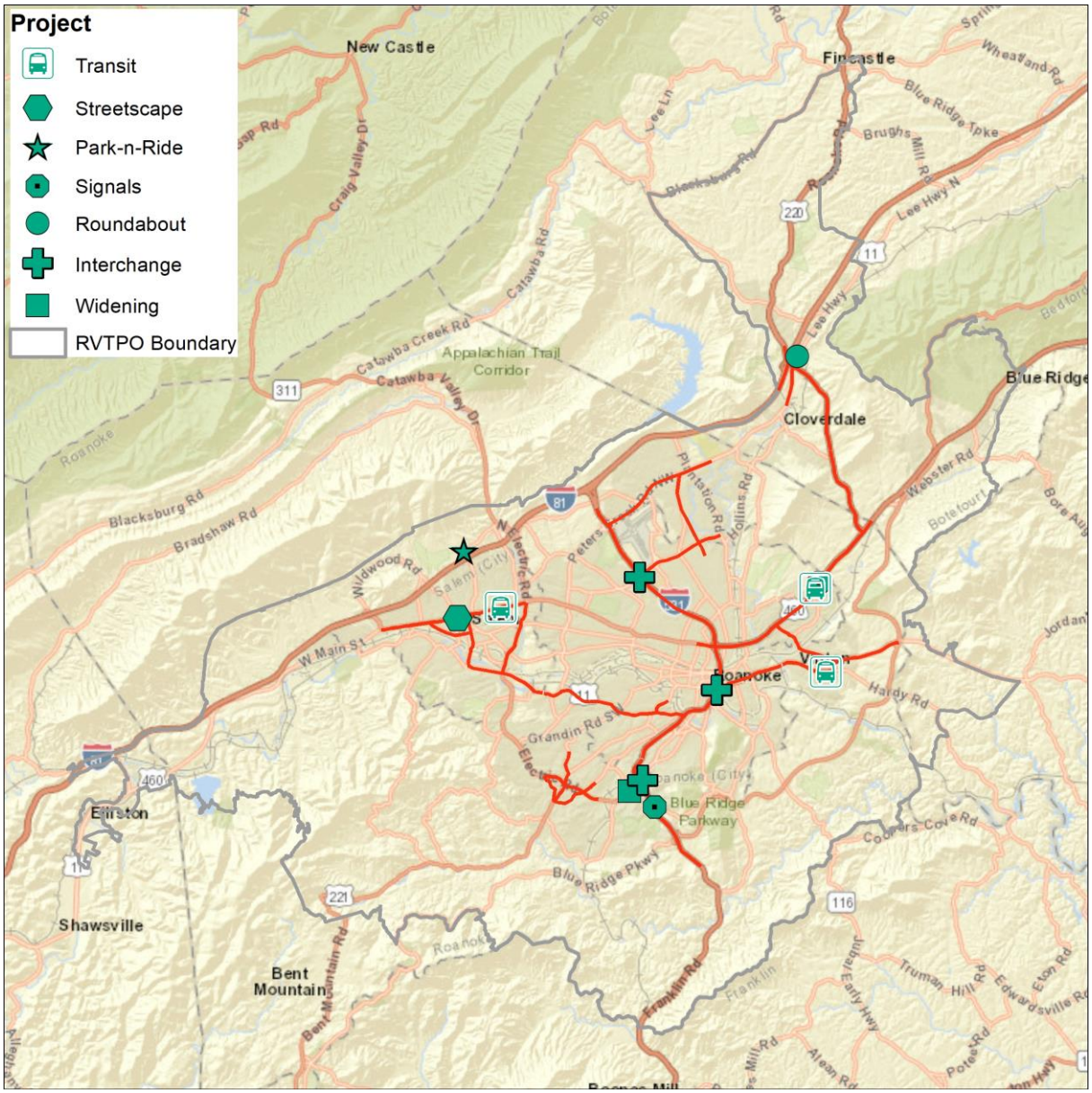


Figure 1. Projects to address traffic congestion since 2014

2. Congestion

This Congestion Management Process update takes a fresh look at regional congestion. Identifying areas with unacceptable levels of traffic congestion starts with defining congestion, defining the congestion network, and developing the methodology of measuring traffic congestion. This process results in identifying priority corridors for traffic congestion management.

2.1 Defining Congestion

The RVTPO congestion management process is focused on preventing or mitigating roadway traffic congestion, which the RVTPO defines as when roads fill up with so many vehicles that travel times become longer. The RVTPO's Transportation Technical Committee described traffic congestion as:

Traffic comes in many forms

- experiencing a traffic delay while traveling; or
- a trip taking a few minutes longer than expected; or
- waiting more than one cycle of a traffic light.

The Transportation Technical Committee acknowledged that traffic congestion can be positive – and that a lack of traffic congestion could even put some companies out of business. Difficulty finding a parking space downtown indicates a demand to be downtown shopping, eating, and spending money. Traffic congestion that lowers travel speeds can reduce traffic fatalities and serious injuries. It encourages people to use other ways to travel to avoid delays or the difficulty of finding a place to park. Other types of congestion such as high usage of sidewalks, bikeways, or greenways is positive indicating a popular place to be and to walk or bike.

Managing traffic congestion is part of maintaining a balance of economic growth, efficient movement of people and goods, and a clean healthy environment. The RVTPO's Traffic Congestion Management Process addresses the need to maintain expected travel times or minimize travel time increases on roadways in the Roanoke Valley's congestion management network.

2.2 Measuring Traffic Congestion

Measuring regional traffic congestion and forecasting future conditions previously relied on Volume/Capacity (V/C) ratio (measuring the amount of traffic on a road compared to the amount of traffic it was designed to hold). V/C ratio was calculated once every five years by the Virginia Department of Transportation based on Average Annual Daily Traffic counts. With the increase in use of mobile devices (like smart phones) and GPS-connected vehicles, agencies are developing and adopting methods of assessing traffic congestion based on data obtained from these devices in moving vehicles that provide a real-time understanding of traffic conditions.

During a November 2019 workshop on traffic congestion, the Performance Measures Focus Group reviewed the Planning Time Index method to identify traffic congestion, monitor the level of congestion, and assess the impact of congestion management activities on traffic congestion. The Performance Measures Focus Group concluded that Volume/Capacity ratio is theoretical while Planning Time Index is what people experience every day and can be more easily communicated. Planning Time Index boosts confidence in understanding the data and its accuracy. Therefore, Planning Time Index (PTI) is the way RVTPO is now measuring traffic congestion in the Roanoke Valley because it is related to crashes or other incidents rather than regularly having more traveling vehicles than the roads can manage.

Planning Time Index is the trip time of 95 percent of the trips on a roadway segment divided by the amount of time it would take to travel the segment in free-flow conditions. For example, a Planning Time Index of 3 means that for a trip that normally takes 10-minutes, five percent or fewer of those trips take more than 30 minutes. Planning Time Index is now available via INRIX data for most major roads in the Roanoke Valley and is available for all interstate and non-interstate National Highway System roads.

What is acceptable traffic congestion?

The acceptable level of system performance is 97% of the road network operates at PTI less than 3 during peak hours and at PTI less than 2.5 at other times.

This means that during peak travel times on 3% of major roads, a ten-minute trip may take up to 30 minutes on 95% of the days. At other times of day, that same trip may take up to 25 minutes.

Residents, businesses, and visitors to the Roanoke Valley expect traffic congestion to be worse during peak hours, defined as 7:00 – 9:00 am and 4:00 – 6:00 pm. They know to plan their travel around those hours or to allow more time if they must travel during peak traffic. What is an acceptable trip time during peak hours is not acceptable off-peak.

Based on historical data in the Roanoke Valley and data from regions that struggle with severe traffic congestion, it is reasonable for up to three percent of the road network to operate at PTI of 3 during peak hours and at PTI of 2.5 during off-peak hours.

To maintain this level of system performance, where 97% of the network is operating at acceptable levels of congestion, the region will implement land use, transportation demand management, and operational strategies described in Section 6.

2.3 Congestion Network

The traffic congestion network defines the set of roads within the RVTPO study area boundary being monitored in the Traffic Congestion Management Process. Regional traffic congestion is based on the roads for which Planning Time Index data are available[5] (Figure 2). Priority corridors for traffic congestion management activities and corridors of concern include other roads as well (Section 0). During the development of the 2014 Congestion Management Process, Planning Time Index data was not available. The congestion network at the time, dubbed the Top 10 Areas of Emphasis, was based on

[5] Due to where the segment begins and ends, segments may extend beyond the RVTPO boundaries.

public input. In updating the RVTPO's congestion network and identifying priority corridors for traffic congestion management activities, both Planning Time Index and the Top 10 Areas of Emphasis were considered.

The road network for which Planning Time Index (PTI) data are available has quickly expanded, from 342 miles for 2013 to 452 miles for 2018 and 2019 (a 30% increase). Some roads in the system have a high PTI during peak traffic and some roads experience no delay. Between 2013 and 2019, 2.1% or fewer miles of RVTPO roads had PTI greater than 3 during peak times and 2.6% or fewer miles greater than 2.5 during off-peak times, which is the within RVTPO's acceptable level of traffic congestion. Therefore, the RVTPO congestion network consists of roads that have data available and may change as more data becomes available.

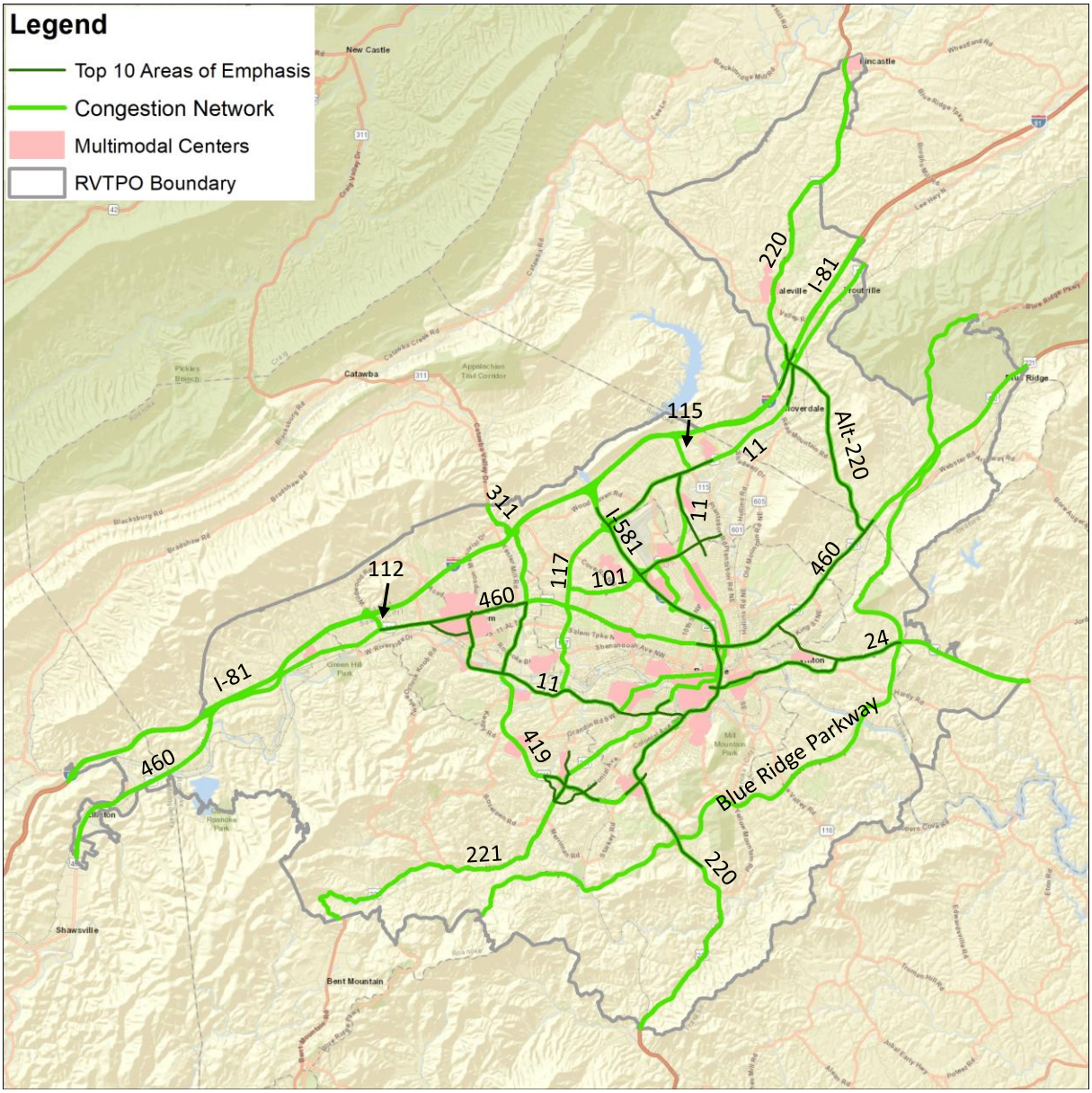


Figure 2. Congestion network for assessing regional traffic congestion

3. Public Input

Input from a stakeholder workshop, a public survey, and freight interviews guided this update.

3.1 Congestion Management Process Update Stakeholder Workshop

A stakeholder workshop was held on November 6, 2019 with representatives from local governments and modal agencies present. During the workshop, three focus groups addressed performance measures to define and monitor traffic congestion, land use strategies to manage traffic congestion, and transportation demand management strategies to manage traffic congestion.

3.1.1. Land Use Focus Group

The Land Use Focus Group discussed "good" land use practices that promote smooth traffic flow and discourage traffic congestion and how to promote these land use practices within their localities and agencies. Participants had a shared understanding and agreement on what land use practices are good, such as parking management and reduced minimum parking requirements, mixed-use and infill development, small parcel sizes, and grid systems of streets.

The concept of a "sidewalk to nowhere" came up frequently: Today's "sidewalk to nowhere" will connect to somewhere someday. However, neither sidewalks nor mixed-use development bring destinations close enough to be walkable, so constructing infrastructure for pedestrians and bicyclists must be paired with good land use/development practices that will bring destinations closer. Similarly, vanpools require land use practices that will create a concentration of people on one end of a trip, such as a dense residential community, and a concentration of jobs on the other trip end.

Participants discussed the challenges in promoting good land use practices. Without severe traffic congestion or high gas prices, for many developers/local government officials/citizens, their motivation for land use changes to prevent future congestion is weak. But pushing for good practices now can prevent severe congestion, improve air and water quality, and prepare for the potential of future high gas prices or an influx of people and activities into the region.

The Land Use Focus Group identified tools to increase land development practices that promote smooth traffic flow and decrease land development practices that promote traffic congestion. Appropriate tools described below that localities can use range from soft encouragement towards developers to mandates in ordinances.

Education: Especially for smaller jurisdictions, showcasing successes and educating developers on the possibilities of exceptions to ordinances are sometimes more feasible than changing ordinances. Educating the community on the advantages of good land use practices creates political will.

Design Guidelines: Design guidelines are an interim step to changing ordinances; they are voluntary, but developers appreciate the transparency and clarity. Localities can use their own design guidelines in rezoning.

Ordinances: Ordinances that require multimodal infrastructure, not just roads for vehicle traffic, and a grid system of streets promote smooth traffic flow. Reducing or eliminating parking minimums and phasing out free parking will promote smooth traffic flow. A less obvious strategy (more obvious since the COVID-19 pandemic) to manage or prevent traffic congestion is a reliable communications infrastructure to enable and promote telework, remote learning, telehealth, etc.

Creativity: Finally, the group discussed the importance of seeking creativity from developers to achieve desired land use patterns.

3.1.2. Performance Measures Focus Group

The Performance Measures Focus Group discussed the use of Planning Time Index versus Volume Capacity Ratio to assess traffic congestion. Planning Time Index is what people experience every day and can be communicated. Planning Time Index data boosts confidence in project selection. Volume/Capacity Ratio is theoretical and difficult to understand. Although it has been used to project traffic in the future, traffic projections more than five years out are unreliable because transportation will change in ways no one can predict.

Next the group discussed peak hours. Drivers expect trips to take longer during peak hours, so the Planning Time Index threshold should be lower for off-peak (<2.5 PTI) and higher for peak (<3 PTI, 7:00 – 9:00 am and 4:00 – 6:00 pm). Planning Time Index can be evaluated on an entire road or on each direction of a road. Most roads in the congestion network do not have much directional split.

Finally, the group discussed the congestion goal. A goal of less than five percent of the road network exceeding the Planning Time Index threshold may be too easy to achieve or meaningless. A lower goal may be more motivating (and ultimately a goal of less than three percent was selected). Alternatively, as traffic congestion improves, reducing the Planning Time Index threshold could identify new priority corridors.

3.1.3. Transportation Demand Management Focus Group

Like the Land Use Focus Group, the Transportation Demand Management (TDM) Focus Group noted that motivation for TDM is weak without severe traffic congestion or high gas prices. Job access, however, is a bigger motivation for TDM.

The Transportation Demand Management Focus Group discussed the role of RIDE Solutions, the transportation demand management agency (TDM) for the region. RIDE Solutions has a very small marketing budget (which was completely eliminated due to the COVID-19 pandemic) and partnering is essential to make the most of its limited resources. The group brainstormed opportunities for partnerships.

Localities can enhance RIDE Solutions' efforts, through funding or other support. For example, localities could provide public space for RIDE Solutions advertisements in traffic congestion hot spots. Law enforcement can integrate changing attitudes about walking and bicycling into safety campaigns and the Greenway Commission can promote replacing car trips with greenway walk and bike trips. RIDE Solutions leveraged its marketing budget (when it had one) for funding from the private sector with bikeshare.

To increase revenue for RIDE Solutions and transit, the group suggested new paid parking, Adopt-A-Park-&-Ride, and fees in lieu of traffic mitigation infrastructure required of developers.

3.2 Public Survey

From January 7, 2020 to February 27, 2020, citizens were invited to participate in an electronic survey (see Appendix) to provide input about their traffic congestion experiences and priorities. Of the 304 participants, 179 (59%) provided zip codes and 146 (48%) provided race/ethnicity. Respondents represented the geography (Table 3) and the race/ethnicity (Table 4) of the population of the region.

Table 3. Zip codes of survey respondents

Geography	Zip Code	# responses received	% population	% responses received	% responses received - % population
Northeast Roanoke City, Northeast Roanoke County	24012	23	11%	13%	1%
Southeast Roanoke City	24013	3	3%	2%	-1%
Southeast Roanoke City, Southeast Roanoke County	24014	11	7%	6%	-1%
Southwest Roanoke City	24015	28	6%	16%	10%
Southwest Roanoke City	24016	9	3%	5%	2%
Southwest Roanoke City	24017	15	9%	8%	-1%
South Roanoke County	24018	14	14%	8%	-6%
North Roanoke County	24019	21	10%	12%	2%
Salem, West Roanoke County	24153	26	14%	15%	0%
Botetourt	24175	13	3%	7%	4%
Vinton, East Roanoke County	24179	7	7%	4%	-3%

Table 4. Race/Ethnicity of survey respondents

Race/Ethnicity	# responses received	% population	% responses received	% responses received – % population
Black	9	14%	6%	-7%
Hispanic	4	4%	3%	-1%
White	129	78%	88%	10%
All Other	4	4%	3%	-1%

Participants placed 733 markers on a map to indicate where they experienced traffic (Figure 3).

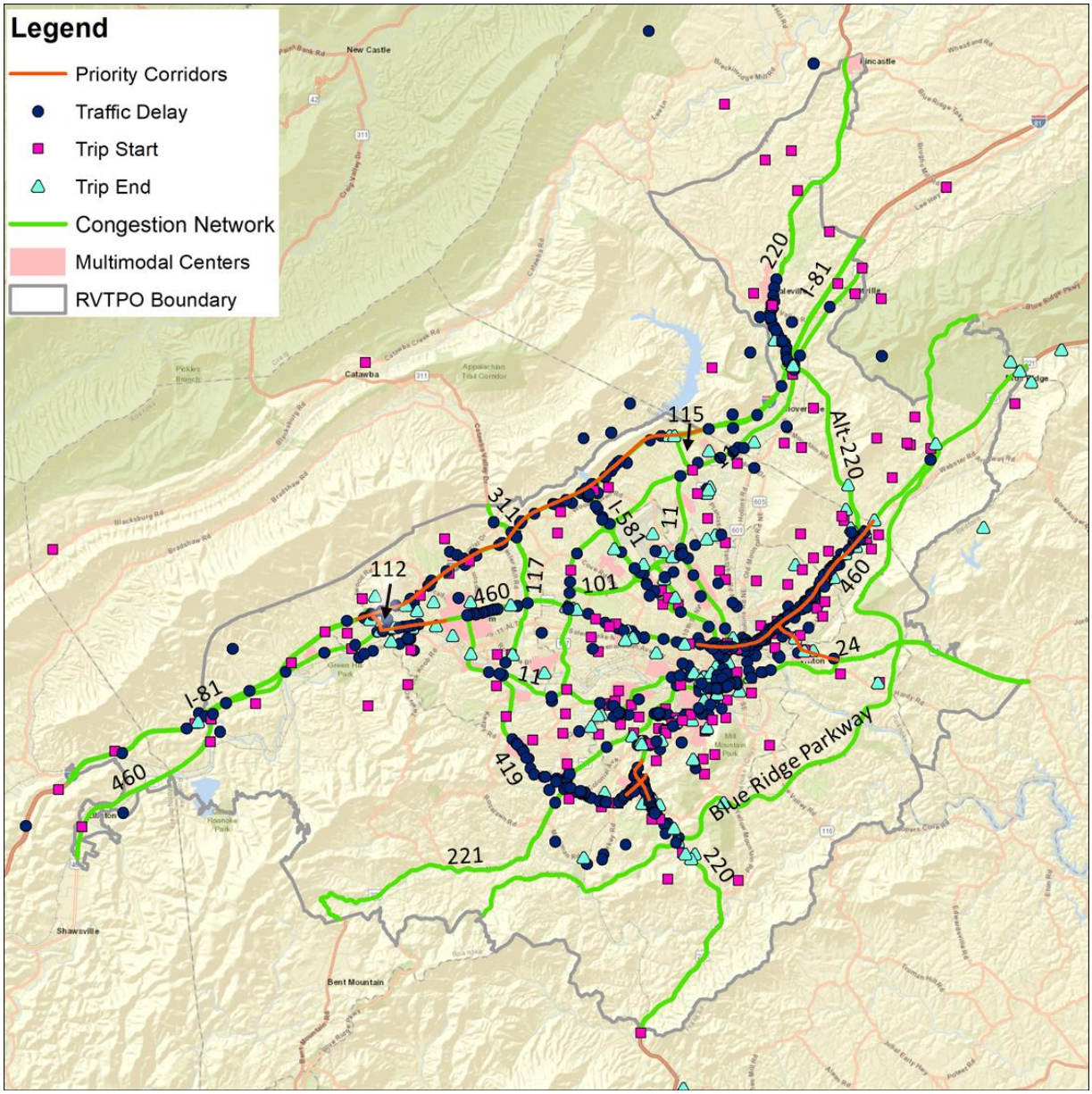


Figure 3. Where survey respondents experienced traffic delay during a trip

Of the 216 who answered how long the trip was delayed, 40% said 5-10 minutes (Figure 4).

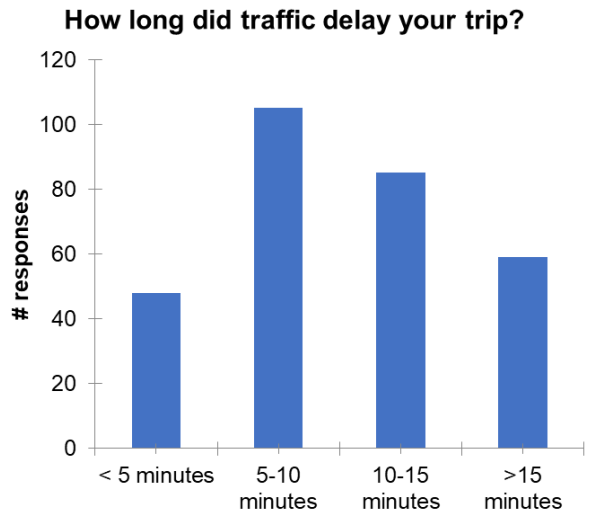


Figure 4. How long traffic delayed a trip

Travelers experiencing traffic congestion can help us learn more about why congestion may be occurring because a traveler experiencing traffic congestion is also part of the congestion. To understand the underlying causes of traffic congestion, participants described where they were coming from and where they were going when they experienced traffic congestion. Most delayed trips started at home and ended at work/school, errands/appointments, or other destinations (Figure 5).

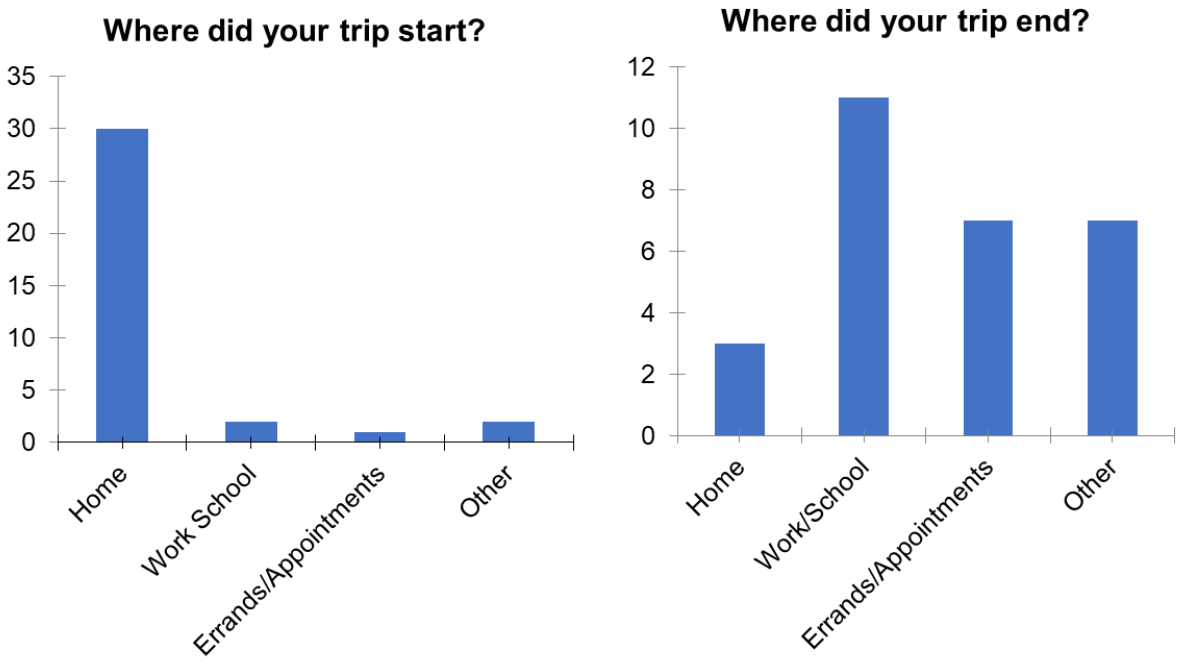


Figure 5. Where a delayed trip started and ended

Five priority corridors were identified starting with the Top 10 Areas of Emphasis from the 2014 Congestion Management Process and examining Planning Time Index data. Participants ranked three of the five corridors to determine which should be prioritized for congestion management strategies. Consistent with Planning Time Index data and consistent with the mapping exercise (Figure 3), the top corridors were Orange Avenue, I-81, and Route 419/U.S.220 (Figure 6).

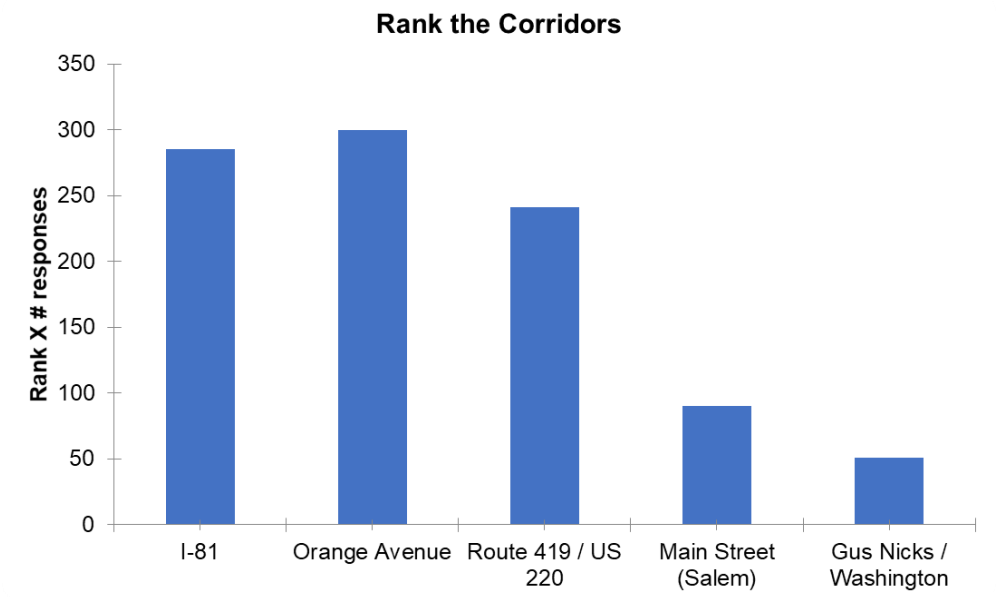


Figure 6. Corridors that should be a priority for traffic congestion management

Traffic flow is not the only transportation goal. Many strategies can support multiple transportation goals, but sometimes difficult decisions have to be made. When asked to prioritize Traffic Flow versus Access, Economy, Environment and Safety, participants prioritized Safety and Environment over Traffic Flow, equally prioritized Traffic Flow and Access, and prioritized Traffic Flow over Economy (Figure *7*).

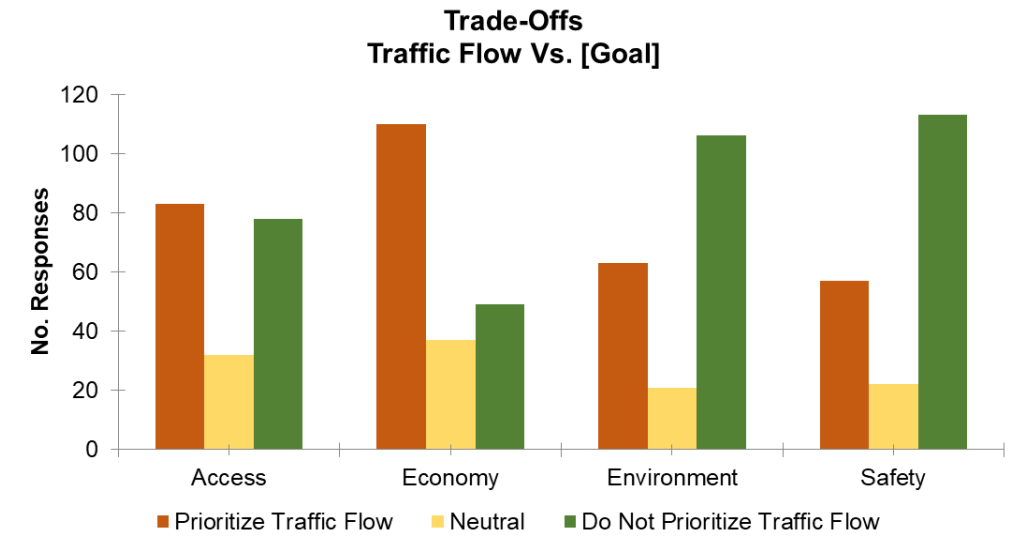


Figure 7. Trade-offs of traffic flow vs. other transportation goals

At several points throughout the survey, participants could provide additional information or other comments. Participants provided 412 comments on the Map It screen, 77 comments on Priorities, 29 comments on Investments, and 42 comments on Wrap Up, for a total of 557 comments. Comments addressed:

- Time of day – Participants mentioned specific times of day such as 5:00 pm or 5-6pm, rush hour, mornings and evenings, weekdays, school start/end times, and commute rush hours.
- Frequency – Participants cited traffic congestion occurring daily, now and then, multiple times a day, every day, constantly, and often.
- Causes – Participants believe traffic congestion is caused by traffic volume, school, commuting, and shopping, land use, construction, turning movements, trucks and trains, events, holidays, and floods.
- Participants suggested solutions to perceived traffic congestion, such as:
    - Facilitate turning movements through right turn exit lanes, restricting left turns, extending turn lanes, and changing lane configurations.
    - Increase road capacity through additional lanes and new roads.
    - Infrastructure to increase intersection capacity such as roundabouts, overpasses, and replacing four-way intersections with T-intersections.
    - Operational changes to increase intersection capacity such as more traffic lights, fewer traffic lights, signal timing changes, and real-time traffic monitoring.
    - Enforcement activities to increase road capacity such as decreased traffic speeds, increased traffic speeds, banning trucks, or adding truck-only lanes.
    - Decrease traffic through access management and restricting developments to undeveloped areas.
    - Decrease traffic delays through increasing traffic enforcement, restricting road work to late night, adding a through-traffic-only lane, faster crash response, expanding rail freight, retrofitting neighborhoods with grid street patterns, and encouraging other travel modes.

This comment illustrates how transportation influences land use: “I refused a house in Blue Ridge because of the traffic and moved my kid out of their daycare when it moved to 460.” Participants reported self-modulating their travel by avoiding traffic congestion: “while the interstate is dealing with a wreck…[y]ou might as well not go out.”

Drivers have discovered how to avoid time-consuming left turns: “Severe issues with merging traffic …to make [a] left turn onto Williamson [Rd]. Most [of the] time [it] is easier to make [a] right turn onto Williamson [Rd.] and …turn [around] in front of [the] civic center.”

Some comments were not relevant to traffic congestion but addressed other transportation goals or issues with the survey itself:

- Maintenance
- Safety

- Participants recognize that crashes contribute to traffic congestion and that traffic congestion increases the likelihood of minor crashes due to more vehicles traveling in proximity with one another.
- Participants took the opportunity to comment on bicycle and pedestrian safety and convenience and on transit service.

- Environment

3.3 Freight Interviews

Four of ten companies that represent a diverse sampling of freight movement in and through the RVTPO area responded to requests for phone interviews: Lawrence Companies, The Orvis Company, R+L Carriers, and Goodwill Industries of the Valley. Lawrence Companies moves freight nationally. The Orvis Company relies on Lawrence Companies to regulate transportation flow. R+L Carriers operates Less Than Truckload freight movement. Goodwill Industries of the Valley is a nonprofit that moves freight locally and regionally.

Freight on I-581

Interviewees were invited to share their thoughts on traffic congestion in the RVTPO area, how it affects freight movement, and how their companies cope with it. The interviewees agreed that traffic congestion is not a major issue in the Roanoke Valley. One interviewee stated, “Congestion isn’t a major factor”. Another commented that I-81 has *improved* over the past 30 years.

The unpredictability of I-81, rather than its traffic congestion, is a major issue for freight movement. Predictability is critical because drivers must operate within restricted hours and clients have restrictions on when they can accept deliveries. The only alternate routing of I-81 is U.S. 460/U.S. 11 which creates bottlenecks. Companies deal with the problem by avoiding the interstate within the urbanized area, communicating traffic conditions with their drivers, and notifying clients promptly about potential delivery delays. Signage and communication of delays on I-81 helps companies keep freight moving and customers satisfied.

Some areas are congested at predictable times of day. One company stated that his company schedules around traffic congestion, particularly I-581 during the evening peak. But another interviewee commented

Freight on U.S. 460

that travel cannot always be limited to certain times of day, such as when pickup and drop off times are set elsewhere in the nation and shipments are Just-In-Time delivery.

One interviewee commented on the need for education to the traveling public about the logistics and constraints of freight movement. For example, a customer expecting a delivery who has hired a train for $10,000 per day faces fines for the cranes that transfer the cargo from the truck to the train if the material is not at the job site on time. The general traveling public on I-81 see only the obstacles trucks pose to their movements rather than the link between trucks and the goods they see in the store, on their doorsteps, and goods that indirectly affect their lives.

The lack of understanding about truck constraints was apparent in public survey responses which blamed trucks as the cause of traffic congestion and suggested removing trucks from the interstate, restricting trucks to the right lane, and forcing trucks to drive faster or deregulating speed governors (devices that set the upper limit of a vehicle's speed, typically set at or below the posted speed limit to save diesel fuel and improve safety, according to one freight interviewee). Other citizens expressed fears of trucks traveling too fast.

4. Corridors for Congestion Management

Data and public input were used to identify Priority Corridors for congestion management activities and Corridors of Concern. State VTrans congestion needs were identified in the region.

4.1 Priority Corridors

Planning Time Index (PTI) was assessed for the Top 10 Areas of Emphasis from the 2014 Congestion Management Process to prioritize specific corridors for further public input (Figure 6). Corridors from the Top 10 Areas of Emphasis that had PTI>3 between 5 pm and 6 pm on some portion of the Area of Emphasis were #1 Elm Avenue and I-581, #3 Salem, #5 Route 419/U.S. 220, #8 Orange Avenue/Challenger Avenue, and #9 I-81 Exit 150 and Route 11 (Figure 8). Congestion mitigation infrastructure projects have been constructed recently to address Areas of Emphasis #1 Elm Avenue and I-581 and #9 I-81 Exit 150 and Route 11. The higher PTI in these areas may have been in part due to construction activities and the Performance Measures Focus Group indicated that these were unlikely to be the focus for additional infrastructure. Therefore, these were not included as Priority Corridors.

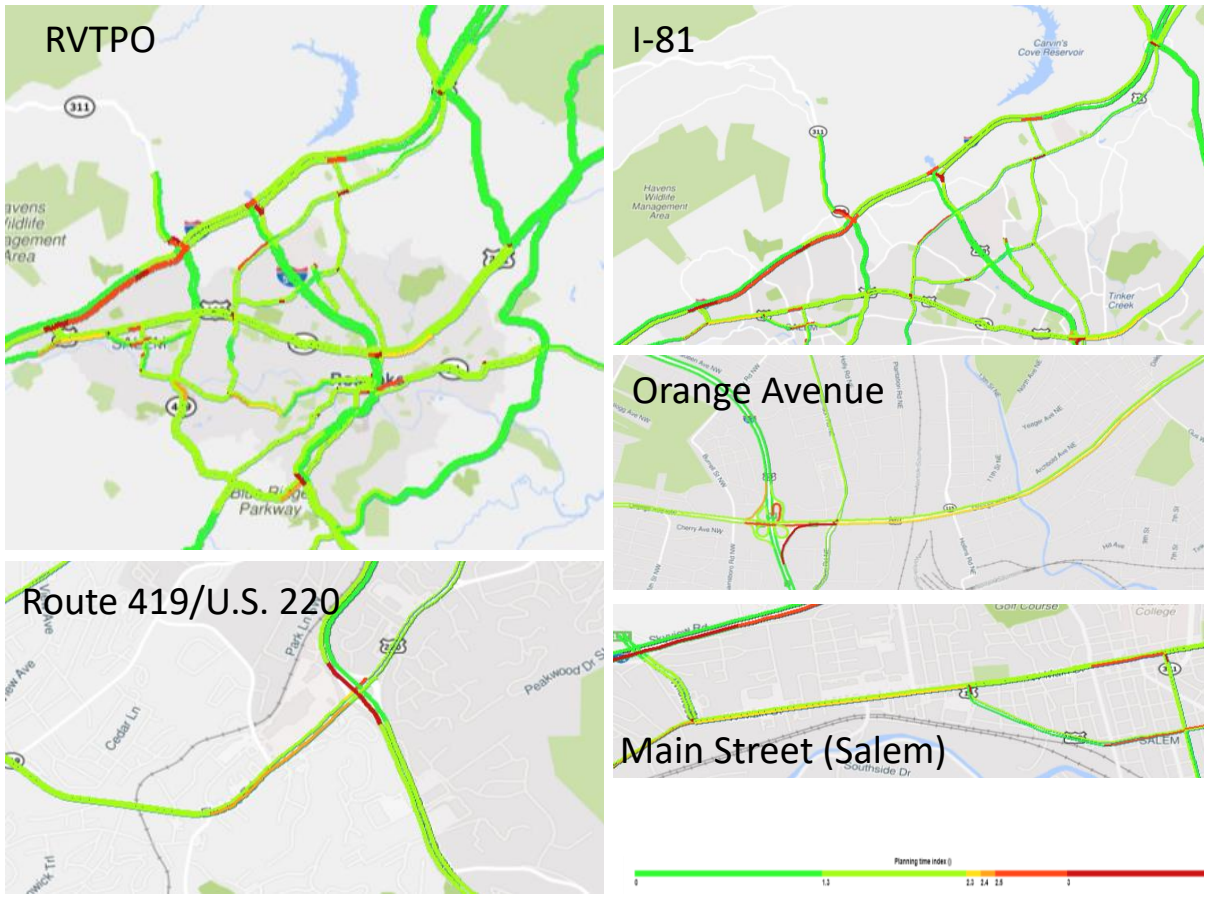


Figure 8. Trend maps of Planning Time Index 5 pm – 6 pm on weekdays in 2019.
Maps produced by Probe Data Analytics Suite.

Planning Time Index data was not available for one of the Top 10 Areas of Emphasis, Gus Nicks Boulevard, and so it was included as a Priority Corridor because it is not known whether its PTI may exceed 3 during peak hours or 2.5 during off-peak. Interstate 81 was also identified as a priority corridor

because it meets the PTI criteria and is the most significant corridor for traveling into or out of the Roanoke Valley, even though it had not been included in the original Top 10 Areas of Emphasis.

Based on this data, the following five corridor segments are priorities for congestion management activities (Figure 9):

Interstate 81

I-81: Interstate 81 from Exit 140 (Rt. 311/Thompson Memorial Dr.) to Exit 146 (Plantation Rd.)

Widening is currently underway between Exit 141 to Exit 143. Widening is funded for the remainder of this corridor.

Orange Avenue

Orange Avenue/Challenger Avenue (U.S. 460): U.S. 460 (Orange Avenue/Challenger Avenue) from 5th St. NW to the Botetourt County/Roanoke County Line (Area of Emphasis #8, Orange Avenue/Challenger Corridor)

As recommended by the Route 460 Operational Improvements Study, seven projects have been submitted for SMART SCALE funding to reduce congestion.

Route 419 / U.S. 220

Electric Road (Route 419)/Franklin Road/U.S. 220: U.S. 220 from ½ mile north of the Route 419 exit ramp to Southern Ln. SW, Franklin Rd. (BUS 220) from Frontage Rd. to Route 419, and Route 419 from Franklin Rd. to Ogden Rd. (Area of Emphasis #5, Route 419/U.S. 220)

Three projects are under construction or funded to reduce congestion on Route 419 and on U.S. 220.

Main Street (Salem)

Main Street/Wildwood Road (Salem): Main St. from Shanks St. to Wildwood Rd. and Wildwood Rd. from Main St. to Interstate 81 (Area of Emphasis #3, Salem)

Gus Nicks Blvd./Washington Ave.

Gus Nicks Boulevard/Washington Avenue: Gus Nicks Blvd. from U.S. 460 to Washington Ave. and Washington Ave. from Gus Nicks Blvd. to ByPass Rd (Area of Emphasis 7, Route 24/Vinton).

Several projects to reduce traffic congestion on these corridors have already been funded, some with construction underway, while other projects are in development. These are discussed in more detail in Section 6, “Strategies”.

4.2 Corridors of Concern

In addition to the Priority Corridors, public input was used to identify the following corridors and intersections of concern for traffic congestion (Table 5, Table 6, Figure 9). Projects already underway or recently completed in these Corridors of Concern are noted in Table 6. Some portions of these corridors were included in some of the Top 10 Areas of Emphasis from the 2014 Congestion Management Process. Some portions had a Planning Time Index greater than 3 between 5:00 pm and 6:00 pm on weekdays in 2019, which meets the regional definition of traffic congestion. Planning Time Index greater than 2.5 (lower than the regional definition) between 5:00 pm and 6:00 pm on weekdays in 2019 is also noted. Strategies similar to those used to address traffic congestion on or near Priority Corridors may be appropriate for corridors and intersections of concern for traffic congestion.

Table 5. Intersections of concern for traffic congestion

Road	Intersecting Road	Planning Time Index (PTI)
Apperson Dr. (U.S. 11)	Electric Rd. (Rt. 419)	
Brandon Ave. (U.S. 11)	Grandin Rd. SW	
Williamson Rd. (U.S. 11)	Hershberger Rd. (Rt. 101)	PTI>3
Franklin Rd. SW (U.S. 220 Bus)	Elm Ave. SW	
Campbell Ave. SW	Williamson Rd. (U.S. 11)	

Table 6. Corridors of concern for traffic congestion

Route	From	To	2014 Top 10 Area of Emphasis	Planning Time Index (PTI)
Interstate 81	Exit 128 (Rt. 603/Fork Rd.)	Exit 140 (Rt. 311/Thompson Memorial Dr.)		
Progress: Widening is funded.				
Interstate 81	Exit 146 (Plantation Rd.)	Trinity Road (RVTPO boundary)		PTI>3 at Exit 150
Progress: Widening is funded from Exit 146 to Exit 150.				
Orange Avenue/Melrose Avenue (U.S. 460)	Peters Creek Rd. (Rt. 117)	5th St. NW		PTI>3 at Peters Creek Rd. (Rt. 117)
Main Street (U.S. 460)	Electric Rd. (Rt. 419)	College Ave. (U.S. 11)	#3. Salem	
Main Street (U.S. 460)	Wildwood Rd. (Rt. 112)	Dow Hollow Rd.		
Riverside Drive	Diuguids Ln. (Rt. 760)	Mill Ln.		PTI not available
Mill Lane	Riverside Dr.	Main St. (U.S. 460)		PTI not available
Electric Road (Route 419)	Thompson Memorial Dr. (Rt. 311)	Ogden Rd.	#6. Apperson Drive and Route 419	
Progress: Signal coordination completed and roundabout on Route 419 at Route 311 is funded.				
Brandon Ave. (Rt. 221)	Brambleton Ave. (Rt. 221)	23rd St. SW	#10. Brandon Avenue Corridor	PTI not available
U.S. 220	I-581	1/2 mile north of the Route 419 exit ramp	#1. Elm Avenue and I-581	
Progress: Signal coordination completed and diverging diamond interchange is funded.				
I-581	I-81	U.S. 220	#1. Elm Avenue and I-581	PTI>3 at I-81, U.S. 460, and Rt. 419
Progress: Interstate 581 at Route 117/Peters Creek Road (Exit 2) Interchange Study is underway.				
Lee Hwy. (U.S. 11)	Williamson Rd. (U.S. 11)	Shadwell Dr. (Rt. 605)	#2. Hollins to Hershberger	PTI>3 at Plantation Rd. (Rt. 115)
Elm/Bullitt/Jamison/Dale Aves.	Franklin Rd. SW (U.S. 220 Bus)	Roanoke City Limit	#1. Elm Avenue and I-581	PTI>2.5 at I-581 interchange
Williamson Rd. SE	Franklin Rd. SW (U.S. 220 Bus)	Orange Ave. (U.S. 460)		
U.S. 220	Southern Ln. SW	Blue Ridge Parkway	#5. Route 419/U.S. 220	
Progress: Thru-cut project is funded				
U.S. 220	Lee Hwy. (U.S. 11)	Glebe Rd.	#9. I-81 Exit 150 and Route 11	
Peters Creek Rd. (Rt. 117), southbound lane	Cove Rd.	I-581		PTI>2.5
Progress: An interchange project has been submitted for SMART SCALE funding.				
Virginia Ave./Hardy Rd.[6]	Vinton Town Limit (west)	ByPass Rd.	#7. Route 24/Vnton	

[6] This corridor was added to address concerns of Vinton staff; there may have been low survey participation from users of this corridor.

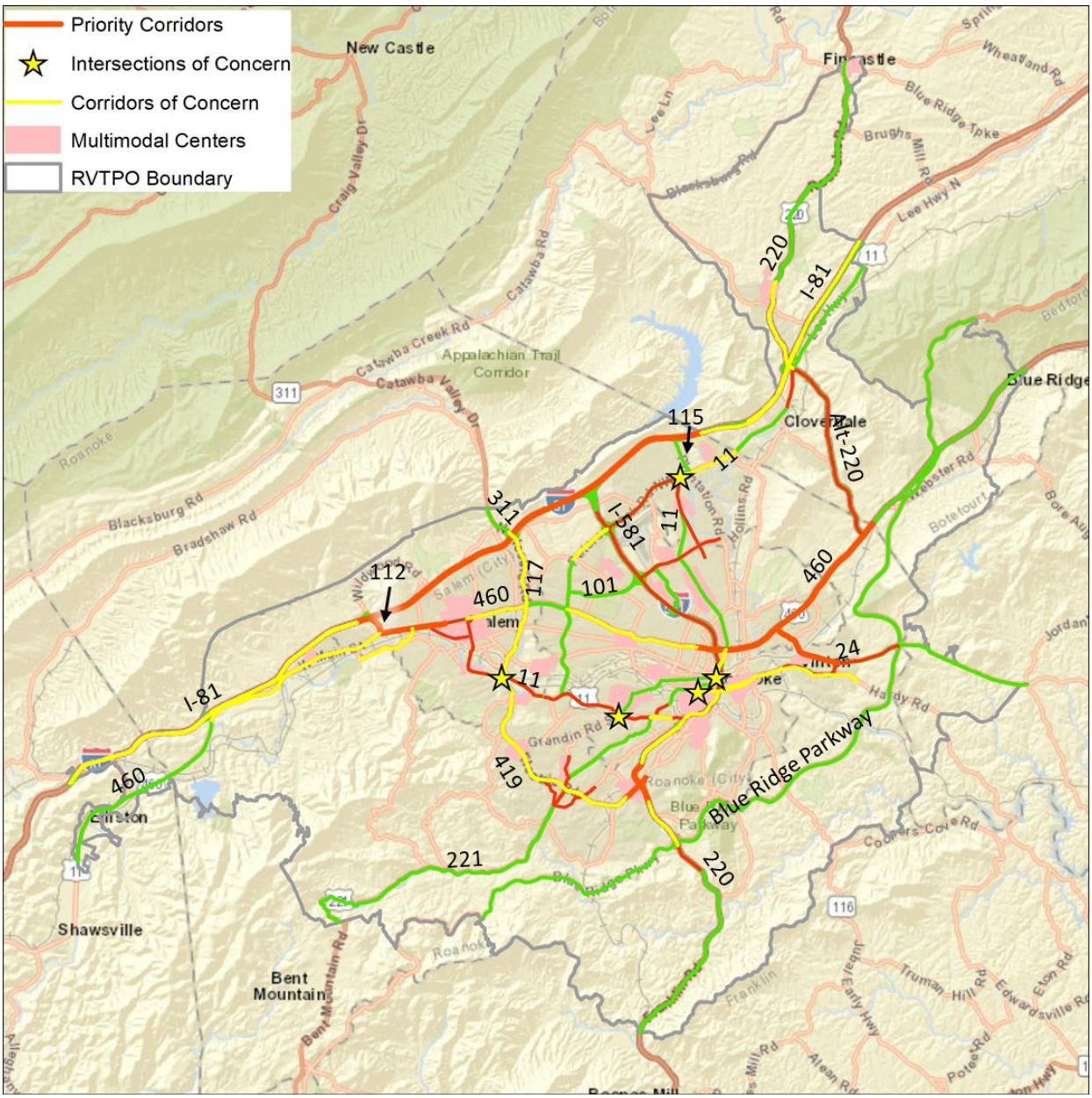


Figure 9. Priority corridors for traffic congestion

4.3 Relationship to VTrans Needs

VTrans is Virginia's multimodal transportation plan that lays out the overarching statewide vision and goals, identifies transportation investment priorities, and provides direction on implementation strategies and programs to many organizations including the RVTPO. The VTrans methodology identified congestion mitigation needs using INRIX data and public input[7]. The VTrans congestion mitigation needs are very similar to the RVTPO's Priority Corridors (Figure 10). Two locations that are worth noting from VTrans are Interstate 81 Exit 150 and Elm Avenue at Interstate 581. These were both among the original RVTPO Top 10 Areas of Emphasis and have a Planning Time Index greater than 3 but are not designated as Priority Corridors because extensive congestion mitigation has been done in the last five years at both

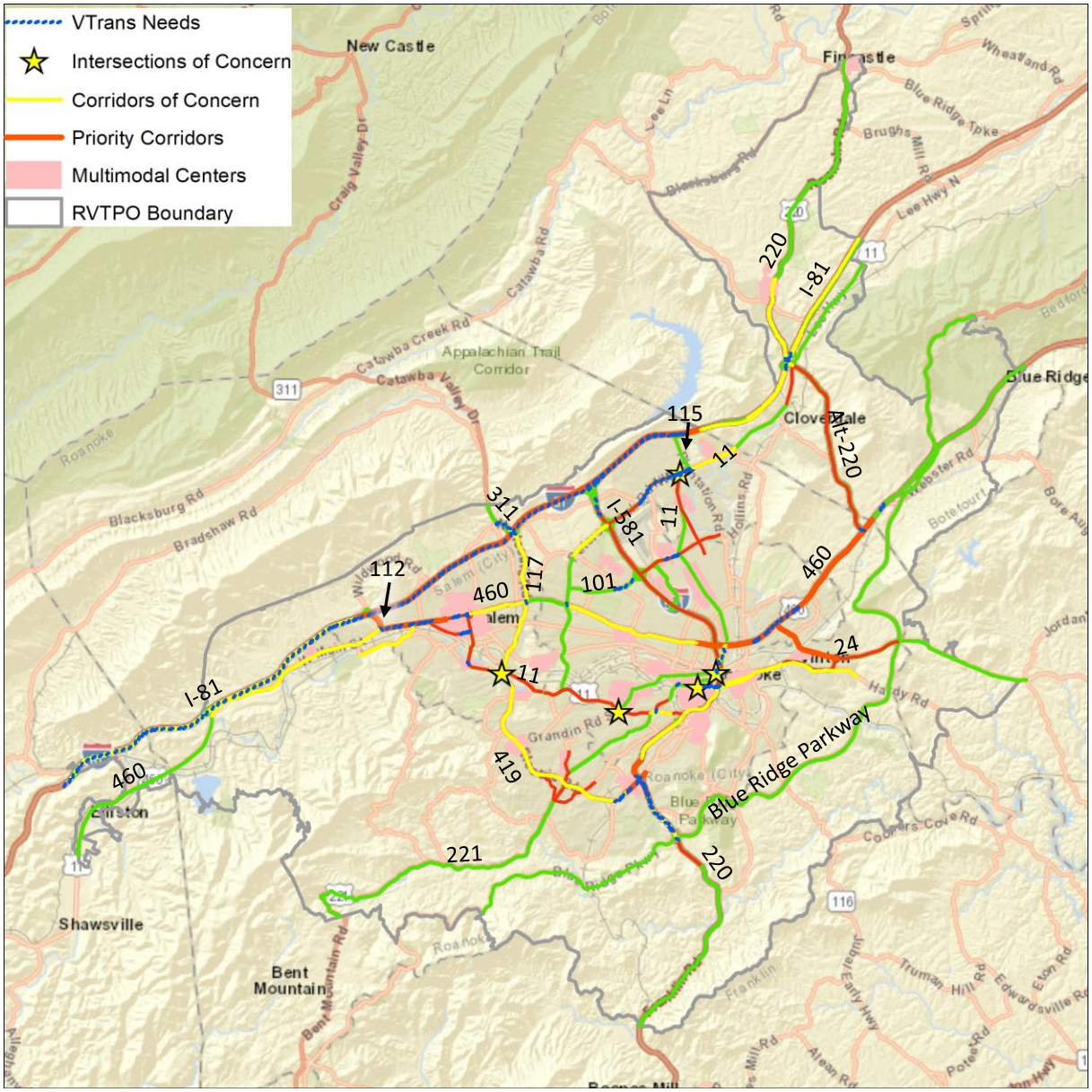


Figure 10. VTrans congestion needs

[7] VTrans website, https://www.vtrans.org/mid-term-planning/mid-term-needs, accessed 8/10/2020.

locations. Considerable resources have been invested into mitigating congestion at these locations, and the traffic flow has improved though at this time there are no plans for additional improvements.

While the VTrans congestion mitigation needs and the Priority Corridors are similar, the purposes are different: VTrans Needs are used by the state to determine project eligibility for SMART SCALE funding and in SMART SCALE scoring while Priority Corridors are the region's priorities for congestion management. Both VTrans and the Priority Corridors are iterative processes and will likely become more similar over time. Differences are also due to methodology. A new performance measure was created for the VTrans analysis (based on INRIX data) to assess statewide congestion mitigation needs and is applicable to the entire state. Planning Time Index, also based on INRIX data, was the appropriate performance measure to assess traffic congestion in the Roanoke Valley.

5. Regional Objectives

Land use and development practices, the number of driving-alone trips, and the number of people using alternate transportation options affect the number of vehicles using a roadway at the same time. The existence and practicality of alternate transportation options affect the number of people using these options versus driving. The following objectives are specific desired results as the member stakeholders of the RVTPO work to achieve the goal of preventing or minimizing increases in traffic congestion.

Objective 1. Maintain the RVTPO's acceptable driving times, even as population increases over the next ten years (through 2030).

Objective 2. Reduce land use/development practices that promote solely single-occupant vehicle trips and increase land use/development practices that promote mixed land uses and multimodal trips.

Objective 3. Increase the number of people using alternate transportation options for access to work.

6. Strategies

The topic of traffic congestion elicits common initial suggestions to increase road capacity – more lanes, better signal timing, measures to move more vehicles faster. However, with few exceptions, solutions that increase road capacity, especially adding lanes, have not effectively reduced traffic congestion long-term. There is a place for these solutions, but there are many other strategies that should also be pursued as well.

Strategies to manage traffic congestion are:

- Increase the mix and density of land uses and development,
- Make alternatives to driving alone to work (telework, carpool, transit, bicycling, and walking) possible, convenient, and appealing; and
- Improve the efficiency of road operations.

The strategies outlined in the following sections are targeted to the Priority Corridors (Table 13). Similar strategies may be employed to address other corridors of concern (See Appendix, Table 6 and Table 5).

6.1 Strategies on Land Use and Development

Changing the way land is used has a strong influence on the convenience of driving alone and changing land use patterns is palatable to citizens because it occurs gradually over time and does not require a

change in one's mobility choices. Land use is therefore a preventative strategy and appropriate for a region without severe traffic congestion problems like the Roanoke Valley.

Land use practices can affect traffic congestion by mixing or separating uses, placing destinations near or far from one another, and connecting or disconnecting adjacent uses (Table 7). Development density impacts trip distance, the likelihood that multimodal options exist, the propensity to use multimodal transportation to travel, and the number of residents or employees needing to travel.

Table 7. Effects of land use on traffic congestion

Less traffic congestion	More traffic congestion
Mix uses	Separate uses
Place destinations near each other	Place destinations far from each other
Connect adjacent uses	Disconnect adjacent uses

An analysis of available workers, or unemployed persons, as of 2019 shows a concentration in the City of Roanoke, Salem, Vinton, and Roanoke County (Figure 11). Businesses are concentrated near Glenvar, Cave Spring, Vinton, Daleville, North Roanoke County, and the City of Roanoke (Figure 12). Transit lines are also out of reach of many available workers and of many businesses. Missing multimodal connections, scattered development, and separated residential and employment land uses contribute to traffic congestion. To decouple economic growth from increasing traffic congestion, new employers and new population need to align geographically.

Sustainable land use and development practices are among the most influential steps a region can take to manage traffic congestion but has not been a part of the RVTPO's congestion management process. As the role of land use/development practices in promoting or preventing traffic congestion has become better understood, the RVTPO sees land use/development practices as key in managing traffic congestion. While the general effect of land use on traffic congestion is appreciated today, the details of what activities to select and how to implement them are less clear. Some specific land use/development practices are proposed in this document. The RVTPO, localities, and agencies will continue to study, develop, and implement land use/development practices, discarding those that are not feasible or effective.

During the Congestion Management Workshop, the Land Use Focus Group noted that without severe traffic congestion or high gas prices, the motivation to change land use and development patterns to prevent congestion is weak. However, pushing for land development practices that promote good traffic congestion management now can prevent severe congestion and prepare the region for future events, such as high gas prices or an influx of people into the region. The Land Use Focus Group referred to the concept of a "sidewalk to nowhere" frequently: in twenty years, today's sidewalk to nowhere will go somewhere, serving destinations that grew up out of parking lots, helping people who don't drive by choice or by circumstance, and contributing to a higher quality of life at a higher population density than we think is possible today.

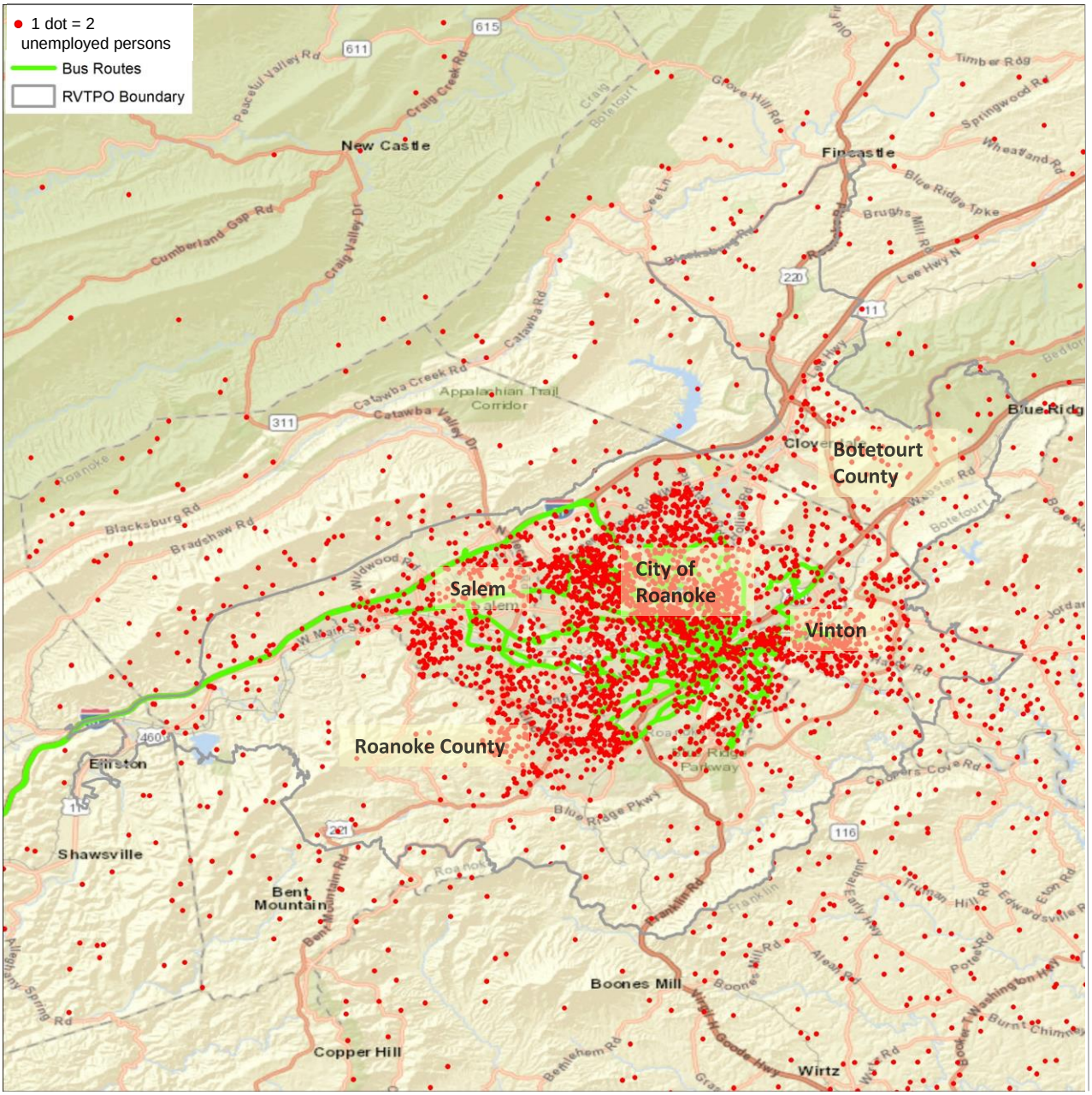


Figure 11. Available workers, or unemployed persons, in the Roanoke Valley

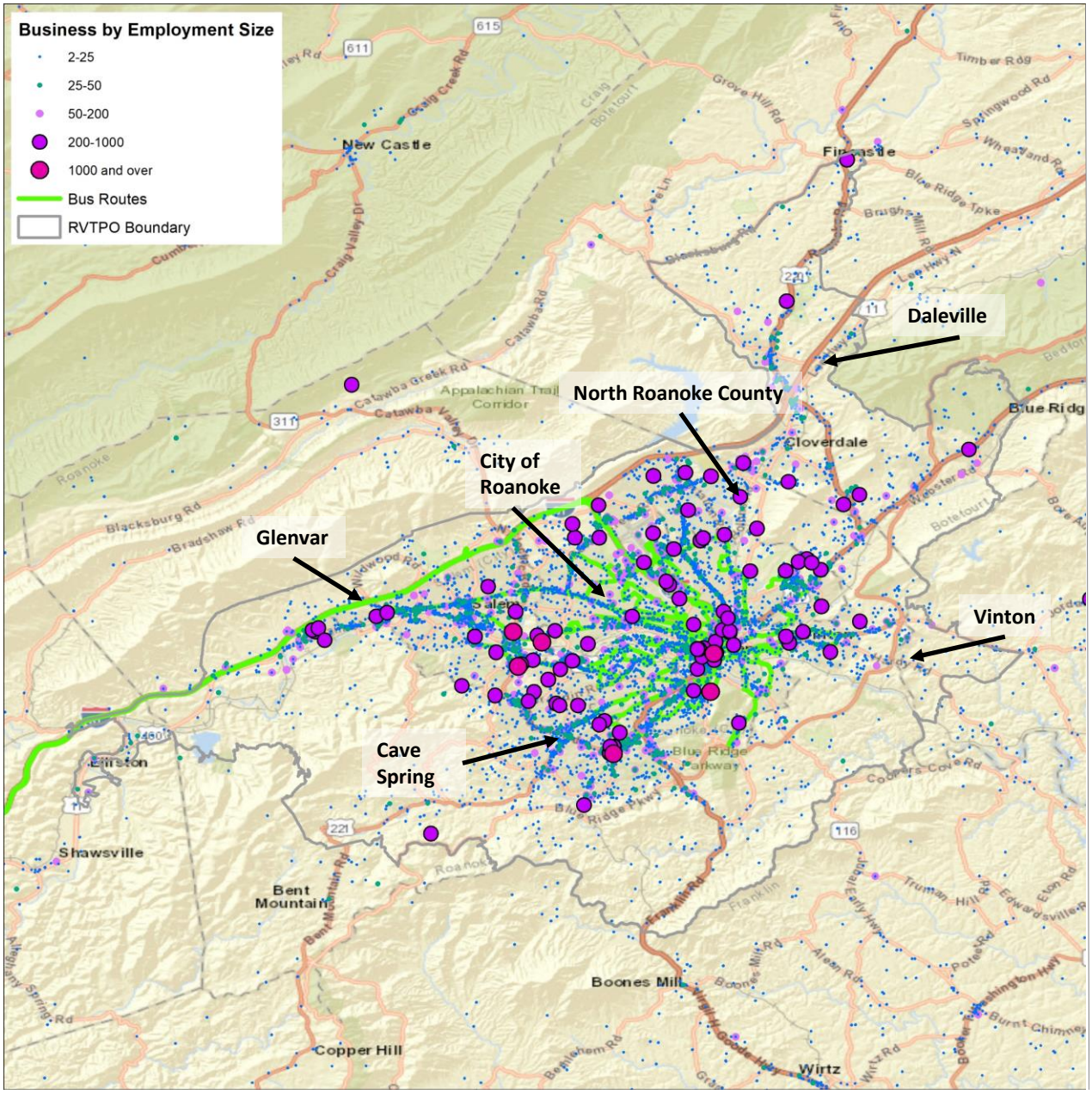


Figure 12. Job concentration in the Roanoke Valley.

Desired land use/development practices that may improve traffic flow are:

Parking management affects traffic congestion

- Reduced or abolished parking minimums for developments, parking located out of sight and toward the back of the lot. The effect of parking and good parking management on traffic congestion is well documented[8].
- Encouraging or selectively allowing development in multimodal centers/districts (areas where walking, biking, and taking transit are more likely due to the density of people and jobs), designated growth areas, and urban development areas.
- Mixed-use and infill development that keep origins and destinations close together in multimodal centers/districts. In the Traffic Congestion survey, participants who experienced traffic delays – and thus were contributing to traffic congestion – were predominantly traveling from their homes to other destinations (Figure 5). Mixing homes and destinations shortens many trips to a walkable or bikeable distance. Concentrating activities in multimodal centers makes transit and carpooling more efficient and feasible.
- Small parcels that concentrate destinations. Vanpools require a concentration of people on the one end (such as a bedroom community) and a concentration of jobs on the other (such as a downtown). Small parcels enhance other strategies to promote walking and vanpooling.
- Taking advantage of development opportunities to manage access by consolidating driveways, increasing the distance between signals, and implementing safe turning lanes and median treatments. In one study, each additional traffic signal increased travel times by 6%, while in another, every ten access points per mile reduced traffic speeds by 2.5 miles per hour[9]. Traffic speeds do not necessarily equate to traffic congestion, but there is a strong relationship between number of accesses and number of crashes, which do contribute to traffic congestion.
- Grid system of streets. Multiple connections increase capacity by providing alternatives to the main street.

Recent planning efforts throughout the Roanoke Valley implement many of these strategies, such as Roanoke County's Route 419 Town Center Plan and the City of Roanoke Comprehensive Plan. The Virginia Department of Transportation has been discouraging the addition of new traffic signals on Corridors of Statewide Significance for several years.

Mixed-use rendering from the Reimagine Hollins plan (Roanoke County)

[8] Donald Shoup, "The High Cost of Free Parking". American Planning Association, 2005.
[9] Federal Highway Administration "Benefits of Access Management Brochure", https://ops.fhwa.dot.gov/access_mgmt/docs/benefits_am_trifold.htm

Strategies that promote these land use/development practices are described as follows and include education, design guidelines, ordinances, and creativity[10] (Table 8).

6.1.1. Education

Education targeting developers and the community may be most effective for smaller jurisdictions where educating developers on the possibilities of exceptions to ordinances is more feasible than changing the ordinances themselves. Developers appreciate clarity and transparency written into ordinances, but until the ordinances can be updated, education and showcasing successes are good tools. Educating the community on the advantages of traditional neighborhood development creates political will for mixed use developments. Roanoke County and the City of Roanoke have talked with the communities engaged in planning efforts about the benefits of mixed and multimodal development.

6.1.2. Design Guidelines

Design guidelines are an interim step to changing ordinances: they are voluntary, but developers can use them, and the localities can use their own design guidelines in rezoning. Design guidelines can promote development patterns that do not encourage congestion. The City of Roanoke has Street Design Guidelines (adopted 2007) and Roanoke County has a Design Handbook (adopted 2009, amended 2011). As it has been over a decade since these documents were adopted, they could be revisited for updates. Other localities do not have design guidelines. This process may start in a Comprehensive Plan. For example, Botetourt County updated the Transportation chapter of their Comprehensive Plan in 2017 and included a rich discussion of land use and transportation[11]. Future Land Use Maps and Plans influence development. Roanoke County has updated its Future Lane Use Map to encourage mixed uses and greater development density.

6.1.3. Ordinances

Some localities have ordinances in place that promote land uses which discourage congestion, while other ordinances still primarily promote auto-only development. An example of locality whose ordinance has positive land use/development practices is the City of Roanoke, which abolished parking minimums downtown, requires sidewalks, and created the Mixed-Use District zoning classification.

6.1.4. Creativity

Creativity might seem like an odd land use strategy, but developers hold substantial power over site development that promotes good traffic congestion management and their creativity can be key. It is up to localities to communicate to the developers that they welcome and seek creativity to achieve desired land use/development patterns.

The Land Use Focus Group commented that reliable communications infrastructure promotes telework. Communications infrastructure became critical when the COVID-19 pandemic swept the nation in 2020 and abruptly forced businesses to adopt telework policies.

Creativity is more palatable with an experimental approach. Steps that are riskier can be more appealing when implemented as a temporary experiment that includes data collection and analysis.

[10] Federal law requires strategies to be metropolitan-wide and cooperatively developed. The Congestion Management Process Workshop included a Land Use Focus Group which involved staff from several localities and agencies. The group discussed how strategies are better suited to smaller or larger localities.
[11] "Botetourt Transportation", 2017.

Table 8. Land use/development strategies to manage traffic congestion

Strategy	Responsibility party	Outputs	Outcomes	Measures of Effectiveness
Update Future Land Use Maps and Plans to incorporate greater mixes of uses and higher densities, especially within Urban Development Areas/Designated Growth Areas				
	Locality Staff	Future plans promote shorter trips and multimodal transportation.	Shorter trips due to closer destinations.	To be developed
Update Subdivision and Zoning Ordinances and Development Approval Practices to implement desired land use/development practices during development review.				
	Locality Staff	Development proposals that promote density and multimodal transportation in UDAs/DGAs[12].	More people use alternative transportation to access destinations.	To be developed
Educate developers about desired land uses and development practices				
	Locality staff	Developers receive information	Developers' proposals are consistent with desired land uses and development practices.	To be developed
Educate the community about the benefits of desired land uses and development practices				
	Locality staff, RVARC	Public outreach	Community members support desired land uses and development practices.	To be developed
Encourage developers to submit creative proposals.				
	Locality staff	Developers receive information	Developers submit creative proposals	To be developed
Solicit input from developers on how to promote desired land uses				
	RVARC	Next Congestion Management Process update includes information	Localities are aware of the information	To be developed
Research locality policies and ordinance language that achieve desired land uses				
	RVARC	Share information with RVTPO localities.	Localities adjust ordinances to promote desired land use and development practices.	Next Congestion Management Process update includes examples of improved local ordinances/policies.

[12] UDA, Urban Development Area. DGA, Designated Growth Area.

Strategy	Responsibility party	Outputs	Outcomes	Measures of Effectiveness
Document examples of new land uses and developments in the RVTPO region that are consistent or inconsistent with desired land use/development practices				
	RVARC	Share information with RVTPO localities. Section in Congestion Management Process annual report.	Localities are aware of the information and adjust ordinances to promote desired land use and development practices.	Next Congestion Management Process update includes examples of improved local ordinances/policies.

6.2 Strategies to Make Alternatives to Driving Alone Possible, Convenient, and Appealing

While waiting for the long-term effects of changes in land use to materialize, transportation options such as telework, carpooling, transit, walking, and bicycling can make alternatives to driving alone possible, convenient, and appealing. These options are also types of transportation demand management because they can reduce the number of vehicles on roadways. Encouraging transit, walking, and bicycling isn't effective if people are not physically able to access work and other destinations by bus, on foot, or by bike. A 10-minute walkshed (1/2-mile radius) is the maximum area that most people will walk to access daily activities including to/from a bus stop. The location of the walking path is also an important factor as few will choose to walk for transportation where buildings are greatly separated and high-speed traffic is near. Improvements to transit service availability and walking/biking infrastructure in conjunction with land use/development practices that bring destinations closer together can make these options possible for more people which may reduce vehicle trips.

6.2.1. Transportation Demand Management

RIDE Solutions is the Roanoke Valley's transportation demand management program to reduce traffic and vehicle emissions through incentive programs, education, and encouragement to individuals and businesses. The RIDE Solutions' Six-Year Transportation Demand Management Plan 2016-2021 identified transportation demand activities to manage traffic congestion (Table 9)[13]. RIDE Solutions is also developing a Commuter Assistance Strategic Plan due to be complete in Fiscal Year 2022 that will further define these activities.

RIDE Solutions offers services to help employers encourage and incentivize alternative transportation. Employer services are time- and resource-intensive but possibly the most impactful strategy employed by the small program. In addition to employer services, RIDE Solutions offers carpool matching, facilitates vanpools, and encourages efficient travel and commute alternatives to the single occupant vehicle. RIDE Solutions marketing promotes "clean" (less polluting) commute options. One commute

[13] Federal law requires strategies to be metropolitan-wide and cooperatively developed. RIDE Solutions manages a service area that extends far beyond the RVTPO boundary. Transportation demand management strategies are a combination of best practices and collaboration with local government, depending on what the specific issue is being addressed.

option promoted by RIDE Solutions is telework. The COVID-19 pandemic demonstrated the feasibility of teleworking as businesses scrambled to adopt telework policies and employees moved to home offices. In response to the pandemic, the Virginia Department of Rail and Public transportation expanded its Telework!VA (www.teleworkva.org) program to the RIDE solutions service area. Telework!VA provides free consultation and training services for businesses seeking to implement or strengthen a telework program. Previously, Telework!VA services were available only to businesses in the Northern Virginia and Hampton Roads areas.

The Transportation Demand Management Focus Group noted that RIDE Solutions has a very small marketing budget and emphasized the importance of partnering with other programs and agencies to get the most of its limited resources. The RideSolutions Six-Year Plan and the Focus Group emphasized the importance of getting the RIDE Solutions brand better known and at the same time promoting the idea that bicycling, walking, and transit are mainstream modes of transportation.

The Focus Group suggested supplementing RIDE Solutions' budget through development fees in lieu of infrastructure to accommodate increased traffic from developments that would go toward transit and RIDE Solutions. The Focus Group also noted that without severe traffic congestion or high gas prices, enticing current single-occupant vehicle drivers to walk, bike, or use transit is weak, but job access is a motivation for people seeking employment where driving is not possible.

Telework has proven to be effective for more jobs and employees than was known prior to the COVID-19 pandemic. Maintaining some telework above levels previous to the pandemic will help manage traffic congestion.

RIDE Solutions offer telework webinars for employers during the COVID-19 pandemic.

Pedestrian crashes and fatalities are a deterrent to walking.

Table 9. Transportation demand management strategies to reduce automobile trips

Strategy	Responsible Parties	Outputs	Outcomes	Measures of Effectiveness
Targeted outreach to businesses to promote multimodal transportation to access work and for mid-day trips	RVARC	Businesses encourage employees to carpool, walk, bike, or take transit for trips.	More employees choose to use alternative commute options	Numbers of businesses reached, mode shift
Targeted advertising to businesses to institute telework policies	RVARC	Billboard, sign-spinner, and related advertising methods	Commuters choose to use alternative modes	New commuters in database, mode shift
Targeted advertising to commuters using geofencing	RVARC	Digital advertising to mobile phones to drivers passing through targeted areas	Commuters choose to use alternative modes	New commuters in database, mode shift
Increase RIDE Solutions marketing budget	RVARC	Additional regional mass-media and targeted advertising	Commuters register for RIDE Solutions and see alternative modes	New commuters in database, mode shift
Alternatives to priority corridor routing for driving and biking	RVARC	Identify and promote alternative routes for driving and biking	Commuters are aware of and use parallel routes for driving and biking	Pre/post traffic volumes on alternative driving routes; Pre/post bike counts on alternate biking route, New bike commuters in database

6.2.2. Transit Operations & Infrastructure

A robust and comprehensive transit system can reduce traffic congestion regionally by:

- Mitigating increases in vehicle roadway traffic induced by low gas prices or a growing economy,
- Enhancing the effects of other efforts to mitigate traffic congestion, and
- Providing travel options without further burdening the road network.

To affect traffic congestion on a specific corridor, accessible localized transit service must be backed by a strong regional transit system. Expanding the transit network and connecting multimodal centers/districts are key to building such a transit system.

The Valley Metro Comprehensive Operational Analysis[14], Valley Metro Transit Development Plan[15], and Roanoke Valley Transit Vision Plan[16] describe short-, medium-, and long-term improvements to make transit reach more destinations and operate more conveniently for peoples' needs and schedules. Many of the recommended service extensions or improvements are relevant to priority corridors for traffic congestion management (Table 10)[17].

The Comprehensive Operational Analysis outlined minor route modifications which Valley Metro implemented in October 2019. To reduce the crowding of buses and pedestrians that occurs each hour in and around the 30-year-old Campbell Court Bus Station in downtown Roanoke, the City of Roanoke announced in 2019 a redevelopment plan for Campbell Court for new commercial and residential spaces and a new downtown bus station on a different site.

The Transit Development Plan recommends expanding service to key areas, adding routes within the existing service area, updating route and schedule publications, providing real-time passenger information, and shifting 30-minute frequency from morning to mid-day to better accommodate current transit ridership demand which does not mirror the noted peak times for roadways. Adding routes within the existing service area will better connect key destinations and encourage new ridership. Updating route and schedule printed and electronic publications will provide citizens with the most current information so prospective riders understand how to maneuver within the transit system. Sharing real-time arrival/departure times makes it easier for bus riders to plan their trips and makes transit more reliable and convenient.

The Valley Metro Transit Development Plan focus areas include:

- Expanding service to the Route 419 Corridor, Hollins area, and Glenvar area.
- Adding routes within the existing service area to connect key destinations and encourage new ridership.
- Updating route and schedule publications and real-time passenger information with up-to-the-minute arrival and departure times so passengers understand how to maneuver within the transit system and to ease concerns over schedules and timeliness.

Bus riders exiting a bus

[14] *Valley Metro Comprehensive Operational Analysis: Final Report,* 2018
[15] *Valley Metro Transit Development Plan Fiscal Years 2019-2028: Final Report*, 2018
[16] *Roanoke Valley Transit Vison Plan,* 2016
[17] Federal law requires strategies to be metropolitan-wide and cooperatively developed. These strategies provide recommendations for service improvements including and beyond the current transit system service area. They address the need to access places currently unserved or underserved by transit. They were developed by a team of steering committee members representing private businesses, local governments, and local transit providers. The Transit Vision Plan received record numbers of citizen comments, was reviewed by the RVTPO Transportation Technical Committee, and was approved by the RVTPO Policy Board. The Transit Development Plan incorporated the recent public input from the Transit Vision Plan, was developed by Valley Metro staff, a consultant, and RVARC staff, and was approved by the Greater Roanoke Transit Company Board of Directors.

Route 419 is a busy travel route and the only option for many trips but has no transit service. The Transit Vision Plan and the Transit Development Plan recommend adding transit service along Route 419 between Tanglewood Mall and the Salem VA Medical Center. This route could connect to existing transit service at Tanglewood Mall, Lewis Gale Medical Center, the Salem VA Medical Center, and a proposed extension of Routes 61/62 at Brambleton Avenue.

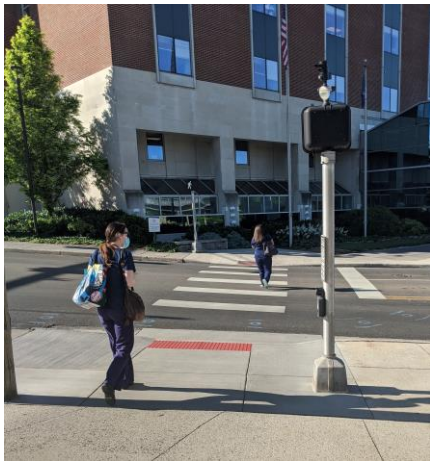
Proposed transit service in the Hollins area would connect people to jobs on Plantation Road and throughout the Hollins area. In addition to providing access to jobs, this service would create new transit access to the Department of Motor Vehicles, Green Ridge Recreation Center, Hollins University, and the Town Square shopping area where it would connect with existing service.

Table 10. Transit strategies to reduce automobile trips on priority corridors

Strategy	Priority corridor	Responsible Parties	Outputs	Outcomes	Measures of Effectiveness
Add transit service along Route 419 between Tanglewood Mall and the Salem VA Medical Center					
	Route 419/U.S. 220	Roanoke County, Salem, Valley Metro	New transit service along Route 419	People choose to use transit for trips along Route 419	Ridership on Route 419 transit service
Extension of Routes #91/#92 to the Glenvar area and add a new route to replace the current Routes #91/#92 connection between Downtown Salem and the medical centers.					
	Main Street (Salem)	Roanoke County, Salem, Valley Metro	Expanded transit service to the Glenvar area	People choose to use transit for trips to/from the Glenvar area	Ridership on Glenvar transit service
Maintaining updated route and schedule publications					
	System-wide	Valley Metro	Up-to-date online schedules and mapping	People can easily find and understand how to use transit services	Accuracy of information on Valley Metro website and Google maps
Implement real-time passenger information					
	System-wide	Valley Metro	Real-time information available	People can monitor vehicle locations and time to next vehicle from their mobile devices	Vehicle locations can be monitored

6.2.3. Walking & Bicycling Operations and Infrastructure

Like a robust and comprehensive transit network, the infrastructure and land use/development, policies, and programs that support walking and bicycling, including the proximity of destinations and the presence of sidewalks, safe crossings, and bike lanes, may reduce traffic congestion regionally. Closer destinations and better/more walking and biking accommodations can help mitigate increases in traffic induced by low gas prices or a growing economy, enhance the effects of other efforts to mitigate traffic congestion, and provide travel options without further burdening the road network. To affect traffic congestion on a specific corridor, localized walking and biking improvements must be backed by a strong



People crossing at a crosswalk

regional transit system. Addressing walking and biking deficiencies within multimodal centers and districts and connecting multimodal centers and districts with transit are key to preventing and mitigating traffic congestion.

The Roanoke Valley's Pedestrian Vision Plan[18] identifies pedestrian accommodations needed in multimodal centers/districts and areas beyond. The RVTPO's Bikeway Plan[19] from 2012 is being updated to reflect biking needs within and between multimodal centers/districts; the Roanoke Valley Greenway Plan[20] offers a broad vision for greenways with paved or unpaved trails throughout the region. The Pedestrian Vision Plan and the Bikeway Plan identify locations where walking and bicycling accommodations are needed but do not stipulate how walking and bicycling should be accommodated. For example, signage may be a sufficient bicycle accommodation on a street with little traffic and slow traffic speeds, while protecting and physically separating bicycle and pedestrian paths from motor vehicle traffic is necessary on roads with more and faster traffic and more lanes. Therefore, an accommodation for bicyclists on the busiest segments of U.S. 460 could re-route bicycle traffic to a quieter parallel route, a separated protected path on U.S. 460, or another option.

These plans describe improvements to build more robust walking and biking networks in the Roanoke Valley, some of which are relevant to the priority corridors for traffic congestion management (Table 11, Table 12, Figure 13). The lists in Table 11 and Table 12 of walking and biking locations from these plans that are relevant to priority corridors is not exhaustive of all projects that could benefit the priority corridors and other locations that do not appear in these tables or in the plans may also be useful for traffic congestion management.

Broadly pursuing more infrastructure opportunities for people to walk and bike may have an impact on traffic congestion depending on the proximity of the accommodation to trip origins/destinations, the perceived safety of the route, and the travel time required to walk or bike that path. Other infrastructure, land use/development, policies, and programs that make walking and bicycling possible, appealing, and convenient in multimodal centers and districts and throughout the region work toward creating a culture of walking and bicycling.

Employees at Bike to Work Day

[18] *Regional Pedestrian Vision Plan: A Coordinated Approach to a Walkable Roanoke Valley*, 2015.
[19] *Bikeway Plan for the Roanoke Valley Area Metropolitan Planning Organization 2012 Update*, 2012.
[20] *Roanoke Valley Greenway Plan*, 2018.

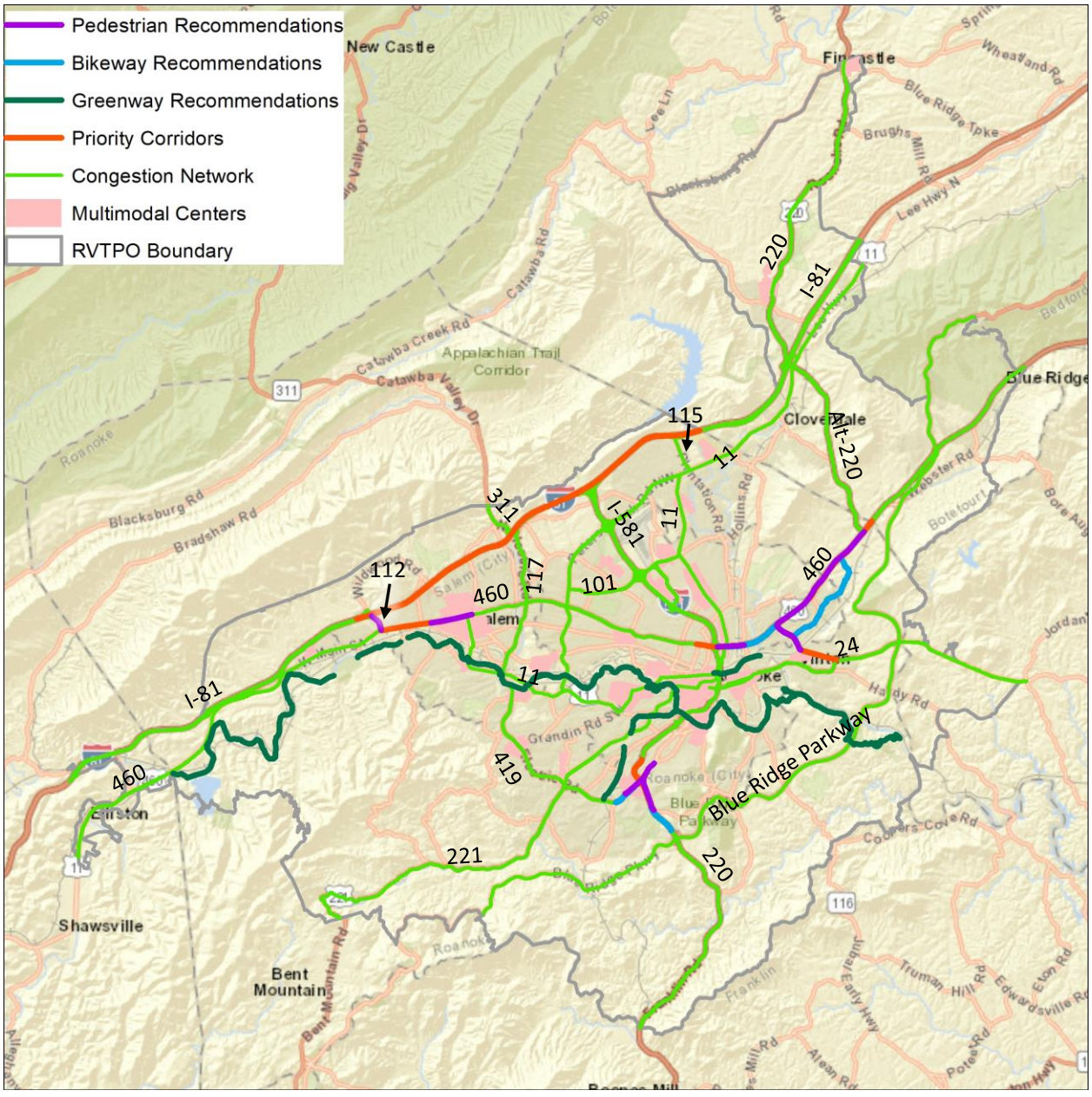


Figure 13. Strategies to improve walking and bicycling on or near priority corridors

Table 11. Pedestrian strategies to reduce automobile trips on priority corridors

Congestion Reduction Strategy	Priority Corridor	Responsible Parties	Outputs	Outcomes	Measures of Effectiveness
Build streetscapes on Orange Avenue and improved crossings at select intersections					
	Orange Avenue/ Challenger Avenue	City of Roanoke, Roanoke County	Streetscape, improved crossings	More people walk for short trips on Orange Avenue	Number of people walking for transportation rather than driving on Orange Avenue
Add sidewalks on both sides of U.S. 460 east of Gus Nicks Blvd. to Cloverdale Rd. (Alt. 220)					
	Orange Avenue/ Challenger Avenue	City of Roanoke, Roanoke County	Sidewalks	More people walk for short trips on U.S. 460	Number of people walking for transportation rather than driving on U.S. 460
Improve pedestrian crossings at signalized intersections near Tanglewood					
	Route 419/U.S. 220	Roanoke County, VDOT	Sidewalks, improved crossings (Project underway to add pedestrian signals and crosswalks at three traffic signals in front of Tanglewood Mall)	More people walk for short trips within the Tanglewood area	Number of people walking for transportation rather than driving on Route 419
Add sidewalks on Franklin Rd. from Willow Oak to west city limit and improve crossings at select intersections					
	Route 419/U.S. 220	City of Roanoke (Project in progress)	Sidewalks, improved crossings	More people walk for short trips on Franklin Road	Number of people walking for transportation rather than driving on Franklin Road
Add sidewalks on U.S. 220 from Route 419 to Old Rocky Mount Rd.					
	Route 419/U.S. 220	Roanoke County, City of Roanoke, VDOT	Sidewalks	More people walk for short trips on U.S. 220	Number of people walking for transportation rather than driving on U.S. 220
Add sidewalks on both sides of Wildwood Rd. from Main St. to I-81					
	Main Street (Salem)	Salem	Sidewalks	More people walk for short trips on Wildwood Road	Number of people walking for transportation rather than driving on Wildwood Road
Build a streetscape on Main St. from Thompson Memorial Ave. to 4th St.					
	Main Street (Salem)	Salem	Streetscape	More people walk for short trips on Main Street	Number of people walking for transportation rather

Congestion Reduction Strategy	Priority Corridor	Responsible Parties	Outputs	Outcomes	Measures of Effectiveness
					than driving on Main Street
Fill the sidewalk gap on Gus Nicks Blvd.					
	Gus Nicks Boulevard/ Washington Avenue	City of Roanoke, Vinton	Sidewalk complete on both sides	More people walk for short trips on Gus Nicks Blvd.	Number of people walking for transportation rather than driving on Gus Nicks Blvd.
Fill in sidewalk gaps, construct a midblock crossing, and complete the greenway connection on Washington Ave.					
	Gus Nicks Boulevard/ Washington Avenue	Vinton	Sidewalk complete, midblock crossing	More people walk for short trips on Washington Ave.	Number of people walking for transportation rather than driving on Washington Ave.
Adjust development processes to build sidewalks with any new development proposal in multimodal centers and districts and UDAs/DGAs[21]					
	All	Localities	Sidewalks built with new developments	More people walk for short trips.	Number of new developments built with sidewalks.

[21] UDA, Urban Development Area. DGA, Designated Growth Area.

Table 12. Bicycling strategies to reduce automobile trips on priority corridors

Strategies	Priority Corridor	Responsible Parties	Outputs	Outcomes	Measures of Effectiveness
Add bicycle accommodations to U.S. 460 corridor (East Roanoke City Limit to West Roanoke City Limit)					
	Orange Avenue/ Challenger Avenue	City of Roanoke	Bicycle accommodations on U.S. 460 and/or parallel routes	More people bicycle for transportation	Number of bicyclists using accommodations for transportation rather than driving on Orange Avenue
Add bicycle accommodations on King St. (U.S. 460 to Gus Nicks Blvd.)					
	Orange Avenue/Challenger Avenue, Gus Nicks/ Washington	City of Roanoke	Bicycle accommodations	More people bicycle for transportation	Number of bicyclists on King St. and Gus Nicks Blvd. for transportation rather than driving on the priority corridors listed
Add bicycle accommodations on Route 419 (Franklin Rd. to Starkey Rd.)					
	Route 419/ U.S. 220	Roanoke County, VDOT	Bicycle accommodations (Project underway on Route 419 between Route 220 and Ogden Rd., project submitted for SMART SCALE funding on Route 419 from Ogden Rd. to Starkey Rd.	More people bicycle for transportation	Number of bicyclists on Route 419 for transportation rather than driving on Route 419/U.S. 220
Add bicycle accommodations on U.S. 220 (Route 419 to Blue Ridge Parkway)					
	Route 419/ U.S. 220	City of Roanoke	Bicycle accommodations	More people bicycle for transportation	Number of bicyclists on U.S. 220 for transportation rather than driving on Route 419/U.S. 220
Add bicycle accommodations on Gus Nicks Blvd., (U.S. 460 to Washington Ave.)					
	Gus Nicks Boulevard/ Washington Avenue	City of Roanoke, Vinton	Bicycle accommodations	More people bicycle for transportation	Number of bicyclists on Gus Nicks Blvd. for transportation rather than driving on Gus Nicks Boulevard/Washington Avenue

Strategies	Priority Corridor	Responsible Parties	Outputs	Outcomes	Measures of Effectiveness
Connect the Tinker Creek and Lick Run Greenways					
	Orange Avenue/ Challenger Avenue	City of Roanoke	Off-road greenway trail and/or on-street route	More people bicycle for transportation	Number of bicyclists on this trail for transportation rather than driving on Orange Avenue/Challenger Avenue
Complete the Murray Run Greenway					
	Route 419/U.S. 220	City of Roanoke, Roanoke County, VDOT	Off-road greenway trail and/or on-street route	More people bicycle for transportation	Number of bicyclists on this trail for transportation rather than driving on Route 419 / U.S. 220
Complete the Roanoke River Greenway					
	Orange Avenue/ Challenger Avenue, Main Street (Salem), Gus Nicks Boulevard/ Washington Avenue	City of Salem, City of Roanoke, Roanoke County	Off-road greenway trail and/or on-street route	More people bicycle for transportation	Number of bicyclists on this trail for transportation rather than driving along the priority corridors listed.
Connections to Greenways in Salem (#2, #3, #12 from the Greenway Plan)					
	Main Street (Salem)	Salem	Bicycle accommodations	More people bicycle for transportation	Number of bicyclists using connections for transportation rather than driving on Main Street (Salem)
Connections to Greenways near I-81 (#15, #16, #52 from the Greenway Plan)					
	I-81	Roanoke County	Bicycle accommodations	More people bicycle for transportation	Number of bicyclists using connections for transportation rather than driving on I-81
Connection to Greenway near Gus Nicks Blvd./Washington Ave. (#37 from the Greenway Plan)					
	Gus Nicks Boulevard/ Washington Avenue	Vinton	Bicycle accommodations	More people bicycle for transportation	Number of bicyclists using connection for transportation rather than driving on Gus Nicks Boulevard/Washington Avenue

6.3 Strategies to Improve Roadway Operations

Minor operational changes that improve the efficiency of roadways can alleviate traffic congestion hot spots at moderate expense (compared to the expense of adding lanes). Traffic operational changes include signal timing and lane reconfigurations. Intelligent transportation systems can reduce traffic delays by sharing information efficiently and responding quickly to changing conditions. Freight operational changes such as autonomous trucks or truck-to-rail diversion programs can improve freight movement and increase capacity for all traffic (freight and people).

6.3.1. Plans and Studies on Priority Corridors

There are several corridor-specific plans and studies that are relevant to congestion management on the five Priority Corridors (Table 13).

Table 13. Plans and studies on Priority Corridors

Plan/Study Name	Priority Corridor	Description
I-81 Capital Improvements: I-81 Corridor Plan	I-81	This study was completed in 2018 recommending capital and operational improvements for I-81. With a dedicated funding source in place, projects outlined in the plan are moving forward.
Route 460 Operational Improvement Study	Orange Avenue/ Challenger Avenue	This study was completed in 2020. Seven projects identified in the study were submitted for SMART SCALE round 4 funding.
Route 460 Arterial Preservation Program Study	Orange Avenue/ Challenger Avenue	This study is underway.
Route 220 Arterial Preservation Program Study	Route 419/ U.S. 220	This study is underway.
Gus Nicks Boulevard/Washington Avenue Corridor Improvement Study	Gus Nicks Boulevard/ Washington Avenue	This study, completed in 2019, generated ideas for projects that can be submitted for SMART SCALE and other funding opportunities to improve Gus Nicks Boulevard/ Washington Avenue corridor in Vinton

6.3.2. Traffic Operations

Traffic operations focus on moving vehicles through intersections and clearing crashes. VDOT works with localities on traffic operations to optimize traffic flow through intersections.

Turn lanes and traffic signals improve safety and manage traffic congestion at intersections. The Federal Highway Administration recommends retiming signals every two to three years for optimal traffic flow[22]. Signal timing coordination is a popular concept; survey participants enthusiastically recommended and demanded signal timing changes to optimize their trips but may not be aware of the constraints and

[22]"Managing Traffic Flow Through Signal Timing", S. Lawrence Paulson, Public Roads 65(4), 2002. https://www.fhwa.dot.gov/publications/publicroads/02janfeb/timing.cfm

costs involved. Replacing signalized intersections entirely with alternative intersections is an increasingly popular option that improves safety and manages traffic congestion.

Survey participants frequently cited the need for signal timing improvements on U.S. 460. The City of Roanoke and Roanoke County coordinated several signals on U.S. 460 (Orange Avenue/Challenger Avenue). The Virginia Department of Transportation coordinated two sets of signals on U.S. 460: 1) West Ruritan Road with Valley Gateway Boulevard and 2) U.S. 220 Alternate with the Walmart signal. In addition to signals on U.S. 460, the signals on Electric Road/Route 419 through Roanoke County and the City of Roanoke have been coordinated, and the signals on Brambleton Avenue/Route 221 have been coordinated. The signals on U.S. 220 have been coordinated and further signal timing work is planned to reduce signal phases by re-routing through-movements.

Finally, the Virginia Department of Transportation is systemically installing flashing yellow arrow signals that reduce left turn wait times.[23]

Quick clearance of traffic incidents is of interest for improving safety for incident responders and travelers and it also reduces traffic congestion caused by crashes[24]. Standardized incident response and coordination among the many agencies involved in crash clearance reduces the clearance time, prevents secondary crashes, and reduces incident-related traffic congestion.

Roanoke County and the City of Roanoke began using the Collision Reporting Center through Accident Support Services International LTD in 2016 which reduces secondary incidents and reduces incident-related traffic congestion. Instead of collecting information at the site of the crash, routine property-damage-only crashes can be cleared more quickly and data collection can happen away from the crash site through the Collision Reporting Center. Not all crashes are eligible for the Collision Reporting Center. Since its inception, 27% of reportable crashes have gone through the Collision Reporting Center, saving roadside time. Salem is unable to use the Collision Reporting Center because of incompatible records management software.

6.3.3. Intelligent Transportation Systems

Established and emerging technology is rapidly making the transportation network more intelligent by quickly communicating travel information to drivers and agencies. The City of Roanoke joined the Waze Connected Citizens Program. Through this program, the City can communicate information such as road closures to Waze users.

The Virginia Department of Transportation (VDOT) employs dynamic messaging which the Traffic Operations Center uses to alert travelers to relevant conditions such as travel times, construction, crashes, closed exits, detours, etc. Their Innovation Team is researching the use of drones for collecting real-time traffic information.

VDOT is also installing adaptive traffic signal systems in two locations in 2021. Automated software will assess traffic and adapt signal timing to traffic queues on Electric Road/Route 419 near U.S. 220. On Brambleton Avenue near Electric Road/Route 419, an adaptive system will link to the Traffic Operations

[23]Flashing Yellow Arrow Signals, Virginia Department of Transportation https://www.virginiadot.org/projects/resources/NorthernVirginia/Flashing_Yellow_Arrow_General_Information.pdf

[24] Quick Clearance, Federal Highway Administration. https://ops.fhwa.dot.gov/eto_tim_pse/about/qc.htm

Center which monitors real-time information from cameras and other data where personnel can moderate signal timing.

6.3.4. Freight Operations

The congestion management process should address the movement of goods and people, but the movement of goods, or freight, is often overlooked. Many of the strategies identified for managing traffic congestion facilitate the movement of both goods and people but considering the movement of goods specifically may identify additional strategies. To develop freight strategies, ten companies engaged in freight movement were invited to interviews, and the four that responded represent a range of companies who move freight within and through the RVTPO.

The Planning Time Index of I-81 shows that it experiences more traffic congestion than is typical for most roads in the region, but the traffic congestion is confined to peak hours and affects only a short segment of I-81 (Figure 14). In interviews, freight stakeholders commented that traffic congestion in the Roanoke Valley is not a major factor.

In interviews, freight stakeholders identified the unpredictability of I-81, rather than its traffic congestion, as a major freight issue because of pickup and delivery schedules and the restricted hours of drivers. The unpredictability of I-81 may be resolved by the widening and other efforts currently underway as identified in the I-81 Corridor Improvement Plan. A new regional gas tax initiated in July 2019 is generating funding for major projects on I-81 to improve safety and increase traffic flow.

Diverting truck traffic to rail could create capacity on I-81. A report by RVARC, *Truck Diversion from Interstate 81 to Rail*, assessed the ability of rail improvements outlined in the 2010 *Feasibility Plan for Maximum Truck to Rail Diversion in Virginia's I-81 Corridor* to divert 2019 truck traffic volumes.

Additional roadway operations strategies to manage traffic congestion beyond what is currently funded are listed in the following table (Table 14).

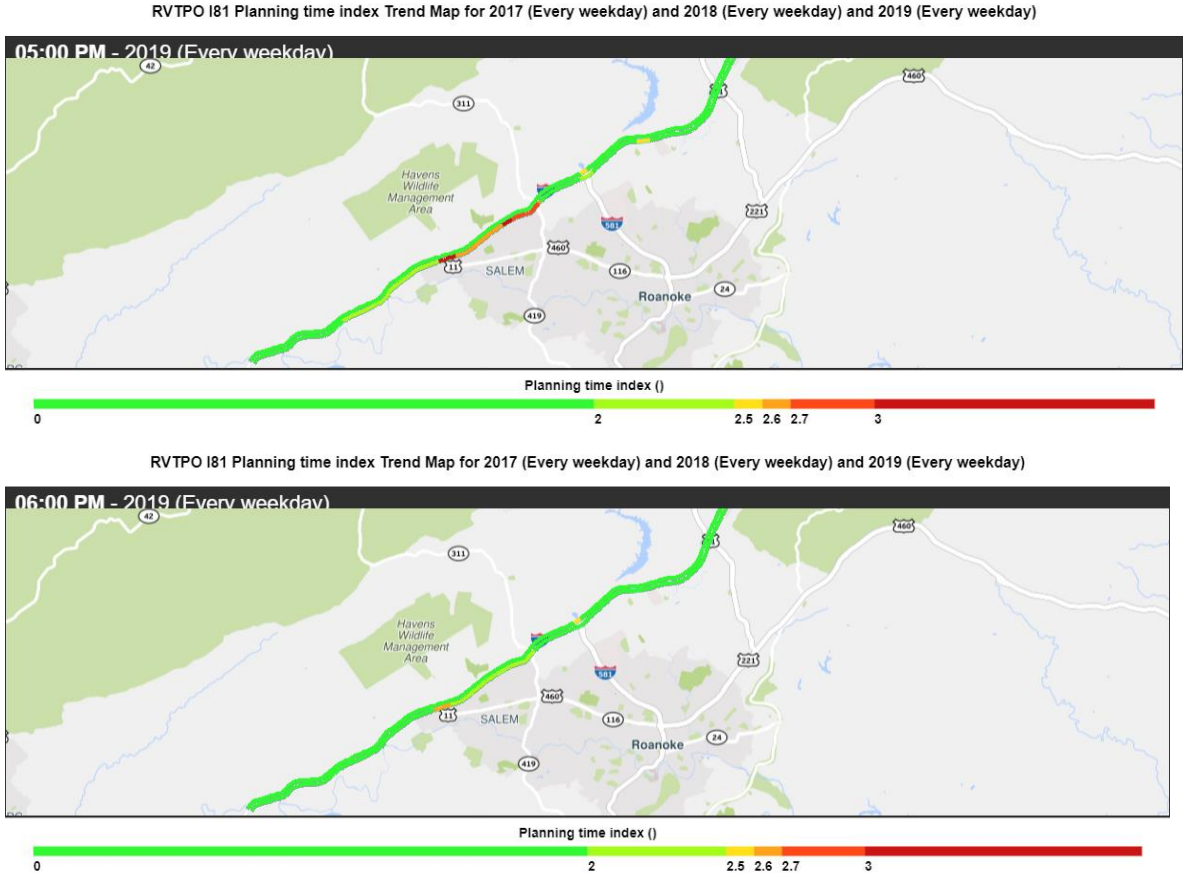


Figure 14. Average 2017 weekday Planning Time Index on I-81 at 5 pm (top) and 6 pm (bottom).

Table 14. Roadway operations strategies to manage traffic congestion

Strategy	Priority Corridor	Responsibility party	Outputs	Outcomes	Measures of Effectiveness
Construct "Route 419 Streetscape Improvements, Phase 2" including signal modifications to eliminate turning movements at intersections on Electric Rd. and Ogden Rd. (Submitted for SMART SCALE Round 4)					
	Route 419/ U.S. 220	Roanoke County, VDOT	Access restrictions, new/longer turn lanes, signal timing updates	Increased vehicle capacity, reduced travel delays	PTI, Crash rates
Construct access restrictions, new/longer turn lanes, signal timing updates, and geometric improvements per Route 460 Operational Improvements Study on Orange Avenue from Williamson Road to Alternate U.S. 220. (Seven projects submitted for SMART SCALE Round 4 funding)					
	Orange Avenue/ Challenger Avenue	City of Roanoke, Roanoke County, VDOT	Access restrictions, new/longer turn lanes, signal timing updates	Increased vehicle capacity, reduced travel delays	PTI, Crash rates
Identify preferred alternate routing to I-81 through the Roanoke Valley and study operational and wayfinding improvements needed					
	I-81, Main Street (Salem)	RVARC, VDOT, Botetourt, Roanoke, & Montgomery Counties, Salem	Marked I-81 alternative route. Operational improvements identified.	Motorists easily maneuver through the Roanoke Valley on I-81 alternate routes; option for regional trips.	PTI, Average Annual Daily Traffic
Conduct a study of Intelligent Transportation System (ITS) infrastructure needs for priority corridors in the Roanoke Valley					
	All	RVARC, VDOT	Study of ITS needs for the Roanoke Valley	ITS infrastructure improves motorists' travel decisions and VDOT's roadway management	Amount of new ITS infrastructure installed in the Roanoke Valley
Conduct a business survey to better understand freight operation needs in the Roanoke Valley					
	All	RVARC	Business survey conducted	Stakeholders are aware of business transportation needs and freight operation deficiencies	Future strategies reflect business/ freight needs
Conduct a regional freight study for the Roanoke Valley and develop a plan to address needs					
	All	RVARC / VDOT	Regional Freight Study	Stakeholders have a better understanding of freight movements in/out of the Roanoke Valley and a plan to address needs.	Freight Study incorporated into the Long-Range Plan
Provide more truck parking in the region					
	I-81	VDOT / Businesses / Localities	More safe places for trucks to park	Fewer trucks illegally parked or driving on roads when the drivers need to be resting	Number of truck parking spaces in the Roanoke Valley

7. Evaluation

Because some of the strategies identified to manage congestion in this process are new, RVARC anticipates a time of experimentation. Evaluation will separate successful activities from those that are infeasible or unsuccessful. With changing technology and conditions, activities that are more effective than those described in this document may become available. These evaluation steps will help guide the evolution of activities. RVARC will produce an annual Traffic Congestion Management Process report to:

- Document the progress of each strategy, monitoring the effects of strategies on traffic congestion,
- Justify changing, eliminating, or adding strategies,
- Showcase successes and identify missed opportunities,
- Assess the impact of strategies on traffic congestion and monitor regional traffic congestion trends, and
- Review the balance of traffic congestion management strategies with other transportation goals.

RVARC staff will analyze local traffic congestion before and after projects or strategies that are likely to have a localized effect. Only localized effects can be linked directly to a specific activity, although strategies could have broad effects on traffic congestion.

Planning Time Index can be analyzed before and after completion of projects that have traffic congestion mitigation as a purpose to assess their impact on localized traffic congestion.

Example Evaluation

As an example, the I-581 and Elm Avenue interchange project, completed in 2016 and intended to alleviate traffic congestion, was analyzed before and after construction (Figure 15). For each segment, all average hourly PTIs greater than 1.5 were summed and multiplied by the distance of the segment. (PTI 1.5 was selected because the segments rarely experienced an annual average hourly PTI greater than that at any time before or after construction.) The resulting number is the daily sum of the annual average hourly PTI weighted by the distance of the segment. This analysis shows that traffic congestion was reduced after the Elm Avenue project was completed, but the signal timing adjustment did not further

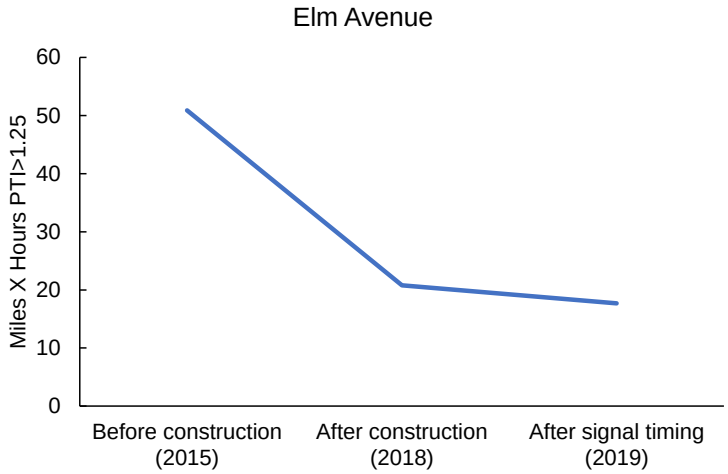


Figure 15. Planning Time Index (PTI) on Elm Avenue before and after traffic

alleviate traffic congestion (although it may have improved the operation of the interchange in other ways).

It is not possible to link an individual strategy with regional traffic congestion trends. In fact, regional traffic congestion may be more greatly influenced by factors beyond regional controls, such as the economy, the price of gas, or a pandemic. Regional traffic congestion trends tell us if traffic congestion is getting worse or if it is improving, despite or because of factors beyond our control as well as due to the strategies identified. RVARC staff will monitor regional traffic congestion trends and produce maps identifying traffic congestion problems (or the lack thereof). RVARC staff will continue to learn about technologies to monitor traffic congestion.

Two Vision 2040 transportation goals are directly related to traffic congestion:

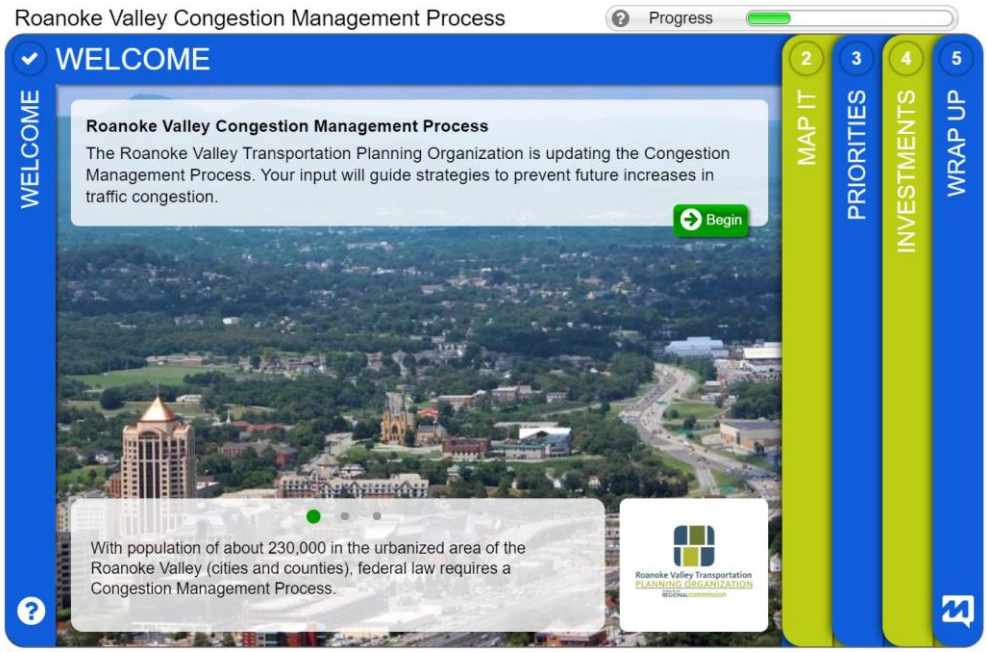
- Proactive and efficient system management
- Resiliency and reliability.

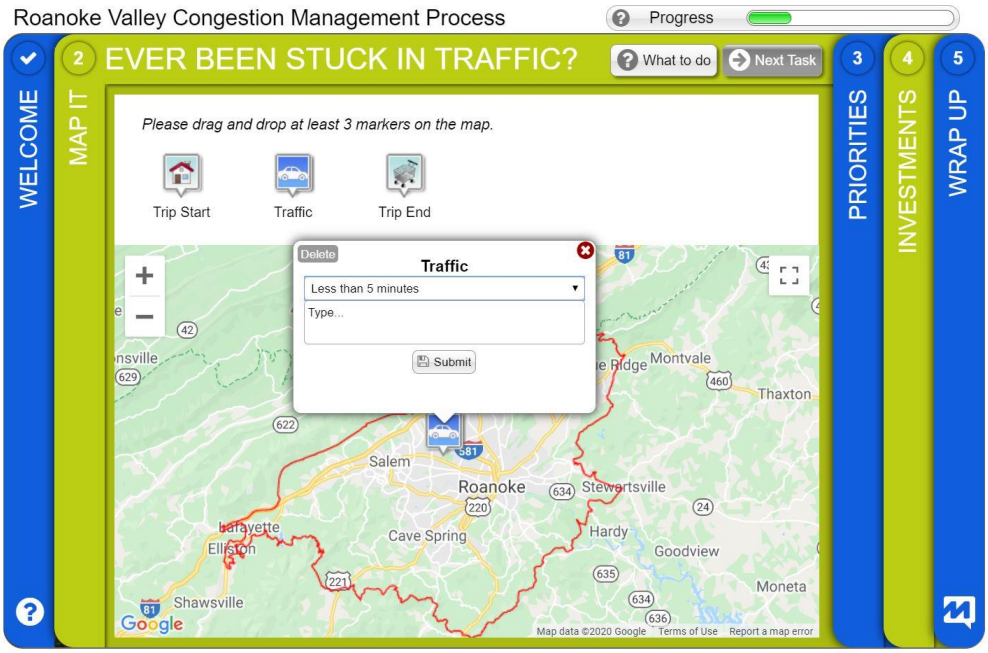
RVARC staff will work with the RVTPO Transportation Technical Committee to ensure that strategies for congestion management are balanced with strategies that meet other transportation goals:

- Economic competitiveness and prosperity
- Accessible and connected places
- Safety and Security
- Healthy Environment

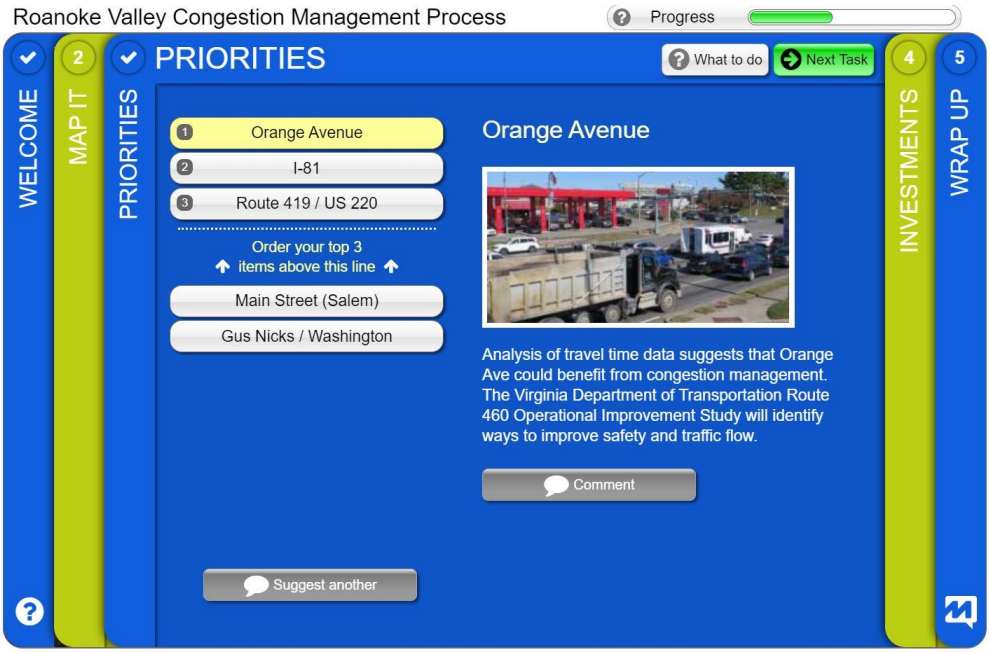
As technology, regulations, and conditions change, the Traffic Congestion Management Process must also change. During this update, the COVID-19 pandemic dramatically altered traffic patterns in a manner no one had predicted and likely precipitated the most severe economic downturn in decades with a profound effect on traffic patterns. Several of the strategies identified in this document are new; the RVTPO will experiment with these congestion management strategies and continue to learn about new strategies to try. Documenting lessons learned in an annual Traffic Congestion report will keep the Traffic Congestion Management Process relevant and current and will be easy to incorporate into future updates of the Traffic Congestion Management Process.

Appendix



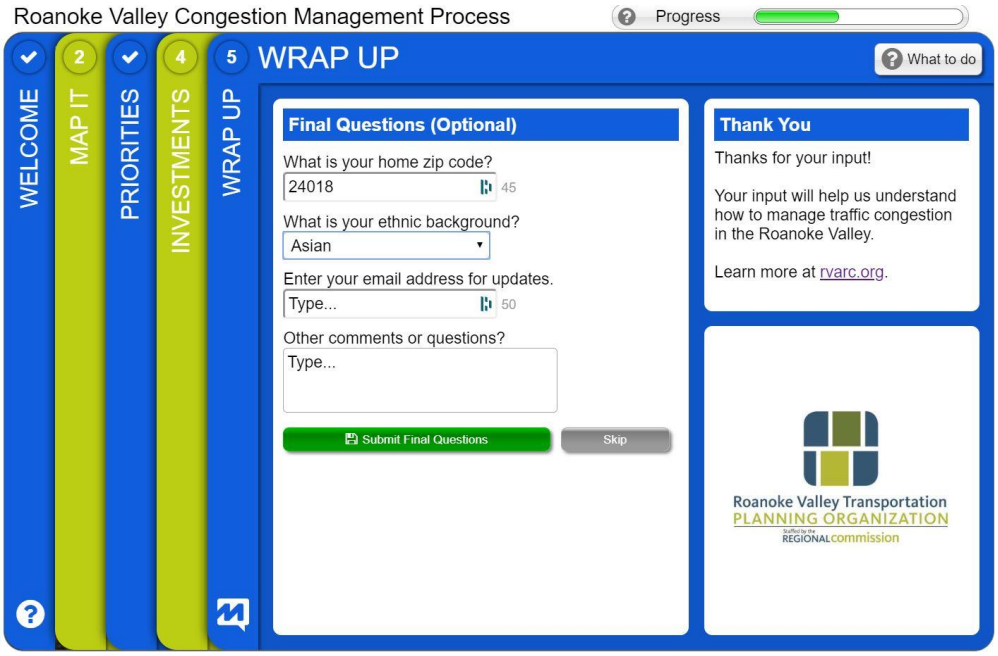


Participants dragged and dropped markers onto a map to indicate where they experienced a traffic delay, where they were coming from when they experienced the delay, and where they were going. They answered how long the delay was and whether the origin and destination were home, work/school, or other.



Participants ranked three of the five suggested corridors to determine which corridors should be prioritized for congestion management strategies.

Participants selected whether traffic flow should be prioritized higher or lower than other transportation goals.



To determine if the demographics of respondents was typical of the demographics of the region, participants were asked to provide their zip code and race/ethnicity. Participants were invited to provide their email address and had a final opportunity for comment.