# CHAPTER 4 – FUTURE TRENDS

## 4.1 LAND USE SCENARIO PLANNING

Scenario planning represents the analytical processes created to evaluate the influence of development intensities and land use patterns on the efficiency of a proposed transportation system. Stronger links between land use (demand), urban form (design), and transportation (supply) can significantly improve the efficiency of the regional transportation system while also promoting revitalization of cities, towns and rural areas while protecting the natural environment to produce more livable and economically viable communities.

In 2012, FAMPO initiated the first phase of a scenario planning initiative entitled *Your Vision, Our Future*. FAMPO delineated five distinct land use growth scenarios for evaluating the relationship between land use, urban form, and travel behavior. Phase II of the scenario planning initiative focused on testing transportation-oriented scenarios' effects on regional travel behavior and traffic conditions.

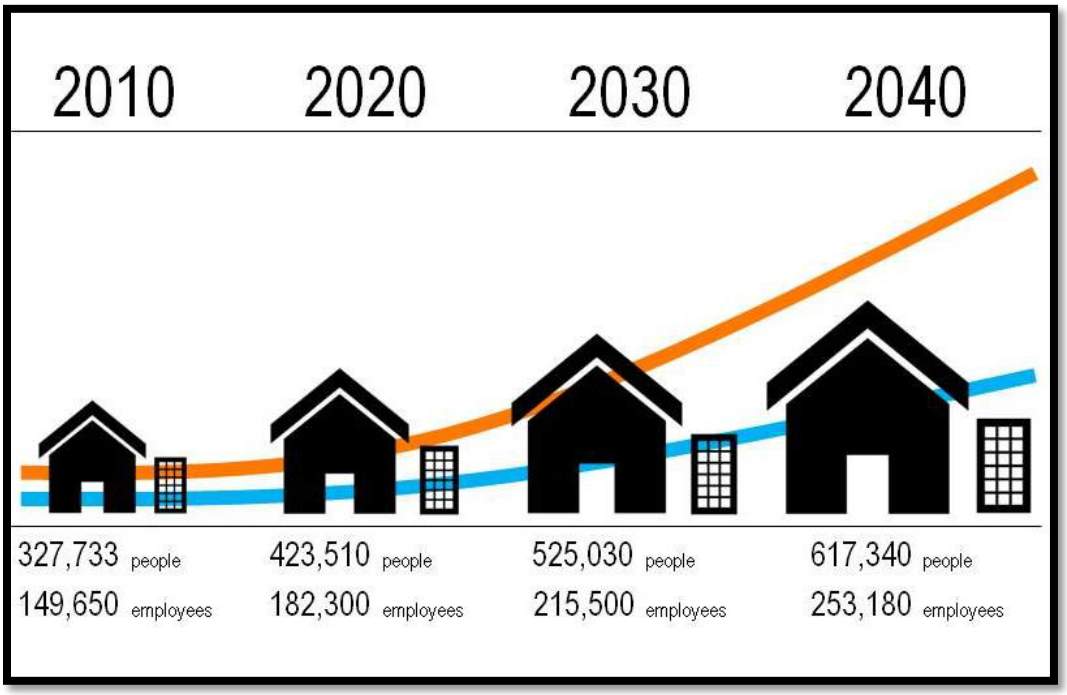
For the 2050 LRTP update, FAMPO Staff worked with VDOT's modelling team to model three alternative future scenarios which examined the effect of greater than expected population growth, jobs growth or significant transit improvements. Finally, this edition recommends future steps to prepare for the future 2055 LRTP update.

### 4.1.1 PHASE I STUDY OUTCOMES

The 2012 Phase I analysis defined four initial alternative growth scenarios for *Your Vision, Our Future*. The four alternative growth scenarios included:

1. Decentralized Growth
2. Compact Centers & Growth Corridors
3. Green Print Initiative
4. Greater Jobs-Housing Balance

Ultimately, the steering committee decided to create a fifth growth scenario — Community Plans. The Community Plans Growth Scenario contemplated how the region develops if city and county comprehensive plans were fully implemented. It projected a growth in population of 90 percent by 2040, and employment growth of 70 percent, see figure 4.1.




## 4.1.2 PHASE II SCENARIOS

Phase II scenarios examined transportation system and technology shifts to improve mobility in the region:

***All-in-Transit Scenario***
The All-in-Transit Scenario considered how the region might develop if a significant number of single-occupant automobile trips shifted to transit or vanpools.

***Region of Telecommuters Scenario***
The Region of Telecommuters Scenario considers the transportation impacts if a significant number of people in the labor force shifted from traditional office work to telecommuting for work.

***Thinking Cars Scenario***
The Thinking Cars Scenario considers the impacts if automotive technologies were advanced to a point where more capacity was available in the regional transportation system.

## 4.1.3 PHASE II SCENARIO RESULTS

For each scenario, the FAMPO Travel Demand Model was used to project travel demand on the roadway system for 2040. The performance measures used were:

1. Vehicle miles of travel (VMT)
2. Vehicle hours of travel (VHT)
3. Average roadway speed
4. Percent travel on congested roadways

Vehicle miles of travel (VMT) is calculated by multiplying each vehicle trip by the distance of that trip. Vehicle hours of travel (VHT) measures travel time by multiplying each vehicle trip by the duration of that trip. Average roadway speeds are calculated by dividing regional VMT by VHT. The percentage of travel on congested roadways is calculated by adding the VMT that travels on congested roadway links.

***Vehicle Miles of Travel Results***

The All-in-Transit and Region of Telecommuter Scenarios showed a 2-3 percent reduction in regional VMT, while the Thinking Cars Scenario results in a 10 percent increase in regional VMT.

***Vehicle Hours of Travel Results***

The All-in-Transit Scenario results in a 6-7 percent reduction in vehicle trips. The Region of Telecommuters Scenario shows a 7 percent reduction in VHT. The 20 percent reduction in VHT under the Thinking Cars Scenario is a result of increased roadway speeds and capacities.

***Average Roadway Speed Results***

These results are consistent with the VHT results above. For example, lower VHT is generally a result of higher speeds on the roadway network.

## 4.1.4 PLANNING AND IMPLEMENTATION

Each of the Phase II scenarios would require new policy decisions and infrastructure investments, which are discussed below for each scenario.

### All-in-Transit

This scenario would require changes to land use development plans and transportation infrastructure. High-capacity transit facilities need to serve higher density mixed use environments. Phase II called for new growth to be focused on compact, walkable communities with opportunities to live, work, shop, and be entertained. This scenario assumes that all funds would be spent on transit improvements with almost zero funds left to spend on highway improvements. This is unlikely to occur in real world conditions.

### Region of Telecommuters

Data shows that less than 20 percent of trips are work-related[1] so a finite number of trips can be taken off the transportation system and not all jobs are compatible with telecommuting. Analyses in this study showed marginal improvements to VMT, VHT, average speeds and congestion. The COVID-19 pandemic has given the closest real-world experience of what this would potentially look like. After an initial shock of rapidly reducing traffic (highway commuting) most traffic rebounded quickly, even with many continuing to telecommute. A continued rise in freight traffic followed to between 7 percent and 10 percent over pre-pandemic levels and a shift of peak traffic on highways to a reduced but longer daily peak.

### Thinking Cars

This scenario tested potential impacts of widespread use of autonomous vehicles. Positive impacts include improved mobility and circulation, increased ridesharing, and increased roadway throughput. Negative impacts could include increased VMT and urban sprawl. It is likely that a roll-out of driverless vehicles will happen more slowly than first predicted. The technology takes longer to perfect than anticipated and has significant legal and insurance implications. Initial testing has involved several high-profile accidents.

[1] Commuting in America 2013, The National Report on Commuting Patterns and Trends, AASHTO, May 2013.

For more information on the Phase II Scenario Planning Study, please refer to Appendix C from the 2045 LRTP.

## 4.2 TRENDS SINCE 2016 SCENARIO PLANNING EFFORT

Undoubtedly, significant changes have occurred in the Region over the past decade as indicated by the rapid population growth, less rapid employment growth, and physical changes via highway improvements and many new residential developments in the area. Since 2016 there has been an increased focus on construction of new commercial and industrial facilities as well as a large new regional Veterans Affairs medical facility currently being constructed in Spotsylvania County.

### 4.2.1 NATIONWIDE & STATEWIDE TRENDS IN SCENARIO PLANNING

The 2020 Census produced data with the latest population trends in the FAMPO Region and surrounding counties. As noted in Chapter 3, the population is growing at a rapid rate. As one of the fastest growing regions in Virginia, there is significant pressure on the infrastructure in the Region. Should this growth rate increase, it will have an extensive impact on the current road, bus, and rail infrastructure. Scenario Planning forecasts these population changes into the future and projects possible alternatives to these changes through potential future scenarios.

National trends that will have a local impact include ongoing population growth in the US, as well as demographic shifts identified in the 2020 Census, which will be published in the coming months. National trends in transportation include a slow but steady ongoing average drop in transit ridership with many significant exceptions. These are usually brought about through transit network redesign, such as in Houston, TX, implementation of large new infrastructure and systems, such as in Seattle, WA, and small positive effects of ride-hailing on heavy rail ridership such as the Toronto subway.

Studies, such as the Washington D.C. based Resources for the Future (RFF) study[2] in 2021 demonstrate the link between rising incomes and private automobile purchases. A continued increase in automobile purchases due to rising incomes coupled with the increased use of ride-hailing services with the duopoly of Uber and Lyft spur congestion. These issues, together with increasing urban sprawl, are leading to several mega-congested regions in the US such as the greater Boston metropolitan area and I-95 in Virginia and many others. Congestion rankings are now published annually together with data indicating degree of time wasted on highways. This data shows worsening travel time indexes and congestion on major highways across the US, including on the I-95 corridor in Virginia.

There is increased roll out of bike and scooter sharing operations nationally. Sharing and renting of personal mobility devices, while a growing trend, may experience sustainability difficulties due to the economics of this industry and local regulation. All of this leads to existing- and future-planning problems which are being tackled across the country

The future of ride-sharing and ride-hailing is uncertain. It appears that bike sharing, scooter-sharing, and automobile-based ride-sharing companies have a difficult path to long term profitability. The Financial Times in November 2021 reported research confirming a decade of losses from Uber and Lyft and the first

[2] https://media.rff.org/documents/VehicleDemandWorkingPaper.pdf

month of profitability for ride-hailing companies requiring a 92 percent increase in fees and large-scale job cuts: "The business model of most ride-hailing companies relies on narrow margins, but rides are becoming more expensive as more costs come for the companies. Keeping prices down will be even less sustainable if drivers win full employee rights. Both Uber and Lyft have already had to offload their self-driving divisions and slash costs via lay-offs to reach profitability."[3] - FT November 5, 2021. Bike and scooter sharing are experiencing similar difficulties. Yet curb-space use for cabs, deliveries, bikes, ride-hailing and the like has generally become a key planning headache for local jurisdictions. Electrification of cars, buses, and trains brings its own concerns around charging infrastructure, battery life, and the increased need in the future for electricity generation.

Finally, the question of financing new infrastructure is prepped for a revolution. With an increased switch to electrified automobiles in future, there will be greatly reduced gas tax revenues to rely upon. Planners must navigate these complex and fast-changing environments to plan for unknown future outcomes, particularly for large infrastructure projects that have long planning, funding, and construction timelines.

### 4.2.2 CHANGES IN THE FREDERICKSBURG REGION

Local land use changes and large new infrastructure projects will affect future transportation systems, often in unpredictable ways. A few key megaprojects in the pipeline will change the area significantly and are highlighted in the following text as examples of change coming to the local area.

Stafford County is pursuing a new "Downtown Stafford" town center which will bring new jobs to the area and significantly change local transportation patterns when it is fully built out. Map 4.1, below, is from the Stafford Comprehensive Plan and highlights the planned changes.

[3]

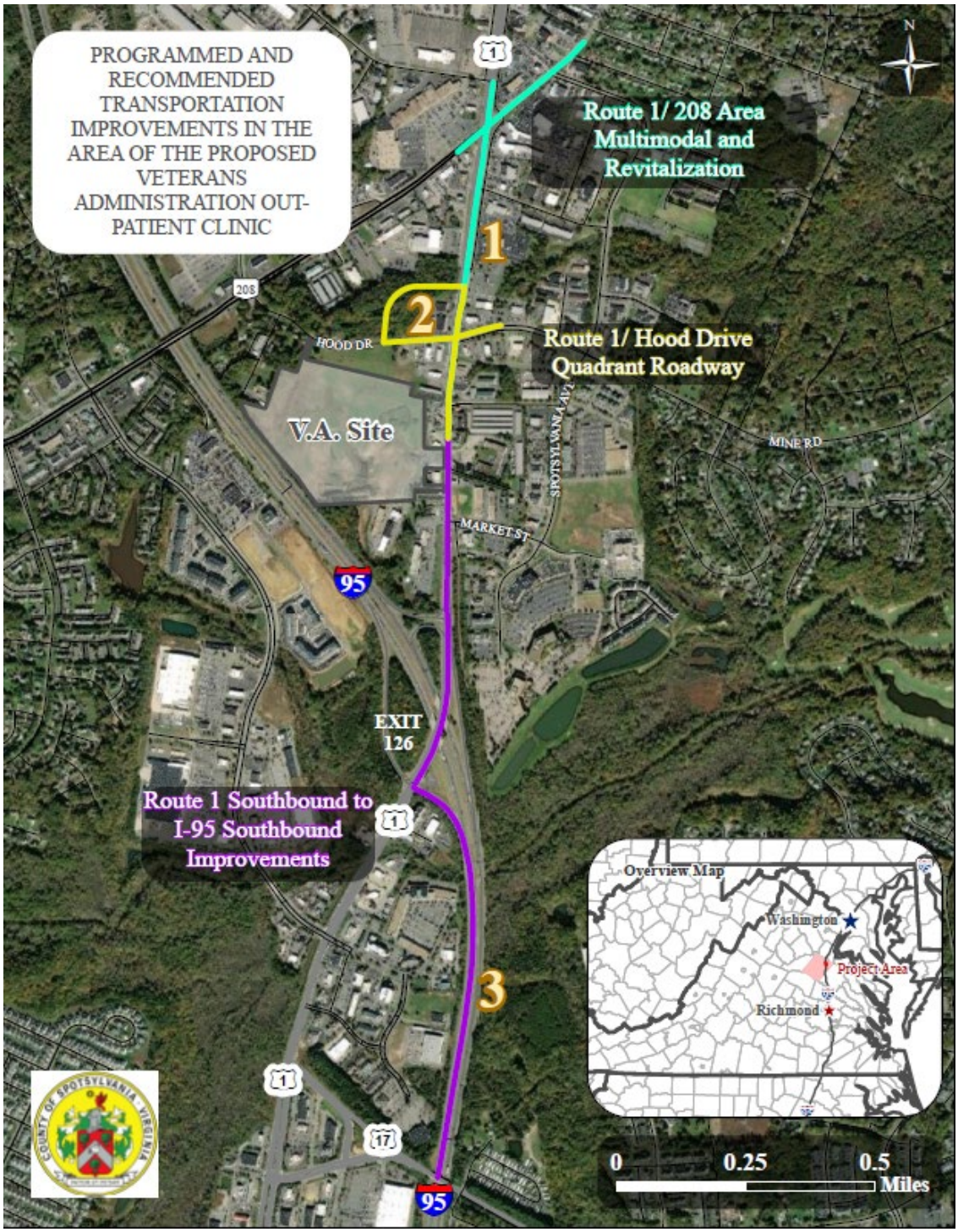
**Map 4.1:** Proposed Downtown Stafford

Source: Stafford Comprehensive Plan

Spotsylvania County is in the process of further developing the transportation infrastructure around and leading to the new Veterans Affairs healthcare facility planned between US-1 and the I-95 highway corridors. This project will be one of the largest such facilities[1] in the country, potentially attracting up to 3,000 jobs, including related and supporting services, to the area. This is a significant change to the area's transportation infrastructure, including access to I-95, US-1, and the Fredericksburg train station. Maps 4.2 and 4.3, from the County, illustrate where the roadway and multimodal systems are to be upgraded.

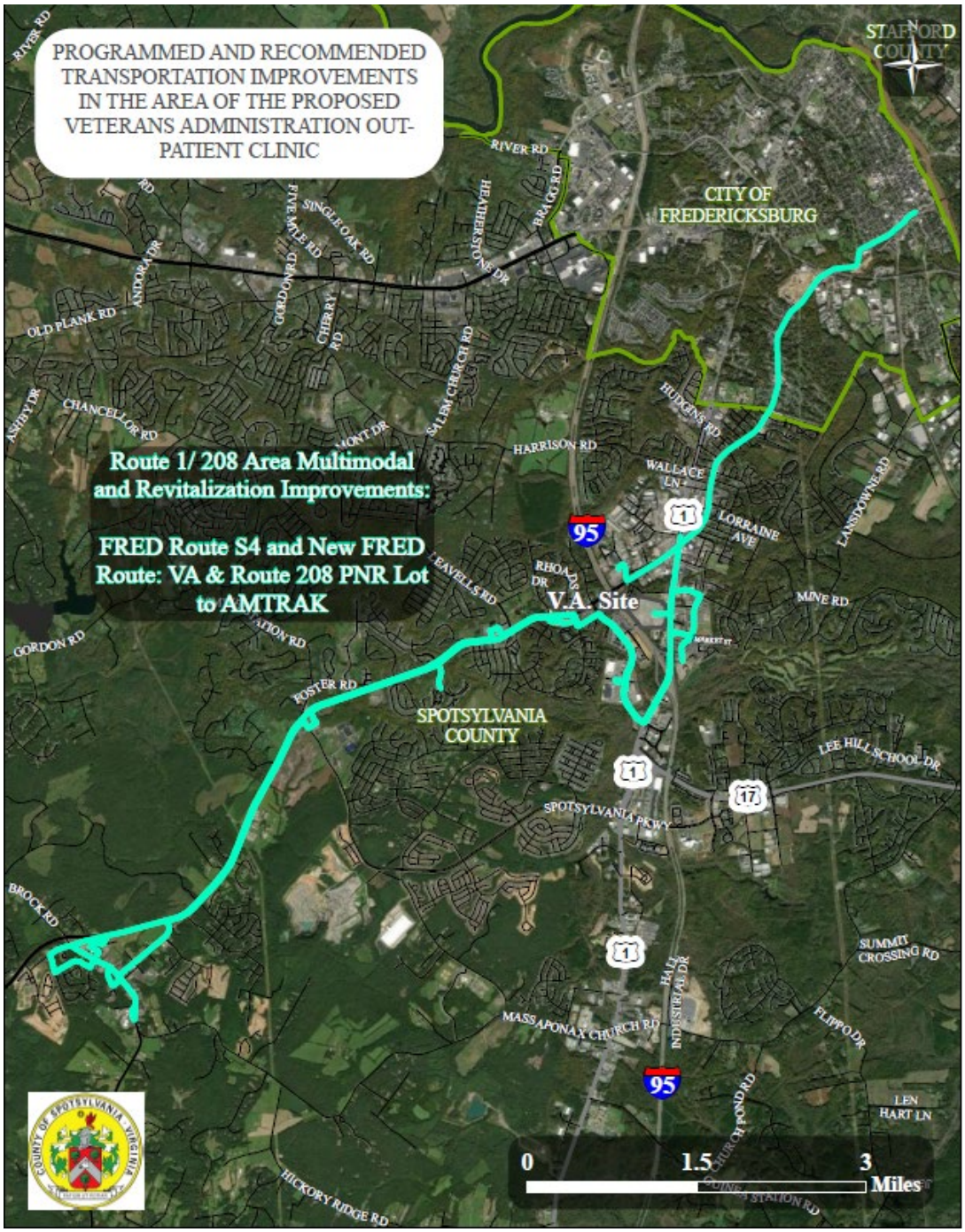
[1] https://richmond.com/news/virginia/va-health-care-center-coming-to-fredericksburg-will-be-nations-largest/article_093a5137-8c68-5453-b5f2-b37500a7a2e8.html

**Map 4.2:** Planned Improvements in Spotsylvania County near I-95 Exit 126 and Four Mile Fork




Source: Spotsylvania County Transportation Planning Department

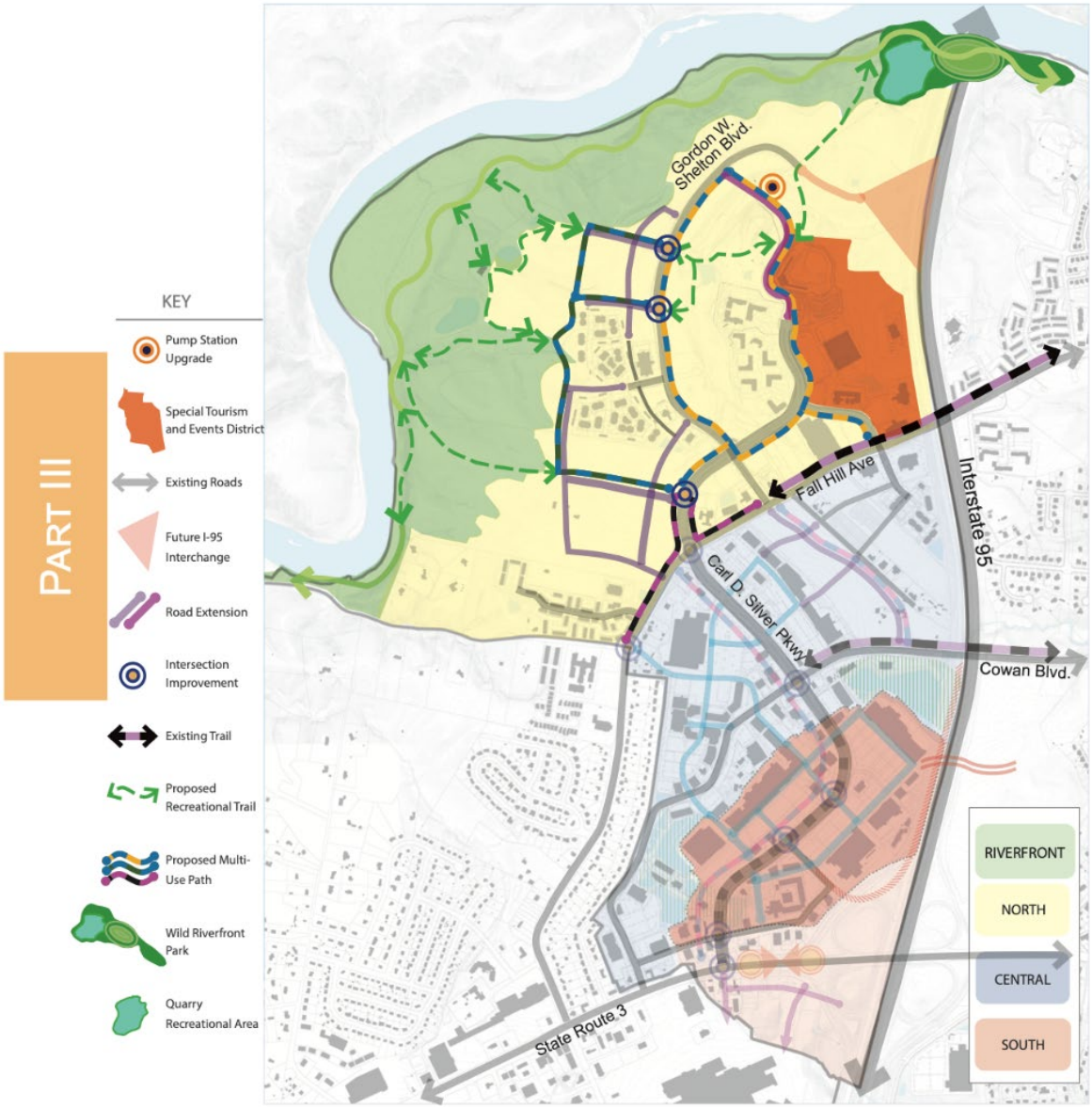
**Map 4.3:** Planned Improvements in Spotsylvania County along Route 208




Source: Spotsylvania County Transportation Planning Department

The City of Fredericksburg is adopting a new small area plan for Area 1, the largest small area plan in the City. This includes a redefinition of the land uses in and Central Park and its surrounding neighborhoods. Further, the plan includes a proposal for additional access points to and across I-95, as well as additional bike and pedestrian paths, see Map 4.4.

**Map 4.4:** Small Area Plan 1, City of Fredericksburg

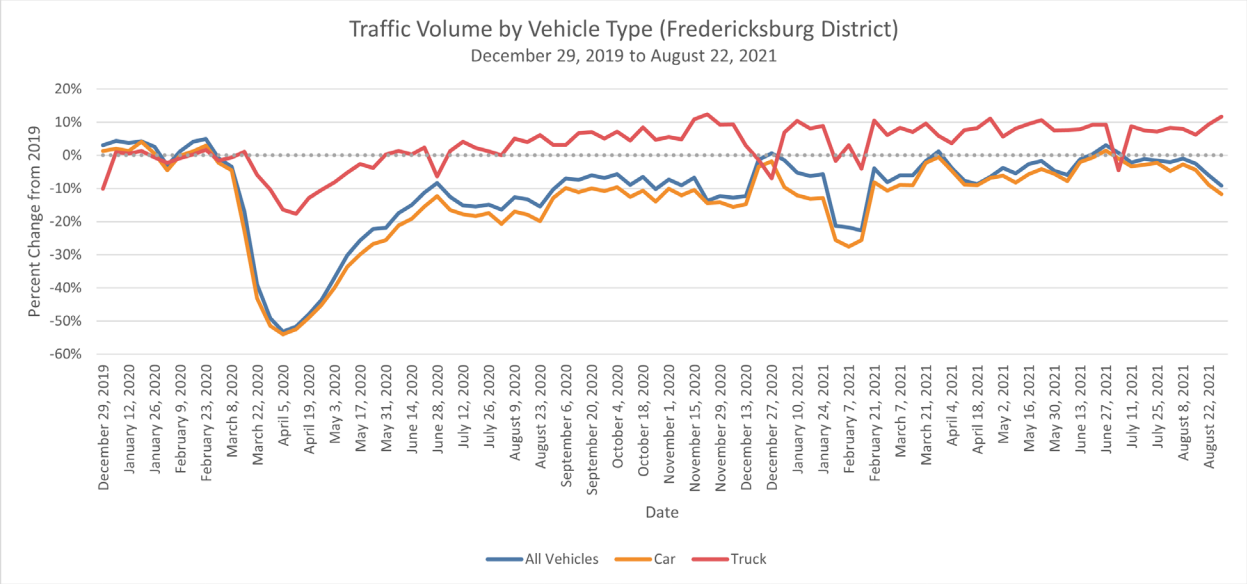



Source: City of Fredericksburg

### 4.2.3 COVID-19 IMPACTS

COVID-19 has proved a challenge across the country and across the globe. Transit ridership has been significantly affected and highway traffic has partly shifted from heavy peak hour commuting to more local, weekend, and alternative destination traffic. Freight traffic, however, has been growing at a rapid rate in the FAMPO Region. The freight traffic has increased 10 percent above pre-pandemic levels during the pandemic. Figure 4.5 indicates local traffic over the covid period.

**Figure 4.5:** Traffic Volume by Vehicle Type, December 2019 to August 2021




Source: Virginia Office of Intermodal Planning and Investment

## 4.3 2021 SCENARIO PLANNING & MODELING

In conjunction with VDOT's Transportation & Mobility Planning Division, FAMPO examined three broad scenarios for the 2050 LRTP. This initiative builds upon the findings of the Phase I and Phase II study outcomes and was executed to gain a general understanding of how potential changes in employment, population, and transit would affect congestion for the 2050 forecast year. These scenarios are described below as Employment Growth 2050, Population Growth 2050, and Transit Growth 2050, respectively.

Each scenario was modeled independently and done so using the FAMPO travel demand model forecast year (2050) build scenario. This means that for this scenario planning exercise, the list of planned projects that have been approved for the 2050 CLRP that result in capacity changes, such as lane widening, interchange modifications, new ramps, roadway removal, and new roadways are included. Intersection modifications (signals, adding turn lanes, etc.), bike lanes, and pedestrian lanes were not included. Map 4.5 below indicates the build scenario for 2050 showing congestion levels modeled to include the 2050 CLRP list of approved projects.

**Map 4.5:** 2050 Build Scenario

### 4.3.1 SCENARIO 1: EMPLOYMENT GROWTH 2050

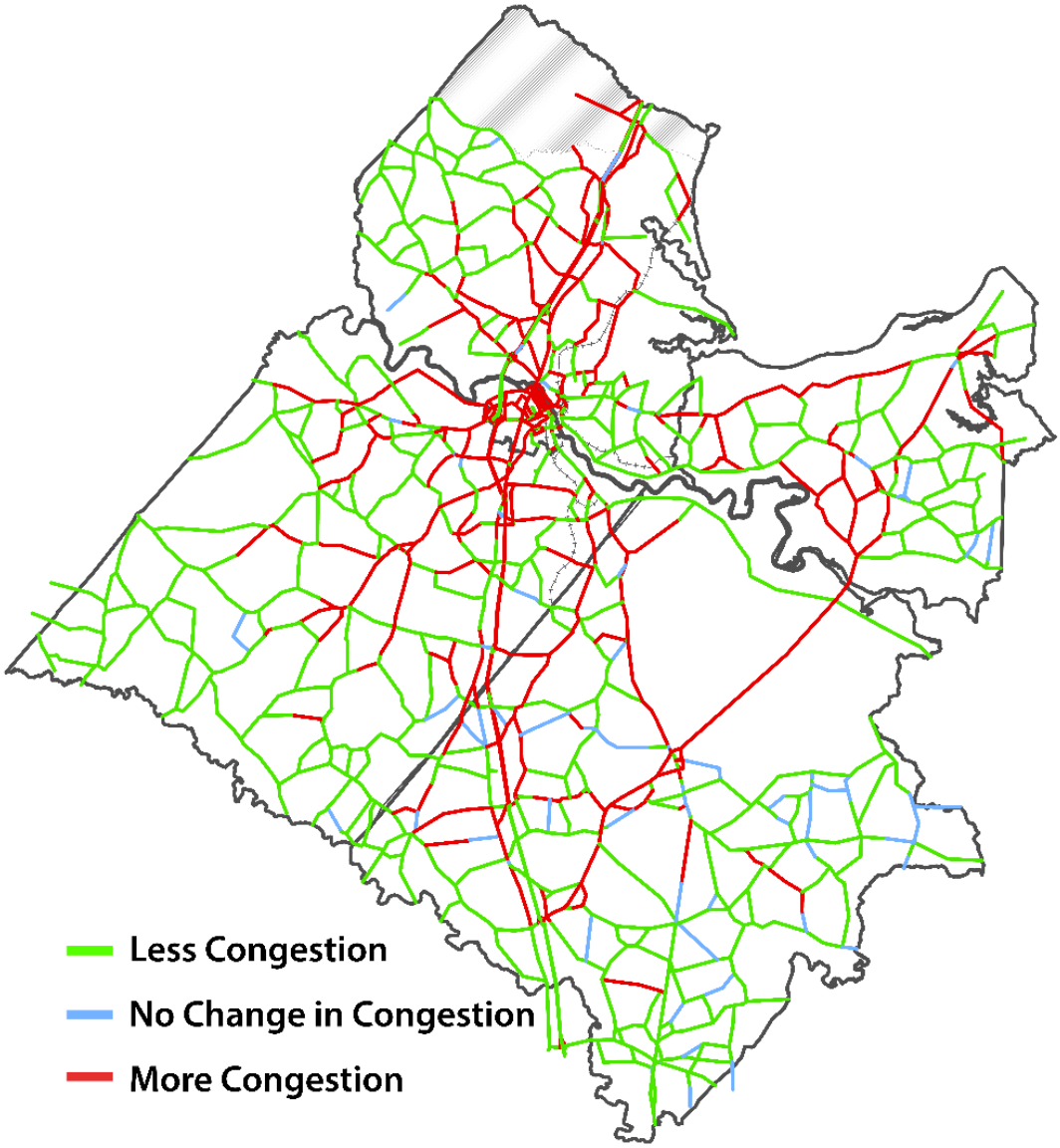
The Employment Growth 2050 scenario looked at what a 50 percent increase in local employment would mean for the Fredericksburg Region. For this scenario, employment is expected to increase by 50 percent in all TAZs from the 2050 build scenario. Without the 50 percent employment increase, the current expected employment growth is shown in Table 4.1.

**Table 4.1:** Employment Change 2017 to 2050

| Jurisdiction | 2017 | 2050 | Percent Change |
|---|---|---|---|
| Fredericksburg | 28,543 | 51,041 | 78.82 |
| Spotsylvania | 35,335 | 52,175 | 47.66 |
| Stafford | 42,116 | 83,227 | 97.61 |
| FAMPO Total | 105,994 | 186,443 | 75.9 |

The Employment Growth 2050 Scenario added 50 percent to the values in the percent change column to examine what the congestion impact would be with much greater than expected local employment growth. Map 4.6 below indicates whether roadways would be less congested, more congested, or unchanged. Blue indicates no measurable change in congestion, red indicates increased congestion, and green indicates less congestion.

**Map 4.6:** Scenario 1 Congestion Change 2017 to 2050



When modeled against the 2050 build scenario, the Map 4.7 indicates the magnitude of effects. Green represents free flow traffic, yellow is moderate congestion, and red indicates significant congestion.

**Map 4.7:** Employment Growth 2050 Scenario Impact on Congestion

Increasing availability of employment 50 percent above 2050 projections will have mixed results regarding the impact on regional congestion. Some local roads have reduced congestion, while some regional roads have increased congestion.

### 4.3.2 SCENARIO 2: POPULATION GROWTH 2050

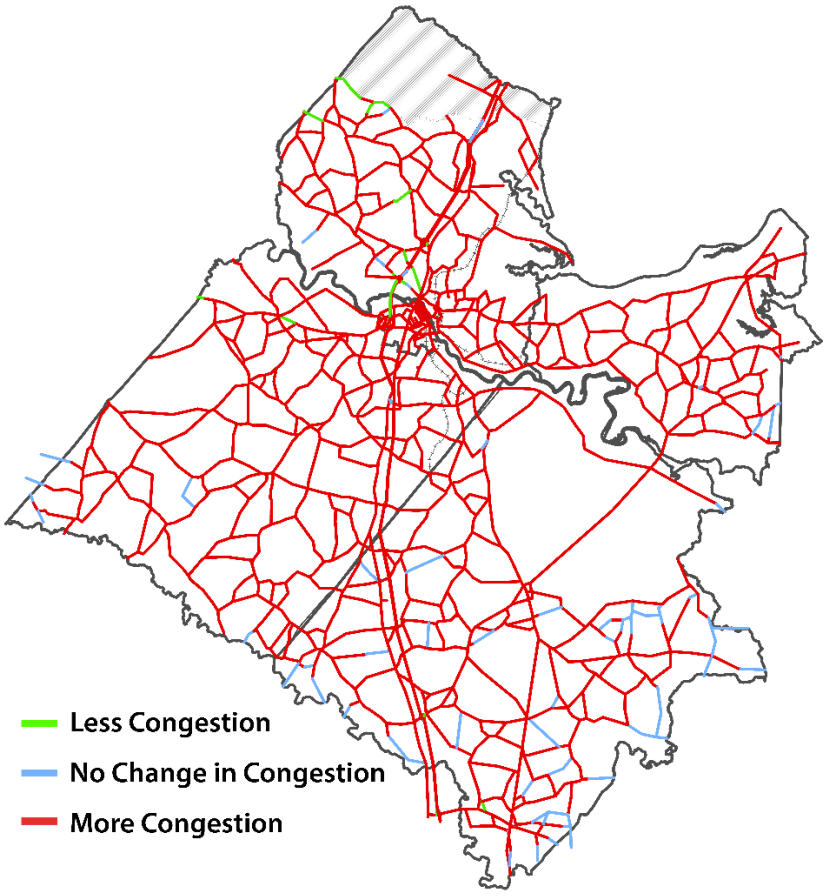
The Population Growth 2050 scenario examined the impact of a 50 percent increase in local population growth above the 2050 build scenario growth predictions. For this scenario, population is expected to increase by 50 percent in all TAZs from the 2050 base year prediction. Without the scenario of increased population growth, the current growth can be seen in Table 4.2

**Table 4.2:** Population Change 2017 to 2050

| Jurisdiction | 2017 | 2050 | Percent Change |
|---|---|---|---|
| Fredericksburg | 24,997 | 38,286 | 53.16 |
| Spotsylvania | 131,095 | 246,652 | 88.15 |
| Stafford | 142,297 | 276,663 | 94.43 |
| FAMPO | 298,389 | 561,601 | 88.21 |

This scenario added 50 percent to the percent change column to examine what the impact on congestion and travel demand would be with this large population increase. Map 4.8 indicates whether roadways would be less congested, more congested, or unchanged:

**Map 4.8:** Scenario 2 Congestion Change 2017 to 2050



When mapped, the magnitude of the impact can be assessed in Map 4.9 below. Green represents free flow traffic, yellow is moderate congestion, and red indicates significant congestion.

**Map 4.9:** Population Growth 2050 Scenario Impact on Congestion

In this scenario it is easy to see that almost all roads will be affected by a larger population growth than is expected for the FAMPO Region. However, in many cases, the magnitude of the increase is not severe. In the urban parts of the region, the impact would be quite large.

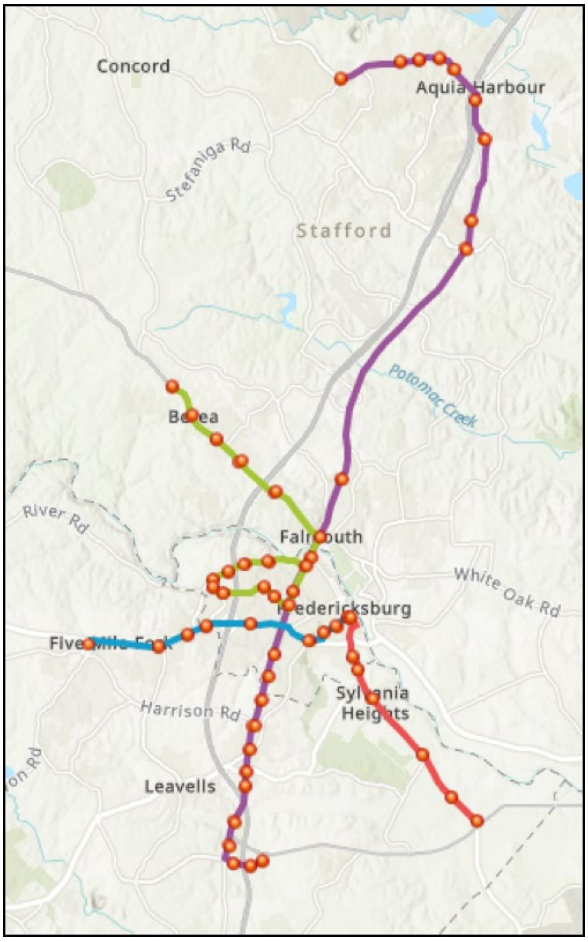
### 4.3.3 SCENARIO 3: TRANSIT GROWTH 2050

The Transit Growth 2050 scenario modeled 50 percent faster headways for all transit routes including FRED, VRE, and four new Bus Rapid Transit (BRT) routes in the Region. The BRT routes, described below, are proposed along Route 610/U.S. 1, Route 2, Route 3, and U.S. 17/Central Park, and indicated on the Map 4.10.

- Route 610/U.S. 1: BRT runs along 610 in Northern Stafford and U.S. 1 through Stafford County, the City of Fredericksburg, and Spotsylvania County with its terminus at Spotsylvania Regional Medical Center
- Route 2: BRT runs along Route 2 starts in the City of Fredericksburg at the train station and runs along Route 2 into Spotsylvania County with its terminus in New Post.
- Route 3: BRT runs along Route 3 from the Gordon Road Park and Ride Lot in Spotsylvania County and ends in the City of Fredericksburg at the train station.
- U.S. 17/Central Park: BRT starts in Stafford County in the Berea area along U.S. 17 and goes to Falmouth where it crosses the Rappahannock River at US 1 and follows Fall Hill Avenue to Central Park, then follows Cowan Boulevard to FRED Central along U.S. 1.

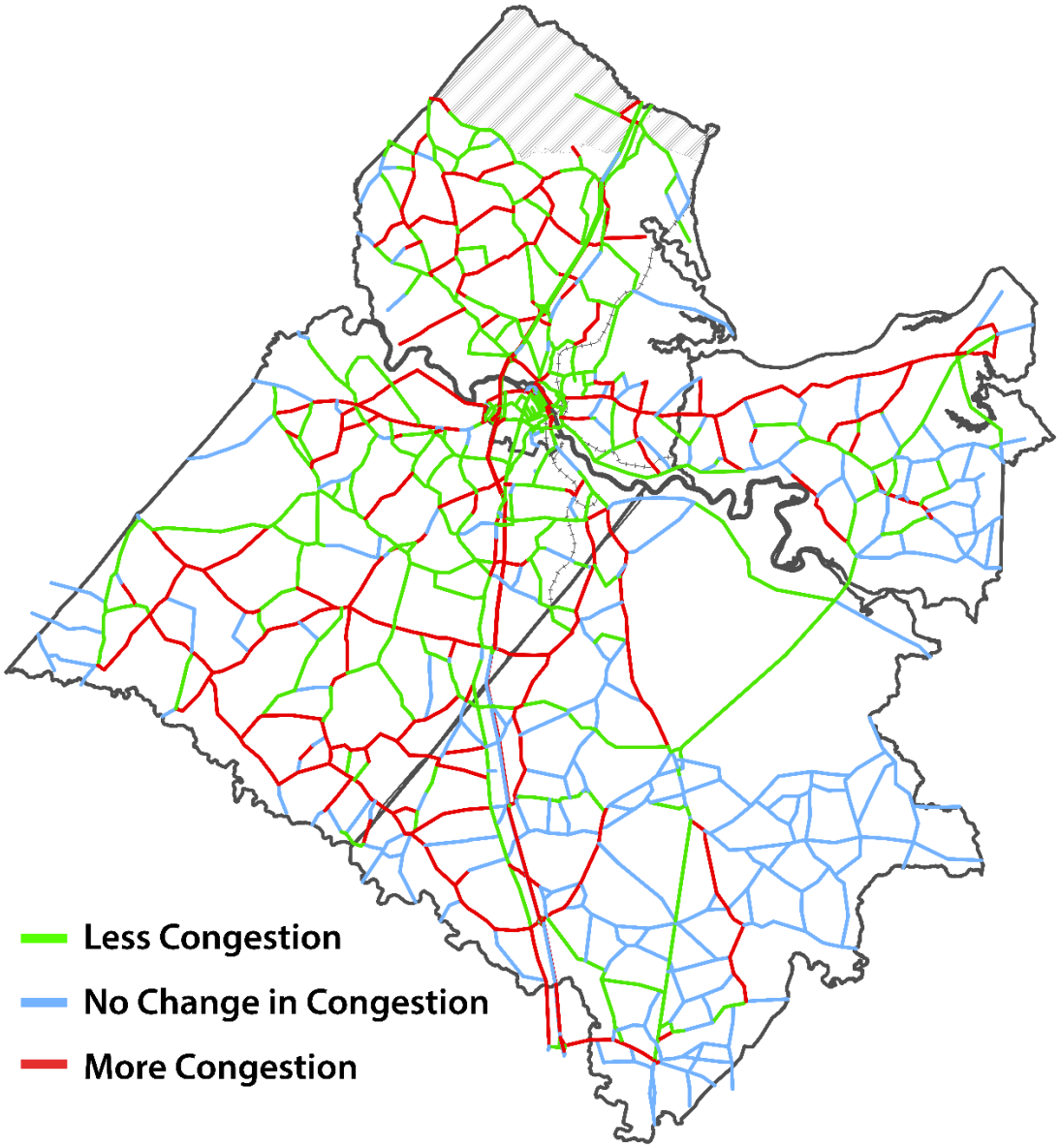
On Map 4.10, Route 610/U.S. 1 is in purple, Route 2 is in red, Route 3 is in blue, and U.S. 17/Central Park is in green. Bus stops are marked as orange dots.

**Map 4.10**: Potential BRT Routes and Stops




Map 4.11 shows the magnitude of impact on congestion with the Transit Growth 2050 scenario. Blue indicates no measurable change in congestion, red indicates increased congestion, and green indicates less congestion.

**Map 4.11:** Scenario 3 Congestion Change 2017 to 2050




Again, there are mixed results. Increased local transit will produce reduced congestion in some areas and no change in others. The red lines indicate increased congestion due to people driving to the major transit stations on local roads. However, the increase is incredibly subdued. Green lines indicate reduced congestion on regional roads. The magnitude of the impact on the travel demand model is however muted as can be seen in Map 4.12 below.

**Map 4.12:** Transit Growth 2050 Scenario Impact on Congestion

The 2045 LRTP indicated weaknesses in the Fredericksburg Travel Demand model around how it accounts for transit improvements. From the modeling efforts shown above, it appears likely that commuter rail impacts on congestion are not fully taken into account in the model as-is. This should be addressed in a future update to the travel demand model and potentially by utilizing additional tools to better account for improvements to transit infrastructure and service.

## 4.4 FUTURE SCENARIO PLANNING EFFORTS AT FAMPO

While the efforts in 4.3 surveyed a limited number of possible outcomes in the area, new large-scale transportation projects and continuing rapid growth of the population and employment in the region warrant a new round of comprehensive scenario planning efforts.

### 4.4.1 SCENARIOS TO CONSIDER IN THE FAMPO REGION

In identifying which scenarios should be considered, a combination of factors will be playing out simultaneously. A multifaceted approach will be required that factors in land use, population growth, jobs growth, traffic increase – including freight movements and delay – as well as planned improvements to the transportation system.

The following potential scenarios could inform such a process:

1. Concentrated Urban Smart Growth: A larger increase in urban population, smaller increase in employment and an increase in transit and smart technology
2. General Population Growth: A larger increase in population generally without an increase in transit and a smaller increase in jobs
3. Sprawl Growth: A larger increase in rural population growth without a corresponding increase in roads and highway growth or transit growth above current expected levels.
4. Fast Employment Growth: A rapid increase in local employment growth with corresponding population growth and freight movements.

Future modeling and planning efforts should also deal with questions of resilience of the transportation system. With climate change, localized flooding events and excessive impacts of events on major highways, resilience metrics should be developed to make a concerted effort to "future proof" the transportation infrastructure and systems in this unpredictable environment. This will include weather events, homeland security challenges, and economic growth impacts.

### 4.4.2 PLANNED COURSE OF ACTION

The former FAMPO scenario planning work completed in 2012 and 2015 is now somewhat dated, making use of datasets that have been superseded and subject to limitations pointed out in the 2045 LRTP update and reaffirmed again here. It is time for review. The 2020 Census data is producing new insights into the growth and change in the FAMPO Region demonstrating rapid growth rates of up to 22 percent in some jurisdictions. The following key processes should be undertaken in the next three years to prepare for the following update to the LRTP (LRTP 2055):

1. A thorough revision of the Fredericksburg Area Travel Demand Model to incorporate more up-to-date practices and data to better model transit impacts on traffic, incorporate population data from the 2020 census and update land use data and new construction impacts throughout the region. Several jurisdictions have made significant changes to land use maps and zoning ordinances which should be incorporated. It will also be important to analyze impacts of land use in neighboring

jurisdictions which will have an impact on the FAMPO model such as new construction in the Counties of Orange, Culpeper, King George, Caroline, Fauquier, and Prince William.

2. A thorough analysis of regional and national trends identified in Census 2020 and the impacts for local planning and the transportation system in the FAMPO Region.
3. A new scenario planning process along the lines laid out in 4.4.1 above including an analysis of proposed land use involving key stakeholders at the local government level and local economic development role players. The FAMPO 2021 Transportation Improvements Survey identified a keen interest in improved transit offerings in the region and this should be included in the scenario planning efforts.